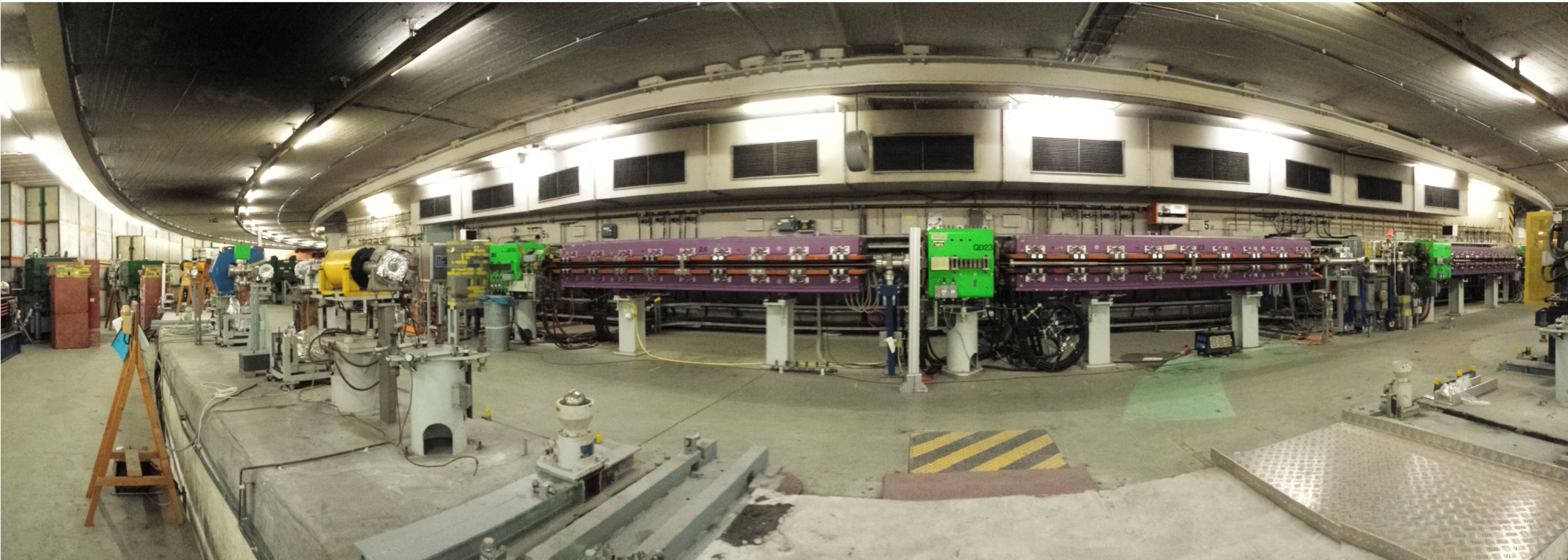


WP5: Data acquisition system for test beams

Task: TPC & Si external tracker needs and capabilities

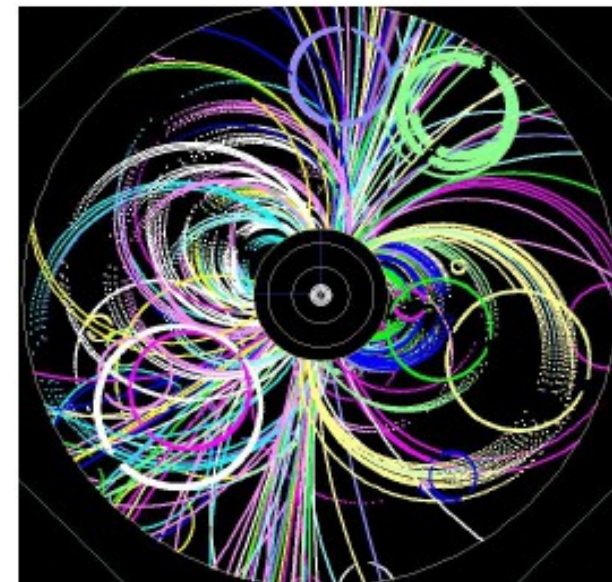


Dimitra Tsionou
On behalf of the TPC community



- TPC infrastructure installed at the test beam area at DESY
 - Used by different groups (GEMs, Micromegas, InGrid)
 - Each group uses its own (different) DAQ system for now
- Plans to build and install a Si telescope (to be used also as a prototype for the ILC Si external Si tracker)
 - DAQ system to be used with the Si sensors/chips?
 - Si DAQ system should be able to be combined with the current TPC DAQ

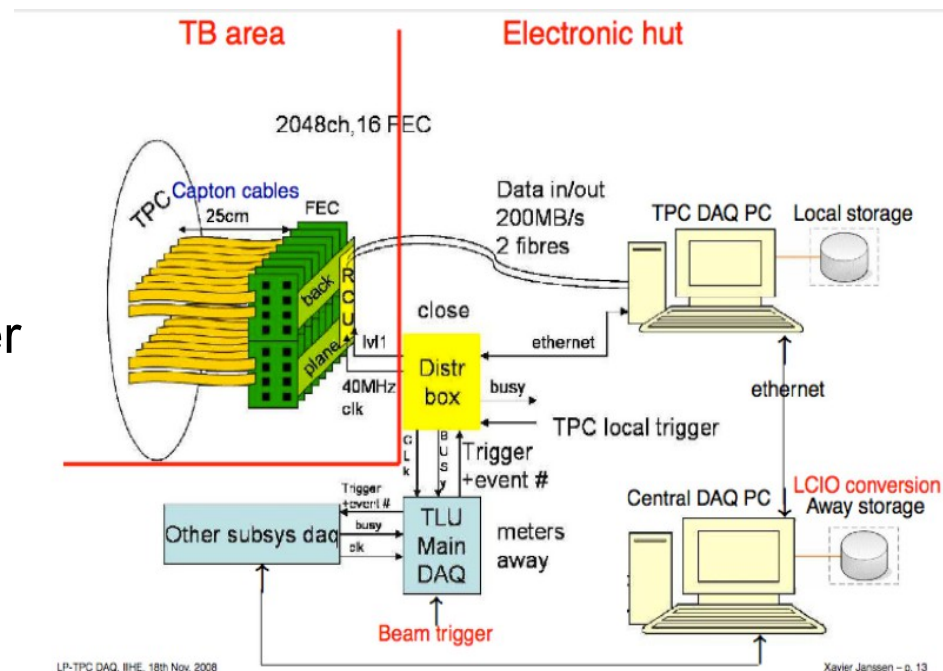
- Tracking efficiency
 - Close to 100% down to low momenta for Particle Flow
 - ~200 position measurements along each track in the TPC
- Minimum material
 - TPC: less than $0.05X_0$ in barrel / $0.35 X_0$ in endcap
 - $0.5X_0$ per Si layer
- Momentum resolution
 - $\sigma(1/pt) = 2 \cdot 10^{-5} \text{ 1/GeV}$ (combined)
- Some more impressive numbers for TPC
 - For $1 \times 6 \text{ mm}^2$ pads \rightarrow 4M channels
 - For pixel TPC \rightarrow 3B channels



- Different DAQ used by the TPC groups using GEMs / Micromegas / InGrid

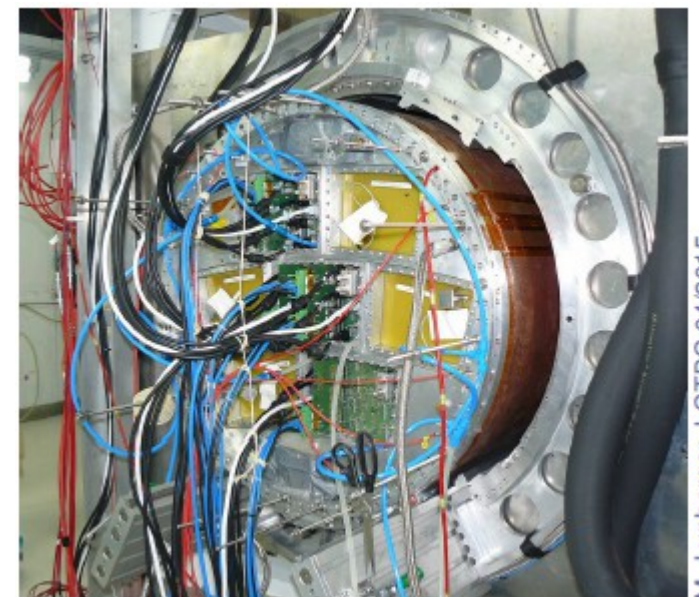
- GEMs: ALTRO electronics (Lund/CERN) based on Alice TPC

- 16ch chip with 10bit precision ADC, digital signal processing (zero suppression, buffer storage)
- Sampling frequencies at 5/10/20/40 MHz
- 10K ch for LCTPC



- Plan to move to sAltro system (new readout chips)
 - 64ch analog/digital mixed chip mounted directly on the backside pad plane of the MPGD detector
 - Issues of power switching, power delivery and cooling to be addressed

- Micromegas: After electronics from T2K experiment
 - Also tested Altro system in the past
- InGrid: Timepix (Bonn)
 - 256x256 pixels, 55x55 μm^2 pixel pitch
 - Different operation modes: single hit, time of arrival, time over threshold
 - Readout with Medipix (to be replaced by Scalable Readout System), acquisition and control with Pixelman
- TPC wants to move to a common DAQ system!



M. Lupberger, LCTPC 04/2015

- Simulation studies to determine characteristics of the sensors/telescope
 - Sensor spatial resolution, geometry & coverage, material budget (talk tomorrow at WP15)
 - Investigating available sensors/chips that could fit our needs (considering the possibility of either strips or pixels)
- Started thinking about possible DAQ systems → Keen on using EUDAQ

- Some possible choices for sensors → Vienna and Mimosas
- Mimosas sensors (M. Winter) → DAQ details still evolving. Mimosas telescopes using EUDAQ
- Vienna sensors (Th. Bergauer)

- Vienna sensors and APV25 → In the past used for a Si ILC prototype, currently implemented in a Si telescope at CERN

- [AIDA-NOTE-2014-003.pdf](#)

- DAQ hardware

- DAQ developed for the vertex Belle detector
- TLU (EUDET) used to distribute clock and trigger signals

- DAQ Software

- TuxDAQ controlling DAQ and TuxOA used for online analysis of measured tracks
- TuxDAQ possible to communicate with EUDAQ

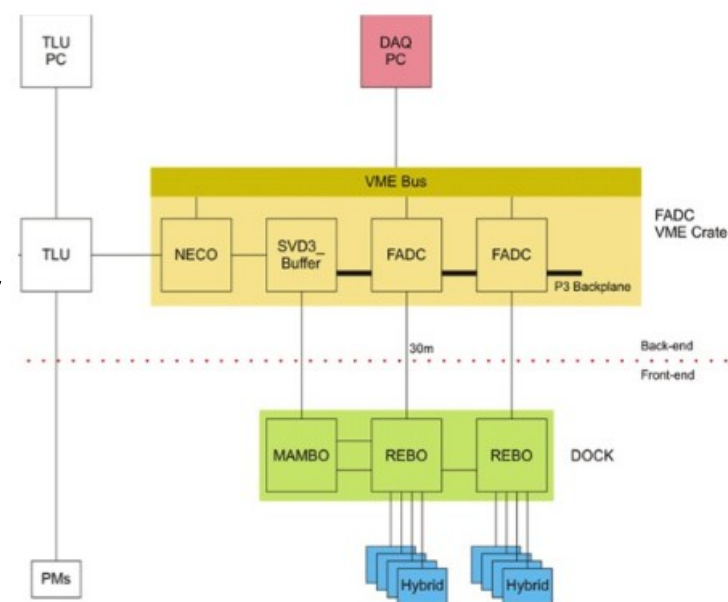


Figure 14: Schematics of the DAQ electronics

- In the past (~2010), there was an attempt for a combined TPC+Si prototype test beam
- Attempt to use TLU but combination with Altro was not successful
- Did not succeed in combining the data streams. Instead 2 data streams were used: 1 for the TPC and 1 for Si
- Tried to combine them later with trigger (time stamping) but problems due to different requirements by each system (1 seems to use a common start while the other a common stop)
- We (TPC collaboration + Si) strongly support and are interested in EUDAQ scheme

- Si tracker advancing towards sensors and chip hardware
- Si DAQ at an early stage however we desire to use EUDAQ from the start
- Combination of TPC Altro (GEM group) + Si EUDAQ was not successful in the past. Will need to invest more time on combining using TLU
- TPC groups use a variety of DAQ systems
- High interest in moving to a common DAQ system centrally supported and TPC compatible

BACK UP