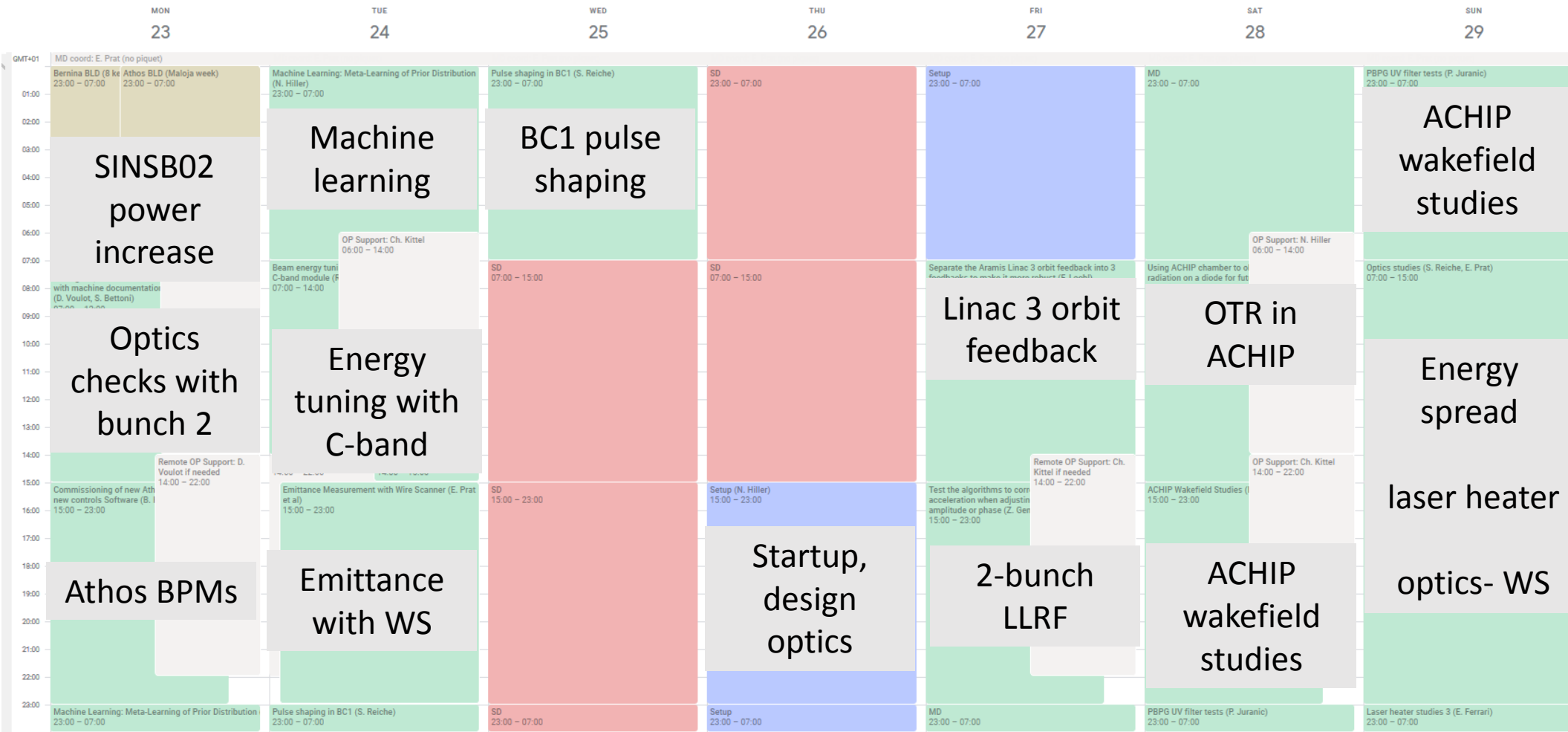


# MD week 48 report

**E. Prat**

**SEM meeting, November 30**

# Overview

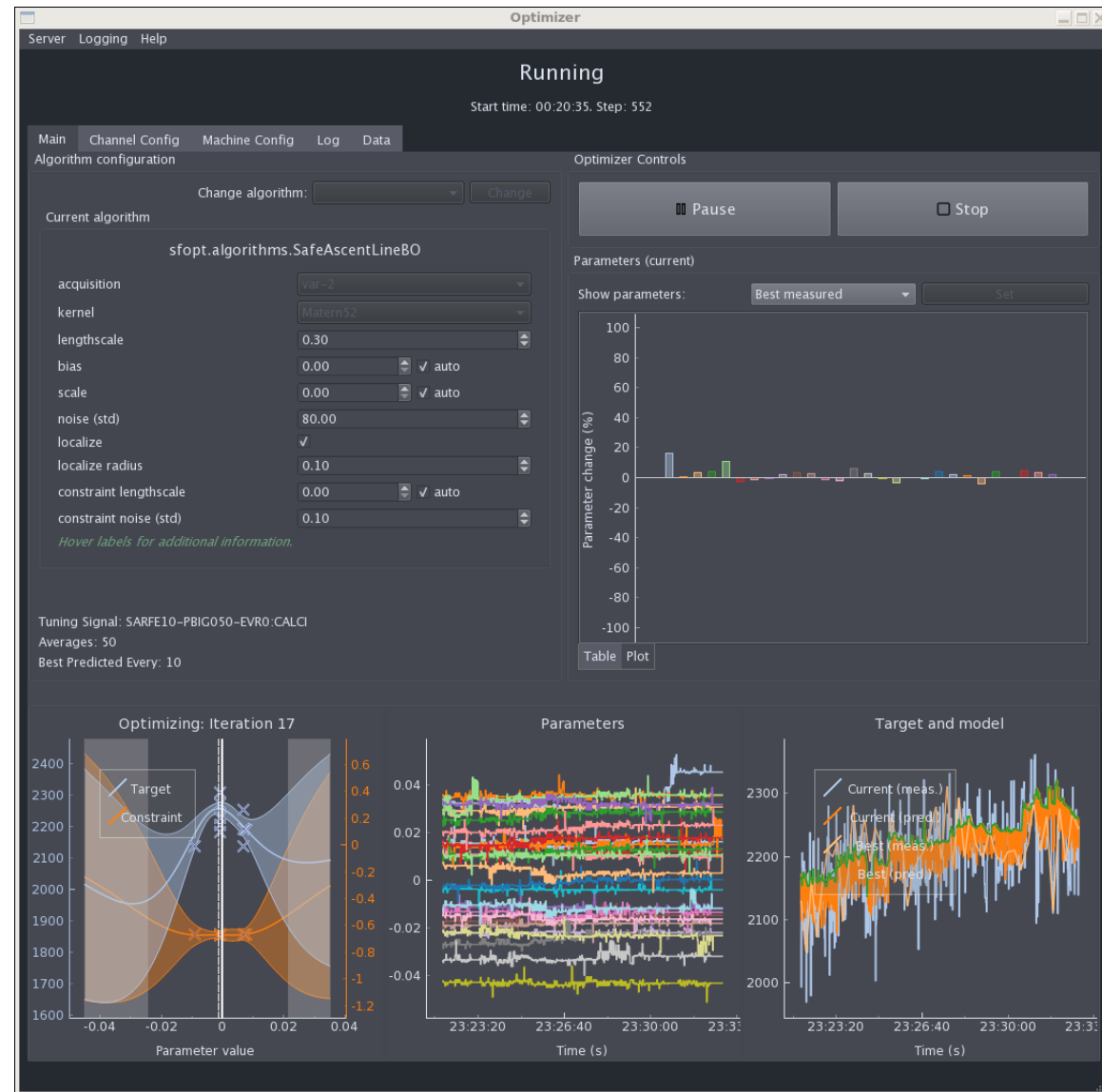


- ✓ Week roughly as planned – few changes (design optics set already on the startup and some other swaps)
- ✓ No major issues

# Machine learning

Courtesy of N. Hiller

- Tested new server deployment (can now be (re-)started via “restart\_mlopt” (the GUI can still be started via “start\_opt\_gui.sh”
- Deployed updated GUI version that now has a more sophisticated data browser and many helpful tool tips concerning the different hyperparameters
- Tool is now ready to be used -> Nicole will add documentation
- Tested a configuration for Athos -> works in principle, but it's not yet easy to switch between Aramis and Athos, we will prepare a separate server for Athos to allow parallel operation
- Tested a new Bayesian optimization algorithm that does more local sampling which looks also promising



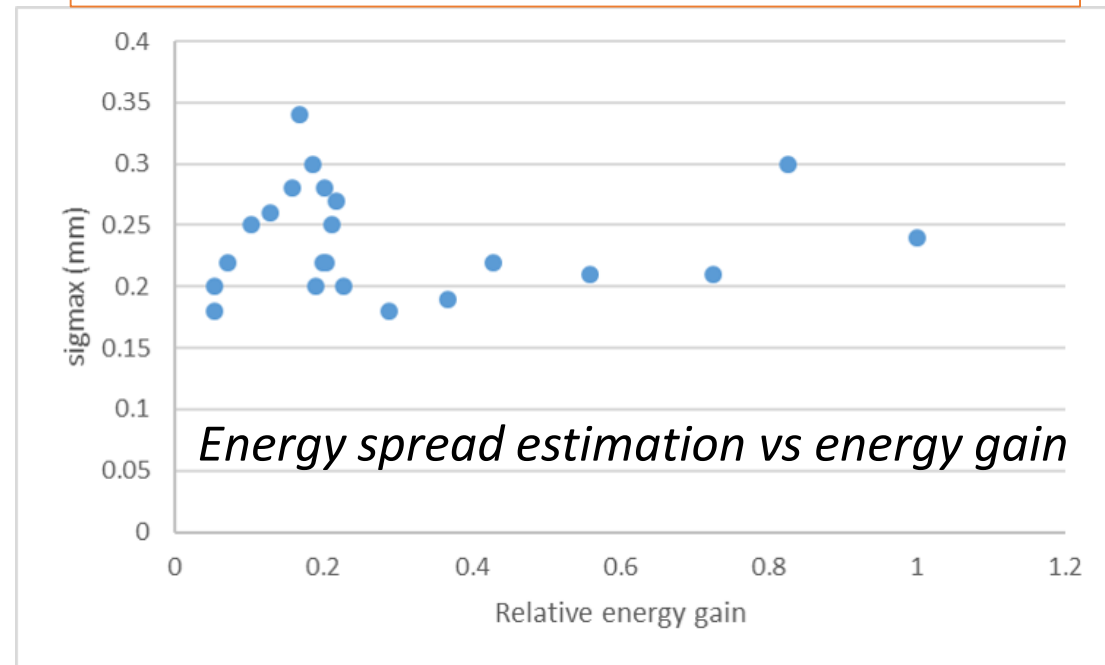
Mon 23.11.2020 Night shift

Participants: Nicole Hiller, Johannes Kirschner (ETHZ)

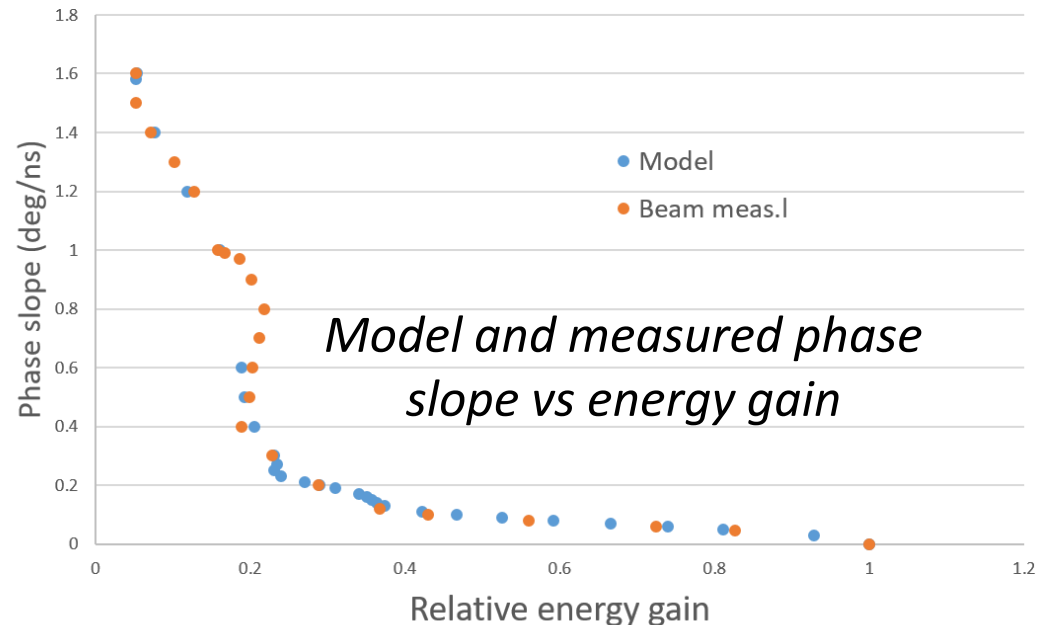
# C-band tuning with phase slope and offset

- Goal: vary energy gain of 1 C-band module without changing energy spread with phase slope and offset – important for Athos tuning
- Measurements at S10CB01/02. Energy varied between 13 to 250 MeV
- Energy spread constant for different energy gains
- Excellent agreement between measured and expected phase slope/offset for different energy variations
- Next: create lookup table for LLRF
- More info: <https://elog-gfa.psi.ch/SwissFEL+commissioning/17181>

R. Zennaro, Q. Geng, P. Craievich, C. Kittel



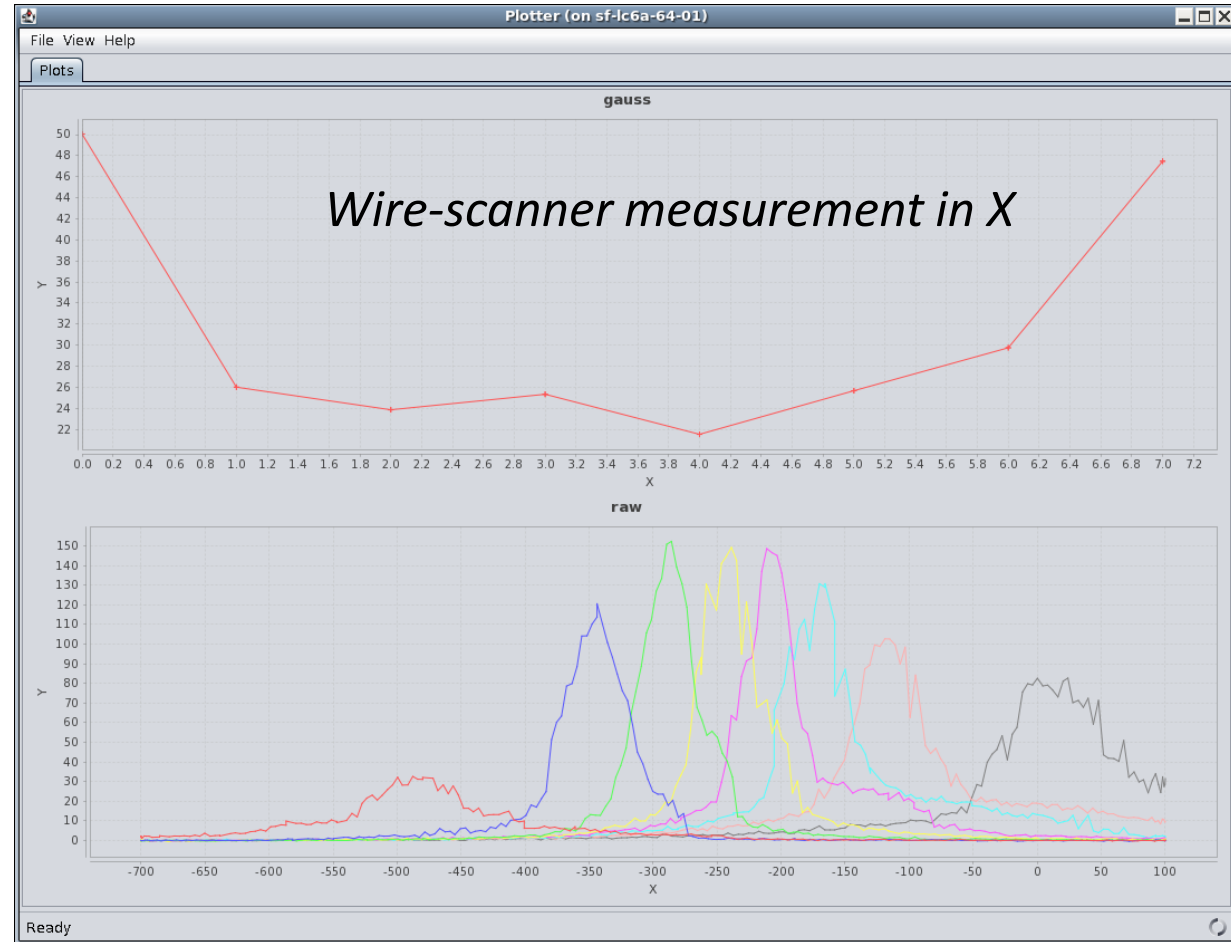
Slope vs. relative Energy gain



# Emittance measurements with wire-scanners

P. Dijkstal, E. Ferrari, B. Hermann,  
R. Ischebeck, S. Reiche, E. Prat

- WS better than screens to measure emittance and match the optics at the linac end
- Tested emittance measurements with WS at SARCL and SARMA:
  - SARCL not suitable (as seen in the past): signal-to-noise ratio poor, DRPS losses
  - SARMA much better: good signal-to-noise, no losses
- Measurements confirmed the need to use the WS
- Need work to improve robustness and easiness of the measurement
- More info: <https://elog-gfa.psi.ch/SwissFEL+commissioning/17182>

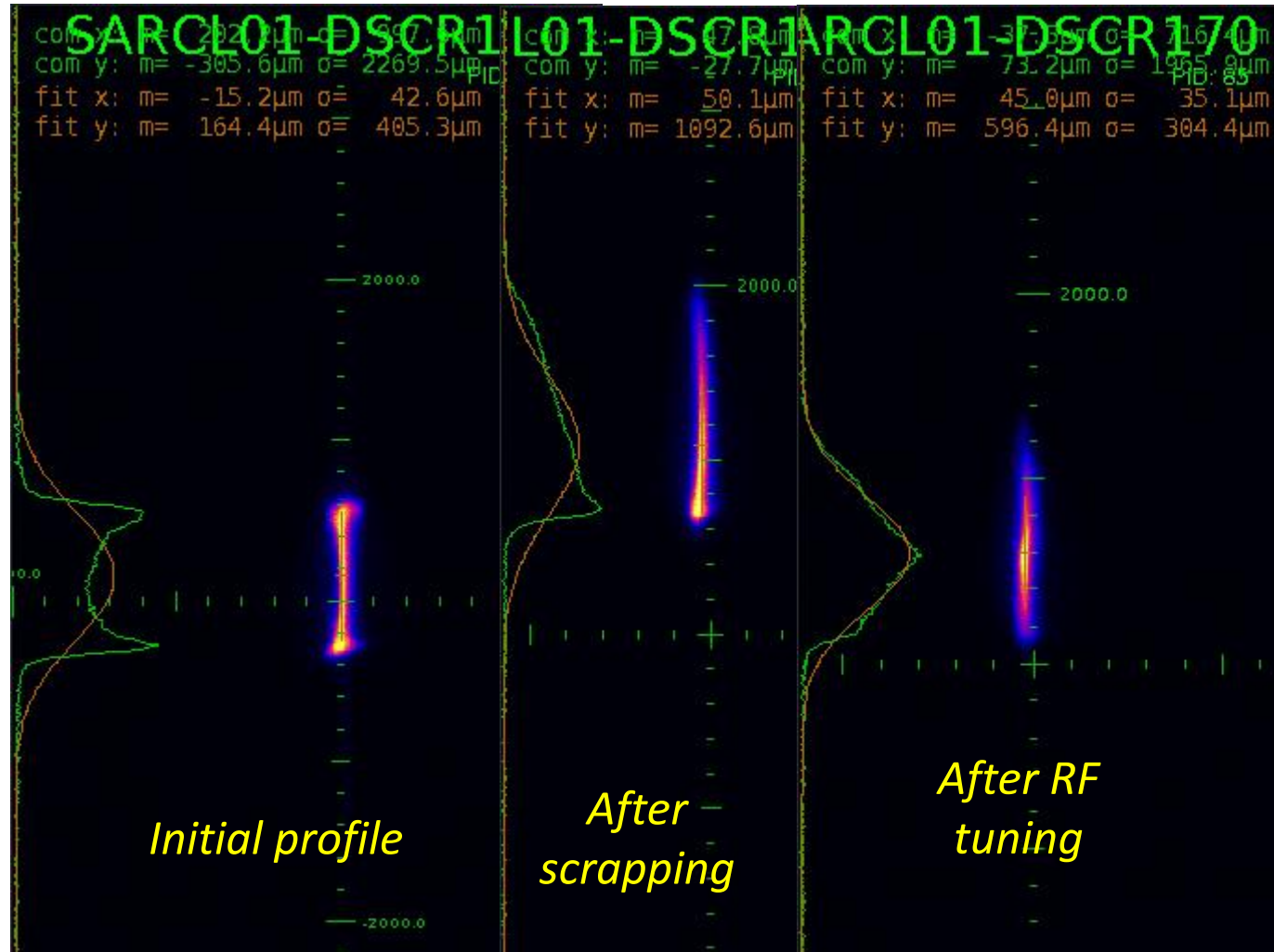


Results at SARMA	X	Y
Screen	740 nm, M=2.35	1350 nm, M=1.03
Wire	420 nm, M=1.05	245 nm, M=2.0

# Pulse shaping in BC1

S. Reiche

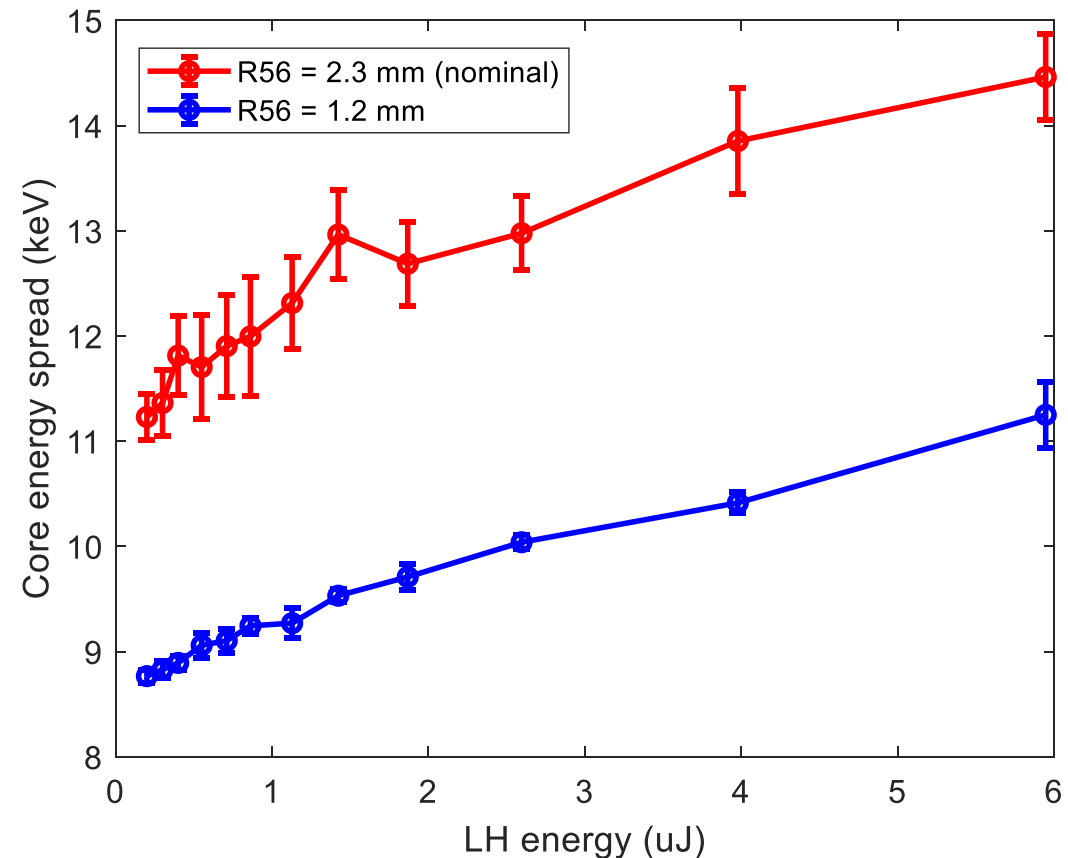
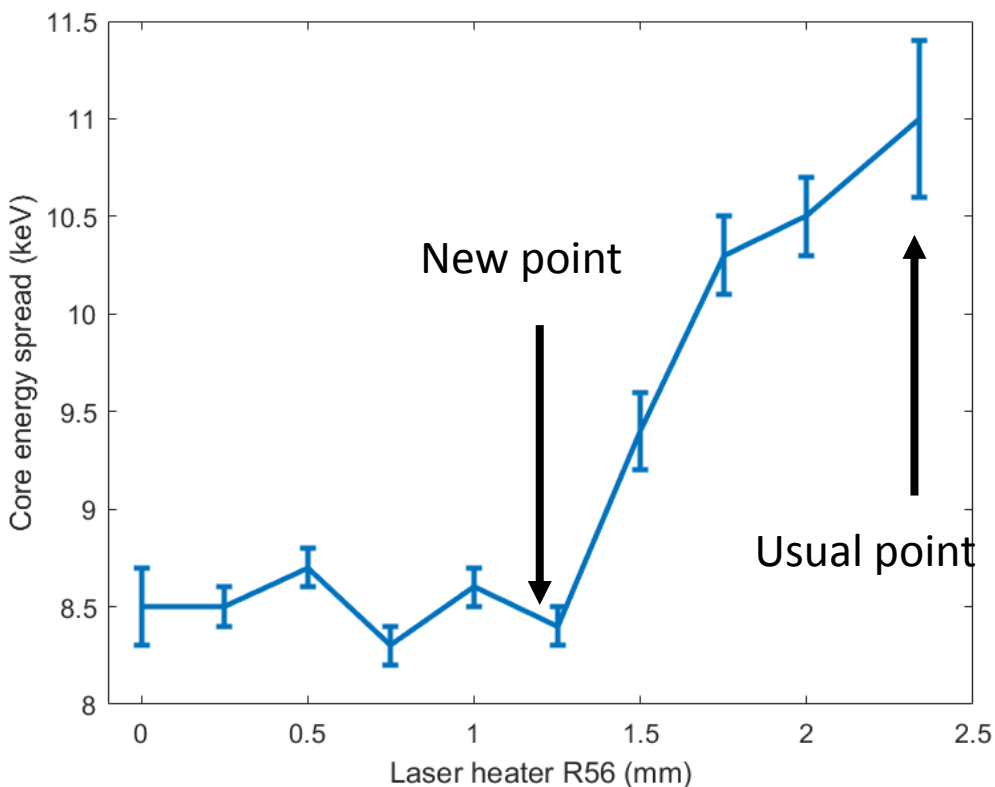
- Scrapping the beam in BC1 can remove the horns, give a smoother current profile and more robust operation
- Adjusted BC1 collimator to cut the horns (15% of the total charge). LLM limits rate to 10 Hz
- RF adjusted to get symmetric profile
- CDR drops a lot, normally running mostly on the horns
- Pulse energy reduced from ~400 to ~200  $\mu\text{J}$
- Next: optimize compression for flatter current profile, maximize pulse energy



More info: <https://elog-gfa.psi.ch/SwissFEL+commissioning/17196>

# Energy spread & laser heater measurements

- Re-measured injector energy spread vs laser heater R56, without laser heater (now with properly calibrated R56) → lower values for  $R56 < 1.5$  mm (similar as previous meas.).
- From 11 to 8 keV → 10-20% higher pulse energies
- Measured effect of laser heater on energy spread for nominal and reduced R56
- We decided to stay at  $R56 = 1.2$  mm, laser heater ready to be used (laser heater did not have a positive influence on lasing when we had  $\sim 200$  uJ)



P. Dijkstal, E. Ferrari, M. Huppert,  
A. Malyzhenkov, E. Prat, S. Reiche

<https://elog-gfa.psi.ch/SwissFEL+commissioning/17286>

# Others

- Increase of SINSB02 power (RF + operations, Monday morning): energy gain increased by ~10 MeV – energy at laser heater is now 150 MeV.
- Athos BPMs (Boris, Monday late): scaling factors of SATUN04/06/07/08/09 calibrated in X and Y.
- Startup with design optics on Thursday
- Linac 3 orbit FB (Florian, Friday morning): feedback split in 3 parts to improve reliability
- 2-bunch RF setup (Qiao, Friday late): <https://elog-gfa.psi.ch/SwissFEL+commissioning/17247>
- OTR in ACHIP (Pavle et al, Saturday morning): <https://elog-gfa.psi.ch/SwissFEL+commissioning/17268>, see separate report
- Gas detector filter studies (Pavle et al, Saturday): see separate report
- ACHIP shift (Benedikt et al, Saturday): <https://elog-gfa.psi.ch/SwissFEL+commissioning/17272>