Beam dynamics report of weeks 22-23: Short pulses, Aramis BBA and Athos commissioning

E. Prat

SEM meeting, June 8

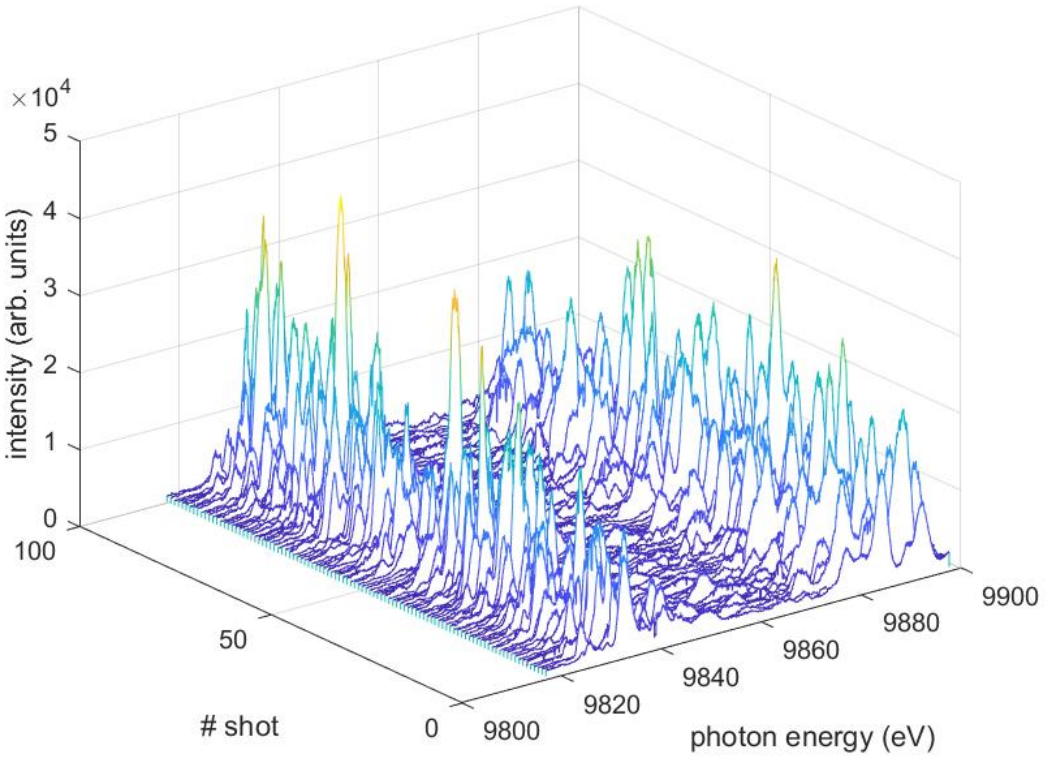
Short pulses (May 25, morning + a bit of night)

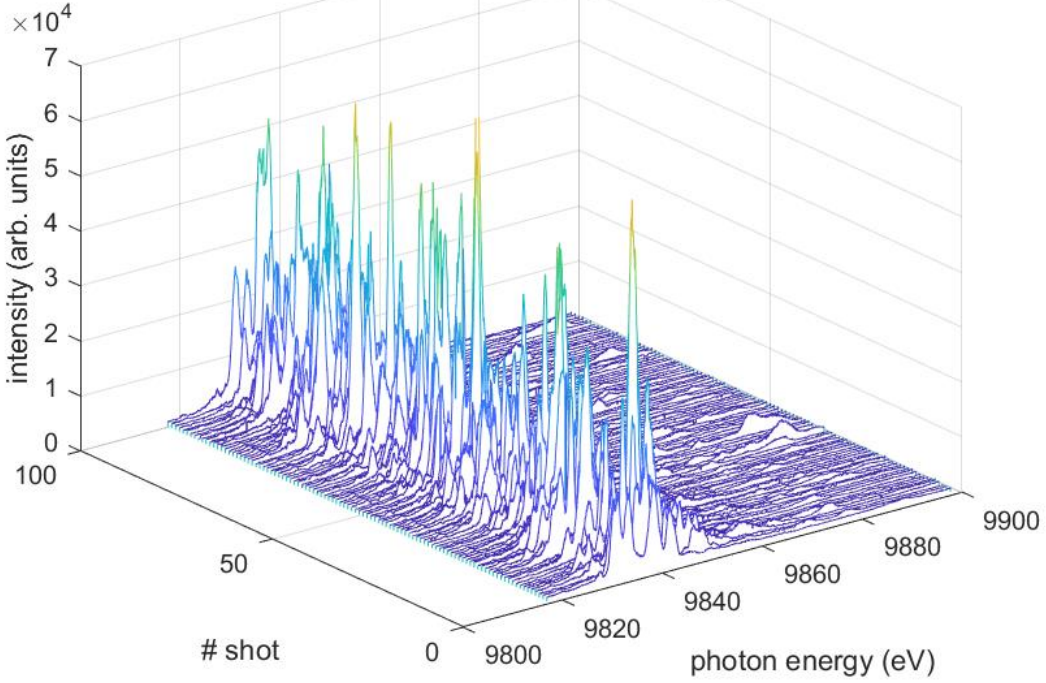
Laser group, A. Malyzhenkov, P. Dijkstal, Y. Arbelo, P. Craievich, E. Ferrari, N. Hiller, P. Juranic, S. Reiche, E. Prat

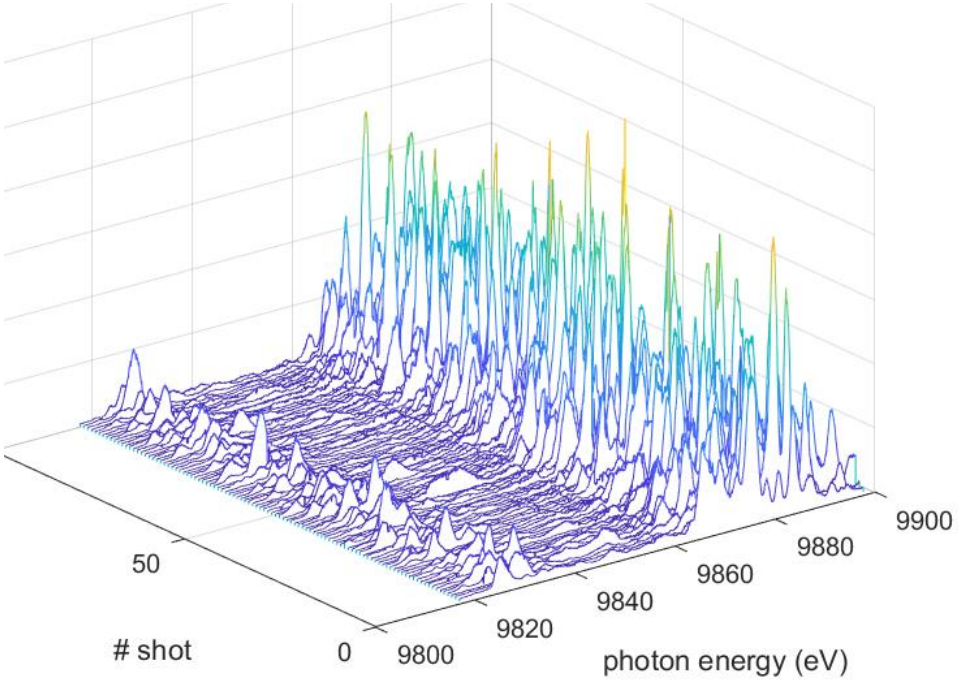
- 10 pC, 10 keV
- Setup of short pulses (~1 fs) took about 6 hours.
- Generation of two colors with 3 stage compression, easy tuning of the intensity balance between the peaks
- Demonstration of post-undulator streaking with 10 pC
- More details in shift summary: https://elog-gfa.psi.ch/SwissFEL+commissioning/14523

Two colors

The relative intensities of the two colors can be modified by changing the linac 1 phase

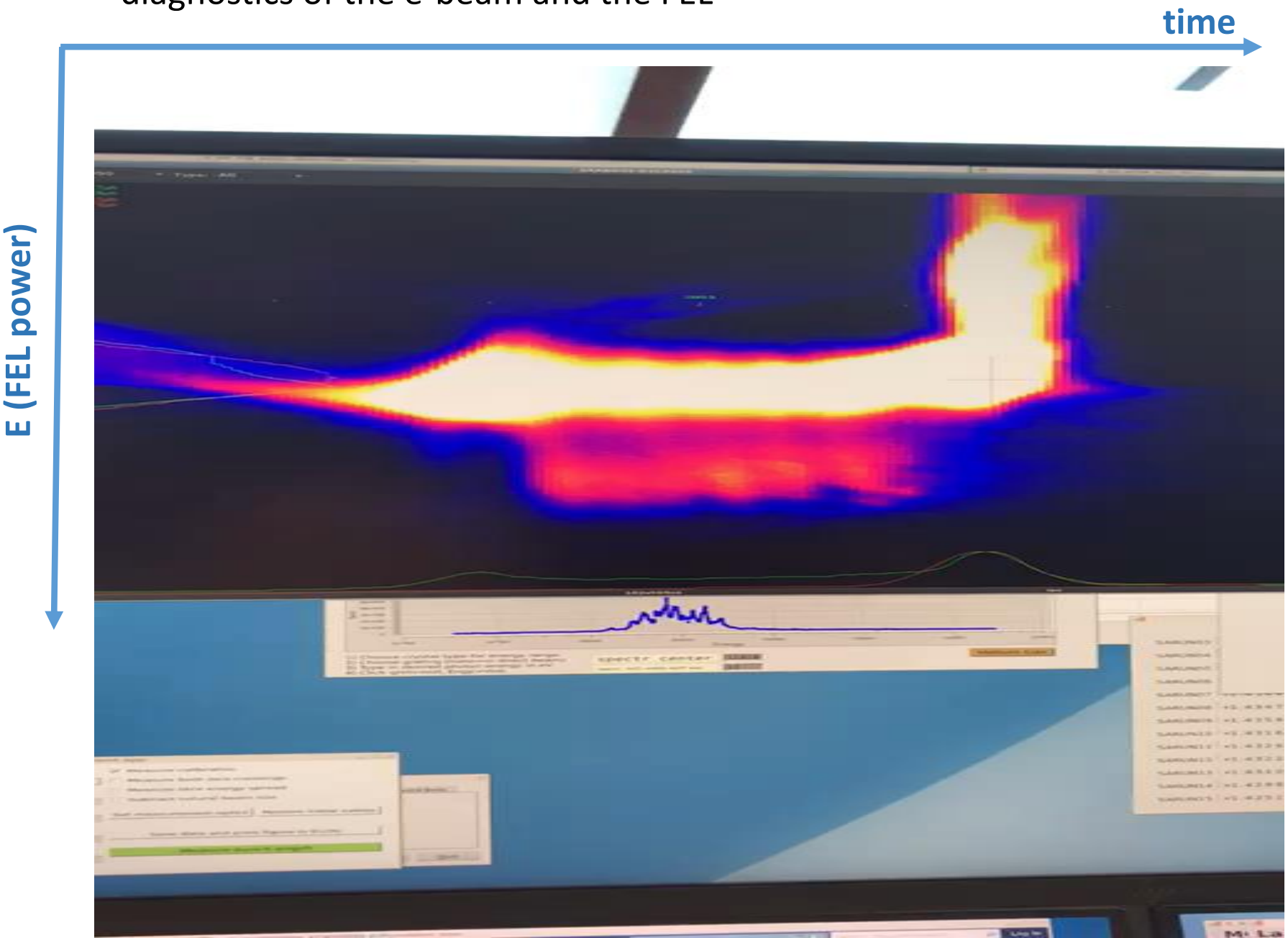






Post-undulator streaking (200 pC, old shift)

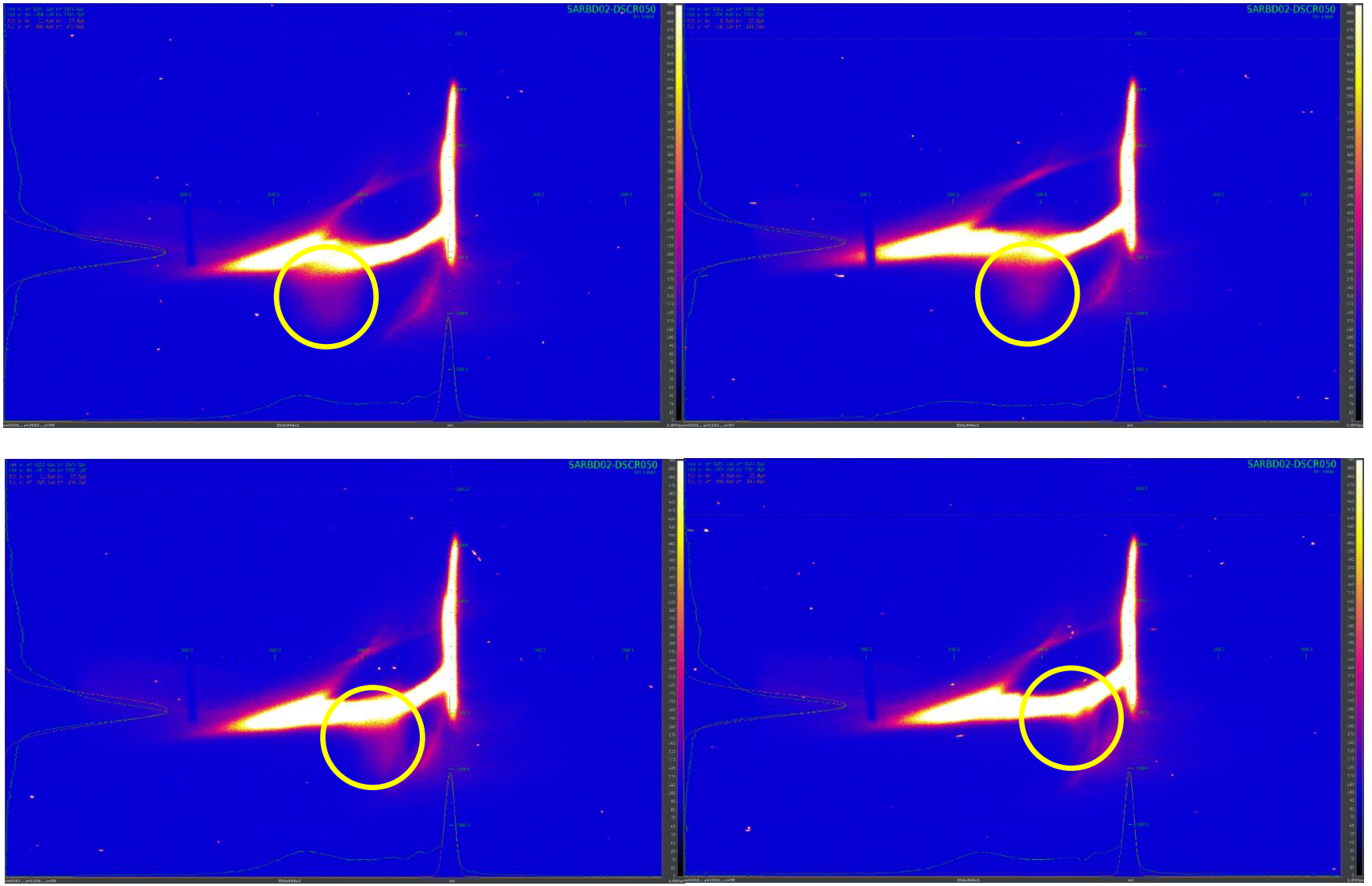
- Wakefields of corrugated structure after the undulator can be used as temporal diagnostics of the e-beam and the FEL



Post-undulator streaking (200 pC, old shift)

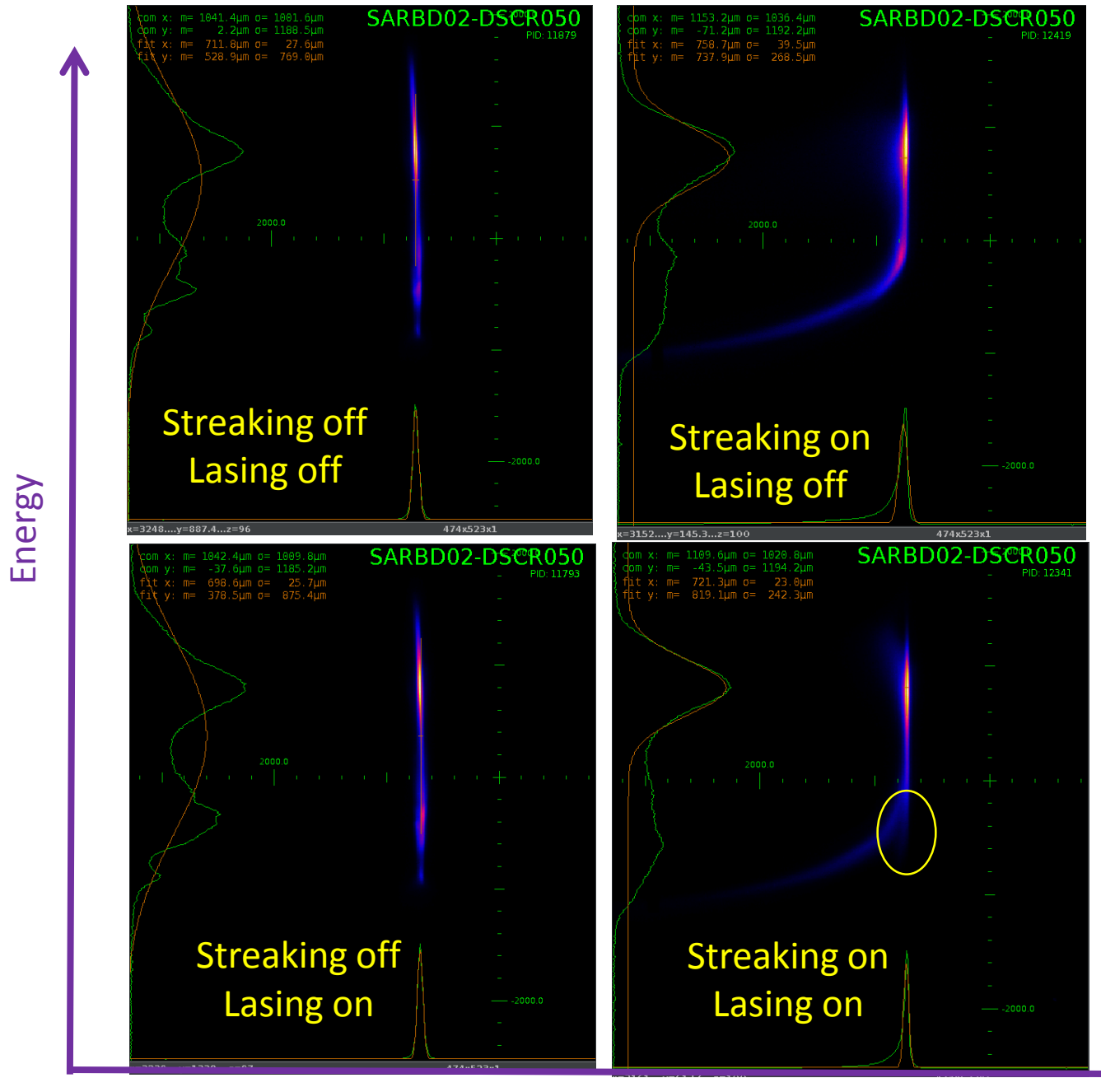
Fresh-slice demonstration:

- Short pulse is generated with a skew quad in a BC
- Lasing part is moved along the bunch with a corrector magnet



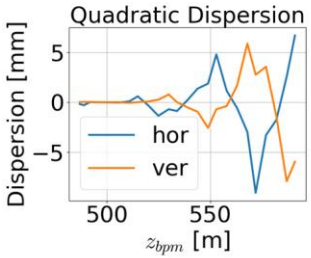
Post-undulator streaking (10 pC, May 25)

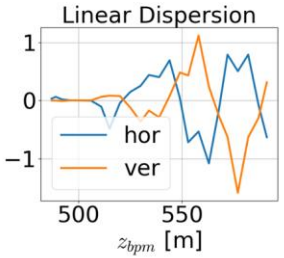
- Streaking possible also for 10 pC!

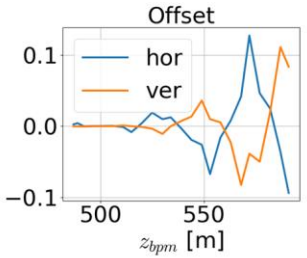


Aramis BBA (May 27, E. Ferrari)

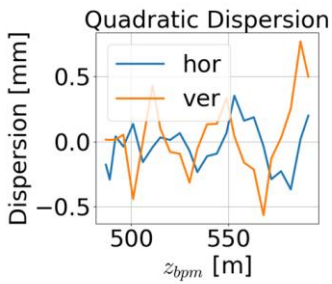
Initial

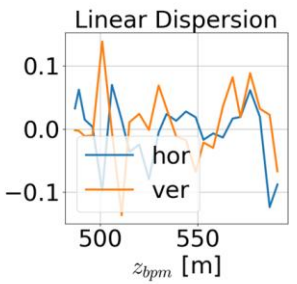


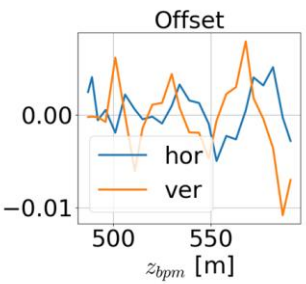




After 5 loops







Started with undulator open (K=0.5), then proceeded with closing undulator at nominal K.

Mistake in the correction strategy for the initial conditions: Dispersion is reduced in the undulator, but opens in the launch (another lesson learnt) :-(

Tried several loops with different svd reduction.

Measurement is now versatile and robust :-)

Athos commissioning (June 3 and 4, late)

E. Ferrari, C. Kittel, D. Voulot, E. Prat

- In parallel to Aramis photon delivery
- Undulator and CHIC controls updated for 6 modules.
- Lasing at 350 eV (K=3.5), 6 undulators, circular polarization, CHIC on.
- June 3: only a couple of hour since photon shutter was closed, fixed by Reno the next day.
- June 4 (https://elog-gfa.psi.ch/SwissFEL+commissioning/14656):
  - Check that all undulators contribute
  - Pulse energy of 15-20 uJ, less than expected with 6 modules (we had the same with 4 modules)
  - Transverse mode not great
  - Most likely reason: deteriorated e- beam quality, probably due to a suboptimal 2-bunch setup
  - Another issue: SATUN18 kick correction was wrong (bug found and fixed later)
- Next shift today. 2-bunch setup from scratch.
- For the future: setup (blue) shifts should setup both bunches, need to think how to use PSICO.