Contribution ID: **208** Type: **Oral presentation**

Precise rise time measurements of inorganic scintillators using X-ray and 511 keV excitation

Thursday 21 September 2017 11:00 (15 minutes)

The emergence of new solid-state avalanche photodetectors, e.g. SiPMs, with unprecedented timing capabilities opens new ways to profit from ultrafast and prompt photonemission in scintillators. In time of flight positron emission tomography (TOF-PET) and high energy timing detectors based on scintillators the ultimate coincidence time resolution (CTR) achievable is proportional to the square root of the scintillation rise time, decay time and the reciprocal light yield, $CTR \propto \sqrt{\tau_r \tau_d / LY}$. Hence, the precise study of light emission in the very first tens of picoseconds is indispensable to understand time resolution limitations imposed by the scintillator. We developed a time correlated single photon counting setup having a Gaussian impulse response function (IRF) of 63ps sigma, allowing us to precisely measure the scintillation rise time of various materials with 511keV excitation. In L(Y)SO:Ce we found two rise time components, the first below the resolution of our setup $<$10ps and a second component being $\sim$300ps. Codoping with Ca^{2+} almost completely suppresses the slow rise component leading to a very fast initial scintillation emission with a rise time of $<$10ps. A very similar behavior we observe in LGSO:Ce crystals. The results are further confirmed by complementary measurements using a streak-camera system with pulsed X-ray excitation. Additionally we will present the scintillation kinematics in Ca^{2+} or Mg^{2+} codoped LuAG:Ce, YAG:Ce and GAGG:Ce samples. Finally the merits of a very fast scintillation rise time will be discussed in view of prompt photonemission in the crystal (e.g. Cherenkov radiation) in order to achieve 10ps in TOF-PET.

Author: GUNDACKER, Stefan (Universita & INFN, Milano-Bicocca (IT))

Co-authors: MARTINEZ TURTOS, Rosana (Universita & INFN, Milano-Bicocca (IT)); AUFFRAY HILLEMANNS, Etiennette (CERN); LECOQ, Paul Rene Michel

Presenter: GUNDACKER, Stefan (Universita & INFN, Milano-Bicocca (IT))

Session Classification: Characterization

Track Classification: S12_Characterization 2 (Orals)