LUXE CDR- Cerenkov Chapters

Ruth Jacobs

28th July 2020

HELMHOLTZ RESEARCH FOR GRAND CHALLENGES

DESY.

Photon before IP (Brems) Setup

Proposed Structure:

See link for more detail

- Design
  - Design requirements (particle rates)
  - Prototype description
  - High-rate mitigation
  - Dimensions, Segmentation

- Performance
  - What is our money plot?

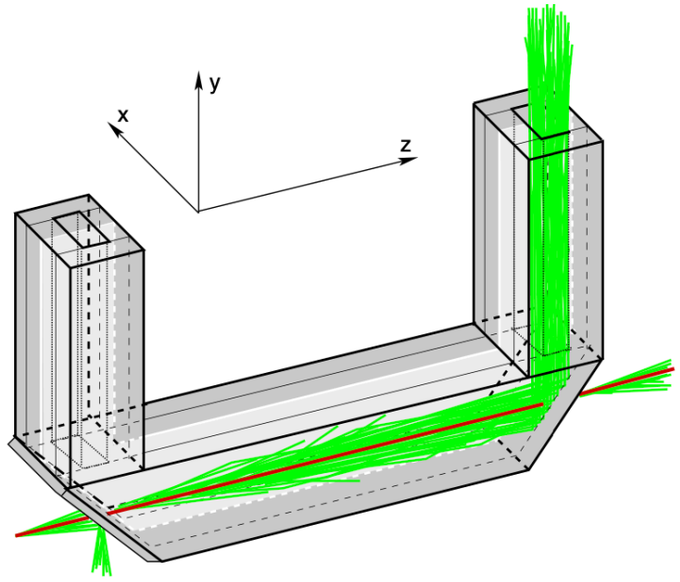
- Integration and Readout
  - readout scheme from prototype
  - not much thought about mounting, support structures etc.
  - LED calibration?
- Cost estimate (core, personnel)
  - help needed!

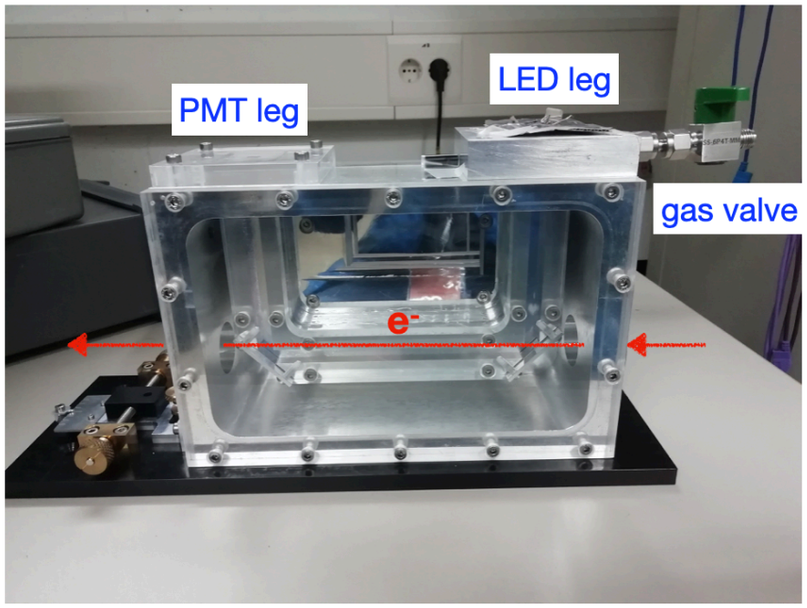
Missing:

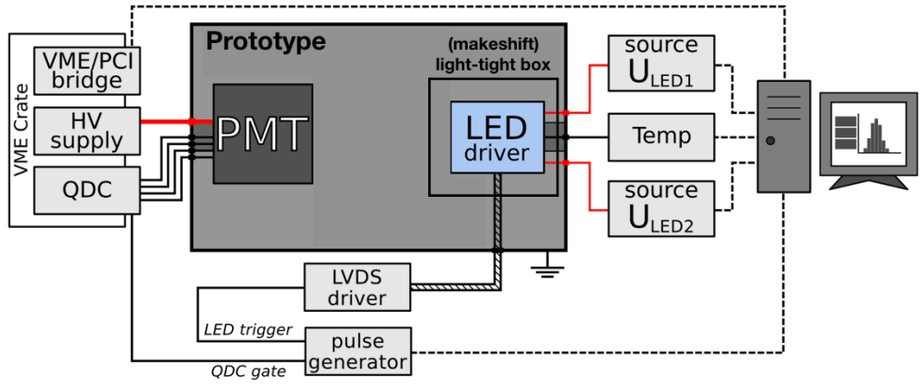
- Measure Brems in-situ during physics runs? Dedicated Brems measurement + monitoring only? “Double-use detector”?
  → Changes requirements

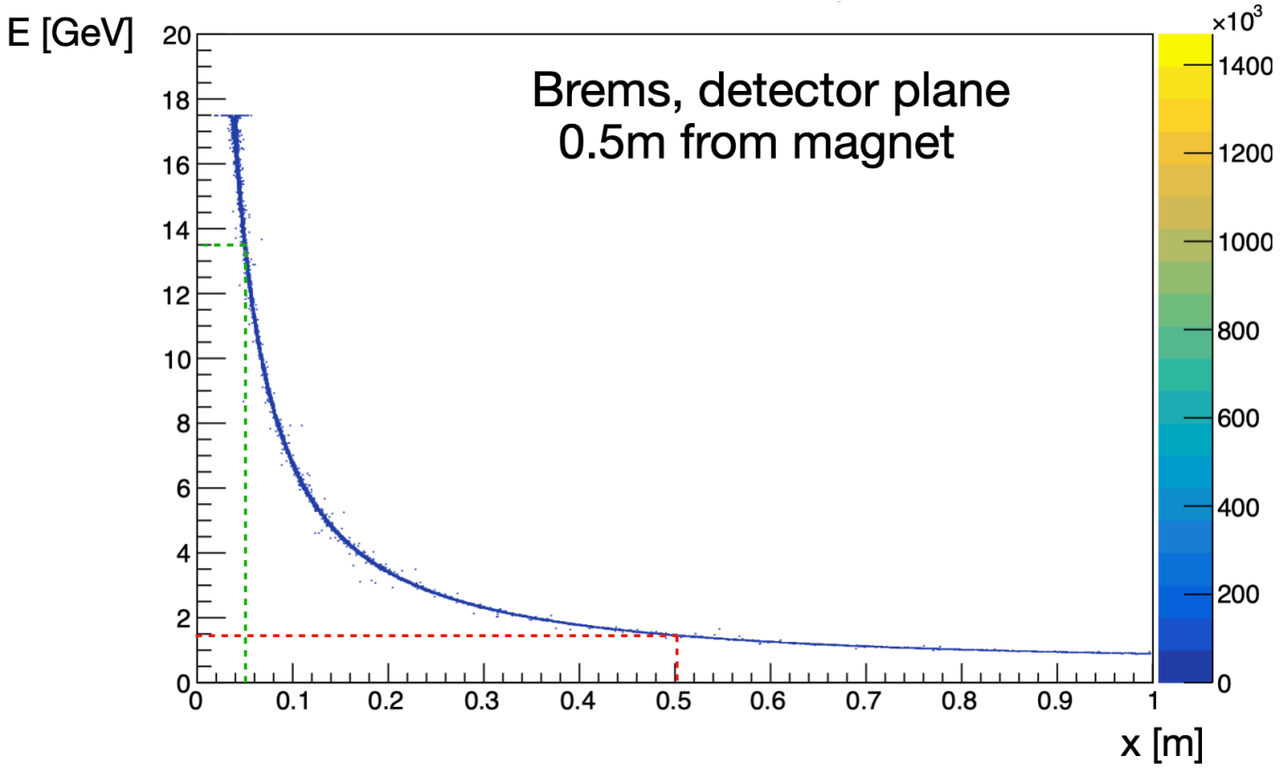
- Cerenkov/Scintillator combined system?
  → John and I started thinking about possible configurations

Photon before IP (Brems) Setup — Proposed Plots









“Final” performance Plot — could be:

- “reco” Brems energy spectrum from lcpolmc emulation? Overlaid with “truth”?

- detector-based: QDC counts vs. x
  → show we can deal with the rates

Brems Cerenkov Detector Summary (prelim.!)

	In situ measurement	Monitoring only	Trident double use?
Detector Length x	~550mm	individual probe stations	~600mm
Detector Length y	150mm	150mm	150mm
Length z	50mm	50mm	50mm
Number of channels	50	~10 (?)	>50
Channel segmentation	9x18mm	9x18mm	finer in x, 18mm y
Channel length	15mm	15mm	≥15mm
Cerenkov Gas	He	He	He/Air?
PMT gain	10^4	10^4	$\geq 10^4$ (smaller channel size)

Electrons after IP (Trident) Setup

See link for more detail

Proposed Structure:

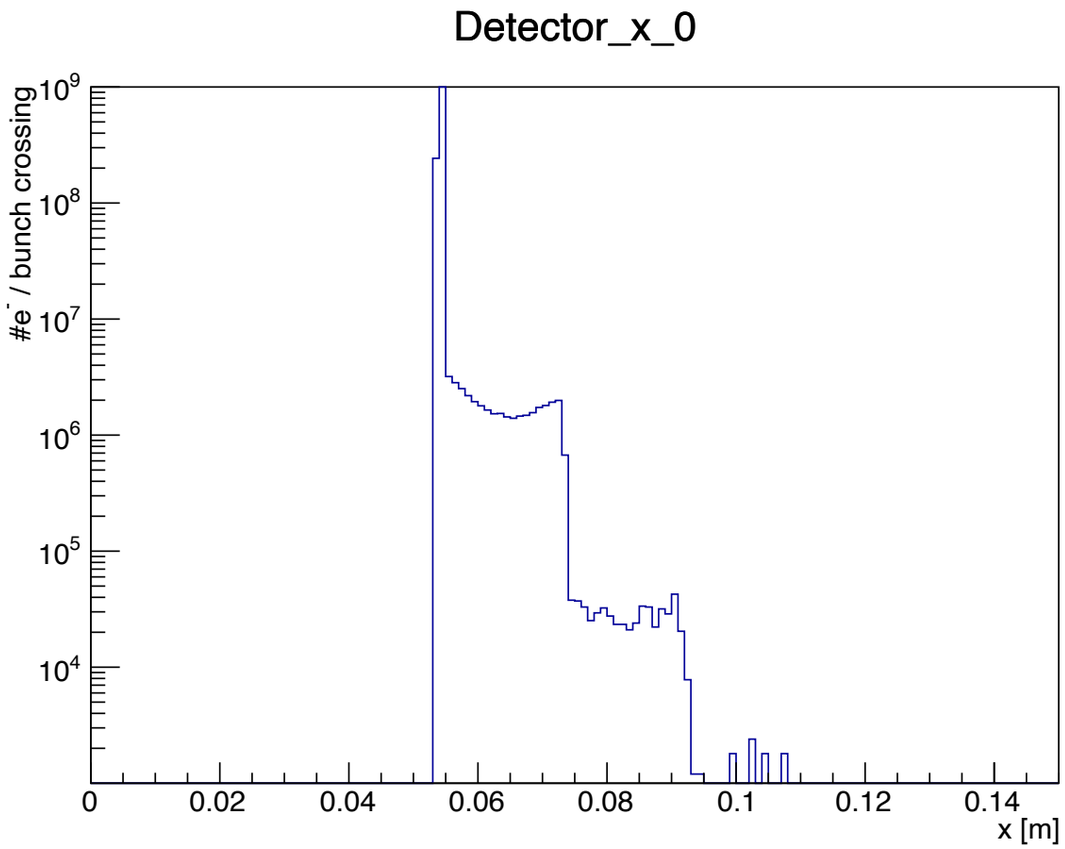
- Design
  - Design requirements (particle rates)
  - Prototype description → already done in Brems chapter
  - High-rate mitigation → already done in Brems chapter
  - Dimensions, Segmentation
  → studied this a while ago… which ξ to optimize for?

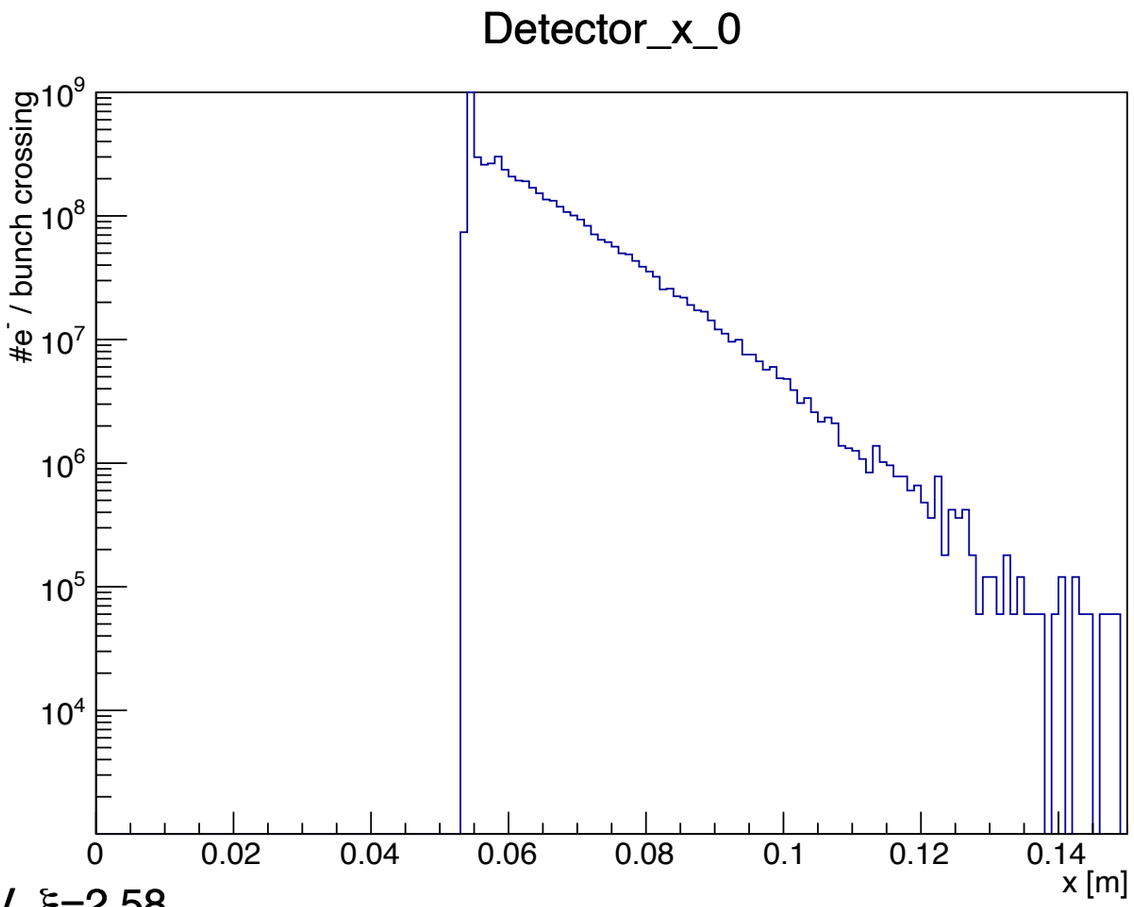
- Performance
  - What is our money plot?
  - Measurement goal? Compton edges? Or just monitoring?

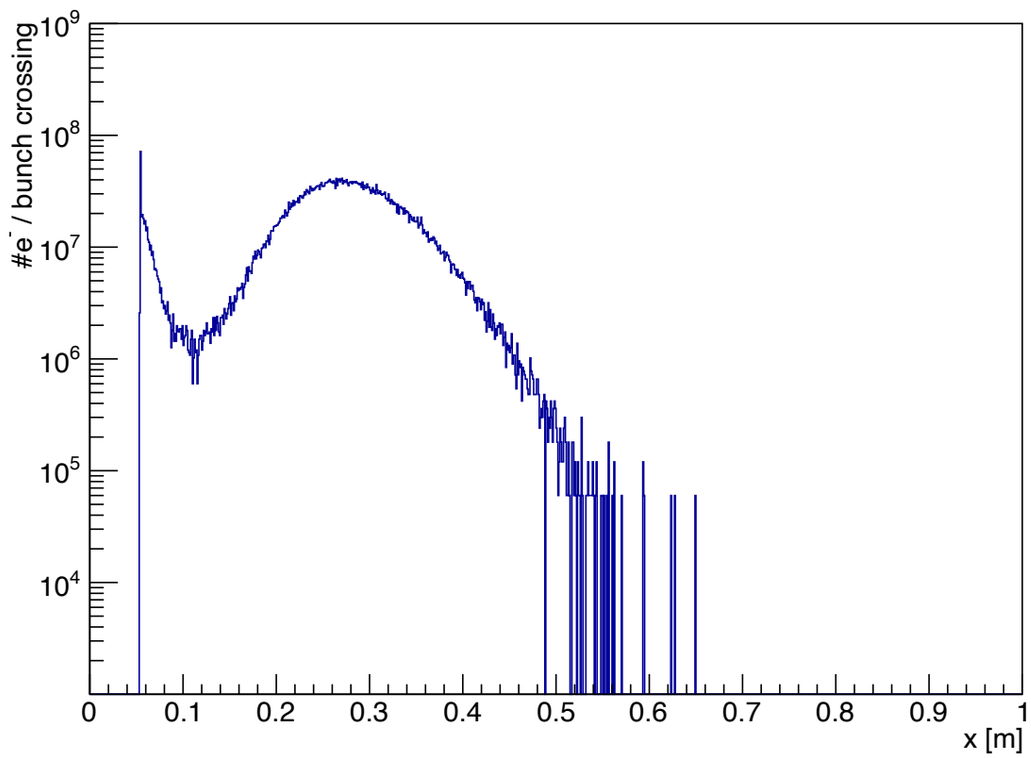
- Integration and Readout
  - readout scheme from prototype → already done in previous chapter

- Cost estimate (core, personnel)
  - help needed!

XY distribution of Electrons after IP: Trident







Electrons after IP (Trident) Setup — Proposed Plots