

Potential SAD activities with significant contribution from EU partners

D. Villamarín and E. González
CIEMAT

BFS experiments during SAD construction

- Design of the most suitable BFS configurations
- Set-up of the selected configurations
- Calibration of the detectors and electronic chains present in BFS
- Transport and tuning to BFS of the data acquisition systems used during the MUSE experiments
- Calibration and monitoring of the (D-T) source during the experiments
- Determination of the kinetic parameters of the system in the critical configuration
- Kinetic experiments in subcritical configurations with $k_{eff} = 0.95$ and 0.97
- Analysis of the experimental results
- Detailed description of the configuration to be used as international benchmark (simulation code calibration)
- To study the possibility to load BFS with the SAD fuel in a critical configuration in order to determine the kinetic parameter k_{eff} of SAD fuel.

Start-up experiments using the (D-T) source

- Design of the two configurations
- Set-up of the configurations
- Calibration of the detectors and electronic chains present in SAD to work with low intensity source (pulse mode)
- Transport and tuning to SAD of the data acquisition systems used during the MUSE and BFS experiments
- Calibration and monitoring the (D-T) source
- Validation of the thermal neutron shielding for diagnostic techniques
- Estimation of SAD kinetic parameters with the simulation tools calibrated at BFS
- Kinetic experiments in the subcritical configuration to determine the reactivity of the system
- Analysis of the experimental results
- To study a core heating system to perform the kinetic experiments at the same temperature conditions that will be found with the proton accelerator

Test and calibration of the actual spallation target outside SAD

- Dedicated off-core cooling system for the spallation target
- Set-up of the same detector systems as in the previous target experiments
- Measurement of the neutron source intensity and energy distribution

Experiments using the 660 MeV proton accelerator (I)

- Determination of the detectors and electronic chains required in SAD to work at full power
 - Using fast extraction
 - Using slow extraction
- Calibration of the detectors and electronic chains at full power
 - Using fast extraction
 - Using slow extraction
- Development and validation of new data acquisition systems adapted to work with current mode detectors for kinetic measurements
 - Using fast extraction
 - Using slow extraction
- Definition of experiments
 - Using fast extraction (area method, slopes method)
 - Using slow extraction (source jerk, integrated slopes method, power to reactivity method)
 - Simulation support for the experiments

Experiments using the 660 MeV proton accelerator (II)

- Monitoring of the accelerator and the importance of the source
 - Online monitoring of the beam current
 - Monitor the number of neutrons per proton (part of source important)
 - Monitor the geometric distribution of primary neutron source (diagnostics for source importance)
- Neutron fluence determination across large thickness shielding
 - Definition and set-up of the detectors
 - Measurement of the neutron fluence after lead, concrete and iron shielding
 - Comparison with the results obtained by simulation codes
- Determination of the effects of using the thermal neutron shielding in the kinetic experiments

Experiments using the 660 MeV proton accelerator (III)

- Kinetic experiments using fast extraction mode of the accelerator: area method and slopes method
- Kinetic experiments using slow extraction mode of the accelerator: source jerk and integrated slopes method
- Calibration of SAD power
- Determination of the techniques that will be used to calibrate the power to reactivity technique
- Experiments of power to reactivity online monitoring
- Feedback experiments
 - Temperature variation of the fuel
 - Fast reactivity variation using insertion or extraction of absorbers
 - Oscillation of reactivity with absorbers and/or fissile material
- Static and kinetic measurements of the axial and radial(?) fission rate traverses to validate simulation codes
- Interpretation of the experimental results

Similarities and differences between the experimental results in different conditions

- Extensive simulations should allow the calibration of simulation tools and the study of the correlation between the different reactivity determination techniques

Post-irradiation experiments

- Extensive post-irradiation program to determine the spallation fragments in the target and fission products in the fuel
- The experimental results will be used to validate simulation tools and for international benchmarking