

Science and Technology Facilities Council

Beam stacking experiment at KURNS 13/10/22

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Figure 18: The layout of experimental setup without shunt impedance of $10k\Omega$ (b).

CNT position is around 11.5 MeV

Beam Size	
Kinetic Energy	Beam Size
21 MeV	$5.49 \pm 0.65 \mathrm{mm}$
24 MeV	$5.40 \pm 0.81 \mathrm{mm}$
25 MeV	$5.34 \pm 0.51 \mathrm{mm}$
26 MeV	$5.11 \pm 0.40 \mathrm{mm}$





Beam size from momentum spread: ~3 mm Beam size from transverse size $(10 \ \pi \text{ mm.mrad}, \beta=0.9 \text{ m}): ~3 \text{ mm}$





 $\omega \sqrt{2\pi}$ $J_{-\infty}$ $\sqrt{2\pi}$ Z_{π} ζ ξ : location, ω : scale, α : shape https://en.wikipedia.org/wiki/Skew_normal_distribution

- * When the wire thickness is larger,
 - * Profile has asymmetry
 - * Mean has offset from the centre of beam
 - * Variance is within statistical errors when the wire diameter is less than 50um.
 - Statistical errors are given by RMS of 10 different simulations with 1um wire radius but no error angle.

Beam size ~±5 mm

JB Lagrange





Error of measurement

$$\sigma_{\text{beam}} = \sqrt{D^2 \left(\frac{\Delta P}{P}\right)^2 + \epsilon\beta}$$

$$\left(\frac{\Delta P}{P}\right) = \frac{1}{D}\sqrt{\sigma_{\text{beam}}^2 - \epsilon\beta} \implies d\left(\frac{\Delta P}{P}\right) = \left|\frac{\partial\left(\frac{\Delta P}{P}\right)}{\partial D}\right| dD + \left|\frac{\partial\left(\frac{\Delta P}{P}\right)}{\partial\sigma}\right| d\sigma + \left|\frac{\partial\left(\frac{\Delta P}{P}\right)}{\partial\epsilon}\right| d\epsilon + \left|\frac{\partial\left(\frac{\Delta P}{P}\right)}{\partial\beta}\right| d\sigma$$

$$\frac{d\left(\frac{\Delta P}{P}\right)}{\left(\frac{\Delta P}{P}\right)_0} = \left|\frac{dD}{D_0}\right| + \left|\frac{\sigma_0^2}{\sigma_0^2 - \epsilon_0\beta_0}\frac{d\sigma}{\sigma_0}\right| + \left|\frac{\epsilon_0\beta_0}{2\left(\sigma_0^2 - \epsilon_0\beta_0\right)}\frac{d\epsilon}{\epsilon_0}\right| + \left|\frac{\epsilon_0\beta_0}{2\left(\sigma_0^2 - \epsilon_0\beta_0\right)}\frac{d\beta}{\beta_0}\right|$$

 $(D_0, \sigma_0, \epsilon_0, \beta_0) = (0.54 \,\mathrm{m}, \pm 5 \,\mathrm{mm}, 10 \,\pi\mathrm{mm.mrad}, 0.9 \,\mathrm{m})$ $\left(\frac{\Delta P}{P}\right)_0 = \pm 0.007 \qquad \frac{d\left(\frac{\Delta P}{P}\right)}{\left(\frac{\Delta P}{P}\right)_0} = 1 \times \left|\frac{dD}{D_0}\right| + 1.56 \times$









Confirmation error numbers

Obtained by the second seco check the results with the present method for comparison



Next steps



