III. Physikalisches Institut A

RWTH AACHEN UNIVERSITY

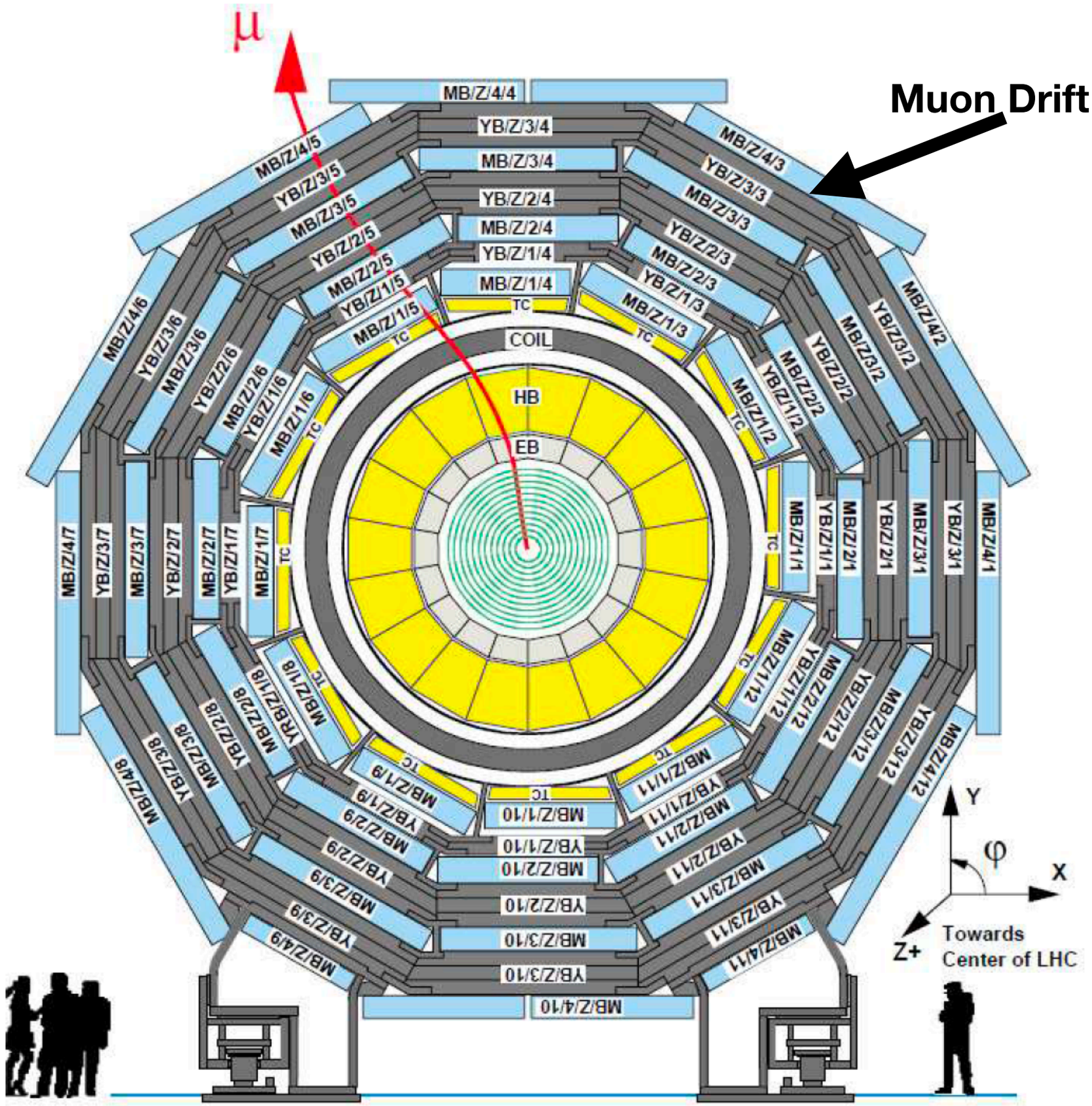
Experimental Techniques in Particle Physics (WS 2020/2021)

Exercises: the CMS muon DT system

08.12.2020

Prof. Alexander Schmidt

Intro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Muon Drift Tubes (DT)
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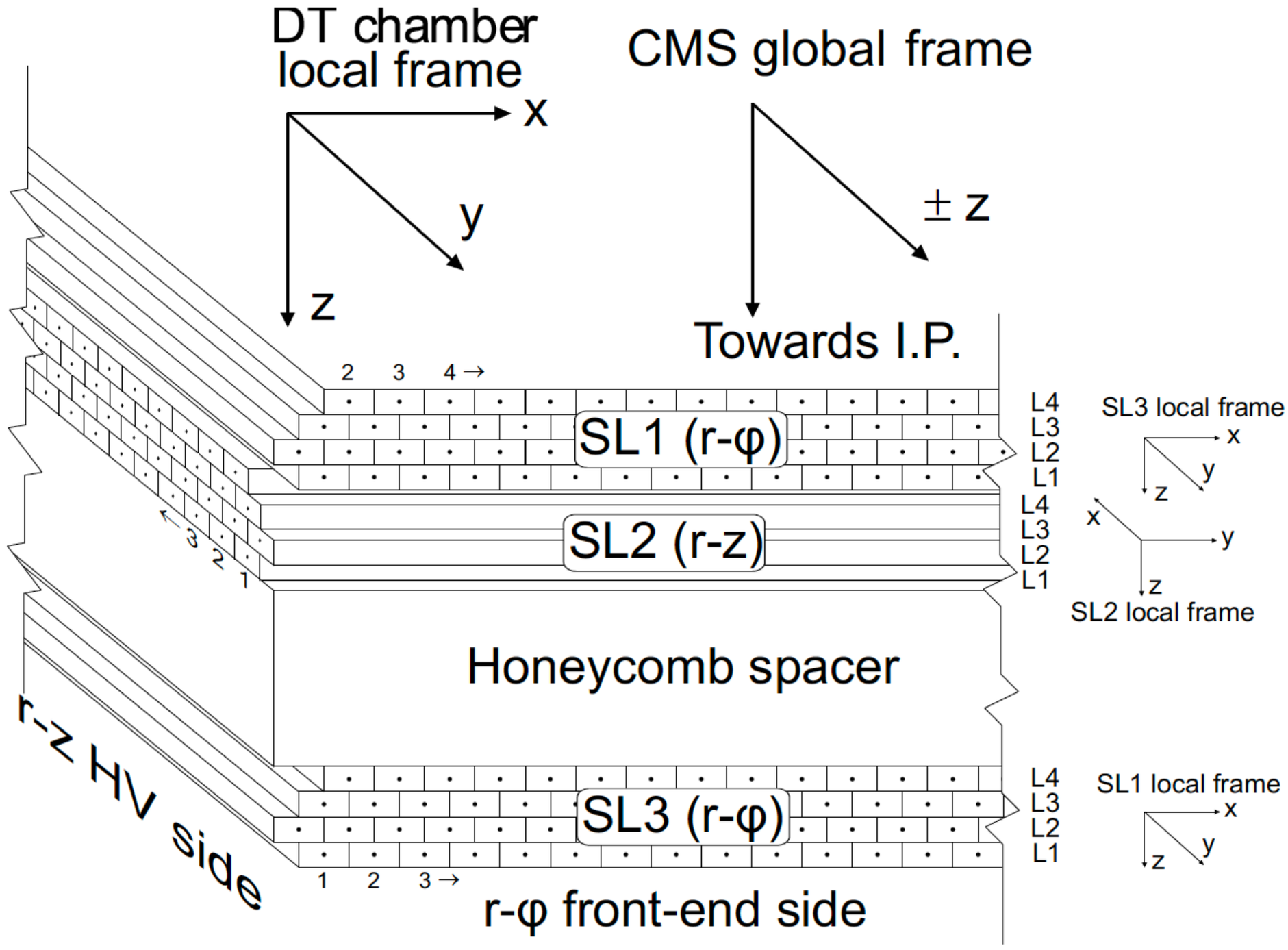
φ
X
Z+
Towards
Center of LHC

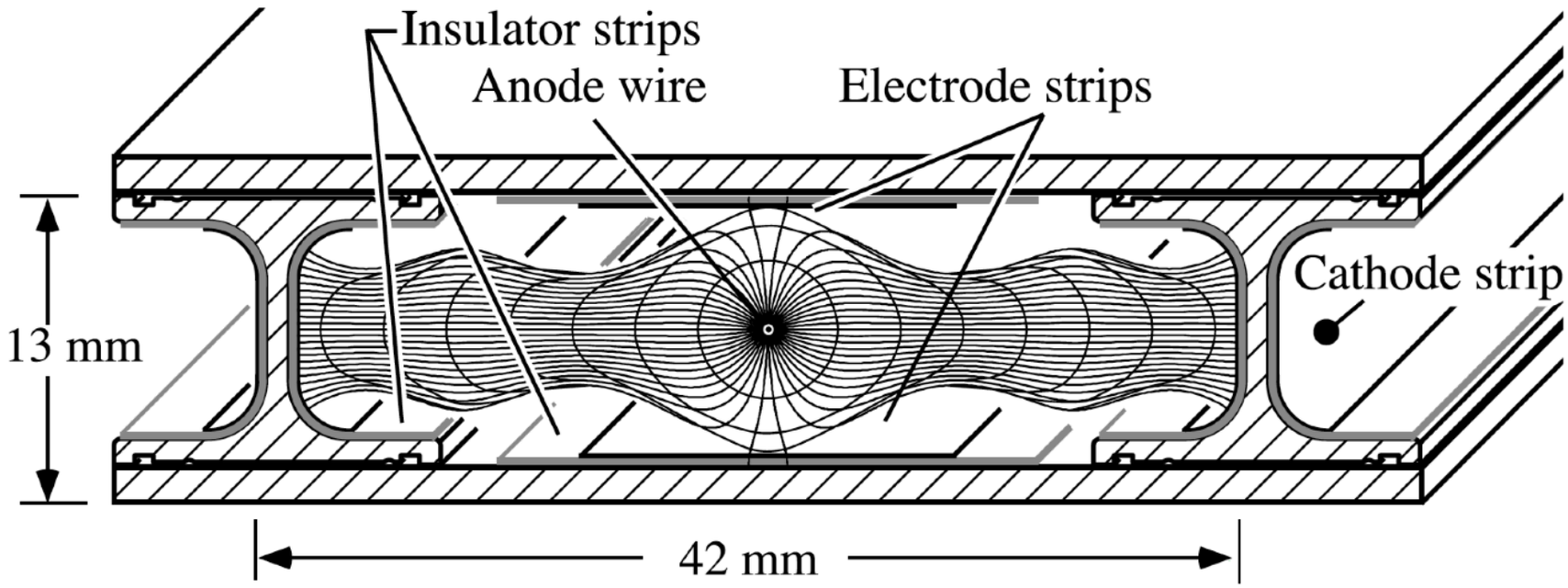
Intro

schematic of a DT layer consisting of many cells



Intro

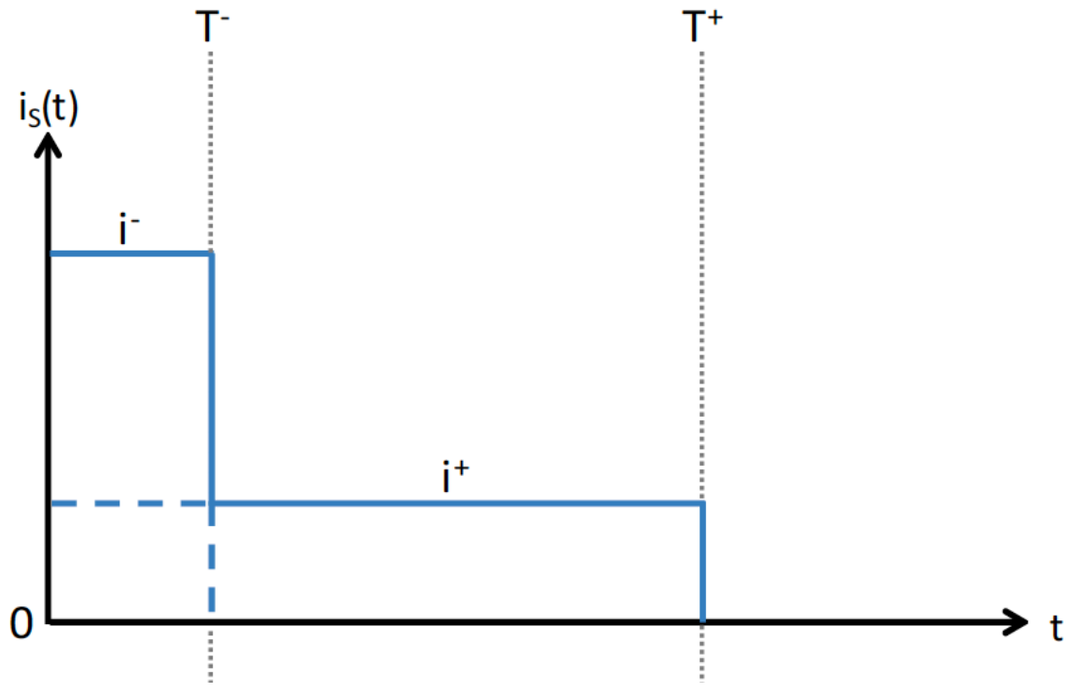
one DT cell:

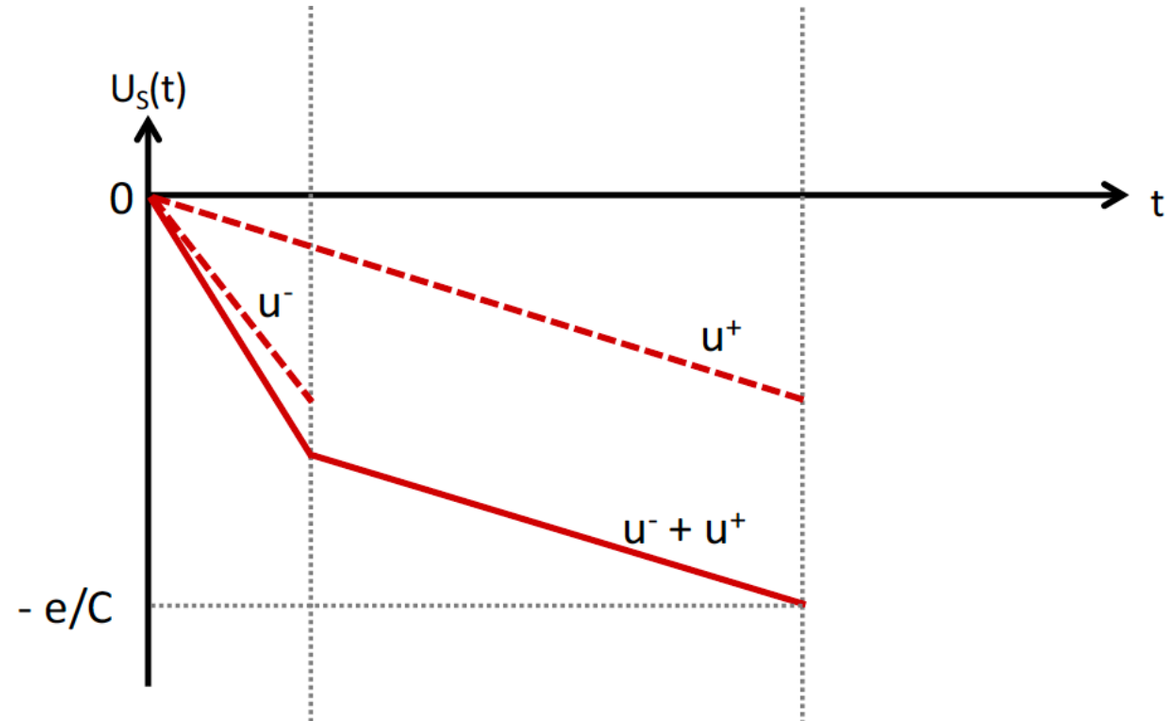


Important facts:

- wire diameter 50 µm
- 85% / 15% Argon-CO2 gas mixture
- designed in a rectangular way with almost homogeneous field !!
- the drift velocity is therefore almost constant v=54 µm/ ns
- the maximum drift time is therefore 390 ns (15 bunch crossings !!!)
- muons go through almost straight upright
- reconstruction of the **position** of the charge deposit possible from the drift time t_{drift} (this leads to a reconstructed hit position → “rechit”)
- left-right ambiguity is resolved through staggered arrangement

Intro:





- the drift time (for electrons) is read out by the CMS data acquisition system

- it needs to be calibrated with other time effects:
  - propagation time of the signal along the anode wire
  - cable length
  - read-out electronics processing time
  - trigger latency

Exercise:

- A file is provided in jupyter in the directory ex6-CMS_DT
- the file contains 1000 drift times (in ns) which are already pre-calibrated
- the file also contains the true rechit position (in cm), which is an extrapolation from a track using other layers (or true position based on simulation)
- from the given information: calculate the **resolution** of the CMS muon rechits
- compare your result with the official documentation available from the CMS collaboration