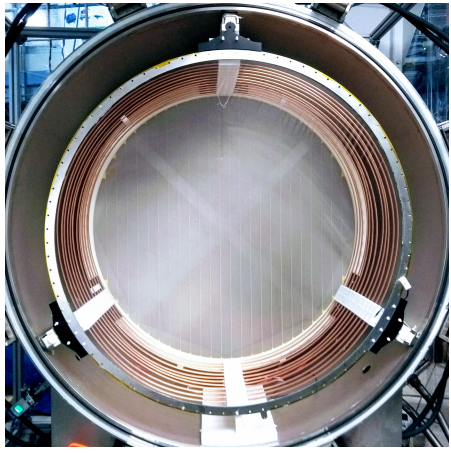
High Pressure TPC beam test in T10/PS

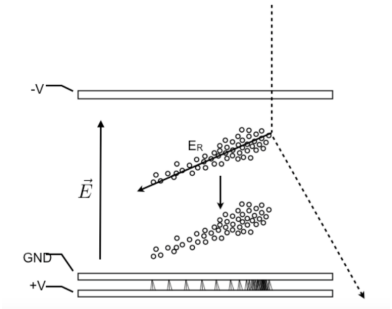
A. Deisting for the HPTPC collaboration

Royal Holloway University of London

20^{th} of September, 2018



The High Pressure TPC



- The TPC is embedded in a pressure vessel allowing gas pressures of up to 5 bar
- A 2D projection of particle tracks is recorded with four FLI Proline PL09000 CCD cameras
  - Each camera is centred on one quadrant of the readout area and coupled to a Nikon f/1.2 50mm focal length lens
  - The cameras provide a granularity of 3056 vixels (vixel length of 230 µm) and they image a region of 71×71 cm each
- The amplification region consists out of three (four) meshes
- The induced charge on each mesh is read out to provide eventually a time coordinate for each track

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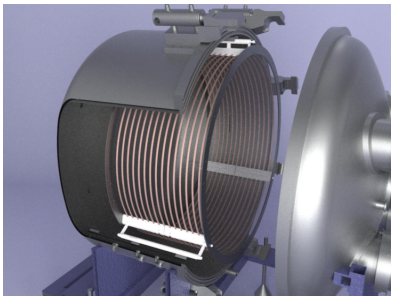

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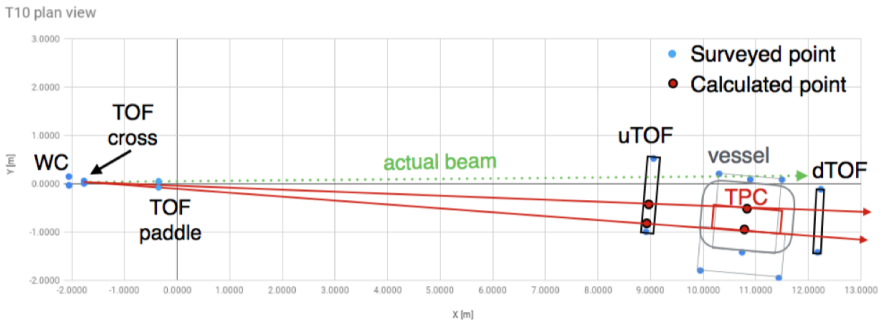
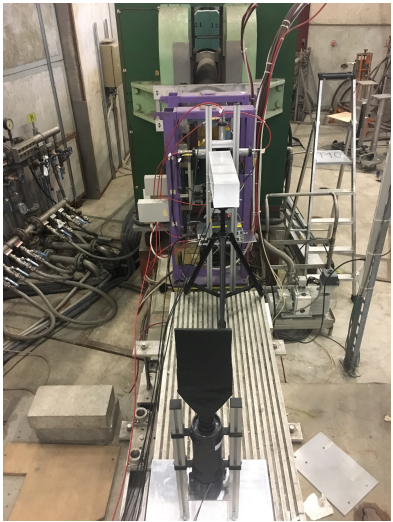
HPTPC beam test in T10 – 0.8 GeV hadron beam

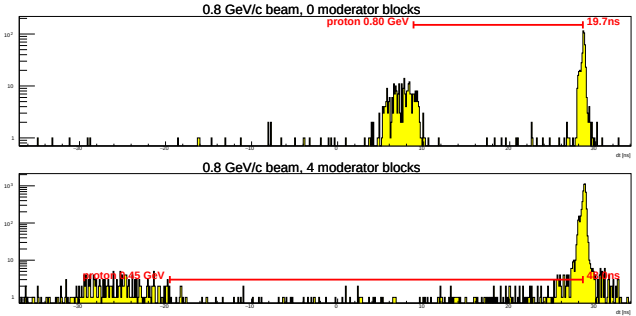
- Goal: Study of p-Ar interactions
- Measures to enhance the proton-to-pion ratio: The beam impinges on a plastic absorber and the TPC active area is displaced with respect to the beam axis
- Upstream- and downstream Time Of Flight (TOF) system for beam characterisation
- Gas quality monitoring with a High Pressure Gas Monitoring Chamber (HPGMC)

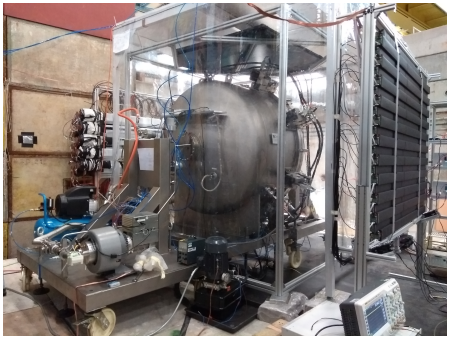




TOF measurements

Proton energy for different absorbers

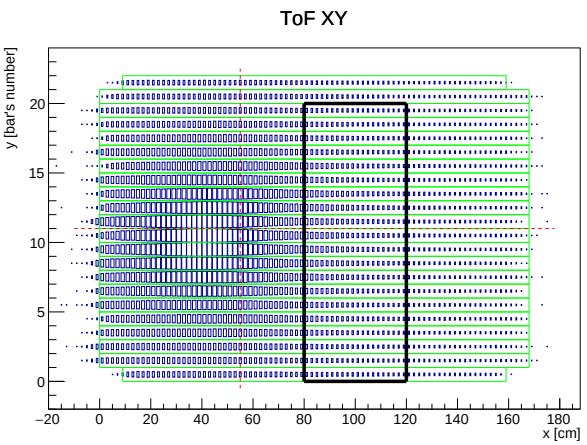




Upstream TOF, TPC vessel and downstream TOF

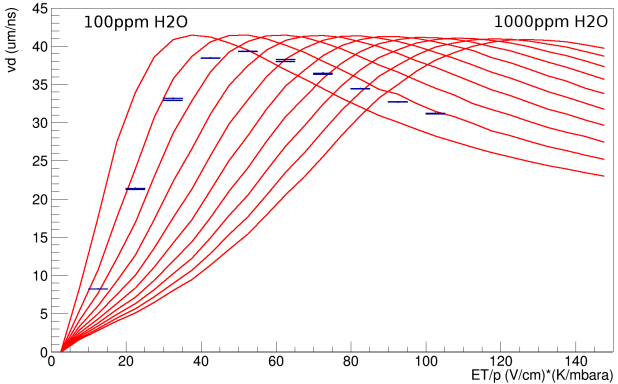
TOF measurements

Beam profile compared to the TPC position



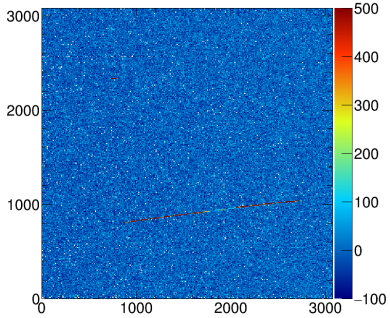
Upstream TOF, TPC vessel and downstream TOF

High Pressure Gas Monitoring Chamber (HPGMC)



- The signals of two sources at defined positions, amplified at a wire are measured
- Different electric fields are scanned for a given gas at certain pressure and the drift velocity is measured
- Shown is a measurement of the P5 calibration gas versus Magboltz simulations with different H_2O content

Tracks in the HPTPC



- We were limited by sparking and did not reach our target gas gain
- Tracks with low diffusion – *e.g.* tracks crossing the amplification region and close to the amplification region – are well visible in the raw data
- Examples for long tracks with low diffusion are shown
- Most tracks have a length on the order of a cm or less
- Through analysis with a high level tracking algorithm is necessary to identify tracks with higher diffusion.
- Possibly the effective gas volume was smaller than the TPC's drift space

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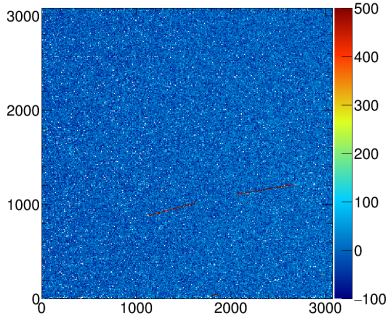

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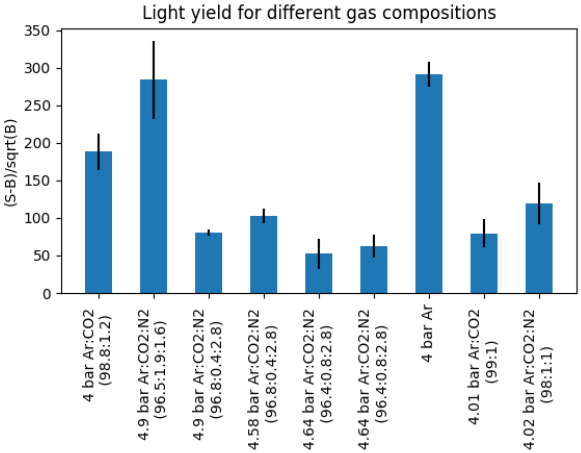
High Pressure TPC light yield measurements

- Gas mixtures with different quencher and quencher content have been tested
- Calibration sources were used to measure the yield of scintillation light
- The measurements were performed at the highest voltages at which the amplification region could be stably operated
- After pure Ar, Ar-CO_2-N_2 (96.5-1.9-1.6) performs best in terms of light yield



Outlook

The next ToDo items

- Adopting the TREX reconstruction from T2K for track-finding (work in progress) to our data
- Analysing the data: Determining the $\mathrm{d}\varepsilon/\mathrm{d}x$ of the measured tracks, Extracting the scattering cross section
- Continue to further develop the detector

Thank you!

In particular to: Johannes, Michael Jeckel, Alexandre, Sean, Michael Lazzeroni and Stefania Bordon, the craning people and all the staff which helped us during this beam test

Backup