UNIVERSITY OF WASHINGTON MEDICAL CYCLOTRON FACILITY (UWMCF)

WORKSHOP ON APPLIED NUCLEAR DATA ACTIVITIES WASHINGTON, D.C.

> GREG MOFFITT, PHD JANUARY 22-24, 2019



OF MEDICINE

DEPARTMENT OF RADIATION ONCOLOGY UW MEDICINE | DEPARTMENT OF RADIATION ONCOLOGY

UWMCF – MULTI-PARTICLE, VARIABLE ENERGY

- Multi-use facility
 - Fast neutron therapy (50.5 MeV protons incident on a beryllium target)
 - Proton research (medical applications, radiation effects testing)
 - Isotope production
- Available accelerated particles with UWMCF
 - Protons (¹H⁺): 28.0 50.5 MeV (~70 μA extracted)
 - Protons (¹H₂⁺):
 7.0 12.0 MeV (~30 μA extracted)
 - Deuterons (²H⁺): 14.0 24.0 MeV (~30-40 μA extracted)
 - Helium-3 (³He⁺⁺): 21.0 35.5 MeV (being developed)
 - Alphas (⁴He⁺⁺): 27.0 47.3 MeV (~40-60 μA extracted)
- UWMCF isotope program is a recently stewarded facility of the USDOE-IP, part of the University Isotope Network (UIN)
- Helium-3 development currently a high priority for DOE



ISOTOPE PRODUCTION AT UWMCF

- Past: ¹¹C, ¹³N, ¹⁵O, ¹⁸F
- Current: ⁵⁷Ni, ⁷²Se/⁷²As, ^{99m}Tc, ^{117m}Sn, ¹⁸⁶Re, ¹⁹⁰Ir, ²⁰⁵Bi, ²¹¹At, ²³⁶Np
- Future: ⁷⁷Br, ¹⁶⁷Tm, ²²⁶Th
- Multiple users in medical, industrial, and government applications



BEAMLINE LAYOUT





ISOTOPE DEVELOPMENT AND PRODUCTION





ISOTOPE DEVELOPMENT AND PRODUCTION FUTURE



DEPARTMENT OF RADIATION ONCOLOGY

PRODUCTION STATION





EXPERIMENTAL STATION





FAST NEUTRON THERAPY

50.5 MeV protons incident on a beryllium target



UW SCHOOL OF MEDICINE

ISOCENTRIC GANTRY





MULTILEAF COLLIMATOR





SUMMARY

- UWMCF accelerates the following particles:
 - ¹H⁺, ¹H₂⁺, ²H⁺, ³He⁺⁺, ⁴He⁺⁺
- On-site expertise in target design and isotope production
- Access to machine shop for custom target development
- Target modeling with MCNP6 and ANSYS
- High purity germanium detector for target analysis
- Radiochemistry group performs target processing
- Goal of developing accurate and efficient methods for production cross section measurements

