# CsI(Tl) crystals for the CALIFA R3B/FAIR Calorimeter

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Several studies with different Large Area Avalanche Photo-Diodes (LAAPDs) coupled to ad-hoc bi-frustum shaped CsI(Tl) crystals have been carried out as a part of the R&D program for the CALIFA R3B/FAIR calorimeter. This calorimeter will surround the target of the R3B experiment a versatile reaction setup with high efficiency, acceptance, and resolution for obtaining kinematically complete measurements of reactions induced by high-energy radioactive beams at FAIR in Darmstadt, Germany. CALIFA, is a calorimeter that has been proposed for the detection of gamma-rays and light charged particles originated in nuclear reactions from relativistic exotic beams in a wide energetic domain.

We report in this work the status of the optimization study of CsI(Tl) scintillating crystals and Large Area Avalanche Photo-Diodes (LAAPDs). In particular, we present here our studies on the energy resolution for gamma-rays using LAAPDs as photosensors, as well as the results obtained with a prototype of fifteen CsI(Tl) crystals for several gamma and proton beam (See Fig. 1) tests performed at several facilities (CMAM – Madrid, TSL – Uppsala, TUD – Darmstadt).

The goals of this tests was to measure the prototype with high energy gammas and protons, to perform a comparison between different APDs active areas coupled to crystals with different exit faces, to measure the energy resolution and linearity of the CsI(Tl) coupled to APDs. We also wanted to apply the reconstruction technique in order to check the add back simulations.

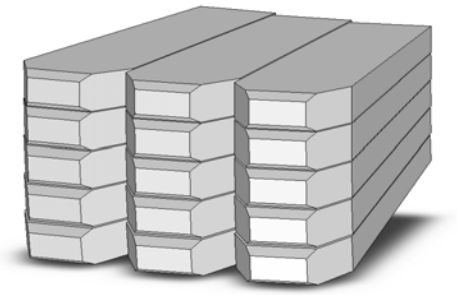

**Fig 1: Prototype set of CsI(Tl) crystals (ProtoZero)**

Results indicate that these detectors are linear up to 6 MeV gammas and the energy resolution is around 2.5% for this value. The results also shows energy resolution less than 1% for 173 MeV protons.

The results here obtained with some of the APD-crystal assemblies are close to the 5% energy resolution for 1 MeV photons, indicating that they are a suitable solution for the CALIFA barrel.