



Report on Three CsI Crystals and Recovery of Four CsI Crystals

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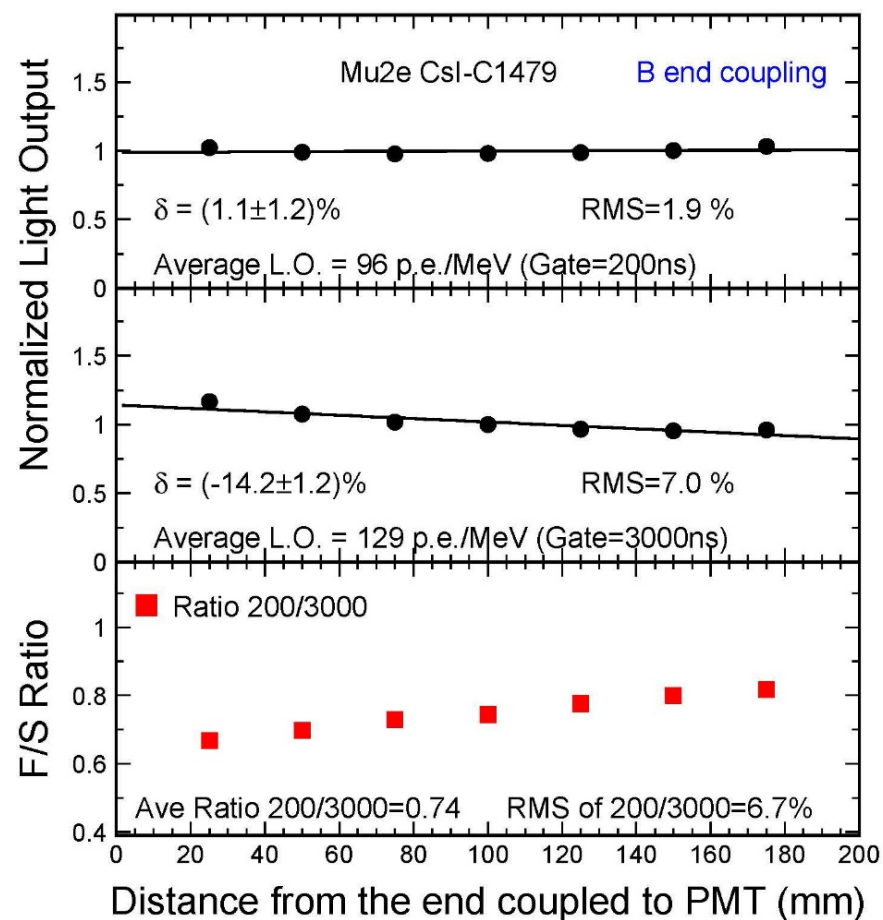
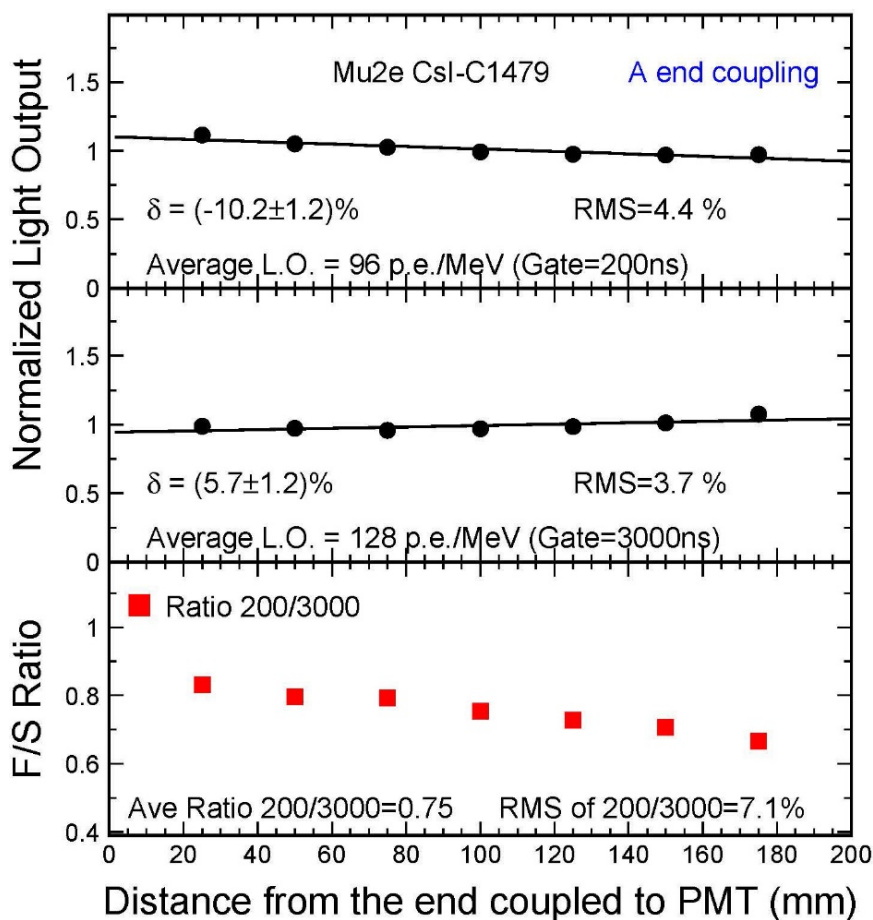
September 16, 2020

A Brief Summary

- Two measurements for Mu2e CsI crystals: (1) C1479, C1482 and C1493 with the Mu2e wrapping, provided by Dr. Dexu Lin and (2) long term recovery of four CsI crystals after irradiation.
- Average light output (LO), FWHM energy resolution, Fast/Total (F/T) ratio and rms of LO were measured at seven points along the sample by using the Hamamatsu R2059 PMT for two alternative ends coupled to the PMT, and were compared to the Mu2e specifications: > 100 p.e./MeV, $< 45\%$, $> 75\%$ and $< 5\%$, respectively.
- The measured LO & energy resolution for the Mu2e wrapping was corrected to the standard two layers Tyvek paper wrapping.
- C1479 and C1493 meet the Mu2e spec, while C1482 fails the LO spec of > 100 p.e./MeV.
- No recovery was observed up to 1,313 & 929 days in four CsI crystals, indicating a stable calorimeter.

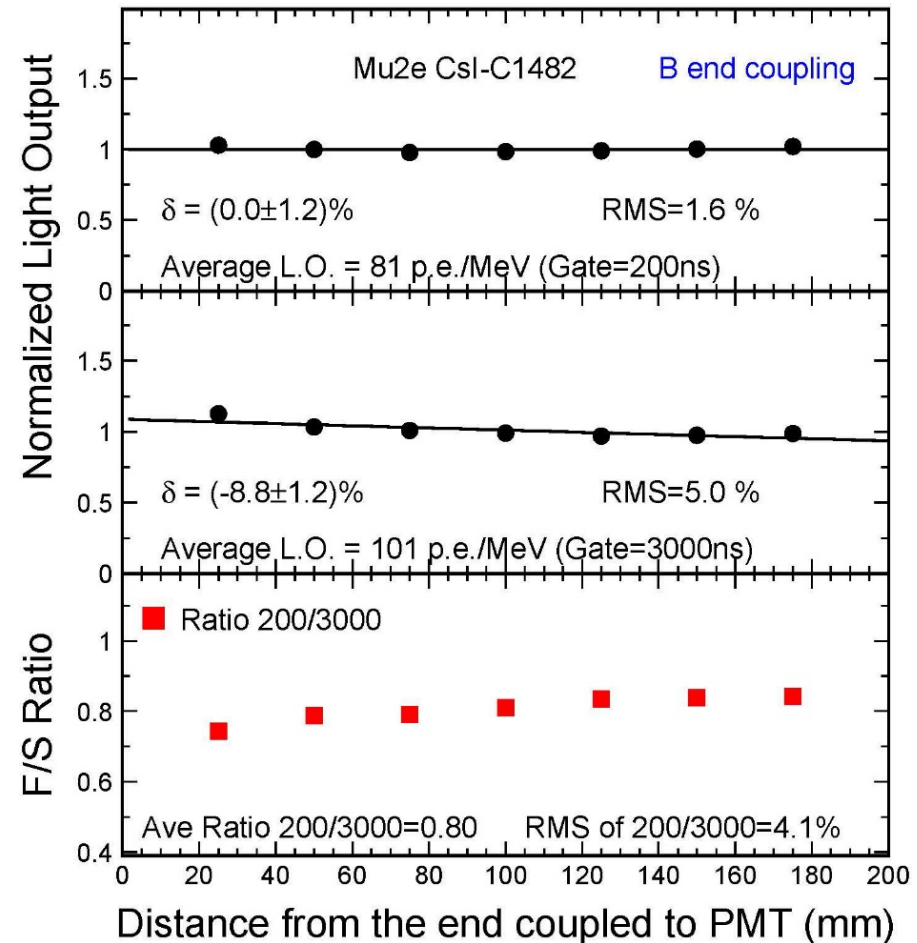
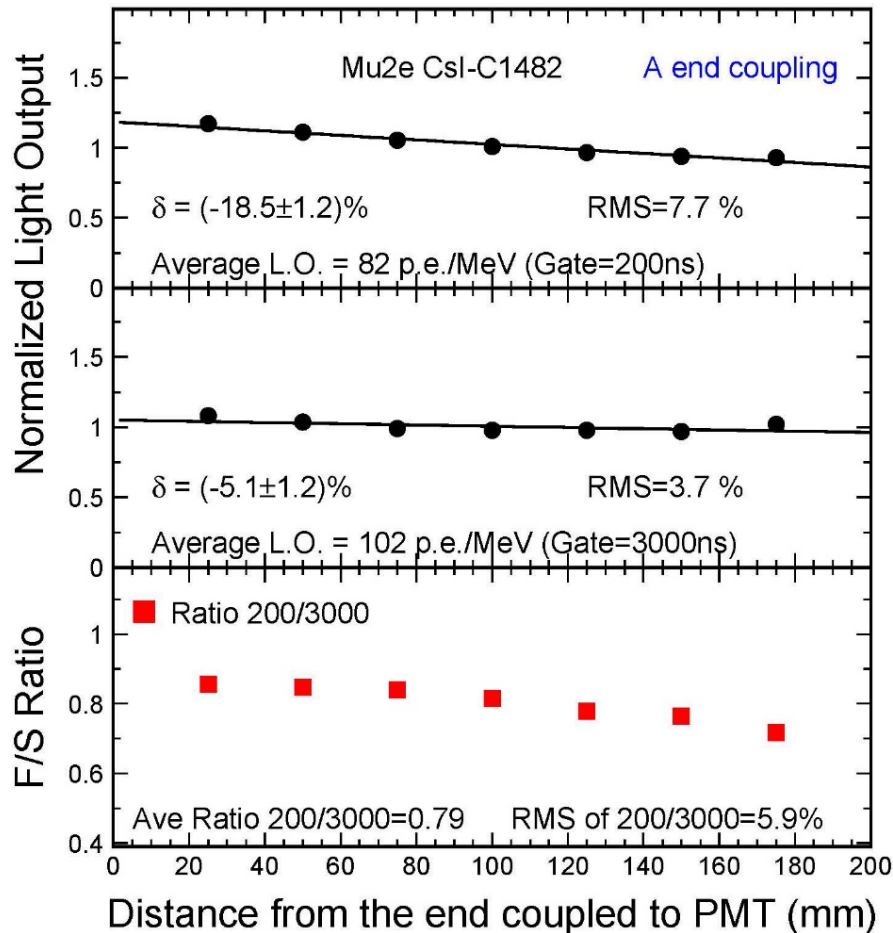
Mu2e Undoped CsI Crystal C1479

Crystal ID	Coupling end	L.O. (p.e./MeV)	E.R. (%)	F/T (%)	LRU (%)
C1479	A	96	42	75	4.4
	B	96	42	74	1.9



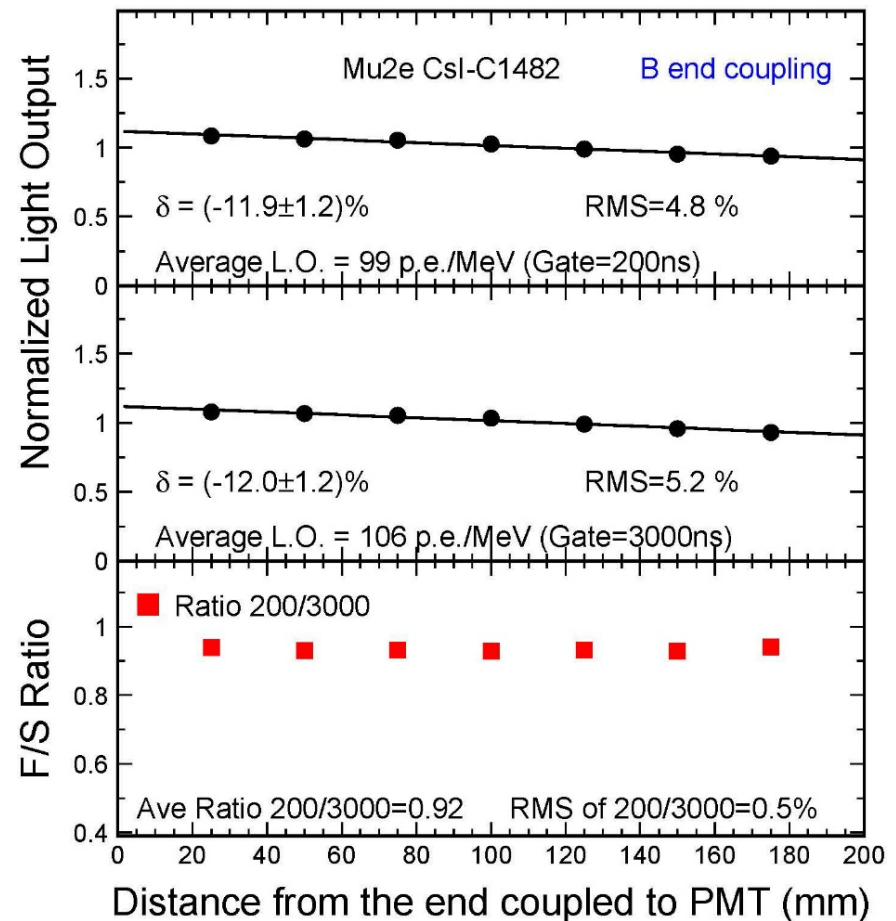
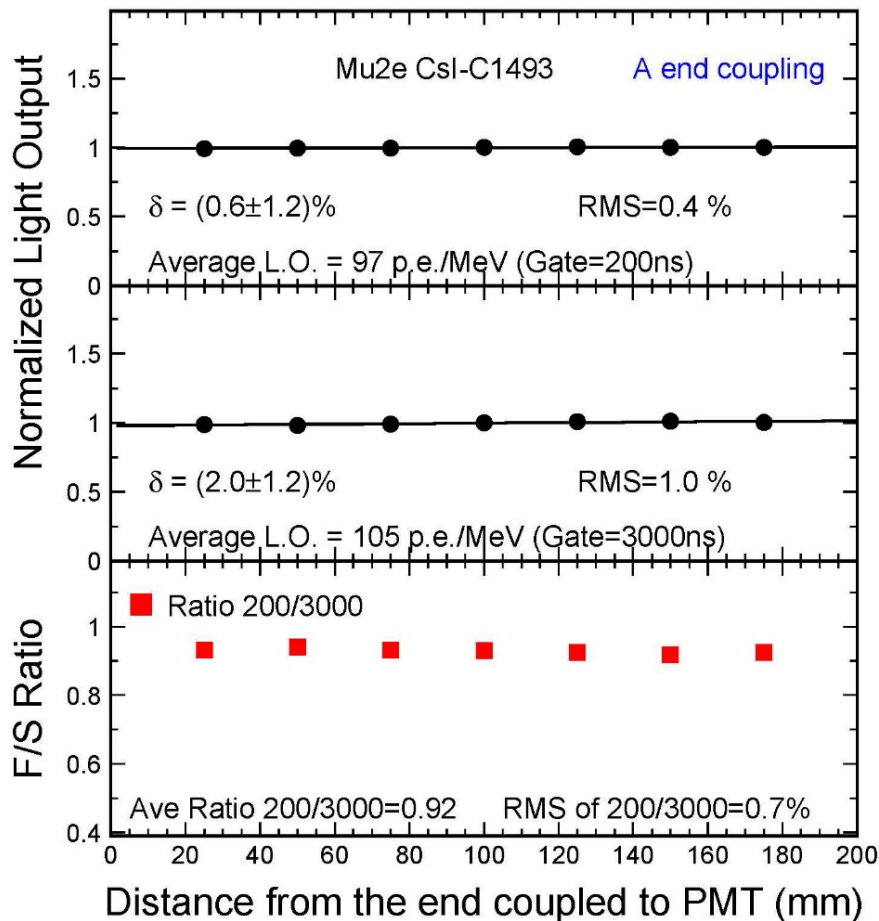
Mu2e Undoped Csl Crystal C1482

Crystal ID	Coupling end	L.O. (p.e./MeV)	E.R. (%)	F/T (%)	LRU (%)
C1482	A	82	45	79	7.7
	B	81	45	80	1.6



Mu2e Undoped Csl Crystal C1493

Crystal ID	Coupling end	L.O. (p.e./MeV)	E.R. (%)	F/T (%)	LRU (%)
C1493	A	97	39	92	0.4
	B	99	40	92	4.8

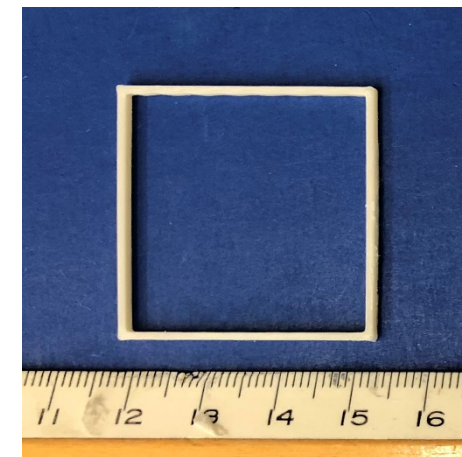
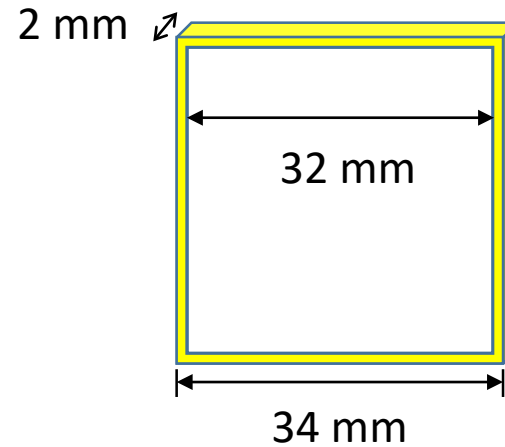
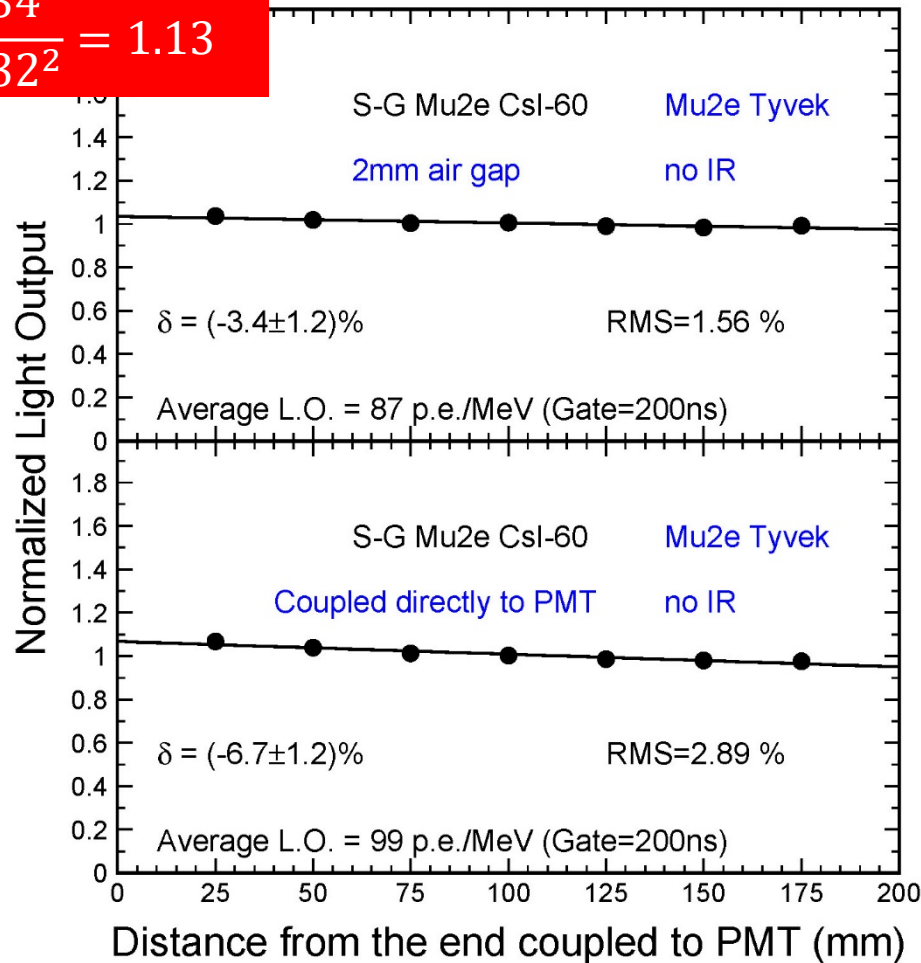


Light Output Correction

LO/resolution Correction due to different wrapping

http://www.hep.caltech.edu/~zhu/talks/ryz_180328_Tyvek.pdf

$$\frac{34^2}{32^2} = 1.13$$



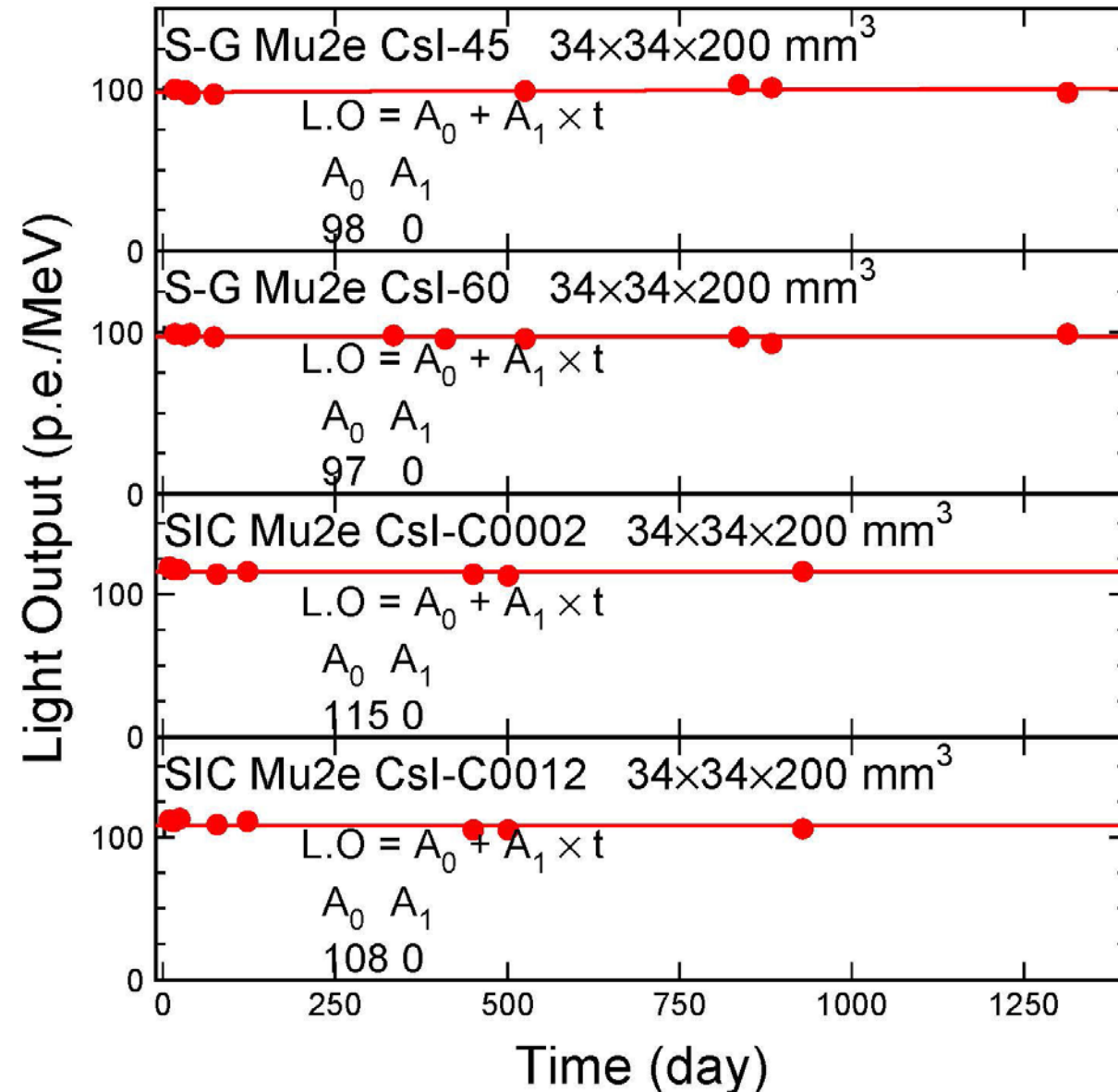
Summary

C1479 and C1493 meet the Mu2e spec
C1482 fails the LO spec: >100 p.e./MeV

Crystal ID	Coupling end	L.O. (p.e./MeV)	E.R. (%)	F/T (%)	LRU (%)
C1479	a	109	40	75	4.4
	b	109	40	74	1.9
C1482	a	93	42	79	7.7
	b	92	42	80	1.6
C1493	a	110	37	92	0.4
	b	113	38	92	4.8

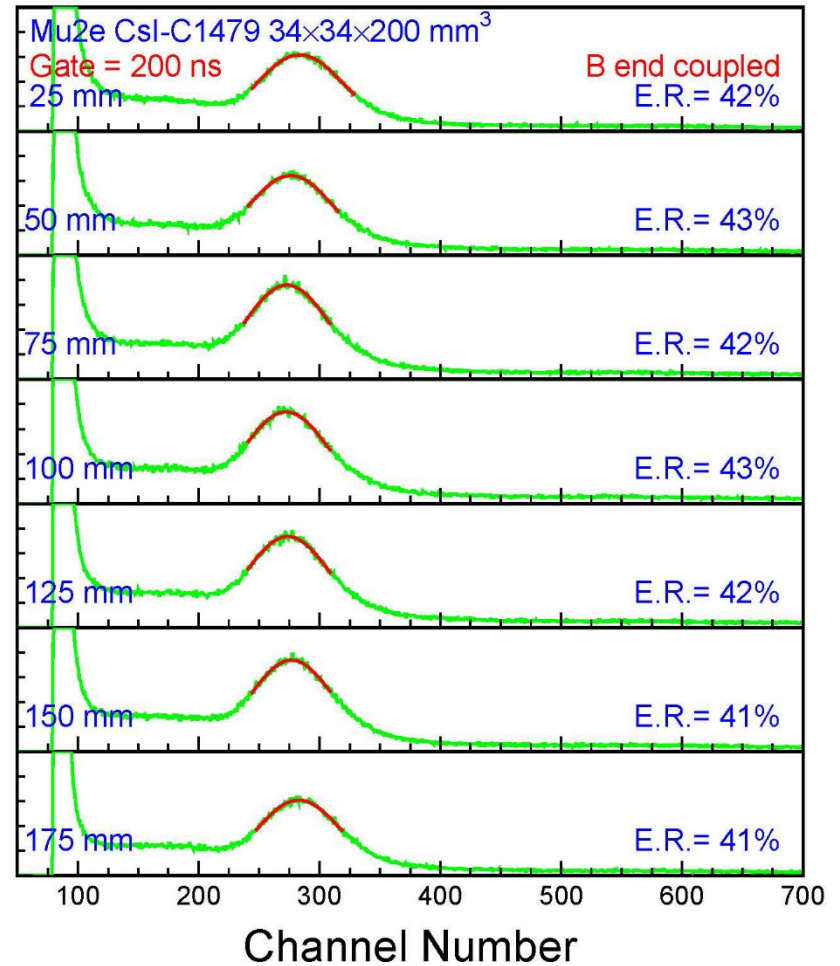
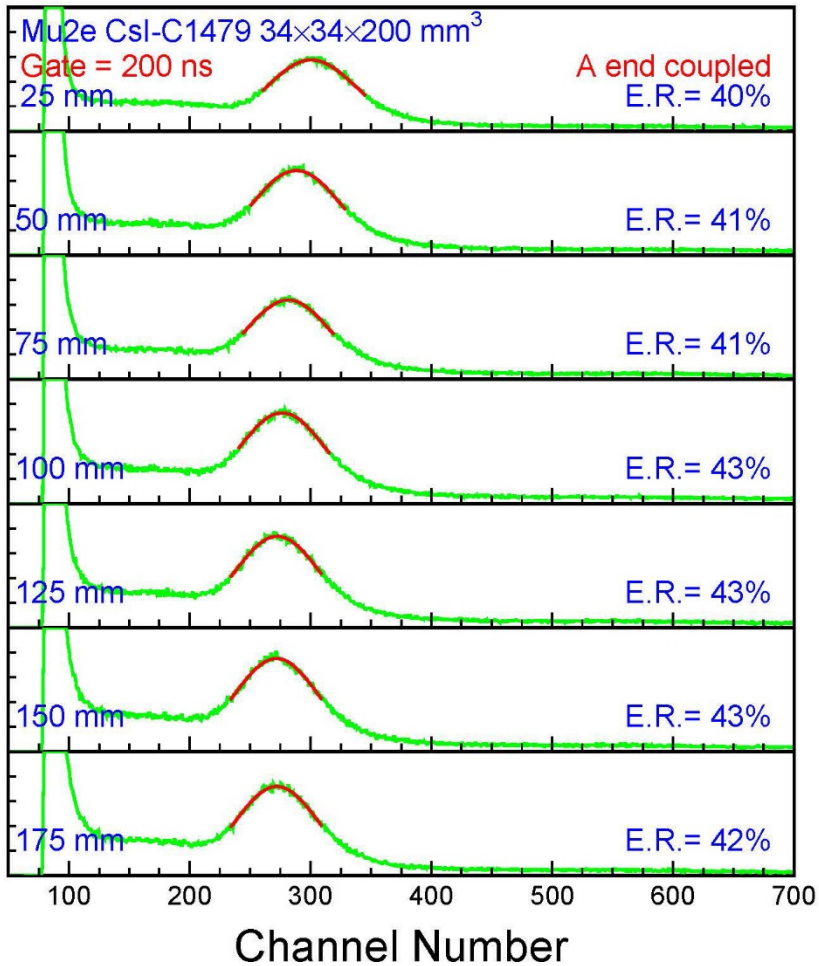
F/T: C1479 at the boundary, C1483 and C1492 are OK

Long Term LO Recovery after Radiation

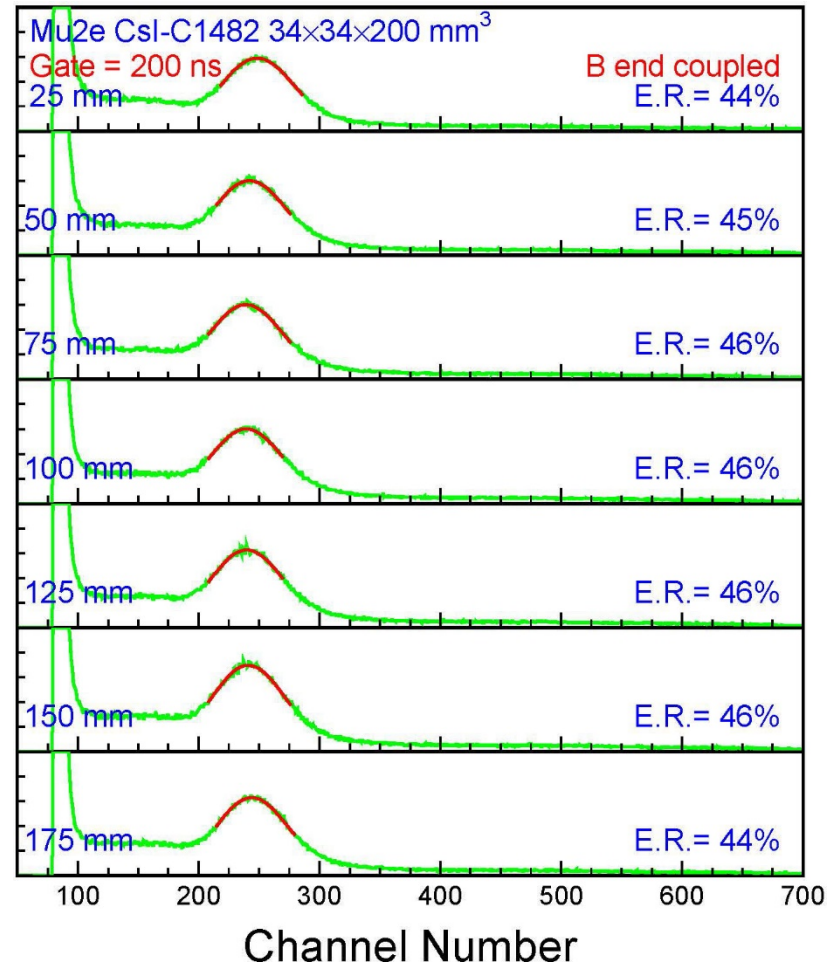
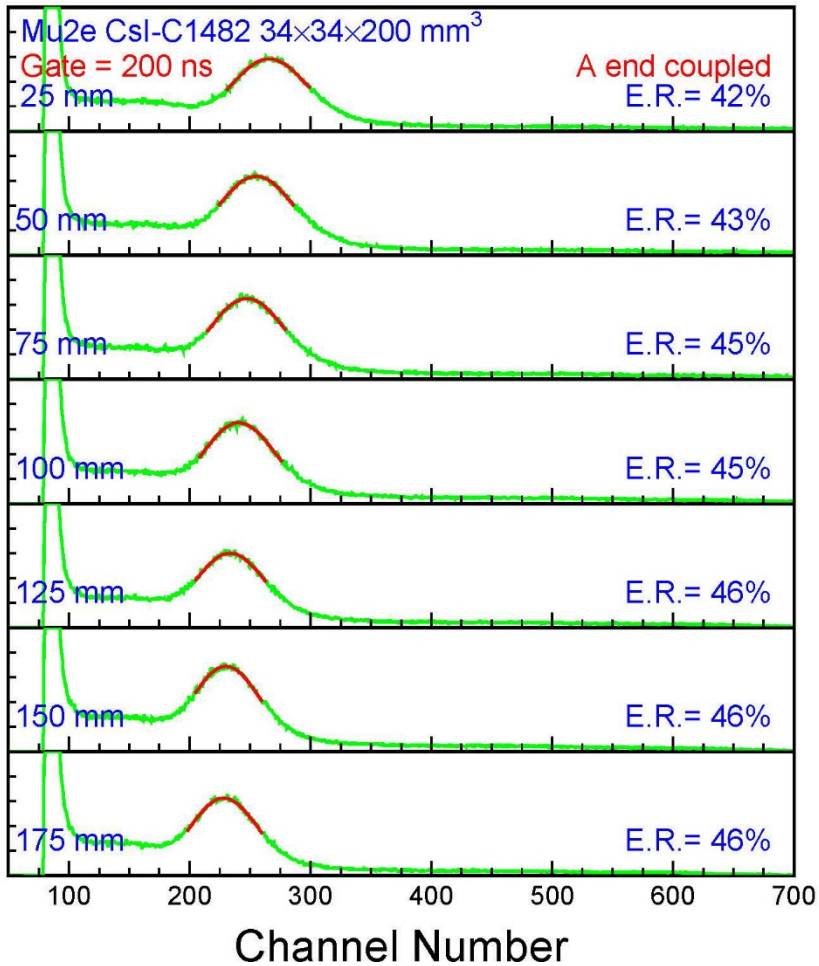


No recovery was observed up to 1,313 & 929 days for two CsI crystals each from S-G and SIC respectively, indicating a stable calorimeter

200 ns PHS: CsI Crystal C1479



200 ns PHS: CsI Crystal C1482



200 ns PHS: CsI Crystal C1493

