Novel Inorganic Scintillators for Future HEP Calorimetry

Liyuan Zhang and Ren-Yuan Zhu

California Institute of Technology

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R&D On-going at Caltech

Fast/ultrafast, radiation hard and cost-effective heavy scintillators

Bright, fast and radiation hard inorganic scintillators for the severe radiation environment expected by the proposed FCC_{hh}. YAG, LuAG, GGAG, GYAG and GLuAG suffer from slow scintillation component.

Ultrafast inorganic scintillators: Cross-luminescence. Wide gap semiconductor-based scintillators with sub-ns decay time and quantum confinement-based inorganic $CsPbX_3$ (X = Cl, Br, I, mixed Cl/Br and Br/I), halide perovskite quantum dots may help to break the ps timing barrier for future HEP TOF.

Dense, UV-transparent, cost-effective heavy inorganic scintillators for the homogeneous hadron calorimeter (HHCAL) concept for the Higgs factory.

Compact UV sensitive photodetectors with sufficient dynamic range for ultrafast calorimeters.

Collaboration with labs and industry is crucial

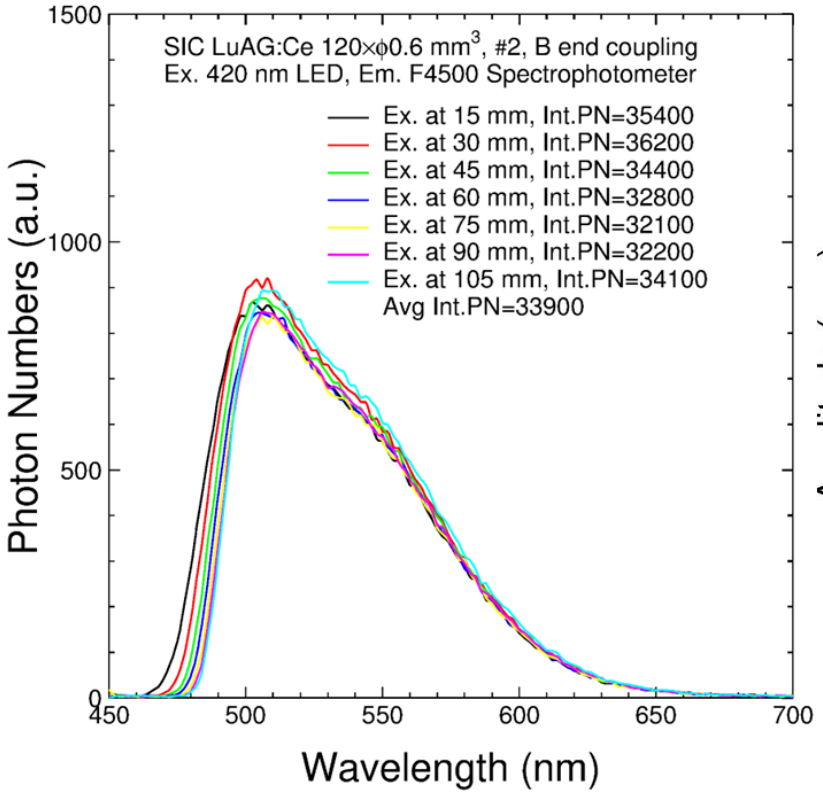
Novel Inorganic Scintillators

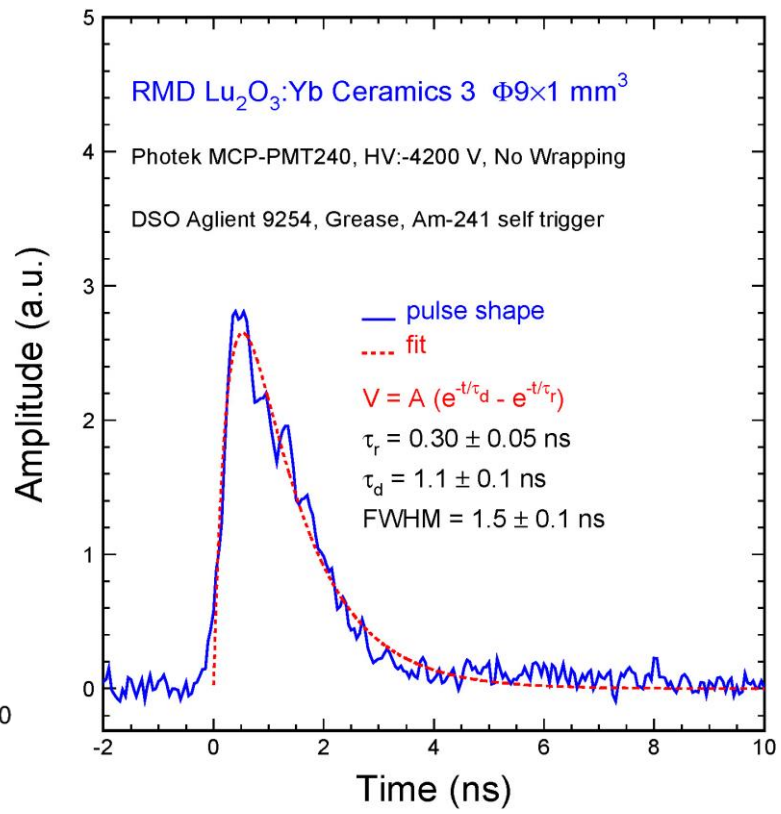
Inorganic crystal ceramic and glass scintillators

ABS Glass of 6 g/cc, 1.55 cm X_0, 2.5 cm R_M, 24.7 cm λ_I and < $1/cc

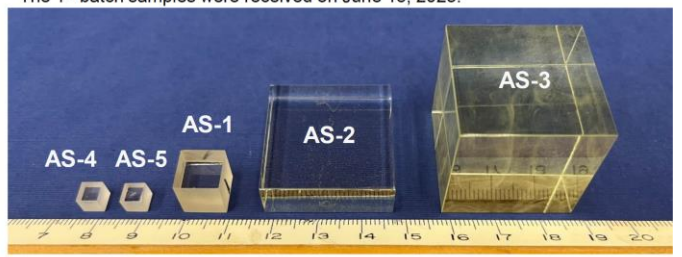
Radiation Hard LuAG:Ce ceramic fiber of Φ0.6 ×120 mm^3

Ultrafast Lu_2O_3:Yb ceramics of 9.4 g/cc

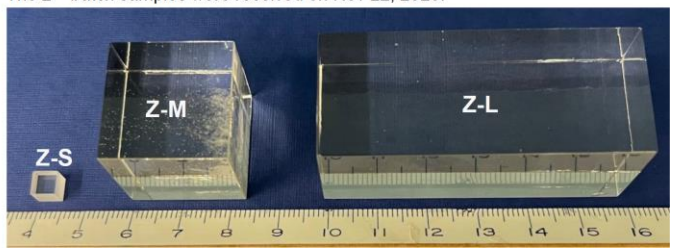


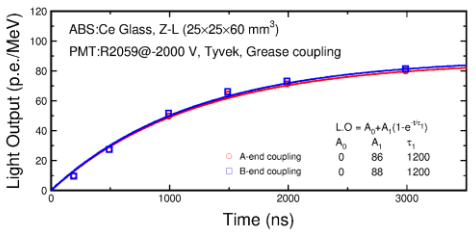


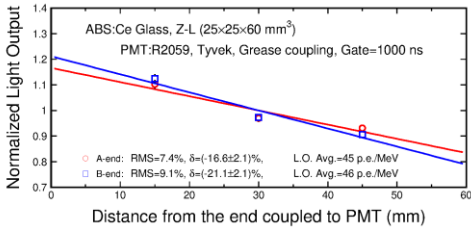
The 1st batch samples were received on June 15, 2023.

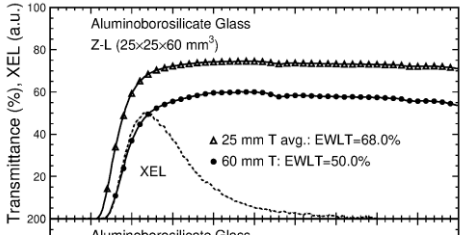


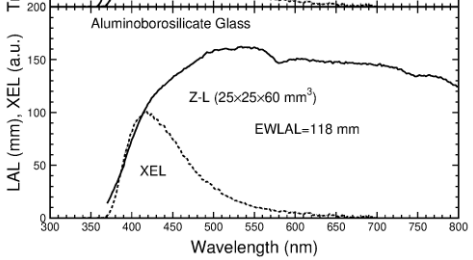
The 2nd batch samples were received on Nov 22, 2023.





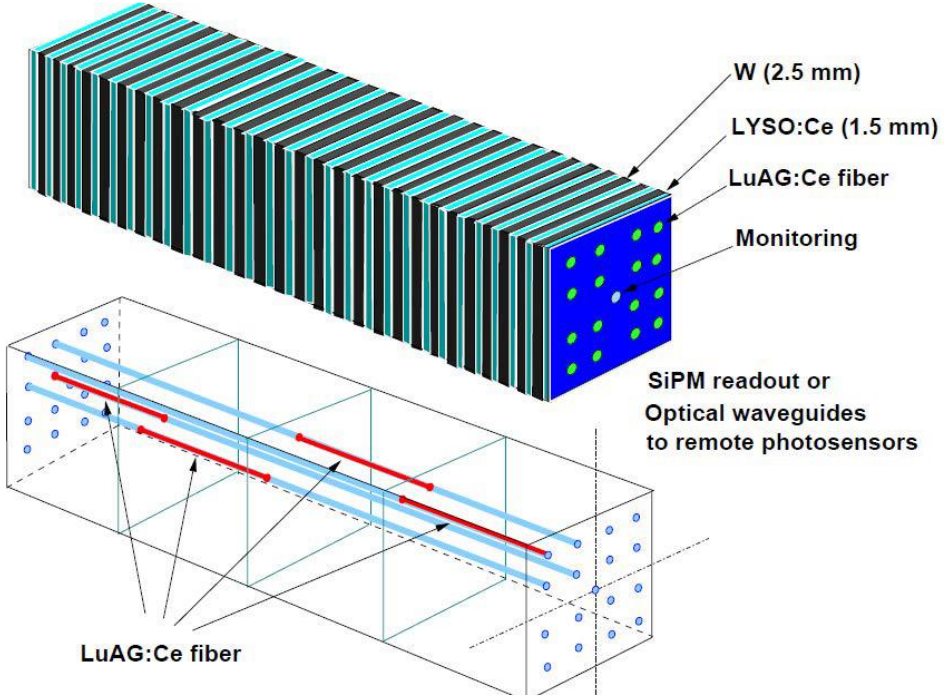






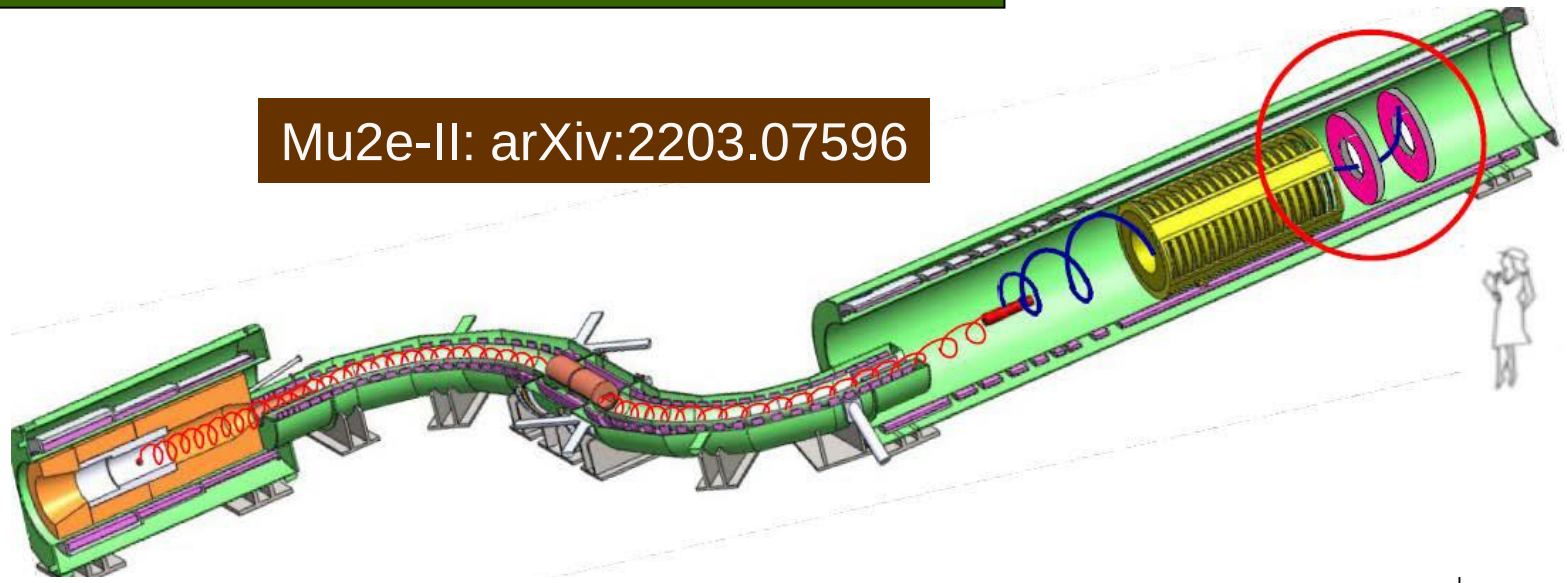
Potential Applications in Calorimetry

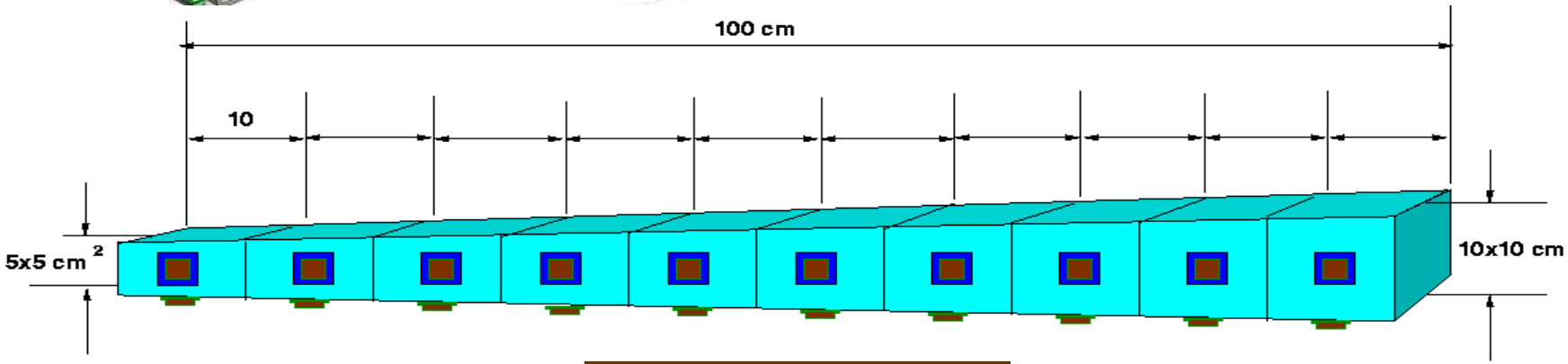
Inorganic crystal/ceramic/glass scintillators



RADiCAL

Mu2e-II: arXiv:2203.07596





CalVision & HHCAL