

# Detectors for online dosimetry and beam monitoring at laser-driven protons sources

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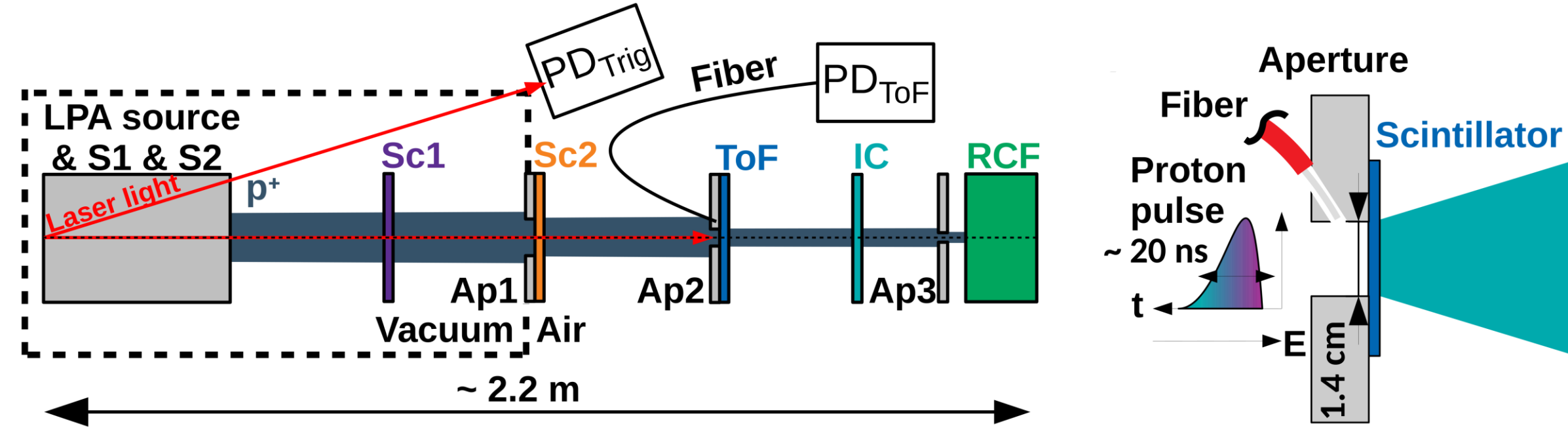
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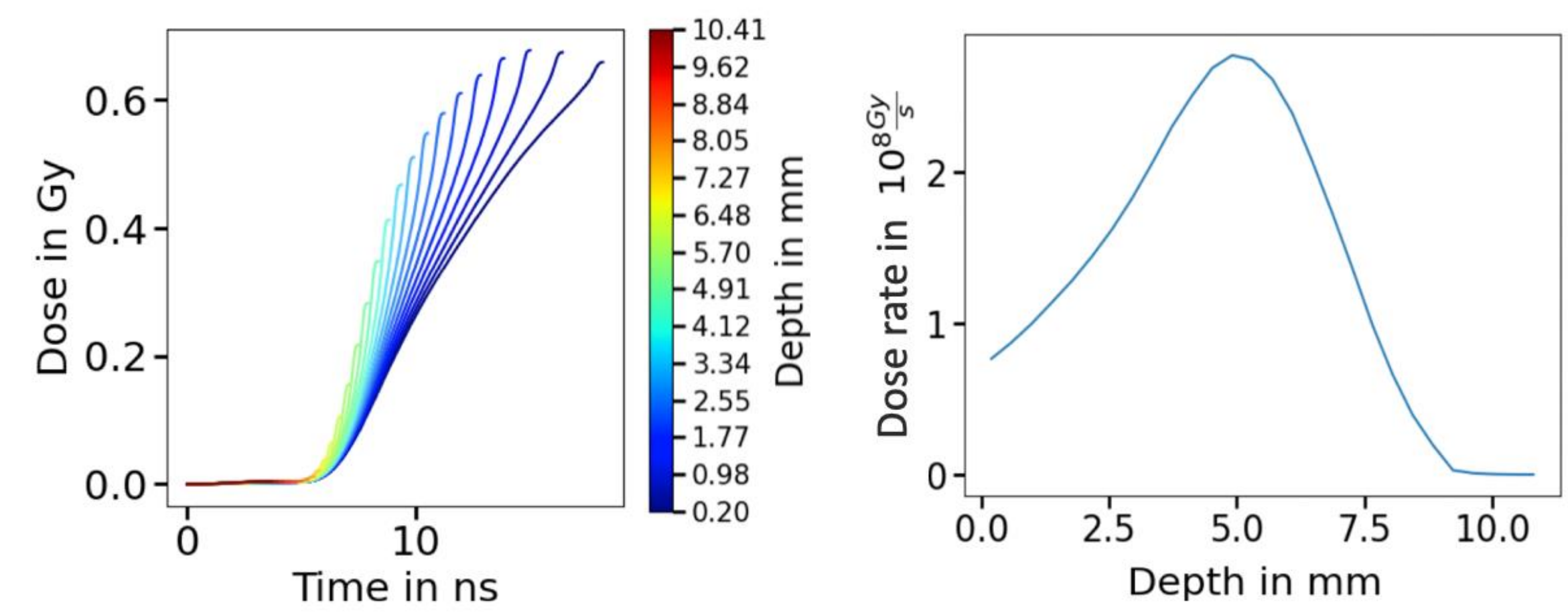
## Scintillator-based time-of-flight (TOF) beam monitoring system

(Transmissive, spectrally resolved beam monitoring system and dosimeter for single LPA proton bunches transported by beamline)

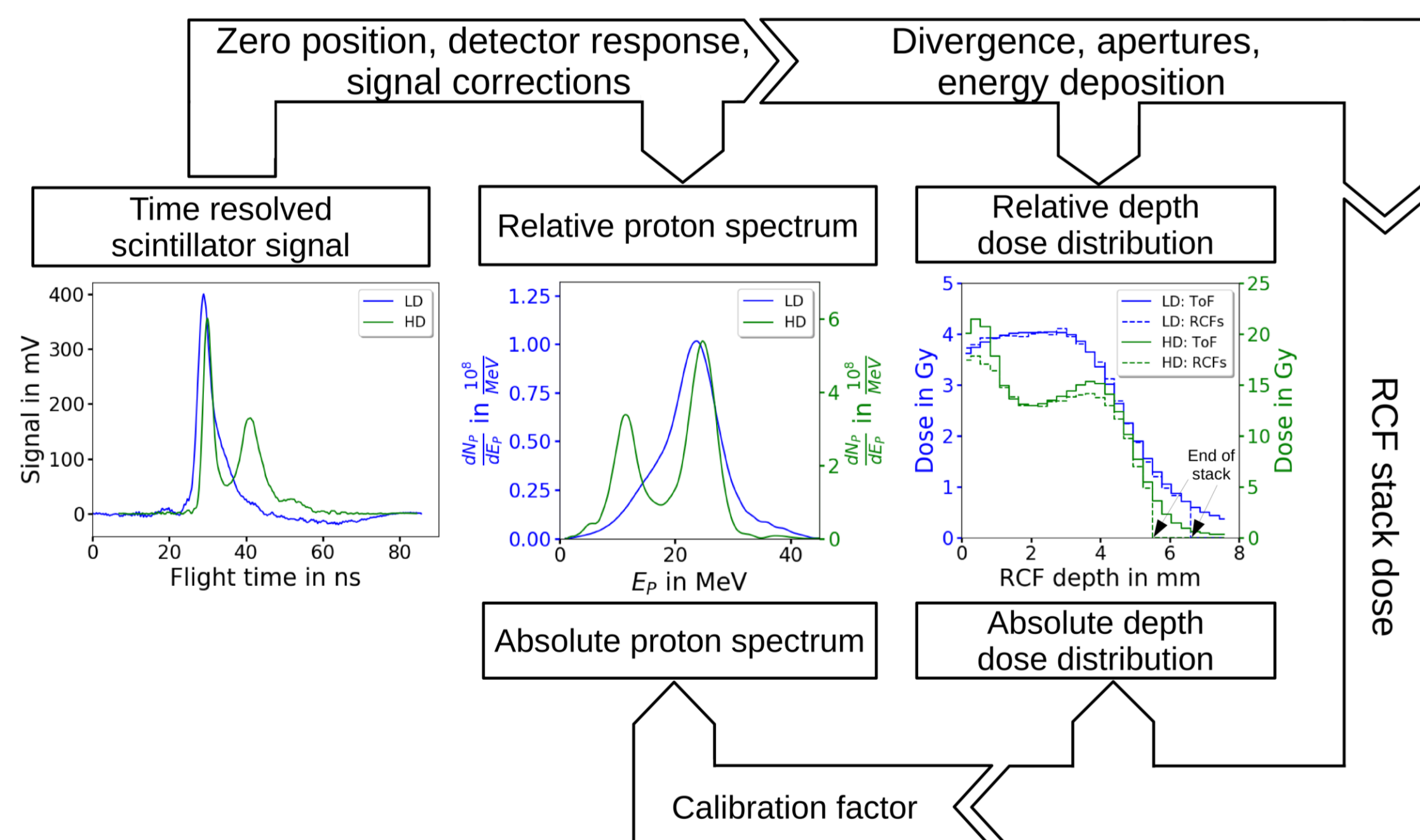
Setup of TOF at proton beamline:



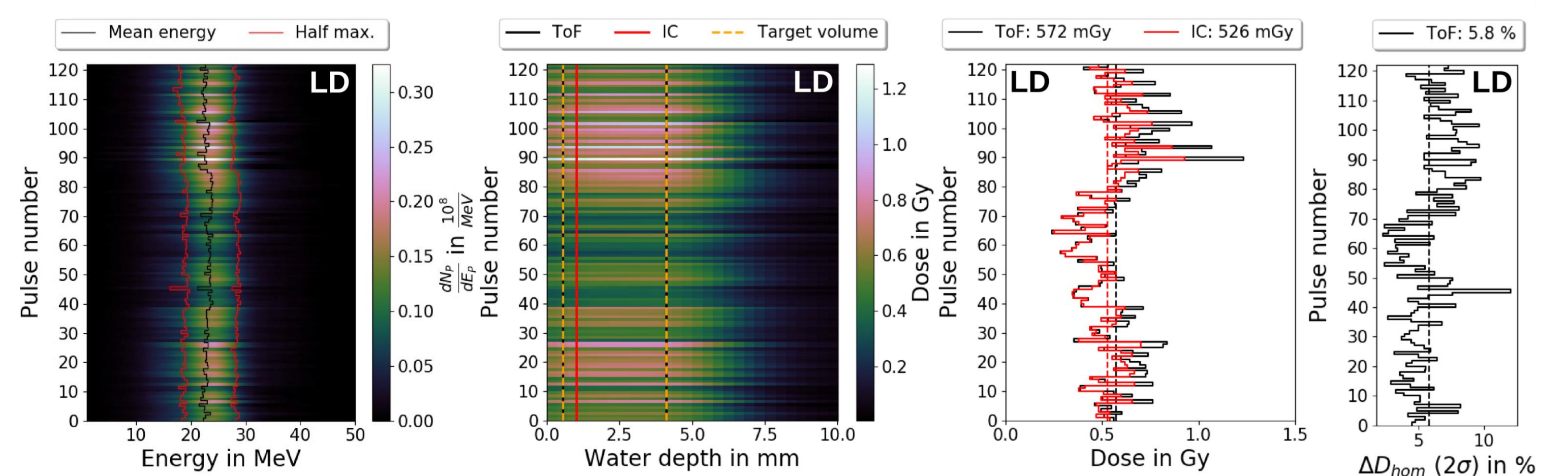
Ultra high dose rate at proton LPA source due to dose deposition dynamics:



How to derive the energy spectrum from the TOF signal:



Energy spectrum, depth dose distribution at irradiation site and agreement with IC:

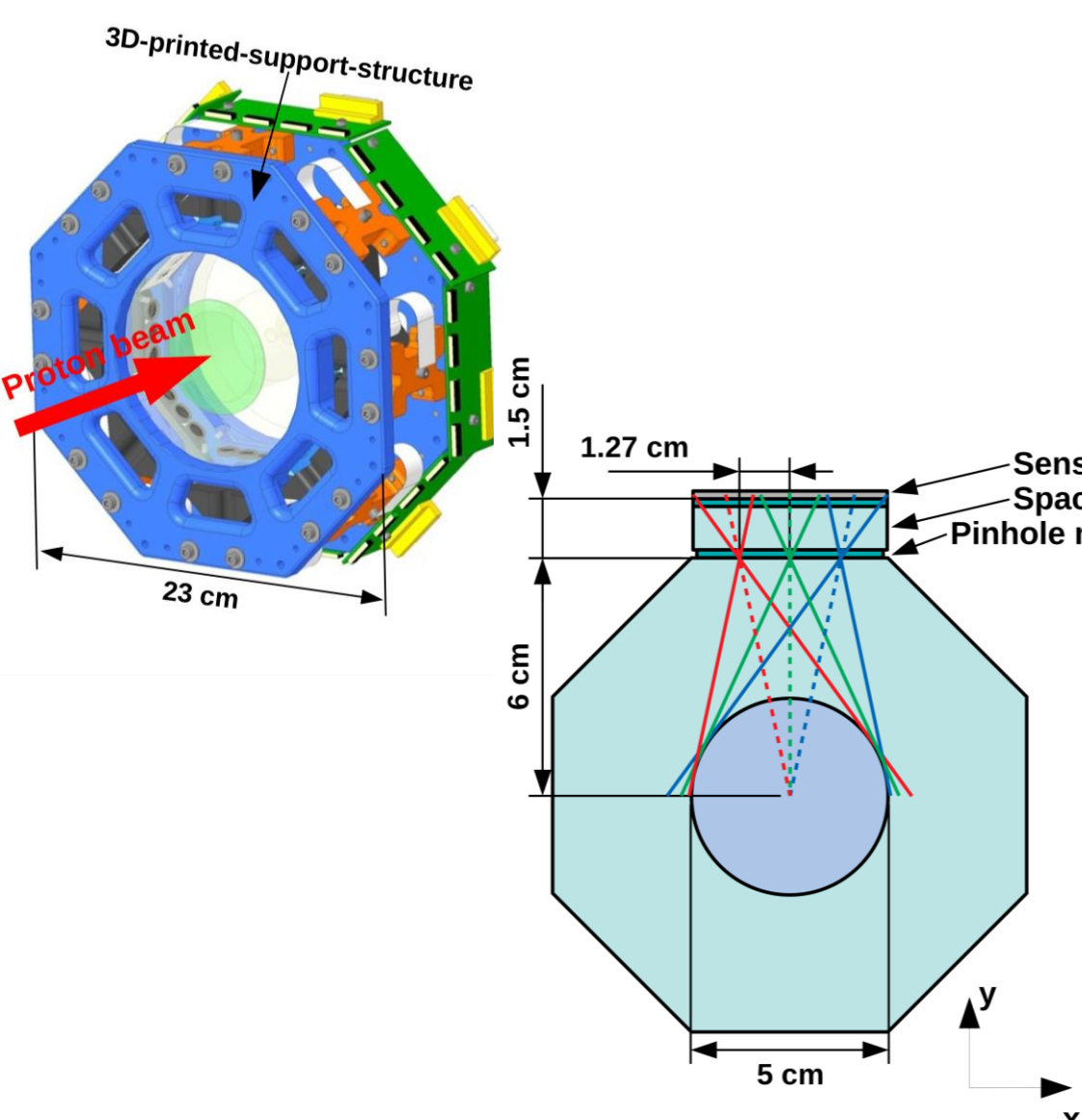


M. Reimold et al., Sci. Rep. 12 (2022)

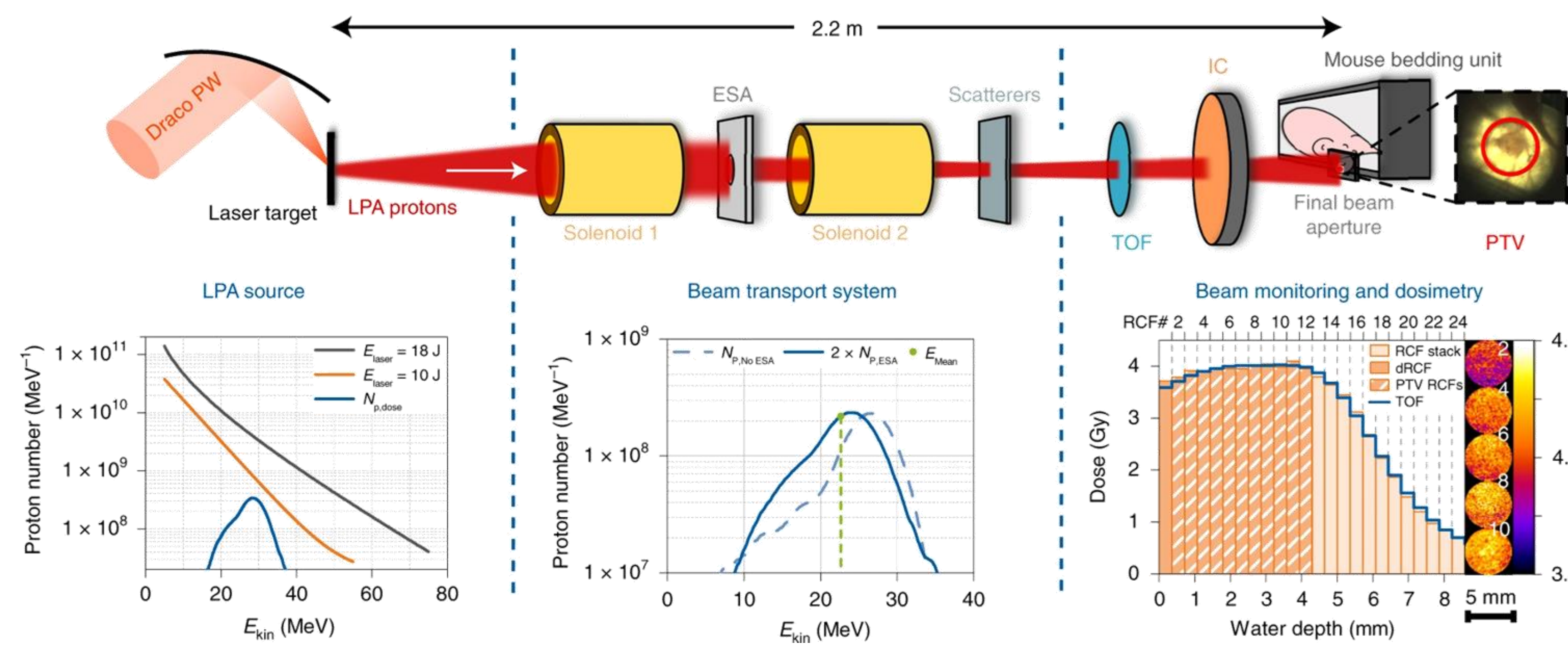
## OCTOPOD

(Online characterization of LPA proton source)

Detector setup:



Overview of the model-conform dose delivery at Draco PW:

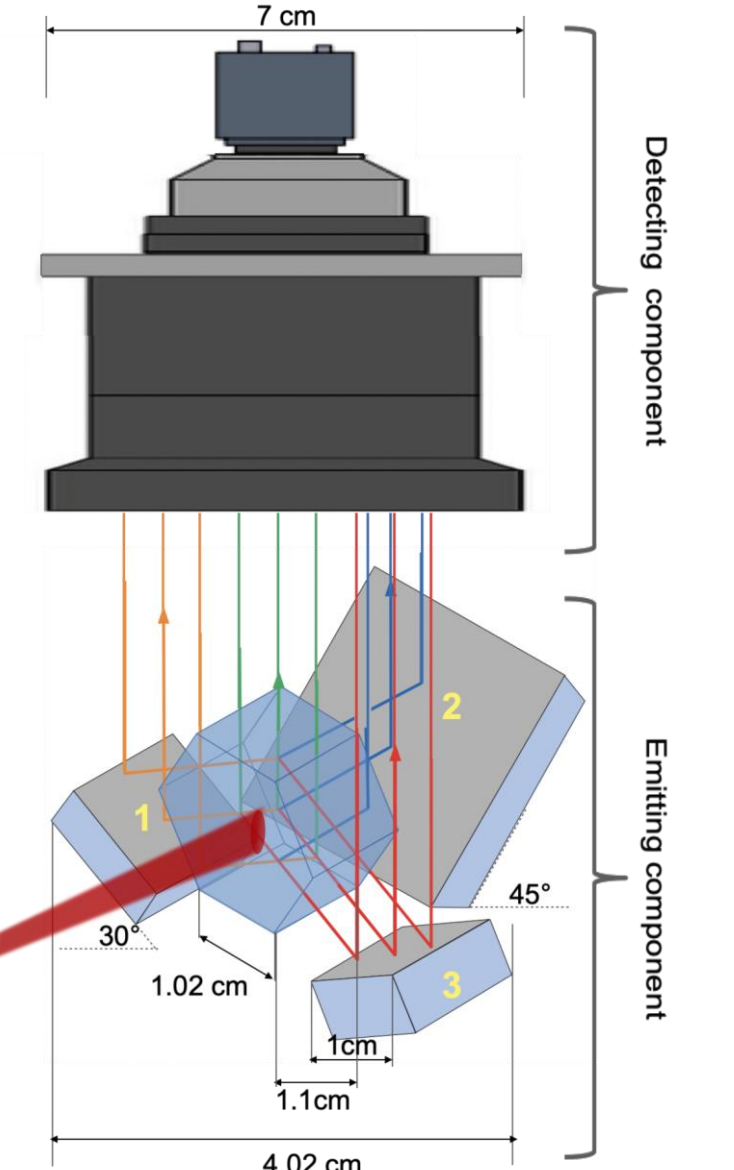


F. Kroll et al., Nat. Phys. 18 (2022), 316 | F.-E. Brack et al., Sci. Rep. 10 (2020), 9118 | M. Reimold et al., Phys. Med. Biol. (in review)

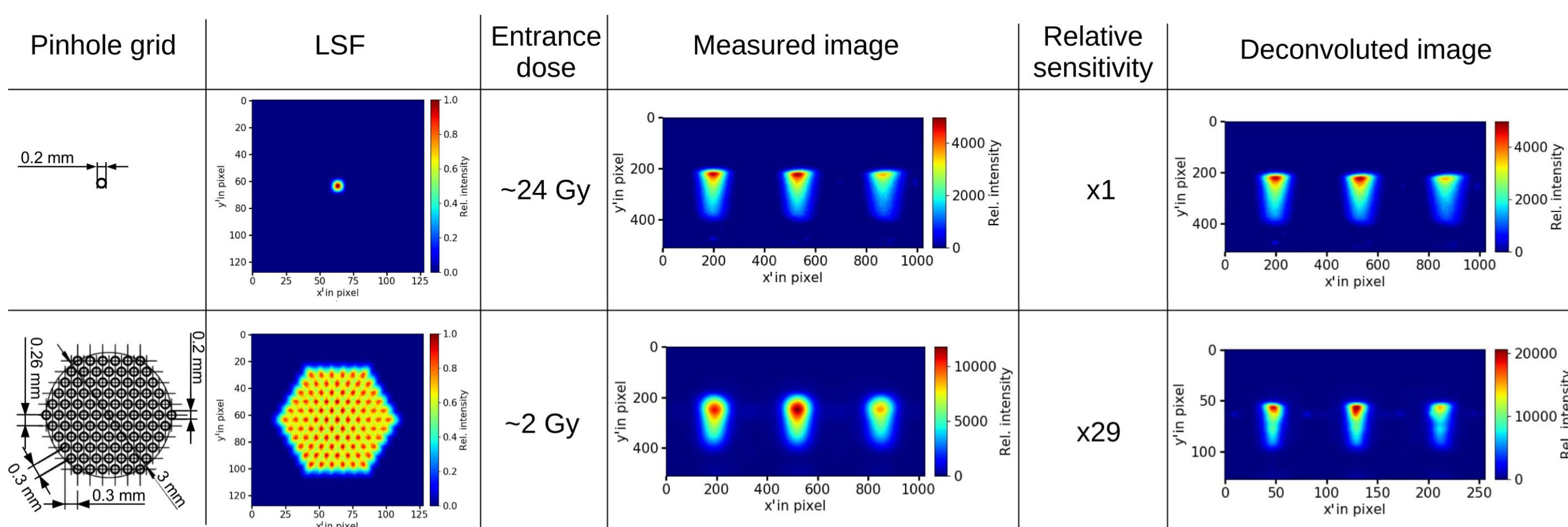
## miniSCIDOM

(Online measurement of 3D dose distribution of transported LPA proton bunches at sample site)

Detector setup:

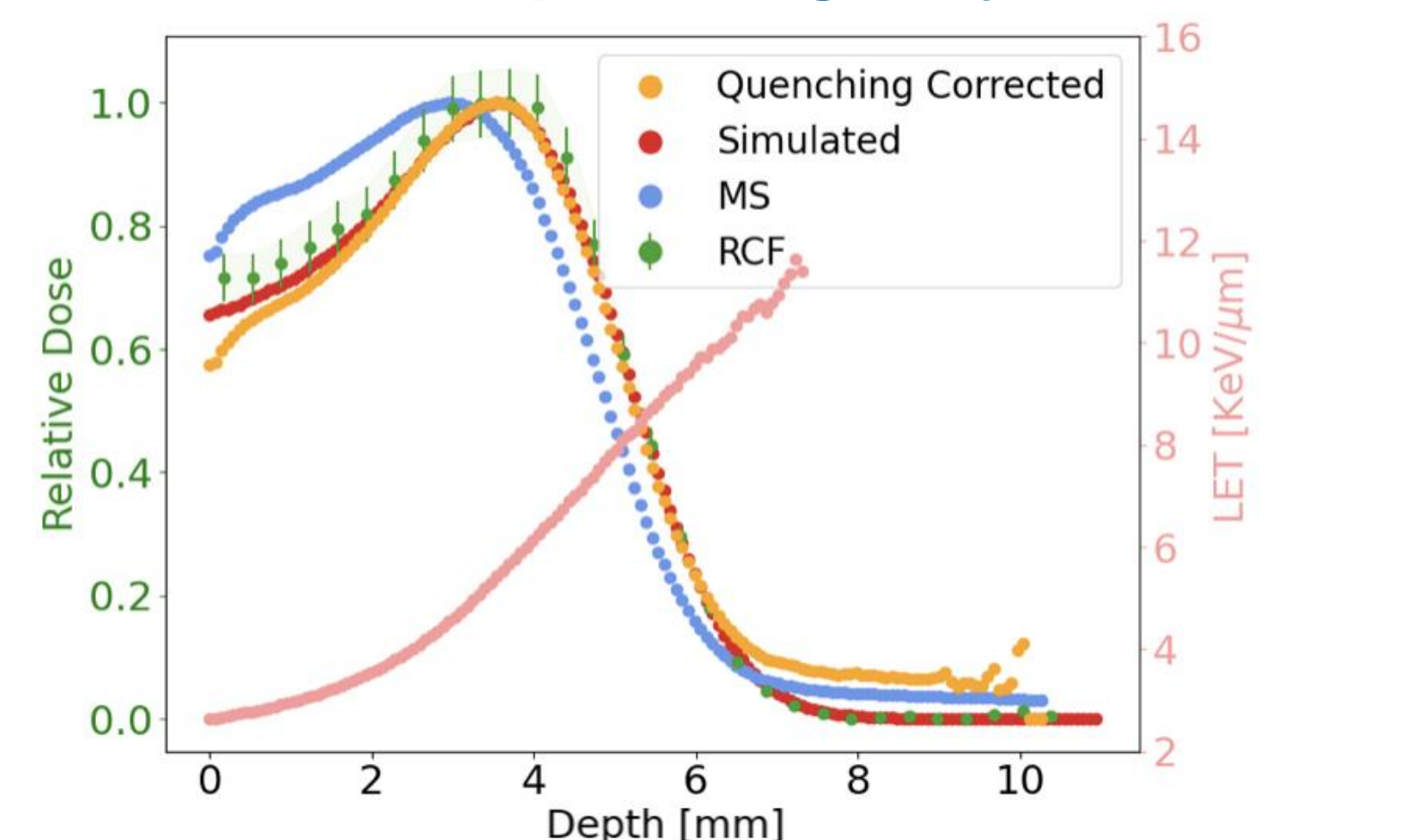


Multi-pinhole grid for increased sensitivity:



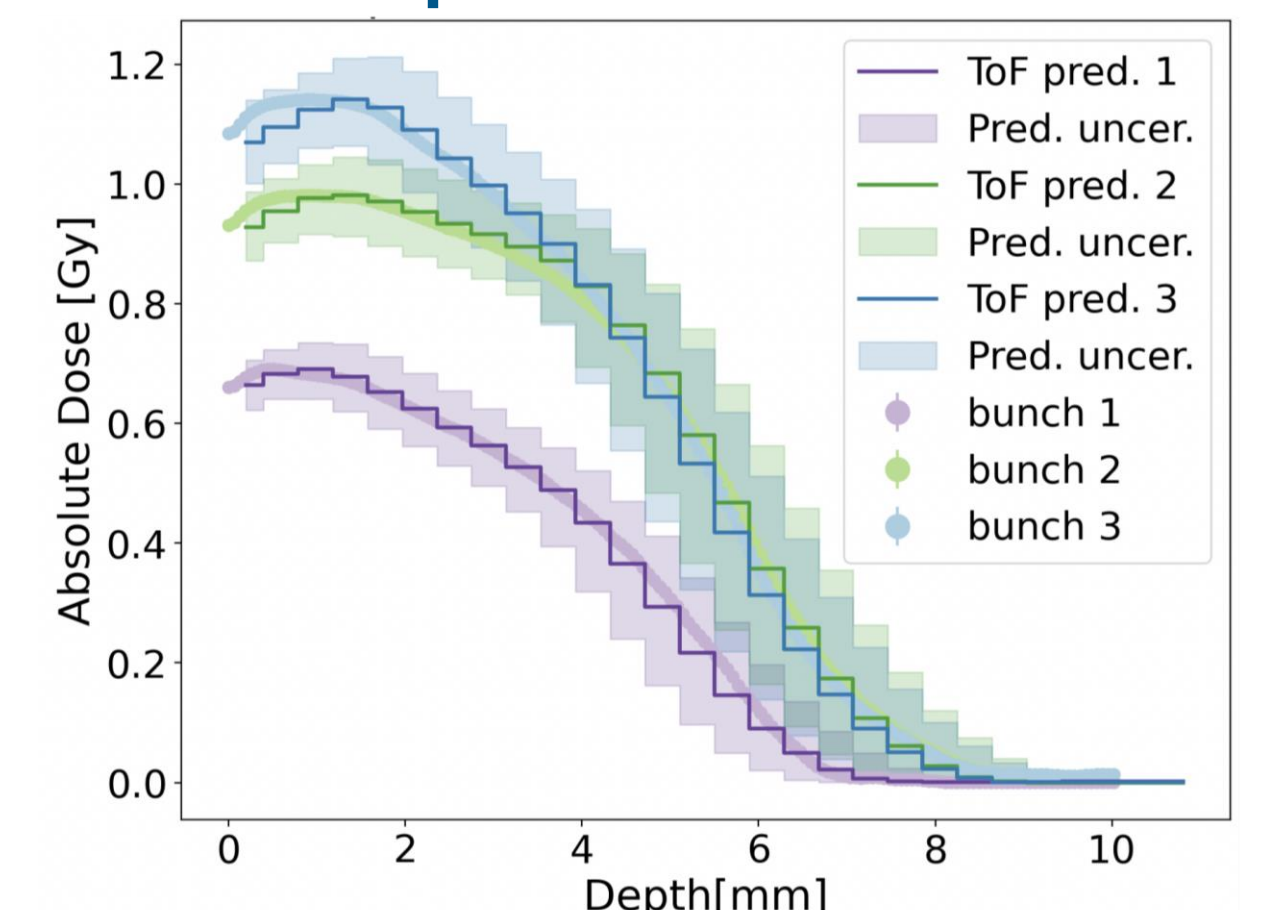
- Compact design due to pinhole imaging
- 3D dose reconstruction
- Outlook: online proton spectra measurements through machine learning

Correction for quenching at cyclotron:



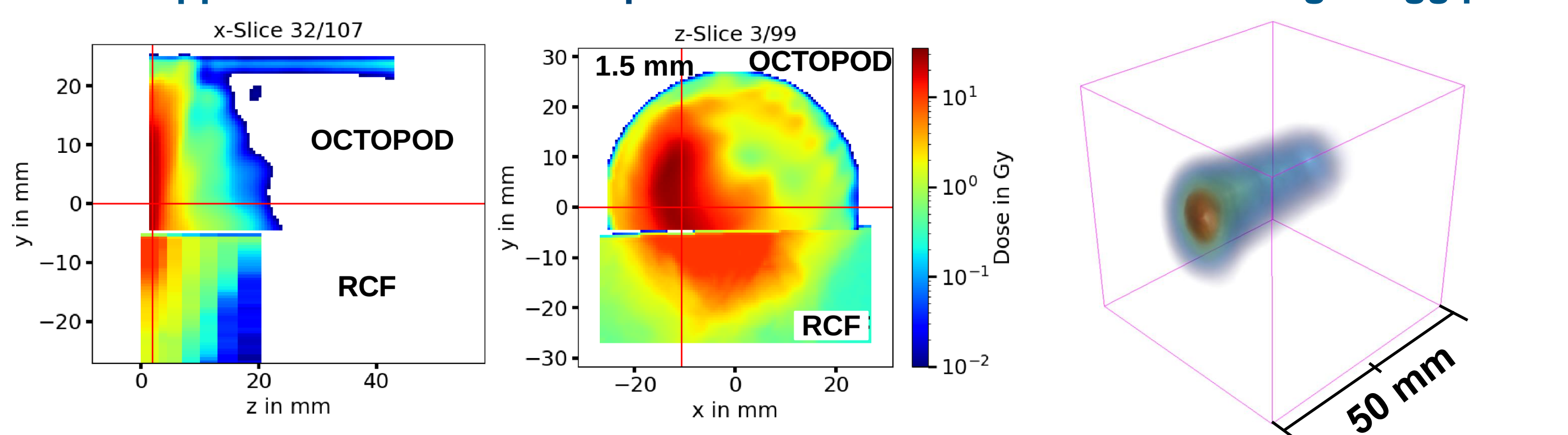
- Resolution < 500 μm | sensitivity ≅ 100 mGy
- Outlook: increase spatial resolution, reduce background

Depth dose distribution compared to TOF at LPA:



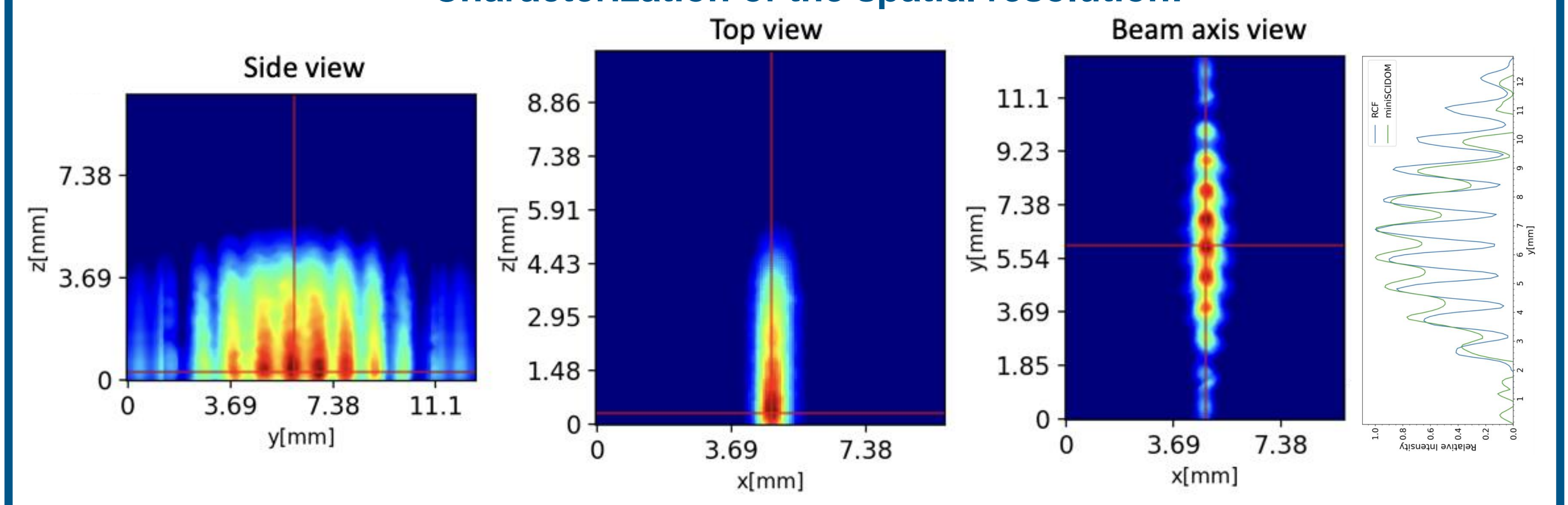
Application at Draco LPA proton source:

Volume rendering Bragg peak:



M. Reimold et al., HPLSE 11 (2023)

Characterization of the spatial resolution:



A. Corvino, M. Reimold et al., HPLSE (in review)