Biweekly GBP meeting

Radiation damage analysis

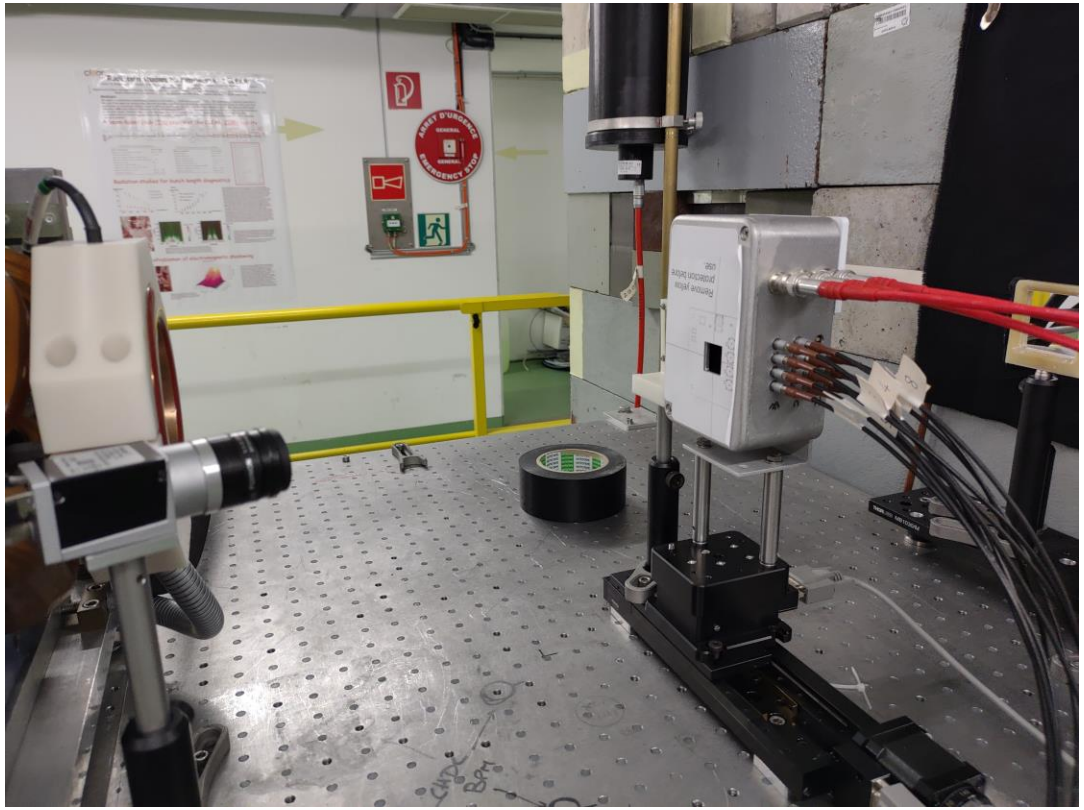
Test beam CLEAR 6-12 Sept.

Università degli Studi di Padova

Recap of CLEAR test

Detectors + equipment

- A stack of three 4-strip sapphire sensors of three different companies
- Digitizers 8-bit 1GS/s 1MHz connected directly with 30m cables
- Power supply CAEN N1471H



Nb. channels	4	4	3 (1 not working)
Thickness	110um	150um	150um
Manufacturer	Wuppertal	University	M-type
Beam intercept	first	second	third
Digitizer channel associations (s	5 (1) 11 (2) 12 (3) 6 (4)	7 (1) 3 (2) 4 (3) 8 (4)	9 (1) 1 (2) 2 (3) 10 (4) - not working

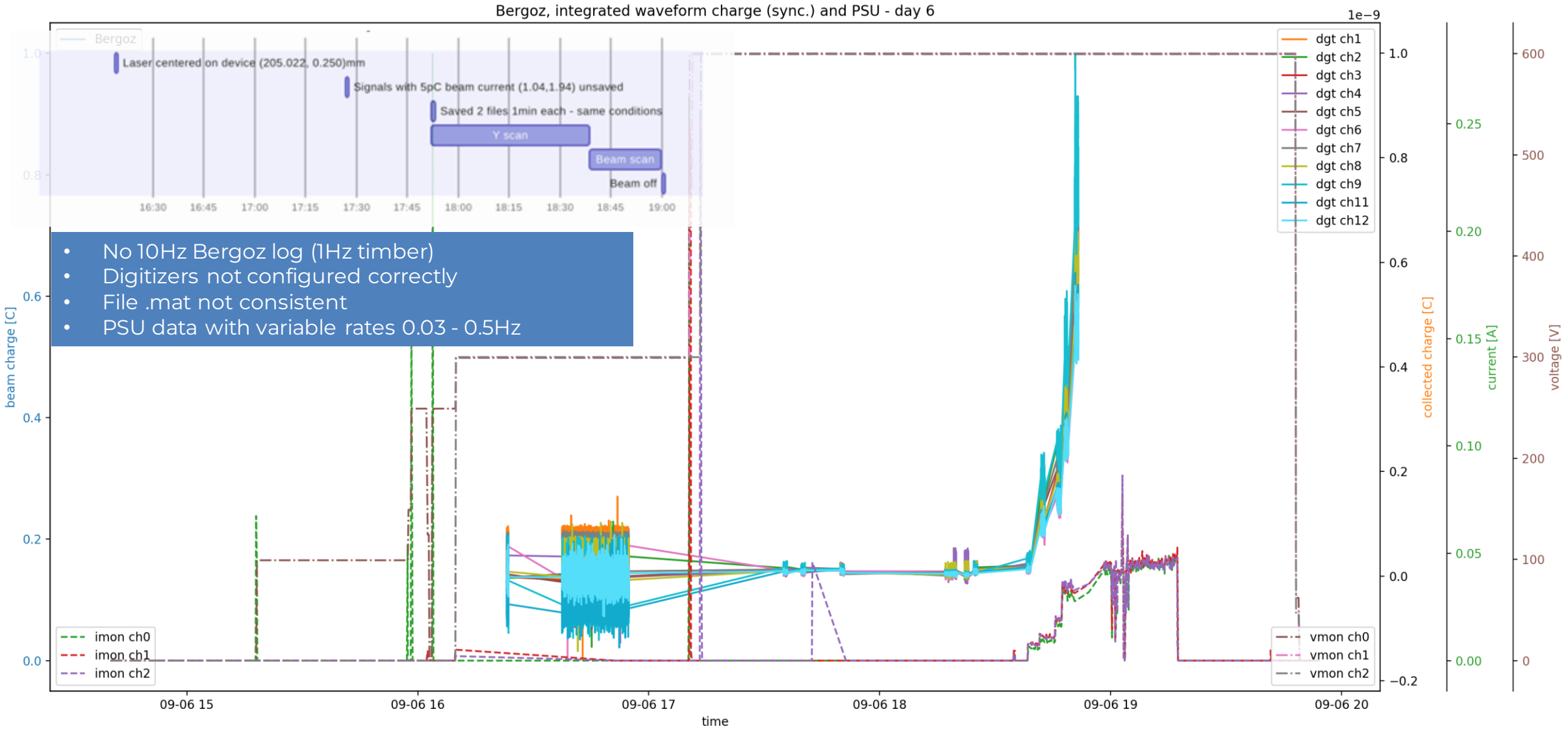
Recap of CLEAR test

Measure types

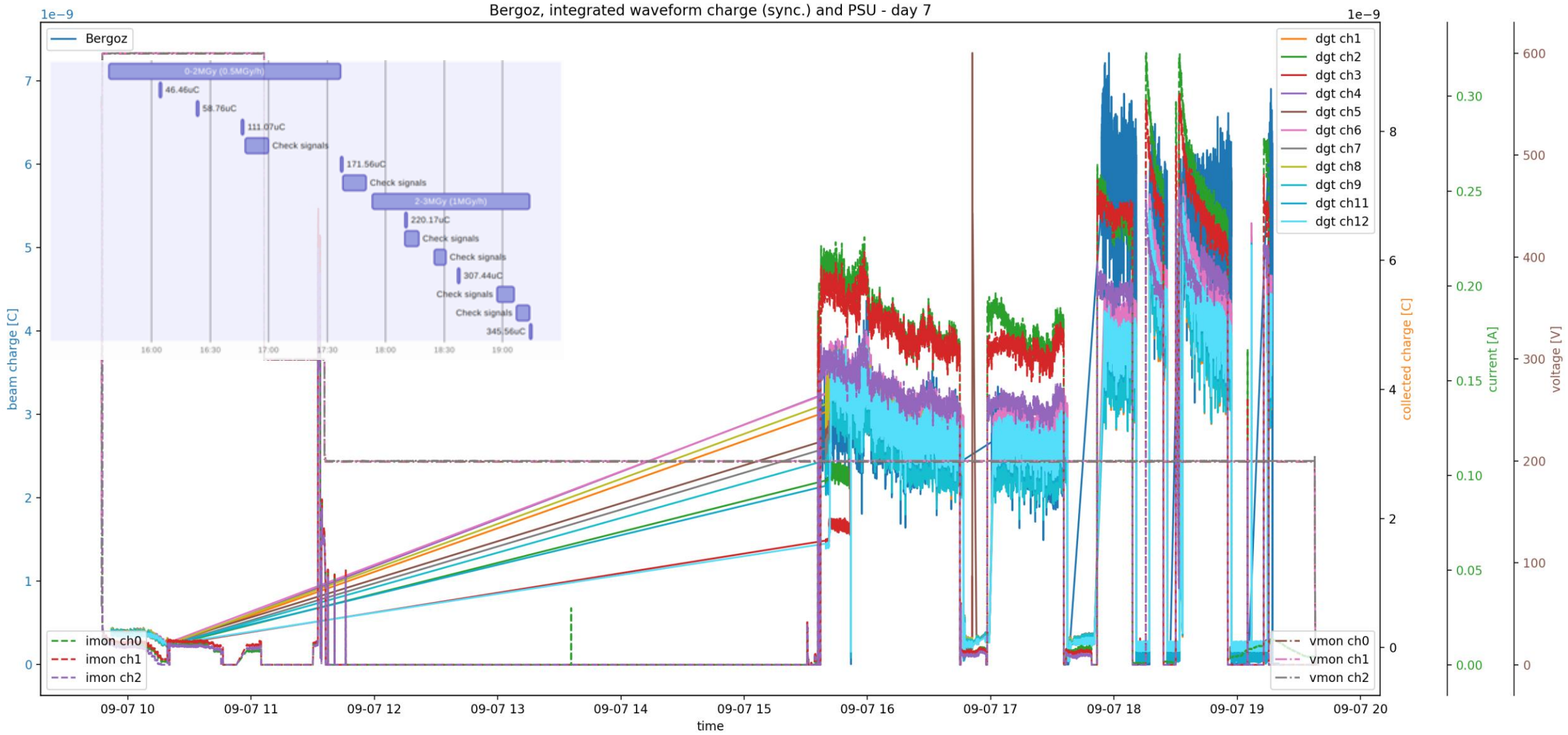
- Bare signals as a function of the beam charge
- Scan in the vertical position (to find beam center)
- Scan in the horizontal position (along strip) for strip response uniformity
- Irradiation of the sample up to 15MGy
- Scan in HV to measure CCE in both irradiated/non-irr. area
- Scan in beam charge to investigate detector response in both irradiated/non-irr. areas
- Detector response as function of the beam chg. During irradiation
- CCE in 1 bunch/train operations irradiated/non-irradiated areas

Day by day overview

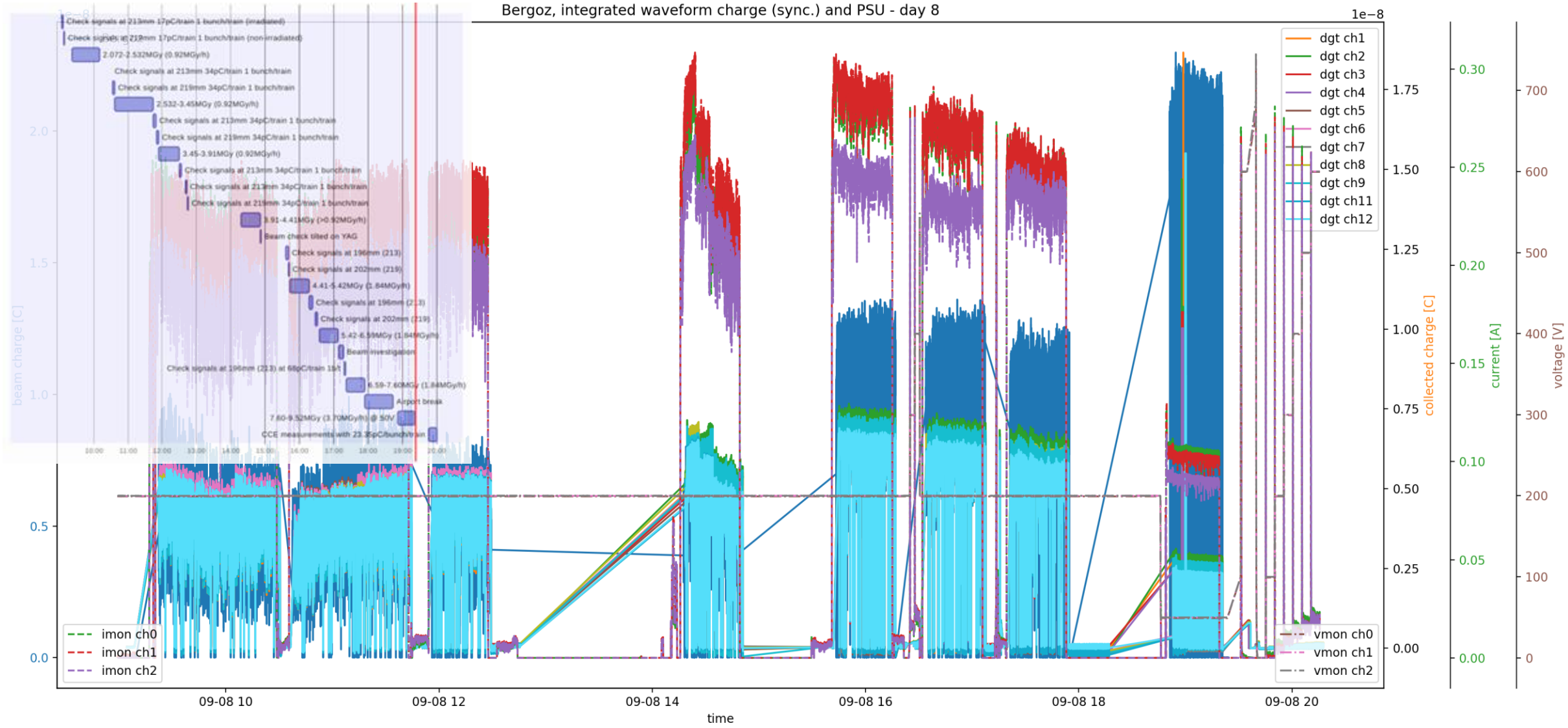
6th Sept.


Bergoz, integrated waveform charge (sync.) and PSU - day 6
Bergoz
Laser centered on device (205.022, 0.250)mm
Signals with 5pC beam current (1.04,1.94) unsaved
Saved 2 files 1min each - same conditions
Y scan
Beam scan
Beam off
16:30
16:45
17:00
17:15
17:30
17:45
18:00
18:15
18:30
18:45
19:00
• No 10Hz Bergoz log (1Hz timber)
• Digitizers not configured correctly
• File .mat not consistent
• PSU data with variable rates 0.03 - 0.5Hz
beam charge [C]
collected charge [C]
current [A]
voltage [V]
1e−9
dgt ch1
dgt ch2
dgt ch3
dgt ch4
dgt ch5
dgt ch6
dgt ch7
dgt ch8
dgt ch9
dgt ch11
dgt ch12
imon ch0
imon ch1
imon ch2
vmon ch0
vmon ch1
vmon ch2
09-06 15
09-06 16
09-06 17
09-06 18
09-06 19
09-06 20
time

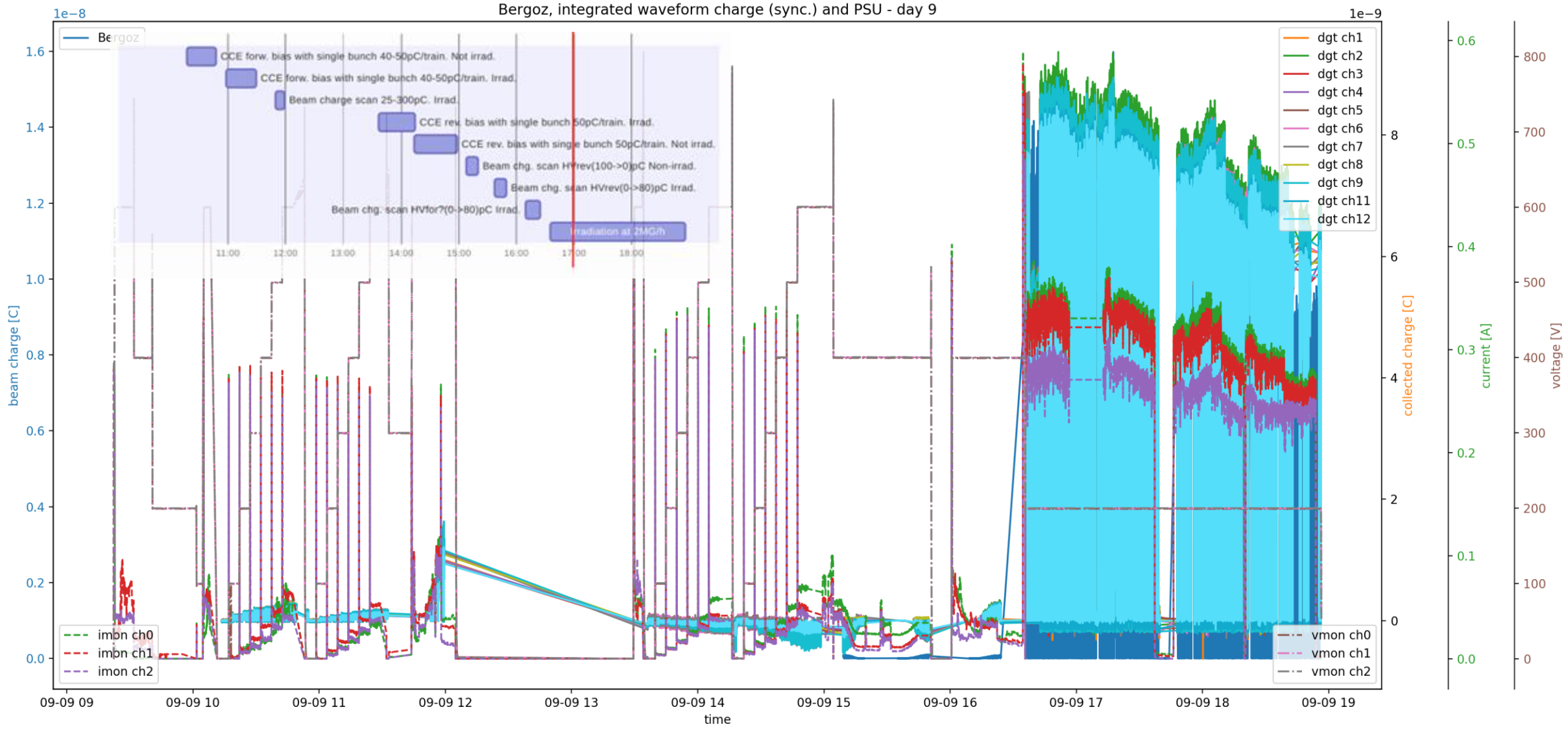
7th Sept.


Bergoz, integrated waveform charge (sync.) and PSU - day 7
1e−9
1e−9
Bergoz
0-2MGy (0.5MGy/h)
46.46uC
58.76uC
111.07uC
Check signals
171.56uC
Check signals
2-3MGy (1MGy/h)
220.17uC
Check signals
Check signals
307.44uC
Check signals
Check signals
345.56uC
16:00
16:30
17:00
17:30
18:00
18:30
19:00
dgt ch1
dgt ch2
dgt ch3
dgt ch4
dgt ch5
dgt ch6
dgt ch7
dgt ch8
dgt ch9
dgt ch11
dgt ch12
imon ch0
imon ch1
imon ch2
vmon ch0
vmon ch1
vmon ch2
beam charge [C]
collected charge [C]
current [A]
voltage [V]
09-07 10
09-07 11
09-07 12
09-07 13
09-07 14
09-07 15
09-07 16
09-07 17
09-07 18
09-07 19
09-07 20
time

8th Sept.


Bergoz, integrated waveform charge (sync.) and PSU - day 8
1e−8
beam charge [C]
collected charge [C]
current [A]
voltage [V]
time
09-08 10
09-08 12
09-08 14
09-08 16
09-08 18
09-08 20
dgt ch1
dgt ch2
dgt ch3
dgt ch4
dgt ch5
dgt ch6
dgt ch7
dgt ch8
dgt ch9
dgt ch11
dgt ch12
imon ch0
imon ch1
imon ch2
vmon ch0
vmon ch1
vmon ch2

9th Sept.



x=09-09 14 y=181.6

Table of beam spec.s measurements

Table of beam measurements

Attachment legend
1: picture of the bea on scintillator screen
2: picture of beam (bunch attenuation, bunch number) and transport (magnets, etc.) parameters
(1) or 3: picture of the beam on detector

Day 6

Time	Beam sigma (mm)	Train charge (nC)	Bunch/train	Attenuation	Attachments
14:17:59	?	0.005	10	100	2
14:46:11	?	1.403	10	100	1, 2
15:07:22	?	0.008	10	100	2
15:20:47	1.035x1.939	1.8	5	100	1, 2, 3
19:00:37	?	0.108	?	?	(1)
19:06:30	?	0.108	?	?	(1)
19:38:40	??	0.108	80	?	1

Table of beam measurements

Day 7

Time	Beam sigma (mm)	Train charge (nC)	Bunch/train	Attenuation	Attachments
09:17:37	1.02x2.02	0.086	1	5	1, 2
09:18:37	1.05x1.92	0.086	60?	5	1
09:38:26	?	0.025	20	5	(1), 2
09:46:53	?	0.0274	20	5	2
11:12:05	0.97x1.88	0.028	20	5	1
11:22:55	1.01x1.99	0.056	40	5	1, 2
12:04:59	1.01x2.03	0.34	40	12	1, 2
15:22:38	1.02x3.00	2.6	160	22	1, 2, 3
15:45:09	?	3.0	160	22	(1), 2
17:02:36	?	2.8	160	21	2
17:54:01	?	6.1	160	35	2, 3
18:21:25	?	5.4	160	32	2
18:32:16	?	5.26	160	32	2, 3
19:33:23	off	off	off	off	(1)

Table of beam measurements

Day 8

Time	Beam sigma (mm)	Train charge (nC)	Bunch/train	Attenuation	Attachments
08:26:18	1.08x2.18	0.386	13	33	1, 2
08:27:39	1.25x2.52	4.0	160	33	1, 2
09:05:47	?	0.016	1	9	1
09:24:01	(1.0x3.0)	5.4	160	60	(1), 2
14:04:27	1.1x2.2	0.300	1	55	1, 2
14:15:46	?	0.4	10	55	(1), 2
14:20:30	?	6.0	160	55	(1), 2
14:56:13	1.38x3.26	4.2	160	40	1
14:59:00	1.20x2.8	4.22	160	40	1, 2
15:30:36	?	0.04	1	50	(1), 2
15:34:40	?	0.04	1	45	(1), 2
15:45:56	?	11.4	160	100	(1), 2
16:34:55	?	11.4	160	100	(1), 2
17:11:09	1.21x2.7	11.74	(160)	100	1
17:23:40	?	10.0	160	60	(1), 2
18:44:30	1.38x2.32	19.0	200	100	1, 2, 3
18:46:47	1.39x2.30	19.0	200	100	1
18:47:13	1.39x2.30	19.0	200	100	1
18:53:35	?	19.48	200	100	(1), 2

Table of beam measurements

Day 9

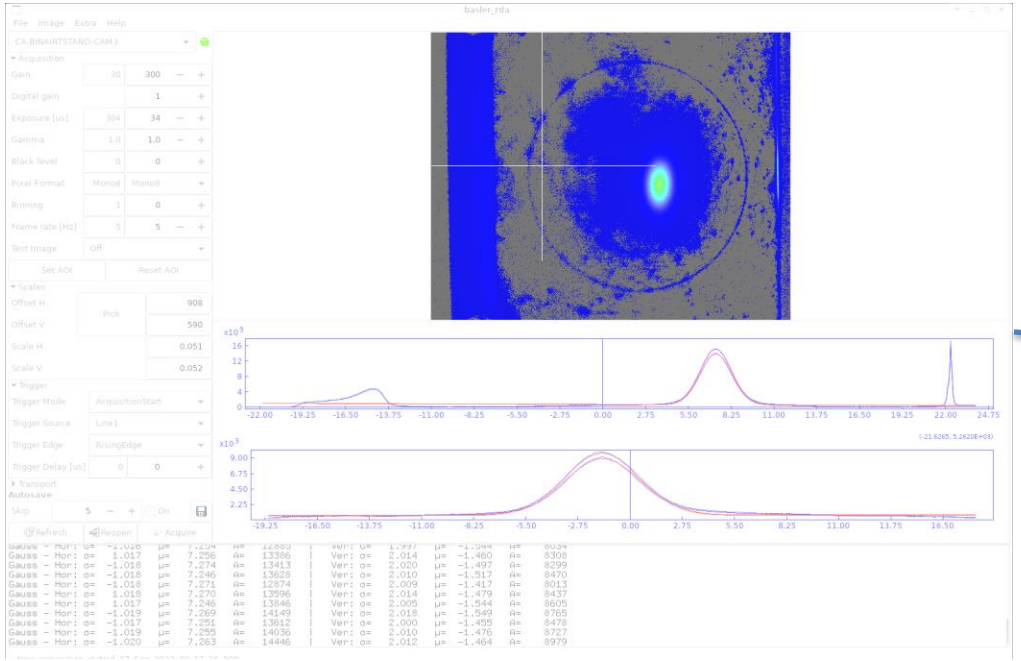
Time	Beam sigma (mm)	Train charge (nC)	Bunch/train	Attenuation	Attachments
09:11:20	1.61x2.96	7.6	160	100	1, 2
09:59:03	?	0.30	6	100	(1), 2
12:05:30	?	7.4	?	?	1
16:33:23	?	10	160	50	1, 2
16:40:14	?	11.	160	53	(1), 2
17:55:48	?	10.0	?	?	(1)

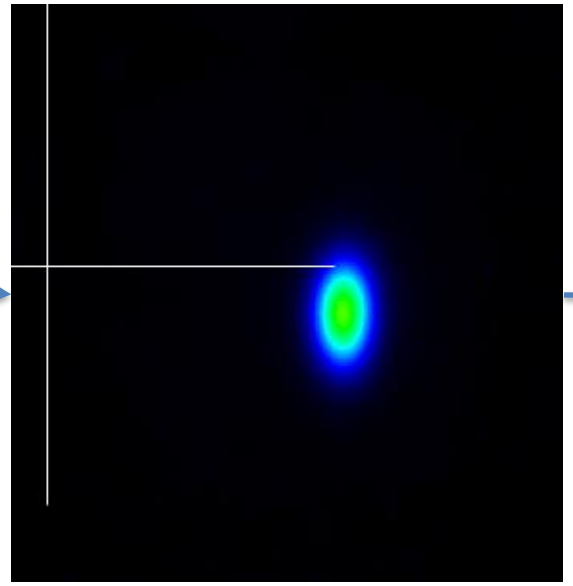
Day 12

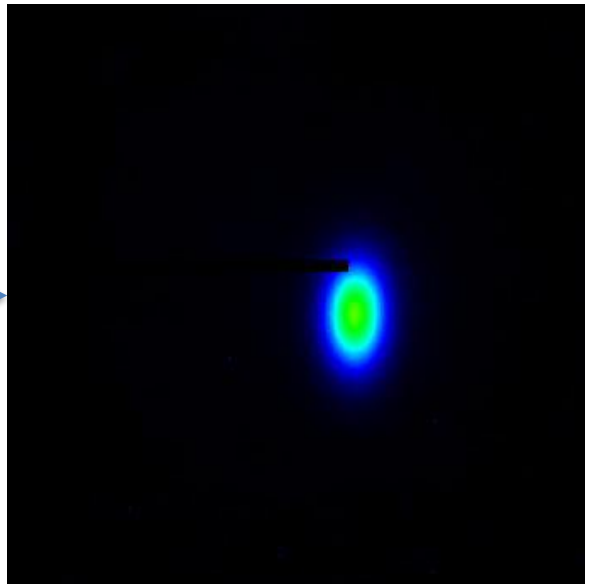
Time	Beam sigma (mm)	Train charge (nC)	Bunch/train	Attenuation	Attachments
14:15:03	—	0.200	1	100	1, 2
14:54:51	1.19x3.09	26.16	125	100	1, 2, 4
15:10:01	?	0.016	1	4	(1), 2
15:56:04	?	0.019	1	4	(1), 2
16:50:10	1.19x3.12	28.0	134	100	1, 2, (1), 4
18:42:42	?	0.02	1	3	2
20:17:18	?	58.3	200	100	1, 2, 4

Beam profile reconstruction with scintillator

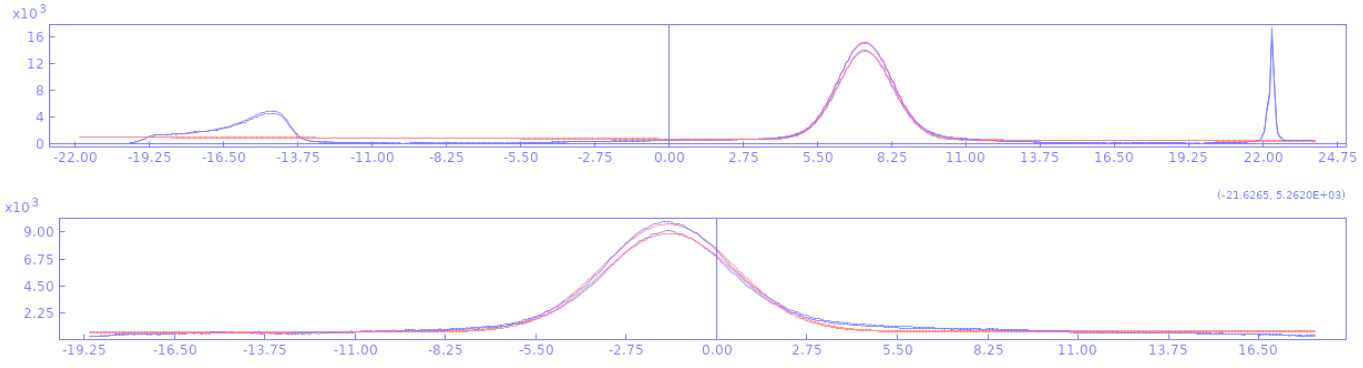
Profile reconstruction check YAG







First, we have to be sure that the beam parameters as reconstructed from the camera are reliable. The figure shows a picture where the external ring of the scintillator screen (diameter 30mm) is visible.
Using the AOI one can check the beam reconstruction



Profile reconstruction check YAG

Colour image is converted to grayscale by taking RBG and mapping to pixel intensity by

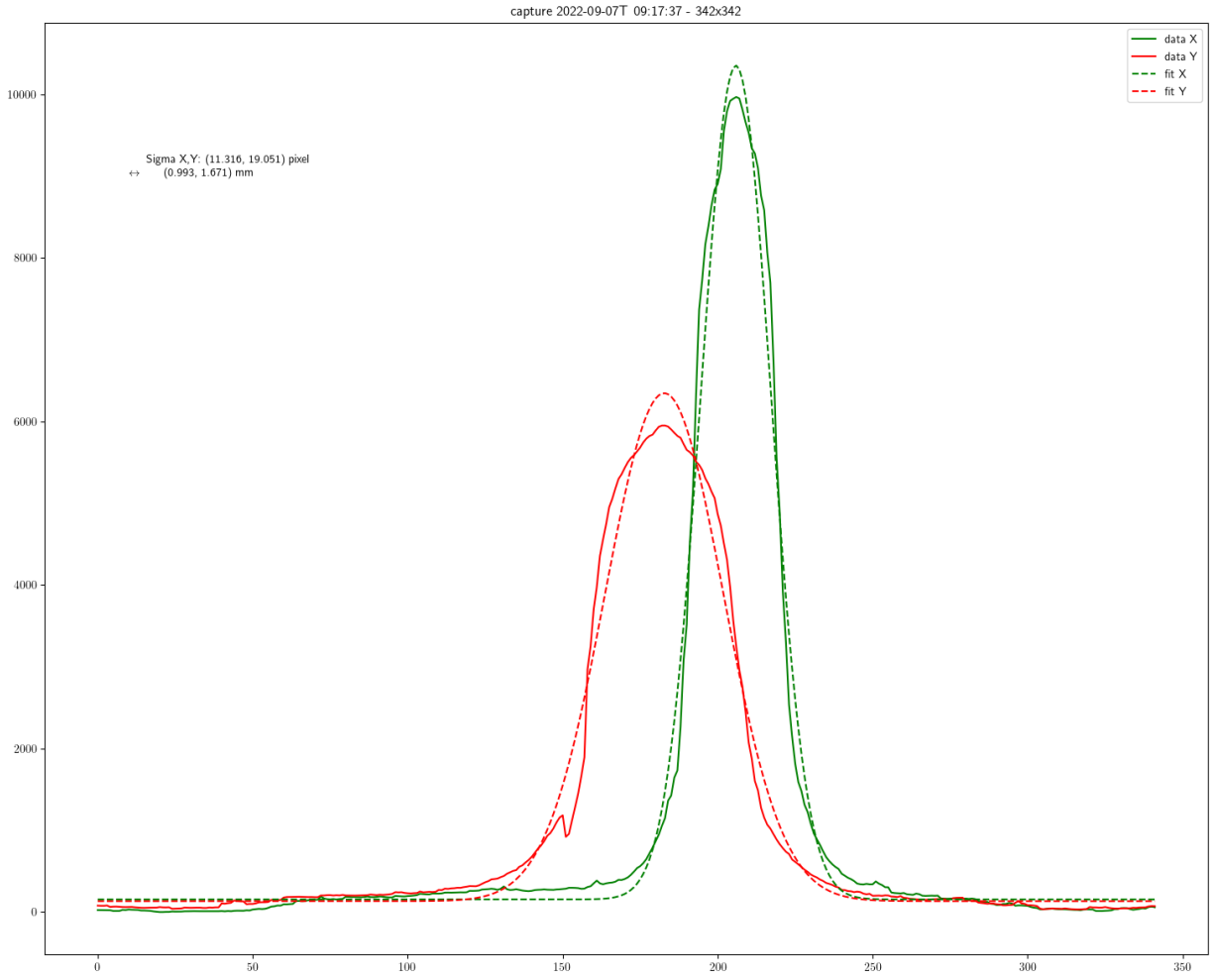
intensity = red*0.2989 + green*0.5870 + blue*0.1140

First, we must be sure that the beam parameters as reconstructed from the camera are reliable. The figure shows a picture where the external ring of the scintillator screen (diameter 30mm) is visible. Using the AOI one can check the beam reconstruction

Reconstructed sigma
Sigma X,Y: (0.993, 1.671) mm

Nominal sigma
Sigma X,Y: (1.019, 2.010) mm

SigmaY/X is 1.683 in the reconstructed case and 1.972 in the nominal case

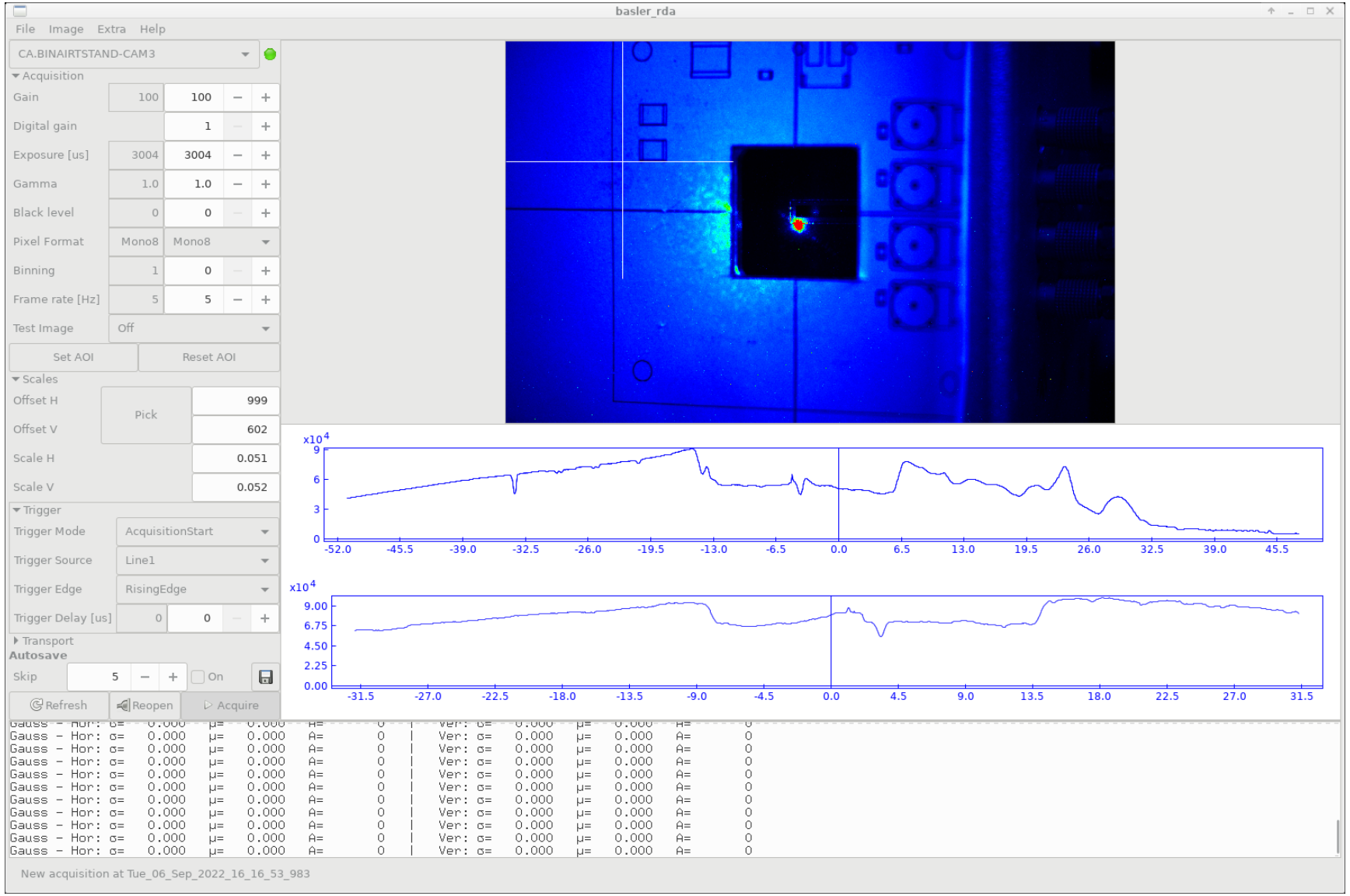


6 Sept.
Vertical scan Y

Measure conditions

Title: Vertical scan along Y-axis
Description: Scan in the vertical position. Hor. pos fixed at 205.022mm
Date: 6Sept. from 173938 to 182304
HV: (600, 600, 600) V
Beam sigma: (1.04, 1.94) mm
Beam charge: 5pC/bunch 1bunch/train 10Hz
Dgt time scale: 20 ns/div
Data
Point 1/4: (205.022, 0.250) mm from 174946 to 175046
Point 2/4: (205.022, 0.450) mm from 181659 to 182002
Point 3/4: (205.022, 0.650) mm from 182204 to 182304
Point 4/4: (205.022, 0.050) mm from 182424 to 182524

Vertical Y-scan - 6Sept.

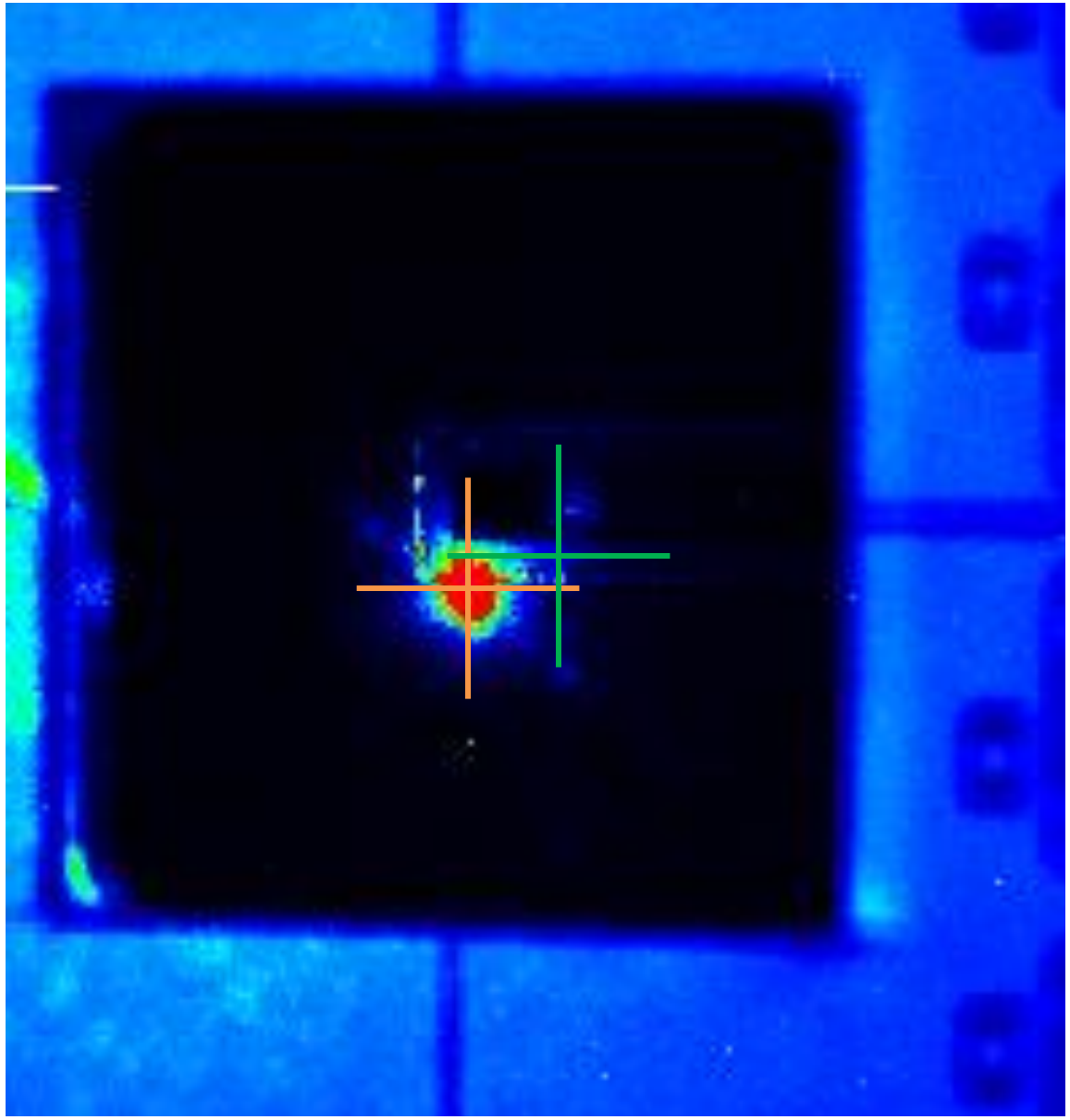


Stage position here:
(203.023, 1.000)

Then stage is moved such that:
'laser is centered on device'
but no picture is saved.
Stage pos. is
(205.022, 0.250)

Displacement of
2mm right
0.75mm up

Vertical Y-scan - 6Sept.



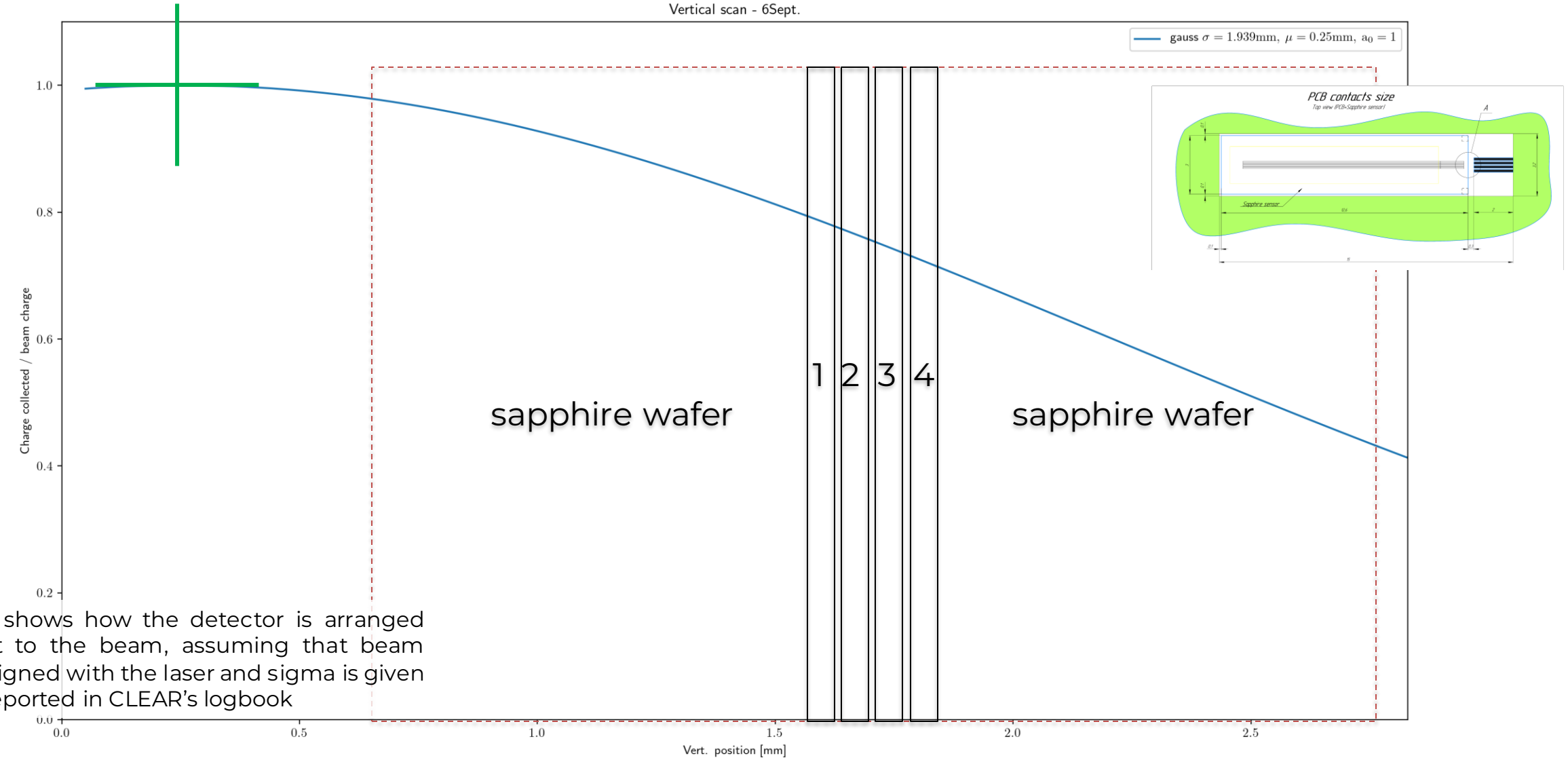
On the basis of the image and motor displacement logs, the position of the laser beam when ‘centered on device’ is the green cross.

Stage pos. is
(205.022, 0.250)

If the beam center is aligned with the laser position, then the centroid is 9px = 1.14mm away from the sensor vertical center.

Vertical beam sigma measured that at 15:20:47 is 1.939mm

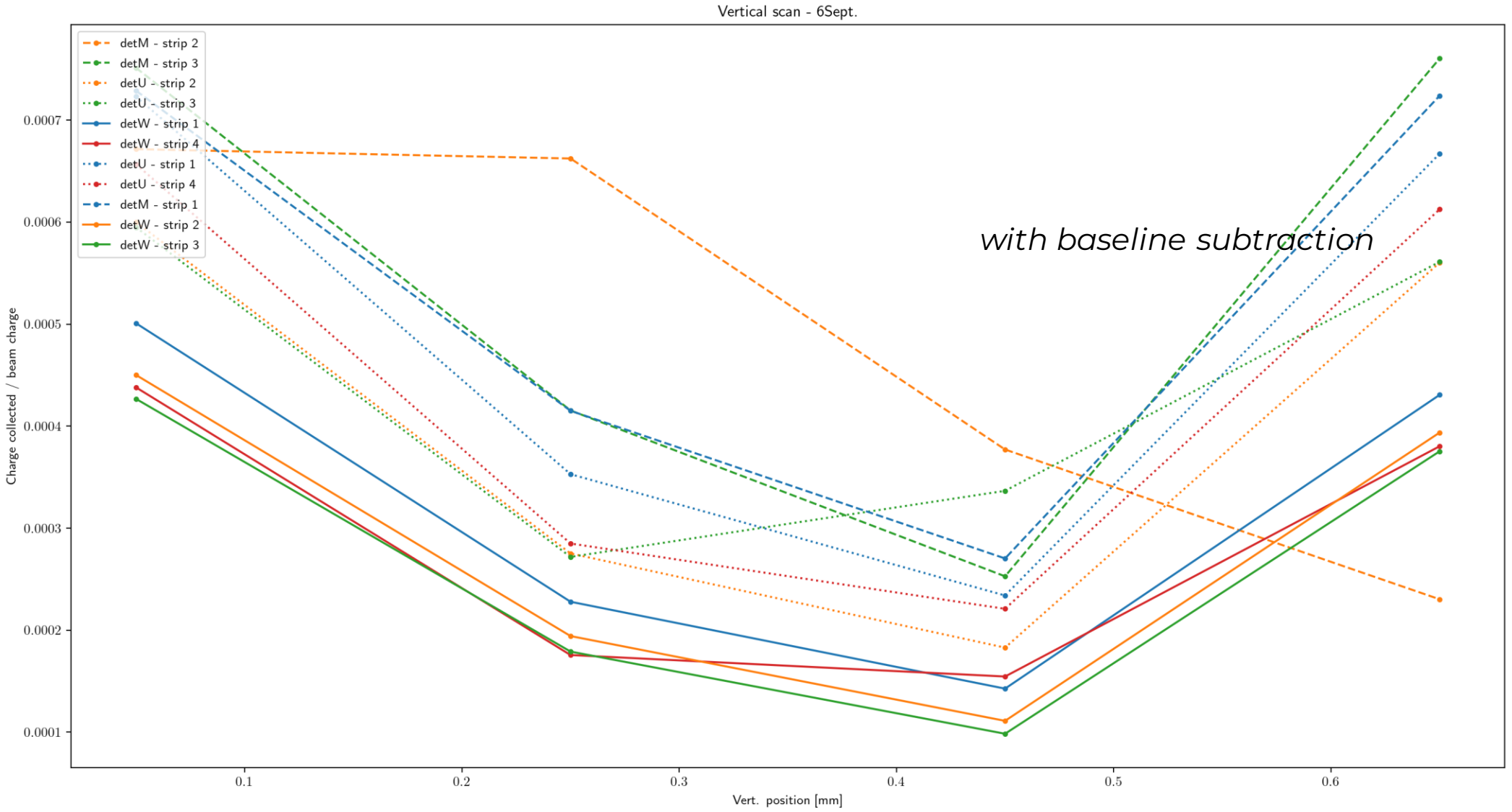
Vertical Y-scan - 6Sept.



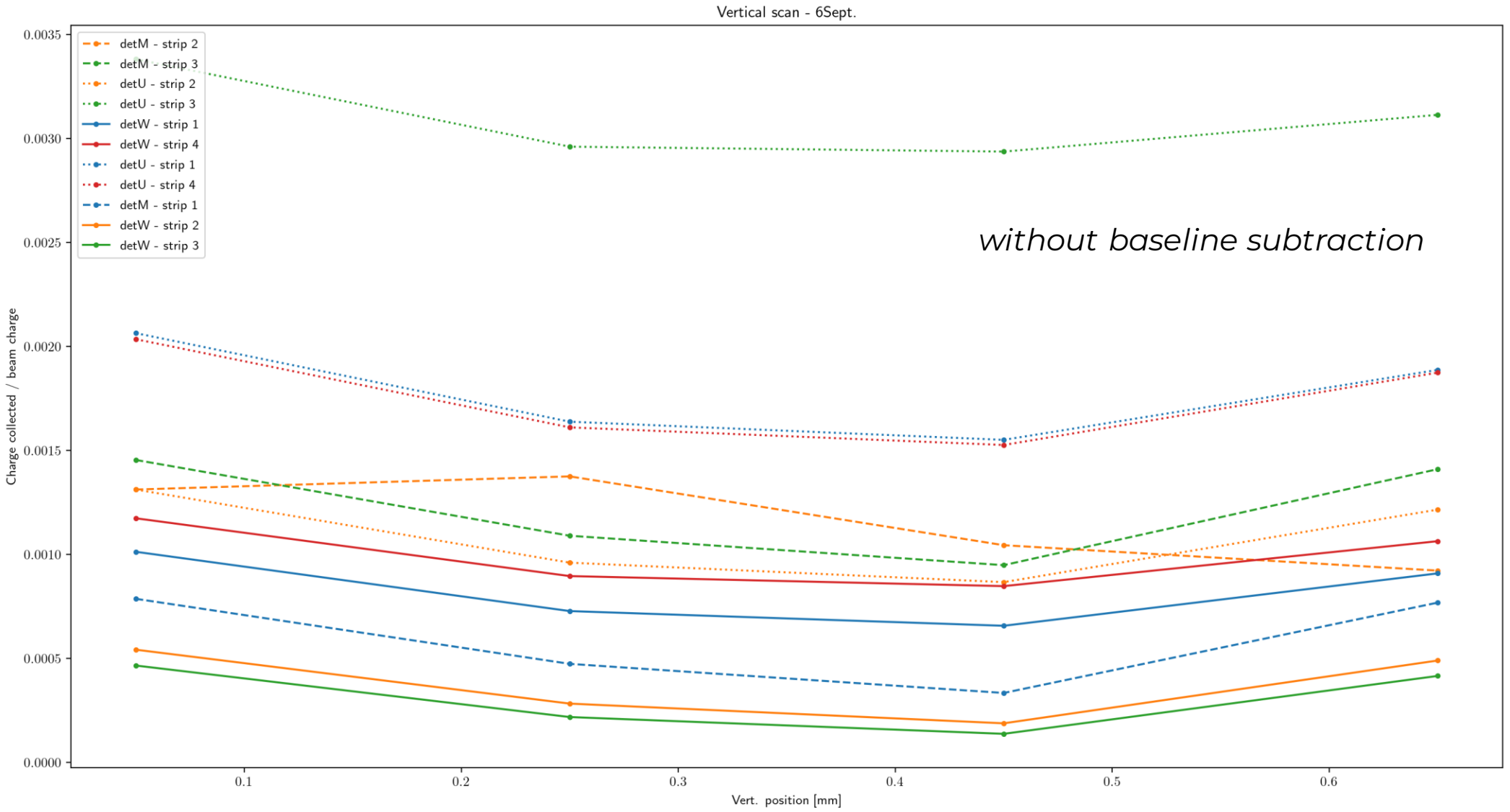
This picture shows how the detector is arranged with respect to the beam, assuming that beam centroid is aligned with the laser and sigma is given by the one reported in CLEAR's logbook

x=1.41932 y=0.303111

Vertical Y-scan - 6Sept.

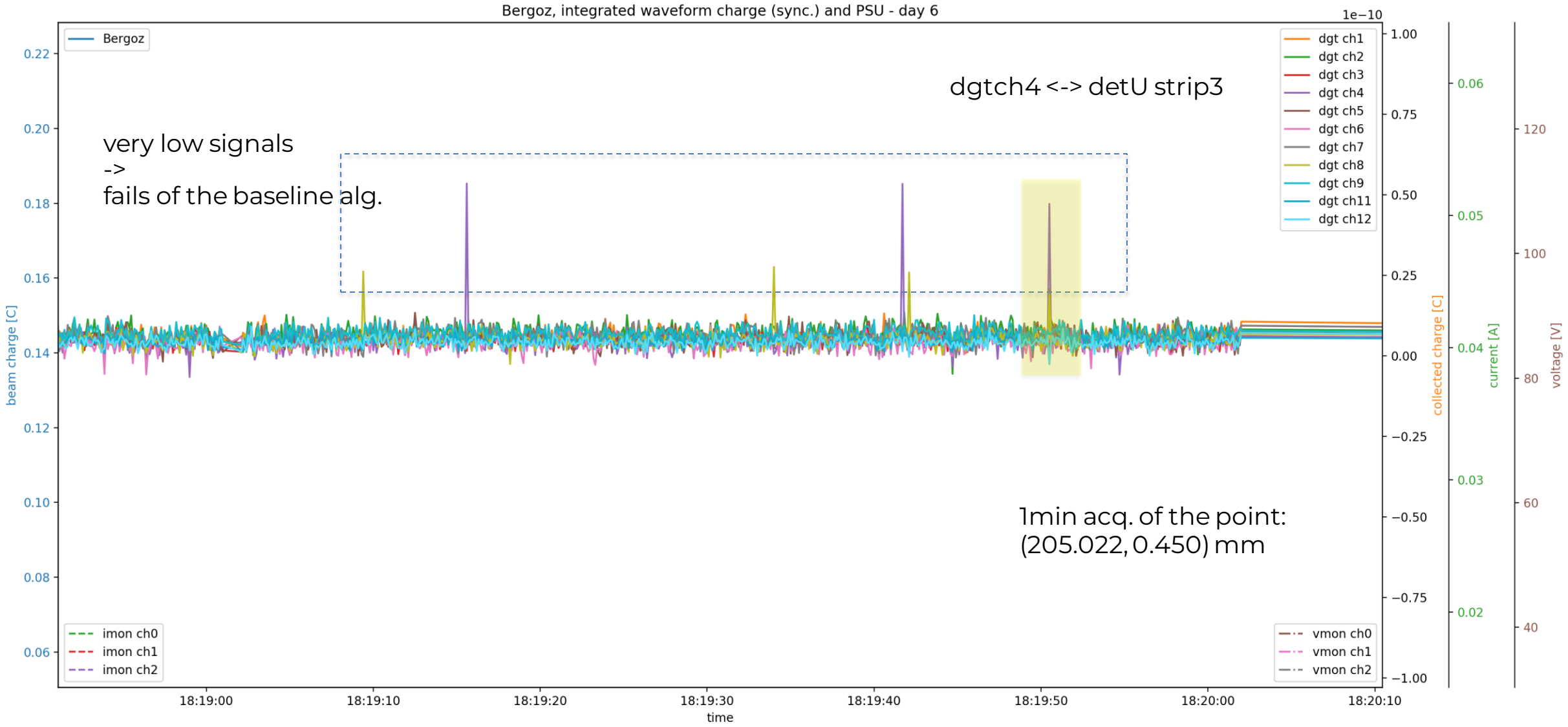


Vertical Y-scan - 6Sept.



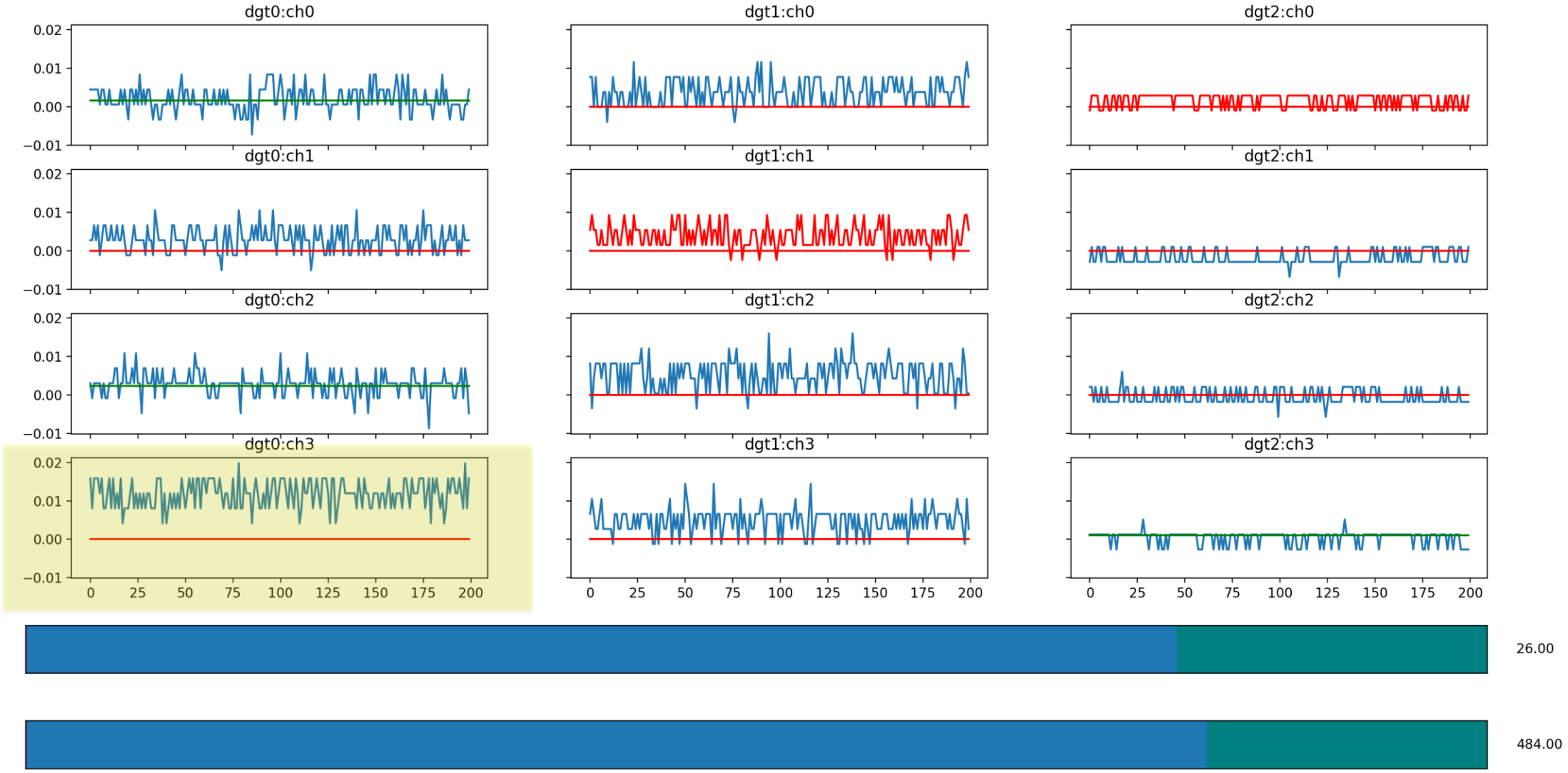
x=0.677492 y=0.00326947

Vertical Y-scan - 6Sept.



pan/zoom, x=18:19:31 y=76.5156

Vertical Y-scan - 6Sept.



7 Sept.
Horizontal scan X

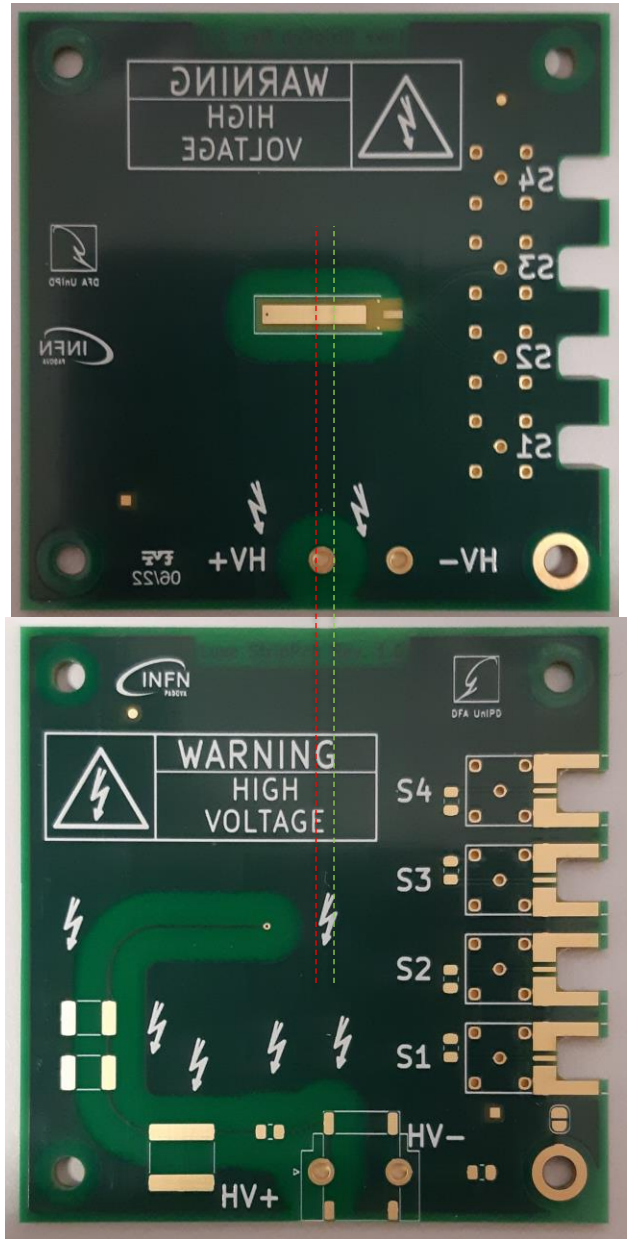
Measure conditions

Title: Horizontal scan along X-axis
Description: Scan in the horizontal position. Position 216mm should be the center
Date: 7Sept. from 095203 to 101950.9
HV: (600, 600, 600) V
Beam sigma: (1.05, 1.92) mm
Beam charge: (1.25)pC/bunch 20bunch/train 25pC/train 10Hz
Linear stage: X ranging from 209.0mm to 225.0mm with fixed Y=1.5mm
Dgt time scale: 20 ns/div
Notes: There is no Bergoz 10Hz charge information available for such a measurement.

Data

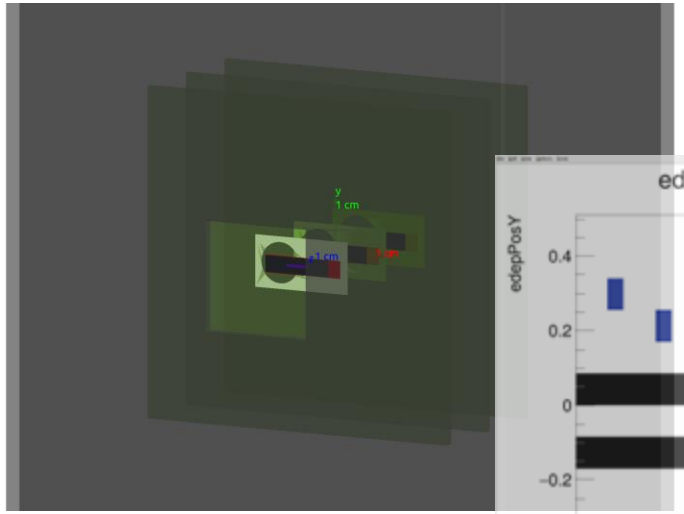
Point 1/17: (209.000, 1.500) mm from 95203 to 95303
Point 2/17: (210.000, 1.500) mm from 95425 to 95525
Point 3/17: (211.000, 1.500) mm from 95617 to 95717
Point 4/17: (212.000, 1.500) mm from 95747 to 95847
Point 5/17: (213.000, 1.500) mm from 95926 to 100026
Point 6/17: (214.000, 1.500) mm from 100059 to 100159
Point 7/17: (215.000, 1.500) mm from 100254 to 100354
Point 8/17: (216.000, 1.500) mm from 100429 to 100529
Point 9/17: (217.000, 1.500) mm from 100555 to 100655
Point 10/17: (218.000, 1.500) mm from 100725 to 100825
Point 11/17: (219.000, 1.500) mm from 100937 to 101037
Point 12/17: (220.000, 1.500) mm from 101047 to 101147
Point 13/17: (221.000, 1.500) mm from 101156 to 101256
Point 14/17: (222.000, 1.500) mm from 101325 to 101425
Point 15/17: (223.000, 1.500) mm from 101505 to 101605
Point 16/17: (224.000, 1.500) mm from 101630 to 101730
Point 17/17: (225.000, 1.500) mm from 101851 to 101951

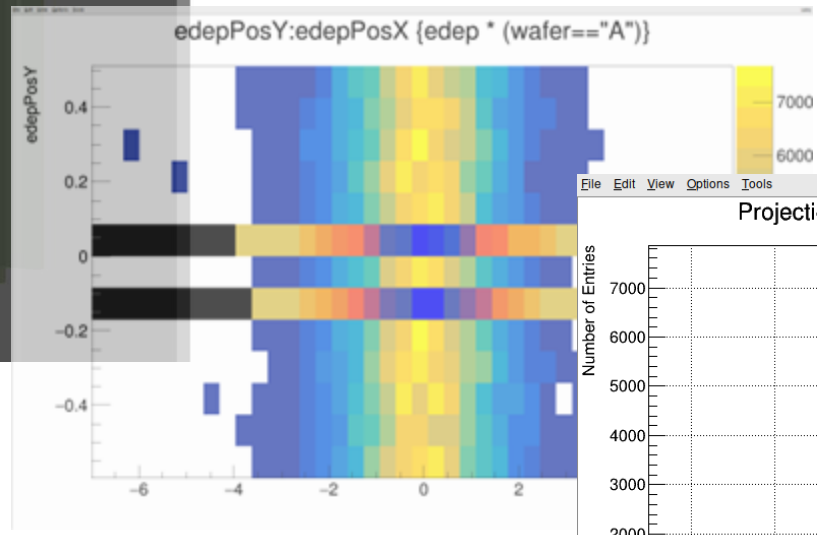
Possible source of left/right asymmetry

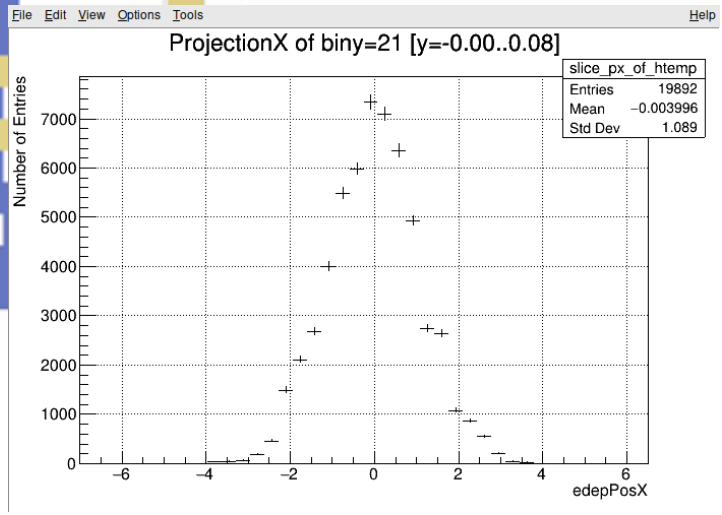


There is a difference in the amount of material crossed by the incident beam if the beam centroid is moved left or right with respect to the sensor's geometric center.

If table is moved to the left (decreasing X) the beam won't cross backside PCB ground plane (35um copper)

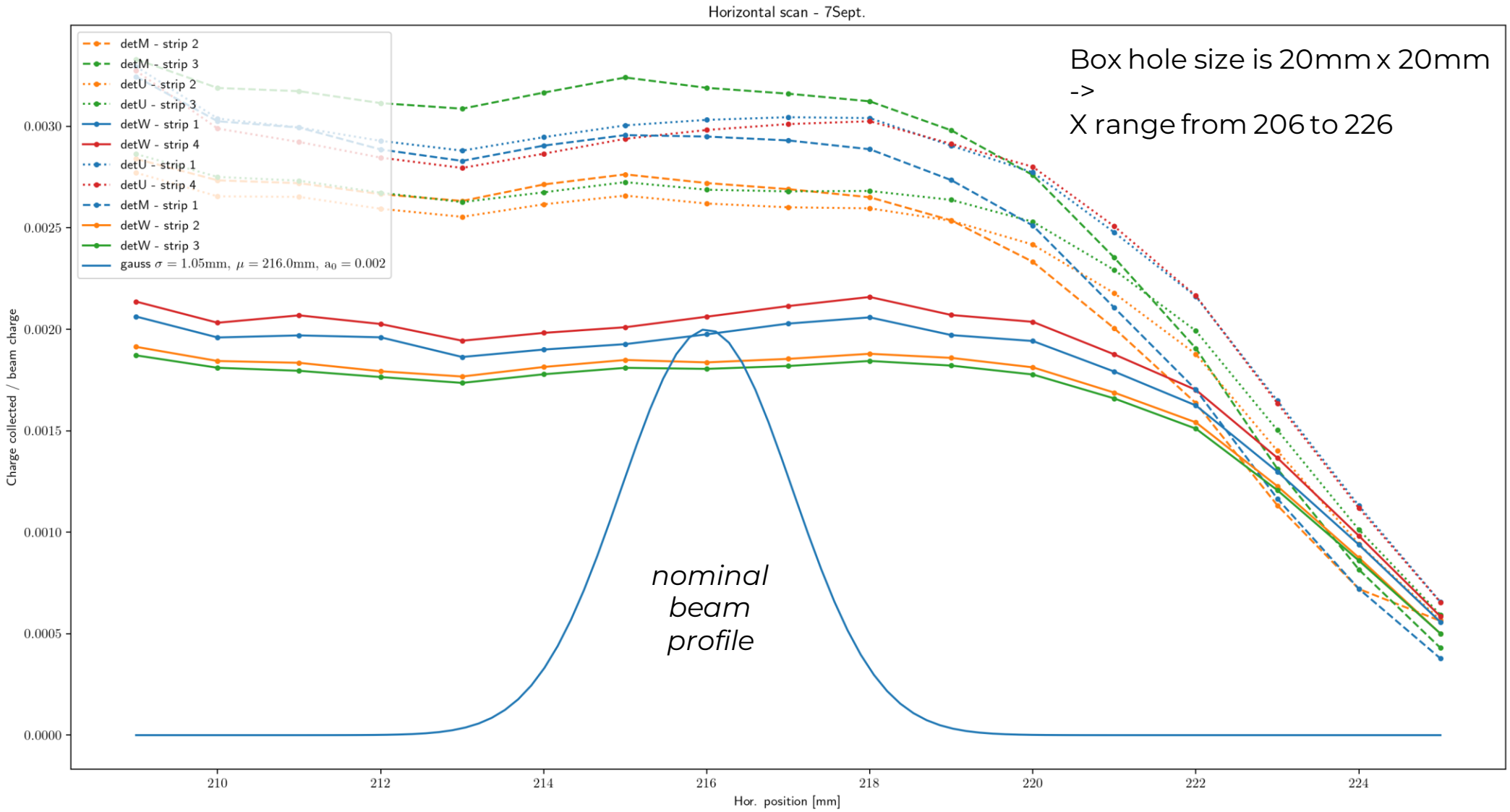






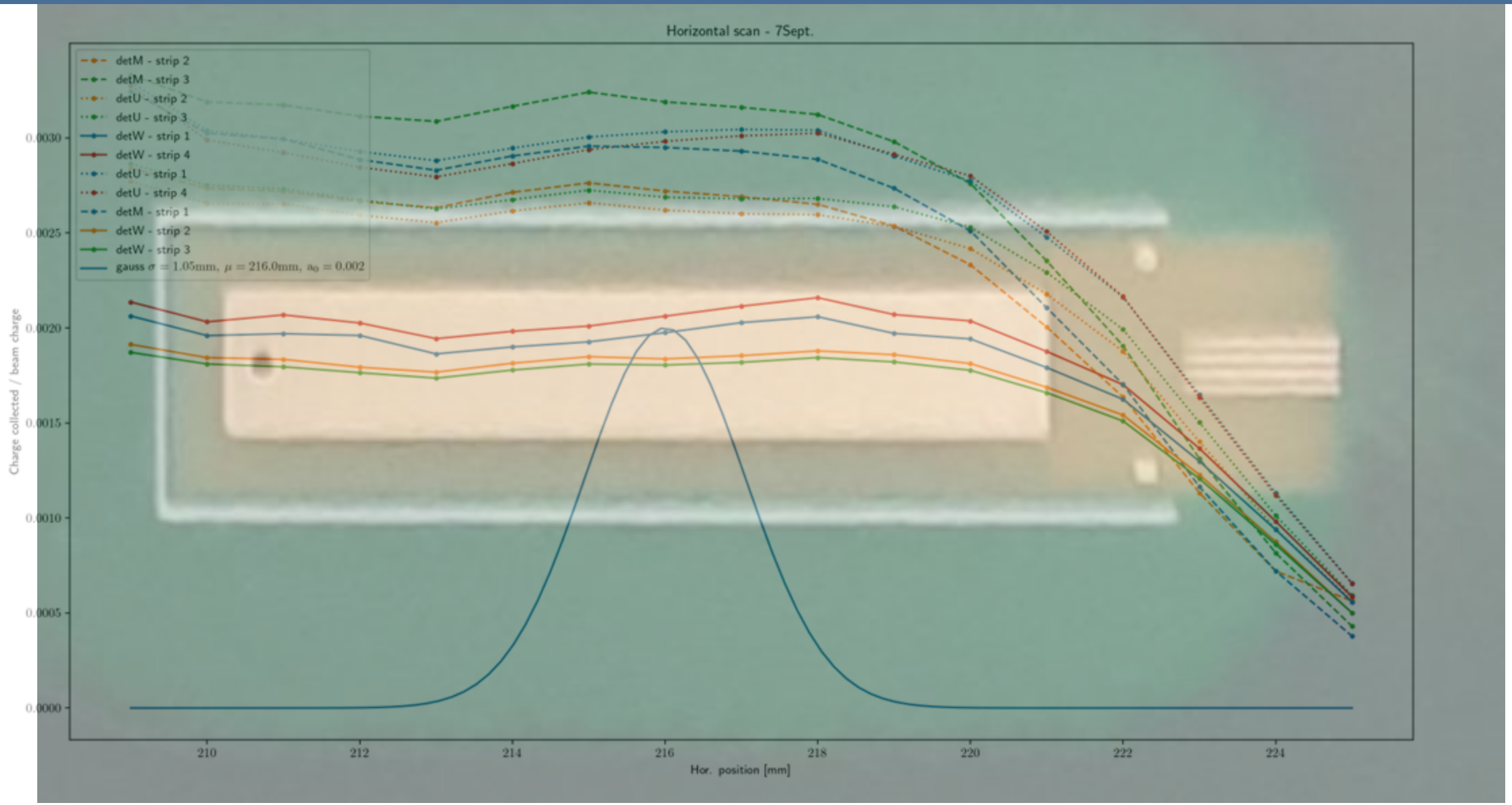
Backside GND copper layer has no effects in strip edep.s

Horizontal X-scan - 7Sept. (actual beam spec.s)



x=220.424 y=0.00186222

Horizontal X-scan - 7Sept. (sensor overlay)

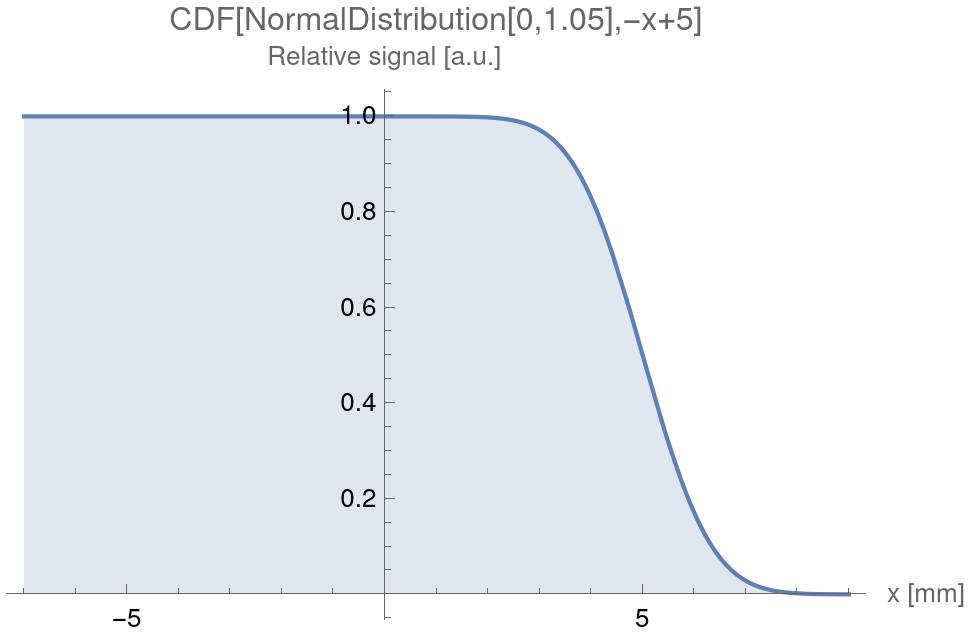


x=220.424 y=0.00186222

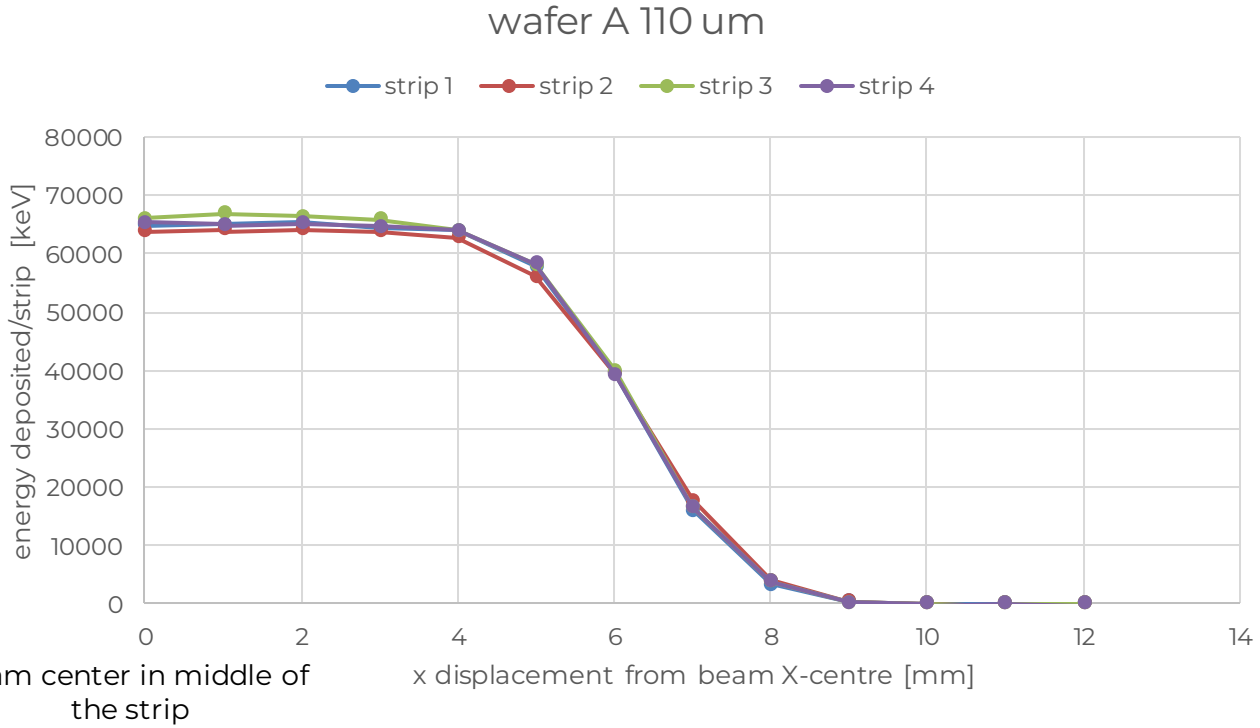
Horizontal X-scan - 7Sept. - theory

Data according to the expected behaviour is

Cumulative distribution function for a 1D normal with $\sigma_x = 1.05mm$



Geant4 simulation of the energy deposited in the strip volume for 10k e- primaries.

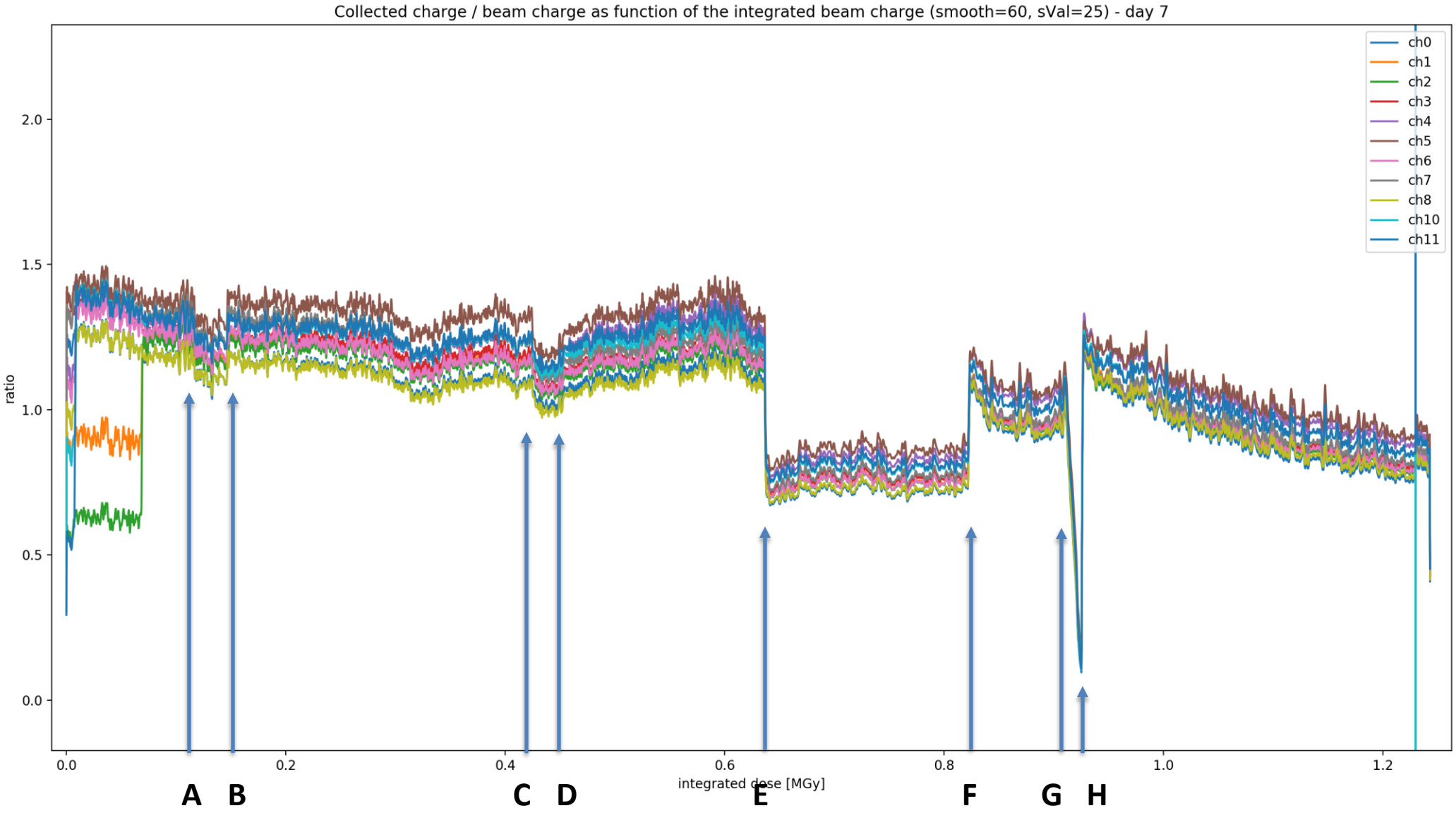


Beam center in middle of the strip

Taking the x-derivative of the CDF, the gaussian distribution is found.
Fit of the standard deviation can be compared with the nominal 1.05mm beam width.

7 Sept.
Irradiation 0-1MGy

0-1MGy



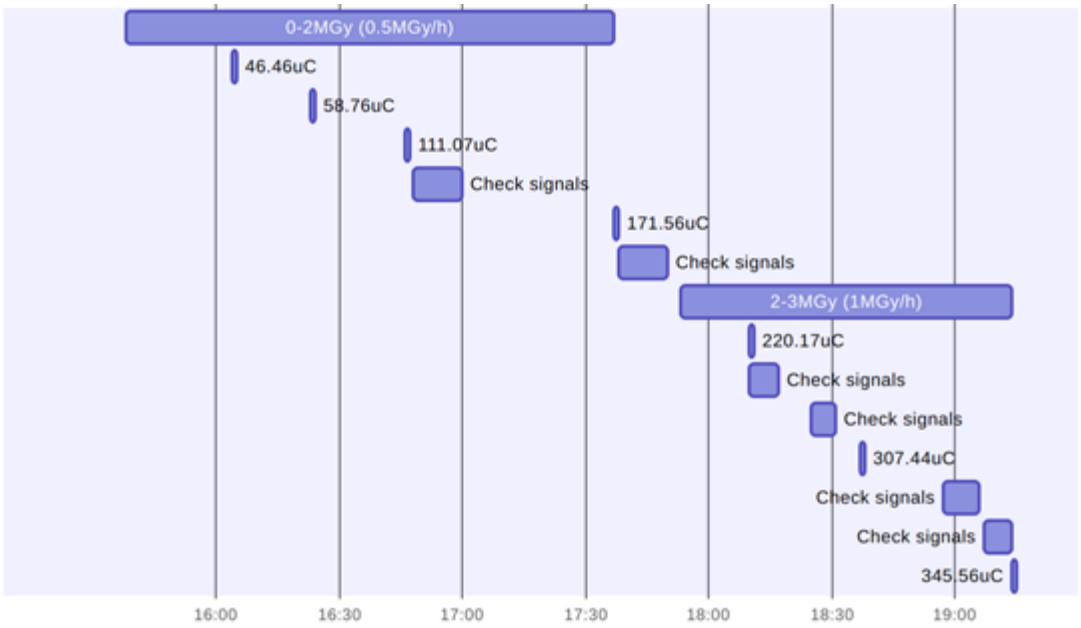
pan/zoom, x=0.437288 y=0.685187

A-H dose to time map

A stays at 0.11MGy
B stays at 0.146MGy
C stays at 0.42MGy
D stays at 0.45MGy
E stays at 0.63MGy
F stays at 0.67MGy
G stays at 0.91MGy
H stays at 0.92MGy

A stays at 15:57:50
B stays at 16:01:57
C stays at 17:01:16
D stays at 17:03:58
E stays at 17:56:01
F stays at 18:17:46
G stays at 18:32:02
H stays at 18:33:29

A stays at 15:57:50
B stays at 16:01:57
C stays at 17:01:16
D stays at 17:03:58
E stays at 17:56:01
F stays at 18:17:46
G stays at 18:32:02
H stays at 18:33:29



A (as for B,C,D)

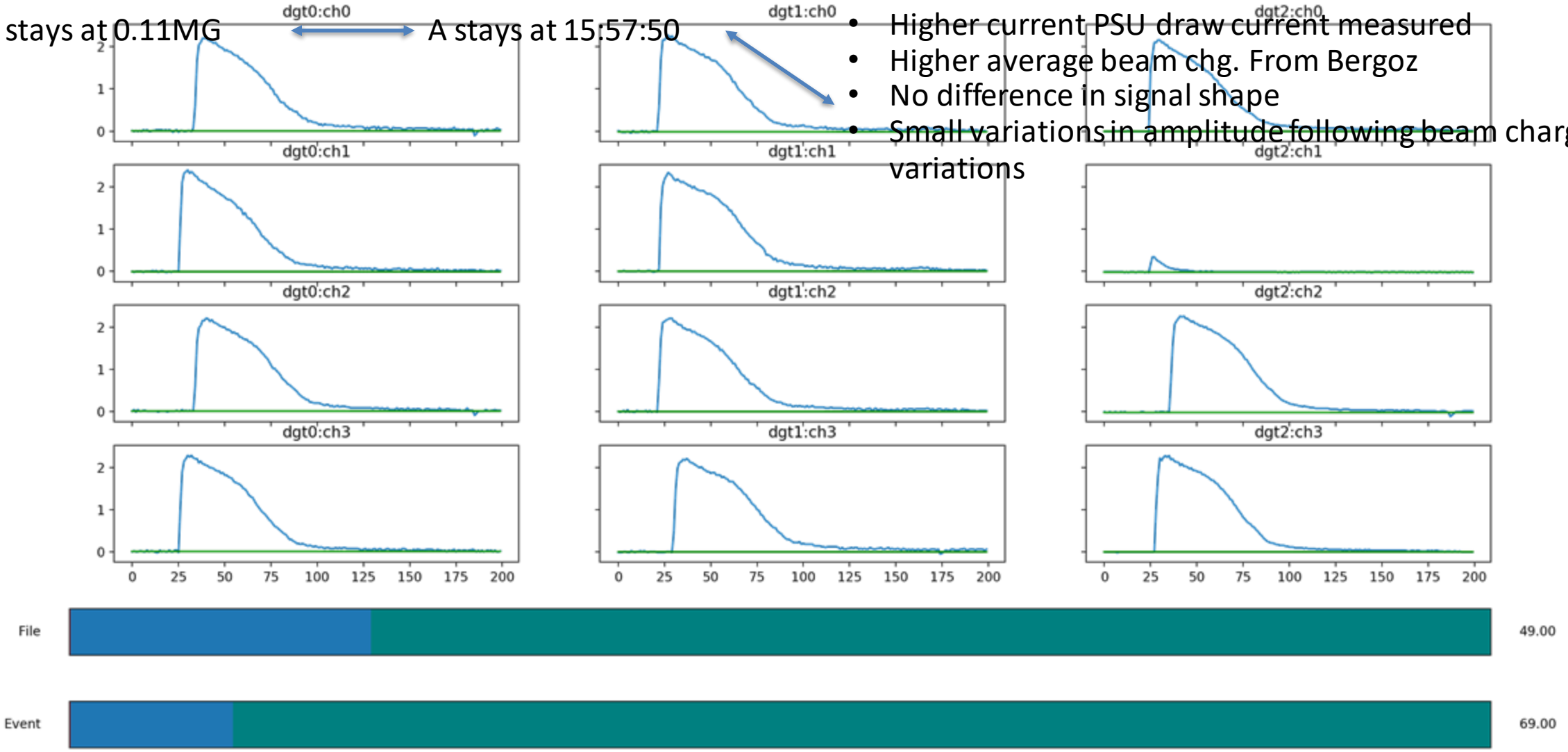
A stays at 0.11MG ⟷ A stays at 15:57:50 ↘

- Higher current PSU draw current measured
- Higher average beam chg. From Bergoz

A (as for B,C,D)

A stays at 0.11MG ⟷ A stays at 15:57:50

- Higher current PSU draw current measured
- Higher average beam chg. From Bergoz
- No difference in signal shape
- Small variations in amplitude following beam charge variations



Lower ratio means that strips collect less charge with respect to the previous measurements.

x=122.911 y=0.486268

A (as for B,C,D)

A stays at 0.11MGy ⟷ A stays at 15:57:50

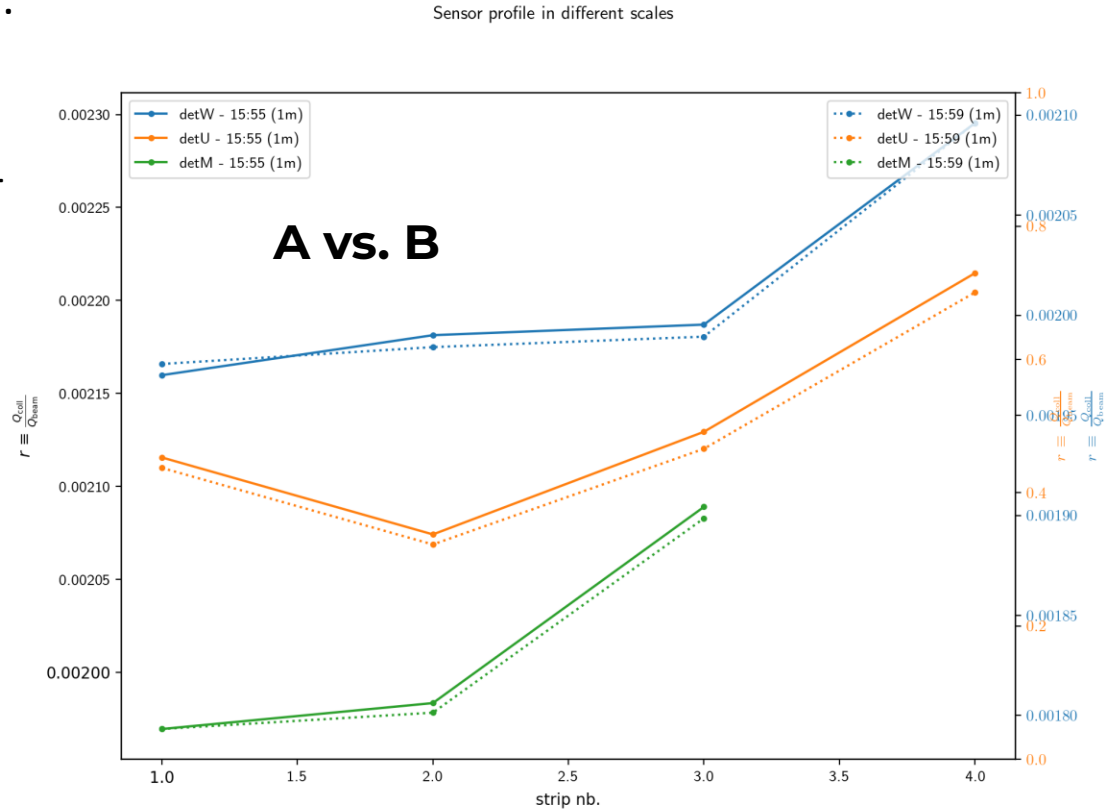
- Higher current PSU draw current measured
- Higher average beam chg. From Bergoz
- No difference in signal shape
- Small variations in amplitude following beam charge variations

Lower ratio means that strips collect less charge with respect to the previous measurements. It may have happened that with the 'kick' of beam charge the beam width or the centroid moved.
Let's check on strip profile averaged over 1 minute time before

15:55:00 -> 15:56:00 and after 15:59:24 -> 16:00:24

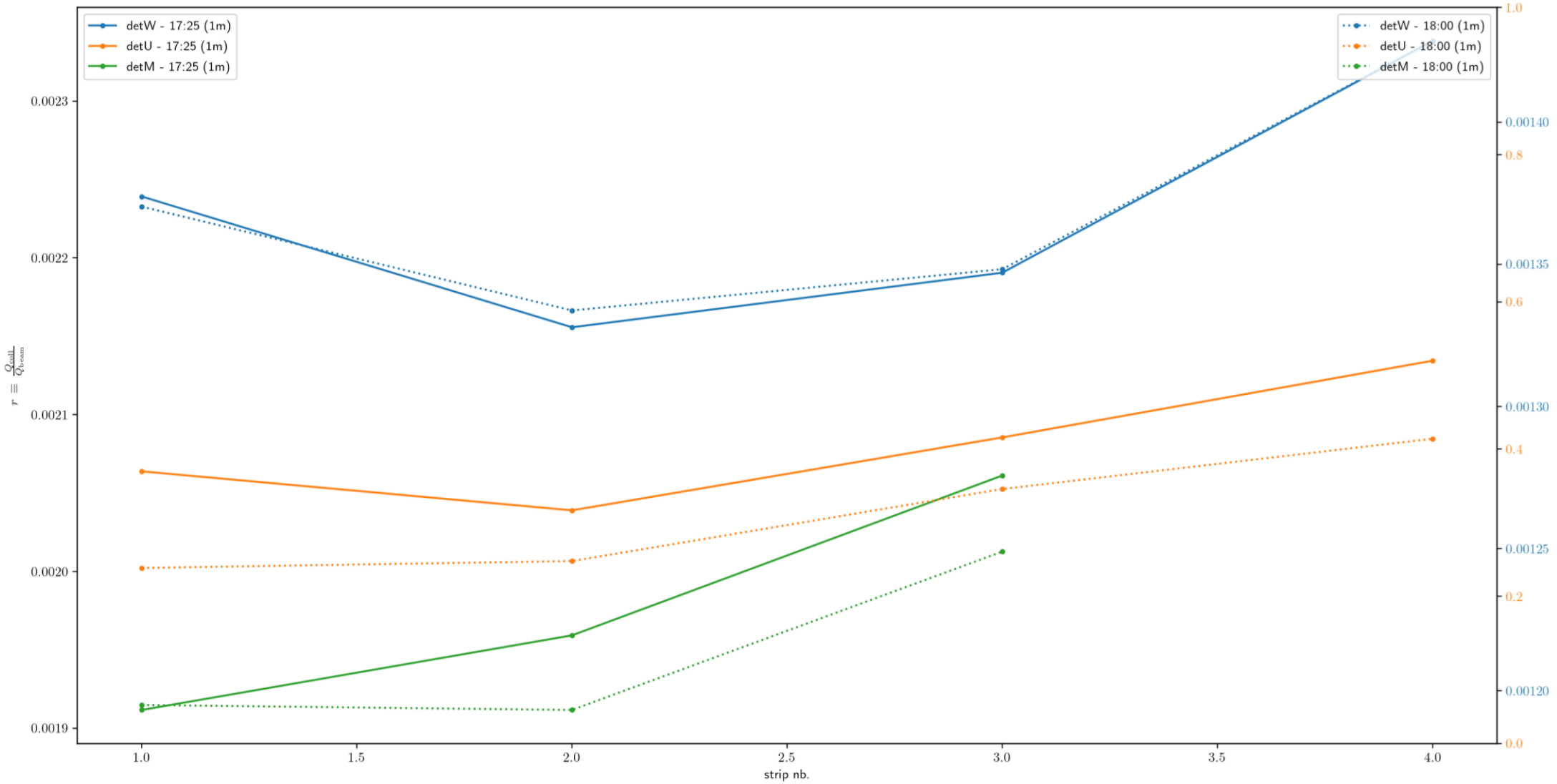
There is no clear evidence of a displacement of the beam centroid as well as a variation in the beam sigma.

It seems that this effect depends on the bunch charge, rather than geometric variations of the beam.



B-C-D (E)

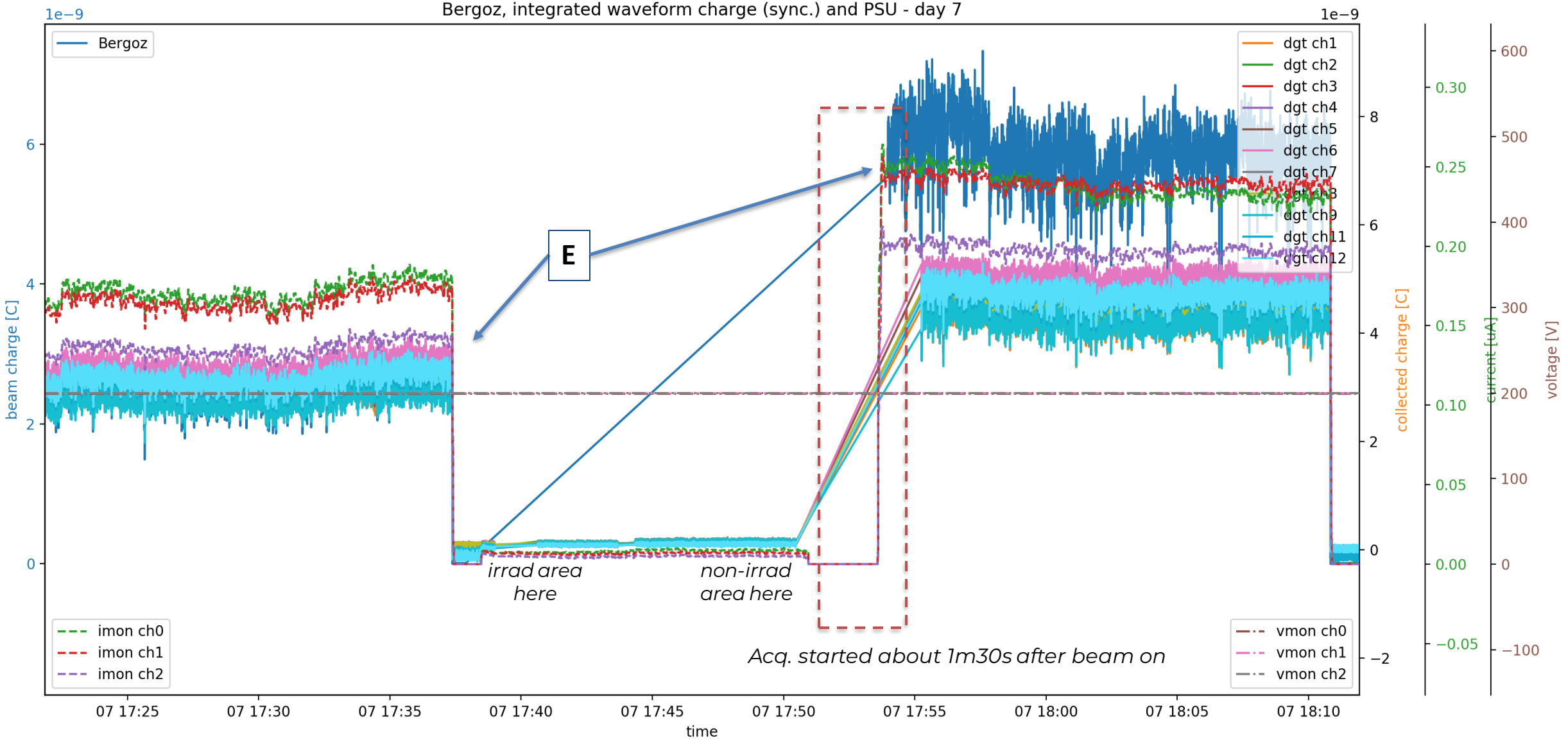
Spatial profile on the sensors over 1 minute acquisitions for D<(t=17:25)<E and for E<(t=18:00)<F.



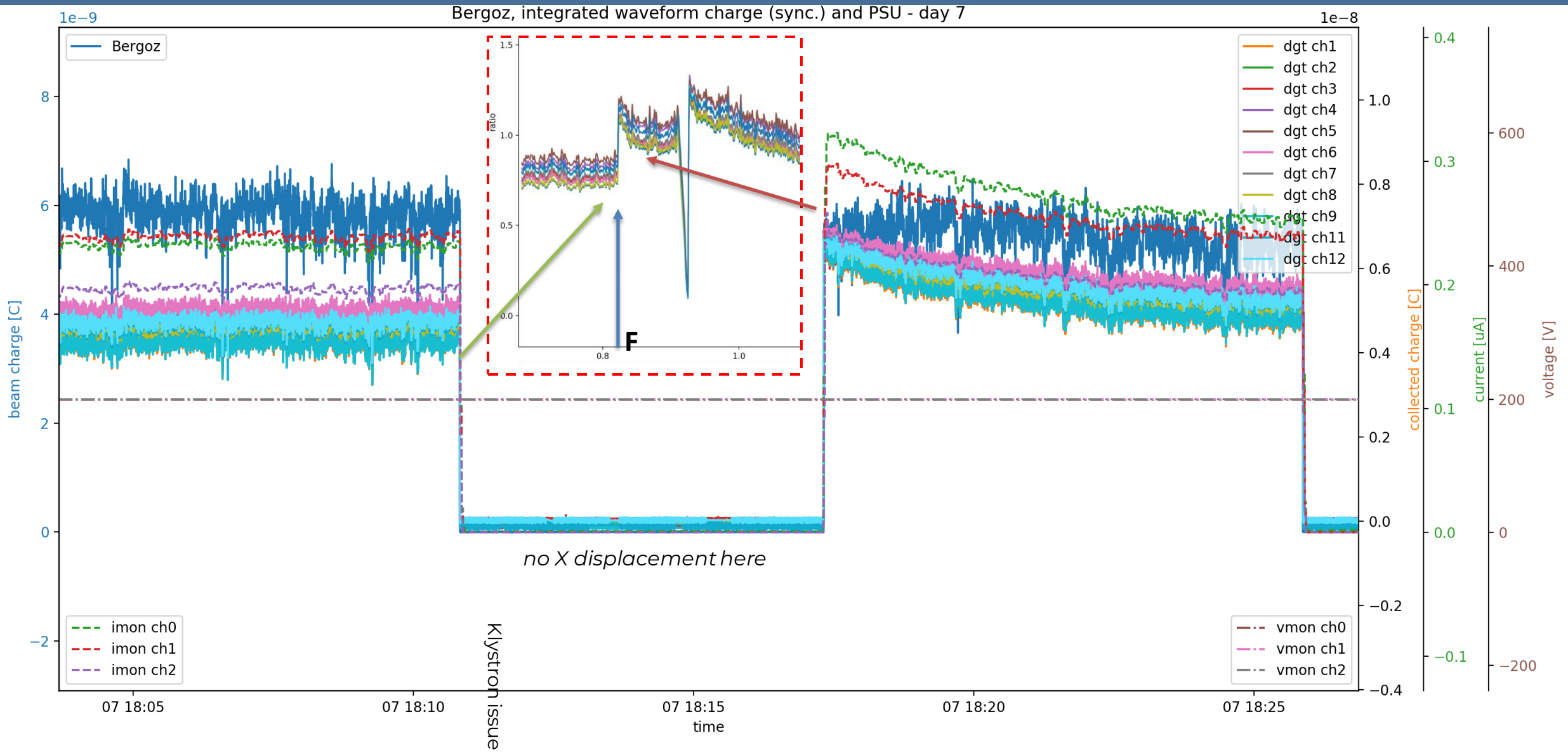
E

- Beam charge going from 2.5nC to 6.0nC
- PSU currents going from 0.175uA to 0.24uA

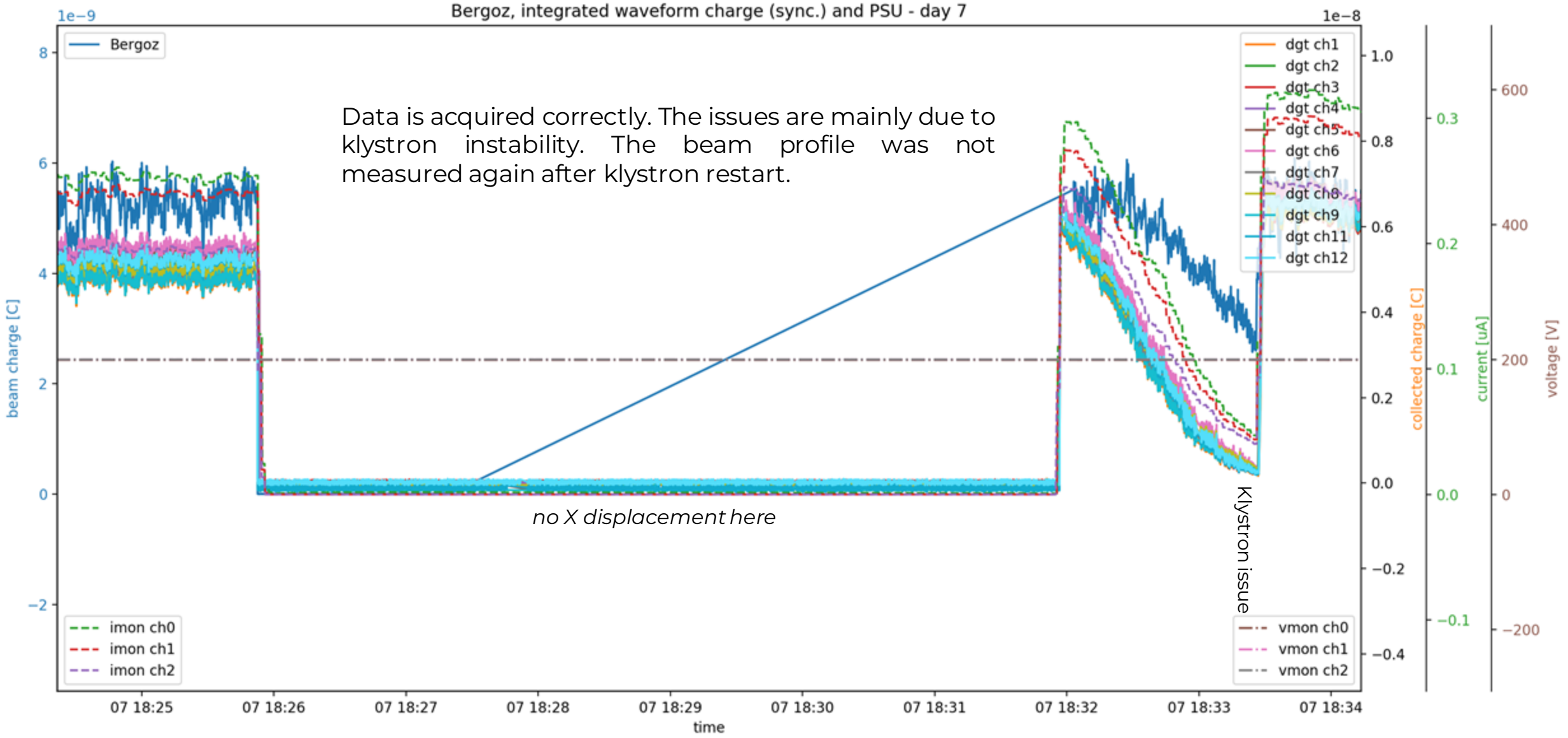
E stays at 0.63MGy ⟷ E stays at 17:56:01 ⟷



F

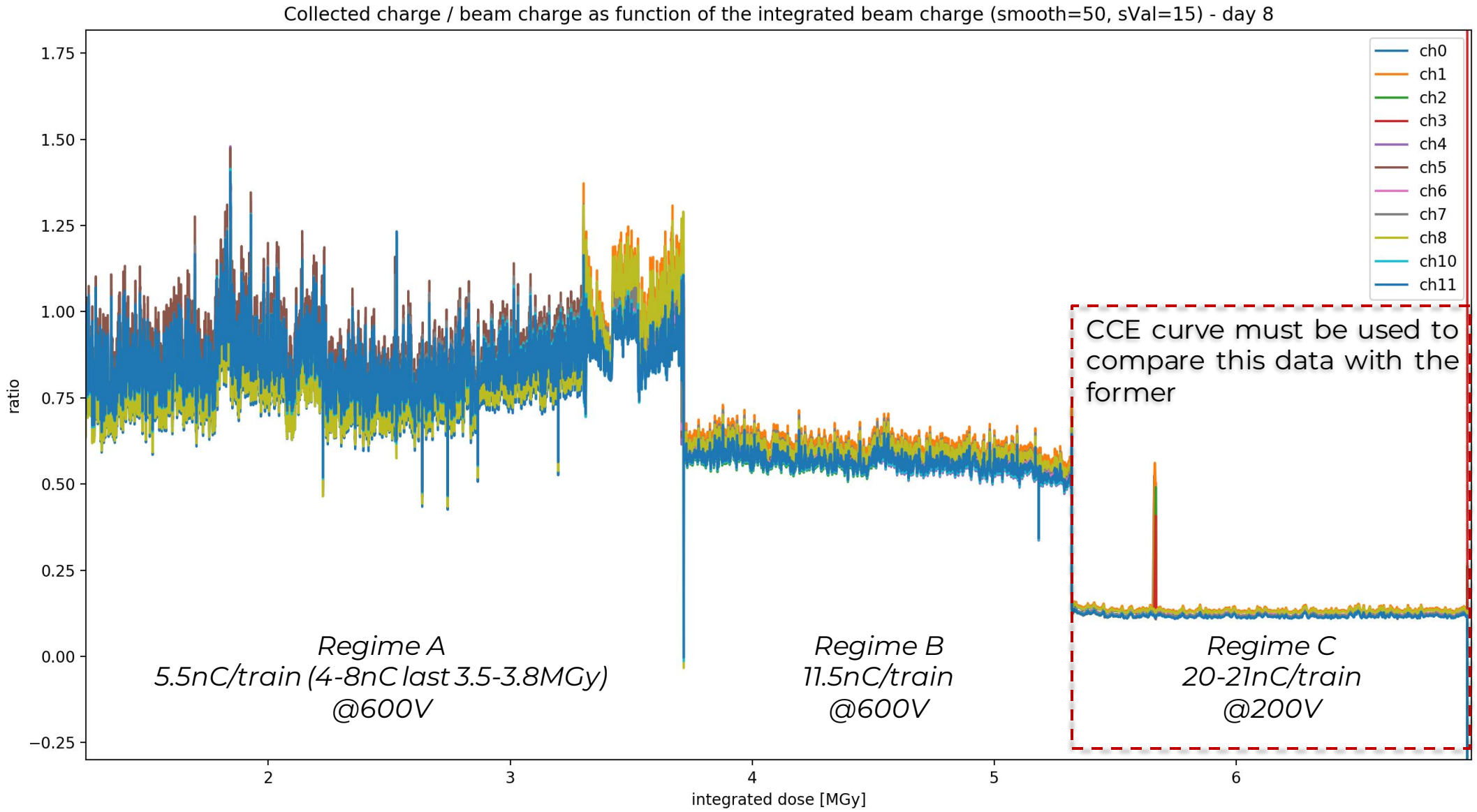

Bergoz, integrated waveform charge (sync.) and PSU - day 7
1e−9
1e−8
Bergoz
dgt ch1
dgt ch2
dgt ch3
dgt ch4
dgt ch5
dgt ch6
dgt ch7
dgt ch8
dgt ch9
dgt ch11
dgt ch12
ratio
F
no X displacement here
Klystron issue
imon ch0
imon ch1
imon ch2
vmon ch0
vmon ch1
vmon ch2
beam charge [C]
collected charge [C]
current [uA]
voltage [V]
07 18:05
07 18:10
07 18:15
07 18:20
07 18:25
time

G, H

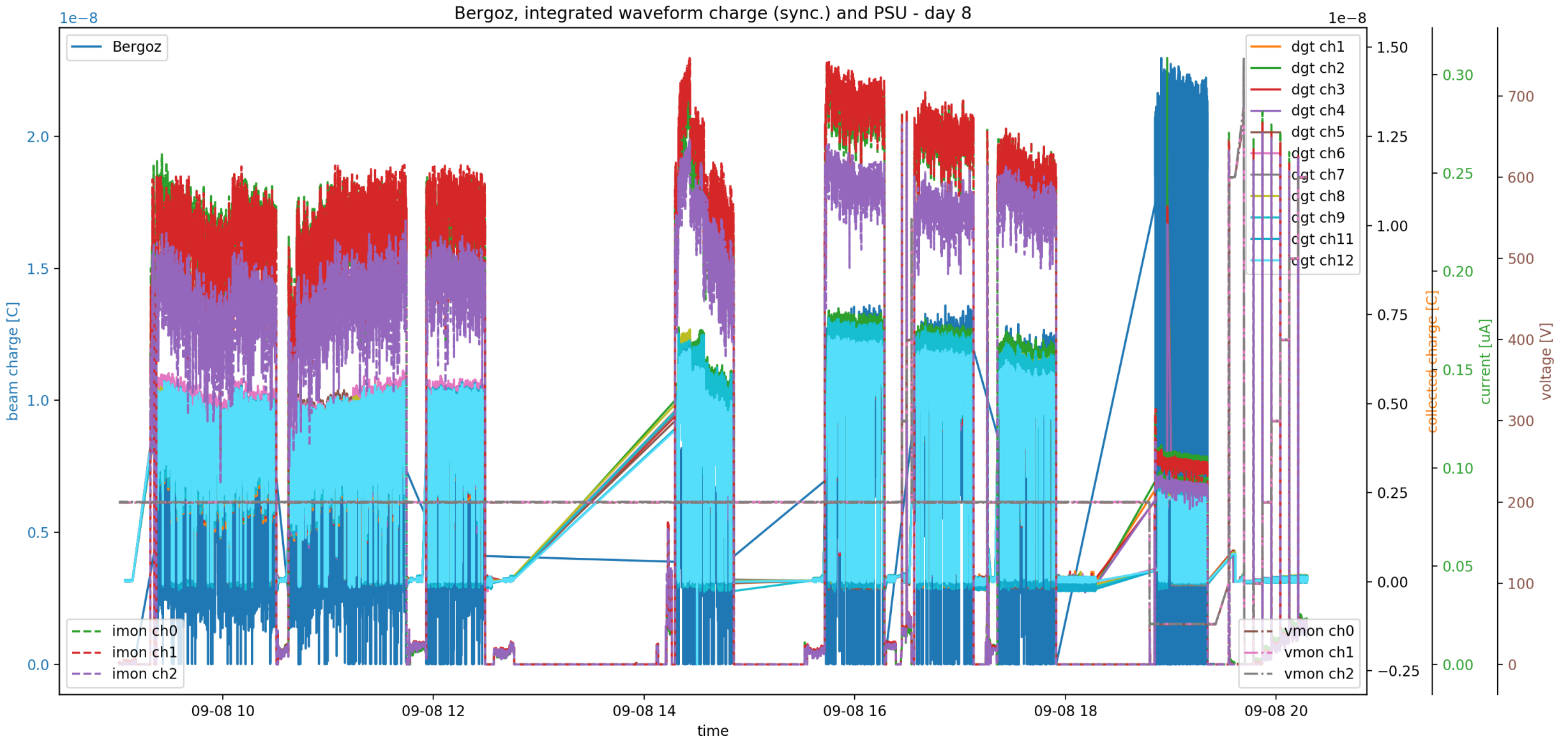

Bergoz, integrated waveform charge (sync.) and PSU - day 7
Data is acquired correctly. The issues are mainly due to klystron instability. The beam profile was not measured again after klystron restart.
no X displacement here
Klystron issue
Bergoz
dgt ch1
dgt ch2
dgt ch3
dgt ch4
dgt ch5
dgt ch6
dgt ch7
dgt ch8
dgt ch9
dgt ch11
dgt ch12
imon ch0
imon ch1
imon ch2
vmon ch0
vmon ch1
vmon ch2
beam charge [C]
collected charge [C]
current [uA]
voltage [V]
time
07 18:25
07 18:26
07 18:27
07 18:28
07 18:29
07 18:30
07 18:31
07 18:32
07 18:33
07 18:34
pan/zoom

8 Sept.
Irradiation 1-7MGy

8 Sept. Irradiation 1-7MGy



8 Sept. Irradiation 1-7MGy



Irradiation. Comment and analysis strategy

- The detector's behaviour during irradiation, where different beam charges have been used, depends on the absolute train charge value.
  - Timescale of $\sim 5\,min$ is observed on day 7 (point H). However, this is likely to be an effect due to 'beam displacement' rather than a 'charge saturation' effect. In fact, this is not observed anymore neither in signals nor psu currents.
- To deduce radiation damage one has to use measures where the same charge/train is delivered to the sensor -> 1 bunch operations **TODO**

Day	From	To	Dose at start
7	16:45:51	17:00:08	?
7	17:37:23	17:50:56	?
7	17:10:50	18:17:19	?
7	18:25:53	18:31:56	?
7	18:57:12	19:14:44	?
8	10:30:31	10:36:27	?
8	11:44:51	11:53:43	?
8	12:29:16	12:45:38	?
8	15:36:17	15:42:10	?
8	16:16:53	16:31:12	?
8	17:07:38	17:16:20 (17:20:00)	?
8	17:54:14	18:17:07	?

Irradiation. Comment and strategy

Single bunch measure for irradiation **TODO list**

1. Function to calculate the integrated dose as a function of the beam characteristics (stored in the beamTable array) but based on the 1Hz bergoz data (always available)
2. Function to plot a canvas with beam+ch1+psucurr1+positionX as a function of time and integrated dose
3. Inspect files for these measures (something odd near 17:20 day8 found)

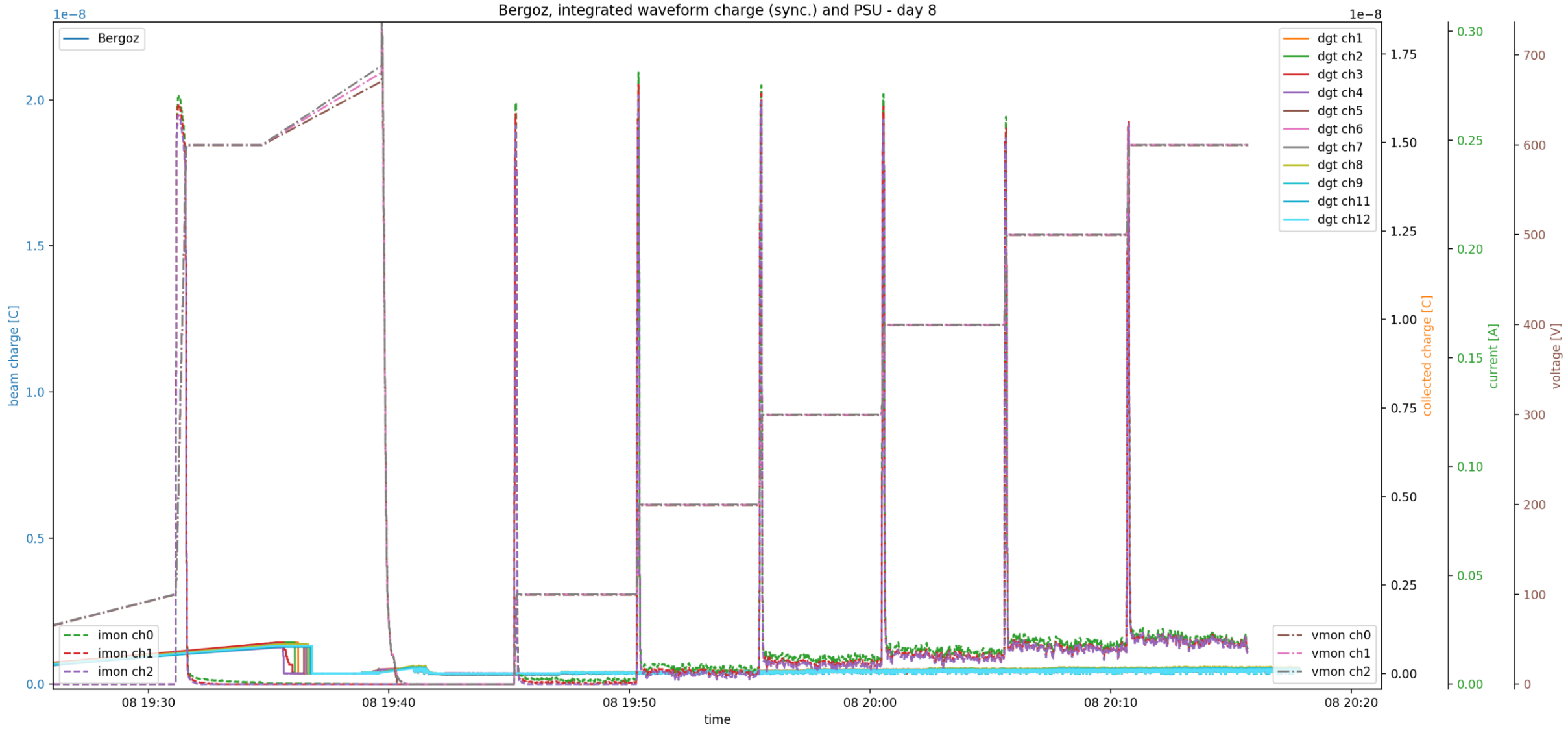
Day	From	To	Dose at start
7	16:45:51	17:00:08	?
7	17:37:23	17:50:56	?
7	17:10:50	18:17:19	?
7	18:25:53	18:31:56	?
7	18:57:12	19:14:44	?
8	10:30:31	10:36:27	?
8	11:44:51	11:53:43	?
8	12:29:16	12:45:38	?
8	15:36:17	15:42:10	?
8	16:16:53	16:31:12	?
8	17:07:38	17:16:20 (17:20:00)	?
8	17:54:14	18:17:07	?

8 Sept.
CCE in the irradiated area (forward bias)

Measure conditions

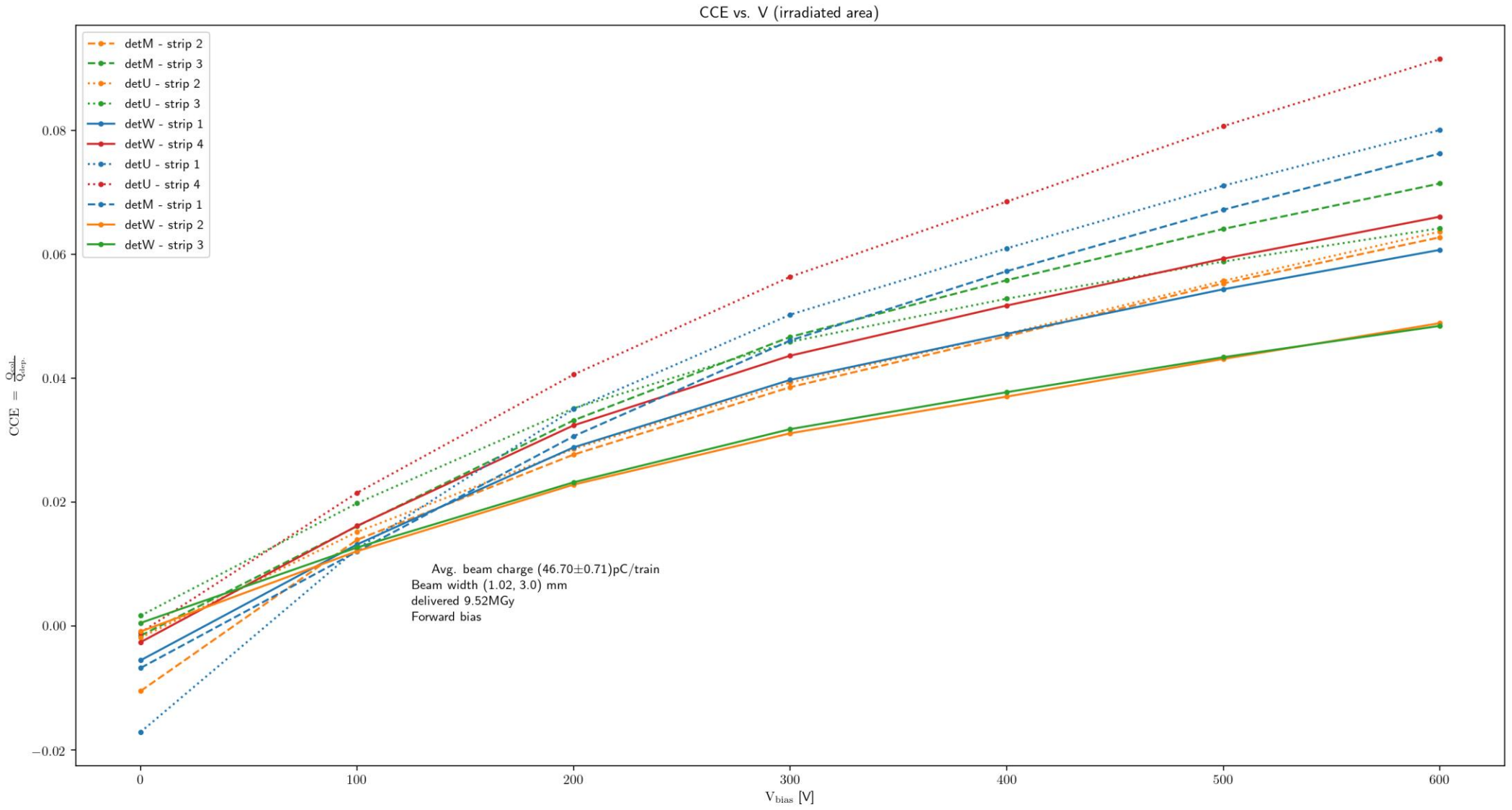
Title: Charge collection efficiency irradiated area 0-600V
Description: CCE scan in the HV from 0 to 600V in the irradiated area position, after
irradiation day with accumulated dose of roughly 9.52MGy.
Date: 8Sept. from 194200 to 201500
HV: variable from 0 to 600V
Beam sigma: (1.02, 3.0) mm
Beam charge: avg. 23.35 pC/train with 1 bunch/train 10Hz
Linear stage: (196.0, 1.5) mm
Dgt time scale: 10 ns/div
Notes: There is no Bergoz 10Hz charge information available for such a measurement,
therefore we have to rely on Timber data. Deposited charge is (68keV/22eV)*(d/110) * trainChg.

8 Sept. CCE in the irradiated area (forward bias)

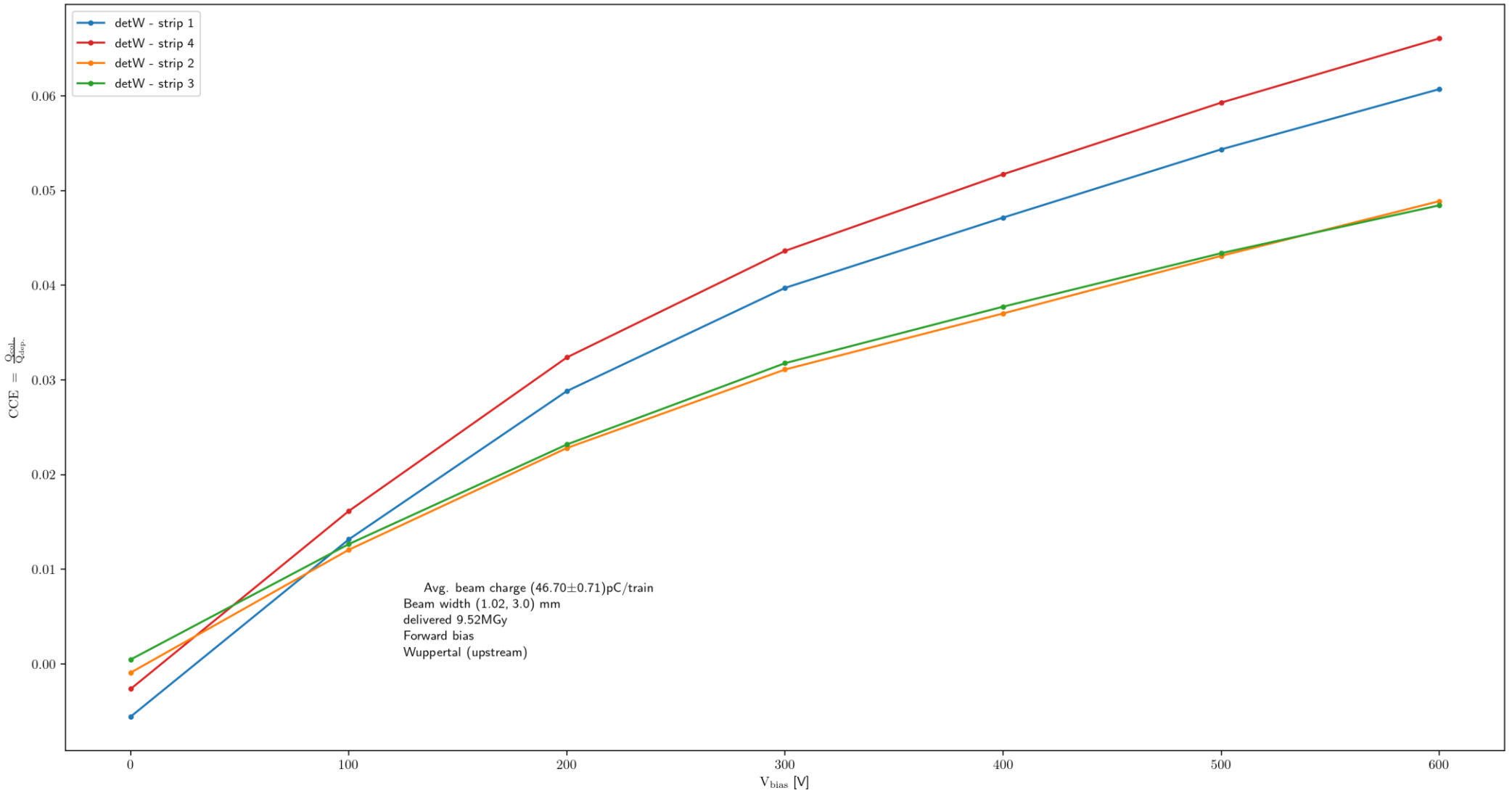


zoom rect, x=08 19:54 y=179.697

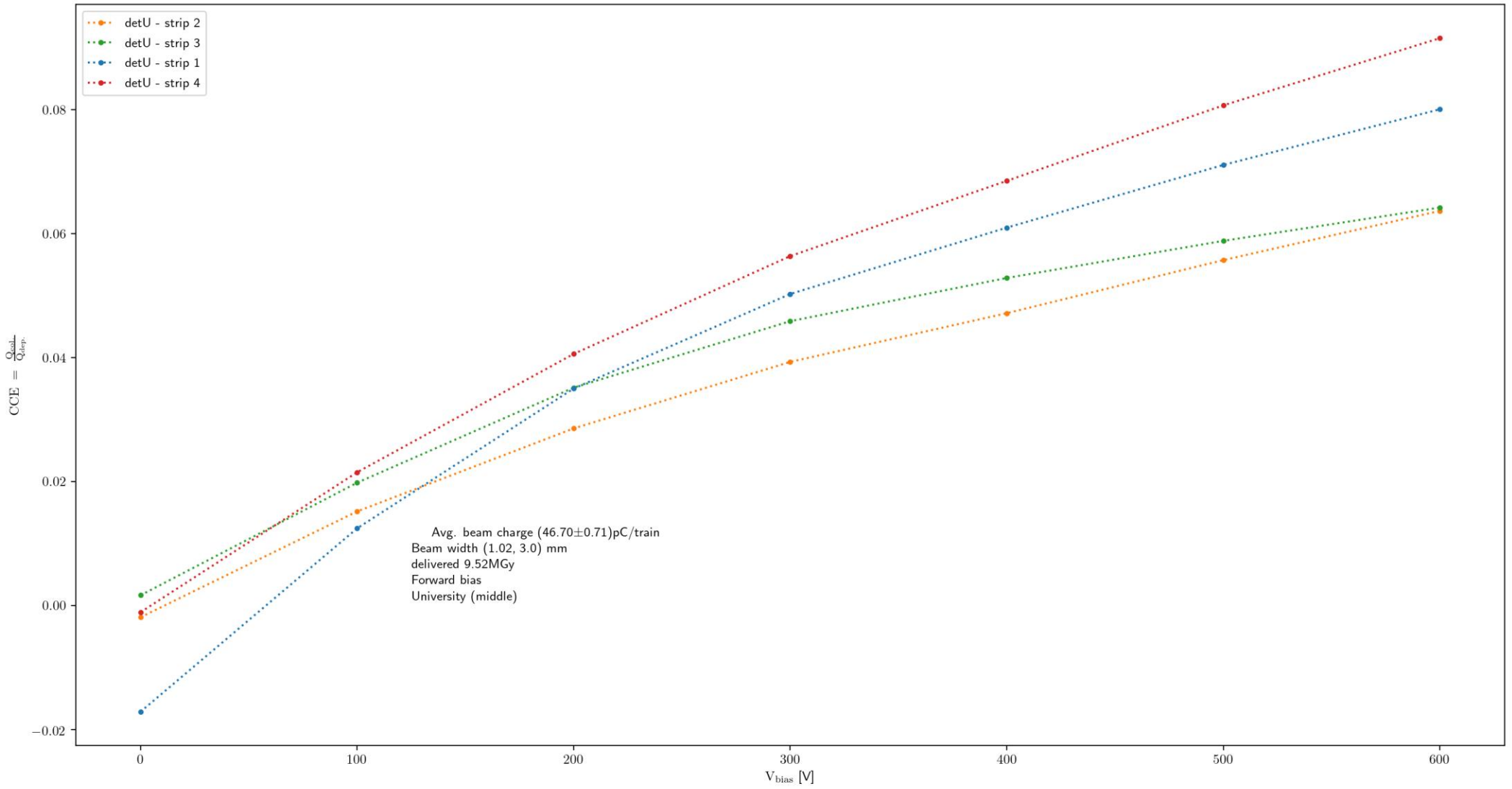
8 Sept. CCE in the irradiated area (forward bias)



CCE vs. V (irradiated area) - Wuppertal (150um)

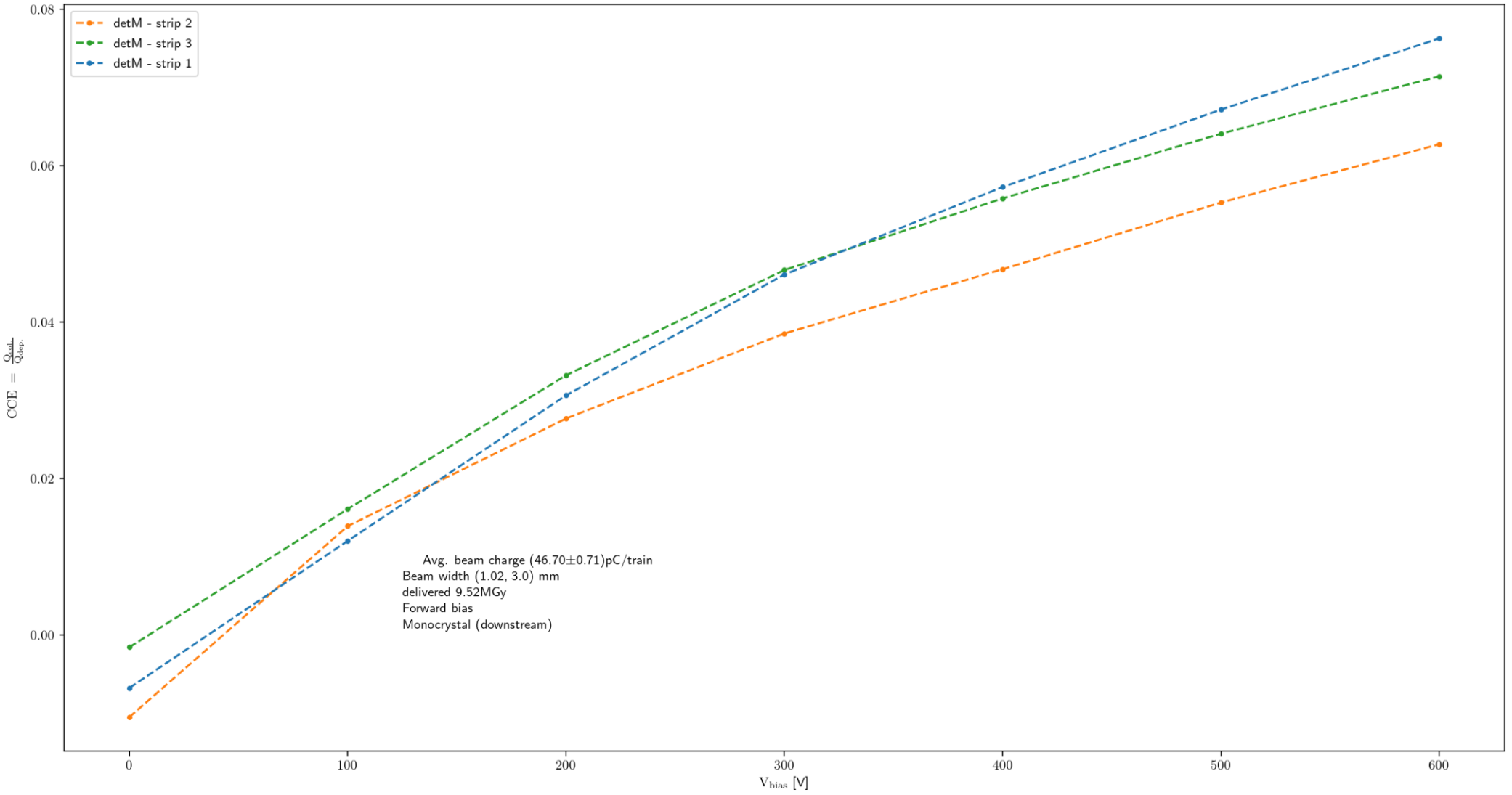


x=324.09 y=0.0133435



x=320.982 y=0.0182043

CCE vs. V (irradiated area) - Monocrystal (110um)

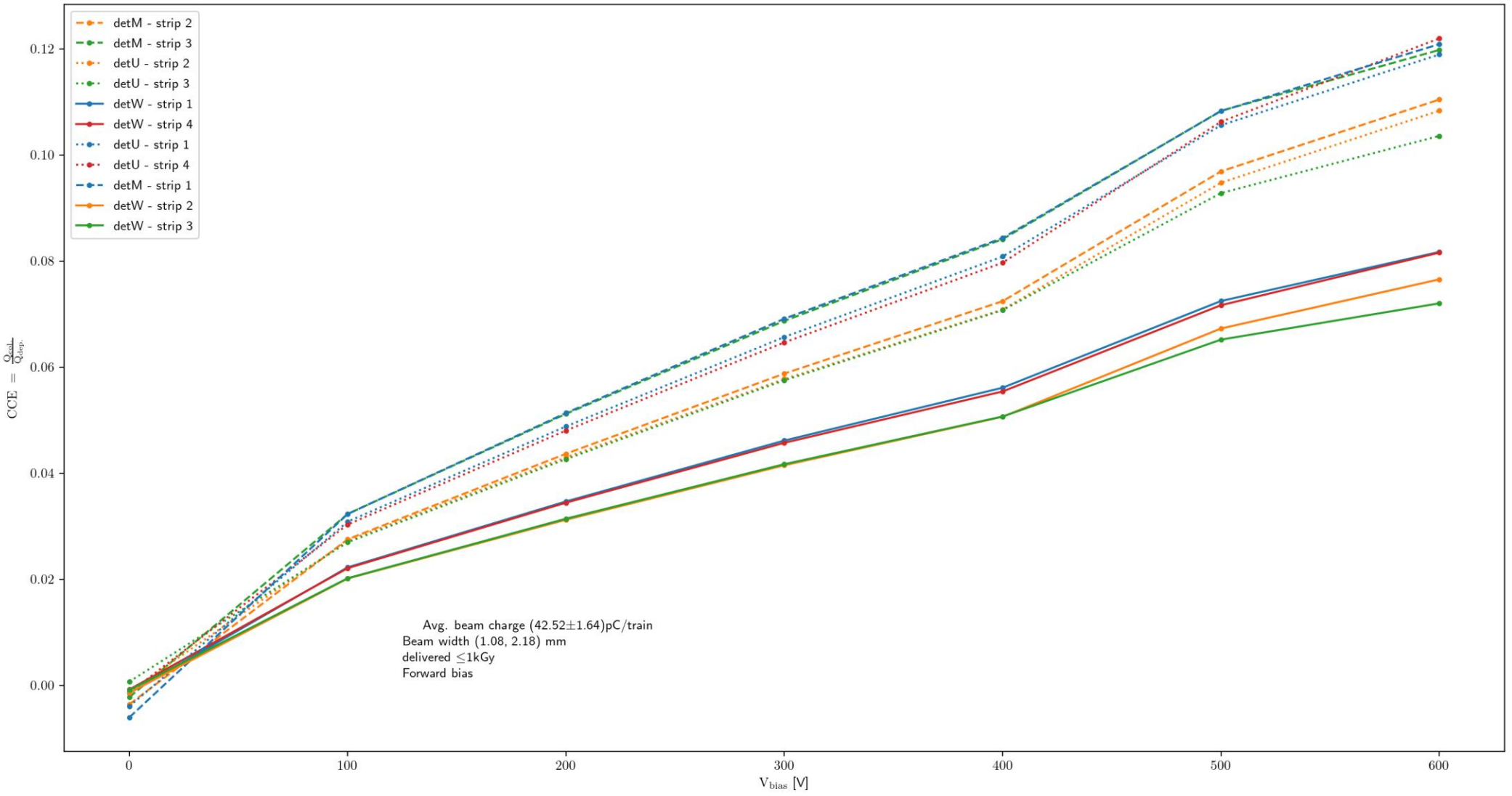


9 Sept.
CCE in the non-irradiated area (forward bias)

Measure conditions

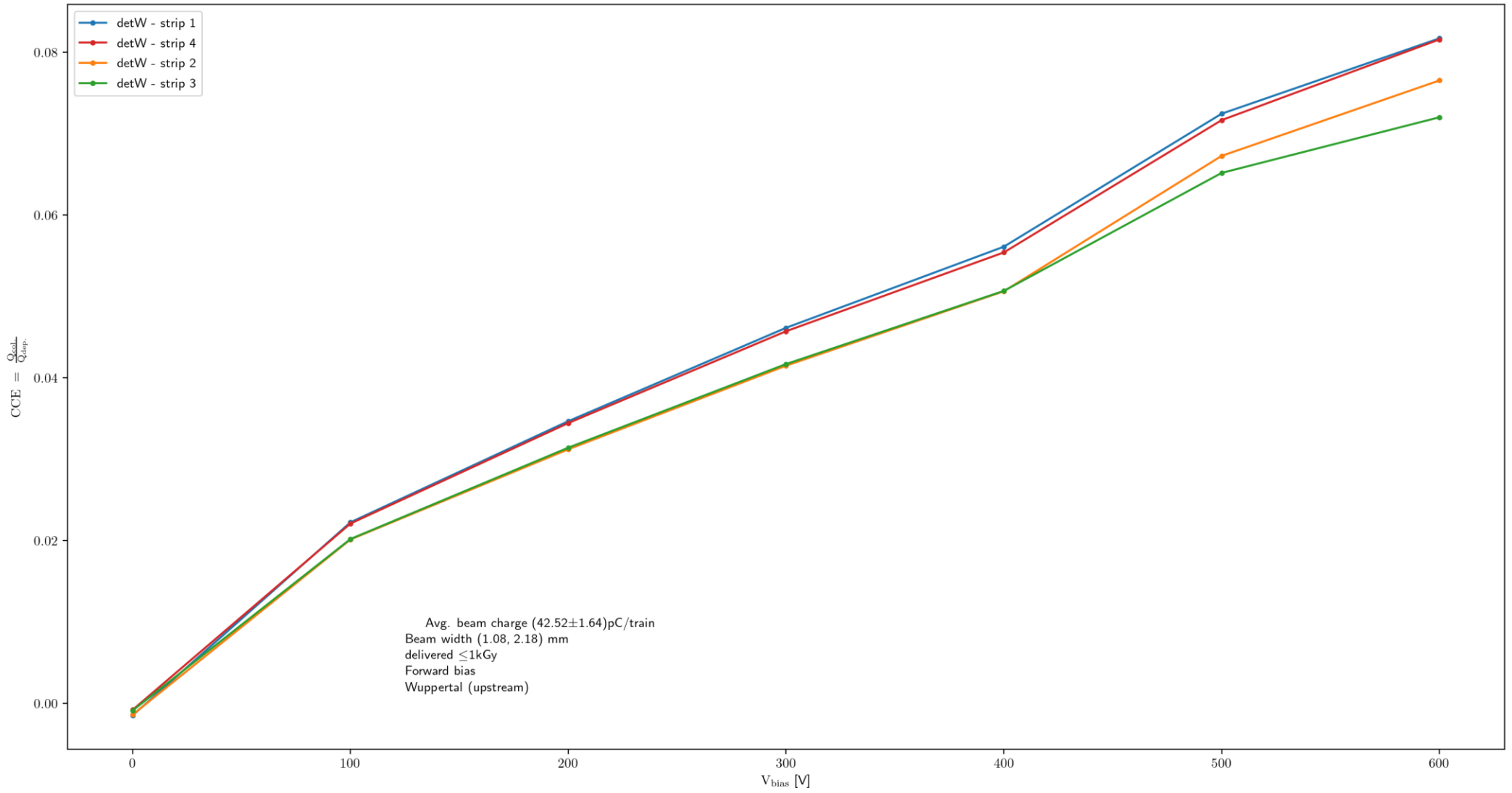
Title: Charge collection efficiency non-irradiated area 0-600V
Description: CCE scan in the HV from 0 to 600V in the non-irradiated area position.
Date: 9Sept. from 101355 to 104900
HV: variable from 0 to 600V
Beam sigma: (1.08, 2.18) mm - measured at 09:08:46
Beam charge: avg. 42.53 pC/train with 1 bunch/train 10Hz
Linear stage: (219.0, 1.5) mm - (203.0 today is 196.0 yesterday)
Dgt time scale: 10 ns/div
Notes: There is no Bergoz 10Hz charge information available for such a measurement,
therefore we have to rely on Timber data. Deposited charge is (68keV/22eV)*(d/110) *trainChg.

9 Sept. CCE in the non-irradiated area (forward bias)



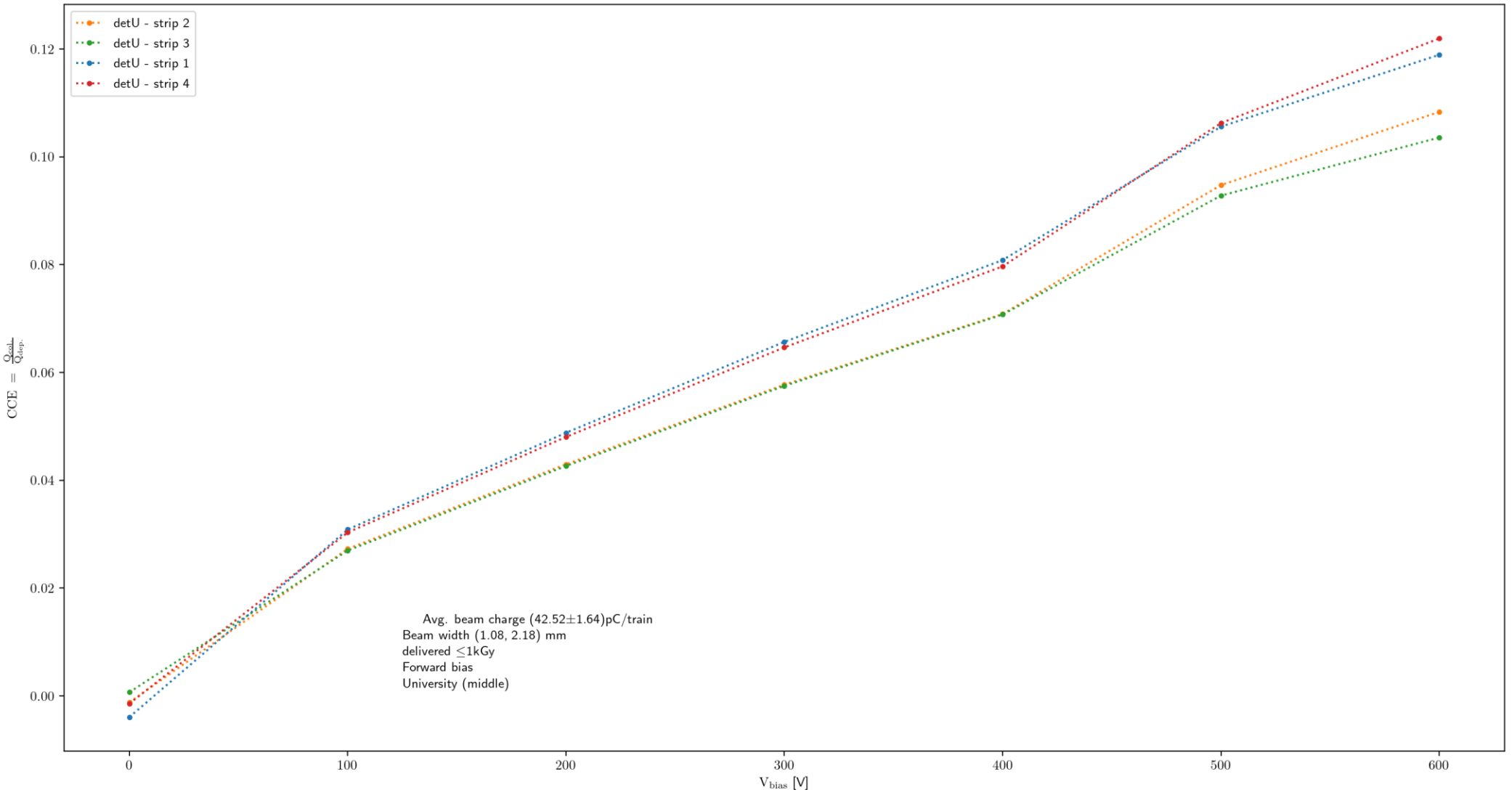
x=300.563 y=0.0270865

CCE vs. V (irradiated area) - Wuppertal (150um)



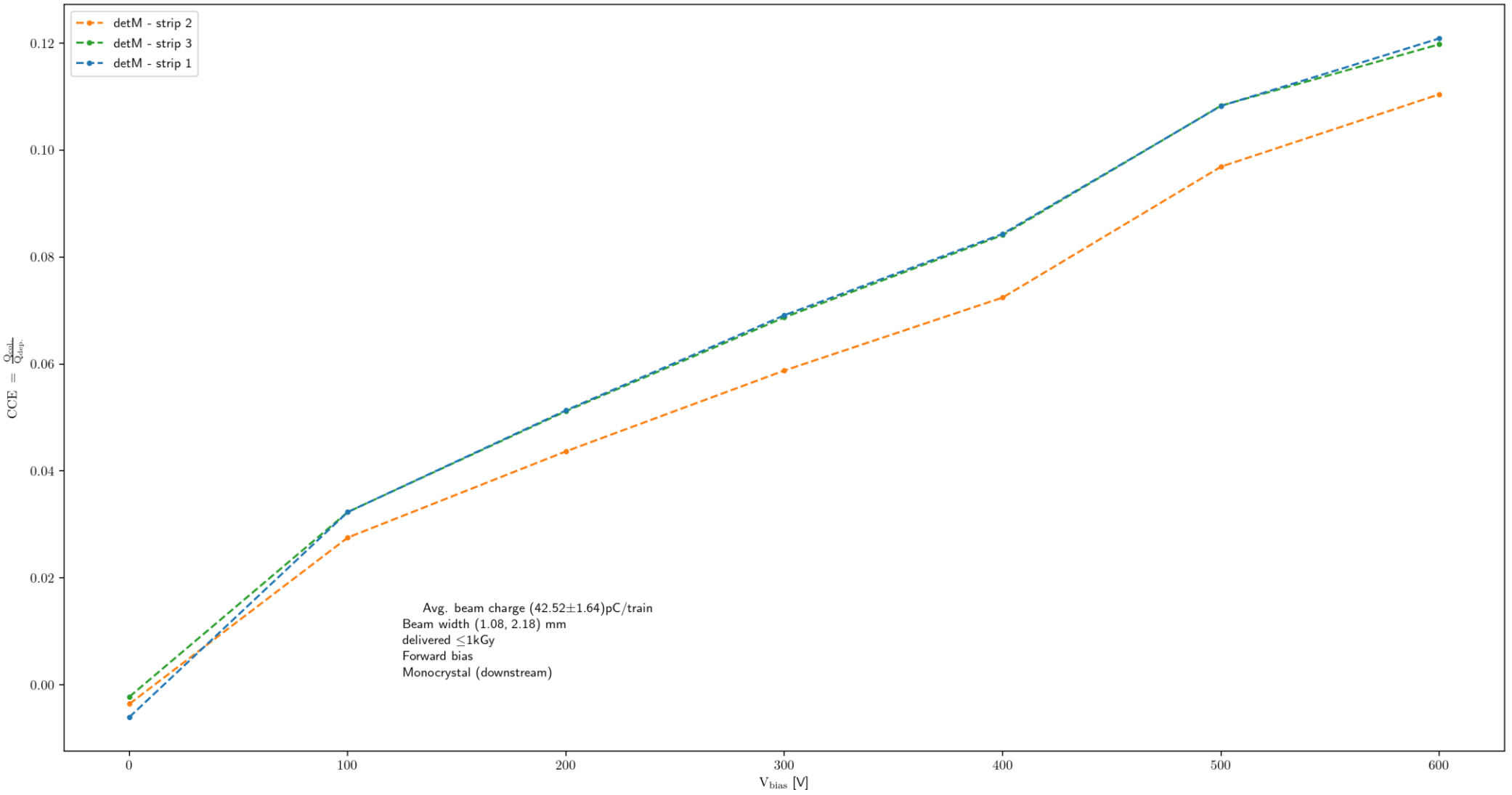
x=348.948 y=0.0349538

CCE vs. V (irradiated area) - University (110um)



x=453.041 y=0.0494017

CCE vs. V (irradiated area) - Monocrystal (110um)



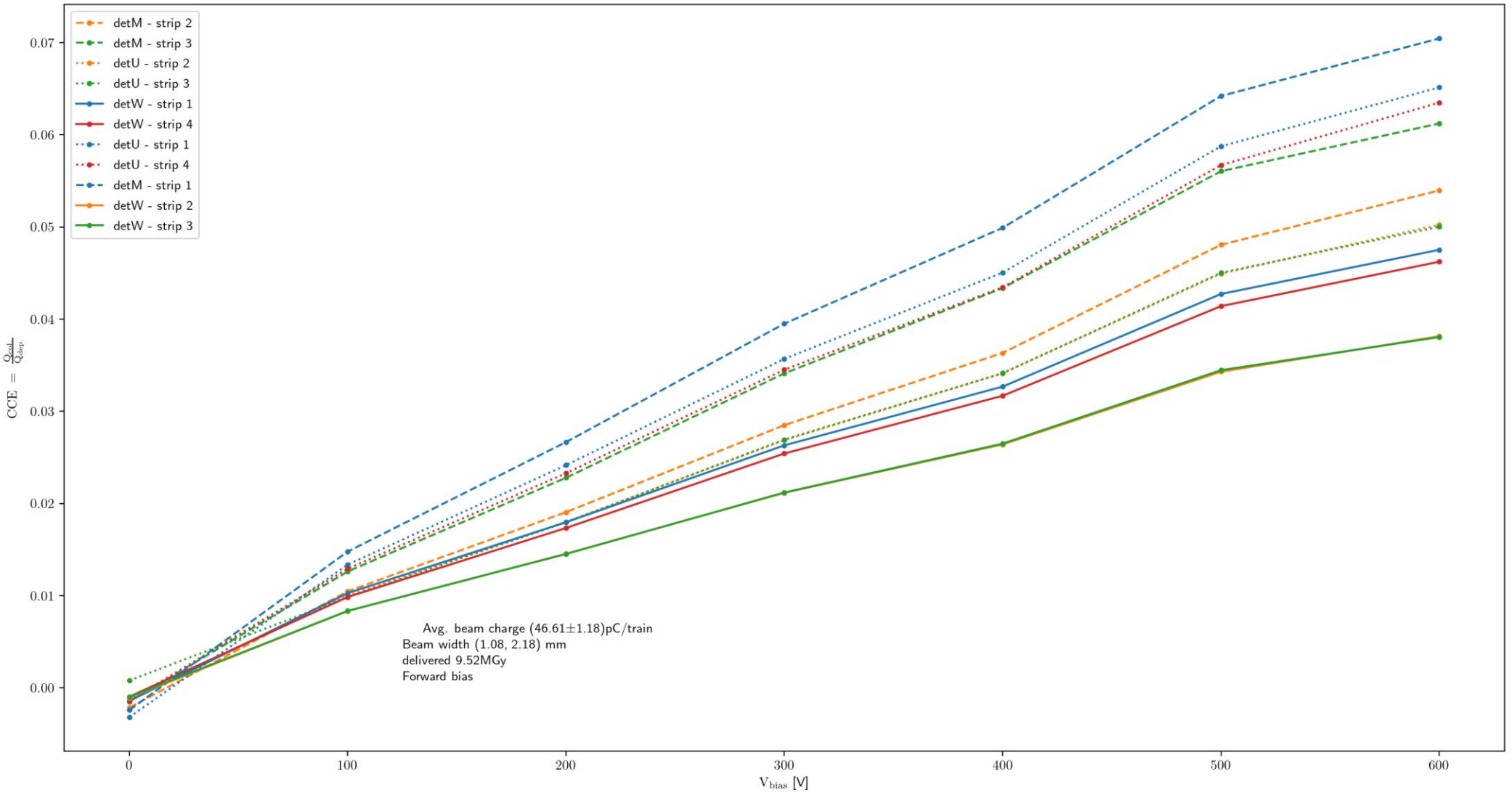
x=589.095 y=0.0589603

9 Sept.
CCE in the irradiated area (forward bias)

Measure conditions

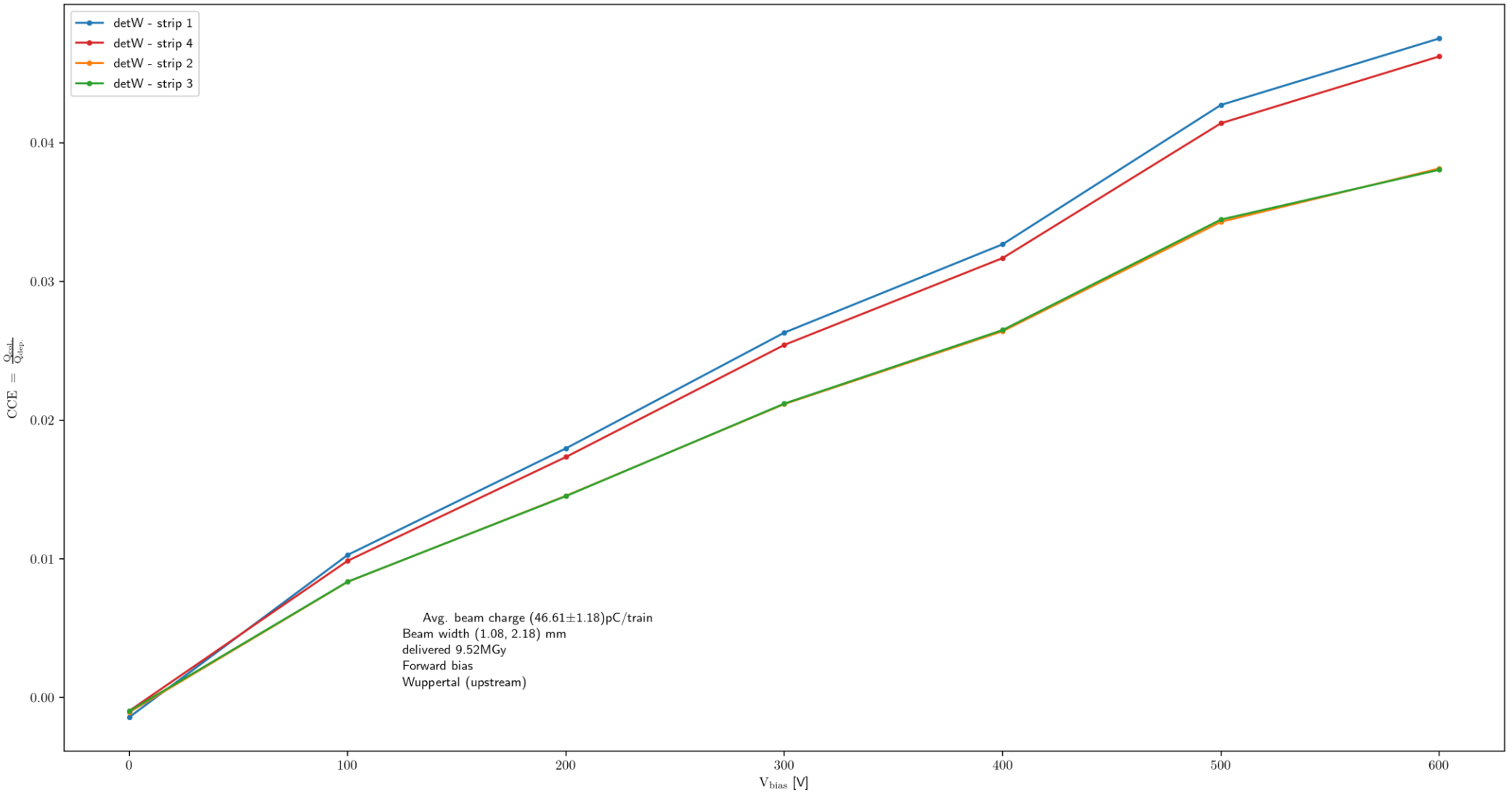
Title: Charge collection efficiency irradiated area 0-600V
Description: CCE scan in the HV from 0 to 600V in the irradiated area position with accumulated dose of \sim 9.52MGy.
Date: 9Sept. from 105300 to 113200
HV: variable from 0 to 600V
Beam sigma: (1.08, 2.18) mm - measured at 09:08:46
Beam charge: avg. 46.60 pC/train with 1 bunch/train 10Hz
Linear stage: (213.0, 1.5) mm - (203.0 today is 196.0 yesterday)
Dgt time scale: 10 ns/div
Notes: There is no Bergoz 10Hz charge information available for such a measurement,
therefore we have to rely on Timber data. Deposited charge is (68keV/22eV)*(d/110) *trainChg.

9 Sept. CCE in the irradiated area (forward bias)



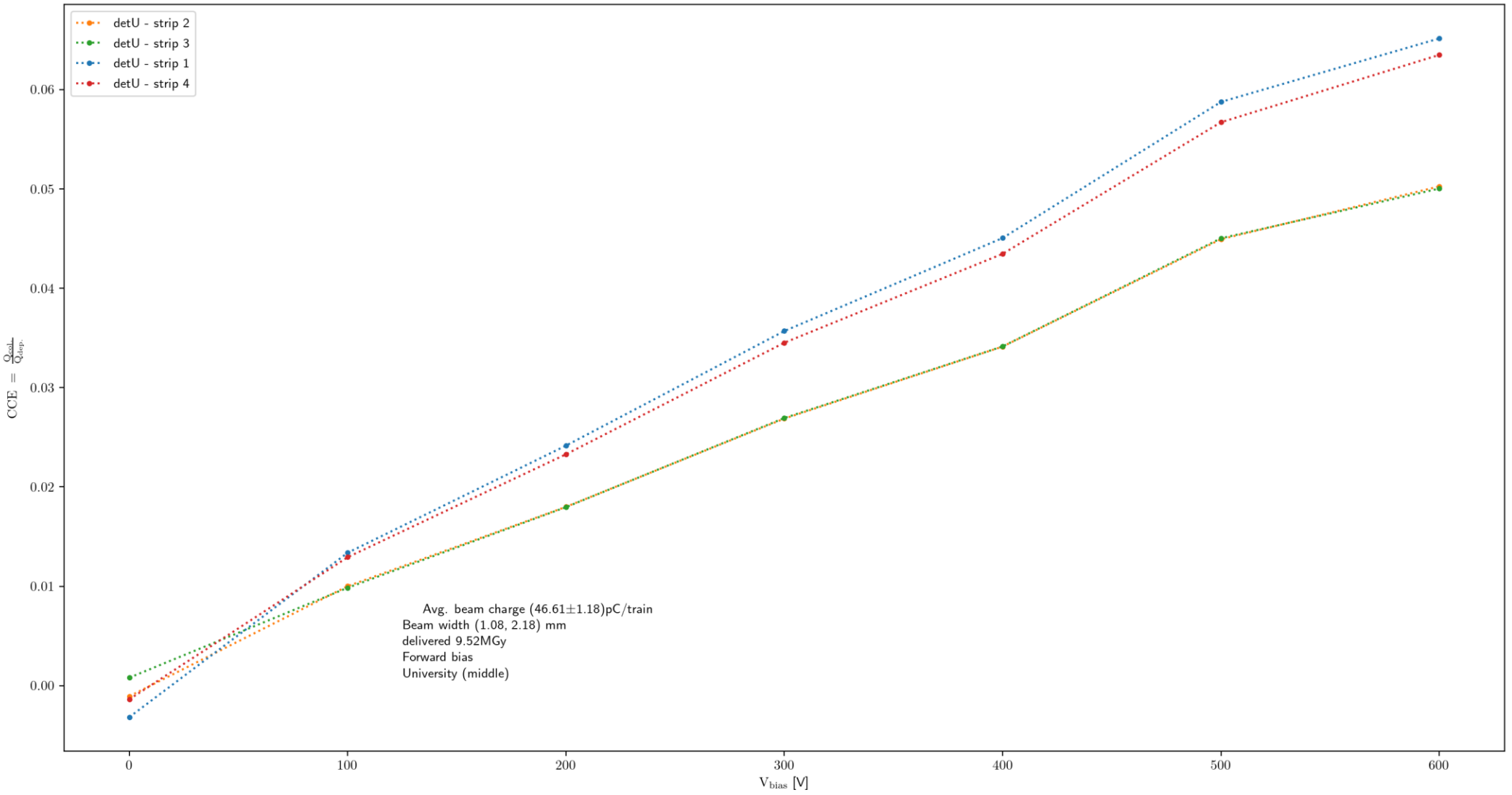
x=410.427 y=0.0301761

CCE vs. V (irradiated area) - Wuppertal (150um)



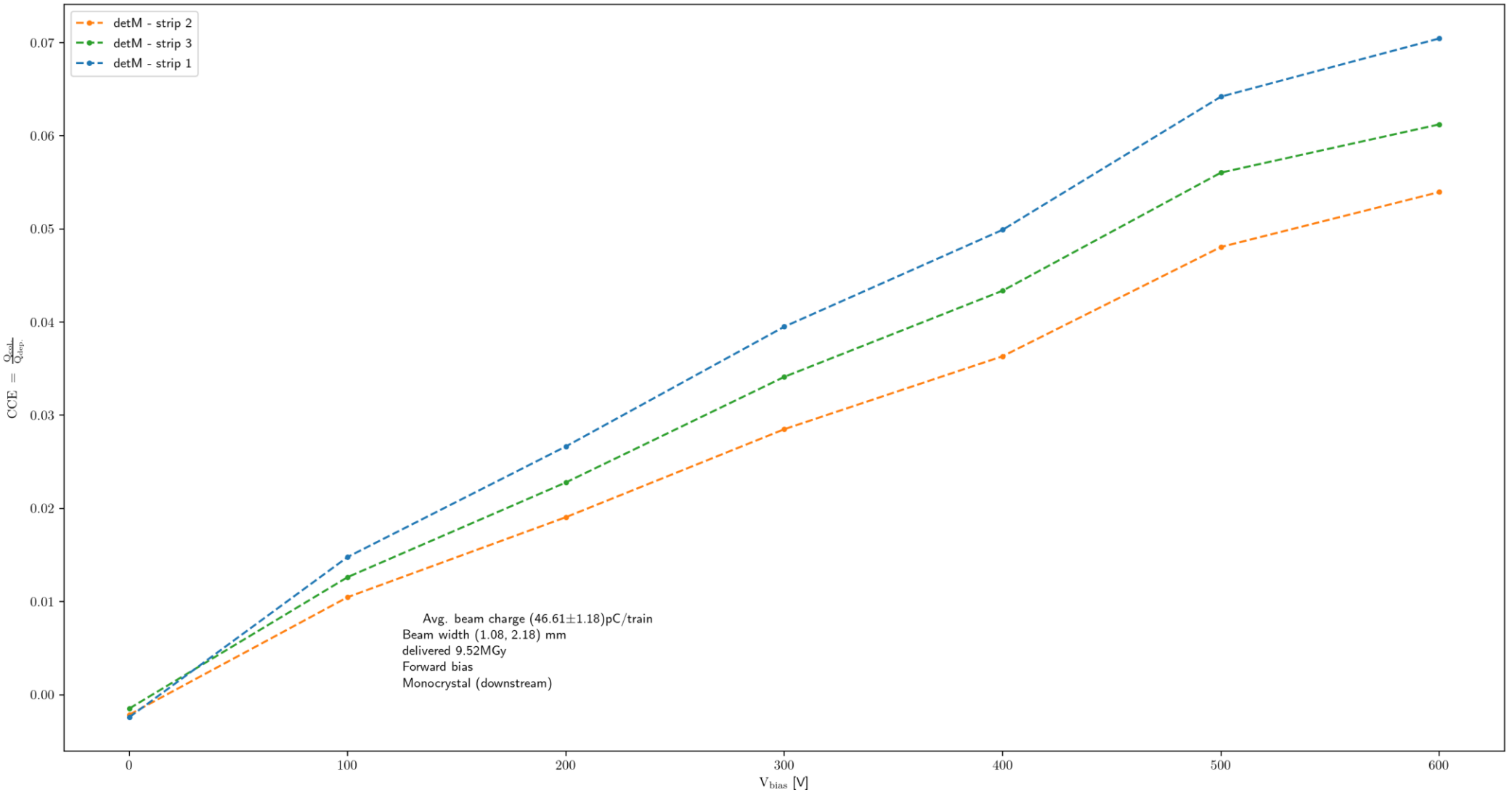
x=452.597 y=0.0264099

CCE vs. V (irradiated area) - University (110um)



x=541.82 y=0.0432231

CCE vs. V (irradiated area) - Monocrystal (110um)



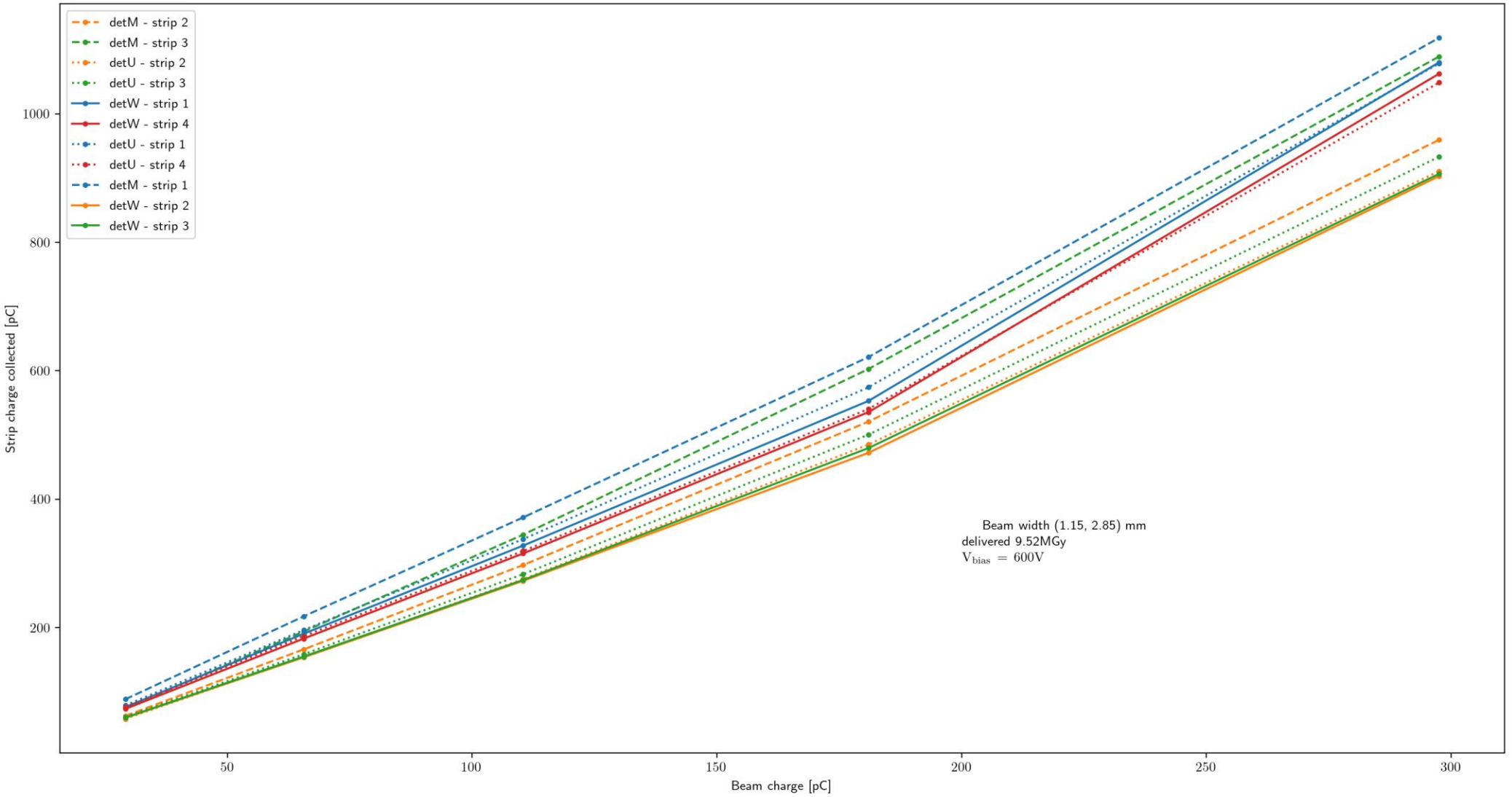
x=448.38 y=0.0302311

9 Sept.
Beam charge in the irradiated area (forward bias)

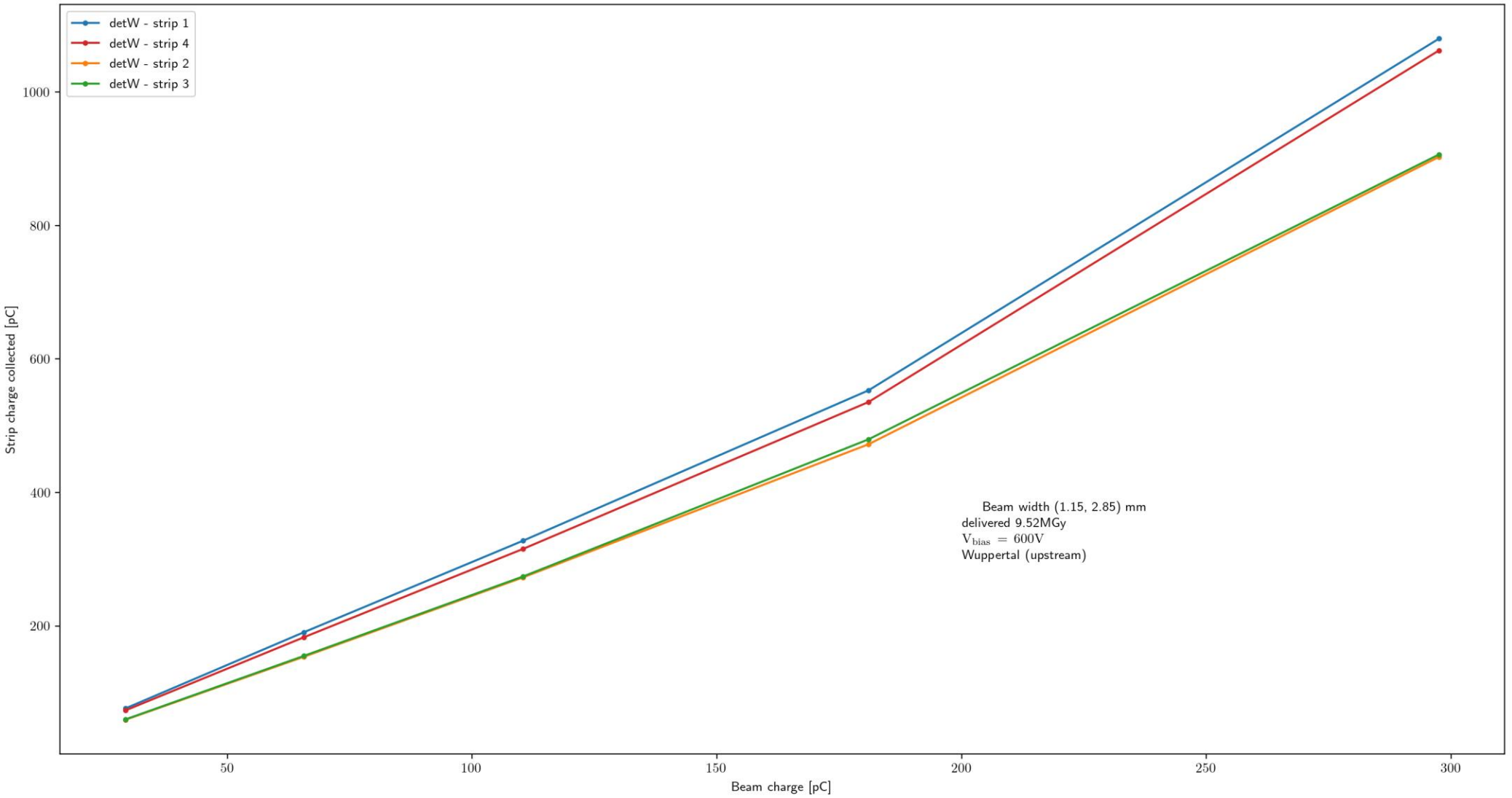
Measure conditions

Title: Beam charge in the irradiated area
Description: Scan in the beam charge with fixed HV in the irradiated area. Beam charge radning from 25-400pC
with doubling values (e.d. 25, 50 , 100, 200, 400) by doubling the bunch number. Avg. bunch charge 2.5pC
Date: 9Sept. from 114914 to 115836
HV: (600.0, 600.0, 600.0) V fixed
Beam sigma: (1.15, 2.85) mm - measured at 12:05:08
Beam charge: 25, 50 , 100, 200, 400 pC/train 10Hz 1.5GHz
Linear stage: (213.0, 1.5) mm - (203.0 today is 196.0 yesterday)
Dgt time scale: 10 ns/div
Notes: There is no Bergoz 10Hz charge information available for such a measurement,
therefore we have to rely on Timber data. Deposited charge is (68keV/22eV)*(d/110) * trainChg.

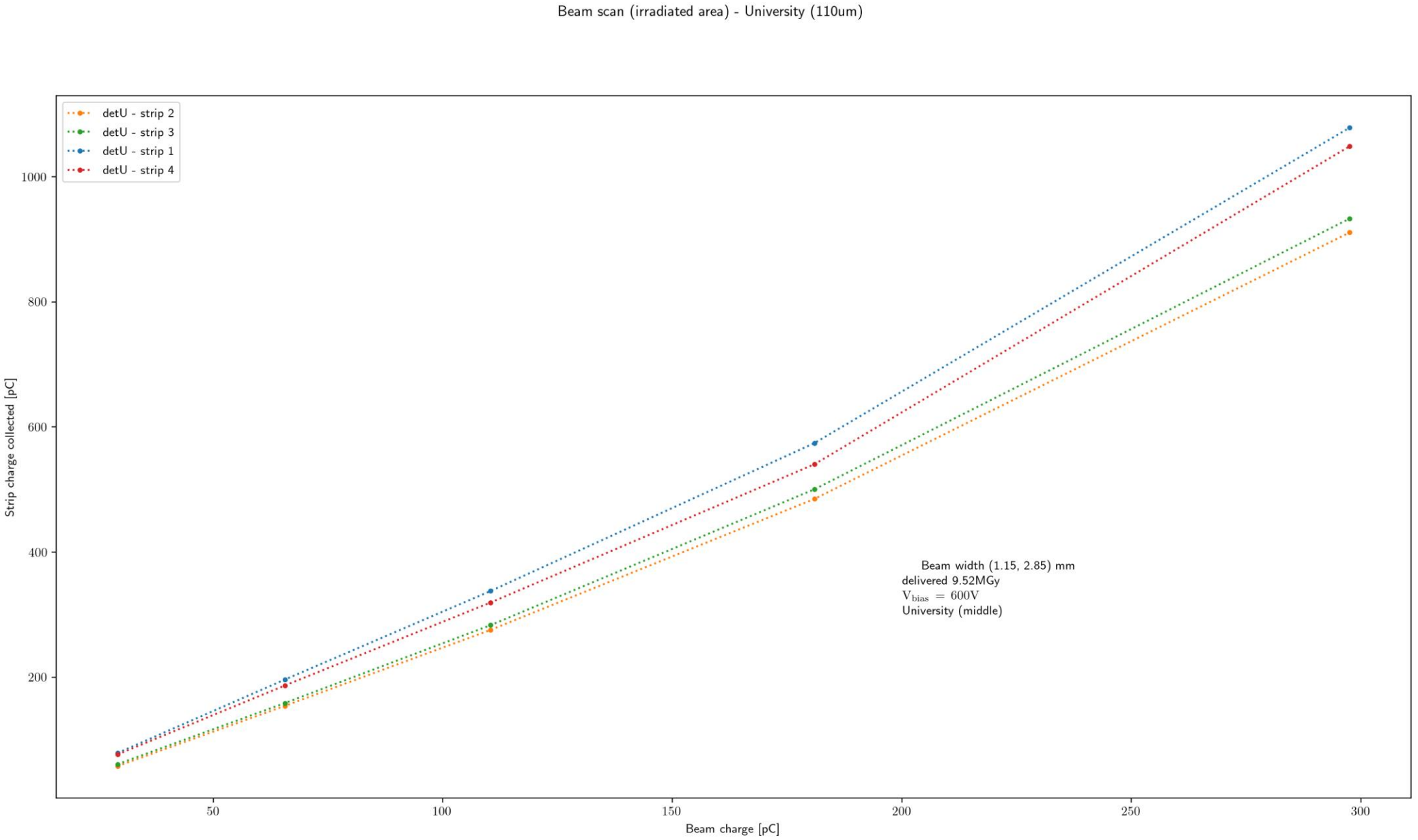
9 Sept. Beam charge in the irradiated area (forward bias)



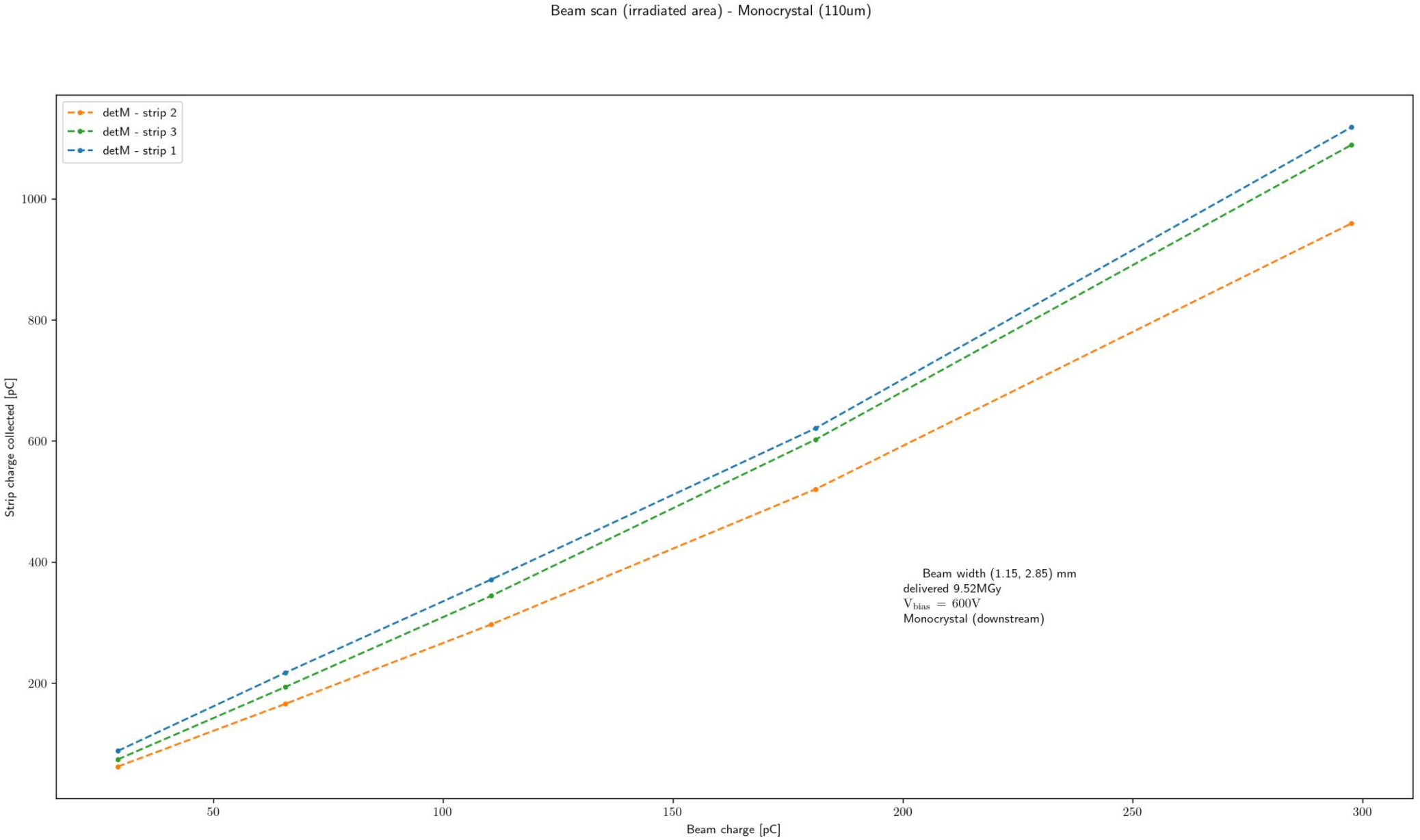
Beam scan (irradiated area) - Wuppertal (150um)



x=282.141 y=442.256



x=272.909 y=418.915



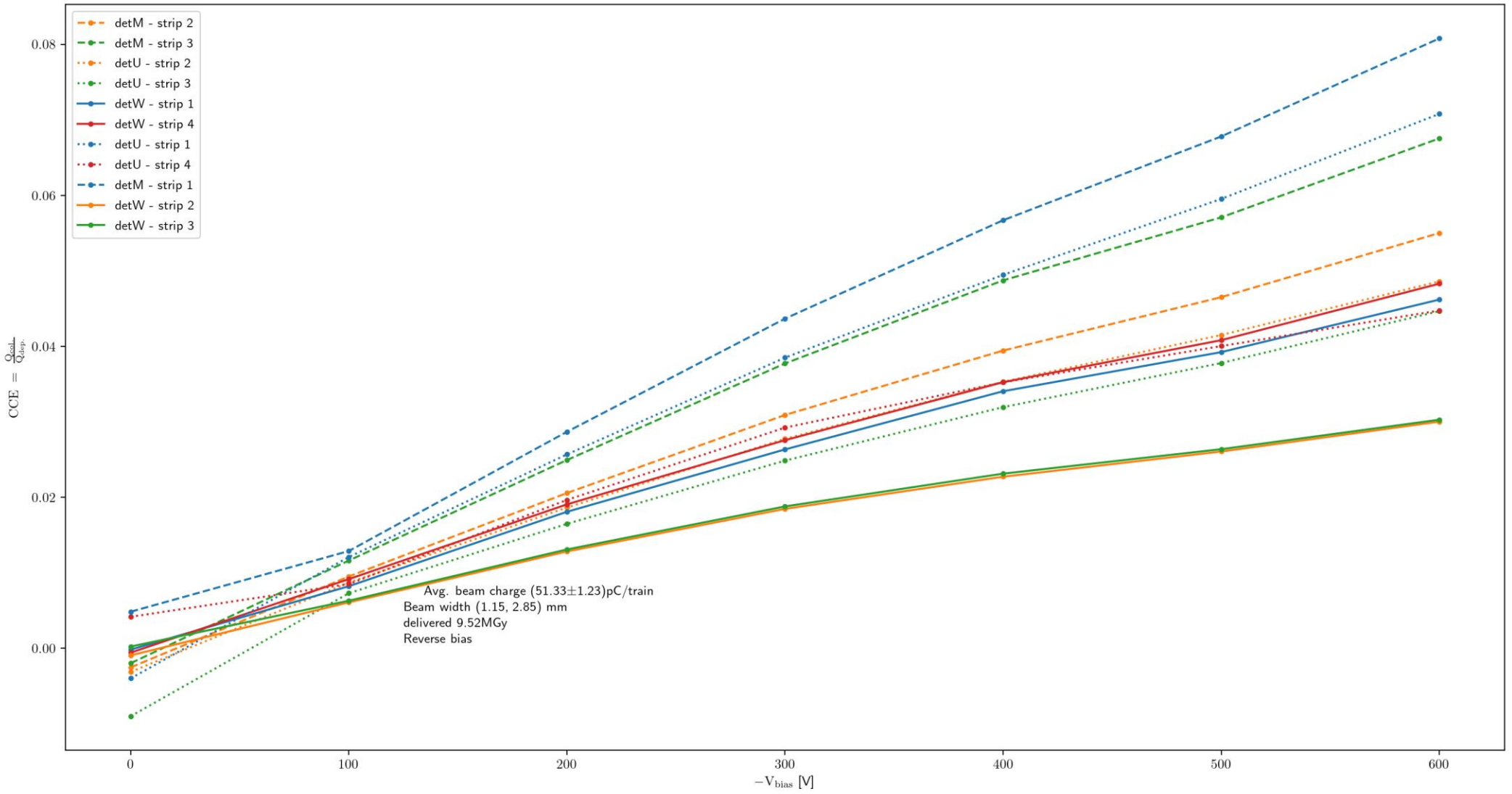
x=227.244 y=431.516

9 Sept.
CCE in the irradiated area (reverse bias)

Measure conditions

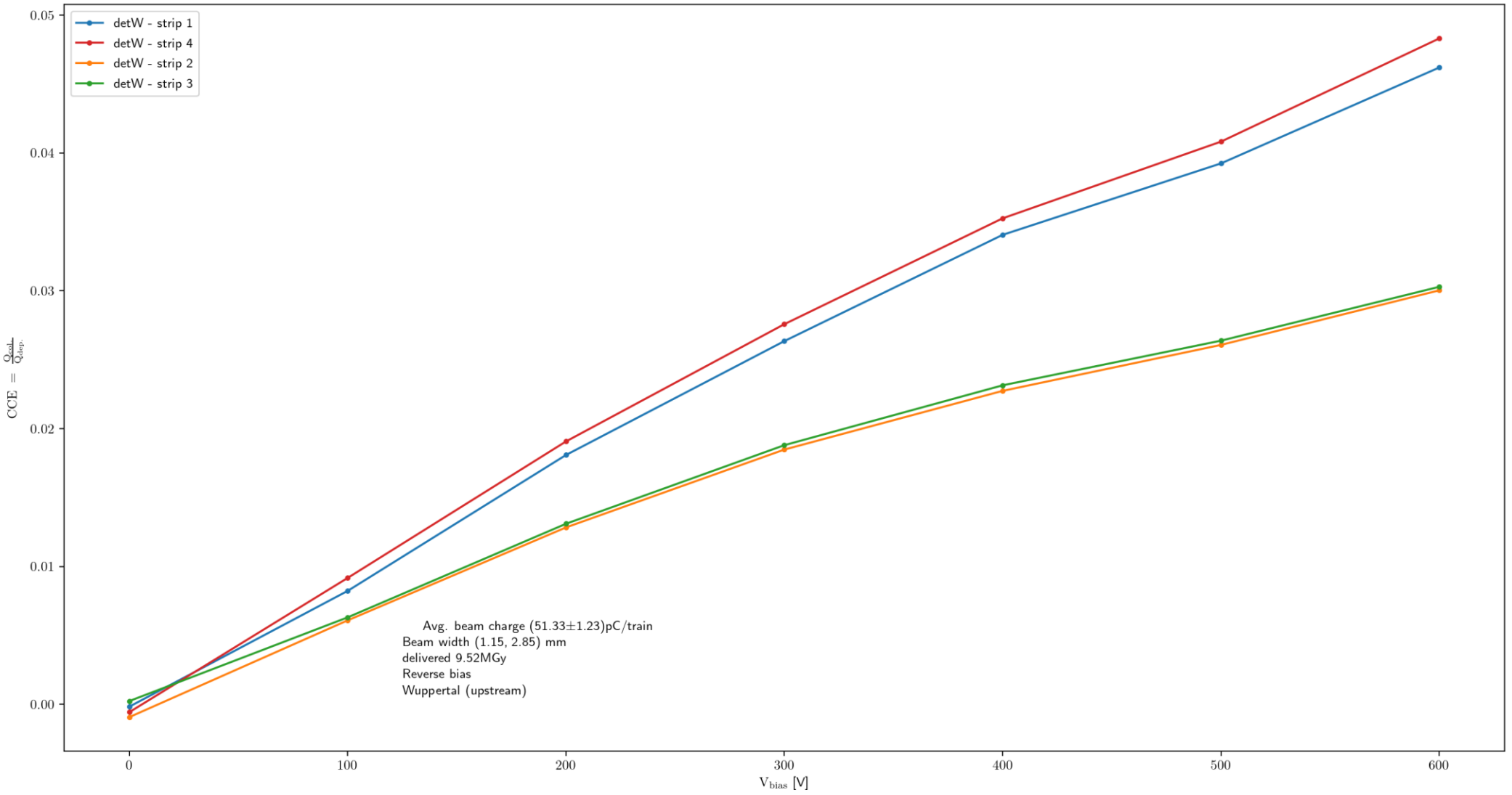
Title: Charge collection efficiency irradiated area 0-600V (reverse bias)
Description: CCE scan (reverse bias) in the HV from 0 to 600V in the irradiated area position with accumulated dose of \sim 9.52MGy.
Date: 9Sept. from 133534 to 141600
HV: variable from 0 to -600V
Beam sigma: (1.15, 2.85) mm - measured at 12:05:08
Beam charge: avg. 51.33 pC/train with 1 bunch/train 10Hz
Linear stage: (213.0, 1.5) mm - (203.0 today is 196.0 yesterday)
Dgt time scale: 10 ns/div
Notes: There is no Bergoz 10Hz charge information available for such a measurement: Timber data is used.

9 Sept. CCE in the irradiated area (reverse bias)



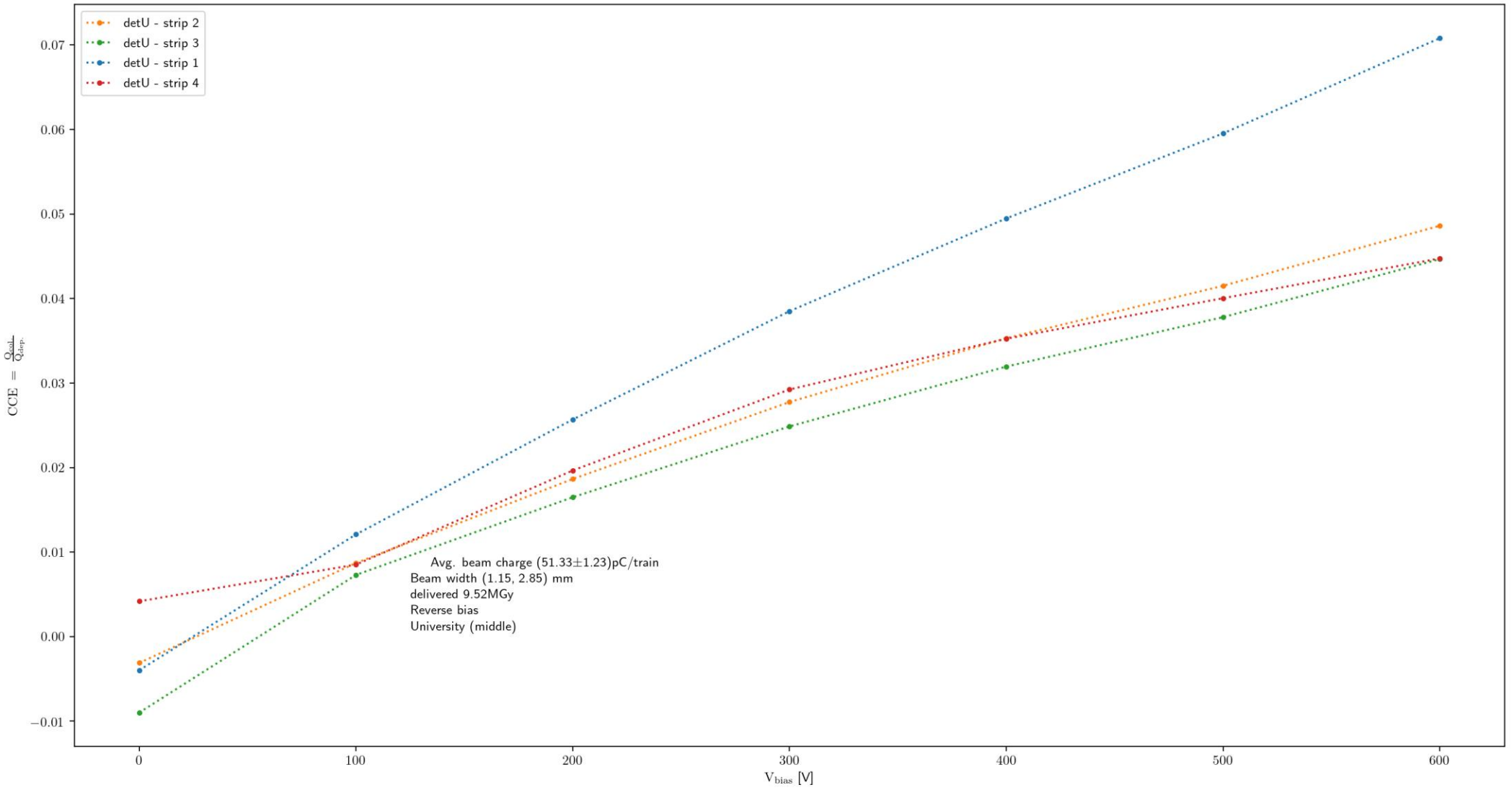
x=534.274 y=0.0153384

CCE vs. V (irradiated area) - Wuppertal (150um)

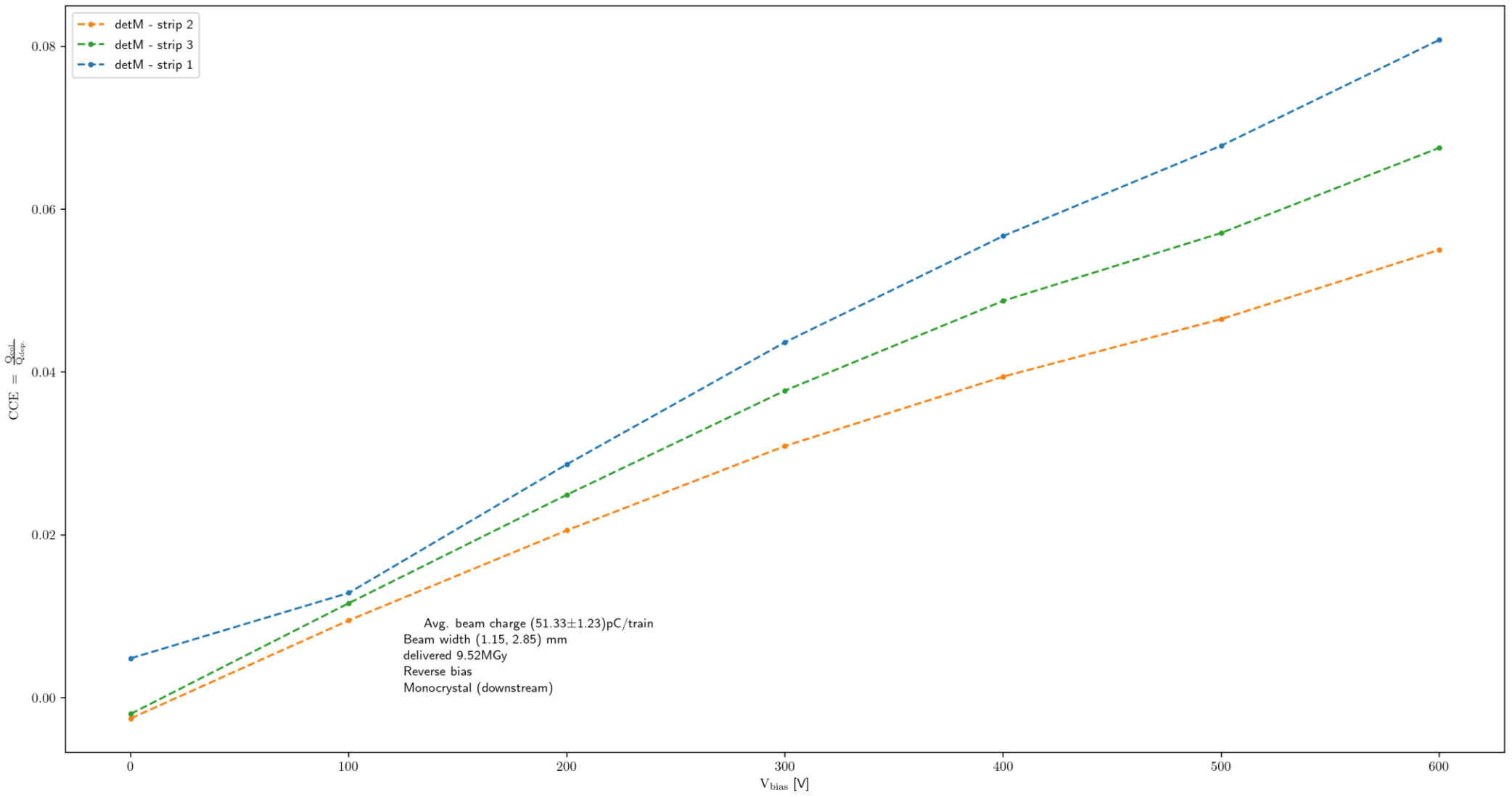


x=594.866 y=0.0248491

CCE vs. V (irradiated area) - University (110um)



x=447.492 y=0.0289136



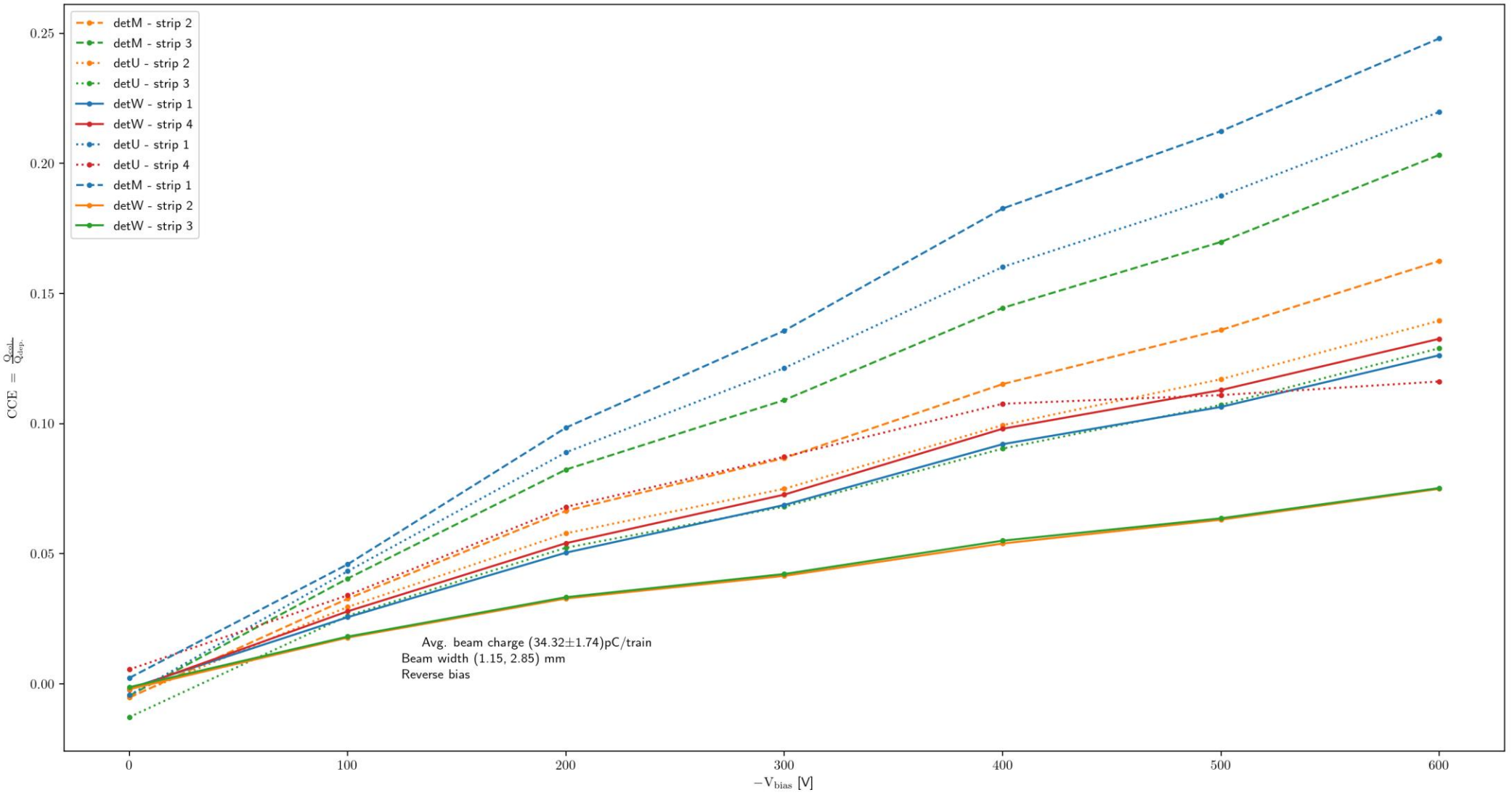
x=315.434 y=0.0223114

9 Sept.
CCE in the non-irradiated area (reverse bias)

Measure conditions

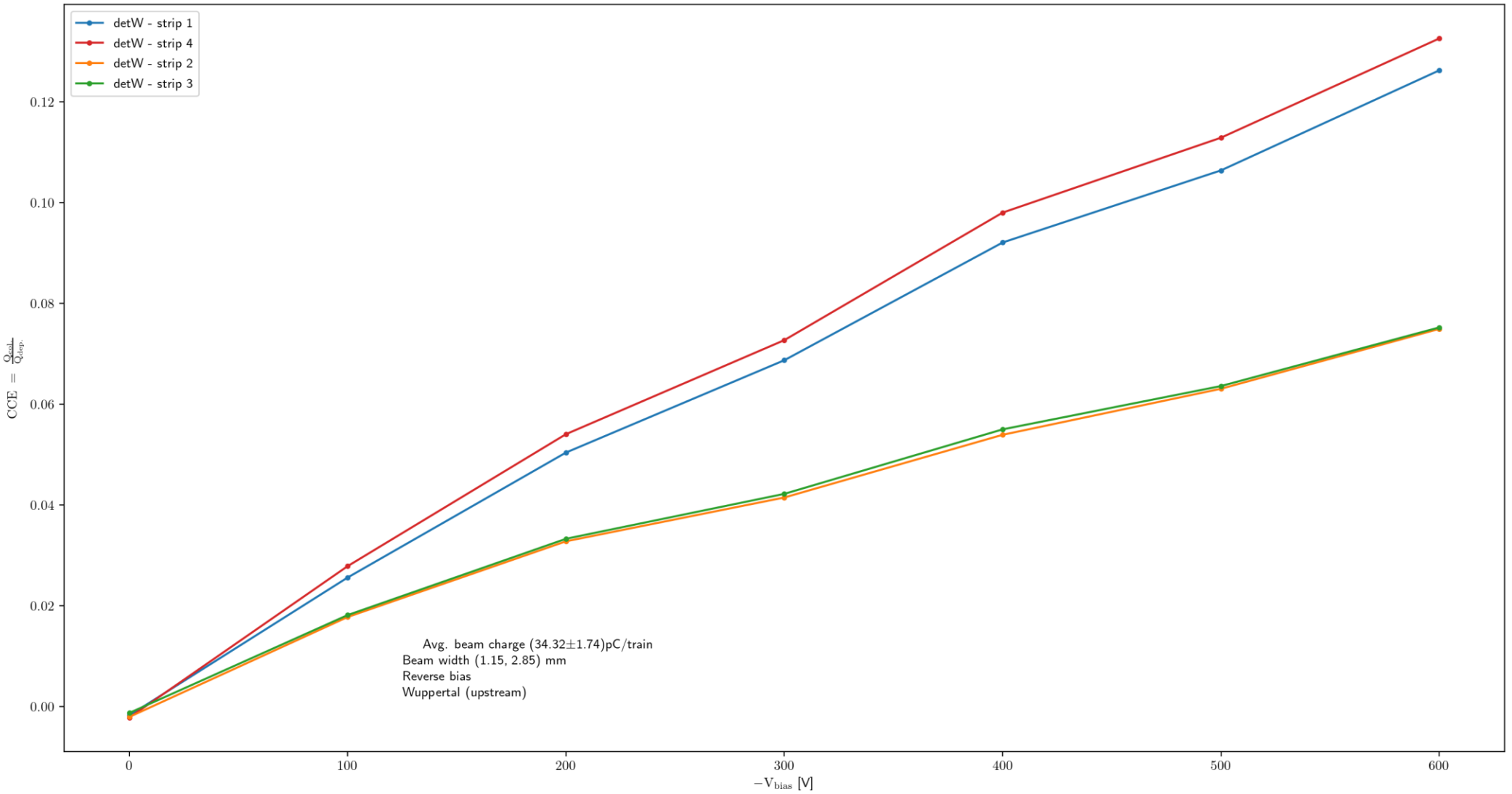
Title: Charge collection efficiency non-irradiated area 0-600V (reverse bias)
Description: CCE scan (reverse bias) in the HV from 0 to 600V in the non-irradiated area.
Date: 9Sept. from 141800 to 145300
HV: variable from 0 to -600V
Beam sigma: (1.15, 2.85) mm - measured at 12:05:08
Beam charge: avg. 34.32 pC/train with 1 bunch/train 10Hz
Linear stage: (219.0, 1.5) mm - (203.0 today is 196.0 yesterday)
Dgt time scale: 10 ns/div
Notes: There is no Bergoz 10Hz charge information available for such a measurement: Timber data is used.

9 Sept. CCE in the non-irradiated area (reverse bias)

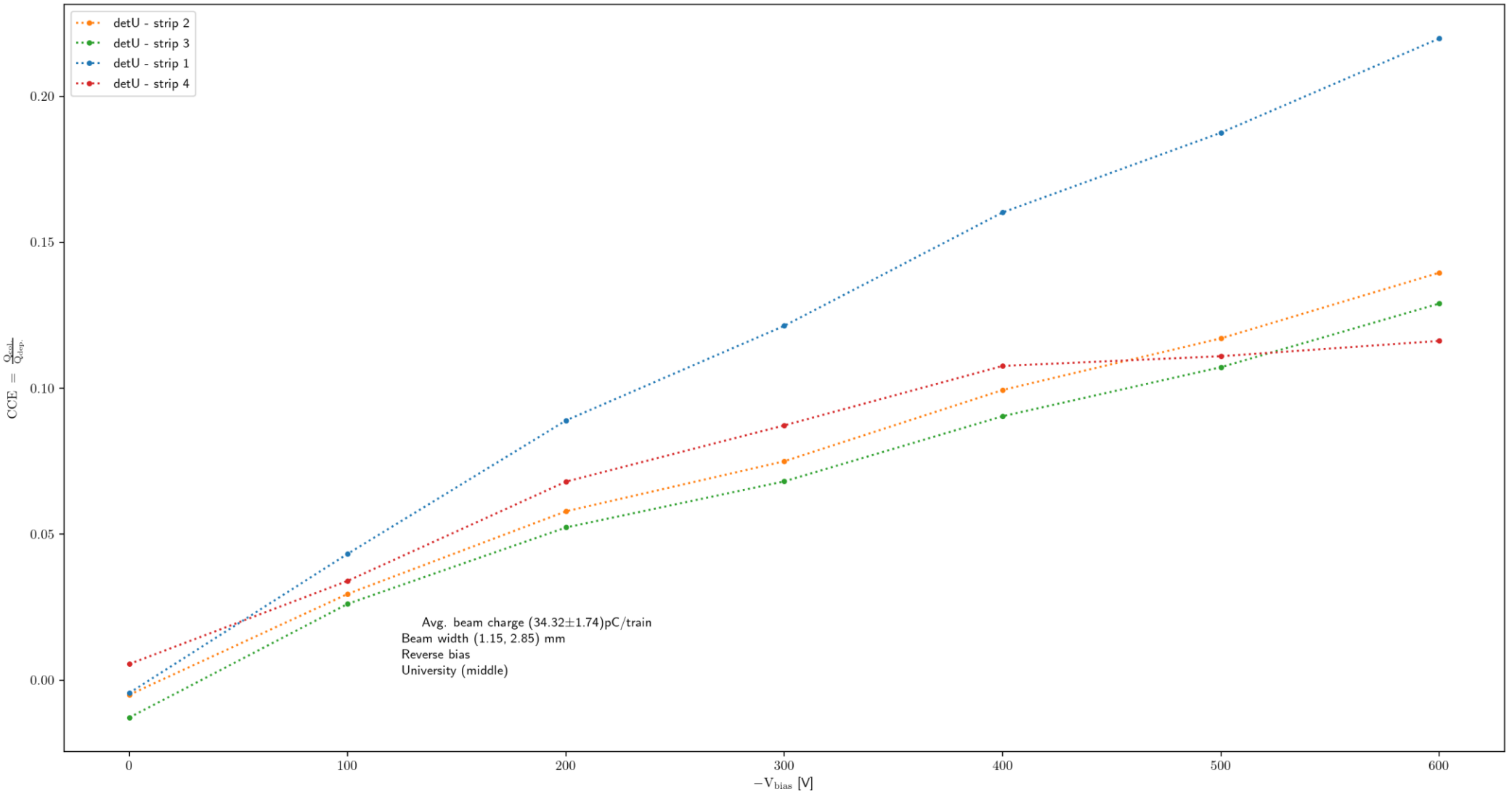


x=483.004 y=0.114475

CCE vs. V (non-irradiated area) - Wuppertal (150um)

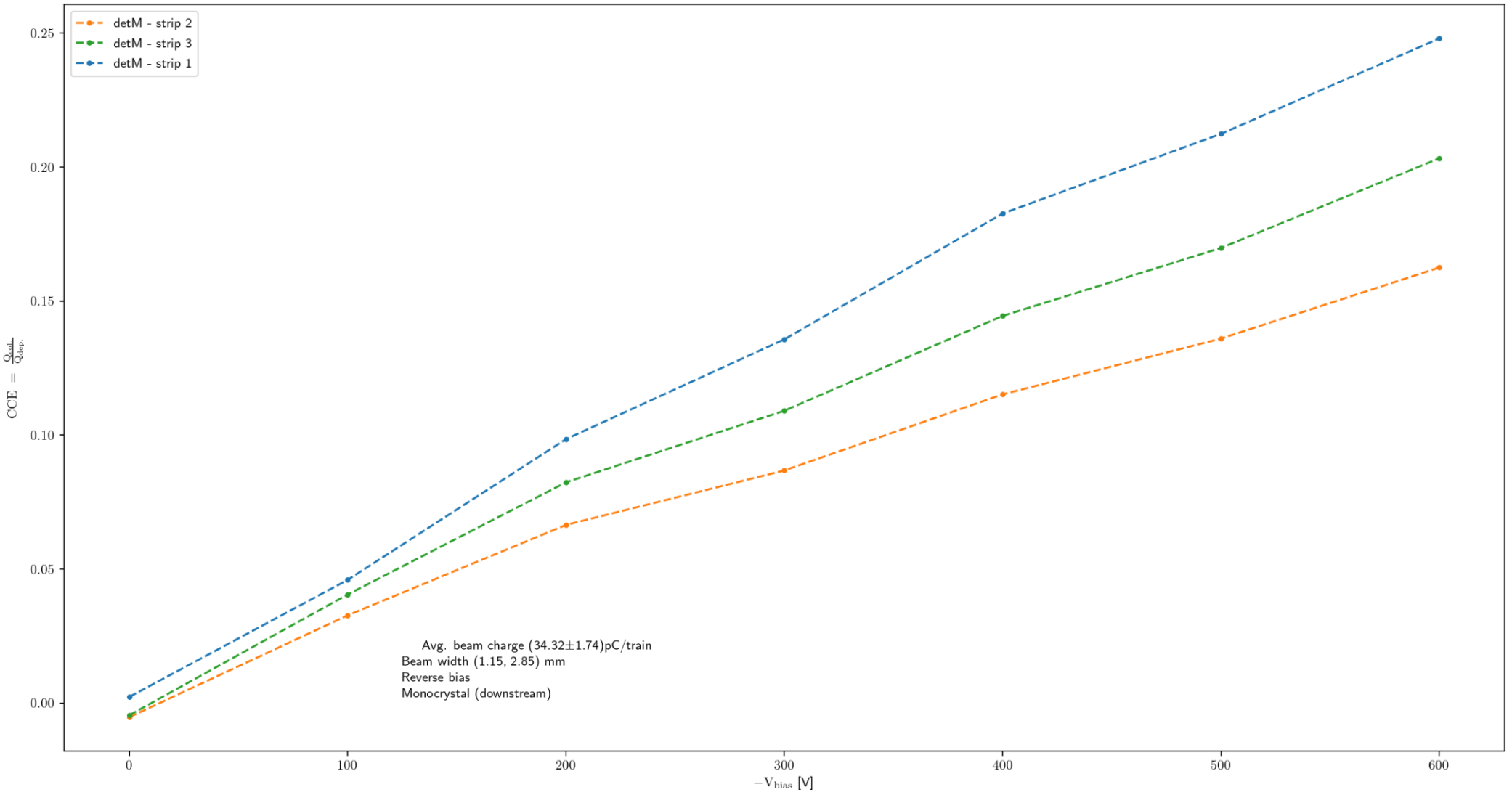


CCE vs. V (non-irradiated area) - University (110um)



x=328.529 y=0.056222

CCE vs. V (non-irradiated area) - Monocrystal (110um)



x=462.141 y=0.110184

9 Sept.
DUT response to beam charge irradiated area (rev. bias)

Measure conditions

Title: Beam charge scan rev. HV non-irradiated area
Description: Scan in the beam charge from about 100pC to 0pC in the non-irradiated area, keeping HV fixed to -400V
Date: 9Sept. from 150900 to 151937
HV: (-400, -400V, -400V)
Beam sigma: (1.15, 2.85) mm - measured at 12:05:08
Beam charge: variable from 75pC down to 0pC
Linear stage: (219.0, 1.5) mm - (203.0 today is 196.0 yesterday)
Dgt time scale: 10 ns/div
Notes: Beam charge data is recorded at 10Hz for such a measure

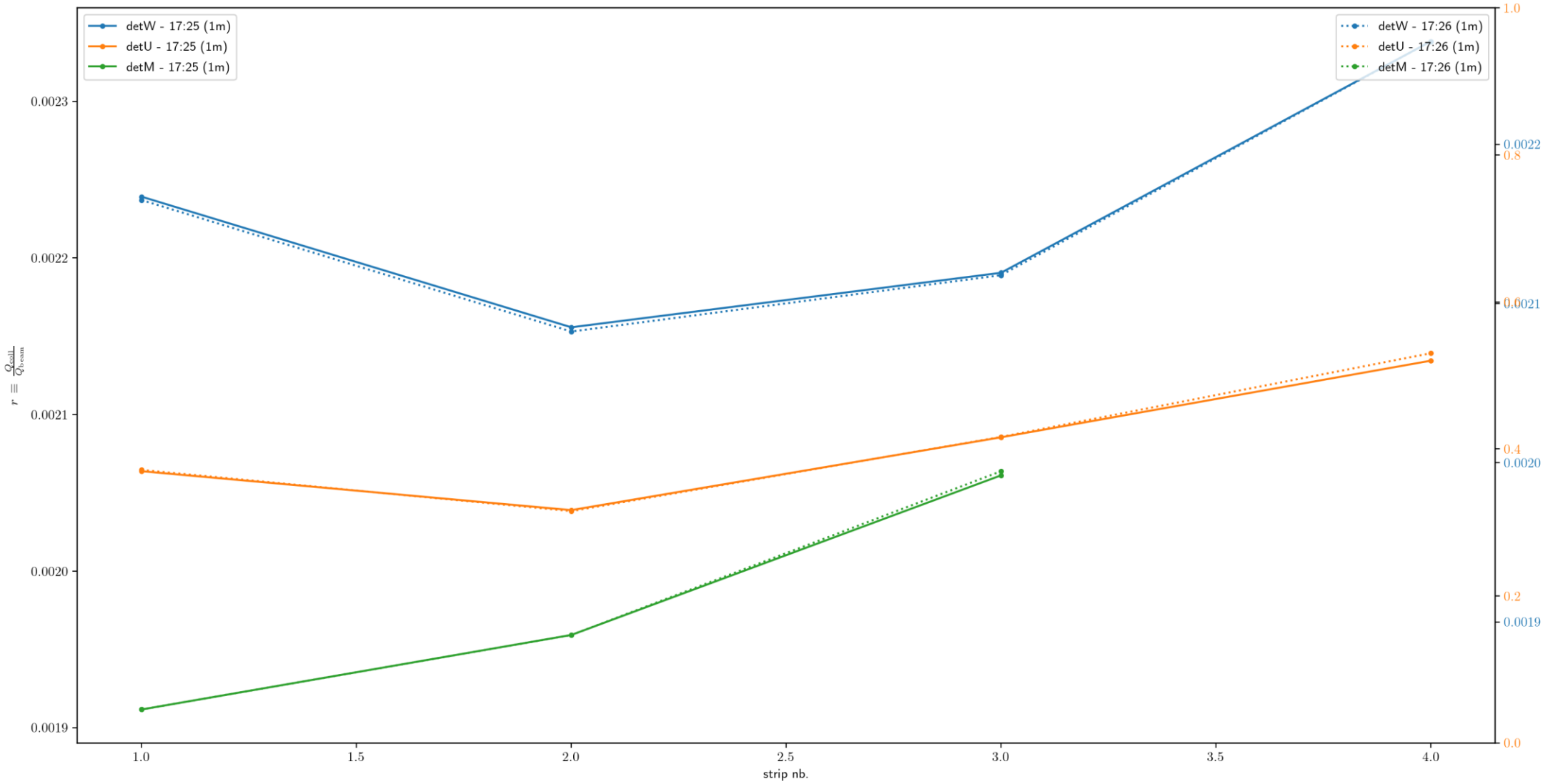
9 Sept. DUT response to beam charge irradiated area (rev. bias)

TODO

- Look for _wip_analyze9Sept_BeamChgScanIrradAreaREVBias (line 7528) and implement it.

extra

plotAllDay_Profile



x=2.67964 y=0.31791

Python script changelog

1. Fixed offset in PSU synchronization
2. d