Contribution ID: **83** Type: **not specified**

Gamma beam collimation and characterization system for ELI-NP-GBS

Tuesday, 4 September 2018 14:25 (18 minutes)

The Gamma Beam System of ELI-Nuclear Physics is a high-brilliance monochromatic gamma source based on the inverse Compton interaction between a high-power laser and an accelerated electron beam. The source, currently being assembled in Magurele (Romania), is designed to provide photons with tunable average energy ranging from 0.2 to 19.5 MeV, energy bandwidth down to 0.5% and flux of about 10^8 photons/s.
The time structure of the gamma beam will consists of 32 ultra-short pulses of 10^5 photons separated by 16 ns and delivered at repetition rate of 100 Hz. Given the challenging characteristics of this gamma beam, dedicated devices and techniques have been developed to measure and monitor the beam parameters during the commissioning and the operational phase.
The characterization system includes four main elements: a Compton spectrometer, a sampling calorimeter, a nuclear resonant scattering spectrometer (NRSS) and a beam profile imager.
The Compton Spectrometer was designed to reconstruct the gamma energy spectrum, by measuring the energy and the scattering angle of electrons produced in Compton interactions on thin mylar targets. A new-concept sampling calorimeter, made of layers of silicon detectors and polyethylene absorbers, was developed to measure the average energy and beam intensity.
To obtain an accurate absolute measurement of the gamma beam energy the NRSS will use as calibration candles a few selected nuclear levels, whose fluorescence condition will be monitored by a scintillators system.
To complete the characterization of the source, a gamma beam profile imager, based on a scintillator screen and a CCD camera, has been developed to evaluate the transverse spatial distribution of the beam.
Due to the nature of inverse Compton interaction, in order to obtain a monochromatic beam a collimation of the emitted photons is necessary. Depending on the energy, the angular aperture required for a relative bandwidth $\Delta E/E=0.5\%$ is between 70 and 700 microrad. A collimation system to provide a continuously adjustable aperture having such a demanding positioning accuracy was designed and assembled.
In this talk an overview of these collimation and characterization system will be presented. We will focus on the working principles and technological solutions to realize such a challenging experimental apparatus. We will describe the expected performance, the result of tests carried out and the current status of the system assembly.

Selected session

Accelerators and Instrumentation

Primary author: CARDARELLI, Paolo (FE)

Co-authors: VARIOLA, Alessandro (LNF); TRICOMI, Alessia Rita (CT); SERBAN, Alin Titus (FI); ITALIANO, Antonio Stefano (ME); ZERBO, Bruno (CT); CONSOLI, Elisabetta Maria Grazia (FE); EVANGELISTI, Federico (FE); MALETTA, Fernando (FI); GRAZIANI, Giacomo (FI); PATERNÒ, Gianfranco (FE); CAPPELLO, Gigi (CT); DI DOMENICO, Giovanni (FE); PASSALEVA, Giovanni (FI); GAMBACCINI, Mauro (FE); LENZI, Michela (FI); MARZIANI, Michele (FE); VELTRI, Michele (FI); ANDREOTTI, Mirco (FE); STARODUBTSEV,

Oleksandr (FI); ADRIANI, Oscar (FI); BORGHERESI, Rita (FI); CIARANFI, Roberto (FI); ALBERGO, Sebastiano (CT); SQUERZANTI, Stefano (FE)

Presenter: CARDARELLI, Paolo (FE)

Session Classification: Accelerators and Instrumentation