



中国科学院高能物理研究所
Institute of High Energy Physics
Chinese Academy of Sciences



The Chinese Academy
of Sciences



闪烁玻璃合作组
Glass Scintillator Collaboration

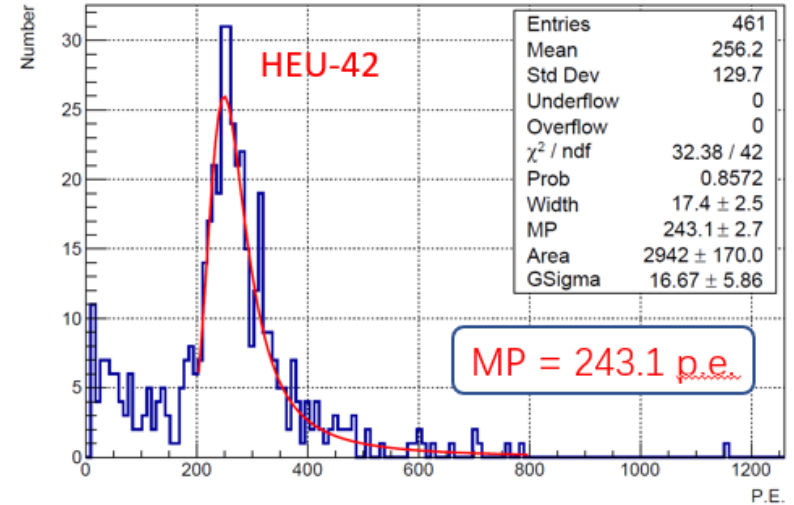
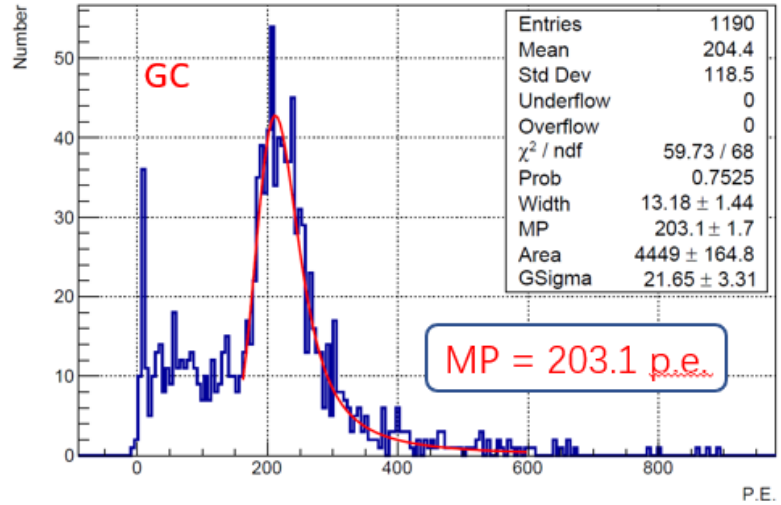
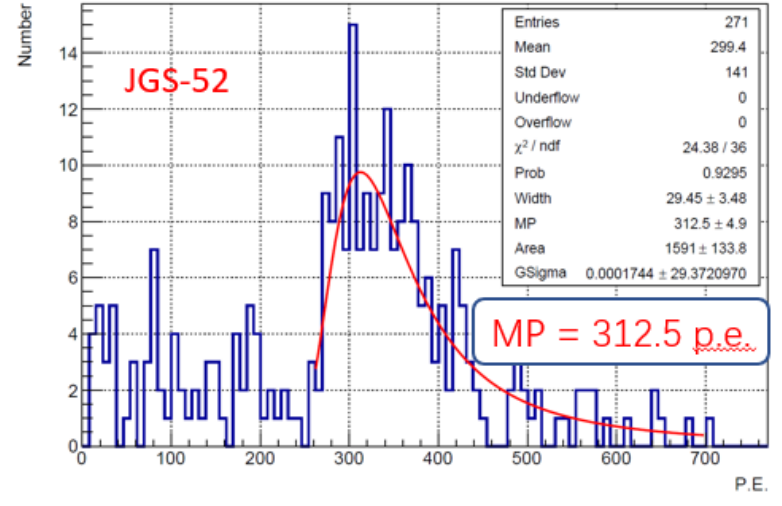
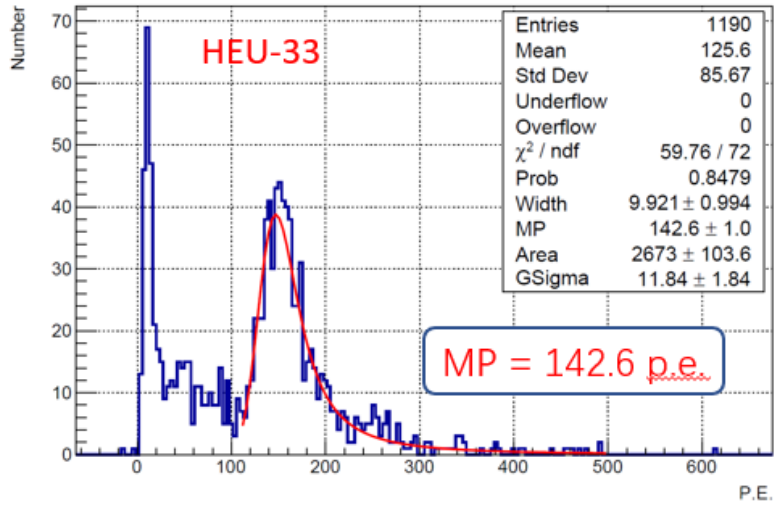
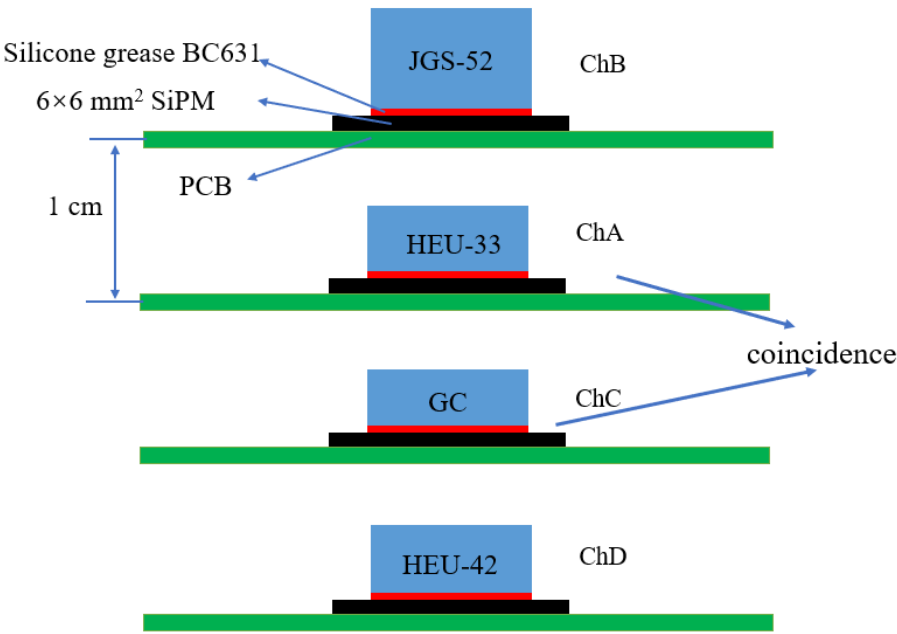
Research on the effect of integral time on glass scintillator

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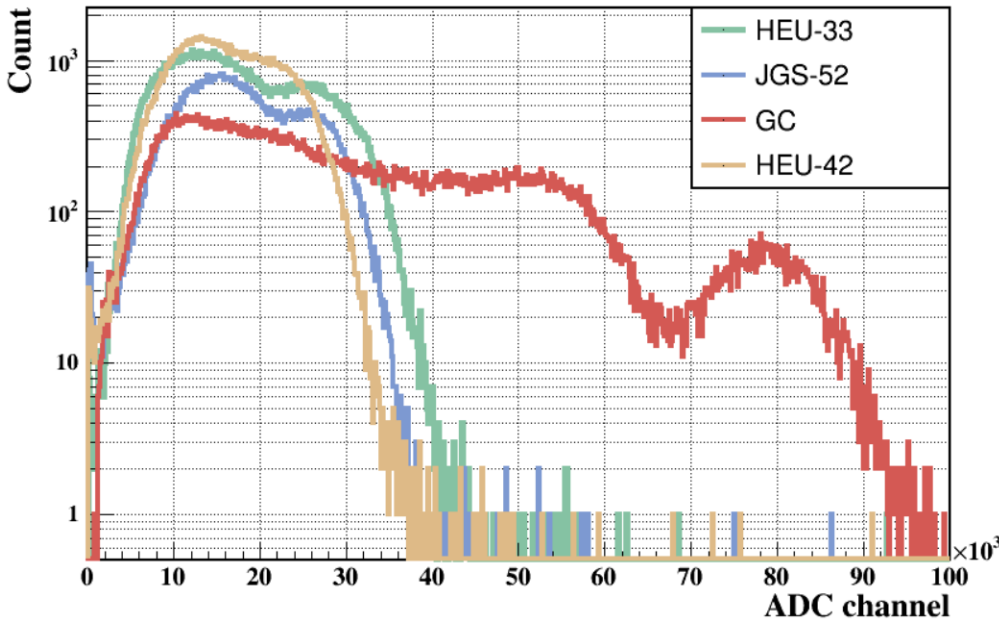
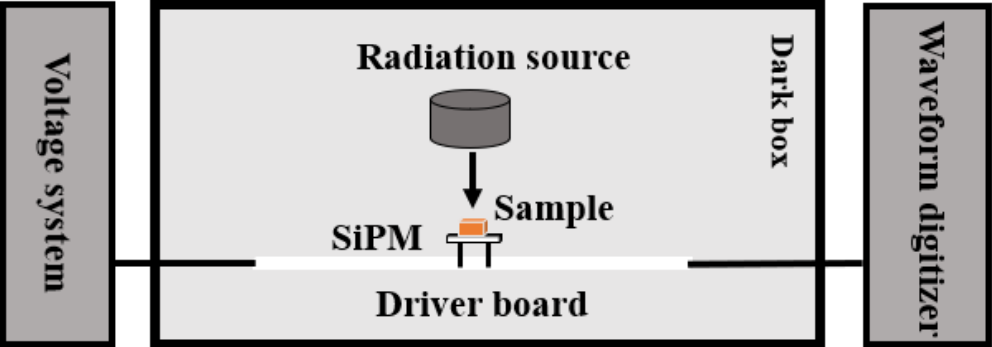
Cosmic ray experiments

By Du Dejing



- The MIP response of the glasses was measured by cosmic ray experiment

Gamma light yield vs MIP response

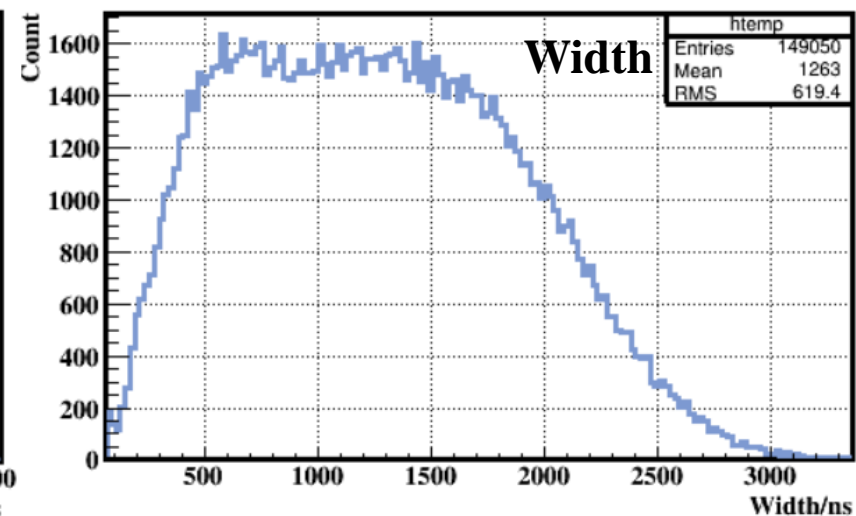
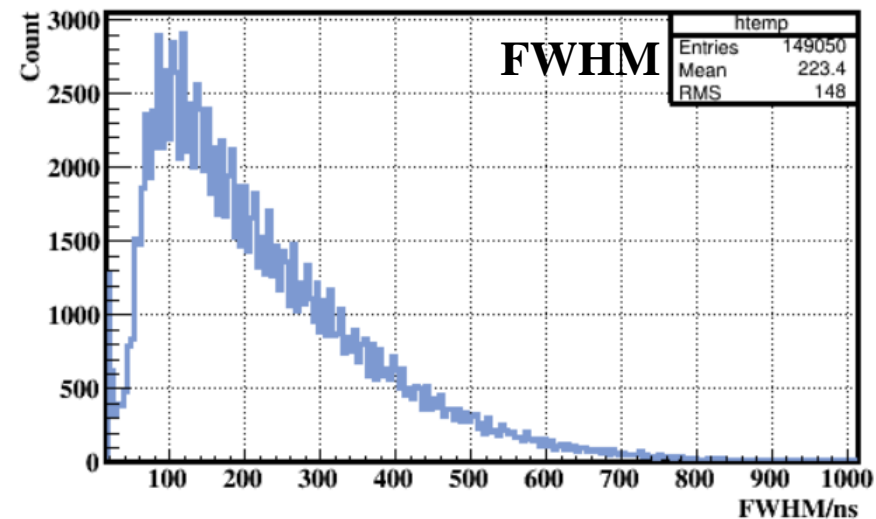
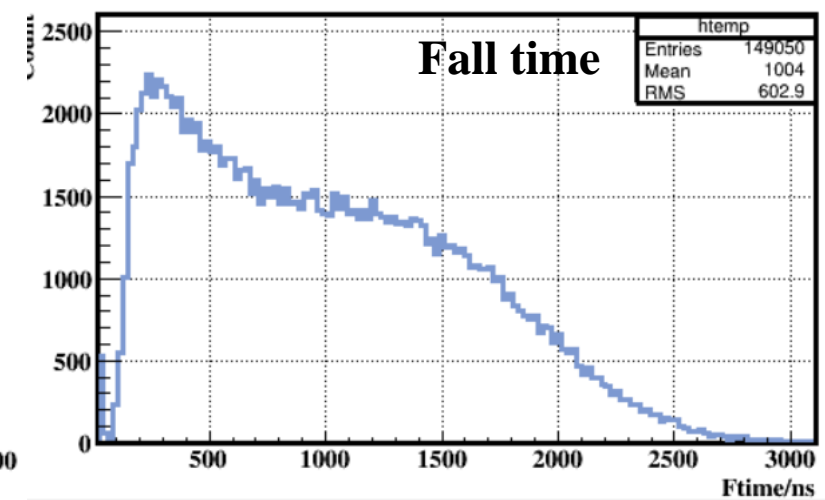
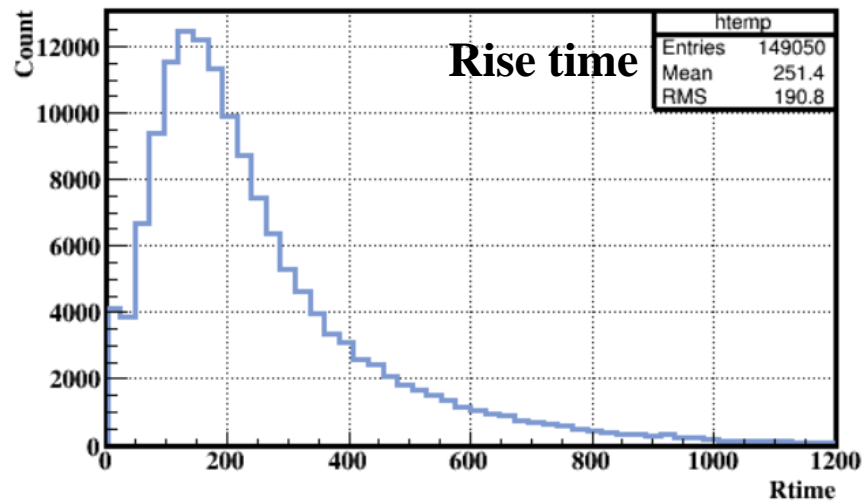
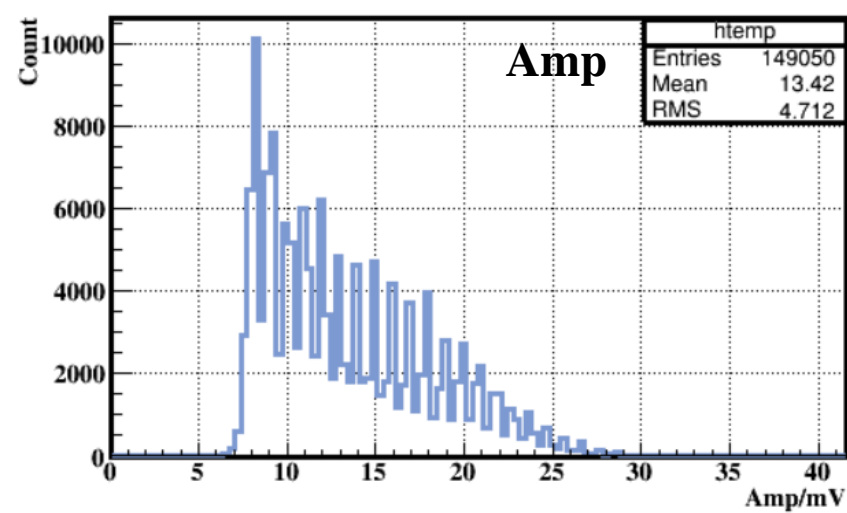


	MIP (p.e.)	LY (ph/MeV)	Thickness (mm)	Density (g/cm ³)	MIP/ (Thi*Den)	
HEU-33	143	1117	2.6	5.4	10.2	110
JGS-52	313	1070	5	6.0	10.4	103
GC	203	3455	2	3.3	30.6	113
HEU-42	243	1100	3	6.0	13	85

- The light yield is consistent with the MIP response, there is no problem in the test process

Waveform information

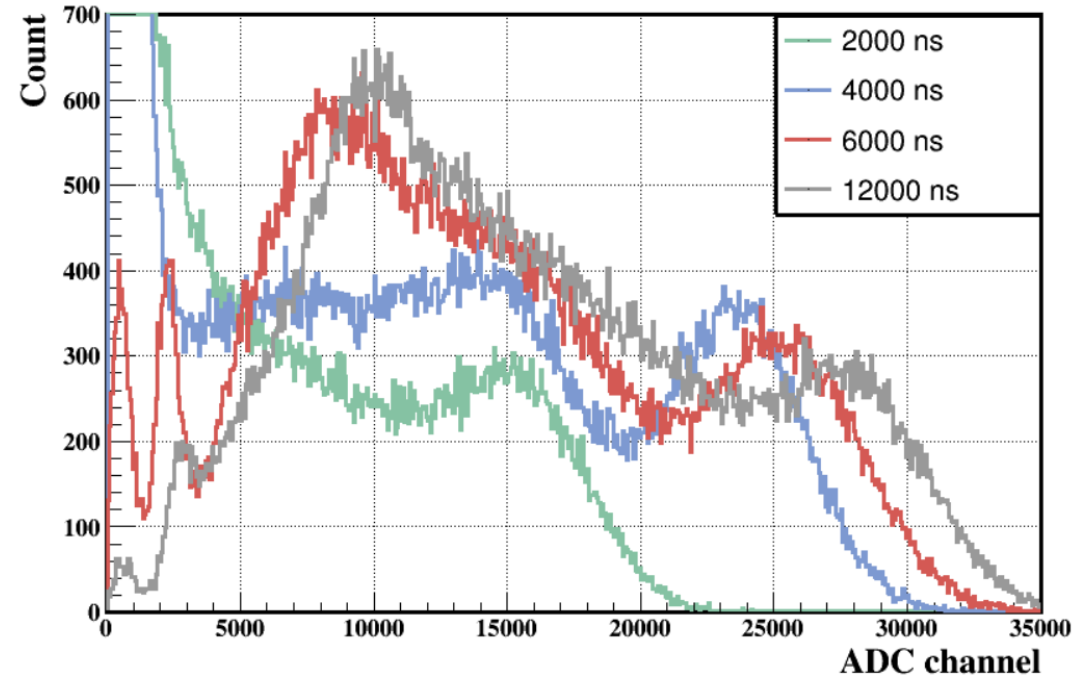
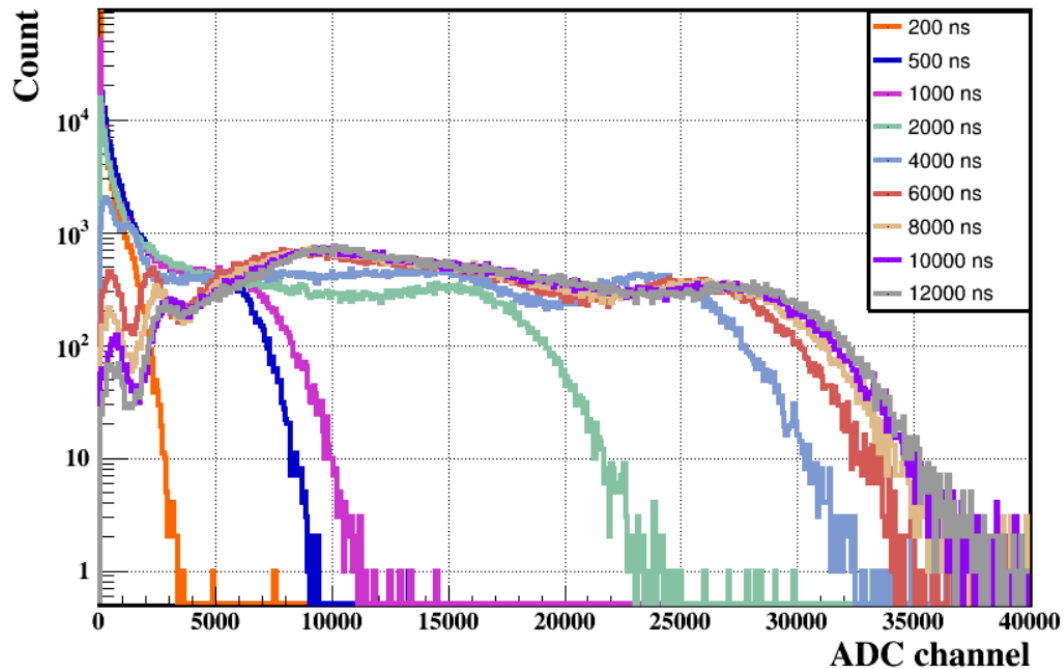
	Composition	Ce ³⁺ (mol%)	Density (g/cm ³)	LY of 6000 ns	ER (%)	LY of 2000 ns	T (%)	Decay time (ns)
JGS-65	Gd-Al-B-Si-Ce ³⁺	0.5	6.0	1231	30.0	447	59	149 (0.5%), 1639



- UpEdge: Time corresponding to rise to 10% * Amp
- DownEdge: Time corresponding to fall to 10% * Amp
- Width: UpEdge+DownEdge
- According to Width, Rise time+Fall time, the integral time should be set to more than 4000 ns

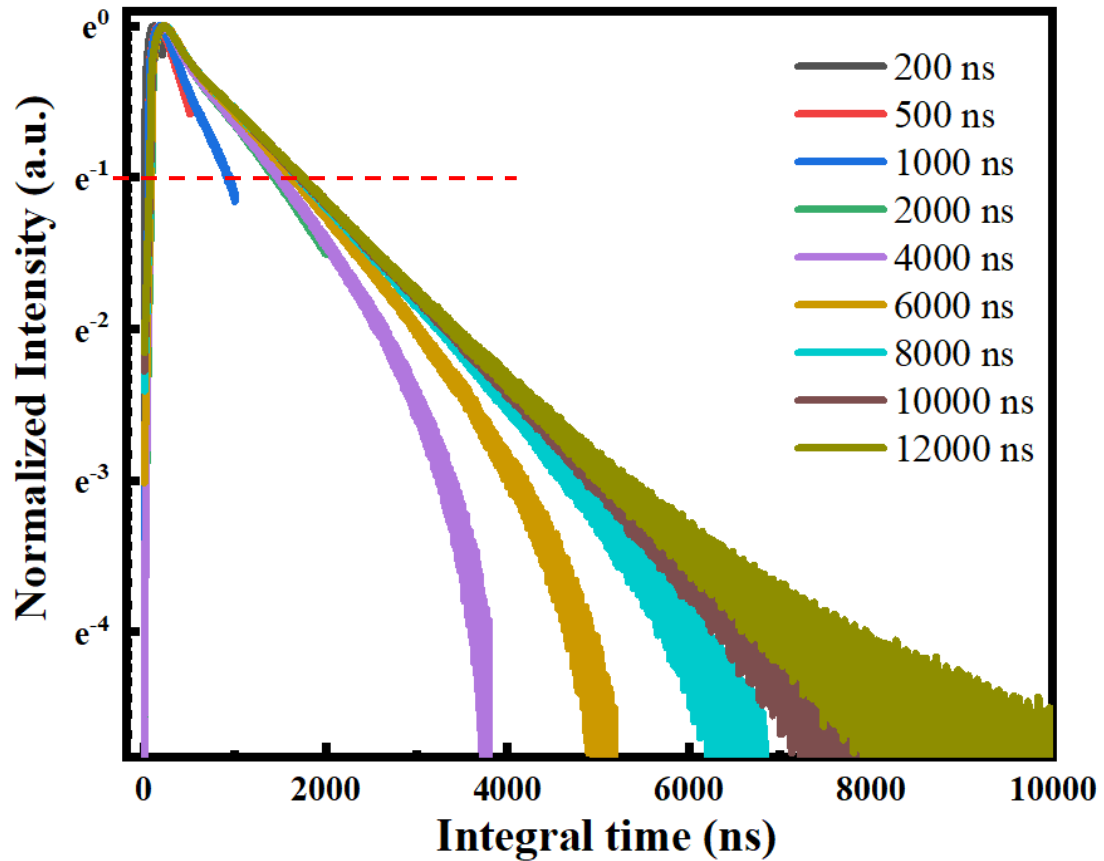
Energy spectra

	Composition	Ce ³⁺ (mol%)	Density (g/cm ³)	LY (ph/MeV)	ER (%)	Proportion of LY (2000 ns)	T (%)	Decay time (ns)
JGS-65	Gd-Al-B-Si-Ce ³⁺	0.5	6.0	1231	30.0	447	59	149 (0.5%), 1639



- The calculated light yield increases with the increase of the integral time due to long decay time in the glass
- The integral time is set at 4000 ns, the complete energy spectra can be measured
- The energy resolution of the glass is about 28% @662 keV, and the longer the integration time, the worse the energy resolution

Scintillation decay time



Integral time (ns)	Decay time (ns)
200	/
500	/
1000	619.9
2000	279.4 (0.3%), 3594.7
4000	198.7 (0.9%), 1708.0
6000	165.8 (0.6%), 1652.2
8000	152.2 (0.5%), 1653.5
10000	167.5 (0.6%), 1649.0
12000	166.0 (1.0%), 1642.4

- When the integral window is set to 4000 ns, the decay time of the glass is almost unchanged, and the proportion of fast components is very small, which is highly likely to be the contribution of SiPM dark noise
- There was slight change in the slow component, indicating that is originated from the glass

Summary

Integral time (ns)	Proportion of LY (ph/MeV)	Energy resolution (%)	Sigma (Channel number)	Scintillation decay time (ns)
200	/	/	/	/
500	/	/	/	/
1000	/	/	/	619.9
2000	708	44.2	2689.3	279.4 (0.3%), 3594.7
4000	1126	26.4	2620.3	198.7 (0.9%), 1708.0
6000	1204	28.6	3038.3	165.8 (0.6%), 1652.2
8000	1247	28.8	3170.4	152.2 (0.5%), 1653.5
10000	1278	28.6	3218.6	167.5 (0.6%), 1649.0
12000	1296	30.0	3428.5	166.0 (1.0%), 1642.4

- Next, we would build the cosmic ray experiment facility

Thank you!

Backup—Waveform information

	Composition	Ce ³⁺ (mol%)	Density (g/cm ³)	LY of 6000 ns	ER (%)	LY of 2000 ns	T (%)	Decay time (ns)
JGS-65	Gd-Al-B-Si-Ce ³⁺	0.5	6.0	1231	30.0	447	59	149 (0.5%), 1639

