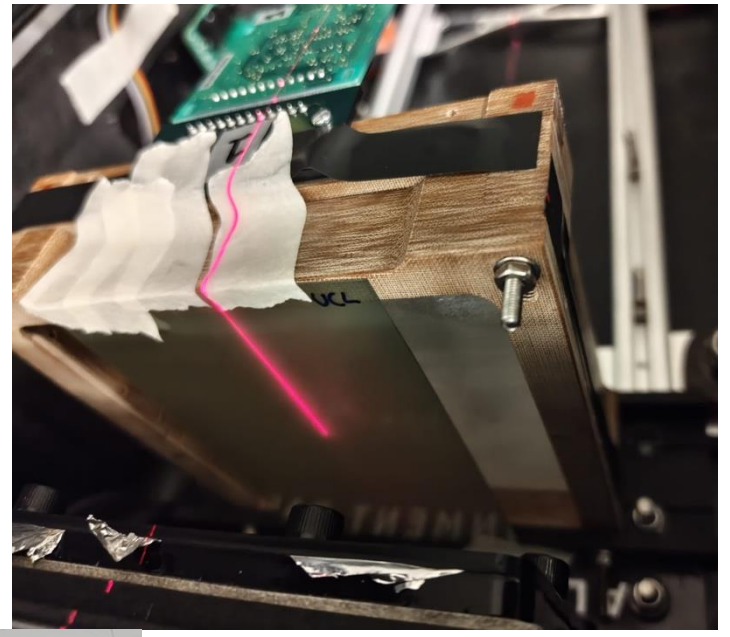
Trento PTC Fibre Beam Profile Measurement Comparisons with Film

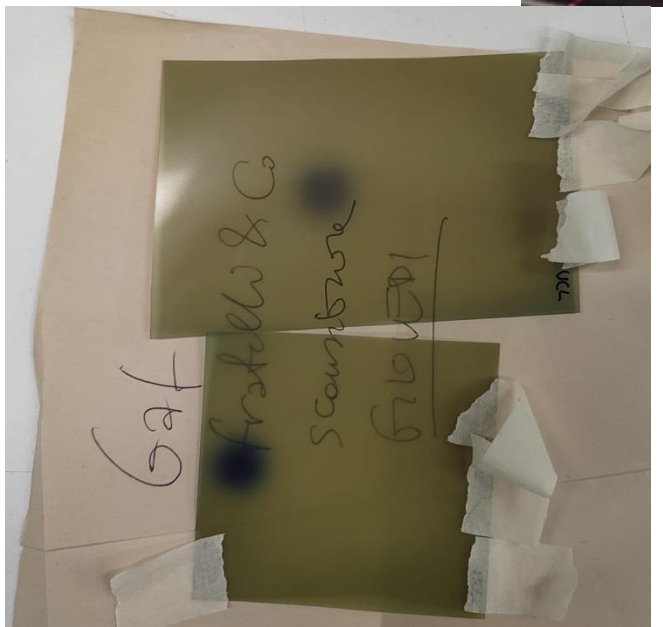
Joe Bateman

University College London

Overview and Setup

- 2 measurements performed at end of night 3 at Trento to compare beam size measured on radiochromic film to that by the fibre arrays (with the photodidoides in high gain mode).
- Radiochromic film attached directly in front of first fibre array (Y array).
- Measurements at 228 MeV and 148 MeV.





Radiochromic Film

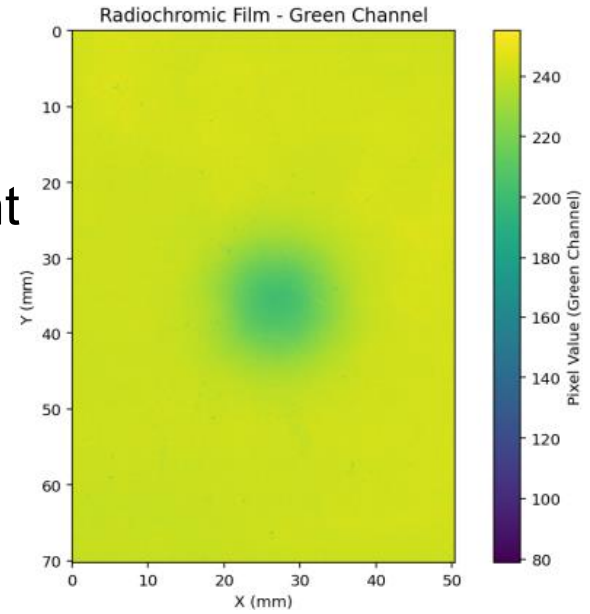
- Film scanned on flatbed scanner and saved as TIFF image, using 20-bit colour and 1200 dpi.

- In radiochromic film dosimetry typically either the red or green colour channel is used (blue is more sensitive scanner and film artifacts).

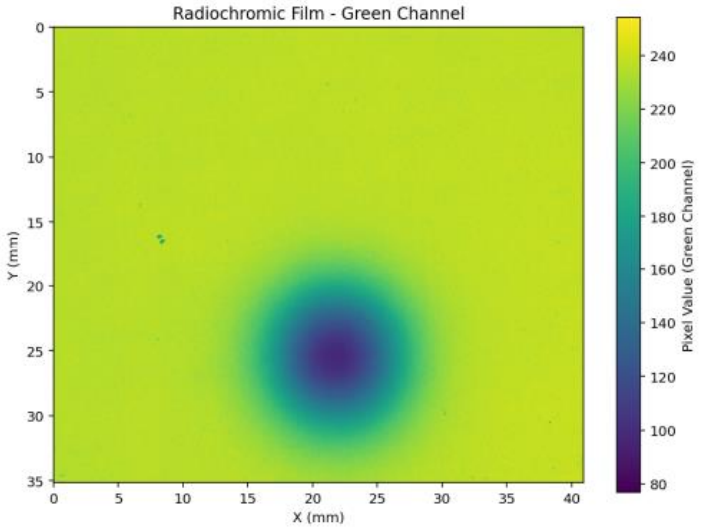
- Green channel used and converted to optical density (OD) using:

$$OD = -\ln\left(\frac{PV}{2^{20}}\right)$$

148 MeV
10 nA ion source current
10s acquisition

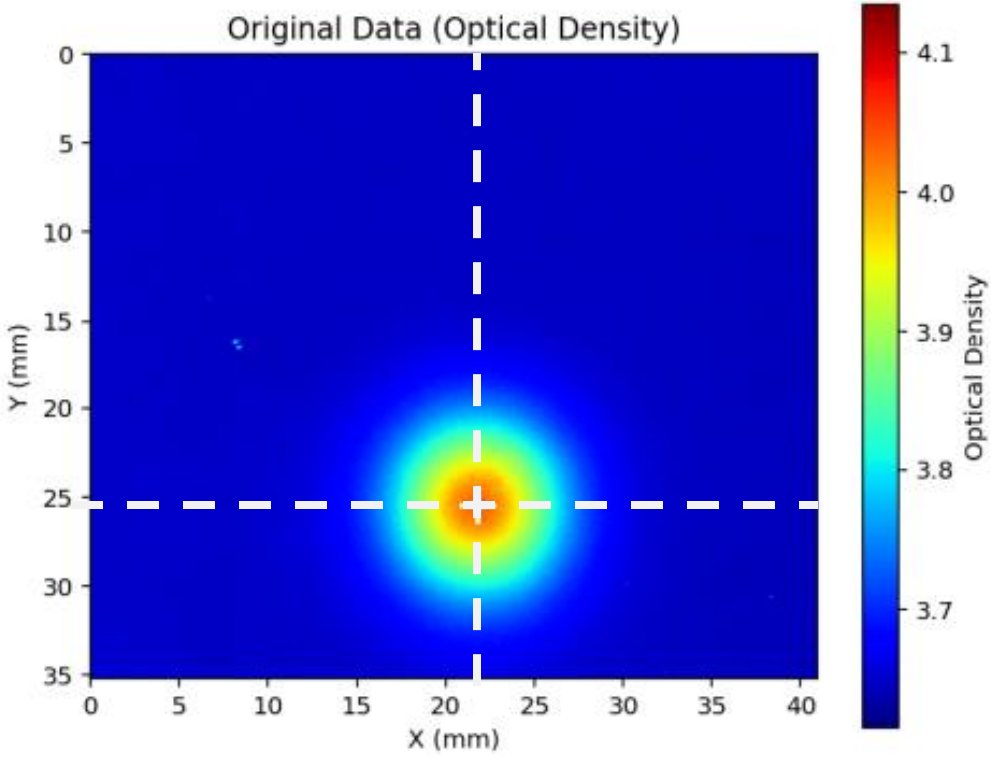


228 MeV
7 nA ion source current
5s acquisition

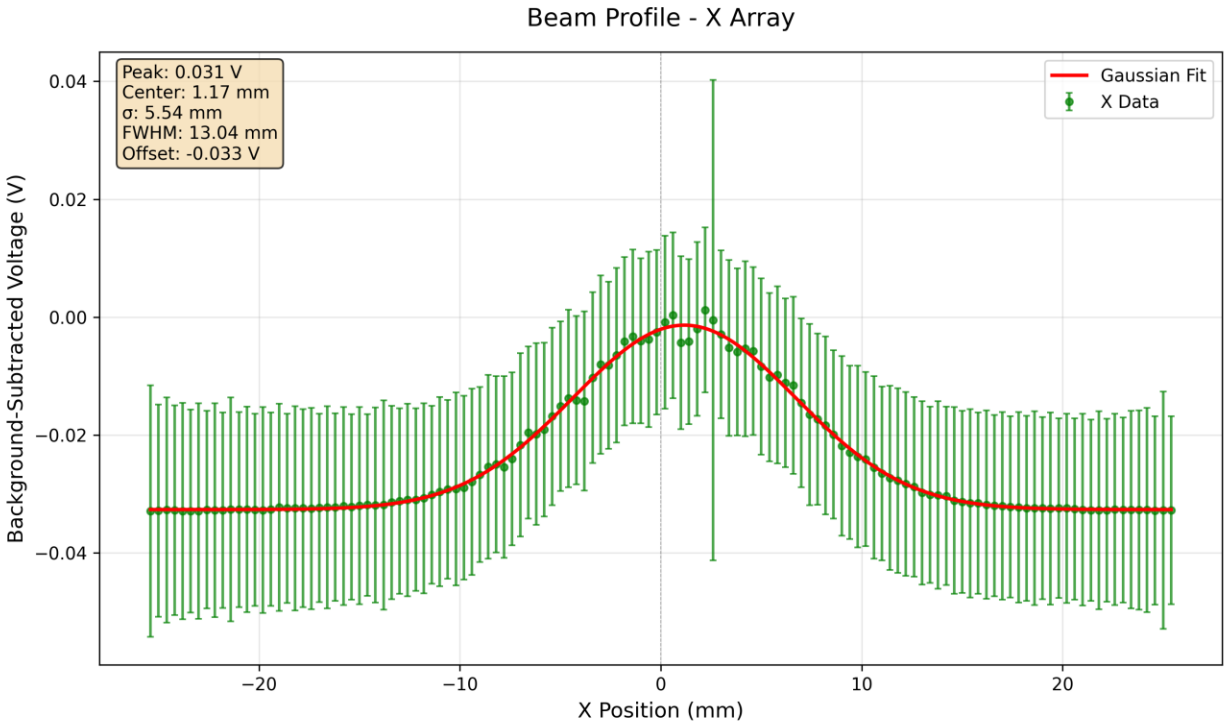


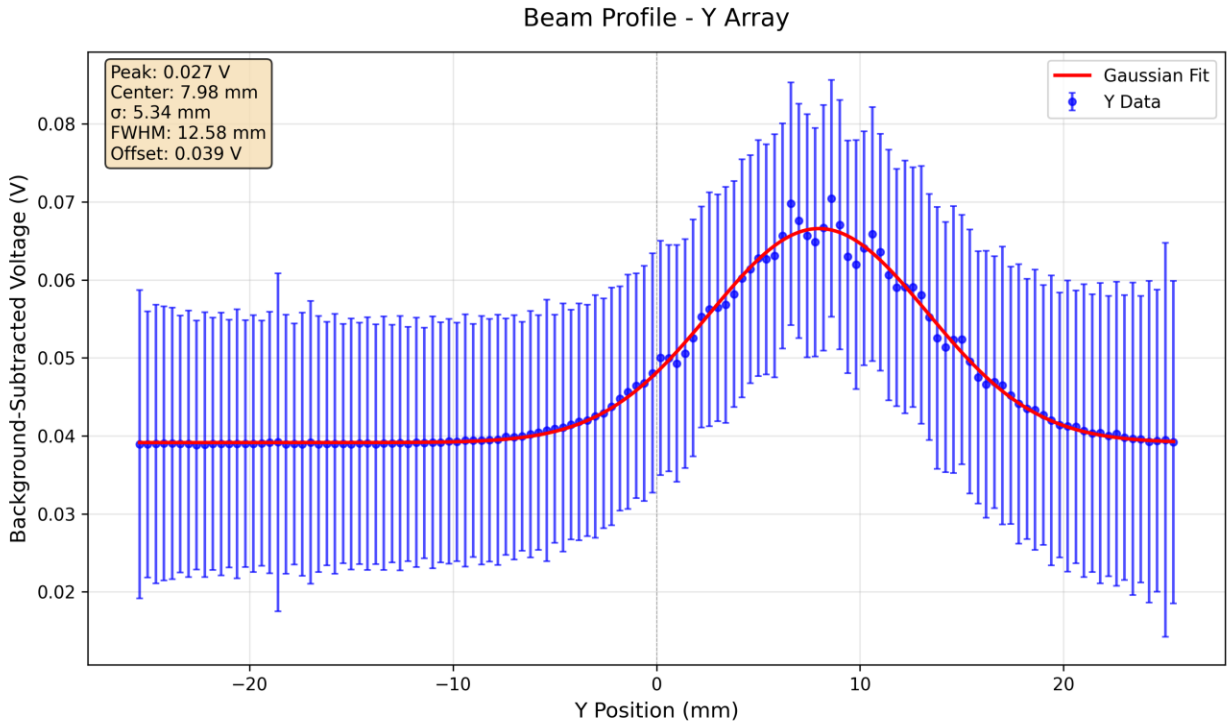
Gaussian Fitting

- 3 methods used to determine beam size ($\sigma_{x,y}$) from film profile:
  1. 2D Gaussian fit applied to entire distribution
  2. 1D Gaussian fit applied to X and Y slice (0.5 mm thick) across centre o profile
  3. 1D projection of 2D distribution in X and Y (i.e. most similar to how fibre arrays measure the profile).

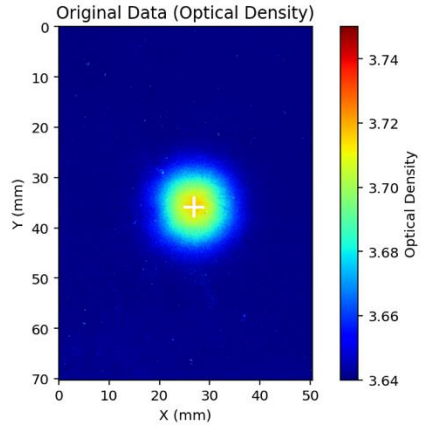


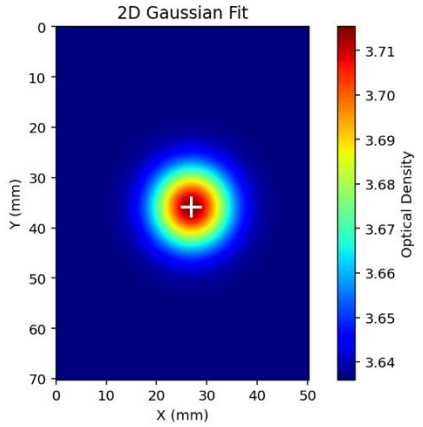
148 MeV 10 nA 10s – Fibre Array

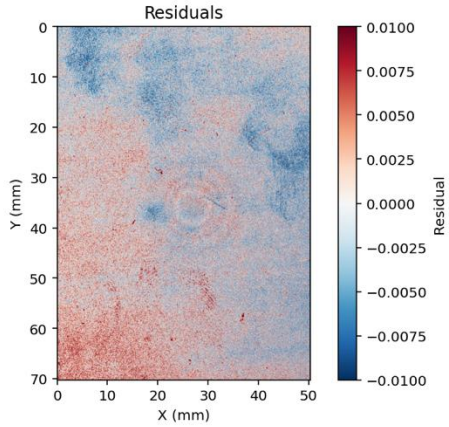


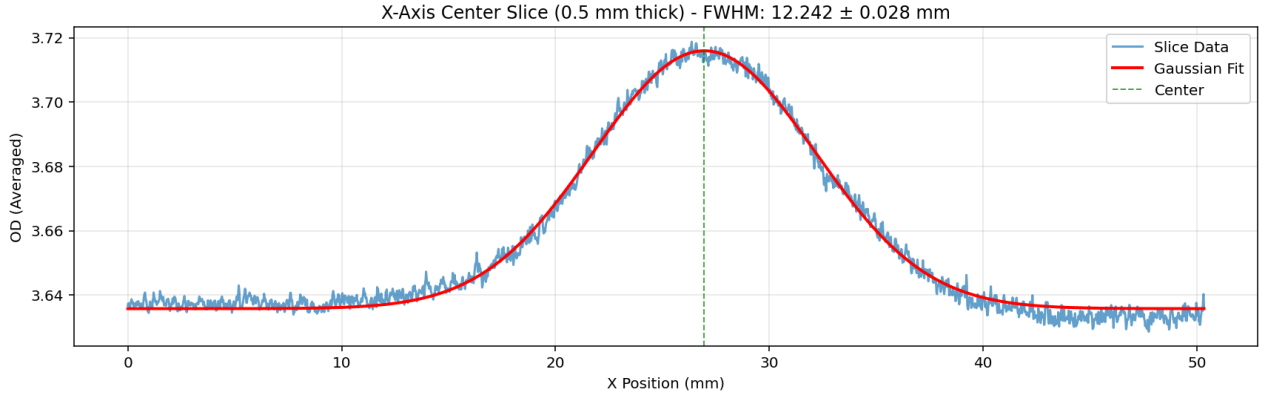


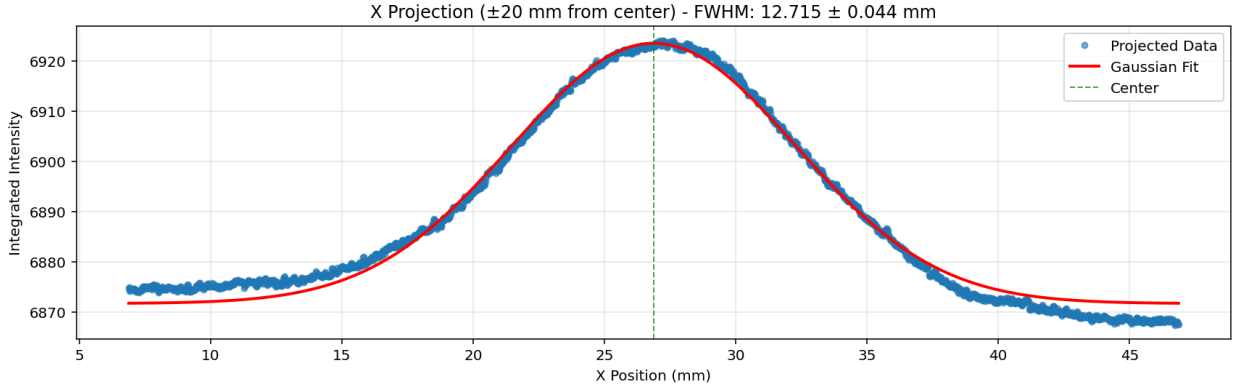
148 MeV 10 nA 10s – Film

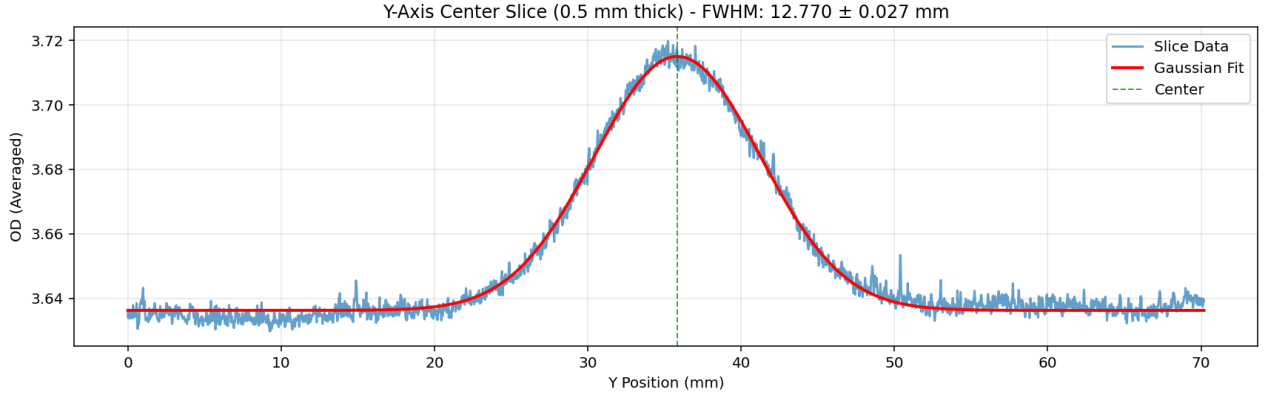


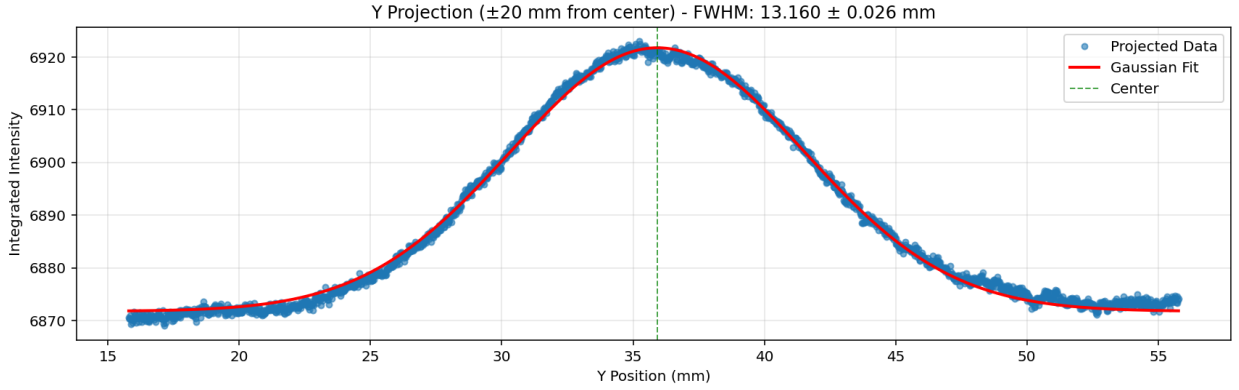








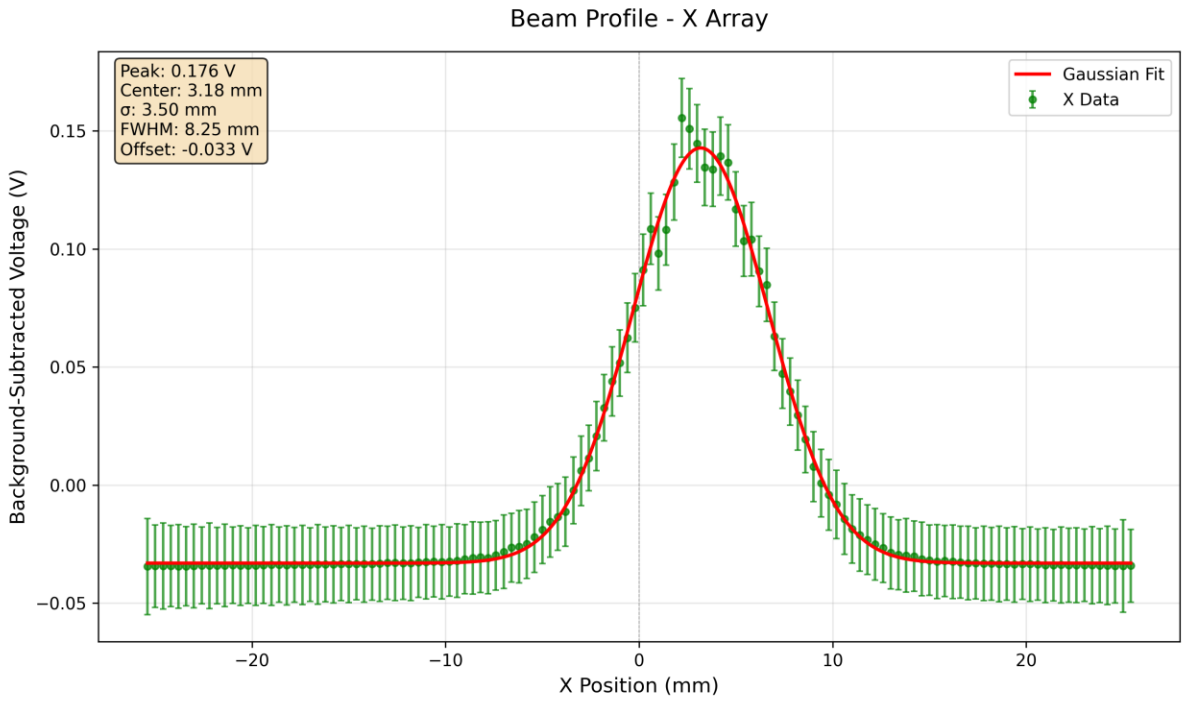


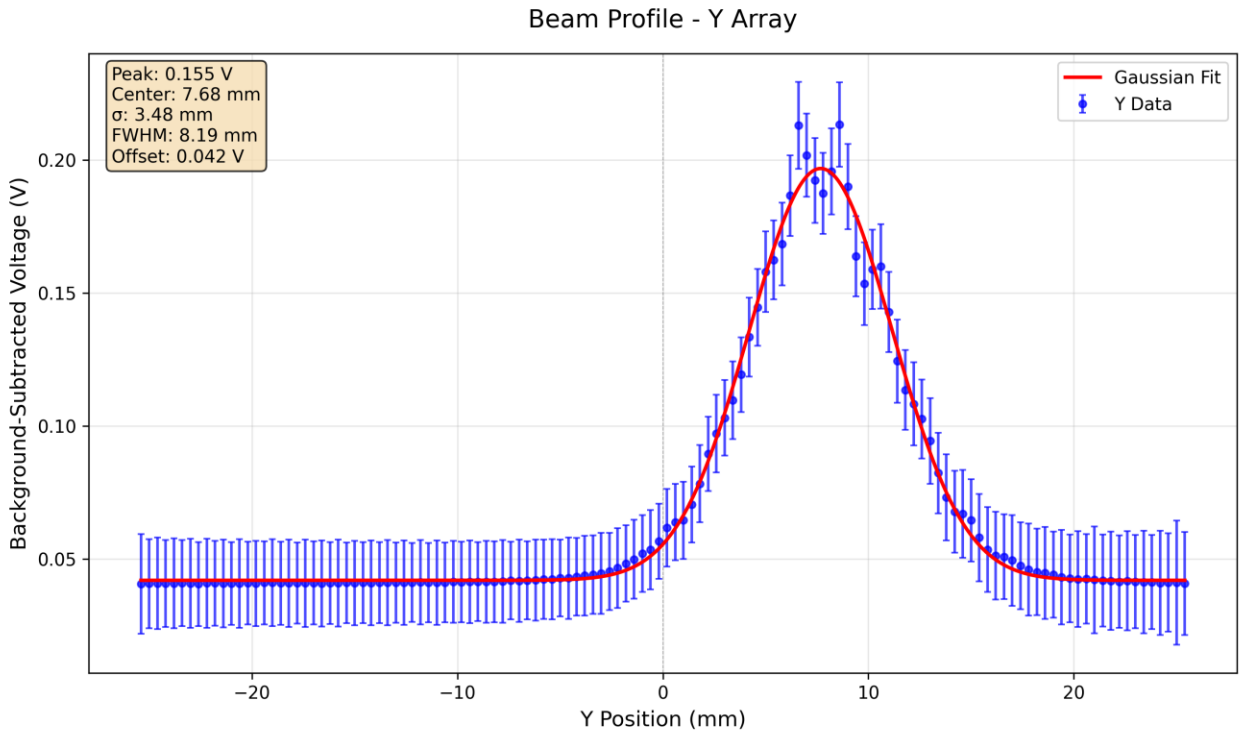


148 MeV Gaussian Fit Parameters

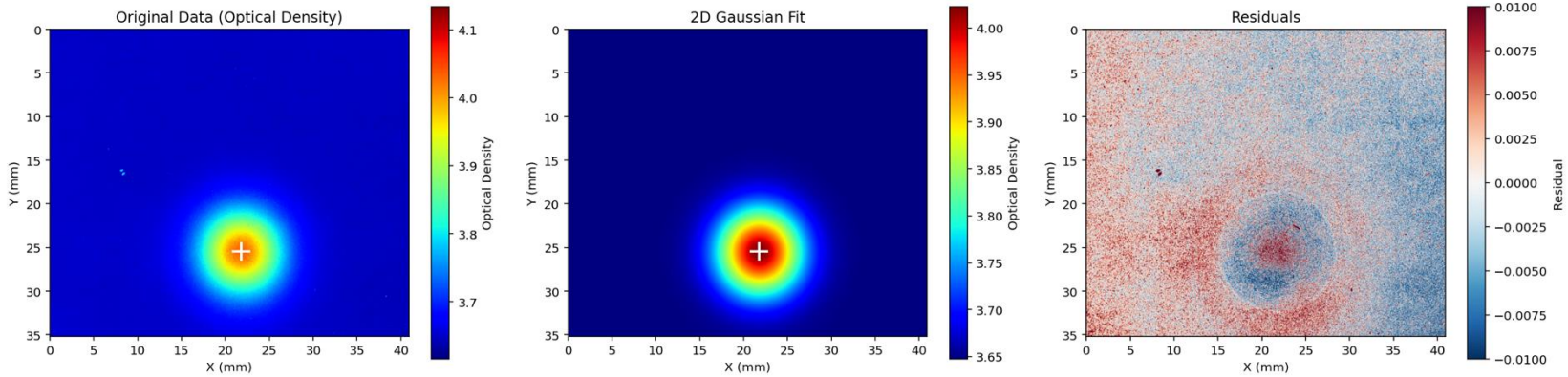
	Fibre Array	Film 2D Gaussian	Film 1D Gaussian Slice	Film 1D Gaussian Projection
σ_x (mm)	5.538 ± 0.938	5.491 ± 0.001	5.423 ± 0.012	5.588 ± 0.011
σ_y (mm)	5.339 ± 1.062	5.353 ± 0.001	5.198 ± 0.012	5.399 ± 0.019

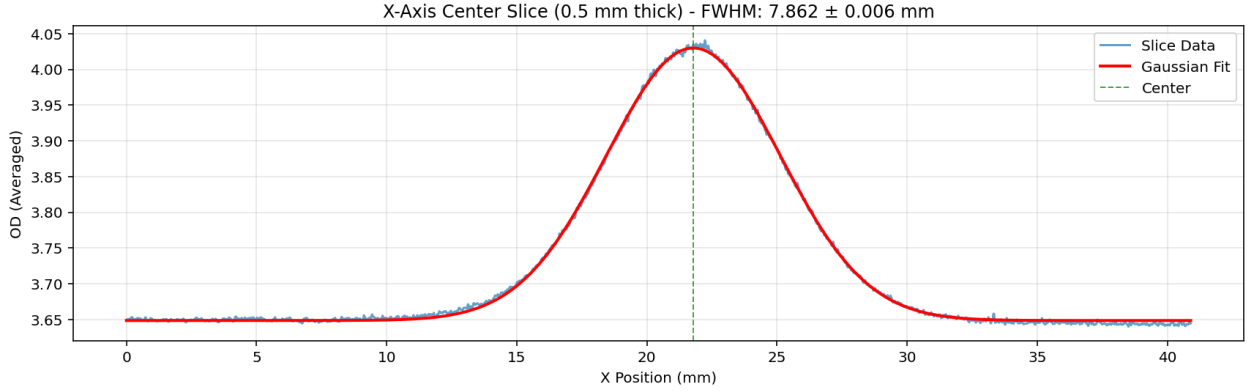
228 MeV 7nA 5s – Fibre Array

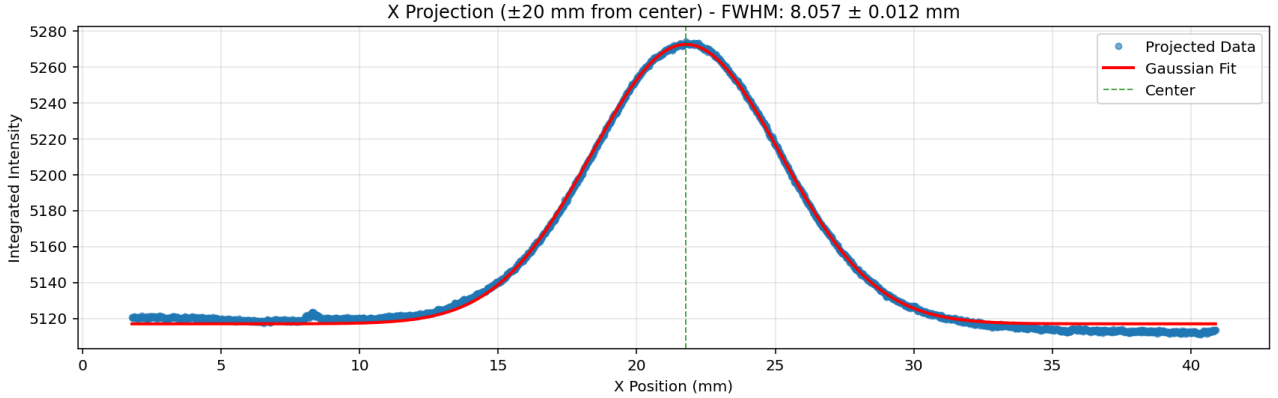


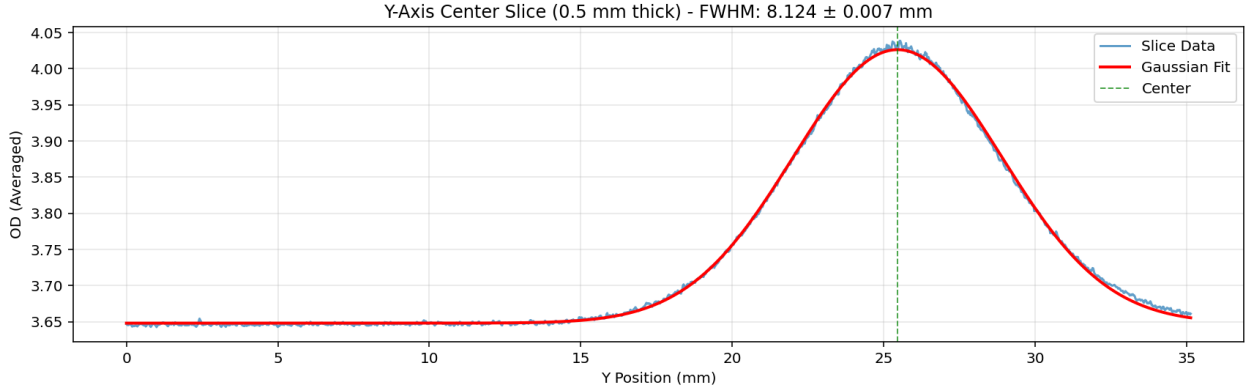


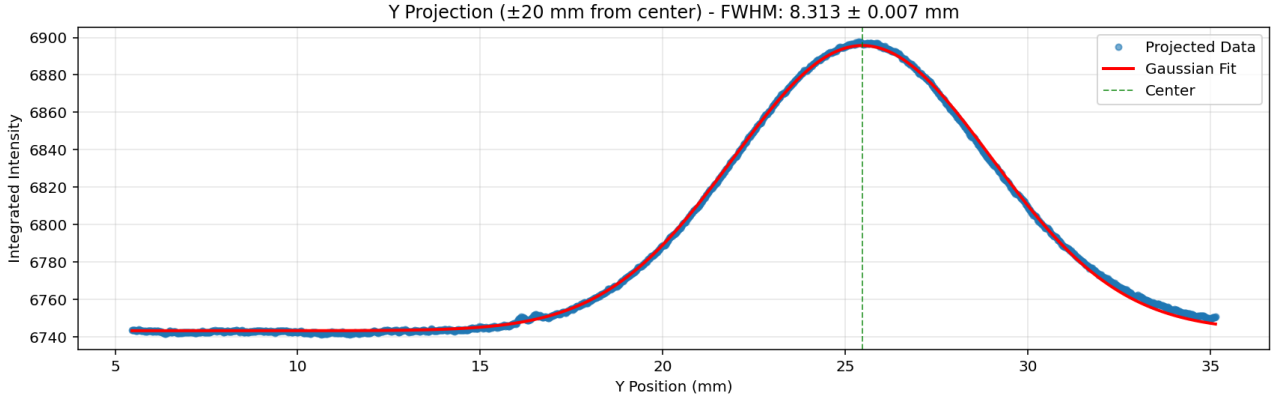
228 MeV 7nA 5s - Film











228 MeV Gaussian Fit Parameters

	Fibre Array	Film 2D Gaussian	Film 1D Gaussian Slice	Film 1D Gaussian Projection
σ_x (mm)	3.502 ± 0.117	3.396 ± 0.001	3.338 ± 0.003	3.421 ± 0.005
σ_y (mm)	3.479 ± 0.135	3.502 ± 0.001	3.450 ± 0.003	3.530 ± 0.003

Observations and Summary

- As expected, the beam size is indeed larger than reference values at isocentre as measured by fibre array. Likely due to beam monitors.
  - Agrees with other observations i.e. QuARC energies being lower than reference energies and difference increases as energy decreases.

- Impressive agreement between uncalibrated fibre and film beam sizes.

- Large uncertainty of fibre $\sigma_{x,y}$ from fit compared to film measurements.