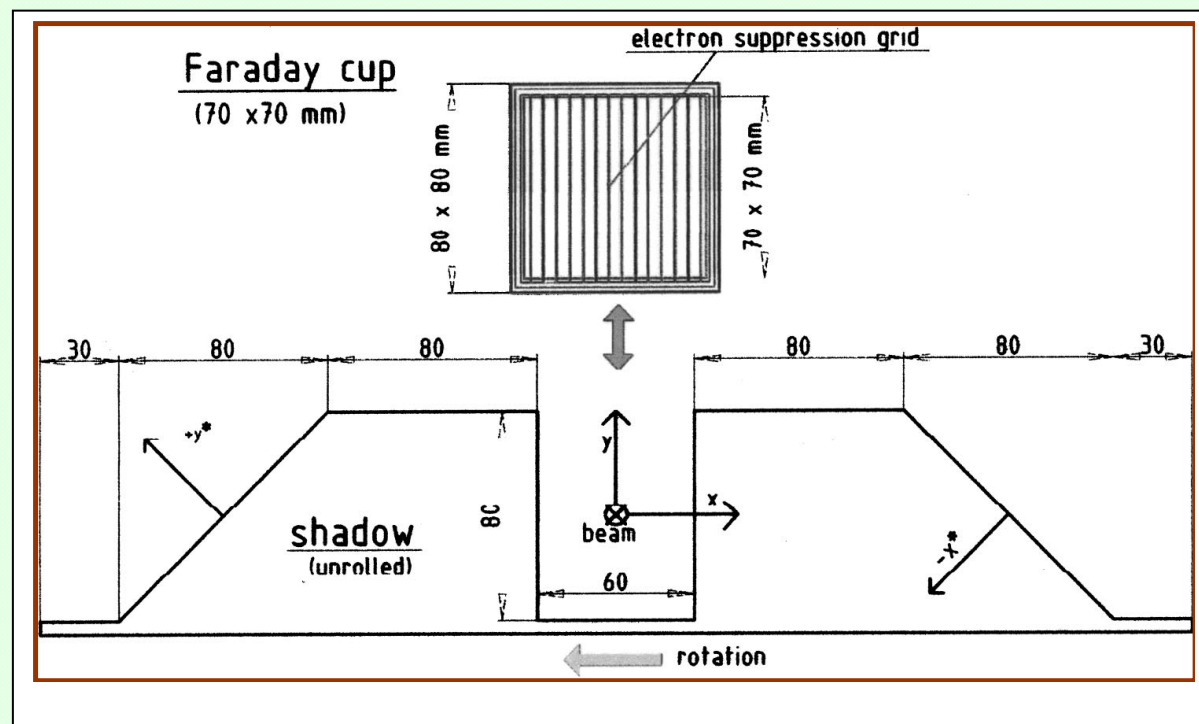


Beam-Profile/-Emittance Measurements at the Frankfurt ECRIS

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Institut für Kernphysik der Johann Wolfgang Goethe-Universität, Max-von-Laue-Straße 1, D-60438 Frankfurt am Main



SCANNER: Trapezoidal Aluminum screen rotates on a wheel around a Faraday cup of the standard beam diagnosis system

measures the lateral beam distribution (primitive of the distribution density) in two orthogonal directions (X and Y)

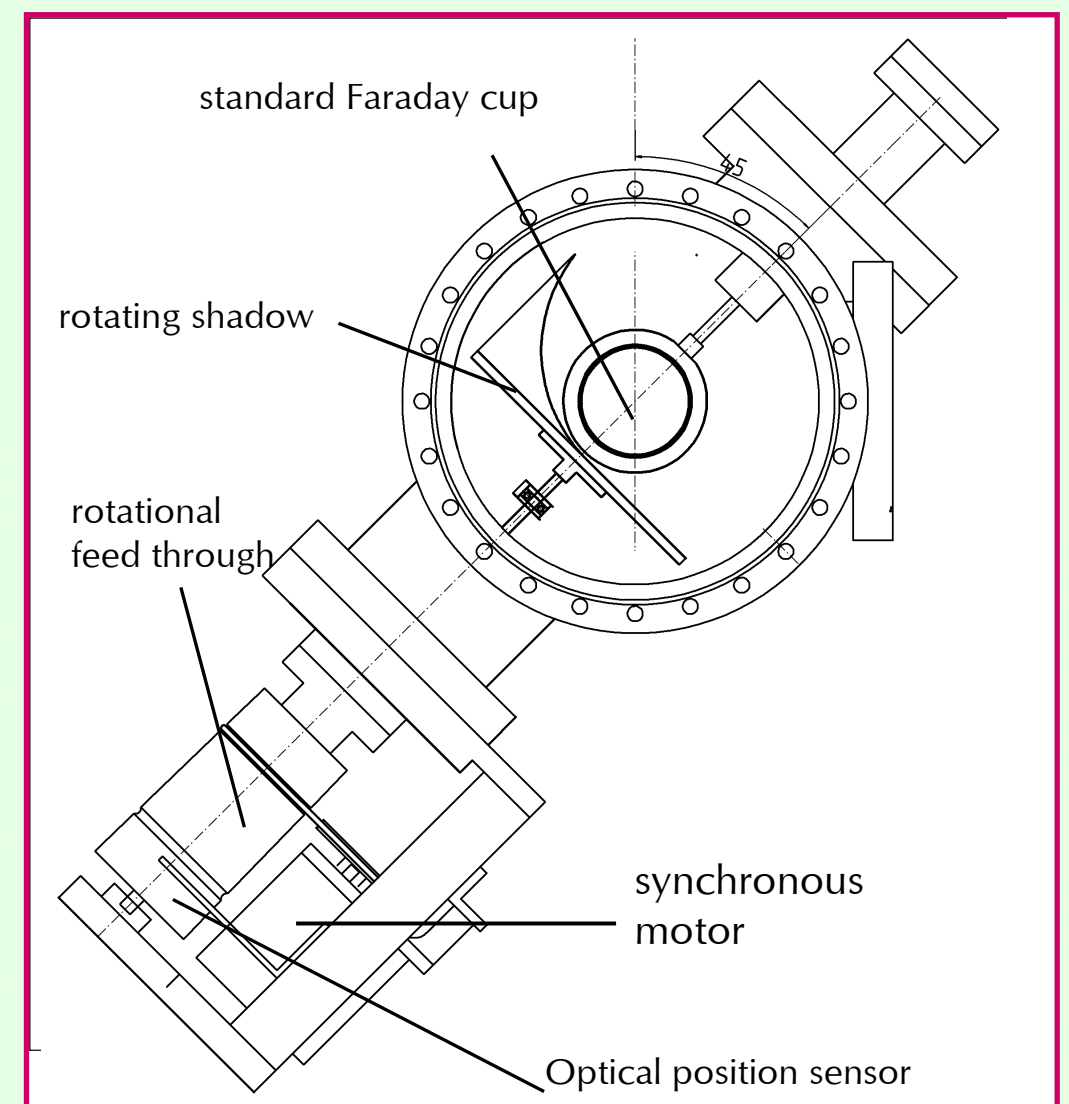
derivative delivers the beam density distribution (beam profile)

the scanner is used for online control of size and position of the beam

Profile- / Emittance-Monitor:

Combination of the SCANNER with a MOVING SLIT:

1. emittance monitor (similar to a slit grid system)
2. high resolution profile monitor (x/y-beam distribution)

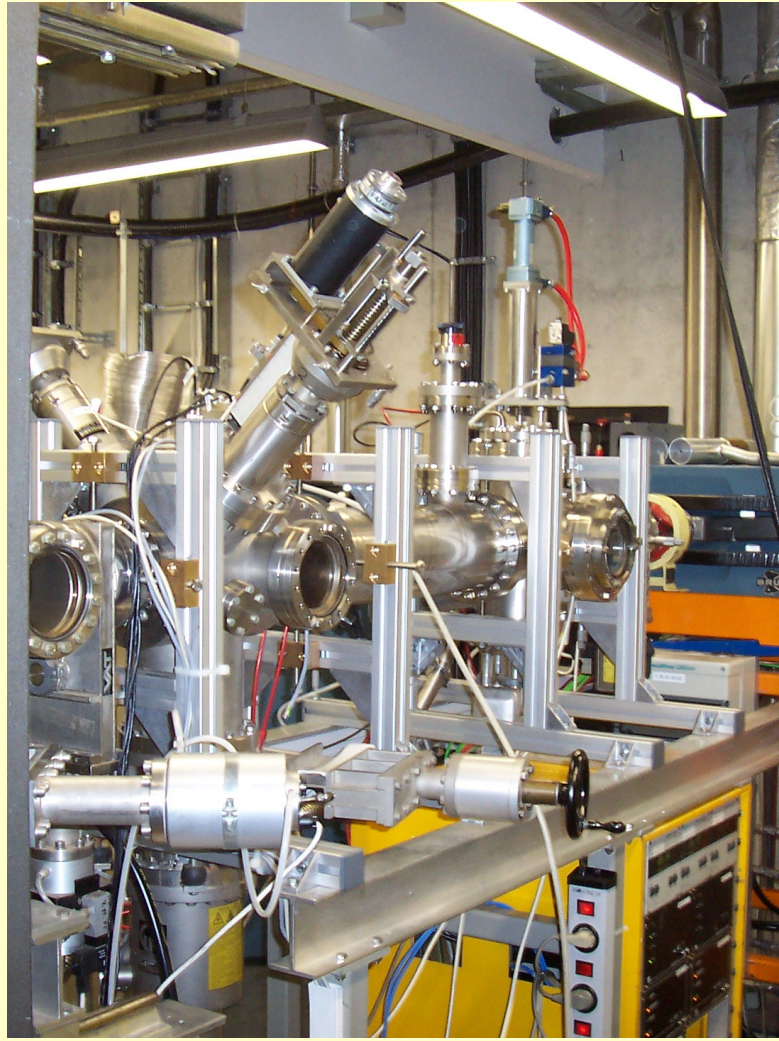


See also:

K. E. Stiebing, M. S. Kaiser, J. D. Meyer, L. Schmidt, H. Schmidt-Böcking, O. Strekalovskij, V. Alexandrov, A. Kayukov, M. Koryevkina, G. Shirkov;
Rev. Sci. Instrum., Vol. 75, No. 5, May 2004 "A profile/emittance-monitor at the Frankfurt 14-GHz ECRIS"

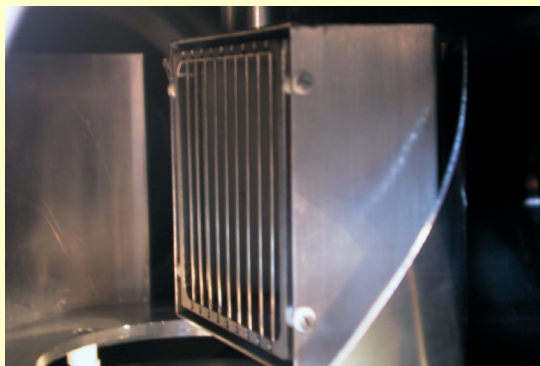
Scanners at the IKF- Accelerator Centre:

ECRIS 0° beam line

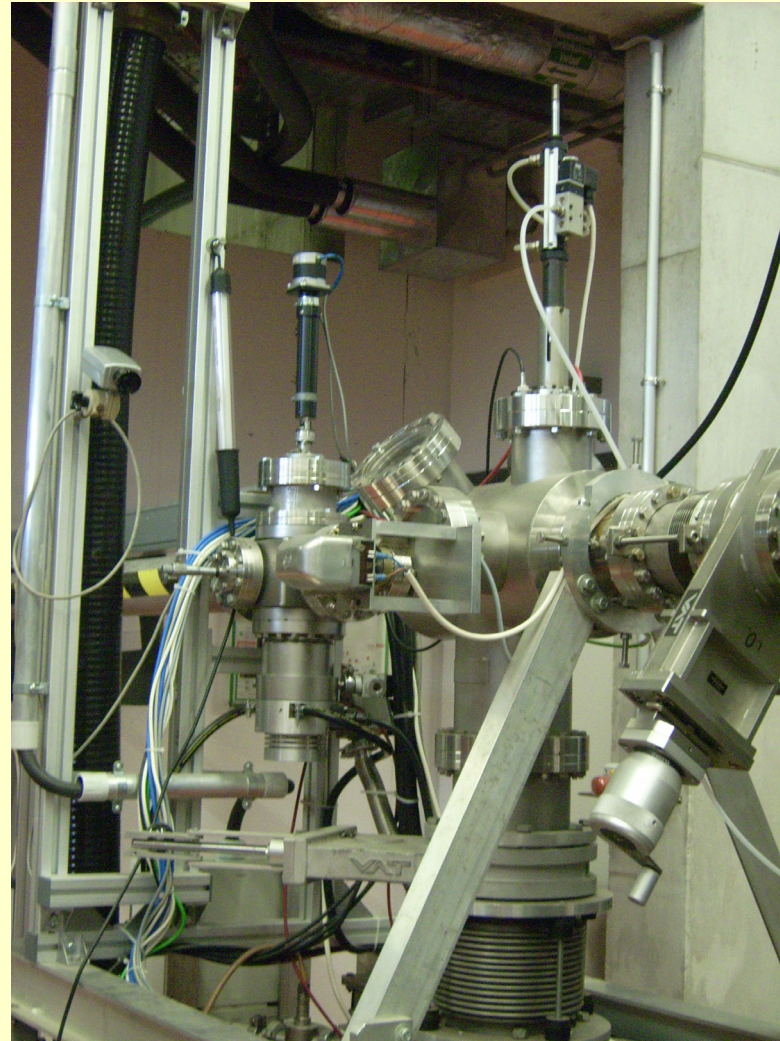


scanning area : 70 x 70 mm
effective slit range : 50 mm
orientation : 45° to beam coordinates
slit -scanner dist. : 1.0 m

two slits (.05mm)
 X - Y profiles
 Y / Y' emittance
 X / X' emittance

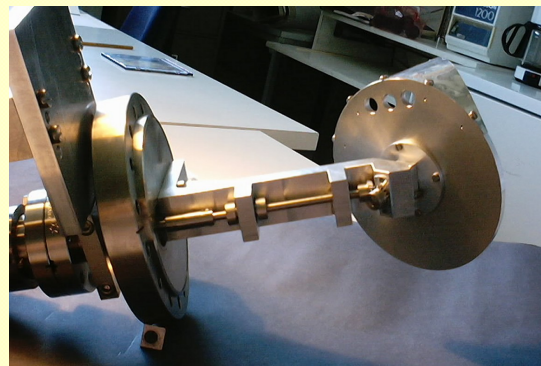


ECRIS analysed beam

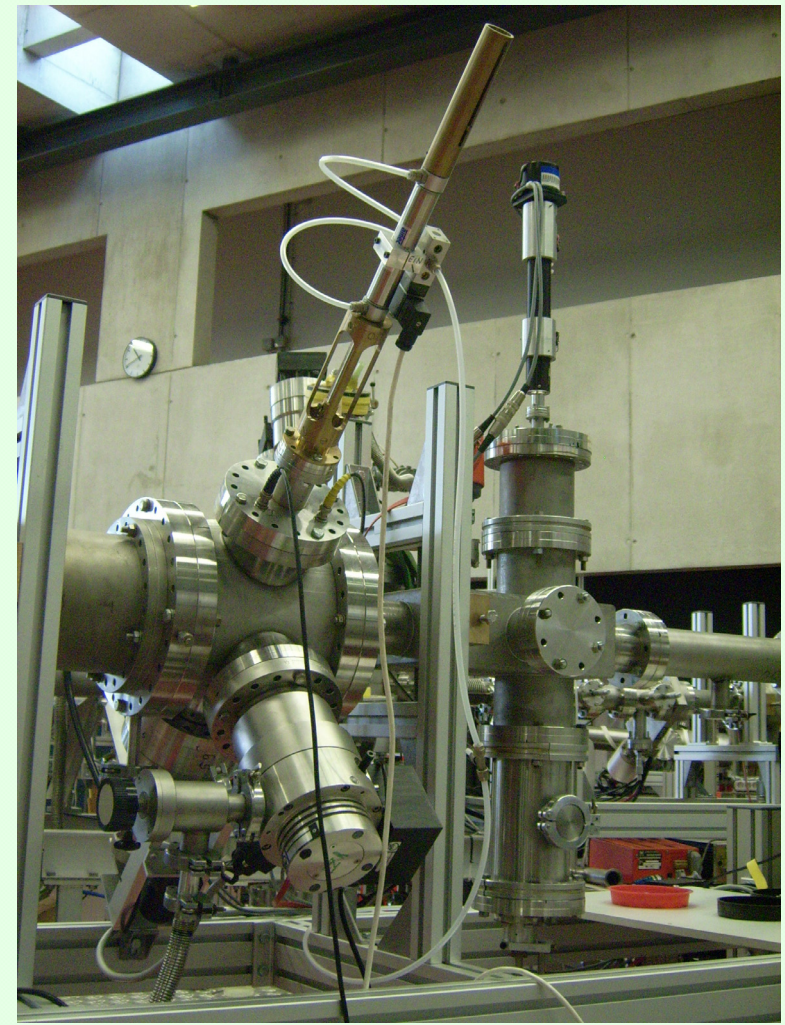


scanning area : Ø 30 mm
effective slit range : 50 mm
orientation : aligned with beam axis
slit -scanner dist. : 0.34m

one slit (0.5mm)
 X - Y profiles
 Y / Y' emittance



Injection line FLSR (Frankfurt Low-Energy Storage Ring)

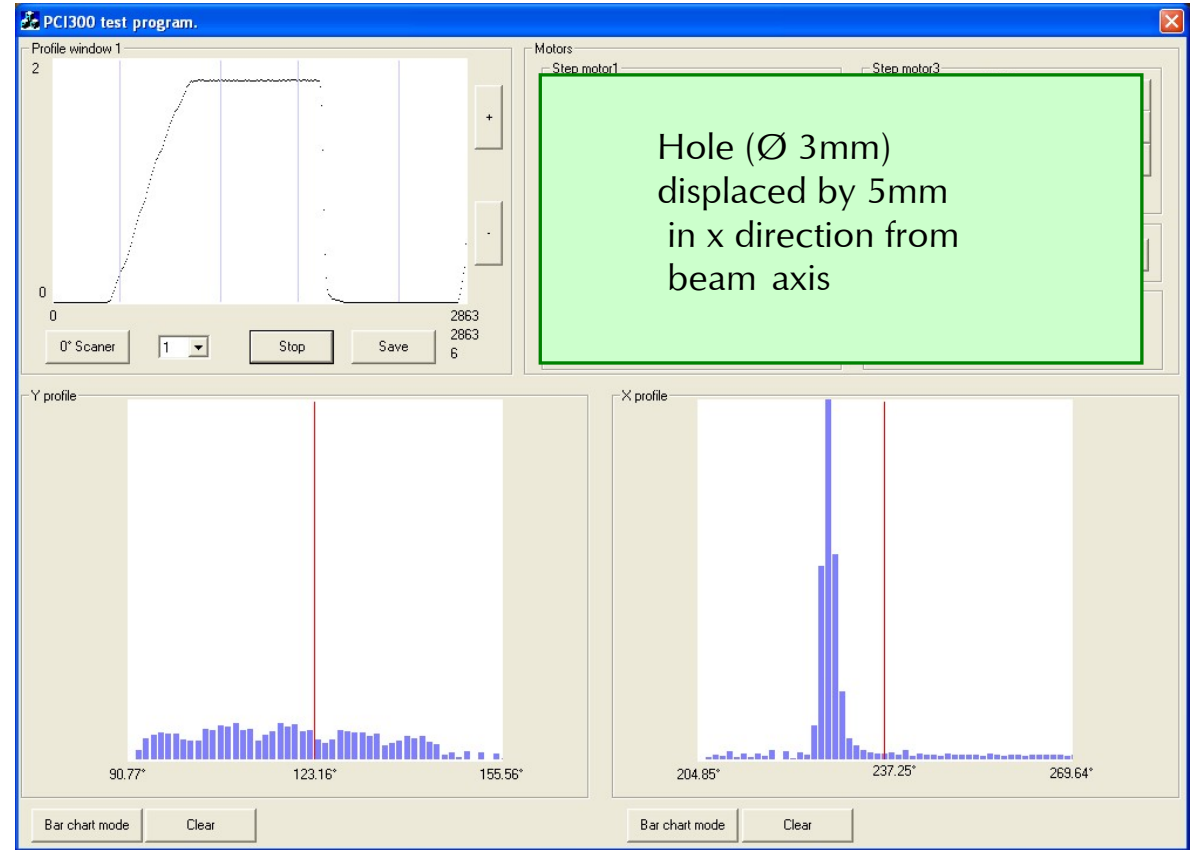
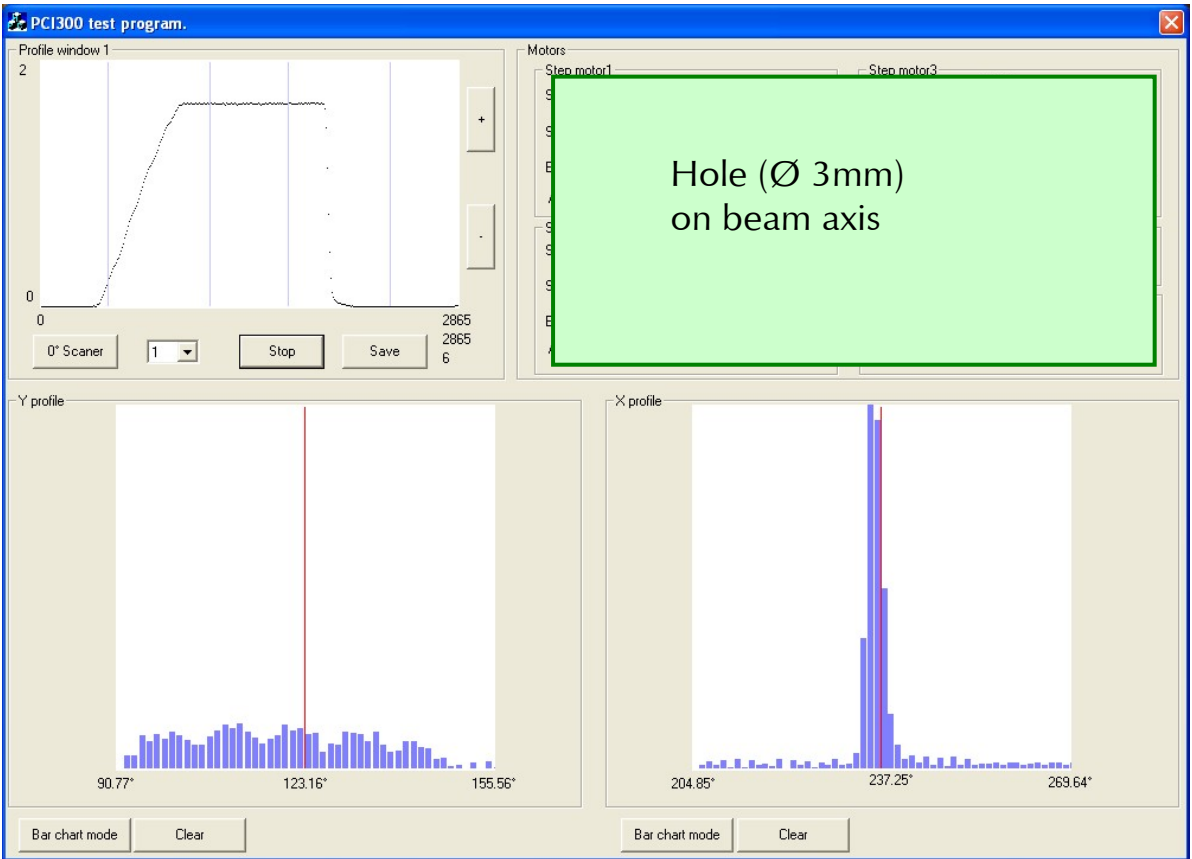
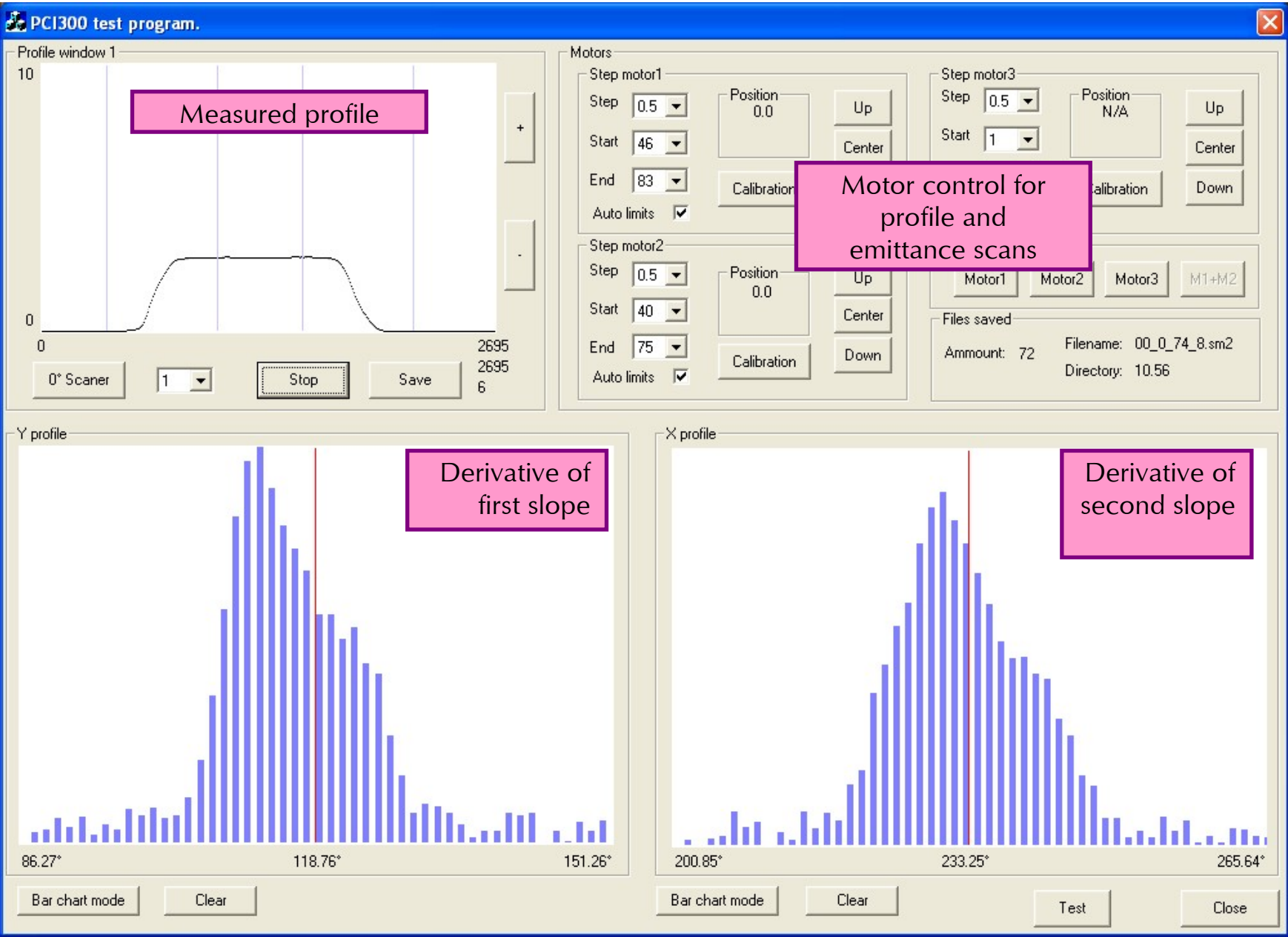


scanning area : Ø 60 mm
effective slit range : 50 mm
orientation : aligned with beam axis
slit -scanner dist. : 0.64 m

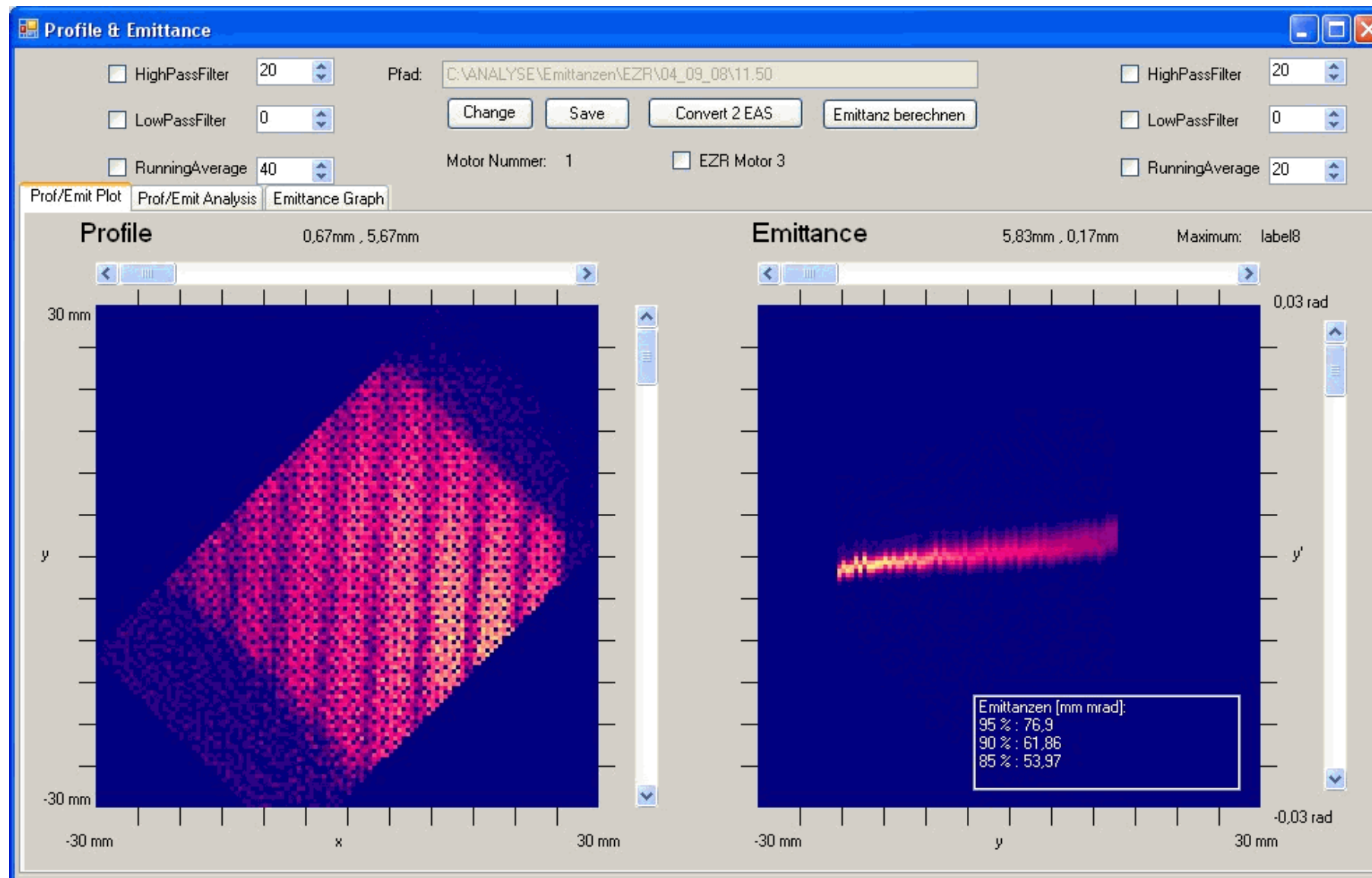
one slit (0.5mm)
 X - Y profiles
 Y / Y' emittances



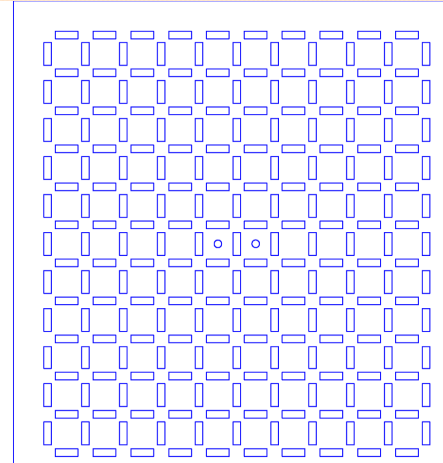
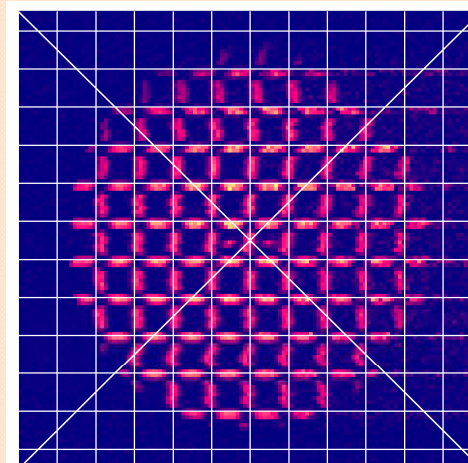
Online program (position monitor)



Offline program (analysis of profiles and emittances)



1. Calibration of online spectra
2. provides filters for noise reduction
3. determines the area emittance at different levels of the relative profile height
4. Conversion of the data into format compatible for the EAS Code (determination of Twiss parameters)

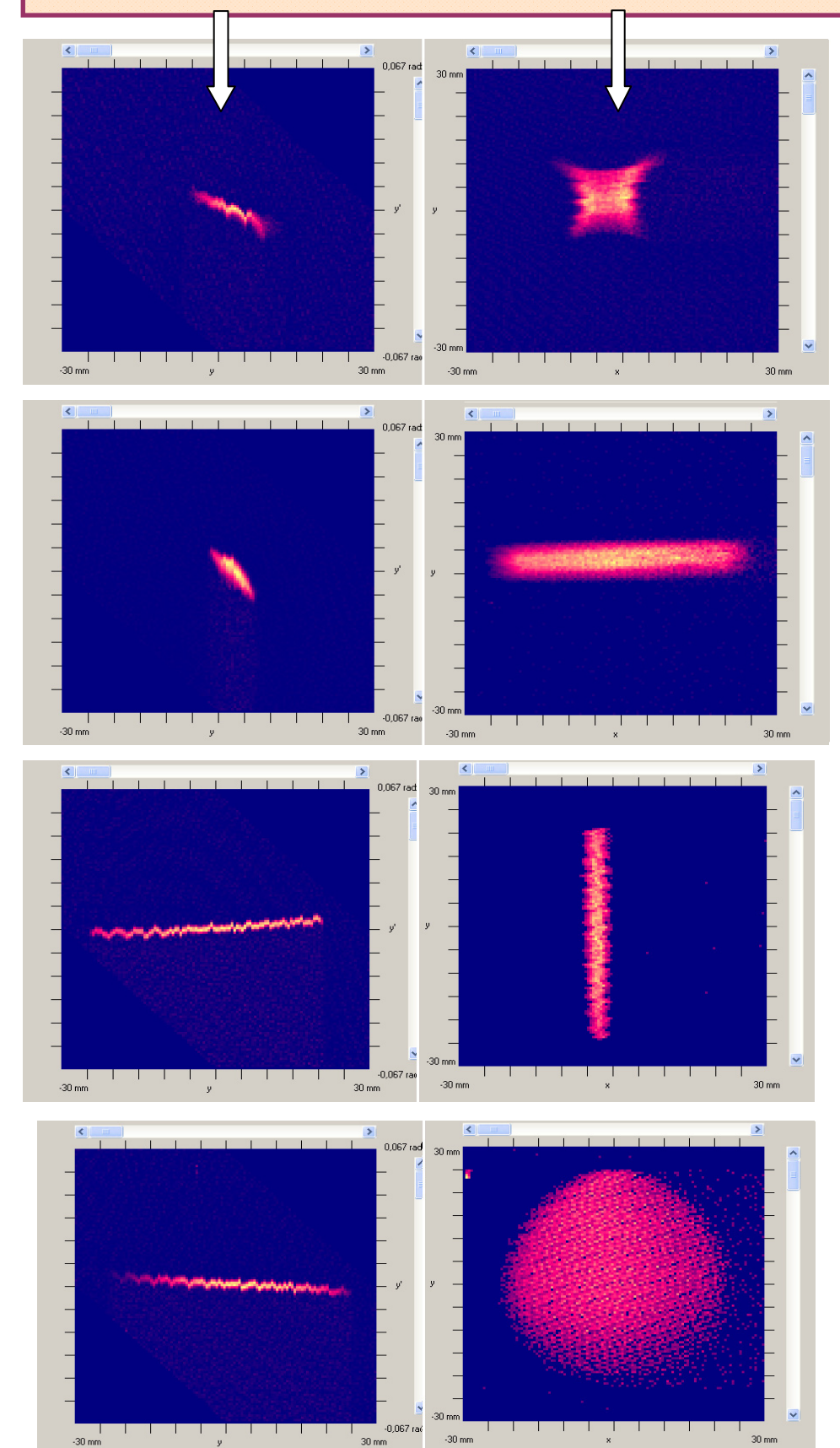


Profile scan (left hand side) and mask (right hand side) testing the linearity of the profile scan. (Mesh size of the grid: 5 x 5 mm)

“Playing” with a quadrupol triplet (FLSR test bench)

y / y' - emittance

x - y - profile



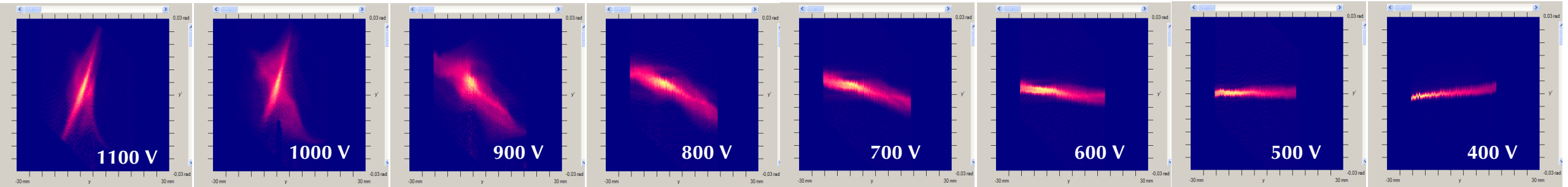
Analysis of Twiss parameters by EAS-code

Emittance Analysis System (EAS)

Accelerator Physics Group Codes Spallation Neutron Source (SNS)

<www.sns.gov/APGroup/Codes/Codes.htm>

Series of measurements with the 0°-SCANNER at different voltages on the Einzellens (no other focusing)



EAS code:

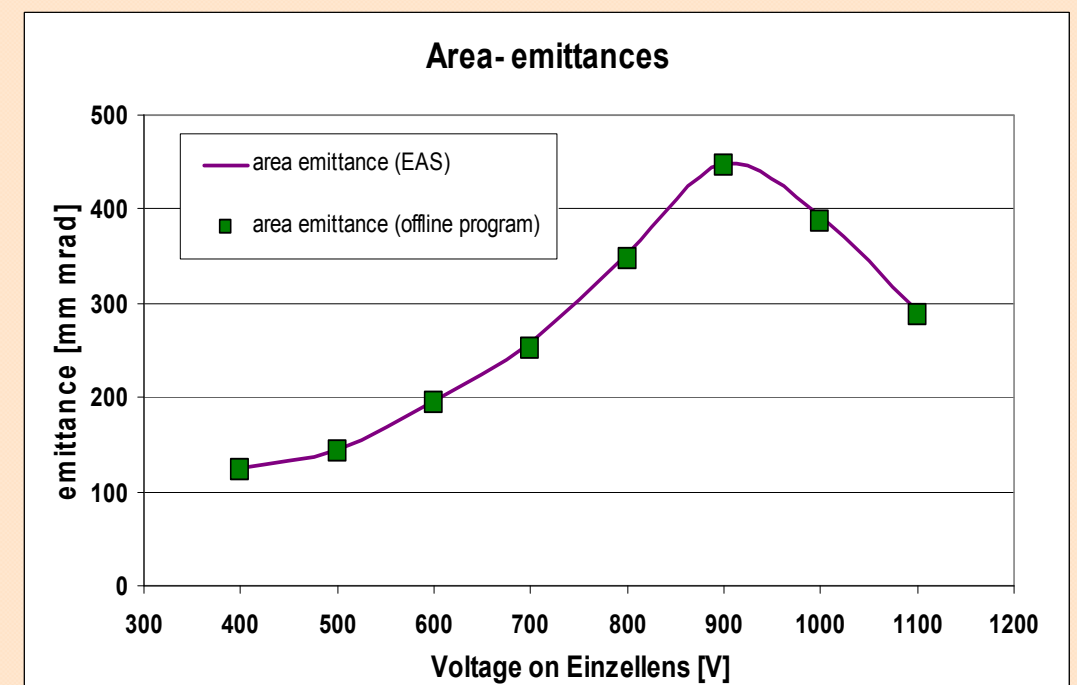
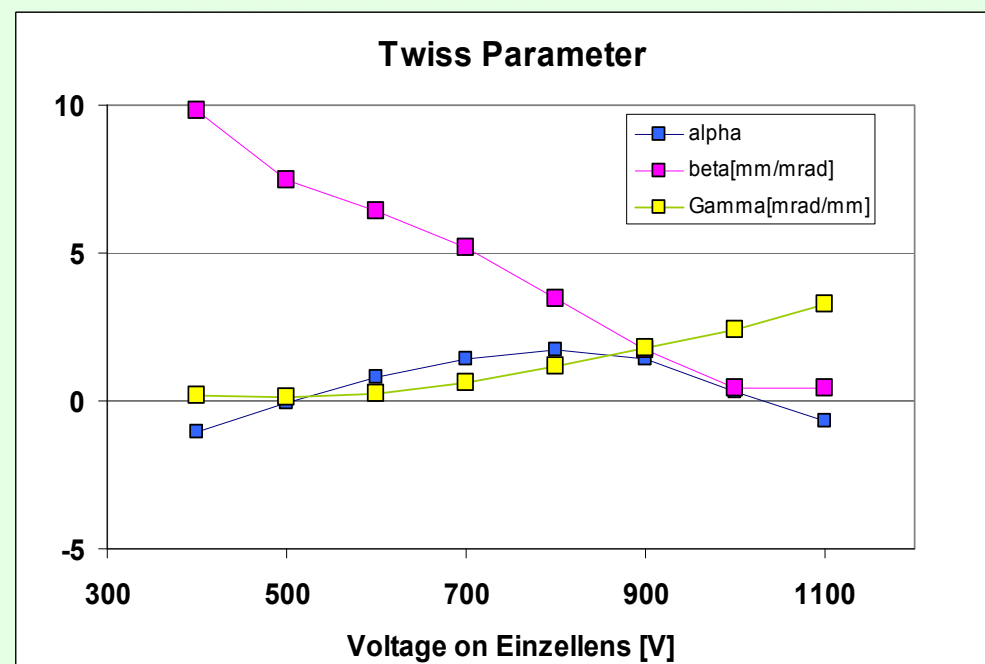
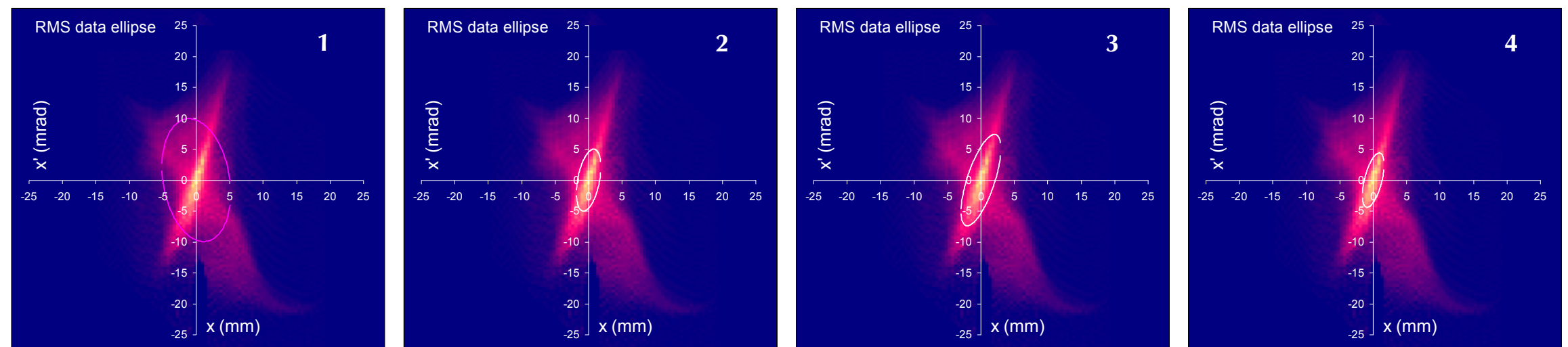
1. all data
2. data filter 30%
3. data ellipse filter
4. data ellipse filter + data filter 50%

left :

Twiss parameters using RMS emittance

right :

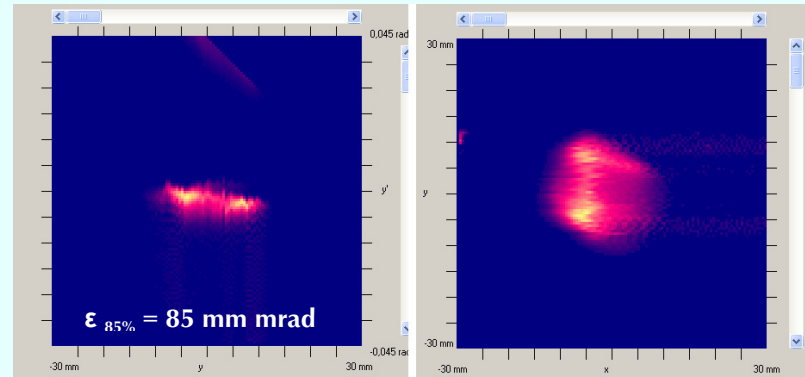
comparison of area emittances EAS and offline program



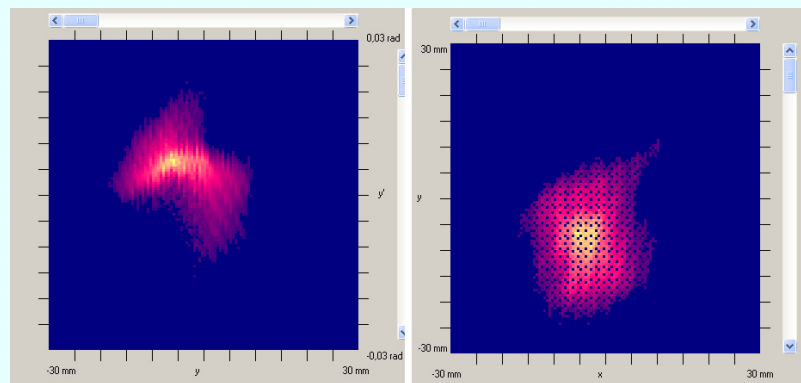
Filament beam?

(measurements without Q-3 in 0° beam-line)

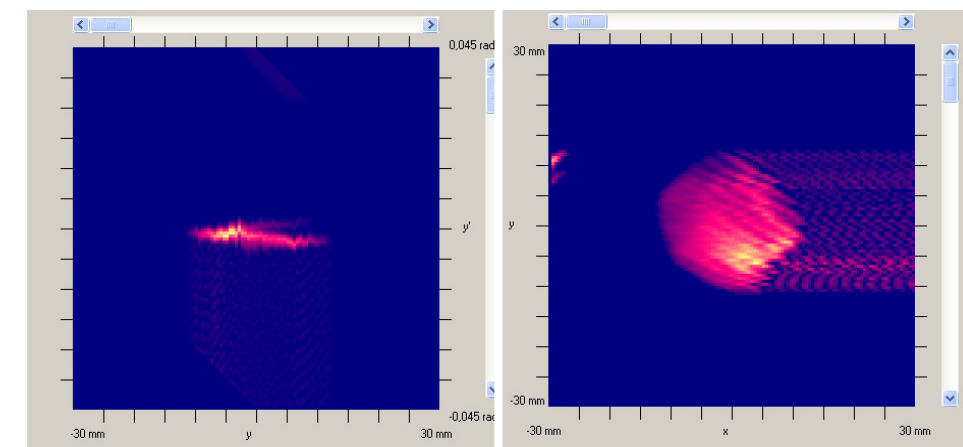
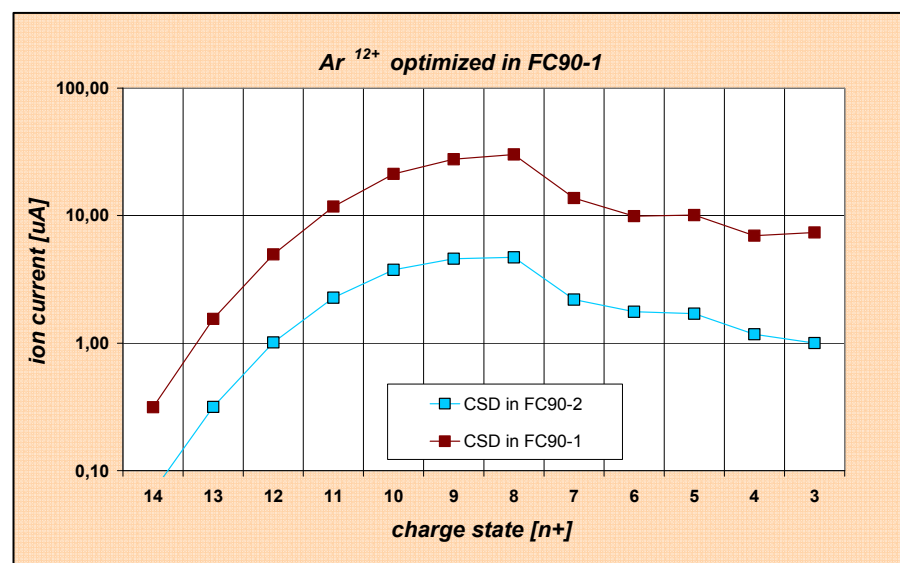
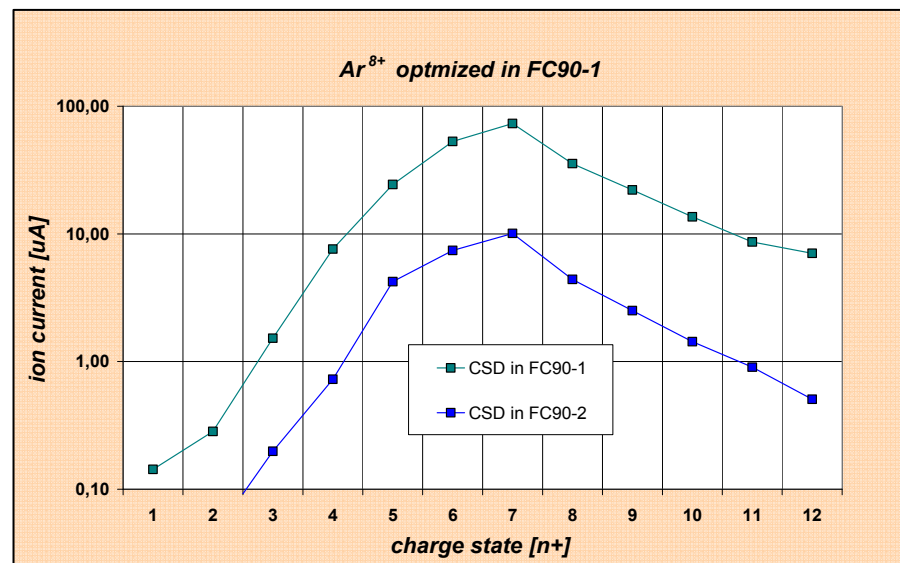
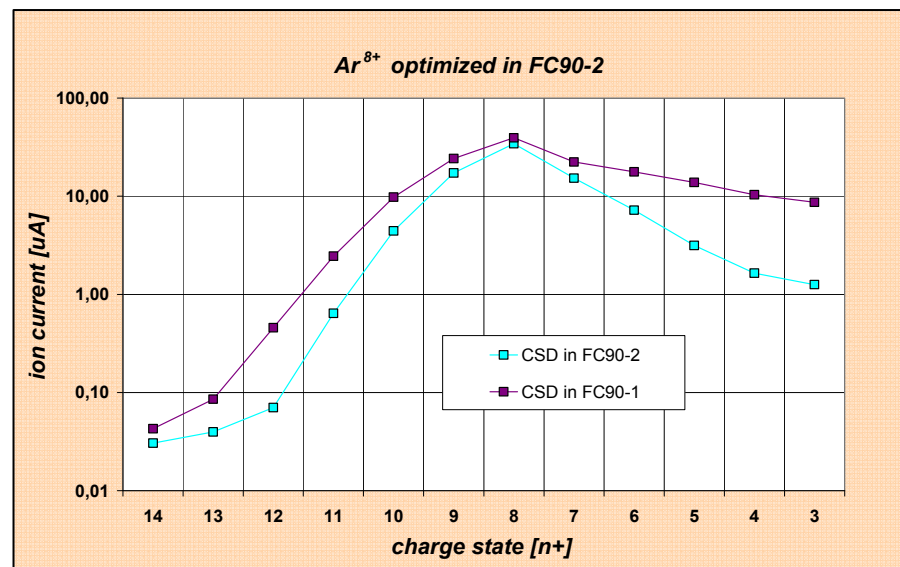
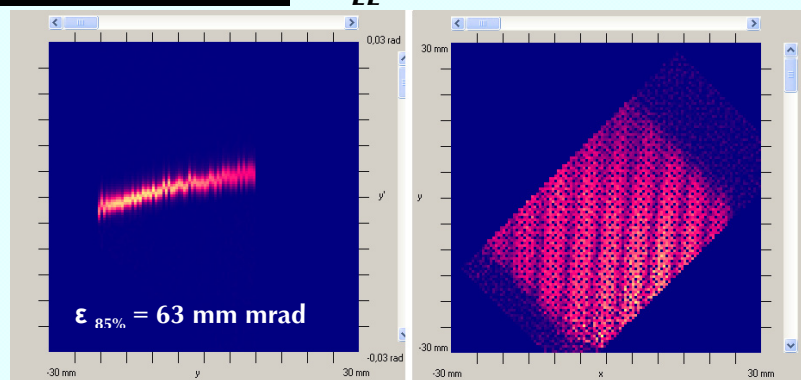
Scanner at FC90-2:



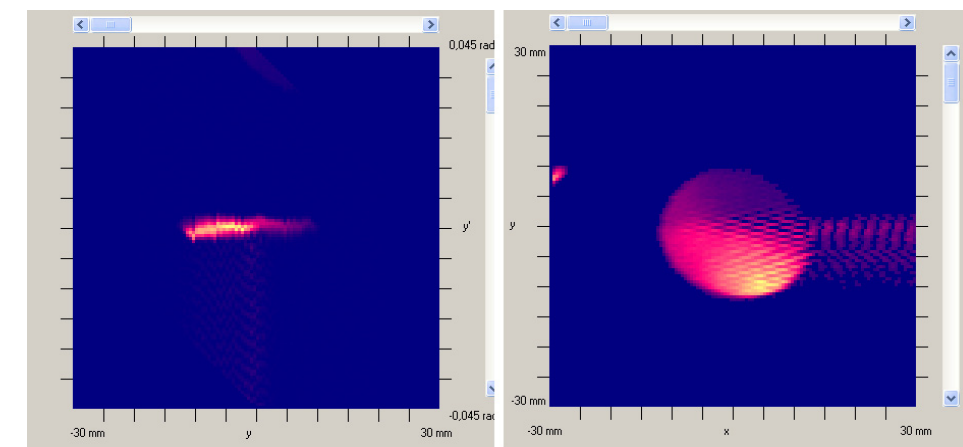
Scanner at FC-0°: $U_{EL} = 1012V$ (opt.)



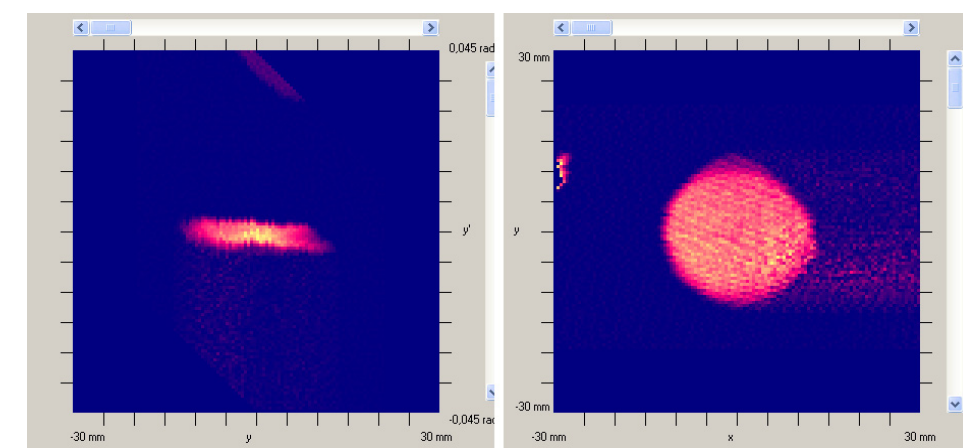
Scanner at FC-0°: $U_{EL} = 500 V$



Emittance: 44mm mrad



Emittance: 40 mm mrad



Emittance: 82 mm mrad