Concepts for TPC Calibrations

$\bar{P}ANDA$ meeting

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Parameters need to be calibrated

Track reconstruction

- Drift velocity v_d
- Field distortions
- Gain of readout channels

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dE/dx measurement

- Linearity of readout
- Energy calibration

dE/dx with cosmic tracks

Method

- dE/dx distribution from cosmics per pad
- Determine calibration factors

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Cons

- Statistical process of energy deposition
- No energy calibration or linearity check
- Not tuneable rate

dE/dx with ^{83m}Kr method

Method

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- Charge deposition up to 42 keV with several peaks

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- Absolute energy calibration from totally absorbed γ's
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Cons

- Handle of radioactive material (^{83}Rb)

Method used e. g. in NA49 and ALICE.

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Determination of drift velocity over whole volume

Use external tracking devices to determine the z coordinate of the track and measure Δt

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Measuring momentum resolution

Compair momentum of reconstructed tracks in the upper and the lower half of the TPC. Inhomogeneities in gas and $\vec{B}$ get visible.

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Alignment to external tracking devices

Employ reconstructed tracks in sub detectors to align them

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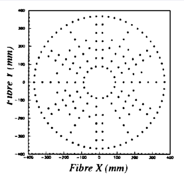
Cons

- Requires additional space and much more equipment
- No ionization of drift gas itself, but of impurities
- Laser produces electrons on surfaces

Track calibration with electron point sources

Method

Grid of point like triggerable electron sources on the drift cathod



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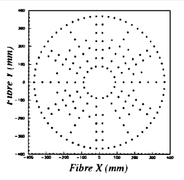

Pros

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- Measurement of drift velocity and field distortions

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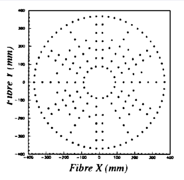

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Cons

- Determines only integrated v_d

Triggered electron source

Field emission

Fails, needs vacuum

Triggered electron source

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Metalized fiber tips

Very fragile & needs high power UV laser + space

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UV LED + metal coating

Efficiency and spread of e^-?

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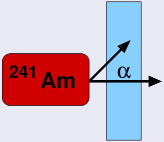
α discreter



Only perpendicular α traverse discreter

Discreter = diode

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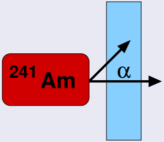

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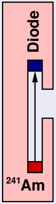
α ionizer



α ionizes gas

detected with PIN diode

e− pulled out by field

Conclusion

- Many parameters need to be calibrated
- No all-in-a-wonder solution - need of different methods
- For dE/dx calibration use ^{83m}Kr method (cmp. w/ cosmics)
- Use electron sources and cosmics for track calibration

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Outlook

- Setup ^{83m}Kr method on test TPC
- Investigate pointlike electron sources
- Integration into prototype