Update on Lifetime Measurement

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and the bachelor students
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ERLANGEN CENTRE FOR ASTROPARTICLE PHYSICS
FRIEDRICH-ALEXANDER UNIVERSITÄT ERLANGEN-NÜRNBERG
NATURWISSENSCHAFTLICHE FAKULTÄT

Outline

- MCP lifetime measurements
- Further work with new Hamamatsu 2 inch MCP-PMTs
- Summary

MCP lifetime measurements

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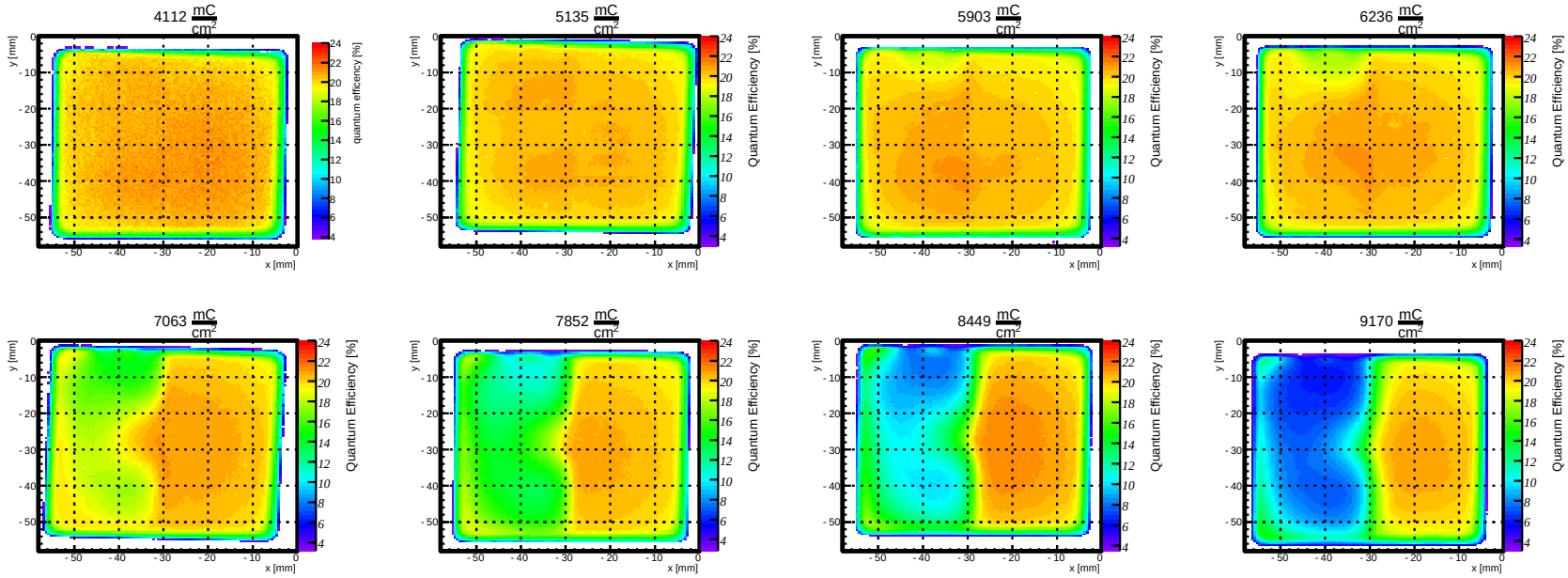
Illumination Overview Time

Manufacturer	Senor ID	Integral Charge [mC/cm2]	# of measurement	# of QE scans	Start/End of Measurement
Photonis P85112	9001223	9223.0	159	16	23.08. 11/ongoing
	9001332	7721.7	63	9	12.12.12/ongoing
	9001393	4721.3	27	5	23.01.14/ongoing
Hamamatsu R10754X	KT0001 (M16M)	8741.6	39	7	20.08.13/ongoing
	KT0002 (M16M)	5135.2	34	8	21.10.13/ongoing
BINP	3548	6697.8	135	9	21.10.11/Jul. 15

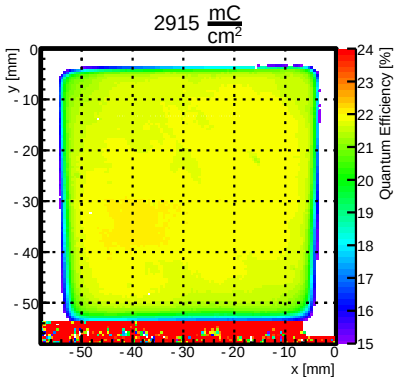
Illumination Overview QE

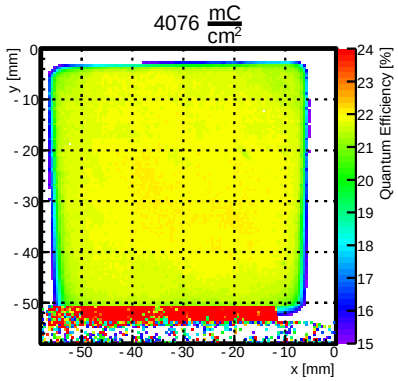
Manufacturer	Senor ID	Integral Charge [mC/cm2]	QE start [%]	QE latest [%]	QE latest/QE start [%]
Photonis P85112	9001223	9223.0	22.11	5.85	12.89
	9001332	7721.7	22.62	22.78	100.71
	9001393	4721.3	19.05	19.90	104.46
Hamamatsu R10754X	KT0001 (M16M)	8741.6	21.71	16.25	74.85
	KT0002 (M16M)	5135.2	21.14	15.12	71.52
BINP	3548	6697.8	12.23	4.58	37.45

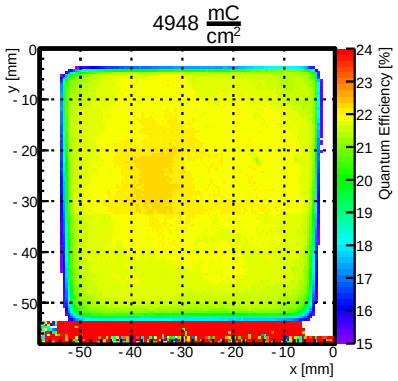
QE Scan Photonis 9001223

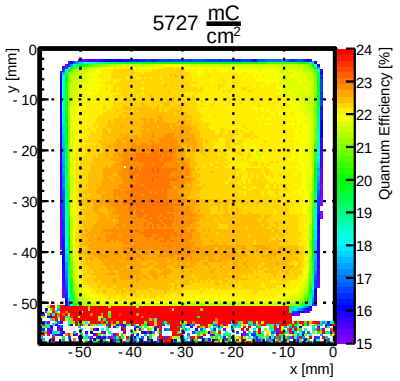


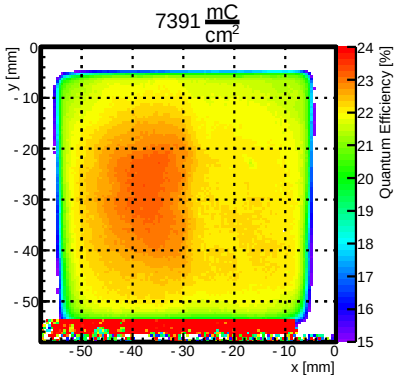
QE Scan Photonis 9001332



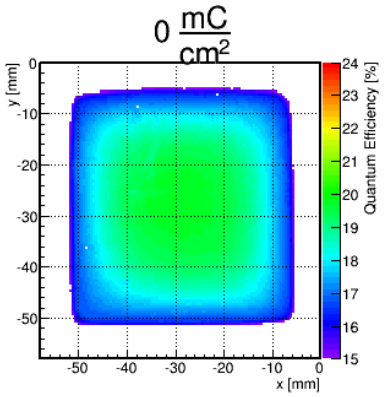


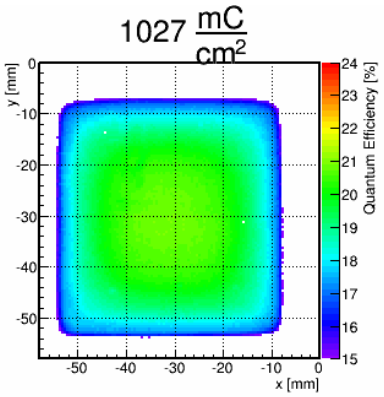


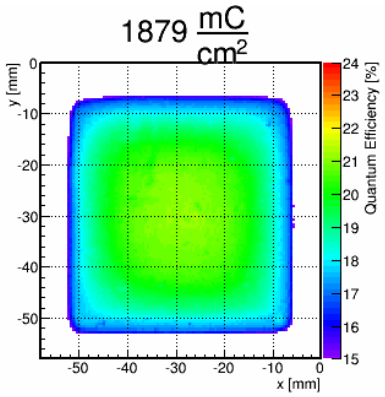


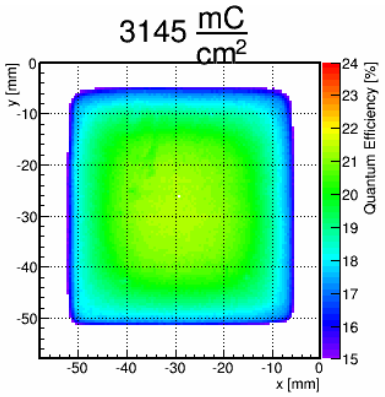


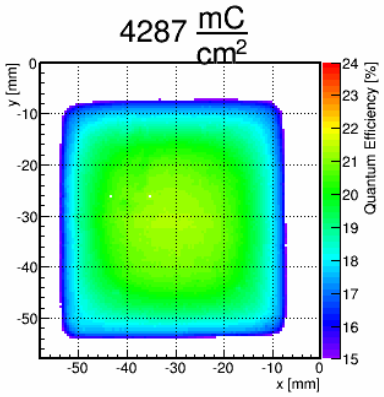
QE Scan Photonis 9001393-URD



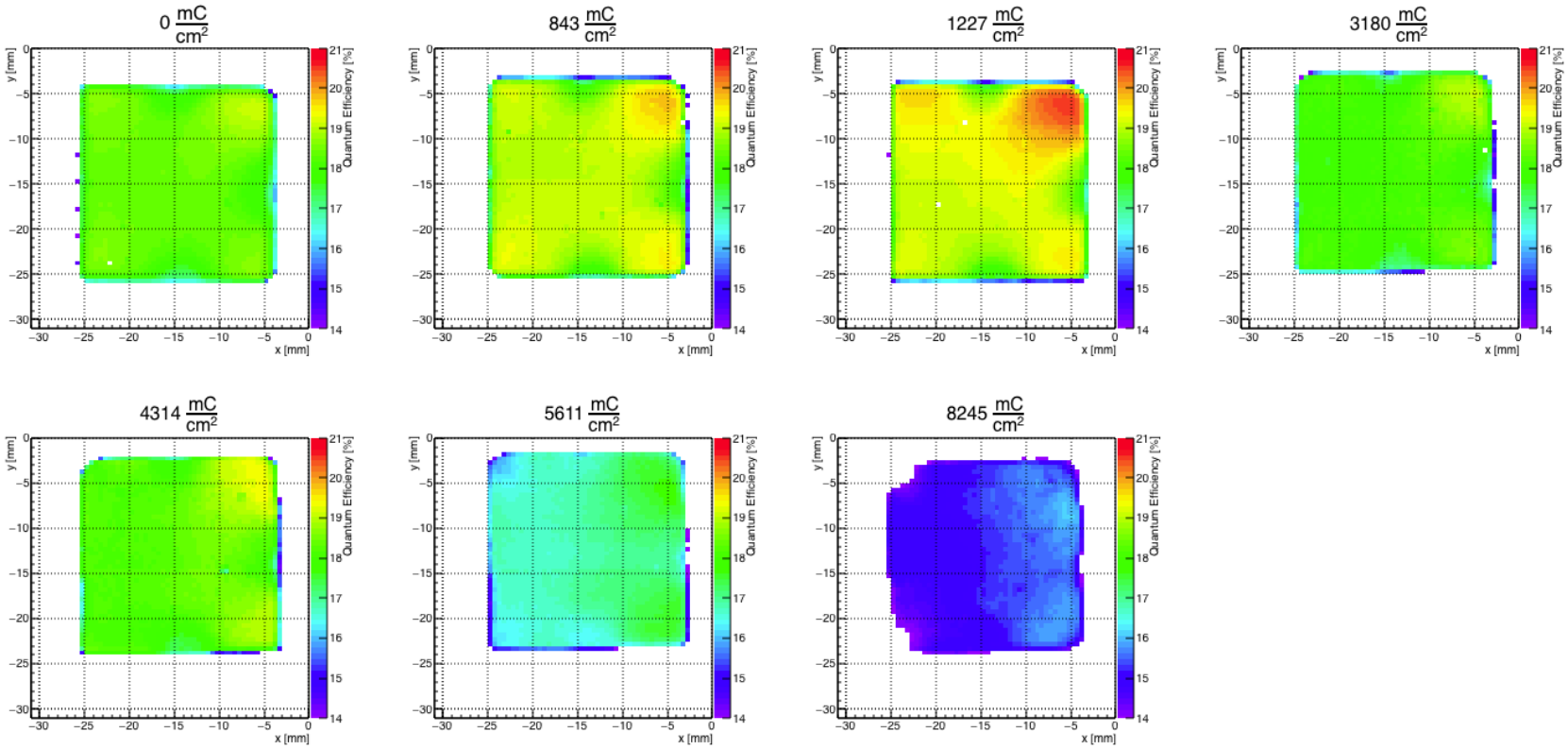




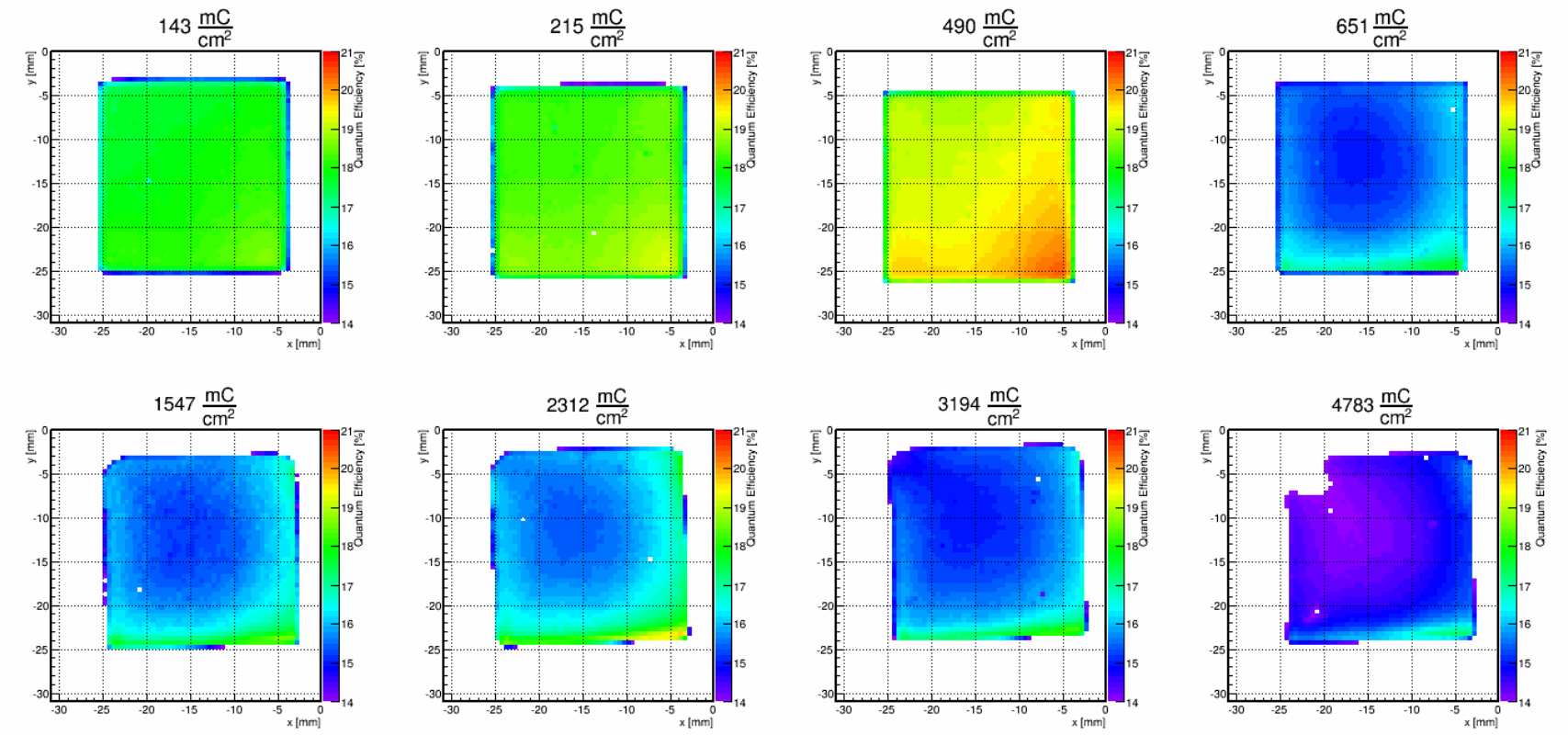




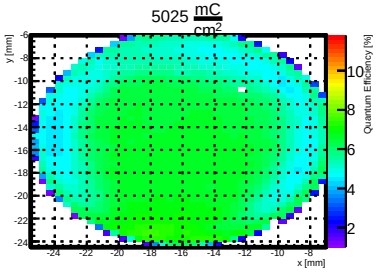
QE Scan KT0001 (M16M)

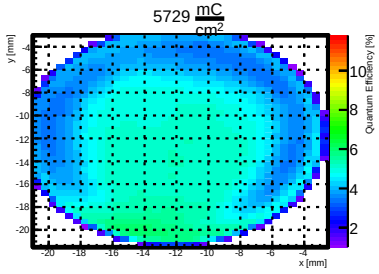


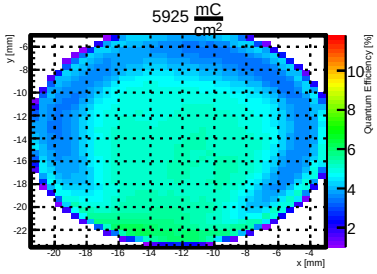
QE Scan KT0002 (M16M)

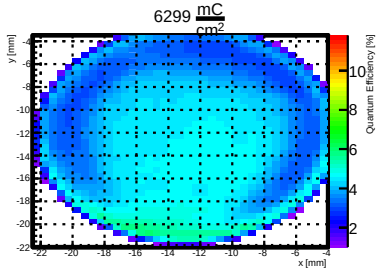


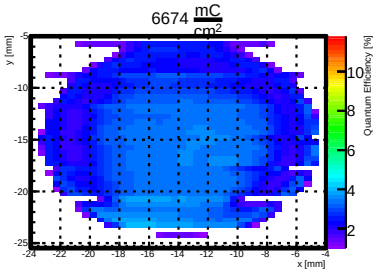
BINP 3548


5025 mC/cm²
y [mm]
x [mm]
Quantum Efficiency [%]

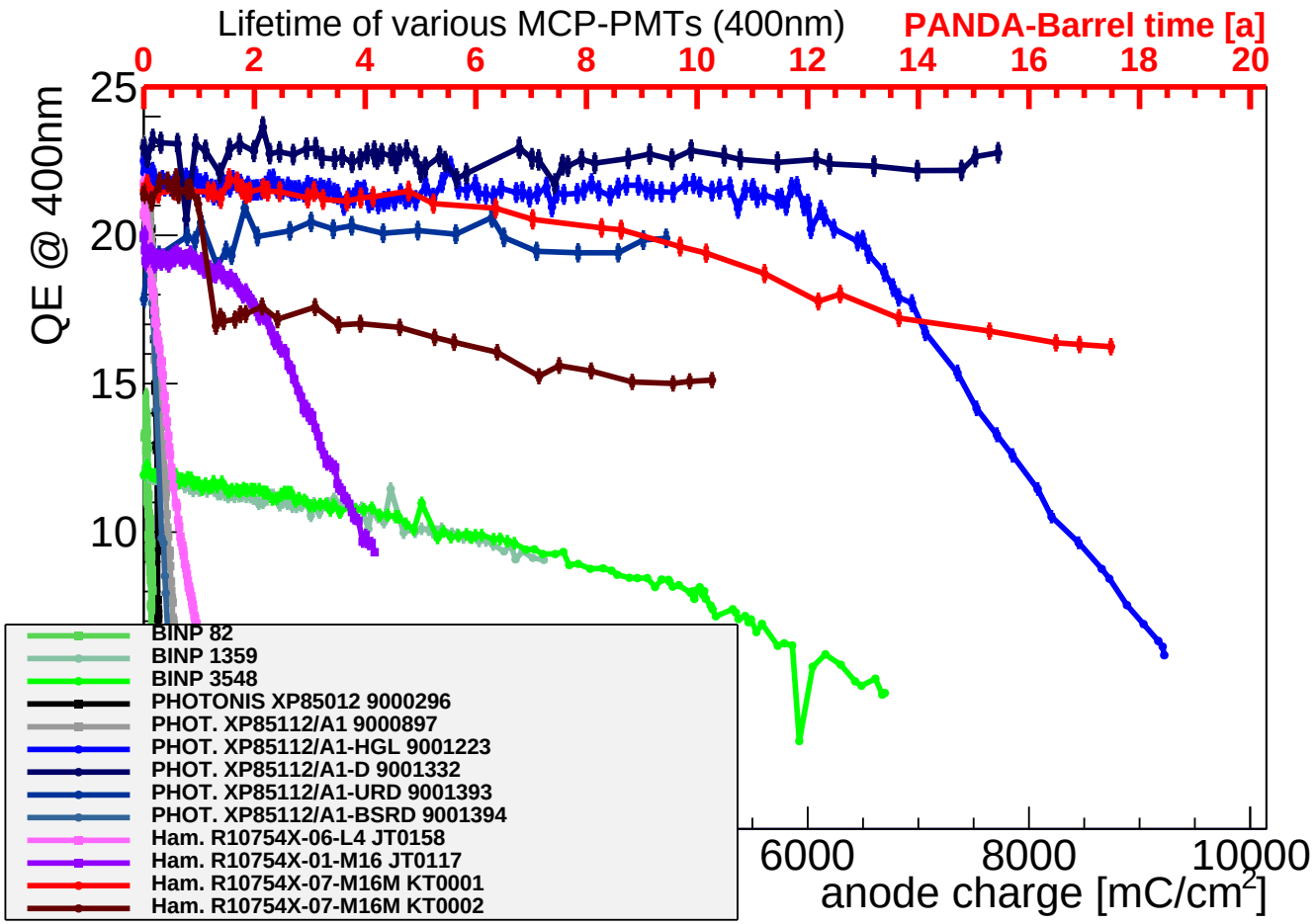

5729 mC/cm²
y [mm]
x [mm]
Quantum Efficiency [%]


5925 mC/cm²
y [mm]
x [mm]
Quantum Efficiency [%]


6299 mC/cm²
y [mm]
x [mm]
Quantum Efficiency [%]


6674 mC/cm²
y [mm]
x [mm]
Quantum Efficiency [%]

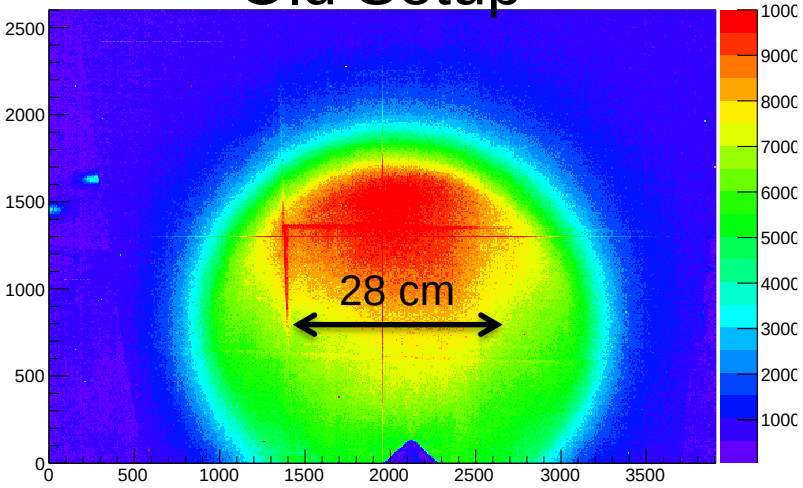
Lifetime of MCP-PMTs (August 2015)



Present Setup and new Diffuser (Thorlabs)

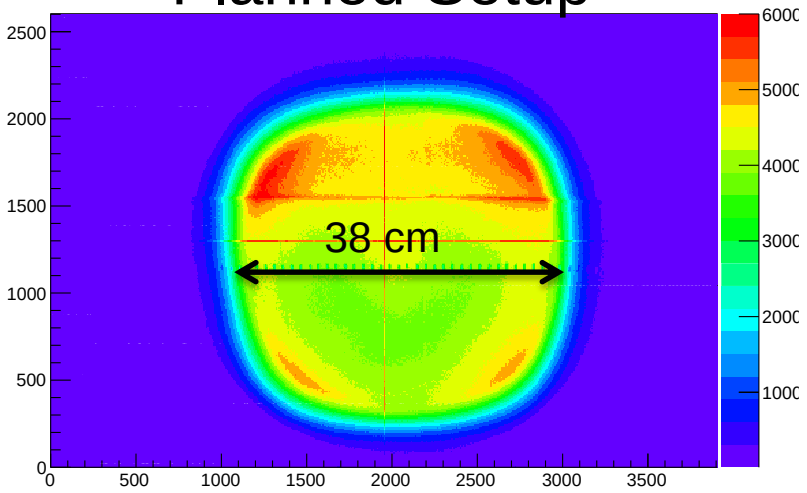
New Diffuser for Lifetime Measurement

Old Setup



400mm Distance

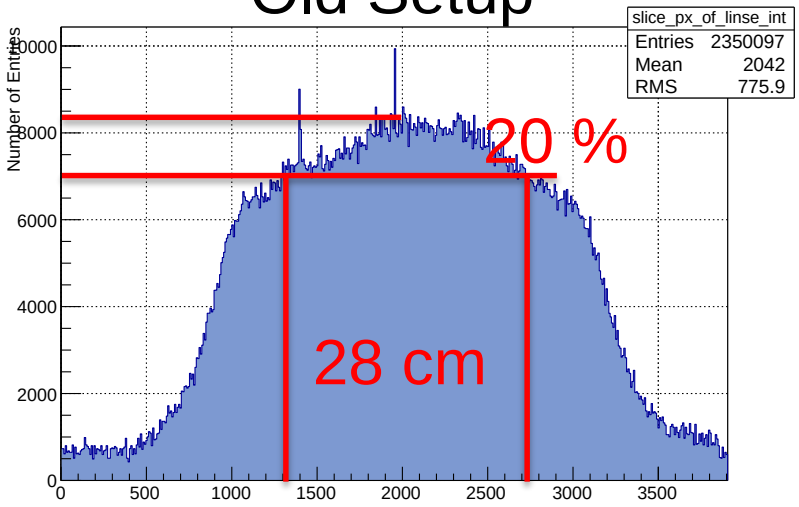
Planned Setup



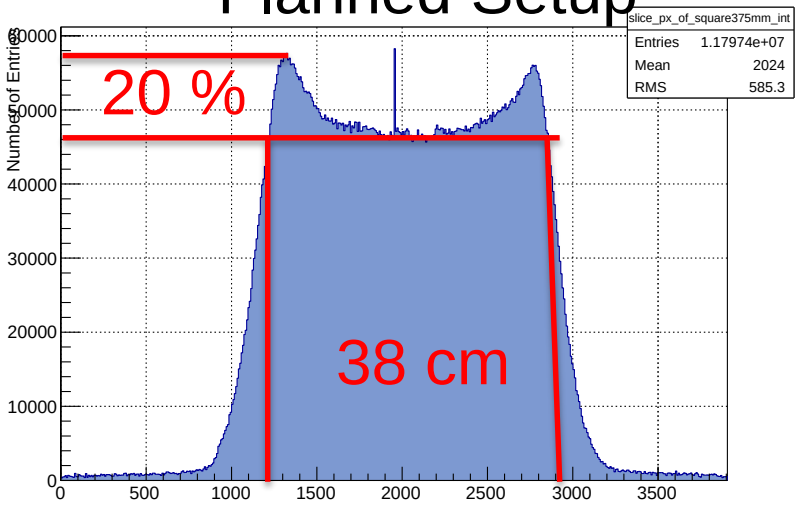
375mm Distance

X Projection of Intensity

Old Setup

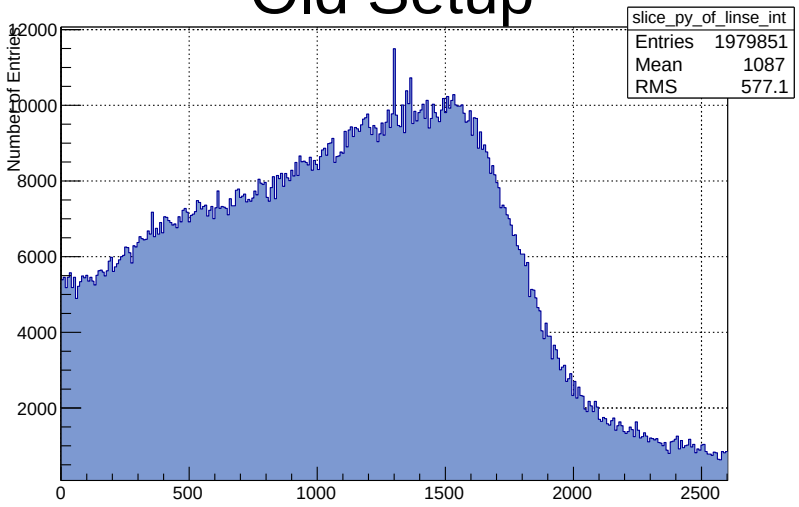


Planned Setup

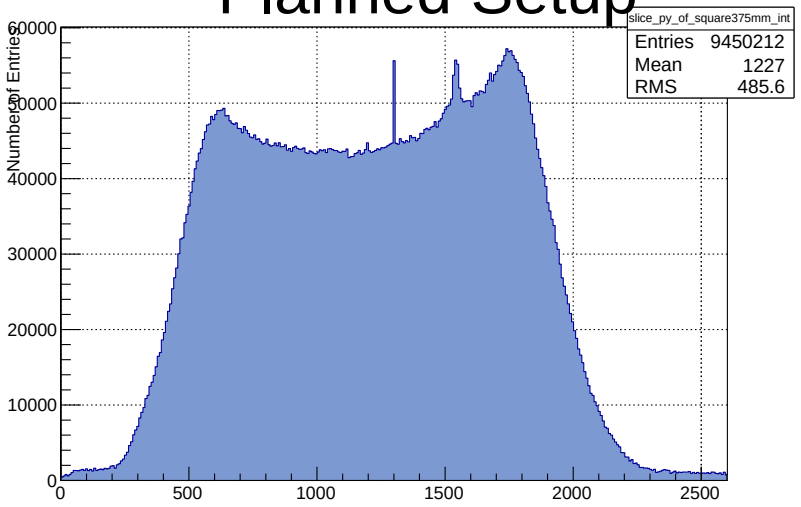


Y Projection of Intensity

Old Setup



Planned Setup



Hamamatsu 2 inch MCP-PMT

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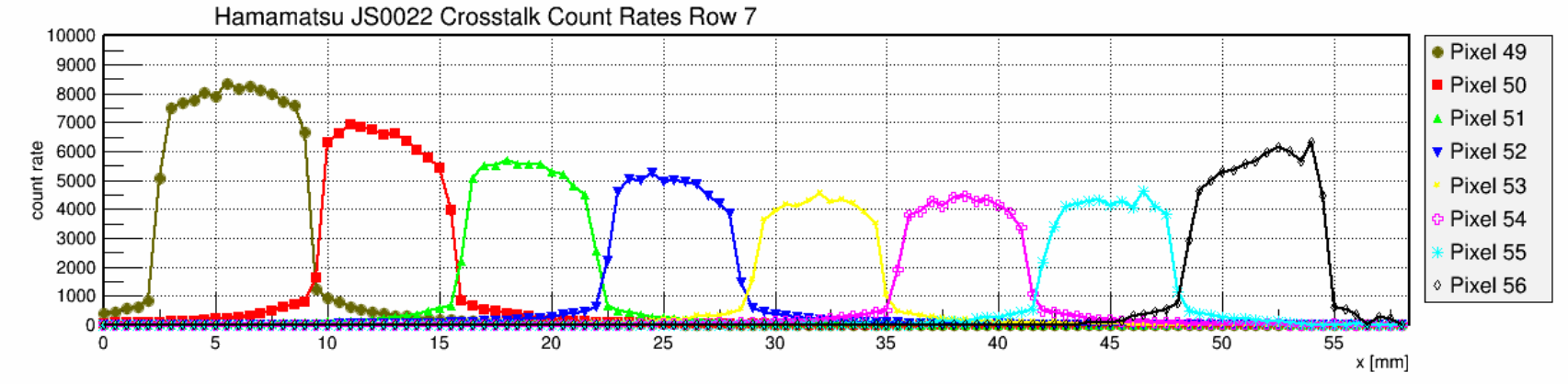
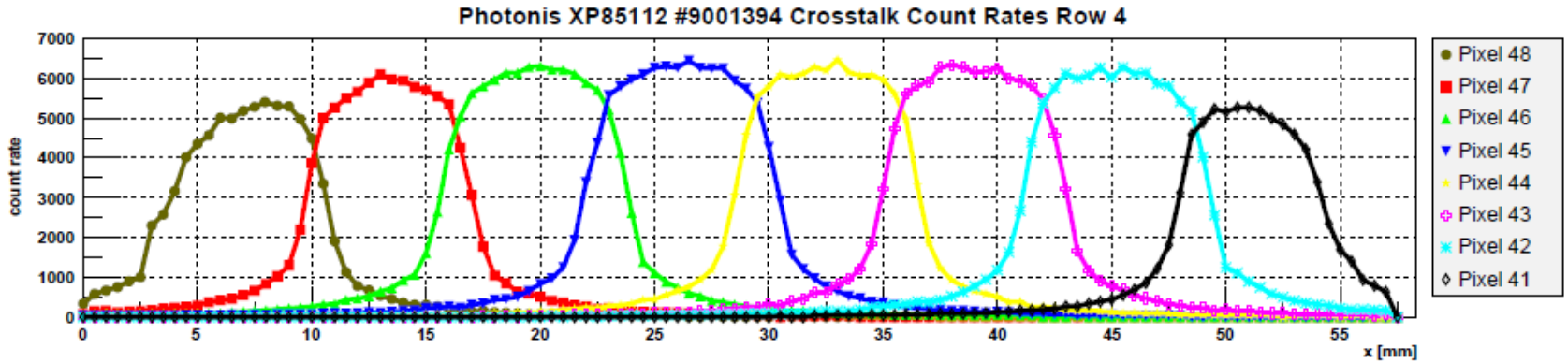
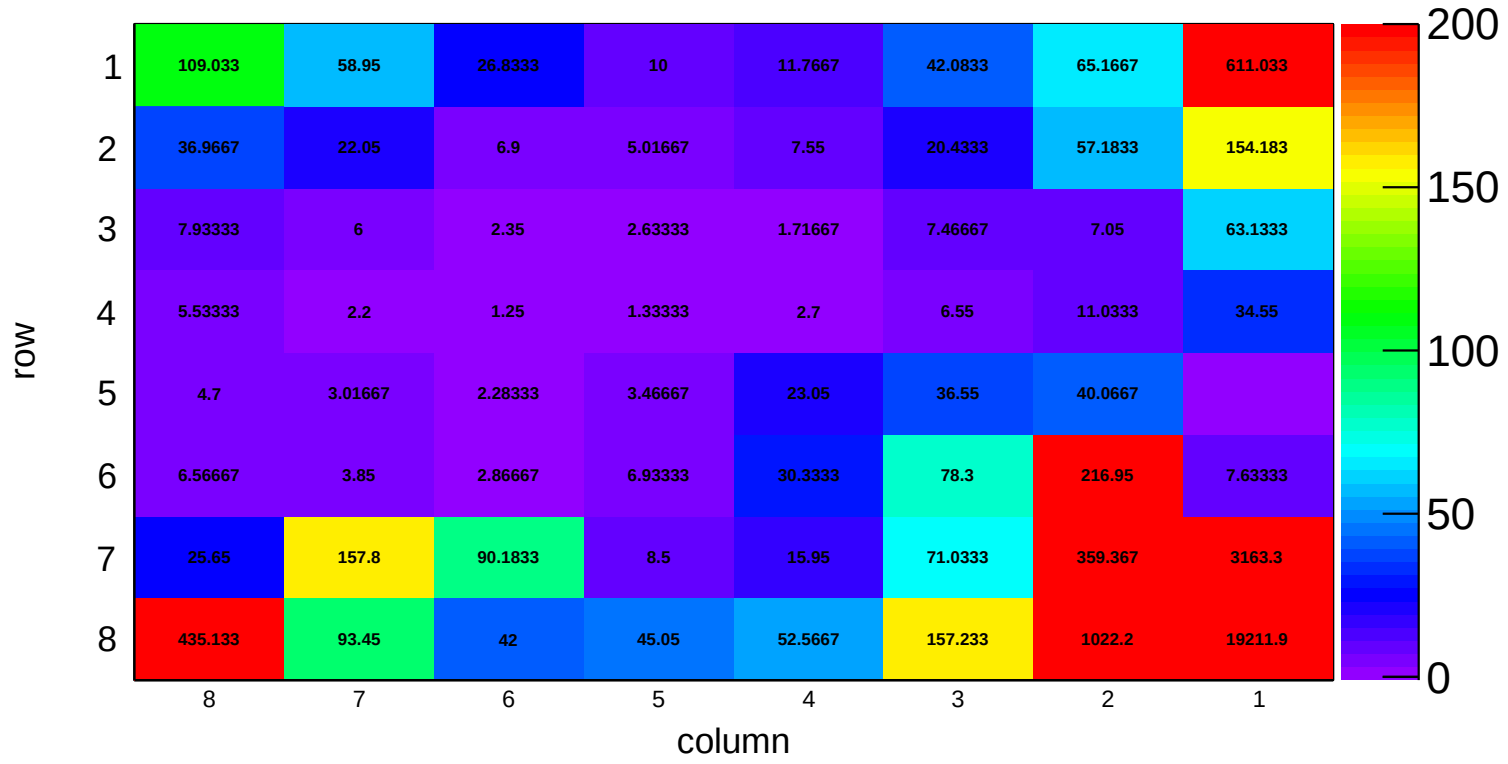
Crosstalk

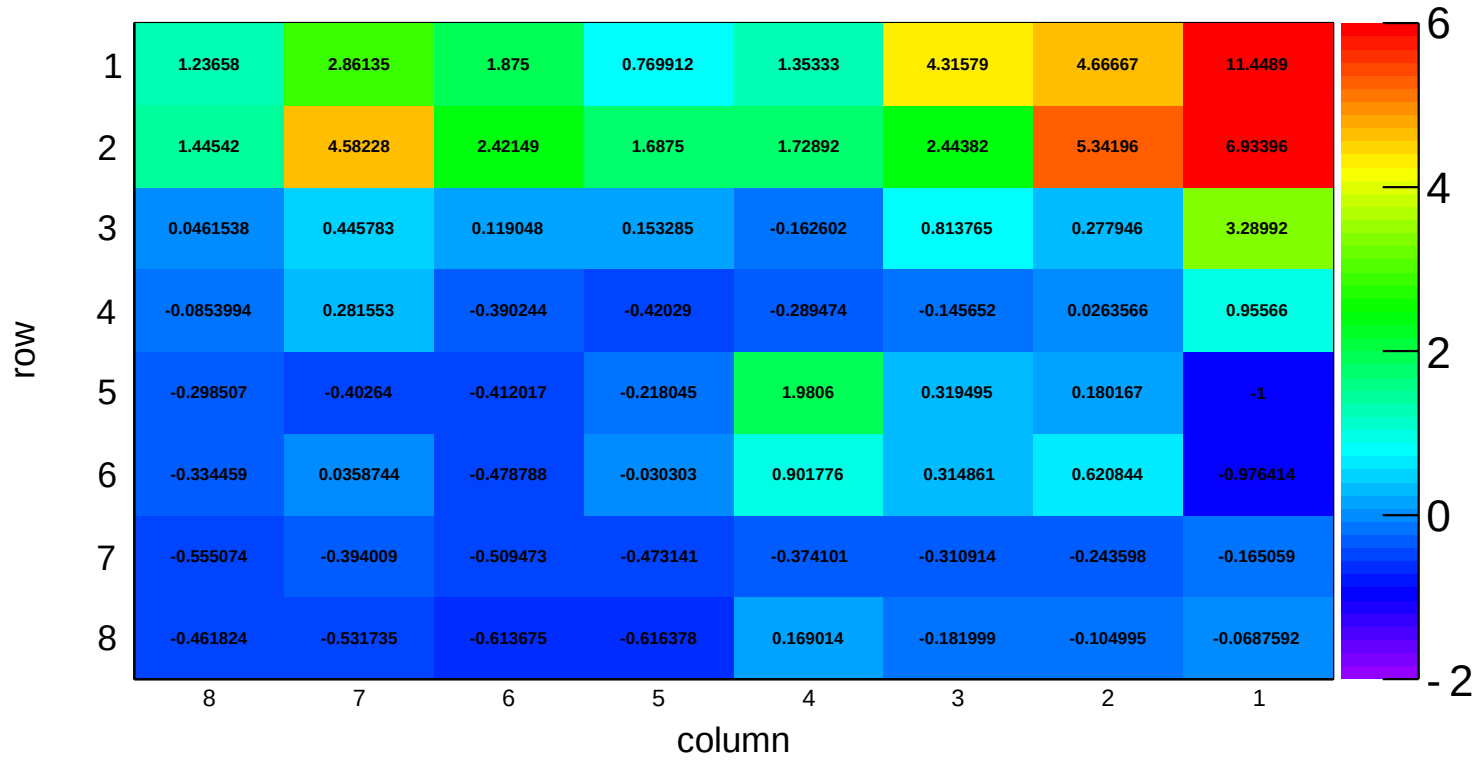

Hamamatsu JS0022 Crosstalk Count Rates Row 7
count rate
x [mm]
Pixel 49
Pixel 50
Pixel 51
Pixel 52
Pixel 53
Pixel 54
Pixel 55
Pixel 56


Photonis XP85112 #9001394 Crosstalk Count Rates Row 4
count rate
x [mm]
Pixel 48
Pixel 47
Pixel 46
Pixel 45
Pixel 44
Pixel 43
Pixel 42
Pixel 41

Dark Counts of JS0022 (50mV threshold, Hz)



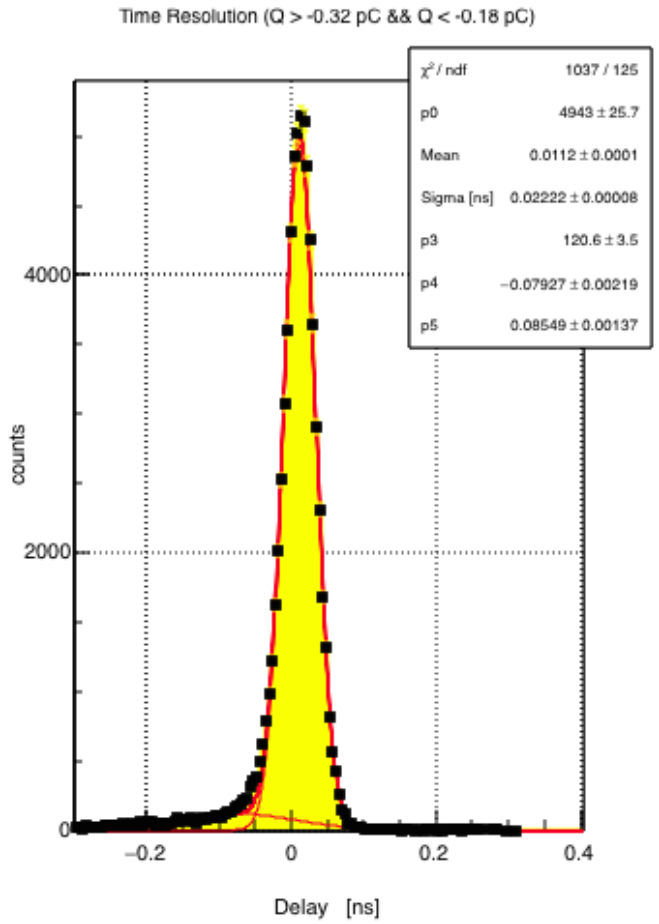
Comparison of two measurements



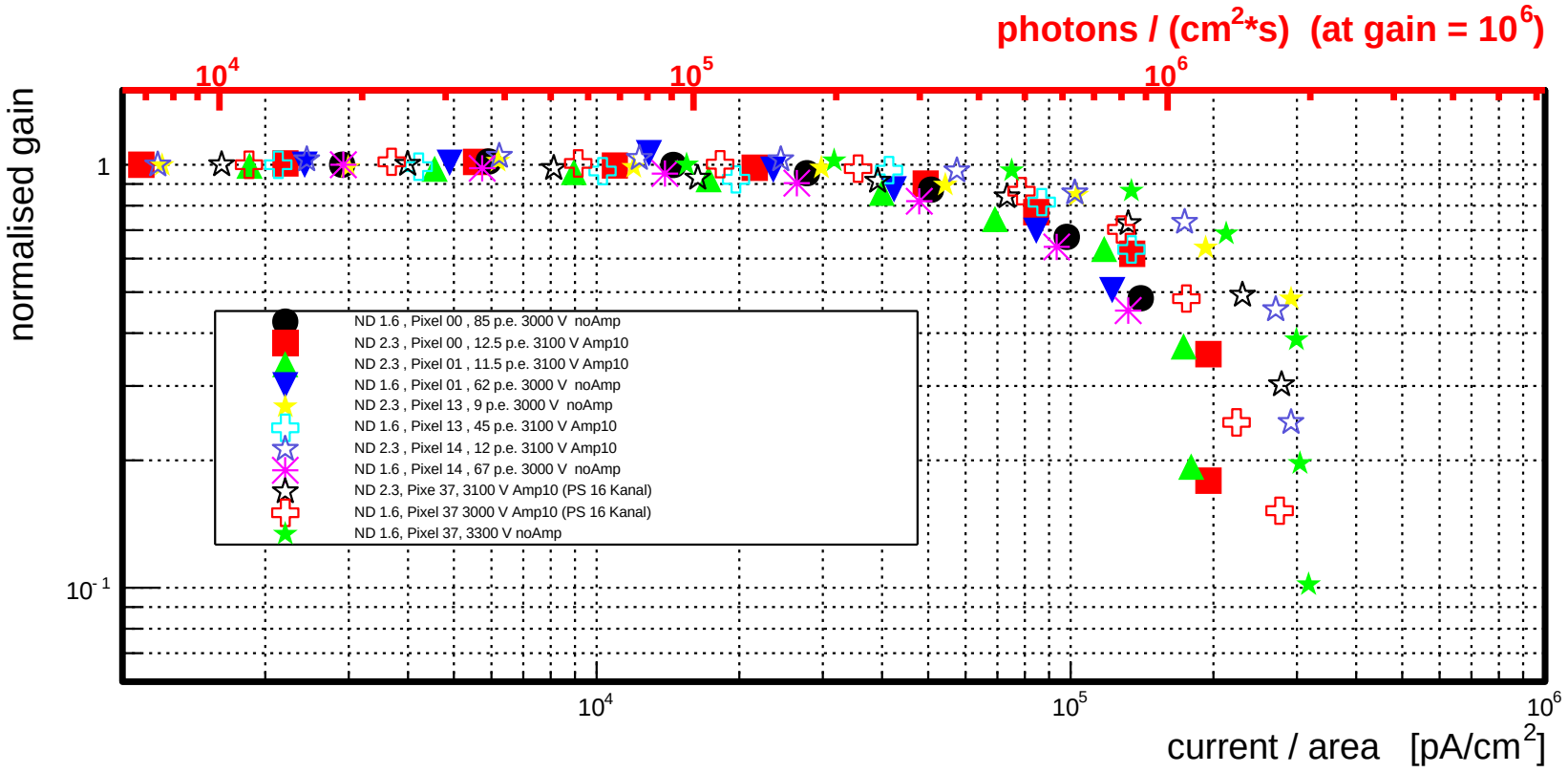
(difference of count rates divided by rate of measurement two)

Time resolution of JS0022 (30mV threshold, 3.3kV)

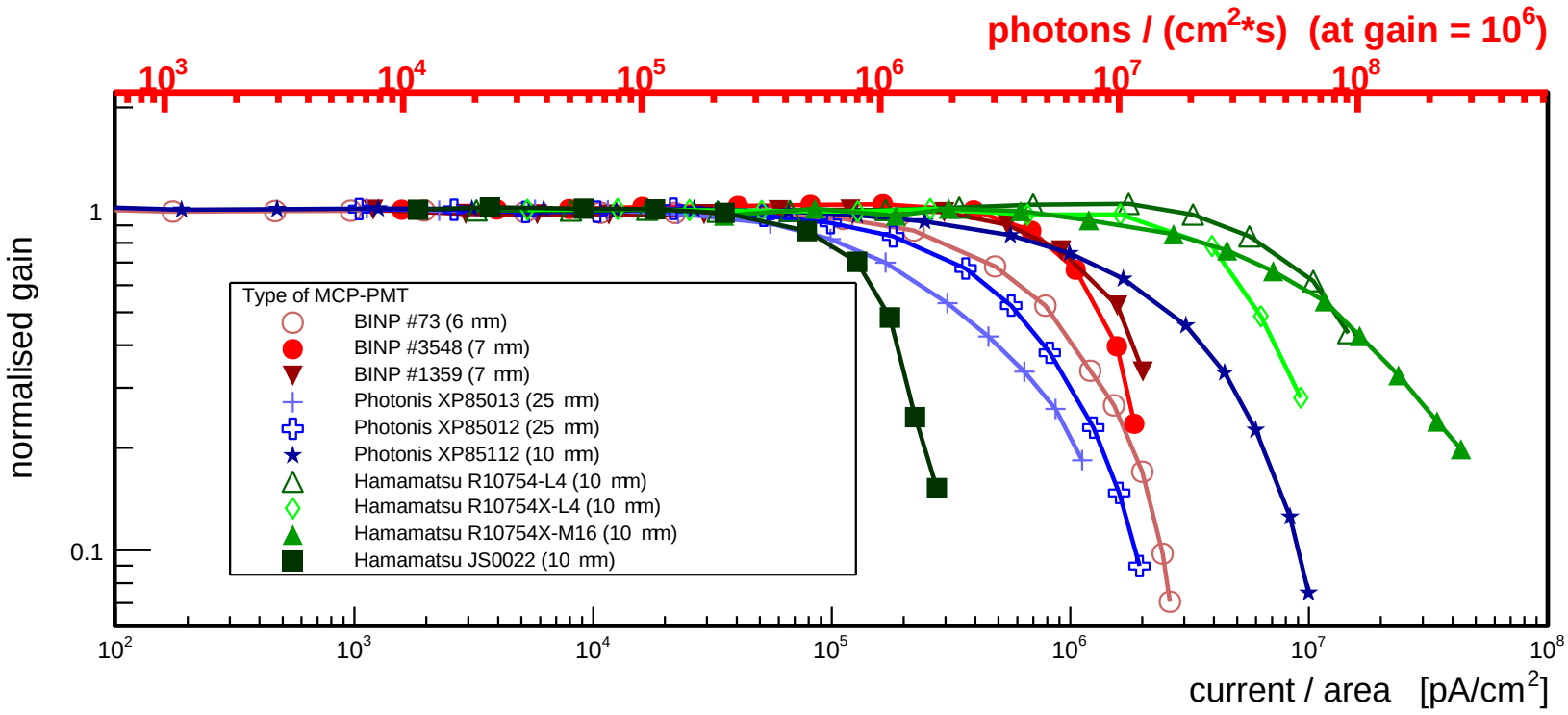
- With 200 times Amplifier
  - Pixel 17: 22.2ps
  - Pixel 37: 24.1ps
  - Pixel 42: 22.9ps
  - Pixel 64: 23.3ps



Rate Stability of JS0022



Comparison with other MCP-PMT



Summary and Outlook

- Lifetime of MCP-PMTs
  - Photonis 1223 at end of his life
  - Photonis 1332 drop in QE coming soon
- New Hamamatsu
  - Low crosstalk
  - Low rate stability
  - High dark count on some pixels
  - 126*6 Pixel readout ready

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Thank you for your attention!

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