

DoPET: summary of the CNAO data taking (may 2014)

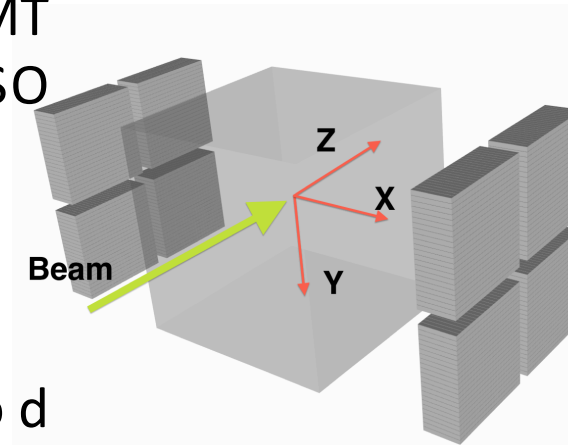
Niccolò Camarlinghi,
niccolo.camarlinghi@df.unipi.it

Outline

- DoPET hw upgrade
- Results obtained at CNAO
 - Default phantom vs modified phantom
 - FLUKA vs experimental data
 - Preliminary results on Carbon
- Conclusion & Discussion

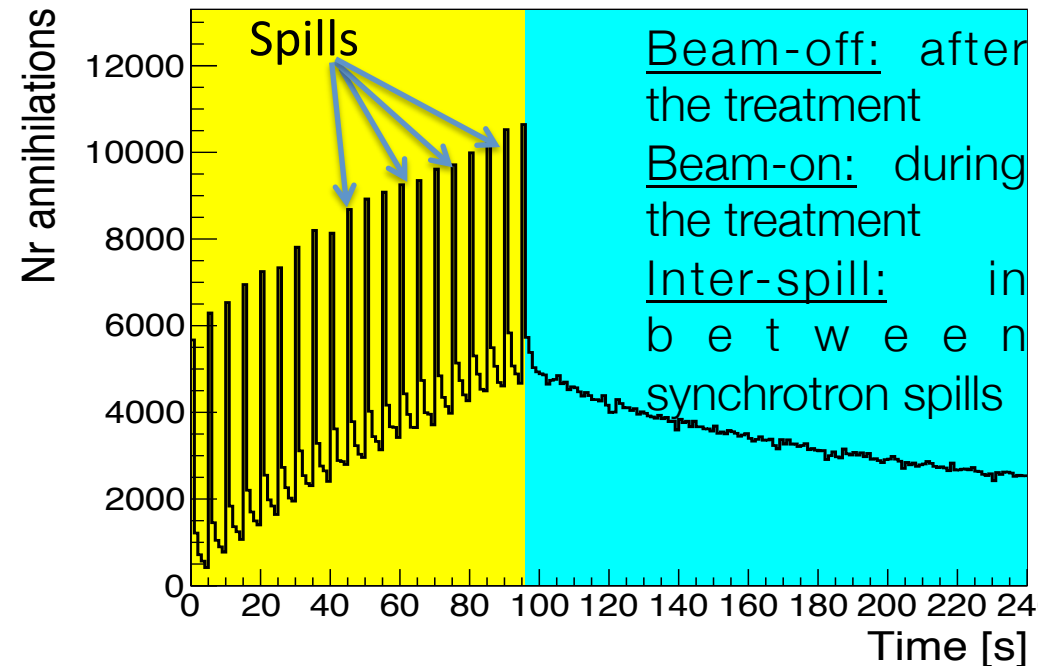
DoPET 4 vs 4

- 8 modules (4 vs 4)
- Each module is a H8500 PMT coupled to a 23x23 LYSO matrix
- Module size $\sim 10 \times 10$ cm
- Head distance 20 cm
- Maximum Likelihood Estimation Maximization (MLEM) image reconstruction based on ITK
- Field of view $100 \times 100 \times 100$ mm³
- Image voxel physical dimension 1mm³
- Normalization correction (Planar source $110 \times 110 \times 3$ mm³)



- Spill duration: 1s
- Pause between spills: 4s

Time vs Annihilations



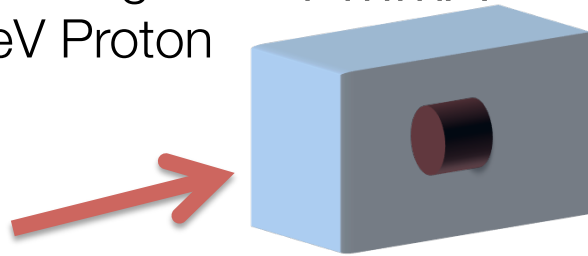
95 MeV protons: cavity vs no cavity

Beam-OFF

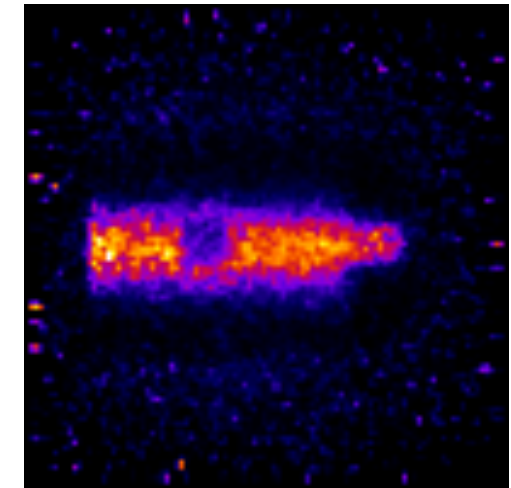
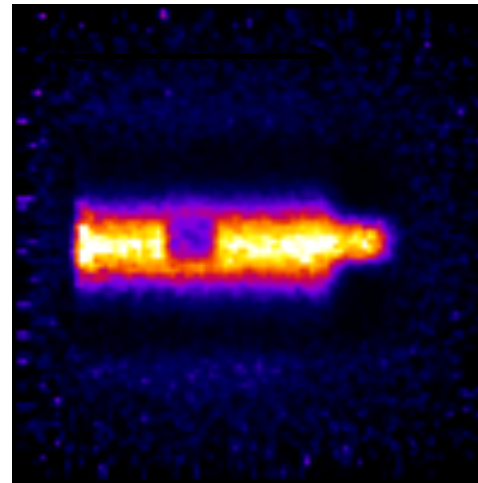
Inter-spill

Mono-energetic
95 MeV Proton
beam

PMMA



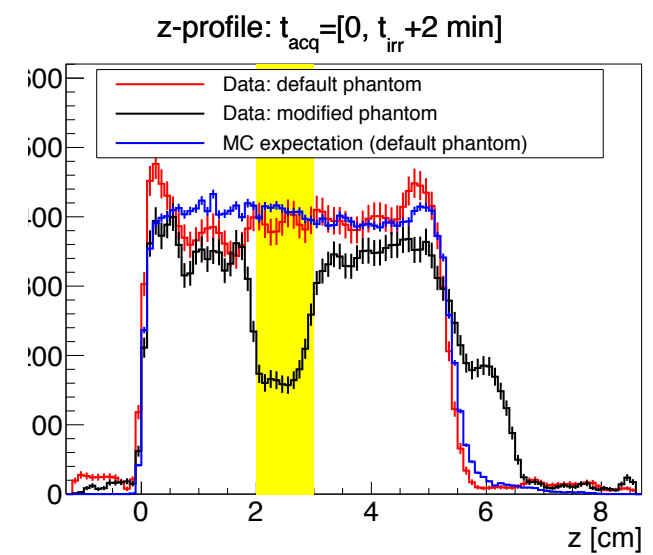
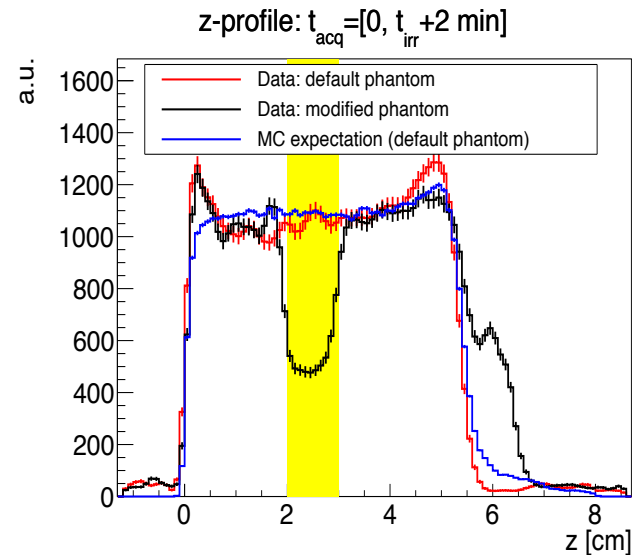
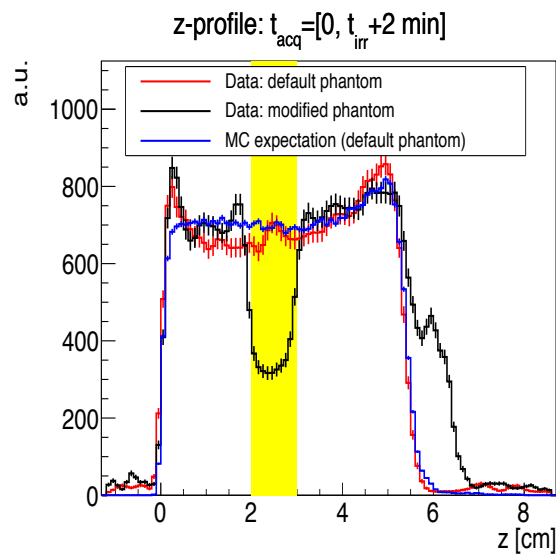
Hole size: 1 cm \varnothing h=1 cm,
Depth: 2 cm



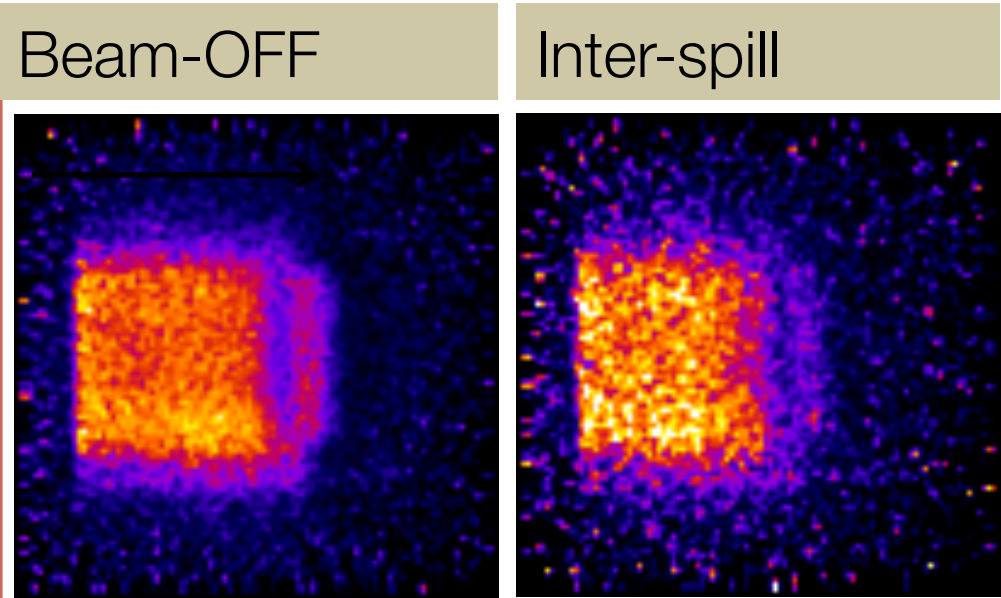
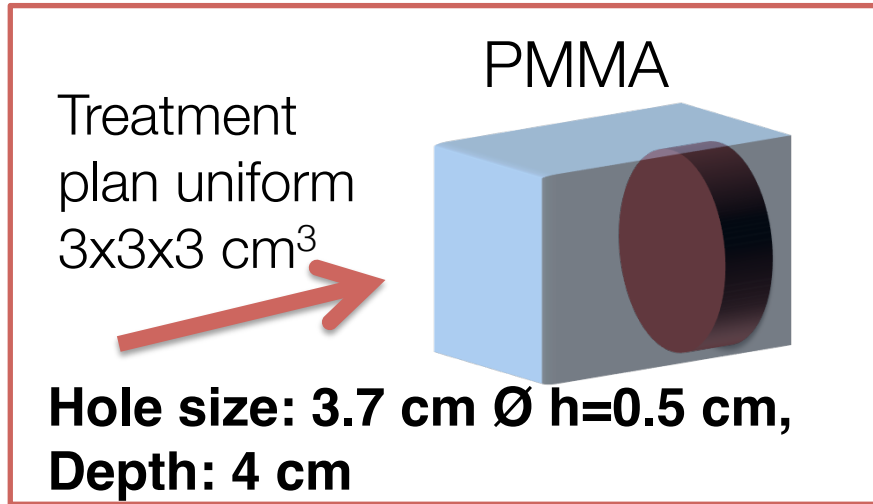
2 min beam-off

Inter-spill +2 min beam-off

Inter-spill



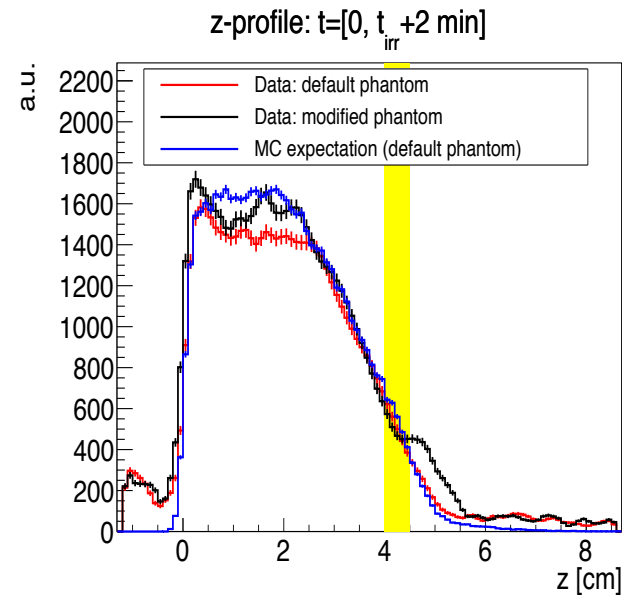
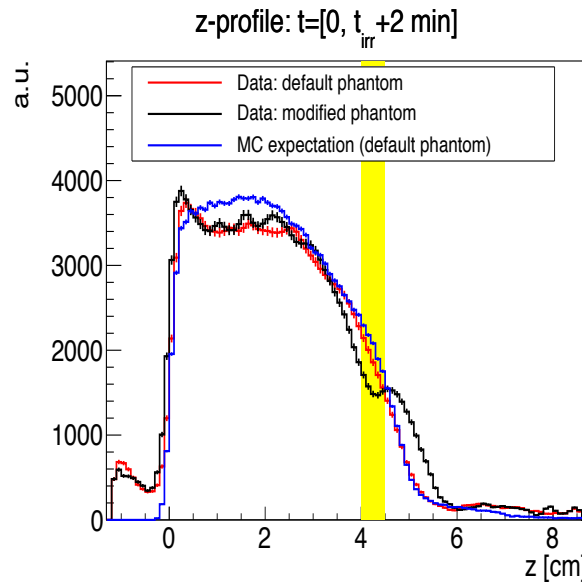
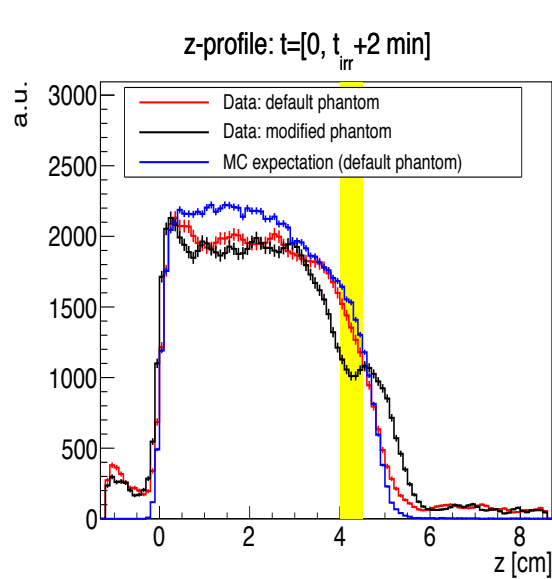
2 Gy treatment plan: cavity vs no cavity



2 min beam-off

Inter-spill +2 min beam-off

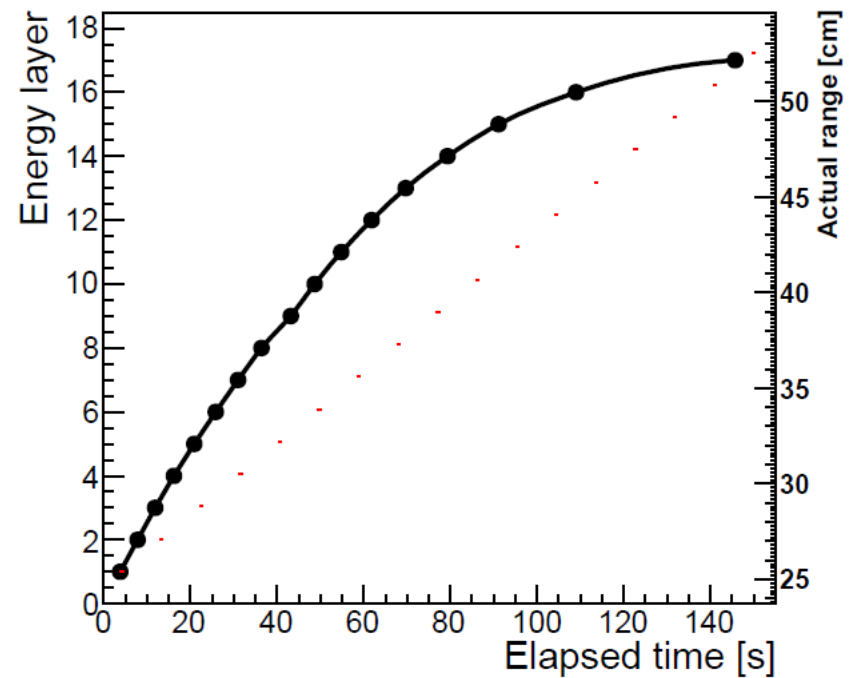
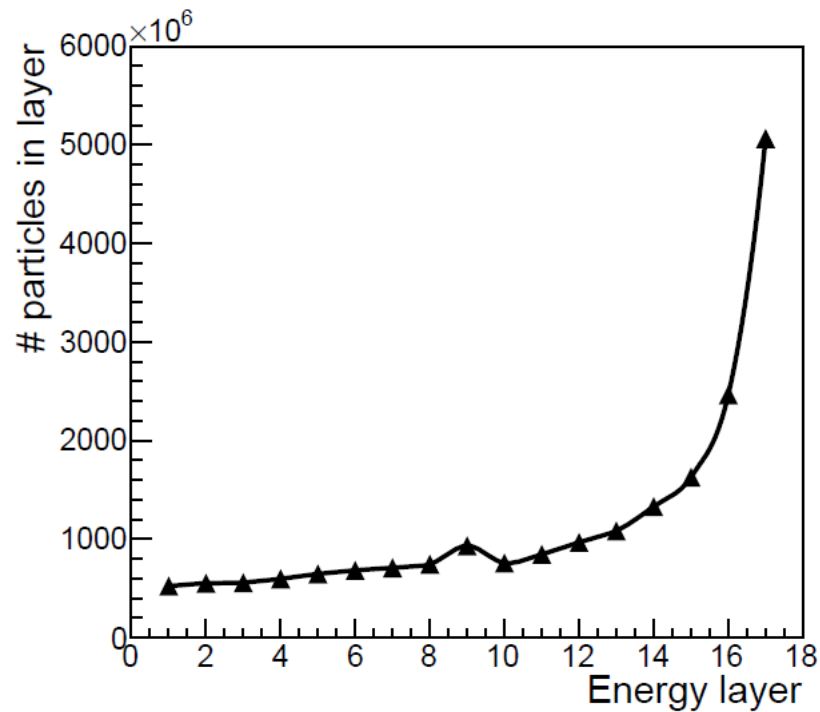
Inter-spill



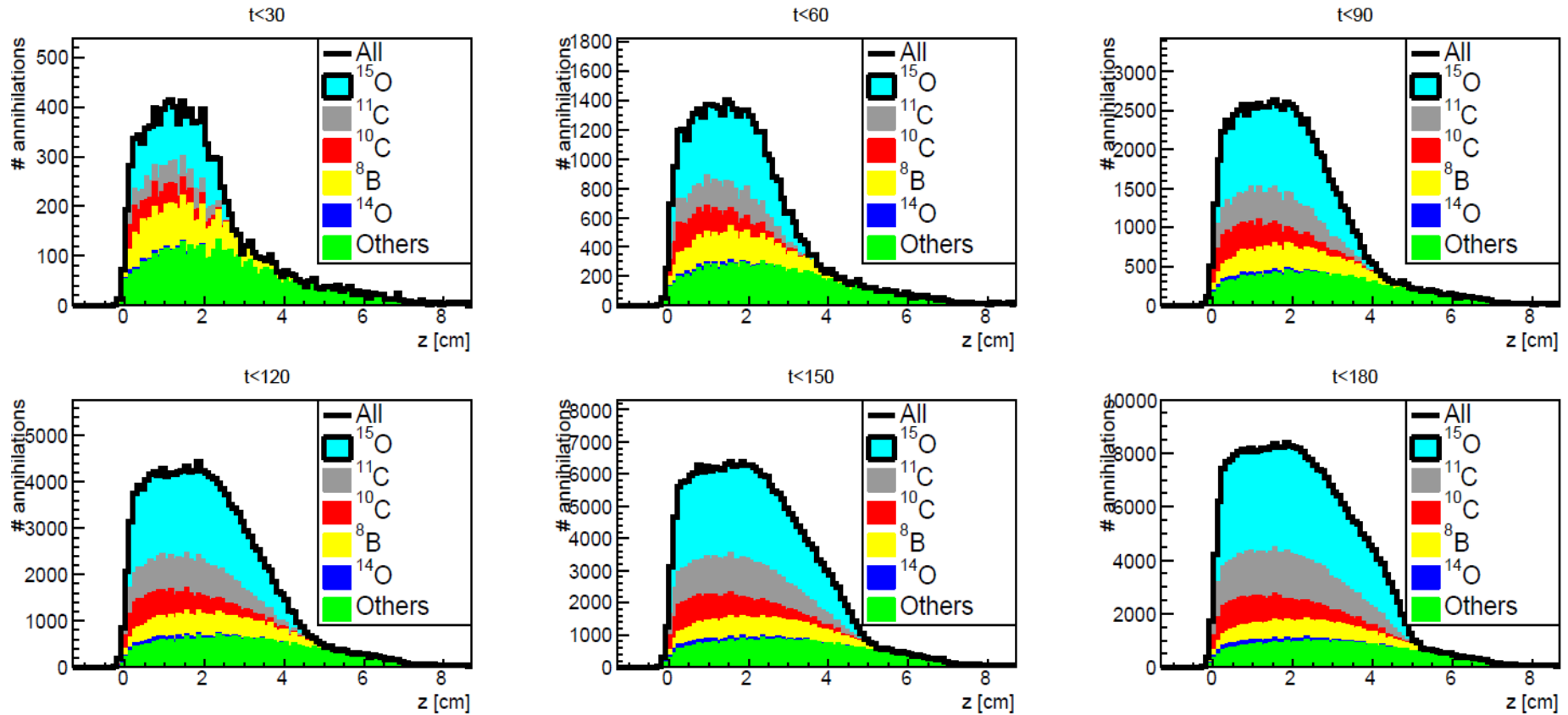
Treatment plan time behavior:
FLUKA vs experimental data

2 Gy Protons plan on PMMA specifics:

- Delivery time 146 s
- 17 layers
- Uniform dose in $3 \times 3 \times 3 \text{ cm}^3$

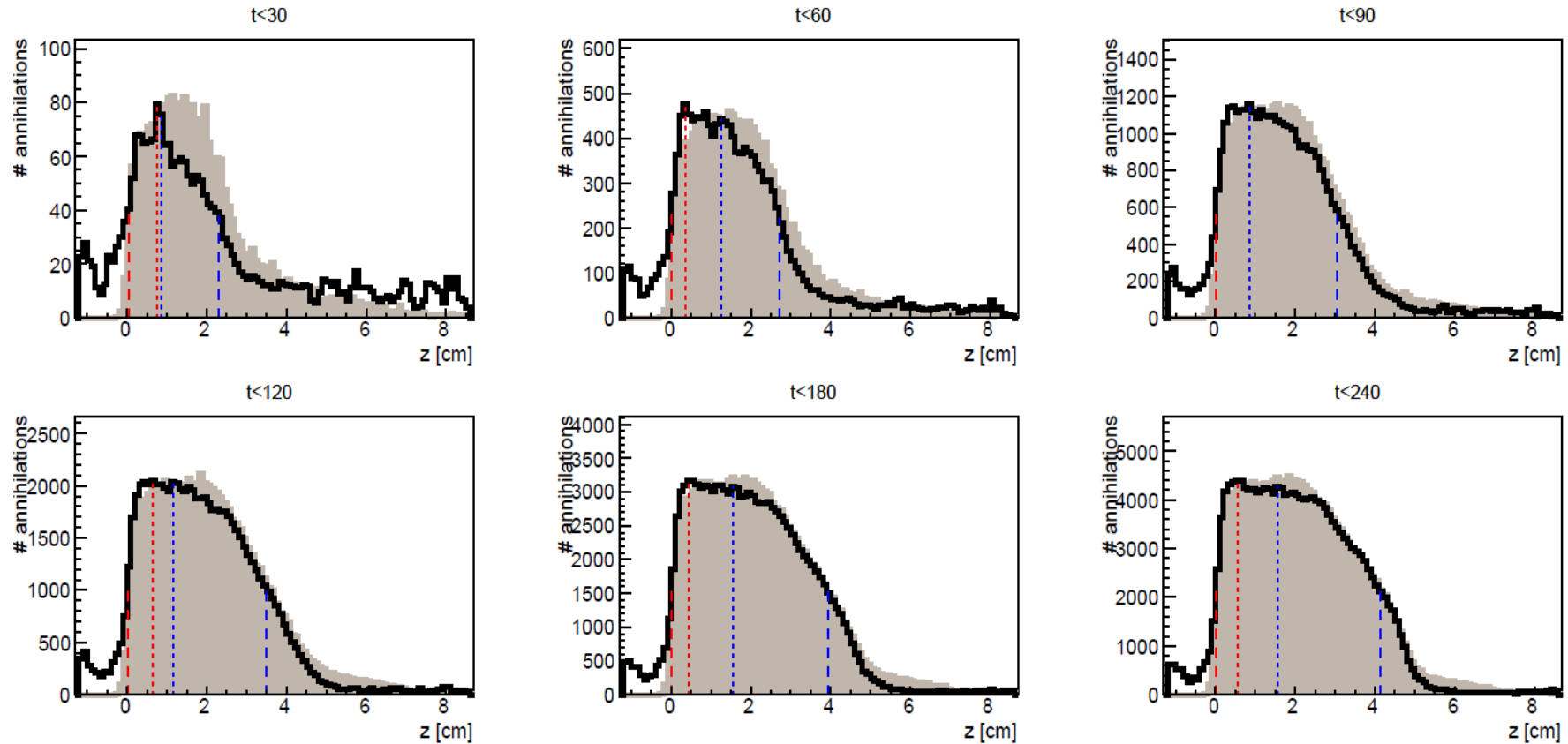


FLUKA 1-D activity profiles and contribution



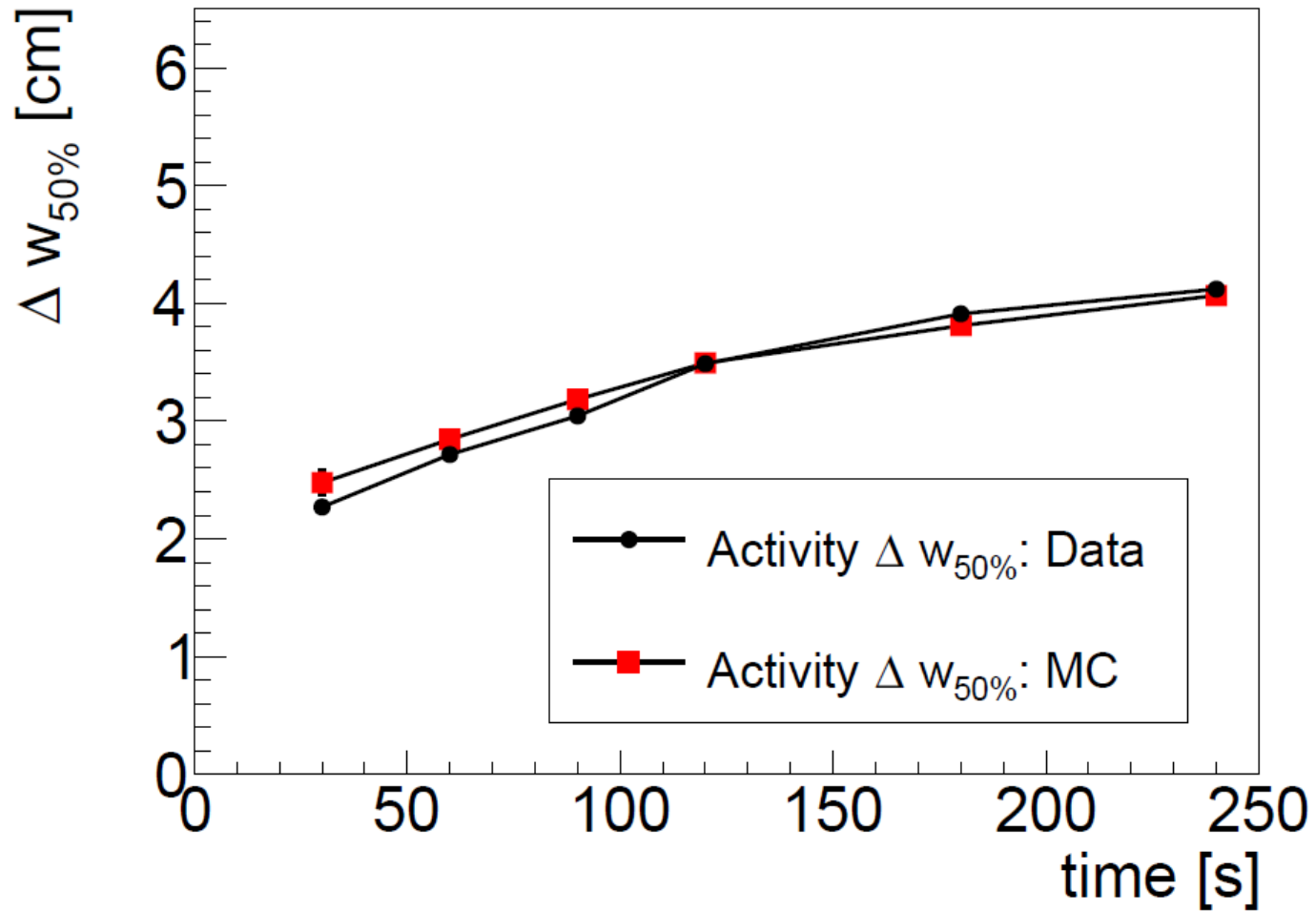
2 Gy plan on homogeneous PMMA
2 Gy plan delivered in 146 s
17 Layers

2 Gy plan on homogeneous PMMA

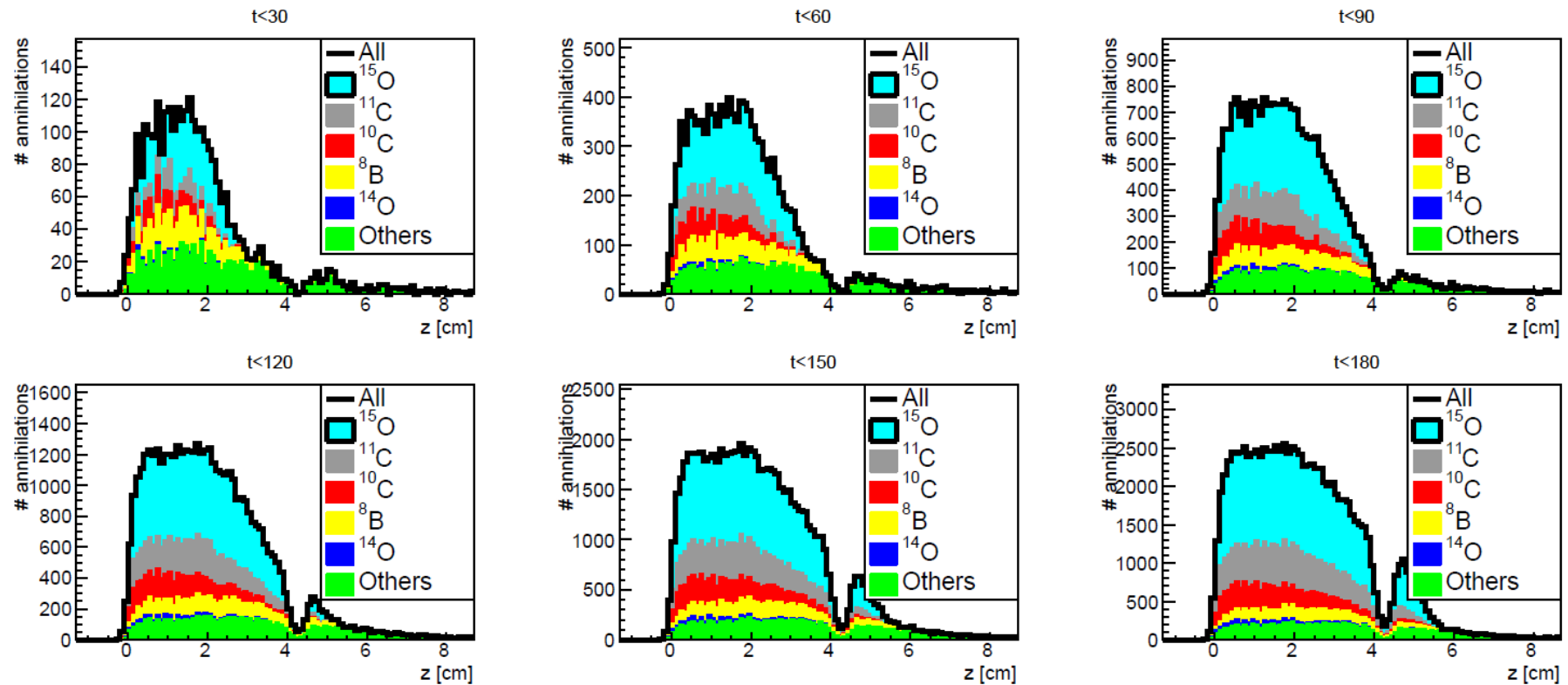
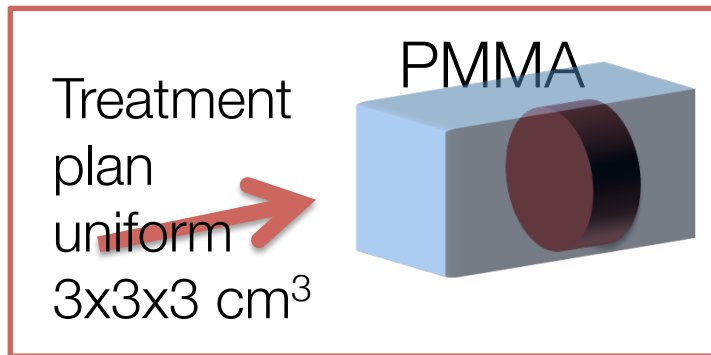


Experimental data: 1-D activity profiles black line
FLUKA 1-D activity profiles light brown area

Activity width MC vs Data

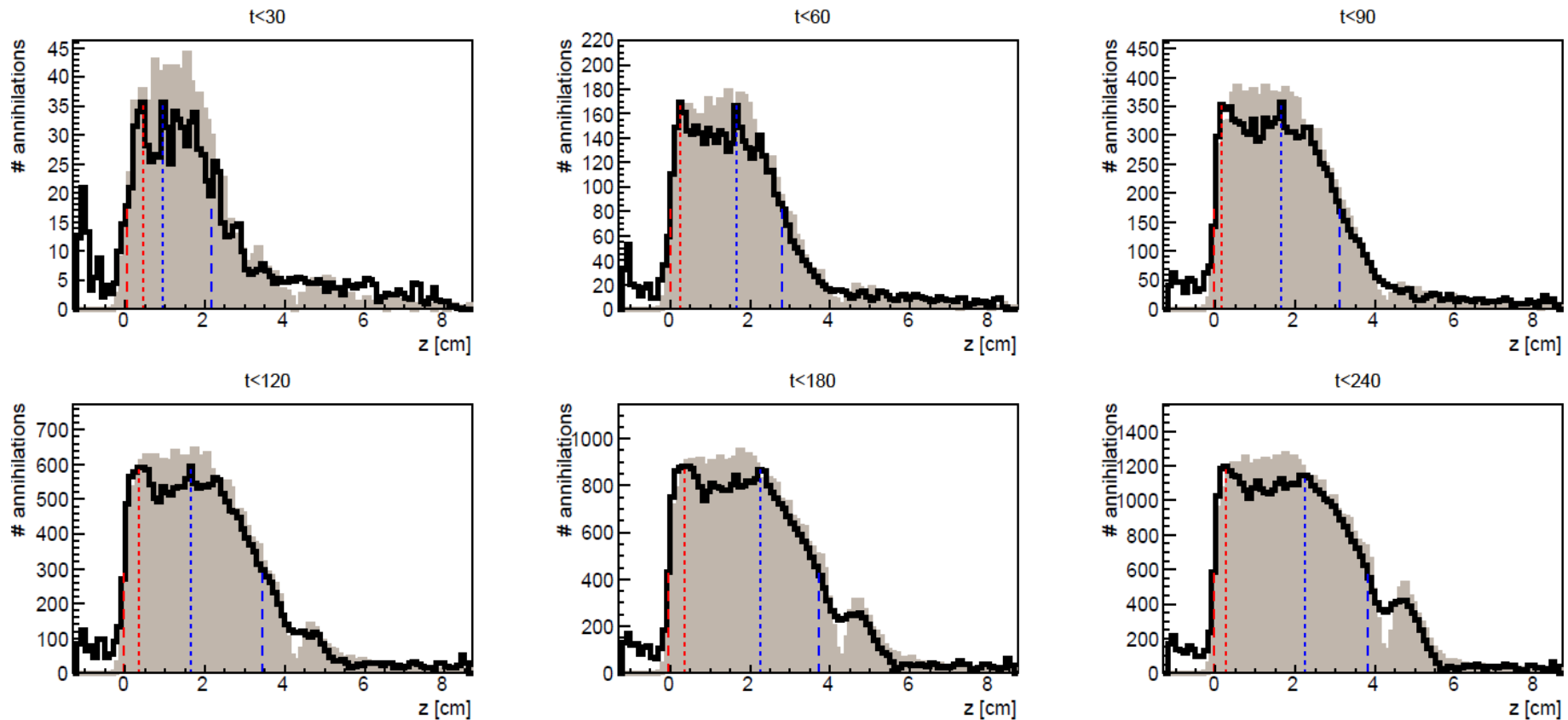


FLUKA 1-D activity profiles and isotopes contribution



2 Gy plan on PMMA with a cavity, delivered in $\Delta t = 146 \text{ s}$

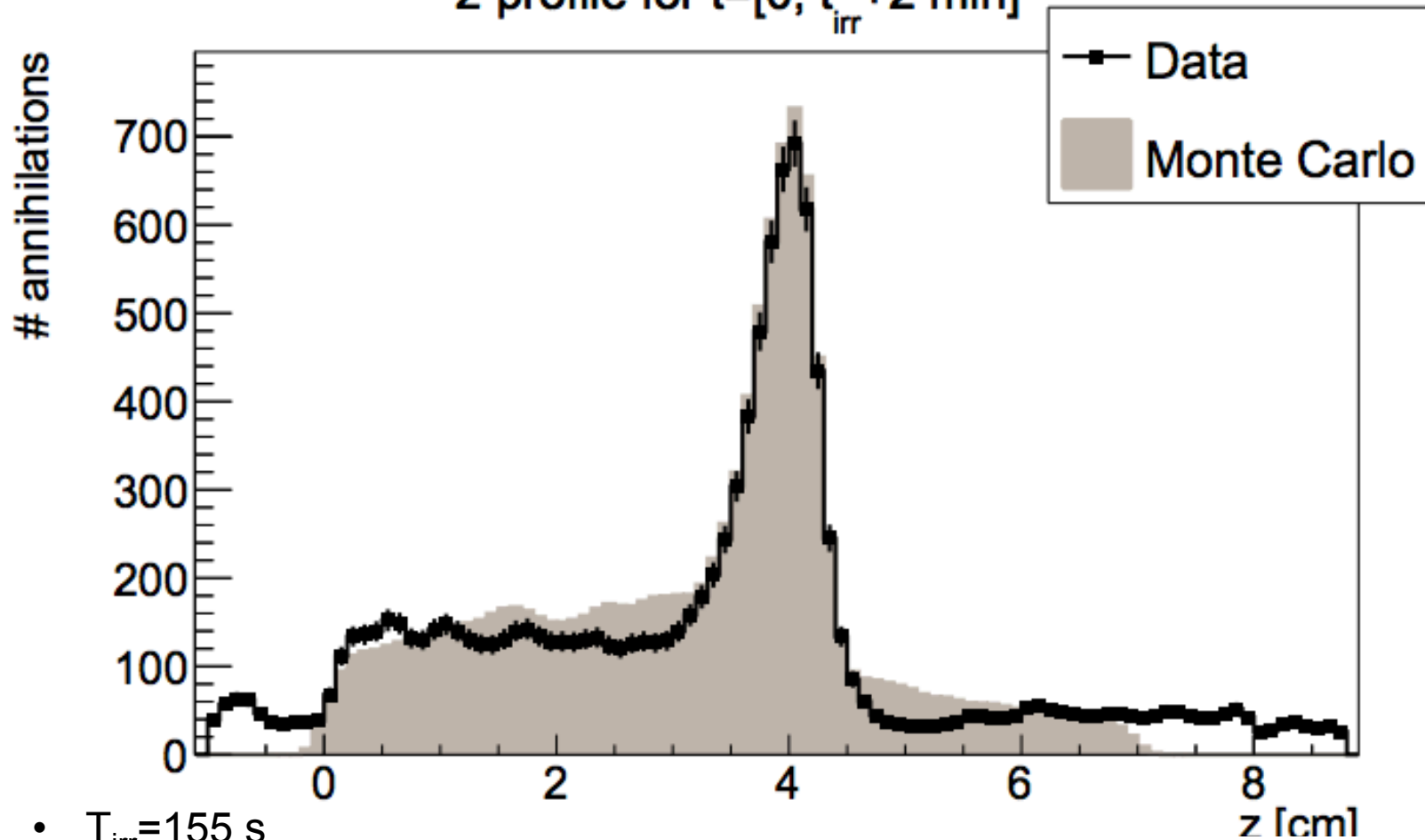
2 Gy plan on PMMA with a cavity



Experimental data: 1-D activity profiles black line, FLUKA 1-D activity profiles light brown area. Cavity is located between 4 and 4.5 and is fully irradiated after 70s

Carbon beam data 178.28 MeV/u on carbon target

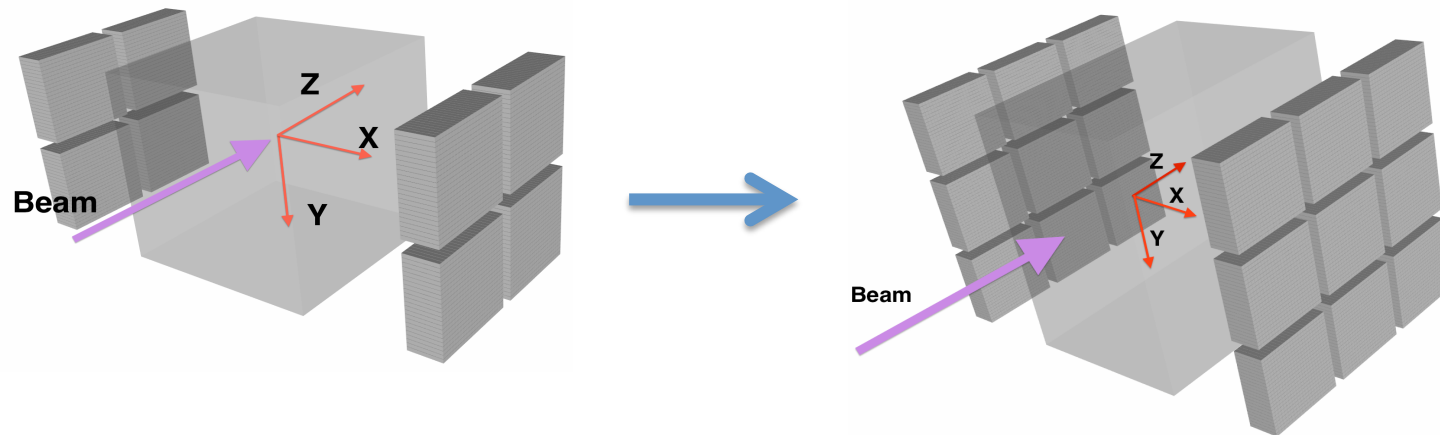
z-profile for $t=[0, t_{\text{irr}}+2 \text{ min}]$



- $T_{\text{irr}}=155 \text{ s}$
- 32 spills

Conclusions

- Good results experimental proton beam data vs FLUKA MC
- Promising results Carbon beam on Carbon target vs FLUKA MC
- Upgrade to 9vs9 in progress



Work in progress...