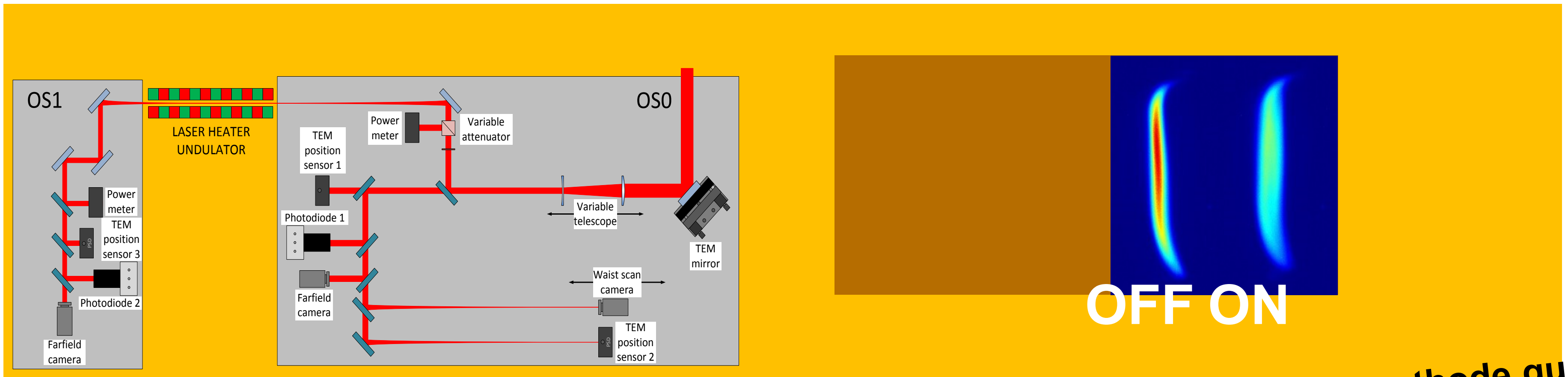
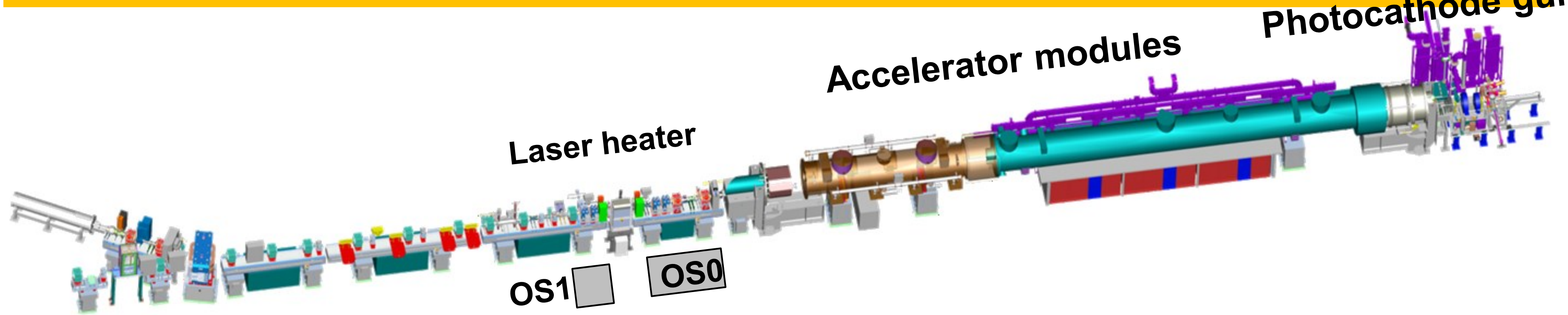
The laser heater at the European XFEL – in kind from Sweden, Uppsala university with modifications and add-ons from DESY, FS-LA





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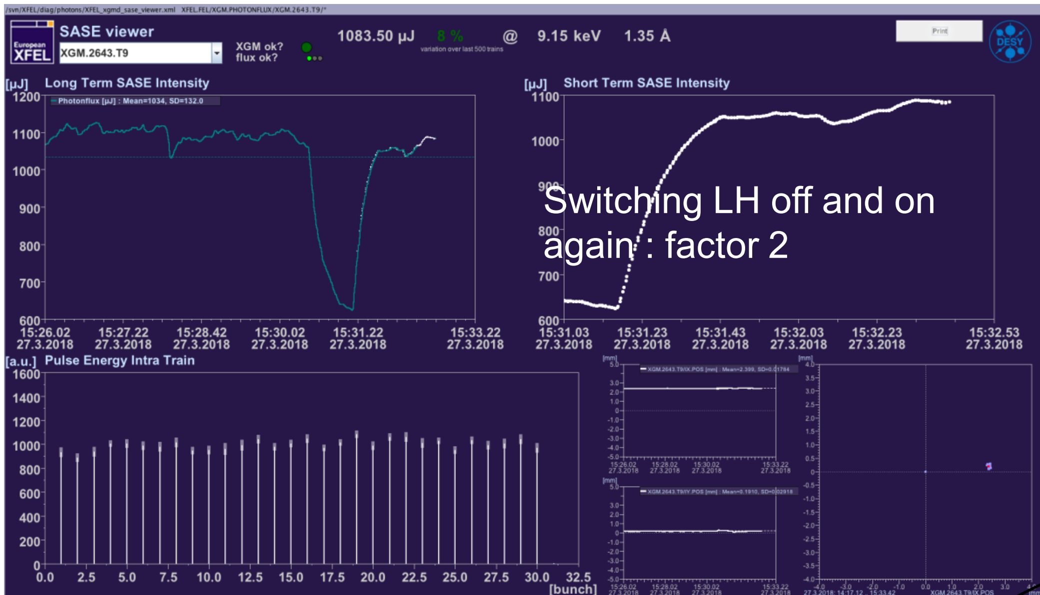
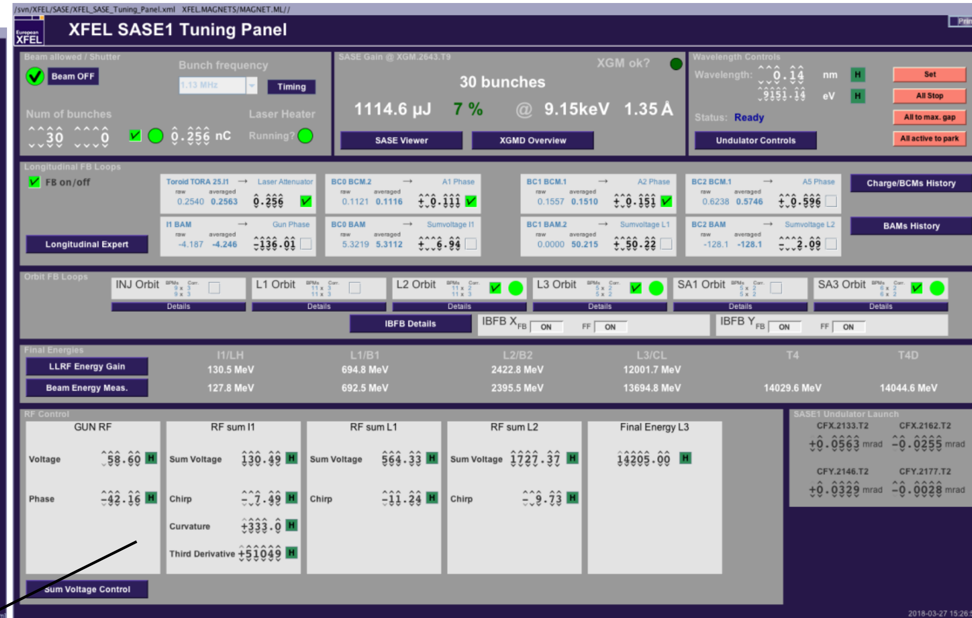
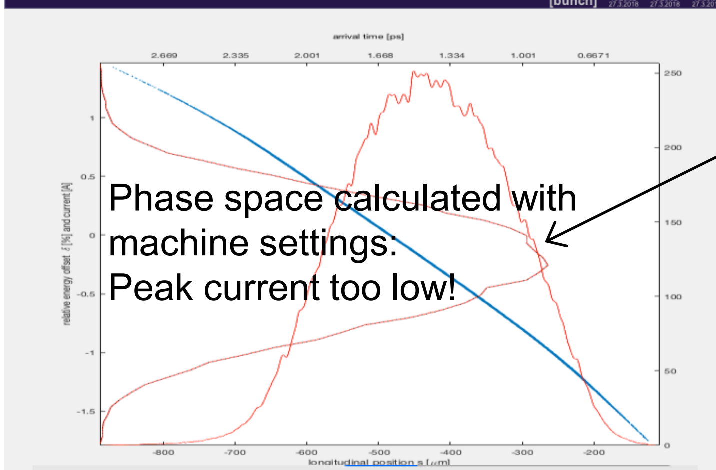
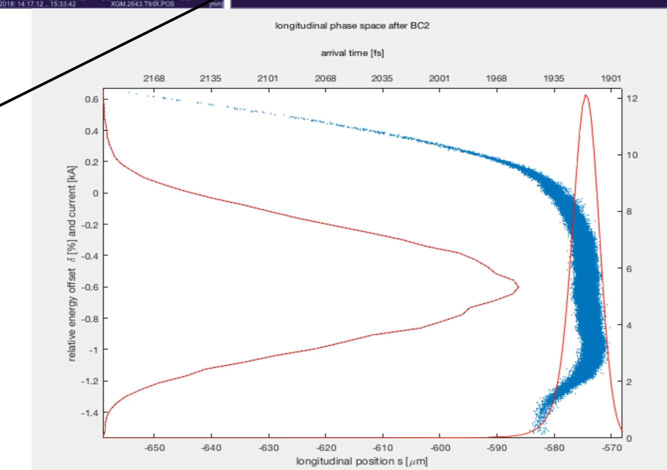






	amplitude [MV]	phase [deg]
A1	147.1198	-0.3001
AH1	25.8743	151.9259
L1	632.1793	26.8551
L2	1.8940e+03	26.6675
L3	15100	0

	setpoint	fit	calculated
A1/AH1 energy (0th)	130.0810	130.0003	130.0810
A1/AH1 chirp (1st)	-7.4900	-7.3006	-7.4900
A1/AH1 curvature (2nd)	333.0000	340.5155	333.0000
A1/AH1 skewness (3rd)	5.1000e+04	1.5097e+04	5.1000e+04
L1 energy gain (0th)	564.0000	NaN	564.0000
L1 chirp (1st)	-11.2400	NaN	-11.2400
L2 energy gain (0th)	1.6925e+03	NaN	1.6925e+03
L2 chirp (1st)	-9.7300	NaN	-9.7300



	amplitude [MV]	phase [deg]
A1	148.2248	0.9782
AH1	26.4658	150.3320
L1	632.8123	28.1424
L2	1.9038e+03	27.2518
L3	15100	0

	setpoint	fit	calculated
A1/AH1 energy (0th)	131.0000	130.0003	131.0000
A1/AH1 chirp (1st)	-8.7000	-8.5763	-8.7000
A1/AH1 curvature (2nd)	333.0000	342.8687	333.0000
A1/AH1 skewness (3rd)	55000	1.9523e+04	55000
L1 energy gain (0th)	558	NaN	558
L1 chirp (1st)	-11.8343	NaN	-11.8343
L2 energy gain (0th)	1.6925e+03	NaN	1.6925e+03
L2 chirp (1st)	-10.0000	NaN	-10.0000

Encreased chirp in calculation to get a reasonable peak current

I1: -7.49 -> -8.7

L1: -11.2 -> -11.8

L2: -9.73 -> -10

Change in phase <2 degree!

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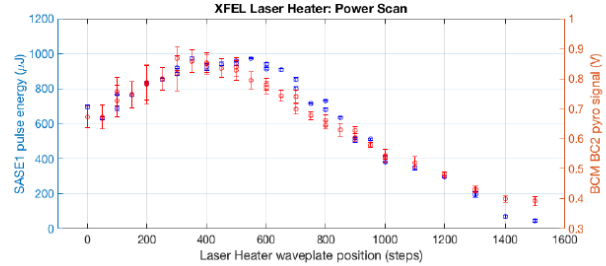
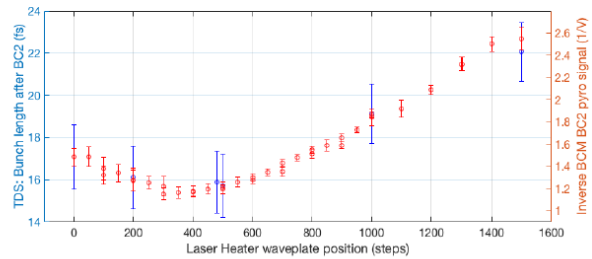
XFEL Laser Heater: Laser Power Scan

Date: 2018-06-05 (morning shift)



(Note: laser power increases with steps of waveplate position.)



Top:

Increase in SASE1 intensity (blue) from ~ 650 μJ to maximum ~ 950 μJ (~ 1.5 increase) with laser power. At higher laser powers (steps > 600) the SASE intensity drops to zero.

BCM BC2 Pyro signal "follows" SASE1 intensity.

My expectation was that pyro signal would go down at maximum SASE1 level, as micro-bunching is suppressed by the laser heater and, therewith, spectral range ~μm - ~10 μm should be suppressed.

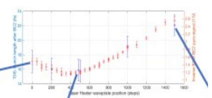
Bottom:

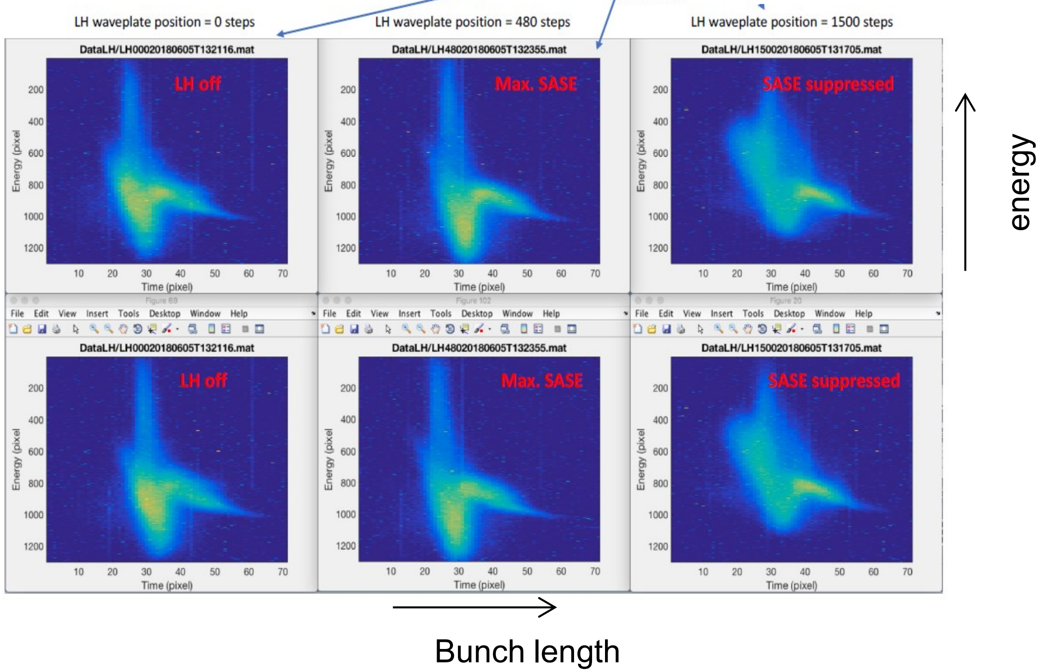
Results from TDS bunch length measurements in the B2D dump section compared with the inverse of the BCM BC2 Pyro signal.

It seems that the variation of the Pyro signal is connected to the bunch length that is changed for different laser heater powers. Maximum SASE1 intensity at shortest bunch length.

XFEL Laser Heater: Laser Power Scan: TDS Beam images

Date: 2018-06-05 (morning shift)





Two random examples of beam images

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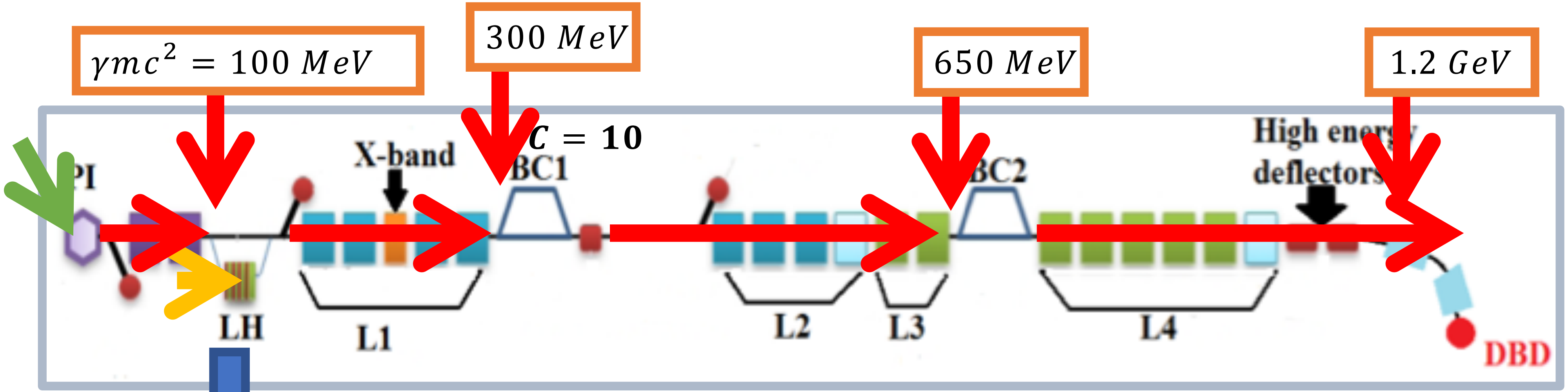
Study for the generation of ultrashort pulses in a seeded FEL

8th Topical Workshop on Longitudinal Diagnostics for FELs
Hamburg 25-26-27 June 2018

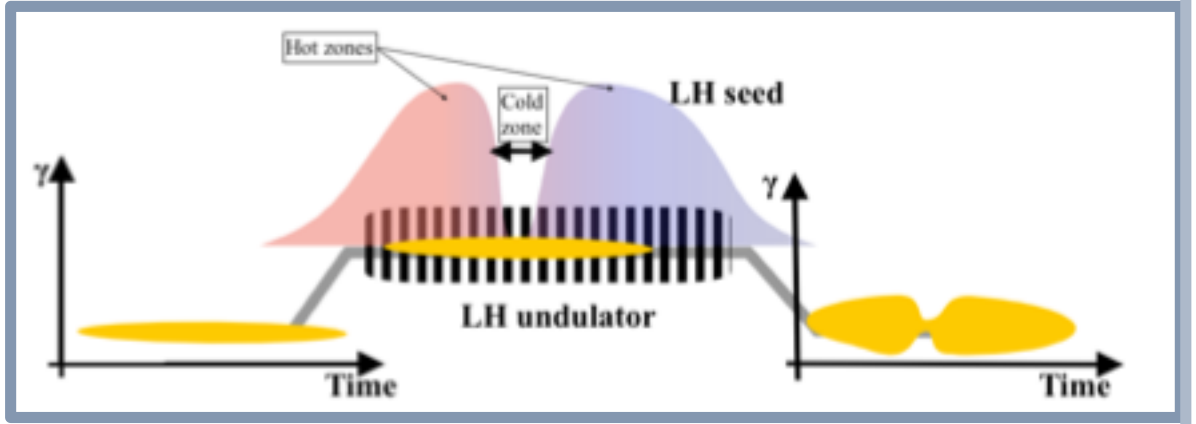
Vanessa Grattoni

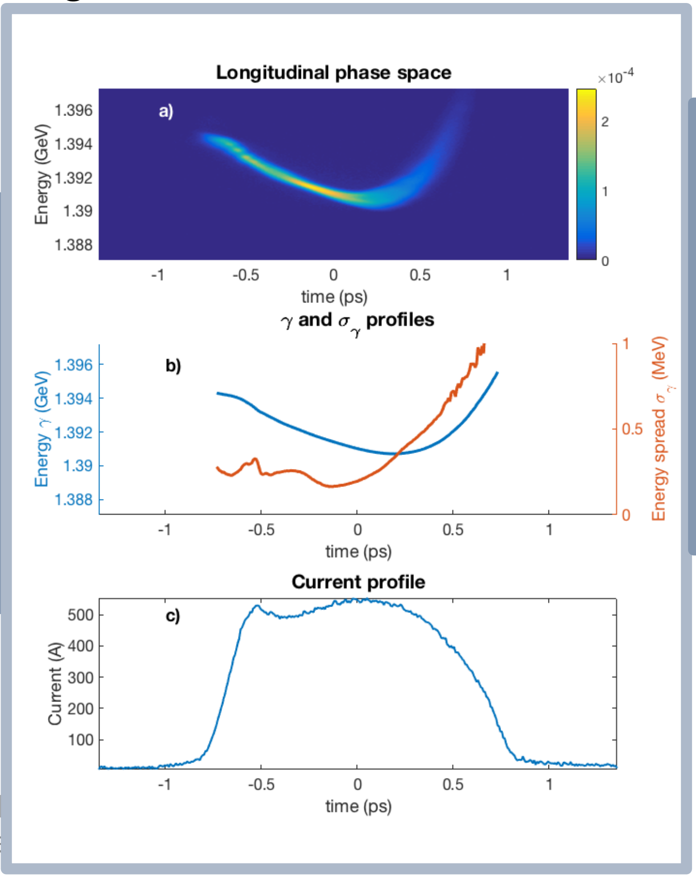
FERMI LINAC

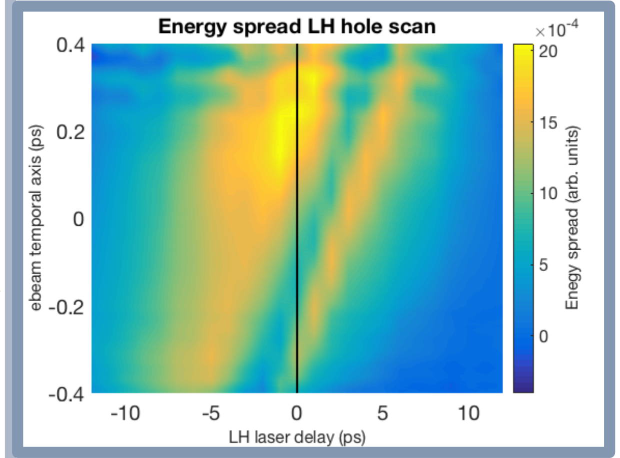
Q=700pC
$\sigma t = 10\ ps$
I=70A



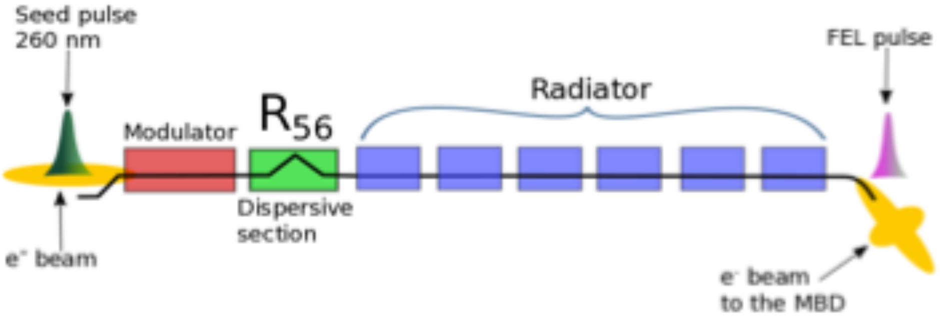
= diagnostic section

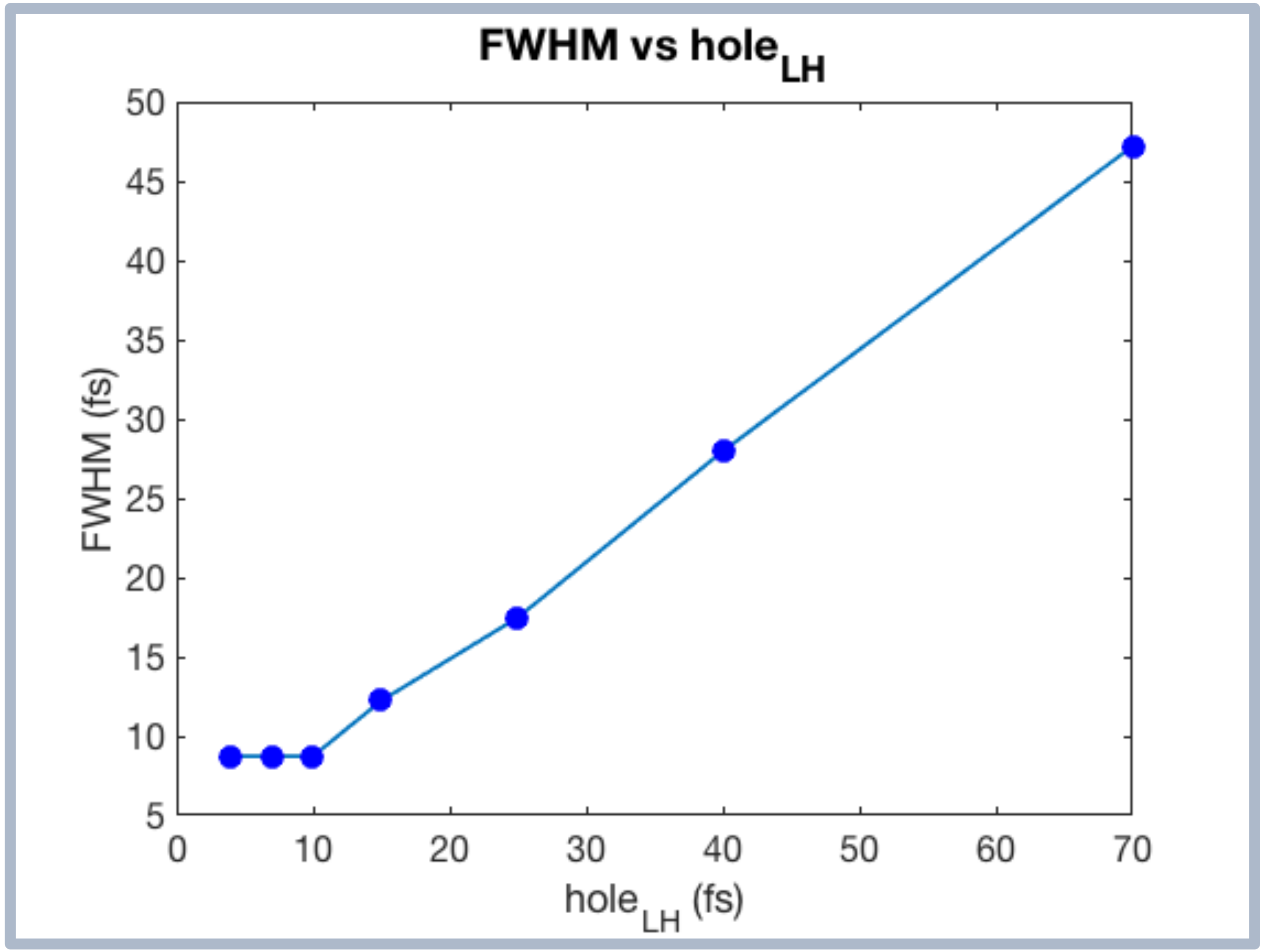


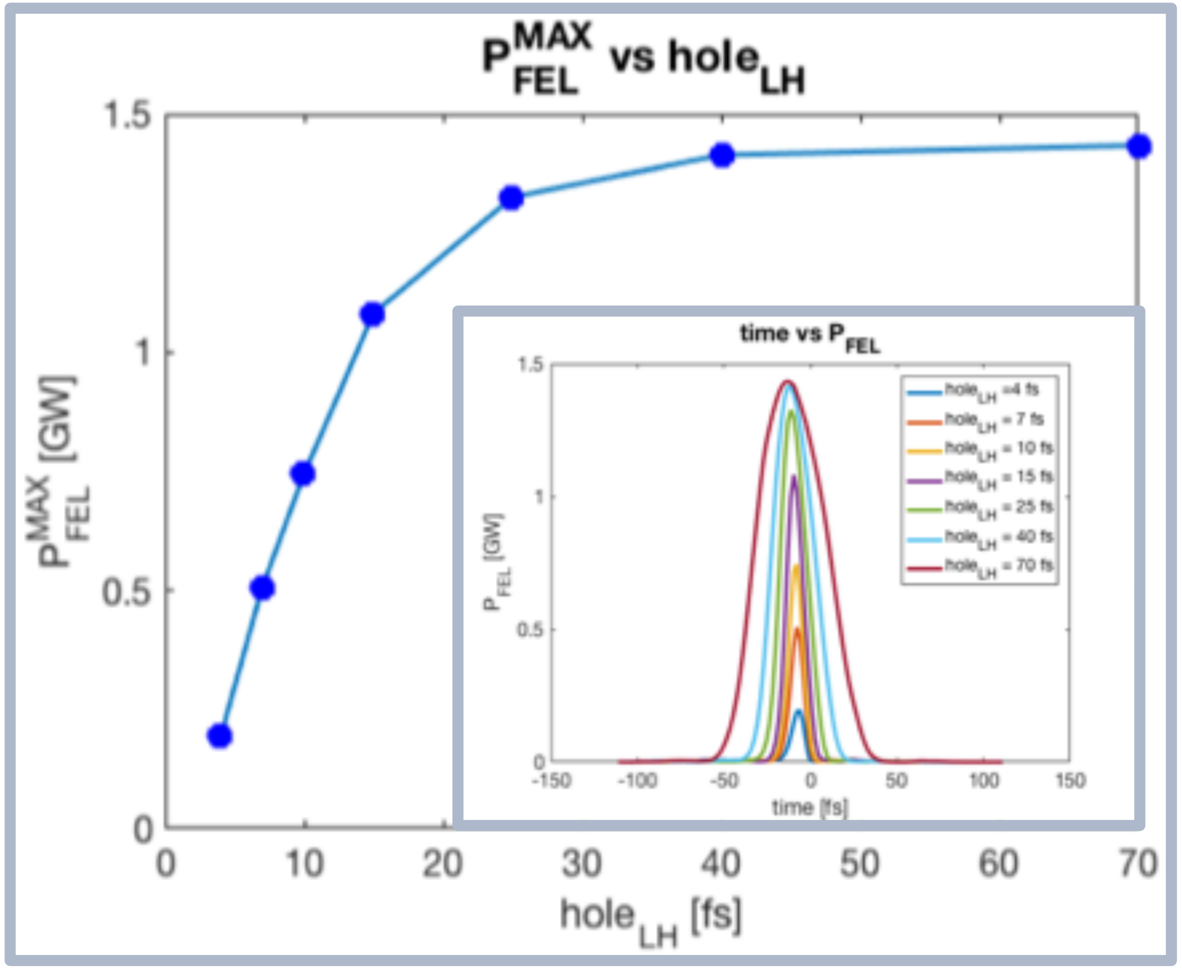




FERMI FEL 1







Simulations have shown that FEL pulse down to 10 fs with peak power of 700 MW can be achieved.

PAUL SCHERRER INSTITUT

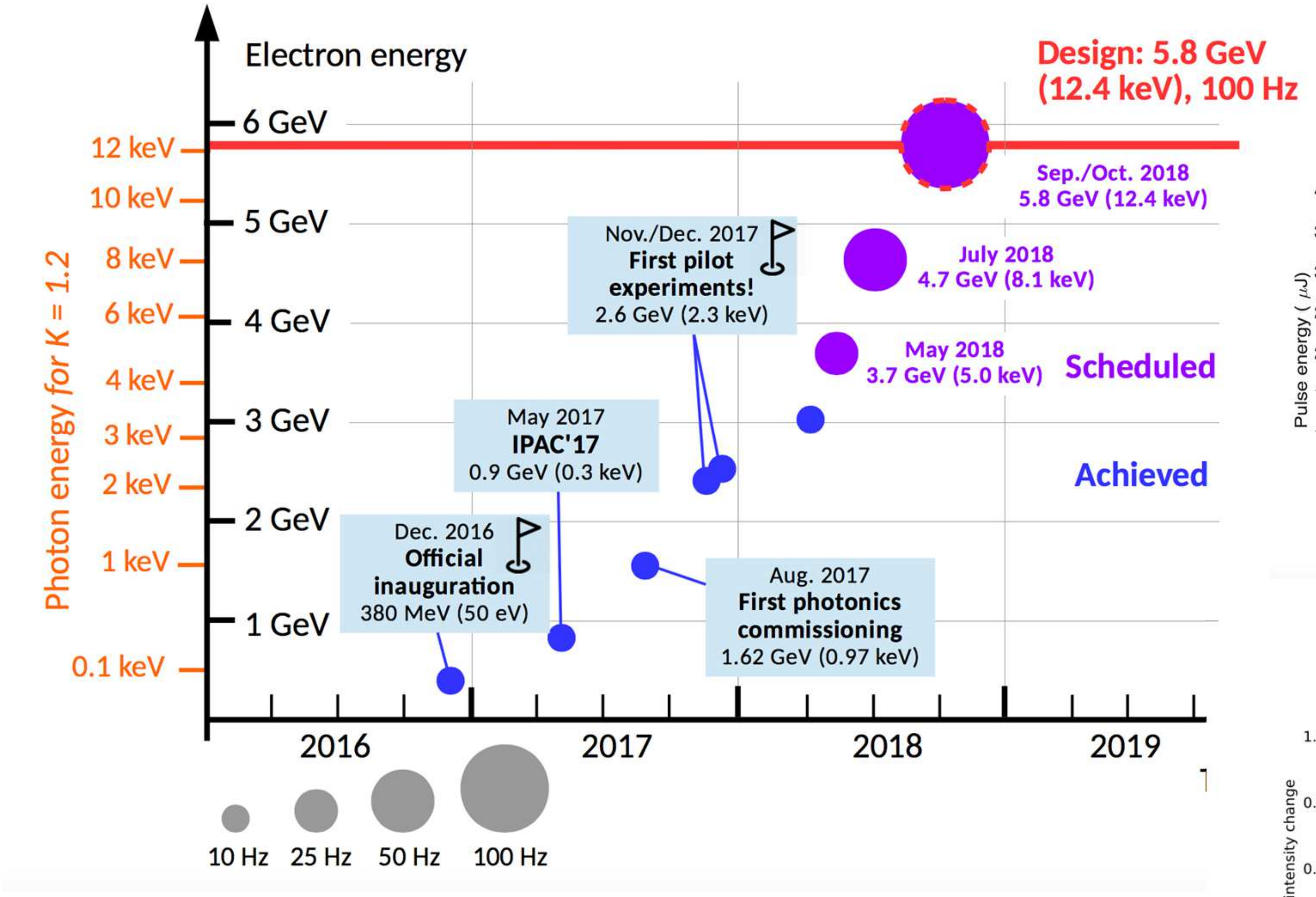
C. Vicario, S. Bettoni..:: Paul Scherrer Institut

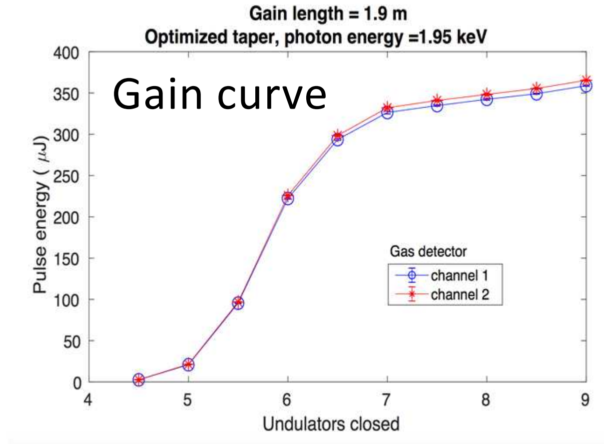
Laser heater at SwissFEL

8^{TH} Topical Workshop on Longitudinal Diagnostics for FEL

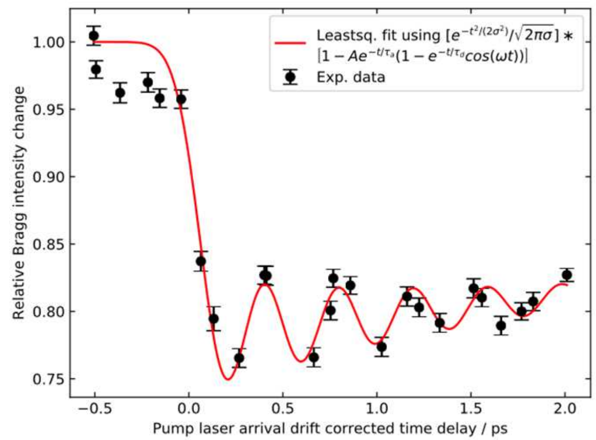
PAUL SCHERRER INSTITUT PSI

SwissFEL performance evolution



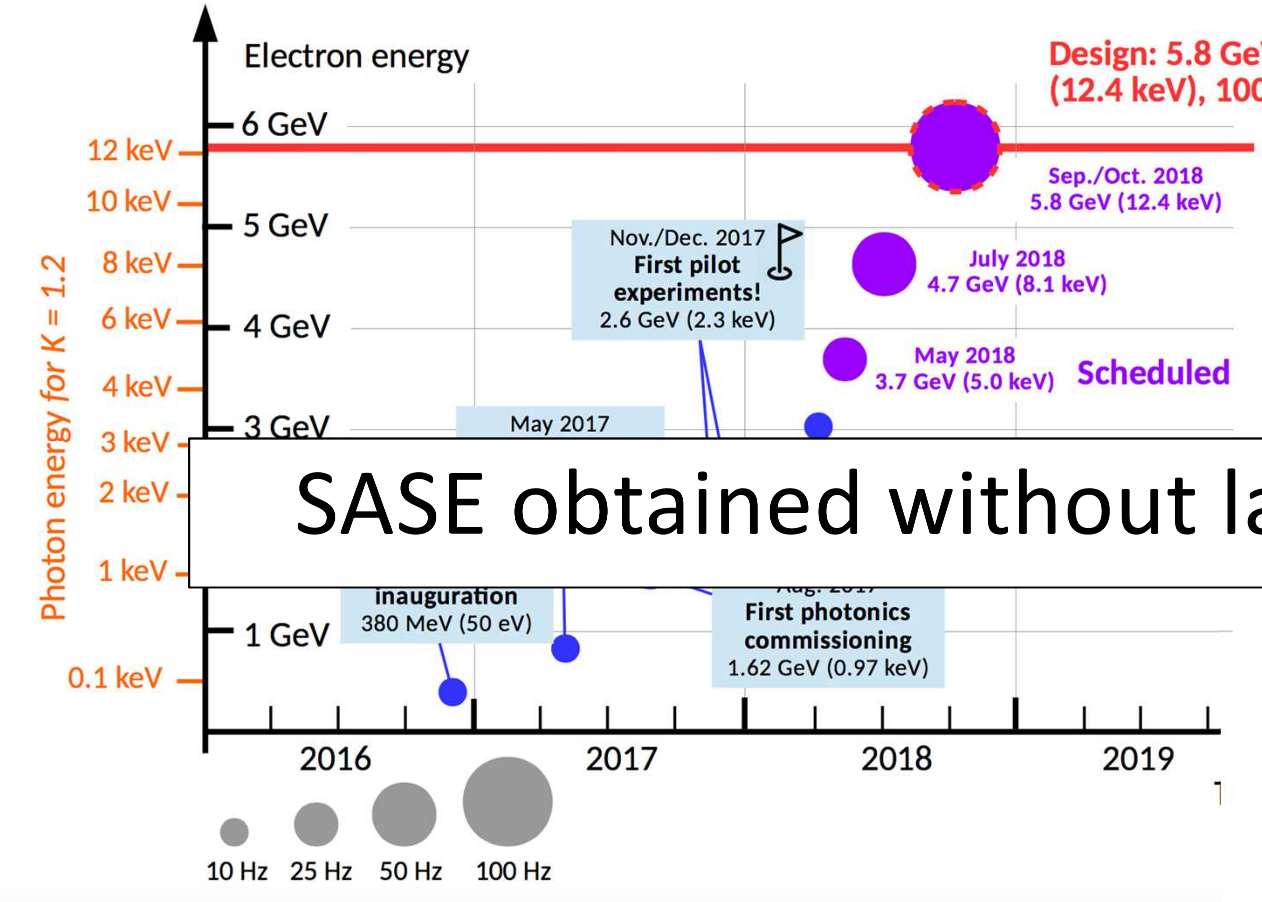


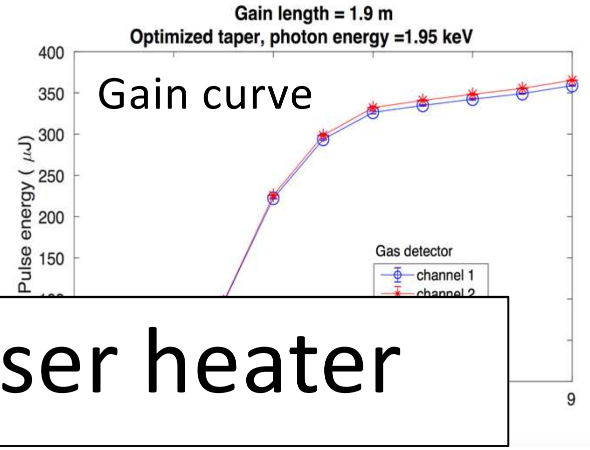
1st Pump-probe result



Schietinger IPAC18

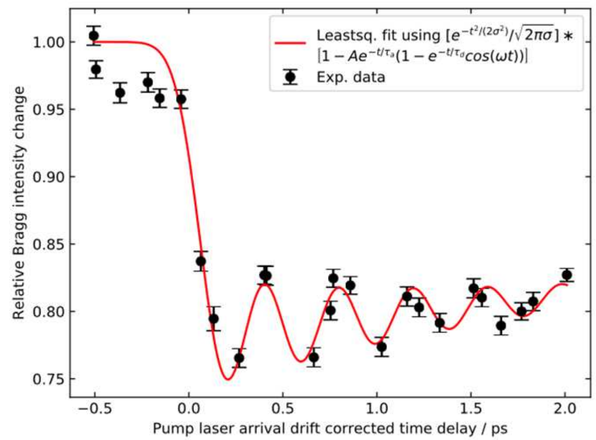
SwissFEL performance evolution





SASE obtained without laser heater

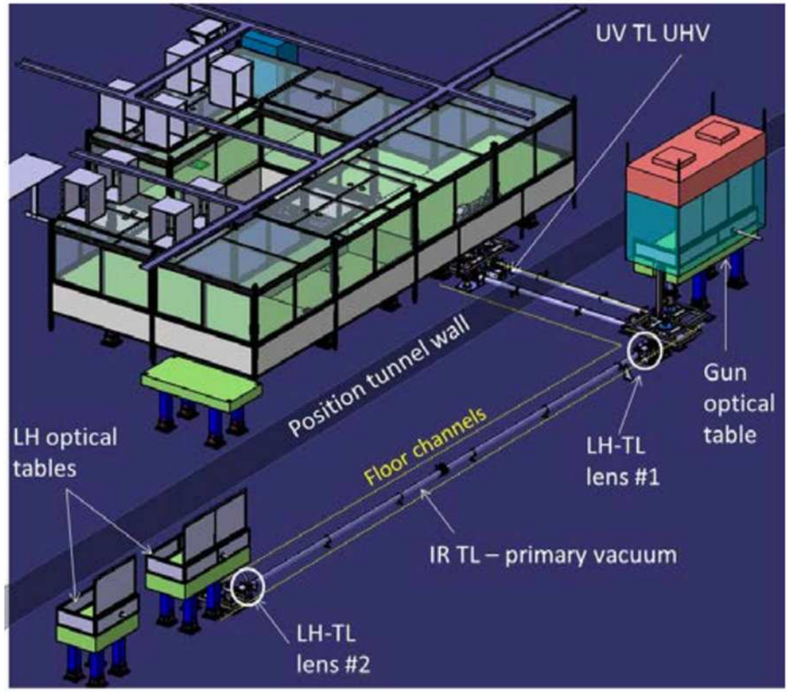
1st Pump-probe result

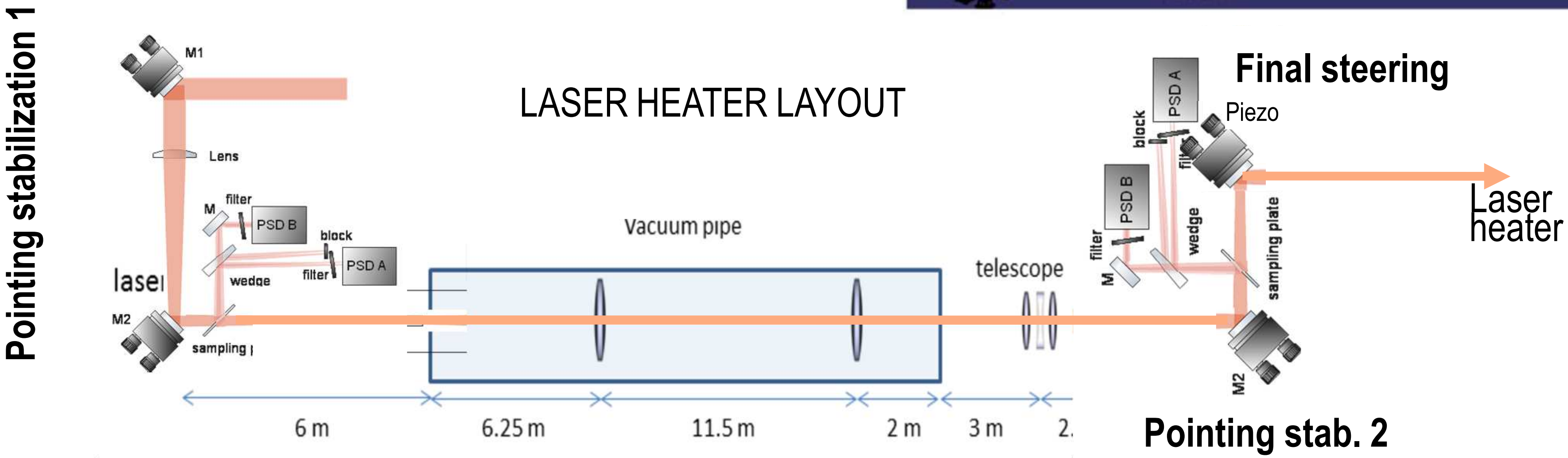


Schietinger IPAC18

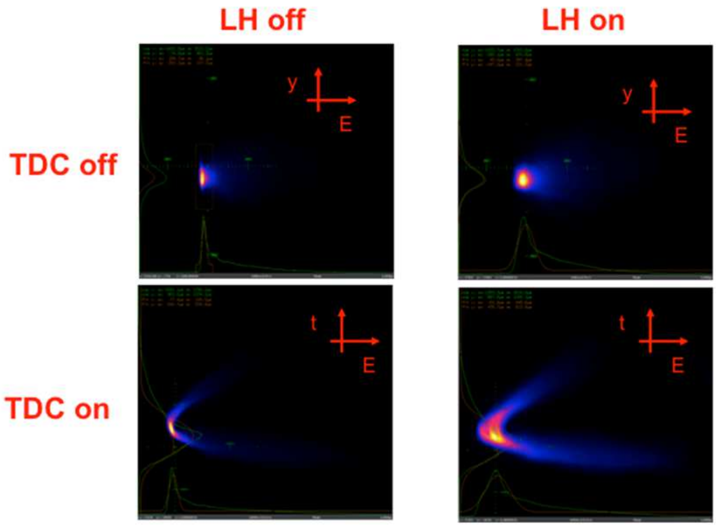
Laser heater optical transport

- Transport in vacuum
- Multiple active stabilization (Aligna+ in house system)
- Energy control
- Diagnostics
- Beam size free adjustment

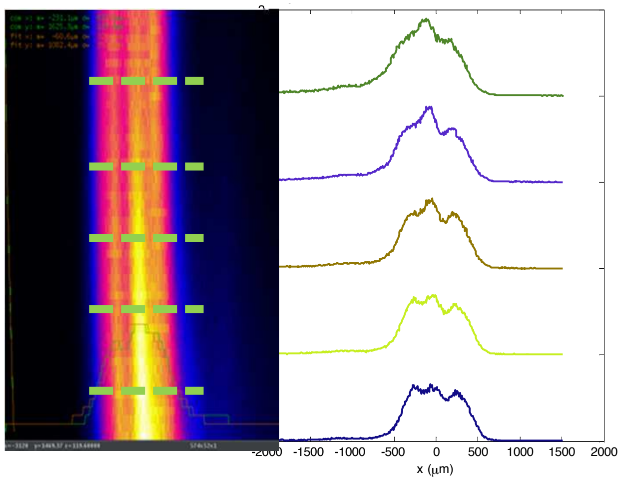




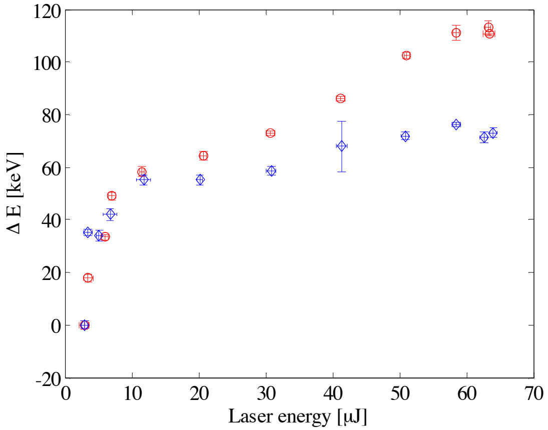
Laser heater commissioning



Slice energy spread



Energy spread



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LH e-beam cross-correlation

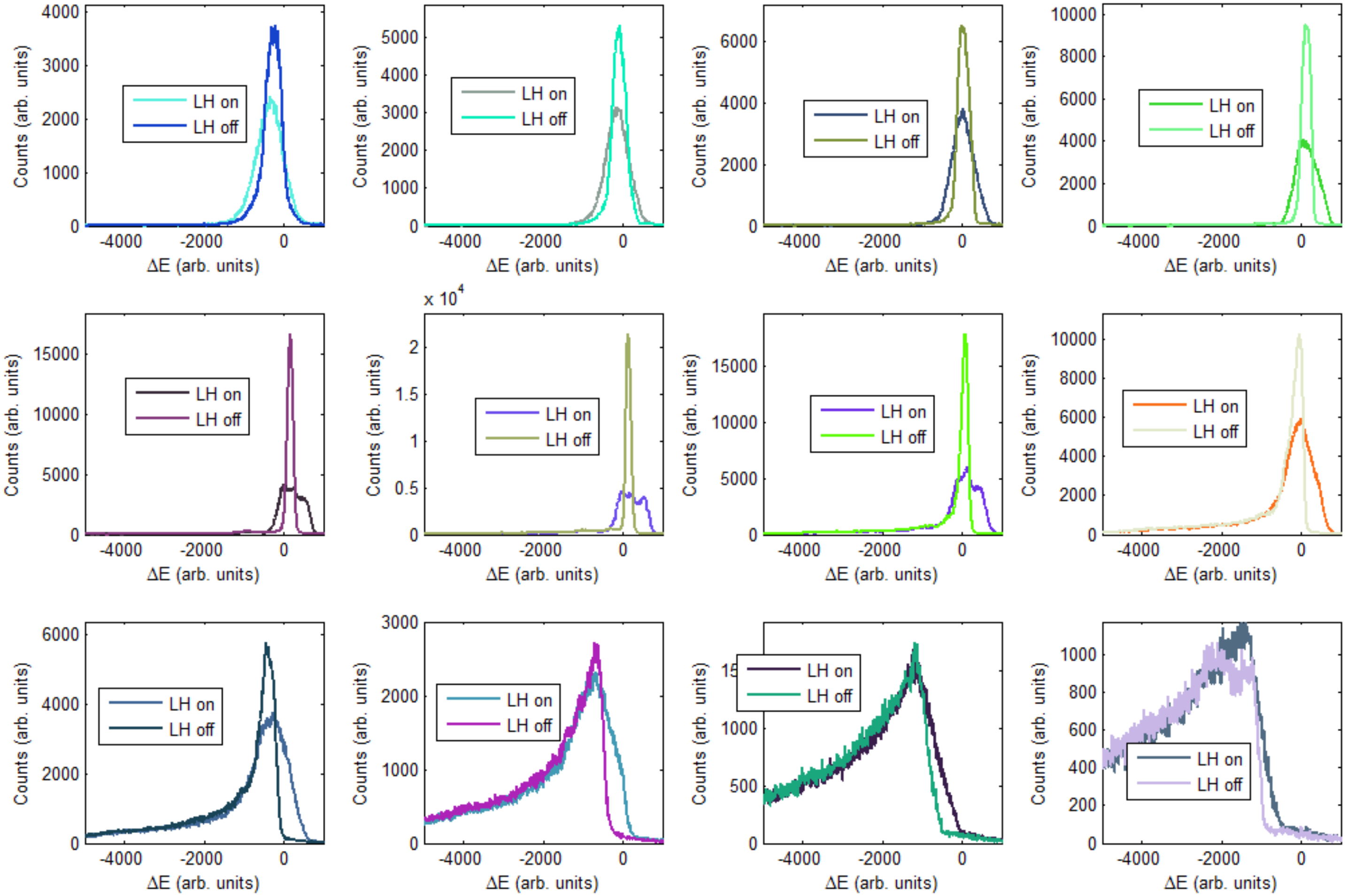
index_y_start = 700; index_y_end = 1000; index_y_step = 25;

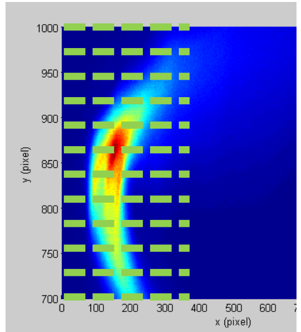
Pixel

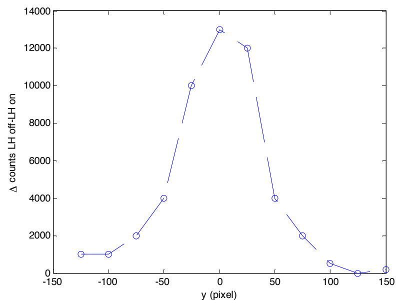
700

800

900



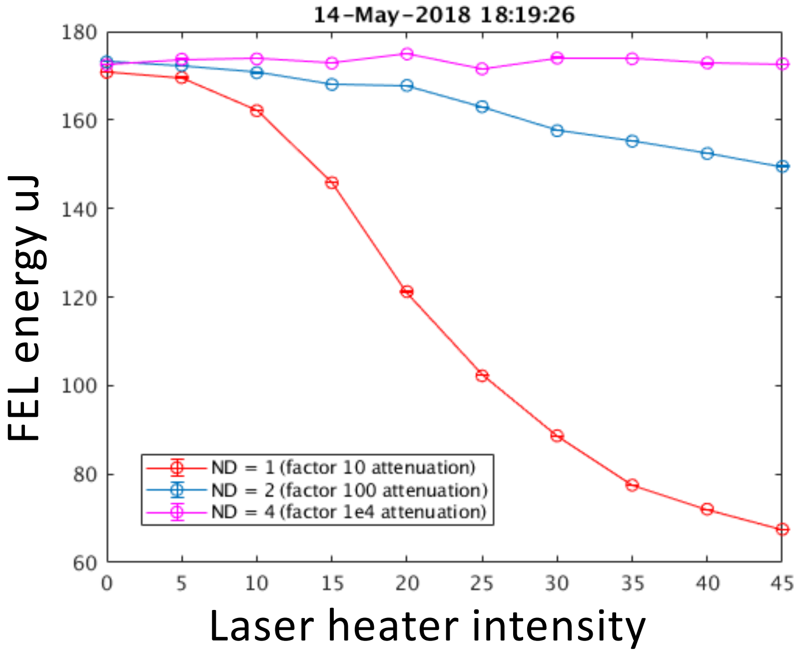




Jaguar LH

10 ps

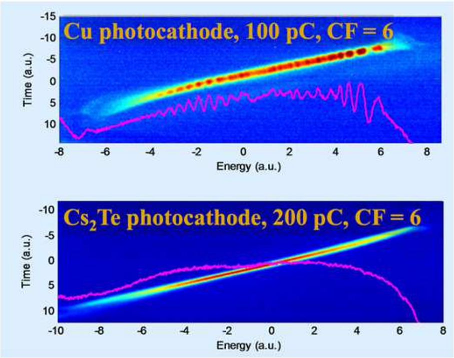
FEL performances and laser heater



Beam energy 3 GeV

FEL photon energy 3 KeV

Pulse stacking at the photocathode



Reasons for laser heater inefficiency:

Cathode response time suppresses microbunching?

Photocathode pulse stacking dominate??

Other reasons? Machine settings?