

# International Conference on Fast Reactors and Related Fuel Cycles: Next Generation Nuclear Systems for Sustainable Development (FR17)



Contribution ID: 313

Type: ORAL

## PLINIUS-2: a new corium facility and programs to support the safety demonstration of the ASTRID mitigation provisions under Severe Accident Conditions

*Thursday, June 29, 2017 8:40 AM (20 minutes)*

The ASTRID reactor (Advanced Sodium Technological Reactor for Industrial Demonstration) is a technological demonstrator of sodium-cooled fast reactor (SFR) designed by the CEA with its industrial partners, with very high levels of requirements. Innovative options have been integrated to enhance the safety, to reduce the capital cost and improve the efficiency, reliability and operability, making the Generation IV SFR an attractive option for electricity production.

In the ASTRID project, the safety objectives are first to prevent the core melting, in particular by the development of an innovative core (named CFV core) with heterogeneous pins and complementary safety prevention devices, and second, to enhance the reactor resistance to severe accident by design. In order to mitigate the consequences of hypothetical core melting situations, specific dispositions or mitigation devices are added to the core and to the reactor: some corium Transfer Tubes are implemented, allowing molten corium discharge outside the core region toward a core catcher which insures sub-criticality, cooling and confinement of the relocated materials.

For a robust safety demonstration, CEA with its partners is improving or developing codes (SIMMER, SCONE and EUROPLEXUS) to simulate de Severe Accidents progression. These codes must be assessed, and the mitigation devices qualified against experiments. Since no facility is worldwide available allowing tests with Sodium and large masses of prototypic corium (about 500kg) to study corium discharge through full-scale Corium Transfer Tube, Fuel-Sodium-Interactions and subsequent Sodium vapor explosion, and Corium Interactions with the sacrificial material which protects the Core-Catcher tray, CEA has decided to build a new versatile facility, called PLINIUS-2; this new experimental platform will extend the PLINIUS capabilities where the handled corium mass was limited to 50kg of UO<sub>2</sub>, and only Fuel-Water-Interaction where studied.

After describing the ASTRID design options related to Severe Accidents and the main features of the PLINIUS-2, the paper will describe the analytical and global experimental programs planned in PLINIUS-2, supporting the ASTRID development; the used molten mass of UO<sub>2</sub> will range from few grams to 500kg. The programs will be devoted to the study of Fuel-Sodium Interactions (Droplet fragmentation, Corium Jet Fragmentation, Sodium Vapor Explosion), of Corium-Sacrificial Material Interactions (corium jet impingement, long term sacrificial material ablation by the corium), and to the qualification of the corium Transfer Tubes.

### Country/Int. Organization

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**Session Classification:** 6.8 Experimental Facilities

**Track Classification:** Track 6. Test Reactors, Experiments and Modeling and Simulations