

PET SCANNING OF OCULAR MELANOMA AFTER PROTON THERAPY (PT)

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TRIUMF



Introduction

Ocular Melanoma:

- Uncommon type of cancer, but most common type of eye cancer.
- The survival rate at 2 years is 8%.

TRIUMF:

- Canada's National Laboratory for particle and Nuclear physics
- Successfully treated 183 patients since 1995.
- Local control rate of 91%.

No present method of verifying the depth dose deposition

Introduction

PT at TRIUMF

Objective

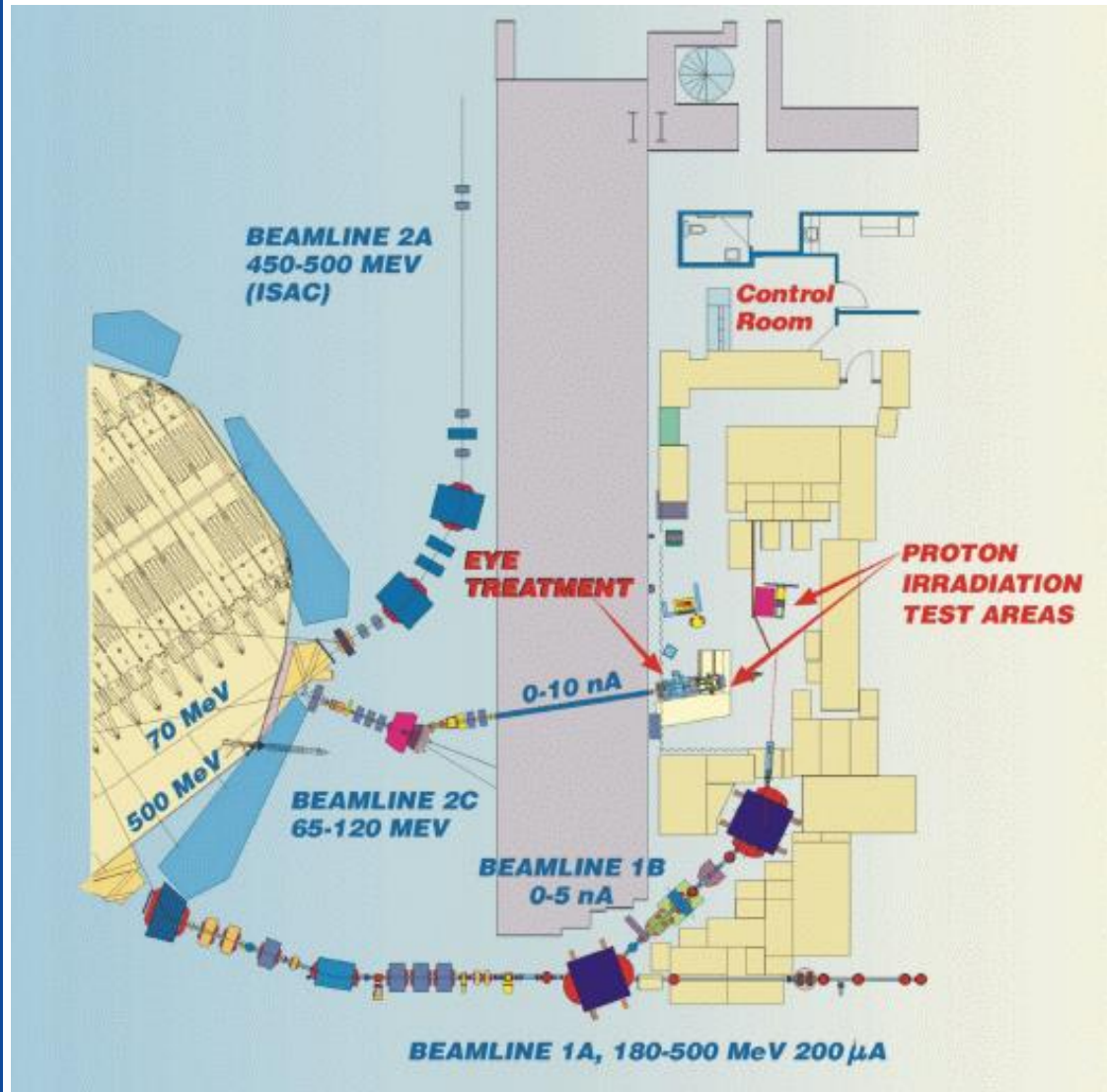
Results

Summary and

Conclusion

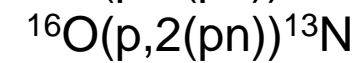
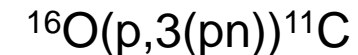
Future Work

PT at TRIUMF



PET isotopes produced in tissue during proton therapy:

Reaction:



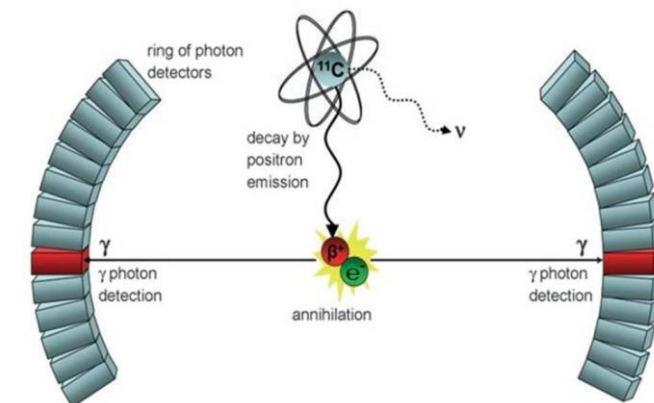
Half Life:

20 mins

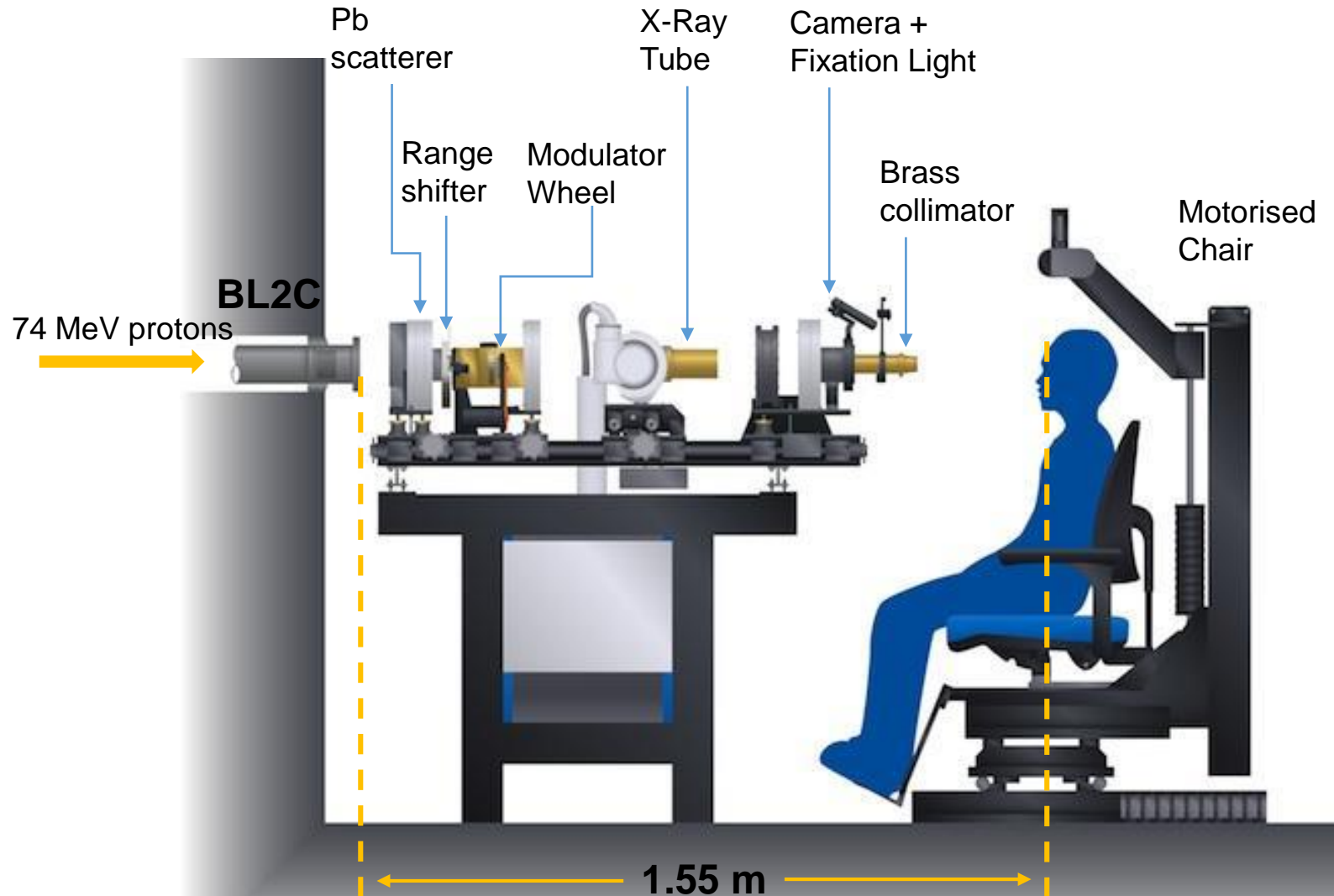
20 mins

10 mins

2 mins



PT at TRIUMF: beamline



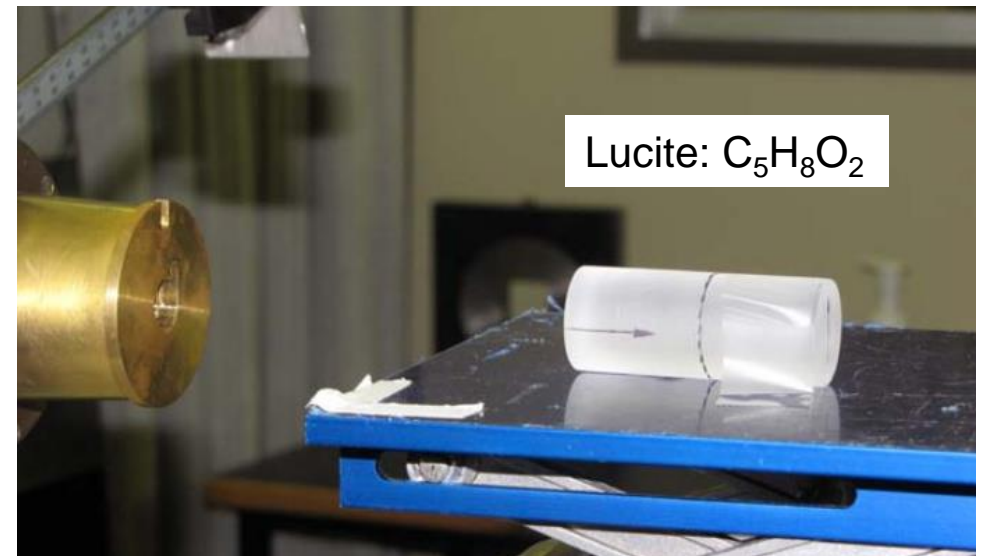
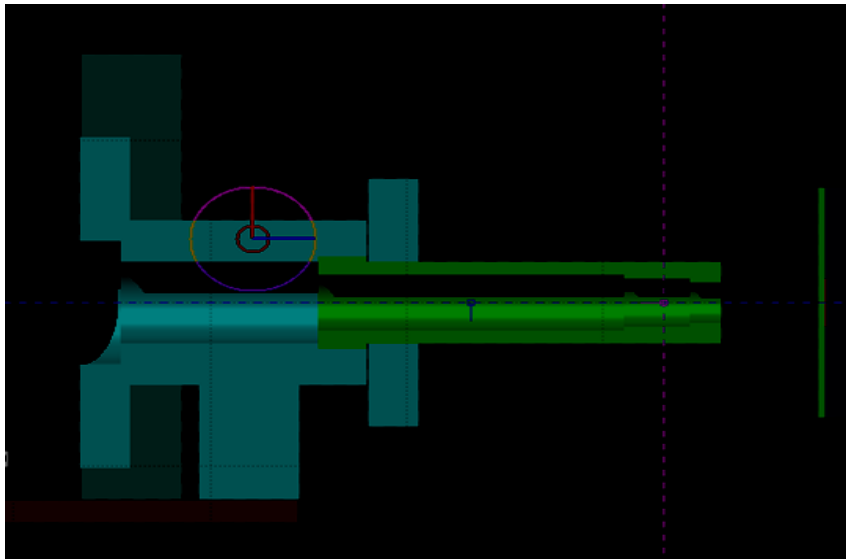
- Introduction
- PT at TRIUMF**
- Objective
- Results
- Summary and Conclusion
- Future Targets

Objective

Explore the possibility of using PET as a tool for depth dose verification after proton therapy in ocular melanomas:

Are we irradiating what we think we are irradiating?

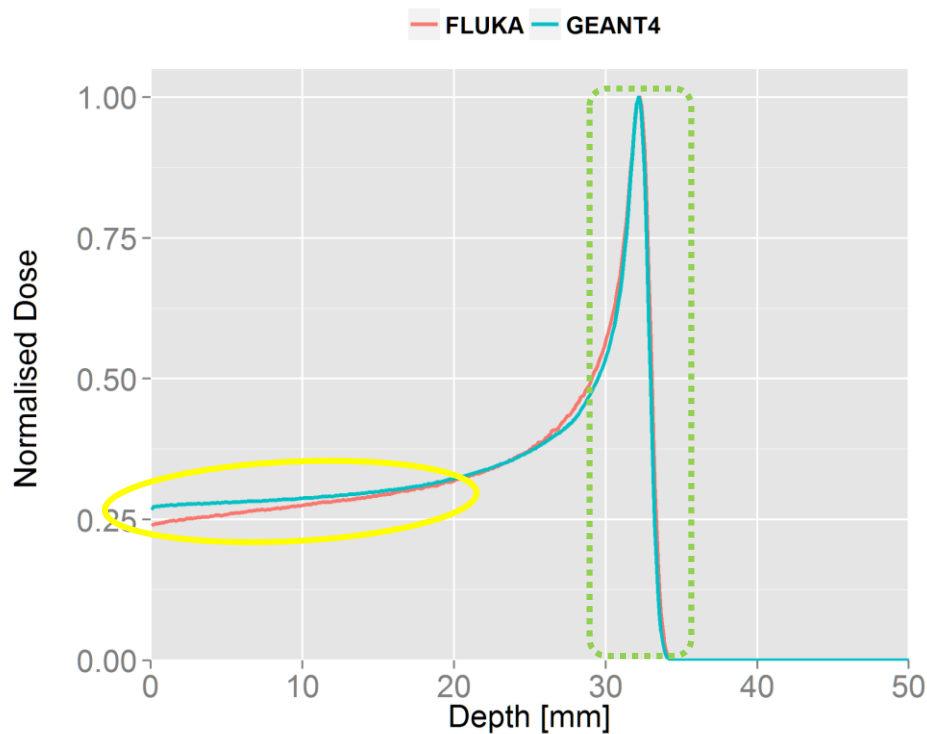
Compare simulations (GEANT4, FLUKA) with experimental results from two different PET scanners from UBC Hospital



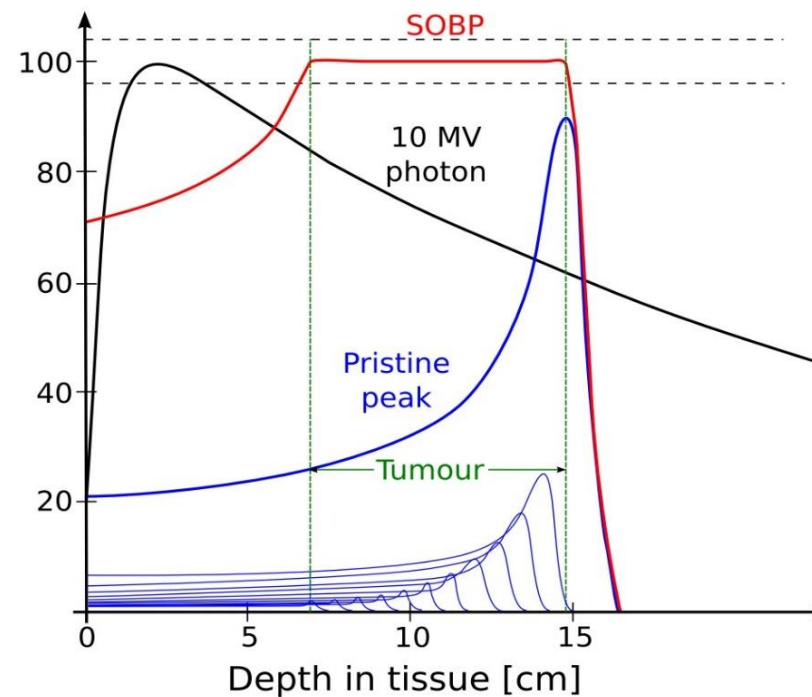
Results: GEANT and FLUKA

Depth Comparison:

Raw Bragg Peak (RBP)



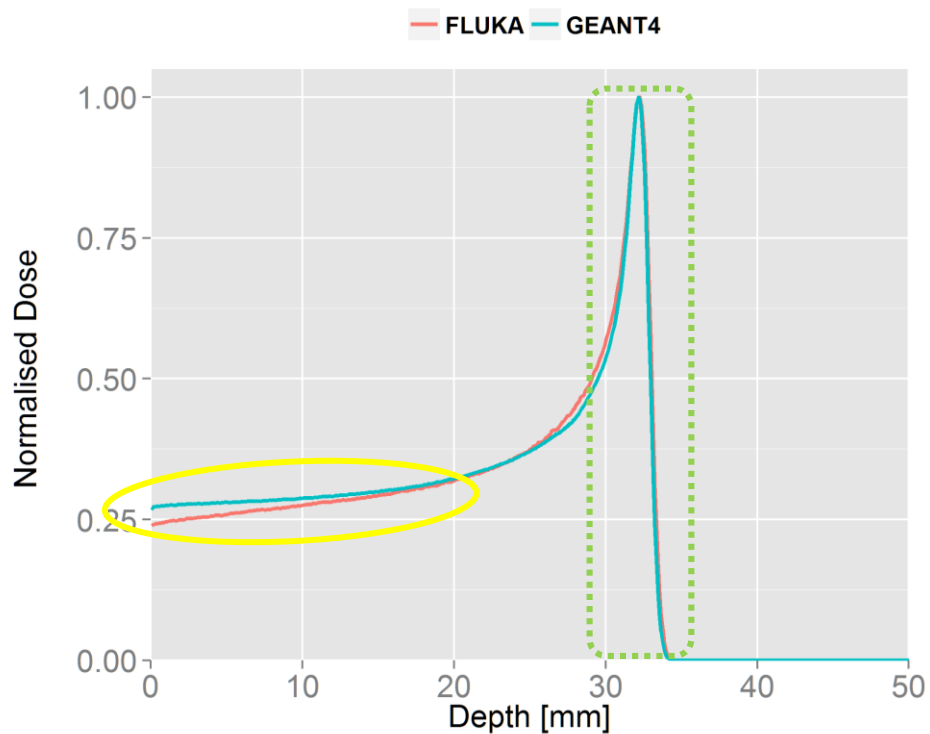
IDEAL Spread Out Bragg Peak (SOBP)



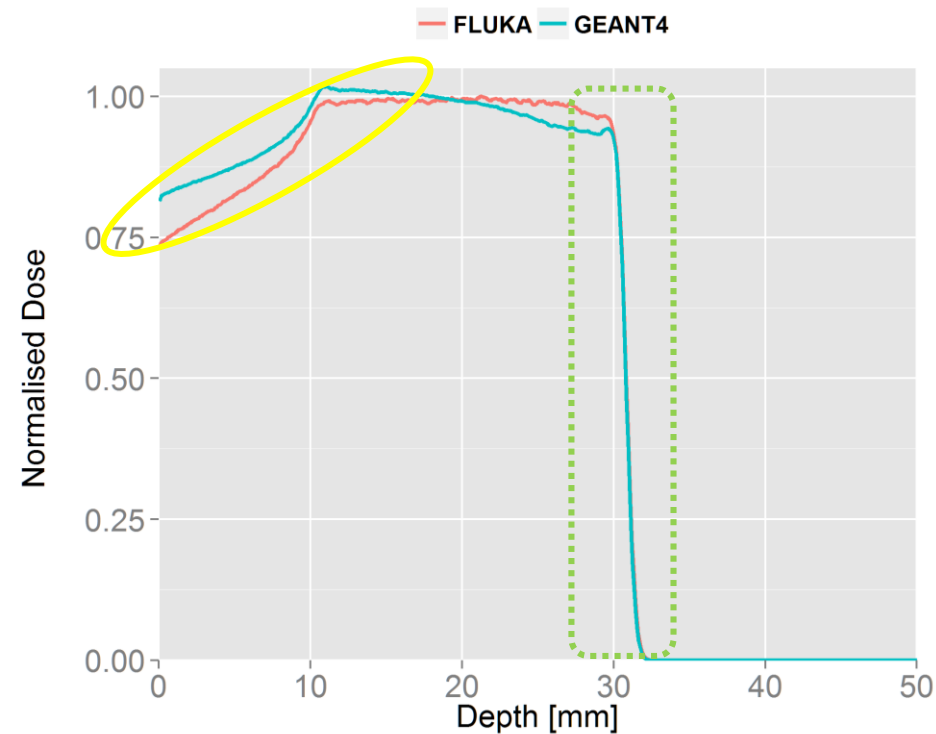
Results: GEANT and FLUKA

Depth Comparison:

Raw Bragg Peak (RBP)

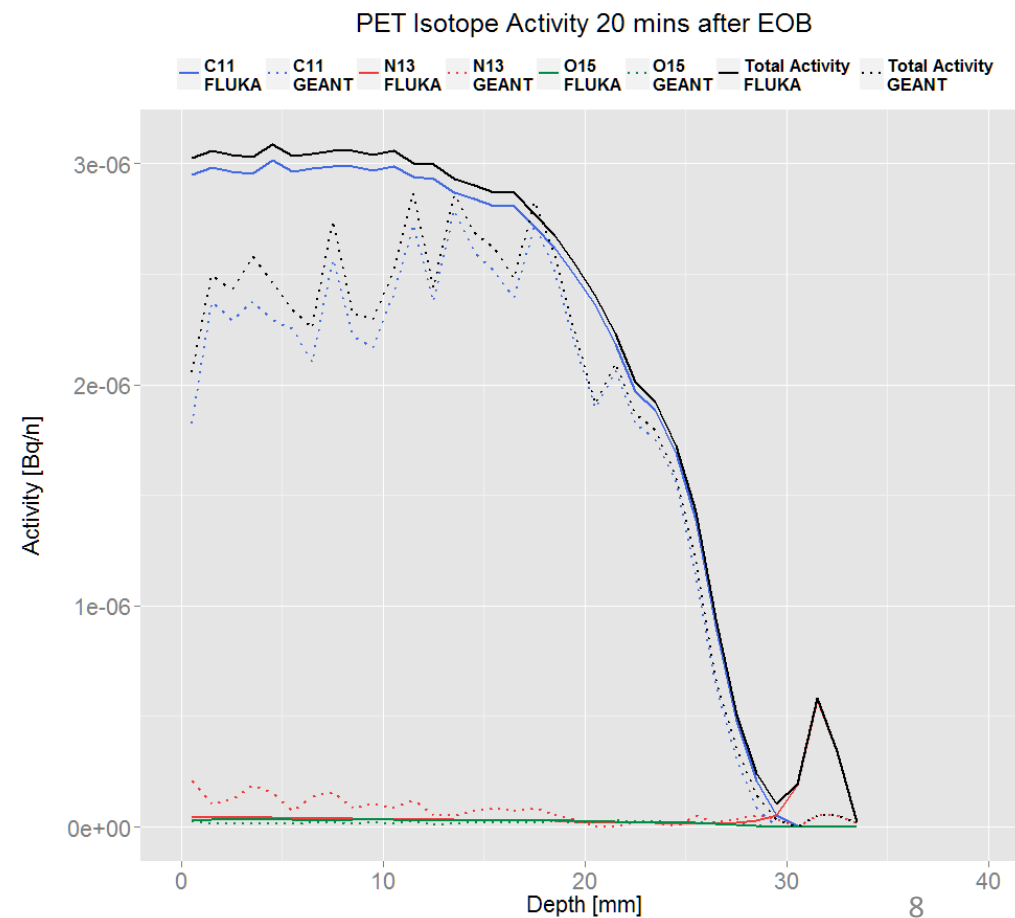


Spread Out Bragg Peak (SOBP)



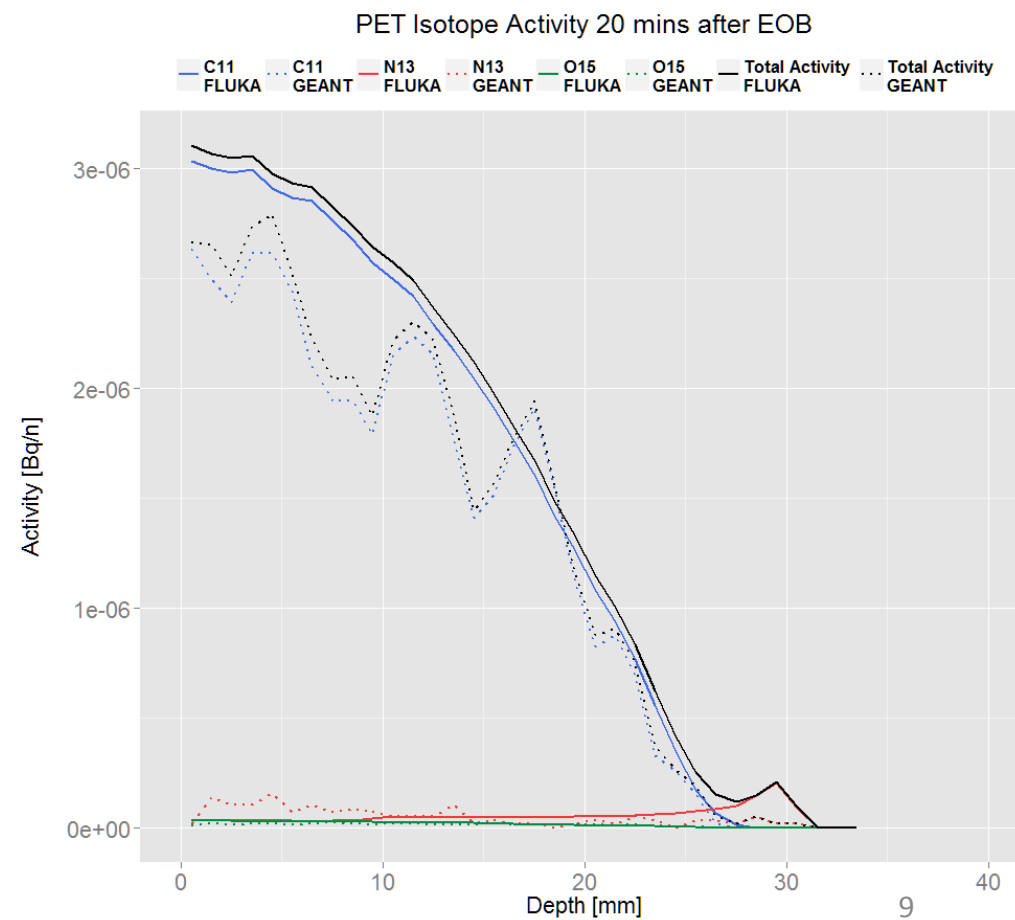
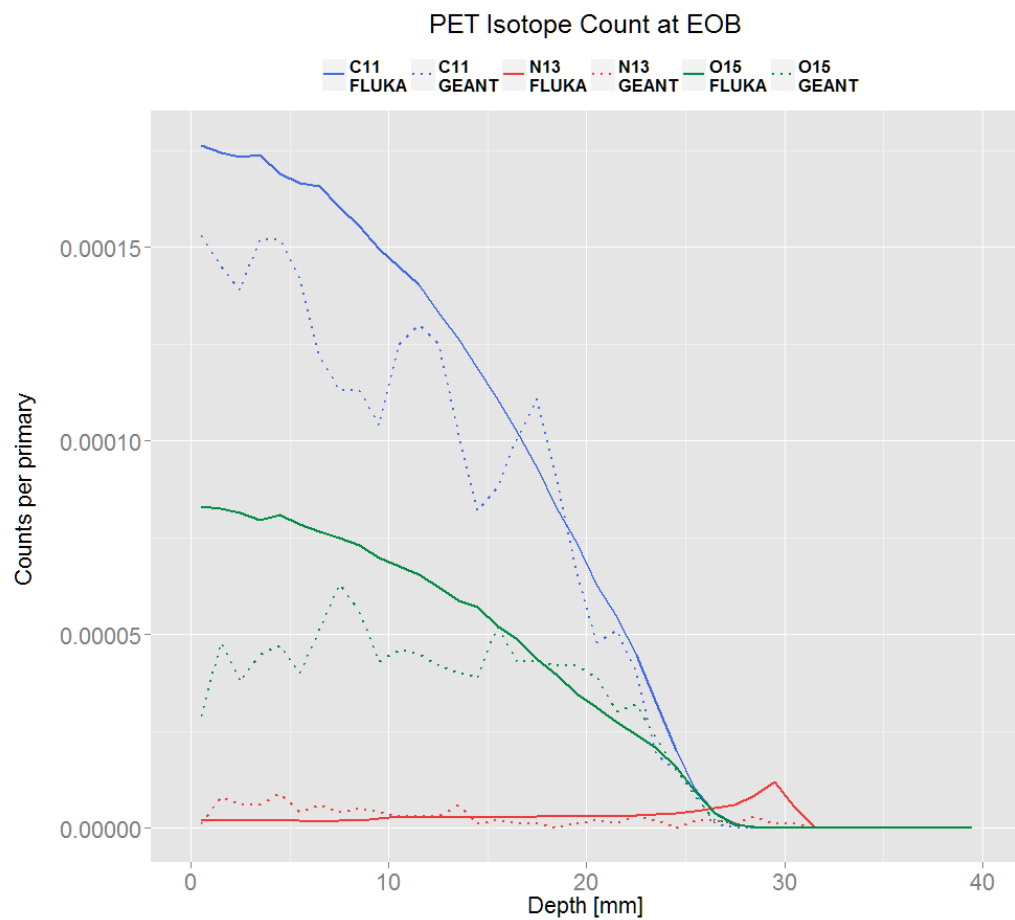
Results: GEANT and FLUKA

Axial Isotopic Yield from RBP:



Results: GEANT and FLUKA

Isotopic Yield from SOBP:

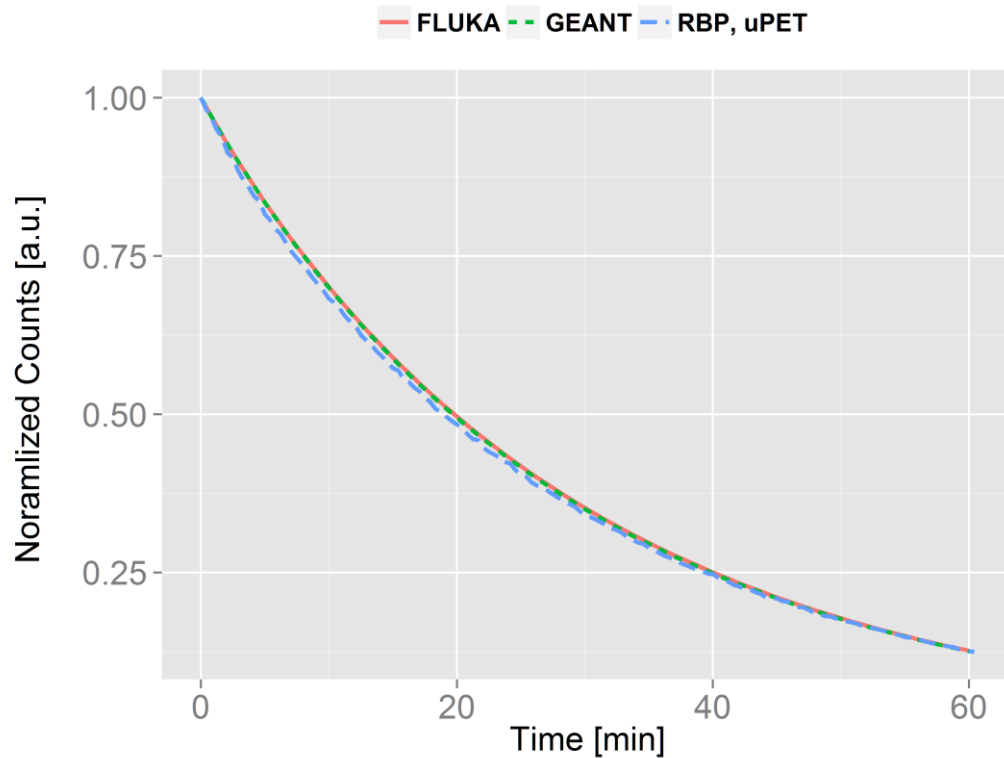


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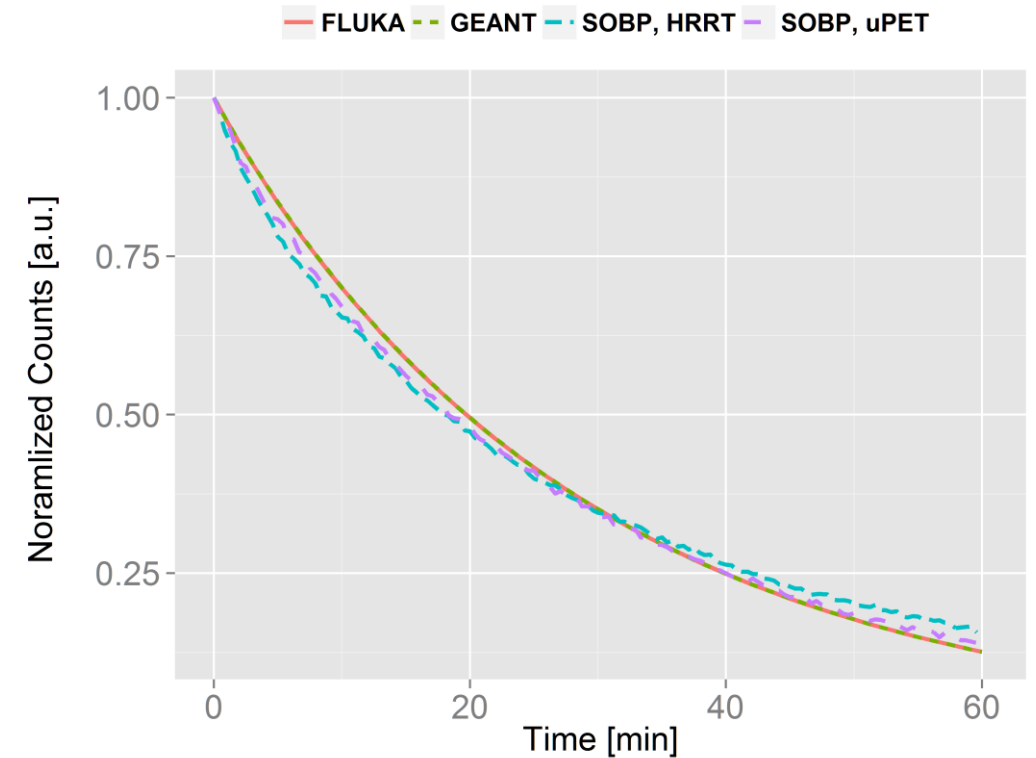
Results: GEANT, FLUKA and PET Scan

Isotope Decay Curve:

PET Isotope Activity 20 mins after EOB, RBP

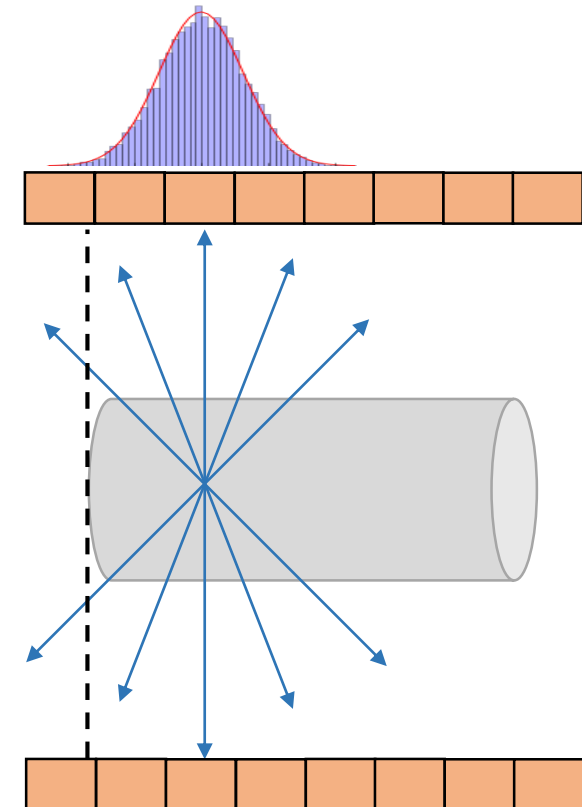
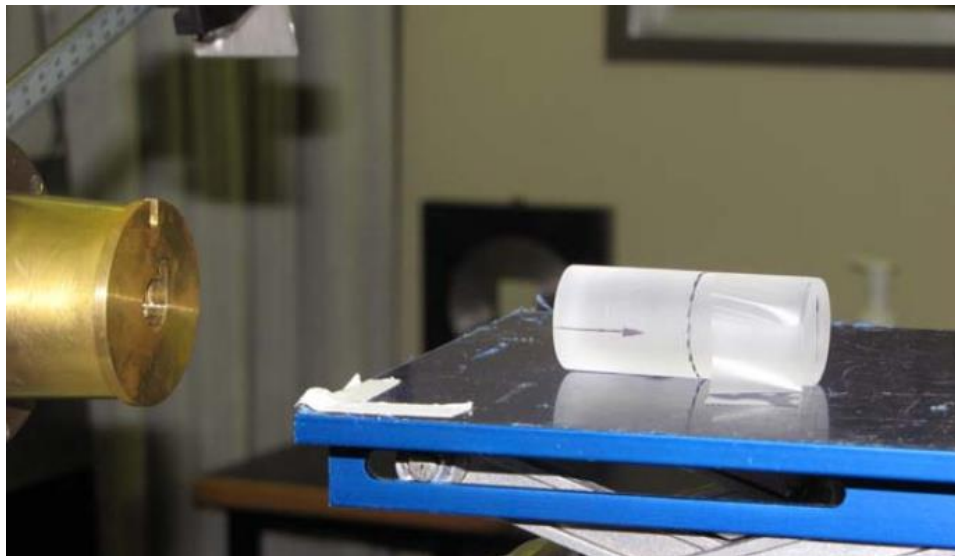


PET Isotope Activity 20 mins after EOB, SOBP



Results: GEANT, FLUKA and PET Scan

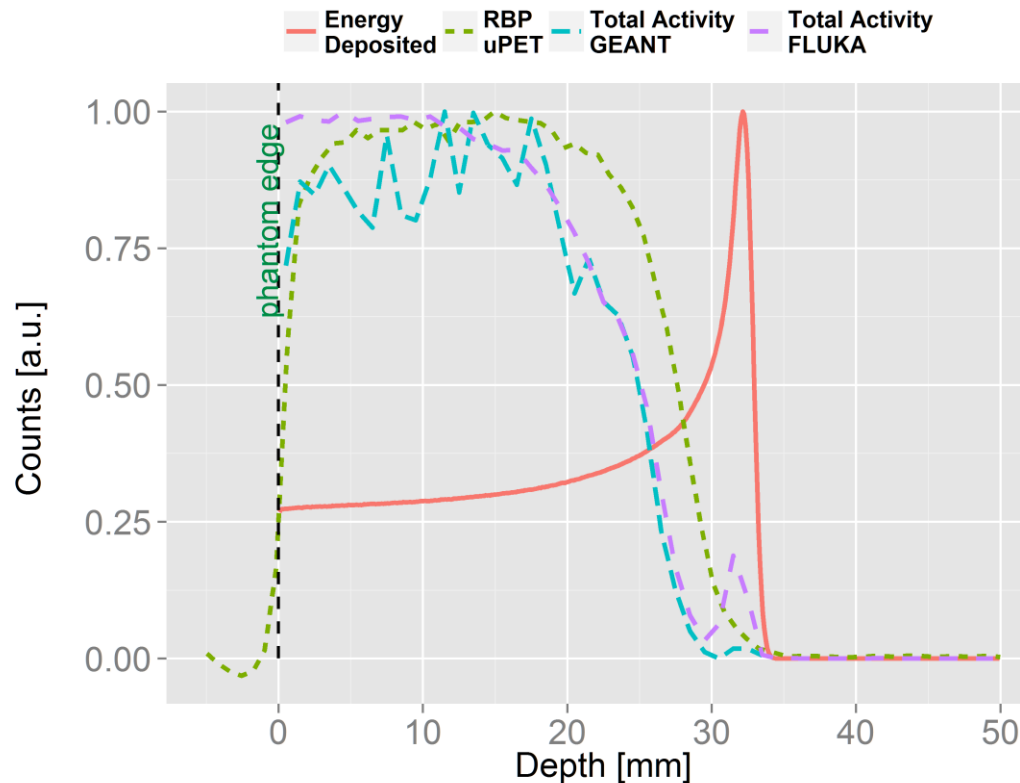
Axial Profile:



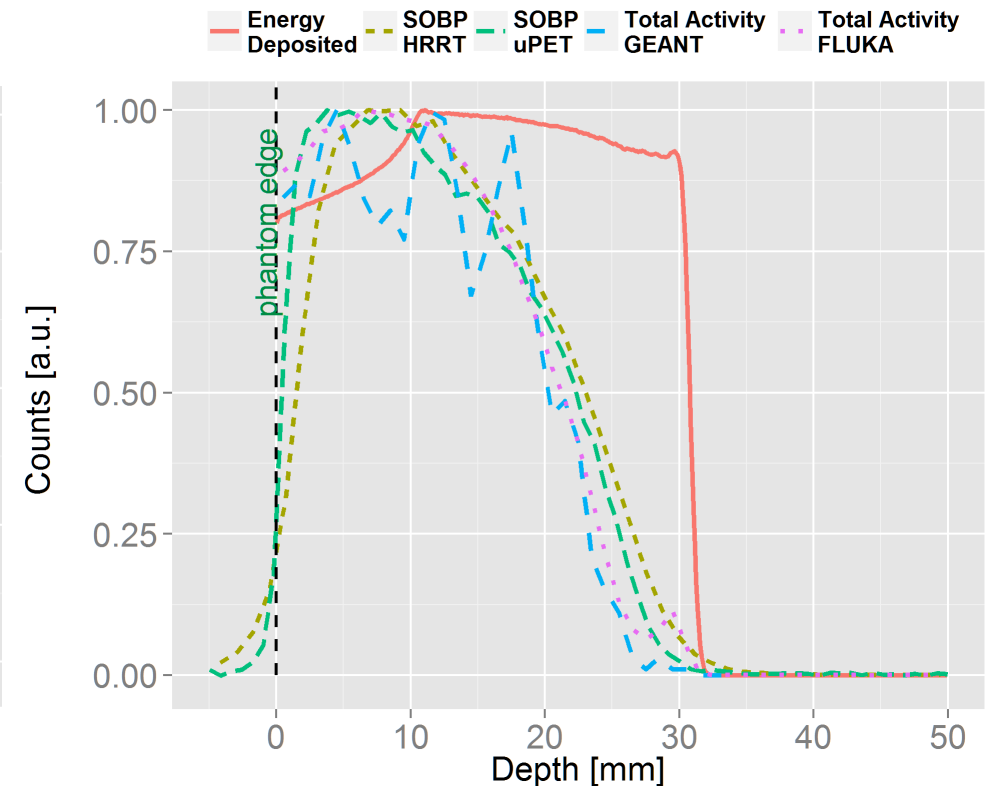
Results: GEANT, FLUKA and PET Scan

Axial Profile:

PET Isotope Activity 20 mins after EOB

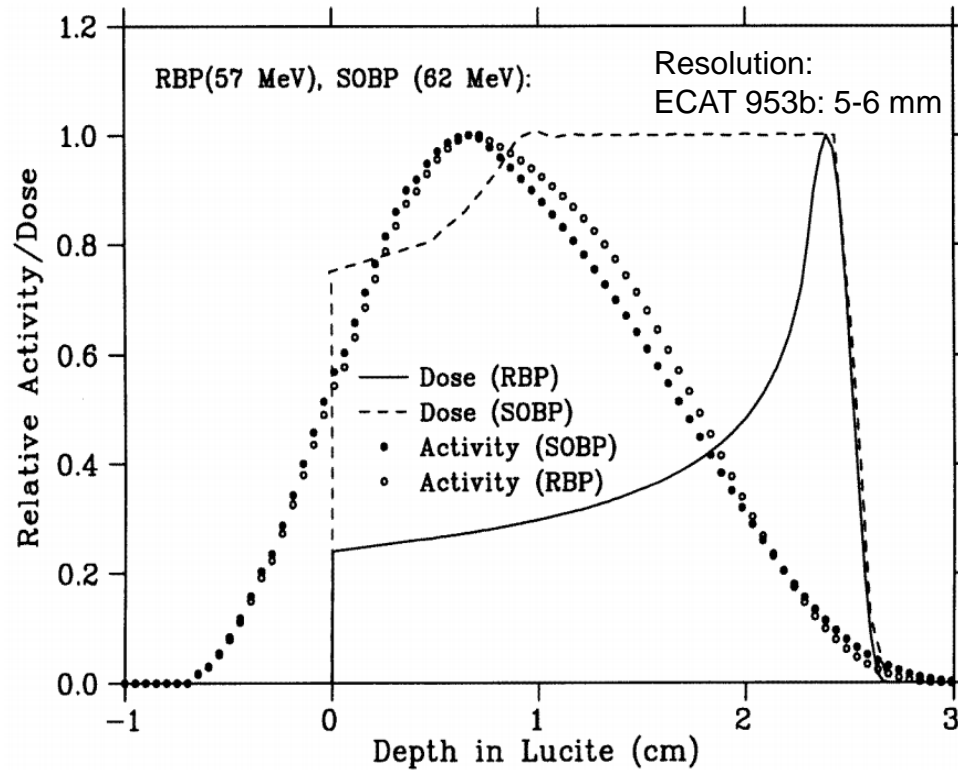


PET Isotope Activity 20 mins after EOB for SOBP

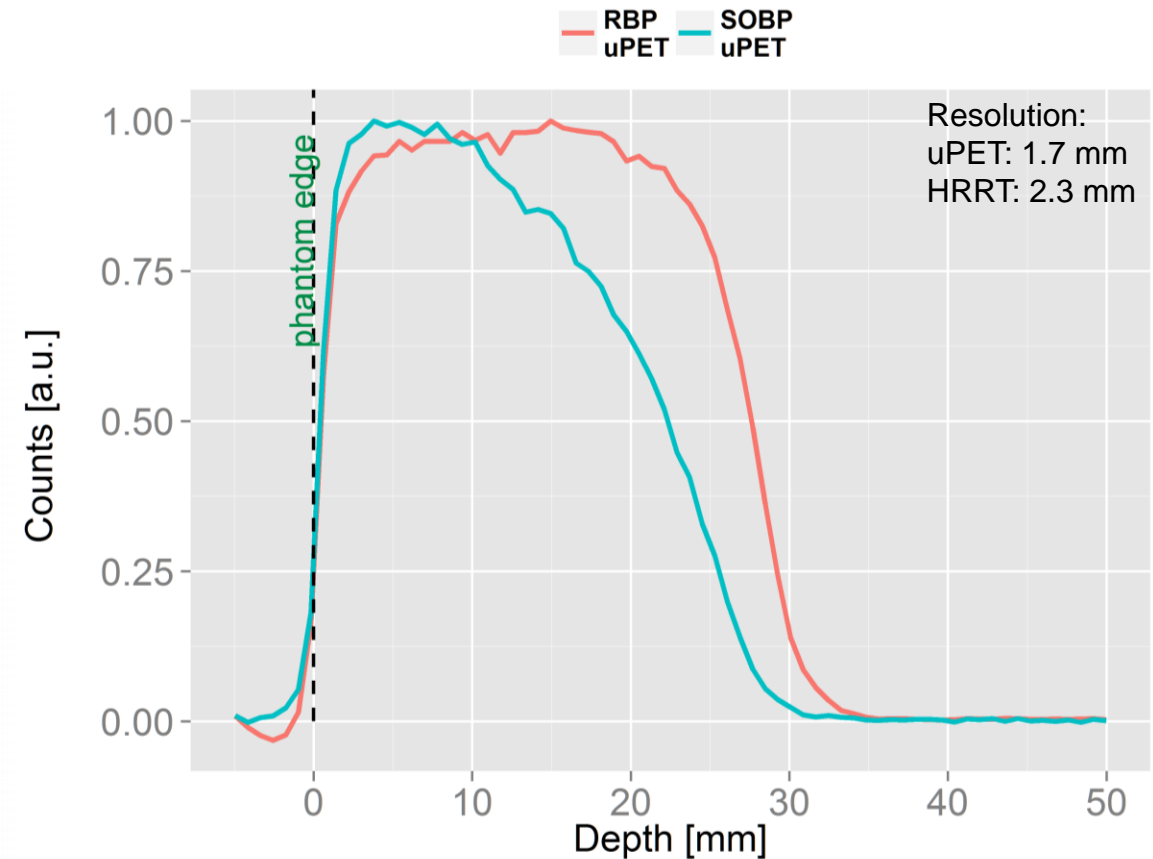


Results: PET Scan and PET Scan

Improvement in PET scan resolution:



U Oelfke et al, 1996

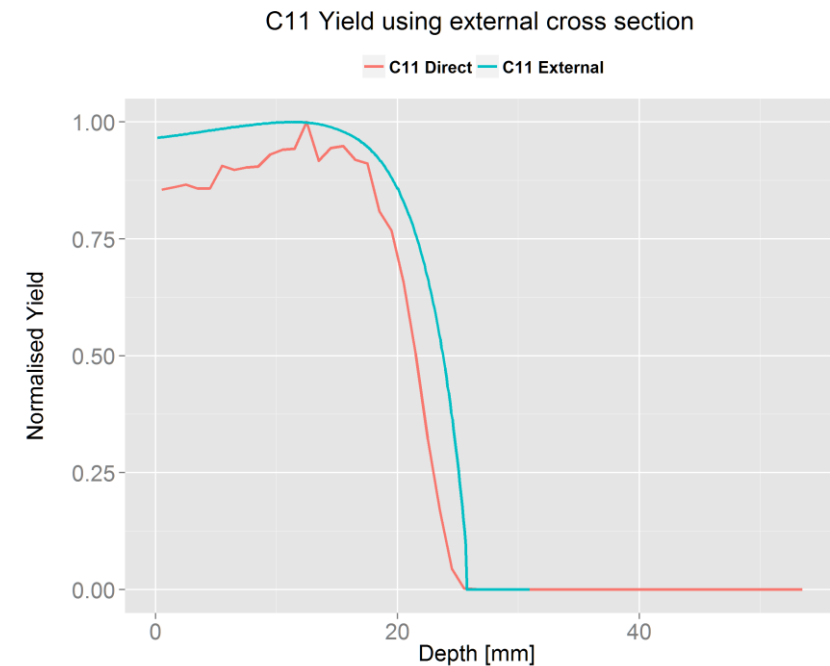


C. Hoehr et al, 2012

Summary and Conclusion

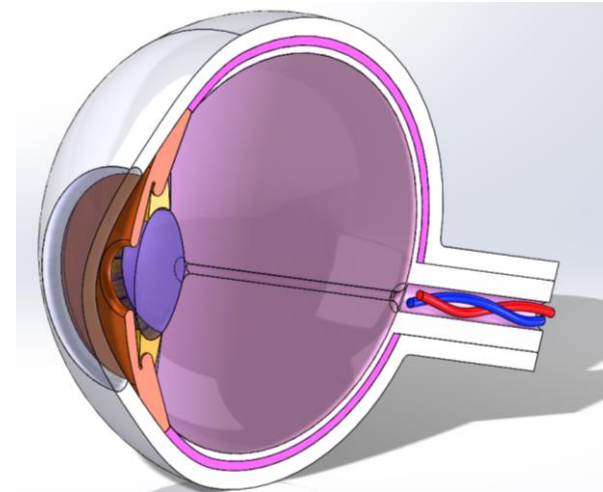
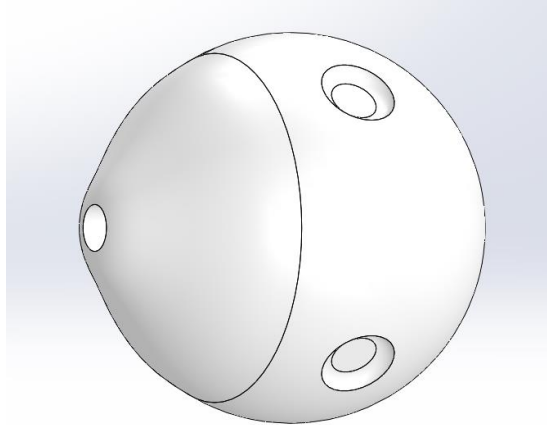
Conclusion:

- Very good confidence for production of Bragg peaks
 - We are irradiating what we think we are irradiating.
- Isotope profiles vary slightly between GEANT and FLUKA
 - Convolution used to calculate activity.
 - Certain cross sections have large uncertainties.
 - Spline fit greatly determines yield curves.
 - Comparable to literature from PET community.

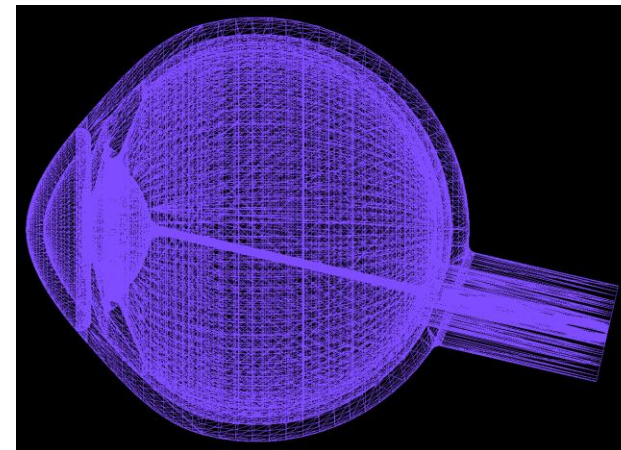
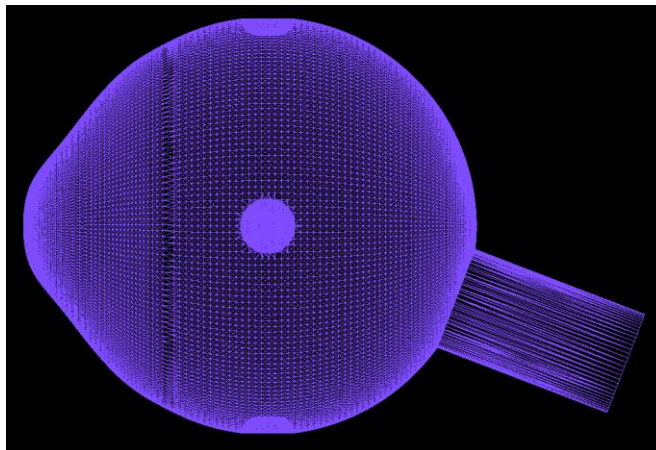


Future Work: New Targets

SolidWorks model:

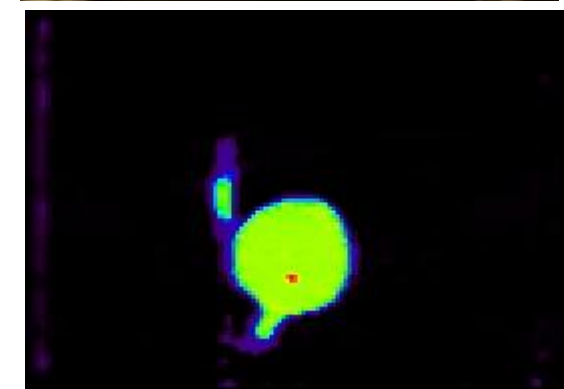
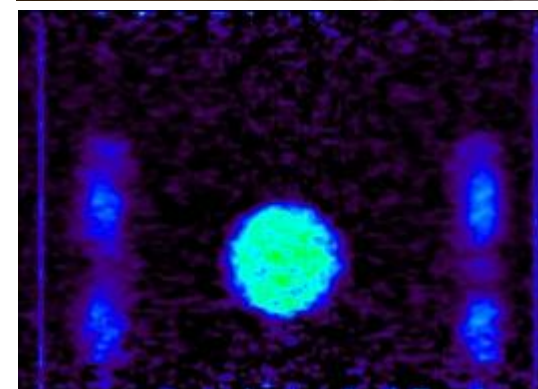
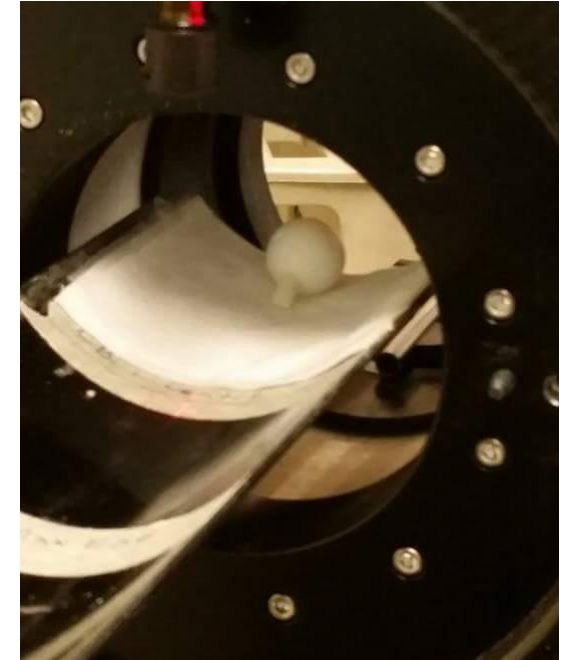
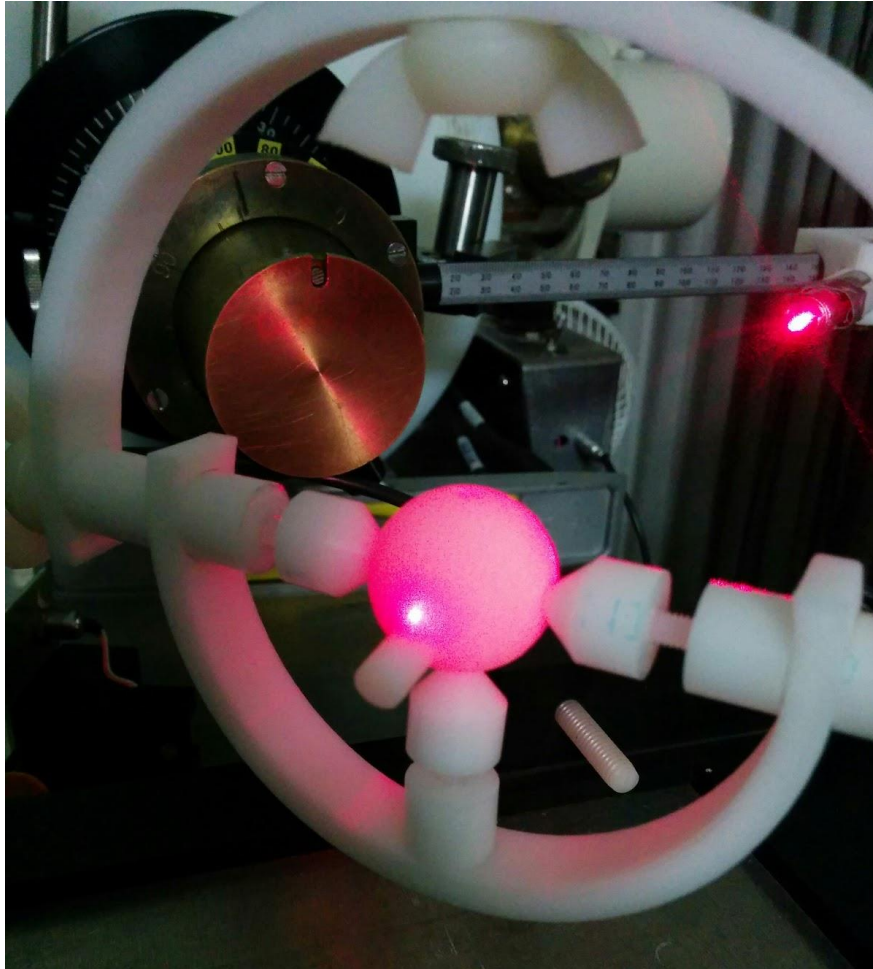


SolidWorks model imported into GEANT4:



Future Work: New Targets

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Acknowledgements

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