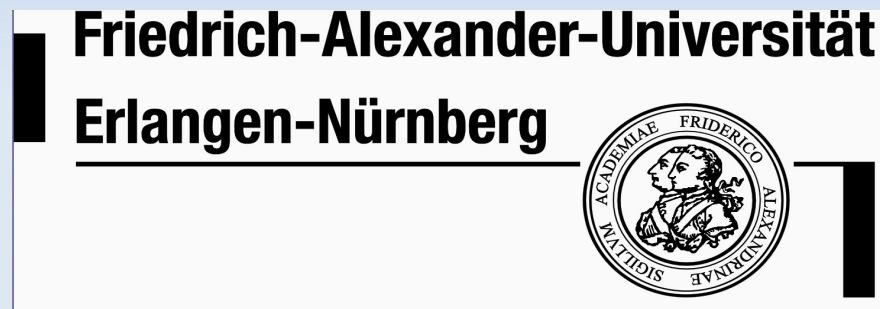


# Update on lifetime measurements



Alexander Britting, Wolfgang Eyrich, Albert Lehmann, Fred Uhlig

supported by BMBF and GSI

# Overview



- Results of the latest measurements:
  - Gain measurements
  - QE measurements
  - QE surface scans
- Comparison with previous lifetime measurements
- Lifetime of a 'used' MCP-PMT
- Summary and outlook

# Setup

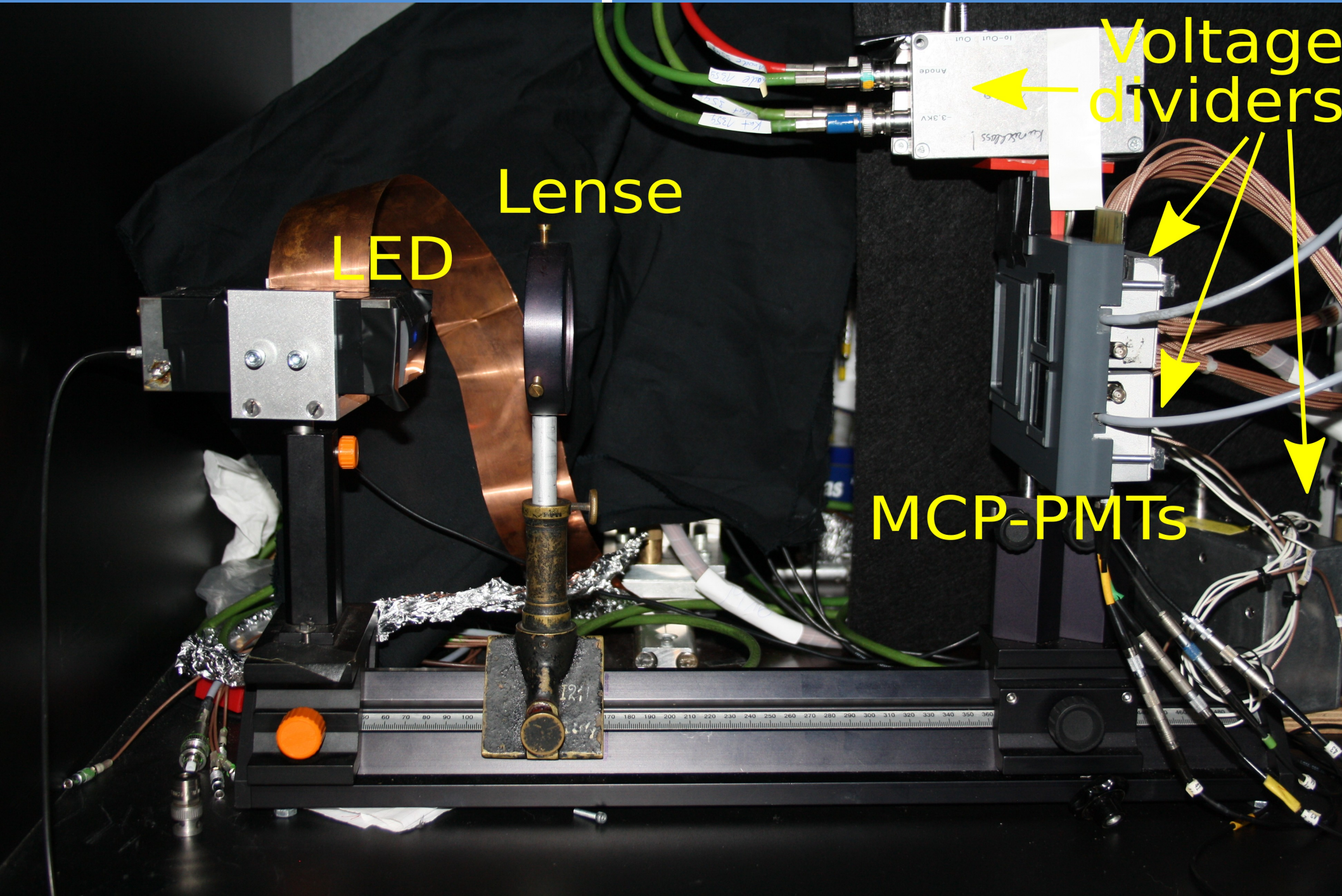


Lense

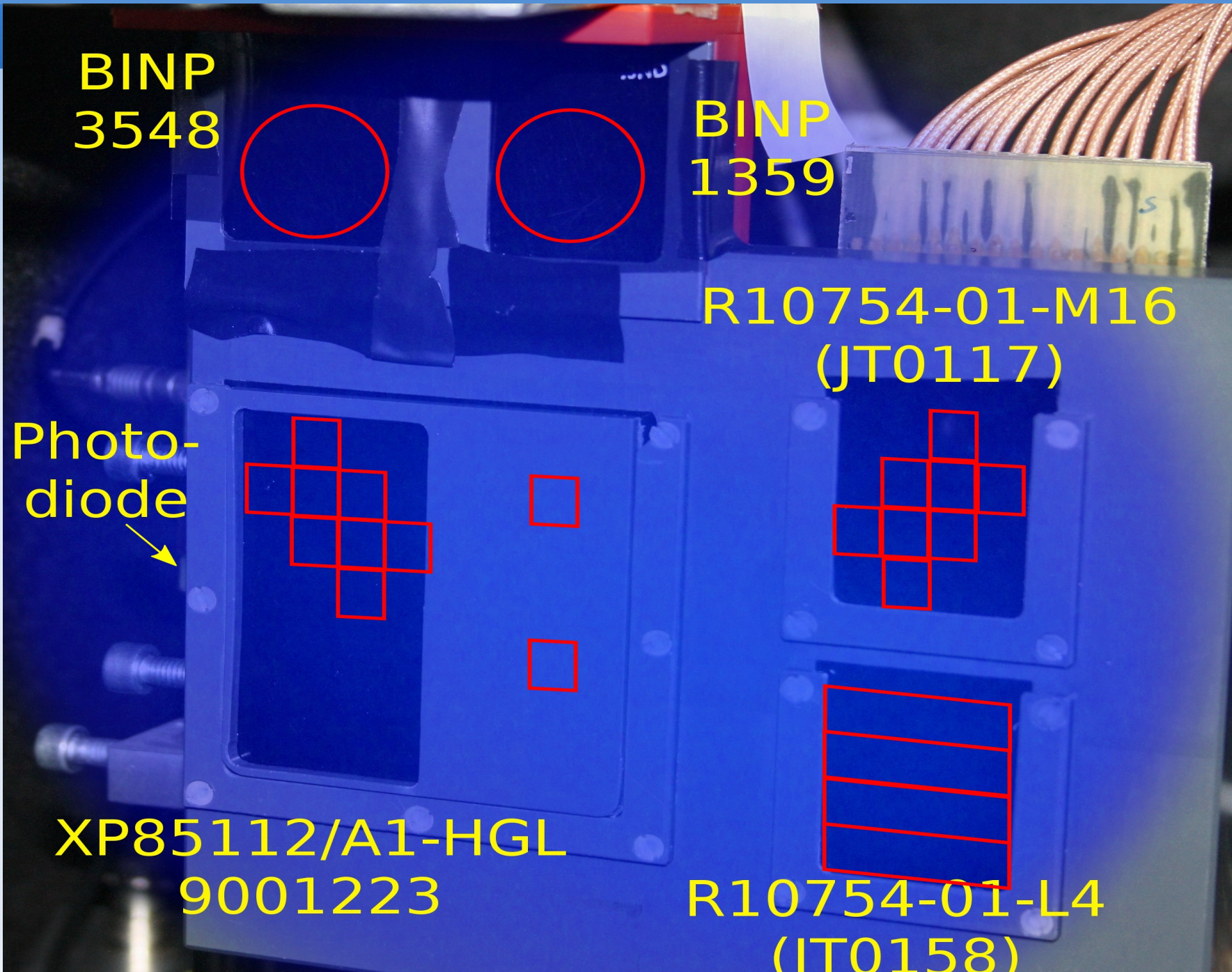
LED

Voltage dividers

MCP-PMTs



# Setup (2)



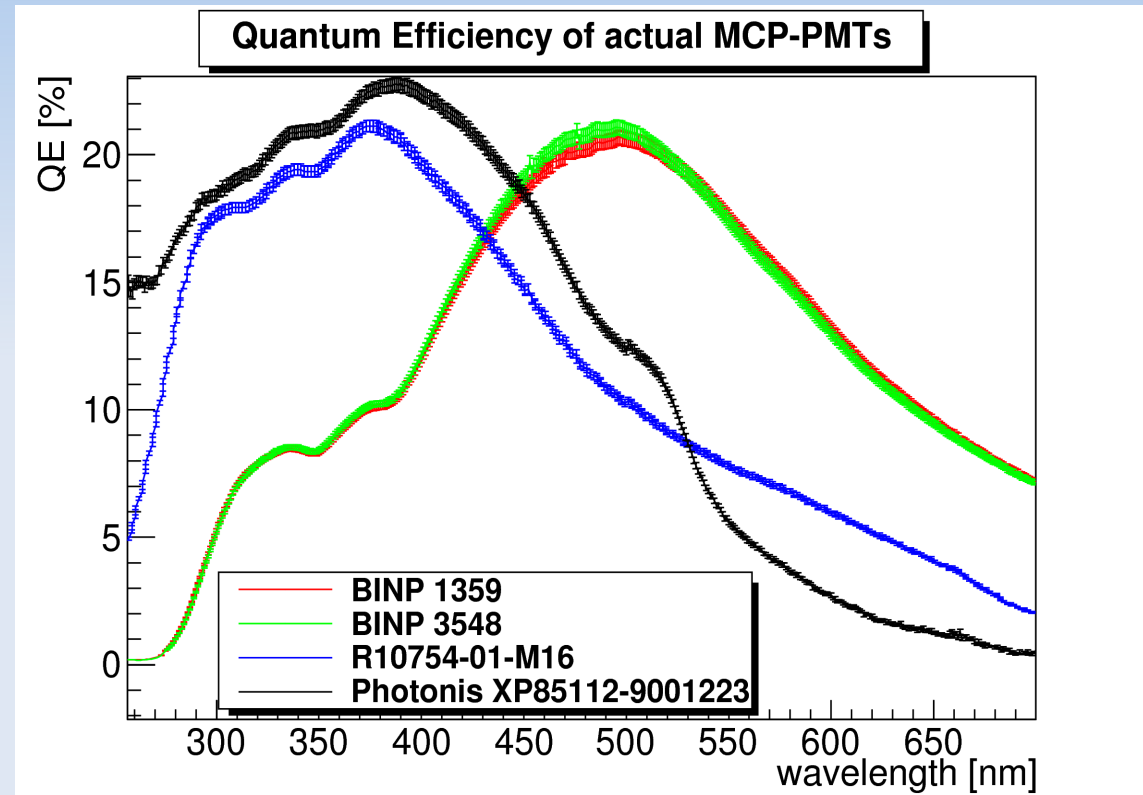
# Illumination overview



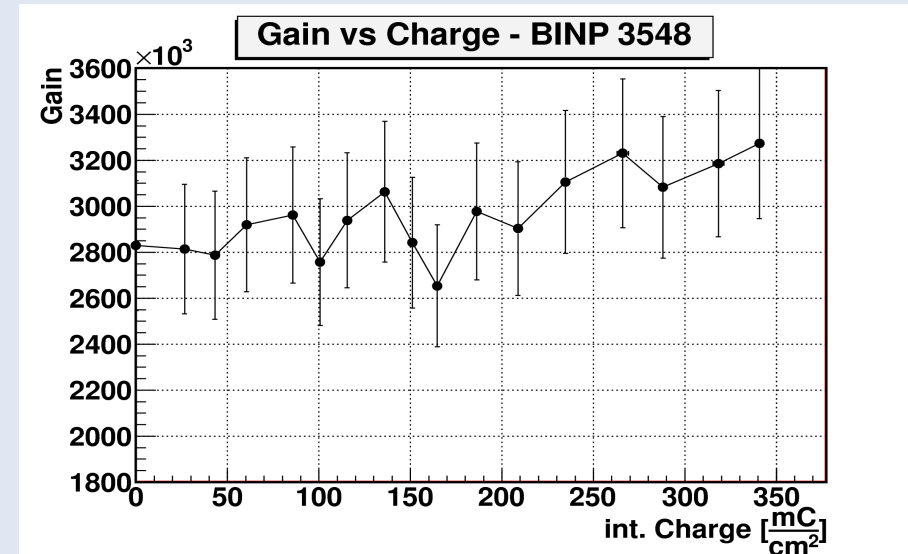
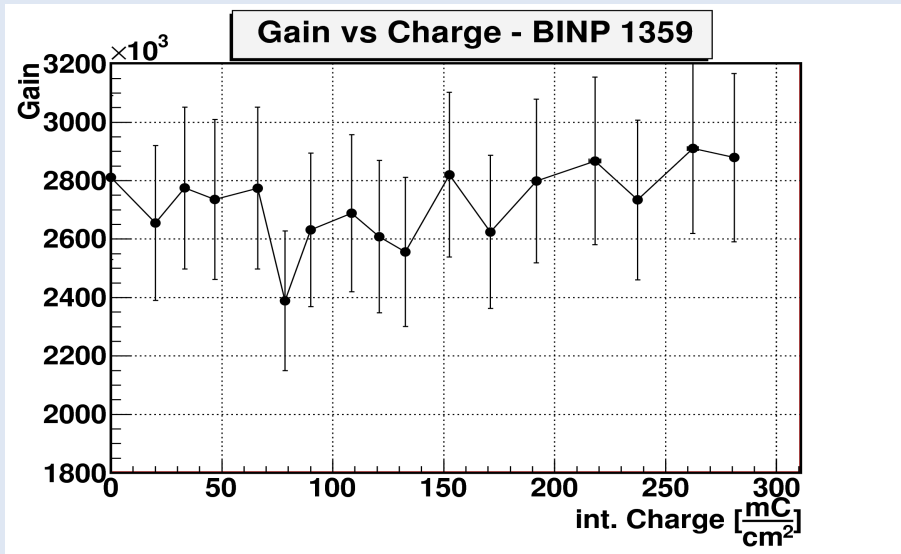
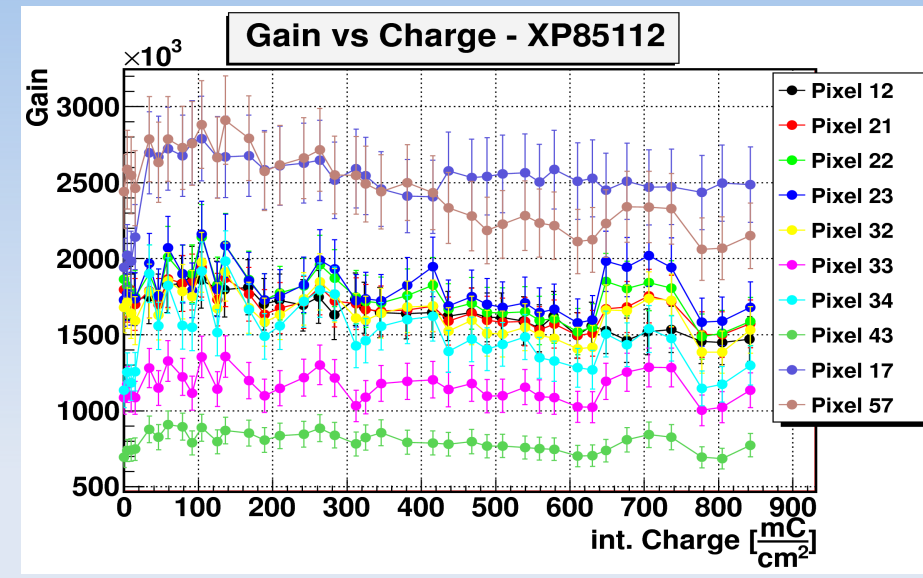
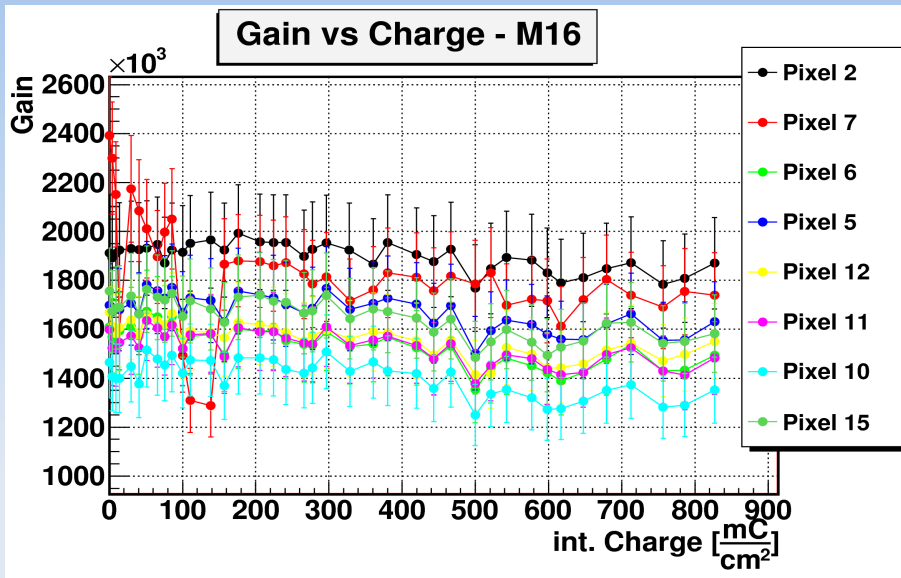
	Ham. M16	Ham. L4	Phot. XP85112	BINP 1359	BINP 3548
Int. Collect. Charge (Dec 8th) [mC/cm <sup>2</sup> ]	826.8	309.8	842.8	280.9	340.7
Current per anode (695kHz) [nA]	40.8	51.1 - 58.1	43	212	245
Specified max. DC anode cur. [nA]	100	100	47 (64 Chans.) 94 (32 Chans.)	1000	1000
Diff. Charge [mC/cm <sup>2</sup> /d]	11.1	3.5 - 4.0	10.3	7.2	8.3
Anode area (cm <sup>2</sup> )	0.32	1.27	0.36	2.54	2.54
Number of meas.	39	39	39	16	16
QE-Scans	5 (2 for 0mC/cm <sup>2</sup> )	7 (4 for 0mC/cm <sup>2</sup> )	4	2	2

# Comparison of spectral QE

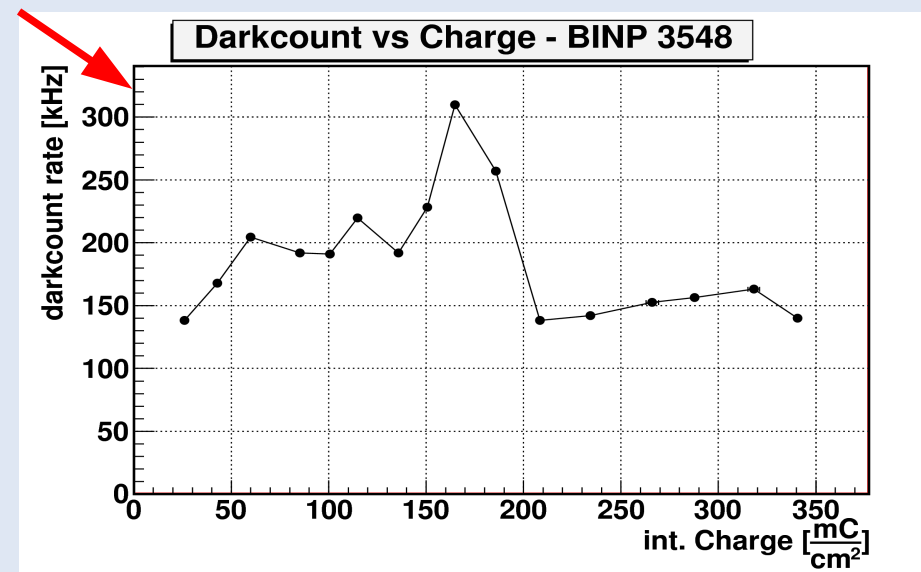
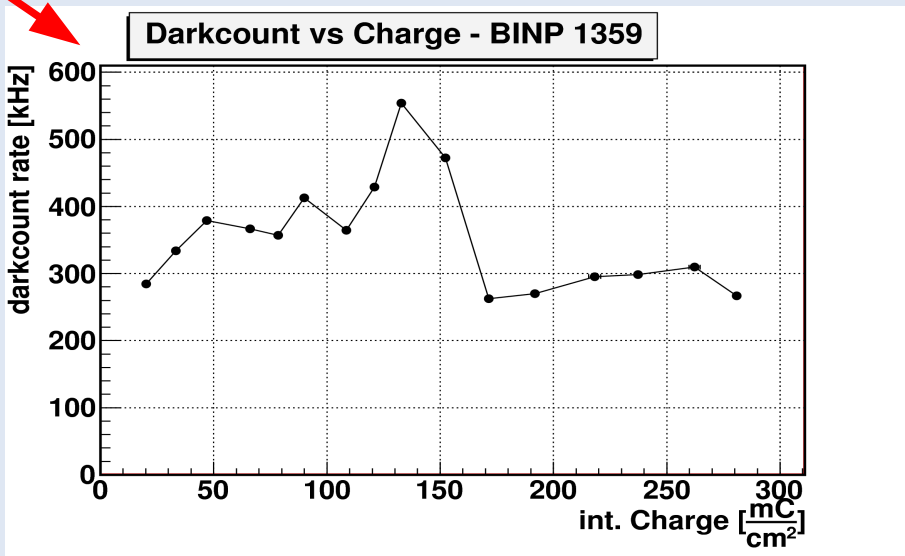
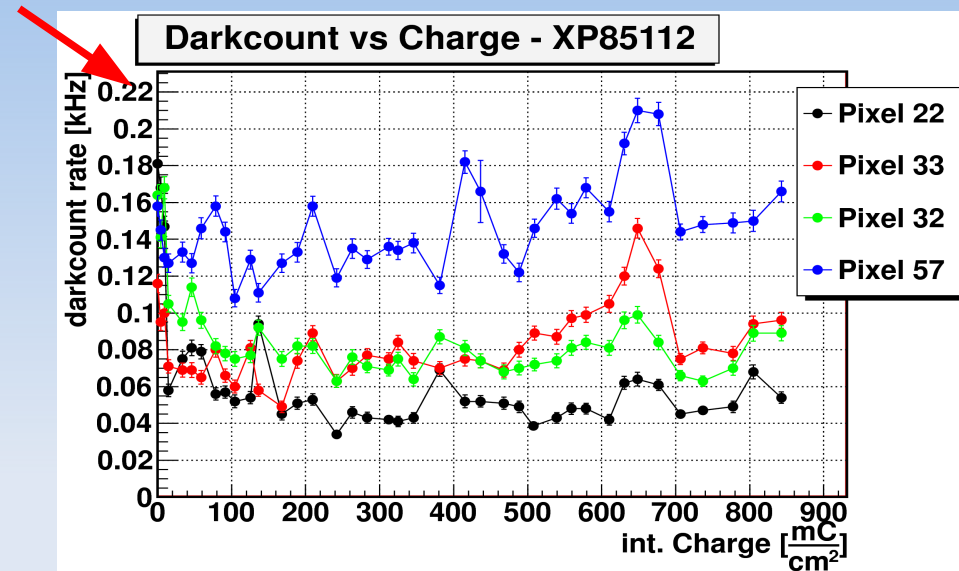
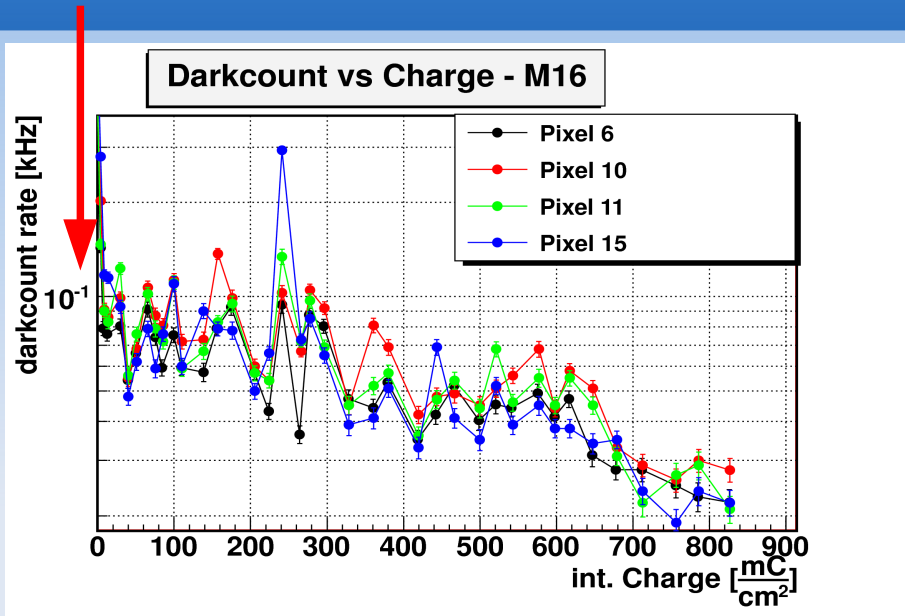
- QE at 460 nm (LED):  
14% (M16), 17.2% (85112), 19.5% (BINPs)  
=> requires add. ND 0.3 for Russian devices
- Maximum at about 390 nm (M16, 85112) and ~500nm (BINPs)



# Gain measurements



# Dark count

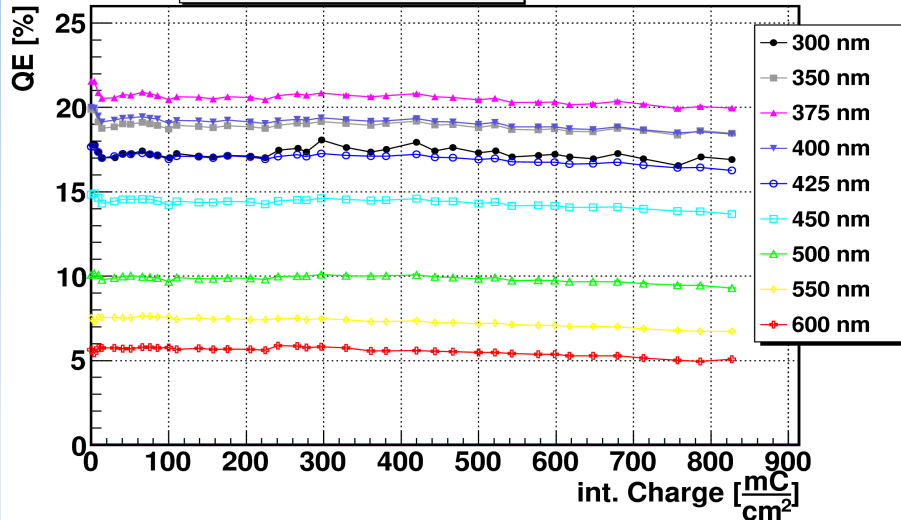




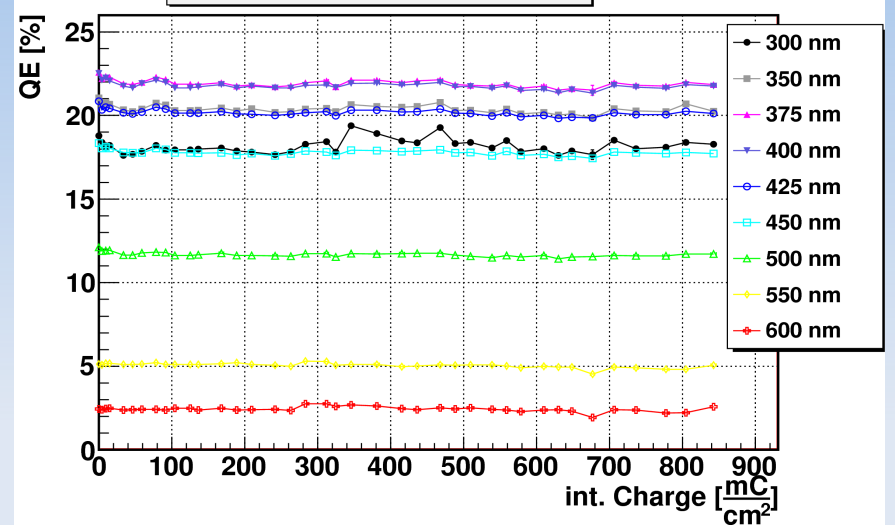
# QE measurements



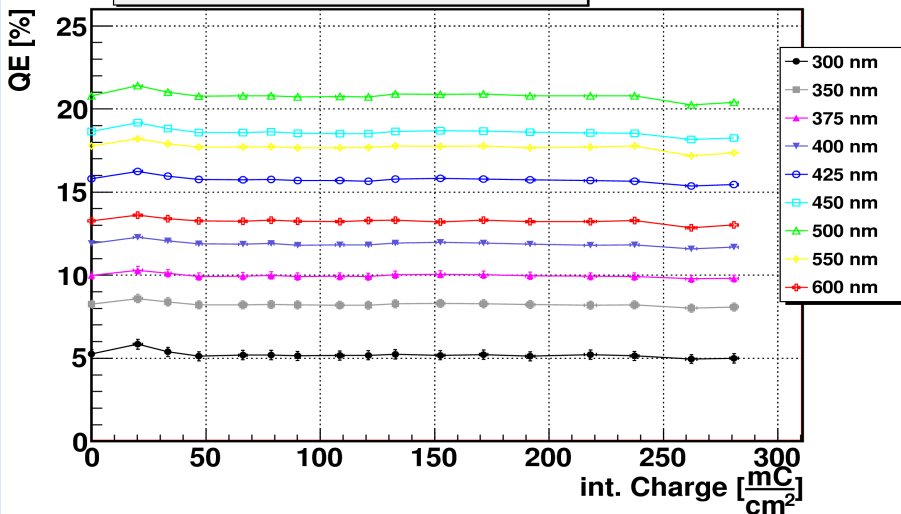
### QE vs Charge - M16



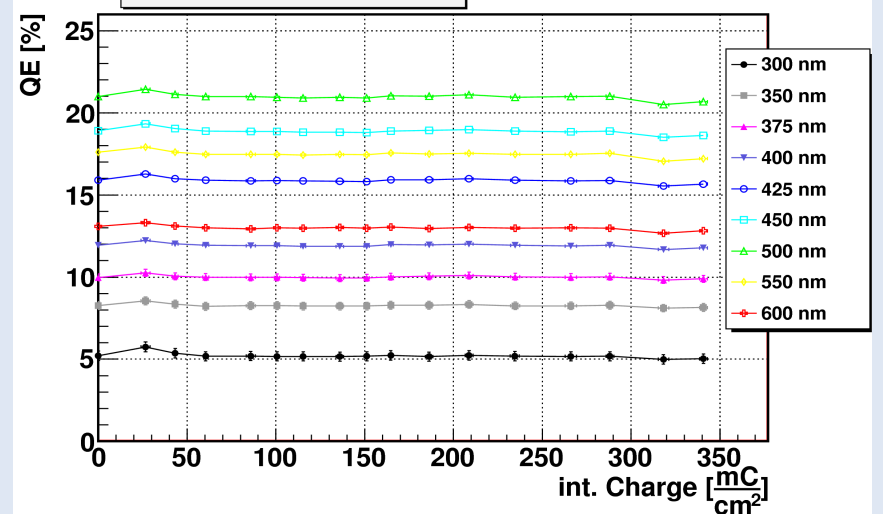
### QE vs Charge - XP85112



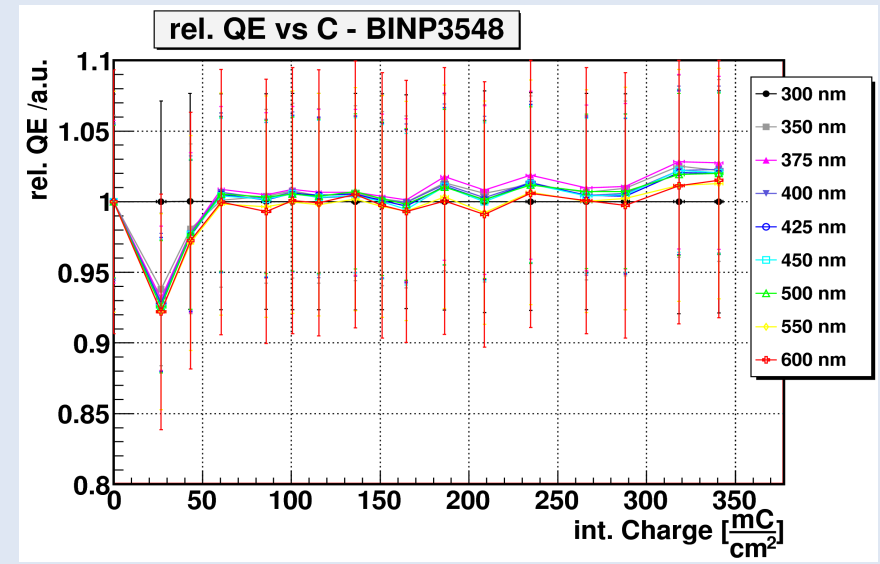
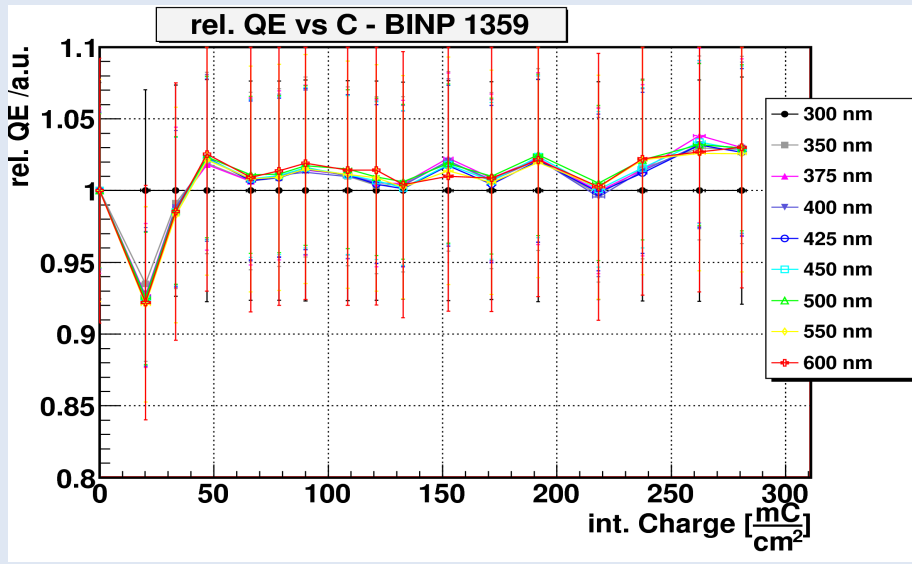
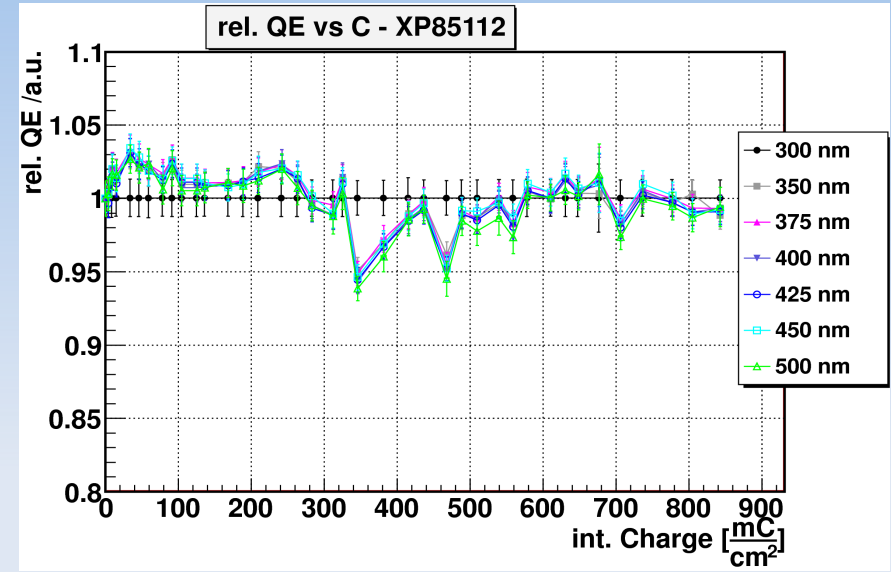
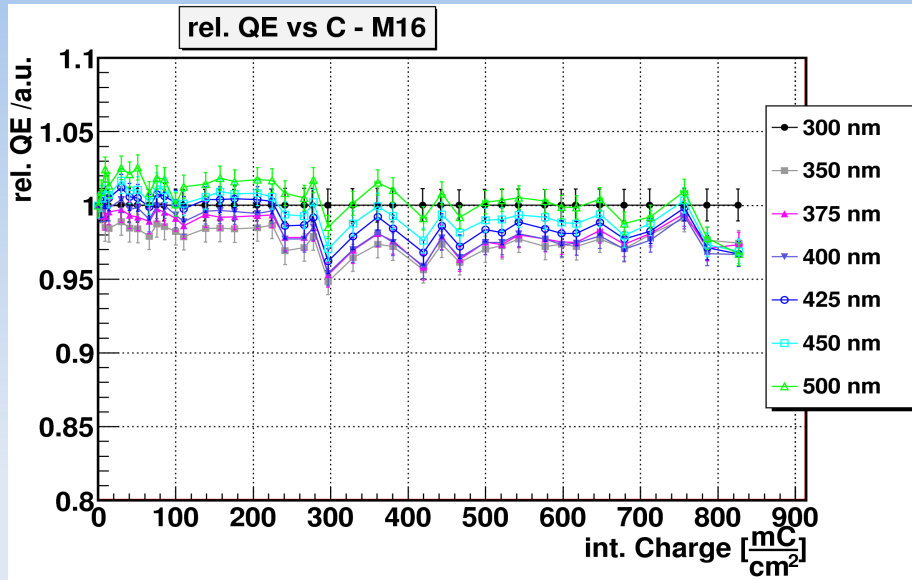
### QE vs Charge - BINP 1359



### QE vs Charge - BINP 3548



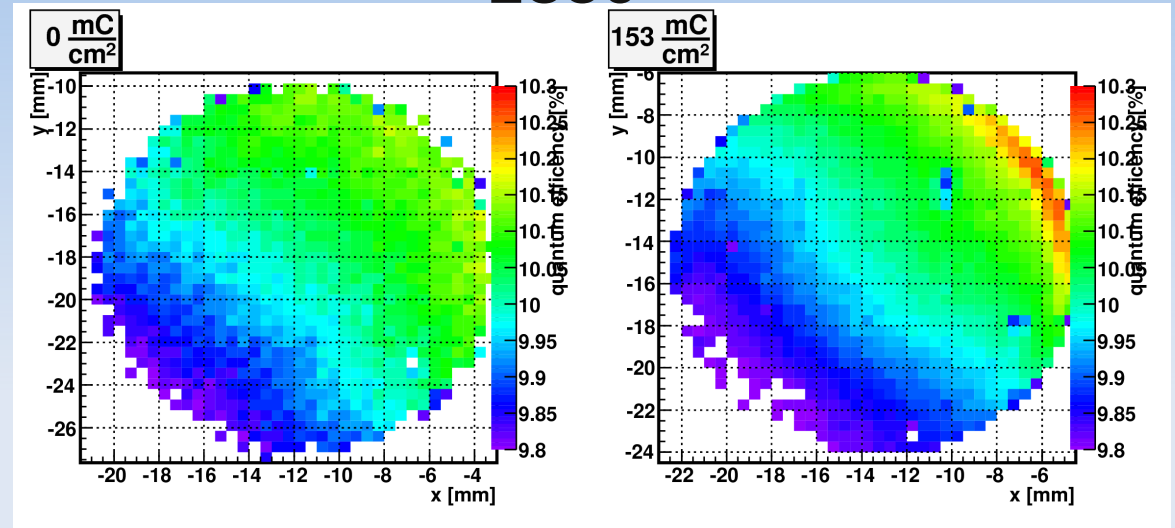
# Rel. Quantum efficiency



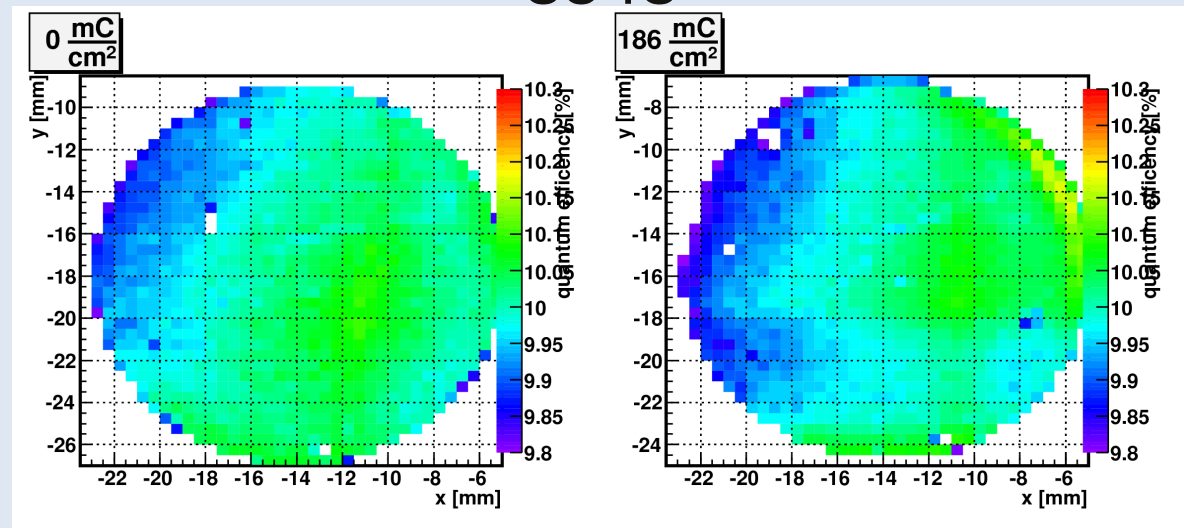
# QE-Scans (BINPs)

Photocathode is quite homogenous for both detectors. (9.8% - 10.2%)

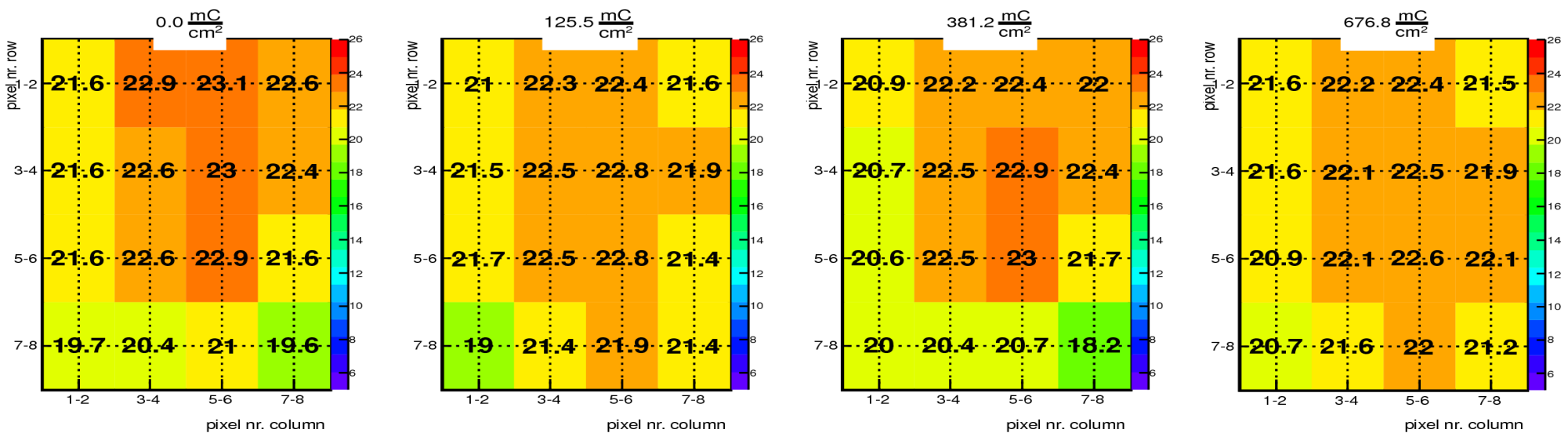
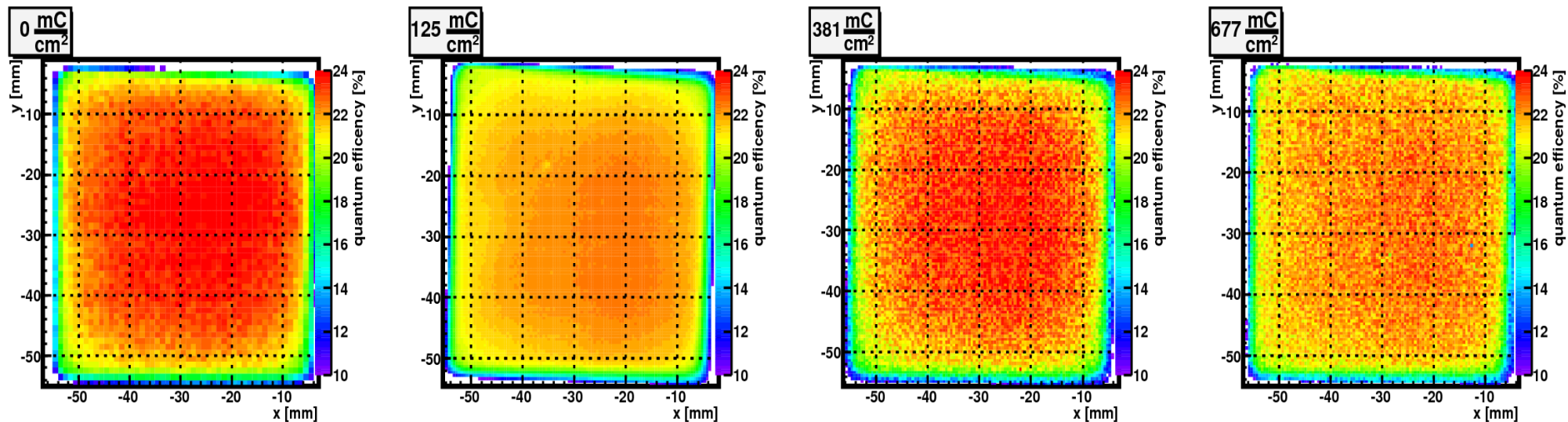
1359



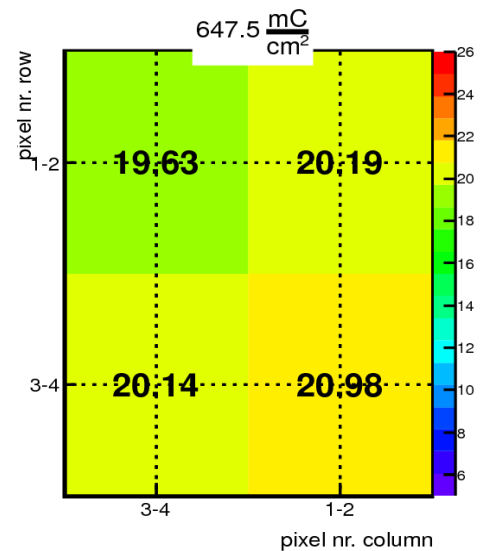
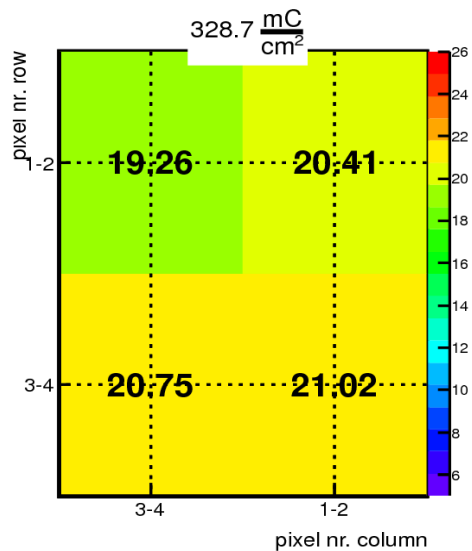
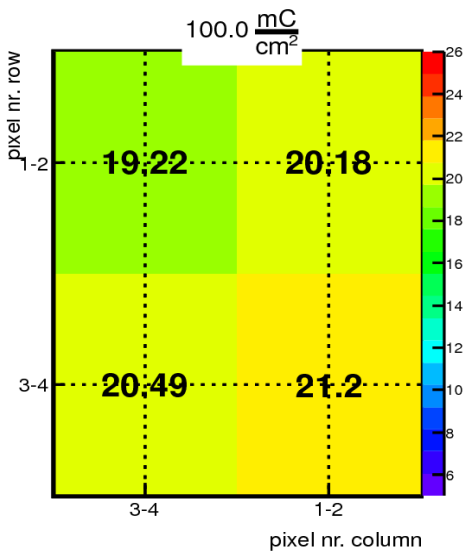
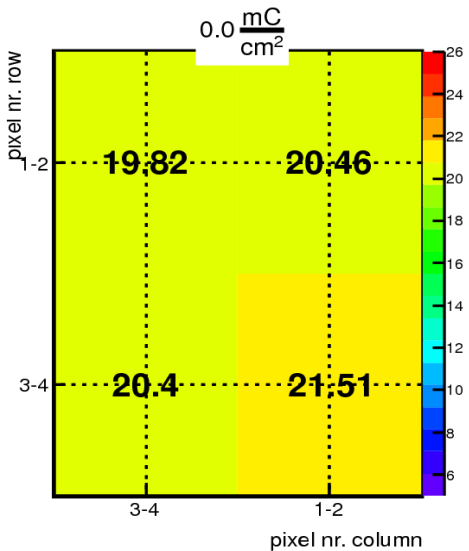
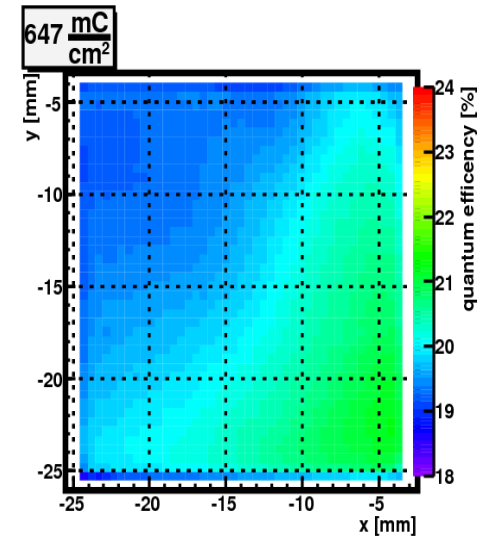
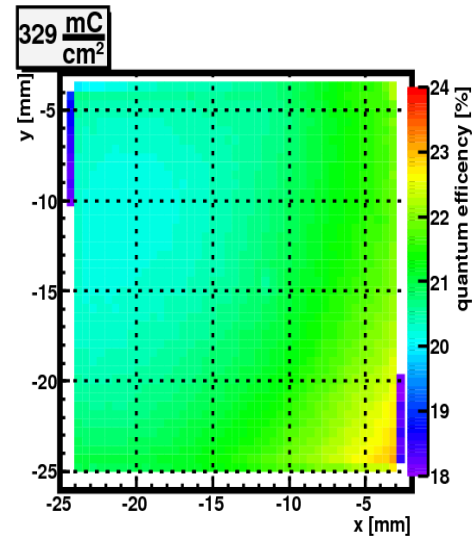
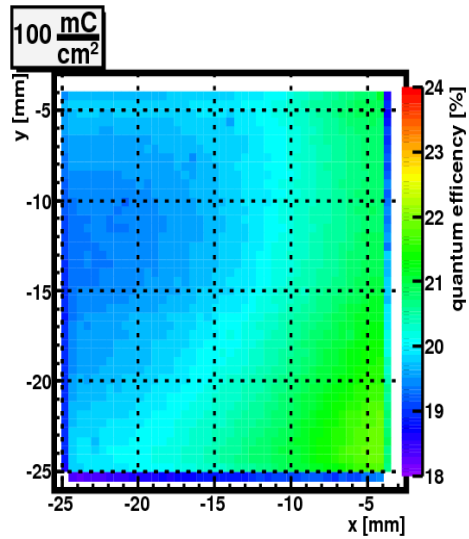
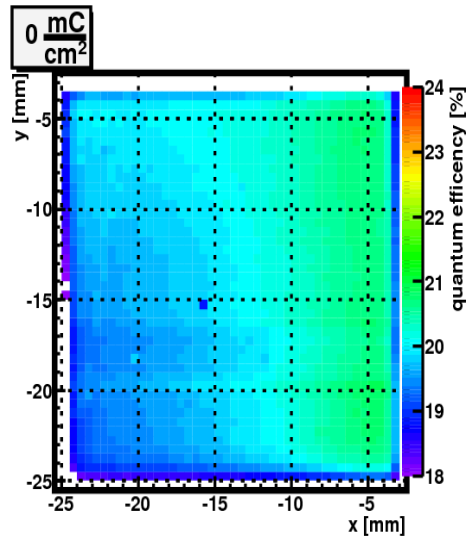
3548



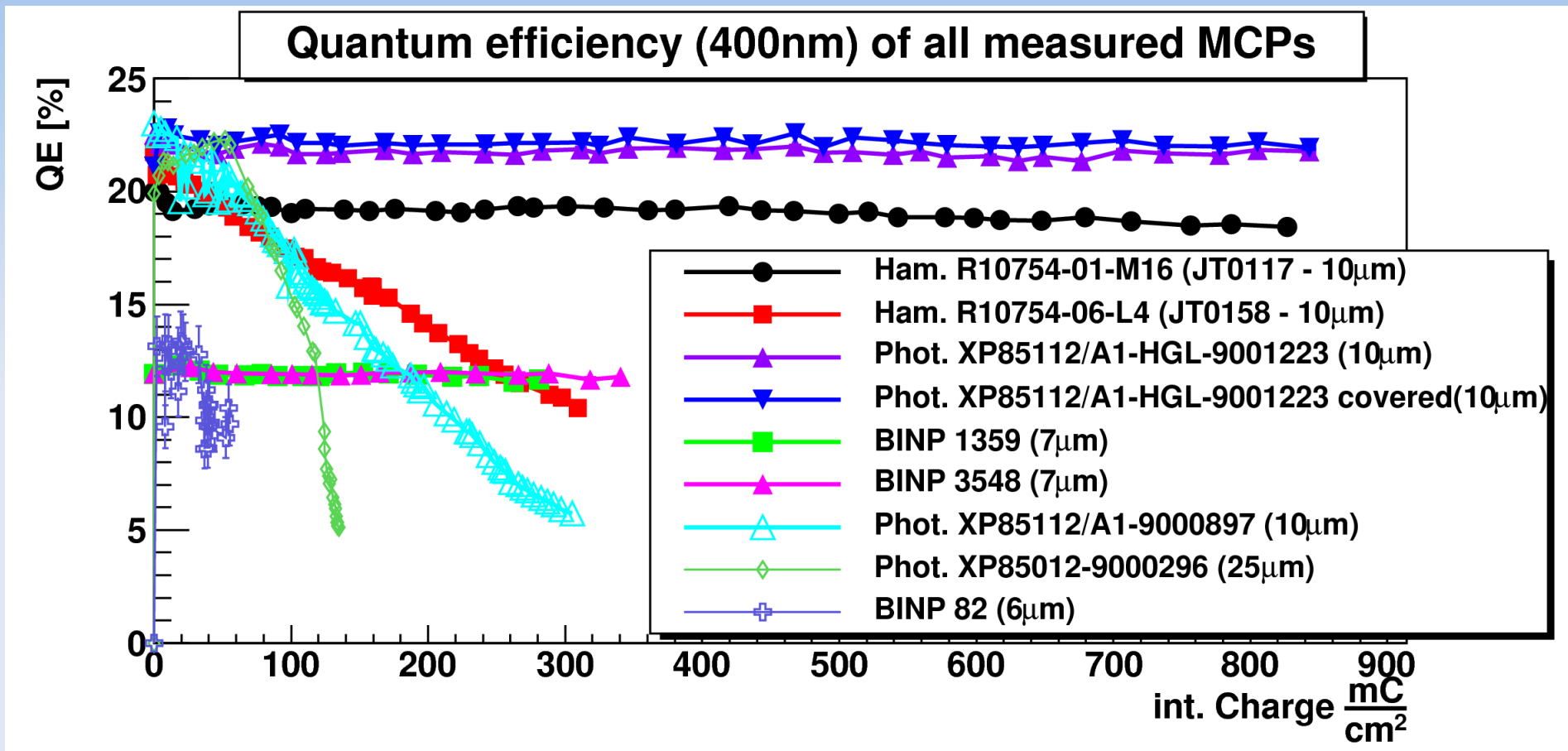
# QE-Scans (XP85112)



# QE-Scans (M16)



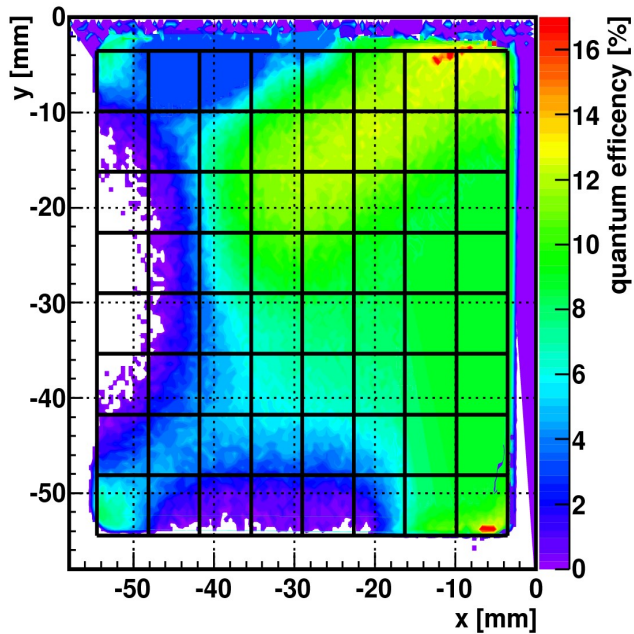
# Comparison with old measurements



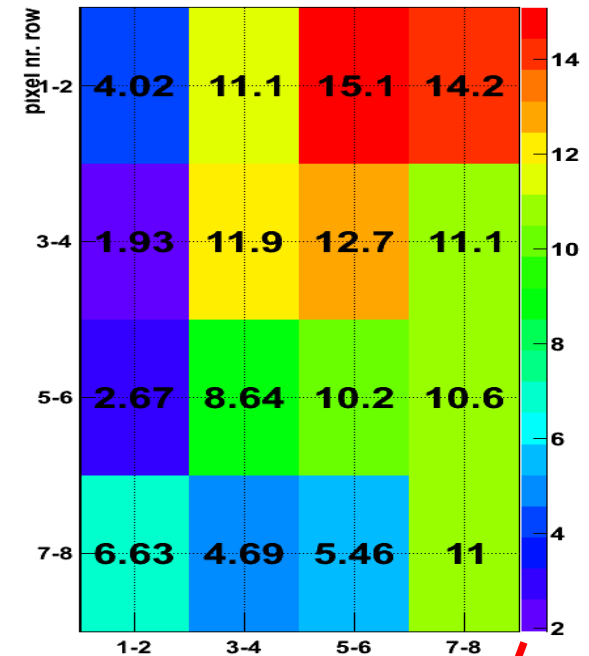
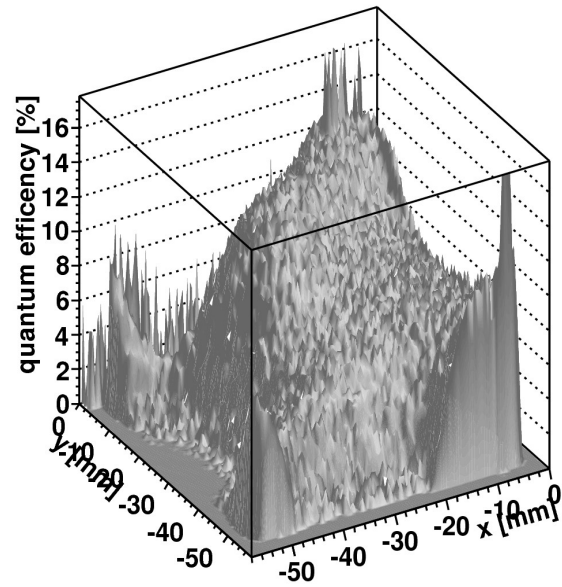
- Lifetime of the latest models tremendously exceeds older ones
- M16 and 9001223 have almost passed "the first PANDA year"

# Lifetime of a 'used' MCP

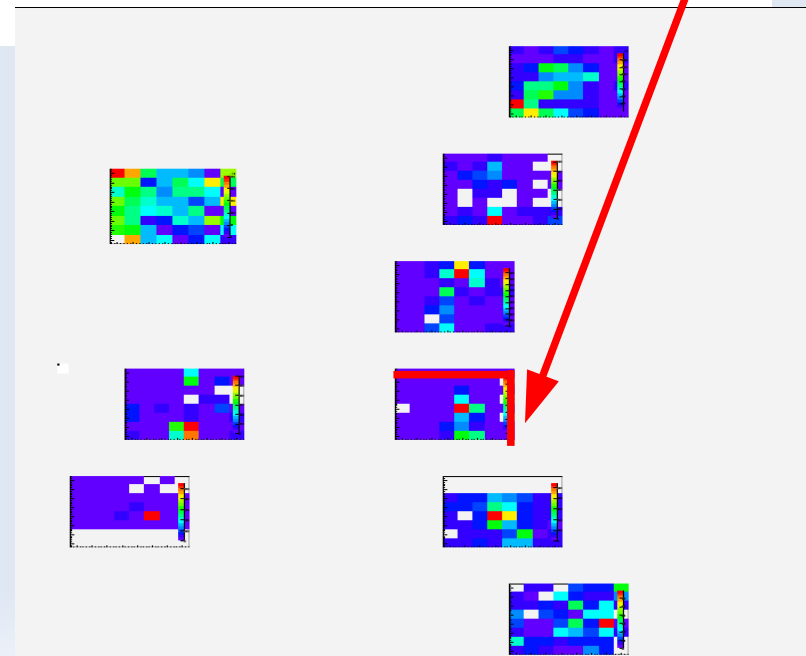
Quantum Efficiency - Photonis XP85012 - 9000413



Quantum Efficiency - Photonis XP85012 - 9000413



- QE has dropped a lot at the left and lower edge
- Possible explanation for degradation: exposure to light at CERN during test beam
- Attention: MCPs at CERN are mirrored and rotated by 90°!



# Summary and Outlook



- Lifetime of the latest MCP-PMTs outmatch older ones, (almost) no degradation after 826.8 (M16), 842.8 (85112) mC/cm<sup>2</sup>. New BINPs seem promising as well (280.9mC/cm<sup>2</sup> for 1359 and 340.7mC/cm<sup>2</sup> for 3548)
- Darkcount has decreased as expected
- Gain and QE stable, no 'edge/corner' effects so far
- Other 'used' XP85012 should be checked as well. Maybe QE (and Gain) has dropped, too