

Update on MCP Lifetime Measurements

A. Lehmann, A. Britting, W. Eyrich, F. Uhlig

- Illumination overview
- Gain and darkcount rates versus C
- QE surface scans and trends
- Absolute and relative QE versus C
- Summary



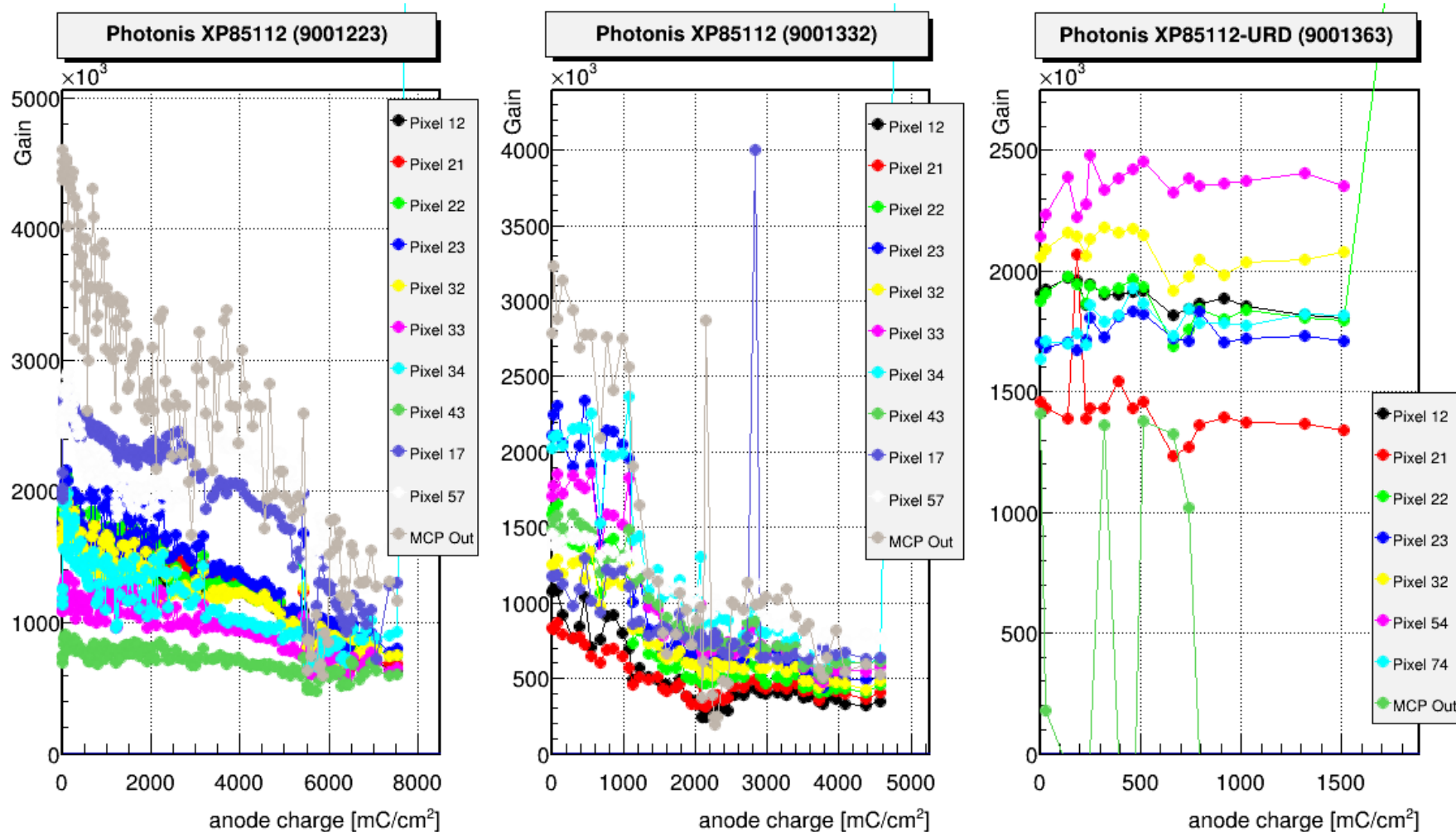


Illumination Overview

	Sensor ID	Integral charge (Sep. 3, 2014) [mC/cm ²]	Diff. charge (maximum) [mC/cm ² /d]	# of mea- surements	# of QE scans	Comments
Photonis XP85112	9001223	7710	13.5	150	13	Start: 23 Aug. 11 ongoing
	9001332	4774	21.8	54	6	Start: 12 Dec. 12 ongoing
	9001393	1711	11	18	2	Start: 23 Jan. 14 ongoing
Hamamatsu R10754X	JT0117 (M16)	2086	14.1	86	7	Start: 23 Aug. 11 Stop: 24 Jul. 12
	KT0001 (M16M)	4155	30.1	30	4	Start: 20 Aug. 13 ongoing
	KT0002 (M16M)	1957	12.5	25	5	Start: 21 Oct. 13 ongoing
BINP	1359	3616	10.6	90	8	Start: 21 Oct. 11 Stop: 06 May 13
	3548	5860	11.8	127	10	Start: 21 Oct. 11 ongoing

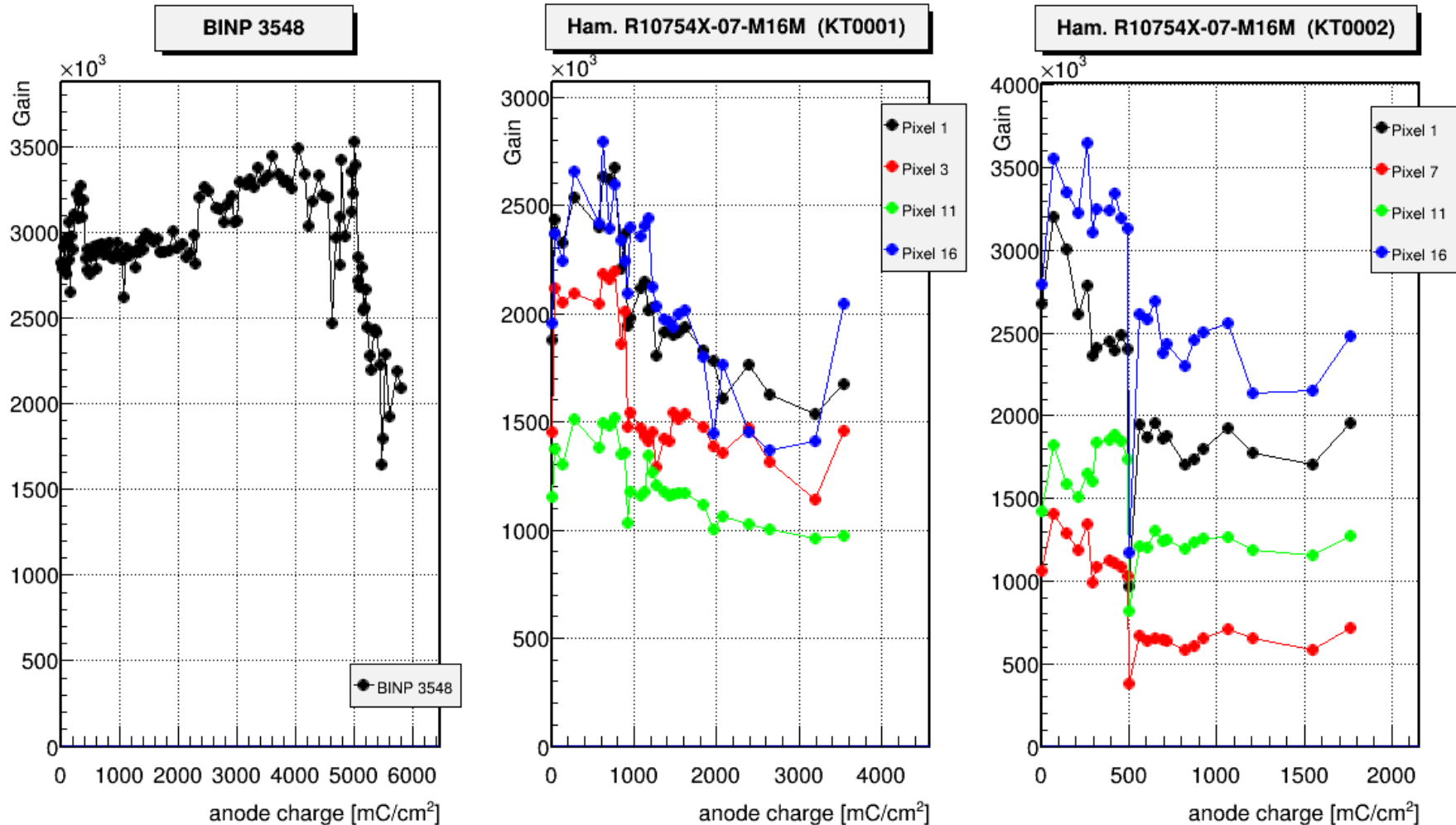


Gain vs. Charge (Photonis)



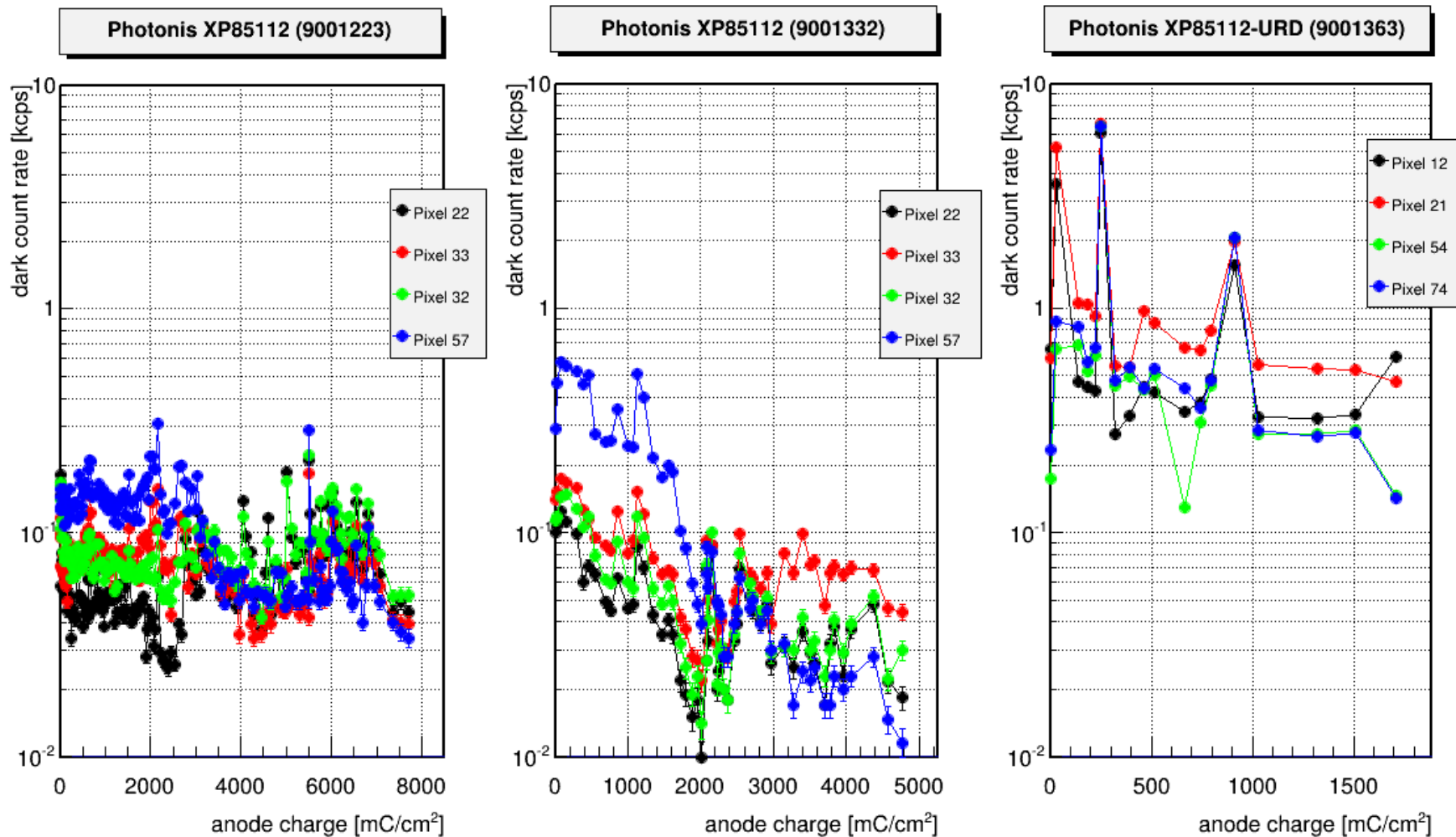
- No gain changes in XP85112-URD (2 ALD layers)
- Continuous gain changes in other Photonis MCP-PMTs

Gain vs. Charge (BINP + Hamam.)



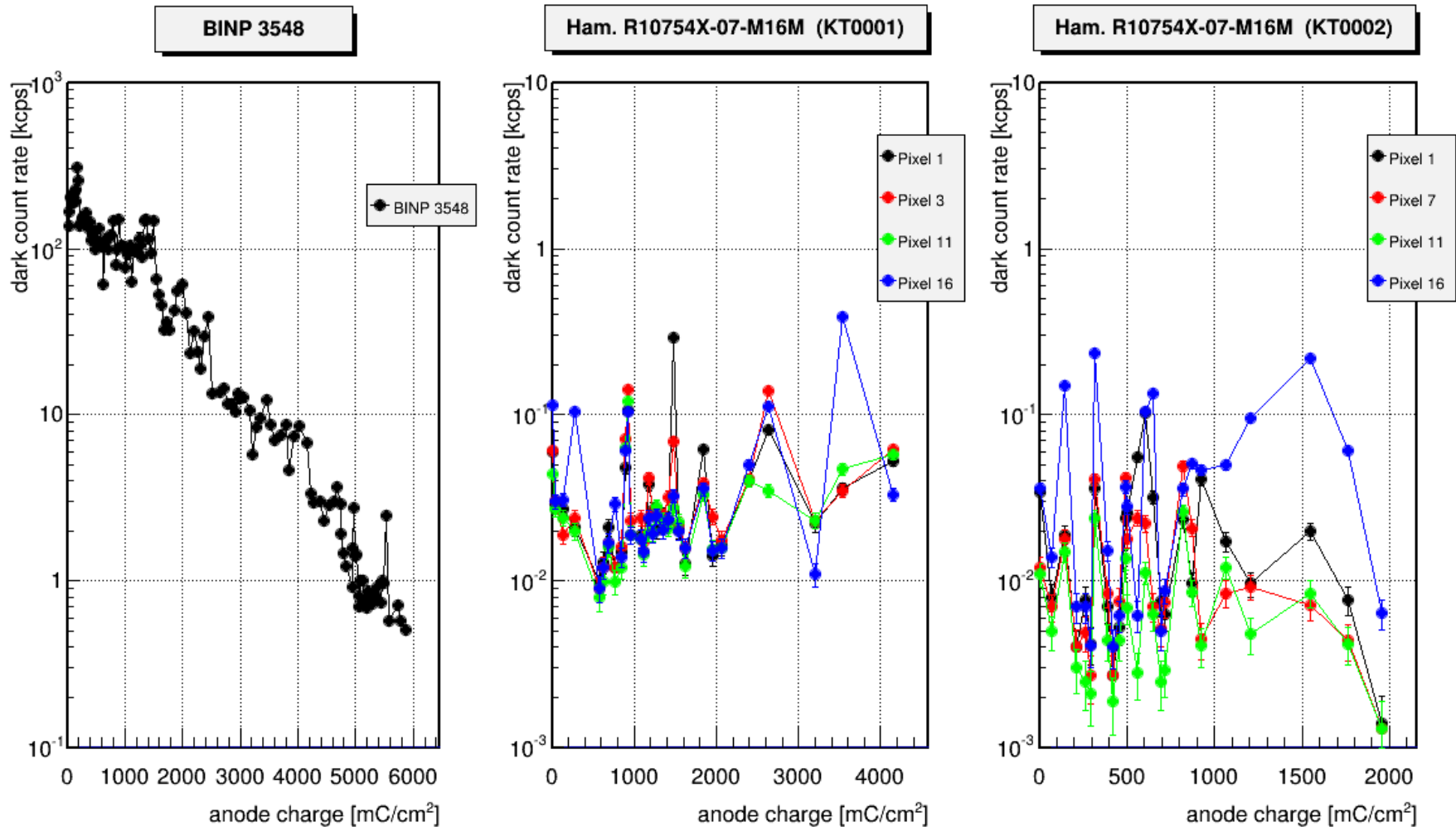
- Moderate gain changes
- Slight gain drop in KT0002, maybe because of HV spike

Darkcount vs. Charge (Photonis)



- Only few changes of darkcount rate for 9001223 and 9001393
- 9001332 shows significant drop in darkcount rate

Darkcount vs. Charge (BINP + Ham.)



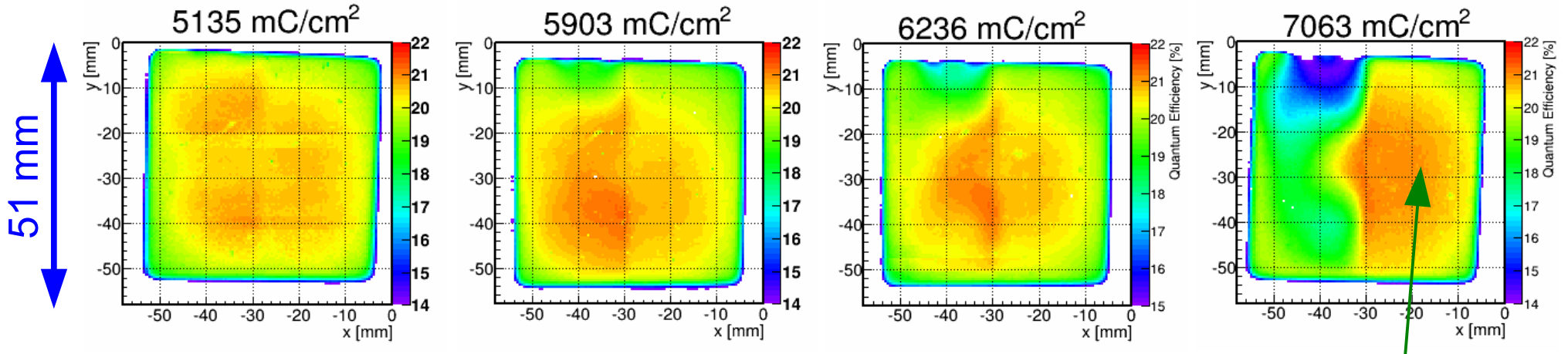
- Only few changes of darkcount rate in Hamamatsu ALD tubes
- Big reduction in BINP



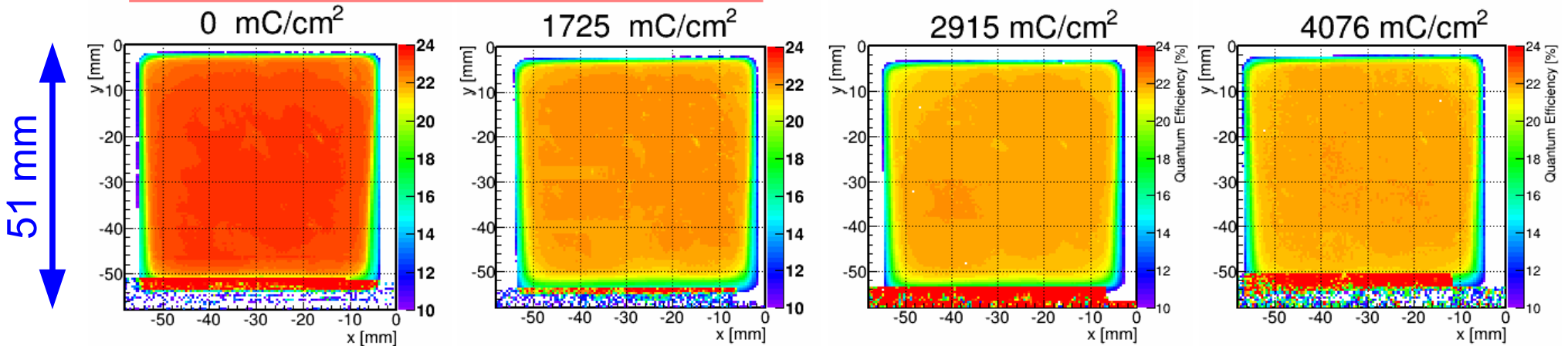
Q.E. Scans (PHOTONIS ALD)

Q.E. measured at 372 nm

PHOTONIS XP85112 (9001223)



PHOTONIS XP85112 (9001332)

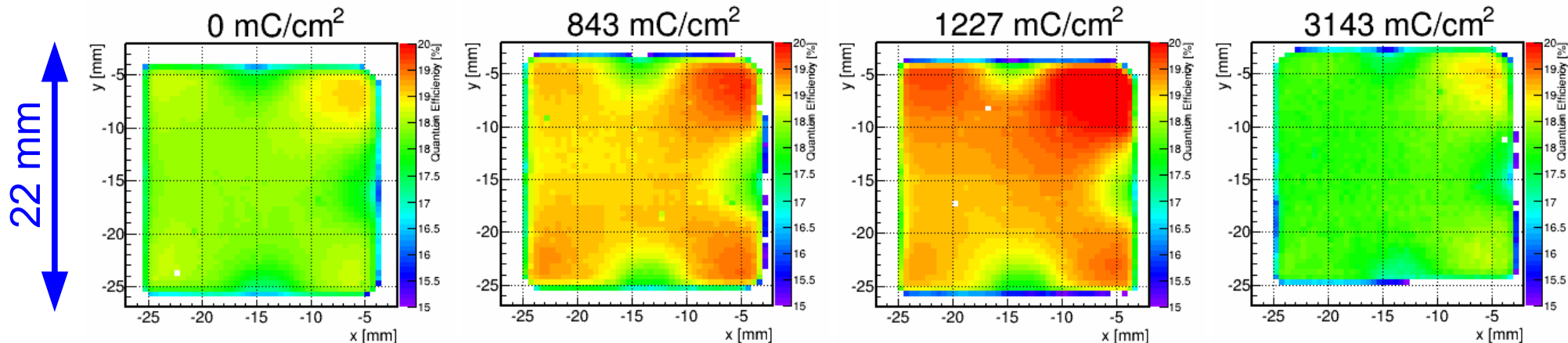




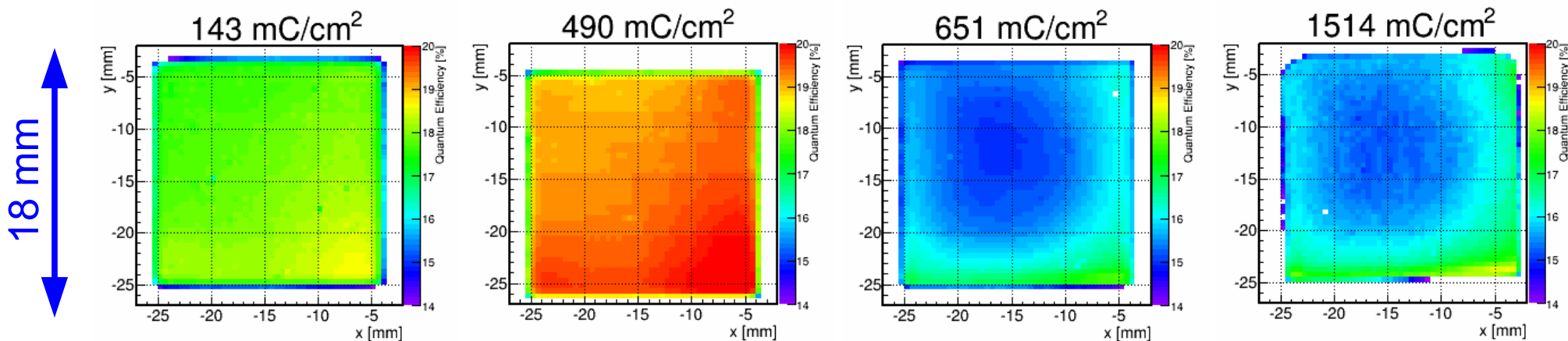
Q.E. Scans (Hamamatsu)

Q.E. measured at 372 nm

Hamamatsu R10754X-07-M16M (KT0001)

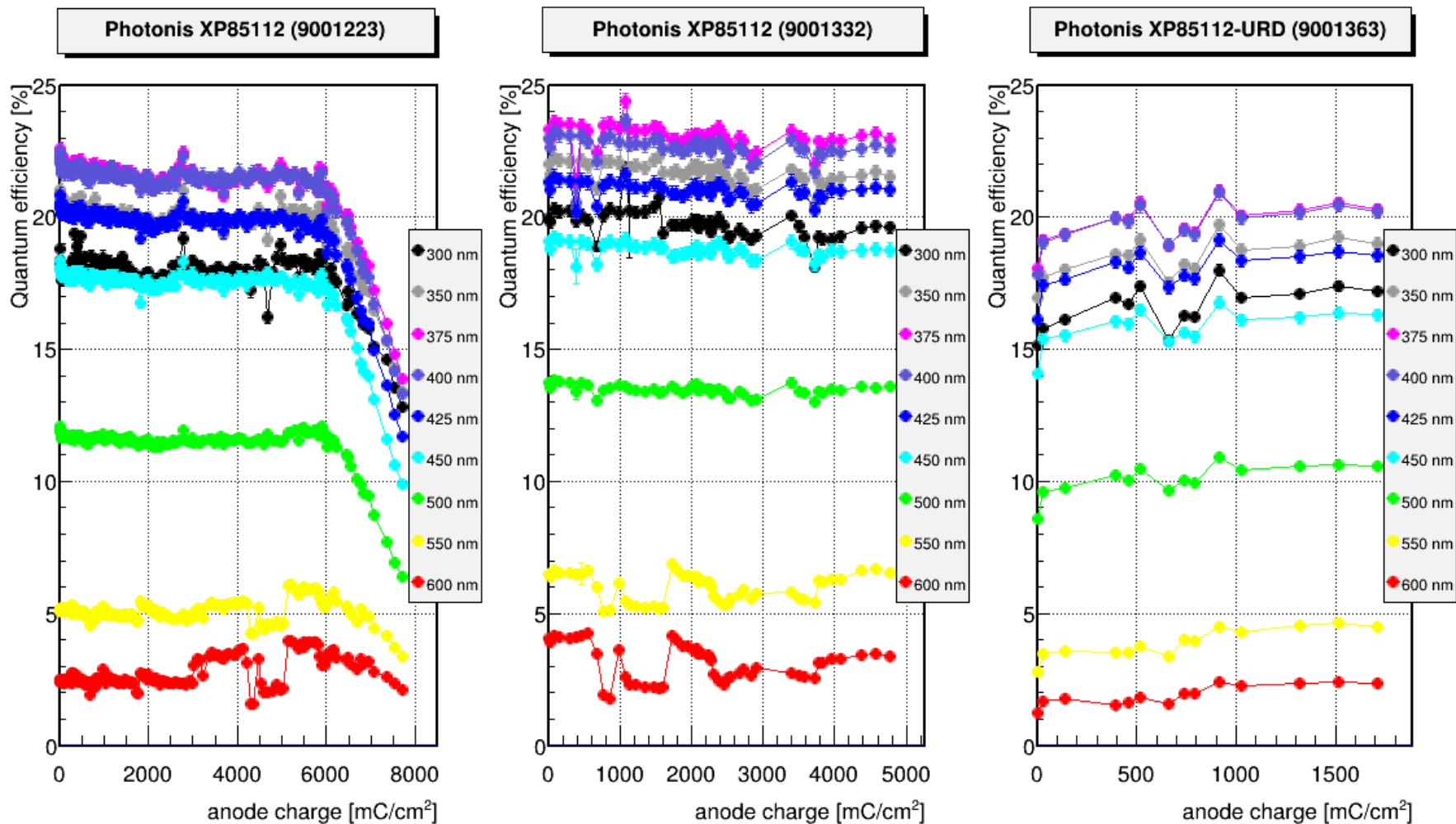


Hamamatsu R10754X-07-M16M (KT0002)



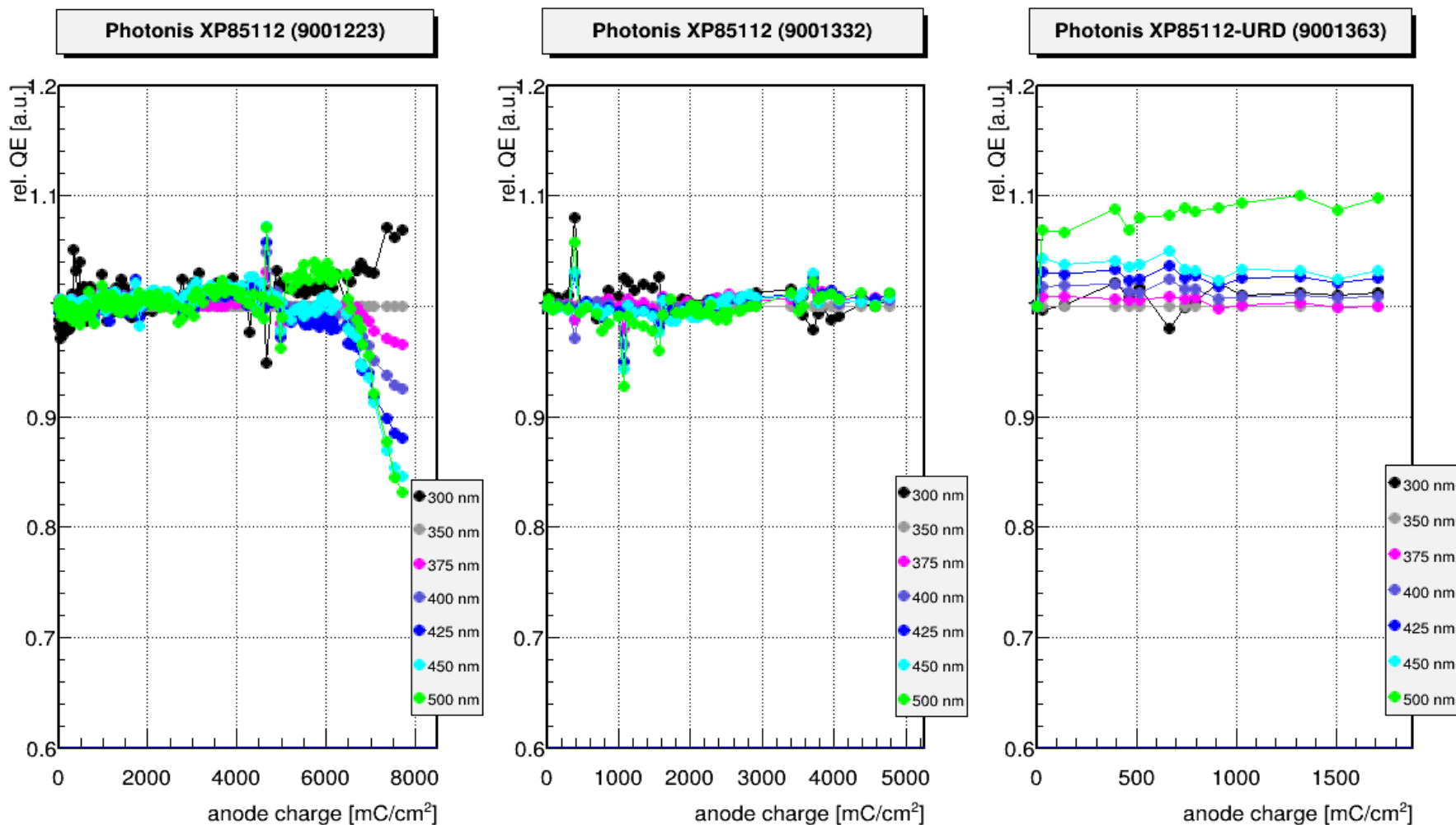


Q.E.(λ) vs. Charge (Photons)



- 9001223: Q.E. drops significantly above $\sim 6 \text{ C/cm}^2$
- Others: if at all, only moderate Q.E. drop seen

Relative Q.E.(λ) vs. Charge (Phot.)

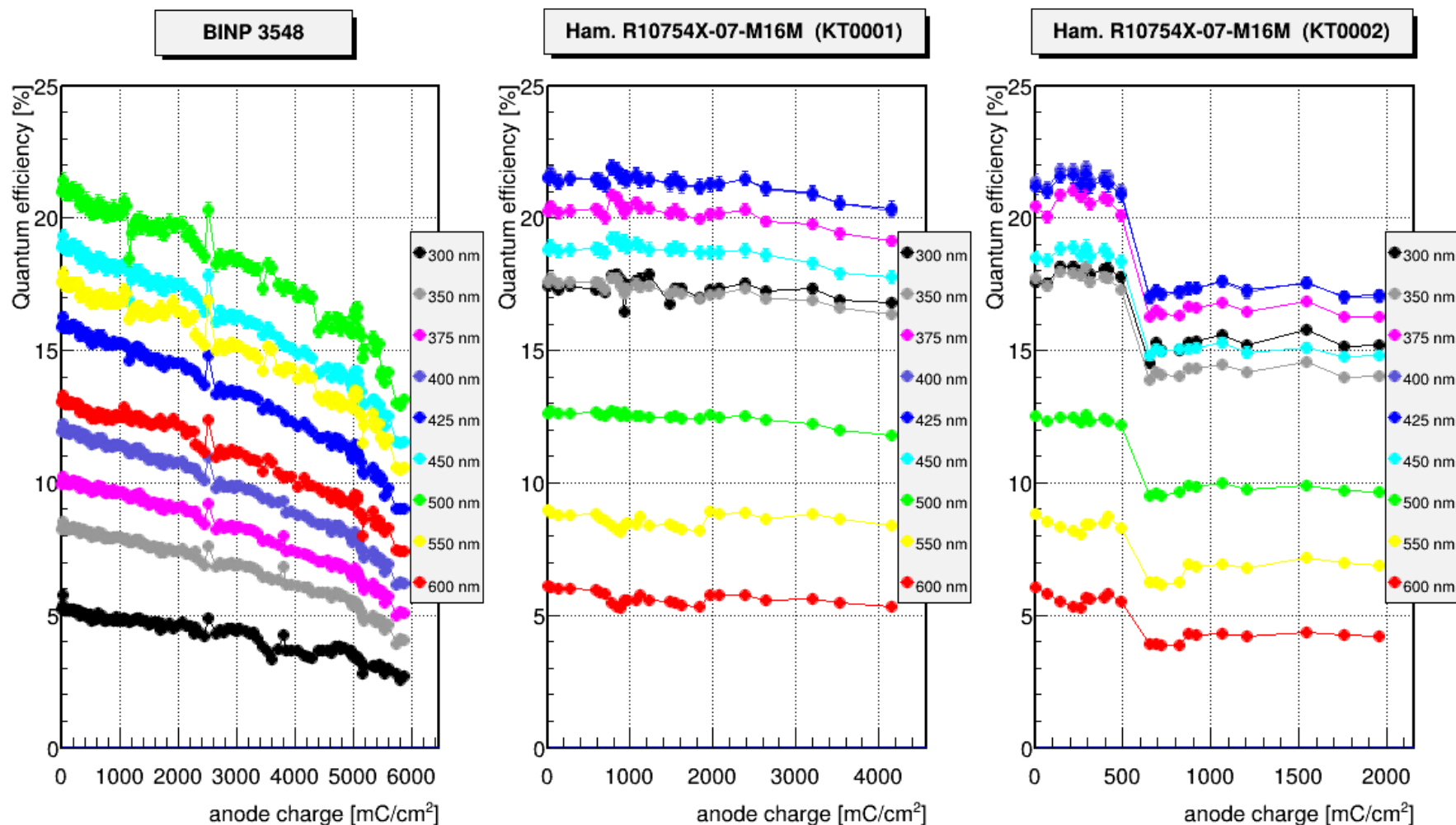


PHOTONIS 9001332 and 9001393: no wavelength dependence

PHOTONIS 9001223: red drops faster than blue starting at 6 C/cm²

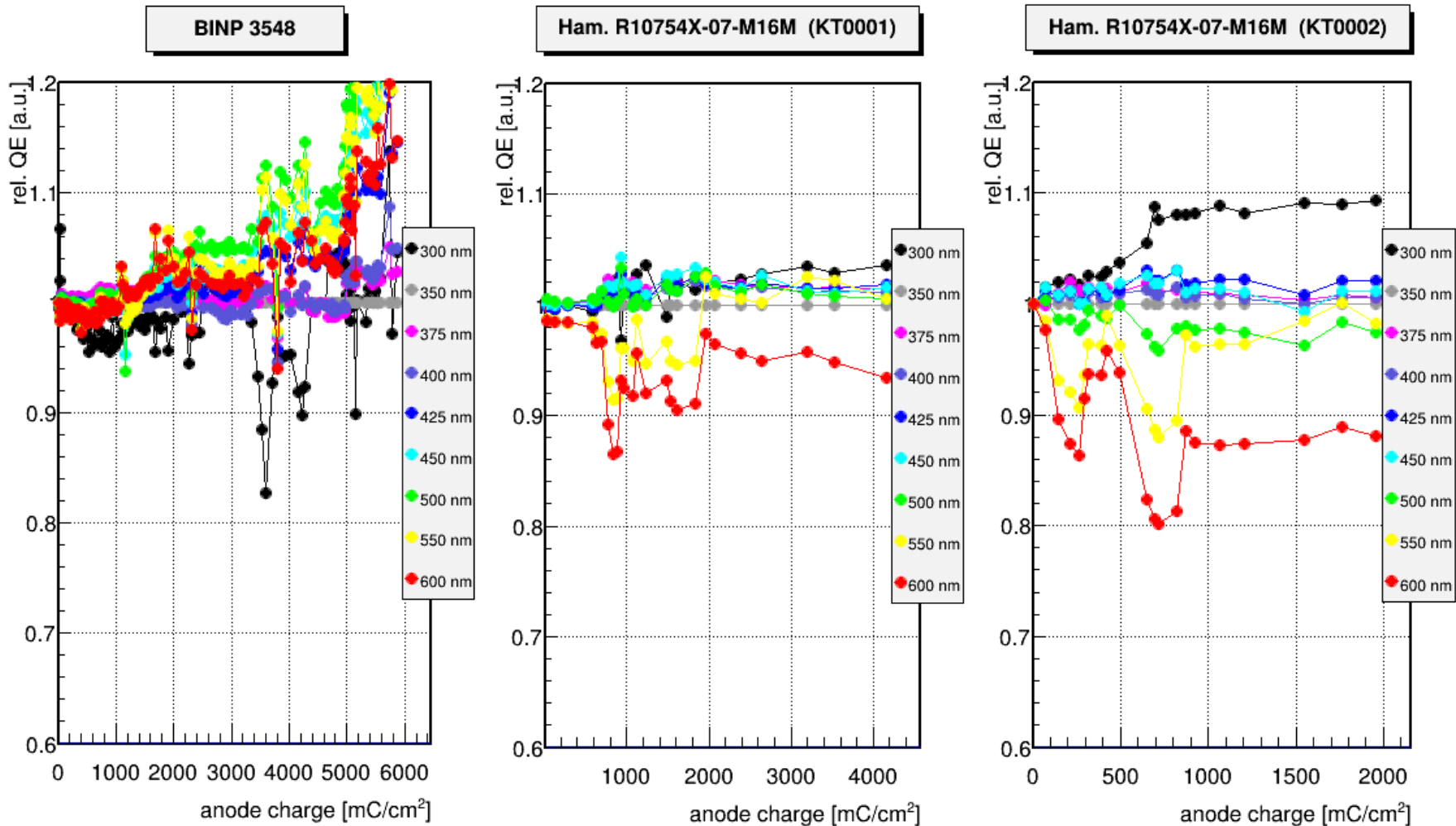


Q.E.(λ) vs. Charge (BINP + Ham.)



- KT0002: QE step at 0.5 C/cm^2 (because of HV spike !!)
- **BINP: Q.E. drops continuously**

Rel. Q.E.(λ) vs. Charge (BINP+Ham.)

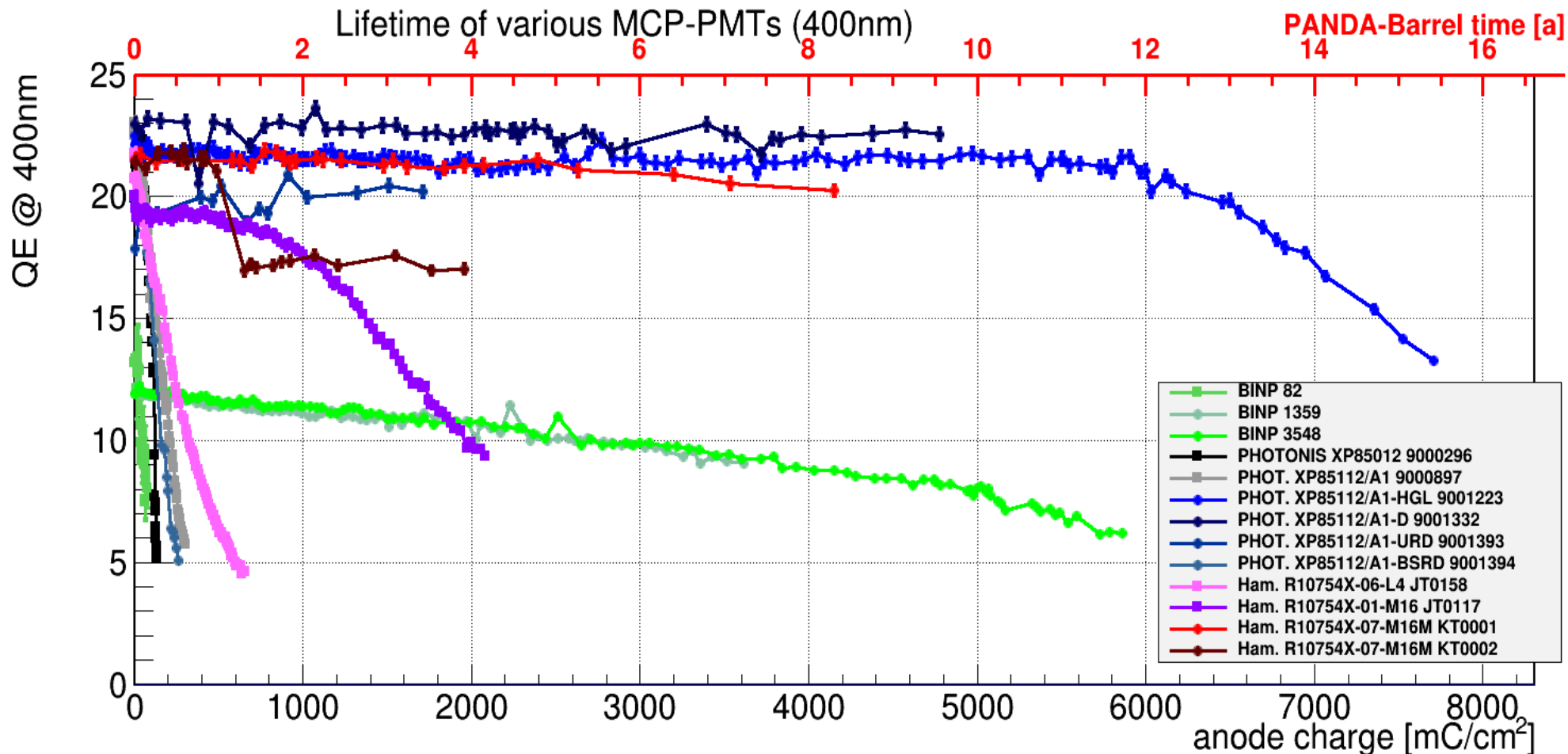


Ham. R10754X-M16M: no clear tendency seen

BINP 3548: slopes are hard to interpret



Lifetime of Different MCP-PMTs



● PHOTONIS 9001223: Q.E. degradation started at 6 C/cm²

● other PHOTONIS and ALD Hamamatsu: **no Q.E. drop yet**



Summary

- Trends in gains and darkcount rate not so obvious
- All ALD-coated MCP-PMTs show very good performance up to now
- QE of PHOTONIS MCP-PMTs
 - **9001223 started dropping at 6 C/cm², but only at illuminated side**
 - 9001332 still good (no degradation) at almost 5 C/cm²
 - 9001393 with 2 ALD-layers: no degradation seen up to now
- QE of Hamamatsu MCP-PMTs (ALD-coated)
 - KT0001: Only small degradation seen up to 4 C/cm²
 - KT0002: drop at 0.5 C/cm² caused by HV spike, otherwise still okay