

# PITZ Run Coordination

2023 (Weeks 40-41)

X.-K. Li  
05.10.2023



# Run weeks 40-41

Status 28.09.2023

to do:	Gun conditioning						
Week 40	Mon Oct-02	Tue Oct-03	Wed Oct-04	Thu Oct-05	Fri Oct-06	Sat Oct-07	Sun Oct-08
Morn. 07:00 to 15:30	Gross Zeeshan	Automatic Conditioning	Stephan Zeeshan <b>Gun conditioning / beam tests?</b>	Stephan Zeeshan	Vashchenko Riemer	Vashchenko Riemer	Li Good
Late 15:00 to 23:30	Automatic Conditioning	Automatic Conditioning	Li Riemer	Li Amirkhanyan	Gross Zeeshan	Gross Villani	Gross Villani
Night 23:00 to 07:30	Automatic Conditioning	Automatic Conditioning	Automatic Conditioning	Automatic Conditioning <b>A.C.</b>	Automatic Conditioning	Automatic Conditioning	Automatic Conditioning
Resp. Phys	Gross	Gross	Li	Li	Gross	Gross	Gross

to do:	Nepal-P commissioning						
Week 41	Mon Oct-09	Tue Oct-10	Wed Oct-11	Thu Oct-12	Fri Oct-13	Sat Oct-14	Sun Oct-15
Morn. 07:00 to 15:30	<b>Cathode exchange+ Laser work</b>	Stephan Amirkhanyan	Stephan Amirkhanyan	Stephan Kalantaryan	Stephan Kalantaryan	Hoffmann Amirkhanyan	Hoffmann Kalantaryan
Late 15:00 to 23:30	Gross Kalantaryan	Vashchenko Villani	Vashchenko Grebinyk	Li Grebinyk	Krasilnikov Riemer	Krasilnikov Riemer	Krasilnikov Grebinyk
Night 23:00 to 07:30	<b>A.C. / QEmap?</b>	Hoffmann Kalantaryan	Hoffmann Riemer	Gross Good	Gross Good	Vashchenko Zeeshan	Vashchenko Zeeshan

## Program weeks 40-41:

- Proceed with 100 us
  - Then 100 us, 200 us < 6.7 MWg
  - 400 us, 650 us, 800 us, 1 ms
  - For short PL=10,20us manual ramping up the gun power
- Dark current:
  - 20us 6.7MWg – monitor
  - 200us, measure DC vs gun power (<6.7 MWg); DC imaging
  - DCM1 monitoring (especially during A.C.)
- Check mini-BD for “broken” pulse rate (use mini-breakdown tool)
- In case of Gun trip, restart from 10us
- A.C. → Keeping the machine running, monitor DCM1

## Problems (challenges):

- Try image Breakdown events with camera at DDC (`\\scripts\Tools\RFgunCondImager\ImageStacker.m`)
- Try to image dark current? (localize field emitters)
- Change (vary) strategy? (long pulses low peak power?)
- Longitudinal momentum check?
- ...

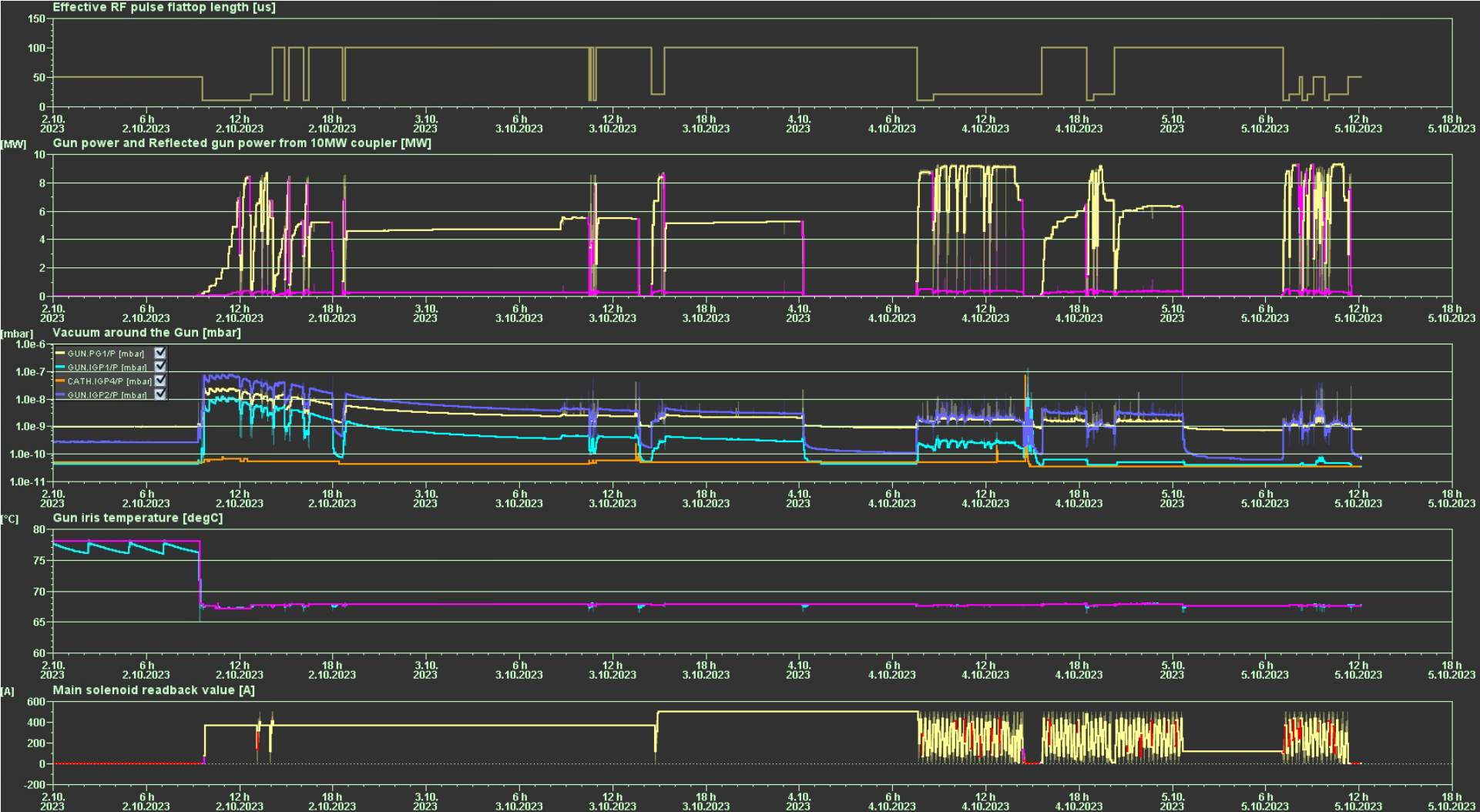
# Progress

- Dark current measured for 20 us over days  
→ Currently ~680 uA@6.7 MWg (1.1 mA@6.5 MWg from last run)
- Reached full power for 10 us and 20 us with solenoid sweeping
- Reached 6.3 MWg for 100 us (>2h) with solenoid sweeping
- VC2 is working now

# & problems

- Gun SP reset to 10 when maximum reflection was detected by SMAC: be careful with max.ref.power in SMAC
- Strange vacuum reading during TSP firing → TSP's were fired in different order and some of them parallel/twice by Stefan
- Ripples in vacuum observed at full power, 20 us
  - Also seen at lower power but longer RF pulses
  - Broken pulses seen from miniBD analysis
- Too many warnings and infos in logbook → fixed by GV
- Gun trips
  - The strobe range is outside the RF pulse for  $PL \leq 100$  us
  - Gun trips preceded by multiple RF reflections

# Conditioning history

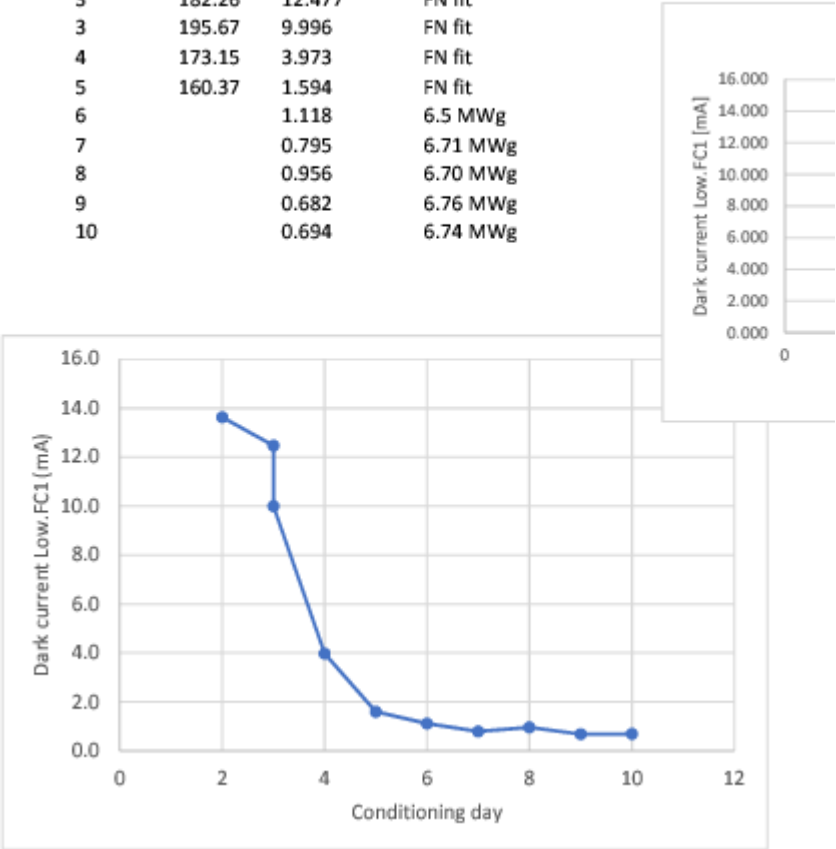


# Dark current scan at 20 us

Max. amp. ~ 6.7 MWg vs conditioning day

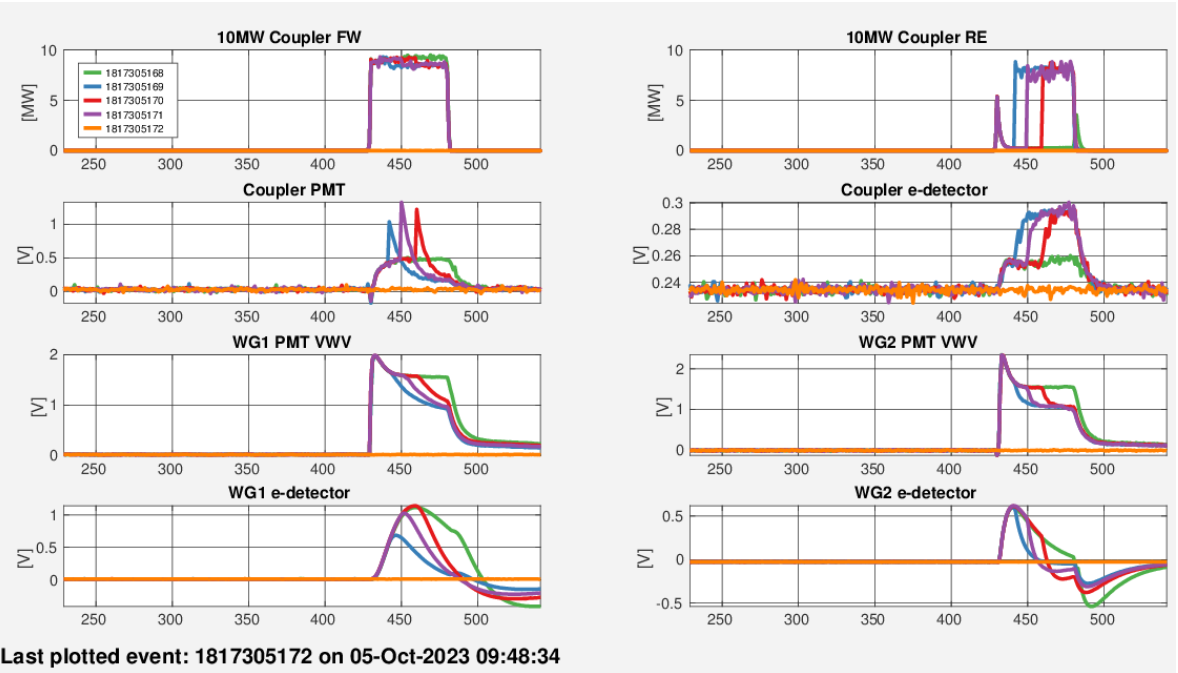
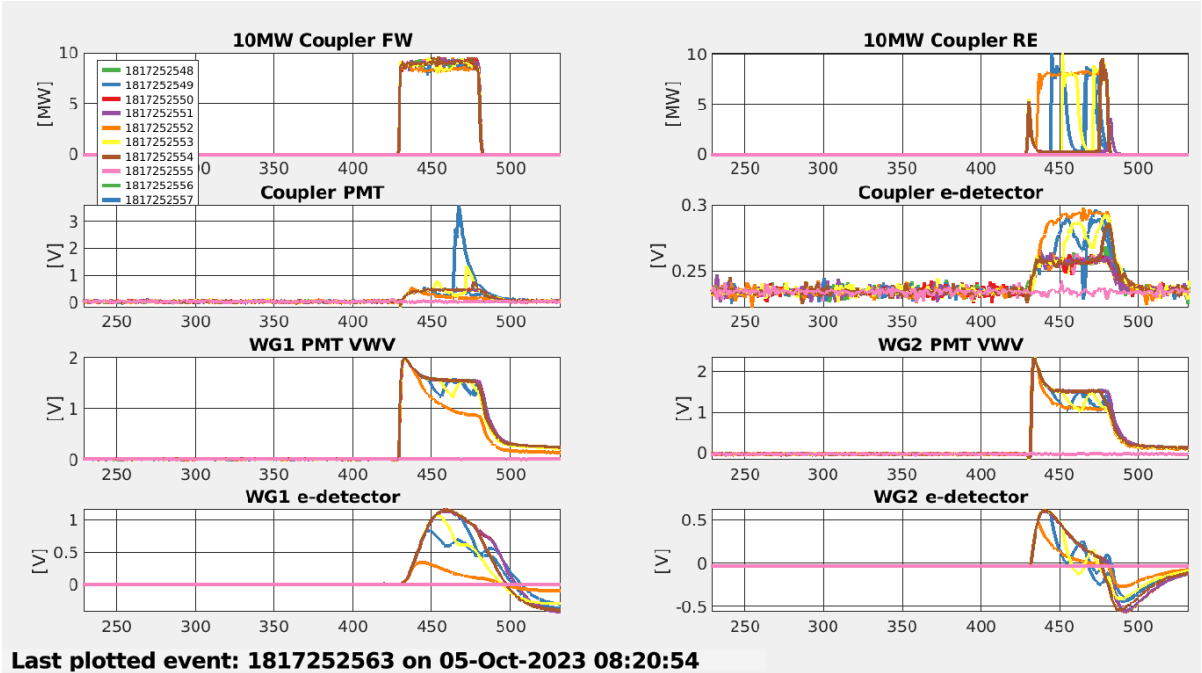
- Seemed to get stuck now

day	beta	amp (mA)	comment
2	356.48	13.632	FN fit
3	182.26	12.477	FN fit
3	195.67	9.996	FN fit
4	173.15	3.973	FN fit
5	160.37	1.594	FN fit
6		1.118	6.5 MWg
7		0.795	6.71 MWg
8		0.956	6.70 MWg
9		0.682	6.76 MWg
10		0.694	6.74 MWg



# Gun conditioning stopped by gun trips

Multiple RF reflections accompanied the gun trips



# “Broken” pulses analysis

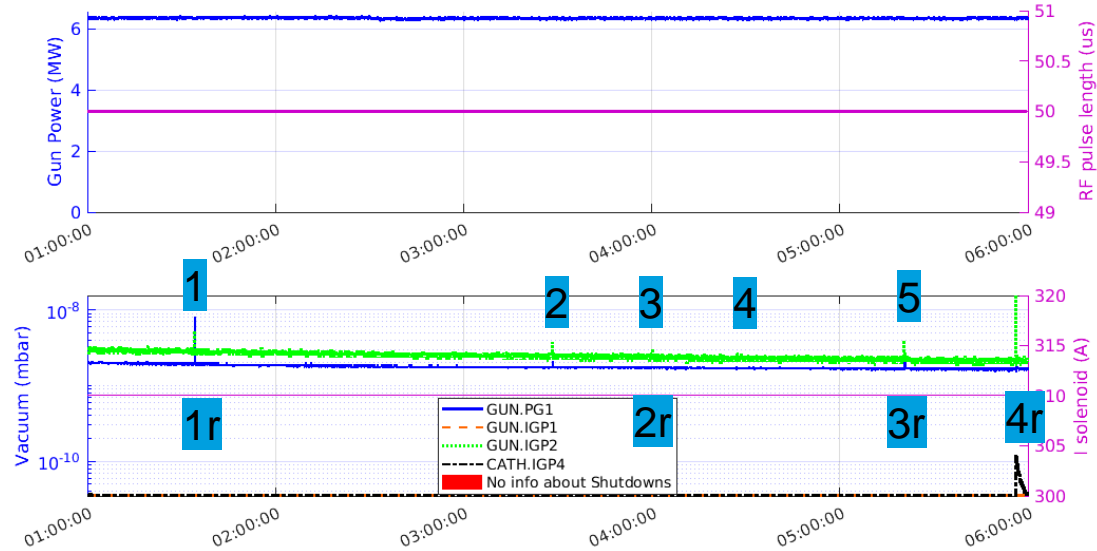
Using “standard” miniBD analysis tools

/nfs/group/pitz/Measure/scripts/Development/BDRcalculator:

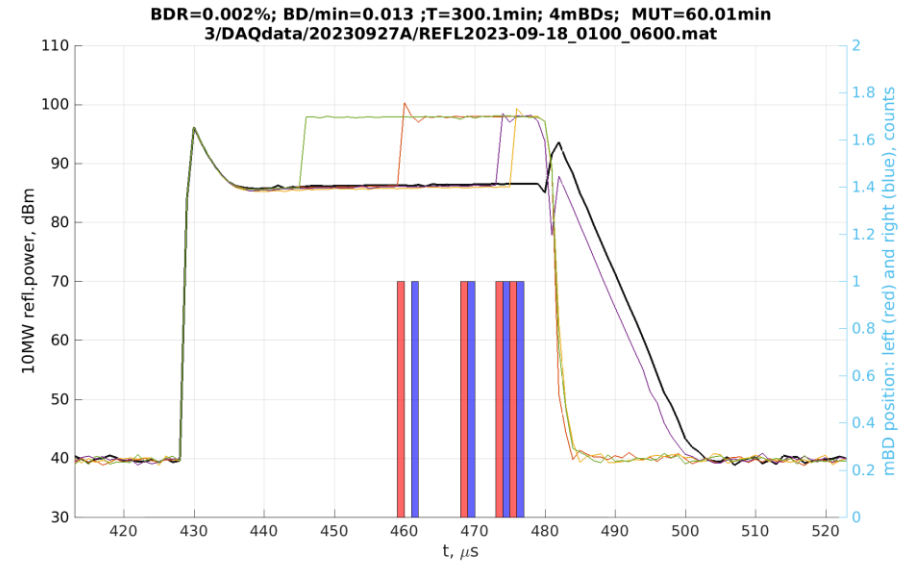
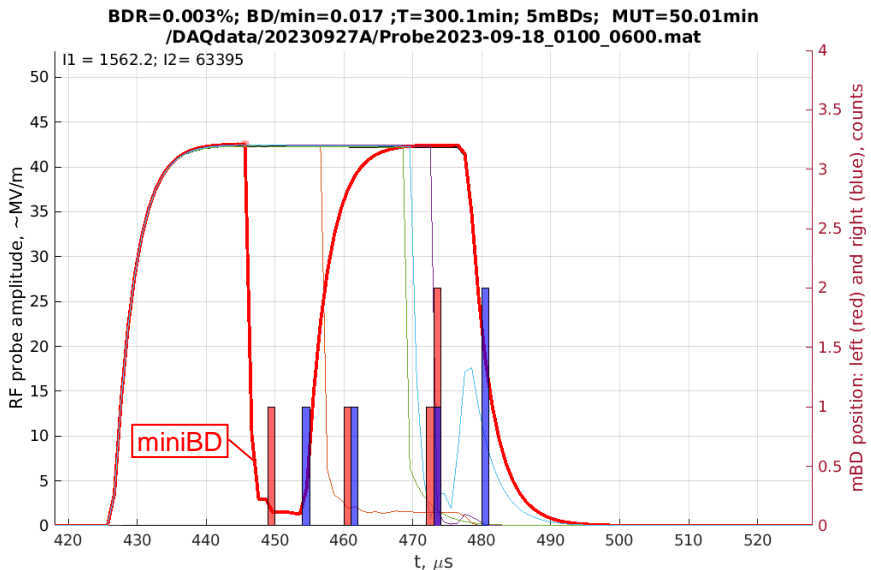
→get\_DAQdata4BD.m (select probe/refl.power + time range + file name)

→plotProbe\_DAQ\_BDUNI.m or plot10MWDC\_DAQ\_BDUNI.m

#	date	time	EN	strt	end
1	18-Sep-2023	01:34:01	1802320562	460.5817	461.5786
2	18-Sep-2023	03:28:12	1802389091	449.6154	454.6001
3	18-Sep-2023	04:00:17	1802408360	473.5417	480.5203
4	18-Sep-2023	04:30:38	1802426579	473.5417	480.5203
5	18-Sep-2023	05:20:31	1802456514	472.5448	473.5417



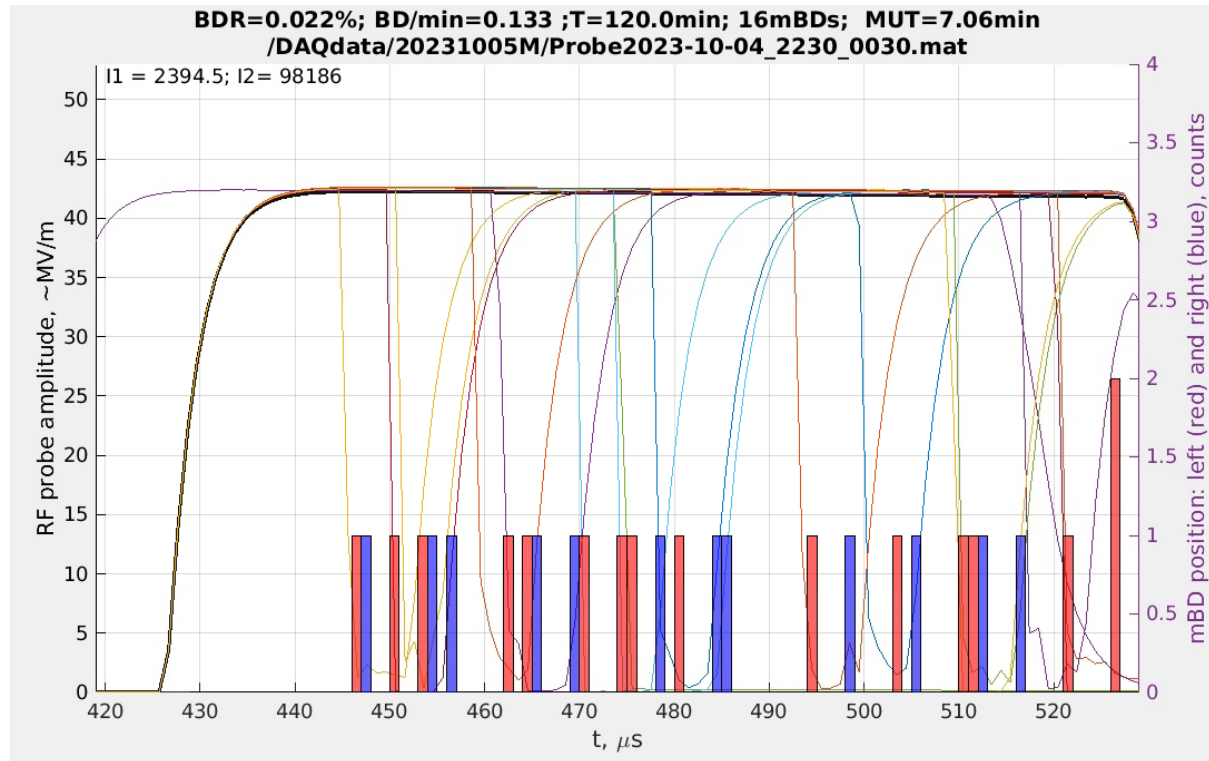
#	date	time	EN	strt	end
1r	18-Sep-2023	01:34:01	1802320562	459	461
2r	18-Sep-2023	04:00:17	1802408360	475	476
3r	18-Sep-2023	05:20:31	1802456514	473	474
4r	18-Sep-2023	05:56:09	1802477885	468	469



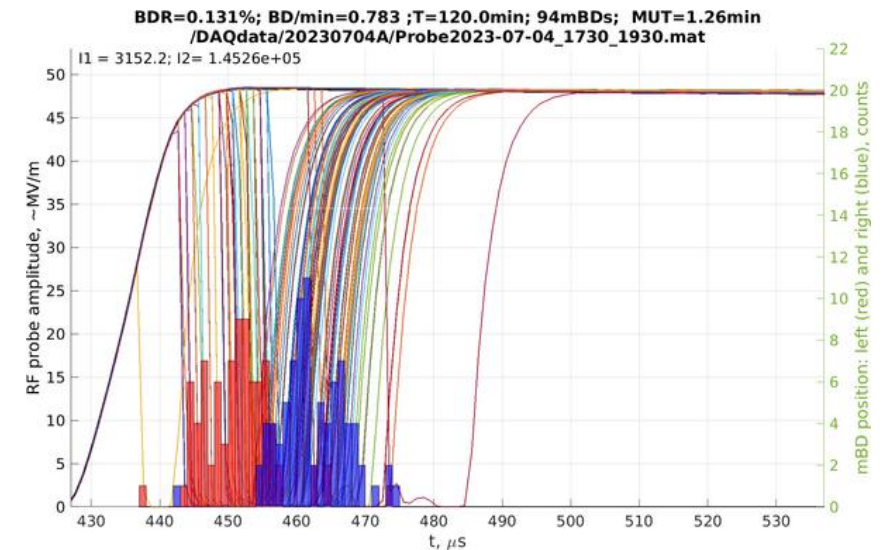
# miniBD analysis for 2h night run

## 6.3 MWg, 100 us

- Broken pulses around 460 us looked like mini BD events; but there were also broken pulses a bit later



Now



One mini BD analysis in July



# Run weeks 40-41

Status 05.10.2023

Possible program if gun is available:

- Nepal-P commissioning
- Beam transport with DC
- Quadrupole steering free tuning, steerer calibration
- Hardware check, script tuning

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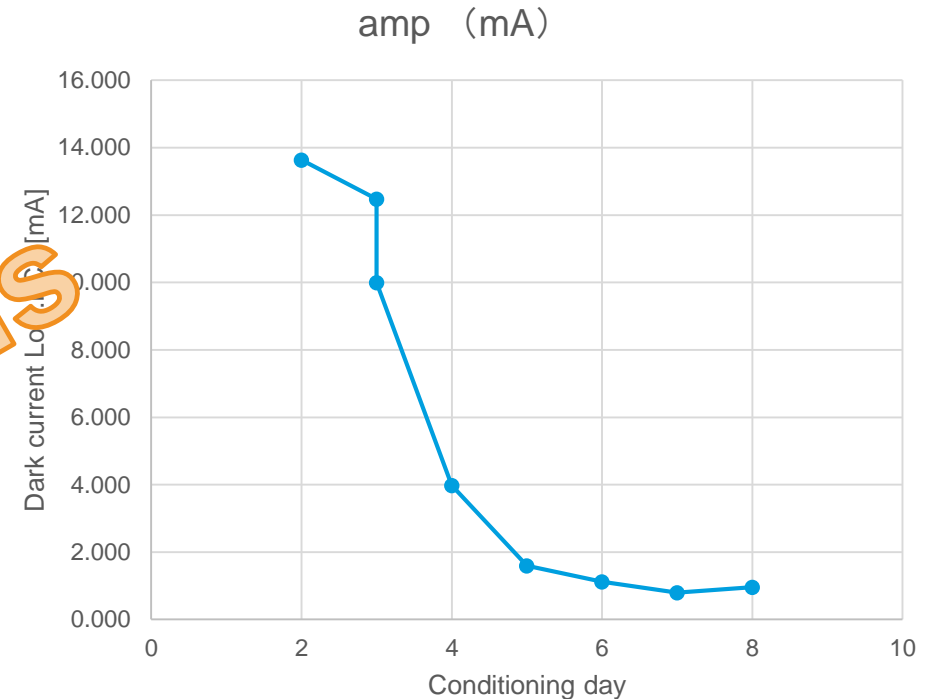
## Shutdown work

- Defect **corner valve** at gun was **replaced**, gun area was heated – **vacuum looks good** afterwards
- Low.Scr2 was reinstalled, everything connected; next: test of operation
- **Laser trolley** was put back (VC2 is not working, connection to be checked)

## Operation started 02.10.2023

- Gun (re-)conditioning starting from short RF pulses:
  - 10us → 20us →  $\geq 8\text{MWg}$  (~max)
  - 50us → 6.7MWg (working point)
  - 100us → 5.5MWg
- **Dark current** has strongly reduced (started at ~mA at 6.7MWg) so far, but is still much higher than before breakdown.  
Latest measurement yesterday: **956 $\mu\text{A}$  amplitude**

Previous



- ➔ Restart was done with fixed solenoid current,
- ➔ now **solenoid sweeping** is ongoing

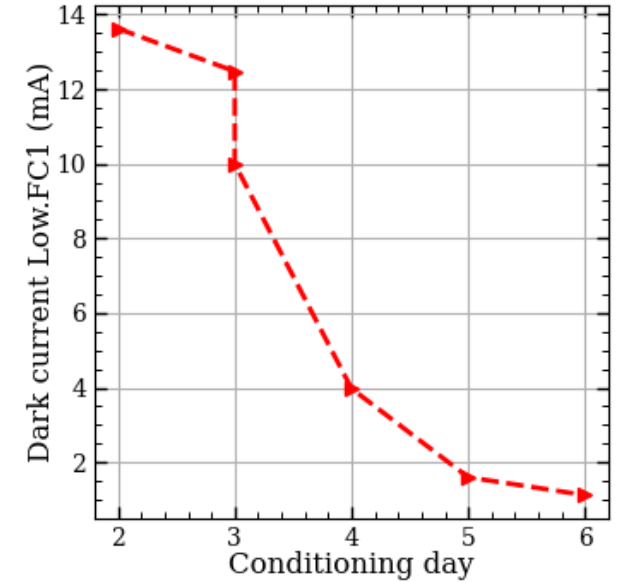
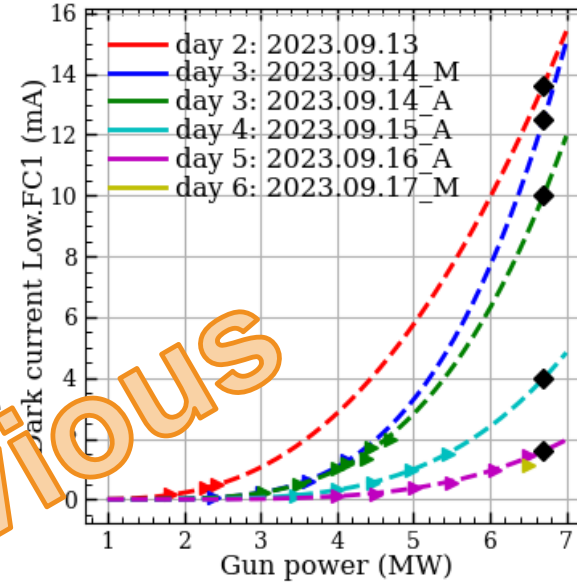
# PITZ report

20.9.2023



## Operation started 12.09.2023

- Gun (re-)conditioning starting from short RF pulses:
  - 10us → 20us → ≥ 8MWg (~max)
  - 50us → 6.7MWg (working point)
  - 100us → 4.5MWg
- Extremely high **dark current** (~mA at 6.7MWg), but reduced with conditioning
- Strong **multipacting** (MP) observed after main RF pulse
- **No damage on Mo cathode plug** after 1 week of conditioning



Previous

## NEPAL-P progress:

- New frame → Filter Fan Units mounted

## Gun5.2 production

- Brazing of all gun parts together is taking place today



Visit of 2 persons from **Varian** on last Friday :

- Vidhya Krishnamurthi and Michael Folkerts stayed for **6.5 hours**
- Ilka Mahns was joining as well
- Varian/Siemens funding
- External grants