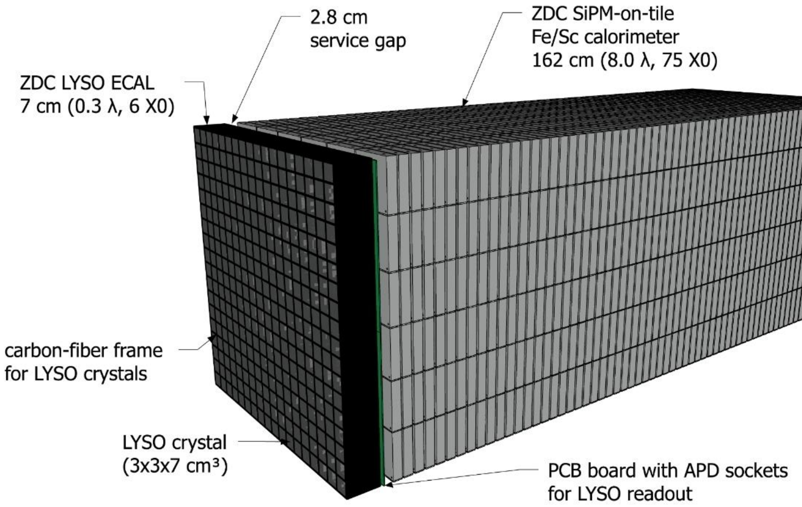
Slide presented in TIC ZDC mtg, December 2023

Reminder: Combined system could be LYSO crystal ECAL (Oct 9th design) and SiPM-on-tile Fe/Sc



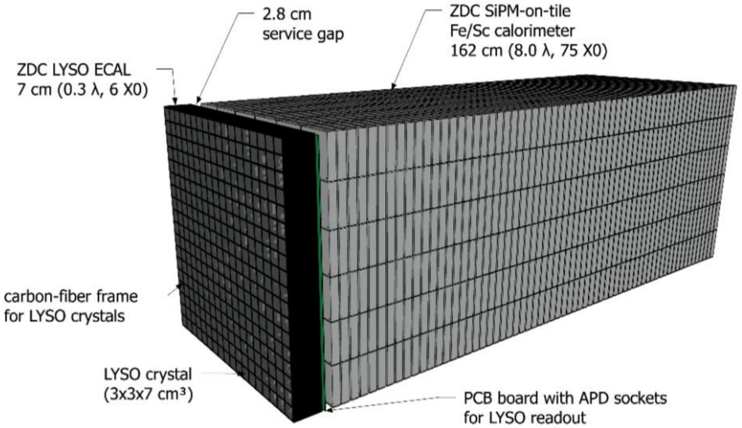
Meets all physics requirements while maximizing synergies with other ePIC subsystems, reducing cost and risks.

Low-energy ɣ→ LYSO
High-energy ɣ and π0→ Fe/Sc
High-energy neutrons → Fe/Sc

Slide presented in ePIC collaboration meeting @ Lehigh U.

Take-Home Message

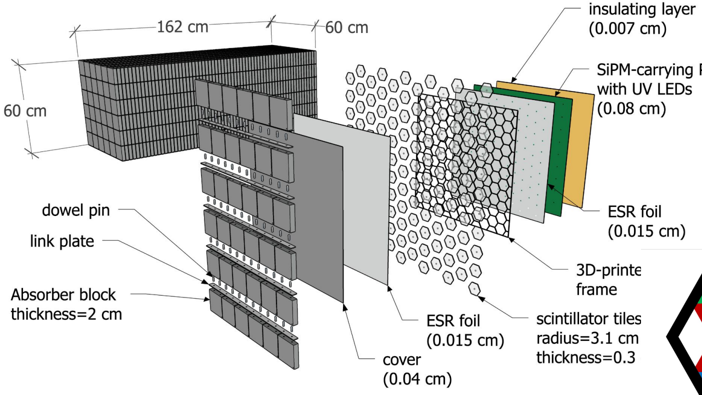
SiPM-on-tile Fe/Sc and <u>short</u> LYSO crystal meet all physics requirements,
We have found no good reason to keep long PbW04 crystal in baseline.



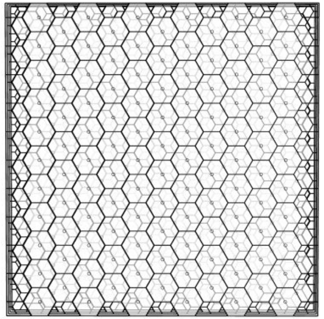
Low-energy [1 MeV-O(1) GeV] ɣ→ LYSO
High-energy ɣ and π0 → Fe/Sc
High-energy neutrons, Lambda → Fe/Sc

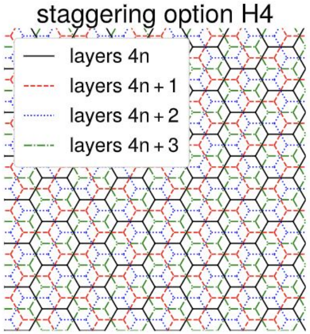
SiPM-on-tile Fe/Sc ZDC

High-granularity from CALICE-style tech
Staggered design as in *NIMA 1060 (2024) 169044*
Design and performance in arXiv:2406.12877



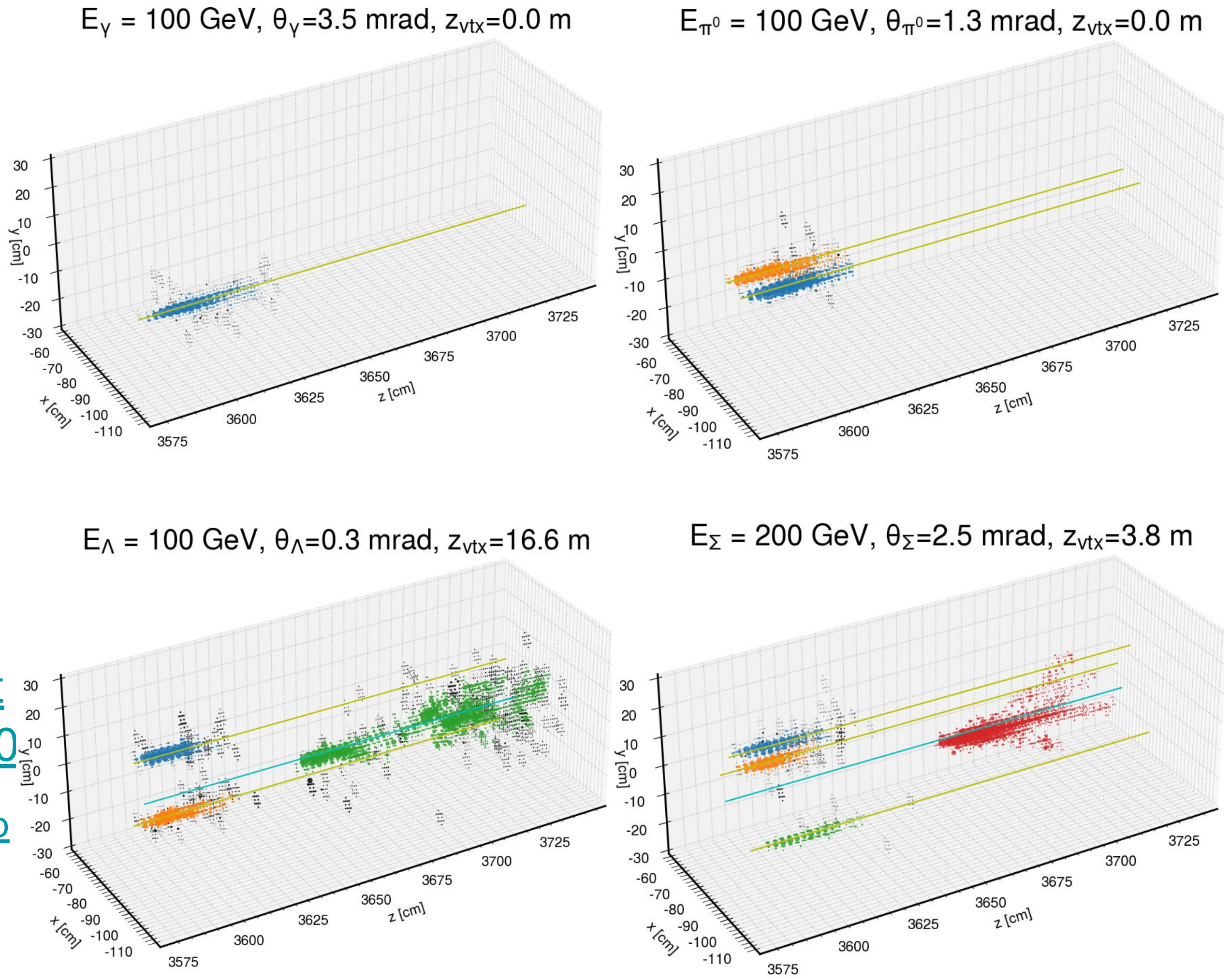
Cells~25 ㎠





Benchmarks for the SiPM-on-tile ZDC

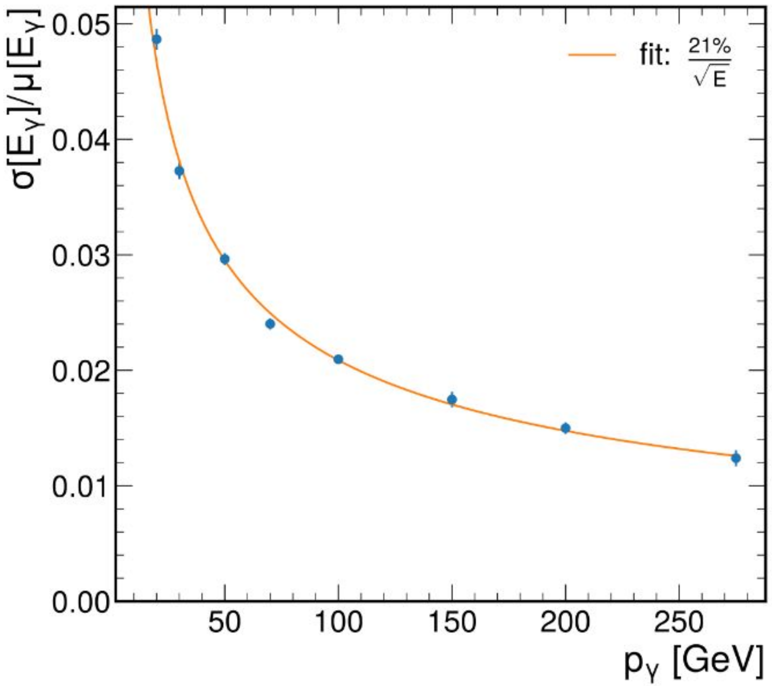
- Single photon
- $\pi^0 \to \gamma\gamma$
- $\Lambda \to n\pi^0 \to n\gamma\gamma$
- $\Sigma \to \Lambda\gamma \to n\pi^0\gamma \to n\gamma\gamma\gamma$

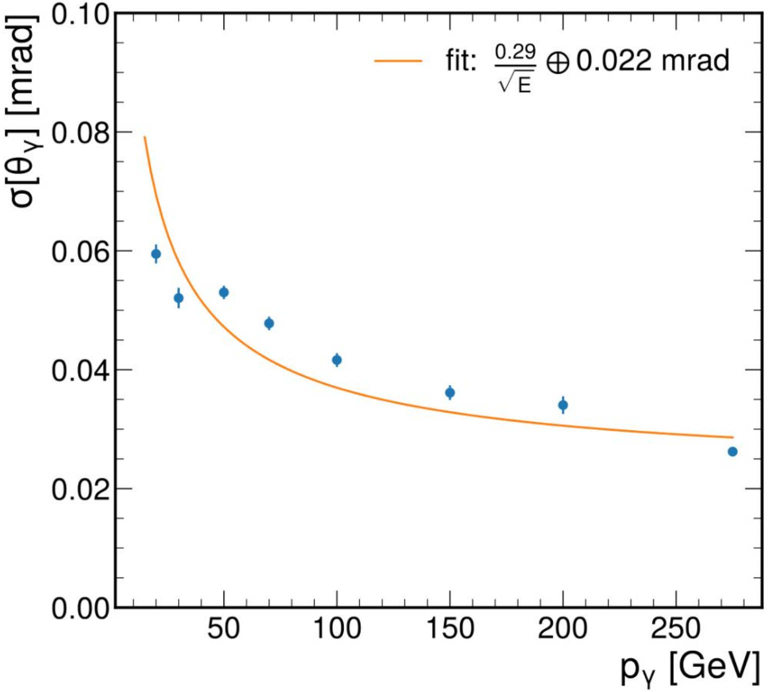


https://github.com/eic/detector_benchmarks/pull/70

https://github.com/eic/detector_benchmarks/pull/63

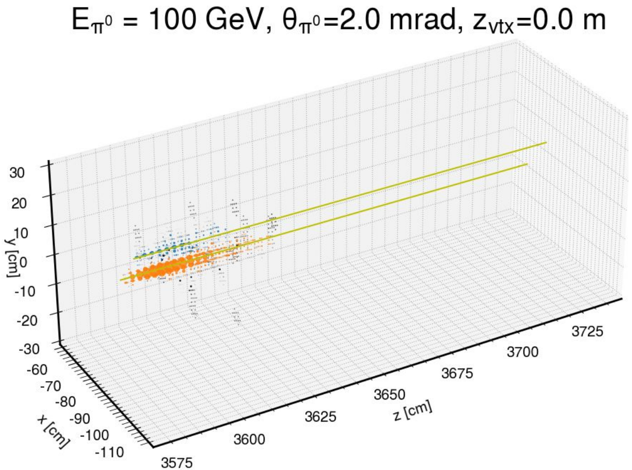
Photon Performance (SiPM-on-tile only)

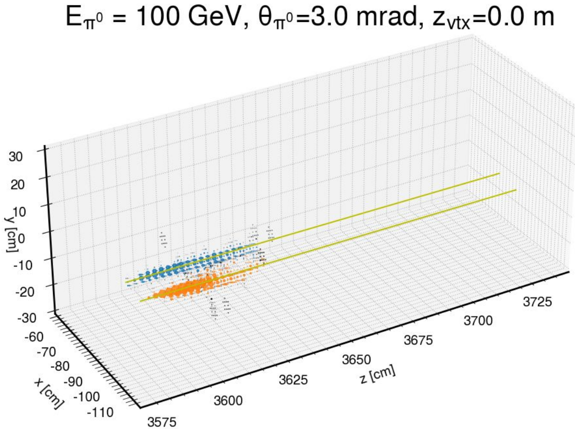


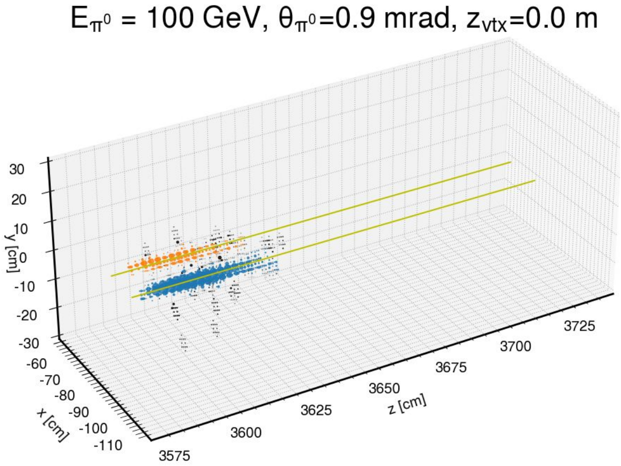


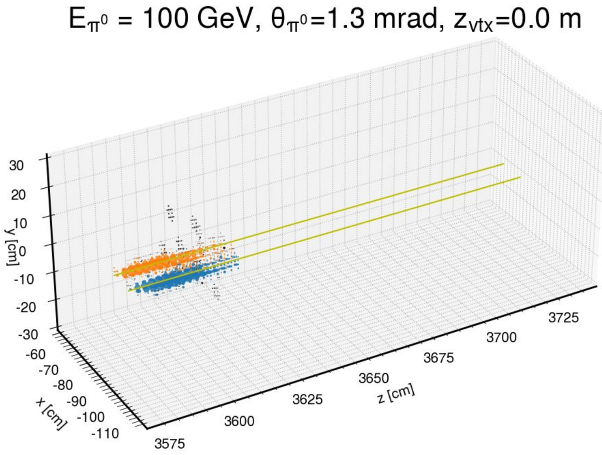
This performance meets all physics requirements

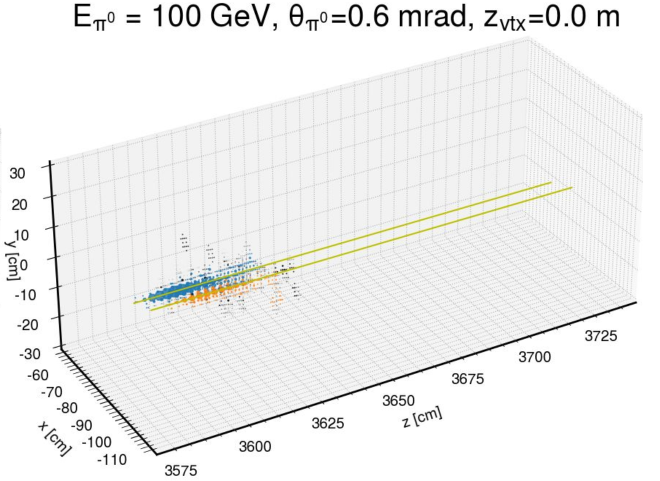
Some π0 events



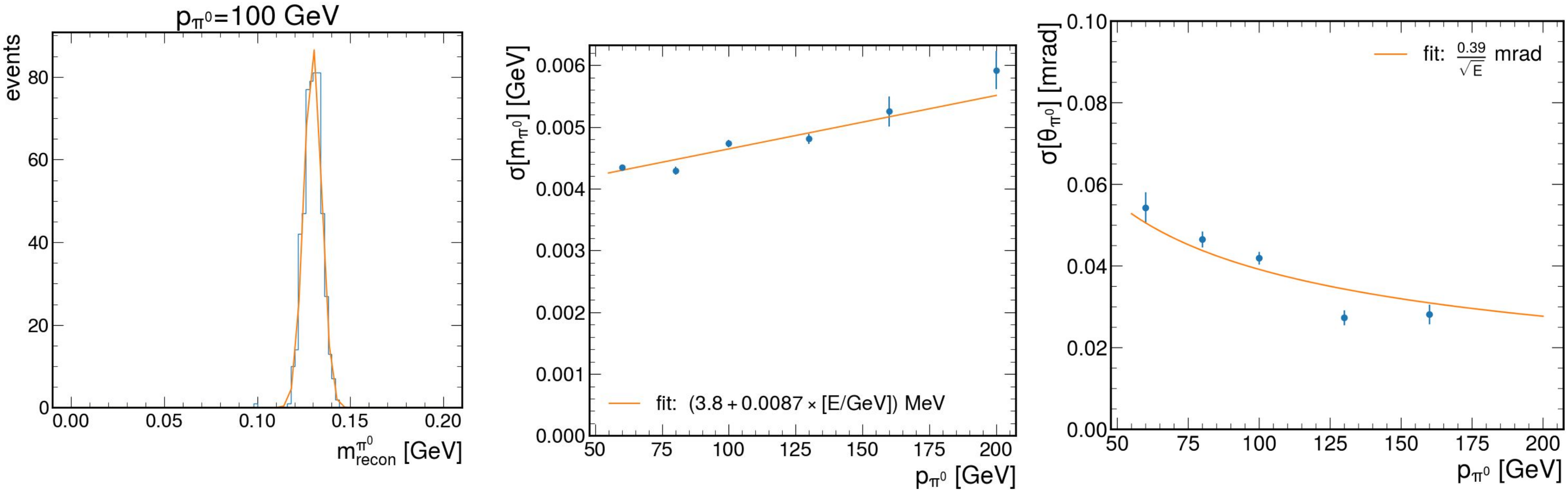






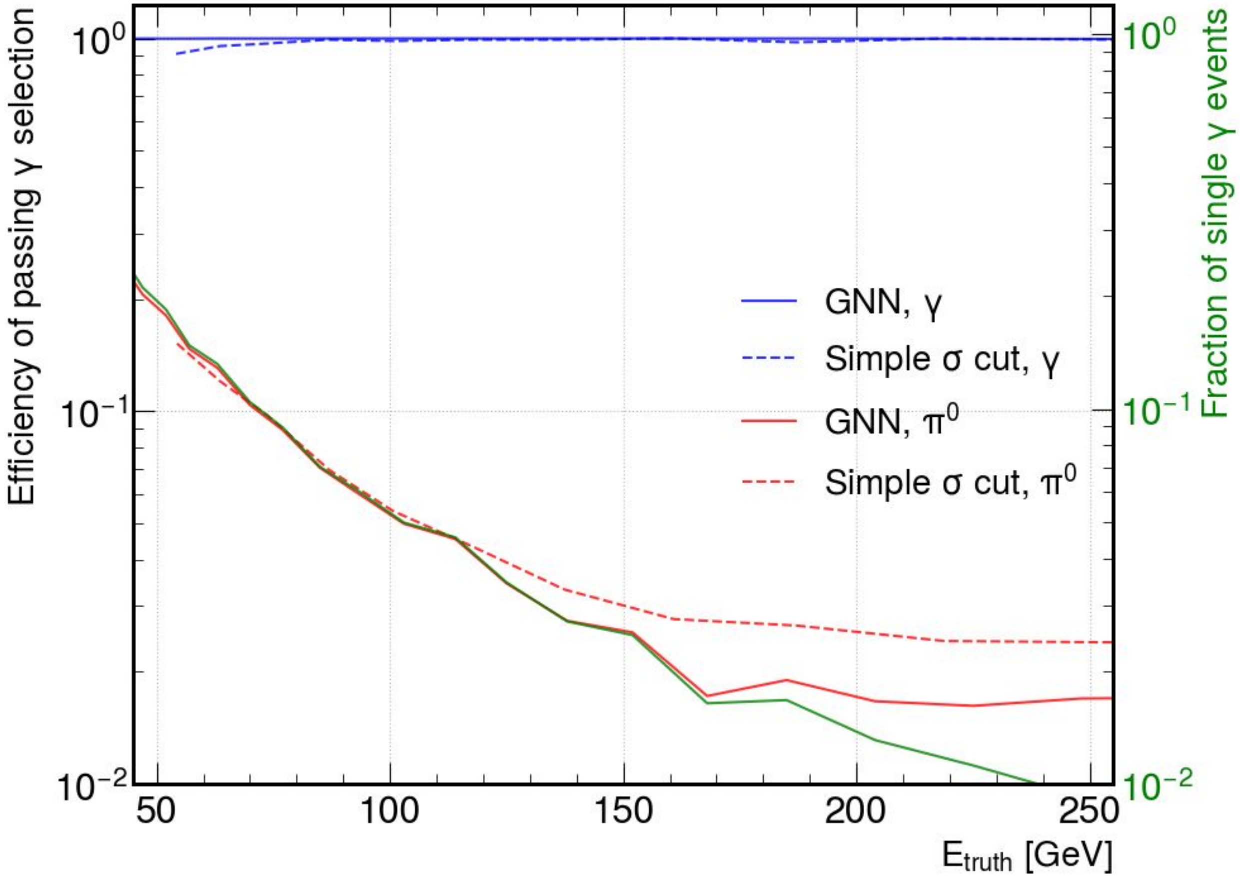


Pi0 performance (SiPM-on-tile only)



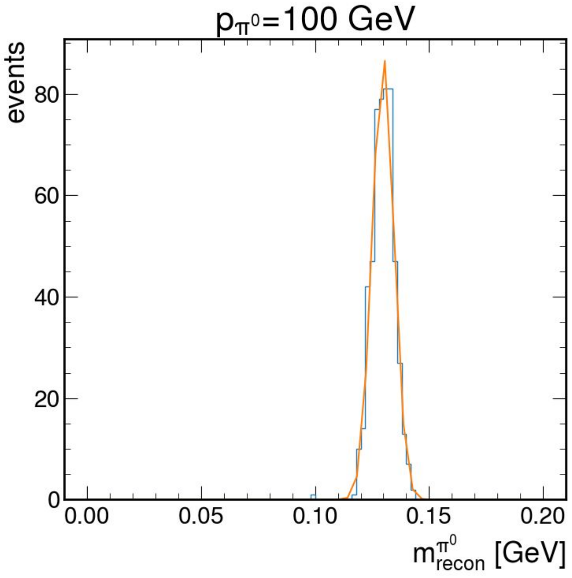
This performance meets all requirements. See Zach's comprehensive study: https://indico.bnl.gov/event/20935/#9-zdc-studies-for-u-channel-ph

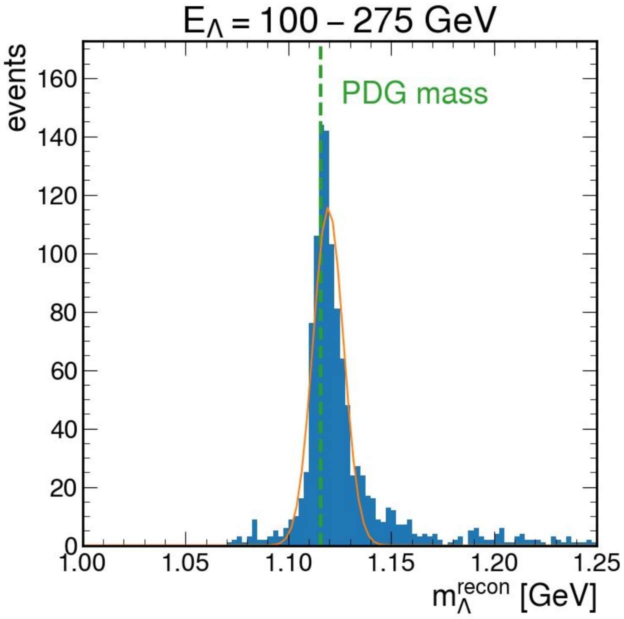
Pi0 / photon separation (with GNN)

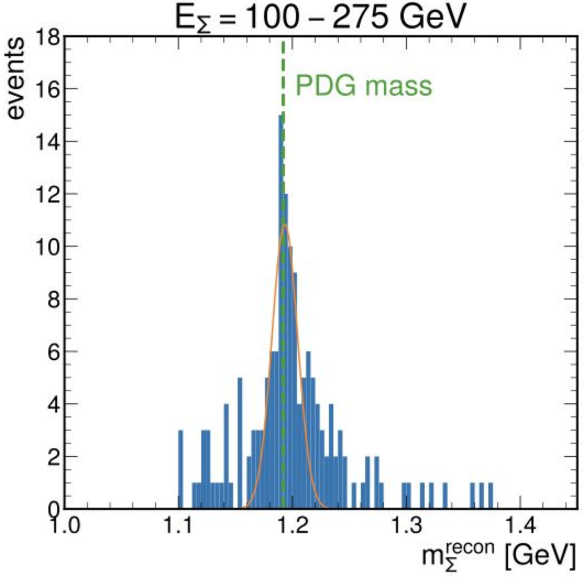


SiPM-on-tile is enough for near optimal performance (which is limited by geometrical acceptance)

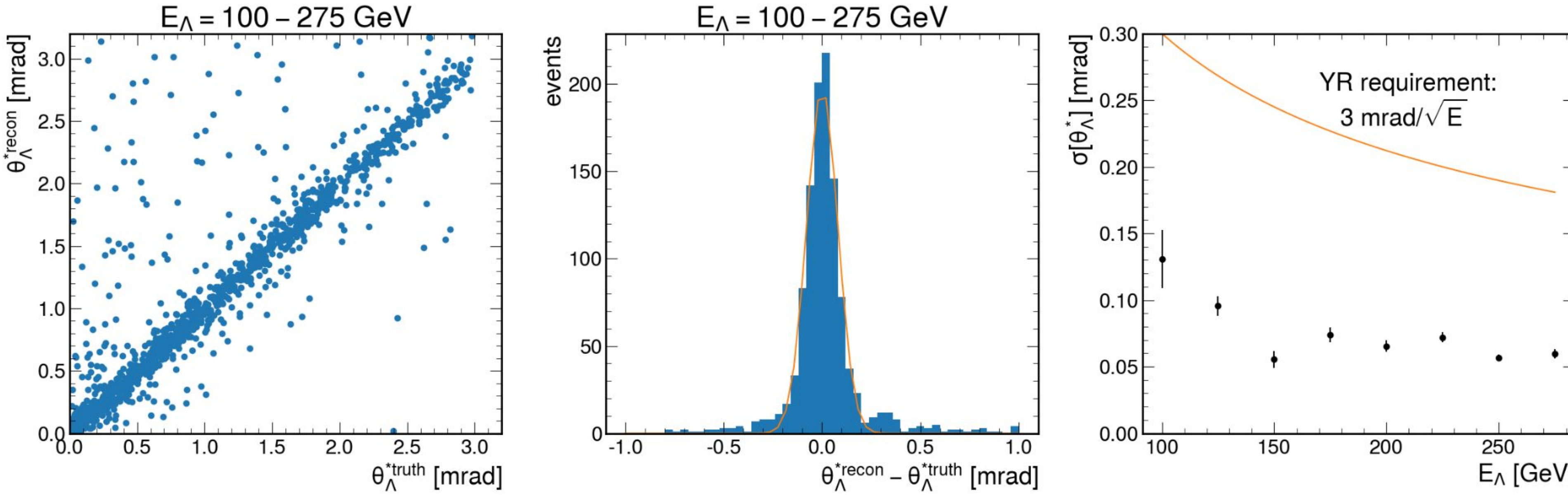
Pi0, Lambda, Sigma_0





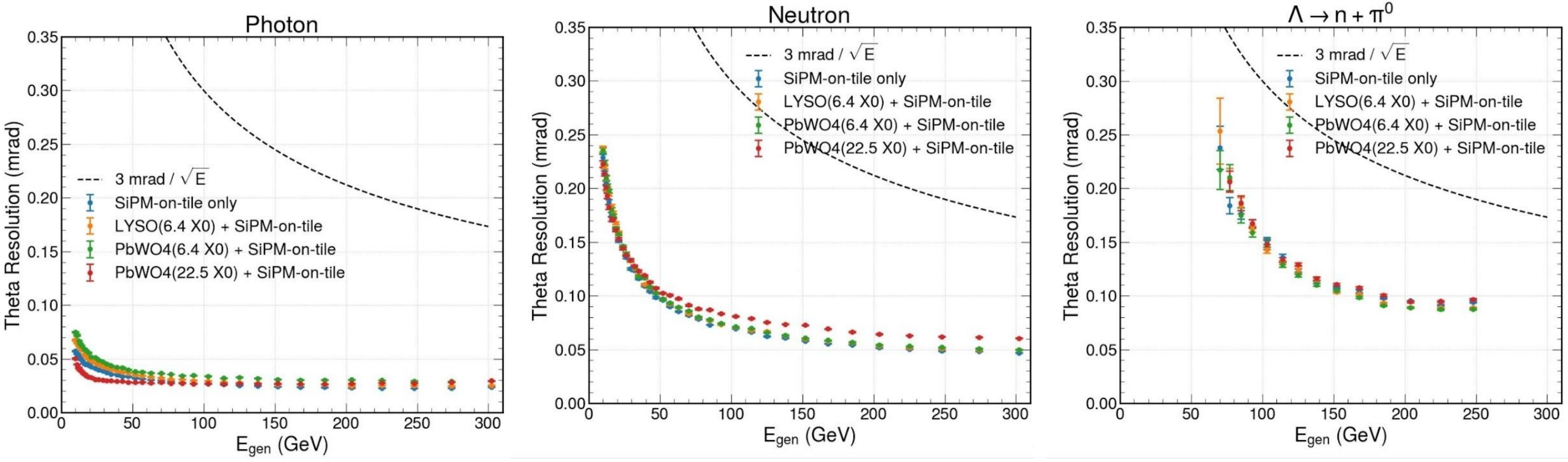


Position Resolution for Lambda



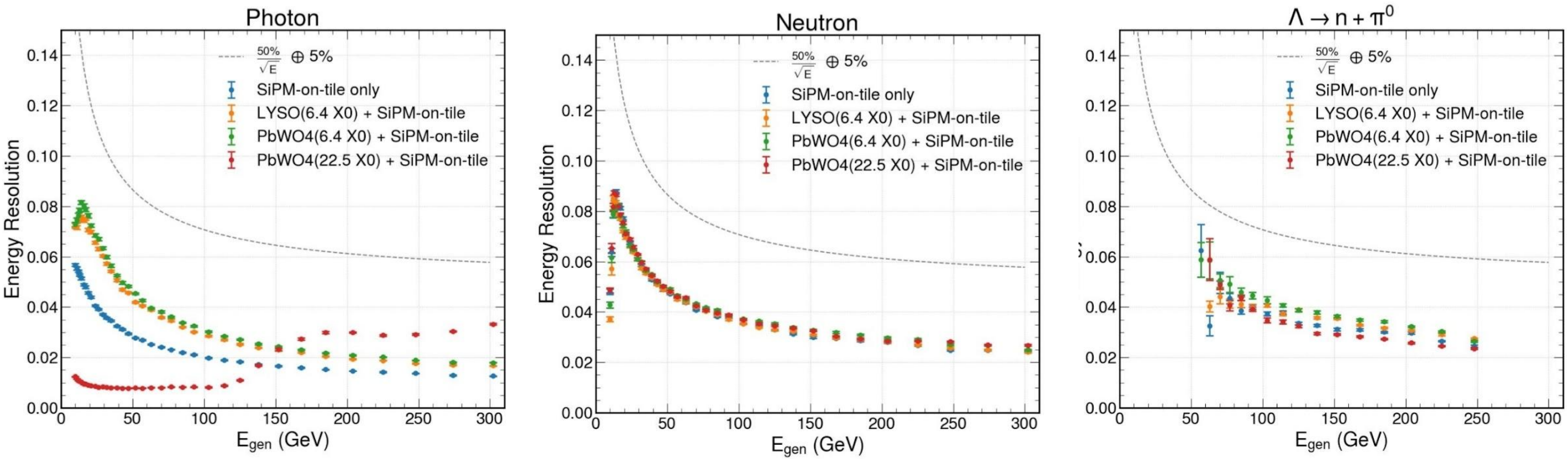
This performance meets all requirements

Summary position resolution, all options (GNN)



Bottom line: SiPM-on-tile alone is enough, no need for anything else

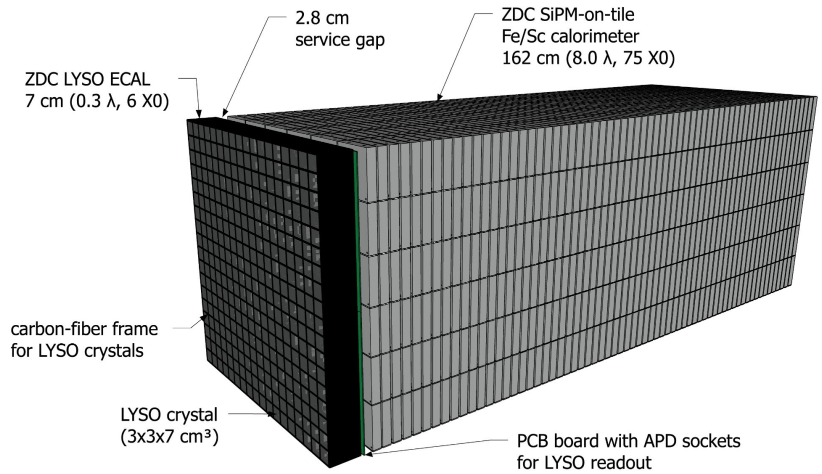
Summary energy resolution, all options (GNN)



Bottom line: SiPM-on-tile alone is enough, no need for anything else

Take-Home Message

SiPM-on-tile Fe/Sc standalone meets all requirements, no separate ECAL needed. (except for low energy photons for eA, for which short LYSO preferred)



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