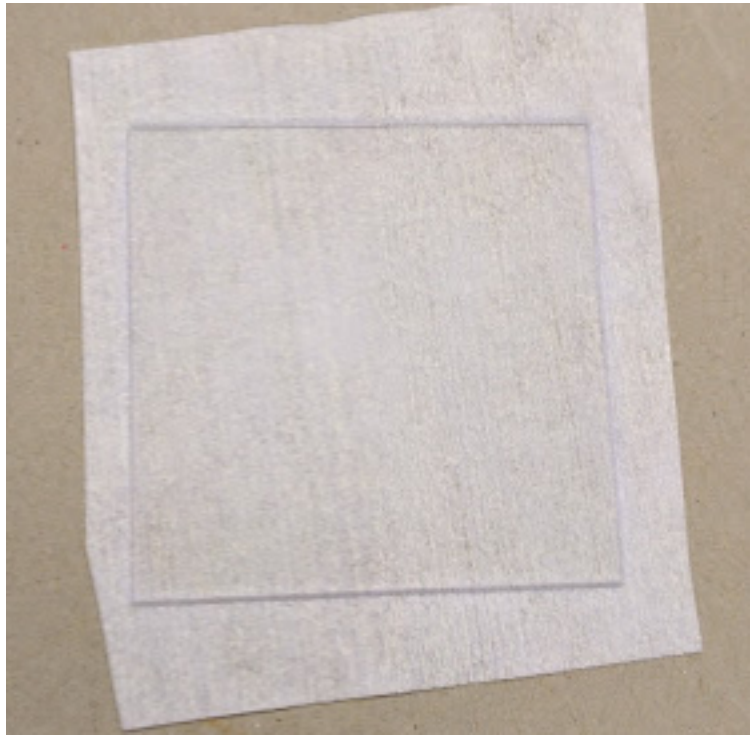
Presentation at SoNDe upscaling retreat

Amanda Jalgén

29-31/8 2017

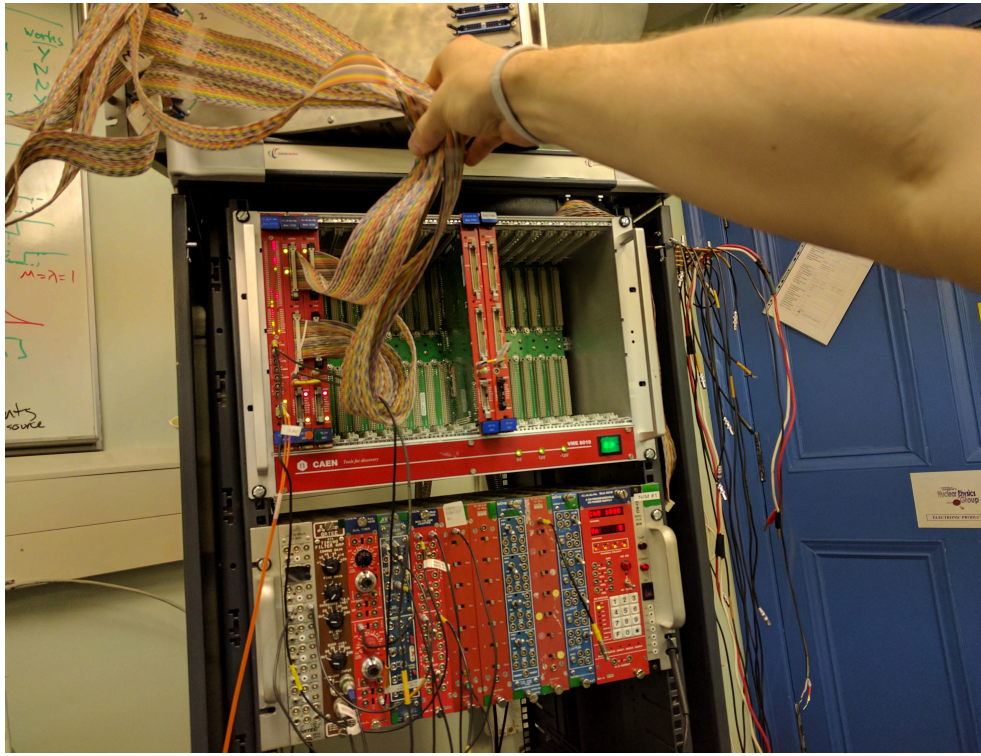
SoNDe-module prototype

Lithium6-glass scintillator



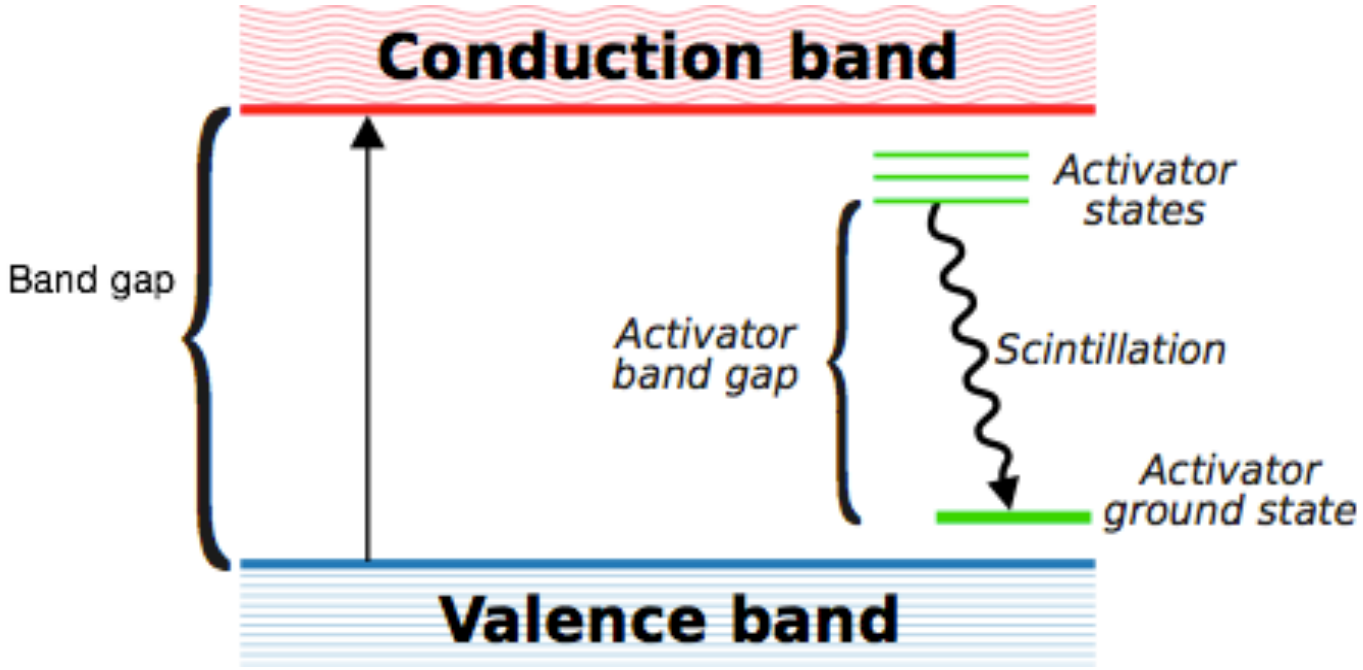
Multi-anode photomultiplier tubes

VME/NIM electronics



Scintillators

Glass scintillator



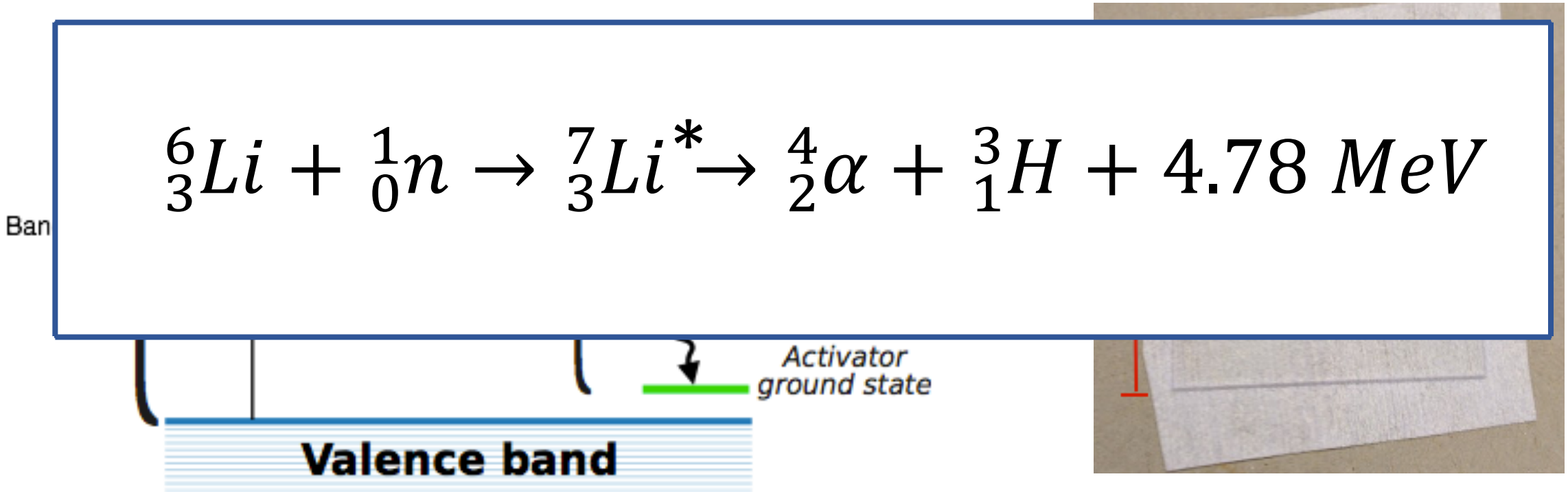
Lithium6-glass scintillator GS20

Scintillators

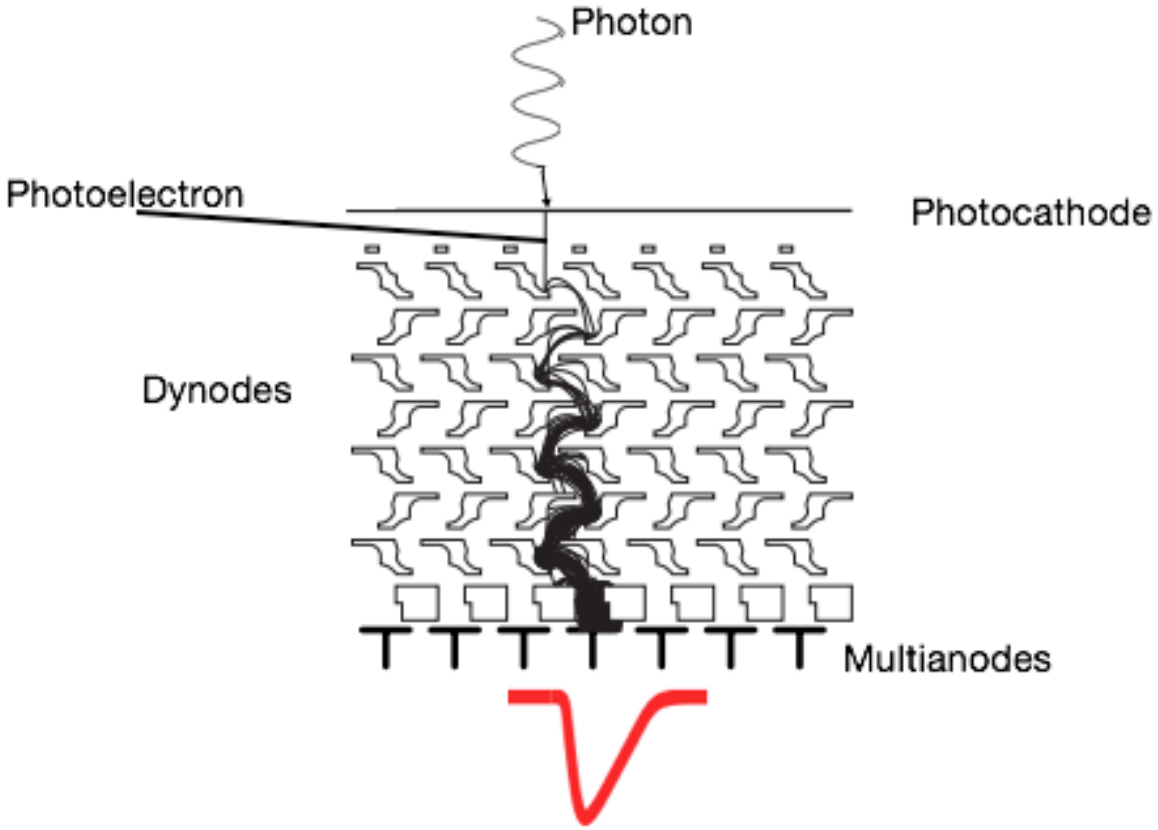
Glass scintillator

Lithium6-glass scintillator GS20

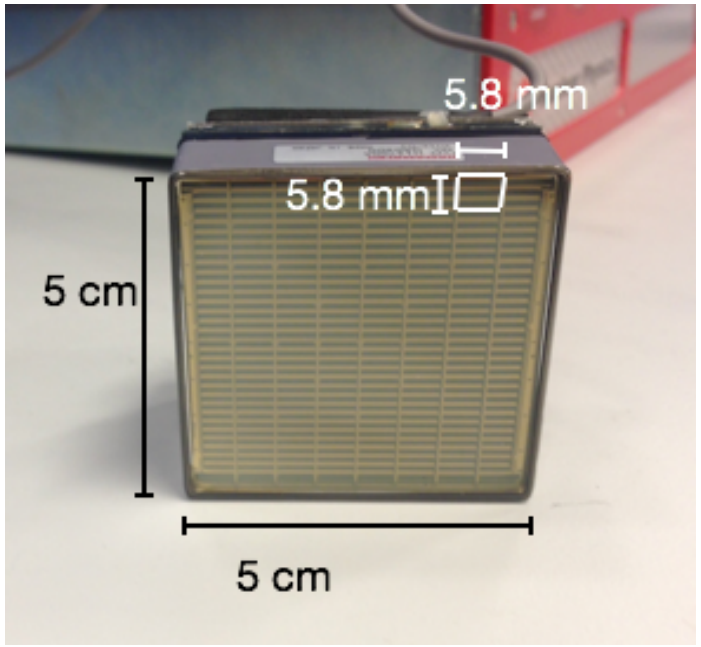
$$^{6}_{3}Li + ^{1}_{0}n \rightarrow ^{7}_{3}Li^{*} \rightarrow ^{4}_{2}\alpha + ^{3}_{1}H + 4.78\ MeV$$



Multi-anode Photomultiplier tube (MaPMT)

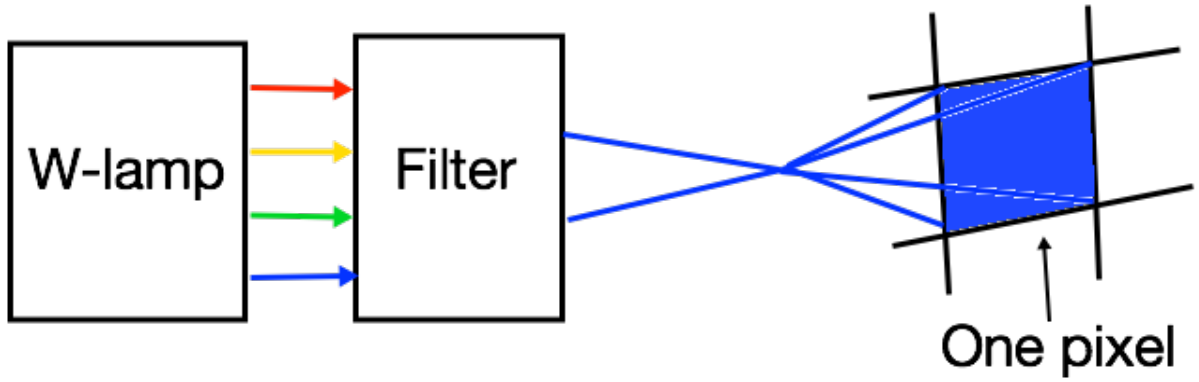


Hamamatsu H8500C



Calibration

- Different gain for the 64 pixels
- Want even response
- Hamamatsu provides a calibration sheet



Anode Uniformity of H8500C

Supply Voltage : -1000 V
Light Source : W-Lamp with blue filter (DC Light)
Spot Illumination : 6 mm square on each channel

Serial No. : CA9466

Ratio of Anode Output = 1 : 1.5

P1 83	P2 81	P3 82	P4 89	P5 100	P6 99	P7 95	P8 92
P9 76	P10 68	P11 72	P12 76	P13 82	P14 78	P15 79	P16 87
P17 77	P18 76	P19 76	P20 78	P21 81	P22 85	P23 81	P24 91
P25 76	P26 78	P27 77	P28 79	P29 83	P30 87	P31 83	P32 93
P33 79	P34 80	P35 80	P36 85	P37 87	P38 90	P39 85	P40 96
P41 84	P42 82	P43 90	P44 89	P45 92	P46 88	P47 88	P48 98
P49 85	P50 81	P51 90	P5 89	P53 95	P54 93	P55 89	P56 98
P57 89	P58 86	P59 89	P60 91	P61 95	P62 98	P63 96	P64 88

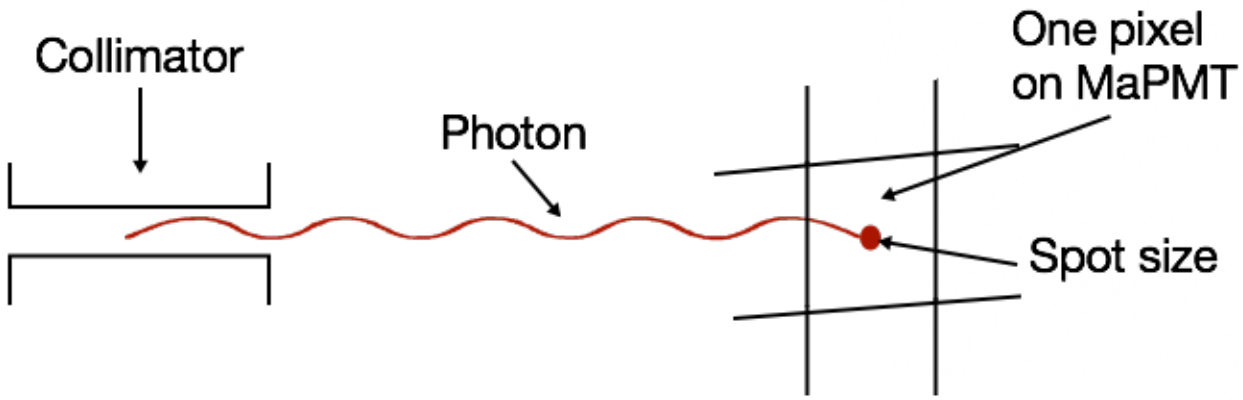
Top View

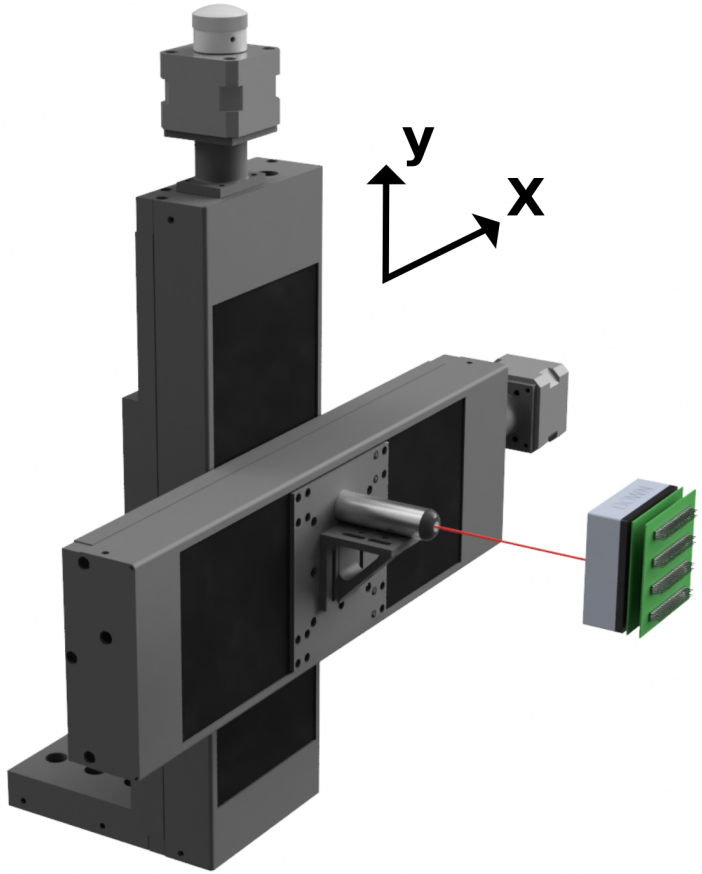
Test bench at the University of Glasgow

Test bench at the University of Glasgow

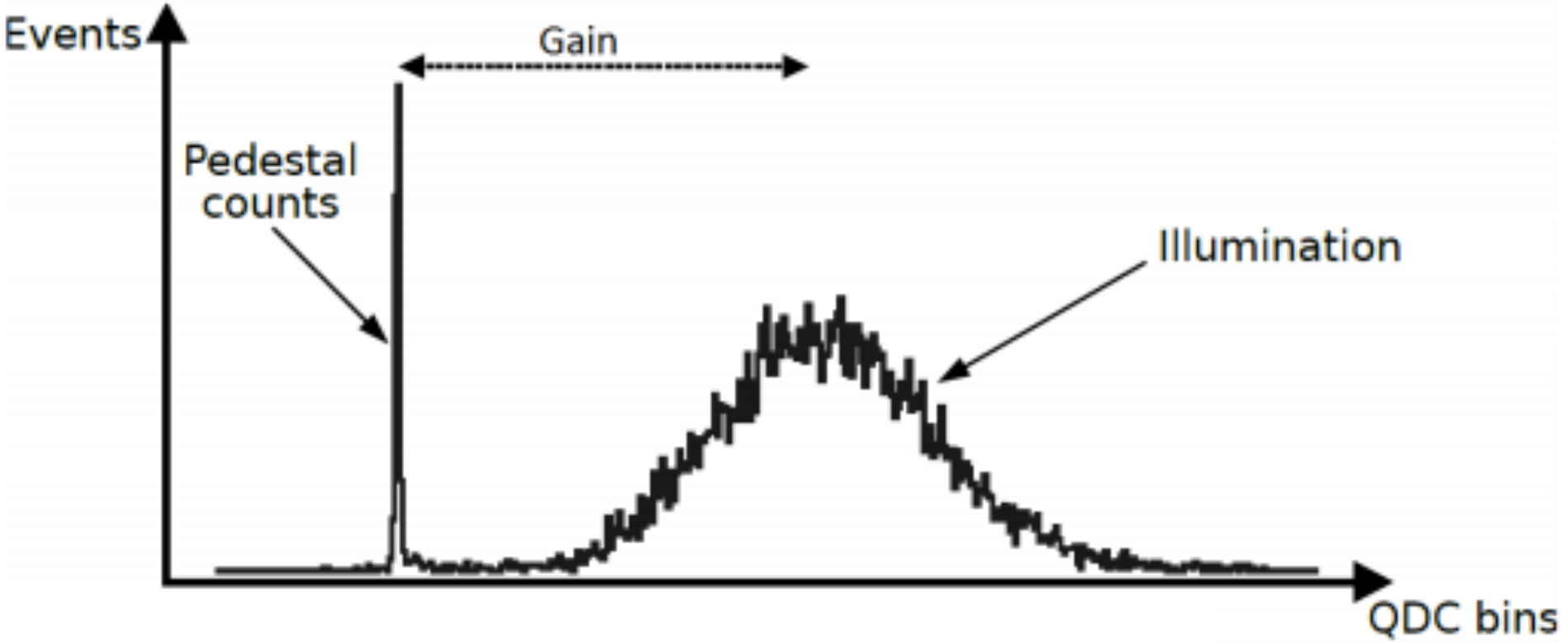
Produce laser calibration

- Used a collimated laser beam
- SoNDe-module prototyp placed in the focal spot of the laser
- Central scan

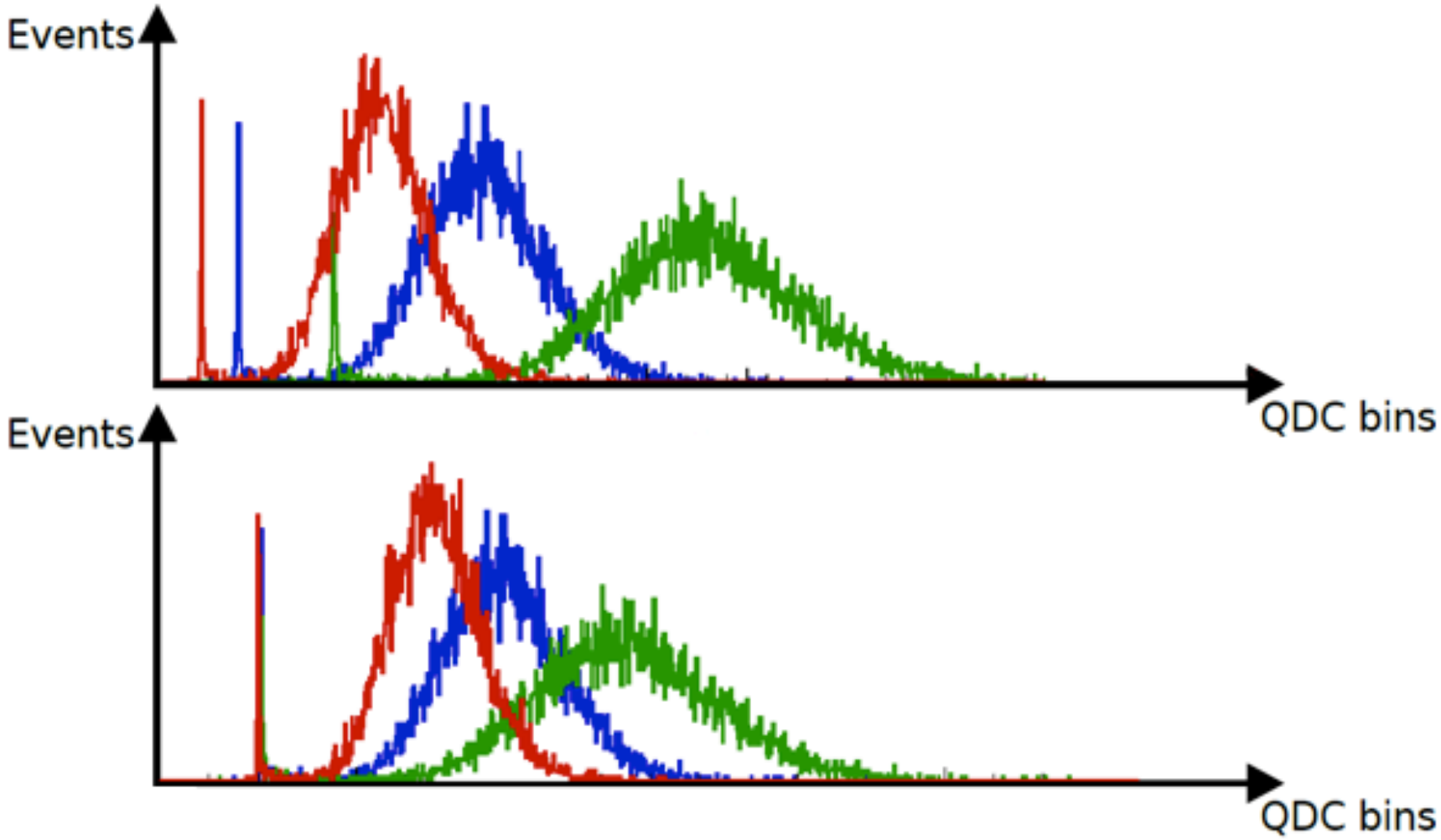




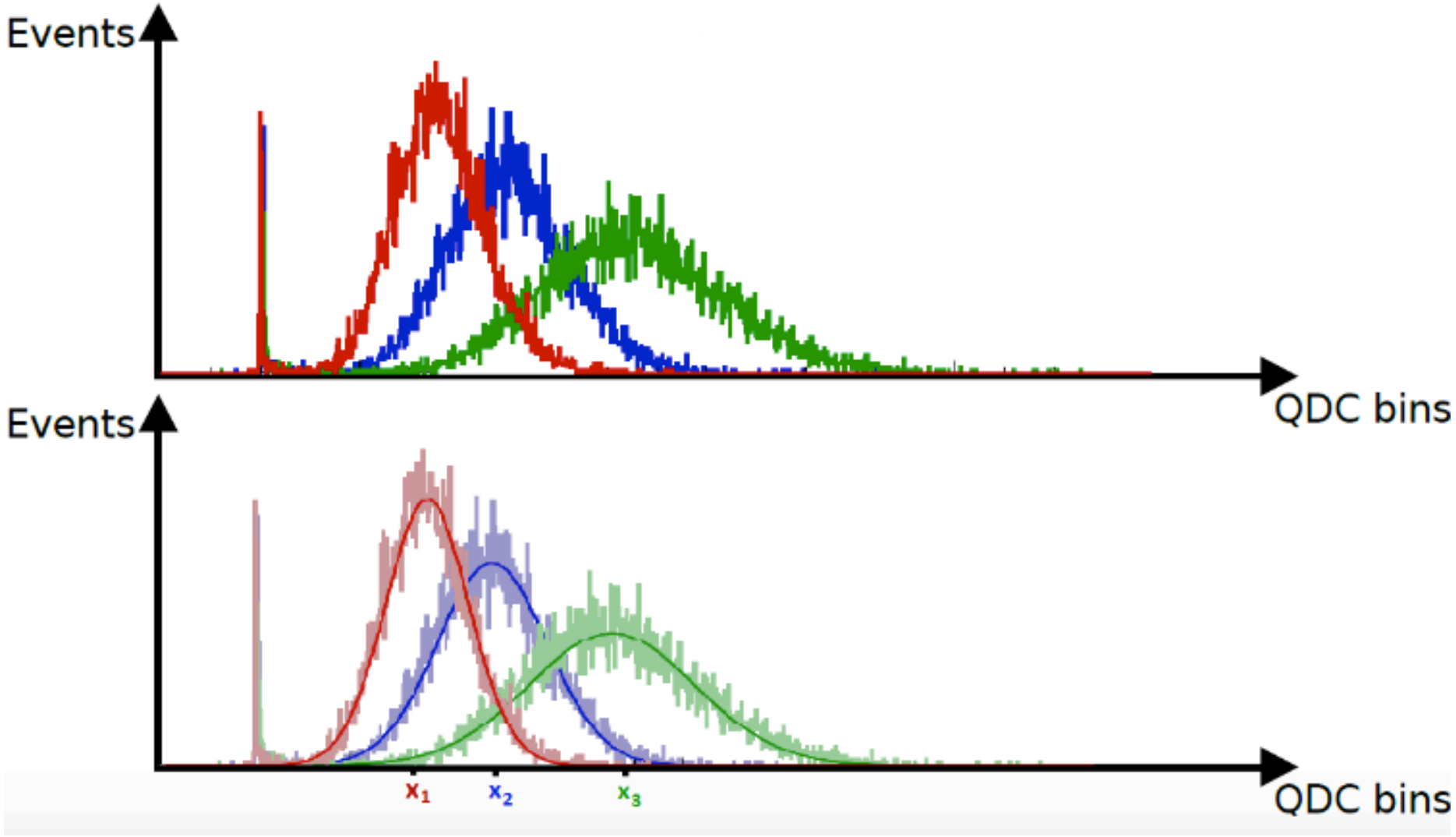
Spectrum from laser calibration



Pedestal correction

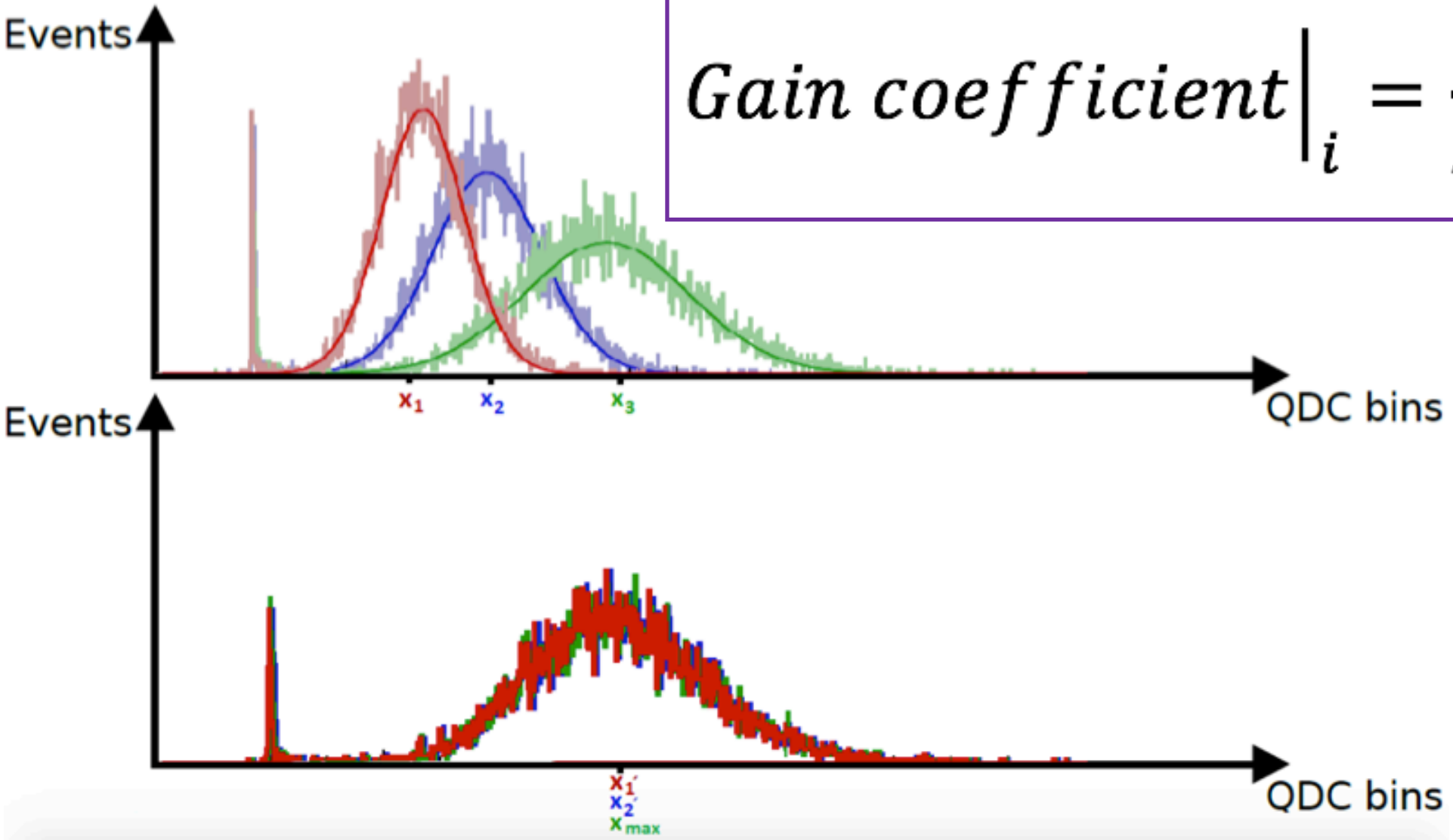


Gaussian fit



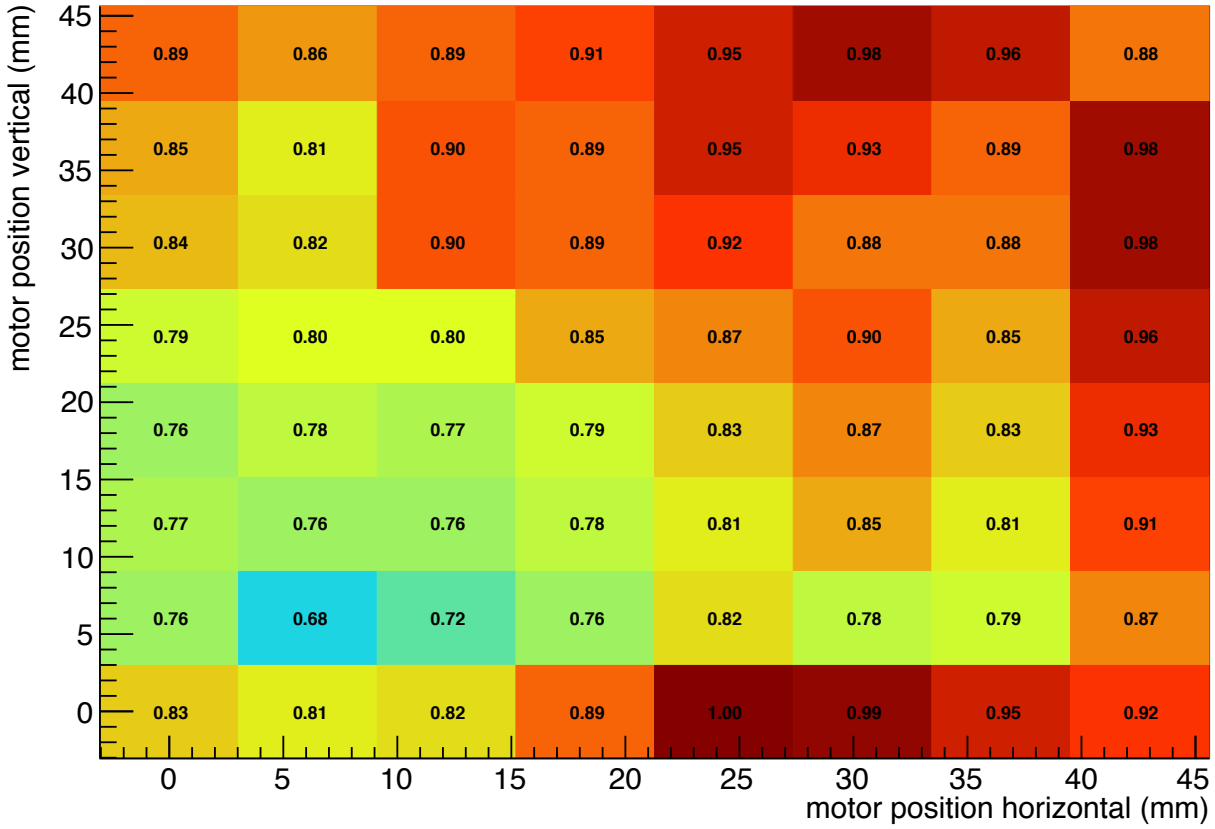
Gain fitting

$$Gain\ coefficient\Big|_i = \frac{x_i}{x_{max}}$$

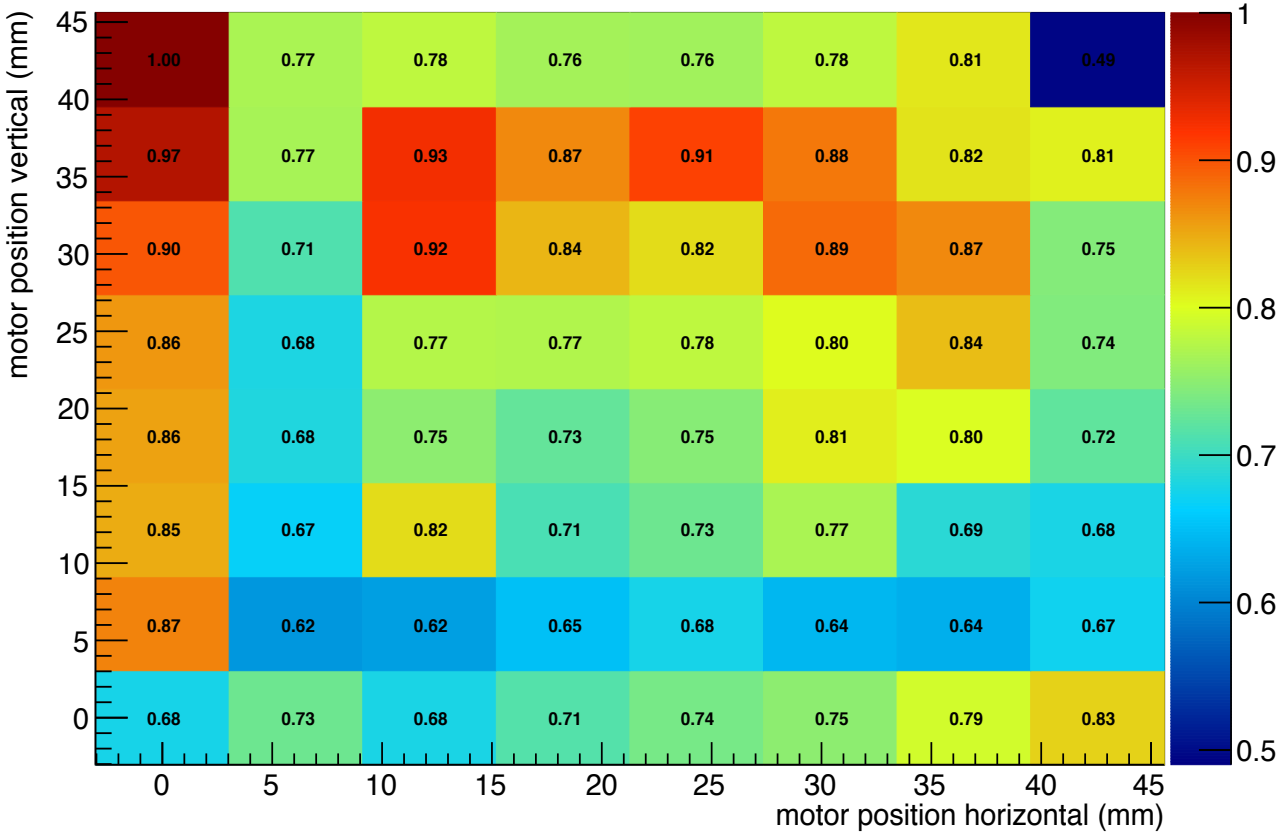


Comparing calibrations

Hamamatsu calibration sheet

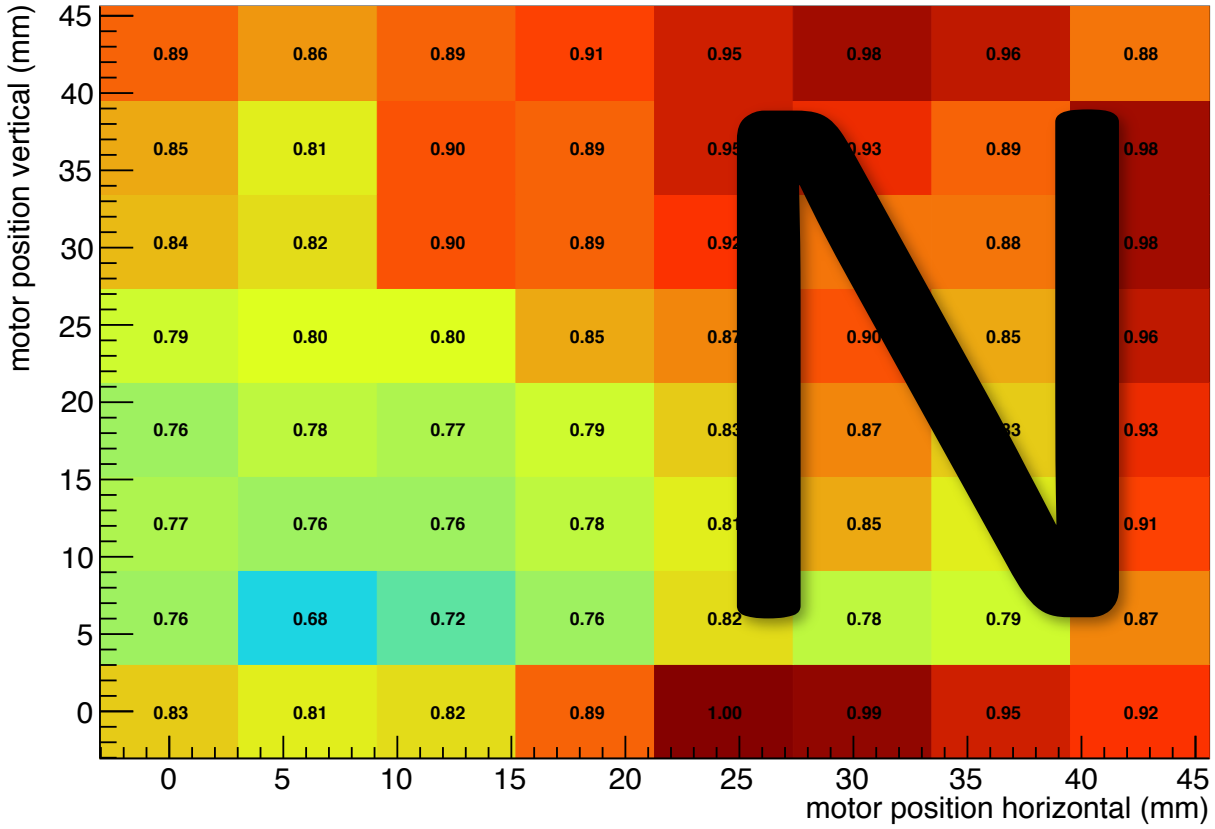


Laser calibration



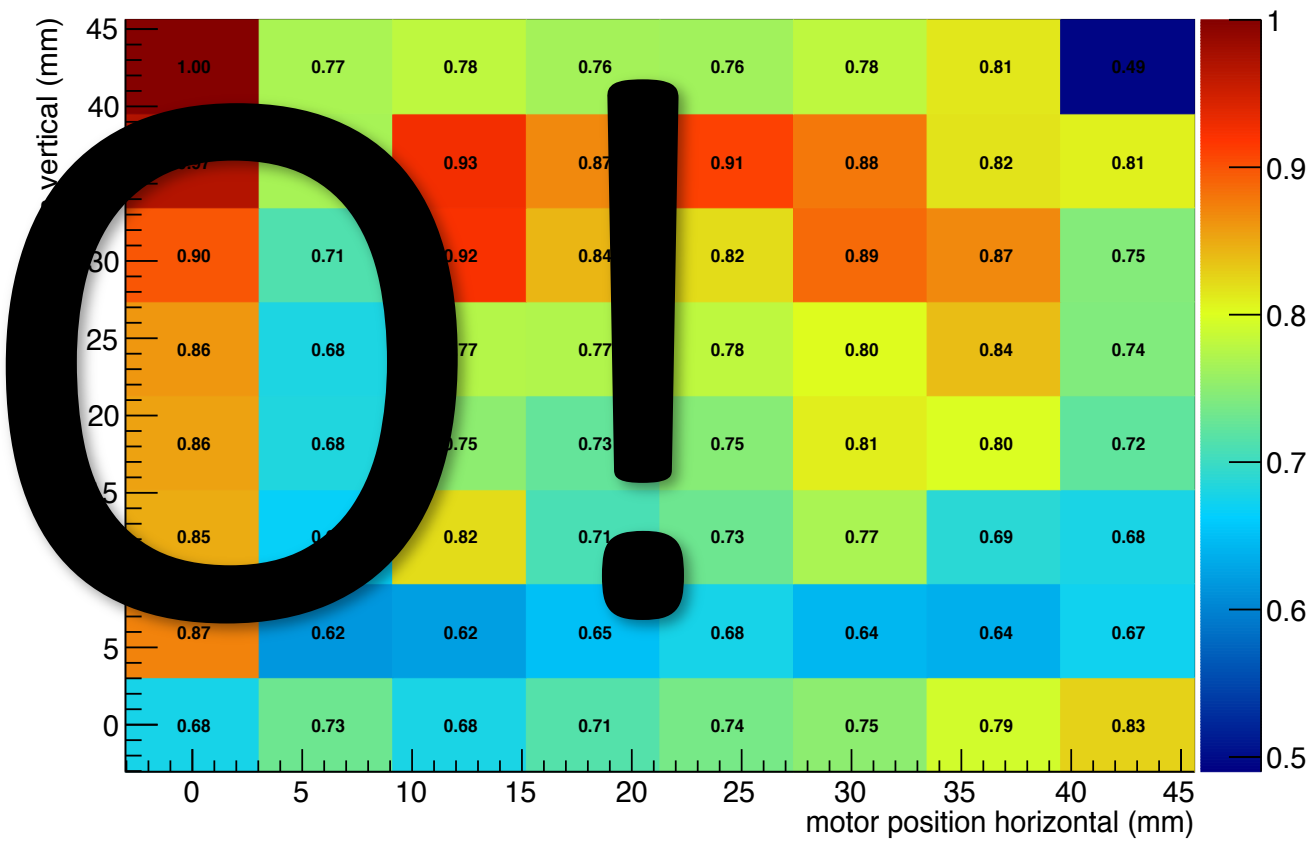
Comparing calibrations

Hamamatsu calibration sheet



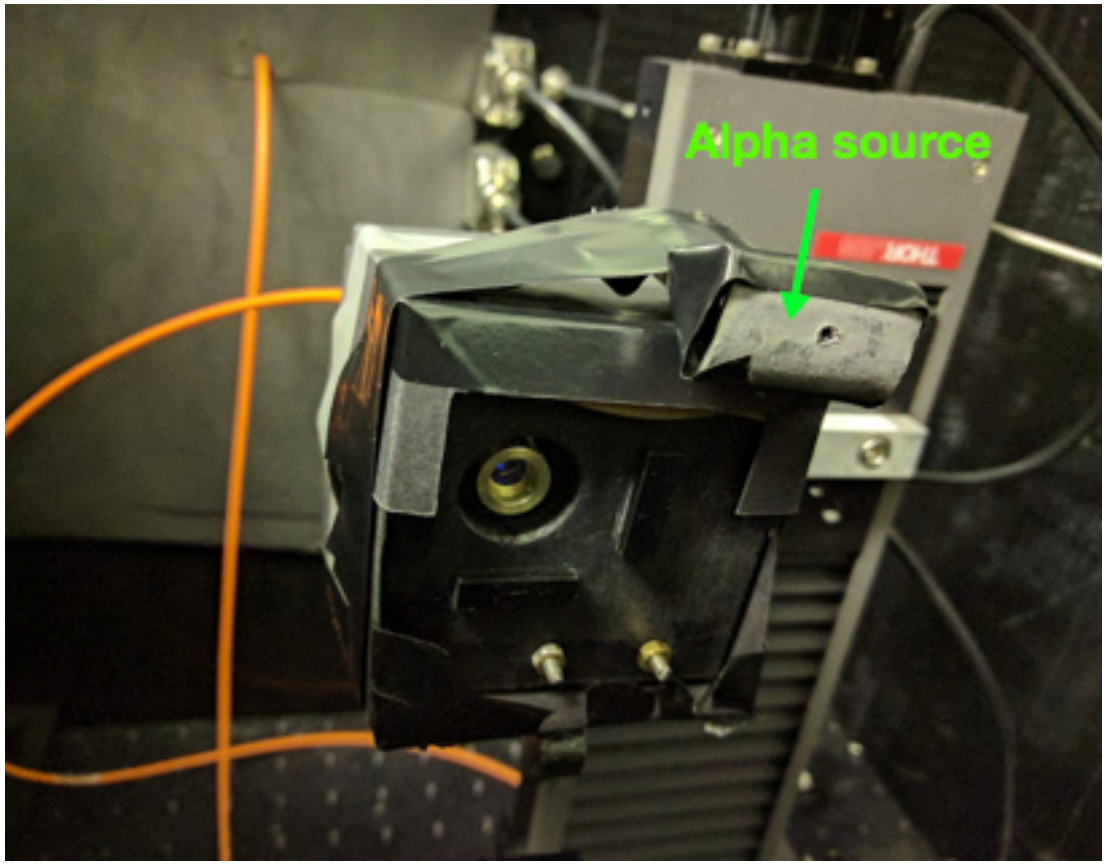
NO!

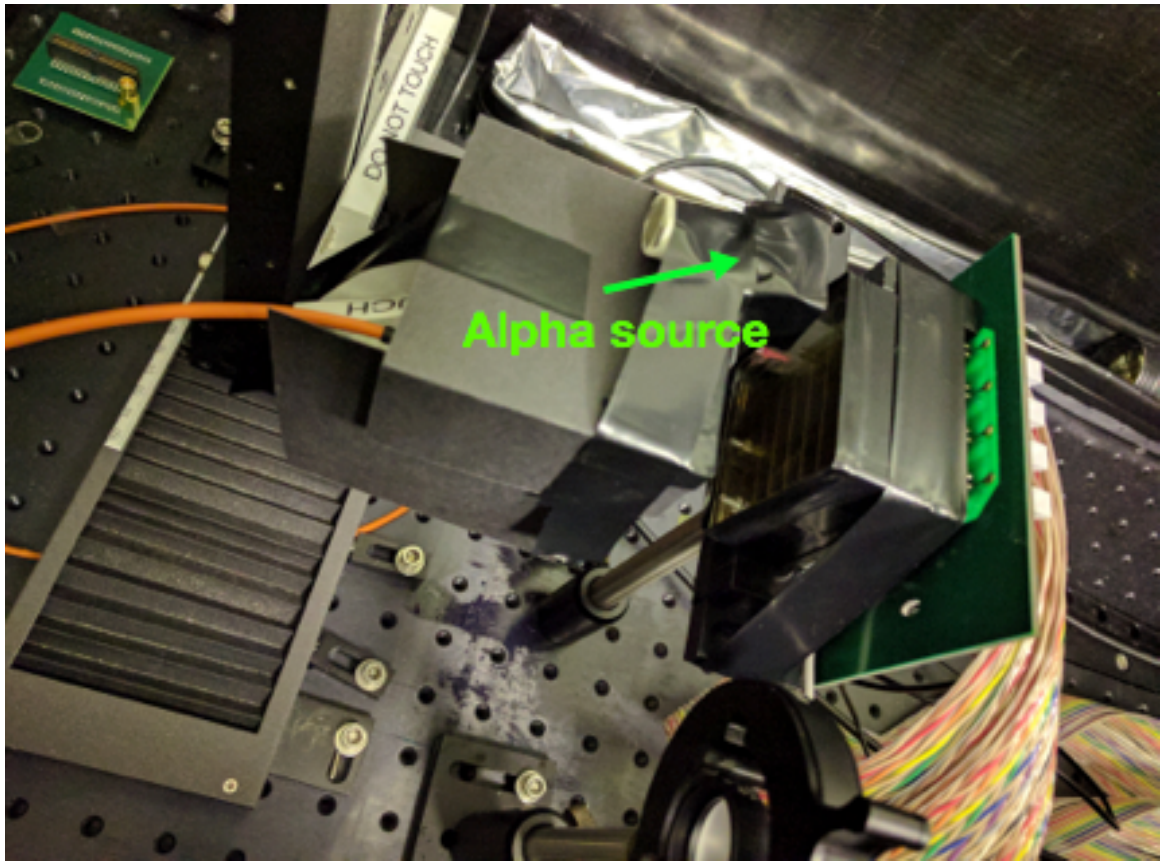
Laser calibration



Alpha irradiation

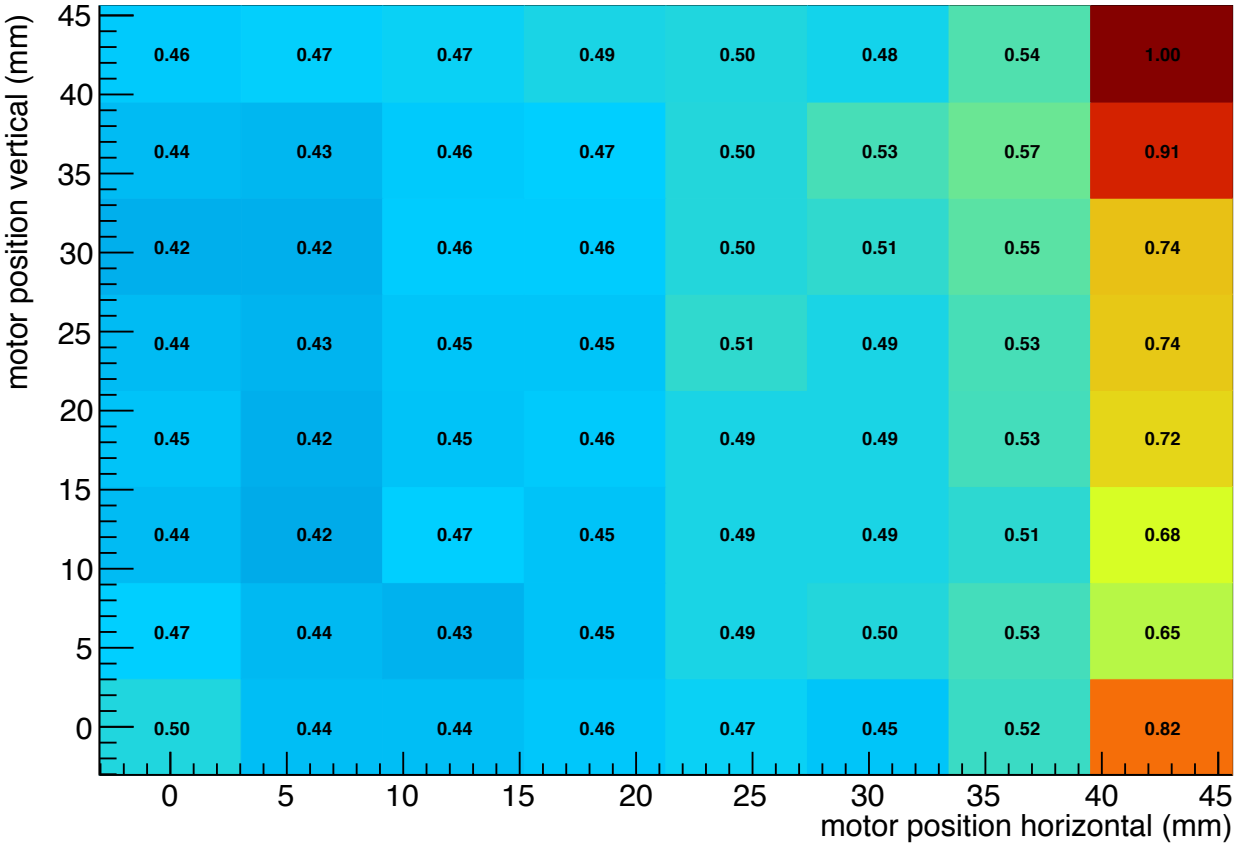
$$^{6}_{3}Li + ^{1}_{0}n \rightarrow ^{7}_{3}Li \rightarrow ^{4}_{2}\alpha + ^{3}_{1}H + 4.78\ MeV$$



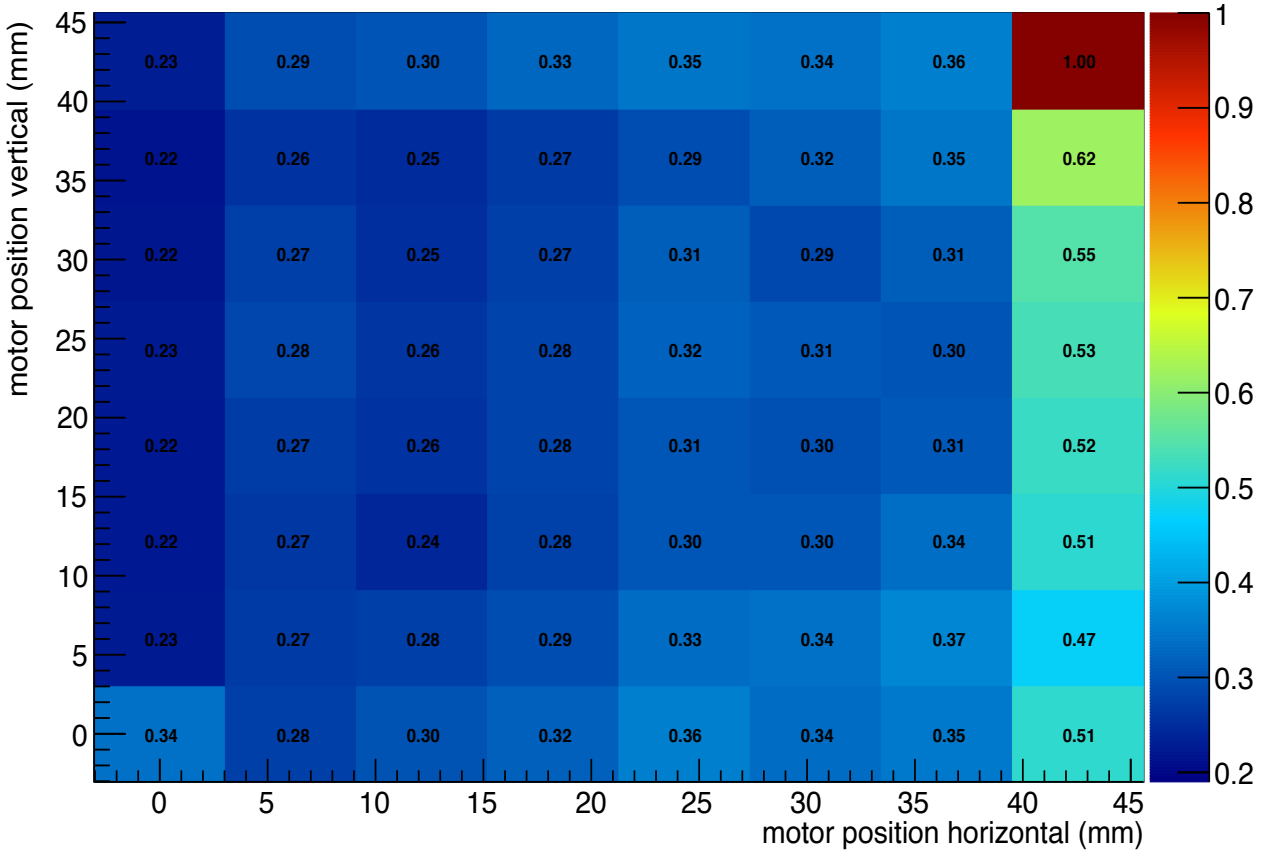


Calibrations applied

Hamamatsu calibration sheet



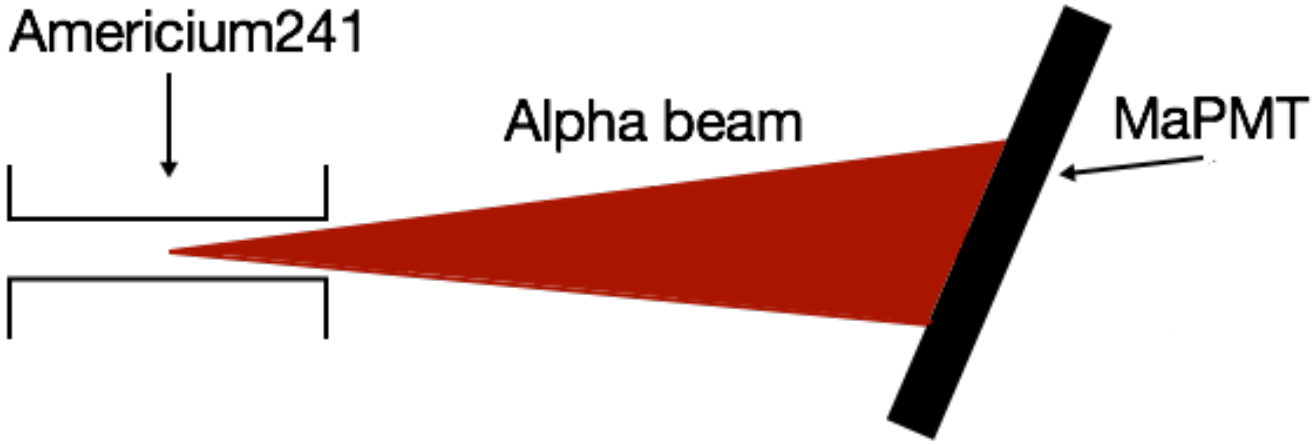
Laser calibration

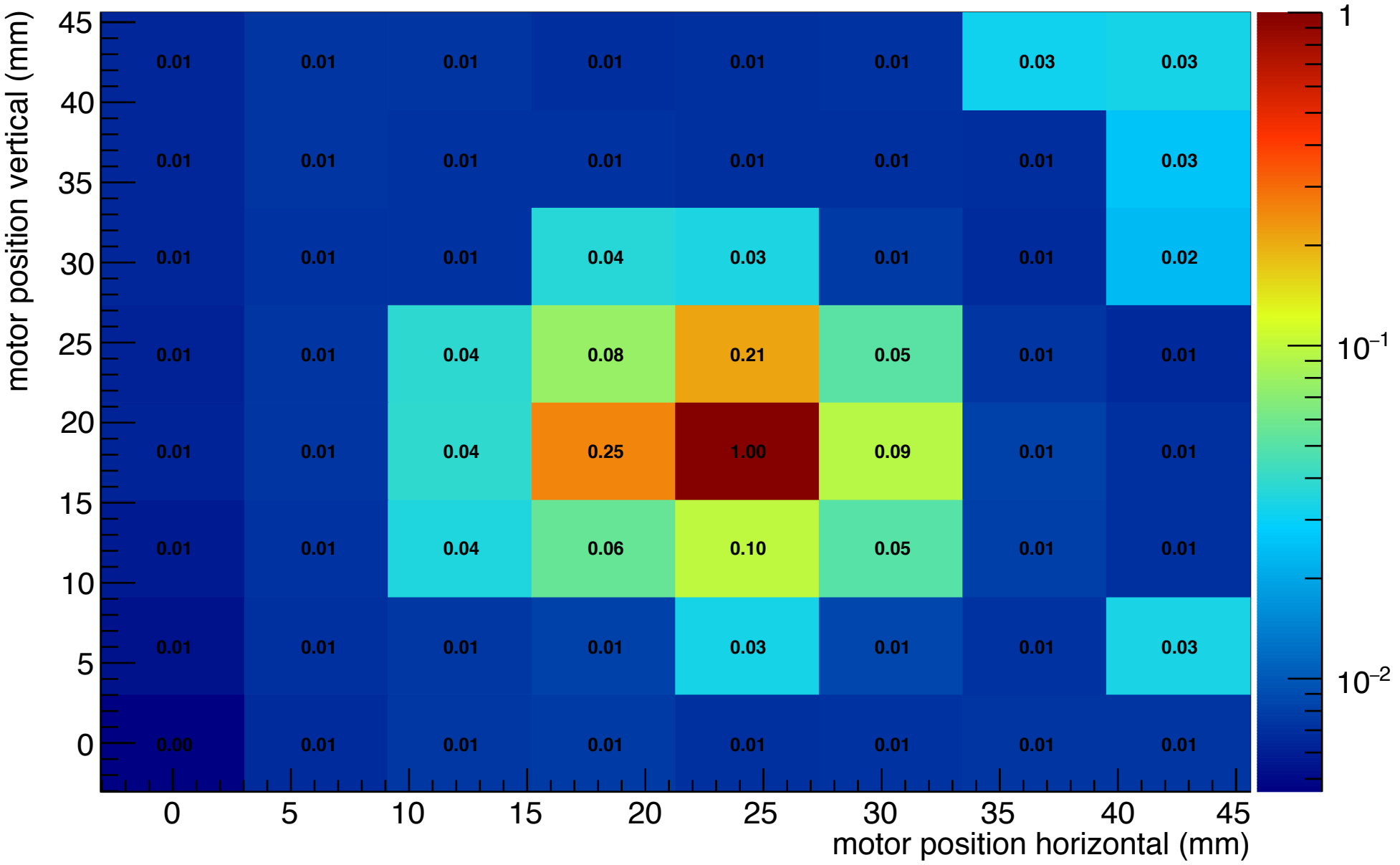


Misalignement

Three effects:

- More alpha-particle irradiation
- Irradiation with higher energy
- Ionize the air between the source and the SoNDe-module prototype.




motor position vertical (mm)
45
40
35
30
25
20
15
10
5
0
0.01 0.01 0.01 0.01 0.01 0.01 0.03 0.03
0.01 0.01 0.01 0.01 0.01 0.01 0.01 0.03
0.01 0.01 0.01 0.04 0.03 0.01 0.01 0.02
0.01 0.01 0.04 0.08 0.21 0.05 0.01 0.01
0.01 0.01 0.04 0.25 1.00 0.09 0.01 0.01
0.01 0.01 0.04 0.06 0.10 0.05 0.01 0.01
0.01 0.01 0.01 0.01 0.03 0.01 0.01 0.03
0.00 0.01 0.01 0.01 0.01 0.01 0.01 0.01
0 5 10 15 20 25 30 35 40 45
motor position horizontal (mm)
1
10^{-1}
10^{-2}

Next steps

- Misaligned or not? – Either do a full simulation or taking the measurements again
- Analyze the measurements from second trip to Glasgow
- Lots of light spread (“Glow effect”) - need a grooved scintillator for further studies