

# ARES Operation Meeting

Summary of week 35

**Frank Mayet**, on behalf of the ARES shift crew

# Summary

## Week 35

	Tuesday 25 <sup>th</sup> August	Wednesday 26 <sup>th</sup> August	Thursday 27 <sup>th</sup> August	Friday 28 <sup>th</sup> August
<b>Achievements</b>	<ul style="list-style-type: none"> <li>• Clean ramp up of the gun power w.o. DC bursts</li> <li>• Collimator studies (beam on R1 with down to 0.8mm, on R2 down to 3.0mm)</li> <li>• Preparation for coupling measurement</li> </ul>	<ul style="list-style-type: none"> <li>• Gun cavity coupling measurements</li> <li>• Transport of the beam through powered TWS1</li> <li>• Tools development (TWS solenoids can now be operated as a group with alternating signs)</li> </ul>	<ul style="list-style-type: none"> <li>• Re-established the transport through powered TWS1 w.o. problems</li> <li>• Faraday Cup signal ringing studies</li> <li>• Laser spot positioning tutorial by L. Winkelmann; <i>but only in theory (see below)</i></li> </ul>	<ul style="list-style-type: none"> <li>• Laser spot re-aligned with auto-alignment</li> <li>• Beam on R3 (after TWS2) w.o. TWS2 powered and w.o. TWS2 solenoids</li> <li>• Beam on R2 and R3 just using the gun solenoid (avoid kick from misaligned TWS1 solenoids)</li> <li>• First momentum measurement after powered TWS1 on R3 using the PCB + TCA steerers</li> <li>• Started TWS1 phase scan</li> </ul>
<b>Difficulties</b>	<ul style="list-style-type: none"> <li>• Problem with the power supply of the 2nd TWS1 solenoid (solved)</li> <li>• Missing trigger signal for the AR.LI.BSC.R.3 screen station (now solved)</li> </ul>	<ul style="list-style-type: none"> <li>• Missing Unix permissions to operate the screen stations downstream of AR.LI.BSC.R.3 (should be solved &gt; to be checked)</li> </ul>	<ul style="list-style-type: none"> <li>• Severe DOOCS/network problems in the afternoon; had to postpone laser positioning studies (seems to be solved)</li> <li>• Limited beam time due to the <i>Sicherheitsbegehung</i></li> </ul>	<ul style="list-style-type: none"> <li>• The TWS1 phase scan was stopped by a TWS1 modulator fault, which needs to be investigated by the experts</li> </ul>

# Summary

## Week 35

- **First momentum measurement downstream of TWS1**

- Momentum from the gun:  $\sim 2.5$  MeV/c (*in order to avoid dark current*)
- TWS1:  $\sim 30$  MW power ( $\rightarrow \sim 21.5$  MV/m) @ arb. phase of  $+75^\circ$
- Measured momentum:  **$50.3 \pm 1.1$  MeV/c**

https://jddd-xfel.desy.de/jddd/global/commonAll\_In\_One\_Camera\_Expert.xml SINBAD.DIAG/CAMERA/AR.LI.BSC.R.3/\*

SINBAD.DIAG CAMERA AR.LI.BSC.R.3

EXPERT Panel AR.LI.BSC.R.3 812 SINBAD.DIAG/CAMERA/AR.LI.BSC.R.3/

Camera ID: 812 Basler acA2440-20gm#00305326D5BE#... Coreboard 57.0 °C Online

ok

Camera Connection Server ☒ Power Expert On Off

Params W: 2464 H: 2056

Images ☒ Start / Stop

Frame 81765

Scale X/Y ☐ X Scale ☐ Y Scale

image comp. jpeg off rotation: off Flip: ☒ H ☒ V

Tool Box ☐ BG. Subst. ☐ Histogram ☐ X & Y Spectrum ☐ ROI 1 ☐ ROI 2 Write Images Write ROIs

Acquisition (def=off) Off Trigger Frame On Activation RisingEdge

Src Software Src Line1

Rate [Hz]: Delay [us] Fr Cnt

Rem.Lim. Gain Auto Off Select All Value

DAQ Mode Sender: OFF

☒ Cfg Restore Camera SN: 22545086 Camera IP: 169.254.1.60 Interface IP: 169.254.1.1

Acq. Mode Continuous

Exposure Mode Auto Off Timed Value

Black Level Selector All Value

Binning X bin Offset Width Y bin Offset Height

Configuration Doocs Camera SAVE Hold Off LOAD AutoSave (sec)

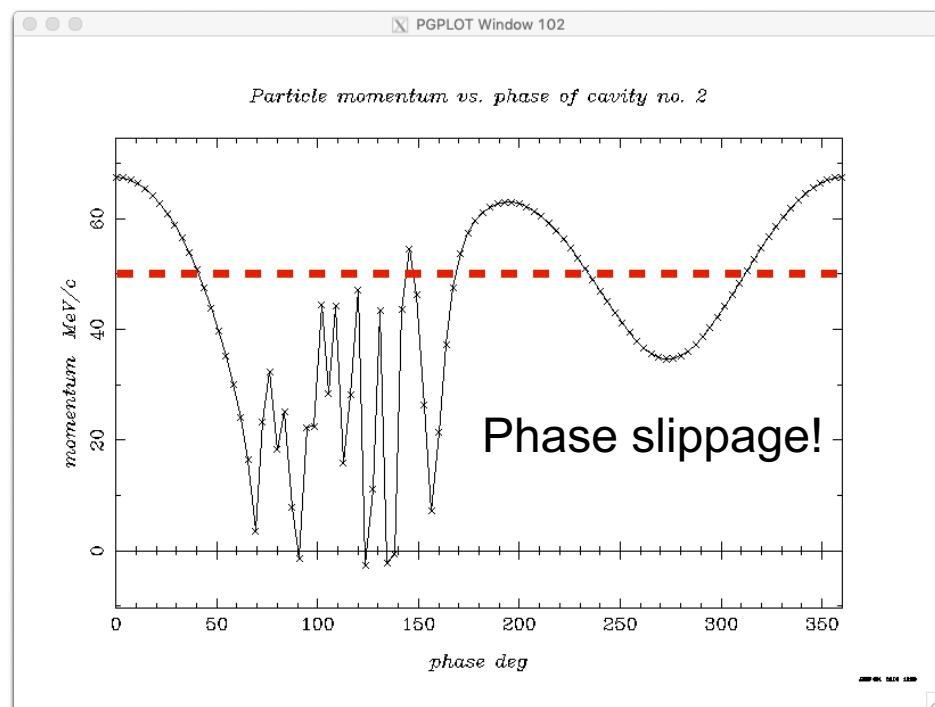
Rate Control On Frame/s Bandwidth(B/s) Max 11059486 Act 11059486 MTU 8228

Image Format In Mono12Pac... Out Mono16 Pixels 312732 Truncate Gamma Raw Size (B) 469098 Test Image Off

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Configuration Doocs Camera SAVE Hold Off LOAD

AutoSave (sec)

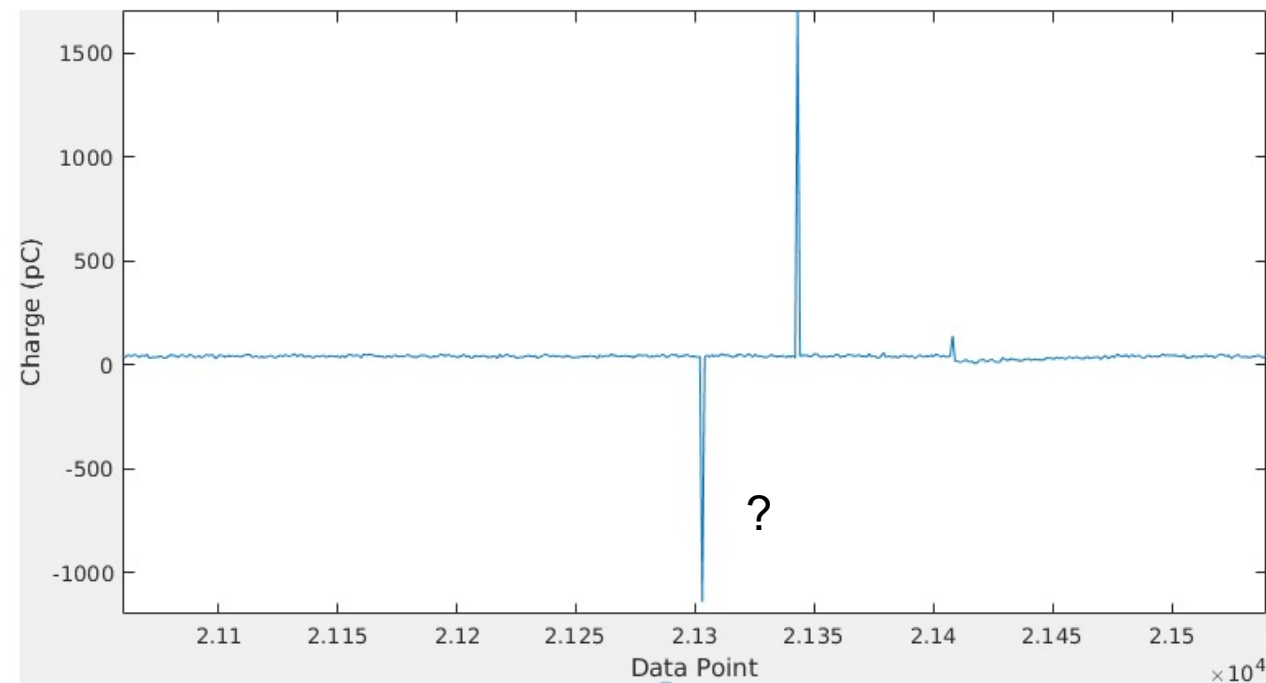
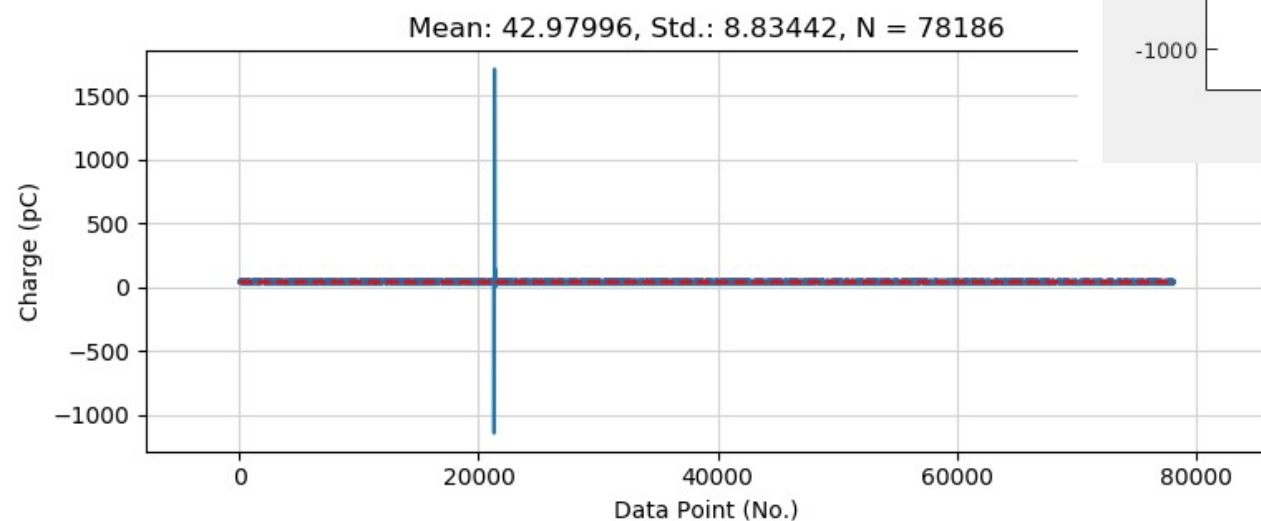
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## Week 35

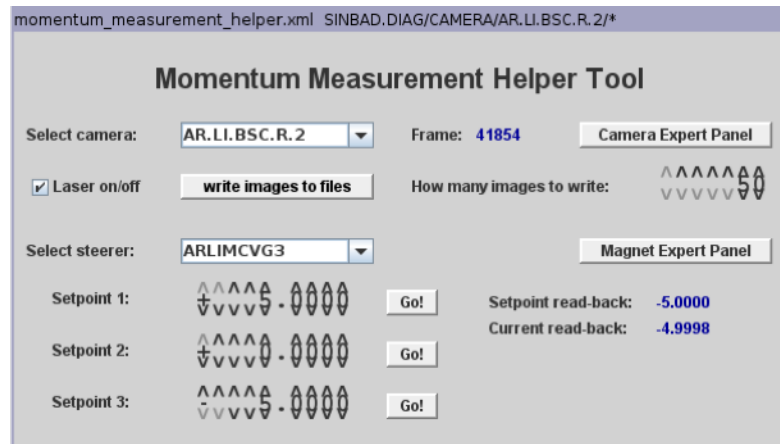
- **Dark charge bursts**
  - Night from 25th to 26th



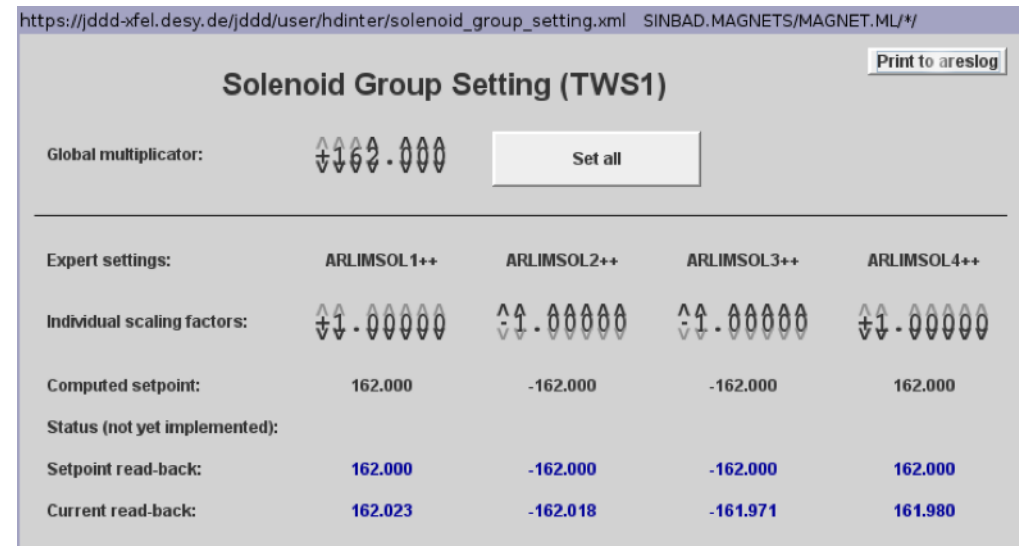
# Summary

## 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

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

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

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

Refl. coeff. for 0 detuning (due to impedance mismatch)      Half-bandwidth of the resonator      Detuning  
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)

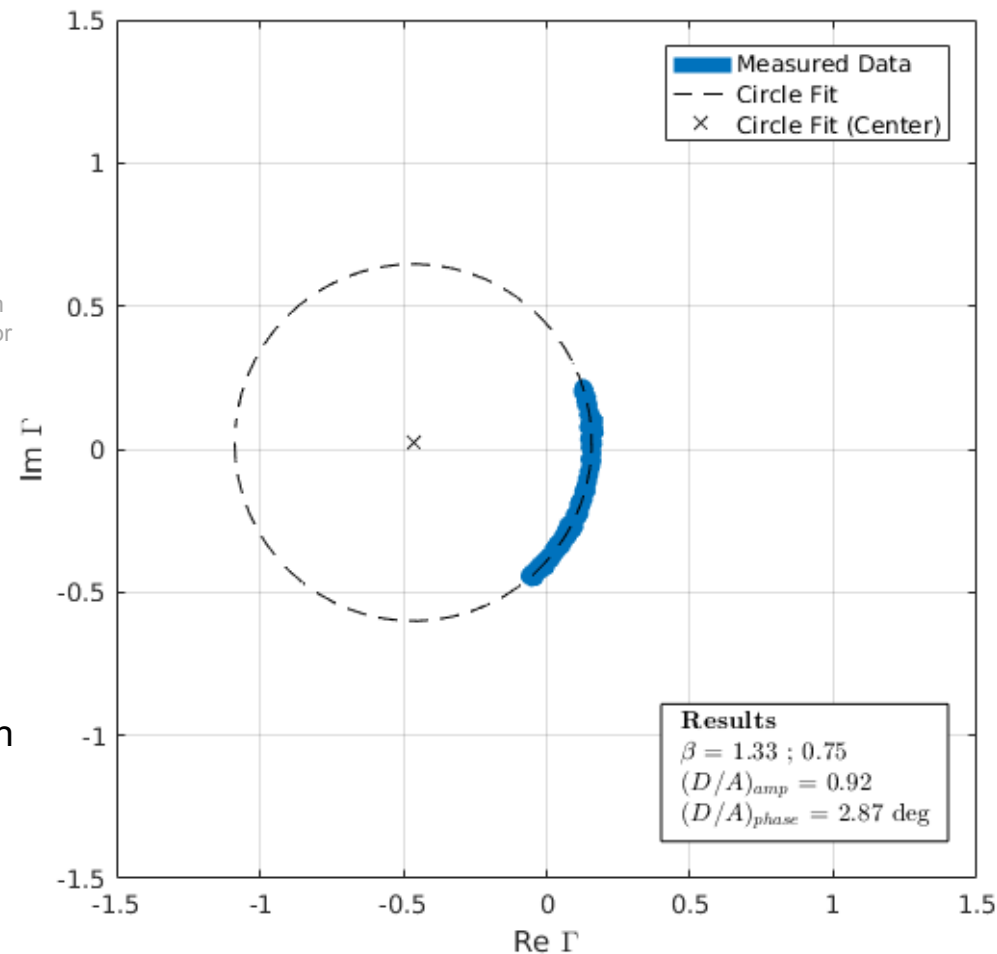
$$\tilde{\alpha}_{FW} = A \cdot \alpha_{FW}$$
$$\tilde{\alpha}_{REF} = D \cdot \alpha_{REF}$$

- 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

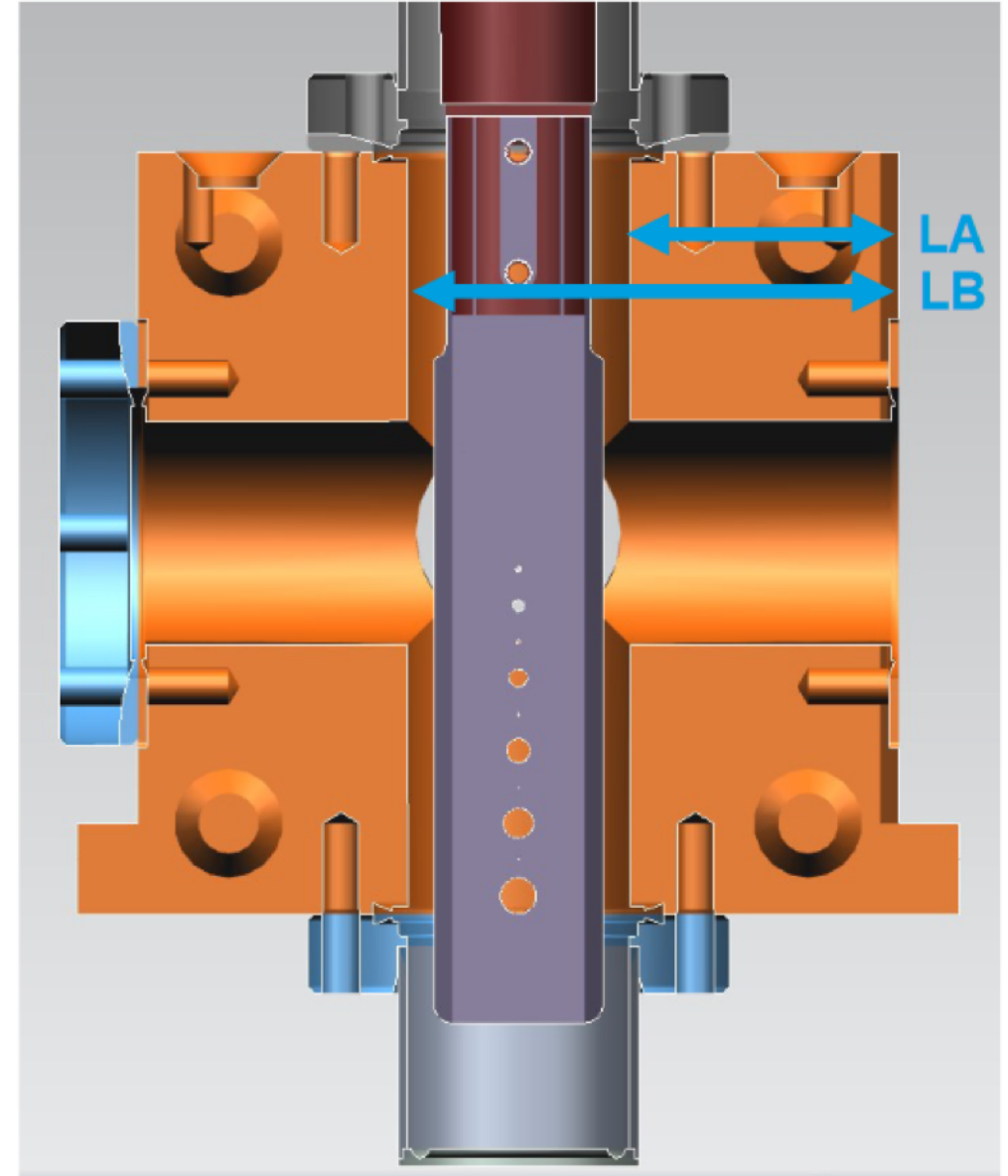
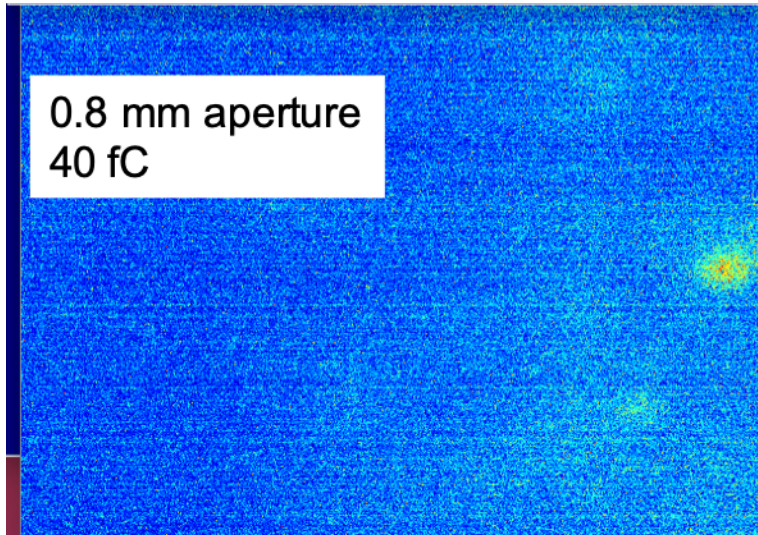
[3] <https://regae-wiki.desy.de/images/1/12/PhaseCalib.pdf>



# Summary

## Week 35

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





# Summary

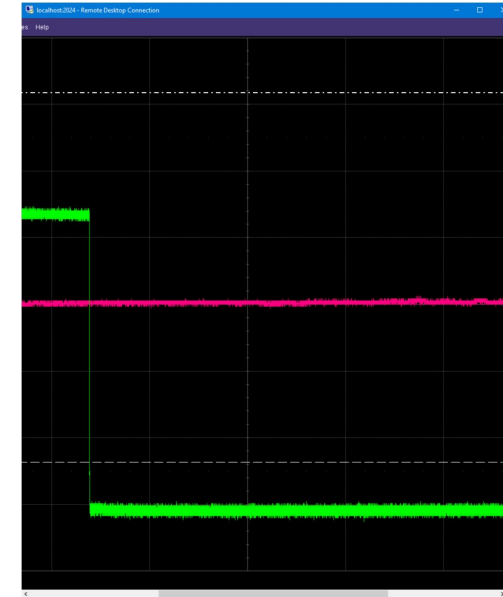
## Week 35

- **Grounding issues**

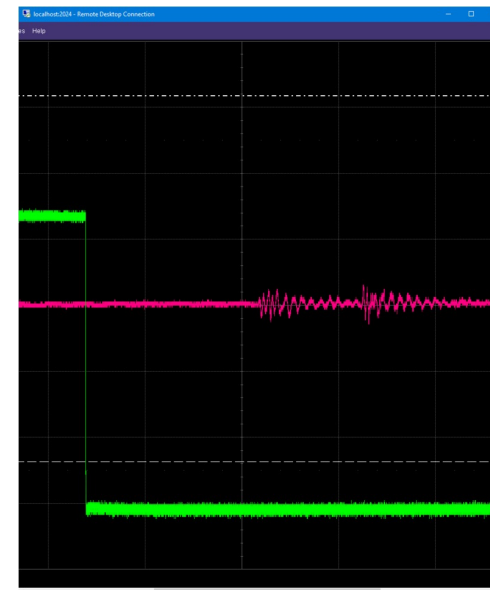
- Ringing on FC oscilloscope signals observed
- Beam jumping on R2 with klystron on

>> 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

### Juni

M	D	M	D	F	S	S
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	1	2	3	4	5
6	7	8	9	10	11	12

### Juli

M	D	M	D	F	S	S
29	30	1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31	1	2
3	4	5	6	7	8	9

### August

M	D	M	D	F	S	S
27	28	29	30	31	1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
31	1	2	3	4	5	6

### September

M	D	M	D	F	S	S
31	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	1	2	3	4
5	6	7	8	9	10	11

### Oktober

M	D	M	D	F	S	S
28	29	30	1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	1
2	3	4	5	6	7	8

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