

Radiation Hardness Testing at HollandPTC

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Facility Overview

HollandPTC is a Varian (Siemens Healthineers) proton therapy center, operating a ProBeam superconducting cyclotron.

The facility includes two fixed beamlines and two rotating gantries: one dedicated R&D room, two clinical treatment gantries, and one Eye Treatment Room (ETR).

The cyclotron accelerates protons up to 250 MeV and degrades the energy down to 70 MeV, providing a clinical energy range of 70–250 MeV. The nominal beam current ranges from 1 to 800 nA.

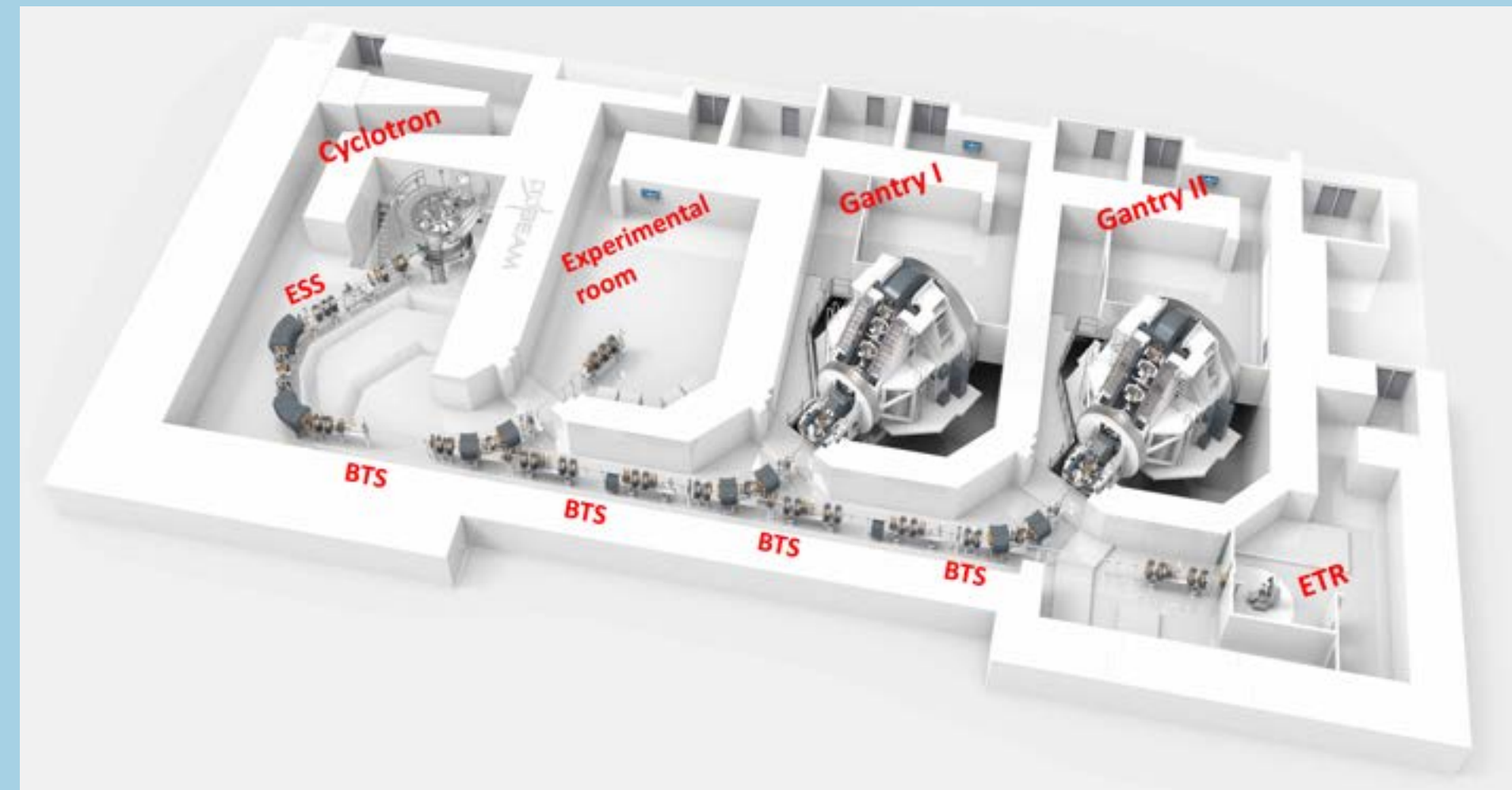


Figure 1: Schematic overview of HollandPTC

Experimental Capabilities

The HollandPTC R&D beamline provides proton pencil beams with energies from 70 to 250 MeV. The beams have Gaussian profiles with adjustable fluxes from 5×10^6 to 2×10^{12} p/s.

Capabilities

- **Pencil beams:**
 - Energy range: 70–250 MeV
 - Gaussian profiles
 - Flux: $5 \times 10^6 - 2 \times 10^{12}$ p/s
- **Uniform fields:**
 - Sizes: 4×4 and 10×10 cm²
 - Energies: 50, 70, 120, 200 MeV
 - Flux: $1.5 \times 10^4 - 1 \times 10^9$ p/(cm² s)
 - Uniformity: >86%
- **Large square field:**
 - Size: 25×25 cm² (120 MeV)
 - Flux: $4.0 \times 10^4 - 3.2 \times 10^7$ p/(cm² s)
 - Uniformity: 91.5%
- **Circular field:**
 - Size: 20×20 cm² (187 MeV)
 - Flux: $4.9 \times 10^5 - 4.0 \times 10^8$ p/(cm² s)
 - Uniformity: 86%
- **Custom setups:**
 - Tailored beam configurations available upon request
 - Preparation time may vary

Applications

- Single-event effects (SEE)
- Total ionizing dose (TID)
- Electronics testing for aerospace, medical, and physics applications

Support & Collaboration

Expert support is available, with strong collaborations with TU Delft, Erasmus MC, and LUMC, serving both academic and industrial users.

References

- [1] Rovituso M, et al. Characterisation of the HollandPTC RD proton beamline for physics and radiobiology studies. Phys Med. 2025 Feb;130:104883. doi: 10.1016/j.ejmp.2024.104883. Epub 2025 Jan 7. PMID: 39778326.

The R&D Bunker

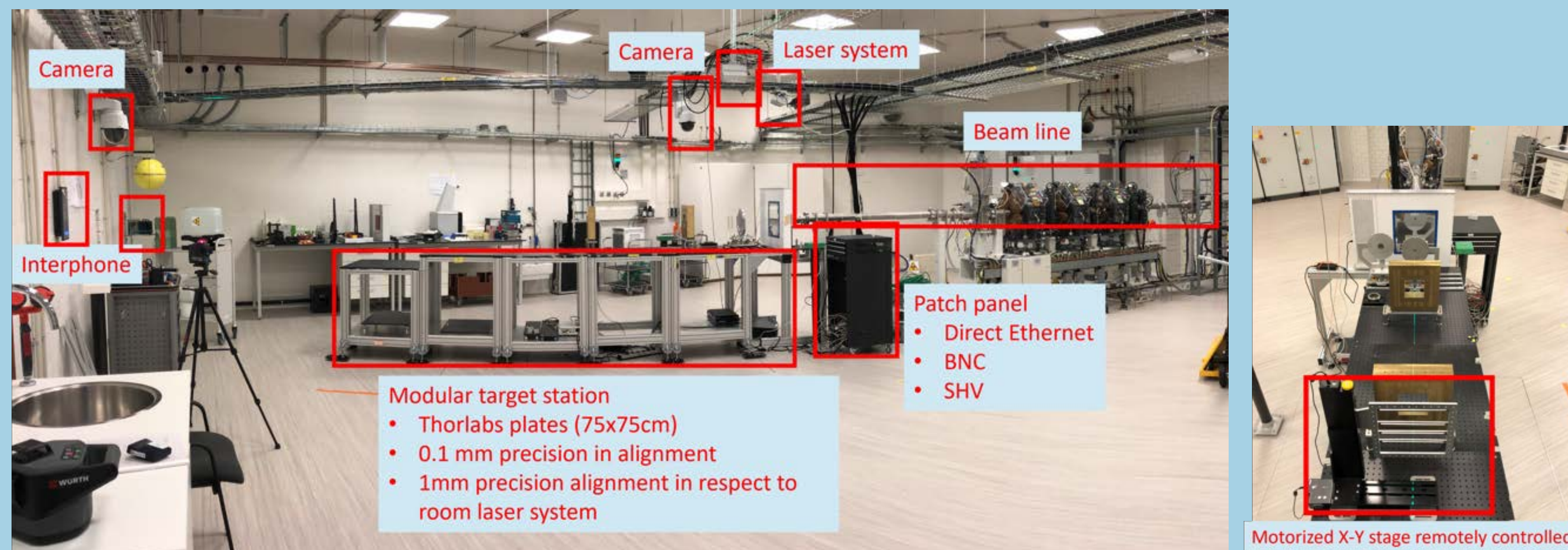


Figure 2: Overview of the R&D bunker

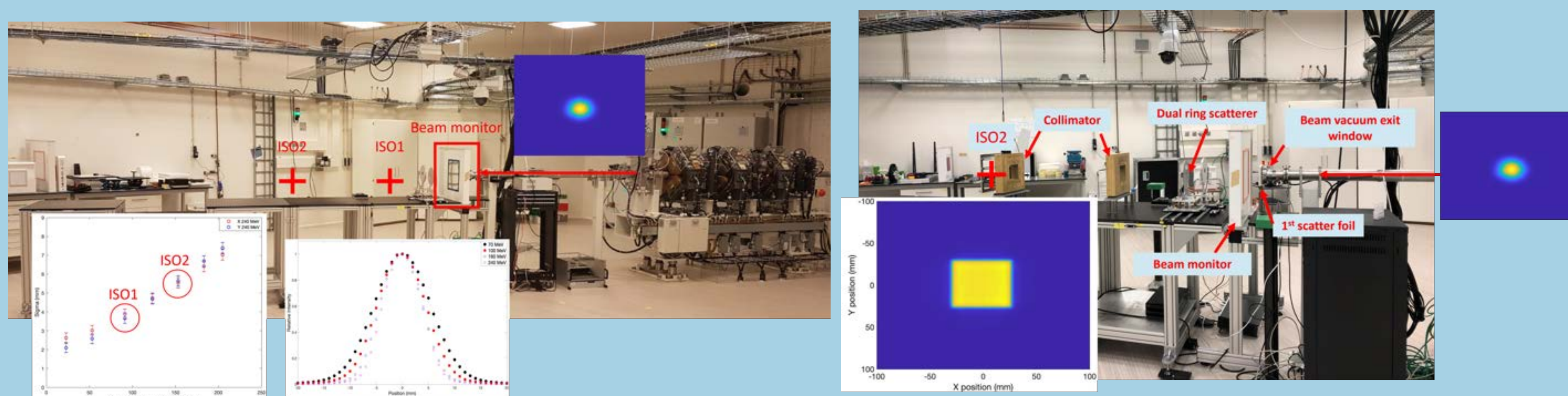
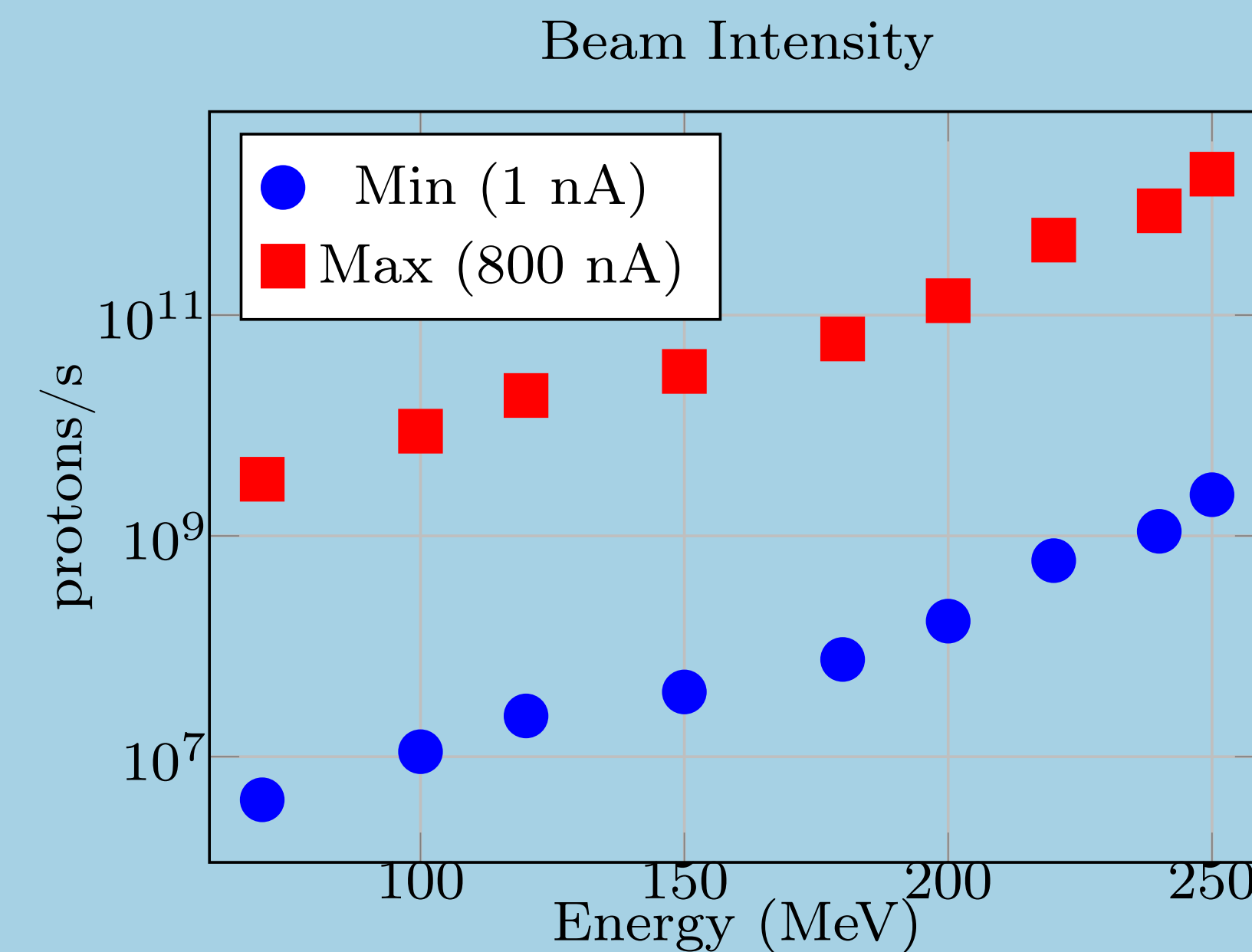
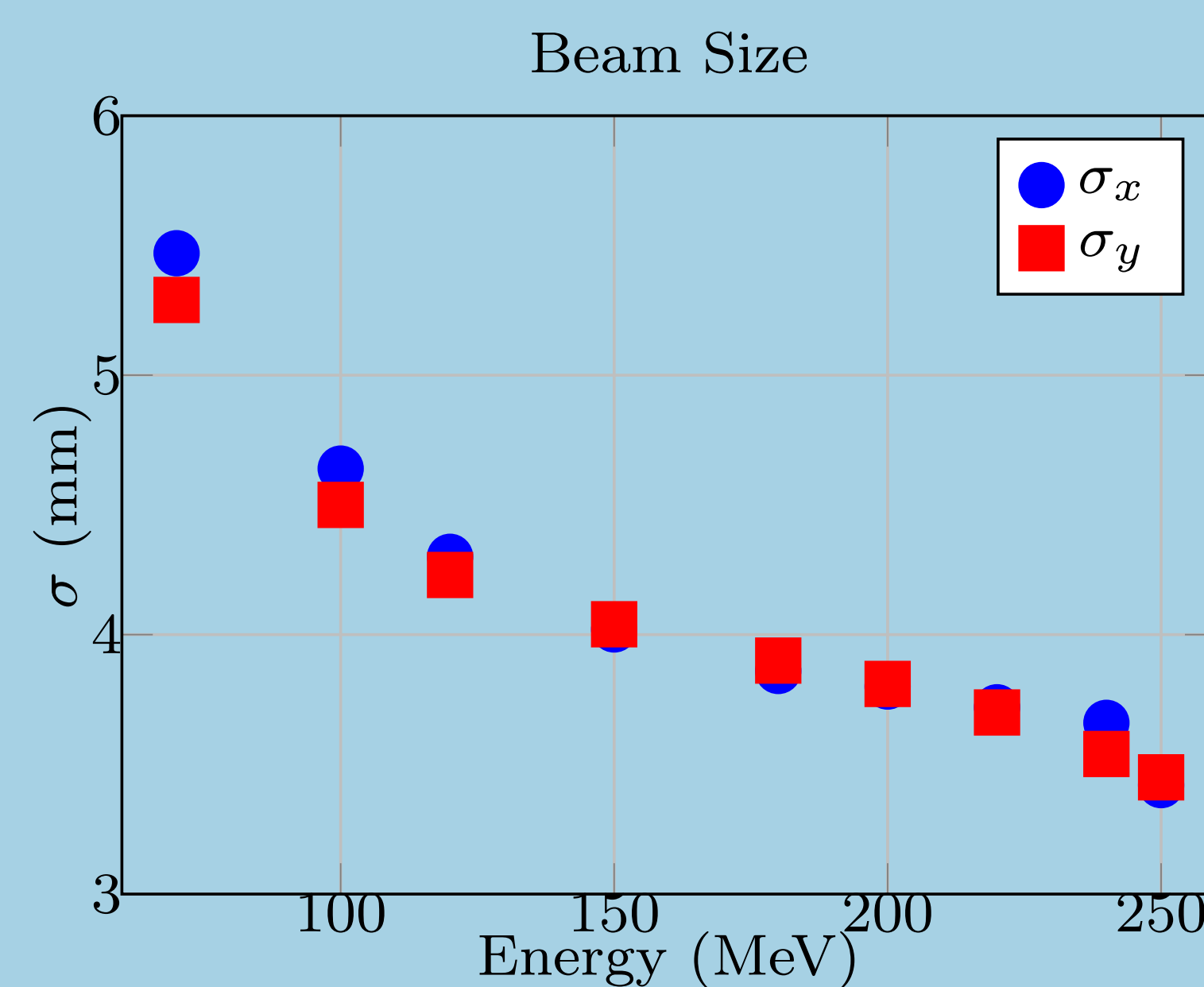


Figure 3: Pencil beam vs broad beam set up.

Pencil Beam Intensity and Sizes



Broad Beam Profiles and Dose Rates

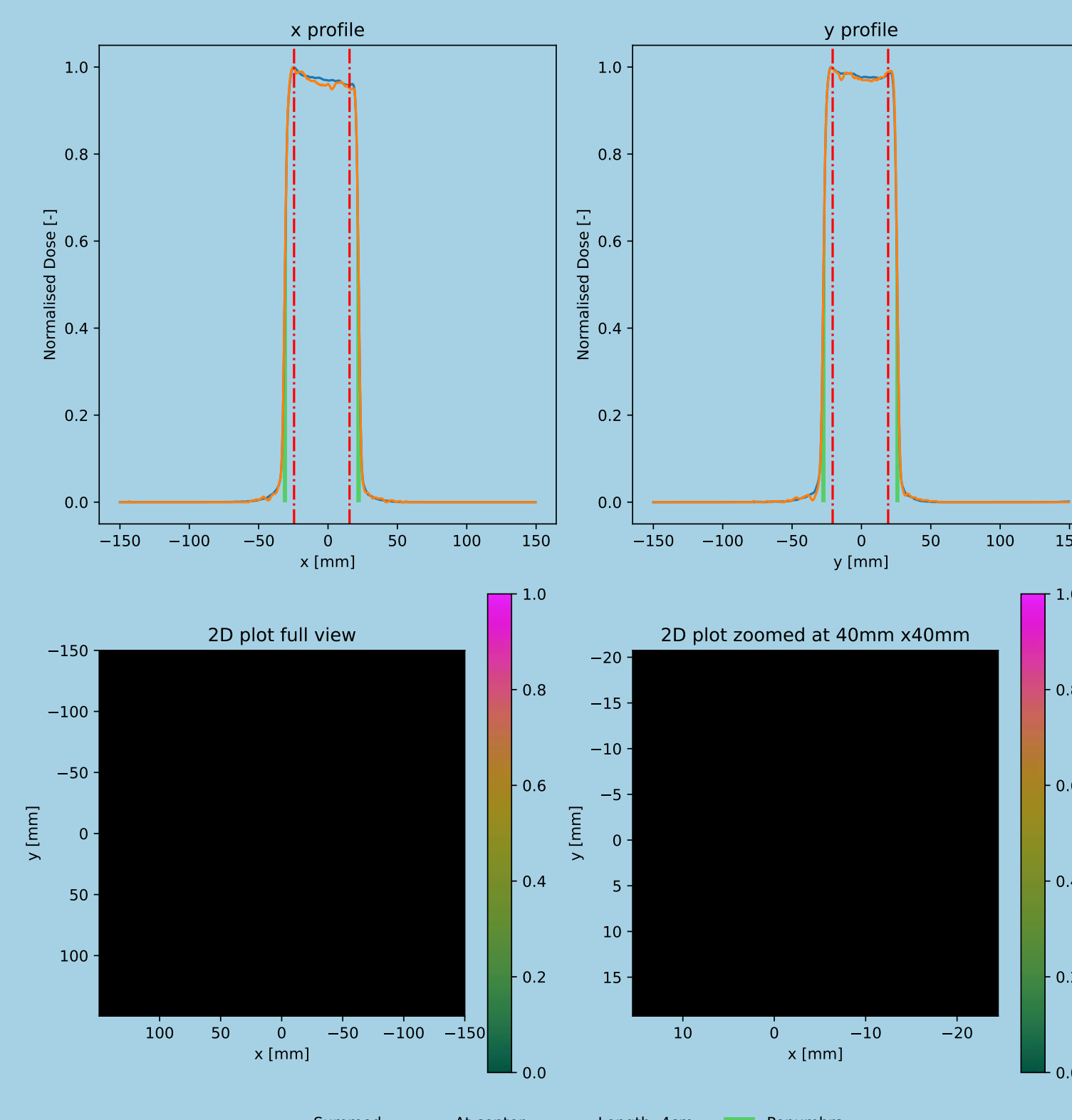
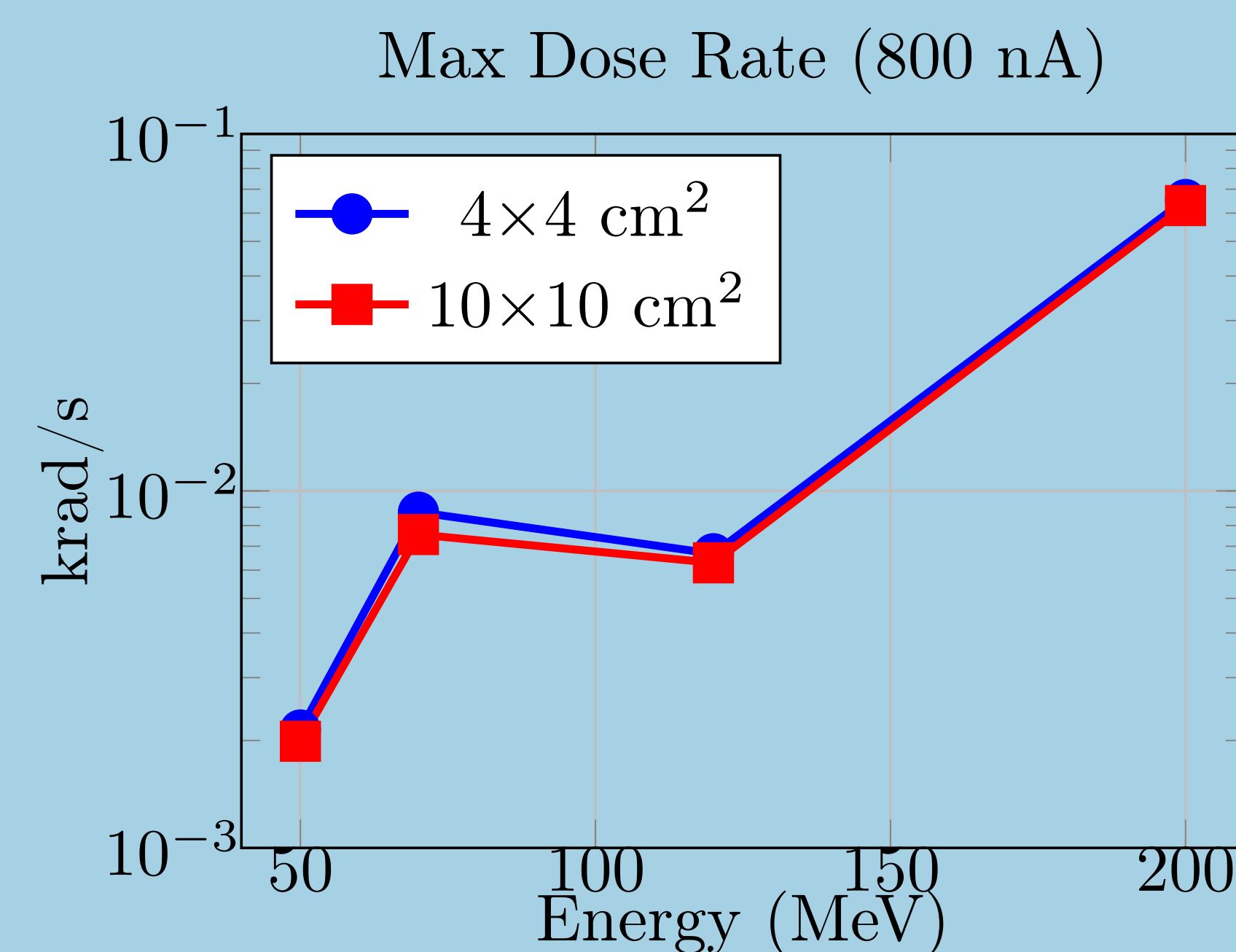
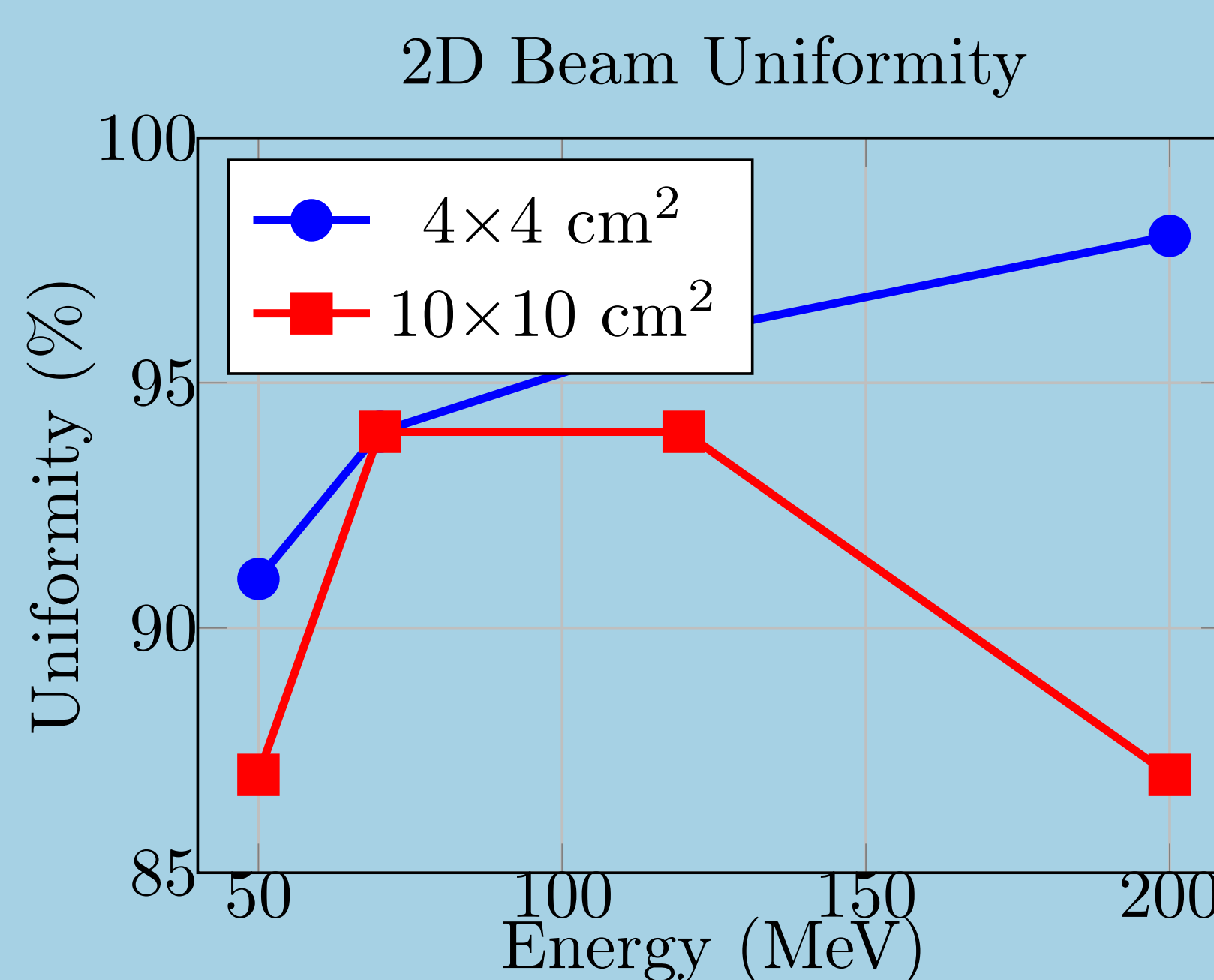


Figure 4: Broad proton beam profile at 150 MeV for a 4×4 cm² field, measured with a LynxPT scintillation screen.

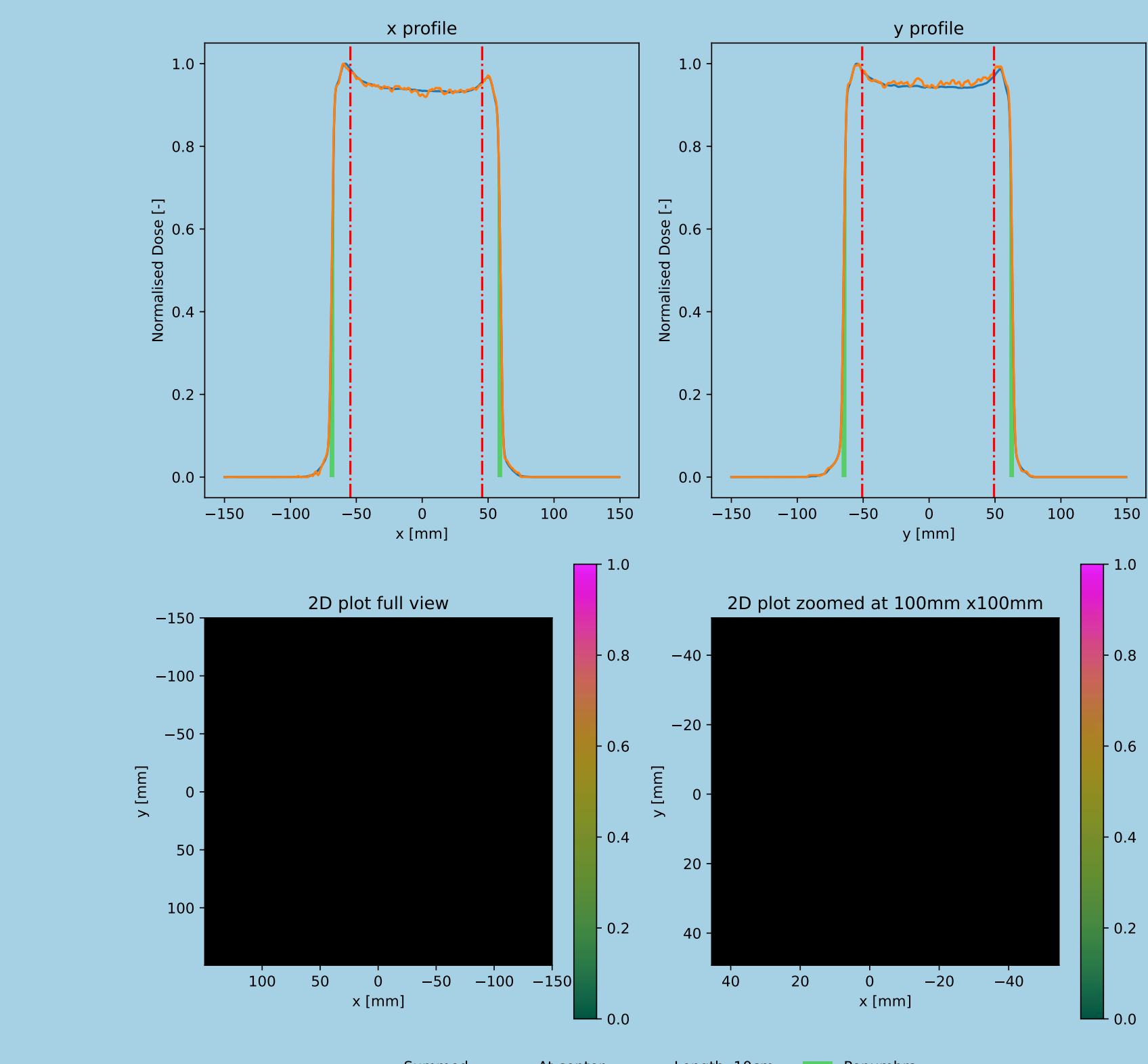


Figure 5: Broad proton beam profile at 150 MeV for a 10×10 cm² field, measured with a LynxPT scintillation screen.