Towards large calorimeters based on Lanthanum Bromide or LYSO crystals coupled to silicon photomultipliers: A first direct comparison for future precision physics

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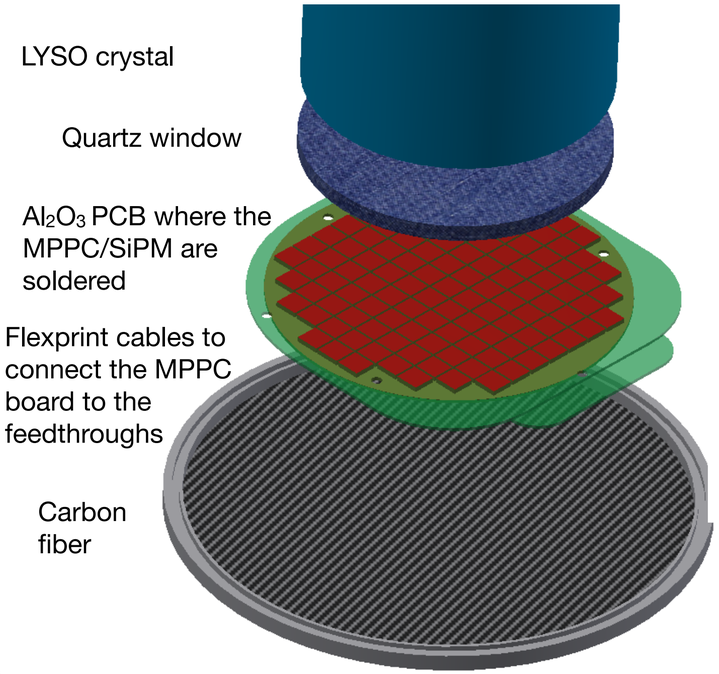
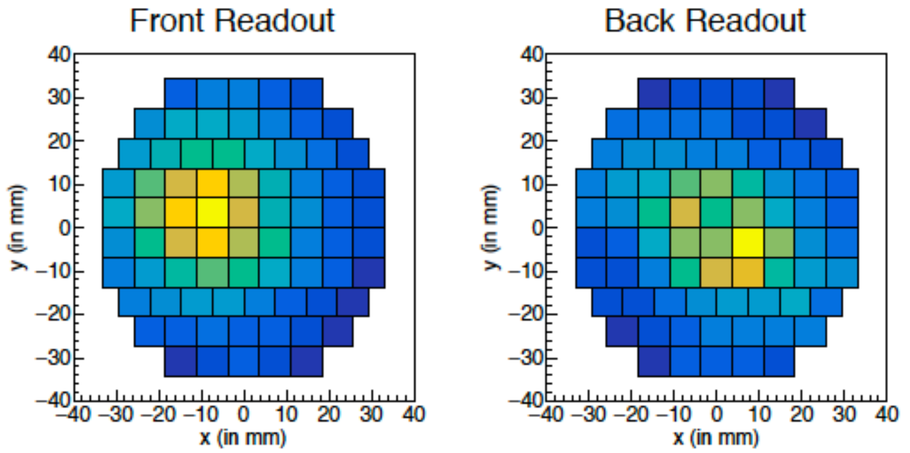
- **Goal: Detect photons with energy O(50) MeV with ultra-precise time resolution and supreme energy resolution at the Intensity Frontiers**
- LYSO or LaBr(Ce) big crystals
- Photosensor: MPPC/SiPM for a front and back readout
- Use granularity for geometrical reconstruction
- MC simulations based on GEANT4 and including the photosensors and the electronics. Reconstruction algorithm based on waveform analysis

The first large prototype is under construction (D = 7 cm and L = 16 cm)



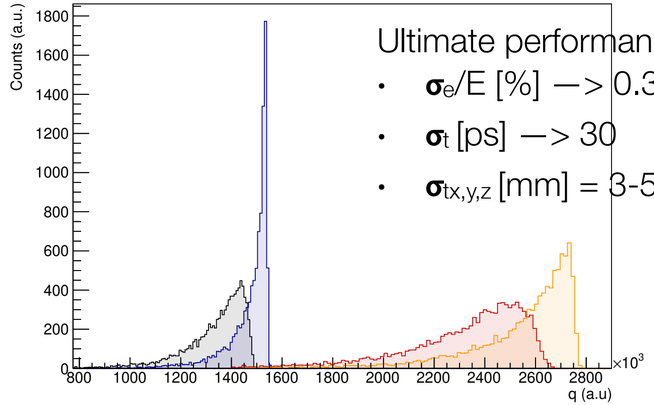


(a) Hit in Central Region: $(x, y) = (-10\,\text{mm}, 3\,\text{mm})$

Expected performances:

- σ_e/E [%] = 1.7(1)
- σ_t [ps] = 35(1)
- $\sigma_{tx,y,z}$ [mm] = 3-5

Energy Resolution at O (50 MeV)

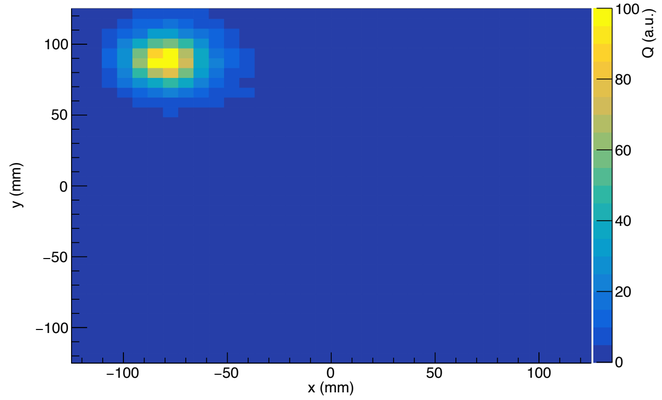


Ultimate performances

- σ_e/E [%] —> 0.3-0.4
- σ_t [ps] —> 30
- $\sigma_{tx,y,z}$ [mm] = 3-5

D = 7 cm, L = 16 cm, LYSO	σ/μ = 1.69(6) %
D = 9 cm, L = 20 cm, $LaBr_3$(Ce)	σ/μ = 2.52(8) %
D = 15 cm, L = 16 cm, LYSO	σ/μ = 0.444(10) %
D = 15 cm, L = 20 cm, $LaBr_3$(Ce)	σ/μ = 0.94(3) %

Photons detected per SiPM on the inner surface of an ultimate big crystal



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