Cerenkovs: 2T and 1T geometry and Charge Sharing

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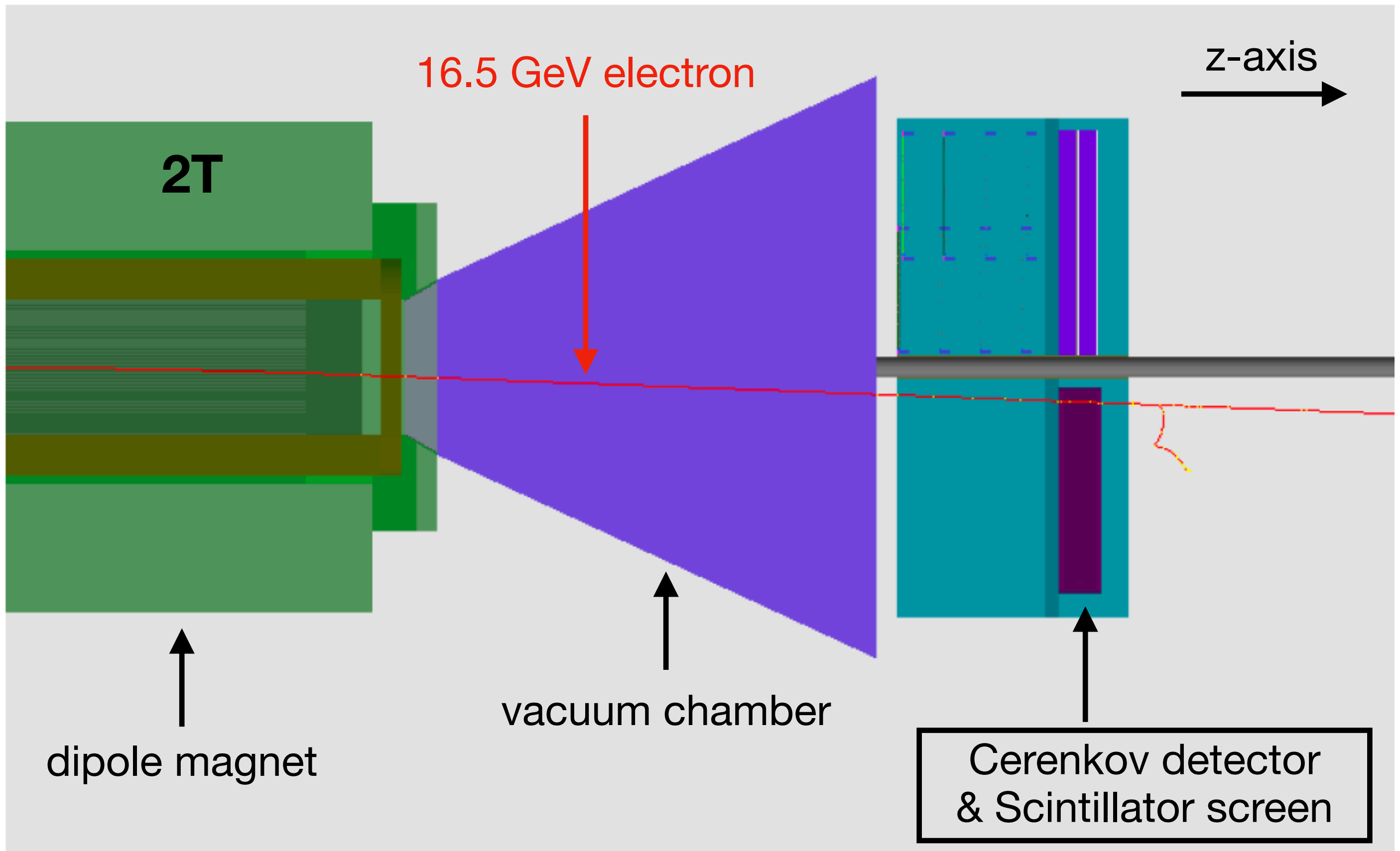
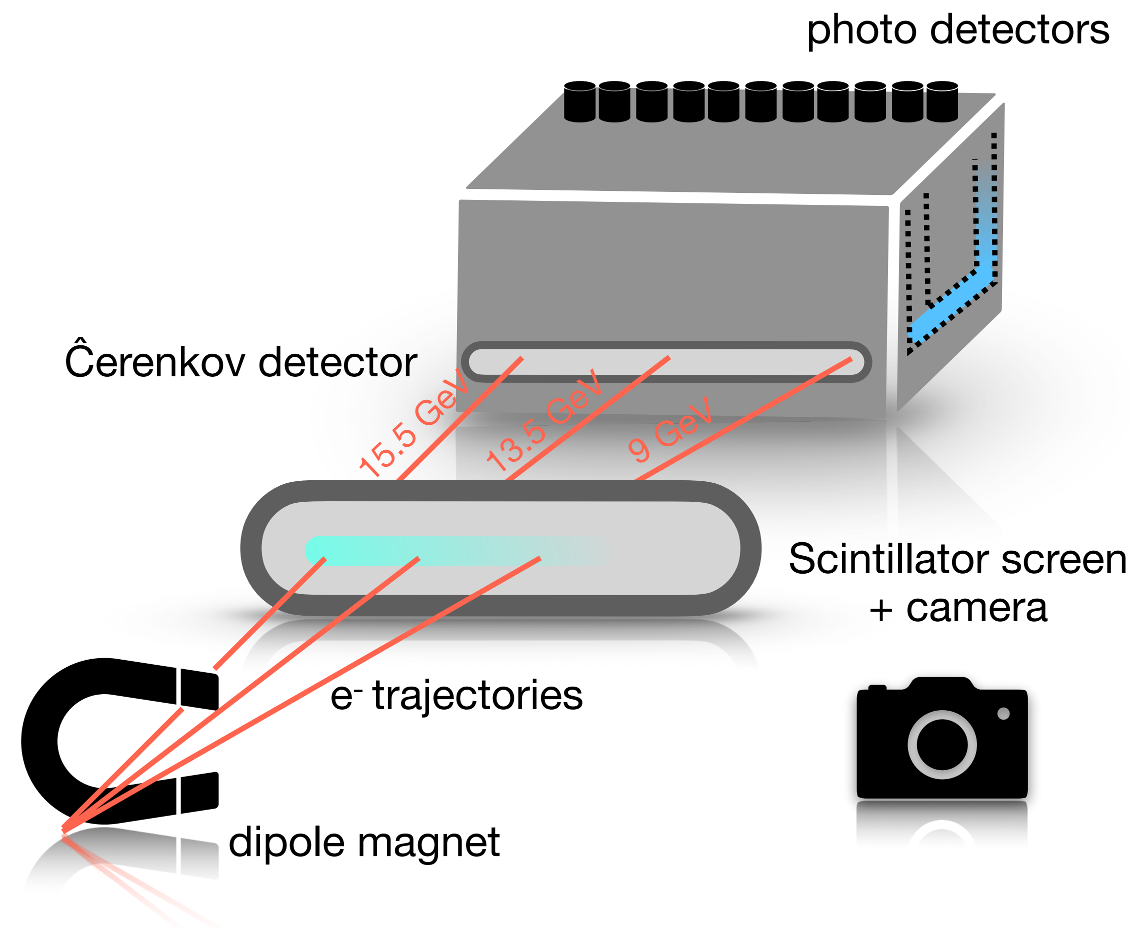
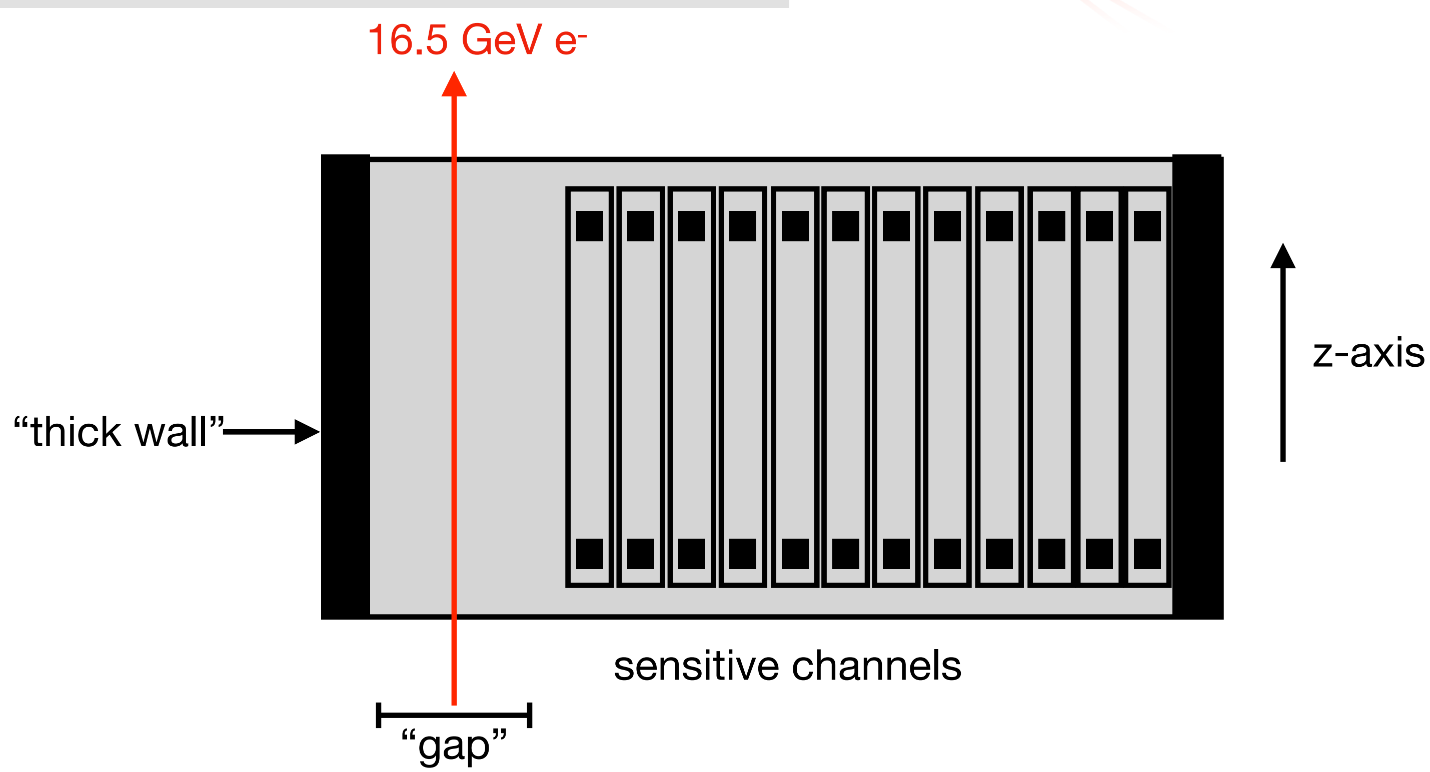
HELMHOLTZ RESEARCH FOR GRAND CHALLENGES

DESY.

Sketches







Avoid beam hitting thick Al wall: "empty gas volume" in Cerenkov box,
beam passes in and out the thin Al windows without hitting sensitive channels.

e^- + LASER: Running with different IP B-fields

Proposal:

- have a special run with 2T magnetic field to do high-resolution edge studies at low ξ
- then change to 1T field, study Trident particles at high ξ

→ How do we need to change Cerenkov position between 2T and 1T runninng?

$$E(x) = 0.3 \cdot B \cdot z_m(\frac{z_m}{2} + z_d) \cdot \frac{1}{x}$$

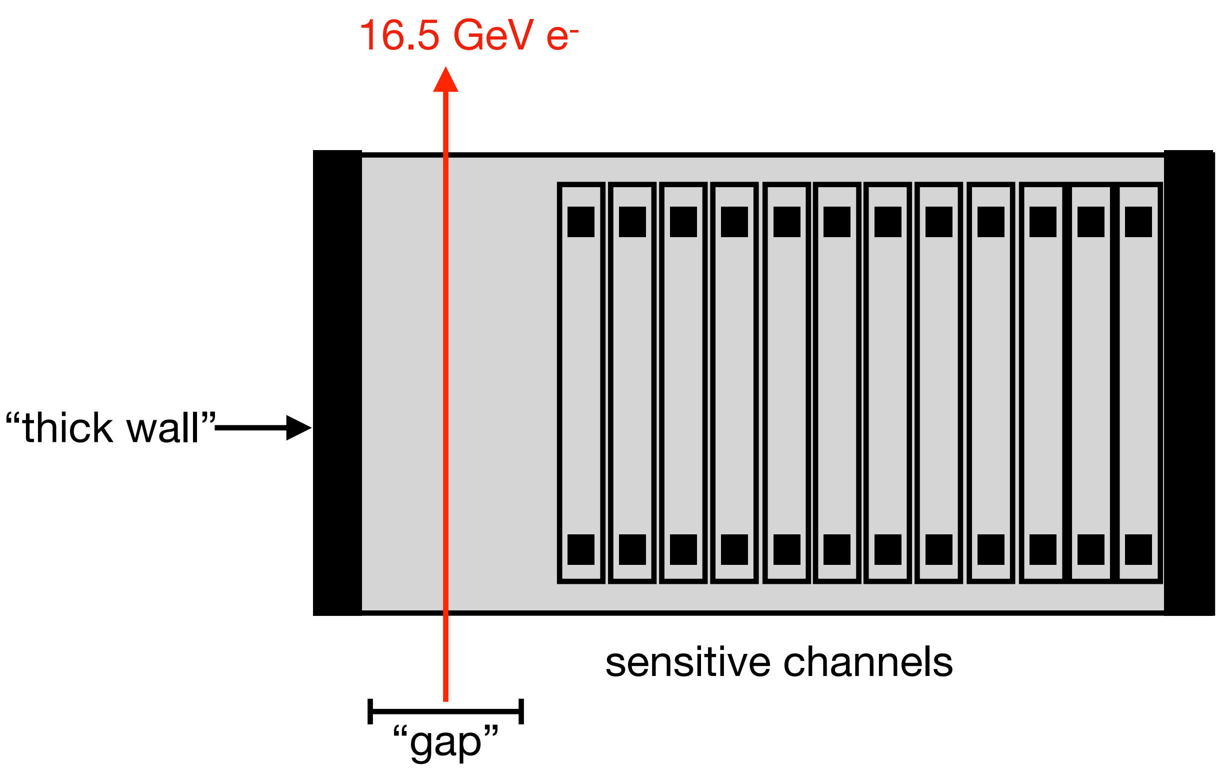
Dipole parametrization for Compton IP Cerenkovs:

- z_m=1.029m (length of magnetic field)
- z_d=1.69m (distance magnet - detector plane)
- B=1T, 2T (magnetic field strength)

	e^- energy [GeV]	x (B=1T) [cm]	x (B=2T) [cm]
beam	**16.5**	4.12 cm	8.25 cm
start acc.	**15.5**	4.4 cm	8.78 cm
end acc. 1T	**5.72**	11.9 cm	
end acc. 2T	**8.35**		16.3 cm

Going from 2T → 1T : Shift Cerenkov box 4.4cm closer to the beam axis!
Acceptance at 15.5 GeV: Beam traverses Box 2.6mm (5.3 mm) next to first channel!

Consequences



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Going from 2T → 1T : Shift Cerenkov box 4.4cm closer to the beam axis!

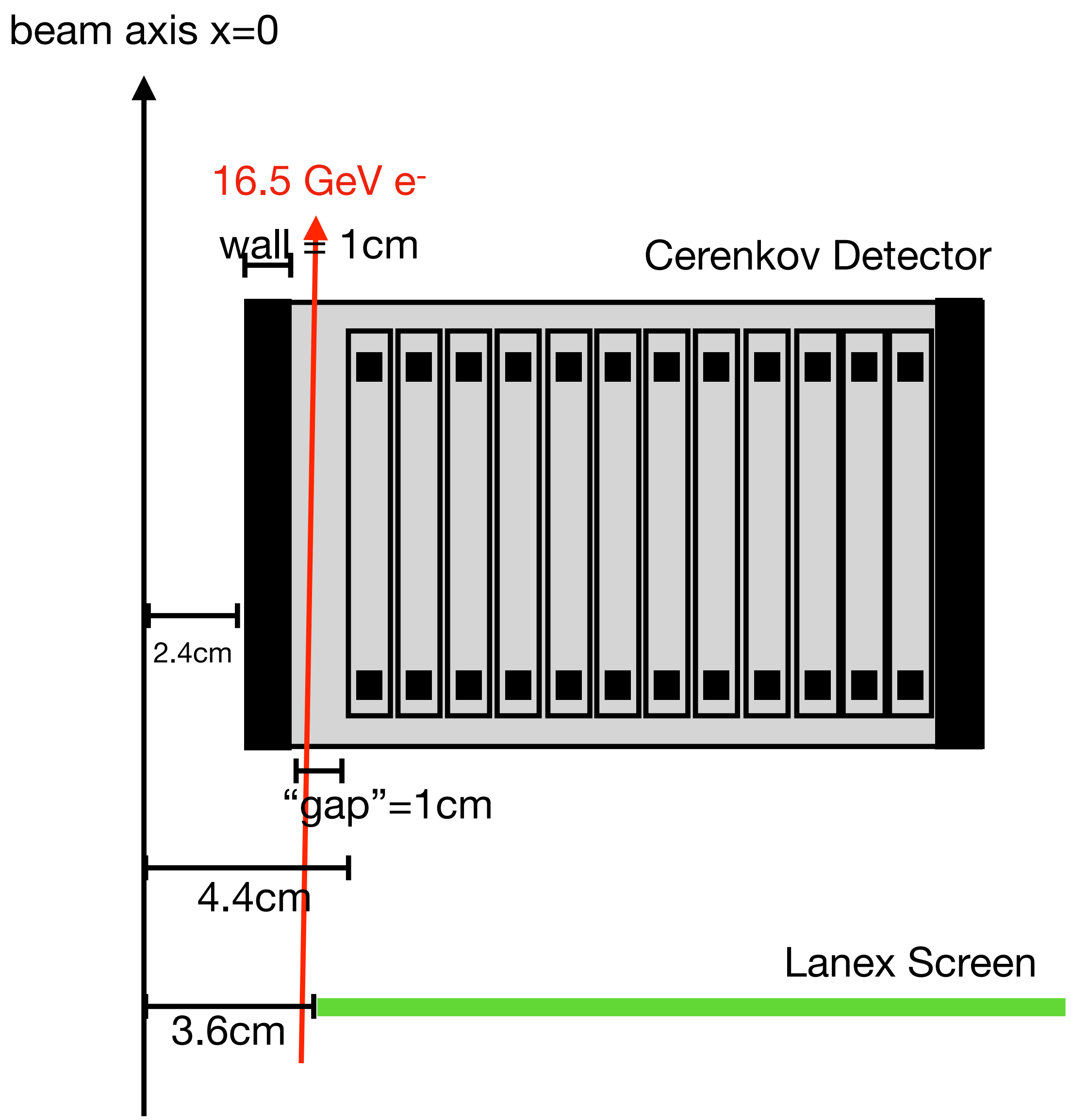
Consequences for Cerenkov geometry:

1. We should not make the gap too big (otherwise thick wall hits the beam pipe when shifting the setup closer).
2. But also not too small: Take difference in beam angle between 1T and 2T running into account!
   (for 1cm channel length: Δx=0.25mm (0.5mm) for 1T (2T))
   → 1cm gap should be ok!

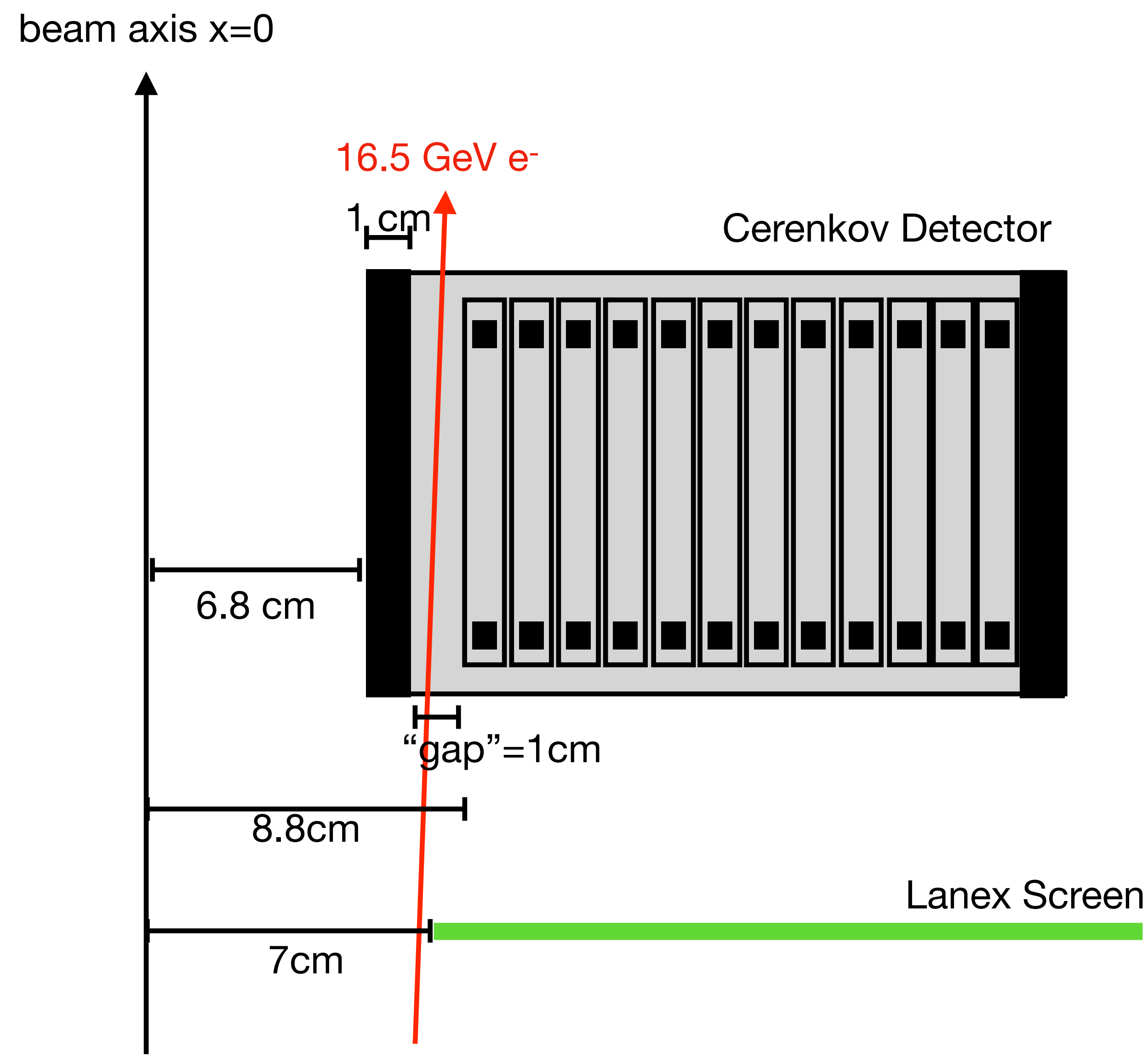
Compton Measurement at 1T:

1. Our edge resolution will be a bit worse with 1T, but probably can still do edge monitoring quite well.
2. We have a bigger acceptance to lower energies with 1T.

Summary: Geometry

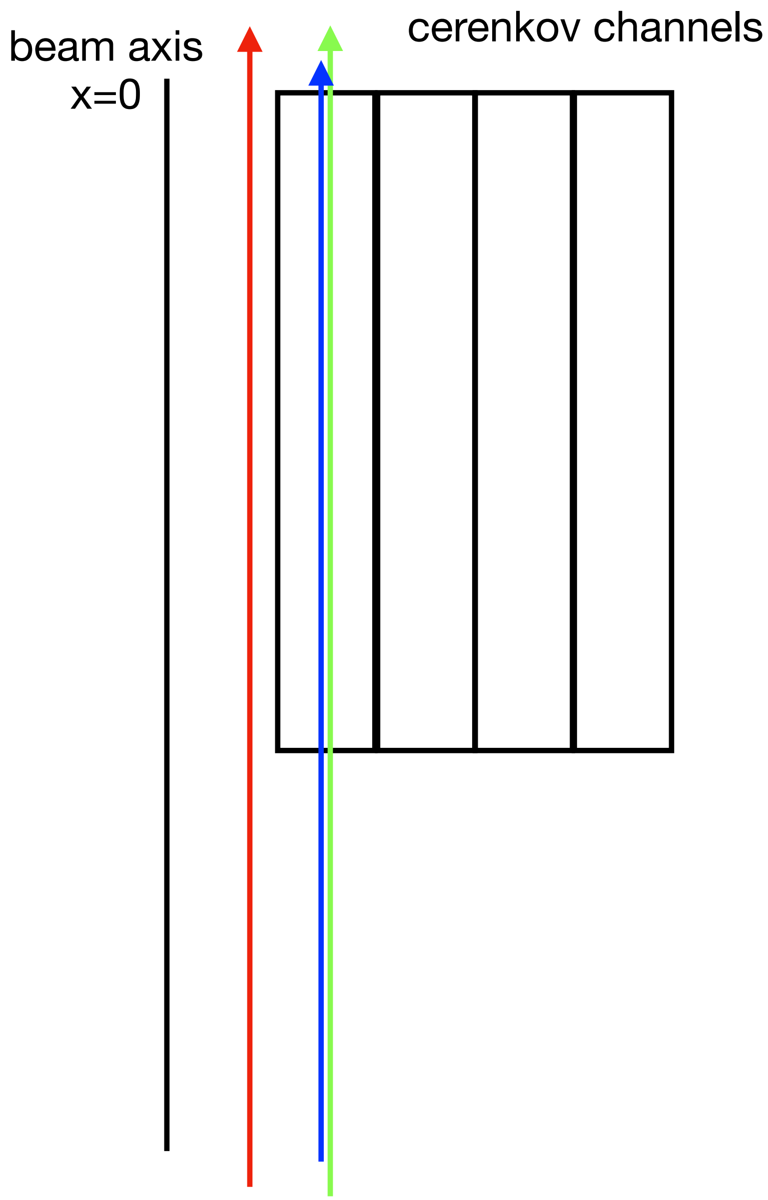


1T setup

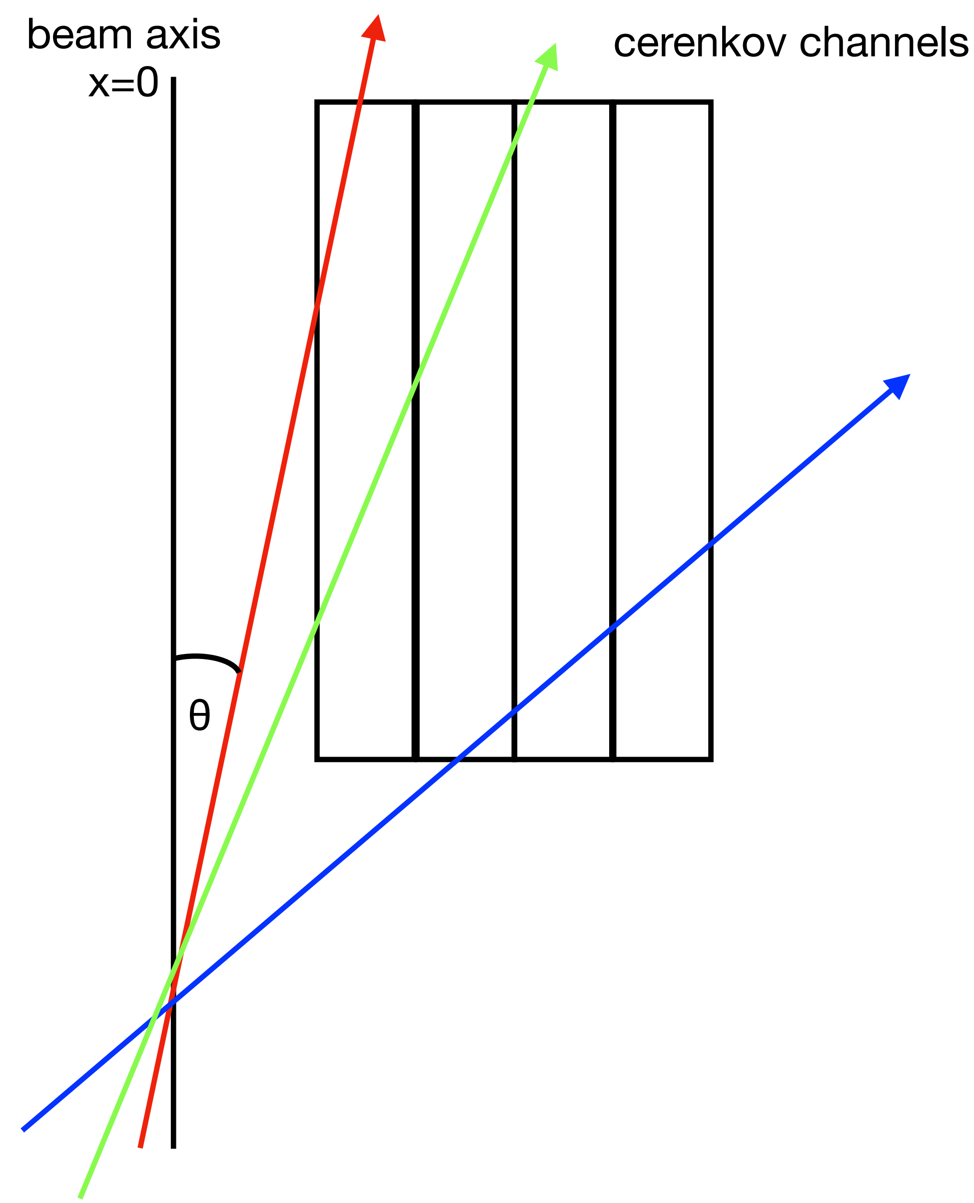


2T setup

Charge sharing

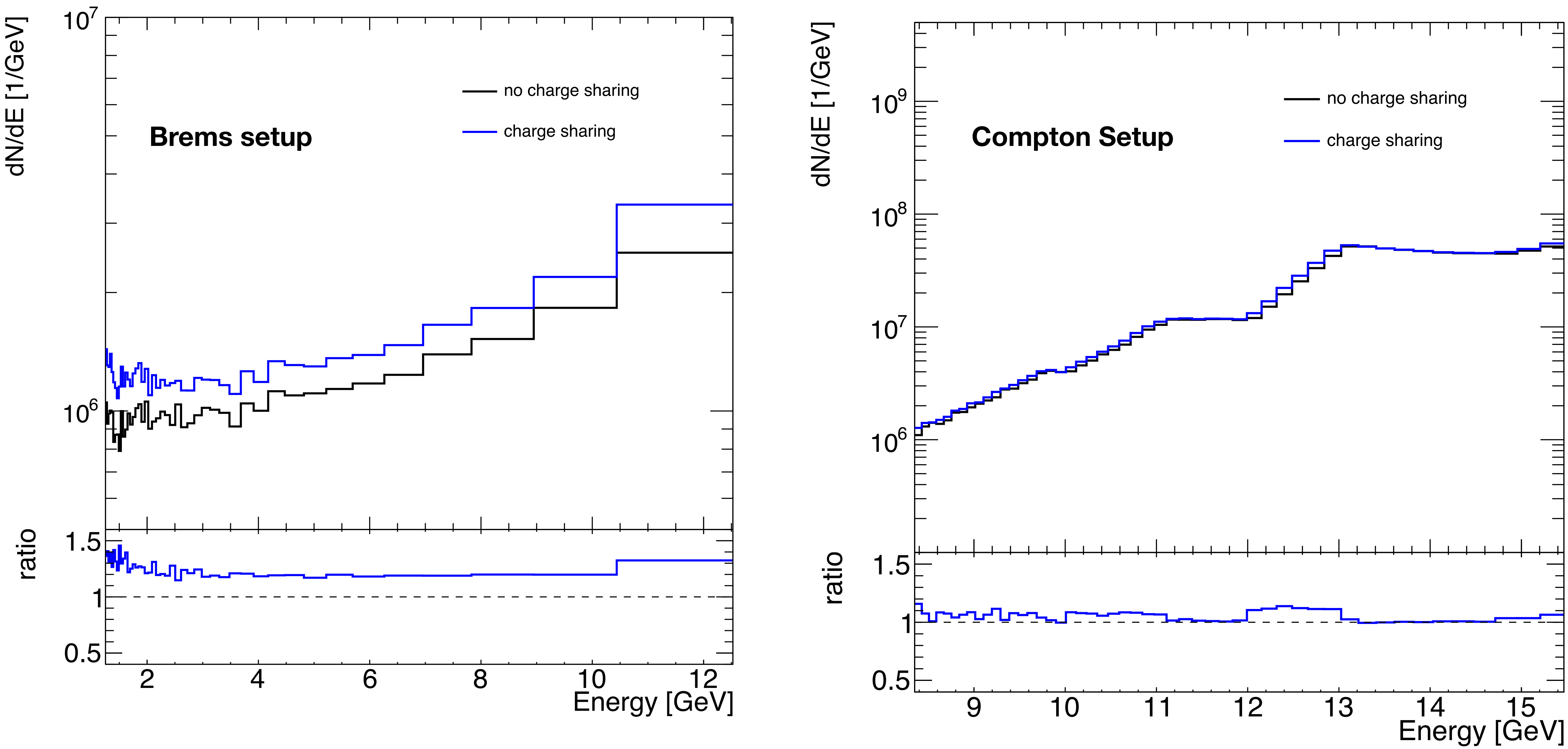


idealized



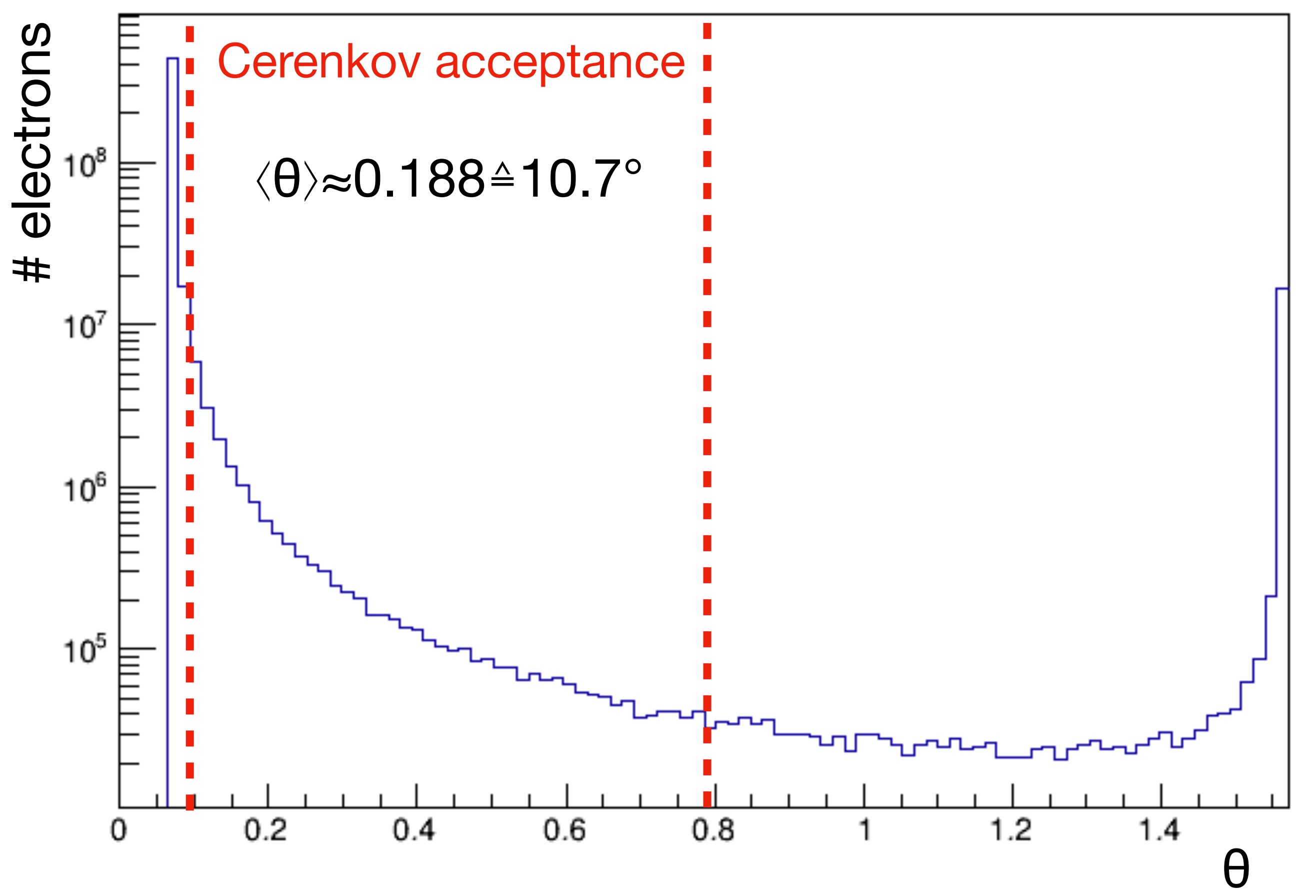
in reality

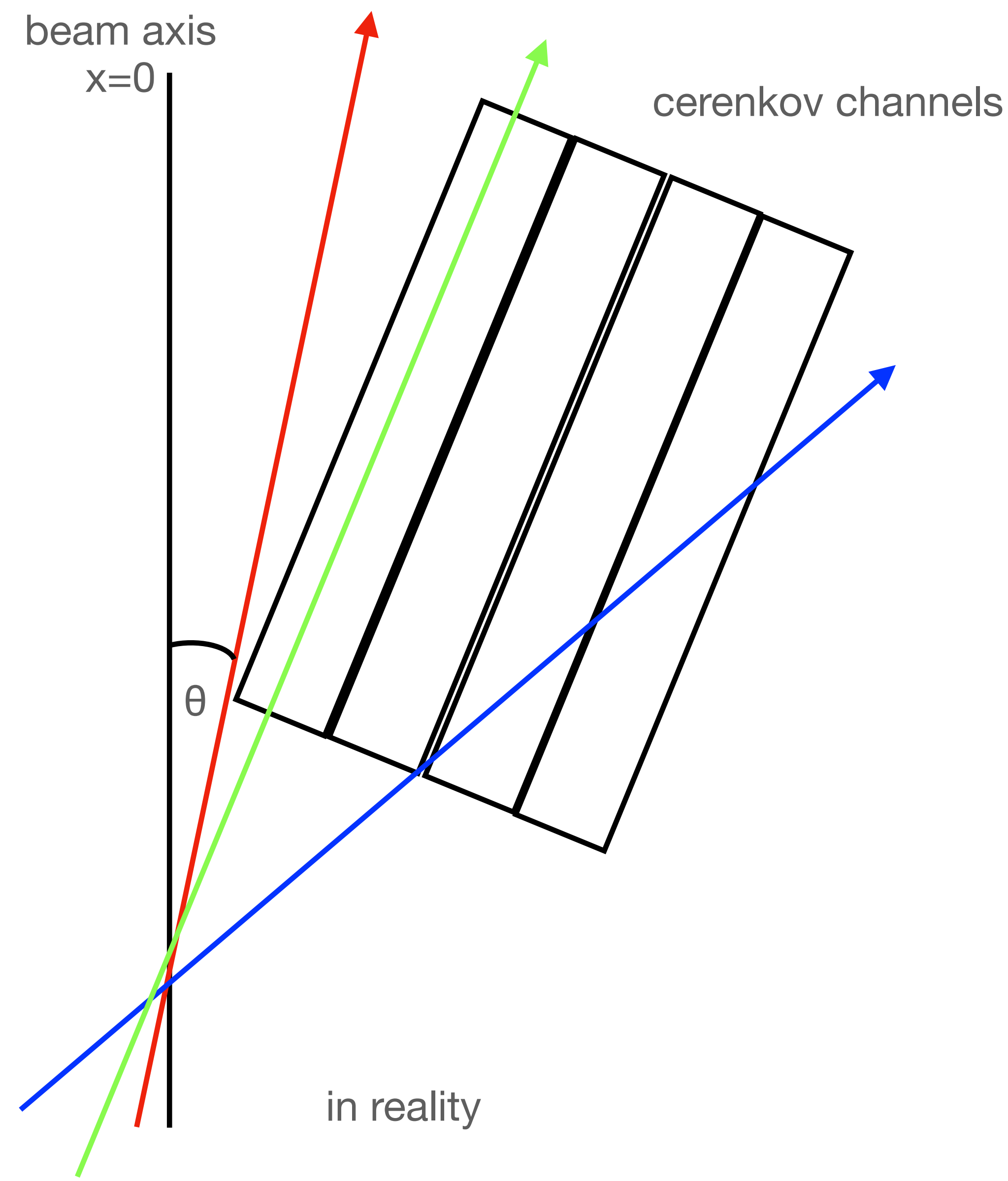
Charge sharing



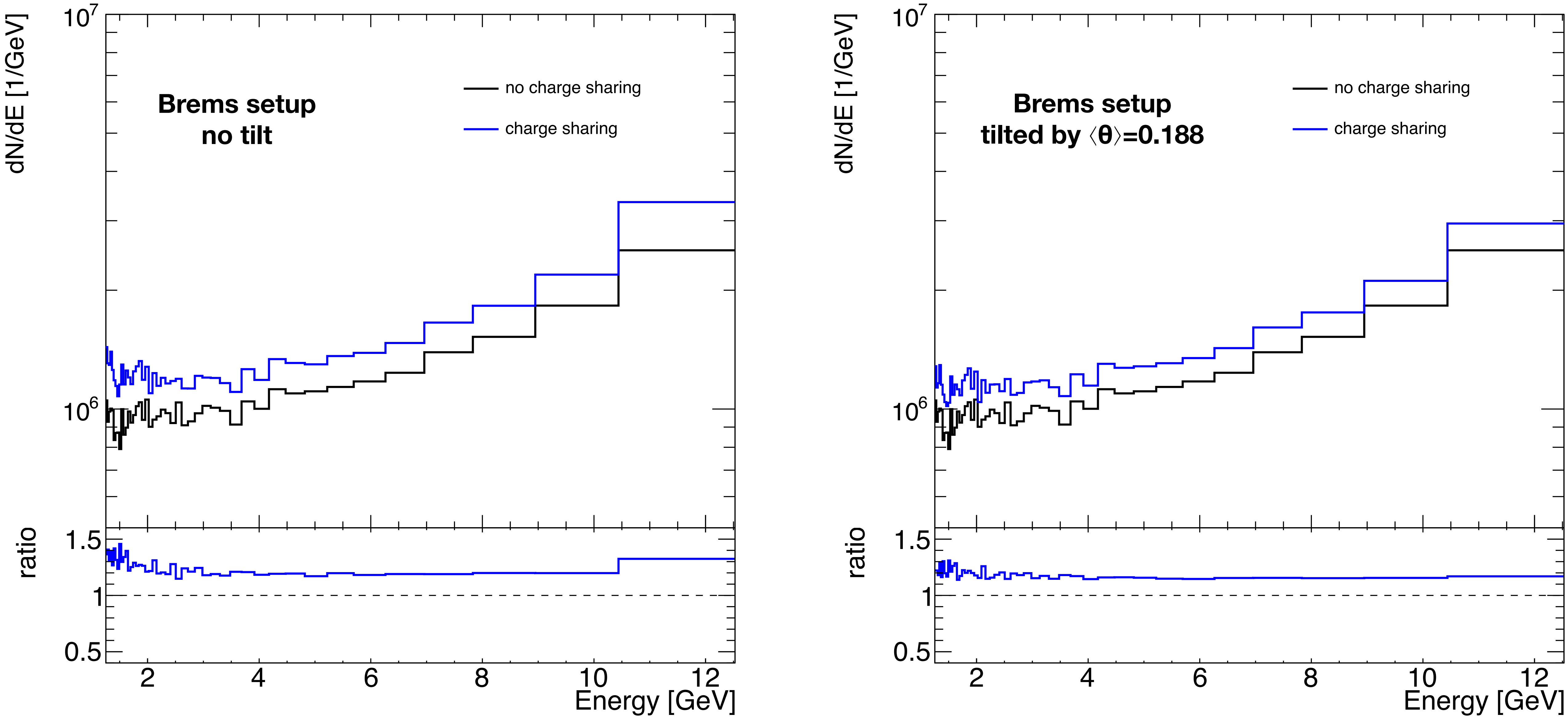
- Brems setup is more affected by charge sharing (it's wider, so theta angles are larger)
- steeply falling spectra!
- need to correct for this effect based on simulation

Tilting the Brems detector





Tilting the Brems detector



- tilting the detector by average incidence angle helps!

Summary

Compton IP Geometry for different B-field runs:

- Compton Edge measurement: propose special runs with 2T Dipole field
- 1T run for Trident: need to move the Cerenkov+Screen 4.4 cm closer to the beam, rate (& edge) monitoring

Charge sharing:

- electrons traversing Cerenkov at an angle create light in more than 1 channel
- effect more pronounced in Brems setup (wider, larger angles)
- propose to correct using simulation
- can mitigate by tilting the setup to average incidence angle