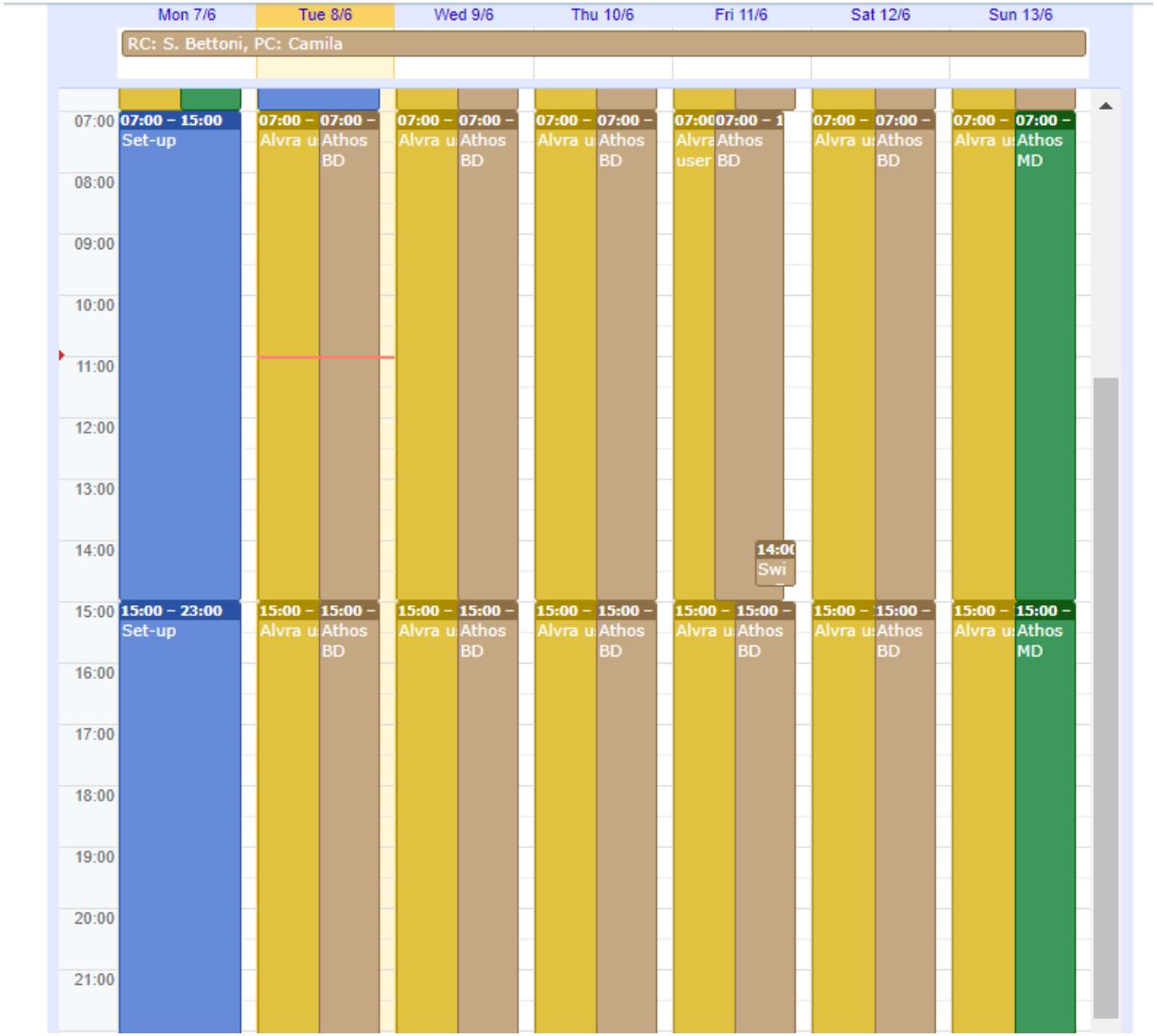
SwissFEL week 23/2021

- **Setup**
- **Loss optimization**
- **Aramis and Athos performance**
- **Observation**
- **Issues**
- **Conclusions**

S. Bettoni
7-13 June 2021

Calendar

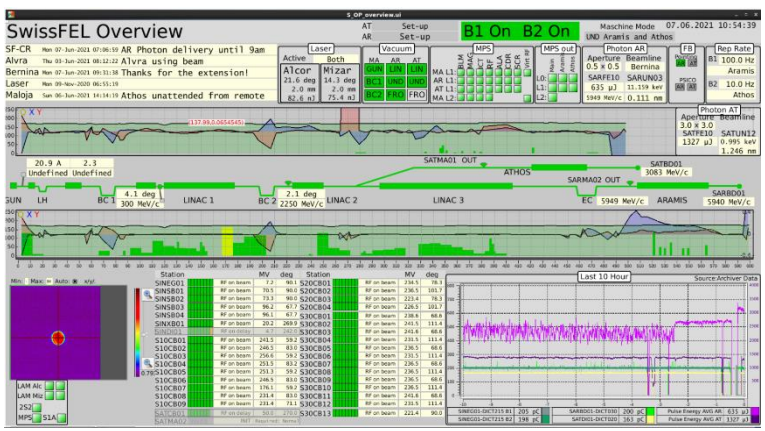


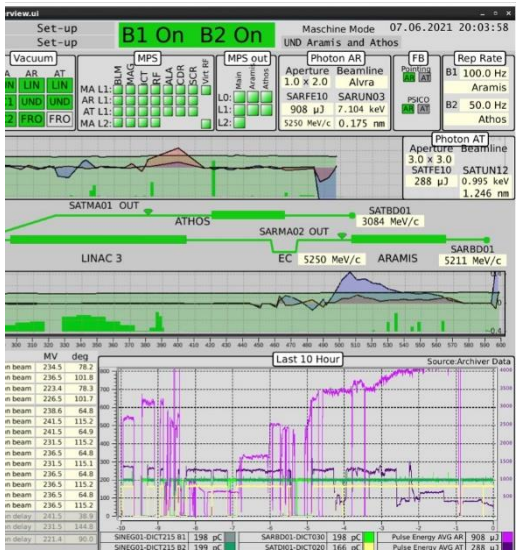
Compared to the initial schedule:

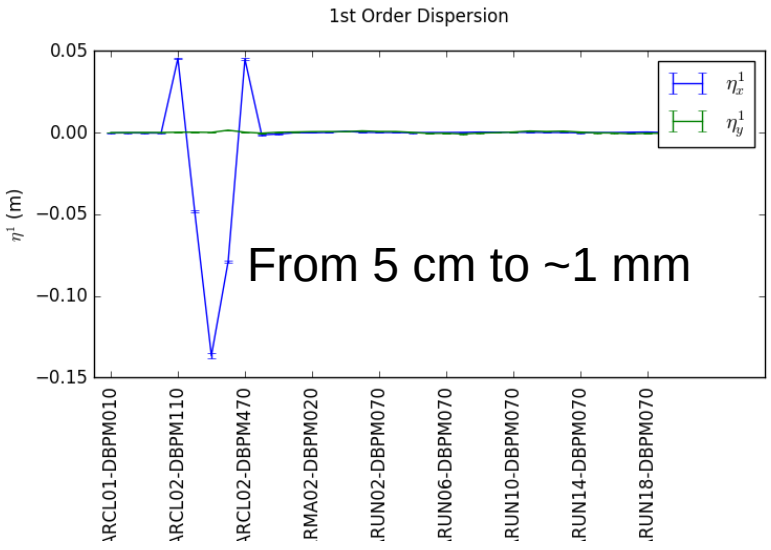
- Furka could not take the beam:
  - Ulrich used few hours on Tuesday
  - Maloja used the beam from Wednesday to Saturday included
  - No beam used on Sunday in Athos

Setup Monday-Aramis for experiment

- **Machine stabilization:**
  - Aramis lasing: laser and small adjustment of first part of the machine
  - Mizar orbit with A. Dax
- **Machine settings:**
  - Check on the different **energy profiles** (with D. Voulot, and N. Hiller) to correct from something applied few weeks ago. For the time being reverted back: dedicated shift tomorrow
  - Scaling to 7.1 keV
  - Corrected the **dispersion** to a level we consider to be more than ok
- **System issues:**
  - Controls of the **PSSS** (fixed by C. Arrell with controls)
- **Machine status for the experiment:**
  - Start of the photon delivery in Aramis already on Monday afternoon
  - About 930 uJ at 8 PM



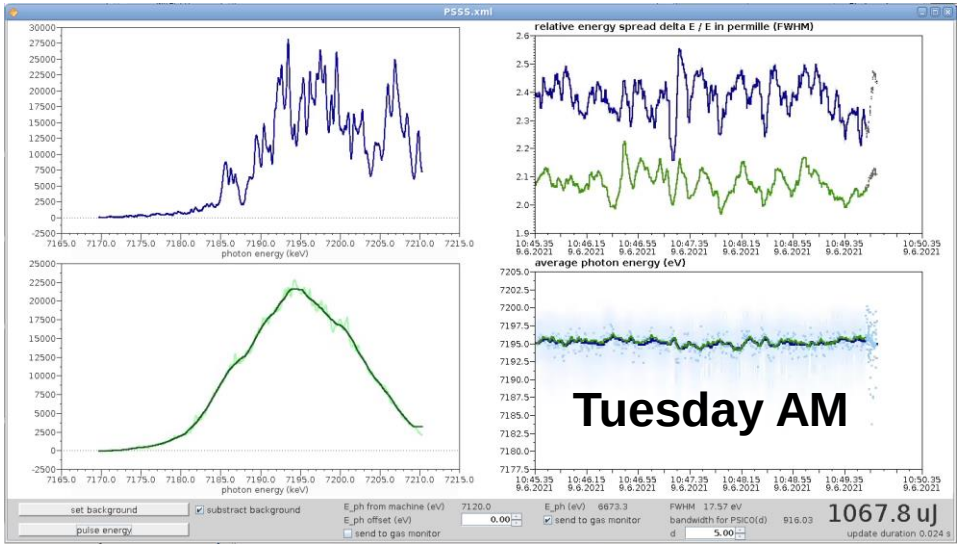




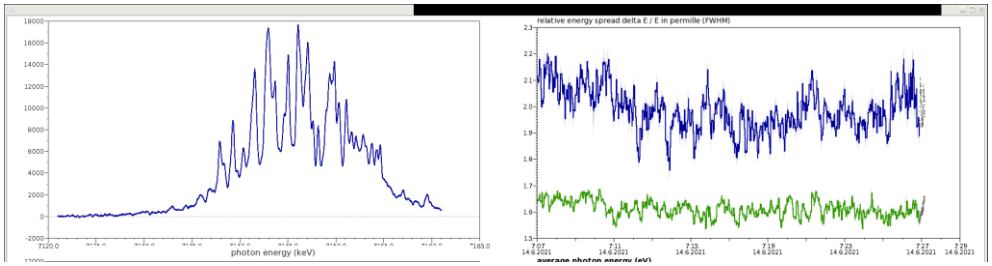
Aramis BW

- **Request:**
  - Compromise between BW as large as possible, but still large number of shots fully inside the PSSS range
  - Final check by photonics only possible on Wednesday evening. I started the optimization at 8 PM

- **Machine setup:**
  - Re-optimized on Wednesday night, and on Thursday early morning
  - Touched also the common part, so also Athos had to be re-optimized. Used this occasion to do a careful optimization of the losses in Athos
  - Around 850 uJ, BW ok for users
  - Would have been necessary to revert back BC2 compression from 1900 to 1500 to come back to 1 mJ. Users had too much lasing already, so they preferred to stay



Today



Athos loss optimization on Monday

- **Request from Maloja:**
  - Run at 100 Hz for the nominal long pulse
  - 5 Hz operation point with pulses as short as possible
  - Possibility to sacrifice lasing intensity, if necessary

- **Starting conditions on Monday:**
  - Lasing about 1.3 mJ
  - Hotspots of the losses at SATUN06-DBLM, SATUN09-DLLM (end of the line)
  - Checked the possible pulse reduction in these conditions:
    - Between factor 3 and 4 only. Checked in the morning (N. Hiller), and confirmed in the evening with some optimizations (C. Kittel, F. Loehl, and partially myself)

-----> more done during the week to optimize this

Athos losses: list of actions

Wednesday with Florian, and Alessandro (from after 8 PM-BW change until 3 AM):

- quads in SATUN06, which were not like the others along the line (no FODO)
- compression settings only bunch 2
- found some offsets different in the snapshot of the 1.4 mJ compared to what was in the machine. Some of them I reverted back, some I was scared it would have been given too many losses
- CHIC delays
- orbit in SATUN (adaptive tool)
- **Correctors at +9, -7 A both in H and in V. Not concluded, but started**.

Reduction of the losses at the end of the Athos line

Thursday with Didier (from 8 AM to lunch):

- **opened dechirper SATDI**
- balanced dechirpers in SATCL02
- optimized the matching quads
- restored the CHIC gaps from yesterday afternoon
- restored the BPM FB in BC1

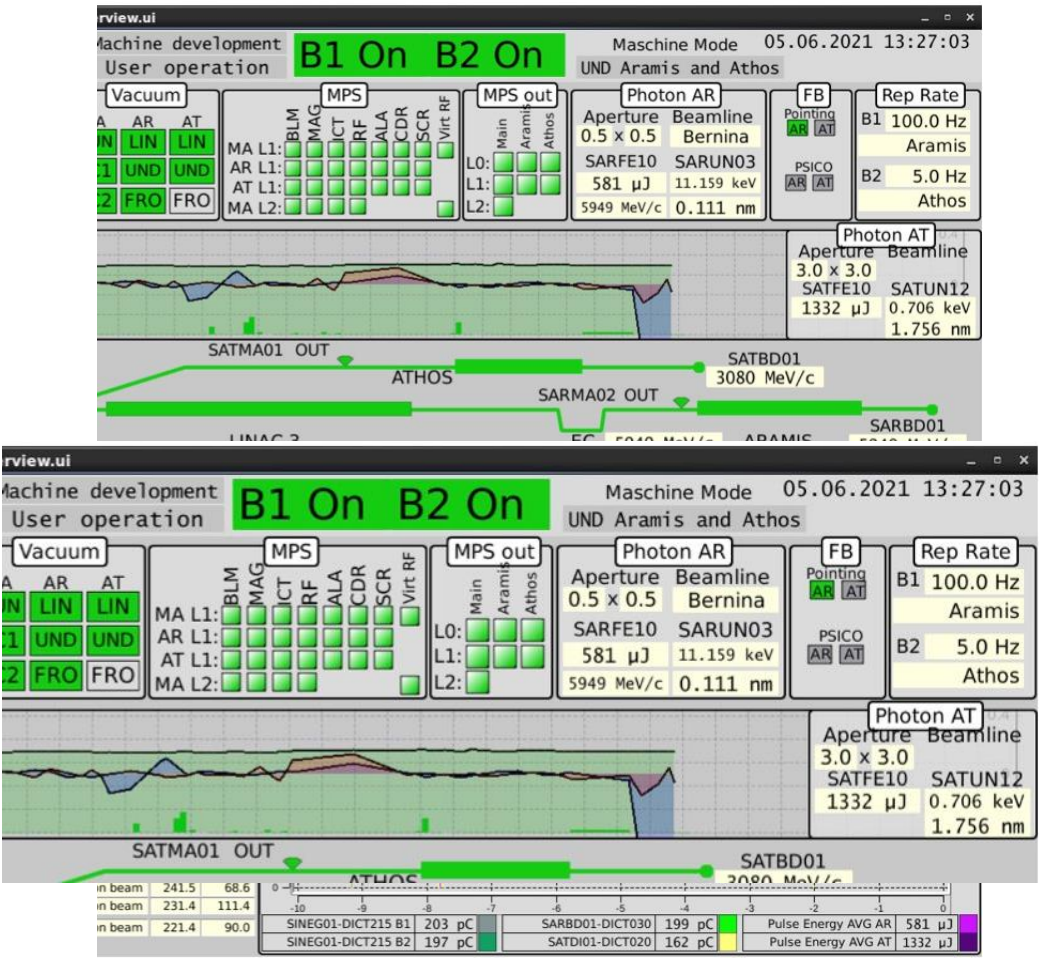
Reduction of the losses along the Athos line

All actions documented in a logbook entry

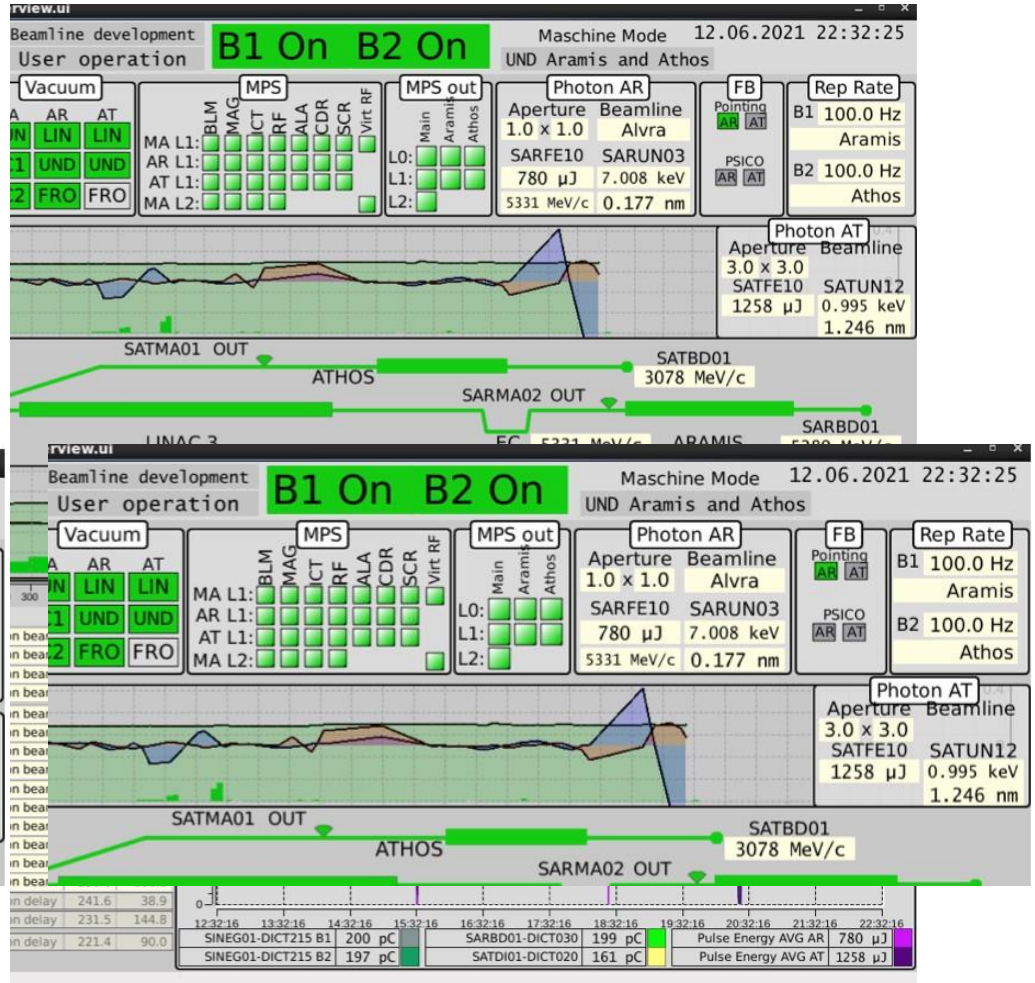
Athos losses: losses situation

Reported to Florian at the Friday meeting, and he lowered again the LLM thresholds by more than a factor 2

5 Hz, Sunday 6 June

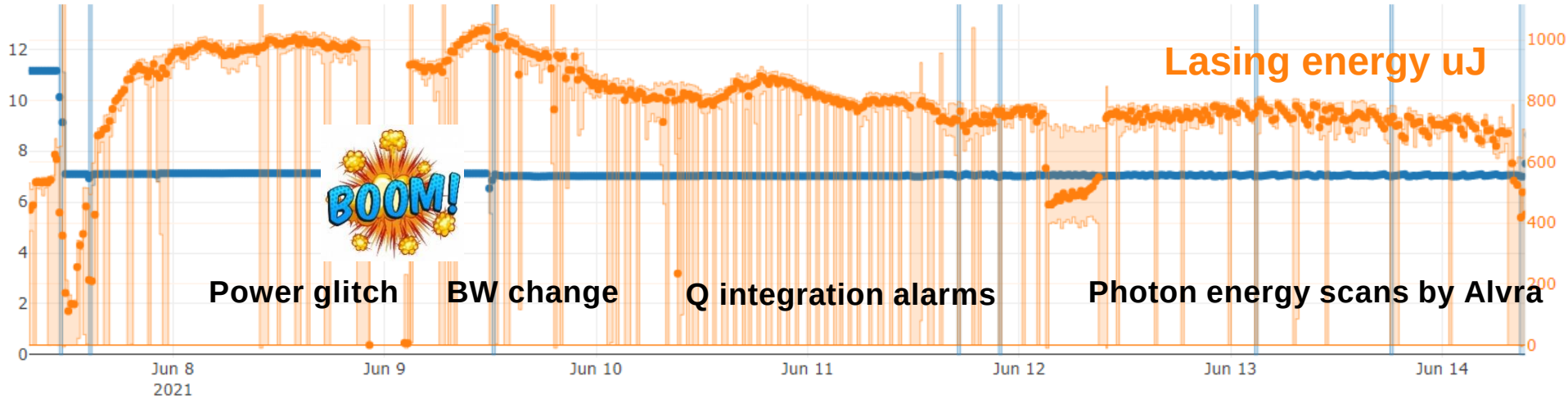


100 Hz, Sunday 13 June

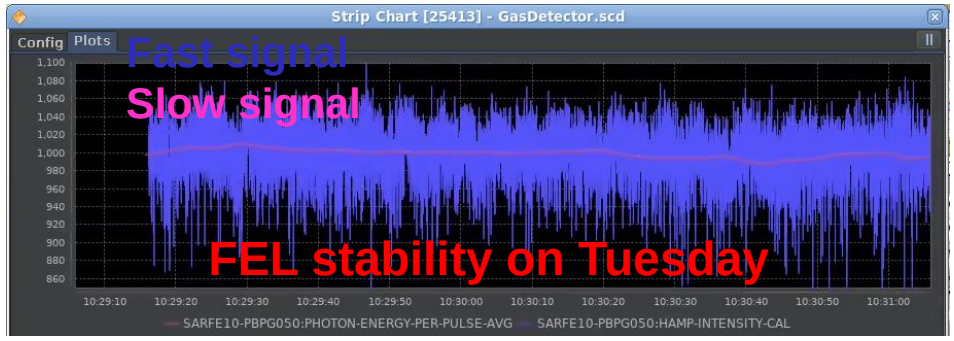


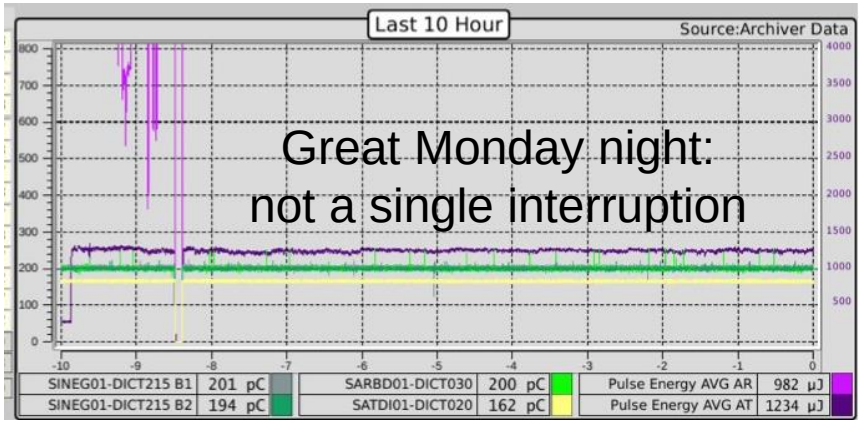
Maloja did not ask for the pulse shortening anymore, but optimization was useful in any case. All actions documented and saved.

Aramis performance



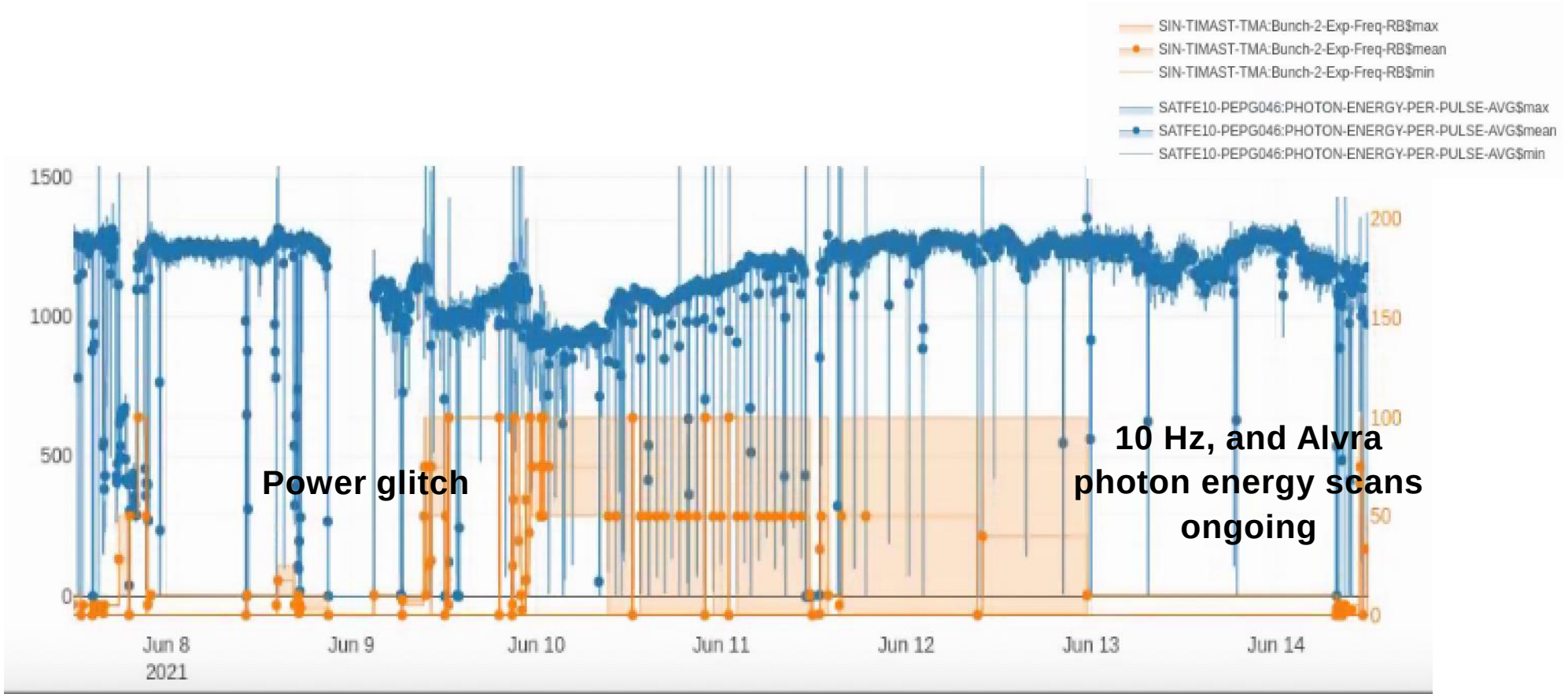
- Maximum lasing **1.055 mJ at 7.1 keV**
- After the power glitch machine came back quite well. Only some adjustments necessary to further improve





Athos performances

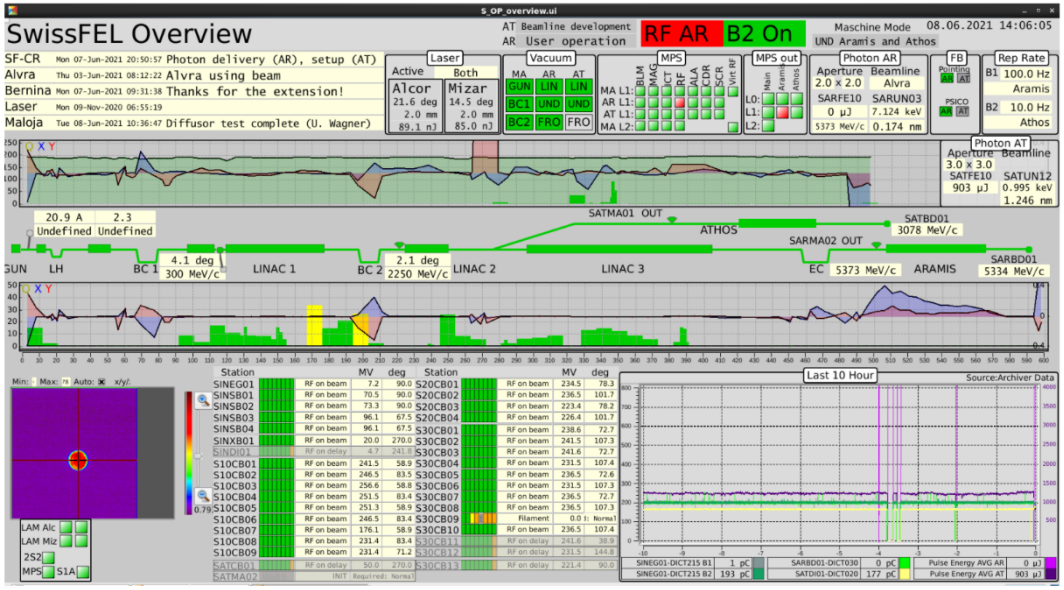
- Maximum lasing **1.31 mJ at 1 keV** starting from about 1.4 mJ
- **Losses** optimized to allow for stable operation at 100 Hz
- Asked to go to 10 Hz when the beam was not used because of the interplay bunch 2-Linac 3

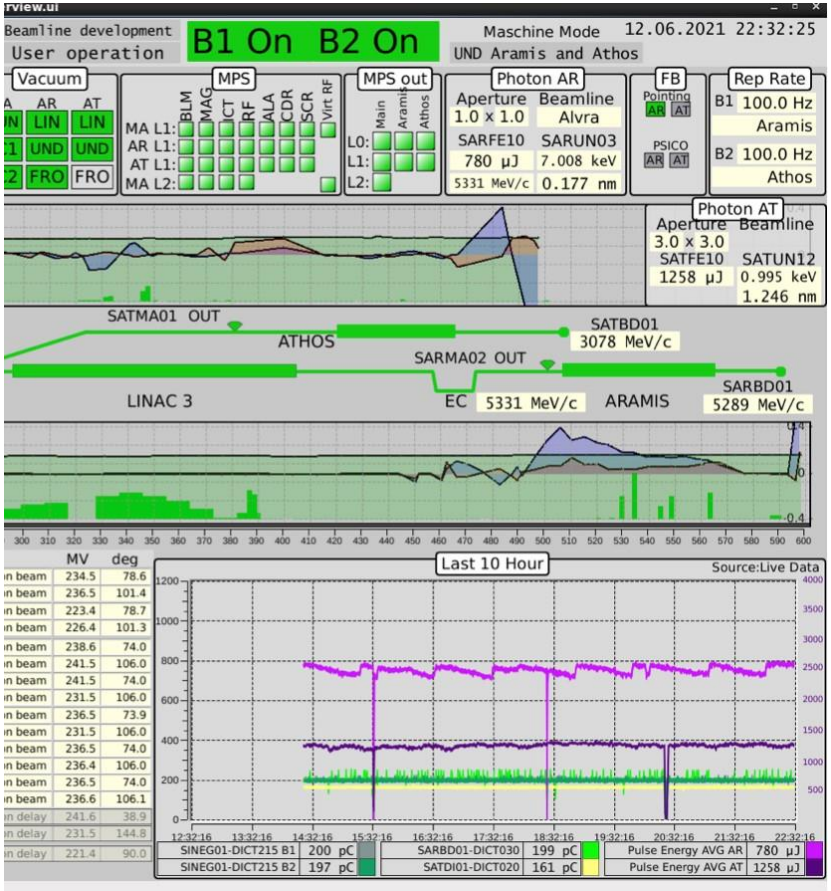


Observation

Linac3 speaks with the Athos beam

- **Observations:**
  - On Tuesday afternoon a station in Linac3 tripped and the Ahos lasing went down from 1.3 mJ to 900 uJ
  - When Alvra cycled the SARCL02 bend (at the entrance of Aramis) Athos could not run because of losses going crazy
  - When Alvra run the photon energy scans Athos sees them





Reported here. No time to investigate also this yet.

Issues: not what I would call a calm week

2 power glitches:
- one big (Tue night): all PSI machines down
- one small (Wed morning): some magnets, an RF station sending values

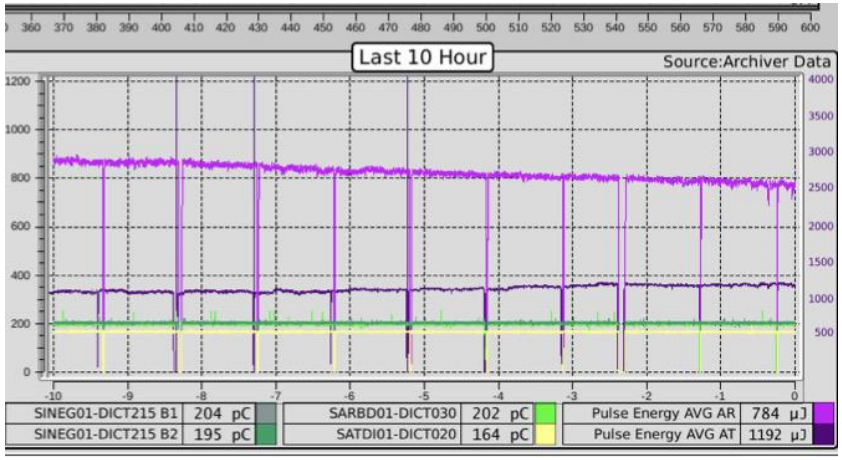
2 tunnel accesses:
- Athos pumps in the area of the gas detector failed on Fri AM
- At 3:10 AM on Saturday some systems failed. From machine side ARAMIS gas detector. More issues for photonics side.

Others:
- general failures of several systems on Sat 3 AM-> gas detector, users side
- controls of the SINBC02 compressor monitor on Friday afternoon

Piquets called this week:
- Laser
- RF
- Controls
- T&S
- Support from diagnostics during working time

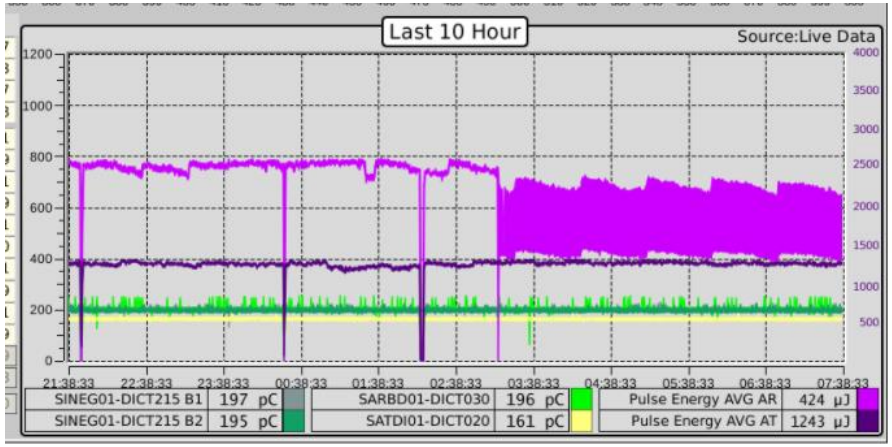
Other minor issues

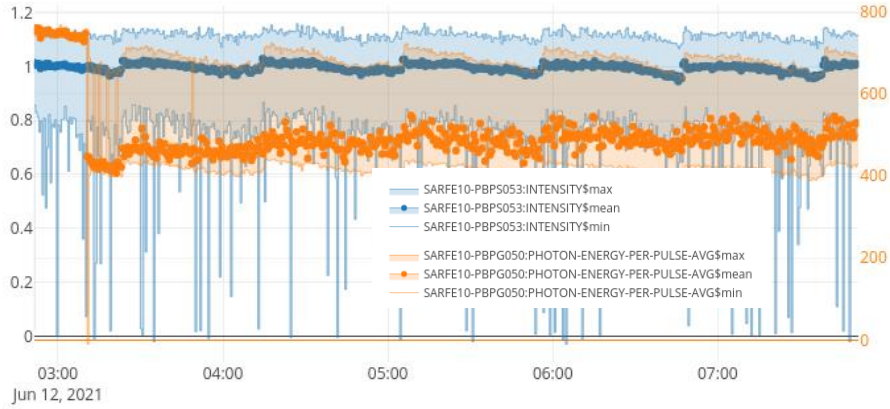
Slow drift during a night



- Stabilized the machine changing the gun knobs
- Source not understood
- Someone changed the charge of bunch 2. This caused many Q integration alarms. The control room did resets
- Florian noticed it in the morning. We readjusted the charge of bunch 2

Aramis gas detector false reading





- Since 3 AM on Saturday morning
- No issues from users side
- Problem probably due to a third power glitch? Issues in photonics too. C. Arrell and Camila diagnosed it. Thanks.

Conclusions

Aramis:

- The setup went very smoothly: already almost 1 mJ on Monday evening
- Maximum Aramis lasing at 7.1 keV: **1.055 mJ** reched after the power glitch
- BW optimization brought down the signal, but users happy with the intensity, so not retouched

Athos:

- A lot of time spent to optimize the losses
- Run at **100 Hz possible**, about **1.3 mJ**

Issues:

- Power glitches: one put down all the PSI machines
- Tunnel accesses: due to power glitches, and vacuum problem (in the Athos gas detector area)

Observations:

- Bunch 2 and Linac 3 speak among themselves
- Learnt that the “Cirelli boom” is possible, also if Claudio is not at PSI

Acknowledgements

Last week spent many hours connected to try to make happy both lines (Aramis for photon intensity and BW, and Athos for the losses)

Many thanks to all the piquet and not only people we called during this crazy week:

- Laser: A. Dax, and also C. Vicario helped
- RF: T. Lippuner, who had to go to PSI after the power glitch
- Controls: T. Humar, called multiple times
- T&S: V. Arsov, because after this super long week when I saw the lasing jittering in Aramis I suspected the laser or the timing
- Operation: especially Didier, who accepted to connect on Thu AM when I asked after these crazy days

A huge thank to Florian, who connected all the times I asked and before

Thanks for supporting me in the last year all the times this was needed with suggestions and comments