A TPC for the Chrystal Ball at the MAMI-C- accelerator: Some ideas concerning Electronics

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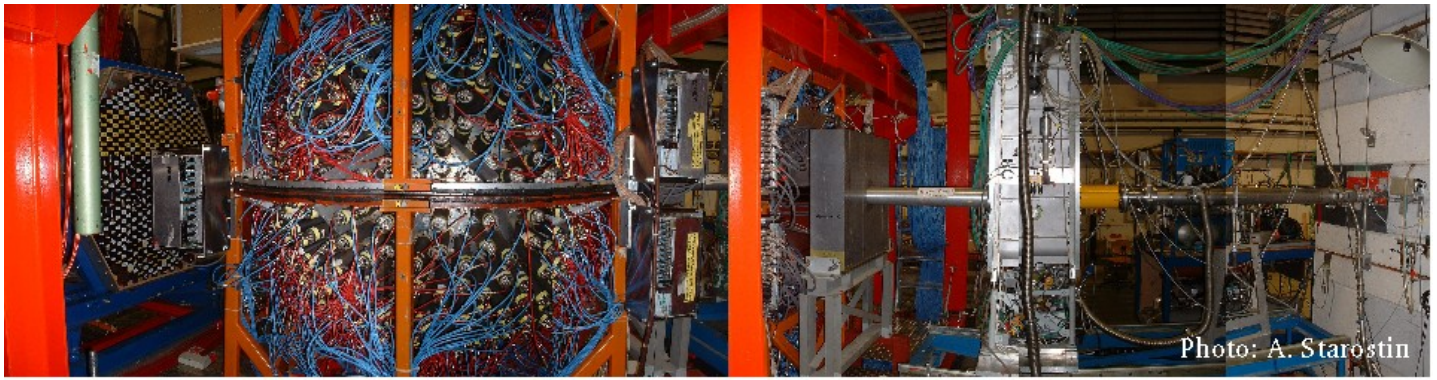
Overview over the Existing Experiment

A2-Collaboration operates the famous Crystal Ball detector at the MAMI-C accelerator.

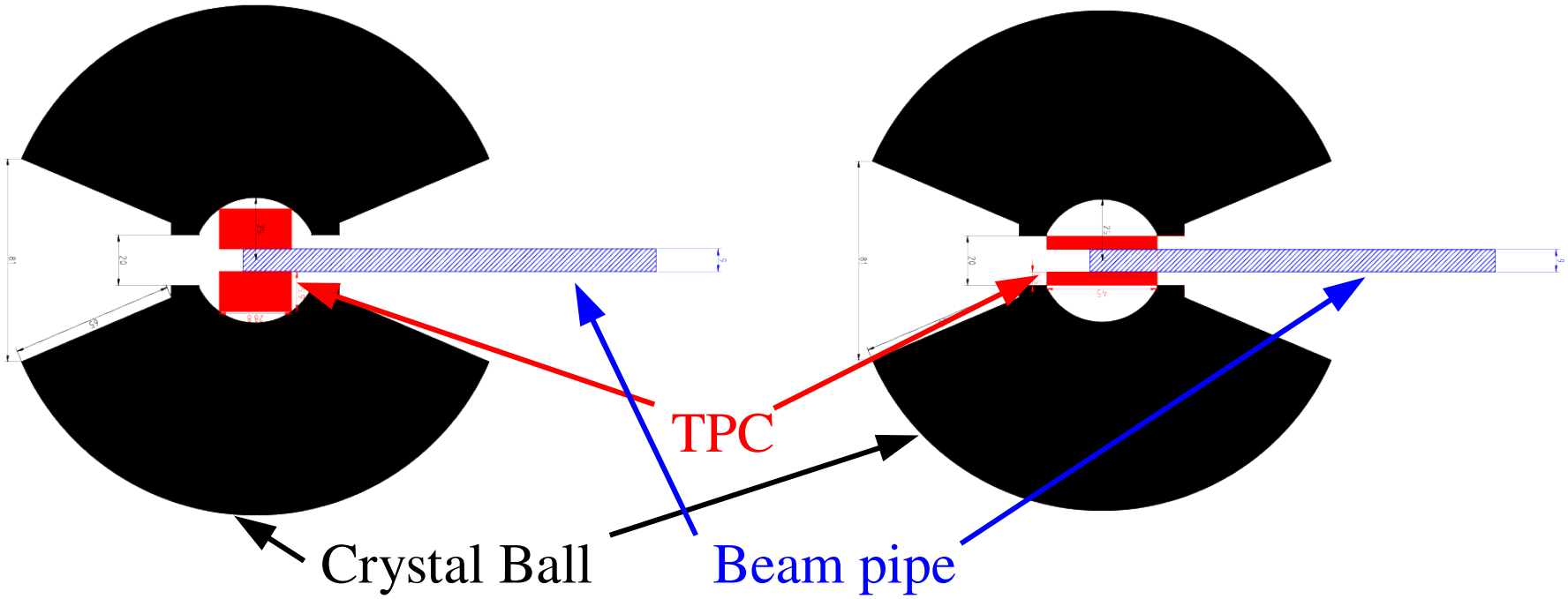
- Photon beam with energies up to 1.5 GeV on nuclear target
- Studying nuclear and mesonic resonances
- Detector: - 672 optically isolated NaI(Tl) crystals
  - Built at SLAC, operated also at DESY
  - Scintillator trigger around beam pipe
  - 2 layer MWPC



New Idea – Replace MWPC with a TPC

- Better tracking – longer tracks
- Improves dE/dx
- In case of magnetic field (stray field from target) – charge discrimination

Currently two concepts for mechanical setup: large volume vs. long



Length: 28 cm
Outer Radius: 4.5 – 20 cm

Length: 45 cm
Outer Radius: 4.5 – 10 cm

Current Plans about Readout

Trigger rate of 'physics events': 1 kHz
Background rate: 10 kHz

1. Long TPC drift velocity:
   - Number of pads: 1600-6200
     (depending on pad size, exact radii – still to be optimized)
   - maximum drift time of primary electrons: ~10 µs
     (use a relatively fast gas mixture with low diffusion e.g. Ar:CF_4/CH_4:CO_2)
   - good signal to noise – of course 
2. Large Volume TPC:
   - Number of pads: 10000-18500
   - low material budget (front-end electronic before the calorimeter)
   - not too expensive
3. change on demand from data taking period to data taking period

Scalable Readout System

Scalable readout system sounds like the exact thing that is need.

We hope that the APV25 in combination with the AFTER-Chip could fulfill the requirements – similar to the Valencia design, adapted for shorter drift times.

- ✔ Scalable from 1600 – 185000 channels
- ✔ Price tag seems okay
- ✔ Timescale is also okay