

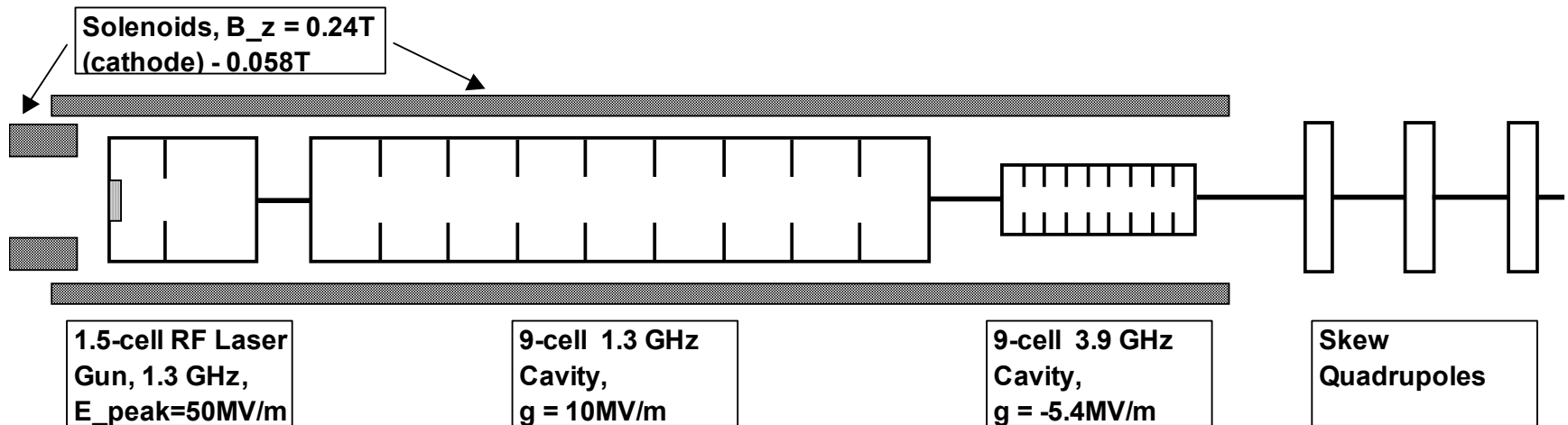
Beam dynamics in combined cavity – solenoid sections

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Bright Electron Beams

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Simulation study for a Flat-beam Injector



$$\begin{aligned} \varepsilon_x &= 1.1 \cdot 10^{-5} \text{ m} \\ \varepsilon_y &= 3 \cdot 10^{-8} \text{ m} \end{aligned} \quad \varepsilon_x / \varepsilon_y = 370$$

Electron source parameters

At the Cathode:

bunch charge	0.8 nC
laser pulse flat top	100 ps
rms radius at cathode	0.26 mm
estimated thermal emittance	$< 0.15 \cdot 10^{-6} \text{ m}$

Electron source parameters

At the Exit:

energy spread 30 keV

bunch length 8 mm

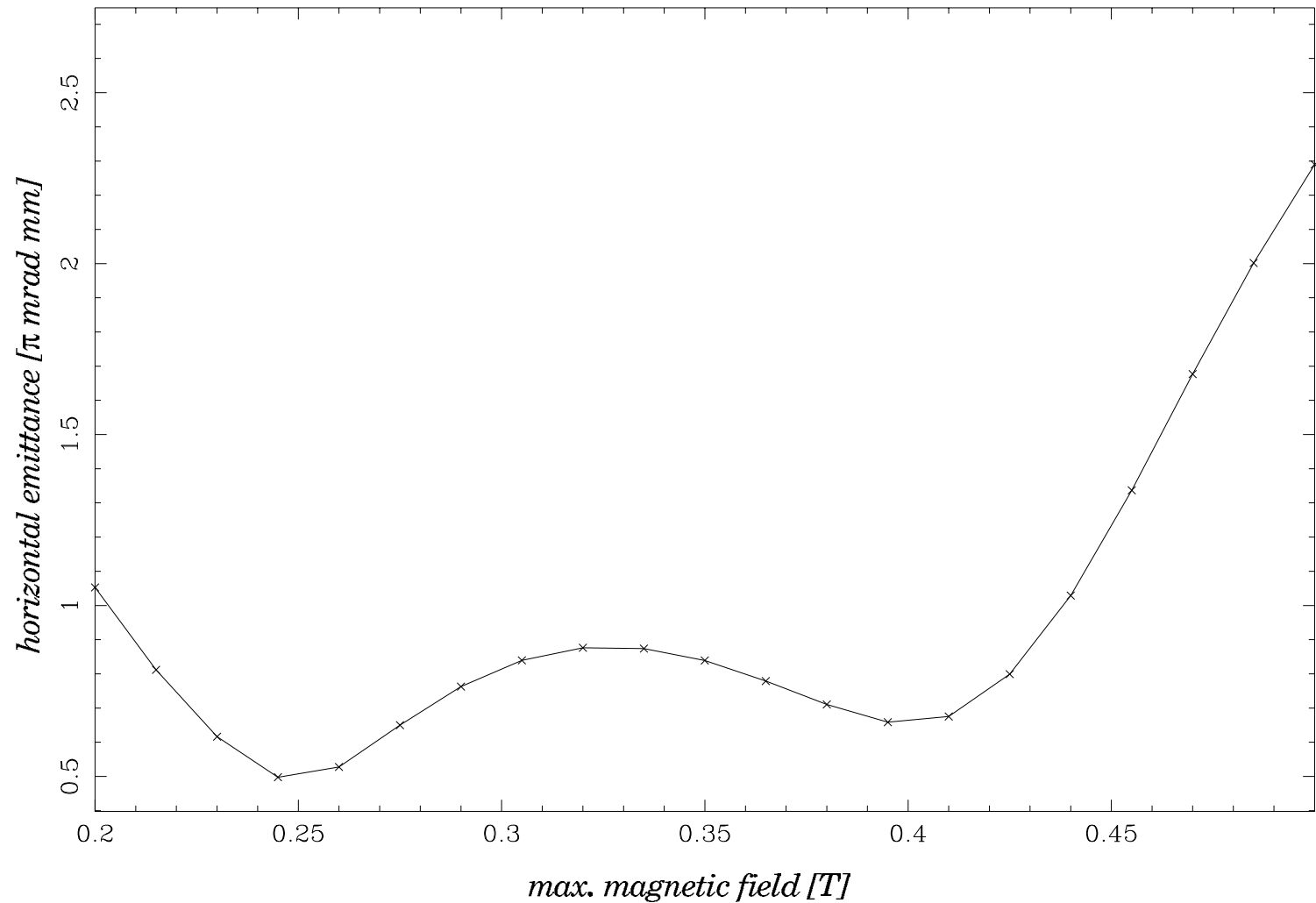
transverse emittance before adapter

$\varepsilon_x = \varepsilon_y$ $0.5 \cdot 10^{-6} \text{ m}$

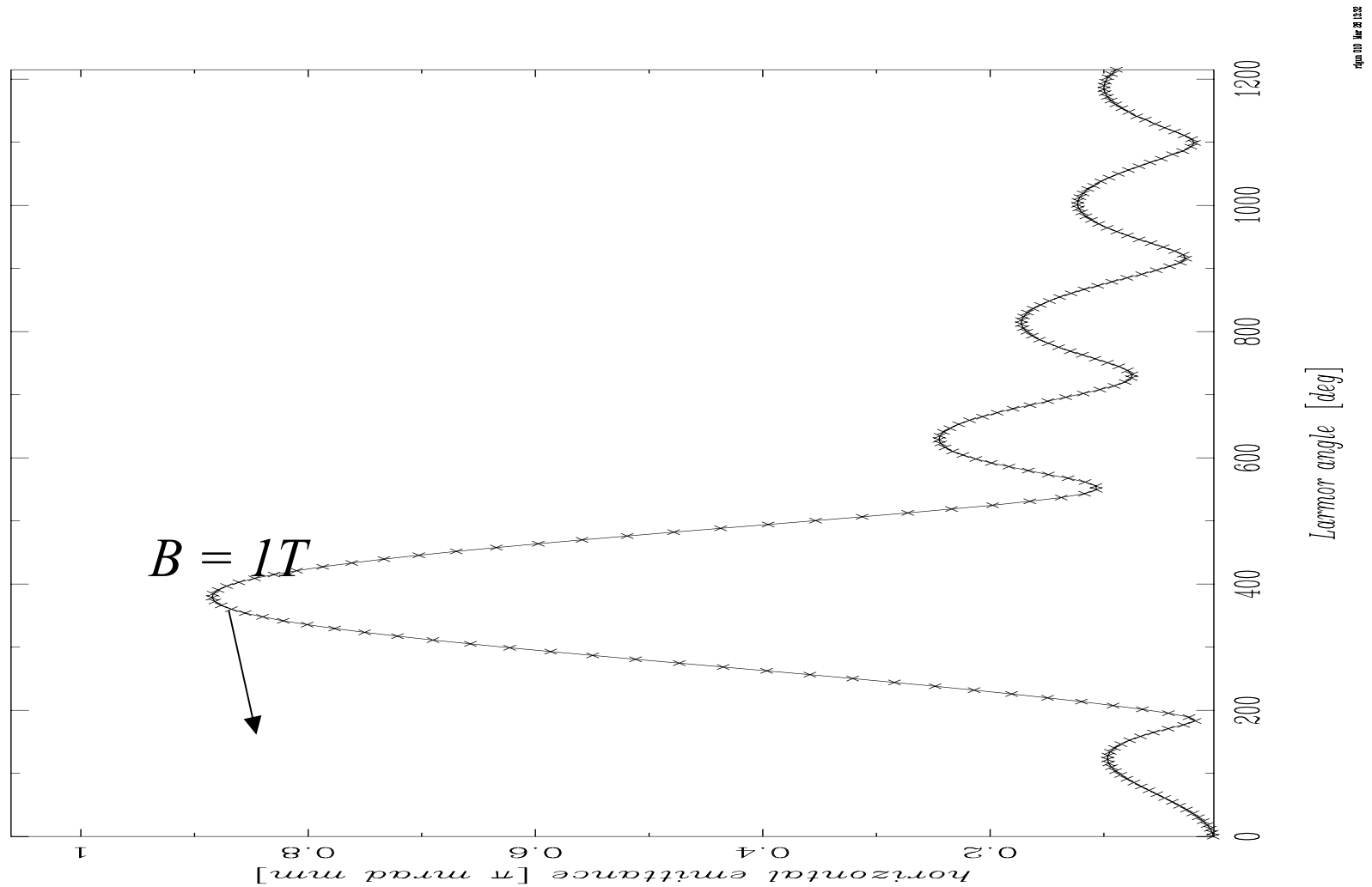
the product emittance is conserved:

$$(\varepsilon_x \cdot \varepsilon_y)_{\text{before}} = (\varepsilon_x \cdot \varepsilon_y)_{\text{after}}$$

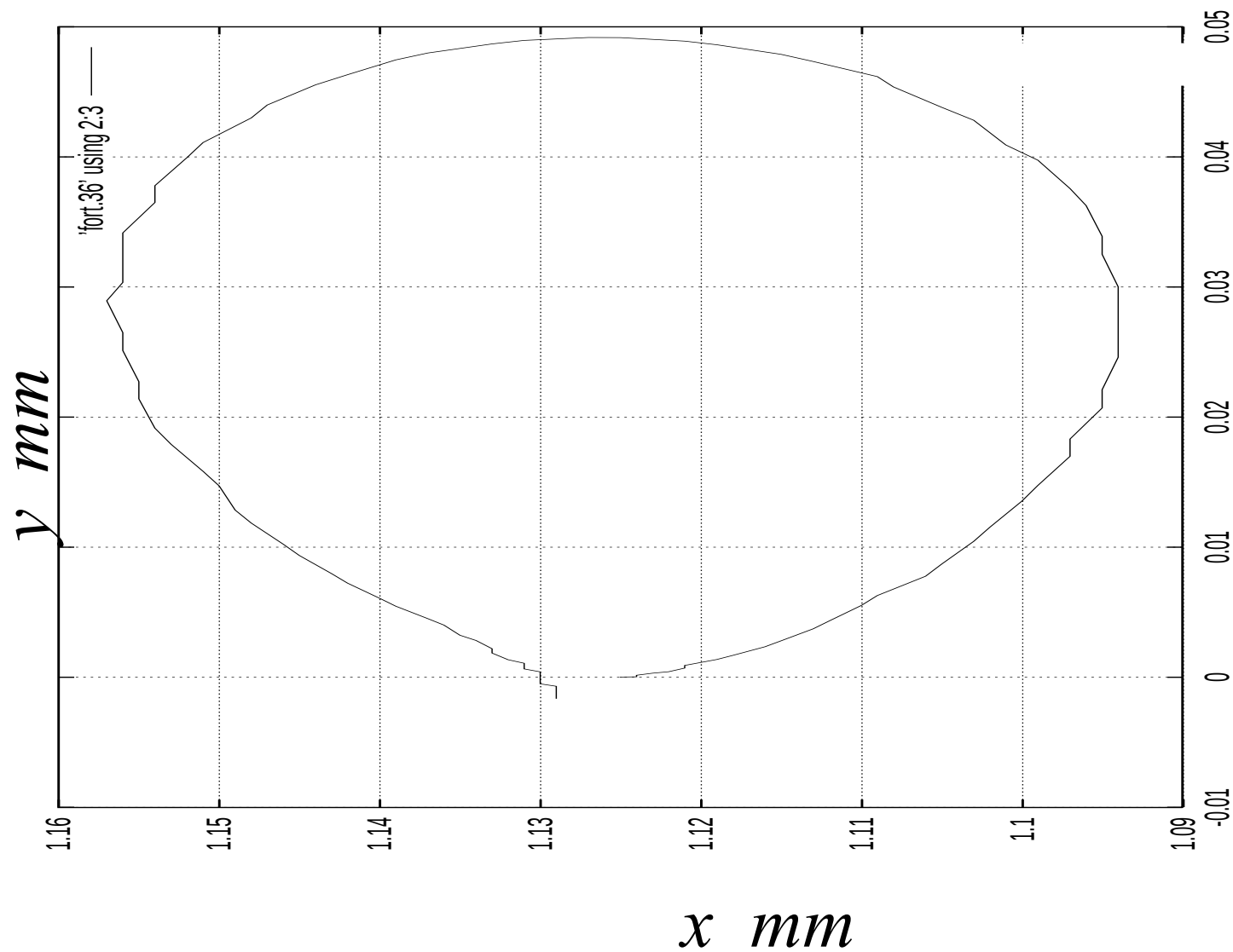
Emittance at the exit of the gun vs. solenoid field on the cathode



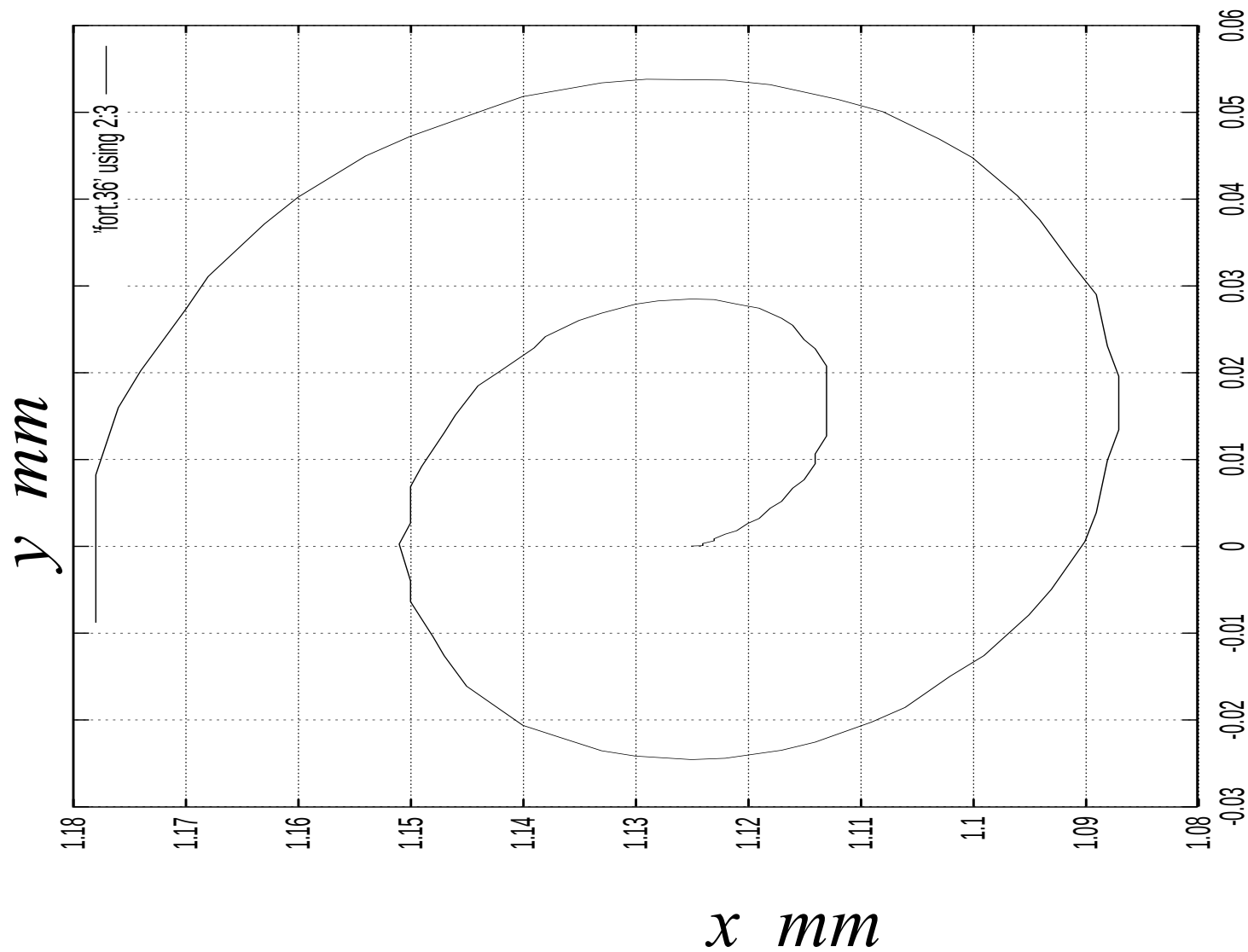
Emittance growth of a ‘magnetized’ bunch passing a two cell cavity embedded in a solenoid



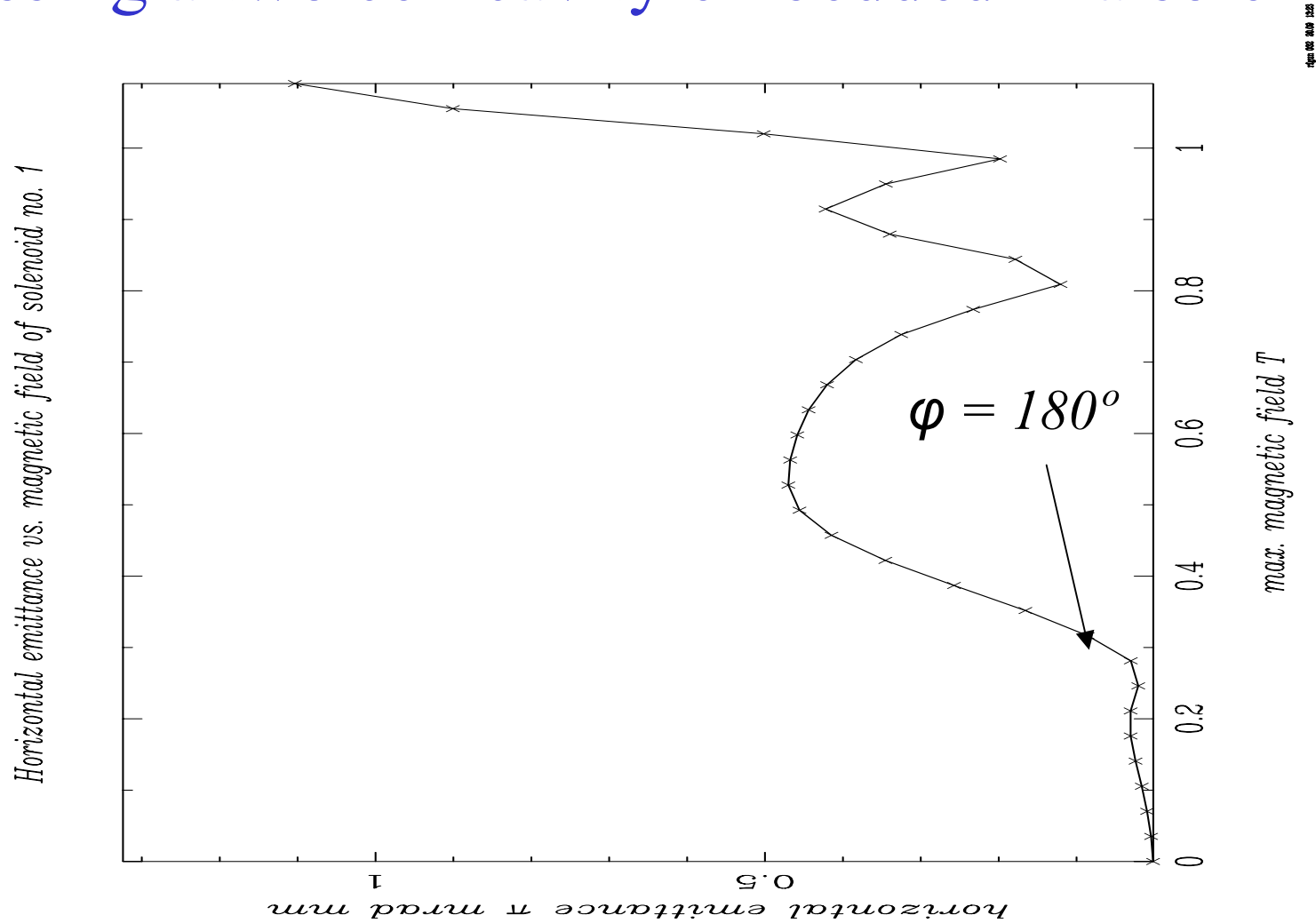
Trajectory of an off-axis particle, $\varphi = 180^\circ$



Trajectory of an off-axis particle, $\varphi = 360^\circ$

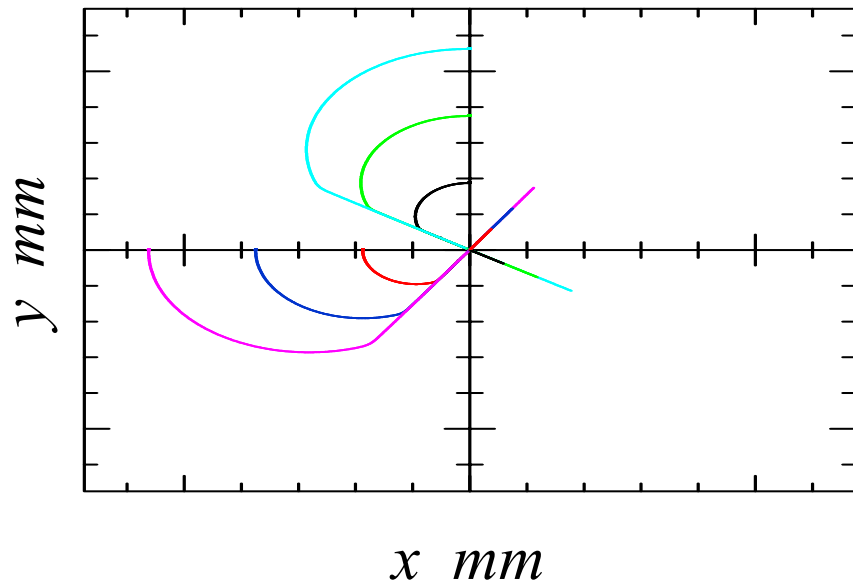


Emittance growth of an 'unmagnetized' bunch passing a two cell cavity embedded in a solenoid



Trajectories of off-axis particles

cavity off



cavity on

