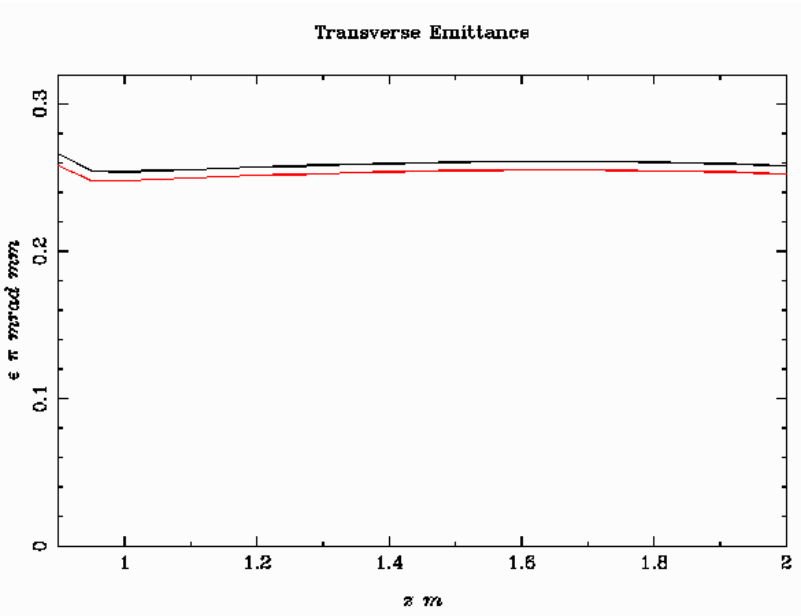
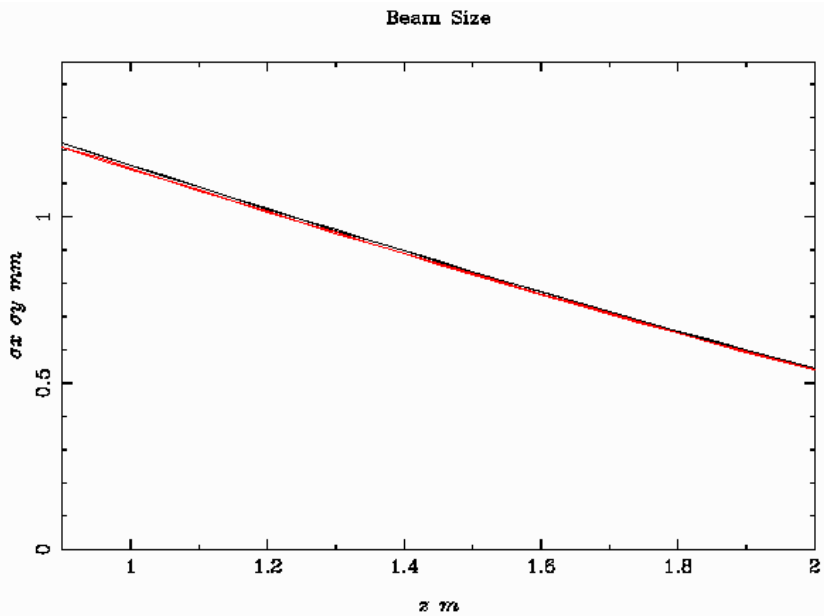
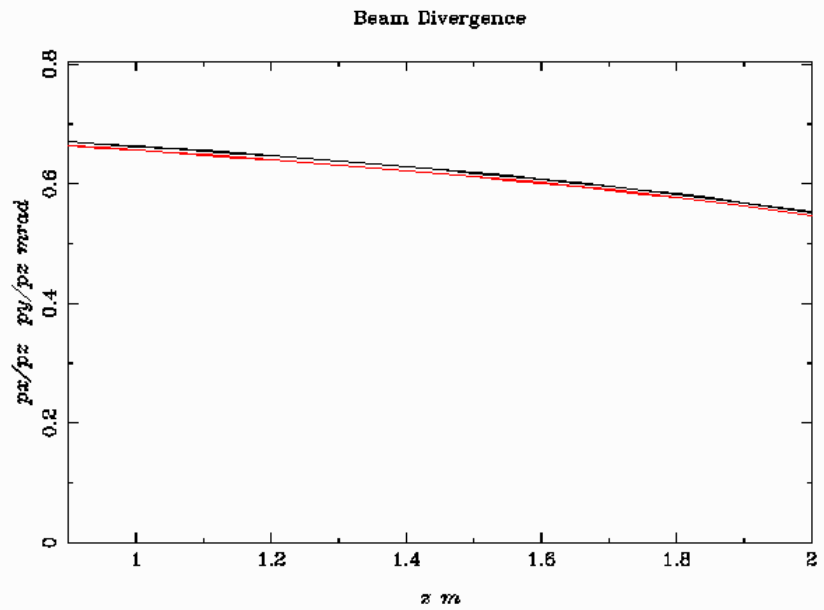
Optimization of Laser Spot on Cathode

Emittance Calculation in ASTRA



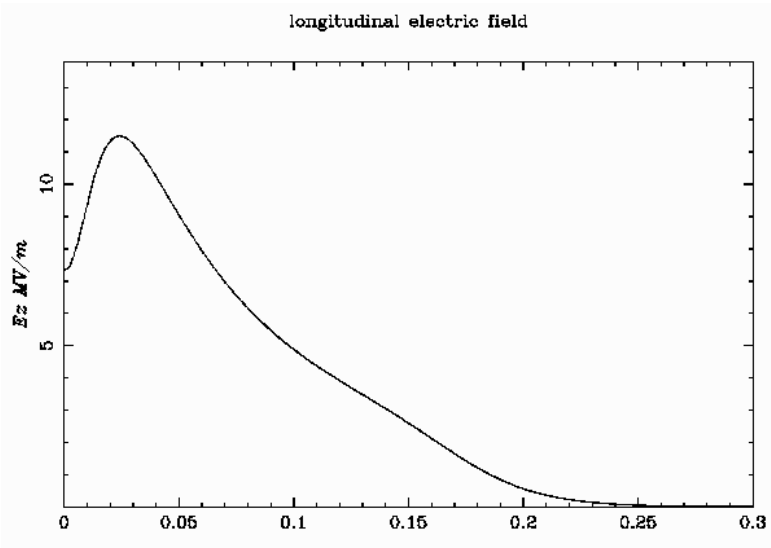


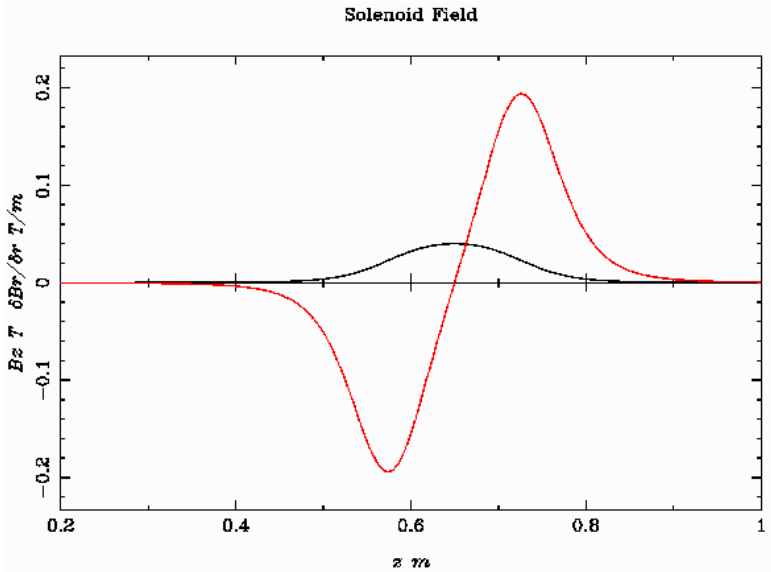


ASTRA e=0.26 mm mrad
From distribution e=0.052 mm mrad
Ratio 5.0, g=5.02 (2.06 MV)
(For E_k=1.1 MeV g=3.15)
ASTRA displays normalized emittance

Simulation Parameters

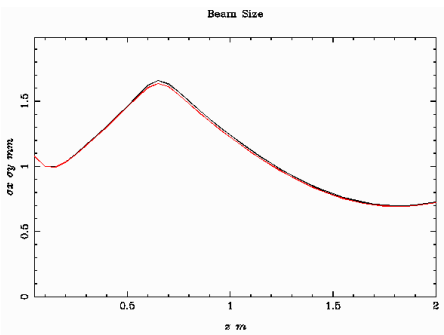
- Simulations performed using ASTRA
- Cavity field corresponding to new cathode position (8.5 mm from the nose face)
- Beam kinetic energy 1.1 MeV (β=0.9483, E_{max}=11.5 MV/m, φ =-3°)
- Bunch length 250 ps (plateau distribution with 10 ps edges)
- Radial uniform distribution with varying radius
- Zero initial emittance and energy spread
- Peak solenoid field 0.04 T
- Charge was changed (scaled with no change in macroparticles distribution)

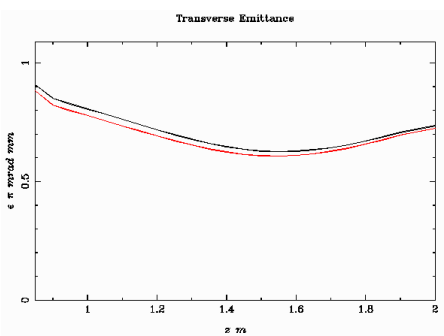




0.3 nC Charge

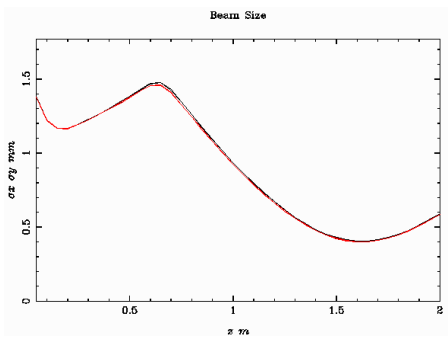
σ=1.5 mm, r=3 mm

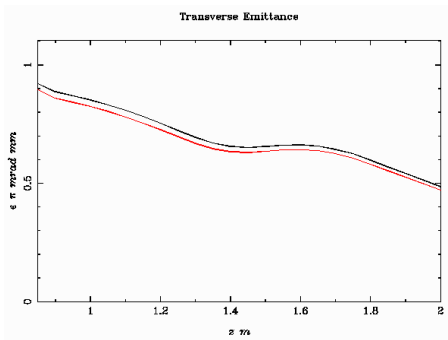




ε_{min}=0.6

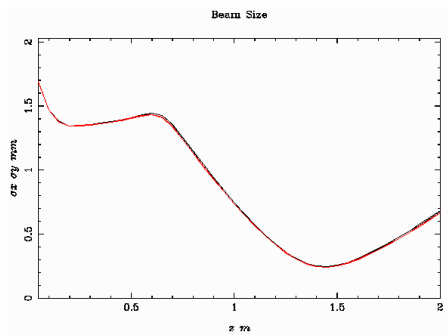
σ=2.0 mm, r=4 mm

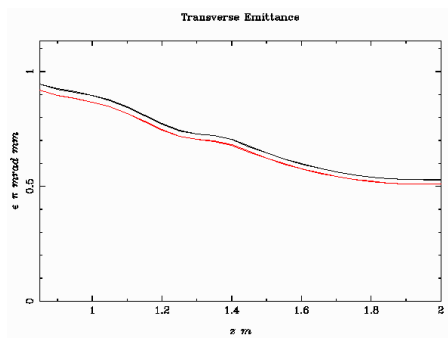




ε_{min}=0.5 (?)

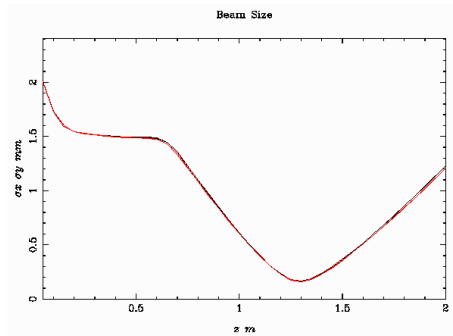
σ=2.5 mm, r=5 mm

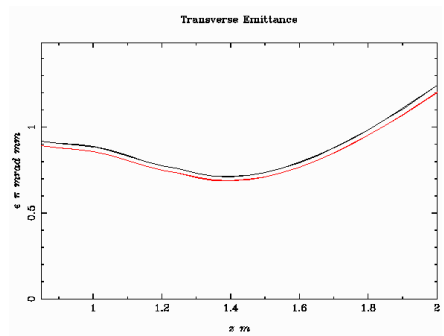




ε_{min}=0.5

σ=3.0 mm, r=6 mm



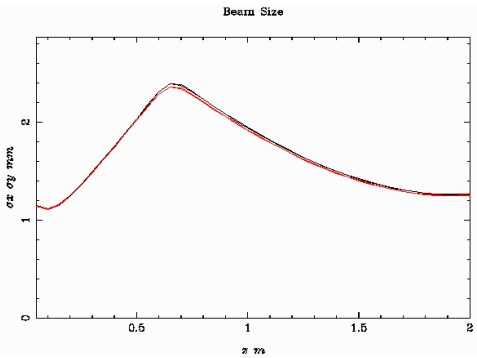


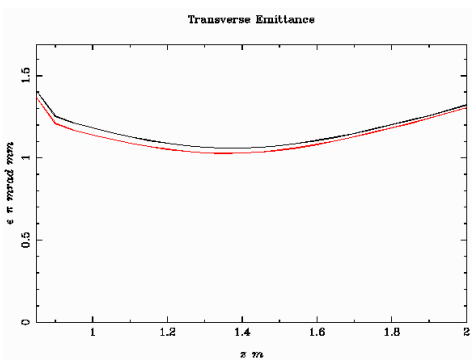
ε_{min}=0.7

Horizontal axes have different scales for beam size and emittance

0.5 nC Charge

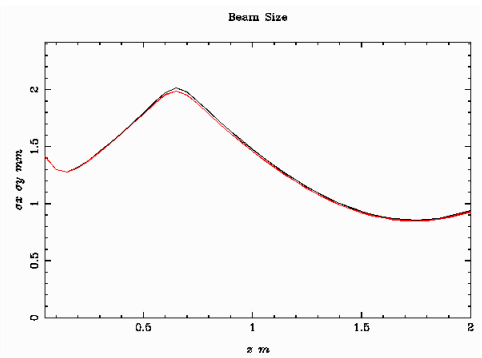
σ=1.5 mm, r=3 mm

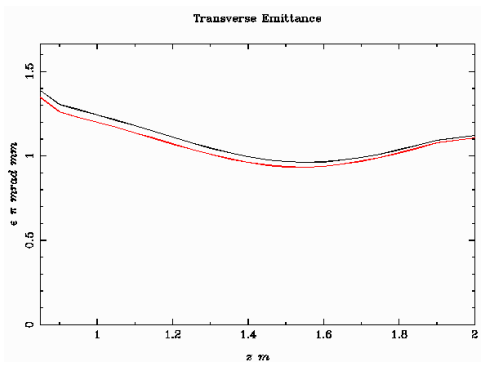




ε_{min}=1.0

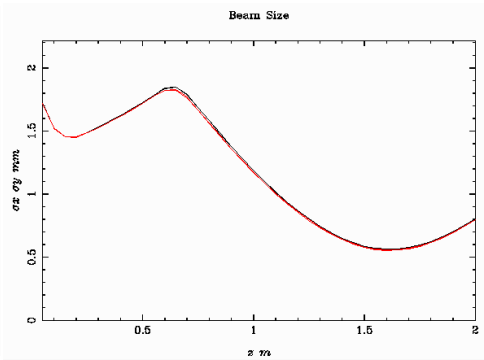
σ=2.0 mm, r=4 mm

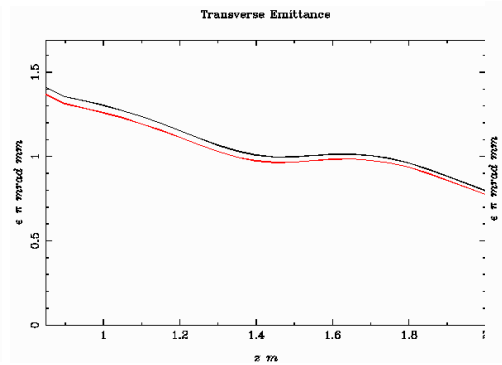




ε_{min}=0.9

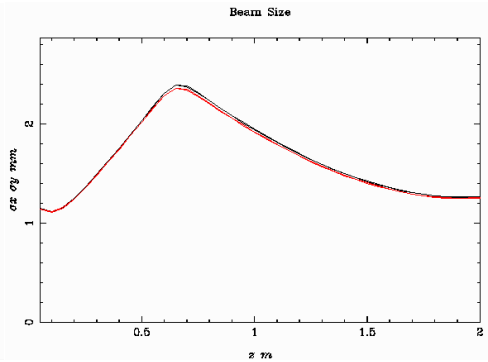
σ=2.5 mm, r=5 mm

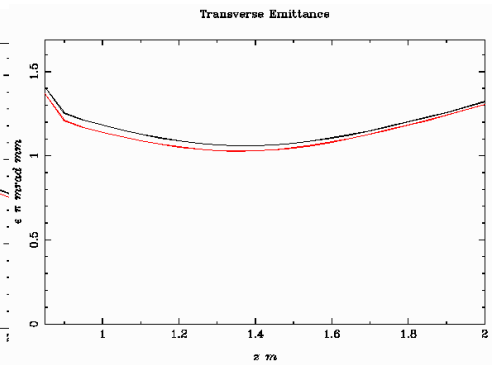




ε_{min}=0.8(?)

σ=3.0 mm, r=6 mm

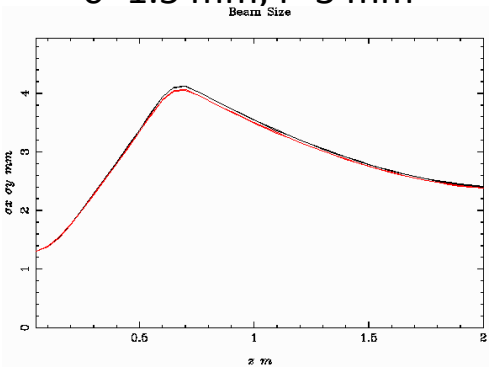


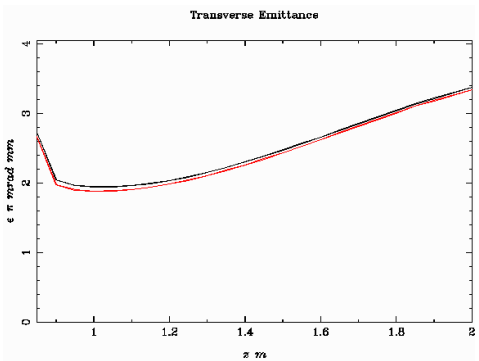


ε_{min}=1.0

1.0 nC Charge

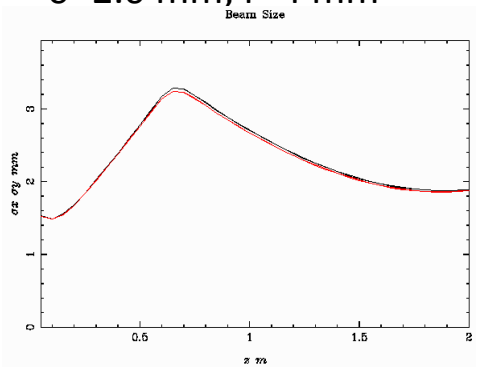
σ=1.5 mm, r=3 mm

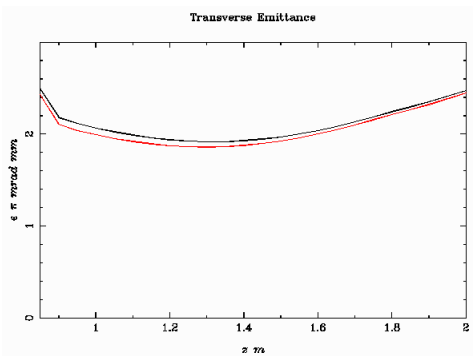




ε_{min}=1.9

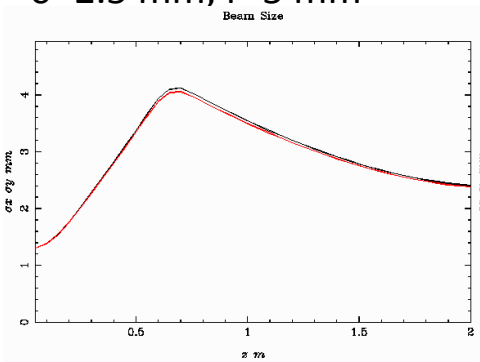
σ=2.0 mm, r=4 mm

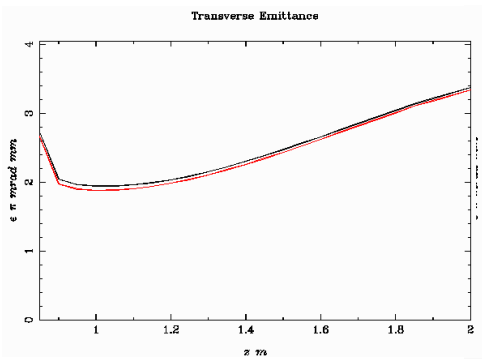




ε_{min}=1.9

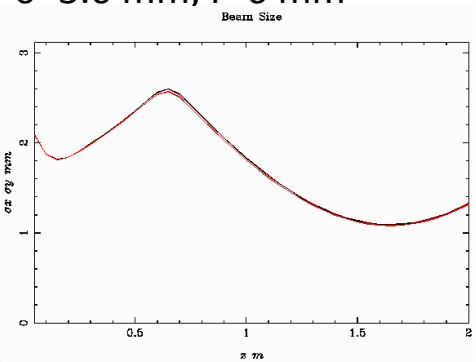
σ=2.5 mm, r=5 mm

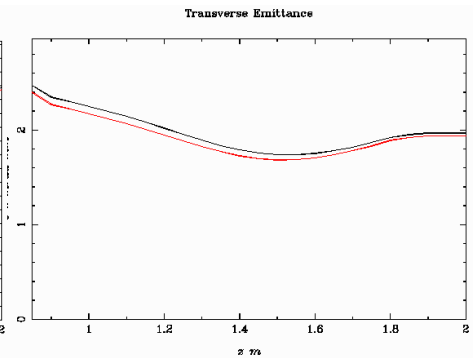




ε_{min}=1.9

σ=3.0 mm, r=6 mm

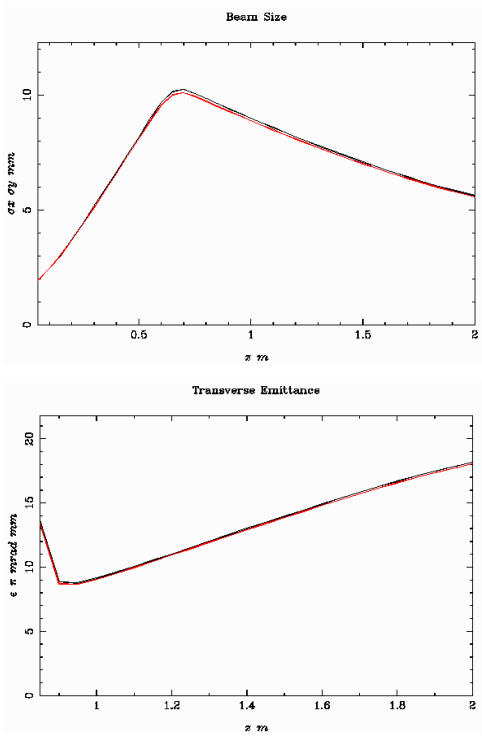




ε_{min}=1.7

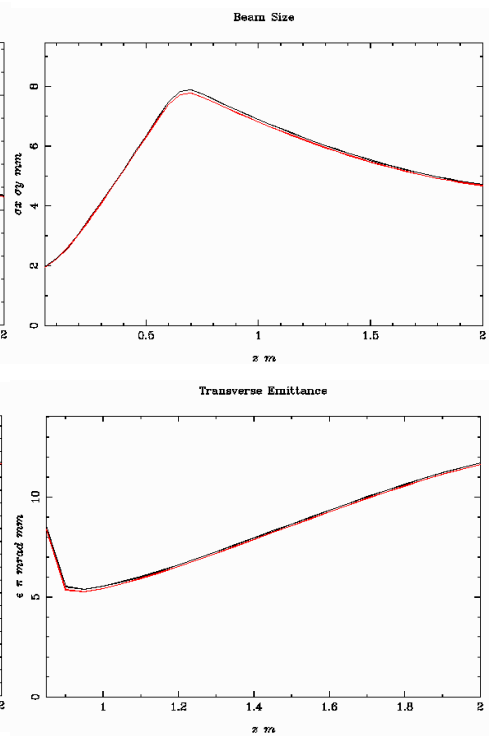
2.0 nC Charge

σ=1.5 mm, r=3 mm



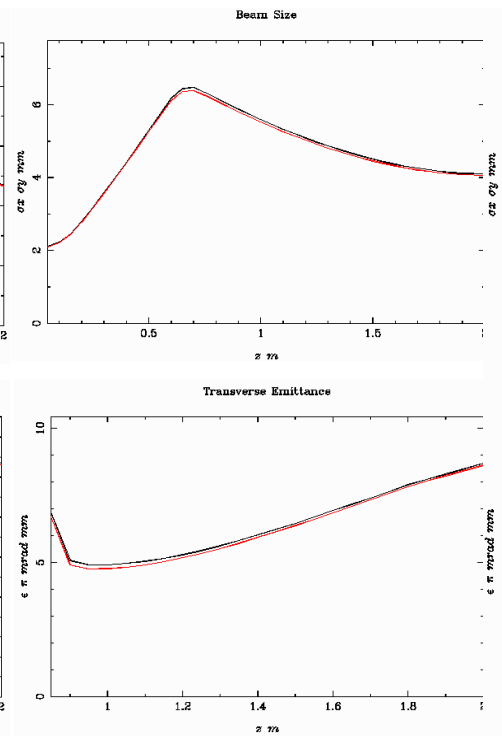
ε_{min}=8.8

σ=2.0 mm, r=4 mm



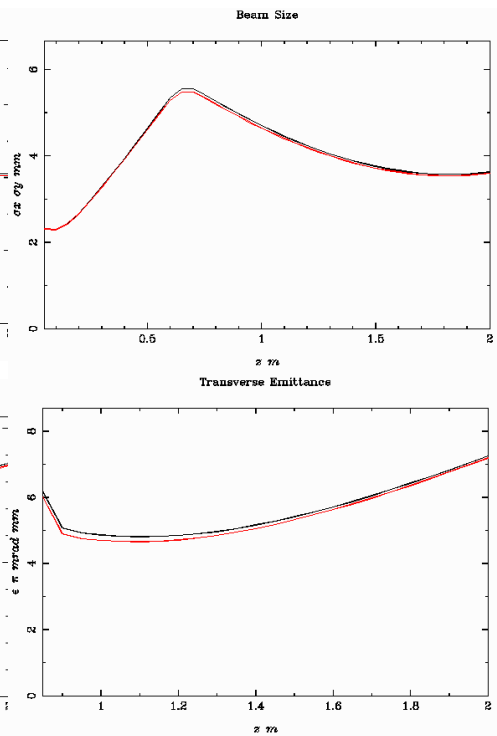
ε_{min}=5.3

σ=2.5 mm, r=5 mm



ε_{min}=4.8

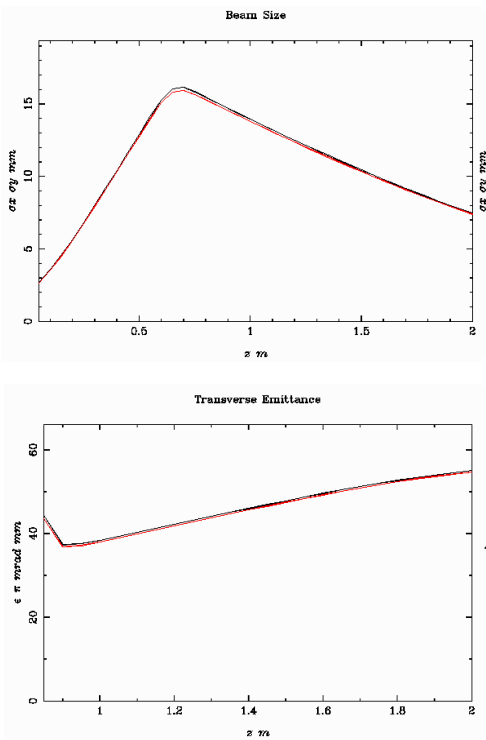
σ=3.0 mm, r=6 mm



ε_{min}=4.7

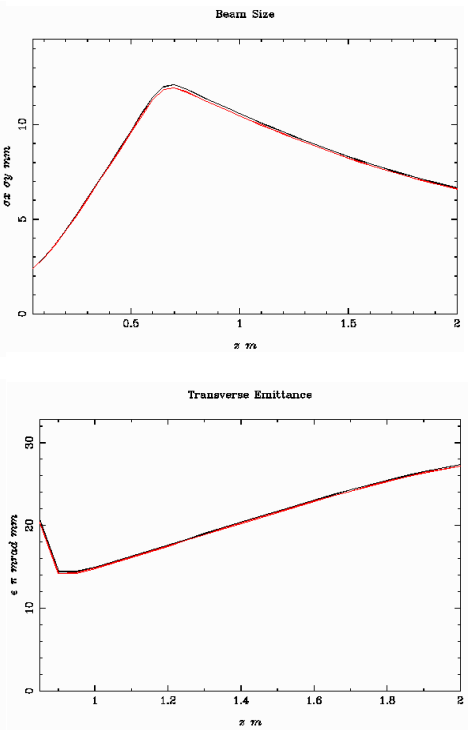
5.0 nC Charge

σ=1.5 mm, r=3 mm



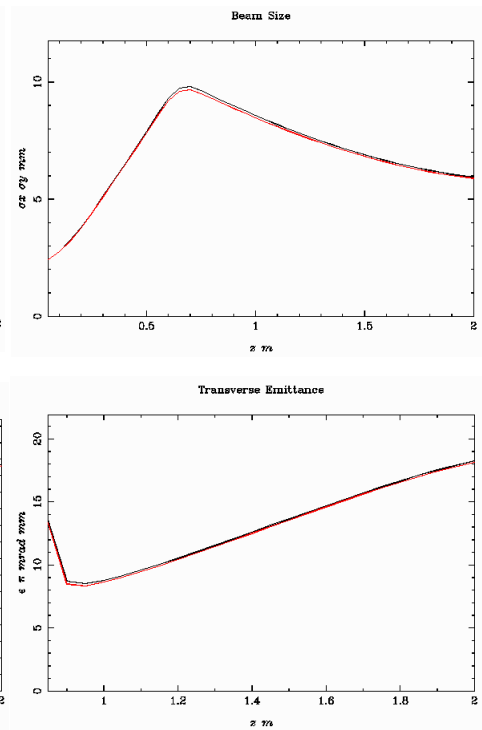
ε_{min}=37.3

σ=2.0 mm, r=4 mm



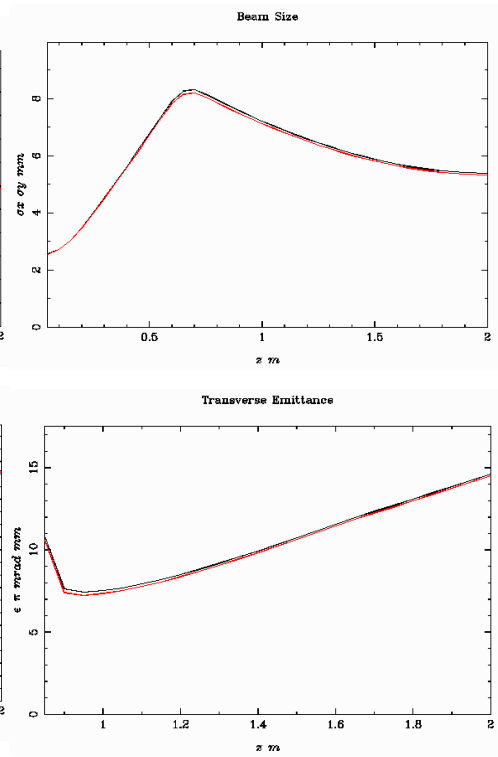
ε_{min}=14.2

σ=2.5 mm, r=5 mm



ε_{min}=8.3

σ=3.0 mm, r=6 mm



ε_{min}=7.2