PITZ Run Coordination

2024 (Weeks 19/20)

X.-K. Li

23.05.2024

Run weeks 19-20

Status 20.05.2024

to do:	Run						
Week 20	Mon May-13	Tue May-14	Wed May-15	Thu May-16	Fri May-17	Sat May-18	Sun May-19
Morn. 07:00 to 15:30	Gross Amirkhanyan	Li Amirkhanyan	Vashchenko Kalantaryan	Vashchenko Kalantaryan	Krasilnikov Kalantaryan	Krasilnikov Zeeshan	Krasilnikov Zeeshan
Late 15:00 to 23:30	Krasilnikov Zeeshan	Gross Zeeshan	Hoffmann Amirkhanyan	Li Lotfi	Dmitriiev Lotfi	Gross Amirkhanyan	Gross Amirkhanyan
Night 23:00 to 07:30	Dmitriiev Kalantaryan	Aftab Riemer	Aftab Riemer	Hoffmann Villani	Hoffmann Villani	Vashchenko Good	Vashchenko Good

Slice & Proj. emittance characterization

THz Diag

SASE 2 nC Pyro & Diag

DLW 1 nC

~~SASE 2 nC, 60 um~~

Cont. slice emittance

Gun 5

Fine QE map

to do:	Run						
Week 20	Mon May-13	Tue May-14	Wed May-15	Thu May-16	Fri May-17	Sat May-18	Sun May-19
Morn. 07:00 to 15:30	Gross Amirkhanyan	Li Amirkhanyan	Vashchenko Kalantaryan	Vashchenko Kalantaryan	Krasilnikov Kalantaryan	Krasilnikov Zeeshan	Krasilnikov Zeeshan
Late 15:00 to 23:30	Krasilnikov Zeeshan	Gross Zeeshan	Hoffmann Amirkhanyan	Li Lotfi	Dmitriiev Lotfi	Gross Amirkhanyan	Gross Amirkhanyan
Night 23:00 to 07:30	Dmitriiev Kalantaryan	Aftab Riemer	Aftab Riemer	Hoffmann Villani	Hoffmann Villani	Vashchenko Good	Vashchenko Good

Slice & Proj. emittance characterization

SASE 2 nC Recovery

THz Cam

THz MIR

THz Camera

THz MIR

DLW 1 nC

Cont. slice emittance

Gun 5 QE map

Progress

- Finished slice emittance program at two laser pulse lengths (8 ps and 6 ps, stretched Pharos)
- THz camera was commissioned and images were taken (vs focusing, SCCs, polarizer)
- THz Michelson interferometer was commissioned, “resonance” was observed but cannot be repeated later, maybe due to the unstable lasing
- THz DLW program was finished: beam transport and characterization, radiation energy optimized without DLW because the beam position/distribution fluctuated a lot once the DLW was inserted
- Gun resonance studies finished
- E beams were produced with a rotational slit in the laser beamline
- QE measured at various BSAs and detailed QE map done

Problems

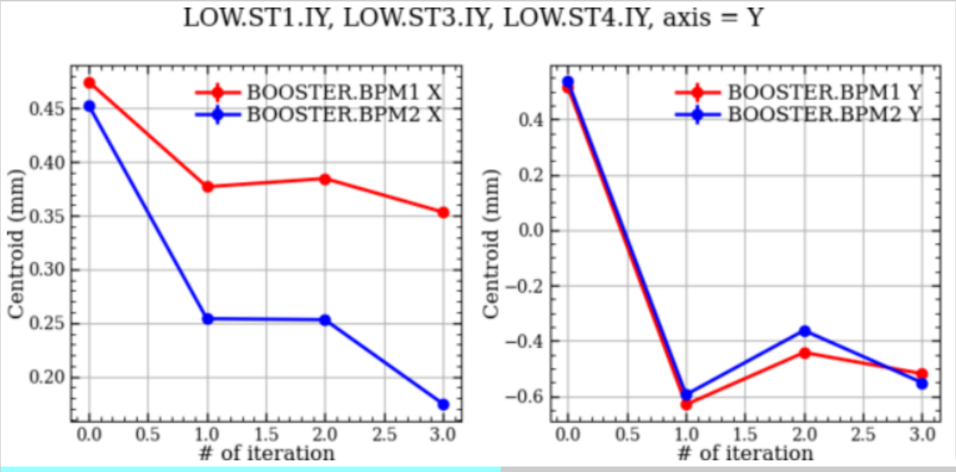
- Gun and booster ILs (Booster ILs: ~6 times; Booster+gun ILs: ~3 times)
- Tunnel 2 access not working → fixed by GV (caused by access rights issues (caused by HH))
- Gain curve measurements stops with an error: NoP address set for NEPAL → worked later
- MIR script ran very slowly, motor position readback took too long (refreshed every 3s)
- Many spikes observed in the spectrum (FFT of MIR data): alignment or unstable beam
- Beam trajectory changed frequently with DLW inserted
- VC2 camera setting not good, changed by chance by someone?
- Bucking solenoid current was off since about 10:30am Saturday; was switched on at the beginning late shift
- Laser drifted by unknown reason while preparing the slit
- Ran out of SLEM space on afs - Grygorii increased allocation
- High1Q5 was not degaused but zero from night shift (may be degaussing procedure did this)
- BSA goes to wrong diameter when going in small steps

Working week 19-20

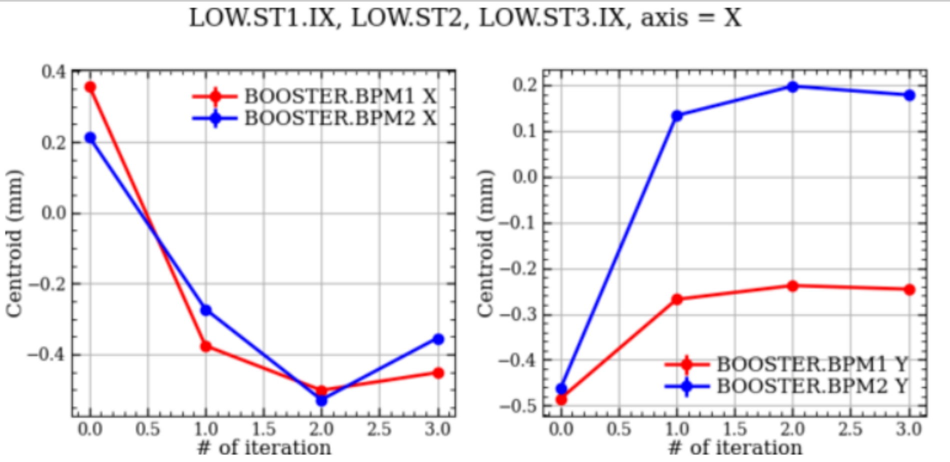
Low section trajectory studies

To set the desired position different than [0;0] at both axis one needs to make several iterations.

12.05.2024 06:51 D.Dmytriiev, D.Kalantaryan **Goal = [-0.5;-0.5] in Y**

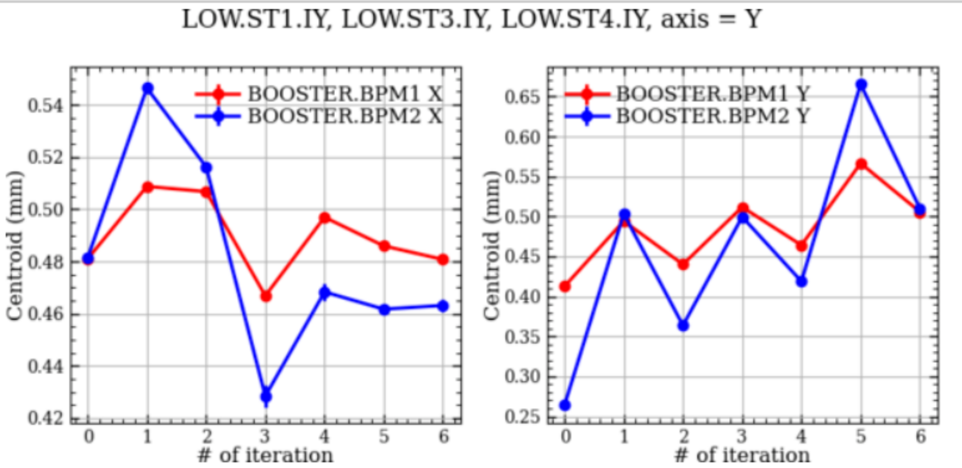


12.05.2024 06:53 D.Dmytriiev, D.Kalantaryan **Goal = [-0.5;-0.5] in X**

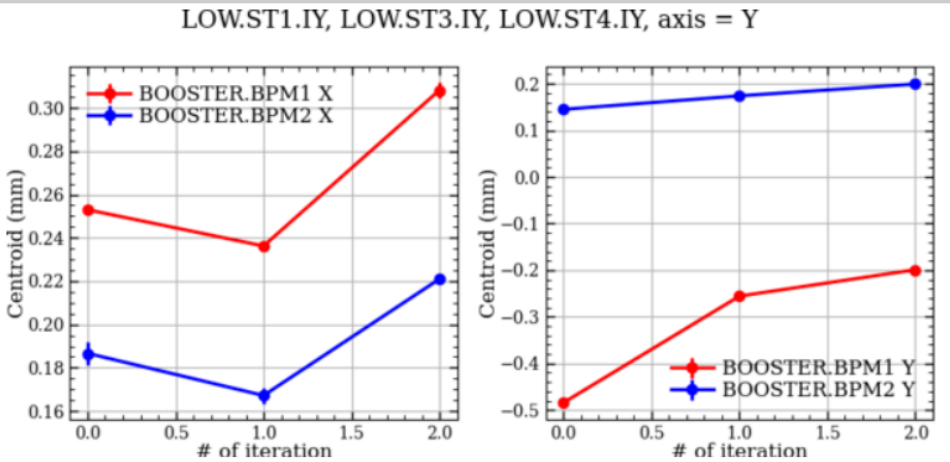


D. Dmytriiev

12.05.2024 06:49 D.Dmytriiev, D.Kalantaryan **Goal = [0.5;0.5] at X and Y at both BPMs**



12.05.2024 05:33 D.Dmytriiev, D.Kalantaryan **Goal = [-0.2;0.2]**



S. Zeeshan

Emittance Measurements May 2024 (week 20)

Planned

- Laser: Gaussian, (6, 8) ps
- Slice Emittance & Projected Emittance
- Solenoid scan for each BSA
- (BSA: 0.9, 1.0, 1.1, 1.5, 1.6, 1.7) to observe the two minima's as per simulation

Completed

- Laser: Gaussian, (6, 8) ps
- Slice Emittance & Projected Emittance
- Solenoid scan for each BSA for Slice Emittance
- Solenoid scan for Projected Emittance is done for 6 ps
- (BSA: 0.9, 1.0, 1.1,
- 1.3, 1.5)

Results

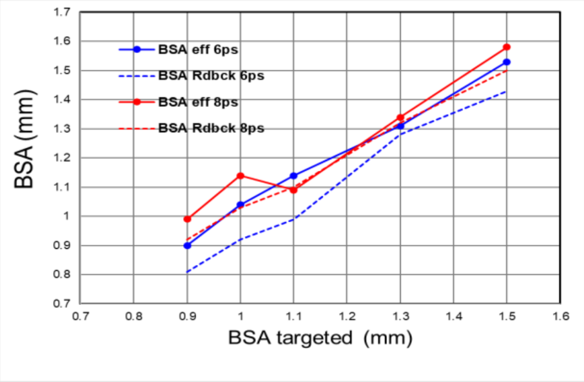
- **Gaussian 6ps**
  - Min Slice Xemit for 6ps : 0.490 @ 1.1 mm BSA
  - Min Projected Xemit for 6 ps (SES): 0.507 @ 0.9 mm BSA
  - Min Proj XYemit for 6ps (FS)

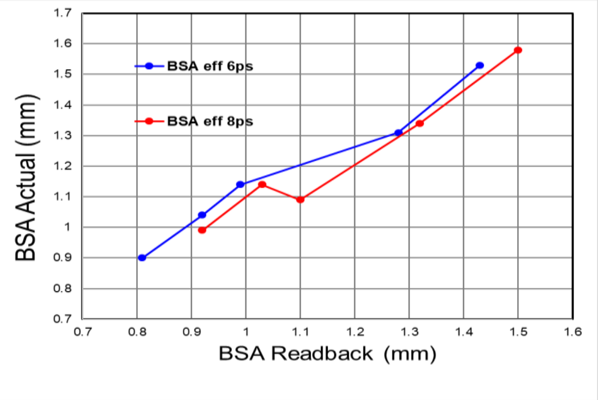
    : 0.727 @ 1.0 mm BSA(scaled)

    : 0.549 @ 1.0 mm BSA(nonscaled)
- **Gaussian 8.5 ps**
  - Min Slice Xemit for 8ps : 0.540 @ 0.9 mm BSA
  - Min Projected Xemit for 6 ps (SES): 0.590 @ 0.9 mm BSA
  - Min Proj XYemit for 6ps (FS)

    : 0. 761 @ 1.0 mm BSA(scale)

    : 0.600 @ 1.0 mm





Difficulties

- TDs measurement for 6ps settings was missing, after changing from 8.5ps
- BSA's readback and effective number calculated from 4*sqrt(xrms*yrms) is different, (for 8.5ps data set)
- GunQuads optimization is critical for emittance measurement as we observed emittance higher numbers without gun quads (8.5 ps data set)
- Booster Interlock changed/increased the emittance (8.5 ps, 1.5 BSA)
- Nonscaled Projected emittance from Slice Emittance tool and fast scan tool are different

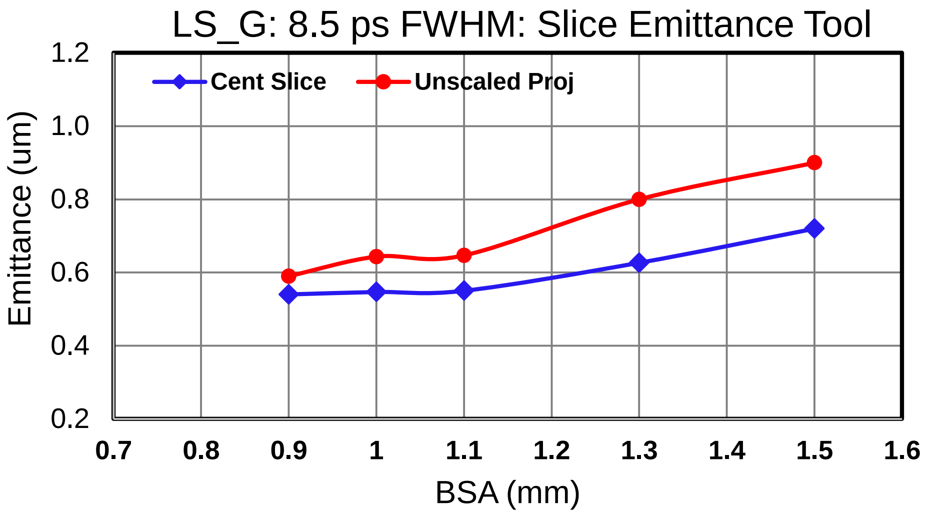
Next Steps

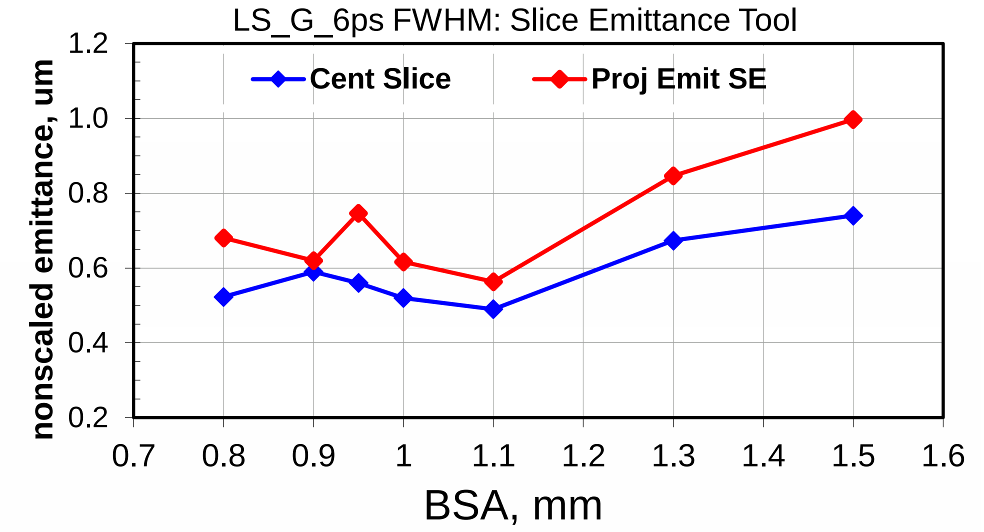
- 8.5 ps may be repeated with BSA set as per its effective value
- Emittance for 10 ps FWHM
- CoreHalo analysis to see the reason of higher emittance with longer laser pulses

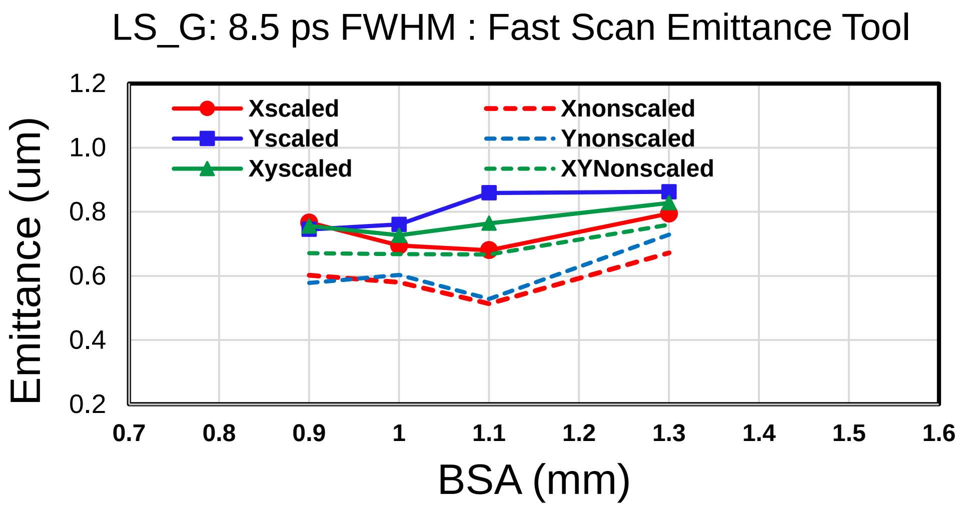
S. Zeeshan

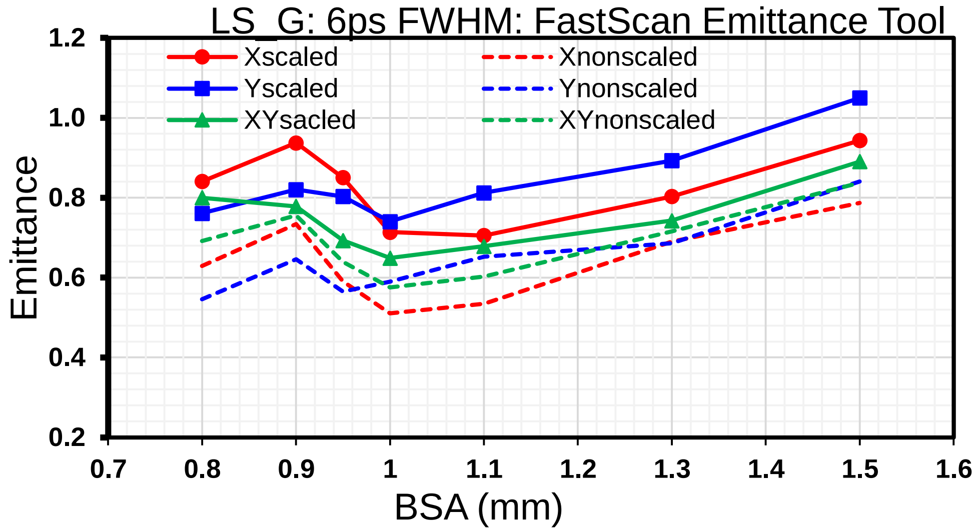
Summary

Optimized Solenoid Emittance vs BSA







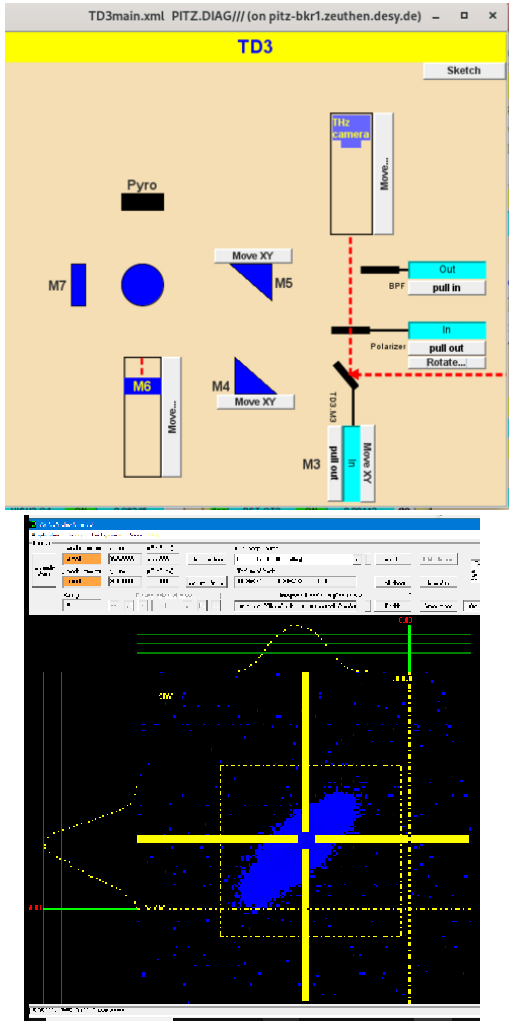


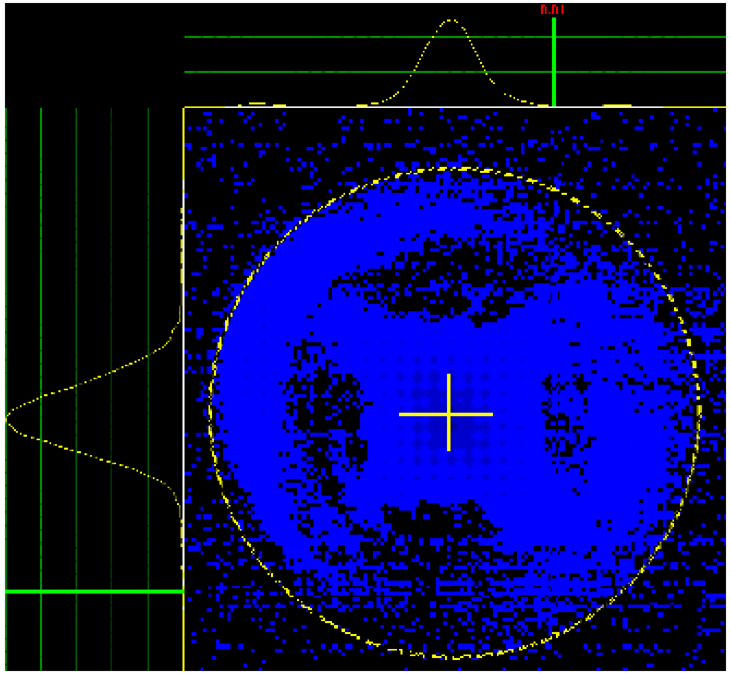
M. Krasilnikov

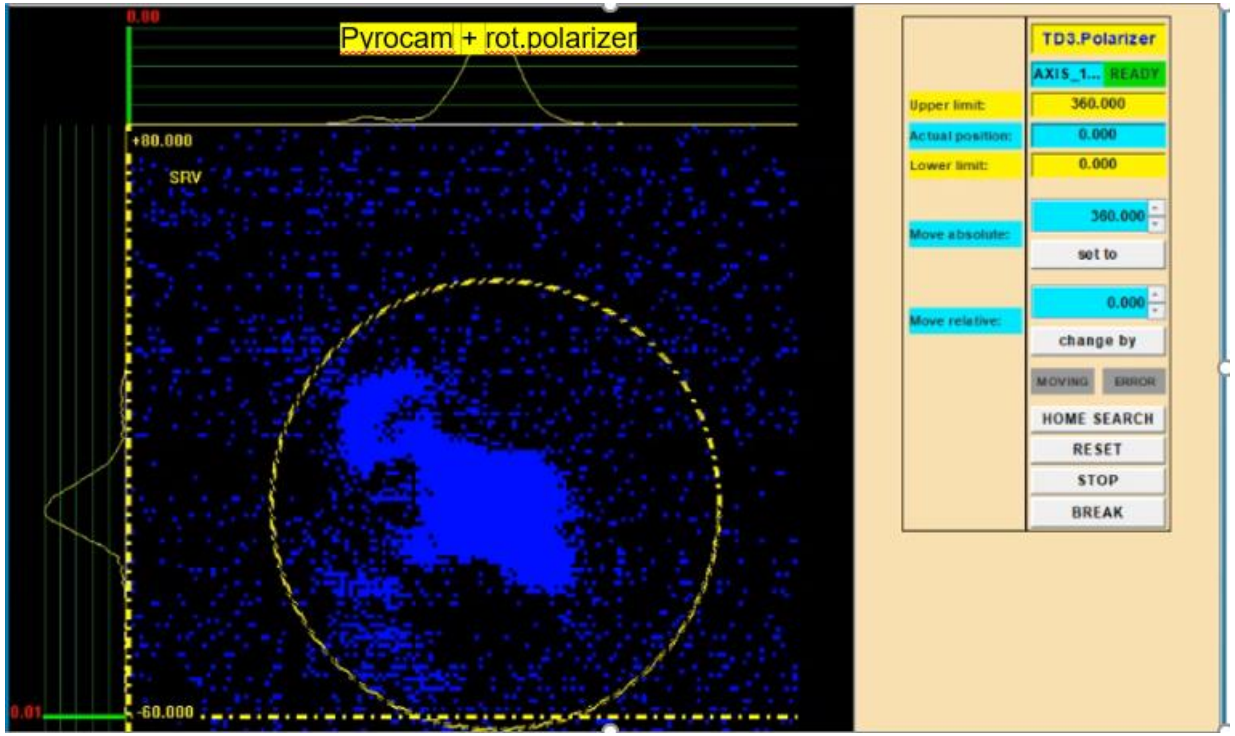
First images with THz camera

22.05.2024

- **THz:** 2nC Gaussian e-beam: Michelson Interferometry, first images with **Pyrocam**





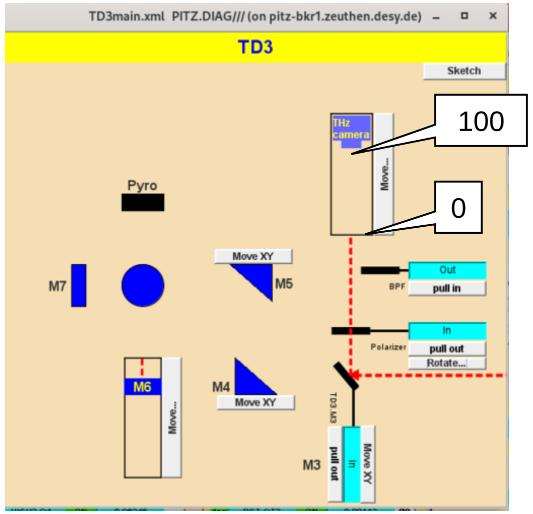


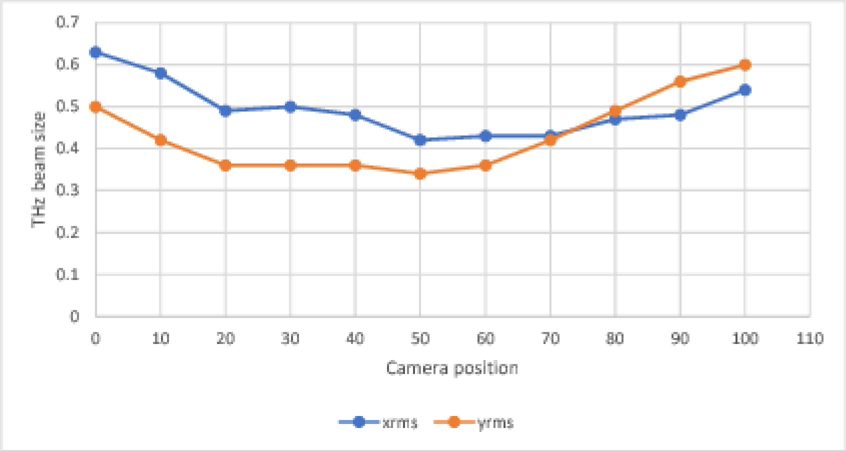
M. Krasilnikov

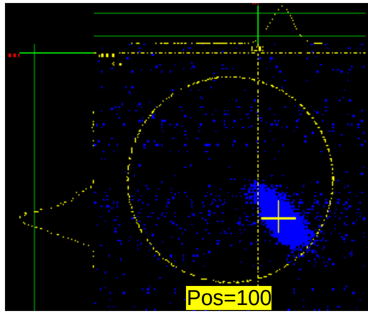
Images with THz camera vs camera position

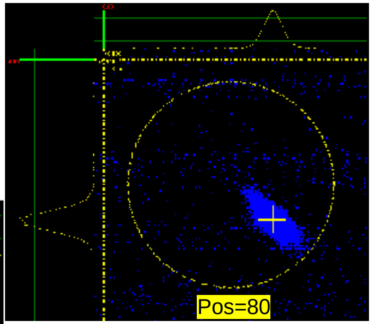
15.05.2024N

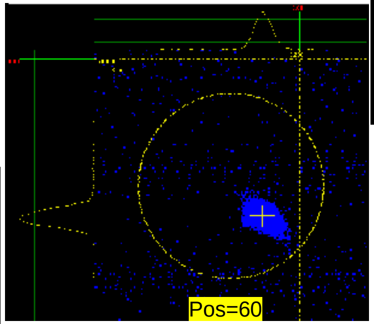
- **THz:** 2nC Gaussian e-beam: Michelson Interferometry, first images with **Pyrocam**

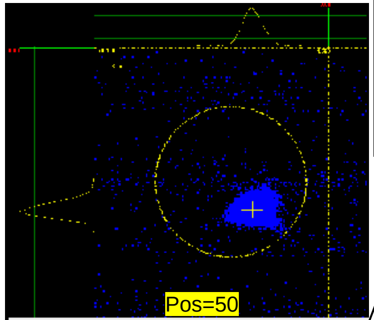


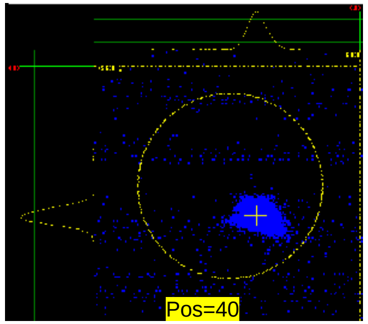


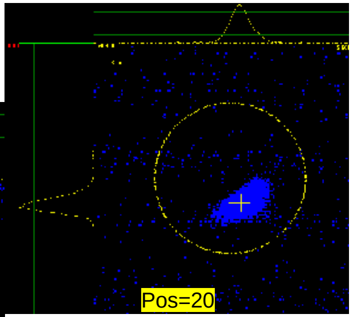


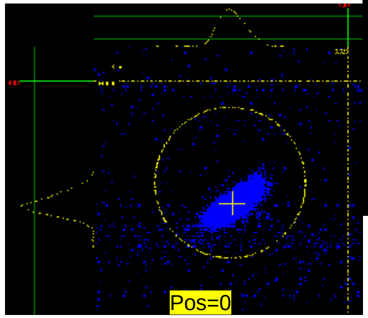




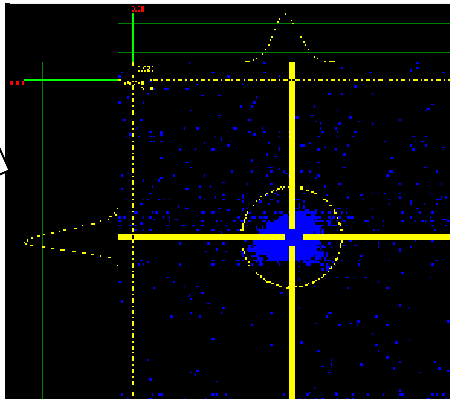








centered



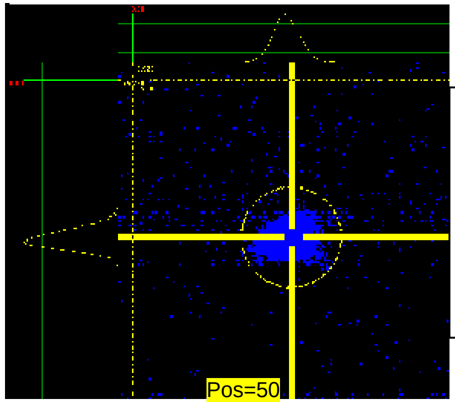
In-vacuum mirror at TD2 was inserted

M. Krasilnikov

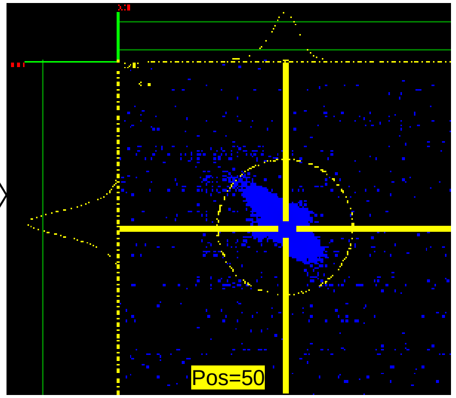
Images with THz camera vs camera position

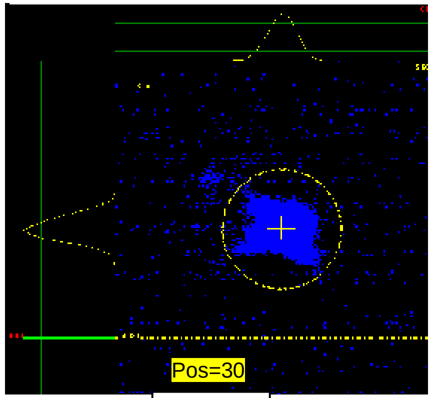
15.05.2024N

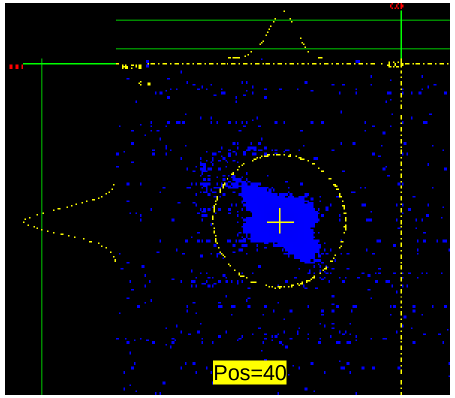
- **THz:** 2nC Gaussian e-beam: Michelson Interferometry, first images with **Pyrocam**

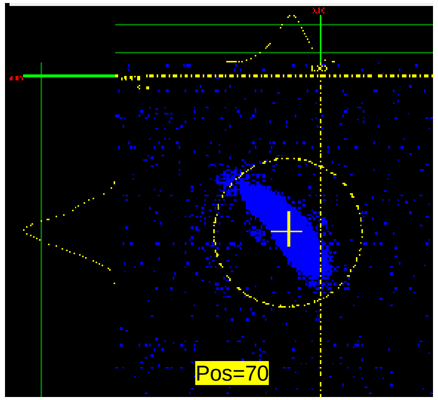


In-vacuum mirror at TD2 removed









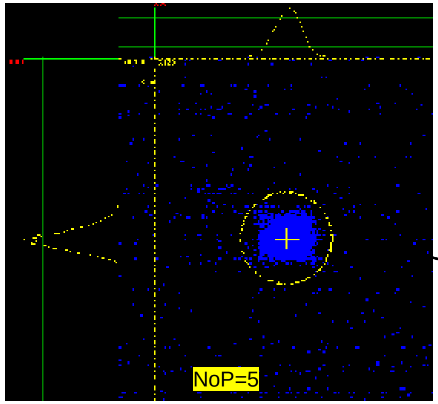
For gain curve

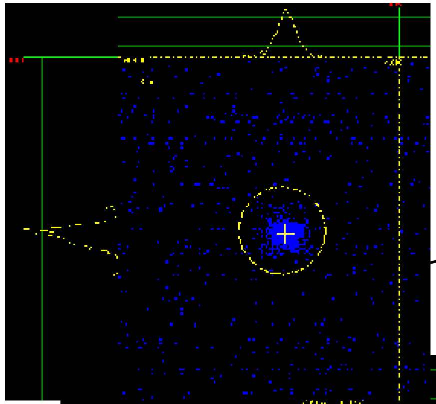
M. Krasilnikov

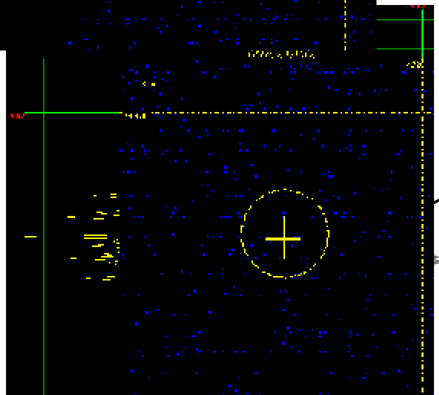
Images with THz camera along gain curve

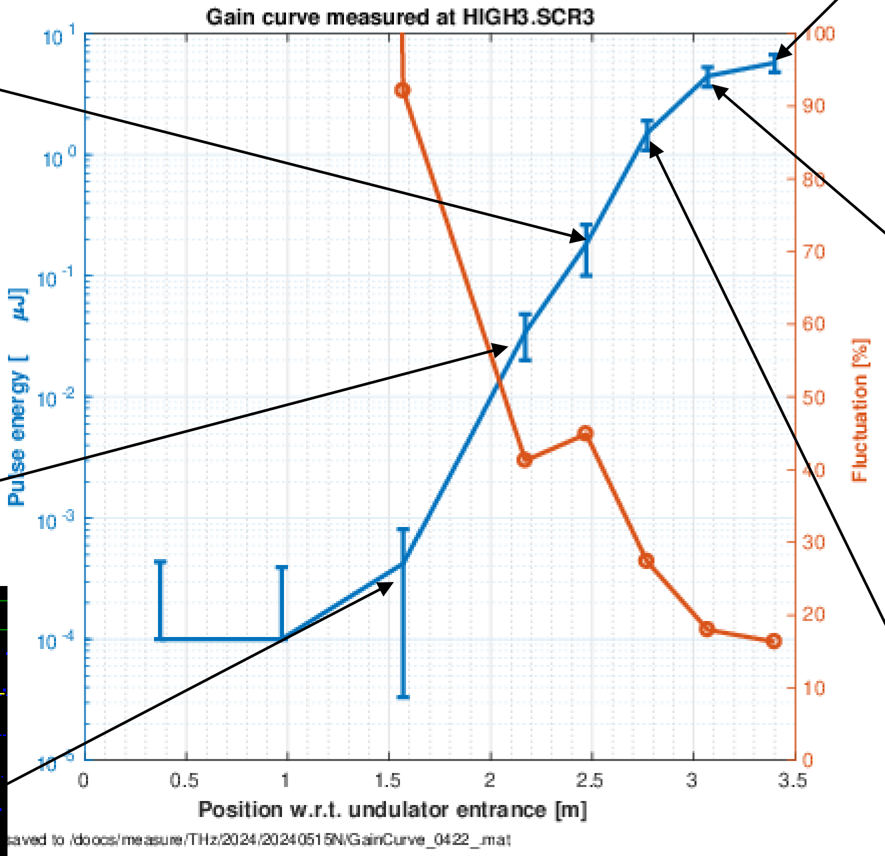
15.05.2024N

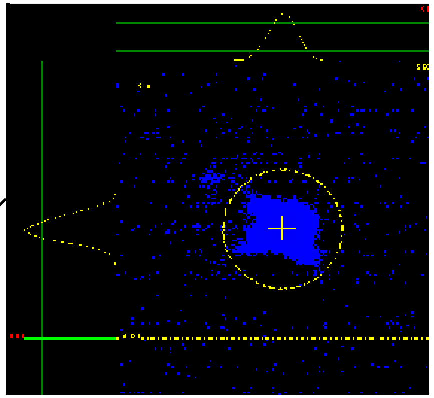
- **THz:** 2nC Gaussian e-beam: Michelson Interferometry, first images with **Pyrocam**

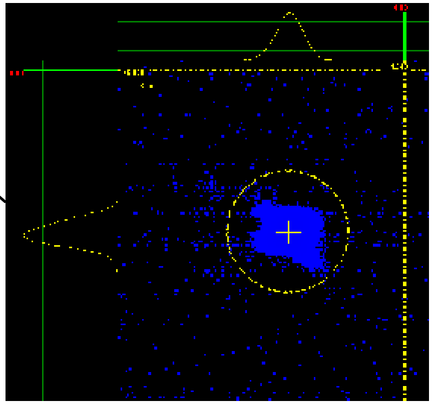


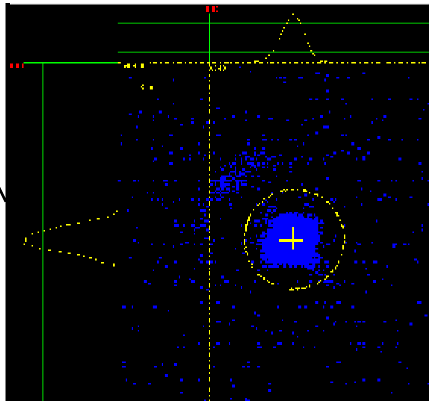




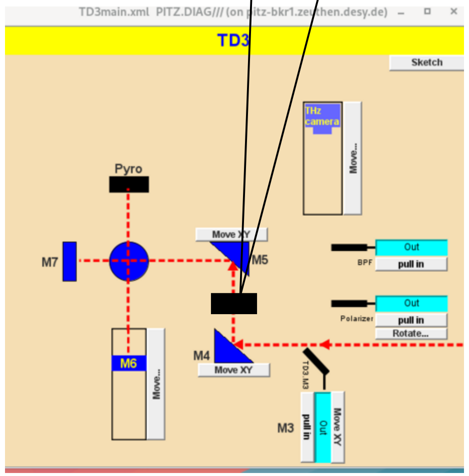








Pyrodetector used for the gain curve

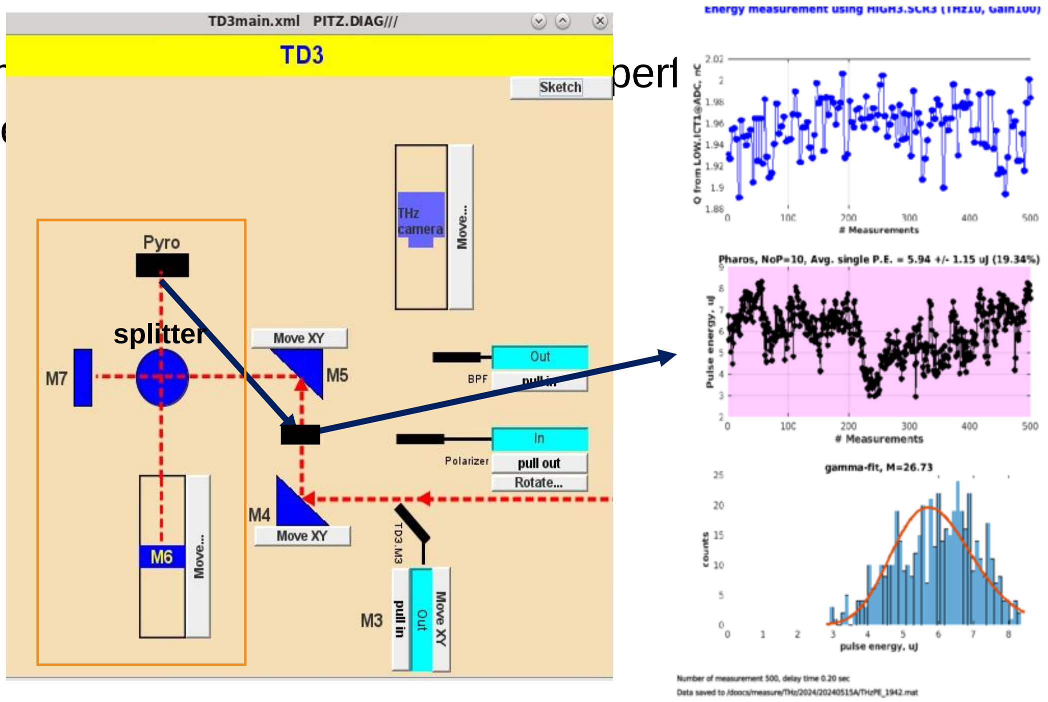


N. Aftab

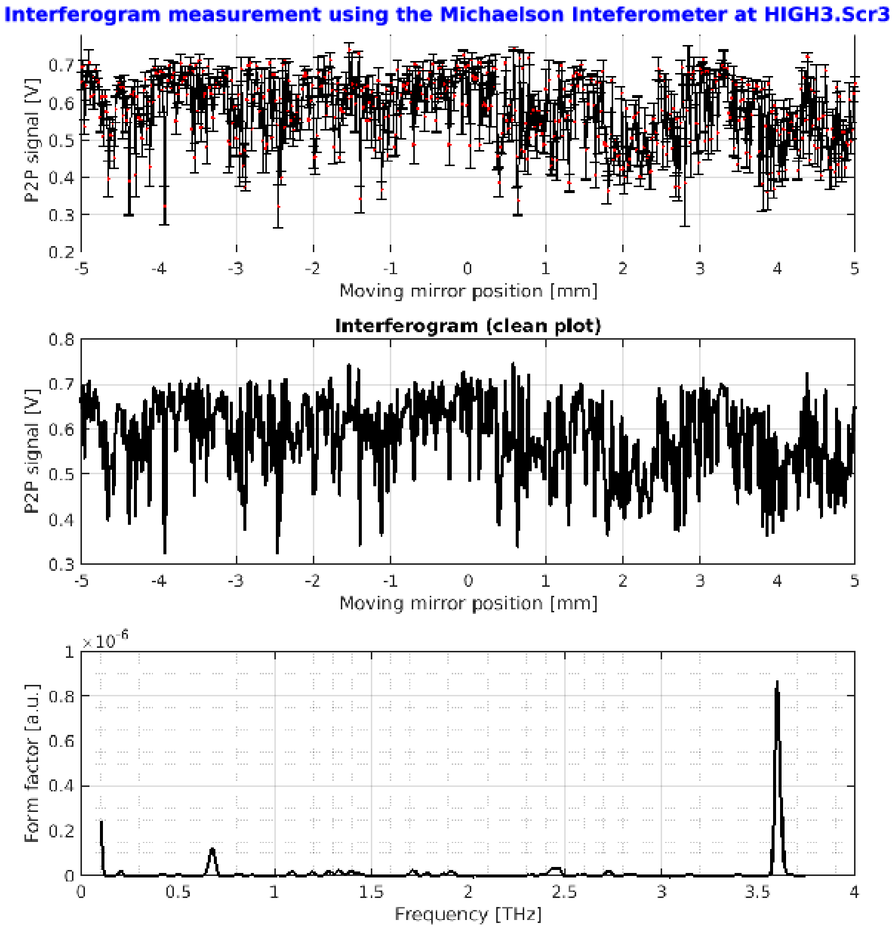
Michelson InterFerometer (MIF)

Setup and results

- Beam charge 2.4nC , Signal at High3.Scr2 ~20uJ
- During shut down pyro placed between M4 and M5 → measured 5 uJ
- **16.05.2024A** installed pyro detector after MIF & optimized M4 and M5 for higher THz transmission to MIF (Bayesian optimizer) -> 0.5 uJ
- Im perf per st



Measured spectrum with MIF, step 0.02, resonant frequency ~ 3.7*20/26 = 2.8 THz, single spike

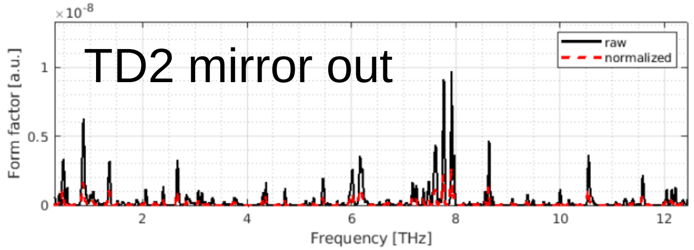


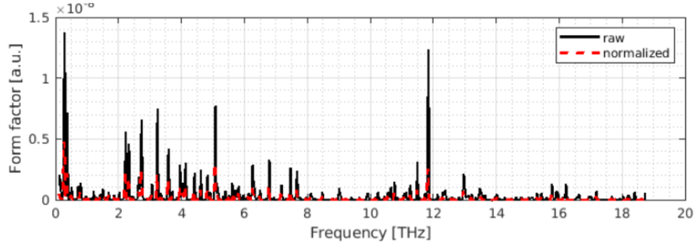
N. Aftab

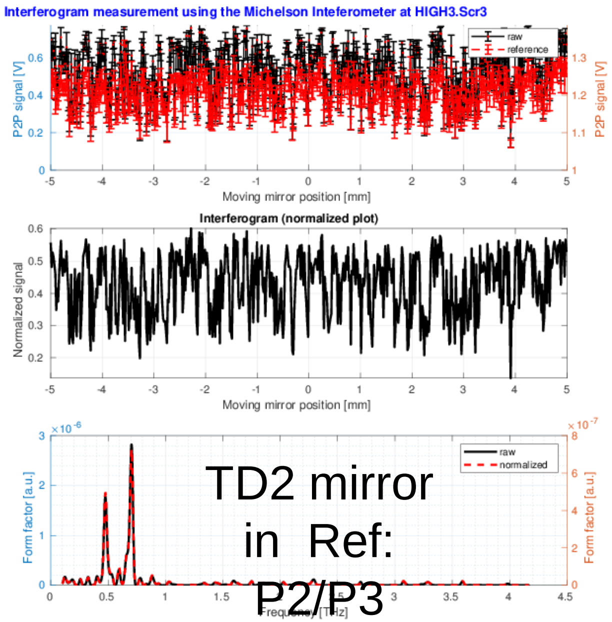
Michelson InterFerometer (MIF)

Optimization and next steps

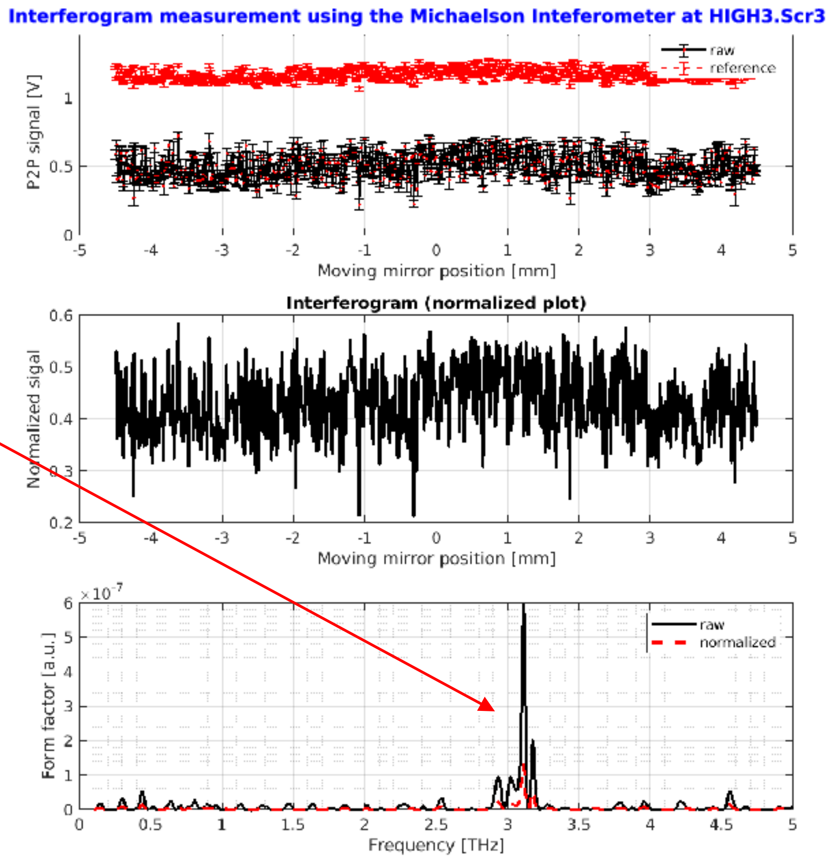
- Added TD2 signal (leaked signal without TD2 mirror inserted) as a reference in the MIF script
- Measured spectrum with MIF, step 0.015, resonant frequency ~ 3.2*20/26 = 2.5 THz, multi spikes
- **16.05.2024N** and **17.05.2024M** also MIF measurements → 2 to 4 hours and results with many spikes !!



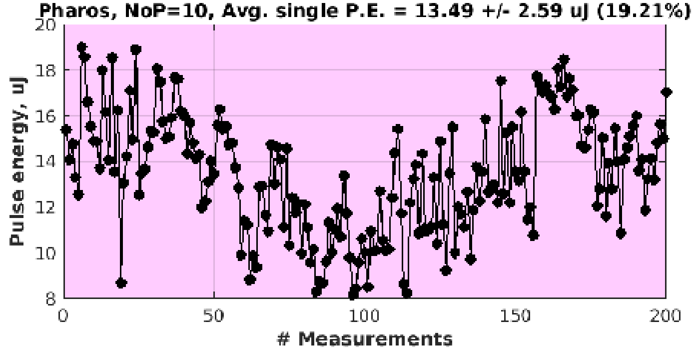




- Improved alignment (prepare MIF as a separate unit)
- Install shutters infront of mirrors to view signal from each
- Install THz camera in place of pyro initially, tune to have overlapping profiles (fringes)
- Insert a parabolic mirror before the pyro to improve the signal strength (focusing)

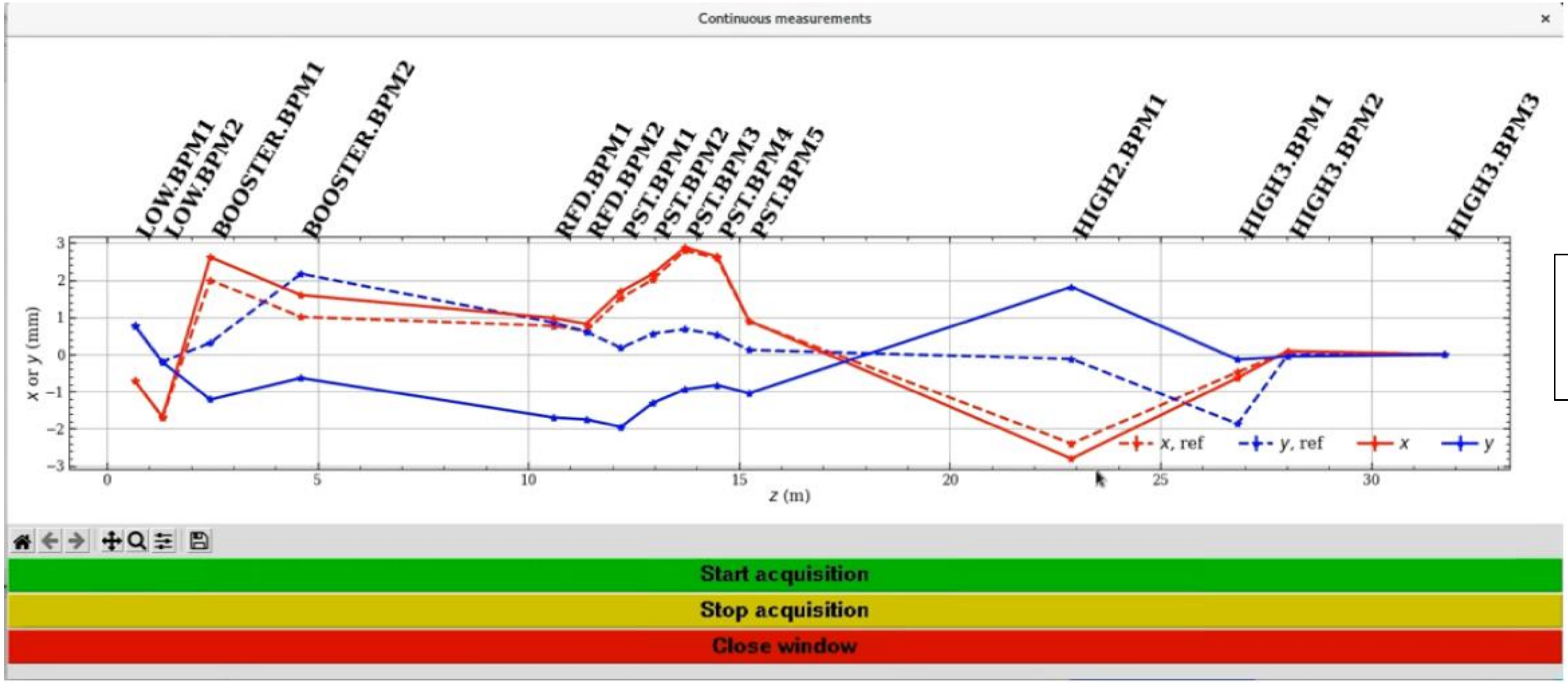


→ Again pyro detector placed between M4 and M5 at a focused point of alignment



THz DLW program

- Pharos laser 6 ps, bunch charge 1 nC
- Beam prepared without DLW from cathode to undulator, because of fluctuation of beam trajectory (due to the dipole kick from wake fields?) → checked history with NEPAL laser, looked similar

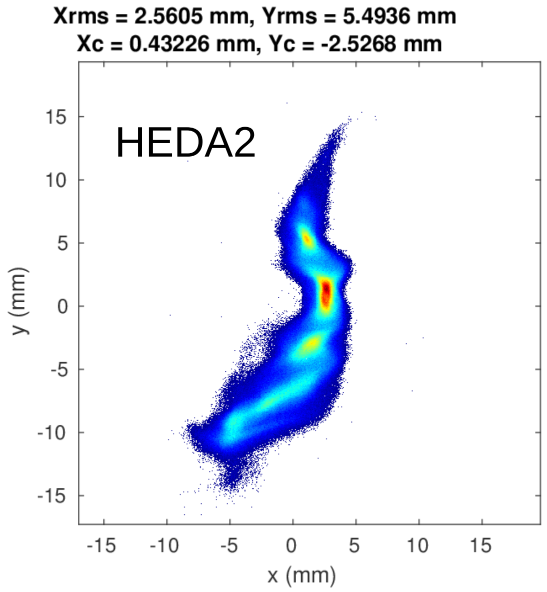


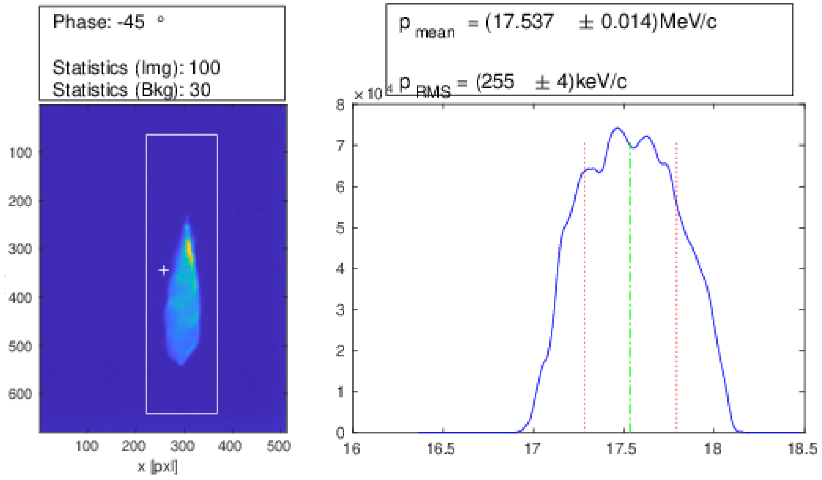
Reference curves were measured without DLW

DLW program

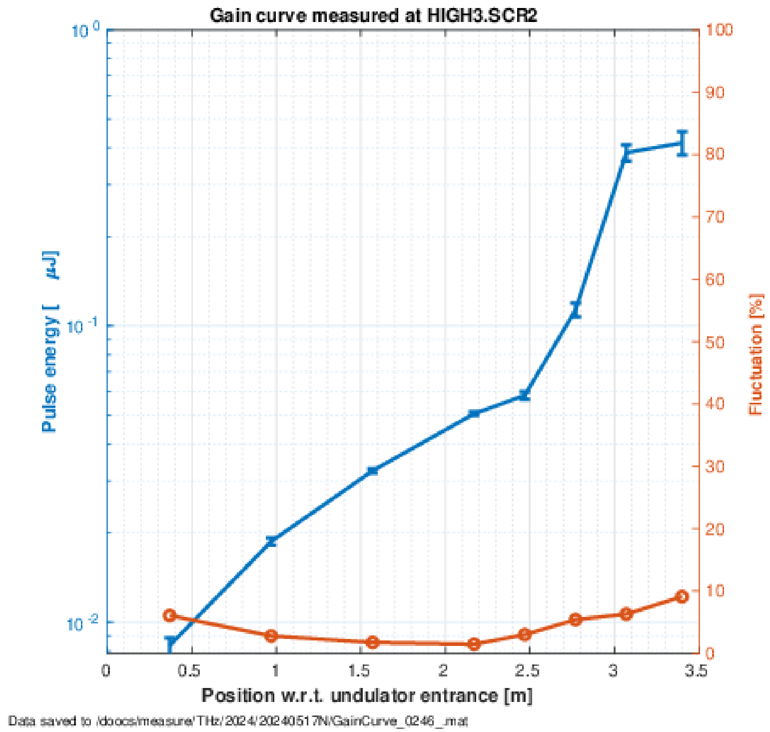
- Energy modulation observed at HEDA1 and density modulation observed at HEDA2 with EMSY2 slit inserted, but very unstable due to trajectory issue

- THz radiation energy optimized without DLW → ~0.5 uJ
- Then measured with coated DLW at Low.Scr3 → 0.1 uJ
  - Optimization with DLW insertion not possible



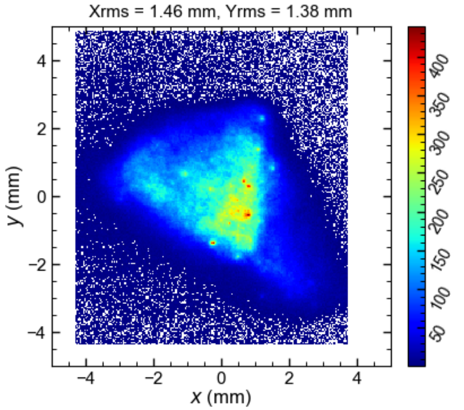


HEDA1

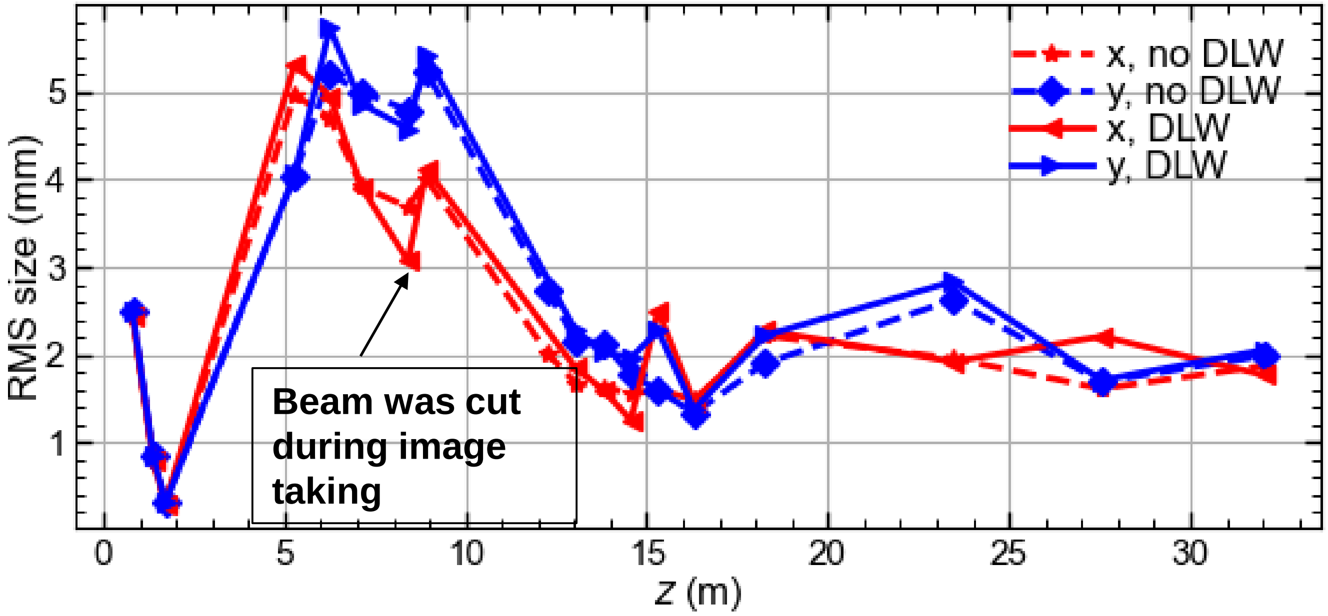


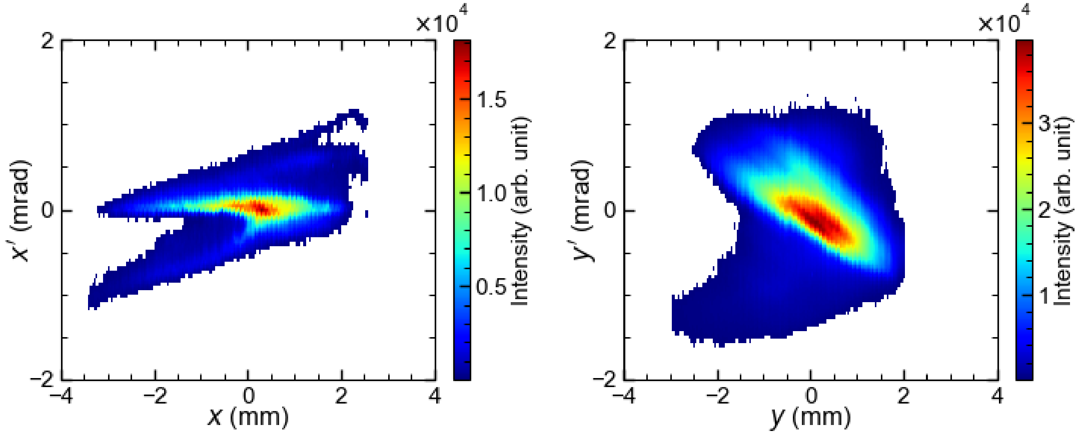
DLW program

- Beam transport was documented and emittance at EMSY3 was measured (looked OK)



EMSY3





Transverse phase spaces

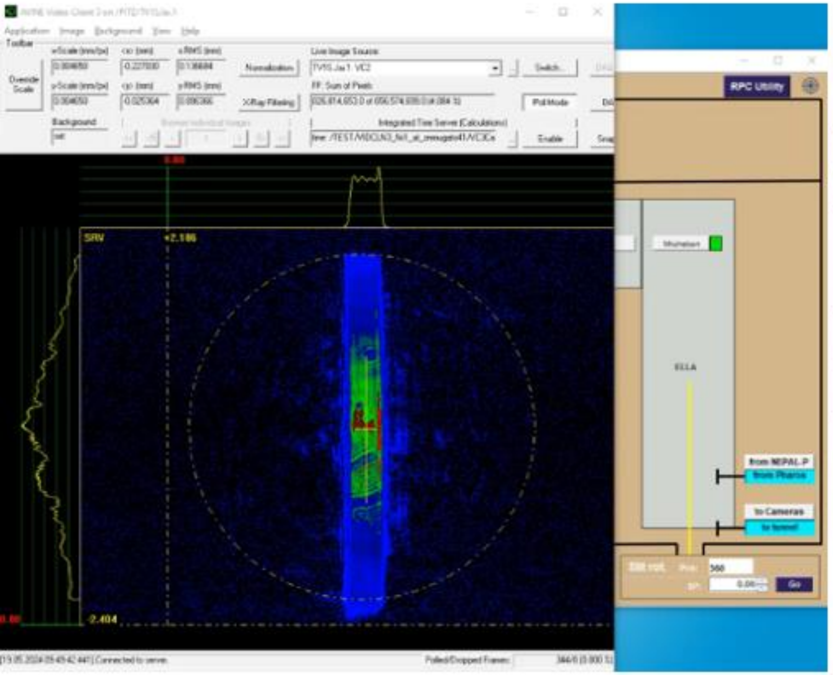
Scaled1 emittance (scaling factor ~1.15):	
Xemit	= 9.478 +/- 0.263 mm mrad
Yemit	= 9.161 +/- 0.191 mm mrad
XYemit	= 9.318 +/- 0.225 mm mrad

M. Krasilnikov

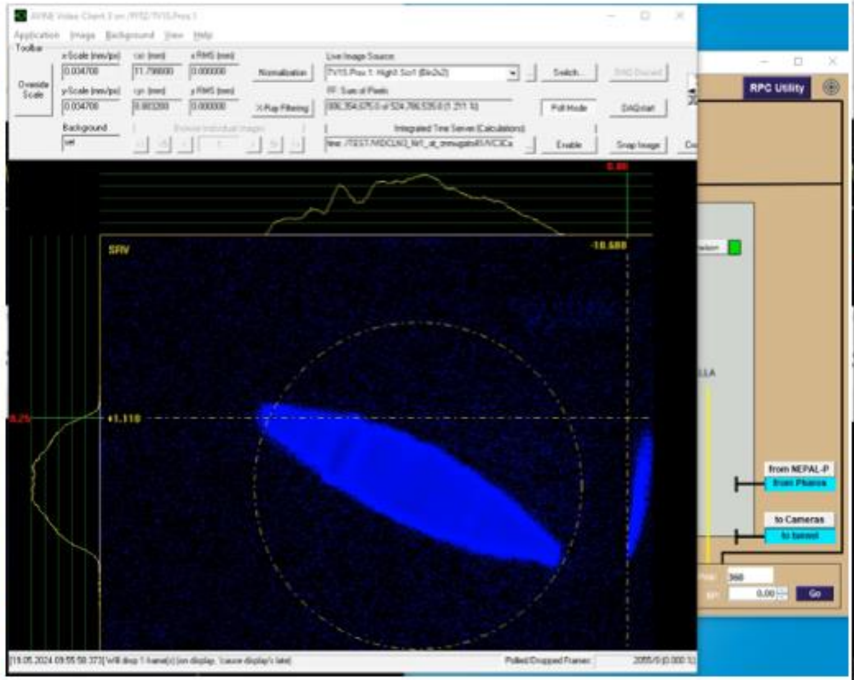
Rotational Slit in the laser BL

First tests

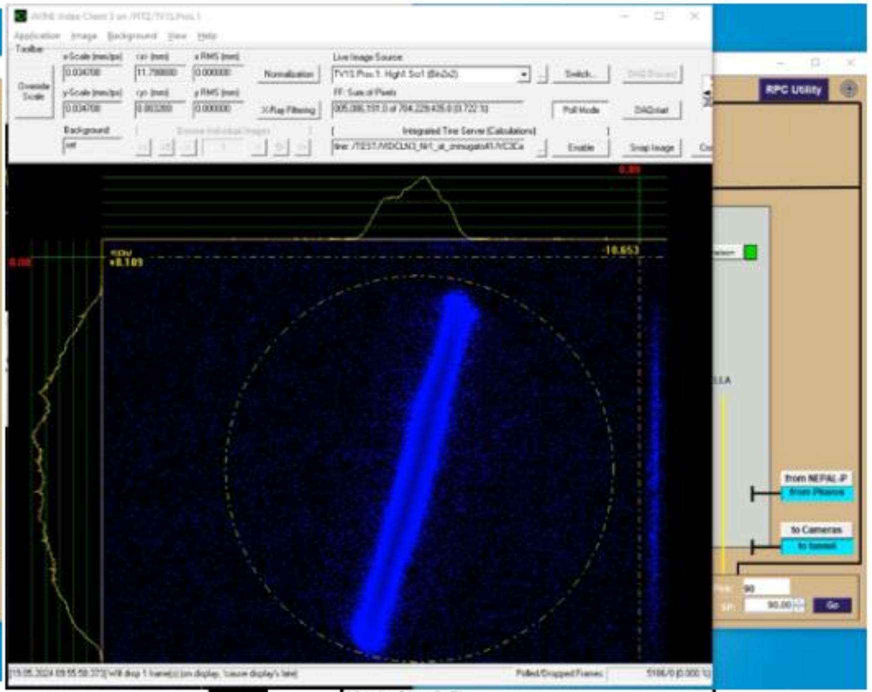
Laser at VC2 (BSA4mm)

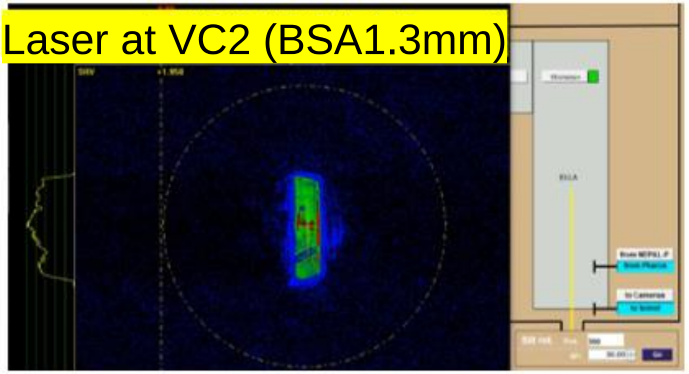


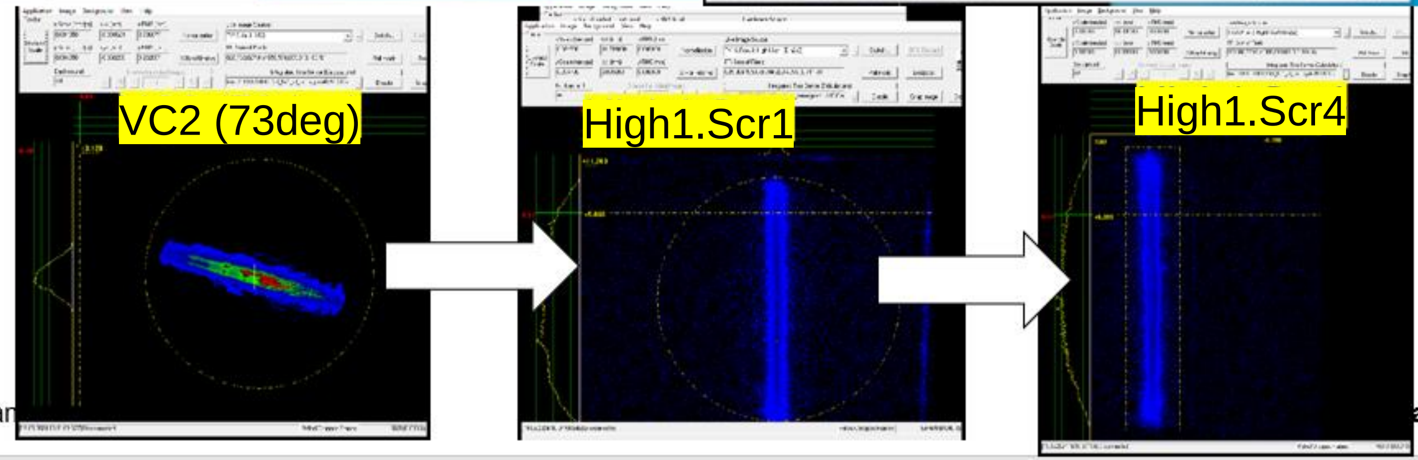
E-beam at High1.Scr1



Focused e-beam at High1.Scr1







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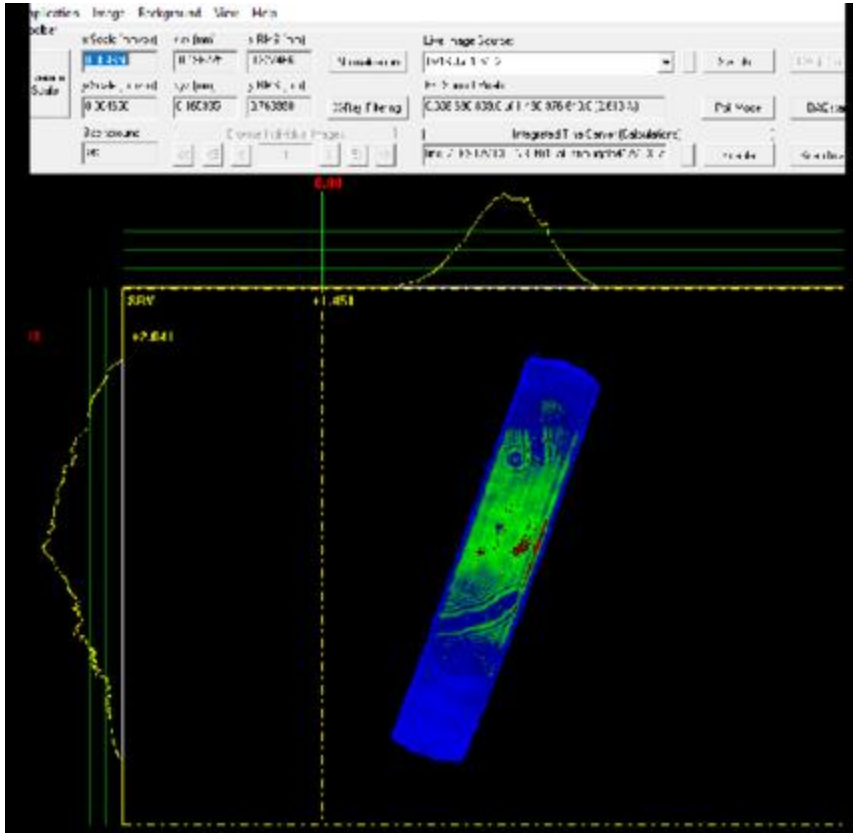
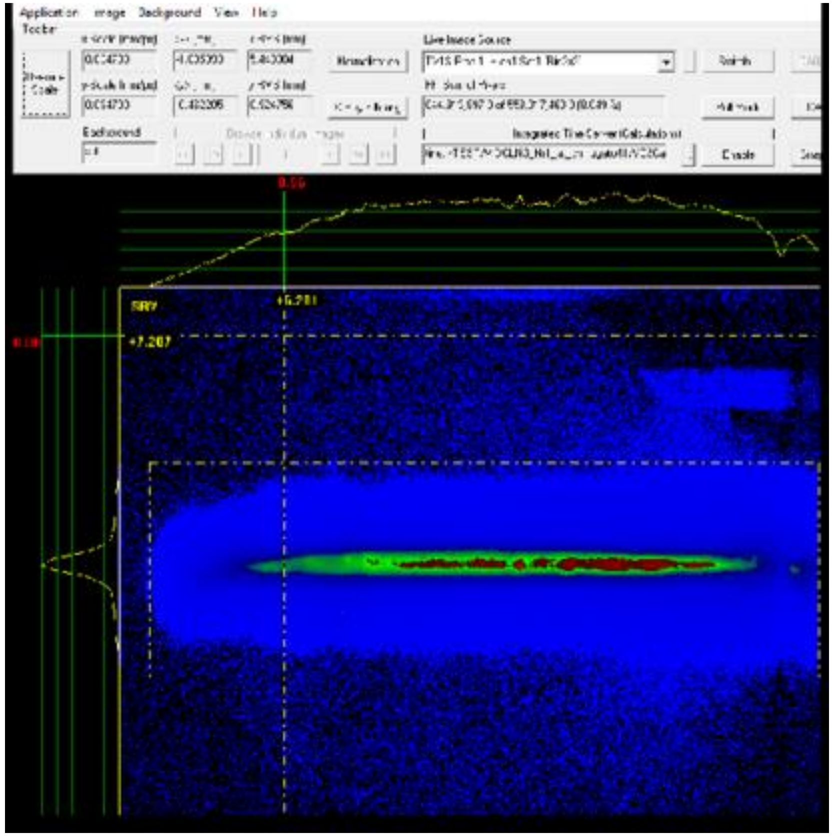
Rotational Slit in the laser BL

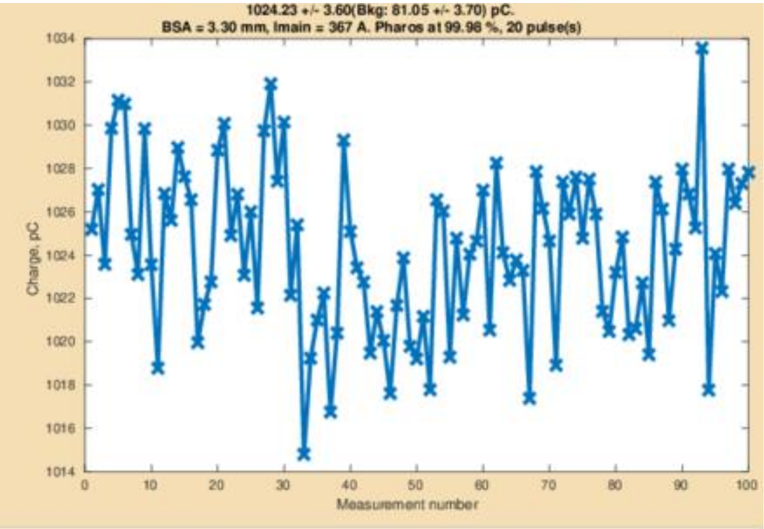
More tuning for horizontal flat (x>>y) beam on 19.05.2024N

Laser at VC2
1mm slit at 251deg with BSA = 3.5mm



1nC e-beam at High1.Scr1



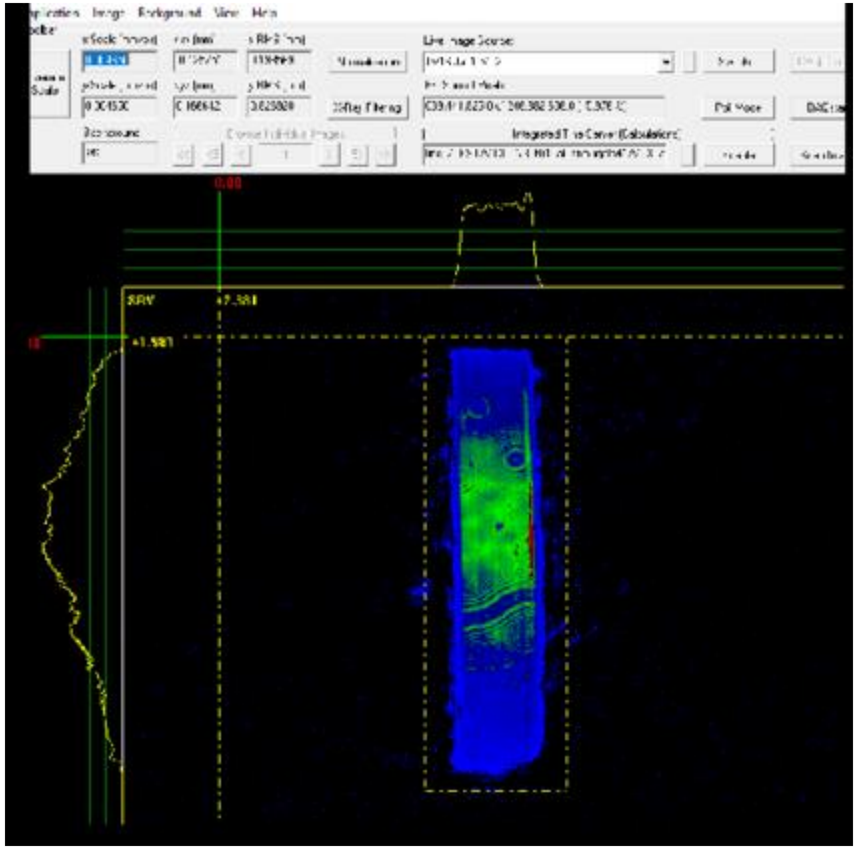


M. Krasilnikov

Rotational Slit in the laser BL

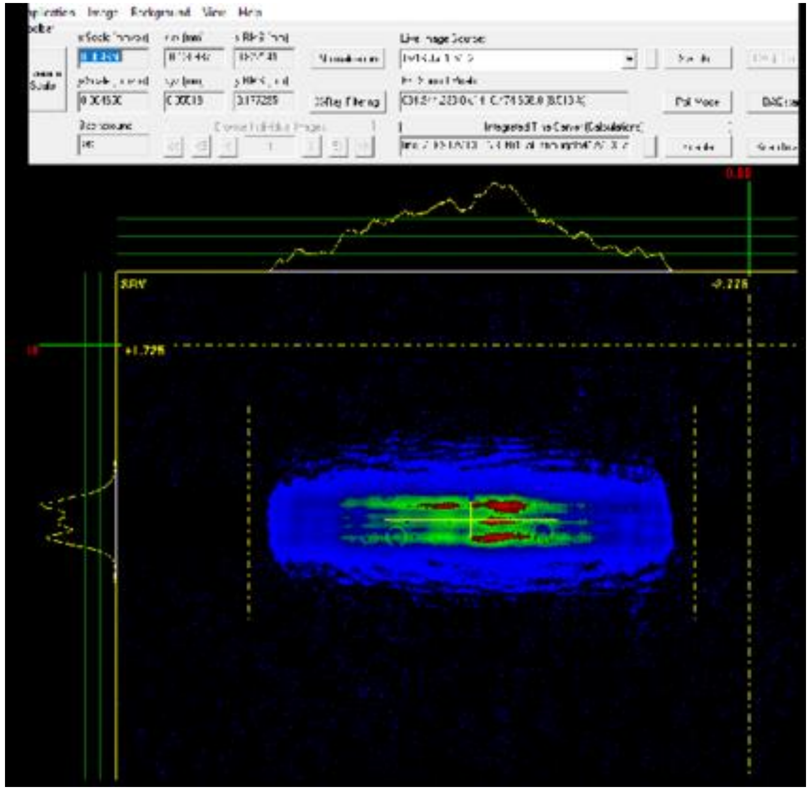
Some observations on 19.05.2024N

Laser at VC2
1mm slit at 90deg with BSA = 3.5mm



xRMS=0.199mm
yRMS=0.827mm

Laser at VC2
1mm slit at180deg with BSA = 3.5mm

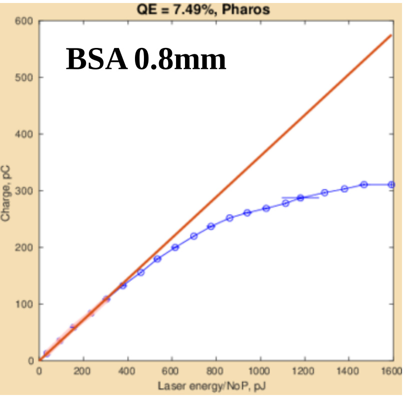


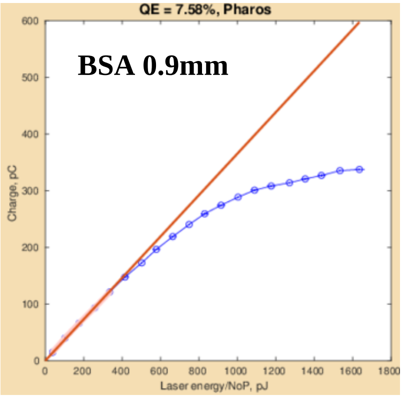
xRMS=0.822mm
yRMS=0.177mm

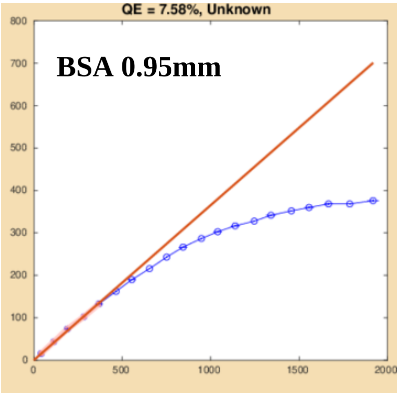
Cathode #699.1 (Cs2Te), Pharos laser 6ps

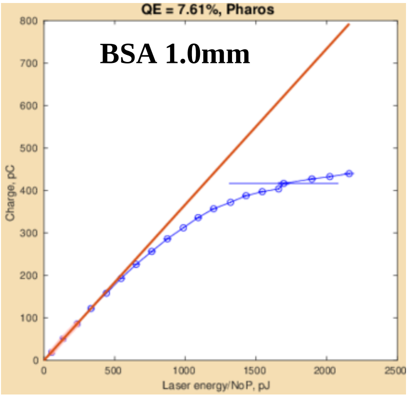
QE map → a “hole” in the center part detected

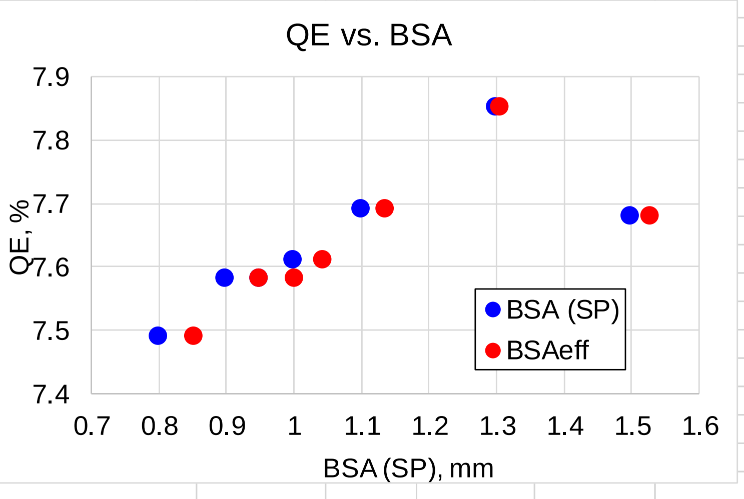
date, time	BSA (SP)	QE	VC2,Xrms	VC2,Yrms	BSAeff
19.05.2024 16:26	0.8	7.49	0.22	0.207	0.854
19.05.2024 10:46	0.95	7.58	0.245	0.23	0.950
19.05.2024 04:56	1.5	7.68	0.388	0.377	1.530
18.05.2024 22:53	1.3	7.85	0.34	0.314	1.307
18.05.2024 20:02	1.1	7.69	0.299	0.27	1.137
18.05.2024 14:58	1	7.61	0.275	0.248	1.045
18.05.2024 09:35	0.9	7.58	0.264	0.238	1.003

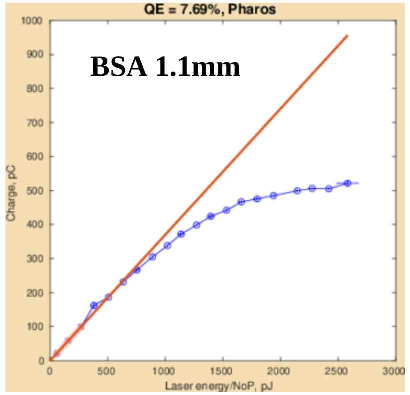


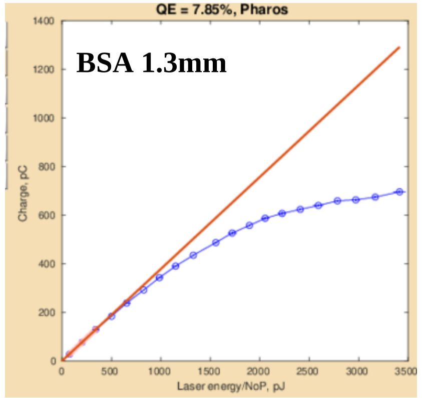


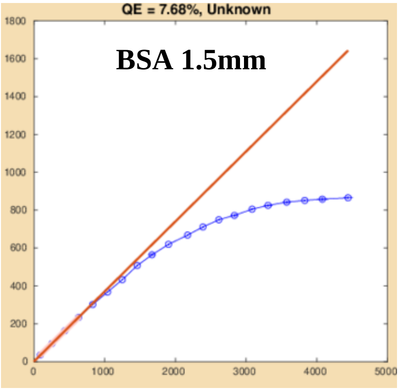


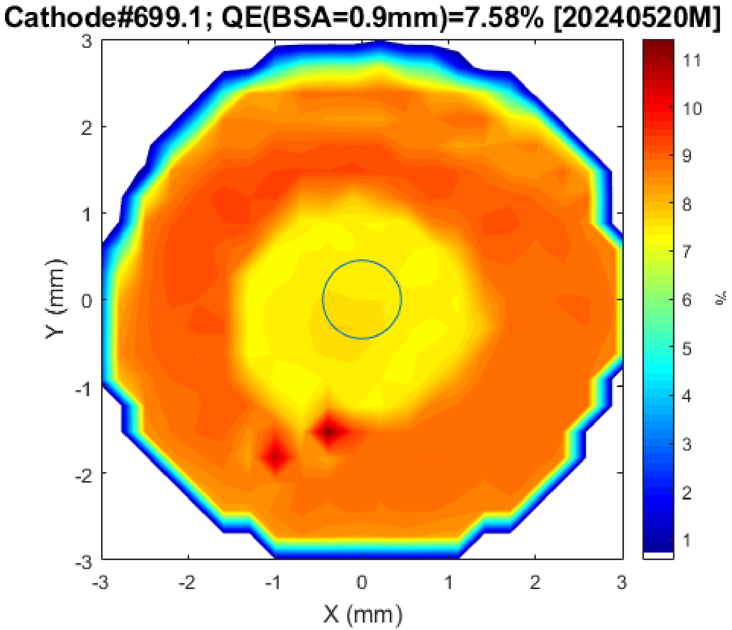












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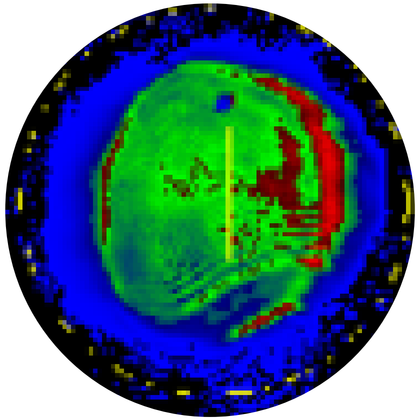
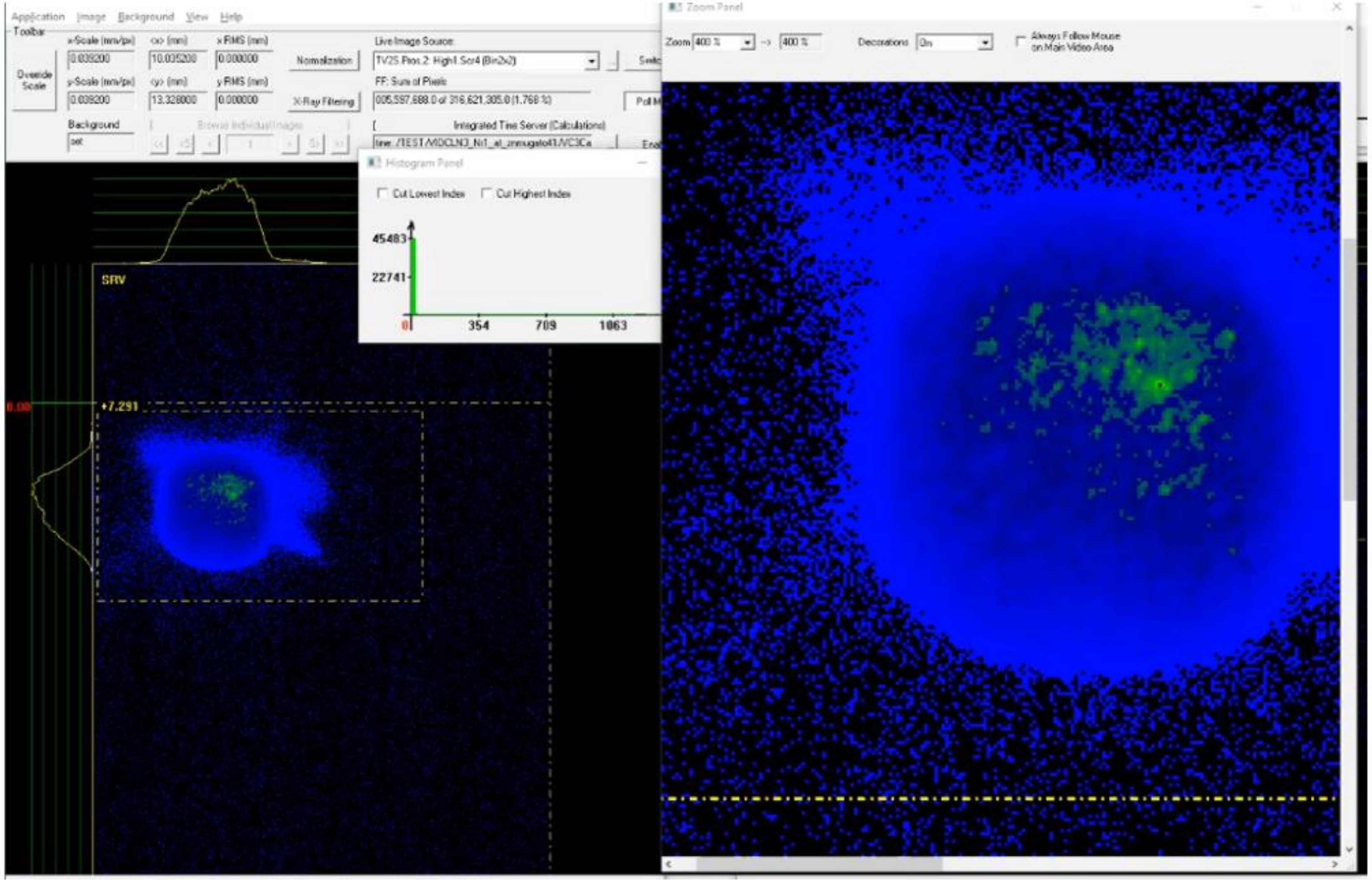
Problems

Beam size fluctuations at High1.Scr4 (Imain356A, 250pC, BSA0.95mm eff)

VC2





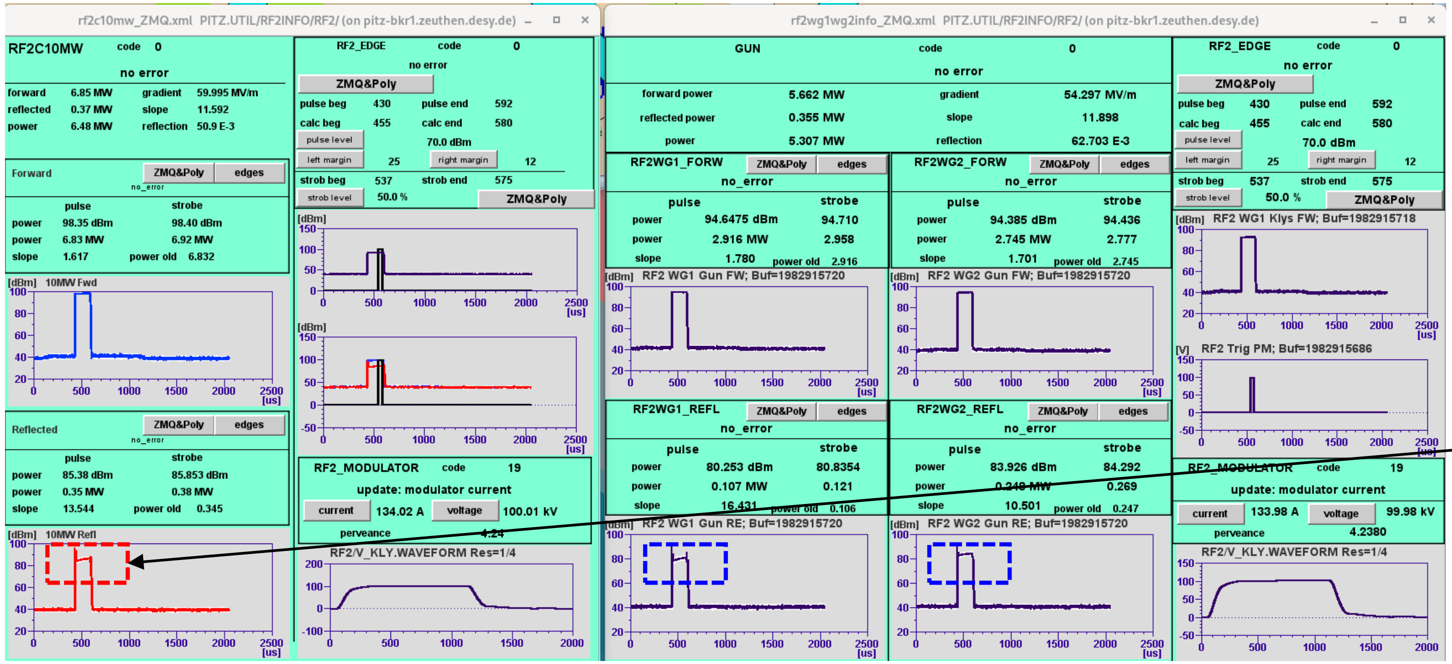
Gun5 RF studies for the cavity resonance control - 3

M. Krasilnikov

Gun5 Resonance Studies

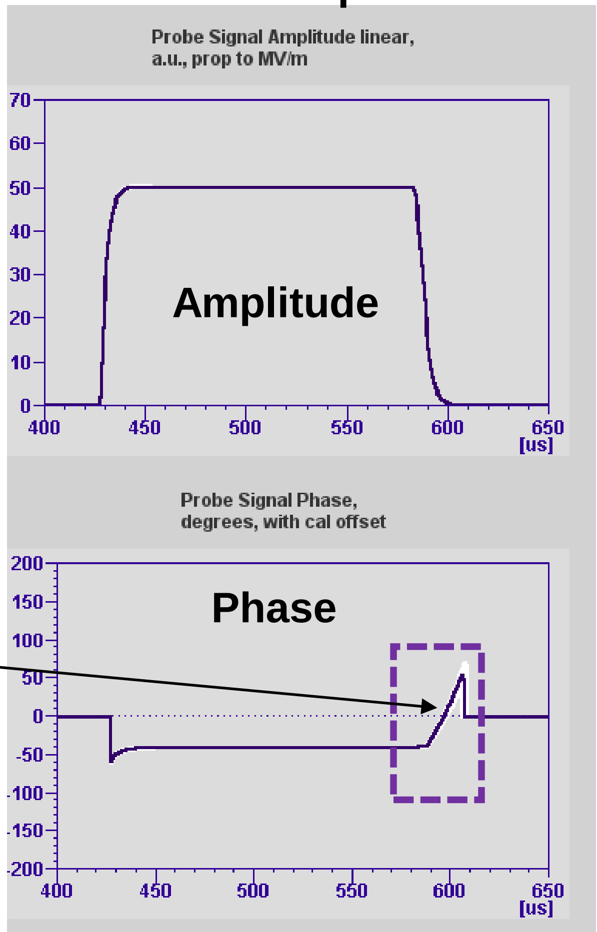
Preparation for Gun5.2 (no 10MW directional coupler, only RF pickups and 2x5MW directional couplers*)

- Motivation: find a criterium for a proper resonance for the Gun5.2 operated with symmetric power coupler
- Gun5.1 resonance:
  - Signal (spectrum) from **10MW reflected power**: level and slope
  - There are also signals from **5MW couplers**



Observed correlation

RF Pickup



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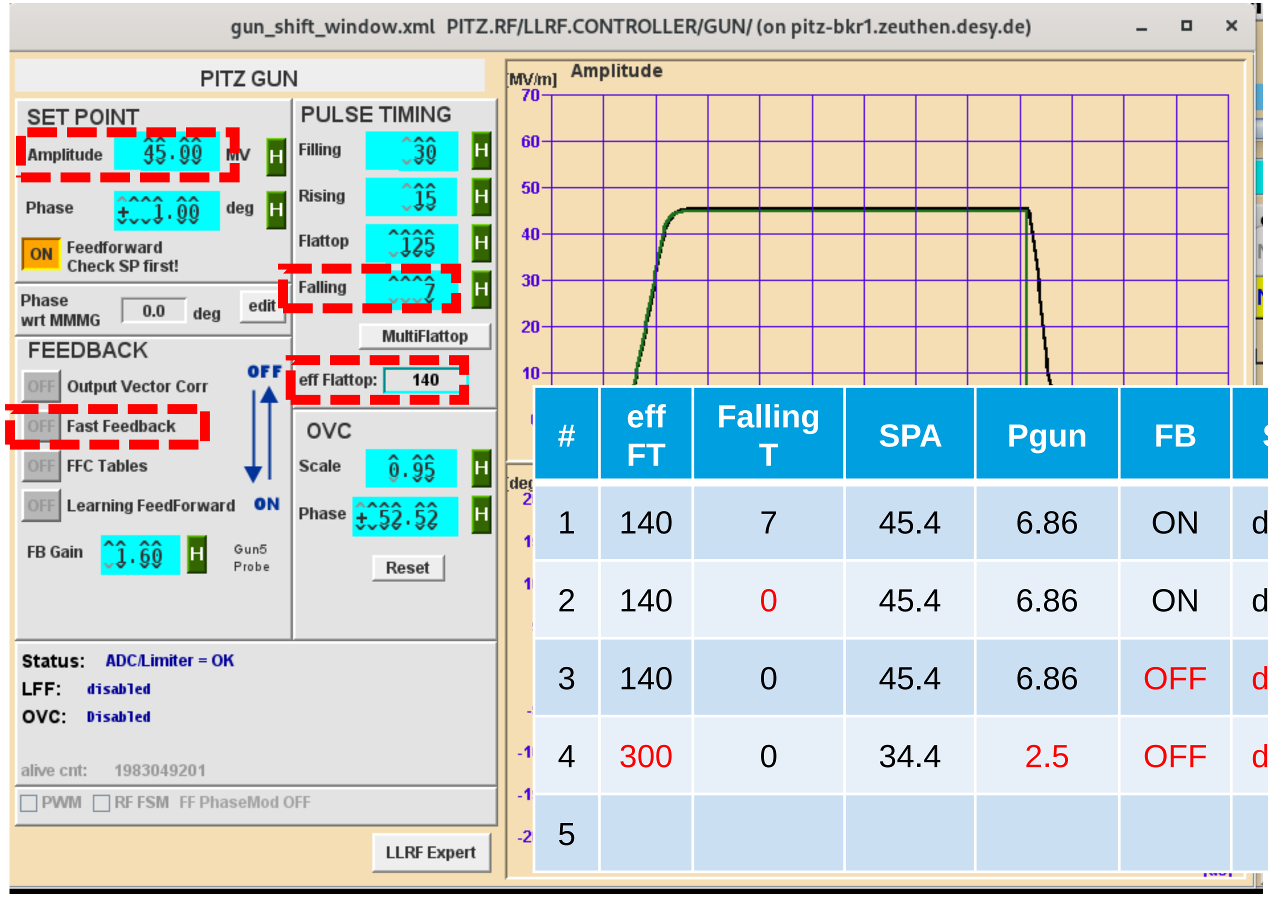
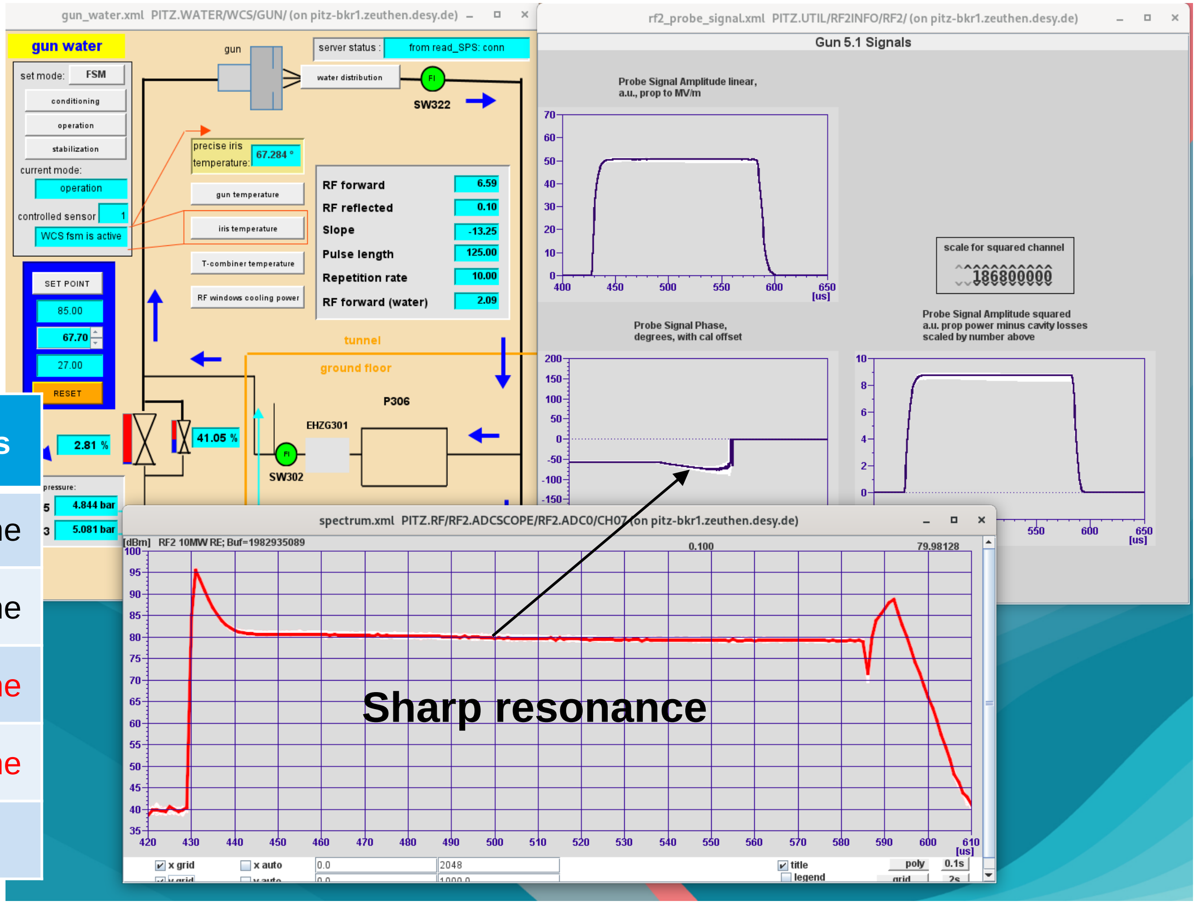
Gun5 Resonance Studies

12.05.2024 – gun resonance (SPT) scan for PL=140us, SP=45.4 (~6.9MWg)

- Method: scan gun SPT, record related DOOCS data (RF signals 10MW, 2x5MW, RF pickup, RFinfo values)



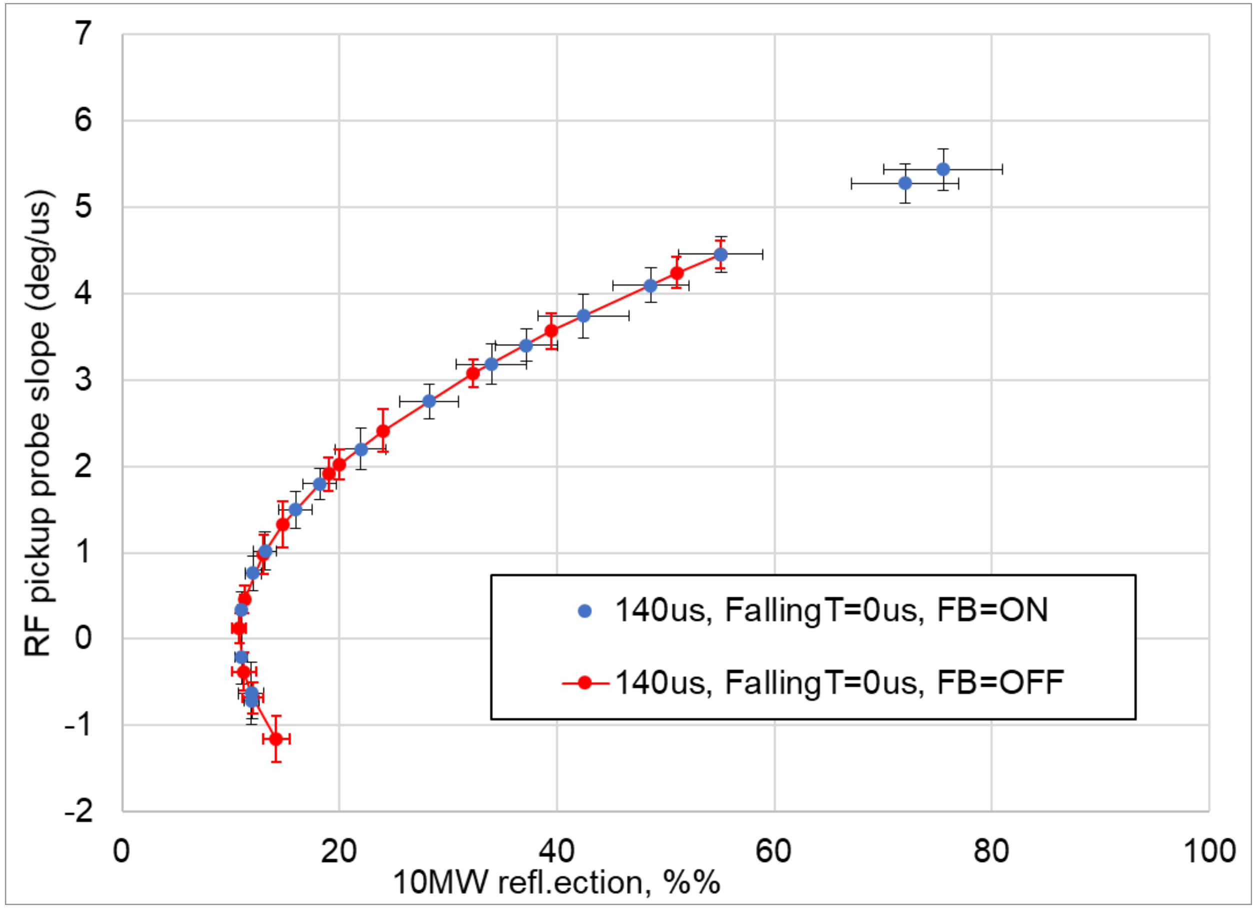
#	eff FT	Falling T	SPA	Pgun	FB	Sts
1	140	7	45.4	6.86	ON	done
2	140	0	45.4	6.86	ON	done
3	140	0	45.4	6.86	OFF	done
4	300	0	34.4	2.5	OFF	done
5						

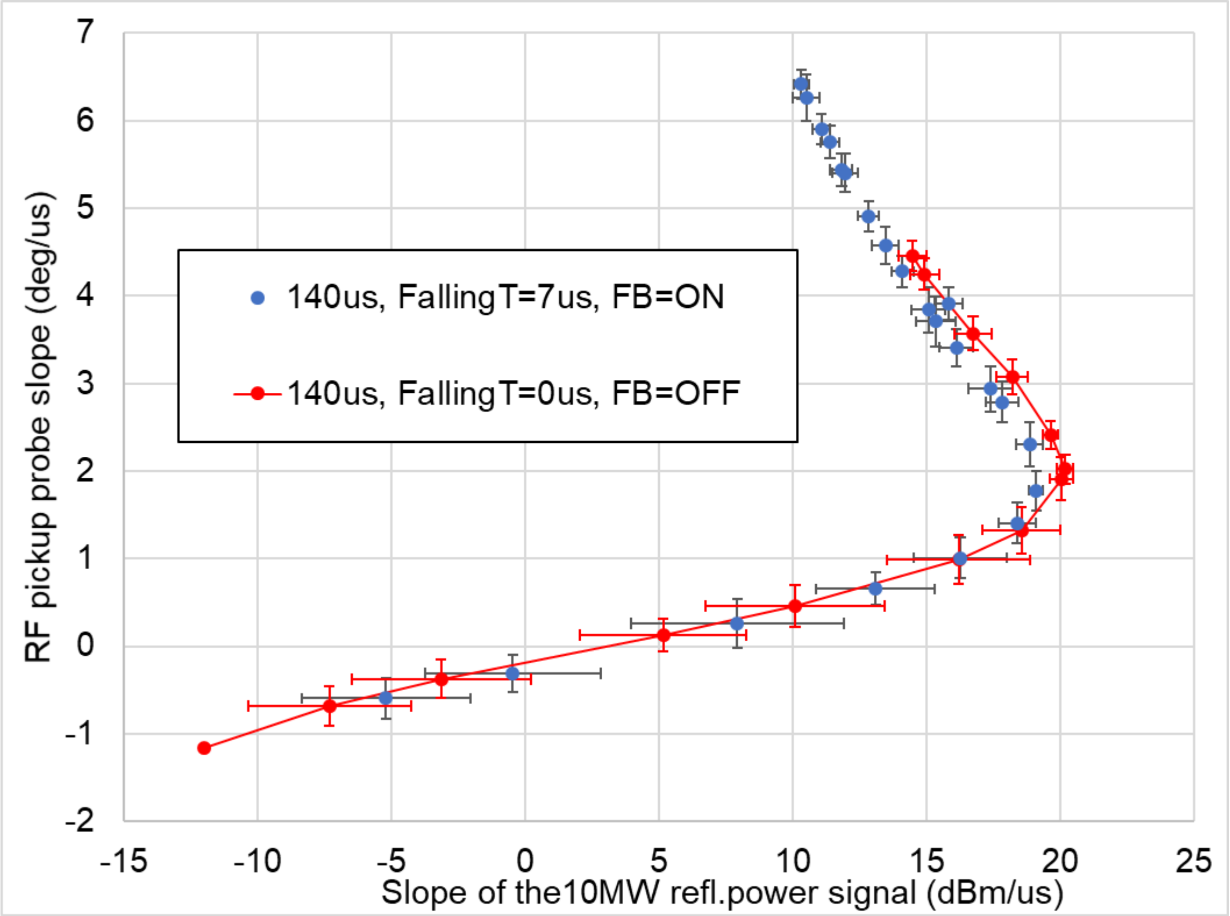


Gun5 Resonance Studies

Data analysis (p2 vs p3)

#	eff FT	Falling T	SPA	Pgun	FB	Sts
1	140	7	45.4	6.86	ON	done
2	140	0	45.4	6.86	ON	done
3	140	0	45.4	6.86	OFF	done
4	300	0	34.4	2.5	OFF	done





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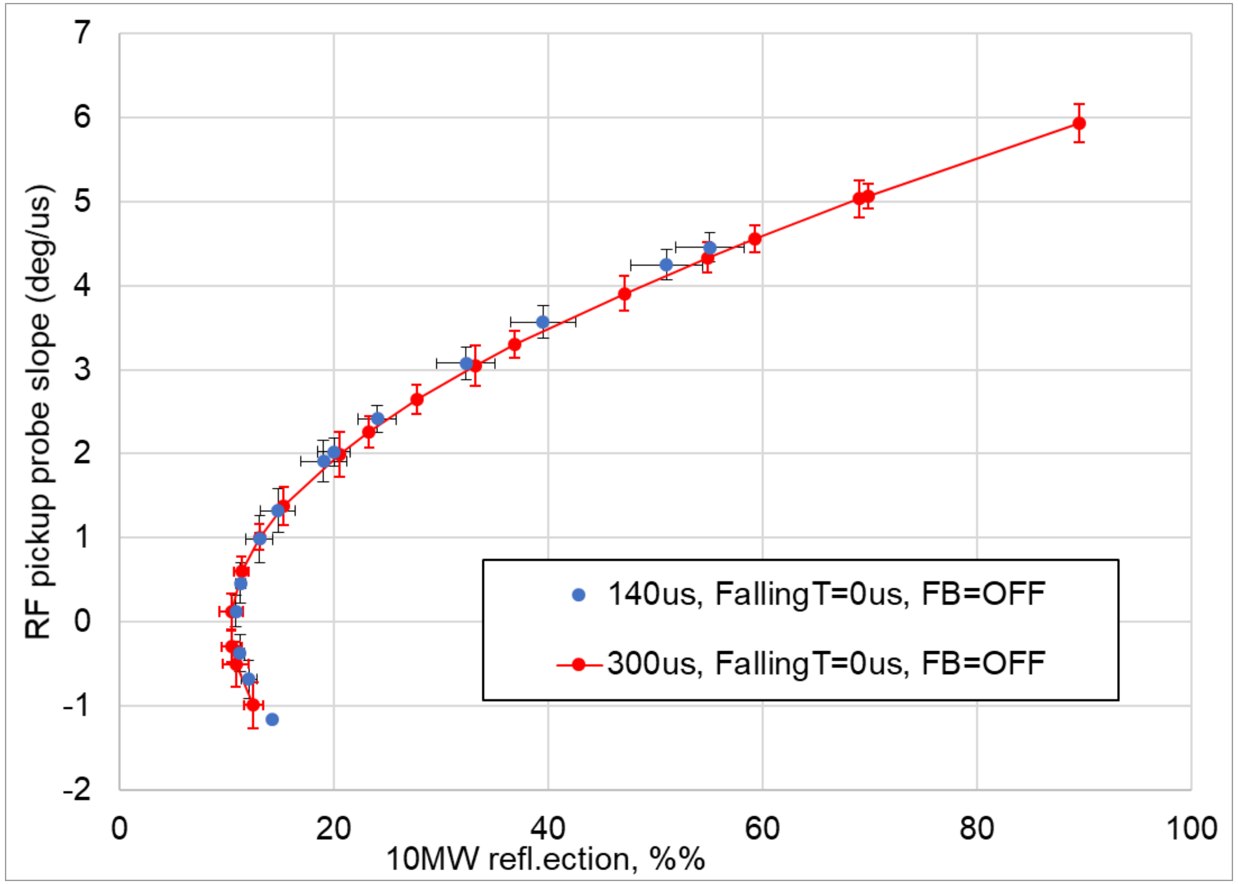
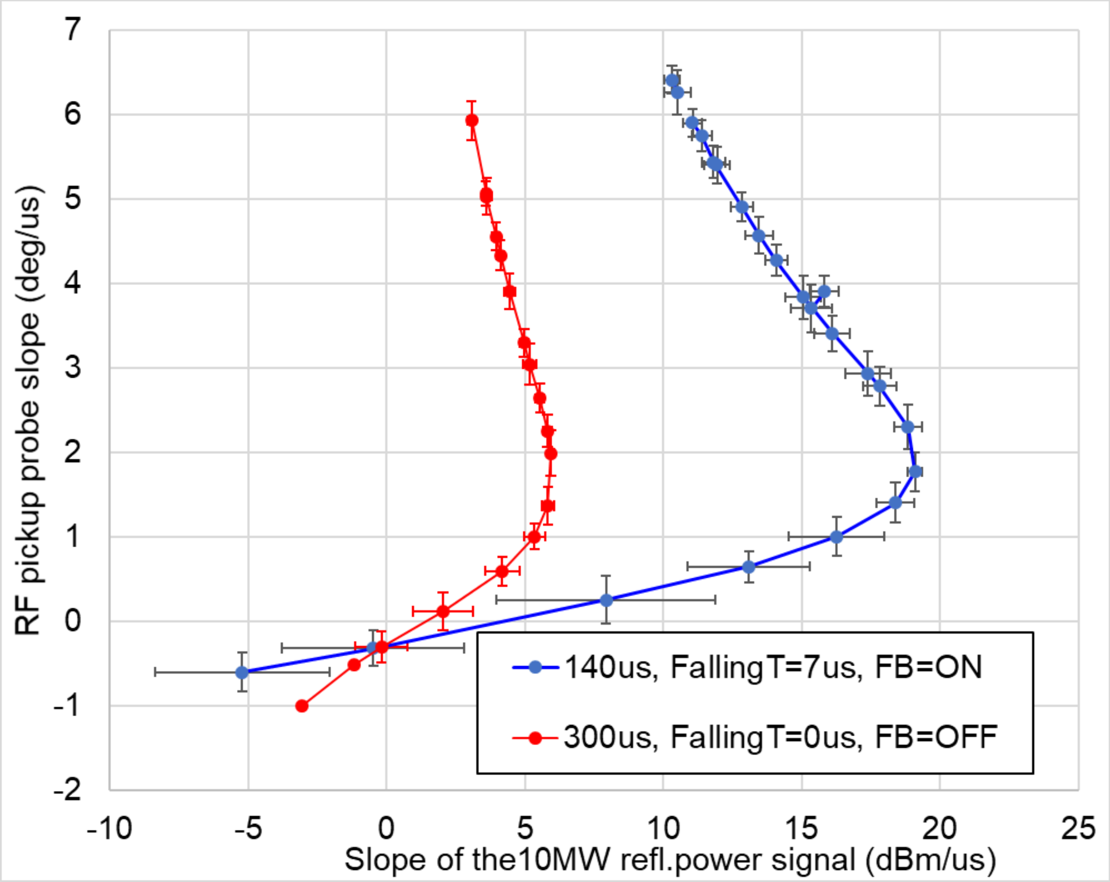
Gun5 Resonance Studies

Data analysis (p3 vs p4)

#	eff FT	Falling T	SPA	Pgun	FB	Sts
1	140	7	45.4	6.86	ON	done
2	140	0	45.4	6.86	ON	done
3	140	0	45.4	6.86	OFF	done
4	300	0	34.4	2.5	OFF	done





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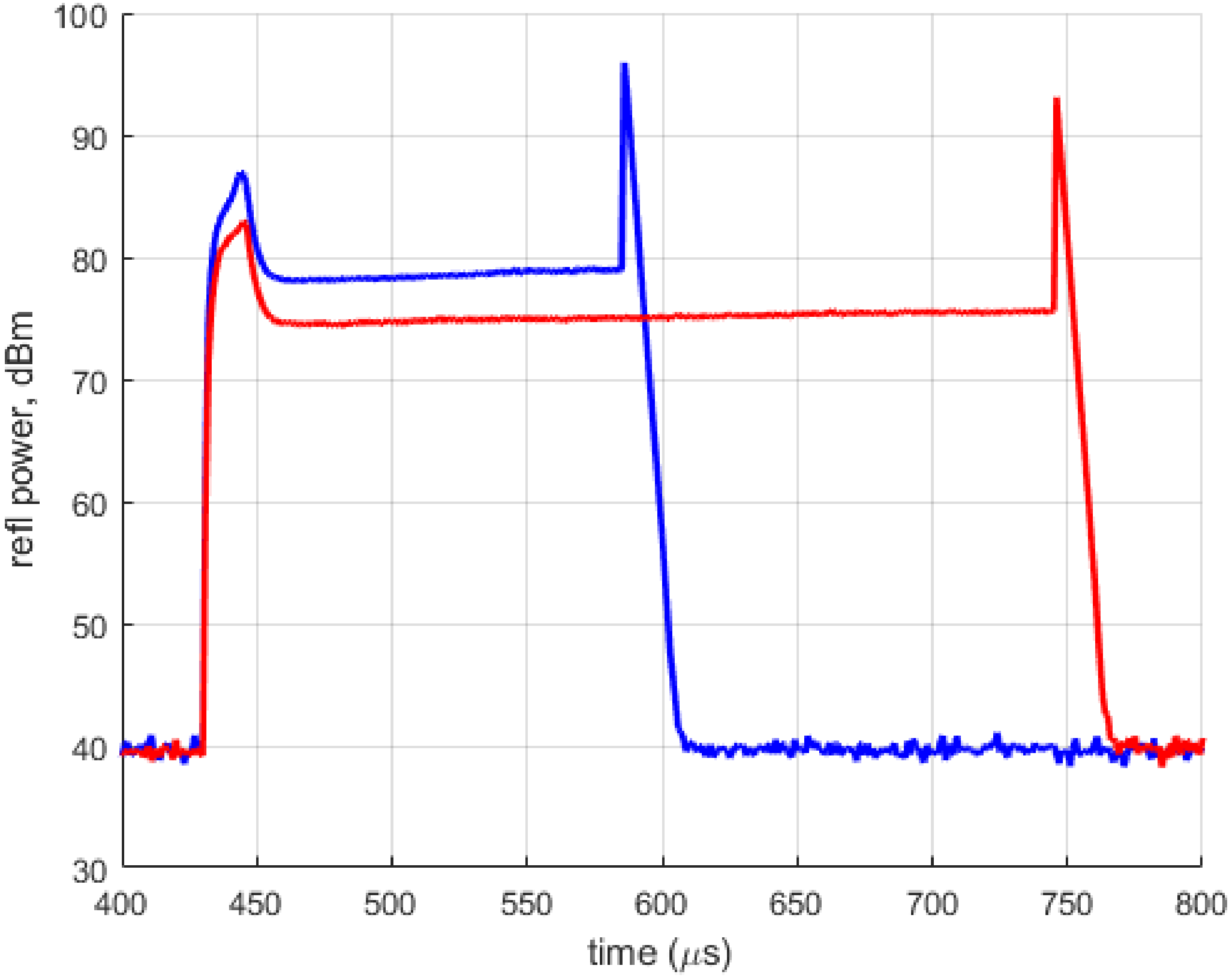
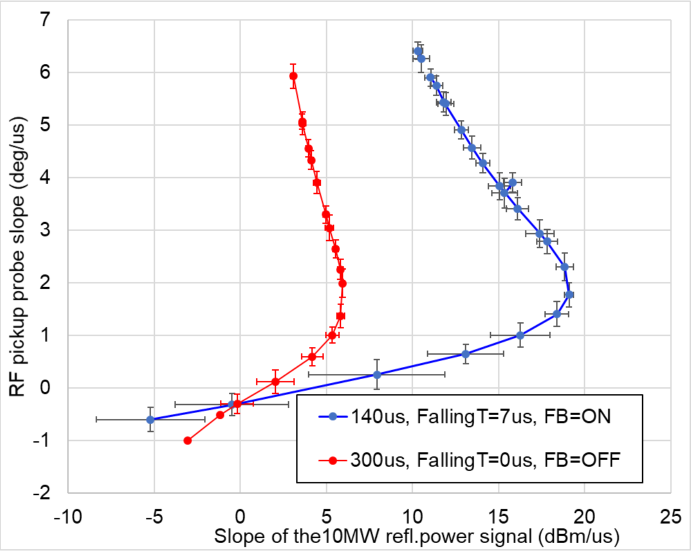
Gun5 Resonance Studies

Data analysis (p3 vs p4)

#	eff FT	Falling T	SPA	Pgun	FB	Sts
1	140	7	45.4	6.86	ON	done
2	140	0	45.4	6.86	ON	done
3	140	0	45.4	6.86	OFF	done
4	300	0	34.4	2.5	OFF	done





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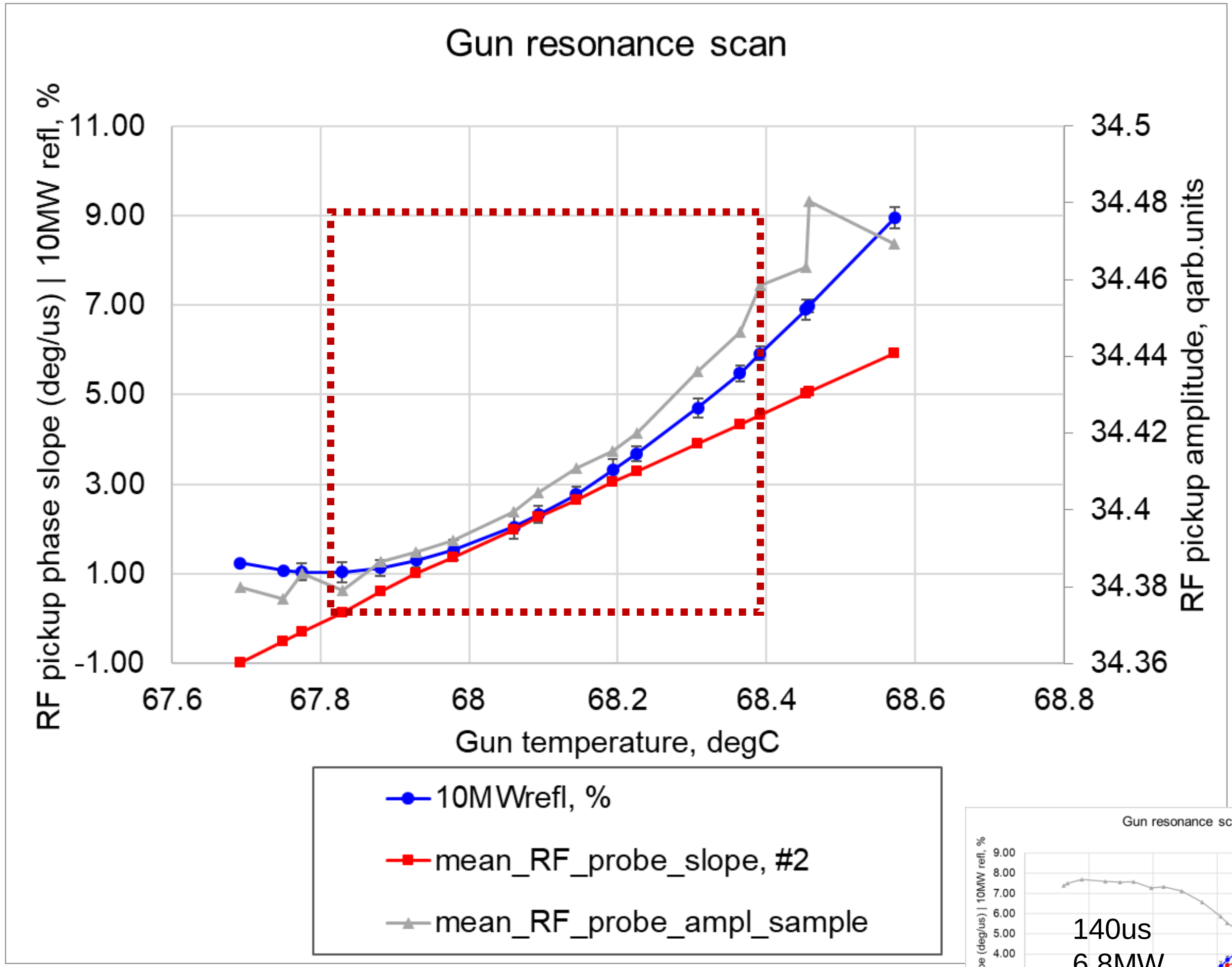
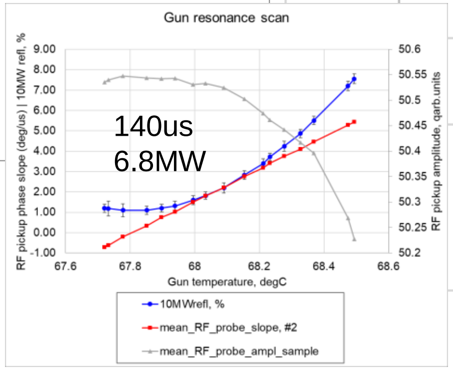
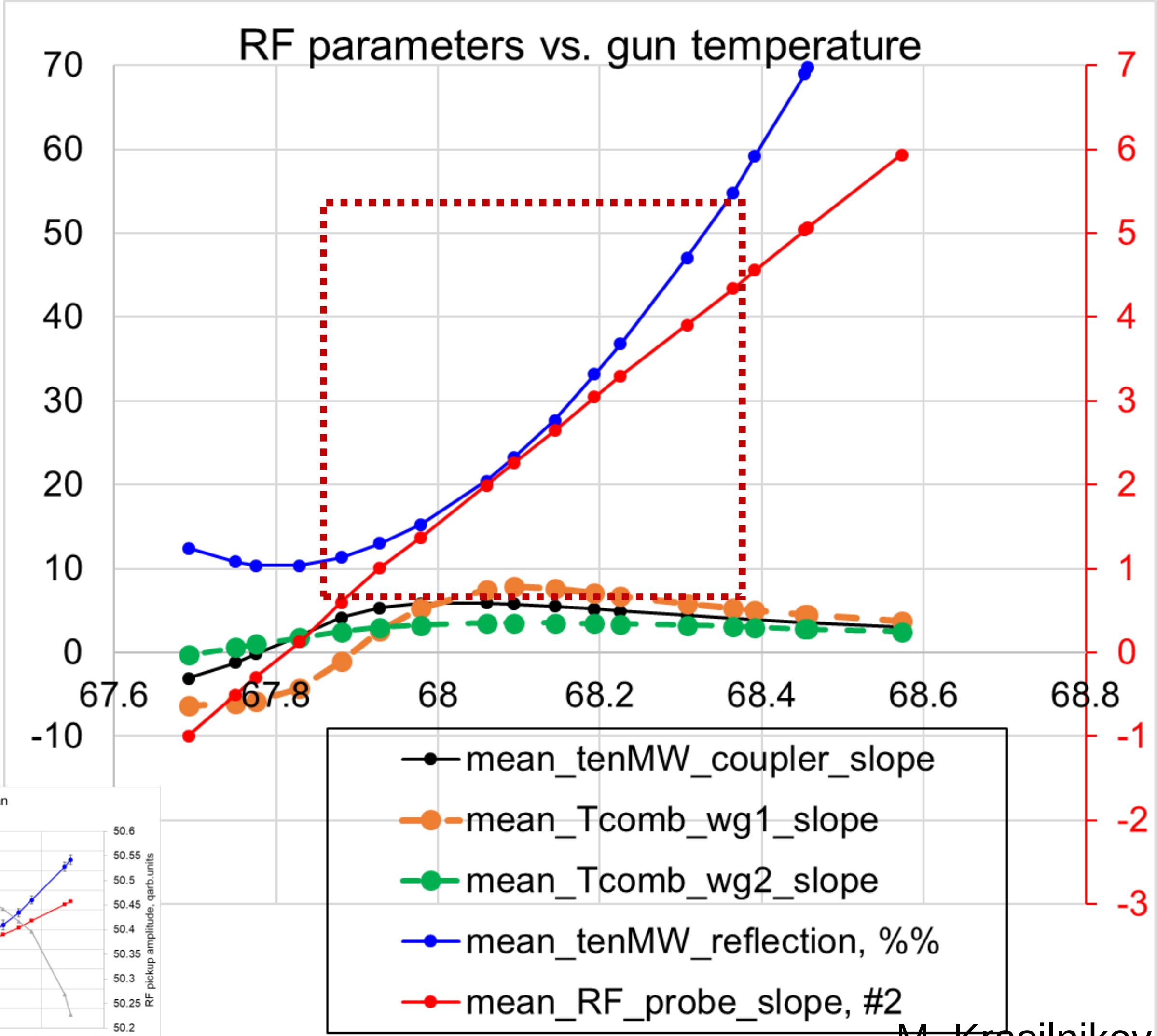
Gun5 Resonance Studies

Data analysis (p4)

#	eff FT	Falling T	SPA	Pgun	FB	Sts
4	300	0	34.4	2.5	OFF	done







M. Krasilnikov

Generation and characterization of ellipsoidal electron bunches in the blow-out regime

Experimental results

Simulations

Next steps

Andreas Hoffmann

Requirements

Pharos, 250 fs

$$\frac{eE_{acc}c\tau_l}{mc^2} \ll \frac{\sigma_0}{\epsilon_0 E_{acc}} \ll 1$$

PHYSICAL REVIEW SPECIAL TOPICS - ACCELERATORS AND BEAMS **16**, 010102 (2013)

Formation and acceleration of uniformly filled ellipsoidal electron bunches obtained via space-charge-driven expansion from a cesium-telluride photocathode

P. Piot,[1,2] Y.-E Sun,[2] T. J. Maxwell,[1,2,*] J. Ruan,[3] E. Secchi,[2,†] and J. C. T. Thangaraj[2]

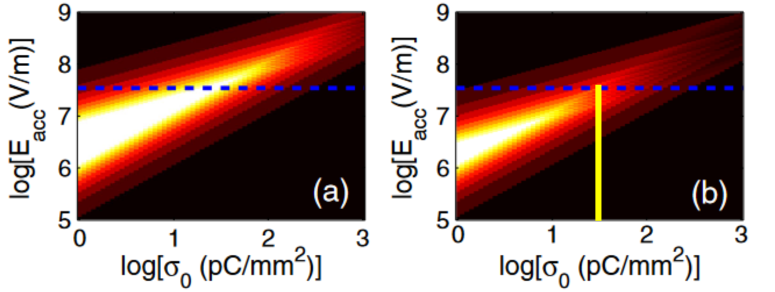
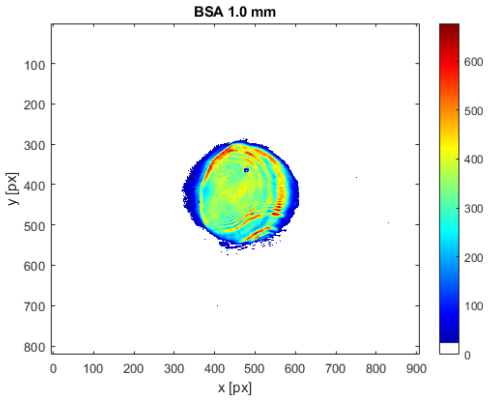
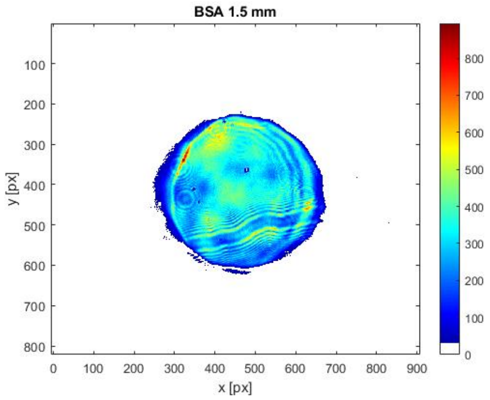


FIG. 1. Domain of existence of the blow-out regime (lighter colors) in the (σ_0, E_{acc}) parameter space for $\tau_l = 50$ fs (a) and $\tau_l = 200$ fs (b). The horizontal blue dashed lines correspond to $E_0 = 35$ MV/m. (This figure was adapted from Ref. [13].)

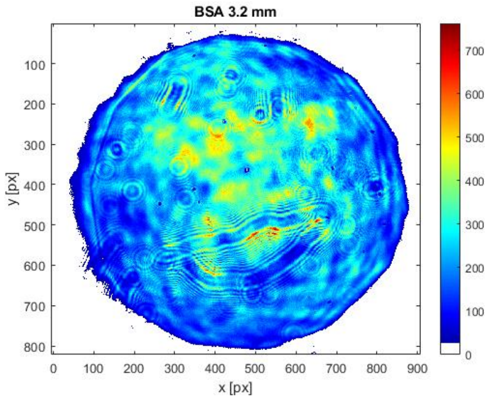
100 pC

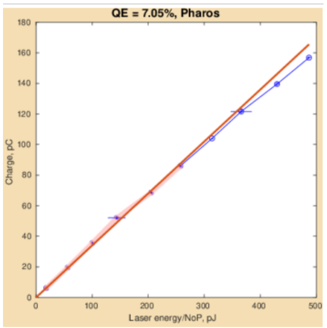


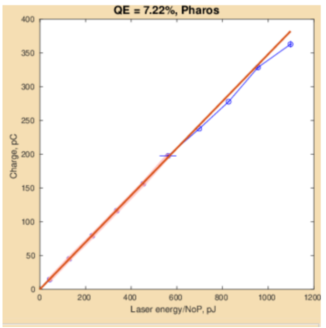
250 pC

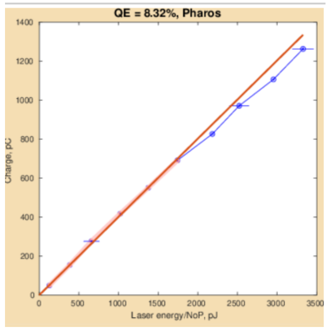


1000 pC



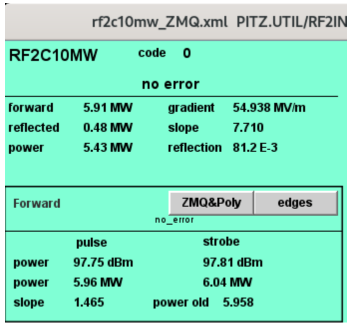


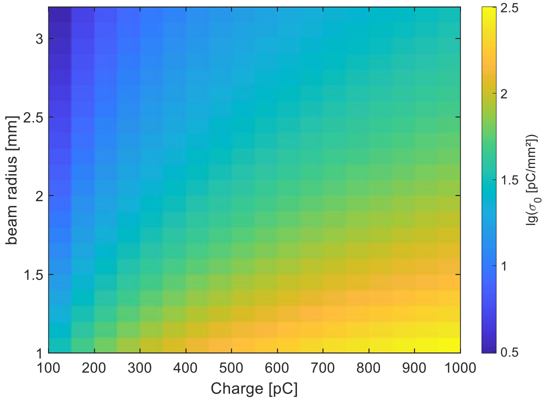




LT Range 3:3:30

55 MV/m

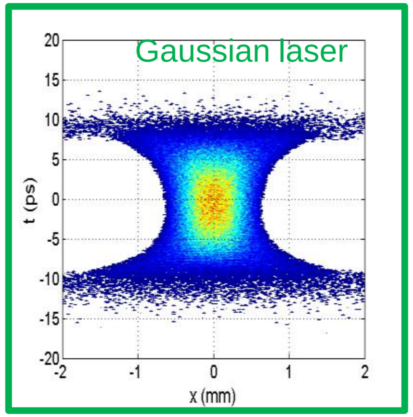


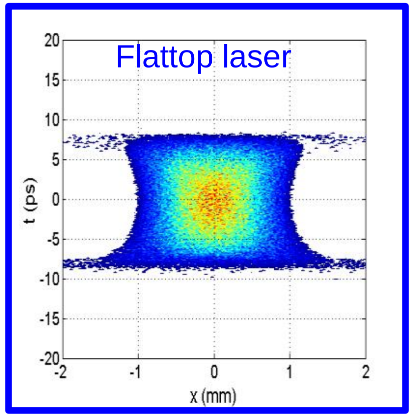


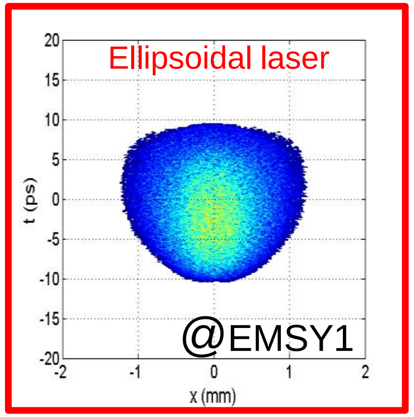
TDS measurements

Comparison with historic and new results

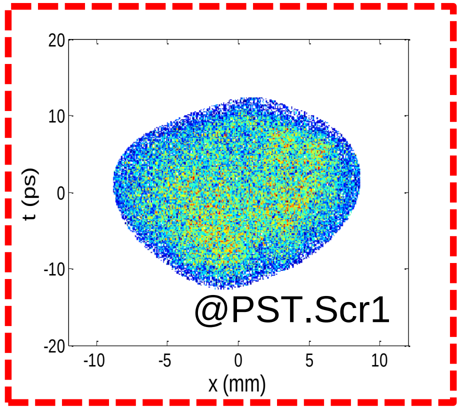
Simulation (500 pC)



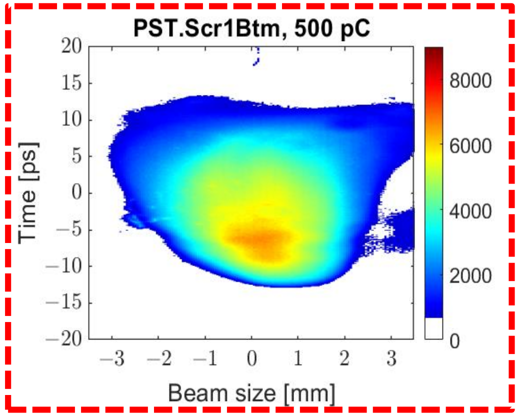




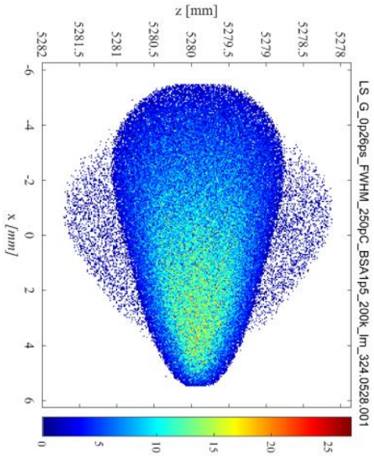
First measurement at PITZ 2016



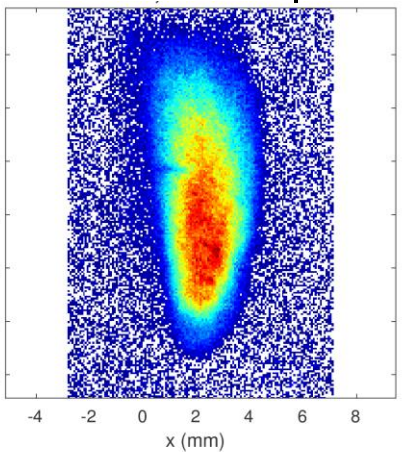
2024



250 pC, 1.5 mm BSA

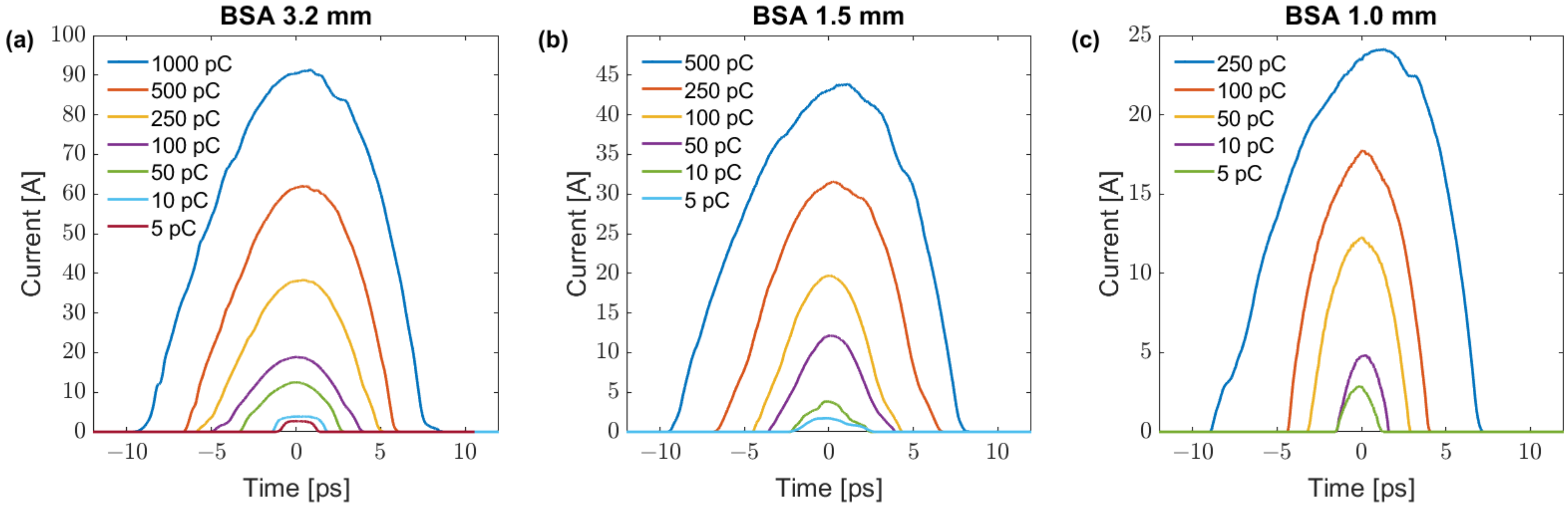


PST.Scr1Top

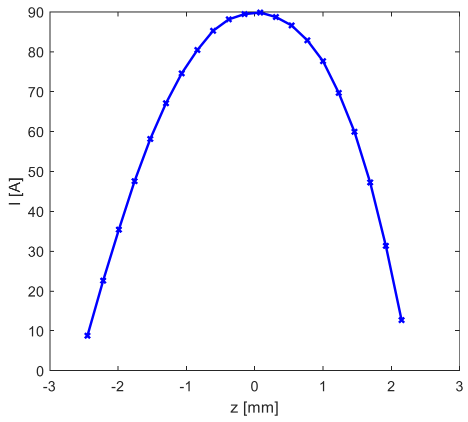


TDS measurements

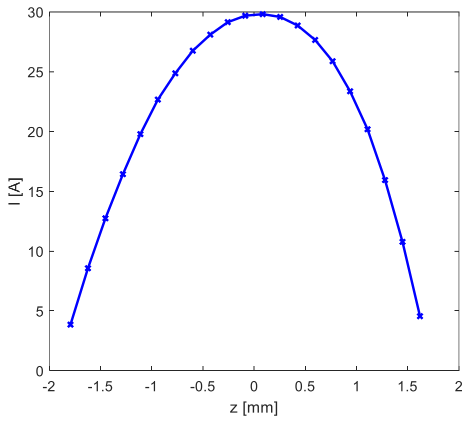
Comparison between measurement and ASTRA simulations



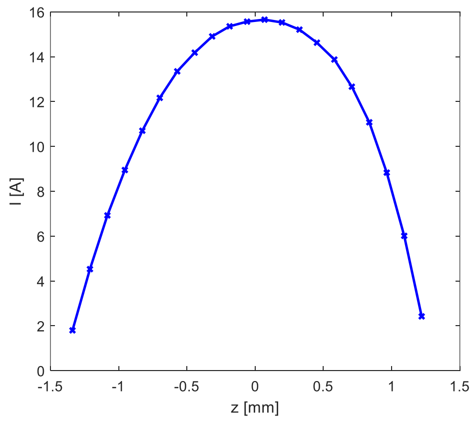
1000 pC



250 pC



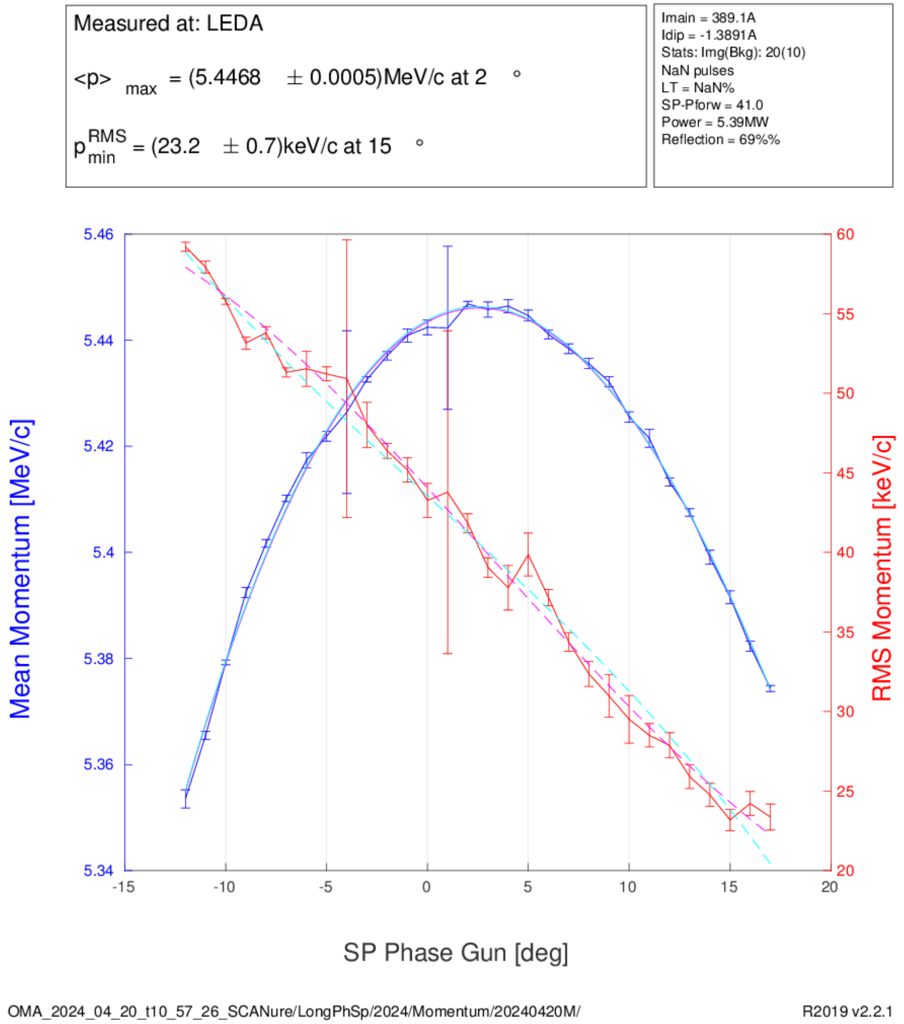
100 pC

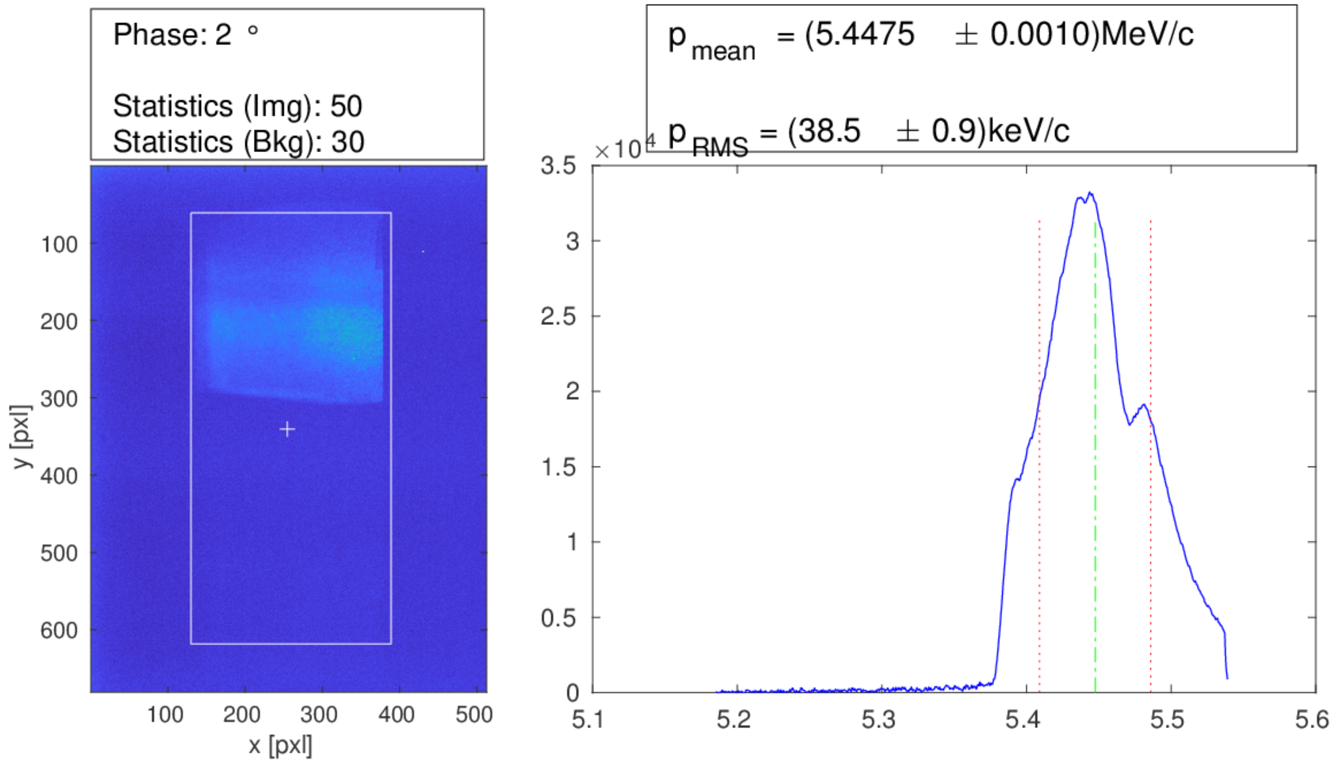


c=3 ps/mm

LEDA

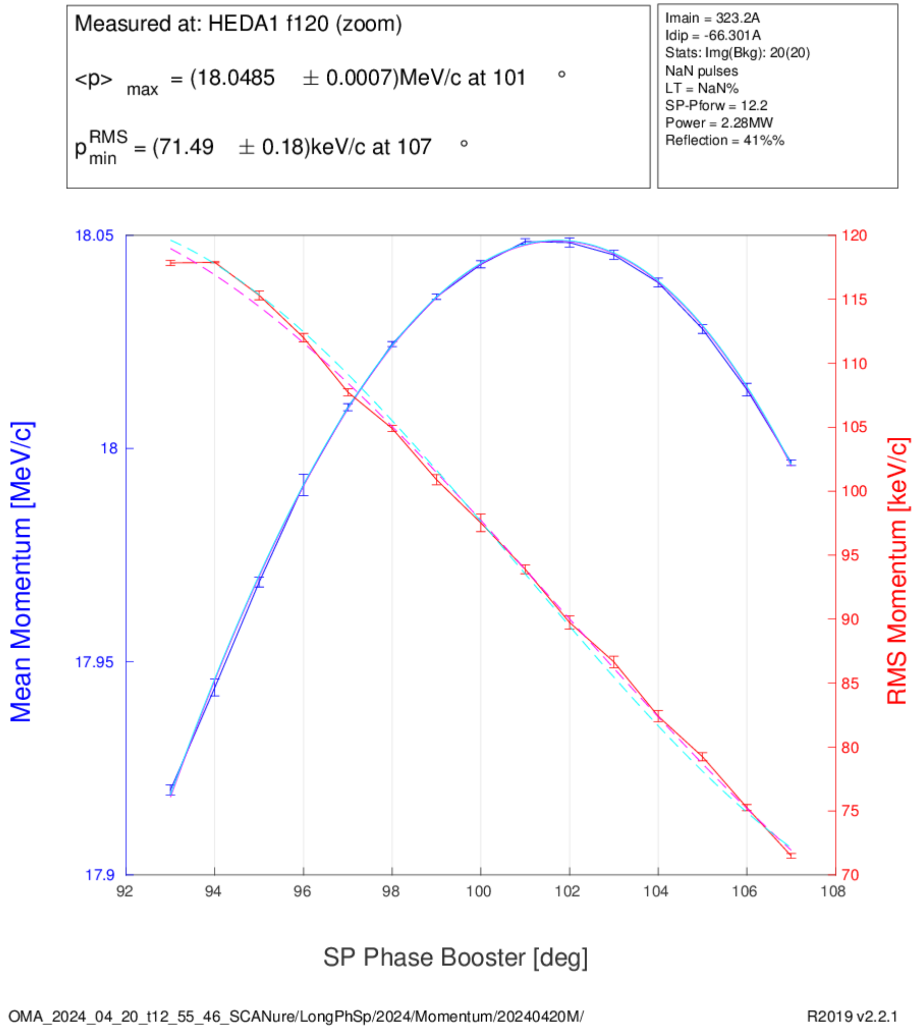
250 pC, 1.5 mm BSA

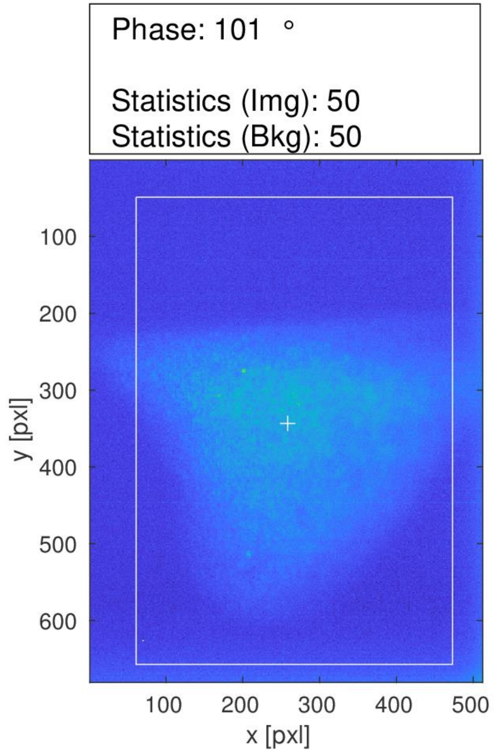


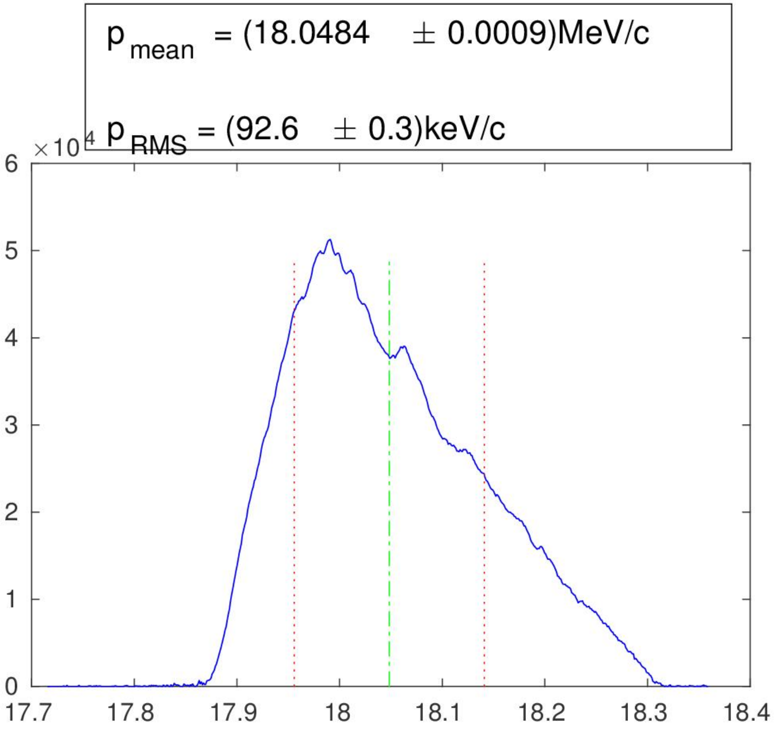


HEDA1

250 pC, 1.5 mm BSA

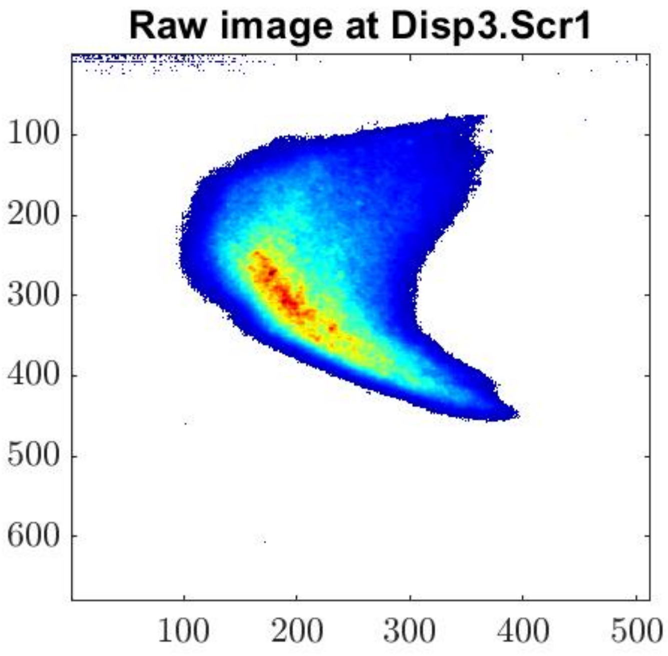


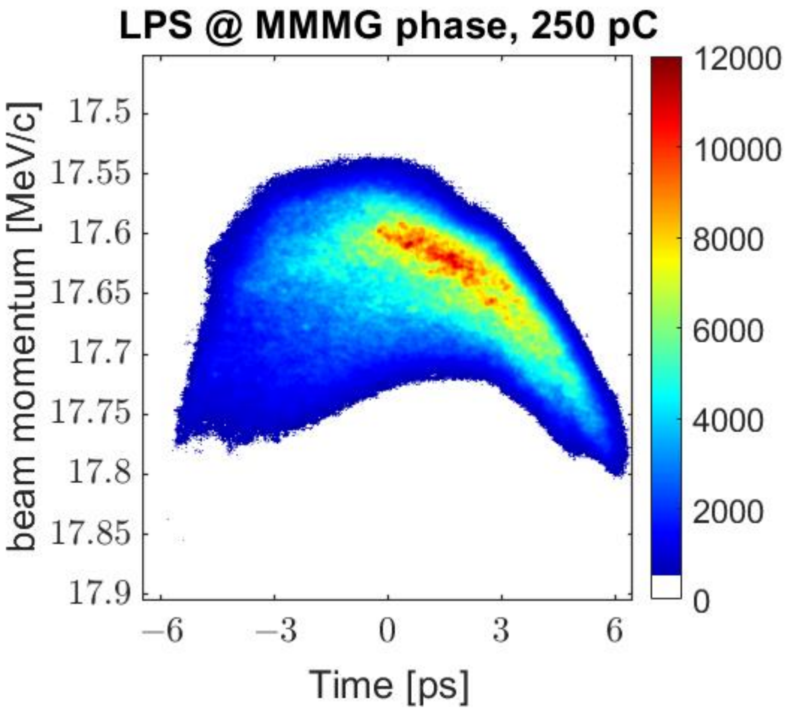


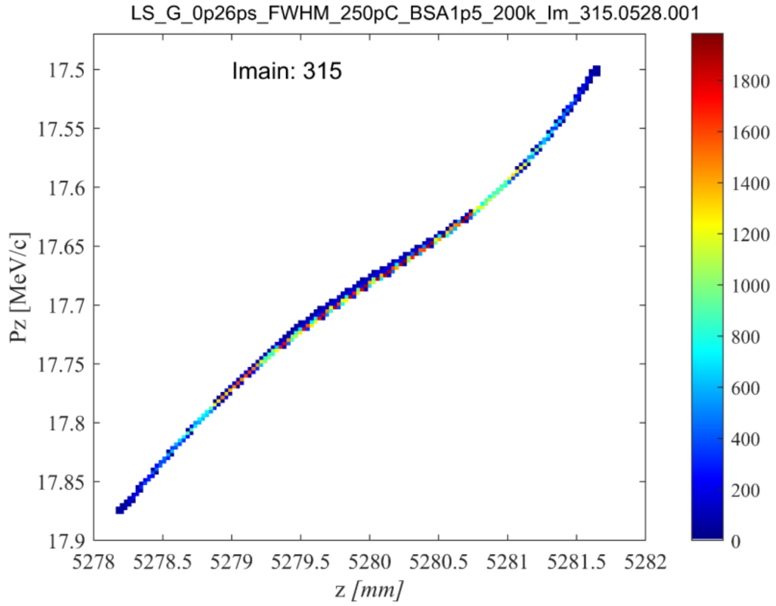


LPS

250 pC, 1.5 mm BSA

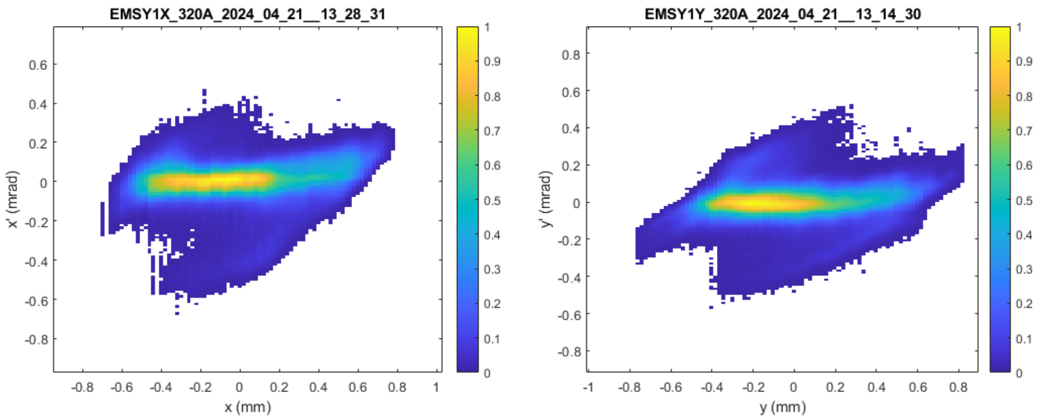






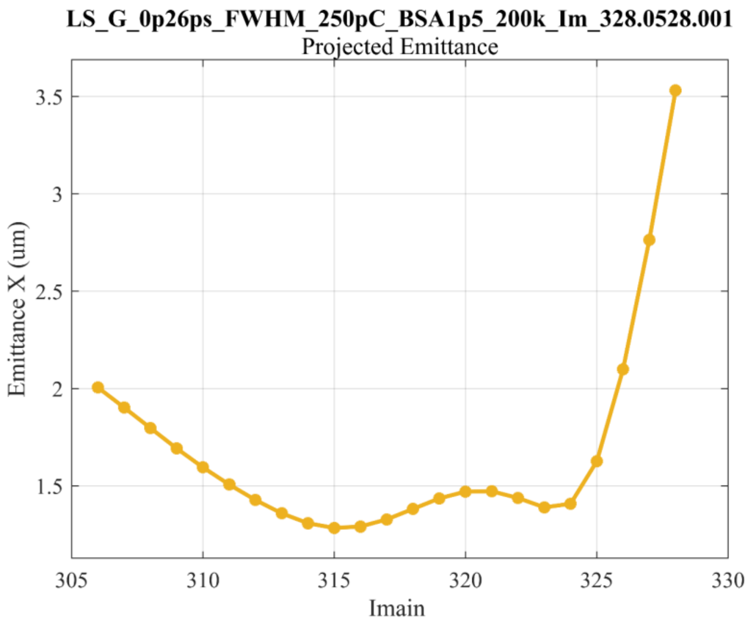
Projected emittance

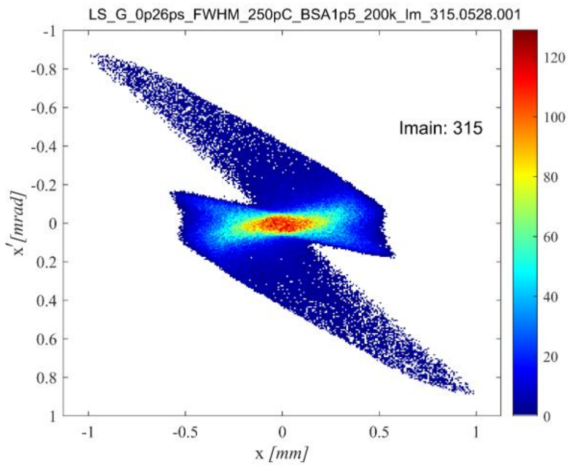
Experimental results



250 pC, 1.5 mm BSA, 320A
Xemit= 1.190 +/- 0.013 mm mrad
Yemit= 1.163 +/- 0.040 mm mrad
XYemit= 1.176 +/- 0.017 mm mrad

Lowest reported: **1.7 mm mrad**
for 1.2 mm BSA, 266 pC

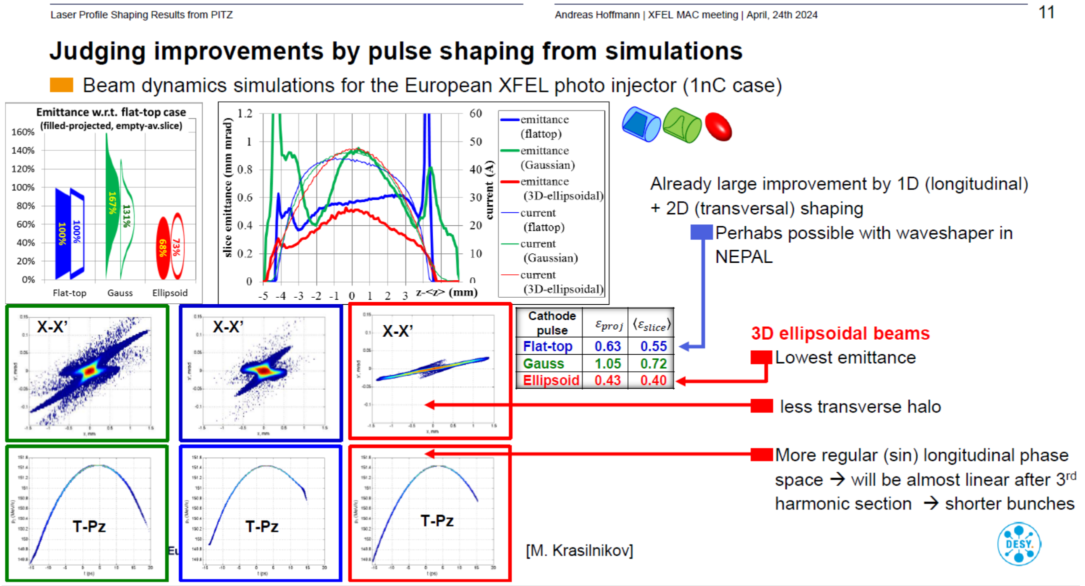




Next steps

Optimize parameter range, remeasure some details （4 shifts)

- Increase transversal beam size on VC2 (last time LT 25%)
- Optimize parameter range to reduce thermal emittance (250 pC, ~1mm BSA, ~1.9 pC/mm²)
- TDS measurements to proof ellipsoidal shape
- Optimize gun quads
- Solenoid scan for slice emittance + statistics + statistics for EMSY1
- Optional: EMSY1 statistics for 0.9 and 1.1 mm BSA
- Detailed LPS using OMA

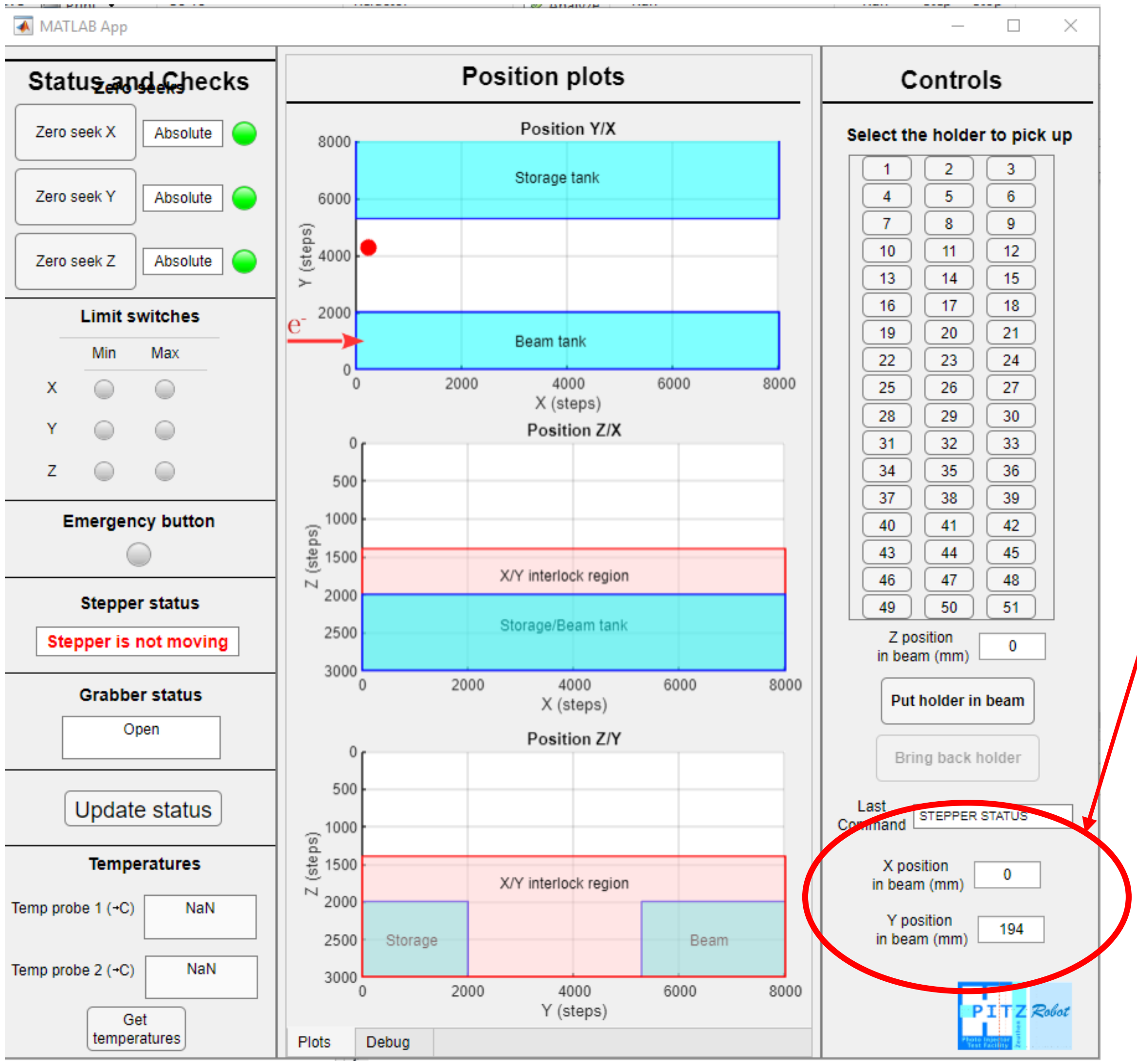


Possible connection to other projects

- Bunch compressor (LPS)
- THz (1 nC and 2 nC)

C-Robot: current status and next steps

D. Villani



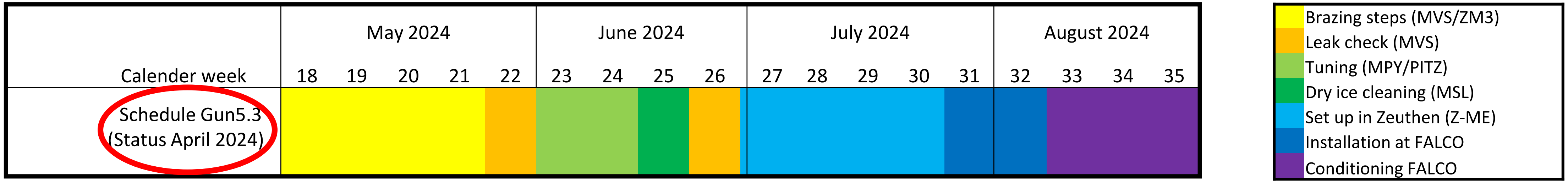
- C-Robot remote connection done thanks to Grygorii and Stefan;
- Provided original script was swapped in Y-axis, debug was done;
- New features in the GUI are implemented: adustable position of the samples to fine tune the samples in the center of the beam;

- Next:
  - Check if the motor steps – to – mm conversion is accurate
  - Check if new sample holders fit in the Robot
  - Put Robot to commisioning and use in the June Run?

Topics for the remaining run periods with Gun5.1

A. Oppelt

Proposed planning till ~August



Gun5.3 is currently delayed by 4 weeks

Run period 15.-28.7.2024 (week 29/30)

Proposed program: Green cathodes

Preconditions: get new cathode box from Milan beginning of week 27, change cathode box end week 27 and get good vacuum before starting

Run period 12.-25.8.2024 (week 33/34) ??? (no valid planning possible at the moment)

Proposed program: Gun5.1 with new spring development

Preconditions: change back to old cathode box, open the gun and refurbish the cathode area, get good vacuum in gun and cathode region before starting

Week 25/26 plan

Status 24.05.2024

to do:	Run						
Week 25	Mon Jun-17	Tue Jun-18	Wed Jun-19	Thu Jun-20	Fri Jun-21	Sat Jun-22	Sun Jun-23
Morn. 07:00 to 15:30	Li Zhang	Li Zhang	Zeeshan Oppelt	Zeeshan Amirkhanyan	Hoffmann Amirkhanyan	Gross Kelisani	Gross Kelisani
Late 15:00 to 23:30	[illegible] Good	Aftab Good	Aftab Riemer	Richard Lotfi	Richard Lotfi	Hoffmann Amirkhanyan	Hoffmann Amirkhanyan
Night 23:00 to 07:30	Richard Kalantaryan	Richard Kalantaryan	Vashchenko Kalantaryan	Vashchenko Riemer	Dmitriiev Riemer	Dmitriiev Villani	Dmitriiev Villani

Startup
BBAs
BPMs

Irradiation
LDR/HDR
Uni Potsdam

THz 2 nC
with MIR
THz camera

Blow-out
Emittance

Dosimetry

THz 2 nC
Recovery

Recovery
HDR

to do:	Run						
Week 26	Mon Jun-24	Tue Jun-25	Wed Jun-26	Thu Jun-27	Fri Jun-28	Sat Jun-29	Sun Jun-30
Morn. 07:00 to 15:30	Vashchenko Kalantaryan	Vashchenko Kalantaryan	Zeeshan Kalantaryan	Krasilnikov Oppelt	Krasilnikov Riemer	Richard Good	Richard Good
Late 15:00 to 23:30	Li Zhang	Li Zhang	Li Dmitriiev	Zeeshan Lotfi	Aftab Lotfi	Krasilnikov Kalantaryan	Krasilnikov Kalantaryan
Night 23:00 to 07:30	Dmitriiev Good	Hoffmann Good	Hoffmann Good	Gross Amirkhanyan	Gross Amirkhanyan	Aftab Zeeshan	Aftab Zeeshan

FLASH-RT

SES

Irradiation
LDR/HDR
Uni Potsdam

NitroFLASH

Cathode plug
Cs2Te / Mo

Recovery LDR

Beam prep.
NitroFLASH

Emittance

C-Robot?

FLASH-RT: gun SP 41, ~5.5 MeV/c at MMMG phase
Others: gun SP **45, ~6** MeV/c at MMMG phase

FLASHlab Irradiation BAM/Uni Potsdam

6 shifts

FLASHlab Irradiation BAM/Uni Potsdam

Release date: 21-May-24

Responsible person: Matthias Gross, Marc Hahn (U Potsdam)

☒ *Responsible person must be present during the experiment*

Estimated number of shifts required: ~6; ideally: irradiations in late shifts on 18./19./25./26. June (starting around noon) with LDR on first day and HDR on second day in both weeks

Priority: PITZ is getting paid for beam time (3 to 5 experimental sessions in 2024)

Brief description of the experiment: Irradiation of selected biomolecules (Protein,DNA and their complexes) under varying oxygen conditions at LDR/HDR

Expected results: Input for understanding FLASH effect

Prerequisites: Beam available at Disp5 experimental station

Initial parameters for the experiment:

Photocathode laser:	NEPAL
Temporal profile:	standard
BSA size:	2mm
Maximum number of pulses:	420(?)
Electron beam	
Bunch charge:	low/high (TBD) at Disp5.FC2, *Number of pulses:*
RF Gun	
RF pulse length:	140
RF power in the cavity/Beam momentum at LEDA:	5.6 MeV/c (SP 41)
RF phase:	0 w.r.t. MMMG
Booster	
RF pulse length:	150
RF power in the cavity/Beam momentum at HEDA1:	18 MeV/c (SP 12.2)
RF phase:	0 w.r.t. MMMG
TDS	
LLRF amplitude set point:	-
RF phase range:	-

Measurement procedures: Put here a step-by-step instruction for the measurement

Option: indicate explicitly which beamline elements must/must not be used

Save data: What and where to save? Prepare a table for results and put it in proper folder, if needed

Expected difficulties and options: Put here an alternative measurement conditions or alternative measurement instructions in case the main measurement is not possible

FLASH-RT water samples at 4 and 1% O_2

6 shifts

FLASH RT – June PITZ 2024

Release date: 16-May-24

Responsible person: Sepideh Aminzadeh Gohari, Matthias Gross

☒ *Responsible person must be present during the experiment*

Estimated number of shifts required: 6 shifts

Brief description of the experiment: dosimetry prep, irradiation of water-based samples at 4 and 1 % O2

Expected results: Chemical and biological effects of PITZ beam at 4 and 1 % O2

Prerequisites: Additional measurements, such as QE, Laser BBA, proj. emittance or bunch length

Initial parameters for the experiment:

Photocathode laser: NEPAL-P (or PHAROS)
Temporal profile: 8ps Gauss
BSA size: ________________
Maximum number of pulses: ~200 (or less)
Electron beam
Bunch charge: __ at Charge measurement device, *Number of pulses*: __
RF Gun
RF pulse length: 140 us
RF power in the cavity/Beam momentum at LEDA: 6.3 MeV/c
RF phase: 0 w.r.t. MMMG
Booster
RF pulse length: 200
RF power in the cavity/Beam momentum at HEDA1: ~18 MeV/c
RF phase: 0 w.r.t. MMMG
TDS
LLRF amplitude set point: ________________
RF phase range: ________________

Measurement procedures: low dose rate beam used on 01. March 2024 (better 08. May 2024), high dose rate beam used on 02. March 2024 (better 09. May 2024). The measurementplan with detailed information on the doses and samples will be uploaded at ...FLASH-RT\2024\MeasurementPlans

Save data: Note the irradiation conditions ...FLASH-RT\2024\MeasurementPlans

Expected difficulties and options:
The prep dosimetry shift is needed for the delivered dose test that is better to be done at previous night; for what SSB is needed. Or previous day late shift.
Samples are to be taken out of the tunnel, for what SSB is needed. All samples are to be returned to the bioteam for analysis.

Summary of beam preparation for FLASH-RT

- Use ref beam (100 pC) to define the beam trajectory from booster to High3
  - Use PST.ST2 and ST6 to center the beam in **y** at PST.BPM5 and High2.BPM1 (y steerers in between BPMs off)
  - Use High2.ST2 and High2.ST3.IX to make the quads High2.Q4 and High2.Q5 steering free in **x**
  - Go to LT for LDR (20 pC), focus the beam at High3.Scr1 horizontally
  - Go to LT for ref beam (100 pC)
  - Use High2.ST5.IX and High3.ST1.IX to center the beam at High3.BPM1 and High3.BPM2 in x
  - Use High2.ST5.IY and High3.ST1.IY to center the beam at High3.BPM1 and High3.BPM2 in x