

**PSI** Center for Accelerator Science  
and Engineering

# SF RC Report 2024 Week 24

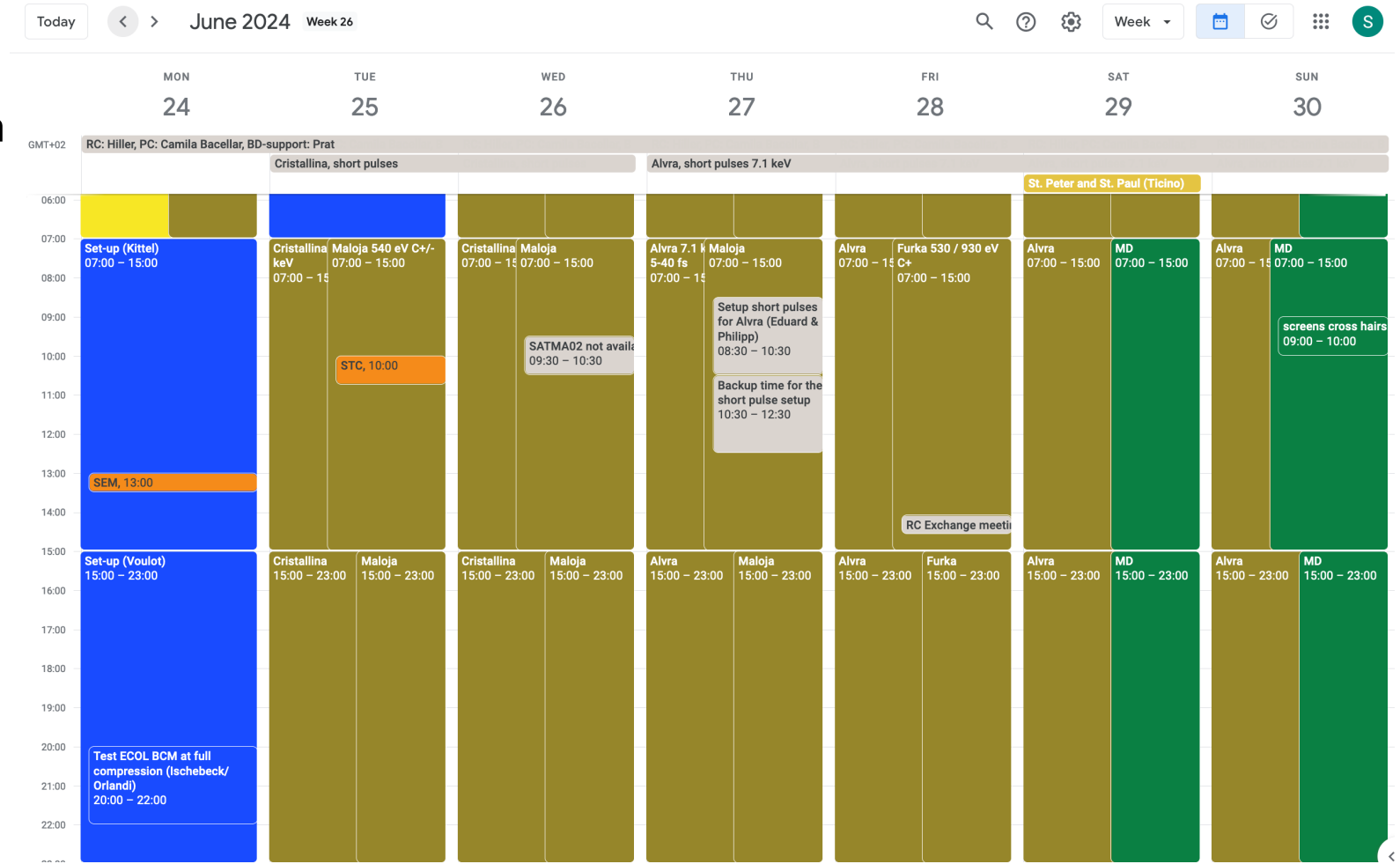
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N. Hiller  
PSI 1.7.2024

# Week 26 24.6.-1.7.2024

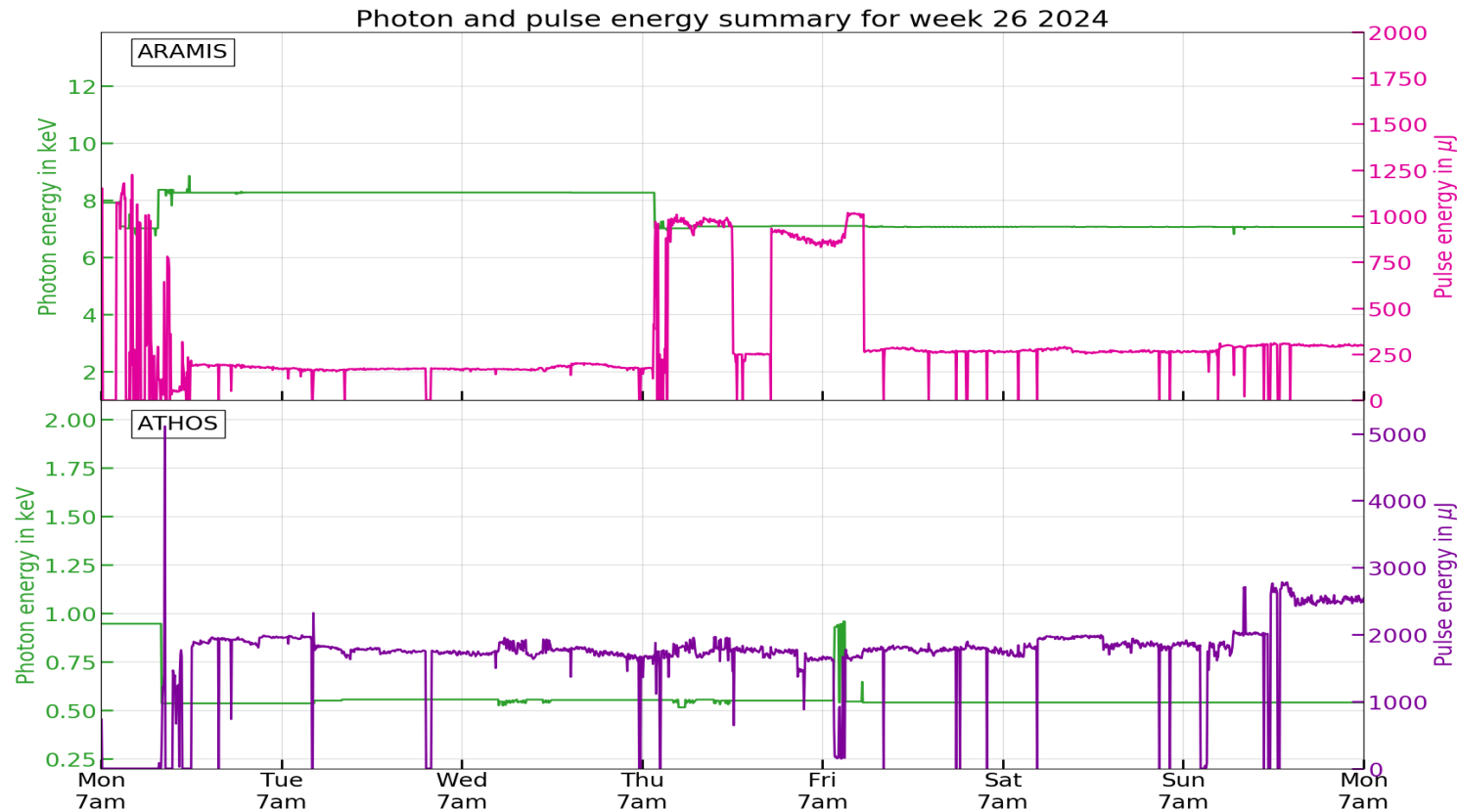


- Aramis:
  - Short pulses for Cristallina 8.35 keV
  - Short pulses for Alvra 7.1 keV
- Athos:
  - Maloja 540 eV C+-
  - Furka 530 eV & 930 eV



# Performance during the week

~200  $\mu\text{J}$  for Short pulses for Cristallina  
Alvra: settings for “standard”, “shortish” and “very short” -> see Philipp’s slides for measurements



- **Aramis:**
  - Beam degraded Thur-Fri (had to re-optimize -> re-setup)
  - Losses in Undulators were increasing in tilted beam mode
- **Athos:**
  - BC2 compression feedback had to stay off
  - Performance is not at optimum -> need to find out why but for this we need a “calm” week with “standard settings” in both branches or MD

# Monday/Thursday beam setup for Aramis (with Eduard)



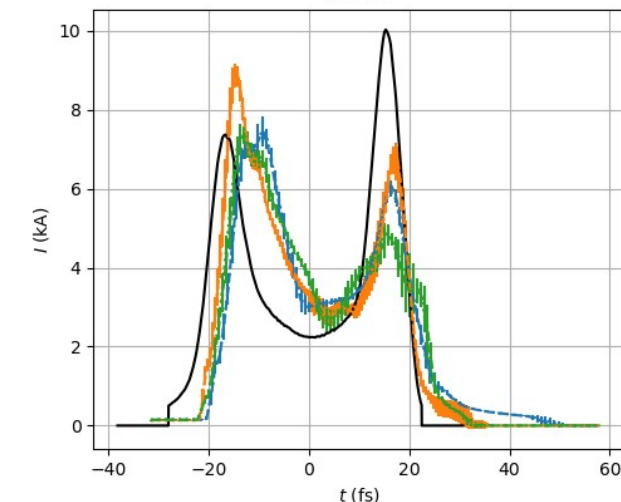
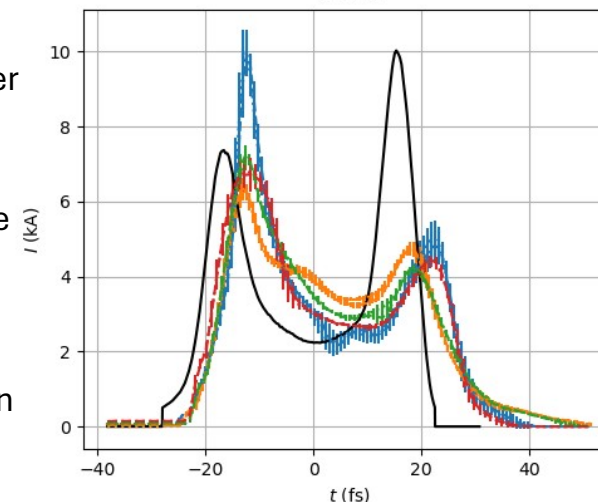
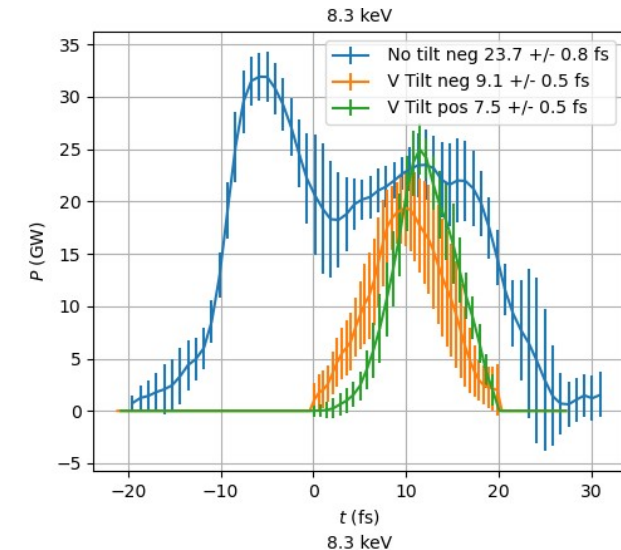
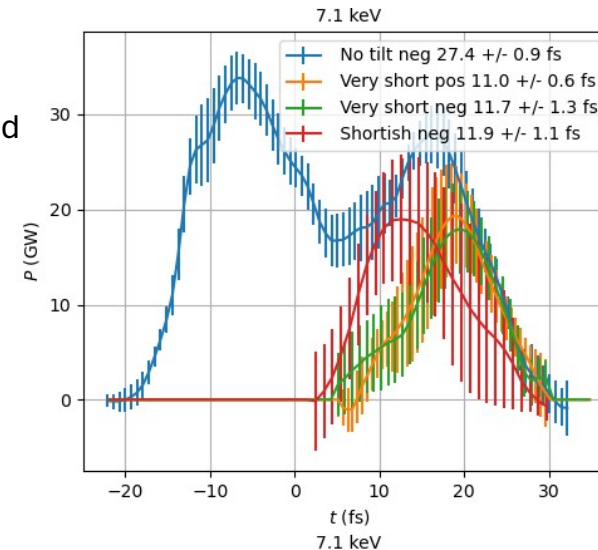
## Specifications

- FEL pulse duration
  - Cristallina: 8.3 keV, 20-30 fs FWHM and as short as possible
  - Alvra: 7.1 keV, several durations between 5 and 40 fs FWHM, and  $>200 \mu\text{J}$  pulse energy at all times
- General requirements: low losses to allow for 100 Hz operation, sufficient pulse energy, and low bandwidth

A different beam setup compared to previous short pulse weeks:

- Usually we use the passive streaker without changing the orbit feedback targets. In this way, the center of mass is aligned with the undulators. This beam time we could not get good performance with this approach.
- Instead we chose an aggressive compression setup and used the feedback system to align the tail spike. This gives short and high power pulses due to the high peak current (10 kA) in combination with the increasing beam tilt along the bunch.
- The downside is a more difficult passive streaker measurement, since the defocusing quadrupole wakefields are highest at the tail. The tail has a worse time resolution compared to the core.

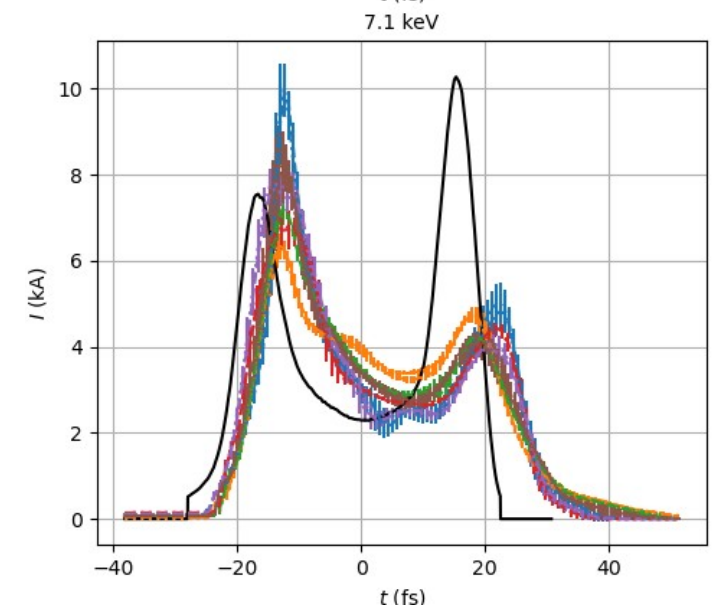
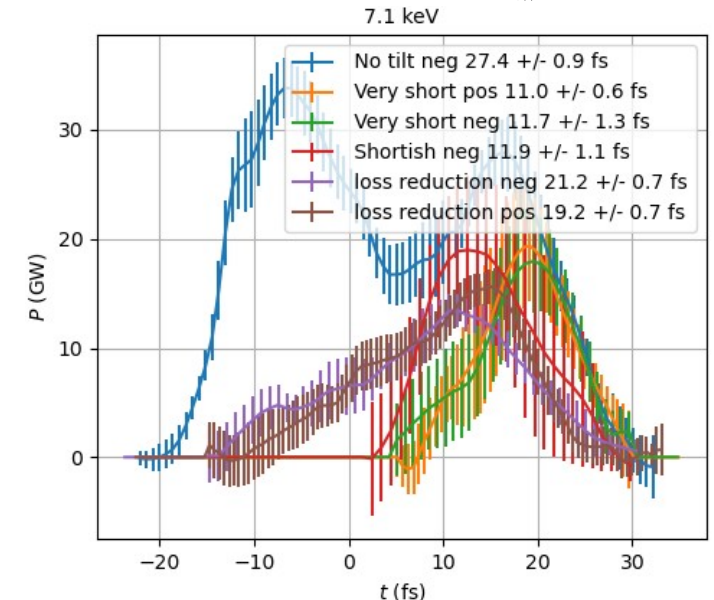
Conclusion: setup was successful overall. While we cannot differentiate in the measurement between the two shorter FEL durations for Alvra, based on our understanding one of the two has to be shorter.



# Problems during the week



- Evidence of some drifts (some of them likely in the cathode laser)
  - On Thursday around 2pm, the compression and BC1 arrival time feedbacks were at the limit. Operator team increased feedback limits.
  - Alcor UV apertures were changed on Friday afternoon.
  - On Sunday the beam losses in the Aramis undulator increased and the dechirper center was moved slightly (only 10  $\mu\text{m}$ !) to reduce the beam tilt and the losses. The machine was in „shortish“ setting at that point.
- I later remeasured the FEL power profile (assuming the current profile measured on Thursday is still correct) and unfortunately the FEL pulse duration was almost doubled.
- I tried to remeasure the current profile with the rf TDS but made a mistake in not removing the vertical dechirper. But based on the current profiles reconstructed by the passive streaker, there seems to have been no change.
- Comparing reference snapshot for “shortish”, taken on Thursday morning, to machine setting on Sunday evening:
  - S10 Rf phases different by 0.5 degrees
  - SINDLH Rf phases different by 0.25 degrees.
  - Unchanged compression feedback targets.



# Outlook / conclusions



Small improvements / suggestions for future short pulse weeks:

- We will try to set maximum focusing in the undulator beamline to enhance the effectiveness of the beam tilt. This week, we have the quads at around 8.5/10 A.
- With more time available for the setup next short pulse week (only Alvra), I will try to optimize the passive streaker time resolution at the beam tail.

Overall summary:

- no problems for the Cristallina beam setup. Machine was stable between Monday and Thursday morning.
- drifts that happened between Thursday 2pm and Sunday morning impacted the losses, and therefore the beam shaping dechirper position was changed. Hence the FEL pulse delivered on Sunday morning until Monday morning was longer than originally specified (but still shorter than the standard duration).