PITZ RC, 06.06.2013

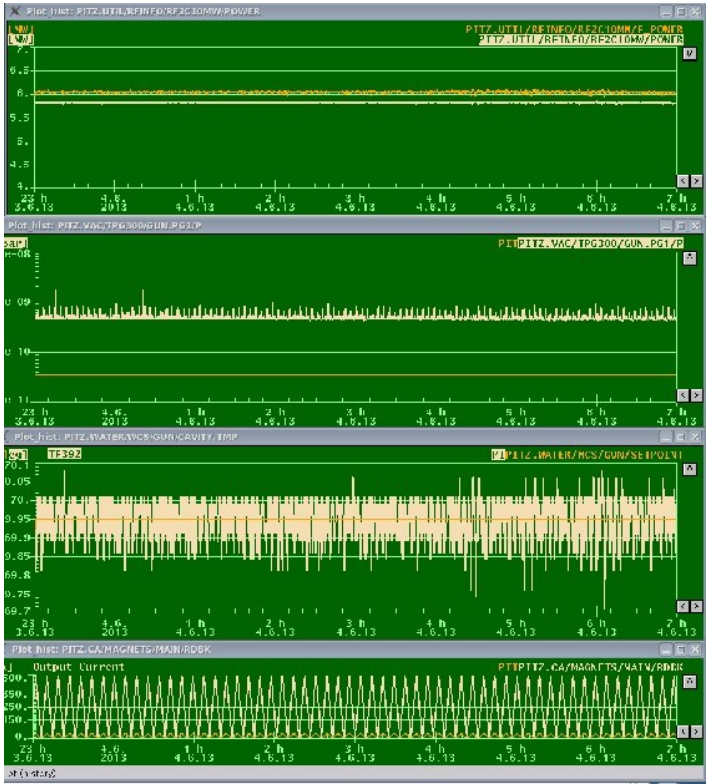
Gun 4.3 conditioning run in weeks 22-23

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 -> done

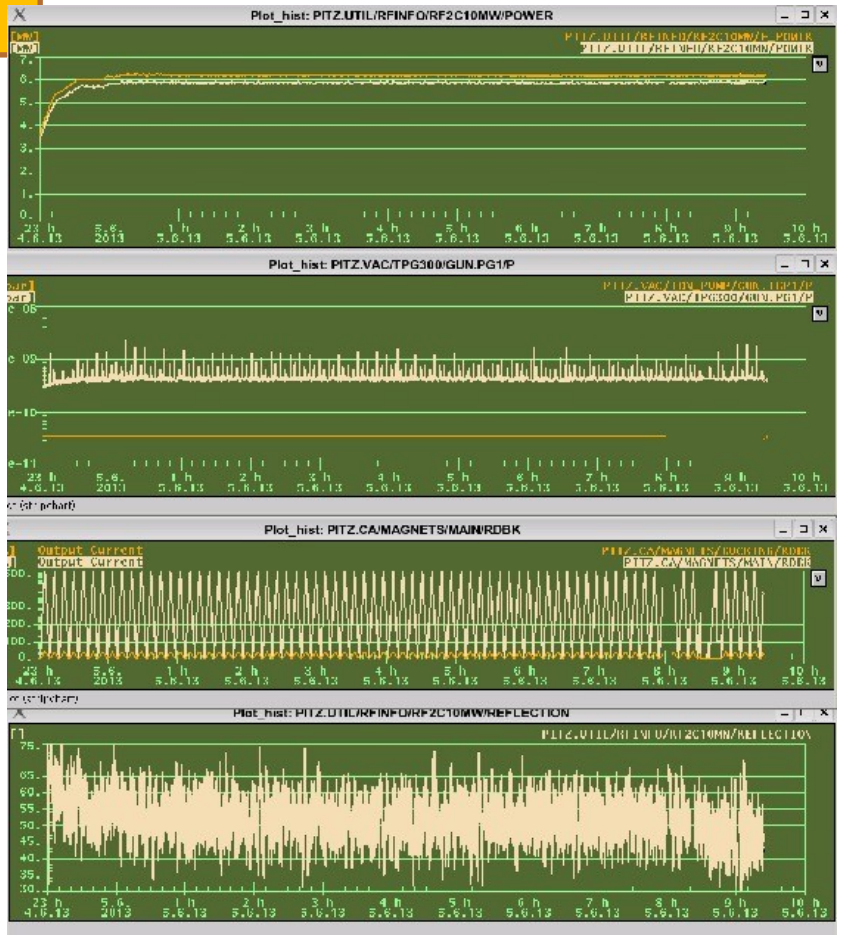
BUT: Cs2Te (#149) →
→still IL at Imain>450A

03.06.2013N 650us, 0-500A solenoid sweep, No IL!



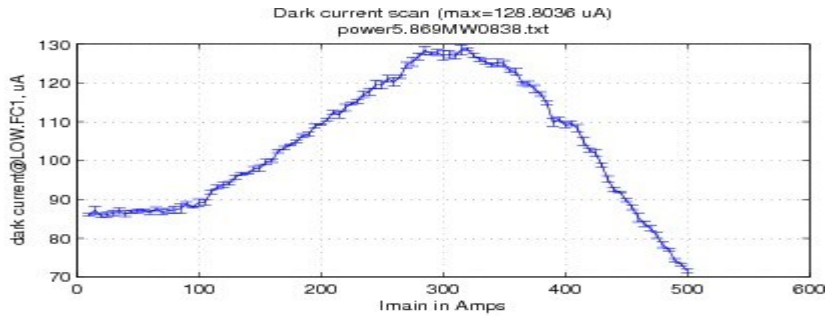
04.06.2013N History from the night run - stable, no IL (5.85MW in the gun)

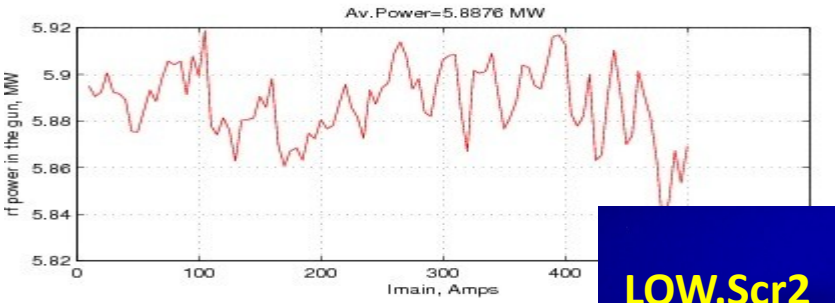
10hours of unperturber run at 5.85MW x 50/650\20us x 10Hz



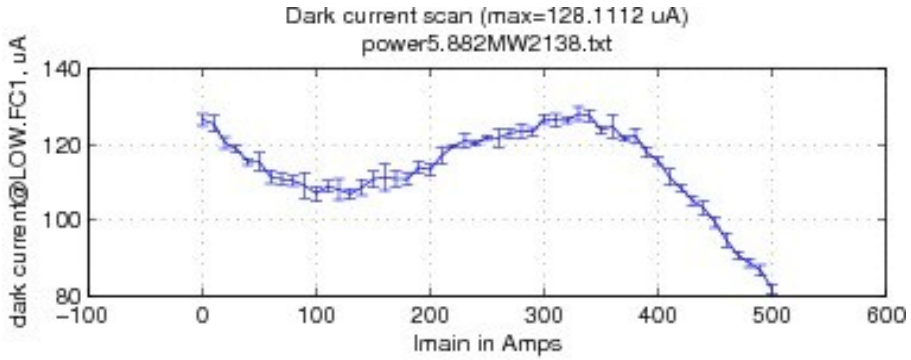
Dark current

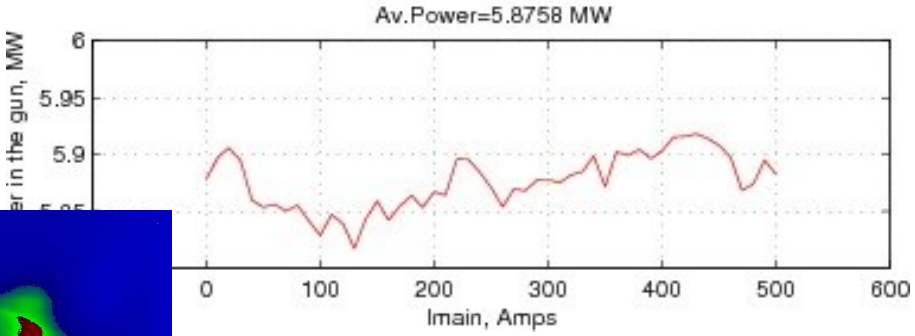
Mo (#622)

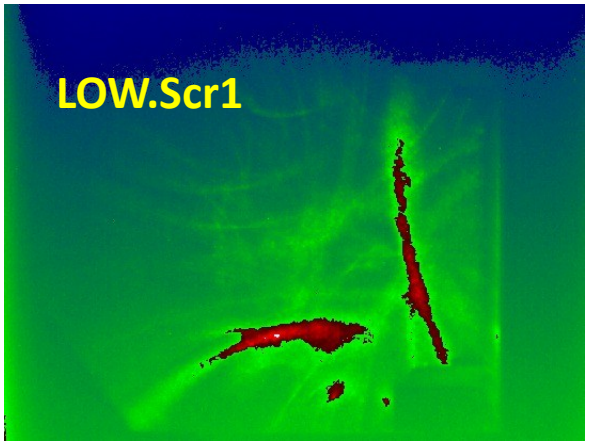


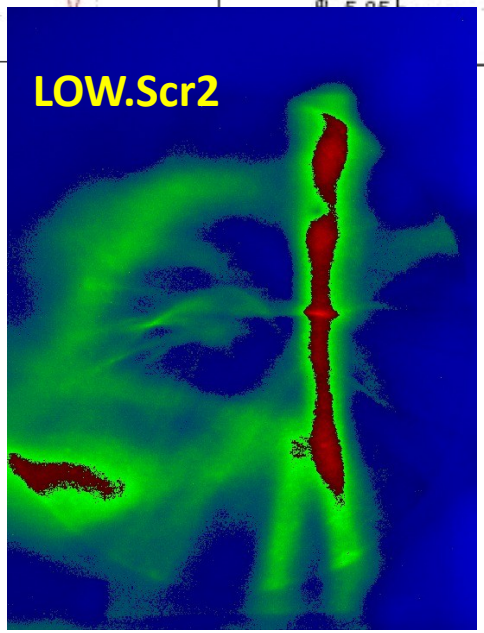


Cs2Te (#149.1)





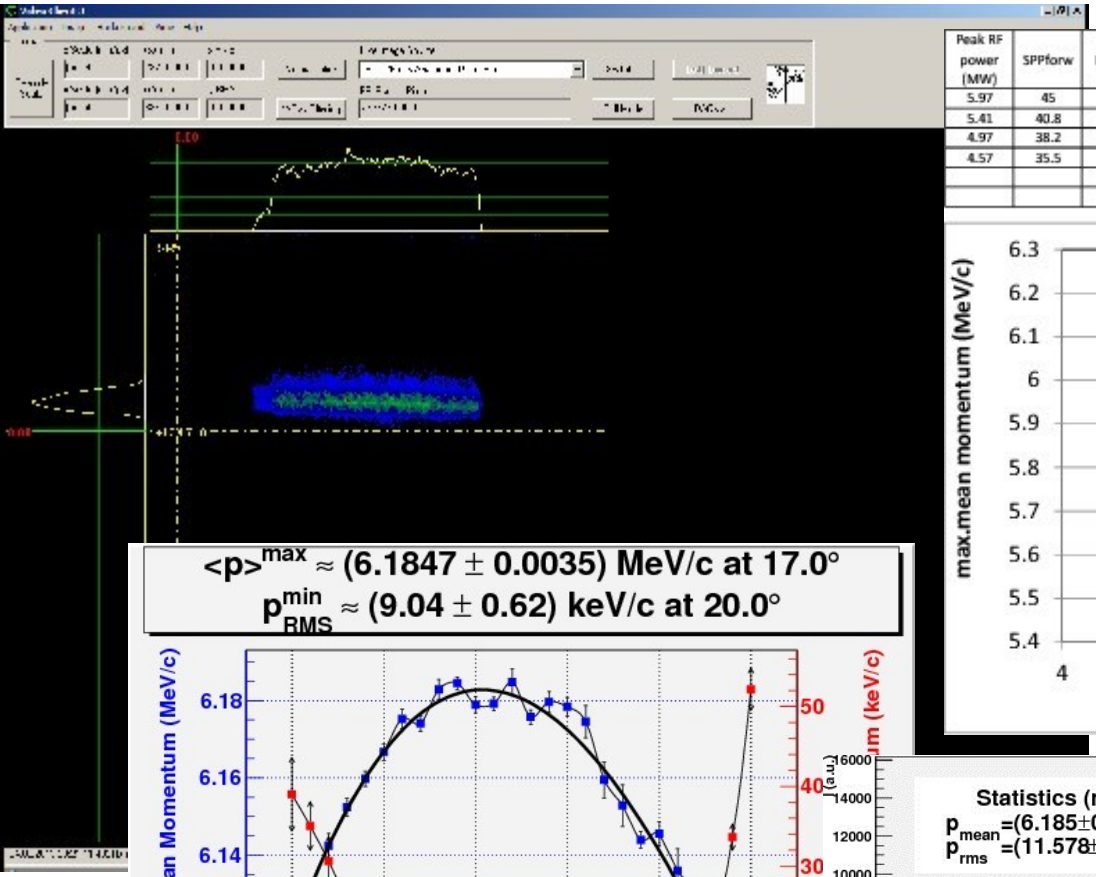




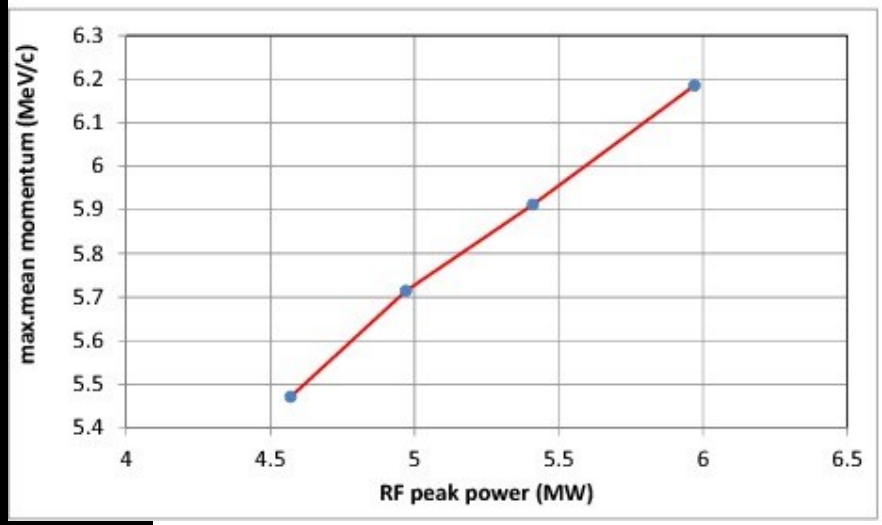
Cross-check with cathode orientation?

First electron beam

04.06.2013 20:21 MK, HA **Electron beam, at LEDA**

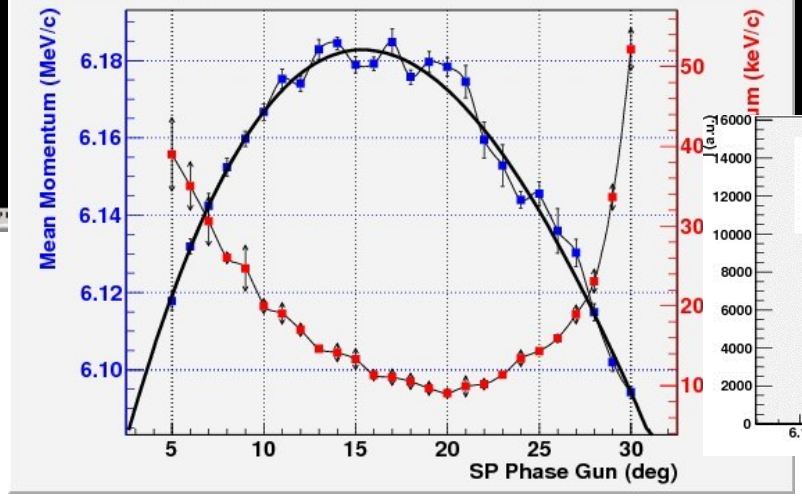


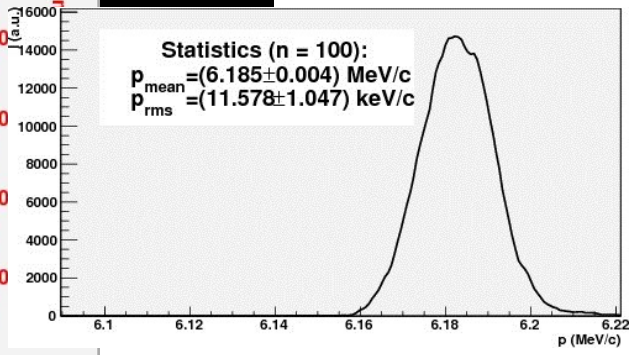
Peak RF power (MW)	SPPforw	FB gain	SPT (degC)	Imain (A)	SPPhase (MMMG) (deg)	LT (%)	NoP	Max <Pz> (MeV/c)	+/-	PZrms	+/-	Reecon (%)
5.97	45	9	69.3	426	16	50	21	6.185	0.004	11.6	1	4
5.41	40.8	9	96.2	406	19	50	21	5.912	0.004	9.031	1.371	3
4.97	38.2	9	69.09	387	24	50	31	5.714	0.005	12.046	0.708	2.2
4.57	35.5	9	69.03	375	23	50	31	5.471	0.006	13.436	0.905	2.05



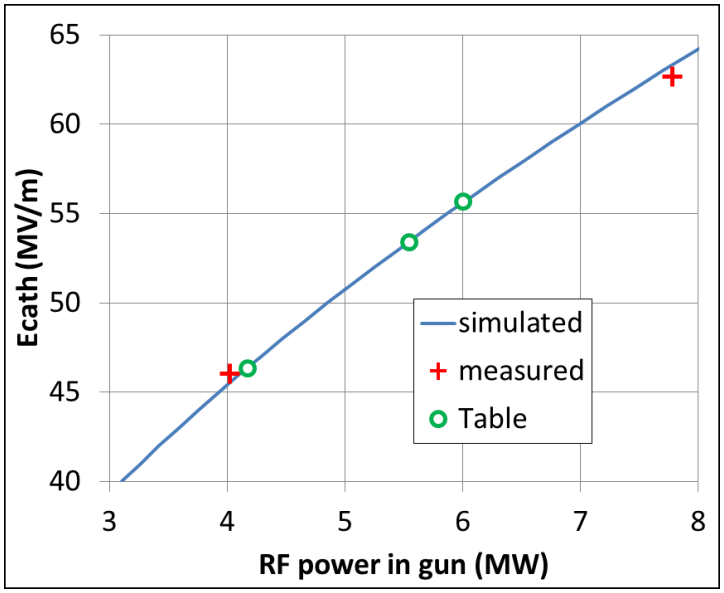
$\langle p \rangle^{max} \approx (6.1847 \pm 0.0035)$ MeV/c at 17.0°

$p^{min}_{RMS} \approx (9.04 \pm 0.62)$ keV/c at 20.0°





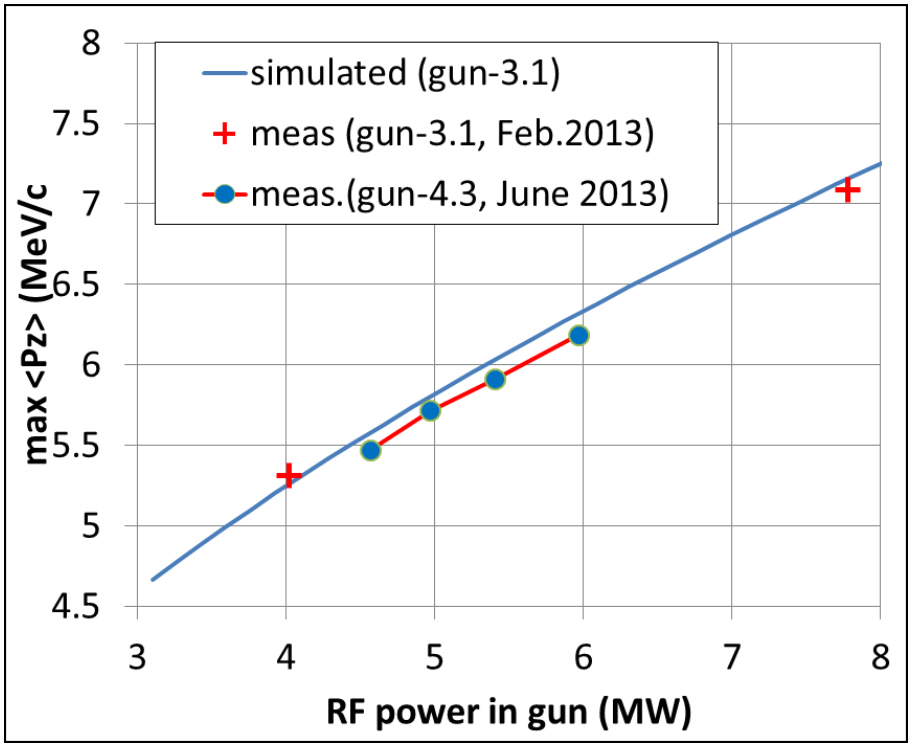
Electric field at the cathode vs. RF power in gun



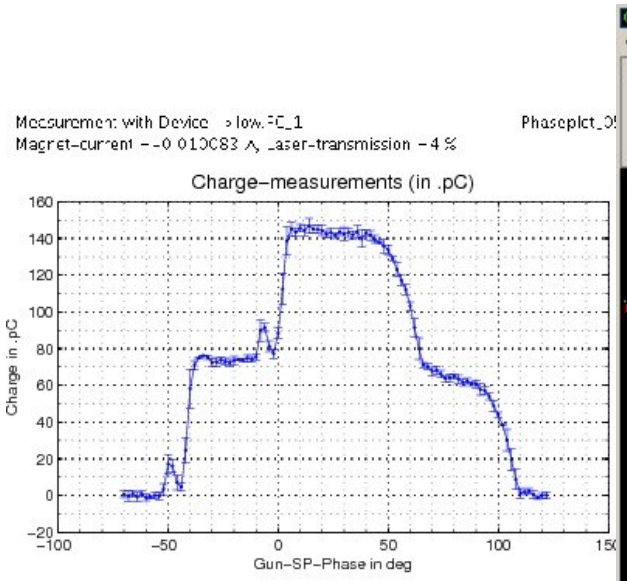
Simulations based on the beam maximum momentum simulations:

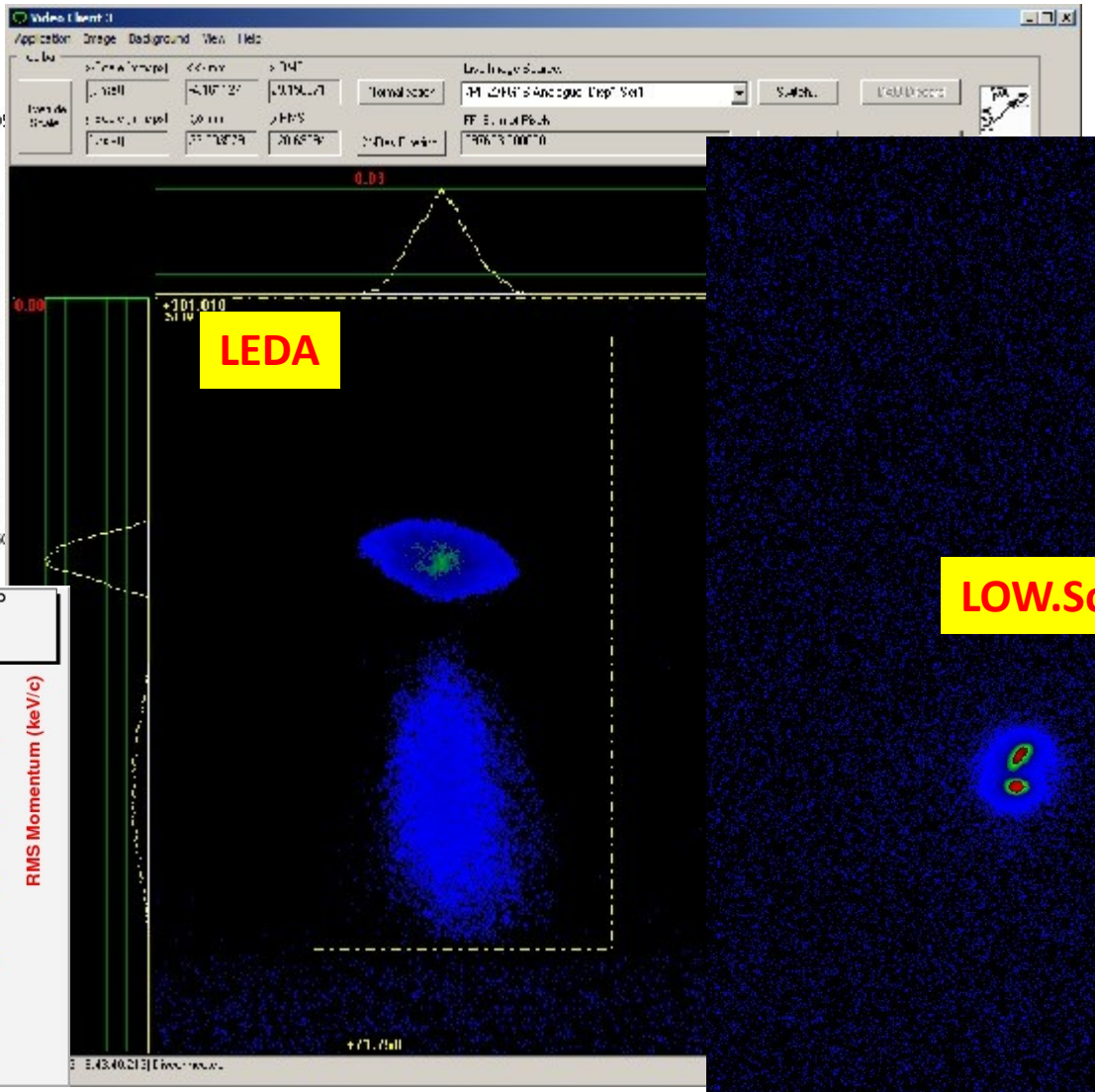
- Measured maxPz → measured RF power →simulated maxPz → needed Ecath
- Based on recent measurements with previous gun cavity (Gun-3.1, February, 2013)

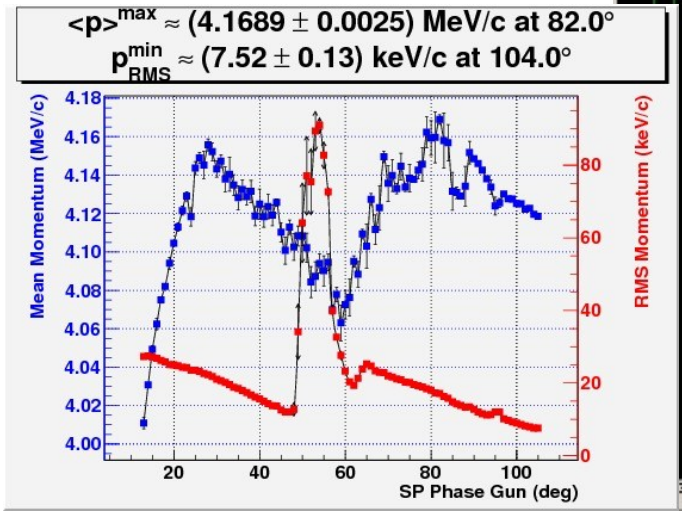
Regular measurements (with FB and good laser) are still to be done



Double beam structure (temporal laser satellite)

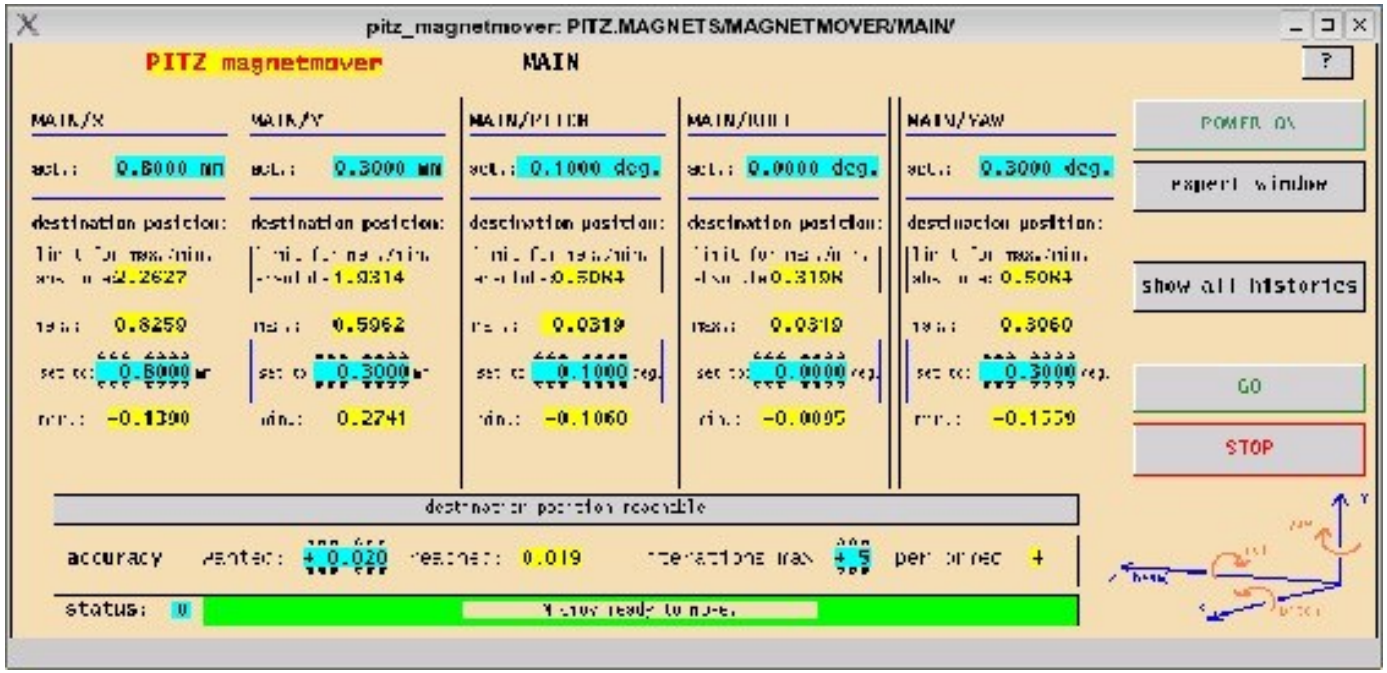






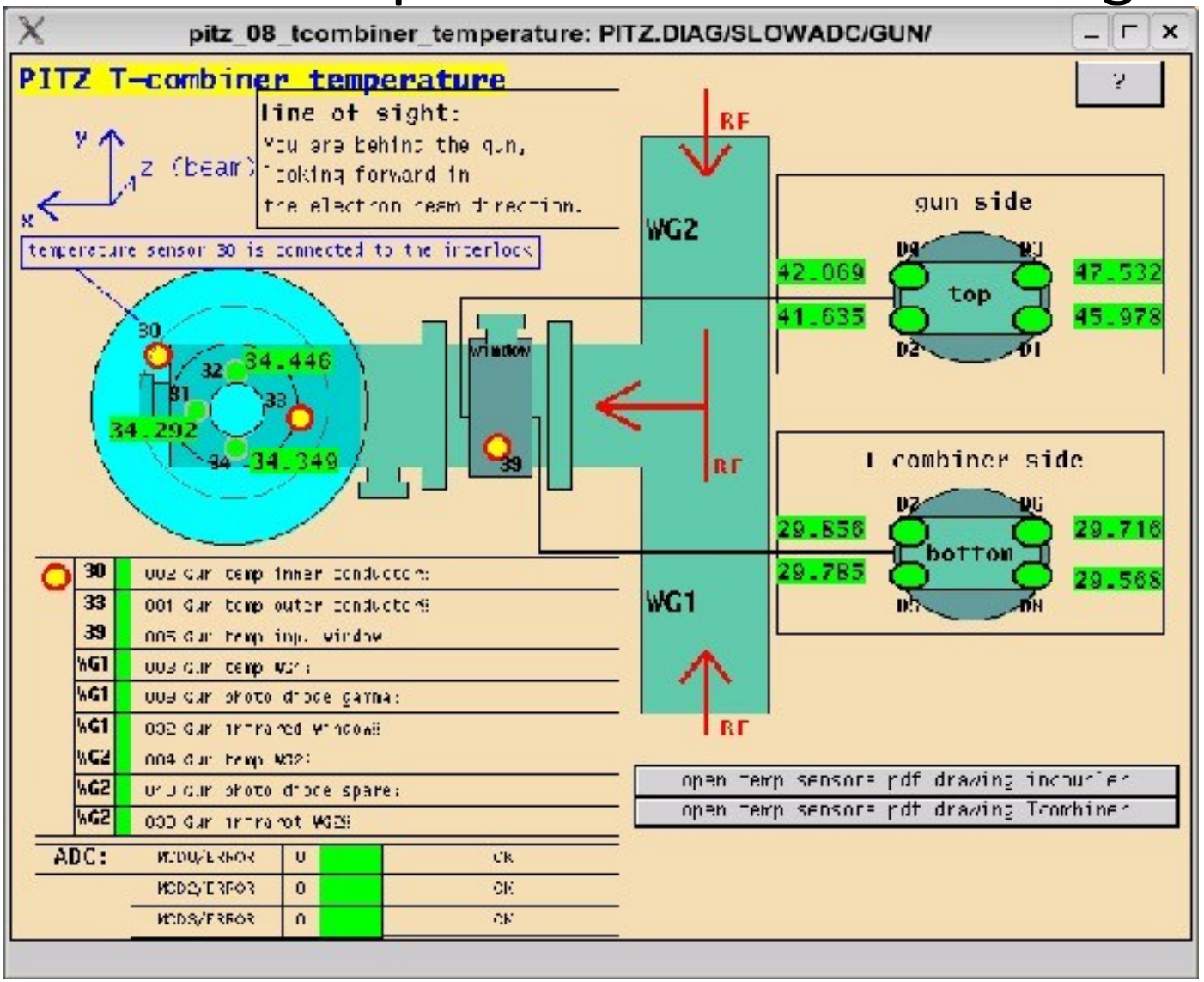
Solenoid

- No hysteresis
- Micromover seems to be working



Interesting observation

- RF window temperature: Vac-SF6~10degC



Problems and next steps

Fixed:

- Scope signal from LOW.FC1 (dark current measurements)
- Solenoid → survey + alignment
- The saturation of the Gun PD-gamma
- LOW.St1
- LOW.ST6 can be managed from this script /doocs/data/PCB/PCB

Not yet:

- Gun temperature (sensor) drift → yes, at 650us a small drift observed!
- Gun FB behavior
- **Temporal satellites in the laser**

Conditioning: next steps

- Get gun conditioned with Cs2Te cathode and solenoid sweep (0→500A) with 650us RF pulses, RF power from 0 to Pforw=6.0MW, monitor dark current
- Longitudinal momentum measurements vs. peak power (MK)
- Solenoid BBA (MK)
- LPS tomography measurements (DM)
- Booster steering measurements (MO)
- Gun phase stabiulity measurements (IgI) → after laser problems will be solved
- Measure the **trip rate** **(during beam measurements)**

Gun-4.3: measurement program

M.Krasilnikov

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;… FB=ON
- Cathode laser pulse:
  - Temporal → short Gaussian
  - BSA→ 1.2mm (?)
- Measurements:
  - Momentum scan in LEDA vs. gun SPPhase (new MAMA tests?) (10 frames, 0.5 deg phase step)
  - Statistics for the MMMG phase (100 frames statistics)
  - 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