Contribution ID: **150** Type: **Oral**

Monte Carlo Simulation of a Collimation System for Low-Energy Beamline (1-5 MeV) of ELI-NP Gamma Beam System

Thursday, 9 October 2014 17:15 (15 minutes)

ELI-NP is one of the three pillars of ELI (Extreme Light Infrastructures) European Project, to be built in Bucharest, Romania. This facility will host the Gamma Beam System (GBS), an intense and monochromatic gamma beam source based on inverse Compton interaction between a high-power laser and an accelerated electron beam produced by a warm linac. The EuroGammaS association, composed by many European research institutes and companies, guided by INFN, will provide the design, manufacturing, installation, commissioning of the GBS, to be completed in 2018.
The gamma beam produced, with energy ranging from 1 to 20 MeV, an energy bandwidth 0.5% and a flux of about 10^8 photons/s, will be devoted to the investigation a broad range of applications, from nuclear physics and astrophysics, to material science and life sciences.
As a result of the inverse Compton interaction, the radiation emitted is not intrinsically monochromatic. In fact, the energy is related to the emission angle, it is maximum in the backscattering direction and decreases as the angle increase. Therefore, the required energy bandwidth can be obtained only by developing specific methods of collimation of the gamma beam, i.e. filtering out the radiation emitted at larger angles.
The angular acceptance of the collimation, needed obtain the required bandwidth, must be continuously adjustable in a range from few hundreds of micro-radians to 40 micro-radians, to operate in the entire energy range. The solution identified is a stack of linear tungsten slits, each with an adjustable aperture, arranged with a relative rotation around the beam axis to obtain, as result of the overlapping, a circular shaped hole.
In order to define the specifications and to design the collimation system for the low-energy beamline (1-5 MeV), a detailed MC simulation activity has been carried out using MCNPX and Geant4. The simulation included the transport of the gamma beam produced in the IP to the collimation system along the vacuum pipes and chambers and relative shielding.
The effectiveness of the collimation system to obtain the required energy distribution, avoiding the contamination due to secondary radiation production, was evaluated. Also, the background generated in the experimental area and the effectiveness of the shielding has been verified.
Furthermore, an analysis of the effects of possible collimation system misalignments, in order to define the mechanical tolerances requirements, was carried out.

Primary author: GAMBACCINI, Mauro (FE)

Co-authors: BACCI, Alberto Luigi (MI); CURATOLO, Camilla (M); VACCAREZZA, Cristina (LNF); Dr ILLYA, Drebot (MI); BAGLI, Enrico (FE); Dr MARZIANI, Michele (FE); CARDARELLI, Paolo (FE); Dr PETRILLO, Vittoria (Università degli Studi di Milano)

Presenter: GAMBACCINI, Mauro (FE)

Session Classification: S5: Novel Sources: FEL/Laser/Plasma Channels