Report on the session “n-ToF” at the New Opportunities on the Physics Landscape at CERN.

Convenor: Frank Gunsing

This session was devoted to n_TOF, CERN's neutron time-of-flight facility based on the spallation pulsed white neutron source. n_TOF has become a unique world-leading facility for the measurement of nuclear cross sections of neutron induced reactions, particularly for radioactive or rare material samples. With the upgrades proposed by the collaboration, particularly the construction of a second short path experimental area and eventually the utilization of the SPL/PS2 beams, the facility will surpass during many years all other existing time-of-flight facilities for this type of measurements.

After an initial and successful period of data taking in phase I from 2000-2004, and a period without beam since the end of 2004, the facility has been recently refurbished and upgraded to today's security standards at CERN. A challenging scientific programme has been set up, of which much has already been recommended for approval by the INTC, and data taking for this phase-II has just been started.

The collaboration had decided to submit for the given time slot two overview talks preceeded by an introduction in order to provide a general outline for its future. The first presentation by A. Mengoni and F. Käppeler highlighted the need for accurate nuclear data for nuclear astrophysics and in particular for stellar evolution and nucleosynthesis calculations. It was stressed that neutron cross section data are crucial input for the understanding of the origin of the elements in the universe. Several of the relevant contributions from n_TOF phase-I were mentioned.

The second presentation by E. González dealt with neutron data for nuclear technology, emphasizing the impact of the results obtained in phase-I and proposed in phase-II on safety, environmental friendliness and sustainability of nuclear energy. He also described the strong support from the past and current European Framework programmes, particularly for the data needed in the conception and safety design of the transmutation systems and for the minimization of nuclear waste.

Both presentations emphasized the large common interest in the same reactions, energy ranges, and nuclei to be studied for applications in both fields as well as the close relation with nuclear structure physics. In addition to a significant number of publications, conference proceedings and PhD theses, the inclusion of n_TOF data in the most recent model calculations and evaluations for international nuclear data libraries and in the astrophysical libraries illustrates the claimed impact.

The combination of a very high instantaneous neutron flux with an excellent energy resolution is one of the unique characteristics of the n_TOF facility, which in this respect outperforms all other existing time-of-flight facilities. The high flux is particularly favourable for measurements of radioactive samples which cannot be done elsewhere. The significant contribution to nuclear data that CERN can deliver with its n_TOF facility, including the developed detector systems and high performance data acquisition system, is well established and generally recognized.

Nevertheless, it has become clear that attention should be drawn to the following points:

• **Handling of radioactive targets**
The need to handle radioactive targets in the existing experimental area is an issue of importance. The n_TOF facility has excellent characteristics for measurements with radioactive targets, but the use of such radioactive targets is condition to specific limitations and regulations at CERN.
Currently radioactive samples can be used only if they are sealed in an ISO2919 compliant way. Insome cases this can hinder measurements due to the large backgrounds produced by the cannings. Although the measurement programme as planned for the moment can cope with this constraint, the construction of a class A laboratory in the experimental area will provide a much wider range of samples to be measured without compromising the safety of the experiment.

• **A second experimental area**
The construction of an additional short flight path at about 20 m would increase the neutron flux by a factor of 100. Since in this case much lower sample masses are needed this would open entirely new possibilities to measure radioactive nuclei. The increase in brightness will maintain the leadership of n_TOF beyond the upgrades planned at competing facilities. The construction of such a flight path should be foreseen in the near future.

• **Proton beam SPL/PS2**
On the longer term, the integration of n_TOF within SPL or PS2 could provide a further increase in the brightness of the neutron source. The n_TOF facility needs an intense pulsed proton beam.
Currently a 20 GeV/c proton beam with a width of 6 ns is supplied by the PS, but lower energies are desirable and widths of up to 100 ns could be acceptable. A detailed plan for the implementation of n_TOF within SPL/PS2 will be prepared on the very short term.