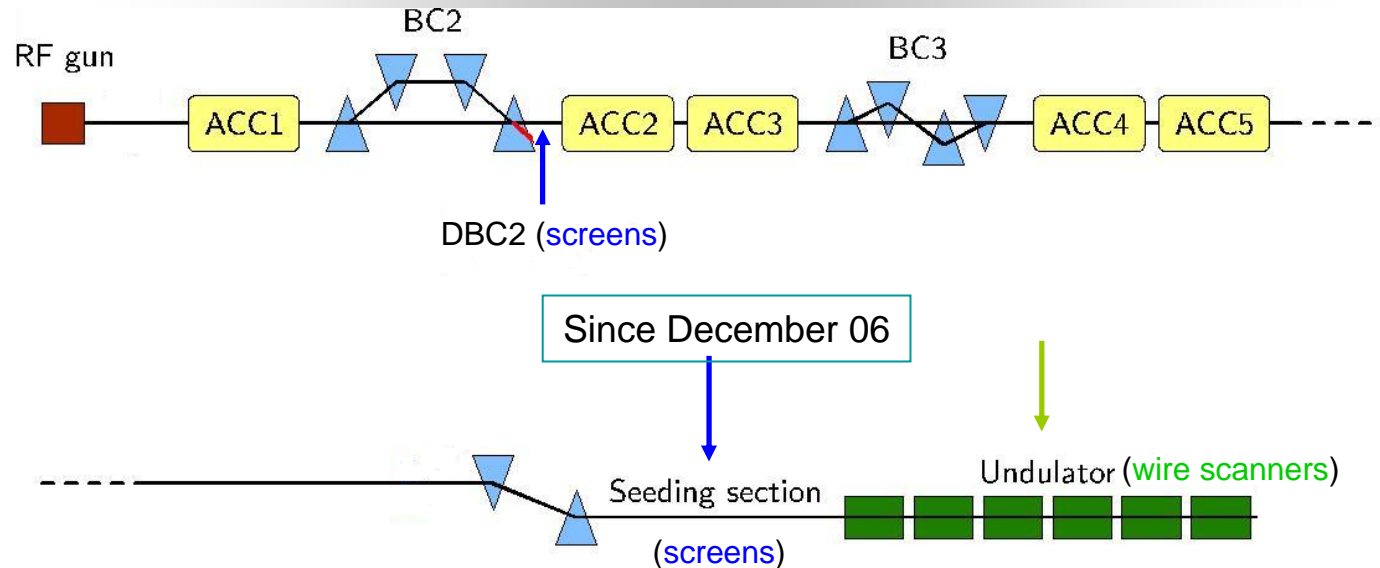


SUMMARY OF PROJECTED EMITTANCE MEASUREMENTS AT FLASH

Accelerator studies
December 2006 – January 2007

Katja Honkavaara, Florian Loehl, Eduard Prat



- When: 17th and 20th of December 2006 , 21st of January 2007 (~12h per day)
- Where: DBC2, SEED (for the 1st time) and undulator
- Conditions: on crest for all accelerator modules, 1nC

About the measurements at the [SEED section](#):

We had to steer the beam when going from one screen to the next one and OTR intensity was low at 2SUND3 & 14SEED. This is probably due to a misalignment of the optical set-up and/or of the OTR screen

About the measurements in the [undulator](#):

3 available wires: 10 μm carbon, 10 μm tungsten & 50 μm tungsten (the “usual one”)

Where & when	Comments	ϵ_x [mm mrad]	ϵ_y [mm mrad]
Injector 17.49h	Matched	3.32 ± 0.10	3.35 ± 0.06
Seed 18.22h	Matched	3.85 ± 0.17	2.72 ± 0.12
Seed 21.56h	Sext off – only vertical is matched	6.03 ± 0.18	3.32 ± 0.10
Seed 22.23h	Sext off – only horizontal is matched	5.15 ± 0.12	1.39 ± 0.05
Seed 23.03h	Design optics in seed & und – matched	3.43 ± 0.10	2.84 ± 0.10
Undulator 19.03h	50 μm Tungsten wire – Not matched	6.24 ± 1.39	9.90 ± 1.30
Undulator 19.39h	50 μm T wire – unsuccessful attempt to match	-	6.87 ± 1.66
Undulator 23.31h	Design optics in seed & und – 50 μm T wire - Not matched	6.25 ± 1.11	12.31 ± 0.45

SEED section

Similar emittances as in the injector
Matching worked properly (except when sext were off)

Undulator

Much bigger and/or imaginary emittances
Not possible to match

Where & when	Comments	ϵ_x [mm mrad]	ϵ_y [mm mrad]
Injector 8.29h	Matched	2.94 ± 0.07	3.30 ± 0.06
Seed 9.18h	Not matched	4.38 ± 0.14	11.52 ± 0.22
Seed 10.45h	Corrected to orbit from 17-12 – matched	4.43 ± 0.12	2.61 ± 0.11
Seed 13.02h	Same conditions as 9.18h / Not matched	4.31 ± 0.30	12.05 ± 0.24
Seed 17.08h	Orbit from 17-12 + 6mm y bump in ACC23 – matched	4.09 ± 0.10	6.18 ± 0.15
Seed 18.27h	Corrected to orbit from 17-12 – matched	3.83 ± 0.13	2.64 ± 0.08
Und. 18.52h	50 μm Tungsten wire	10.40 ± 0.25	-

SEED section

Similar emittances as in the injector
 6mm vertical orbit bump in ACC23 caused emittance increase by more than a factor of 2
 Matching worked properly in all the cases.

Undulator

Much bigger and/or imaginary emittances
 Not possible to match

Where & when	Comments	ϵ_x [mm mrad]	ϵ_y [mm mrad]
Injector 10.55h	Matched	3.66 ± 0.12	3.15 ± 0.11
Seed 12.30h	Matched	3.72 ± 0.17	4.67 ± 0.15
Undulator 13.38h	10 μ m carbon wire – not matched	4.11 ± 0.39	5.56 ± 0.24
Undulator 15.50h	10 μ m carbon wire – not matched	4.36 ± 0.71	4.09 ± 1.27
Undulator 16.51h	10 μ m carbon wire – not matched	5.01 ± 0.28	-
Undulator 17.30h	10 μ m tungsten wire – not matched	9.78 ± 0.15	10.28 ± 2.42
Undulator 18.05	50 μ m tungsten wire – not matched	11.50 ± 0.66	imaginary
Undulator 19.47h	10 μ m carbon / orbit changed – not matched	3.56 ± 0.63	-

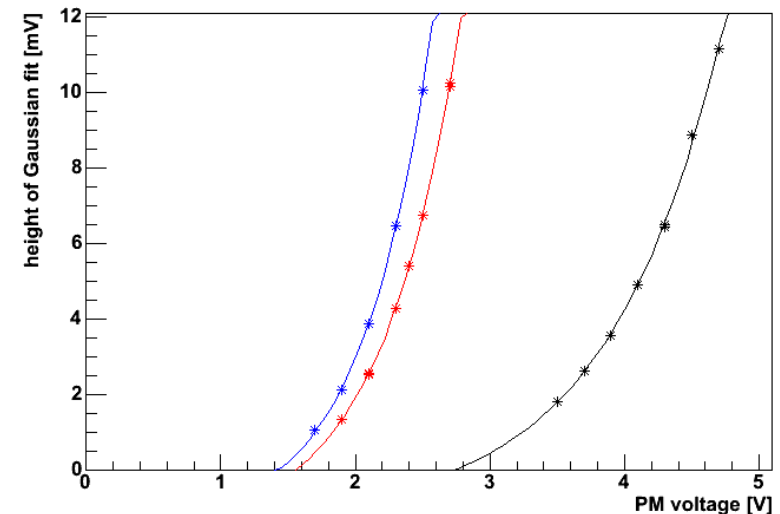
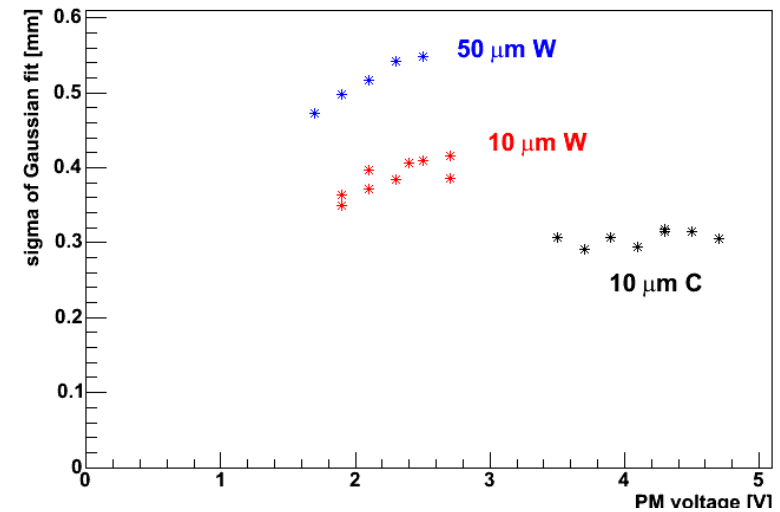
Undulator

The different wires give different emittances
 Emittance with the 10 μ m carbon wire is the most similar to
 the measurement at the SEED section
 Not possible to match

Wire scanner problematic

- Beam size depends heavily on the wire (and for the Tungsten wires it also depends on the PMV)
- Linear behavior of the PM was tested with a LED for a voltage between 2 and 9.5V (Martin Sachwitz). Present PMV is between 1.5 and 5 V.
- Present tests and ideas (Martin Sachwitz)
 - Test linearity of the LED (output light versus voltage)
 - Put a filter to attenuate input light of the PM in order to increase the PMV working point
 - Use the other PMs

Measurements done by Pedro Castro (5UND5.hor)



Eduard Prat, DESY

Summary

- ✓ Emittance measurements done at the SEED section for the 1st time: similar emittances as in the injector, matching worked properly
- ✗ Emittance measurements in the undulator depends strongly on the used wire. Matching did not work for any of them.

Next steps

- Simulation of emittance increase due to orbit bump in ACC23 (wake fields, coupler kicks, ...)
- Work on the alignment of the optical set-up and OTR screens in the SEED section (Spring shutdown)
- Wire scanner work
- Prepare a matching routine for the undulator using the optics toolbox from Vladimir and Nina
- Next measurements on next FEL studies (weeks 7 & 8)