

First Results from the June Test Beam with a GEM-based Timepix Readout

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The Readout Module

Anodenplatte

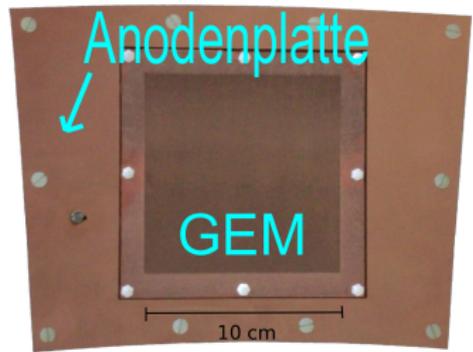
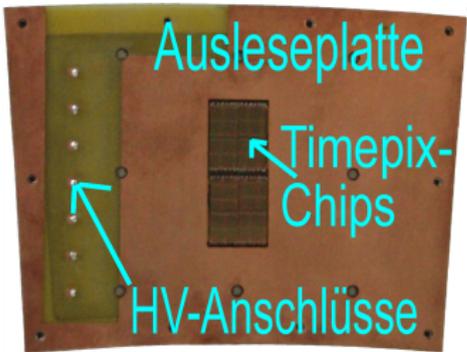
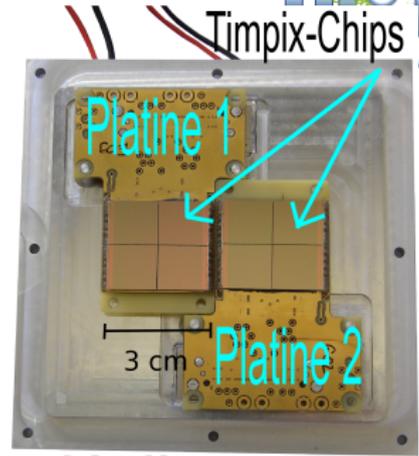
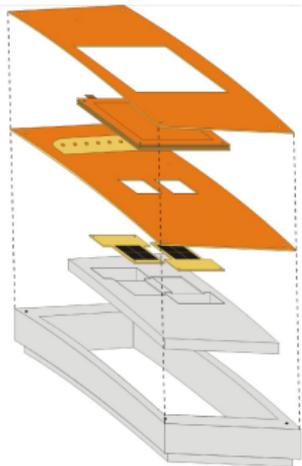
GEM-Stapel

Ausleseplatte

Timepix-Chips

Platinenhalterung

Präzisionsrahmen

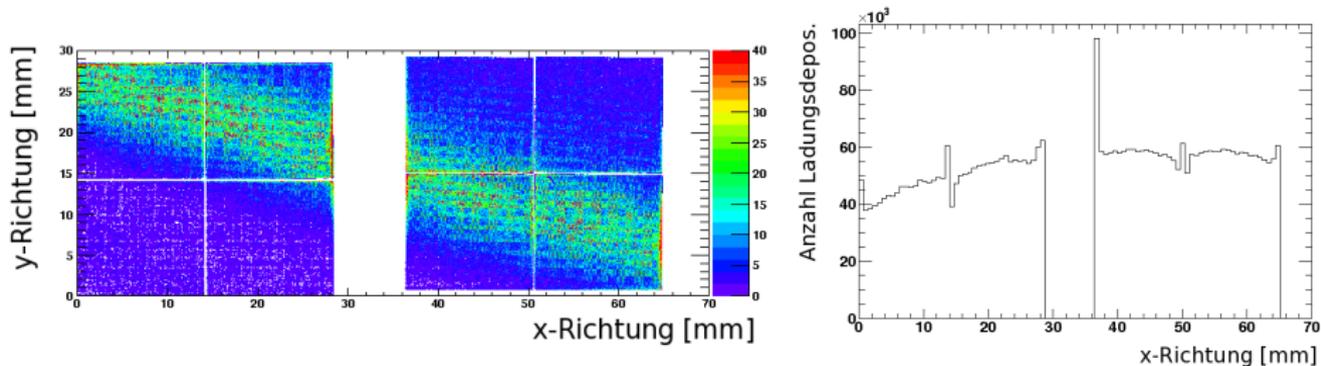


He:CO₂ 70:30

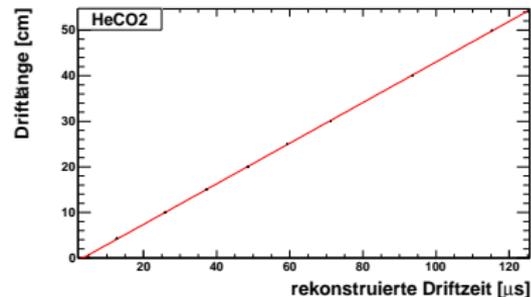
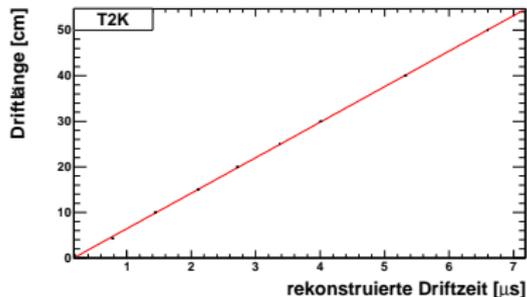
drift distance [cm]	4.3 ; 10 ; 15 ; 20 ; 25 ; 30 ; 40 ; 50
track inclination ϕ	5° ; 10° ; 0° ; -5° ; -10°
beam energy	1 GeV ; 1.6 GeV ; 2.6 GeV ; 3.8 GeV ; 5 GeV
GEM voltages	355 V ; 370 V ; 385 V ; 395 V ; 405 V ; 415 V
magnetic field	0 T ; 1 T

Ar:CF₄:iButan 95:3:2 (T2K)

drift distance [cm]	4.3 ; 10 ; 15 ; 20 ; 25 ; 30 ; 40 ; 50
track inclination ϕ	5° ; 10° ; 0° ; -5° ; -10°
beam energy	1 GeV ; 1.6 GeV ; 2.6 GeV ; 3.8 GeV ; 5 GeV
GEM voltages	260 V ; 270 V ; 280 V
magnetic field	0 T ; 1 T
	Laser dots at 1 T



- Homogenous response across the whole module
- Beam profile clearly visible
- High number of charge depositions at the chip borders may be due to field inhomogeneities between chip and last GEM
- Chip positions were measured to a precision of $2 \mu\text{m}$ with a movable table and microscope



- Comparison of drift velocities:
reconstructed - calculated by Magboltz

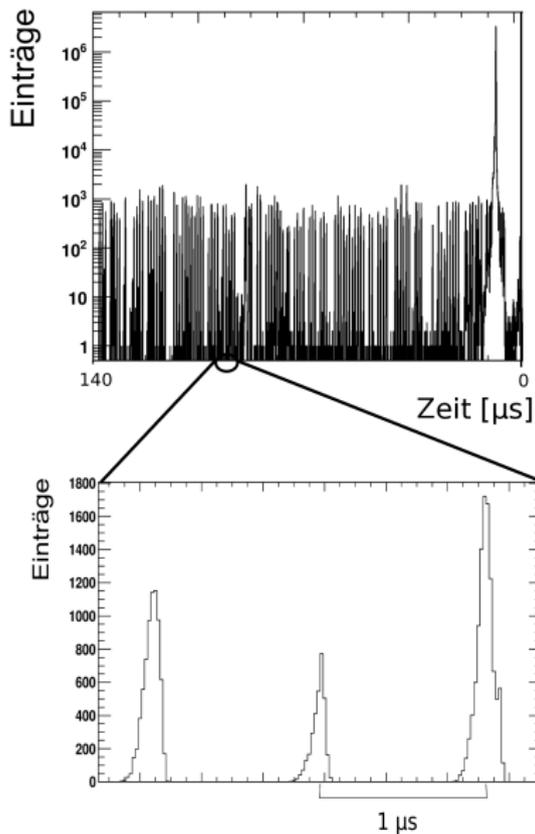
$$v_{\text{reconstructed}} = (0.446 \pm 0.001) \frac{\text{cm}}{\mu\text{s}} \quad \text{for HE:CO}_2 \text{ 70:30}$$

$$v_{\text{Magboltz}} = (0.456 \pm 0.001) \frac{\text{cm}}{\mu\text{s}}$$

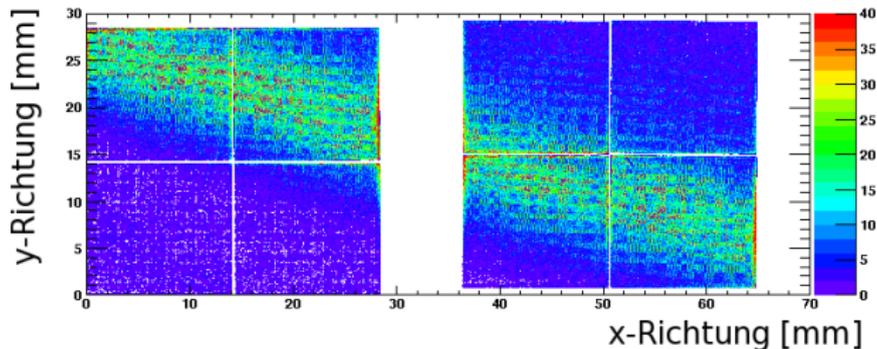
$$v_{\text{reconstructed}} = (7.799 \pm 0.025) \frac{\text{cm}}{\mu\text{s}} \quad \text{for Ar:CF}_4\text{:iButan 95:3:2}$$

$$v_{\text{Magboltz}} = (7.848 \pm 0.002) \frac{\text{cm}}{\mu\text{s}}$$

- Results are in agreement with Magboltz predictions
- Deviations are due to low level contaminations with water e.g.



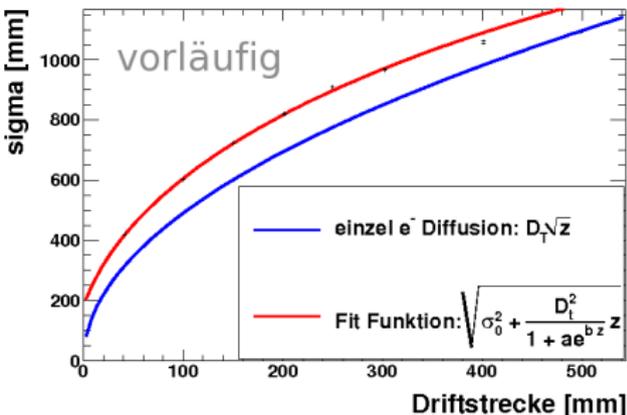
- Clear peak of particles triggering the readout
- Periodic Charge Depositions (frequency 1 MHz: → accelerator)
- 1 MHz corresponds to 78 mm (T2K) and 4.4 mm (He:CO₂)



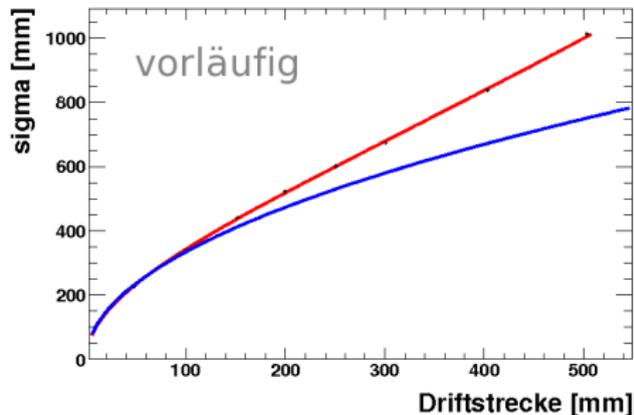
Track Analysis (e.g. spatial resolution)

- Looking at single tracks
- Removing periodic background tracks by removing charge depositions with $\Delta z = \pm 70$ mm
- Removing very short tracks at chip borders and double tracks by removing tracks with less than 40 or more than 110 charge depositions
- Removing tracks with different track inclinations

Ortsauflösung (transversal) HeCO₂



Ortsauflösung (transversal) T2K



- **VERY PRELIMINARY - first results only**
- Strong influence of pollution have been seen for the slow gas mixture He:CO₂ 70:30
- deviations at long drift fields are due to inhomogenous magnetic field