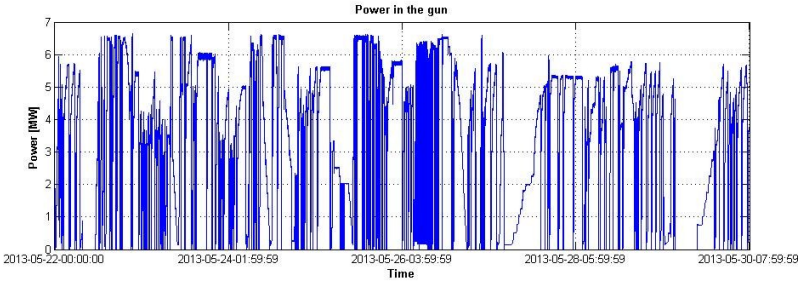
PITZ RC, 30.05.2013

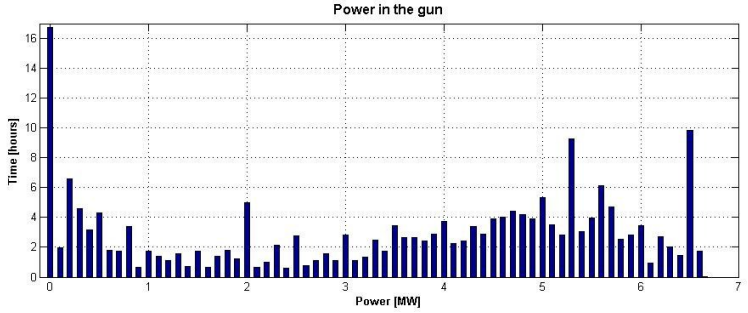
I.Isaev

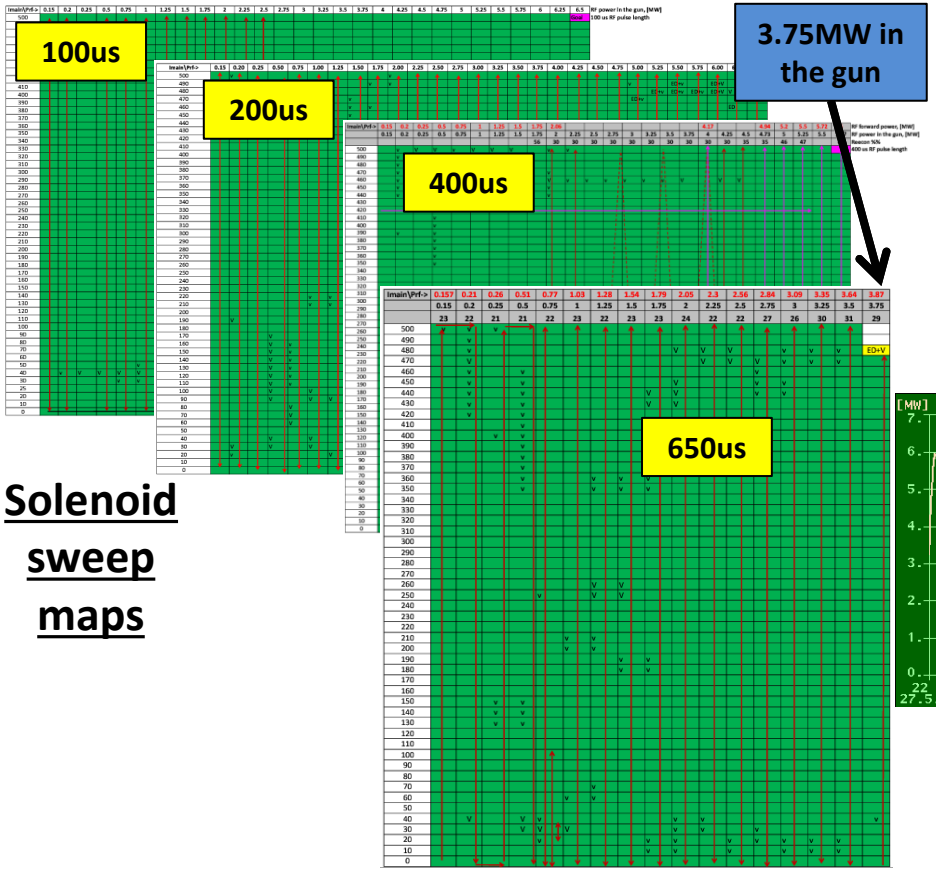
Gun 4.3 conditioning run in weeks 21-22

Conditioning with solenoid sweep Imain = 0÷500A

- conditioning at Pgun = 6.5 MW for shorter rf pulses:
  - 10us -> done
  - 50us -> done
  - 100us -> done
  - 200us -> done
- conditioning at Pforward = 6.0 MW for rf pulses >200us:
  - 400us -> done
  - 650us -> is ongoing done up to 3.5 MW in the gun





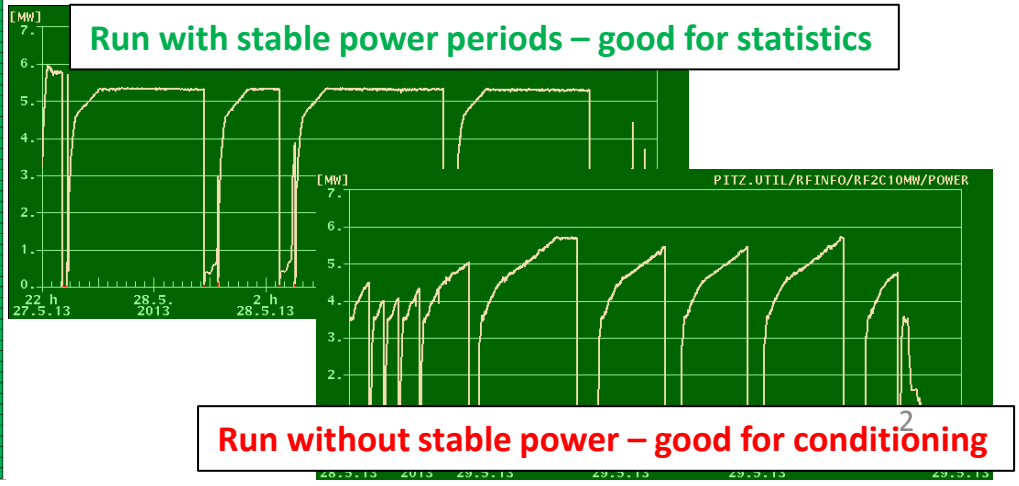


Solenoid sweep maps

Night runs

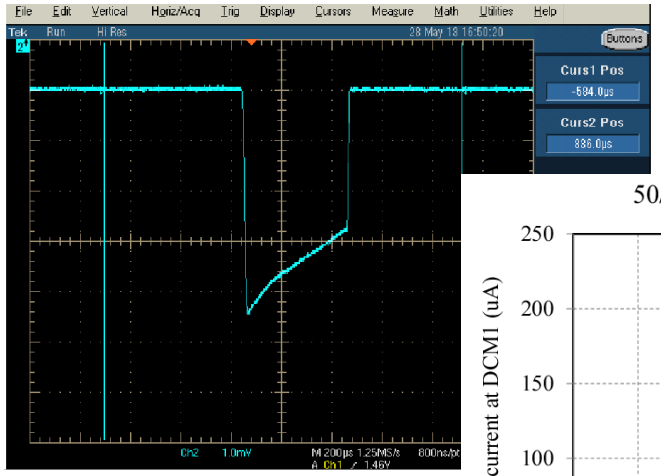
If one wants to collect **stable run** statistics (and trip rate at certain power level) during the nights then the gun parameters should be carefully adjusted otherwise it will be impossible due to PM ILs

Run with stable power periods – good for statistics

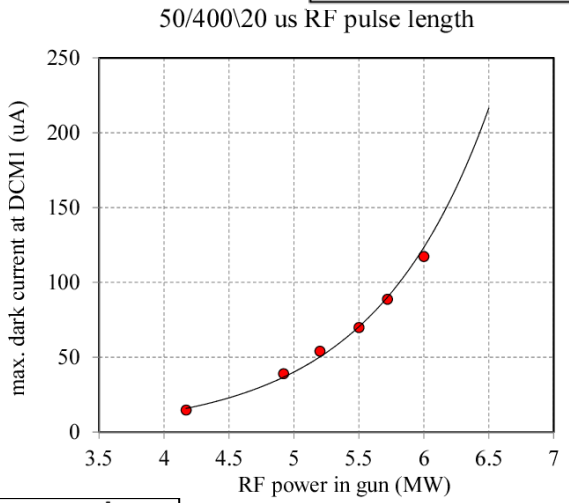


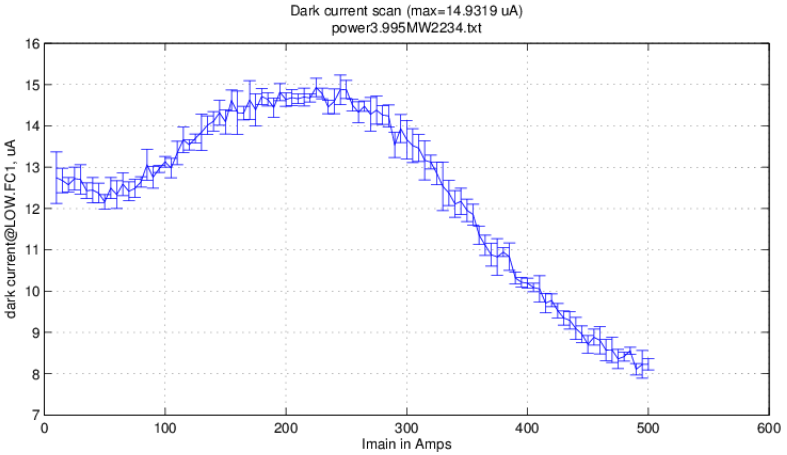
Run without stable power – good for conditioning

FC1 is back into operation

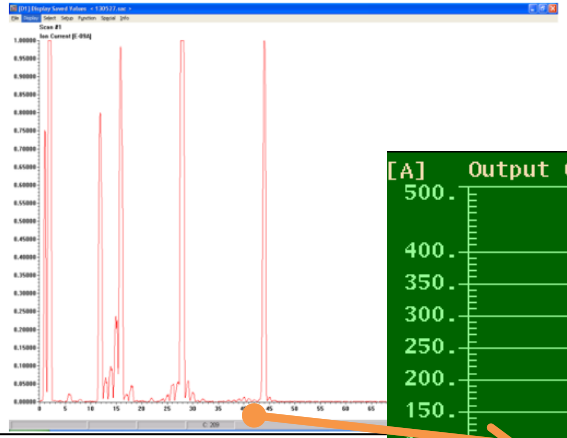


Forward power (MW)	Gun power (MW)	Imain (A)	Max. dark current (uA)
6	5.8	270	117.4
5.72	5.5	270	88.8
5.5	5.25	250	69.9
5.2	5	250	54.1
4.92	4.73	240	39
4.17	4	230	14.8

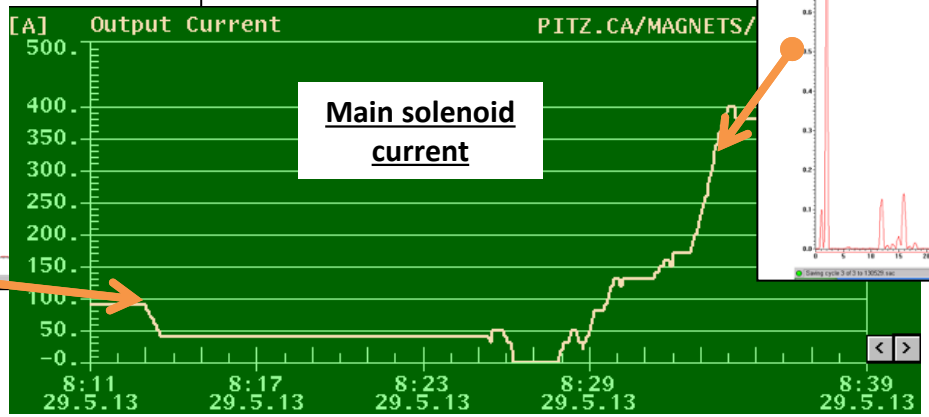




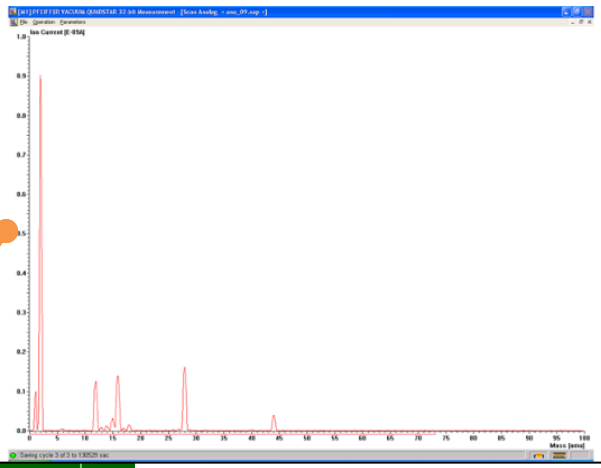
05/29/2013, 8:13,1.5e-8 mbar



RGA spectrum depend on the main solenoid current



05/29/2013, 8:34, 9.4e-10 mbar



Problems and next steps

Fixed:

- Scope signal from LOW.FC1 (dark current measurements)
- Solenoid → survey + alignment (???)

Not yet:

- Gun temperature (sensor) drift → not observed anymore?
- Some problems with degaussing were observed and to be solved
- The saturation of the Gun PD-gamma at 5.5 V

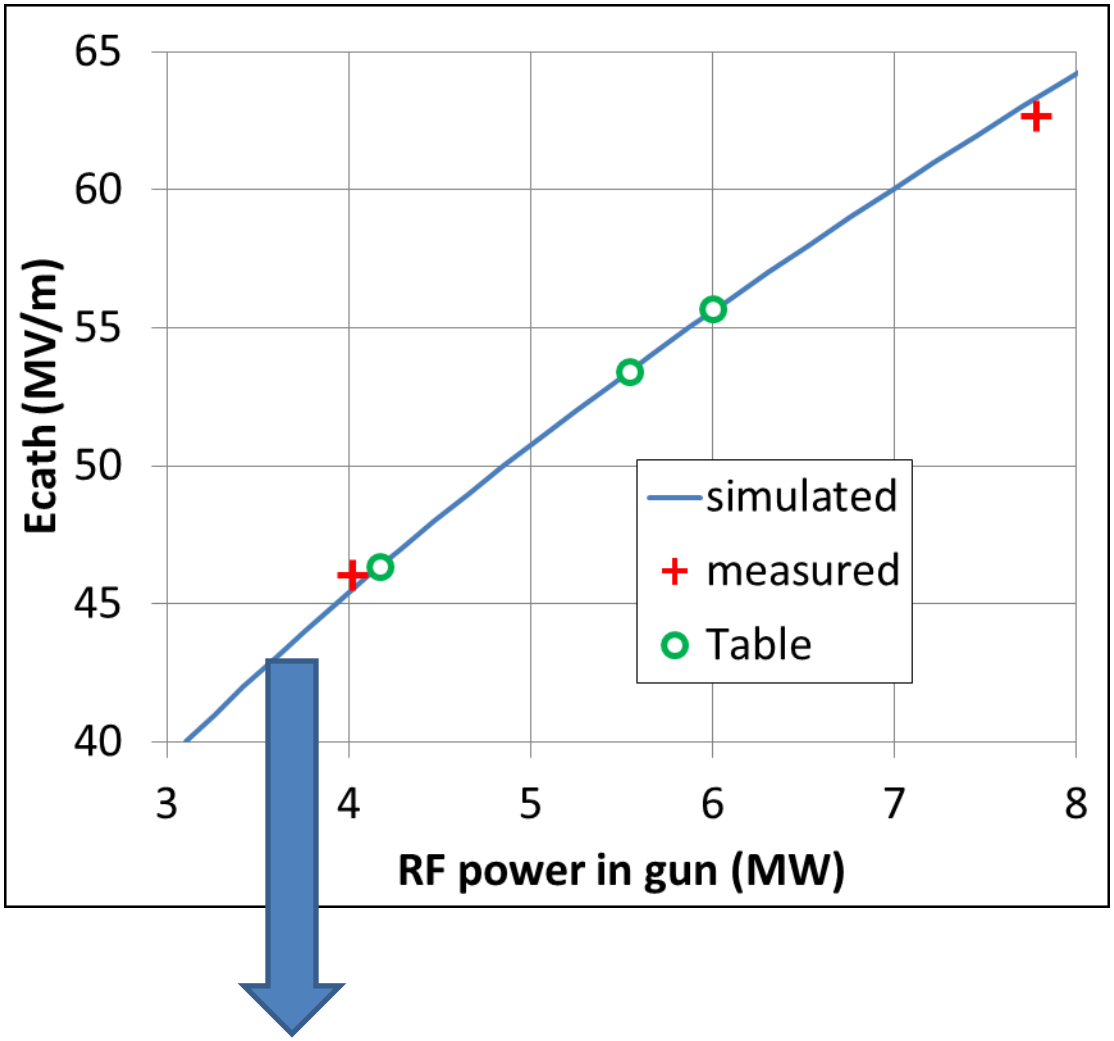
Conditioning: next steps

- Finish solenoid sweep Solenoid sweep (0→500A) with 650us RF pulses, RF power from 0 to Pforw=6.0MW, monitor dark current
- Produce **photoelectrons**, start gun characterization
- Measure the **trip rate** **(possibly during beam measurements?)**

Gun-4.3: measurement program

M.Krasilnikov

Electric field at the cathode vs. RF power in gun



Simulations based on the beam maximum momentum simulations:

- Measured maxPz → measured RF power →simulated maxPz → needed Ecath
- Based on recent measurements with previous gun cavity (Gun-3.1, February, 2013)

RF power in gun (MW)	maxPz (MeV/c)	Ecath (MV/m)
4.022	5.311	46.01
4.17		**46.35**
5.54		**53.40**
6.00		**55.70**
7.783	7.088	62.68

This dependency has to be measured for the gun-4.3:

- maximum momentum vs. RF peak power in the gun

“Boundary conditions”

- Specifications on the maximum peak RF power in the gun (the conditioning goal) have still to be refined (RB: 6MW in the cavity)
- Cathode laser temporal shape (OSS amplifier is broken):
  - First time → only short Gaussian temporal profile (?)
  - Backup solution → profile adjustment using the streak camera
- Solenoid BBA:
  - Micromover has to be put into operation
  - Longitudinal momentum and reference phase are to be defined before

General plan

1. Laser (rough) alignment at the cathode, produce photoelectrons (MG, MK)
2. Rough solenoid alignment (to provide a beam transport) (MK)
3. Longitudinal momentum measurements vs. peak RF power
4. Solenoid BBA (MK)
5. Final decision on the max RF peak power (Pmax→6MW?)
6. Complete the conditioning up to Pmax for RF pulses up to 650us with solenoid sweep
7. CDS booster short recovery (? Still 2 weeks for the high power run)
8. Gun phase stability measurements (Igl)
9. Longitudinal phase space measurements (DM)
10. Trip rate monitoring (➔ all measurements after the conditioning are to be done at full RF average power e.g. 6M x 650us x 10Hz)
11. Booster steering studies (MO)
12. …

Longitudinal momentum vs. RF peak power

- RF pulse length=200us (?)
- RF peak power: 6.5MW; 6MW;5.5MW;…
- Cathode laser pulse:
  - Temporal → short Gaussian
  - BSA→ 1.2mm (?)
- Measurements:
  - Momentum scan in LEDA vs. gun SPPhase (new MAMA tests?)
  - Statistics for the MMMG phase
  - Schottky scan to determine the zero-crossing phase
  - …
- Expected results:
  - Max(<Pz>) vs. RF peak power (3MW:step 0.5MW:6.5MW)
  - MMMG phase vs. RF peak power

Measurement program (D.Malyutin, 2013 v.2): "Longitudinal phase space tomography at PITZ"

- **Goal:** Measurements of the electron bunch longitudinal phase space for different electron bunch charges for short Gaussian laser temporal shape. This is foreseen as additional measurements to try to improve the temporal and momentum resolutions in contrast with the last data taken.
- **Measurement points**: **LEDA**, **HEDA1** and **HEDA2**.
- **Bunch charges:** 20 pC, 100 pC, 400 pC, 700 pC.
- **Laser pulse shapes:** 2.8 ps gauss, BSA = 1.2 – 1.4 mm.
- **Number of laser pulses:** to have enough intensity on the LEDA, HEDA1 and HEDA2 observation screens (1-50).
- **Gun:** 60 MV/m (6.8 MeV/c beam momentum), RF phase for the MMMG.
- **Booster:** 16* MeV/c gain (22.4* MeV/c beam momentum downstream), RF phase scans. 3.2 MW RF power in the booster cavity.
- **Dates:** June 2013.
- **Difficulties:** Gun and booster conditioning is on-going.
- **Required number of shifts 3 – 4:**
  - Beam transport up to HEDA2, booster steering free – 1 shift. Can be done by others? - yes
  - Beam matching for the HEDA2 measurements, HEDA2 momentum resolution studies – 1 shift. Can be done by others? - no
  - Measurements – 1(2) shift. Can be done by others? - no

Organization of shifts

M.Otevrel

Suggestions for the measurement period:

- Conclusion from the 2nd slide: Full run not realistic for more than 4 weeks. For 3-4 weeks may be possible but only if there are
  - NO CONFERENCES
  - NO HOLIDAYS
  - NO OTHER ABSENCES (e.g. illness)
  - AVAILABLE GUESTS to make 2nd persons
  - SHUTDOWN PERIODS BEFORE AND AFTER

- My opinion: Too risky!

- A conservative solution (suggestion)
  - L+N: measurements (shifts)
  - M(!): conditioning/stability-test, tunnel access – if necessary (smac + resp. Physicist (a person outside the shift crew of the corresponding week))