Summary of WP7 Activities in 2009: Facilities and Component Analysis for Detector R&D

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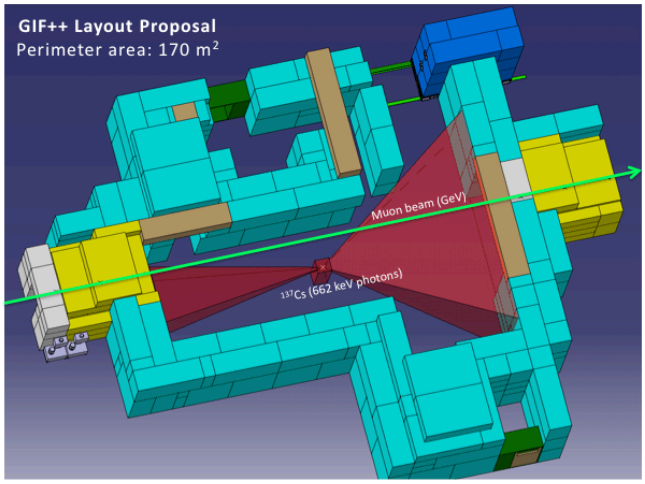
The existing PH irradiation facilities, protons, neutrons and mixed field in the PS East area [1] and the Gamma Irradiation Facility (GIF) in the West Area [2], serve a large number of users and are considered indispensable for understanding the performance of detectors and associated electronics at the LHC, and for starting an efficient sLHC detector R&D program. In the framework of WP7, a number of upgrades are being proposed and implemented.

In collaboration with the Universities of Liverpool and Sheffield and the Queen Mary University of London, a new irradiation station for the PS East Hall irradiation facilities was developed and partly produced in 2009. It consists of a single support structure that can hold up to 5 irradiation tables. Each table can be moved and scanned independently into and through the proton beam thus allowing for several irradiations in parallel. In 2009 the first table was finalized and tested. It was equipped with an environmental cold box that will be used in 2010 to perform a large series of cold irradiations as urgently required by teams working on the development of sLHC silicon-based tracking detectors.

The GIF facility has been extensively used for many years, with scheduled source irradiations during some 50 weeks per year. Despite the disappearance of the west area beam lines in 2004, the photon source at the GIF is still heavily used to date, in particular by the LHC muon systems groups. Yet, in view of sLHC detector R&D, there is a need for a stronger source and for regaining the possibility to carry out simultaneous detector performance tests with a high-energy beam. For this purpose, an upgraded facility called GIF++ is being proposed in the SPS North Area [3]. GIF++ will operate in similar fashion as the present facility, but with a 10 TBq ^{137}Cs source, providing a ×10 higher photon flux and few weeks per year of a high-energetic muon beam. Further improvements in the layout are also proposed, profiting from the experience gained so far by the GIF users; for instance, the current layout permits simultaneous high-rate irradiations of very large-size muon detectors. The facility is expected to be operational in 2011.



Due to the large detector volume of the LHC RPC muon systems and the use of a relatively expensive gas mixture, their gas systems at LHC have been designed to operate in closed-loop mode. In the LHC radiation environment, a large amount of Fluorine-based impurities in the return gas have been detected; they are potentially dangerous for the stable operation of the detectors, the materials in the detector and the gas system. A systematic study to improve the gas filtering in the LHC RPC gas systems is part of WP7 and is being carried out at the GIF set-up [4]. Currently, an optimal combination of gas filters has been found. It optimizes the filtering capacity for H_2O and O_2 in the gas mixture, as well as for the radiation-induced impurities, therefore permitting a more secure operation of the RPC systems. At the same time, the cycle duration of the new set of purifiers is increased, reducing instabilities and downtime of the gas systems. The new configuration will be implemented in the LHC systems in early 2010. Further investigations include the long-term, accelerated irradiation of RPCs at GIF with such filters configuration for an amount of time equivalent to 10 LHC years in terms of accumulated charge by the detectors. This R&D project has hosted two summer students and 2 stagiares during the 2009 summer.

[1] http://irradiation.web.cern.ch/irradiation/

[2] http://cern.ch/SL/eagroup/irrad.html

[3] M.Capeans, R.Fortin, L.Linssen, M.Moll, C.Rembser, *"A GIF++ Gamma Irradiation Facility at the SPS H4 Beam Line"*, CERN-SPSC-2009-029, SPSC-P-339.

[4] M.Capeans, I.Glushkov, R.Guida, F.Hahn, S.Haider, *"Studies of purification of the Resistive Plate Chamber gas mixture for the Large Hadron Collider experiments",* IEEE 2009, Orlando, US.