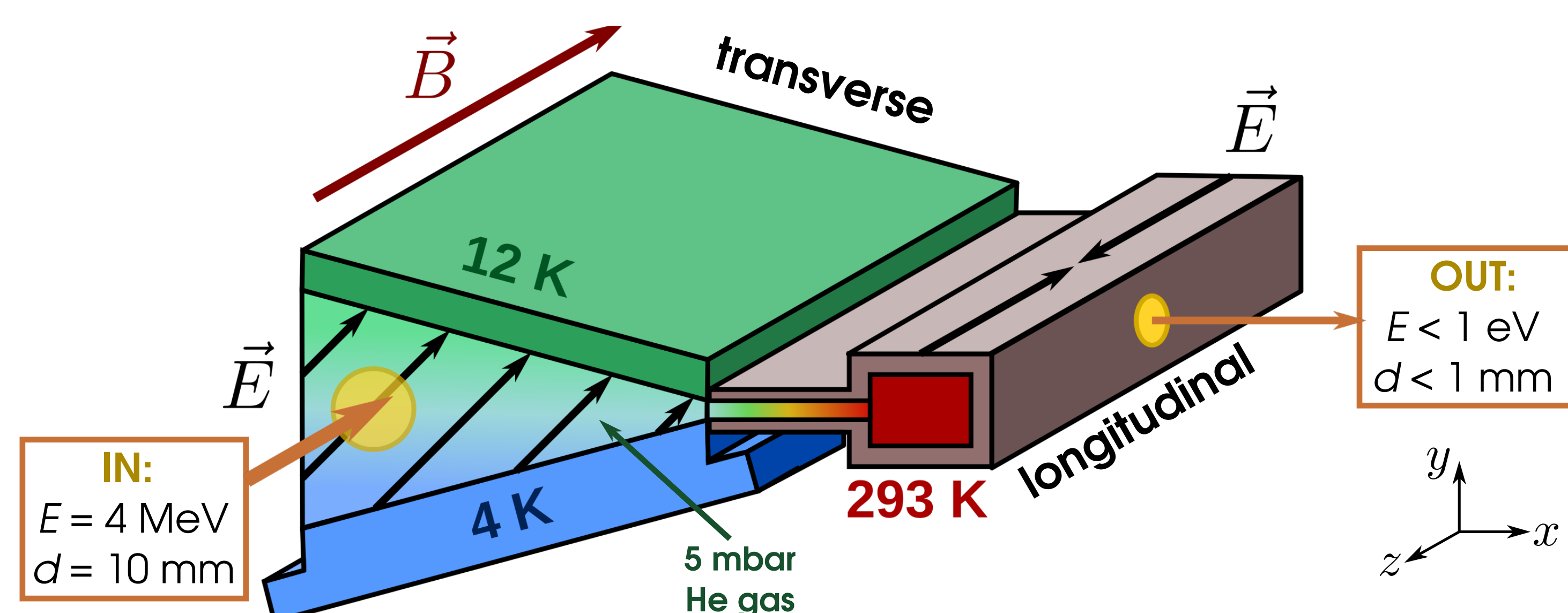


BEAMLINE SCHEME



Goal: develop a novel tertiary μ^+ beam

- sub eV μ^+
- diameter < 1 mm
- polarised
- tagged

Applications:

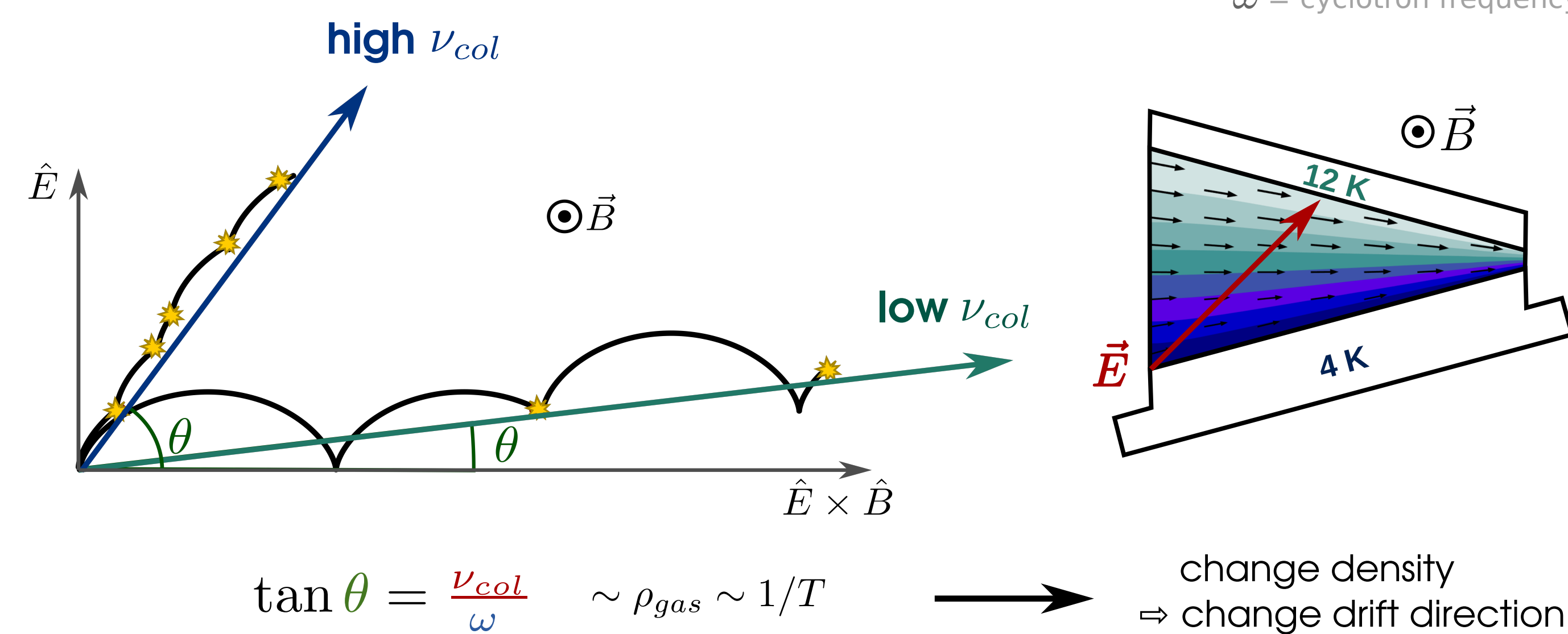
- BSM search with μ^+
- Mu (μ^+e^-) spectroscopy
- micro beam for μ SR applications

DRIFT VELOCITY

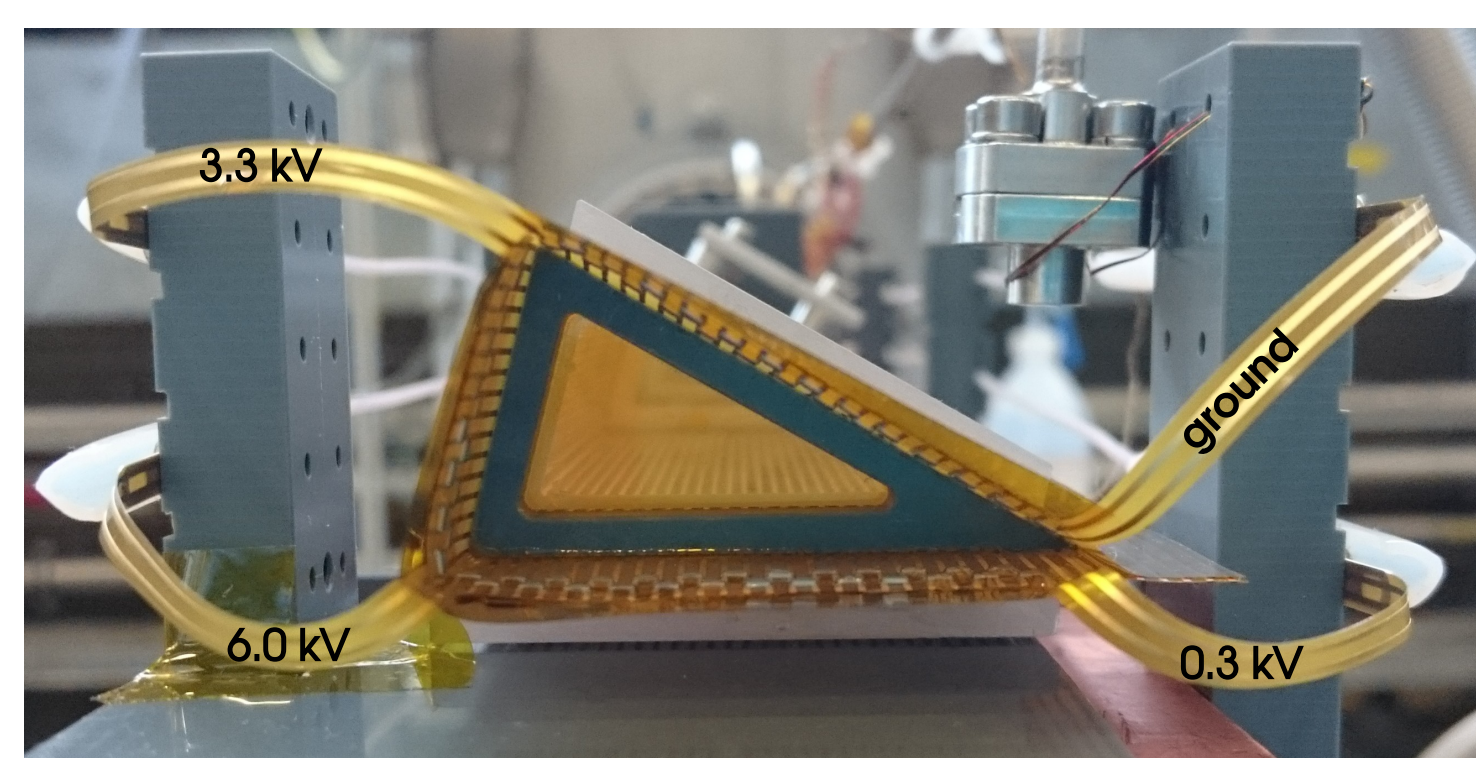
Drift velocity of a charged particle in a crossed $\vec{E}$ and $\vec{B}$ field in the gas:

$$\vec{v}_{drift} = \frac{\mu E}{1 + \left(\frac{\omega}{\nu_{col}}\right)^2} \left[\hat{E} + \frac{\omega}{\nu_{col}} \hat{E} \times \hat{B} + \left(\frac{\omega}{\nu_{col}}\right)^2 (\hat{E} \cdot \hat{B}) \hat{B} \right]$$

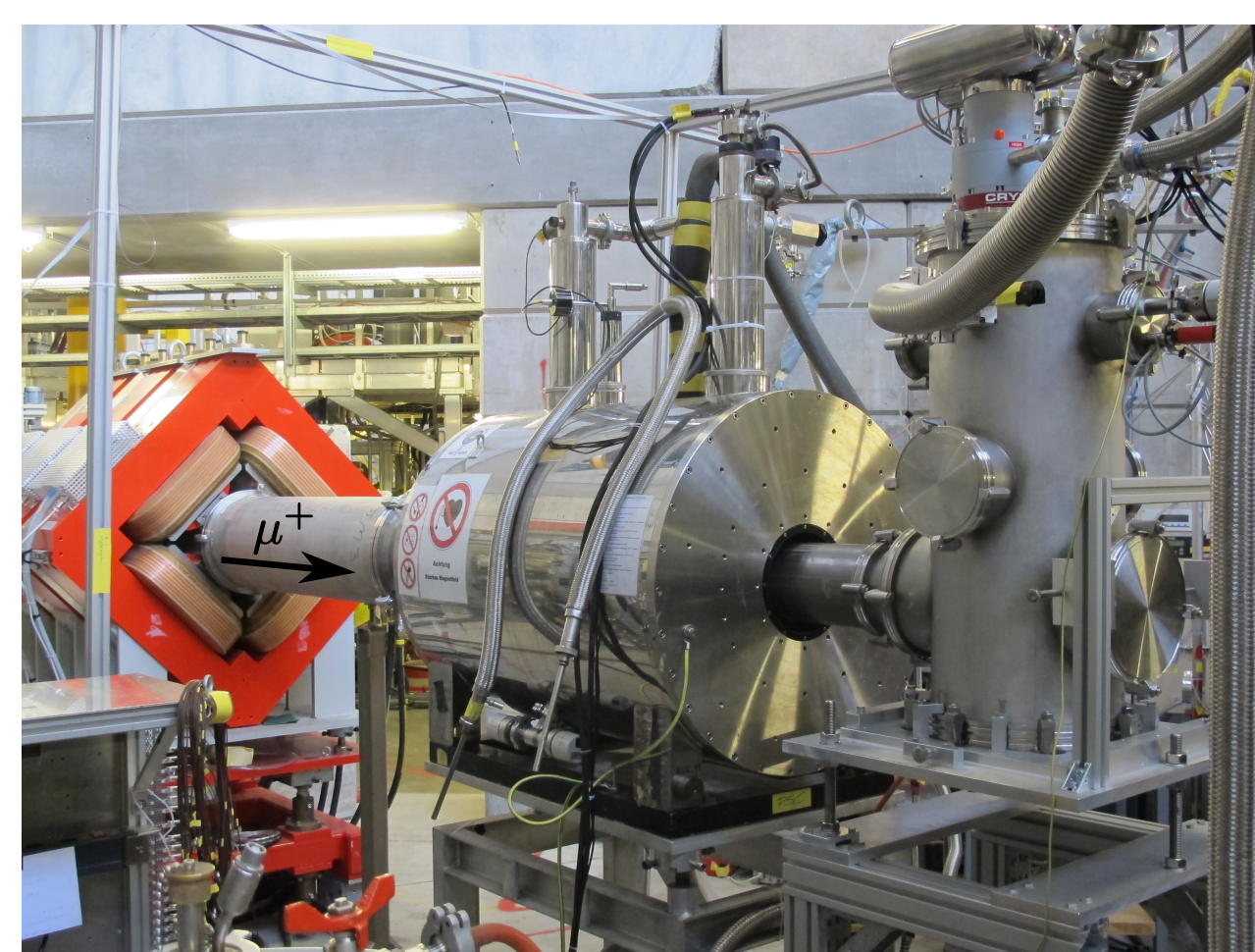
ν_{col} = collision frequency
 ω = cyclotron frequency



TRANSVERSE COMPRESSION

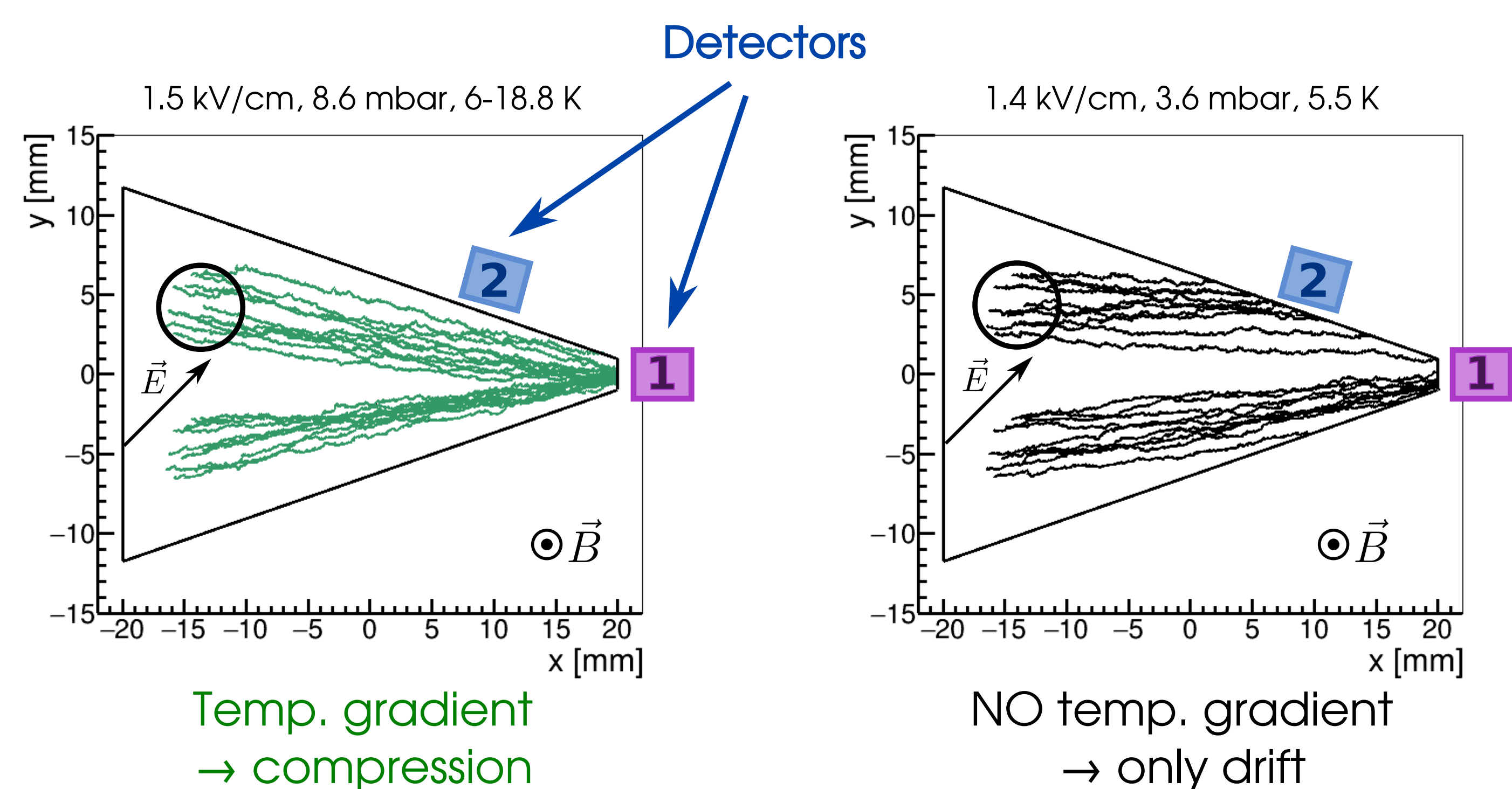


Transverse target

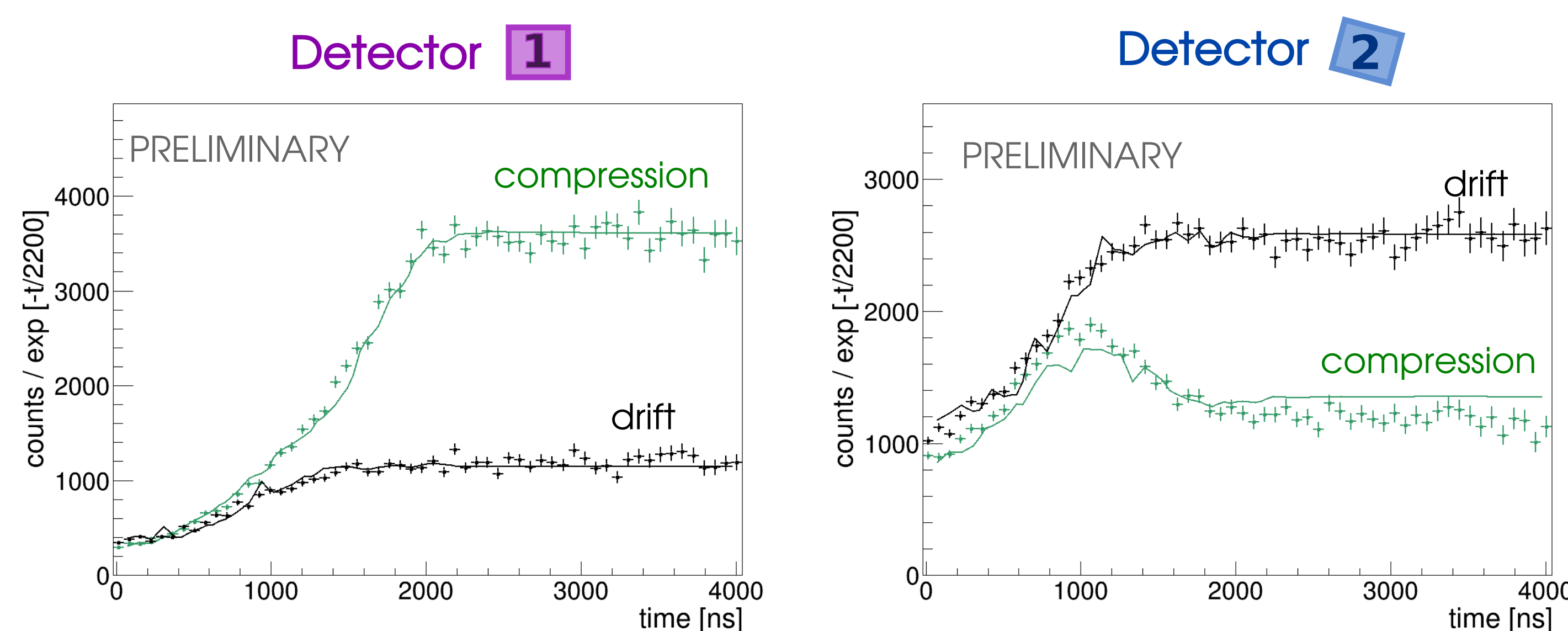


Beamline - solenoid - cryostat

Muon trajectories (simulations)

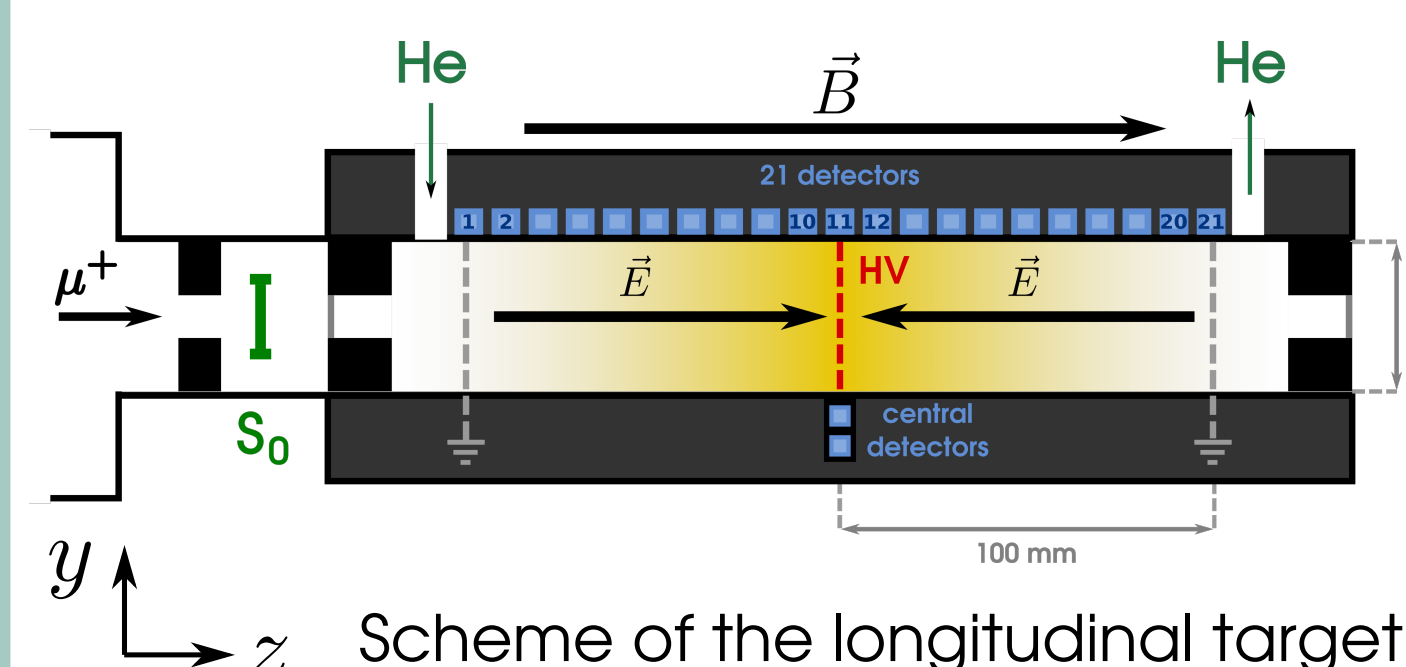


Time spectra (data and simulations)

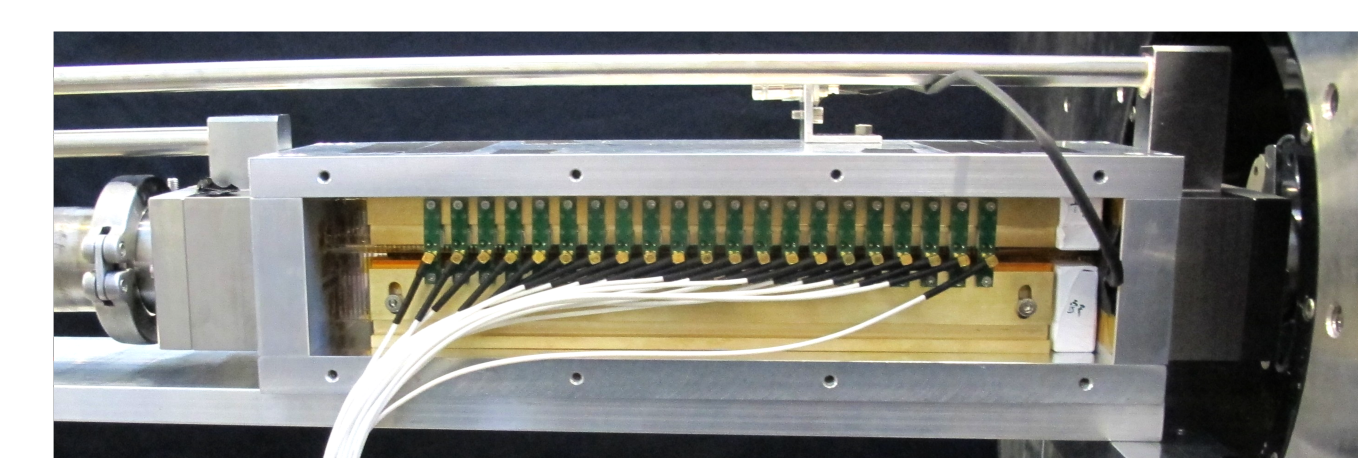


$\rightarrow$ **transverse compression demonstrated**

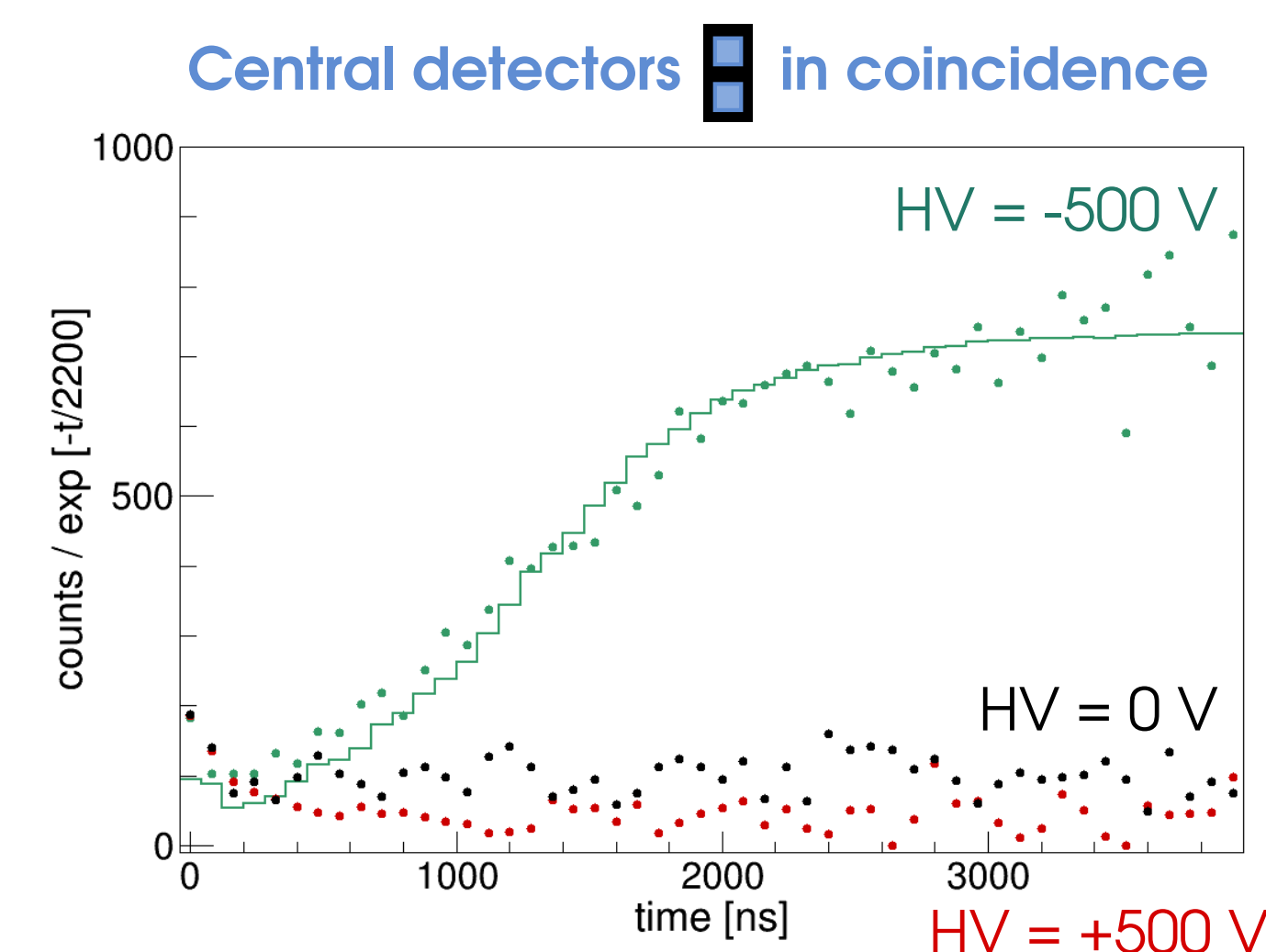
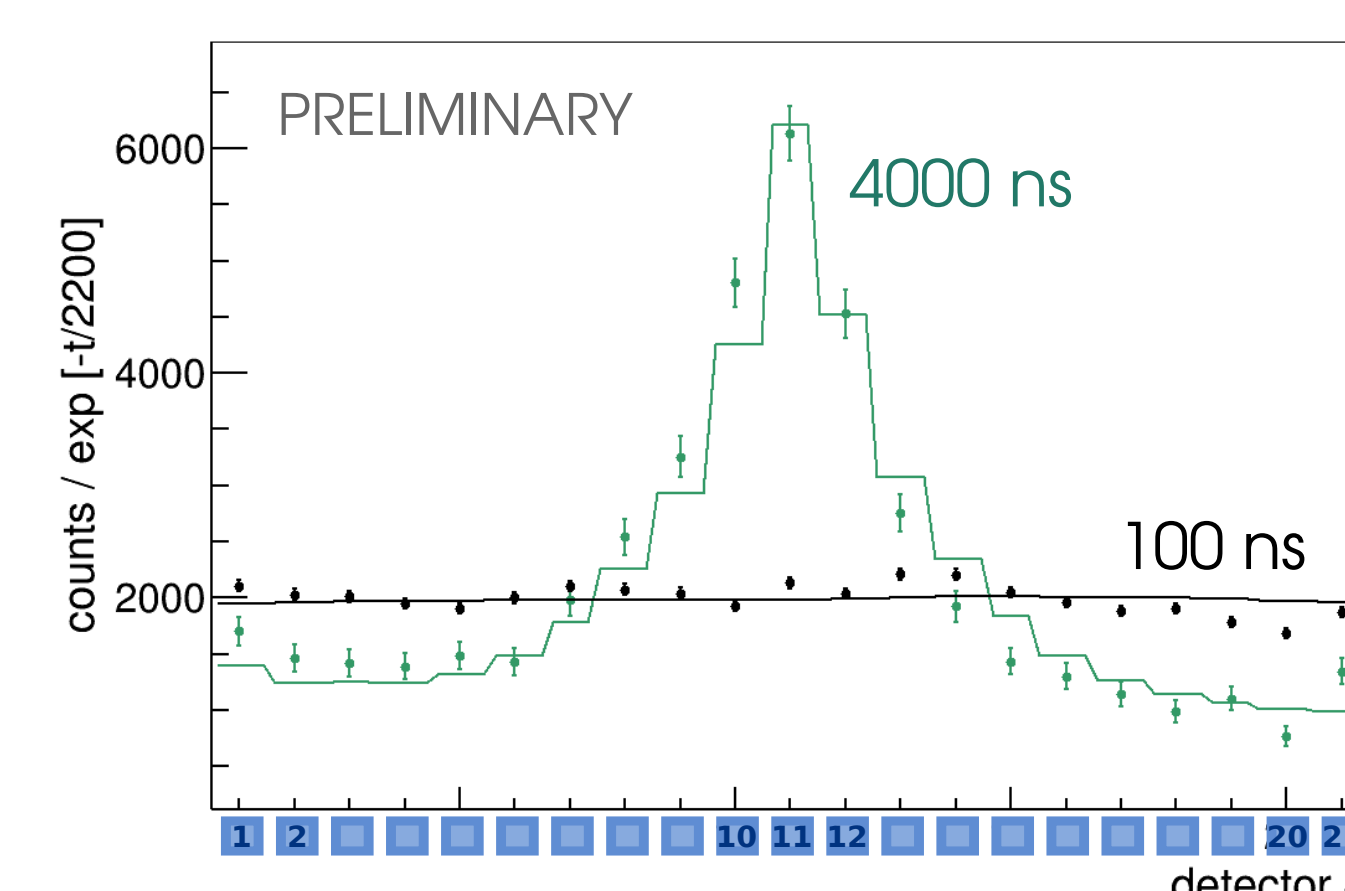
LONGITUDINAL COMPRESSION



Scheme of the longitudinal target

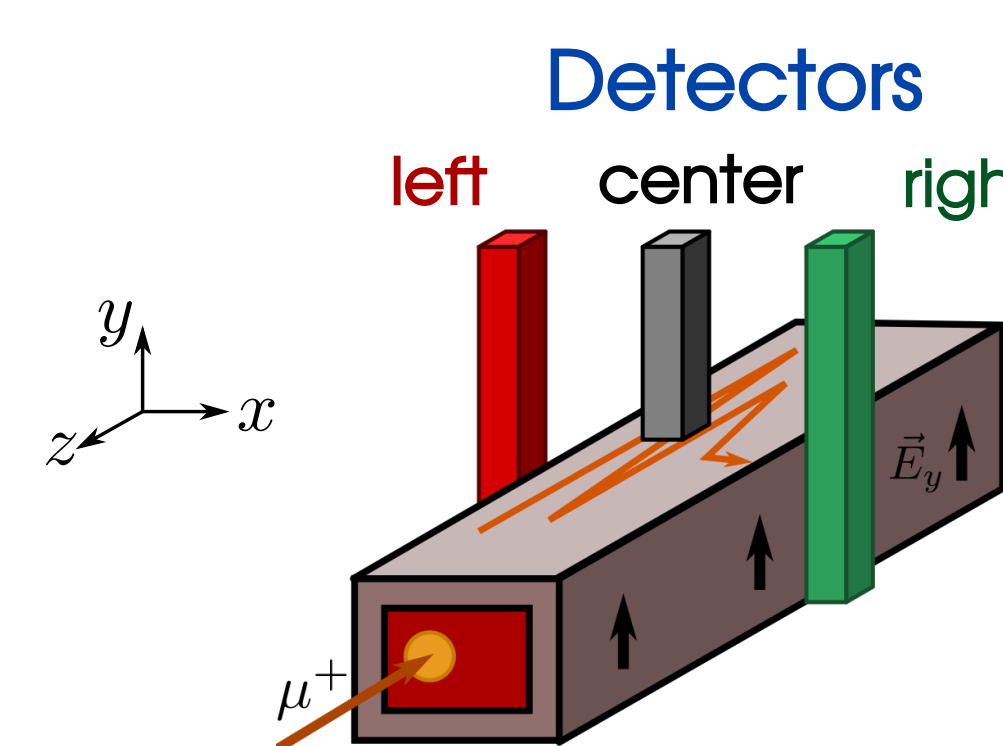


Longitudinal target

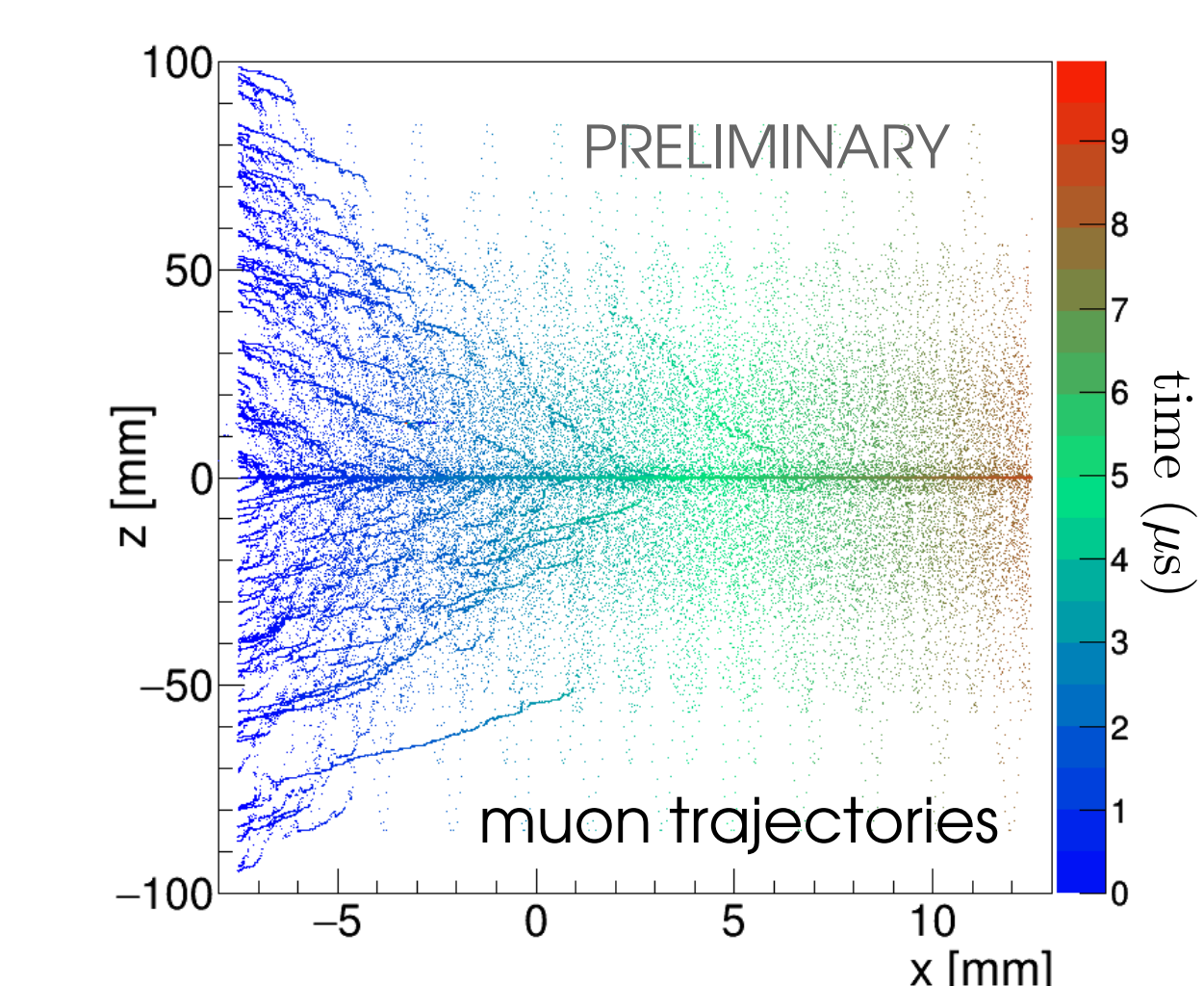
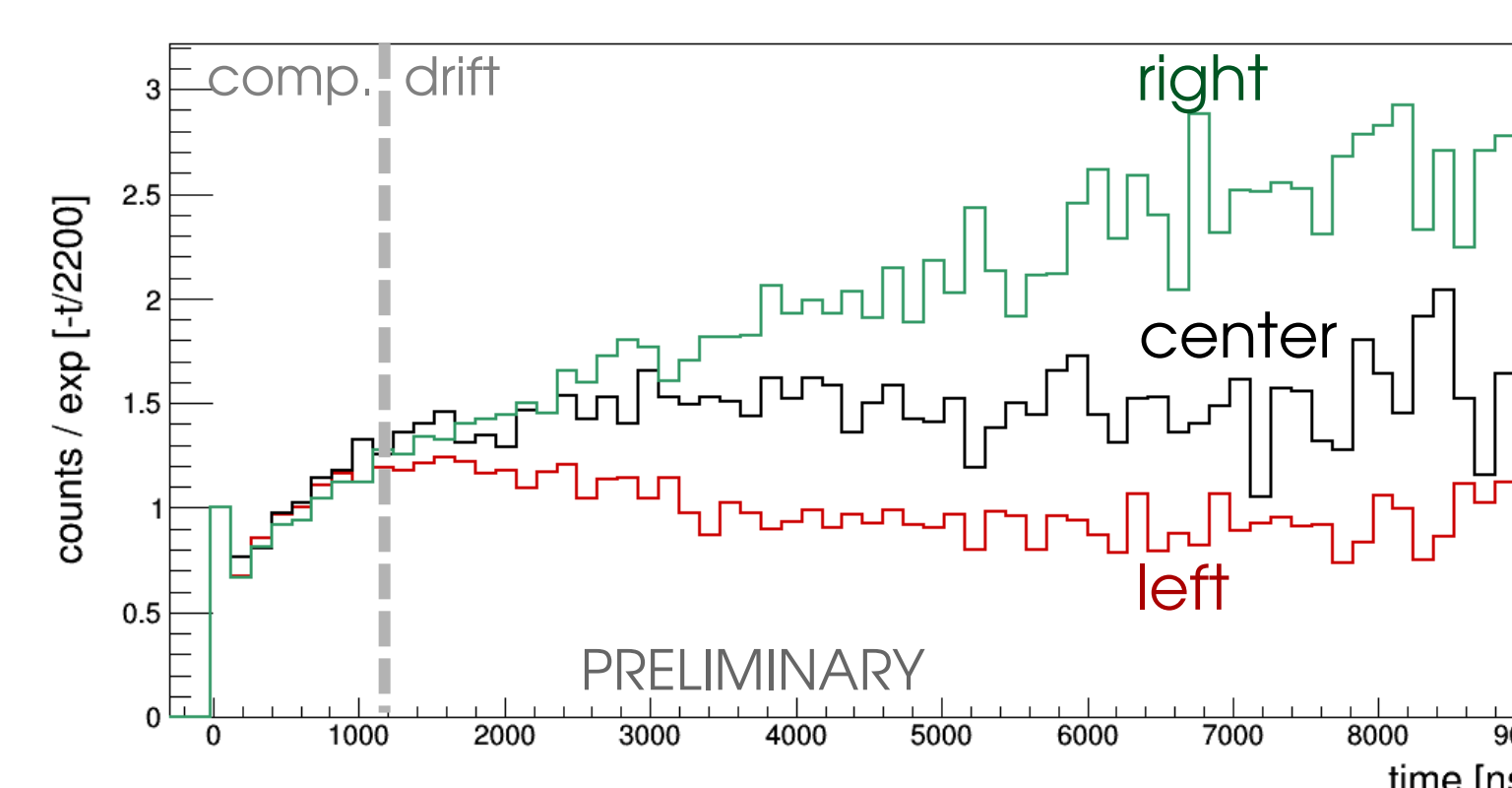


Increase of positron counts in the central detectors at late times
 $\rightarrow$ muons moved to the center of the target.

$\rightarrow$ **longitudinal compression demonstrated**

LONGITUDINAL COMP. + $\vec{E} \times \vec{B}$ DRIFT

Add y-component to the electric field
 $\Rightarrow \vec{E} \times \vec{B}$ drift in x-direction



Increase of counts in the right detector and decrease of counts in the left detector at late times show that muons moved from left to right (in +x direction).

$\rightarrow$ **ExB drift demonstrated**

COLLABORATORS

A. Antognini^{1,2}, Y. Bao², A. Eggenberger¹, M. Hildebrandt², D. M. Kaplan³, K. S. Khaw¹, K. Kirch^{1,2}, A. Knecht², A. Papa², C. Petitjean², T. J. Phillips³, F. Piegsa¹, N. Ritjoh^{1,2}, S. Ritt², K. Sedlak², A. Stoykov², D. Taqu¹ and G. Wichmann¹

¹Institute for Particle Physics, ETH Zurich, Switzerland

²Paul Scherrer Institute, 5232 Villigen-PSI

³Illinois Institute of Technology, Chicago, IL 60616 USA

FUNDING

This work is supported by SNF grant 200020_159754.