# RADIARION DAMAGE OF SCINTILLATION DETECTORS AT HIGH LUMINOSITY LHC EXPERIMENTS

Korjik M.
*Research Institute for Nuclear Problems of Belarusian State University, Minsk, Belarus, Mikhail.Korjik@cern.ch*

Change in the optical transmission due to the formation of color centers under irradiation with high energy protons is only a portion of the effects related to the damage and breaking the regularity of the material structure under ionizing radiation. An interaction of the detector crystals and energetic charged particles at a large fluence, corresponding to collider experiments, gives rise to a range of effects, which are phosphorescence, radio-luminescence due to induced radionuclides in crystals themselves and surrounding construction materials. When combined, these effects can lead to inacceptable degradation of detectors, manifested in the decrease of the statistic term and the increase of the part of the constant term in the energy resolution, the appearance of nonlinearity in the detector response and a noticeable deterioration in the time resolution of both separate detector units and the detector as a whole. The combination of these effects actually forms the limiting value of the absorbed radiation dose for the operation of the crystalline detector material in the high dose rate ionizing radiation environment. This limiting value is obviously a specific parameter for every material. Moreover, operational conditions at the HL LHC put stringent requirements on detector materials in terms of radiation hardness in order to ensure a reliable data taking over its lifetime. As consequence detailed damage effects studies were launched in order to define crystalline species with acceptable combination of damage effects, particularly under hadron irradiation. Recently we have performed a systematic study of the damage effects in heavy crystalline materials which are used and considered for application in high energy experiments [1–4]. It was shown that lighter materials, where Lu is substituted by Y, are subjected to smaller damage under hadron irradiation. Here we present results of the damage effects study in inorganic scintillation materials.

1. E. Auffray, A. Barysevich, A. Fedorov, M. Korjik, et al. Radiation damage of LSO crystals under γ- and 24 GeV protons irradiation, NIM A 721 (2013) 76–82.
2. Auffray, E., Korjik, M., Singovski, A. Experimental Study of Lead Tungstate Scintillator Proton-Induced Damage and Recovery, IEEE Trans. Nucl. Sci., 59 (2012) 2219–2223.
3. Auffray E., Fedorov A., Korjik M. et al. Radiation Damage of Oxy-Orthosilicate Scintillation Crystals Under Gamma and High Energy Proton Irradiation, IEEE Trans. Nucle. Sci. 61(2014)495–500.
4. Dormenev, V., Korjik, M. et al. Comparison of Radiation Damage Effects in PWO Crystals Under 150 MeV and 24 GeV High Fluence Proton Irradiation, IEEE Trans. Nucl. Sci. 61 (2014) 501–506.