LUXE Cerenkov Detectors

Dimensions etc.

Ruth Jacobs, John Hallford, Marius Hoffmann, Jenny List, Matthew Wing
26.05.2020

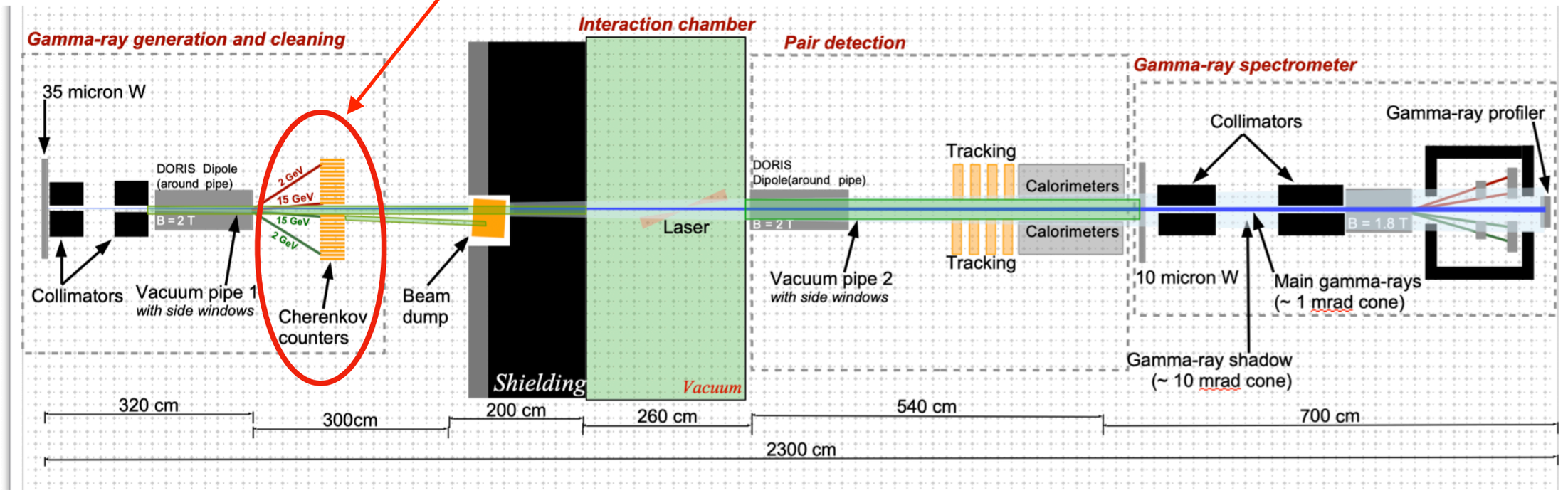
HELMHOLTZ RESEARCH FOR GRAND CHALLENGES

DESY.

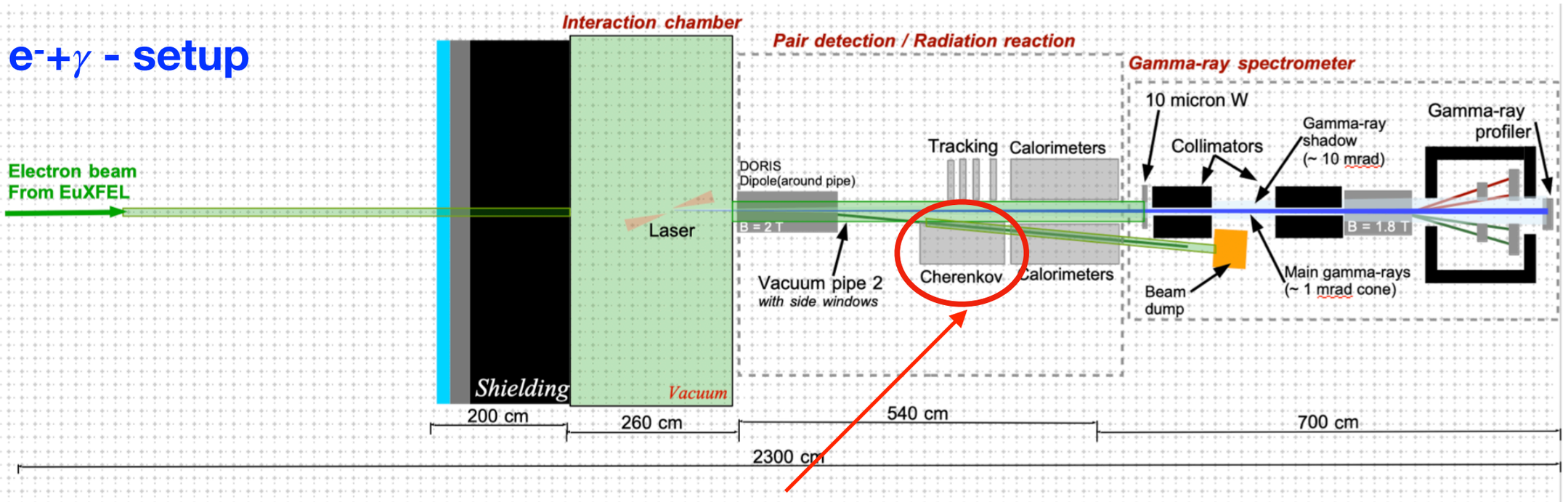
Cerenkov Detectors in LUXE

"CC1": photon flux monitoring

$\gamma+\gamma$ - setup

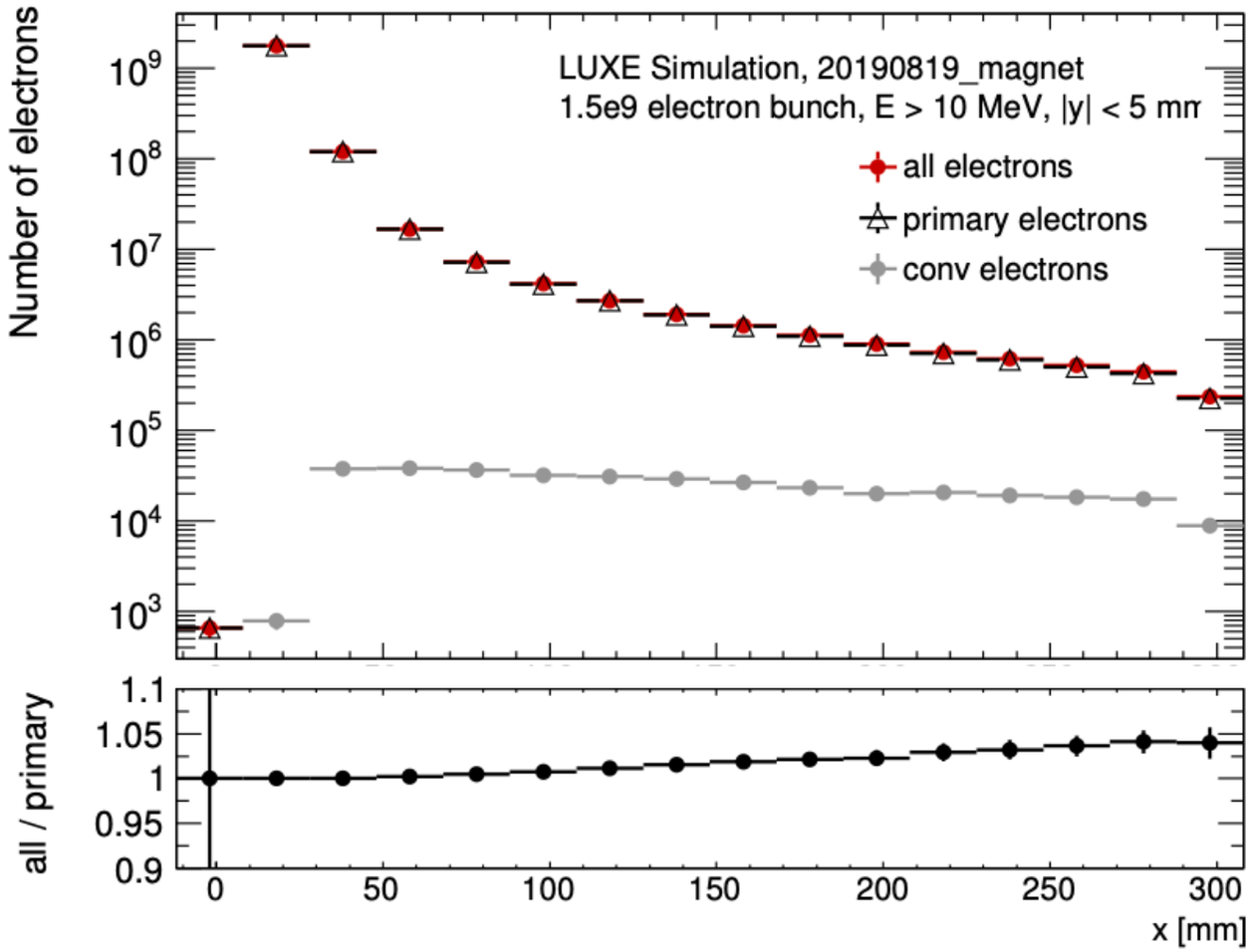


$e^-+\gamma$ - setup



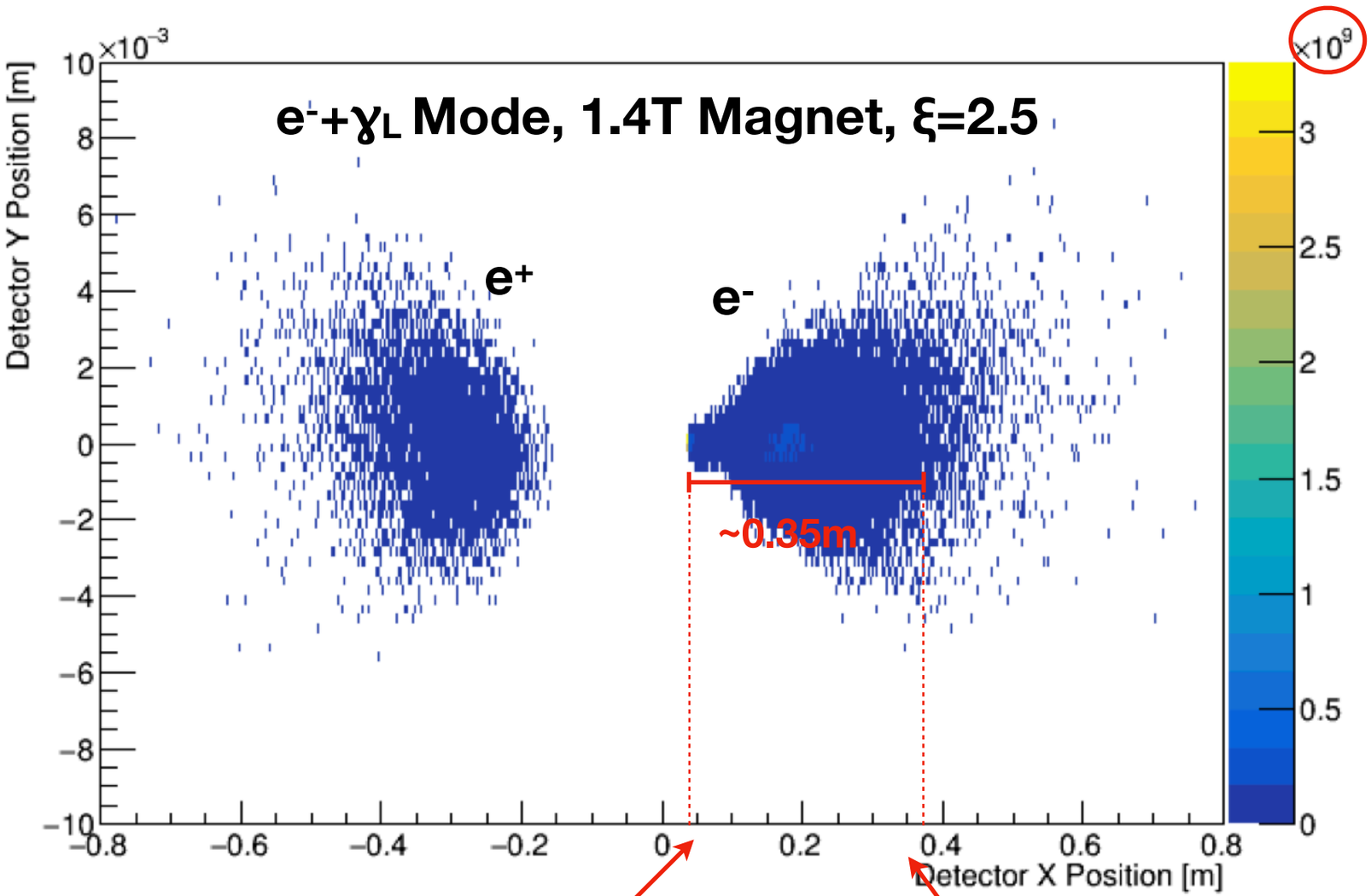
"CC2": Compton & Trident electron detection

CC1: Photon flux monitoring



LoI: “The Cherenkov detector array will consist of 15 detectors, each with a size of 2×2 cm^2 spanning from 3.5 cm to 33.5 cm, covering the energies between 1 and 15 GeV. ”

CC2: Compton electron detection

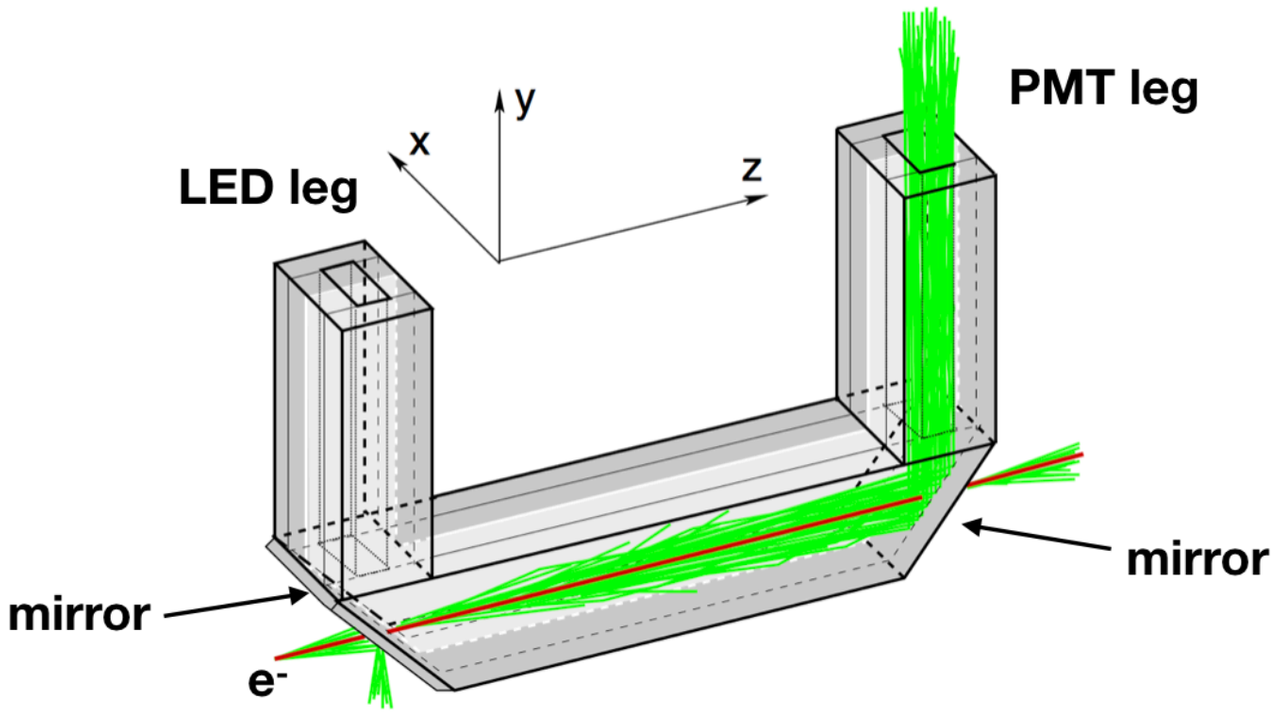


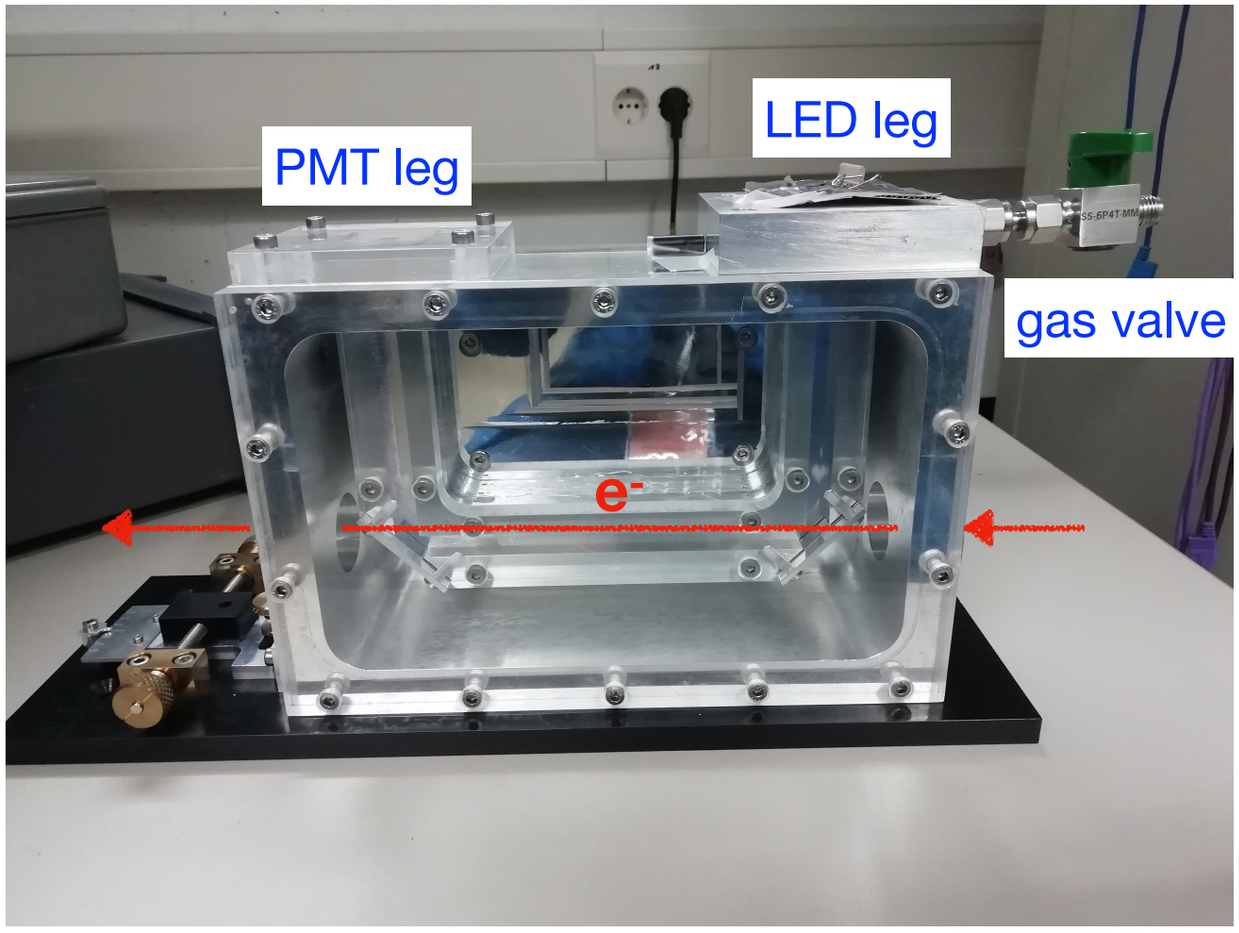
Magnetic field may be higher 1.4 → 2.2 T!

Cerenkov Prototype

Prototype from ILC polarimetry (as described in LUXE LoI)

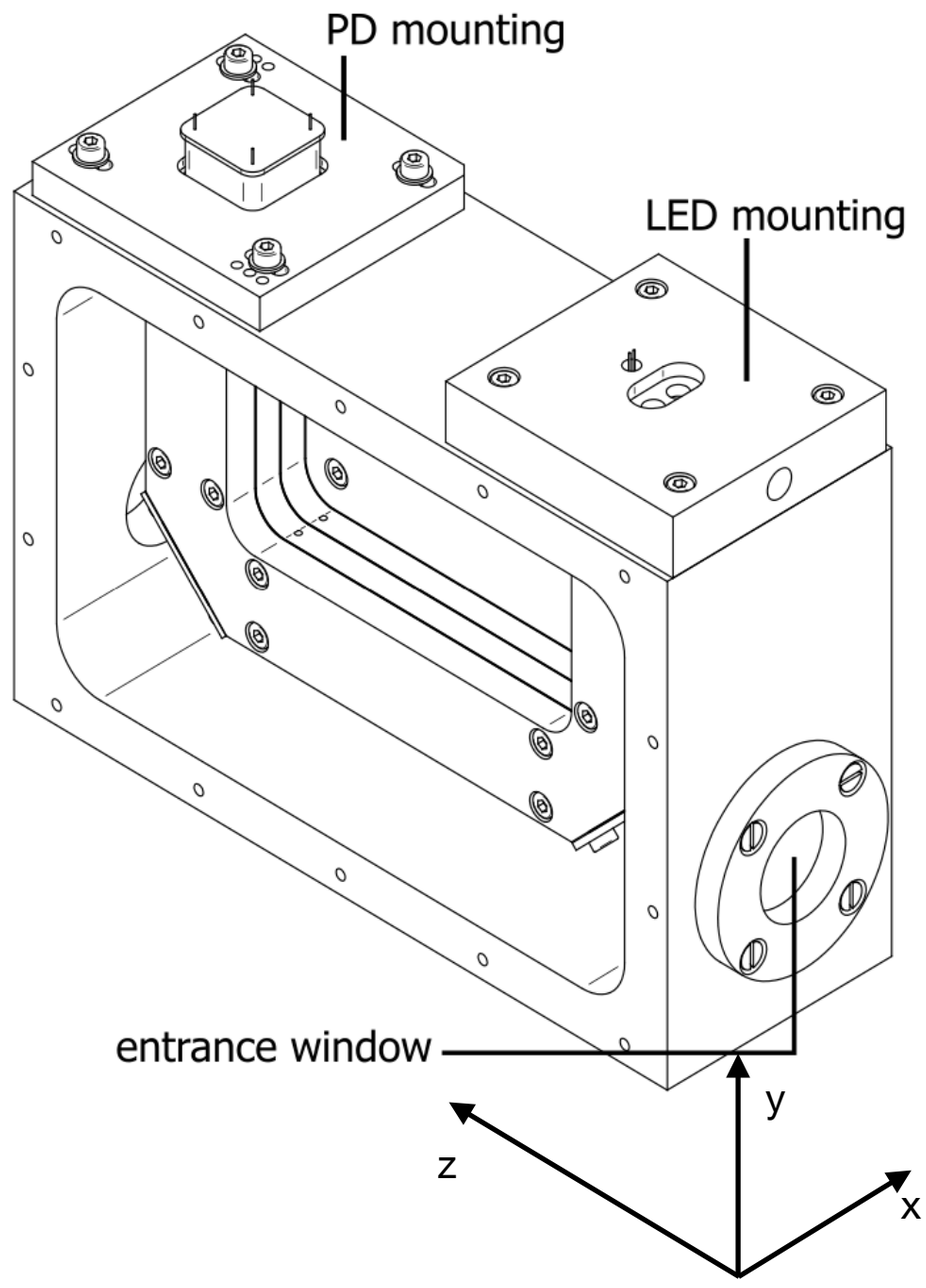
- u-shaped aluminium channels, filled with gas, mirrors to guide light
- several channels (prototype has 2), separated by thin wall
- LED on one leg for calibration, PMT on other leg for light detection





Prototype:Dimension & Services

- box dimensions (2 channels): 90×150x230mm^3 (dx×dy×dz)
- weight: ~2kg
- Each Channel: 8x8mm
- filled with C4F10 Gas at slight overpressure (box gas-tight)
- HV to operate Photo detectors

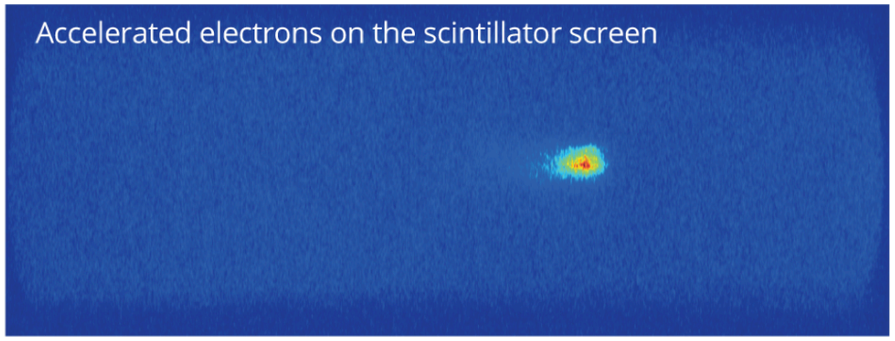


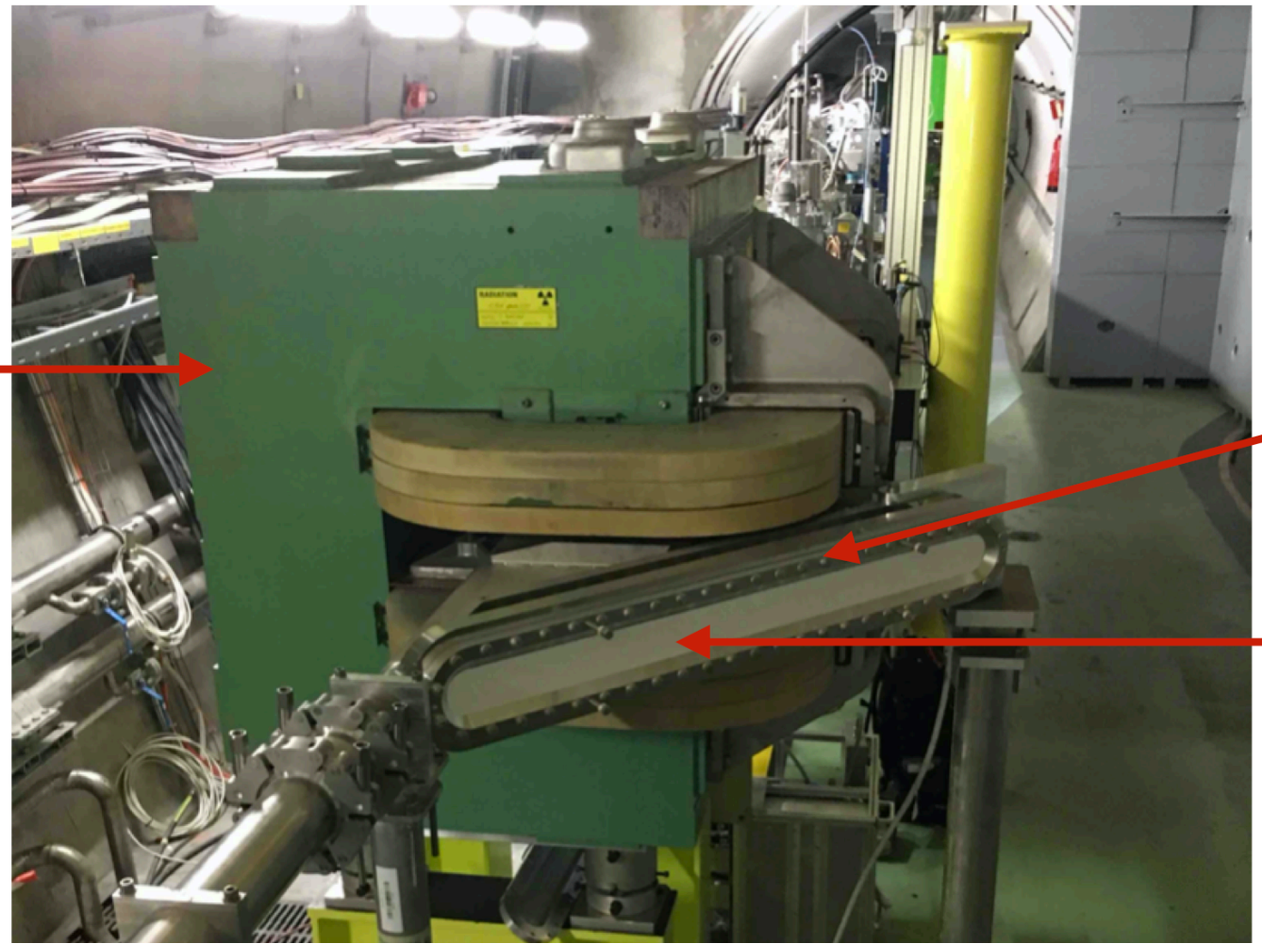
For LUXE setup:

- we may want to change to gas with lower refractive index (maybe even air?)
- we may want to flush gas (radiation hardness?)
- may decrease the distance travelled by the electron in z
- multi-channel detector size/dimension estimate: ~300mm x 150mm x 25mm , < 20kg could be larger for 2.2T

Addition: Scintillator Screen

use in AWAKE





Optical camera

- use scintillator screen + optical camera
  to detect electrons (more detail in Matthew's talk)
- in addition to Cerenkov counters (CC1, CC2) (?)
- needs optical system to image the screen(s) to the camera(s)