

# Development of new large calorimeter prototypes based on Lanthanum Bromide and LYSO crystals coupled to silicon photomultipliers: A direct comparison

*Tuesday, 19 February 2019 16:55 (20 minutes)*

The challenges for new calorimetry for incoming experiments at intensity frontiers is to provide detectors with ultra-precise time resolution and supreme energy resolution.

Two very promising materials on the market are BrillanCe (Cerium doped Lanthanum Bromide, LaBr<sub>3</sub> (Ce)) and LYSO (Lutetium Yttrium Oxyorthosilicate, Lu<sub>2</sub>(1-x) Y<sub>2x</sub> SiO<sub>5</sub> (Ce)), supported by recent developments aiming at providing new relative large crystals.

The response of both LaBr<sub>3</sub> (Ce) and LYSO prototypes fired with gammas at an energy of 55 MeV have been studied. Very promising results have been obtained.

For the (R = 4.45 cm, L = 20.3 cm) LaBr<sub>3</sub> (Ce) crystal an energy resolution of  $\sigma E / E \sim 2.3(1)\%$  and a timing resolution of  $\sigma t \sim 35(1)$  ps have been predicted. The energy resolution can be further improved by using larger crystals (either R = 6.35 cm or R = 7.6 cm, L = 20.3 cm) approaching respectively a  $\sigma E / E \sim 1.20(3)\%$  and a  $\sigma E / E \sim 0.91(1)\%$ .

Competitive results can be obtained with (R = 3.5 cm, L = 16 cm) LYSO crystal with an energy resolution of  $\sigma E / E \sim 1.48(4)\%$ , that can be further improved (R = 6.5 cm, L = 25 cm,  $\sigma E / E \sim 7.37(1)\%$ ). A timing resolution less performing than the LaBr<sub>3</sub> (Ce) one but better than any available nowadays calorimeter working at this energy can be obtained,  $\sigma t \sim 49(1)$  ps, ultimately improved to  $\sigma t \sim 40(1)$  ps with optimal photosensors.

Such results put these future high energy calorimeters at the detector forefront at intensity frontiers.

**Primary authors:** Dr PAPA, Angela (UniPi&INFN, PSI); Mr SCHWENDIMANN, Patrick (PSI&ETHZ)

**Presenter:** Dr PAPA, Angela (UniPi&INFN, PSI)

**Session Classification:** Calorimeter

**Track Classification:** Calorimeters