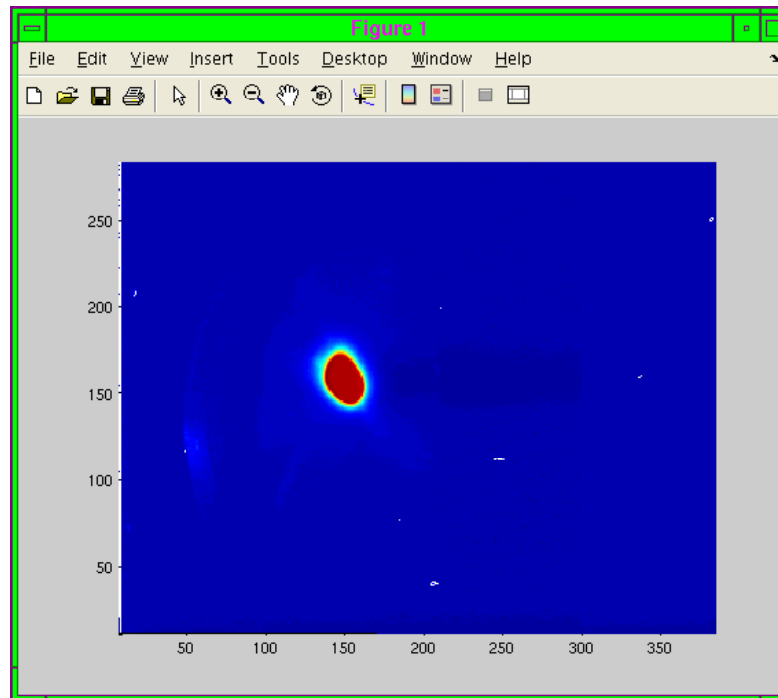


PHIN beam tests, first results

Commissioning of beam diagnostics and first characterization of the beam

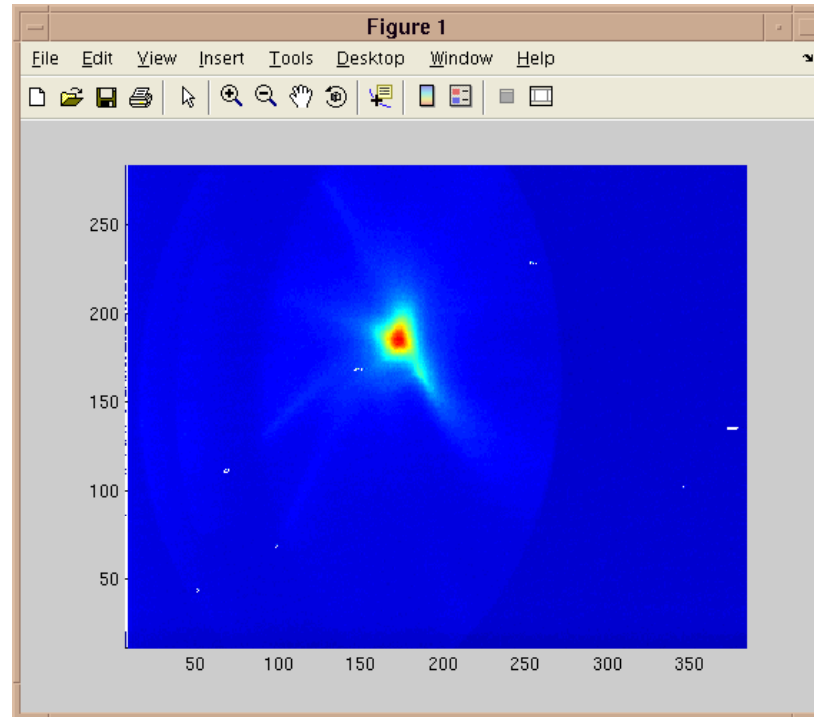
Warning: results are preliminary and calibrations not yet confirmed



CTF3 committee, 20.11.2008

Steffen Döbert

Dark current



Short dark current pulse at the end of rf pulse clearly visible,
Intensity roughly equal to a single bunch ~ 0.1 nC

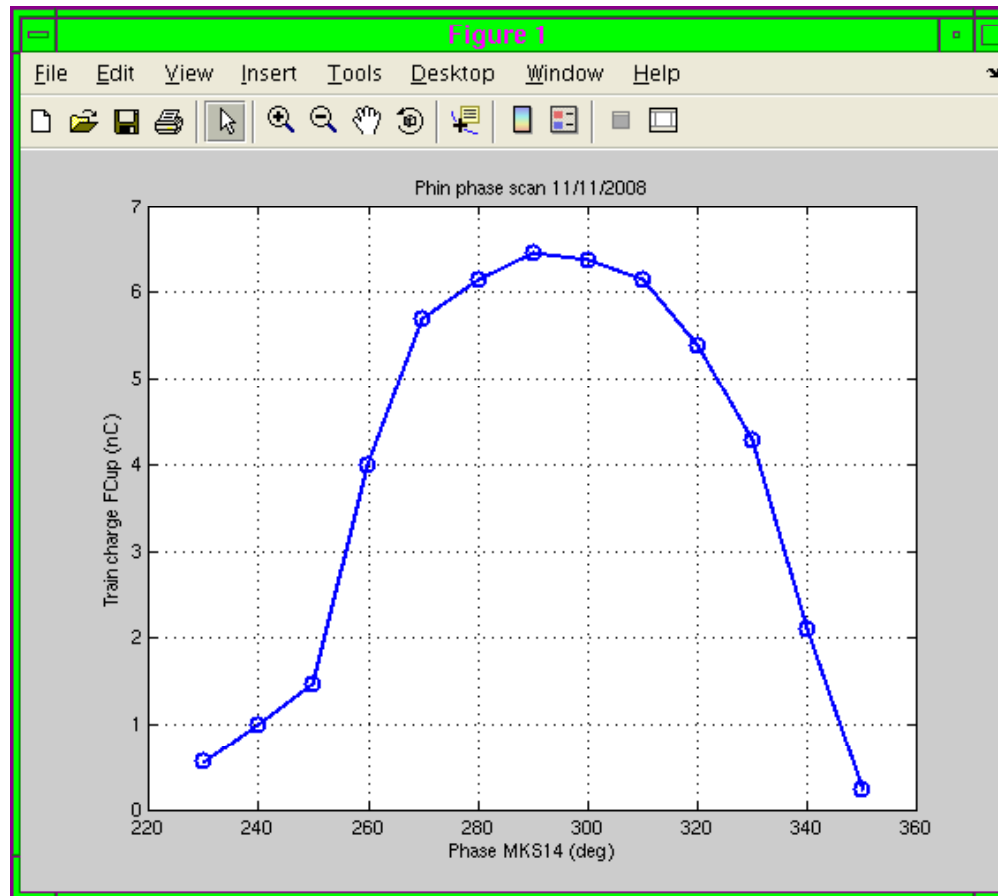
Beam current



Current and charge measurement with BPR, WCM and FCup
FCup (green), BPR sum (red), Pos H (yellow), Pos V (magenta)

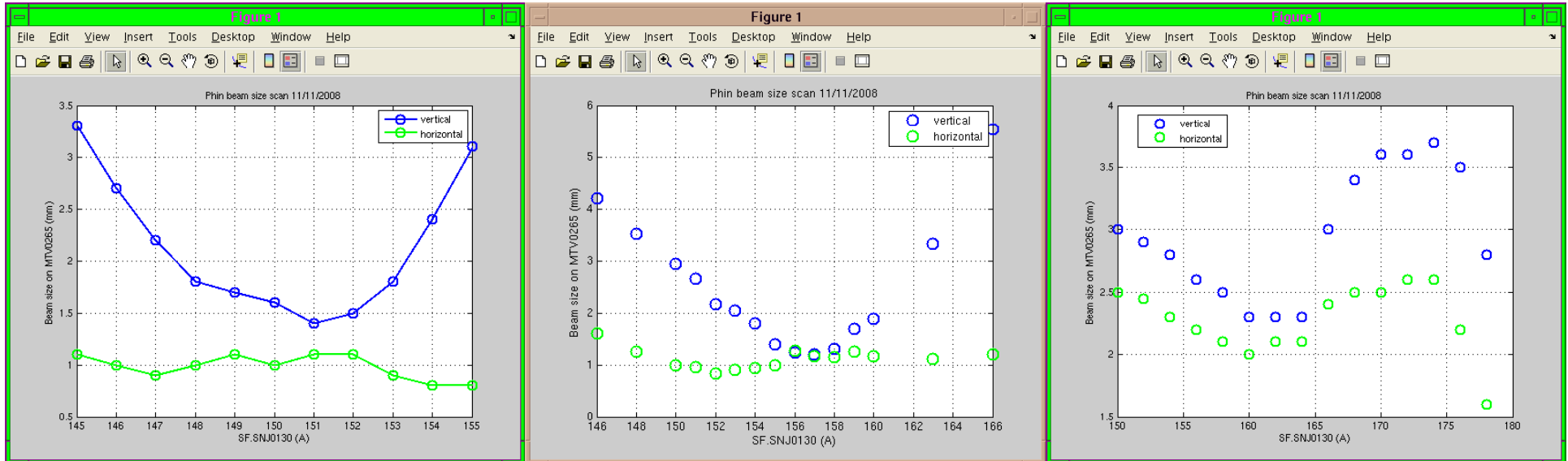
Full 1.3 μs pulse length produced, alignment of beam line is fine

Phase scan, 50 ns beam



Looks normal, Schottky effect visible, laser pulse length ?

Beam size scan

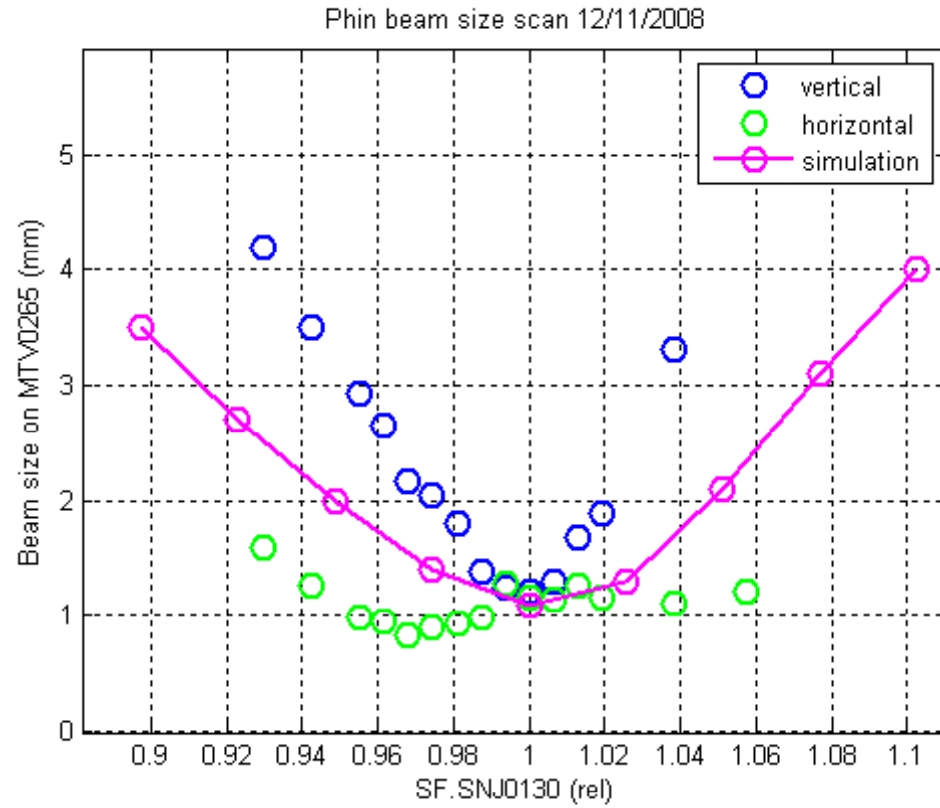


Found clear asymmetry in beam focusing behavior, problem seems to be a horizontal one, vertical beam size seems OK

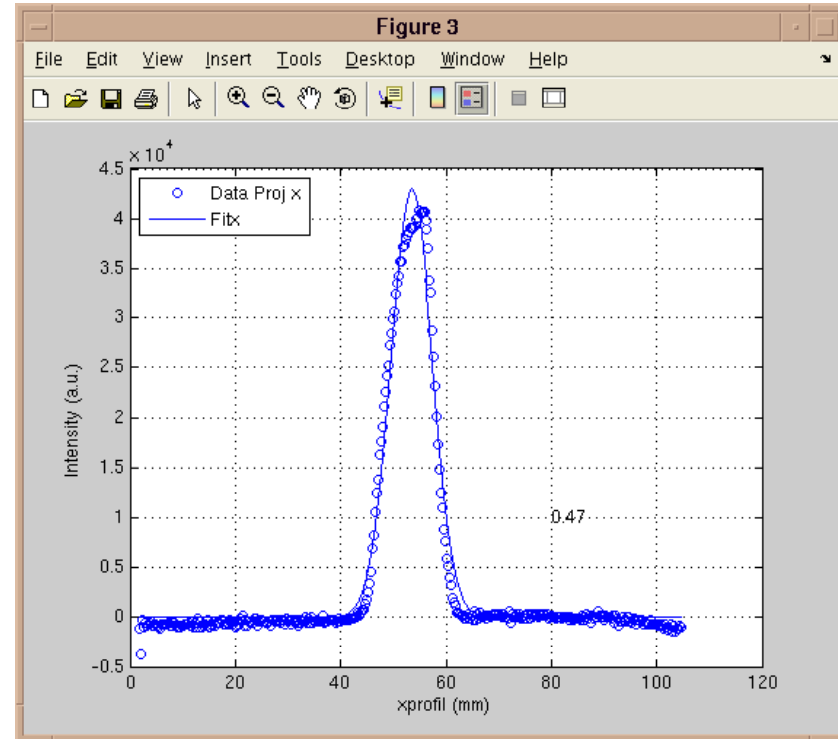
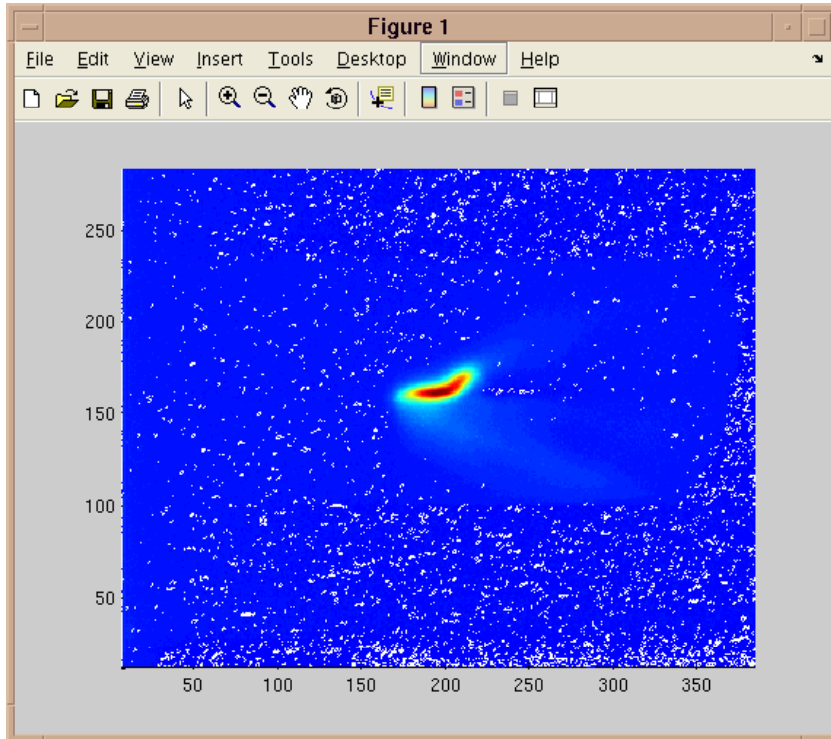
Possible causes: Laser spot, alignment, rf-asymmetry, solenoid alignment

Solenoid set point not as expected

Beam size scan



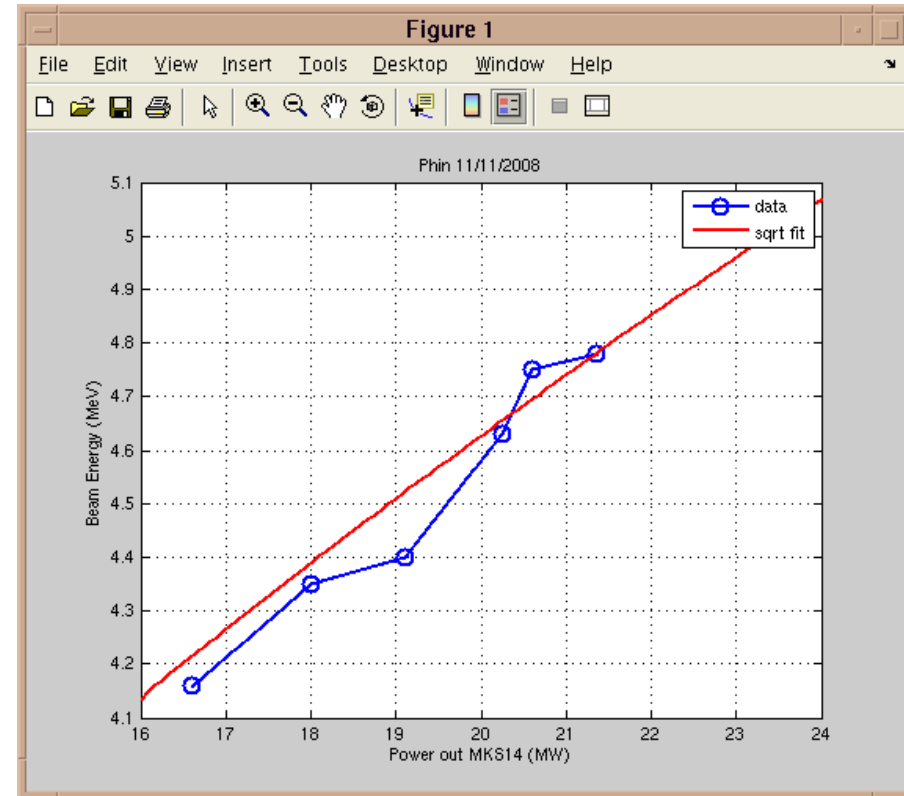
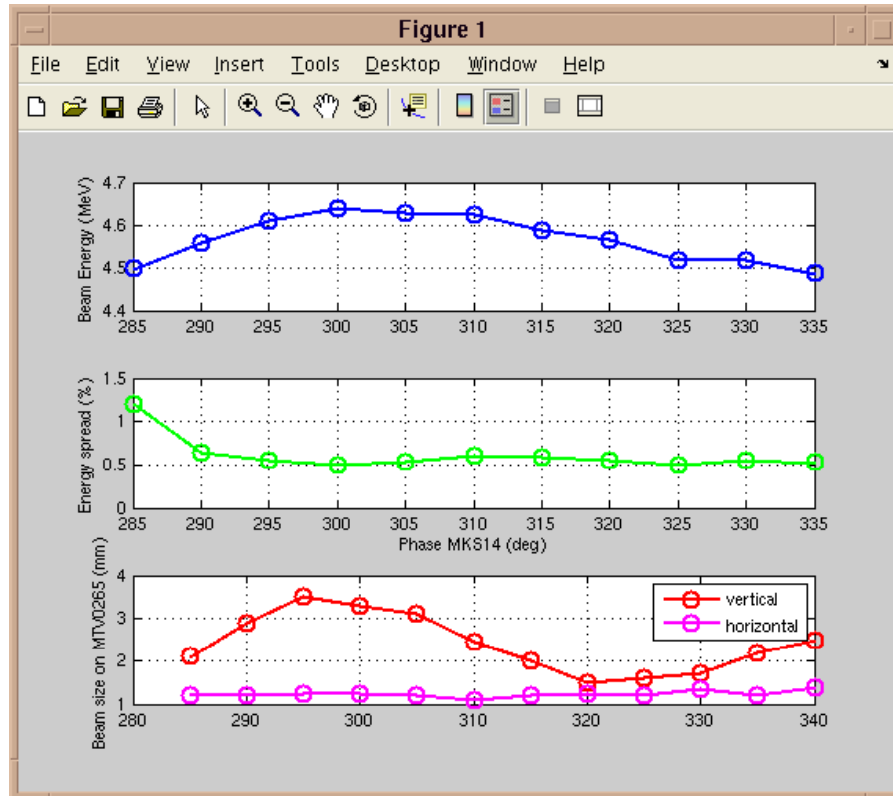
Energy measurement, Spectrometer



Measured nominal energy with good energy spread
(calibration to be checked)

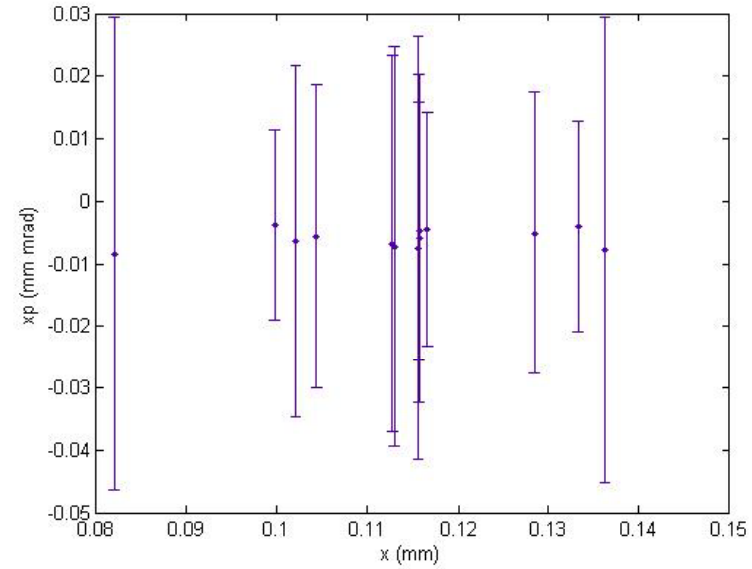
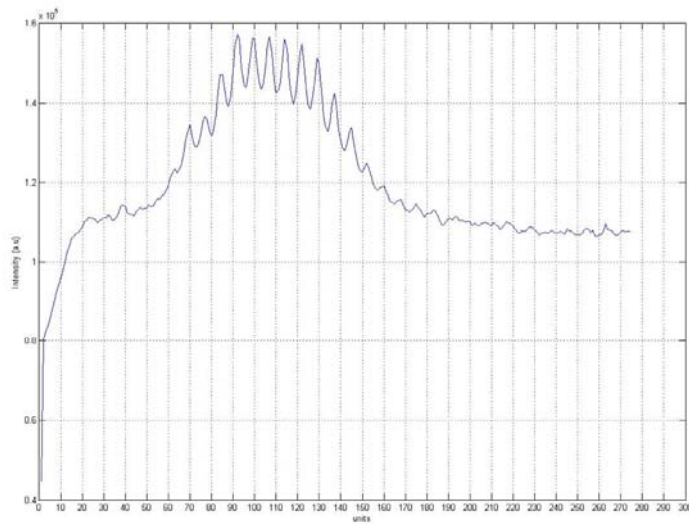
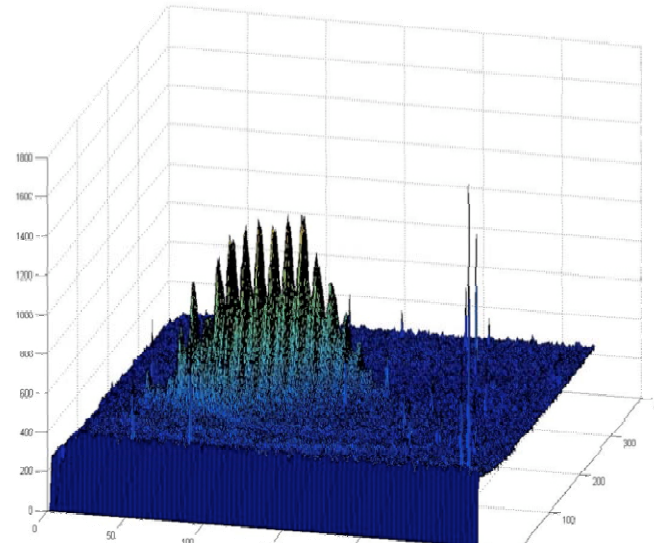
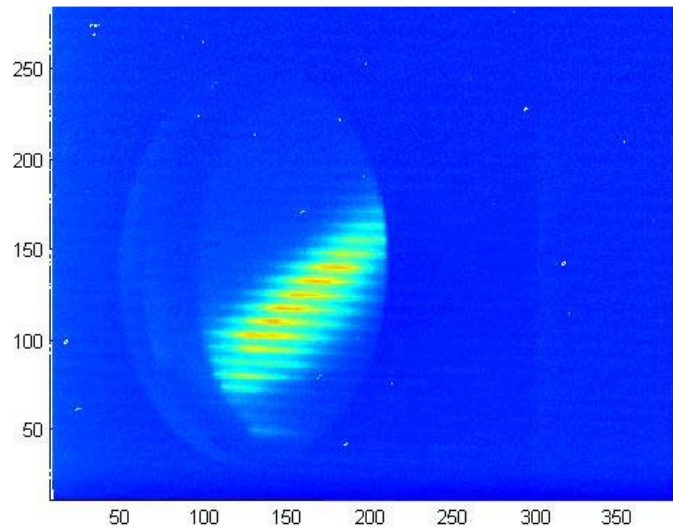
5.3 MeV with 27 keV (0.5 %) sigma energy spread

Energy measurement, Phase scan



Very reasonable behavior

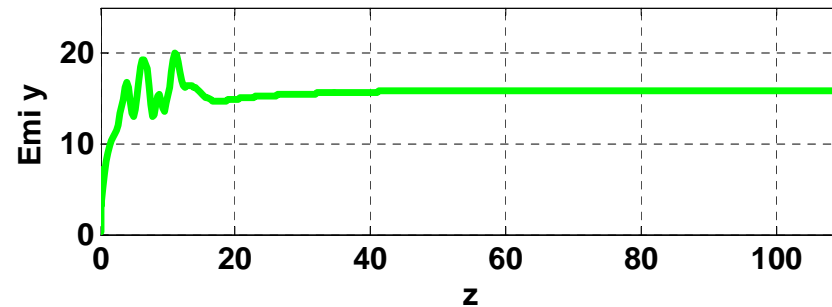
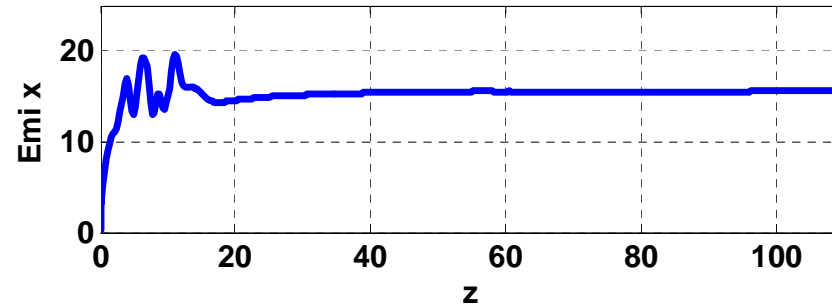
Emittance



Emittance= 4.88 mm mrad
'to good to be true'

Öznür Mete

RF GUN CTF2 , Simulations ref

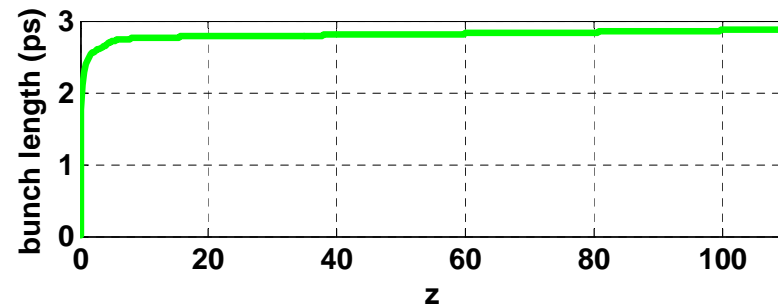
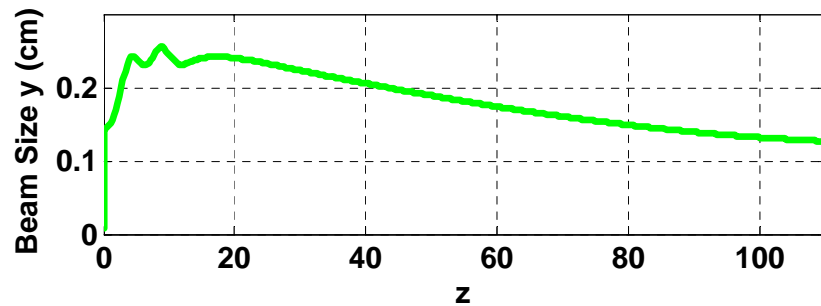
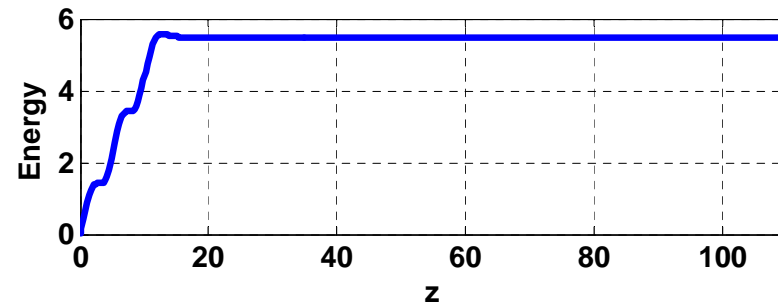
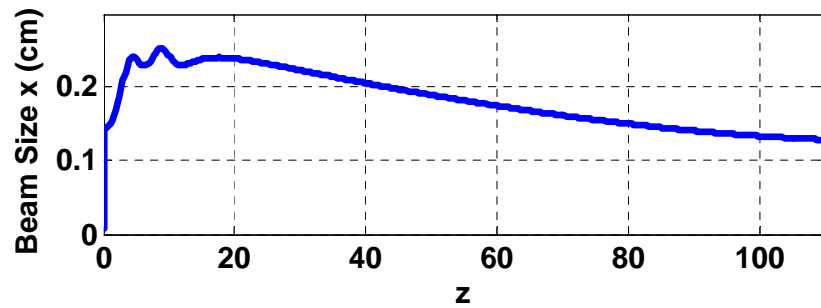


$E = 5.4 \text{ MeV}$

$\Delta E/E = 0.6 \%$

$bl = 6.8 \text{ ps (FWHM)}$

$\epsilon_n = 15.5 \mu\text{m}$



Beam parameter summary

	PHIN design	achieved Nov. 2008
RF frequency [GHz]	2.9985	2.9985
RF power [MW] unloaded	13	13
beam energy [MeV]	5-6	5.3
beam current [A]	3.5	< 0.2*
number of bunches	1908	3000
bunch spacing [ps]	666.7	666.7
charge per bunch [nC]	2.3	< 0.1*
repetition rate [Hz]	5	0.8
bunch length FWHM [ps]	< 10	< 10 ?
rms. energy spread [%]	< 2	< 1
n. emittance [π mm mrad]	< 25	yes
vacuum pressure [mbar]	< 2×10^{-10}	< 4×10^9 *

* photocathode QE < 0.5% (factor 8-11) cathode prod. Dec. 2007
 laser micropulse energy < 0.2 μ J (factor 2-3)

* NEG not yet activated

Conclusions and remarks

- Pretty good start
- RF and vacuum very stable
- Most of the diagnostics worked, dynamic range problem
- Laser stability and availability surprisingly good
(develop diagnostics for laser parameter control)
- Main issues found is the asymmetric beam
- Need to increase beam charge
- Need to understand our measurements

- In general a remarkable success !