



Status of Accelerator-Driven Systems Research and Technology Development

Summary of session 5: Innovative Ideas and New R&D

Session 5 Chair: Markus Nordberg

Thursday February 9, 2017

KEY MESSAGES FROM THE SPEAKERS

- **High Power Target using dense granular flow by gravity (Lei Yang)**
 - Status of on-going R&D work on ADS High Power Target providing efficient heat transfer and a high/flux secondary beam Aiming at 100 MW beam power and 100 $\mu\text{A}/\text{cm}^2$ currents for different use
 - Facilities currently under construction in China
- **High Power Cyclotron CYCLADS (Marcello Losasso)**
 - Proposal submitted for the EU (FET Open) for a high-power, compact, cost effective and easy to operate sc cyclotron for transmutation of nuclear waste
 - Similar concept could also be used to produce nuclear energy (idea of C. Rubbia and others) and wide range of particle physics
 - It will use high temperature superconductors, new magnetic field configuration, new sub-critical unit, etc.
 - iThEC in collaboration with CERN , PSI and ENEA. Funding decision from EU expected in May, 2017
- **Novelty of LFR-AS-200 Project (Luciano Cinotti)**
 - LFR-AS-200 is a sub-critical lead-cooled reactor unit, 200 MWe (CYCLADS will use an adapted subcritical version)
 - Primary reactor vessel system of 1m³/Mwe is expected to be compact, with height ca. 6 m (previous reactors typically 19 m)
 - Simplified access (eg. refueling) and maintenance
- **New Thermal Management Technology for Molten Salt Reactor Vessels (Peter McIntyre)**
 - These require molten salt heat transfer at ~ 800 C, materials challenges: hydrostatic pressure, corrosion, radiation damage etc.
 - Absorbed and transferred heat to a flow of molten salt is of the order of 1000 MW (!)
 - Idea: line the vessels and piping with hermetic insulating bladders: a hermetic blanket containing multi-layers of shiny Ni foils. This is now being developed at a dedicated molten salt loop by Texas A&M.

KEY MESSAGES FROM THE SPEAKERS

- **The ADS-Troitsk project (Stanislav Sidorkin)**

- Status of on-going work to modernize the existing neutron sources at INR. The existing facility would make it possible to carry out a first coupling of a proton beam with a fast neutron core at significant power (≥ 1 MW), at a very advantageous cost, and within 5 years.
- The challenge is to increase the linac beam energy to 350 MeV and obtain a pulsed beam of average intensity 100 μ A
- A new demo ADS looks very feasible at the facility. It will require a licensing procedure.

- **Novelty ADS Irradiation Facility for Fast and Slow Neutrons (Fabio Panza)**

- Starting point: lead based low power ADS for education, training and research on lead systems and waste transmutation
- Use of mixed lead-graphite reflector and water as coolant allows to increase the fission rate, permitting a concept of a "Hybrid fast-slow" ADS
- Improved capture rate measurements and actinides sample irradiation. External integral measurements on fission and capture

- **A Dynamic Beam Window for ADS (Alex Mueller)**

- Presentation of a preliminary idea of using a "propeller" or fast beam chopper window for the spallation target transition region
- To be further investigated (can such a vacuum pump be constructed?)

SOME CONCLUDING REMARKS

- There are a lot of new ideas related to the development of ADS. Impressive
- The on-going R&D is also addressing a number of important societal questions beyond ADS (see e.g. M. Losasso's and P. McIntyre's talks)
- One could imagine a global, collaborative effort becoming a reality, perhaps on a CERN experiment model
- Big labs could play a pivotal role in that