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Study on X-ray diagnosis for phase distribution during corium-sodium interaction

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In case of a severe accident scenario in sodium-cooled fast reactors, the fuel in the core would melt, generating a hot mixture termed as corium. This corium will then be discharged into the sodium pool through the guide tubes. When the hot molten corium comes in contact with sodium, called Molten Fuel-Coolant Interaction (MFCI), it might generate a violent explosion. Such an explosion can be visualized using an X-ray radioscopic device. The PhD thesis aims to study the X-ray diagnosis and develop an X-ray imaging algorithm in order to better realize the interaction mechanism. This study will help us to analyze the three phase repartition (i.e. corium, liquid sodium and its vapors) during such an interaction being carried out in the upcoming experimental facility PLINIUS 2 at CEA, Cadarache. A major difficulty is to detect the extreme fine fragments of corium (˜100 microns) in sodium which is beyond the detection limit of existing tools. This talk will focus on the development of initial models of the representative corium fragments and the associated image processing and analysis techniques, to better realize the interaction mechanism.

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