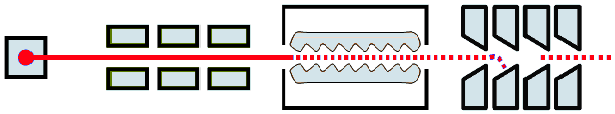

THE UNIVERSITY OF WARWICK

LEBT Alignment Studies, Part 2

John Back
University of Warwick

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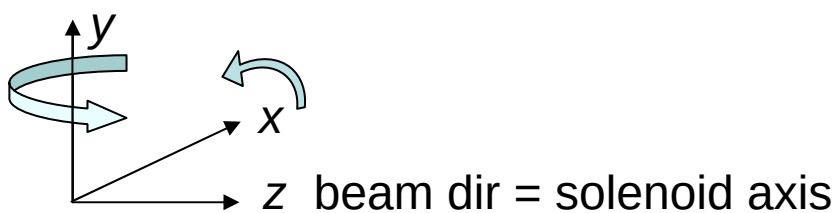
Introduction

- Using GPT to simulate LEBT beam dynamics to study C. Gabor profile measurements:
  - Profiles measured at Δz = +240 mm from LEBT ‘end’ (default profile position)
  - Only solenoid 1 is used: $B_z = 1.4085\ I_c$ (A) mT
  - Initial collimation: 3 mm radius aperture hole
  - Vary initial (mean) x, y beam divergence angles
  - Investigate small mis-alignment rotation about x & y axis for solenoid 1



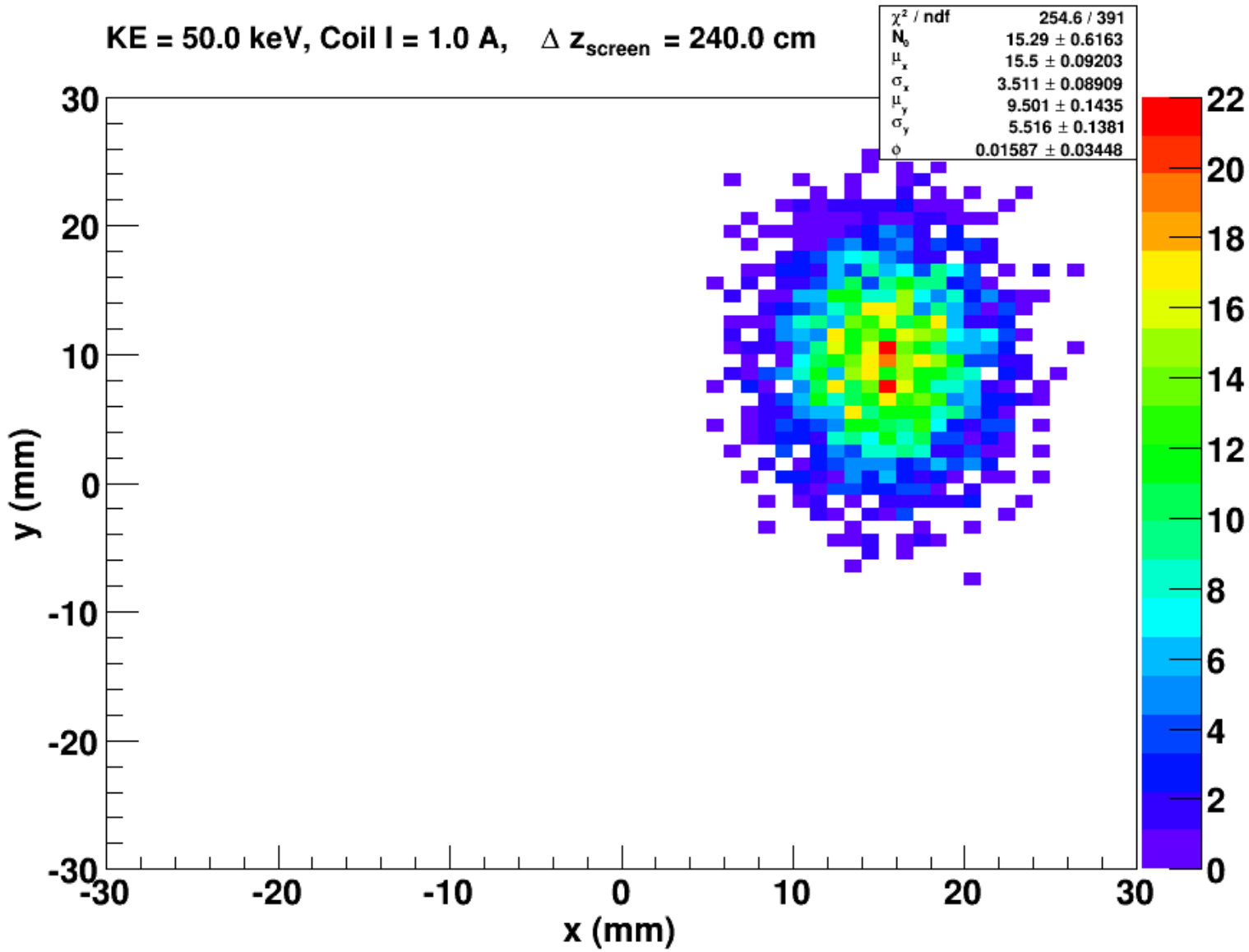
Data-GPT comparisons set-up

- KE = 50 keV, zero space charge
- Initial beam parameters:
  - Uniform in radius, ϕ (r = 3 mm), centre at (0,0,0)
  - Gaussian transverse velocity distribution:
    - Non-zero mean divergence angles θ_x, θ_y:
      $\Rightarrow$ $\beta_x = \beta\gamma\theta_x$ and $\beta_y = \beta\gamma\theta_y$
    - Divergence spread σ_x , σ_y (3 sigma cut-off)

- Find θ_x, θ_y that gives best match to I_c = 1A data:
  θ_x = +7.5 mr , θ_y = +4.5 mr, σ_x = 1.5 mr, σ_y = 2.5 mr
- Keep initial parameters *the same* for all other I_c values

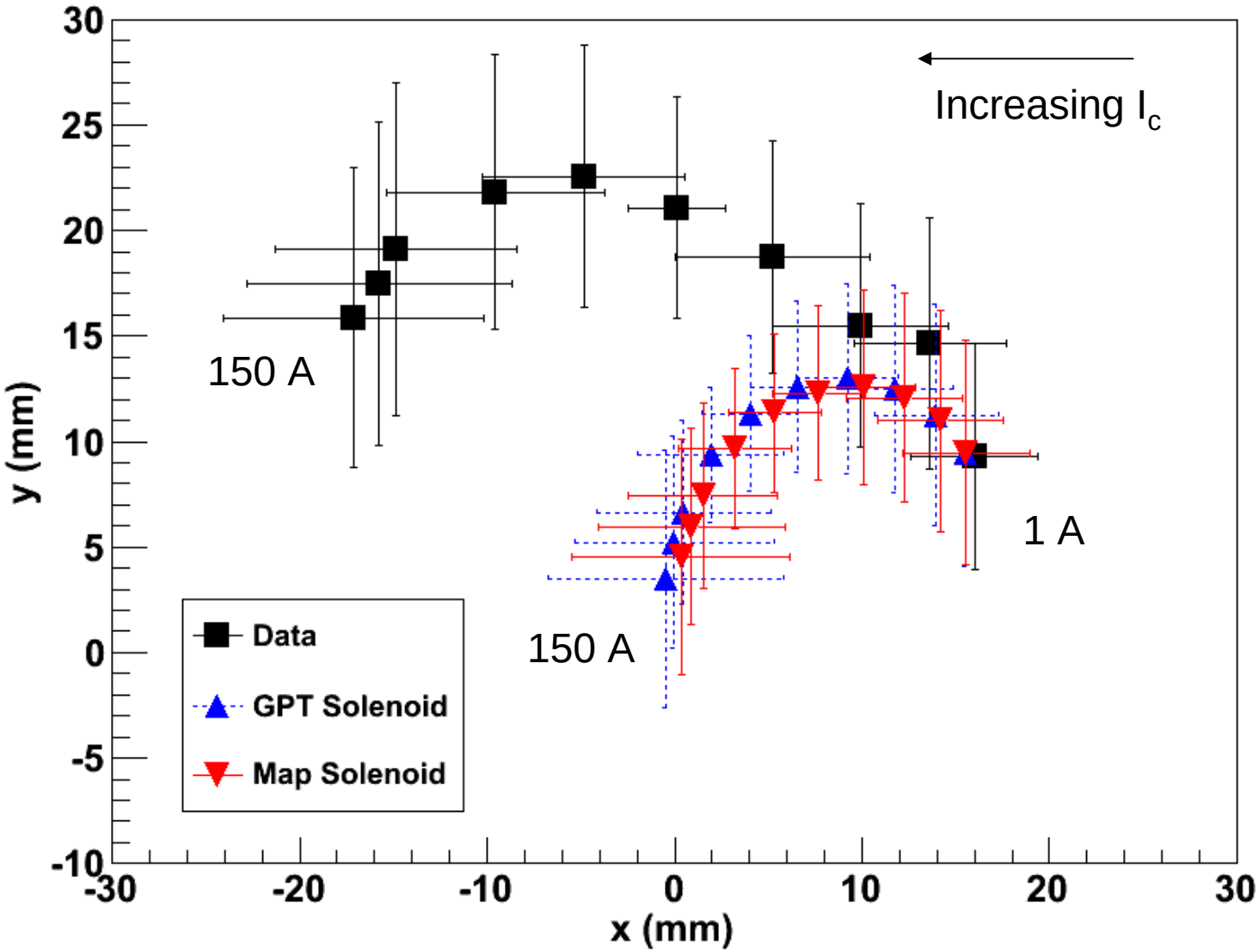
- Rotate solenoid 1 about x (horiz) and y (vert) axes: ϕ_x , ϕ_y

Example GPT x-y profile distribution



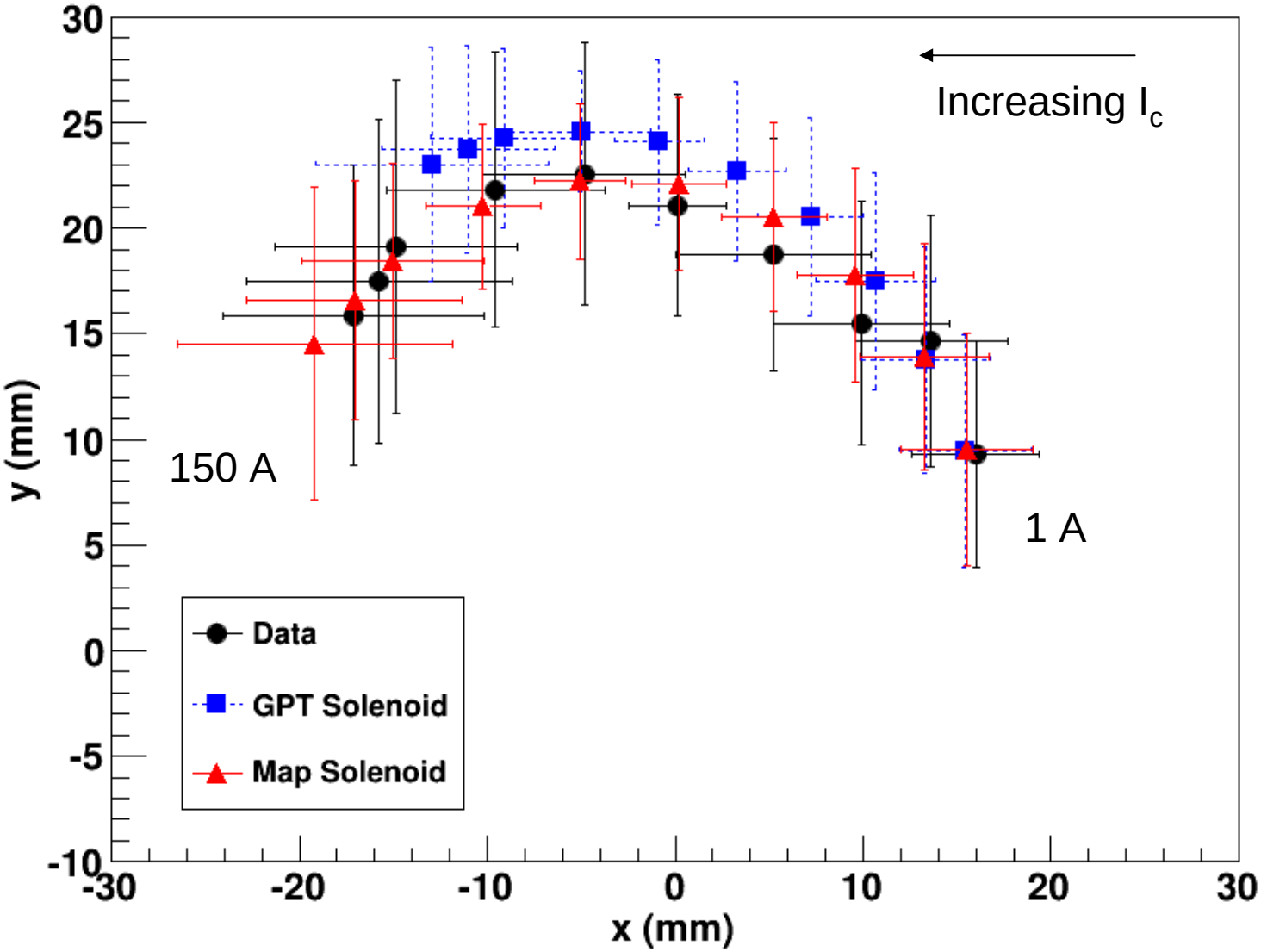
Previously: Comparison of mean x,y profile values

Points: mean values μ, error bars = σ width



Sol1 rotation: ϕ_x = -3 mr (down), ϕ_y = -14 mr (right)

Transverse B field component ≈1.4% of B_z (3 mT for I = 150A, B_z = 0.2 T)



Previous Sol1 rotation, with dipole B_x = +3 mT

Horiz dipole introduces correction to reduce y (& x) co-ordinate