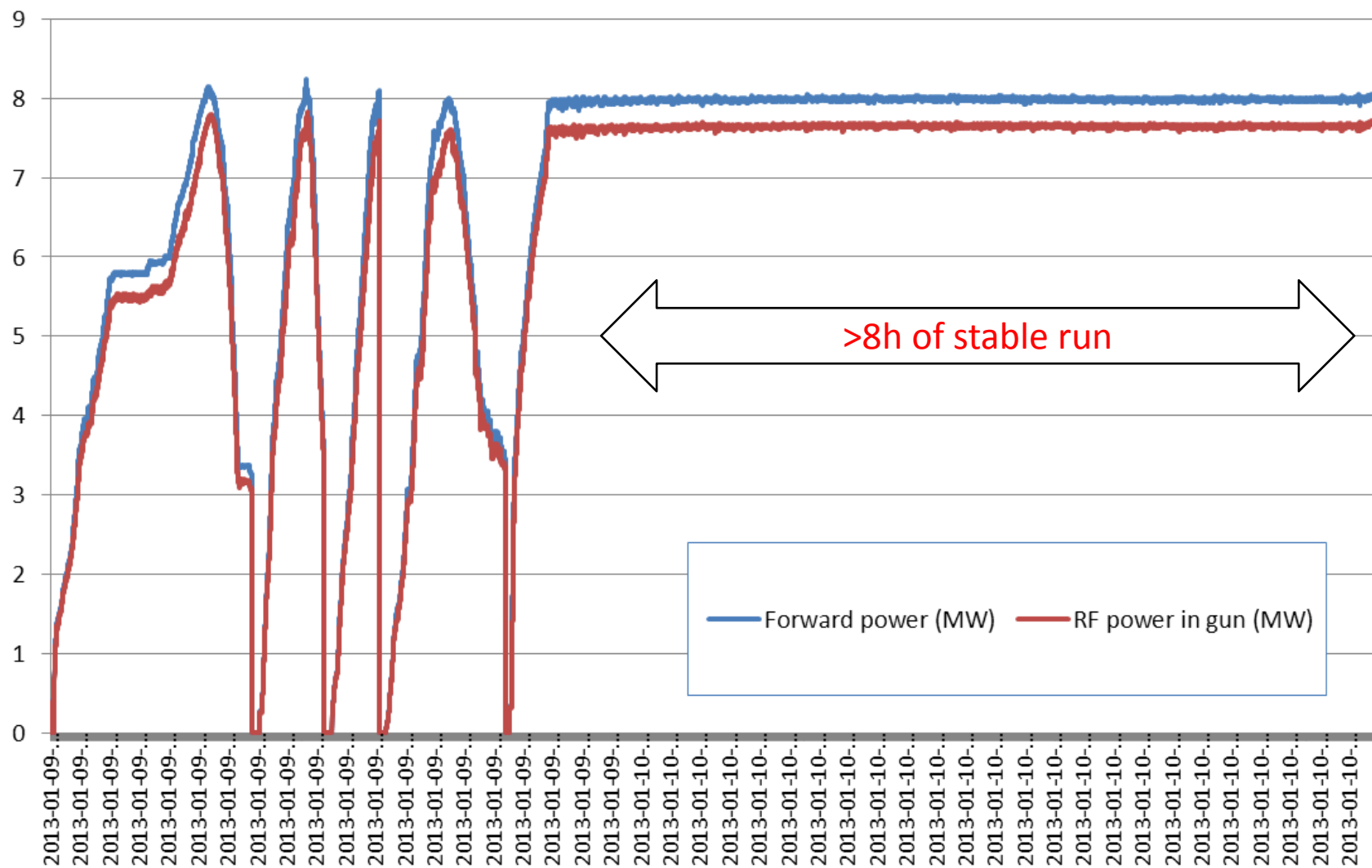


PITZ RC, 24.01.2013

B.Marchetti, M.Krasilnikov

High peak power gun conditioning on 09-10.01.2013: HV=9.7kV, 10Hz, 200us rf pulse



Weeks 2-3: high average power runs

- **650us** x max peak power:
 - 2 hours with 6.5 MW in the cavity at 650 us (13.01.2013)
 - 2 x 8 hours with 6 MW in the cavity at 650 us
 - **830us x ~5MW in the cavity max:**
 - 4 hours with 5 MW in the cavity at 830 us (13.01.2013)
 - **650 us x $P_{\text{forw}} \sim 7\text{MW}$ without solenoid:**
 - 15_01_n, 5 hours, $P = 6.5\text{ MW}$
 - **830 us x $P_{\text{forw}} \sim 4.5\text{ MW}$ without solenoid:**
 - 16_01_n, 5 hours, $P = 4.5\text{ MW}$
 - 17_01_n + 18_01_m, 8 hours, $P = 4.9\text{ MW}$
 - **650 us x $P_{\text{forw}} \sim 4.5\text{ MW}$ with solenoid at 315 A:**
 - 19_01_m, 1 hour $P = 4.3\text{ MW}$
 - **830 us x $P_{\text{forw}} \sim 4.5\text{ MW}$ with solenoid at 315 A:**
 - 19_01_m, $P = 4.2\text{ MW}$ reached
 - 19_01_a, $P = 4.2\text{ MW}$, 7 hours of UNSTABLE run
 - 19_01_n + 20_01_m, $P = 4\text{ MW}$, 8 hours
 - 20_01_a + 20_01_n, $P = 4\text{ MW}$, 8.5 hours
- Total 13 hours
- Total 16.5 hours

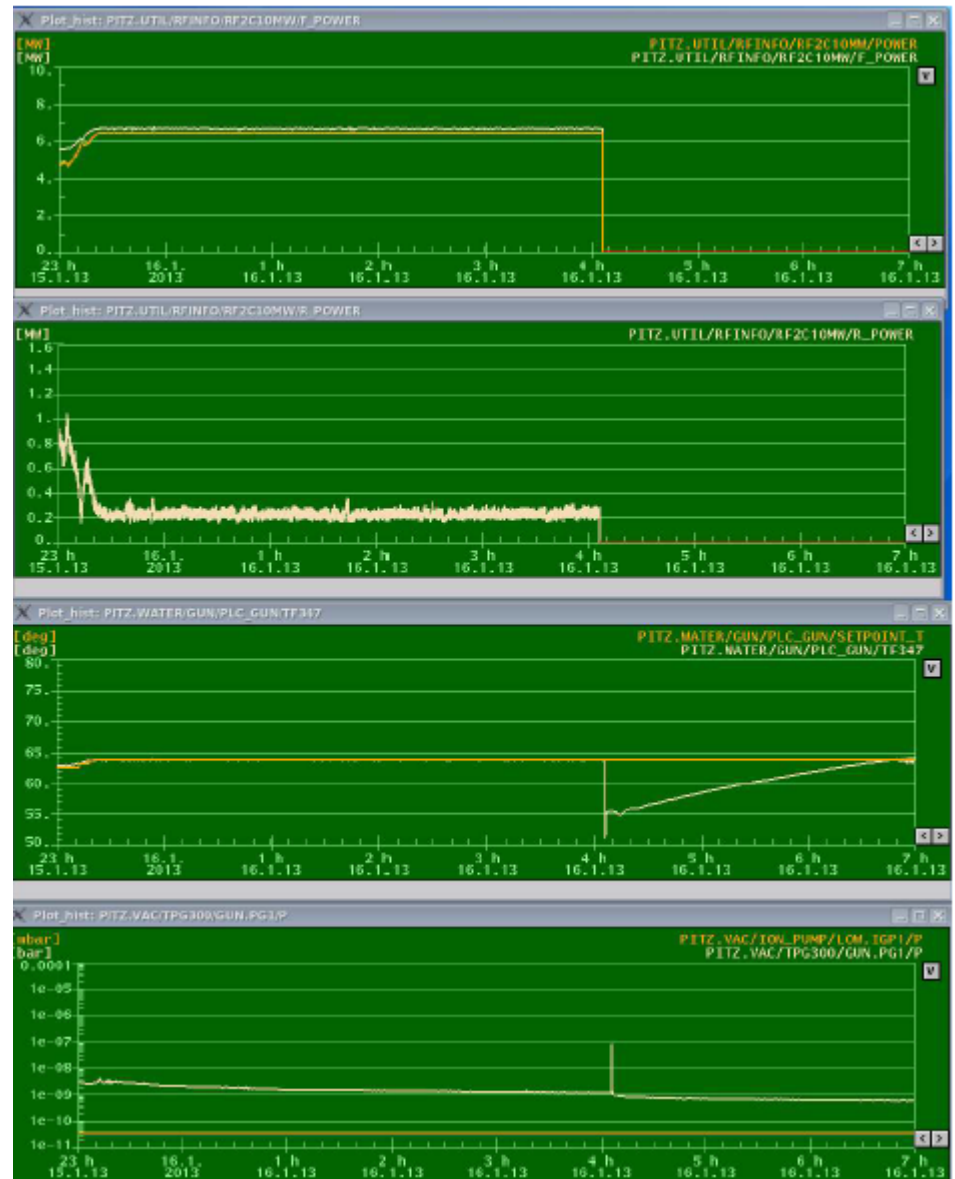
Week 3: high average power runs

RF pulse length RR=10Hz	I _{main} =0A	I _{main} =315A
650us	6.5MW: <ul style="list-style-type: none">• 2h on 13.01.2013• 5h on 15.01.2013N	4.5MW: <ul style="list-style-type: none">• 1h on 19.01.2013M
830us	5MW: <ul style="list-style-type: none">• 4h on 13.01.2013 4.5MW: <ul style="list-style-type: none">• 5h on 16.01.2013N 4.9MW: <ul style="list-style-type: none">• 8h on 17.01N-18.01M*	4MW: <ul style="list-style-type: none">• 8h on 19.01N--20.01M*• 8.5h on 20.01N--21.01M*

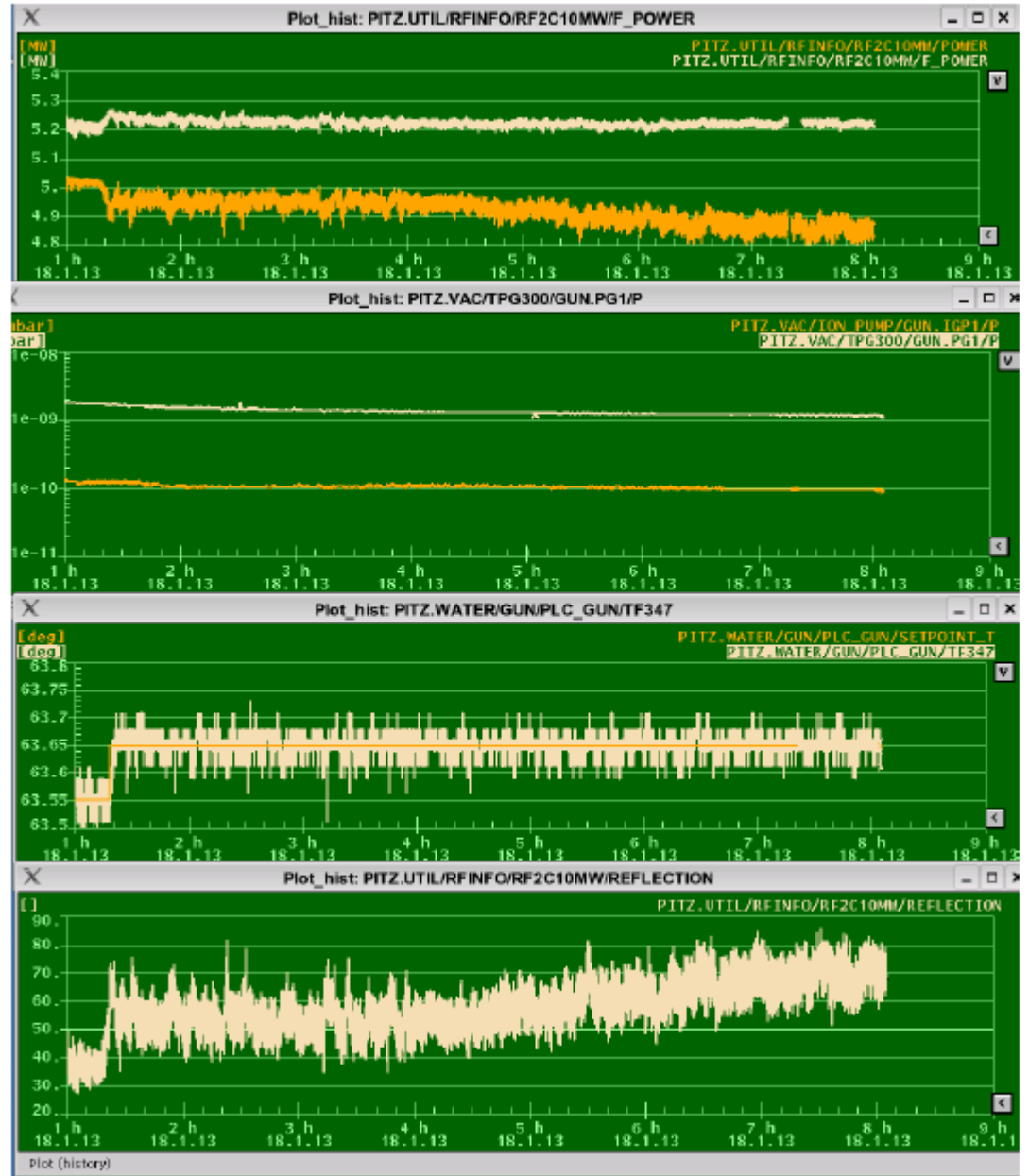
* → automatic stable run was stopped by morning shift to continue with active conditioning

5 hours run with 650 us, without solenoid

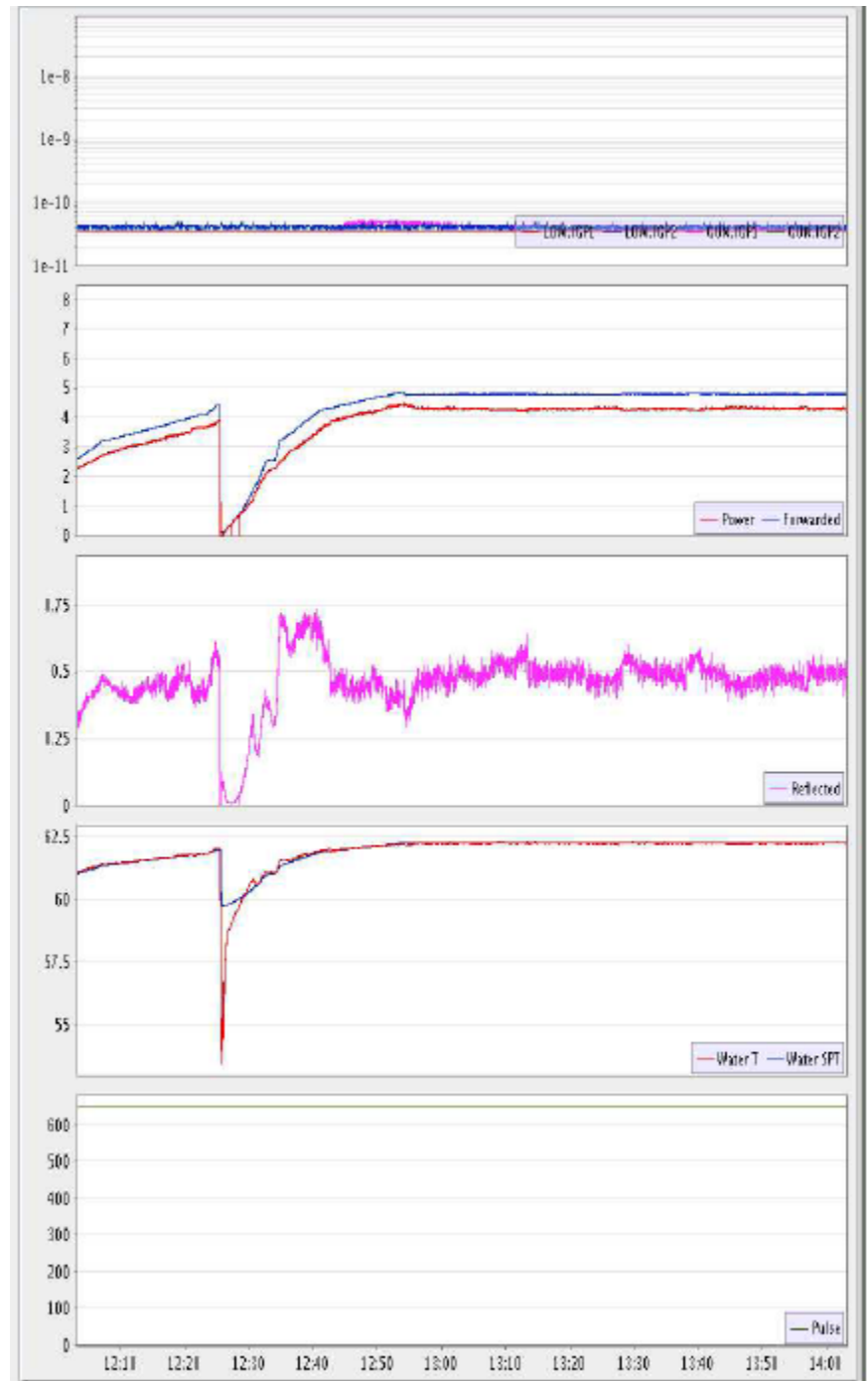
15_01_n



8 hours run with 830 us, without solenoid
17_01_n + 18_01_m

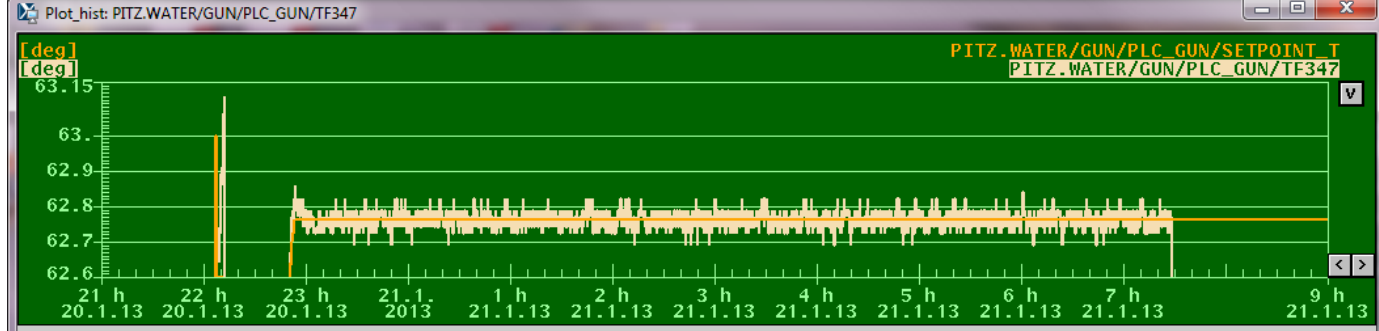
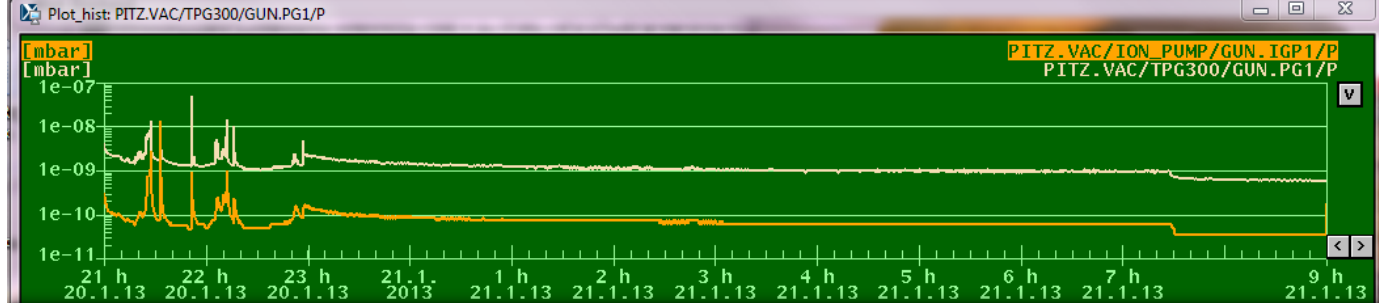
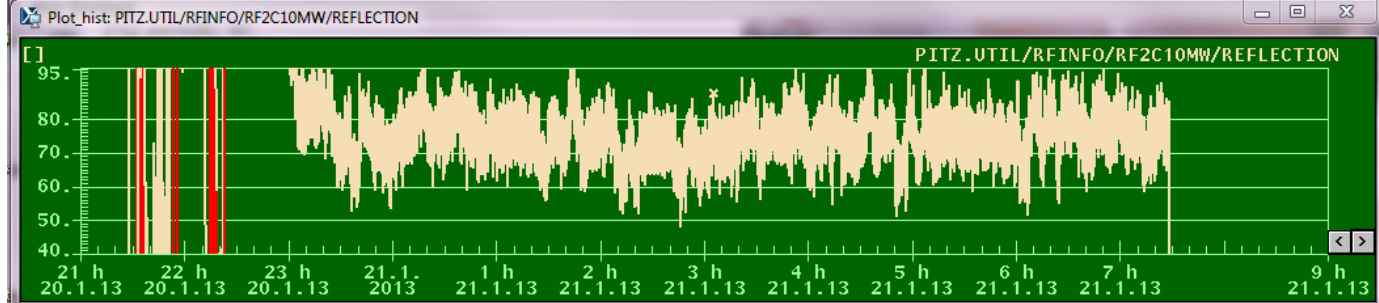
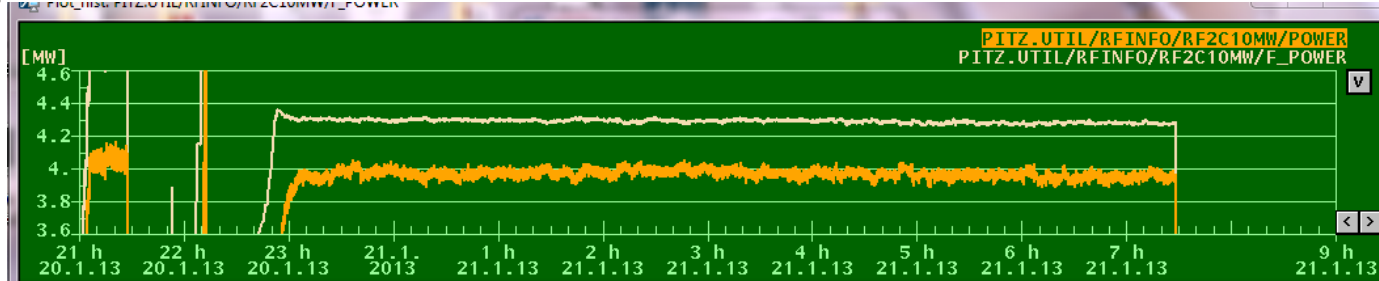


1 hour run with 650 us, sol
315 A
19_01_m



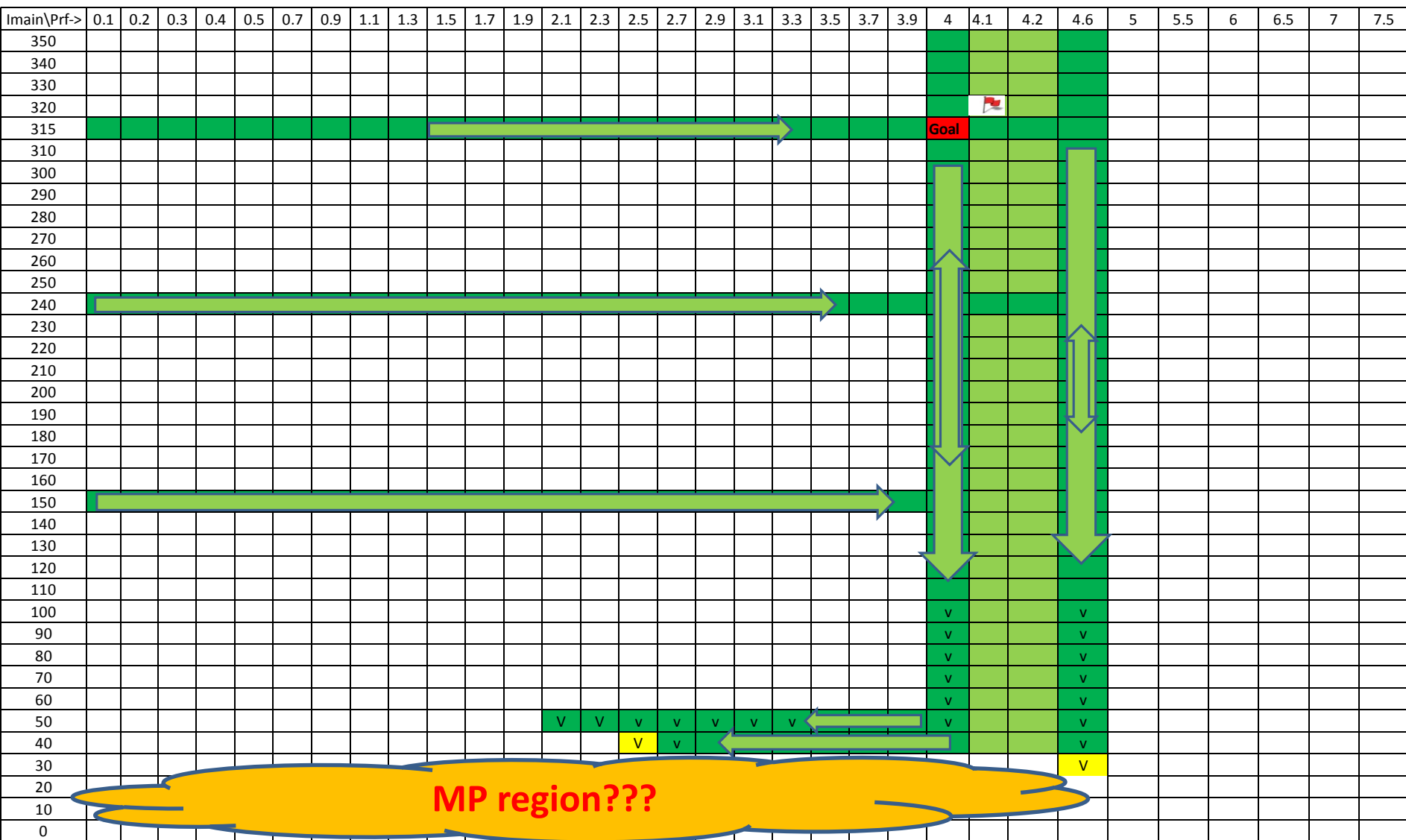
8.5 hours run with 830 us, sol 315 A

20_01_a+20_01_n



Plot (history)

Solenoid sweep (e.g. 20.01.2013M → 10us x 10Hz)

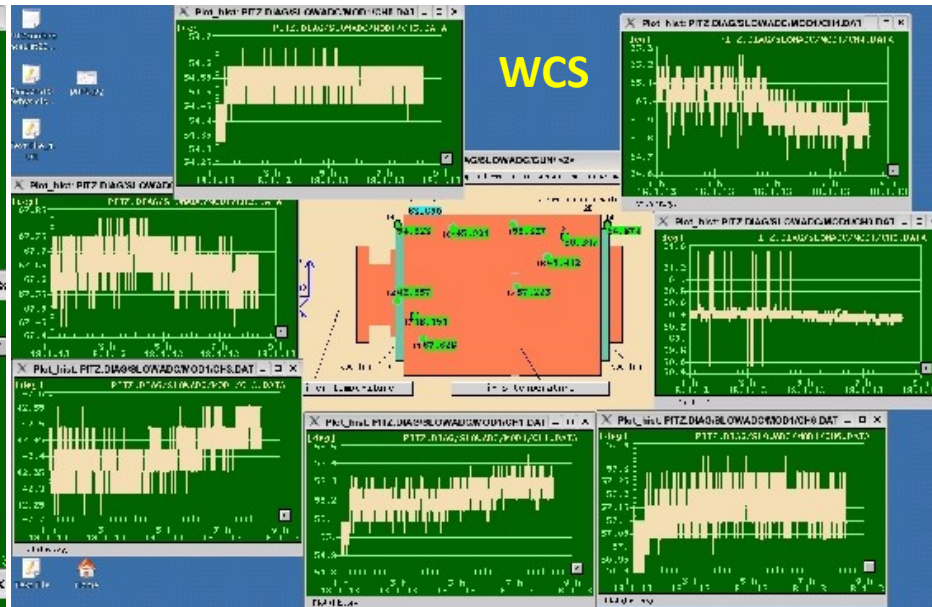
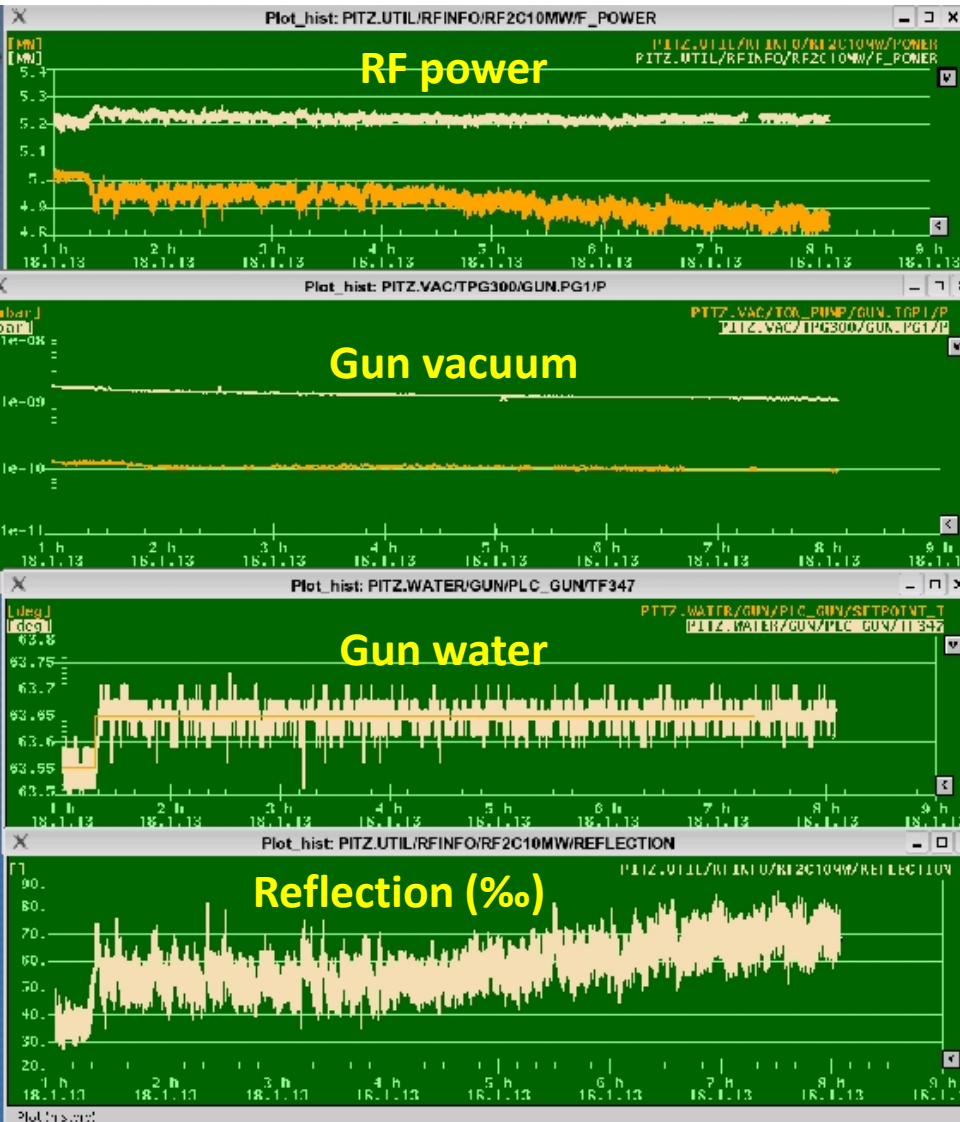


- Passed or conditioned region
- Assumed to be fine
- Problem region
- X
- V Vacuum interlocks
- Goal
- v increased vacuum activity (no IL)

Problems observed

Slow drift observed during high average power run:

- 18.01.2013 (N-M): 150kW drop of the rf power in the cavity whereas the forward power was stably running at 5.2MW ($\sim 5\text{MW} \times 830\mu\text{s} \times 10\text{Hz}$)

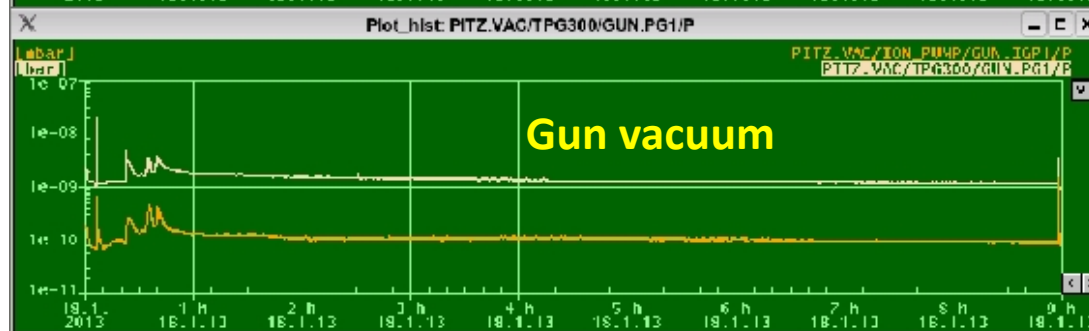
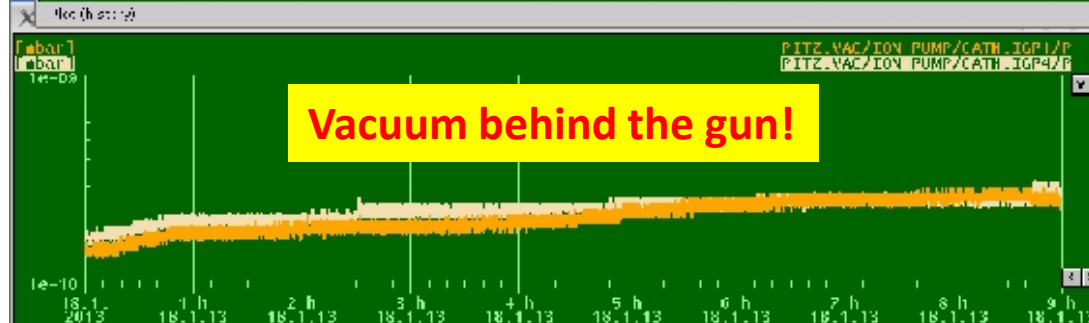
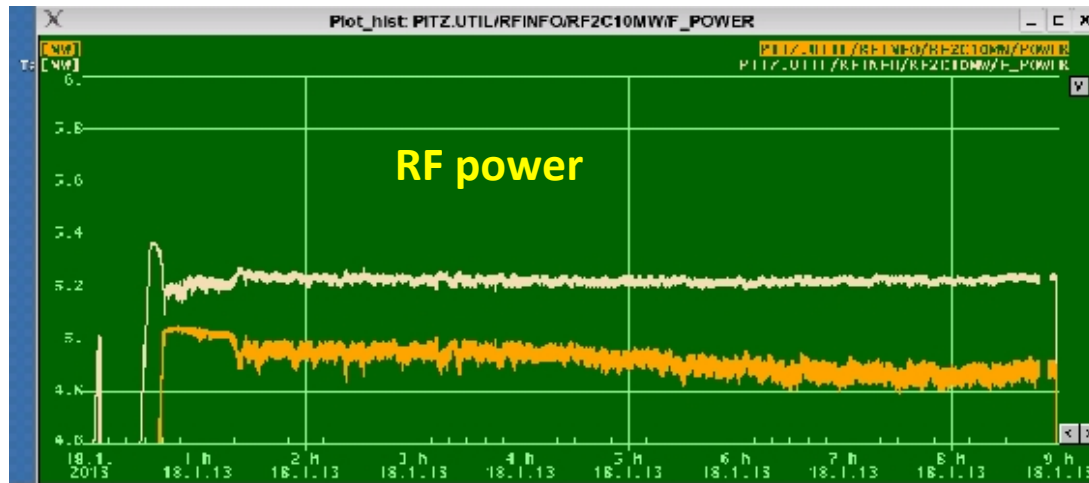


?redistribution (drift) of the gun (effective) temperature?

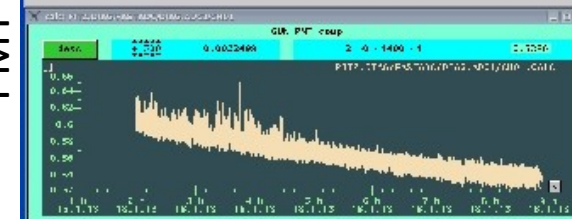
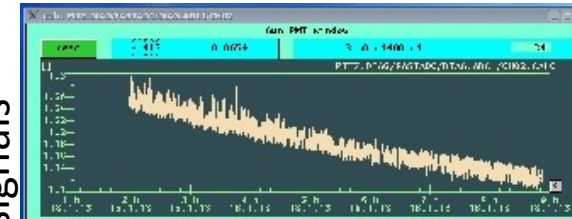
Problems observed

Slow drift observed during high average power run:

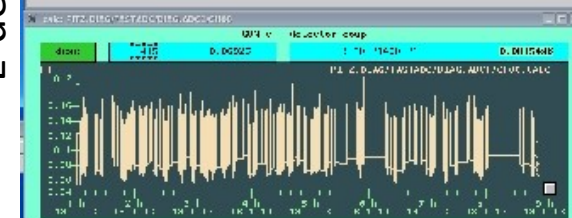
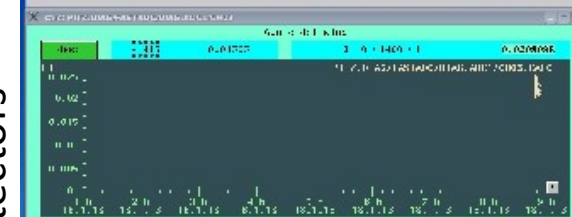
- 18.01.2013 (N-M): 150kW drop of the rf power in the cavity whereas the forward power was stably running at 5.2MW ($\sim 5\text{MW} \times 830\mu\text{s} \times 10\text{Hz}$)



PMT signals



E-detectors

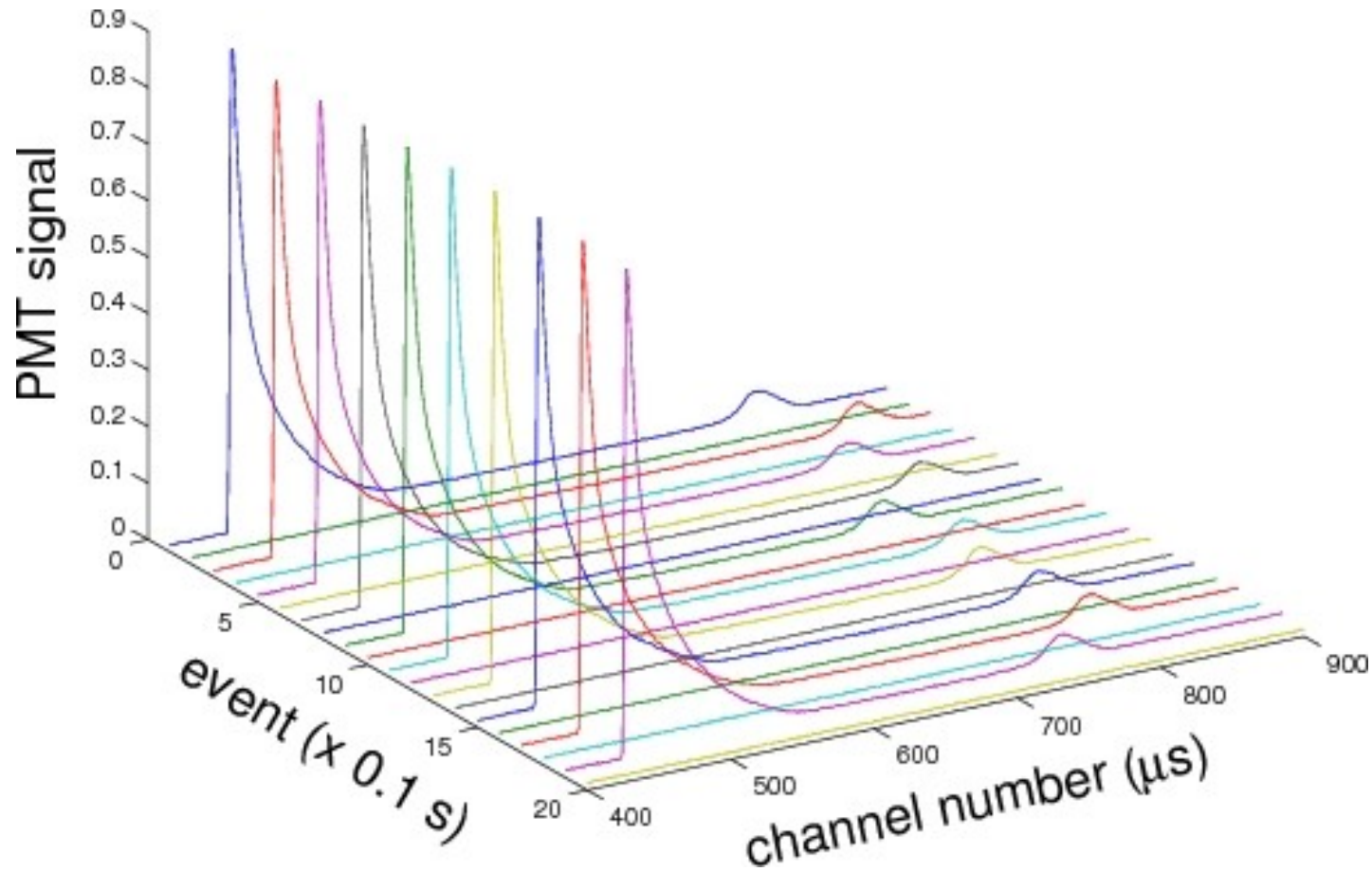


γ -detect.



Problems observed

PMT signals are unstable at long rf pulses (830us, 4MW) → observed 20.01.2013M

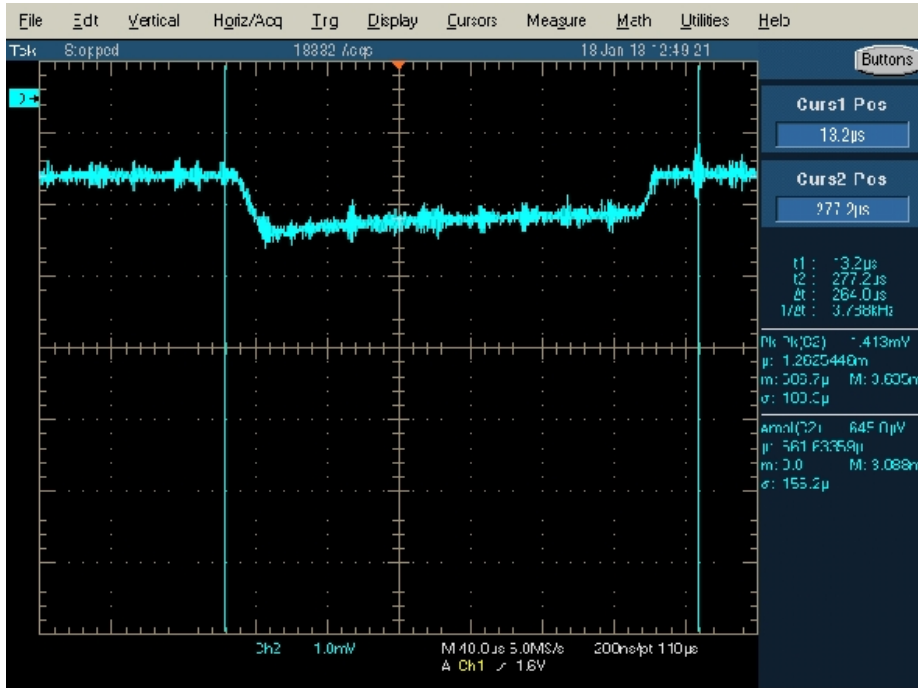


1. Regular PMT signal is missing for each second event (not 0, but noise!)
2. This happens with both PMTs simultaneously
3. This (up to now) was observed only for 830us rf pulse length
4. The second (small) bump is "traveling" along the pulse.

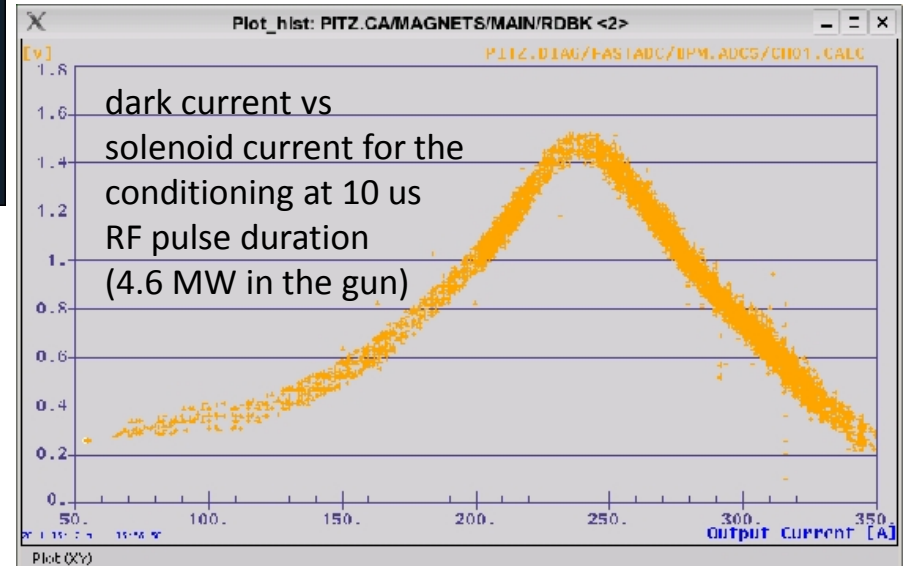
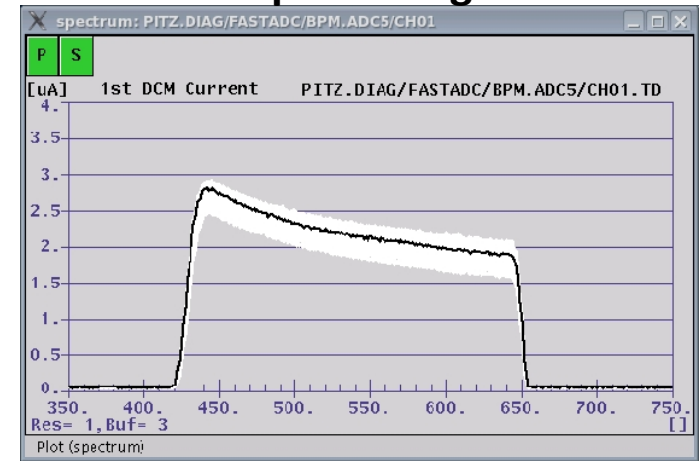
Dark current from the gun-3.1

The CR scope was replaced → measurements are available now (?DOOCS server?)

Dark current measured with the Faraday cup
(about 30 μA), 7.2MW in the cavity

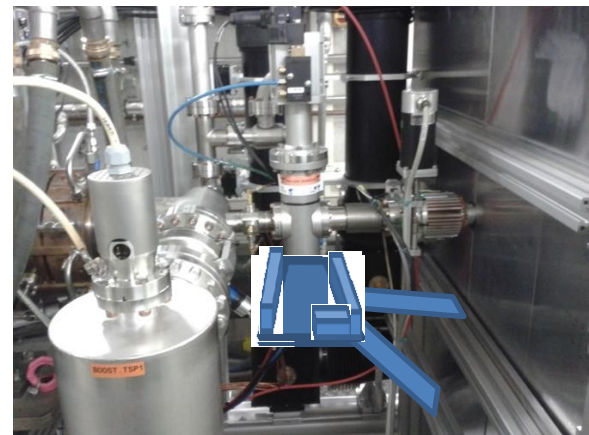
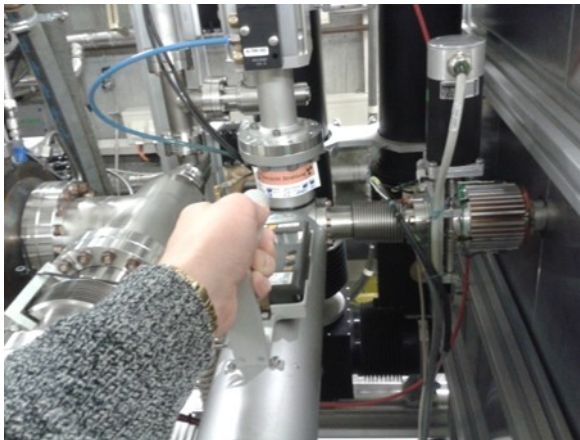


Dark current for 7.2 MW in the gun
for 200 μs RF pulse length



Weeks 4-5: Plans

- Gun-3.1 + RF Window conditioning
 - Solenoid sweep for higher peak power levels ($>5\text{MW}$). Start: $10\mu\text{s}$
 - Try to condition MP region ($I_{\text{main}} < 40\text{A}$)
 - Stability tests (night runs):
 - $10\text{Hz} \times 650\mu\text{s} \times 6.5\text{MW}(\text{or } >)$ $\rightarrow I_{\text{main}} = 0\text{A}; 315\text{A}; 400\text{A}$
 - $10\text{Hz} \times 830\mu\text{s} \times 5\text{MW}(4\text{MW})$ $\rightarrow I_{\text{main}} = 0\text{A} (315\text{A})$
- CDS booster test run:
 - Pre-conditions: radiation measurement supports \rightarrow construction ongoing



Weeks 4-5: Plans

- Cathode box exchange – Mo, 28.01.2013
- CDS booster test run → Tue, 29.01?? → preparatory meeting on Mon, 28.01?
- Cs2Te cathode conditioning – Wed, 30.01.2013
- PE production
- Longitudinal momentum measurements (LMM)
 1. Preparation (resonance and RF FB tuning)
 2. Gun characterization -> Pz vs. gun phase for various gun gradients
 3. LPS tomography (DM program)

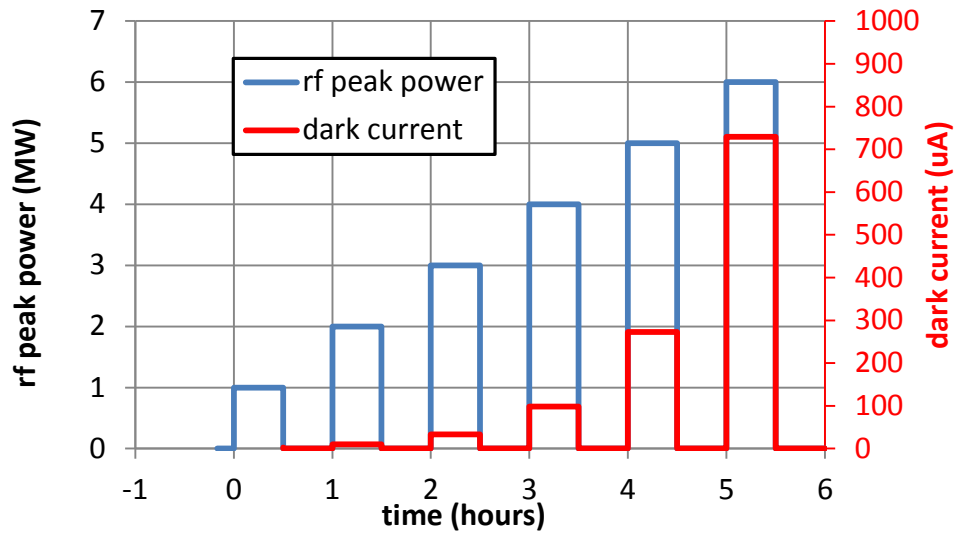
Fri Jan-25	Sat Jan-26	Sun Jan-27	Mon Jan-28	Tue Jan-29	Wed Jan-30	Thu Jan-31	Fri Feb-01	Sat Feb-02	Sun Feb-03	
Khojoyan Kalantaryan	Khojoyan Kalantaryan	Khojoyan Kalantaryan	Cathode box exchange	CDS test run?	Cond. Cs2Te PE	Stephan LMM-1	LMM-2	Stephan Pathak	Stephan Pathak	
					+ MAMA tests	Otevre LMM-2	Malyutin LMM-2,3	LMM-3	Malyutin Kourkafas	Malyutin Kourkafas
Stability tests			Stability LT tests							
Vashchenko	Vashchenko	Vashchenko	Otevre	Otevre	Otevre	Otevre	Malyutin	Malyutin	Malyutin	

Gun-3.1 + RF Window conditioning

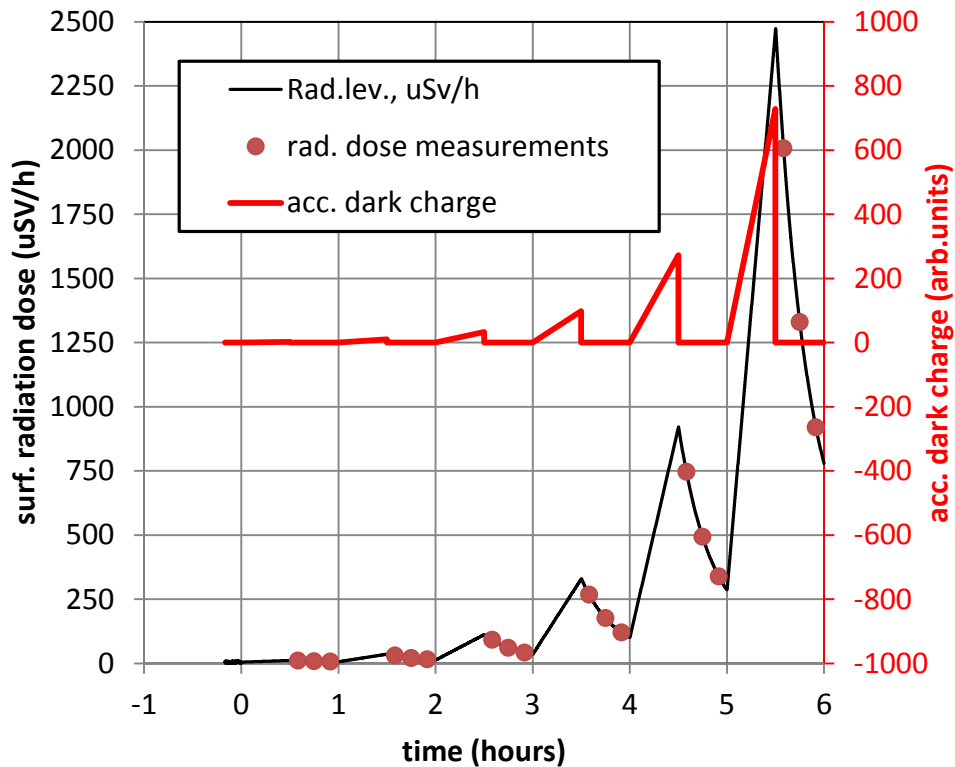
Measurement program 2013/1

item	Task	Description	Responsible	program available?
1	Gun-3.1 conditioning	+Cs2Te cathode	MK	+
2	CDS booster test run		? , MK	+
3	Long. momentum measurements	Gun characterization + data for LPS tomography trial	DM, MK	+
4	Gun stability measurements	Amplitude and phase, + pulse train flatness	Igl	+
5	Emittance measurements	Min emittance for 0.02; 0.1; 0.25;1;2 and 3nC (new), slit scan	MK, GV	
6	Emittance vs. booster gradient	100pC	GV	
7	Emittance vs gun gradient	45 vs. 60MV/m		
8	Emittance vs. laser rt		+MG, GK	
9	Emittance optimization for Gaussian	laser pulse length variation		
10	Emittance along the beam line and tomography	100pC?	GeK	
11	RF gun coupler kick studies	???	MK, Igl	
12	Studies for PWA	Kapton window tests	MG	
13	Solenoid BBA	Still magnetizable parts	MK	
14	BPM commissioning	Timing + calibration	MK	
15	Low charge studies	short pulse characterization	BM	
16	Laser shapes adjustment	Temporal and transverse	GK, MG	

Proposals for the measurement program and simulations of the expected run



Main idea → several short (~30min) run periods with step increase of the peak rf power in the CDS, followed by short off periods (~30min), which should be used for surface dose rate measurements (e.g. 3 measurements 5;15;25 min)



date, time	elapsed time (min)	<Prf> (MW)	<DC> meas. (uA)	accum. dark charge	meas. dose rate (uSv/h)	remark
XX:XX	0	1.1	2.23			
XX:XX	30	1.1	2.23	4.0		
XX:XX	35	0	0.00		10.3	
XX:XX	45	0	0.00		8.2	
XX:XX	55	0	0.00		6.9	
XX:XX	60	2.1	9.91			
XX:XX	90	2.1	9.91	17.8		
XX:XX	95	0	0.00		29.9	
XX:XX	105	0	0.00		20.7	
XX:XX	115	0	0.00		15.1	
XX:XX	120	3.2	33.07			
XX:XX	150	3.2	33.07	59.5		
XX:XX	155	0	0.00		91.2	
XX:XX	165	0	0.00		60.5	
XX:XX	175	0	0.00		41.9	
XX:XX	180	4	119.2			
XX:XX	210	4	119.2	176.6		
XX:XX	215	0	0.00		91.2	
XX:XX	225	0	0.00		60.5	
XX:XX	235	0	0.00		41.9	
XX:XX	240	5.1	272.99			
XX:XX	270	5.1	272.99	491.4		
XX:XX	275	0	0.00		91.2	
XX:XX	285	0	0.00		60.5	
XX:XX	295	0	0.00		41.9	
XX:XX	300	6.2	729.06			
XX:XX	330	6.2	729.06	1312.3		
XX:XX	335	0	0		91.2	
XX:XX	345	0	0		60.5	
XX:XX	355	0	0		41.9	