



Investigations on the Tyvek Wrappings and the 7th Cube Sample from Saint-Gobain

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Introduction



- March 1 Report: Results of two SIC pre series CsI crystals with Tyvek wrapping and six Saint-Gobain 1" cubes without Tyvek wrapping were irradiated to 10 and 110 krad.
- Three Tyvek wrappings are investigated:
 - Mu2e Tyvek not irradiated;
 - Caltech Tyvek not irradiated
 - Mu2e/Caltech Tyvek after 110/10 krad.
- The 7th 1 inch cube sample was received from Saint-Gobain, and its F/T ratio measured.



Results of Two SIC Samples



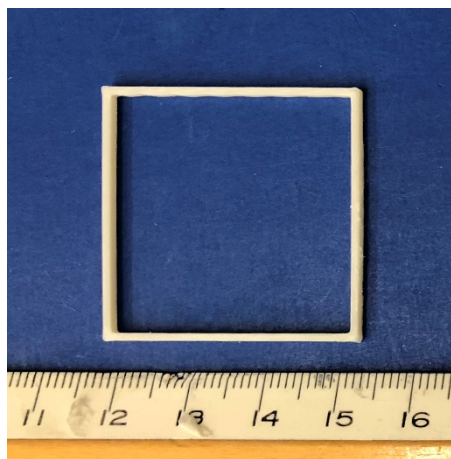
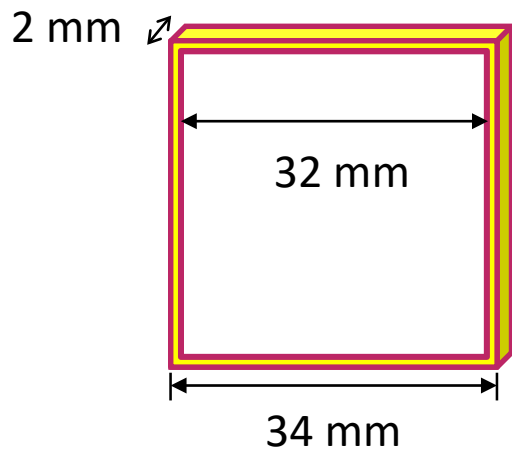
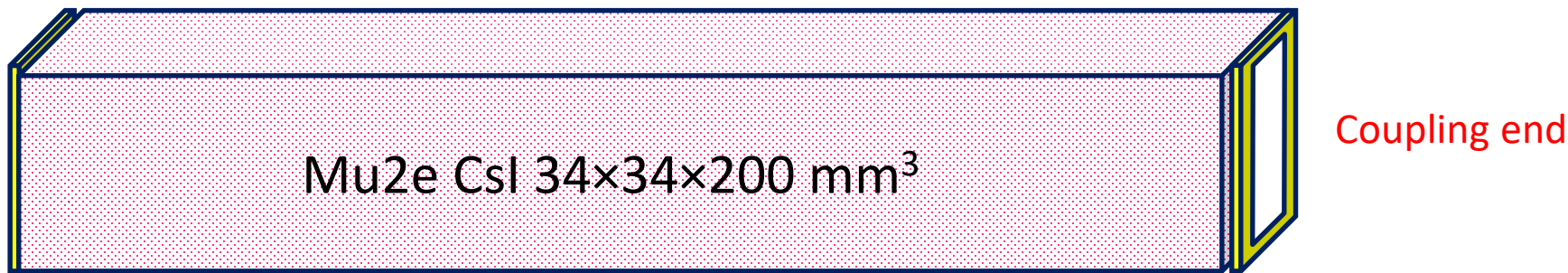
Damages, including Tyvek, meet Mu2e spec after 110 krad, but not after 10 krad

Crystal ID	Dose	L.O. (p.e./MeV)	E.R. (%)	F/T (%)	LRU (%)	δ (%)
SIC-C0002	-	164	34	90.5	2.20	4.7
	10 krad	135 (82.3%)	35	89.8	0.83	1.0
	110 krad	115 (70.1%)	36	91.7	1.88	-3.4
SIC-C0012	-	169	33	88.6	2.71	6.0
	10 krad	133 (78.7%)	35	88.5	1.21	1.5
	110 krad	104 (61.5%)	37	89.6	1.49	-2.5



Investigations on Tyvek Wrapping

Two Mu2e Tyvek wrappings taken from SIC C0002 (after 110 krad) and SIC C0003 (not irradiated) are compared to Caltech Tyvek



The plastic frame at the coupling end was removed

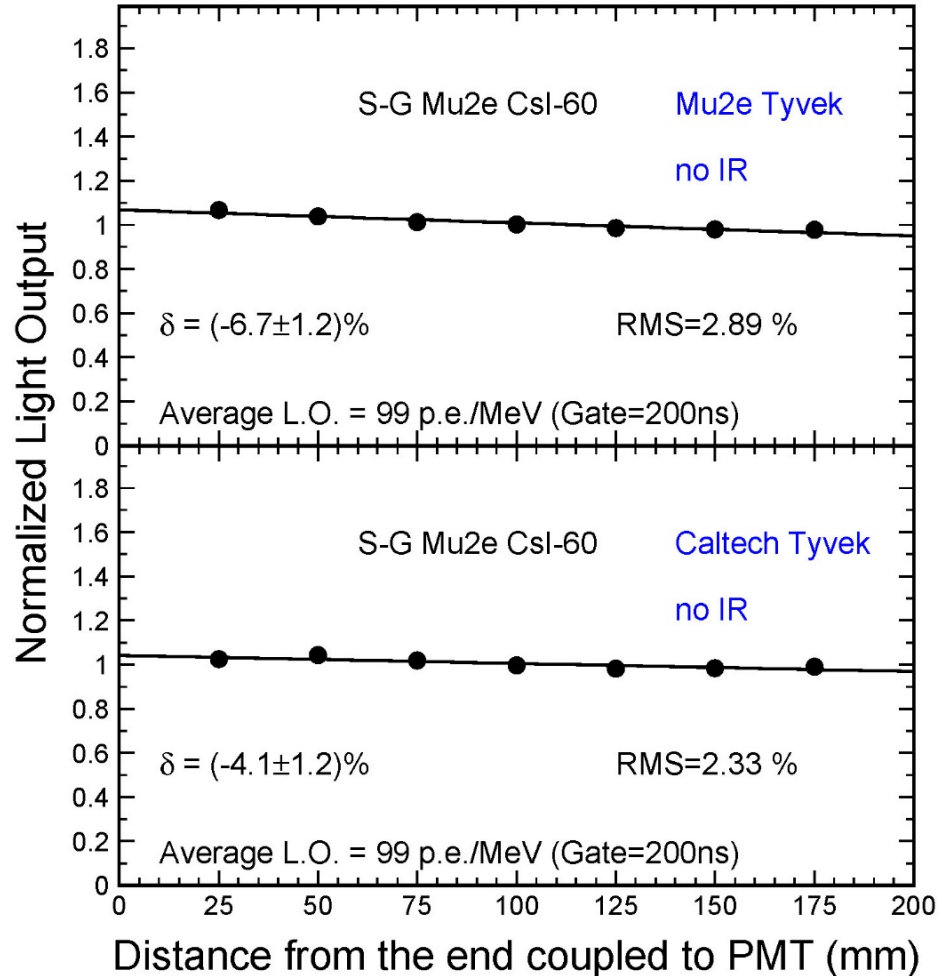
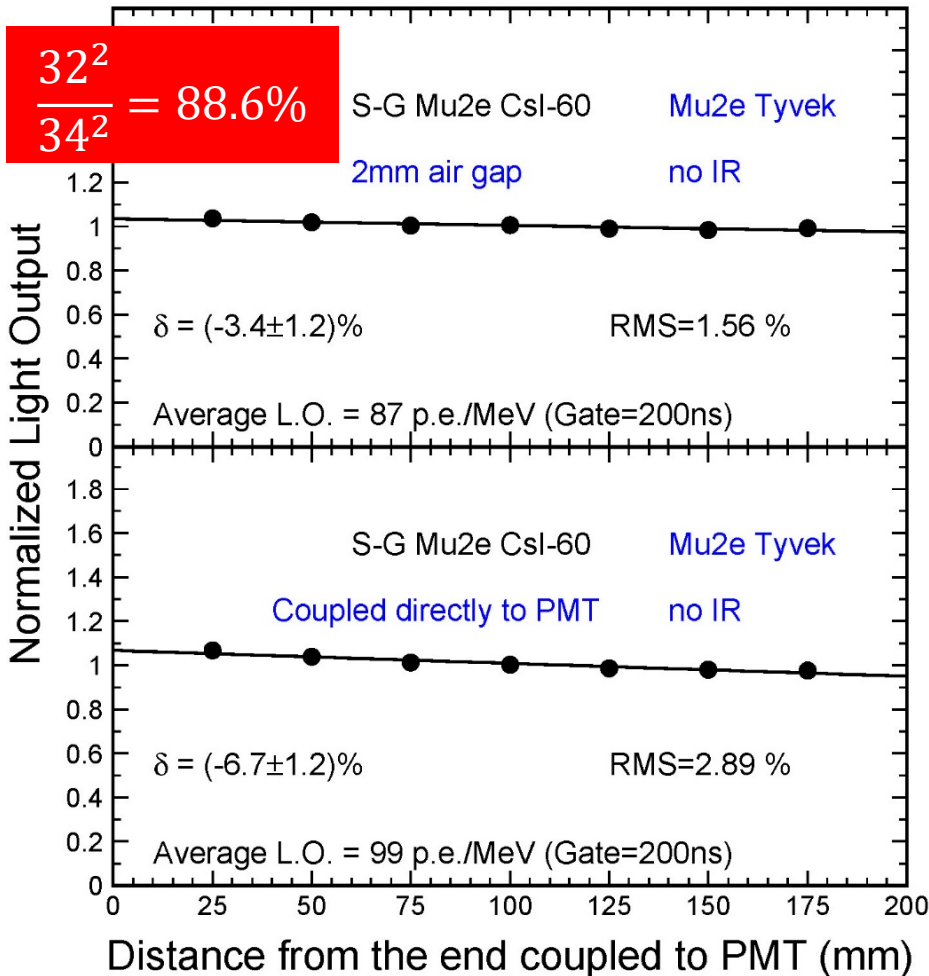


Plastic Frame and Tyvek Paper



Mu2e Wrapping reduces LO by 11% due to area coverage
No difference between Mu2e Tyvek and Caltech Tyvek

$$\frac{32^2}{34^2} = 88.6\%$$

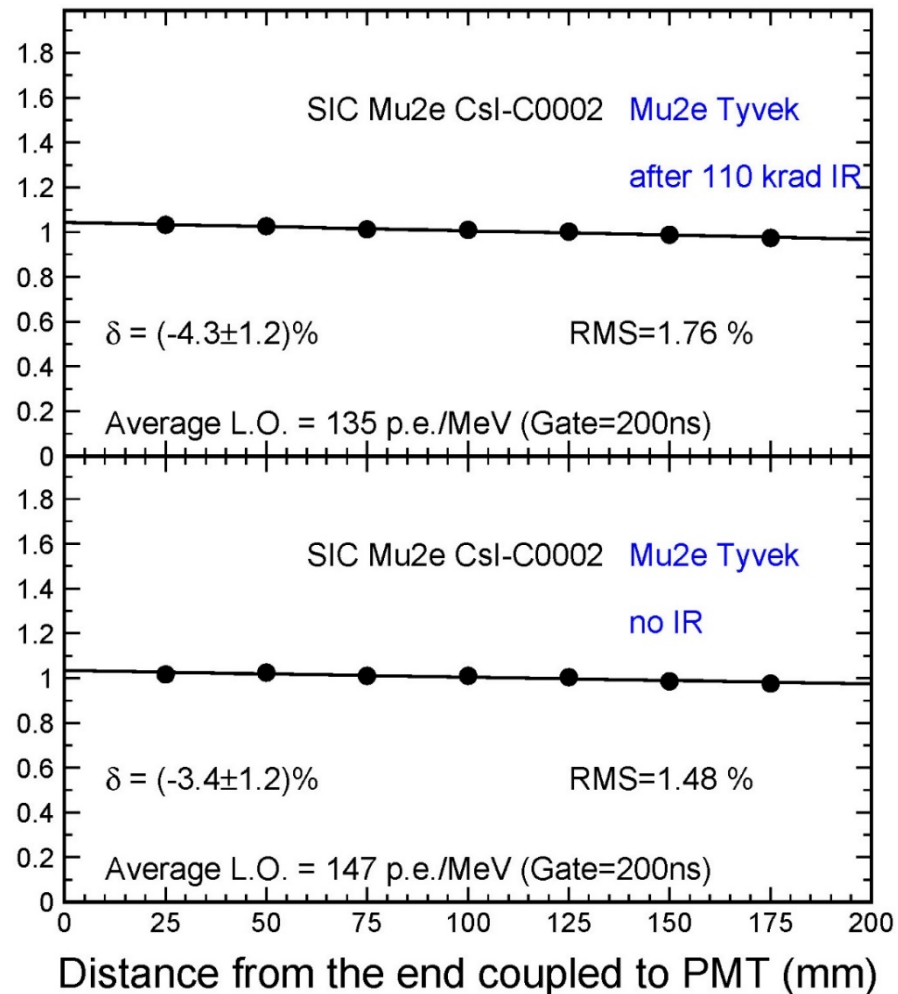
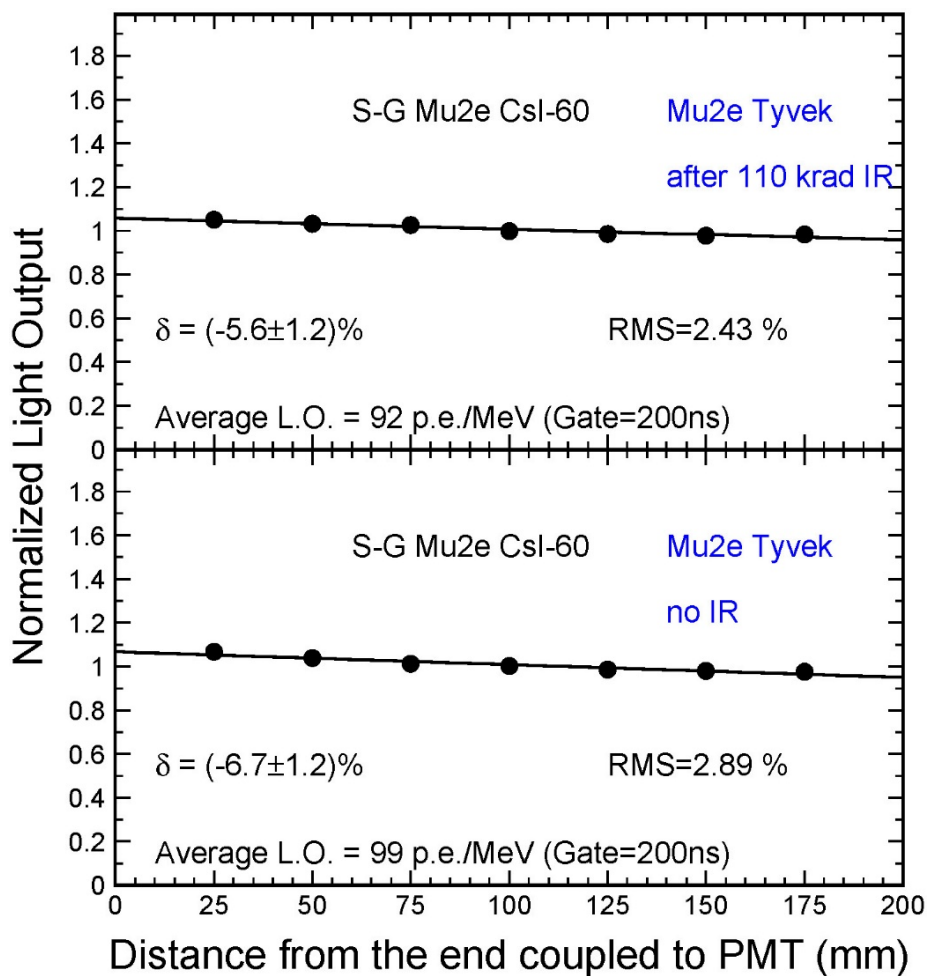




Mu2e Tyvek after 110 krad

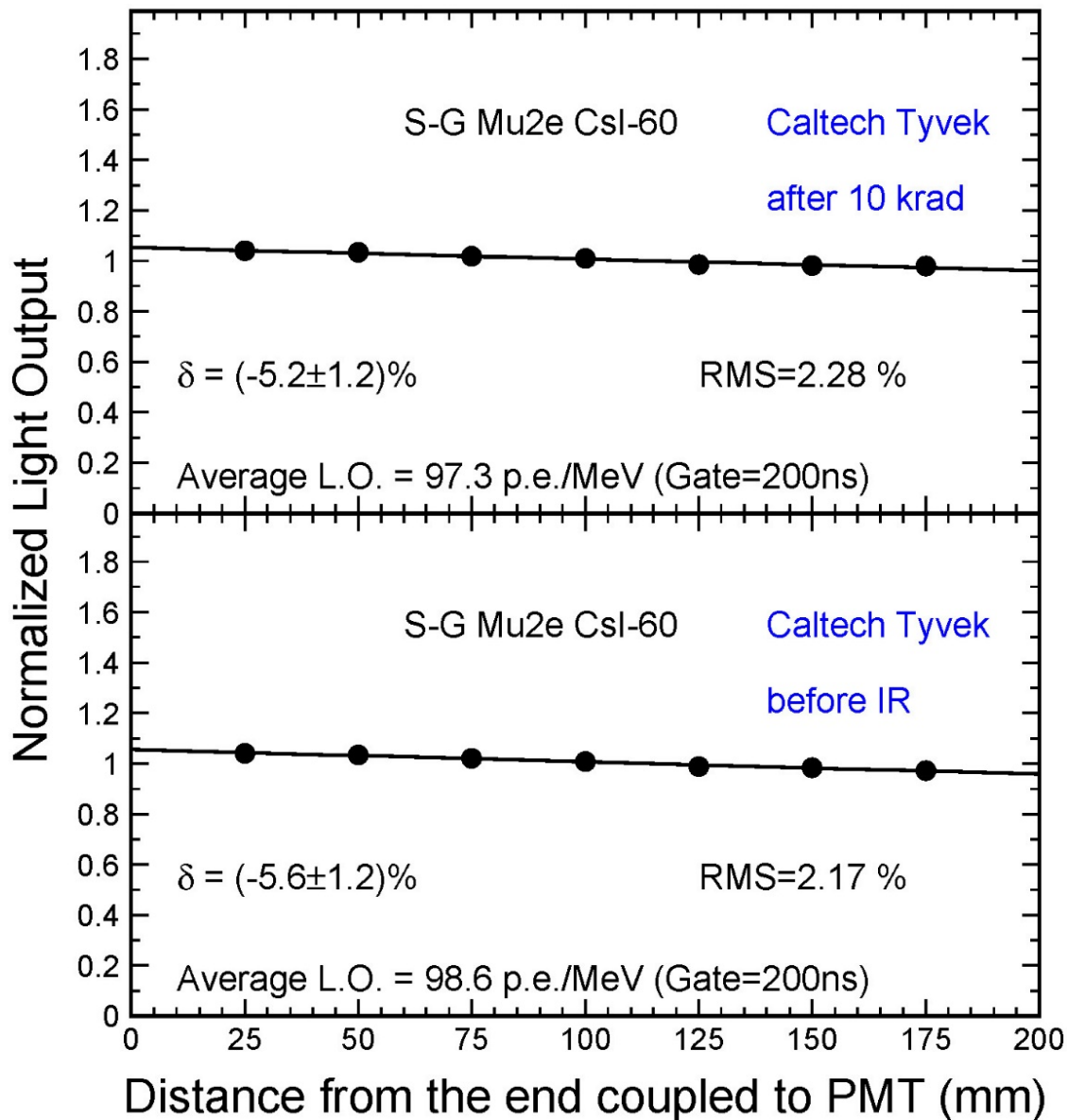


The light collection efficiency of the Mu2e Tyvek wrapping degrades by 7% after 110 krad





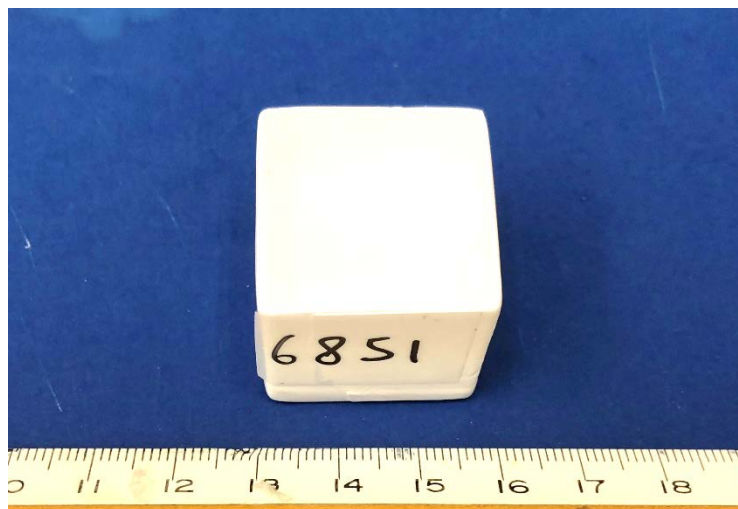
Caltech Tyvek after 10 krad



The light collection efficiency of the Caltech Tyvek wrapping degrades by 1.3% after 10 krad



The 7th S-G Undoped CsI Cube



ID	Dimension (in ³)	Polishing
S-G 6851	1x1x1	One face
All samples received on March 5 th , 2018 (Mon.)		

Experiments

- Properties measured at room temperature : LO, ER, and F/T



Summary for 7 S-G Cubes



ID	200 ns ER (%)	200 ns LO (p.e./MeV)	3000 ns LO (p.e./MeV)	100 ns LO (p.e./MeV)	1000 ns LO (p.e./MeV)	LO(200) /LO(3000)	LO(100) /LO(1000) (Caltech)	Conversion Factor* (Caltech)	LO(100) /LO(1000) (SGCD)	Conversion Factor (Caltech & SGCD)
S-G 6827	26.9	266	273	261	270	97.4	96.5	99.0	87.6	89.9
S-G 6828	25.3	279	283	276	280	98.8	98.4	99.6	87.9	89.0
S-G 6834	25.8	315	326	308	322	96.6	95.6	98.9	86.4	89.4
S-G 6835	22.7	379	389	363	386	97.5	93.6	96.1	88.3	90.6
S-G 6838	24.5	316	324	309	324	97.5	95.3	97.8	87.5	89.7
S-G 6840	24.4	298	301	293	301	98.5	97.3	98.8	88.5	89.8
S-G 6851	24.1	310	323	299	319	95.8	93.7	97.9	85.5	89.3
Ave	24.8	309	317	301	315	97.4	95.8	98.3	87.4	89.7
RMS /Ave	5.0%	10.8%	11.1%	9.9%	11.2%	1.0%	1.7%	1.1%	1.1%	0.5%



Summary

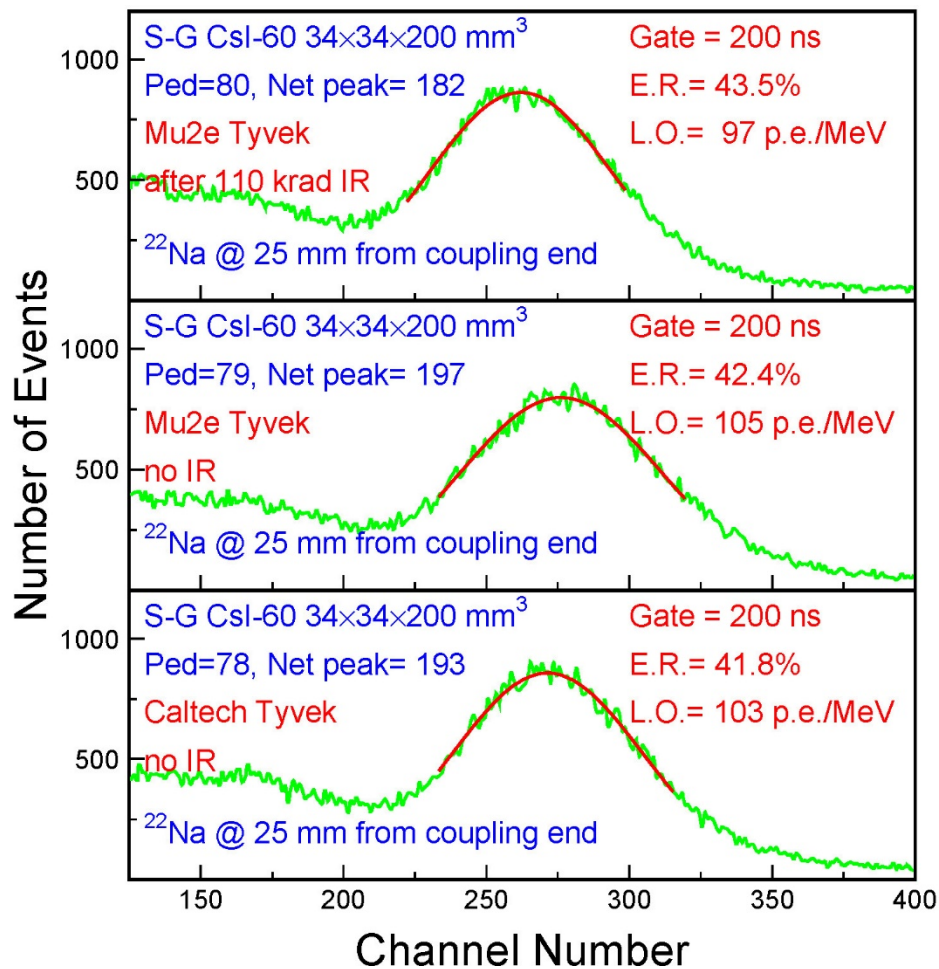
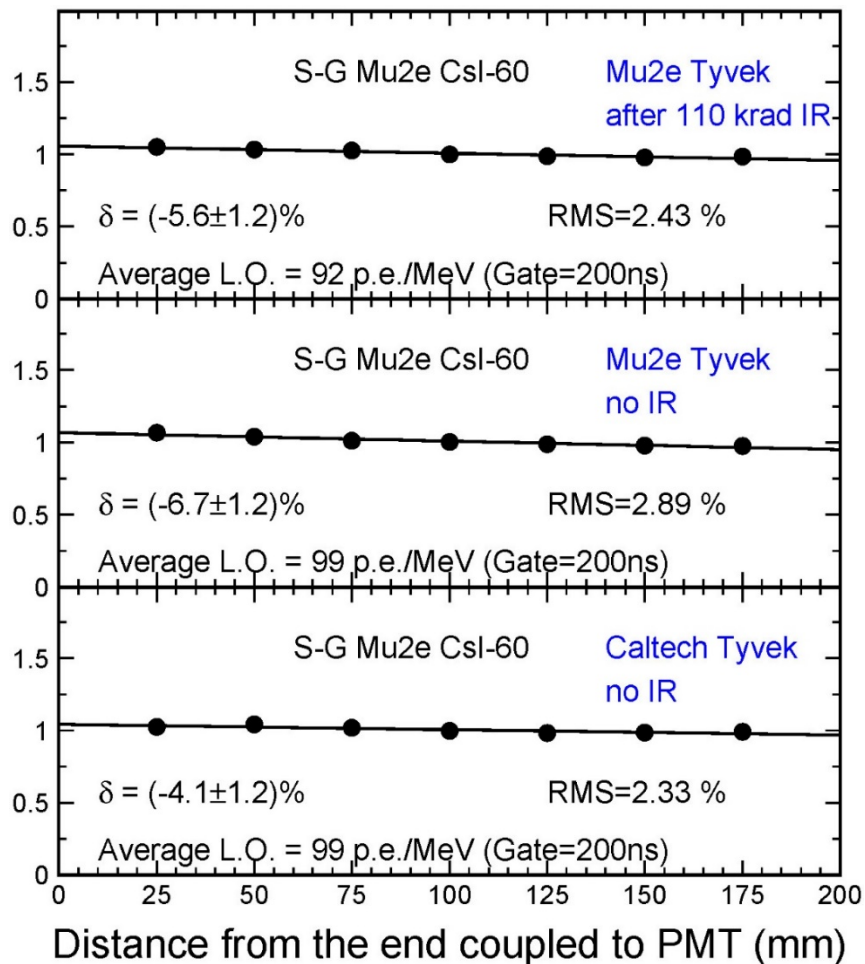
- The plastic frame reduces CsI light output by 11% due to photo-detector area coverage.
- No difference in light collection efficiency was observed between Mu2e and Caltech Tyvek wrappings.
- The light collection efficiency of the Tyvek wrapping reduces by 1.3%/7% after 10/110 krad.
- The 7th S-G cube has the lowest F/T ratio, but is consistent with other six cubes.



Three Tyvek Wrappings



No difference between the Mu2e and Caltech Tyvek wrappings



Light collection efficiency of Mu2e Tyvek decreases by 7% after 110 krad