Advancing Research in Texas through Experiments in Medical Isotope Science

Texas A&M Cyclotron Institute and

Nuclear Science and Engineering Center

Formation of University Network (2018)

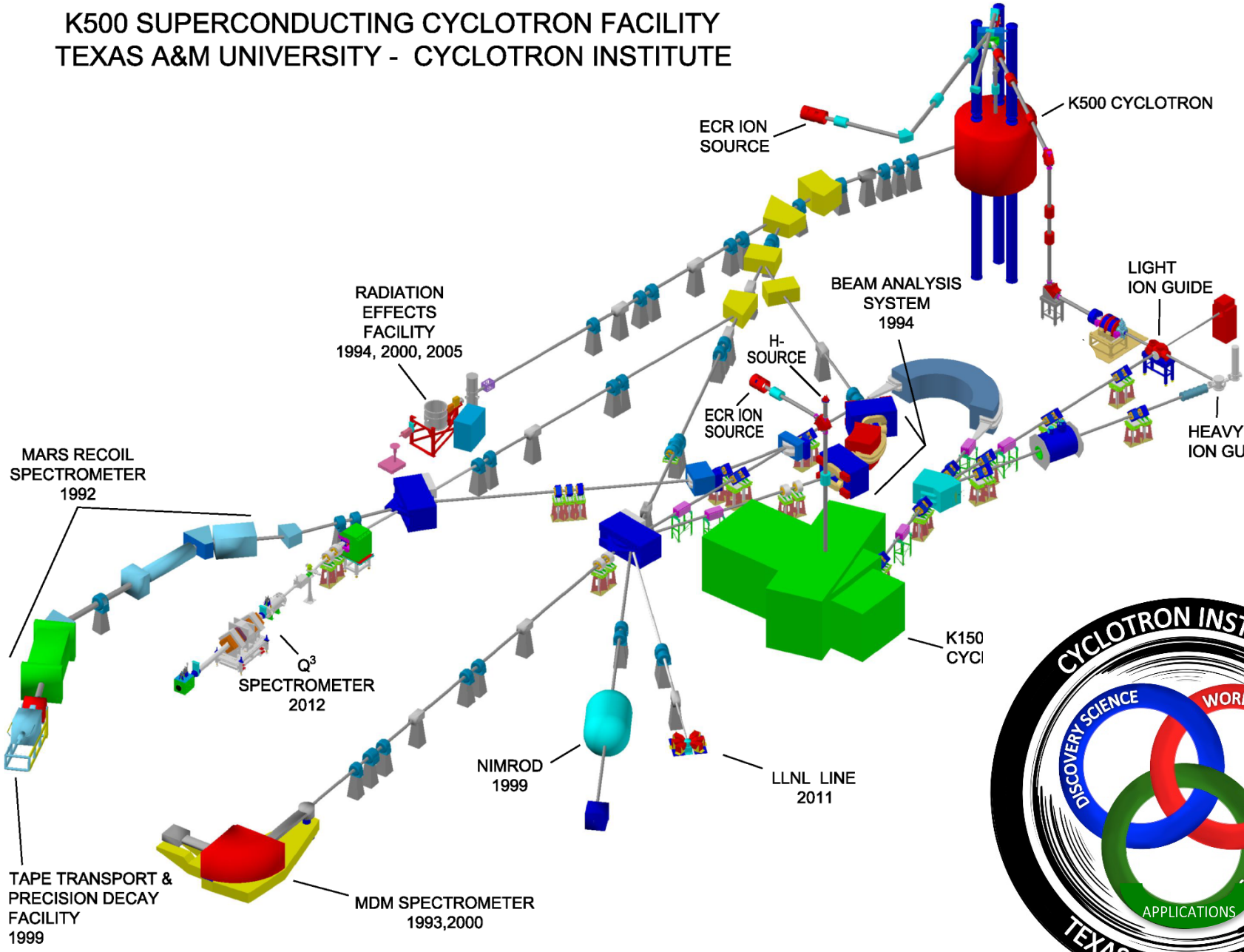
Bi experimentation in preparation for At separation (Summer 2019)

At-211 program started (Fall 2019):

Chem Comm paper accepted (June 2020)

University Network project begins (July 2020)

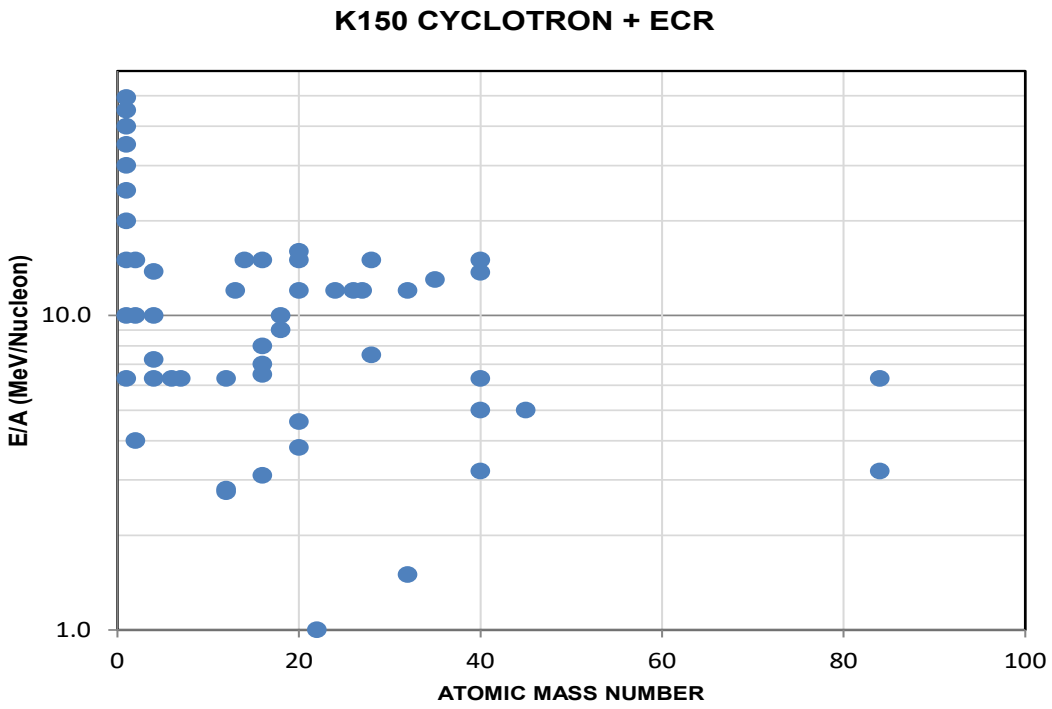
K500 SUPERCONDUCTING CYCLOTRON FACILITY
TEXAS A&M UNIVERSITY - CYCLOTRON INSTITUTE



CYCLOTRON INSTITUTE
DISCOVERY SCIENCE
WORKFORCE DEVELOPMENT
APPLICATIONS
TEXAS A&M UNIVERSITY

Tools: K150

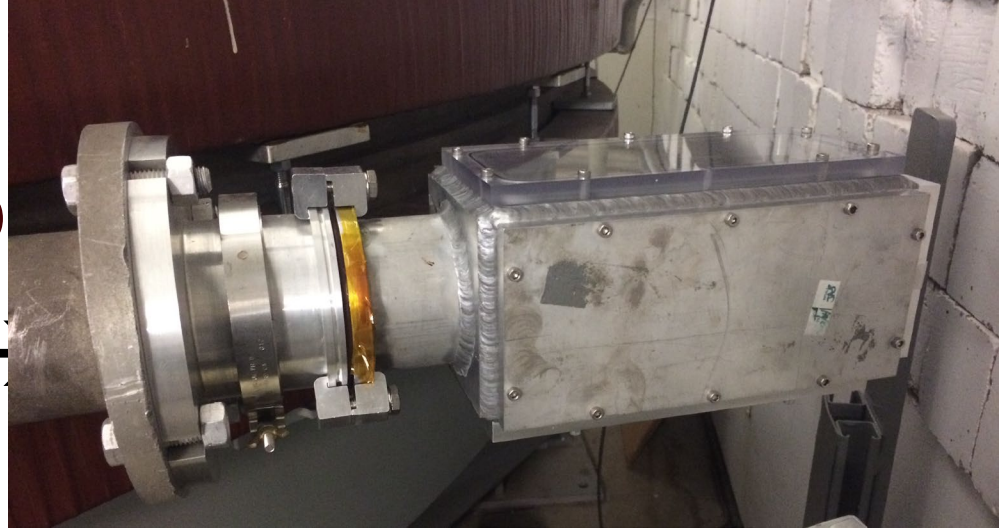
- 88” Cyclotron
- H^- Source & ECR Source
- Protons and Heavy Ions
- High intensity

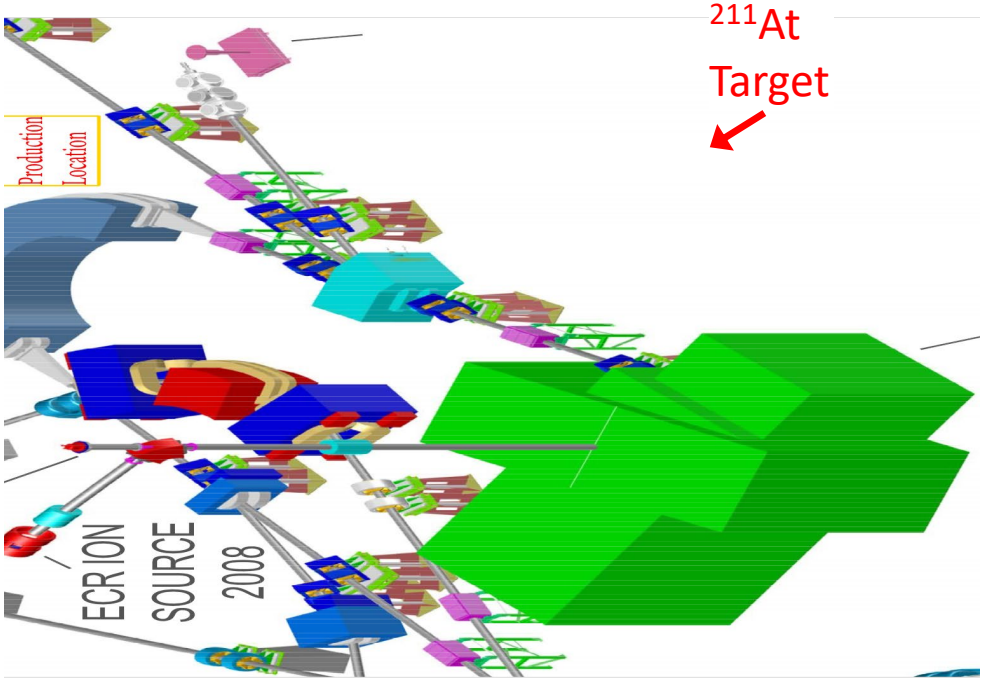


Productio

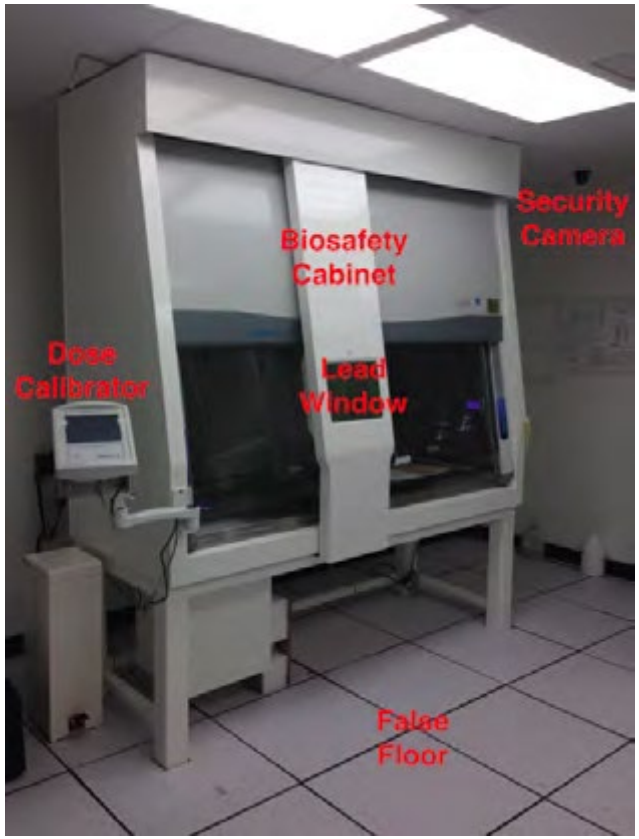
$^{209}Bi + \alpha \rightarrow$

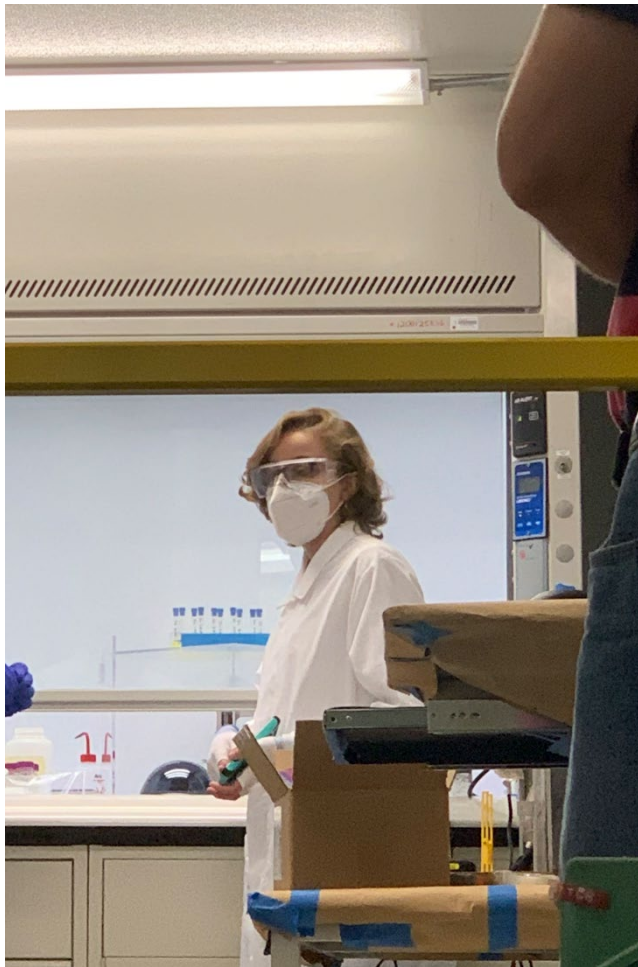
- K150 Cyclotron
- Energy: 28.8 MeV



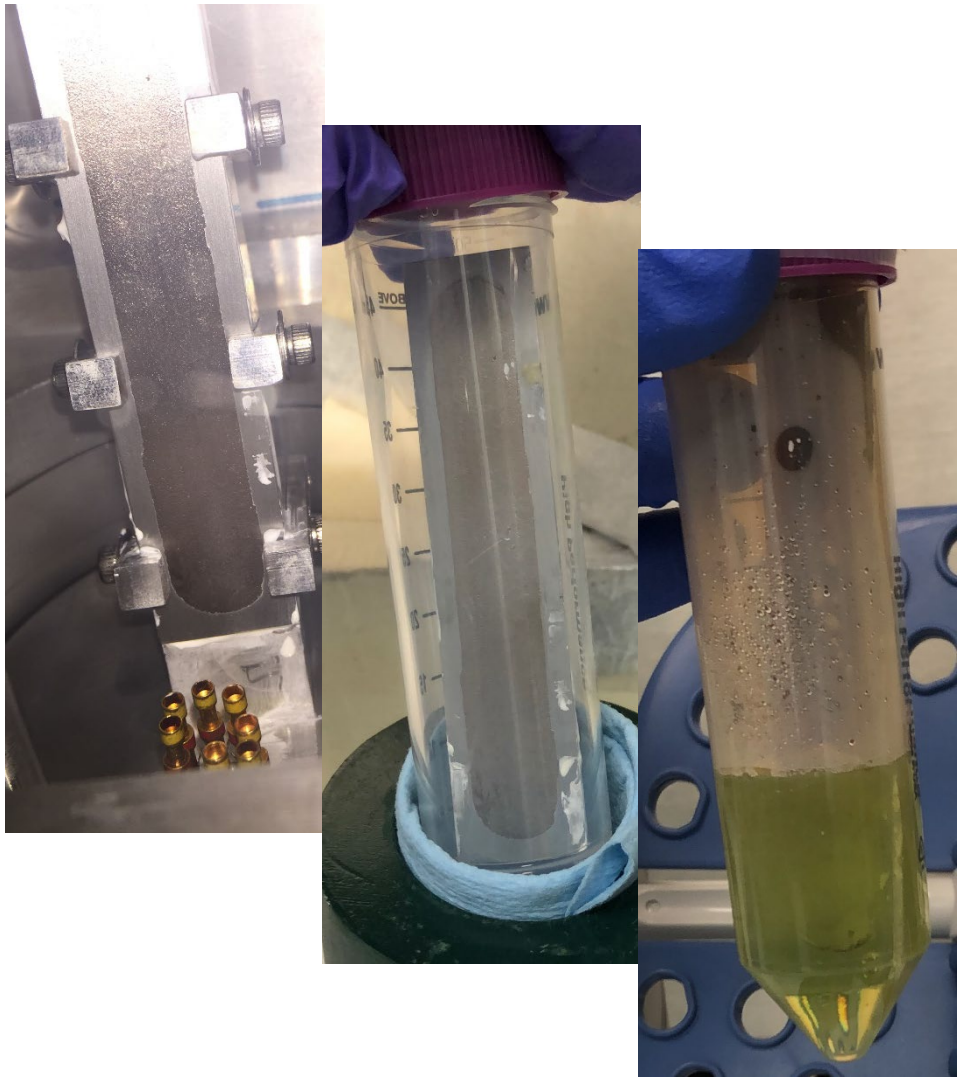


Radiochemistry Facilities





At-211 Chemistry at Texas A&M



Production
$^{209}Bi(\alpha,2n)^{211}At$

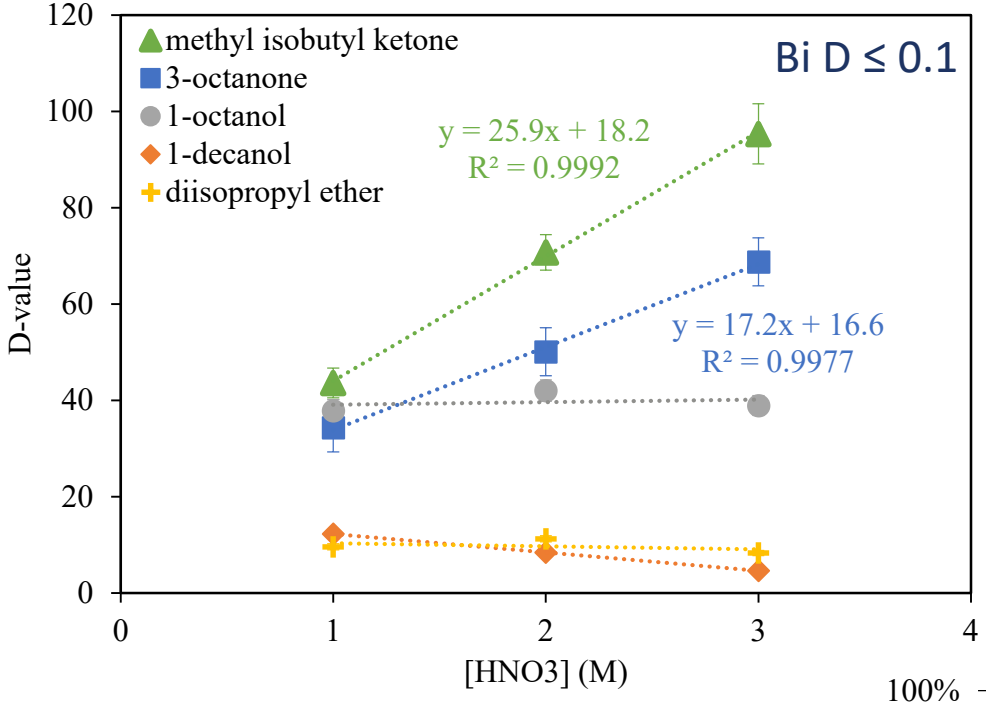
↓

Dissolution of Target
10–16 M HNO_3

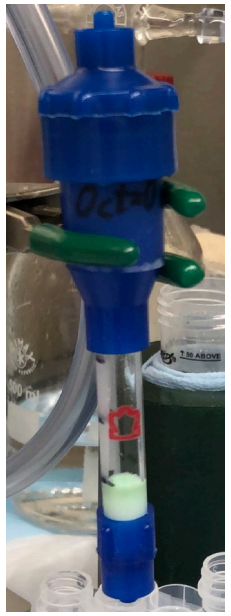
↓

Experimental Chemistry
Separations and Fundamental

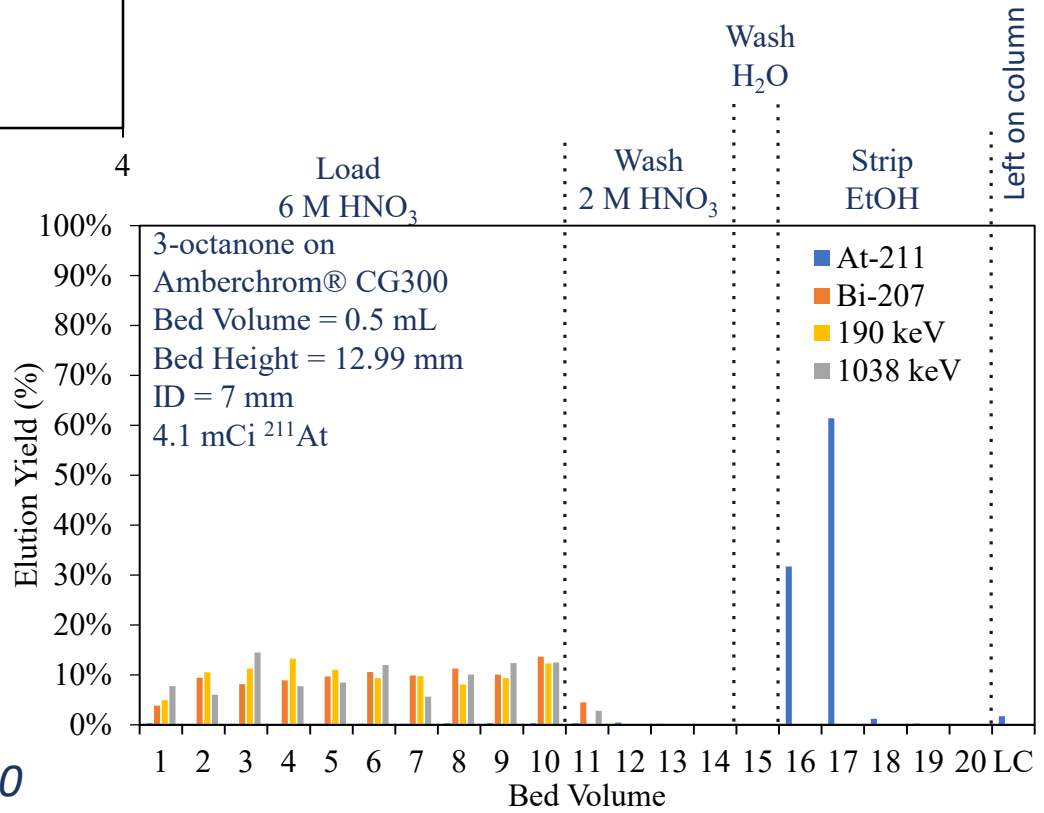
At-211 Separations



$D=C_{org}/C_{aq}$



Solvent	Dielectric Constant
methyl isobutyl ketone	13.11
3-octanone	10.5
1-octanol	10.3
1-decanol	7.93
Diisopropyl ether	3.81

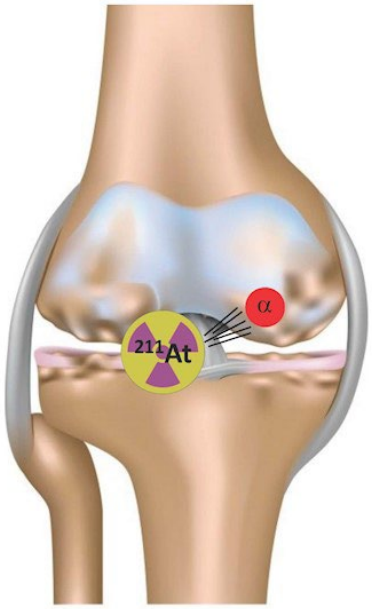


Burns et al, *Chemical Communications, 2020*

Challenges

- Beam
  - Intensity
  - Uniformity
  - Stability
  - Accurate measure of integrated beam current
- Target
  - Able to withstand beam without melting
    - Thermal contact of Bi to Al & target frame to cooling block
  - Excess Bi
  - Reproducibility of fabrication
  - Measure activity before dissolution
  - Removal of target with minimal handling
- Separation
  - Optimize chemistry for separation
  - Implement chemistry on column
    - Understand retention on column at low activity
    - Verify behavior of column at high activity

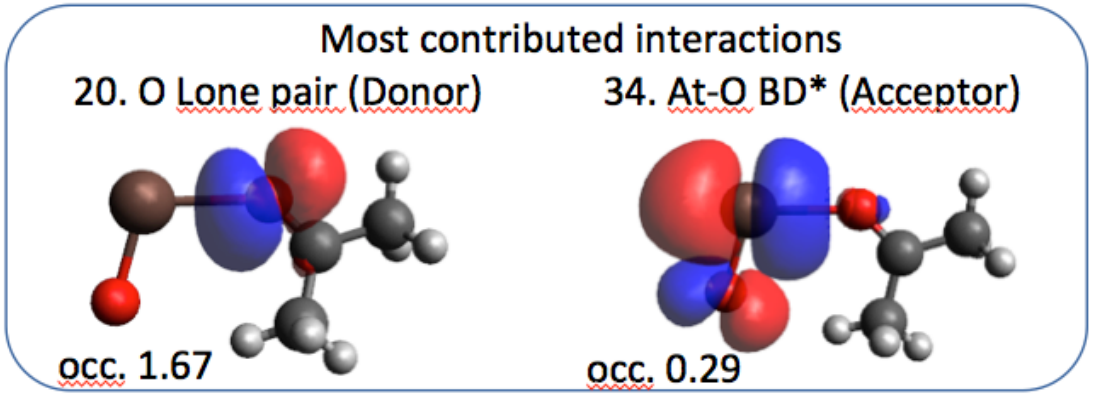
Developing At-211 For Treatment Of Osteoarthritis



Osteoarthritis

Ligand Exchange Experiments

DFT Calculations to understand the interactions



Summary

- Three successful experiments for production and recovery of At-211 have recently been carried out at Texas A&M.
- Extraction chromatography results in high yield, high purity product.
- Building collaborations to facilitate the knowledge, production and utilization of At-211 to improve health.

Acknowledgements

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- Radiological Safety Program Staff

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U.S. DEPARTMENT OF ENERGY | Office of Science

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