

APD Lab @ GSI: Status and News

Following APD properties have to be measured:

- Gain - bias voltage (U_R) dependence (temp dependent)
- Dark current – U_R dependence (temp dependent)
- $1/M$ dM/dV (temp dependent)
- Capacitance (sample wise)
- Quantum efficiency (sample wise)
- Search for surface defects (e.g. resin wounds) with reflective-light microscope

Measurements have to be 're-done'
after any kind of irradiation tests

Additional Transformator station





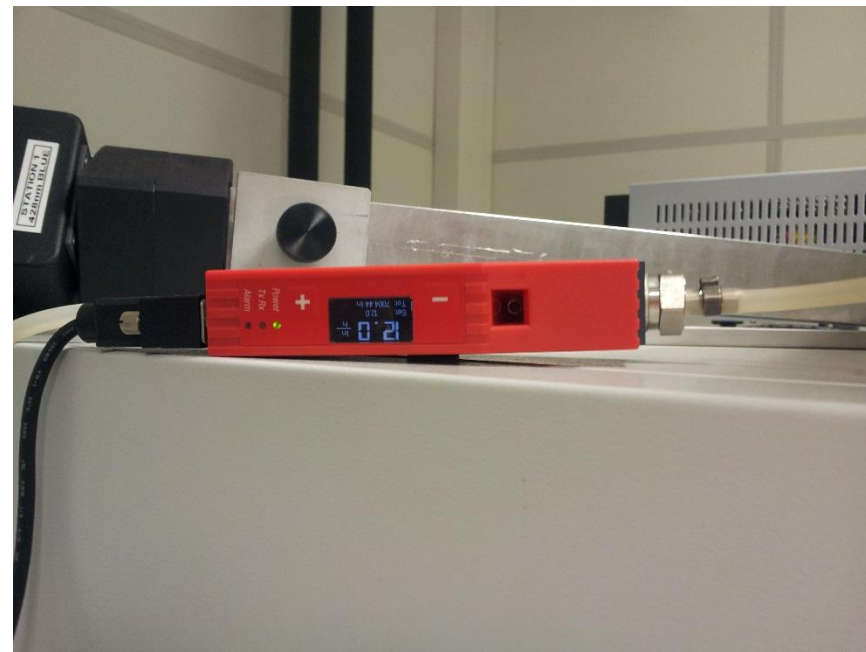
Active bundle



Spare bundle



Nitrogen Alarm system inside the hall
Optical and acustical warning



Programmable Nytrogen flowmeter
for each station
Acustical and optical warning

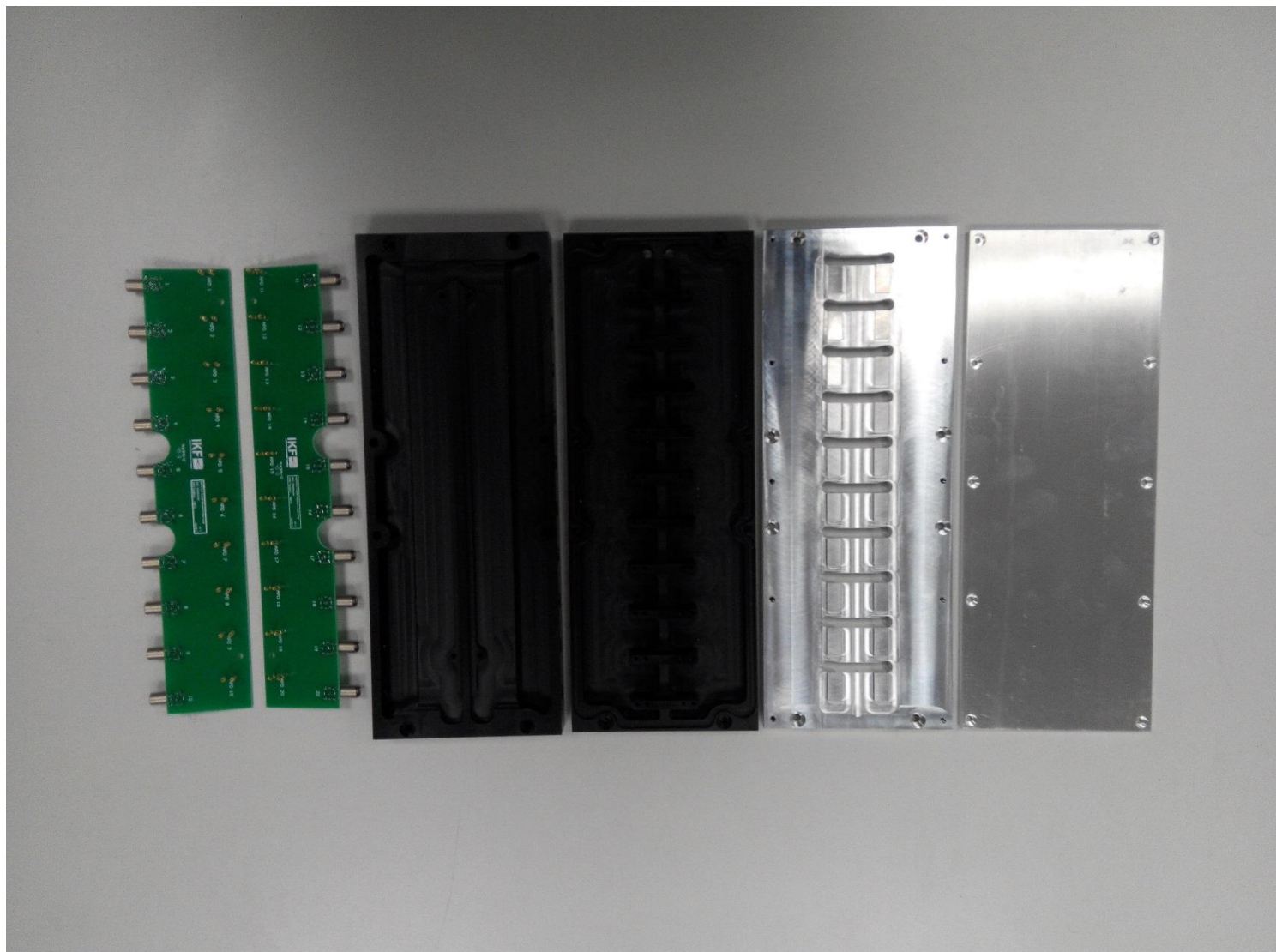
Chiller control
inside the hall

Cooling water temperature:
6 deg C



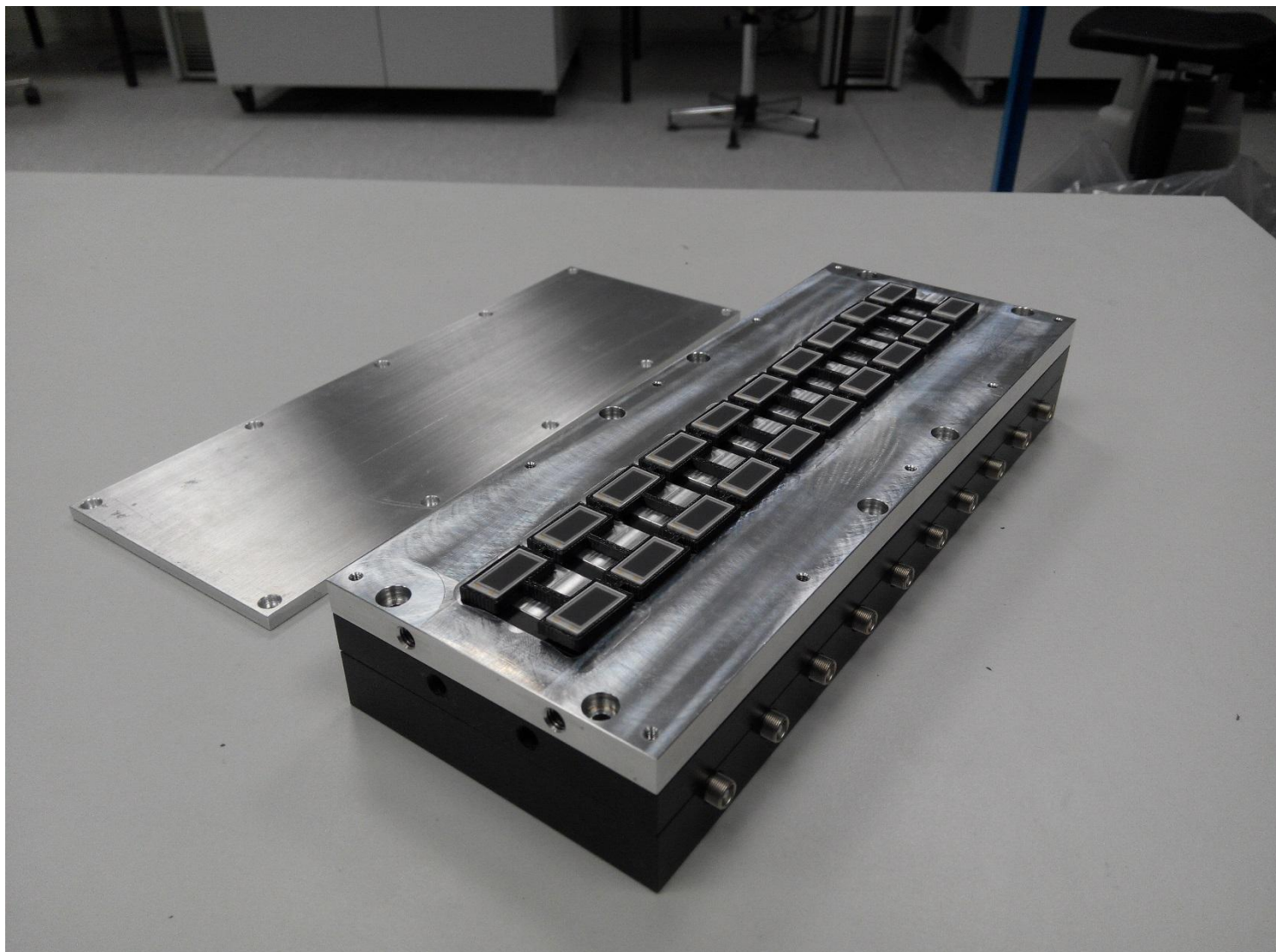
Components of the
Irradiation setup

(design by
Thomas Bel)



Complete setup with
mounted APD grid

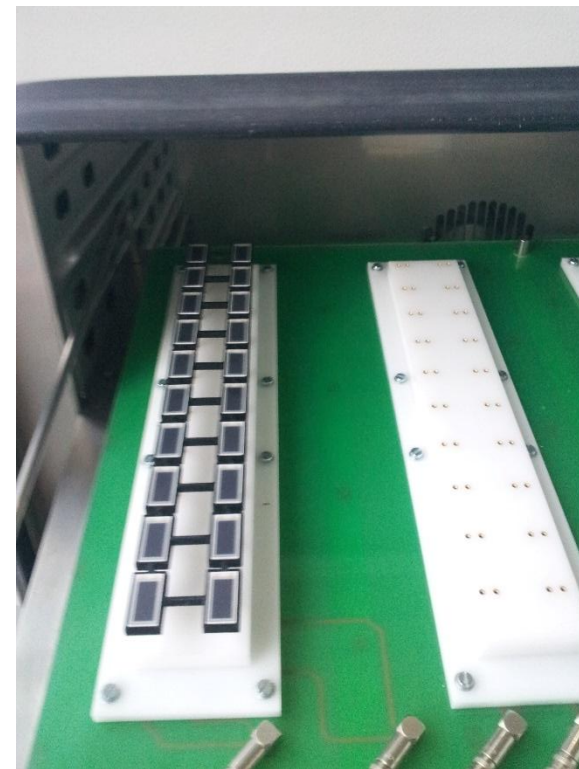
(design by
Thomas Bel)



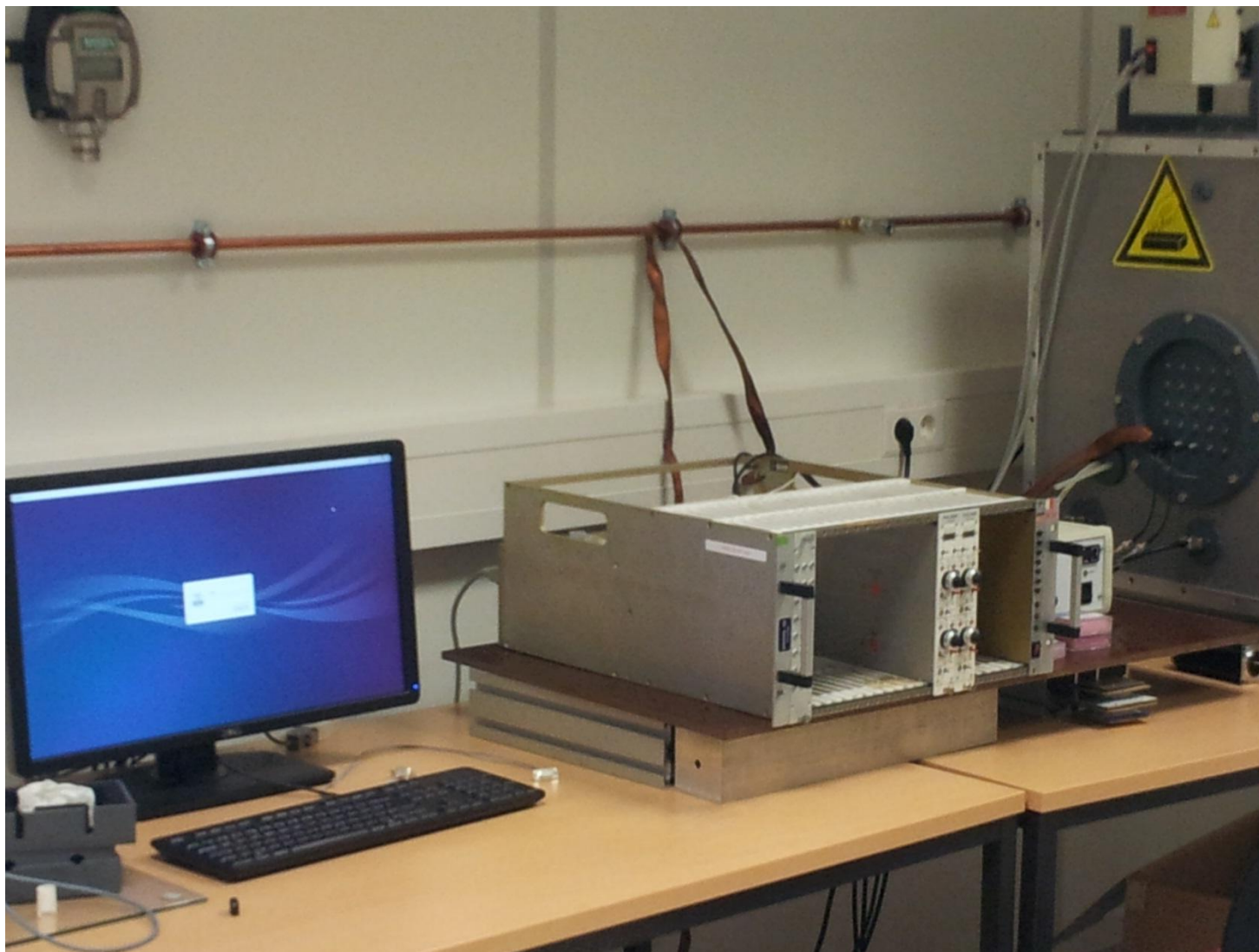


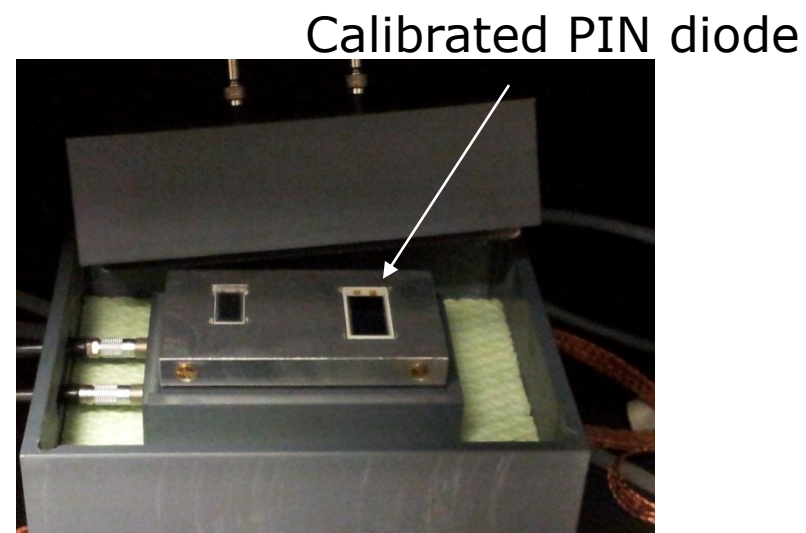
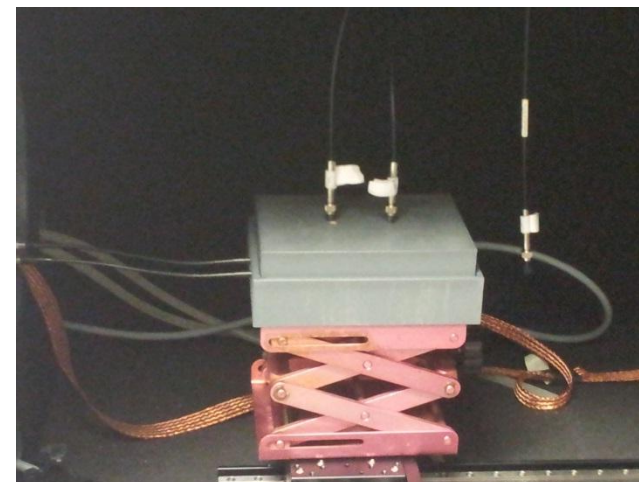
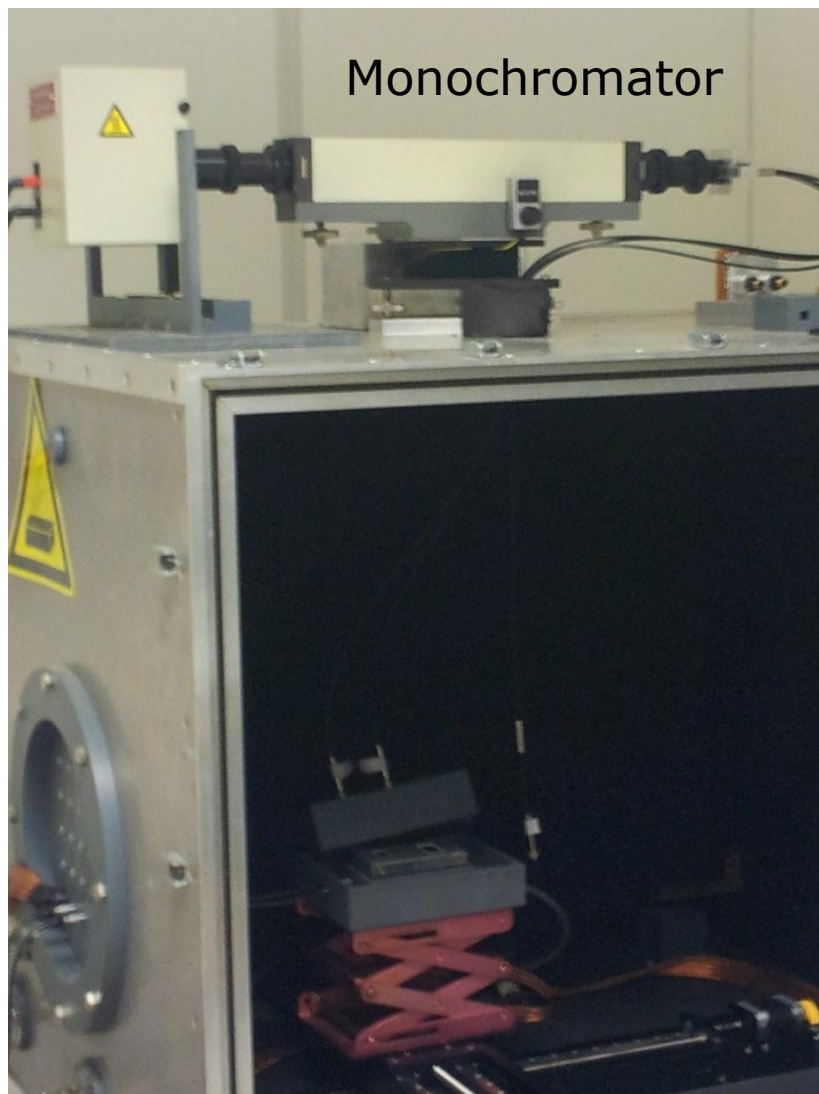


Each Oven: 500 APDs capacity



Look inside with one mounted „APD grid“





Overview over
one station



Next to each climate cabinet: additional cooling for temp stabilization

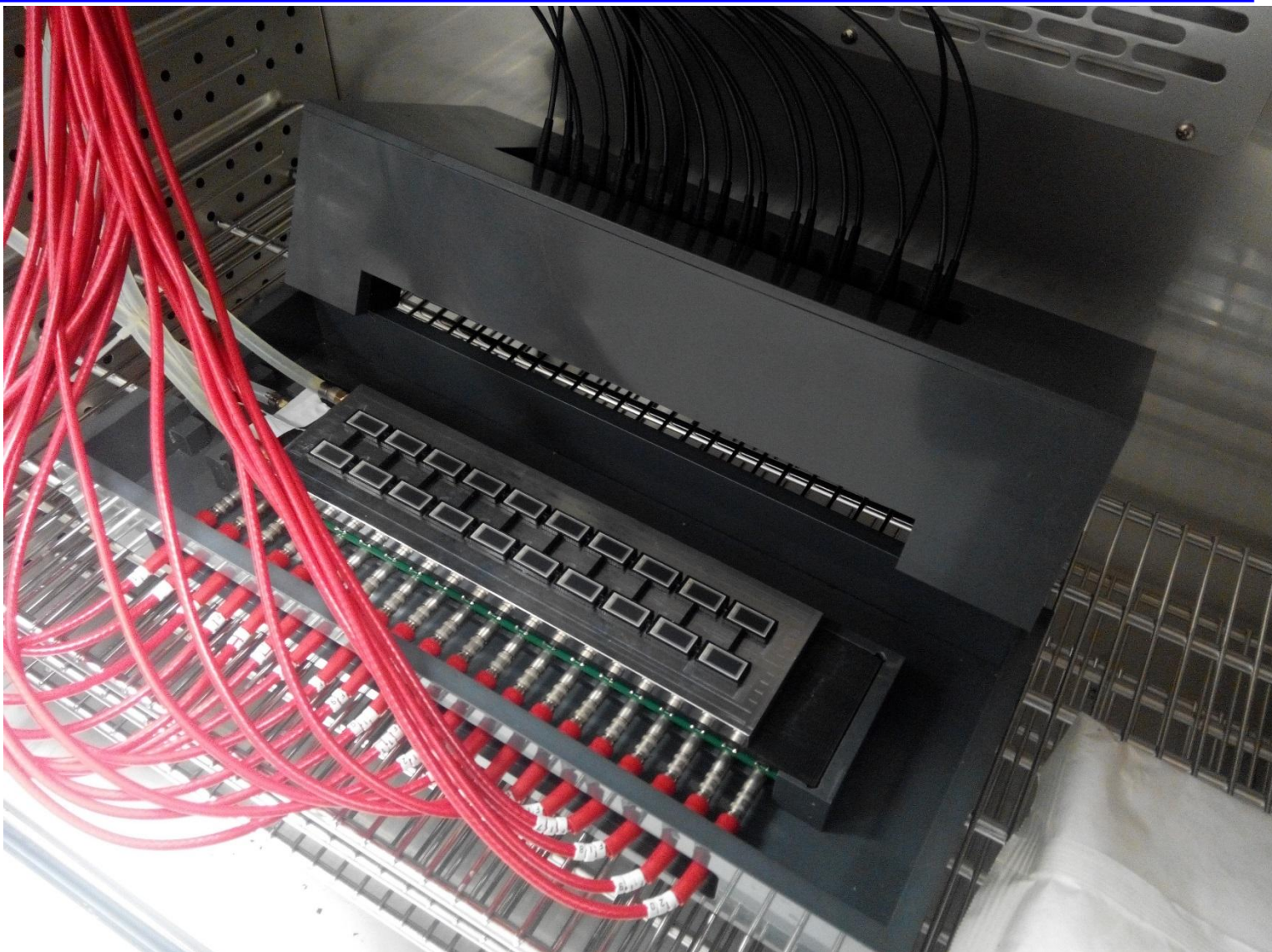
On top of each climate cabinet: temp stabilized light source coupled to fibre bundle



Inside
station view

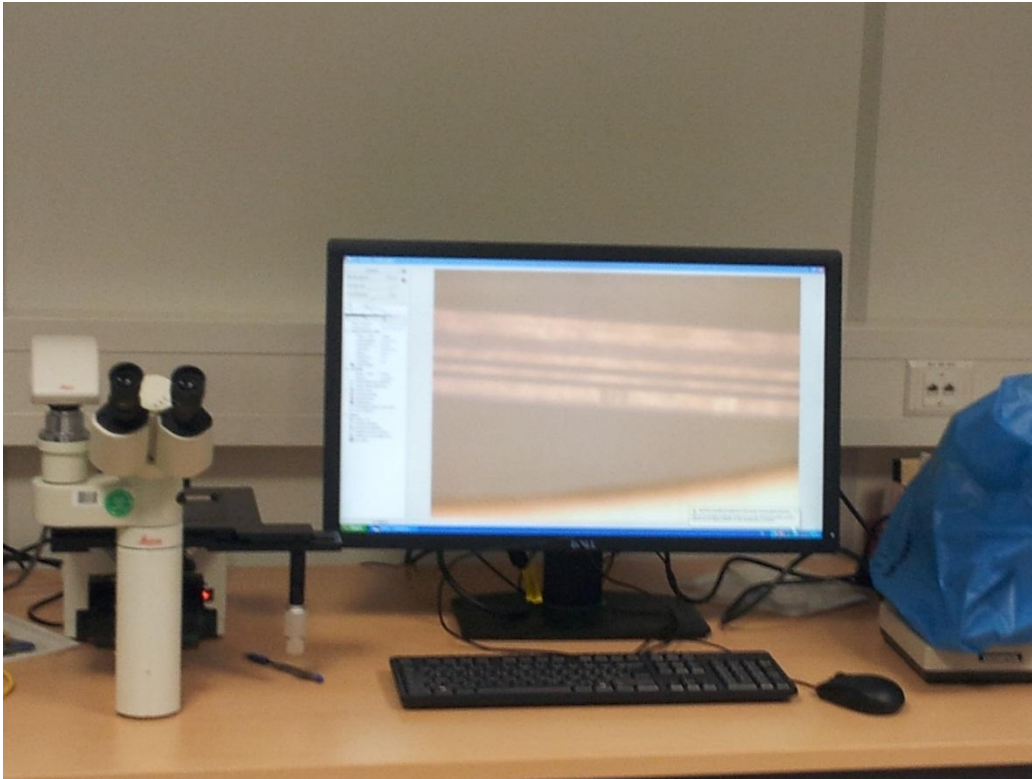


Mounted APD grid:
Ready for screening



Online monitoring
at each station

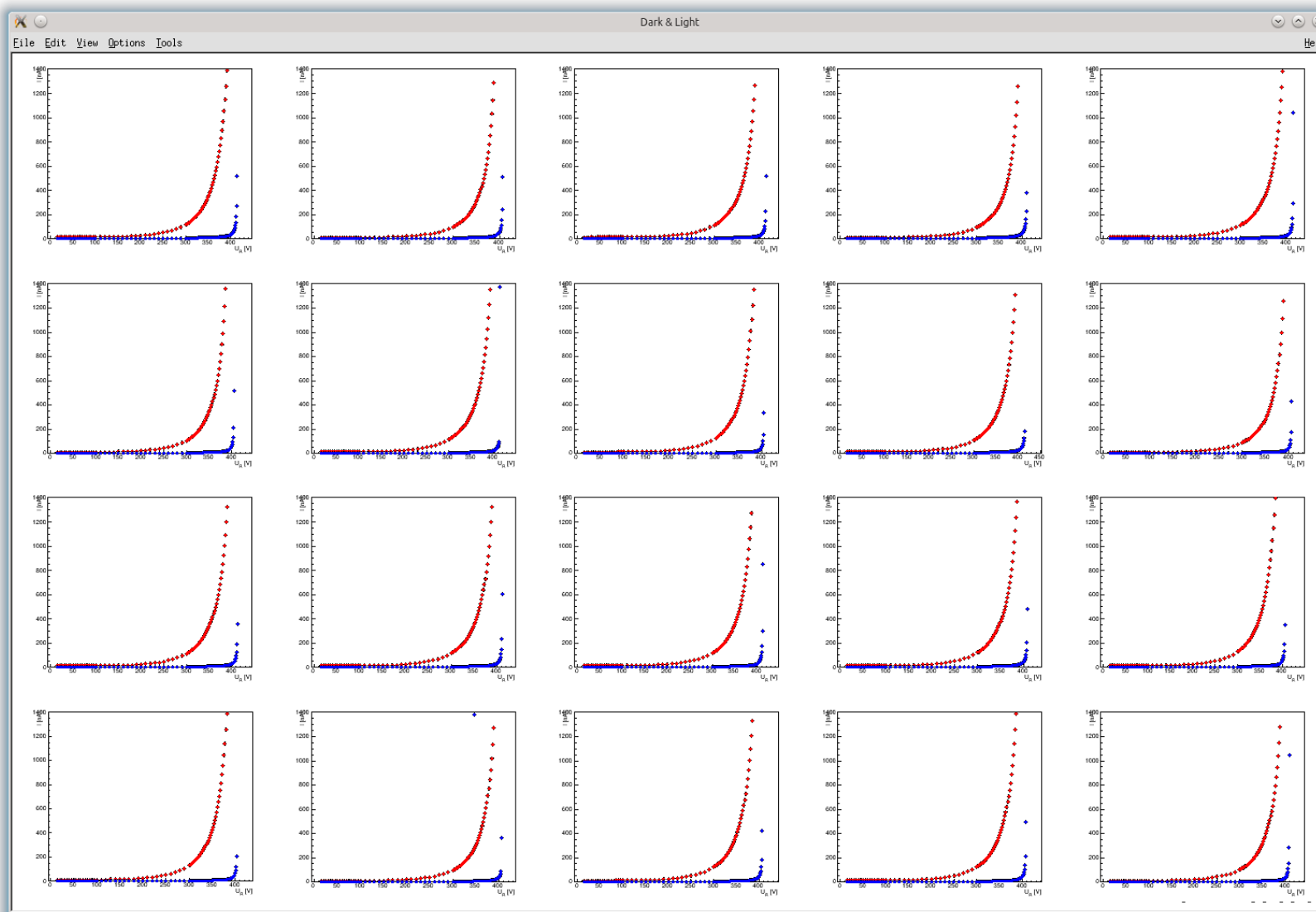


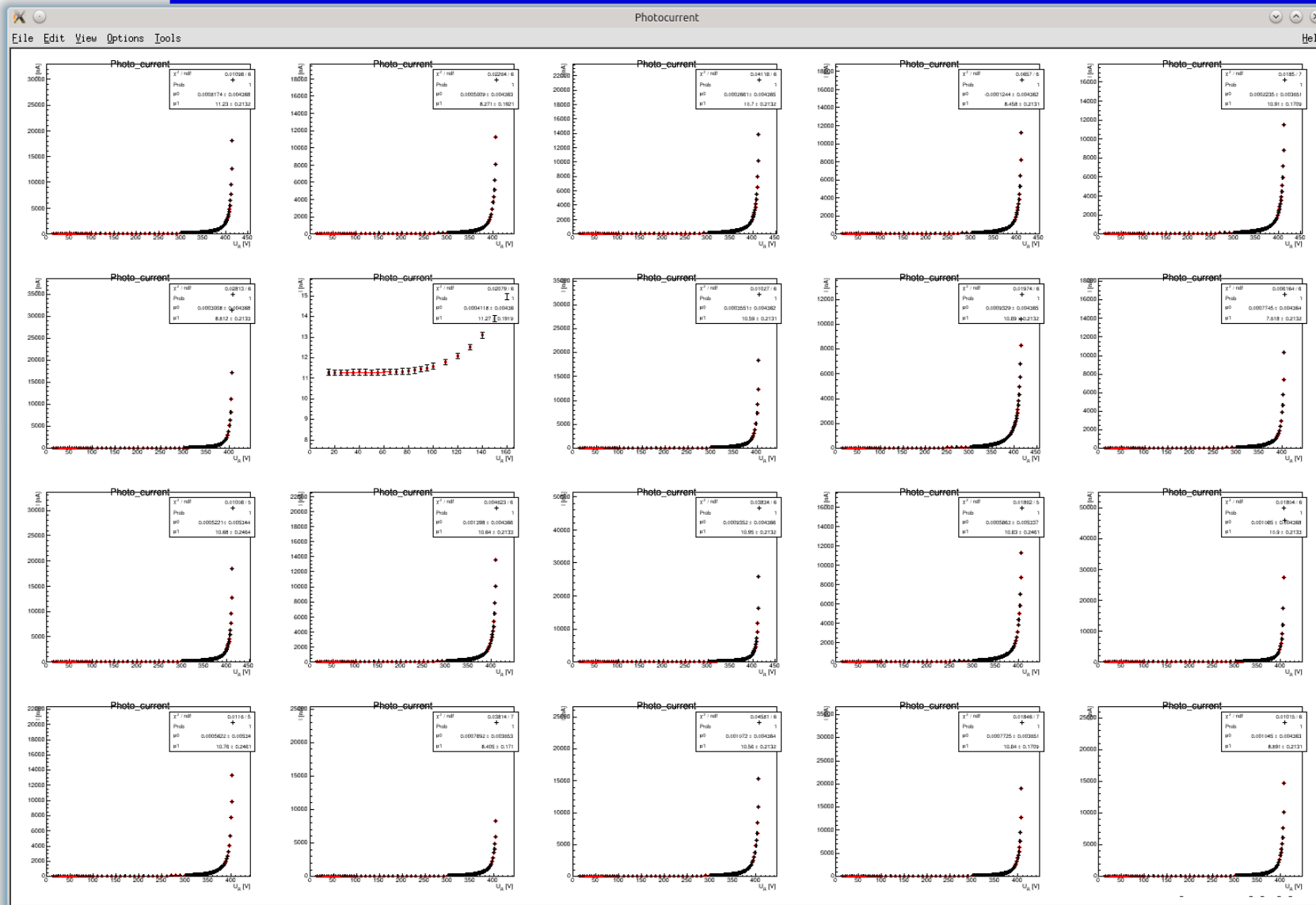


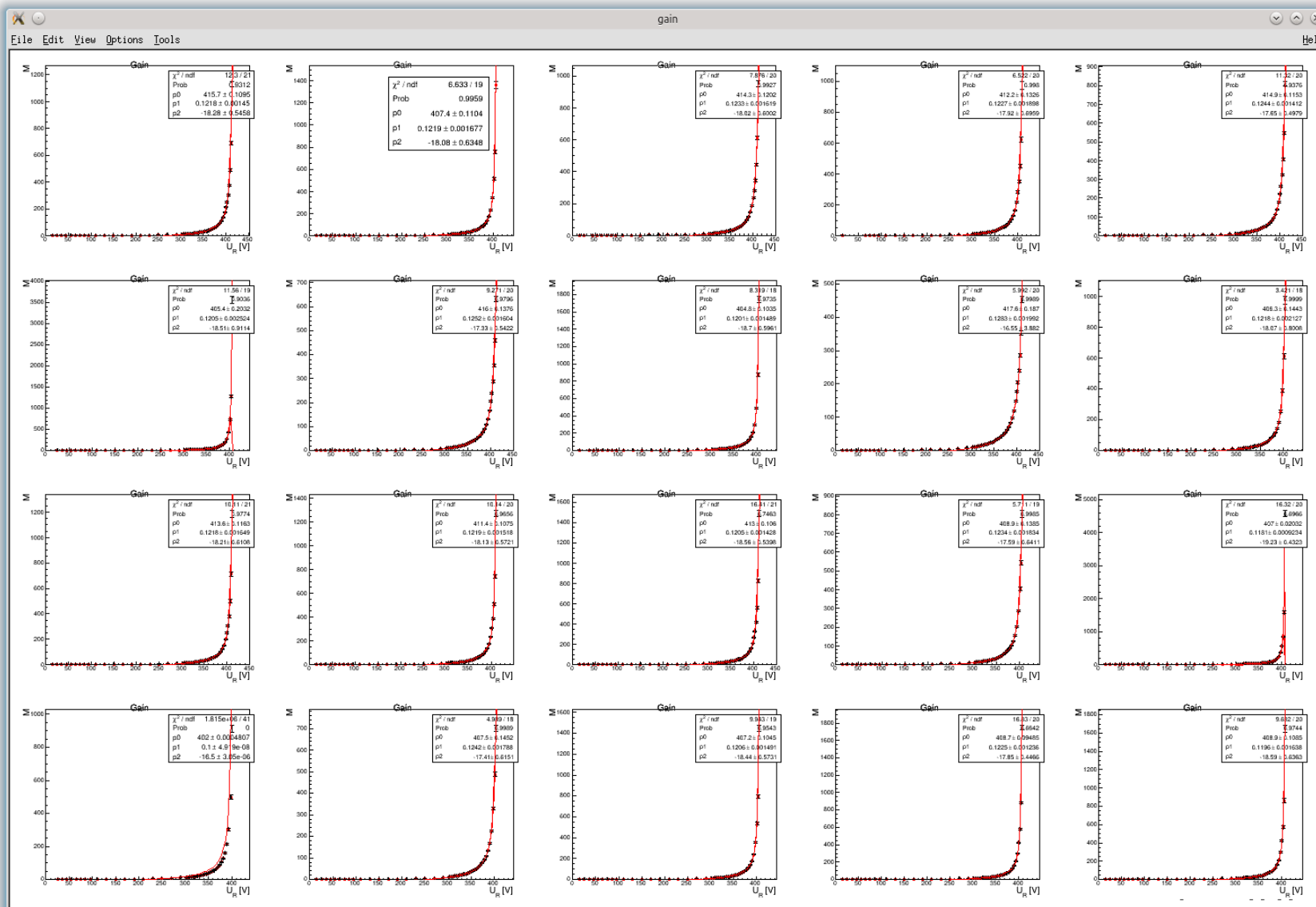
Waferposition on APD surface:
B13

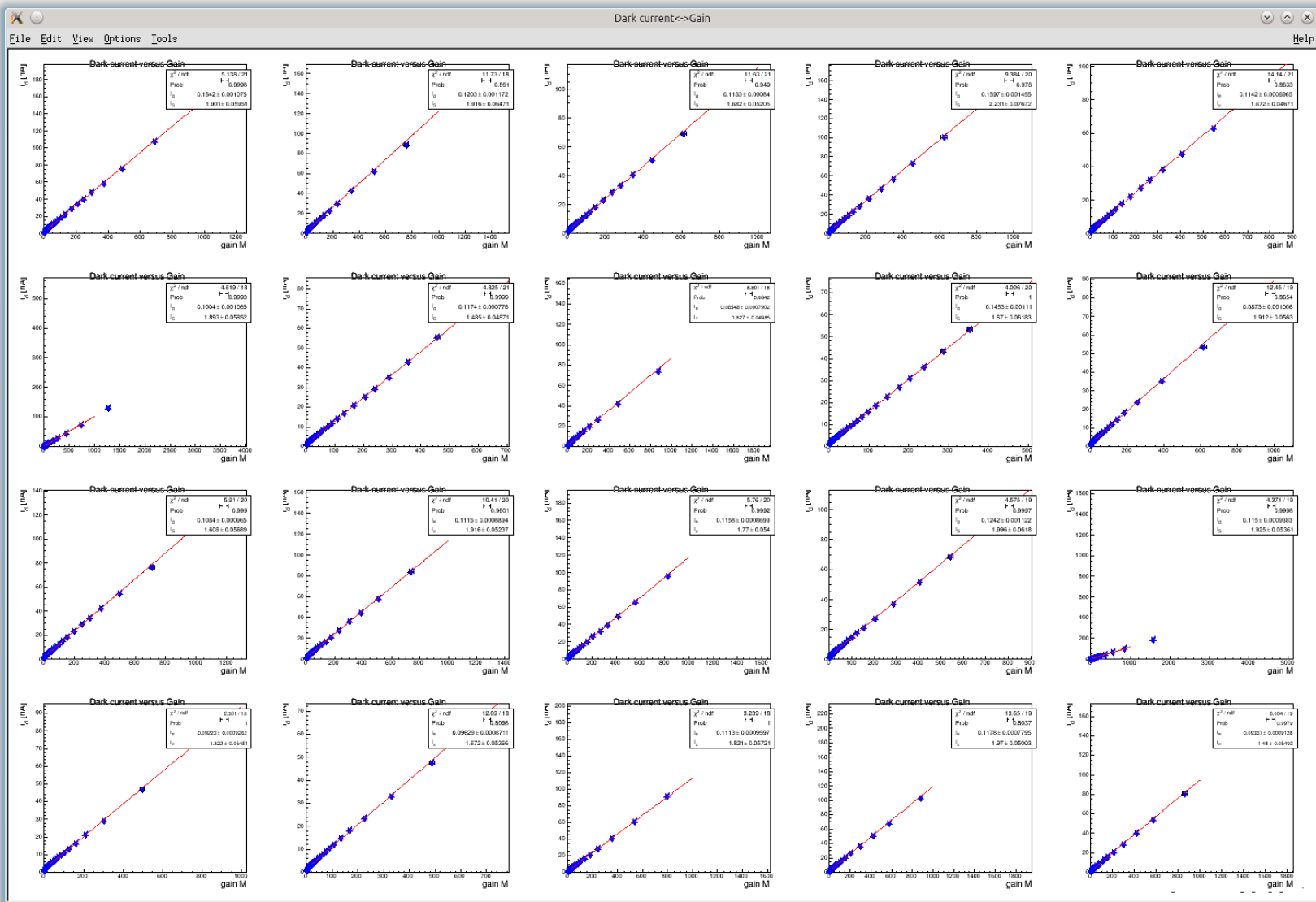
Filling the shifts with life

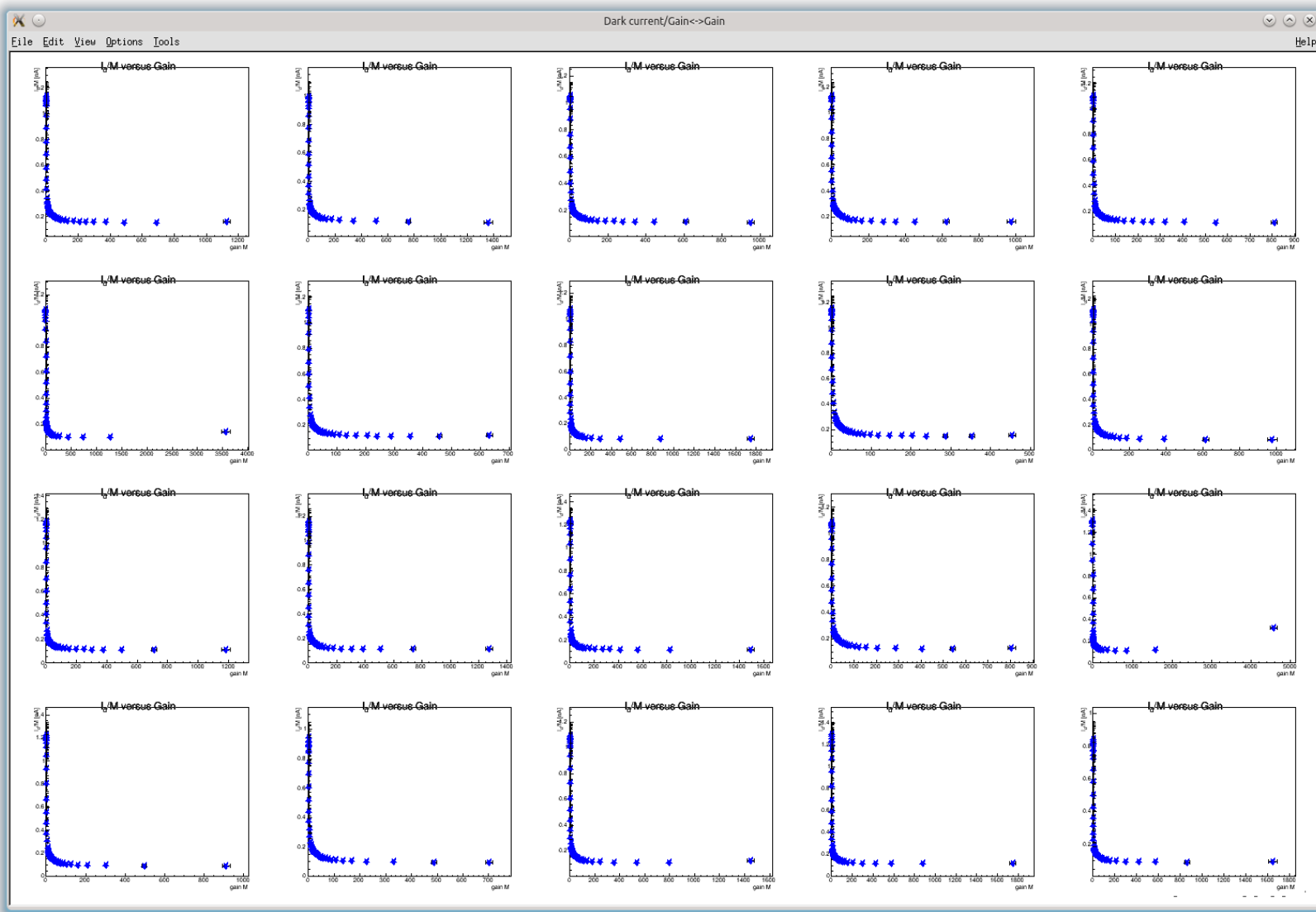


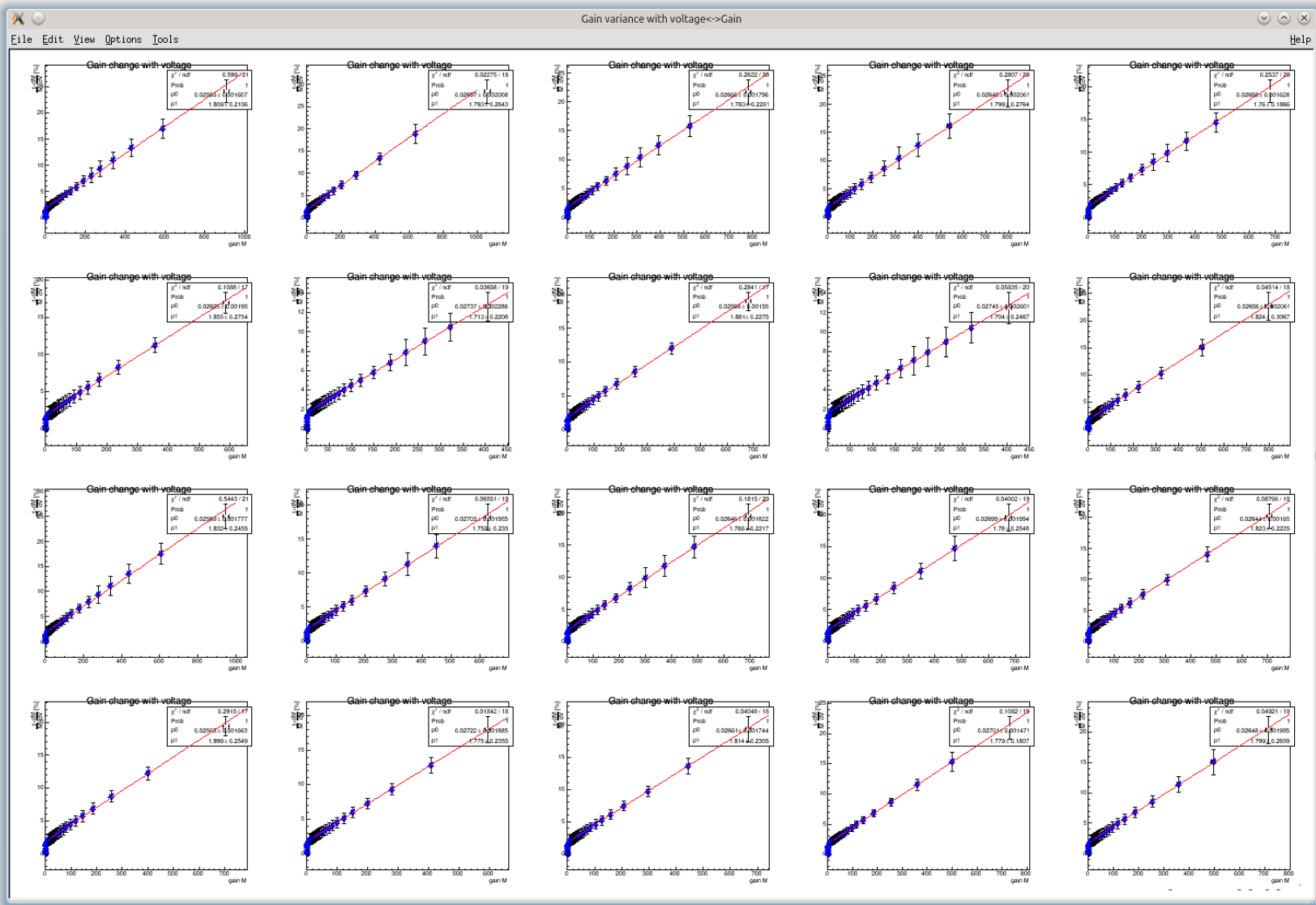












Station 1	Station 2	Station 3	Station 4	Station 5
Status: Running Progress: 28 of 153 Voltage: 210 V Last update: 22 sec ago	Status: Ready Process: - Voltage: - Last update: -	Status: Running Progress: 6 of 153 Voltage: 45 V Last update: 17 sec ago	Status: Running Progress: 110 of 153 Voltage: 423 V Last update: 5 sec ago	Status: Ready Process: - Voltage: - Last update: -

APD 1	APD 2	APD 3	APD 4	APD 5	APD 6	APD 7	APD 8	APD 9	APD 10
210.097961 V -0.424267 nA	210.106934 V -0.695489 nA	209.983185 V -0.687188 nA	209.939209 V -0.639753 nA	209.976898 V -0.715434 nA	209.938354 V -0.574259 nA	209.964844 V -0.675063 nA	209.926849 V -0.571788 nA	210.091782 V -0.911781 nA	209.996582 V -0.565363 nA
APD 11	APD 12	APD 13	APD 14	APD 15	APD 16	APD 17	APD 18	APD 19	APD 20
210.051620 V -0.873286 nA	209.963760 V -0.665401 nA	209.969055 V -0.737338 nA	210.009125 V -0.667115 nA	209.942902 V -0.677294 nA	209.933075 V -0.631506 nA	209.944427 V 0.107274 nA	209.792862 V 0.012699 nA	209.896027 V 0.010116 nA	210.049072 V 0.000000 nA

- Klick on station number to watch the status in detail
- Shown station is marked in yellow
- In case of malfunction: optical and acustical warning



legend: running canceled finished saved

Series	20		10		2		-10		-20	
	Dark	Light	Dark	Light	Dark	Light	Dark	Light	Dark	Light
0	4									
46	3	3								
51	1	1								
54	2	2								
55	1	1								
58	2	2								
65	3	3								
69	1	1								
81	2	2								
110	2	2								
116	5	5	5	5	5	5	5	5	5	5
128	4	4	4	4	4	4	4	4	4	4
134	1	1								
135	3	3								
136	2	2								
137	3	3								
138	1	1								
139	4	4	4	4	4	4	4	4	4	4

Measurement:
overall status
(test version)



Total amount

Send to

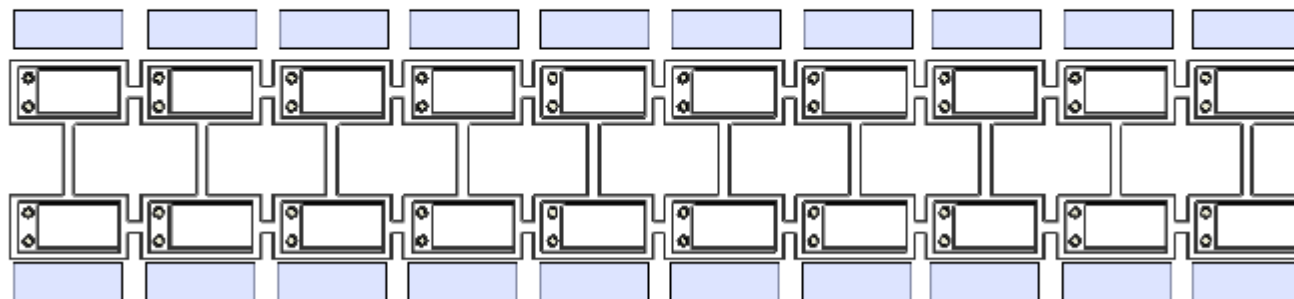
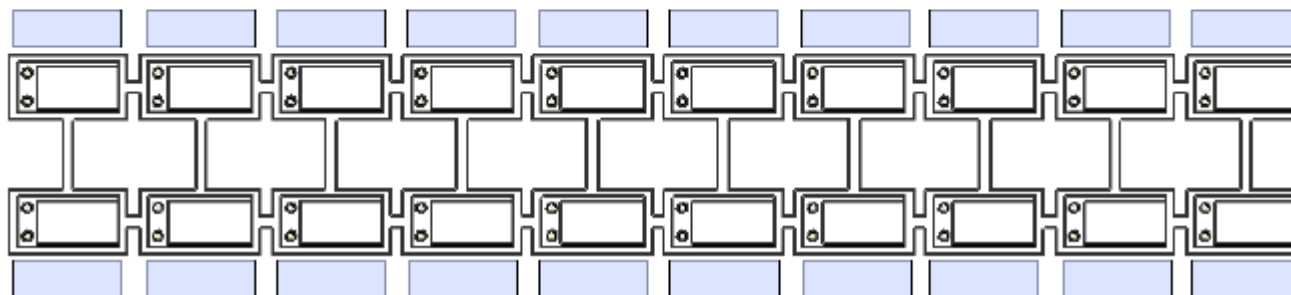
Print document
E-Mail to A.Wilms

Date

APD grid
mounting
and
SN
implementation
form

Reminder:
SN: 10 digits

- Including:
- Lot No
 - Wafer No
 - Pure APD-ID
 - SN



STATION	
Name/Serie	
Beginn der Messung	

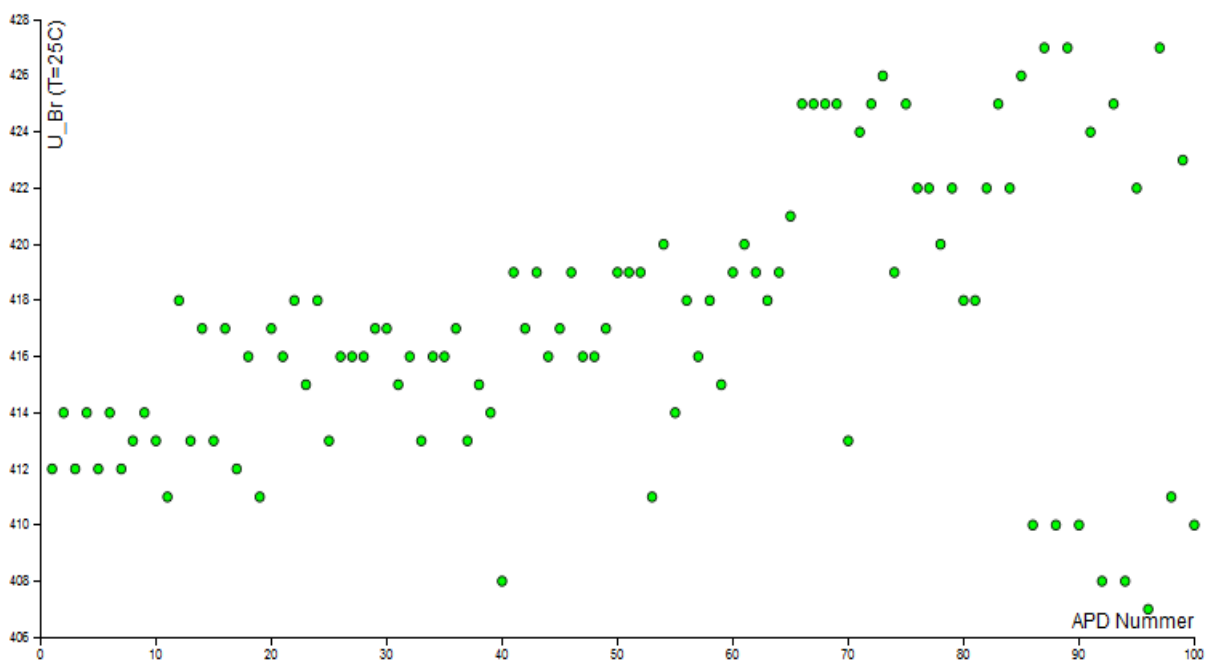
T_soll[°C]	20		10		2		-10		-25	
T_ist[°C]	Dark	Light	Dark	Light	Dark	Light	Dark	Light	Dark	Light
APD #	!Logbuch!		!Logbuch!		!Logbuch!		!Logbuch!		!Logbuch!	
		I_0[nA]		I_0[nA]		I_0[nA]		I_0[nA]		I_0[nA]
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										
11										
12										
13										
14										
15										
16										
17										
18										
19										
20										
STATUS										

Ende der Messung	
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Station sheet:
for mounting
check and
Status report

x: APD Nummer

y: U_Br (T=25C)



APD Nummer 1 - 100

U_Br 370.6 - 388.5

ΔU_{Br} 0.0003365 - 0.1097

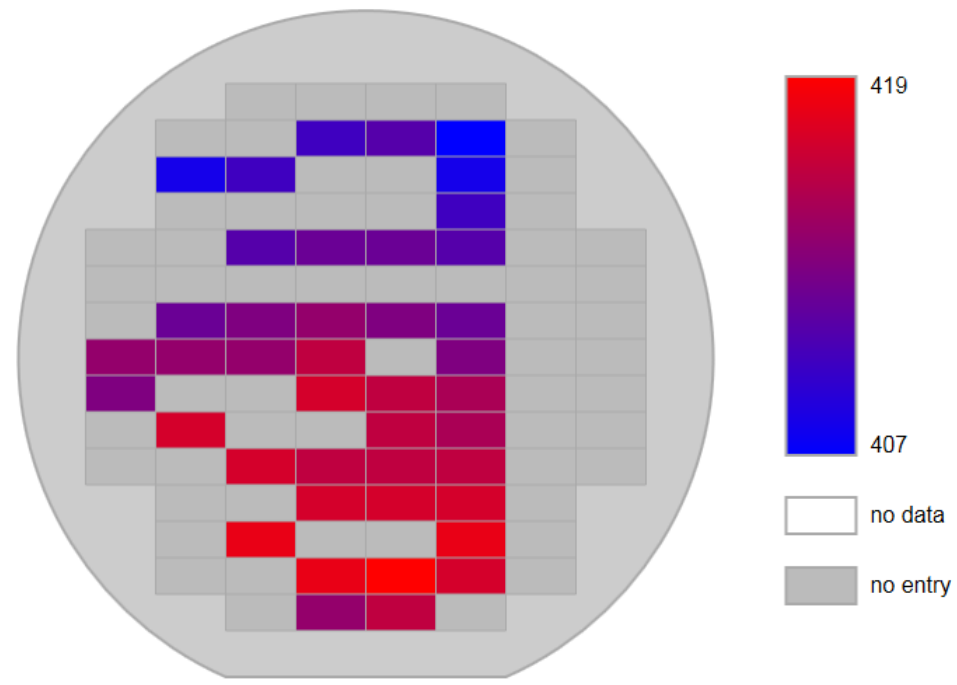
n 0.09965 - 0.1568

Δn 0.00000677 - 0.000600

Wafer overview homepage

panda.data adc. wafer

LOT: 7 WAFER: 4 ham 20°C @ M=100 U_Br



3.2 Electrical and optical characteristics ($T_a=20^\circ\text{C}$)

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Spectral response range	λ		--	320 to 1000	--	nm
Peak sensitivity wavelength	λ_p	M=100	--	580	--	nm
Quantum efficiency	QE	$\lambda=420\text{nm}, M=1$	65	70	90	%
Breakdown voltage	VBR	$I_D=100\mu\text{A}$	--	420	500	V
Operating voltage	V _R	M=100, $\lambda=420\text{nm}$	365	400	445	V
Dark current	I _D	M=100	--	30	40	nA
Gain sensitivity to voltage	$dM/dV \cdot 1/M$	M=100	4.1	4.4	4.7	%
Cutoff frequency	f _c	M=50, R _L =50Ω	--	11	--	MHz
Terminal capacitance	C _t	M=50, f=100kHz	230	250	270	pF
Excess noise factor	F	M=100, $\lambda=420\text{nm}$	--	2.5	3.1	--
Gain	M	$\lambda=420\text{nm}$	--	100	--	--
Voltage gap VBR – V _R	VBR - V _R	M=100	24	--	--	V

At the moment: 350 APDs are delivered per week

Since November 2014: personel increased by a factor of 4

- > shift operation started
- > no shifts on Sundays up to now
- > maximum shift limit per day: 16 h

- > Analysis optimized for simultaneous check of 1 complete APD grid

- max. amount of APDs measured during one operation week:
 - 82 grids (1640 APDs @ $T = 20 \text{ deg C}$)
 - Including 9 grids at 5 temperatures using two climate cabinets (180 APDs)

Foreseen:

- Analysis will start automatically after the two raw data files have been saved
- Increase of personel by a further factor of 2, beginning of January 2015
- > until then: operation day and night possible