

PITZ Run Coordination Meeting

06.02.2014

Week 6: Plans

1. Conditioning

- A. HV=9.7kV → max peak power at 100/200/400/650us → with Mo cathode (3-4 first shifts)
- B. Another approach: conditioning with 800us pulses
- C. **Reach the milestone : 24h=6.5/650/390 → reached 6.0MW**
- D. Monitor resonance temperature (Excel file: ResTemp400usMonitoring.xlsx)
- E. Monitor dark current: 6.5MW, 200us, LOW.FC1 (same Excel file) → + solenoid scan

Conditioning check:

- 9.7kV (+MK) → max peak power (10, 50, 100, 200, 400us)
- 9.3 (9.4)kV 650us:
 - 6.5MW, if 2-3 IIs then
 - 6.4MW ...

2. Measurement program

- 1.2 Kapton foil tests with e-beam → to be repeated
- 1.2 Booster steering
- 1.4 BPM commissioning → (quasi-) parasitic mode
- 1.6 Emittance 1nC or 100pC + Tomo → GeK+GV
- 2.5 Phase stability measurements (+new WCS tests) → Igl+MK
- 2.8 Coupler kick studies → (MK +Igl)
- 2.85 low charge measurements + bunch length measurements → BM+DM+MR+TV
- 3 XFEL Toroid → (quasi-) parasitic mode

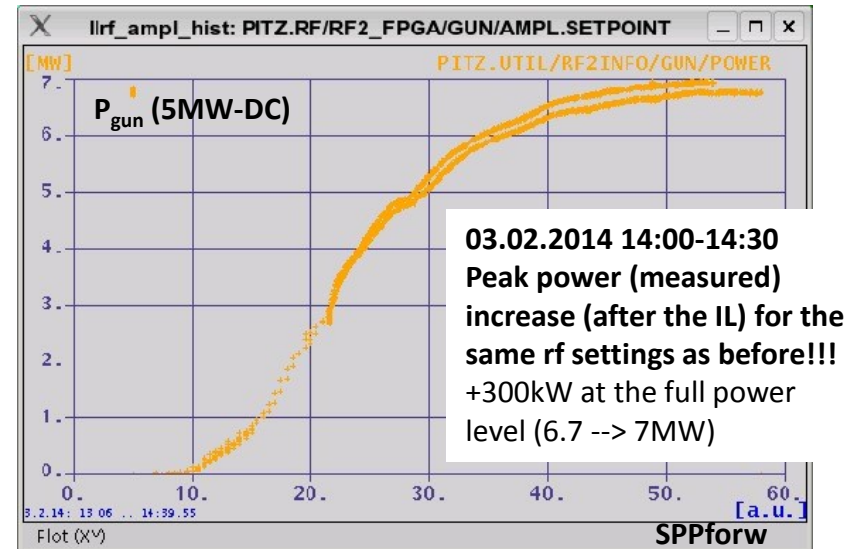
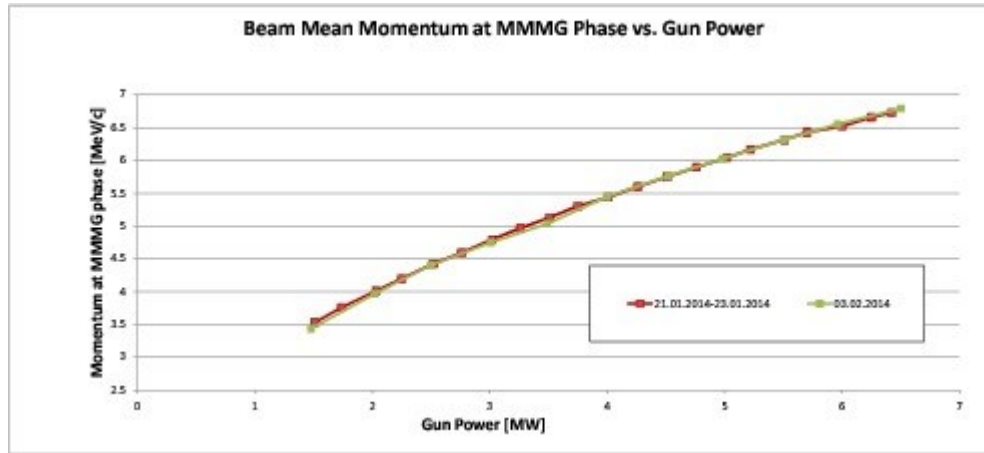
Rather smooth:

- No gun trips
- PMTs (several),
- Max.Refl.Power (more)
- Cs2Te conditioned within 1 shift

Week	Mon	Tue	Wed	Thu	Fri	Sat	Sun	Week	Mon	Tue	Wed	Thu	Fri	Sat	Sun
6	Feb-03	Feb-04	Feb-05	Feb-06	Feb-07	Feb-08	Feb-09	7	Feb-10	Feb-11	Feb-12	Feb-13	Feb-14	Feb-15	Feb-16
Morn.	HV=9.7kV	Cs2Te						Morn.							
7:00	Krasilnikov	Krasilnikov	Krasilnikov	Vashchenko	Vashchenko	Vashchenko	Vashchenko	7:00	Otevel	Otevel	Otevel	Otevel	Otevel	Krasilnikov	Krasilnikov
to	er	er	Heller	er	Good	Good	Good	to	Rublack	Rublack	Rublack	Rublack	Rublack	Rublack	Rublack
15:30								15:30							
Late								Late							
15:00	enko	o	Kourkafas	Kourkafas	Kourkafas	Kourkafas	Kourkafas	15:00	Kourkafas	Isaev	Isaev	Isaev	Isaev	Otevel	Otevel
to	B.	B.	Prach B.	Prach B.	Heller	Heller	Heller	to	Isaev	Vashchenko	Good	Good	Good	Good	Good
23:30								23:30							
Night								Night							
23:00	ss	Gross	Gross	Kapton	Gross	Gross	Gross	23:00	Khojoyan	Khojoyan	Khojoyan	Khojoyan	Khojoyan	Khojoyan	Khojoyan
to	ak	Pathak	Pathak	100pC	Pathak	Pathak	Pathak	to	Prach B.	Prach B.	Prach B.	Prach B.	Prach B.	Prach B.	Prach B.
7:30								7:30							

Problems:

- **RF2 power** readings → fixed and OK now (checked with beam momentum measurements)



- **Booster** is running now (but water temperature oscillations 0.3degC → 0.1degC now)
- RF1 (booster) **phase shifter** cannot be moved → fixed
- Gun.**PG1** and Low.PG1 → in DOOCS hanging periodically → ?
- Problems with **HIGH1.Scr4** (OTR → Kapton) unsafe mode only → solved
- Unknown (lost, spurious) gun/klystron2 **IL** at 10:41:06 – M.Penno asked to investigate
- Emittance measurements: **fastscan3** – DOOCS addresses problems → solved
- E-Beam **trajectory** is still not well established
- **Laser BL** (M4 → vacuum mirror) has to be readjusted (in a big shutdown)
- ...

Cathode exchange on 03.02.2014

Cathode #633.1 (Mo) → cathode# 640.1 (Cs₂Te)

Cathode # 633.1 visual inspection:

08.01.2014



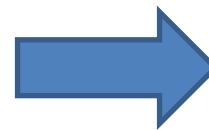
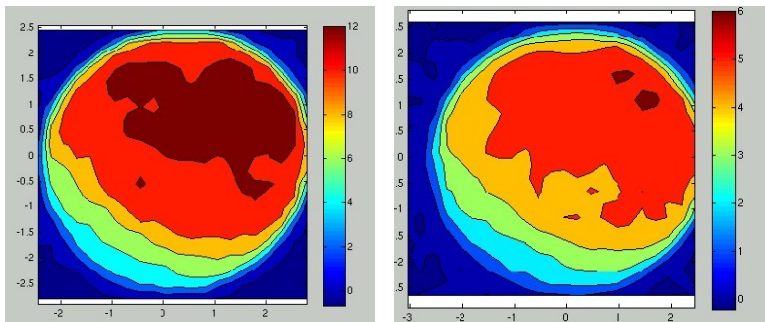
03.02.2014



Cathode # 640.1 visual inspection



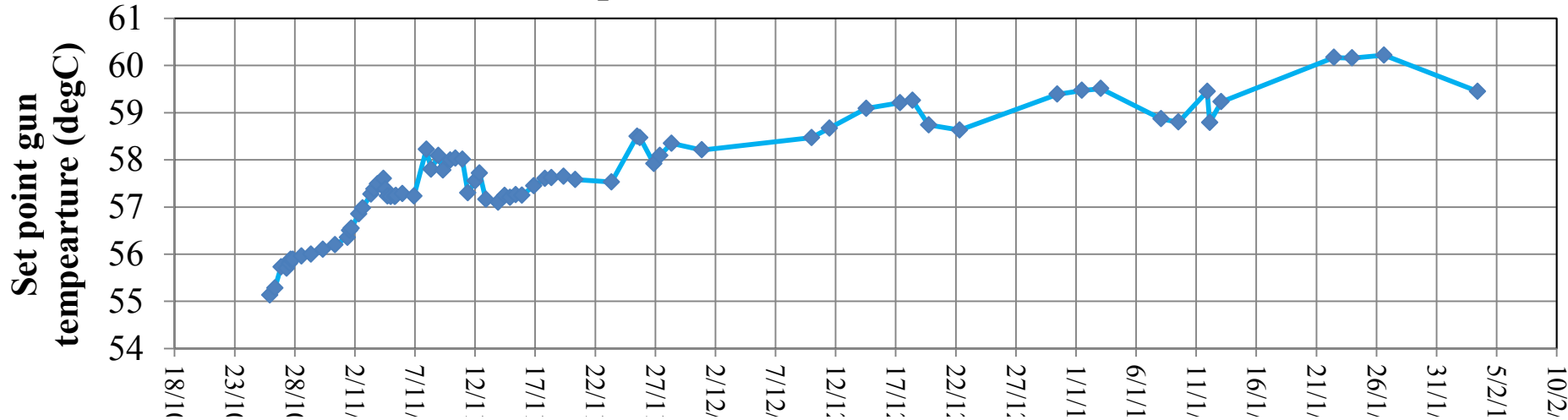
Previous QE-map measurements



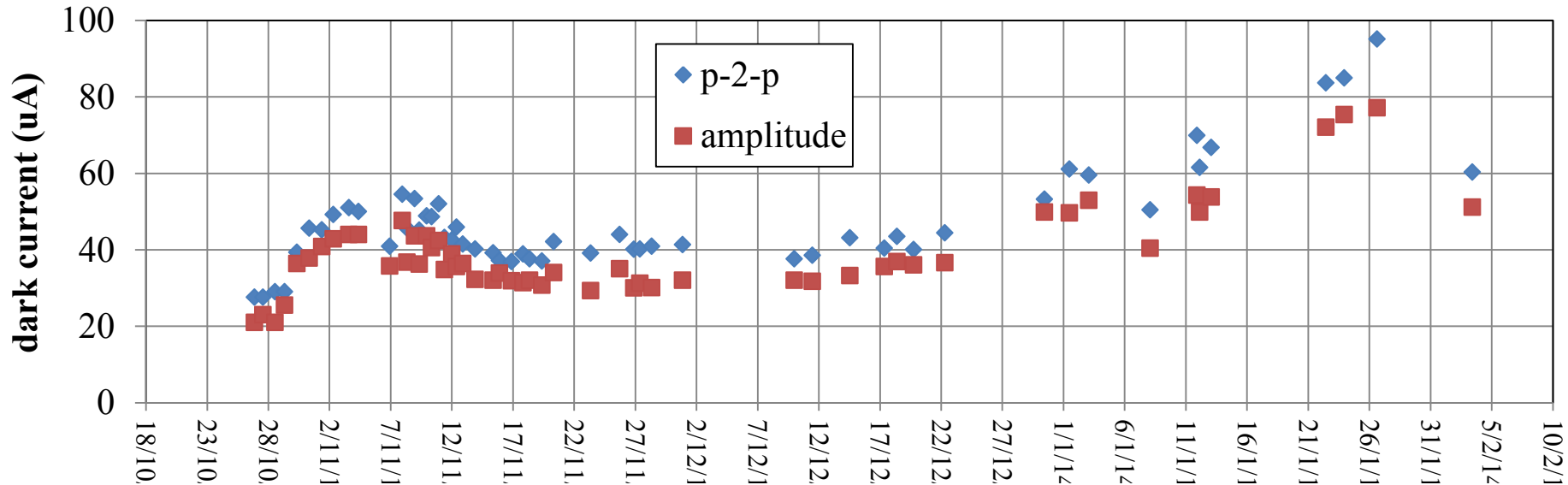
Cathode is inserted with a rotation of about 45 deg CW (looking downstream) →
→ **QE-map** to be re-measured

Gun resonance temperature → -1degC

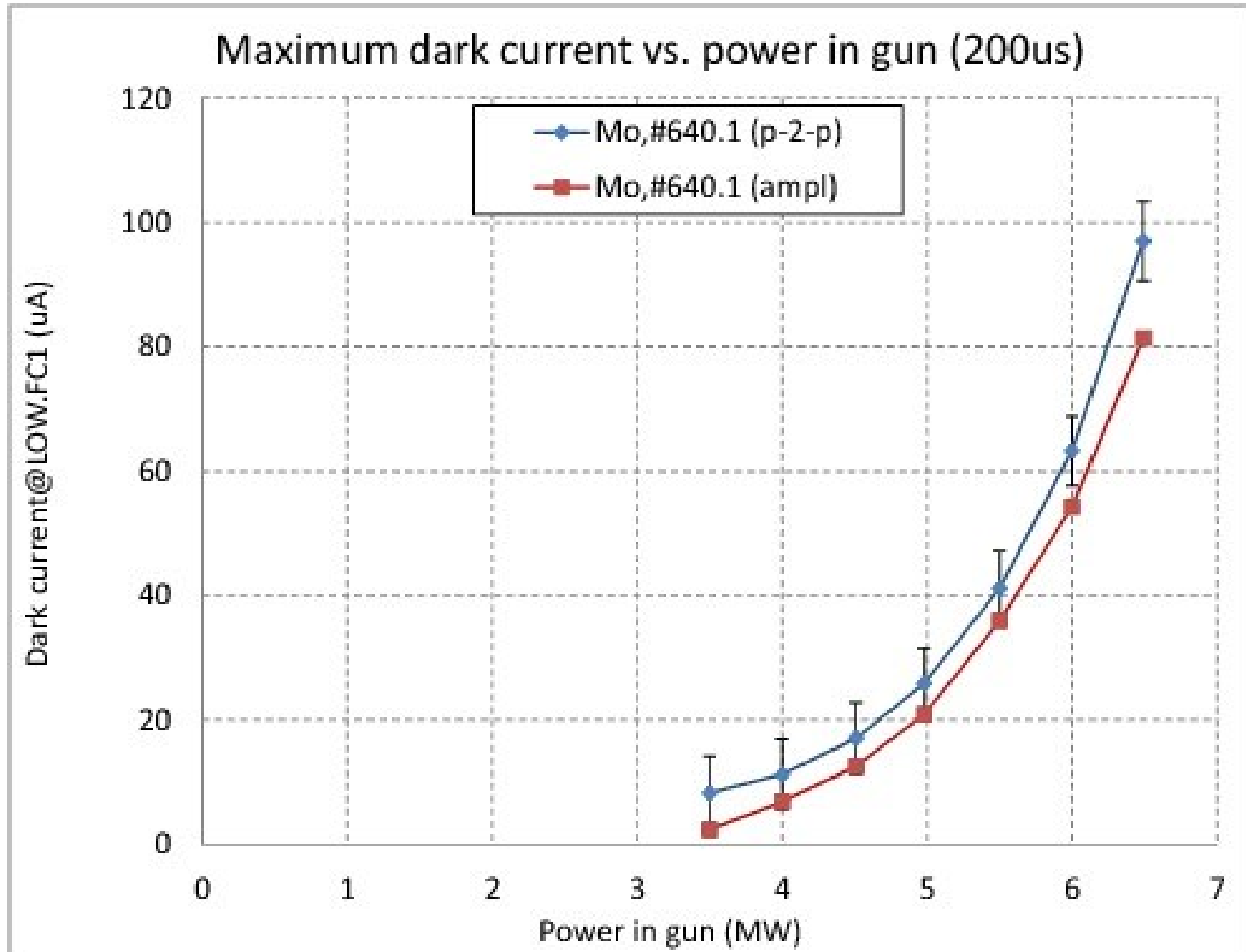
SPTemperature for 3.6MW and 400us



Dark current at LOW.FC1 (Pgun=6.5MW, 200us) @ 0A

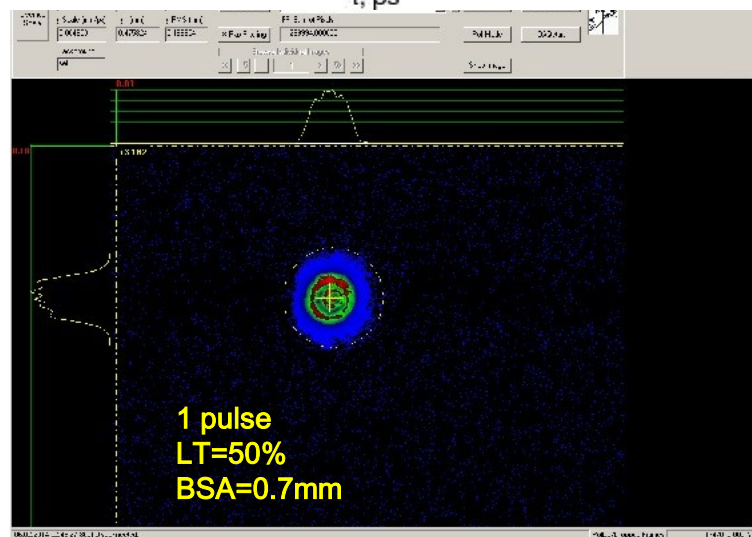
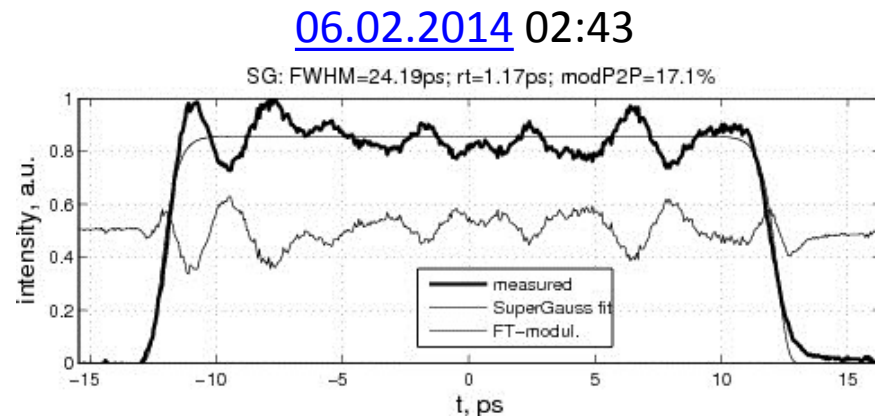
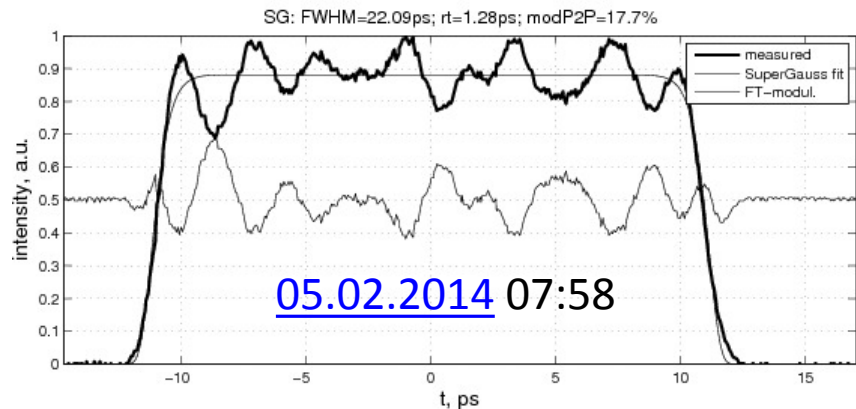
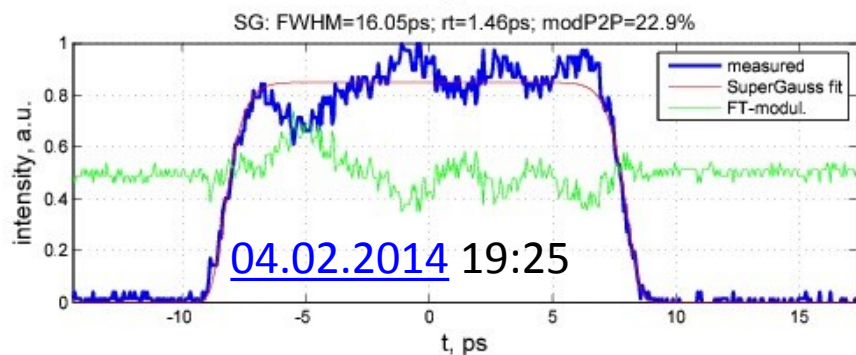
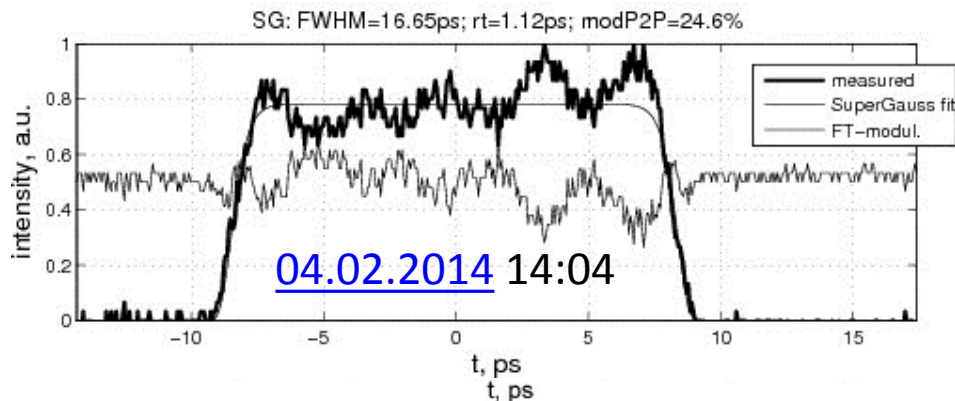


Dark current vs. peak power (04.02.2014)

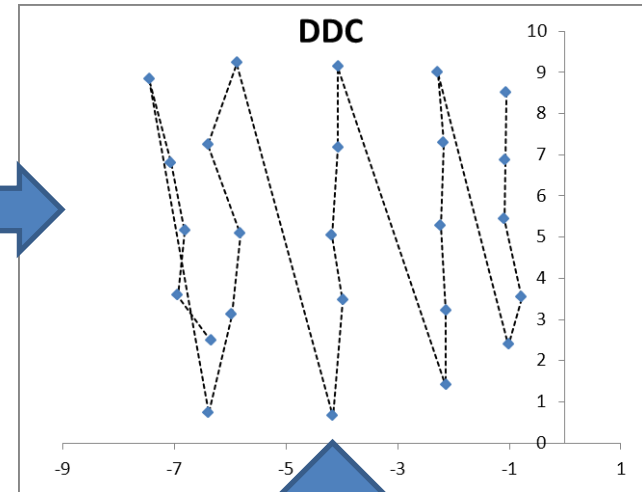
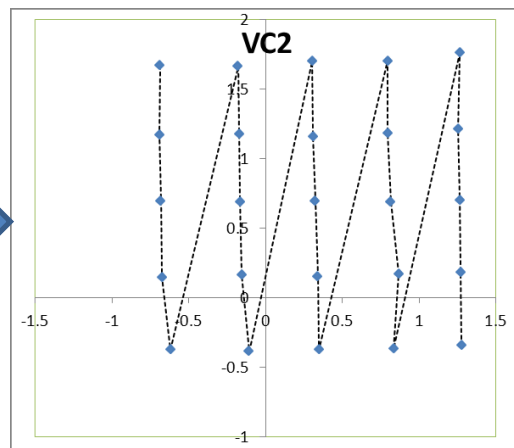
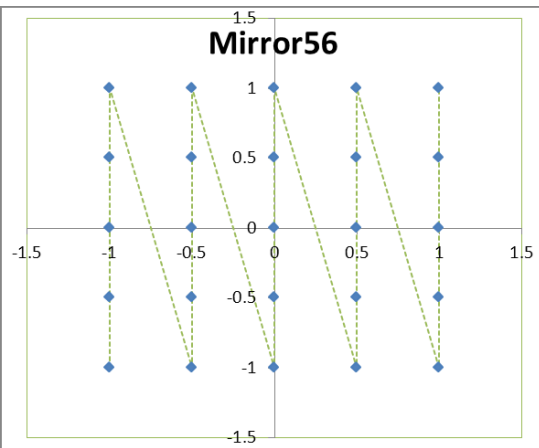


Cathode laser

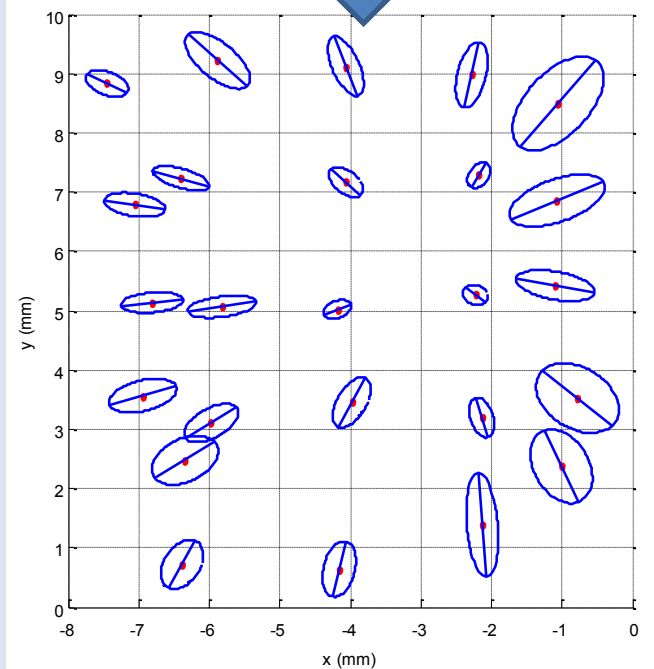
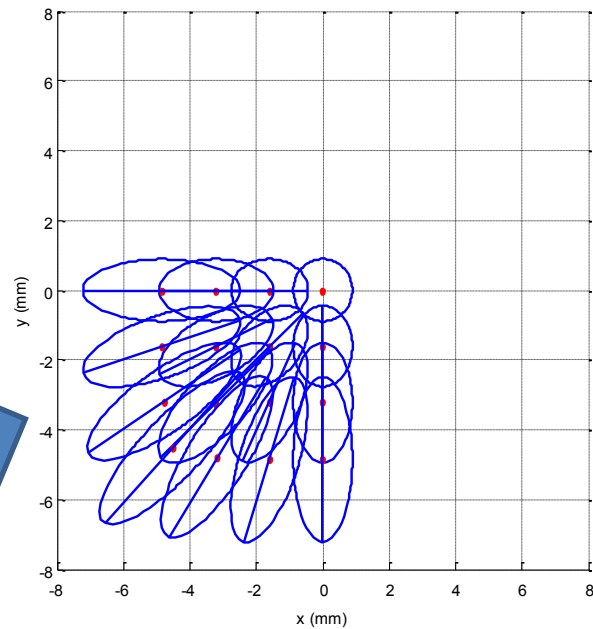
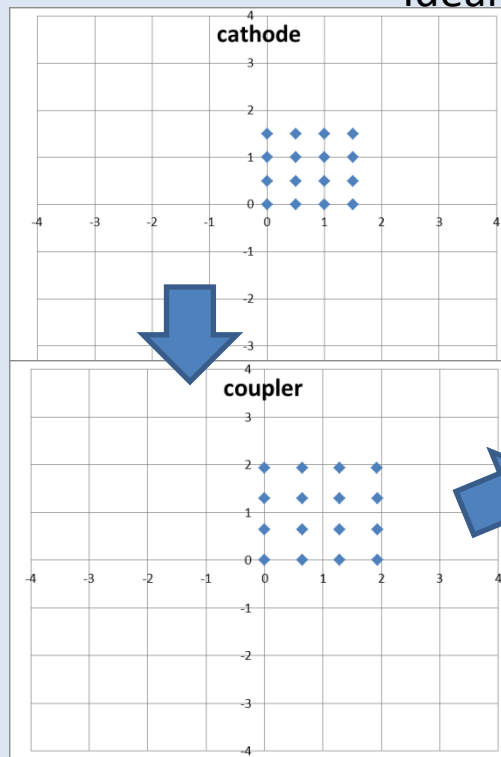
On 05.02.2014 I. Will has readjusted the laser → the pulse energy is doubled!
But the reason for the gradual degradation on 17-19.01 is still not clear



RF coupler kick preliminary studies



Ideal simulations 1/4



Gun FB is working

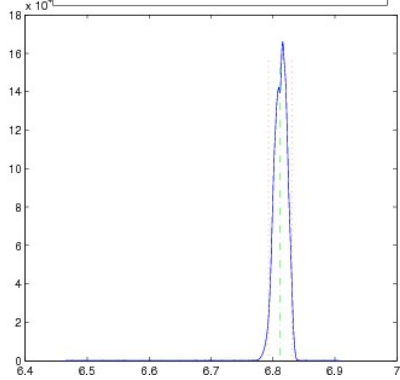
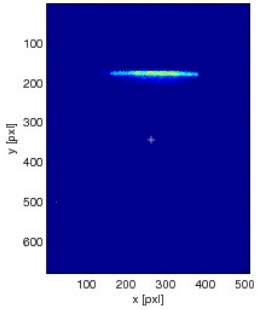
No FB

SET POINT		TIMING	
SP Pfor	+ 58.000 MV	fill length	+ 15 us
SP Phase	+ 62.000 deg	flat length	+ 200 us
Ph. Offset	+ 110.000 deg	pulse decay	+ 10 us
Pfor (power meter) 98.4 dBm			

Phase: 62°
Statistics (Img): 50
Statistics (Bkg): 20

$p_{\text{mean}} = (6.812 \pm 0.004)\text{MeV/c}$

$p_{\text{RMS}} = (19 \pm 6)\text{keV/c}$

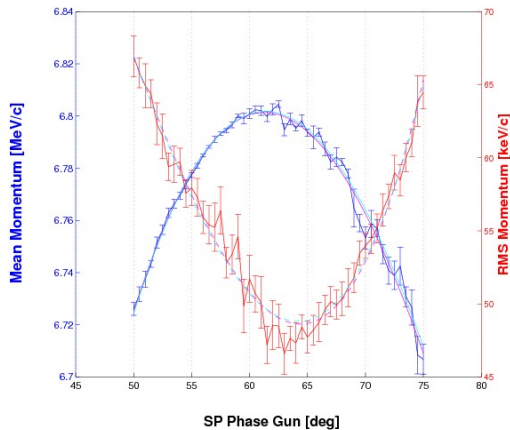


Measured at: LEDA

$\langle p \rangle_{\text{max}} = (6.8046 \pm 0.0013)\text{MeV/c}$ at 62.5°

$p_{\text{min}}^{\text{RMS}} = (46.6 \pm 1.4)\text{keV/c}$ at 63°

I_{main} = 485.0A
I_{dp} = -1.7808A
Stats: Img(Bkg): 10(10)
10 pulses
LT = 90%
SP-Pfor = 58.0
Power = 6.51MW
Reflection = 53%

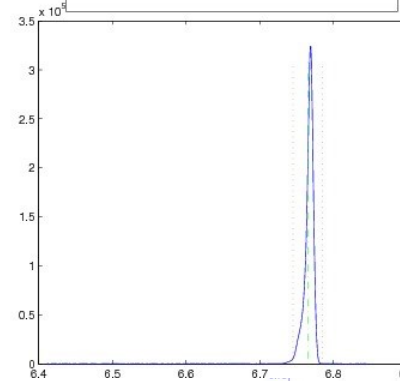
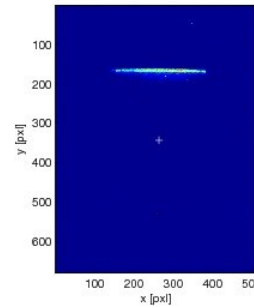


FB=ON

Phase: 62°
Statistics (Img): 50
Statistics (Bkg): 20

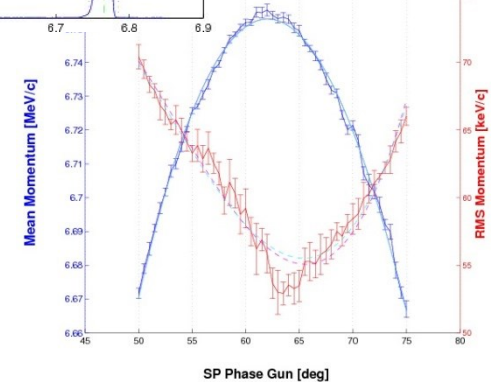
$p_{\text{mean}} = (6.7652 \pm 0.0014)\text{MeV/c}$

$p_{\text{RMS}} = (20 \pm 6)\text{keV/c}$



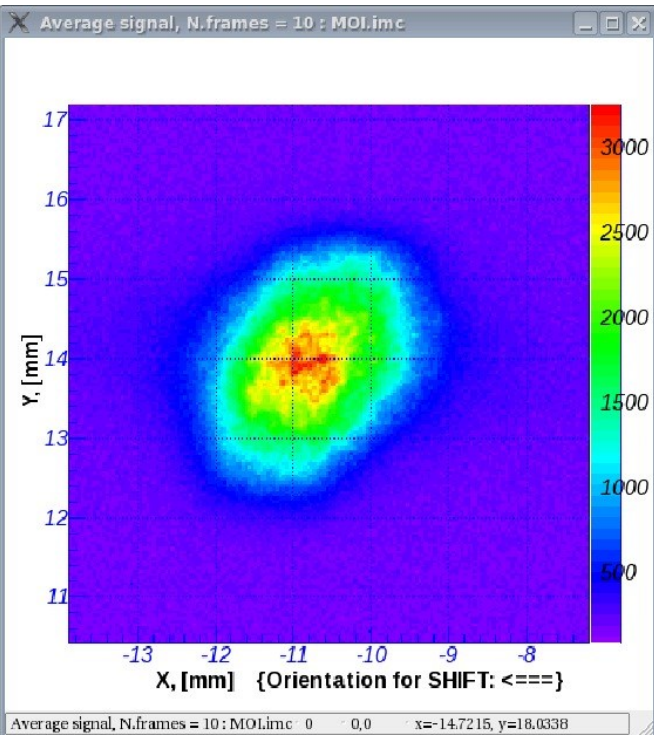
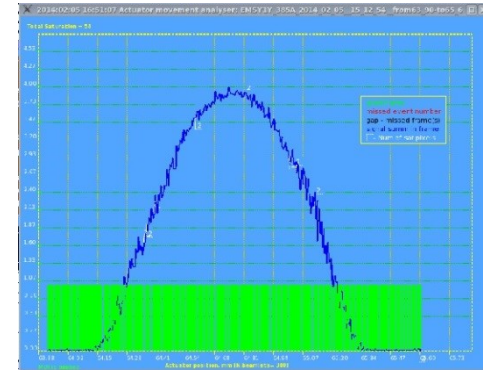
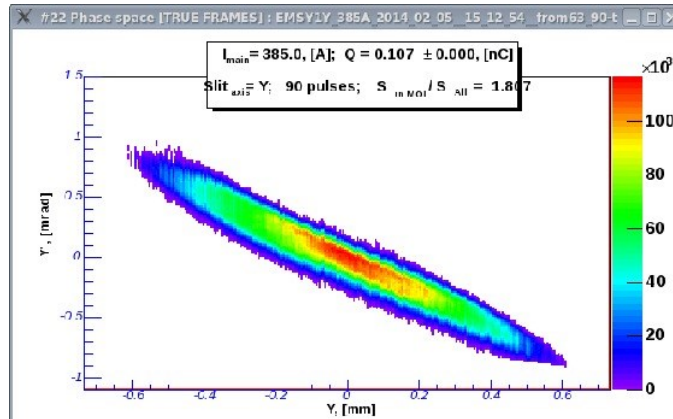
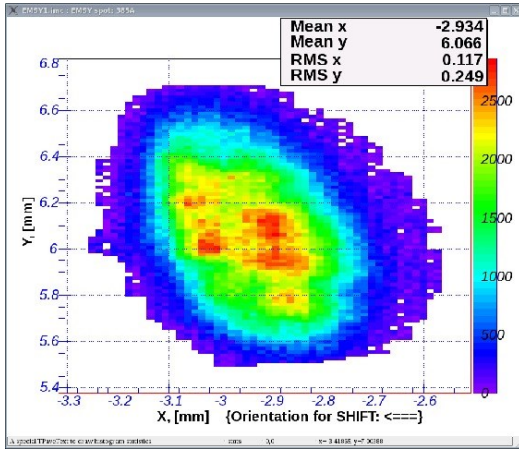
7)MeV/c at 62°
at 63.5°

I_{main} = 485.0A
I_{dp} = -1.761A
Stats: Img(Bkg): 10(10)
10 pulses
LT = 90%
SP-Pfor = 50.0
Power = 6.51MW
Reflection = 40%



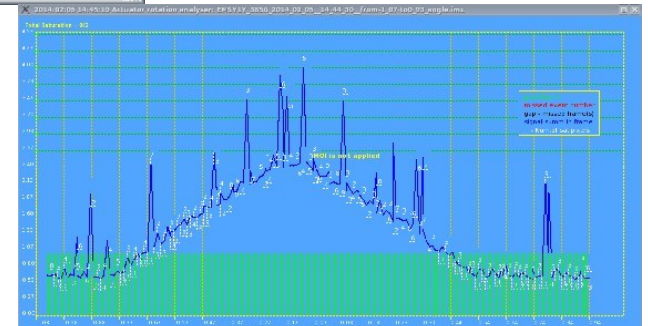
Emittance measurements commissioning

fast scan3



Results			
Plot system ver. Jan 21 2014 15:25:51			
Laser:			
rms size	$\langle x^2 \rangle = 0.18100,$	$\langle y^2 \rangle = 0.18900$	[mm]
Electron beam:			
Momentum gun	6.76600	± 0.0150	[MeV/c]
Momentum booster	22.55900	± 0.0800	[MeV/c]
C_{yx}	0.24940		[mm]
C_{yy}	0.24643		[mm]
divergence	0.34761		[mrad]
covariance	-0.08254		[mm mrad]
sheared div	0.02290		[mrad]
β	2.66408		[mm]
γ	5.21407		[mrad]
c	3.56186		[mm mrad]
$\beta \gamma c^2$	1.30811		
c_{scaled}			[mm mrad]
c_{sheared}	1.000		
$c_{\text{scaled 2D}}$	1.011		[mm mrad]
$c_{\text{scaled 2D}}$	1.023		[mm mrad]

#22 Phase space [TRUE FRAMES]: EMSY1Y_385A_2014_02_05_15_12_54_from63_90-to66_00_fast.imc 0 C.0 x=0 y=0



Weeks 6-7: Plans

1. Conditioning

- A. HV=9.7kV → max peak power at 100/200/400/650?us → with Mo cathode (3-4 first shifts)
- B. Another approach: conditioning with 800us pulses
- C. **Reach the milestone : 24h=6.5/650/390 → reached 6.0MW**
- D. Monitor resonance temperature (Excel file: ResTemp400usMonitoring.xlsx)
- E. Monitor dark current: 6.5MW, 200us, LOW.FC1 (same Excel file) → + solenoid scan

2. Measurement program

- 1.2 Kapton foil tests with e-beam → to be repeated 06.02.2014 → internal summary report
- 1.2 Booster steering
- 1.4 BPM commissioning → (quasi-) parasitic mode → higher charge (~1nC)
- 1.6 Emittance 100pC (then 1nC) + Tomo → GeK+GV → Check max charge vs. BSA
- 2.5 Phase stability measurements (+new WCS tests) → Igl+MK → week 7
- 2.8 Coupler kick studies → preliminary done (MK)
- 2.85 low charge measurements + bunch length measurements → BM+DM+MR+TV
- 3 XFEL Toroid → (quasi-) parasitic mode

Thu Feb-06	Fri Feb-07	Sat Feb-08	Sun Feb-09	Week 7	Mon Feb-10	Tue Feb-11	Wed Feb-12	Thu Feb-13	Fri Feb-14	Sat Feb-15	Sun Feb-16
Vashchenko Heller	Vashchenko Good	Vashchenko Good	Vashchenko Good	Morn. 7:00 to 15:30	QE-map Otevre Rublack	Otevre Rublack	Otevre Rublack	Otevre Rublack	Otevre Rublack	Krasilnikov Rublack	Krasilnikov Rublack
Kourkafas Prach B.	Kourkafas Heller	Kourkafas Heller	Kourkafas Heller	Late 15:00 to 23:30	Kourkafas Isaev	Isaev Vashchenko	Isaev Gross	Isaev Gross	Isaev Gross	Otevre Good	Otevre Good
Gross Pathak	Gross Pathak	Gross Pathak	Gross Pathak	Night 23:00 to 7:30	Khojuyan Prach B.	Khojuyan Prach B.	Khojuyan Prach B.	Khojuyan Prach B.	Khojuyan Prach B.	Khojuyan Prach B.	Khojuyan Prach B.

Emittance + Tomo

**Kapton
100pC**

Gun stability measurements

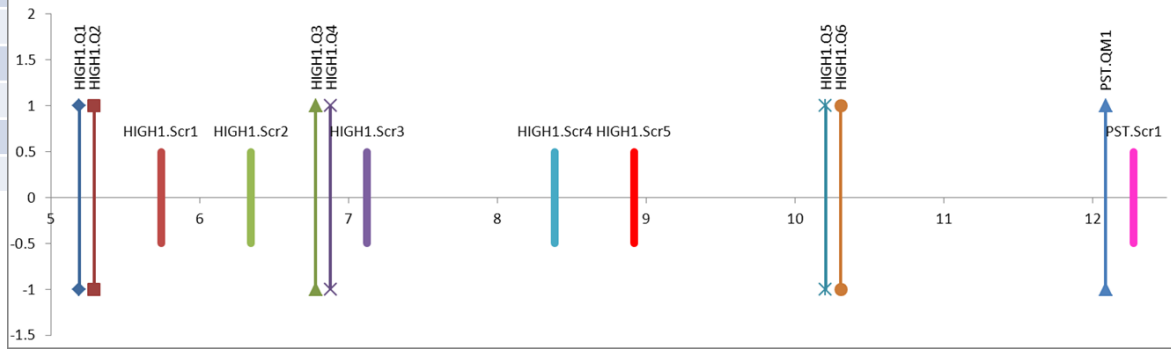
Weeks 4: Kapton foil tests (proposals)

Setup

- Gun 200 (650) us, 6.5 (6) MW, MMMG phase
- Laser temporal – available profile (17ps FWHM?)
- Transverse: smallest BSA for Q=100pC at LT=80%
- Booster 3MW (final Pz=22MeV/c)
- Transport – centered at screens up to Tomo.Scr1
- Solenoid and Quads → to be tuned – see the measurement table for focusing

- For images at PST.S1 with kapton inserted use 2 pulses and 30 pulses (2 files)
- Additional measurement with kapton – try to focus the scattered beam with H1.Q5, H1.Q6, PST.QM1
- 10 frames+bkg for an image
- Keep the same gain for the same camera within the same measurement

meas#	Imain	H1.Q1	H1.Q2	H1.Q3	H1.Q4	H1.Q5	H1.Q6	PST.QM 1	conditions
M1	I1	0	0	0	0	0	0	0	focus at H1.S5
M2	I2	0	0	0	0	0	0	0	focus at PST.S1
M3	I3=0.5*(I1+I2)	0	0	0	0	0	0	0	focus between
M4	I1	Q1M4	Q2M4	0	0	0	0	0	focussed round beam at H1.S5
M5	I1	Q1M5	Q2M5	0	0	0	0	0	focussed round beam at PST.S1
M6	I1	Q1M6	Q2M6	0	0	0	0	0	round equal beams at H1.S5 and PST.S1
M7	I2	Q1M7	Q2M7	0	0	0	0	0	focussed round beam at H1.S5
M8	I2	Q1M8	Q2M8	0	0	0	0	0	focussed round beam at PST.S1
M9	I2	Q1M9	Q2M9	0	0	0	0	0	round equal beams at H1.S5 and PST.S1
M10	I3	Q1M10	Q2M10	0	0	0	0	0	focussed round beam at H1.S5
M11	I3	Q1M11	Q2M11	0	0	0	0	0	focussed round beam at PST.S1
M12	I3	Q1M12	Q2M12	0	0	0	0	0	round equal beams at H1.S5 and PST.S1
M13	I3	Q1M12	Q2M12	Q3M13	Q4M13	0	0	0	focussed round beam at H1.S5
M14	I3	Q1M12	Q2M12	Q3M14	Q4M14	0	0	0	focussed round beam at PST.S1
M15	I3	Q1M12	Q2M12	Q3M15	Q4M15	0	0	0	round equal beams at H1.S5 and PST.S1



Measurement program: Gun-4.4

priority	program item	num.of shifts	coordinator	preferred dates	Remarks
0.9	Dark current measurements	1-2	M.Krasilnikov		200us, 2D scan(RF power, I _{main})
1	Laser alignment (rough)	2-4	M.Gross		done
1.1	Solenoid BBA	4	M.Krasilnikov		done*
1.2	Long momentum measurements	2	M. Otevrel		done*
1.2	QE and QE-map measurements	2	M. Otevrel, M. Gross		done*
1.2	Kapton foil tests with e-beam	1	M.Gross		solenoid scan+booster
1.2	Booster steering studies	7	M.Otevrel, D.Kalantaryan		?combined with Cathode-1?
1.4	<i>BPMs commissioning</i>	3	<i>M.Krasilnikov, F.Tonisch</i>		<i>+booster</i>
1.6	Emittance-1nC	17	G.Vashchenko, M.Krasilnikov		Flattop laser temporal profile
1.61	Emittance-250pC	10	G.Vashchenko, M.Krasilnikov		Flattop laser temporal profile
1.62	Emittance-100pC	20	G.Vashchenko, M.Krasilnikov		Flattop laser temporal profile
1.63	Emittance-20pC	21	G.Vashchenko, M.Krasilnikov		Flattop laser temporal profile
1.7	Tomo-1	14	G.Kourkafas		
2.41	Tomo-2 (matching studies)	14	G.Kourkafas		
2.5	Cathodes-1 (life time)	21	S.Lederer		21 shift/cathode!->63?; 6500nC/sec!
2.5	Gun phase stability	9	I.Isaev		to be combined with Cathodes-1?
2.6	Cathodes-2 (emittance, QE, QE-map)	6	S.Lederer,...		2 cathodes
2.8	Emission studies --> Coupler kick	6	M.Krasilnikov		laser temporal profile to be changed
2.85	Bunch length by 3-phase method	??	T.Vinatier		LPS (D.Malyutin?) + D.Lipka (DCM1)?
2.9	Low charge bunches characterization	9	B.Marchetti, D.Malyutin		Laser=5.4ps FWHM
2.91	Gauss-20pC	12	M.Rehders		laser temporal profile to be changed
2.95	Thermal emittance	??	M.Otevrel		
3	Bunch length with DCM1	3	D.Lipka	KW14	cross-check with LPS Tomo (DM)
3	<i>XFEL Toroid</i>	1	<i>R.Neumann (N.Baboi), F.Tonisch</i>	<i>2013/KW50, 2014/KW3,6,8; Mo-Do</i>	<i>to be combined with Cathodes-1?</i>
3.5	?Booster dark current studies?	??			1week for higher peak power

Emittance 100pC (GV)

Emittance measurement for 100 pC charge:

- Emittance vs. BSA:
0.3 mm?, 0.35 mm?, 0.4 mm, 0.45 mm, 0.5 mm, 0.55 mm, 0.6 mm?,...?
Estimated time 4-7 shifts.
- Emittance vs. gun phase
For optimum BSA : phase range [-9;9] deg in step of 3 deg.
Estimated time: 4-5 shifts.
- Emittance vs. booster gradient:
Optimum gun launching phase, BSA.
Electron beam momentum = Max; 25 MeV/c; 22 MeV/c; 19 MeV/c; 16 MeV/c;
Estimated time: 2-4 shifts.
- Emittance vs laser length:
FWHM: 21.5, 18, 15, 12 ps optimizing BSA for each step
Estimated time: 2-4 shifts.

Laser pulse energy drop 17-19.01.2014

