ARES Operation Meeting

Summary of week 35

Frank Mayet, on behalf of the ARES shift crew

Summary

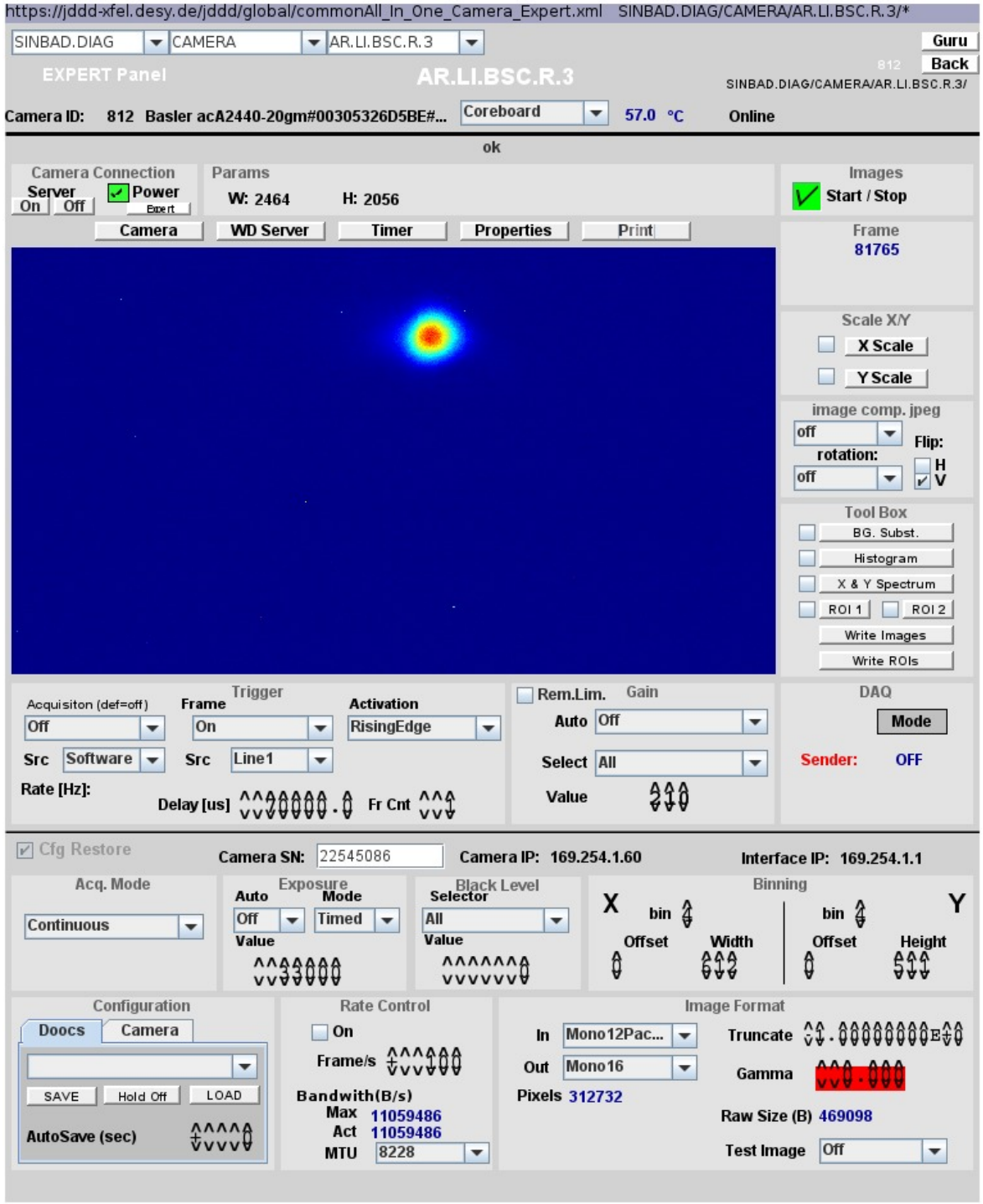
Week 35

	Tuesday 25th August	Wednesday 26th August	Thursday 27th August	Friday 28th August
Achievements	• Clean ramp up of the gun power w.o. DC bursts • Collimator studies (beam on R1 with down to 0.8mm, on R2 down to 3.0mm) • Preparation for coupling measurement	• Gun cavity coupling measurements • Transport of the beam through powered TWS1 • Tools development (TWS solenoids can now be operated as a group with alternating signs)	• Re-established the transport through powered TWS1 w.o. problems • Faraday Cup signal ringing studies • Laser spot positioning tutorial by L. Winkelmann; *but only in theory (see below)*	• Laser spot re-aligned with auto-alignment • Beam on R3 (after TWS2) w.o. TWS2 powered and w.o. TWS2 solenoids • Beam on R2 and R3 just using the gun solenoid (avoid kick from misaligned TWS1 solenoids) • First momentum measurement after powered TWS1 on R3 using the PCB + TCA steerers • Started TWS1 phase scan
Difficulties	• Problem with the power supply of the 2nd TWS1 solenoid (solved) • Missing trigger signal for the AR.LI.BSC.R.3 screen station (now solved)	• Missing Unix permissions to operate the screen stations downstream of AR.LI.BSC.R.3 (should be solved > to be checked)	• Severe DOOCS/network problems in the afternoon; had to postpone laser positioning studies (seems to be solved) • Limited beam time due to the *Sicherheitsbegehung*	• The TWS1 phase scan was stopped by a TWS1 modulator fault, which needs to be investigated by the experts

Summary

Week 35

- **First momentum measurement downstream of TWS1**
  - Momentum from the gun: ~2.5 MeV/c (*in order to avoid dark current*)
  - TWS1: ~30 MW power (—> ~21.5 MV/m) @ arb. phase of +75°
  - Measured momentum: **50.3 ± 1.1 MeV/c**

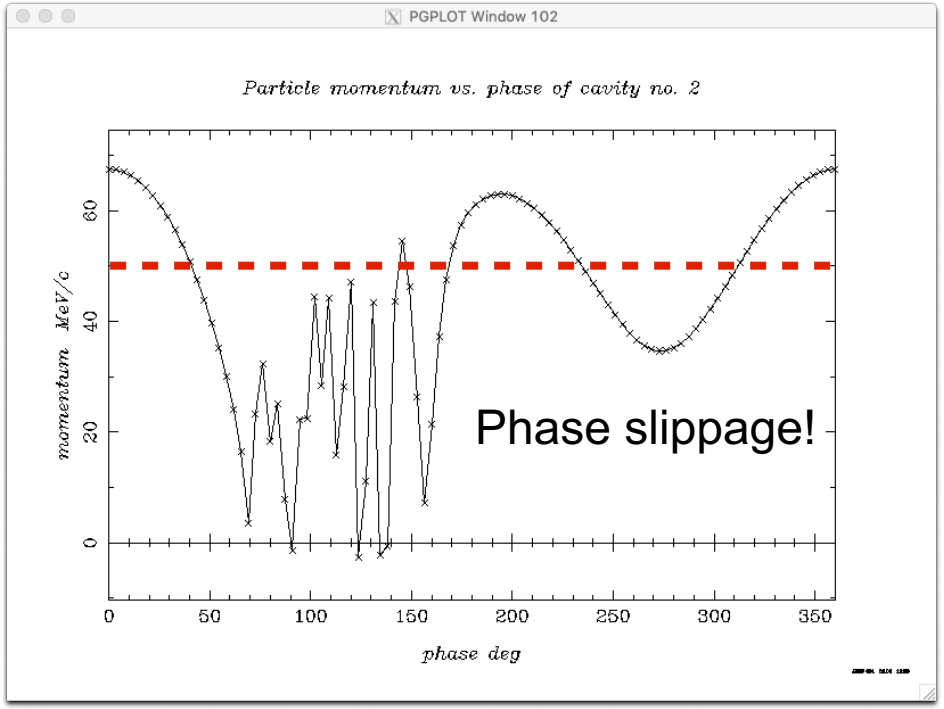


Summary

Week 35

- **First momentum measurement downstream of TWS1**
  - Momentum from the gun: ~2.5 MeV/c (*in order to avoid dark current*)
  - TWS1: ~30 MW power (—> ~21.5 MV/m) @ arb. phase of +75°
  - Measured momentum: **50.3 ± 1.1 MeV/c**

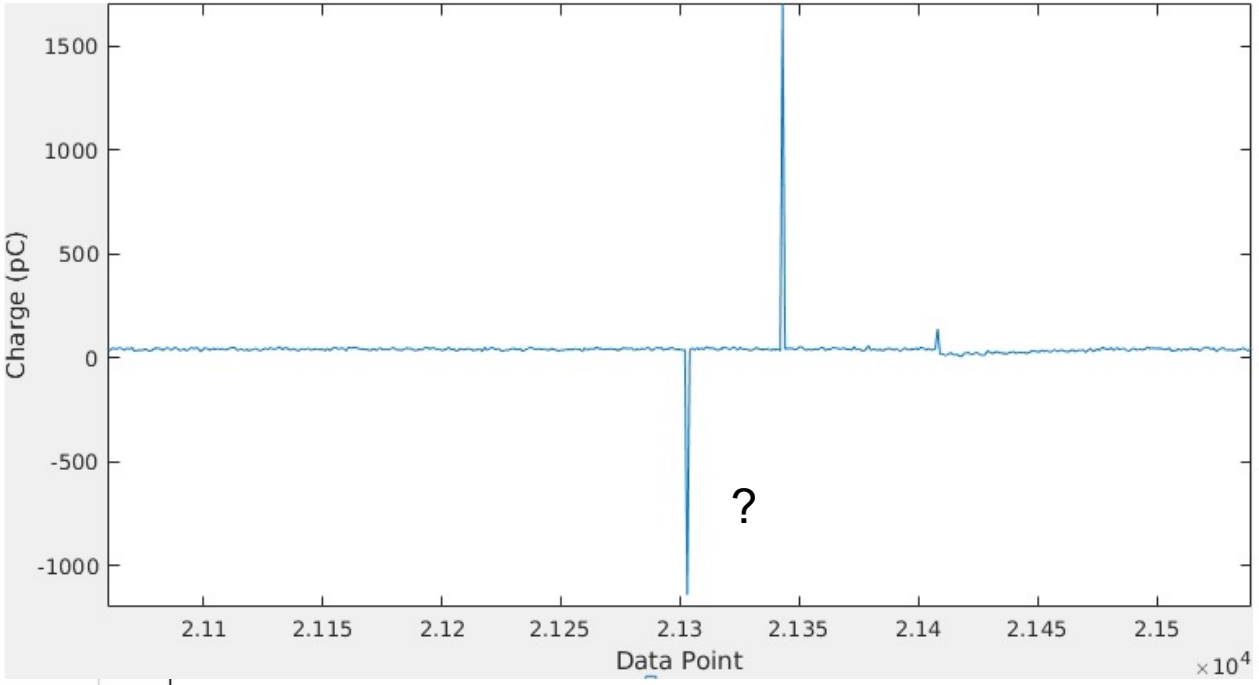
ASTRA

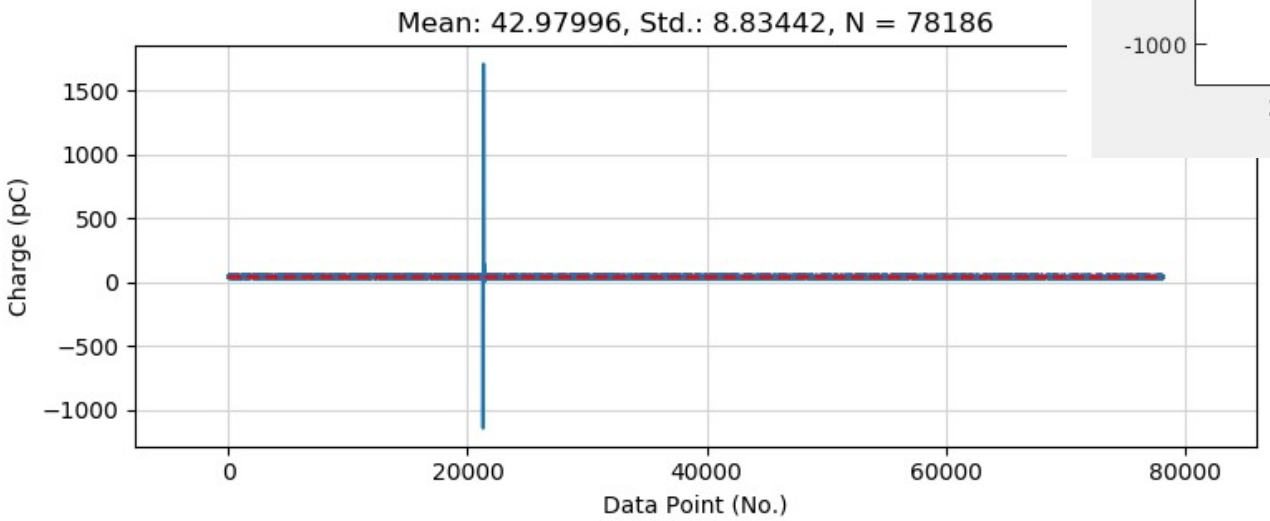


Summary

Week 35

- **Dark charge bursts**
  - Night from 25th to 26th

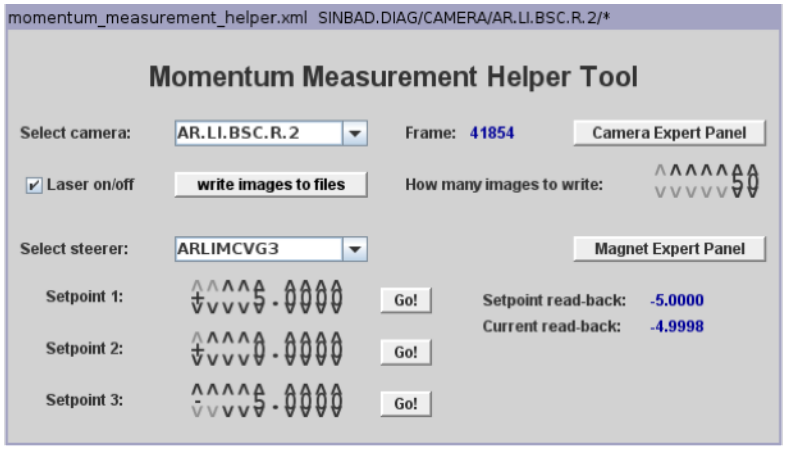




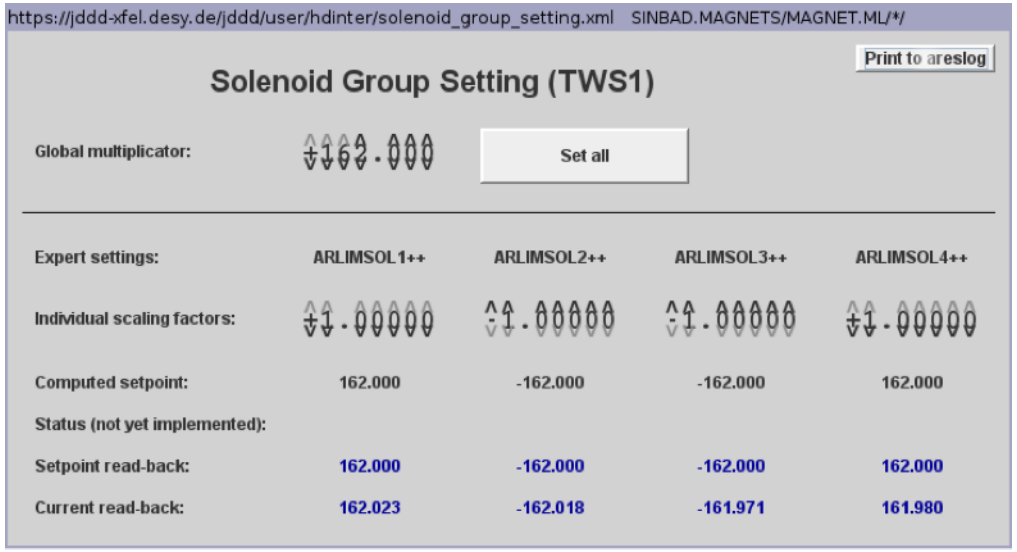
Summary

Week 35

- **Tools development (jDDD panels by H. Dinter)**



Data acquisition helper for momentum measurement



Synchronously drive all TWS solenoids

Summary

Week 35

- **Gun cavity coupling measurement**
  - The coupling factor beta can be determined by recording the forward and reflected RF signals during a cavity temperature scan

$$a_{\mathrm{FW/REF}} = A_{\mathrm{FW/REF}} \cdot \exp(i\phi_{\mathrm{FW/REF}} \cdot \pi/180)$$

  - From this, the complex reflection coefficient can be calculated:

$$\Gamma = \frac{a_{\mathrm{REF}}}{a_{\mathrm{FW}}}. \quad \text{and also} \quad \Gamma = (1+\Gamma_0) \cdot \frac{\omega_{1/2}}{\omega_{1/2} + i\Delta\omega} - 1.$$

Half-bandwidth of the resonator

Detuning

Refl. coeff. for 0 detuning (due to impedance mismatch)

equation describes a circle in complex space!

  - The equation can be re-written as (see [1,2,3])

$$\Gamma_0 = -\frac{D}{A}(|c| - r)\frac{c}{|c|} = -\frac{|c| - r}{|c| + r}$$

where *c* is the center and *r* the radius of the circle. *D* and *A* are calibration errors in the measured RF signals (tilde)

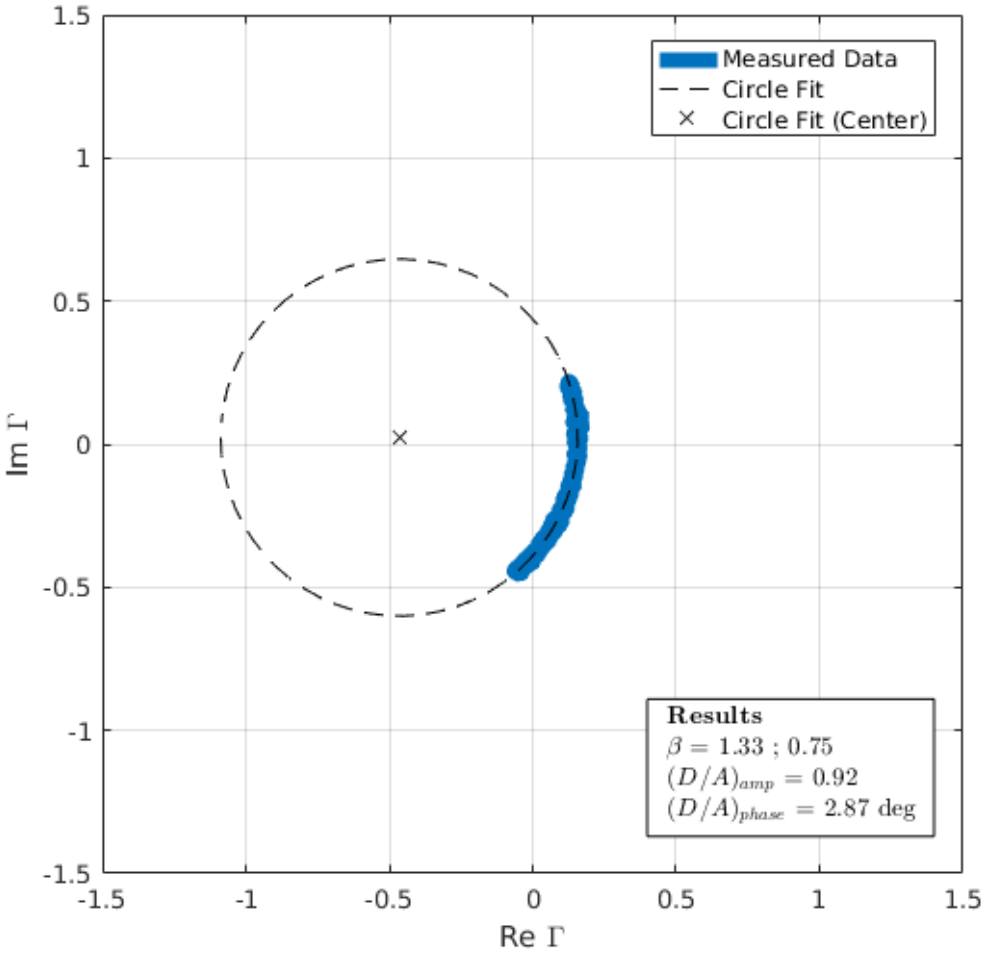
$$\tilde{\alpha}_{\mathrm{FW}} = A \cdot \alpha_{\mathrm{FW}}$$
$$\tilde{\alpha}_{\mathrm{REF}} = D \cdot \alpha_{\mathrm{REF}}$$

  - Then, the coupling factor is given by

$$\beta = \frac{1+\Gamma_0}{1-\Gamma_0}$$

Expected value (lab): ~0.8; Measured value: ~0.75

Note: Temperature scan range was limited by gun modulator interlock limits

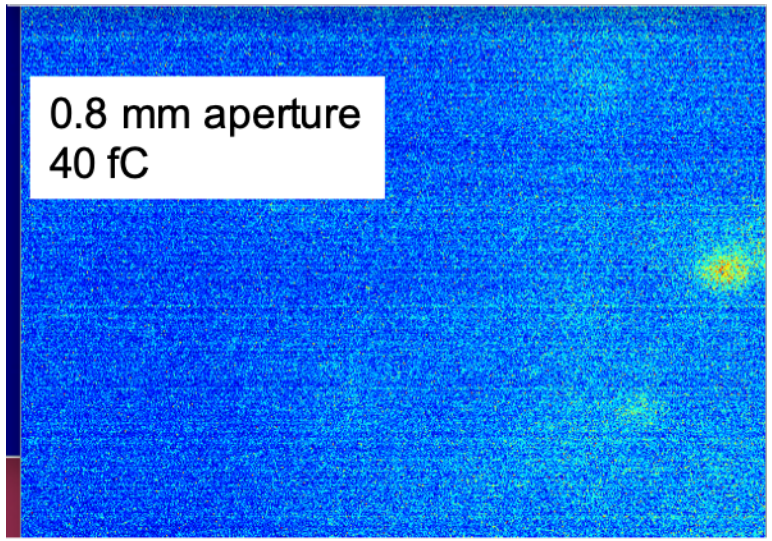


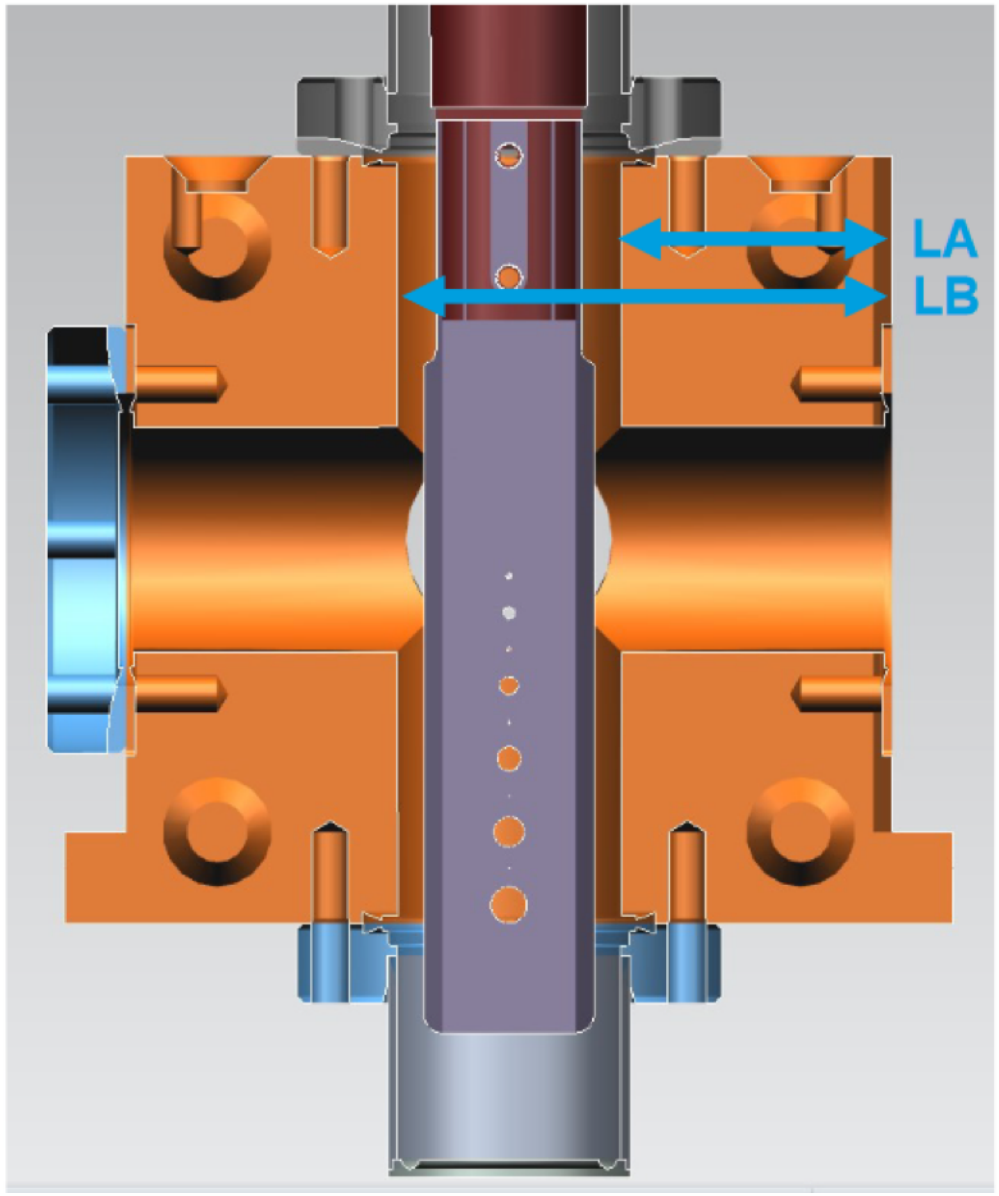
[1] A.Brandt, P.Pucyk and S.Simrock, Field estimation and signal calibration of RF guns without field probe, DESY-TESLA-FEL-2007-01.
[2] F. Mayet, M.Sc. Thesis
[3] https://regae-wiki.desy.de/images/1/12/PhaseCalib.pdf

Summary

Week 35

- **Collimator investigations**
  - Meeting with MVS on Friday
  - Situation improved, but not satisfactory





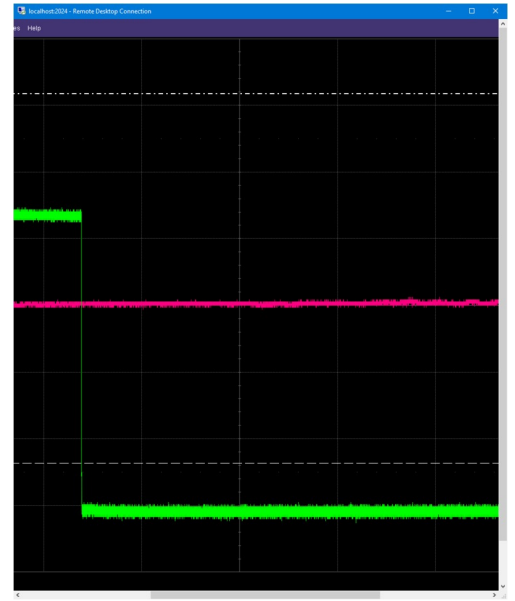
Summary

Week 35

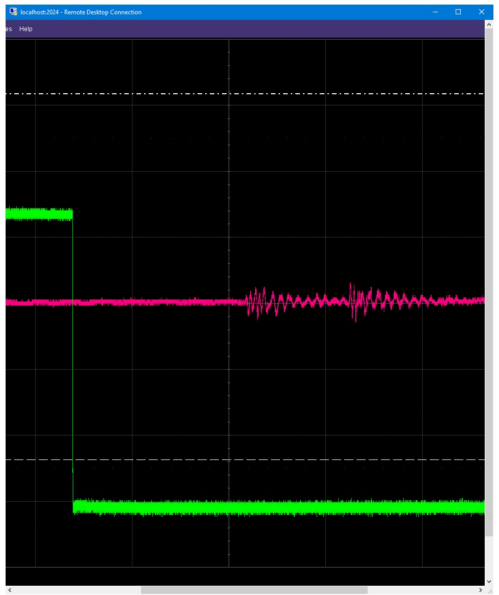
- **Grounding issues**
  - Ringing on FC oscilloscope signals observed
  - Beam jumping on R2 with klystron on

>> Linac not perfectly grounded
>> MKK will investigate this week

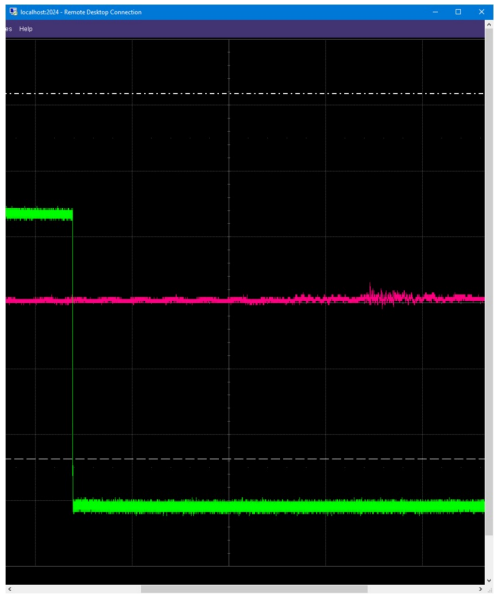
Both TWS Modulators in STDBY



TWS1 in TRIGGER mode
TWS2 in STDBY mode



TWS1 in STDBY mode
TWS2 in TRIGGER mode



Summary

Week 35

- **Other (technical) stuff**
  - Power Cut during the weekend (SAT-5.30, emergency messages were sent) . All machines down – except ARES
  - DOOCS problems – servers were extremely slow. *Solved*.
  - We should have now the permissions for all the screen stations. (to be checked).
  - Screen station cleaning instructions.
  - Schedule MSK and MDI shifts.

  - *Crane works and construction work expected – going back to BKR under discussion.*
  - *Dark Current comparison ongoing.*

Plans for Week 36

- Data analysis
- Hardware Commissioning – Screens and Magnets downstream TWS1.
- Beam Measurements
  - Phase scan vs. Centroid
  - QE measurements (please inform Max!)
  - Emittance vs. Charge
  - Stability measurements
  - Beam acceleration in TWS2 and energy measurement

ARES Schedule

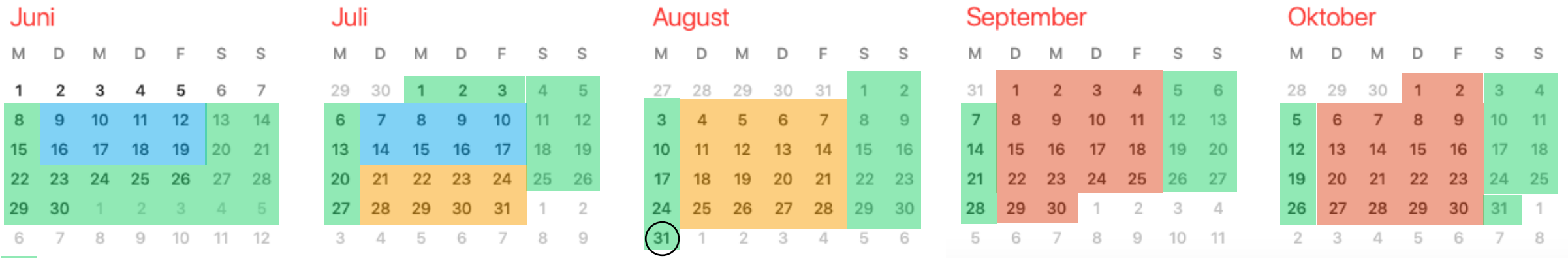
Week 36

Date	Shift Leader
31.8.	2um laser alignment (H. Cankaya)
1.9.	Florian
2.9.	Frank / Willi
3.9.	Florian / Willi
4.9.	Thomas / Hannes

If you want to learn or join the shift: please give the shiftleader a call (2454)

ARES Schedule

Week 36



- Shutdown (Monday = Maintenance day)
- RF Conditioning (Gun)
- Beam Commissioning (Gun section)
- Beam Commissioning (Linac section + EA1)