

# PITZ Run Coordination Meeting

## 16.02.2012

# Tasks for the week 6

## Boundary condition:

- no RF1;
- RF2 phase shifter is not controllable
- screen H1.S4 – structure

## To observe:

- New gamma detectors signals
- Laser position jitter (on request)

1. Dark current measurements SL – 6-7.02 (late, night shifts)
2. **QE and QE map SL – 6.2 (late, night shifts)**
3. By pass of the pulse shaper → short Gaussian laser pulse
4. **Momentum measurements (gun) – phase scans in LEDA for various power levels for short Gaussian laser pulses**
5. **Emission studies – repeat for short Gaussian laser pulses (before FC-ICT cross-check)**
6. **Thermal emittance studies – not possible due to many ILs**
7. E-beam size at various screens (asymmetry investigations)
8. Trajectory studies for best beam shape (emittance)
9. **AOM test – done 7.2 (Late)**

Week 6	Mon Feb-06	Tue Feb-07	Wed Feb-08	Thu Feb-09	Fri Feb-10	Sat Feb-11	Sun Feb-12
Morn. 7:00 to 15:30	RC Malyutin Li	Malyutin Li	Vashchenko	Vashchenko	Vashchenko	Malyutin Orlov	Malyutin Orlov
Late 15:00 to 23:30	AOM						
Night 23:00 to 7:30	Gross Isaev QE, QE-maps dark current (+SL)	Gross Isaev	Otevrel	Otevrel	Otevrel	Otevrel	Otevrel
	Kusoljariyakul	Kusoljariyakul	Kusoljariyakul	Kusoljariyakul	Kusoljariyakul	Kusoljariyakul	Kusoljariyakul

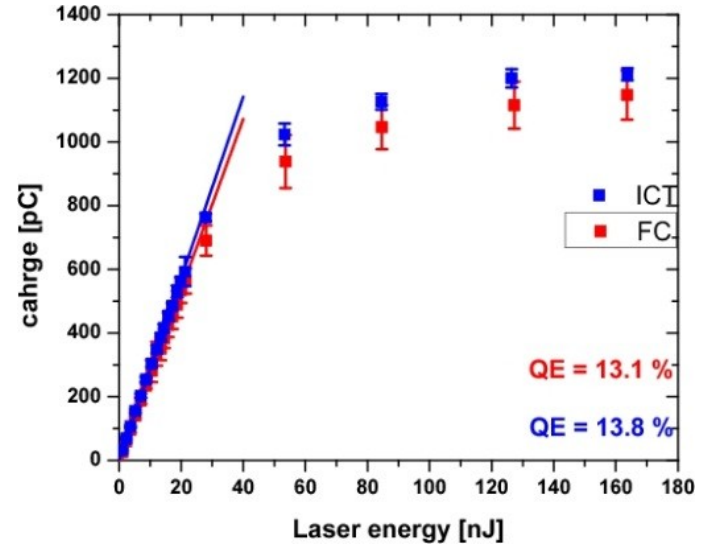
Momentum measurements  
+  
Emission studies with short Gaussian

Thermal emittance

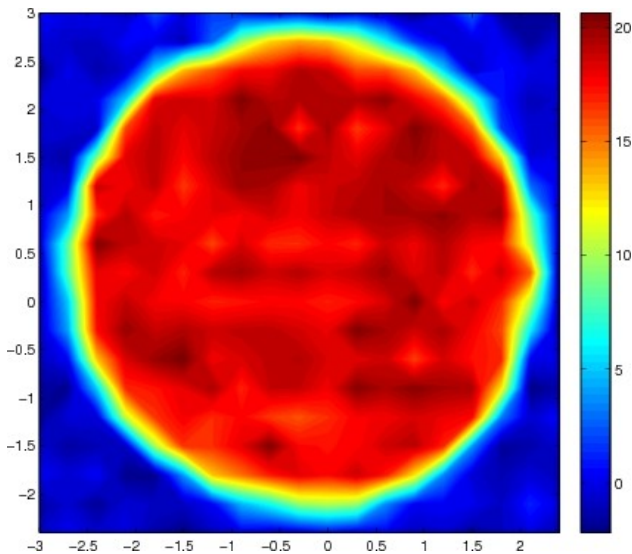
# Achievements of the week 6

QE and QE map:  
(Sven Lederer) – 06.02 (late + night shifts)

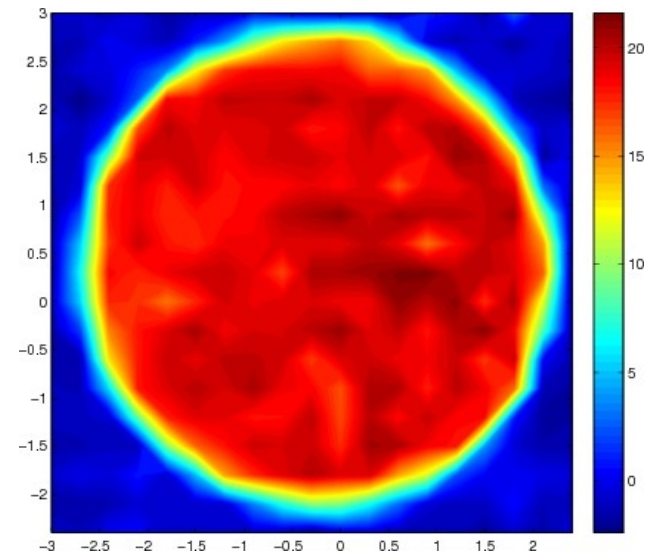
- Measured Quantum efficiency  $\sim 13\%$



QE map for 6.0MW in the gun



QE map for 4.5MW in the gun



# Achievements of the week 6

## Momentum measurements & Emission studies with short Gaussian LASER

- Both programs measured simultaneously for [6.8, 6.0, 5.5, 5.0, 4.5, 4.0, 3.5, 3.0, 2.5, 2.0, 1.5, 1.0, 0.5] MW in the gun, Feedback ON

- BSA = 1.2mm

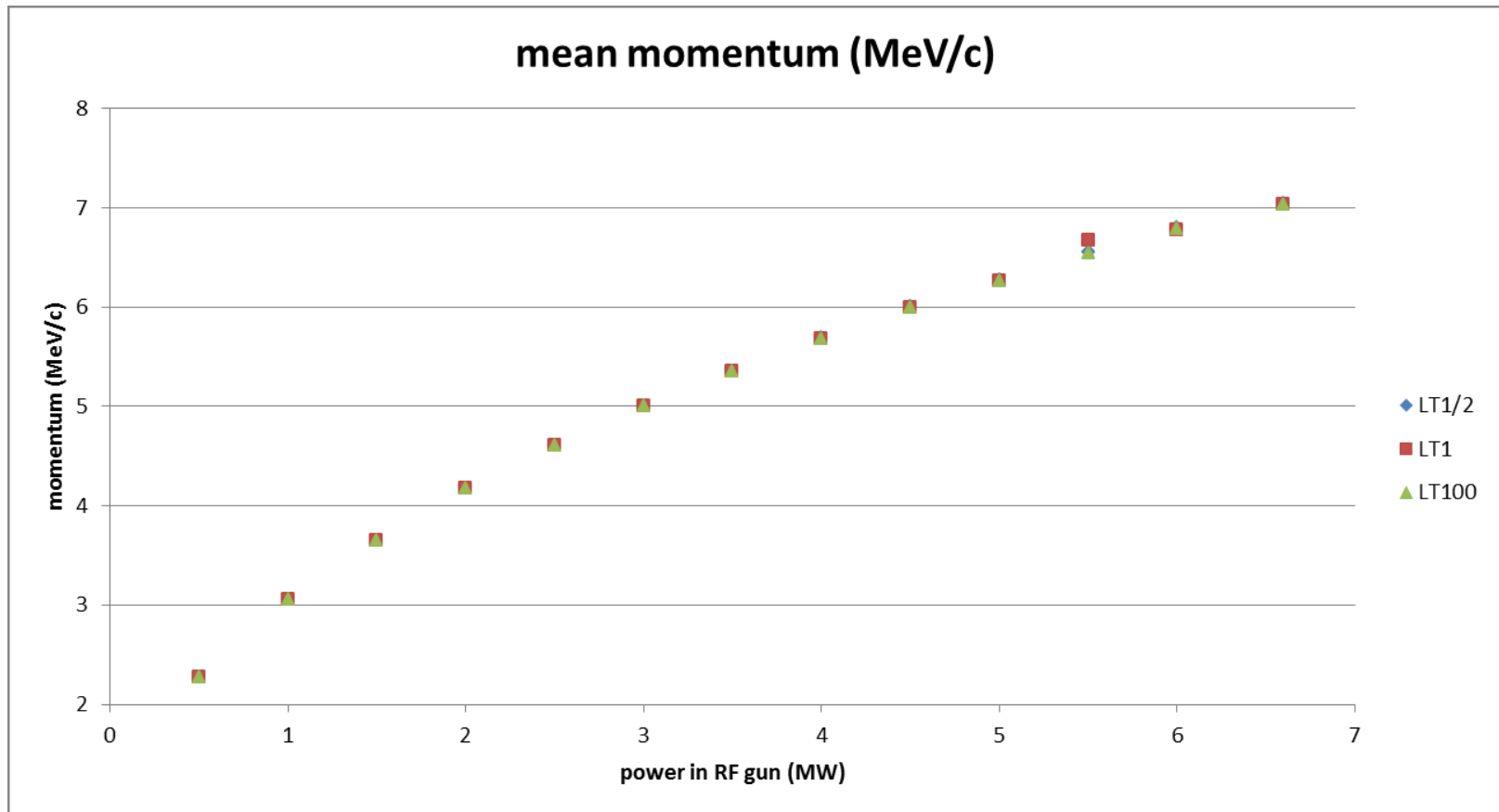
- Measurements for 3 laser transmissions:
  - LT1 defined to have  $\sim 700\text{pJ}$  energy of laser pulse for BSA = 1.2mm (ca. 25%,  $Q_{\text{MaxPower}} = 370\text{pC}$ )
  - LT1/2
  - 100%
- 3x MAMA scan for LT1, LT1/2, 100%
- 1x Attenuator scan done for each power level
- 3x Charge-Phase scan (“Schottky” scan) for LT1, LT1/2, 100%
- 1x Detailed “Schottky” scan around zero-crossing for low charge ( $\sim 10\text{pC}$  max, LT = 1-2%)

### Comment:

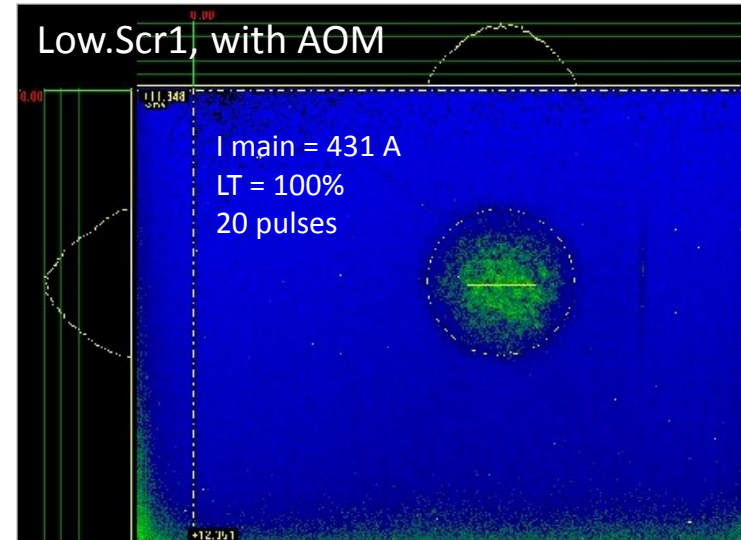
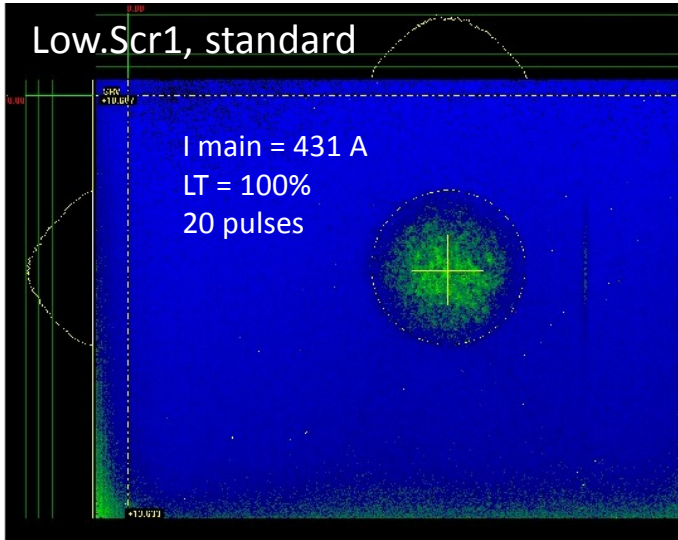
- $I_{\text{main-0}}$  for the phase scans had to be reconsidered, particularly for low gun gradients

# Achievements of the week 6

## Momentum measurements results



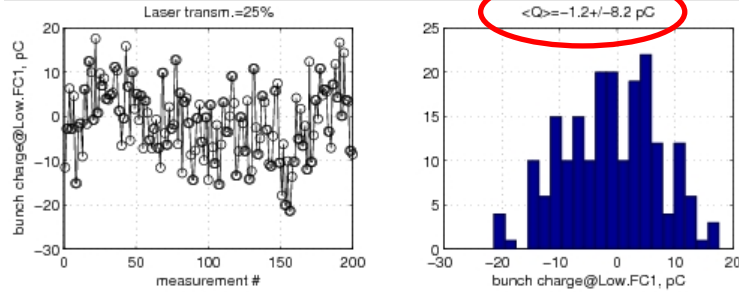
# Tests with AOM (20120207A)



Additional tests with Low.Scr 2&3

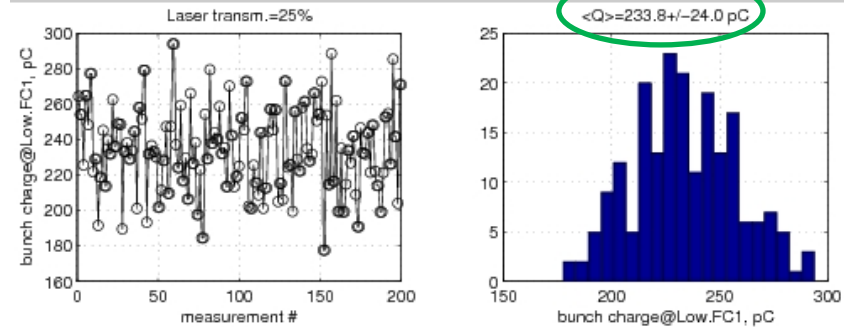
→ No visible influence of AOM on e-beam

07.02.2012 17:38 M.Gross, I.Isaev Charge at Low.FC1  
pulse 1 (kicked by AOM)  
LT 25%  
BSA 1.2mm



Extinction ratio: No charge measurable at position of kicked pulse

07.02.2012 17:42 M.Gross, I.Isaev Charge at Low.FC1  
pulse 2 (non kicked by AOM)



## Summary of Problems, shifts 6-12 February

- RF2
  - **The shape of the vector sum amplitude changes significantly with SP\_Phase when feedback ON**
  - **"Hills" in the SP-Phase vs. gun-power (faked) dependence, distance between the hills 90deg, observed only for high power levels)**
- Gun interlocks
  - **Gun photo-multiplier ILs – HIGH RATE**
  - Gun photo-multiplier interlocks not seen in the ADC spectrum
  - Fake vacuum interlock (10.2N)
- Laser
  - Instability, Laser PTO had to be readjusted (6.2N,7.2A, 8.2N, 12.2A), Laser off suddenly (8.2N) -> *Fixed by Guido (9.2M)*
  - Charge is not unified within the train, visible both on laser train at laser booster exit and at the faraday cup(at FC the non-uniformity is about 50% while at the laser booster exit about 20%)(11.2N,12.2M)
- Communication and software
  - Solenoid micromover server problem (6.2N)
  - **NaN value in the phase field for the gun (8.2A) ... could be a more general communication problem**
  - Universal slow control does not work for Low.Scr2 and Low.Scr3 (12.2 M)
  - We got once the "TextLabel" popup message (12.2 N) – reason unknown
- Hardware
  - Course YAG screen problem
  - LowScr2 possibly not focused (could not be checked because of the univ. slow control problem)
  - No Low.FC2 signal on the scope.

# Problems of the week 6

- PMT Interlocks 6.2-15.2





# Problems of the week 6

The shape of the vector sum amplitude changes significantly with SP\_Phase when feedback ON

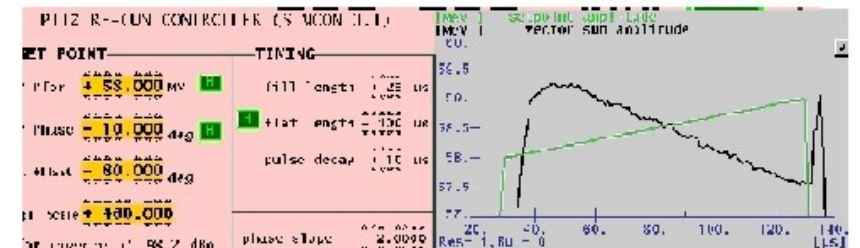
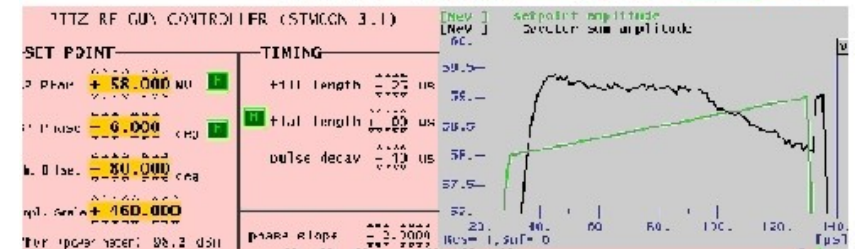
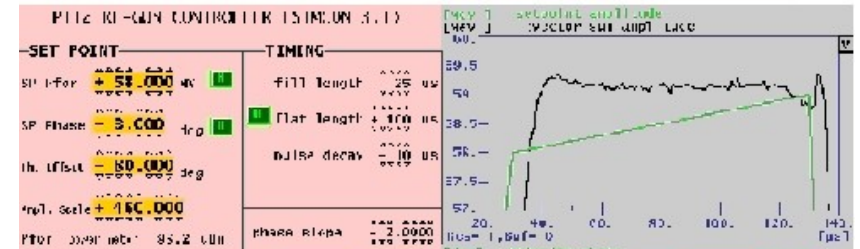
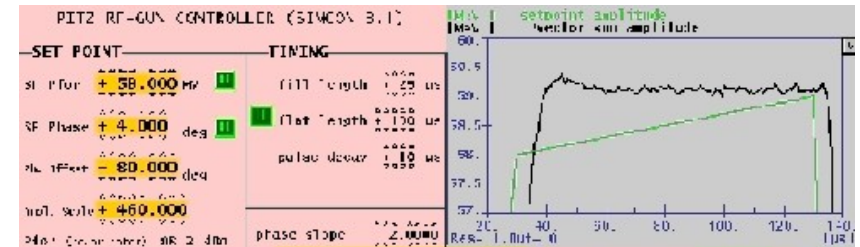
SP\_Pforw = 58 (below saturation)

RF pulse length 100us

Nothing else touched but the phase

*Suggestion for the emittance measurement program:*

- Define goal mean momentum (**margin!**)
- Find corresponding RF2 settings, incl. pulse length
- Calibrate LLRF2 to for those settings



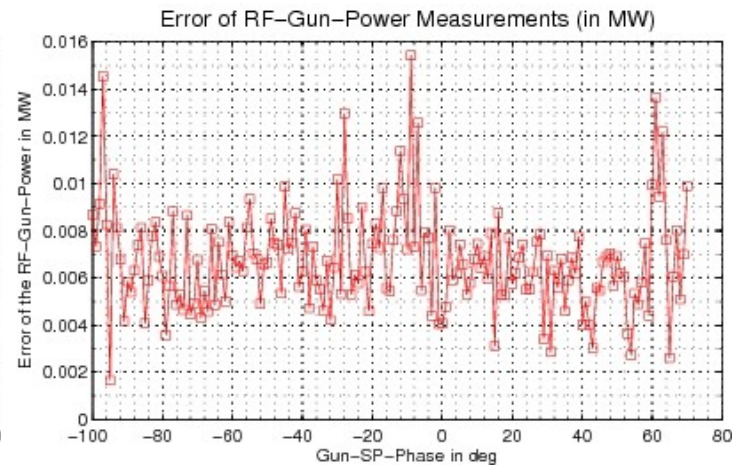
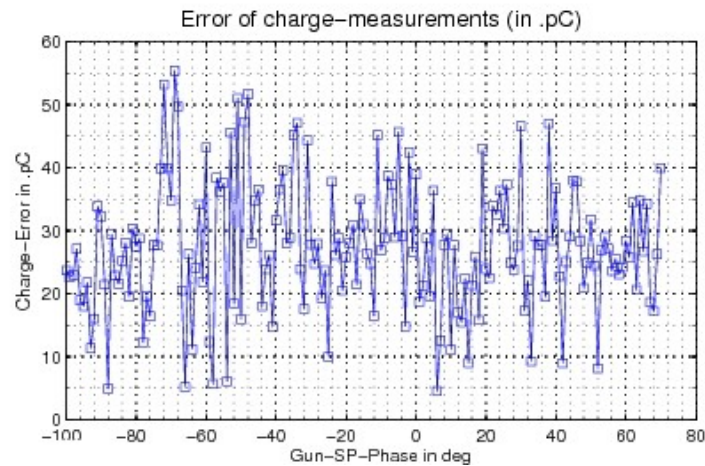
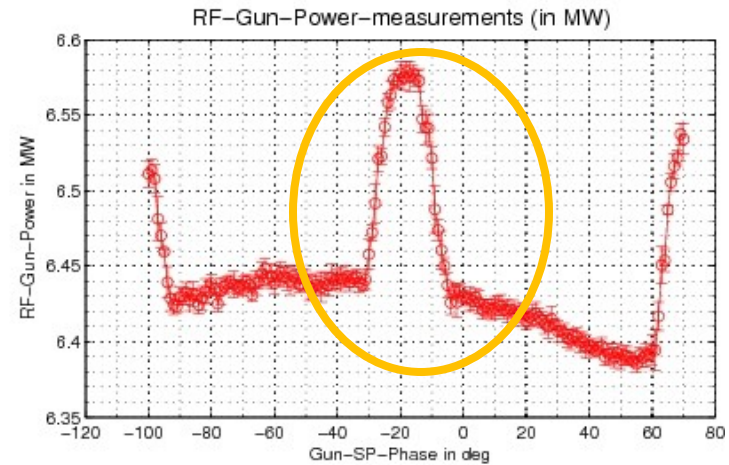
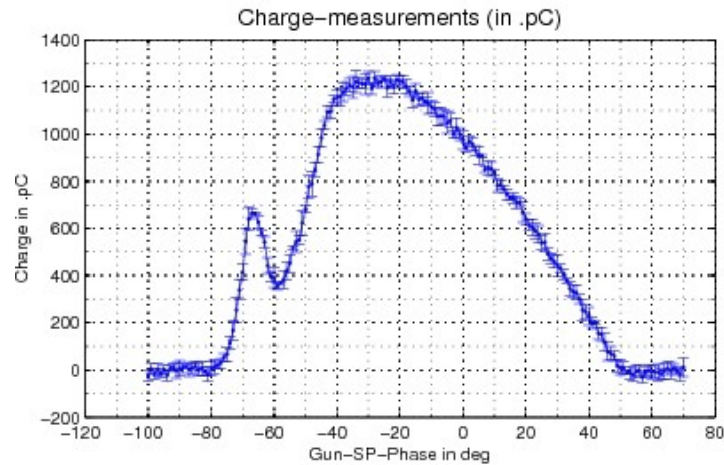
# Problems of the week 6

**"Hills" in the SP-Phase vs. gun-power (faked) dependence, distance between the hills 90deg, observed only for high power levels**

Measurement with Device -> low\_FC\_1  
Magnet-current = 479.4861 A, Laser-transmission = 100 %

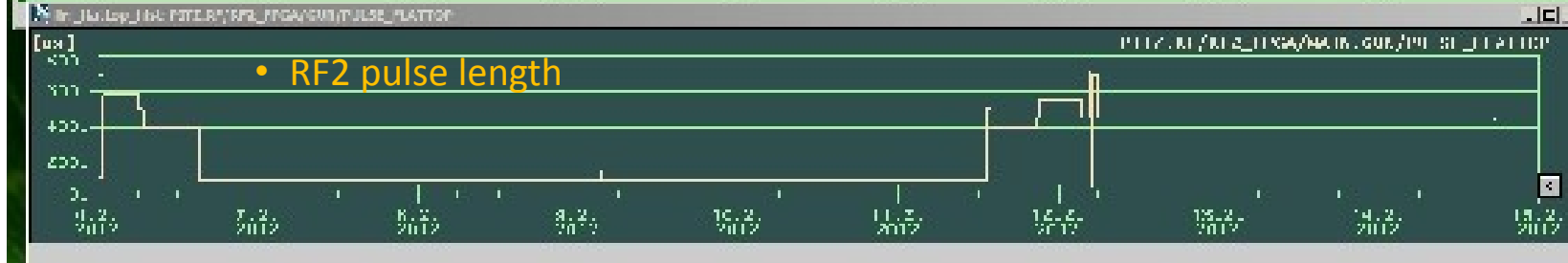
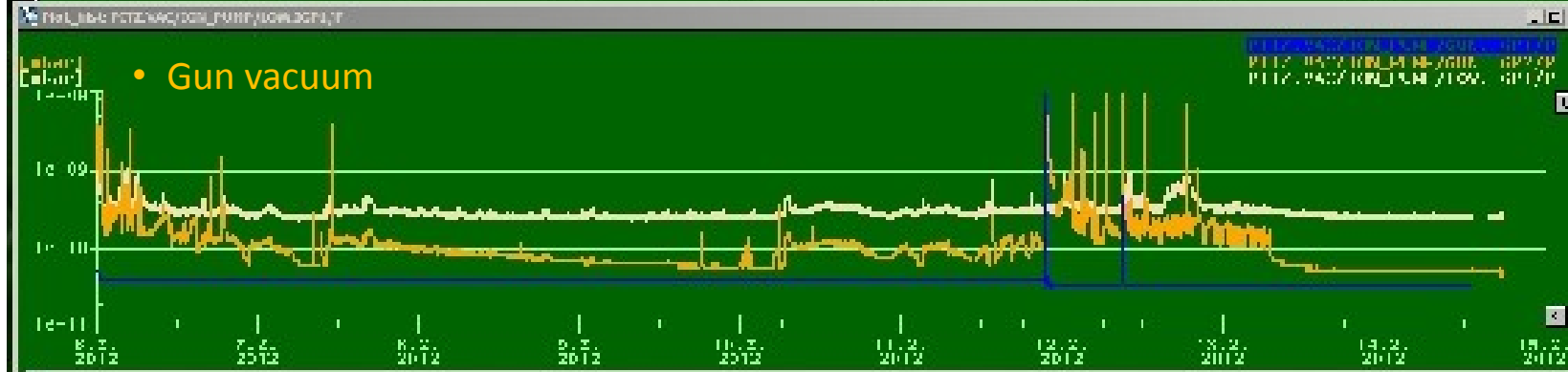
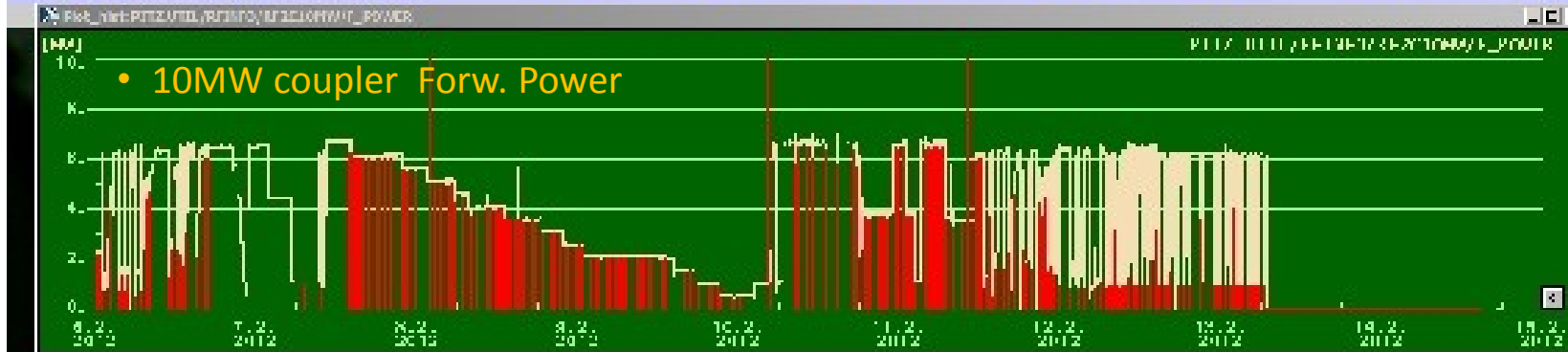
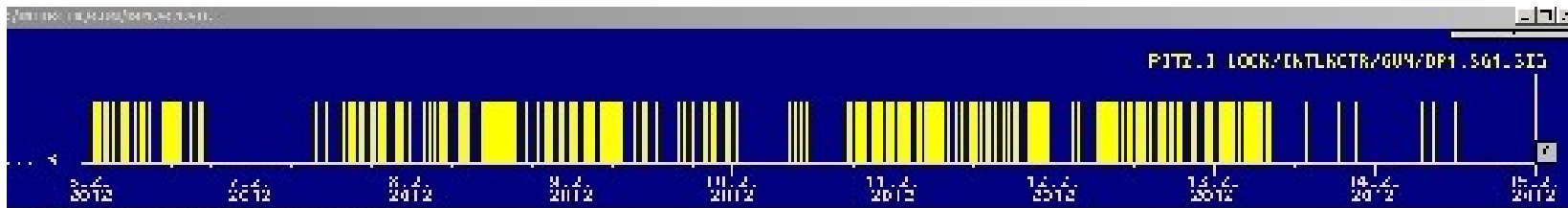
Phaseplot\_10-Feb-2012\_Fri\_10-45-06

Line-Slope = [pC/deg]  
Line-Offset = .0C



# Problems of the week 6

- PMT Interlocks 6.2-15.2



# Tasks for the week 8+9

Boundary condition:

- no RF1;
- RF2 phase shifter is not controllable
- screen H1.S4 – structure

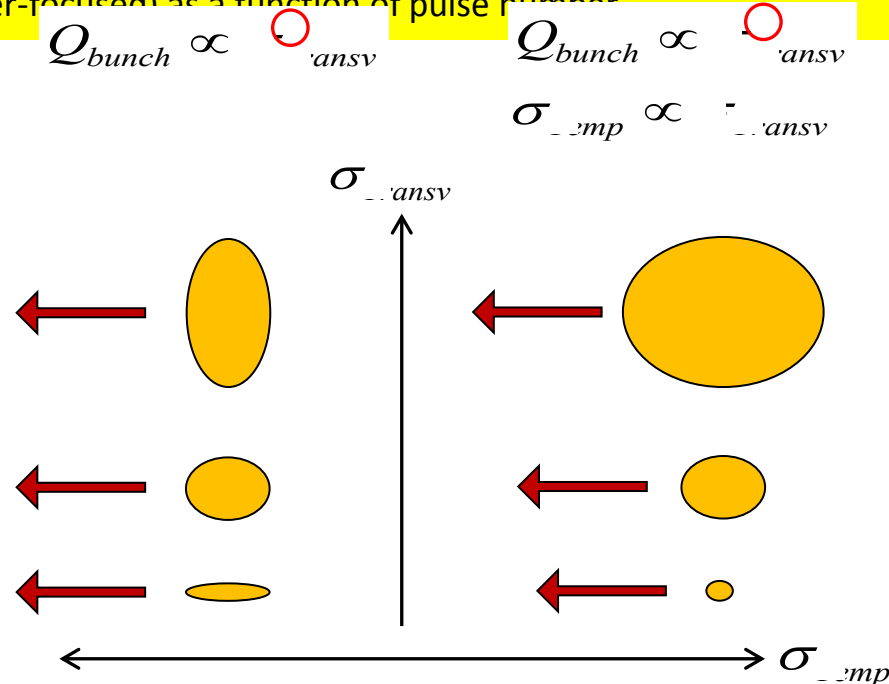
Lyot filters (different kinds) needed (Or alternatively use pulse shaper to create the desired shapes(?))

1. Gun conditioning for long (>400us) pulses
2. LASER transverse/temporal properties improvement
3. BPM test
4. FC2 check
5. Solenoid BBA
6. Steering
7. Thermal emittance studies: **constant "bunch shape"**, variable BSA-Q- $\sigma_T$  (all coupled!),
8. Thermal emittance studies: **constant BSA**, variable Q (BSA>=1.6mm,  $\sigma_T \sim 4$ ps FWHM)
9. Thermal emittance studies (x-check) for very low charges using the **double-quad scan**
10. RF2 feedback test: measure the beam size (under/over-focused) as a function of pulse number

$$\sigma_{emp} = \sigma_{ansv} \cdot \tau_{emp}$$

$$\rho_{\text{bunch}} \equiv \frac{k Q_{\text{bunch}}}{\sigma_{ansv} \cdot \tau_{emp}} = \frac{Q_{\text{bunch}}}{\sigma_{ansv}}$$

Temp.Length	BSA	Qmin	Qmax
2ps	0.23mm	1pC	2pC
...			
16ps	1.8mm	515pC	1030pC





# Tasks for the week 8+9

Week 8	Mon Feb-20	Tue Feb-21	Wed Feb-22	Thu Feb-23	Fri Feb-24	Sat Feb-25	Sun Feb-26
Morn. 7:00 to 15:30	Feedback test	<b>Thermal emittance Constant shape</b>					
Late 15:00 to 23:30	Solenoid BBA						
Night 23:00 to 7:30	Khojuyan Shapovalov						

**RESP. PRYSICIST and SSB needed for the weekend 18+19.2. !**

Week 9	Mon Feb-27	Tue Feb-28	Wed Feb-29	Thu Mar-01	Fri Mar-02	Sat Mar-03	Sun Mar-04
Morn. 7:00 to 15:30	Oteyrel M	Oteyrel	Oteyrel	Oteyrel Isaac	Oteyrel	Vashchenko	Vashchenko Mahgoub
Late 15:00 to 23:30	Kra	<b>Thermal emittance Constant BSA</b>			??	<b>Thermal emittance Quad-Scan</b>	
Night 23:00 to 7:30	Kusa				Kusa		