

Can decay gammas enhance prompt-gamma imaging?

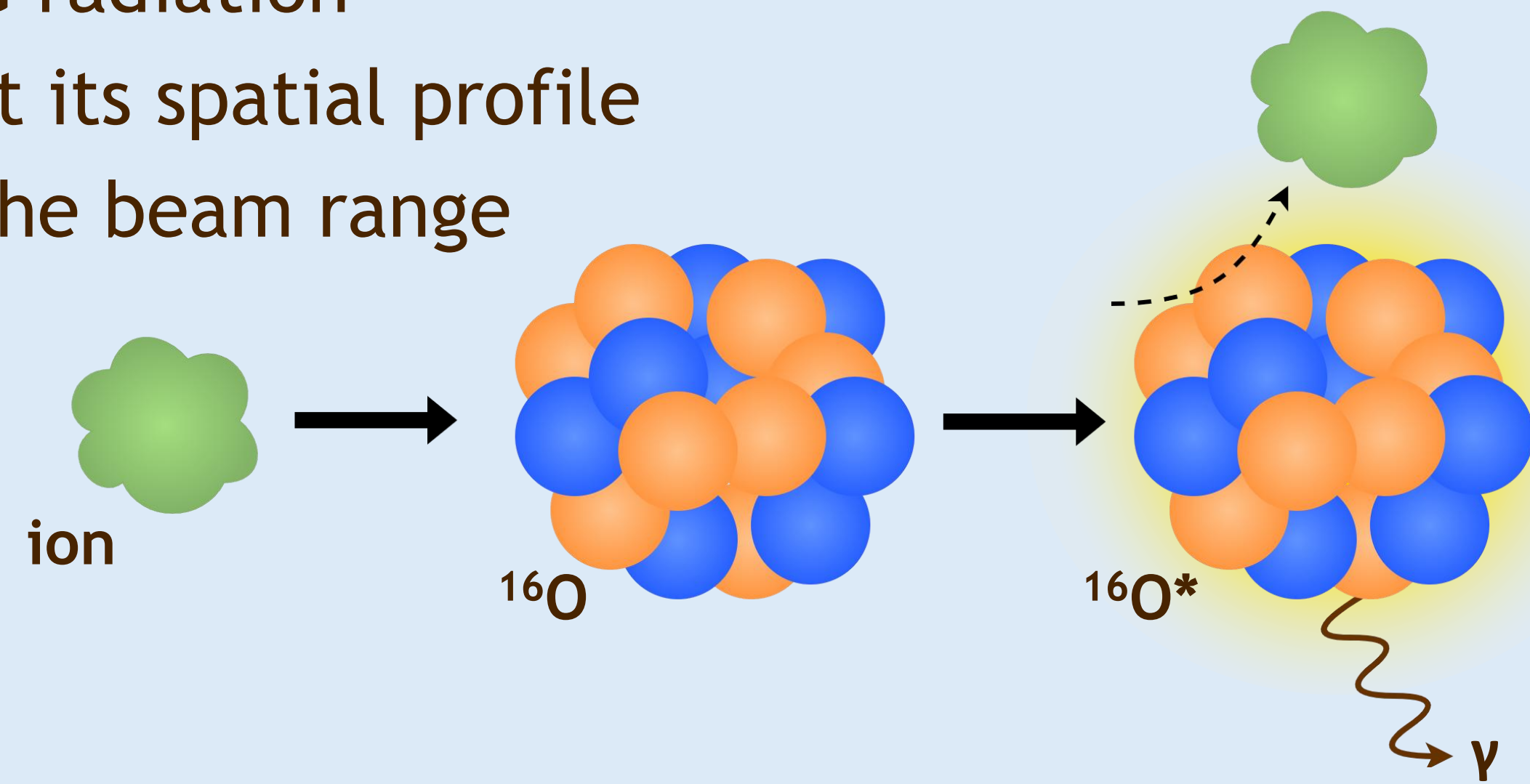
M. Kercz^{1,2}, G. Ostrzolek^{1,2}, D. Boscolo³, M. Durante³, R. Hetzel³, R. Lalik², K. Rusiecka² and A. Wrońska²

¹Doctoral School of Exact and Natural Sciences, Jagiellonian University, Kraków, Poland, ²M. Smoluchowski Institute of Physics, Jagiellonian University, Kraków, Poland, ³GSI Helmholtzzentrum für Schwerionenforschung GmbH, Darmstadt, Germany

✉ monika.kercz@doctoral.uj.edu.pl; gabriel.ostrzolek@doctoral.uj.edu.pl

Prompt-gamma imaging (PGI)

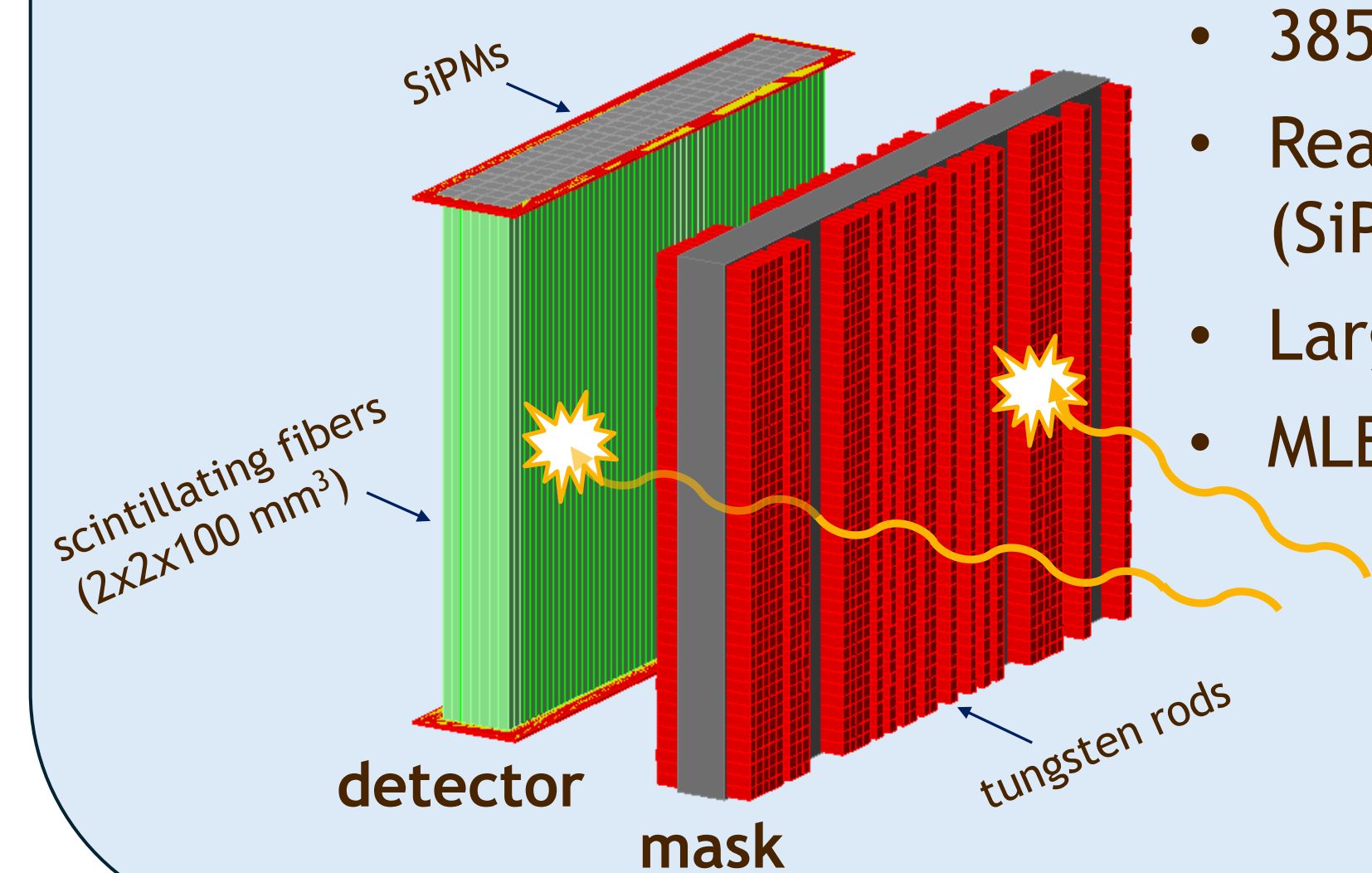
- 1) Register PG radiation
- 2) Reconstruct its spatial profile
- 3) Calculate the beam range



Beyond prompt gammas

Aim: test the SiFi-CC detector with a radioactive beam

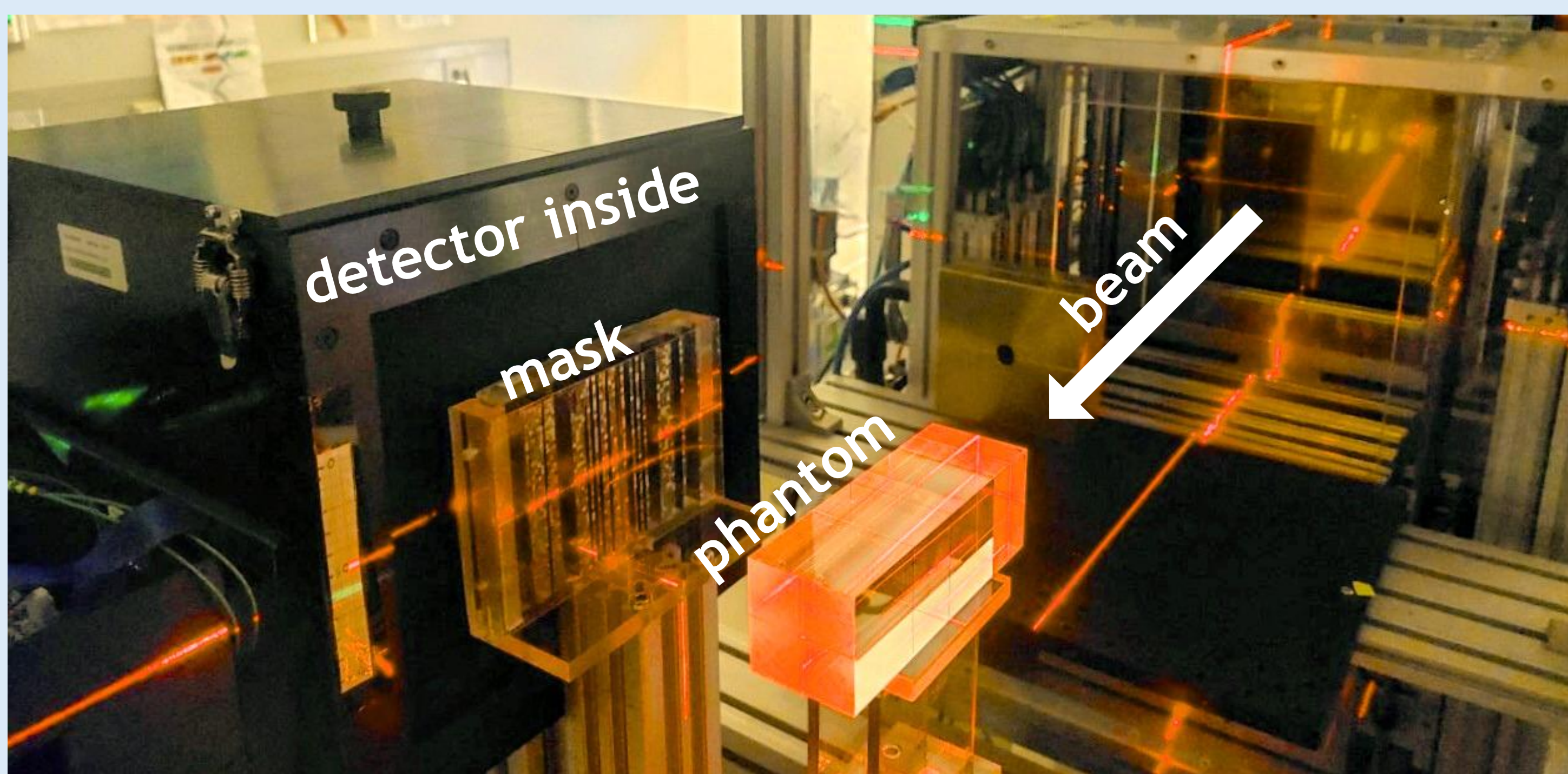
- Coded mask camera^a: mask + detector
- 385 LYSO:Ce,Ca fibers (7 layers)
- Read-out by silicon photomultipliers (SiPMs)
- Large rate capability
- MLEM for image reconstruction



Radioactive beams and where to find them

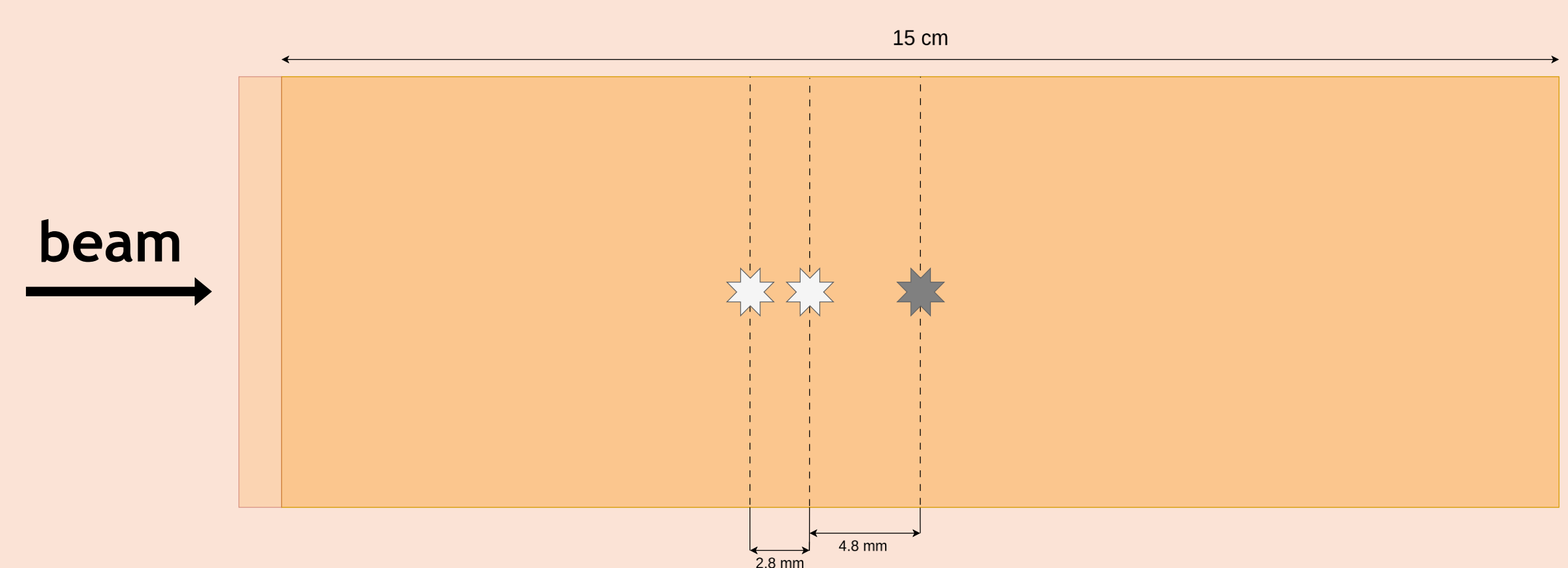
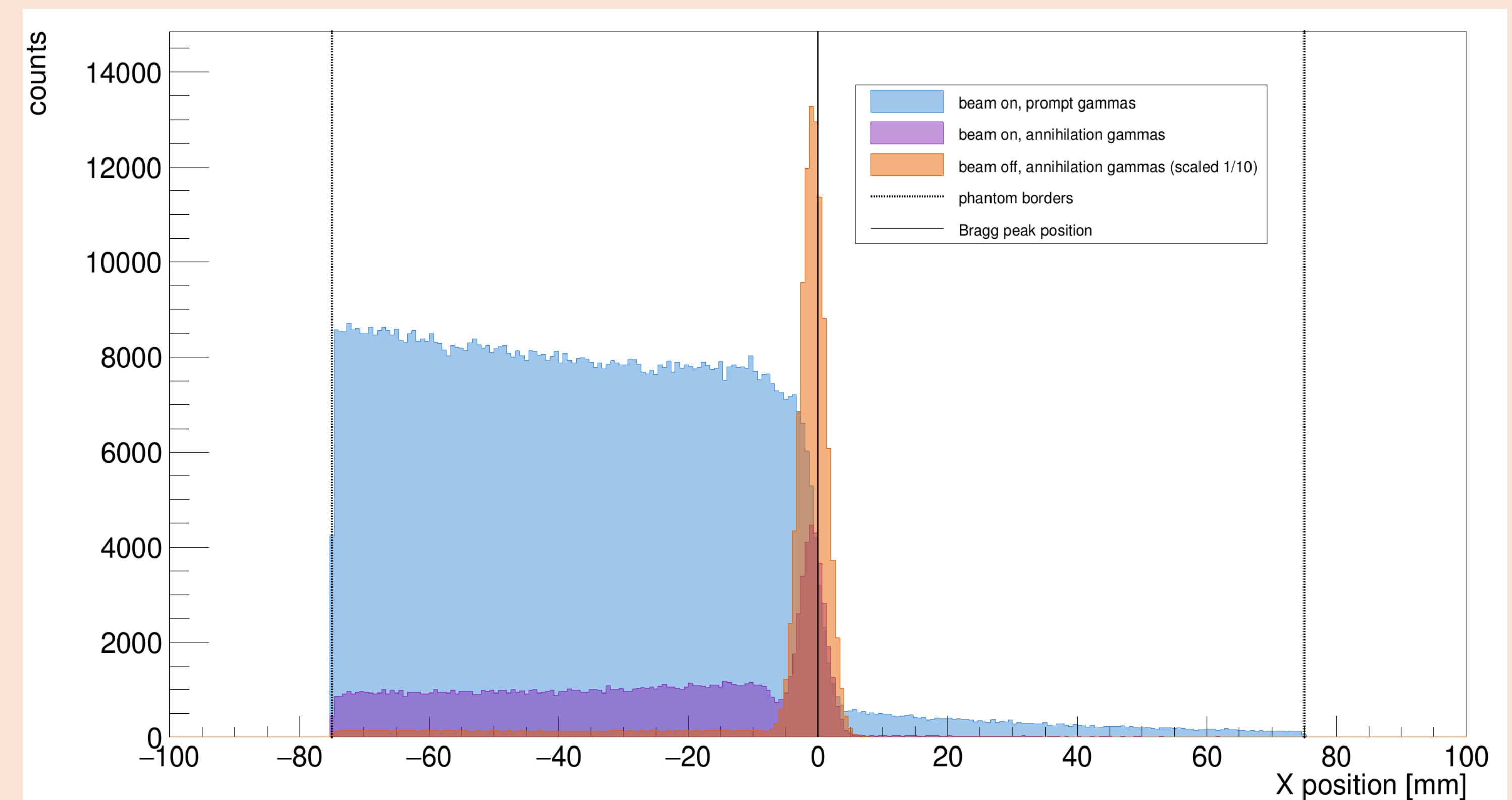
- Radioactive beams for irradiation (¹¹C)
- Protons → prompt gammas
- Radioactive beams → prompt + annihilation gammas
- **BARB experiment** (Biomedical Applications of Radioactive ion Beams) @ GSI Darmstadt^b

Experimental setup



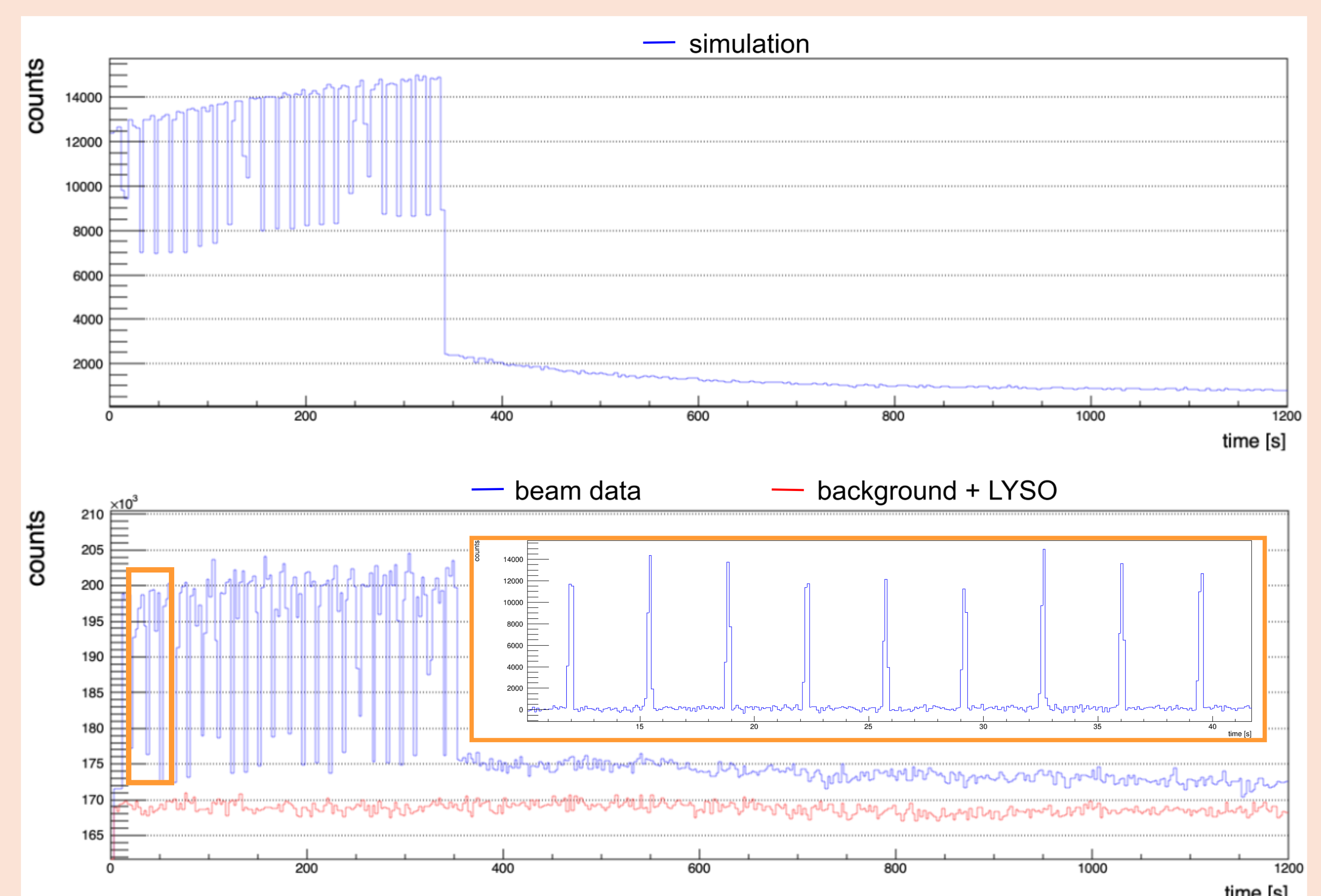
Results

Simulations: spatial deposition of gammas



- PMMA phantom (15 x 5 x 5 cm³)
- 3 spots, 4e8 ions per spot, simulation + experiment
- simulation: 3.6e6 gammas, experiment: 1.3e6 gammas

Time characteristics:



- Radioactive beam ON/OFF
- ¹¹C tail - annihilation gammas
- Separate background measurement + LYSO activity

What did we learn?

- Time characteristics of the beam visible
- ¹¹C decay registered
- Prompt and annihilation gammas distinguished
- Data analysis and image reconstruction ongoing

^aMagdalena Kotodziej et al 2025 Phys. Med. Biol. **70** 15017

^bhttps://www.gsi.de/work/forschung/biophysik/erc_barb



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