Progress of GEM R&D in Lanzhou University

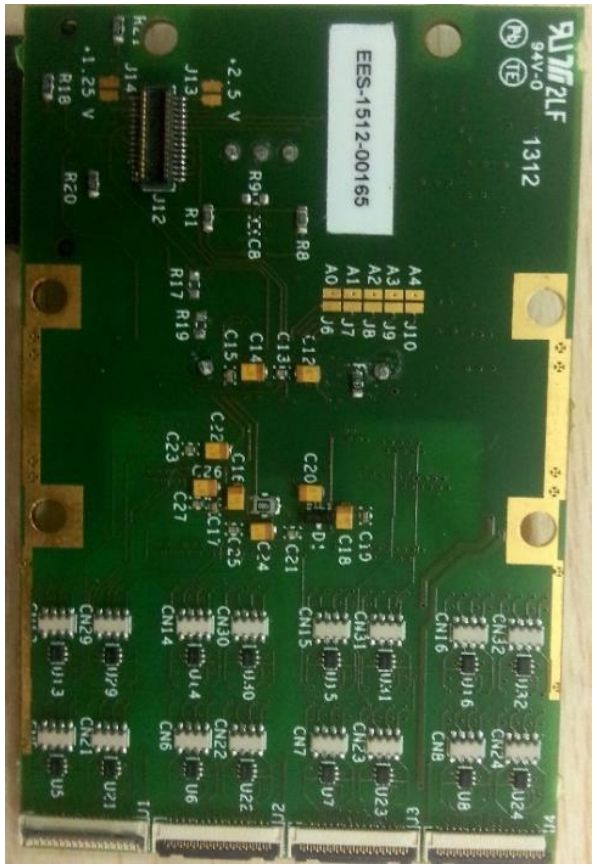
Huiyin Wu

Outline

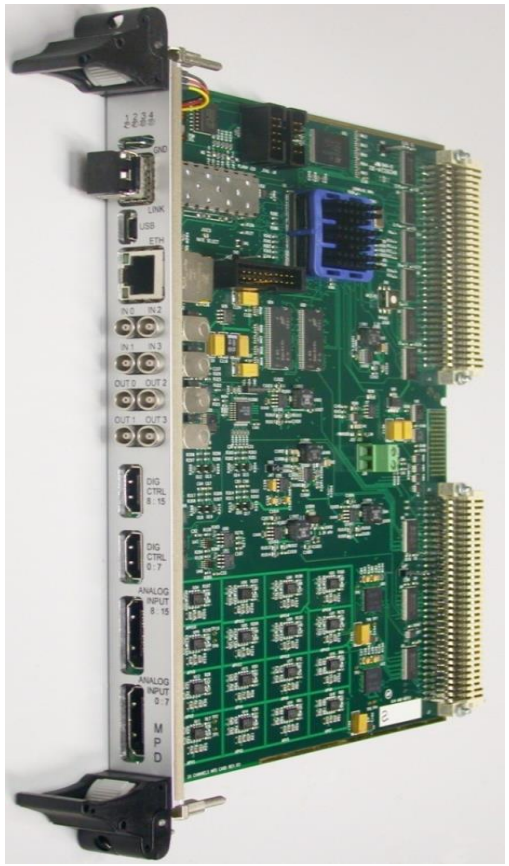
- New DAQ for APV-25
- New DAQ Test
- Alpha measurement with New DAQ
- Summary

New DAQ for APV-25

New DAQ for APV-25



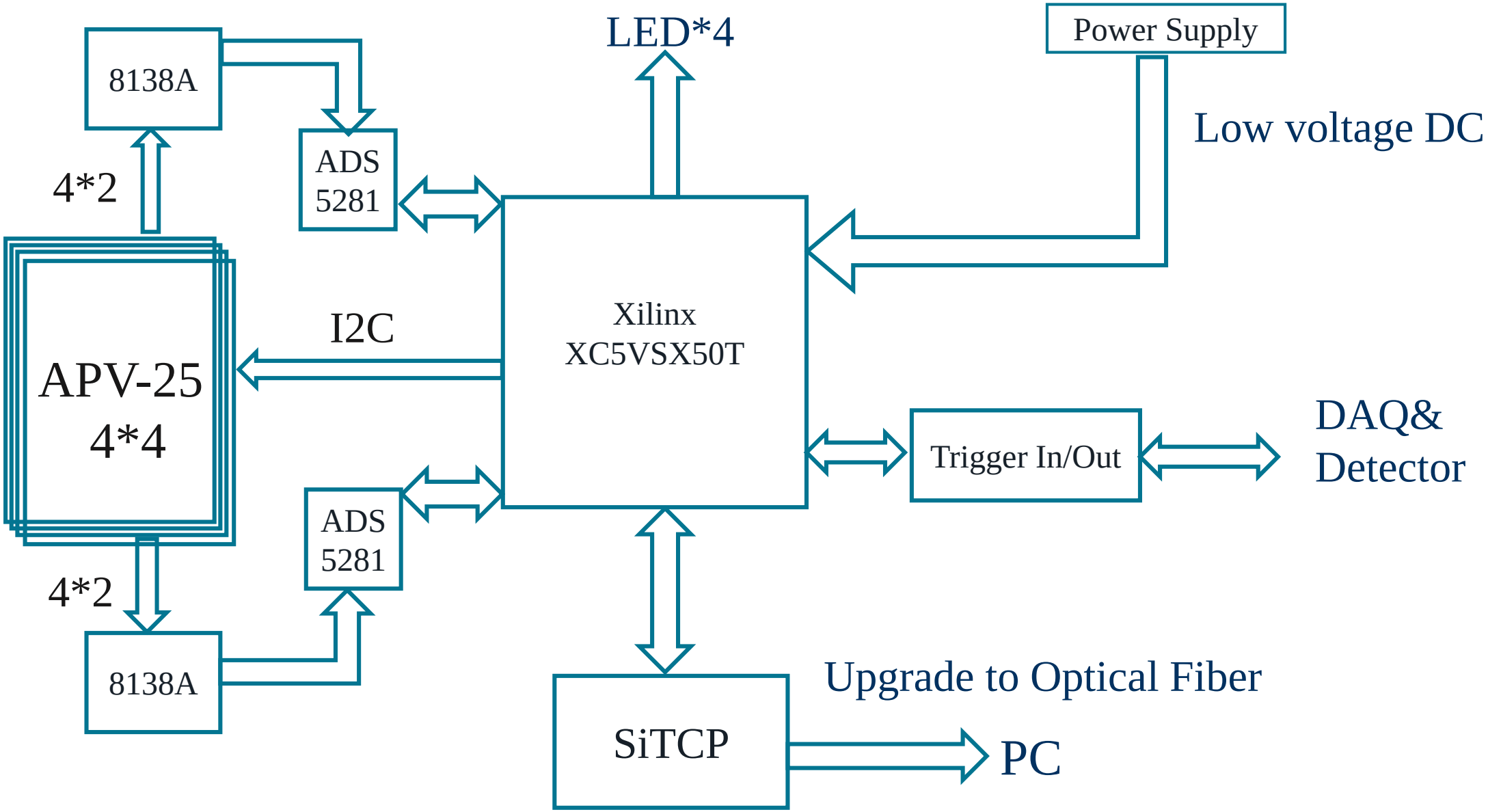
APV-25
128 Channels without ADC
30 samples per event



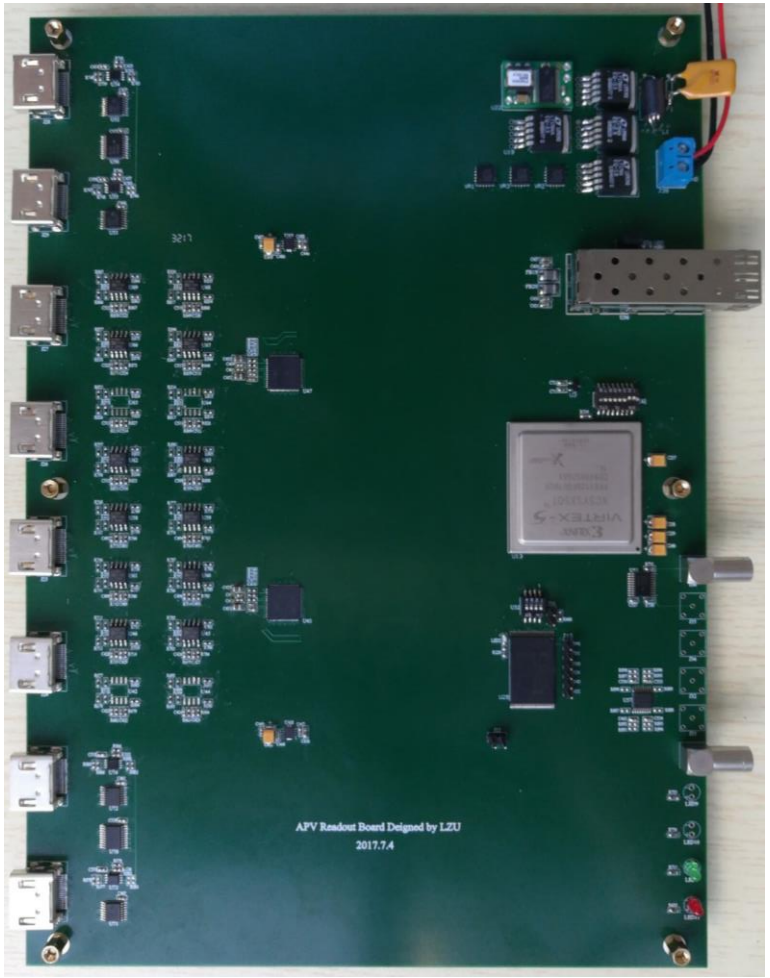
MPD from INFN
ADC&VME

- Only 6 Samples per Event
- VME protocol: slow transmission speed
- Hard to redevelop

New DAQ for APV-25



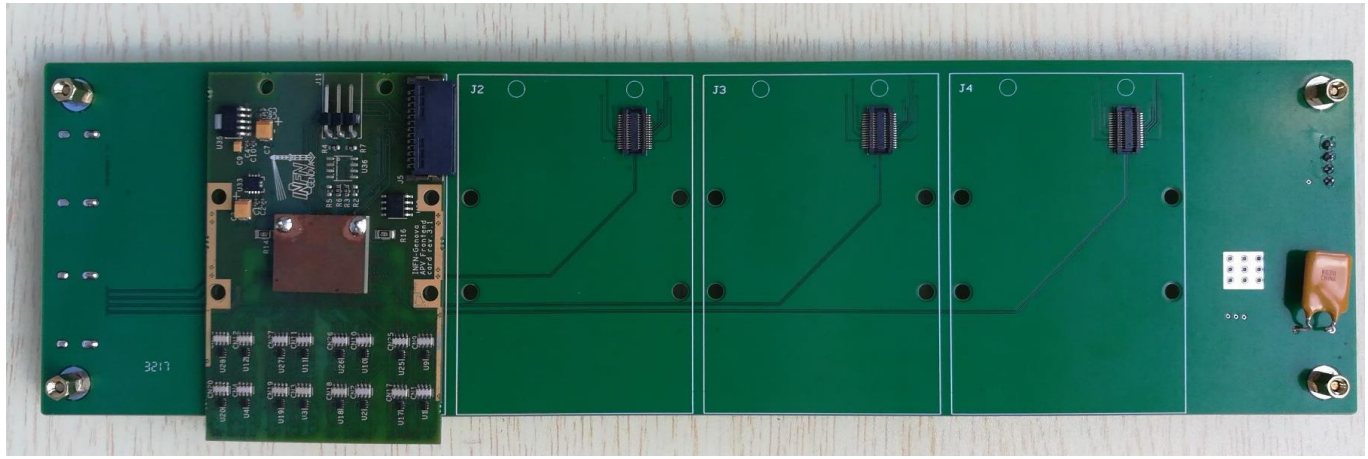
New DAQ for APV-25



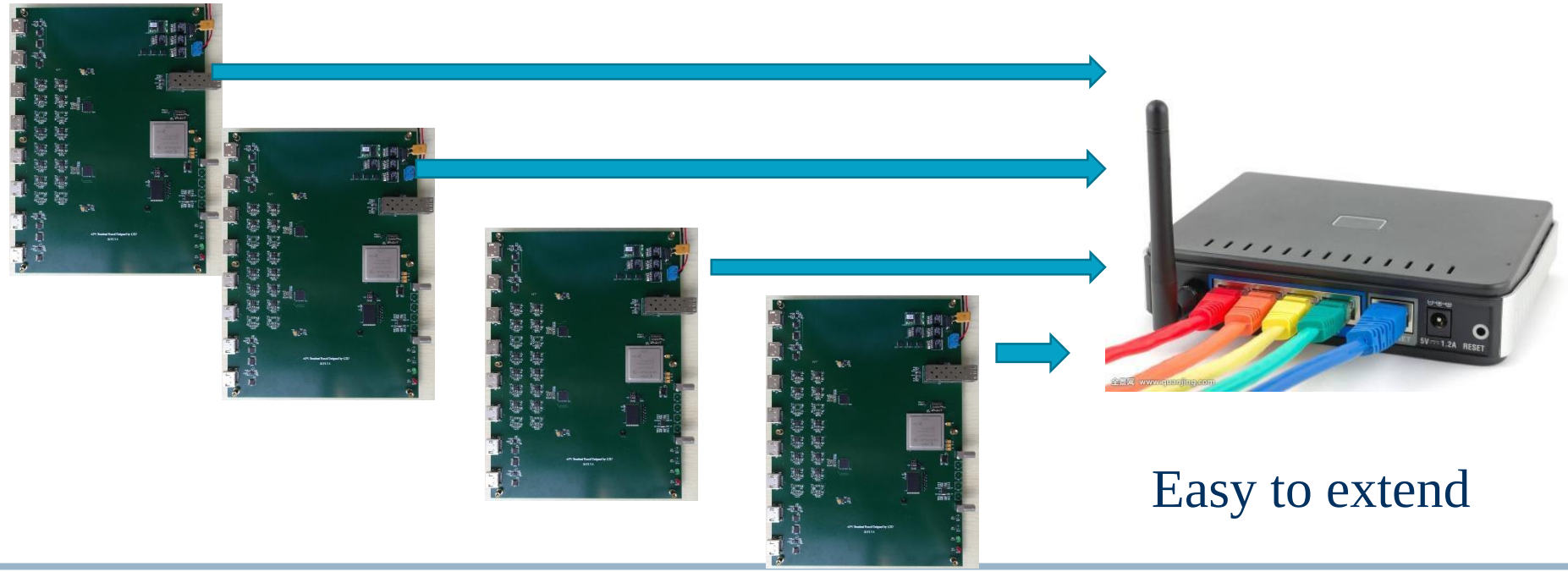
New DAQ 16 APV Chips

	New DAQ	MPD
Chip	Xilinx XC5VSX50T: 4.752Mb-RAM	Altera EP1AGX50DF : 2.475Mb-RAM
Protocol	Ethernet 1000Mbps	VME 60Mbps
I/O	HDMI Type A Easy to buy	
Power	low-voltage power supply	

New DAQ for APV-25



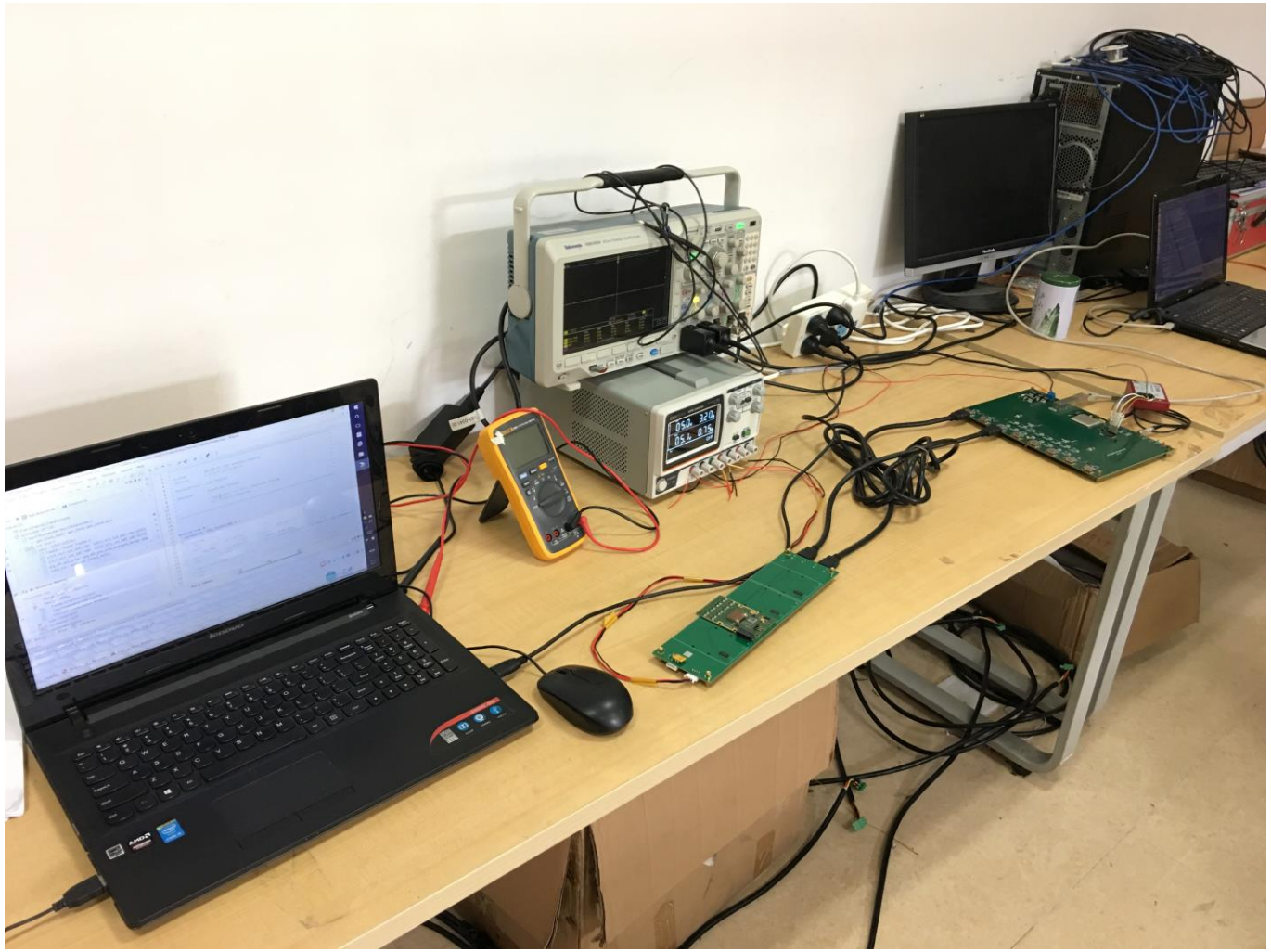
Backboard almost copy from INFN powered by the low-voltage DC power supply



Easy to extend

New DAQ Test

New DAQ Test



One PC for hardware(FPGA), One PC for software(C++)

New DAQ Test

Data transmission speed :
70MB/s Limited by hard disk
without detector

Data transmission speed: 120MB/s
Write to memory
Reach the limits of Gigabit Ethernet
without detector
Rate is about 1000 cps for 16 APV-25 chips
with 30 samples per trigger

Configuration file without UI (C++ / Socket)

New DAQ Test

0xFA	Detector ID	Board ID	Work Mode
Trigger Number			
Total Trigger Counts			
Time_data[63:32]			
Time_data[31:0]			
Reservel			
Channel No_1 Data		Channel No_2 Data	
Channel No_3 Data		Channel No_4 Data	
……			
Channel No_125 Data		Channel No_126 Data	
Channel No_127 Data		Channel No_128 Data	
0xFB		Status	
Byte Count			

Data Format

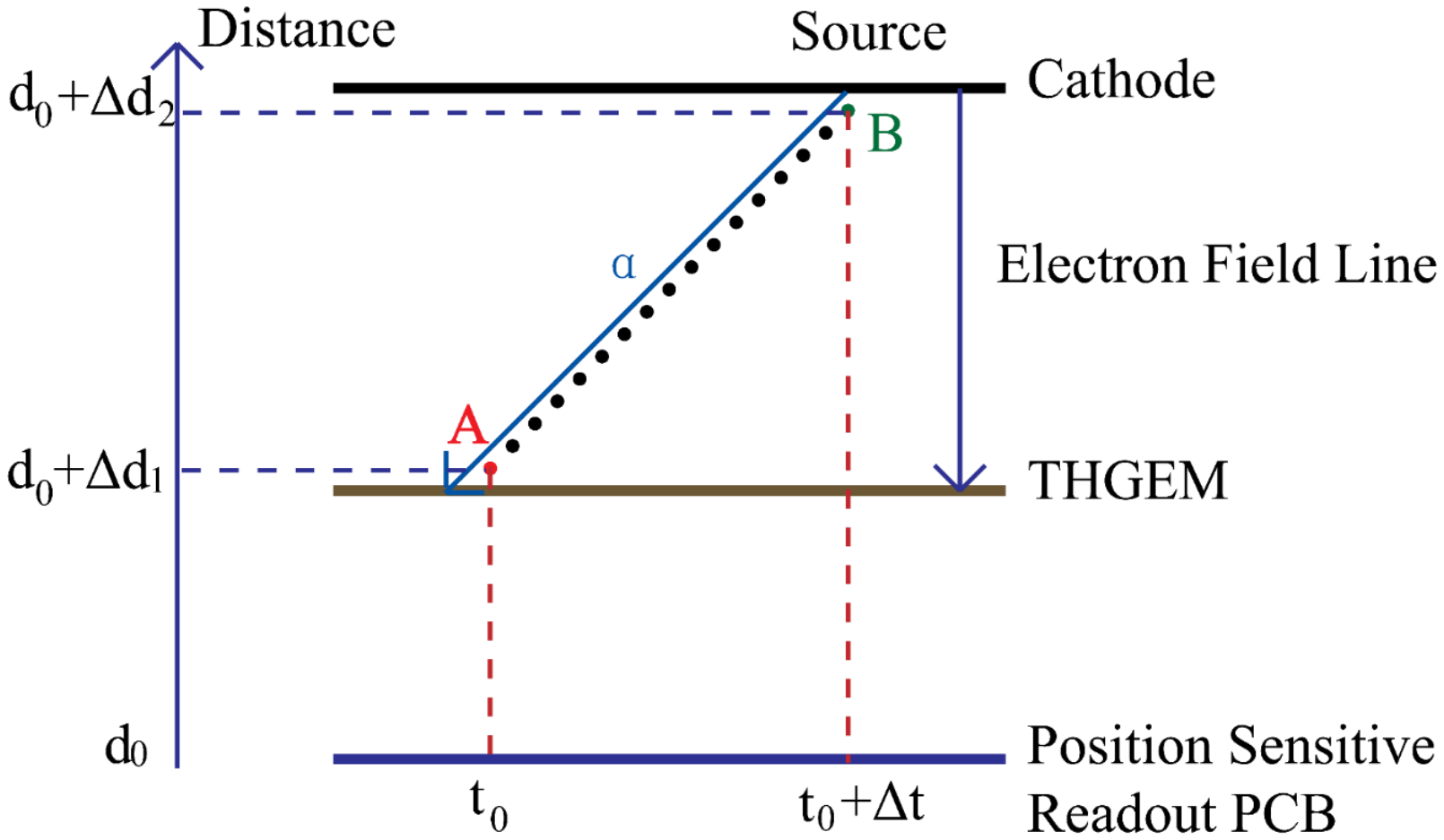
- One APV One sample per trigger : 288B
- One APV 30 samples per trigger : 8.408kB

4 chips * 30 samples * 320 rate *2 hours = 800GB

Work fine with GEM detector/ Alpha source

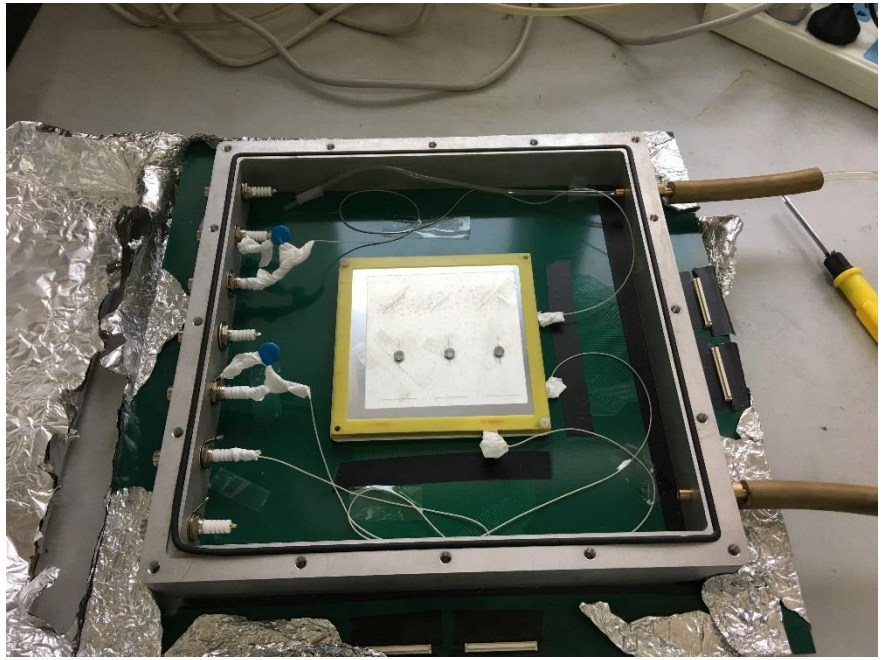
Alpha measurement with New DAQ

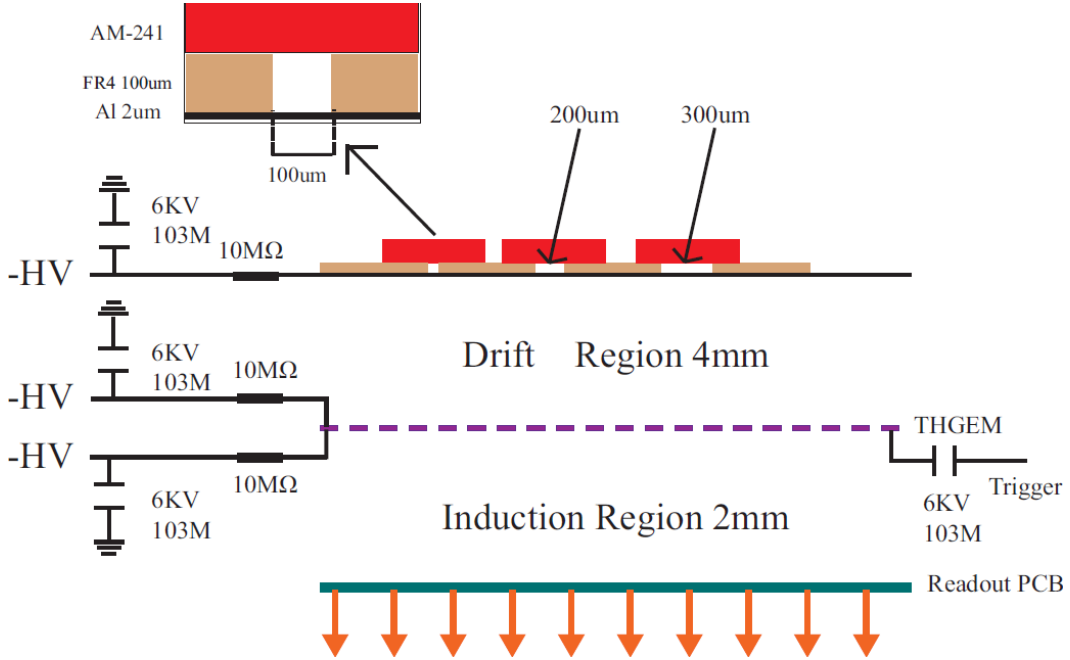
Alpha measurement with New DAQ



Vertex reconstruct based on time information (TPC-like)

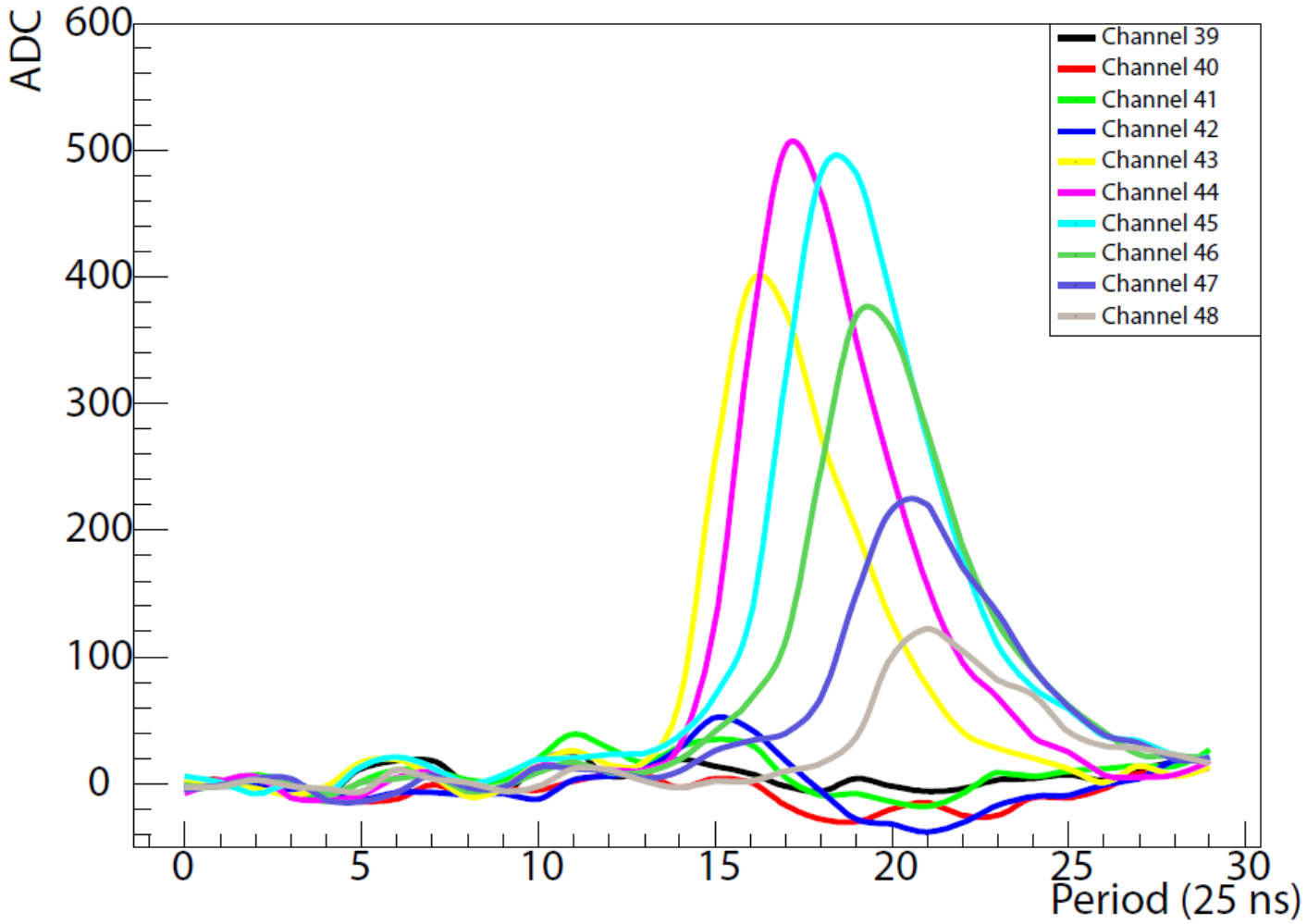
Alpha measurement with New DAQ





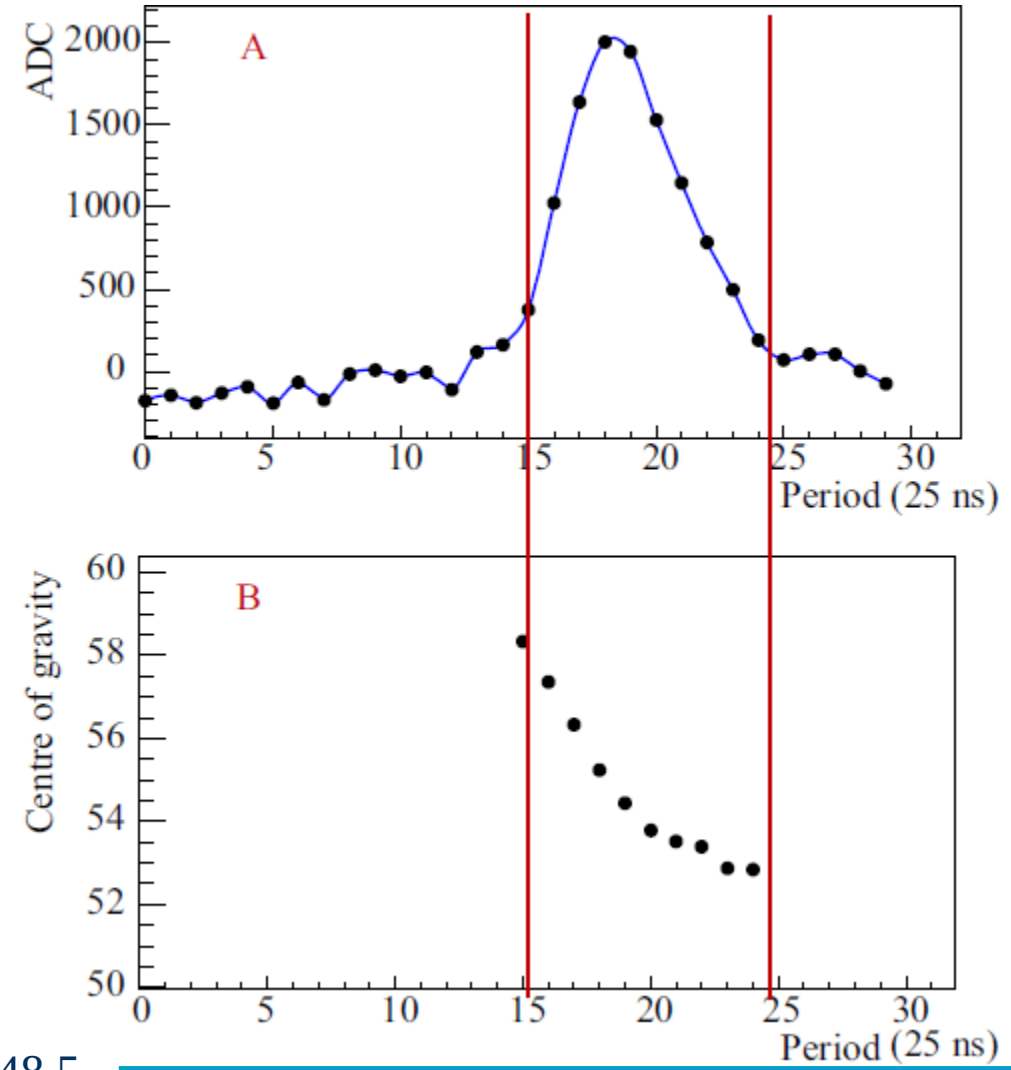
3 Alpha sources (Am-241)
The distance between each slit is 30 mm
Two-dimensional strip readout with 167 for each dimension

Alpha measurement with New DAQ



A typical Alpha signal with 30 samples

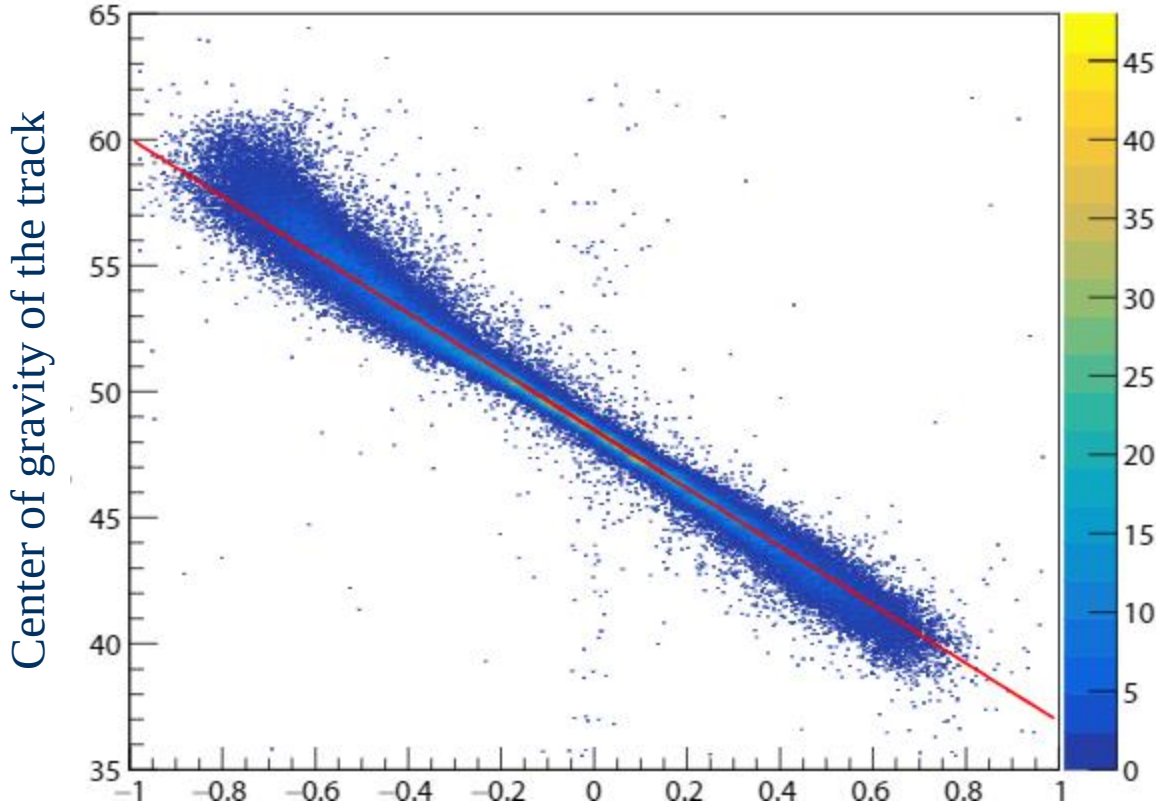
Alpha measurement with New DAQ



48.5

Incidence vertex

Alpha measurement with New DAQ



Weighted average of the shift for the center of gravity for each samples

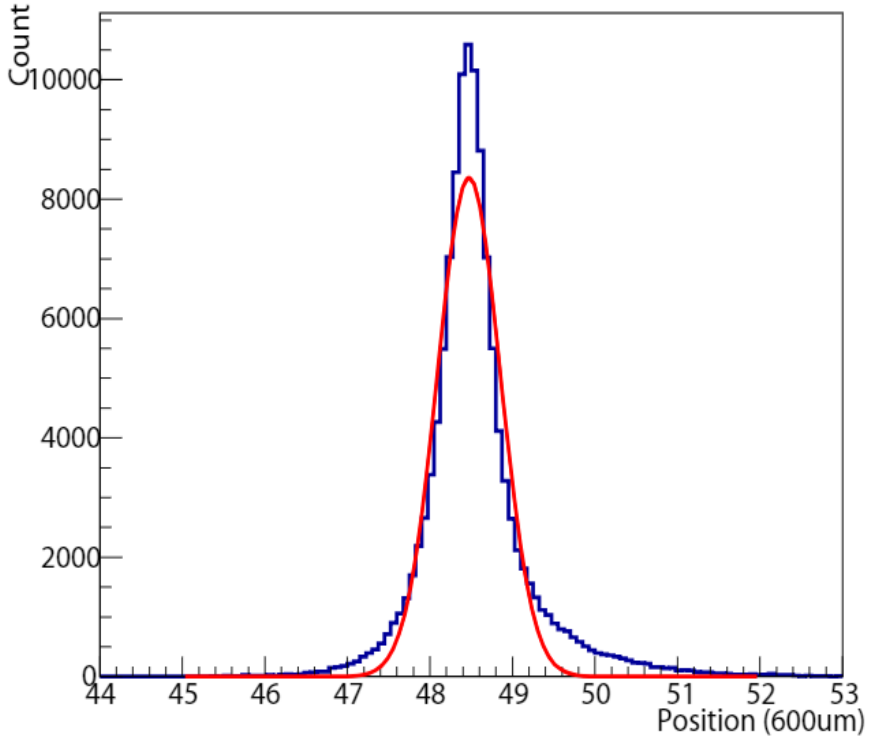
$$P = \alpha * K + \beta$$

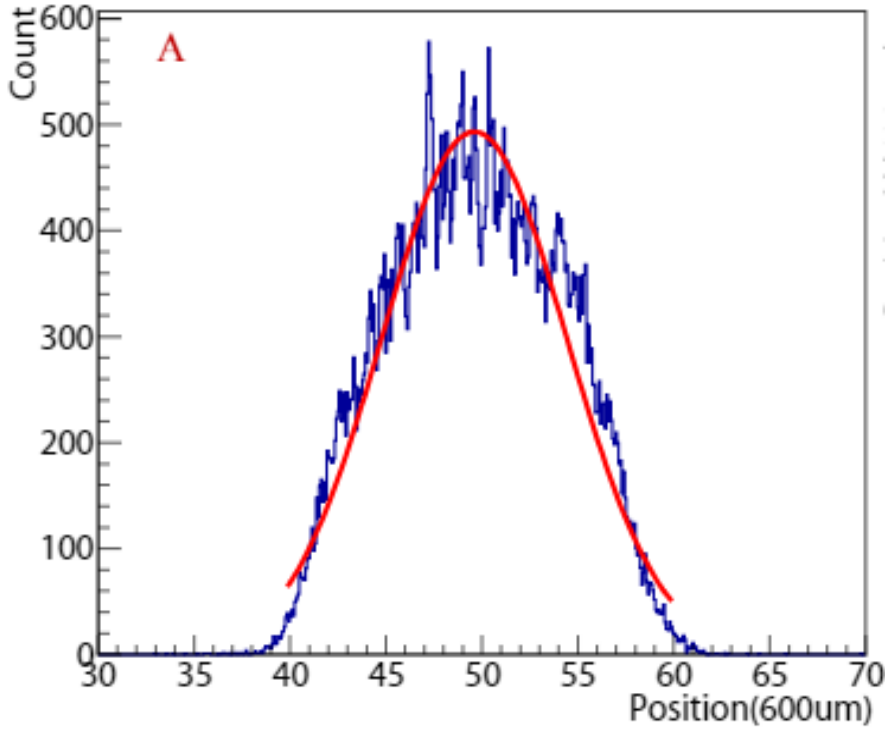
P： Incident vertex

K: A parameter based on the experimental setup, obtained by linear fitting

K= -11.55

Alpha measurement with New DAQ



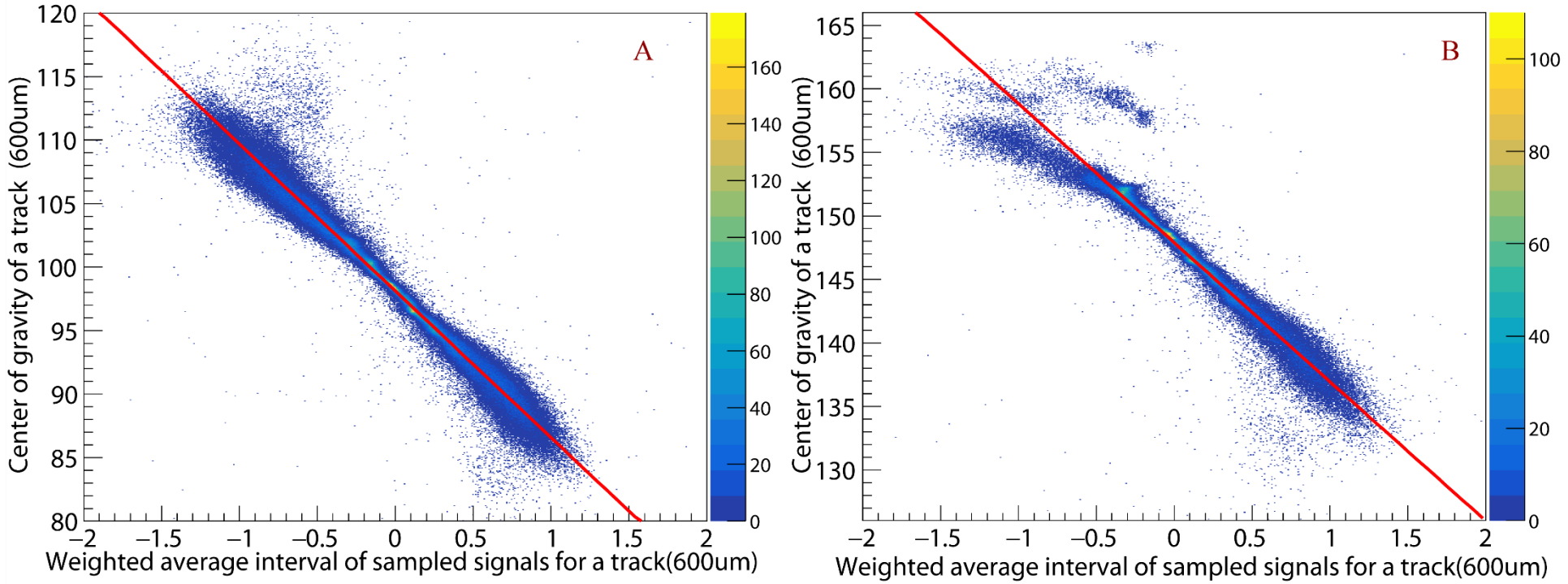


FWHM =0.45mm
TPC-like reconstruct

FWHM =9.1mm
Center of gravity

An order of magnitude optimization

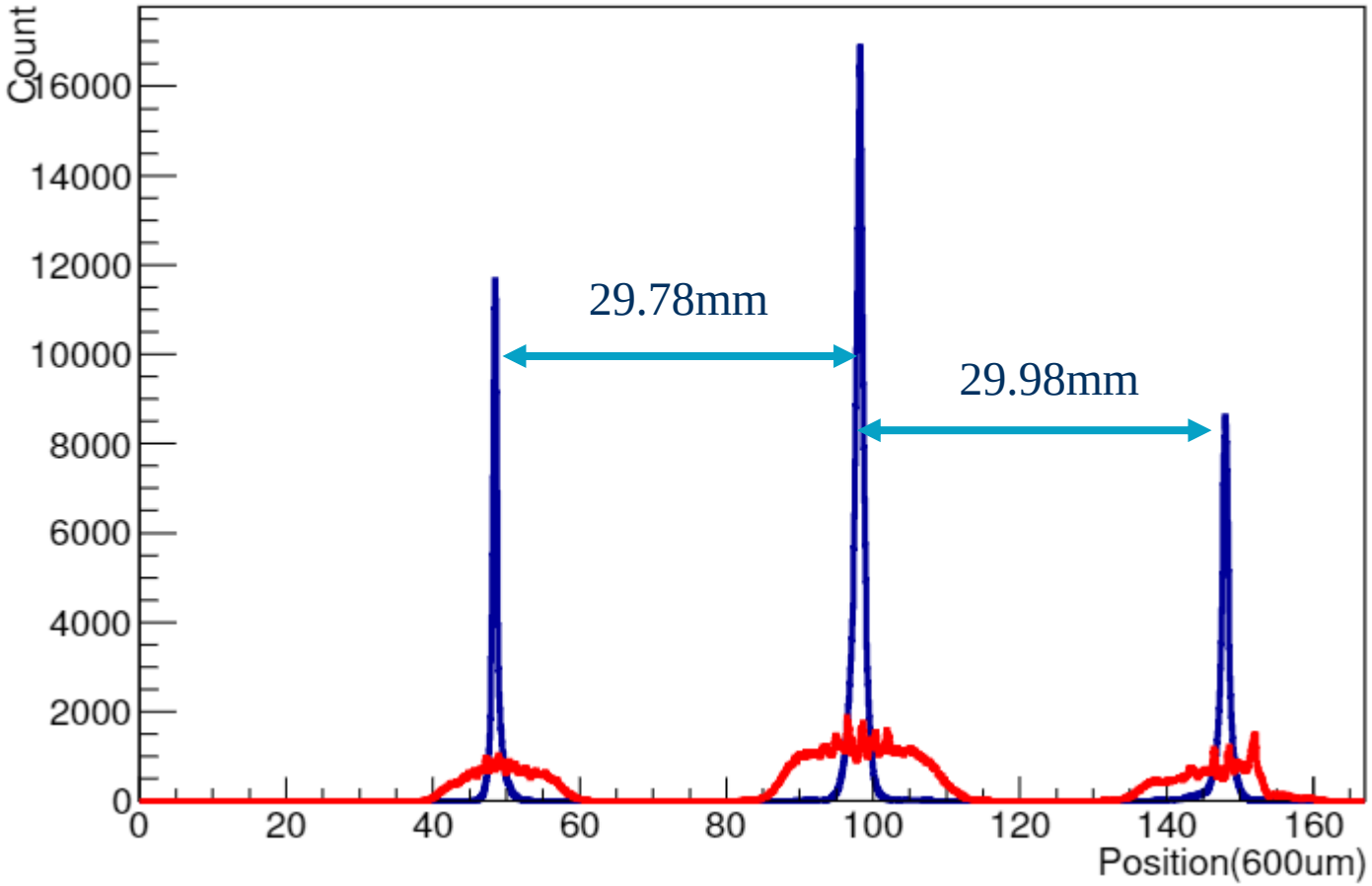
Alpha measurement with New DAQ



Second Slit K=-11.43

Second Slit K=-11.40

Alpha measurement with New DAQ



Red: Center of gravity
Blue: TPC-like

Summary

- We developed a new DAQ for APV-25 with better performance
- We improved the position resolution of alpha particle based on TPC-like method using the new DAQ

Thanks