



Florian Löhl :: Paul Scherrer Institut

Run coordinator report July 6 – 12, 2020

SwissFEL Exchange Meeting, 13.7.2020

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A week of records

Aramis

- First user experiment at 100 Hz
- Narrowest spectrum ever generated in SwissFEL
 - FWHM BW < 0.10 %
- Highest average photon flux ever generated in SwissFEL (up to 560 μ J @ 100 Hz)
 - L-index = 69 d

Athos

- First FEL beam at 10 Hz, no difficulties with losses (during one day)
 - Losses again after laser event on Thursday
- Pulse energy at 539 eV of 110 μJ, 10 Hz
 - There is now a new Athos PSICO expect more to come
 - L-index = 9.6 a







Simona setup the beam Monday morning and early afternoon (E_{ph} = 7.52 keV)

 \rightarrow pulse energy increase from 270 μ J to > 400 μ J

 \rightarrow reduction of spectral width from 0.0185 % to 0.011 %

 \rightarrow reduction of e-beam pulse duration (42 fs rms to 27 fs rms)



Pulse energy over the week



PSICO running all week, mostly optimizing on pulse energy / spectral width

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PSICO was active with most parameters







Machine stability

- Optimized beam-based feedback loops for current machine state
 - Helped a lot in improving the overall stability
 - Some feedback now running with much faster rates
- Added option to feedback on position detector PBPS133 close to Bernina experiment
 - Used from Tuesday on to stabilize FEL pointing
- Added new feedback for the photon energy
 - Thanks a lot to Didier for making new PVs available on such a short time-scale
 - Users adjusted the wavelength themselves to what they needed

New sensor option in FEL pointing feedback

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SARUN05-DBPM070	0.1052	0.0429	0.0000	0.0000	-0.0120	0.0019	0.000 ÷	0.000	0.0932	0.0448	
SARUN06-DBPM070	0.1320	0.0090	0.0000	0.0000	-0.0090	0.0014	0.000 ÷	0.000	0.1229	0.0105	
SARUN07-DBPM070	0.0911	0.0431	0.0000	0.0000	-0.0060	0.0010	0.000 ÷	0.000	0.0850	0.0440	
SARUN08-DBPM070	0.0225	0.0673	0.0000	0.0000	-0.0030	0.0005	0.000 ÷	0.000	0.0195	0.0678	
SARUN09-DBPM070	0.0353	0.0756	0.0000	0.0000	0.0000	-0.0000	0.000 ÷	0.000	0.0353	0.0756	
SARUN10-DBPM070	0.0467	0.0801	0.0000	0.0000	0.0030	-0.0005	0.000	0.000	0.0497	0.0796	
SARUN11-DBPM070	0.0372	0.0576	0.0000	0.0000	0.0060	-0.0010	0.000	0.000	0.0433	0.0566	
SARUN12-DBPM070	0.0274	0.0374	0.0000	0.0000	0.0090	-0.0014	0.000	0.000	0.0365	0.0360	
SARUN13-DBPM070	-0.0538	0.0223	0.0000	0.0000	0.0120	-0.0019	0.000 ÷	0.000	-0.0417	0.0204	
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SARUN15-DBPM070	-0.1307	0.0491	0.0000	0.0000	0.0181	-0.0029	0.000 ÷	0.000	-0.1127	0.0462	
SARUN16-DBPM070	-0.0654	0.0245	0.0000	0.0000	0.0090	-0.0014	0.000 ÷	0.000	-0.0563	0.0231	
SARUN17-DBPM070	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.000	0.000 ÷	0.0000	0.0000	
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10:09 13.7.2020 10:11 13.7.2020 10:13 13.7.2020 10:15 13.7.2020 10:17

10:19 10:20 13.7.2020 13.7.2020 Feedback now on a signal much closer to the experiment.

Note:

Sign of response is inverted with respect to gas monitor signal. To be checked if this is due to the mirrors or if they are different.



- Activated many BPMs again that had been disabled in the Athos orbit feedbacks
- Performed orbit correction in the entire Athos line
 - The orbit was terrible before this (it is still not perfect)
- Running feedbacks allow for a more reproducible state and for automatic tuning
- → After these changes running Athos at 10 Hz beam rate was possible
 → Losses were at around 10% of our allowed daily dose in the undulators, so in principle also 100 Hz would have been possible (limited by laser)
- Losses were again high after laser event on Thursday

New Athos PSICO – still in the setup

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Brought up pulse energy from 58 μ J to 110 μ J on Wednesday / Thursday



Difficulties 1 – Instabilities in gas monitor position reading



- Sudden strong noise on gas monitor position signals
- Brief investigation on Tuesday indicates that this is dues to stray-radiation from the slits
- ightarrow Reason to implement PBPS133 position sensor instead into the feedback



Difficulties 2 – Reboot of DRPS MPS soft-IOC



A soft-IOC was rebooted which writes to the timing system IOC.

- → Timing system dropped a pulse
- → All RF stations went to standby
- → Restart of the stations took a while



Difficulties 3 – SINDI01 deflector set on beam

The deflector SINDI01 was set on beam multiple times on Wednesday afternoon

- Drop in pulse energy
- Beam losses in Aramis & Athos

This turned out to be an unintended action during software tests.





- Recovered by itself around 9:05. Happened again around 10:00.
- At around 12:30, Simona found that lasing can be mostly recovered by adjusting the solenoid.
 - → Alexandre changed centering of laser beam in capillary. Very sensitive.
 - \rightarrow Could not recover lasing with previous settings, but after this the laser remained stable
 - → It would be nice to have a permanent optimization (I successfully tested a PSICO long time ago, would be nice if we were allowed to use it)



Difficulties 5 – losses in Athos BLMs not setup properly

- After the gun laser event, we could not recover the beam in Athos with low losses
- During the investigration, I realized that most BLMs in Athos do not measure the beam losses properly. The DRPS detectors were much more sensitive than the BLMs.
- Started Friday afternoon to setup BLMs together with Gian-Luca. Has to be continued this week.

Goals

- Sensitive and well functioning BLMs for loss tuning in Athos
- Add option in PSICO Athos to minimize losses in Athos line (similar to what exists in Aramis)

Difficulties 6 – Jump undulator orbit feedback



- Observed drops in pulse energy
- These were correlated with large orbit jumps in the undulator line
- The feedback applied some very large corrections which caused the jump the position offsets were then regulated away by the feedback
 - → Network problems? Maybe this caused a large latency at some times?
 - \rightarrow Temporarily fixed by not allowing the feedback to do large corrections.



Overall a great week! Questions?





Many thanks to Simona for her help last week!

Simona's goal for this week: alzare l'asticella