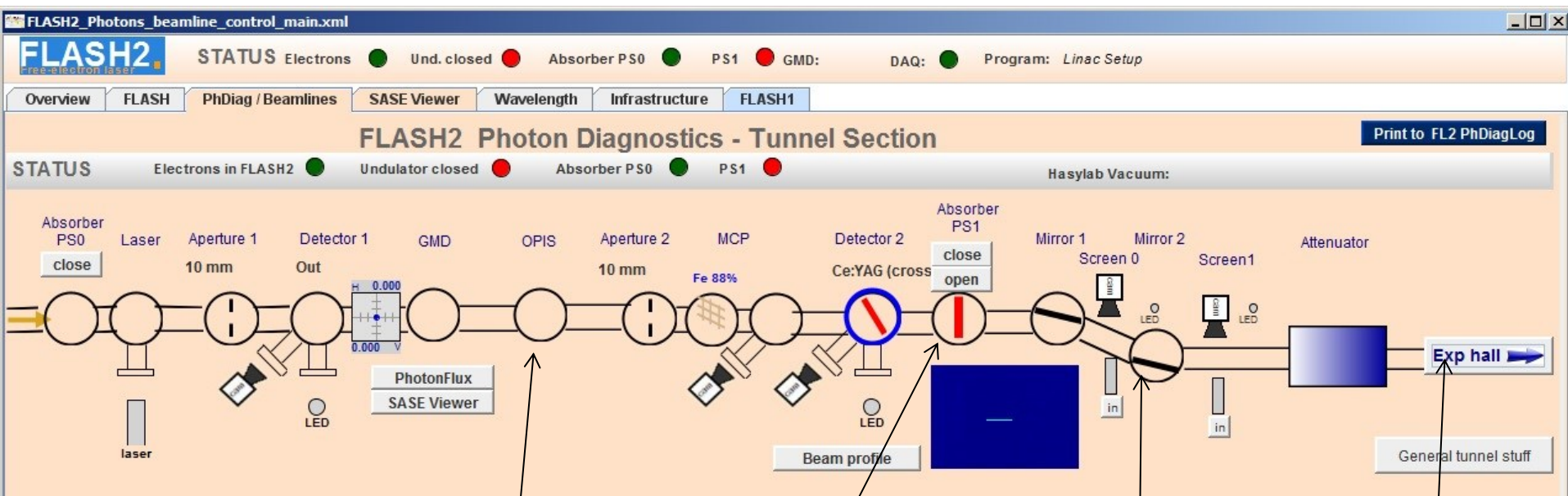


Report on FLASH2 Photon Beam Diagnostics

- Overview of FLASH2 Photon Diagnostics.
- What was done in 2016 so far.
- Accomplishments of FEL beam shifts of last weeks.
OPIS, Grating Spectrometer, Beamlines
- What is next?
 - What is different to FLASH1.
 - Comments on status of operation.
 - Comments on 'how to operate' and jddd features.
 - Comments on 'nice beam'.

Photodiagnostics

Differences to FLASH1



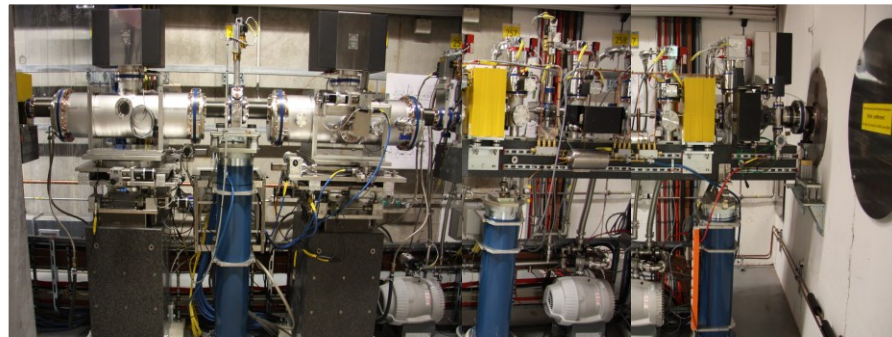
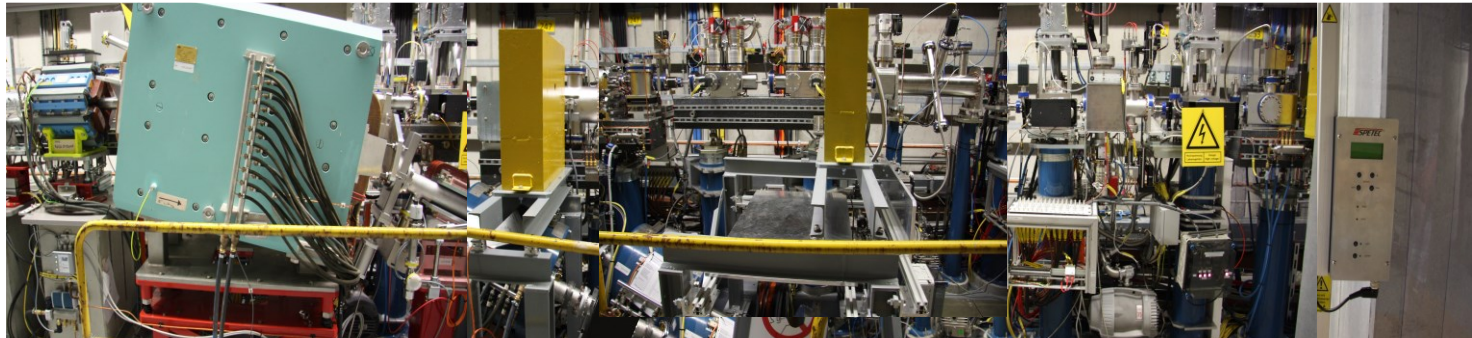
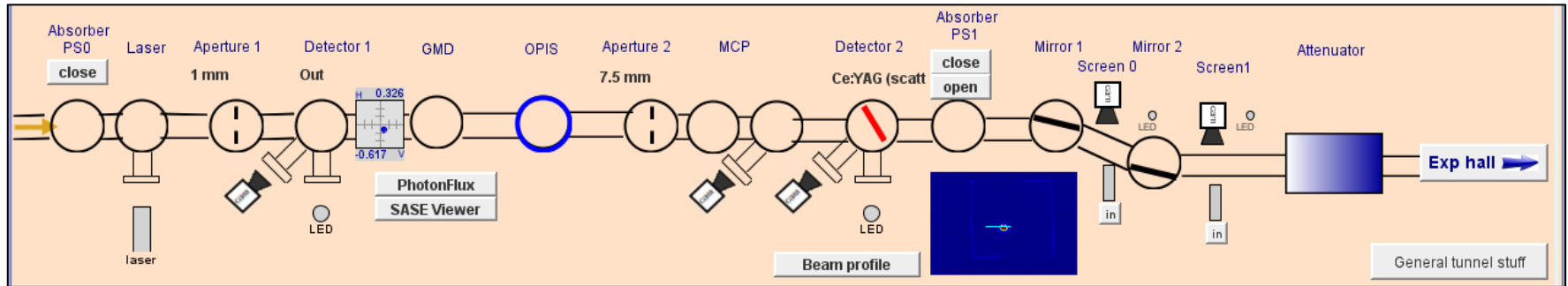
More than one Absorber!

Online wavelengths measurement

Mirrors in the tunnel

Grating Spectrometer in ExpHall

FLASH2: Tunnel Section

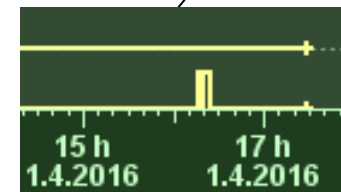
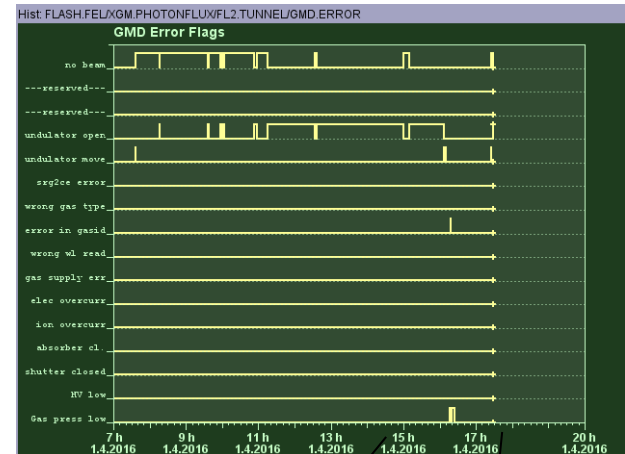


GMD

FLASH XGMD Photonflux - Developer Operator View
calculating photon flux

Name	Auto	Manual	Used values
Gas Type:	2	---	Neon
Cross-Section:	6.57 Mb	24.87 Mb	6.57 Mb
Gamma:	1.00	2.17	1.00
Current left offset:	---	20.0f A	20.0f A
Current left:	-25.23f A	---	-45.23f A
Current right offset:	---	280.0f A	280.0f A
Current right:	292.38f A	---	12.38f A
Current sum:	---	---	-32.86f A
Detector length:	---	22.90 cm	22.90 cm
Temperature:	24.00 °C	---	24.00 °C
SRG Pressure:	8.42E-7 mbar	---	8.42E-7 mbar
RVC Pressure:	1.79E-6 mbar	---	1.79E-6 mbar
Nr. of Bunches:	1.00	---	1.00
Wavelength:	20.00 nm	0.00 nm	20.00 nm
Undulator open:	0	---	0
Undulator moving:	0	---	0
Frequency:	10.00	---	10.00
Delay:	99.96	---	99.96
Sample:	4248 271 9 1	---	4248 271 9 1
Error Flags:	0x0	---	
Photon Flux:	---	---	-0.12 µJ

Standard gas change in 6 min.
Larger wavelengths regions to cover.
Automatic error handling.



FLASH2: OPIS

svn/FLASH/Hasylab/FLASH2_Photons_beamline_control_main.xml

FLASH2 STATUS Electrons ● Und. closed ● Absorber PS0 ● PS1 ● GMD: ● DAQ: ● Program: FEL Beamline comissioning

Overview FLASH PhDiag / Beamlines SASE Viewer Wavelength Infrastructure FLASH1

FLASH2 Photon Diagnostics - Tunnel Section

Print to FL2 PhDiagLog

STATUS Electrons in FLASH2 ● Undulator closed ● Absorber PS0 ● PS1 ● Hasylab Vacuum:

FLASH2 OPIS

User	Advanced	Expert
14.29		eTOF2
60.56	11.81 nm	Xe_5pSP_2
65.63	11.77 nm	Xe_5s_2
128.00	11.71 nm	Xe_4d52_2
137.30	11.71 nm	Xe_4d32_2
		eTOF3
		Prompt_3
		Xe_5pSP_3
		Xe_5s_3
		Xe_4d52_3
		Xe_4d32_3

Mean Wavelength
11.72 nm

Mean Photon Energy
105.8 eV

X-Pos = 0.8
Y-Pos = -0.8

Δ13 = 0.0 **Δ24 = 0.0**

HistoryPlot TOF HistoryPlot WL

Retardation Voltage: 25 V

Phot. Energy used for ROI settings: 105.9 eV

show Spectrum in IDL: OFF

Message: o.k.

Last updated: 2016-Mar-22 03:20:22.036

General Informations
Program: FEL Beamline comissioning

Property	Value
Set wavelength	11.3 nm / 109.6 eV
Energy	6.4 μJ
Bunch RepRate	1003 kHz
Bunches per Train	1
Bunch charge	0.27 nC

save buffer No. of pulses to average: 600

bunch selector No. of bunch analyzed: 1

Vacuum

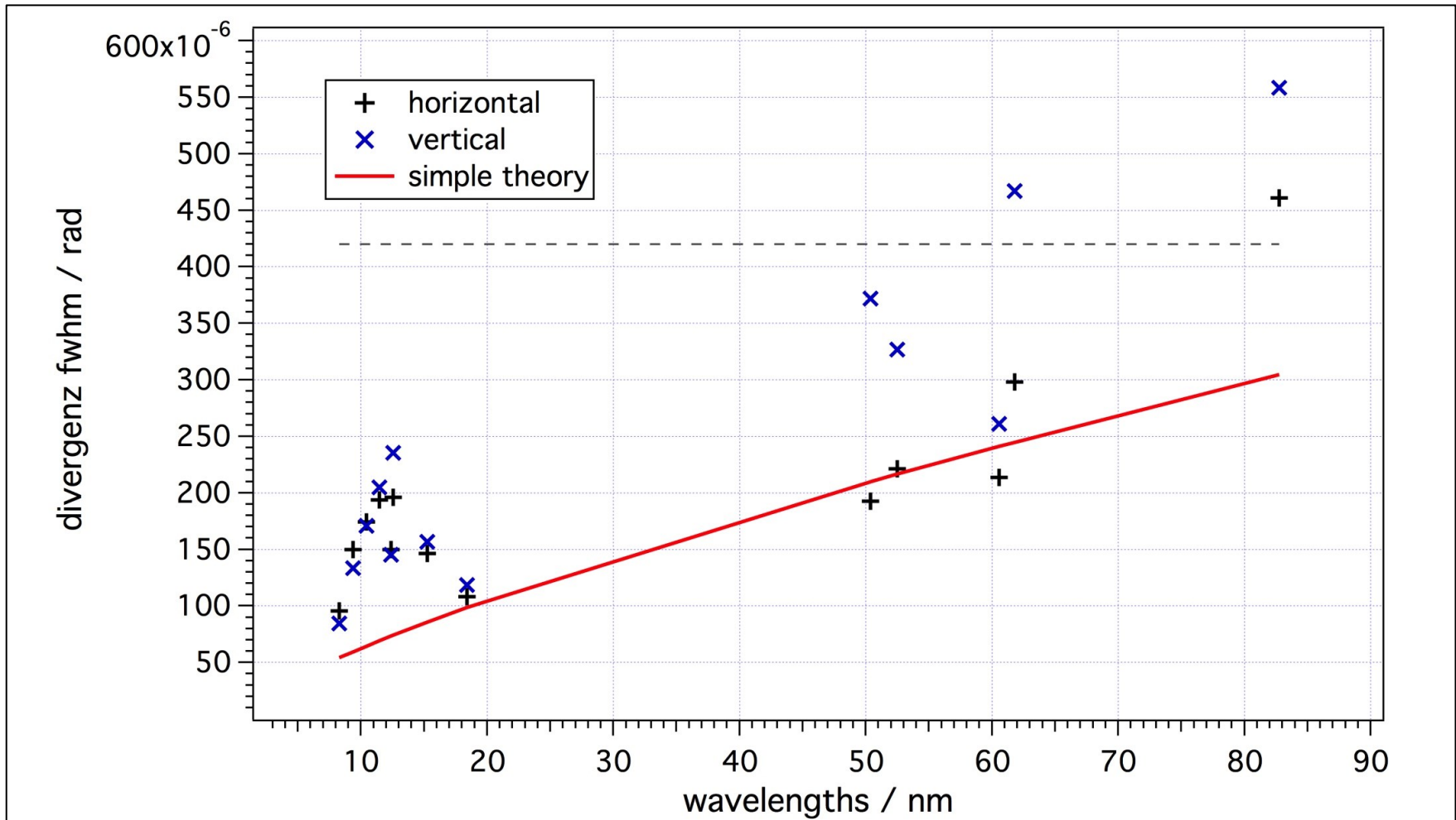
Link to FL2 Vacuum SPS

Link to FL2 gas change SPS

Link to FL2 PHdiag elog

Markus Braune

FLASH2 Photon Beam Divergence



(insufficient statistics!)

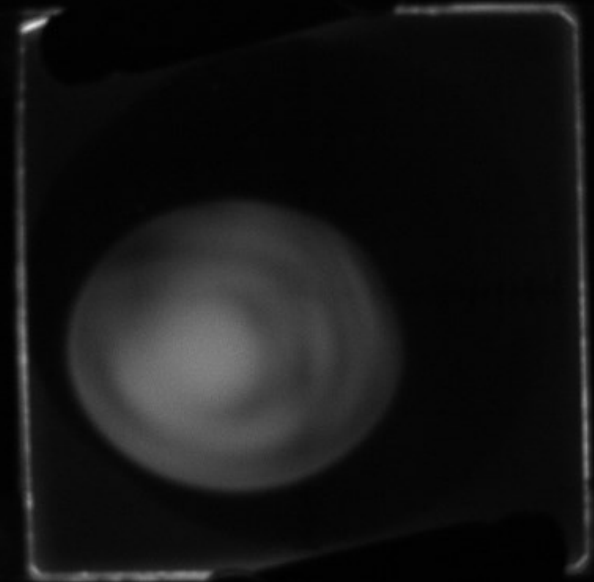
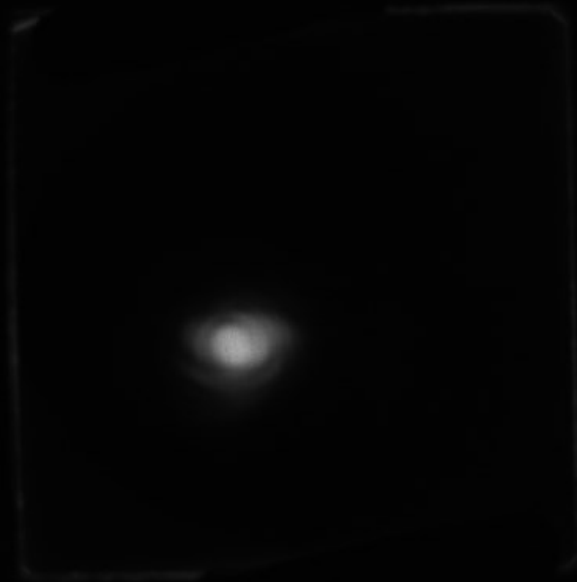
FLASH2 Photon Beam Divergence

FL1 4,2 nm

FL2 8.27 nm (9.3 μ J)

FL2 82,74 nm (100 μ J)

FL1 25,8 nm



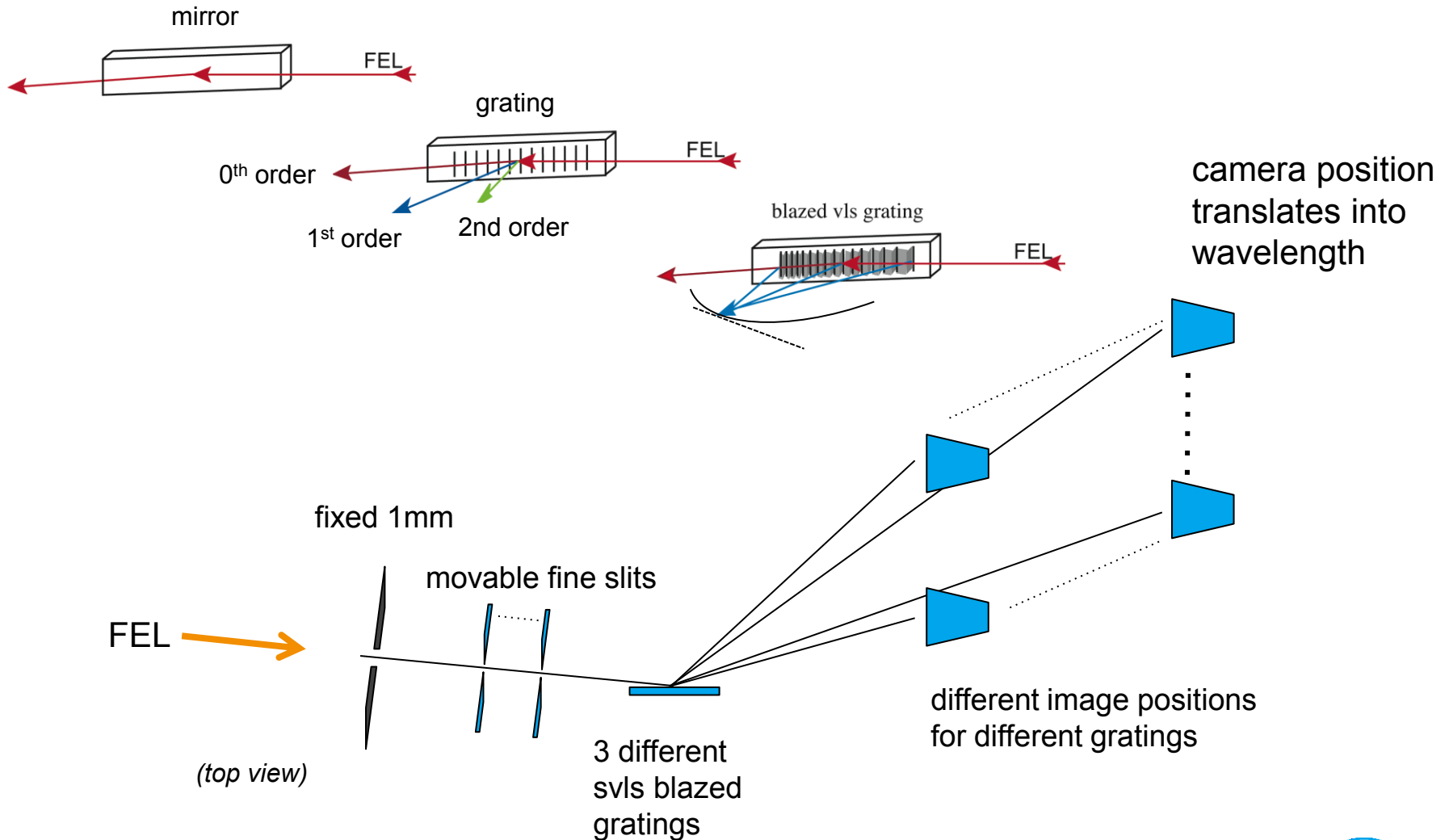
FLASH2 Experimental Hall

Grating Spectrometer FL22

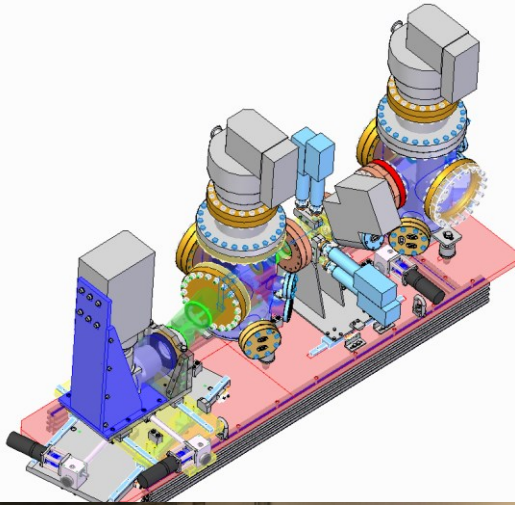


First Experiments FL24

Grating Spectrometer: Concept and Design



Grating Spectrometer:



svn/global/commonAll_In_One_Camera_Expert.xml TTF2.FEL/ICCD8.CAMERA/PCO.CAM1*

TTF2.FEL | ICCD8.CAMERA | PCO.CAM1

EXPERT Panel **PCO.CAM1** R02 Back

TTF2.FEL/ICCD8.CAMERA/PCO.CAM1/

Board Nr.: 1 CCD Temp: -11.0 ELE Temp: 26.0 pco dicam pro

ok

Camera Connection Server On Off Expert

Params W: 1280 H: 1024 B-Pix: 12 I-Points: 450560

Images Start / Stop

Frame 271291 DMA Timeout 20 500000 0 0

Scale XY X Scale Y Scale

image comp. jpeg off Flip: off rotation: off H V

Tool Box BG. Subst. Histogram X & Y Spectrum ROI 1 ROI 2

Write Images Write ROIs

DAQ Mode Sender: ON

Trigger Trigger Gain normal 699 Rate [Hz]: 10.0

X bin first last Binning bin first last Y bin first last

1 1280 1 289 640

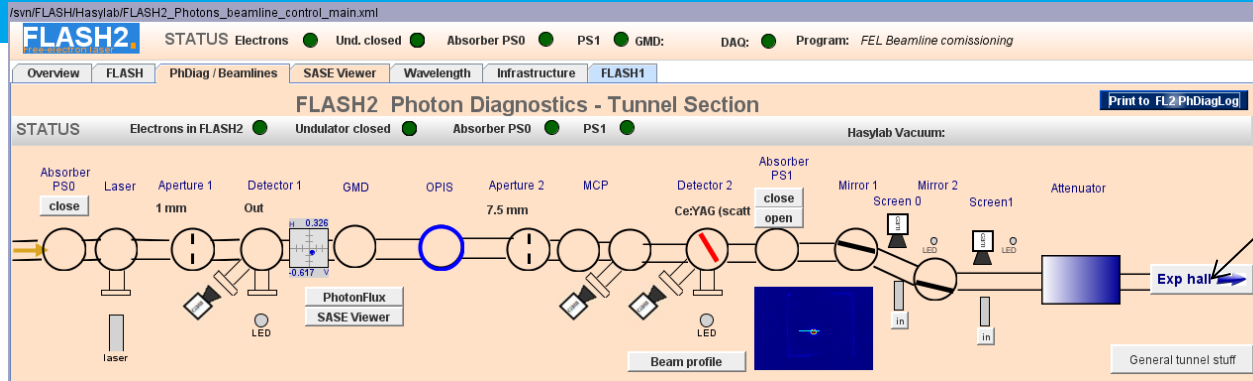
Loops Single Double Multi Shutter

Phosphore-decay: 1.00 ms

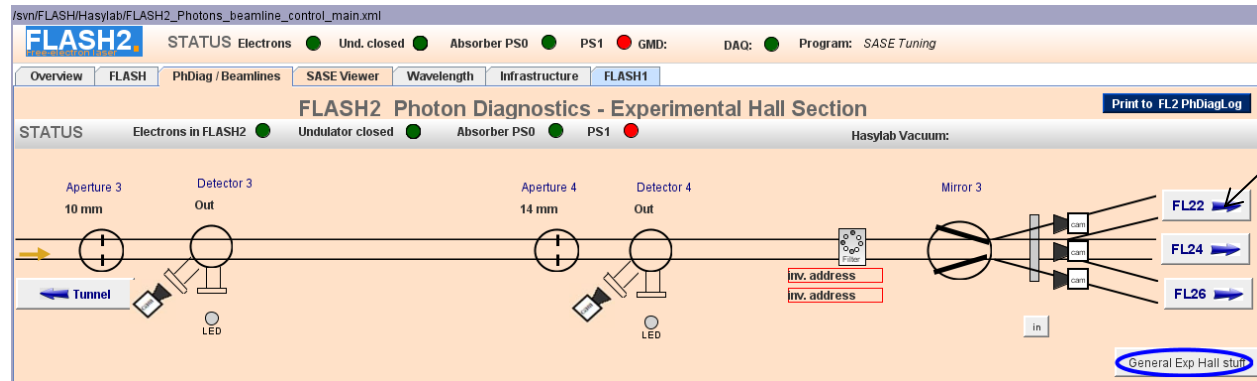
Single Trigger

Delay		Exposure Time	
0 ms + 0 ns	0 ms + 800 ns	0 ms + 0 ns	0 ms + 0 ns
0 ms + 500 ns	3 ms + 0 ns	0 ms + 0 ns	0 ms + 0 ns
0 ms + 500 ns	0 ms + 0 ns	0 ms + 0 ns	0 ms + 0 ns

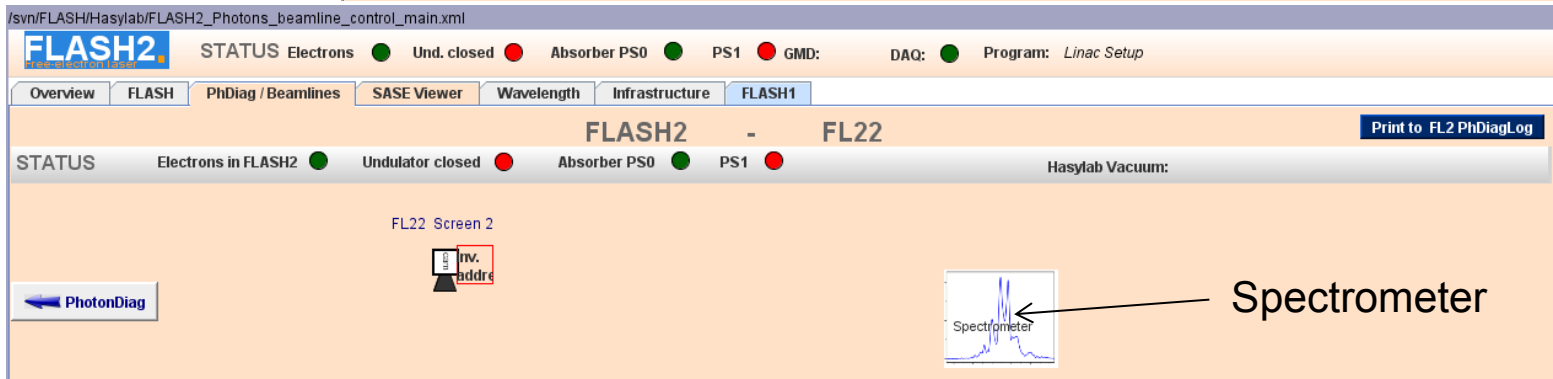
Grating Spectrometer: jddd path



Exp hall



FL22

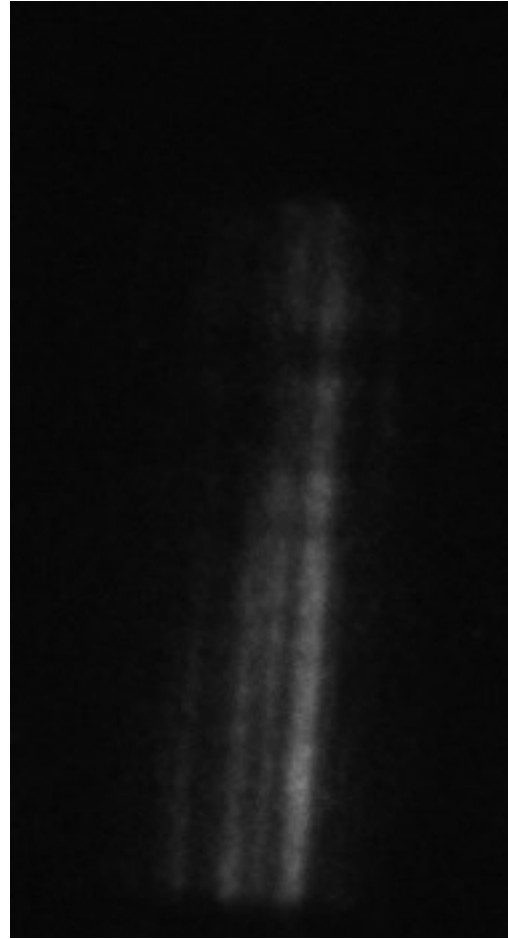
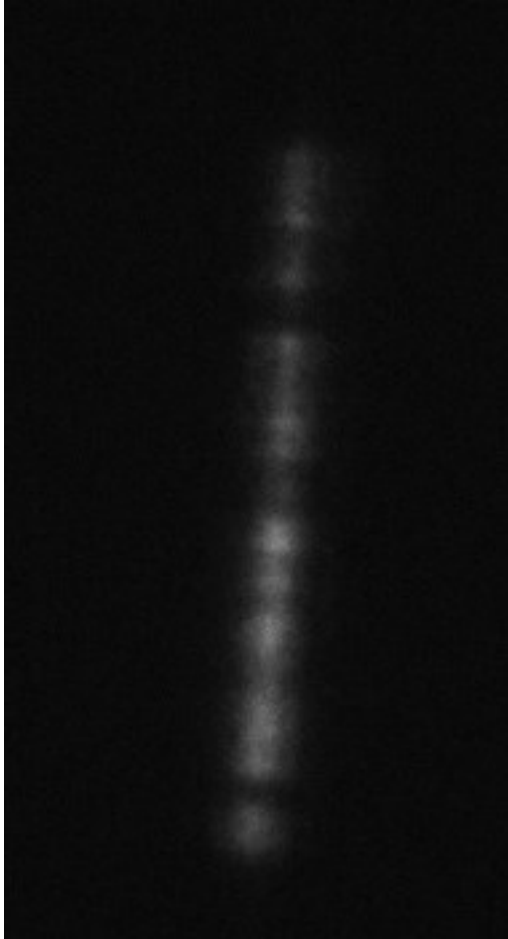


Spectrometer

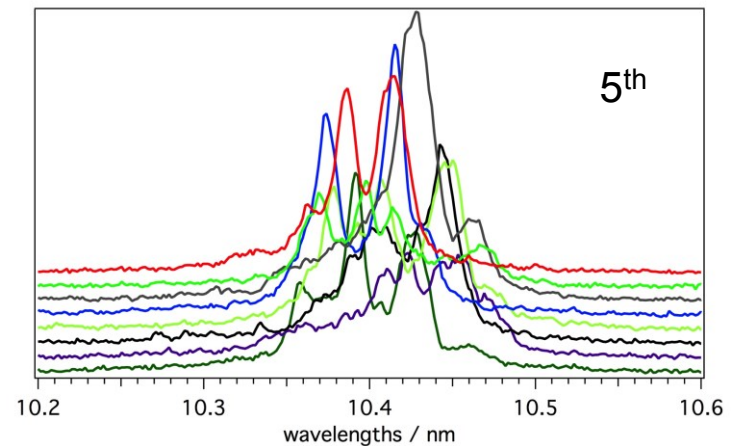
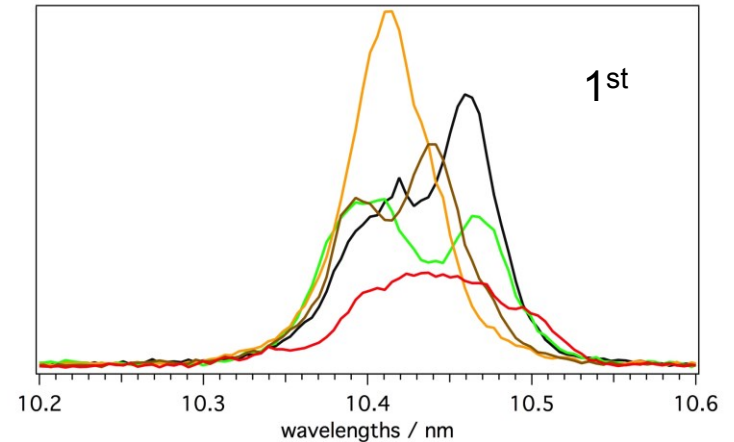
Grating Spectrometer: Higher Orders

1st grating order

5th grating order

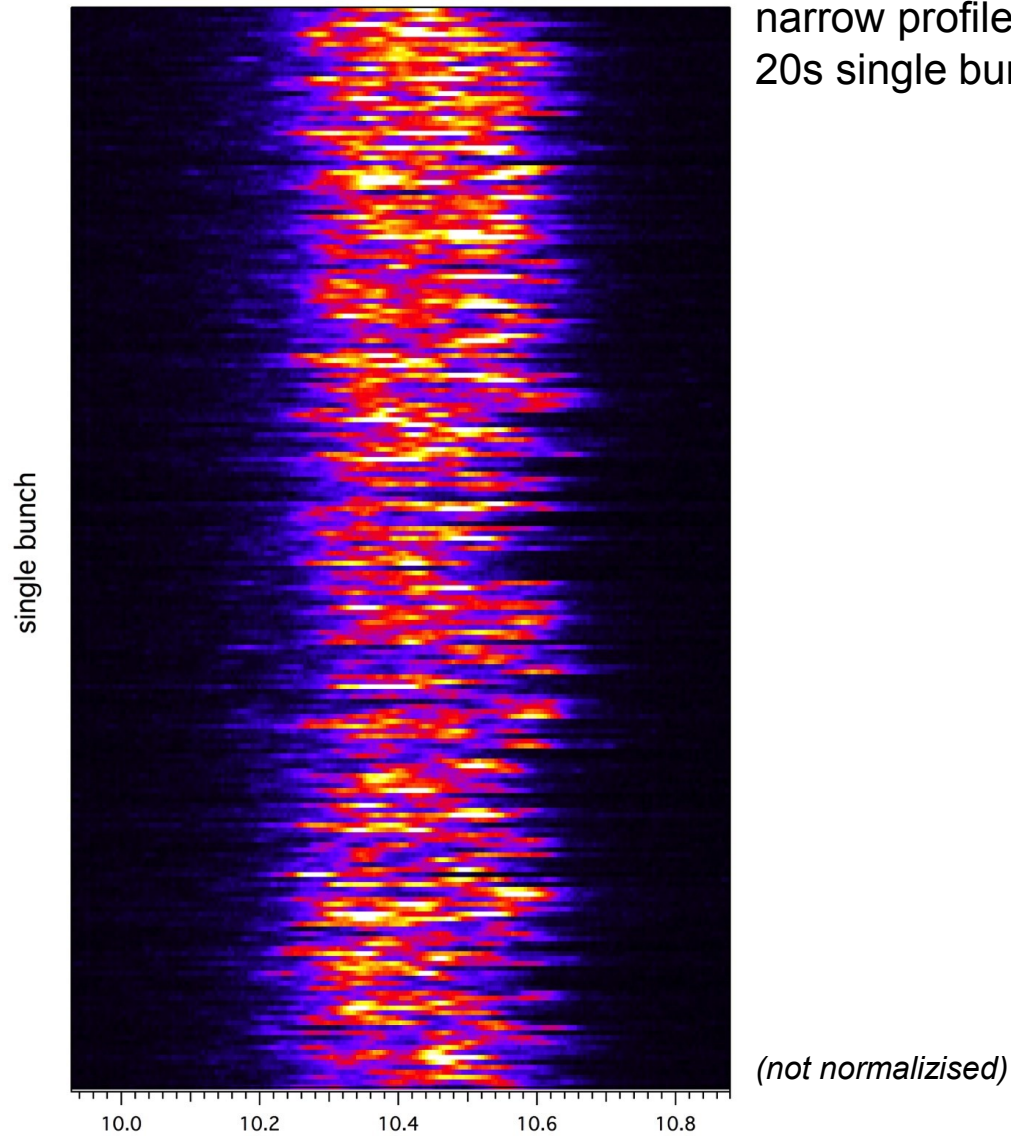


Samples of narrow profiles



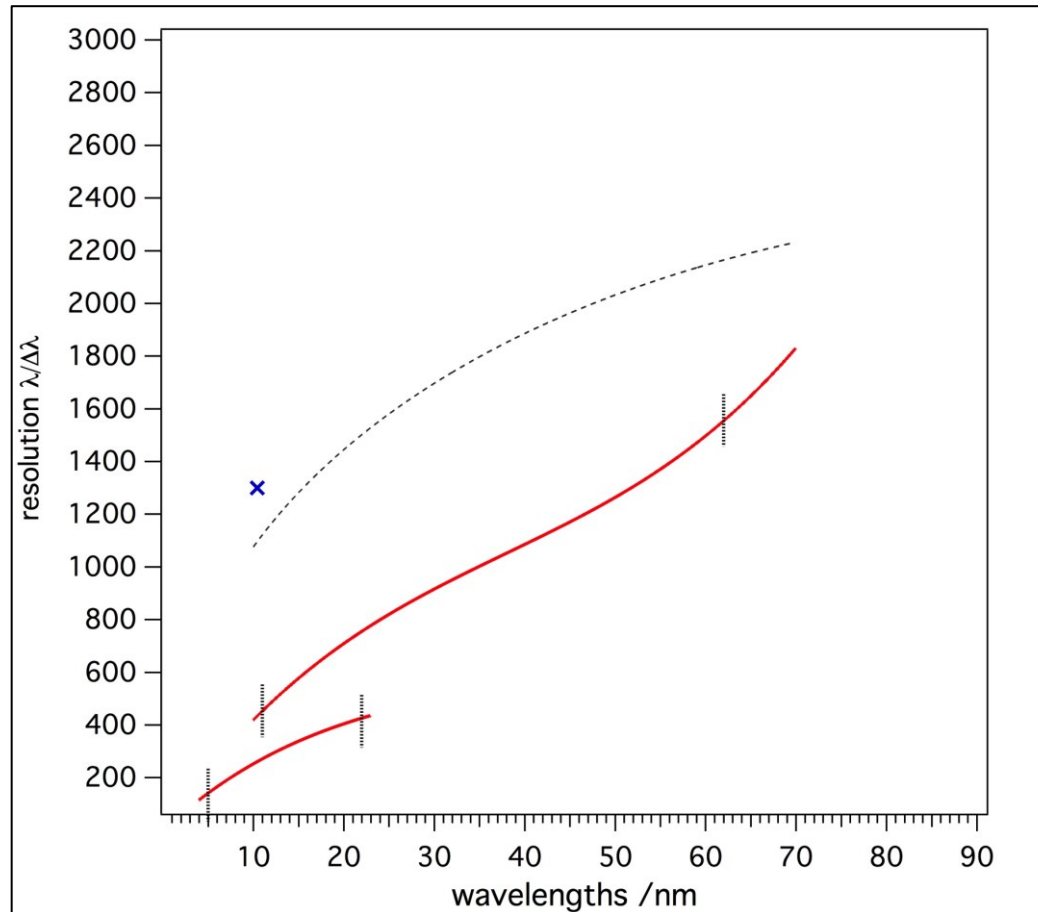
center wavelength standard deviation: 0.08nm
average fwhm of single gaussian fits: 0.42nm

Grating Spectrometer:



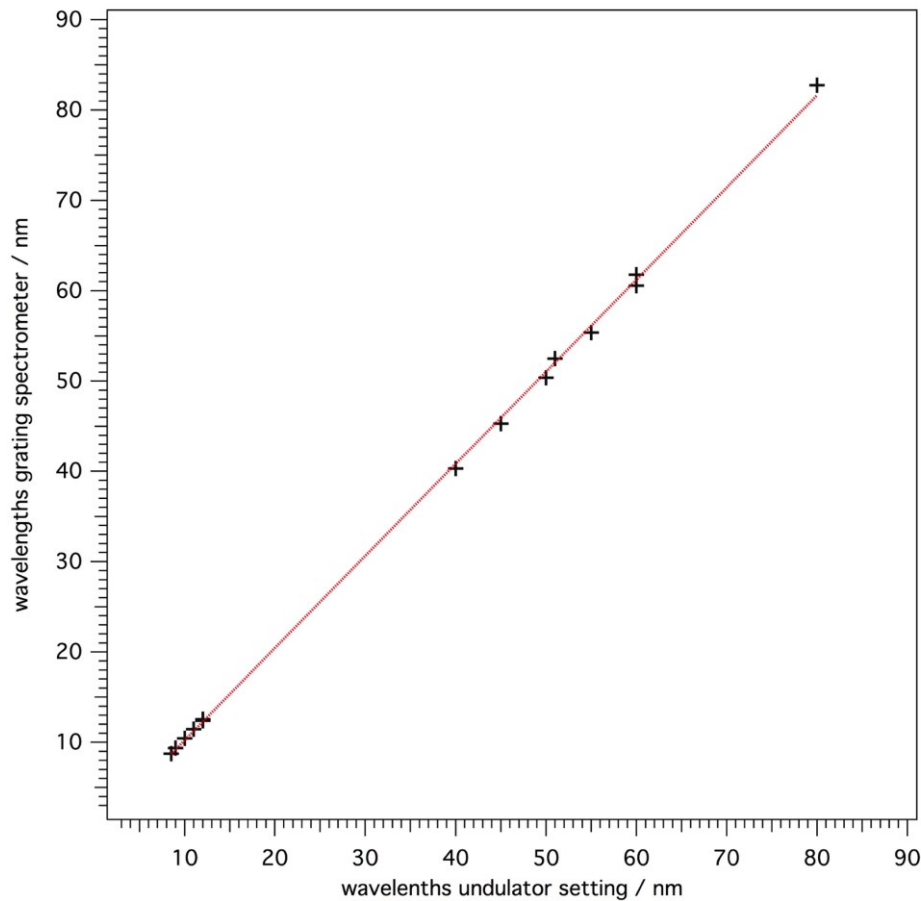
narrow profiles of 5th grating order
20s single bunch 10Hz at 10nm setting.

Grating Spectrometer: Resolution $\lambda/\Delta\lambda$

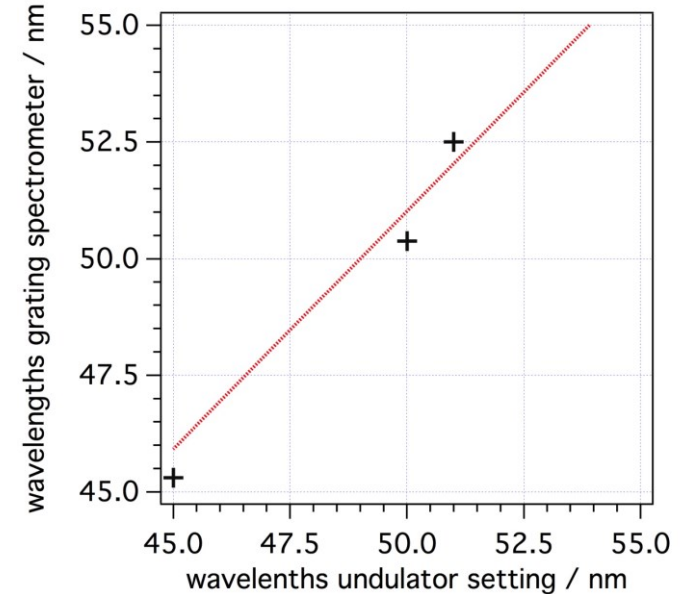


- 1st order grating (measured)
- × measured 5th order
- - - 1st order design theoretical

Grating Spectrometer: Possible Fudge Factor



line fit at 1.96%



(insufficient statistics!)

Grating Spectrometer: jddd Operation

FLASH2 STATUS Electrons ● Und. closed ● Absorber PS0 ● PS1 ● GMD: ● DAQ: ● Program: Linac Setup

Overview FLASH PhDiag / Beamlines SASE Viewer Wavelength Infrastructure FLASH1

FLASH2 - FL22 Print to FL2 PhDiagLog

STATUS Electrons in FLASH2 ● Undulator closed ● Absorber PS0 ● PS1 ● HASYLAB VACUUM:

FL22 Screen 2

PhotonDiag

Spectrometer

FL22 stuff

XUV-Spectrometer at Flash2

User Advanced Expert (calibration) Expert old

Grating Motor
Current Position: 11-62 nm

Wavelength in nm
Current wavelength is: 41.12 nm
Set wavelength to: 17.98 Move

SLIT
Current position: unknown 208200
Current motor status: stopped -61800

Open wide standard small Close

Debug
Active motor: none
Motor Position:

Manual Model Server won't move the motors

Spectrum viewer
Spectrometer PCO

Vacuum

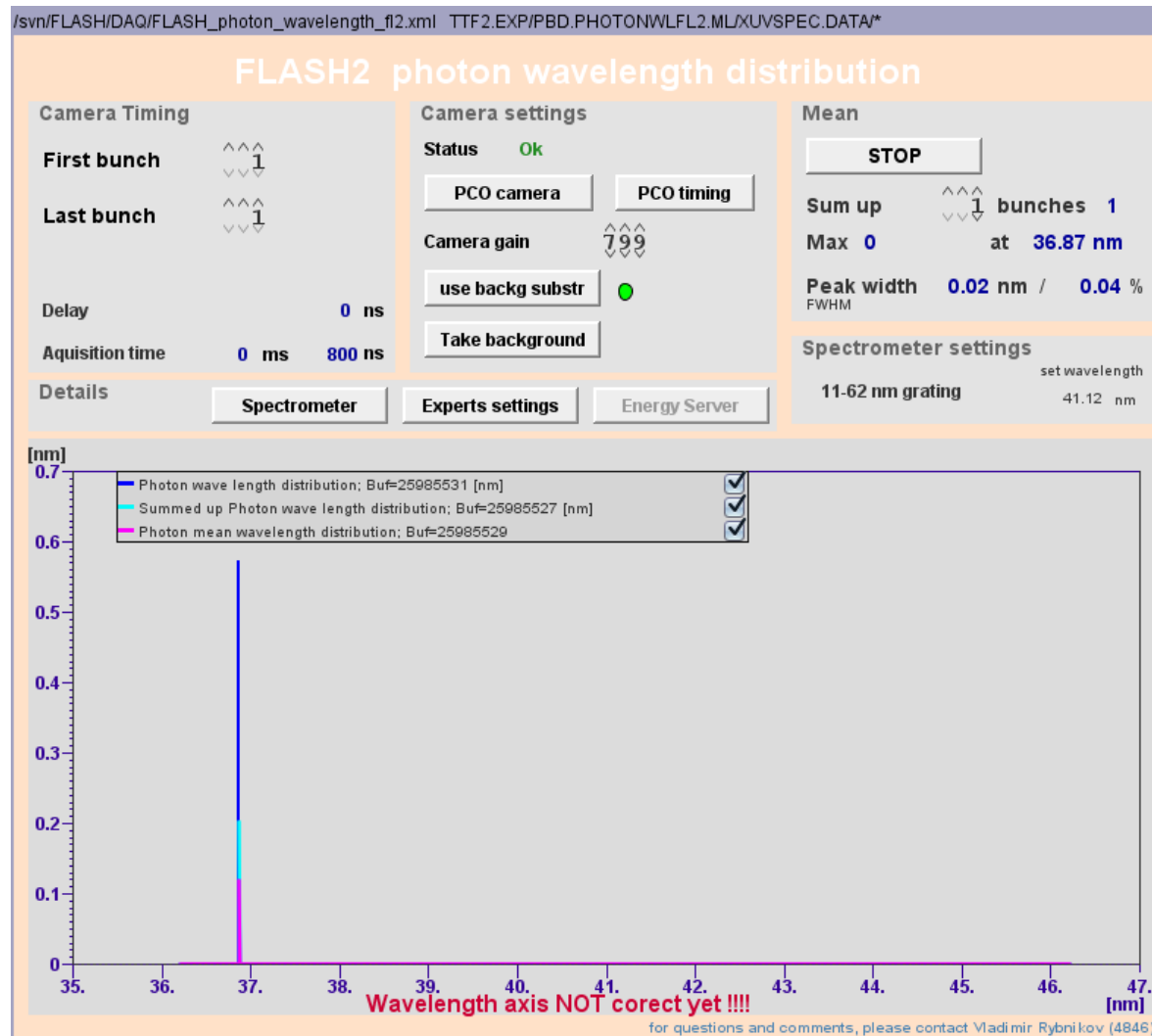
Link to Vacuum SPS
Link to FL2 Vacuum SPS
Link to FL2 gas change SPS

Stop All Movement
Motorbox for spectrometer

Link to FL2 PHdiag elog

General Informations	
Program:	Linac Setup
Property	Value
Set wavelength	20.0 nm / 62.0 eV
Energy:	-0.0 μ J
Bunch RepRate:	1003 kHz
Bunches per Train:	1
Bunch charge:	0.36 nC

Grating Spectrometer: Spectrum Viewer



Grating Spectrometer:

Grating Spectrometer: (34,5h in 7d)

- Tool is in place at FL22 and aligned.
- Operation for Grating 3 [11-62nm] is set up.
- Operation of Grating 1+2 [1-5nm+5-20nm] requires $\lambda < 7\text{nm}$.
- Solve problems with FL20M3.
- Wavelength change by operators.
- Spectrum viewer full operation and grating change by operators.
- DAQ operation on demand.
- Comparison shot to shot with OPIS.
- High μJ operation.
- Encoder for translation movements.
- Change to camera objective as in the original design.
- Build in FL21M1

What is next on the list of FLASH2 Photondiagnostics

User Run

Treusch, Duesterer, Toleikis, Braune, Kuhlmann
Brachmanski, Grunewald, Müller,

More Beamline Setup and Alignment

Treusch, Duesterer, Kuhlmann, Brachmanski,
Grunewald, Müller, Bican, Toleikis, Weigelt
Degenhardt, Steffen, Hans,

FS-BT

More Grating Spectrometer

Kuhlmann, Grunewald, Kreis,

More OPIS

Braune, Jastrow, Grunewald,

Setup GMD H and Attenuator

Jastrow, Tiedtke, Degenhardt, Bican,

First Wavefront Measurements

Keitel, Plönjes, Kuhlmann,

GMD at Experiment

Tiedtke, Jastrow, Sorokin, Bican, Bonfigt,

Compact Spectrometer

Dziarzhytski,

Preparation Pulselengths Diagnostics

Ivanov, Duesterer,