

LUXE Cerenkovs: Reconstruction and in-situ calibration

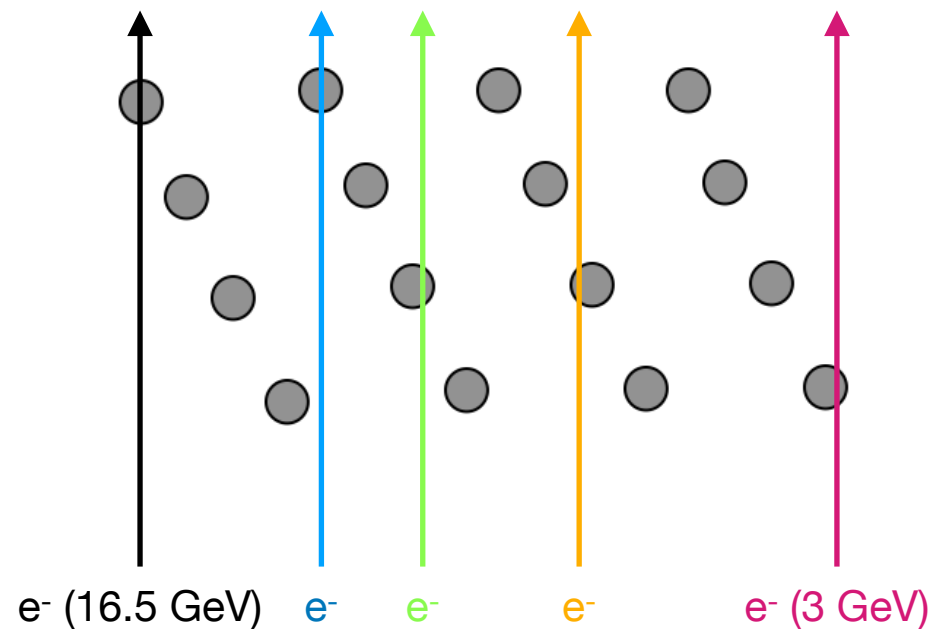
Louis and Ruth

LUXE detectors meeting

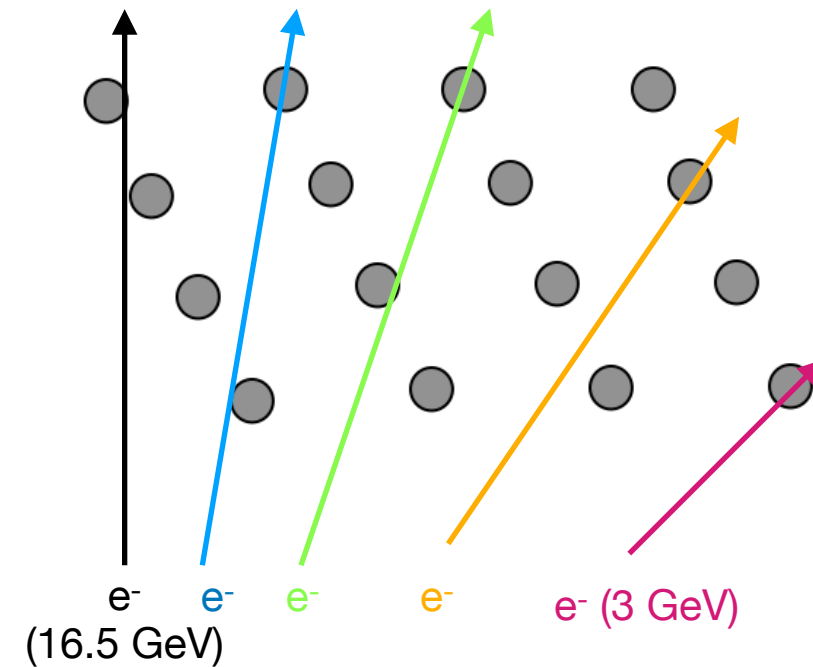
18th August 2021

Reconstruction

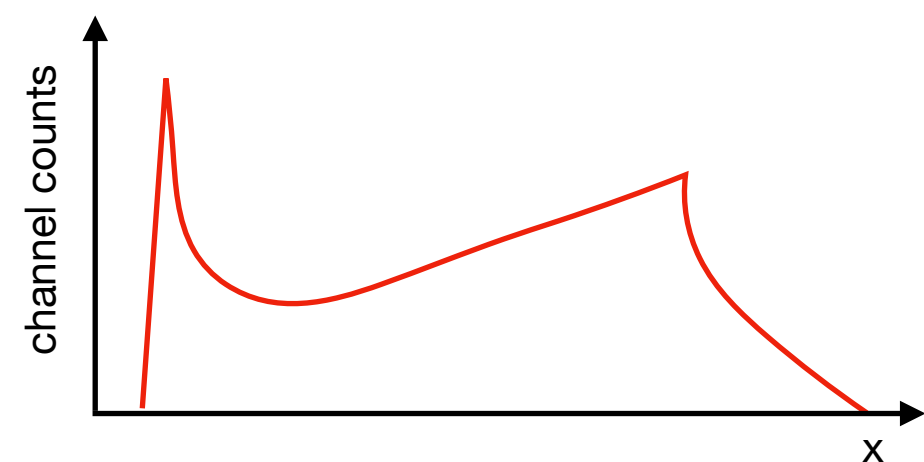
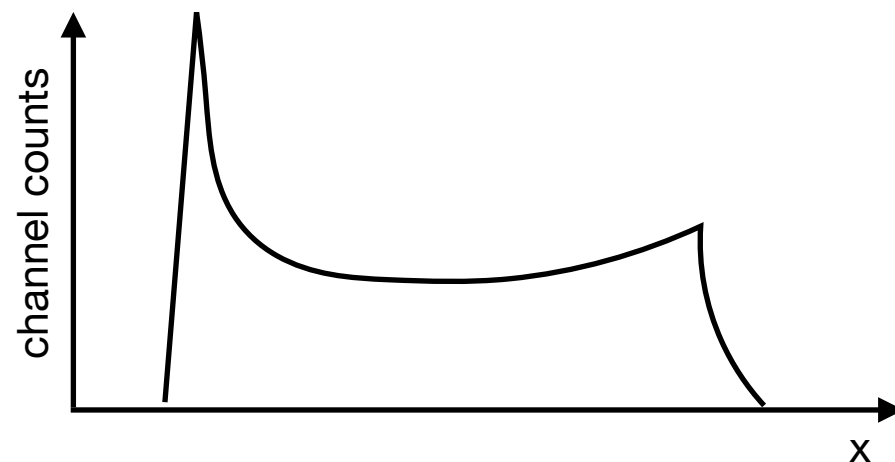
- staggered channels make the reconstruction more complicated:



ideal case



real case (exaggerated)

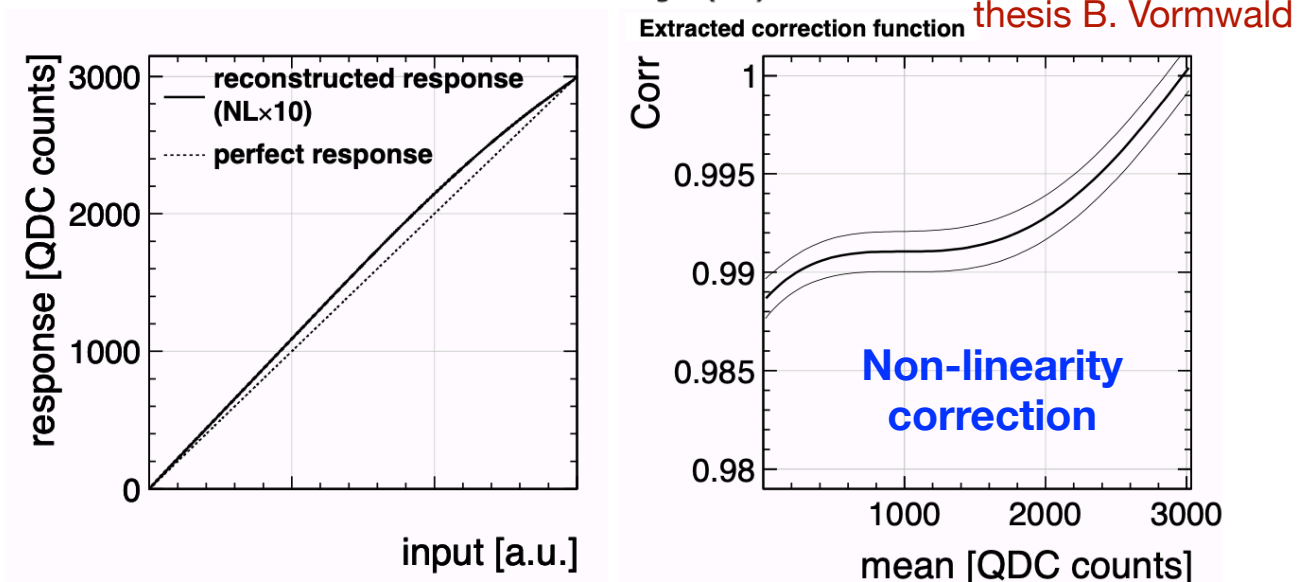
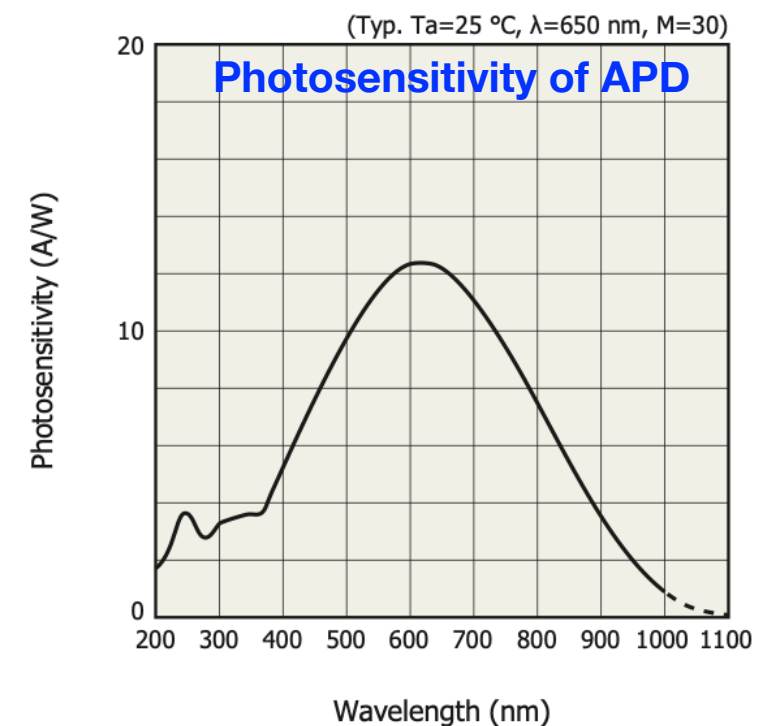
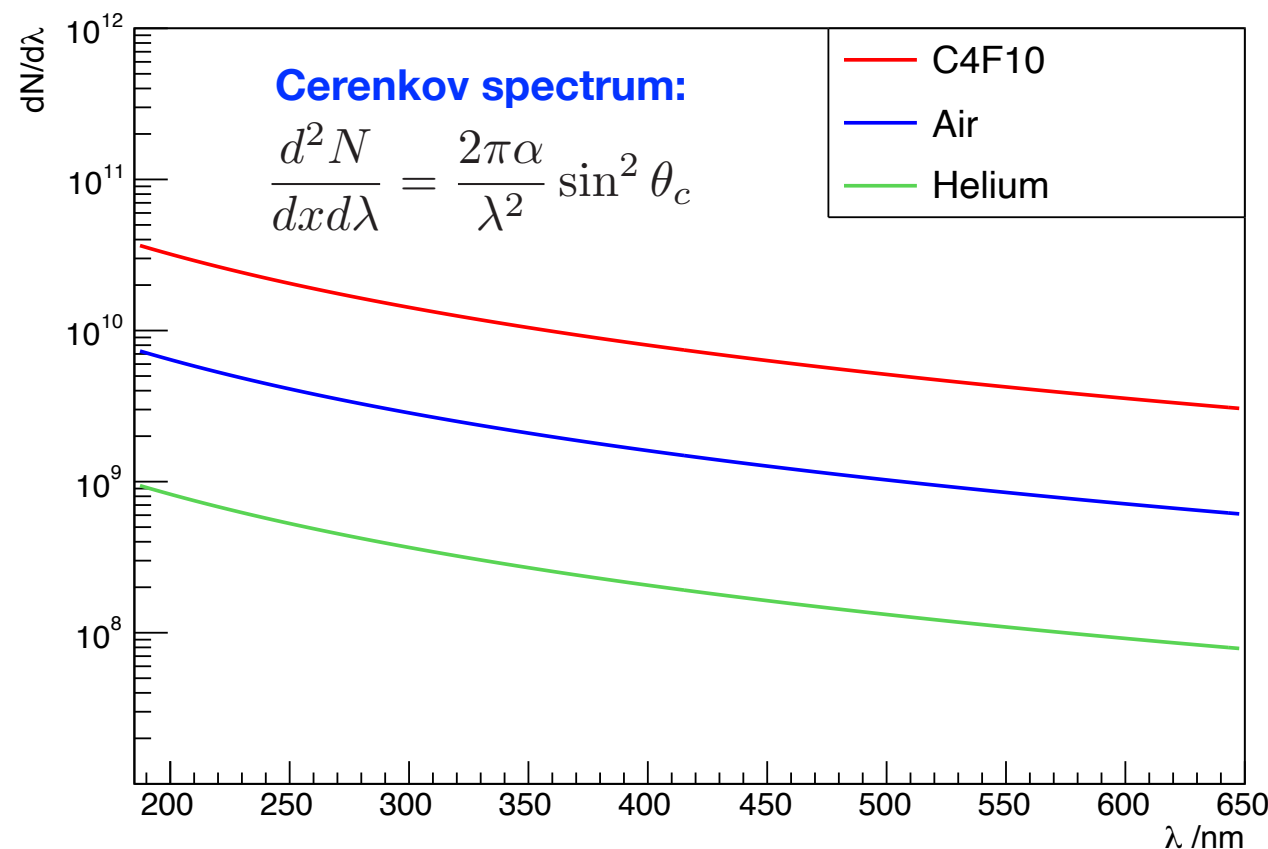


- Need to recover the original spectrum by unfolding using simulation
 - In future iterations of G4 sim would be great to have count rates per straw
- Can use in-situ calibration to cross-check

Detector Fast-Sim

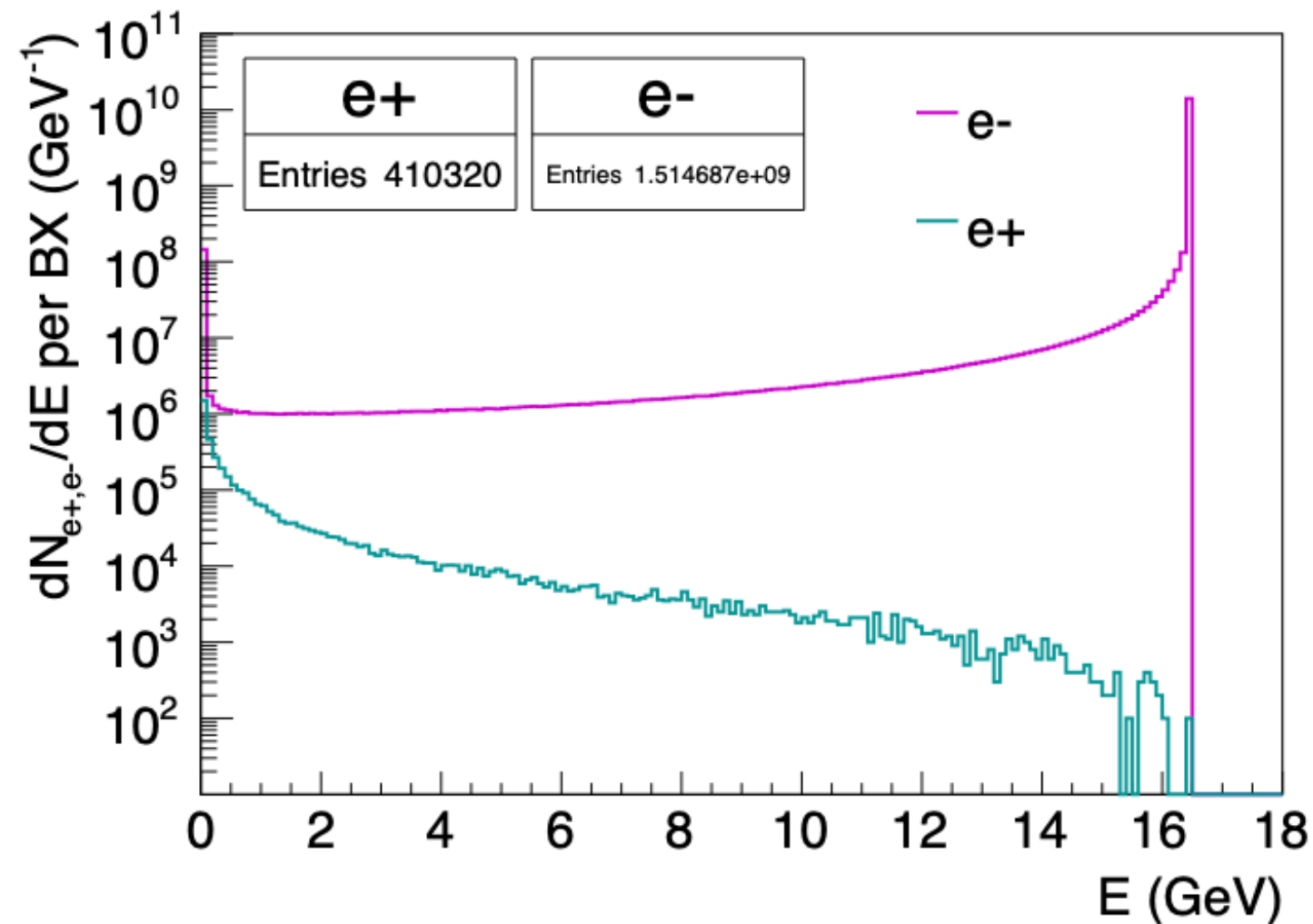
- “old” fast simulation had a parametrization of magnetic field and channel geometry/acceptance
→ with more complicated design better use input from Geant4 (starting from hits per channel)
- Need to simulate:
 - Cerenkov light creation in Gas (Frank-Tamm formula)
 - channel reflectivity (measure)
 - filter transmission (measure)
 - photodetector efficiency (wavelength-dependent)
 - photo detector & readout non-linearity (small)

$$\kappa = \int_{\lambda_{\min}}^{\lambda_{\max}} QE(\lambda) \cdot \epsilon_{\text{refl}} \cdot \epsilon_{\text{filter}}$$



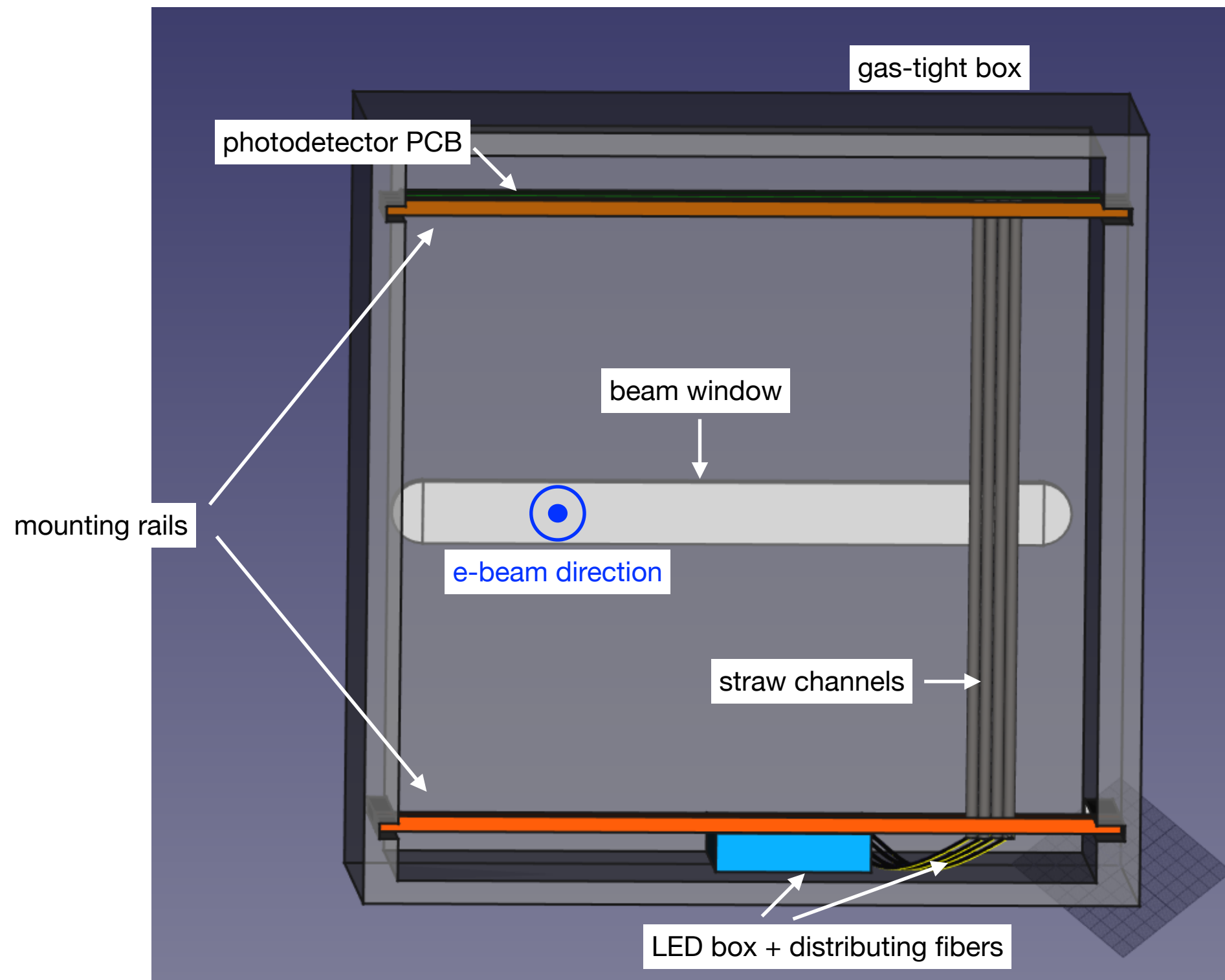
In-situ calibration

- Pulsed LED for continuous monitoring of photodetector stability, between LASER shots
- Special calibration run: Insertable Brem target in interaction region
 - measure spectrum of Brem electrons
 - cross-check of MC-based unfolding technique, data-based corections
 - cross-calibration between photon and electron detectors

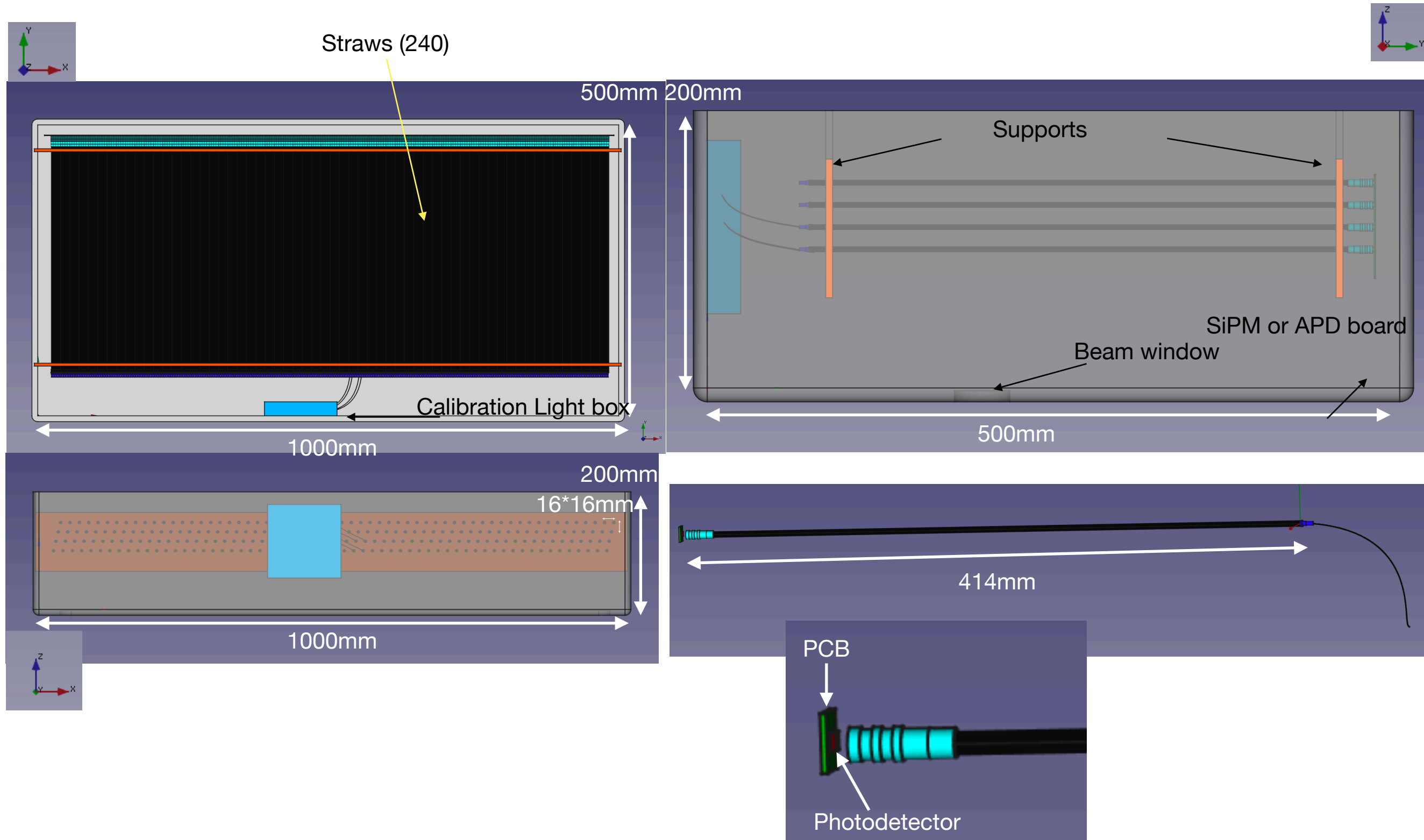


BACKUP

Straw Cerenkov design: For orientation



Most recent design



- New design idea: stagger 4 layers of straw channels spaced ~2cm apart, to have more distance between photodetectors on PCB, but still have full coverage