A study of a TPC readout electronics based on TDC: first results

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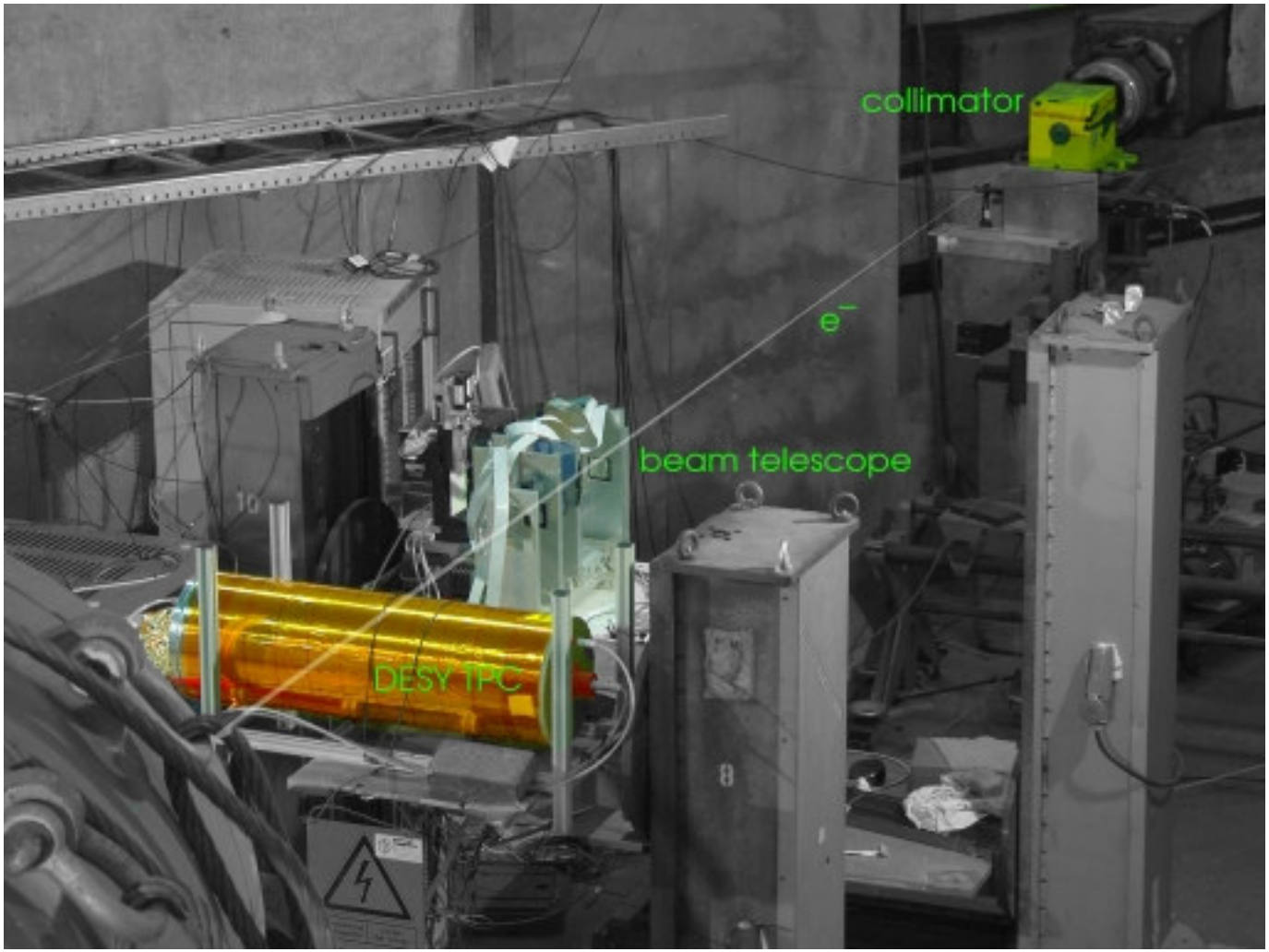
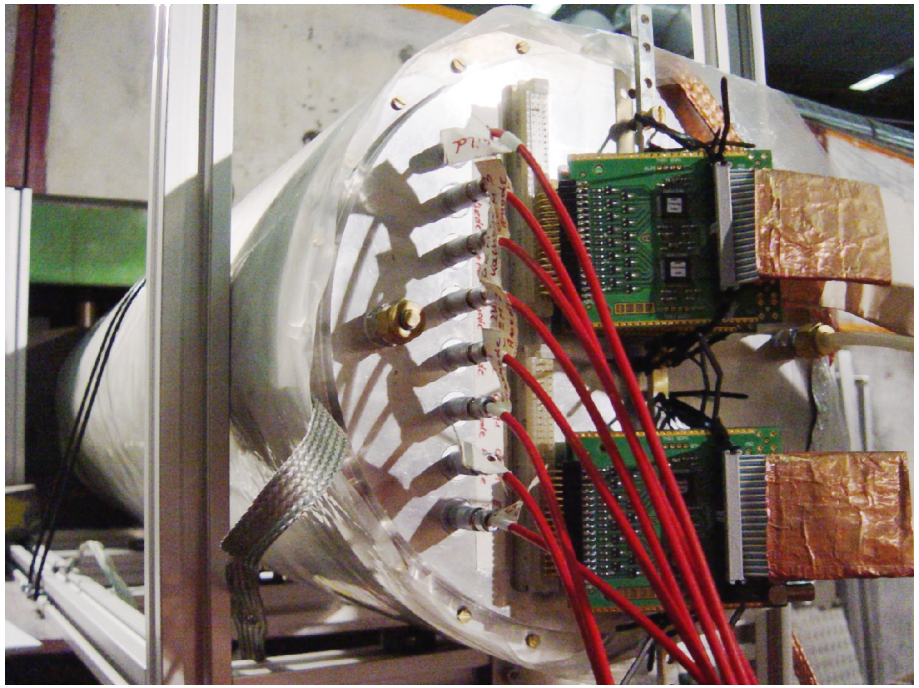
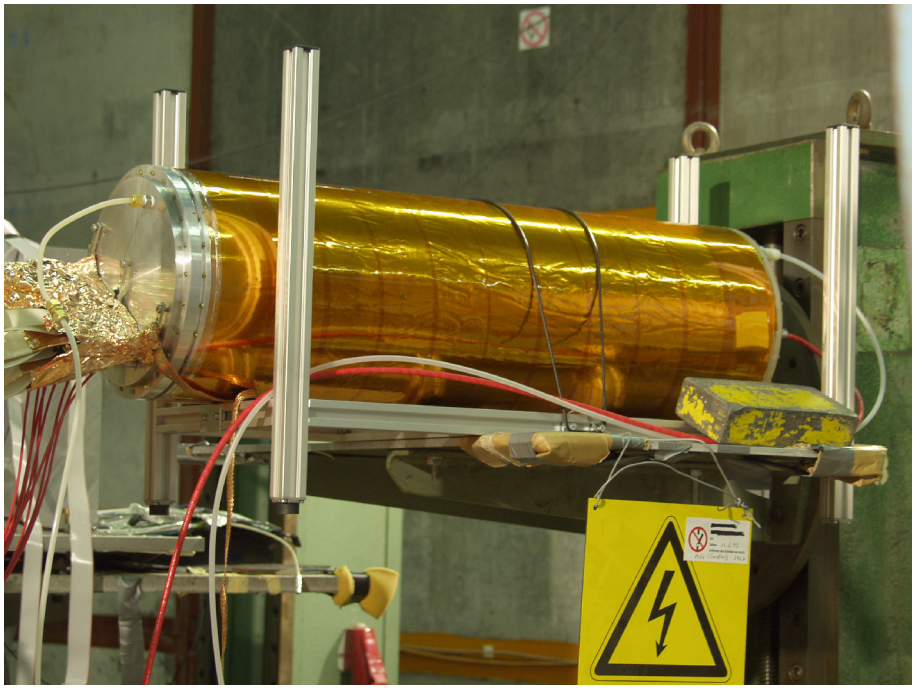
Testbeam TPC setup 14.06.04-12.07.04



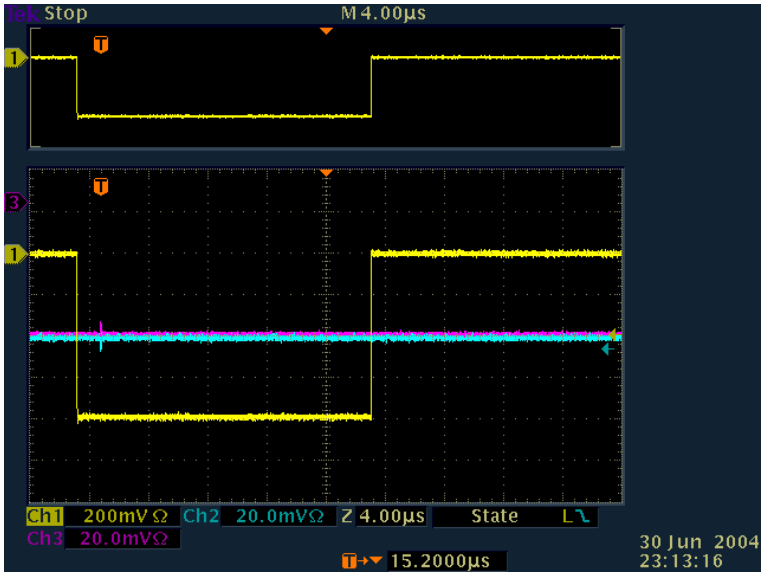
Testbeam TPC setup

- 1-6 GeV electron beam (DESY testbeam 22); most of the time 6GeV electron beam was used
- Beam cross-section (at beam telescope) ~ 1cm
- "medi(um)-TPC" maximum drift length: 80cm. "TDR gas". 2x6 mm^2 pads
- Tripple GEM as preamplifier; GEMs @ 325V & 325V & 325V
- 6 ASDQ amplifier boards installed on TPC (6x16 channels)
- ASDQ discriminator threshold set to ~3–4 fC
- 96 channels in DAQ system (few dead and few hot channels were excluded from readout)





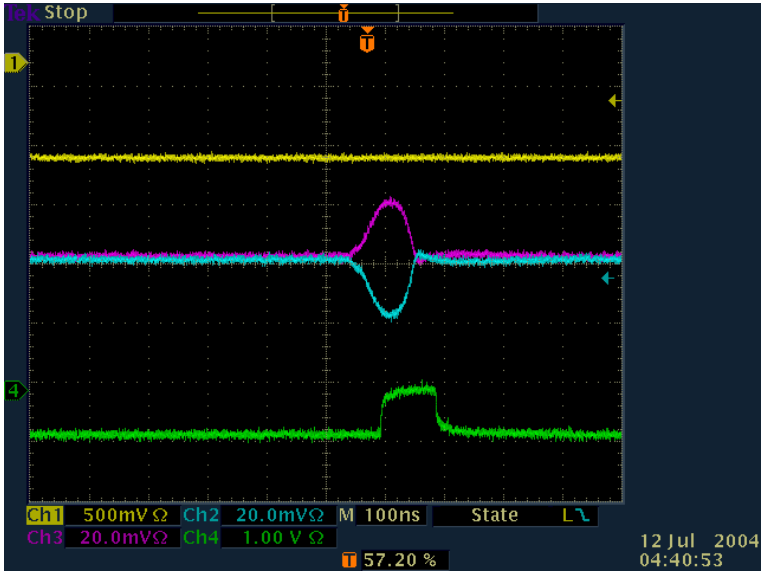
Signals from TPC pad



Signal from single pad:

cyan and magenta – analog monitor of ASDQ amplifier

yellow – Trigger window of 20µs



Signal from single pad:

cyan and magenta – analog monitor of ASDQ amplifier

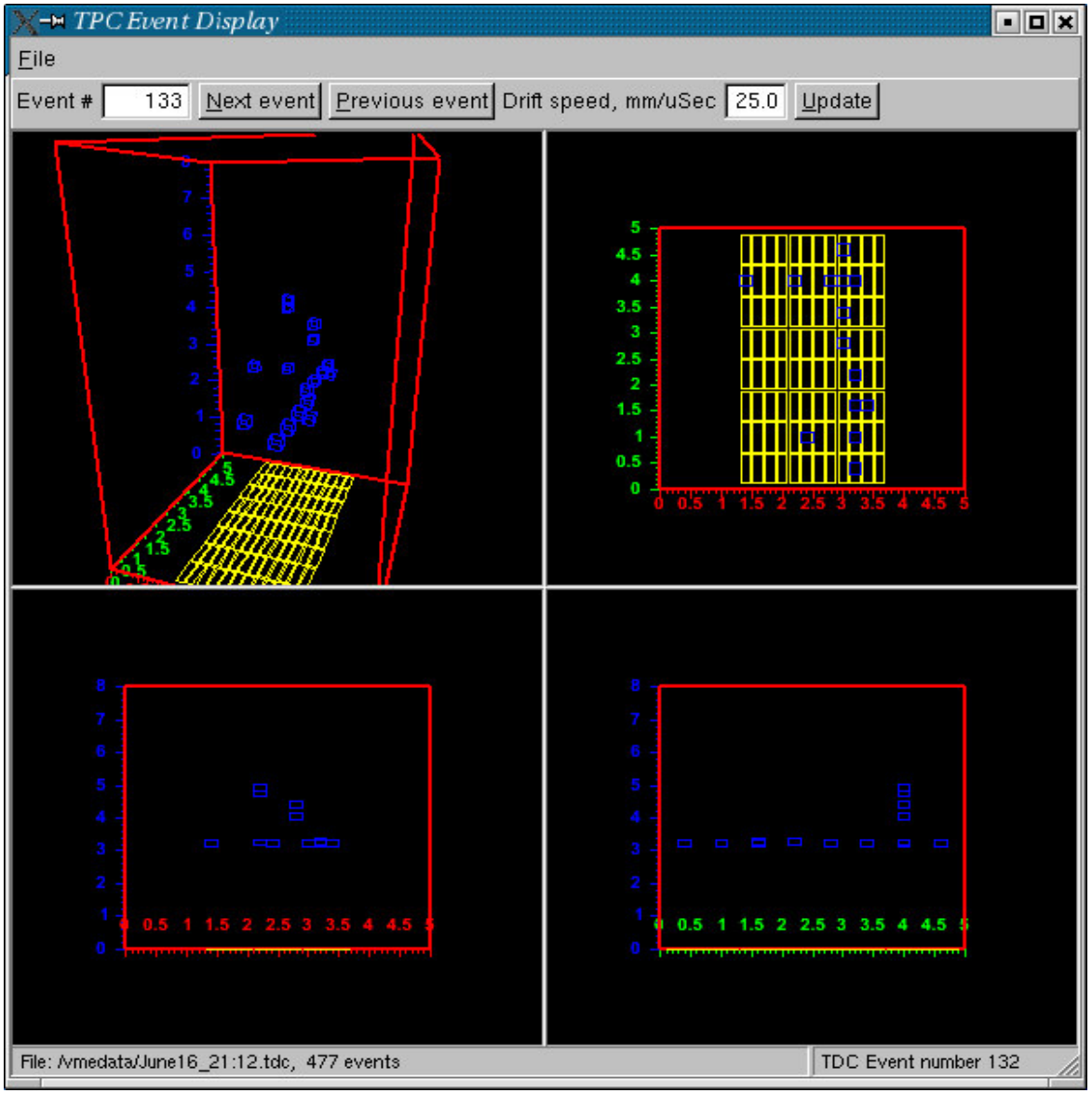
green – digital output of ASDQ (monitored before TDC input)

Data acquisition system

TDC Hit definition:

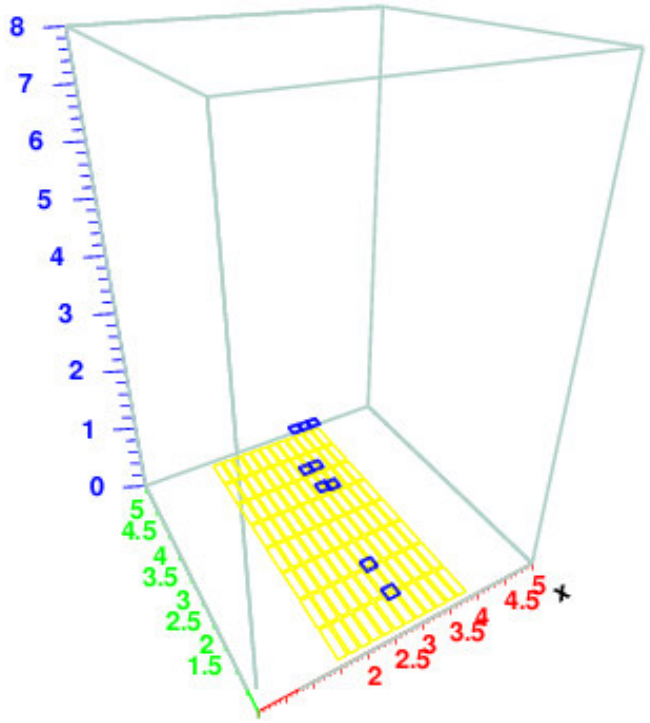
rising or falling edge of the input signal

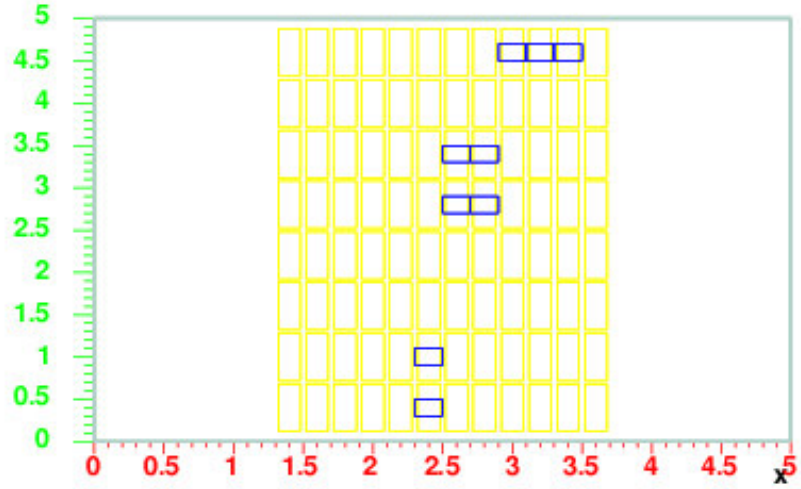
- **Multi-hit TDC CAEN v767 records all the hits during trigger time window**
- **Hit arriving faster than 10 ns (double pulse resolution) after previous one will be lost:** complications to reconstruct charge information
- **Tune of the threshold is a challenge**
- **650 000+ events recorded**

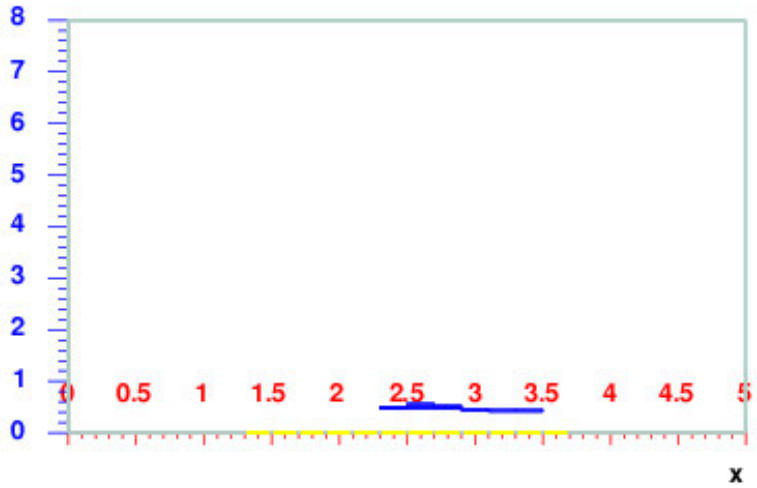


GEM voltages boost

GEM voltages boost: 334V & 334V & 326V
TPC tilted : φ ≈ 18° (φ=arctg 2/6)

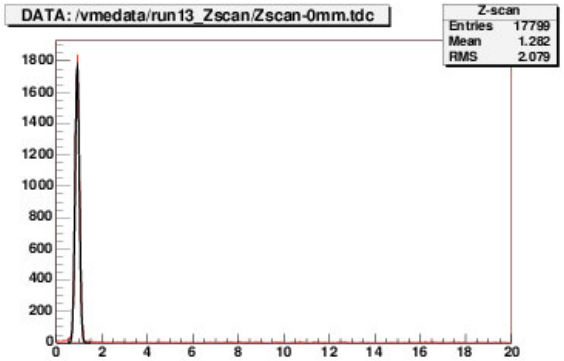


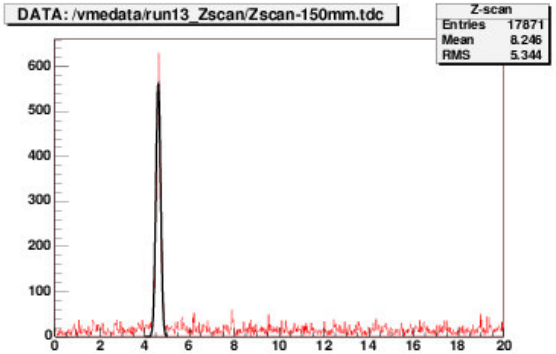


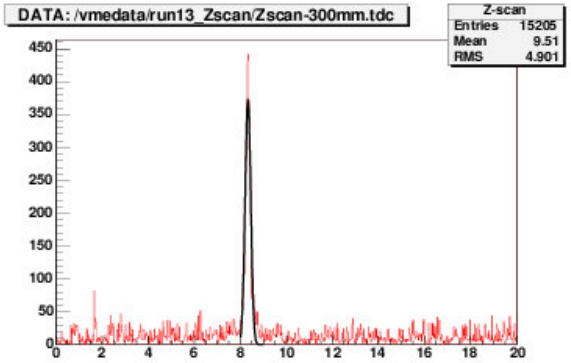


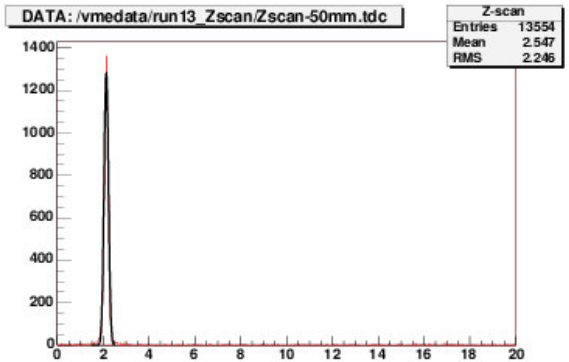
Low efficiency - only few hits seen on the track
Possible cause: short integration time of the ASDQ (~8 ns, 28 ns when charge measured), low GEM gain, oxygen in TPC, space charge effect (?).....

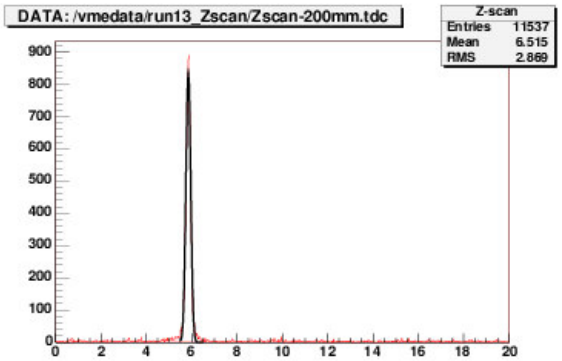
Z-scan with 6GeV electron beam

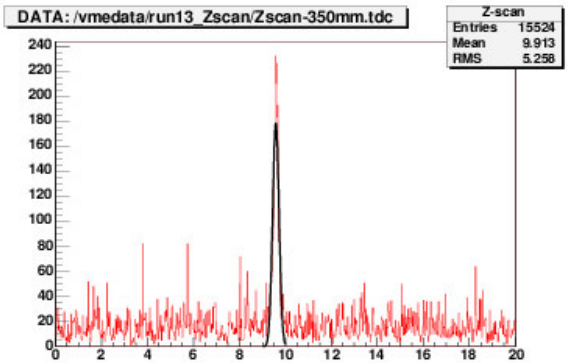


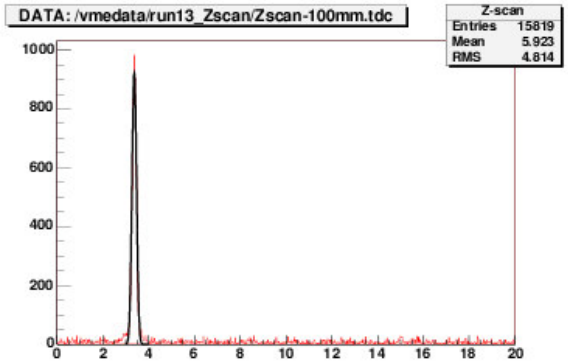


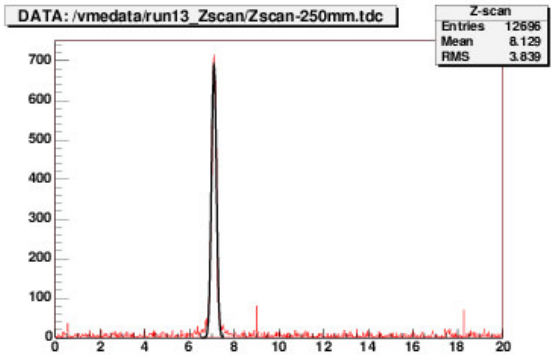


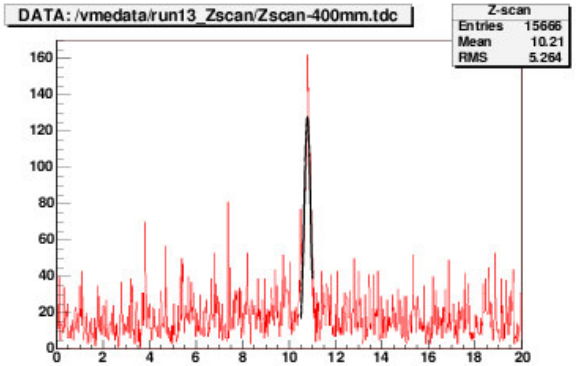










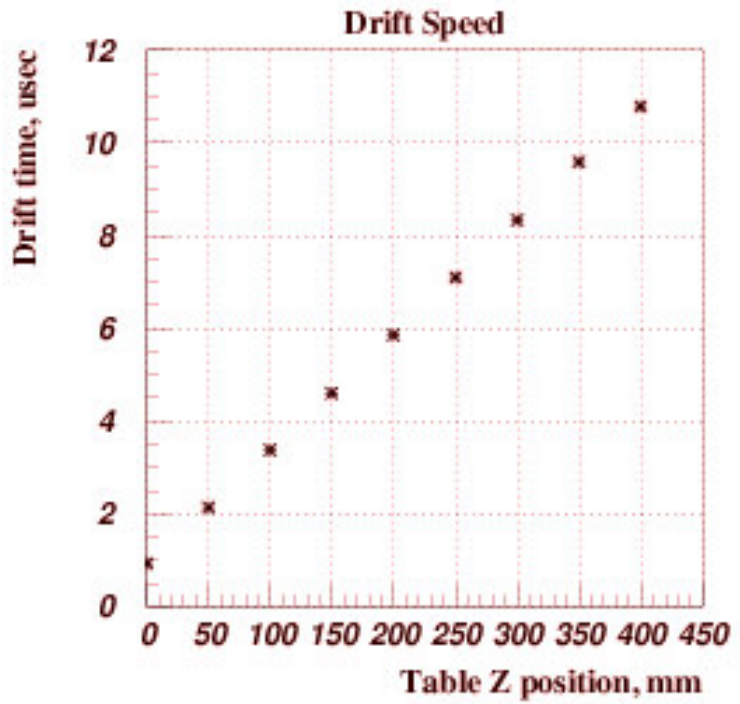


Z-scan with 6GeV electron beam

Z-scan of the electron beam was performed to measure drift speed

~ 6000 events in every of 9 runs

Loss of the 'signal' at large drift length



Preliminary: Drift speed ~ 41mm/usec

Conclusions

- **After one year of construction of TPC readout electronics based on TDC, first very promising results were achieved**
- **Many properties of ASDQ amplifiers (high speed, short double pulse resolution,...) are not very necessary for this study.**
- **Charge information data not yet analyzed**
- **Better understanding of signal development in *GEM-Pad Plane* is required**
- **Study will be continued with laser setup on BIG DESY TPC (in collaboration with Markus Ball)**
- **Many thanks to the DESY FLC group for the support of this study**