Crash testing of nuclear fuel

There have never been big studies made on accidents with nuclear fuel rods from great heights while inside a reactor at Westinghouse. They have only been done on fuel assemblies at a max height of 1 meter. So what happens if one entire fuel assembly is dropped from 6 meters onto another fuel assembly?

Well surprisingly the bottom of the fuel casing and the handle at the top, while not created for this purpose, absorbs a lot of the chock and protects the fuel much better than first thought. Another surprise is that the spacers between individual rods also help protect the entire assembly from bending. It was always assumed that they had little to no impact on the safety of the fuel.

Extensive testing has been made while the fuel is being transported on the road but not when inside the reactor. So to make up for this lack of information a scenario where one batch of nuclear fuel is dropped on top of another inside a reactor was tested. Since no test has been done on a assembly that falls from greater than 1 meter this is the crash with most energy tested. This study is needed so that safety concerns regarding the fuel can be addressed. The type of accident that is explored here is unlikely since there are several safety measures in place already but should they fail it is nice to know what would happen so that something can be done about it.

The study made can be further improved upon to add more complex scenarios that would show even further the damage that can happen and where possible problem areas are and possible solutions can therefore be created.

Utilizing the software Ansys, the fuel assembly is divided into several thousand pieces and a chock test is performed. The method of dividing the fuel and doing the calculations on the smaller pieces is called Finite Element Method (FEM). With the results from the FE analysis it can be seen that there is massive damage on the fuel rods at the bottom just after impact happens. It has always been assumed that the assembly when hitting the handle will come to a complete stop and then topple over. It turns out that there is a very high chance of it glancing of on impact and can therefore create even more damage by crashing into not just one but several other assemblies. This means that it would be a good idea to create some form of barrier between the several assemblies that sit next to each other inside a reactor. This would be to make sure that not several assemblies would be damaged during an accident.