Structural safety of glass components

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2020

Document Version:
Publisher's PDF, also known as Version of record

Link to publication

Citation for published version (APA):
Kozlowski, M. (2020). *Structural safety of glass components.* (TVSM-7000; No. TVSM-7169). Division of Structural Mechanics, LTH.

Total number of authors:
1

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STRUCTURAL SAFETY OF GLASS COMPONENTS

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ISRN LUTVDG/TVSM--20/7169--SE (1-295) | ISSN 0281-6679

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First published December 2020 *(Pl)*.

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Preface

The report relates to the Research Study Contract (no. 1/RB6/2019) concluded on 08/04/2019 and signed by representatives of Division of Structural Mechanics, Faculty of Engineering, Lund University, Sweden represented by Prof. Erik Serrano and Silesian University of Technology, Gliwice, Poland represented by Marcin Kozłowski, PhD.
It reports the work carried out and summarizes main results of the work related to the project "Structural Safety of Glass Components" carried out by Marcin Kozłowski during his Postdoc position at the Division of Structural Mechanics, Faculty of Engineering, Lund University, Sweden from 01.01.2018 to 31.12.2018. It also provides information about dissemination presentation of the research outcomes.

Summary

An extensive experimental campaign was carried out in this research project. The testing program involved both the static and dynamic characterization of a double-tire impactor, as well as impact testing of glass panels mounted using various fixing methods. The fixing methods included linear clamping, bolted point fixings through holes in glass and local clamp fixings without penetration of glass. The investigation was made by varying glass thickness, types of glass and interlayer stiffness.

Numerical models were created to reproduce the structural behaviour found on the specimens subjected to the soft-body impact. Models were created using the commercial finite element analysis (FEA) software ABAQUS and were analysed using the Implicit Dynamic solver.

Several types of reduction methods were investigated. Such methods are used to reduce the computational effort needed to solve full 3D FE-models. The reduction methods can be categorised according to the type of degrees-of-freedom generated in the reduction process, where condensation methods involve only physical dofs, generalised coordinate methods are based solely on generalised coordinates, and hybrid reduction methods employ a combination of dofs of both types. In the current work on finding a suitable reduction scheme for soft body impact on glass, these methods were studied together with updated methods based on Ritz vectors.

The main results from the project include verified full 3D FE-models, and data from tests of sof body impact. Furthermore, the results from the project indicate that it is possible to predict the structural behaviour of free-standing glass balustrades subjected to soft-body impact using these full transient non-linear numerical models. However, these model are time consuming to use and require access to advanced commercial FE software and extensive user knowledge. Consequently, another important conclusions is that there is a strong need for reduced modelling techniques that are time efficient and allow for a quick check of alternative designs.

Content

1 Introduction

During the last decades, an increase in structural applications of glass in modern architecture has been observed. This particularly applies to the building components that, in addition to serving as infill elements for openings in buildings, have a special role in ensuring the safety of building occupants. Although glass has been used in construction for almost 2000 years, only during the past decades a remarkable development in structural glass (balustrades, French windows, enclosures, facades, etc.) has been observed (Patterson 2011, Bedon et al. 2018). The development from an infill to a structural material enabled designs that are based on using a large amount of glass in e.g. atriums, skylights, partition walls and structural glass enclosures aiming to achieve a maximum amount of transparency in buildings (Bostic 2009; Louter 2011). Glass structures feature the ability to merge with their surroundings and become invisible, nearly dematerialized if the structural frame or fixings are kept to a minimum, see examples in Fig 1.

a) b) c)

Fig. 1 Examples of structural glass in private houses (a, b) and public buildings (c).

It is important to stress that currently Europe lacks of standardized guidelines, design approaches or standards dedicated for design of structural glass to be used in everyday engineering practice. Practically, the regulation authorities do not follow the development and increasingly used structural glass in buildings. It is very difficult situation for structural engineers who are under constant pressure from architects willing to use more glass in structures. Engineers are expected to deliver the design without adequate background offered by authorities or by taking courses at universities. The research aims at development of current knowledge and contributes to the development of guidelines regarding safety of components.

Safety of a structure is one of the most important performance criteria for glass elements. It involves mechanical resistance, stability and accessibility in use for finishing elements, but primarily for structural (load-bearing) elements. (Regulation of EU parliament 2011, EN 1990). Whenever glass panels are mounted at identified risk areas (for example barriers), the owner of the building is responsible for ensuring that the design and construction is technically safe for general use and that it meets current and accepted technical standards. This applies especially in situations when panels are required to ensure the protection of neighbouring walkways and have to bear the loads of persons leaning against or bumping into the glass.

Traditionally, well-known solutions for glass elements include steel members or handrail and glass panels as infill elements, thus the structural robustness is guaranteed primarily by steel elements, which in case of glass failure carry the full loading. However, nowadays, a common trend of resignation from steel members (handrails or posts) can be observed, see Fig. 1. In these cases, glass is the only load-bearing material - the only structural element which protects users from falling. This might be very dangerous, and even life-threatening, because the structural safety is based on a brittle material, whose behaviour is not fully recognized.

At this point it should be emphasized, that standard design approaches involve basic load requirements, such as wind load and static barrier load, however, impact loads are considered only in limited number of cases. This is due to the lack of clear requirements in standards. To the knowledge of the applicant, omitting dynamic calculations, such as soft body impact, happens very often in nowadays practice. This is caused by lack of detailed knowledge on dynamic transient analysis and lack of simulation tools.

The behaviour of glass panes under impact loading should play an important role in the design of glass structures and it is critical when it comes to the safety of users (Schneider et al. 2011). The brittleness of glass and its linear-elastic stress-strain-relation without plastic deformability can lead to an instantaneous and disastrous failure under both hard and soft body impact. It should be emphasized here that the resistance of glass to impact is usually lower than for most other building materials, therefore, if one wants to use glass as a replacement for commonly used structural materials, one has to make a precise (exact) analysis to ensure that its design ensures the safety of users (Schneider 2001).

A simple numerical example shows that the dynamic force from soft-body impact load may exceed several times the standard static loading (Kozłowski et al. 2018). Results from numerical studies on soft body impact with a 50 kg pendulum show, that even for the lowest value of drop height of 300 mm (as per DIN 18008-4) the contact force reaches a value of 12 kN, which is more than 10 times the static loading (usually 1kN/m). In cases when glass is not designed for such loading this could be a threat to human’s health and life. Moreover, the numerical study shows that, for a more complicated geometry, the stress distribution can dramatically change over time and that stress concentrations can develop at certain locations at a late stage in the impact history (Kozłowski et al. 2018). This cannot be directly capture in a static analysis, normally performed by structural engineers.

The results of the project will be potentially used for the development of a structural design tool for glass components (Clearsight®) created at Structural Mechanics by Prof. Kent Persson. It is planned to add additional features for dynamic loading and the results will be used for validation of the models.

Another important aspect to mention is that the European Commission (CEN) has recently launched work on the codification of structural design of glass (working title is Eurocode 10 for glass – working group CEN/TC250-WG3) in order to provide common design approaches and achieve a harmonized safety level throughout the member states. To date this process has reached the stage when the first draft of a Eurocode for structural glass is under development and any work within this field would provide an important contribution to it.

1.1 Glass barriers

The main purpose of using barriers in buildings is to protect their users against falling from heights. Barrier elements are usually installed in places where there is a difference in levels between both sides of the barrier (Pinto and Reis 2016). To fulfil safety measures, barriers must meet the requirements regarding minimum height (calculated from the finished floor level to the top edge), load capacity for the strength design (statically and dynamically), and minimum stiffness to limit excessive deflections that may disturb its functionality or building occupants.

Barriers should fulfil their function under ordinary circumstances but also in exceptional cases, e.g. when one glass sheet of the laminate is fractured (Pinto and Reis 2016). Since glass components are susceptible to sudden and brittle fracture, it is important to consider other limit states in addition to the ultimate limit state (ULS) ensuring safety and the serviceability limit state (SLS) focusing on aesthetics and comfort. These novel limit states (fracture and post-fracture limit states) relate to the situation in which, e.g. one sheet in the laminated glass is damaged, to ensure sufficient damage tolerance and robustness (Honfi et al. 2014, Lenk and Honfi 2016, CEN 2019). In this case, the fractured element should meet the safety function, however, with reduced load. This limit state will be included in the new Eurocode on structural glass (Feldmann and Di Biase 2018).

To guarantee that barriers meet the code requirements, especially regarding impact loads, experiments are often performed. Such tests are costly and time-consuming and are usually limited to a single design case with fixed geometry, thus neglecting the influence of size effect and temperature on the stiffness of the components (Kozłowski 2019a). Finite Element (FE) simulations are an alternative and complementary method to experimental testing. Despite the good correlation to the results from experiments reported by e.g. Kozłowski (2019a), full nonlinear transient FE models of impact on glass are time consuming and usually require access to advanced commercial FE software and extensive knowledge of users. In the design process, however, time efficient reduction methods allow for a quick check of alternative designs (Fröling et al. 2013, Fröling et al. 2014).

1.2 Classification

The most common classification of glass barriers was originally included in the German regulations (TRAV2003) and later adapted in the German standard (DIN 18008-4). The classification of glass barriers protecting against falling depends on geometric features, fixing method and load-transferring function (primary structural element or secondary, non-structural infill). Three main classes of glass barriers are defined: Class A - full height protective barriers, Class B - free-standing glass safety barriers and Class C - barriers with glass infill panels. The correct classification of a barrier is a key element required for structural design and which governs the value of impact loading.

Full height protection barriers (Class A) are vertical glazings fastened linearly or locally, without a handrail to take the horizontal load. Such barriers can take on different shapes and usually consist of full glazing (from floor to ceiling). However, if a handrail carrying horizontal load is mounted in front of the barrier, such an element is classified as Class C (DIN 18008-4). Free-standing glass barriers (Class B) are panels mounted to the superstructure linearly or locally along its bottom edge. In the case of these barriers, glass is the only structural element carrying the load providing safety for the building users. A handrail along the top edge transfers loads to adjacent panels in the event of glass breakage. Glass filled barriers (Class C) involve a frame carrying the horizontal loads. In this type of protective barrier, glass is only an infill element and does not contribute to the stiffness of the main frame.

There are barriers with glass infills that do not fit into any of the classes described above, see Fig. 1. In such solutions, glass elements are mounted between steel posts, which may seemingly indicate Class C. However, these panels can be defined as primary structural elements carrying horizontal loads and should therefore be classified as Class A.

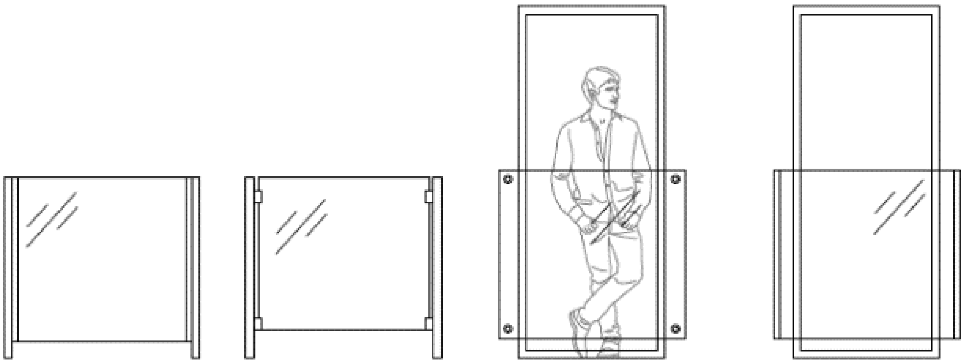


Fig. 1 Barriers classified as Class C.

1.3 Impact loads produced by humans in motion

According to the principles of classical mechanics, the kinetic energy of a moving body is a function of its speed and mass (Nilsson 1976). However, during an impact of a human body to an obstacle, only 30-60% of its mass takes part in the event and the reduction of mass is caused by the fact that the human body is not perfectly rigid but it is a complex dynamic system and some energy remains diffused during the impact (Nilsson 1982).

Nilsson (1982) conducted research to assess impact forces associated with various types of human activities. The researcher employed volunteers leaning on and kicking a glass pane with the dimensions of 1000×2000 mm2 with a 10 mm thickness. The glass pane was equipped with a load cell measuring the applied impact force. The main aim of the research was to define factors to approximate the dynamic force based on the static mass of a human. For kicking, leaning and pushing a person on a glass pane, the dynamic amplification factor achieved was 1.5, 3.9 and 4.1, accordingly.

Huber (1995) carried out experiments with volunteers who shouldered a glass pane measuring 875 × 1938 mm2 with a 10 mm thickness. The specimen was supported along all edges and equipped with a load cell. A maximum dynamic force of 2.2 kN was obtained.

Wörner and Schneider (2000) conducted human body impact tests using volunteers with the following weights 68, 83 and 90 kg. In the first stage, the volunteers ran from a defined distance of 2.5 m and hit a glass pane that measured 847 × 1910 mm2 with a 10 mm thickness. The pane was supported along all edges. In the next stage, the same pane was hit with a 45 kg impactor from drop heights: 450, 700 and 1200 mm. During the experiments, the strain in the glass was measured with gauges mounted on the tensile stress side of the glass. The researchers observed that the microstrain in the glass was much lower as a result of human impact compared to the pendulum impact. The maximum measured strain in the glass, recorded under human impact with a mass of 90 kg, was approximately 60% lower than the strain obtained when the pendulum was dropped from the highest drop height of 1200 mm. It was also observed that the contact time measured during tests with volunteers in relation to the pendulum impact was longer by approximately 50% and lasted in average 80 ms. This result is due to the lower rigidity of the human body as compared to the stiffness of the pendulum. Additional results research are presented in Schneider (2001).

Ummenhofer (2004) conducted research with volunteers running and hitting a wooden board with the dimensions 500 × 500 mm2 and 12 mm in thickness. A load cell was attached to the board measuring the response during impact. An average force obtained in the experiments was 1.66 kN.

Bucak (2004) carried out a study in which a volunteer, weighing 82 kg, was skateboarding and shouldering a glass pane. The glass pane, supported along its short edges, measured 360 × 1100 mm2 with a 8 mm thickness. Before each impact, the speed of the skateboard and the deflection of the pane were measured. The results of the tests were compared with results from a numerical model of a glass pane. The numerical results were based on a 50 kg pendulum load moving at the same velocity as the maximum speed of the skateboard measured during the tests. It was found that the results from the numerical model were approximately 50% greater than that observed during the experiments with the volunteer. Additional results are presented in Schuler et al. (2005).

Table 1 presents a comparison of impact energies given by standards and produced by experiments with volunteers. The impact energy calculated with the method in DIN 52337 was calculated based on the assumptions that an 80 kg human is moving at a velocity of 2.4 m/s (maximum speed of a human inside buildings) and that 80% of its mass is actively involved in the impact event. For comparison, Table 1 provides corresponding drop heights of a 50 kg double-tire impactor calculated from the impact energies achieved during the experiments with volunteers. The values were calculated using the formula for the potential energy $E_p = m \times g \times h$, where m is the impactor mass, g is the acceleration of gravity (9.81 m/s2) and h is the drop height (in meters).

Table 1: Comparison of impact energies given by standards and produced by experiments with volunteers.

Reference	Drop height of 50 kg double-tire impactor [mm]	Impact energy [J]
EN 12600	190	93
	450	220
	1200	589
DIN 18008-4	450	220
	700	343
	900	442
DIN 52337	281*	138
Experiments with volunteers (Schneider 2001, Schuler et al. 2005)	148-358*	73-176

* calculated values

2 Overview of Experimental Campaign

2.1 Static and dynamic characterization of a double-tire impactor

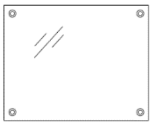
An extensive experimental campaign was carried out in this research project. The testing program involved both the static and dynamic characterization of a double-tire impactor, as well as impact testing of glass panels mounted using various fixing methods. The fixing methods included linear clamping, bolted point fixings through holes in glass and local clamp fixings without penetration of glass. The investigation was made by varying glass thickness, types of glass and interlayer stiffness.

In the project, a double-tire impactor according to EN 12600 was used. The 50 kg impactor consists of two pneumatic tires, inflated to 3.5 bar air pressure, and a central steel cylinder. To define the parameters of the hyperelastic material model assumed for the rubber in the tire, a tensile test of a strip cut from the tire was tested in tension. In addition, static compression of the inflated impactor was performed to obtain stiffness features under static loads. Details of the set-up and results can be found in (Kozłowski 2019a, Kozłowski 2019b). Dynamic characterization of the impactor was performed by setting the impactor into pendulum motion from different drop heights and hitting an obstacle of very high stiffness. By regarding the obstacle as rigid, it was possible to determine the dynamic characteristics of the impactor. In the study, five drop heights were investigated: 100, 200, 300, 450 and 700 mm resulting in impact energies ranging from 49.1 to 343.4 J. To measure the acceleration and contact time of the pendulum during impact, a single-axis accelerometer was mounted to the steel cylinder above the top tire. Acceleration measurements were carried out with data acquisition of 5 kHz.

2.2 Soft body impact tests

An overview of the specimens tested in the soft-body impact tests is presented in Table 2. The specimen type and the boundary conditions employed in the study represent the most prevalent fixing techniques applied in buildings. The glass specimens in this study were regular soda-lime silicate float glass, which is the most common glass type in the building industry. Two types of heat treated glass were applied: heat-strengthened (HS) and fully tempered (FT) glass. Three types of interlayers were applied: regular polyvinyl butyral (PVB), ethylene vinyl acetate (EVA) and SentryGlas® (SG).

Table 2: Overview of tested specimens.

Specimen type	Sketch	Boundary conditions	Specimen dimensions [mm]	Glass type	Glass build-up [mm]	Interlayer [mm]
I		Simply-supported, restrained along vertical edges	1000 × 800	Monolithic, toughened	8 10 12	-
				Laminated, toughened	8 + 8	1.52 PVB 1.52 SGP
				Laminated, heat-strengthened	8 +8	1.52 PVB 1.52 SGP
II		Point-fixed at corners		Laminated, toughened	5 + 5	1.52 PVB
III		Clamp-fixed at corners			5 + 5	1.52 PVB
IV		Simply-supported along all edges (IGU)			5 / 16 mm / 5	-
					5 + 5 / 16 mm / 5	1.52 PVB
V		Cantilevered, restrained along whole bottom edge (steel shoe)	1100 × 1000		10 + 10	1.52 PVB
VI		Cantilevered panels restrained at bottom edge (four point-fixings)	1100 × 1393	Laminated, toughened	10 + 10	0.76 EVA

The research project included the following elements:

- Glass panels supported along their vertical edges. Panels with dimensions of 1000 × 800 mm2 supported linearly along their vertical edges were investigated. Three monolithic panels of various thickness: 8, 10 and 12 mm made of toughened glass were tested to obtain data to calibrate numerical models. Moreover, two laminated glass panels (8+8 mm) made of toughened and heat-strengthened glass with two interlayer materials: PVB and SG 1.52 mm in thickness were investigated.

- Point and clamp fixed panels. These types of elements are usually installed as infill panels for steel balustrades. Panels measuring 1000 × 800 mm2 supported locally (with point fixings and clamps) at points located approximately 50 mm from the corners were investigated. A single laminated panel composed of two 5 mm toughened glass panes laminated with a 1.52 mm PVB interlayer was investigated.

- Insulated glass units. Two specimens with symmetric and asymmetric configuration were investigated. The first specimen consisted of two single 5 mm panes, while the second specimen had a laminated ply with 5+5 mm glass, and a 1.52 mm thick PVB layer on one side. In both cases, the gas-filled cavity was 16 mm in width and the glass was fully toughened. The panels were simply supported along all edges.

- Free-standing glass balustrades (Biolzi et al. 2018, Baidjoe et al. 2018). These are cantilevered elements supported at the bottom edge only. In the research project, both line and point fixed configurations were tested in both static and dynamic loading. Laminated glass panels were composed of two 10 mm plies made of toughened glass laminated with a 1.52 mm thick PVB interlayer for the line fixed configuration and a 0.76 mm EVA interlayer for the point fixed configuration.

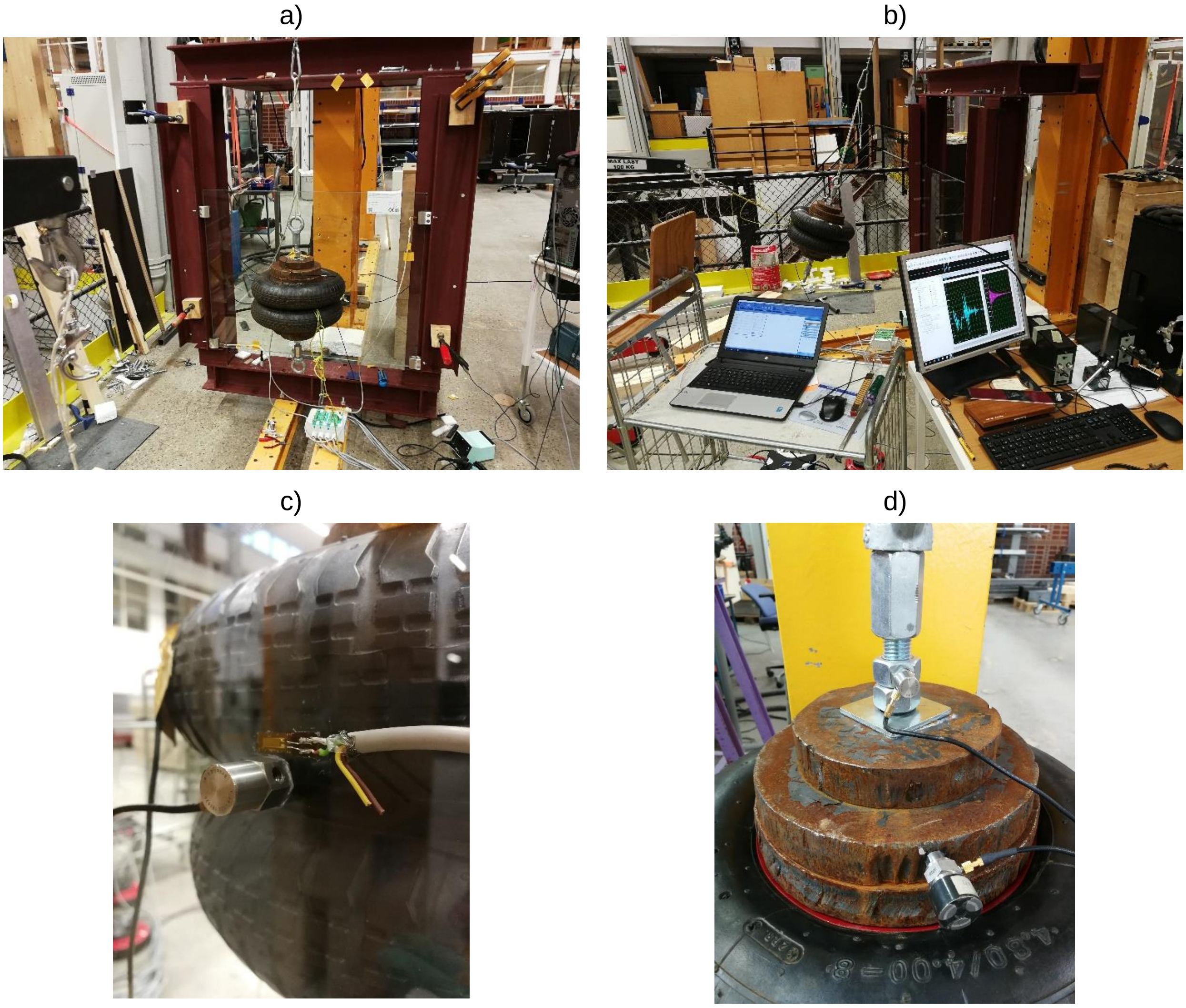


Fig. 2 Soft-body impact test set-up: a) steel rig, b) computers logging data from strain gauges and accelerometers, c) strain gauge and accelerometer mounted to the glass specimen, d) accelerometer mounted to the impactor.

Specimens I-V were tested in a custom-made steel frame of high stiffness (Fig. 2a). The set-up allowed for fixing the various specimens and releasing the impactor from defined drop heights. To measure the structural response of the glass elements during soft-body impact, two systems with a number of sensors were installed (Fig. 2b). To measure strains in glass, strain gauges with a measurement length of 10 mm and a single axis accelerometer were bonded to the specimens (Fig. 2c). The signals from the strain gauges were logged at a frequency of 600 Hz, whereas the readings from the accelerometers were recorded at 5 kHz. A single-axis accelerometer was also mounted to the impactor (Fig. 2d). To obtain statistically reliable results, at least six repetitions for each drop height were performed. All tests were carried out at a temperature of 22±1 °C.

The specimens were tested in both an intact (Fig 3a) and a damaged state (Fig 3b) to investigate the behaviour of specimens, where one of the plies were intentionally fractured. To brake one of the panes in the laminate, a hammer and a steel chisel were used. Due to the energy stored in the heat-treated glass (introduced to the glass in a tempering process), the damaged ply increased its volume and some of the strain gauges bonded to the cracked glass were damaged.

a) b)

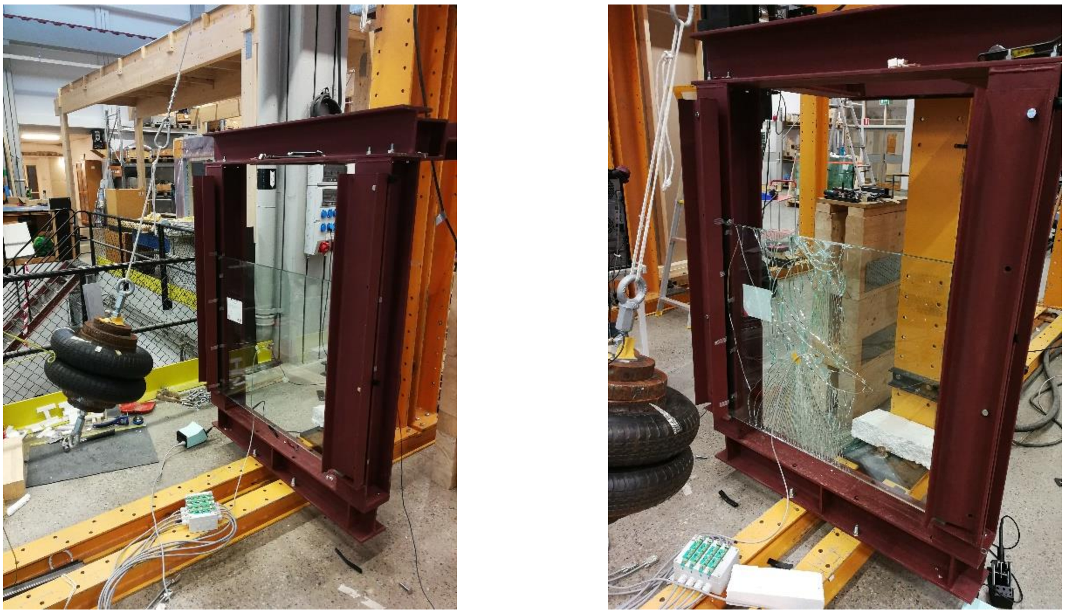


Fig. 3 Soft-body impact test set-up: a) intact specimen, b) specimen with one glass pane in the laminate fractured.

Specimen VI was tested at another laboratory and in a different set-up, as described in Williams Portal et al. (2019). Static and impact tests were conducted on a self-supporting glass balustrade with point-fixings. The specimen was subjected to both static and impact loading (with various drop heights). The dynamic structural response of the glass specimen was analysed by three-dimensional Digital Image Correlation (3D-DIC) measurements using a stereoscopic camera setup with two high-speed cameras. This measurement technique makes it possible to determine the strain and deformation of any point on the specimen surface and to study its deformed shape in detail.

3 Full Transient and Reduced Numerical modelling

3.1 Full modelling

Numerical models were created to reproduce the structural behaviour found on the specimens subjected to the soft-body impact. Models were created using the commercial finite element analysis (FEA) software ABAQUS and were analysed using the Implicit Dynamic solver (Simulia 2018). An example of a numerical model of a free-standing glass balustrade and the impactor is shown in Fig. 4a.

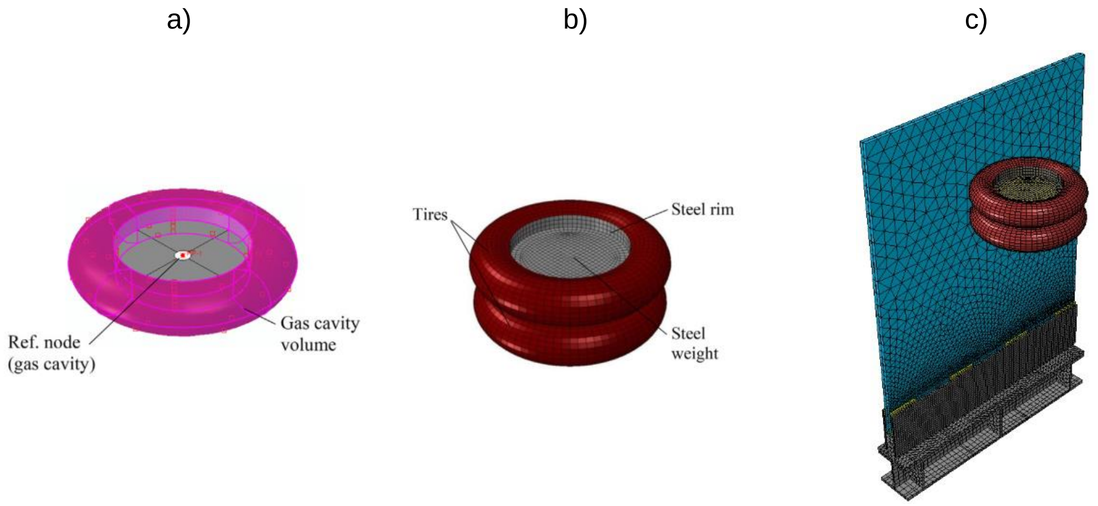


Fig. 3 Soft-body impact test set-up: a) gas volume with reference point, b) double-tire impactor, c) numerical model of the glass balustrade subjected to soft body impact

The model of the impactor followed that of EN-12600 and consisted of two tires and a steel weight (Fig. 4a). The model of a single pneumatic tire was created by revolving a curve corresponding to the mid cross-section of the tire and the steel rim around its perimeter. To achieve a realistic behaviour of the tire, the reinforcement (nylon cords) was included and modelled by using a smeared approach in membrane elements. The displacements of the shell and the membrane elements were fully coupled. In this way, high tensile but low bending stiffness of the tire was achieved. The air inside the tires was modelled using pneumatic elements in the closed cavity. This required the definition of a closed volume between the inner surface of the tires and the outer surface of the rim, the volume of the cavity being controlled by a cavity reference point. In such a case, the stiffness of the tire depends not only on the rubber material and the initial pressure exerted by the gas entrapped inside but also on the volume change of the cavity that is affected by the external loading and deformation of the tire. To achieve equilibrium with the initial pressure of 3.5 bar, as required to conform with EN 12600, an overpressure of 4.25 bar was applied which after equilibrium iterations and tire deformations, settled at 3.5 bar. Laminated glass elements, including the glass panes and the interlayer, were modelled using eight-node continuum shell finite elements. Details of the tire model and the material properties can be found in Kozłowski (2019a).

Laminated glass elements, including the glass panes and the interlayer, were modelled using six-node continuum shell finite elements. Other elements of the model, such as steel elements of the test set-up, setting blocks and other glass fixing elements were modelled using solid elements. A non-regular, triangular mesh pattern was applied for the laminated glass components. A finer mesh with an element size of 5 mm was used for the lower part of the panel where the highest stresses were expected, while the remaining zones were meshed with a coarser pattern with an average element size of 30 mm. For other components of the model, such as the steel plates and fastening elements made of polyoxymethylene (POM), a 10 mm element size was applied. Details of the numerical model and material properties can be found in Kozłowski (2019a).

3.2 Reduced modelling

Full nonlinear transient finite element analyses of impact events are advanced, time consuming and may require access to advanced commercial finite element programs and trained users. In the design process, it is important that the design tools used are such that alternative designs may be tested in an interactive fashion. To achieve this, there is a need to have methods that are very time efficient. A solution may be to employ Model Order Reduction (MOR) methods for the FE-models. This means reducing the initial large number of degrees of freedom with the aim of keeping the dynamics of the original model as intact as possible. In many cases, only a very few degrees of freedom (dofs) are sufficient to provide a good solution, in many cases even only one dof can be sufficient.

In an ongoing study on model reduction of glass impact, the aim is to, in an efficient and simplified manner, be able to determine the maximum principal stress of a glass plate subjected to a dynamic impact load. The method must be valid for glass supported by various types of fixings and with different sizes and laminations. In Fröling et al. (2014) a reduction method for impact on glass based on Ritz vectors was suggested. The method includes two Ritz vectors, calculated from two static load cases representing the glass structure, as well as a spring, dashpot and mass representing the impactor. The load cases are schematically shown in Fig. 4b. Although this method has been shown to provide very good results for many glass types, dimensions and supports, it is not fully general. Since the method is based on two Ritz vectors determined from static load cases, the validity of the solution is dependent on that these load cases are valid.

A vast number of methods for model order reduction of dynamic problems have been developed within structural mechanics where various mode-based methods are the most frequently used methods. Fairly recently, methods originating from control theory have been employed within structural mechanics. In contrast to mode-based methods which have an explicit physical interpretation, the modern reduction methods are developed from a purely mathematical point of view.

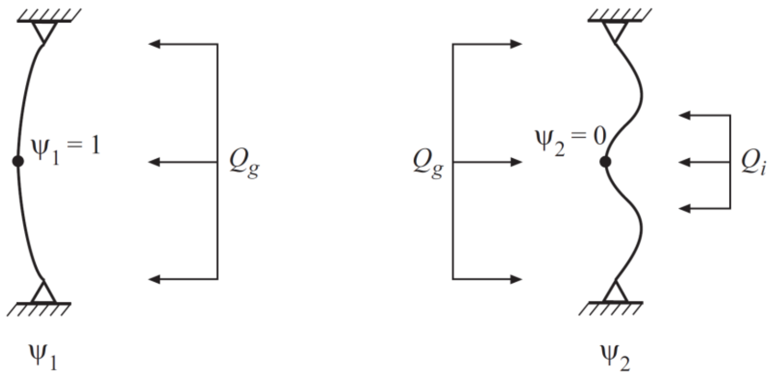


Fig. 4 Static load cases used for calculating the two Ritz vectors for model order reduction of a glass pane.

An FE formulation of a structural dynamics problem results in a linear equation of motion of the following form

$$\mathbf{M\ddot{u}} + \mathbf{C\dot{u}} + \mathbf{Ku} = \mathbf{F} \tag{1}$$

where **M**, **C** and **K** are the mass, damping and stiffness matrices respectively, **F**=**F**(*t*) is the load vector and **u**=**u**(*t*) is the displacement vector with *n* number of dofs. A dot denotes differentiation with respect to time, *t*. The objective of model reduction here is to find a system of *m* number of dofs in which $m << n$, one of which preserves the dynamic characteristics of the full model. The general approach is to approximate the state vector using transformation

$\mathbf{u} = \mathbf{T}\mathbf{u}_R$, where $\mathbf{T}$ is a transformation matrix of size (*m x n*) and $\mathbf{u}_R$ is a reduced state vector of size (m x 1). Applying the transformation in question to Eq. (1) results in

$$\mathbf{M}_R\ddot{\mathbf{u}}_R + \mathbf{C}_R\dot{\mathbf{u}}_R + \mathbf{K}_R\mathbf{u}_R = \mathbf{F}_R \tag{2}$$

$$\mathbf{M}_R = \mathbf{T}^T\mathbf{M}\mathbf{T},\ \mathbf{C}_R = \mathbf{T}^T\mathbf{C}\mathbf{T},\ \mathbf{K}_R = \mathbf{T}^T\mathbf{K}\mathbf{T},\ \mathbf{F}_R = \mathbf{T}^T\mathbf{F} \tag{3}$$

where $\mathbf{M}_R, \mathbf{C}_R, \mathbf{K}_R$ are the reduced mass, damping and stiffness matrices, respectively of size (*m x m*).

The reduction methods can be categorised according to the type of dofs generated in the reduction process, where condensation methods involve only physical dofs, generalised coordinate methods are based solely on generalised coordinates, and hybrid reduction methods employ a combination of dofs of both types. A number of important methods within each category described further by Flodén et al. (2014) are listed below:

- Condensation methods: Guyan reduction, Dynamic reduction, Improved reduction system and System equivalent expansion reduction process
- Generalized coordinate methods: Modal truncation, Component mode synthesis by Craig–Chang, Krylov subspace methods and Balanced truncation
- Hybrid methods: Component mode synthesis by Craig–Bampton, Component mode synthesis by MacNeal and Component mode synthesis by Rubin

In the current work on finding a suitable reduction scheme for soft body impact on glass, these methods were studied together with updated methods based on Ritz vectors.

4 Dissemination of results

The results of the project were disseminated at different levels. This involves journal paper, conference contributions, a published project report, a monography and two Master theses. Currently, a journal contribution is being prepared. Links to the published contributions are given in the text, first pages are provide as annexes to the report.

A journal paper "Experimental and numerical assessment of structural behaviour of glass balustrade subjected to soft body impact" by Marcin Kozłowski was published in the Composite Structures journal (Impact Factor 5.138). The paper provides design principles and a review of existing standards regarding glass balustrades with a special emphasis on dynamic loads. It also presents results of an experimental campaign and numerical studies on the evaluation of the structural safety of fully-glazed balustrades subjected to soft-body impact. It includes experimental characterisation of the impactor and soft body impact tests on a glass balustrade in two states: intact and in post-failure state (with single glass ply damaged). The results of the numerical studies show good agreement with experiments in terms of displacement of the balustrade, stress in glass and acceleration of the impactor.
Link to the document:
https://www.sciencedirect.com/science/article/abs/pii/S026382231930460X

A conference contribution “Structural Behaviour of Glass Panels Under Soft-body Impact” prepared by Marcin Kozłowski, Kent Persson (LTH), Dániel Honfi (RISE), Natalie Williams Portal (RISE) was published after the Challenging Glass conference (September 2020). The paper reports results of the research project involving testing of glass balustrades and infill panels mounted with different fixing methods, such as linear clamps, local clamp fixings and bolted point fixings through holes in the glass. A reduced numerical model for prediction of strength of glass under soft body impact is also presented. In the experimental study toughened and heat-strengthened glass was used in single pane as well as in laminated glass where two interlayer materials of different stiffness were used.
Link to the document: https://journals.open.tudelft.nl/cgc/article/view/4479

A conference contribution “The dynamic structural response of a laminated glass balustrade analysed with optical measurements” prepared by Natalie Williams Portal (RISE), Mathias Flansbjer (RISE), Daniel Honfi (RISE), Marcin Kozłowski was submitted to the “Engineered transparency” conference. A recent research project investigating the structural safety of self-supporting glass components aims to contribute to the development of future guidelines for architectural glazing applications. A specific task within the project was concerned with extending the current knowledge about the effect of impact loading and related testing methods regarding the safety of glass structures. The method described in the paper combines high-speed 3D-DIC and FEA to gain a deeper understanding of the dynamic structural response of self-supporting glass balustrade components, which in turn can enhance product development and user safety.
Due to the COVID-19 situation, the conference was postponed to June 2021.

The above mentioned conference contribution was based on the project report “Testing of self-supporting laminated glass balustrades” prepared by Natalie Williams Portal (RISE), Mathias Flansbjer (RISE) and Daniel Honfi (RISE). The main goal of this project was to improve the understanding about the structural safety of self-supporting glass components. In particular, the results of the project intended to extend the current knowledge about the effect of impact and related testing methods regarding the safety of glass structures. Static and impact tests were conducted on a self-supporting glass balustrade with point-fixings. A static line load was cyclically applied to the top of the specimen to gain an understanding of the static behaviour of the glass structure and to minimize the settlement in the structure prior to applying impact loading. The specimen was subsequently subjected to dynamic loading by impact tests based on EN 12600 (pendulum impact) with different drop heights until attaining failure. The dynamic structural response of the glass balustrade was analysed by three-dimensional Digital Image Correlation (3D-DIC). This measurement technique made it possible to directly relate the measurement of any point to the specimen and to study the deformed 3D shape in detail during the impact test. The FE-analysis (FEA) conducted using SJ Mepla was found to correlate rather well with the dynamic test results particularly up to the initial peak displacement.
Link to the document:
http://www.diva-portal.org/smash/record.jsf?pid=diva2%3A1372865&dswid=-25

The results of the project were also included in the monography “Glass balustrades. experimental and numerical analyses, basis of design” (ISBN) written by Marcin Kozłowski and published at Silesian University of Technology. The monograph is a methodical and synthetic scientific study in the field of experimental and numerical analyses of glass balustrades protecting against falling and subjected to dynamic loading in the form of a soft-body impact with a mass of 50 kg. The work describes the current state of knowledge on the design and testing of glass elements. Subsequently, the basic information about glass necessary in the design process is given and the current state of European regulations and standards is presented. Next, the contemporary classification of barriers and requirements resulting from norms and regulations are presented. The monography also describes the current state of knowledge on the dynamic loads generated by users of buildings and presents a review of world standards for the verification of experimental resistance of glass barriers to impact. The main part of the work is experimental research and numerical implementation of the tyre and pendulum. The current state of knowledge about the current numerical models of the pendulum is presented, as well as the methodology and results of own research. The author's own numerical model of the tyre and pendulum, validated by experimental research, is also described. The main part of the work are experimental studies of a glass balustrade subjected to a pendulum impact in the intact state and in the damage situation An analytical algorithm for estimating the dynamic force for glass balustrades subjected to soft-body impact was proposed. The last element of the monography are author's guidelines for the design of glass balustrades with particular emphasis on dynamic loads and suggestions of the author concerning the procedure and scope of research for technical evaluation of balustrades' performance.

Withing the project two Master theses were prepared, defended and published. The first thesis “Numerical Analysis of Point-Fixed Glass Balustrades” was defended by Johan Höier and Simon Lago at the Halmstad University in Sweden. The purpose of the study was to analyze glass balustrades with point-fixings and to test a structural verification approach using a Finite Element (FE) software. Different models of varying configurations and geometries are created from the evaluation of balustrades with point-fixings available on the Swedish market and the theory. The structural analysis of point-fixed glass balustrades on the Swedish market indicated a lower stress and deflection resistance capacity than the pre-normative Eurocode criterion. Based on the FE calculations, some guidelines for fulfilling the criterion were proposed. The study suggests that the FE approach is an effective method for a relatively quick and easy verification of glass balustrades. The second thesis “Computational modelling and experimental verification of soft-body impact on glass structures” was defended by Ernest Björklund and Axel Christoffersson at the Lund University in Sweden. The purpose of this thesis was to investigate the viability of a numerical method for verifying the resistance of an arbitrary glass panel to soft-body impact. The numerical study is carried out using the finite element program Abaqus. This consisted of high-fidelity models alongside reduced models. The latter were created in an effort to reduce computational costs. To verify the results, the models are compared to data extracted from an extensive experimental campaign carried out at LTH. Both the experimental campaign and the finite element models considered a variety of glass thicknesses, both monolithic and laminated, various interlayer materials, three different fastener configurations, and five different drop heights for the pendulum impactor. For pedagogical reasons, a semi-analytical model of the glass-impactor system was also derived, yielding a damped 2DOF system. The results of the finite element simulations are in good agreement with their experimental counterparts: the stress maxima deviate by approximately 9% for the high-fidelity models, and 6% for the reduced dynamic models. The results demonstrated that numerical methods is a viable approach for designing glass structures to resist soft-body impact.
Link to the documents:
http://hh.diva-portal.org/smash/record.jsf?pid=diva2%3A1343526&dswid=-25,
https://lup.lub.lu.se/student-papers/search/publication/9024292

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Annex I

Monolithic glass 8mm supported at vertical edges, hit location (centre), strain gauge mounted horizontally right behind the impactor

#Nr #	Date	Test type	Glass	Int	Int _thk	Spec	Series	Drop height	Notes
001	2018.12.07	IMP	8	no_interlayer	0	1	1	100	"monolithic 8 mm ESG"
002	2018.12.07	IMP	8	no_interlayer	0	2	1	100	"monolithic 8 mm ESG"
003	2018.12.07	IMP	8	no_interlayer	0	3	1	100	"monolithic 8 mm ESG"
004	2018.12.07	IMP	8	no_interlayer	0	1	1	200	"monolithic 8 mm ESG"
005	2018.12.07	IMP	8	no_interlayer	0	2	1	200	"monolithic 8 mm ESG"
006	2018.12.07	IMP	8	no_interlayer	0	3	1	200	"monolithic 8 mm ESG"
007	2018.12.07	IMP	8	no_interlayer	0	4	1	200	"monolithic 8 mm ESG"
008	2018.12.07	IMP	8	no_interlayer	0	5	1	200	"monolithic 8 mm ESG"
009	2018.12.07	IMP	8	no_interlayer	0	1	1	300	"monolithic 8 mm ESG"
010	2018.12.07	IMP	8	no_interlayer	0	2	1	300	"monolithic 8 mm ESG"
011	2018.12.07	IMP	8	no_interlayer	0	3	1	300	"monolithic 8 mm ESG"
012	2018.12.07	IMP	8	no_interlayer	0	4	1	300	"monolitic 8 mm ESG"
013	2018.12.07	IMP	8	no_interlayer	0	1	1	400	"monolitic 8 mm ESG"
014	2018.12.07	IMP	8	no_interlayer	0	2	1	400	"monolitic 8 mm ESG"
015	2018.12.07	IMP	8	no_interlayer	0	3	1	400	"monolitic 8 mm ESG"
016	2018.12.07	IMP	8	no_interlayer	0	1	1	500	"monolitic 8 mm ESG"
017	2018.12.07	IMP	8	no_interlayer	0	2	1	500	"monolitic 8 mm ESG"
018	2018.12.07	IMP	8	no_interlayer	0	3	1	500	"monolitic 8 mm ESG"
019	2018.12.07	IMP	8	no_interlayer	0	1	1	800	"monolitic 8 mm ESG"
020	2018.12.07	IMP	8	no_interlayer	0	1	1	800	"monolitic 8 mm ESG"

Monolitic glass 10mm supported at vertical edges, hit location (centre), strain gauge mounted horizontally right behind the impactor

021 2018.12.07 IMP 10 no_interlayer 0 1 1 100 "monolitic 10 mm ESG"

022 2018.12.07 IMP 10 no_interlayer 0 2 1 100 "monolitic 10 mm ESG"

023 2018.12.07 IMP 10 no_interlayer 0 3 1 100 "monolitic 10 mm ESG"

024 2018.12.07 IMP 10 no_interlayer 0 1 1 200 "monolitic 10 mm ESG"

025 2018.12.07 IMP 10 no_interlayer 0 2 1 200 "monolitic 10 mm ESG"

026 2018.12.07 IMP 10 no_interlayer 0 3 1 200 "monolitic 10 mm ESG"

027 2018.12.07 IMP 10 no_interlayer 0 1 1 300 "monolitic 10 mm ESG"

028 2018.12.07 IMP 10 no_interlayer 0 2 1 300 "monolitic 10 mm ESG"

#029 2018.12.07 IMP 10 no_interlayer 0 3 1 300 "no file dyn"

030 2018.12.07 IMP 10 no_interlayer 0 1 1 400 "monolitic 10 mm ESG"

031 2018.12.07 IMP 10 no_interlayer 0 2 1 400 "monolitic 10 mm ESG"

032 2018.12.07 IMP 10 no_interlayer 0 3 1 400 "monolitic 10 mm ESG"

033 2018.12.07 IMP 10 no_interlayer 0 4 1 400 "monolitic 10 mm ESG"

034 2018.12.07 IMP 10 no_interlayer 0 1 1 500 "monolitic 10 mm ESG"

035 2018.12.07 IMP 10 no_interlayer 0 2 1 500 "monolitic 10 mm ESG"

036 2018.12.07 IMP 10 no_interlayer 0 3 1 500 "monolitic 10 mm ESG"

037 2018.12.07 IMP 10 no_interlayer 0 4 1 500 "monolitic 10 mm ESG"

038 2018.12.07 IMP 10 no_interlayer 0 5 1 500 "monolitic 10 mm ESG"

Monolitic glass 12mm supported at vertical edges, hit location (centre), strain gauge mounted horizontally right behind the impactor

039 2018.12.07 IMP 12 no_interlayer 0 1 1 100 "monolitic 12 mm ESG"

040 2018.12.07 IMP 12 no_interlayer 0 2 1 100 "monolitic 12 mm ESG"

041 2018.12.07 IMP 12 no_interlayer 0 3 1 100 "monolitic 12 mm ESG"

042 2018.12.07 IMP 12 no_interlayer 0 1 1 200 "monolitic 12 mm ESG"

043 2018.12.07 IMP 12 no_interlayer 0 2 1 200 "monolitic 12 mm ESG"

044 2018.12.07 IMP 12 no_interlayer 0 3 1 200 "monolitic 12 mm ESG"

045 2018.12.07 IMP 12 no_interlayer 0 1 1 300 "monolitic 12 mm ESG"

046 2018.12.07 IMP 12 no_interlayer 0 2 1 300 "monolitic 12 mm ESG"

047 2018.12.07 IMP 12 no_interlayer 0 3 1 300 "monolitic 12 mm ESG"

048 2018.12.07 IMP 12 no_interlayer 0 4 1 300 "monolitic 12 mm ESG"

049 2018.12.07 IMP 12 no_interlayer 0 5 1 300 "monolitic 12 mm ESG"

050 2018.12.07 IMP 12 no_interlayer 0 1 1 400 "monolitic 12 mm ESG"

051 2018.12.07 IMP 12 no_interlayer 0 2 2 400 "monolitic 12 mm ESG"

052 2018.12.07 IMP 12 no_interlayer 0 3 3 400 "monolitic 12 mm ESG"

053 2018.12.07 IMP 12 no_interlayer 0 4 4 400 "monolitic 12 mm ESG"

054 2018.12.07 IMP 12 no_interlayer 0 1 4 500 "monolitic 12 mm ESG"

055 2018.12.07 IMP 12 no_interlayer 0 2 4 500 "monolitic 12 mm ESG"

056 2018.12.07 IMP 12 no_interlayer 0 3 4 500 "monolitic 12 mm ESG"

Laminated glass 88.2mm supported at vertical edges, hit location (centre), strain gauge mounted horizontally right behind teh impactor

057 2018.12.07 TVG 88.2 TVG 1.52 1 1 100 "laminated 88.2 TVG PVB"

058 2018.12.07 TVG 88.2 TVG 1.52 2 1 100 "laminated 88.2 TVG PVB"

059 2018.12.07 TVG 88.2 TVG 1.52 3 1 100 "laminated 88.2 TVG PVB"

060 2018.12.07 TVG 88.2 TVG 1.52 1 1 200 "laminated 88.2 TVG PVB"

061 2018.12.07 TVG 88.2 TVG 1.52 2 1 200 "laminated 88.2 TVG PVB"

062 2018.12.07 TVG 88.2 TVG 1.52 3 1 200 "laminated 88.2 TVG PVB"

063 2018.12.07 TVG 88.2 TVG 1.52 1 1 300 "laminated 88.2 TVG PVB"

064 2018.12.07 TVG 88.2 TVG 1.52 2 1 300 "laminated 88.2 TVG PVB"

065 2018.12.07 TVG 88.2 TVG 1.52 3 1 300 "laminated 88.2 TVG PVB"

066 2018.12.07 TVG 88.2 TVG 1.52 4 1 300 "laminated 88.2 TVG PVB"

067 2018.12.07 TVG 88.2 TVG 1.52 1 1 400 "laminated 88.2 TVG PVB"

068 2018.12.07 TVG 88.2 TVG 1.52 2 1 400 "laminated 88.2 TVG PVB"

069 2018.12.07 TVG 88.2 TVG 1.52 3 1 400 "laminated 88.2 TVG PVB"

070 2018.12.07 TVG 88.2 TVG 1.52 1 1 500 "laminated 88.2 TVG PVB"

071 2018.12.07 TVG 88.2 TVG 1.52 2 1 500 "laminated 88.2 TVG PVB"

072 2018.12.07 TVG 88.2 TVG 1.52 3 1 500 "laminated 88.2 TVG PVB"

073 2018.12.07 TVG 88.2 TVG 1.52 4 1 500 "laminated 88.2 TVG PVB"

074 2018.12.07 TVG 88.2 TVG 1.52 1 1 100 "laminated 88.2 TVG PVB,Cracked glass at impactor side"

075 2018.12.07 TVG 88.2 TVG 1.52 1 1 200 "laminated 88.2 TVG PVB,Cracked glass at impactor side"

076 2018.12.07 TVG 88.2 TVG 1.52 1 1 300 "laminated 88.2 TVG PVB,Cracked glass at impactor side"

077 2018.12.07 TVG 88.2 TVG 1.52 1 1 400 "laminated 88.2 TVG PVB,Cracked glass at impactor side"

078 2018.12.07 TVG 88.2 TVG 1.52 1 1 500 "laminated 88.2 TVG PVB,Cracked glass at impactor side"

079 2018.12.07 TVG 88.2 TVG 1.52 1 1 100 "laminated 88.2 TVG PVB,Cracked glass opposite to impactor side, TAKE ONLY STRAIN, check raw files!"

080 2018.12.07 TVG 88.2 TVG 1.52 1 1 200 "laminated 88.2 TVG PVB,Cracked glass opposite to impactor side, TAKE ONLY STRAIN"

Laminated glass 88.2mm supported at vertical edges, hit location (centre), strain gauge mounted horizontally right behind teh impactor

081 2018.12.07 ESG 88.2 PVB 1.52 1 1 100 "laminated 88.2 ESG PVB"

082 2018.12.07 ESG 88.2 PVB 1.52 2 1 100 "laminated 88.2 ESG PVB"

083 2018.12.07 ESG 88.2 PVB 1.52 3 1 100 "laminated 88.2 ESG PVB"

084 2018.12.07 ESG 88.2 PVB 1.52 1 1 200 "laminated 88.2 ESG PVB"

085 2018.12.07 ESG 88.2 PVB 1.52 2 1 200 "laminated 88.2 ESG PVB"

086 2018.12.07 ESG 88.2 PVB 1.52 3 1 200 "laminated 88.2 ESG PVB"

087 2018.12.07 ESG 88.2 PVB 1.52 4 1 200 "laminated 88.2 ESG PVB"

088 2018.12.07 ESG 88.2 PVB 1.52 1 1 300 "laminated 88.2 ESG PVB"

089 2018.12.07 ESG 88.2 PVB 1.52 2 1 300 "laminated 88.2 ESG PVB"

090 2018.12.07 ESG 88.2 PVB 1.52 3 1 300 "laminated 88.2 ESG PVB"

091 2018.12.07 ESG 88.2 PVB 1.52 1 1 400 "laminated 88.2 ESG PVB"

092 2018.12.07 ESG 88.2 PVB 1.52 2 1 400 "laminated 88.2 ESG PVB"

093 2018.12.07 ESG 88.2 PVB 1.52 3 1 400 "laminated 88.2 ESG PVB"

094 2018.12.07 ESG 88.2 PVB 1.52 1 1 500 "laminated 88.2 ESG PVB"

095 2018.12.07 ESG 88.2 PVB 1.52 2 1 500 "laminated 88.2 ESG PVB"

096 2018.12.07 ESG 88.2 PVB 1.52 3 1 500 "laminated 88.2 ESG PVB"

097 2018.12.07 ESG 88.2 PVB 1.52 1 1 100 "laminated 88.2 ESG PVB,cracked glass on pendulum side"

098 2018.12.07 ESG 88.2 PVB 1.52 1 1 200 "laminated 88.2 ESG PVB,cracked glass on pendulum side"

099 2018.12.07 ESG 88.2 PVB 1.52 1 1 300 "laminated 88.2 ESG PVB,cracked glass on pendulum side"

100 2018.12.07 ESG 88.2 PVB 1.52 1 1 400 "laminated 88.2 ESG PVB,cracked glass on pendulum side"

101 2018.12.07 ESG 88.2 PVB 1.52 1 1 500 "laminated 88.2 ESG PVB,cracked glass on pendulum side"

Laminated glass 88.1mm supported at vertical edges, hit location (centre), strain gauge mounted horizontally right behind teh impactor

110 2018.12.07 ESG 88.1 SGP 0.76 1 1 100 "laminated 88.1 ESG SGP"

111 2018.12.07 ESG 88.1 SGP 0.76 1 1 100 "laminated 88.1 ESG SGP"

112 2018.12.07 ESG 88.1 SGP 0.76 1 1 100 "laminated 88.1 ESG SGP"

113 2018.12.07 ESG 88.1 SGP 0.76 1 1 200 "laminated 88.1 ESG SGP"

114 2018.12.07 ESG 88.1 SGP 0.76 1 1 200 "laminated 88.1 ESG SGP"

115 2018.12.07 ESG 88.1 SGP 0.76 1 1 200 "laminated 88.1 ESG SGP"

116 2018.12.07 ESG 88.1 SGP 0.76 1 1 300 "laminated 88.1 ESG SGP"

117 2018.12.07 ESG 88.1 SGP 0.76 1 1 300 "laminated 88.1 ESG SGP"

118 2018.12.07 ESG 88.1 SGP 0.76 1 1 300 "laminated 88.1 ESG SGP"

119 2018.12.07 ESG 88.1 SGP 0.76 1 1 400 "laminated 88.1 ESG SGP"

120 2018.12.07 ESG 88.1 SGP 0.76 1 1 400 "laminated 88.1 ESG SGP"

121 2018.12.07 ESG 88.1 SGP 0.76 1 1 400 "laminated 88.1 ESG SGP"

122 2018.12.07 ESG 88.1 SGP 0.76 1 1 500 "laminated 88.1 ESG SGP"

122 2018.12.07 ESG 88.1 SGP 0.76 1 1 500 "laminated 88.1 ESG SGP"

124 2018.12.07 ESG 88.1 SGP 0.76 1 1 500 "laminated 88.1 ESG SGP"

125 2018.12.07 ESG 88.1 SGP 0.76 1 1 100 "laminated 88.1 ESG SGP,cracked glass on pendulum side"

126 2018.12.07 ESG 88.1 SGP 0.76 1 1 200 "laminated 88.1 ESG SGP,cracked glass on pendulum side"

127 2018.12.07 ESG 88.1 SGP 0.76 1 1 300 "laminated 88.1 ESG SGP,cracked glass on pendulum side"

128 2018.12.07 ESG 88.1 SGP 0.76 1 1 400 "laminated 88.1 ESG SGP,cracked glass on pendulum side"

129 2018.12.07 ESG 88.1 SGP 0.76 1 1 500 "laminated 88.1 ESG SGP,cracked glass on pendulum side"

Laminated glass 88.1mm supported at vertical edges, hit location (centre), strain gauge mounted horizontally right behind teh impactor

130 2018.12.07 TVG 88.1 SGP 0.76 1 1 100 "laminated 88.1 TVG SGP"

131 2018.12.07 TVG 88.1 SGP 0.76 1 1 100 "laminated 88.1 TVG SGP"

132 2018.12.07 TVG 88.1 SGP 0.76 1 1 100 "laminated 88.1 TVG SGP"

133 2018.12.07 TVG 88.1 SGP 0.76 1 1 200 "laminated 88.1 TVG SGP"

134 2018.12.07 TVG 88.1 SGP 0.76 1 1 200 "laminated 88.1 TVG SGP"

135 2018.12.07 TVG 88.1 SGP 0.76 1 1 200 "laminated 88.1 TVG SGP"

136 2018.12.07 TVG 88.1 SGP 0.76 1 1 300 "laminated 88.1 TVG SGP"

137 2018.12.07 TVG 88.1 SGP 0.76 1 1 300 "laminated 88.1 TVG SGP"

138 2018.12.07 TVG 88.1 SGP 0.76 1 1 300 "laminated 88.1 TVG SGP"

139 2018.12.07 TVG 88.1 SGP 0.76 1 1 400 "laminated 88.1 TVG SGP"

140 2018.12.07 TVG 88.1 SGP 0.76 1 1 400 "laminated 88.1 TVG SGP"

141 2018.12.07 TVG 88.1 SGP 0.76 1 1 400 "laminated 88.1 TVG SGP"

142 2018.12.07 TVG 88.1 SGP 0.76 1 1 500 "laminated 88.1 TVG SGP"

143 2018.12.07 TVG 88.1 SGP 0.76 1 1 500 "laminated 88.1 TVG SGP"

144 2018.12.07 TVG 88.1 SGP 0.76 1 1 500 "laminated 88.1 TVG SGP"

145 2018.12.07 TVG 88.1 SGP 0.76 1 1 100 "laminated 88.1 TVG SGP,cracked glass on pendulum side"

146 2018.12.07 TVG 88.1 SGP 0.76 1 1 200 "laminated 88.1 TVG SGP,cracked glass on pendulum side"

147 2018.12.07 TVG 88.1 SGP 0.76 1 1 300 "laminated 88.1 TVG SGP,cracked glass on pendulum side"

148 2018.12.07 TVG 88.1 SGP 0.76 1 1 400 "laminated 88.1 TVG SGP,cracked glass on pendulum side"

149 2018.12.07 TVG 88.1 SGP 0.76 1 1 500 "laminated 88.1 TVG SGP,cracked glass on pendulum side"

150 2018.12.07 TVG 88.1 SGP 0.76 1 1 100 "laminated 88.1 TVG SGP,cracked glass on glass side"

Laminated glass, point fixings d=50mm, 55.2mm, hit location (centre), strain gauge mounted horizontally right behind the impactor

151 2018.12.07 ESG 55.2 PVB 1.52 1 1 100 "laminated point-fixed 55.2 ESG PVB"

152 2018.12.07 ESG 55.2 PVB 1.52 1 1 100 "laminated point-fixed 55.2 ESG PVB"

153 2018.12.07 ESG 55.2 PVB 1.52 1 1 100 "laminated point-fixed 55.2 ESG PVB"

154 2018.12.07 ESG 55.2 PVB 1.52 1 1 200 "laminated point-fixed 55.2 ESG PVB"

155 2018.12.07 ESG 55.2 PVB 1.52 1 1 200 "laminated point-fixed 55.2 ESG PVB"

156 2018.12.07 ESG 55.2 PVB 1.52 1 1 200 "laminated point-fixed 55.2 ESG PVB"

157 2018.12.07 ESG 55.2 PVB 1.52 1 1 300 "laminated point-fixed 55.2 ESG PVB"

158 2018.12.07 ESG 55.2 PVB 1.52 1 1 300 "laminated point-fixed 55.2 ESG PVB"

159 2018.12.07 ESG 55.2 PVB 1.52 1 1 300 "laminated point-fixed 55.2 ESG PVB"

160 2018.12.07 ESG 55.2 PVB 1.52 1 1 400 "laminated point-fixed 55.2 ESG PVB"

161 2018.12.07 ESG 55.2 PVB 1.52 1 1 400 "laminated point-fixed 55.2 ESG PVB"

162 2018.12.07 ESG 55.2 PVB 1.52 1 1 400 "laminated point-fixed 55.2 ESG PVB"

163 2018.12.07 ESG 55.2 PVB 1.52 1 1 500 "laminated point-fixed 55.2 ESG PVB"

164 2018.12.07 ESG 55.2 PVB 1.52 1 1 500 "laminated point-fixed 55.2 ESG PVB"

165 2018.12.07 ESG 55.2 PVB 1.52 1 1 500 "laminated point-fixed 55.2 ESG PVB"

167 2018.12.07 ESG 55.2 PVB 1.52 1 1 100 "laminated point-fixed 55.2 ESG PVB,,cracked glass on pendulum side"

168 2018.12.07 ESG 55.2 PVB 1.52 1 1 200 "laminated point-fixed 55.2 ESG PVB,,cracked glass on pendulum side"

169 2018.12.07 ESG 55.2 PVB 1.52 1 1 300 "laminated point-fixed 55.2 ESG PVB,,cracked glass on pendulum side"

170 2018.12.07 ESG 55.2 PVB 1.52 1 1 400 "laminated point-fixed 55.2 ESG PVB,,cracked glass on pendulum side"

IGU, 5/16/5, hit location (centre), strain gauge mounted horizontally right behind the impactor

171 2018.12.07 ESG 5.16.5 na 0.00 1 1 100 "IGU, 5/16/5 ESG"

172 2018.12.07 ESG 5.16.5 na 0.00 1 1 100 "IGU, 5/16/5 ESG"

173 2018.12.07 ESG 5.16.5 na 0.00 1 1 100 "IGU, 5/16/5 ESG"

174 2018.12.07 ESG 5.16.5 na 0.00 1 1 200 "IGU, 5/16/5 ESG"

175 2018.12.07 ESG 5.16.5 na 0.00 1 1 200 "IGU, 5/16/5 ESG"

176 2018.12.07 ESG 5.16.5 na 0.00 1 1 200 "IGU, 5/16/5 ESG"

177 2018.12.07 ESG 5.16.5 na 0.00 1 1 300 "IGU, 5/16/5 ESG"

178 2018.12.07 ESG 5.16.5 na 0.00 1 1 300 "IGU, 5/16/5 ESG"

179 2018.12.07 ESG 5.16.5 na 0.00 1 1 300 "IGU, 5/16/5 ESG"

180 2018.12.07 ESG 5.16.5 na 0.00 1 1 300 "IGU, 5/16/5 ESG"

181 2018.12.07 ESG 5.16.5 na 0.00 1 1 400 "IGU, 5/16/5 ESG"

182 2018.12.07 ESG 5.16.5 na 0.00 1 1 400 "IGU, 5/16/5 ESG"

183 2018.12.07 ESG 5.16.5 na 0.00 1 1 400 "IGU, 5/16/5 ESG"

184 2018.12.07 ESG 5.16.5 na 0.00 1 1 500 "IGU, 5/16/5 ESG,specimen broke on pendulum side"

IGU, 55.2/16/5, hit location (centre), strain gauge mounted horizontally right behind the impactor

185 2018.12.07 ESG 5.16.5 PVB 1.52 1 1 100 "IGU, 55.2/16/5 ESG PVB, laminated on pend side"

186 2018.12.07 ESG 5.16.5 PVB 1.52 1 1 100 "IGU, 55.2/16/5 ESG PVB, laminated on pend side"

187 2018.12.07 ESG 5.16.5 PVB 1.52 1 1 100 "IGU, 55.2/16/5 ESG PVB, laminated on pend side"

188 2018.12.07 ESG 5.16.5 PVB 1.52 1 1 200 "IGU, 55.2/16/5 ESG PVB, laminated on pend side"

189 2018.12.07 ESG 5.16.5 PVB 1.52 1 1 200 "IGU, 55.2/16/5 ESG PVB, laminated on pend side"

190 2018.12.07 ESG 5.16.5 PVB 1.52 1 1 200 "IGU, 55.2/16/5 ESG PVB, laminated on pend side"

191 2018.12.07 ESG 5.16.5 PVB 1.52 1 1 300 "IGU, 55.2/16/5 ESG PVB, laminated on pend side"

192 2018.12.07 ESG 5.16.5 PVB 1.52 1 1 300 "IGU, 55.2/16/5 ESG PVB, laminated on pend side"

193 2018.12.07 ESG 5.16.5 PVB 1.52 1 1 300 "IGU, 55.2/16/5 ESG PVB, laminated on pend side"

194 2018.12.07 ESG 5.16.5 PVB 1.52 1 1 400 "IGU, 55.2/16/5 ESG PVB, laminated on pend side"

195 2018.12.07 ESG 5.16.5 PVB 1.52 1 1 400 "IGU, 55.2/16/5 ESG PVB, laminated on pend side"

196 2018.12.07 ESG 5.16.5 PVB 1.52 1 1 400 "IGU, 55.2/16/5 ESG PVB, laminated on pend side"

197 2018.12.07 ESG 5.16.5 PVB 1.52 1 1 500 "IGU, 55.2/16/5 ESG PVB, laminated on pend side"

198 2018.12.07 ESG 5.16.5 PVB 1.52 1 1 500 "IGU, 55.2/16/5 ESG PVB, laminated on pend side"

199 2018.12.07 ESG 5.16.5 PVB 1.52 1 1 500 "IGU, 55.2/16/5 ESG PVB, laminated on pend side"

201 2018.12.07 ESG 5.16.5 PVB 1.52 1 1 100 "IGU, 55.2/16/5 ESG PVB, laminated on pend side, cracked on pend side"

202 2018.12.07 ESG 5.16.5 PVB 1.52 1 1 200 "IGU, 55.2/16/5 ESG PVB, laminated on pend side, cracked on pend side"

203 2018.12.07 ESG 5.16.5 PVB 1.52 1 1 300 "IGU, 55.2/16/5 ESG PVB, laminated on pend side, cracked on pend side"

Laminated glass, clamp fixings, 55.2mm, hit location (centre), strain gauge mounted horizontally right behind the impactor

204 2018.12.07 ESG 55.2 PVB 1.52 1 1 100 "laminated clamp-fixed 55.2 ESG PVB"

205 2018.12.07 ESG 55.2 PVB 1.52 1 1 100 "laminated clamp-fixed 55.2 ESG PVB"

206 2018.12.07 ESG 55.2 PVB 1.52 1 1 100 "laminated clamp-fixed 55.2 ESG PVB"

207 2018.12.07 ESG 55.2 PVB 1.52 1 1 200 "laminated clamp-fixed 55.2 ESG PVB"

208 2018.12.07 ESG 55.2 PVB 1.52 1 1 200 "laminated clamp-fixed 55.2 ESG PVB"

209 2018.12.07 ESG 55.2 PVB 1.52 1 1 200 "laminated clamp-fixed 55.2 ESG PVB"

210 2018.12.07 ESG 55.2 PVB 1.52 1 1 300 "laminated clamp-fixed 55.2 ESG PVB"

211 2018.12.07 ESG 55.2 PVB 1.52 1 1 300 "laminated clamp-fixed 55.2 ESG PVB"

212 2018.12.07 ESG 55.2 PVB 1.52 1 1 300 "laminated clamp-fixed 55.2 ESG PVB"

213 2018.12.07 ESG 55.2 PVB 1.52 1 1 400 "laminated clamp-fixed 55.2 ESG PVB"

214 2018.12.07 ESG 55.2 PVB 1.52 1 1 400 "laminated clamp-fixed 55.2 ESG PVB"

215 2018.12.07 ESG 55.2 PVB 1.52 1 1 400 "laminated clamp-fixed 55.2 ESG PVB"

216 2018.12.07 ESG 55.2 PVB 1.52 1 1 500 "laminated clamp-fixed 55.2 ESG PVB"

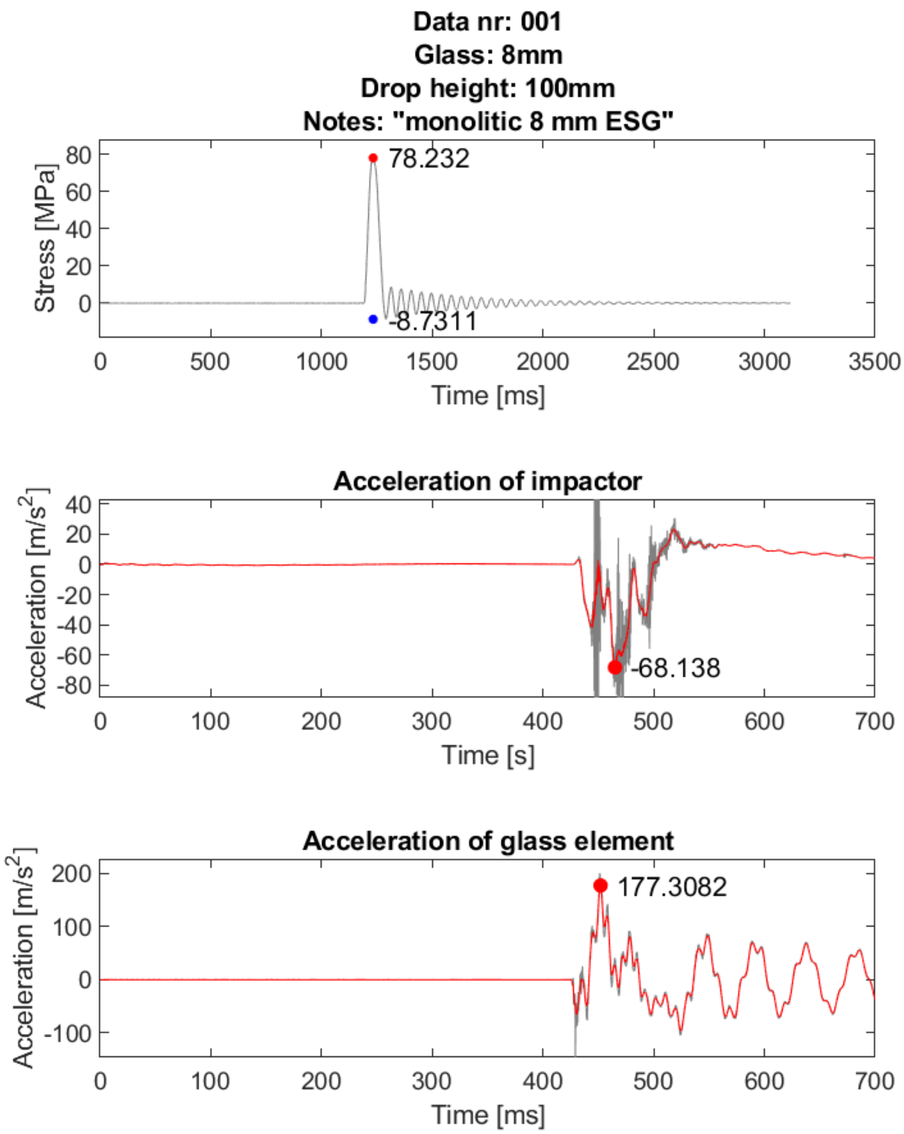
217 2018.12.07 ESG 55.2 PVB 1.52 1 1 500 "laminated clamp-fixed 55.2 ESG PVB"

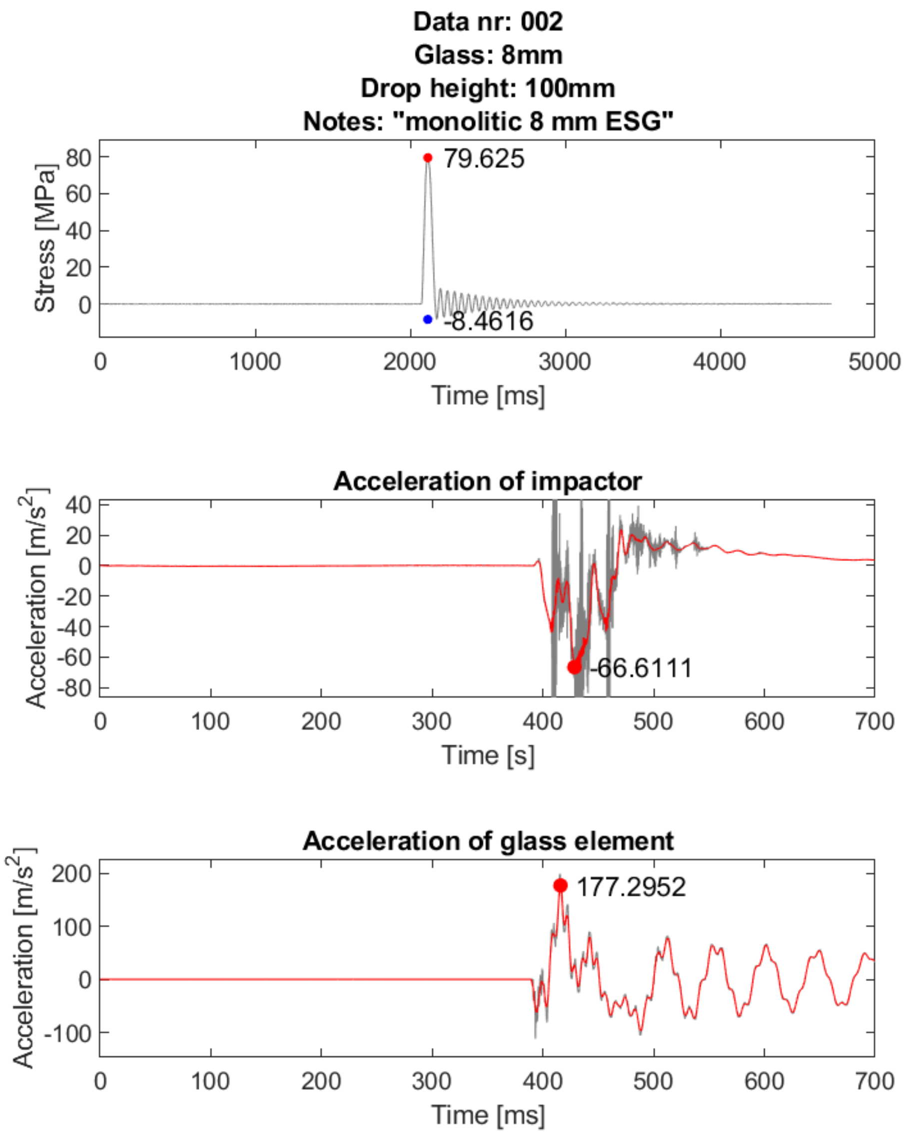
218 2018.12.07 ESG 55.2 PVB 1.52 1 1 500 "laminated clamp-fixed 55.2 ESG PVB"

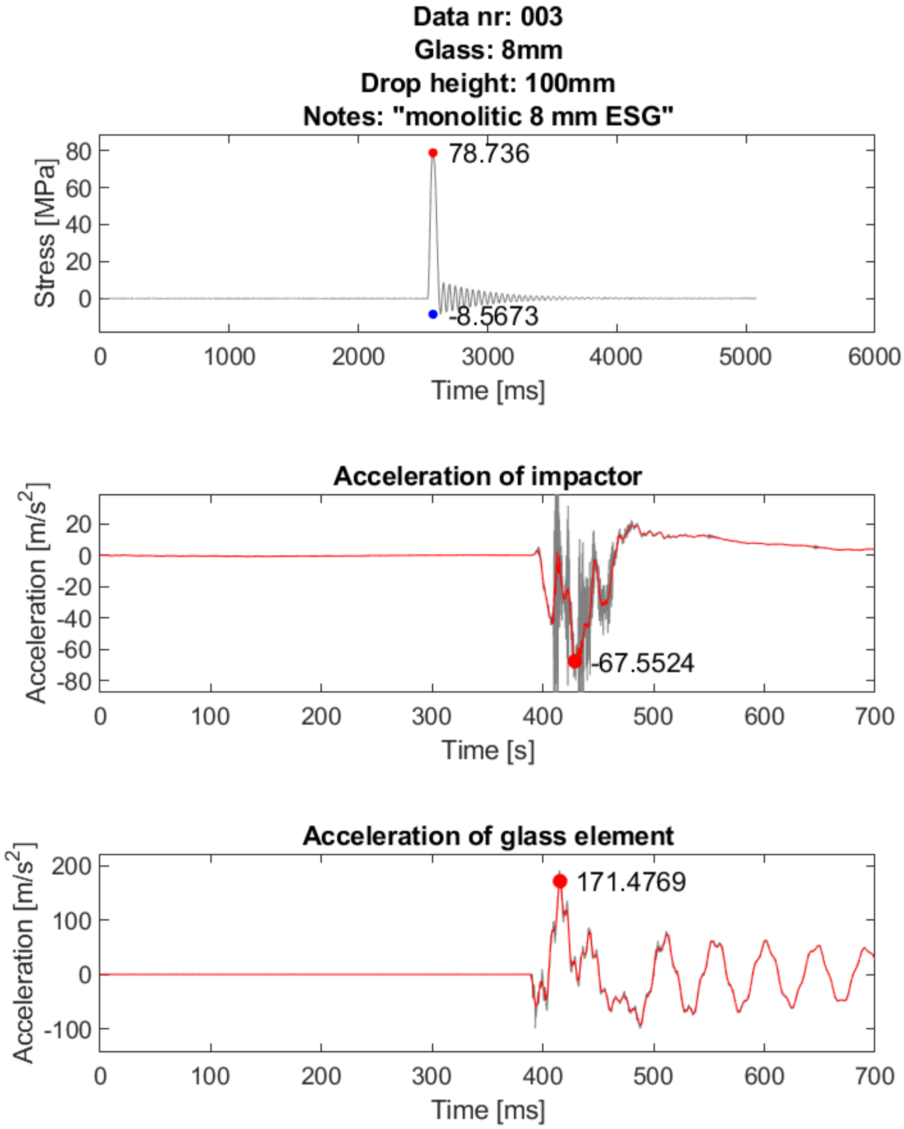
220 2018.12.07 ESG 55.2 PVB 1.52 1 1 100 "laminated clamp-fixed 55.2 ESG PVB,cracked glass on pendulum side"

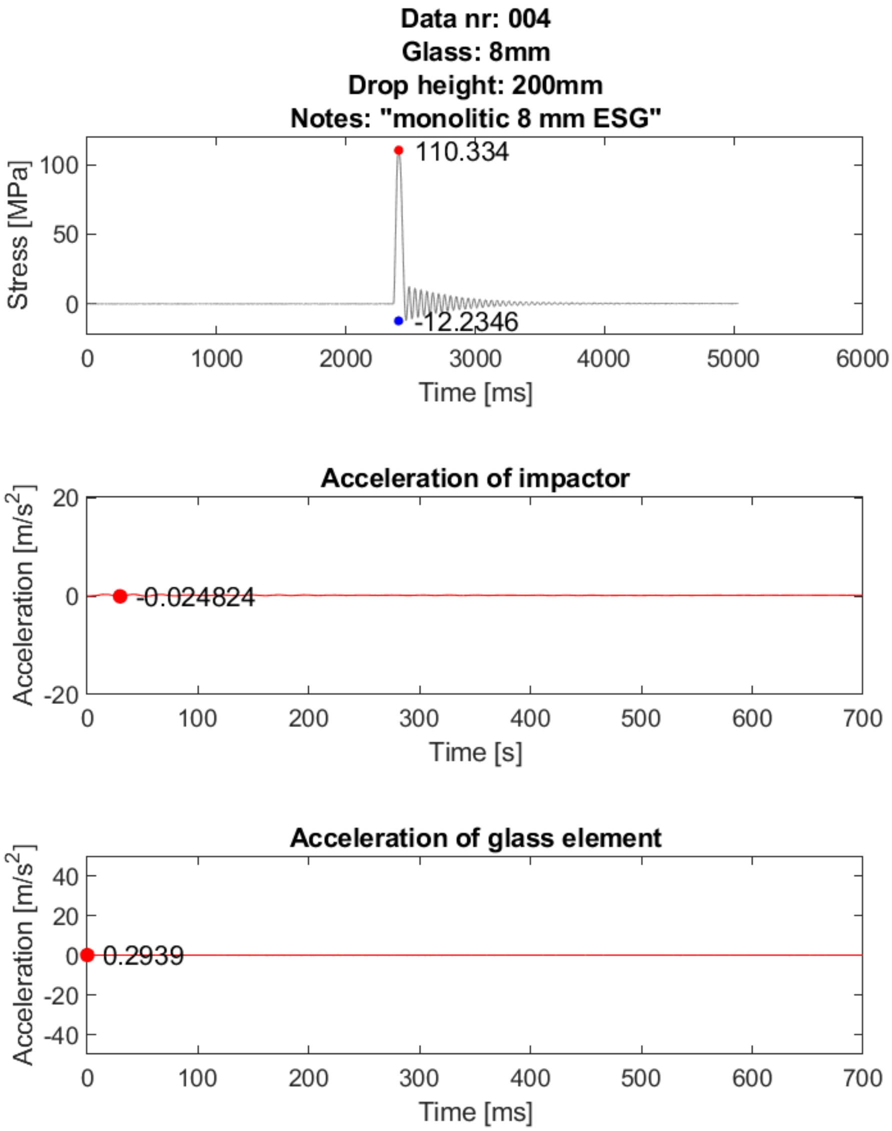
221 2018.12.07 ESG 55.2 PVB 1.52 1 1 100 "laminated clamp-fixed 55.2 ESG PVB,cracked glass on pendulum side"

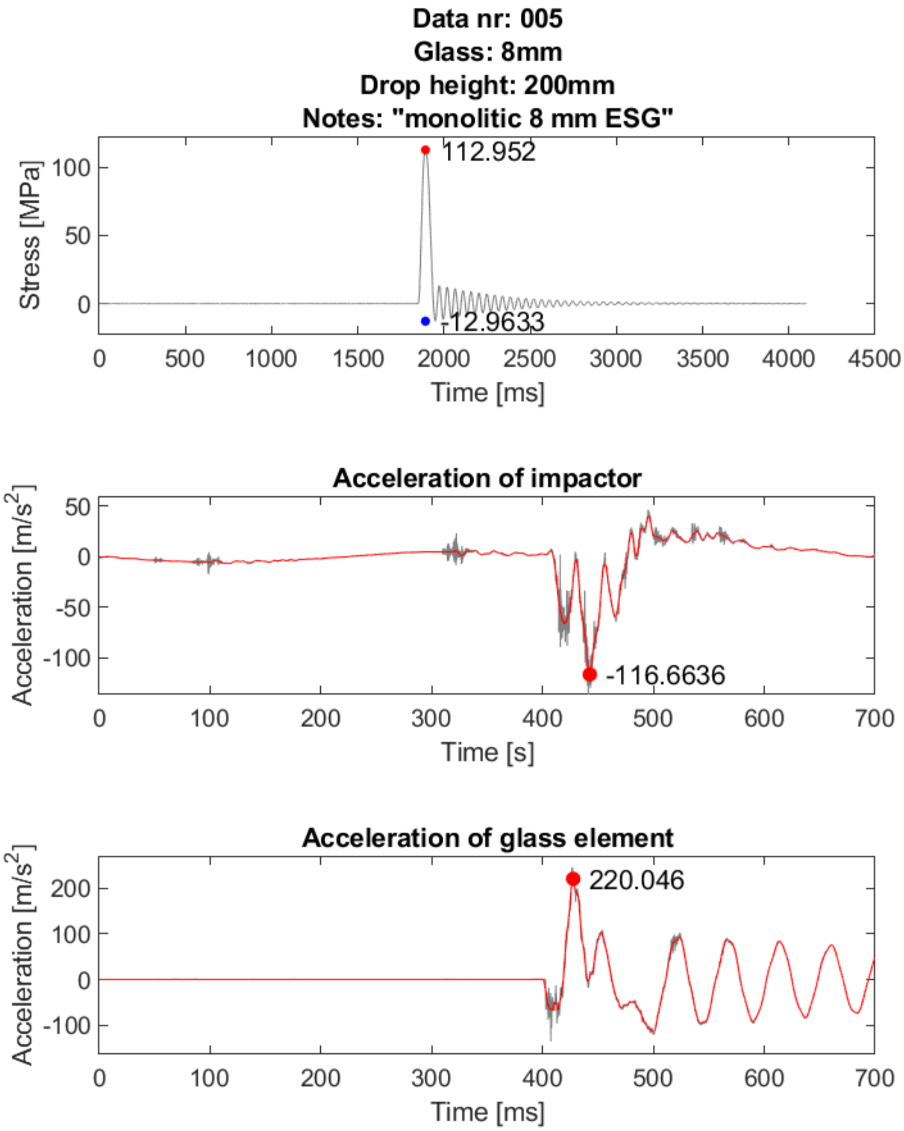
222 2018.12.07 ESG 55.2 PVB 1.52 1 1 100 "laminated clamp-fixed 55.2 ESG PVB,cracked glass on pendulum side"

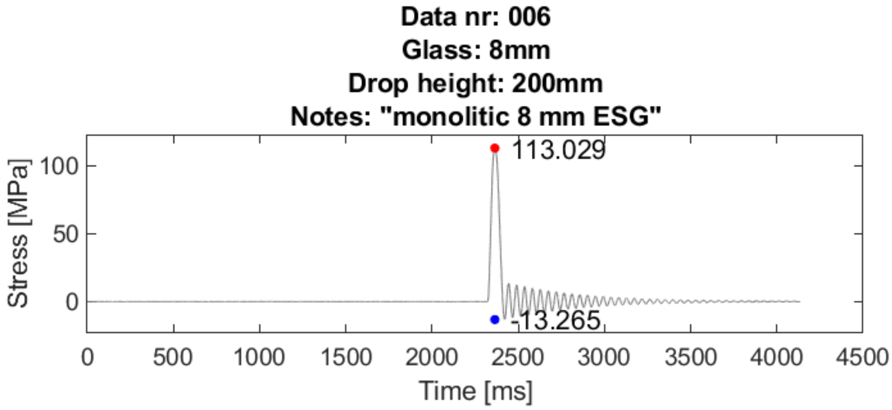

Data nr: 001
Glass: 8mm
Drop height: 100mm
Notes: "monolitic 8 mm ESG"
Stress [MPa]
78.232
-8.7311
Time [ms]
Acceleration of impactor
Acceleration [m/s^2]
-68.138
Time [s]
Acceleration of glass element
Acceleration [m/s^2]
177.3082
Time [ms]

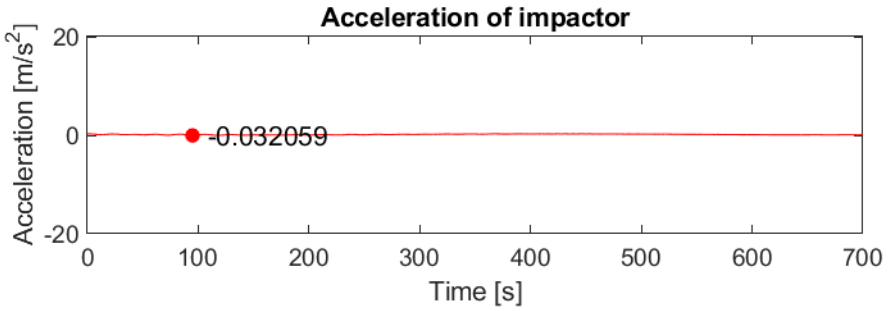

Data nr: 002
Glass: 8mm
Drop height: 100mm
Notes: "monolitic 8 mm ESG"
Stress [MPa]
79.625
-8.4616
Time [ms]
Acceleration of impactor
Acceleration [m/s^2]
-66.6111
Time [s]
Acceleration of glass element
Acceleration [m/s^2]
177.2952
Time [ms]

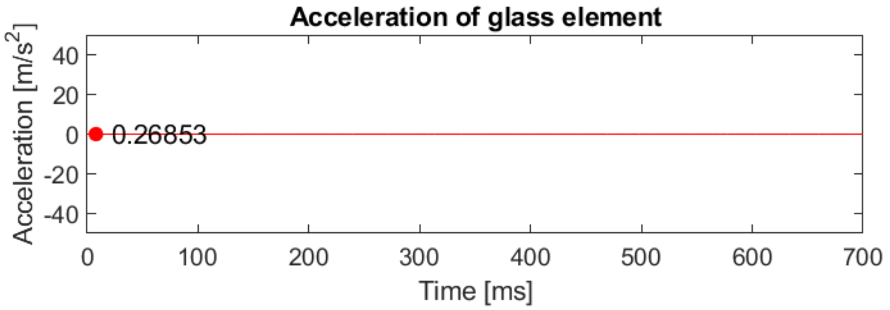

Data nr: 003
Glass: 8mm
Drop height: 100mm
Notes: "monolitic 8 mm ESG"
Stress [MPa]
78.736
-8.5673
Time [ms]
Acceleration of impactor
Acceleration [m/s^2]
-67.5524
Time [s]
Acceleration of glass element
Acceleration [m/s^2]
171.4769
Time [ms]

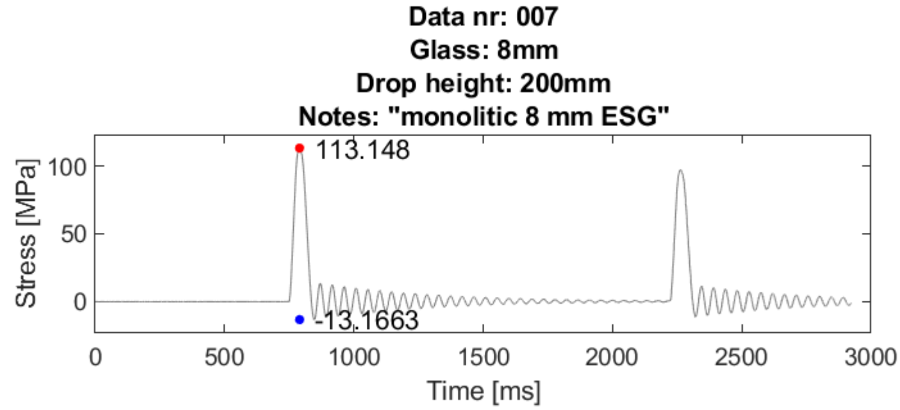

Data nr: 004
Glass: 8mm
Drop height: 200mm
Notes: "monolitic 8 mm ESG"
Stress [MPa]
110.334
-12.2346
Time [ms]
Acceleration of impactor
Acceleration [m/s^2]
-0.024824
Time [s]
Acceleration of glass element
Acceleration [m/s^2]
0.2939
Time [ms]


Data nr: 005
Glass: 8mm
Drop height: 200mm
Notes: "monolitic 8 mm ESG"
Stress [MPa]
112.952
-12.9633
Time [ms]
Acceleration of impactor
Acceleration [m/s2]
-116.6636
Time [s]
Acceleration of glass element
Acceleration [m/s2]
220.046
Time [ms]

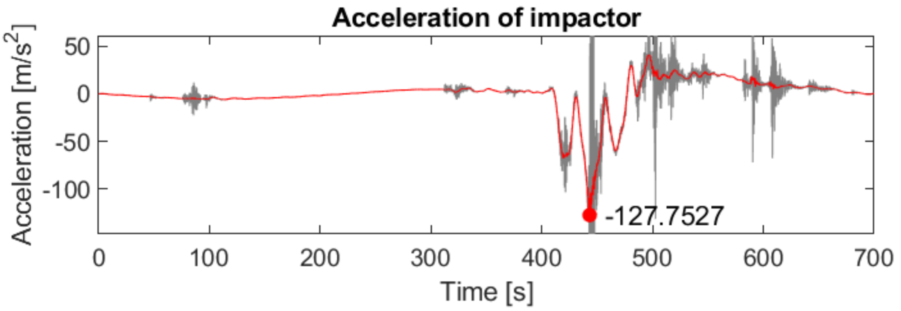

Data nr: 006
Glass: 8mm
Drop height: 200mm
Notes: "monolitic 8 mm ESG"
113.029
-13.265
Stress [MPa]
Time [ms]
0
500
1000
1500
2000
2500
3000
3500
4000
4500
100
50
0


Acceleration of impactor
-0.032059
Acceleration [m/s^2]
Time [s]
20
0
-20
0
100
200
300
400
500
600
700

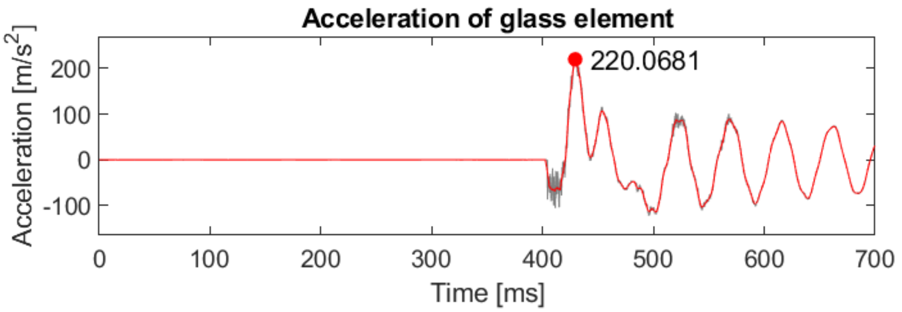

Acceleration of glass element
0.26853
Acceleration [m/s^2]
Time [ms]
40
20
0
-20
-40
0
100
200
300
400
500
600
700



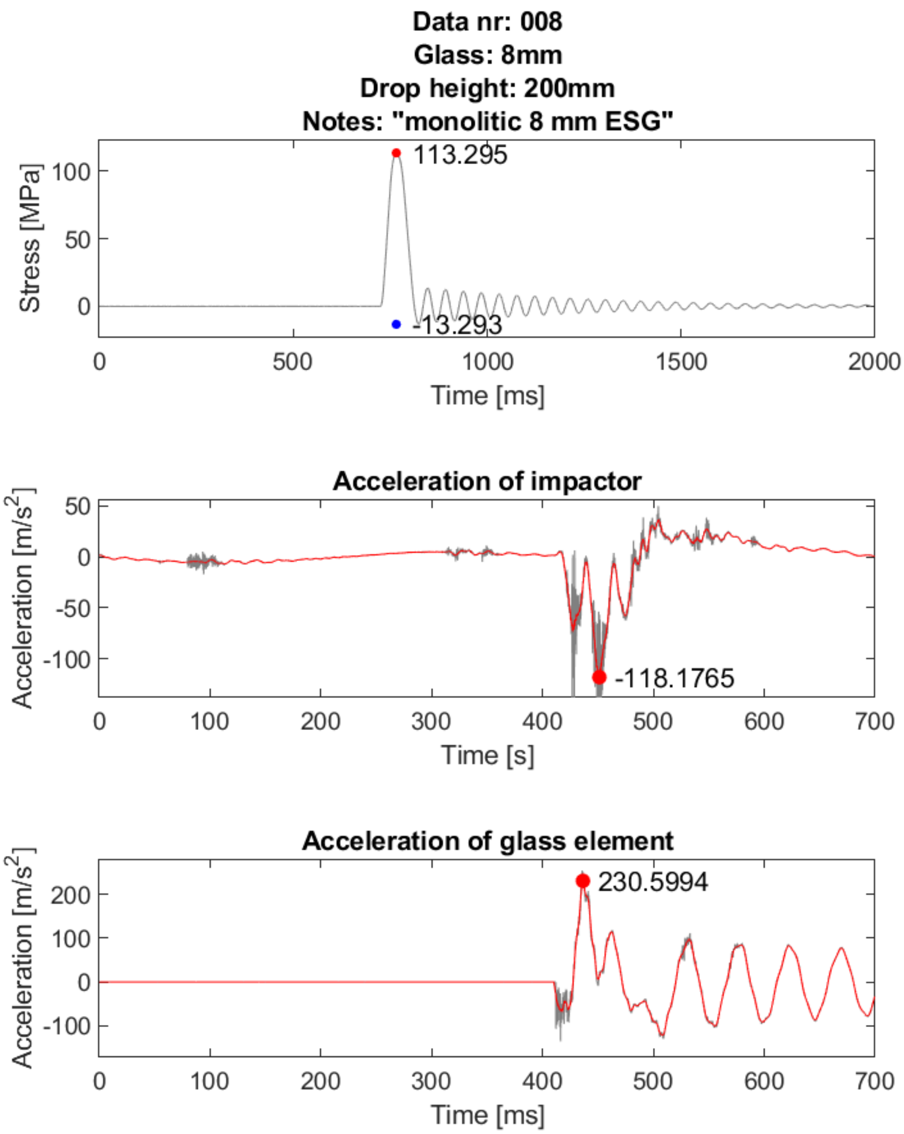
Data nr: 007
Glass: 8mm
Drop height: 200mm
Notes: "monolitic 8 mm ESG"
Stress [MPa]
113.148
-13.1663
Time [ms]

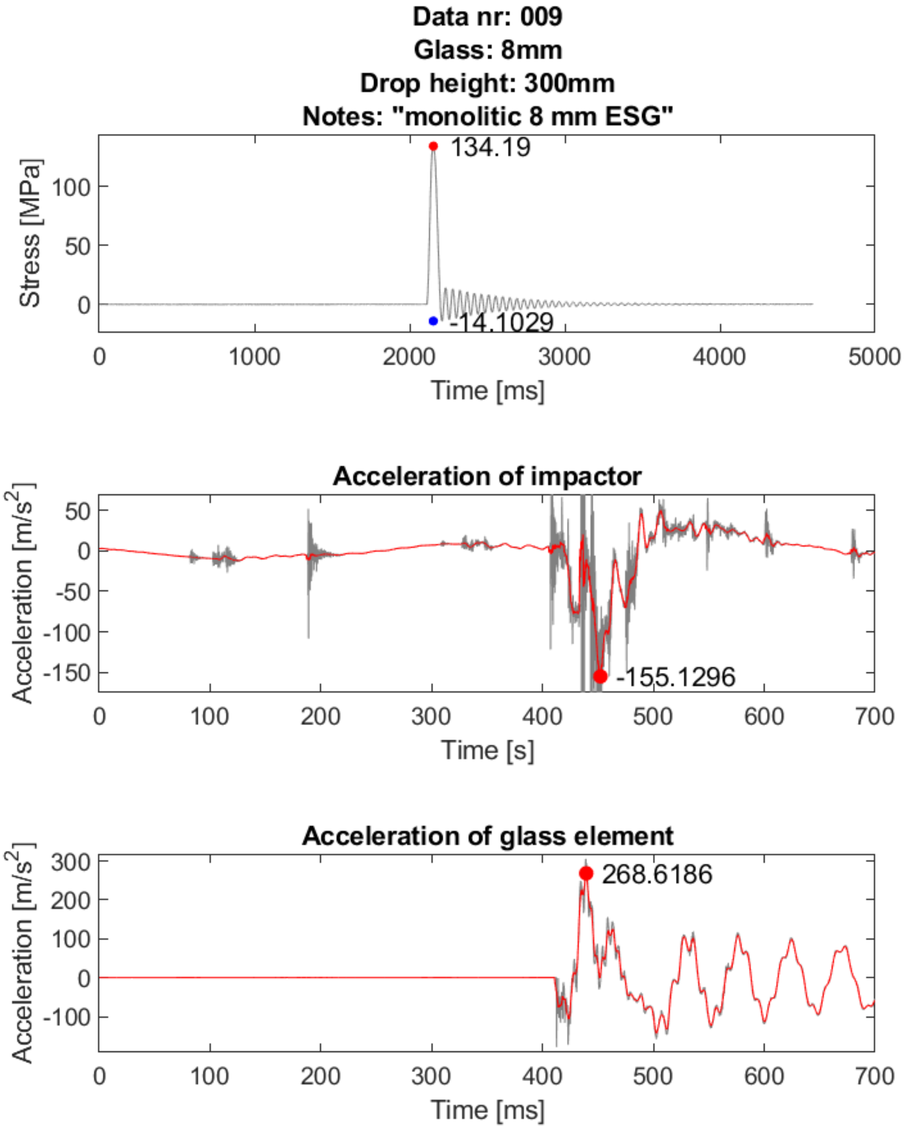


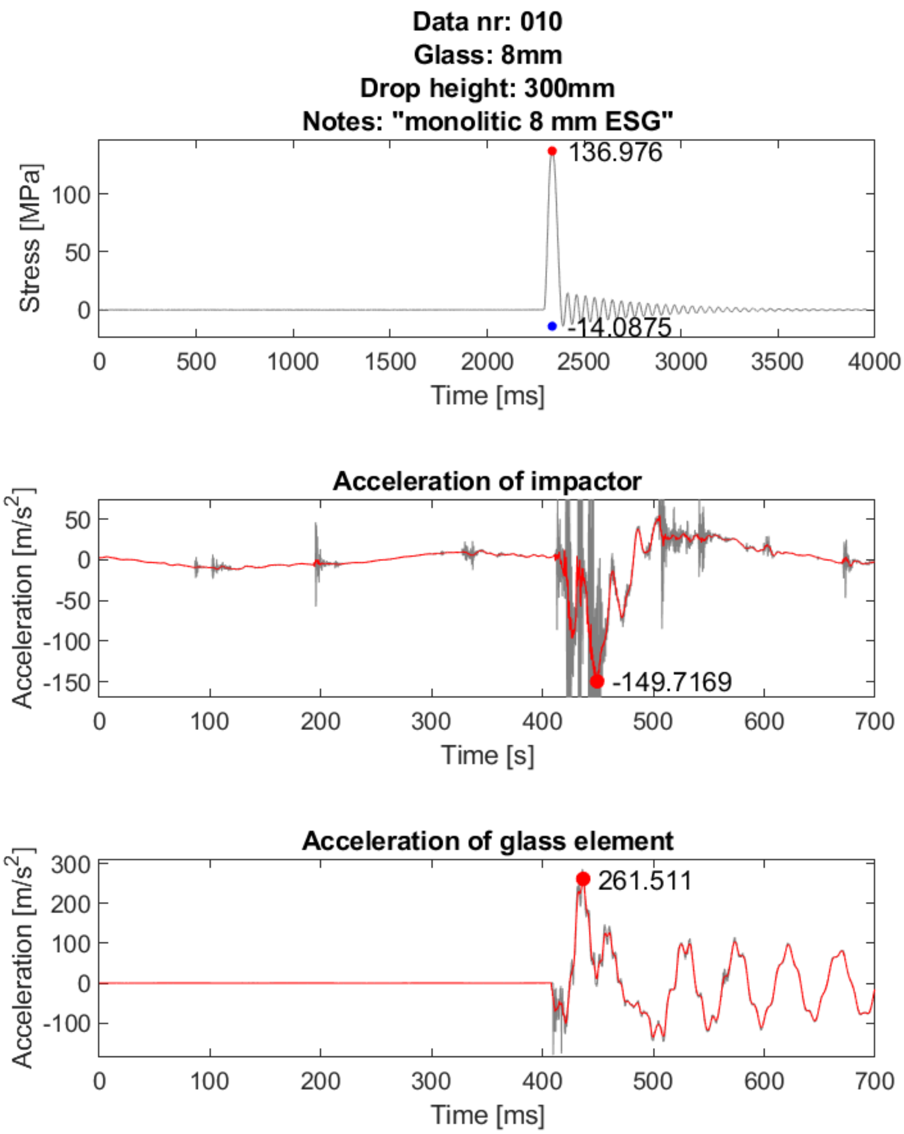
Acceleration of impactor
Acceleration [m/s^2]
-127.7527
Time [s]



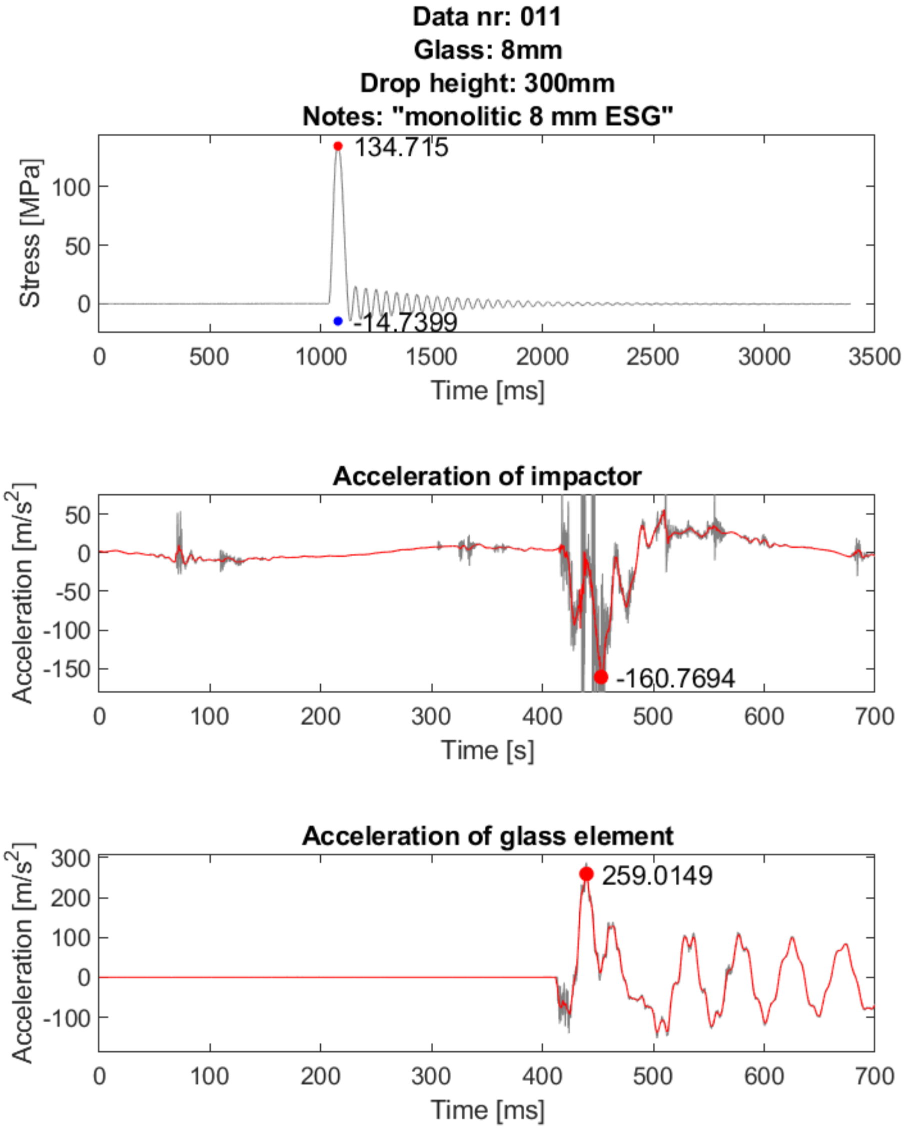
Acceleration of glass element
Acceleration [m/s^2]
220.0681
Time [ms]

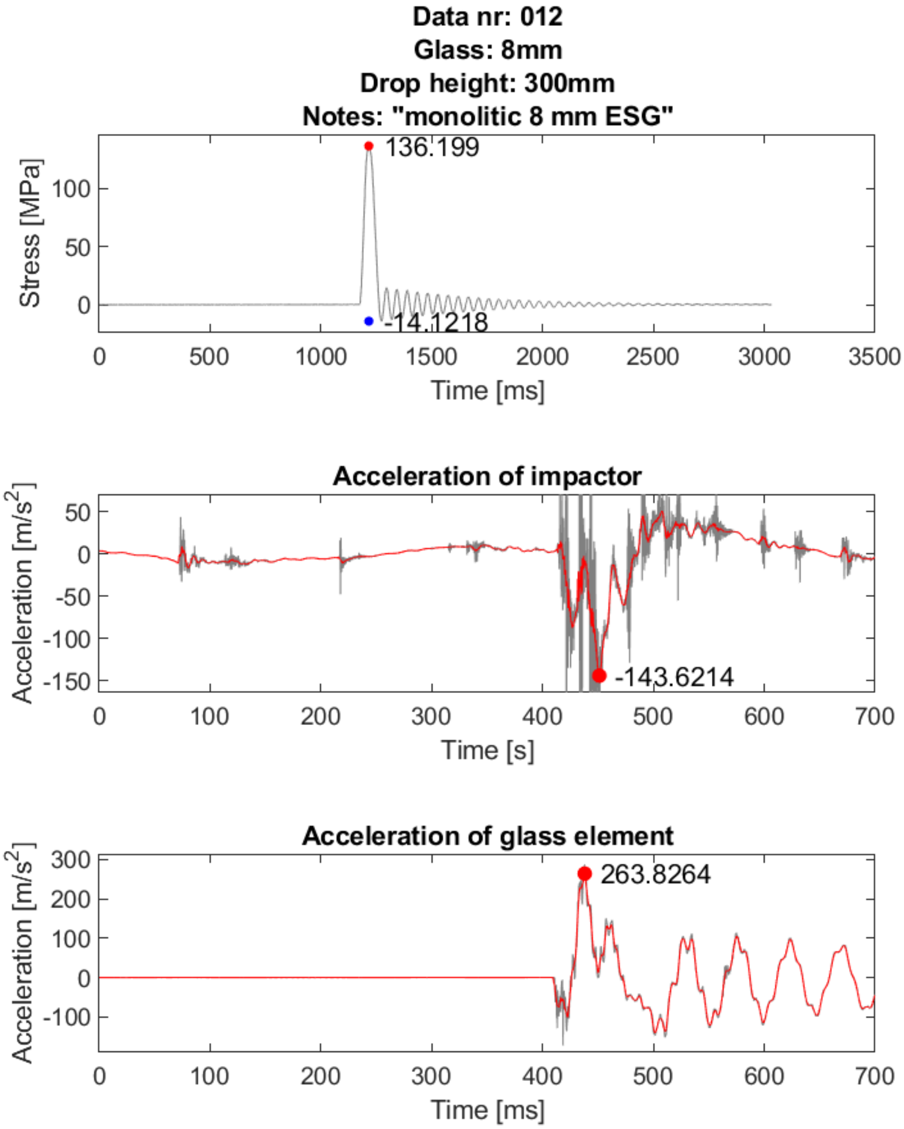

Data nr: 008
Glass: 8mm
Drop height: 200mm
Notes: "monolitic 8 mm ESG"
113.295
-13.293
Stress [MPa]
Time [ms]
Acceleration of impactor
-118.1765
Acceleration [m/s^2]
Time [s]
Acceleration of glass element
230.5994
Acceleration [m/s^2]
Time [ms]


Data nr: 009
Glass: 8mm
Drop height: 300mm
Notes: "monolitic 8 mm ESG"
134.19
-14.1029
Stress [MPa]
Time [ms]
Acceleration of impactor
-155.1296
Acceleration [m/s2]
Time [s]
Acceleration of glass element
268.6186
Acceleration [m/s2]
Time [ms]

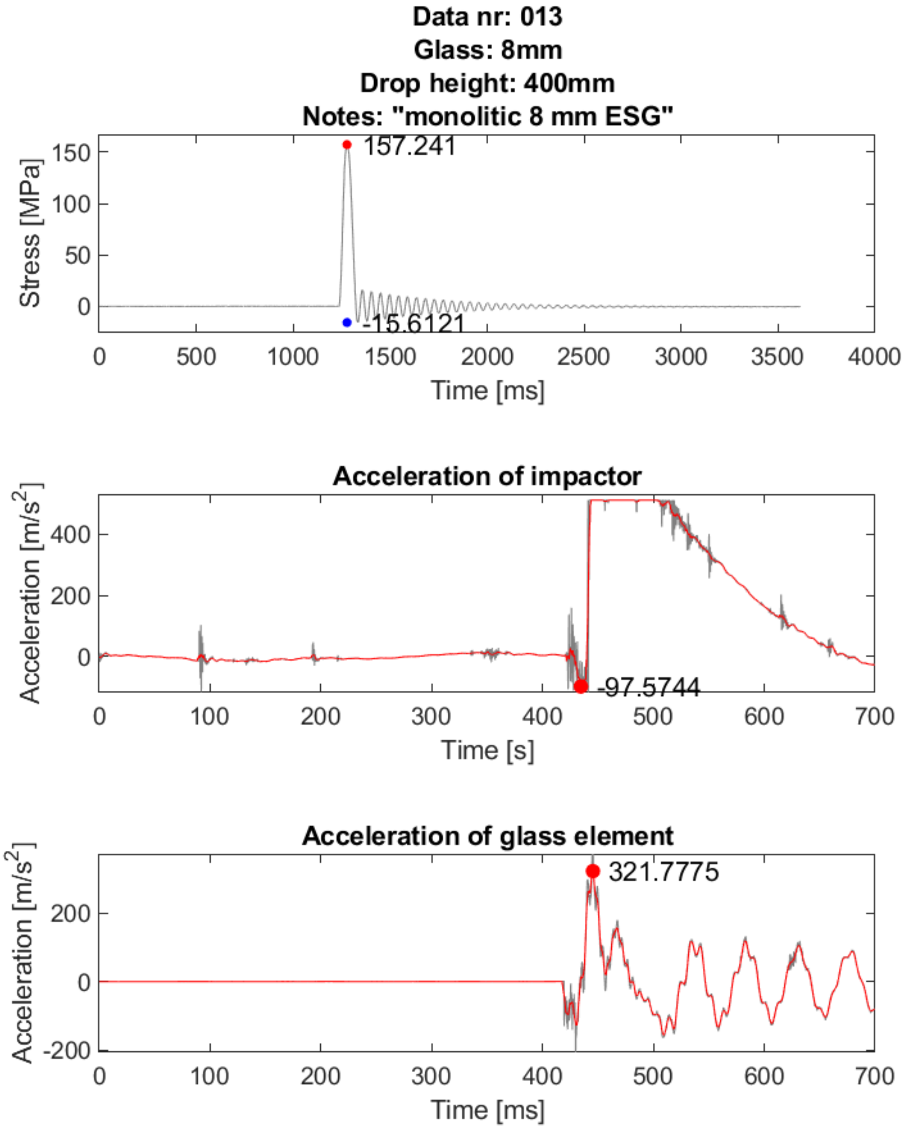


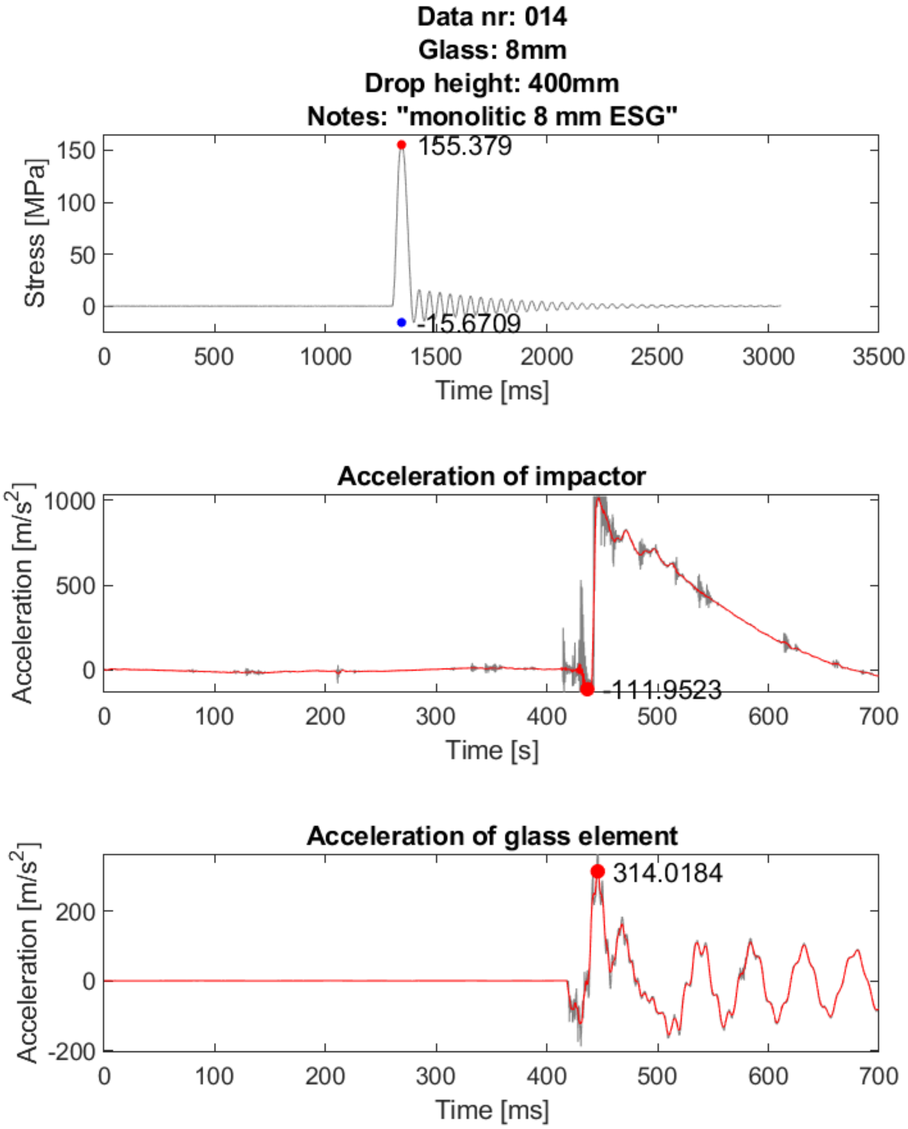
Data nr: 010
Glass: 8mm
Drop height: 300mm
Notes: "monolitic 8 mm ESG"
Stress [MPa]
136.976
-14.0875
Time [ms]
Acceleration of impactor
Acceleration [m/s^2]
-149.7169
Time [s]
Acceleration of glass element
Acceleration [m/s^2]
261.511
Time [ms]

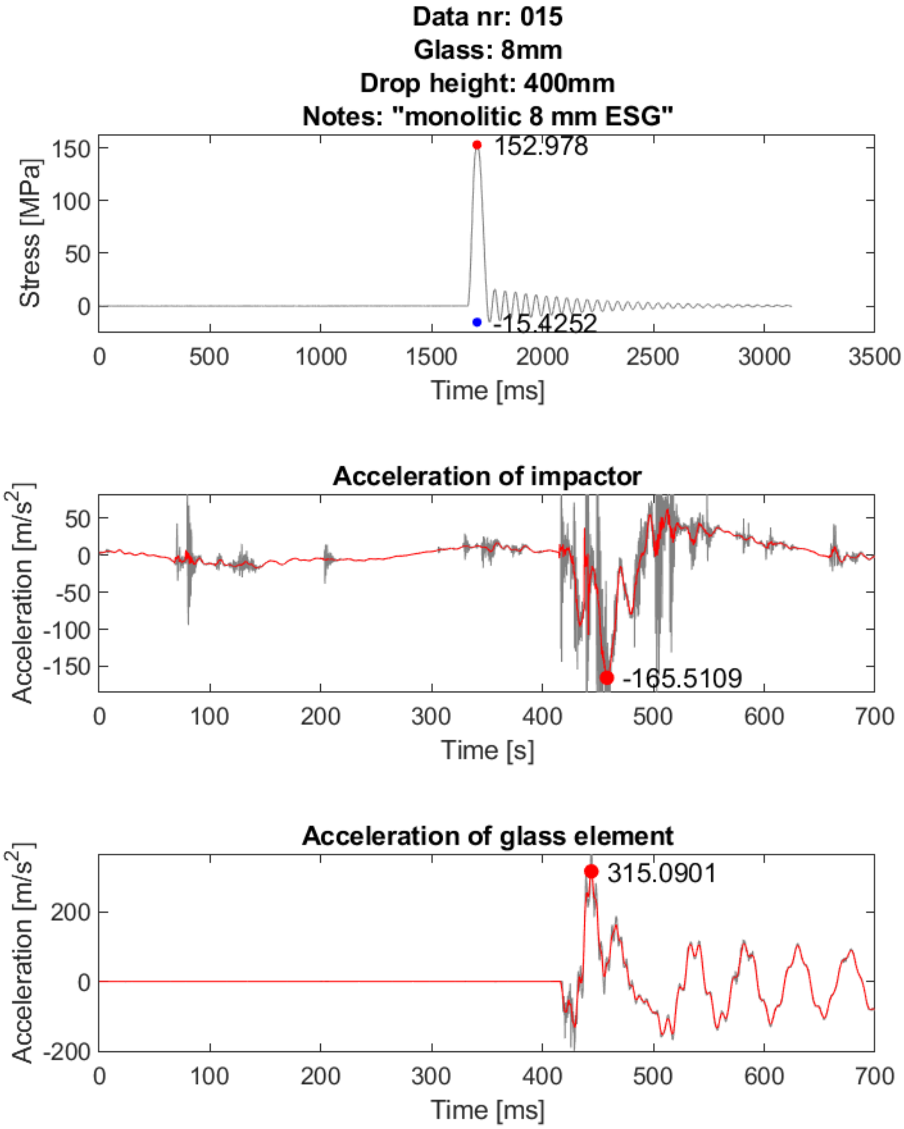

Data nr: 011
Glass: 8mm
Drop height: 300mm
Notes: "monolitic 8 mm ESG"
Stress [MPa]
134.715
-14.7399
Time [ms]
Acceleration of impactor
Acceleration [m/s^2]
-160.7694
Time [s]
Acceleration of glass element
Acceleration [m/s^2]
259.0149
Time [ms]



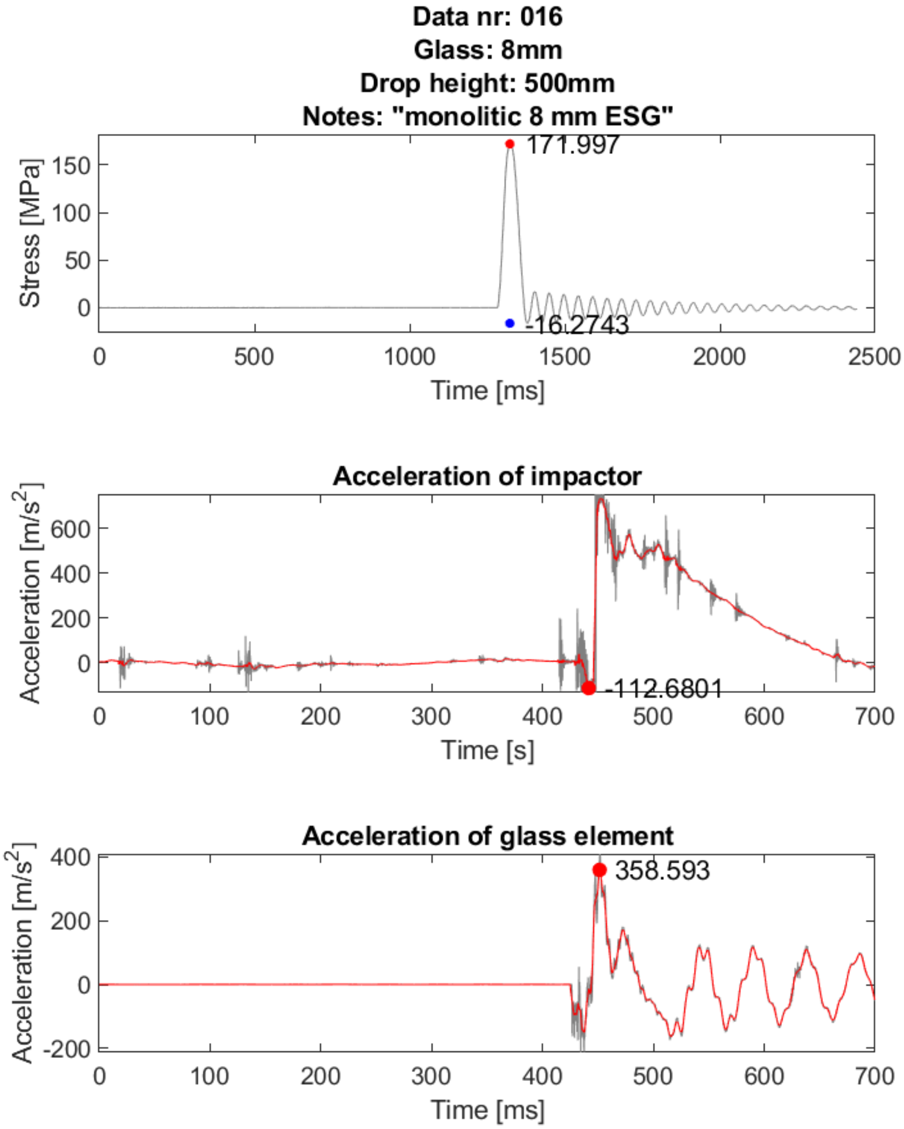
Data nr: 012
Glass: 8mm
Drop height: 300mm
Notes: "monolitic 8 mm ESG"
Stress [MPa]
136.199
-14.1218
Time [ms]
Acceleration of impactor
Acceleration [m/s^2]
-143.6214
Time [s]
Acceleration of glass element
Acceleration [m/s^2]
263.8264
Time [ms]


Data nr: 013
Glass: 8mm
Drop height: 400mm
Notes: "monolitic 8 mm ESG"
Stress [MPa]
157.241
-15.6121
Time [ms]
Acceleration of impactor
Acceleration [m/s^2]
-97.5744
Time [s]
Acceleration of glass element
Acceleration [m/s^2]
321.7775
Time [ms]

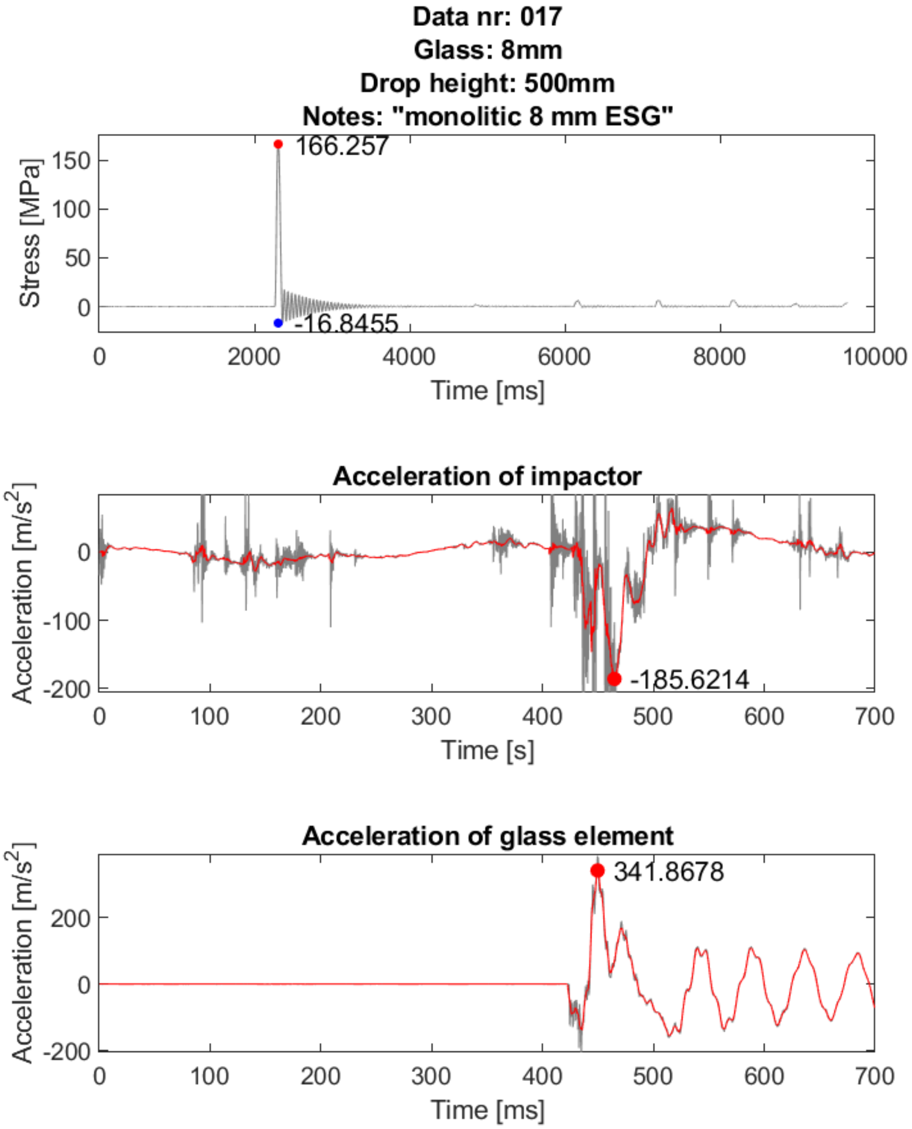

Data nr: 014
Glass: 8mm
Drop height: 400mm
Notes: "monolitic 8 mm ESG"
155.379
-15.6709
Stress [MPa]
150
100
50
0
0
500
1000
1500
2000
2500
3000
3500
Time [ms]
Acceleration of impactor
Acceleration [m/s^2]
1000
500
0
-111.9523
0
100
200
300
400
500
600
700
Time [s]
Acceleration of glass element
Acceleration [m/s^2]
314.0184
200
0
-200
0
100
200
300
400
500
600
700
Time [ms]

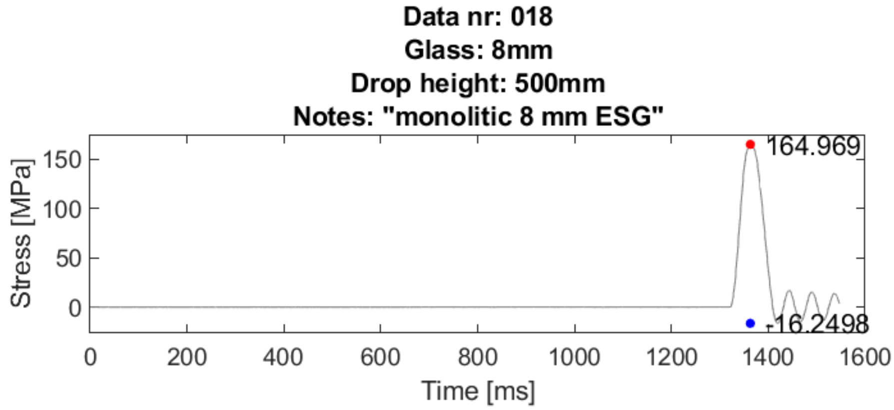


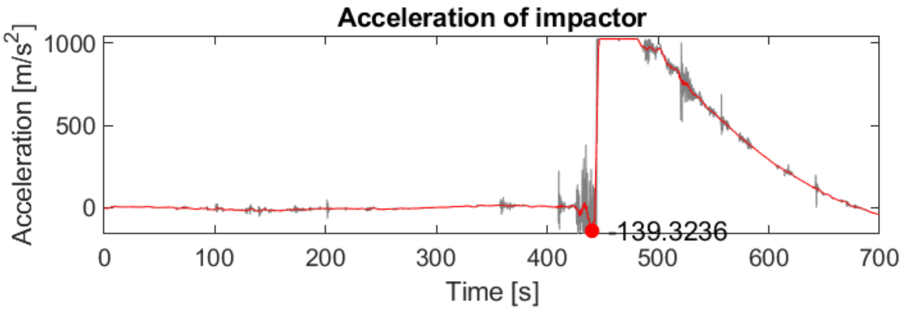
Data nr: 015
Glass: 8mm
Drop height: 400mm
Notes: "monolitic 8 mm ESG"
Stress [MPa]
152.978
-15.4252
Time [ms]
Acceleration of impactor
Acceleration [m/s^2]
-165.5109
Time [s]
Acceleration of glass element
Acceleration [m/s^2]
315.0901
Time [ms]

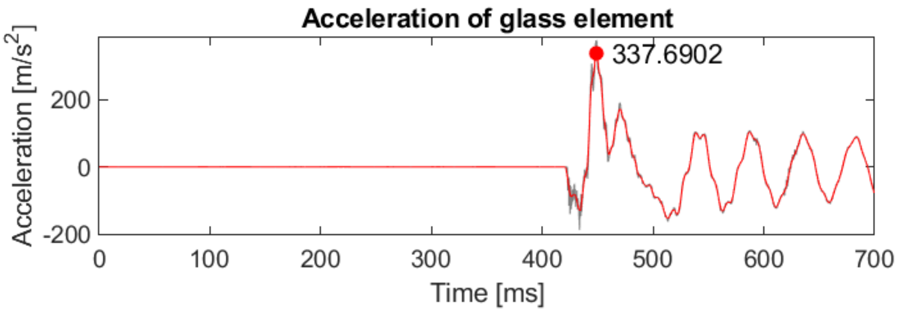


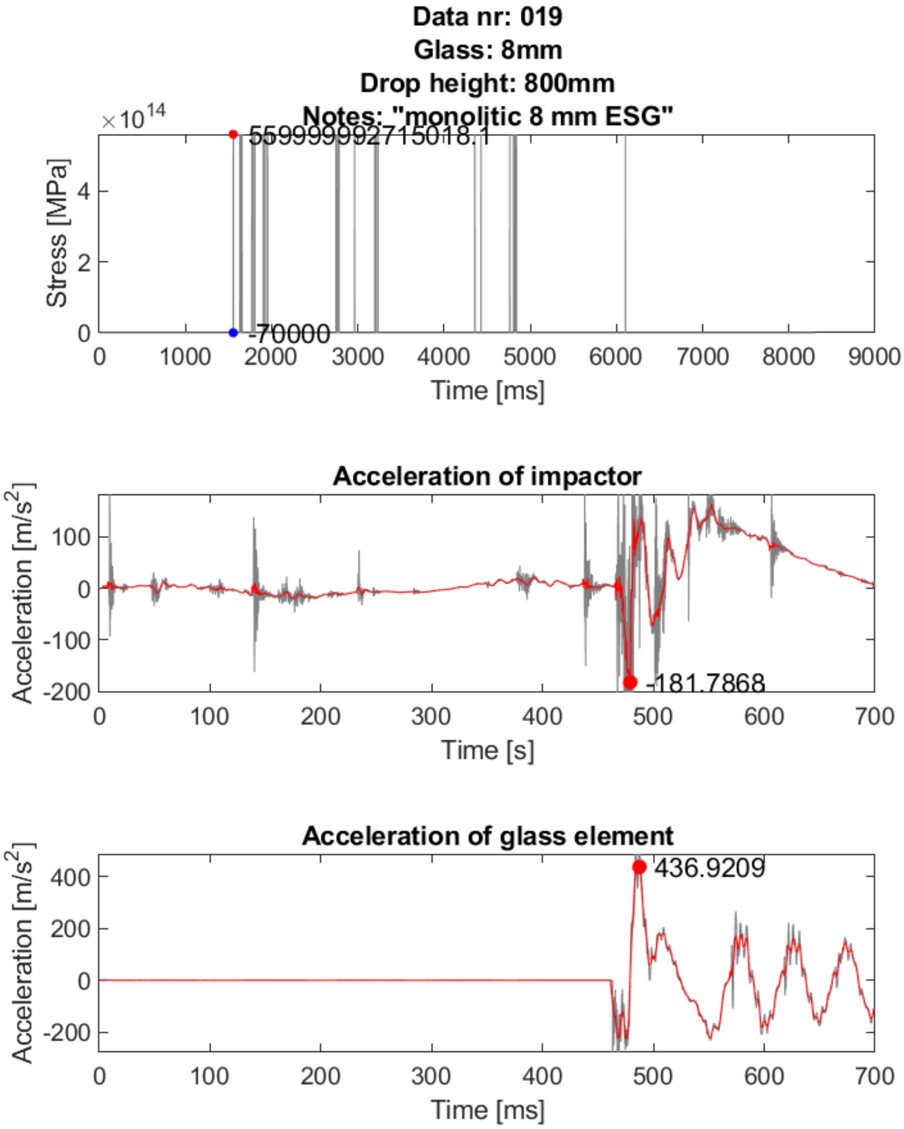
Data nr: 016
Glass: 8mm
Drop height: 500mm
Notes: "monolitic 8 mm ESG"
Stress [MPa]
171.997
-16.2743
Time [ms]
Acceleration of impactor
Acceleration [m/s^2]
-112.6801
Time [s]
Acceleration of glass element
Acceleration [m/s^2]
358.593
Time [ms]

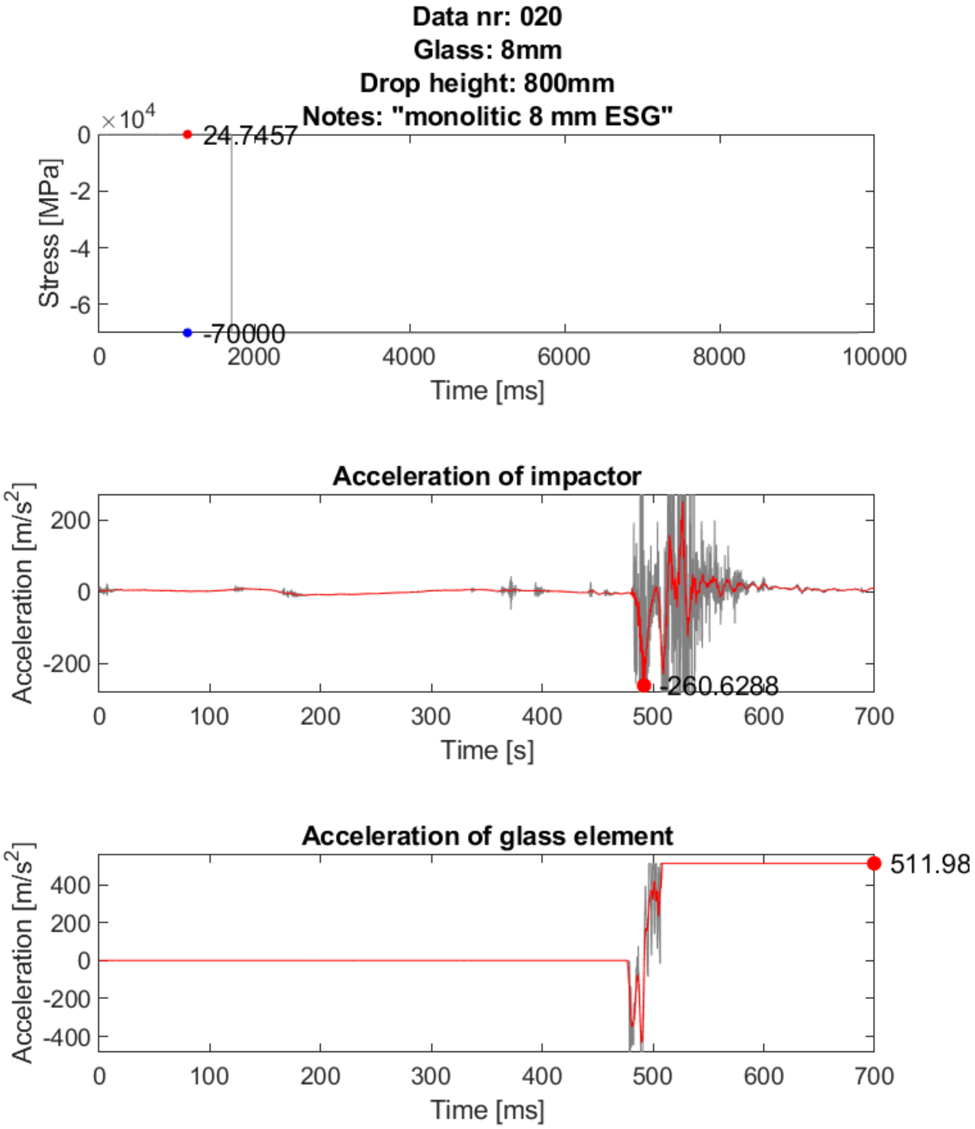

Data nr: 017
Glass: 8mm
Drop height: 500mm
Notes: "monolitic 8 mm ESG"
Stress [MPa]
166.257
-16.8455
Time [ms]
Acceleration of impactor
Acceleration [m/s^2]
-185.6214
Time [s]
Acceleration of glass element
Acceleration [m/s^2]
341.8678
Time [ms]


Data nr: 018
Glass: 8mm
Drop height: 500mm
Notes: "monolitic 8 mm ESG"
164.969
-16.2498
Stress [MPa]
150
100
50
0
0
200
400
600
800
1000
1200
1400
1600
Time [ms]

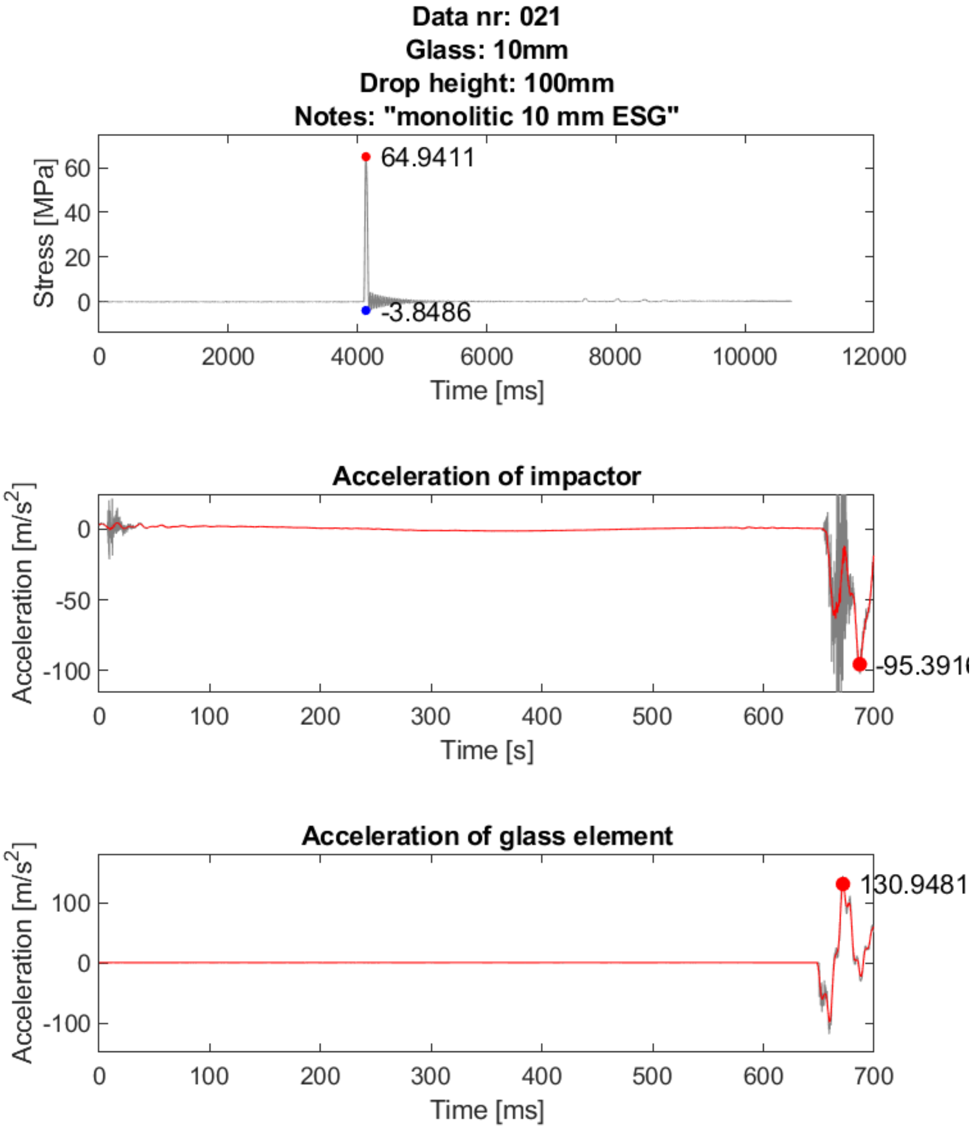

Acceleration of impactor
Acceleration [m/s2]
1000
500
0
-139.3236
0
100
200
300
400
500
600
700
Time [s]

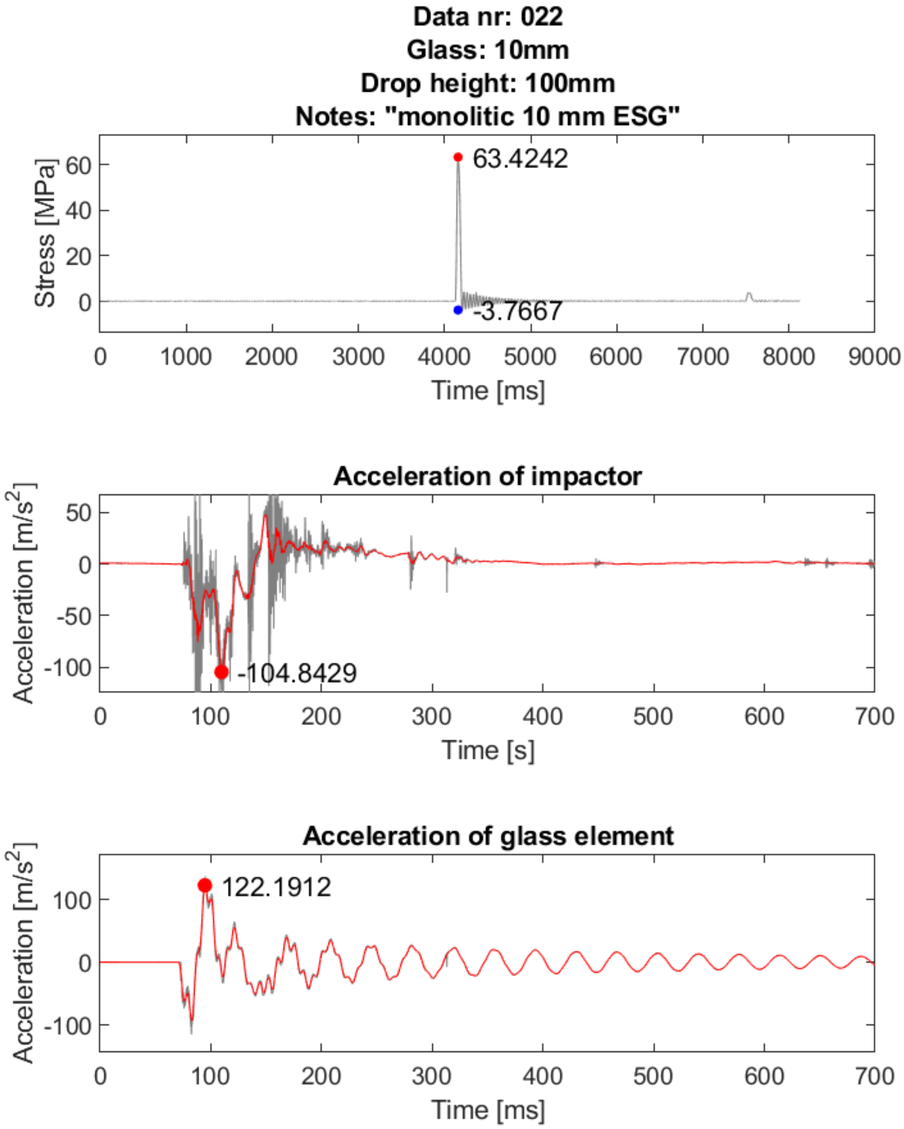

Acceleration of glass element
337.6902
Acceleration [m/s2]
200
0
-200
0
100
200
300
400
500
600
700
Time [ms]

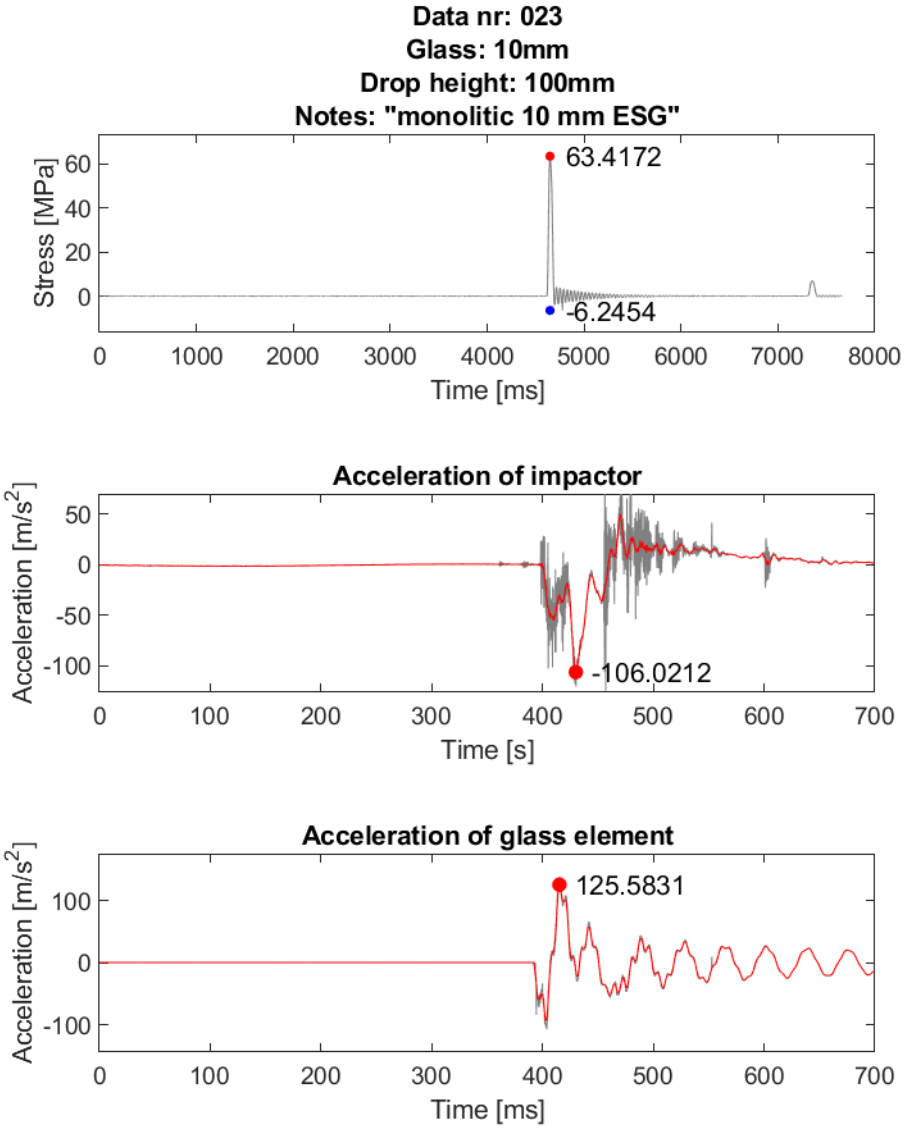

Data nr: 019
Glass: 8mm
Drop height: 800mm
Notes: "monolitic 8 mm ESG"
×10^14
5599999927150l8.1
-70000
Stress [MPa]
Time [ms]
Acceleration of impactor
-181.7868
Acceleration [m/s^2]
Time [s]
Acceleration of glass element
436.9209
Acceleration [m/s^2]
Time [ms]

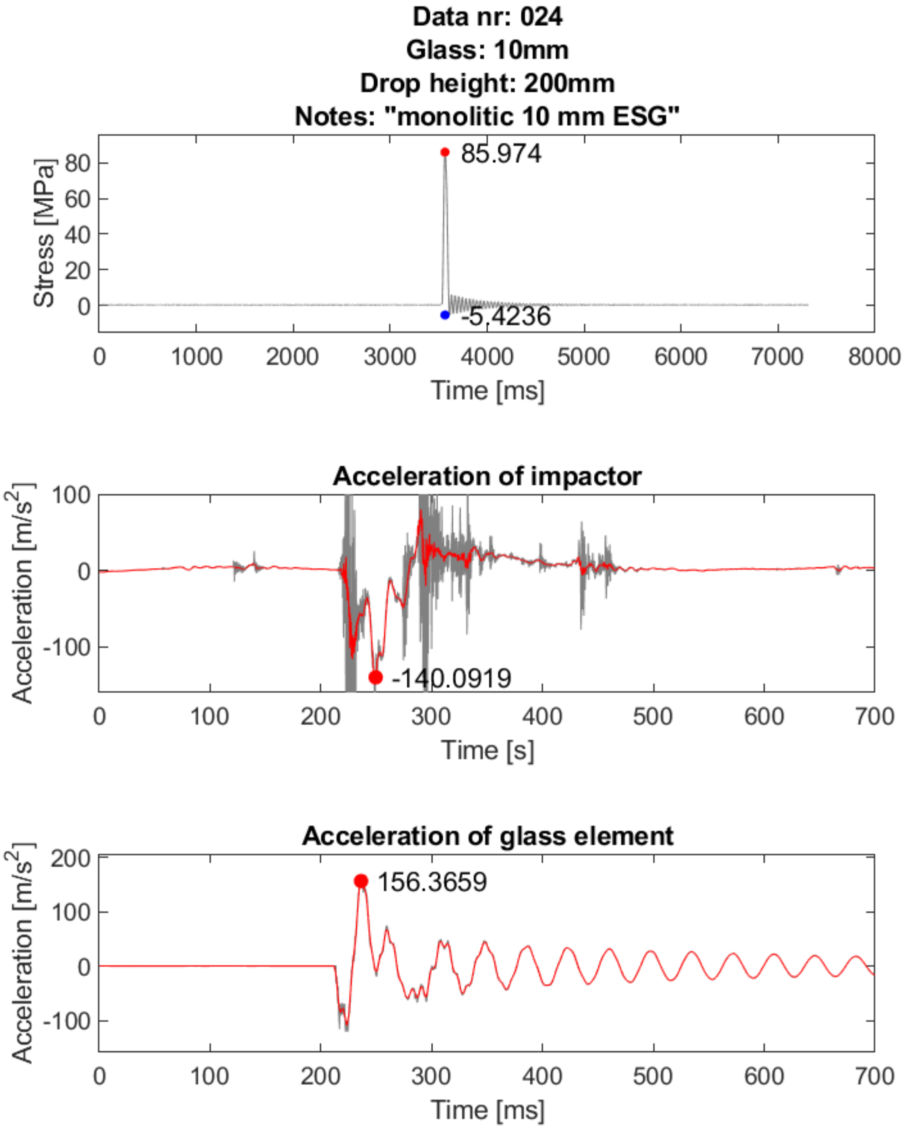


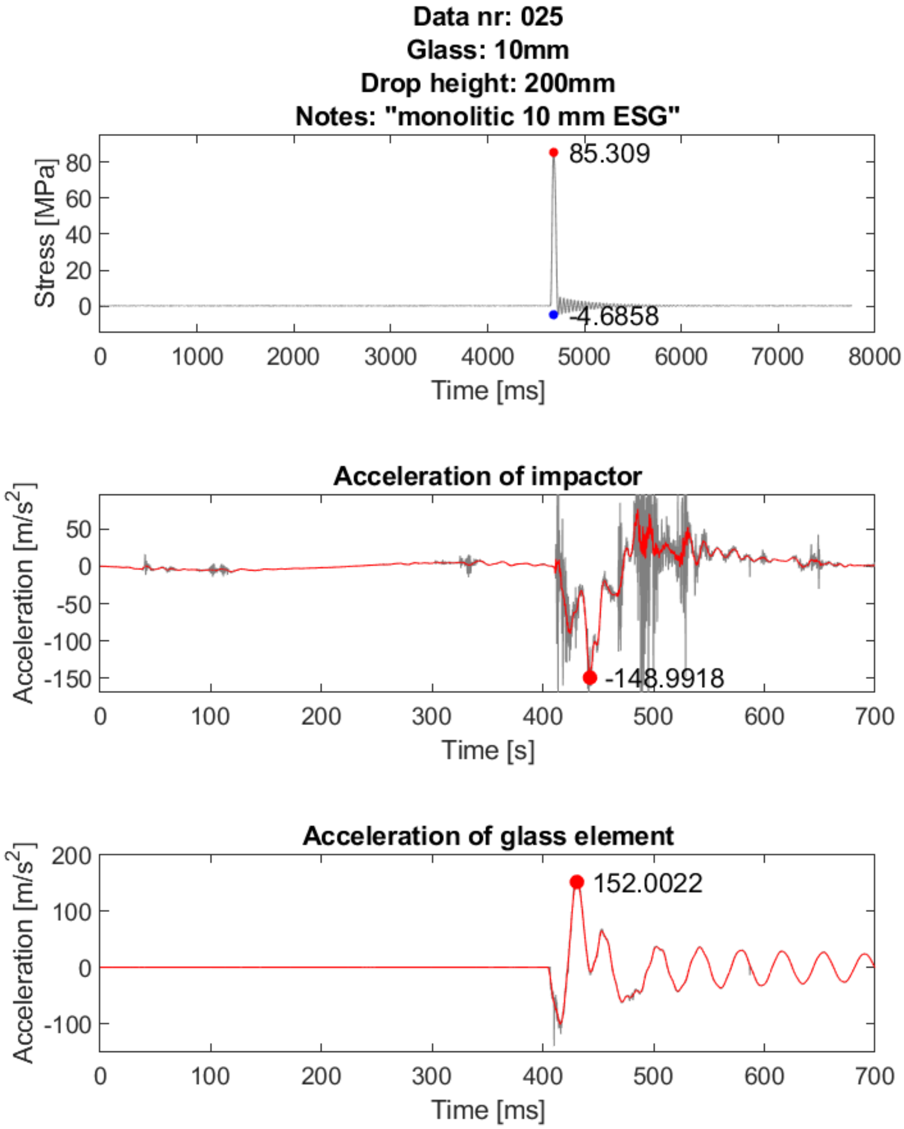
Data nr: 020
Glass: 8mm
Drop height: 800mm
Notes: "monolitic 8 mm ESG"
×10^4
24.7457
-70000
Stress [MPa]
Time [ms]
Acceleration of impactor
-260.6288
Acceleration [m/s^2]
Time [s]
Acceleration of glass element
511.98
Acceleration [m/s^2]
Time [ms]


Data nr: 021
Glass: 10mm
Drop height: 100mm
Notes: "monolitic 10 mm ESG"
Stress [MPa]
64.9411
-3.8486
Time [ms]
Acceleration of impactor
Acceleration [m/s^2]
-95.391
Time [s]
Acceleration of glass element
Acceleration [m/s^2]
130.9481
Time [ms]

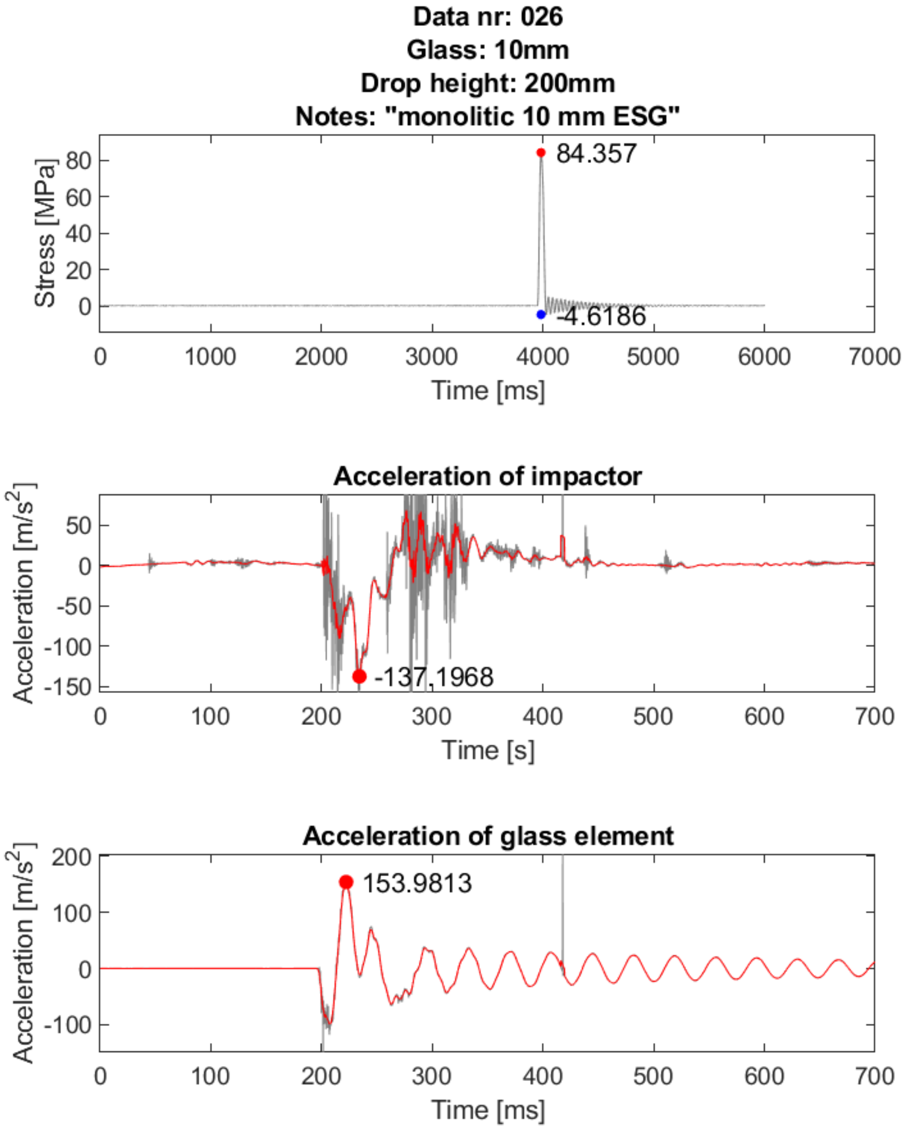

Data nr: 022
Glass: 10mm
Drop height: 100mm
Notes: "monolitic 10 mm ESG"
Stress [MPa]
63.4242
-3.7667
0
20
40
60
0
1000
2000
3000
4000
5000
6000
7000
8000
9000
Time [ms]
Acceleration of impactor
Acceleration [m/s^2]
50
0
-50
-100
-104.8429
0
100
200
300
400
500
600
700
Time [s]
Acceleration of glass element
Acceleration [m/s^2]
122.1912
100
0
-100
0
100
200
300
400
500
600
700
Time [ms]

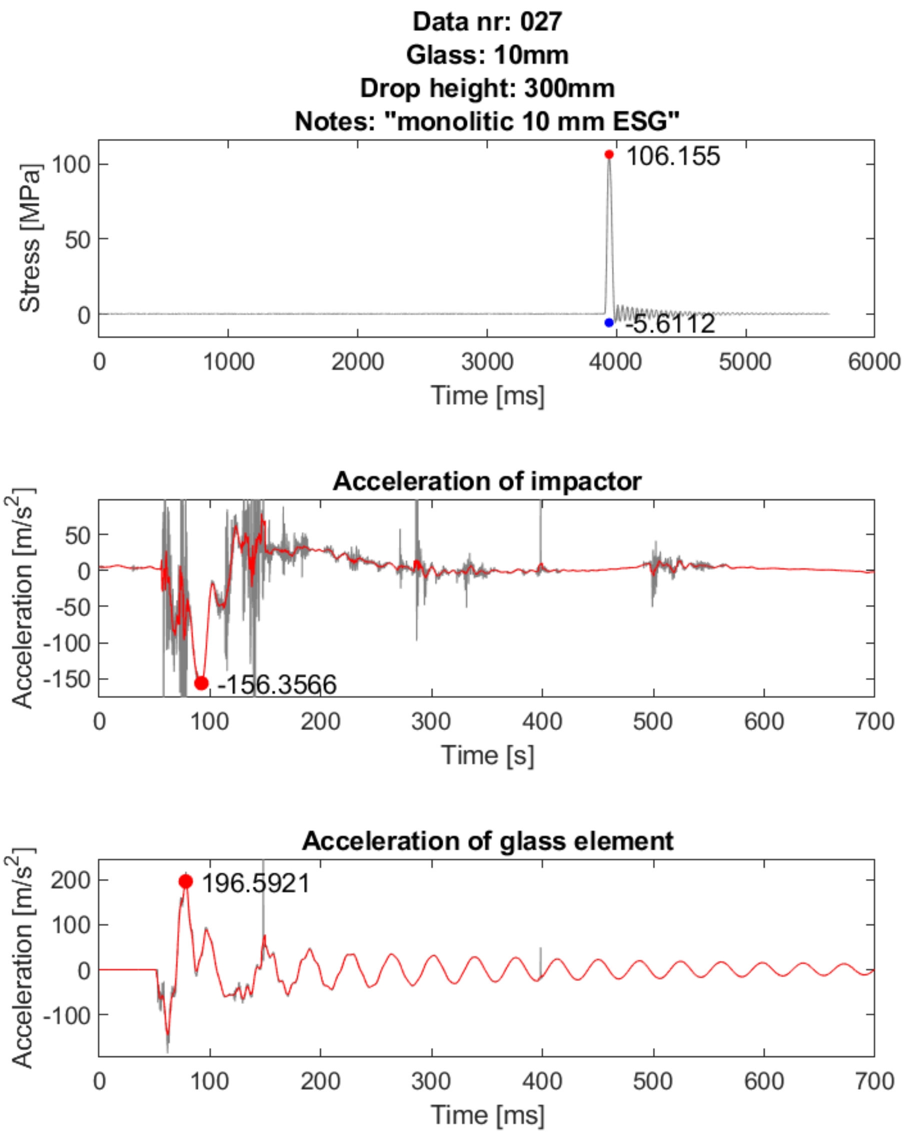

Data nr: 023
Glass: 10mm
Drop height: 100mm
Notes: "monolitic 10 mm ESG"
63.4172
-6.2454
Stress [MPa]
Time [ms]
Acceleration of impactor
-106.0212
Acceleration [m/s^2]
Time [s]
Acceleration of glass element
125.5831
Acceleration [m/s^2]
Time [ms]

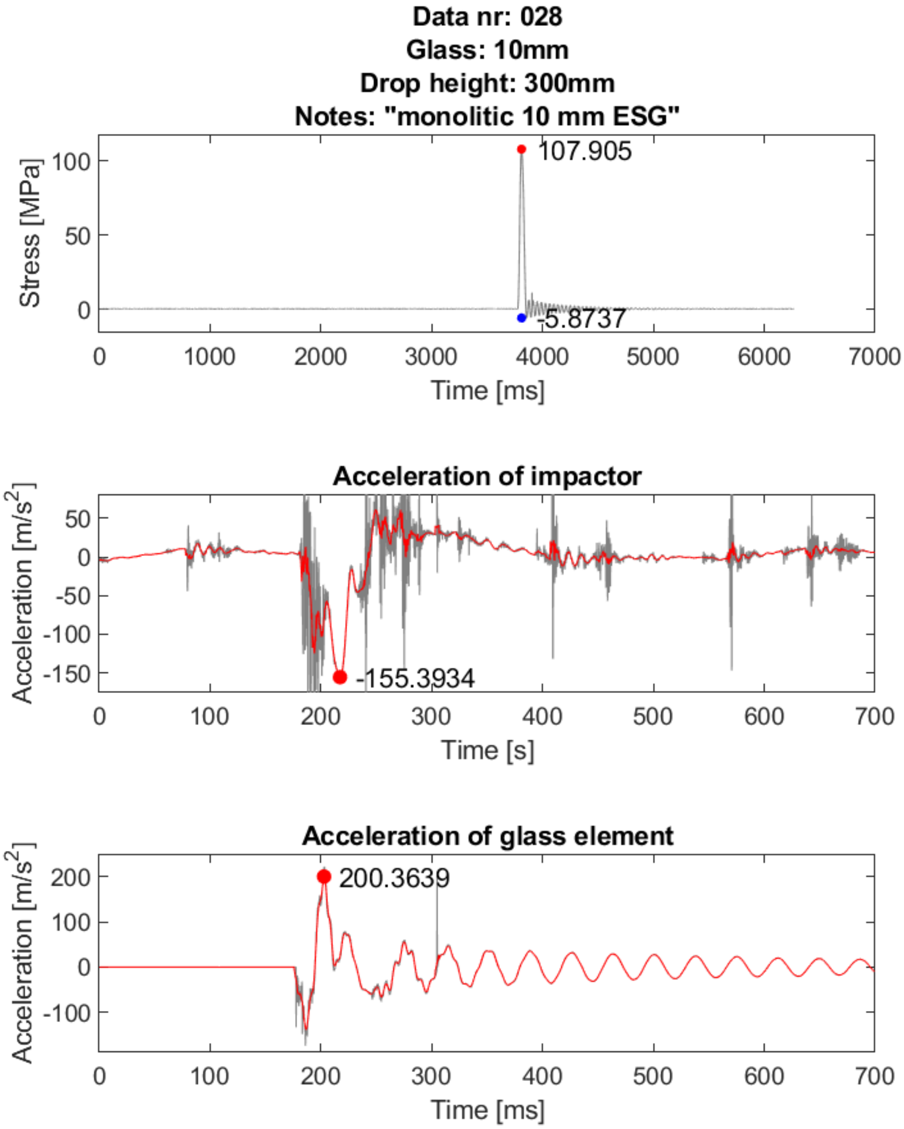

Data nr: 024
Glass: 10mm
Drop height: 200mm
Notes: "monolitic 10 mm ESG"
Stress [MPa]
85.974
-5.4236
Time [ms]
Acceleration of impactor
Acceleration [m/s^2]
-140.0919
Time [s]
Acceleration of glass element
Acceleration [m/s^2]
156.3659
Time [ms]

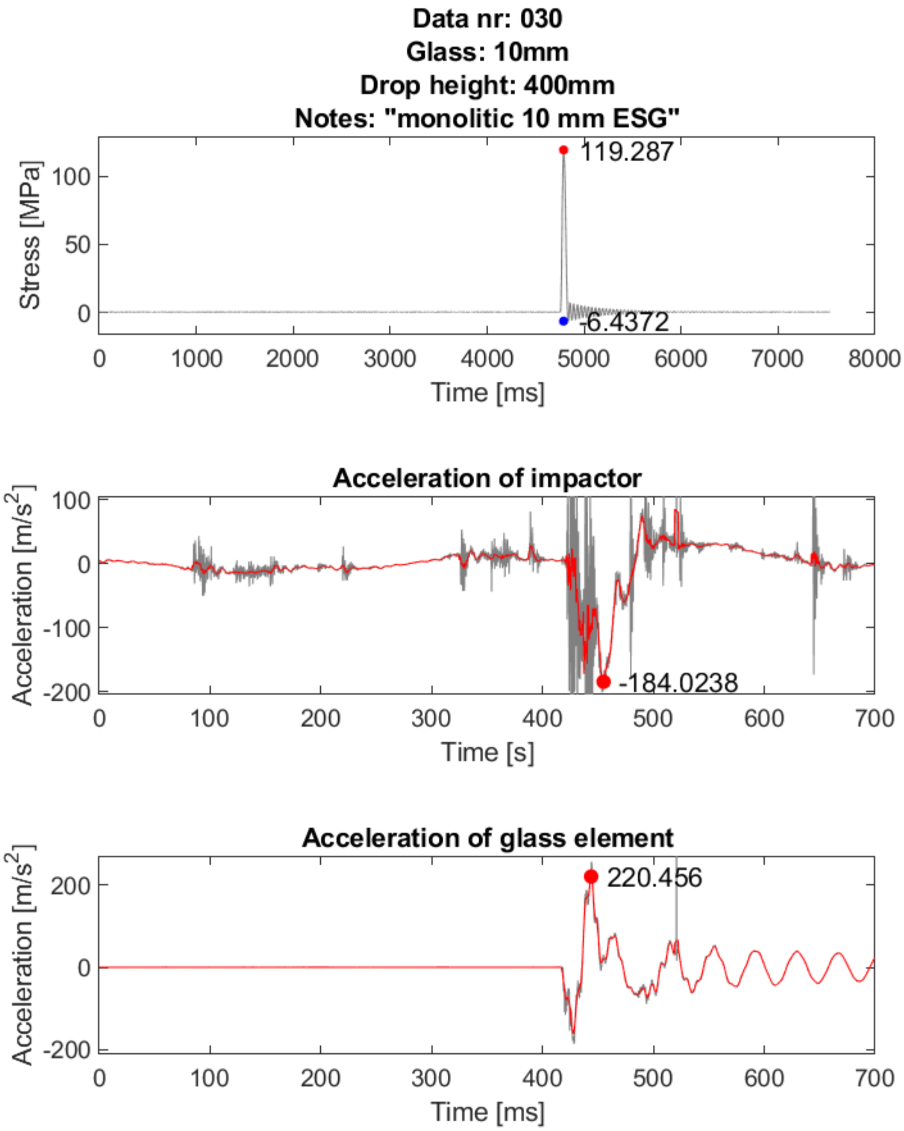


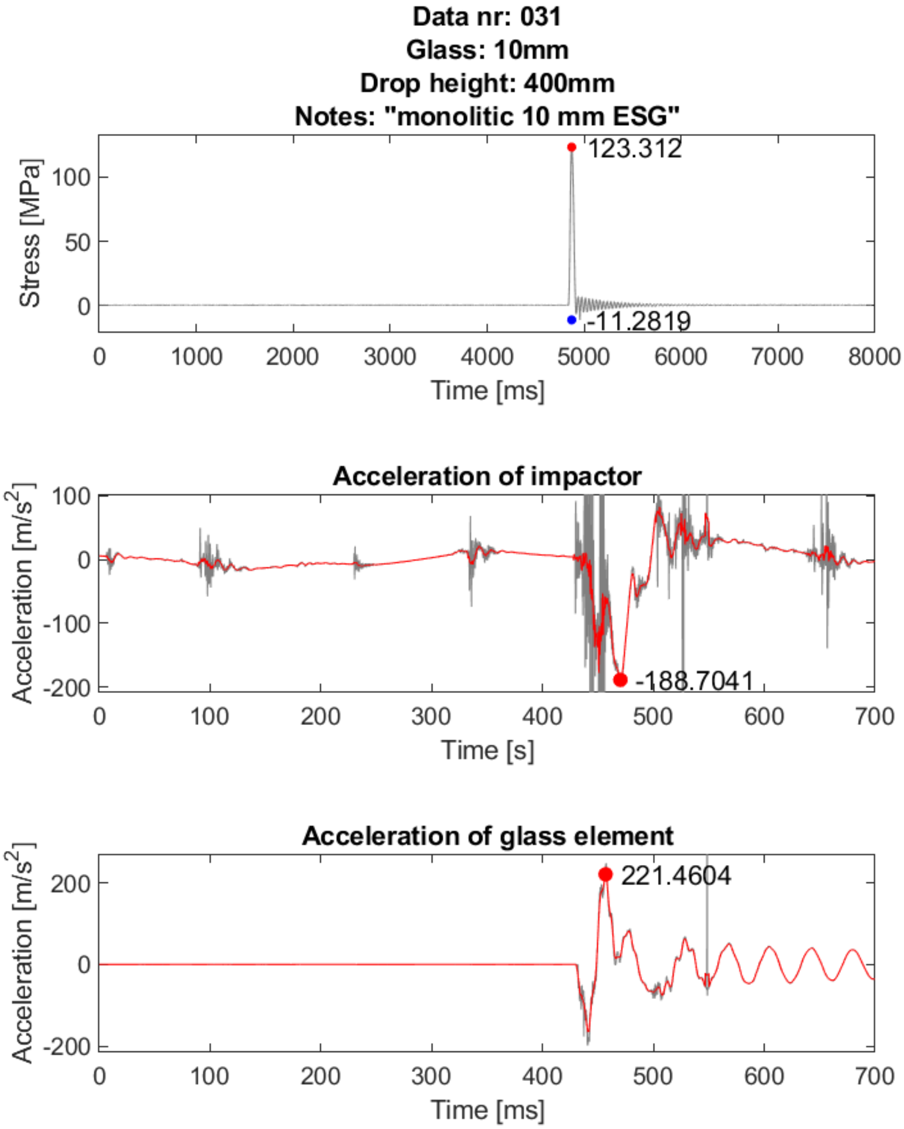
Data nr: 025
Glass: 10mm
Drop height: 200mm
Notes: "monolitic 10 mm ESG"
Stress [MPa]
85.309
-4.6858
Time [ms]
Acceleration of impactor
Acceleration [m/s^2]
-148.9918
Time [s]
Acceleration of glass element
Acceleration [m/s^2]
152.0022
Time [ms]

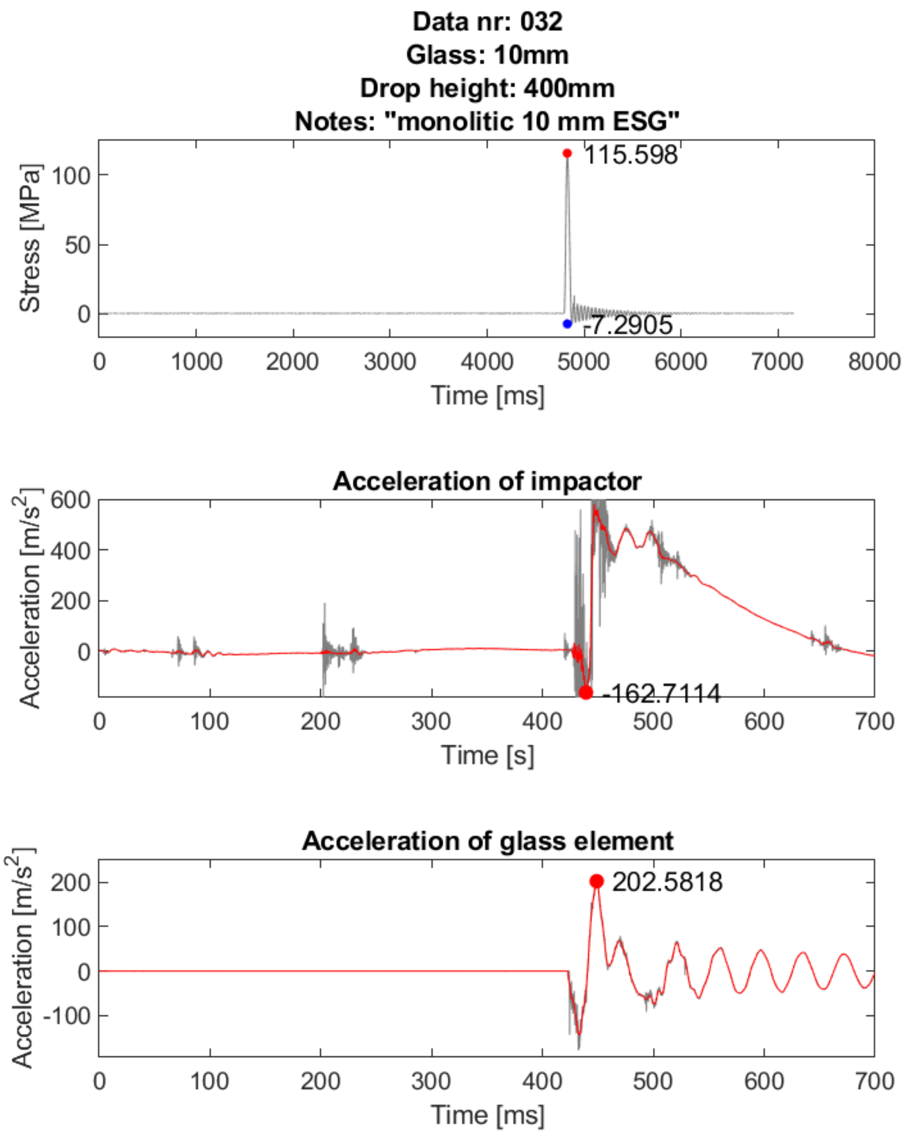

Data nr: 026
Glass: 10mm
Drop height: 200mm
Notes: "monolitic 10 mm ESG"
Stress [MPa]
84.357
-4.6186
Time [ms]
Acceleration of impactor
Acceleration [m/s^2]
-137.1968
Time [s]
Acceleration of glass element
Acceleration [m/s^2]
153.9813
Time [ms]

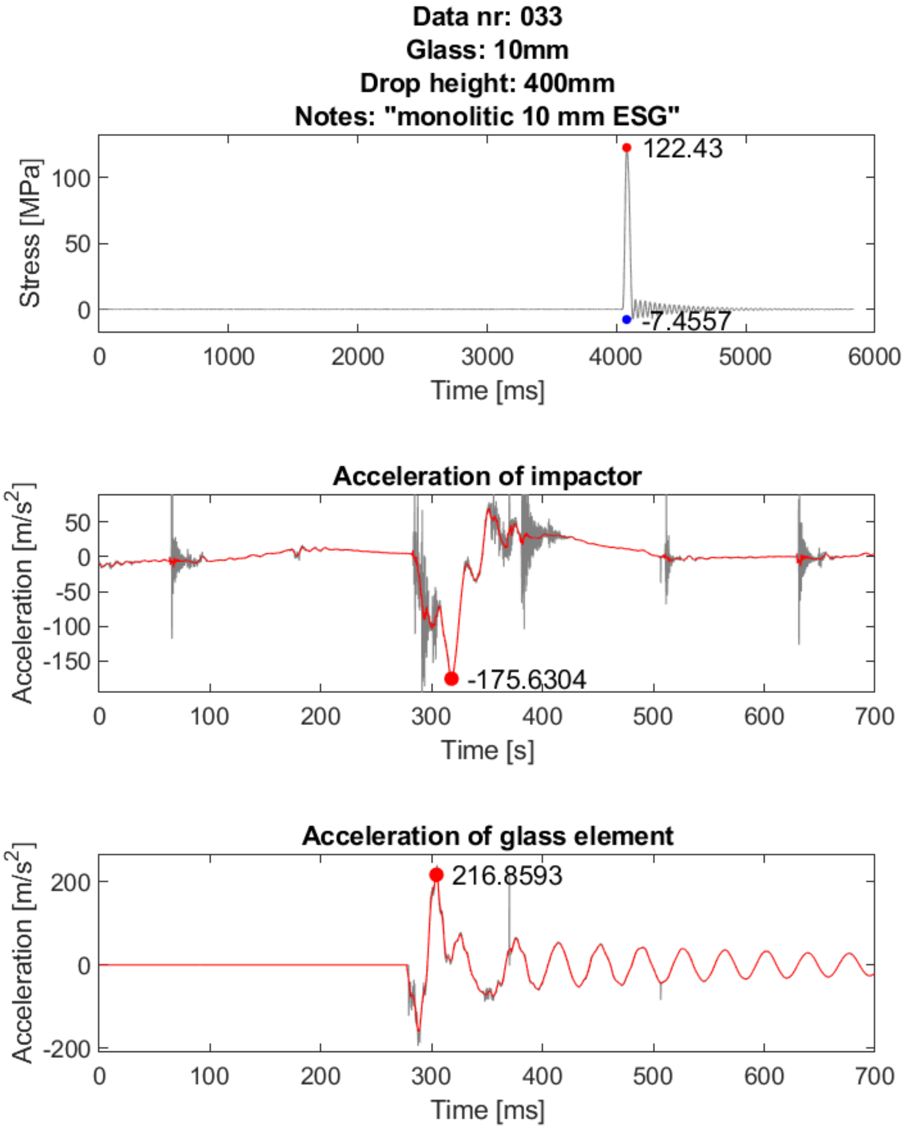

Data nr: 027
Glass: 10mm
Drop height: 300mm
Notes: "monolitic 10 mm ESG"
Stress [MPa]
106.155
-5.6112
Time [ms]
Acceleration of impactor
Acceleration [m/s2]
-156.3566
Time [s]
Acceleration of glass element
Acceleration [m/s2]
196.5921
Time [ms]

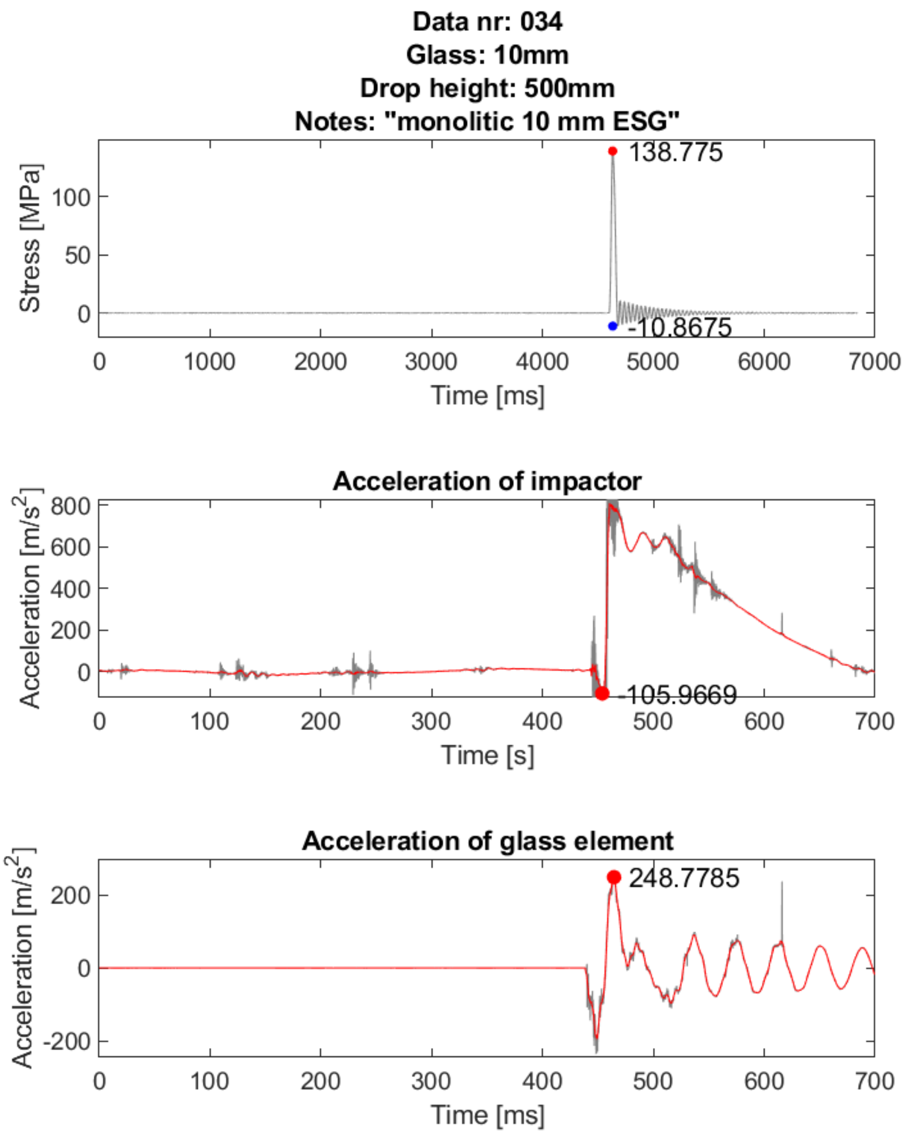

Data nr: 028
Glass: 10mm
Drop height: 300mm
Notes: "monolitic 10 mm ESG"
Stress [MPa]
107.905
-5.8737
Time [ms]
Acceleration of impactor
Acceleration [m/s2]
-155.3934
Time [s]
Acceleration of glass element
Acceleration [m/s2]
200.3639
Time [ms]

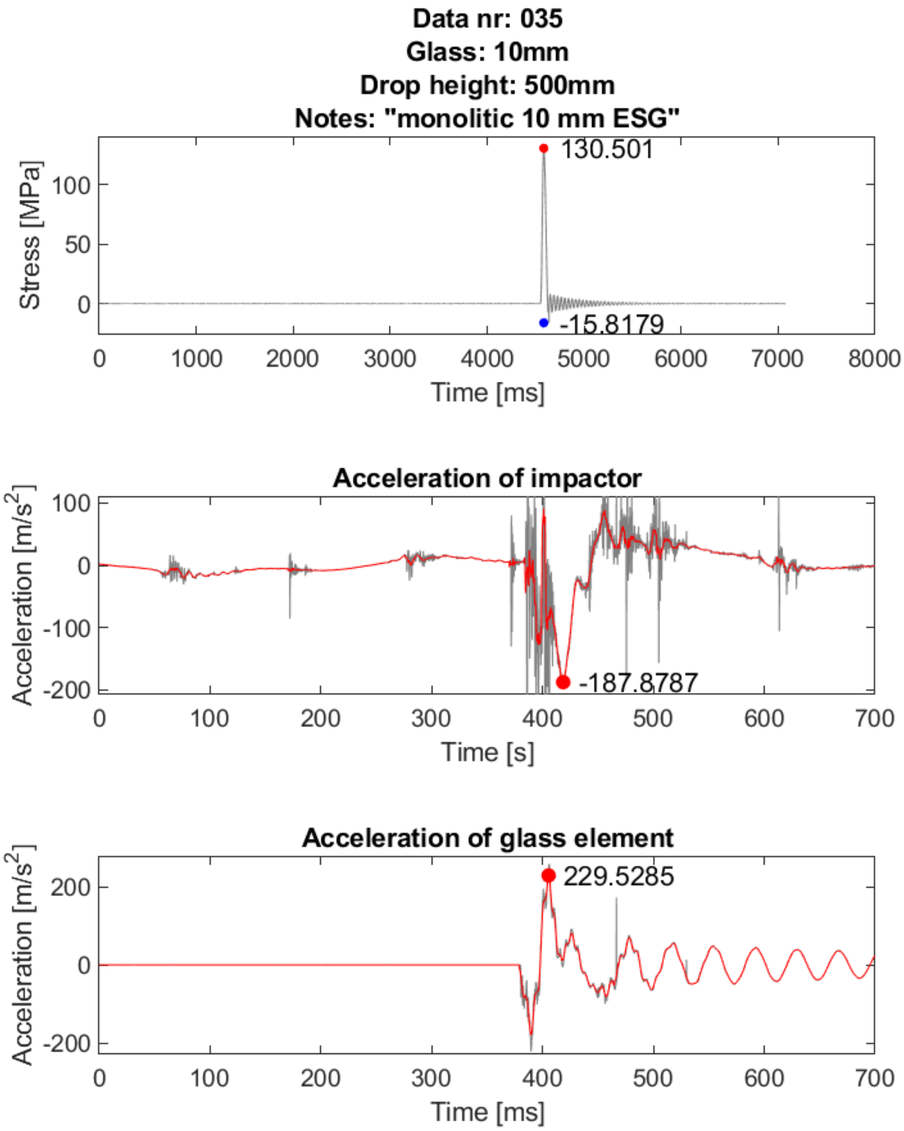

Data nr: 030
Glass: 10mm
Drop height: 400mm
Notes: "monolitic 10 mm ESG"
Stress [MPa]
119.287
-6.4372
Time [ms]
Acceleration of impactor
Acceleration [m/s^2]
-184.0238
Time [s]
Acceleration of glass element
Acceleration [m/s^2]
220.456
Time [ms]

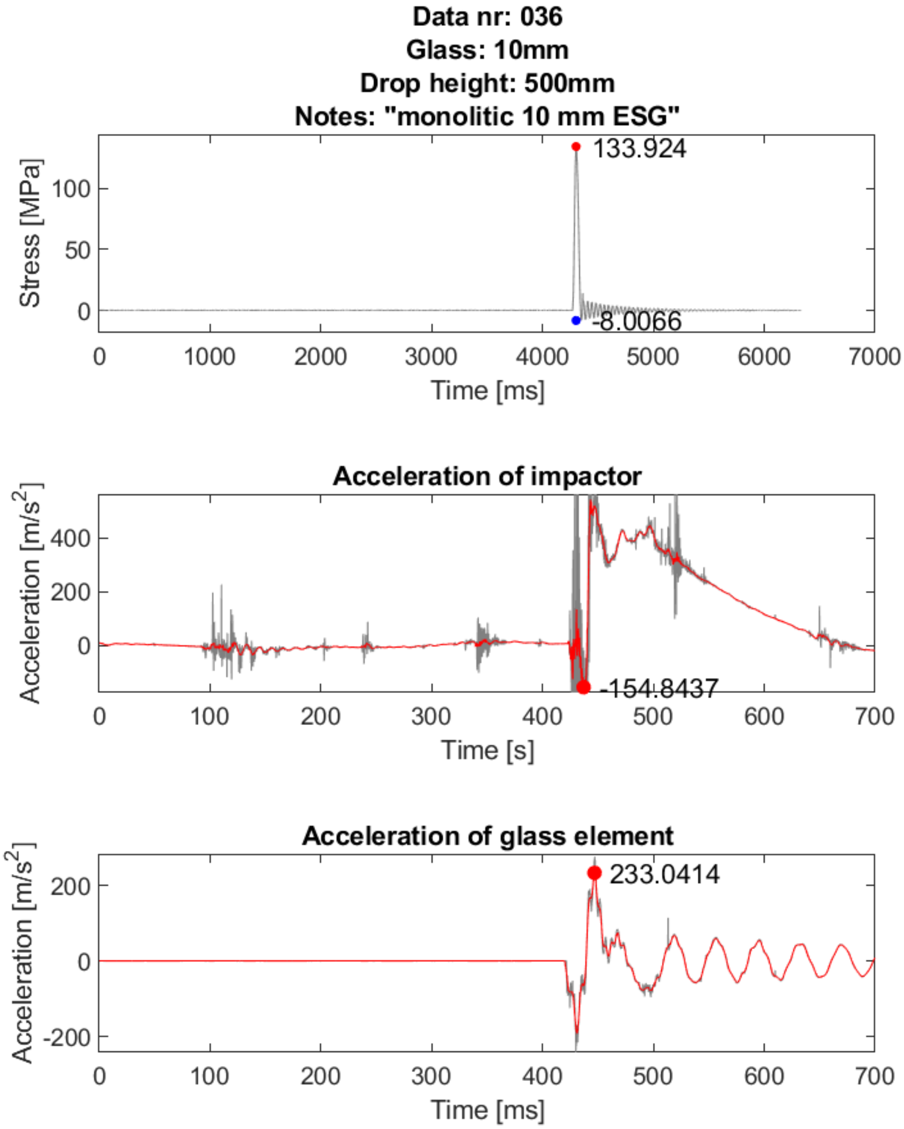

Data nr: 031
Glass: 10mm
Drop height: 400mm
Notes: "monolitic 10 mm ESG"
Stress [MPa]
123.312
-11.2819
Time [ms]
Acceleration of impactor
Acceleration [m/s2]
-188.7041
Time [s]
Acceleration of glass element
Acceleration [m/s2]
221.4604
Time [ms]

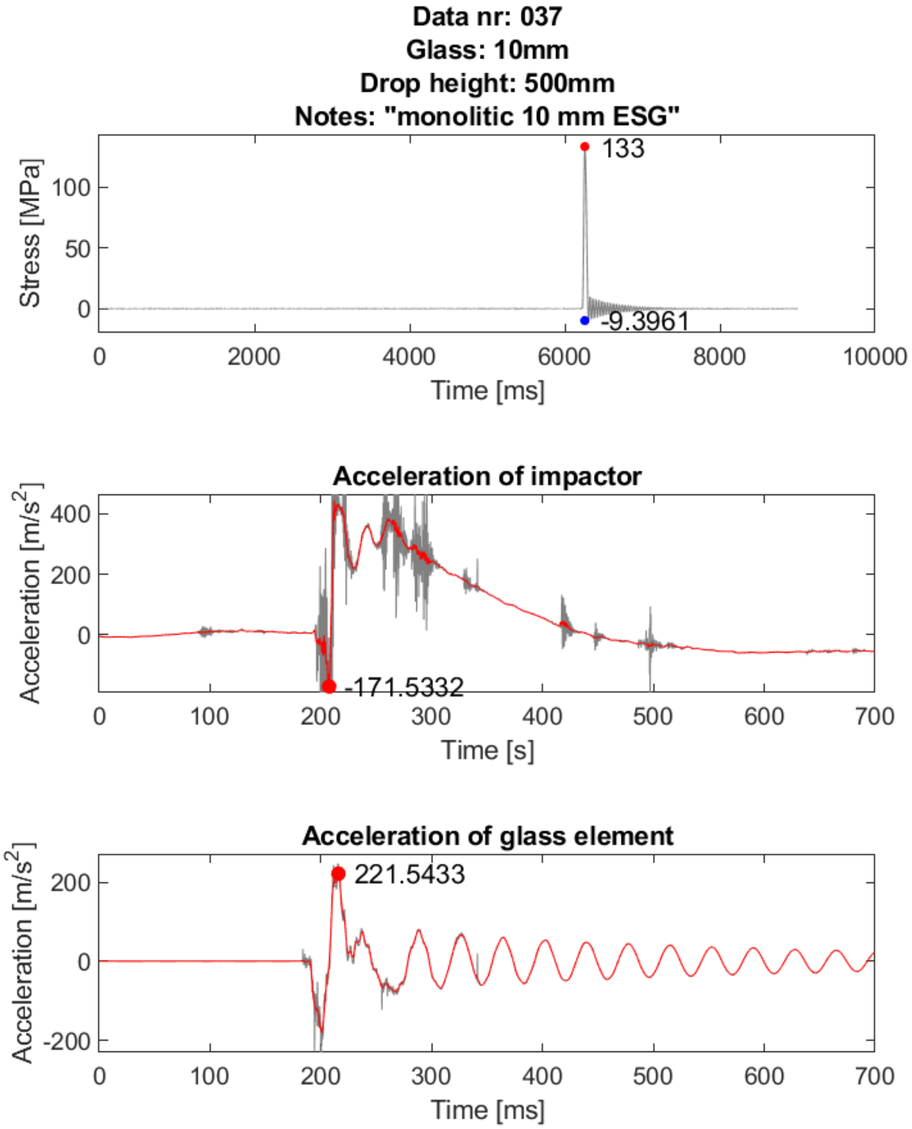

Data nr: 032
Glass: 10mm
Drop height: 400mm
Notes: "monolitic 10 mm ESG"
115.598
-7.2905
Stress [MPa]
Time [ms]
Acceleration of impactor
-162.7114
Acceleration [m/s²]
Time [s]
Acceleration of glass element
202.5818
Acceleration [m/s²]
Time [ms]

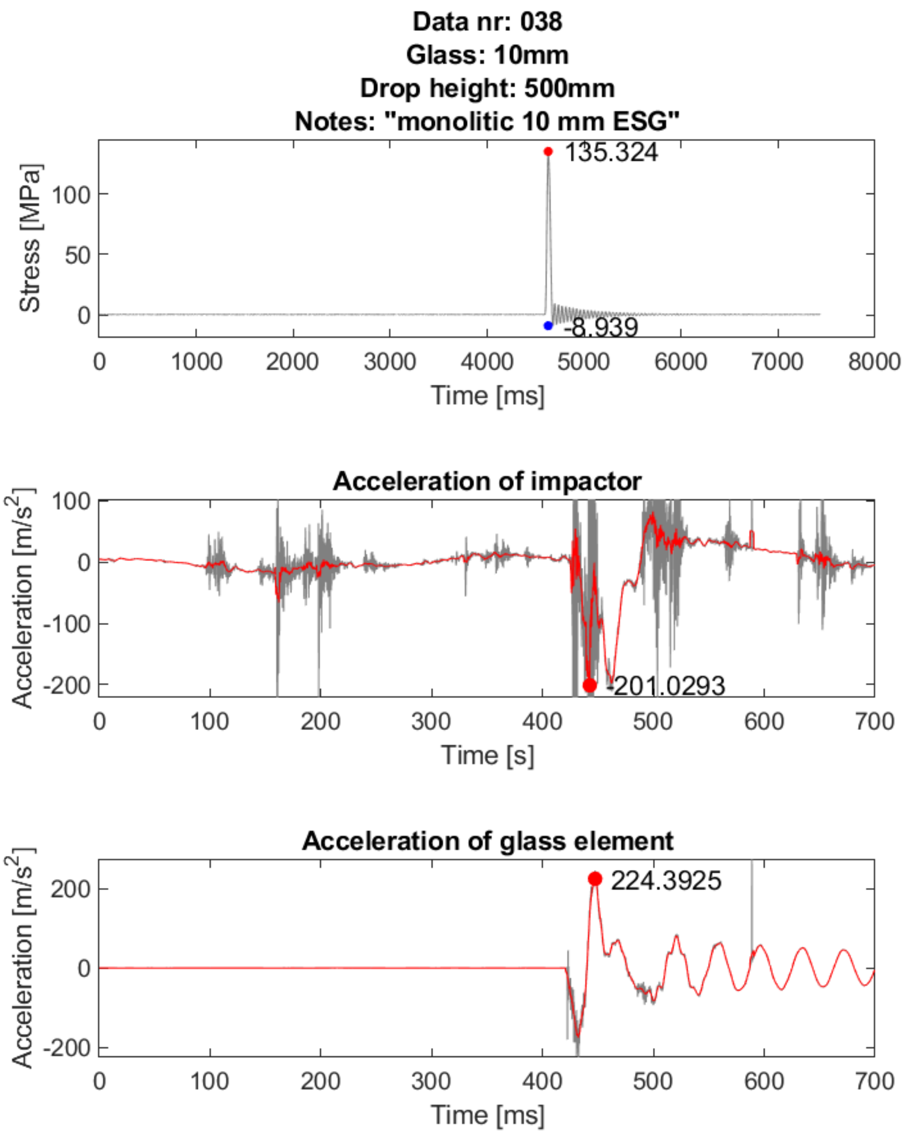

Data nr: 033
Glass: 10mm
Drop height: 400mm
Notes: "monolitic 10 mm ESG"
Stress [MPa]
122.43
-7.4557
Time [ms]
Acceleration of impactor
Acceleration [m/s^2]
-175.6304
Time [s]
Acceleration of glass element
Acceleration [m/s^2]
216.8593
Time [ms]


Data nr: 034
Glass: 10mm
Drop height: 500mm
Notes: "monolitic 10 mm ESG"
138.775
-10.8675
Stress [MPa]
100
50
0
0
1000
2000
3000
4000
5000
6000
7000
Time [ms]
Acceleration of impactor
Acceleration [m/s2]
800
600
400
200
0
-105.9669
0
100
200
300
400
500
600
700
Time [s]
Acceleration of glass element
248.7785
Acceleration [m/s2]
200
0
-200
0
100
200
300
400
500
600
700
Time [ms]

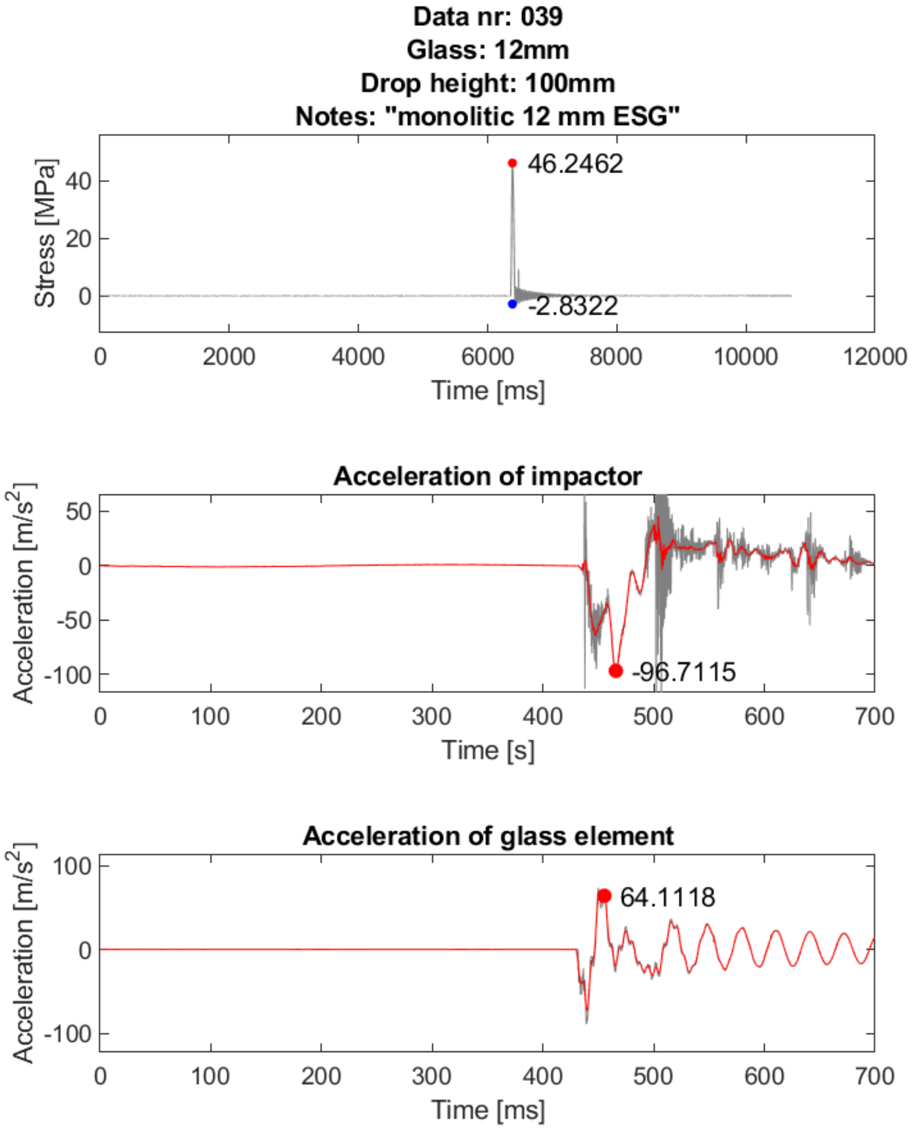

Data nr: 035
Glass: 10mm
Drop height: 500mm
Notes: "monolitic 10 mm ESG"
130.501
-15.8179
Stress [MPa]
Time [ms]
Acceleration of impactor
-187.8787
Acceleration [m/s^2]
Time [s]
Acceleration of glass element
229.5285
Acceleration [m/s^2]
Time [ms]

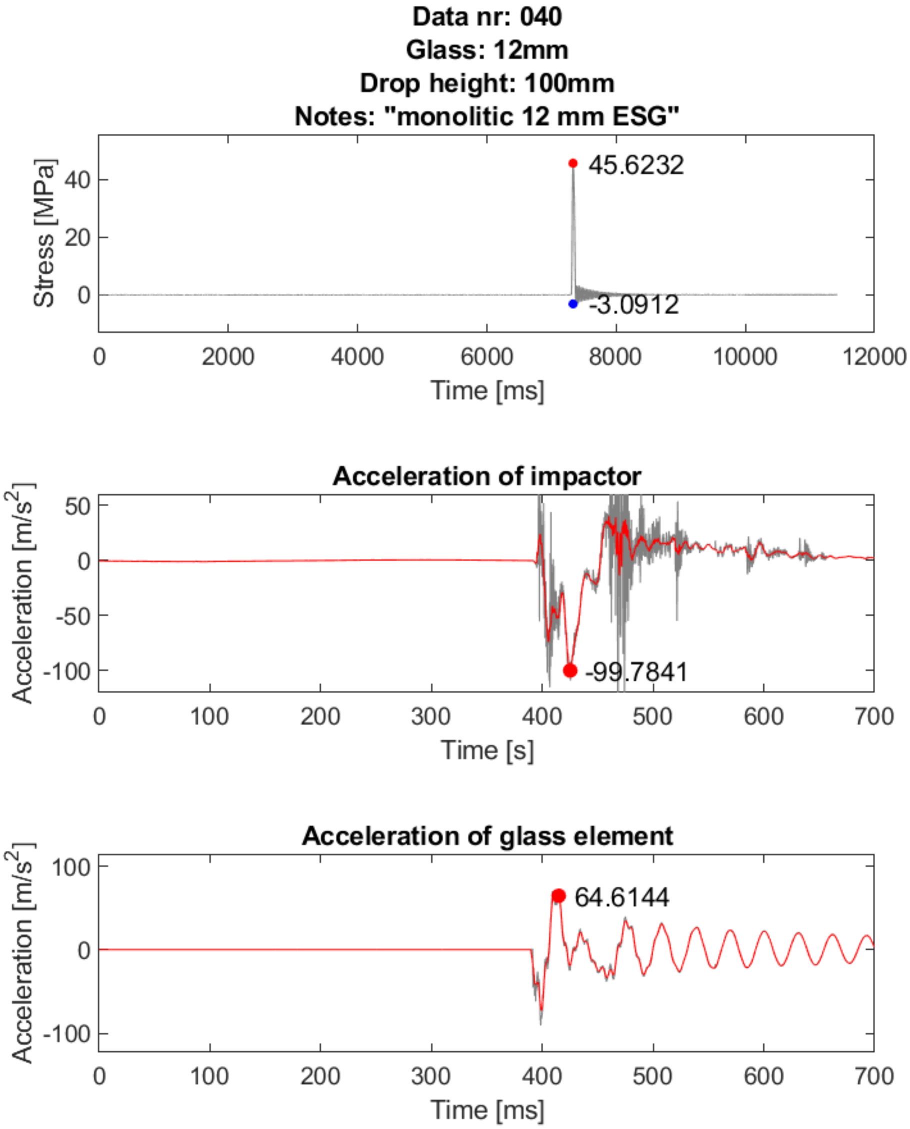

Data nr: 036
Glass: 10mm
Drop height: 500mm
Notes: "monolitic 10 mm ESG"
Stress [MPa]
133.924
-8.0066
Time [ms]
Acceleration of impactor
Acceleration [m/s2]
-154.8437
Time [s]
Acceleration of glass element
Acceleration [m/s2]
233.0414
Time [ms]

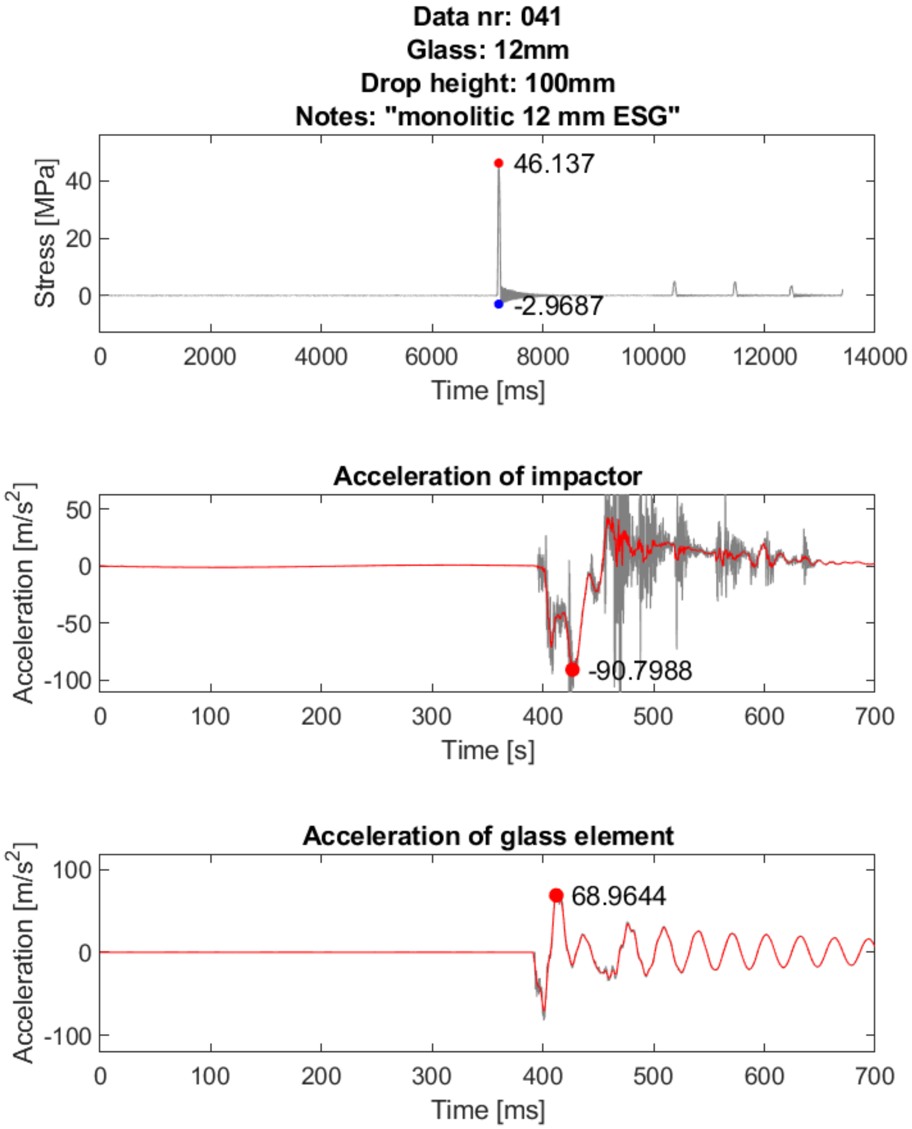

Data nr: 037
Glass: 10mm
Drop height: 500mm
Notes: "monolitic 10 mm ESG"
Stress [MPa]
133
-9.3961
Time [ms]
Acceleration of impactor
Acceleration [m/s^2]
-171.5332
Time [s]
Acceleration of glass element
Acceleration [m/s^2]
221.5433
Time [ms]

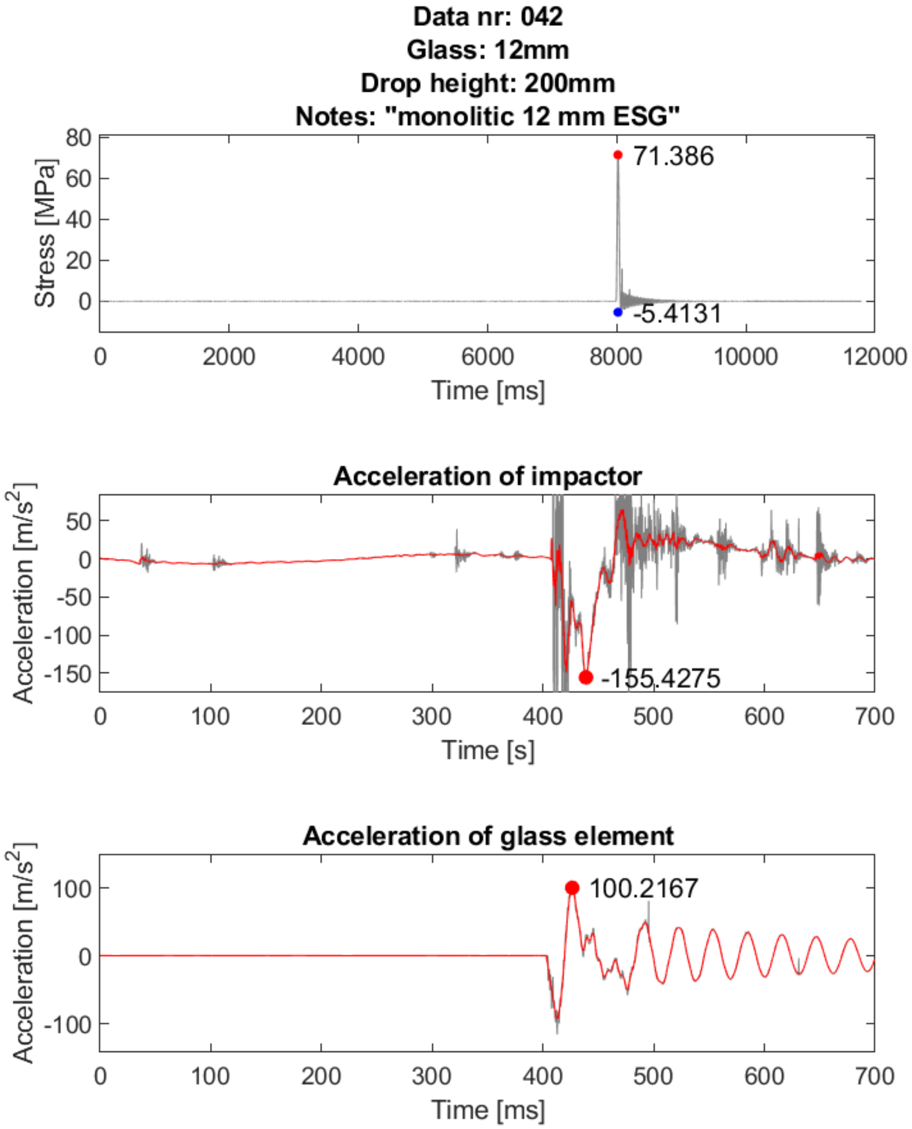


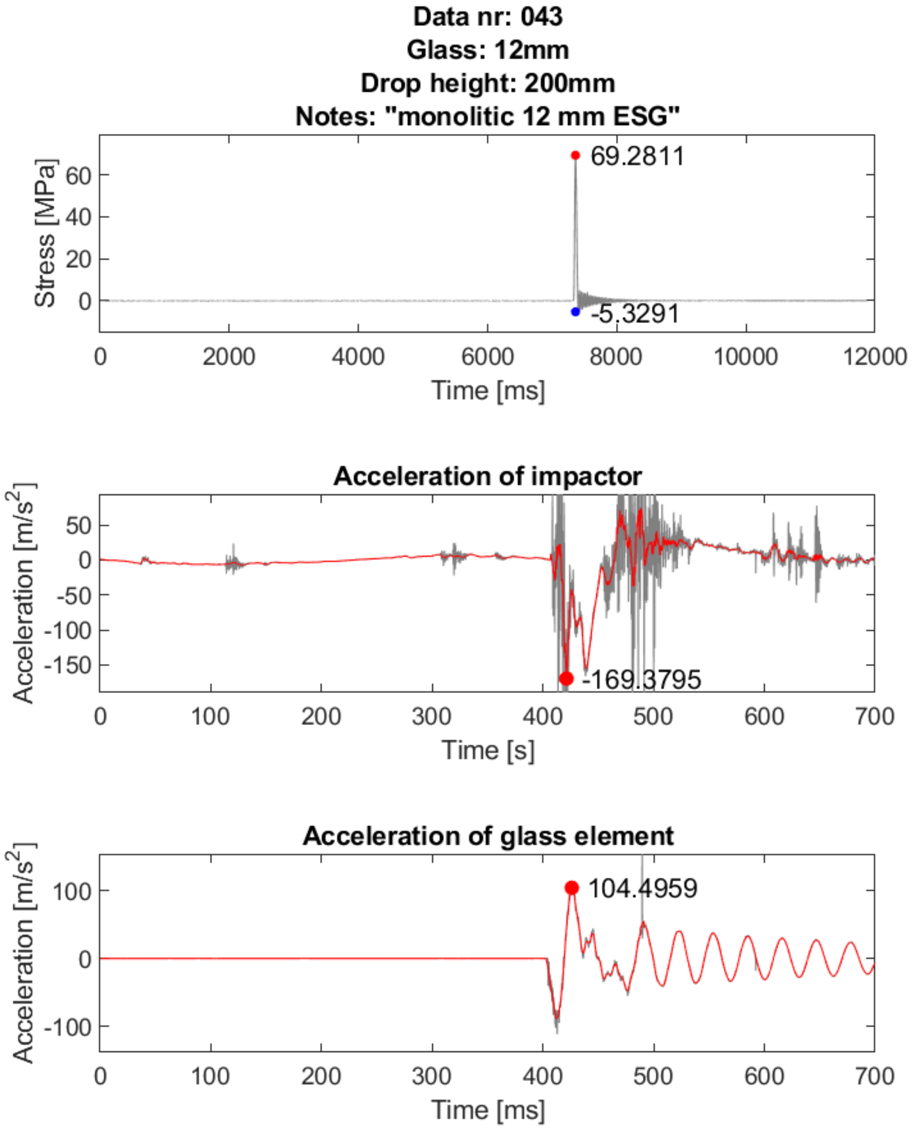
Data nr: 038
Glass: 10mm
Drop height: 500mm
Notes: "monolitic 10 mm ESG"
135.324
-8.939
Stress [MPa]
Time [ms]
Acceleration of impactor
-201.0293
Acceleration [m/s^2]
Time [s]
Acceleration of glass element
224.3925
Acceleration [m/s^2]
Time [ms]


Data nr: 039
Glass: 12mm
Drop height: 100mm
Notes: "monolitic 12 mm ESG"
Stress [MPa]
46.2462
-2.8322
Time [ms]
Acceleration of impactor
Acceleration [m/s^2]
-96.7115
Time [s]
Acceleration of glass element
Acceleration [m/s^2]
64.1118
Time [ms]

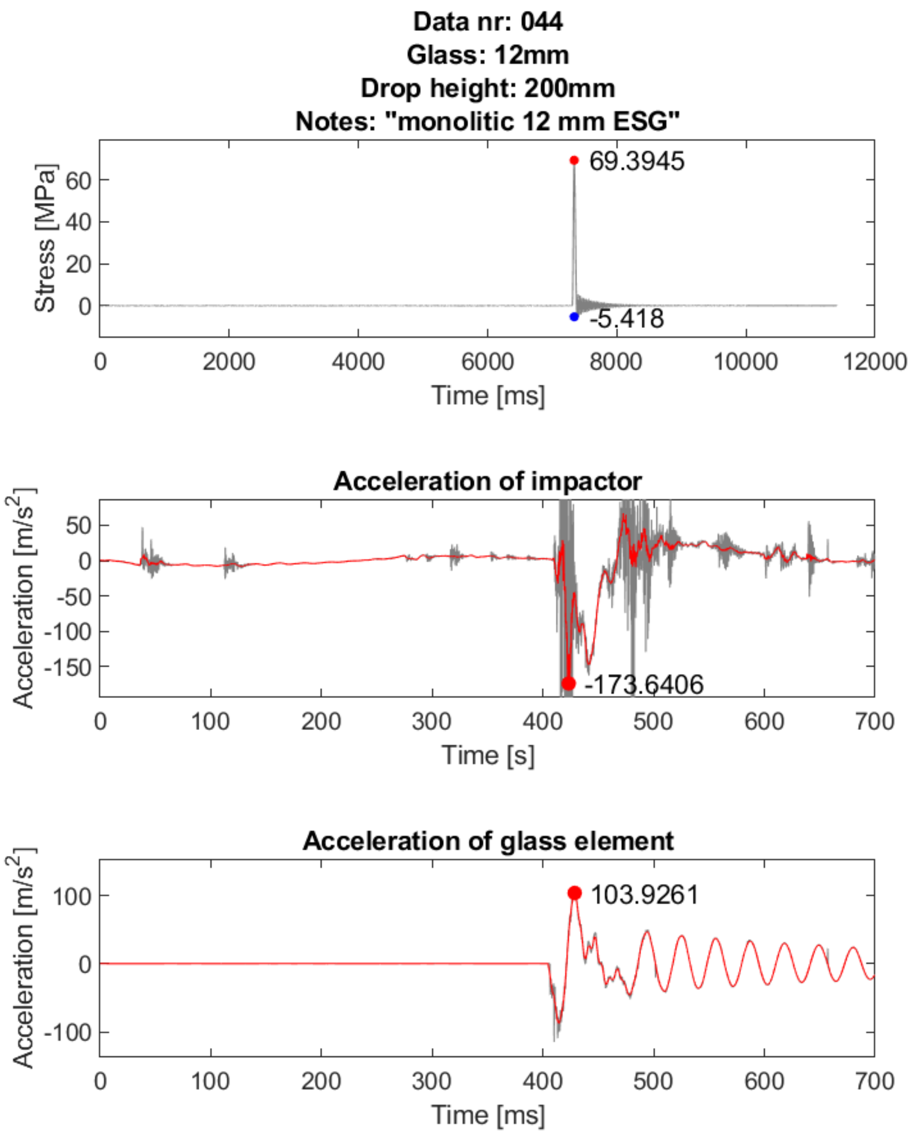

Data nr: 040
Glass: 12mm
Drop height: 100mm
Notes: "monolitic 12 mm ESG"
Stress [MPa]
45.6232
-3.0912
Time [ms]
Acceleration of impactor
Acceleration [m/s^2]
-99.7841
Time [s]
Acceleration of glass element
Acceleration [m/s^2]
64.6144
Time [ms]

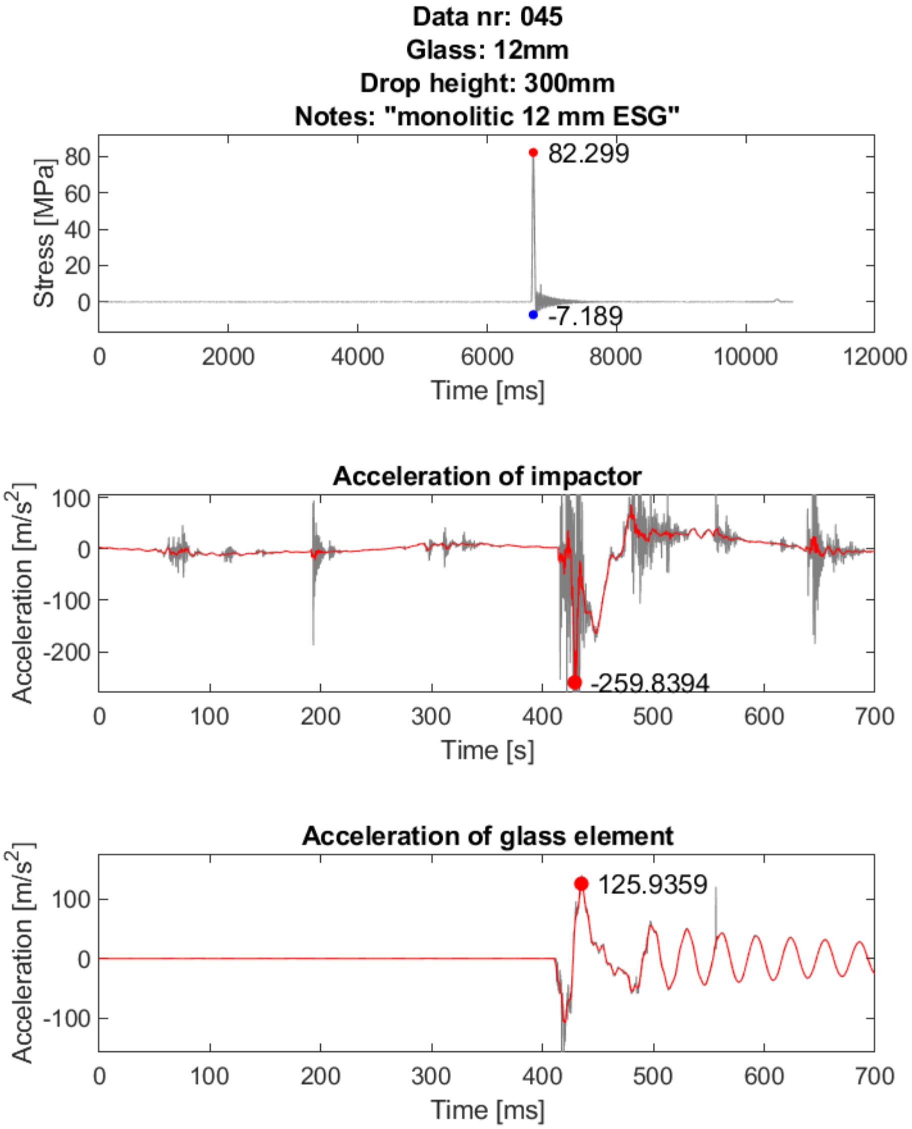

Data nr: 041
Glass: 12mm
Drop height: 100mm
Notes: "monolitic 12 mm ESG"
Stress [MPa]
46.137
-2.9687
Time [ms]
Acceleration of impactor
Acceleration [m/s2]
-90.7988
Time [s]
Acceleration of glass element
Acceleration [m/s2]
68.9644
Time [ms]


Data nr: 042
Glass: 12mm
Drop height: 200mm
Notes: "monolitic 12 mm ESG"
Stress [MPa]
71.386
-5.4131
Time [ms]
Acceleration of impactor
Acceleration [m/s^2]
-155.4275
Time [s]
Acceleration of glass element
Acceleration [m/s^2]
100.2167
Time [ms]

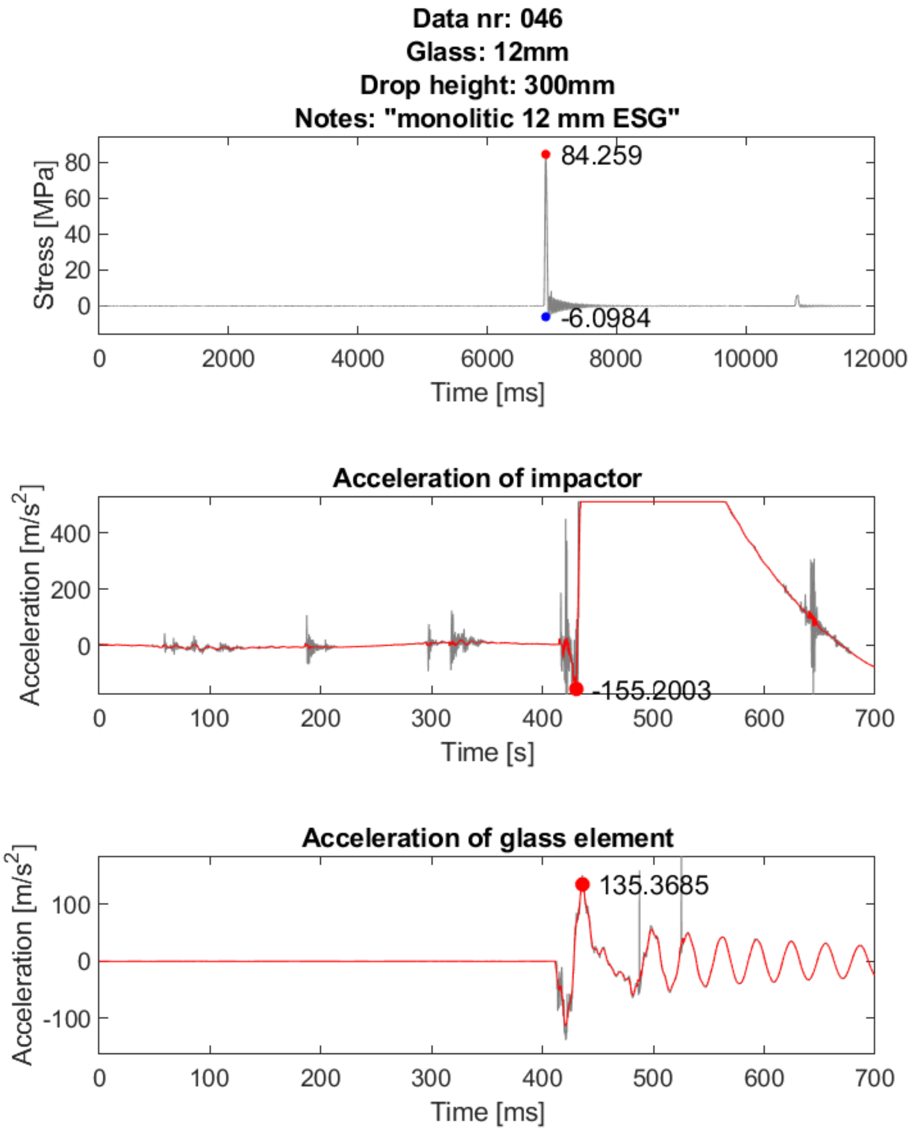


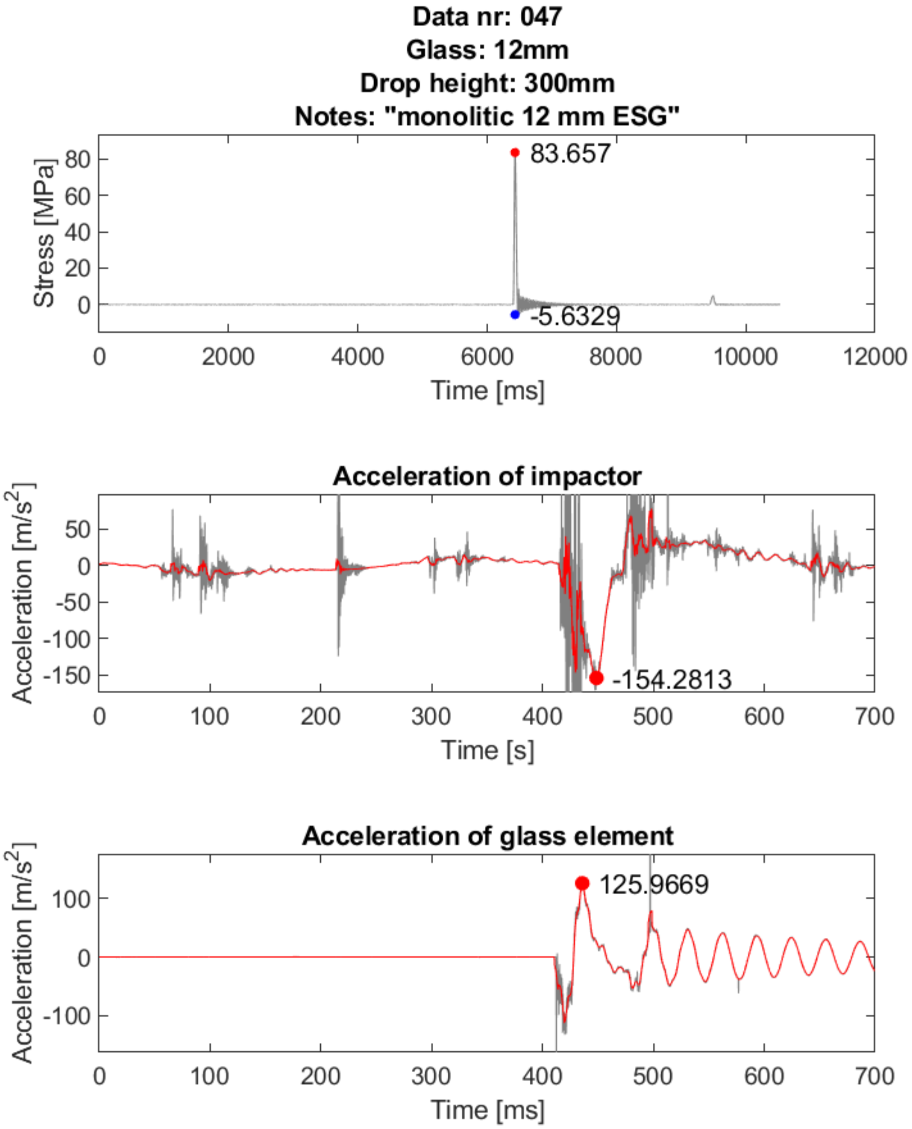
Data nr: 043
Glass: 12mm
Drop height: 200mm
Notes: "monolitic 12 mm ESG"
Stress [MPa]
69.2811
-5.3291
Time [ms]
Acceleration of impactor
Acceleration [m/s2]
-169.3795
Time [s]
Acceleration of glass element
Acceleration [m/s2]
104.4959
Time [ms]

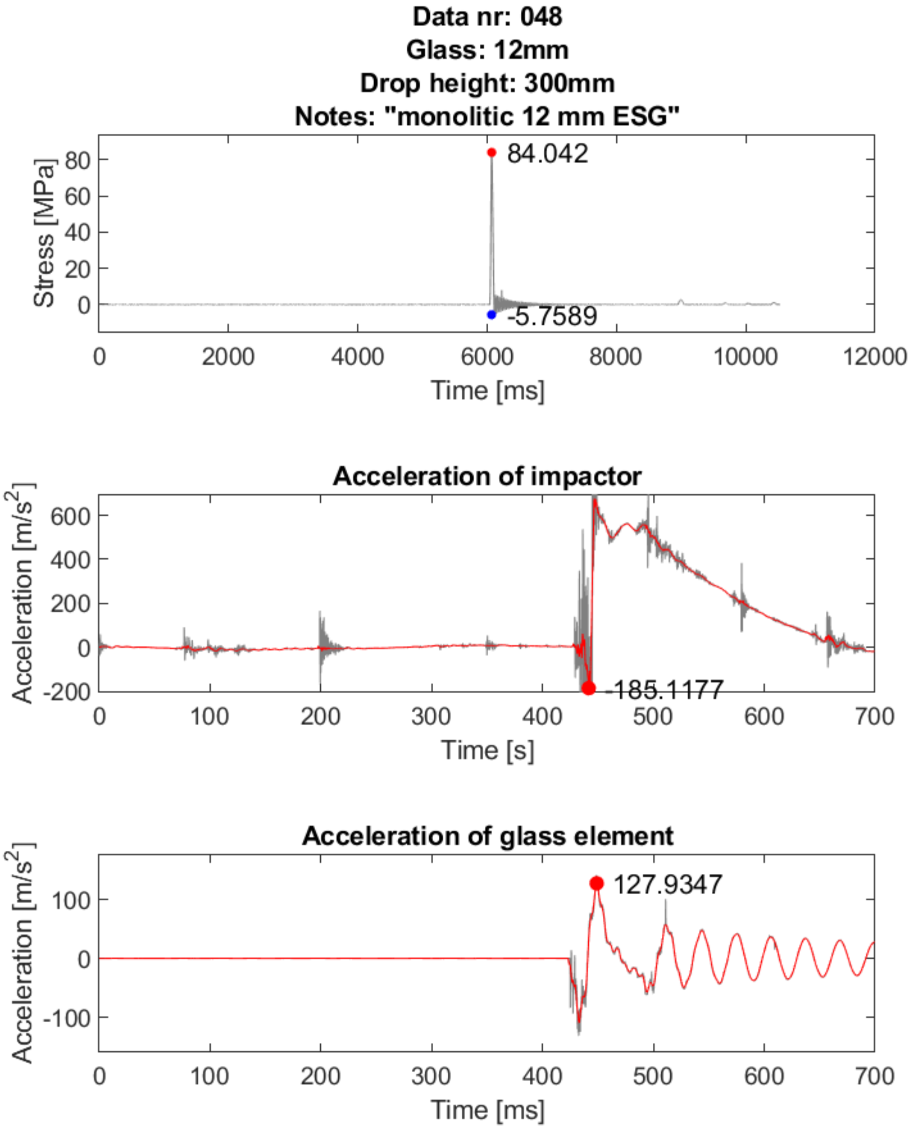

Data nr: 044
Glass: 12mm
Drop height: 200mm
Notes: "monolitic 12 mm ESG"
Stress [MPa]
69.3945
-5.418
Time [ms]
Acceleration of impactor
Acceleration [m/s^2]
-173.6406
Time [s]
Acceleration of glass element
Acceleration [m/s^2]
103.9261
Time [ms]



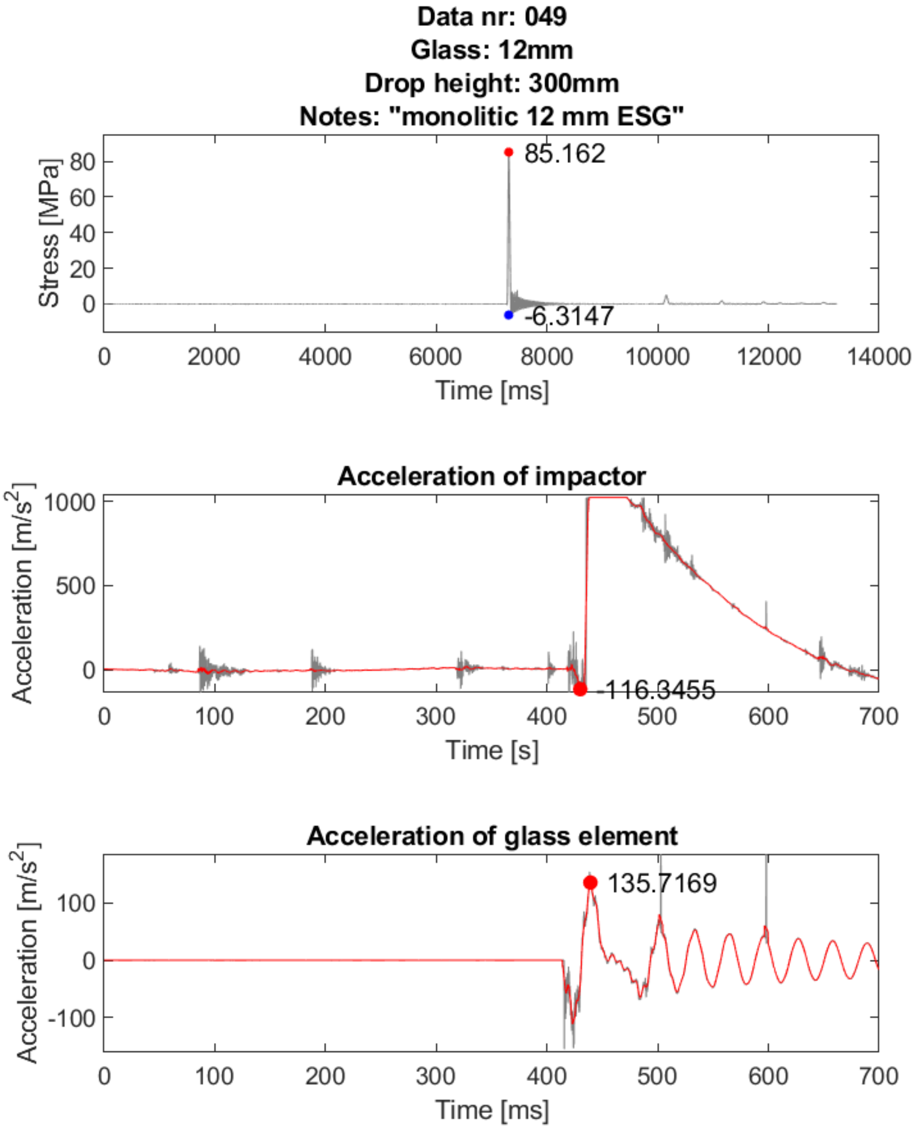
Data nr: 045
Glass: 12mm
Drop height: 300mm
Notes: "monolitic 12 mm ESG"
Stress [MPa]
80
60
40
20
0
82.299
-7.189
0
2000
4000
6000
8000
10000
12000
Time [ms]
Acceleration of impactor
Acceleration [m/s2]
100
0
-100
-200
-259.8394
0
100
200
300
400
500
600
700
Time [s]
Acceleration of glass element
Acceleration [m/s2]
100
0
-100
125.9359
0
100
200
300
400
500
600
700
Time [ms]

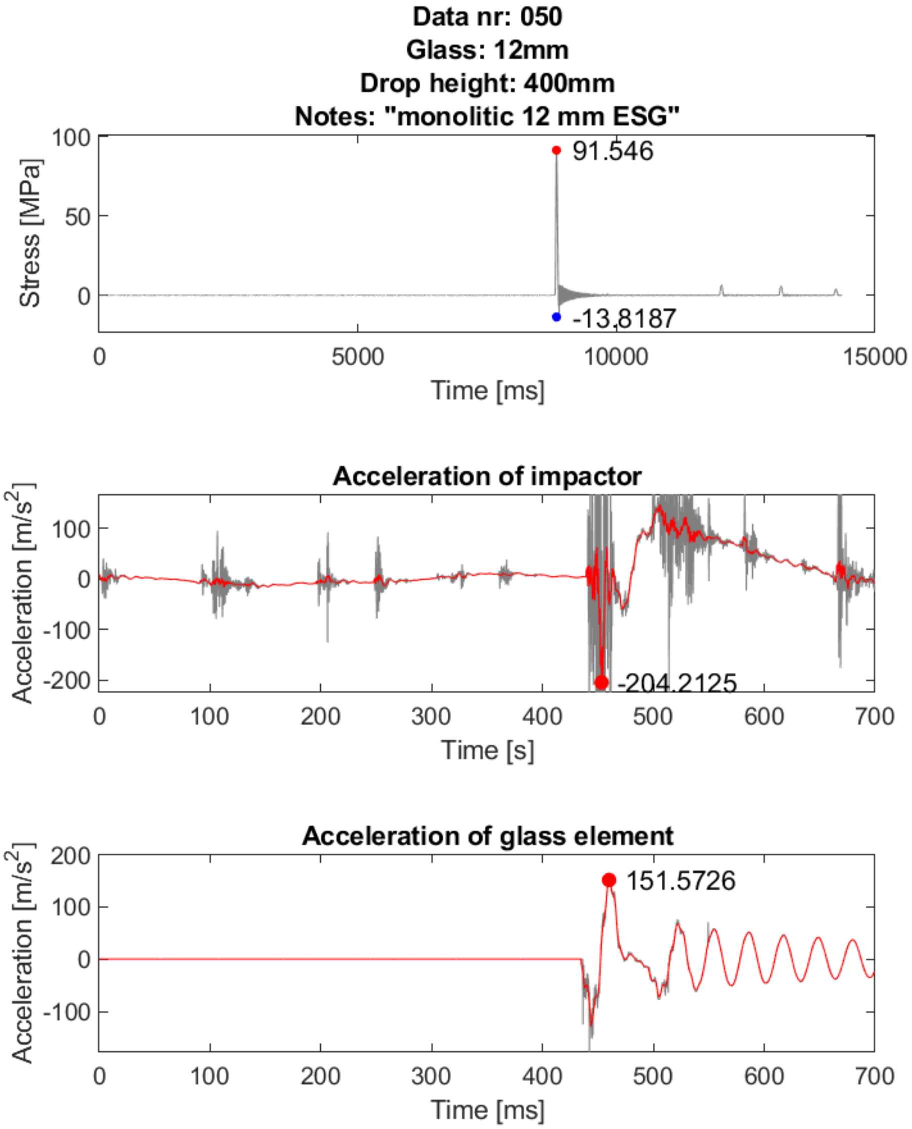

Data nr: 046
Glass: 12mm
Drop height: 300mm
Notes: "monolitic 12 mm ESG"
Stress [MPa]
84.259
-6.0984
Time [ms]
Acceleration of impactor
Acceleration [m/s2]
-155.2003
Time [s]
Acceleration of glass element
Acceleration [m/s2]
135.3685
Time [ms]


Data nr: 047
Glass: 12mm
Drop height: 300mm
Notes: "monolitic 12 mm ESG"
Stress [MPa]
83.657
-5.6329
Time [ms]
Acceleration of impactor
Acceleration [m/s^2]
-154.2813
Time [s]
Acceleration of glass element
Acceleration [m/s^2]
125.9669
Time [ms]

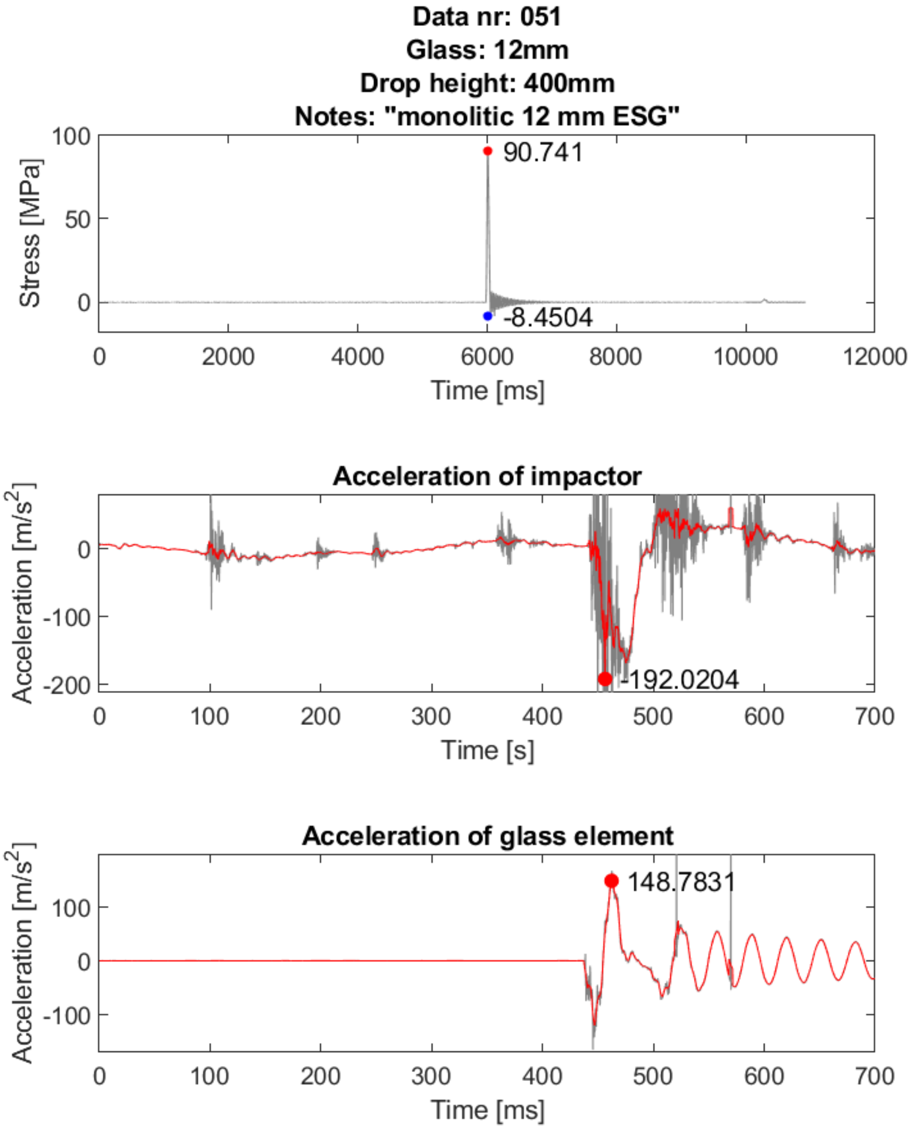


Data nr: 048
Glass: 12mm
Drop height: 300mm
Notes: "monolitic 12 mm ESG"
Stress [MPa]
84.042
-5.7589
0
20
40
60
80
0
2000
4000
6000
8000
10000
12000
Time [ms]
Acceleration of impactor
Acceleration [m/s2]
600
400
200
0
-200
-185.1177
0
100
200
300
400
500
600
700
Time [s]
Acceleration of glass element
Acceleration [m/s2]
127.9347
100
0
-100
0
100
200
300
400
500
600
700
Time [ms]

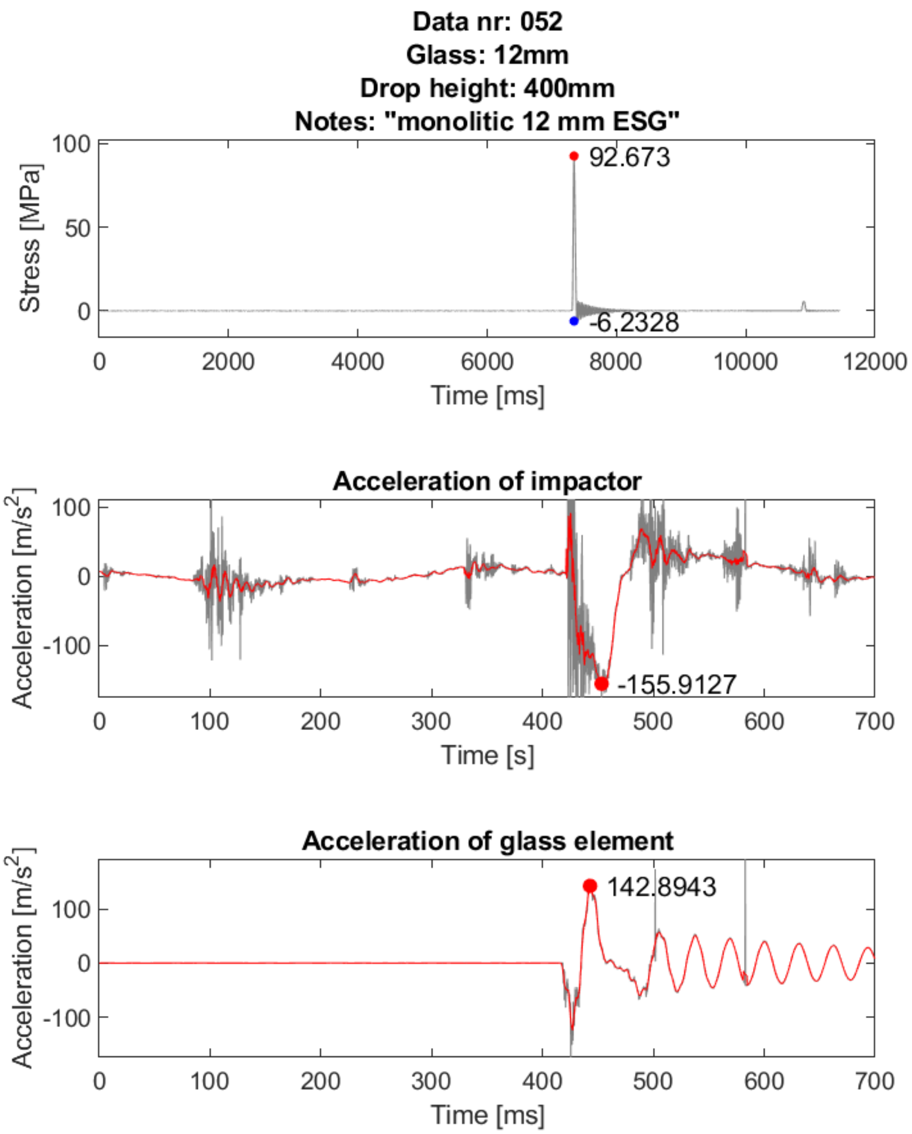

Data nr: 049
Glass: 12mm
Drop height: 300mm
Notes: "monolitic 12 mm ESG"
Stress [MPa]
85.162
-6.3147
Time [ms]
Acceleration of impactor
Acceleration [m/s^2]
-116.3455
Time [s]
Acceleration of glass element
Acceleration [m/s^2]
135.7169
Time [ms]

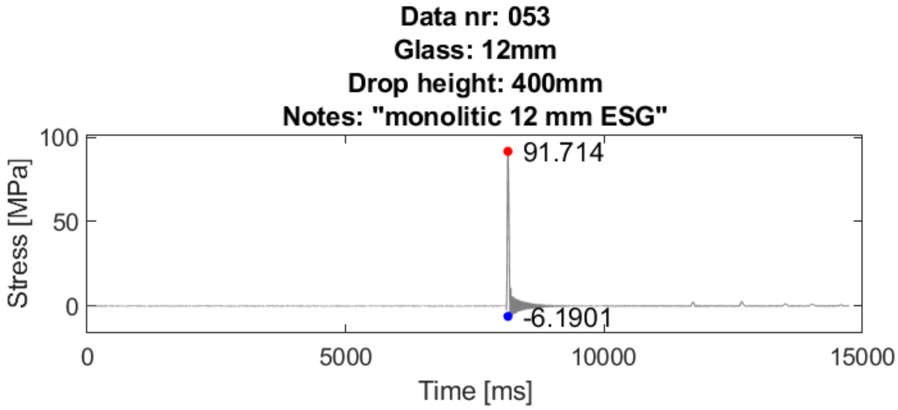


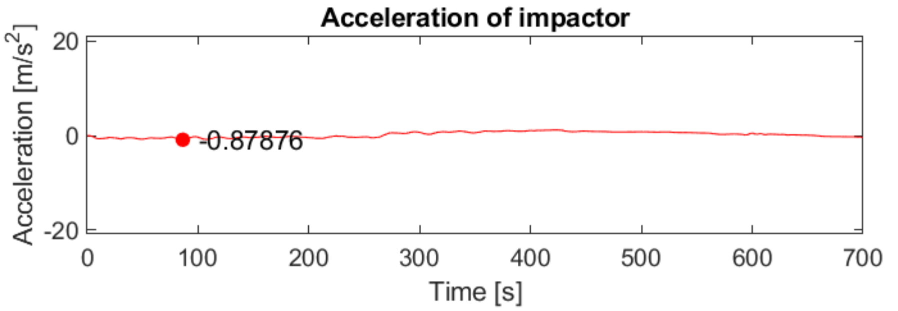
Data nr: 050
Glass: 12mm
Drop height: 400mm
Notes: "monolitic 12 mm ESG"
Stress [MPa]
91.546
-13.8187
Time [ms]
Acceleration of impactor
Acceleration [m/s^2]
-204.2125
Time [s]
Acceleration of glass element
Acceleration [m/s^2]
151.5726
Time [ms]

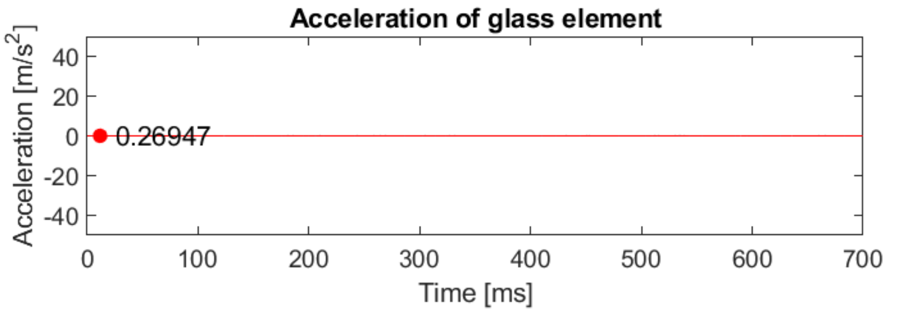


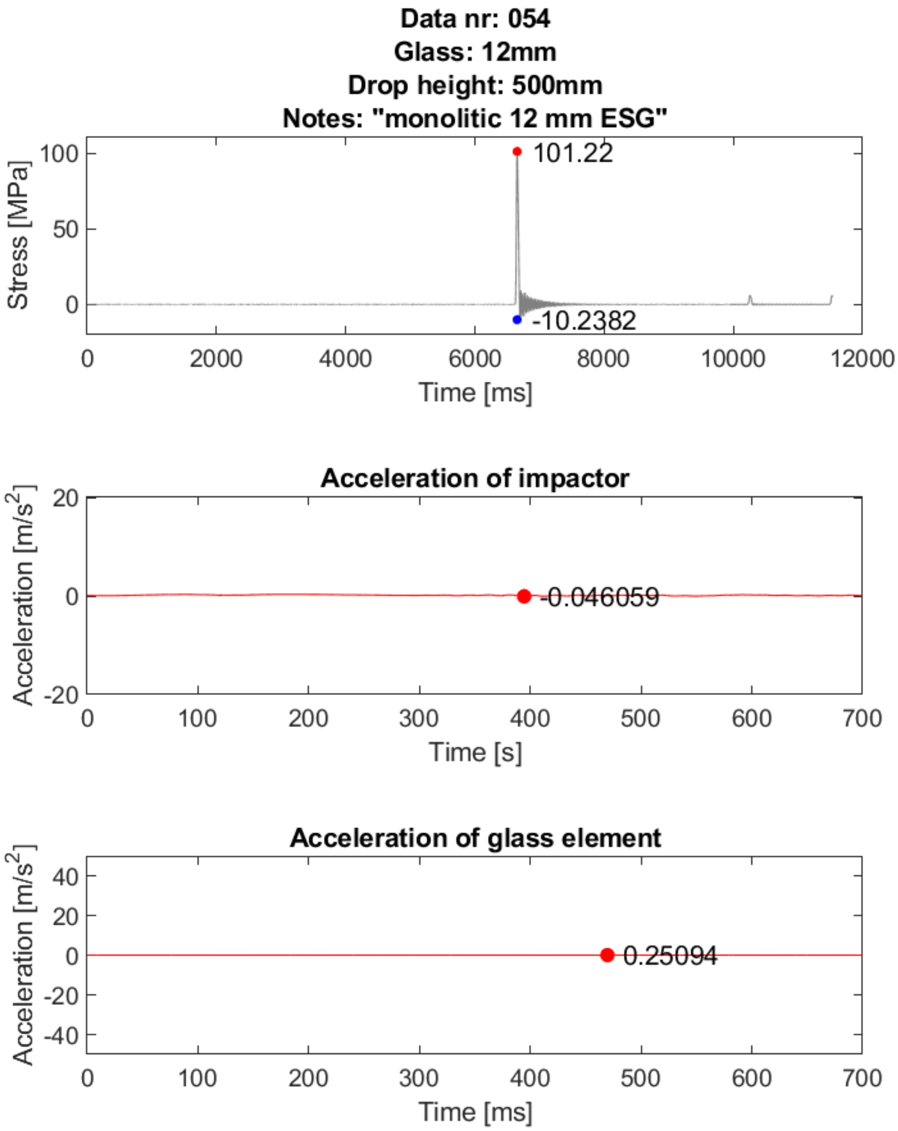
Data nr: 051
Glass: 12mm
Drop height: 400mm
Notes: "monolitic 12 mm ESG"
Stress [MPa]
90.741
-8.4504
Time [ms]
Acceleration of impactor
Acceleration [m/s^2]
-192.0204
Time [s]
Acceleration of glass element
Acceleration [m/s^2]
148.7831
Time [ms]


Data nr: 052
Glass: 12mm
Drop height: 400mm
Notes: "monolitic 12 mm ESG"
Stress [MPa]
100
50
0
92.673
-6,2328
0
2000
4000
6000
8000
10000
12000
Time [ms]
Acceleration of impactor
Acceleration [m/s2]
100
0
-100
-155.9127
0
100
200
300
400
500
600
700
Time [s]
Acceleration of glass element
Acceleration [m/s2]
100
0
-100
142.8943
0
100
200
300
400
500
600
700
Time [ms]

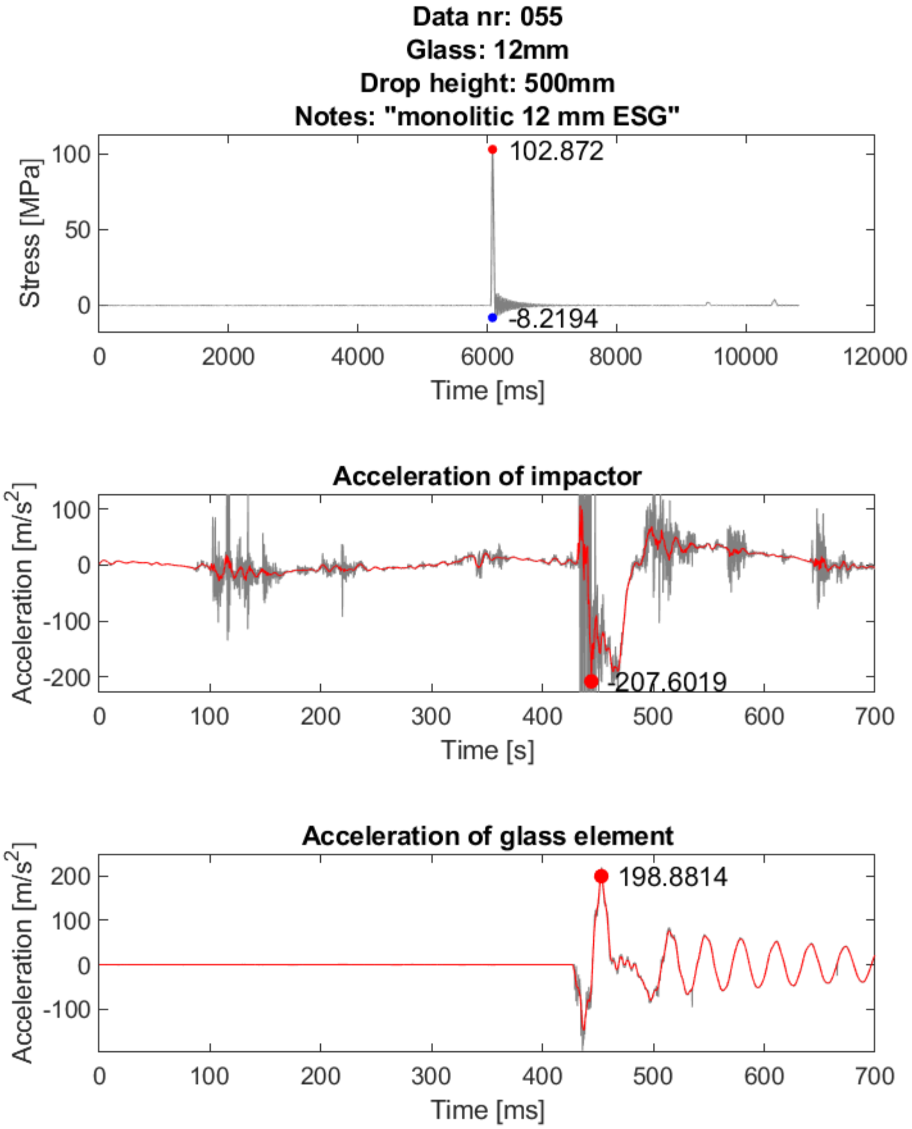

Data nr: 053
Glass: 12mm
Drop height: 400mm
Notes: "monolitic 12 mm ESG"
Stress [MPa]
100
50
0
91.714
-6.1901
0
5000
10000
15000
Time [ms]

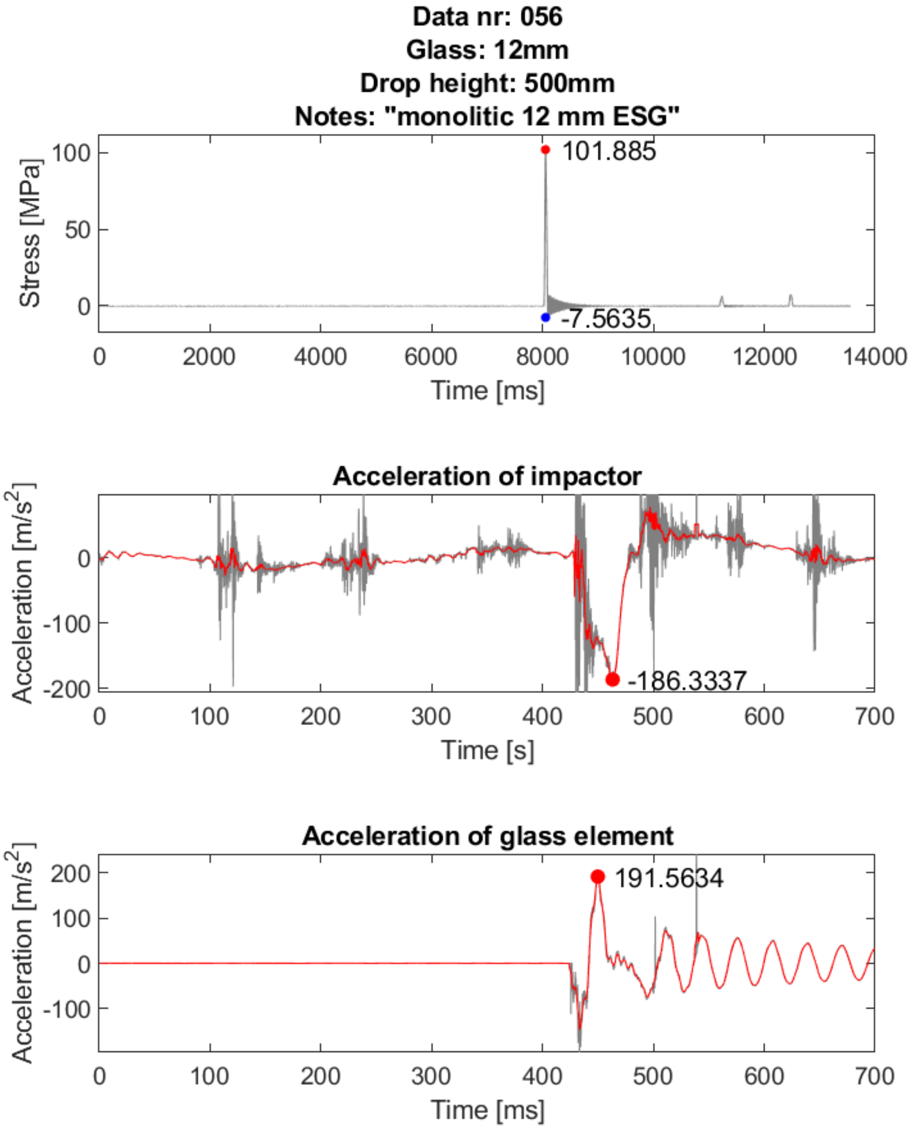

Acceleration of impactor
Acceleration [m/s^2]
20
0
-20
-0.87876
0
100
200
300
400
500
600
700
Time [s]

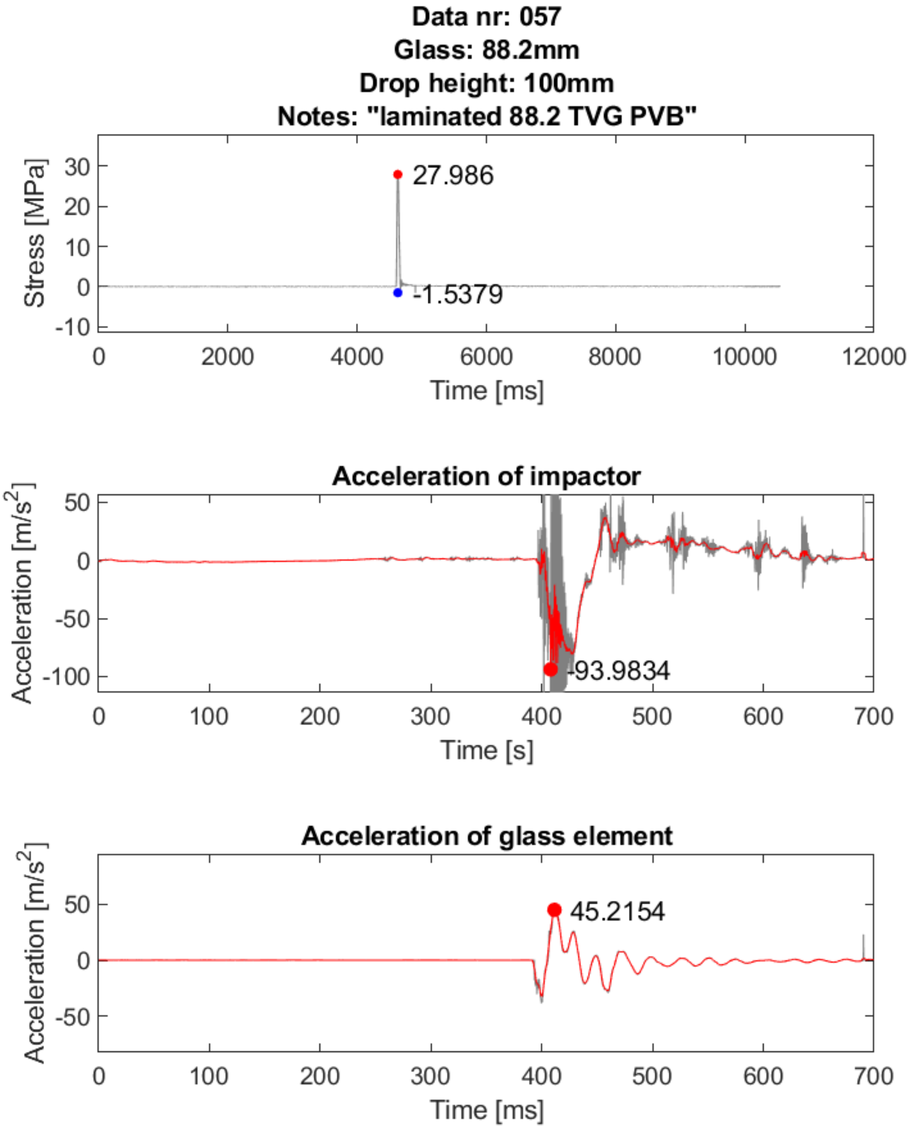

Acceleration of glass element
Acceleration [m/s^2]
40
20
0
-20
-40
0.26947
0
100
200
300
400
500
600
700
Time [ms]

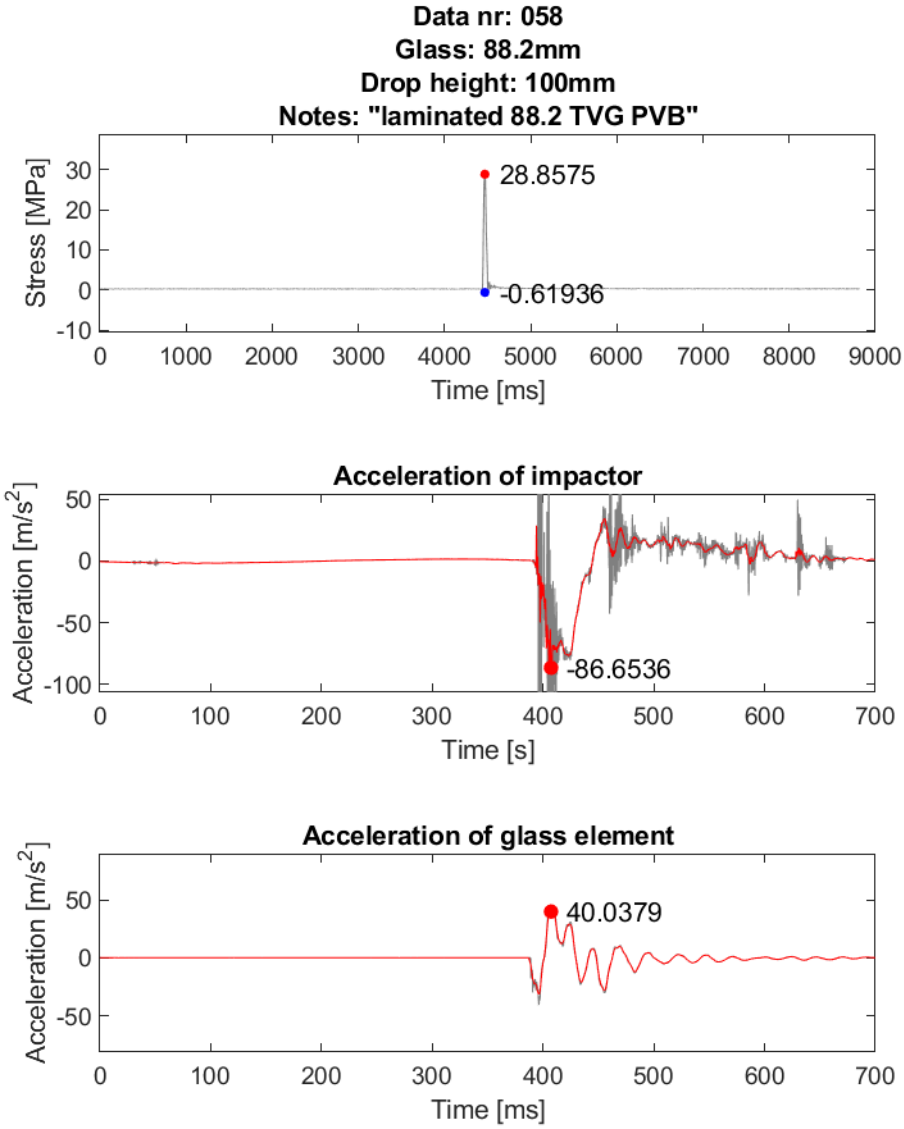


Data nr: 054
Glass: 12mm
Drop height: 500mm
Notes: "monolitic 12 mm ESG"
Stress [MPa]
101.22
-10.2382
Time [ms]
Acceleration of impactor
Acceleration [m/s^2]
-0.046059
Time [s]
Acceleration of glass element
Acceleration [m/s^2]
0.25094
Time [ms]

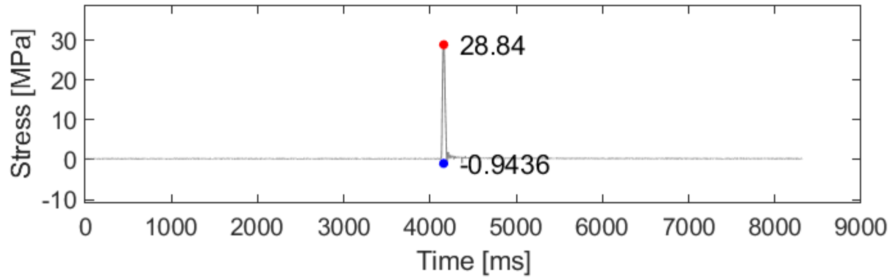

Data nr: 055
Glass: 12mm
Drop height: 500mm
Notes: "monolitic 12 mm ESG"
Stress [MPa]
100
50
0
102.872
-8.2194
0
2000
4000
6000
8000
10000
12000
Time [ms]
Acceleration of impactor
Acceleration [m/s^2]
100
0
-100
-200
-207.6019
0
100
200
300
400
500
600
700
Time [s]
Acceleration of glass element
Acceleration [m/s^2]
200
100
0
-100
198.8814
0
100
200
300
400
500
600
700
Time [ms]

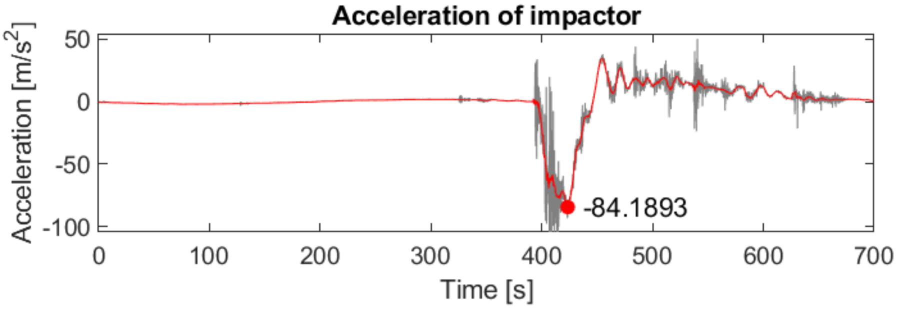

Data nr: 056
Glass: 12mm
Drop height: 500mm
Notes: "monolitic 12 mm ESG"
Stress [MPa]
101.885
-7.5635
Time [ms]
Acceleration of impactor
Acceleration [m/s^2]
-186.3337
Time [s]
Acceleration of glass element
Acceleration [m/s^2]
191.5634
Time [ms]

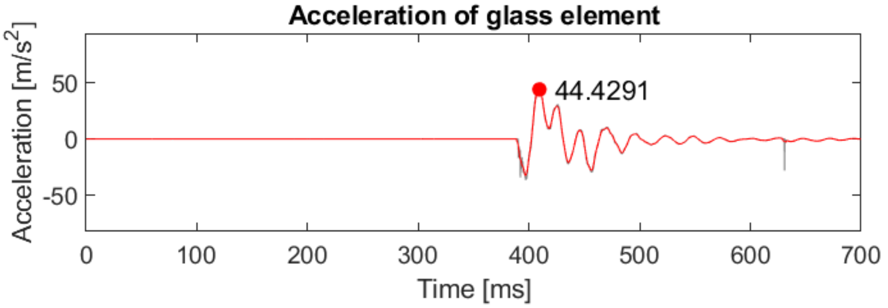

Data nr: 057
Glass: 88.2mm
Drop height: 100mm
Notes: "laminated 88.2 TVG PVB"
Stress [MPa]
27.986
-1.5379
Time [ms]
Acceleration of impactor
Acceleration [m/s^2]
-93.9834
Time [s]
Acceleration of glass element
Acceleration [m/s^2]
45.2154
Time [ms]

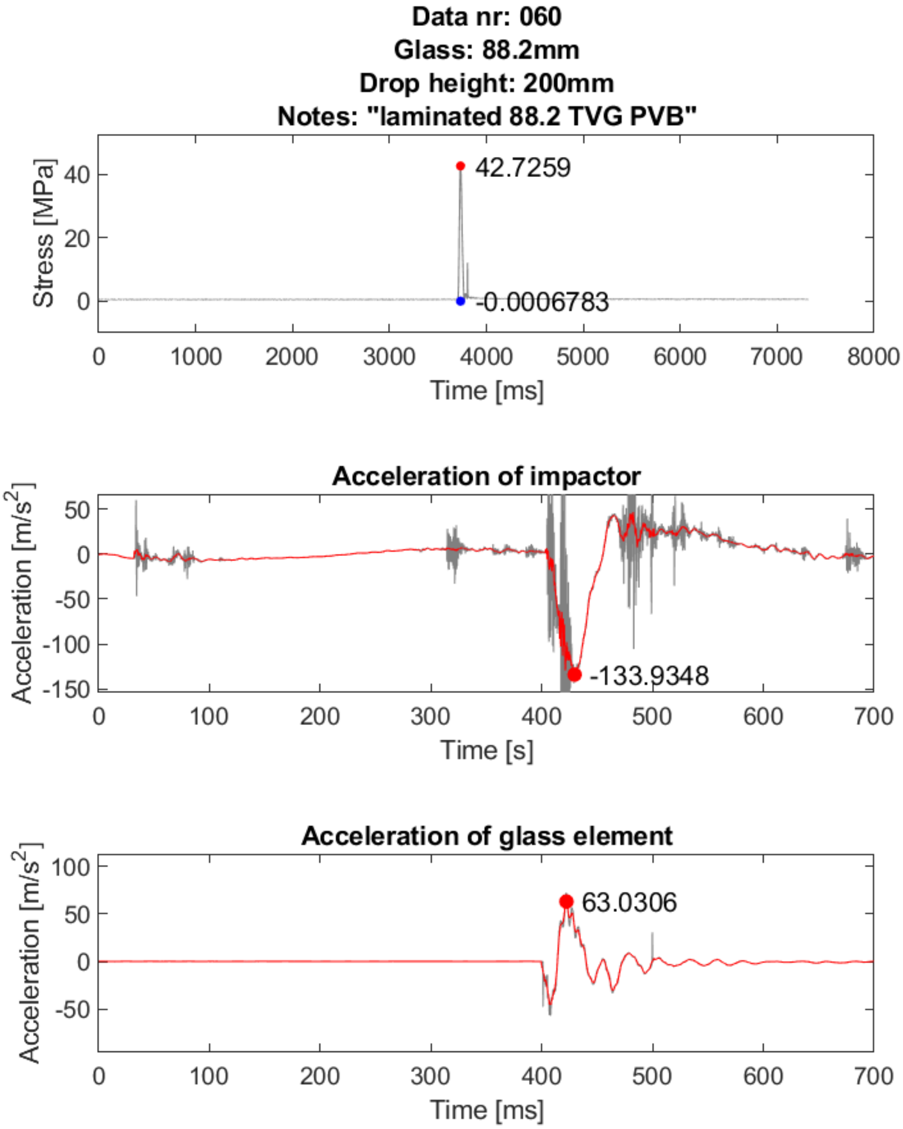

Data nr: 058
Glass: 88.2mm
Drop height: 100mm
Notes: "laminated 88.2 TVG PVB"
Stress [MPa]
28.8575
-0.61936
Time [ms]
Acceleration of impactor
Acceleration [m/s2]
-86.6536
Time [s]
Acceleration of glass element
Acceleration [m/s2]
40.0379
Time [ms]

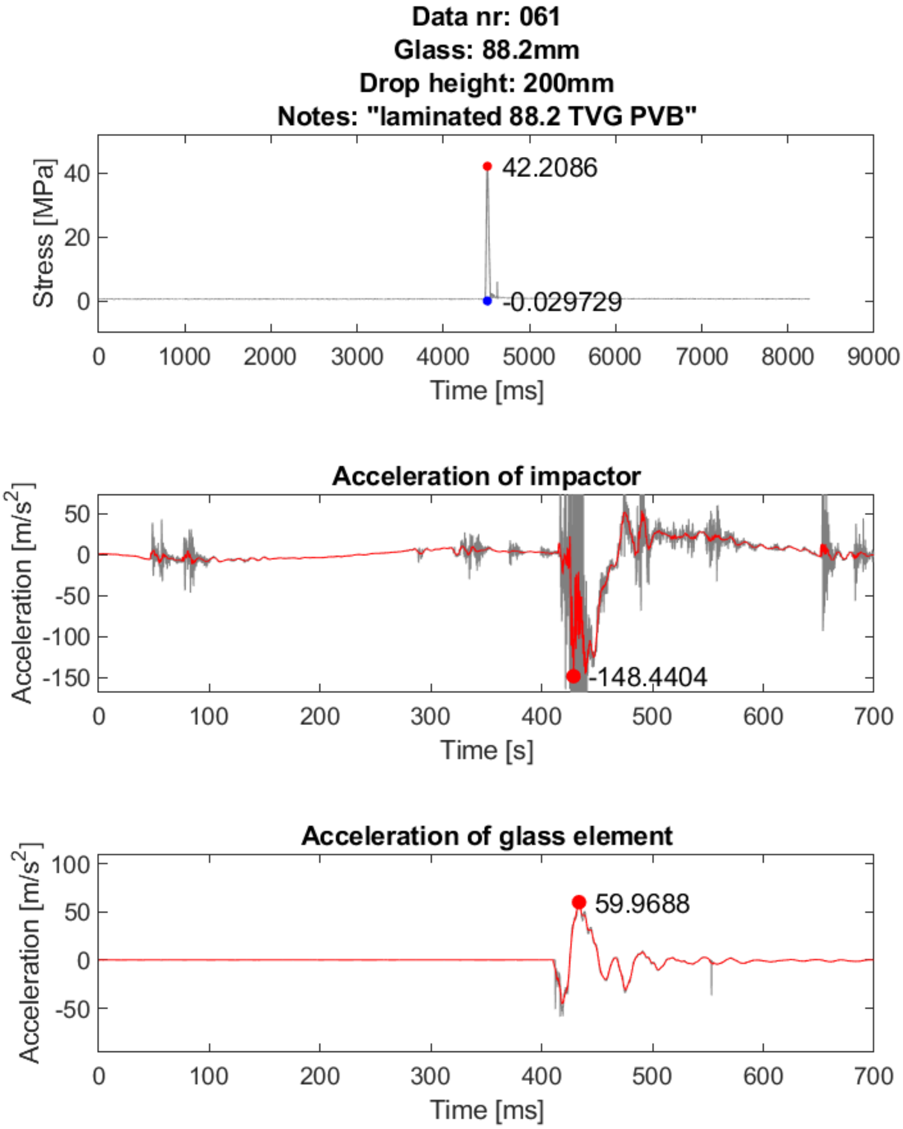
Data nr: 059
Glass: 88.2mm
Drop height: 100mm
Notes: "laminated 88.2 TVG PVB"

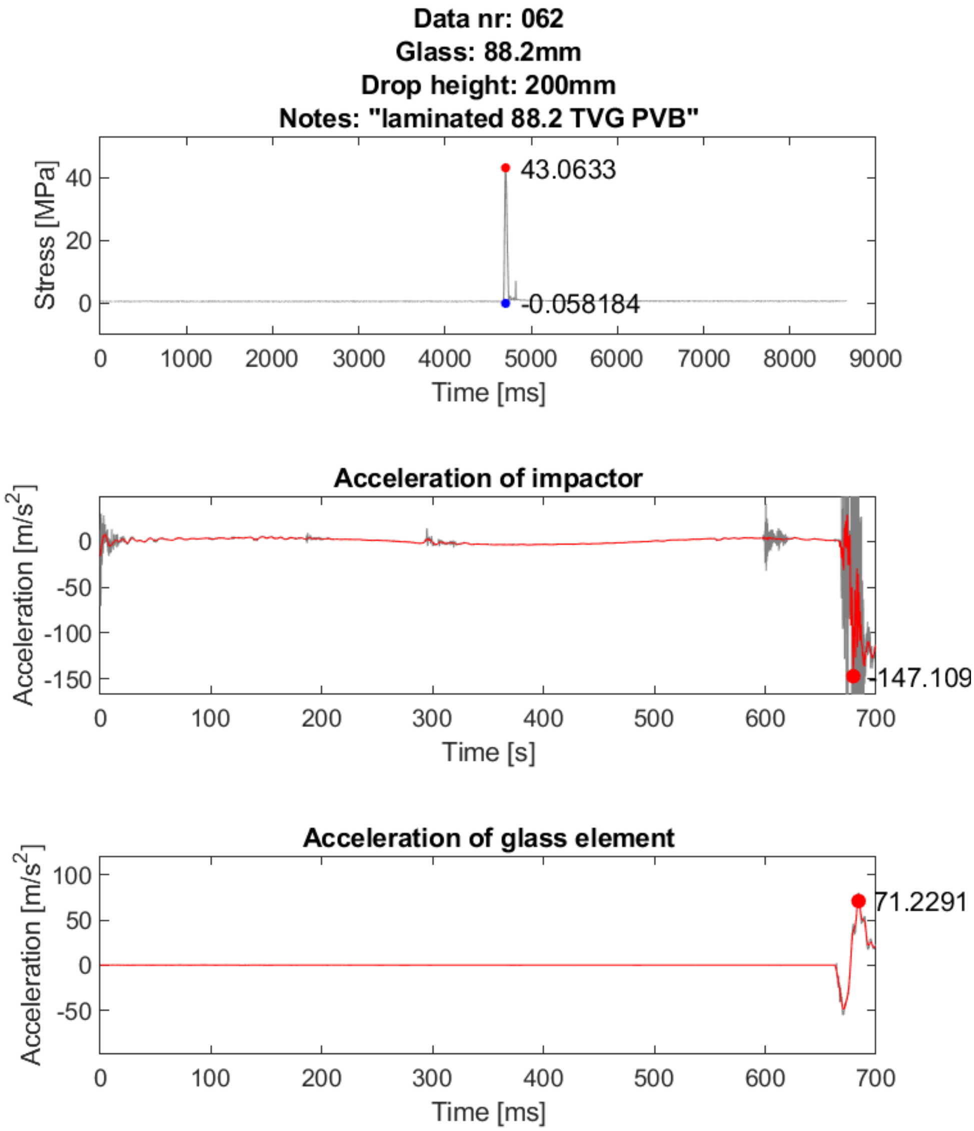


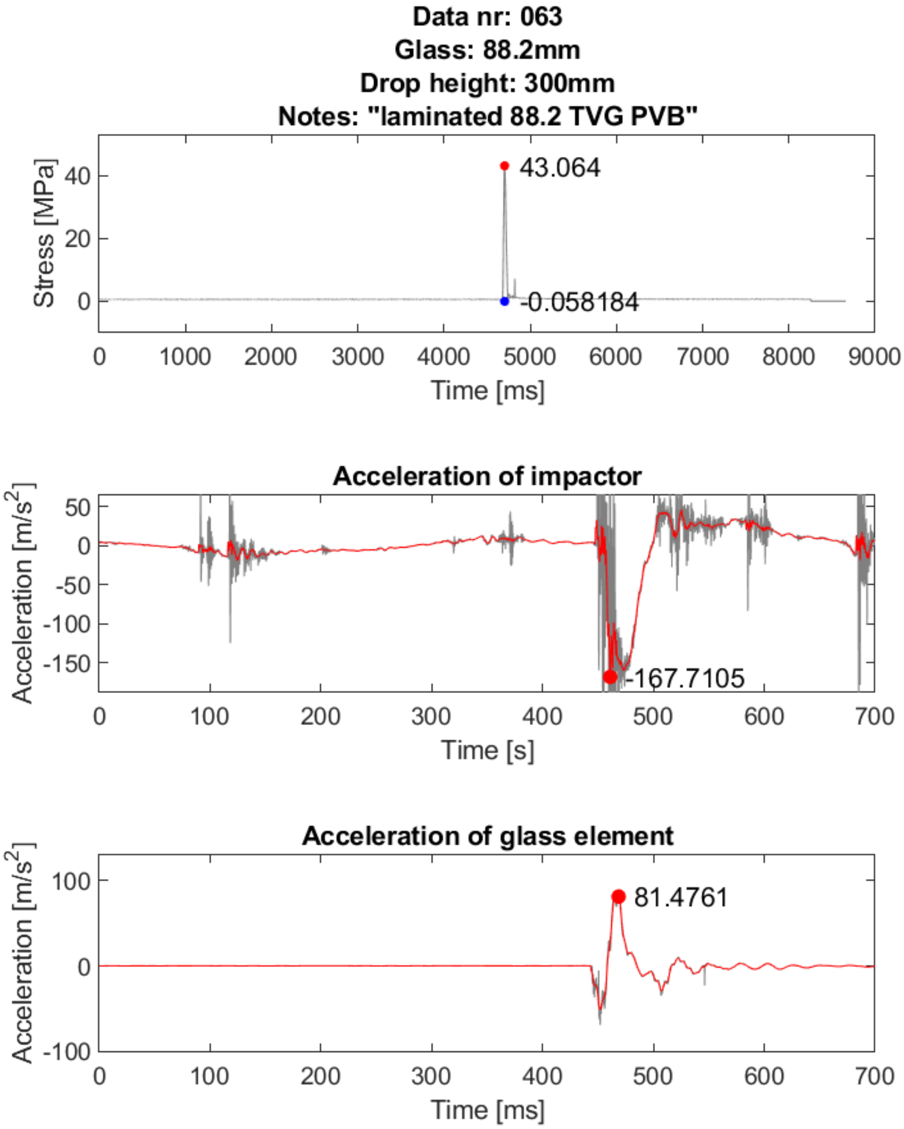




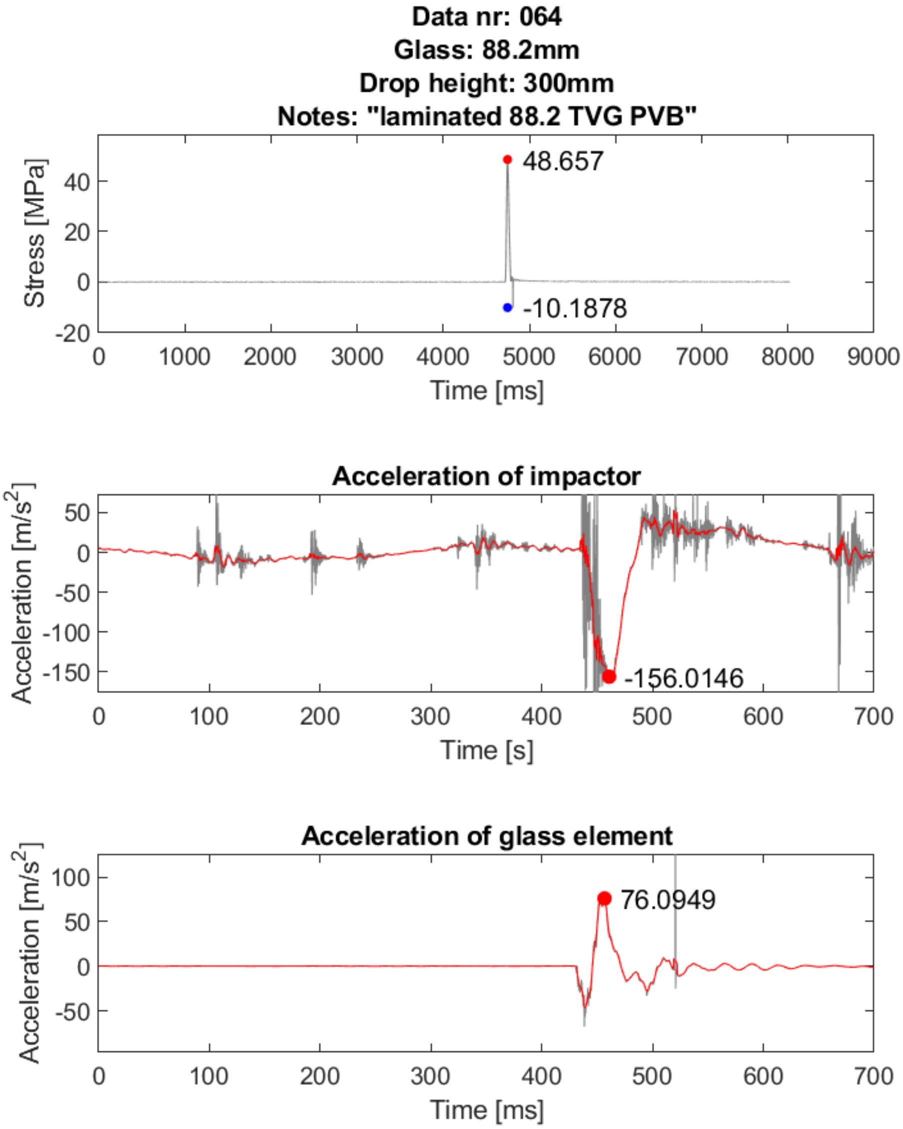

Data nr: 060
Glass: 88.2mm
Drop height: 200mm
Notes: "laminated 88.2 TVG PVB"
42.7259
-0.0006783
Stress [MPa]
Time [ms]
Acceleration of impactor
-133.9348
Acceleration [m/s2]
Time [s]
Acceleration of glass element
63.0306
Acceleration [m/s2]
Time [ms]

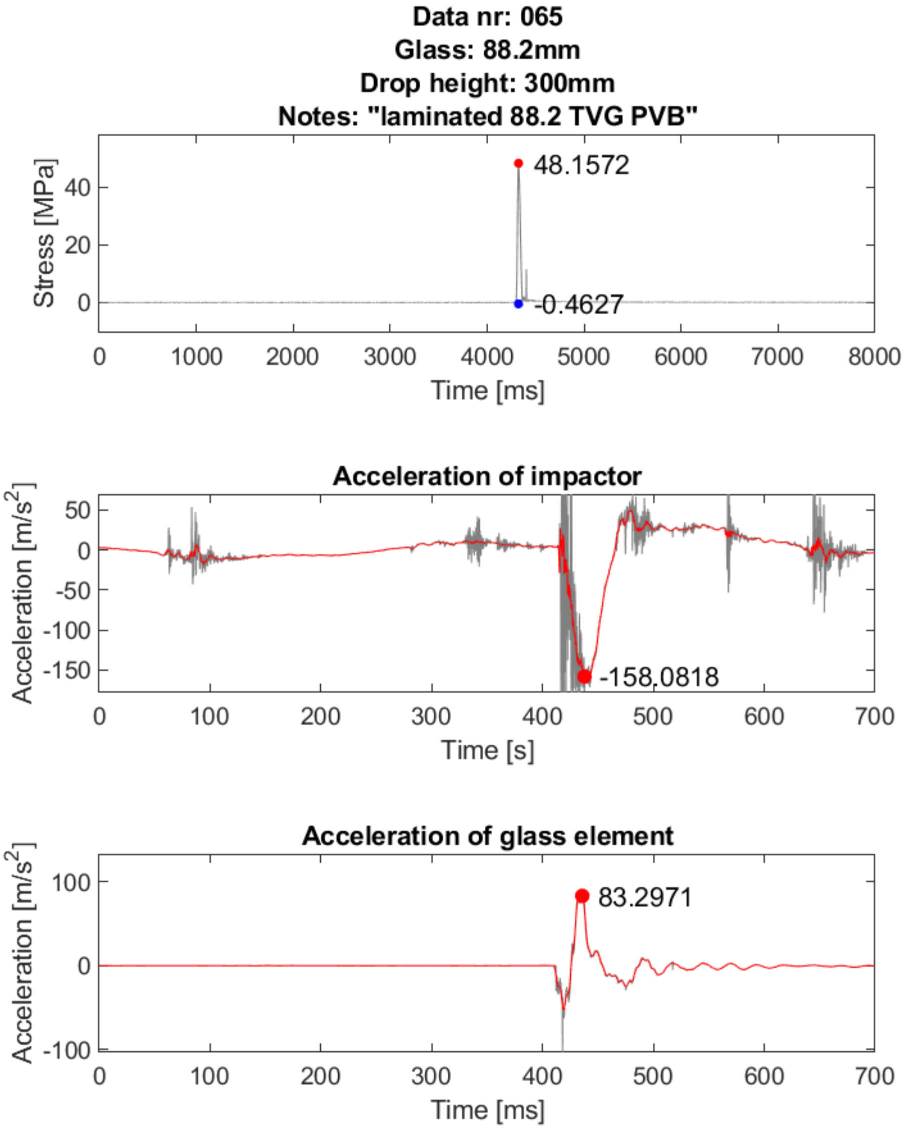

Data nr: 061
Glass: 88.2mm
Drop height: 200mm
Notes: "laminated 88.2 TVG PVB"
Stress [MPa]
42.2086
-0.029729
0 1000 2000 3000 4000 5000 6000 7000 8000 9000
Time [ms]
Acceleration of impactor
Acceleration [m/s^2]
-148.4404
0 100 200 300 400 500 600 700
Time [s]
Acceleration of glass element
Acceleration [m/s^2]
59.9688
0 100 200 300 400 500 600 700
Time [ms]

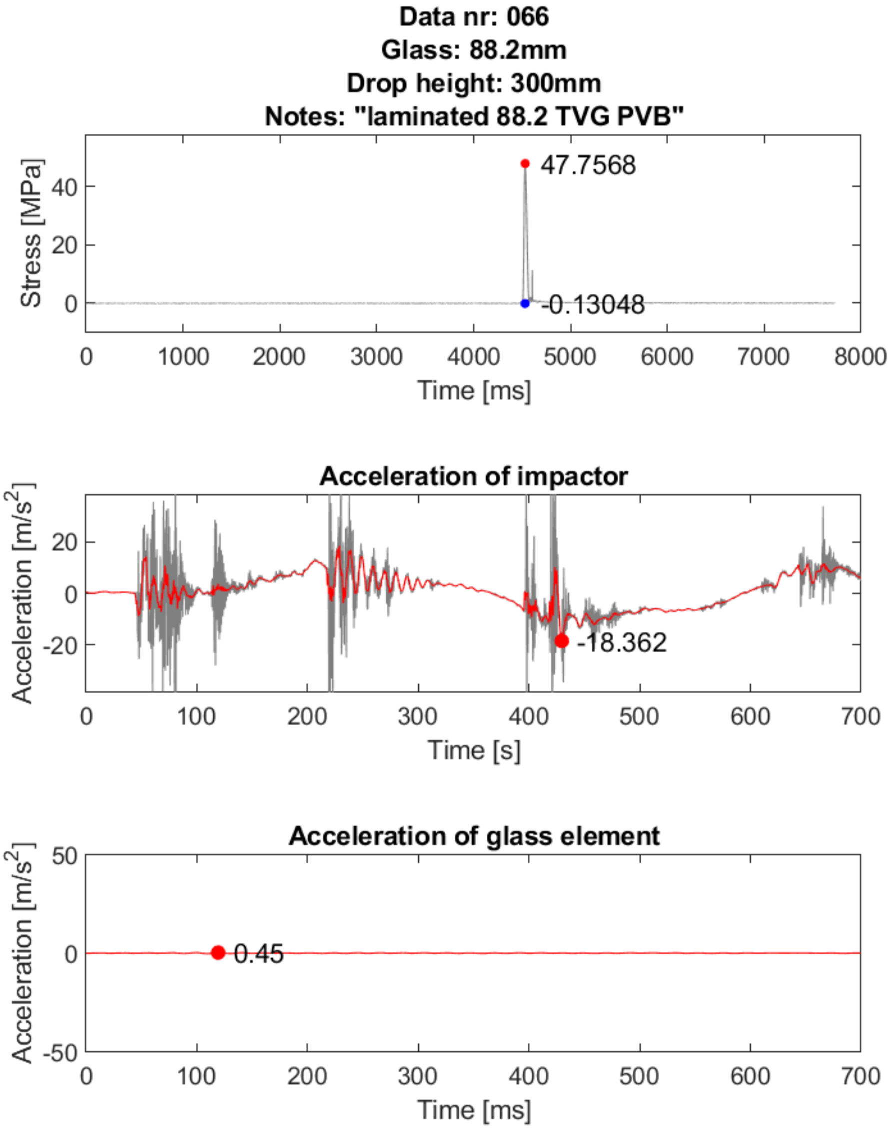

Data nr: 062
Glass: 88.2mm
Drop height: 200mm
Notes: "laminated 88.2 TVG PVB"
Stress [MPa]
43.0633
-0.058184
Time [ms]
Acceleration of impactor
Acceleration [m/s2]
-147.109
Time [s]
Acceleration of glass element
Acceleration [m/s2]
71.2291
Time [ms]

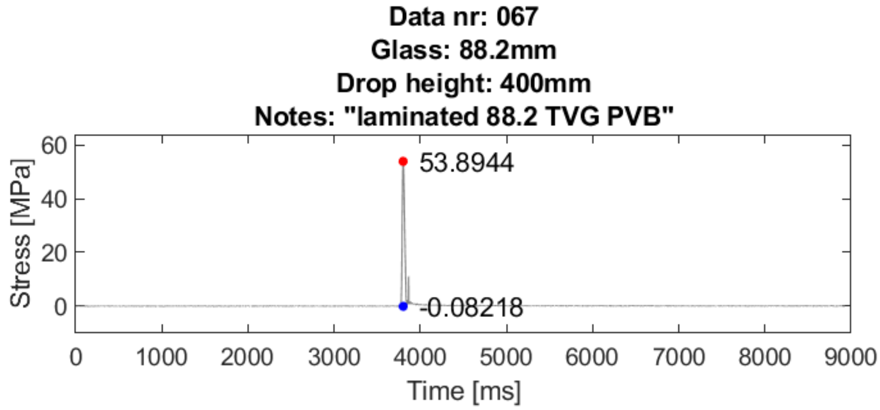


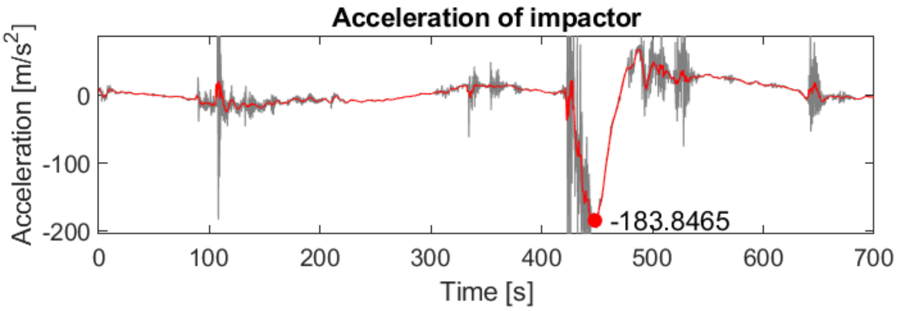
Data nr: 063
Glass: 88.2mm
Drop height: 300mm
Notes: "laminated 88.2 TVG PVB"
Stress [MPa]
43.064
-0.058184
Time [ms]
Acceleration of impactor
Acceleration [m/s^2]
-167.7105
Time [s]
Acceleration of glass element
Acceleration [m/s^2]
81.4761
Time [ms]

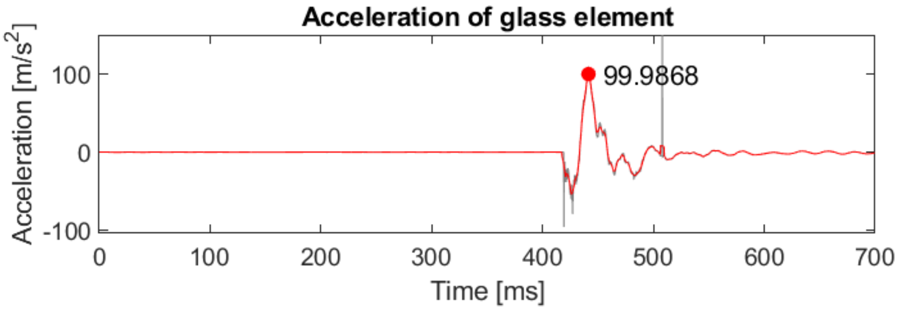

Data nr: 064
Glass: 88.2mm
Drop height: 300mm
Notes: "laminated 88.2 TVG PVB"
Stress [MPa]
48.657
-10.1878
Time [ms]
Acceleration of impactor
Acceleration [m/s2]
-156.0146
Time [s]
Acceleration of glass element
Acceleration [m/s2]
76.0949
Time [ms]

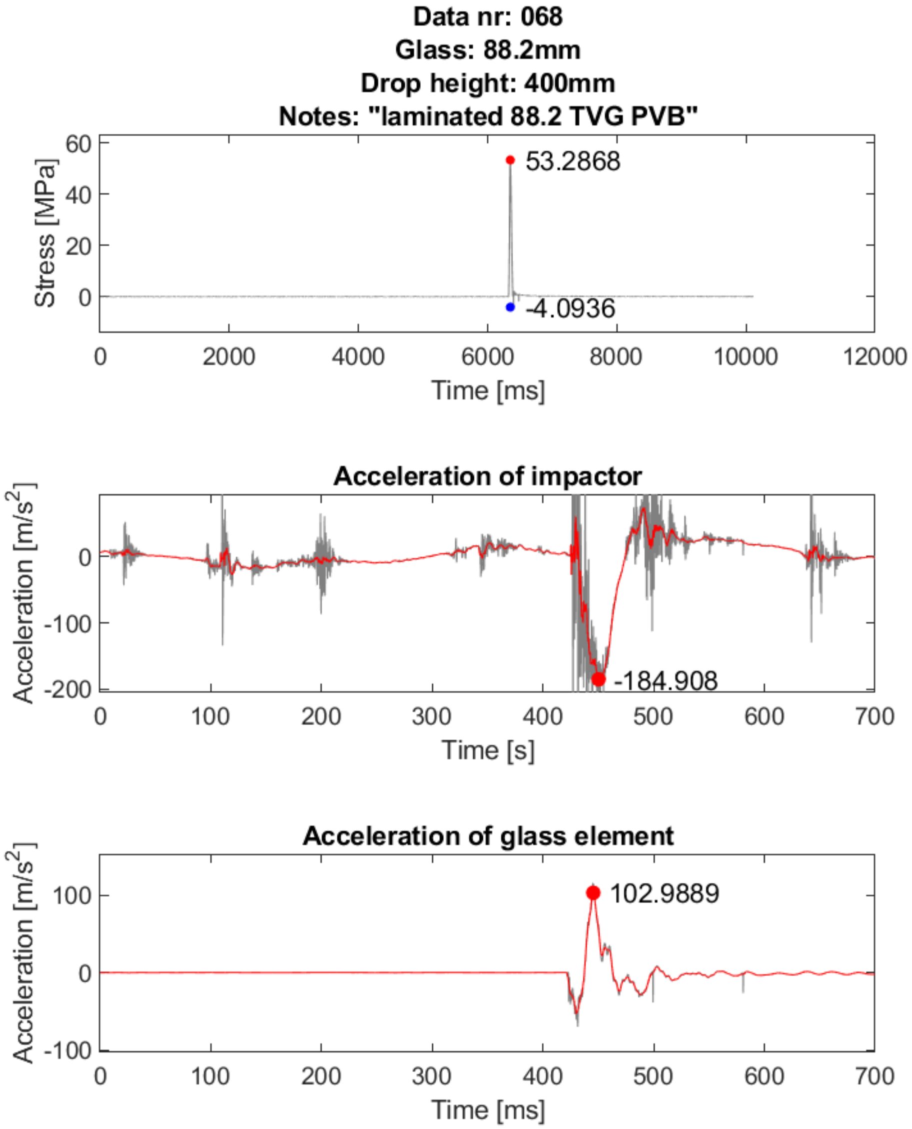

Data nr: 065
Glass: 88.2mm
Drop height: 300mm
Notes: "laminated 88.2 TVG PVB"
Stress [MPa]
48.1572
-0.4627
0
20
40
0
1000
2000
3000
4000
5000
6000
7000
8000
Time [ms]
Acceleration of impactor
Acceleration [m/s2]
50
0
-50
-100
-150
-158,0818
0
100
200
300
400
500
600
700
Time [s]
Acceleration of glass element
Acceleration [m/s2]
100
0
-100
83.2971
0
100
200
300
400
500
600
700
Time [ms]

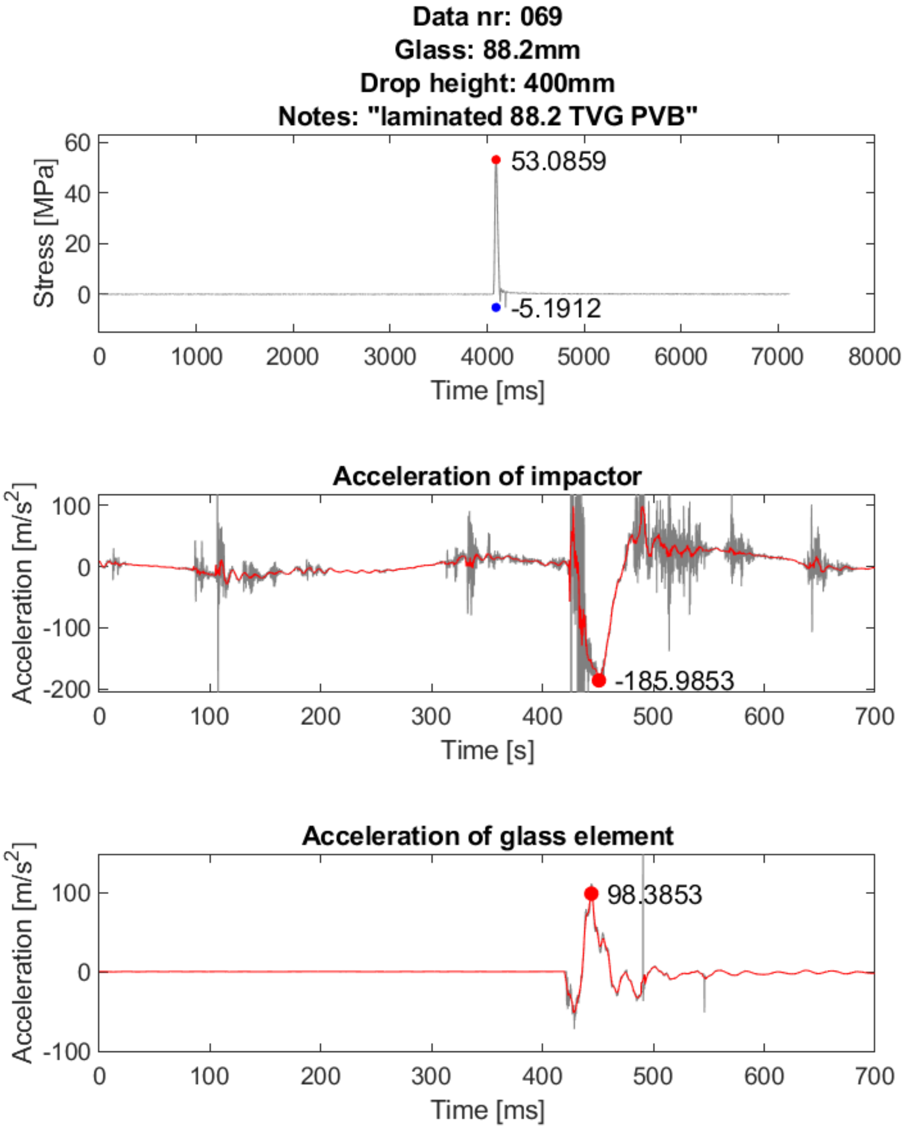

Data nr: 066
Glass: 88.2mm
Drop height: 300mm
Notes: "laminated 88.2 TVG PVB"
47.7568
-0.13048
Stress [MPa]
Time [ms]
Acceleration of impactor
-18.362
Acceleration [m/s^2]
Time [s]
Acceleration of glass element
0.45
Acceleration [m/s^2]
Time [ms]


Data nr: 067
Glass: 88.2mm
Drop height: 400mm
Notes: "laminated 88.2 TVG PVB"
Stress [MPa]
53.8944
-0.08218
Time [ms]

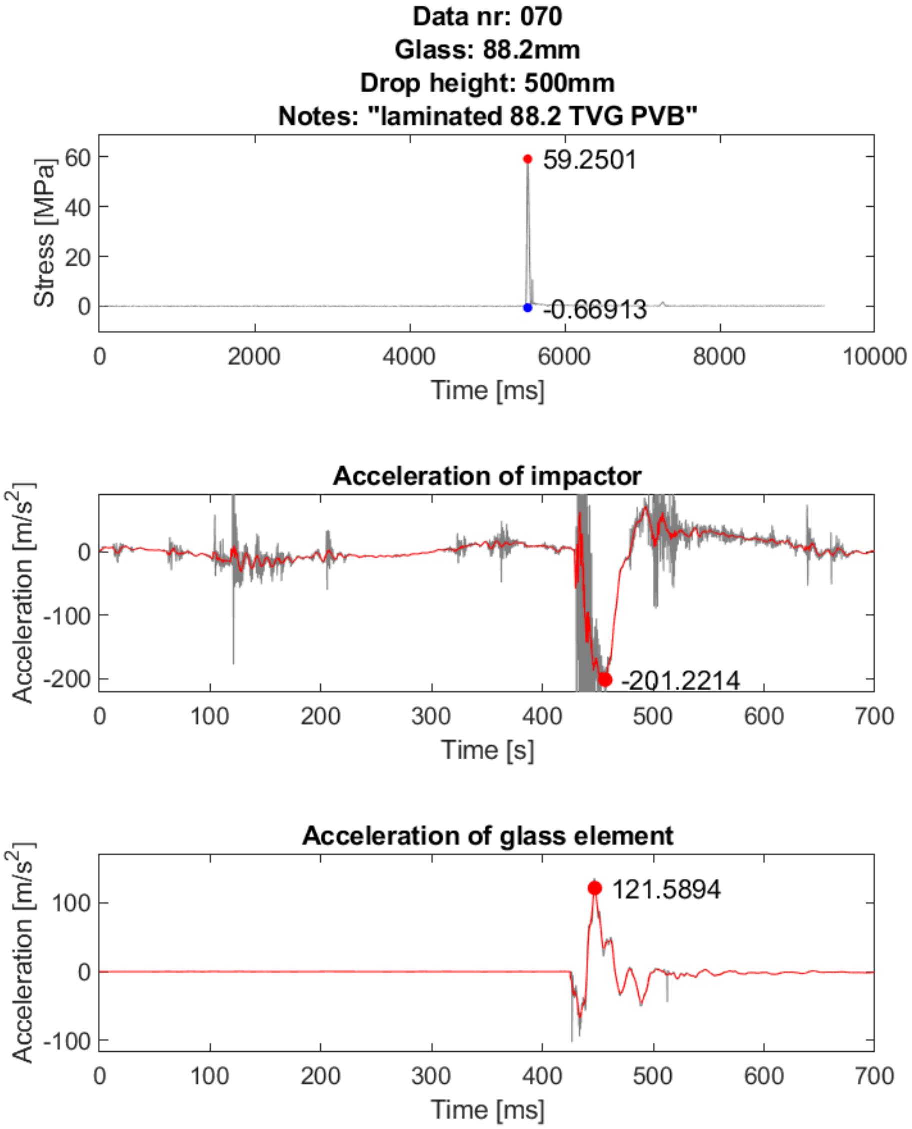

Acceleration of impactor
Acceleration [m/s^2]
-183.8465
Time [s]

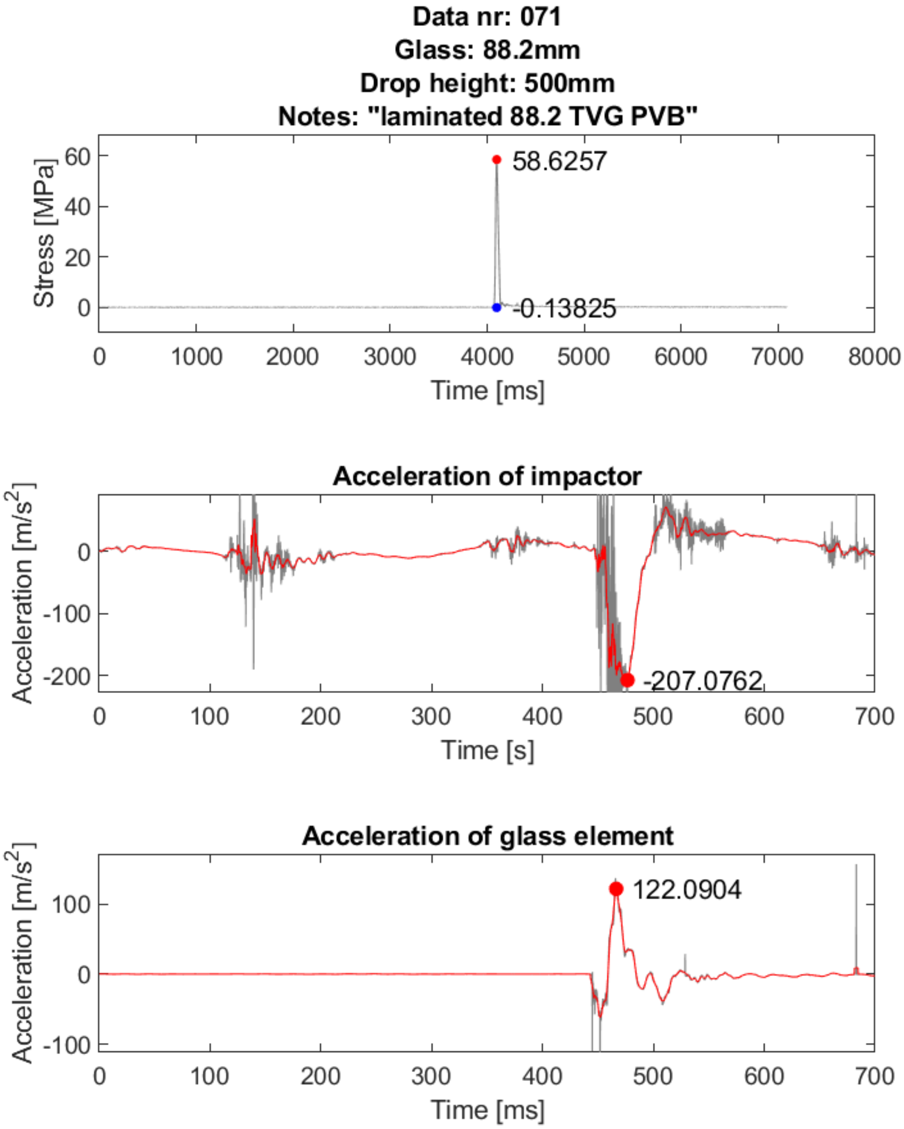

Acceleration of glass element
Acceleration [m/s^2]
99.9868
Time [ms]

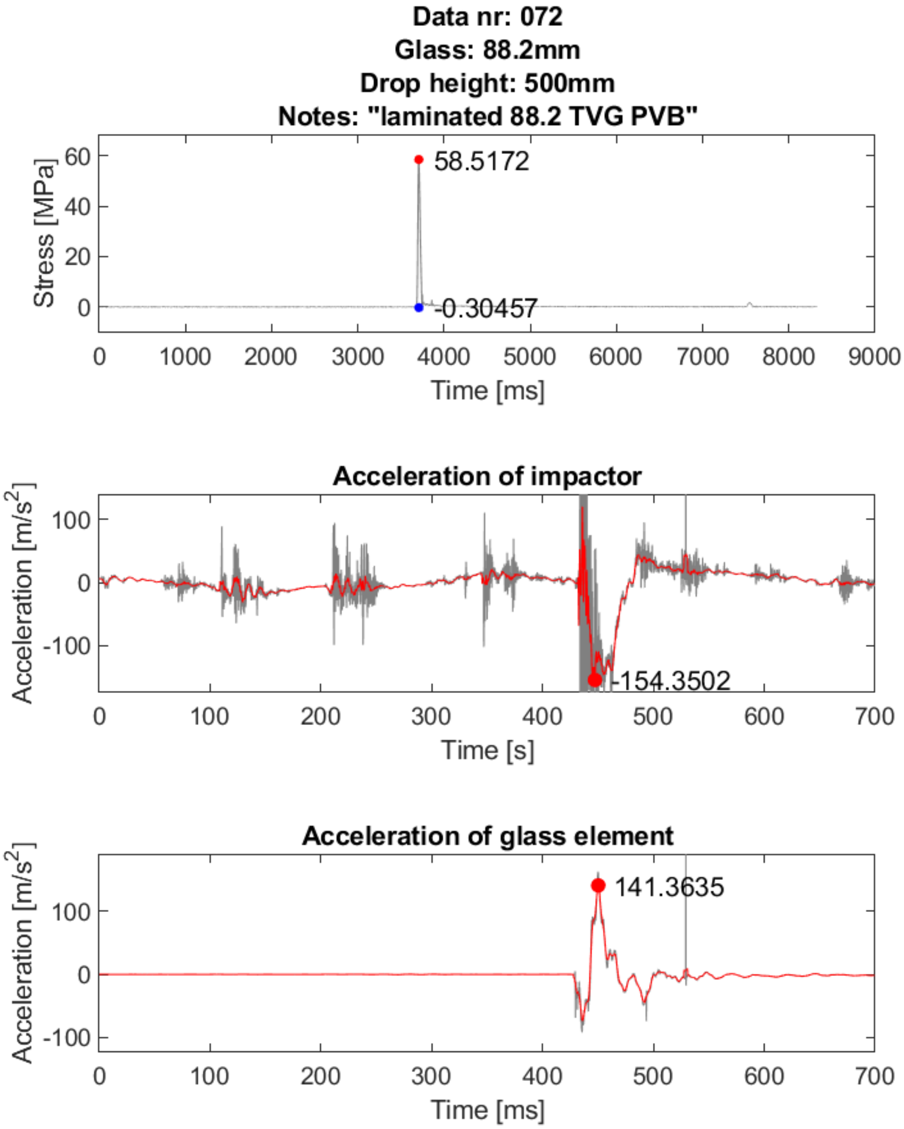

Data nr: 068
Glass: 88.2mm
Drop height: 400mm
Notes: "laminated 88.2 TVG PVB"
Stress [MPa]
53.2868
-4.0936
Time [ms]
Acceleration of impactor
Acceleration [m/s^2]
-184.908
Time [s]
Acceleration of glass element
Acceleration [m/s^2]
102.9889
Time [ms]



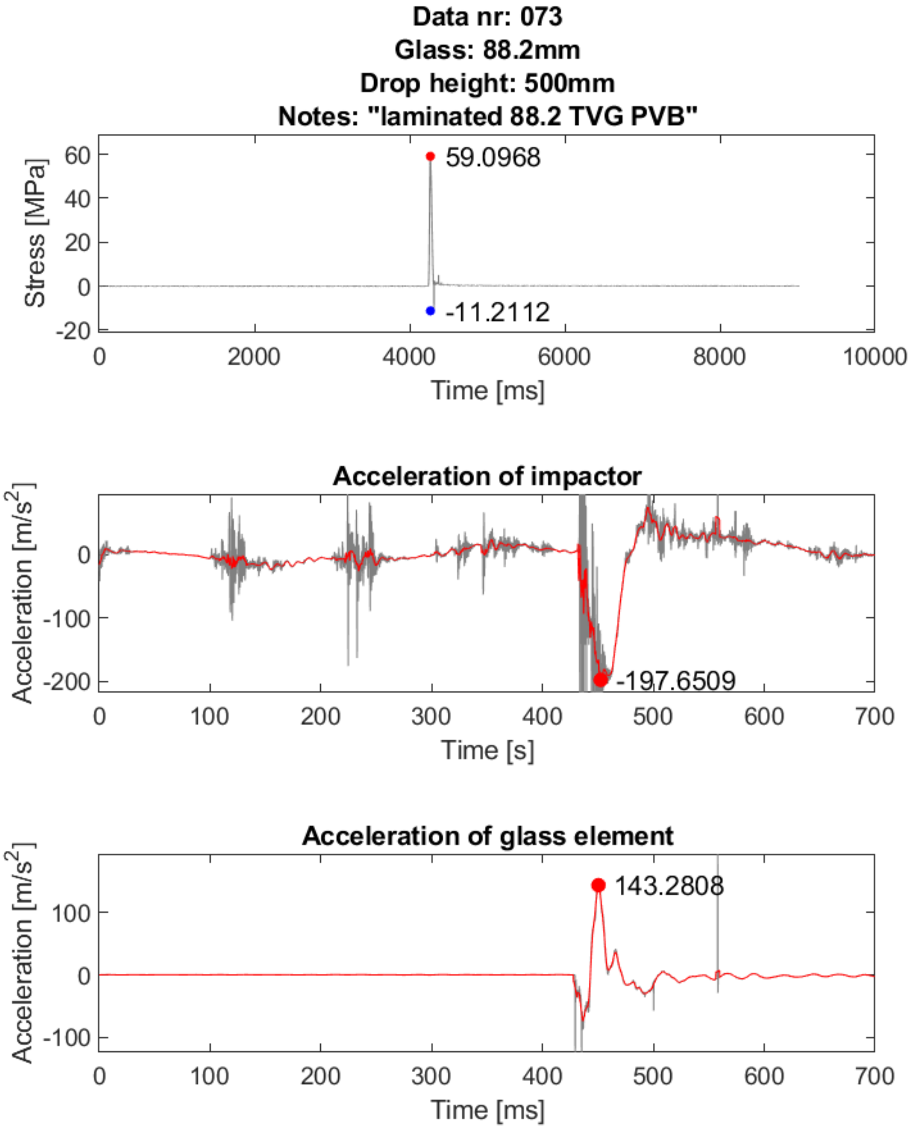
Data nr: 069
Glass: 88.2mm
Drop height: 400mm
Notes: "laminated 88.2 TVG PVB"
Stress [MPa]
53.0859
-5.1912
Time [ms]
Acceleration of impactor
Acceleration [m/s^2]
-185.9853
Time [s]
Acceleration of glass element
Acceleration [m/s^2]
98.3853
Time [ms]

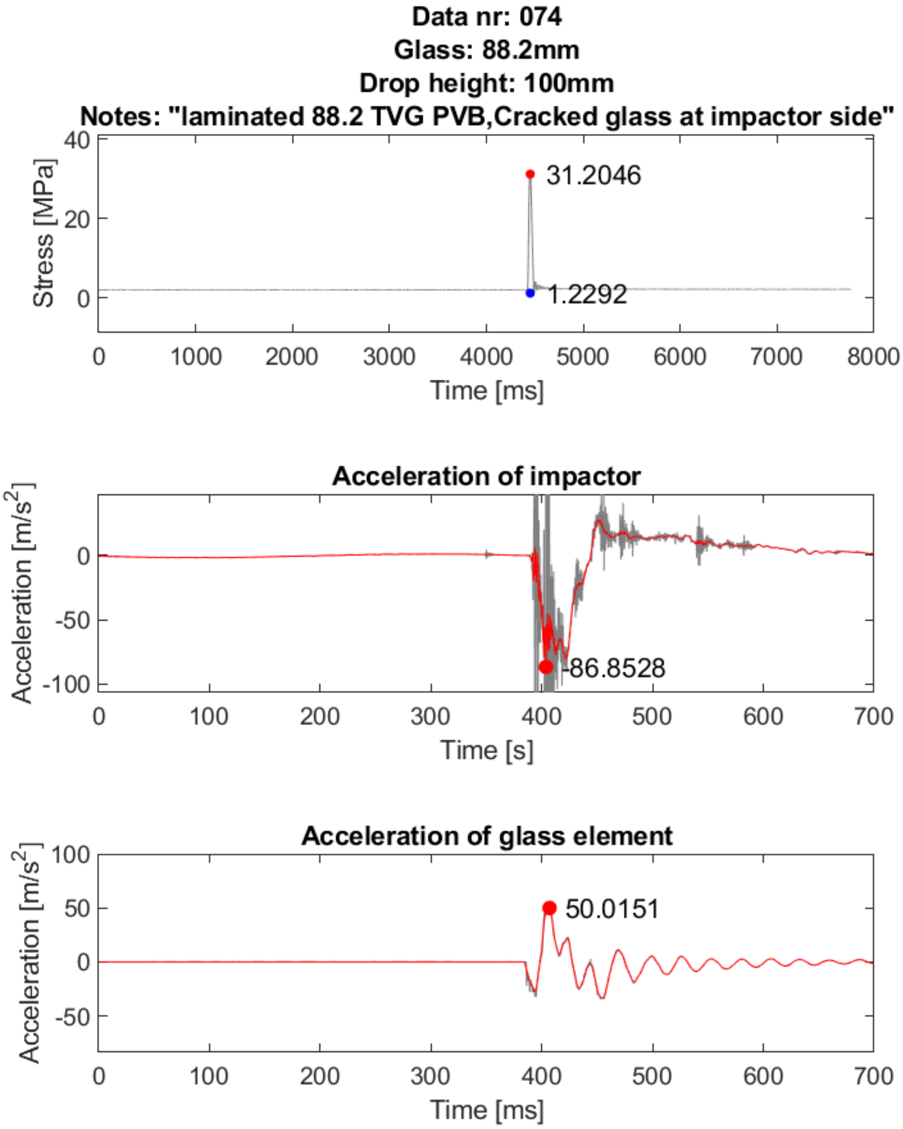

Data nr: 070
Glass: 88.2mm
Drop height: 500mm
Notes: "laminated 88.2 TVG PVB"
Stress [MPa]
59.2501
-0.66913
Time [ms]
Acceleration of impactor
Acceleration [m/s2]
-201.2214
Time [s]
Acceleration of glass element
Acceleration [m/s2]
121.5894
Time [ms]

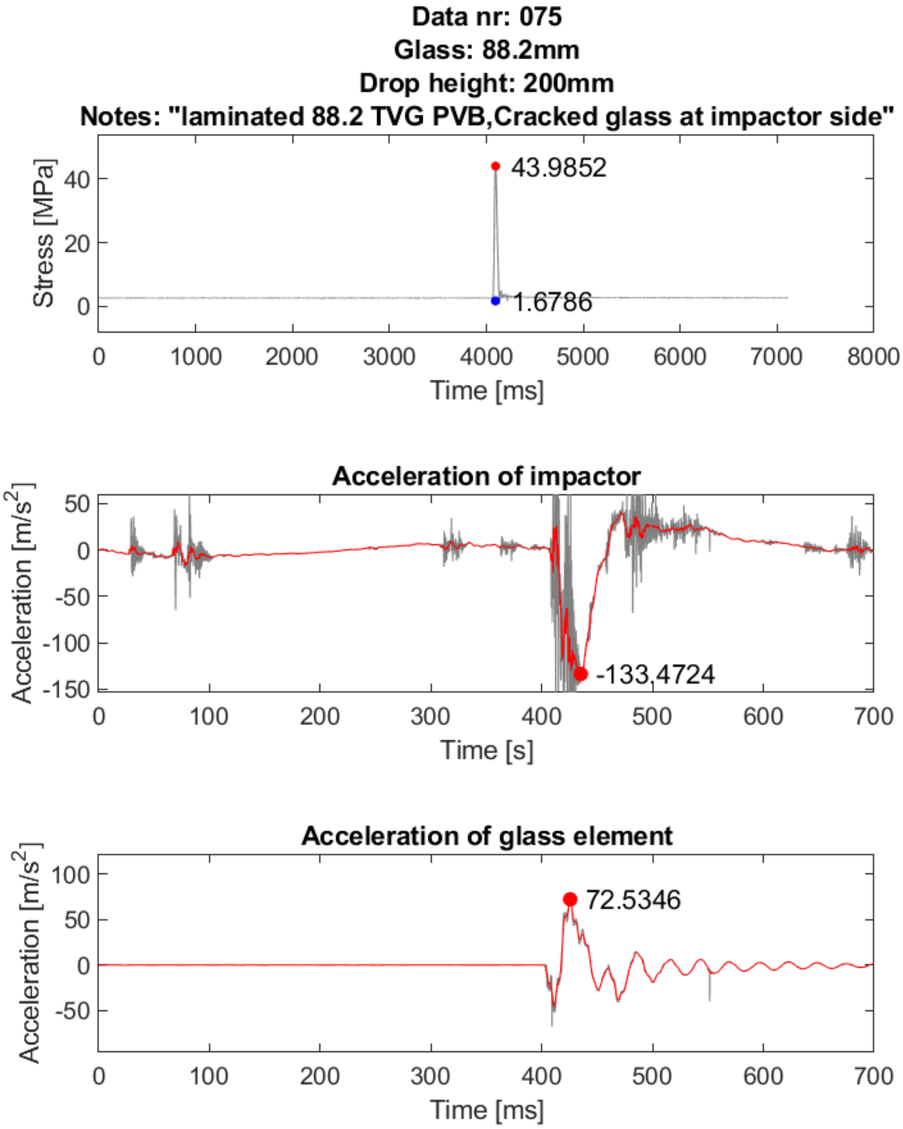

Data nr: 071
Glass: 88.2mm
Drop height: 500mm
Notes: "laminated 88.2 TVG PVB"
Stress [MPa]
58.6257
-0.13825
Time [ms]
Acceleration of impactor
Acceleration [m/s^2]
-207.0762
Time [s]
Acceleration of glass element
Acceleration [m/s^2]
122.0904
Time [ms]



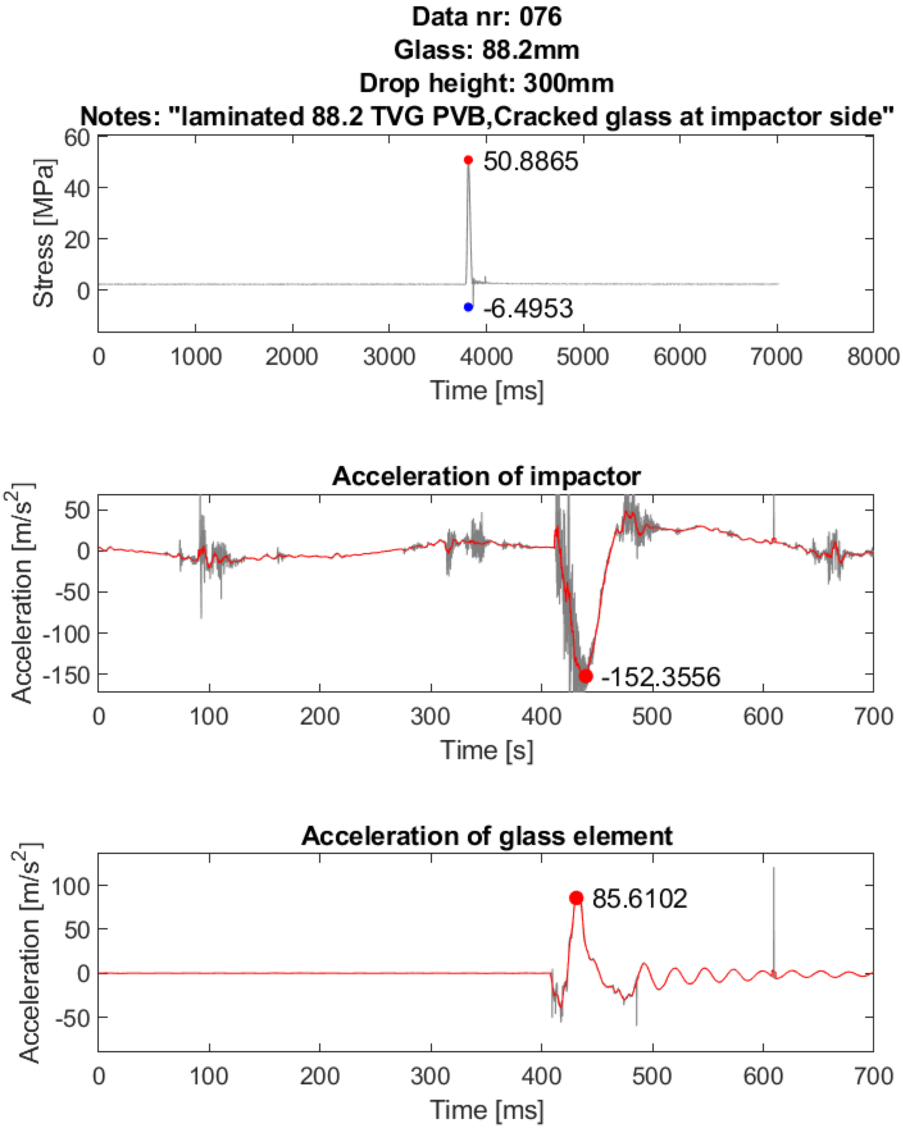
Data nr: 072
Glass: 88.2mm
Drop height: 500mm
Notes: "laminated 88.2 TVG PVB"
Stress [MPa]
58.5172
-0.30457
Time [ms]
Acceleration of impactor
Acceleration [m/s2]
-154.3502
Time [s]
Acceleration of glass element
Acceleration [m/s2]
141.3635
Time [ms]

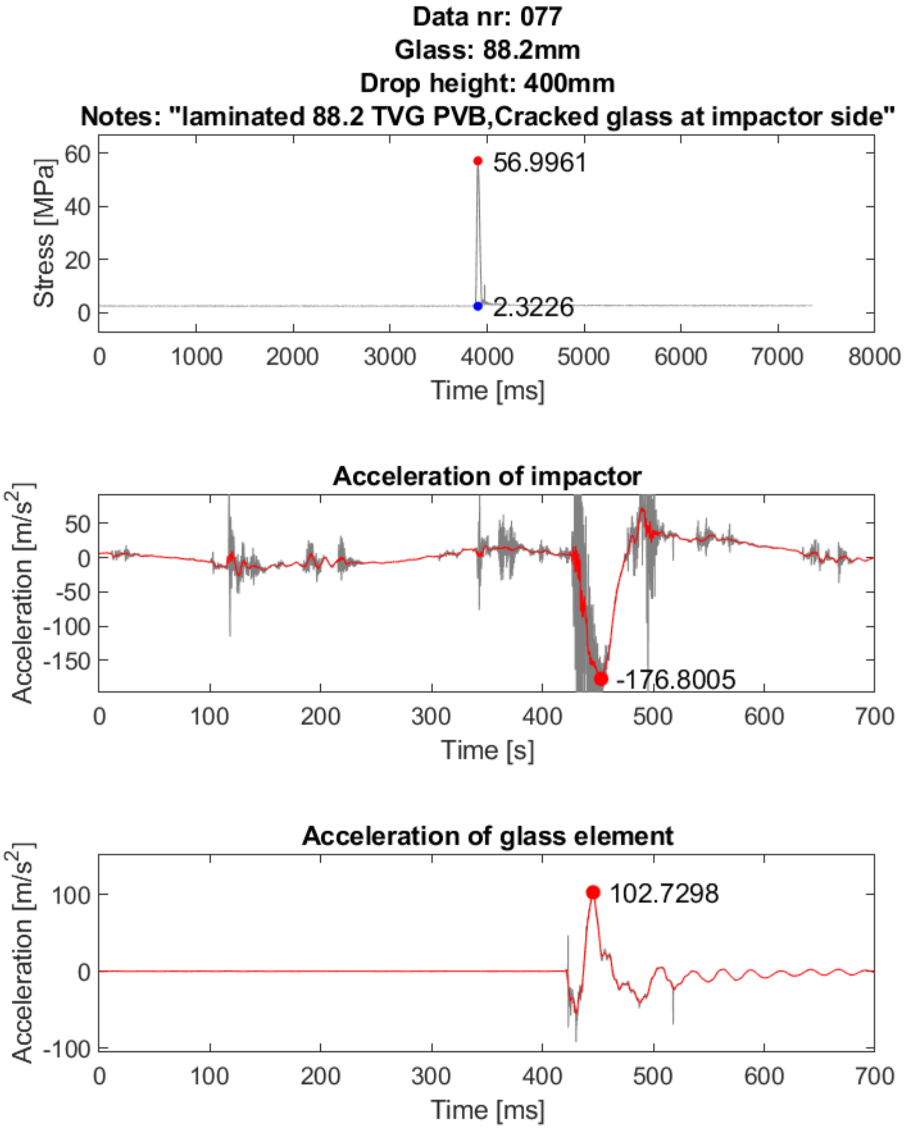

Data nr: 073
Glass: 88.2mm
Drop height: 500mm
Notes: "laminated 88.2 TVG PVB"
Stress [MPa]
59.0968
-11.2112
Time [ms]
Acceleration of impactor
Acceleration [m/s^2]
-197.6509
Time [s]
Acceleration of glass element
Acceleration [m/s^2]
143.2808
Time [ms]


Data nr: 074
Glass: 88.2mm
Drop height: 100mm
Notes: "laminated 88.2 TVG PVB,Cracked glass at impactor side"
Stress [MPa]
31.2046
1.2292
Time [ms]
Acceleration of impactor
Acceleration [m/s2]
-86.8528
Time [s]
Acceleration of glass element
Acceleration [m/s2]
50.0151
Time [ms]

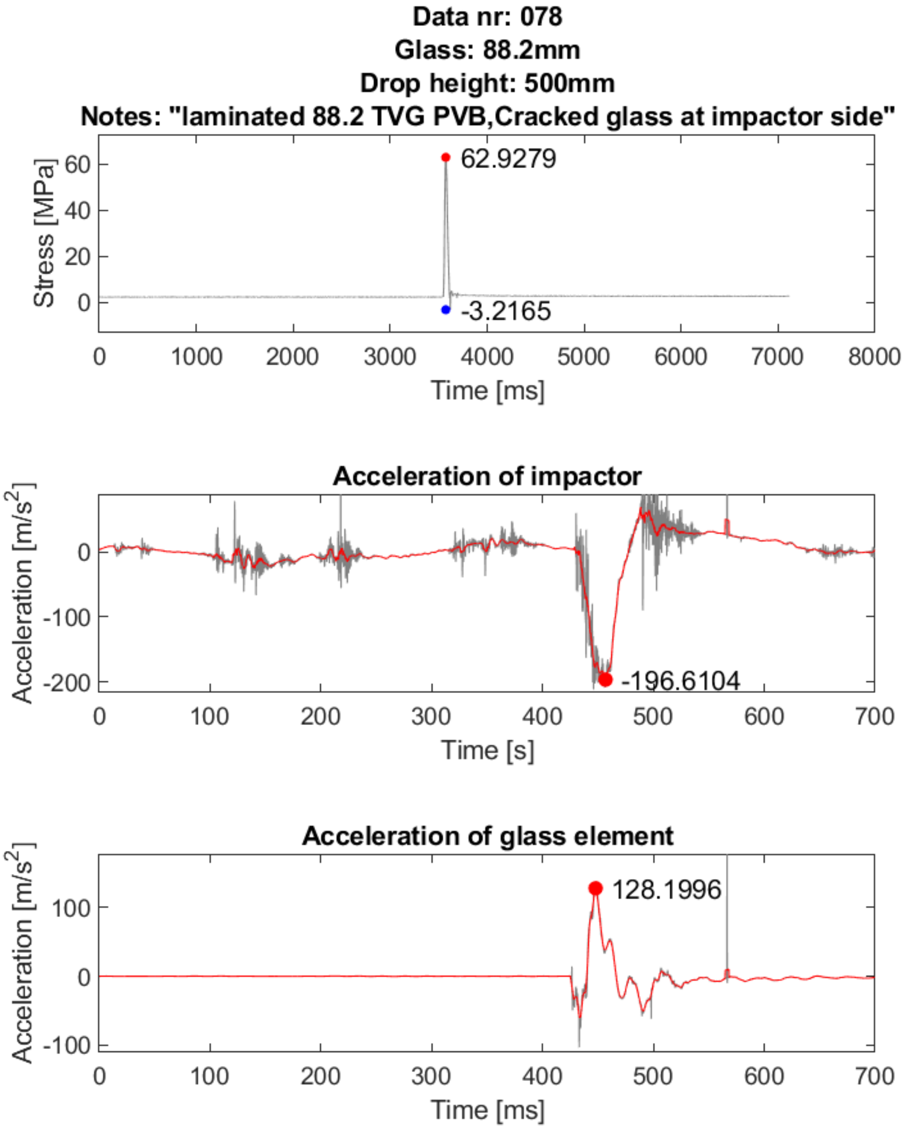


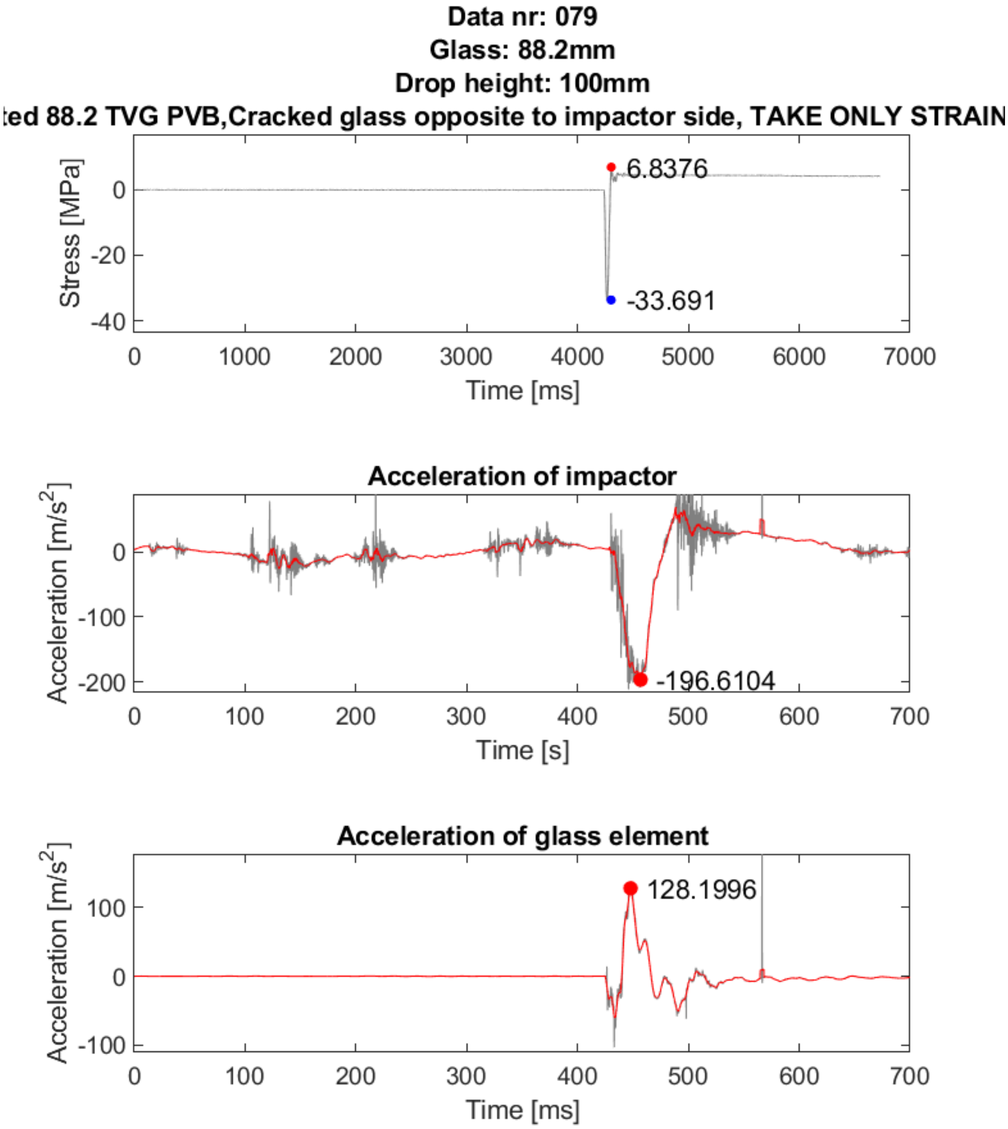
Data nr: 075
Glass: 88.2mm
Drop height: 200mm
Notes: "laminated 88.2 TVG PVB,Cracked glass at impactor side"
Stress [MPa]
43.9852
1.6786
Time [ms]
Acceleration of impactor
Acceleration [m/s2]
-133.4724
Time [s]
Acceleration of glass element
Acceleration [m/s2]
72.5346
Time [ms]

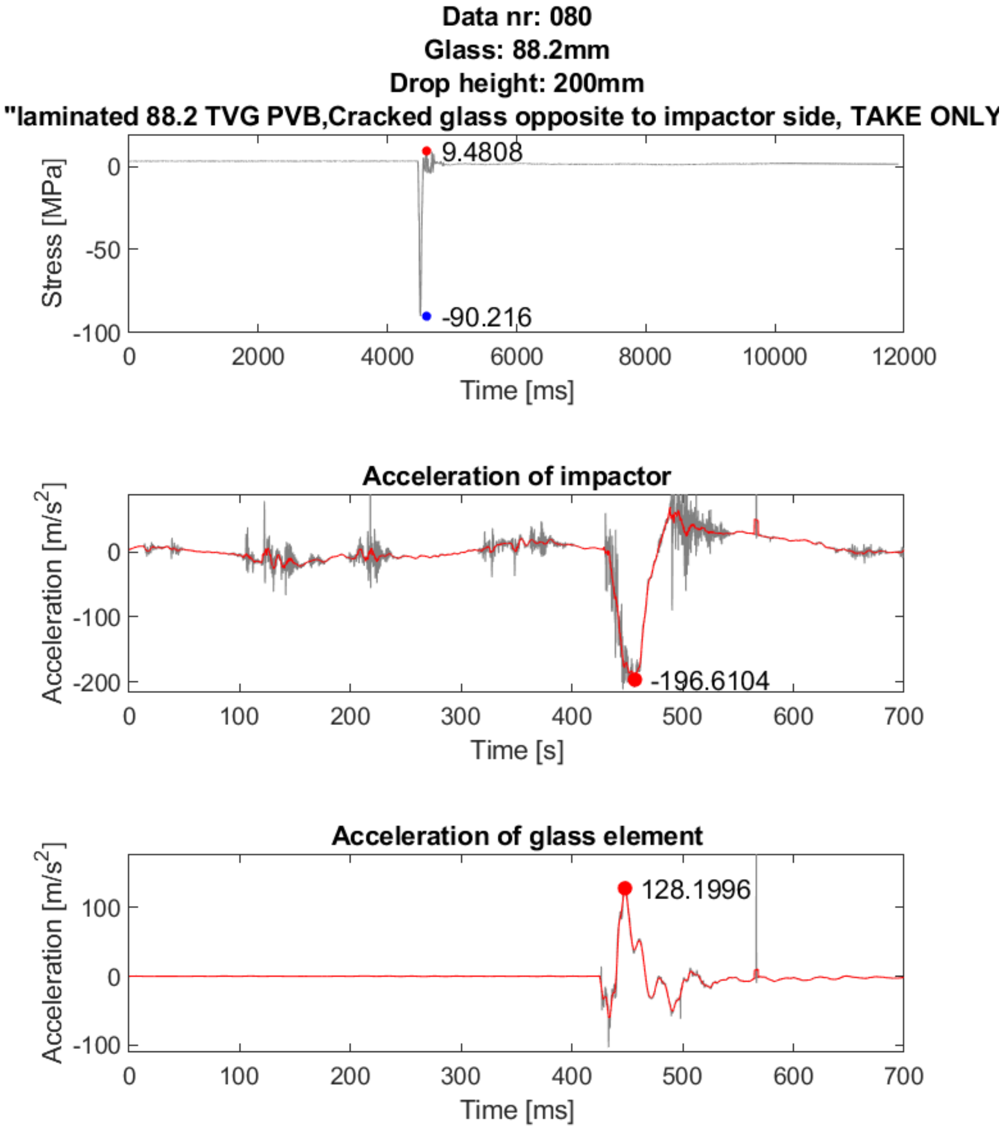

Data nr: 076
Glass: 88.2mm
Drop height: 300mm
Notes: "laminated 88.2 TVG PVB,Cracked glass at impactor side"
Stress [MPa]
50.8865
-6.4953
Time [ms]
Acceleration of impactor
Acceleration [m/s2]
-152.3556
Time [s]
Acceleration of glass element
Acceleration [m/s2]
85.6102
Time [ms]

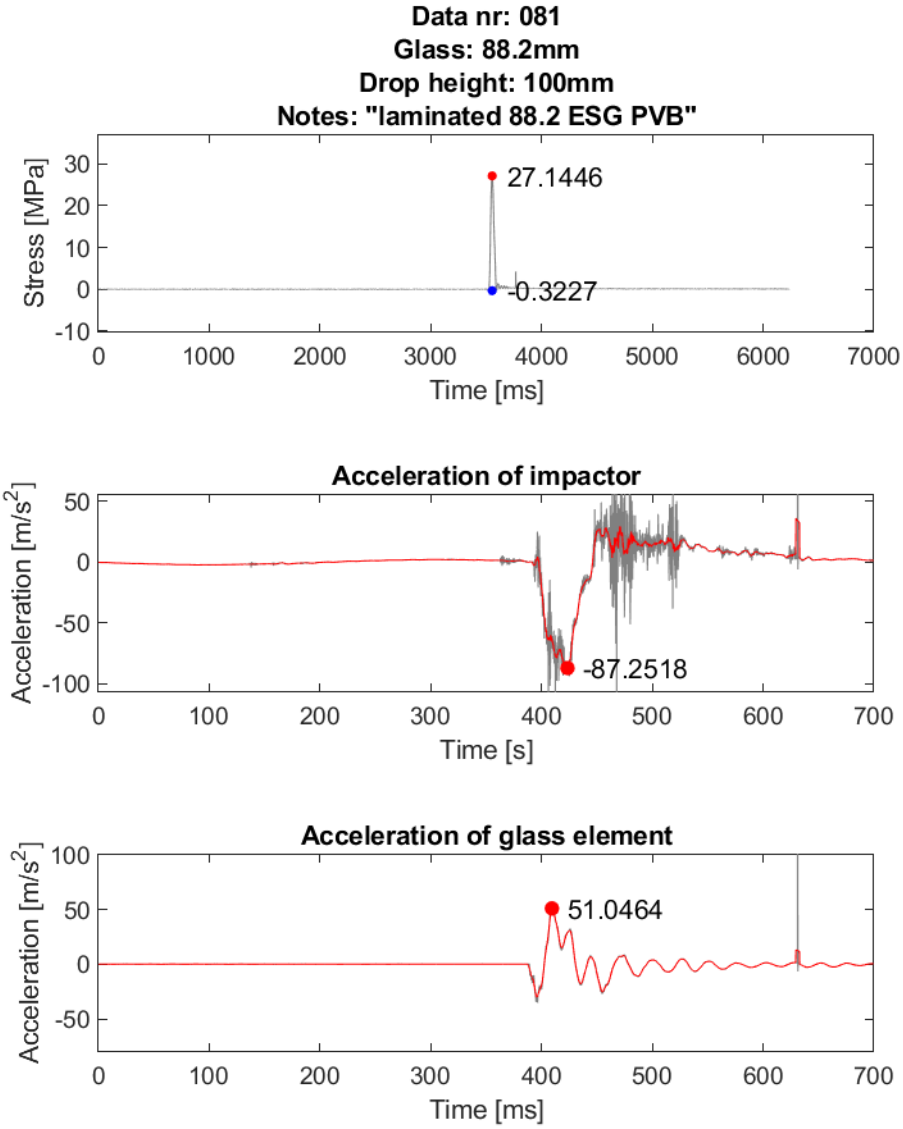


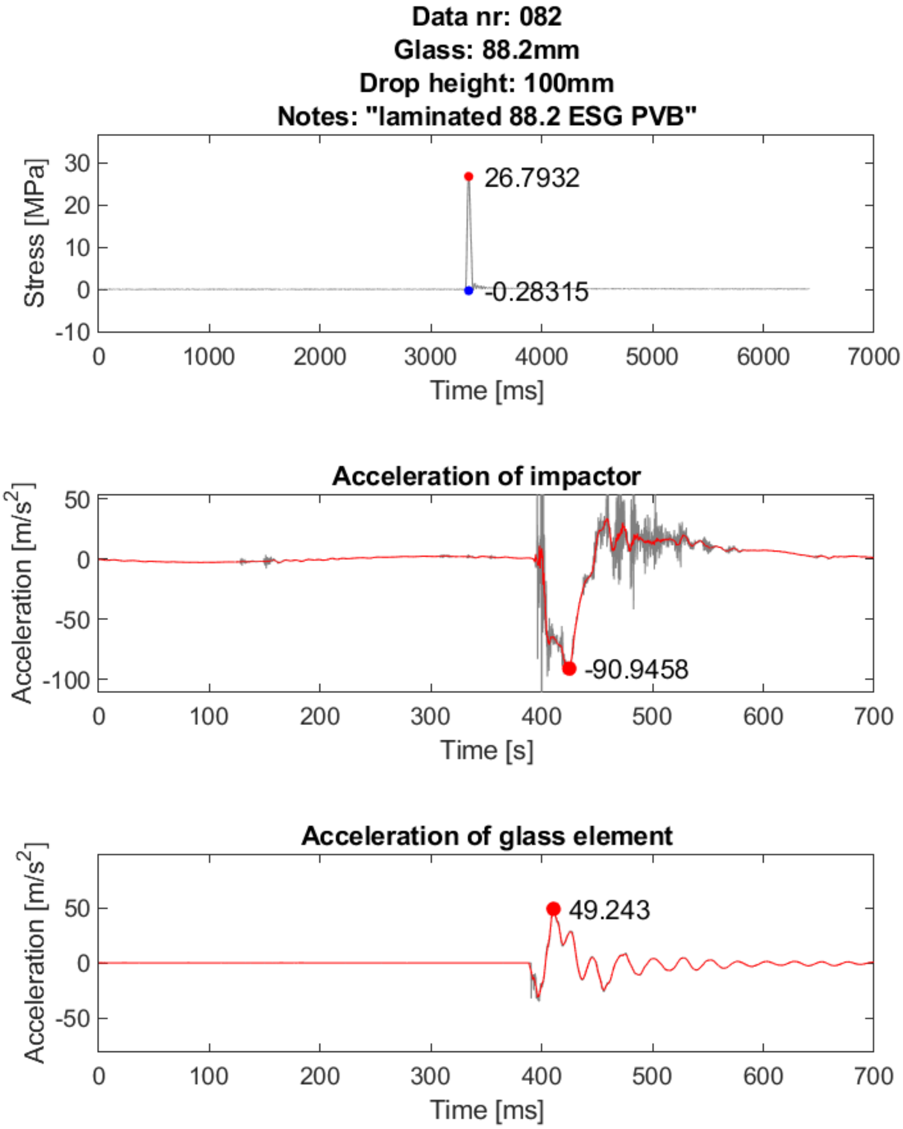
Data nr: 077
Glass: 88.2mm
Drop height: 400mm
Notes: "laminated 88.2 TVG PVB,Cracked glass at impactor side"
Stress [MPa]
56.9961
2.3226
Time [ms]
Acceleration of impactor
Acceleration [m/s^2]
-176.8005
Time [s]
Acceleration of glass element
Acceleration [m/s^2]
102.7298
Time [ms]

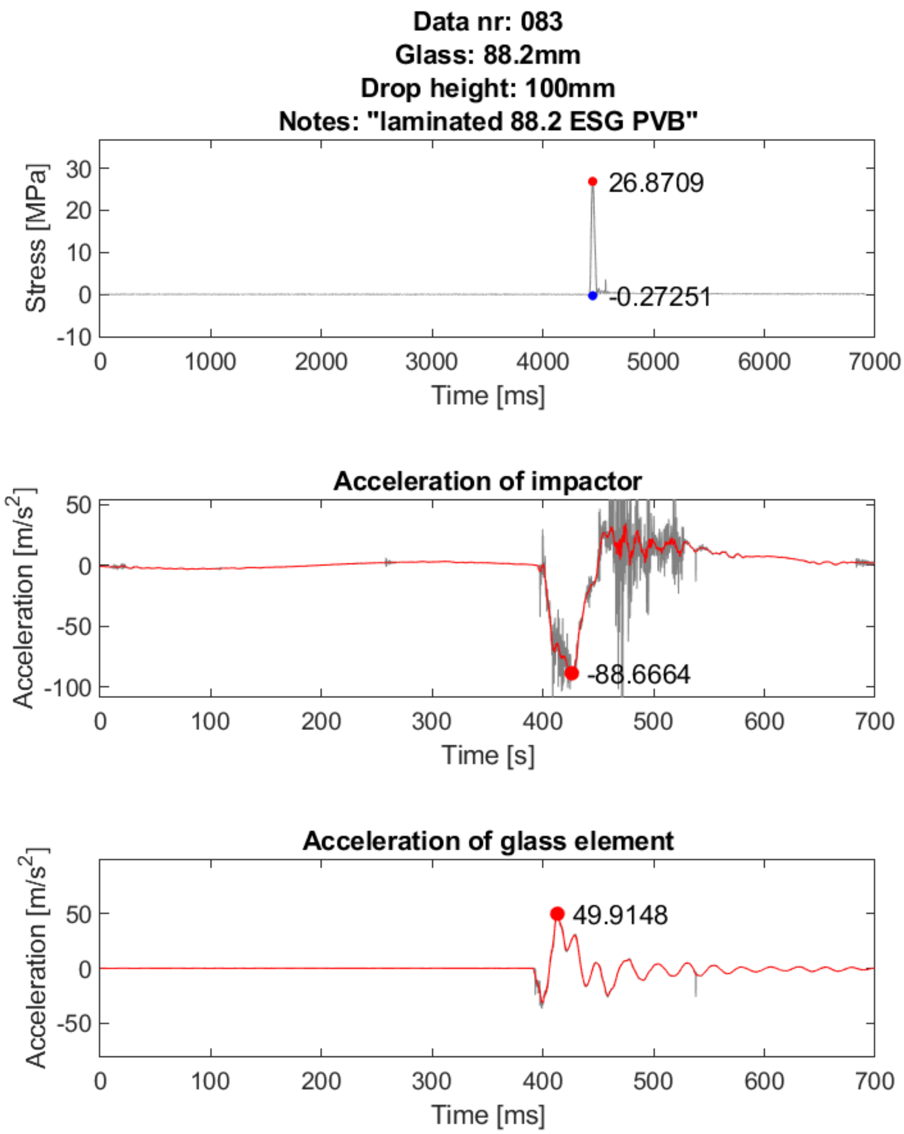

Data nr: 078
Glass: 88.2mm
Drop height: 500mm
Notes: "laminated 88.2 TVG PVB,Cracked glass at impactor side"
Stress [MPa]
62.9279
-3.2165
Time [ms]
Acceleration of impactor
Acceleration [m/s^2]
-196.6104
Time [s]
Acceleration of glass element
Acceleration [m/s^2]
128.1996
Time [ms]

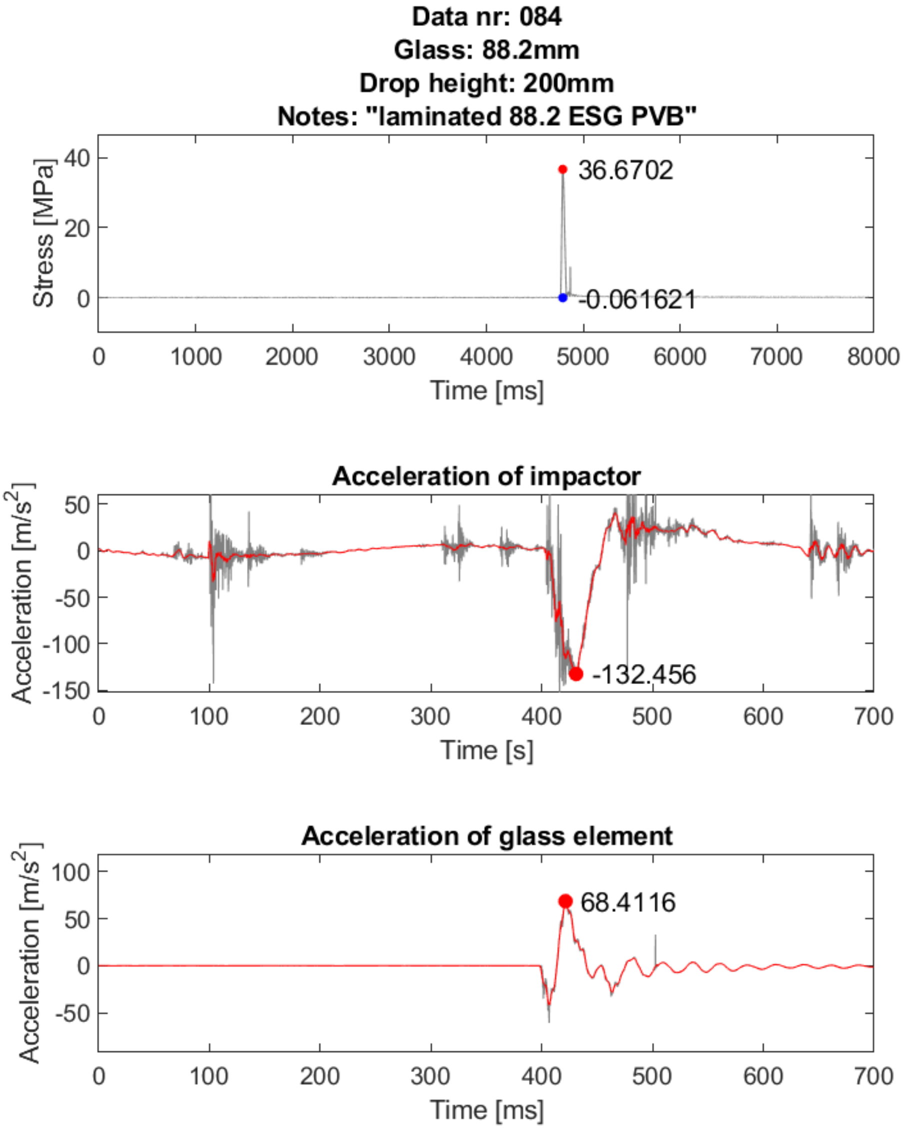

Data nr: 079
Glass: 88.2mm
Drop height: 100mm
ted 88.2 TVG PVB,Cracked glass opposite to impactor side, TAKE ONLY STRAIN
Stress [MPa]
6.8376
-33.691
Time [ms]
Acceleration of impactor
Acceleration [m/s^2]
-196.6104
Time [s]
Acceleration of glass element
Acceleration [m/s^2]
128.1996
Time [ms]

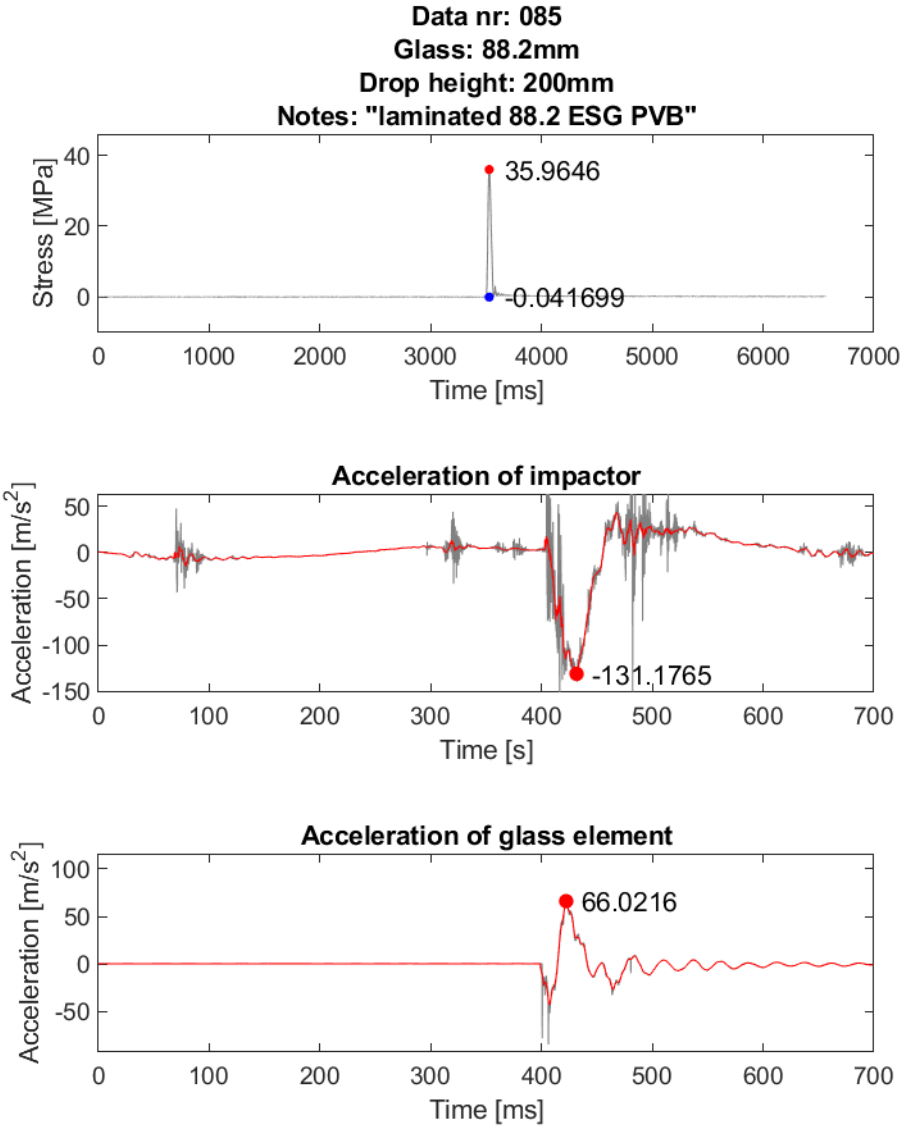

Data nr: 080
Glass: 88.2mm
Drop height: 200mm
"laminated 88.2 TVG PVB,Cracked glass opposite to impactor side, TAKE ONLY
Stress [MPa]
9.4808
-90.216
Time [ms]
Acceleration of impactor
Acceleration [m/s^2]
-196.6104
Time [s]
Acceleration of glass element
Acceleration [m/s^2]
128.1996
Time [ms]


Data nr: 081
Glass: 88.2mm
Drop height: 100mm
Notes: "laminated 88.2 ESG PVB"
Stress [MPa]
27.1446
-0.3227
Time [ms]
Acceleration of impactor
Acceleration [m/s^2]
-87.2518
Time [s]
Acceleration of glass element
Acceleration [m/s^2]
51.0464
Time [ms]

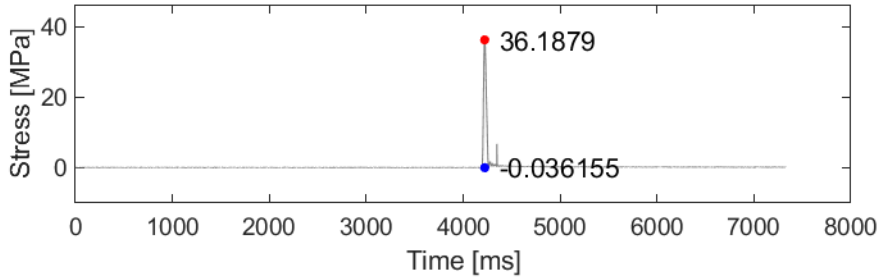

Data nr: 082
Glass: 88.2mm
Drop height: 100mm
Notes: "laminated 88.2 ESG PVB"
Stress [MPa]
26.7932
-0.28315
Time [ms]
Acceleration of impactor
Acceleration [m/s2]
-90.9458
Time [s]
Acceleration of glass element
Acceleration [m/s2]
49.243
Time [ms]


Data nr: 083
Glass: 88.2mm
Drop height: 100mm
Notes: "laminated 88.2 ESG PVB"
Stress [MPa]
26.8709
-0.27251
Time [ms]
Acceleration of impactor
Acceleration [m/s²]
-88.6664
Time [s]
Acceleration of glass element
Acceleration [m/s²]
49.9148
Time [ms]

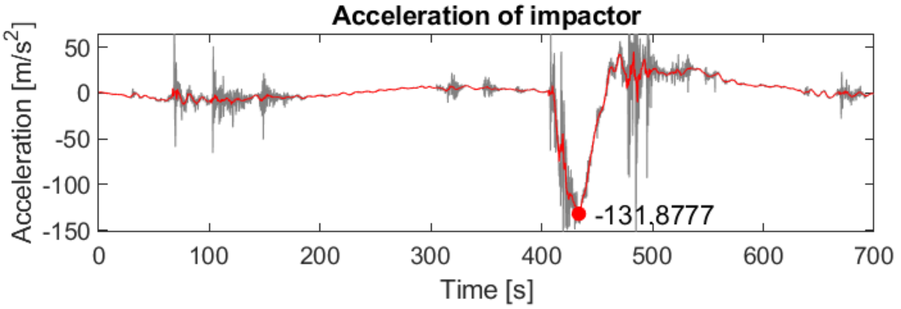

Data nr: 084
Glass: 88.2mm
Drop height: 200mm
Notes: "laminated 88.2 ESG PVB"
Stress [MPa]
40
20
0
36.6702
-0.061621
0
1000
2000
3000
4000
5000
6000
7000
8000
Time [ms]
Acceleration of impactor
Acceleration [m/s2]
50
0
-50
-100
-150
-132.456
0
100
200
300
400
500
600
700
Time [s]
Acceleration of glass element
Acceleration [m/s2]
100
50
0
-50
68.4116
0
100
200
300
400
500
600
700
Time [ms]


Data nr: 085
Glass: 88.2mm
Drop height: 200mm
Notes: "laminated 88.2 ESG PVB"
Stress [MPa]
35.9646
-0.041699
Time [ms]
Acceleration of impactor
Acceleration [m/s2]
-131.1765
Time [s]
Acceleration of glass element
Acceleration [m/s2]
66.0216
Time [ms]

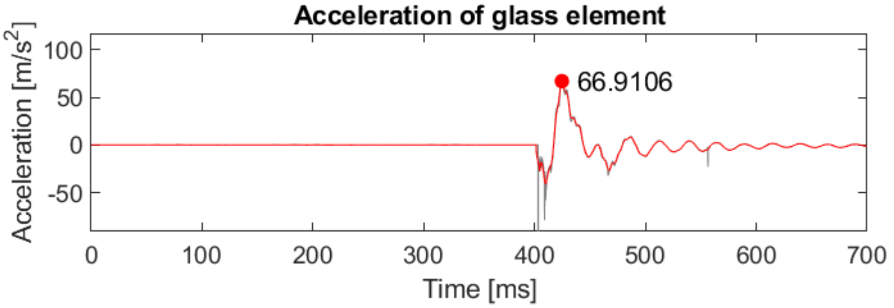
Data nr: 086
Glass: 88.2mm
Drop height: 200mm
Notes: "laminated 88.2 ESG PVB"

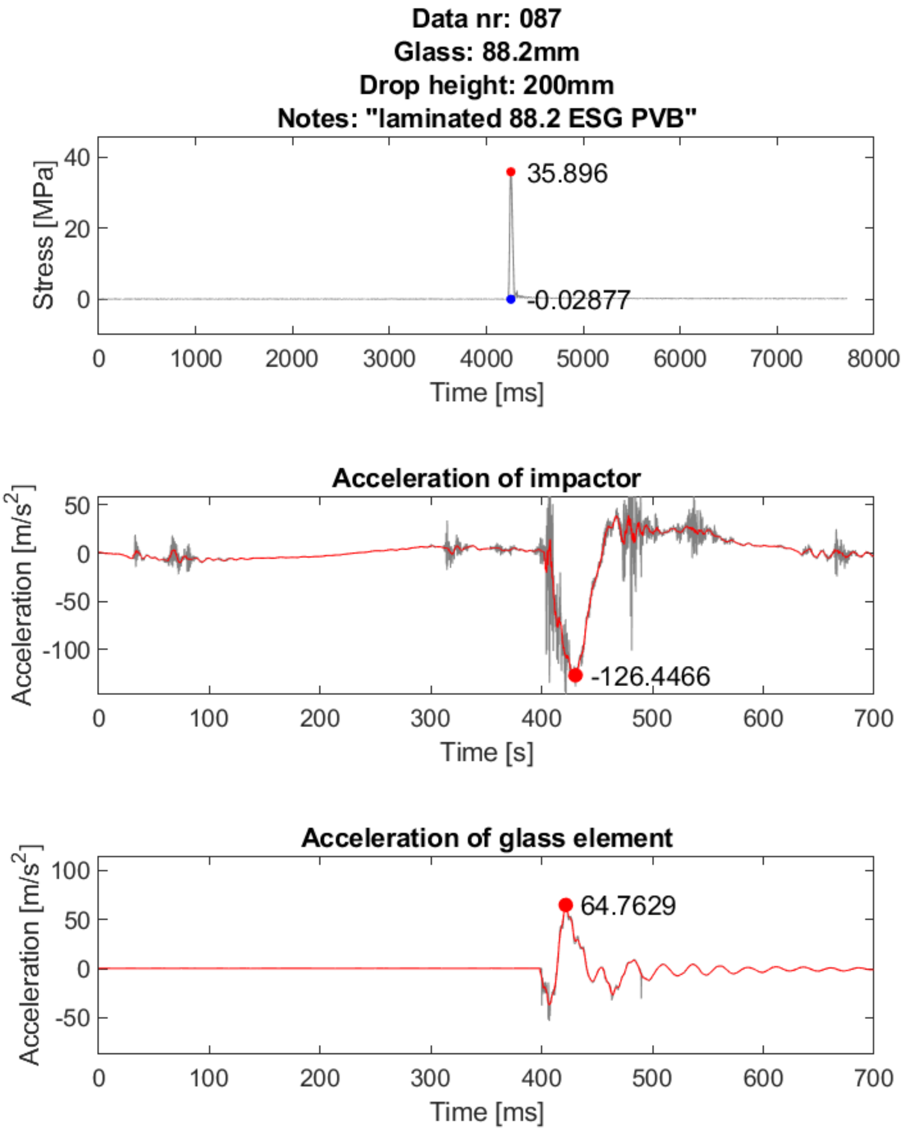


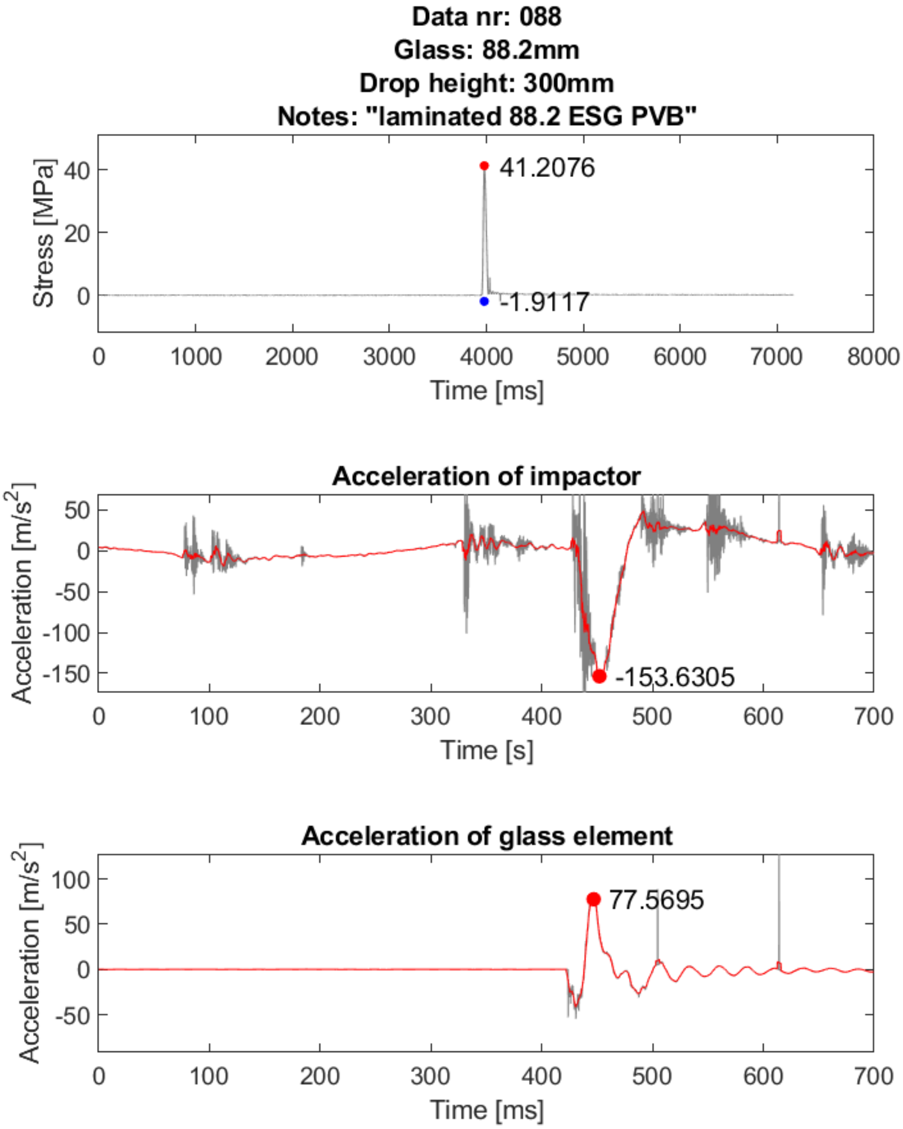
Acceleration of impactor

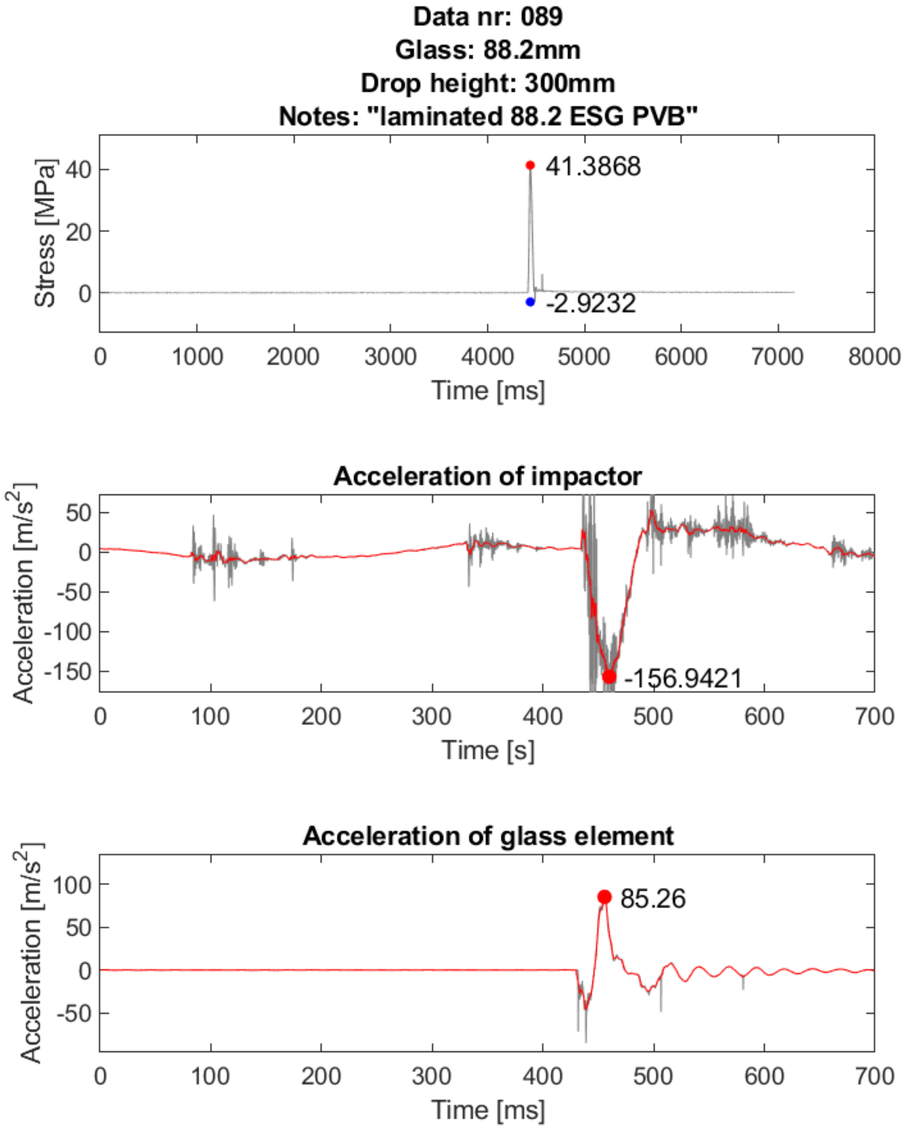


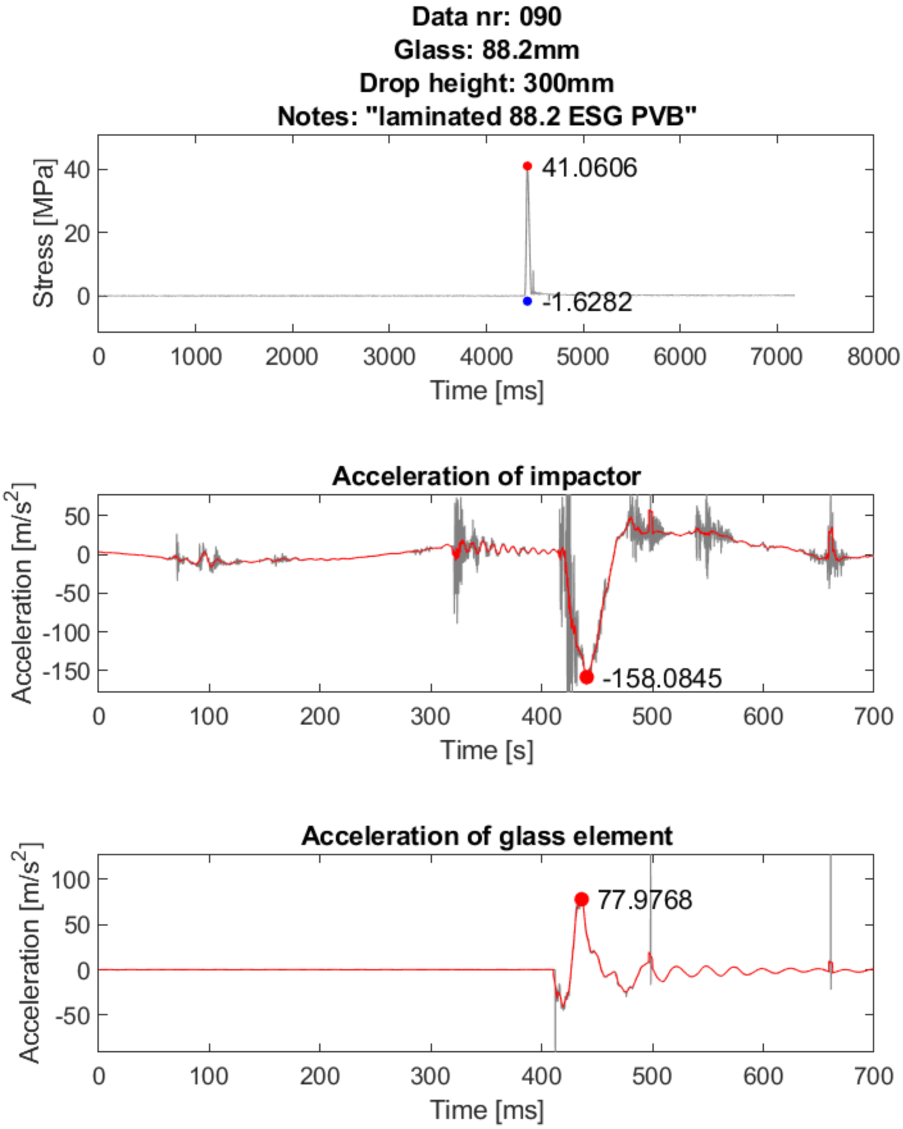
Acceleration of glass element

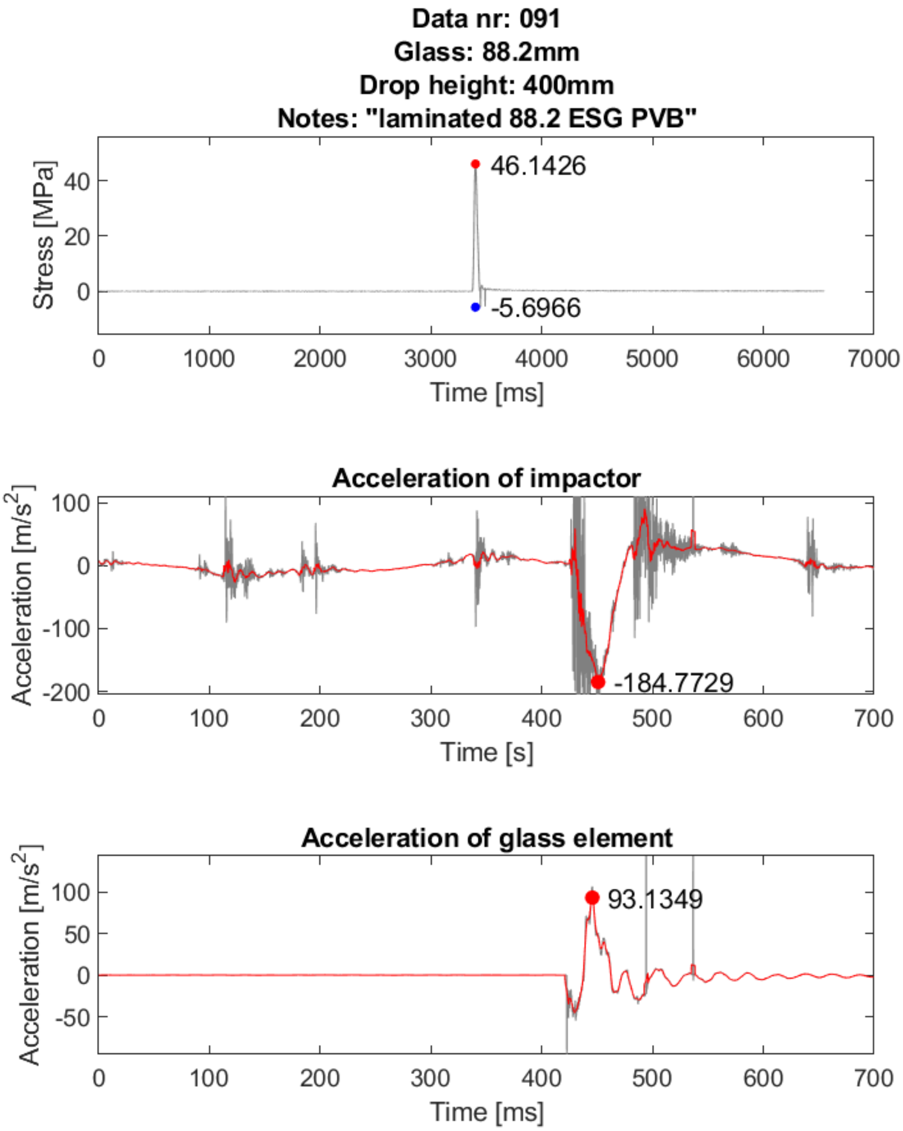


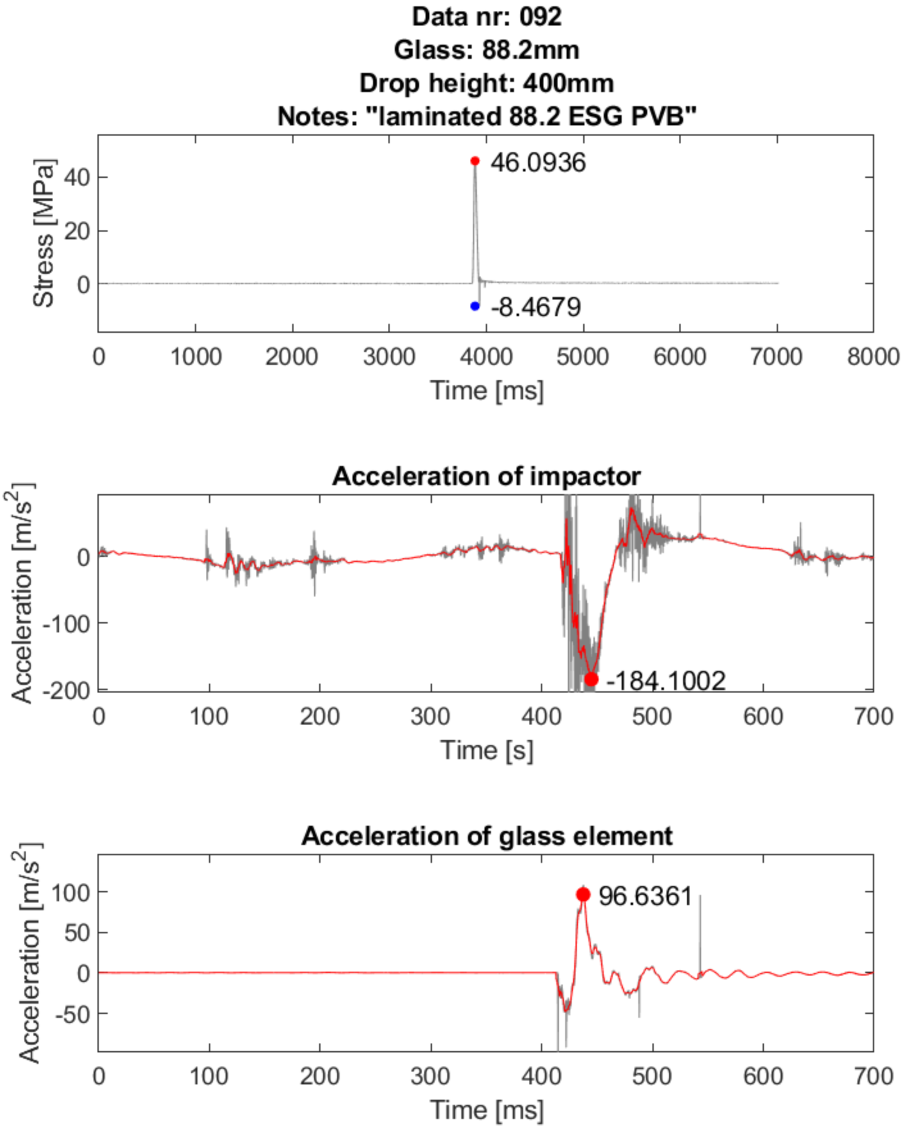

Data nr: 087
Glass: 88.2mm
Drop height: 200mm
Notes: "laminated 88.2 ESG PVB"
Stress [MPa]
35.896
-0.02877
Time [ms]
Acceleration of impactor
Acceleration [m/s2]
-126.4466
Time [s]
Acceleration of glass element
Acceleration [m/s2]
64.7629
Time [ms]

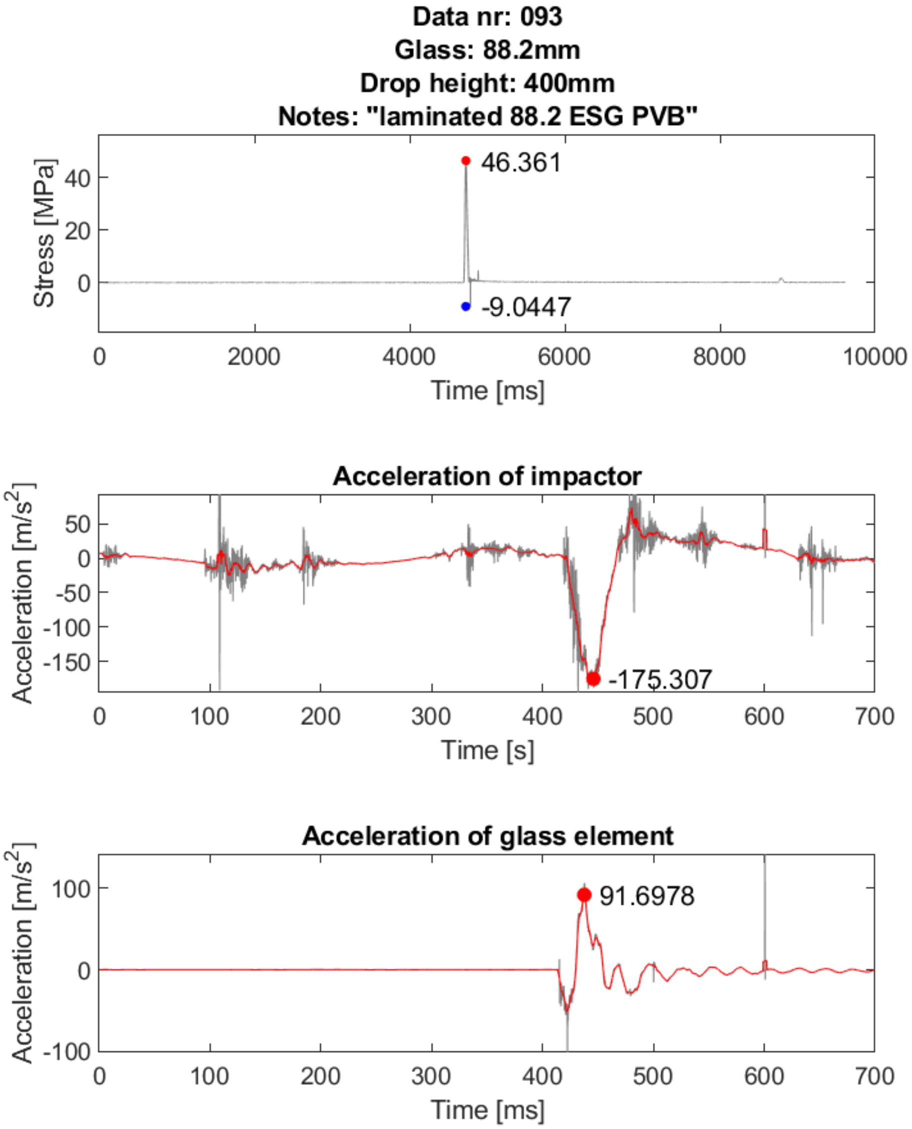

Data nr: 088
Glass: 88.2mm
Drop height: 300mm
Notes: "laminated 88.2 ESG PVB"
Stress [MPa]
41.2076
-1.9117
Time [ms]
Acceleration of impactor
Acceleration [m/s2]
-153.6305
Time [s]
Acceleration of glass element
Acceleration [m/s2]
77.5695
Time [ms]

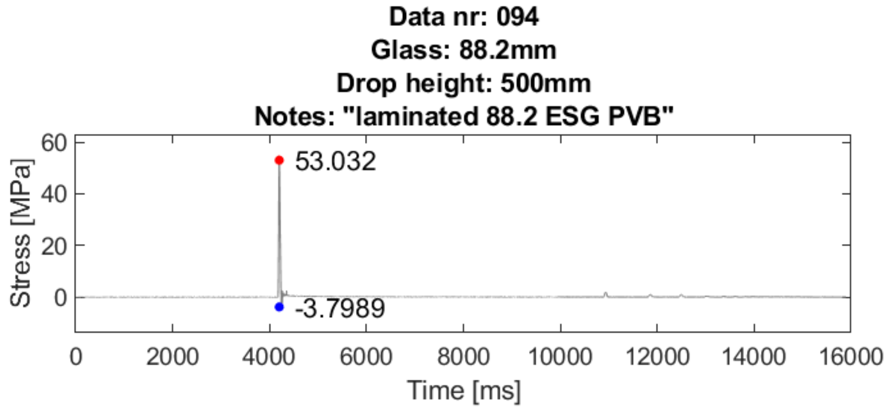

Data nr: 089
Glass: 88.2mm
Drop height: 300mm
Notes: "laminated 88.2 ESG PVB"
Stress [MPa]
41.3868
-2.9232
Time [ms]
Acceleration of impactor
Acceleration [m/s^2]
-156.9421
Time [s]
Acceleration of glass element
Acceleration [m/s^2]
85.26
Time [ms]

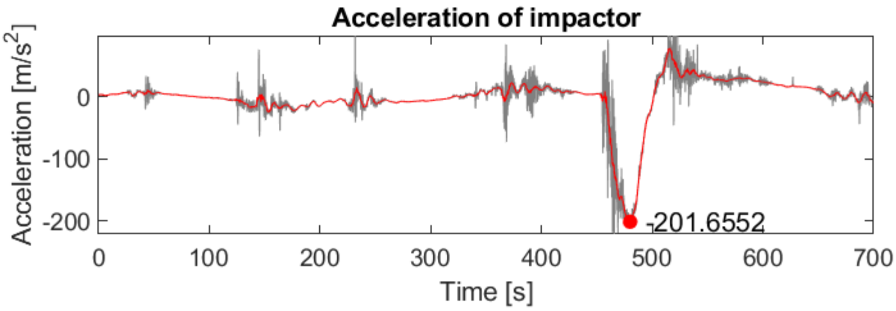

Data nr: 090
Glass: 88.2mm
Drop height: 300mm
Notes: "laminated 88.2 ESG PVB"
Stress [MPa]
41.0606
-1.6282
Time [ms]
Acceleration of impactor
Acceleration [m/s^2]
-158.0845
Time [s]
Acceleration of glass element
Acceleration [m/s^2]
77.9768
Time [ms]

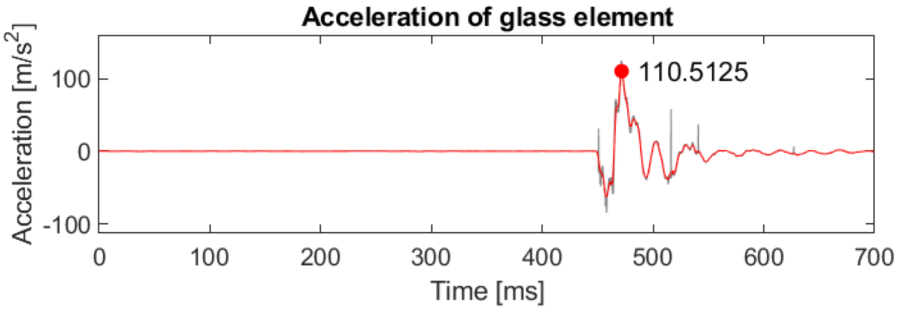

Data nr: 091
Glass: 88.2mm
Drop height: 400mm
Notes: "laminated 88.2 ESG PVB"
Stress [MPa]
40
20
0
46.1426
-5.6966
0
1000
2000
3000
4000
5000
6000
7000
Time [ms]
Acceleration of impactor
Acceleration [m/s2]
100
0
-100
-200
-184.7729
0
100
200
300
400
500
600
700
Time [s]
Acceleration of glass element
Acceleration [m/s2]
100
50
0
-50
93.1349
0
100
200
300
400
500
600
700
Time [ms]

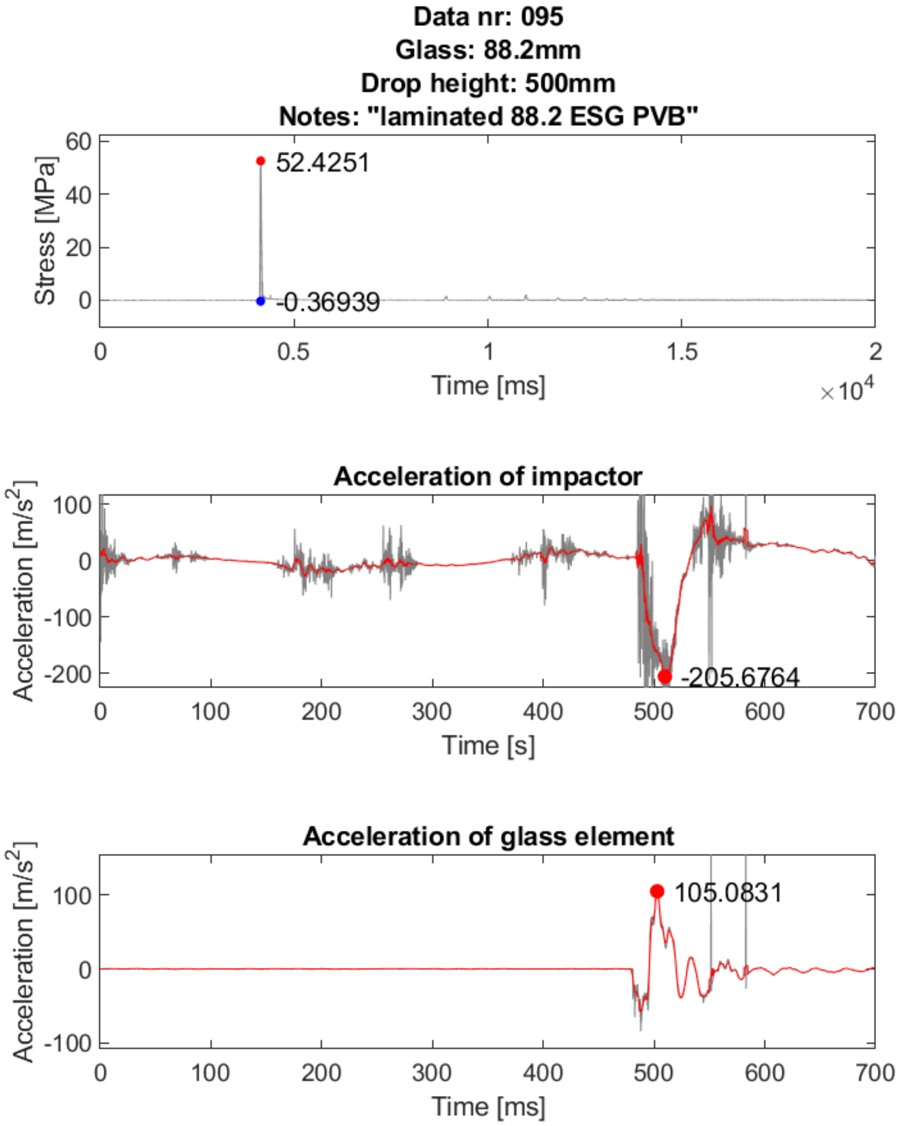

Data nr: 092
Glass: 88.2mm
Drop height: 400mm
Notes: "laminated 88.2 ESG PVB"
46.0936
-8.4679
Stress [MPa]
Time [ms]
Acceleration of impactor
-184.1002
Acceleration [m/s2]
Time [s]
Acceleration of glass element
96.6361
Acceleration [m/s2]
Time [ms]

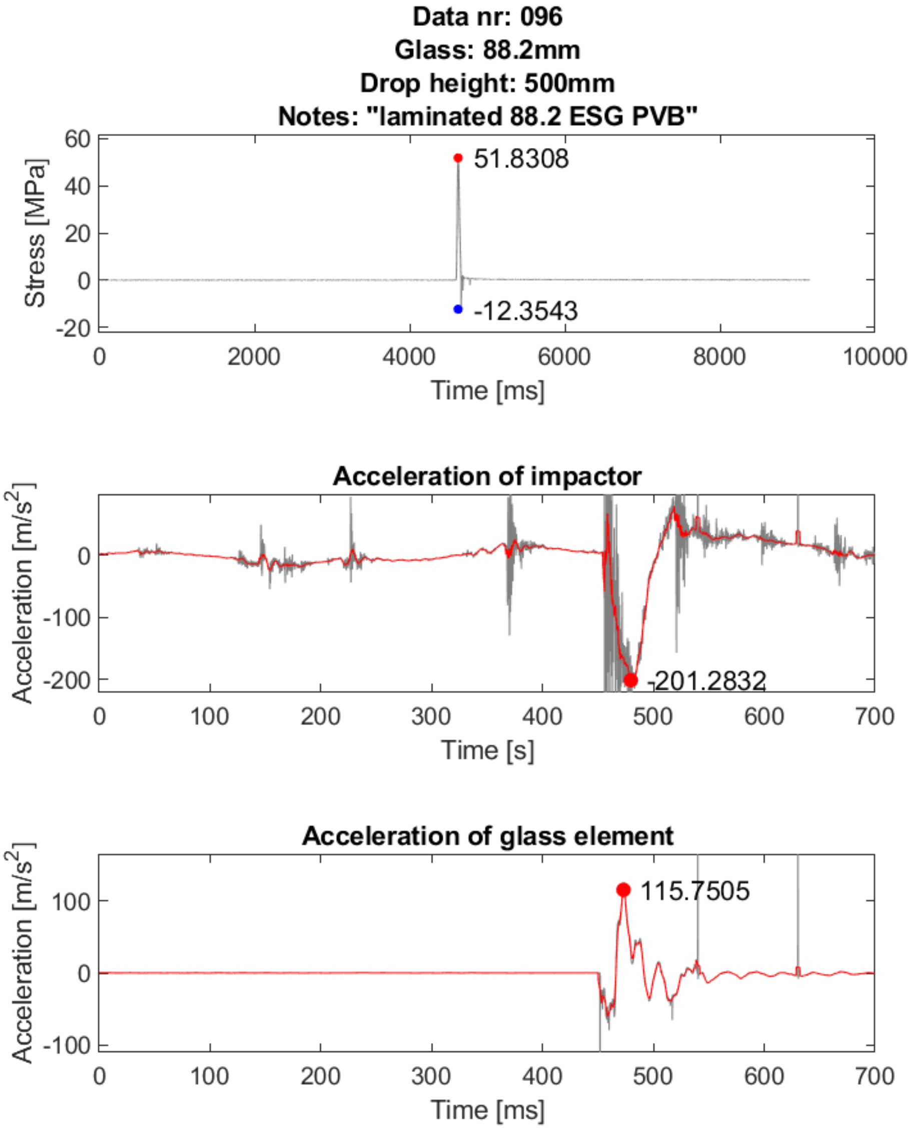

Data nr: 093
Glass: 88.2mm
Drop height: 400mm
Notes: "laminated 88.2 ESG PVB"
Stress [MPa]
46.361
-9.0447
Time [ms]
Acceleration of impactor
Acceleration [m/s^2]
-175.307
Time [s]
Acceleration of glass element
Acceleration [m/s^2]
91.6978
Time [ms]


Data nr: 094
Glass: 88.2mm
Drop height: 500mm
Notes: "laminated 88.2 ESG PVB"
Stress [MPa]
53.032
-3.7989
Time [ms]

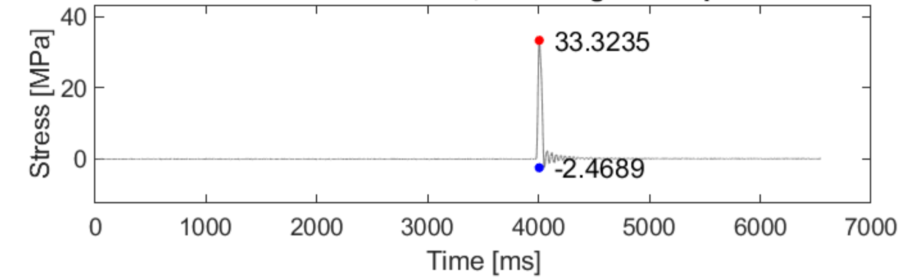

Acceleration of impactor
Acceleration [m/s2]
-201.6552
Time [s]

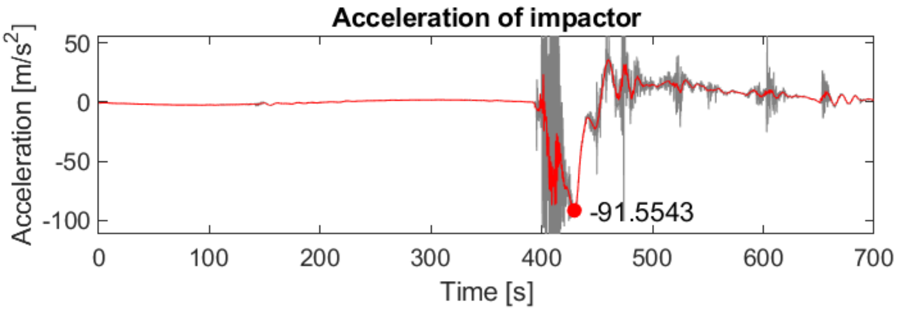

Acceleration of glass element
Acceleration [m/s2]
110.5125
Time [ms]

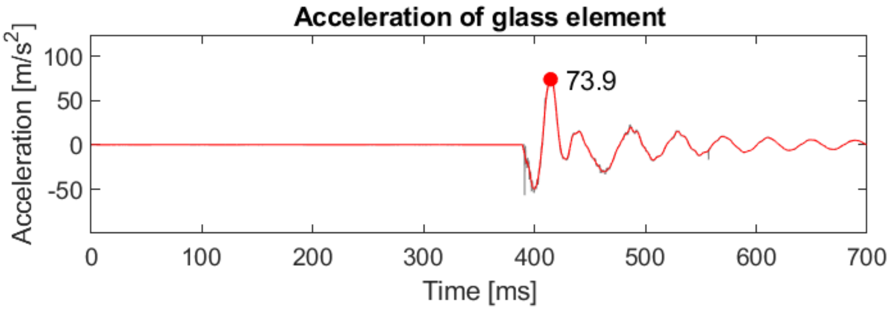

Data nr: 095
Glass: 88.2mm
Drop height: 500mm
Notes: "laminated 88.2 ESG PVB"
Stress [MPa]
52.4251
-0.36939
Time [ms]
×10^4
Acceleration of impactor
Acceleration [m/s^2]
-205.6764
Time [s]
Acceleration of glass element
Acceleration [m/s^2]
105.0831
Time [ms]

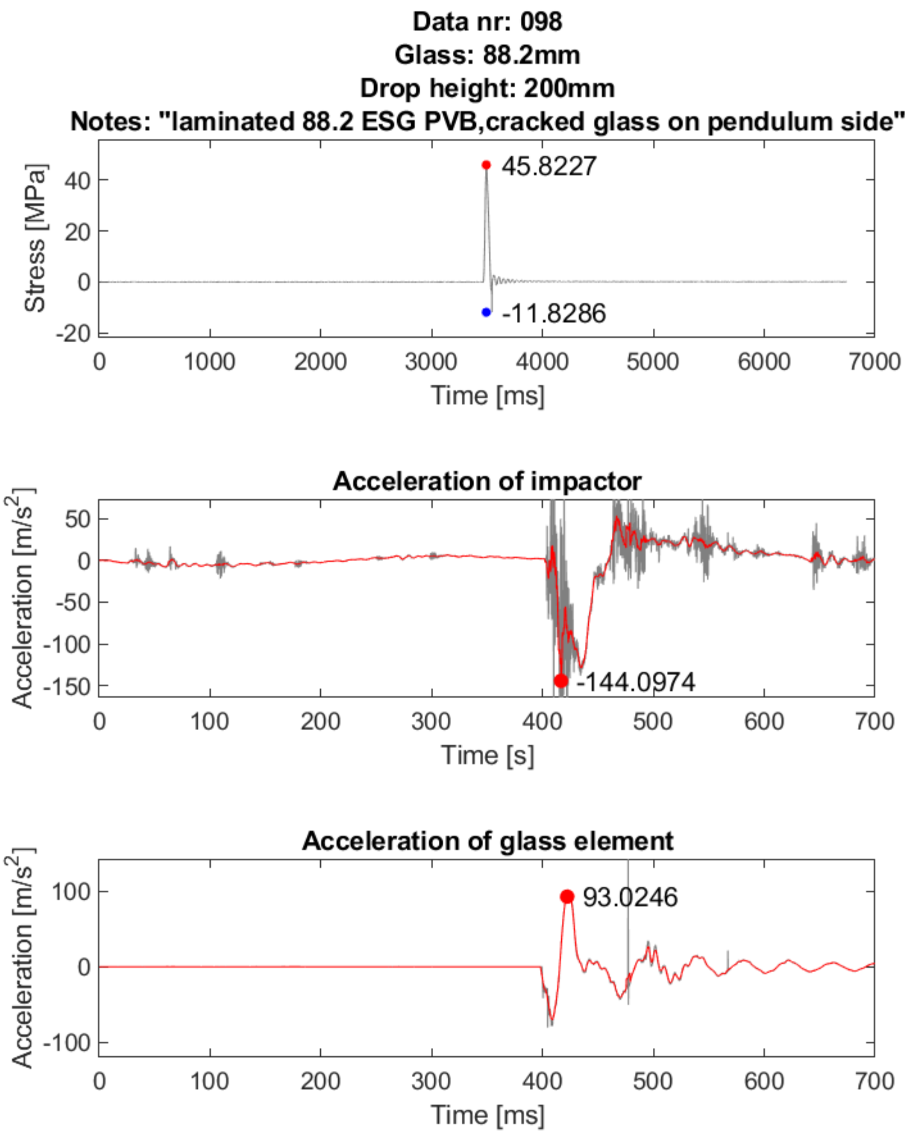

Data nr: 096
Glass: 88.2mm
Drop height: 500mm
Notes: "laminated 88.2 ESG PVB"
Stress [MPa]
51.8308
-12.3543
Time [ms]
Acceleration of impactor
Acceleration [m/s^2]
-201.2832
Time [s]
Acceleration of glass element
Acceleration [m/s^2]
115.7505
Time [ms]

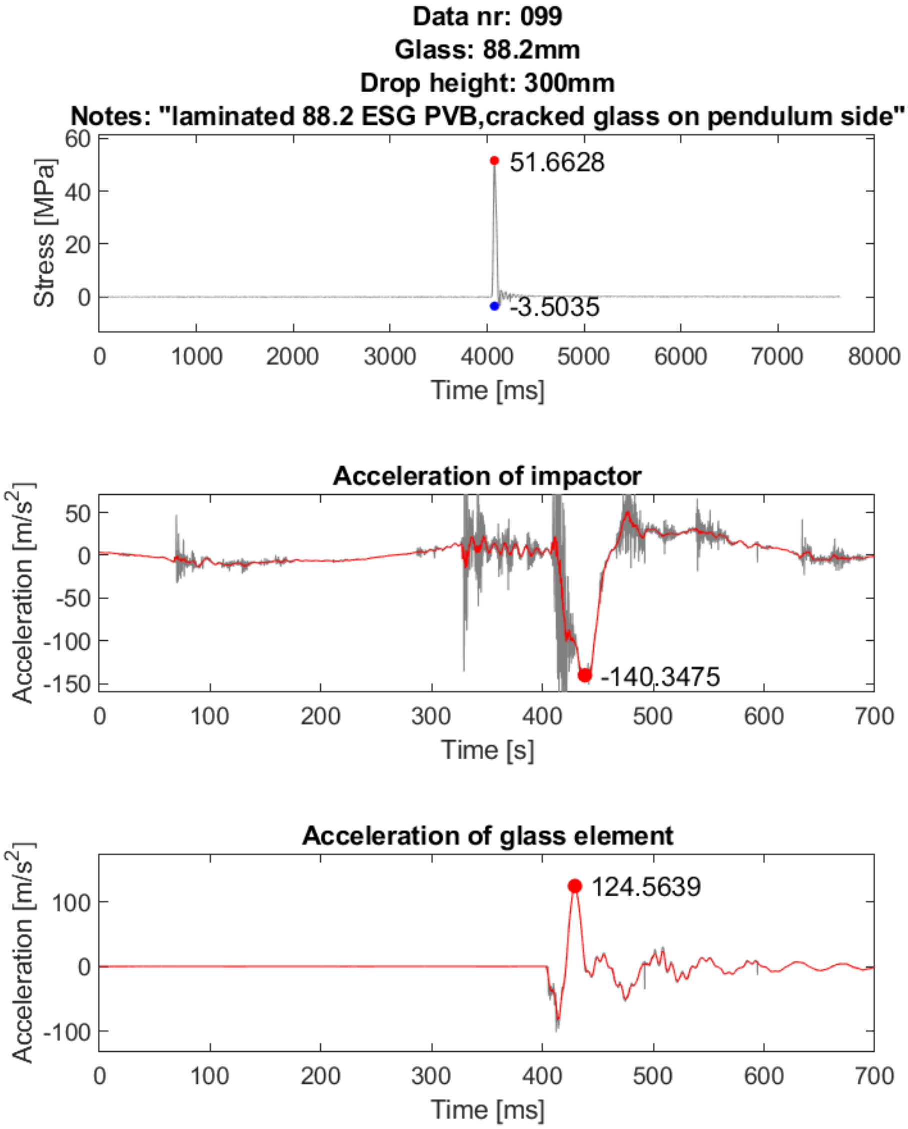
Data nr: 097
Glass: 88.2mm
Drop height: 100mm
Notes: "laminated 88.2 ESG PVB,cracked glass on pendulum side"

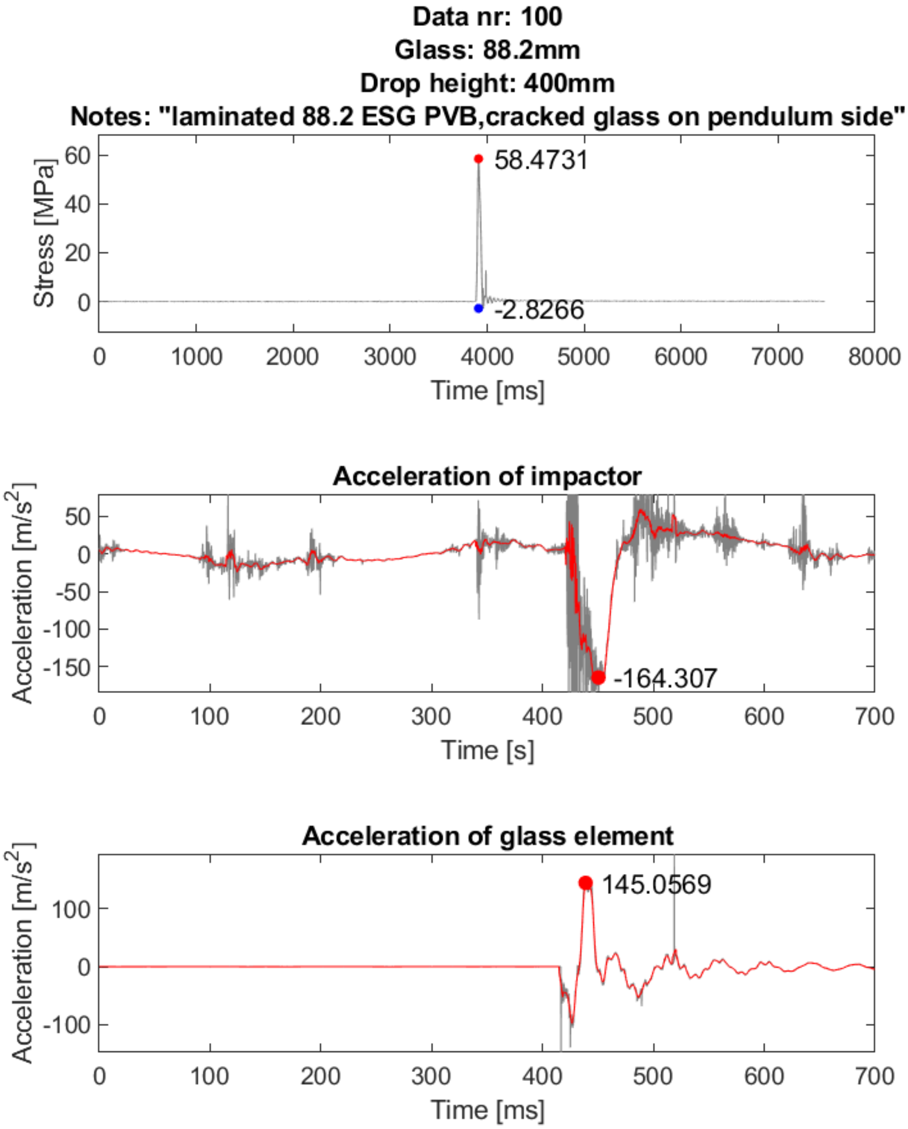


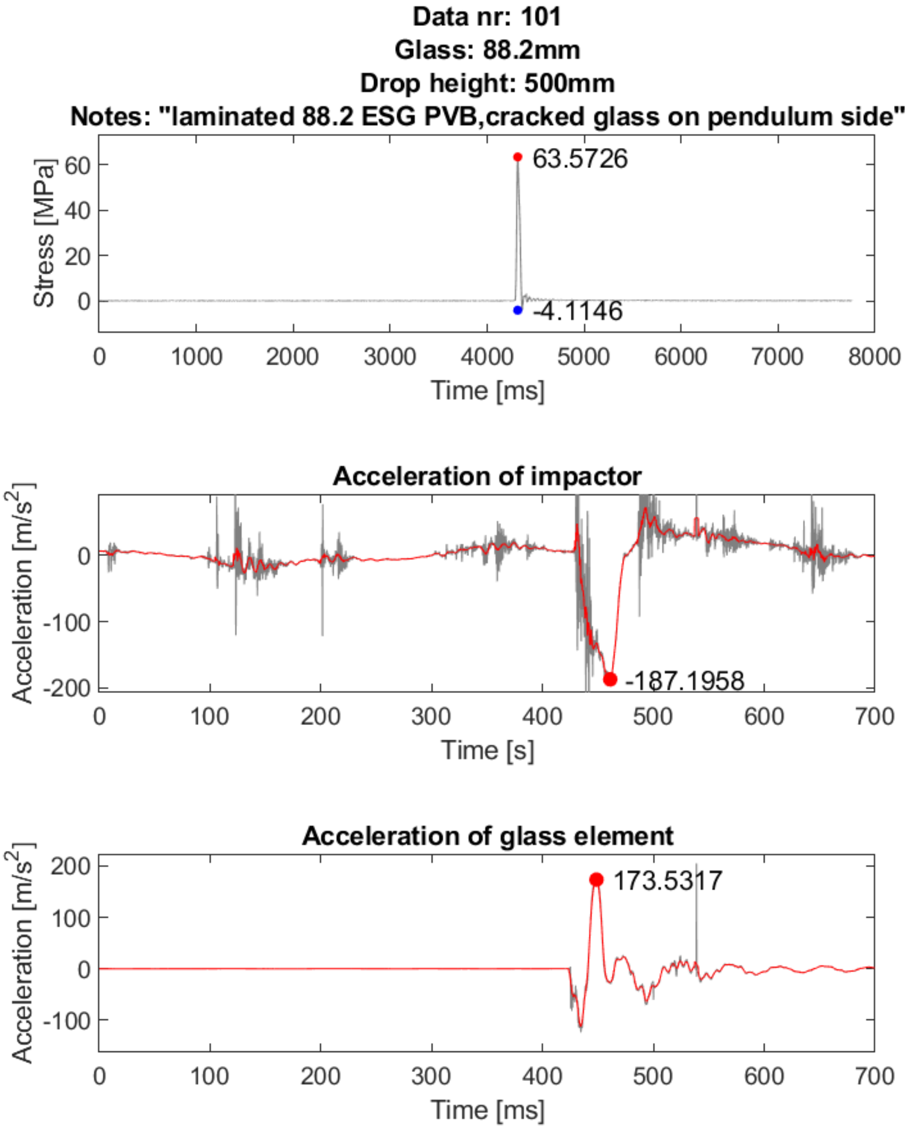


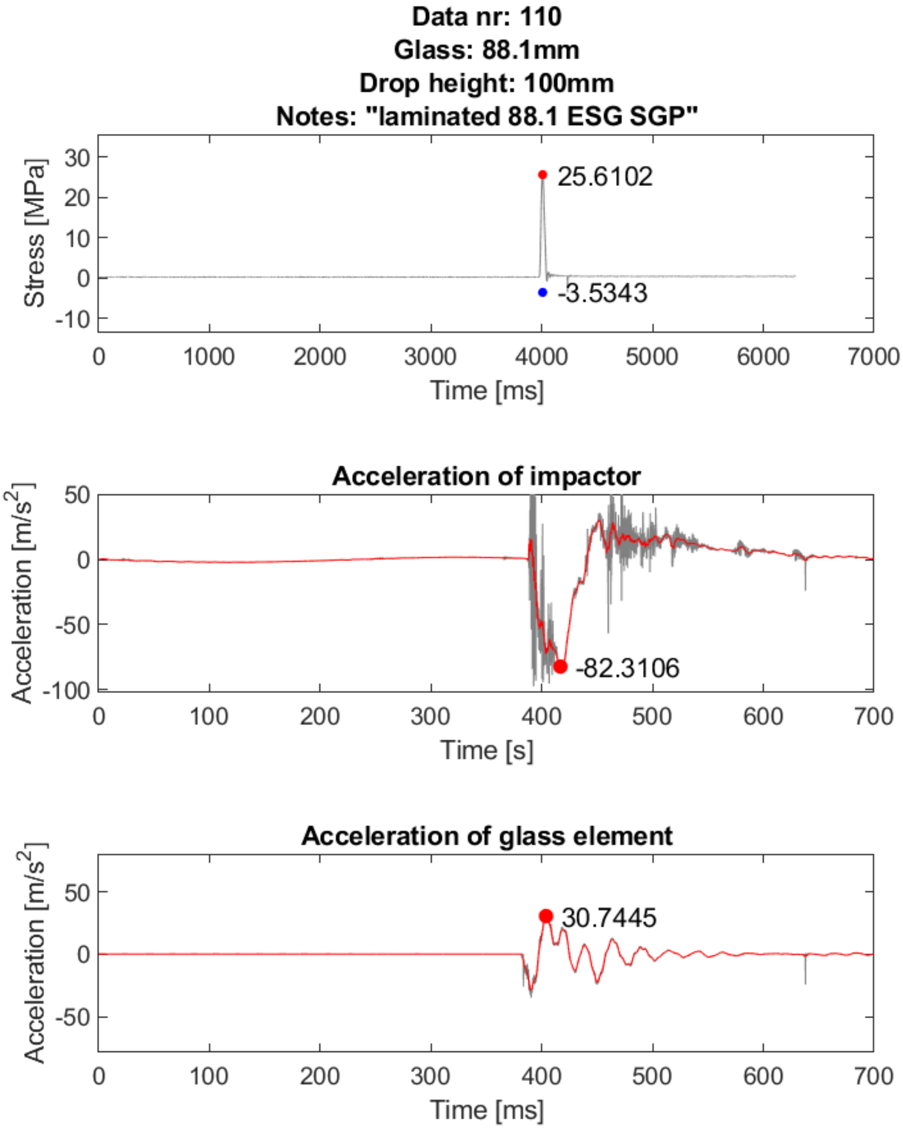


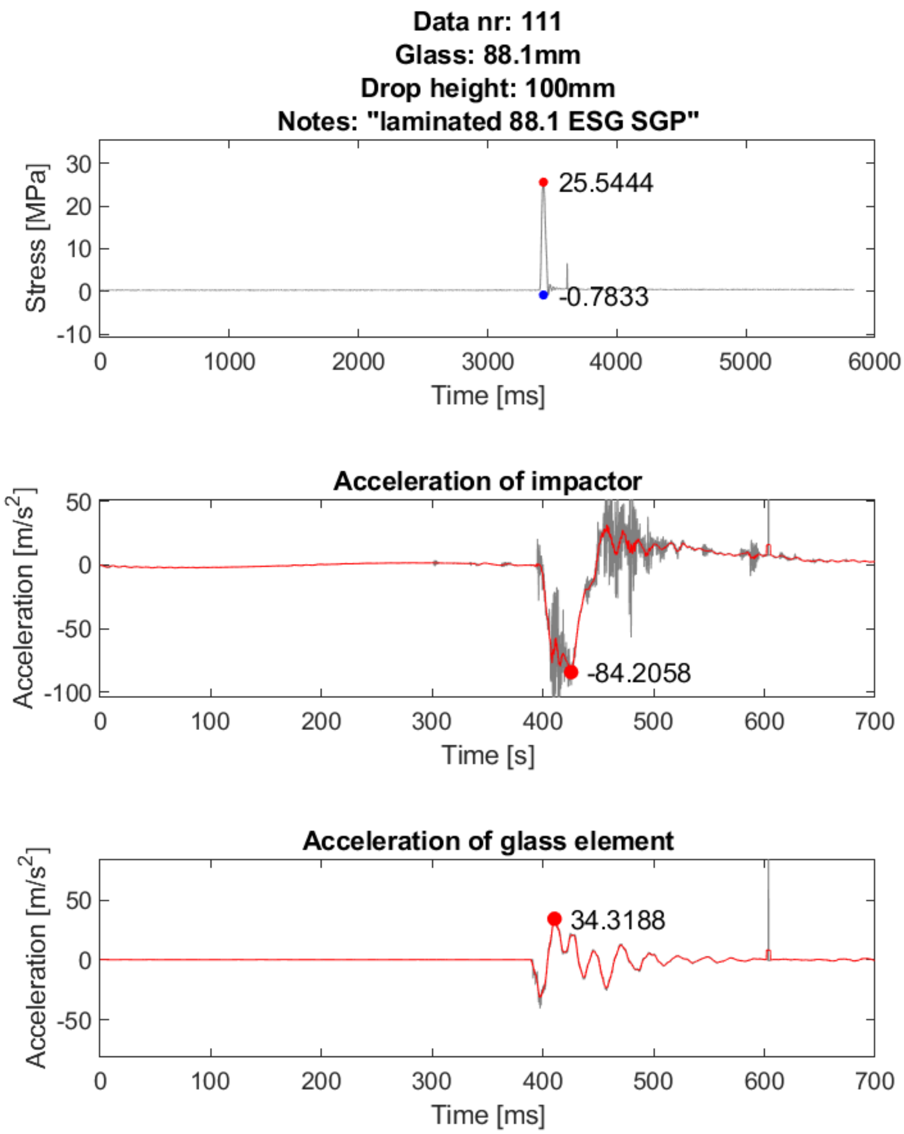

Data nr: 098
Glass: 88.2mm
Drop height: 200mm
Notes: "laminated 88.2 ESG PVB,cracked glass on pendulum side"
Stress [MPa]
45.8227
-11.8286
Time [ms]
Acceleration of impactor
Acceleration [m/s2]
-144.0974
Time [s]
Acceleration of glass element
Acceleration [m/s2]
93.0246
Time [ms]

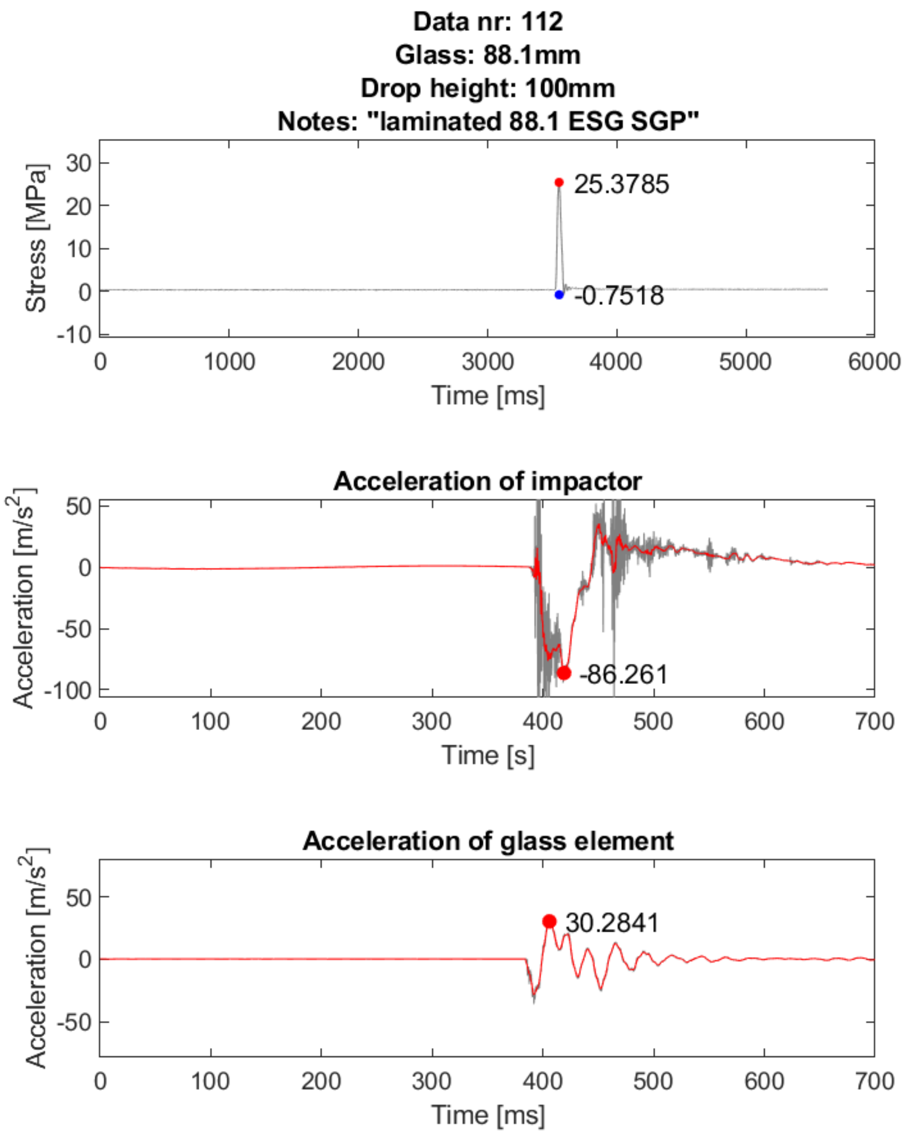

Data nr: 099
Glass: 88.2mm
Drop height: 300mm
Notes: "laminated 88.2 ESG PVB,cracked glass on pendulum side"
Stress [MPa]
51.6628
-3.5035
Time [ms]
Acceleration of impactor
Acceleration [m/s2]
-140.3475
Time [s]
Acceleration of glass element
Acceleration [m/s2]
124.5639
Time [ms]

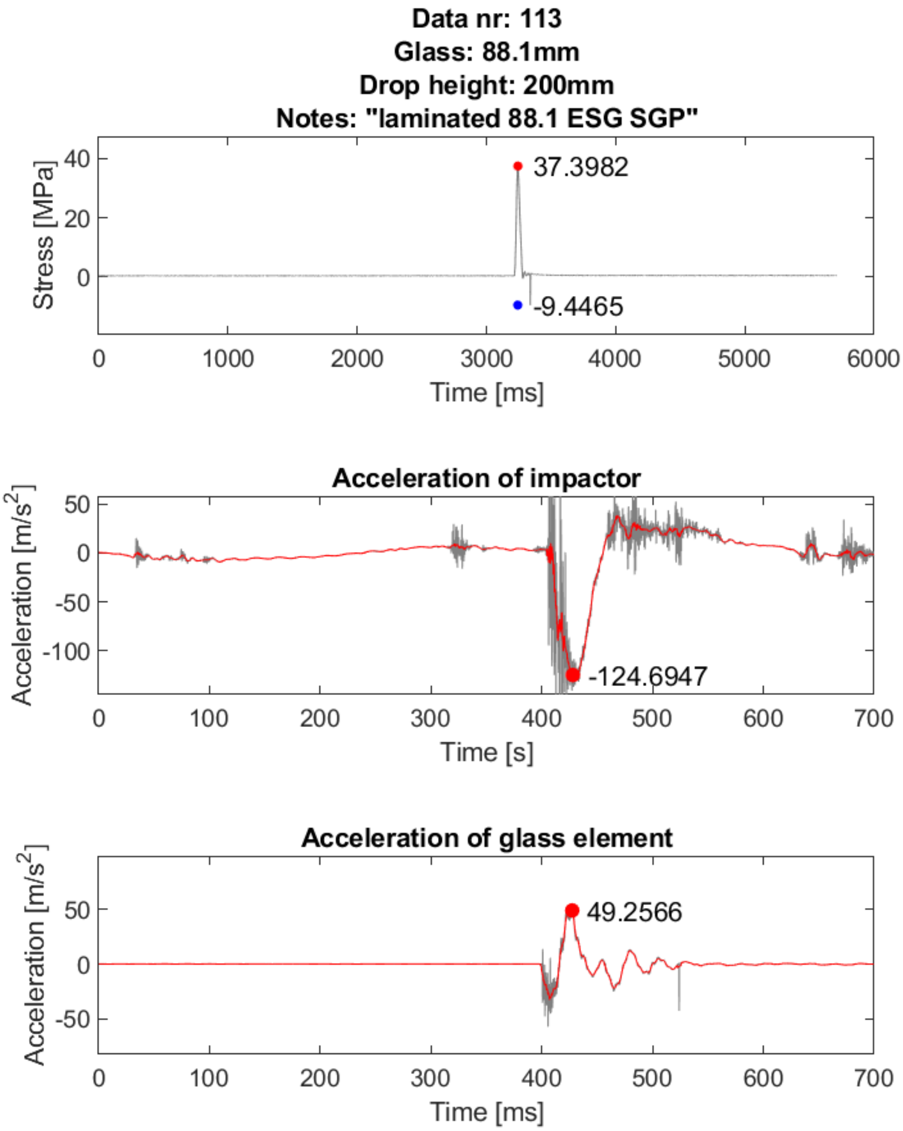

Data nr: 100
Glass: 88.2mm
Drop height: 400mm
Notes: "laminated 88.2 ESG PVB,cracked glass on pendulum side"
Stress [MPa]
58.4731
-2.8266
Time [ms]
Acceleration of impactor
Acceleration [m/s^2]
-164.307
Time [s]
Acceleration of glass element
Acceleration [m/s^2]
145.0569
Time [ms]

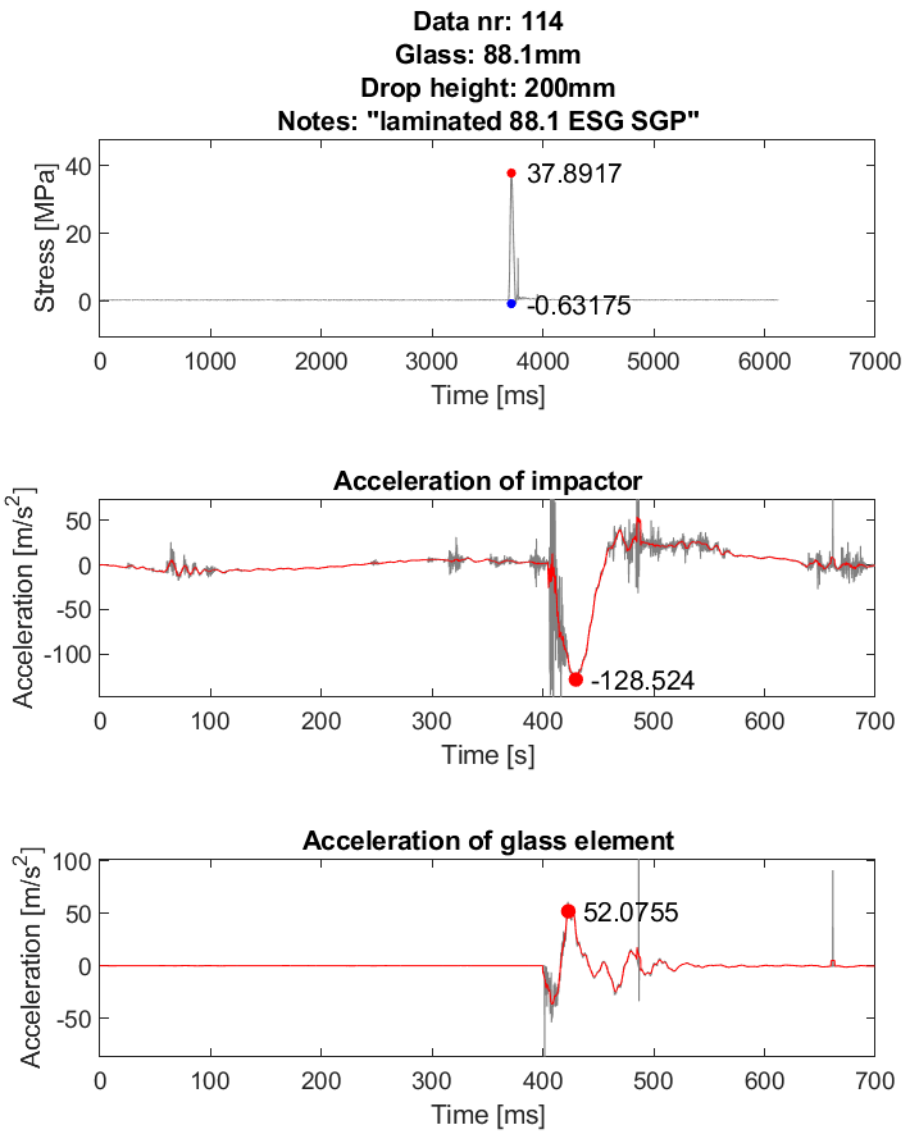

Data nr: 101
Glass: 88.2mm
Drop height: 500mm
Notes: "laminated 88.2 ESG PVB,cracked glass on pendulum side"
Stress [MPa]
63.5726
-4.1146
Time [ms]
Acceleration of impactor
Acceleration [m/s^2]
-187.1958
Time [s]
Acceleration of glass element
Acceleration [m/s^2]
173.5317
Time [ms]

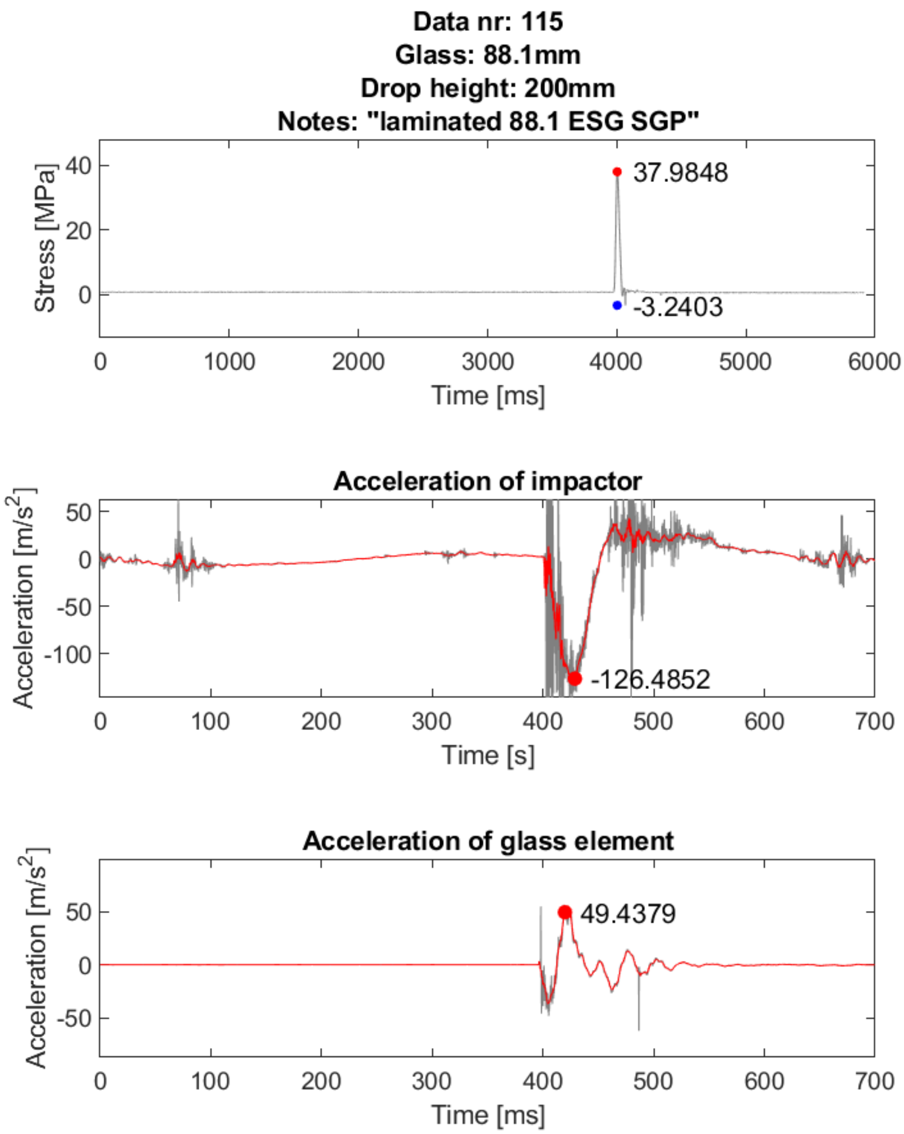

Data nr: 110
Glass: 88.1mm
Drop height: 100mm
Notes: "laminated 88.1 ESG SGP"
Stress [MPa]
25.6102
-3.5343
Time [ms]
Acceleration of impactor
Acceleration [m/s2]
-82.3106
Time [s]
Acceleration of glass element
Acceleration [m/s2]
30.7445
Time [ms]

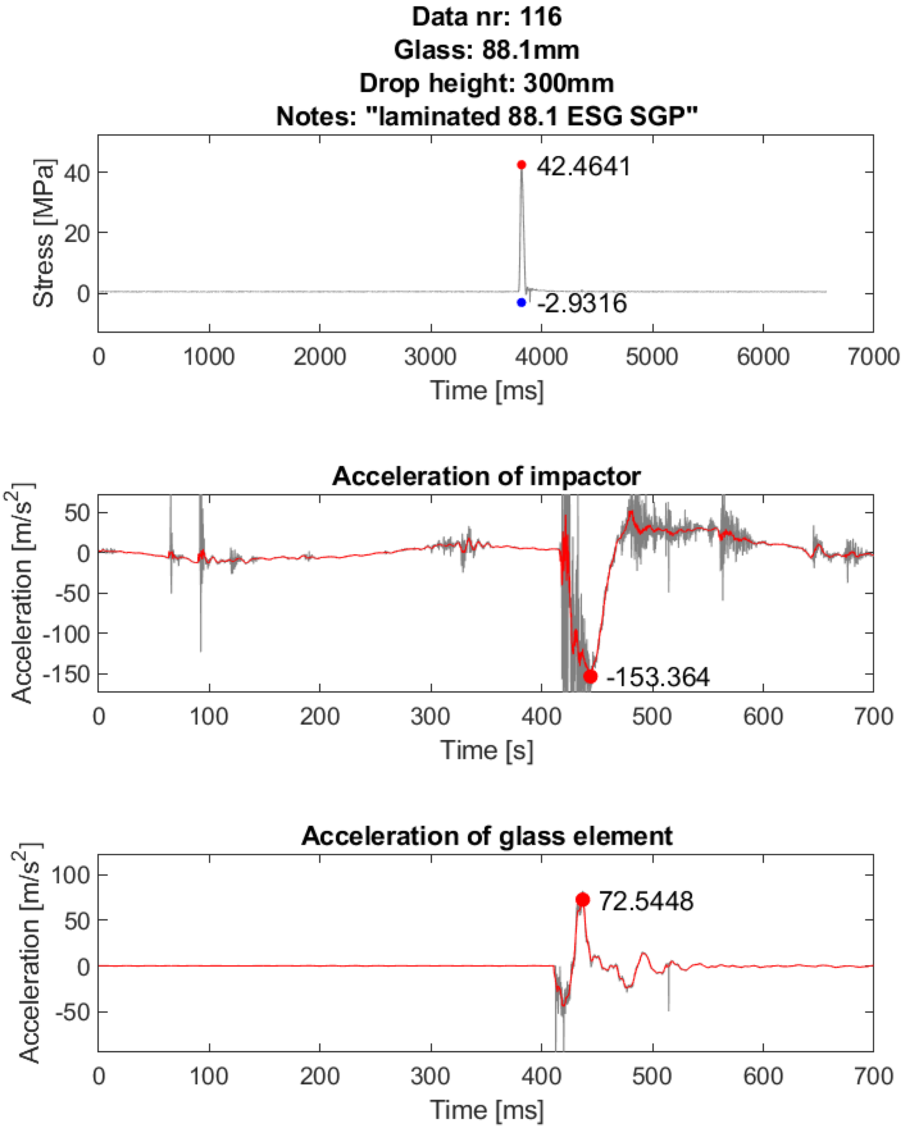

Data nr: 111
Glass: 88.1mm
Drop height: 100mm
Notes: "laminated 88.1 ESG SGP"
Stress [MPa]
25.5444
-0.7833
Time [ms]
Acceleration of impactor
Acceleration [m/s2]
-84.2058
Time [s]
Acceleration of glass element
Acceleration [m/s2]
34.3188
Time [ms]

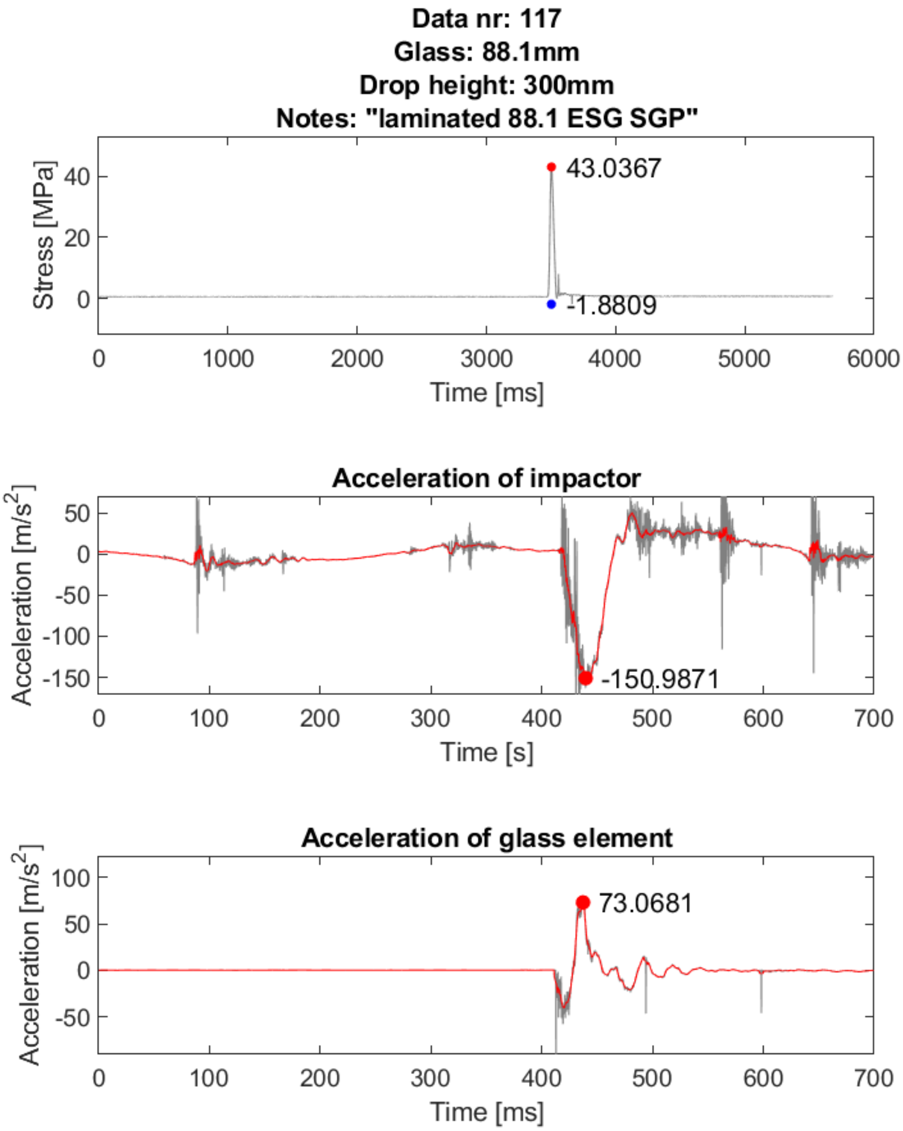

Data nr: 112
Glass: 88.1mm
Drop height: 100mm
Notes: "laminated 88.1 ESG SGP"
Stress [MPa]
25.3785
-0.7518
Time [ms]
Acceleration of impactor
Acceleration [m/s^2]
-86.261
Time [s]
Acceleration of glass element
Acceleration [m/s^2]
30.2841
Time [ms]

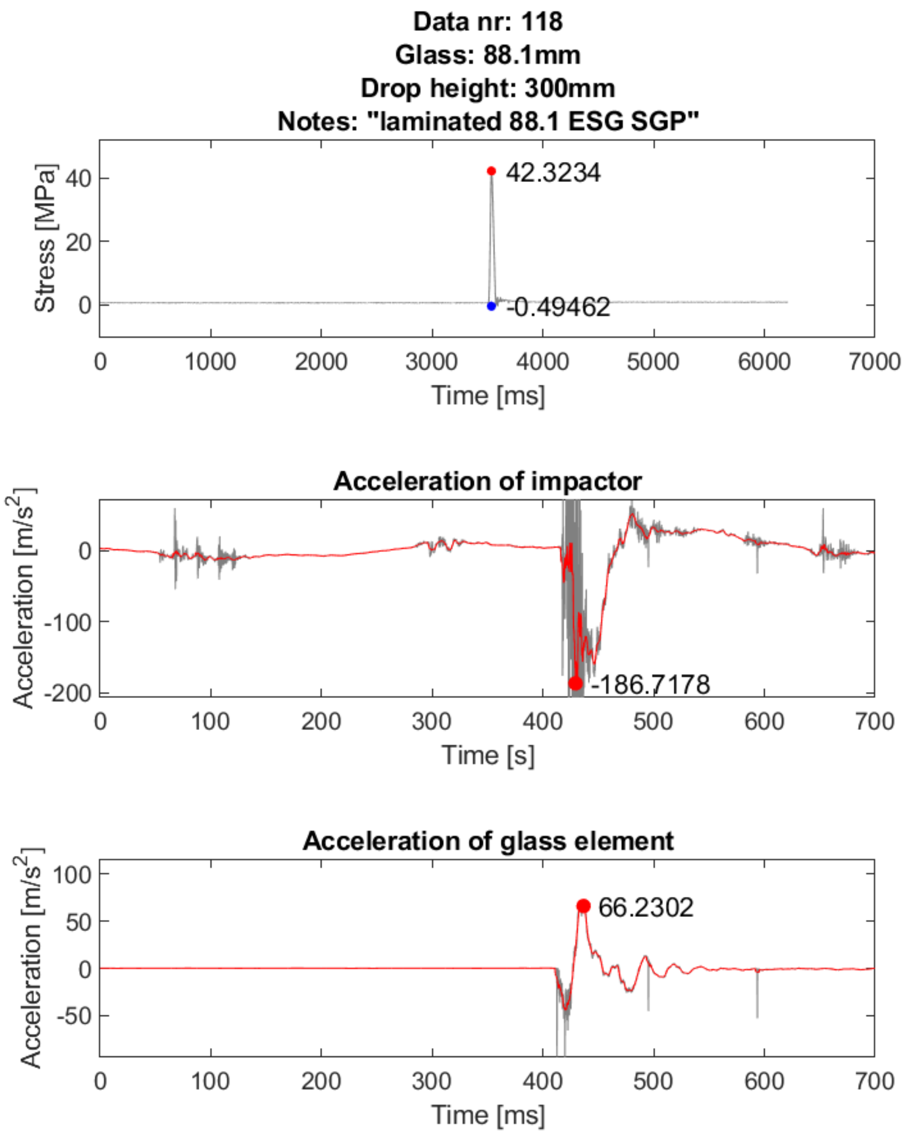

Data nr: 113
Glass: 88.1mm
Drop height: 200mm
Notes: "laminated 88.1 ESG SGP"
Stress [MPa]
37.3982
-9.4465
Time [ms]
Acceleration of impactor
Acceleration [m/s2]
-124.6947
Time [s]
Acceleration of glass element
Acceleration [m/s2]
49.2566
Time [ms]


Data nr: 114
Glass: 88.1mm
Drop height: 200mm
Notes: "laminated 88.1 ESG SGP"
Stress [MPa]
37.8917
-0.63175
Time [ms]
Acceleration of impactor
Acceleration [m/s2]
-128.524
Time [s]
Acceleration of glass element
Acceleration [m/s2]
52.0755
Time [ms]

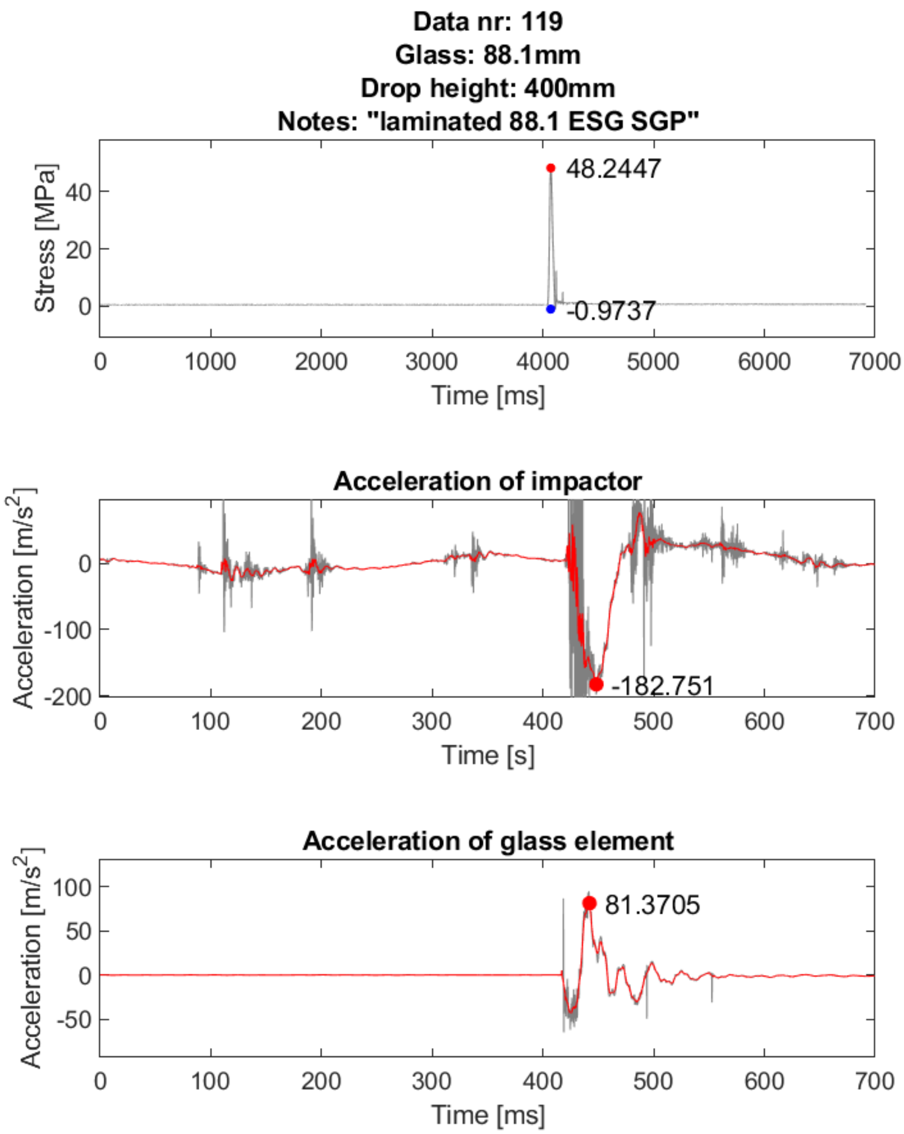

Data nr: 115
Glass: 88.1mm
Drop height: 200mm
Notes: "laminated 88.1 ESG SGP"
Stress [MPa]
37.9848
-3.2403
Time [ms]
Acceleration of impactor
Acceleration [m/s2]
-126.4852
Time [s]
Acceleration of glass element
Acceleration [m/s2]
49.4379
Time [ms]


Data nr: 116
Glass: 88.1mm
Drop height: 300mm
Notes: "laminated 88.1 ESG SGP"
Stress [MPa]
42.4641
-2.9316
Time [ms]
Acceleration of impactor
Acceleration [m/s^2]
-153.364
Time [s]
Acceleration of glass element
Acceleration [m/s^2]
72.5448
Time [ms]

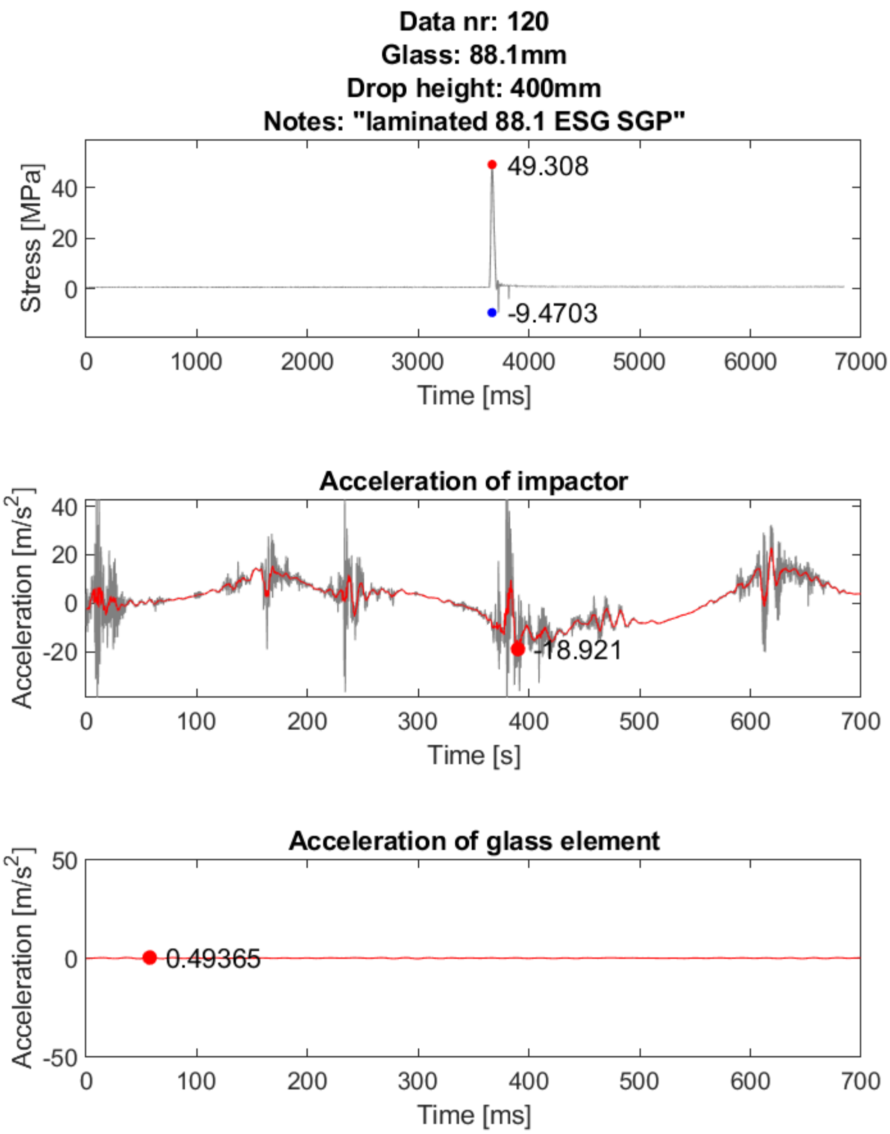

Data nr: 117
Glass: 88.1mm
Drop height: 300mm
Notes: "laminated 88.1 ESG SGP"
Stress [MPa]
43.0367
-1.8809
Time [ms]
Acceleration of impactor
Acceleration [m/s2]
-150.9871
Time [s]
Acceleration of glass element
Acceleration [m/s2]
73.0681
Time [ms]



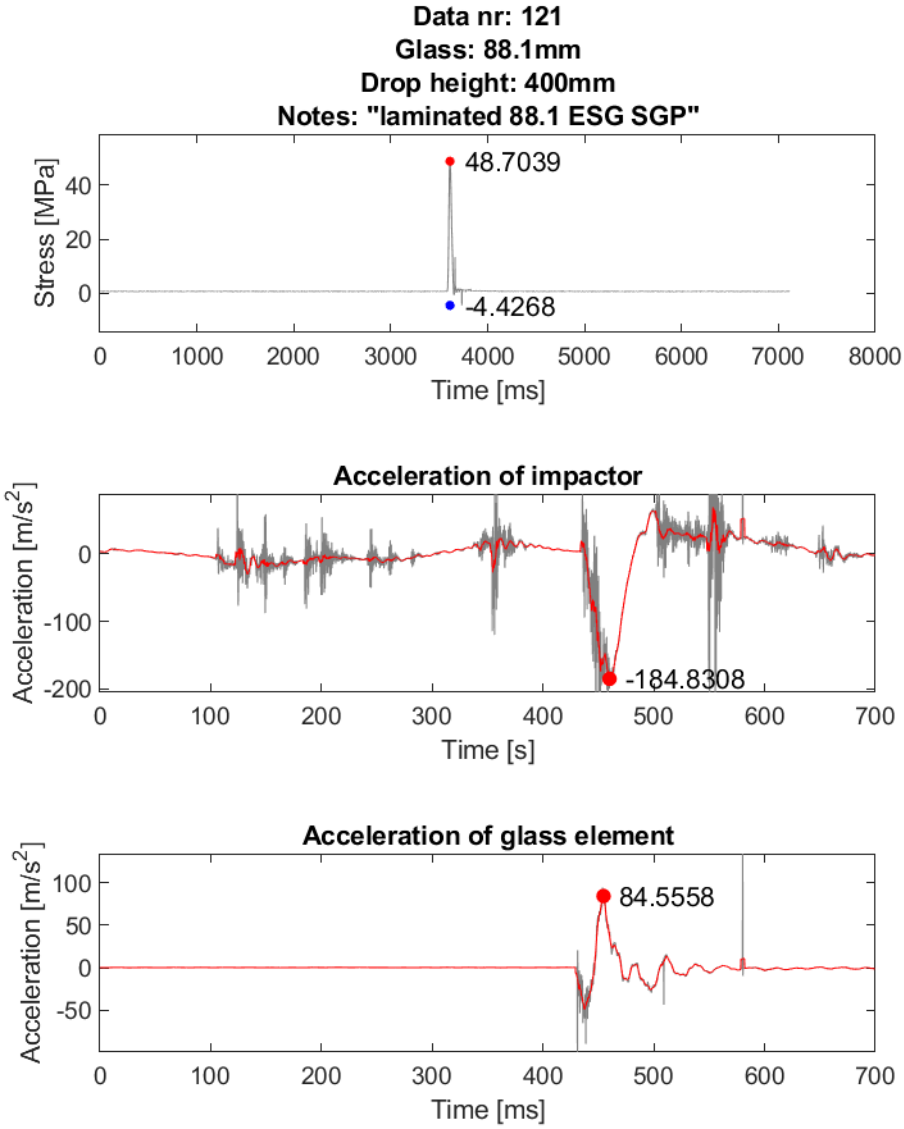
Data nr: 118
Glass: 88.1mm
Drop height: 300mm
Notes: "laminated 88.1 ESG SGP"
Stress [MPa]
42.3234
-0.49462
Time [ms]
Acceleration of impactor
Acceleration [m/s2]
-186.7178
Time [s]
Acceleration of glass element
Acceleration [m/s2]
66.2302
Time [ms]

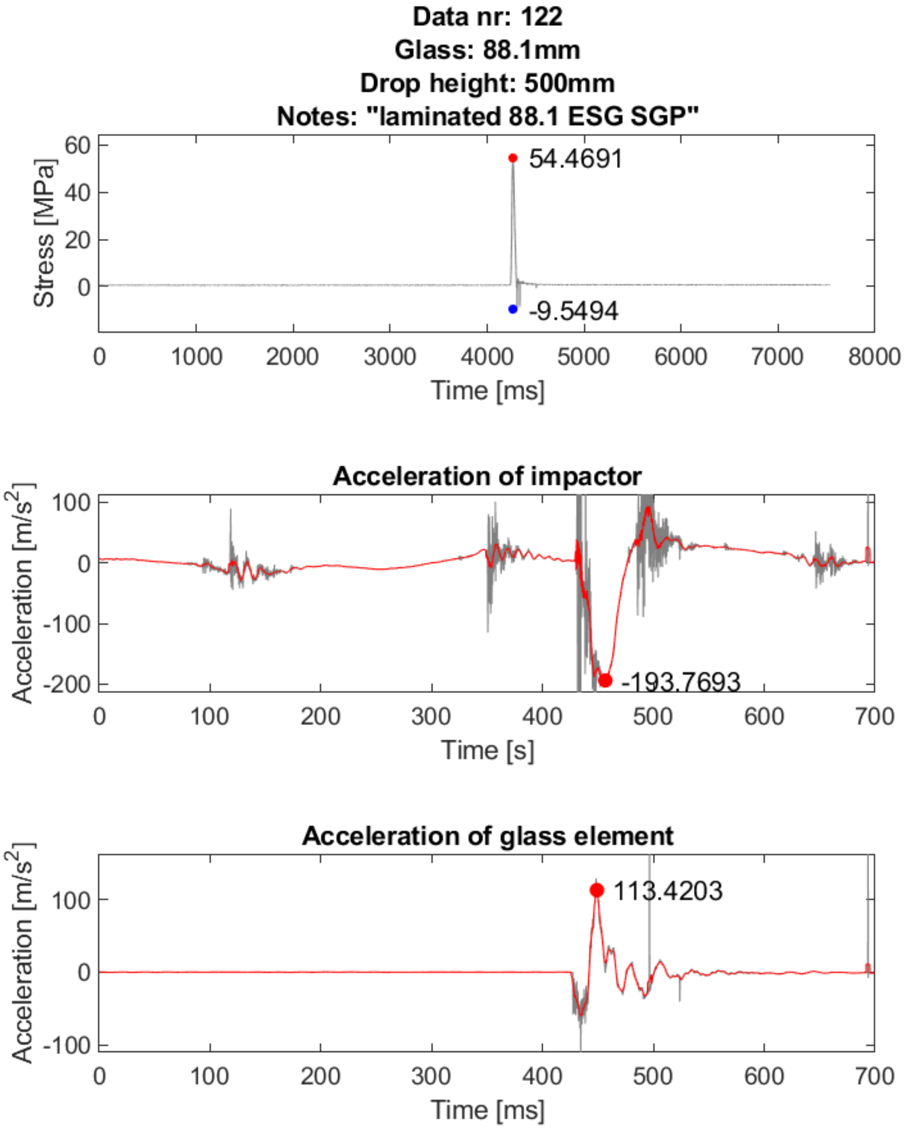


Data nr: 119
Glass: 88.1mm
Drop height: 400mm
Notes: "laminated 88.1 ESG SGP"
Stress [MPa]
48.2447
-0.9737
Time [ms]
Acceleration of impactor
Acceleration [m/s^2]
-182.751
Time [s]
Acceleration of glass element
Acceleration [m/s^2]
81.3705
Time [ms]

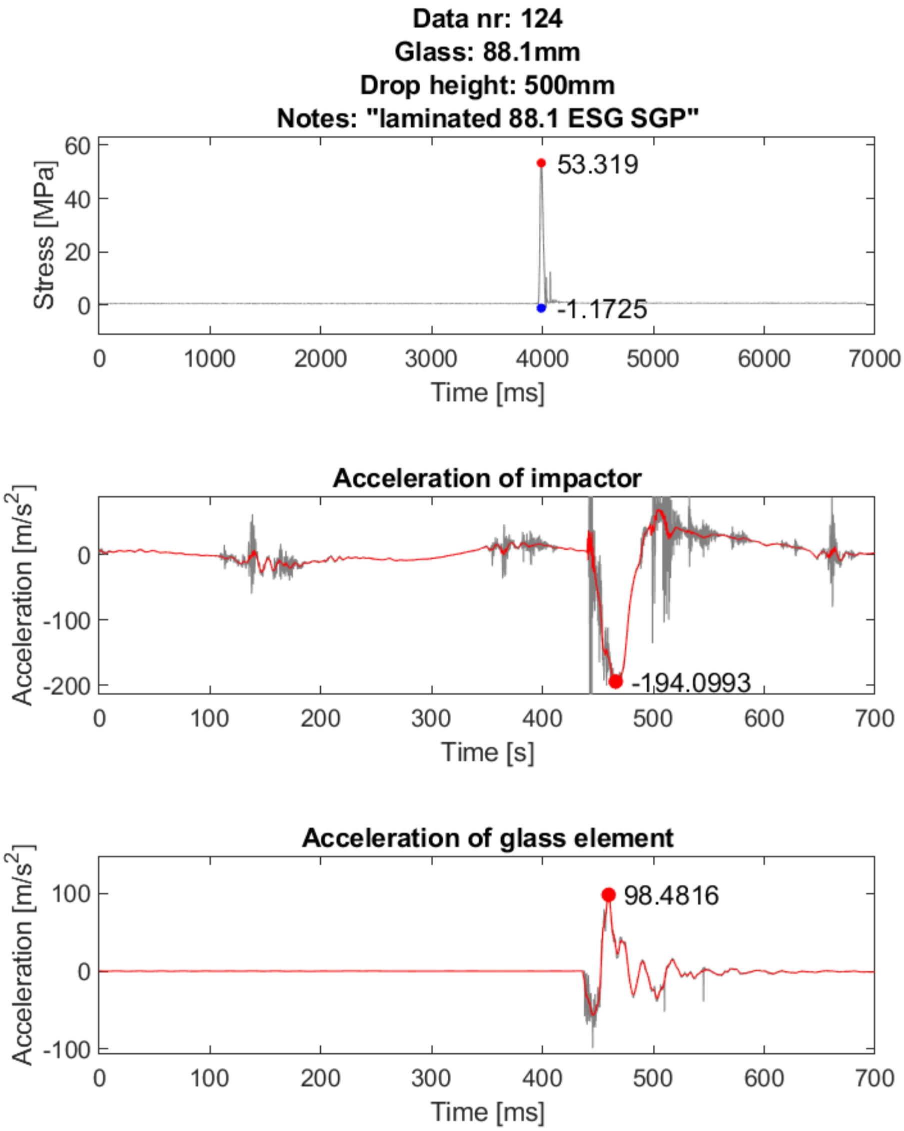


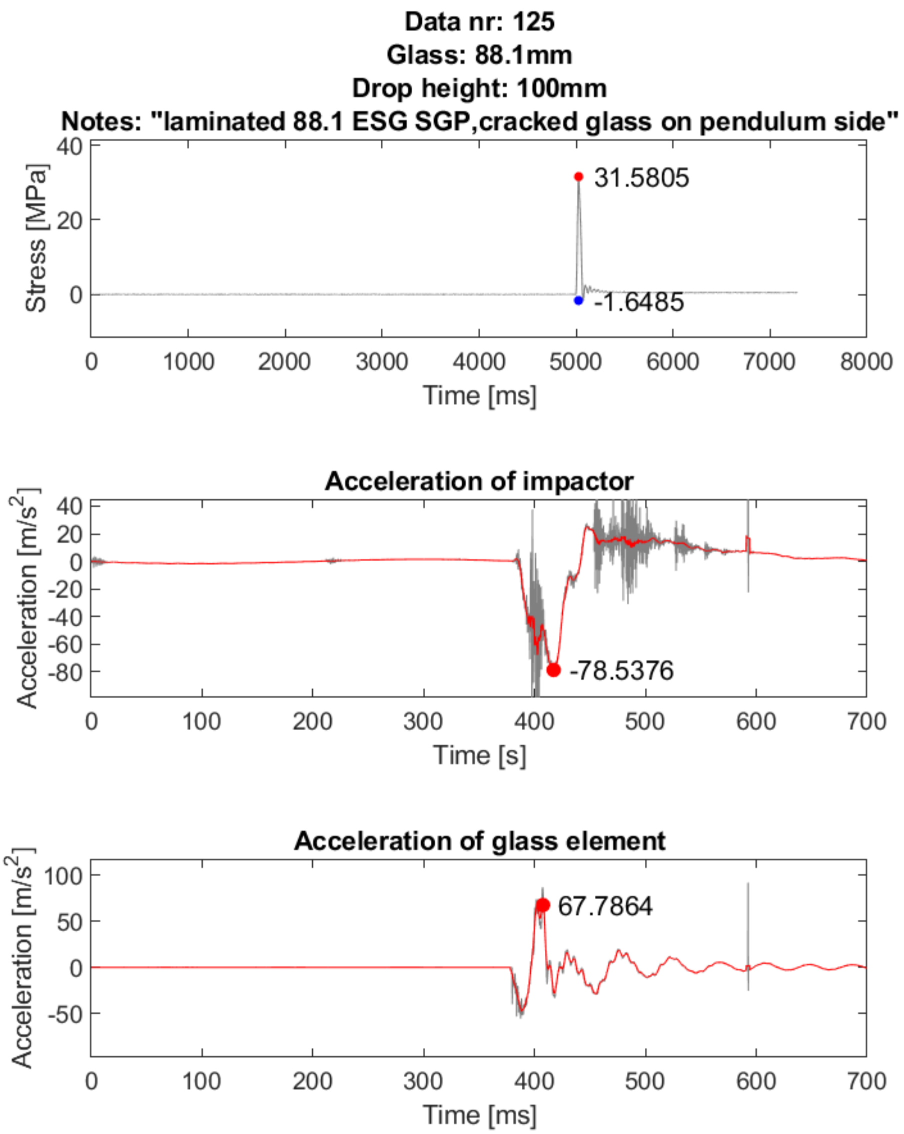
Data nr: 120
Glass: 88.1mm
Drop height: 400mm
Notes: "laminated 88.1 ESG SGP"
Stress [MPa]
49.308
-9.4703
Time [ms]
Acceleration of impactor
Acceleration [m/s^2]
-18.921
Time [s]
Acceleration of glass element
Acceleration [m/s^2]
0.49365
Time [ms]


Data nr: 121
Glass: 88.1mm
Drop height: 400mm
Notes: "laminated 88.1 ESG SGP"
Stress [MPa]
48.7039
-4.4268
Time [ms]
Acceleration of impactor
Acceleration [m/s^2]
-184.8308
Time [s]
Acceleration of glass element
Acceleration [m/s^2]
84.5558
Time [ms]

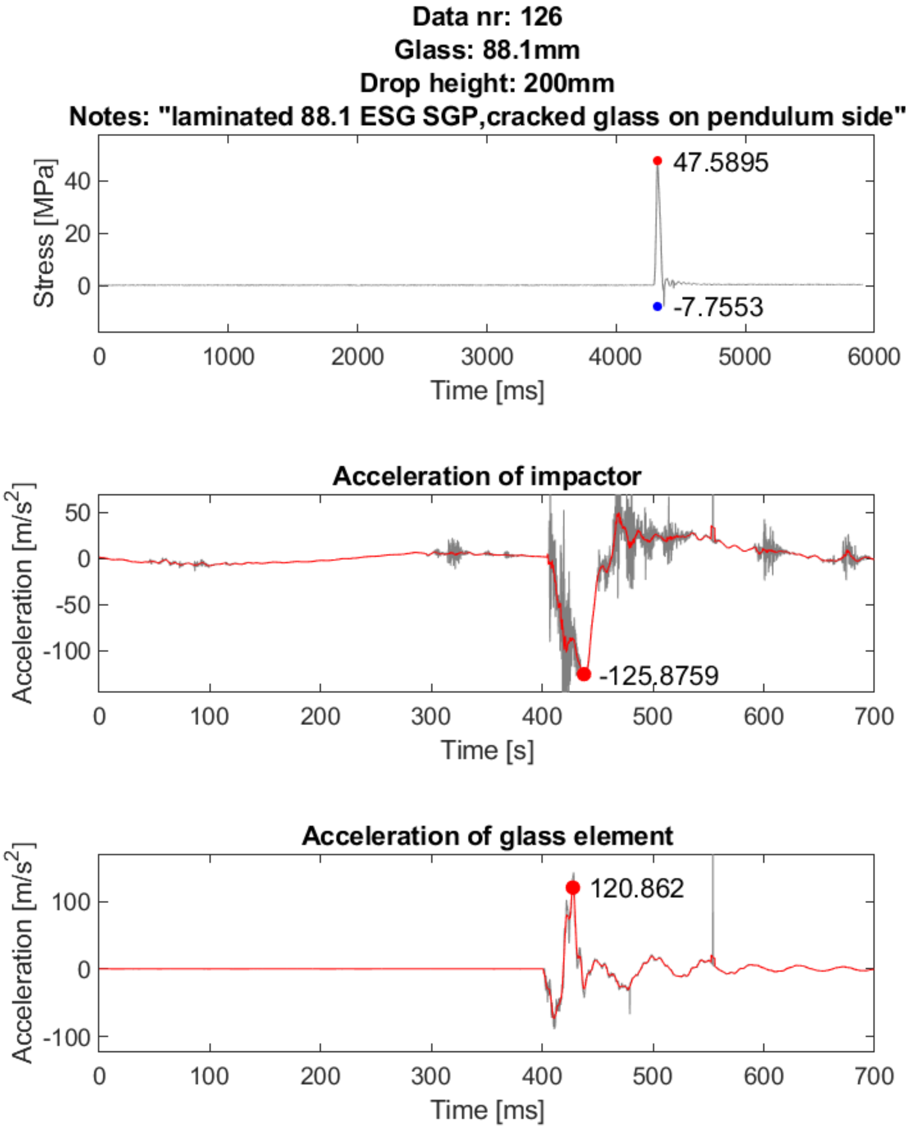


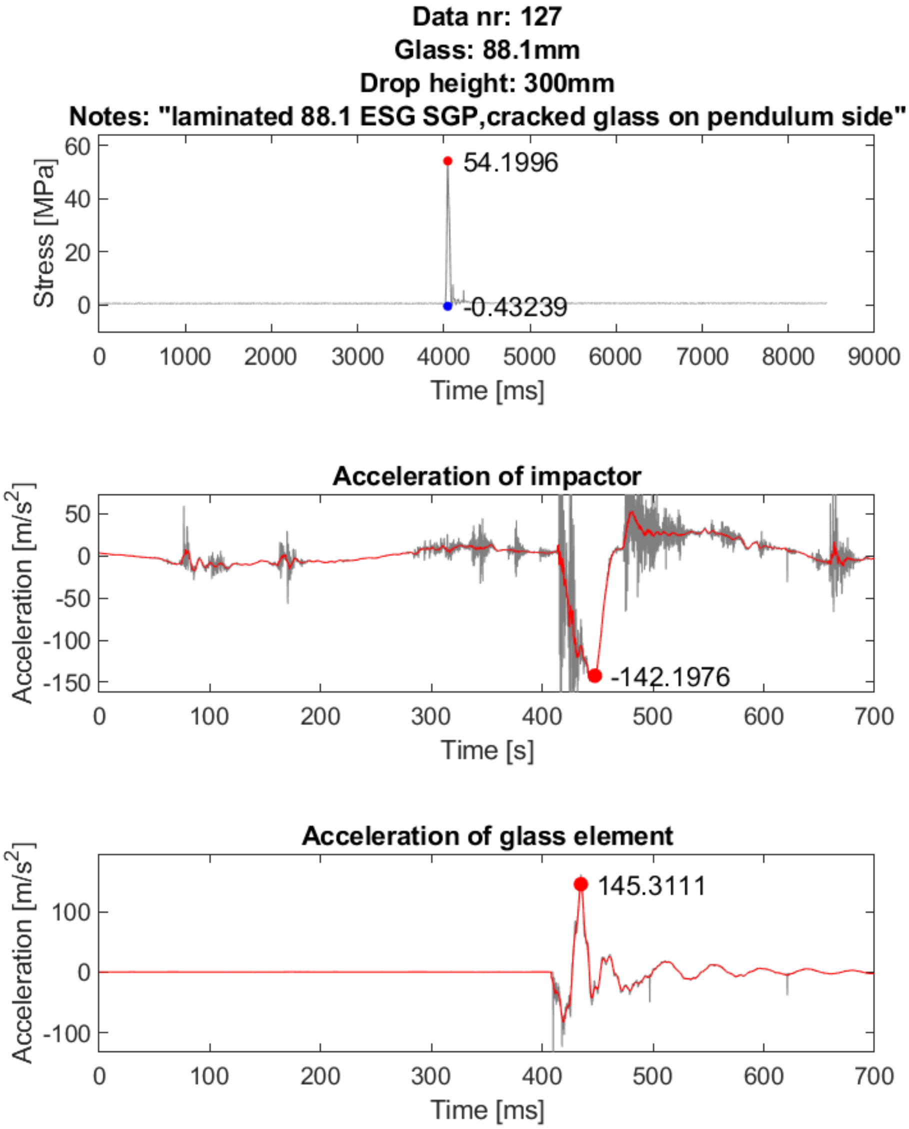
Data nr: 122
Glass: 88.1mm
Drop height: 500mm
Notes: "laminated 88.1 ESG SGP"
Stress [MPa]
60
40
20
0
54.4691
-9.5494
0
1000
2000
3000
4000
5000
6000
7000
8000
Time [ms]
Acceleration of impactor
Acceleration [m/s2]
100
0
-100
-200
-193.7693
0
100
200
300
400
500
600
700
Time [s]
Acceleration of glass element
Acceleration [m/s2]
100
0
-100
113.4203
0
100
200
300
400
500
600
700
Time [ms]

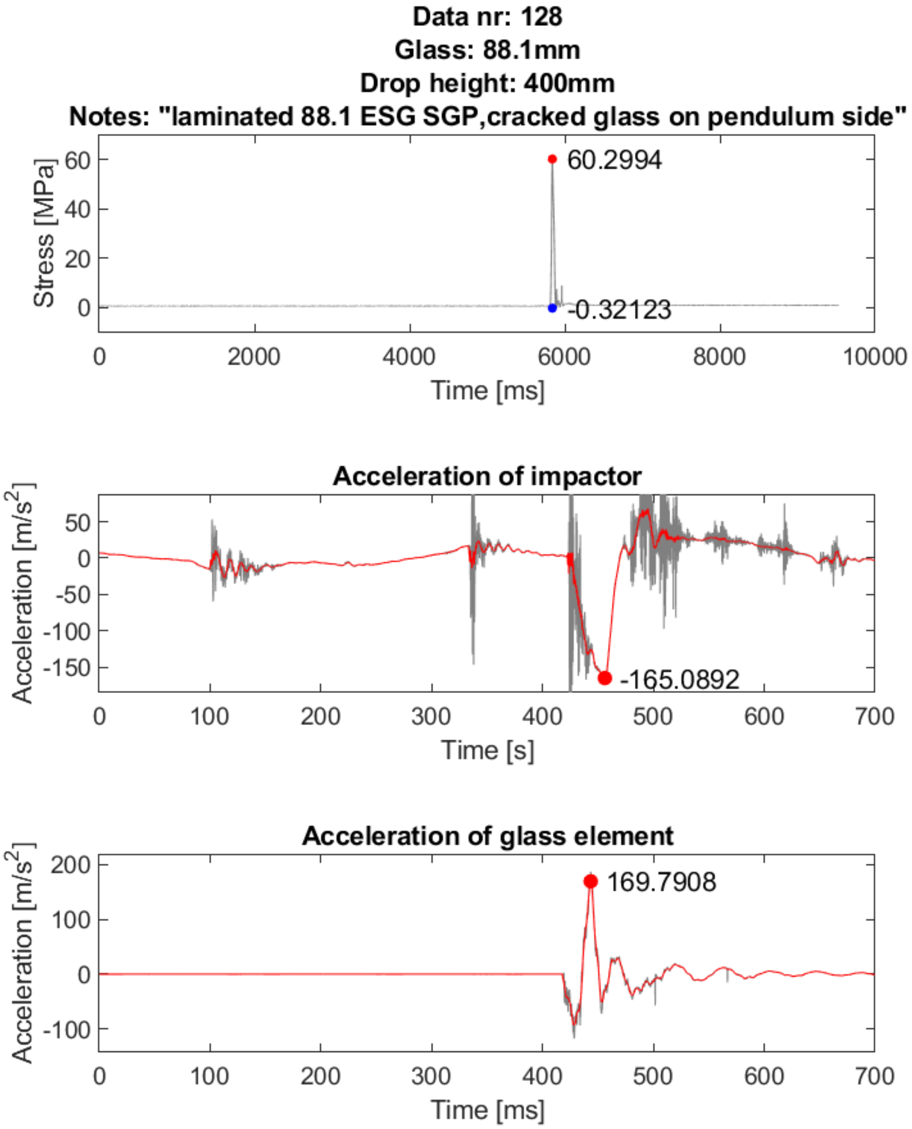

Data nr: 124
Glass: 88.1mm
Drop height: 500mm
Notes: "laminated 88.1 ESG SGP"
Stress [MPa]
60
40
20
0
53.319
-1.1725
0
1000
2000
3000
4000
5000
6000
7000
Time [ms]
Acceleration of impactor
Acceleration [m/s2]
0
-100
-200
-194.0993
0
100
200
300
400
500
600
700
Time [s]
Acceleration of glass element
Acceleration [m/s2]
100
0
-100
98.4816
0
100
200
300
400
500
600
700
Time [ms]



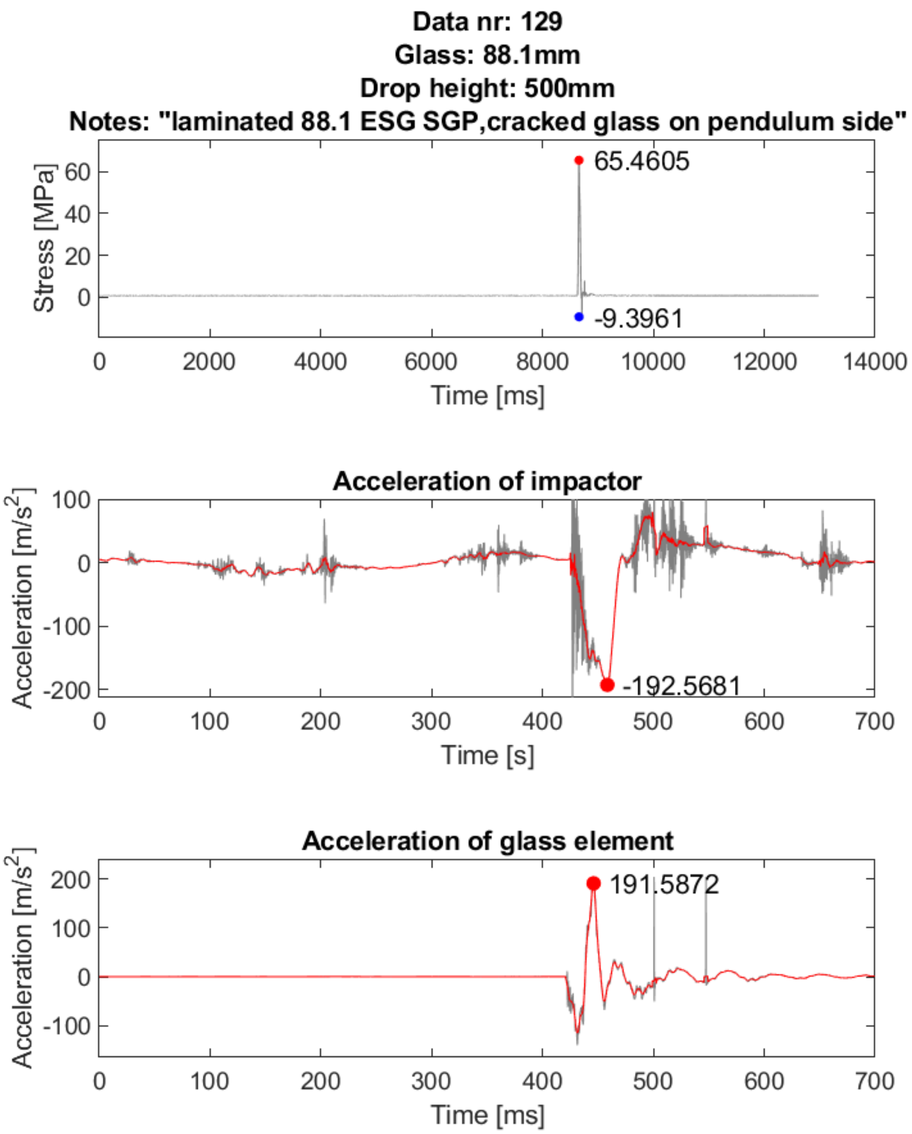
Data nr: 125
Glass: 88.1mm
Drop height: 100mm
Notes: "laminated 88.1 ESG SGP,cracked glass on pendulum side"
Stress [MPa]
31.5805
-1.6485
Time [ms]
Acceleration of impactor
Acceleration [m/s^2]
-78.5376
Time [s]
Acceleration of glass element
Acceleration [m/s^2]
67.7864
Time [ms]

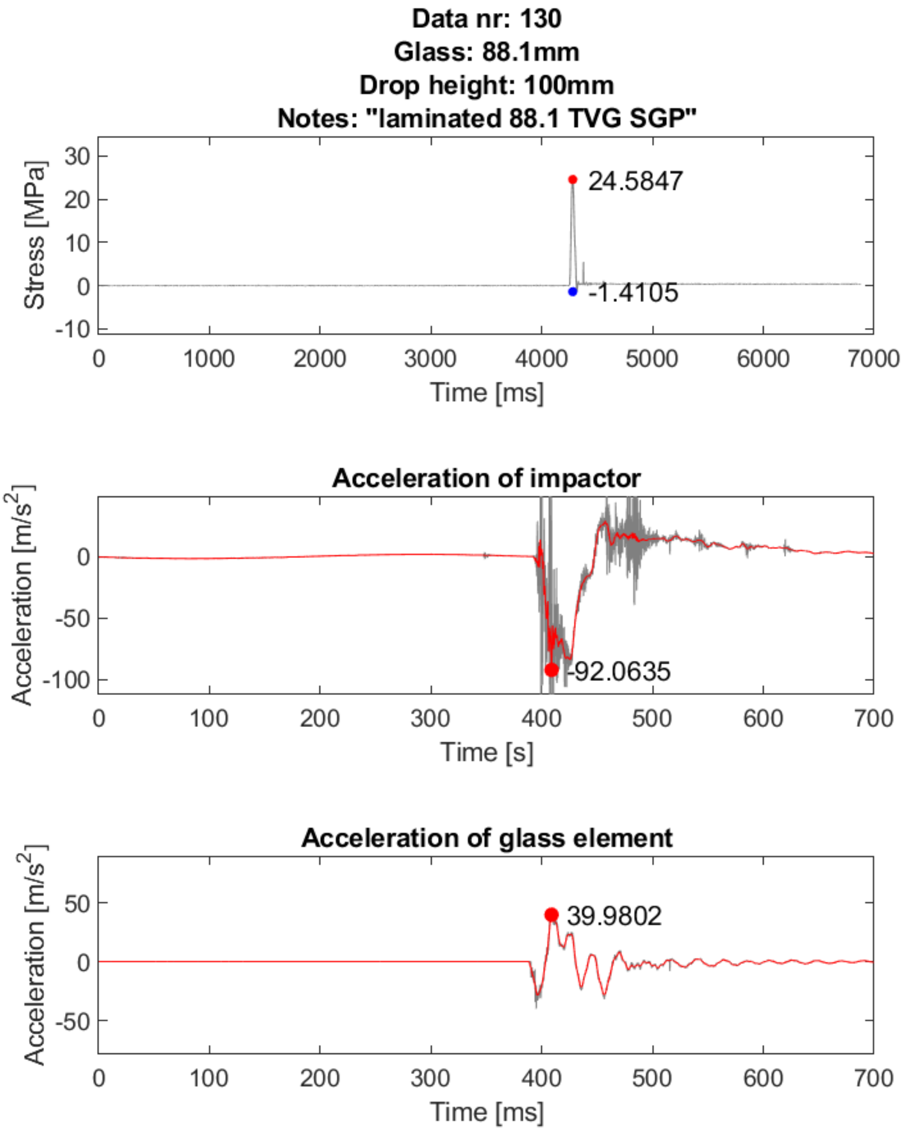

Data nr: 126
Glass: 88.1mm
Drop height: 200mm
Notes: "laminated 88.1 ESG SGP,cracked glass on pendulum side"
Stress [MPa]
47.5895
-7.7553
Time [ms]
Acceleration of impactor
Acceleration [m/s^2]
-125,8759
Time [s]
Acceleration of glass element
Acceleration [m/s^2]
120.862
Time [ms]

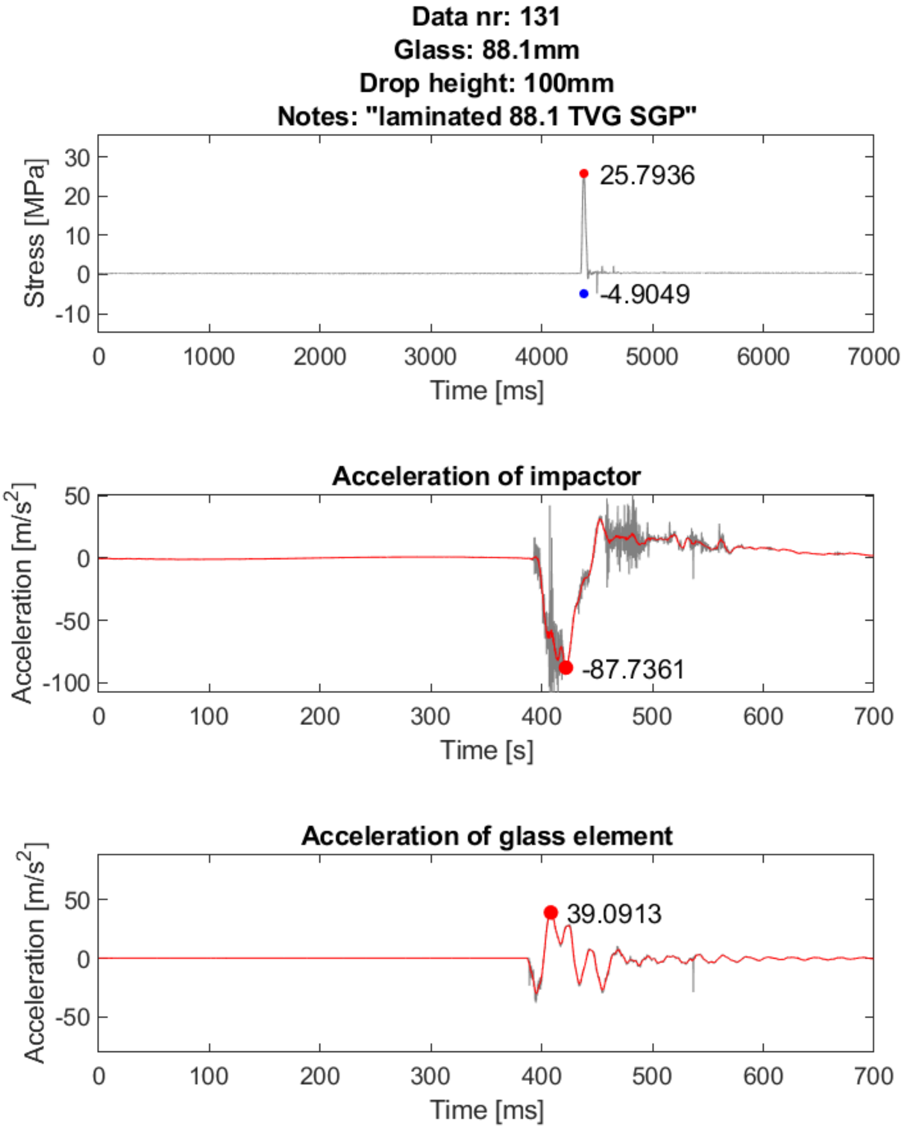

Data nr: 127
Glass: 88.1mm
Drop height: 300mm
Notes: "laminated 88.1 ESG SGP,cracked glass on pendulum side"
Stress [MPa]
54.1996
-0.43239
Time [ms]
Acceleration of impactor
Acceleration [m/s^2]
-142.1976
Time [s]
Acceleration of glass element
Acceleration [m/s^2]
145.3111
Time [ms]

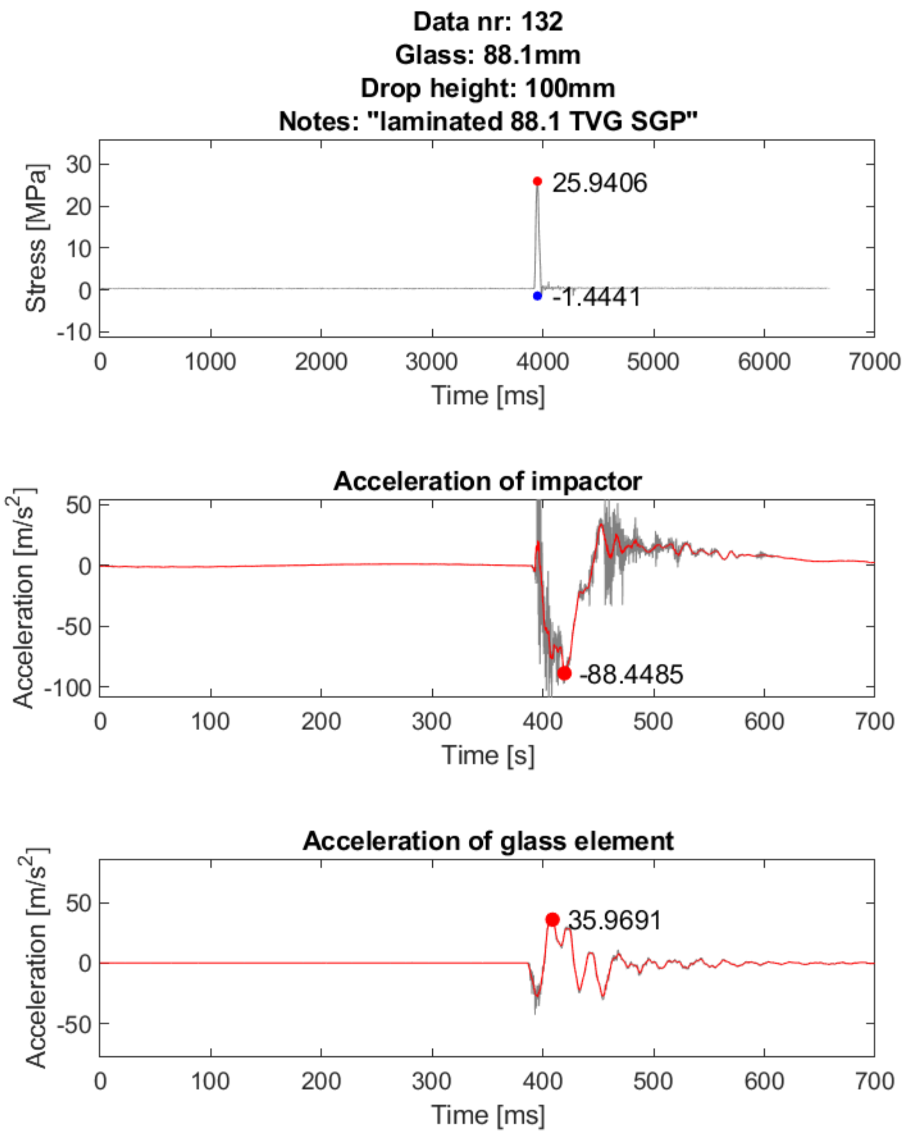


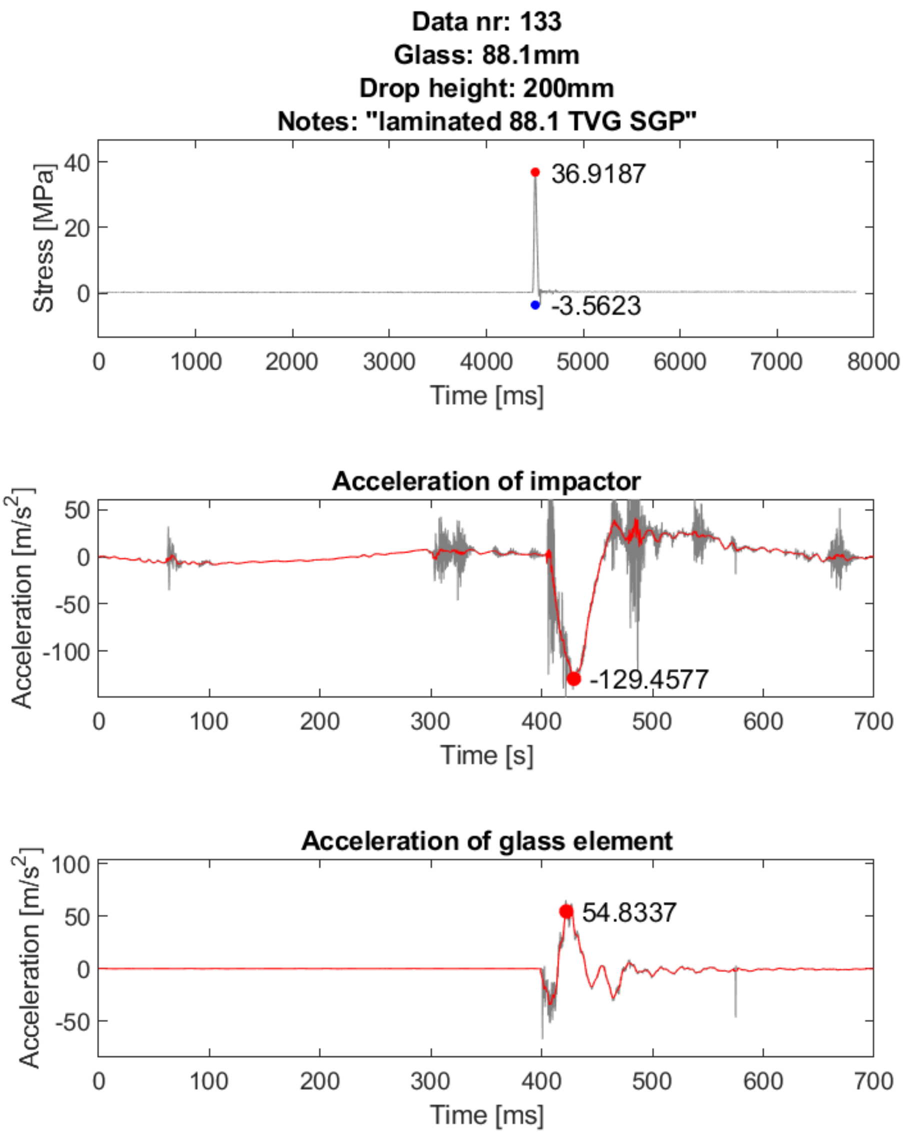
Data nr: 128
Glass: 88.1mm
Drop height: 400mm
Notes: "laminated 88.1 ESG SGP,cracked glass on pendulum side"
Stress [MPa]
60.2994
-0.32123
Time [ms]
Acceleration of impactor
Acceleration [m/s2]
-165.0892
Time [s]
Acceleration of glass element
Acceleration [m/s2]
169.7908
Time [ms]

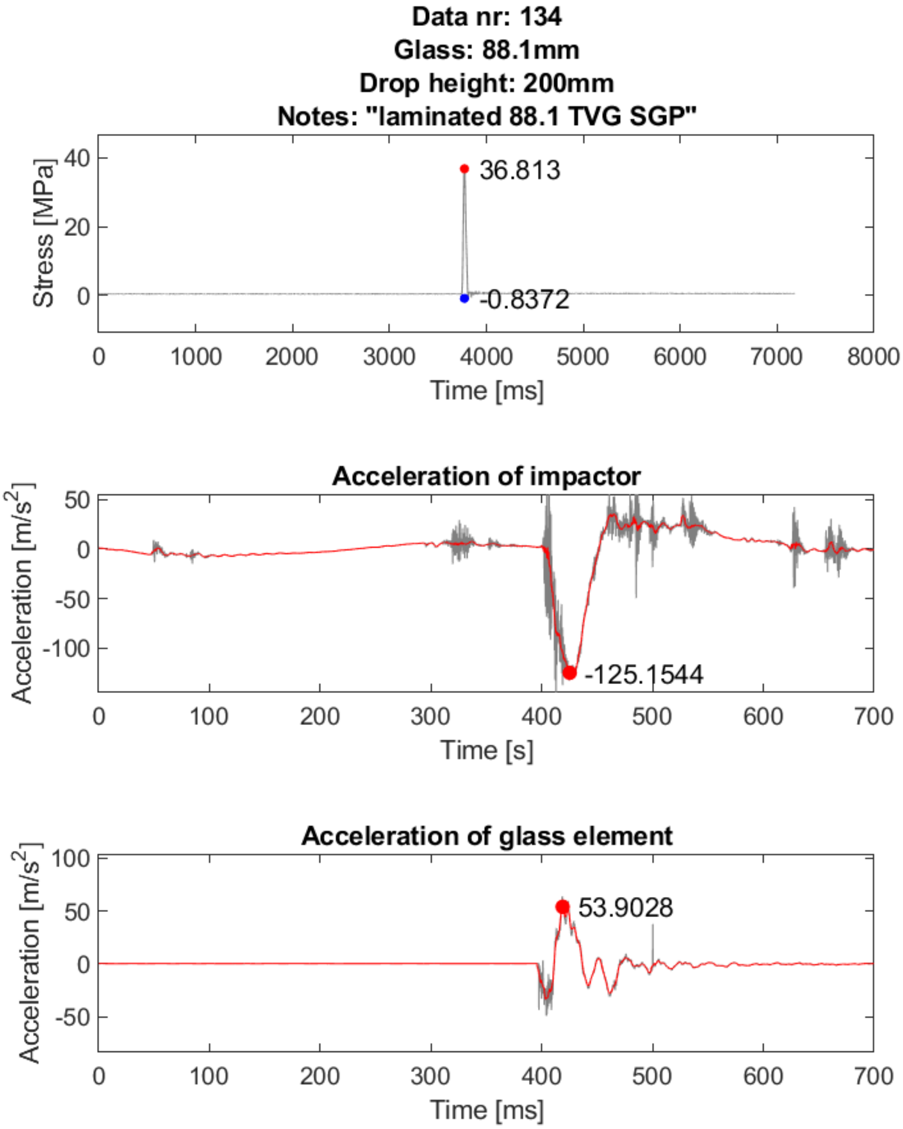

Data nr: 129
Glass: 88.1mm
Drop height: 500mm
Notes: "laminated 88.1 ESG SGP,cracked glass on pendulum side"
Stress [MPa]
65.4605
-9.3961
Time [ms]
Acceleration of impactor
Acceleration [m/s^2]
-192.5681
Time [s]
Acceleration of glass element
Acceleration [m/s^2]
191.5872
Time [ms]

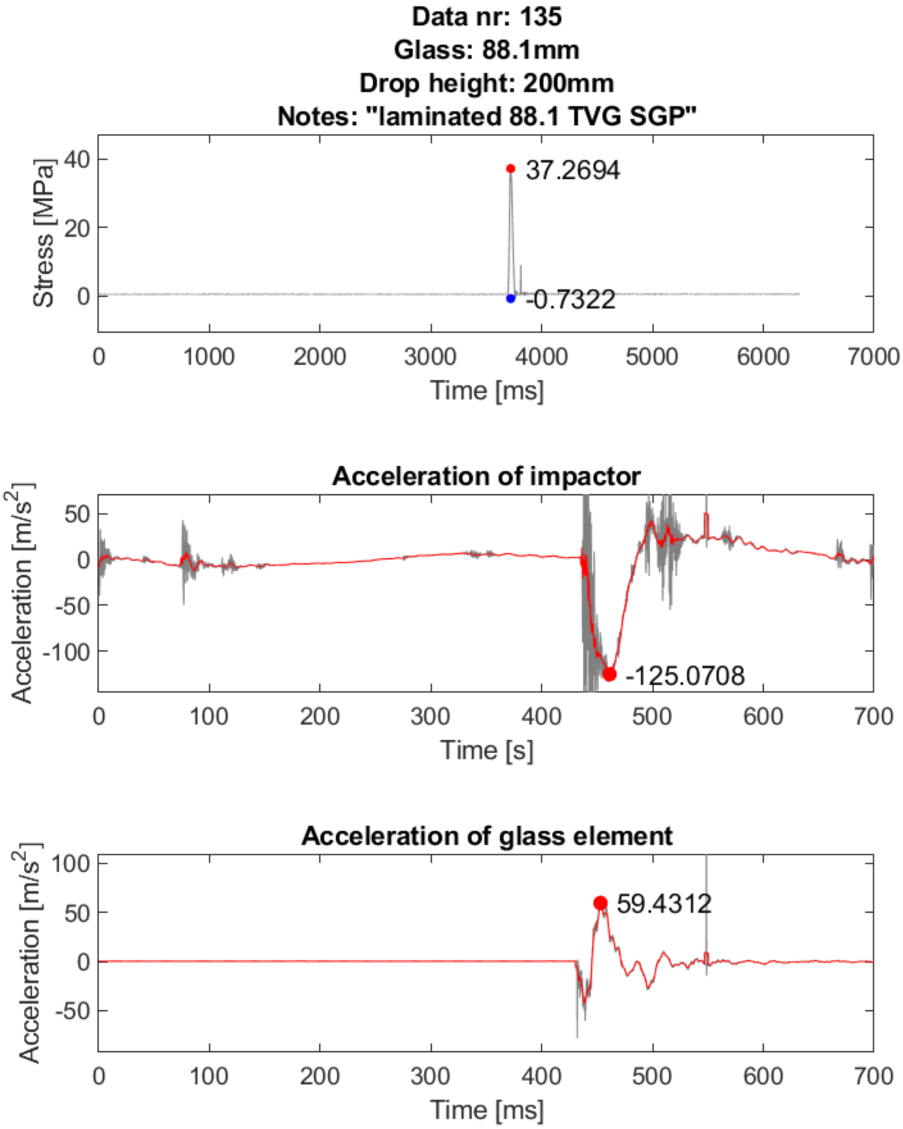

Data nr: 130
Glass: 88.1mm
Drop height: 100mm
Notes: "laminated 88.1 TVG SGP"
Stress [MPa]
30
20
10
0
-10
24.5847
-1.4105
0
1000
2000
3000
4000
5000
6000
7000
Time [ms]
Acceleration of impactor
Acceleration [m/s2]
0
-50
-100
-92.0635
0
100
200
300
400
500
600
700
Time [s]
Acceleration of glass element
Acceleration [m/s2]
50
0
-50
39.9802
0
100
200
300
400
500
600
700
Time [ms]

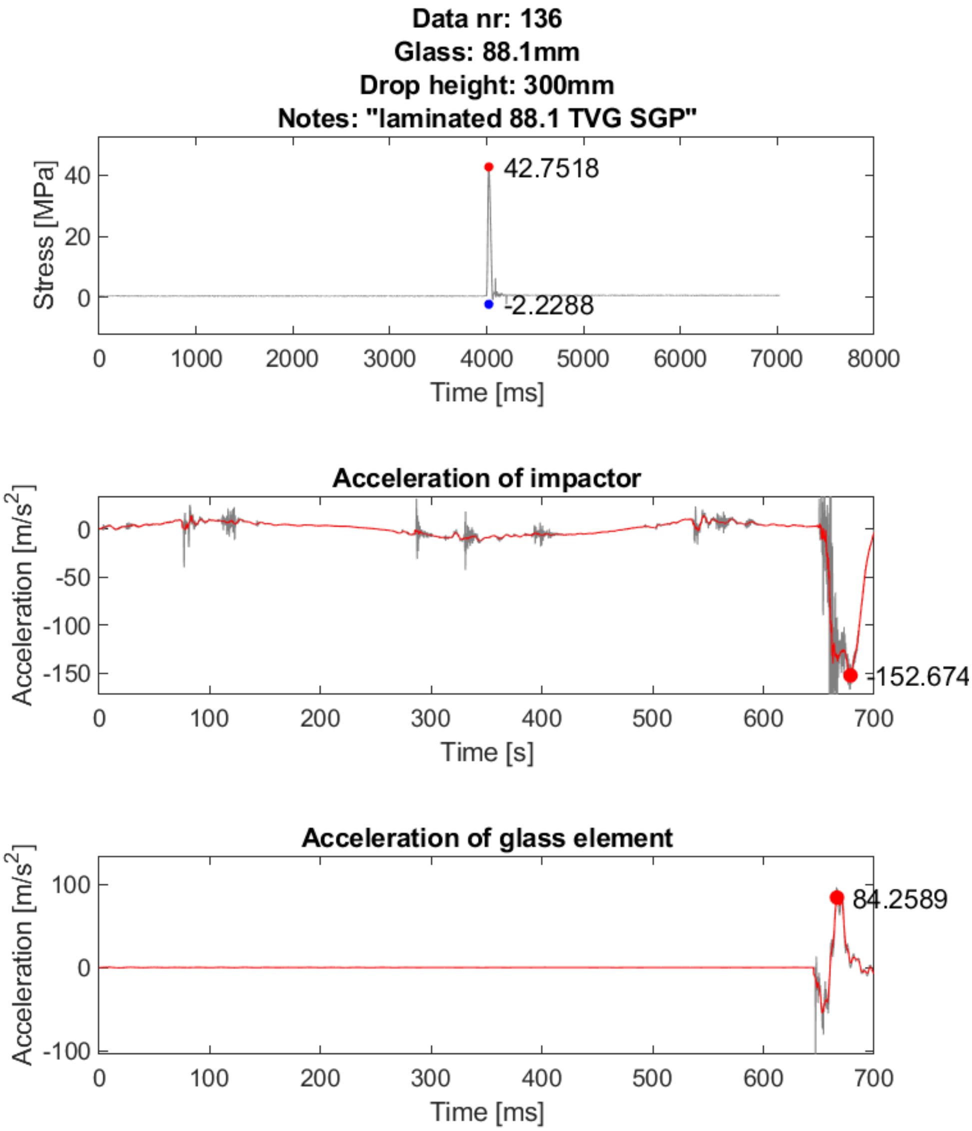

Data nr: 131
Glass: 88.1mm
Drop height: 100mm
Notes: "laminated 88.1 TVG SGP"
Stress [MPa]
25.7936
-4.9049
Time [ms]
Acceleration of impactor
Acceleration [m/s2]
-87.7361
Time [s]
Acceleration of glass element
Acceleration [m/s2]
39.0913
Time [ms]

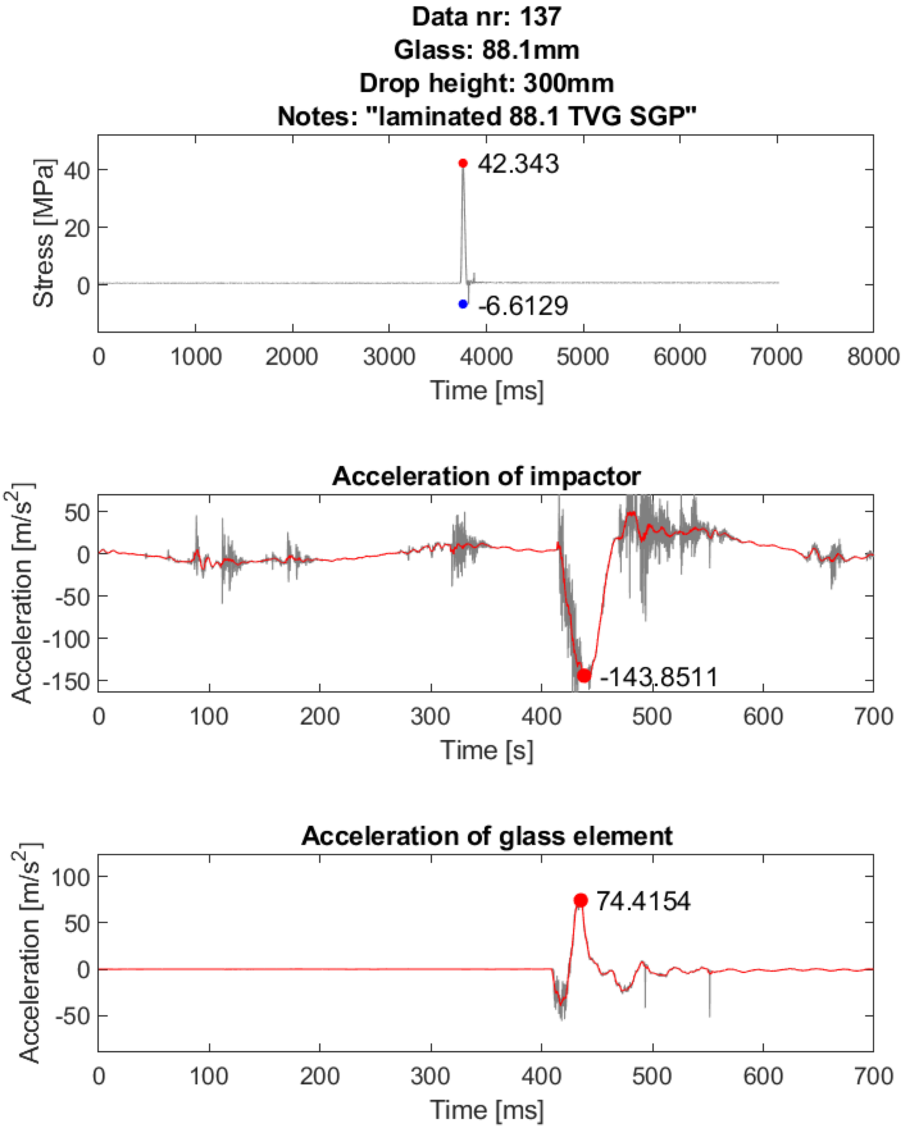

Data nr: 132
Glass: 88.1mm
Drop height: 100mm
Notes: "laminated 88.1 TVG SGP"
Stress [MPa]
25.9406
-1.4441
Time [ms]
Acceleration of impactor
Acceleration [m/s^2]
-88.4485
Time [s]
Acceleration of glass element
Acceleration [m/s^2]
35.9691
Time [ms]

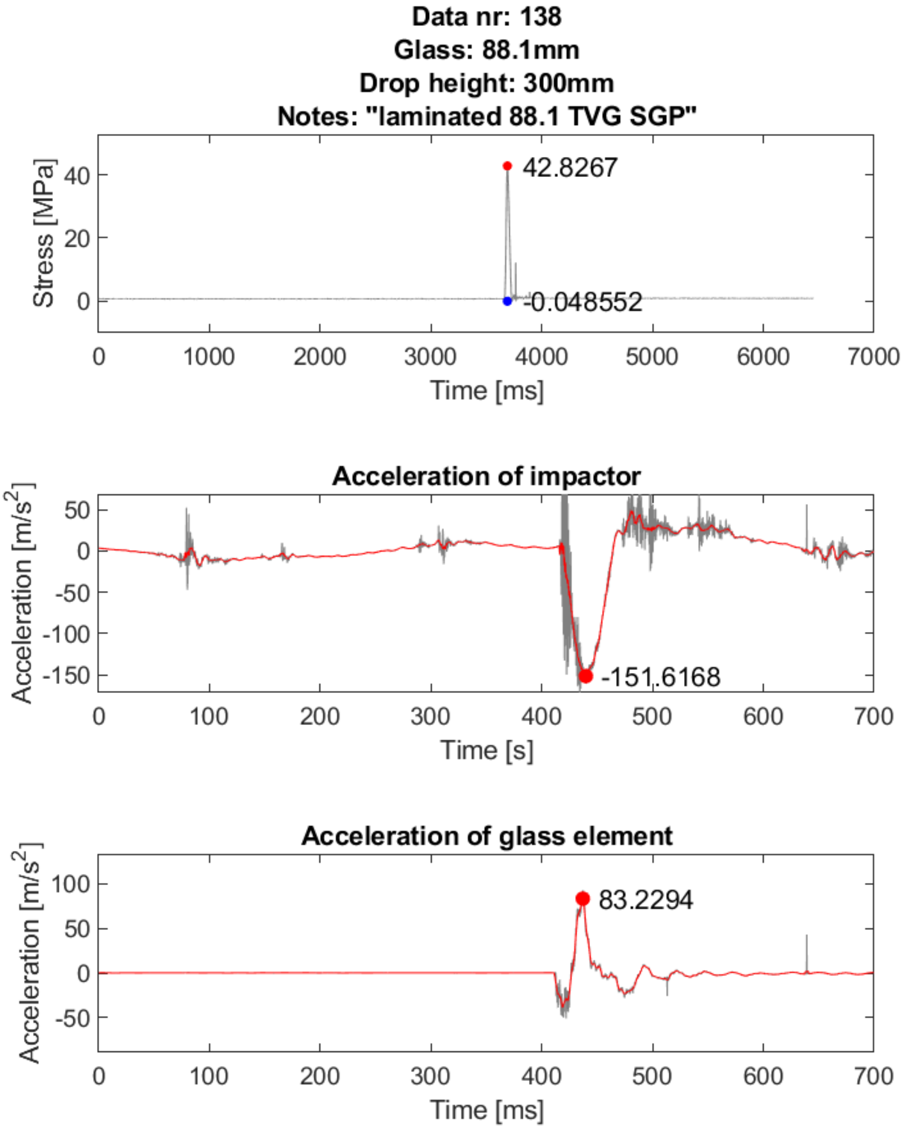

Data nr: 133
Glass: 88.1mm
Drop height: 200mm
Notes: "laminated 88.1 TVG SGP"
Stress [MPa]
36.9187
-3.5623
Time [ms]
Acceleration of impactor
Acceleration [m/s^2]
-129.4577
Time [s]
Acceleration of glass element
Acceleration [m/s^2]
54.8337
Time [ms]

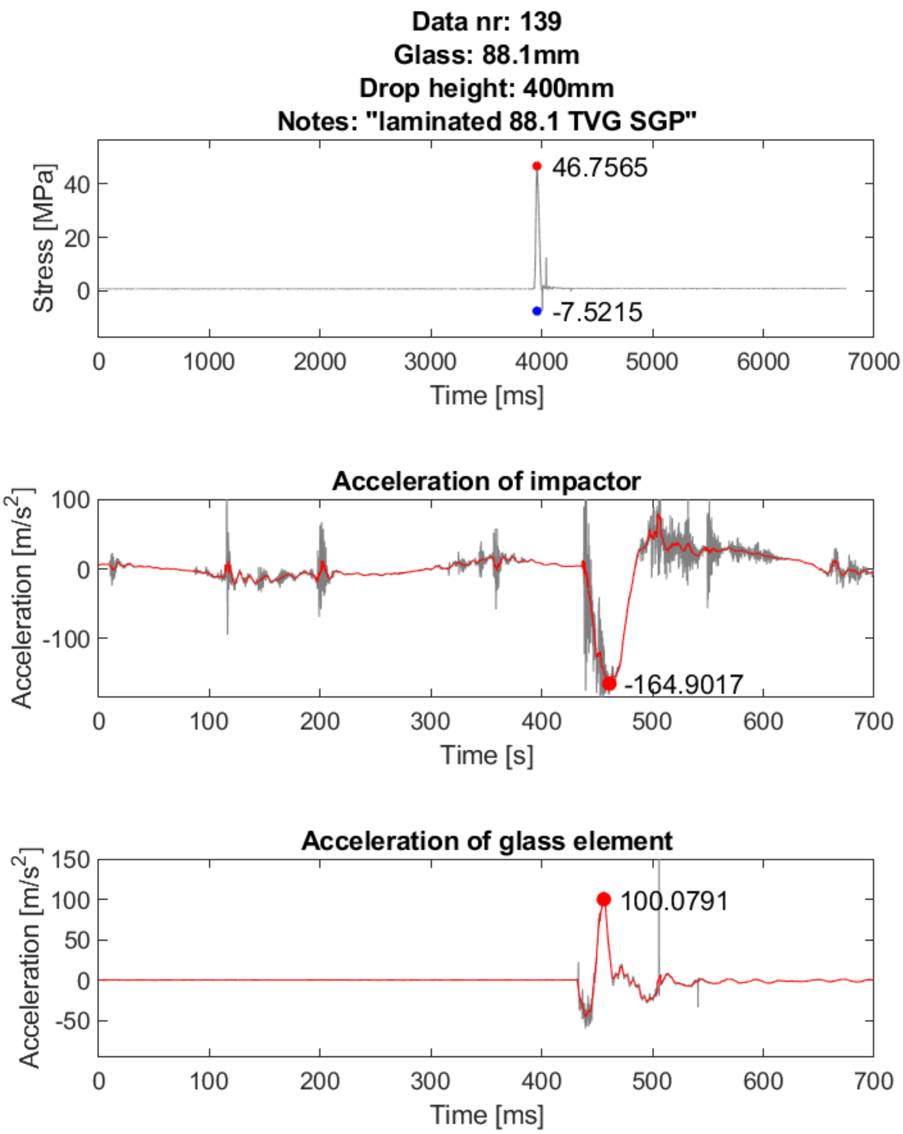

Data nr: 134
Glass: 88.1mm
Drop height: 200mm
Notes: "laminated 88.1 TVG SGP"
Stress [MPa]
36.813
-0.8372
Time [ms]
Acceleration of impactor
Acceleration [m/s^2]
-125.1544
Time [s]
Acceleration of glass element
Acceleration [m/s^2]
53.9028
Time [ms]

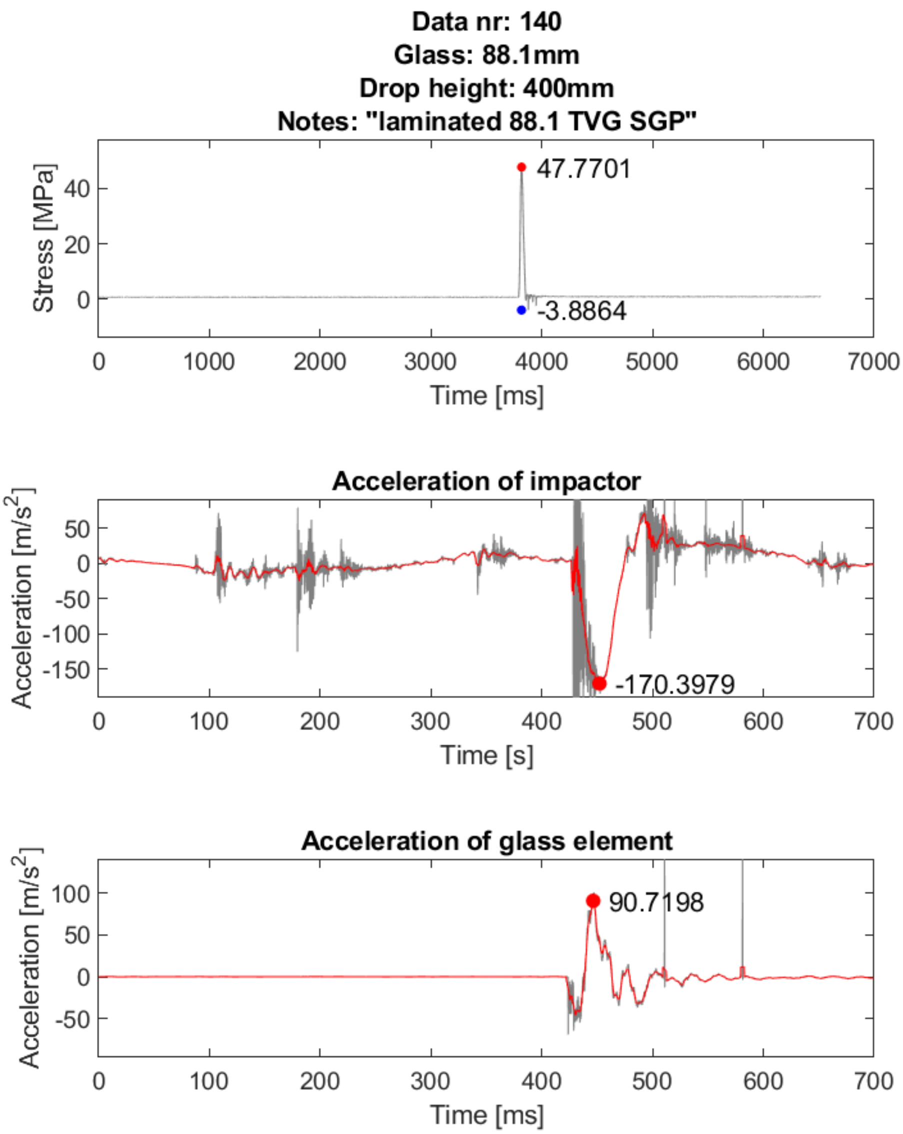

Data nr: 135
Glass: 88.1mm
Drop height: 200mm
Notes: "laminated 88.1 TVG SGP"
Stress [MPa]
37.2694
-0.7322
Time [ms]
Acceleration of impactor
Acceleration [m/s^2]
-125.0708
Time [s]
Acceleration of glass element
Acceleration [m/s^2]
59.4312
Time [ms]

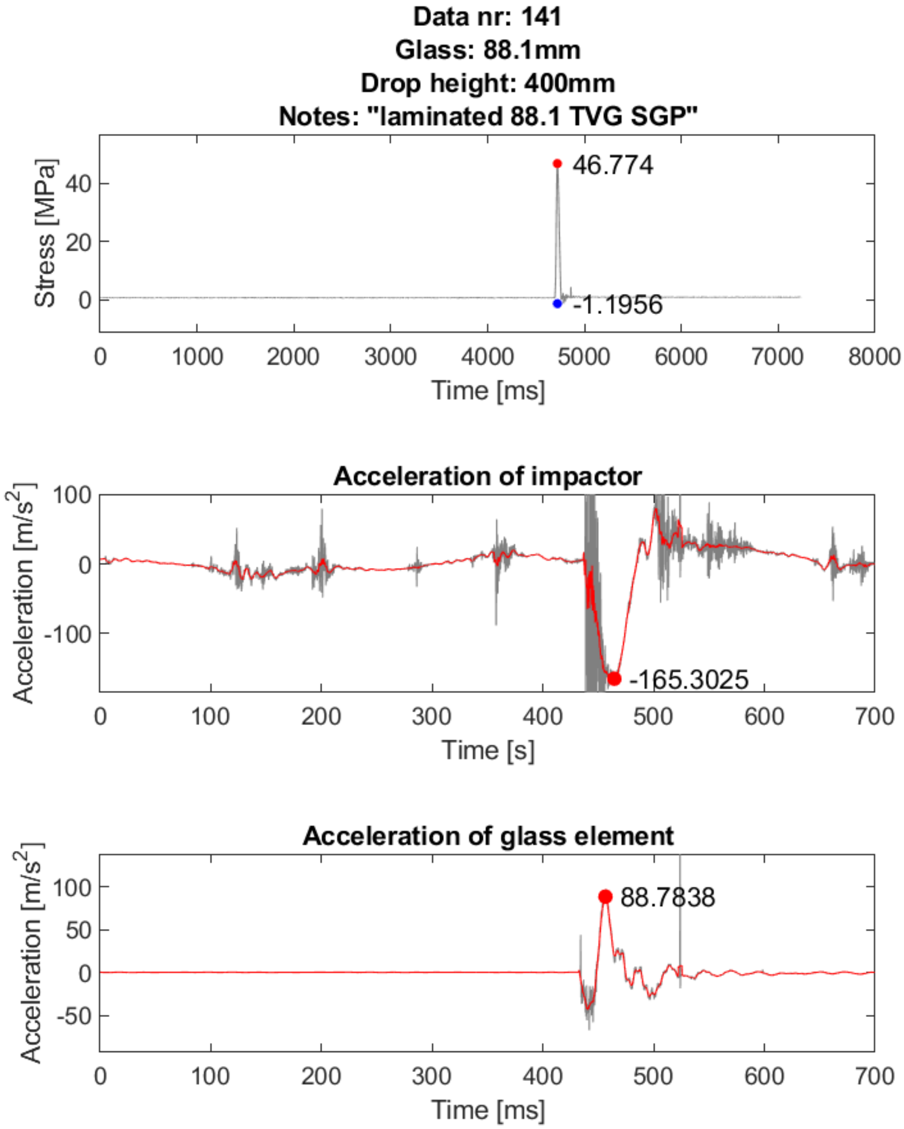

Data nr: 136
Glass: 88.1mm
Drop height: 300mm
Notes: "laminated 88.1 TVG SGP"
Stress [MPa]
42.7518
-2.2288
Time [ms]
Acceleration of impactor
Acceleration [m/s^2]
-152.674
Time [s]
Acceleration of glass element
Acceleration [m/s^2]
84.2589
Time [ms]

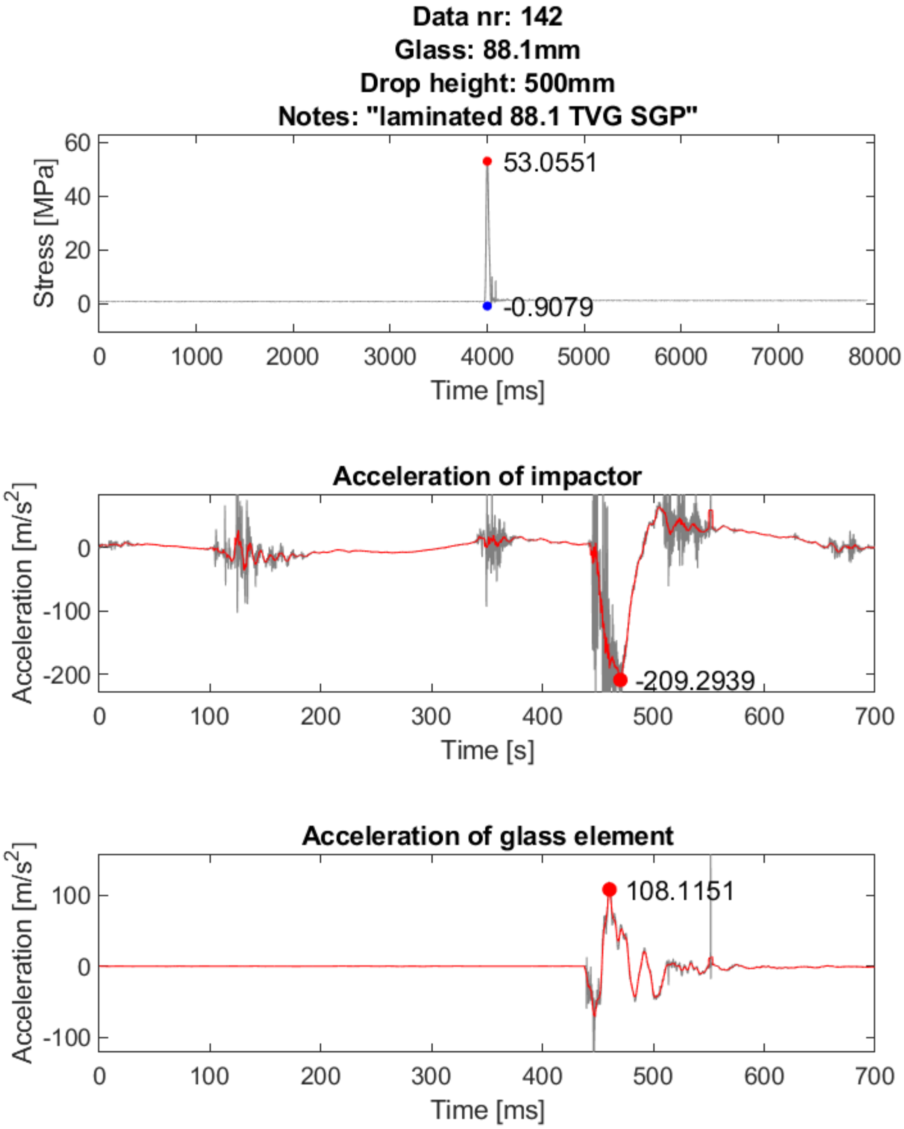

Data nr: 137
Glass: 88.1mm
Drop height: 300mm
Notes: "laminated 88.1 TVG SGP"
Stress [MPa]
42.343
-6.6129
Time [ms]
Acceleration of impactor
Acceleration [m/s^2]
-143.8511
Time [s]
Acceleration of glass element
Acceleration [m/s^2]
74.4154
Time [ms]

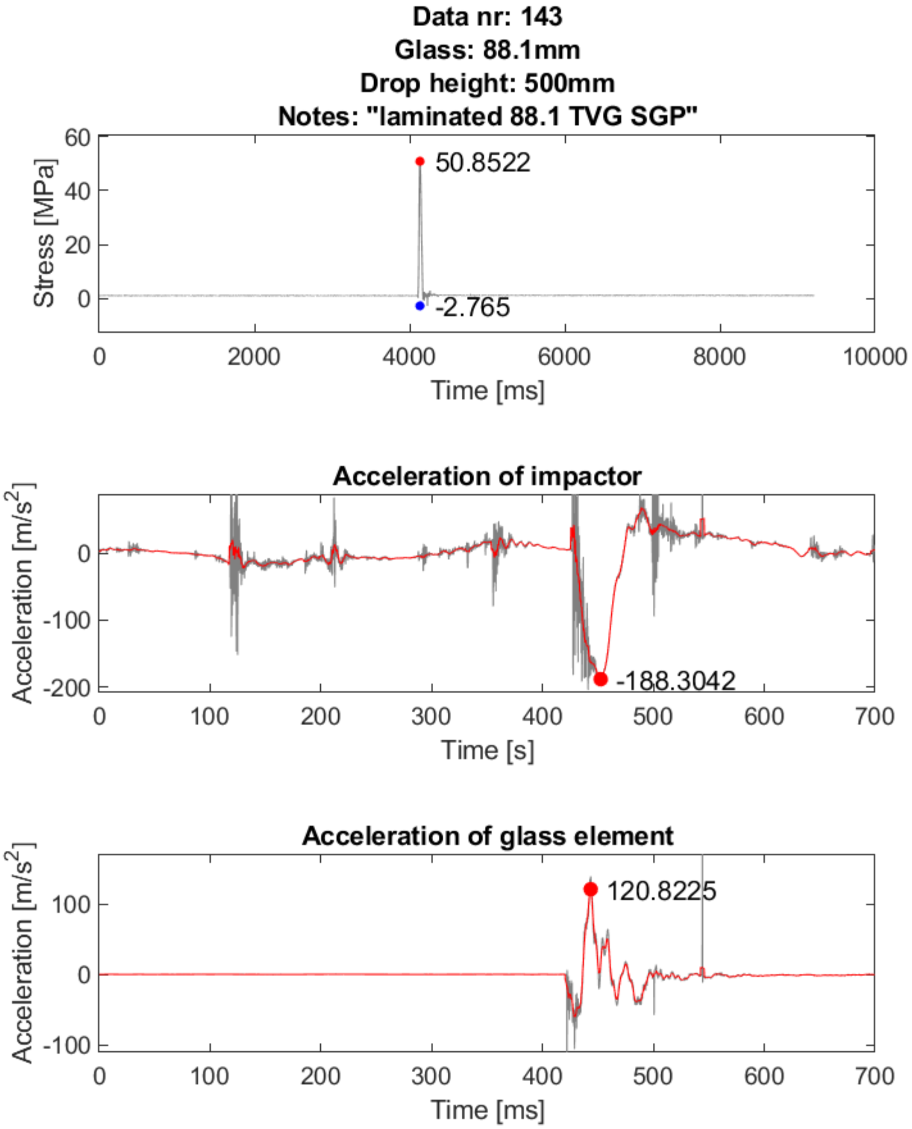

Data nr: 138
Glass: 88.1mm
Drop height: 300mm
Notes: "laminated 88.1 TVG SGP"
Stress [MPa]
42.8267
-0.048552
Time [ms]
Acceleration of impactor
Acceleration [m/s^2]
-151.6168
Time [s]
Acceleration of glass element
Acceleration [m/s^2]
83.2294
Time [ms]

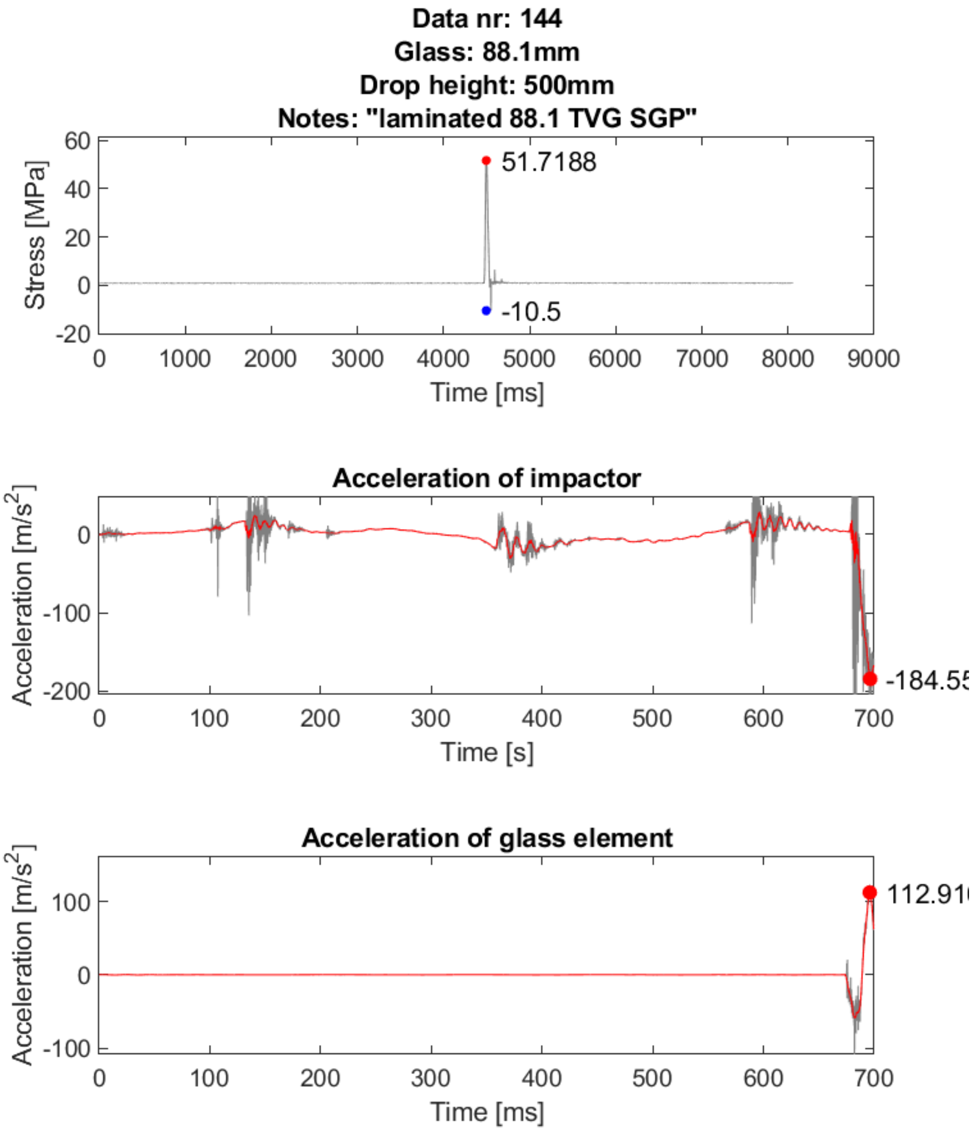

Data nr: 139
Glass: 88.1mm
Drop height: 400mm
Notes: "laminated 88.1 TVG SGP"
Stress [MPa]
46.7565
-7.5215
Time [ms]
Acceleration of impactor
Acceleration [m/s2]
-164.9017
Time [s]
Acceleration of glass element
Acceleration [m/s2]
100.0791
Time [ms]

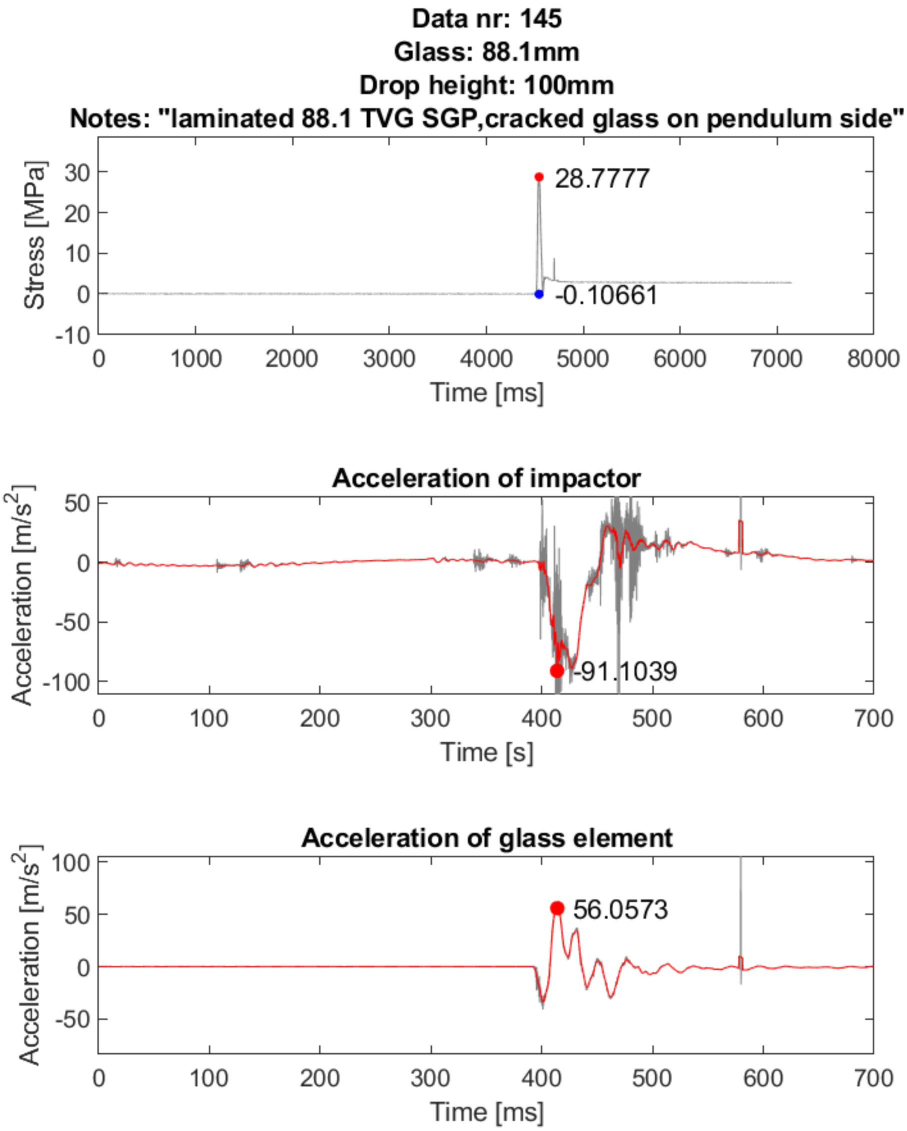

Data nr: 140
Glass: 88.1mm
Drop height: 400mm
Notes: "laminated 88.1 TVG SGP"
Stress [MPa]
47.7701
-3.8864
Time [ms]
Acceleration of impactor
Acceleration [m/s^2]
-170.3979
Time [s]
Acceleration of glass element
Acceleration [m/s^2]
90.7198
Time [ms]

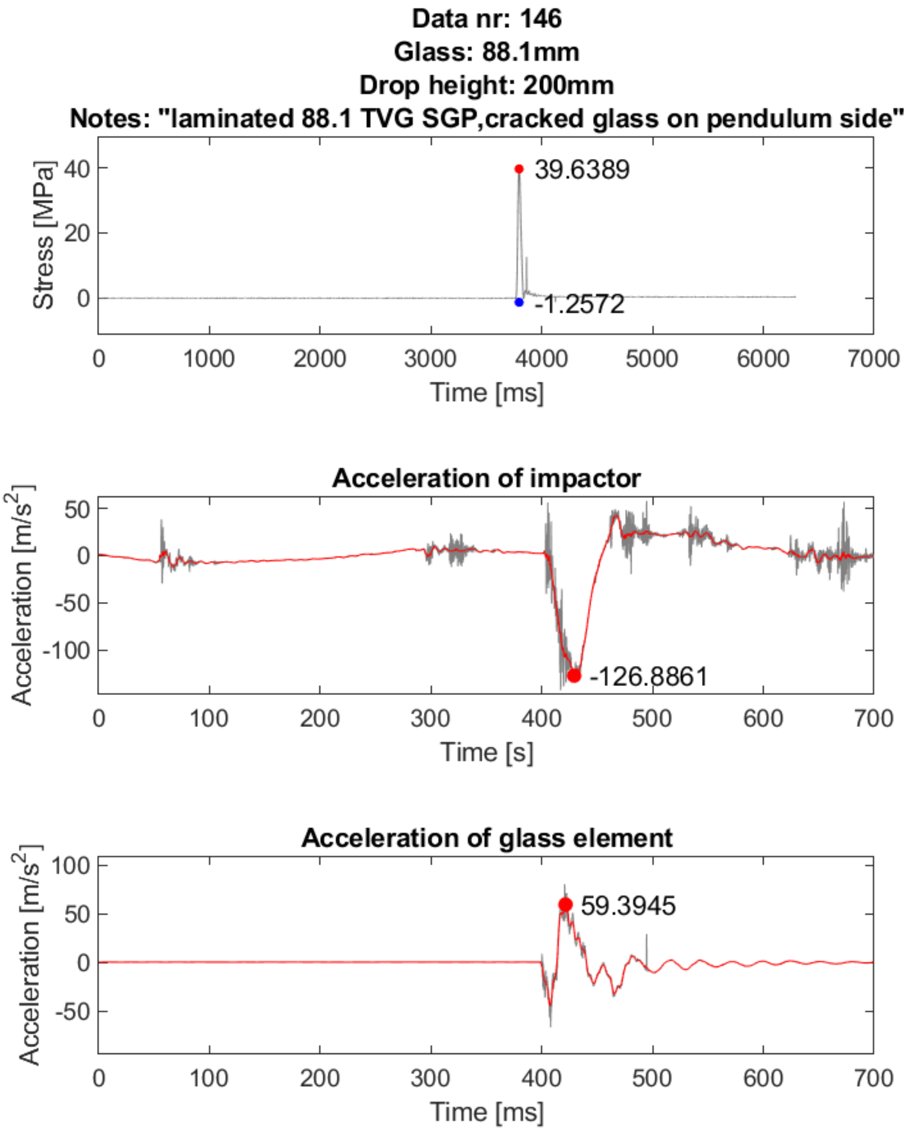

Data nr: 141
Glass: 88.1mm
Drop height: 400mm
Notes: "laminated 88.1 TVG SGP"
Stress [MPa]
46.774
-1.1956
Time [ms]
Acceleration of impactor
Acceleration [m/s^2]
-165.3025
Time [s]
Acceleration of glass element
Acceleration [m/s^2]
88.7838
Time [ms]

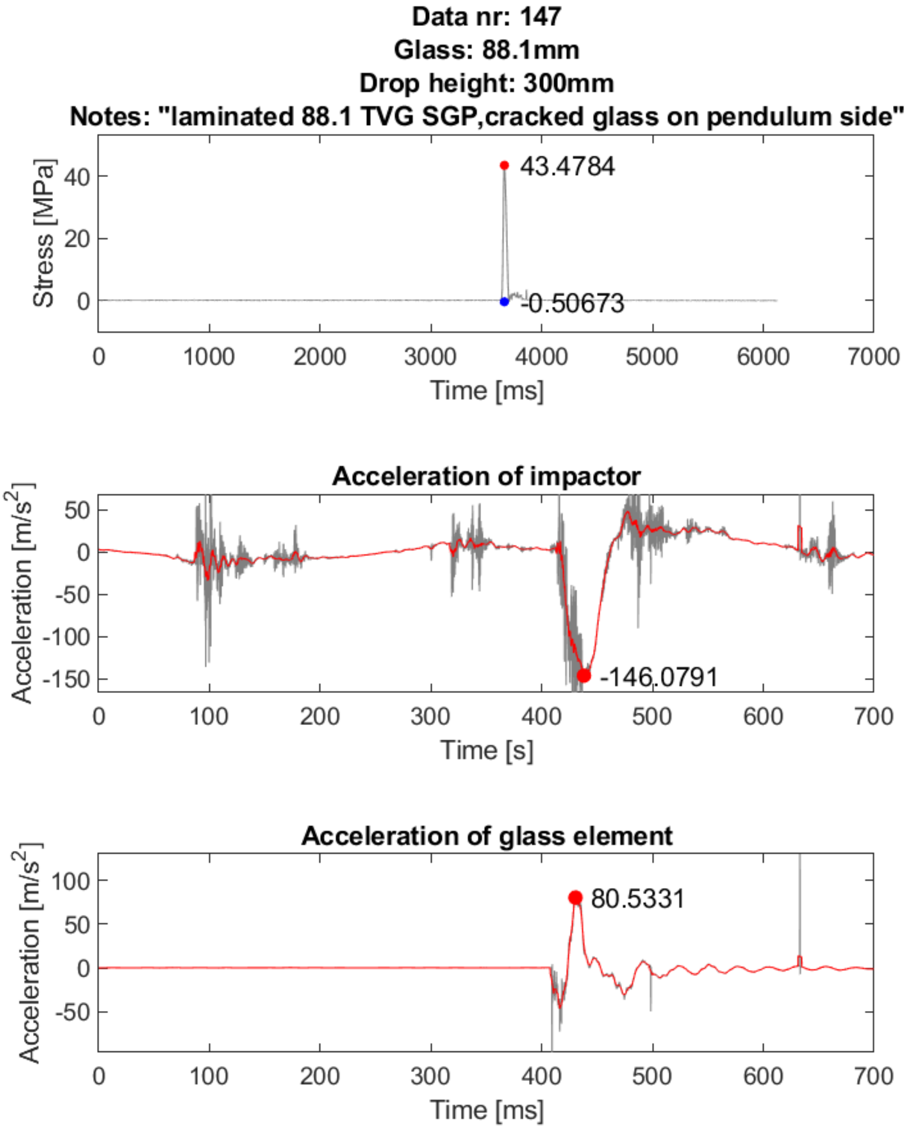

Data nr: 142
Glass: 88.1mm
Drop height: 500mm
Notes: "laminated 88.1 TVG SGP"
Stress [MPa]
60
40
20
0
53.0551
-0.9079
0
1000
2000
3000
4000
5000
6000
7000
8000
Time [ms]
Acceleration of impactor
Acceleration [m/s2]
0
-100
-200
-209.2939
0
100
200
300
400
500
600
700
Time [s]
Acceleration of glass element
Acceleration [m/s2]
100
0
-100
108.1151
0
100
200
300
400
500
600
700
Time [ms]

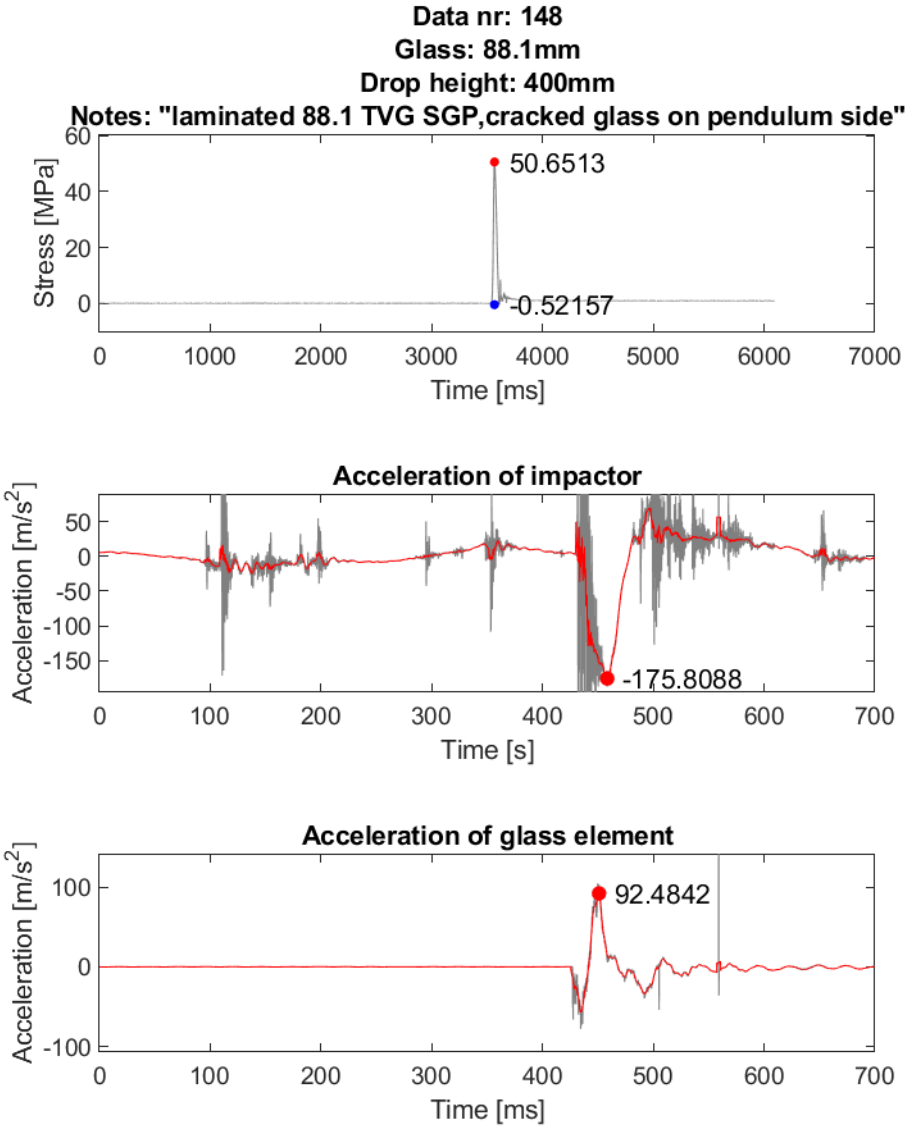

Data nr: 143
Glass: 88.1mm
Drop height: 500mm
Notes: "laminated 88.1 TVG SGP"
Stress [MPa]
50.8522
-2.765
Time [ms]
Acceleration of impactor
Acceleration [m/s^2]
-188.3042
Time [s]
Acceleration of glass element
Acceleration [m/s^2]
120.8225
Time [ms]

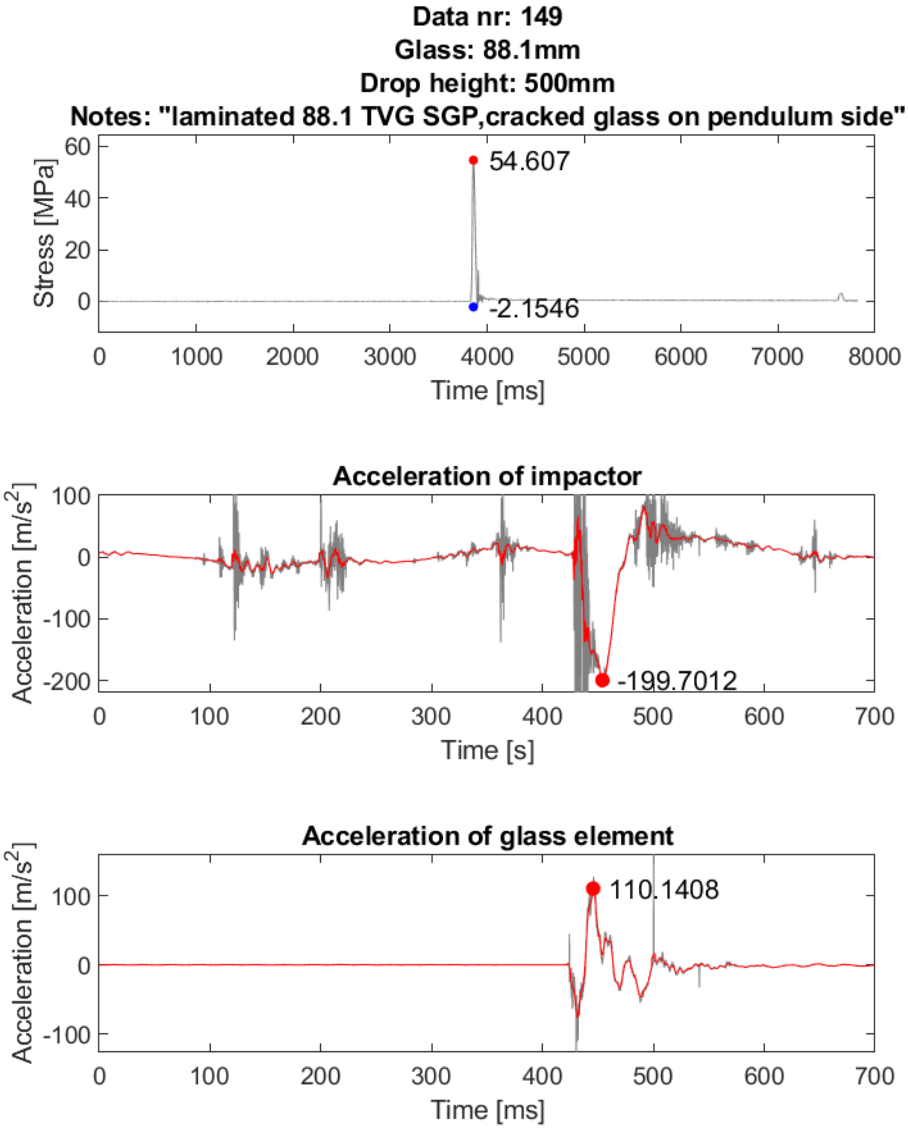

Data nr: 144
Glass: 88.1mm
Drop height: 500mm
Notes: "laminated 88.1 TVG SGP"
Stress [MPa]
51.7188
-10.5
Time [ms]
Acceleration of impactor
Acceleration [m/s^2]
-184.55
Time [s]
Acceleration of glass element
Acceleration [m/s^2]
112.91
Time [ms]

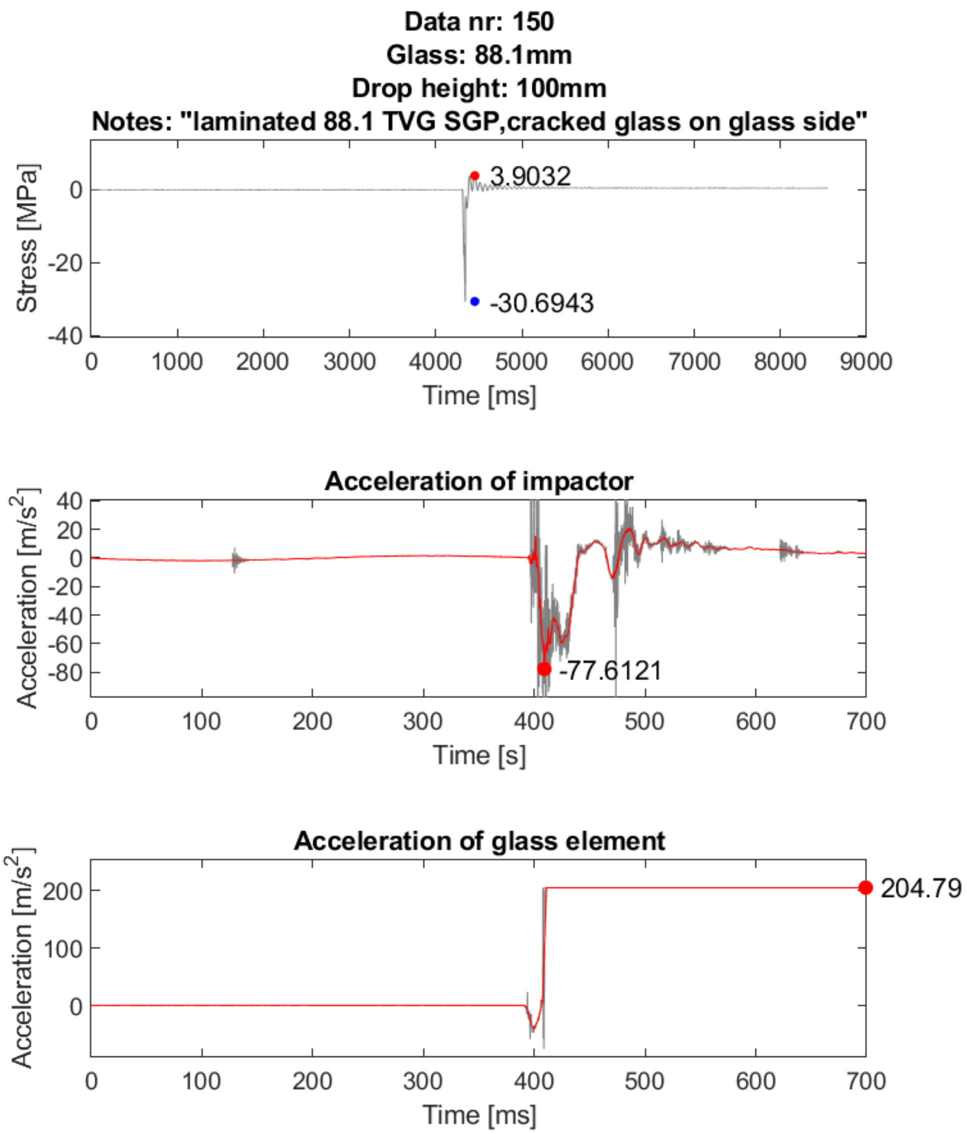

Data nr: 145
Glass: 88.1mm
Drop height: 100mm
Notes: "laminated 88.1 TVG SGP,cracked glass on pendulum side"
Stress [MPa]
28.7777
-0.10661
Time [ms]
Acceleration of impactor
Acceleration [m/s^2]
-91.1039
Time [s]
Acceleration of glass element
Acceleration [m/s^2]
56.0573
Time [ms]

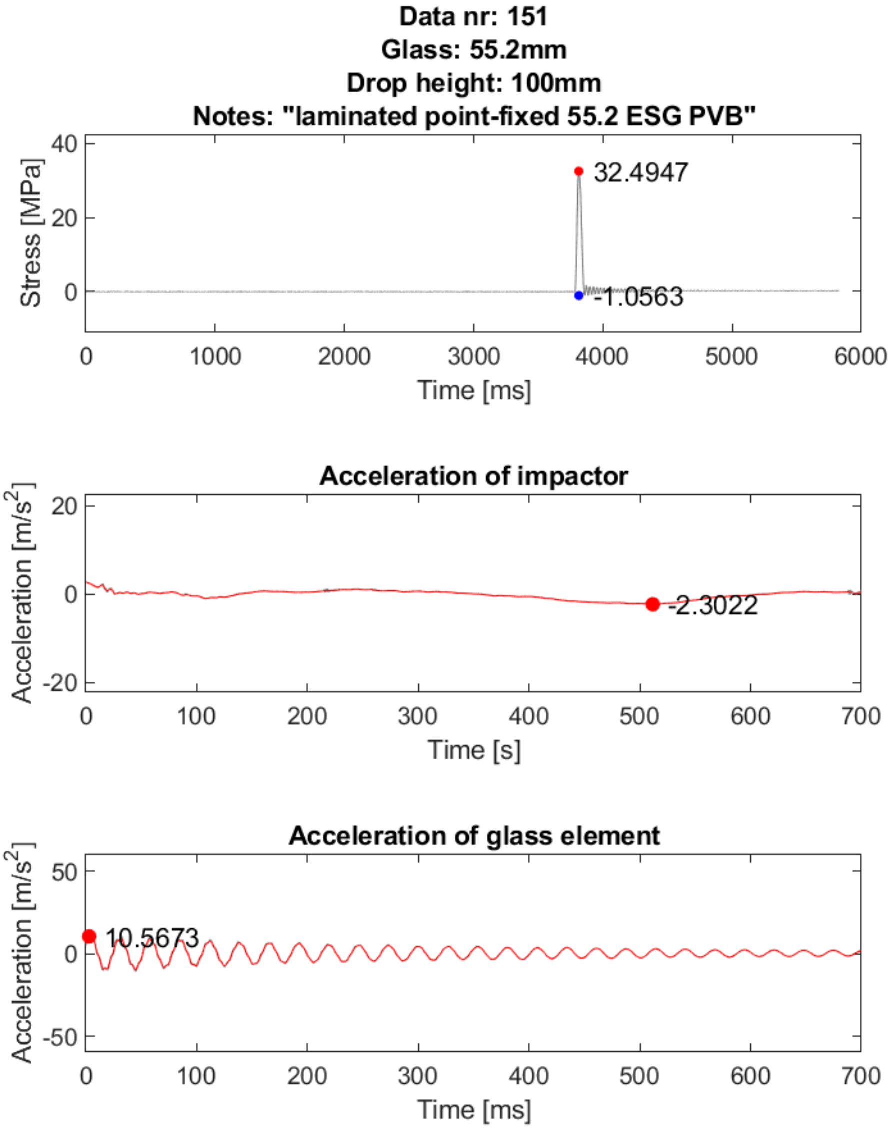

Data nr: 146
Glass: 88.1mm
Drop height: 200mm
Notes: "laminated 88.1 TVG SGP,cracked glass on pendulum side"
Stress [MPa]
39.6389
-1.2572
Time [ms]
Acceleration of impactor
Acceleration [m/s^2]
-126.8861
Time [s]
Acceleration of glass element
Acceleration [m/s^2]
59.3945
Time [ms]

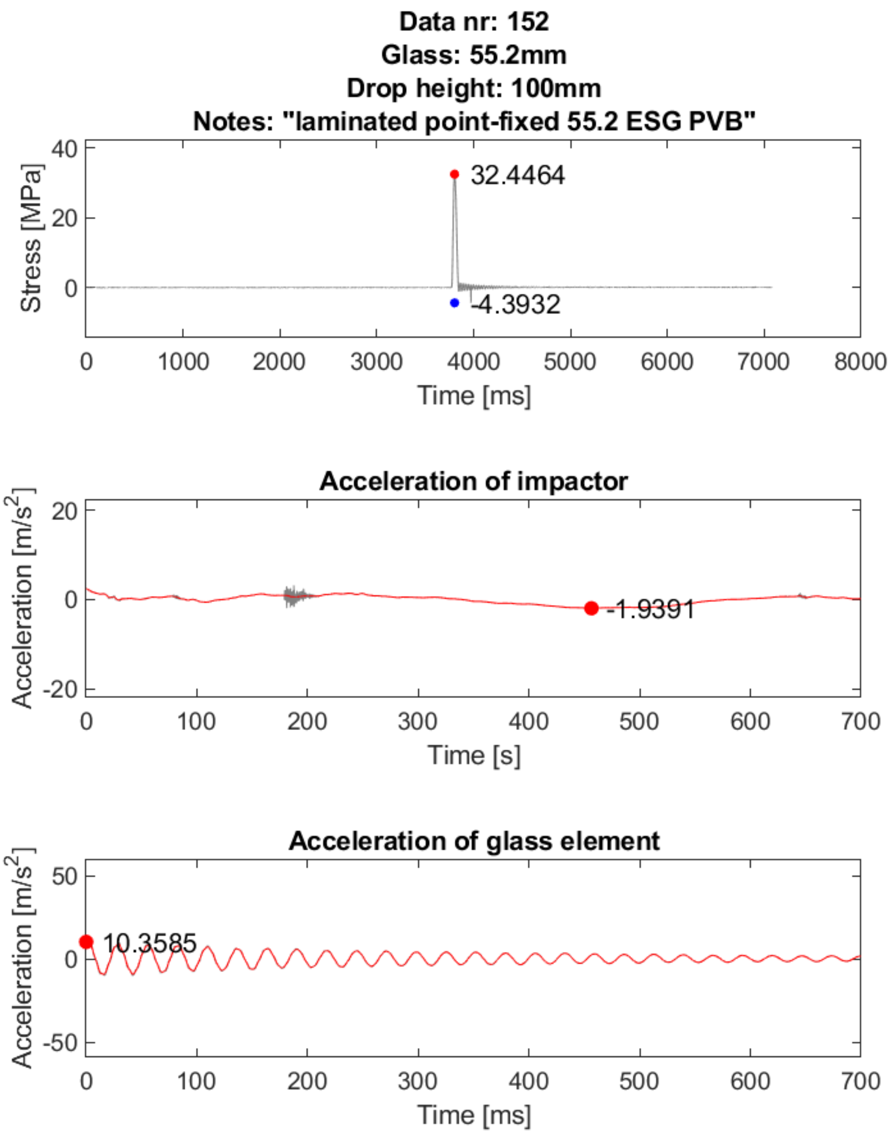

Data nr: 147
Glass: 88.1mm
Drop height: 300mm
Notes: "laminated 88.1 TVG SGP,cracked glass on pendulum side"
43.4784
-0.50673
Stress [MPa]
Time [ms]
Acceleration of impactor
-146.0791
Acceleration [m/s^2]
Time [s]
Acceleration of glass element
80.5331
Acceleration [m/s^2]
Time [ms]

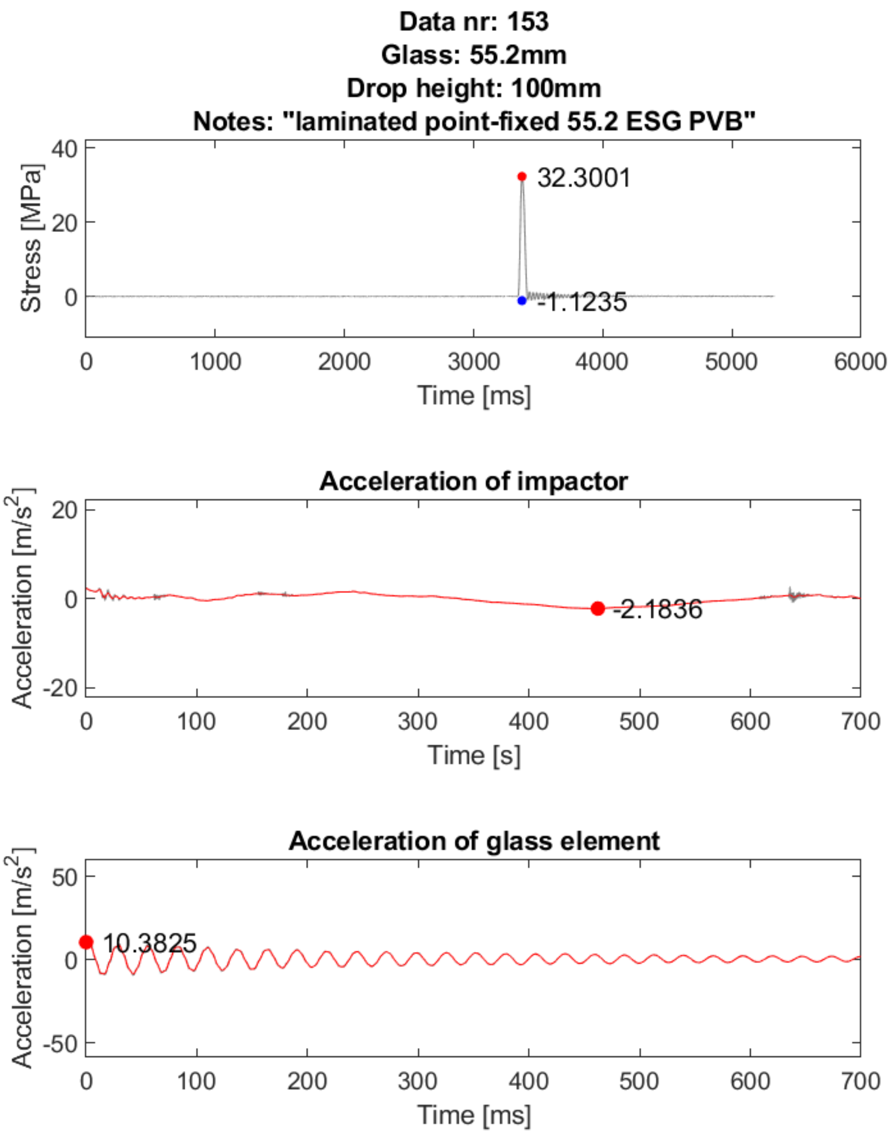

Data nr: 148
Glass: 88.1mm
Drop height: 400mm
Notes: "laminated 88.1 TVG SGP,cracked glass on pendulum side"
Stress [MPa]
50.6513
-0.52157
Time [ms]
Acceleration of impactor
Acceleration [m/s^2]
-175.8088
Time [s]
Acceleration of glass element
Acceleration [m/s^2]
92.4842
Time [ms]

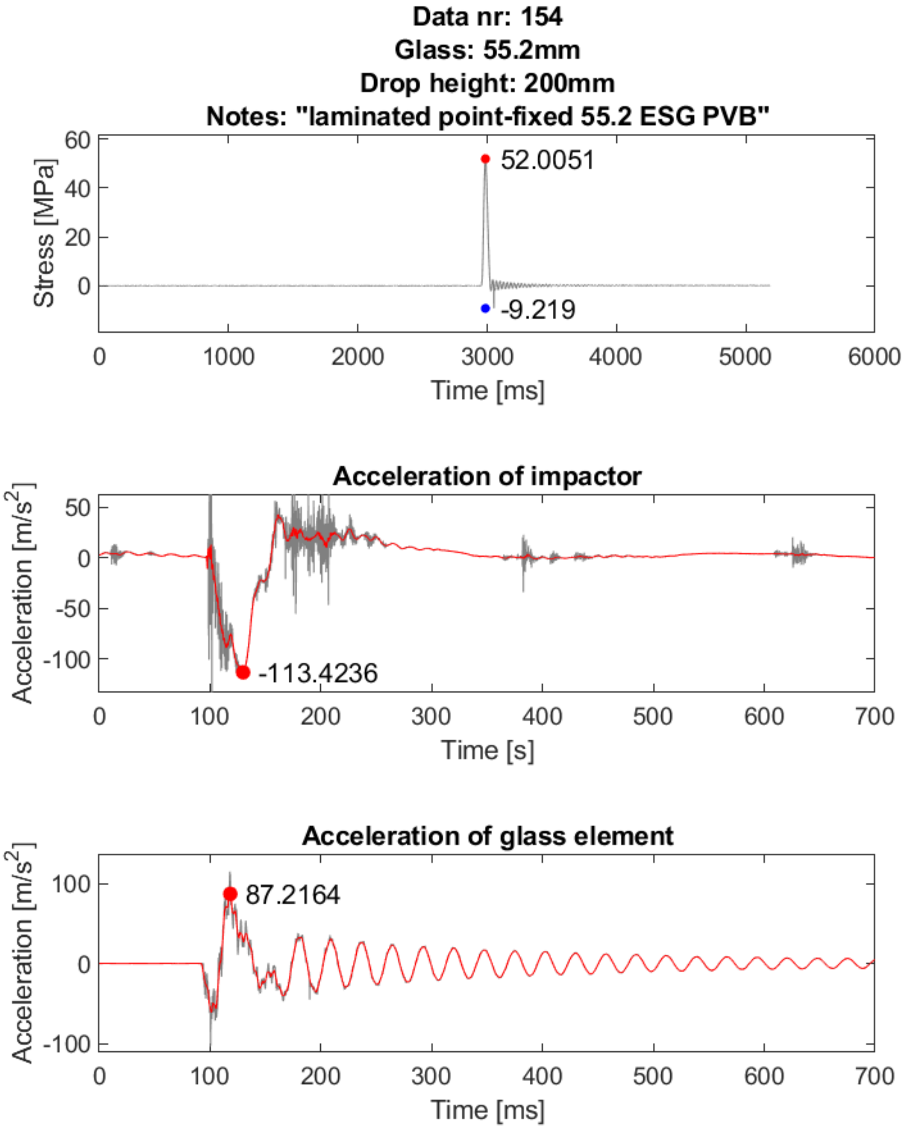

Data nr: 149
Glass: 88.1mm
Drop height: 500mm
Notes: "laminated 88.1 TVG SGP,cracked glass on pendulum side"
Stress [MPa]
54.607
-2.1546
Time [ms]
Acceleration of impactor
Acceleration [m/s^2]
-199.7012
Time [s]
Acceleration of glass element
Acceleration [m/s^2]
110.1408
Time [ms]

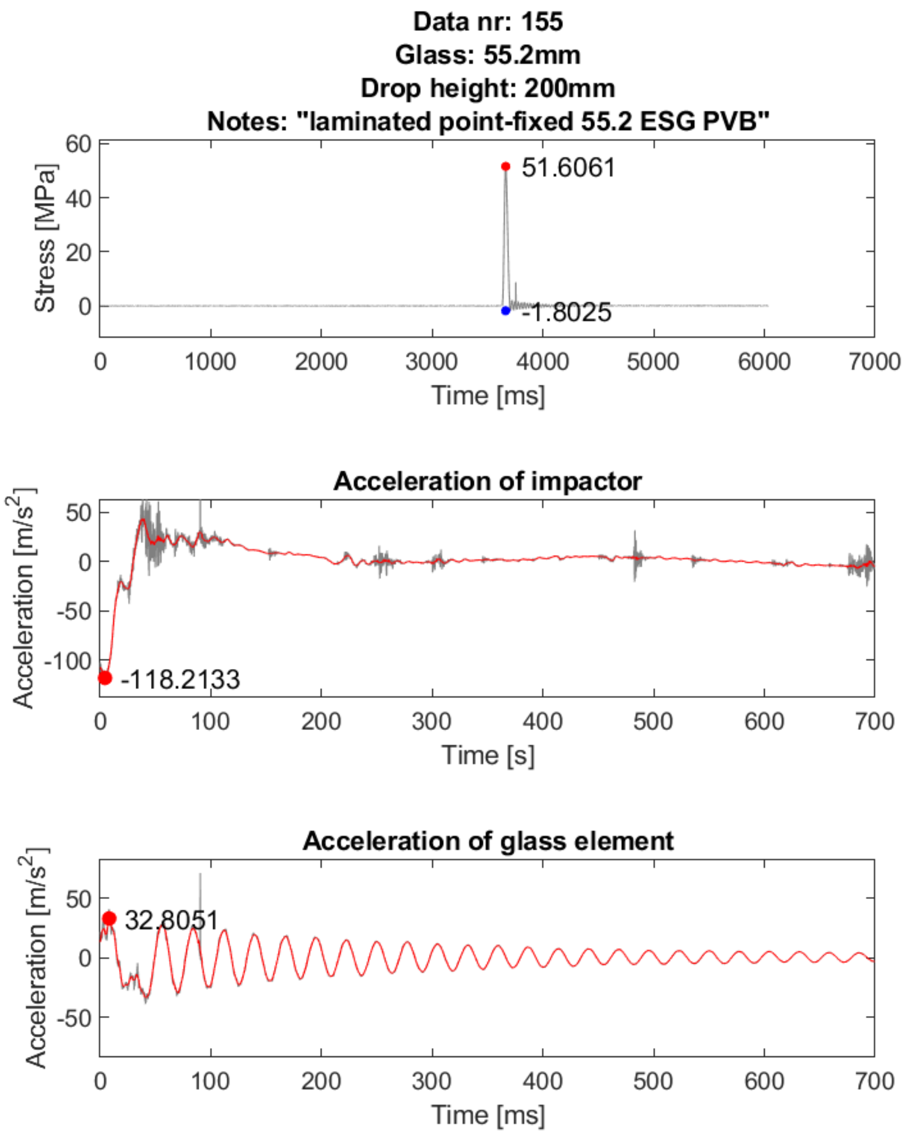

Data nr: 150
Glass: 88.1mm
Drop height: 100mm
Notes: "laminated 88.1 TVG SGP,cracked glass on glass side"
Stress [MPa]
3.9032
-30.6943
Time [ms]
Acceleration of impactor
Acceleration [m/s2]
-77.6121
Time [s]
Acceleration of glass element
Acceleration [m/s2]
204.79
Time [ms]

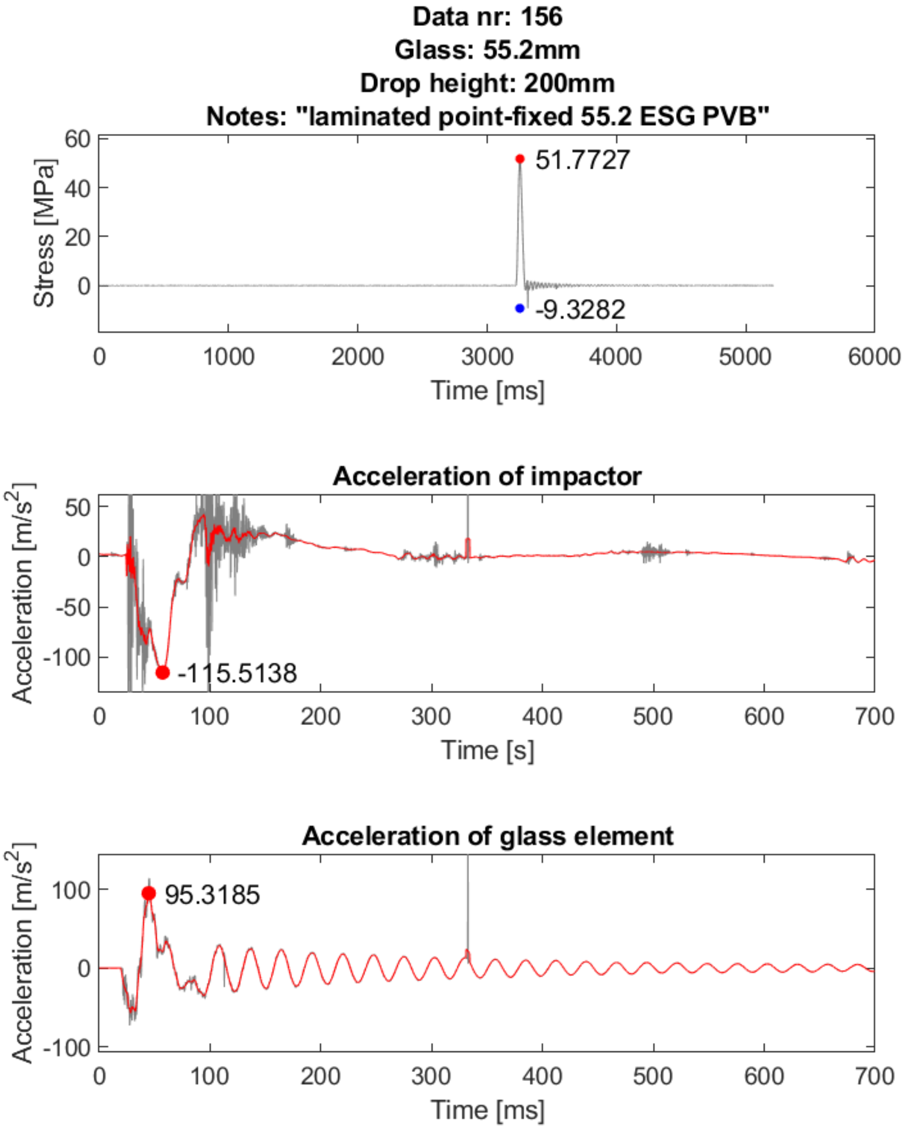

Data nr: 151
Glass: 55.2mm
Drop height: 100mm
Notes: "laminated point-fixed 55.2 ESG PVB"
Stress [MPa]
32.4947
-1.0563
Time [ms]
Acceleration of impactor
Acceleration [m/s^2]
-2.3022
Time [s]
Acceleration of glass element
Acceleration [m/s^2]
10.5673
Time [ms]

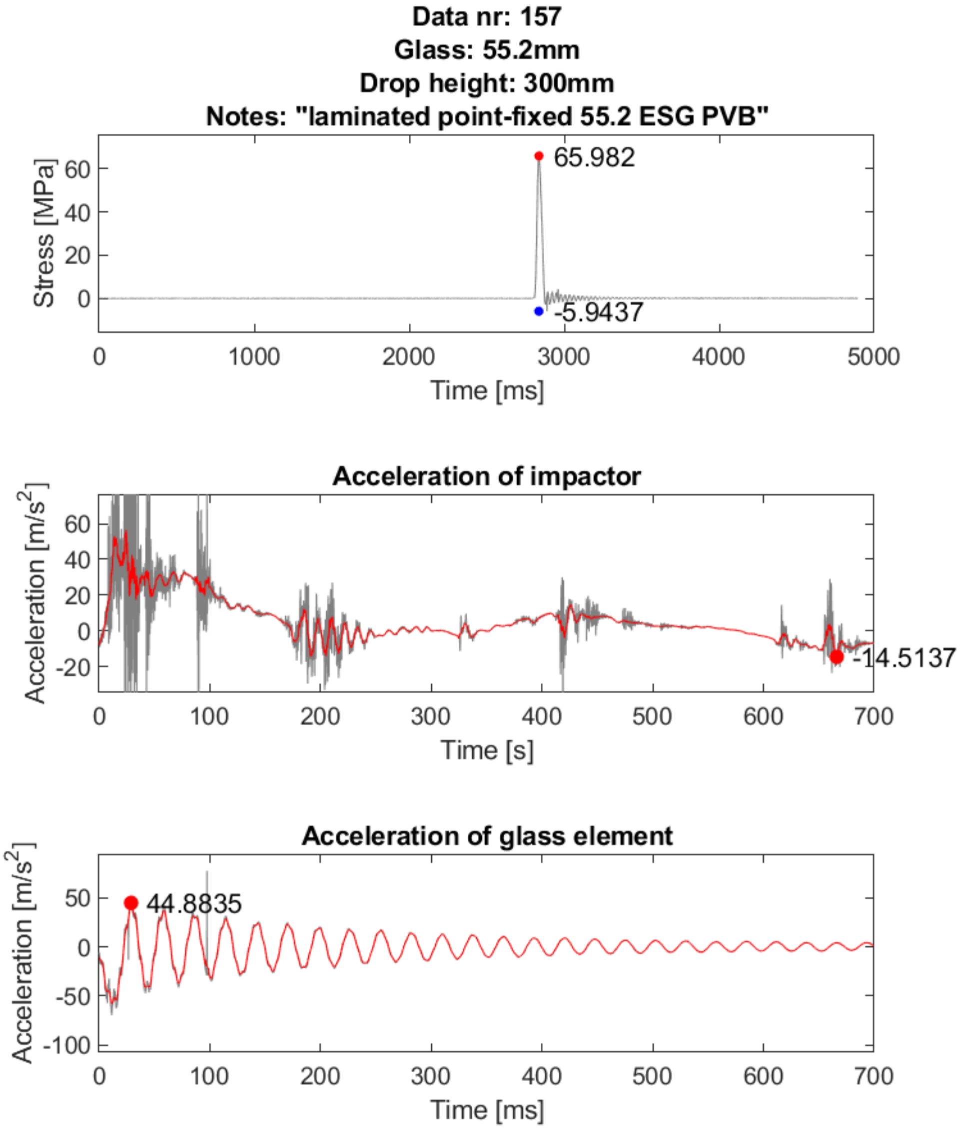

Data nr: 152
Glass: 55.2mm
Drop height: 100mm
Notes: "laminated point-fixed 55.2 ESG PVB"
Stress [MPa]
Time [ms]
32.4464
-4.3932
Acceleration of impactor
Acceleration [m/s^2]
Time [s]
-1.9391
Acceleration of glass element
Acceleration [m/s^2]
Time [ms]
10.3585

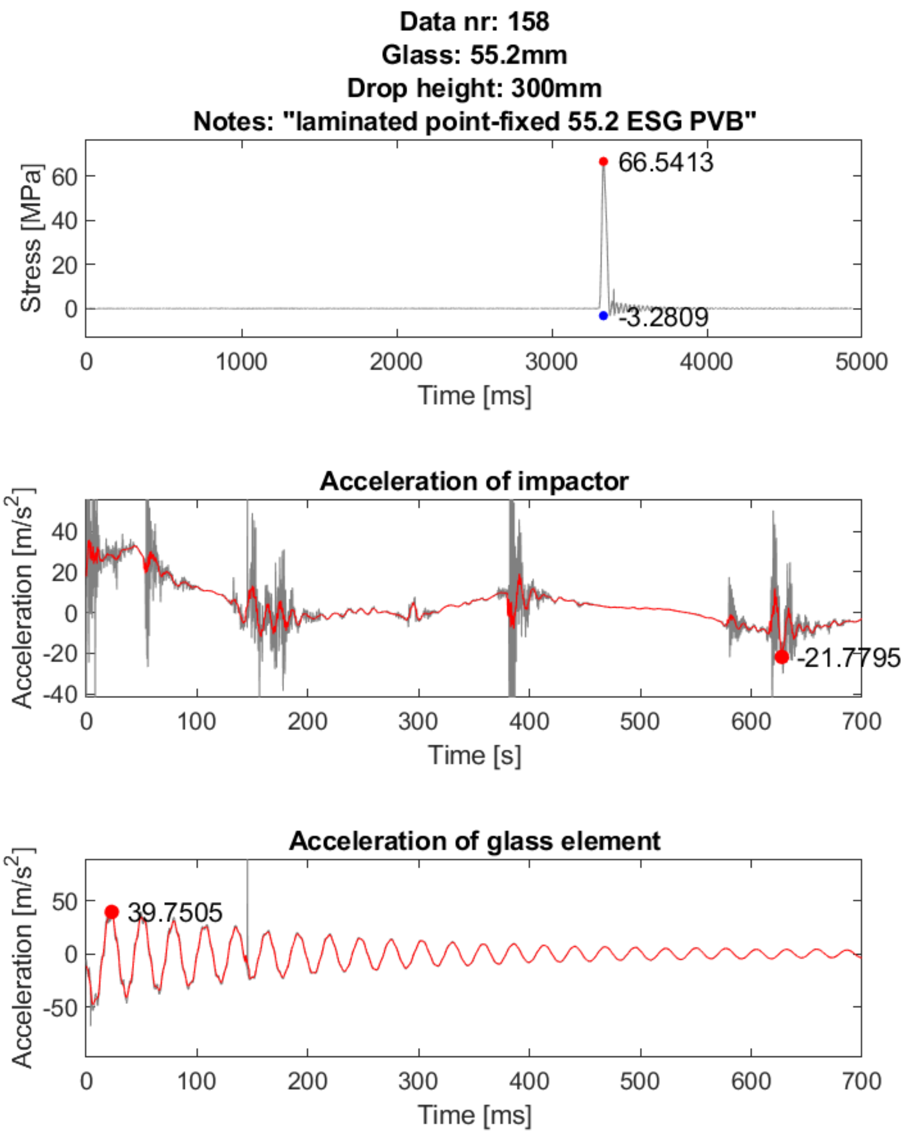

Data nr: 153
Glass: 55.2mm
Drop height: 100mm
Notes: "laminated point-fixed 55.2 ESG PVB"
Stress [MPa]
32.3001
-1.1235
Time [ms]
Acceleration of impactor
Acceleration [m/s^2]
-2.1836
Time [s]
Acceleration of glass element
Acceleration [m/s^2]
10.3825
Time [ms]

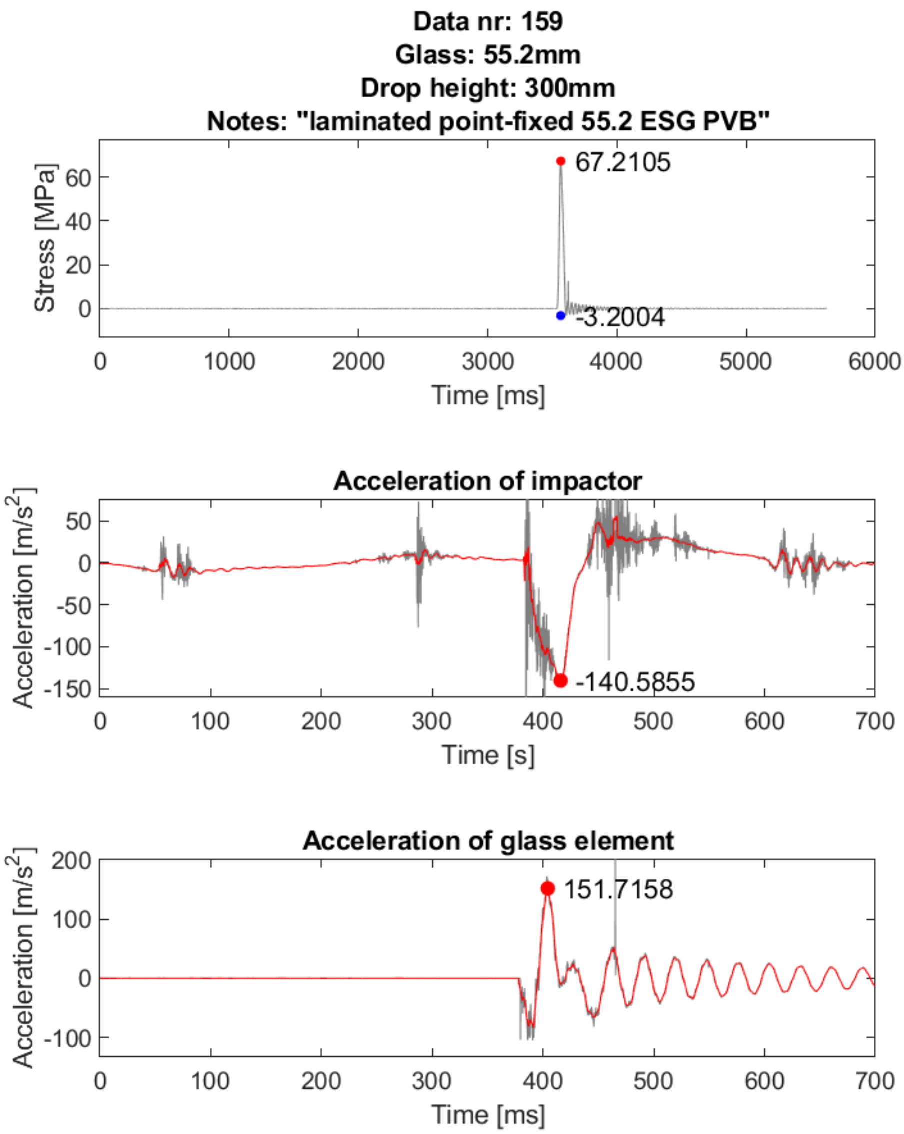

Data nr: 154
Glass: 55.2mm
Drop height: 200mm
Notes: "laminated point-fixed 55.2 ESG PVB"
Stress [MPa]
52.0051
-9.219
Time [ms]
Acceleration of impactor
Acceleration [m/s^2]
-113.4236
Time [s]
Acceleration of glass element
Acceleration [m/s^2]
87.2164
Time [ms]

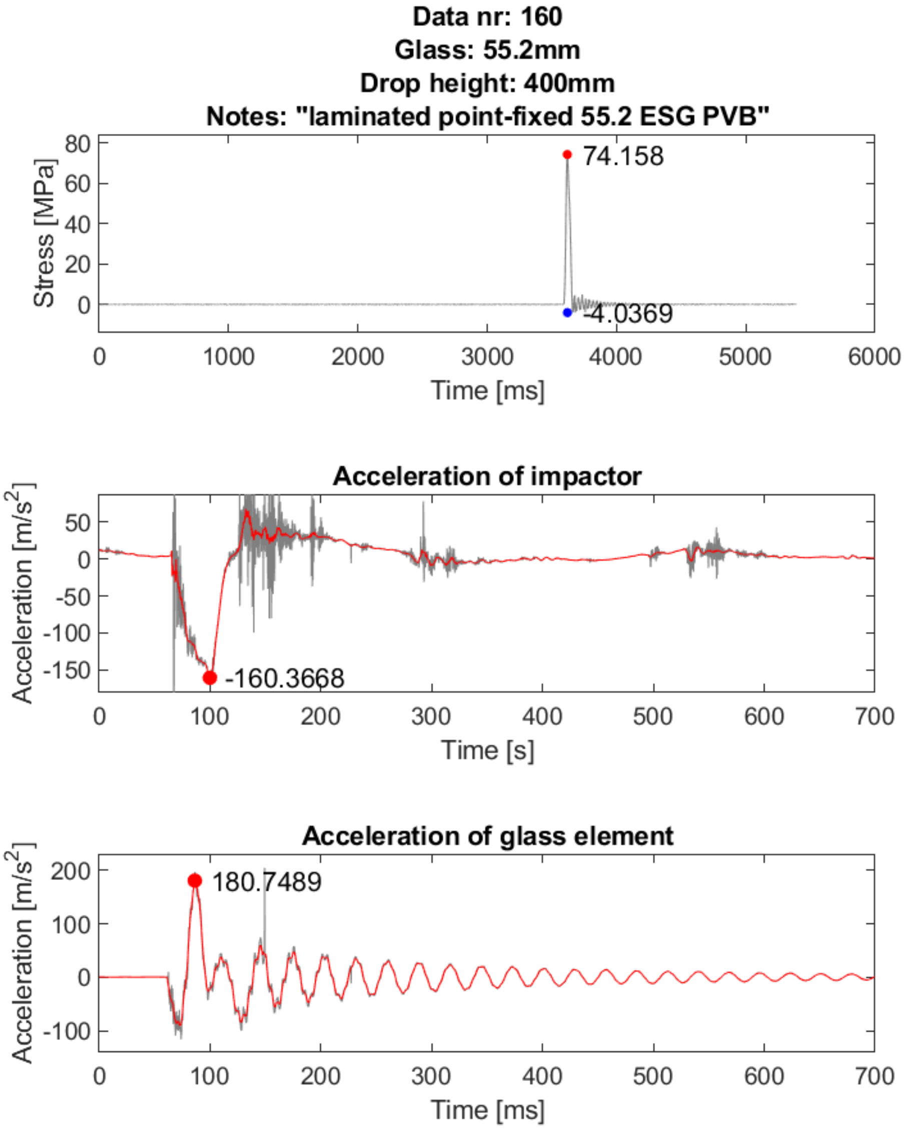

Data nr: 155
Glass: 55.2mm
Drop height: 200mm
Notes: "laminated point-fixed 55.2 ESG PVB"
Stress [MPa]
51.6061
-1.8025
Time [ms]
Acceleration of impactor
Acceleration [m/s2]
-118.2133
Time [s]
Acceleration of glass element
Acceleration [m/s2]
32.8051
Time [ms]

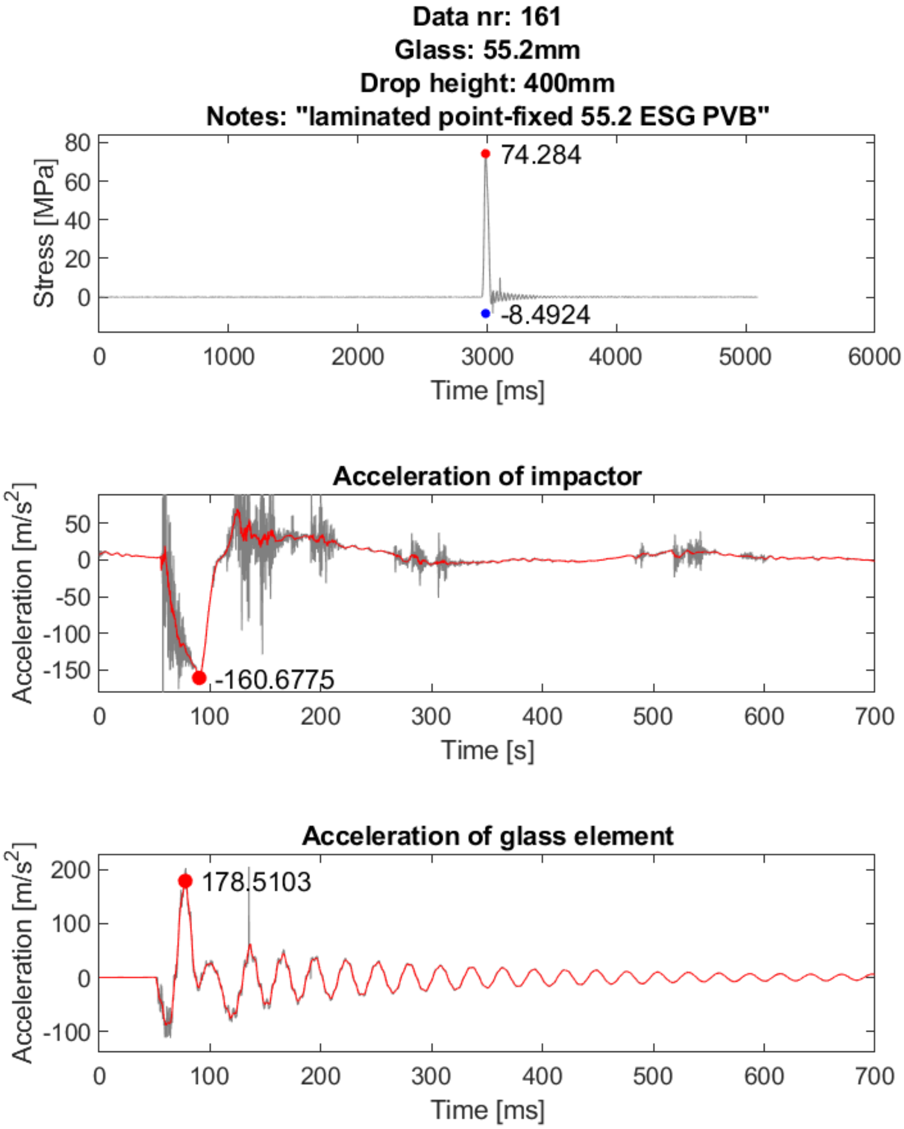

Data nr: 156
Glass: 55.2mm
Drop height: 200mm
Notes: "laminated point-fixed 55.2 ESG PVB"
Stress [MPa]
51.7727
-9.3282
Time [ms]
Acceleration of impactor
Acceleration [m/s^2]
-115.5138
Time [s]
Acceleration of glass element
Acceleration [m/s^2]
95.3185
Time [ms]


Data nr: 157
Glass: 55.2mm
Drop height: 300mm
Notes: "laminated point-fixed 55.2 ESG PVB"
Stress [MPa]
65.982
-5.9437
Time [ms]
Acceleration of impactor
Acceleration [m/s^2]
-14.5137
Time [s]
Acceleration of glass element
Acceleration [m/s^2]
44.8835
Time [ms]

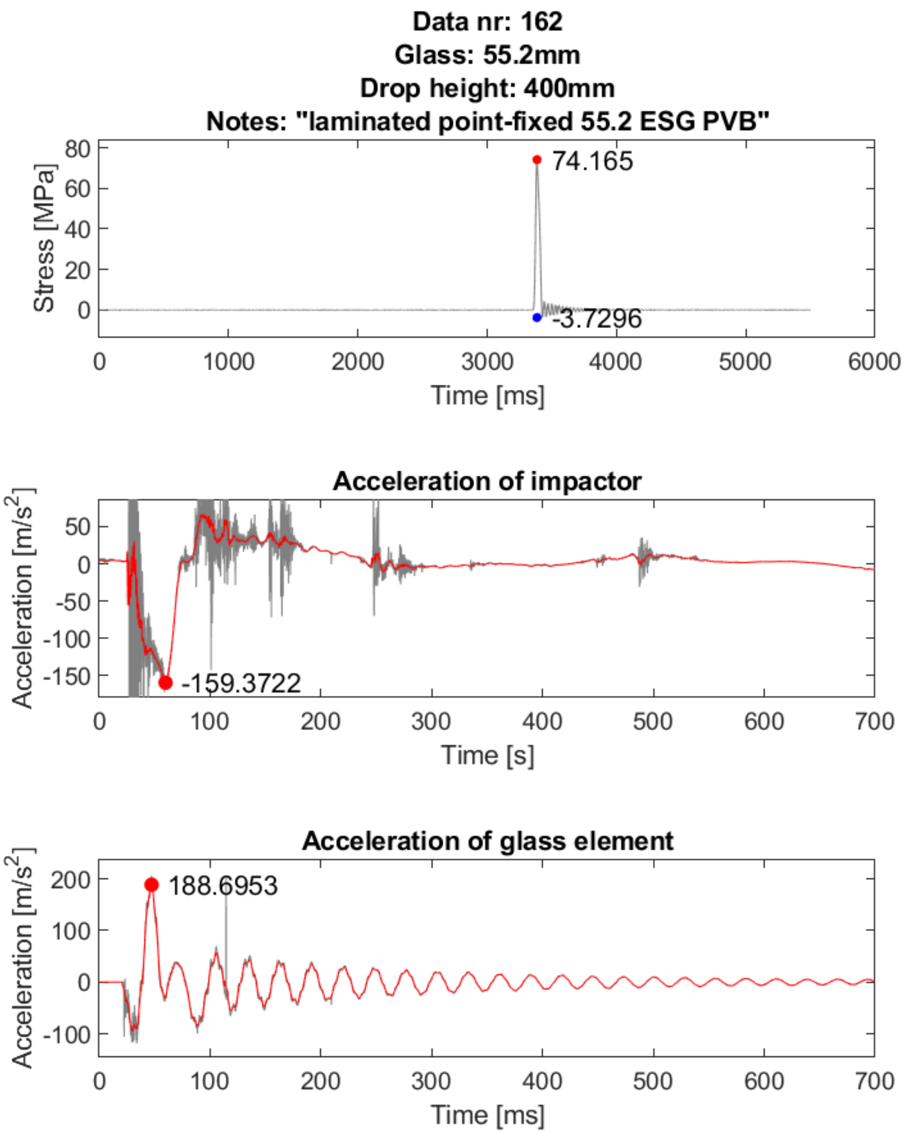

Data nr: 158
Glass: 55.2mm
Drop height: 300mm
Notes: "laminated point-fixed 55.2 ESG PVB"
Stress [MPa]
66.5413
-3.2809
0
1000
2000
3000
4000
5000
Time [ms]
60
40
20
Acceleration of impactor
Acceleration [m/s^2]
-21.7795
0
100
200
300
400
500
600
700
Time [s]
-20
-40
Acceleration of glass element
Acceleration [m/s^2]
39.7505
50
-50
Time [ms]

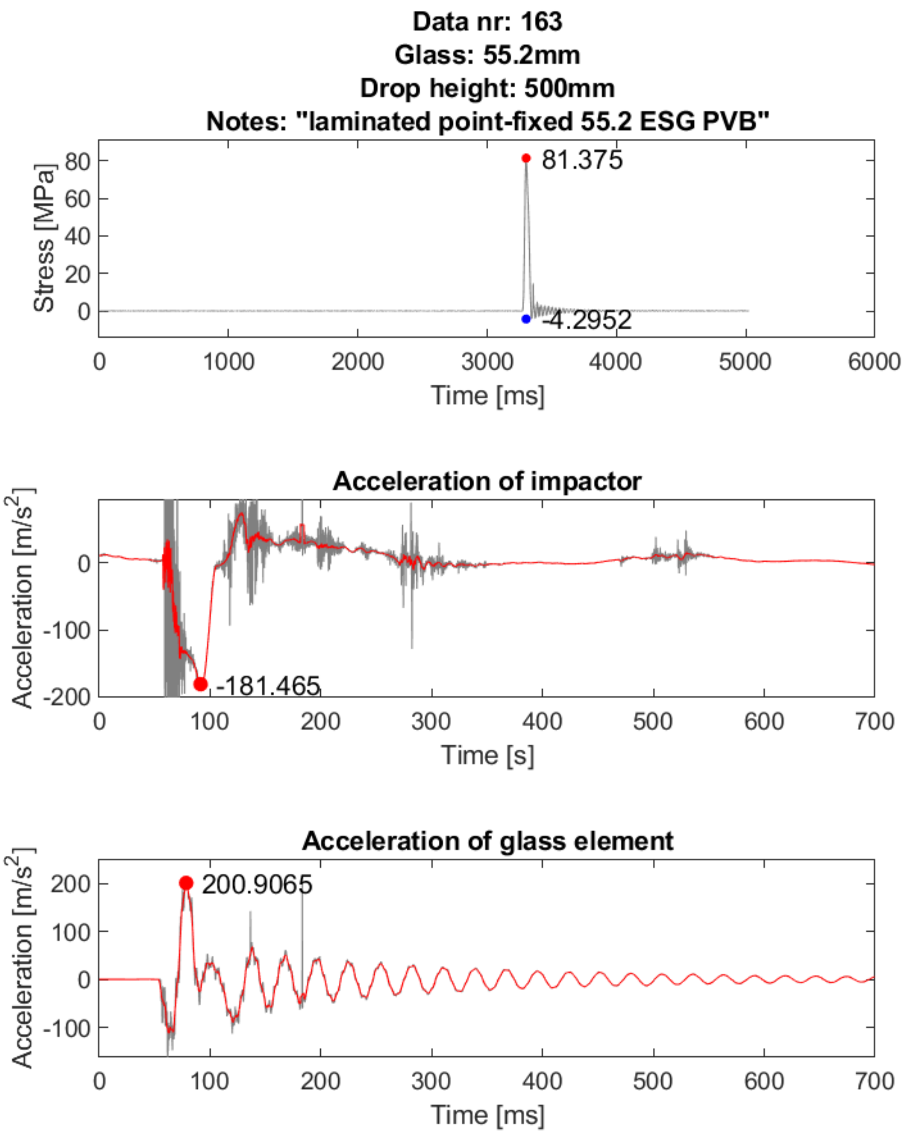

Data nr: 159
Glass: 55.2mm
Drop height: 300mm
Notes: "laminated point-fixed 55.2 ESG PVB"
Stress [MPa]
67.2105
-3.2004
Time [ms]
Acceleration of impactor
Acceleration [m/s^2]
-140.5855
Time [s]
Acceleration of glass element
Acceleration [m/s^2]
151.7158
Time [ms]

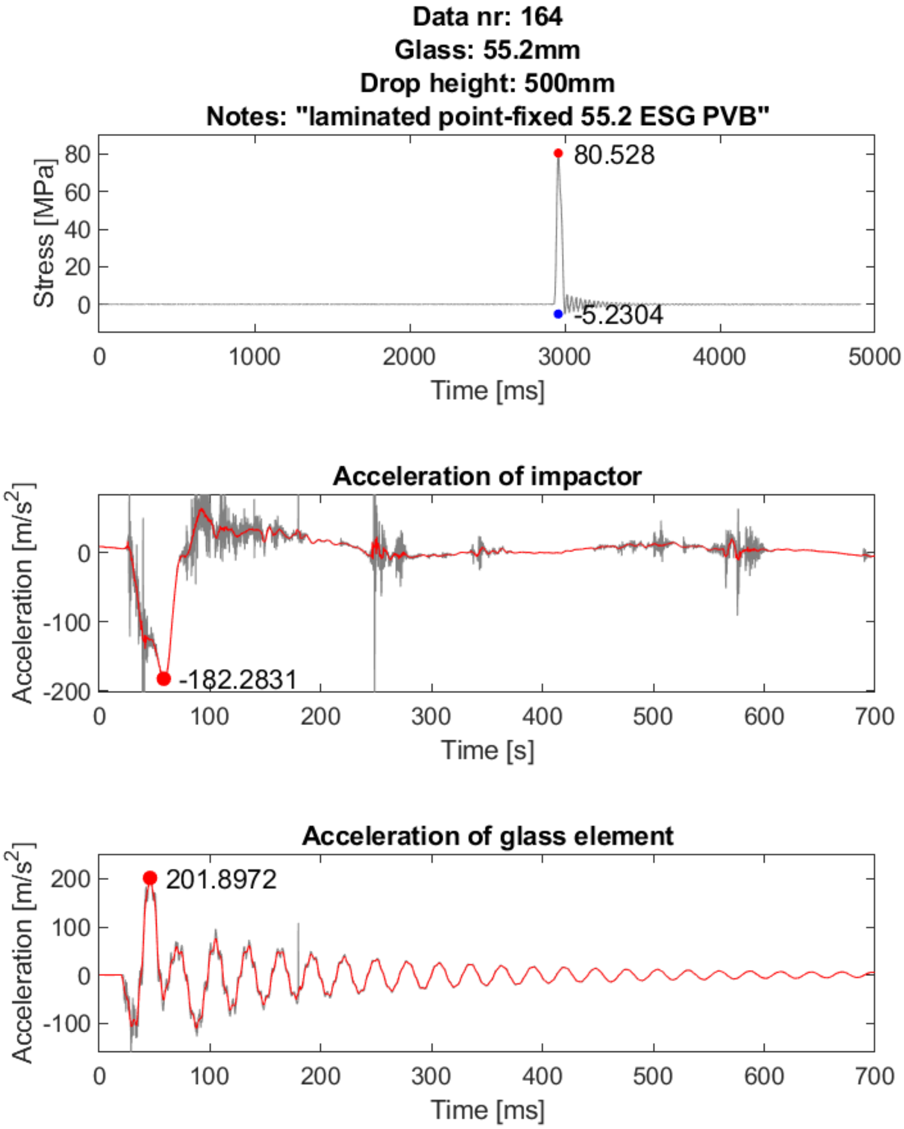

Data nr: 160
Glass: 55.2mm
Drop height: 400mm
Notes: "laminated point-fixed 55.2 ESG PVB"
Stress [MPa]
74.158
-4.0369
Time [ms]
Acceleration of impactor
Acceleration [m/s^2]
-160.3668
Time [s]
Acceleration of glass element
Acceleration [m/s^2]
180.7489
Time [ms]

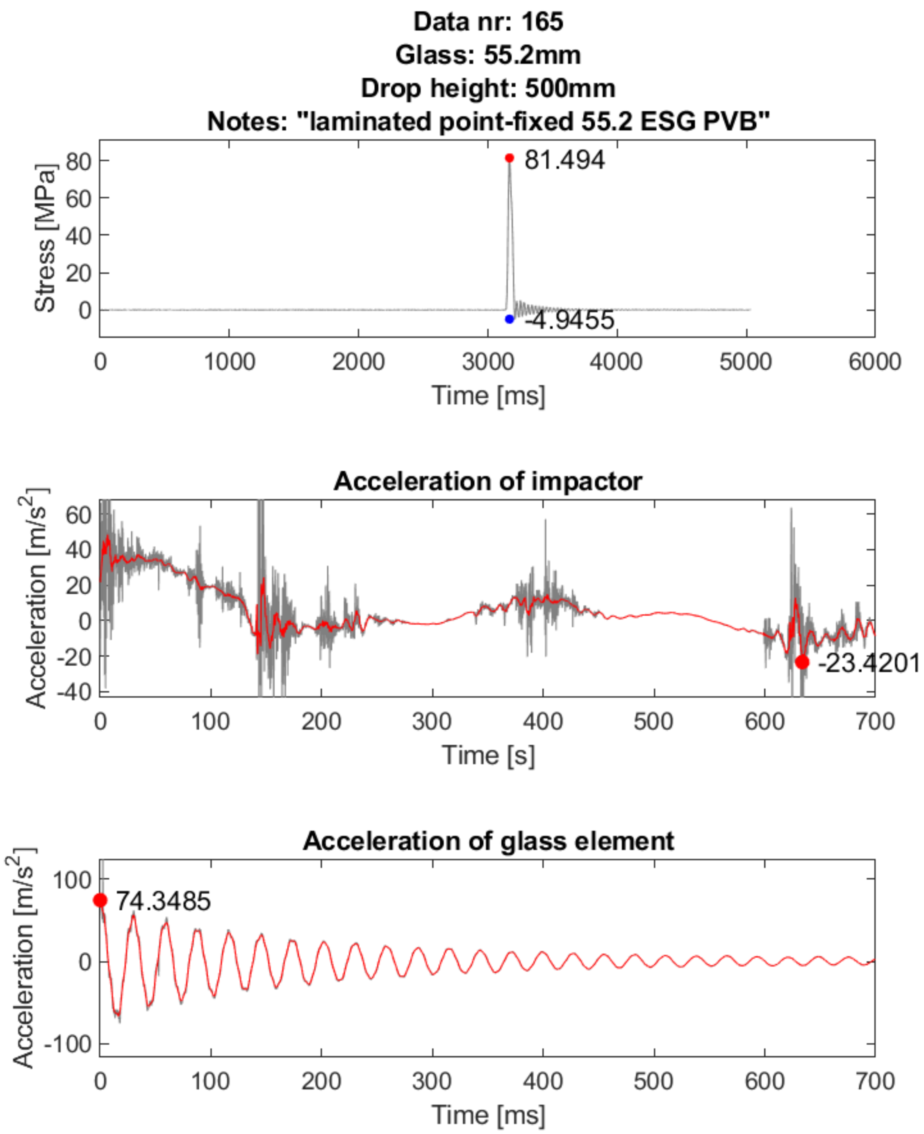


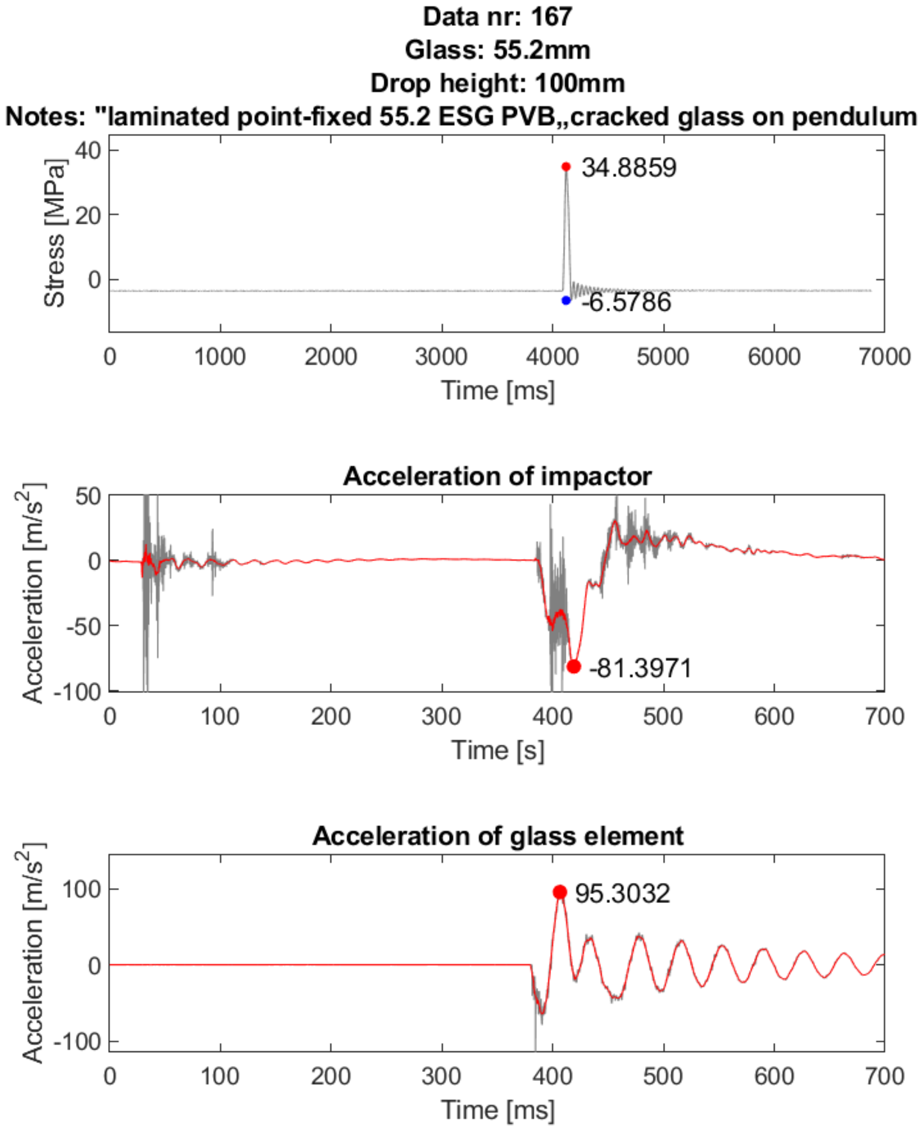
Data nr: 161
Glass: 55.2mm
Drop height: 400mm
Notes: "laminated point-fixed 55.2 ESG PVB"
Stress [MPa]
74.284
-8.4924
Time [ms]
Acceleration of impactor
Acceleration [m/s^2]
-160.6775
Time [s]
Acceleration of glass element
Acceleration [m/s^2]
178.5103
Time [ms]


Data nr: 162
Glass: 55.2mm
Drop height: 400mm
Notes: "laminated point-fixed 55.2 ESG PVB"
Stress [MPa]
74.165
-3.7296
Time [ms]
Acceleration of impactor
Acceleration [m/s^2]
-159.3722
Time [s]
Acceleration of glass element
Acceleration [m/s^2]
188.6953
Time [ms]

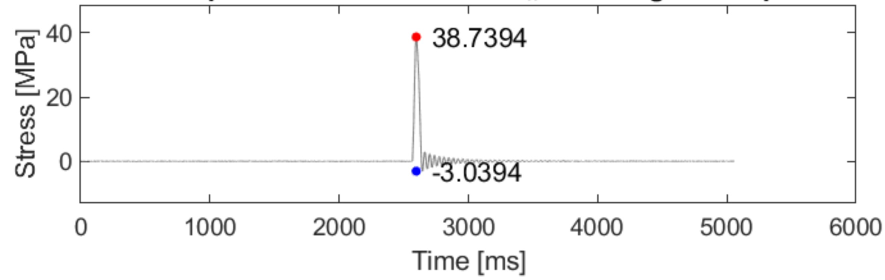

Data nr: 163
Glass: 55.2mm
Drop height: 500mm
Notes: "laminated point-fixed 55.2 ESG PVB"
Stress [MPa]
81.375
-4.2952
Time [ms]
Acceleration of impactor
Acceleration [m/s^2]
-181.465
Time [s]
Acceleration of glass element
Acceleration [m/s^2]
200.9065
Time [ms]

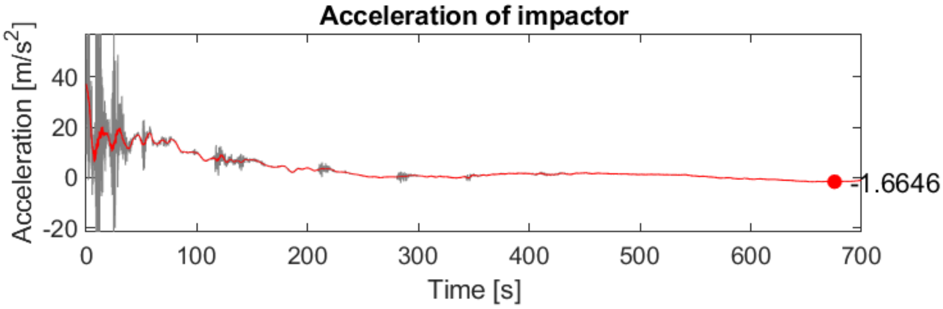

Data nr: 164
Glass: 55.2mm
Drop height: 500mm
Notes: "laminated point-fixed 55.2 ESG PVB"
Stress [MPa]
80.528
-5.2304
Time [ms]
Acceleration of impactor
Acceleration [m/s^2]
-182.2831
Time [s]
Acceleration of glass element
Acceleration [m/s^2]
201.8972
Time [ms]

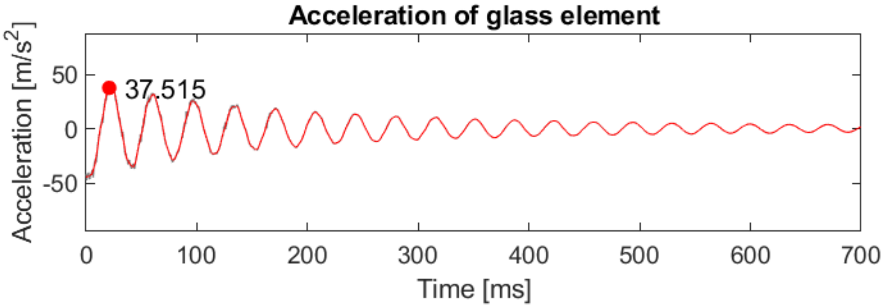

Data nr: 165
Glass: 55.2mm
Drop height: 500mm
Notes: "laminated point-fixed 55.2 ESG PVB"
Stress [MPa]
81.494
-4.9455
Time [ms]
Acceleration of impactor
Acceleration [m/s^2]
-23.4201
Time [s]
Acceleration of glass element
Acceleration [m/s^2]
74.3485
Time [ms]

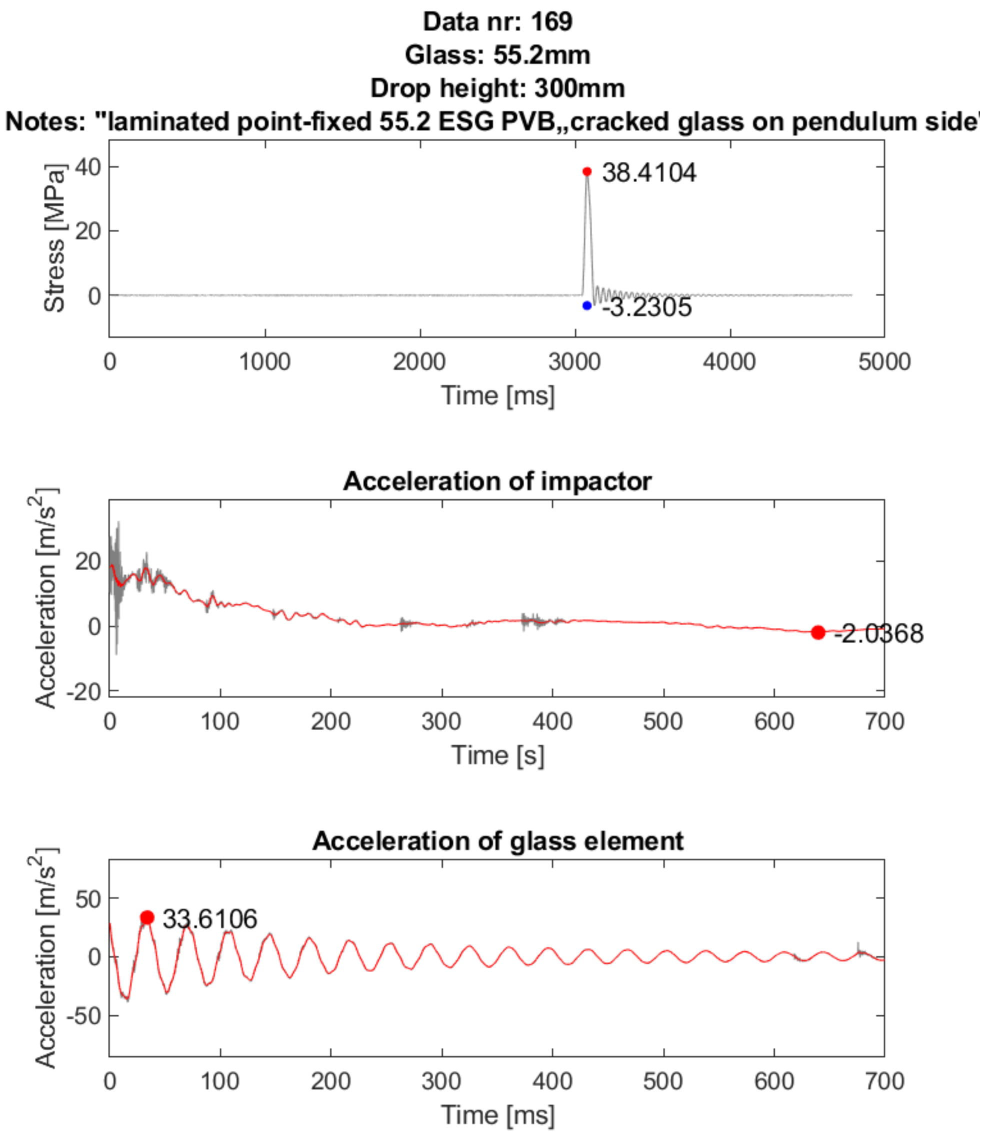

Data nr: 167
Glass: 55.2mm
Drop height: 100mm
Notes: "laminated point-fixed 55.2 ESG PVB,,cracked glass on pendulum side'
Stress [MPa]
34.8859
-6.5786
Time [ms]
Acceleration of impactor
Acceleration [m/s^2]
-81.3971
Time [s]
Acceleration of glass element
Acceleration [m/s^2]
95.3032
Time [ms]

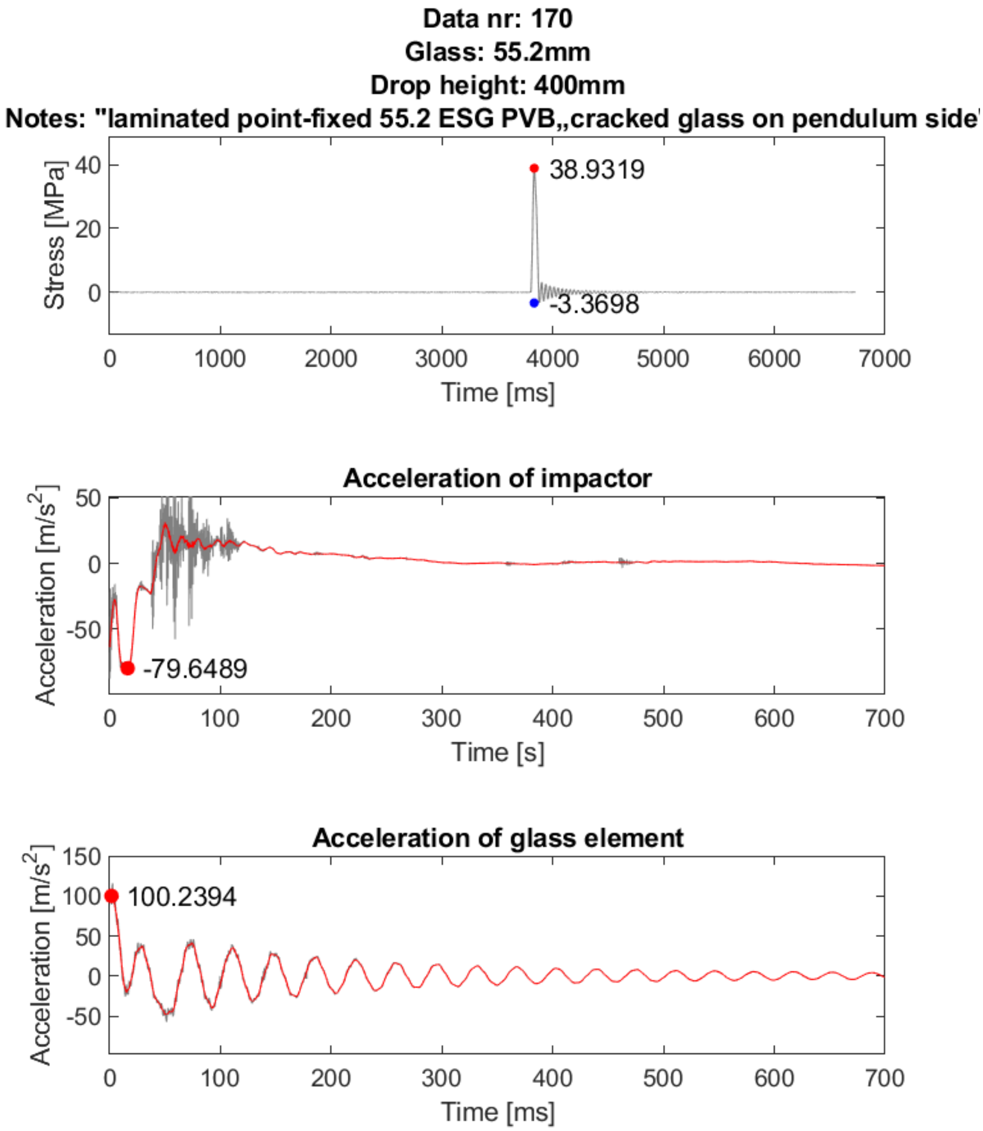
Data nr: 168
Glass: 55.2mm
Drop height: 200mm
Notes: "laminated point-fixed 55.2 ESG PVB,,cracked glass on pendulum side'

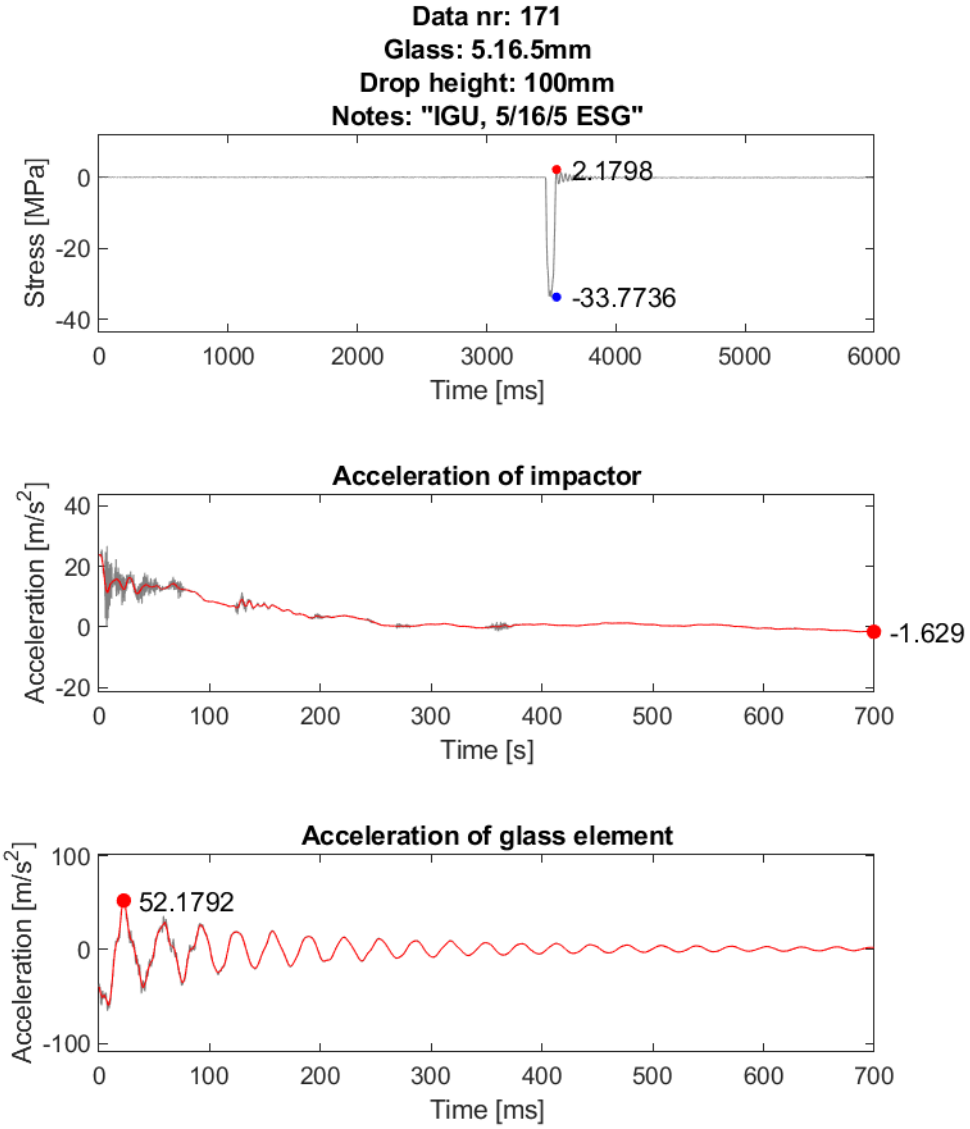


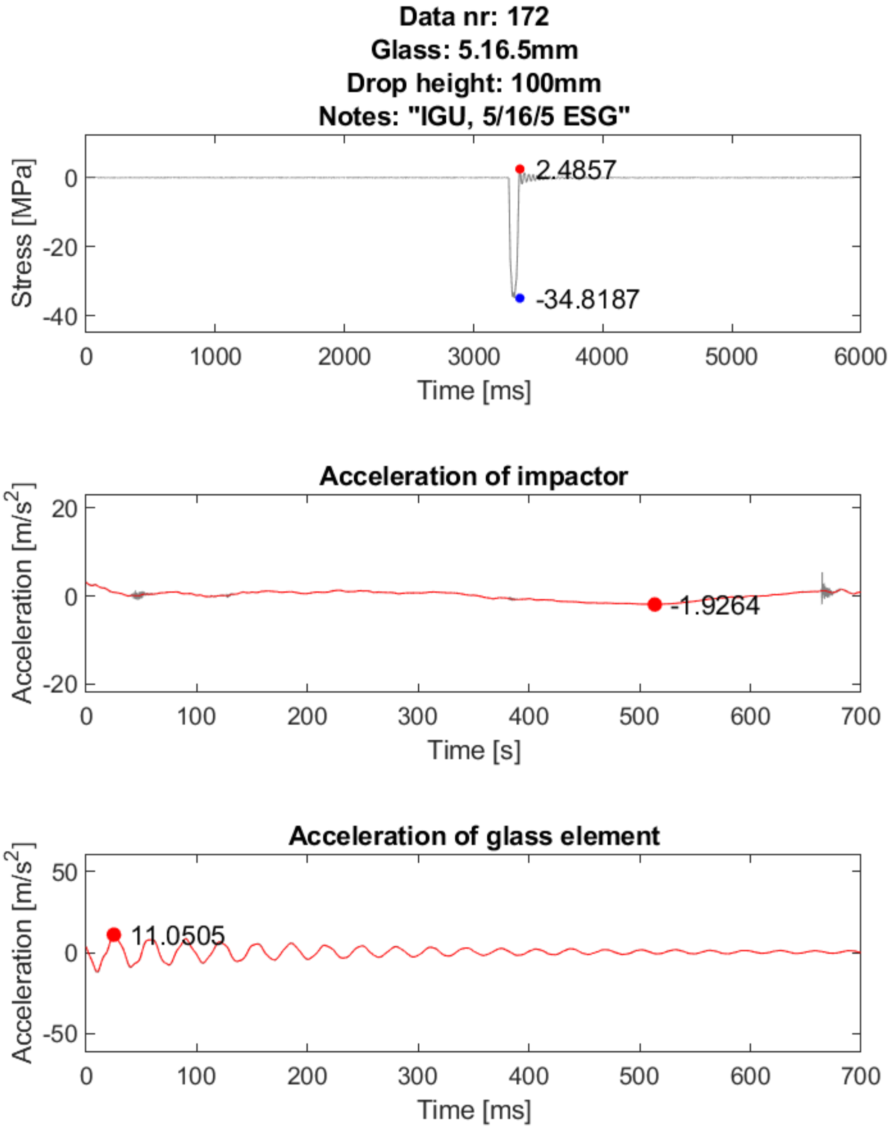


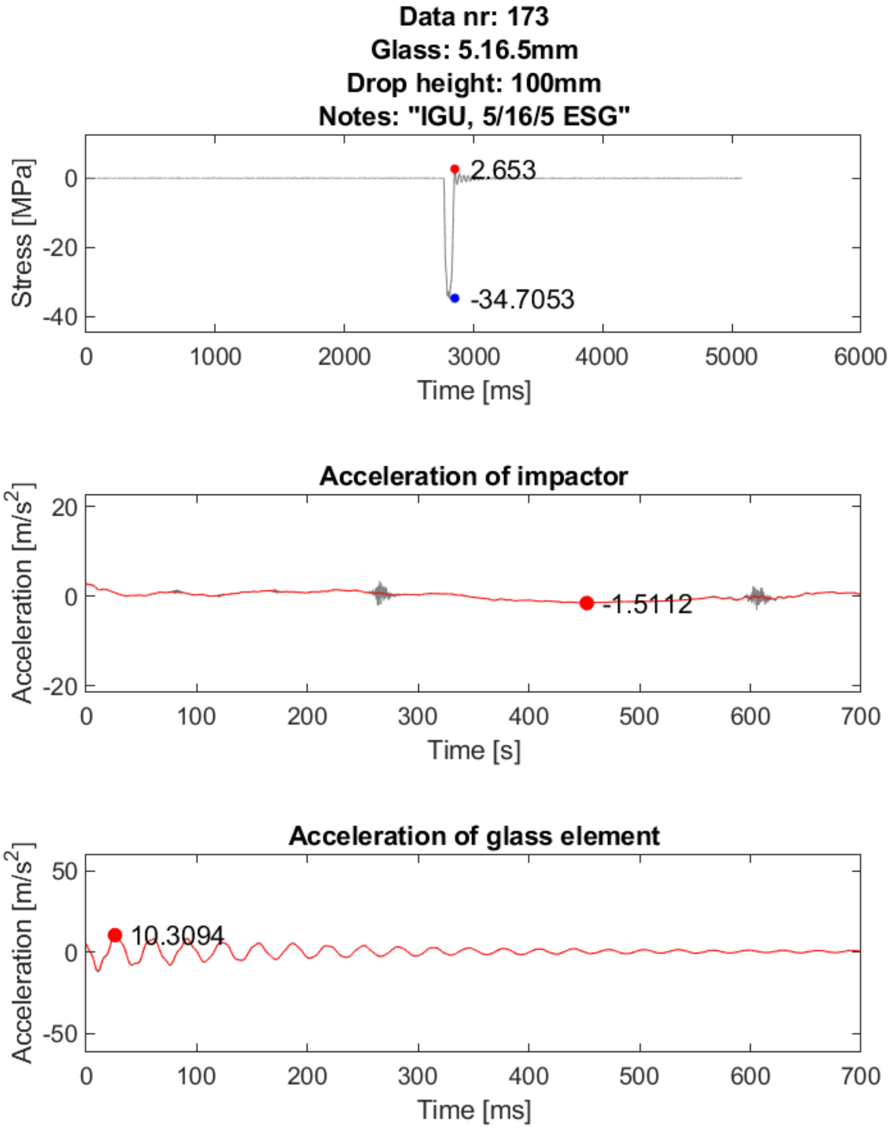


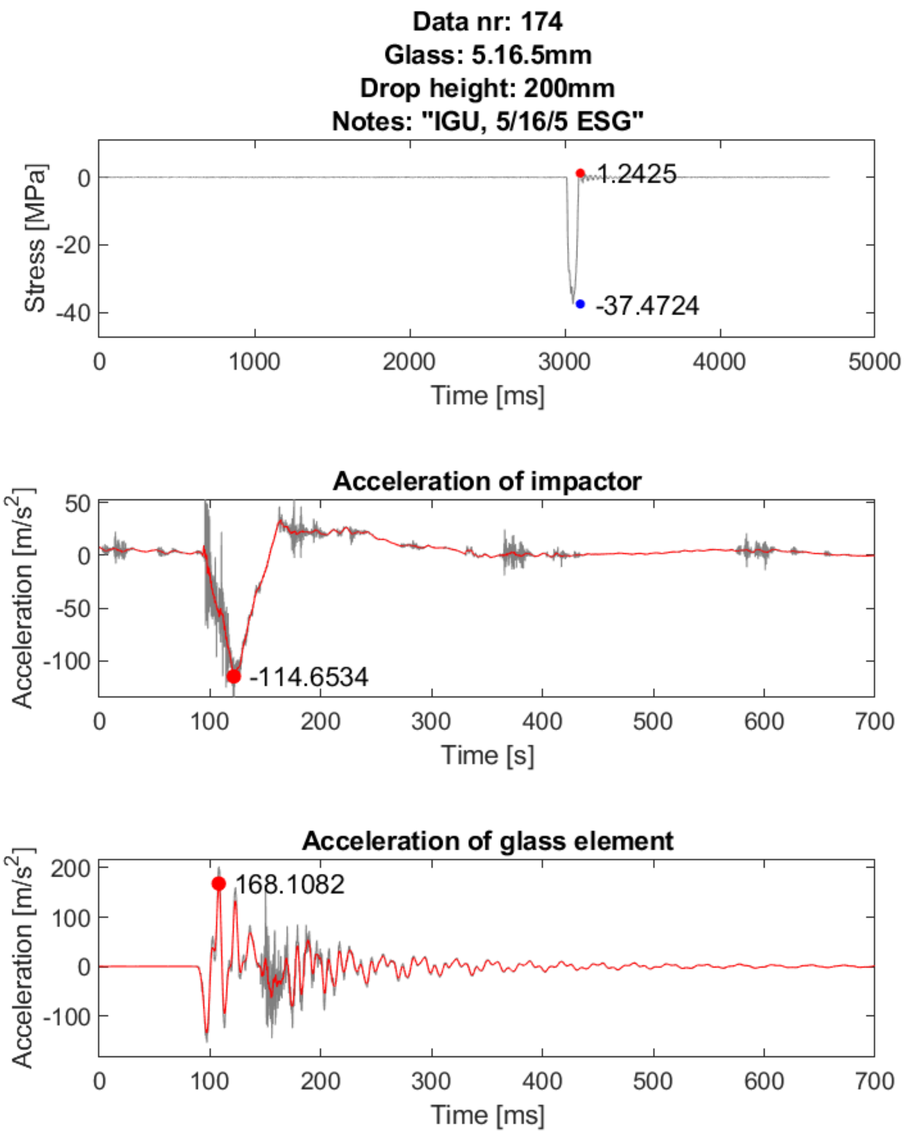

Data nr: 169
Glass: 55.2mm
Drop height: 300mm
Notes: "laminated point-fixed 55.2 ESG PVB,,cracked glass on pendulum side'
Stress [MPa]
38.4104
-3.2305
Time [ms]
Acceleration of impactor
Acceleration [m/s^2]
-2.0368
Time [s]
Acceleration of glass element
Acceleration [m/s^2]
33.6106
Time [ms]

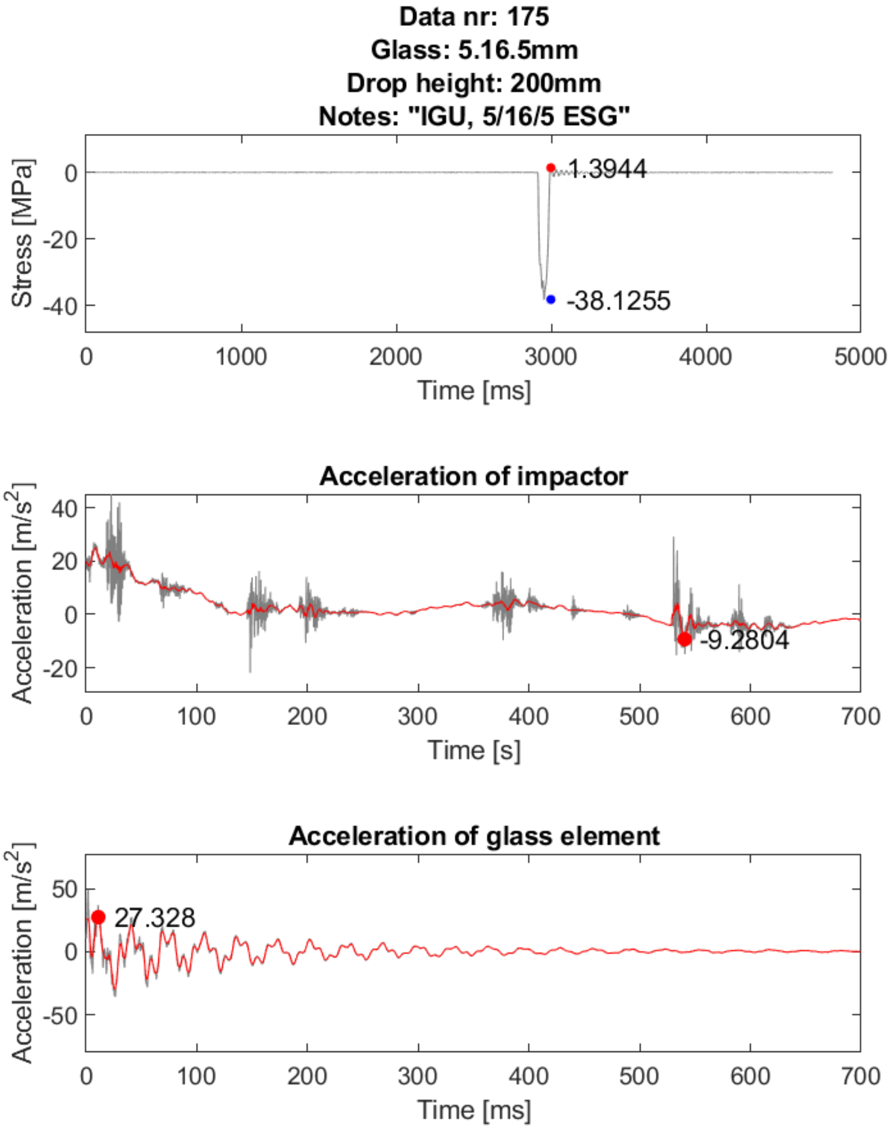

Data nr: 170
Glass: 55.2mm
Drop height: 400mm
Notes: "laminated point-fixed 55.2 ESG PVB,,cracked glass on pendulum side'
Stress [MPa]
38.9319
-3.3698
Time [ms]
Acceleration of impactor
Acceleration [m/s2]
-79.6489
Time [s]
Acceleration of glass element
Acceleration [m/s2]
100.2394
Time [ms]


Data nr: 171
Glass: 5.16.5mm
Drop height: 100mm
Notes: "IGU, 5/16/5 ESG"
Stress [MPa]
2.1798
-33.7736
Time [ms]
Acceleration of impactor
Acceleration [m/s^2]
-1.629
Time [s]
Acceleration of glass element
Acceleration [m/s^2]
52.1792
Time [ms]

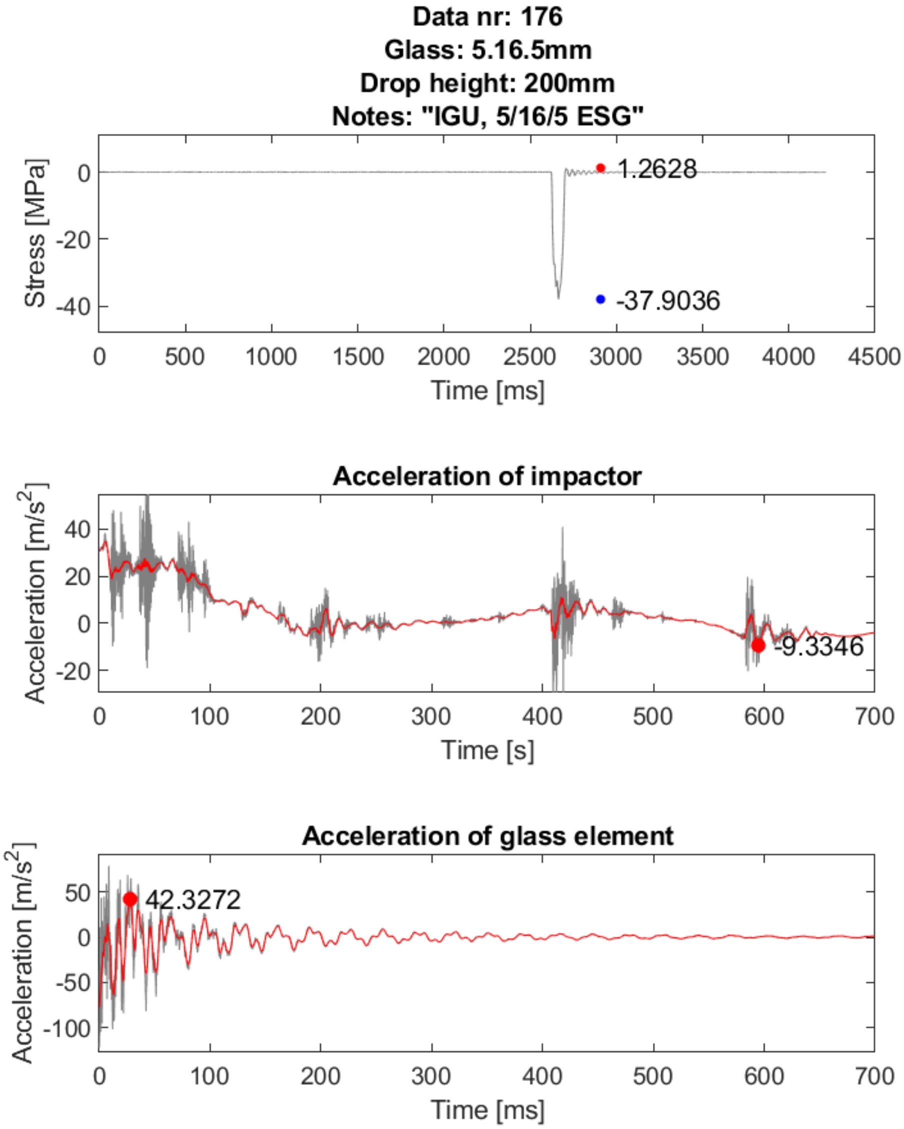

Data nr: 172
Glass: 5.16.5mm
Drop height: 100mm
Notes: "IGU, 5/16/5 ESG"
Stress [MPa]
Time [ms]
2.4857
-34.8187
Acceleration of impactor
Acceleration [m/s2]
Time [s]
-1.9264
Acceleration of glass element
Acceleration [m/s2]
Time [ms]
11.0505


Data nr: 173
Glass: 5.16.5mm
Drop height: 100mm
Notes: "IGU, 5/16/5 ESG"
Stress [MPa]
2.653
-34.7053
Time [ms]
Acceleration of impactor
Acceleration [m/s^2]
-1.5112
Time [s]
Acceleration of glass element
Acceleration [m/s^2]
10.3094
Time [ms]

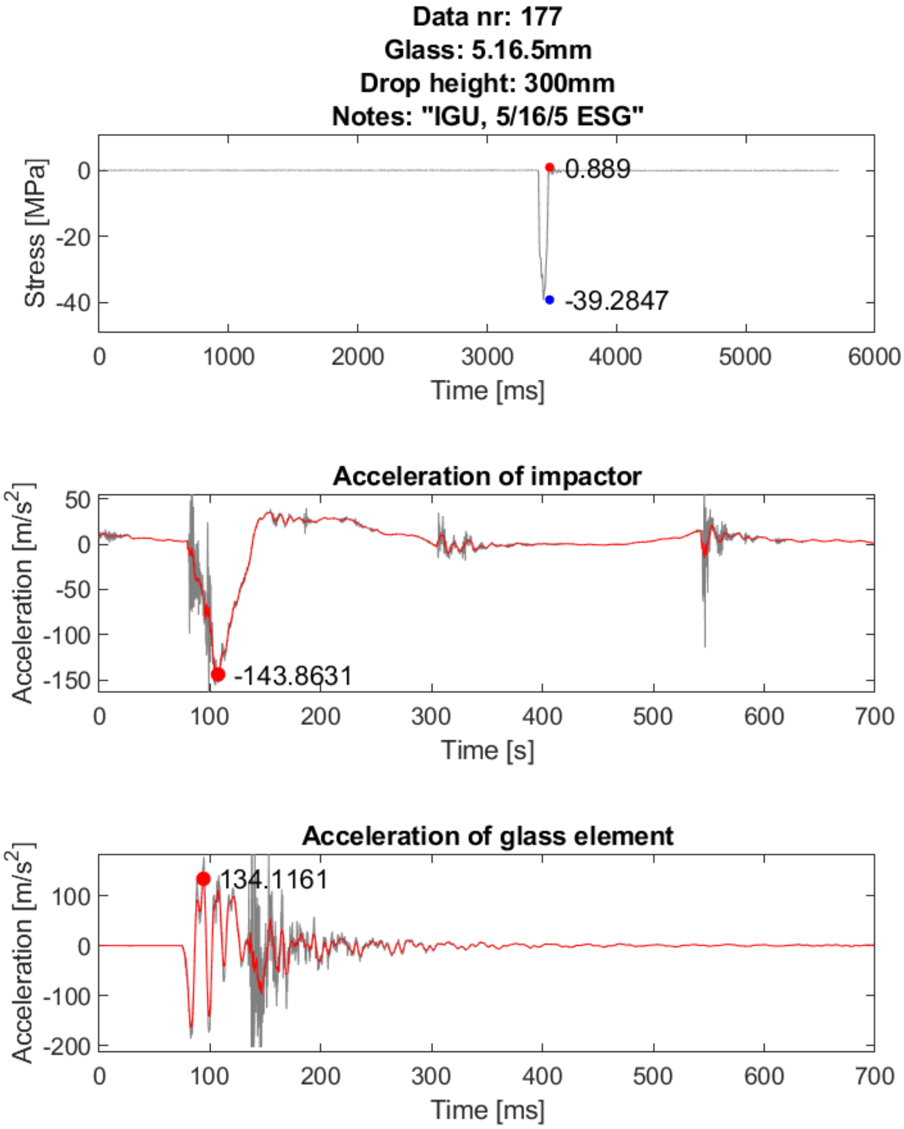

Data nr: 174
Glass: 5.16.5mm
Drop height: 200mm
Notes: "IGU, 5/16/5 ESG"
Stress [MPa]
1.2425
-37.4724
Time [ms]
Acceleration of impactor
Acceleration [m/s^2]
-114.6534
Time [s]
Acceleration of glass element
Acceleration [m/s^2]
168.1082
Time [ms]

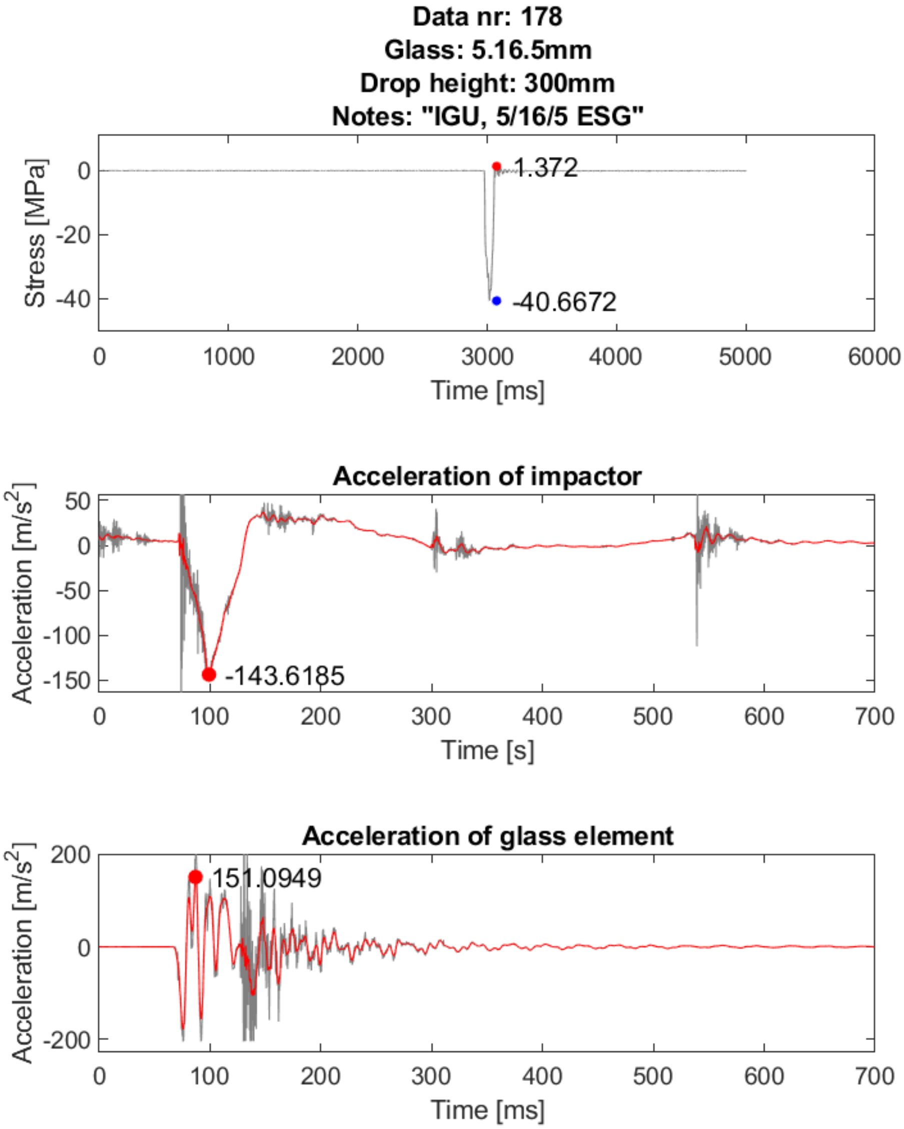


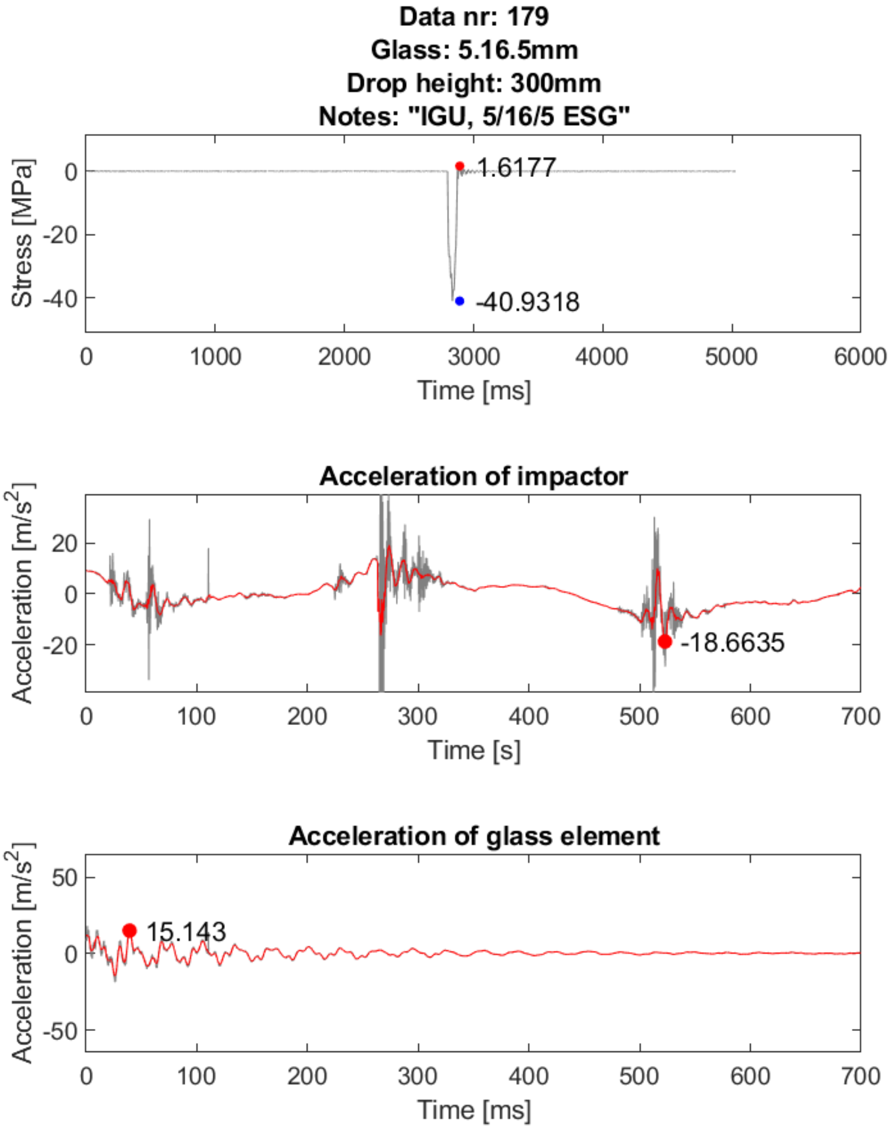
Data nr: 175
Glass: 5.16.5mm
Drop height: 200mm
Notes: "IGU, 5/16/5 ESG"
Stress [MPa]
1.3944
-38.1255
Time [ms]
Acceleration of impactor
Acceleration [m/s^2]
-9.2804
Time [s]
Acceleration of glass element
Acceleration [m/s^2]
27.328
Time [ms]

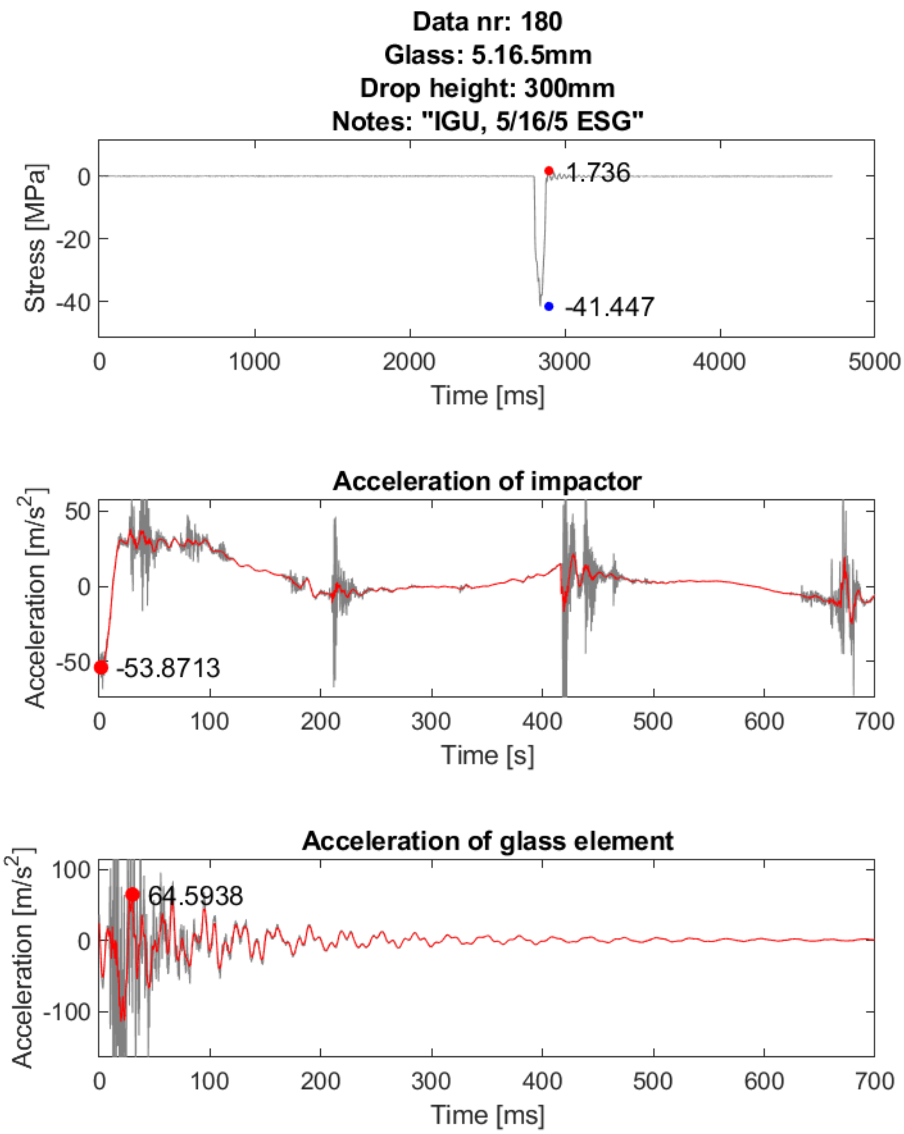


Data nr: 176
Glass: 5.16.5mm
Drop height: 200mm
Notes: "IGU, 5/16/5 ESG"
Stress [MPa]
1.2628
-37.9036
Time [ms]
Acceleration of impactor
Acceleration [m/s^2]
-9.3346
Time [s]
Acceleration of glass element
Acceleration [m/s^2]
42.3272
Time [ms]

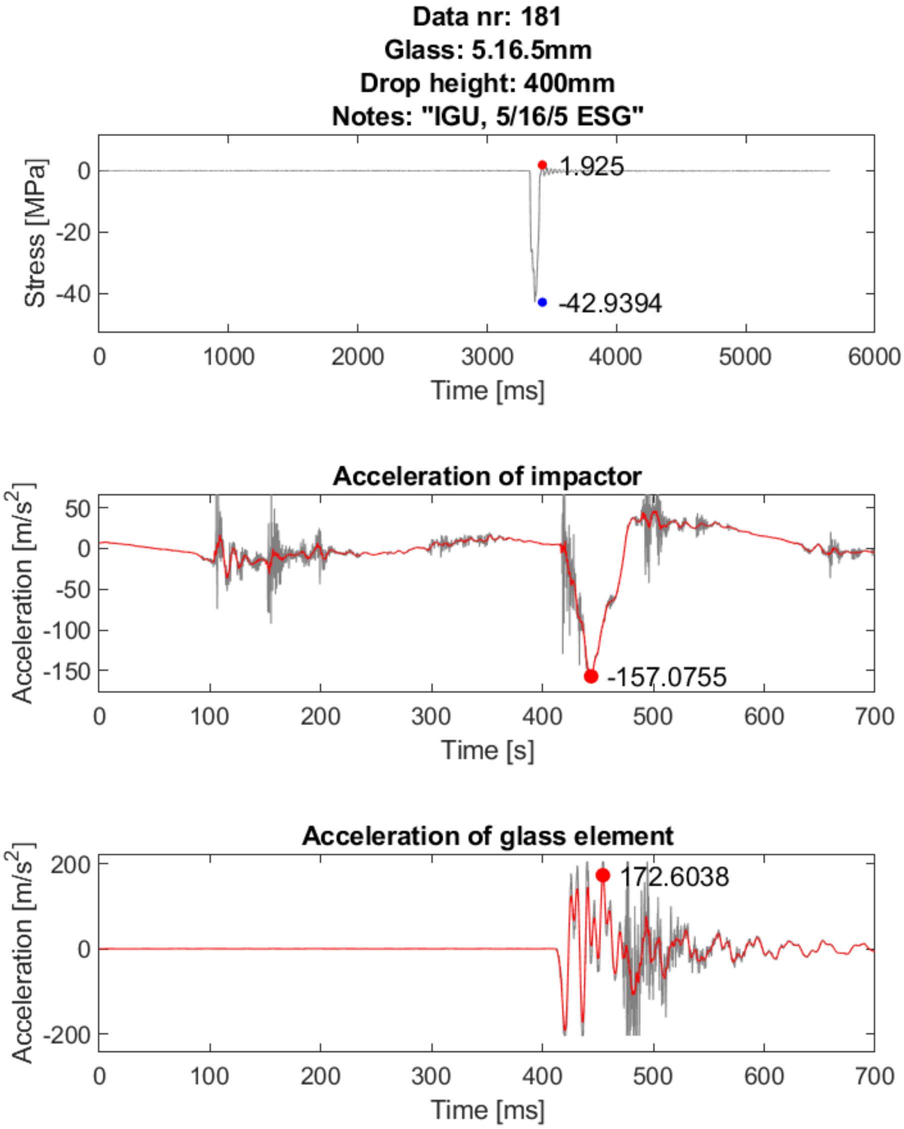

Data nr: 177
Glass: 5.16.5mm
Drop height: 300mm
Notes: "IGU, 5/16/5 ESG"
Stress [MPa]
0.889
-39.2847
Time [ms]
Acceleration of impactor
Acceleration [m/s^2]
-143.8631
Time [s]
Acceleration of glass element
Acceleration [m/s^2]
134.1161
Time [ms]


Data nr: 178
Glass: 5.16.5mm
Drop height: 300mm
Notes: "IGU, 5/16/5 ESG"
Stress [MPa]
1.372
-40.6672
Time [ms]
Acceleration of impactor
Acceleration [m/s^2]
-143.6185
Time [s]
Acceleration of glass element
Acceleration [m/s^2]
151.0949
Time [ms]


Data nr: 179
Glass: 5.16.5mm
Drop height: 300mm
Notes: "IGU, 5/16/5 ESG"
Stress [MPa]
1.6177
-40.9318
Time [ms]
Acceleration of impactor
Acceleration [m/s^2]
-18.6635
Time [s]
Acceleration of glass element
Acceleration [m/s^2]
15.143
Time [ms]

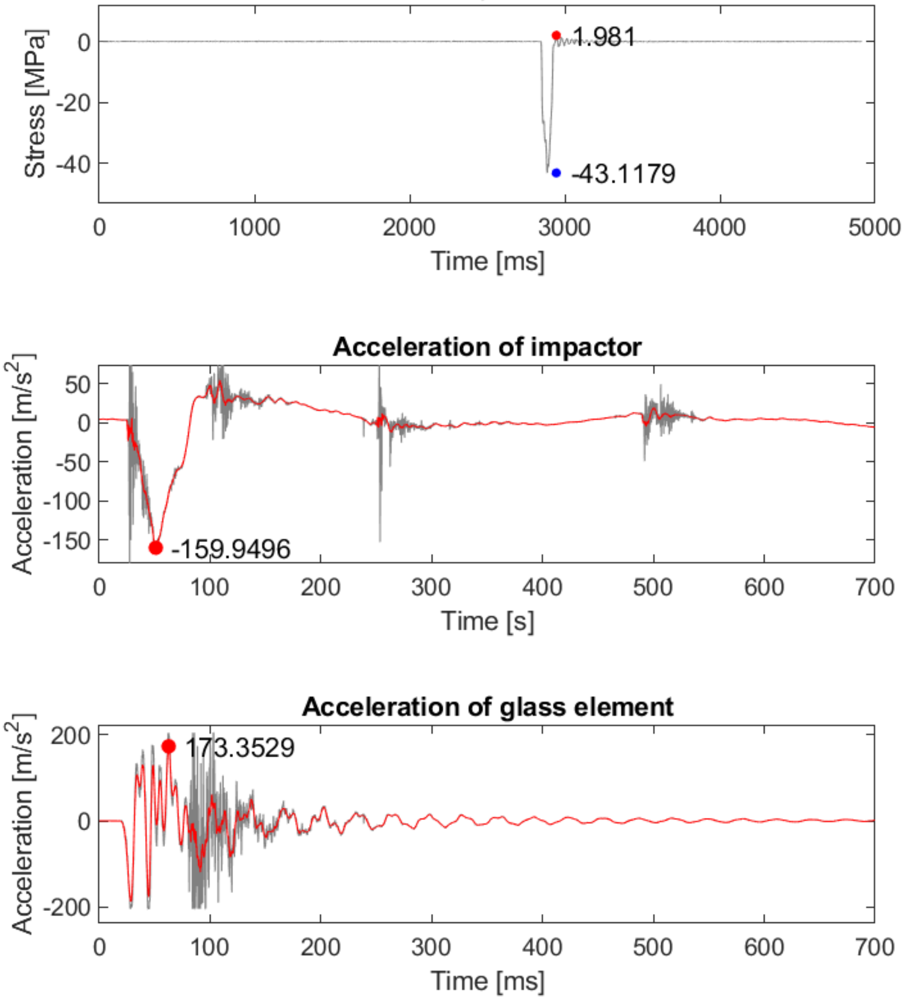


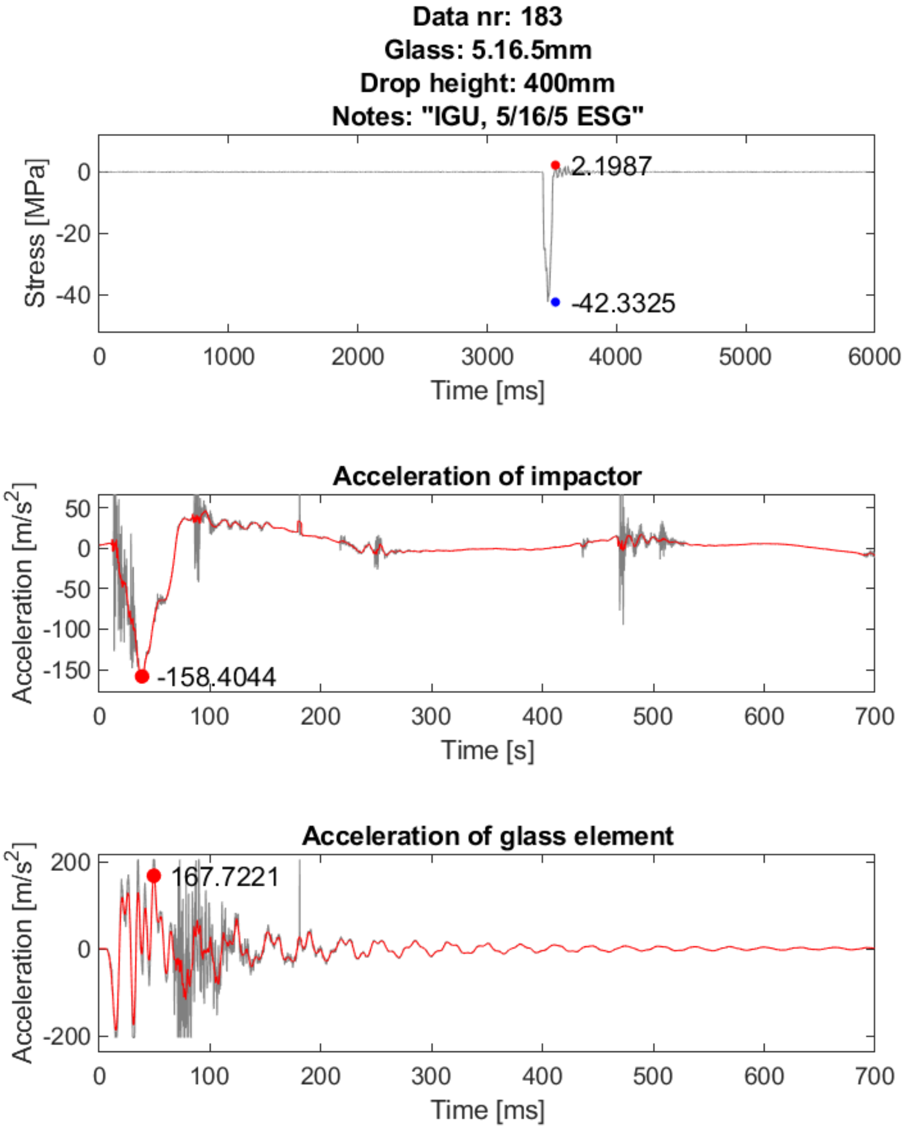
Data nr: 180
Glass: 5.16.5mm
Drop height: 300mm
Notes: "IGU, 5/16/5 ESG"
Stress [MPa]
0
-20
-40
1.736
-41.447
0
1000
2000
3000
4000
5000
Time [ms]
Acceleration of impactor
Acceleration [m/s^2]
50
0
-50
-53.8713
0
100
200
300
400
500
600
700
Time [s]
Acceleration of glass element
Acceleration [m/s^2]
100
0
-100
64.5938
0
100
200
300
400
500
600
700
Time [ms]

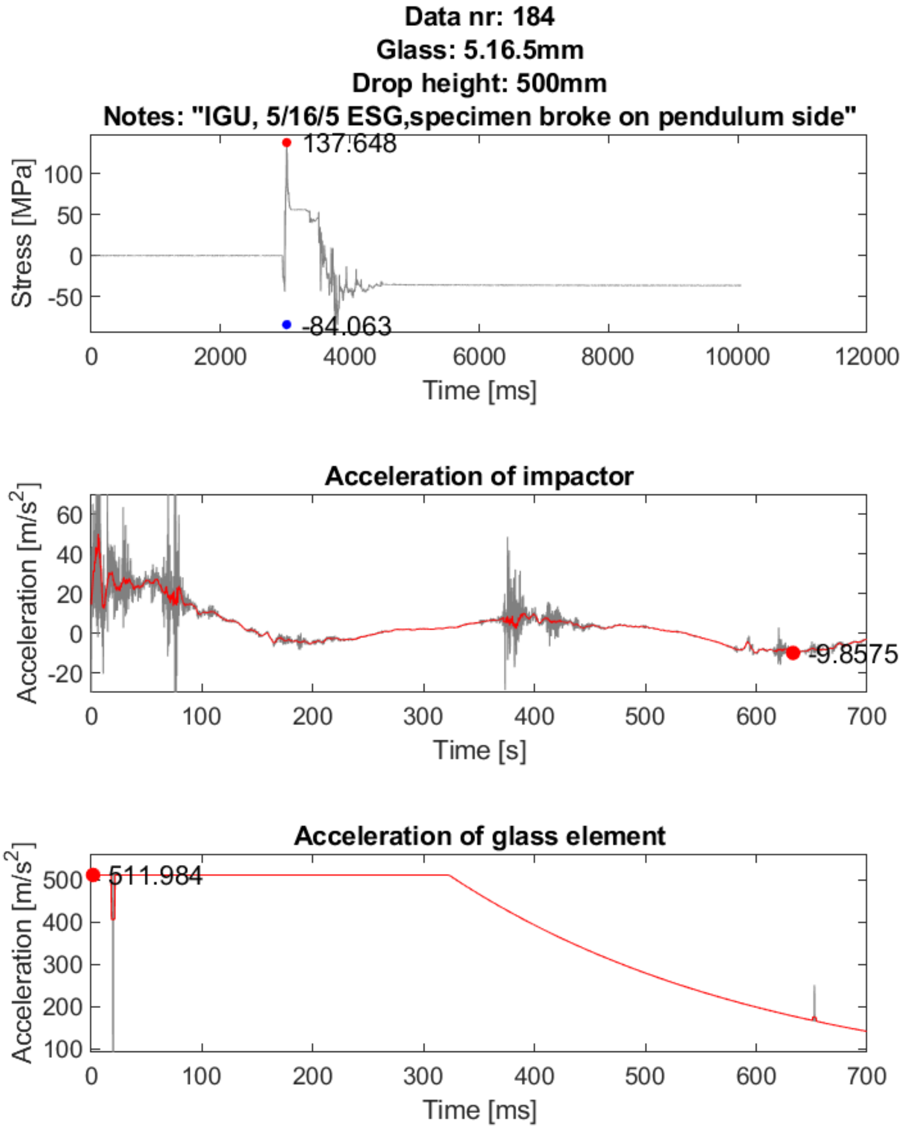


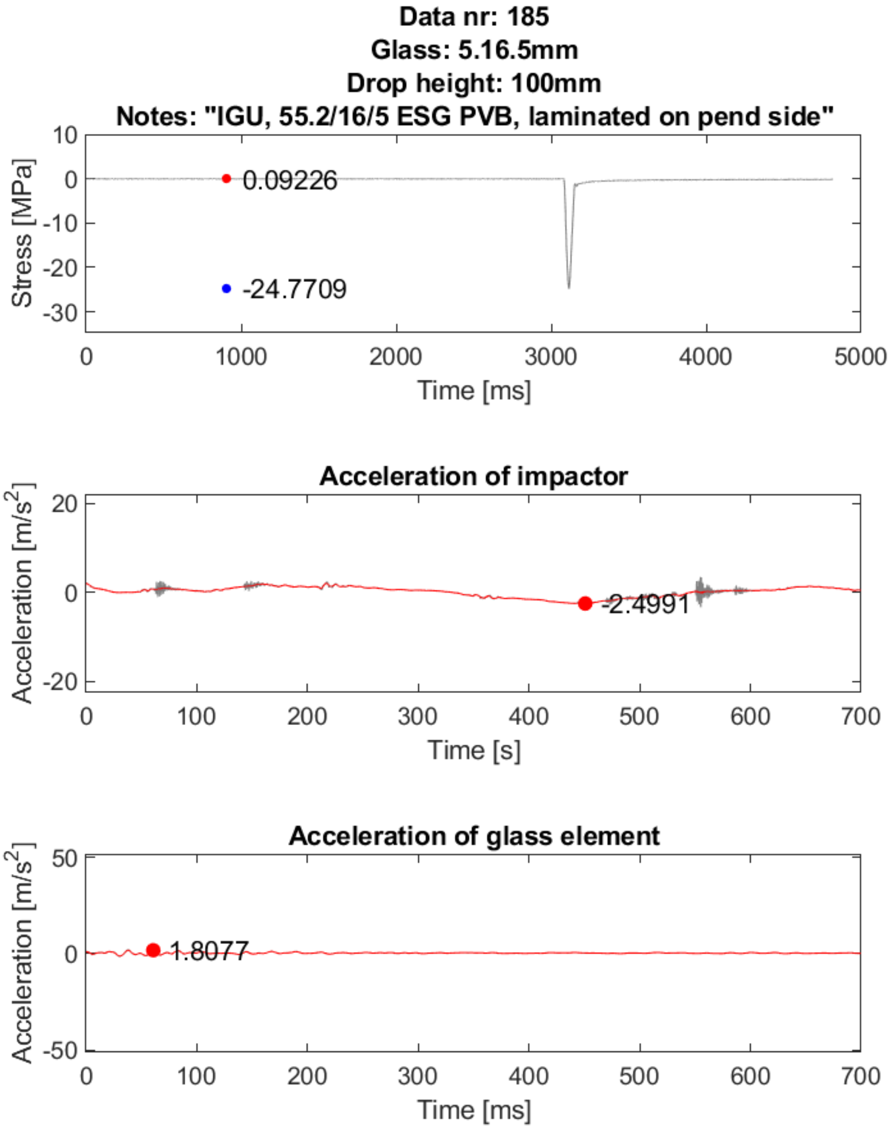
Data nr: 181
Glass: 5.16.5mm
Drop height: 400mm
Notes: "IGU, 5/16/5 ESG"
Stress [MPa]
1.925
-42.9394
Time [ms]
Acceleration of impactor
Acceleration [m/s^2]
-157.0755
Time [s]
Acceleration of glass element
Acceleration [m/s^2]
172.6038
Time [ms]

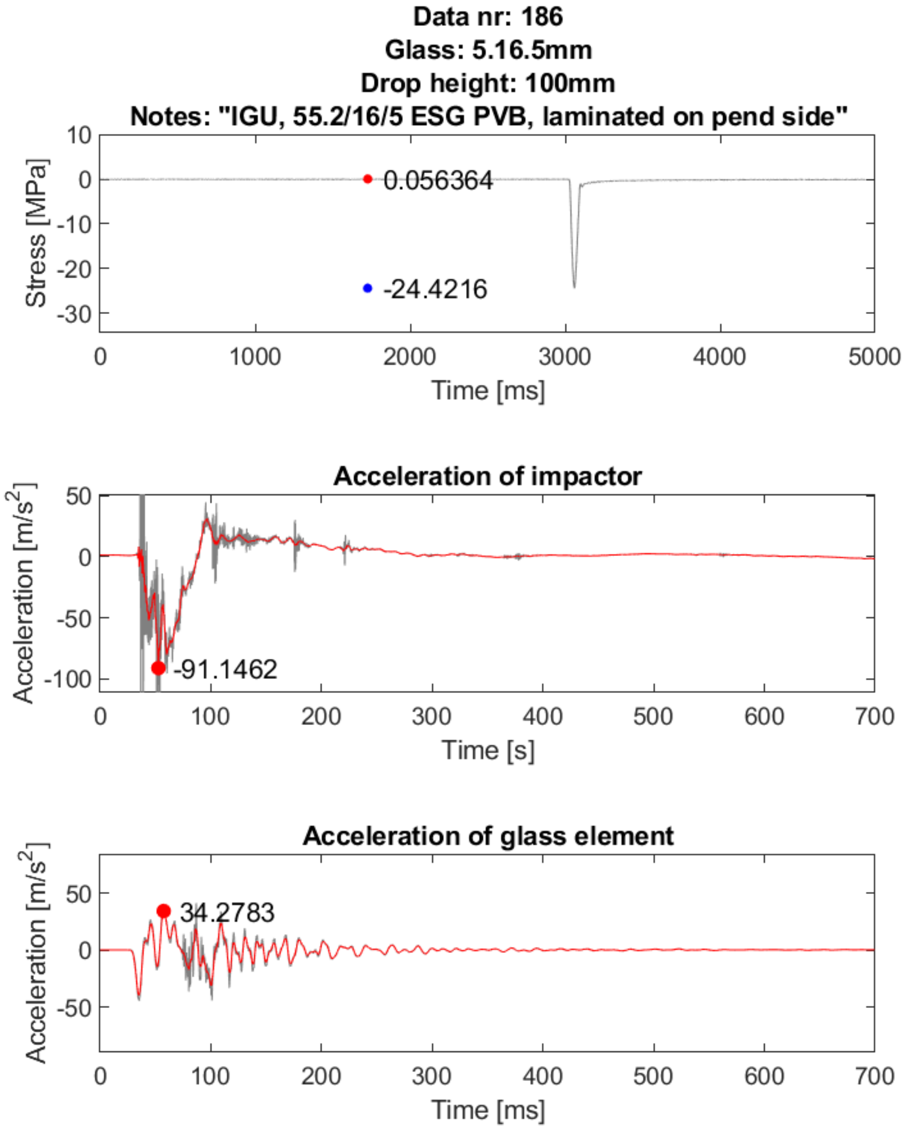
Data nr: 182
Glass: 5.16.5mm
Drop height: 400mm
Notes: "IGU, 5/16/5 ESG"

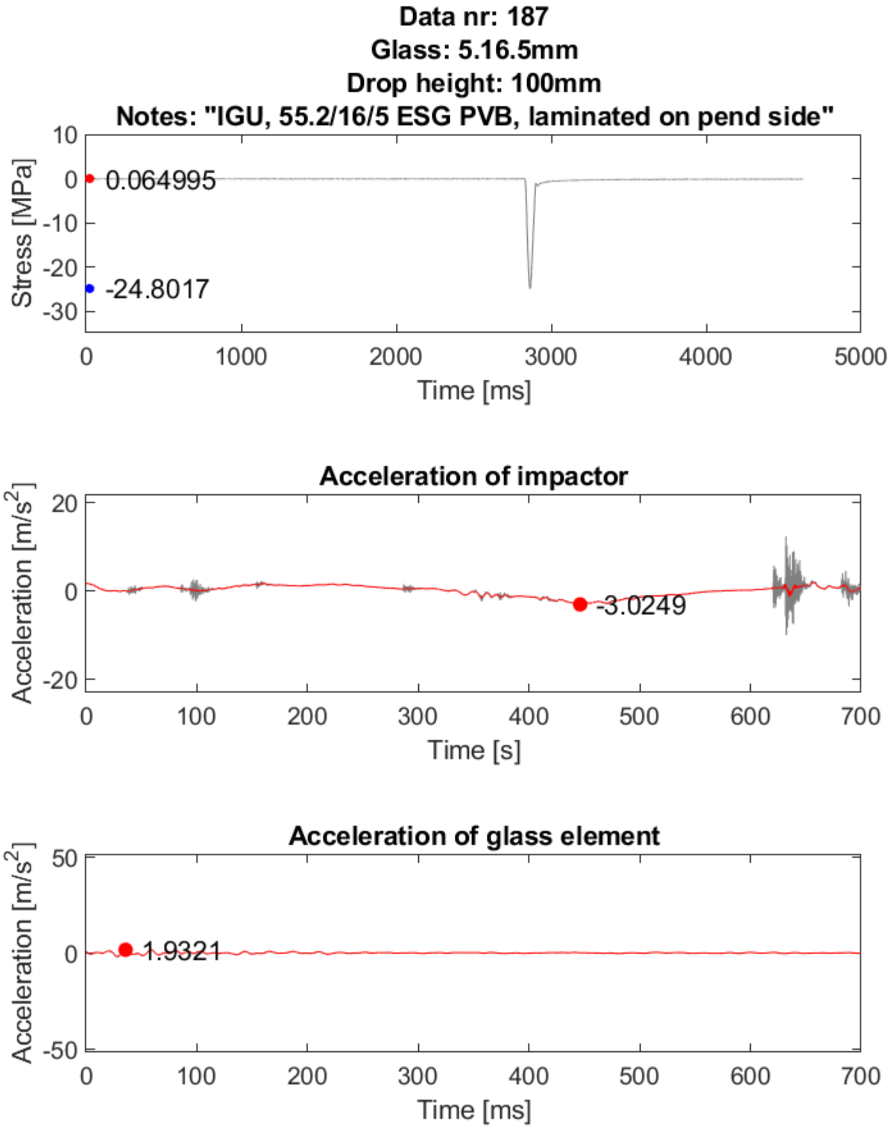


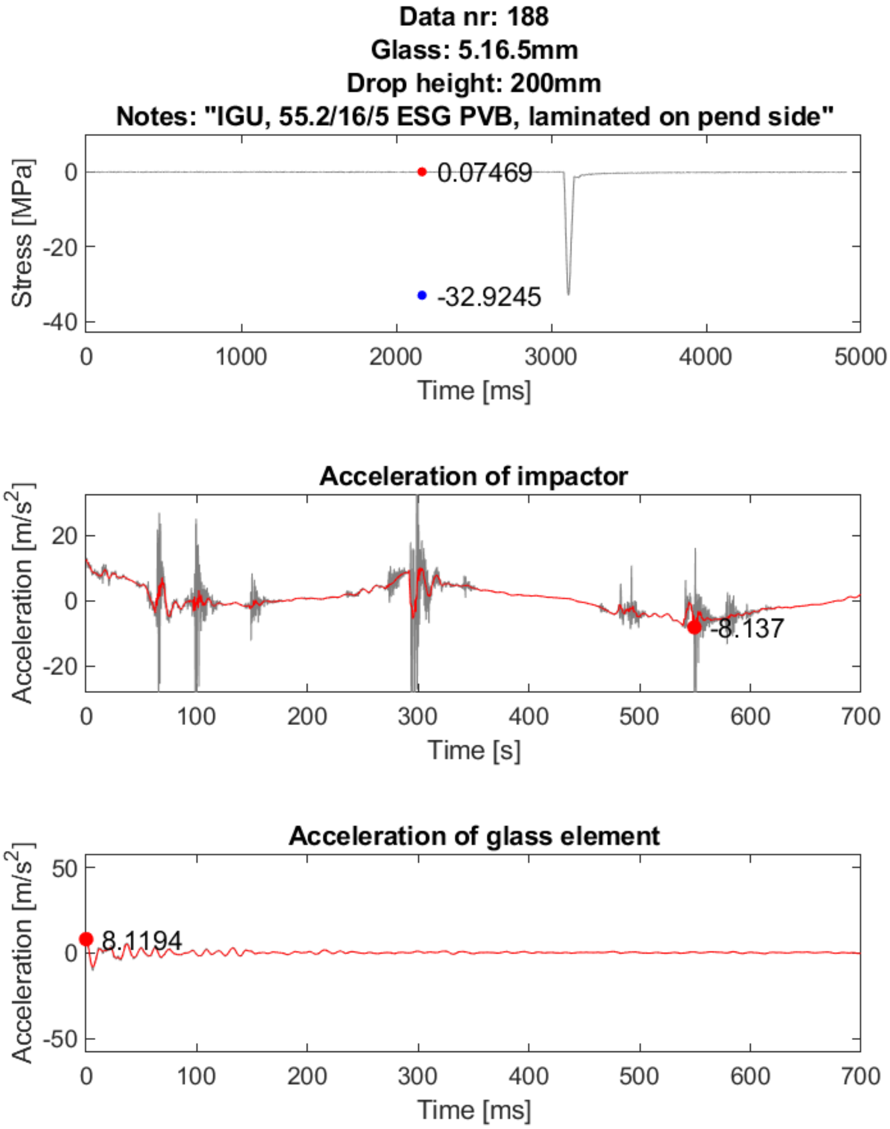

Data nr: 183
Glass: 5.16.5mm
Drop height: 400mm
Notes: "IGU, 5/16/5 ESG"
Stress [MPa]
0
-20
-40
2.1987
-42.3325
0
1000
2000
3000
4000
5000
6000
Time [ms]
Acceleration of impactor
Acceleration [m/s^2]
50
0
-50
-100
-150
-158.4044
0
100
200
300
400
500
600
700
Time [s]
Acceleration of glass element
Acceleration [m/s^2]
200
0
-200
167.7221
0
100
200
300
400
500
600
700
Time [ms]

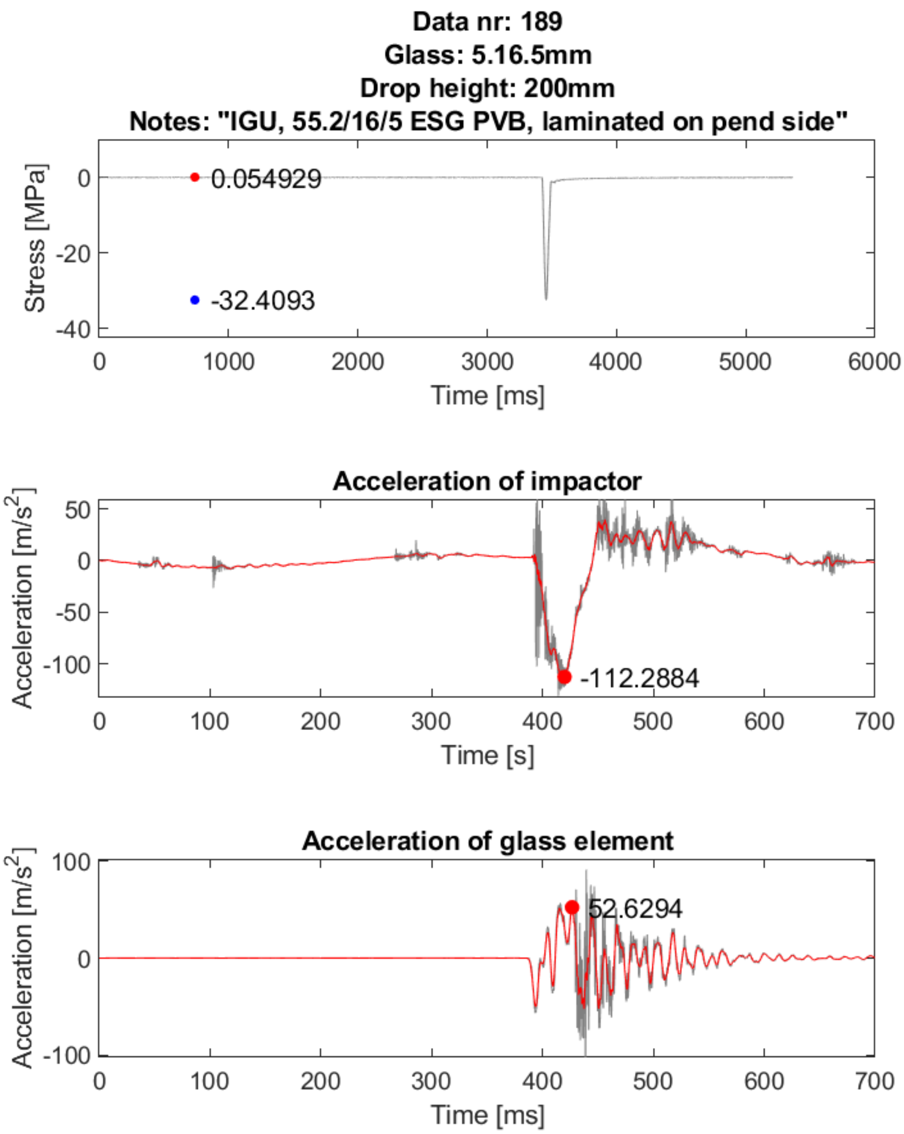

Data nr: 184
Glass: 5.16.5mm
Drop height: 500mm
Notes: "IGU, 5/16/5 ESG,specimen broke on pendulum side"
137.648
-84.063
Stress [MPa]
Time [ms]
Acceleration of impactor
-9.8575
Acceleration [m/s^2]
Time [s]
Acceleration of glass element
511.984
Acceleration [m/s^2]
Time [ms]

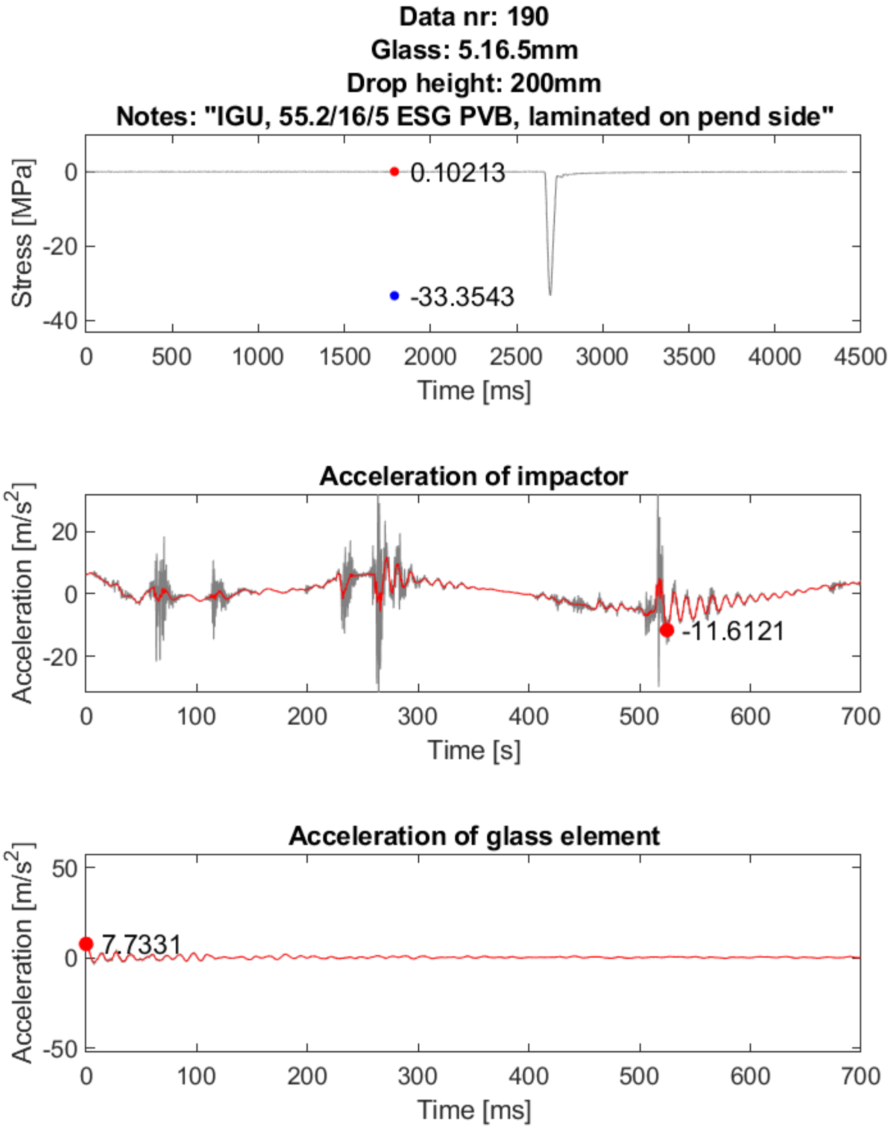

Data nr: 185
Glass: 5.16.5mm
Drop height: 100mm
Notes: "IGU, 55.2/16/5 ESG PVB, laminated on pend side"
Stress [MPa]
0.09226
-24.7709
Time [ms]
Acceleration of impactor
Acceleration [m/s2]
-2.4991
Time [s]
Acceleration of glass element
Acceleration [m/s2]
1.8077
Time [ms]

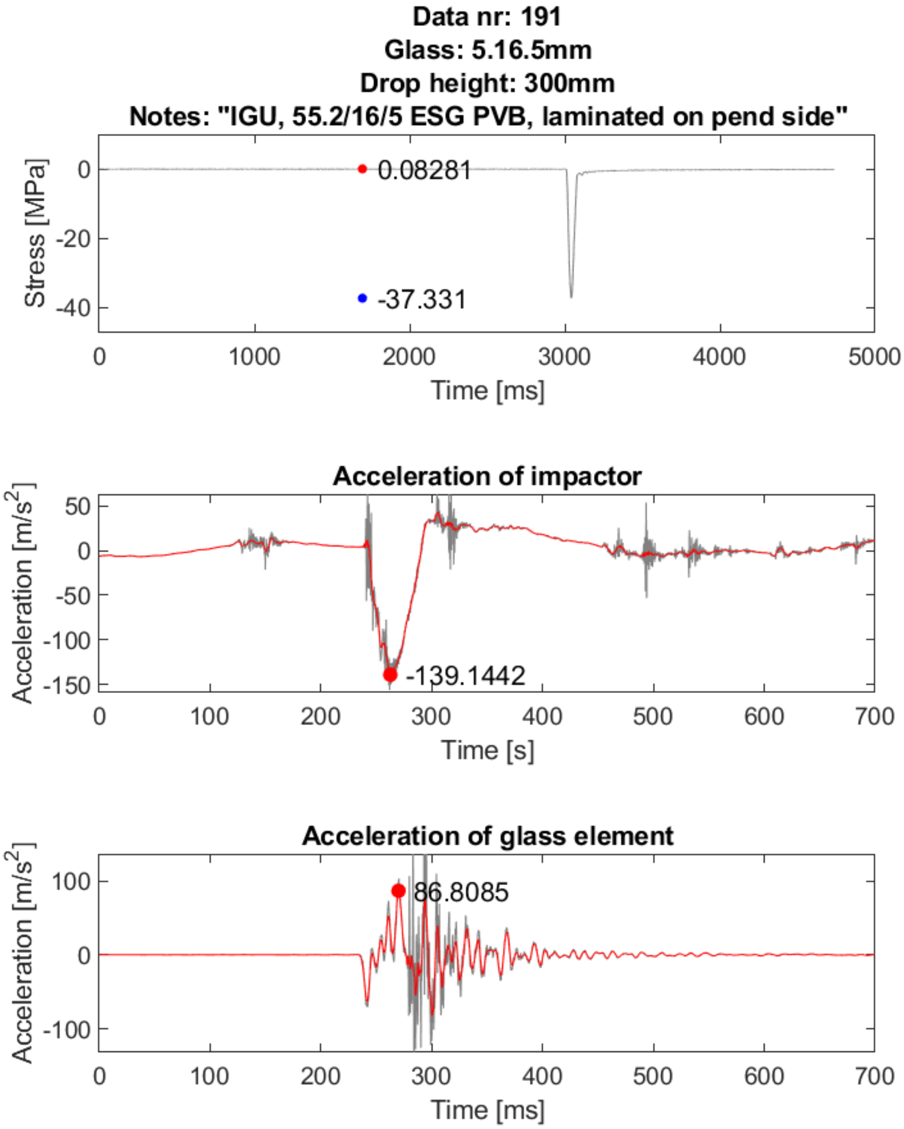

Data nr: 186
Glass: 5.16.5mm
Drop height: 100mm
Notes: "IGU, 55.2/16/5 ESG PVB, laminated on pend side"
Stress [MPa]
0.056364
-24.4216
Time [ms]
Acceleration of impactor
Acceleration [m/s2]
-91.1462
Time [s]
Acceleration of glass element
Acceleration [m/s2]
34.2783
Time [ms]

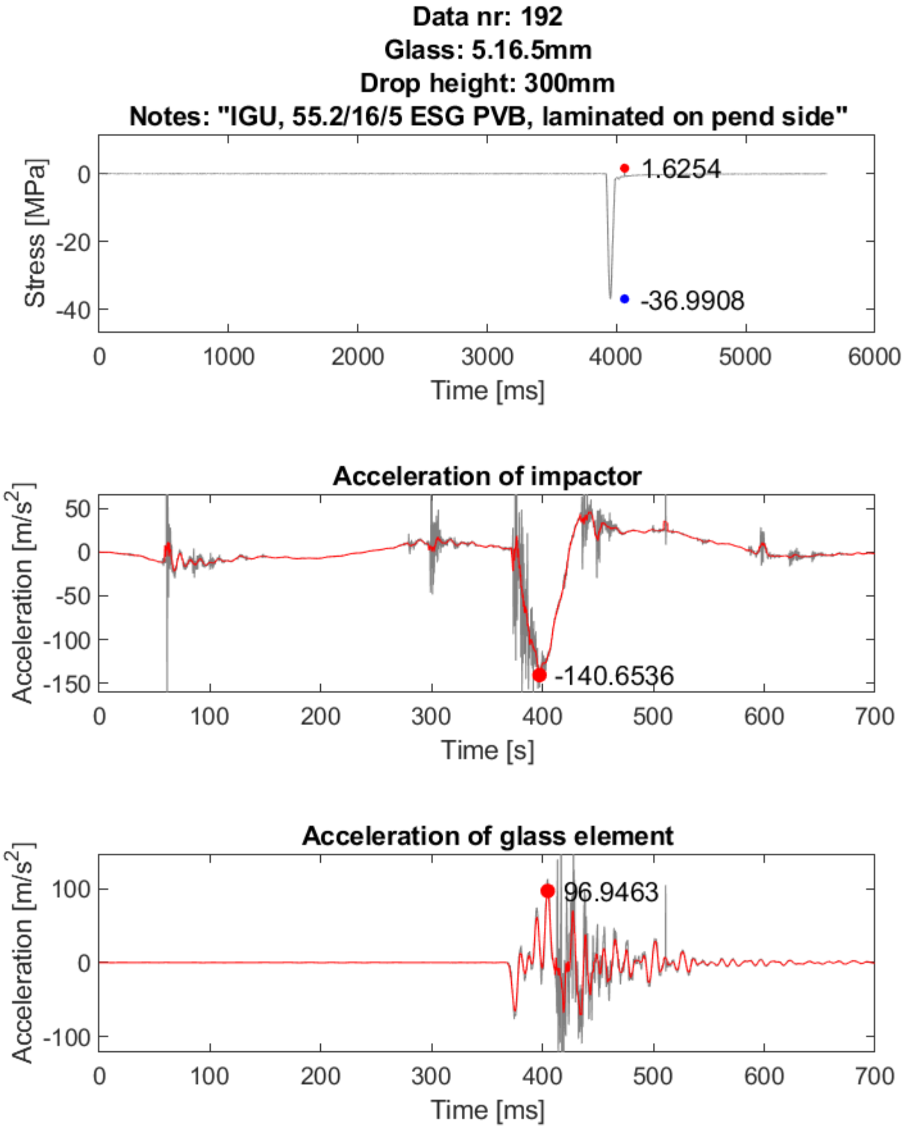

Data nr: 187
Glass: 5.16.5mm
Drop height: 100mm
Notes: "IGU, 55.2/16/5 ESG PVB, laminated on pend side"
Stress [MPa]
0.064995
-24.8017
Time [ms]
Acceleration of impactor
Acceleration [m/s^2]
-3.0249
Time [s]
Acceleration of glass element
Acceleration [m/s^2]
1.9321
Time [ms]


Data nr: 188
Glass: 5.16.5mm
Drop height: 200mm
Notes: "IGU, 55.2/16/5 ESG PVB, laminated on pend side"
Stress [MPa]
0.07469
-32.9245
0
-20
-40
0
1000
2000
3000
4000
5000
Time [ms]
Acceleration of impactor
Acceleration [m/s^2]
20
0
-20
-8.137
0
100
200
300
400
500
600
700
Time [s]
Acceleration of glass element
Acceleration [m/s^2]
50
0
-50
8.1194
0
100
200
300
400
500
600
700
Time [ms]

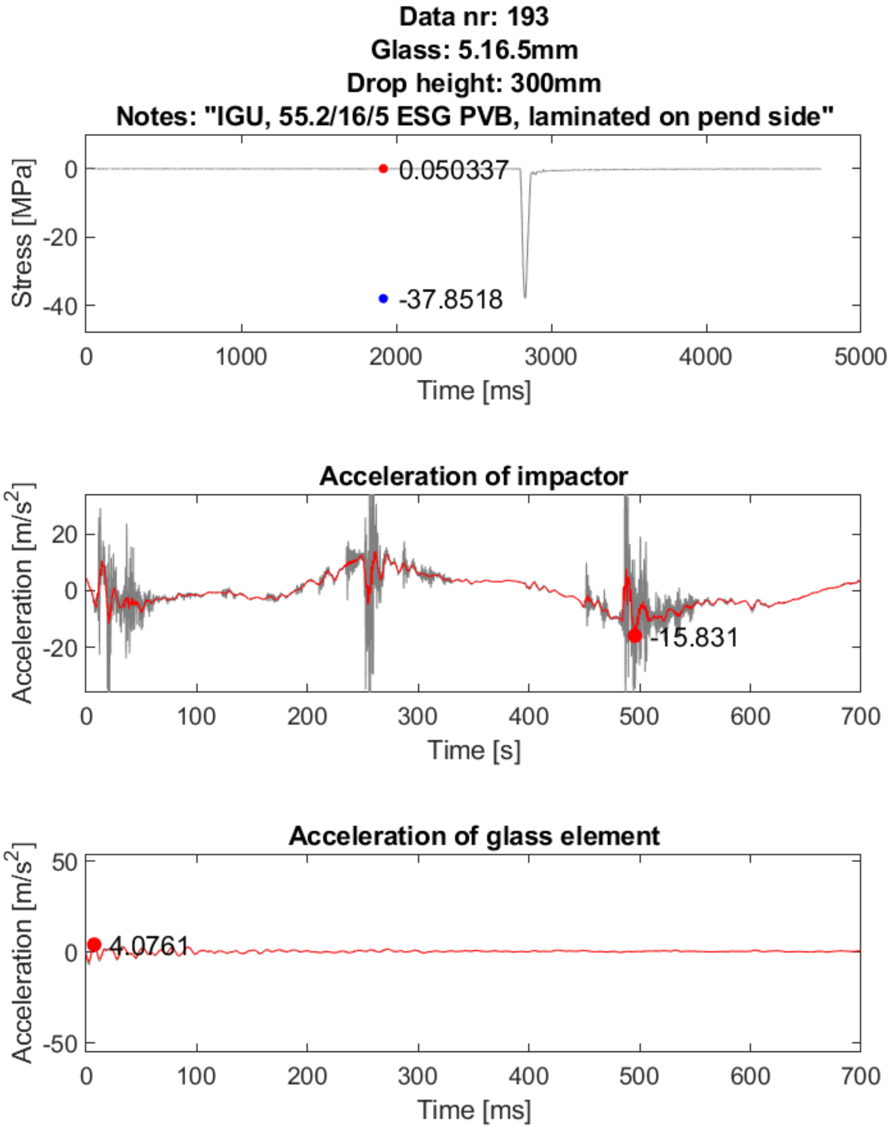

Data nr: 189
Glass: 5.16.5mm
Drop height: 200mm
Notes: "IGU, 55.2/16/5 ESG PVB, laminated on pend side"
Stress [MPa]
0.054929
-32.4093
0
-20
-40
0
1000
2000
3000
4000
5000
6000
Time [ms]
Acceleration of impactor
Acceleration [m/s^2]
50
0
-50
-100
-112.2884
0
100
200
300
400
500
600
700
Time [s]
Acceleration of glass element
Acceleration [m/s^2]
100
0
-100
52.6294
0
100
200
300
400
500
600
700
Time [ms]

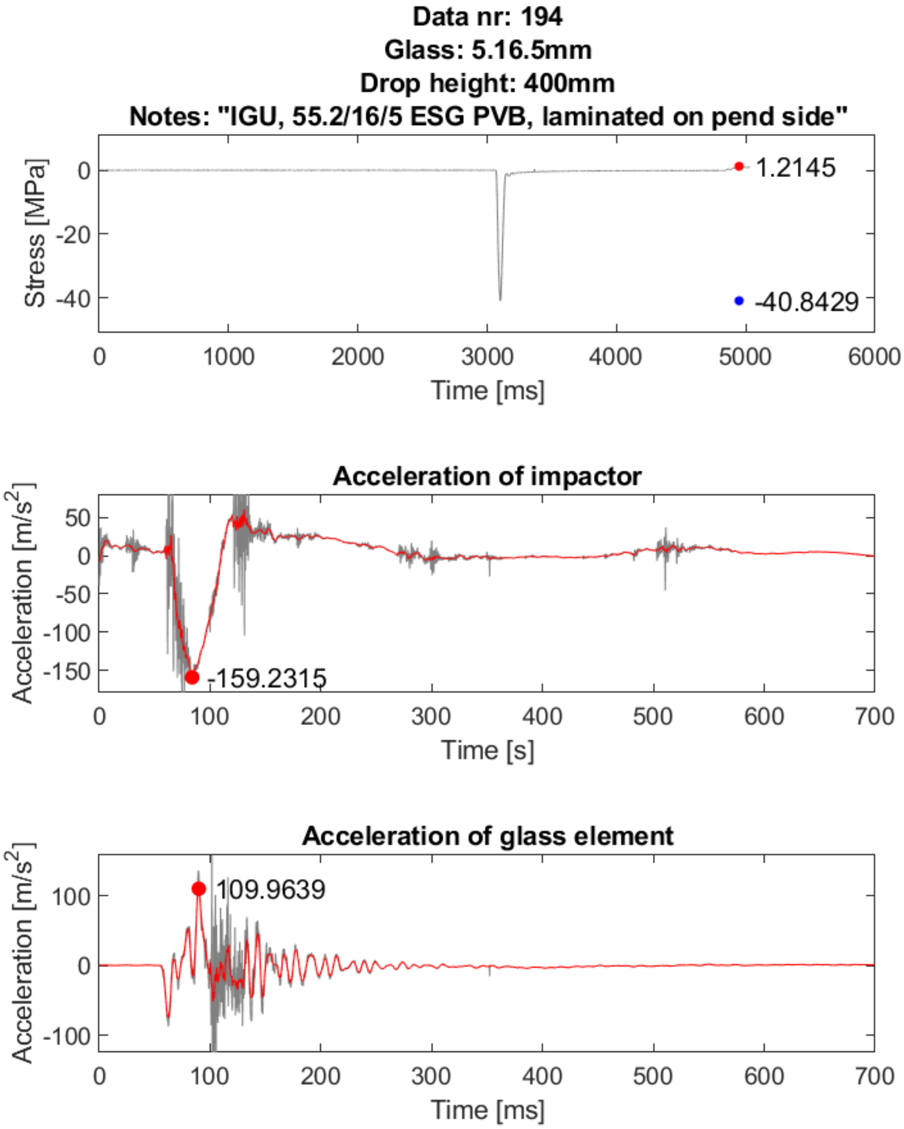

Data nr: 190
Glass: 5.16.5mm
Drop height: 200mm
Notes: "IGU, 55.2/16/5 ESG PVB, laminated on pend side"
Stress [MPa]
0.10213
-33.3543
Time [ms]
Acceleration of impactor
Acceleration [m/s2]
-11.6121
Time [s]
Acceleration of glass element
Acceleration [m/s2]
7.7331
Time [ms]

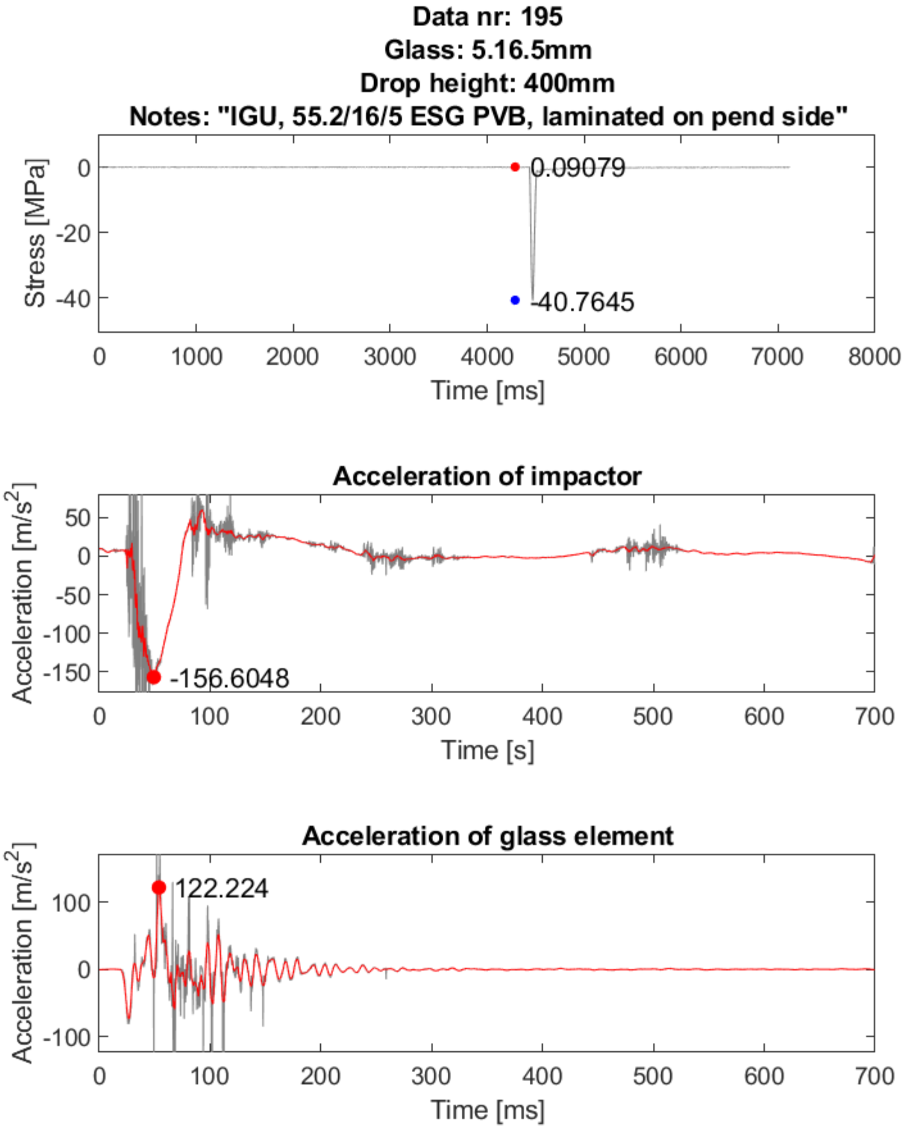

Data nr: 191
Glass: 5.16.5mm
Drop height: 300mm
Notes: "IGU, 55.2/16/5 ESG PVB, laminated on pend side"
Stress [MPa]
0.08281
-37.331
Time [ms]
Acceleration of impactor
Acceleration [m/s²]
-139.1442
Time [s]
Acceleration of glass element
Acceleration [m/s²]
86.8085
Time [ms]



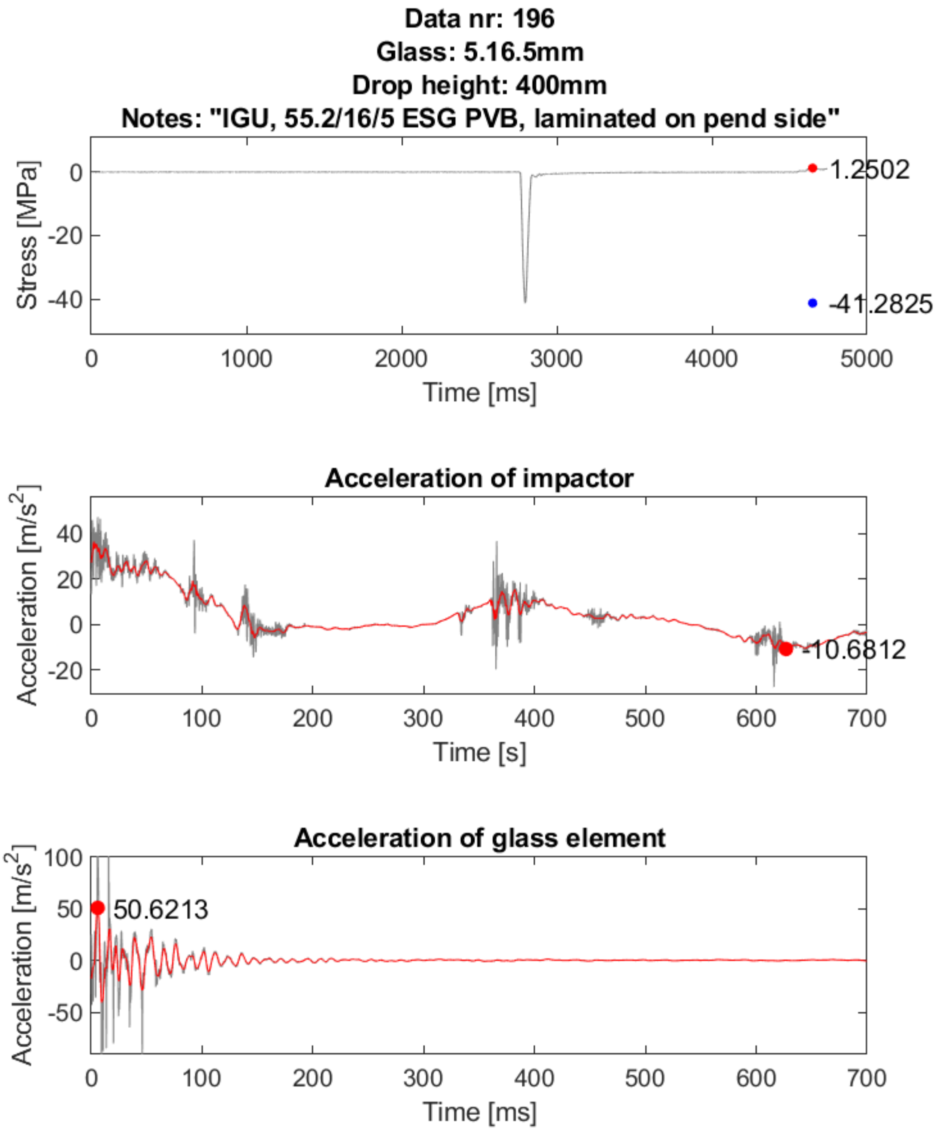
Data nr: 192
Glass: 5.16.5mm
Drop height: 300mm
Notes: "IGU, 55.2/16/5 ESG PVB, laminated on pend side"
Stress [MPa]
1.6254
-36.9908
0
-20
-40
0
1000
2000
3000
4000
5000
6000
Time [ms]
Acceleration of impactor
Acceleration [m/s2]
50
0
-50
-100
-150
-140.6536
100
200
300
400
500
600
700
Time [s]
Acceleration of glass element
96.9463
Time [ms]

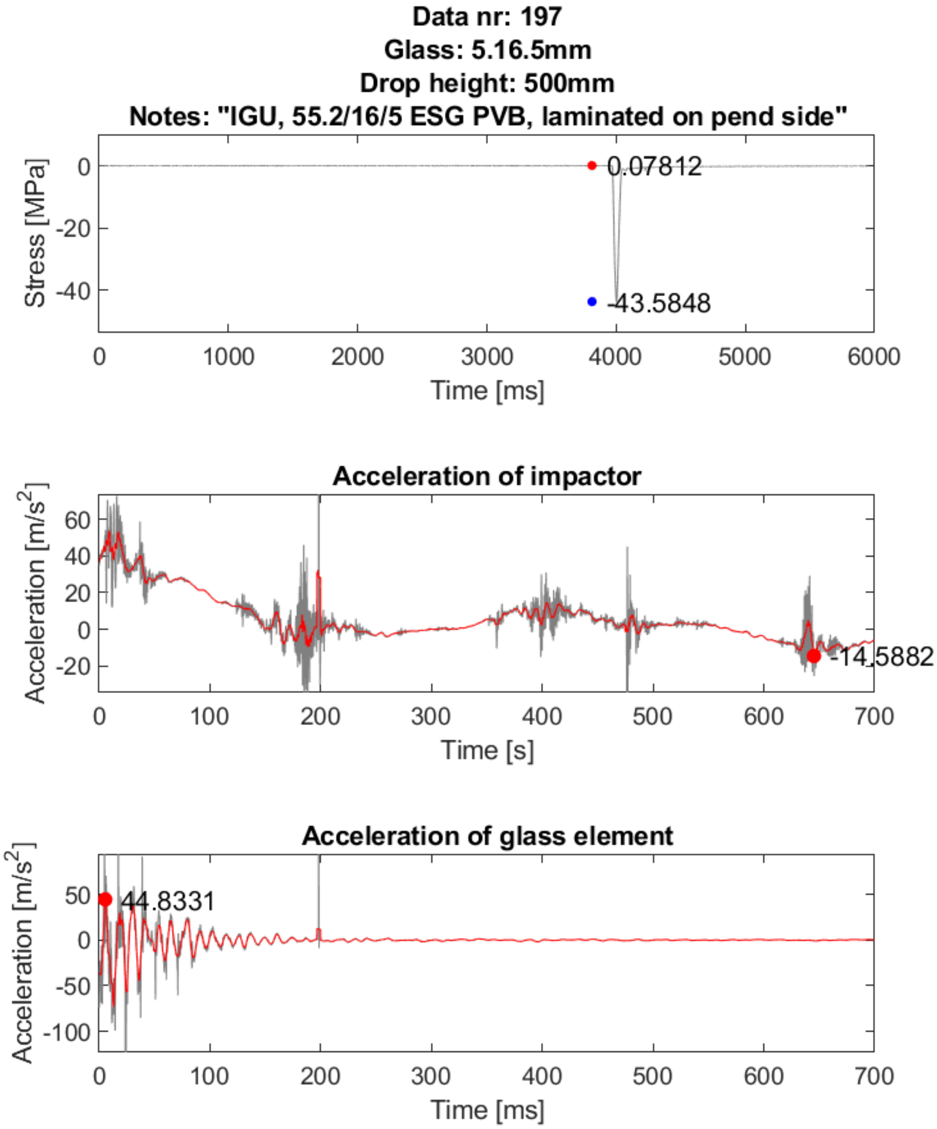

Data nr: 193
Glass: 5.16.5mm
Drop height: 300mm
Notes: "IGU, 55.2/16/5 ESG PVB, laminated on pend side"
Stress [MPa]
0.050337
-37.8518
Time [ms]
Acceleration of impactor
Acceleration [m/s^2]
-15.831
Time [s]
Acceleration of glass element
Acceleration [m/s^2]
4.0761
Time [ms]


Data nr: 194
Glass: 5.16.5mm
Drop height: 400mm
Notes: "IGU, 55.2/16/5 ESG PVB, laminated on pend side"
Stress [MPa]
1.2145
-40.8429
Time [ms]
Acceleration of impactor
Acceleration [m/s^2]
-159.2315
Time [s]
Acceleration of glass element
Acceleration [m/s^2]
109.9639
Time [ms]

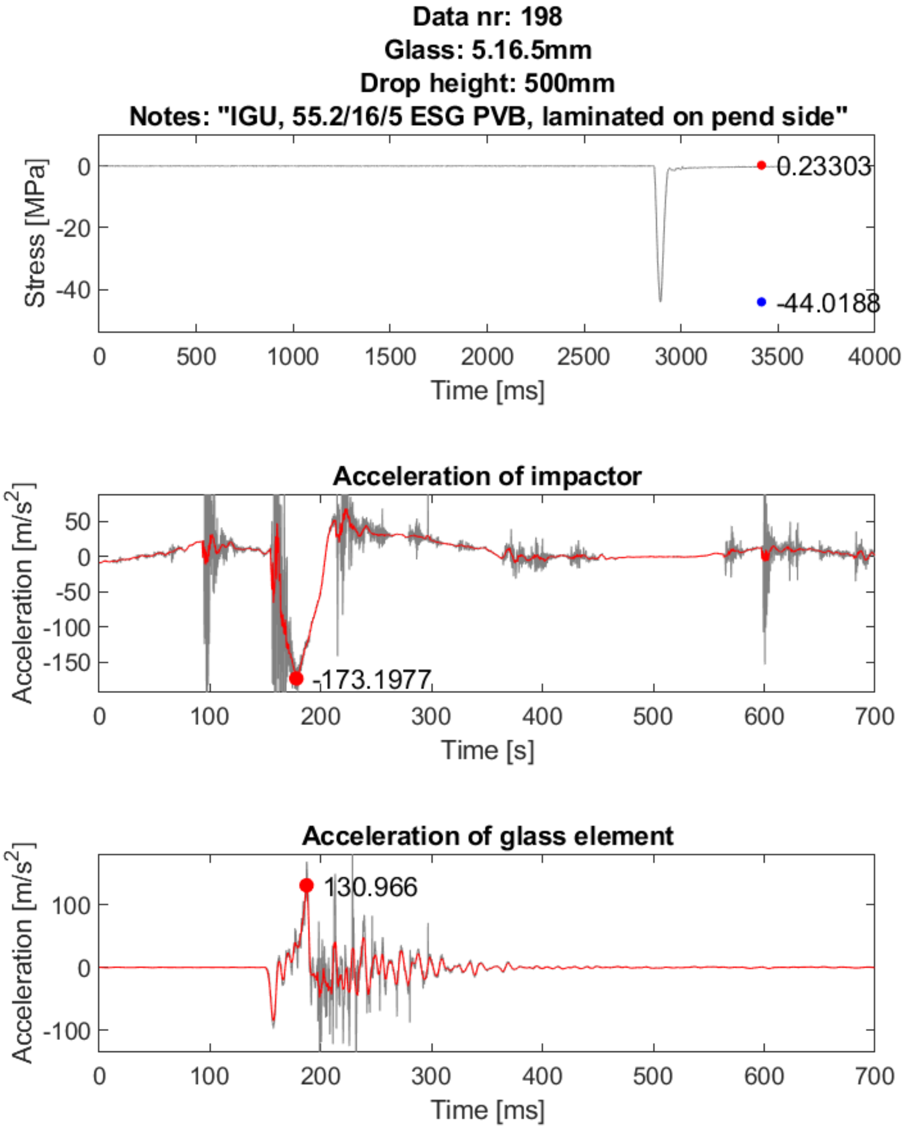


Data nr: 195
Glass: 5.16.5mm
Drop height: 400mm
Notes: "IGU, 55.2/16/5 ESG PVB, laminated on pend side"
Stress [MPa]
0.09079
-40.7645
Time [ms]
Acceleration of impactor
Acceleration [m/s^2]
-156.6048
Time [s]
Acceleration of glass element
Acceleration [m/s^2]
122.224
Time [ms]

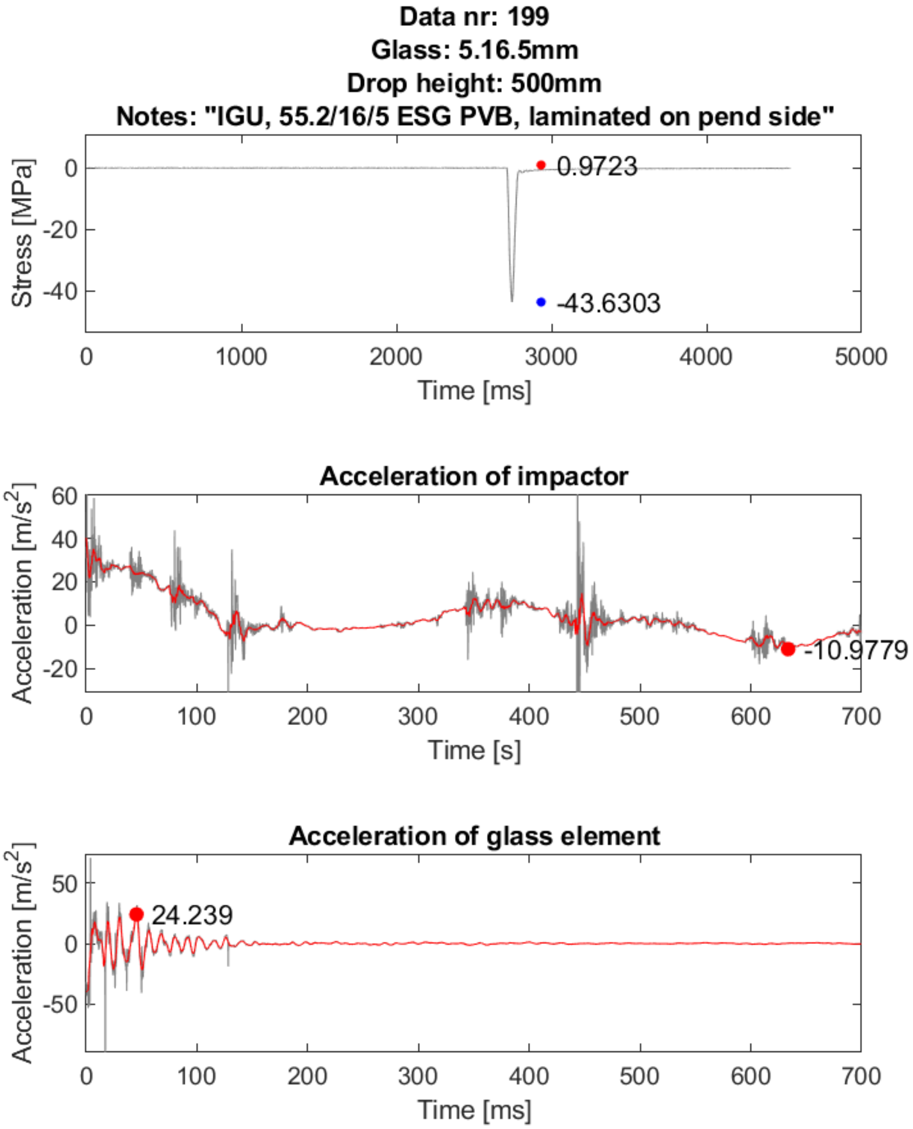

Data nr: 196
Glass: 5.16.5mm
Drop height: 400mm
Notes: "IGU, 55.2/16/5 ESG PVB, laminated on pend side"
Stress [MPa]
0
-20
-40
1.2502
-41.2825
0
1000
2000
3000
4000
5000
Time [ms]
Acceleration of impactor
Acceleration [m/s2]
40
20
0
-20
-10.6812
0
100
200
300
400
500
600
700
Time [s]
Acceleration of glass element
Acceleration [m/s2]
100
50
0
-50
50.6213
0
100
200
300
400
500
600
700
Time [ms]

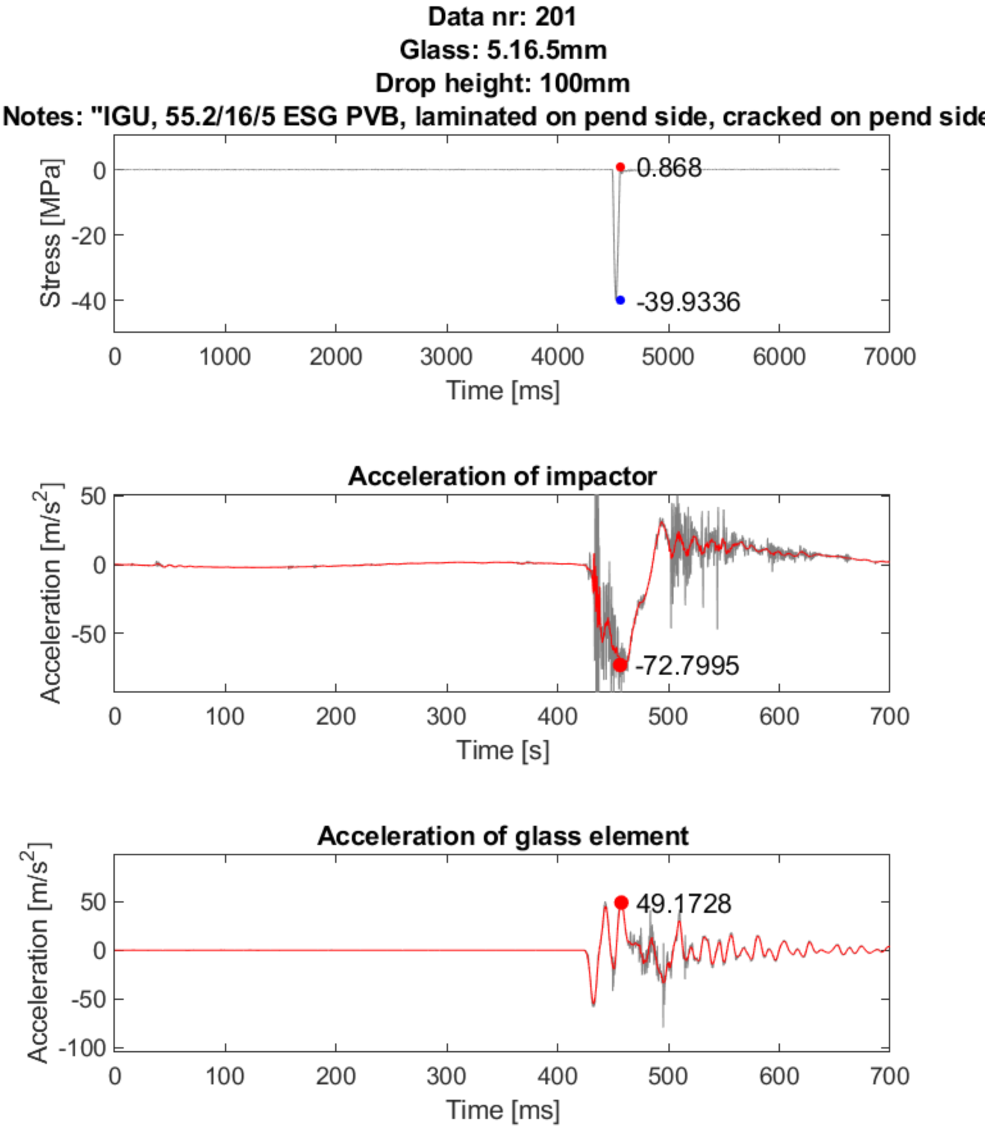


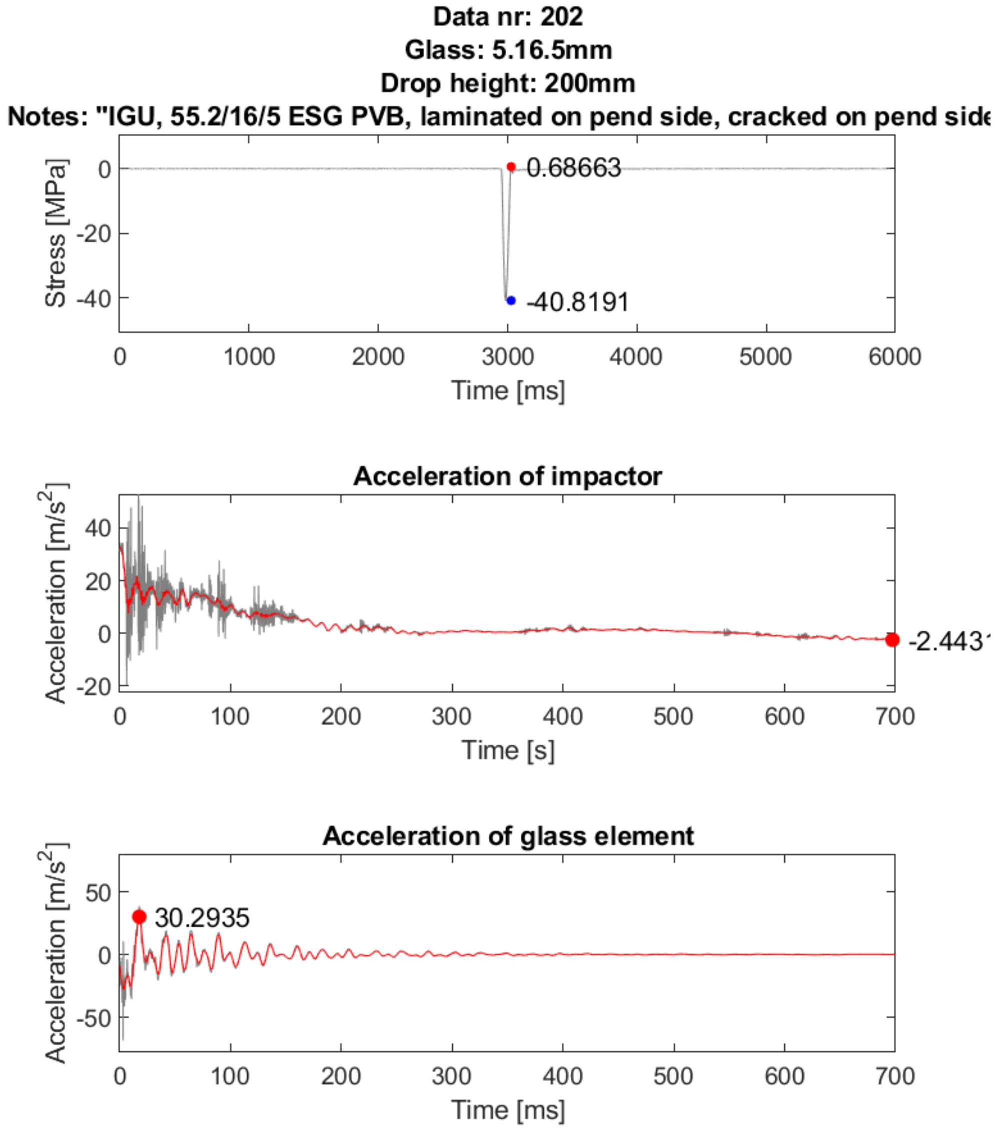
Data nr: 197
Glass: 5.16.5mm
Drop height: 500mm
Notes: "IGU, 55.2/16/5 ESG PVB, laminated on pend side"
Stress [MPa]
0.07812
-43.5848
Time [ms]
Acceleration of impactor
Acceleration [m/s^2]
-14.5882
Time [s]
Acceleration of glass element
Acceleration [m/s^2]
44.8331
Time [ms]



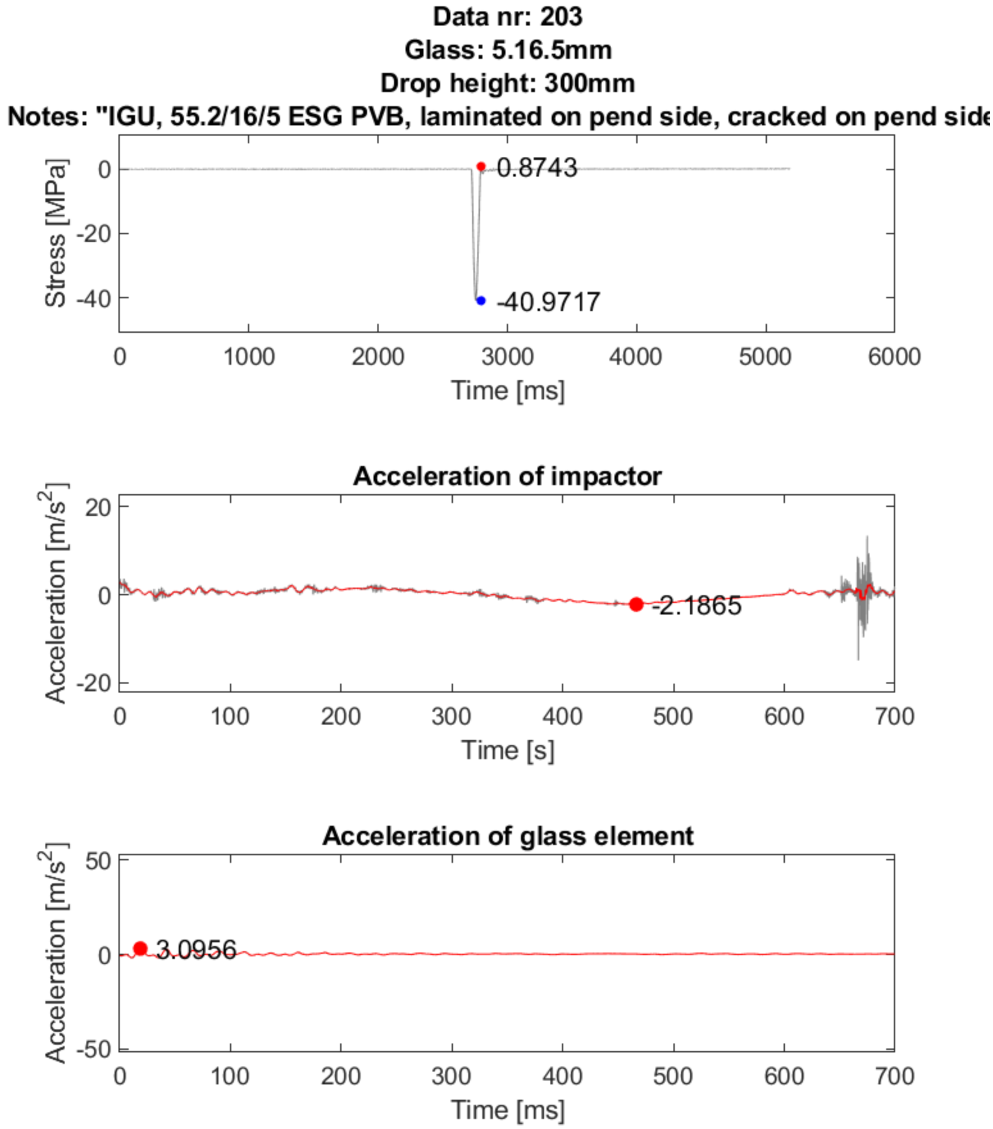
Data nr: 198
Glass: 5.16.5mm
Drop height: 500mm
Notes: "IGU, 55.2/16/5 ESG PVB, laminated on pend side"
Stress [MPa]
0.23303
-44.0188
Time [ms]
Acceleration of impactor
Acceleration [m/s^2]
-173.1977
Time [s]
Acceleration of glass element
Acceleration [m/s^2]
130.966
Time [ms]

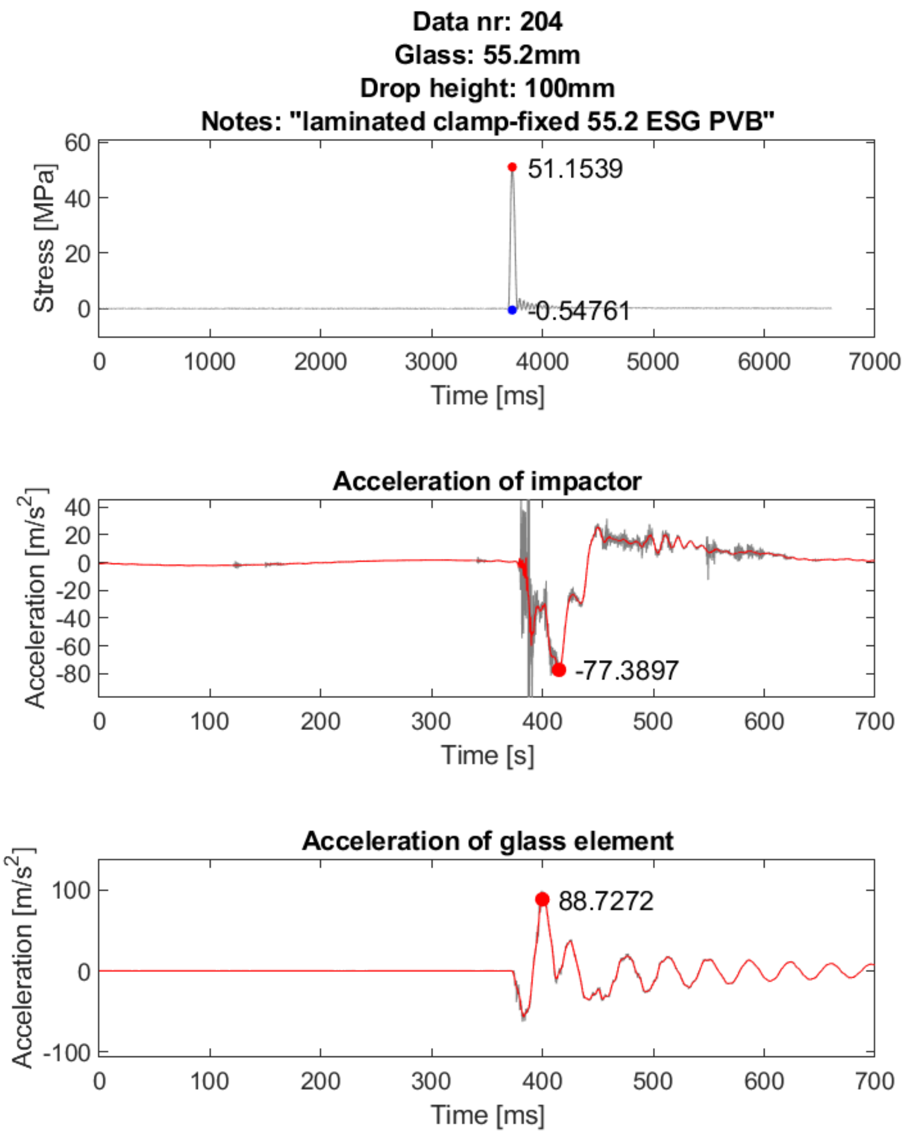

Data nr: 199
Glass: 5.16.5mm
Drop height: 500mm
Notes: "IGU, 55.2/16/5 ESG PVB, laminated on pend side"
Stress [MPa]
0.9723
-43.6303
Time [ms]
Acceleration of impactor
Acceleration [m/s^2]
-10.9779
Time [s]
Acceleration of glass element
Acceleration [m/s^2]
24.239
Time [ms]

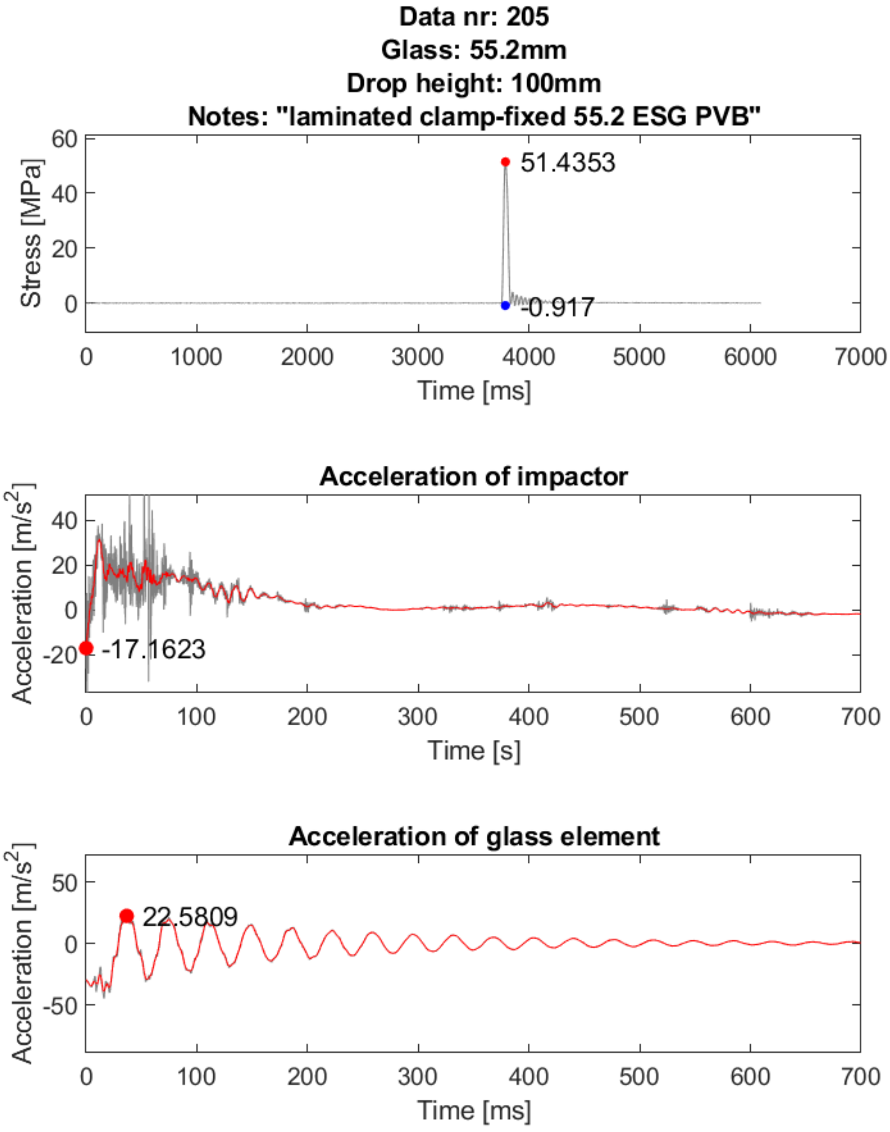

Data nr: 201
Glass: 5.16.5mm
Drop height: 100mm
Notes: "IGU, 55.2/16/5 ESG PVB, laminated on pend side, cracked on pend side
Stress [MPa]
0.868
-39.9336
Time [ms]
Acceleration of impactor
Acceleration [m/s^2]
-72.7995
Time [s]
Acceleration of glass element
Acceleration [m/s^2]
49.1728
Time [ms]

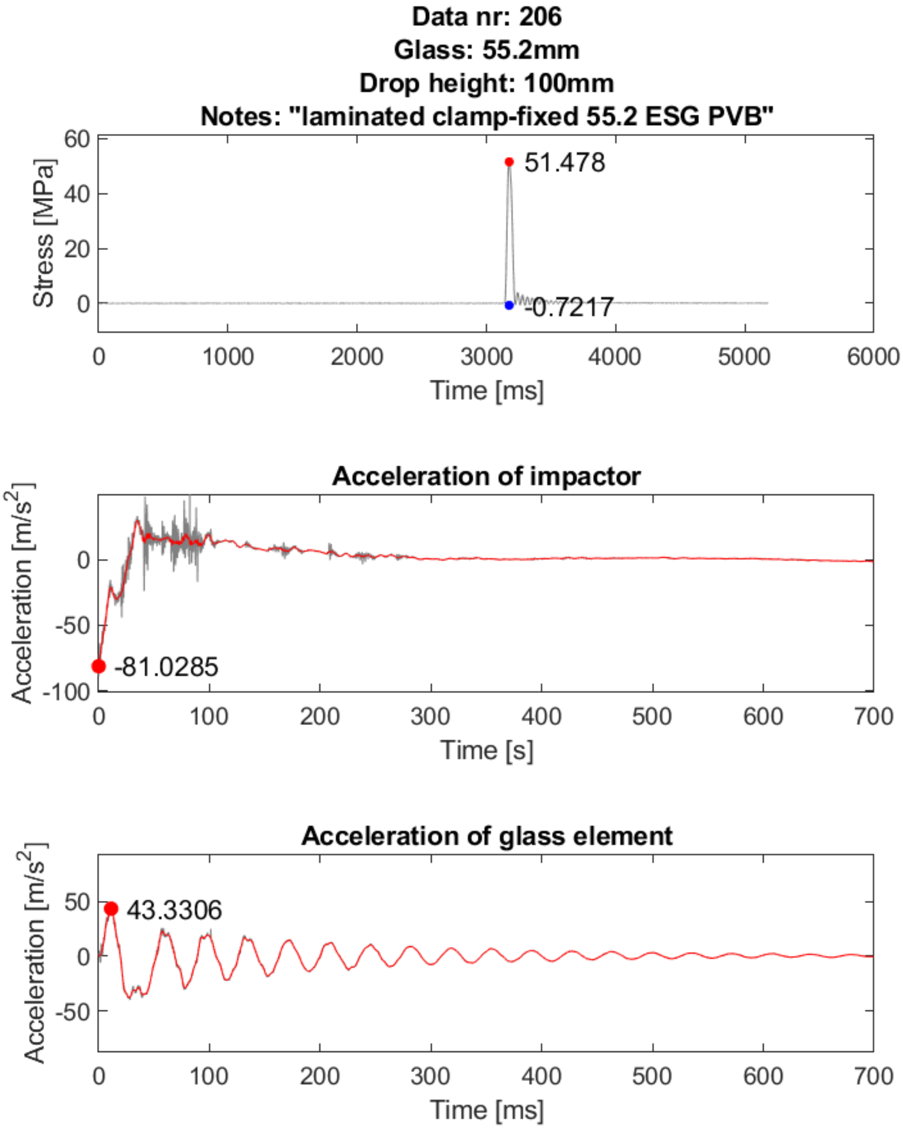


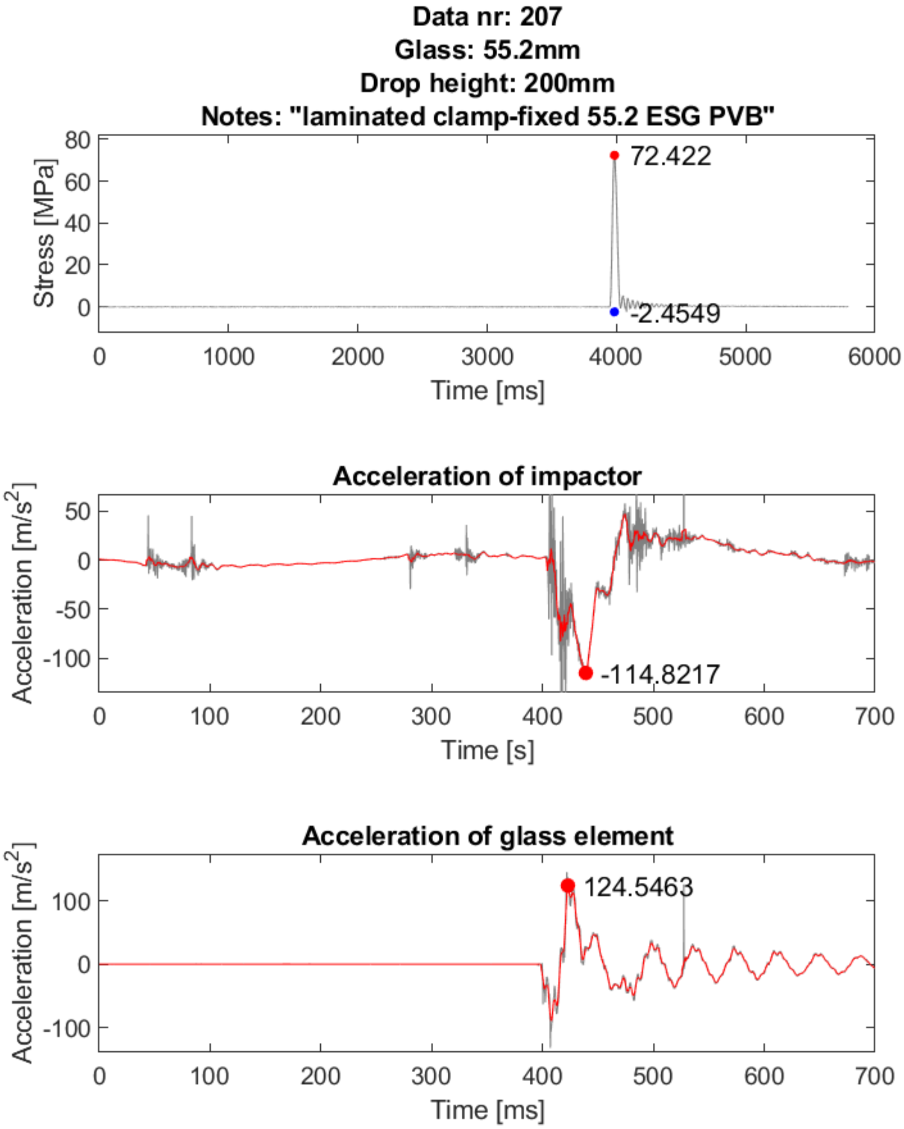
Data nr: 202
Glass: 5.16.5mm
Drop height: 200mm
Notes: "IGU, 55.2/16/5 ESG PVB, laminated on pend side, cracked on pend side
Stress [MPa]
0.68663
-40.8191
Time [ms]
Acceleration of impactor
Acceleration [m/s2]
-2.443
Time [s]
Acceleration of glass element
Acceleration [m/s2]
30.2935
Time [ms]

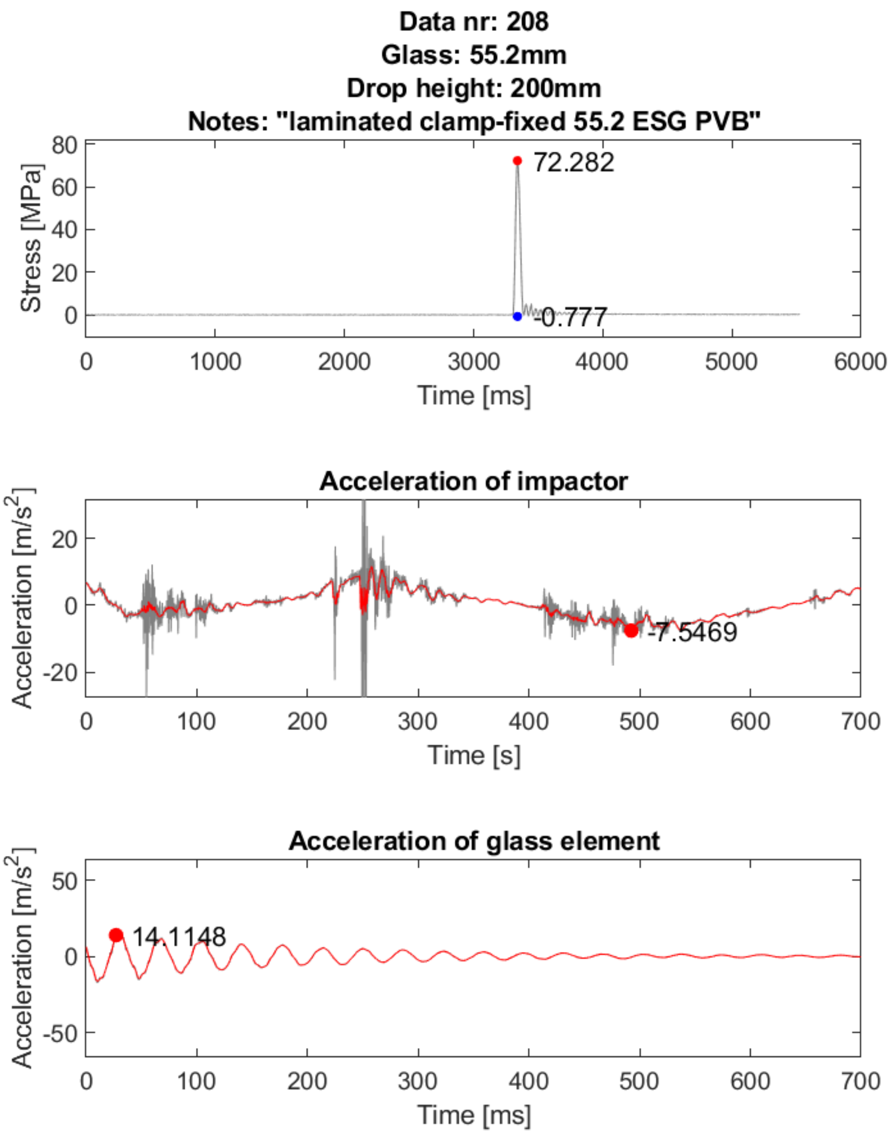

Data nr: 203
Glass: 5.16.5mm
Drop height: 300mm
Notes: "IGU, 55.2/16/5 ESG PVB, laminated on pend side, cracked on pend side
Stress [MPa]
0.8743
-40.9717
Time [ms]
Acceleration of impactor
Acceleration [m/s^2]
-2.1865
Time [s]
Acceleration of glass element
Acceleration [m/s^2]
3.0956
Time [ms]

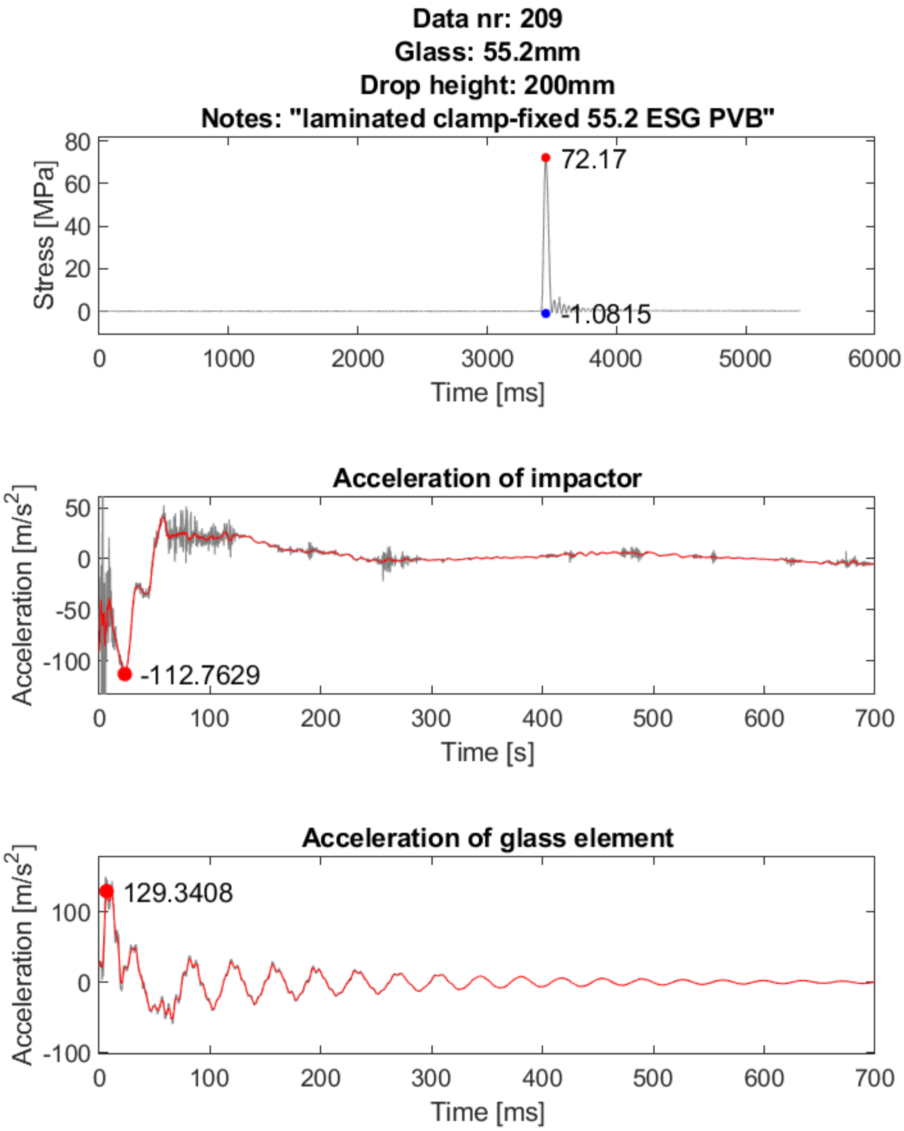

Data nr: 204
Glass: 55.2mm
Drop height: 100mm
Notes: "laminated clamp-fixed 55.2 ESG PVB"
Stress [MPa]
51.1539
-0.54761
Time [ms]
Acceleration of impactor
Acceleration [m/s^2]
-77.3897
Time [s]
Acceleration of glass element
Acceleration [m/s^2]
88.7272
Time [ms]

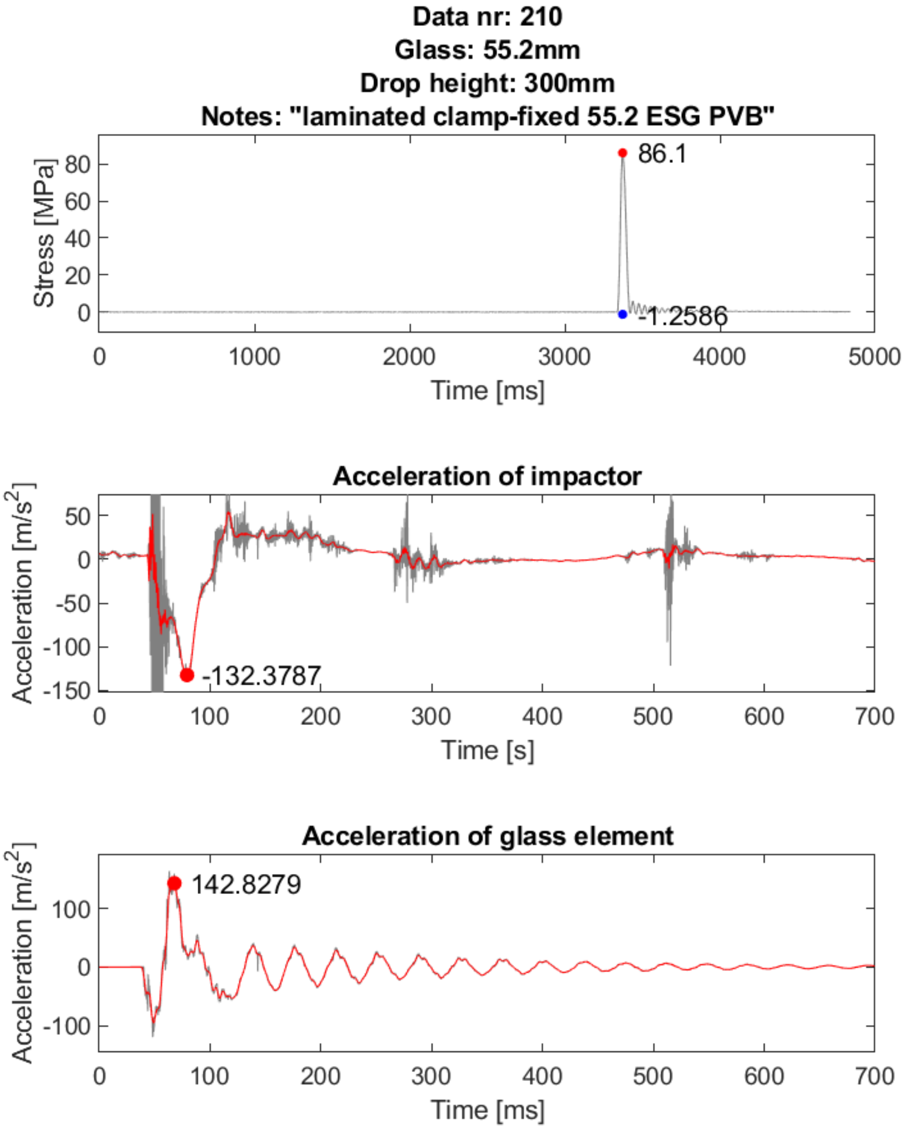

Data nr: 205
Glass: 55.2mm
Drop height: 100mm
Notes: "laminated clamp-fixed 55.2 ESG PVB"
Stress [MPa]
51.4353
-0.917
Time [ms]
Acceleration of impactor
Acceleration [m/s^2]
-17.1623
Time [s]
Acceleration of glass element
Acceleration [m/s^2]
22.5809
Time [ms]

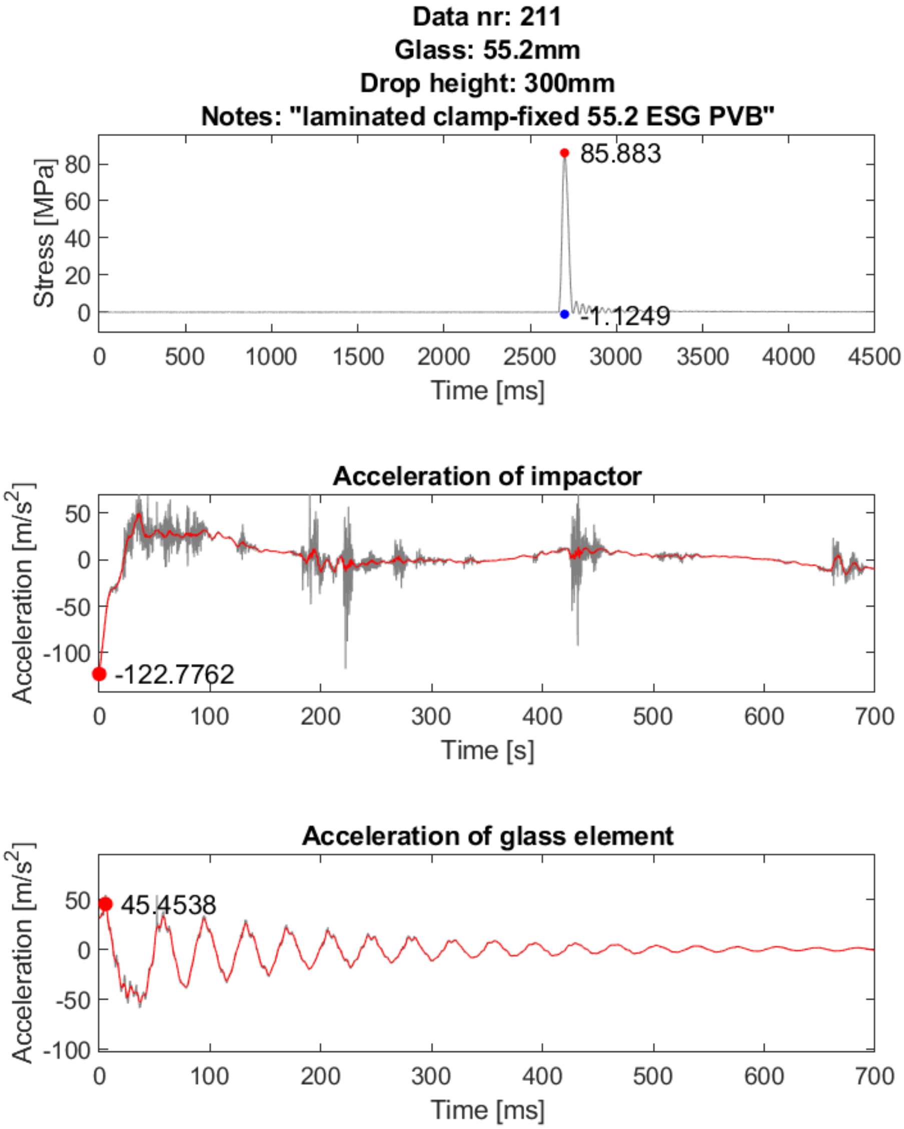

Data nr: 206
Glass: 55.2mm
Drop height: 100mm
Notes: "laminated clamp-fixed 55.2 ESG PVB"
Stress [MPa]
51.478
-0.7217
Time [ms]
Acceleration of impactor
Acceleration [m/s2]
-81.0285
Time [s]
Acceleration of glass element
Acceleration [m/s2]
43.3306
Time [ms]


Data nr: 207
Glass: 55.2mm
Drop height: 200mm
Notes: "laminated clamp-fixed 55.2 ESG PVB"
Stress [MPa]
72.422
-2.4549
Time [ms]
Acceleration of impactor
Acceleration [m/s2]
-114.8217
Time [s]
Acceleration of glass element
Acceleration [m/s2]
124.5463
Time [ms]

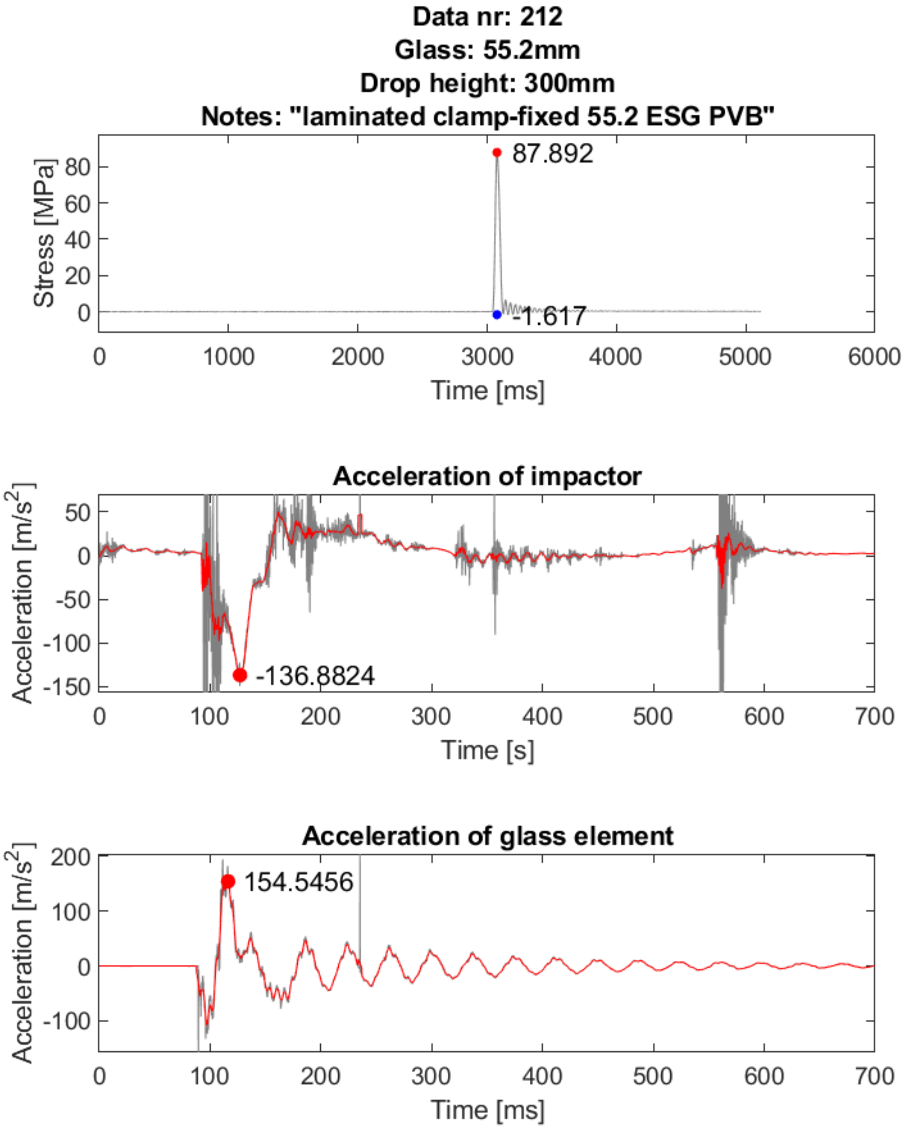

Data nr: 208
Glass: 55.2mm
Drop height: 200mm
Notes: "laminated clamp-fixed 55.2 ESG PVB"
72.282
-0.777
Stress [MPa]
Time [ms]
Acceleration of impactor
-7.5469
Acceleration [m/s^2]
Time [s]
Acceleration of glass element
14.1148
Acceleration [m/s^2]
Time [ms]

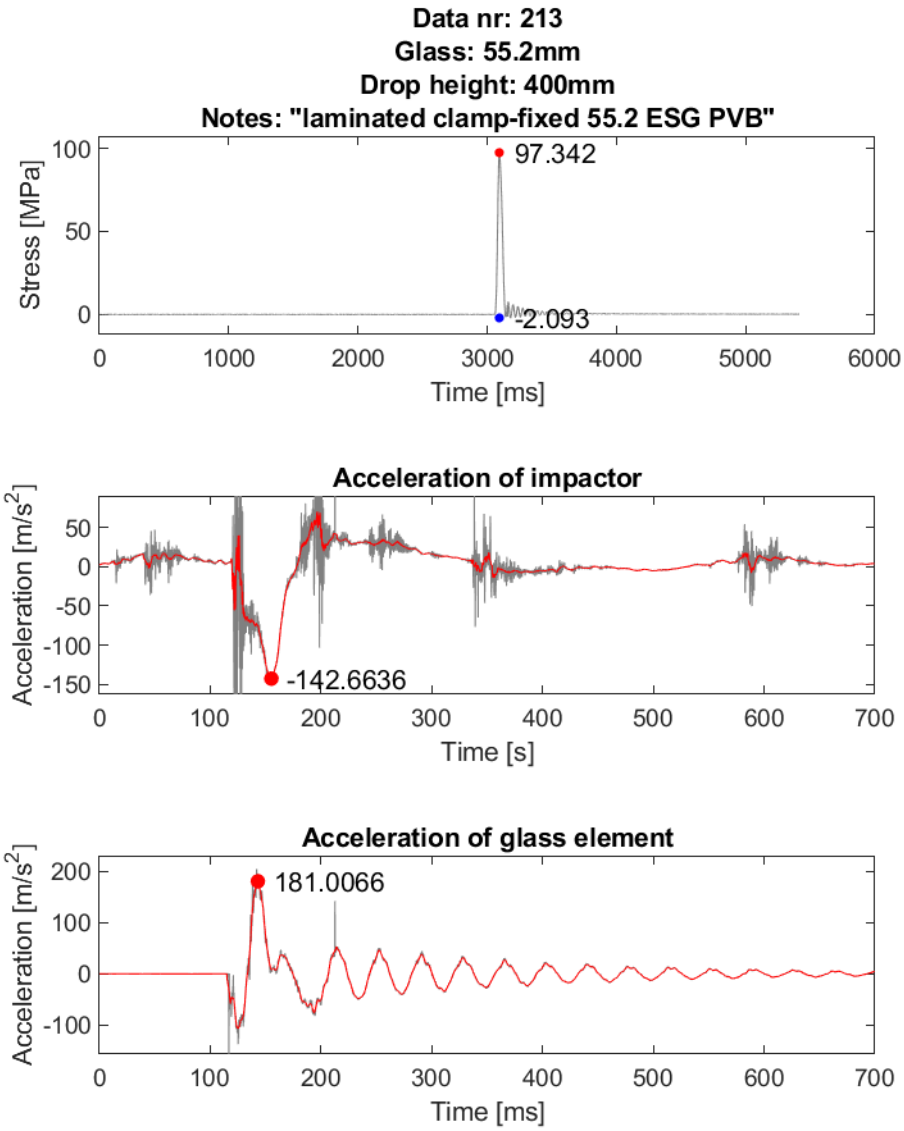

Data nr: 209
Glass: 55.2mm
Drop height: 200mm
Notes: "laminated clamp-fixed 55.2 ESG PVB"
Stress [MPa]
72.17
-1.0815
Time [ms]
Acceleration of impactor
Acceleration [m/s^2]
-112.7629
Time [s]
Acceleration of glass element
Acceleration [m/s^2]
129.3408
Time [ms]

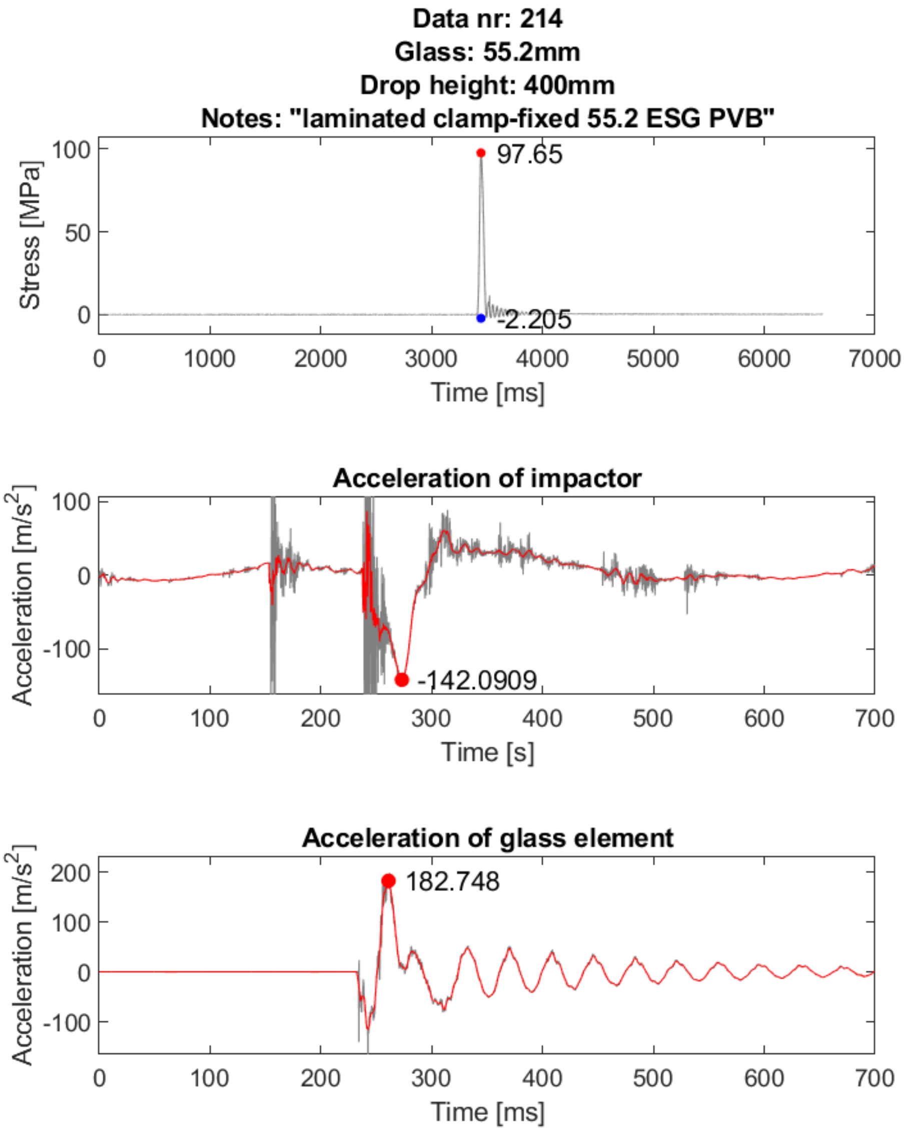

Data nr: 210
Glass: 55.2mm
Drop height: 300mm
Notes: "laminated clamp-fixed 55.2 ESG PVB"
Stress [MPa]
86.1
-1.2586
Time [ms]
Acceleration of impactor
Acceleration [m/s2]
-132.3787
Time [s]
Acceleration of glass element
Acceleration [m/s2]
142.8279
Time [ms]

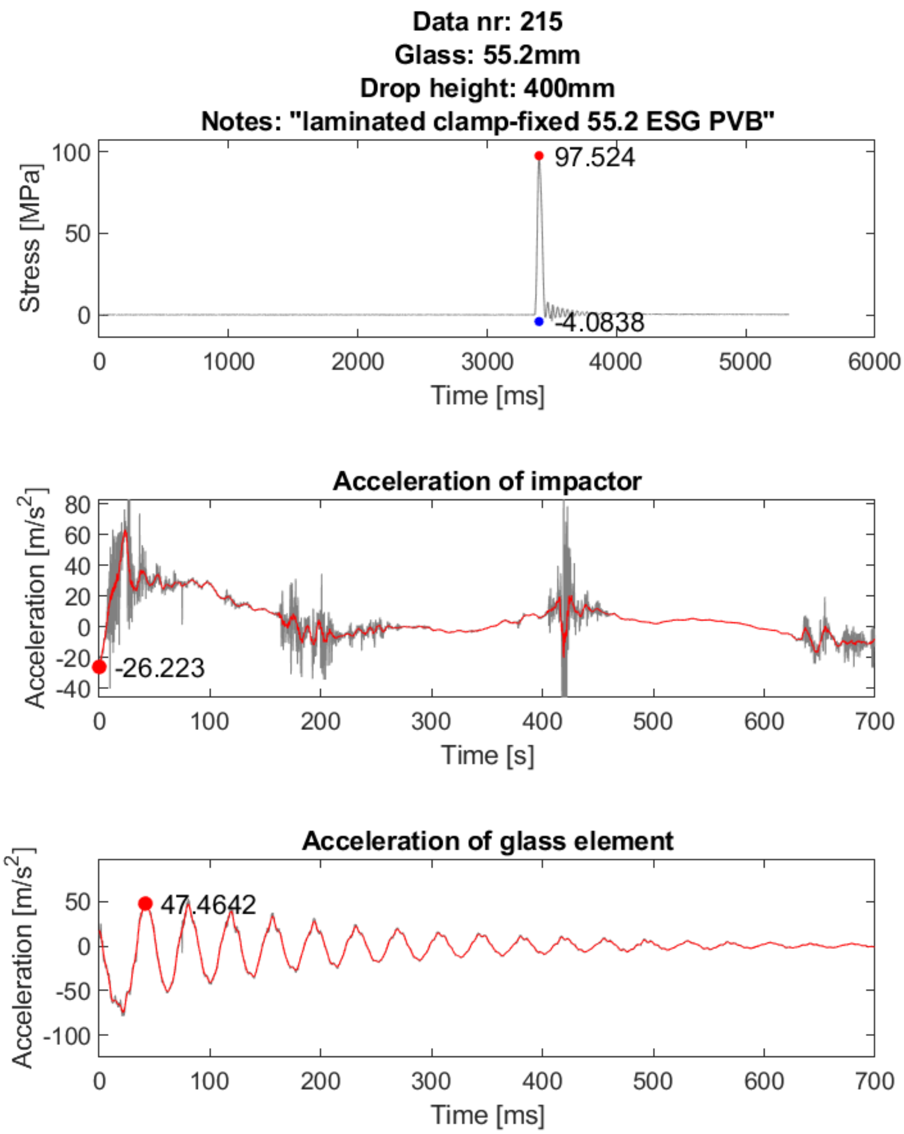


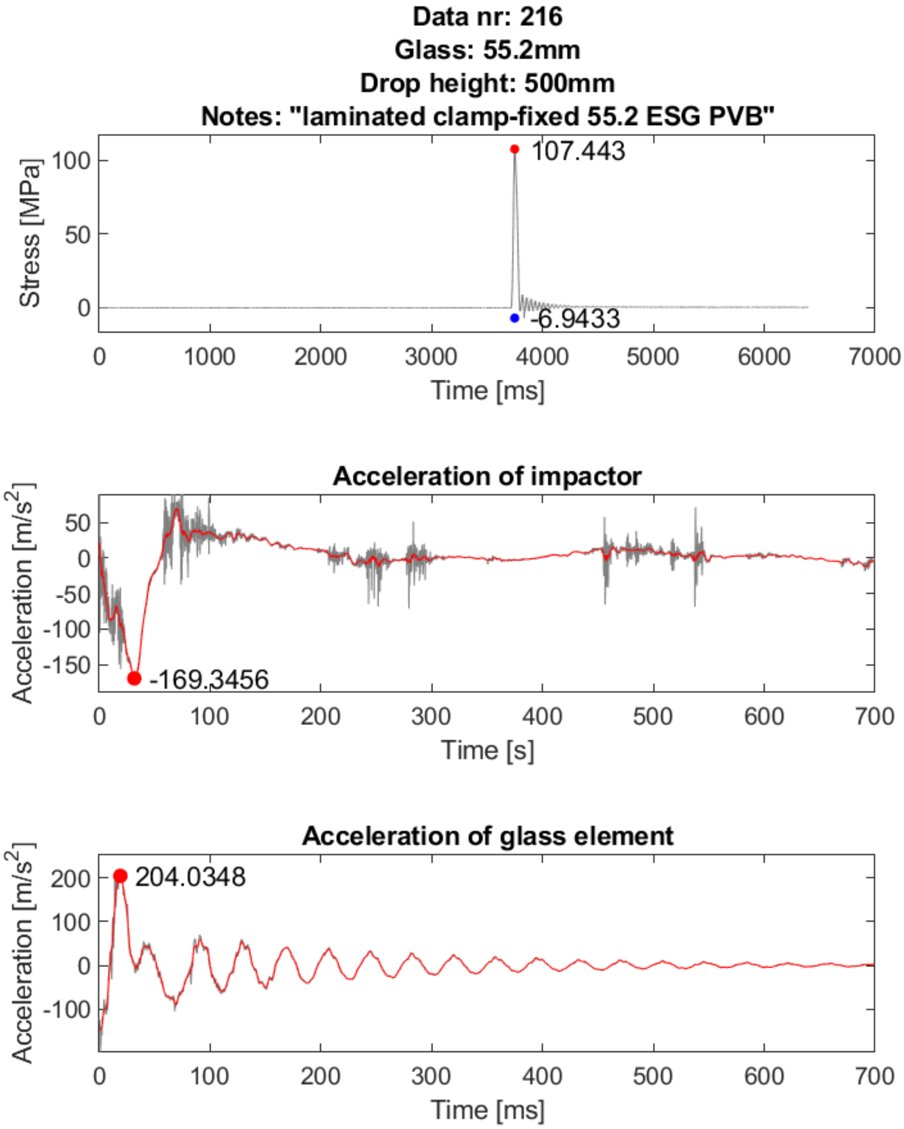
Data nr: 211
Glass: 55.2mm
Drop height: 300mm
Notes: "laminated clamp-fixed 55.2 ESG PVB"
Stress [MPa]
85.883
-1.1249
Time [ms]
Acceleration of impactor
Acceleration [m/s^2]
-122.7762
Time [s]
Acceleration of glass element
Acceleration [m/s^2]
45.4538
Time [ms]

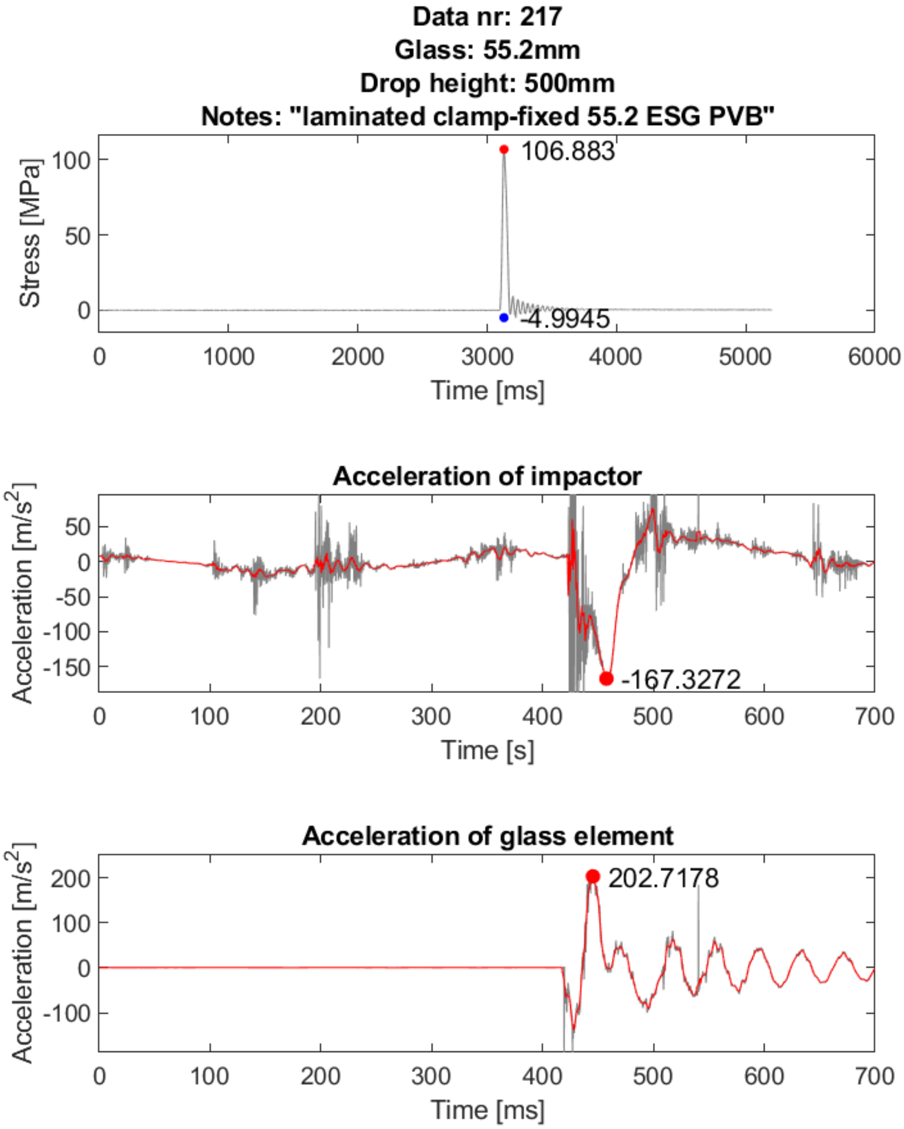

Data nr: 212
Glass: 55.2mm
Drop height: 300mm
Notes: "laminated clamp-fixed 55.2 ESG PVB"
Stress [MPa]
87.892
-1.617
Time [ms]
Acceleration of impactor
Acceleration [m/s^2]
-136.8824
Time [s]
Acceleration of glass element
Acceleration [m/s^2]
154.5456
Time [ms]


Data nr: 213
Glass: 55.2mm
Drop height: 400mm
Notes: "laminated clamp-fixed 55.2 ESG PVB"
Stress [MPa]
97.342
-2.093
Time [ms]
Acceleration of impactor
Acceleration [m/s2]
-142.6636
Time [s]
Acceleration of glass element
Acceleration [m/s2]
181.0066
Time [ms]

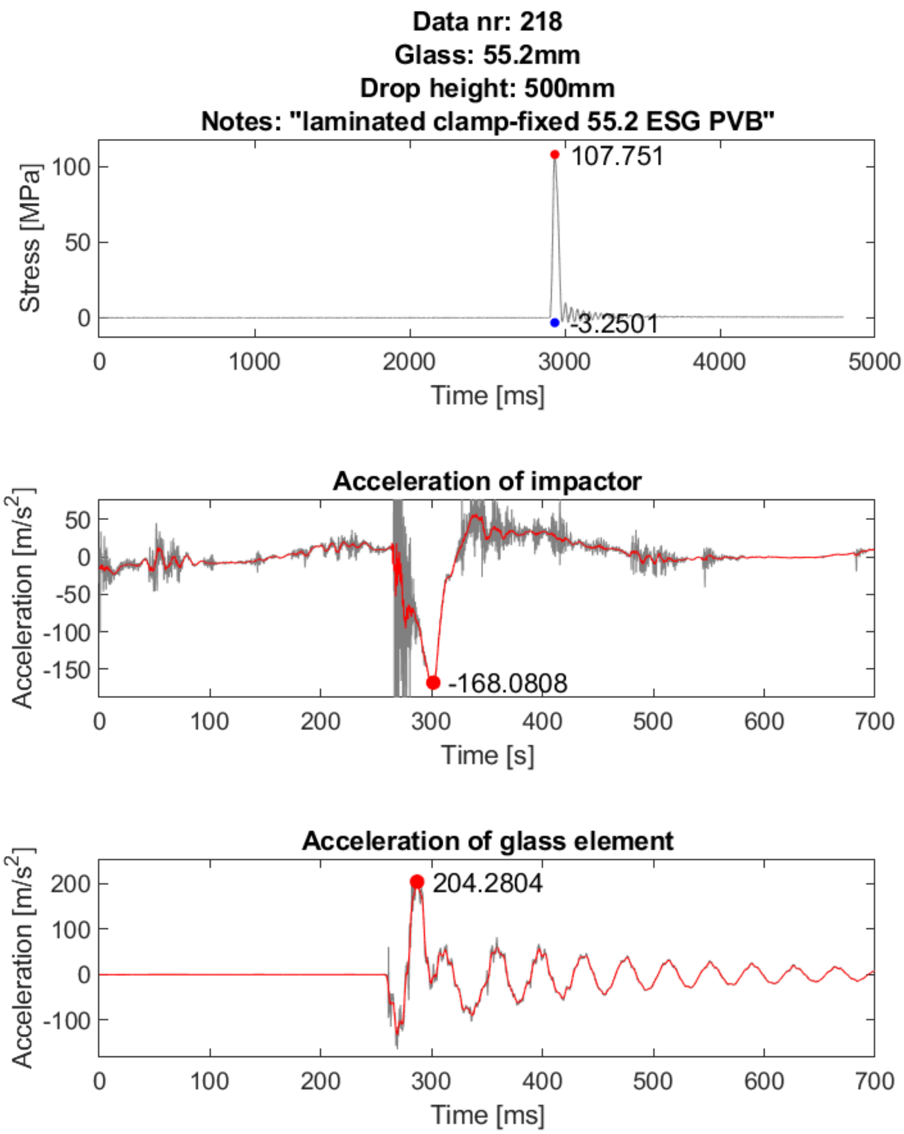

Data nr: 214
Glass: 55.2mm
Drop height: 400mm
Notes: "laminated clamp-fixed 55.2 ESG PVB"
Stress [MPa]
97.65
-2.205
Time [ms]
Acceleration of impactor
Acceleration [m/s^2]
-142.0909
Time [s]
Acceleration of glass element
Acceleration [m/s^2]
182.748
Time [ms]

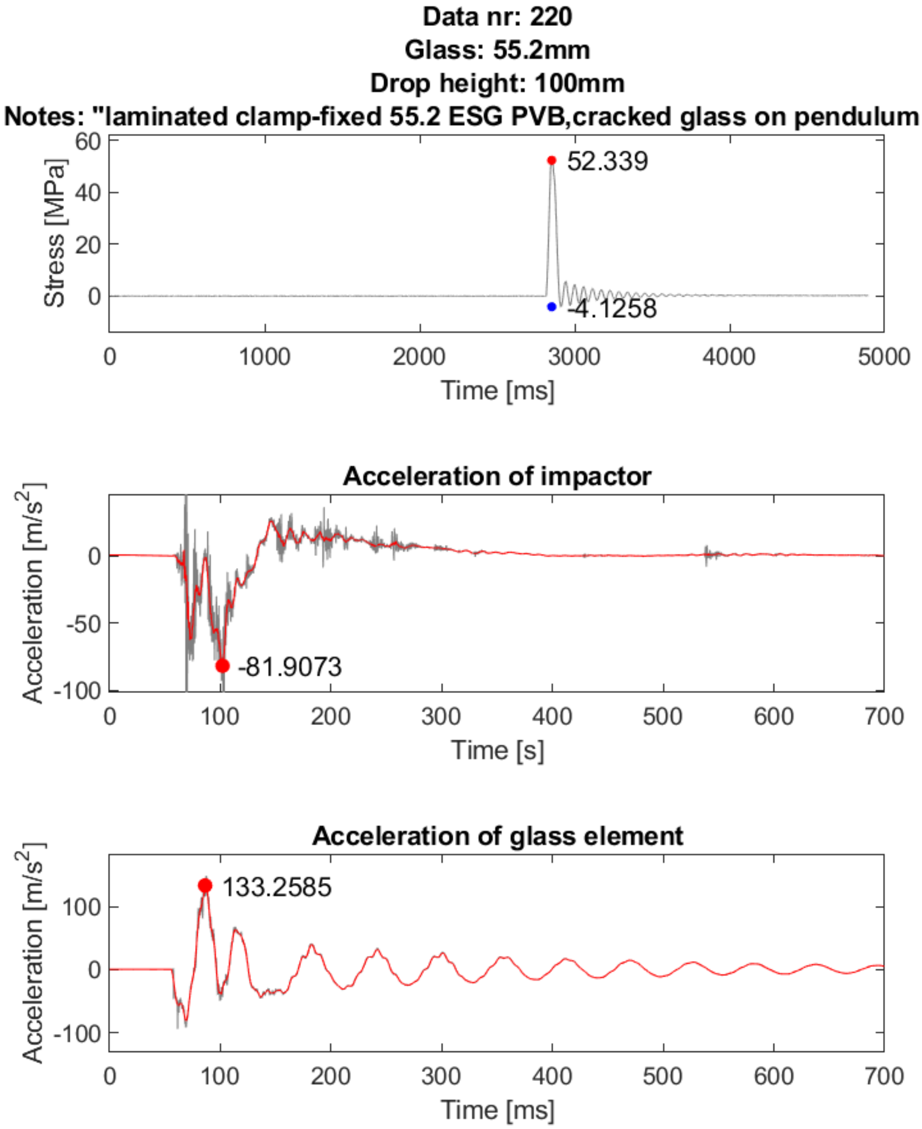

Data nr: 215
Glass: 55.2mm
Drop height: 400mm
Notes: "laminated clamp-fixed 55.2 ESG PVB"
Stress [MPa]
97.524
-4.0838
Time [ms]
Acceleration of impactor
Acceleration [m/s^2]
-26.223
Time [s]
Acceleration of glass element
Acceleration [m/s^2]
47.4642
Time [ms]

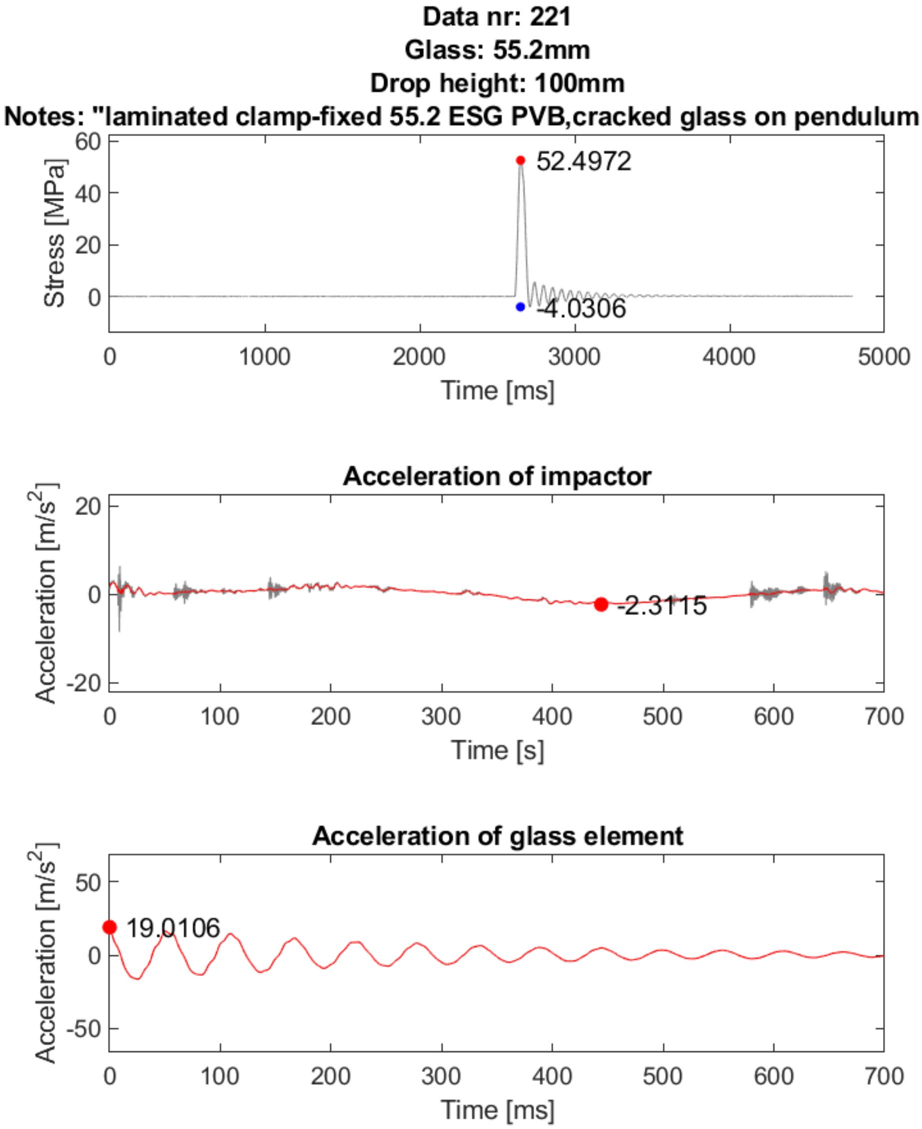

Data nr: 216
Glass: 55.2mm
Drop height: 500mm
Notes: "laminated clamp-fixed 55.2 ESG PVB"
Stress [MPa]
107.443
-6.9433
Time [ms]
Acceleration of impactor
Acceleration [m/s^2]
-169.3456
Time [s]
Acceleration of glass element
Acceleration [m/s^2]
204.0348
Time [ms]

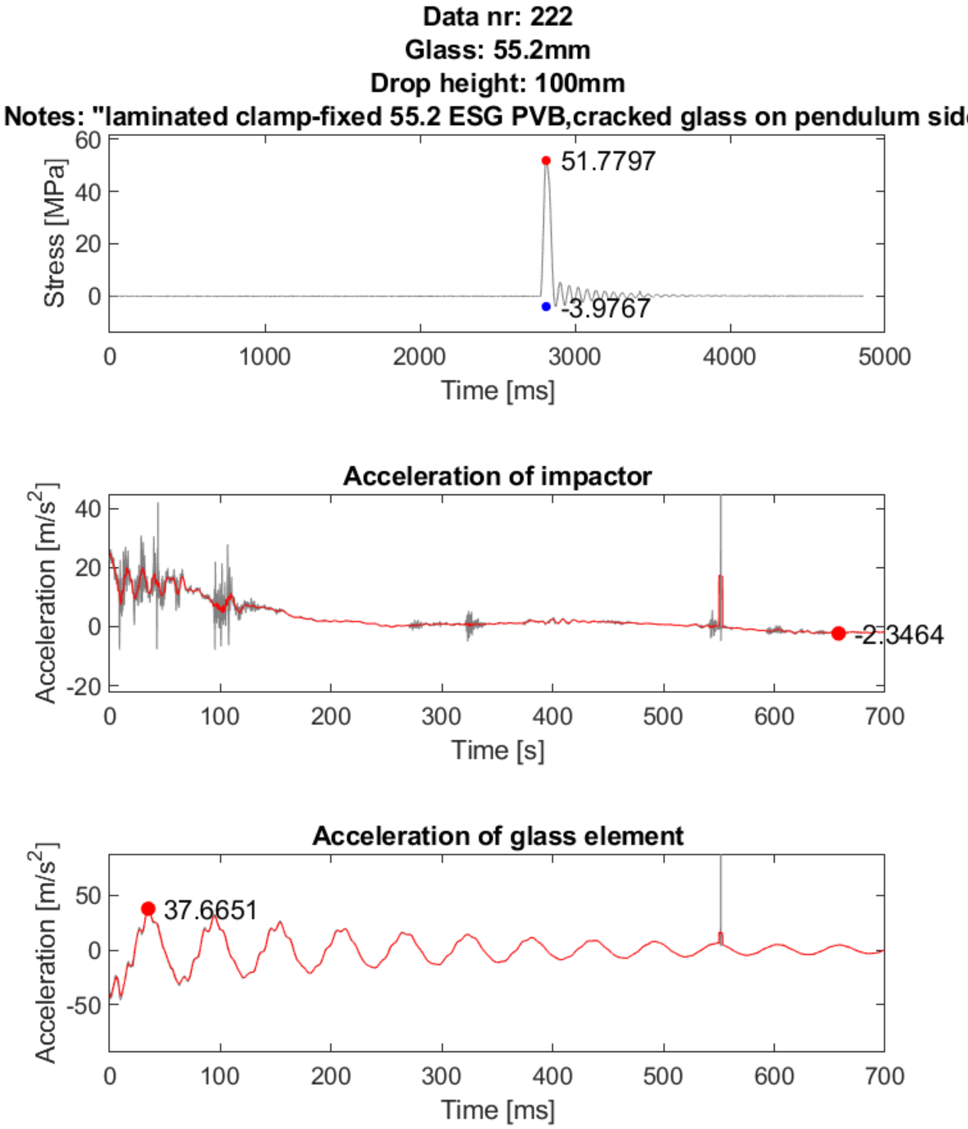


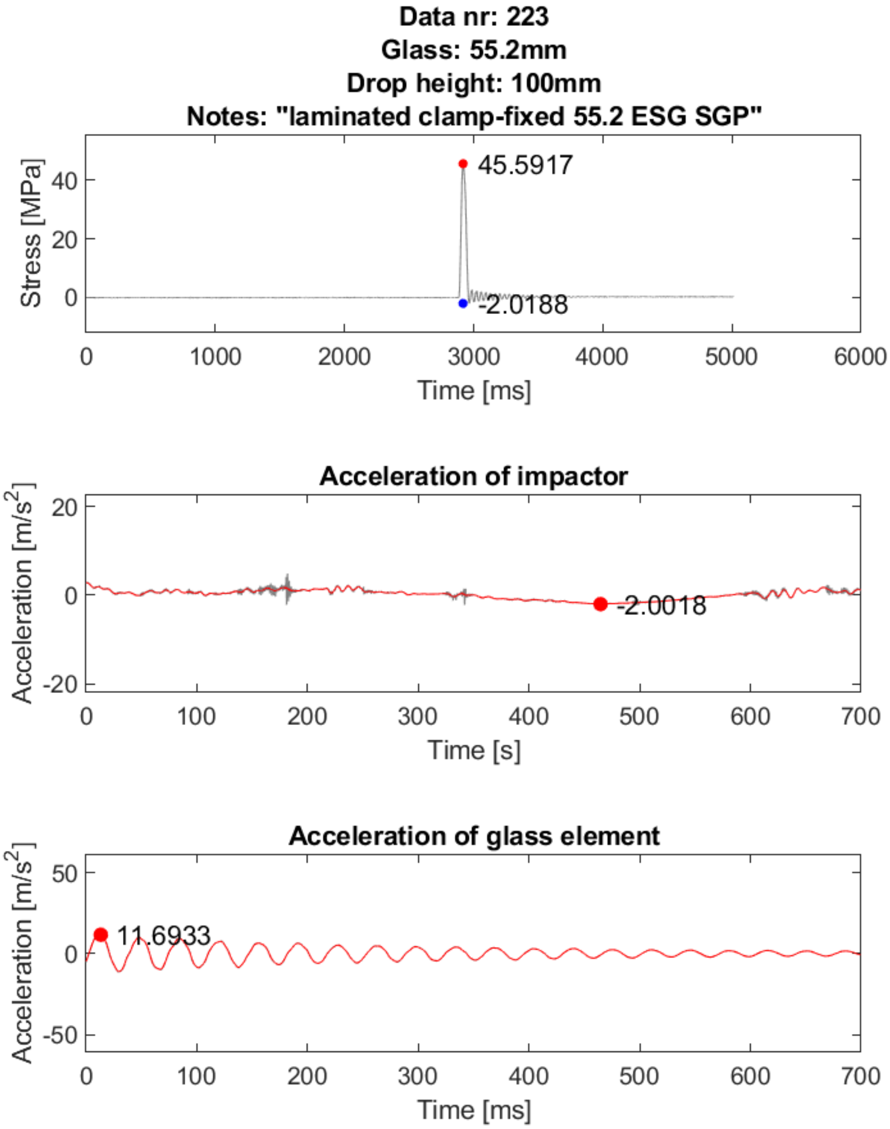
Data nr: 217
Glass: 55.2mm
Drop height: 500mm
Notes: "laminated clamp-fixed 55.2 ESG PVB"
Stress [MPa]
106.883
-4.9945
Time [ms]
Acceleration of impactor
Acceleration [m/s^2]
-167.3272
Time [s]
Acceleration of glass element
Acceleration [m/s^2]
202.7178
Time [ms]

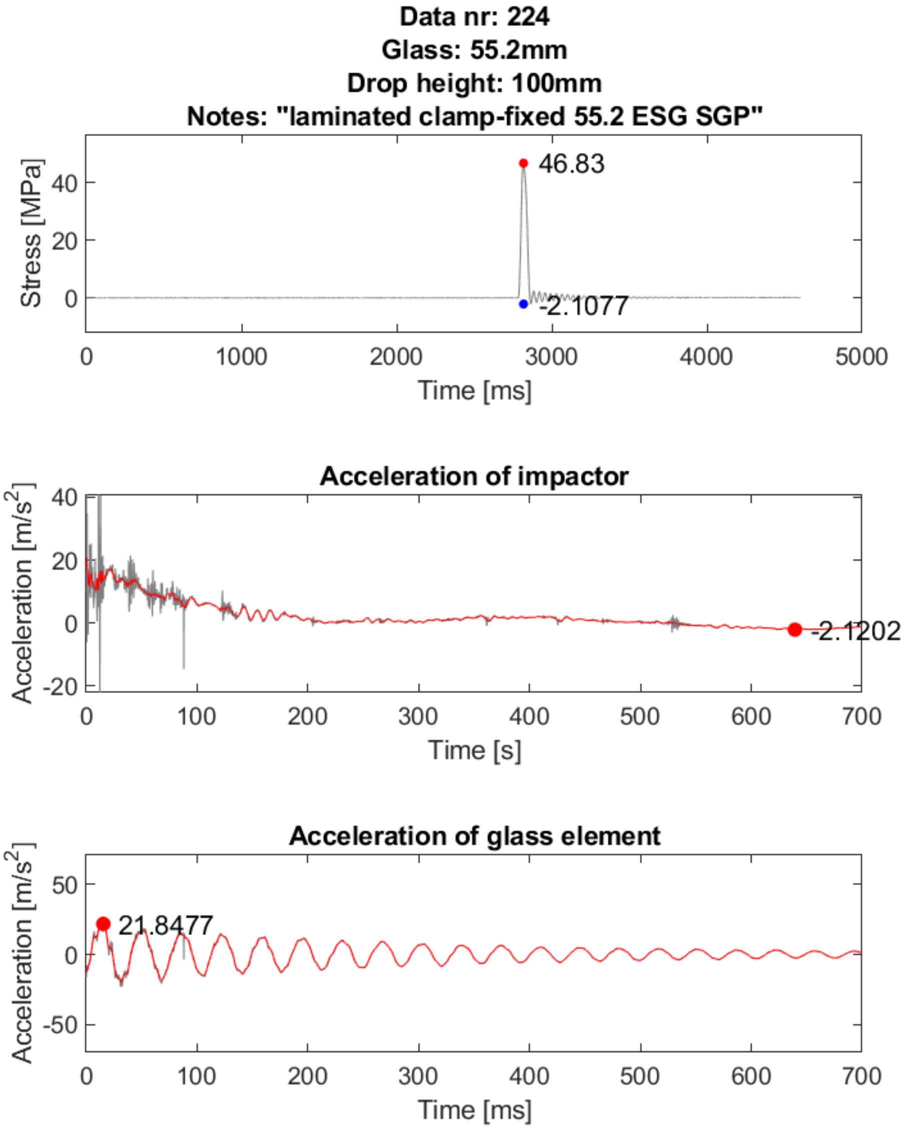

Data nr: 218
Glass: 55.2mm
Drop height: 500mm
Notes: "laminated clamp-fixed 55.2 ESG PVB"
Stress [MPa]
107.751
-3.2501
0
50
100
0
1000
2000
3000
4000
5000
Time [ms]
Acceleration of impactor
Acceleration [m/s2]
-168.0808
50
0
-50
-100
-150
0
100
200
300
400
500
600
700
Time [s]
Acceleration of glass element
Acceleration [m/s2]
204.2804
200
100
0
-100
0
100
200
300
400
500
600
700
Time [ms]

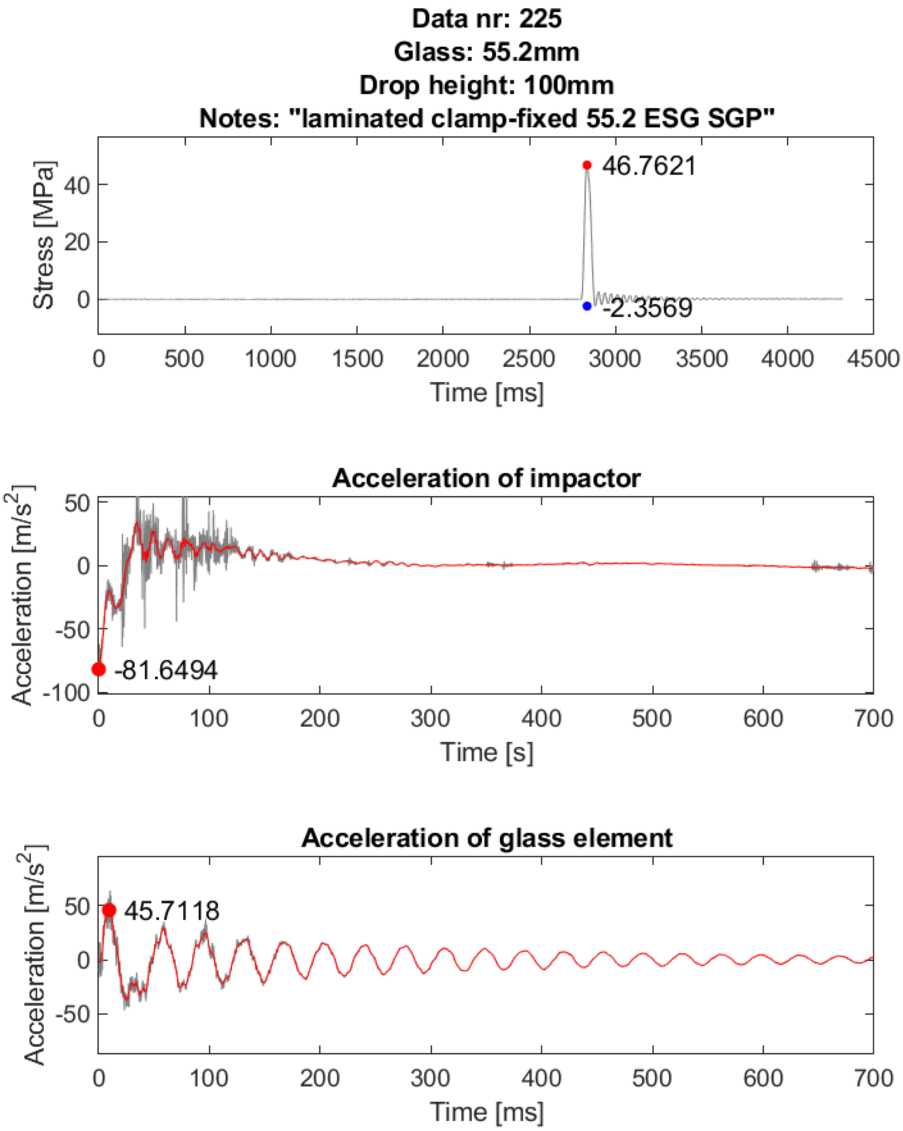

Data nr: 220
Glass: 55.2mm
Drop height: 100mm
Notes: "laminated clamp-fixed 55.2 ESG PVB,cracked glass on pendulum side
Stress [MPa]
52.339
-4.1258
Time [ms]
Acceleration of impactor
Acceleration [m/s2]
-81.9073
Time [s]
Acceleration of glass element
Acceleration [m/s2]
133.2585
Time [ms]


Data nr: 221
Glass: 55.2mm
Drop height: 100mm
Notes: "laminated clamp-fixed 55.2 ESG PVB,cracked glass on pendulum side
Stress [MPa]
52.4972
-4.0306
Time [ms]
Acceleration of impactor
Acceleration [m/s^2]
-2.3115
Time [s]
Acceleration of glass element
Acceleration [m/s^2]
19.0106
Time [ms]

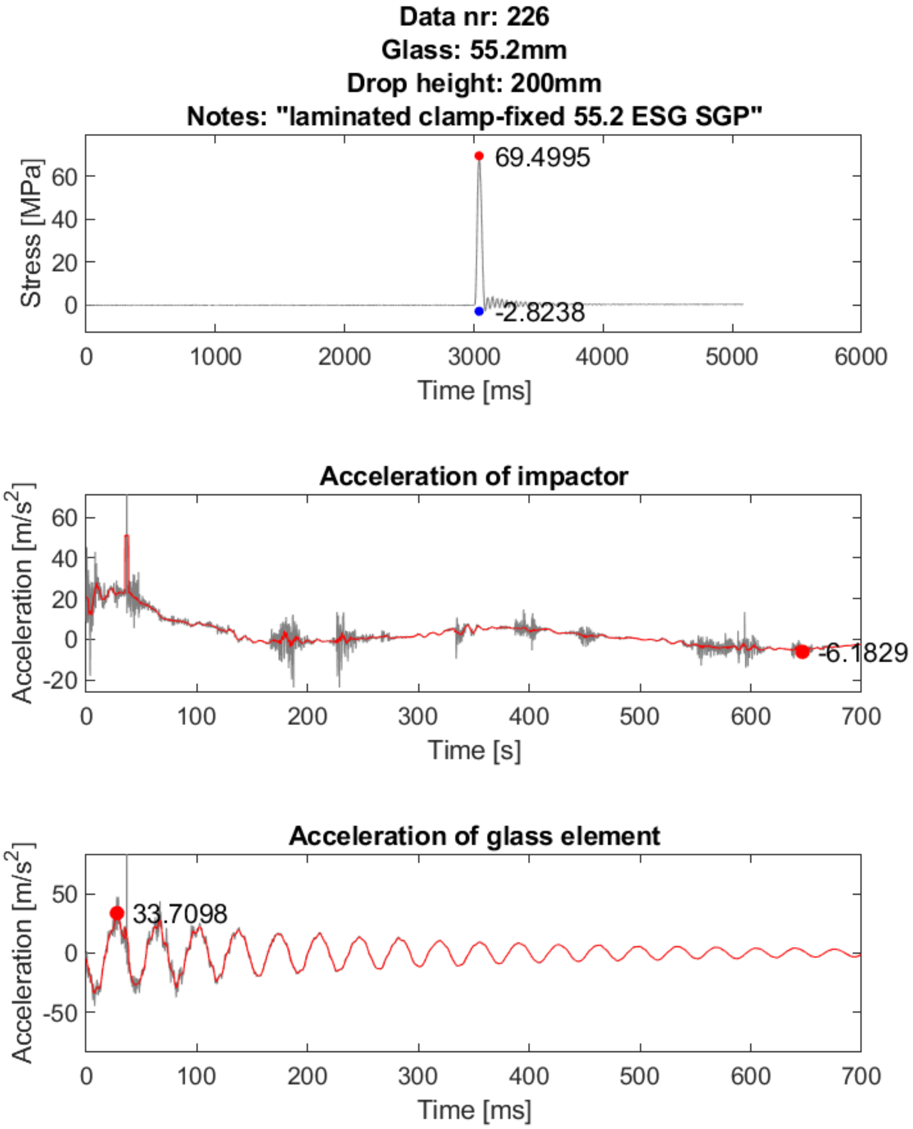

Data nr: 222
Glass: 55.2mm
Drop height: 100mm
Notes: "laminated clamp-fixed 55.2 ESG PVB,cracked glass on pendulum side
Stress [MPa]
51.7797
-3.9767
Time [ms]
Acceleration of impactor
Acceleration [m/s^2]
-2.3464
Time [s]
Acceleration of glass element
Acceleration [m/s^2]
37.6651
Time [ms]

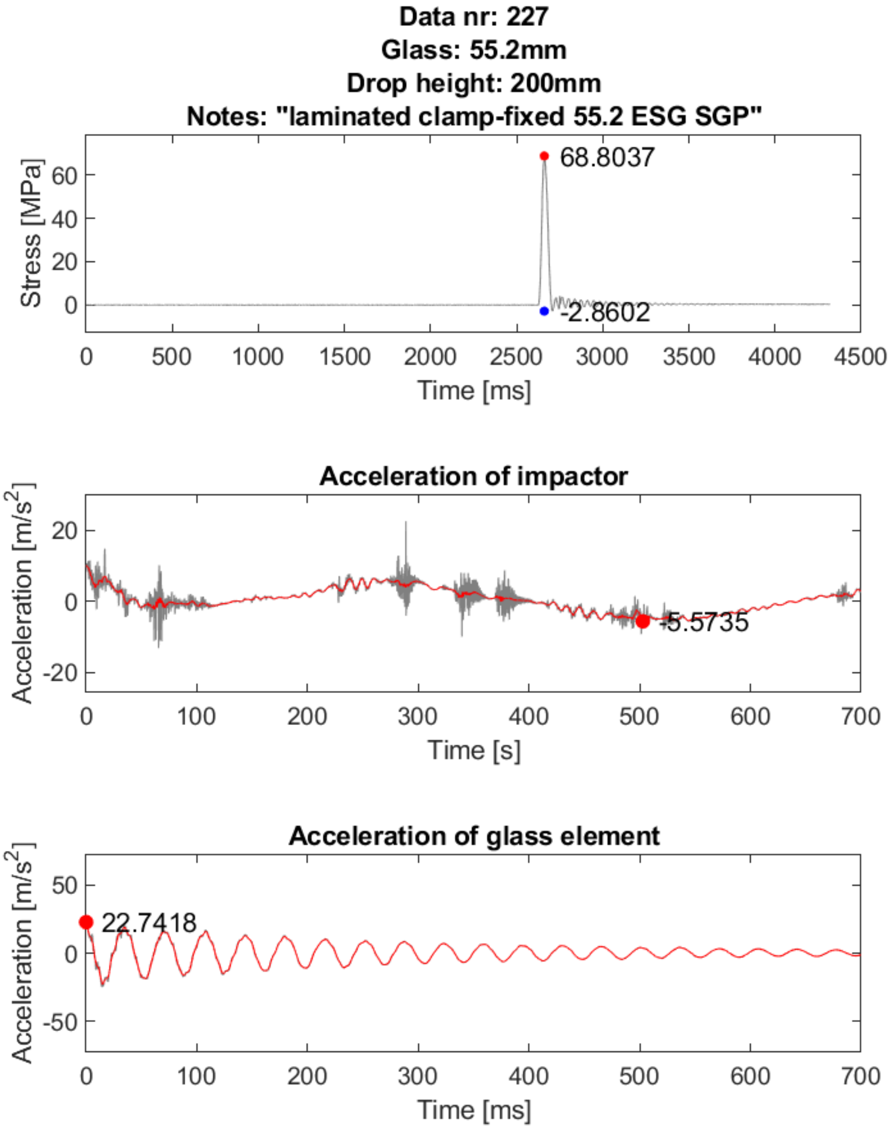

Data nr: 223
Glass: 55.2mm
Drop height: 100mm
Notes: "laminated clamp-fixed 55.2 ESG SGP"
Stress [MPa]
45.5917
-2.0188
Time [ms]
Acceleration of impactor
Acceleration [m/s^2]
-2.0018
Time [s]
Acceleration of glass element
Acceleration [m/s^2]
11.6933
Time [ms]


Data nr: 224
Glass: 55.2mm
Drop height: 100mm
Notes: "laminated clamp-fixed 55.2 ESG SGP"
Stress [MPa]
46.83
-2.1077
Time [ms]
Acceleration of impactor
Acceleration [m/s^2]
-2.1202
Time [s]
Acceleration of glass element
Acceleration [m/s^2]
21.8477
Time [ms]

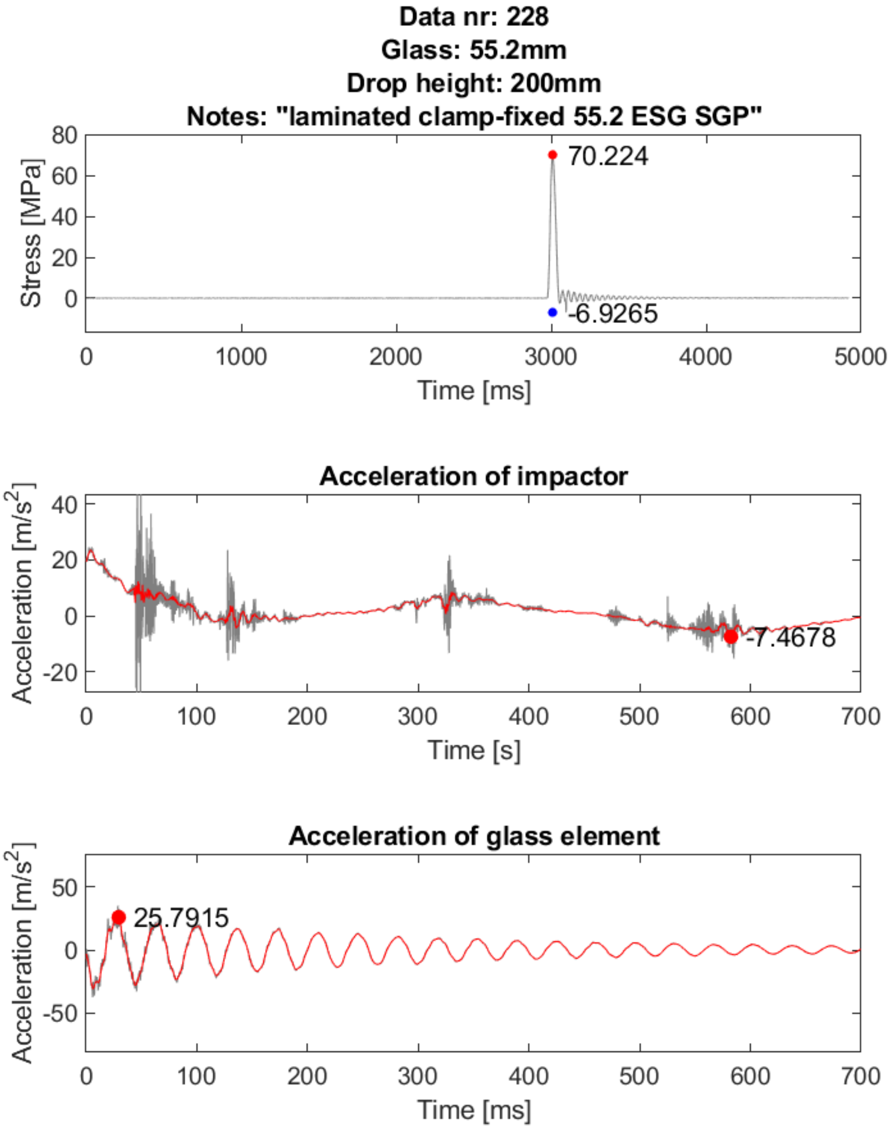


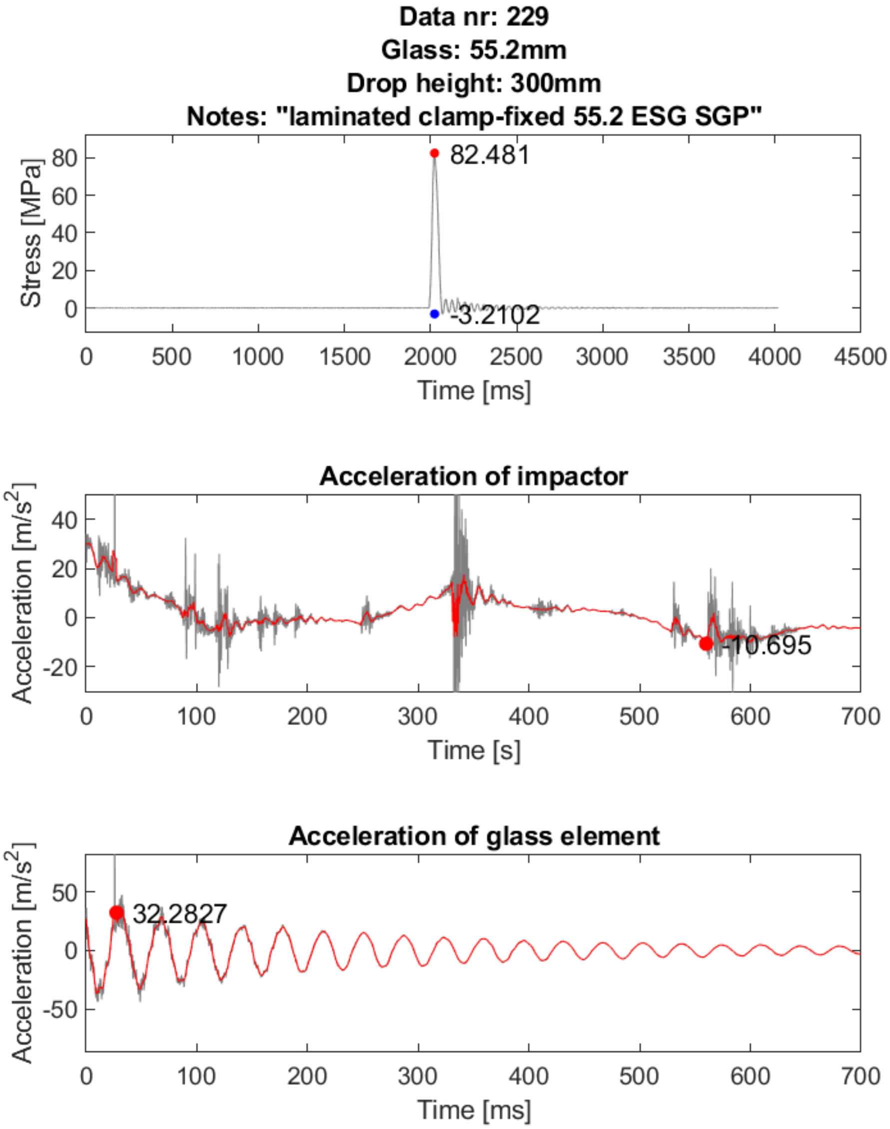
Data nr: 225
Glass: 55.2mm
Drop height: 100mm
Notes: "laminated clamp-fixed 55.2 ESG SGP"
Stress [MPa]
46.7621
-2.3569
Time [ms]
Acceleration of impactor
Acceleration [m/s^2]
-81.6494
Time [s]
Acceleration of glass element
Acceleration [m/s^2]
45.7118
Time [ms]


Data nr: 226
Glass: 55.2mm
Drop height: 200mm
Notes: "laminated clamp-fixed 55.2 ESG SGP"
69.4995
-2.8238
Stress [MPa]
Time [ms]
Acceleration of impactor
-6.1829
Acceleration [m/s^2]
Time [s]
Acceleration of glass element
33.7098
Acceleration [m/s^2]
Time [ms]



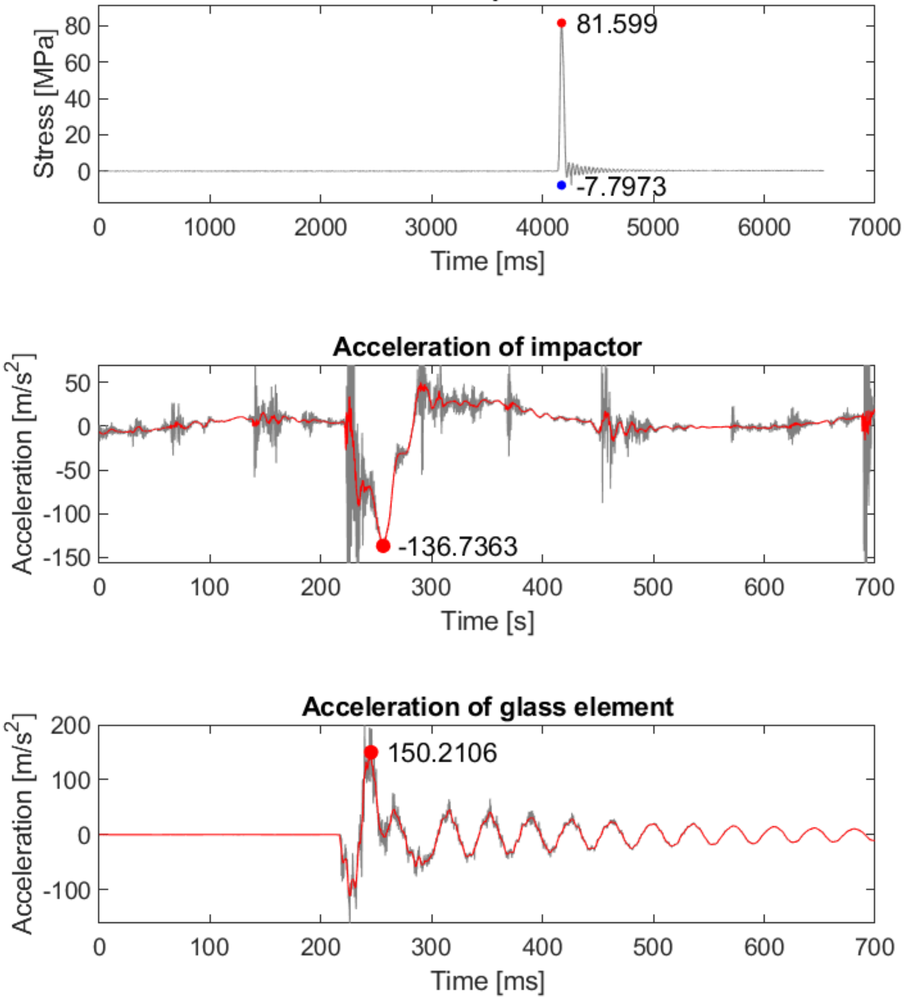
Data nr: 227
Glass: 55.2mm
Drop height: 200mm
Notes: "laminated clamp-fixed 55.2 ESG SGP"
Stress [MPa]
68.8037
-2.8602
Time [ms]
Acceleration of impactor
Acceleration [m/s^2]
-5.5735
Time [s]
Acceleration of glass element
Acceleration [m/s^2]
22.7418
Time [ms]

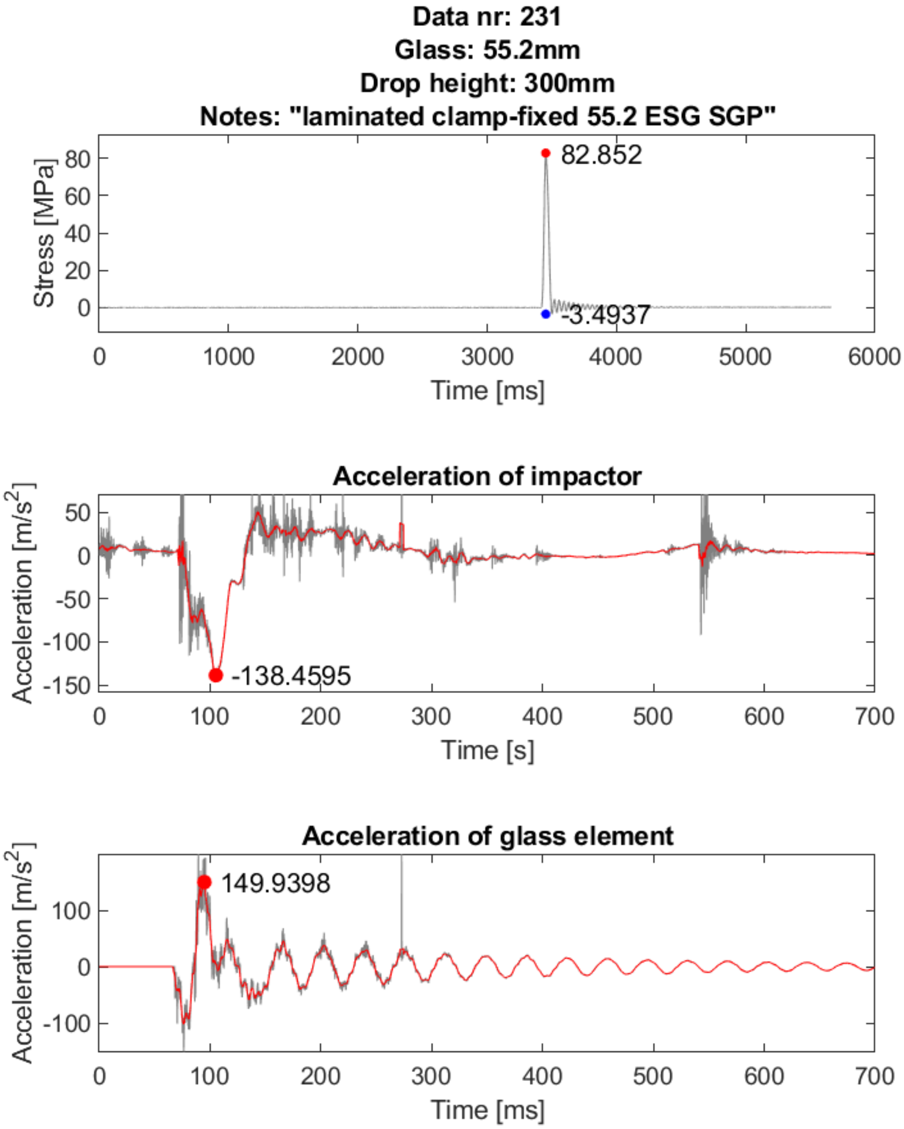

Data nr: 228
Glass: 55.2mm
Drop height: 200mm
Notes: "laminated clamp-fixed 55.2 ESG SGP"
Stress [MPa]
70.224
-6.9265
Time [ms]
Acceleration of impactor
Acceleration [m/s2]
-7.4678
Time [s]
Acceleration of glass element
Acceleration [m/s2]
25.7915
Time [ms]



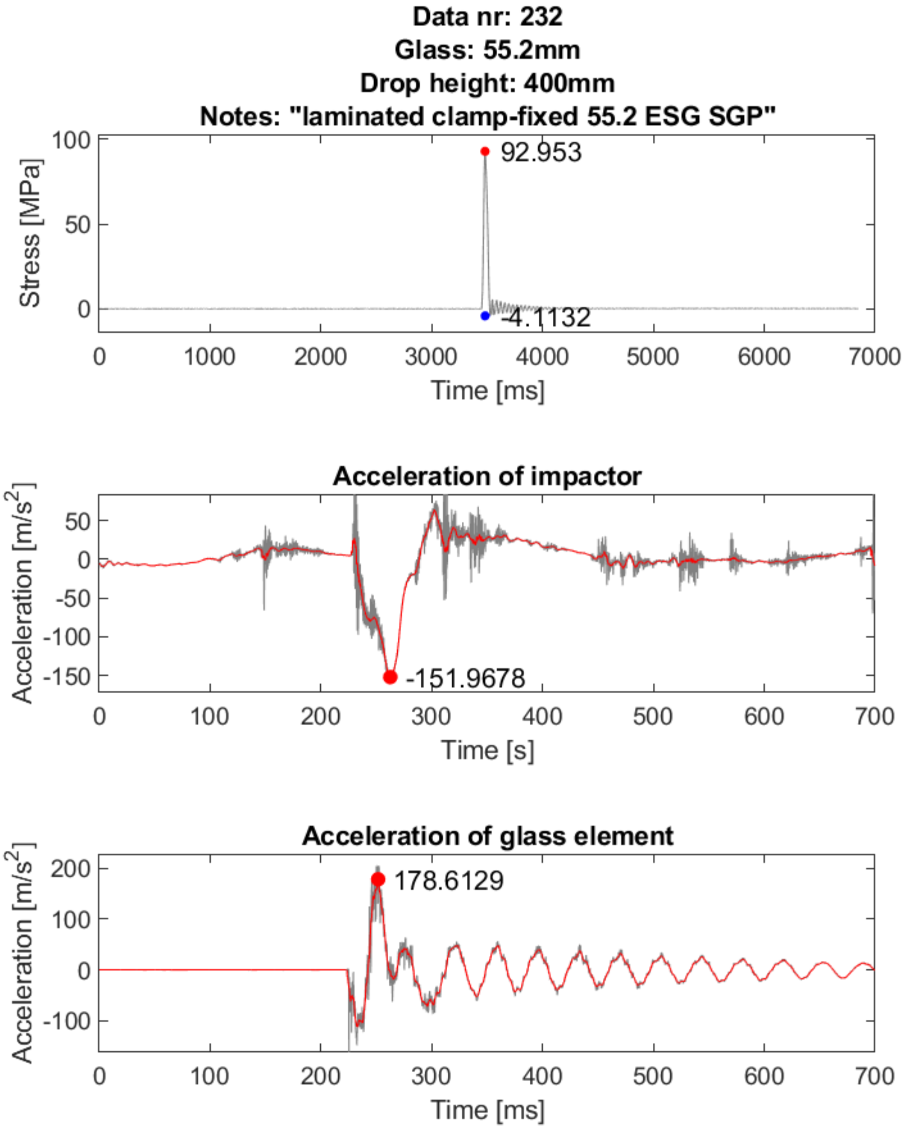
Data nr: 229
Glass: 55.2mm
Drop height: 300mm
Notes: "laminated clamp-fixed 55.2 ESG SGP"
Stress [MPa]
82.481
-3.2102
Time [ms]
Acceleration of impactor
Acceleration [m/s^2]
-10.695
Time [s]
Acceleration of glass element
Acceleration [m/s^2]
32.2827
Time [ms]

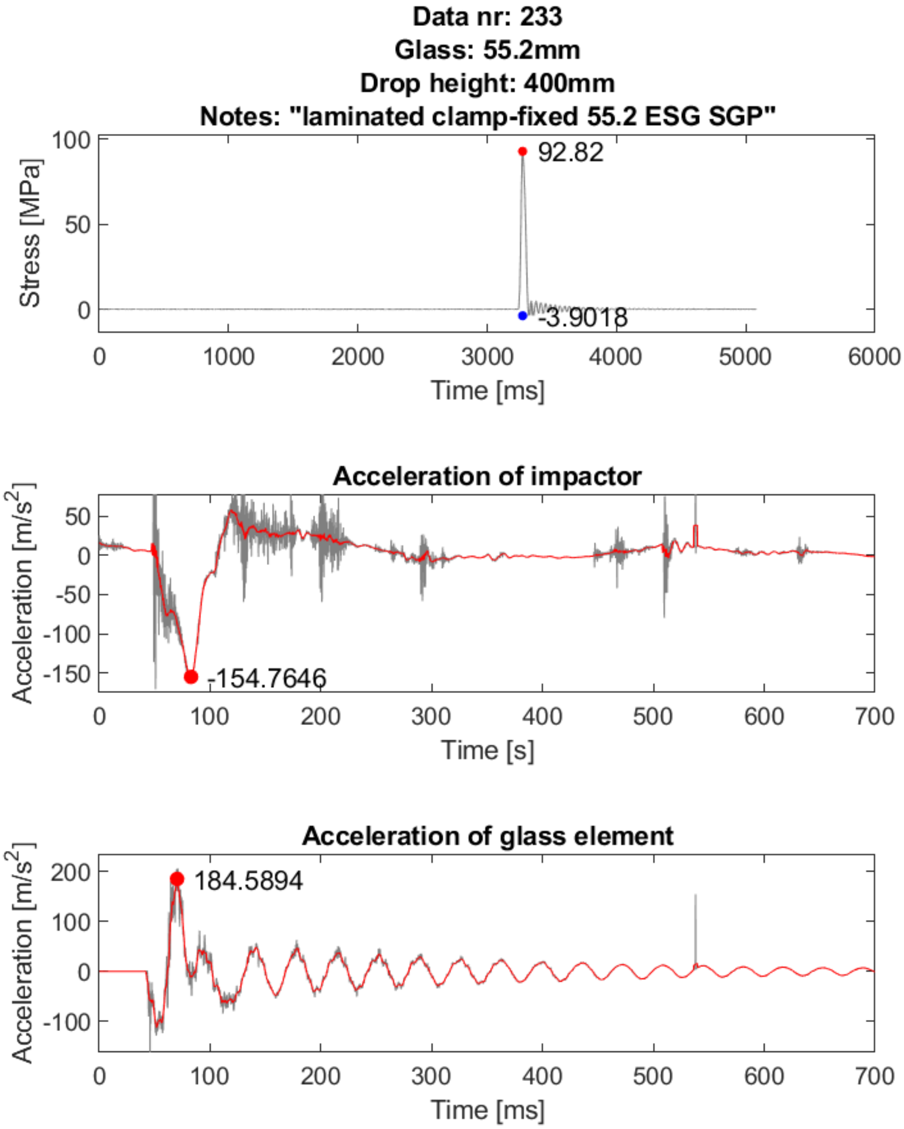
Data nr: 230
Glass: 55.2mm
Drop height: 300mm
Notes: "laminated clamp-fixed 55.2 ESG SGP"

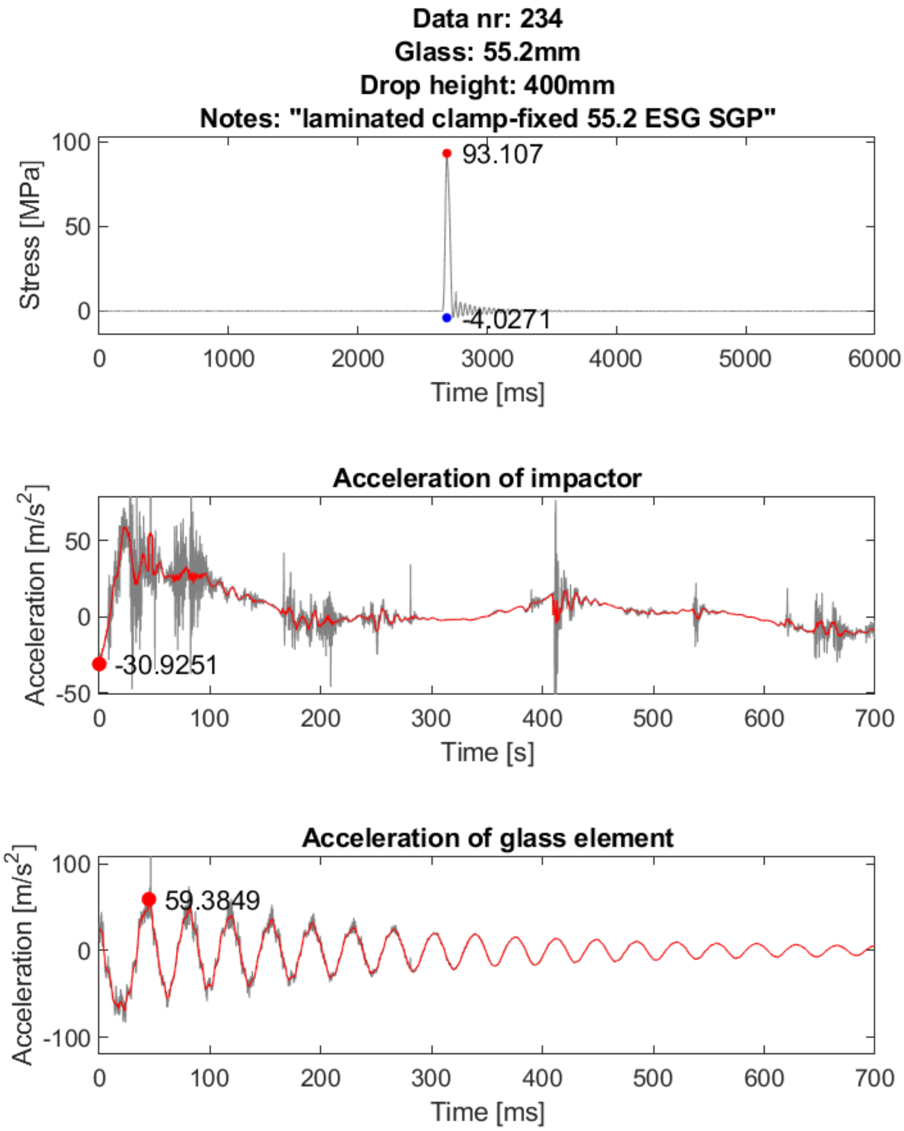


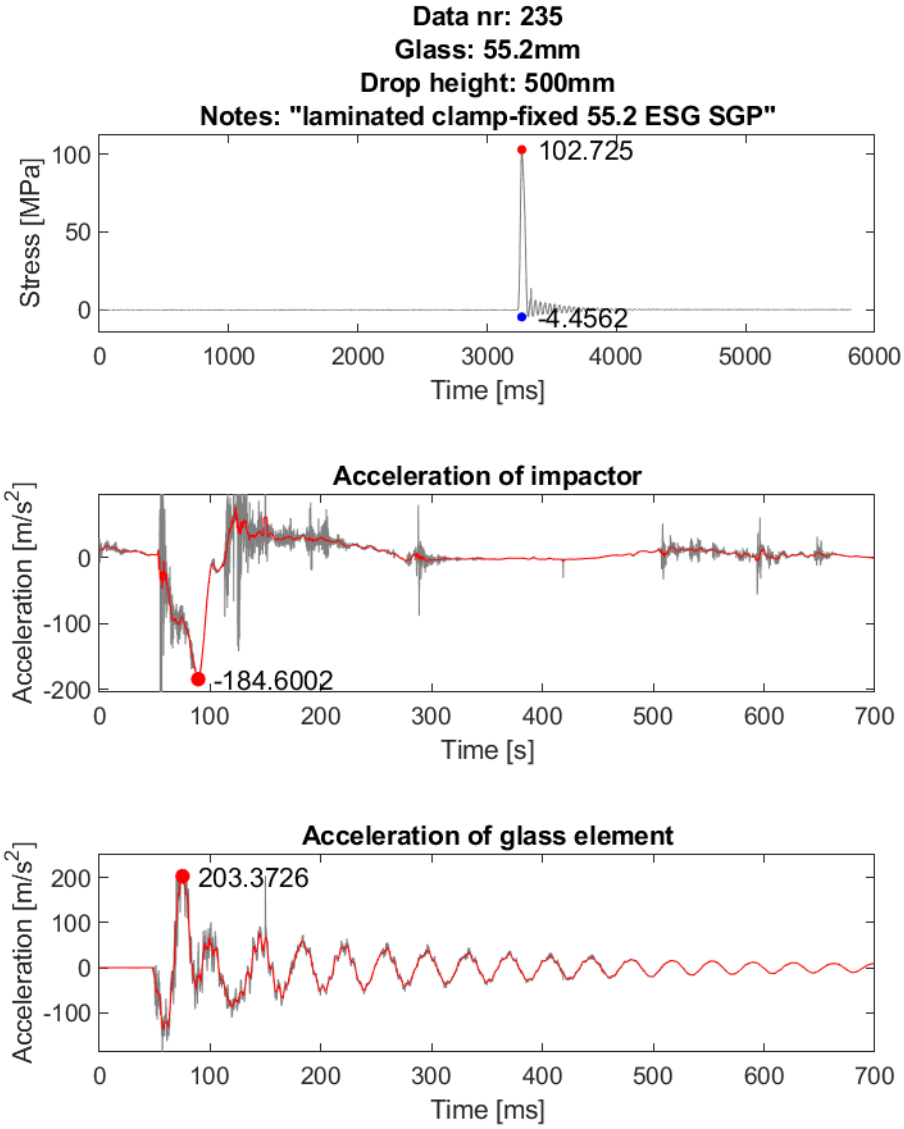


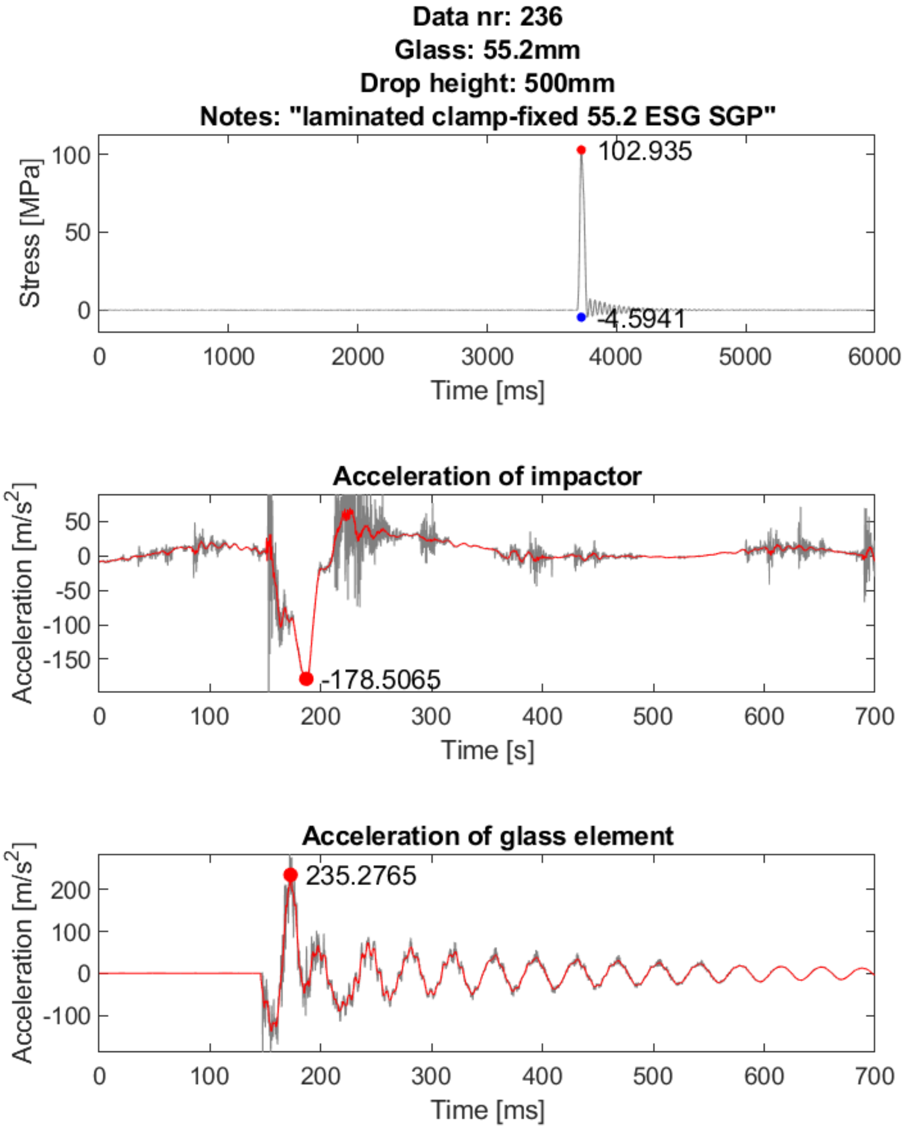
Data nr: 231
Glass: 55.2mm
Drop height: 300mm
Notes: "laminated clamp-fixed 55.2 ESG SGP"
Stress [MPa]
82.852
-3.4937
Time [ms]
Acceleration of impactor
Acceleration [m/s^2]
-138.4595
Time [s]
Acceleration of glass element
Acceleration [m/s^2]
149.9398
Time [ms]

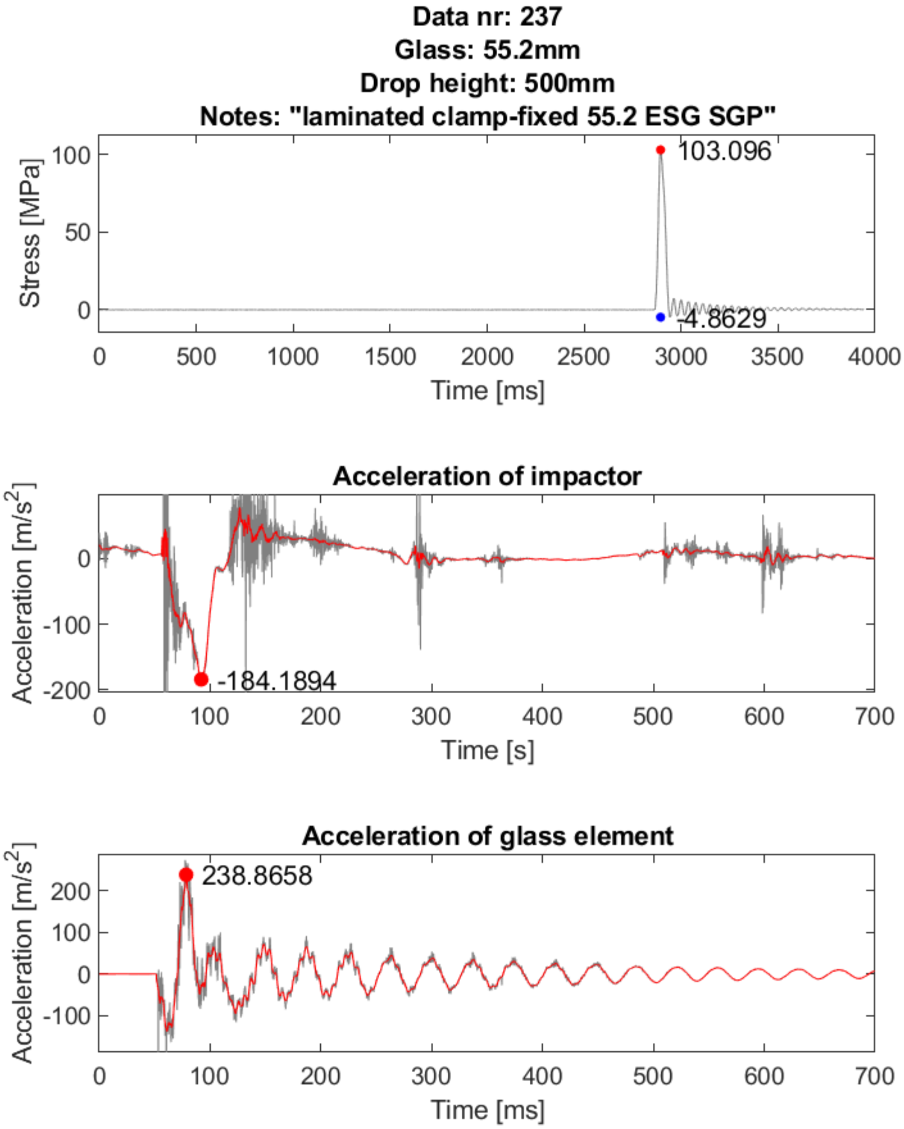

Data nr: 232
Glass: 55.2mm
Drop height: 400mm
Notes: "laminated clamp-fixed 55.2 ESG SGP"
Stress [MPa]
92.953
-4.1132
Time [ms]
Acceleration of impactor
Acceleration [m/s2]
-151.9678
Time [s]
Acceleration of glass element
Acceleration [m/s2]
178.6129
Time [ms]

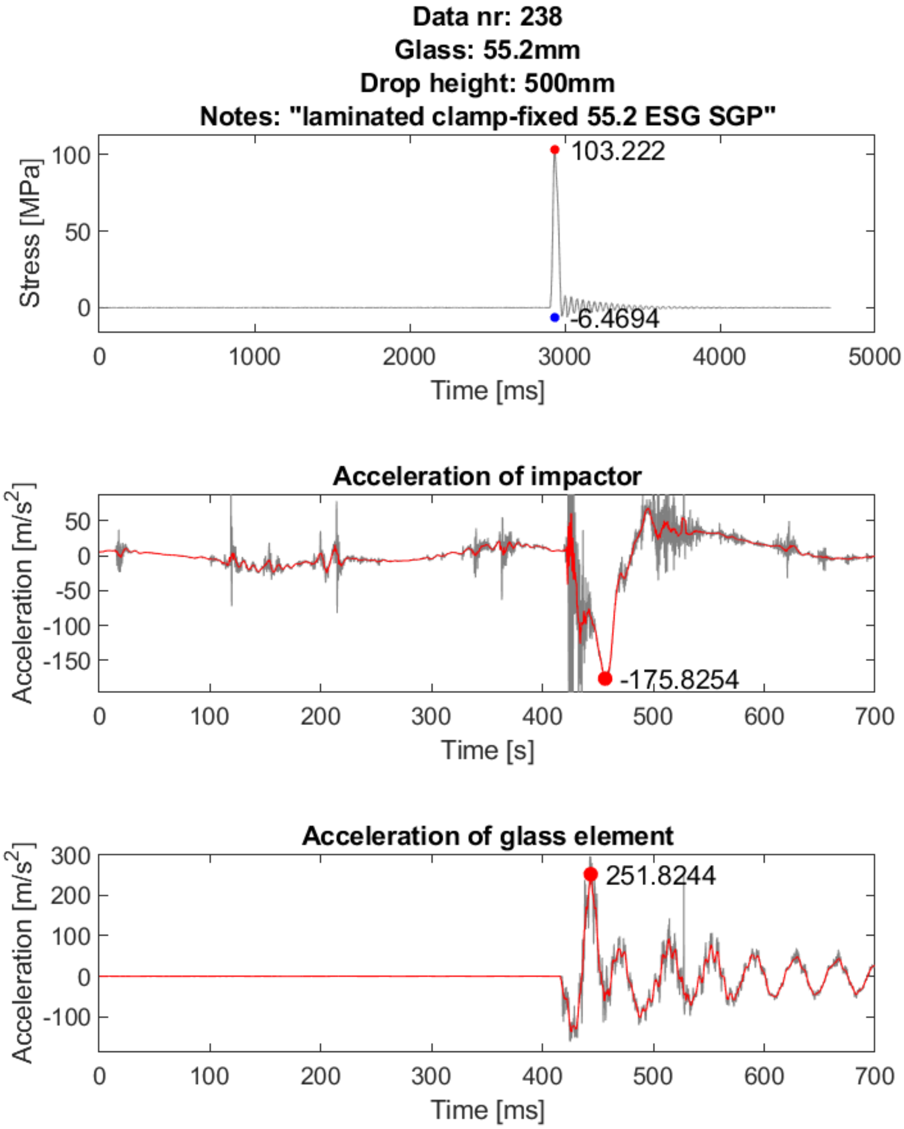

Data nr: 233
Glass: 55.2mm
Drop height: 400mm
Notes: "laminated clamp-fixed 55.2 ESG SGP"
Stress [MPa]
92.82
-3.9018
Time [ms]
Acceleration of impactor
Acceleration [m/s²]
-154.7646
Time [s]
Acceleration of glass element
Acceleration [m/s²]
184.5894
Time [ms]

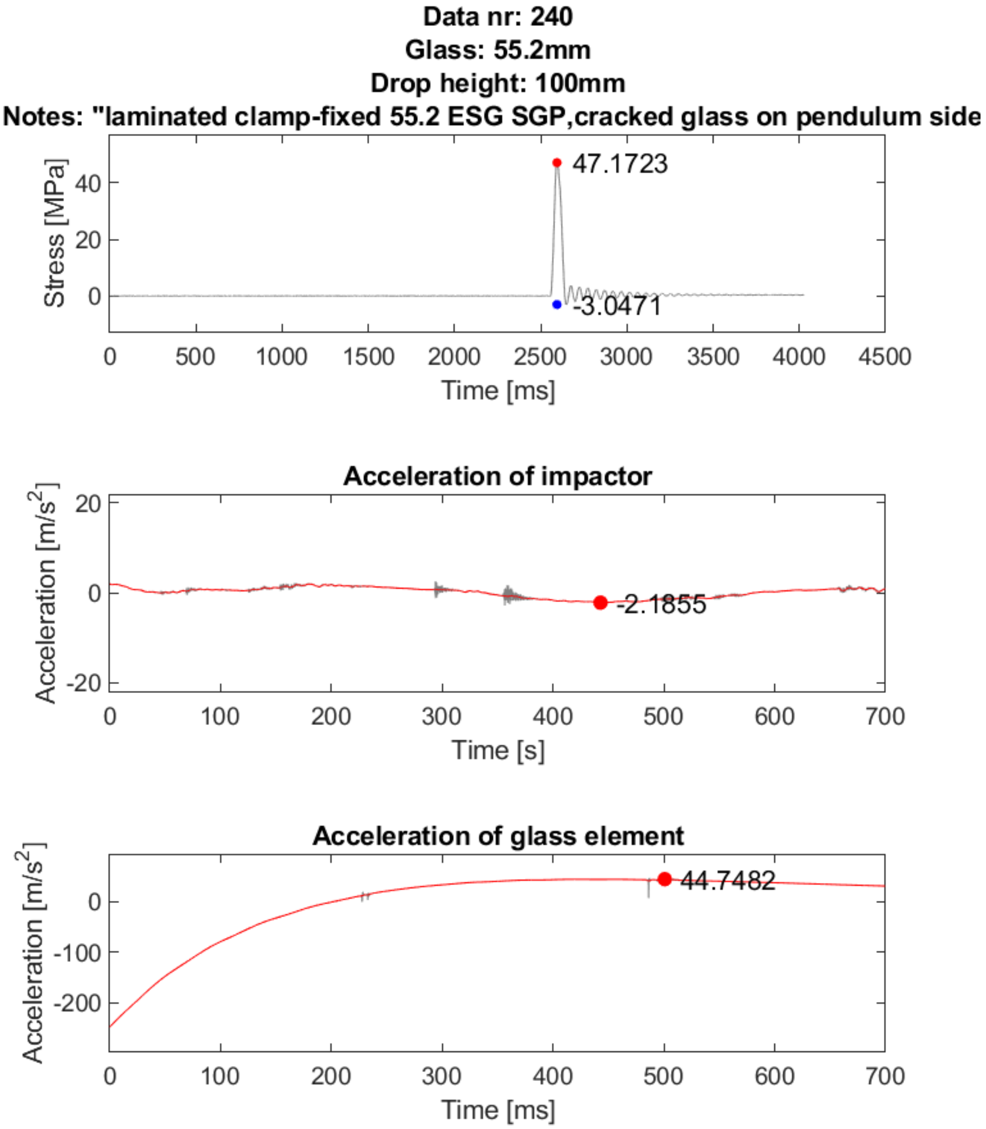

Data nr: 234
Glass: 55.2mm
Drop height: 400mm
Notes: "laminated clamp-fixed 55.2 ESG SGP"
Stress [MPa]
93.107
-4.0271
Time [ms]
Acceleration of impactor
Acceleration [m/s^2]
-30.9251
Time [s]
Acceleration of glass element
Acceleration [m/s^2]
59.3849
Time [ms]


Data nr: 235
Glass: 55.2mm
Drop height: 500mm
Notes: "laminated clamp-fixed 55.2 ESG SGP"
Stress [MPa]
102.725
-4.4562
Time [ms]
Acceleration of impactor
Acceleration [m/s^2]
-184.6002
Time [s]
Acceleration of glass element
Acceleration [m/s^2]
203.3726
Time [ms]

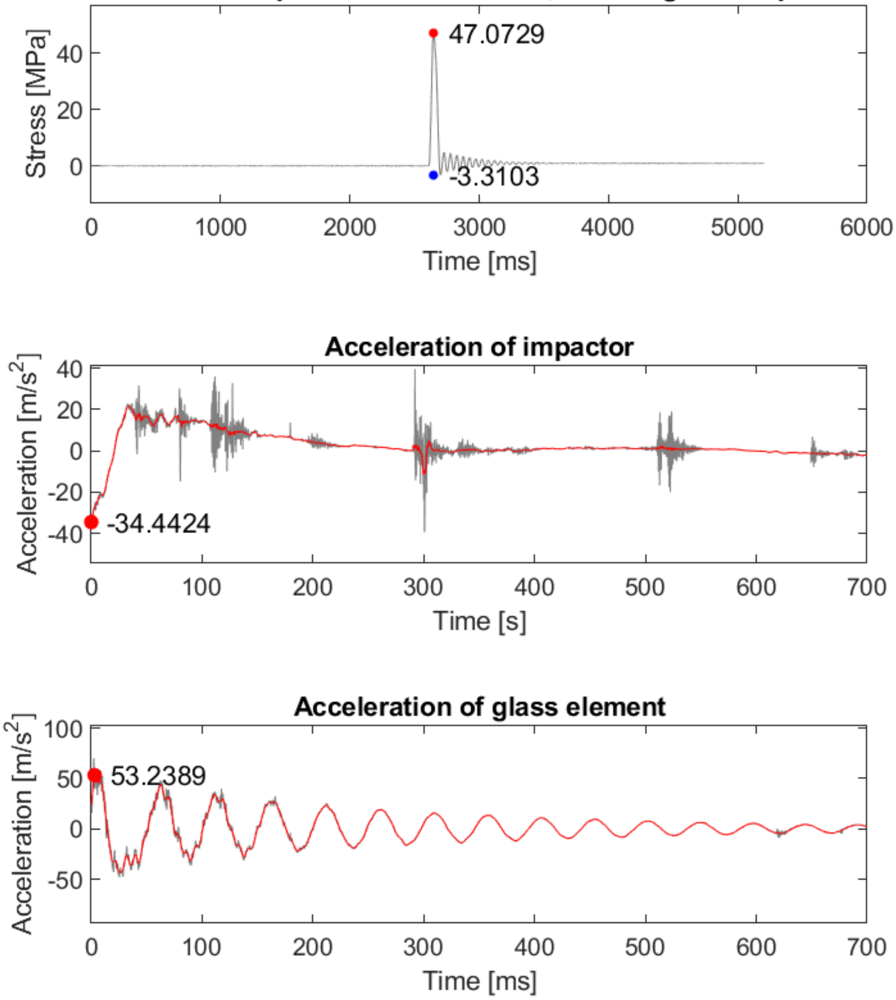

Data nr: 236
Glass: 55.2mm
Drop height: 500mm
Notes: "laminated clamp-fixed 55.2 ESG SGP"
Stress [MPa]
102.935
-4.5941
Time [ms]
Acceleration of impactor
Acceleration [m/s^2]
-178.5065
Time [s]
Acceleration of glass element
Acceleration [m/s^2]
235.2765
Time [ms]

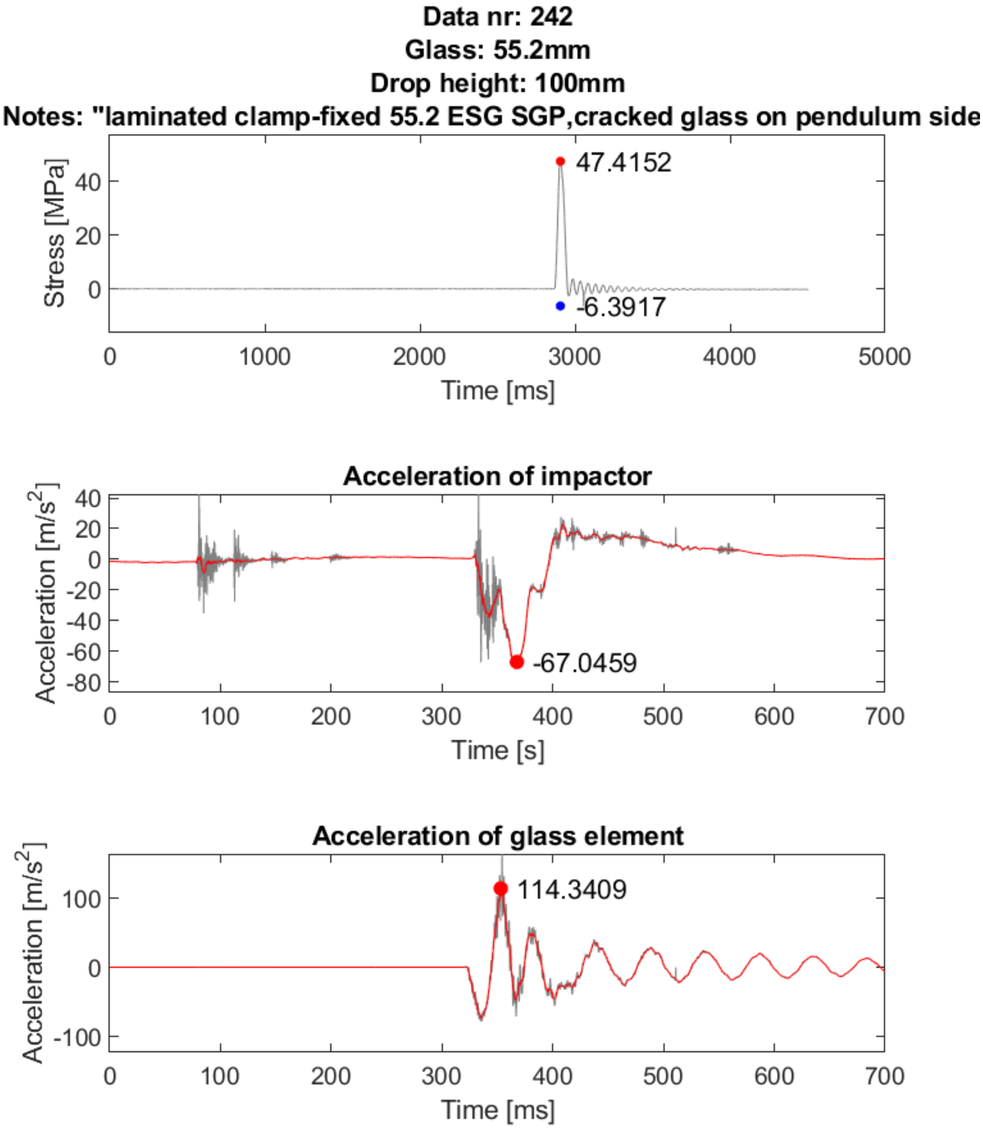

Data nr: 237
Glass: 55.2mm
Drop height: 500mm
Notes: "laminated clamp-fixed 55.2 ESG SGP"
Stress [MPa]
103.096
-4.8629
Time [ms]
Acceleration of impactor
Acceleration [m/s^2]
-184.1894
Time [s]
Acceleration of glass element
Acceleration [m/s^2]
238.8658
Time [ms]

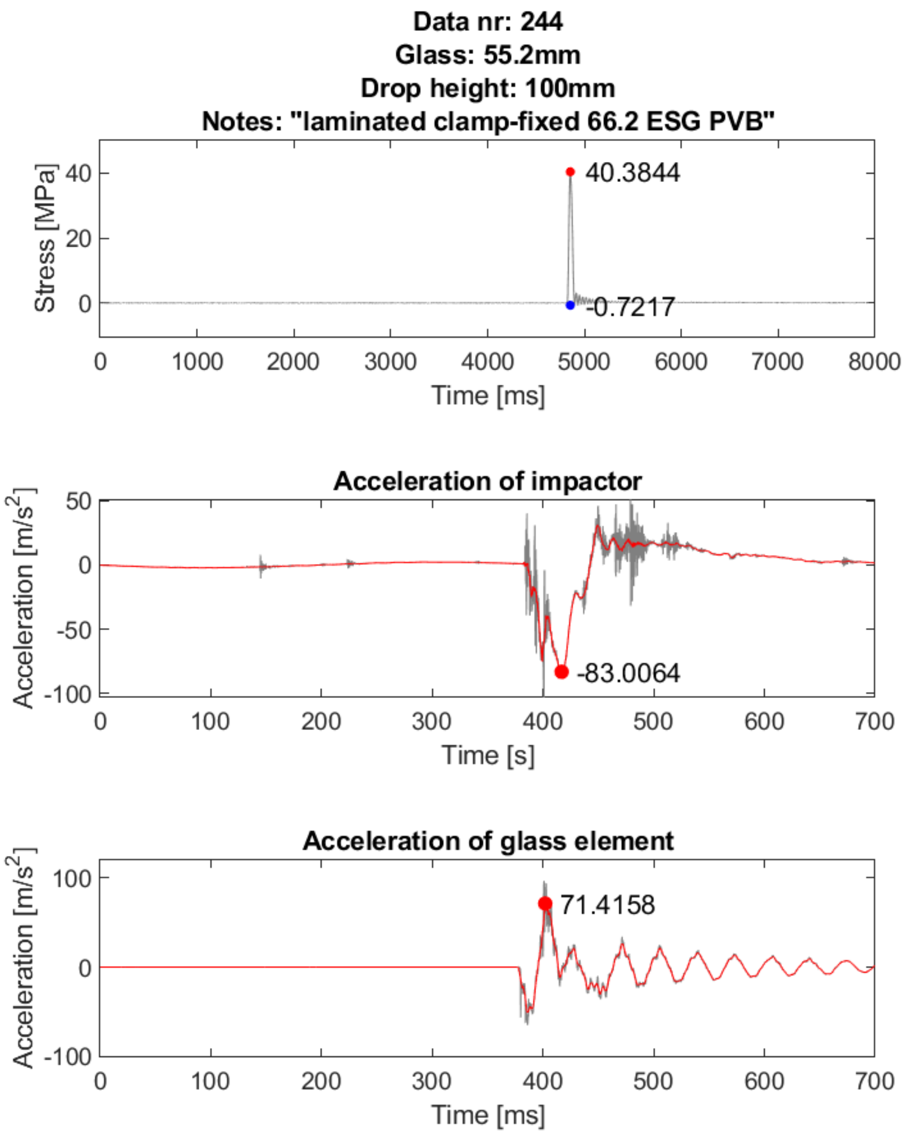

Data nr: 238
Glass: 55.2mm
Drop height: 500mm
Notes: "laminated clamp-fixed 55.2 ESG SGP"
Stress [MPa]
103.222
-6.4694
Time [ms]
Acceleration of impactor
Acceleration [m/s^2]
-175.8254
Time [s]
Acceleration of glass element
Acceleration [m/s^2]
251.8244
Time [ms]

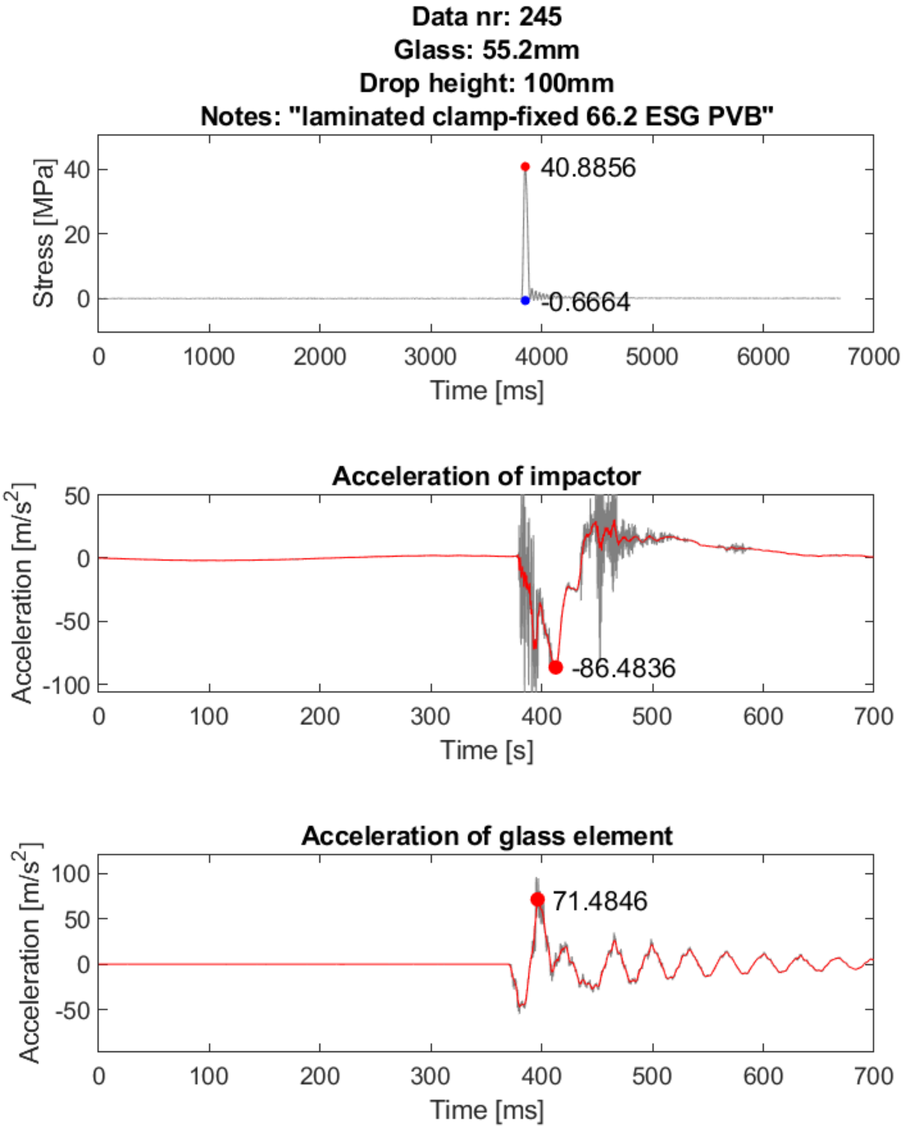

Data nr: 240
Glass: 55.2mm
Drop height: 100mm
Notes: "laminated clamp-fixed 55.2 ESG SGP,cracked glass on pendulum side
Stress [MPa]
47.1723
-3.0471
Time [ms]
Acceleration of impactor
Acceleration [m/s^2]
-2.1855
Time [s]
Acceleration of glass element
Acceleration [m/s^2]
44.7482
Time [ms]

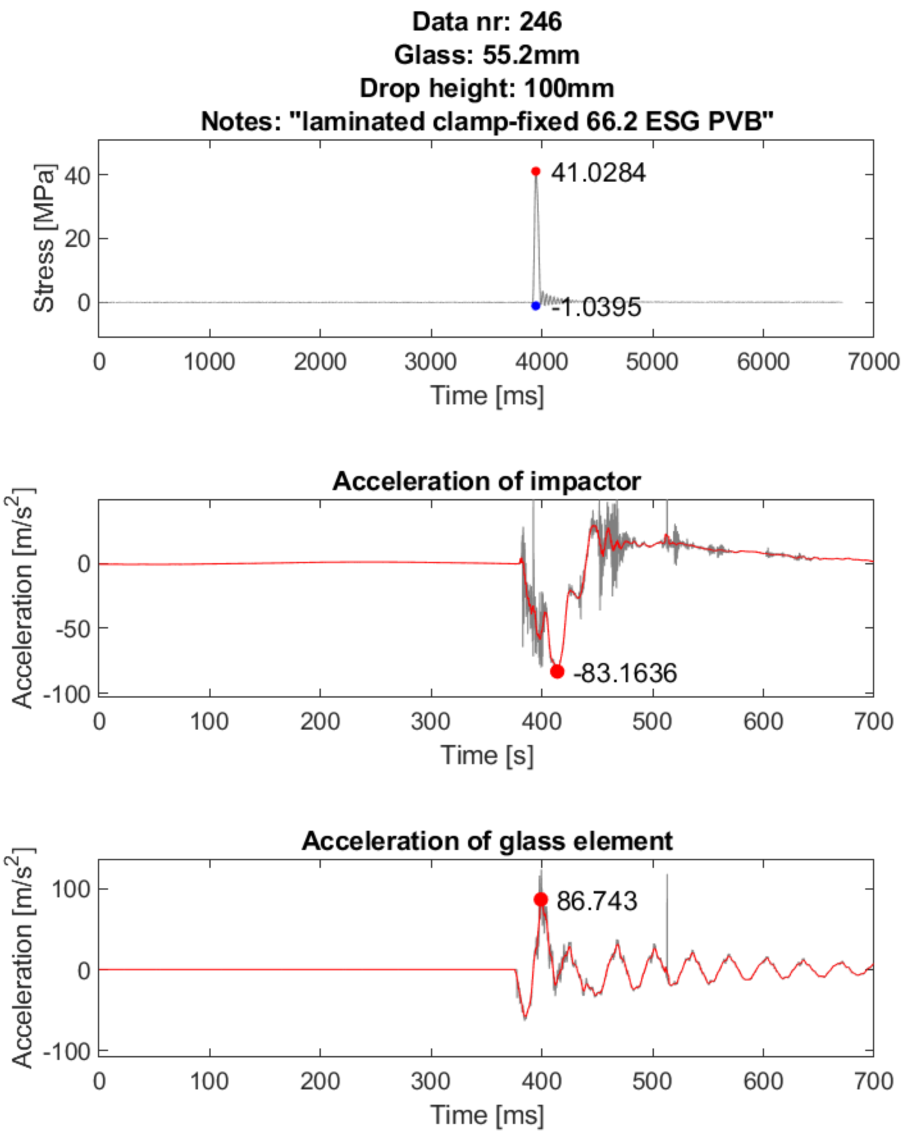
Data nr: 241
Glass: 55.2mm
Drop height: 100mm
Notes: "laminated clamp-fixed 55.2 ESG SGP,cracked glass on pendulum side

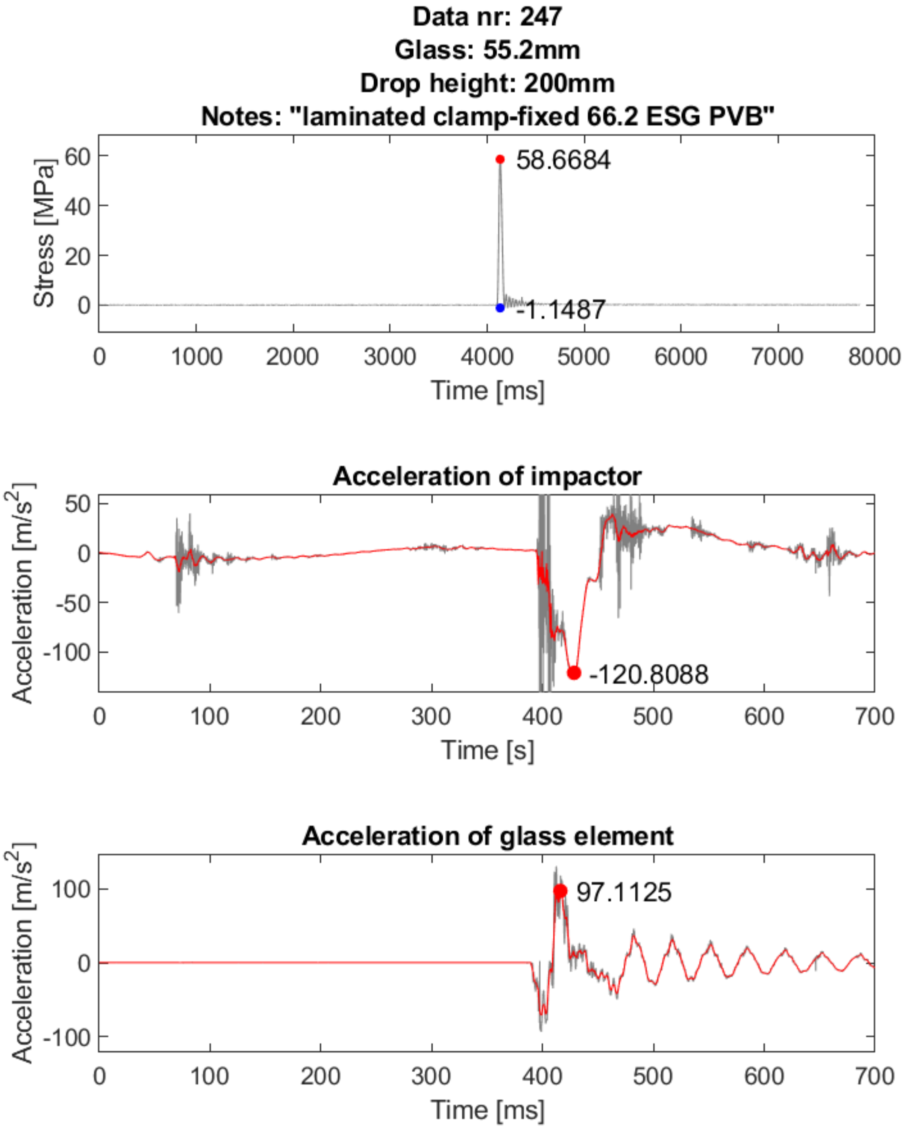


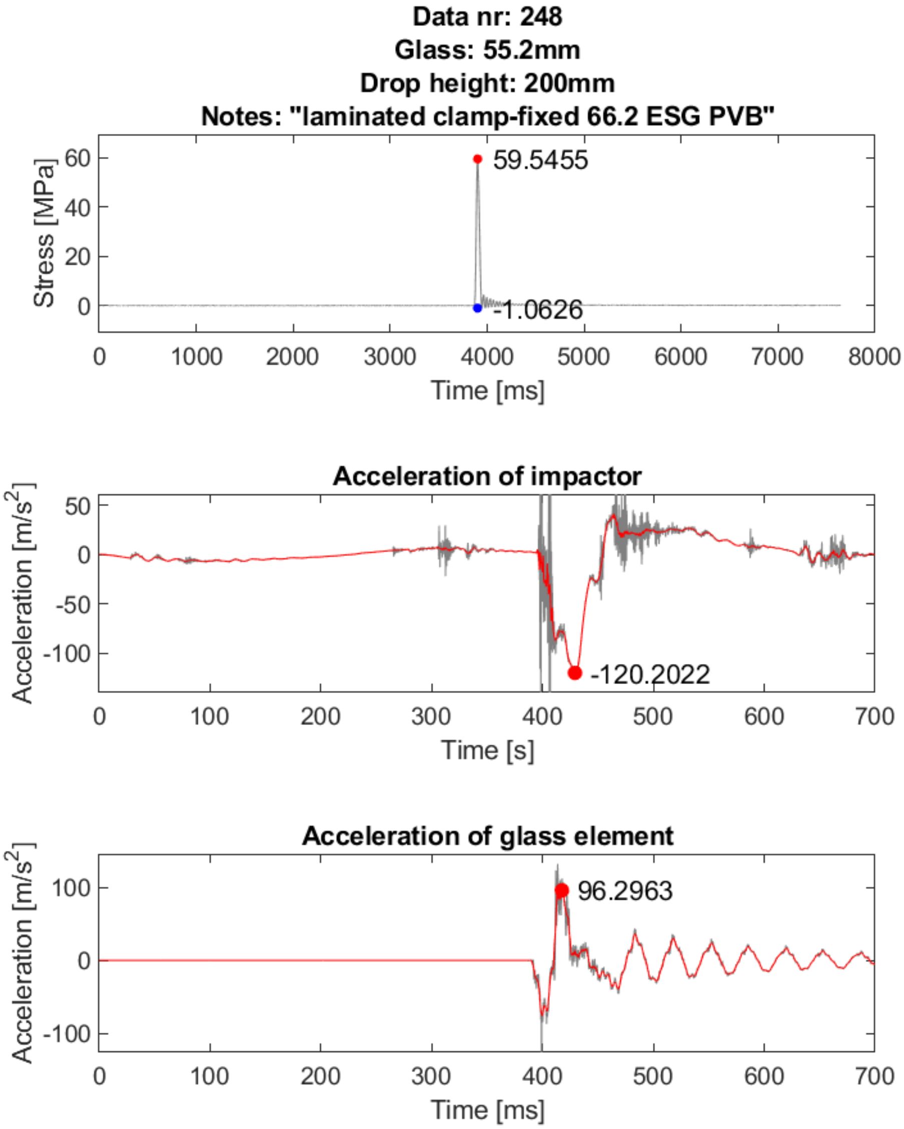

Data nr: 242
Glass: 55.2mm
Drop height: 100mm
Notes: "laminated clamp-fixed 55.2 ESG SGP,cracked glass on pendulum side
Stress [MPa]
47.4152
-6.3917
Time [ms]
Acceleration of impactor
Acceleration [m/s^2]
-67.0459
Time [s]
Acceleration of glass element
Acceleration [m/s^2]
114.3409
Time [ms]


Data nr: 244
Glass: 55.2mm
Drop height: 100mm
Notes: "laminated clamp-fixed 66.2 ESG PVB"
Stress [MPa]
40.3844
-0.7217
Time [ms]
Acceleration of impactor
Acceleration [m/s2]
-83.0064
Time [s]
Acceleration of glass element
Acceleration [m/s2]
71.4158
Time [ms]

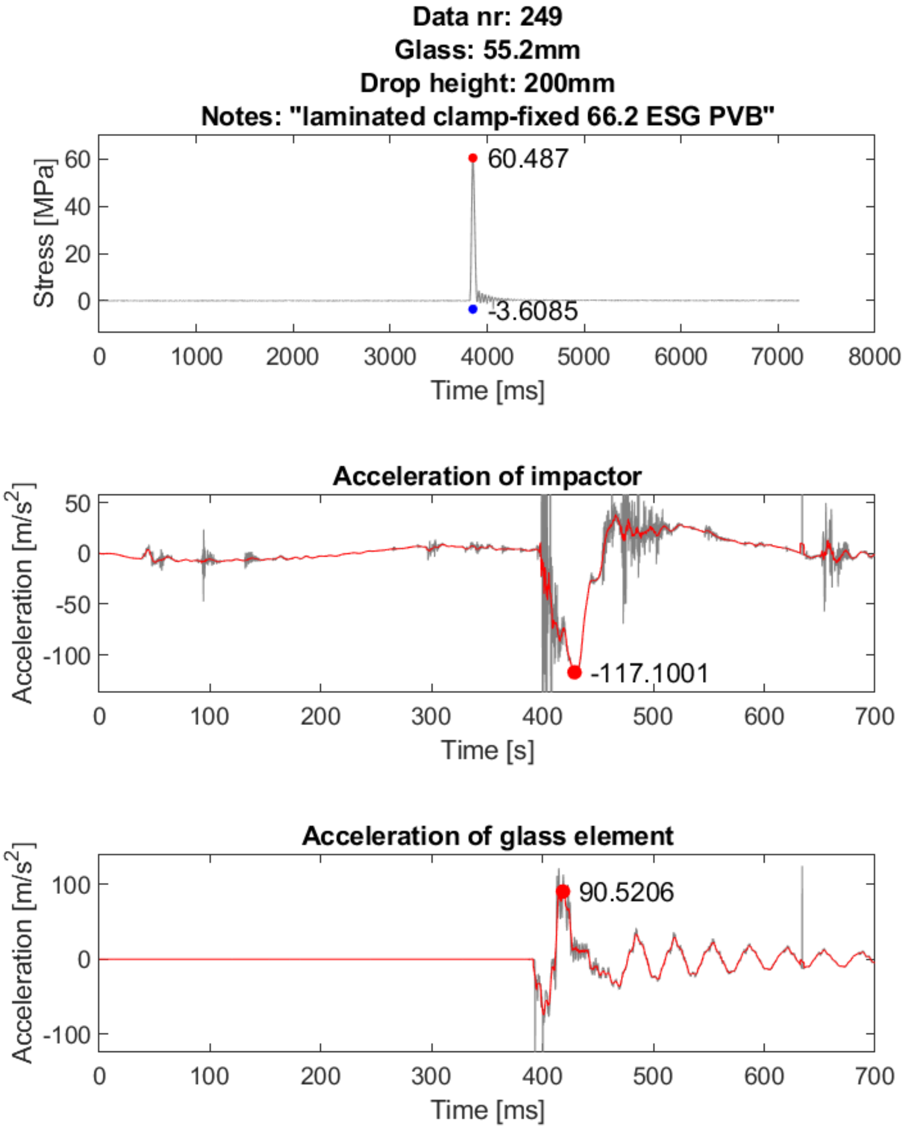

Data nr: 245
Glass: 55.2mm
Drop height: 100mm
Notes: "laminated clamp-fixed 66.2 ESG PVB"
Stress [MPa]
40.8856
-0.6664
Time [ms]
Acceleration of impactor
Acceleration [m/s2]
-86.4836
Time [s]
Acceleration of glass element
Acceleration [m/s2]
71.4846
Time [ms]


Data nr: 246
Glass: 55.2mm
Drop height: 100mm
Notes: "laminated clamp-fixed 66.2 ESG PVB"
Stress [MPa]
41.0284
-1.0395
Time [ms]
Acceleration of impactor
Acceleration [m/s^2]
-83.1636
Time [s]
Acceleration of glass element
Acceleration [m/s^2]
86.743
Time [ms]

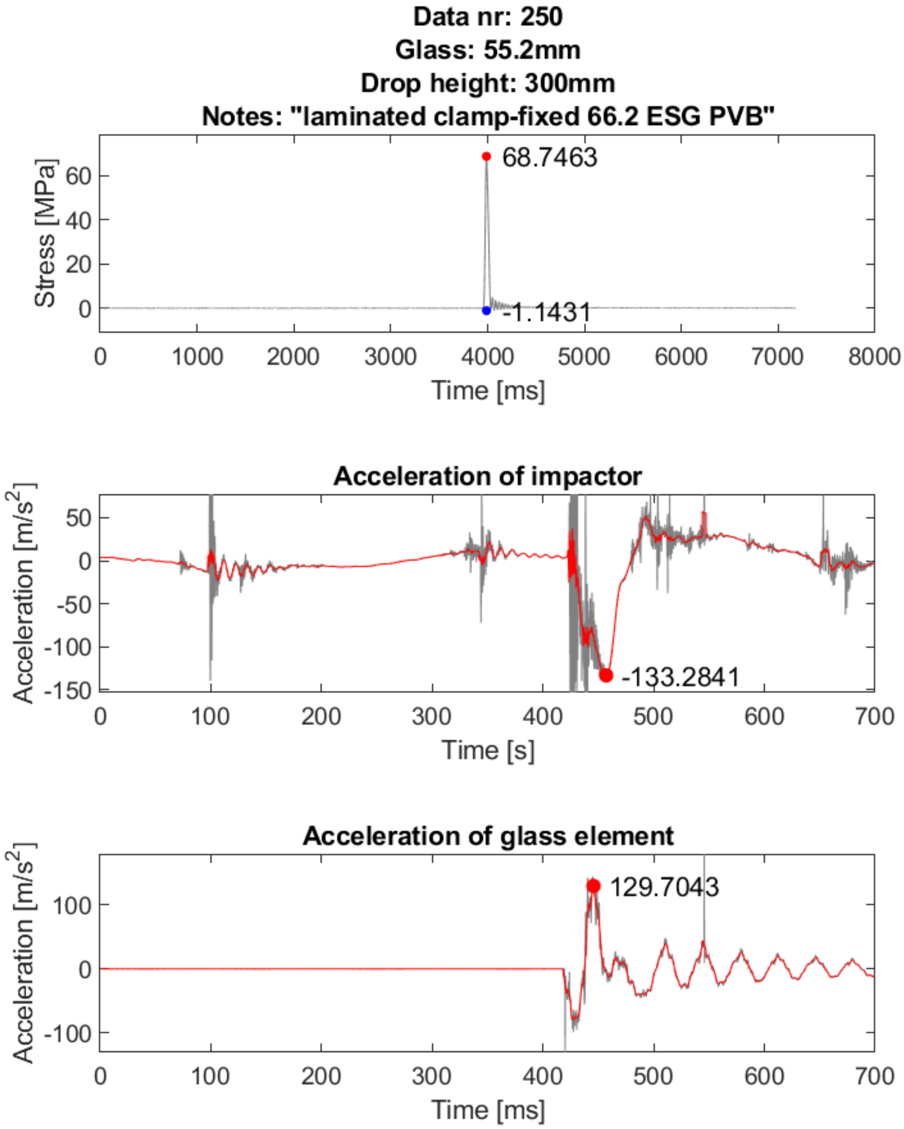

Data nr: 247
Glass: 55.2mm
Drop height: 200mm
Notes: "laminated clamp-fixed 66.2 ESG PVB"
Stress [MPa]
58.6684
-1.1487
Time [ms]
Acceleration of impactor
Acceleration [m/s^2]
-120.8088
Time [s]
Acceleration of glass element
Acceleration [m/s^2]
97.1125
Time [ms]

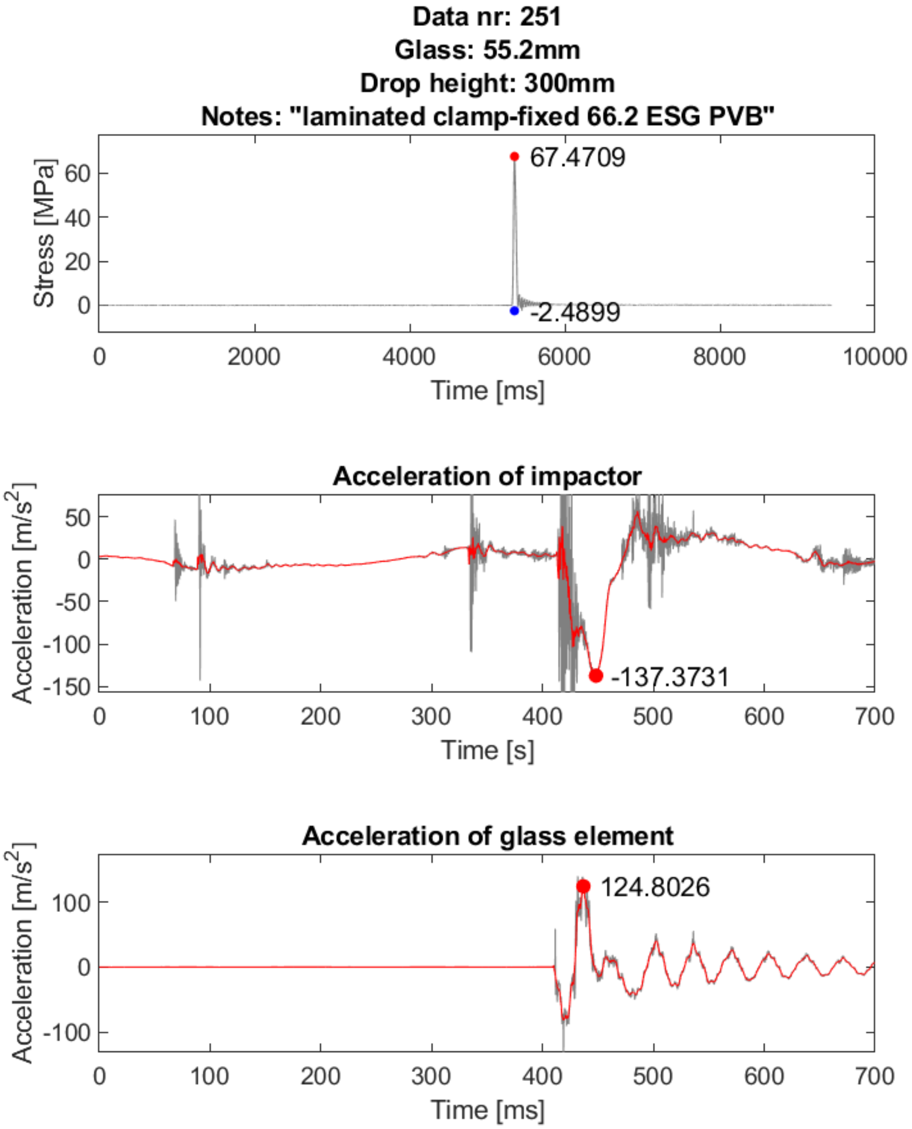


Data nr: 248
Glass: 55.2mm
Drop height: 200mm
Notes: "laminated clamp-fixed 66.2 ESG PVB"
Stress [MPa]
59.5455
-1.0626
Time [ms]
Acceleration of impactor
Acceleration [m/s^2]
-120.2022
Time [s]
Acceleration of glass element
Acceleration [m/s^2]
96.2963
Time [ms]

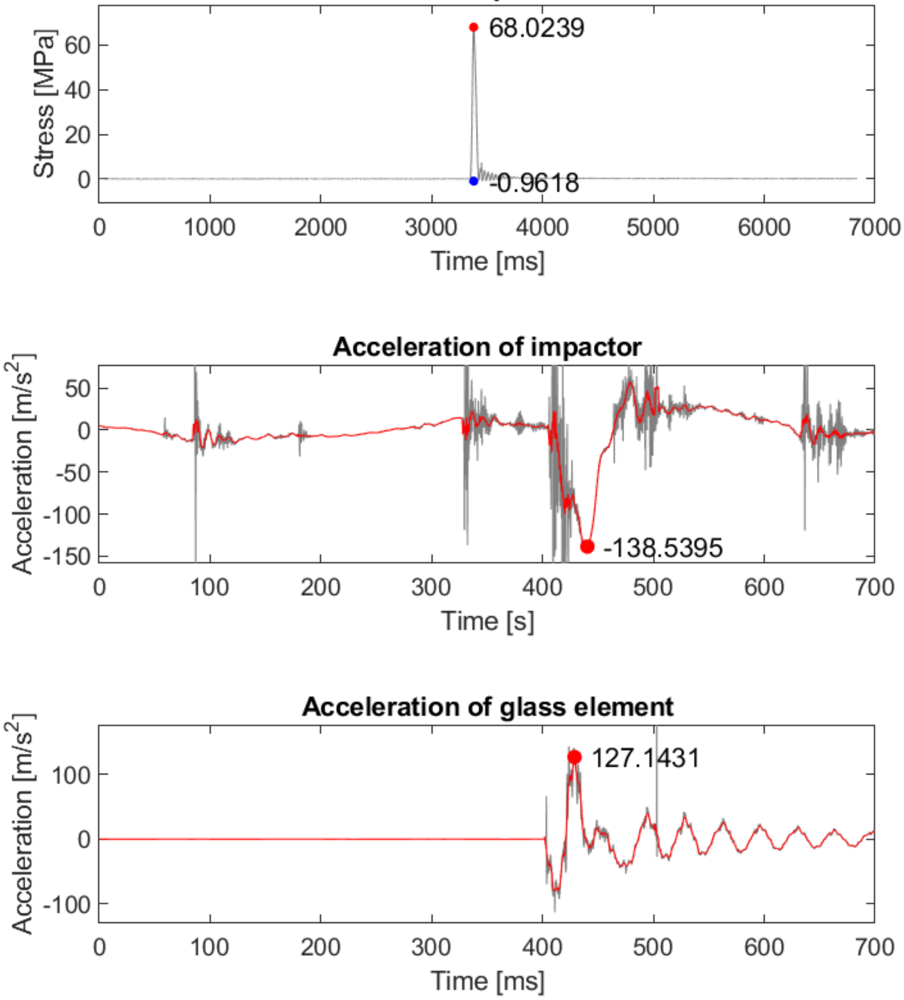


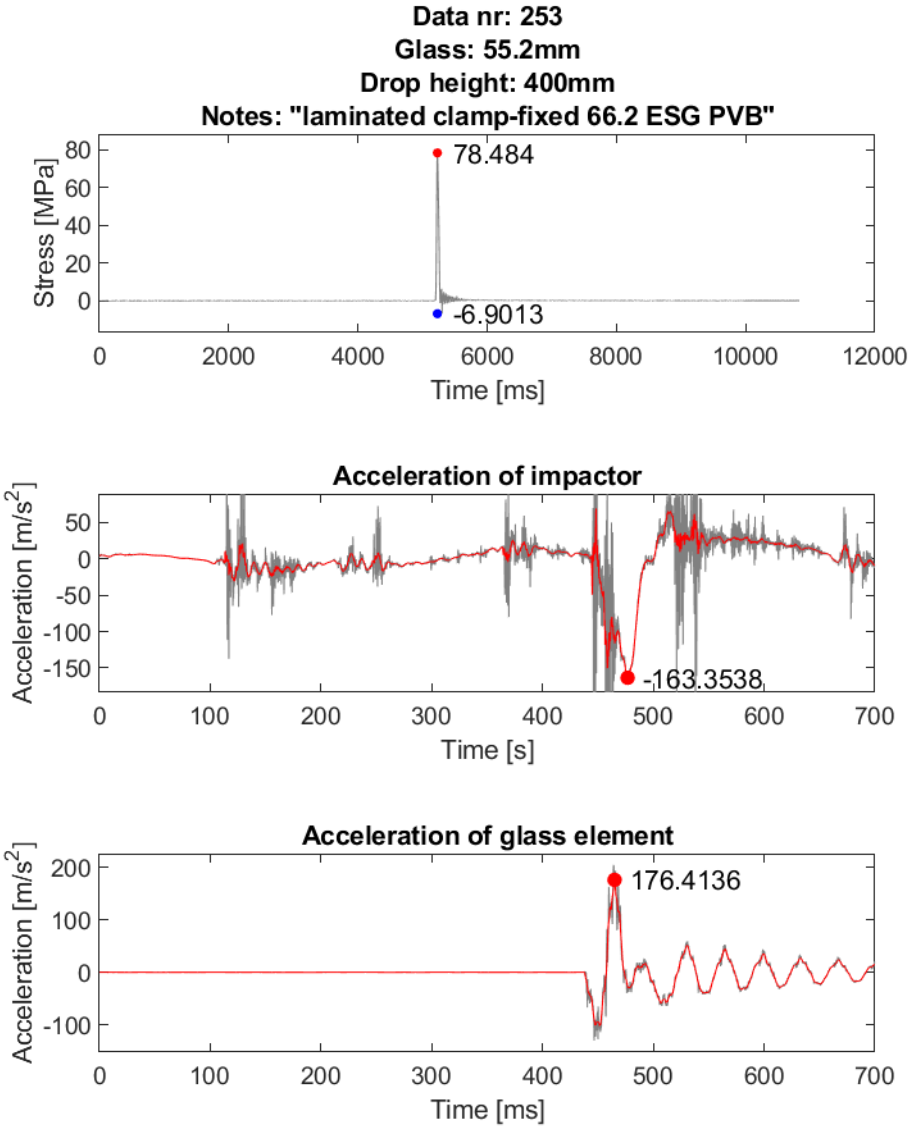
Data nr: 249
Glass: 55.2mm
Drop height: 200mm
Notes: "laminated clamp-fixed 66.2 ESG PVB"
Stress [MPa]
60.487
-3.6085
Time [ms]
Acceleration of impactor
Acceleration [m/s^2]
-117.1001
Time [s]
Acceleration of glass element
Acceleration [m/s^2]
90.5206
Time [ms]

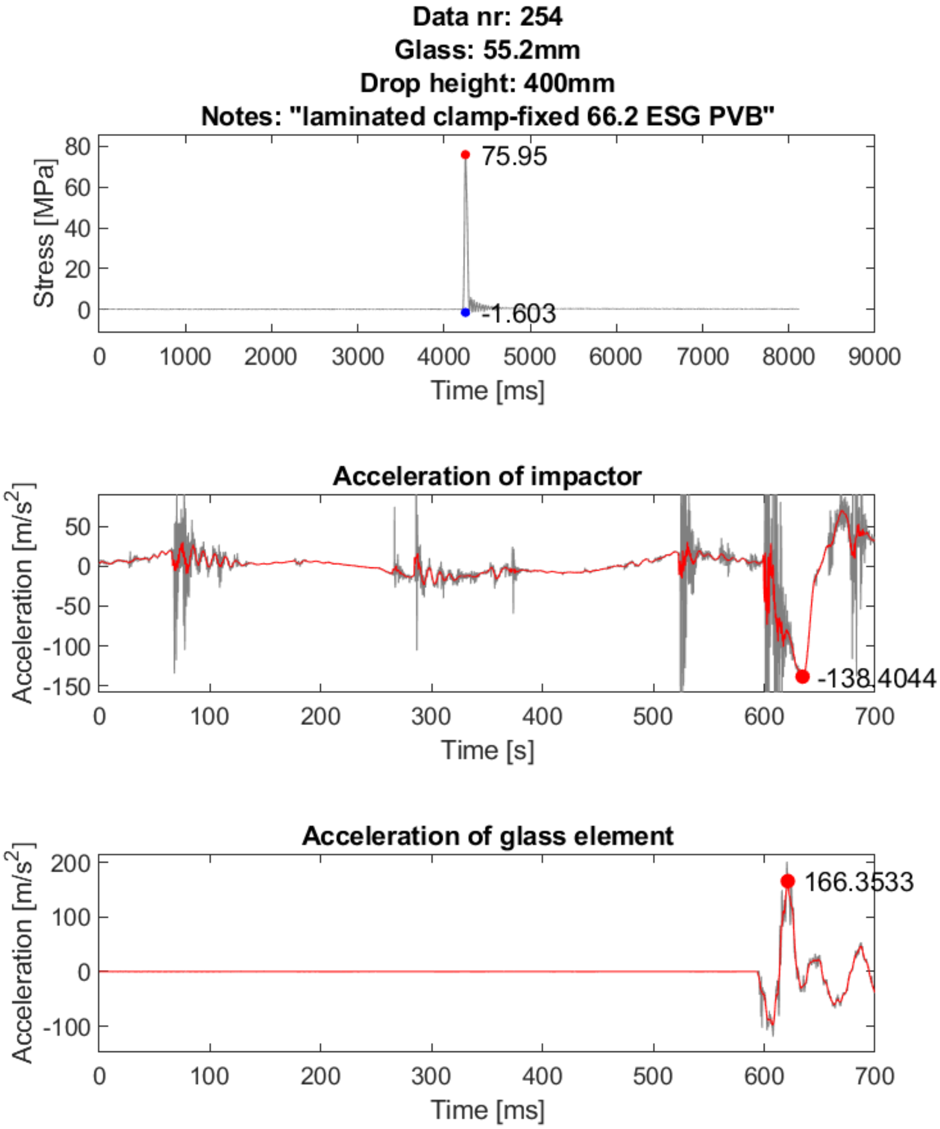

Data nr: 250
Glass: 55.2mm
Drop height: 300mm
Notes: "laminated clamp-fixed 66.2 ESG PVB"
Stress [MPa]
68.7463
-1.1431
Time [ms]
Acceleration of impactor
Acceleration [m/s^2]
-133.2841
Time [s]
Acceleration of glass element
Acceleration [m/s^2]
129.7043
Time [ms]

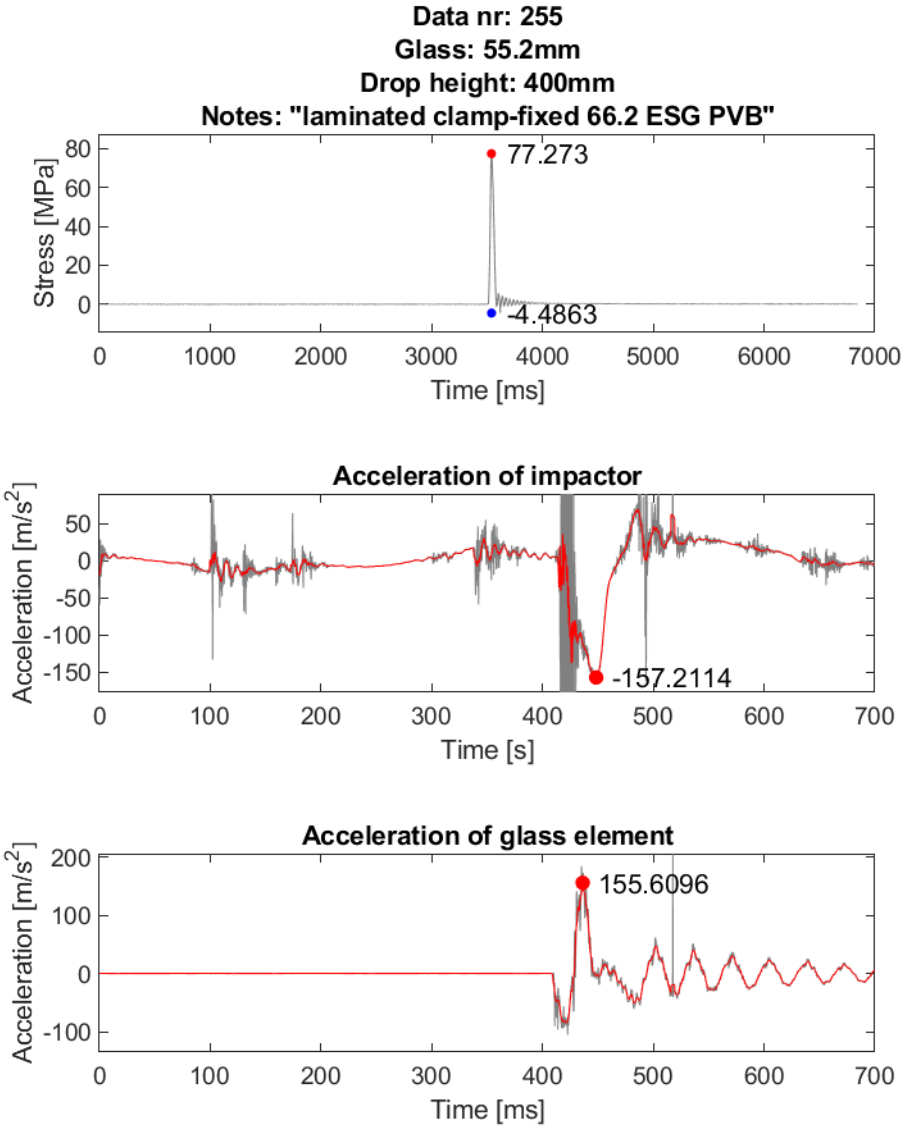

Data nr: 251
Glass: 55.2mm
Drop height: 300mm
Notes: "laminated clamp-fixed 66.2 ESG PVB"
67.4709
-2.4899
Stress [MPa]
Time [ms]
Acceleration of impactor
-137.3731
Acceleration [m/s^2]
Time [s]
Acceleration of glass element
124.8026
Acceleration [m/s^2]
Time [ms]

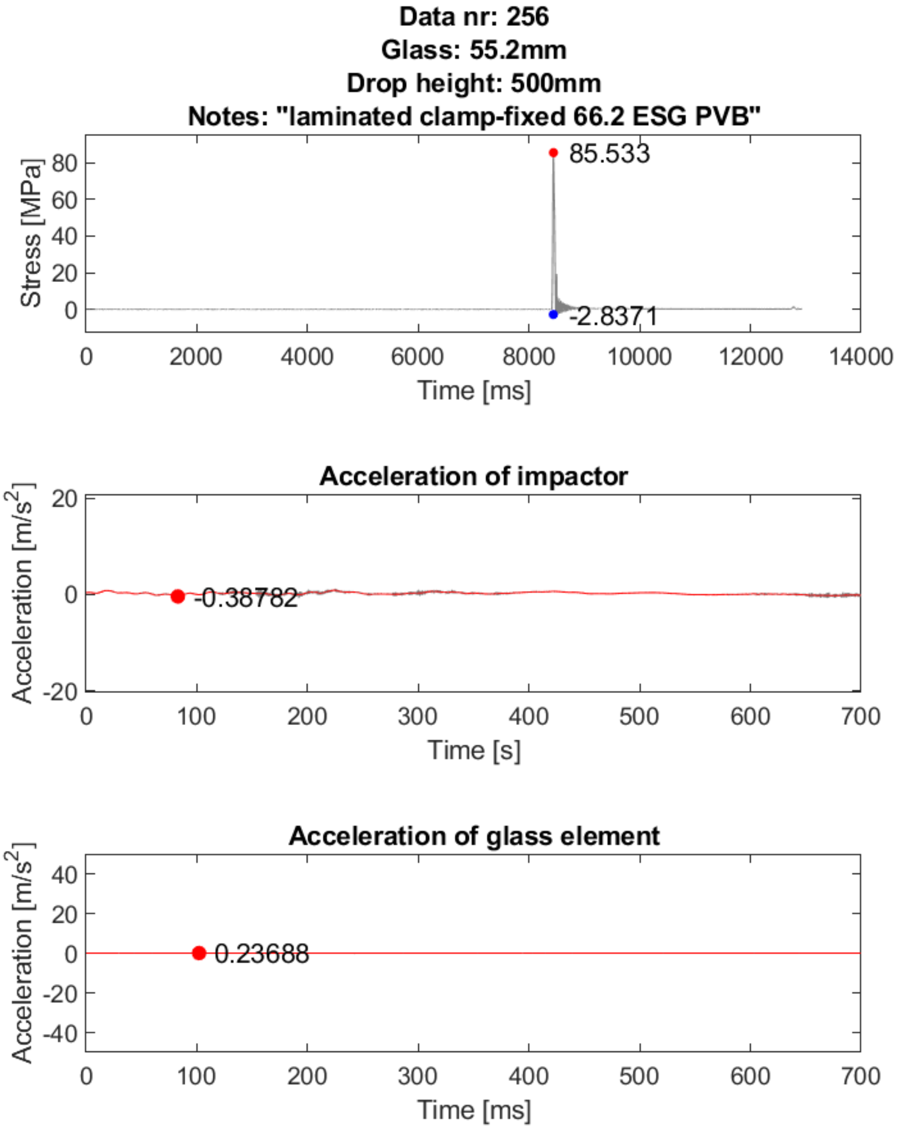
Data nr: 252
Glass: 55.2mm
Drop height: 300mm
Notes: "laminated clamp-fixed 66.2 ESG PVB"



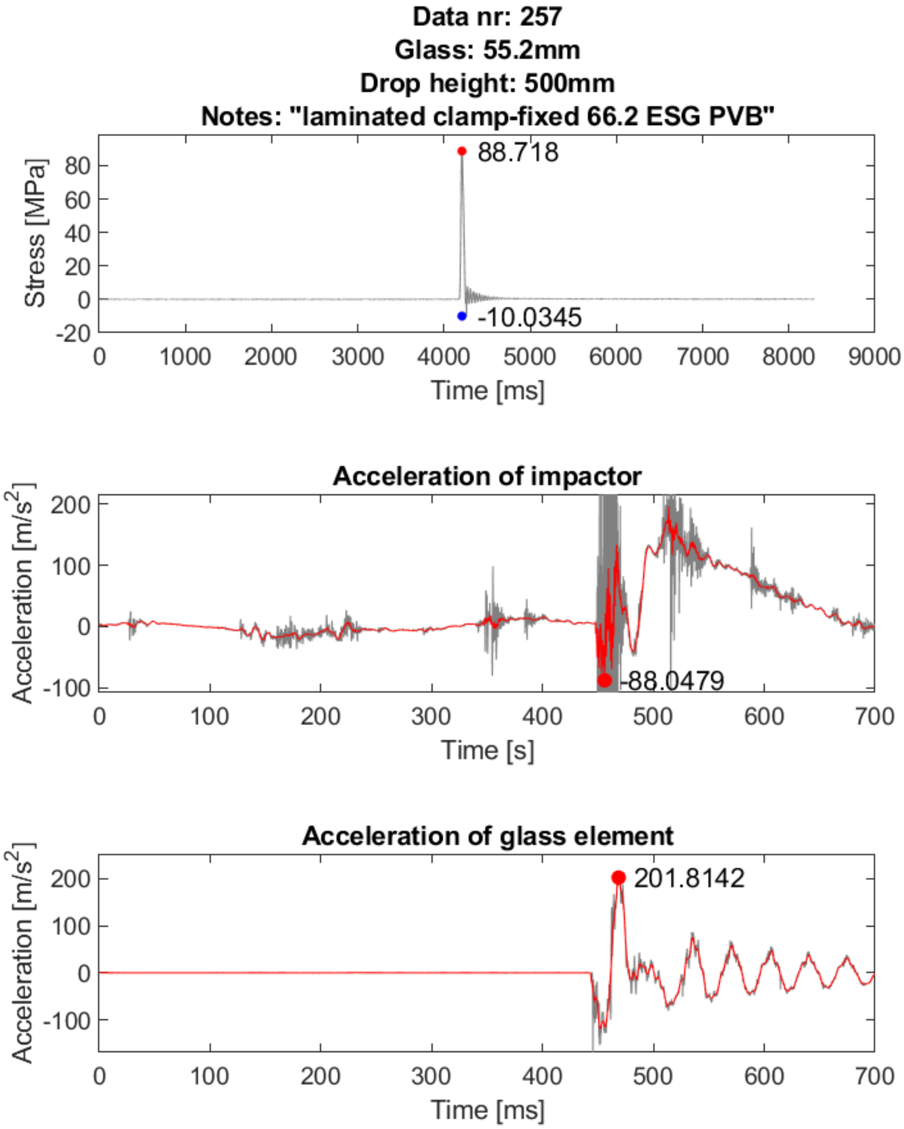

Data nr: 253
Glass: 55.2mm
Drop height: 400mm
Notes: "laminated clamp-fixed 66.2 ESG PVB"
Stress [MPa]
78.484
-6.9013
Time [ms]
Acceleration of impactor
Acceleration [m/s^2]
-163.3538
Time [s]
Acceleration of glass element
Acceleration [m/s^2]
176.4136
Time [ms]


Data nr: 254
Glass: 55.2mm
Drop height: 400mm
Notes: "laminated clamp-fixed 66.2 ESG PVB"
Stress [MPa]
75.95
-1.603
Time [ms]
Acceleration of impactor
Acceleration [m/s^2]
-138.4044
Time [s]
Acceleration of glass element
Acceleration [m/s^2]
166.3533
Time [ms]

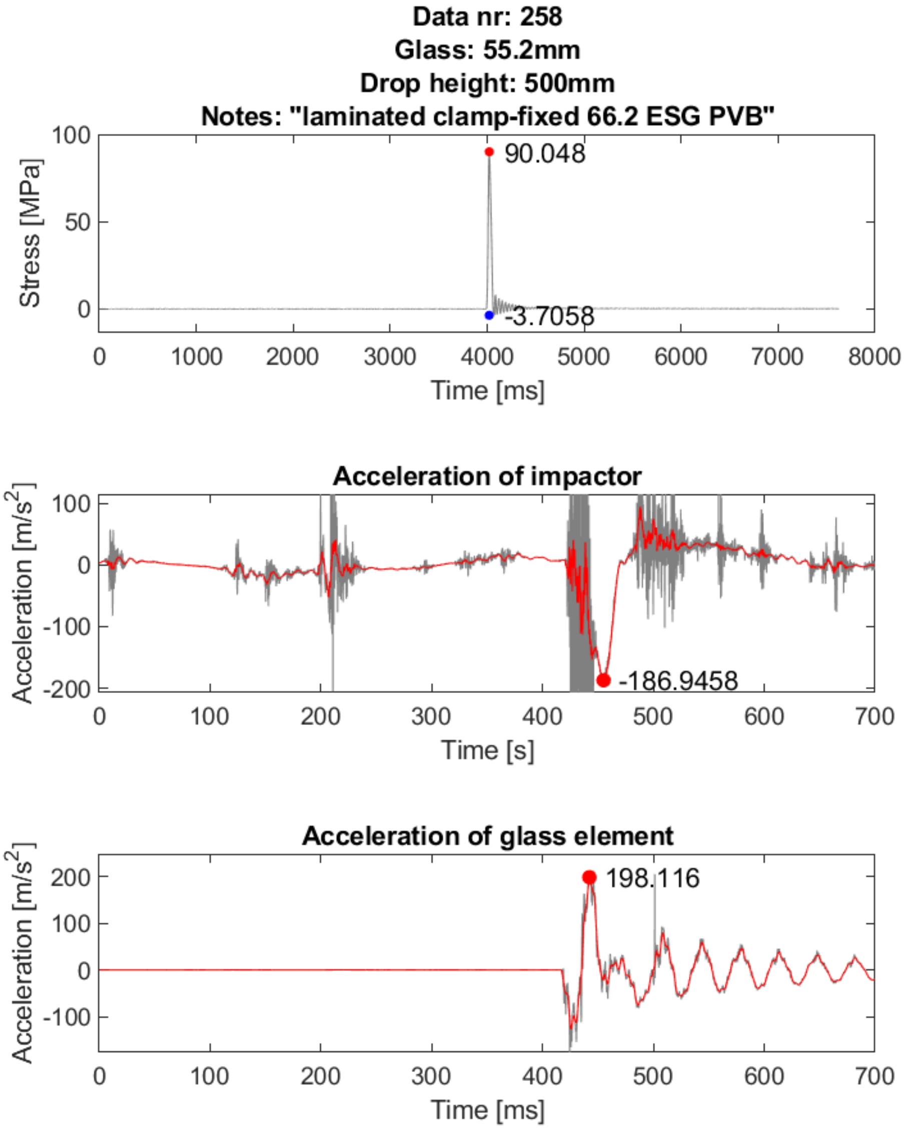

Data nr: 255
Glass: 55.2mm
Drop height: 400mm
Notes: "laminated clamp-fixed 66.2 ESG PVB"
Stress [MPa]
77.273
-4.4863
Time [ms]
Acceleration of impactor
Acceleration [m/s2]
-157.2114
Time [s]
Acceleration of glass element
Acceleration [m/s2]
155.6096
Time [ms]

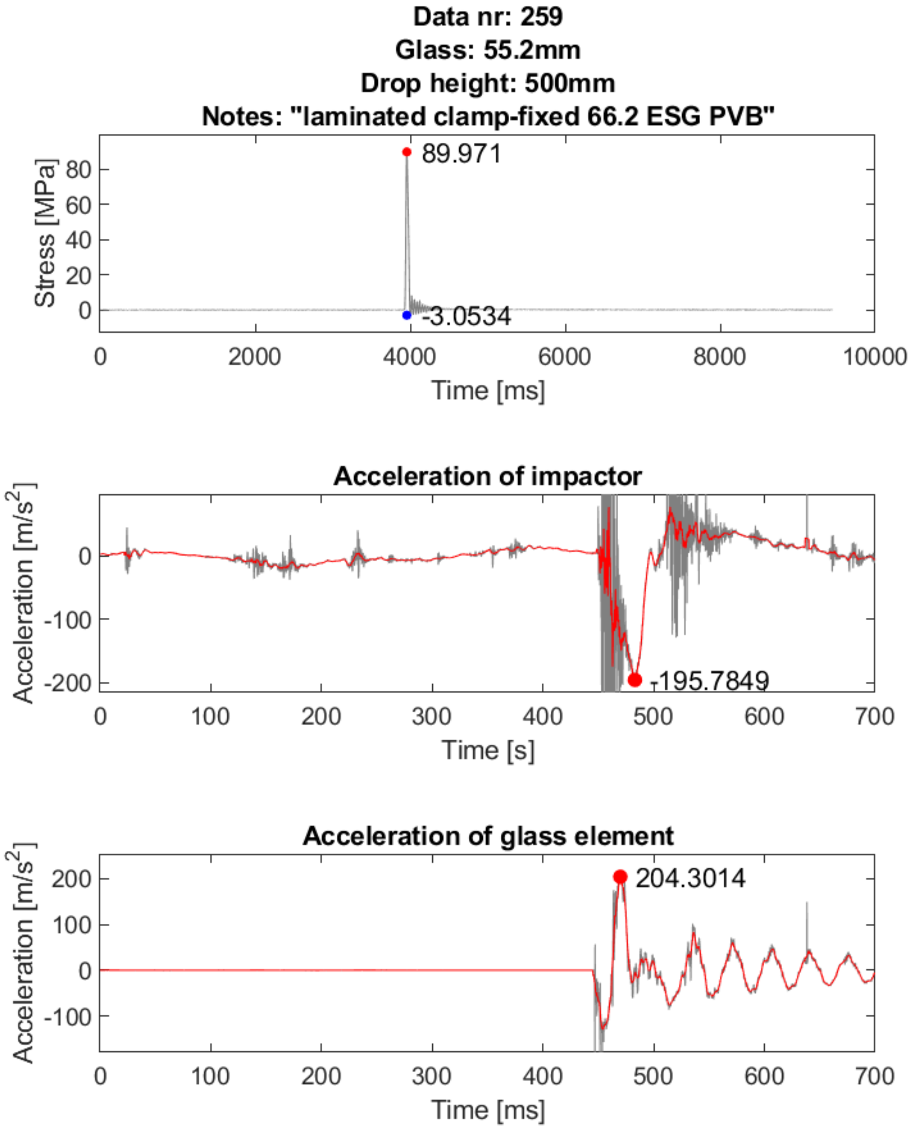


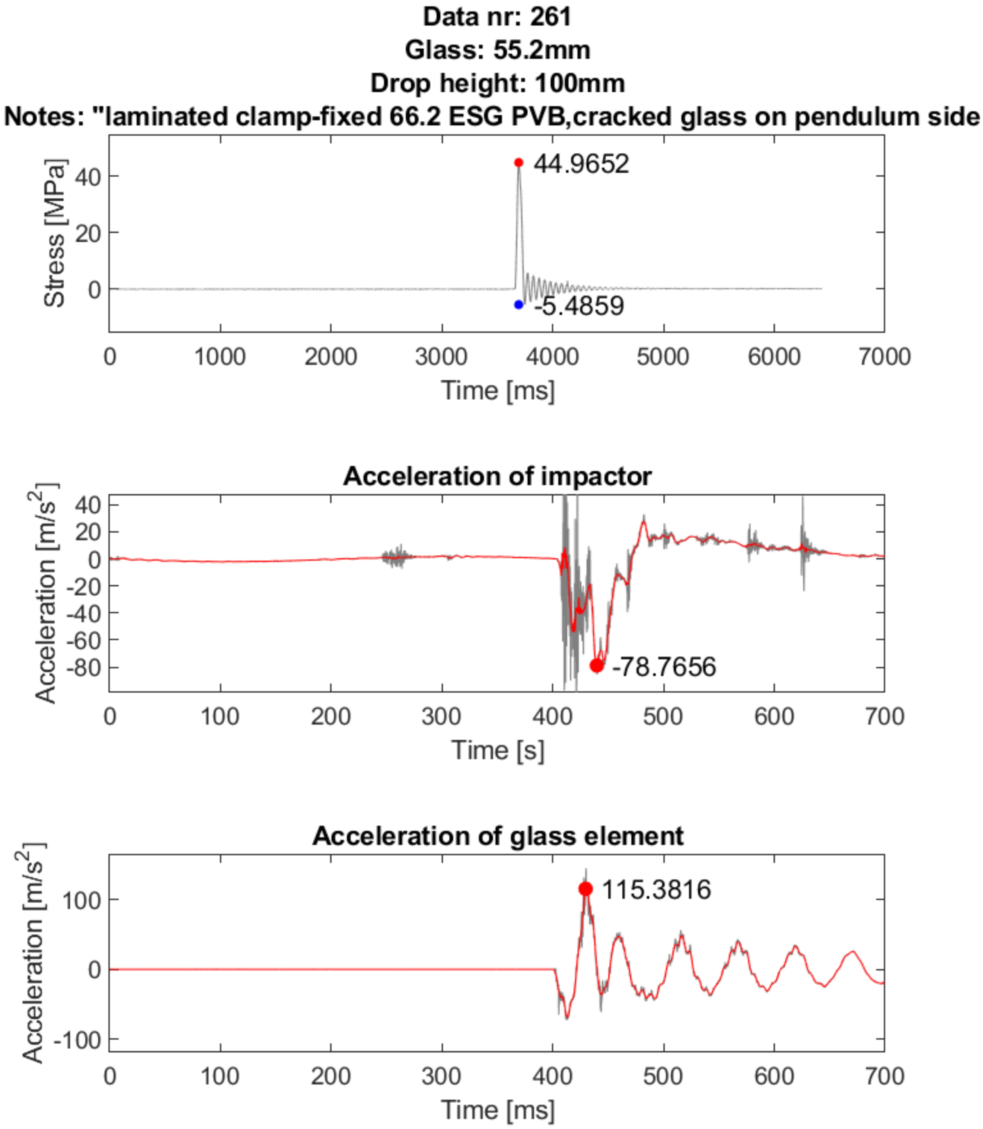
Data nr: 256
Glass: 55.2mm
Drop height: 500mm
Notes: "laminated clamp-fixed 66.2 ESG PVB"
Stress [MPa]
85.533
-2.8371
Time [ms]
Acceleration of impactor
Acceleration [m/s2]
-0.38782
Time [s]
Acceleration of glass element
Acceleration [m/s2]
0.23688
Time [ms]



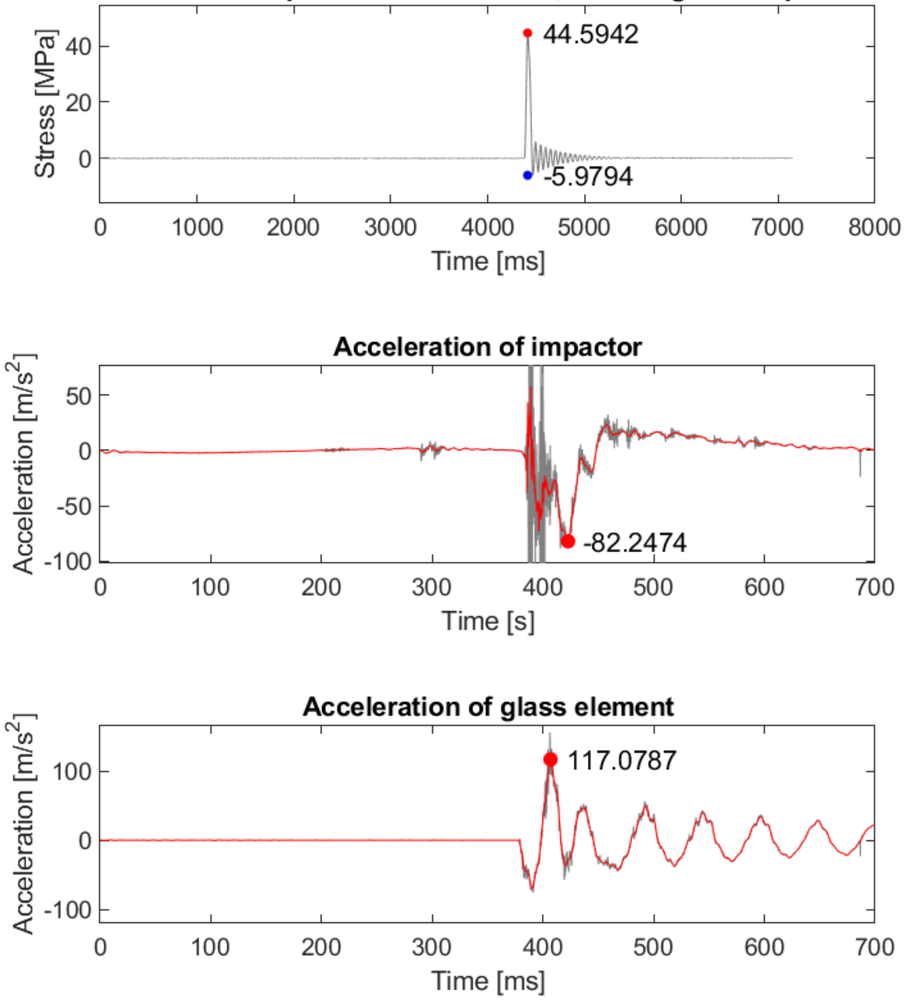
Data nr: 257
Glass: 55.2mm
Drop height: 500mm
Notes: "laminated clamp-fixed 66.2 ESG PVB"
Stress [MPa]
88.718
-10.0345
Time [ms]
Acceleration of impactor
Acceleration [m/s^2]
-88.0479
Time [s]
Acceleration of glass element
Acceleration [m/s^2]
201.8142
Time [ms]

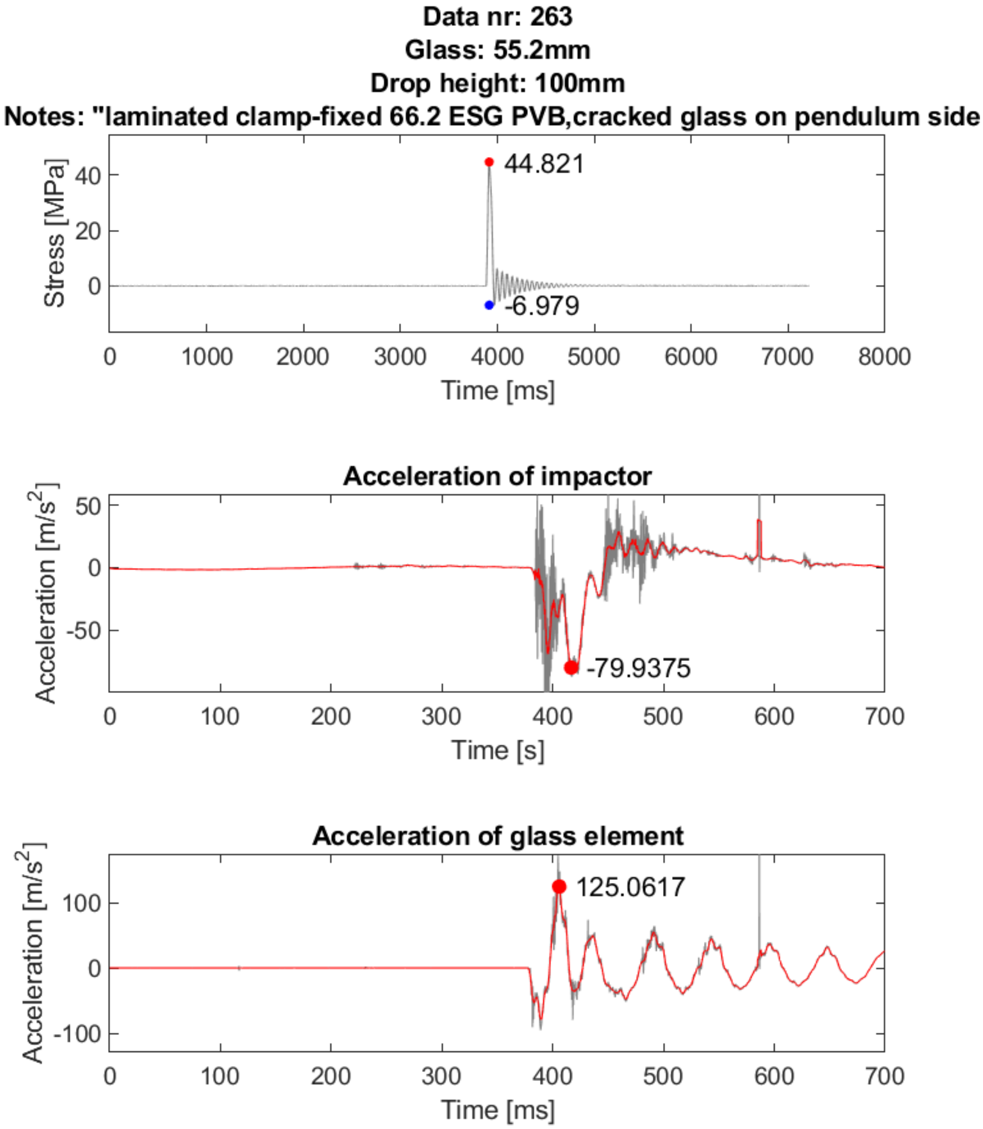

Data nr: 258
Glass: 55.2mm
Drop height: 500mm
Notes: "laminated clamp-fixed 66.2 ESG PVB"
Stress [MPa]
90.048
-3.7058
Time [ms]
Acceleration of impactor
Acceleration [m/s^2]
-186.9458
Time [s]
Acceleration of glass element
Acceleration [m/s^2]
198.116
Time [ms]

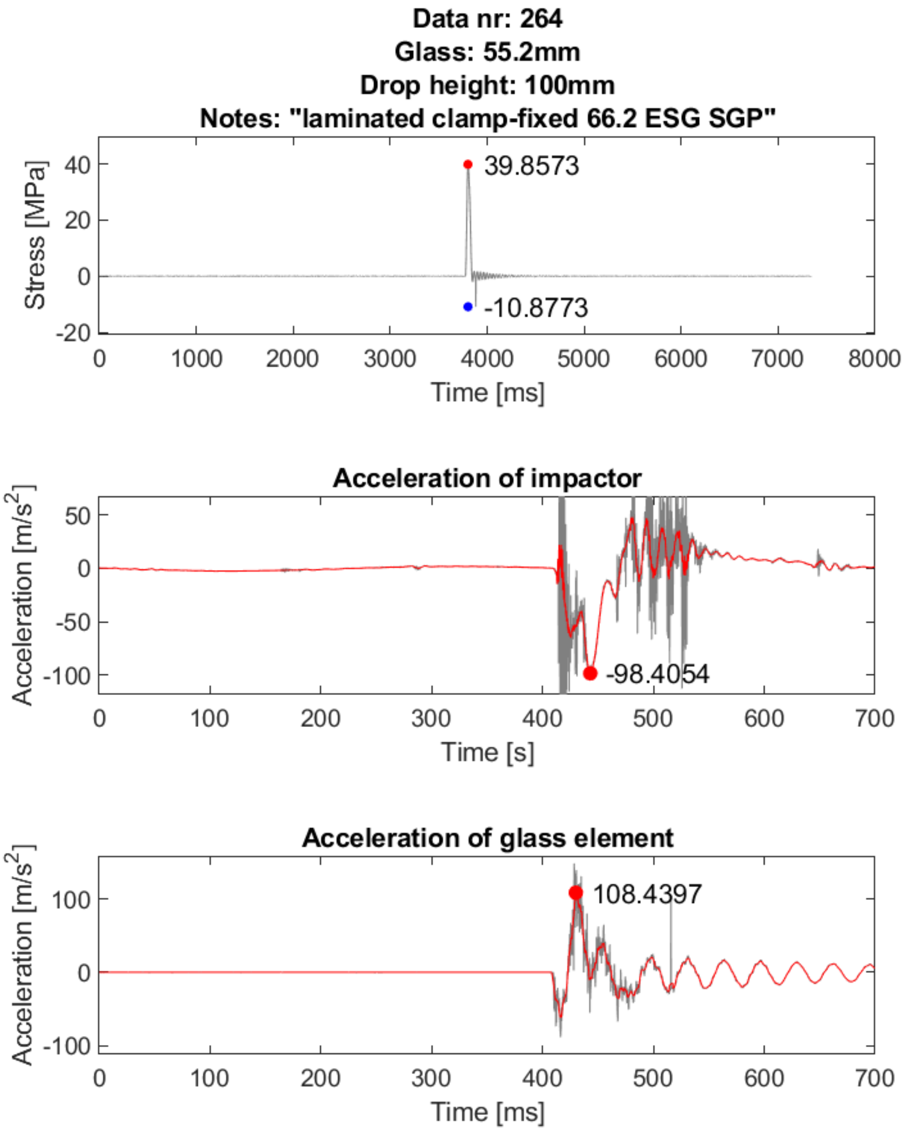

Data nr: 259
Glass: 55.2mm
Drop height: 500mm
Notes: "laminated clamp-fixed 66.2 ESG PVB"
89.971
-3.0534
Stress [MPa]
Time [ms]
Acceleration of impactor
-195.7849
Acceleration [m/s^2]
Time [s]
Acceleration of glass element
204.3014
Acceleration [m/s^2]
Time [ms]

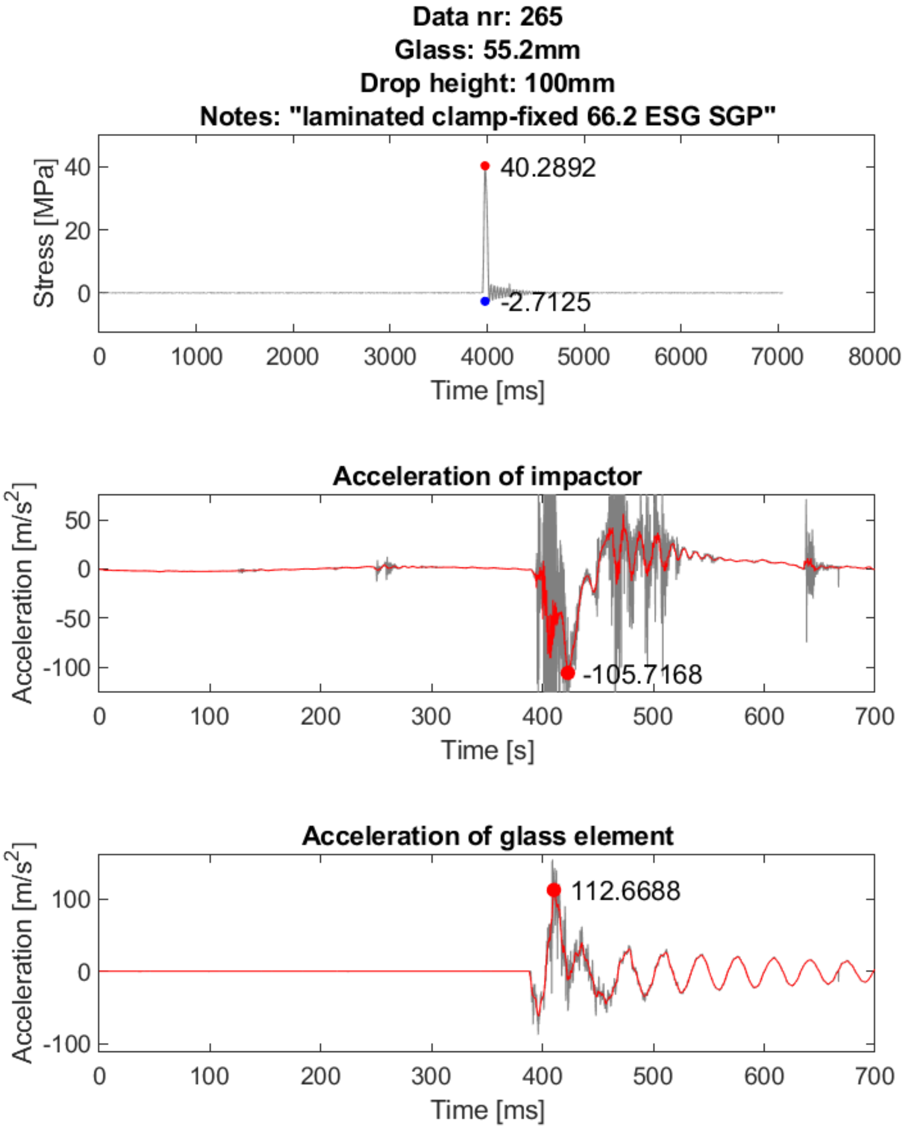

Data nr: 261
Glass: 55.2mm
Drop height: 100mm
Notes: "laminated clamp-fixed 66.2 ESG PVB,cracked glass on pendulum side
Stress [MPa]
44.9652
-5.4859
Time [ms]
Acceleration of impactor
Acceleration [m/s^2]
-78.7656
Time [s]
Acceleration of glass element
Acceleration [m/s^2]
115.3816
Time [ms]

Data nr: 262
Glass: 55.2mm
Drop height: 100mm
Notes: "laminated clamp-fixed 66.2 ESG PVB,cracked glass on pendulum side

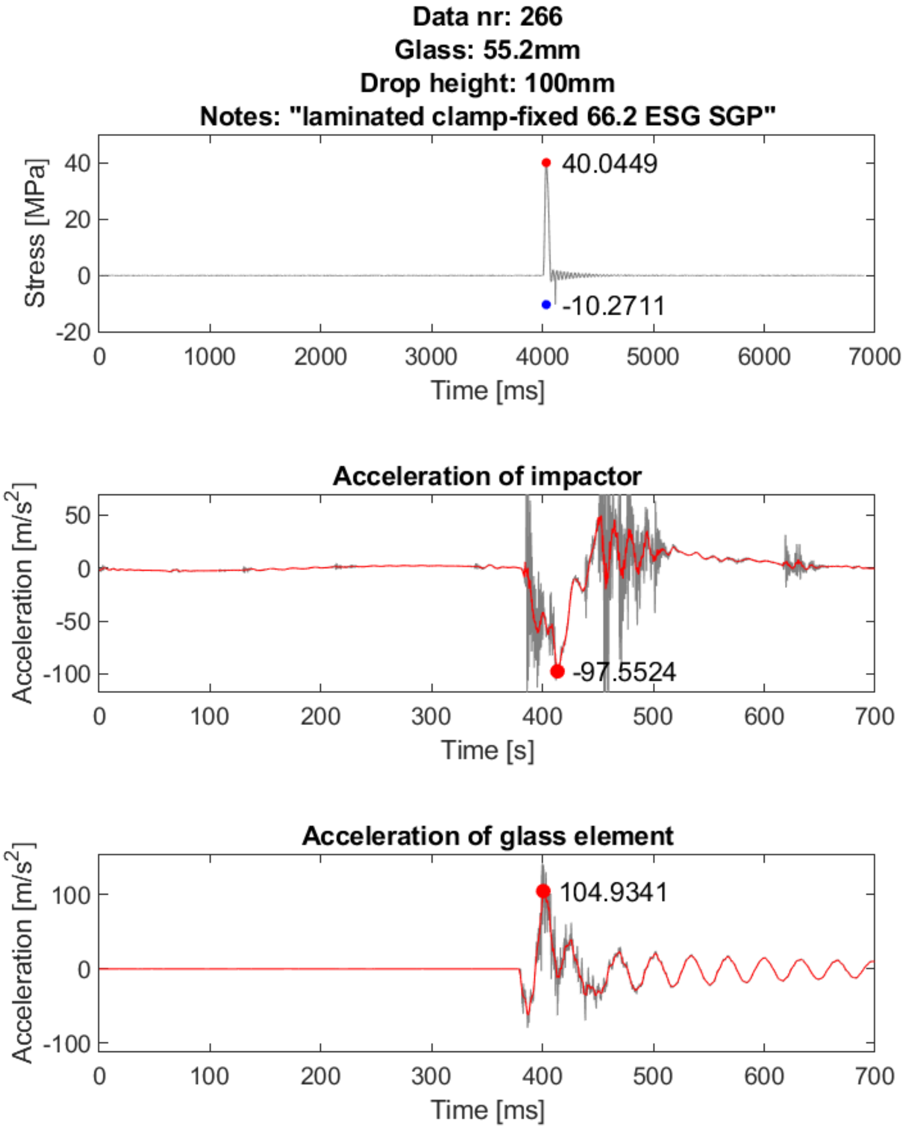


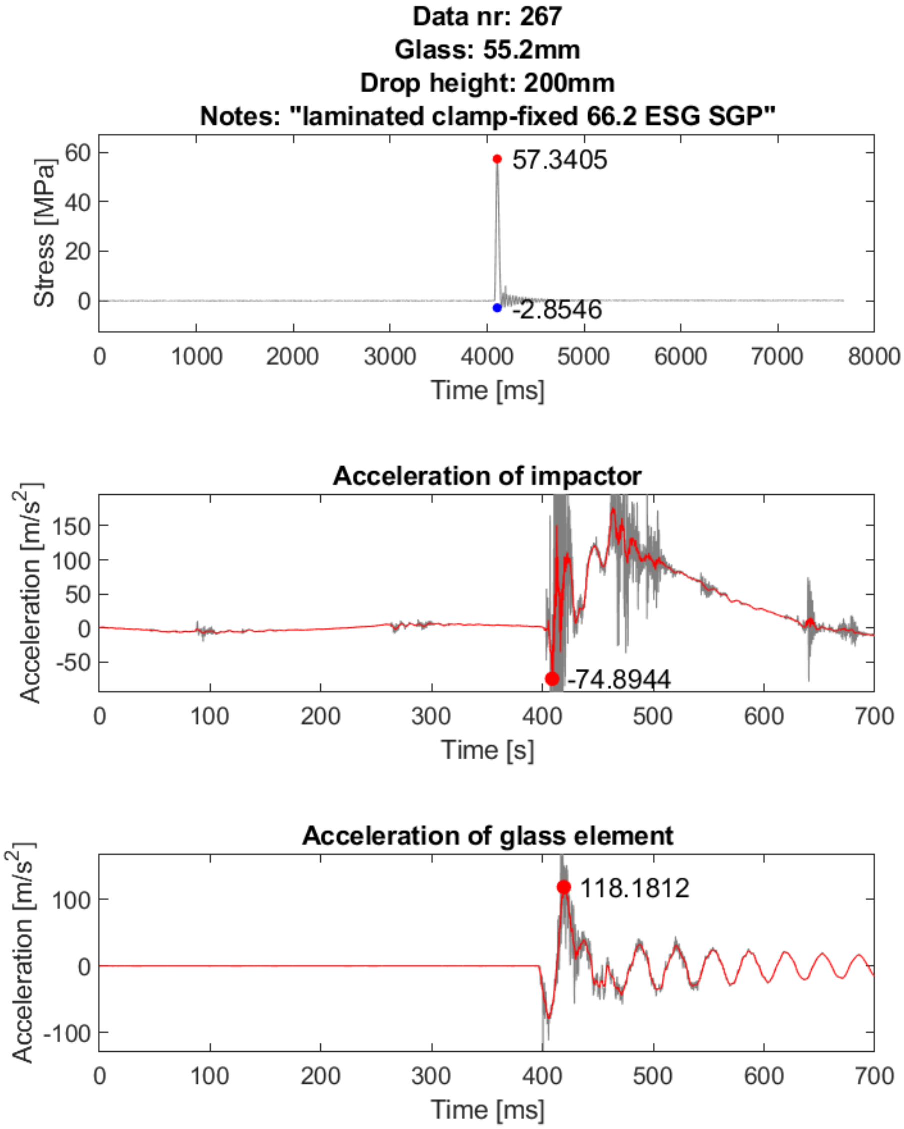

Data nr: 263
Glass: 55.2mm
Drop height: 100mm
Notes: "laminated clamp-fixed 66.2 ESG PVB,cracked glass on pendulum side
44.821
-6.979
Stress [MPa]
Time [ms]
Acceleration of impactor
-79.9375
Acceleration [m/s^2]
Time [s]
Acceleration of glass element
125.0617
Acceleration [m/s^2]
Time [ms]

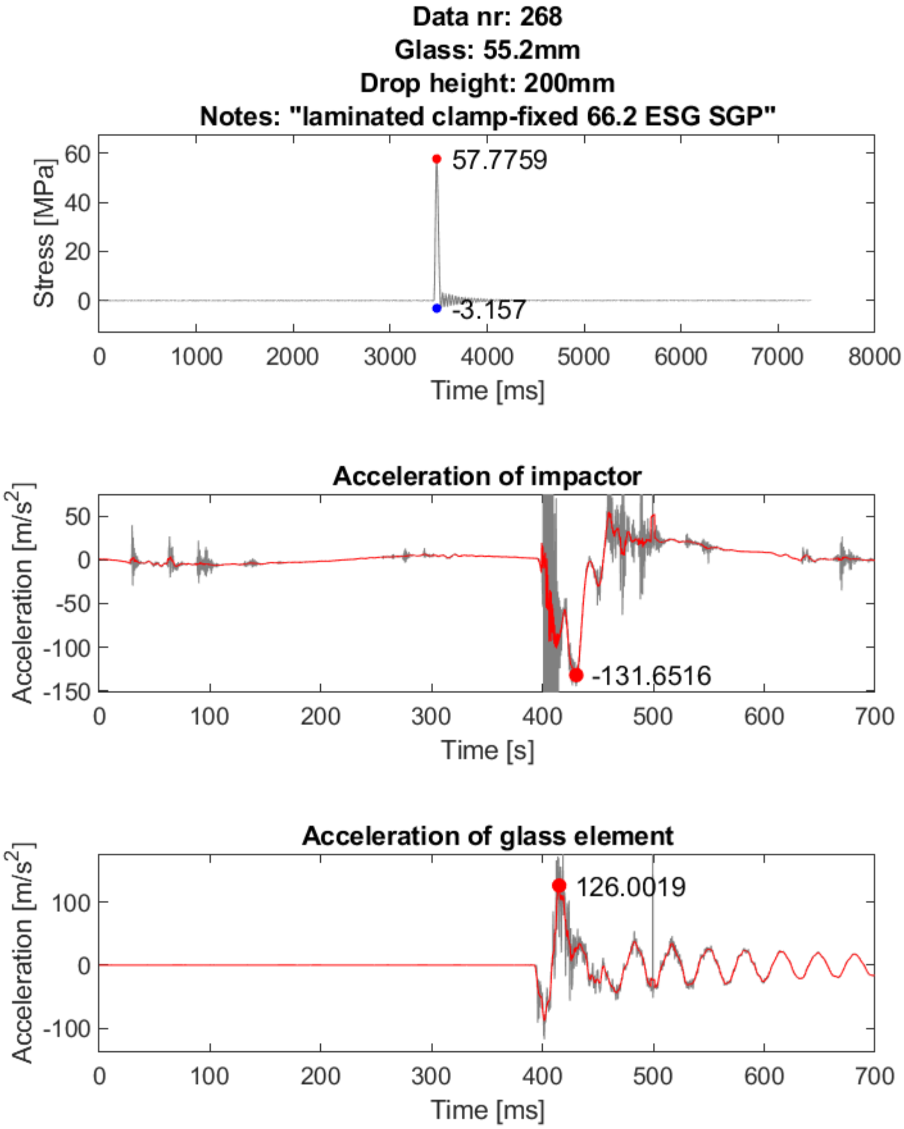

Data nr: 264
Glass: 55.2mm
Drop height: 100mm
Notes: "laminated clamp-fixed 66.2 ESG SGP"
Stress [MPa]
39.8573
-10.8773
Time [ms]
Acceleration of impactor
Acceleration [m/s^2]
-98.4054
Time [s]
Acceleration of glass element
Acceleration [m/s^2]
108.4397
Time [ms]



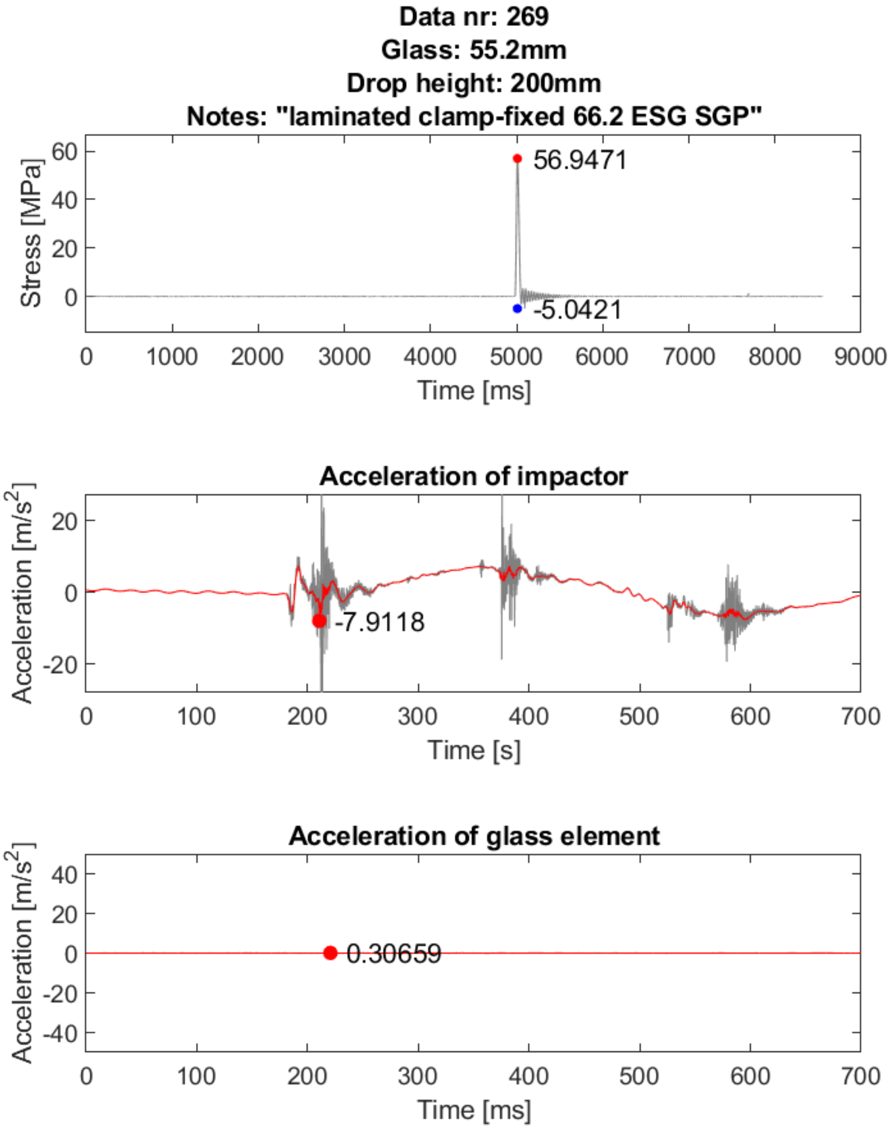
Data nr: 265
Glass: 55.2mm
Drop height: 100mm
Notes: "laminated clamp-fixed 66.2 ESG SGP"
Stress [MPa]
40.2892
-2.7125
Time [ms]
Acceleration of impactor
Acceleration [m/s^2]
-105.7168
Time [s]
Acceleration of glass element
Acceleration [m/s^2]
112.6688
Time [ms]

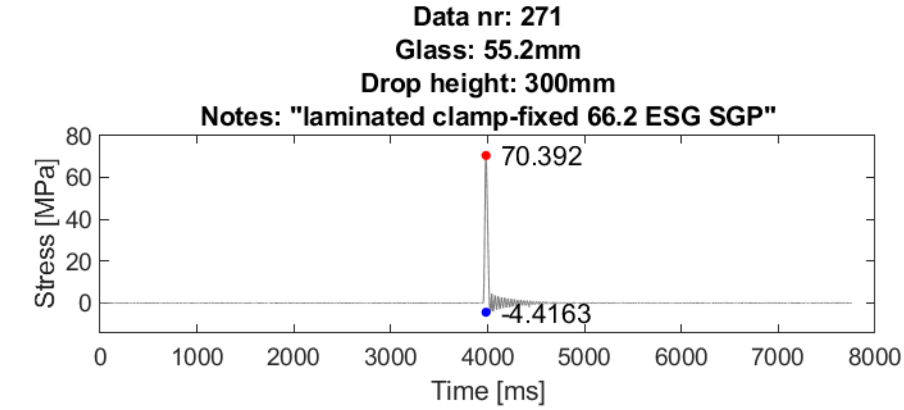

Data nr: 266
Glass: 55.2mm
Drop height: 100mm
Notes: "laminated clamp-fixed 66.2 ESG SGP"
Stress [MPa]
40.0449
-10.2711
Time [ms]
Acceleration of impactor
Acceleration [m/s^2]
-97.5524
Time [s]
Acceleration of glass element
Acceleration [m/s^2]
104.9341
Time [ms]

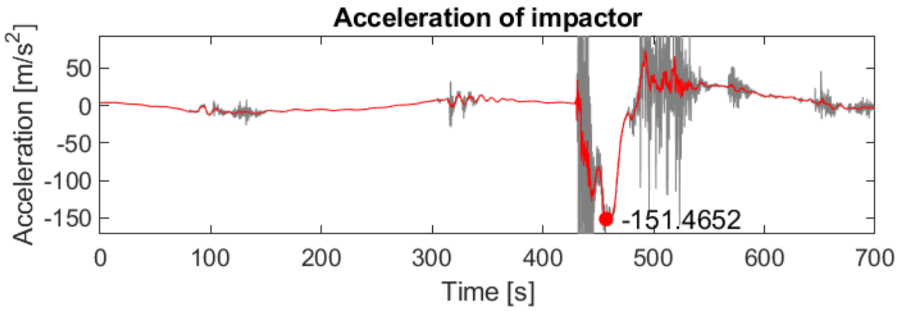

Data nr: 267
Glass: 55.2mm
Drop height: 200mm
Notes: "laminated clamp-fixed 66.2 ESG SGP"
Stress [MPa]
57.3405
-2.8546
Time [ms]
Acceleration of impactor
Acceleration [m/s^2]
-74.8944
Time [s]
Acceleration of glass element
Acceleration [m/s^2]
118.1812
Time [ms]

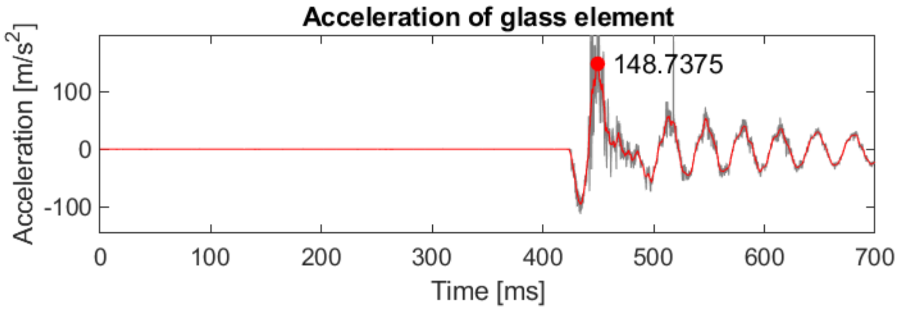


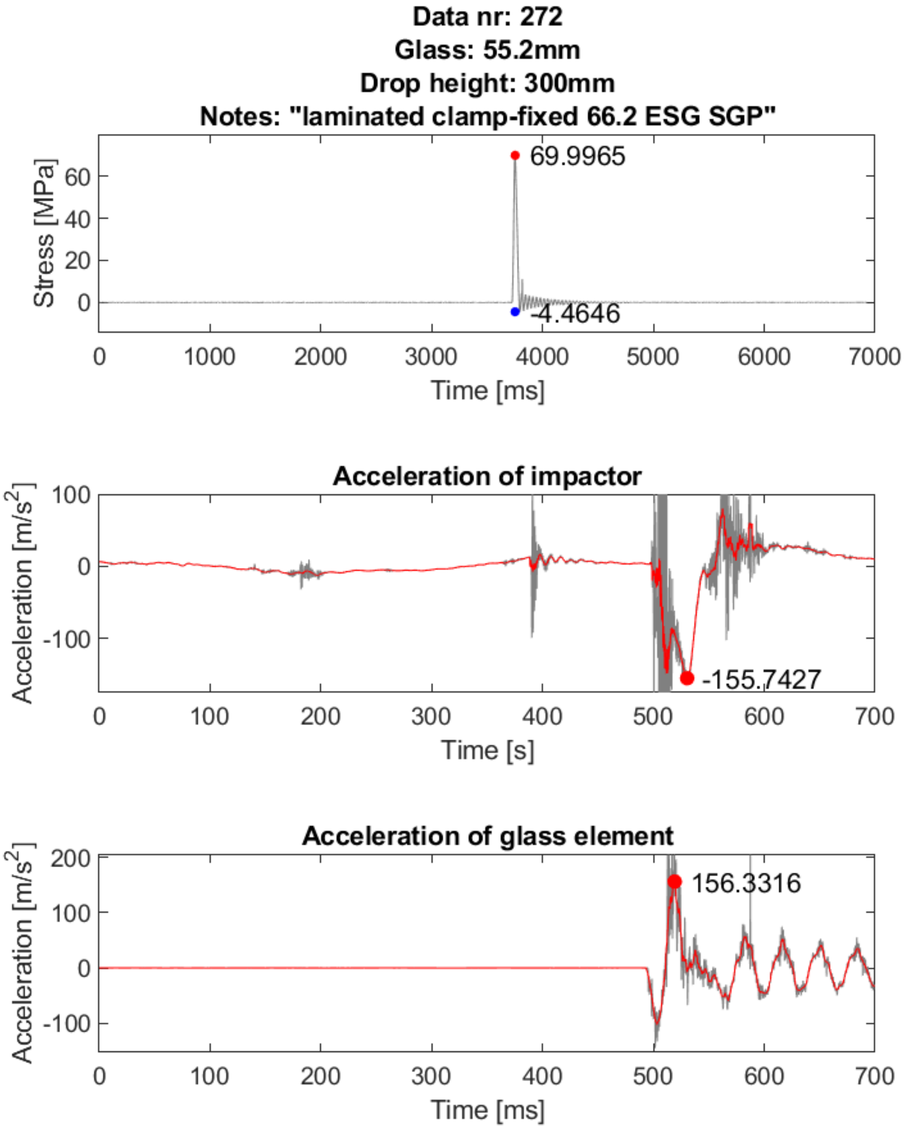
Data nr: 268
Glass: 55.2mm
Drop height: 200mm
Notes: "laminated clamp-fixed 66.2 ESG SGP"
Stress [MPa]
57.7759
-3.157
Time [ms]
Acceleration of impactor
Acceleration [m/s2]
-131.6516
Time [s]
Acceleration of glass element
Acceleration [m/s2]
126.0019
Time [ms]

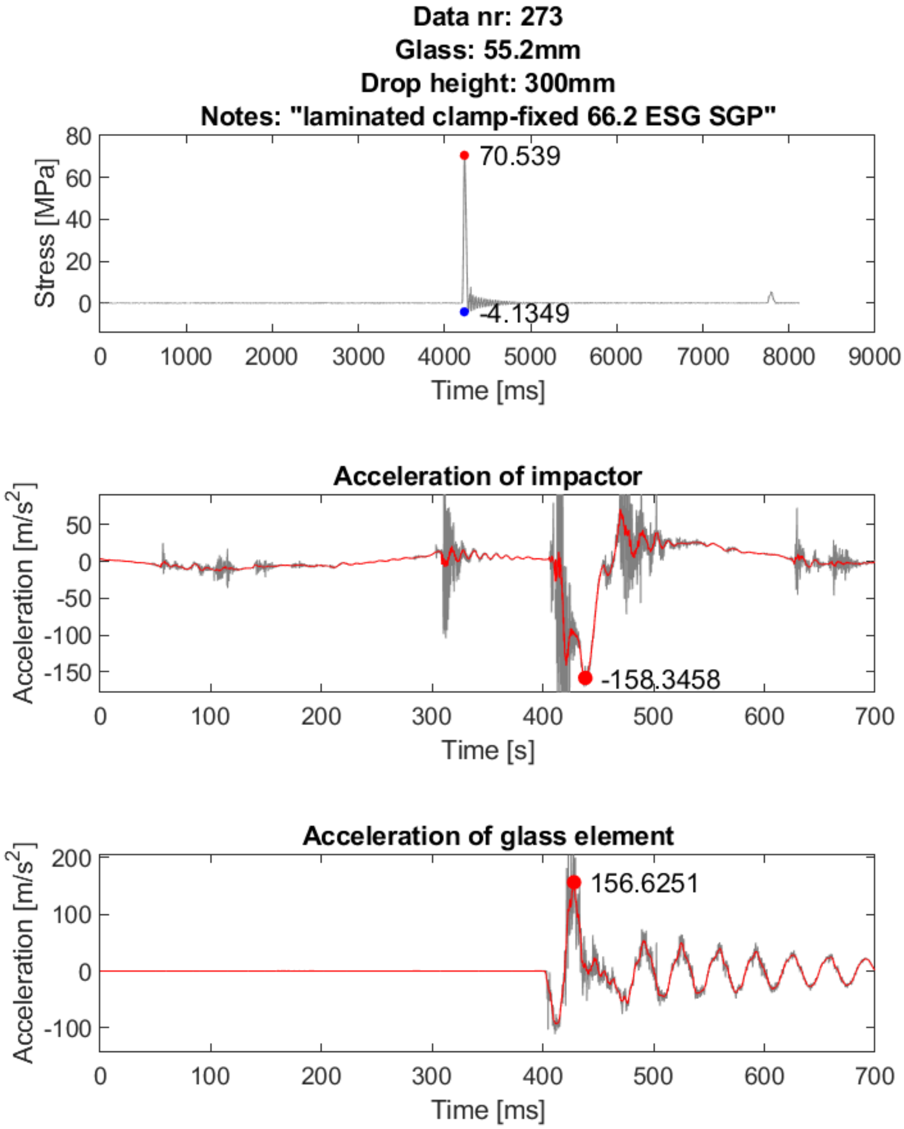

Data nr: 269
Glass: 55.2mm
Drop height: 200mm
Notes: "laminated clamp-fixed 66.2 ESG SGP"
Stress [MPa]
56.9471
-5.0421
Time [ms]
Acceleration of impactor
Acceleration [m/s2]
-7.9118
Time [s]
Acceleration of glass element
Acceleration [m/s2]
0.30659
Time [ms]

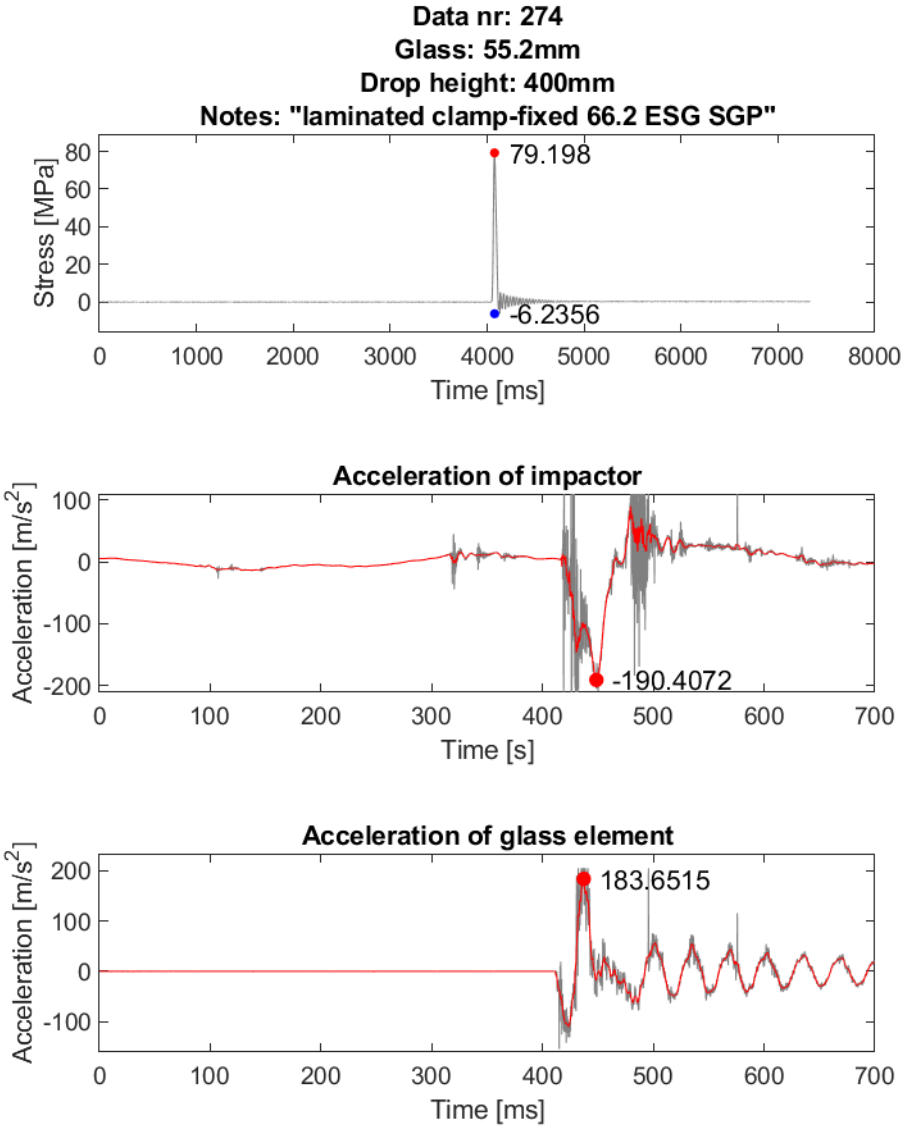

Data nr: 271
Glass: 55.2mm
Drop height: 300mm
Notes: "laminated clamp-fixed 66.2 ESG SGP"
Stress [MPa]
70.392
-4.4163
Time [ms]

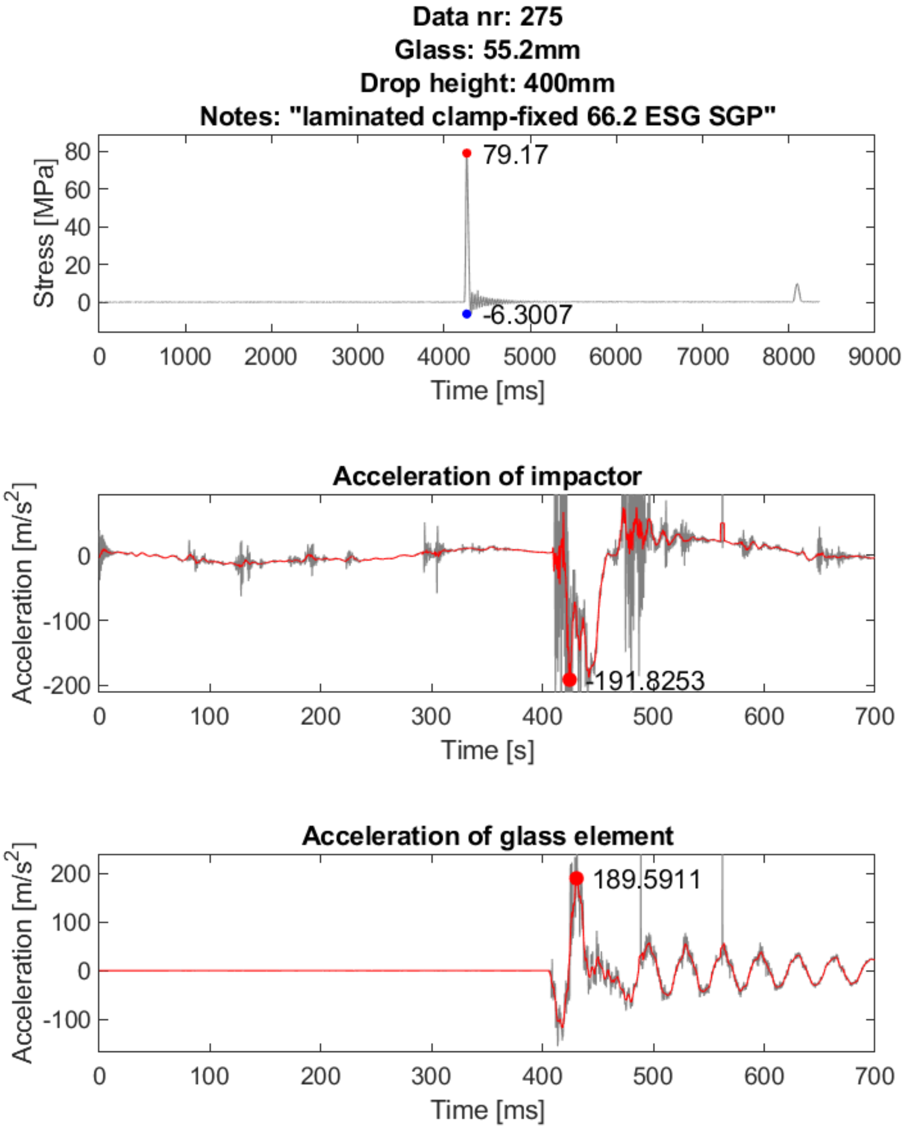

Acceleration of impactor
Acceleration [m/s^2]
-151.4652
Time [s]

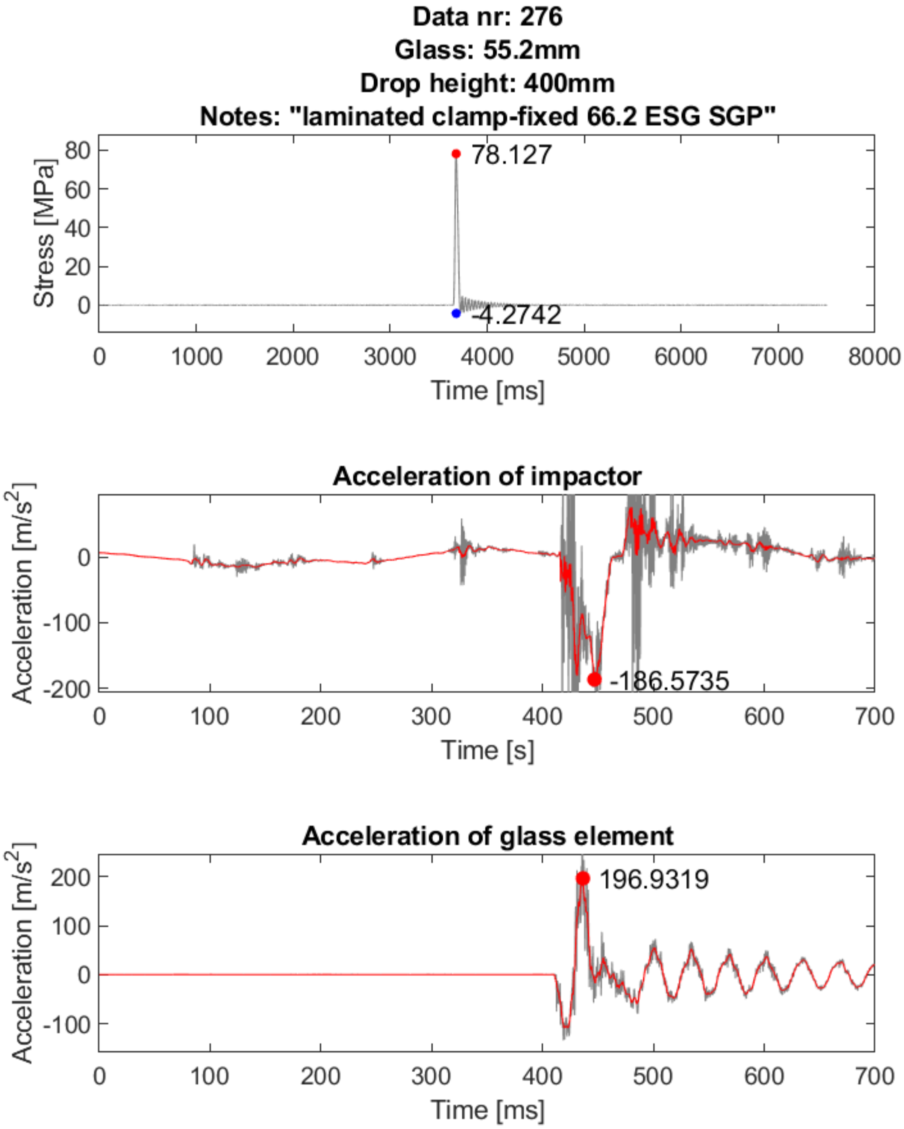

Acceleration of glass element
Acceleration [m/s^2]
148.7375
Time [ms]

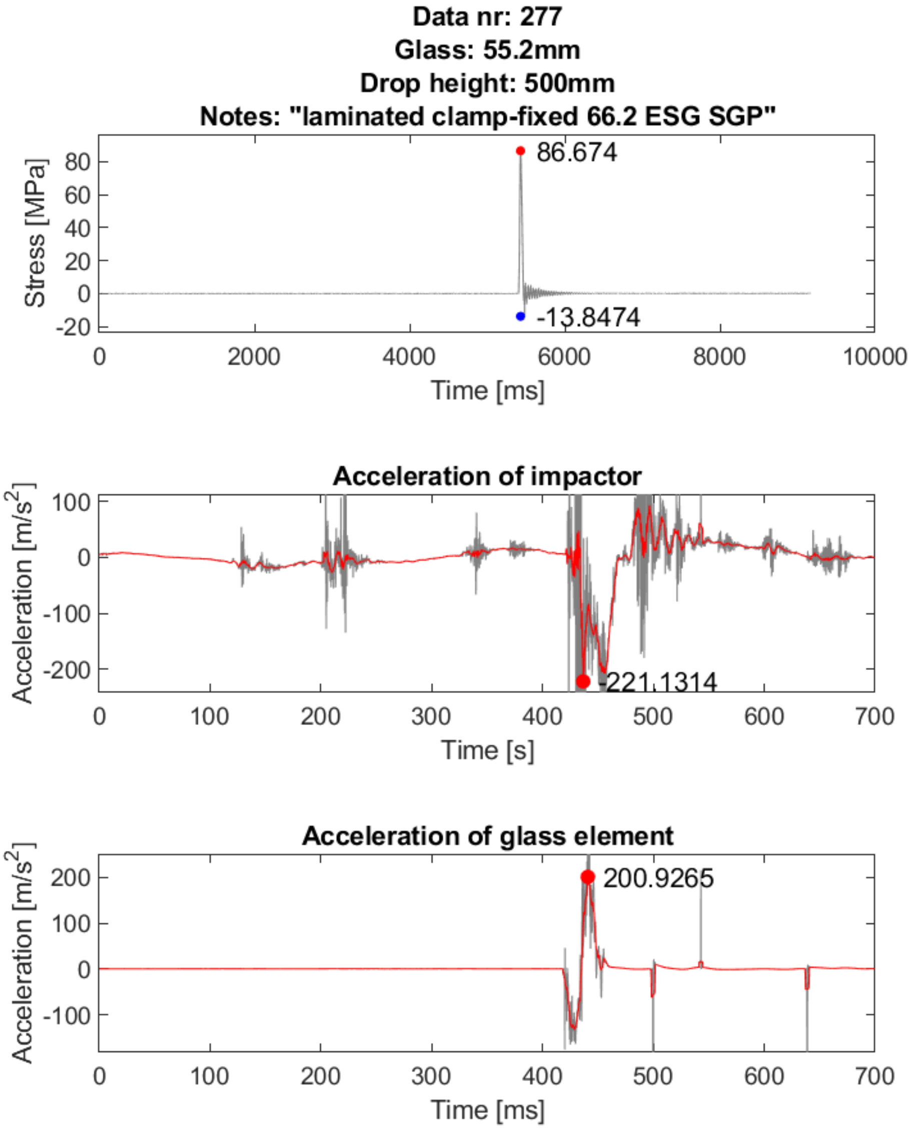

Data nr: 272
Glass: 55.2mm
Drop height: 300mm
Notes: "laminated clamp-fixed 66.2 ESG SGP"
Stress [MPa]
69.9965
-4.4646
Time [ms]
Acceleration of impactor
Acceleration [m/s2]
-155.7427
Time [s]
Acceleration of glass element
Acceleration [m/s2]
156.3316
Time [ms]

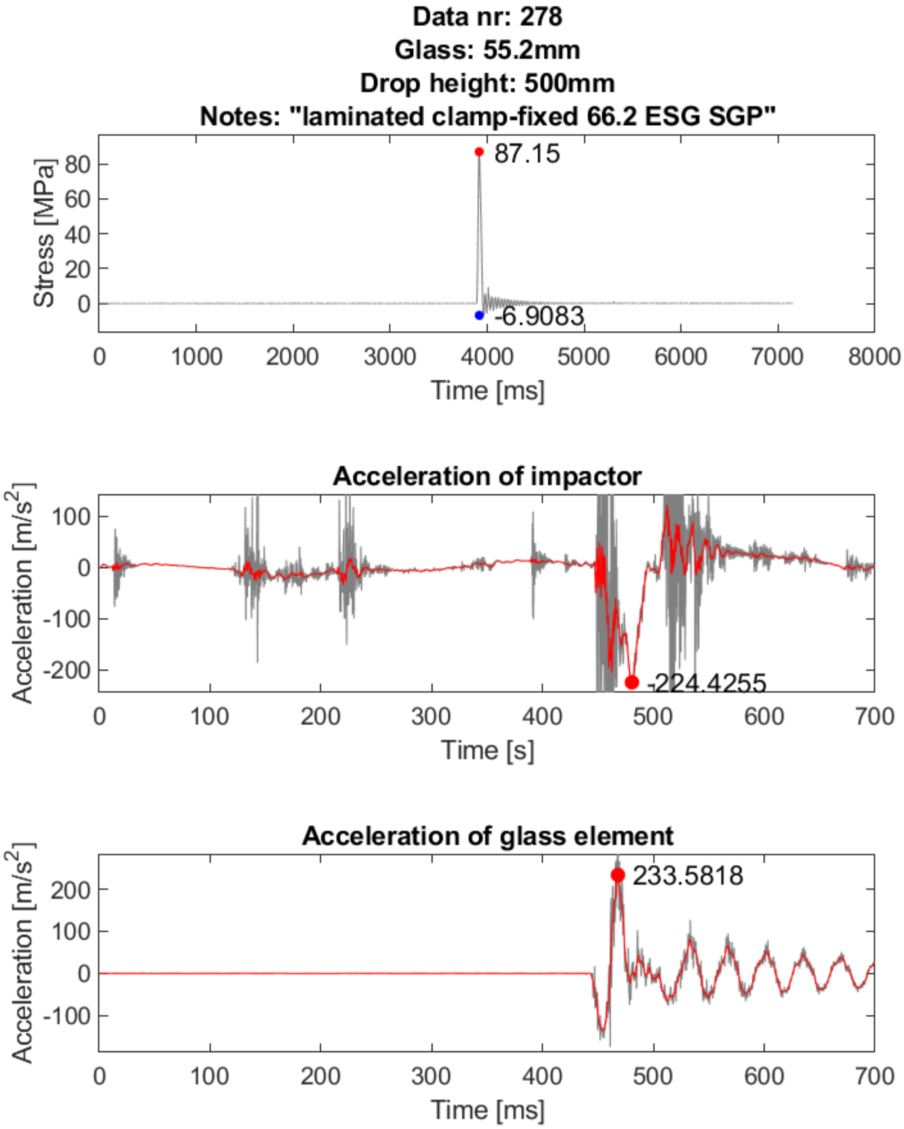

Data nr: 273
Glass: 55.2mm
Drop height: 300mm
Notes: "laminated clamp-fixed 66.2 ESG SGP"
Stress [MPa]
70.539
-4.1349
Time [ms]
Acceleration of impactor
Acceleration [m/s^2]
-158.3458
Time [s]
Acceleration of glass element
Acceleration [m/s^2]
156.6251
Time [ms]

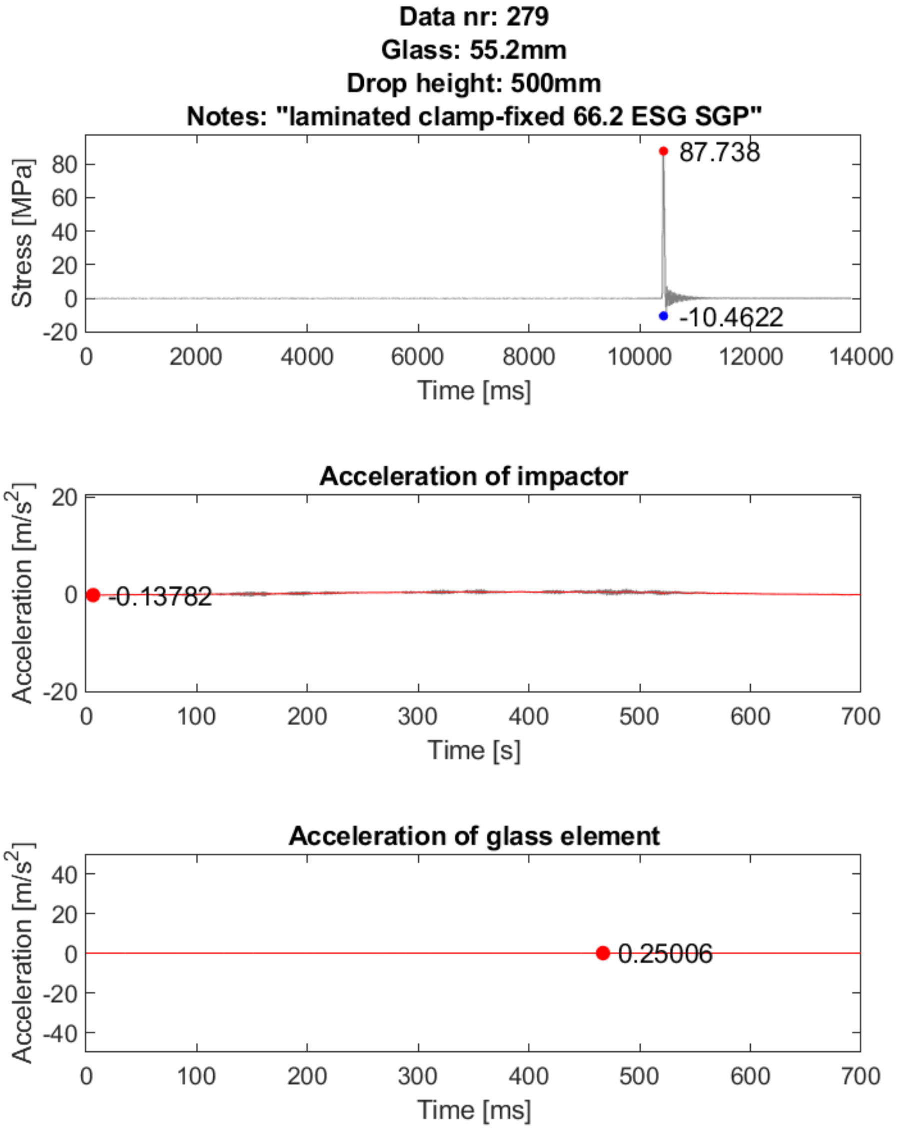

Data nr: 274
Glass: 55.2mm
Drop height: 400mm
Notes: "laminated clamp-fixed 66.2 ESG SGP"
Stress [MPa]
79.198
-6.2356
Time [ms]
Acceleration of impactor
Acceleration [m/s^2]
-190.4072
Time [s]
Acceleration of glass element
Acceleration [m/s^2]
183.6515
Time [ms]

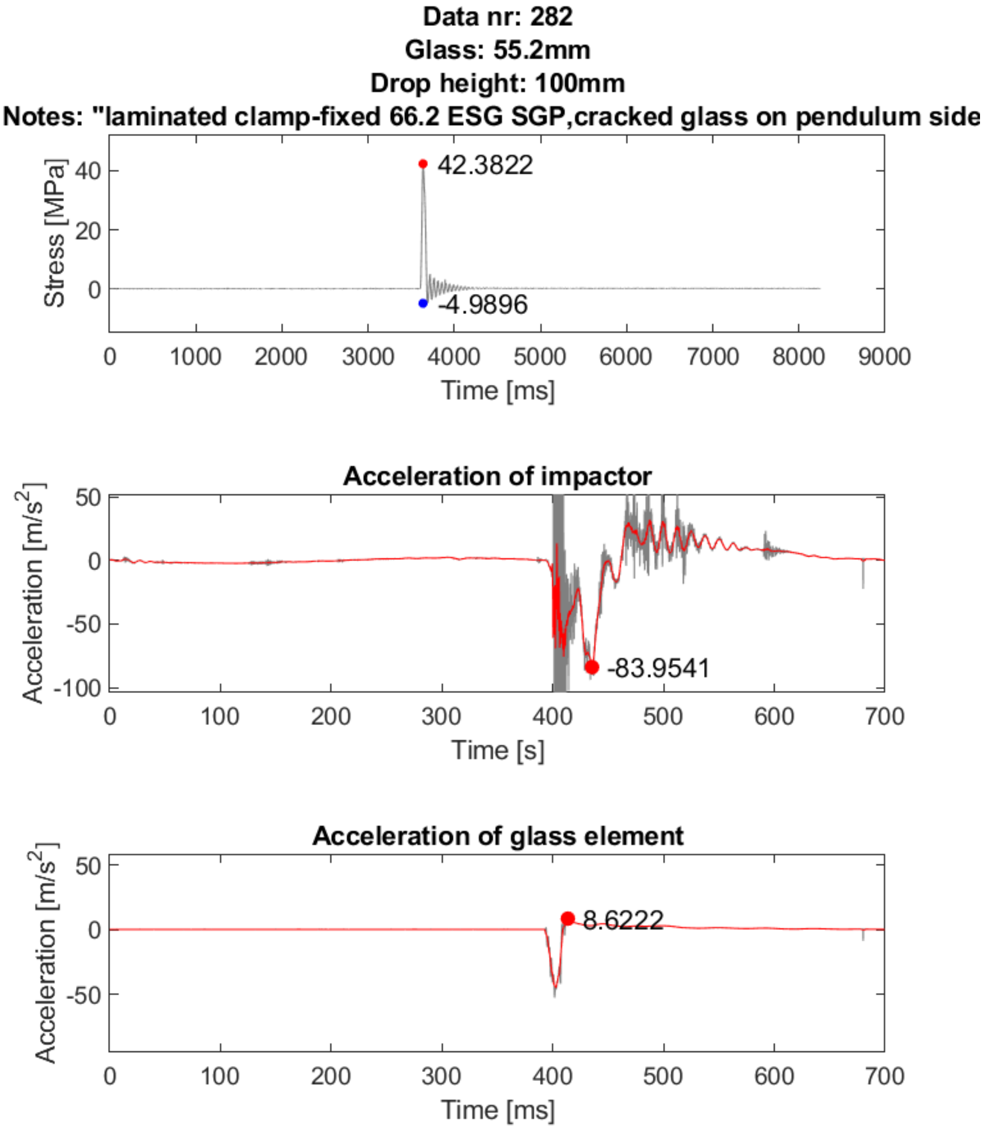

Data nr: 275
Glass: 55.2mm
Drop height: 400mm
Notes: "laminated clamp-fixed 66.2 ESG SGP"
Stress [MPa]
79.17
-6.3007
Time [ms]
Acceleration of impactor
Acceleration [m/s^2]
-191.8253
Time [s]
Acceleration of glass element
Acceleration [m/s^2]
189.5911
Time [ms]


Data nr: 276
Glass: 55.2mm
Drop height: 400mm
Notes: "laminated clamp-fixed 66.2 ESG SGP"
Stress [MPa]
78.127
-4.2742
Time [ms]
Acceleration of impactor
Acceleration [m/s^2]
-186.5735
Time [s]
Acceleration of glass element
Acceleration [m/s^2]
196.9319
Time [ms]

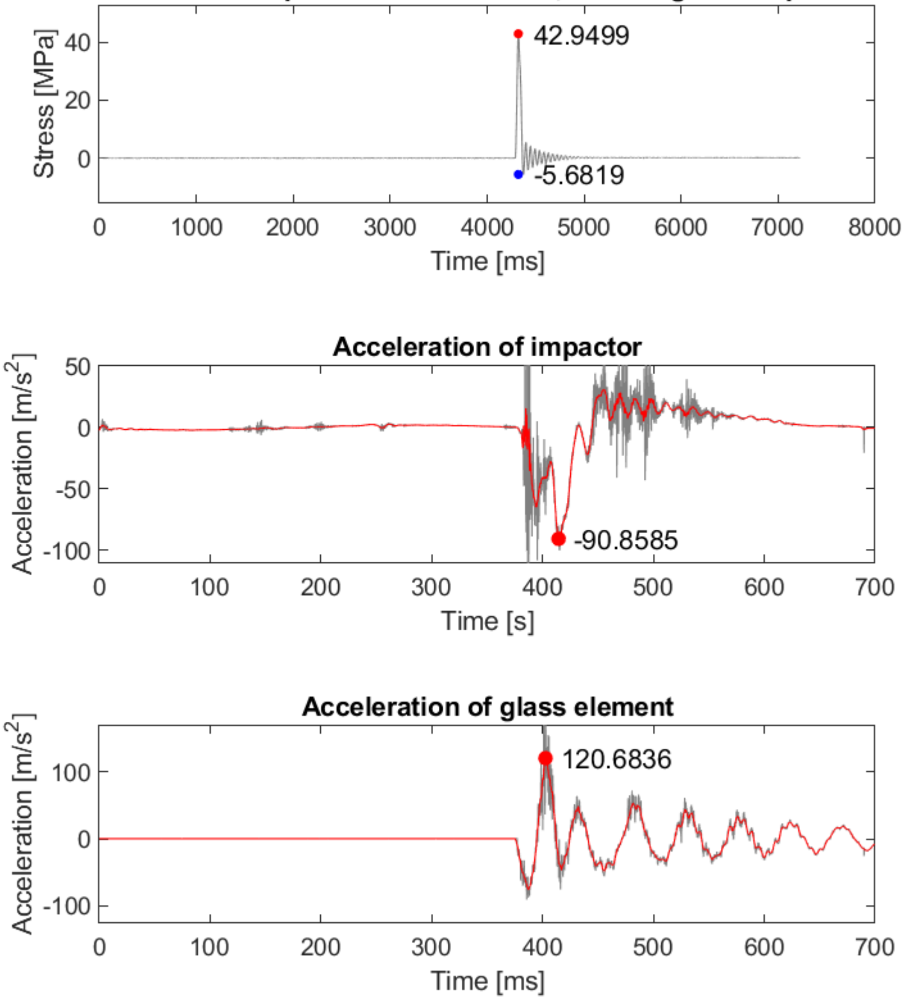

Data nr: 277
Glass: 55.2mm
Drop height: 500mm
Notes: "laminated clamp-fixed 66.2 ESG SGP"
Stress [MPa]
86.674
-13.8474
Time [ms]
Acceleration of impactor
Acceleration [m/s^2]
-221.1314
Time [s]
Acceleration of glass element
Acceleration [m/s^2]
200.9265
Time [ms]


Data nr: 278
Glass: 55.2mm
Drop height: 500mm
Notes: "laminated clamp-fixed 66.2 ESG SGP"
Stress [MPa]
87.15
-6.9083
Time [ms]
Acceleration of impactor
Acceleration [m/s^2]
-224.4255
Time [s]
Acceleration of glass element
Acceleration [m/s^2]
233.5818
Time [ms]


Data nr: 279
Glass: 55.2mm
Drop height: 500mm
Notes: "laminated clamp-fixed 66.2 ESG SGP"
Stress [MPa]
87.738
-10.4622
Time [ms]
Acceleration of impactor
Acceleration [m/s2]
-0.13782
Time [s]
Acceleration of glass element
Acceleration [m/s2]
0.25006
Time [ms]


Data nr: 282
Glass: 55.2mm
Drop height: 100mm
Notes: "laminated clamp-fixed 66.2 ESG SGP,cracked glass on pendulum side
Stress [MPa]
42.3822
-4.9896
Time [ms]
Acceleration of impactor
Acceleration [m/s2]
-83.9541
Time [s]
Acceleration of glass element
Acceleration [m/s2]
8.6222
Time [ms]

Data nr: 283
Glass: 55.2mm
Drop height: 100mm
Notes: "laminated clamp-fixed 66.2 ESG SGP,cracked glass on pendulum side



Data nr: 284
Glass: 55.2mm
Drop height: 100mm
Notes: "laminated clamp-fixed 66.2 ESG SGP,cracked glass on pendulum side