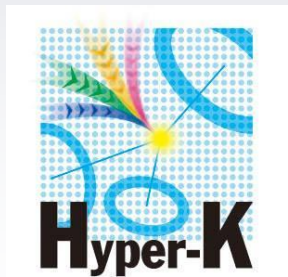


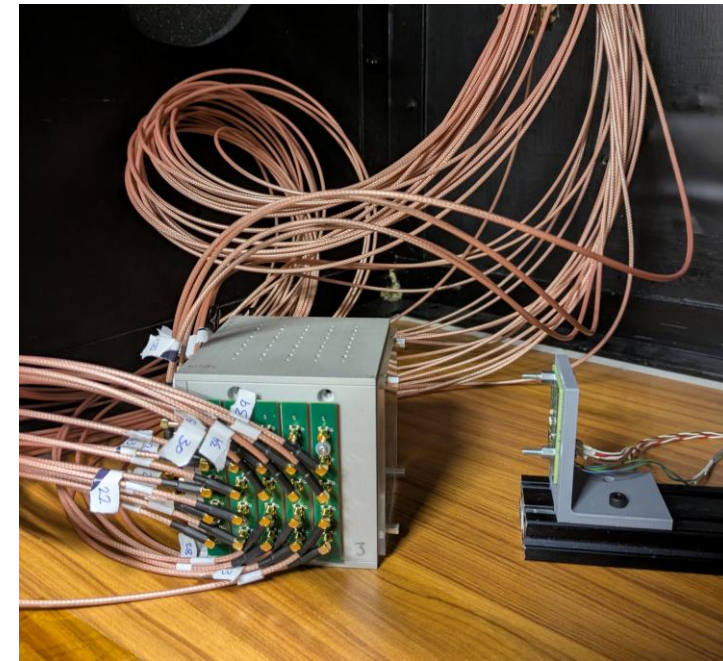
LPNHE status

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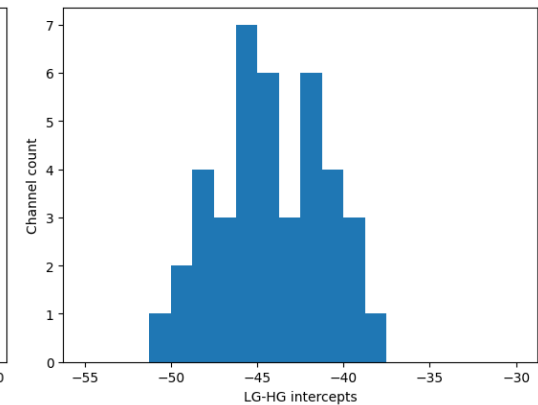
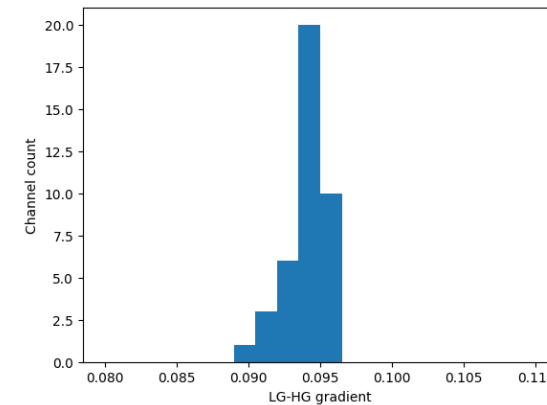
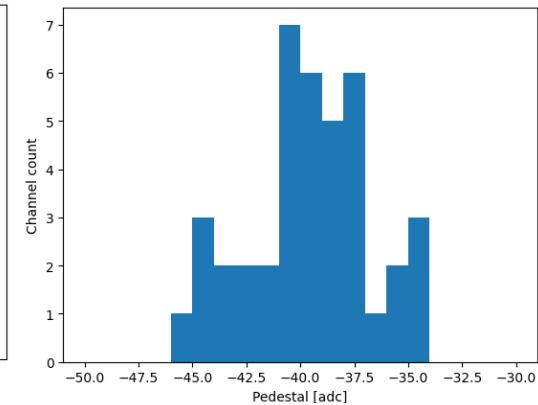
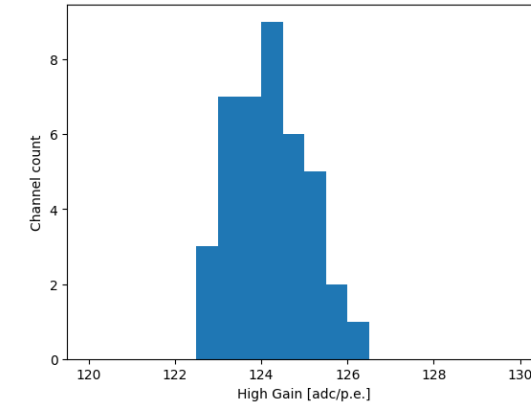
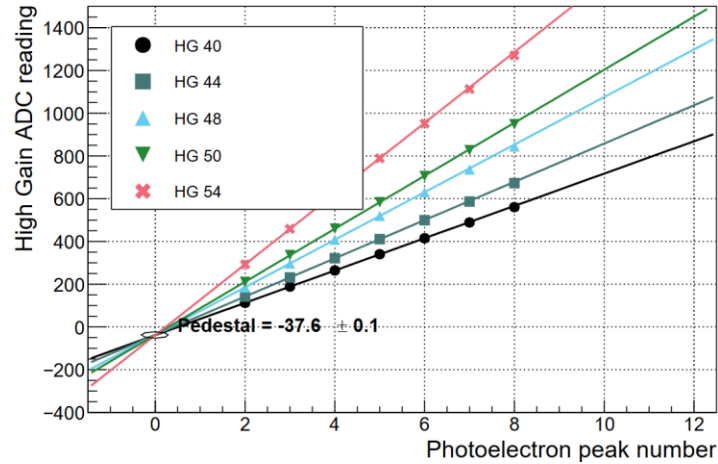
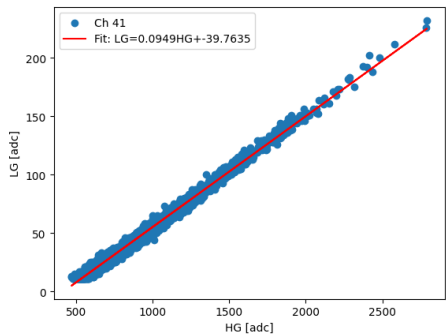
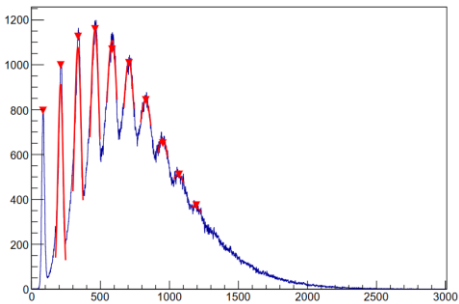
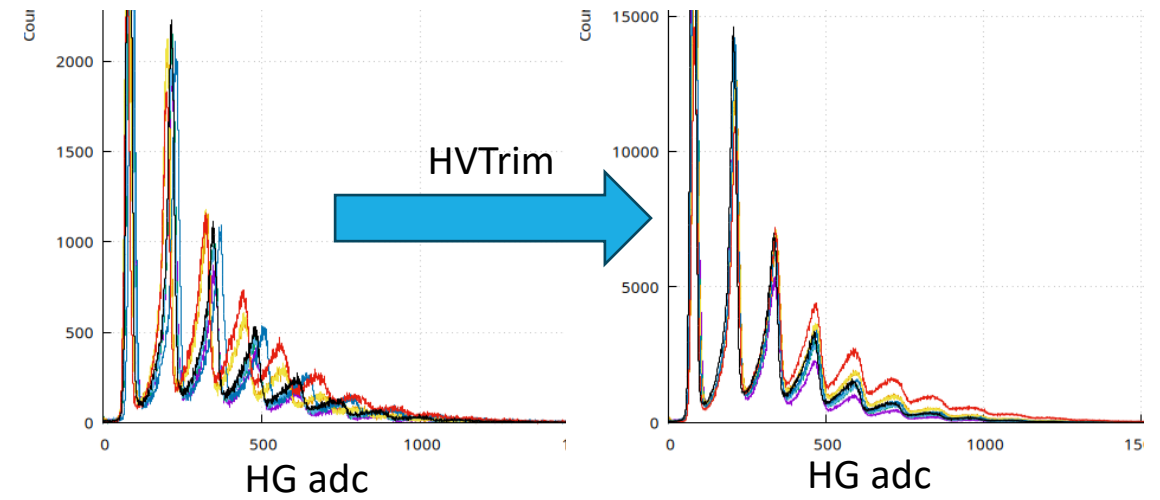
microSFGD

- Will use this to test different triggers, SiPMs and fibres
- Using 5x5x5 SFGD cubes, with additional gap
- 3mm or 1mm SiPMs on a PCB with 3D printed guard
- PMMA panels on sides to secure fibres
- Kuraray Y11 fibres polished on both ends
- Set up x- and y- sides with 20 channels each (40 total)
- Shine LED against each PMMA face for calibration



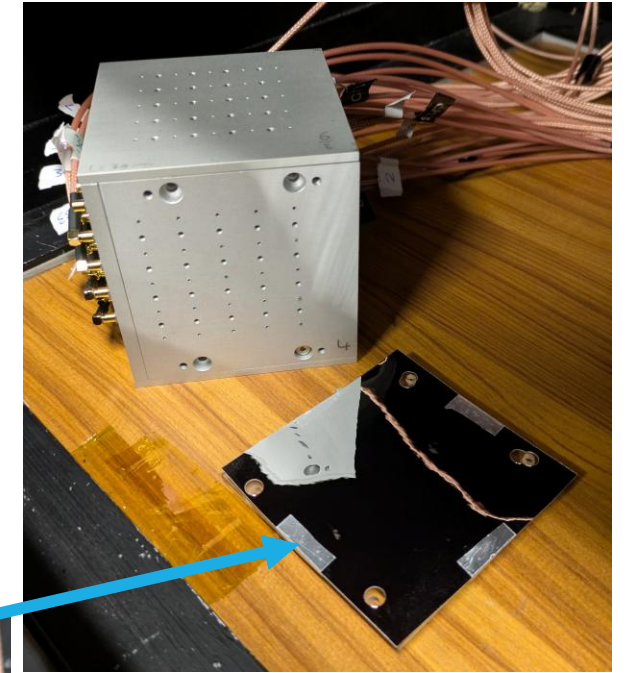
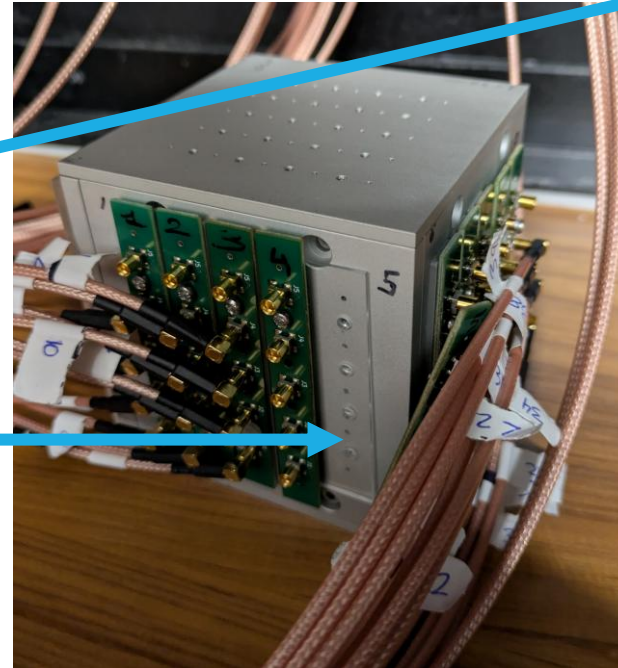
LED Calibration

- Wrote a config file manager to apply settings to all 40 channels
- Adapted SFGD HVTrim algorithm to tune all bias voltages for similar channel responses
 - Gain is aimed to be around 125adc/p.e. for 3mm, 90 for 1mm
- Moved pedestal out of adc range
- Measured gain, pedestal and LG-HG conversion



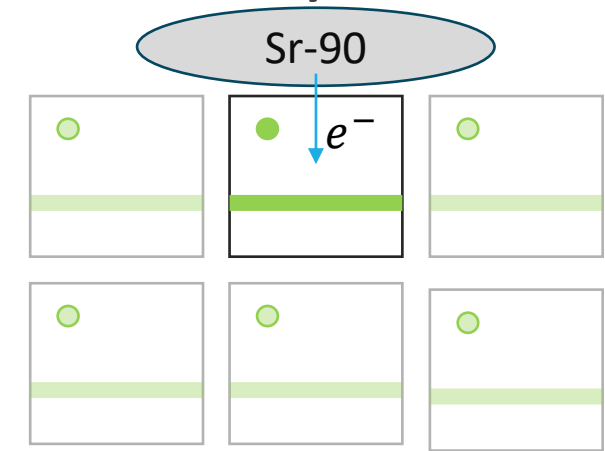
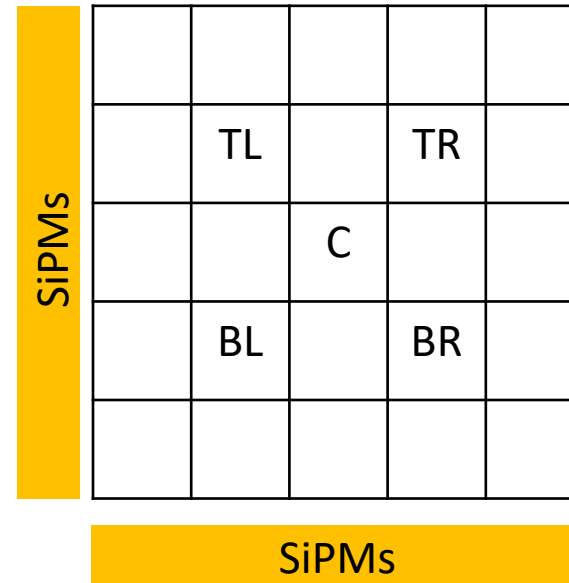
Source data

- Removed the lid and top layer of cubes
- Placed a Sr-90 source in the centre and at four corners
 - Continuous emission spectra beta source
- Took data with with different configurations for 1mm and 3mm SiPMs:
 - Clear PMMA panel at fibre end
 - 3M reflective sheet at fibre end
 - Non-reflective white sheet (back of the 3m)
 - 1mm PMMA between fibres and SiPM



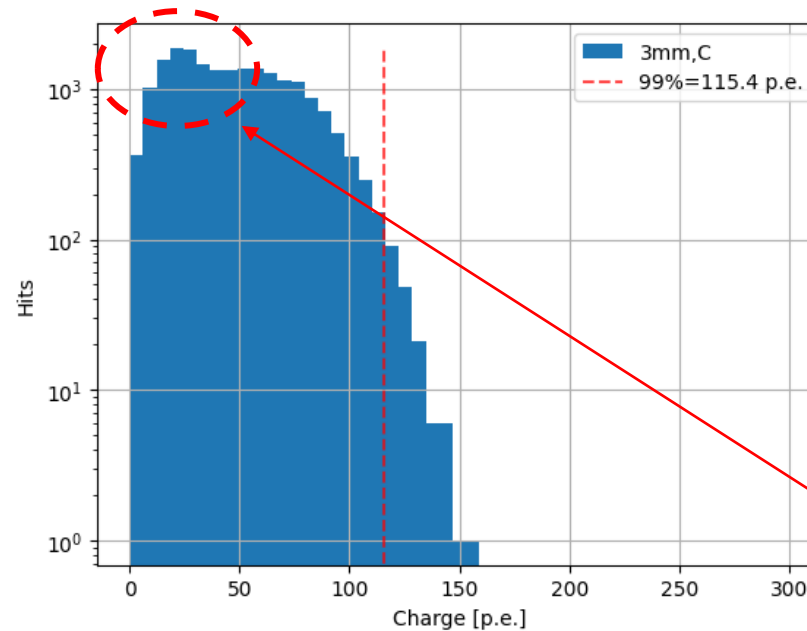
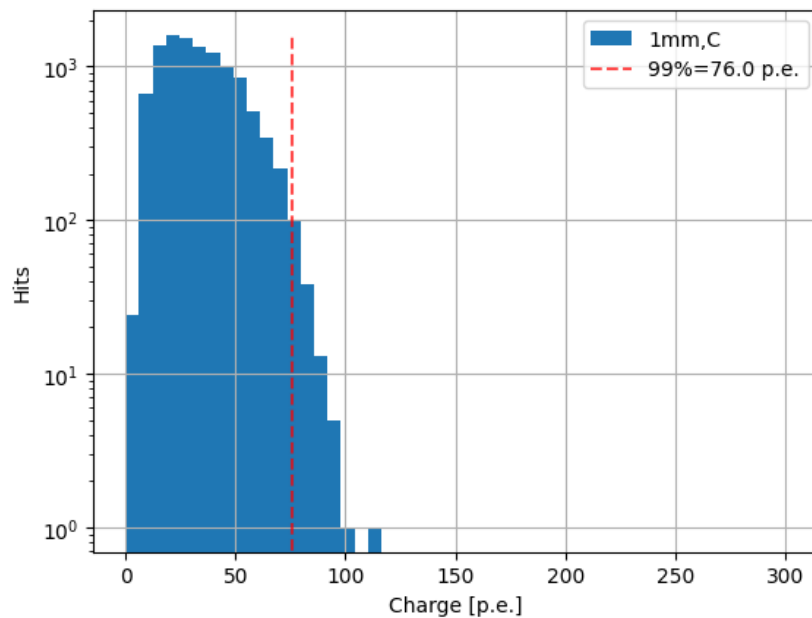
Analysis method

- Add up the charge in the two fibres that cross a cube directly beneath the source
 - Source is directed in the other direction, but we still detect a good signal beneath it
- Also check the difference in each event to find whether there is an asymmetry
 - ie possible attenuation effect



Comparing SiPM size

- Look the basic set up, comparing between 1mm and 3mm SiPMs
- I would have expected the bottom-left position to have highest light yield due to proximity to SiPMs
- Are we understanding SiPM pitch, etc correctly?

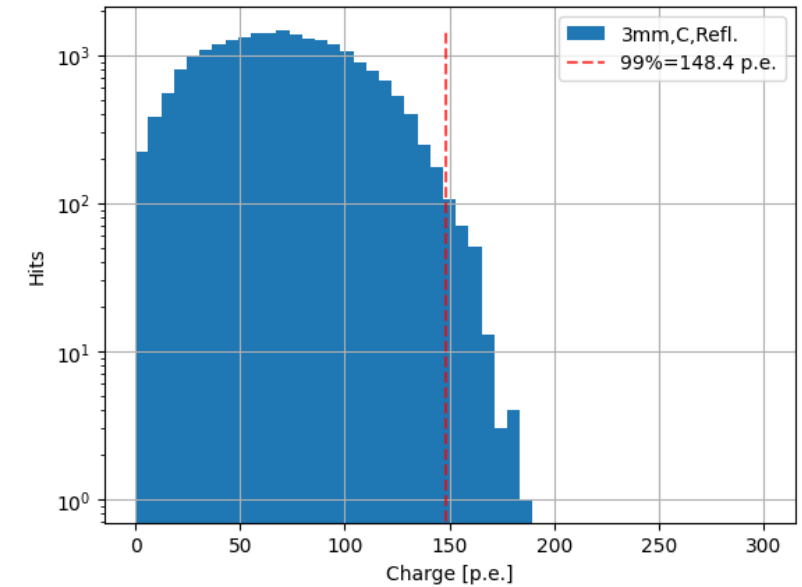
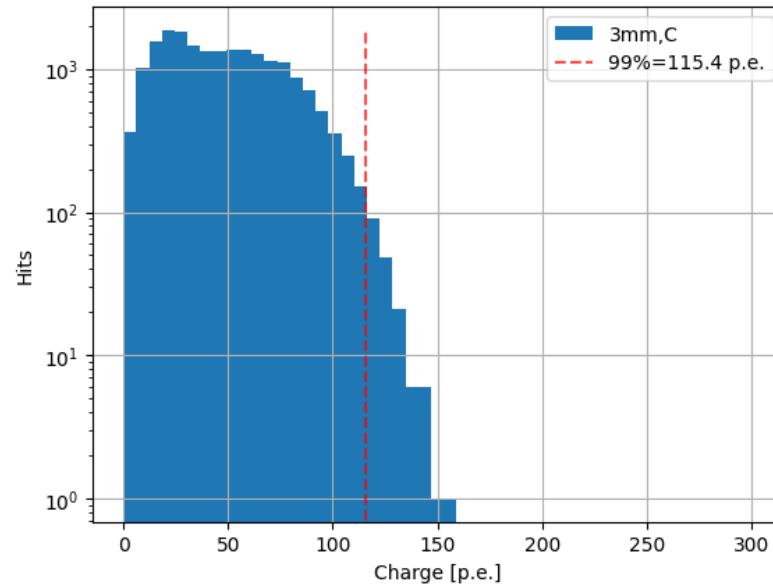


Position	99% 1mm	99% 3mm	Ratio
C	76.0	115.4	1.52
BL	91.2	150.2	1.65
TL	107.6	160.1	1.49
TR	70.6	116.4	1.65
BR	63.1	113.6	1.80

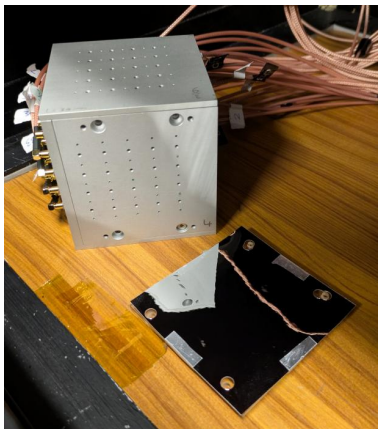
Need to check what this feature is

Reflector

- Placed sheet of 3M at the end of the fibres
- Noticeable increase in light yield in both the 1mm and 3mm cases
 - Probably strongly depends on how close to the fibre end the reflector can get

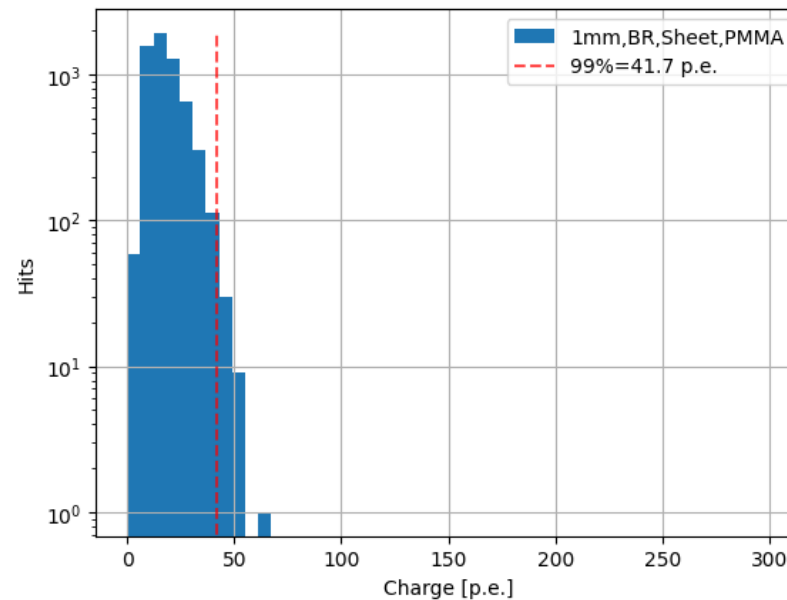
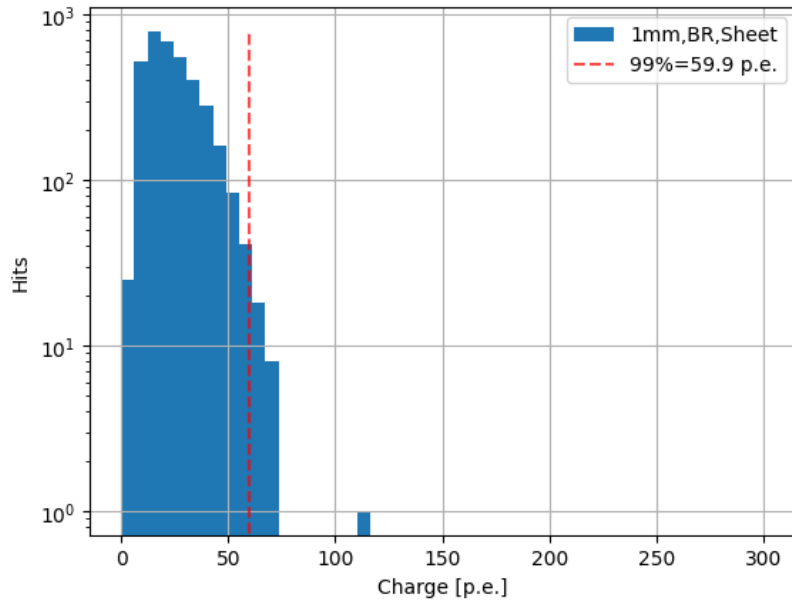
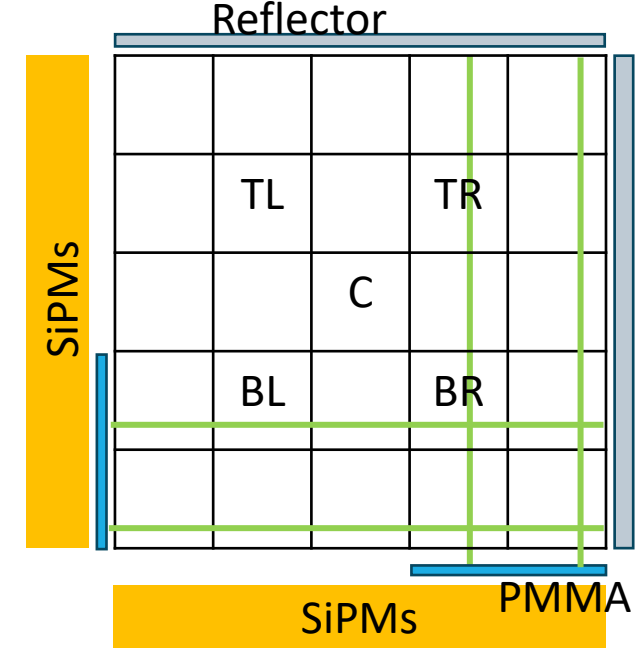


Position	99% no ref, 1mm	99% w ref, 1mm	Ratio, 1mm	99% no ref, 3mm	99% w ref, 3mm	Ratio, 3mm
C	76.0	89.7	1.18	115.4	148.4	1.29
BL	91.2	117.4	1.29	150.2	178.2	1.19
TL	107.6	115.6	1.07	160.1	181.0	1.13
TR	70.6	75.1	1.06	116.4	130.6	1.12
BR	63.1	81.4	1.29	113.6	138.2	1.22



PMMA

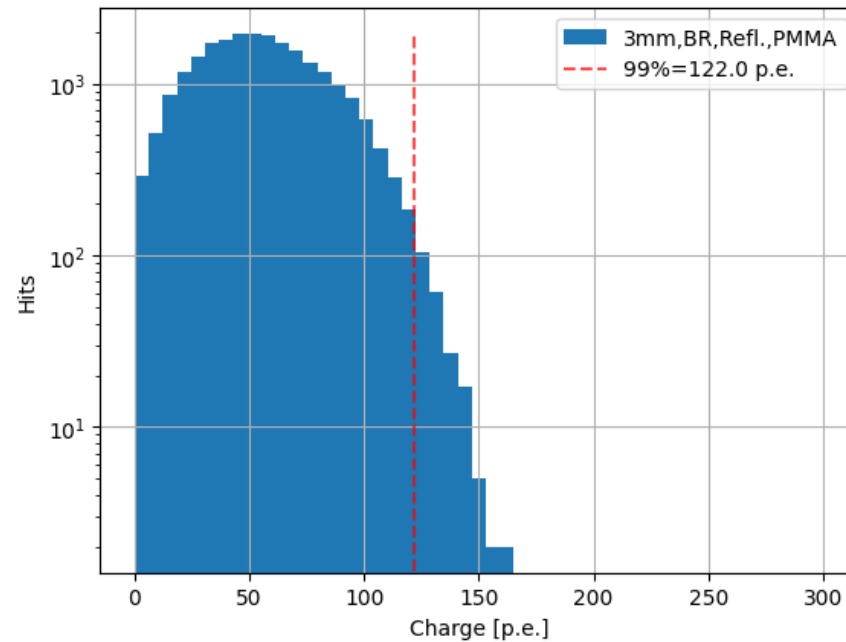
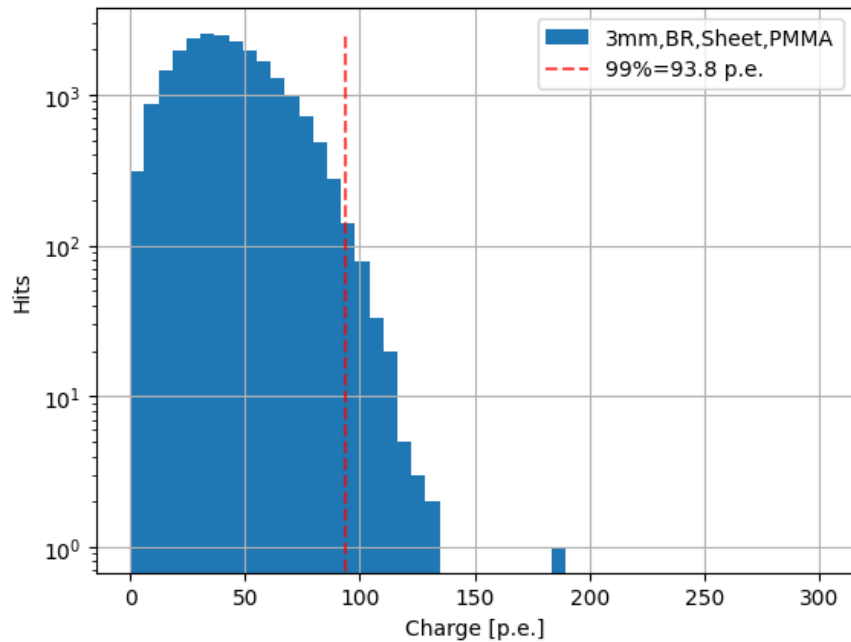
- Attached 1mm between the fibres and SiPMs for two PCBs (8 channels)
 - Different channels affected more – focus on BR
- 1mm SiPM is more affected by the presence of the PMMA
 - PMMA could diffuse the light away from the small SiPM surface



SiPM	PMMA	Reflector	99%
1mm	no	sheet	59.9
1mm	yes	sheet	41.7
1mm	no	yes	81.4
1mm	yes	yes	56.8
3mm	no	sheet	112.3
3mm	yes	sheet	93.8
3mm	no	yes	138.2
3mm	yes	yes	122.0

PMMA+Reflectors

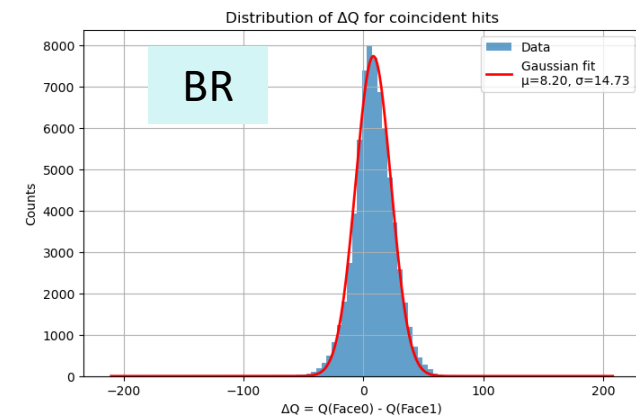
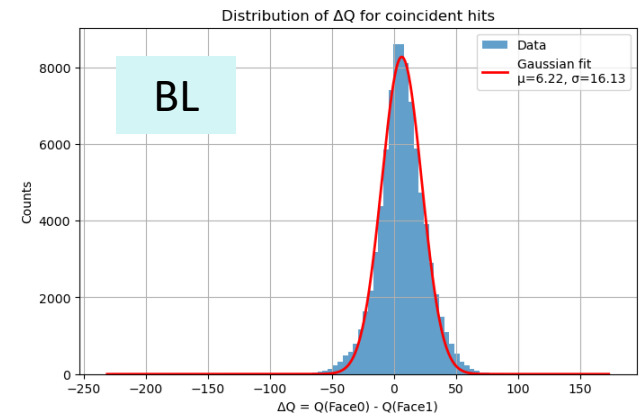
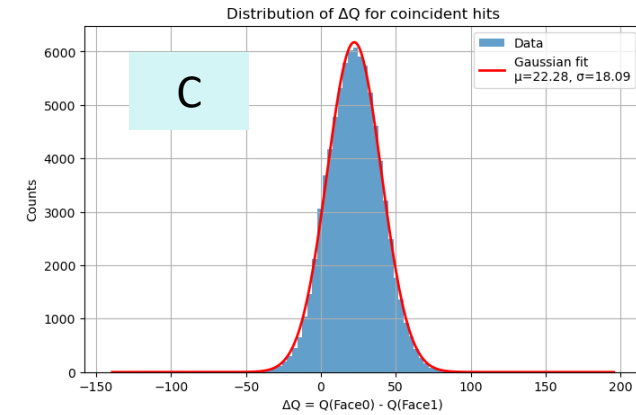
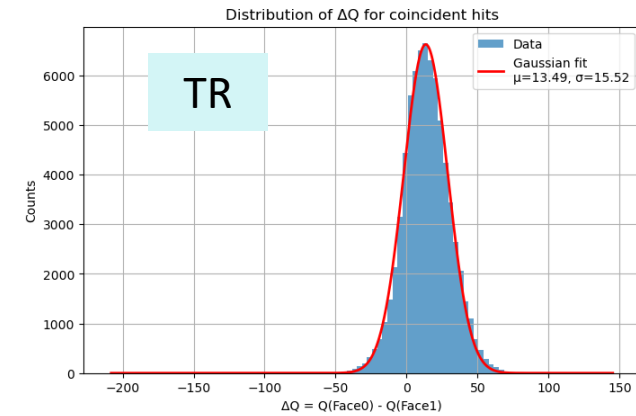
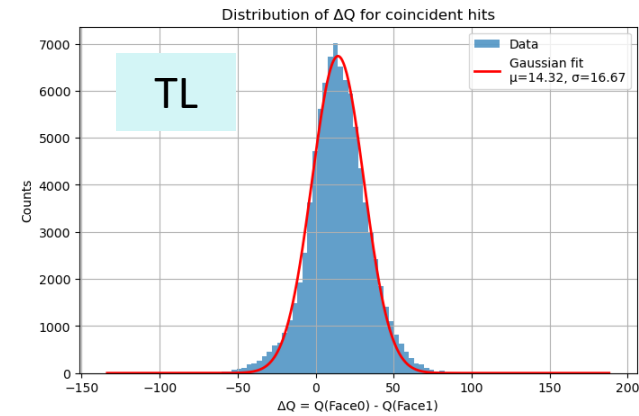
- By adding reflectors at the other end of the fibres, the effect of having PMMA in front of the SiPM can be counteracted



SiPM	PMMA	Reflector	99%
1mm	no	sheet	59.9
1mm	yes	sheet	41.7
1mm	no	yes	81.4
1mm	yes	yes	56.8
3mm	no	sheet	112.3
3mm	yes	sheet	93.8
3mm	no	yes	138.2
3mm	yes	yes	122.0

Charge asymmetry

- Noticed one side of the microSFGD had consistently higher light yield than the other
- Further away from the upper channel SiPMs (face1) has larger asymmetry
- Will check if this is just these specific fibres by looking at lower layers



Conclusion

- Even if we are misunderstanding the increase in LY, 3mm SiPMs are less affected by PMMA in front of them
 - Can compare event rates between the two SiPMs as the data was taken at the same TD thresholds
- Adding a reflector to other end of the fibre can help recover LY
 - Would need to consider gain and pedestal measurements using noise instead of LED data
- Will investigate the charge asymmetry between the faces
- Took cosmic data, so will also compare results from MIPs
- Took source data at different HG and LG settings for the 3mm SiPM, will check how the behaviour compares with the 1mm

Back up

All results

Run	SiPM	PMMA	Reflector	Position	99%
1192	1mm	no	no	C	76.0
1193	1mm	no	no	BL	91.2
1194	1mm	no	no	TL	107.6
1195	1mm	no	no	TR	70.6
1196	1mm	no	no	BR	63.1
1198	1mm	no	yes	C	89.7
1199	1mm	no	yes	BL	117.4
1200	1mm	no	yes	TL	115.6
1201	1mm	no	yes	TR	75.1
1202	1mm	no	yes	BR	81.4
1204	1mm	yes	yes	C	81.6
1205	1mm	yes	yes	BL	89.6
1206	1mm	yes	yes	TL	113.0
1207	1mm	yes	yes	TR	68.3
1208	1mm	yes	yes	BR	56.8
1209	1mm	yes	sheet	C	69.5
1210	1mm	yes	sheet	BL	67.5
1211	1mm	yes	sheet	TL	87.2
1212	1mm	yes	sheet	TR	54.8
1213	1mm	yes	sheet	BR	41.7
1246	1mm	no	sheet	C	75.9
1247	1mm	no	sheet	BL	90.1
1248	1mm	no	sheet	TL	79.3
1249	1mm	no	sheet	TR	46.8
1250	1mm	no	sheet	BR	59.9

Run	SiPM	PMMA	Reflector	Position	99%
1119	3mm	no	no	C	115.4
1120	3mm	no	no	BL	150.2
1121	3mm	no	no	TL	160.1
1122	3mm	no	no	TR	116.4
1123	3mm	no	no	BR	113.6
1215	3mm	yes	yes	C	146.2
1216	3mm	yes	yes	BL	167.2
1217	3mm	yes	yes	TL	183.0
1218	3mm	yes	yes	TR	122.5
1219	3mm	yes	yes	BR	122.0
1220	3mm	yes	sheet	C	128.2
1221	3mm	yes	sheet	BL	134.5
1222	3mm	yes	sheet	TL	154.0
1223	3mm	yes	sheet	TR	105.2
1224	3mm	yes	sheet	BR	93.8
1225	3mm	no	yes	C	148.4
1226	3mm	no	yes	BL	178.2
1227	3mm	no	yes	TL	181.0
1228	3mm	no	yes	TR	130.6
1229	3mm	no	yes	BR	138.2
1233	3mm	no	sheet	C	132.5
1234	3mm	no	sheet	BL	150.0
1235	3mm	no	sheet	TL	139.1
1236	3mm	no	sheet	TR	99.2
1237	3mm	no	sheet	BR	112.3