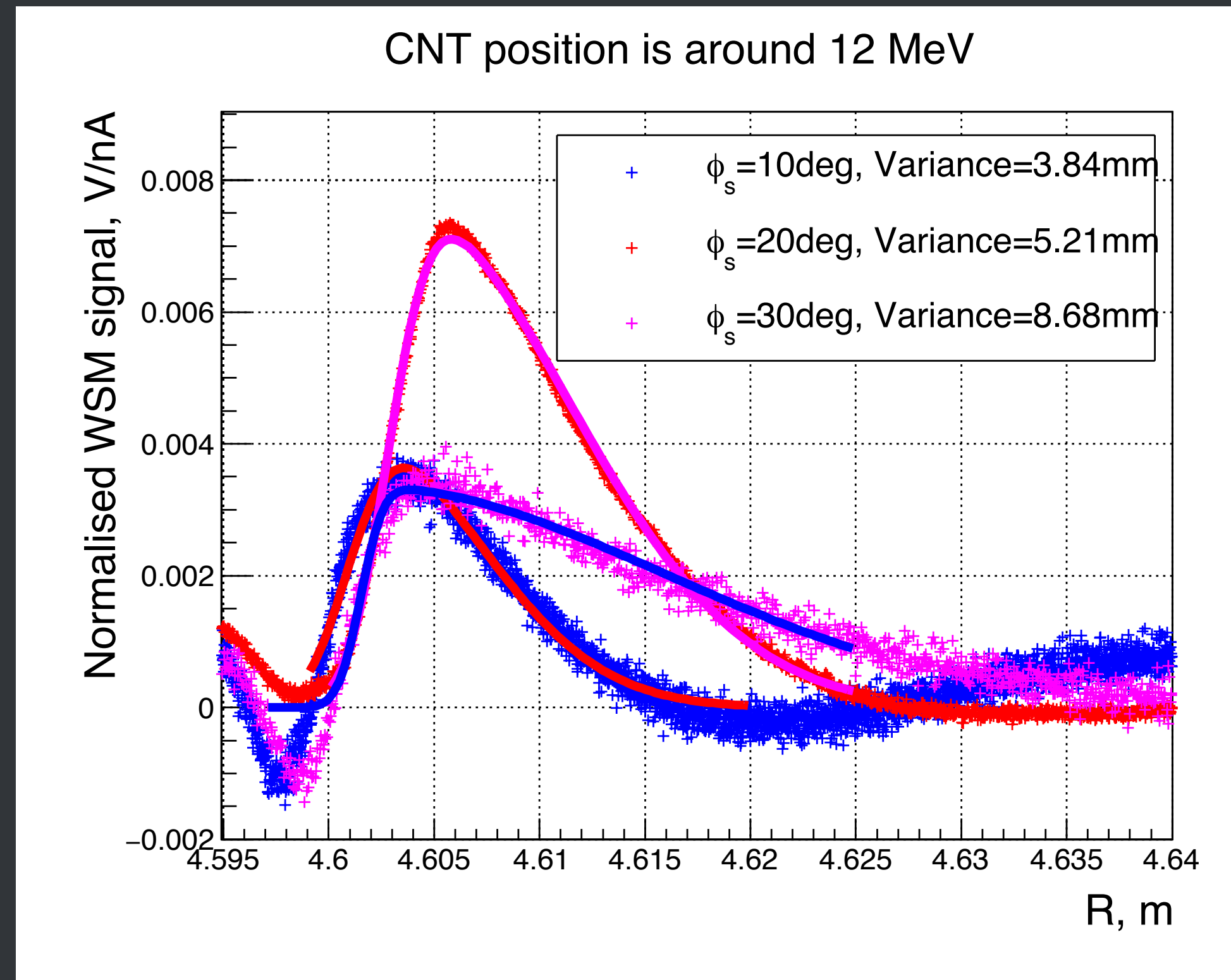# Beam stacking experiment at KURNS
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On behalf of IBG, ISIS, RAL, STFC

Momentum spread measurement

○ Bunched beam: longitudinal tomography

○ Coasting beam: measure of beam size, with known dispersion

  ○ Possible if $\Delta p/p \cdot D >>$ beam size

  ○ Emittance of the beam after injection (i.e. ~100 hits on foil)?

Beam size estimate

CNT position is around 12 MeV

ϕ_s=10deg, Variance=3.84mm
ϕ_s=20deg, Variance=5.21mm
ϕ_s=30deg, Variance=8.68mm

(E. Yamakawa , 21/07/22)

➡ Beam size ~±5 mm

Confirmation with Jordan's thesis?

Beam size from transverse emittance

○ Emittance change from foil hits:

$$\frac{d\epsilon_x}{dz} \approx \frac{1}{2m_p}\frac{13.6^2}{L_R}\frac{\beta_x}{\beta_L^3 E_{\text{tot}}}$$

○ Proton beam at 12 MeV (m_p=938 MeV, β_L=0.158, E_{tot}=950 MeV), β_x ≈1 m

○ Graphite foil (0.1μm, L_R=42.7), 100 hits, so total length 10 μm

○ Change of emittance of $6.2 \cdot 10^{-9}$ m << initial emittance ~$10 \cdot 10^{-6}$ m?

○ If ε_x=$10 \cdot 10^{-6}$ m, beam size from transverse emittance ~ ± 3 mm

Beam size from momentum spread

(D. Kelliher, IPAC19)

⬤ Momentum spread from RF bucket size:
$\Delta p/p \approx \pm 0.005$
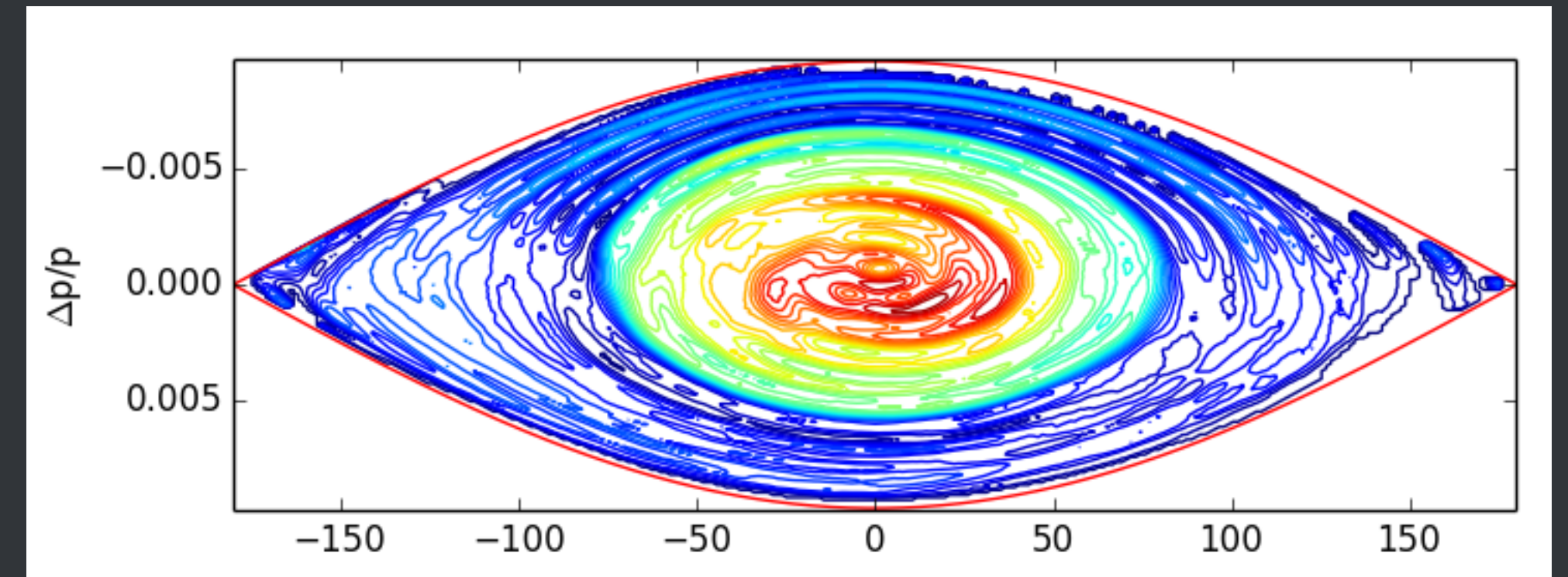
⬤ D=0.53 m,

⬤ If $\Delta p/p \sim \pm 0.005$, beam size from momentum spread ~ $\pm$ 3 mm

$$\Delta p/p \times D \approx \sqrt{\epsilon \beta}$$

Consistent with measurement