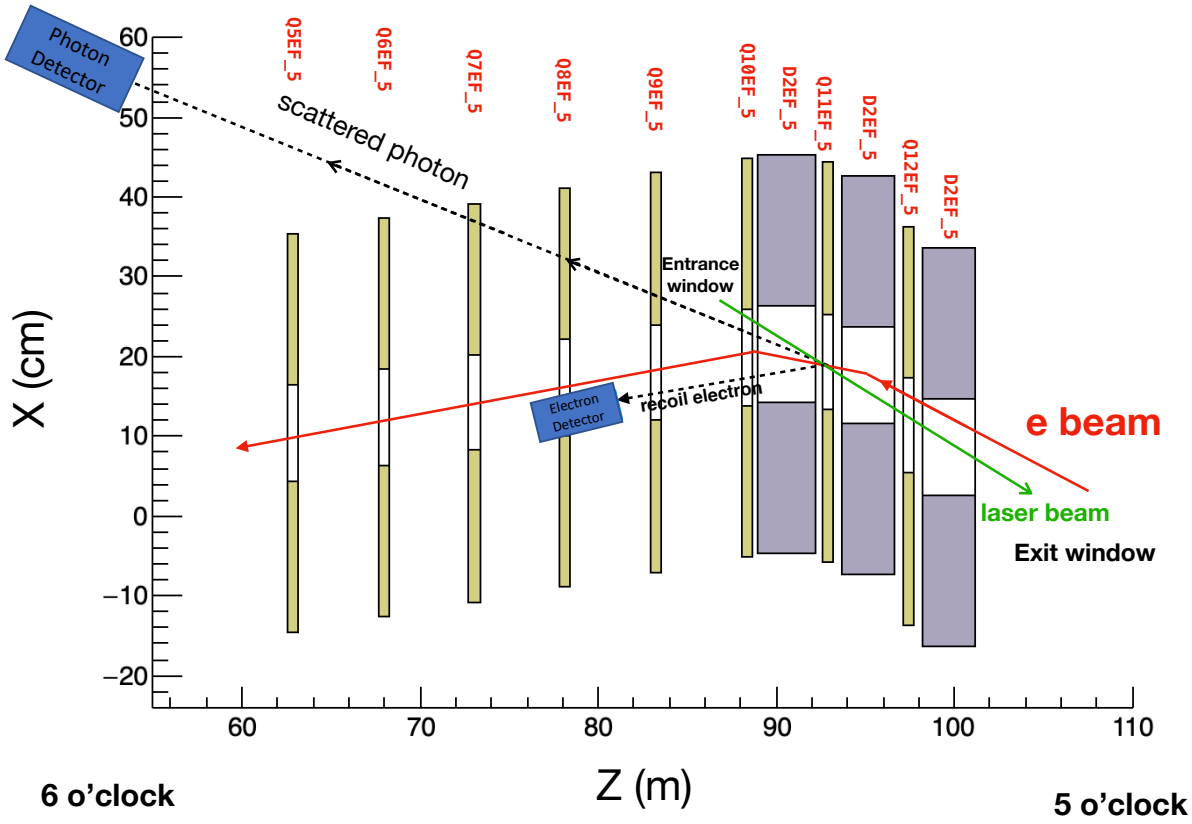
Compton Polarimeter Layout and Detectors



Detect both backscattered photon and scattered electrons

→ Electrons: position sensitive detectors in horizontal direction (P_L only)

→ Photons: position sensitive detector (x) for P_T measurement

calorimeter → P_L

Position Sensitive Detectors

Position sensitive detectors required both for scattered electron and backscattered photon

Electrons:

Need to capture asymmetry endpoint and zero-crossing with at least 30 bins

→ Lowest energy (5 GeV) drives segmentation: **400 μm**

→ Highest energy drives size: **6 cm**

Photons:

→ Need sufficient resolution to fit transverse asymmetry spectrum: **~500 μm**

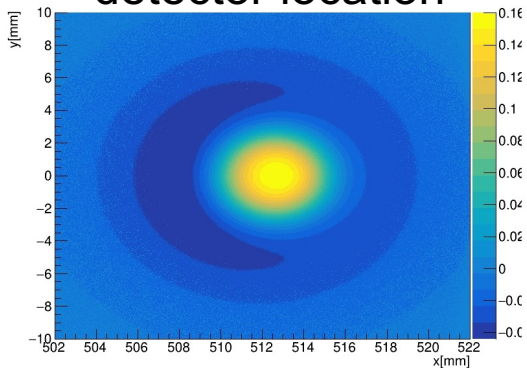
→ Size driven by backscattered photon cone: ~ **5 cm**

Need to measure polarization bunch-by-bunch: <10 ns response times

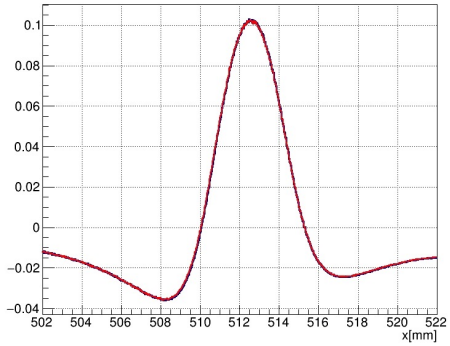
Radiation hard: avg. of 1 event per bunch crossing at 100 MHz

Considering diamond strips or Si for both detectors (the photon detector would need a preshower)

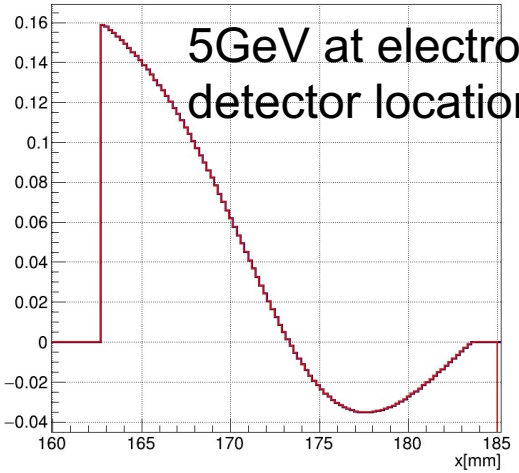
5GeV at photon detector location



5GeV at photon detector location transverse



5GeV at electron detector location



Photon Calorimeter

Photon detector will likely be used in "event mode" to measure the differential asymmetry spectrum

→ Backgrounds likely too large to use integrating method

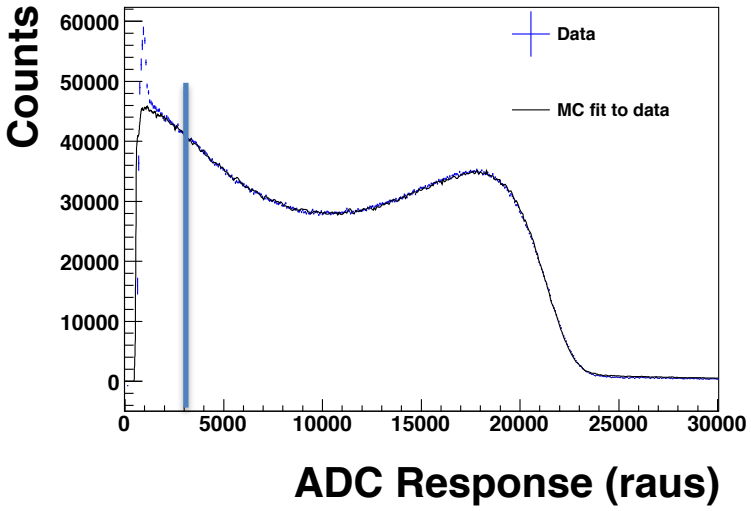
→ Differential method sensitive to precise knowledge of detector threshold → good resolution important

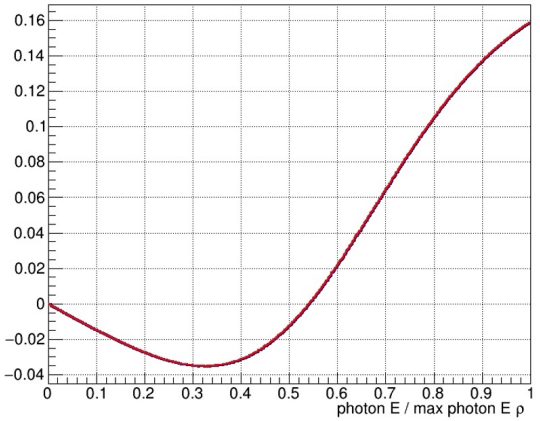
→ Need to detect photons over the range ~0 to 7 GeV

Like position detectors, need radiation hard detector → order 10 MRad/year just from Compton photons

Also need <10 ns time response (bunch-by-bunch measurement)

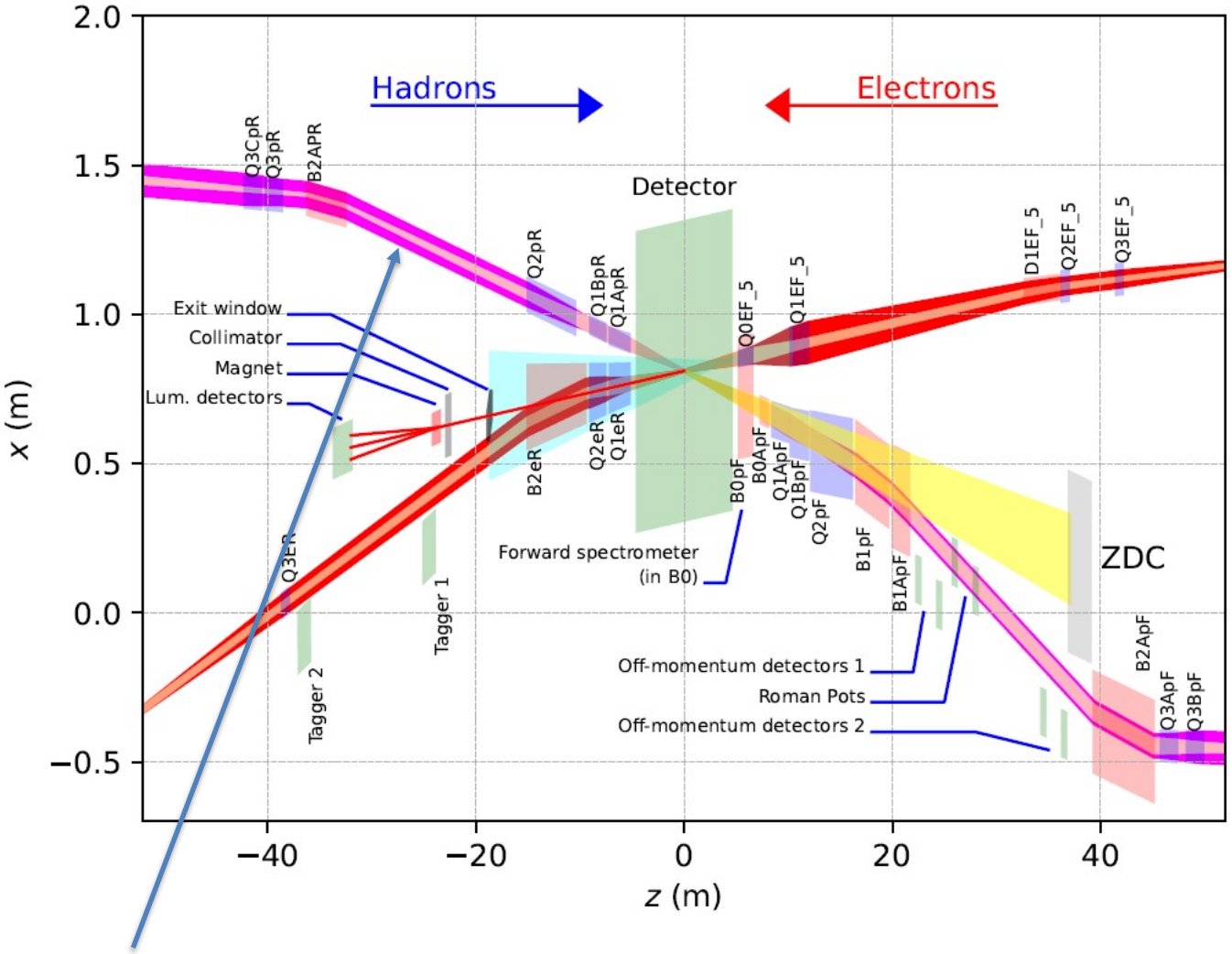
Lead-tungstate? → 4 x 4 cm, 20 cm long





5GeV at photon detector location longitudinal

Hadron Polarimeter



Hadron polarimeter will need ~ 1 meter of the incoming hadron beamline for the target station and detector readout.