High speed readout for spin-filtering experiments

ANKE/PAX Workshop on Spin Physics

29 May - 1 June 2007
IUSS, Via Scienze 41b Ferrara, Italy

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VME system

- 5 MHz ADC clock
- 0,5 ms deadtime
- expensive
- No common-mode

LVDS System

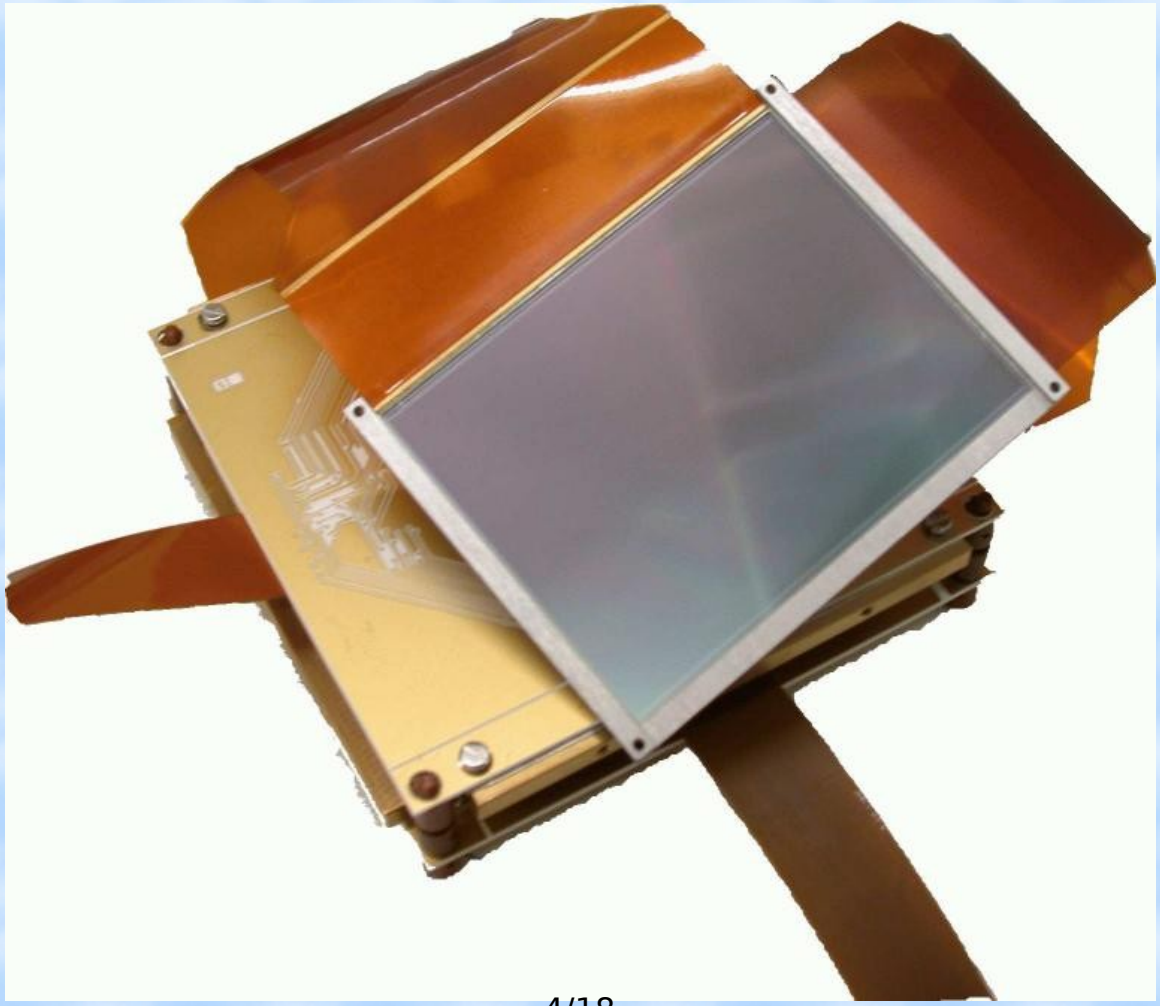
Test system (Test pulse/Alpha particles)

- 1 Si strip detector
- 2 Front-end cards (developed by S.Merzliakov)
- 2 Repeater cards (developed by S.Merzliakov)
- 1 Vertex board (developed/produced by ZEL[(1)])
- 1 LVDS crate (developed/produced by ZEL[(1)])

[(1)] Zentralinstitut für Elektronik - Forschungszentrum Jülich

Test system (Test pulse/Alpha particles)

- **1 Detector** (one 300 μm layer)
- 2 Front-end cards
- 2 Repeater cards
- 1 Vertex board (2 sequencers + 2 ADC)
- 1 LVDS crate (+controller, diskless pc, acquisition pc)



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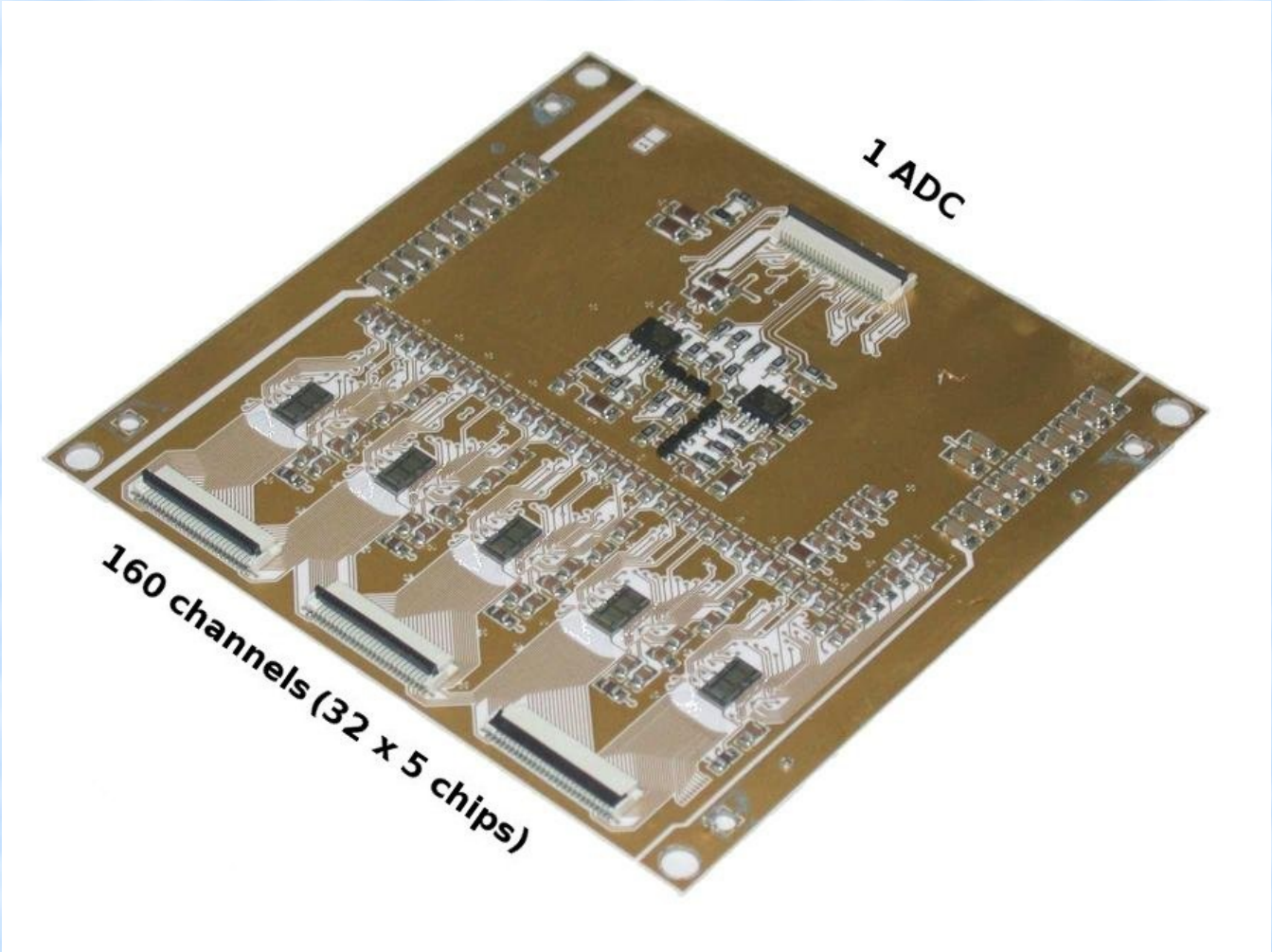

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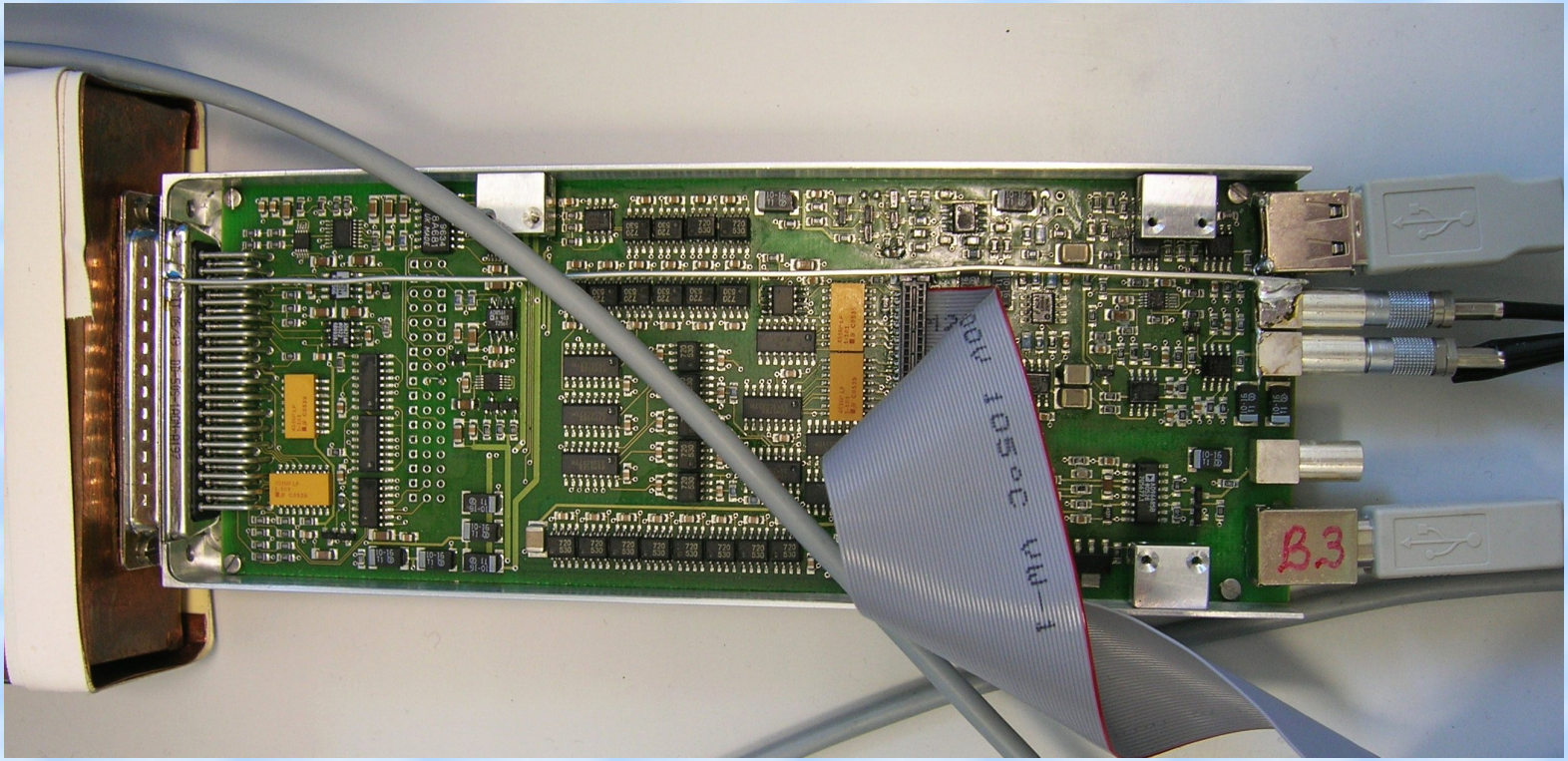

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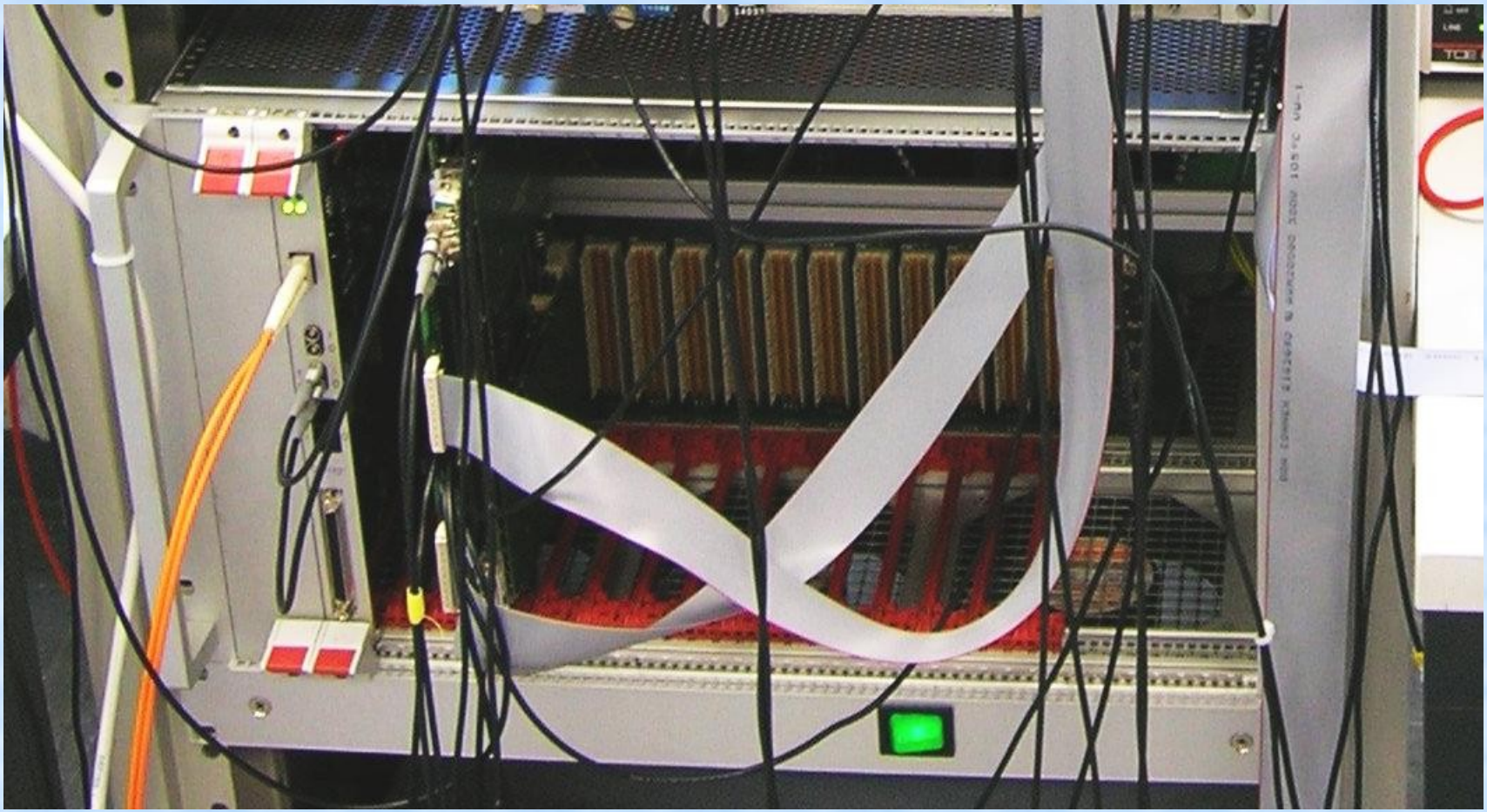
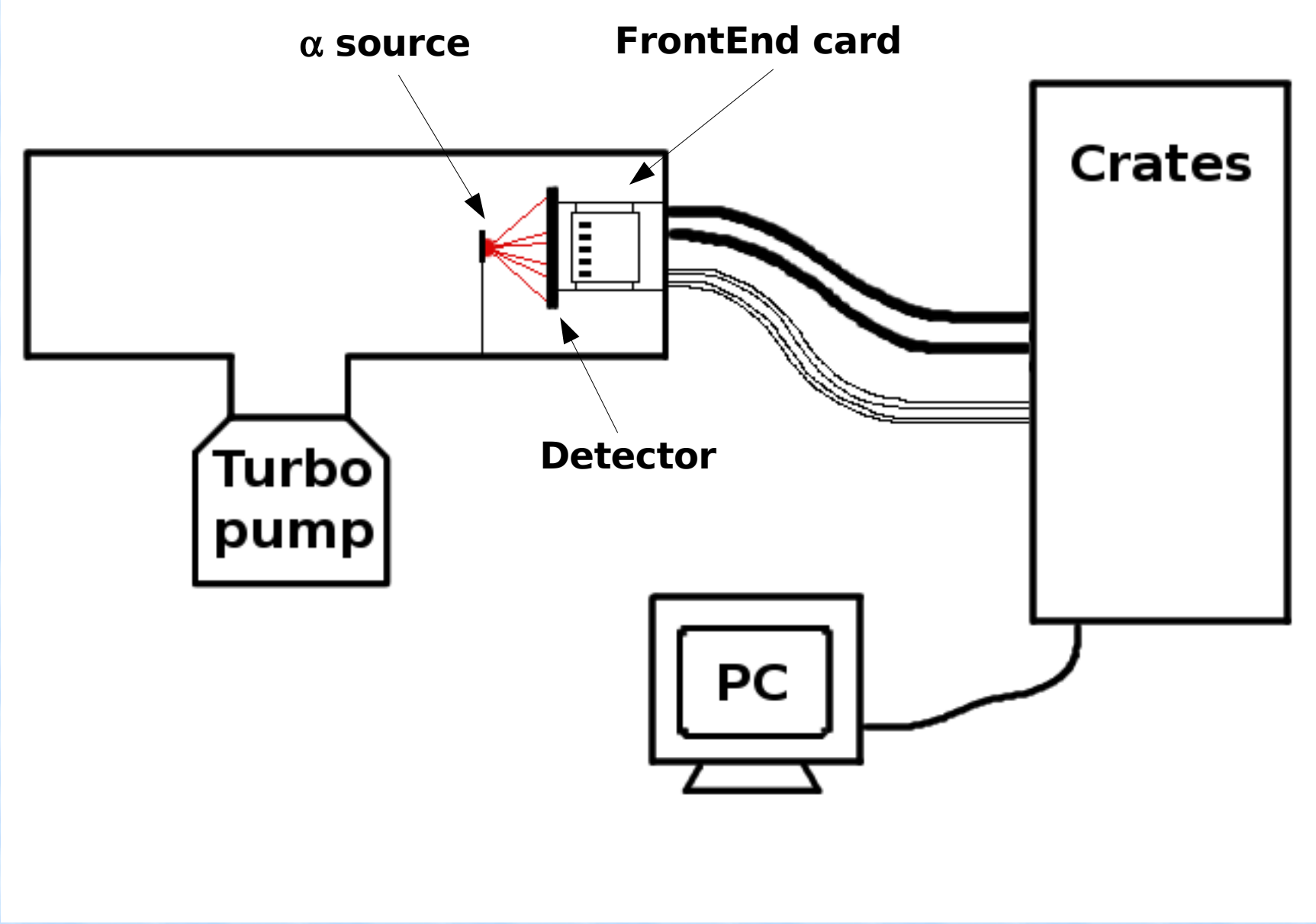
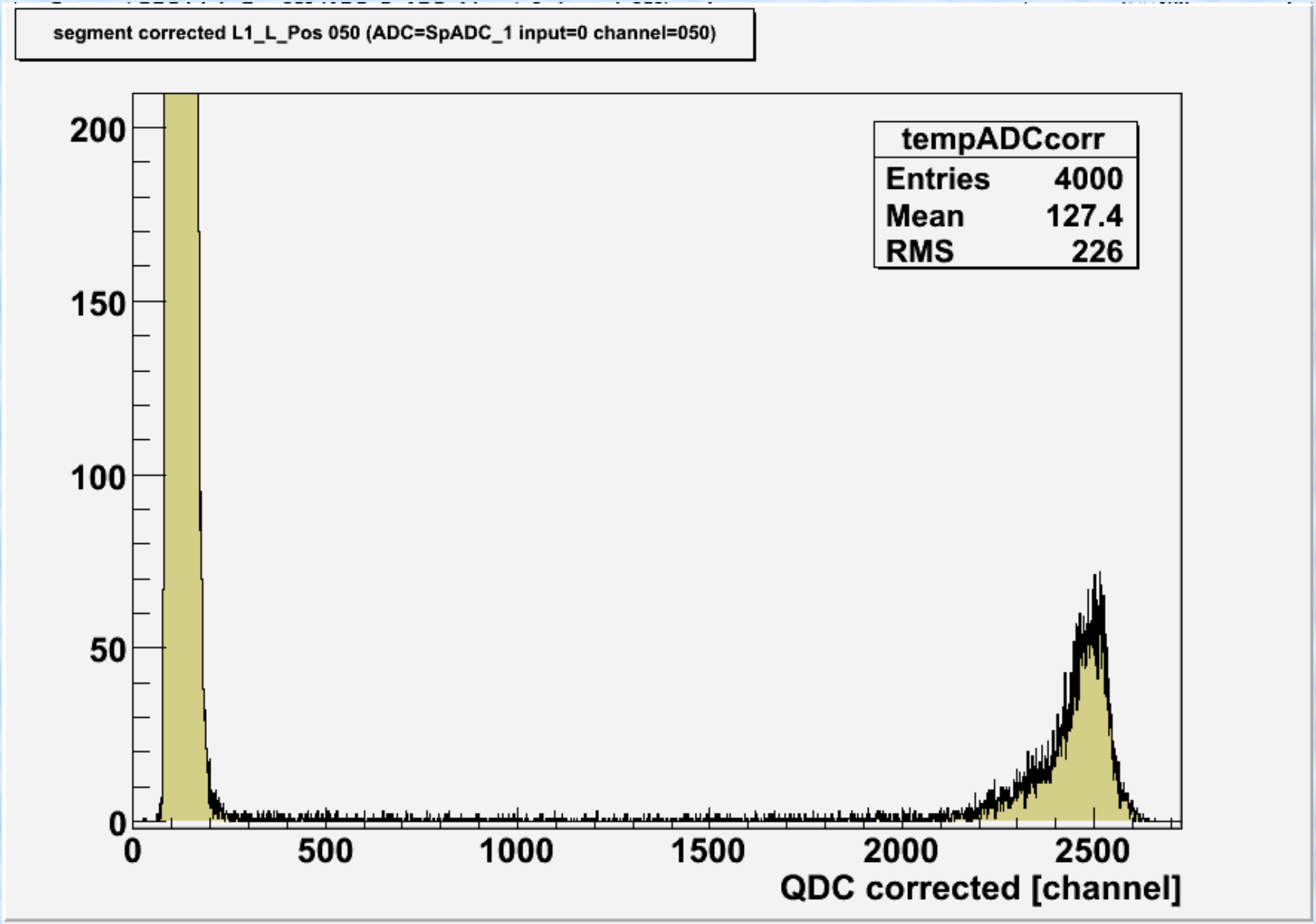


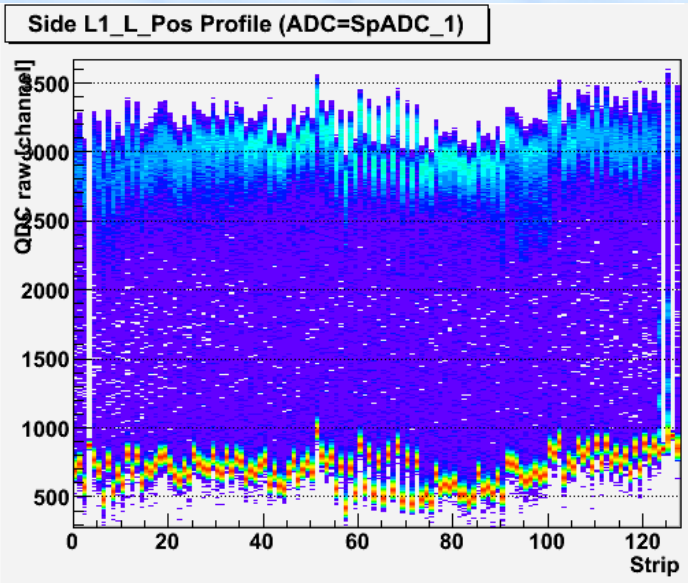
Test system setup

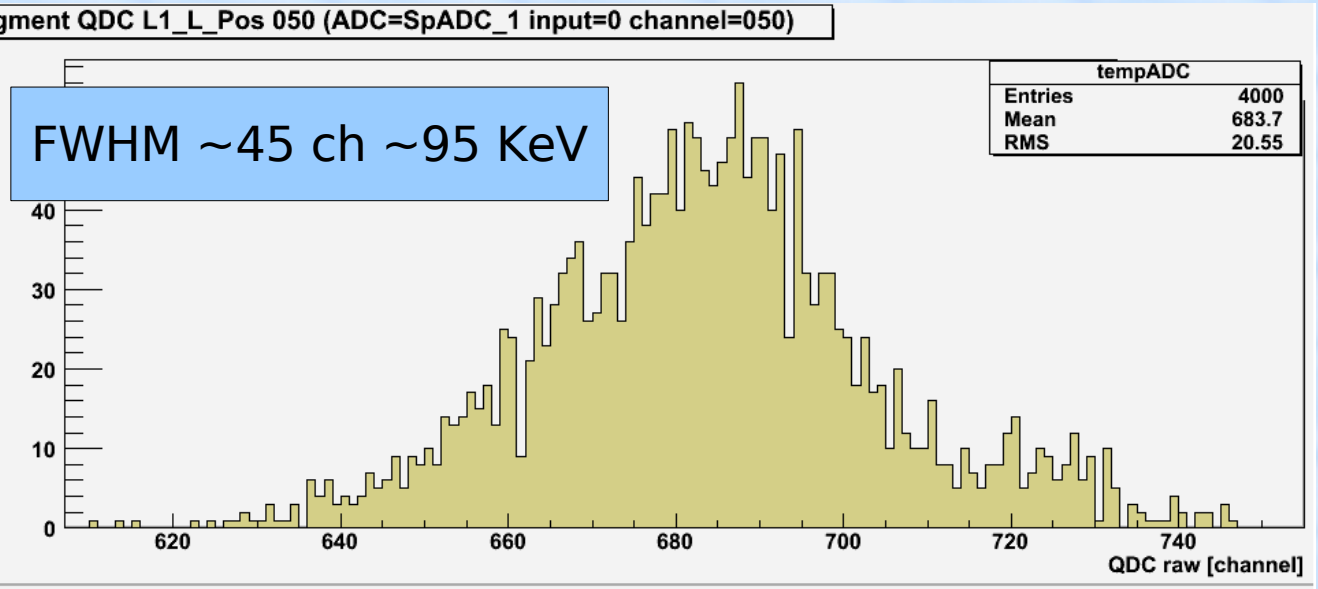


Single strip spectrum

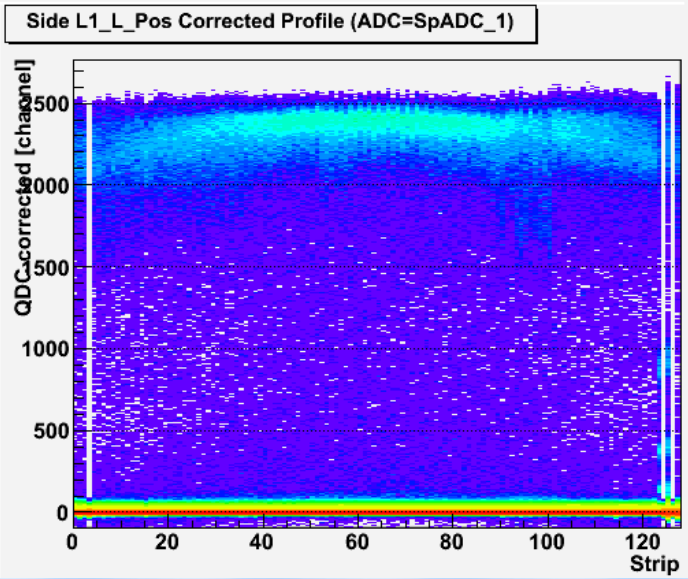


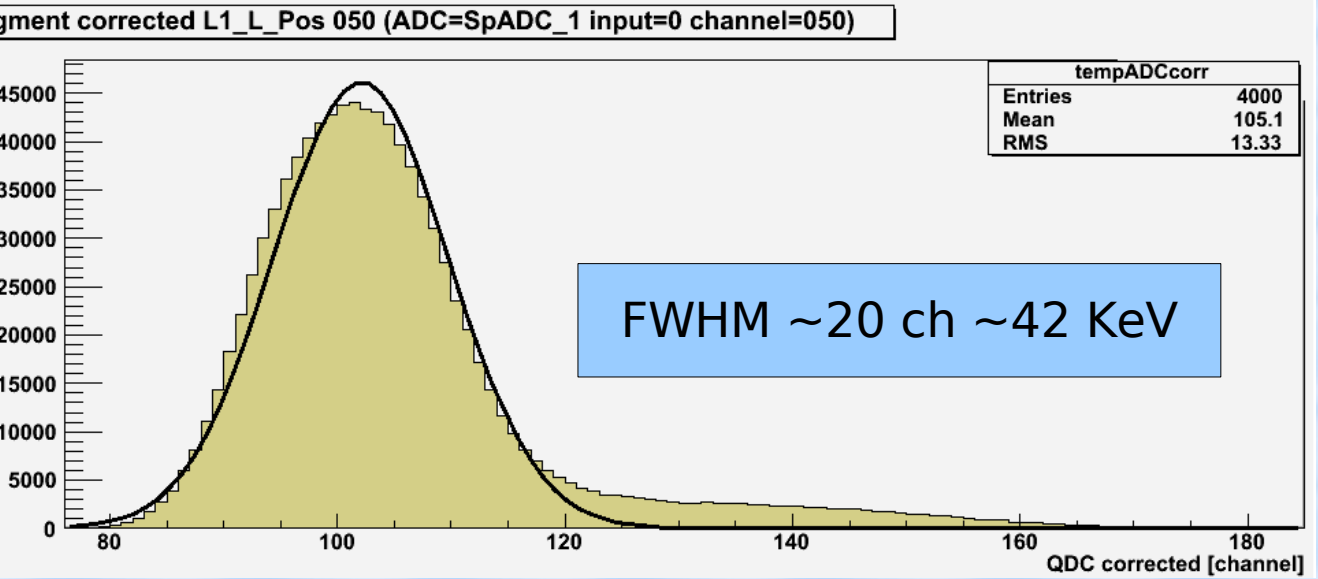
Pedestals, 2 Mhz ADC clock





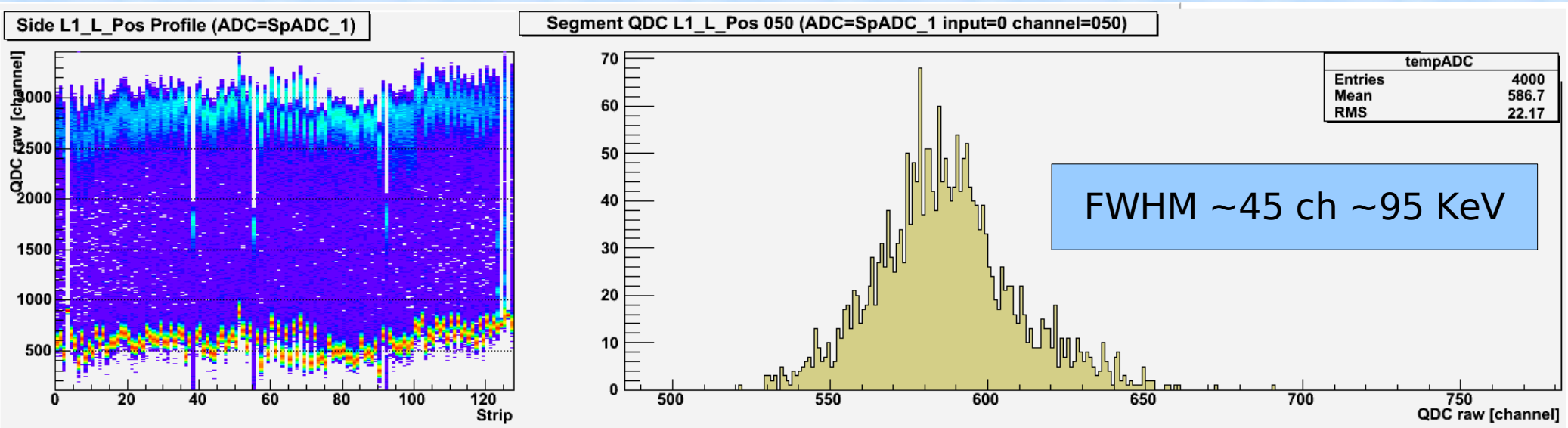
FWHM ~45 ch ~95 KeV

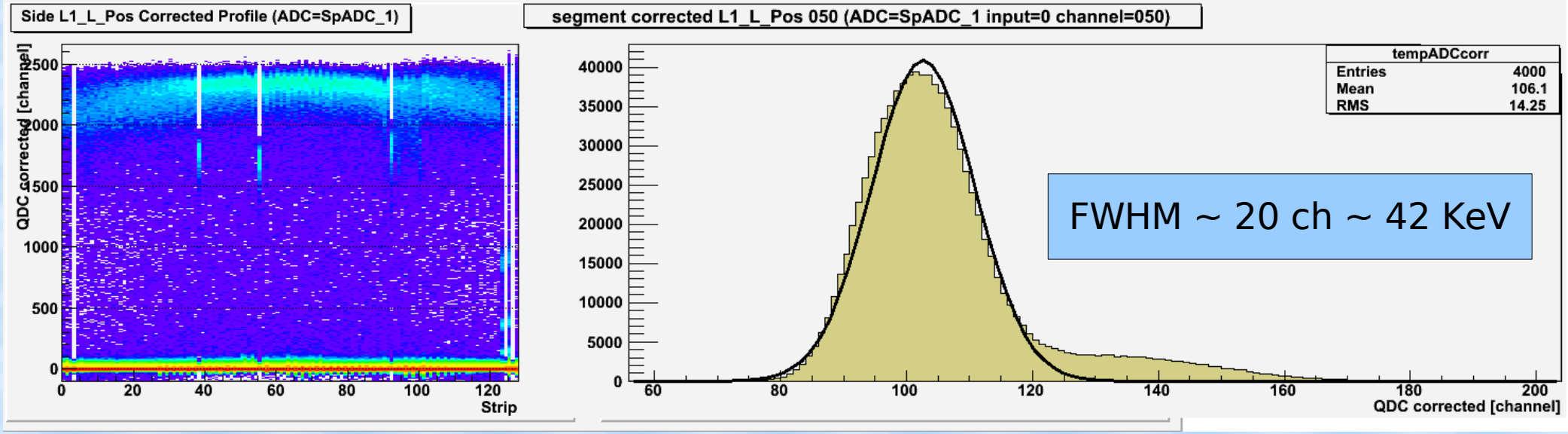


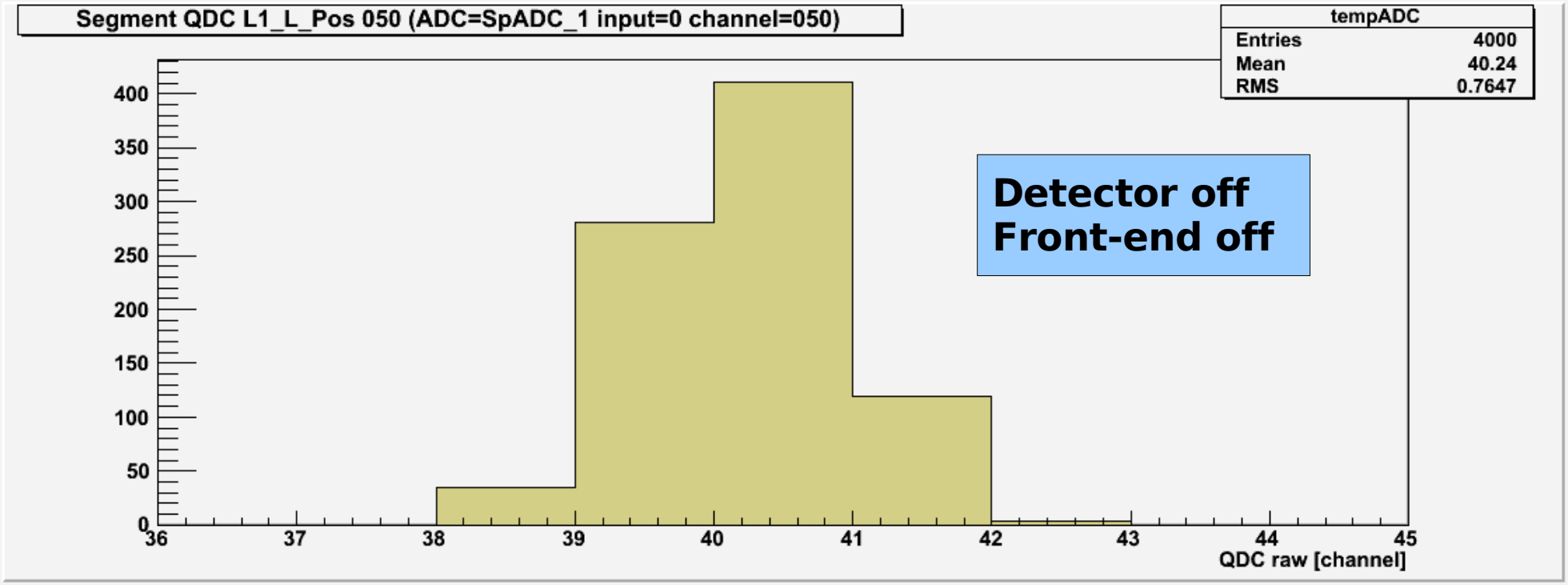


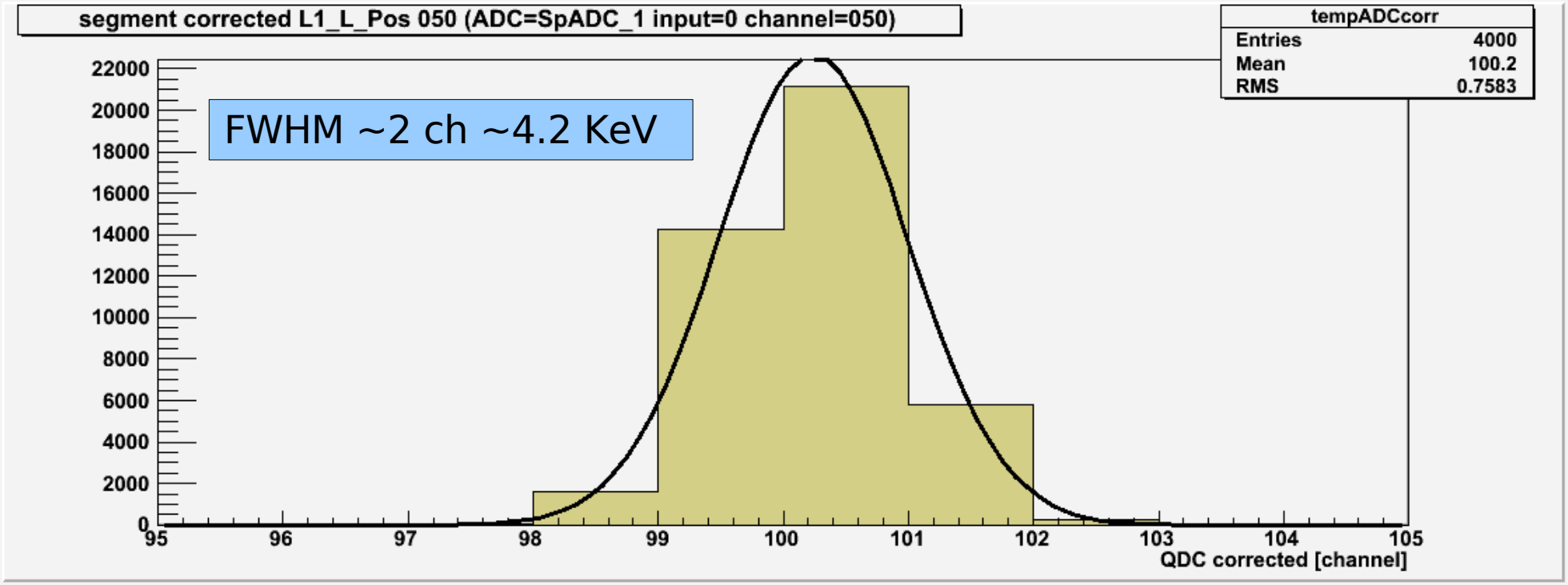
FWHM ~20 ch ~42 KeV

Pedestals, 10 Mhz ADC clock






Segment QDC L1_L_Pos 050 (ADC=SpADC_1 input=0 channel=050)
tempADC
Entries 4000
Mean 40.24
RMS 0.7647
Detector off
Front-end off
QDC raw [channel]


segment corrected L1_L_Pos 050 (ADC=SpADC_1 input=0 channel=050)
tempADCcorr
Entries 4000
Mean 100.2
RMS 0.7583
FWHM ~2 ch ~4.2 KeV
QDC corrected [channel]

- ADC resolution: 1 ch = ~2.1 KeV
- Pedestal width is ~42 KeV (VME system ~60 KeV)

→ Readout is working at 10 MHz
→ Software needs development/tuning performance

Conclusion: vertex boards will be used in November

Goal:
One **Complete readout system**
for November beam-time
(Depolarization studies)

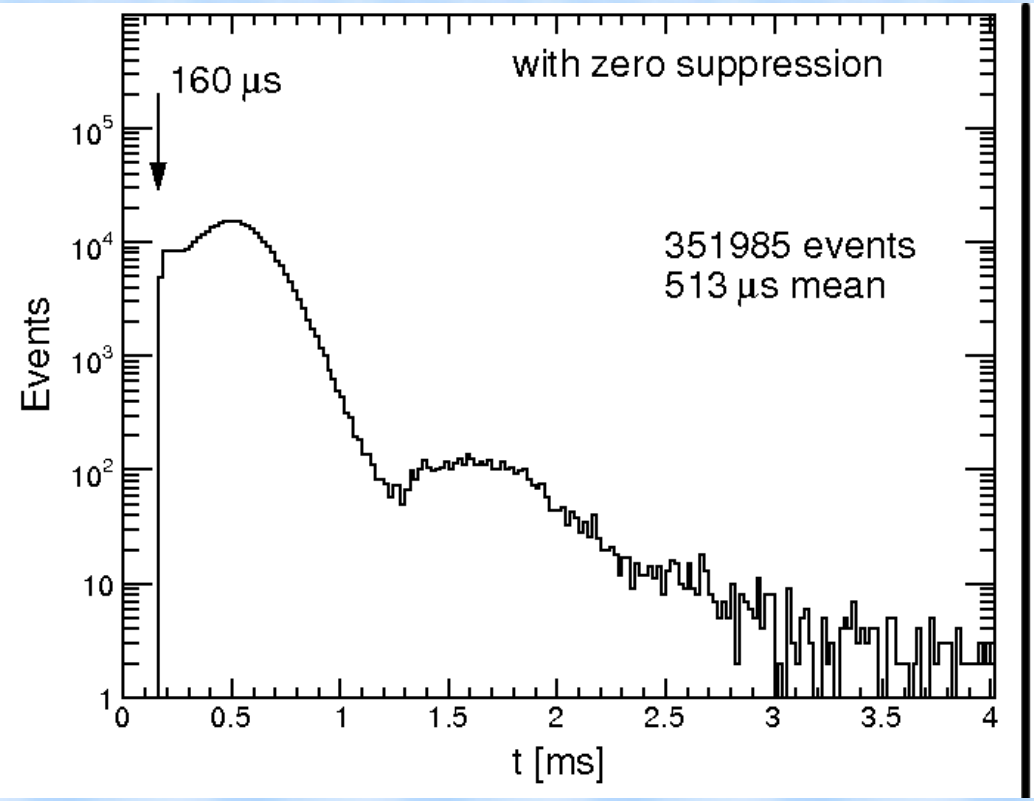
- 6 (upgraded) Vertex boards (1 for detector)
  [2 complete telescopes (3 layer each)]
- 1 LVDS crate (1 LVDS TDC)
- 1 VME crate
- 1 VME trigger unit (A.Cotta) / VME scalers
- Implementation in ANKE
- Software (S.Trusov talk)

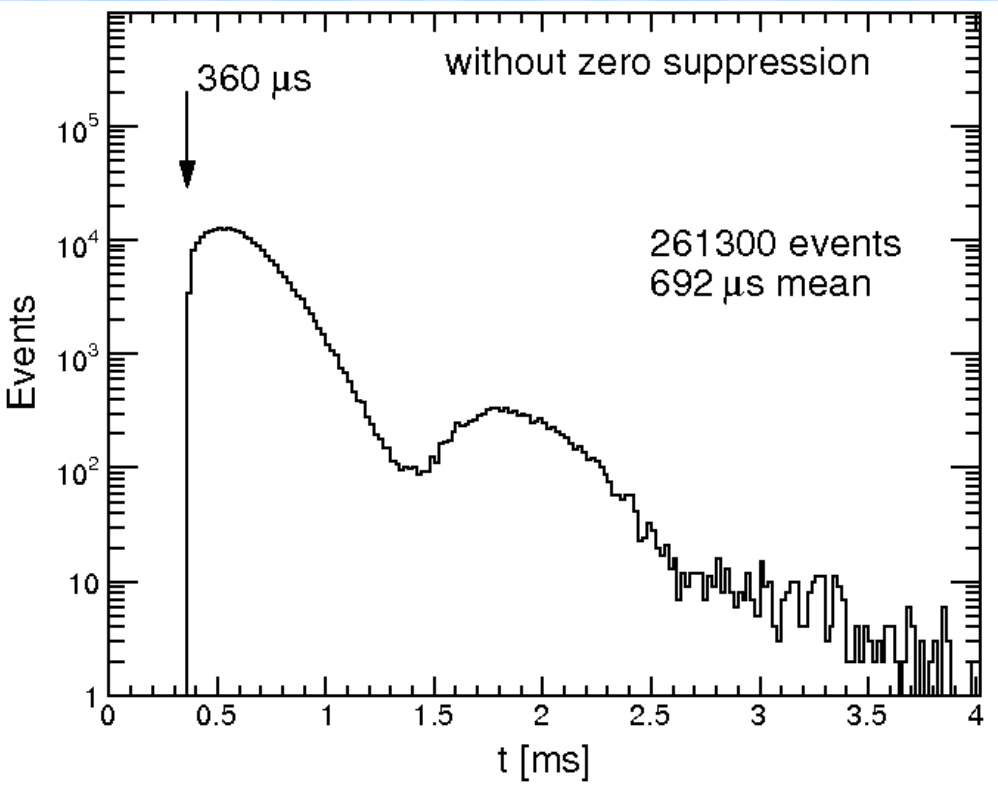
Software:

- Sequencer programming (S. Chiozzi/see later)
- Changes in server software to go to high speed readout (P. Wüstner)
- Client program (GUI) to control (M.Nekipelov)
- Rest of software (S. Trusov)
- Xilinx modifications: common-mode & zero suppression (ZEL)

VME system deadtime

Old system (VME ADCs VME Sequencer, 2 detectors, 5MHz, [1])
Minimum Deadtime (without zero suppression): 360 μs
Minimum Deadtime (with zero suppression): 160 μs
ADC ready in ~ 50 μs (-> ~ 25 μs)

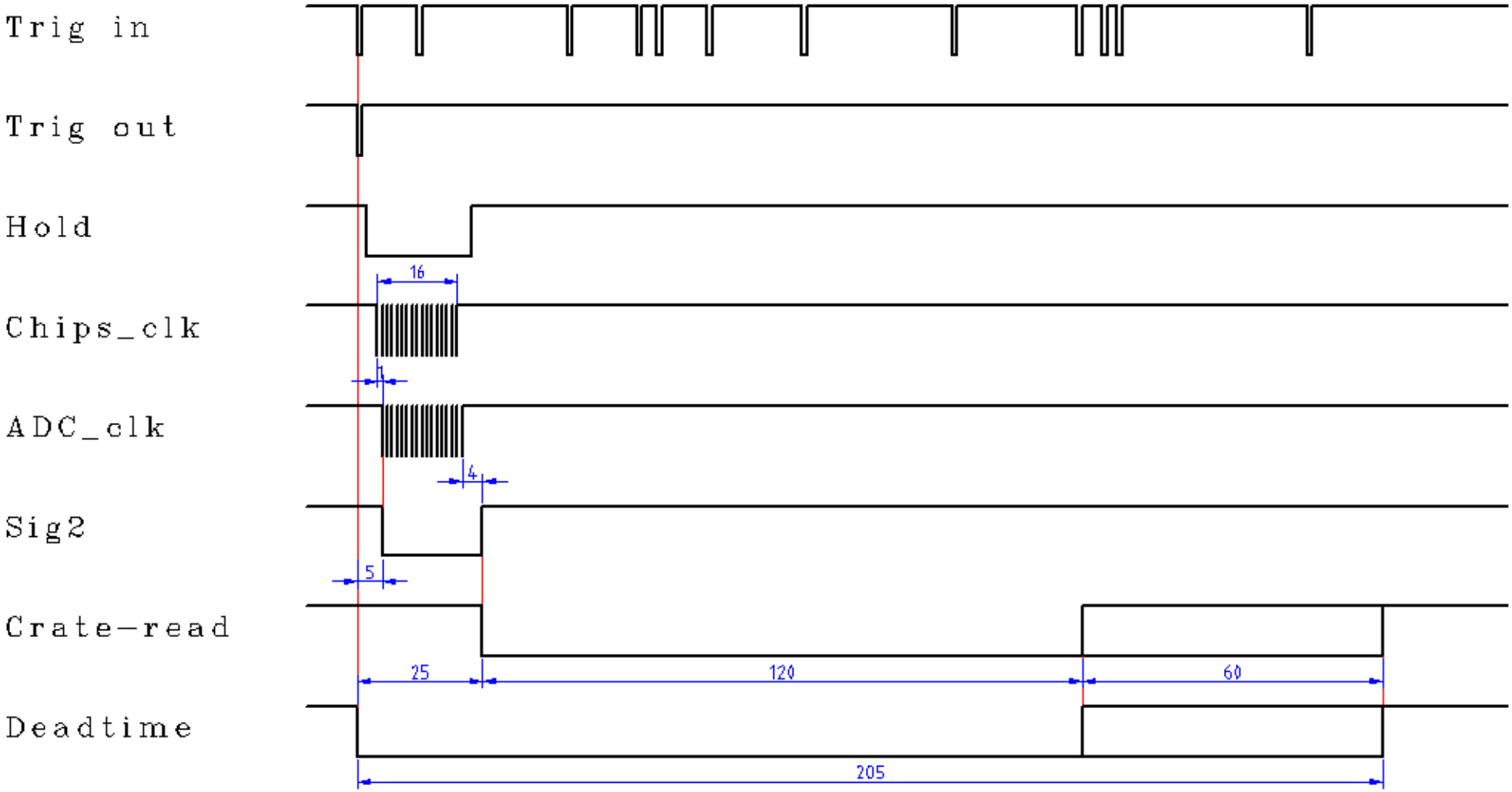




[1] Identification and Tracking of low energy spectator protons
A.Mussgiller, 2005

Data from test LVDS system (10 MHz):

Event size:	1336 byte/ev (1.3GB/10^6ev)
Countrate(det surface):	~1000 Hz
Acquired event rate:	~600 Hz



Conclusion

Good readout system,
still needs software development