

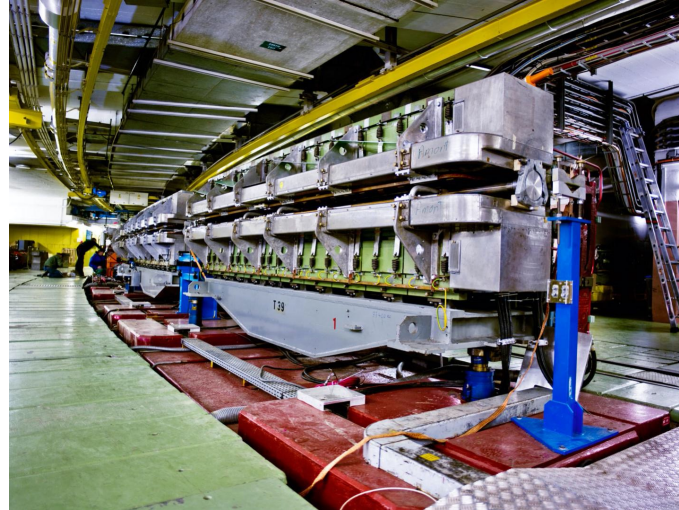
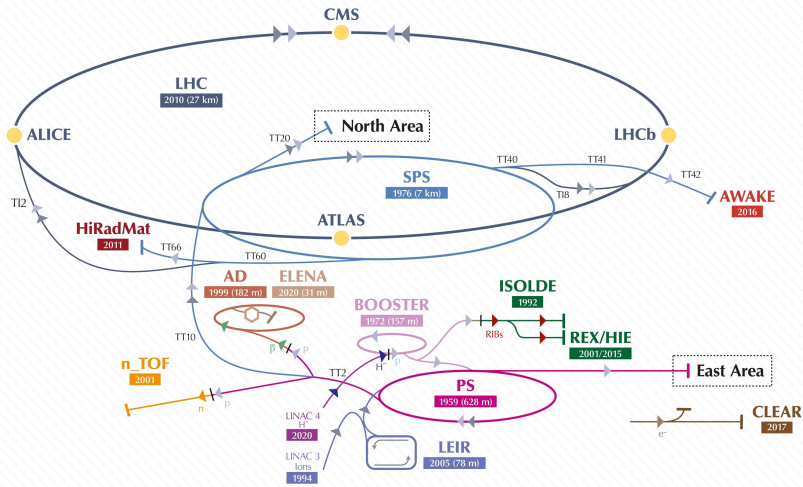
Beam test of glass scintillator tiles

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CEPC Physics and Detector plenary Meeting
June 16, 2023

General status at CERN

- 11 scintillator glass tiles successfully delivered from IHEP to CERN (May 16)
- Beamtest facility: CERN Proton Synchrotron (primary 24GeV protons)
- Parasitic runs with CALICE-CEPC calorimeter prototypes
- Major motivation: to measure the MIP response of each glass tile

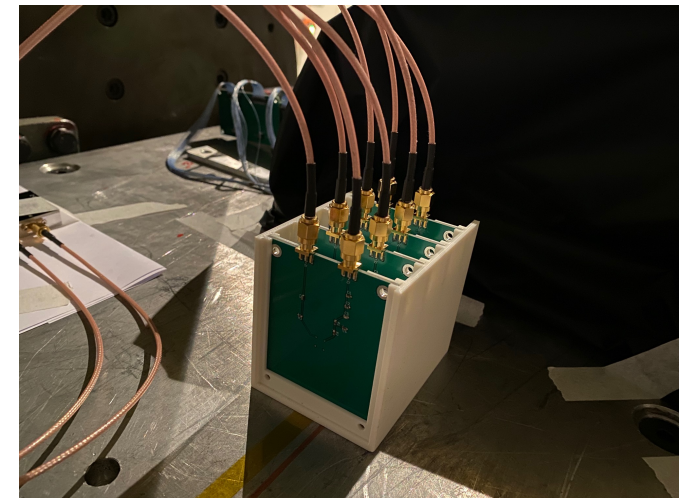
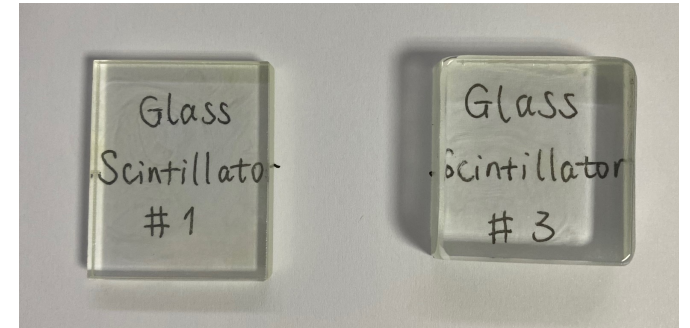
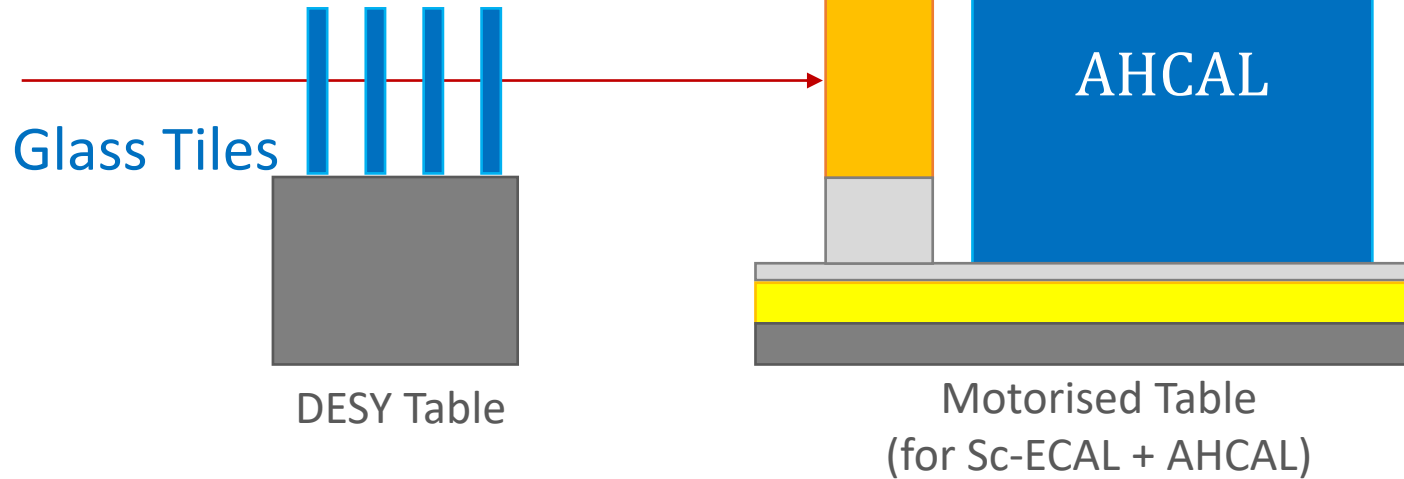


Beam test setup

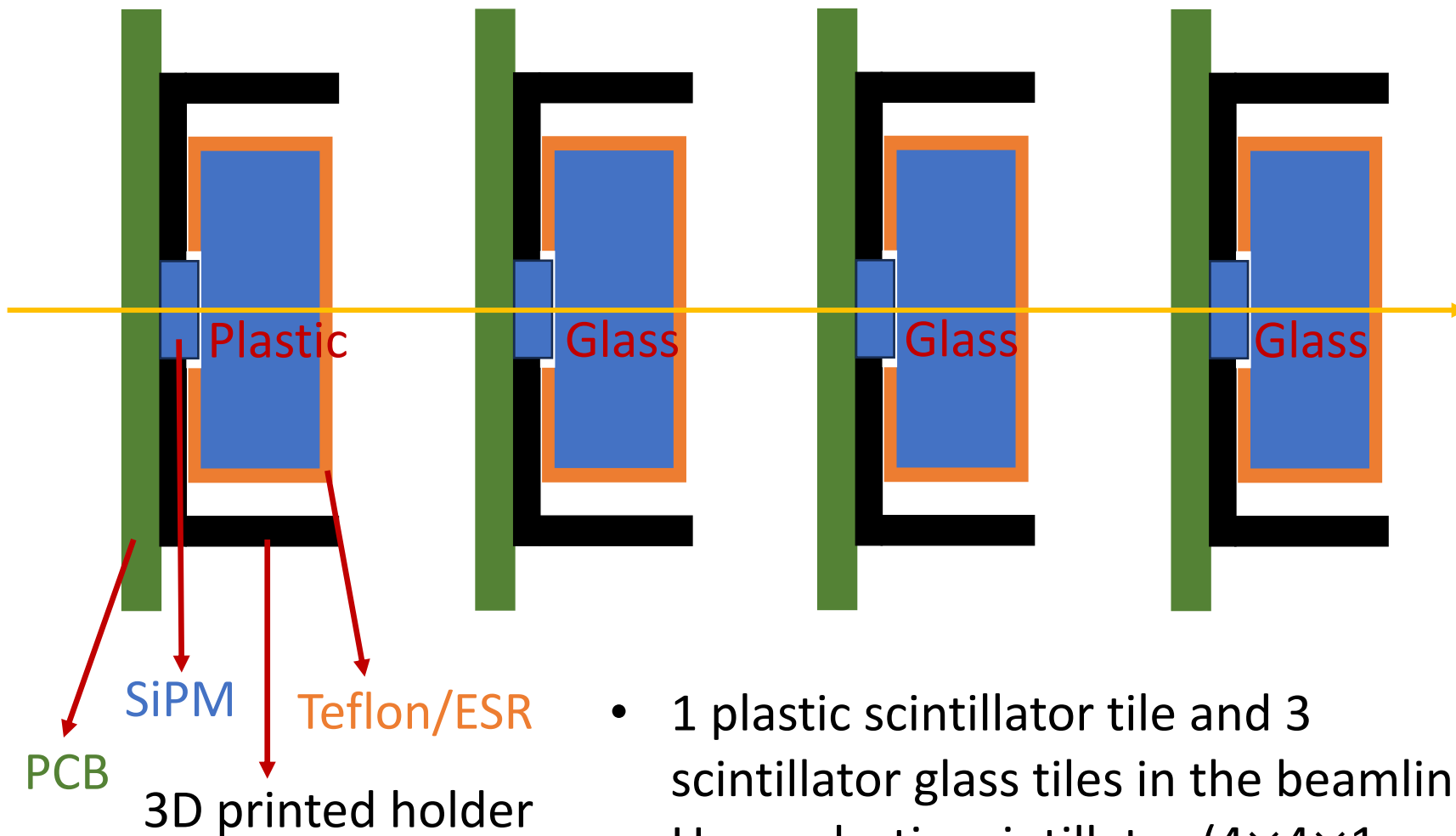
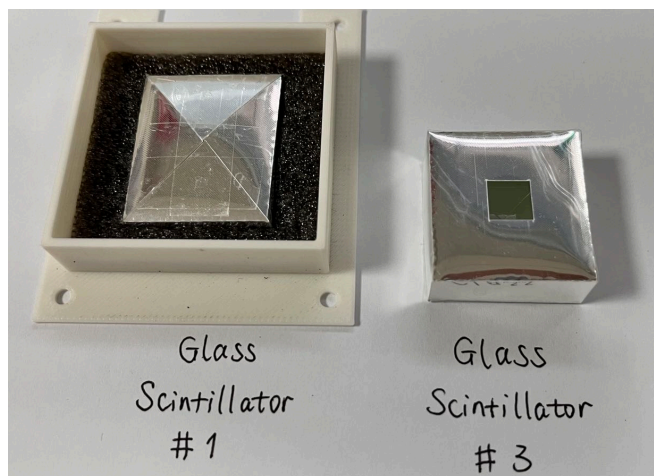
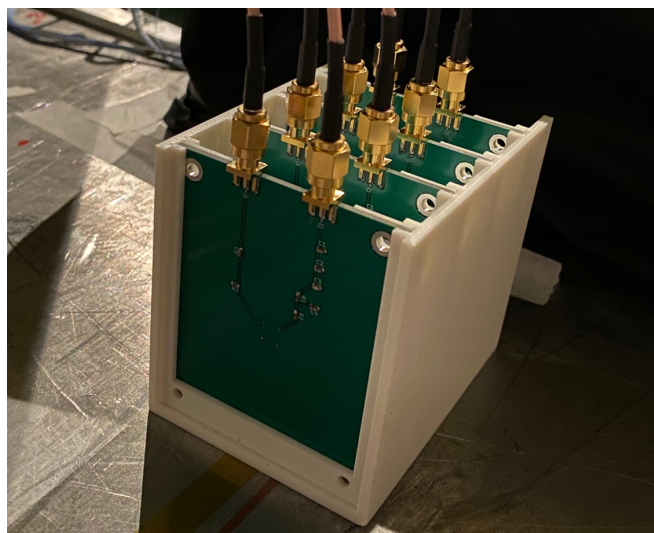
- 4 glass tiles in the beamline: individually read out by one SiPM
- Data acquisition using a 4-ch fast oscilloscope (5GS/s)
- 10GeV negative muon beams

CALICE-CEPC calorimeter prototypes

Beam particles



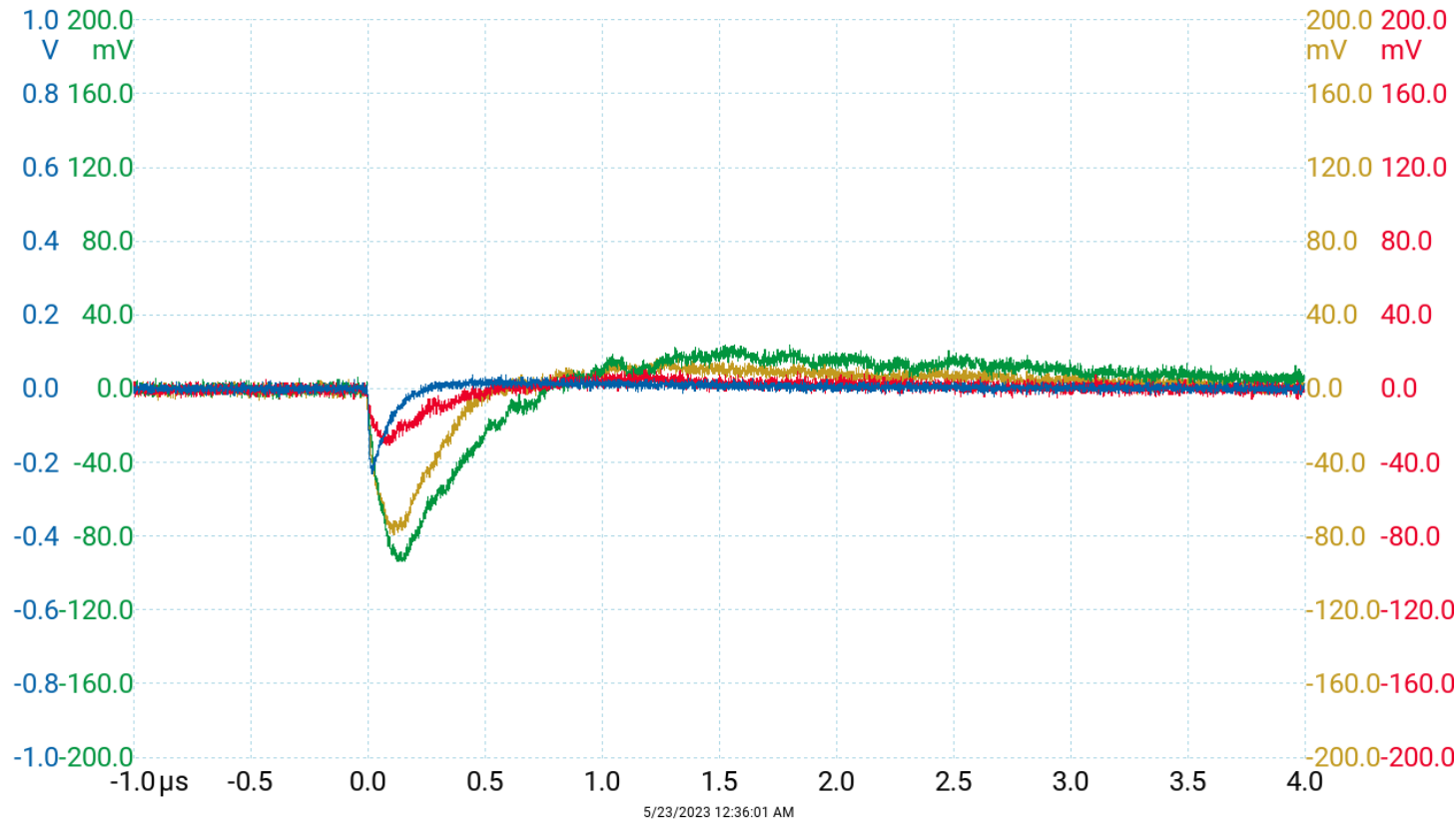
Beam test setup



- 1 plastic scintillator tile and 3 scintillator glass tiles in the beamline
- Use a plastic scintillator ($4 \times 4 \times 1 \text{ cm}^3$) as a reference

Results of beam test with muons

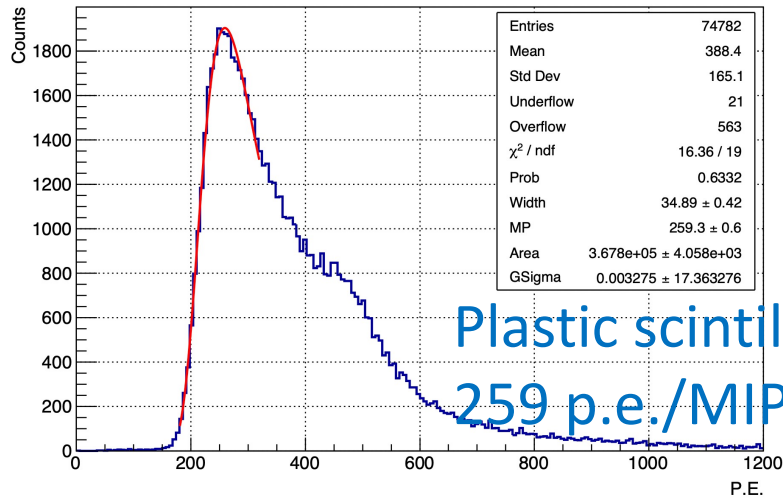
- Tested all 11 glass tiles and a plastic scintillator tile (reference) with 10 GeV muons
- Reminder: target ~ 150 p.e./MIP for large glass tiles (3cm-4cm)



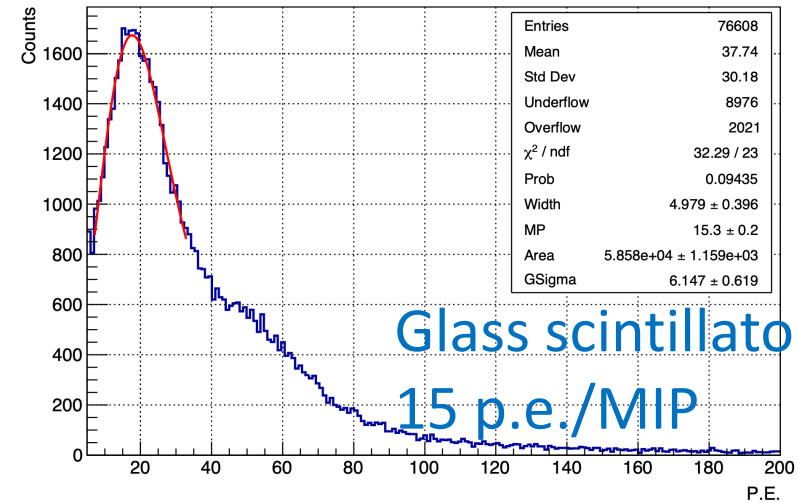
- Typical waveforms (4-ch):
- 3 glass tiles (green, yellow, red)
- 1 plastic tile (blue)

Results of beam test with muons

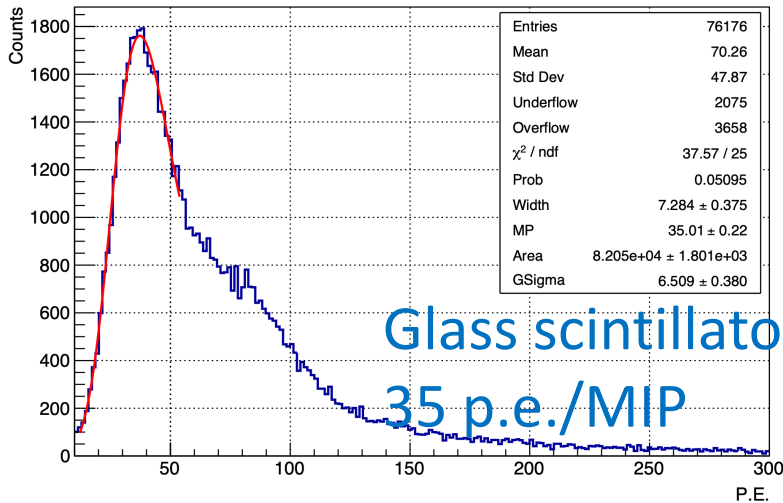
- Selected a group experimental results to show



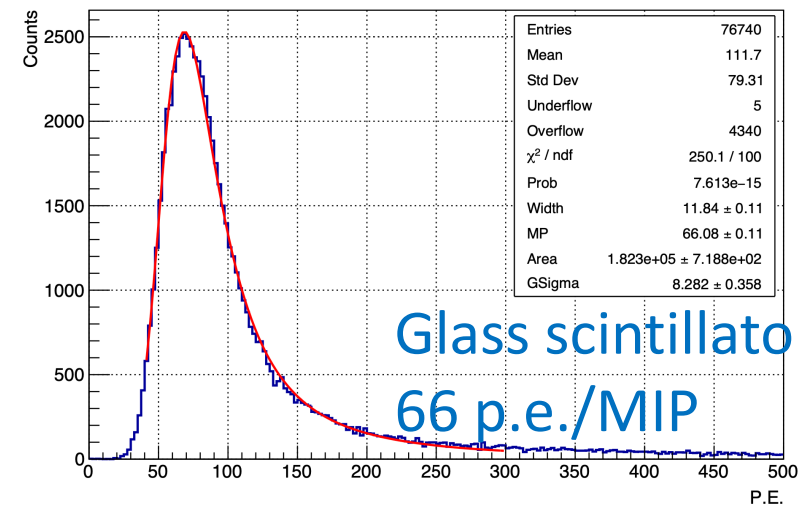
Plastic scintillator:
259 p.e./MIP



Glass scintillator (#1):
15 p.e./MIP



Glass scintillator (#2):
35 p.e./MIP

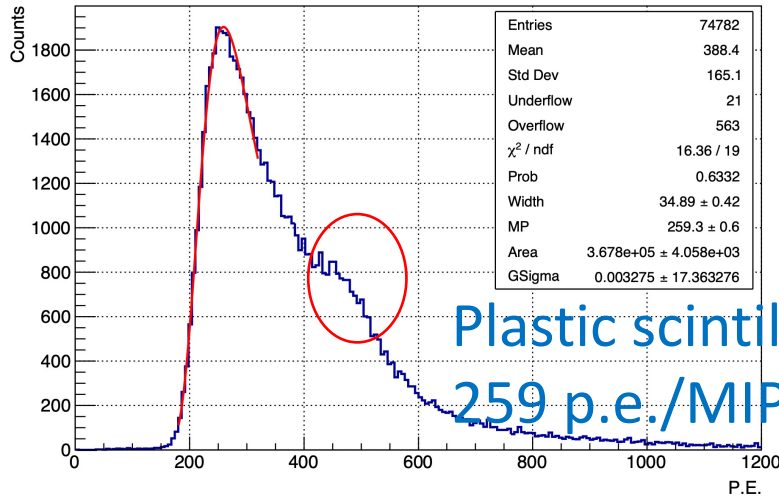


Glass scintillator (#3):
66 p.e./MIP

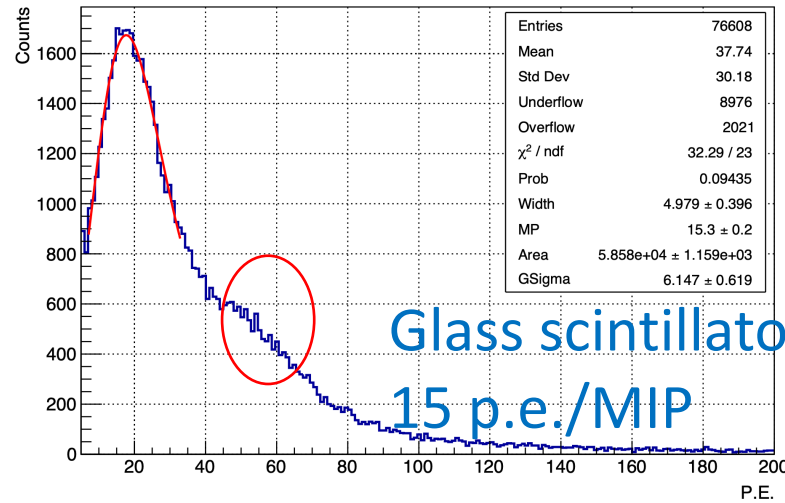


Results of beam test with muons

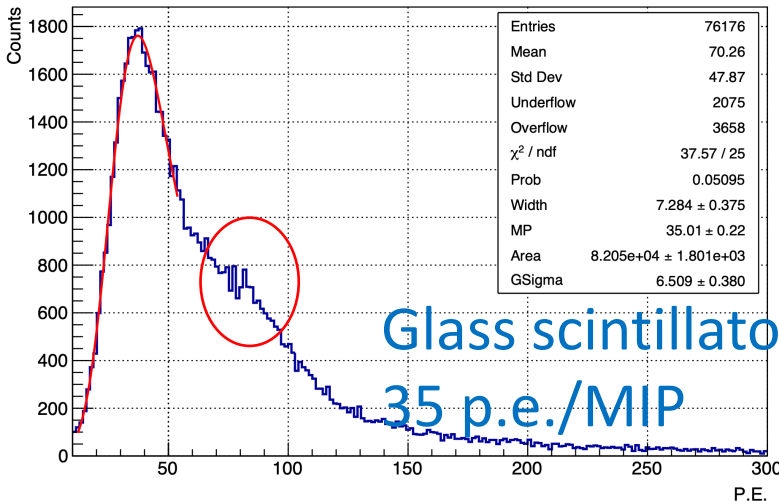
- Selected a group experimental results to show



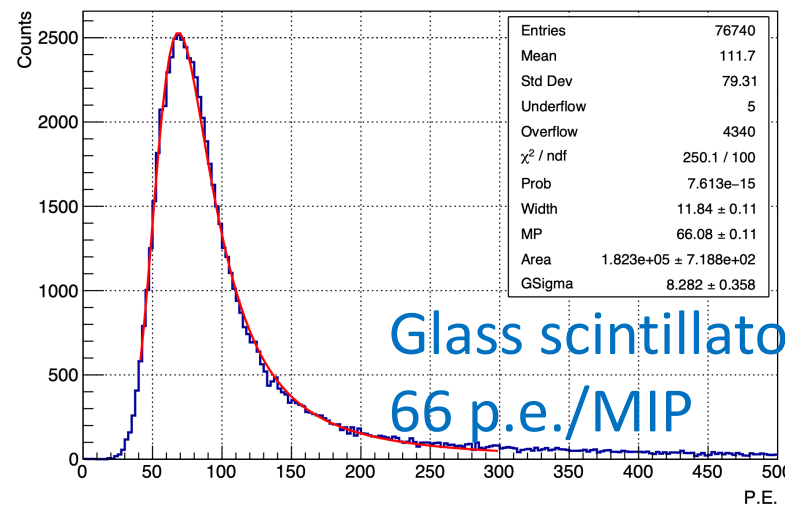
Plastic scintillator:
259 p.e./MIP



Glass scintillator (#1):
15 p.e./MIP



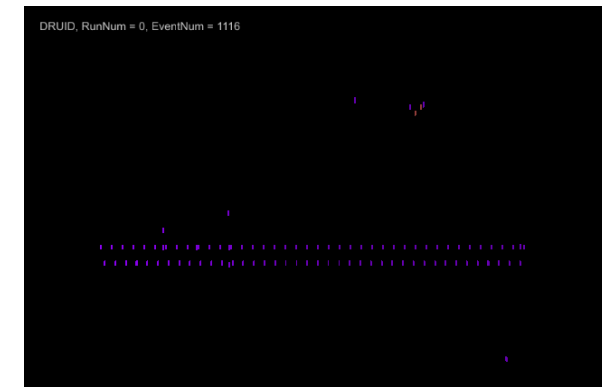
Glass scintillator (#2):
35 p.e./MIP



Glass scintillator (#3):
66 p.e./MIP

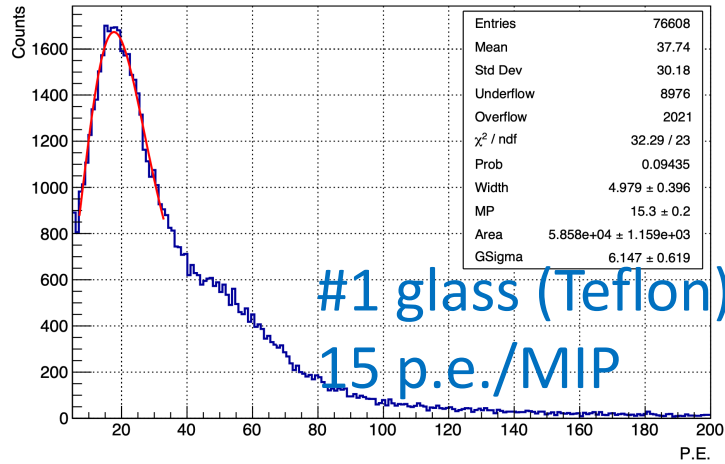
Strange structure:

- It's waveform is no different from any other event
- two-muons events ?
- Why doesn't #3 have this structure ?

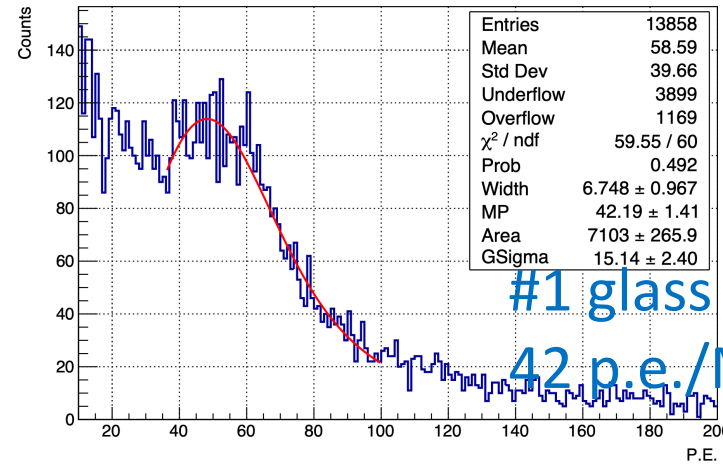


Results of beam test with muons

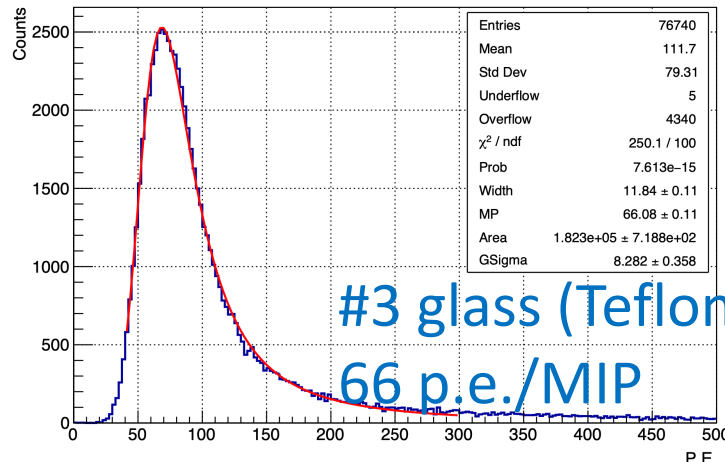
- Impact of different reflecting film (Teflon and ESR)
 - Selected two glass samples with regular shapes (#1 and #3)



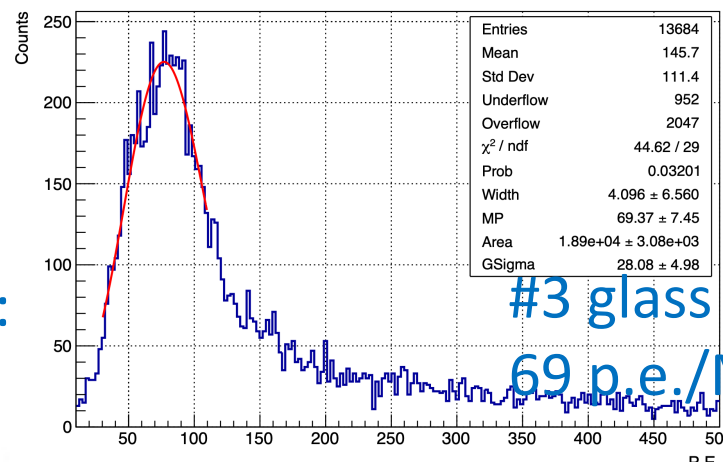
#1 glass (Teflon):
15 p.e./MIP



#1 glass (ESR):
42 p.e./MIP



#3 glass (Teflon):
66 p.e./MIP

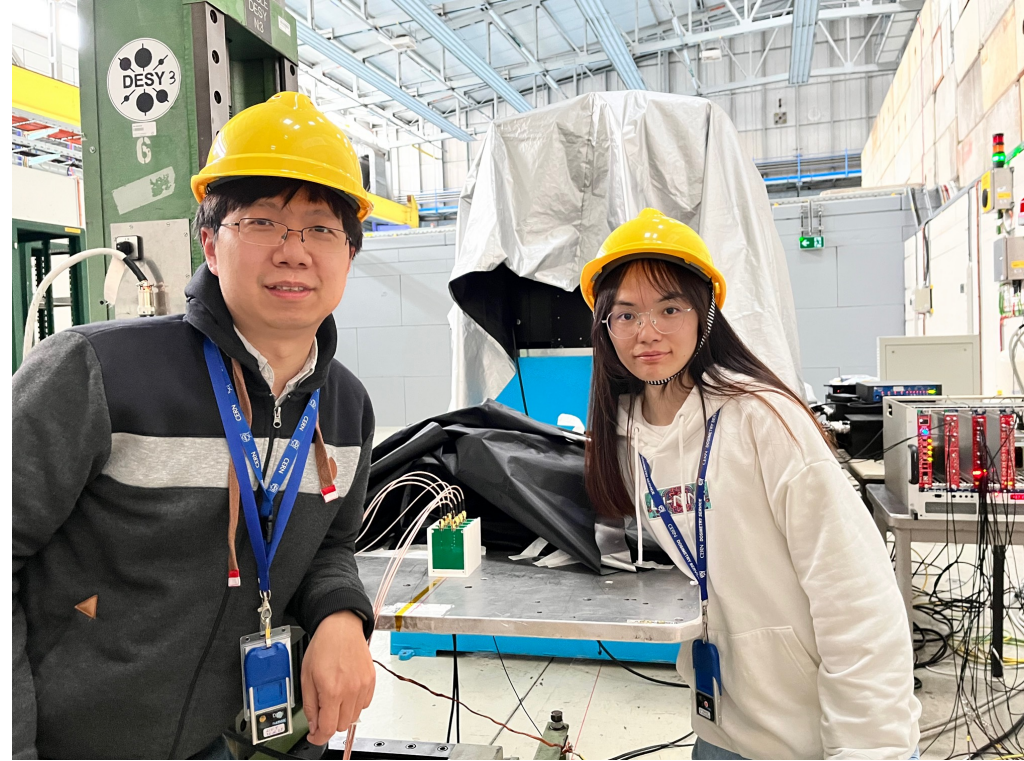
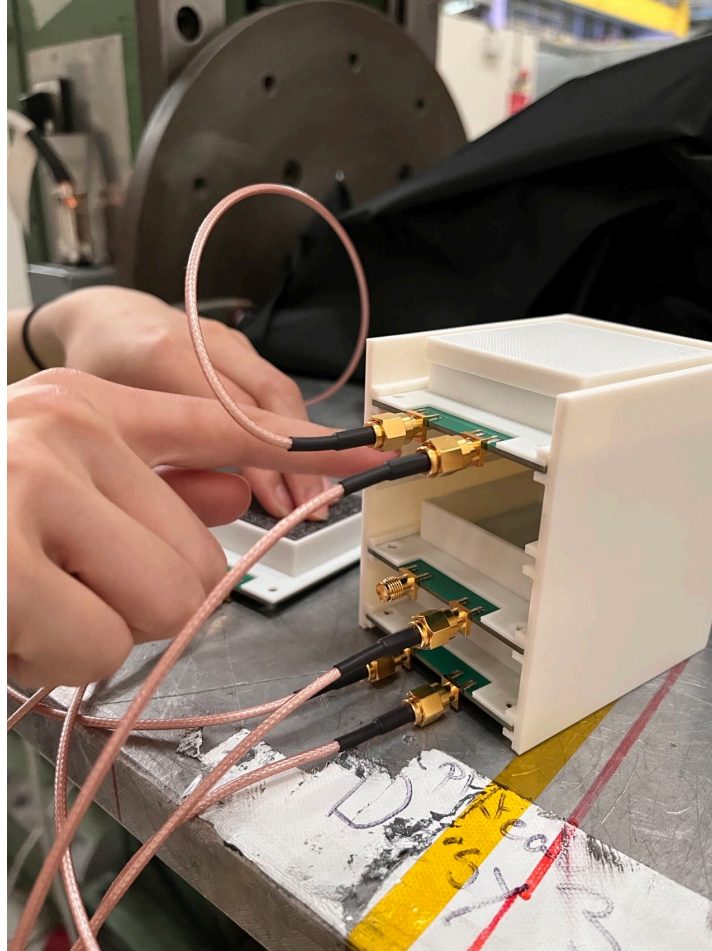
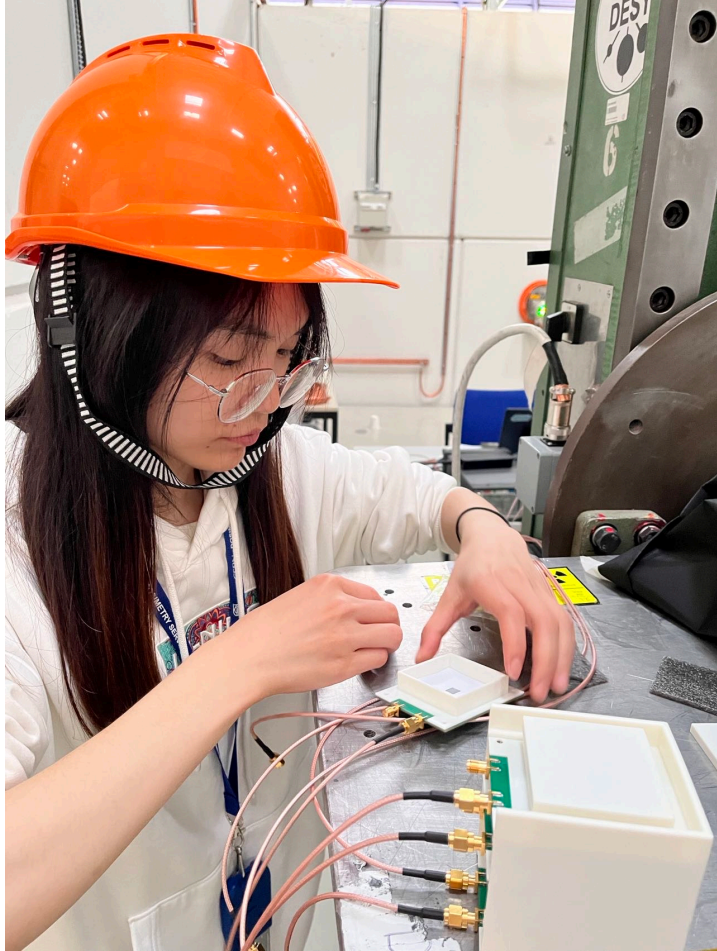


#3 glass (ESR):
69 p.e./MIP

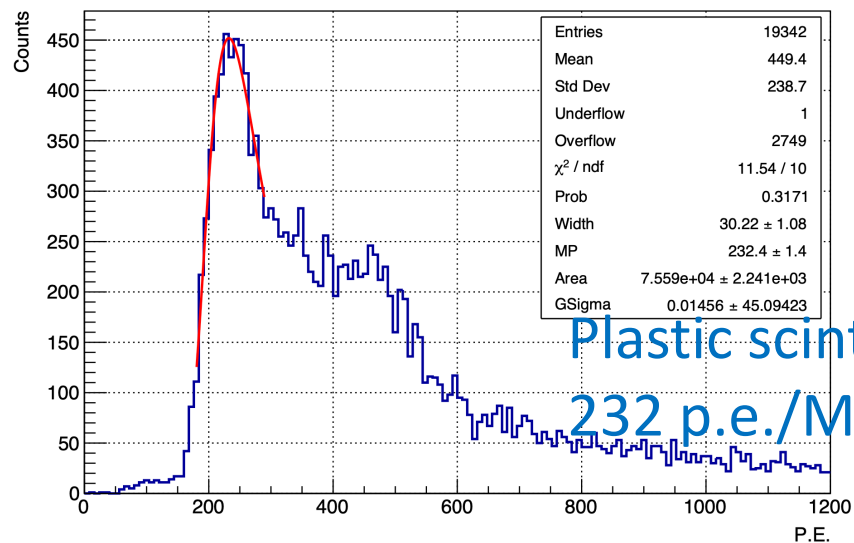
- MIP light yield of #1 was significantly improved by using ESR film
- MIP LY of #3 was slightly improved by using ESR film

	Size (mm ³)	Density (g/cm ³)	T (%)	LY (ph/MeV)	Decay time (ns)	MIP_LY (p.e./MIP)	Normalized 10mm
#1	33.5×27.6×5.1	~5.1	69	600	300 (19%), 881	15	29.4
#1 (ESR)				/		42	82.4
#2	30.2×29.5×6.6	~5.1	61	611	114 (11%), 770	35	53.0
#3	29.9×28.1×10.2	~5.1	70	613	90 (6%), 754	66	64.7
#3 (ESR)				/		69	67.6
#4	37.2×35.1×5.3	~5.1	80	506	96 (6%), 1024	31	58.5
#5	40.0×35.1×4.2	~5.1	78	407	335 (26%), 1068	38	90.5
#6	30.3×29.8×9.4	~5.1	55	393	134 (5%), 1132	67	71.3
#7	34.8×34.8×7.5	~5.1	65	360	113 (27%), 394	60	80.0
#8	27.8×25.6×5.0	~5.1	81	840	136 (23%), 933	41	82.0
#9	34.6×34.7×7.5	~5.1	49	352	141 (12%), 771	69	92.0
#10	34.7×35.2×7.4	~5.1	64	524	129 (10%), 819	74	100.0
#11	30.5×30.0×8.7	~5.1	81	767	153 (12%), 1085	73	83.9

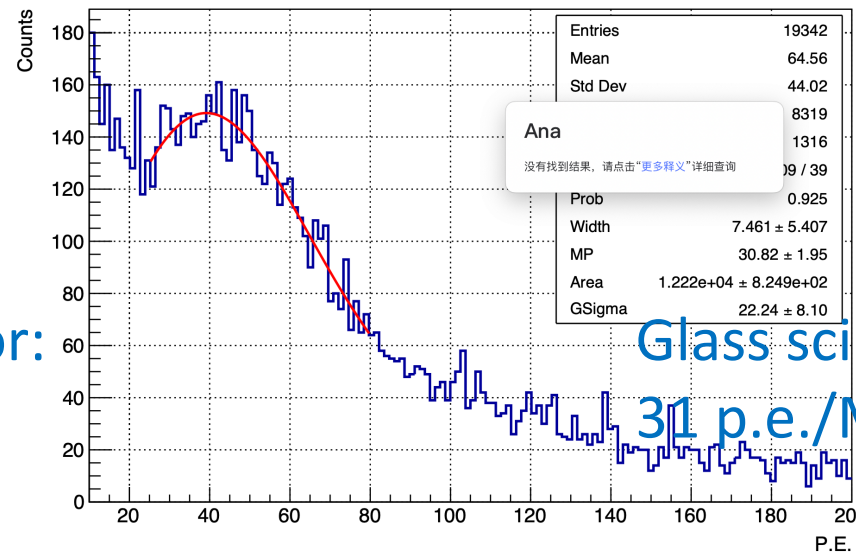
Photos at CERN PS-T09



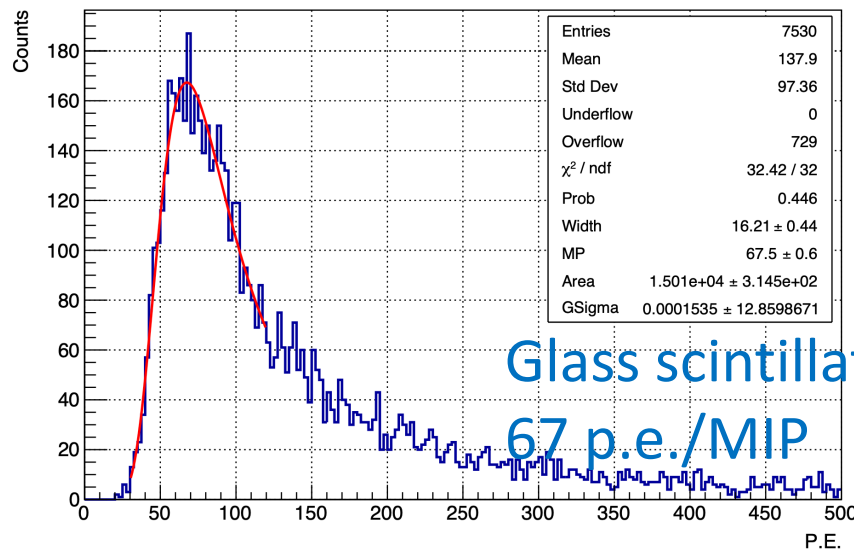
Backups



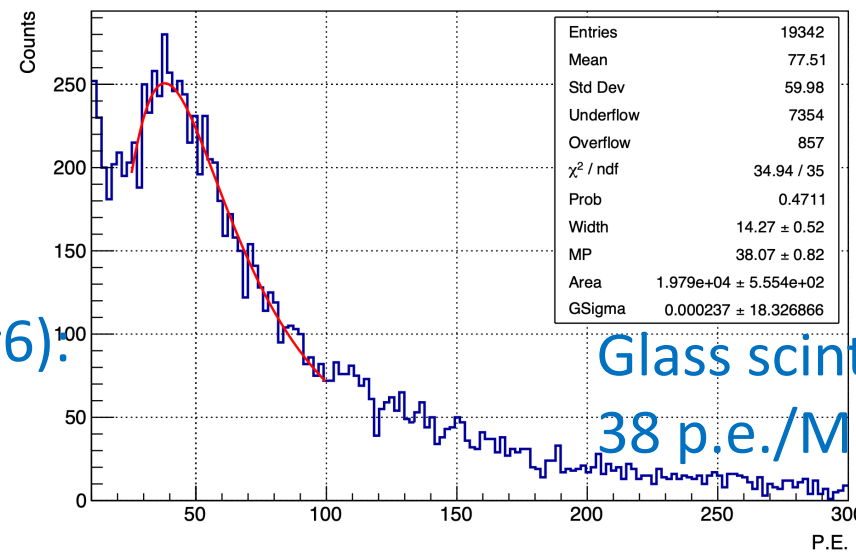
Plastic scintillator:
232 p.e./MIP



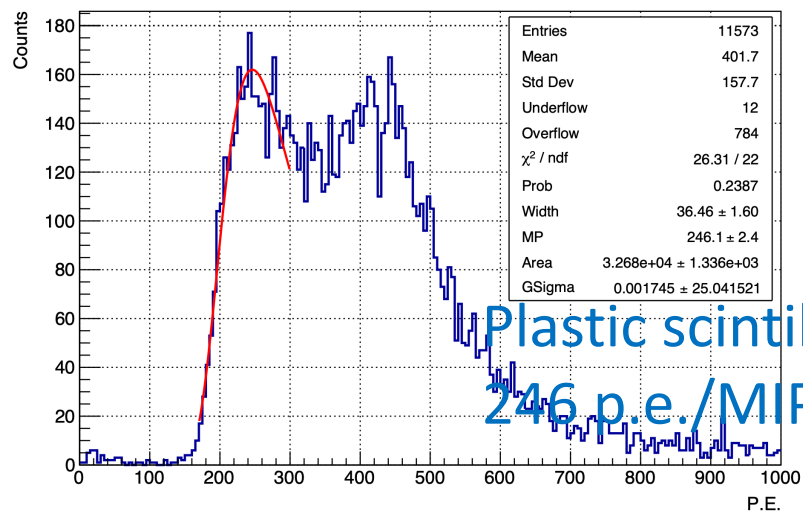
Glass scintillator (#4):
31 p.e./MIP



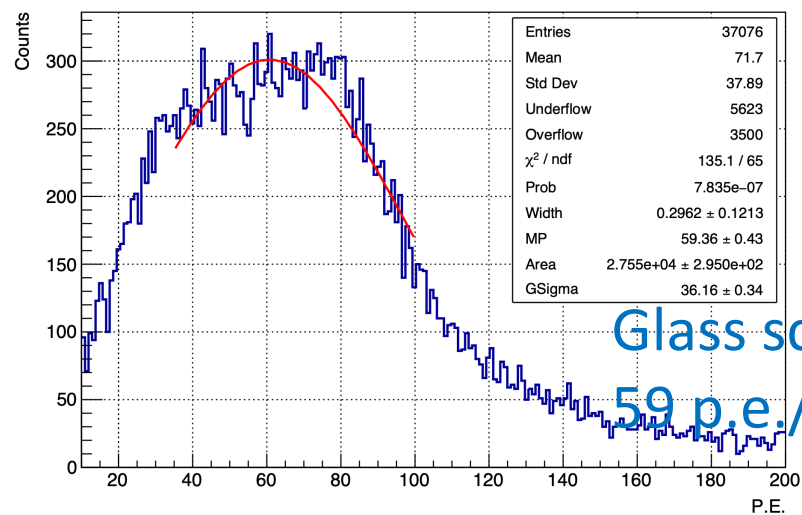
Glass scintillator (#6):
67 p.e./MIP



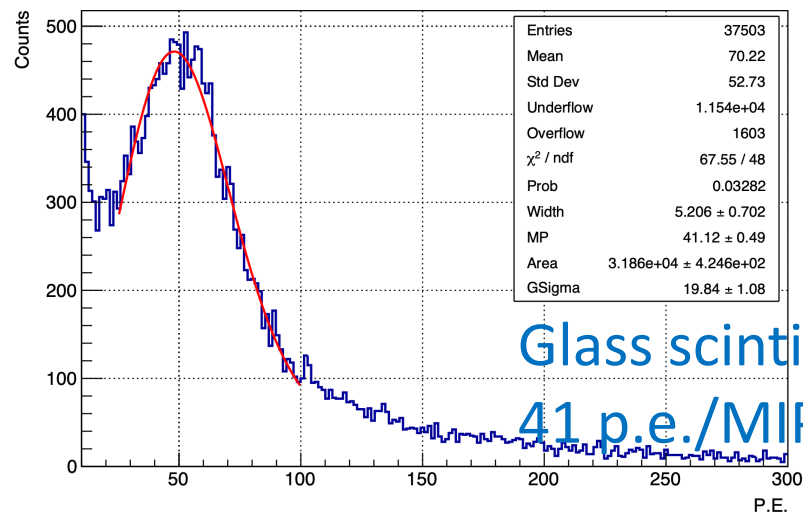
Glass scintillator (#5):
38 p.e./MIP



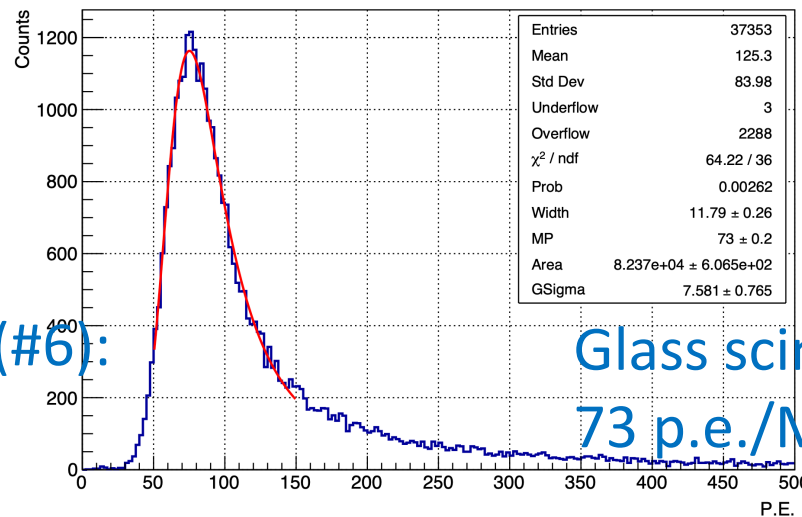
Plastic scintillator:
246 p.e./MIP



Glass scintillator (#4):
59 p.e./MIP

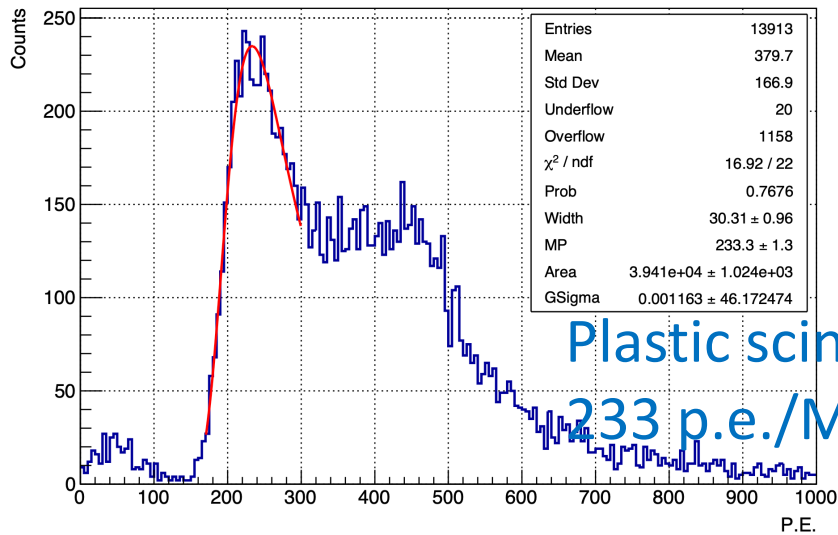


Glass scintillator (#6):
41 p.e./MIP

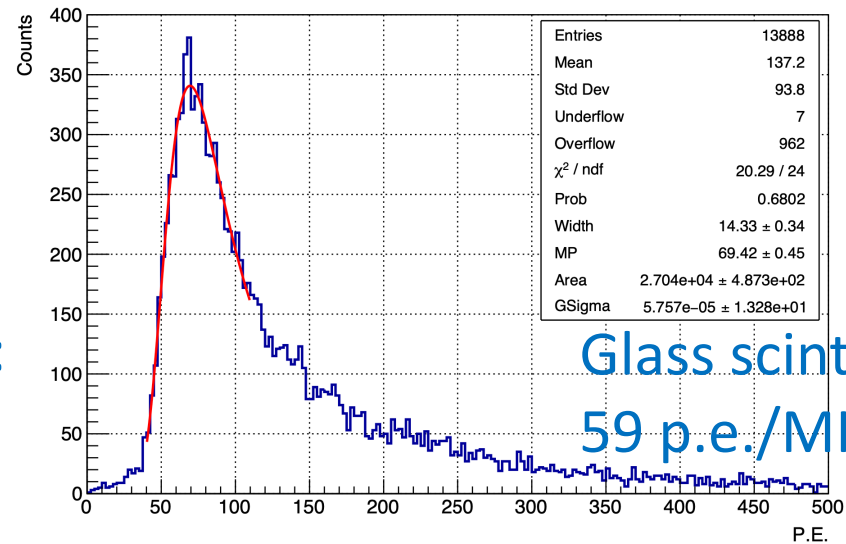


Glass scintillator (#5):
73 p.e./MIP

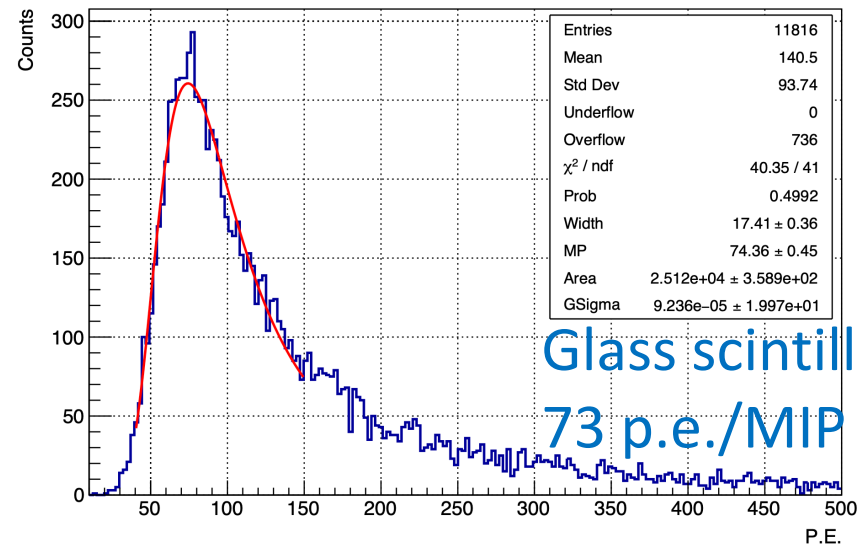




Plastic scintillator:
233 p.e./MIP



Glass scintillator (#4):
59 p.e./MIP



Glass scintillator (#5):
73 p.e./MIP

