

FLASH at DESY

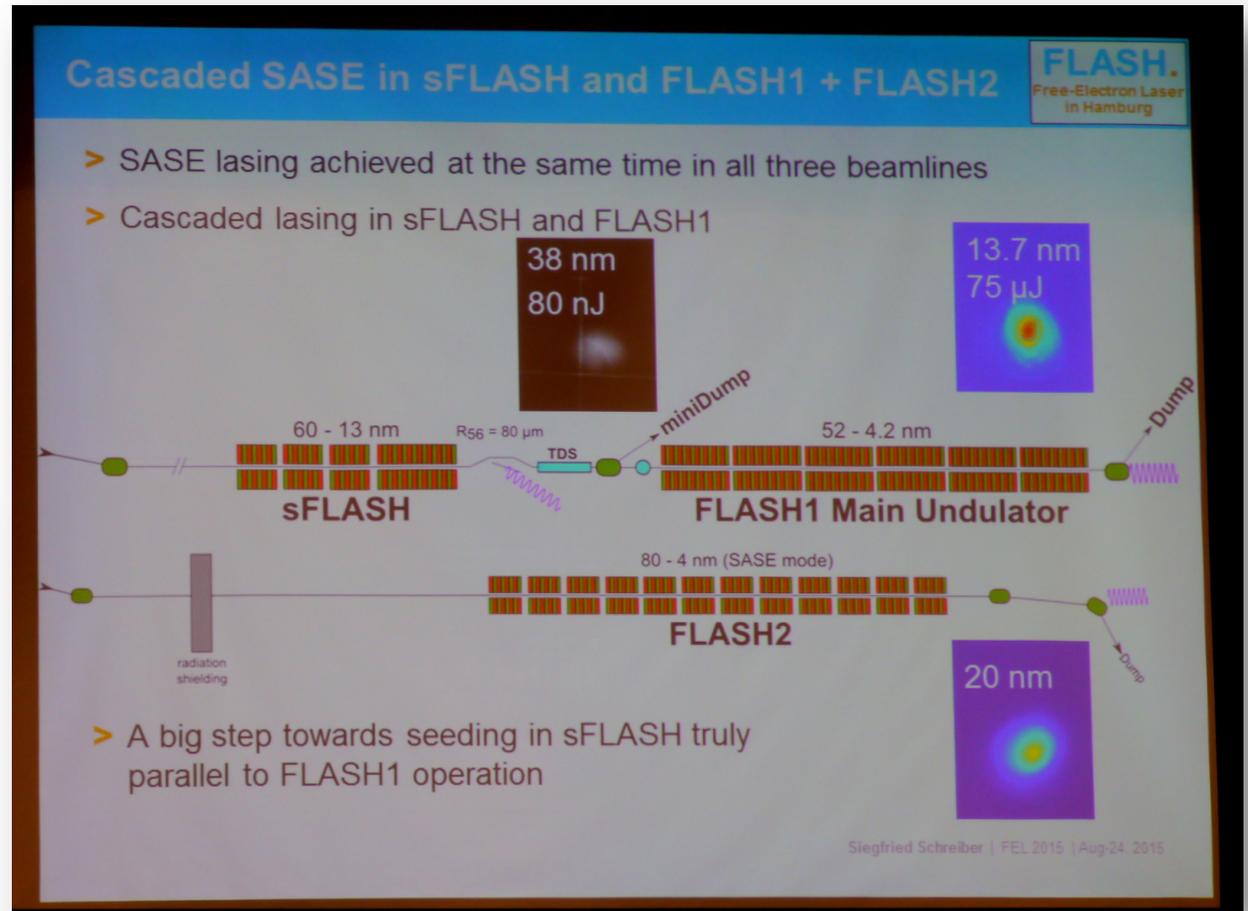
FLASH.
Free-Electron Laser
in Hamburg

First simultaneous operation of two SASE beamlines in FLASH



Matthias Scholz
FEL2015 Conference
Daejeon, August 25, 2015

- > Talk by S. Schreiber, Monday morning
- > Cascaded SASE in sFLASH and FLASH1 + FLASH2

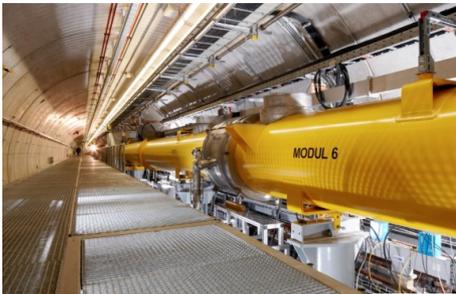


FLASH Layout 2015

> 3rd harmonic sc module 3.9 GHz



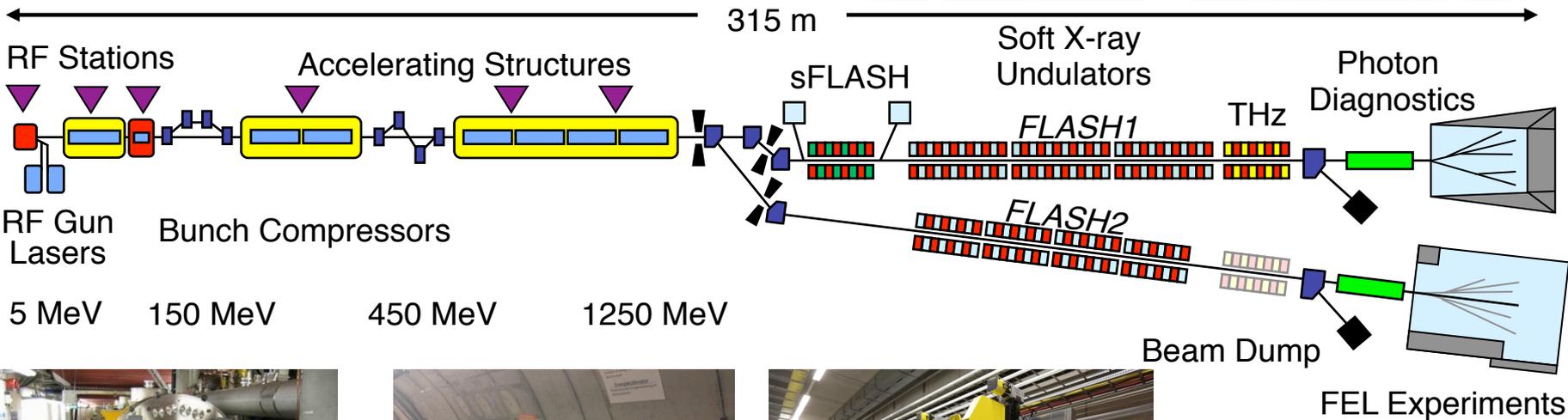
> TESLA type superconducting accelerating modules 1.3 GHz



> FLASH1 fixed gap undulators



> FLASH1 Experimental Hall



> Normal conducting 1.3 GHz RF gun
> Ce₂Te cathode
> Two Nd:YLF based ps photocathode lasers

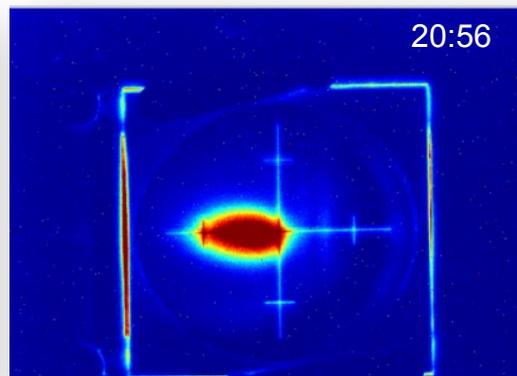
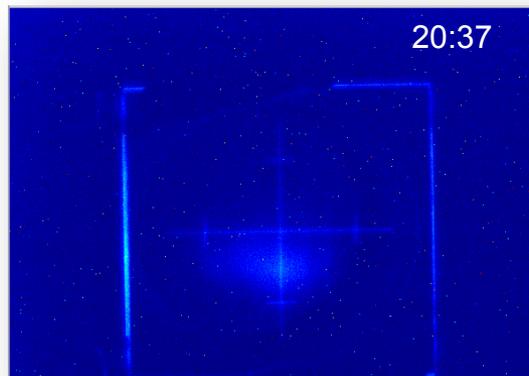
> Extraction to FLASH2

> FLASH2 variable gap undulators

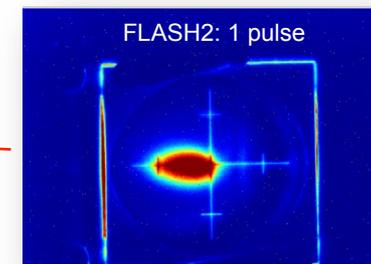
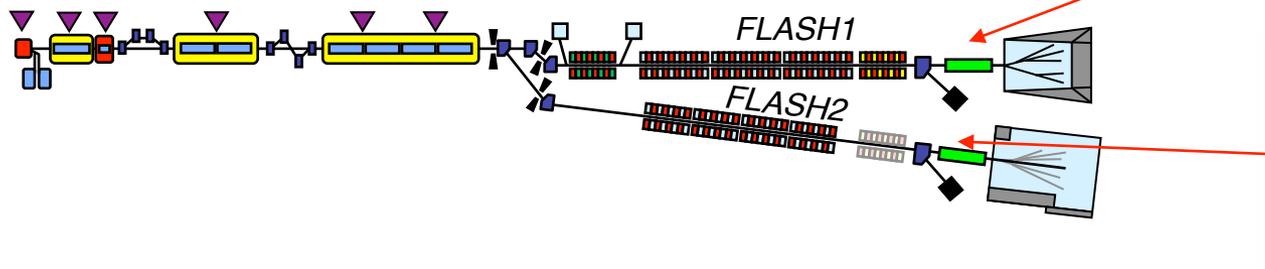
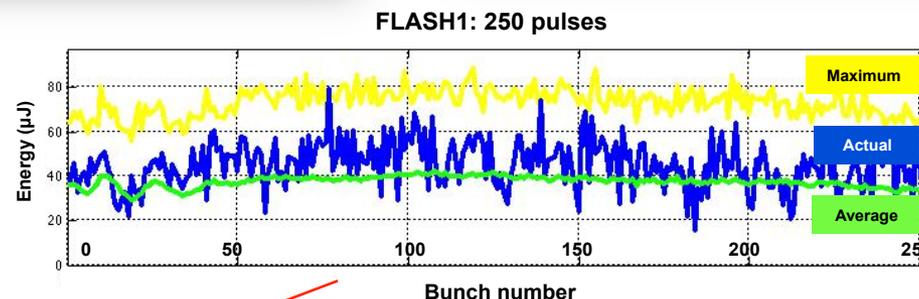
> FLASH2 Experimental Hall

Precondition for parallel SASE operation: First Lasing FLASH2

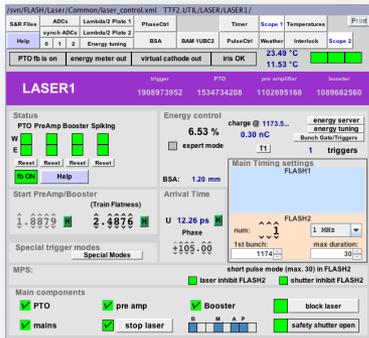
- > First lasing FLASH2: August 20, 2014



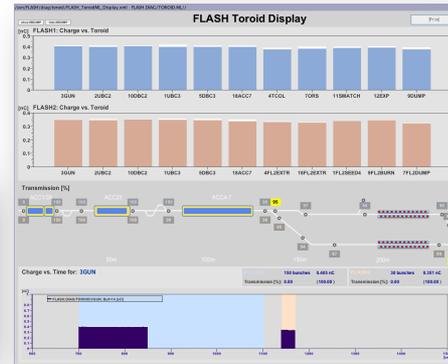
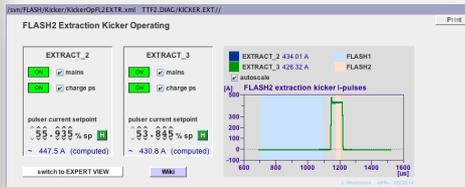
- > FLASH1 lasing in parallel with 250 pulses
- > First lasing FLASH2 was also first parallel operation



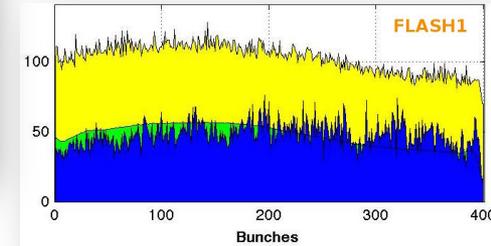
Parallel operation



> Fast kickers

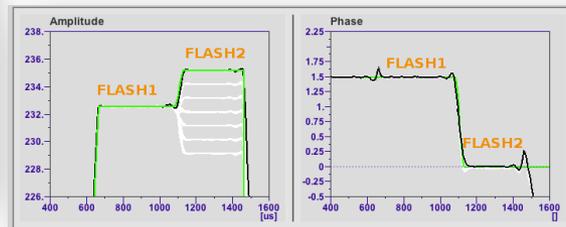
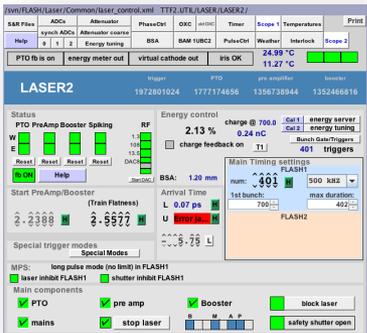


> SASE pulse trains (MCP detectors*)

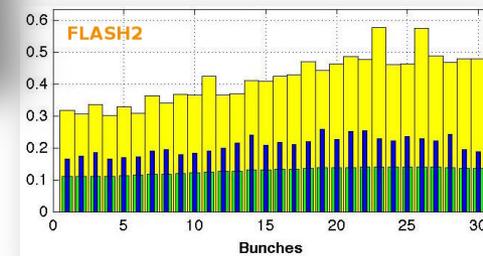


> Transmission

> Two injector lasers

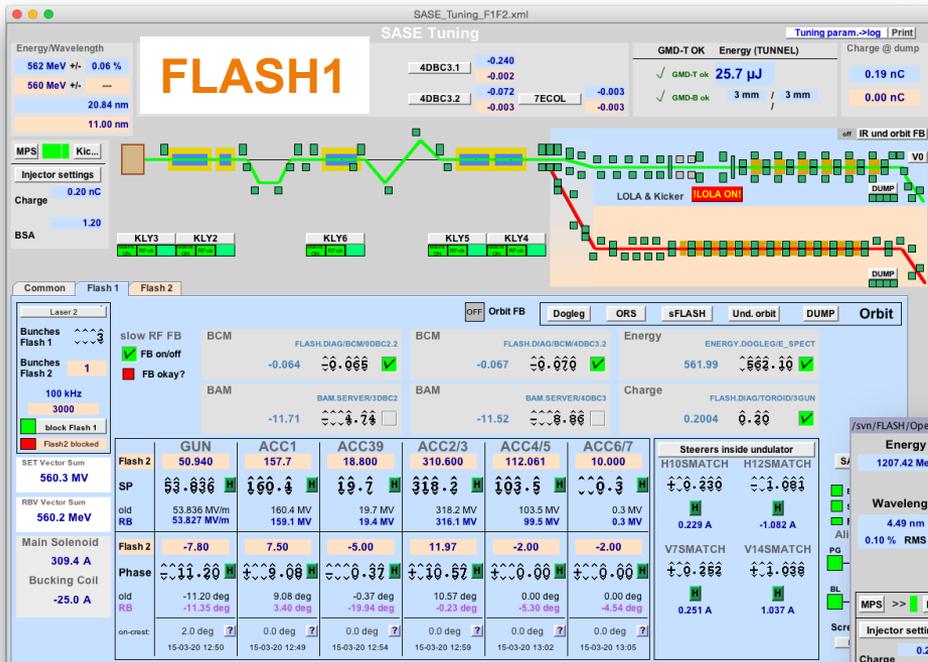


> Long RF pulse trains with separate settings for FLASH1 and FLASH2



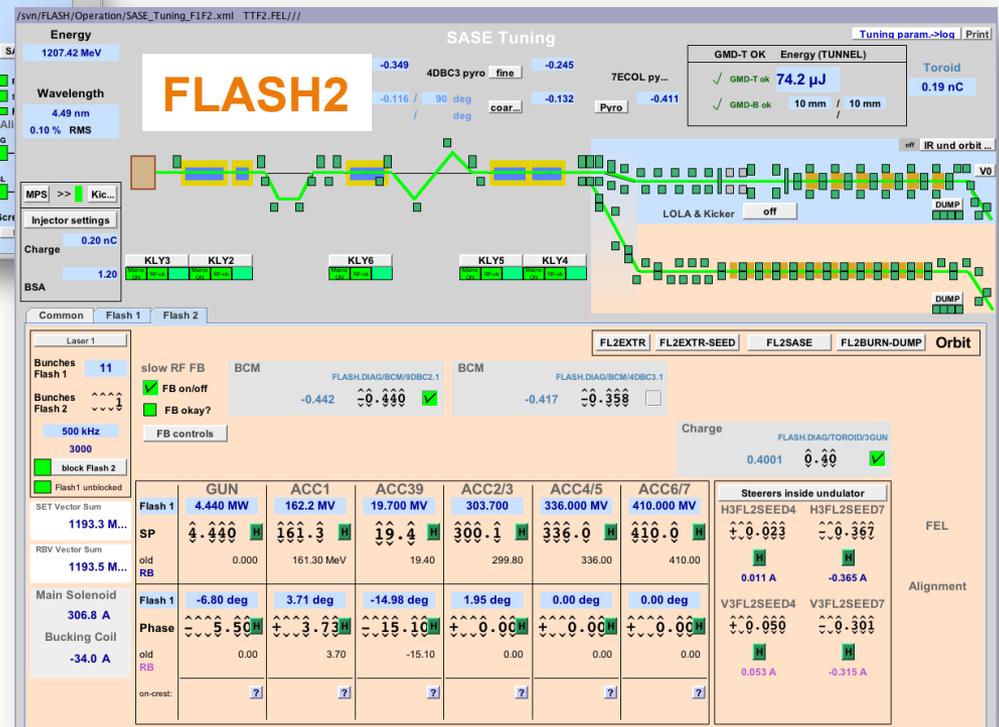
* MCP detector: microchannel plate detector

FLASH1 and FLASH2 operation panels

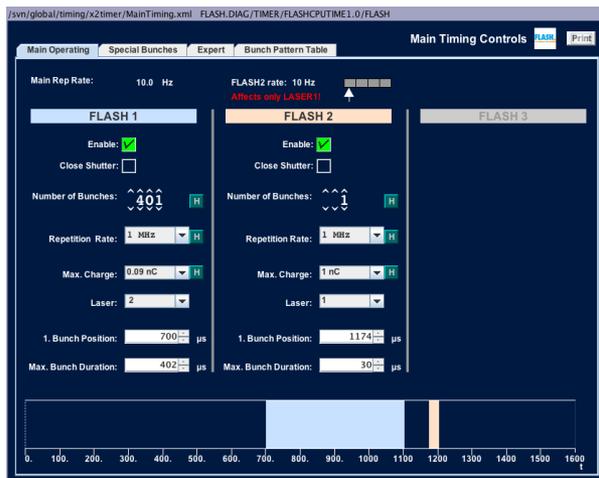


➤ Separate panels for FLASH1 and FLASH2

- RF settings
- Undulator orbit
- Slow feedbacks
- Lasers...

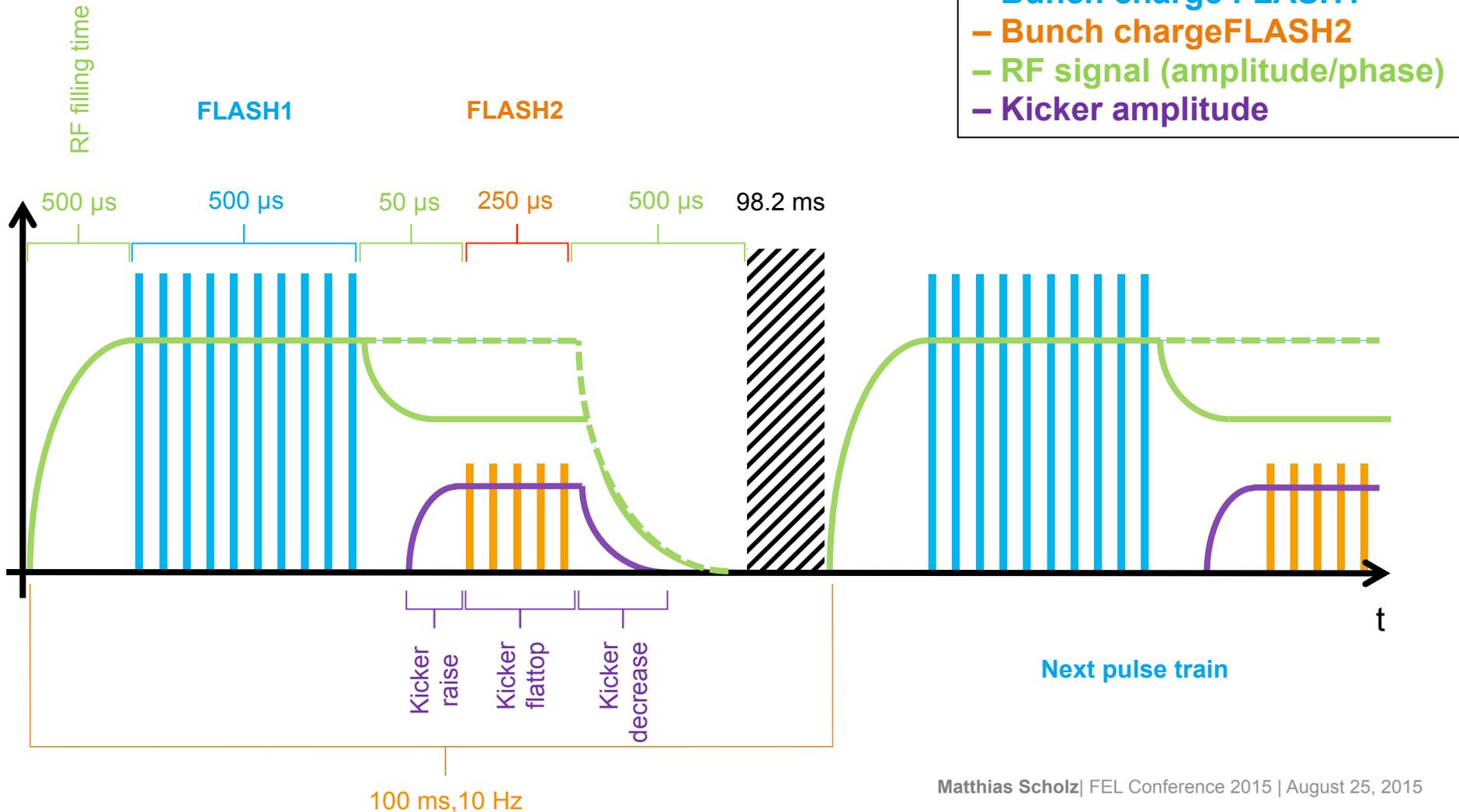


Main timing



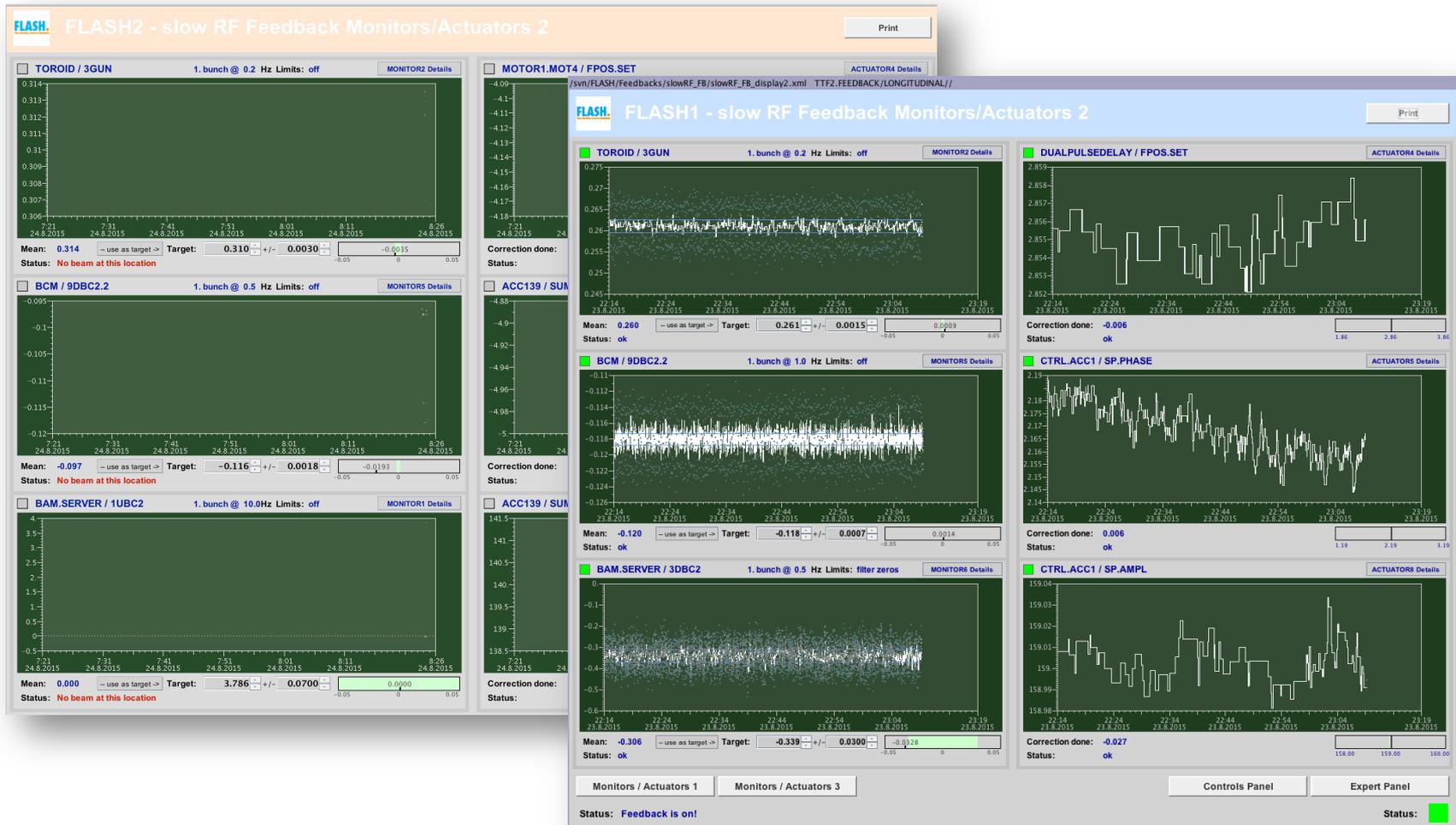
Bunche train separation timing

- Superconducting accelerating modules allow RF pulse lengths up to 800 μs .



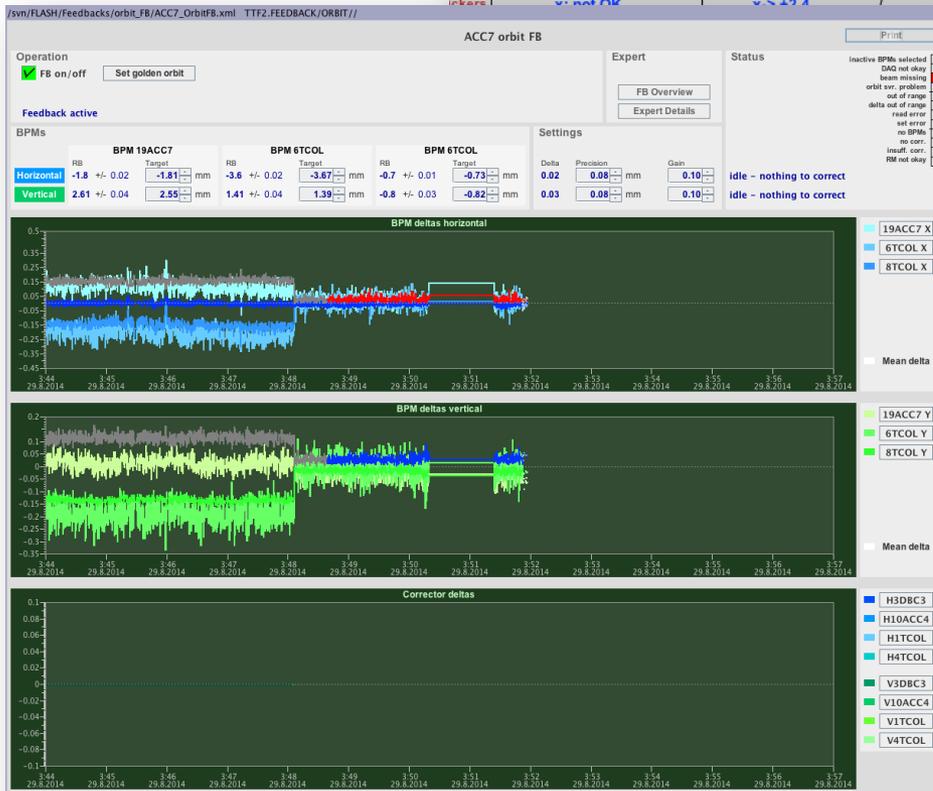
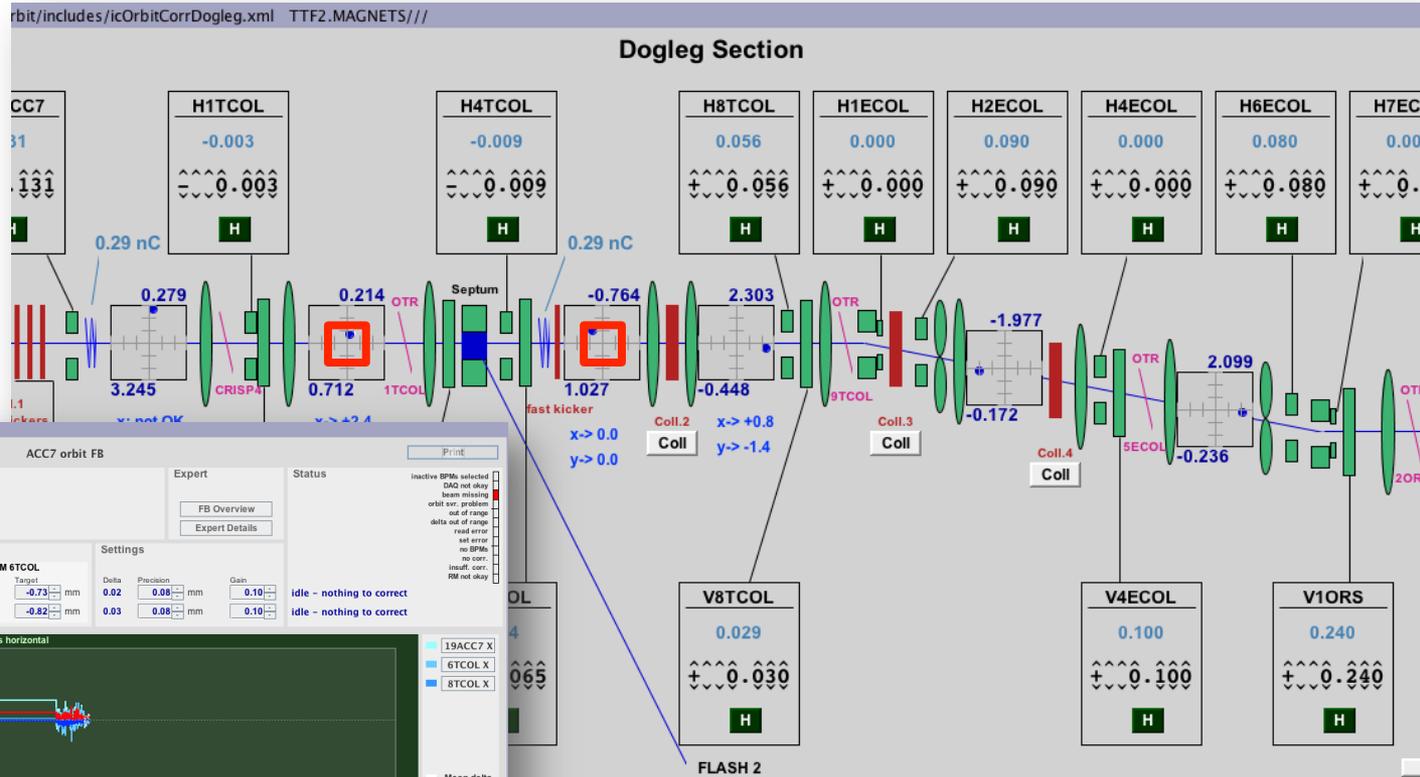
Slow feedbacks for FLASH1 and FLASH2

- Feedbacks for electron bunch compression, beam energy and bunch charge



Orbit feedback at extraction position

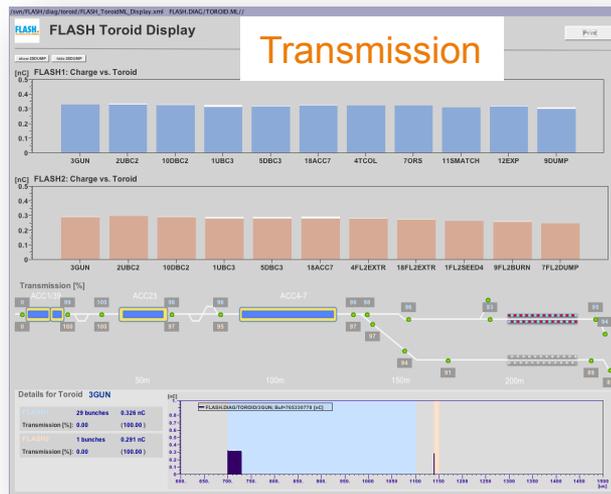
- Stable electron beam position at the extraction point is mandatory



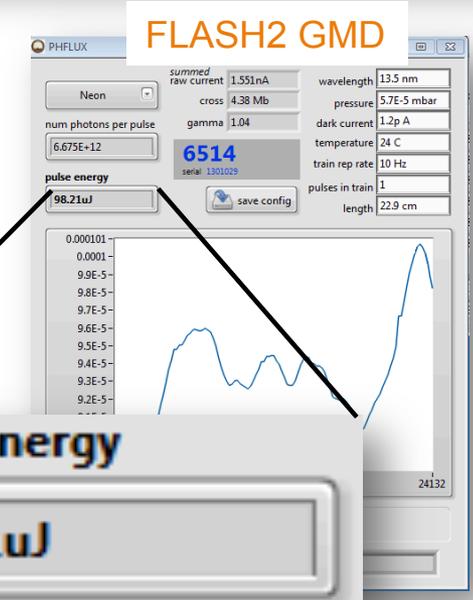
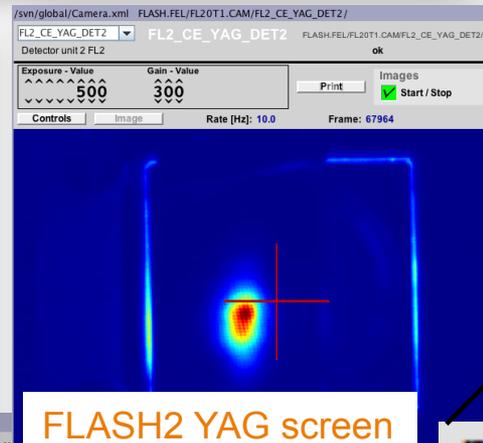
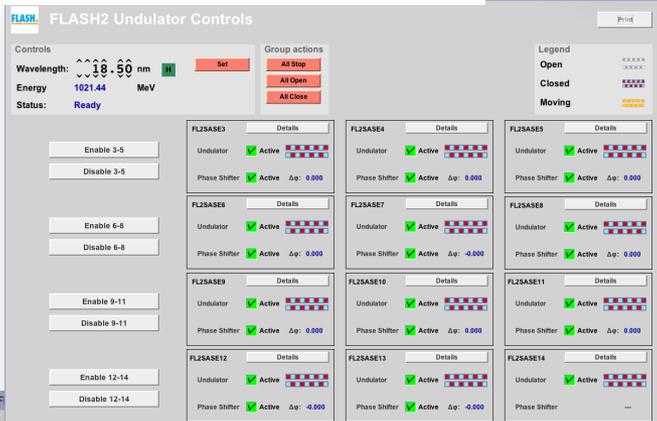
- An orbit feedback keeps the electron beam's position fixed at selected BPMs

Parallel SASE operation of both beamlines

- Example for parallel SASE operation
- FLASH1: 2-30 bunches at 6 nm
- FLASH2: single bunch operation, 18.5 nm with ~100 μJ SASE pulse energy.



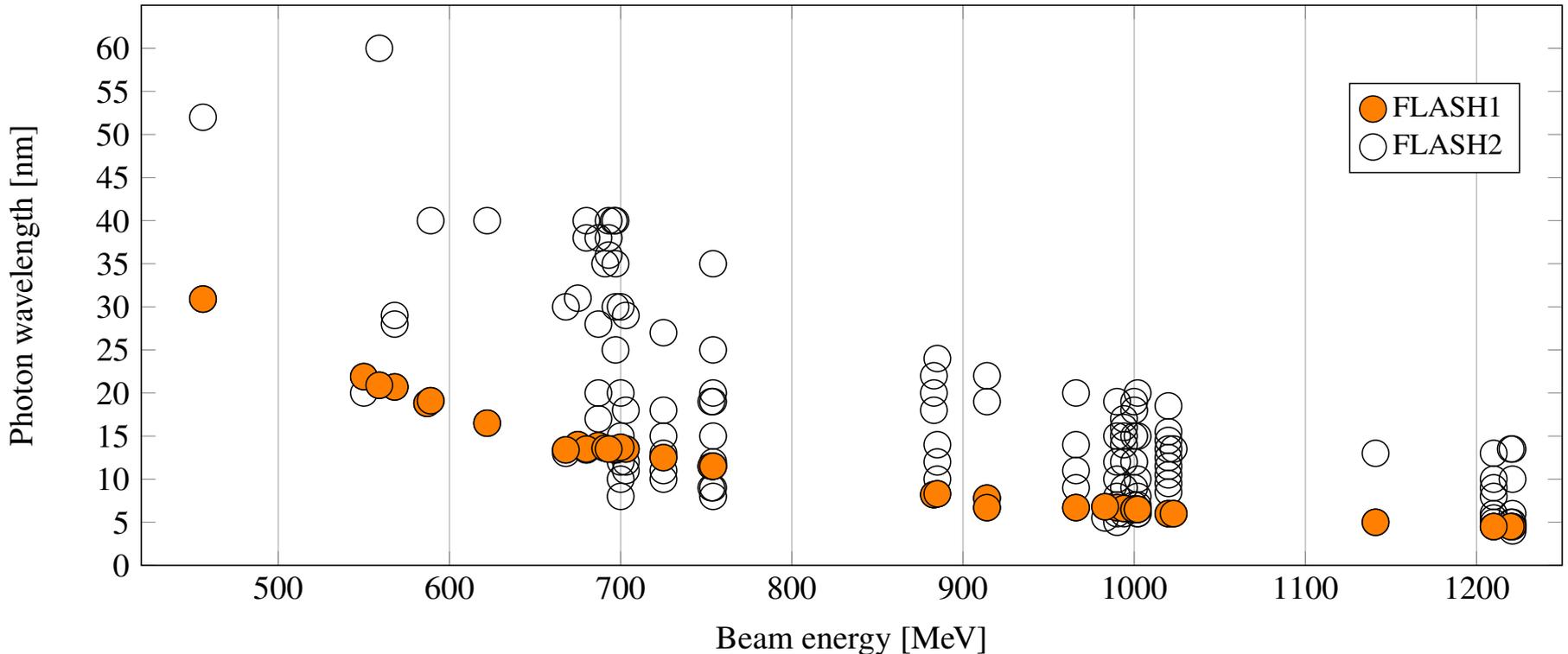
FLASH2 undulator segments



RF settings for FLASH1 and FLASH2

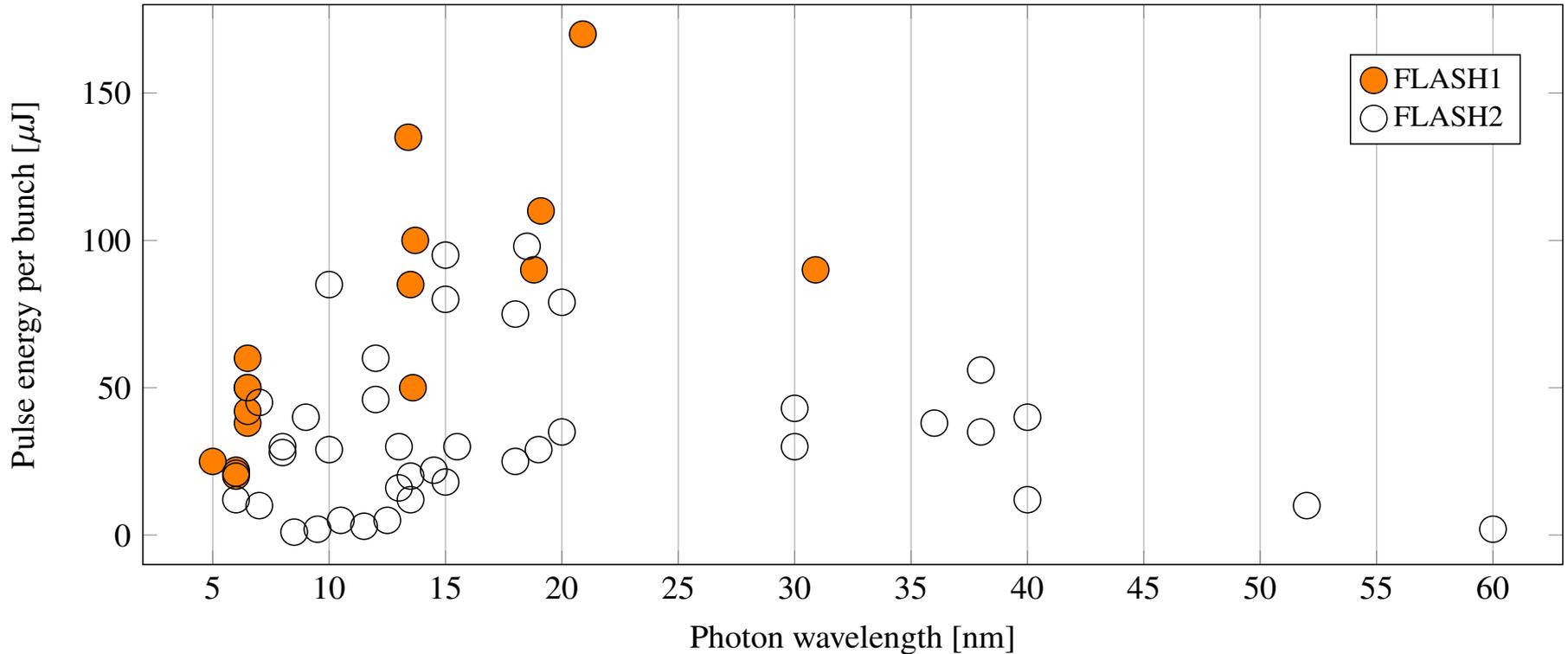
	Flash 1	Flash 2										
Set LFF	Flash 1	Flash 2										
Reset LFF	Reset Flash 2											
Amplitude	53.86	53.90	160.30	160.30	19.61	19.50	313.10	313.10	312.00	312.00	260.80	260.80
Phase	0.50	0.50	0.24	0.24	0.11	0.16	0.82	0.91	0.00	0.00	0.00	0.00
Start	700	1140	700 us	1140 us	700	1140	700	1140	700	1140	700	1140
Transition	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00

Achieved photon wavelengths during parallel SASE operation



- > Achieved photon wavelength during parallel SASE operation in the period from August 2014 to August 2015.
- > Variable gap undulators in FLASH2 allow different photon wavelength at fixed beam energies.

Achieved SASE pulse energy during parallel SASE operation



- Achieved SASE pulse energy during parallel SASE operation in the period from August 2014 to August 2015.

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> Thank you for your attention!