Summary of WP7 activities in 2008

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WP7 is devoted to provide facilities and component analysis for detector R&D. Currently it comprises two main lines of activity: construction of SLHC-compatible gamma and hadron irradiation facilities and, component analysis for detector R&D [1].

A careful assessment of the need for irradiation facilities at CERN has been carried out involving both current and future users [2]. The existing PH proton and neutron facilities in the PS East area [3] serve a large number of users (up to 1500 irradiated samples per year) and are considered indispensable for an efficient understanding of (failure) effects of detectors and associated electronics at the LHC and for starting an efficient SLHC detector R&D program. Within the WP7 program, a series of improvements are considered in the near future such as increasing the proton rate a factor ~2 and adding more user areas. Also, a longer-term plan for a high-intensity proton facility at the future injector complex (SPL, PS2) will be studied.

For the R&D and validation of large muon detectors, the current gamma irradiation facility (GIF) in the old SPS West area [4] will be replaced by mid 2010 by an upgraded set-up, the so-called GIF++, located in the SPS North Area. GIF++ will permit the uniform irradiation of very large detectors, few square meters, with a high rate photon background from a 7TBq ^{137}Cs source, which can provide a dose about 10 times larger than at GIF; the set-up will allow the simultaneous characterization of the detector's performance with a well focused 100 GeV muon beam.

The current WP7 work plan also includes the study of the RPC detectors' gas mixture to improve the filtering stages in the LHC closed-loop gas systems. The ultimate goal is the optimization of the operation of RPCs during the LHC high luminosity phase. Since July 2008 a set of CMS RPC chambers are being irradiated in the GIF facility, having accumulated a charge of 10 mC/cm^2 up to date. The impurities detected in the gas of the irradiated chambers have been identified by gas chromatography/mass spectrometry; they are other stable Freon gases and hydrocarbons (Fig. 1). The rate of production of those contaminants in the gas, and in particular of harmful fluoride ions (F-), as a function of chamber efficiency, and the filtering capacity of eight different absorbers has been assessed. Currently, the effectiveness of an optimal combination of absorbers that could be used in the real, large flow LHC gas systems has been found [5]. Further investigations include the long-term irradiation of RPCs working efficiently with such gas system configuration.

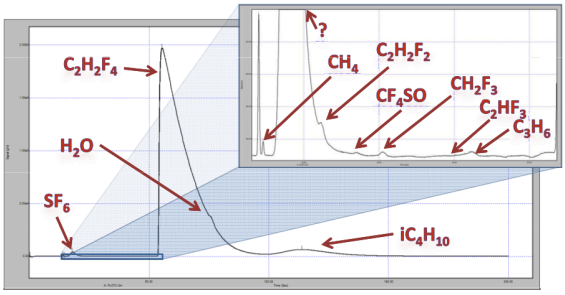

Fig. 1 Mass spectrometry analysis of the irradiated RPC gas mixture ($C_2H_2F_4$-iC_4H_{10}-SF_6-H_2O). Stable freons and hydrocarbon molecules are produced at the ppm level in the avalanche process, as shown in the zoomed box.

[1] http://cern.ch/WP7/

[2] http://cern.ch/irradiation-facilities/

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

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

[5] M.Capeans et al., Studies of purification of the Resistive Plate Chamber gas mixture for the Large Hadron Collider experiments, Contribution to the IEEE Dresden Conference (2008).