

## P2IO Activity Report

**Title of project:** Development and implementation of semi-conductor sensors to probe the Compton recoil electron spectrum and to measure the beam halo after the interaction point of the ATF2 final focus prototype at KEK (Japan)

**P2IO support:** 1 month visit for Dr. Hyojung Hyun (Kyungpook National University, South Korea) in 2012, R&D grant of 55000 euro during 2012-2014.

**Project responsible and author of this report:** Dr. Philip Bambade (LAL, CNRS/IN2P3 and Univ. Paris Sud)

The project supported by P2IO has progressed in significant ways in three of its main areas:

- Simulation of the beam halo propagation from the entrance of the ATF2 beam line to the planned sensor location after the interaction point. A detailed simulation including the aperture profiles along the ATF2 beam line allowed identifying the location of losses due to interception of halo tail particles, and to evaluate the shape of the propagated distribution in the region where the Compton electron signal will be measured. The tightest apertures are a pair of C-band RF cavity beam position monitors attached to quadrupoles of the chromatic correction section about 30 meters upstream of the interaction point. A GEANT4 study of potential regeneration of the beam halo was started in collaboration with the LLR partner (Dr. M. VERDERI and Dr. H. GULER) and will be continued at LAL in 2013 for detailed comparison with the planned measurements.
- Definition and initial specification of the mono-cristalline CVD diamond sensor geometry, mechanics and readout. The spatial granularity and the dynamic range needed for measurements of both the halo and Compton recoil electron distributions were studied in simulation. The arrangement for the first version consists of two single rectangular mono-cristalline CVD diamond sensors, each  $4.6 \times 4.6 \text{ mm}^2$  and 0.5 mm thick, with full metallization on one side and a metallization structured in several pads and strips of variable sizes on the other side. A first sensor (fully metallized on both sides) was bought from Diamond Detectors Ltd for first tests at LAL. The leakage current versus voltage characteristic (IV-curve) provided by the vendor was reproduced. The PARISROC2 ASIC designed by the LAL- $\Omega$  analog electronics group has almost suitable specifications: 16 channels, dynamic range of 900, minimum signal corresponding to 20 MIPs, shaping time tunable down to 20 ns and ns-level time-stamping. Initial tests reading out our first sensor with this ASIC started in collaboration with the designer in the LAL- $\Omega$  group. Concerning mechanics, the design of a system with a motorized fork supporting the sensors in the vacuum chamber is in progress at LAL.
- Integration at KEK: The requirements for modifying the vacuum chamber between the last bending magnet and final beam dump have been agreed with the KEK group, which will take responsibility for the manufacturing of a new larger aperture beam tube with several flanges, in both horizontal and vertical dimensions, to allow our movable sensors to be inserted.
- Human resources: A PhD student, S. LIU, will start working on the project full time in September, funded by 3-year PhD grant from the Chinese Scholarship Council. In addition, an experienced post-doctoral researcher from Kyungpook National University (Korea), Dr. H. HYUN, is contributing together with two mechanical engineers and one electronics engineer from LAL.