

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):

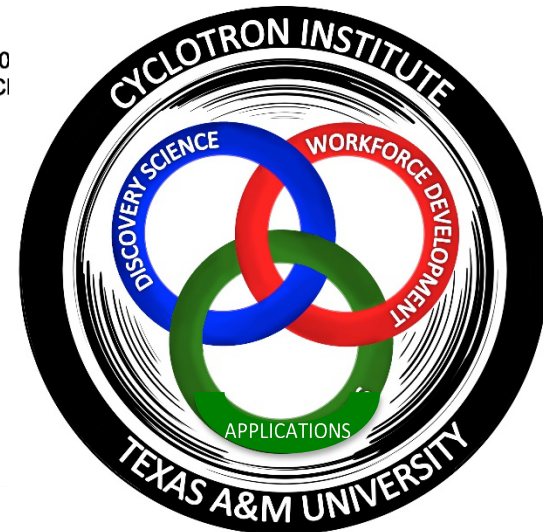
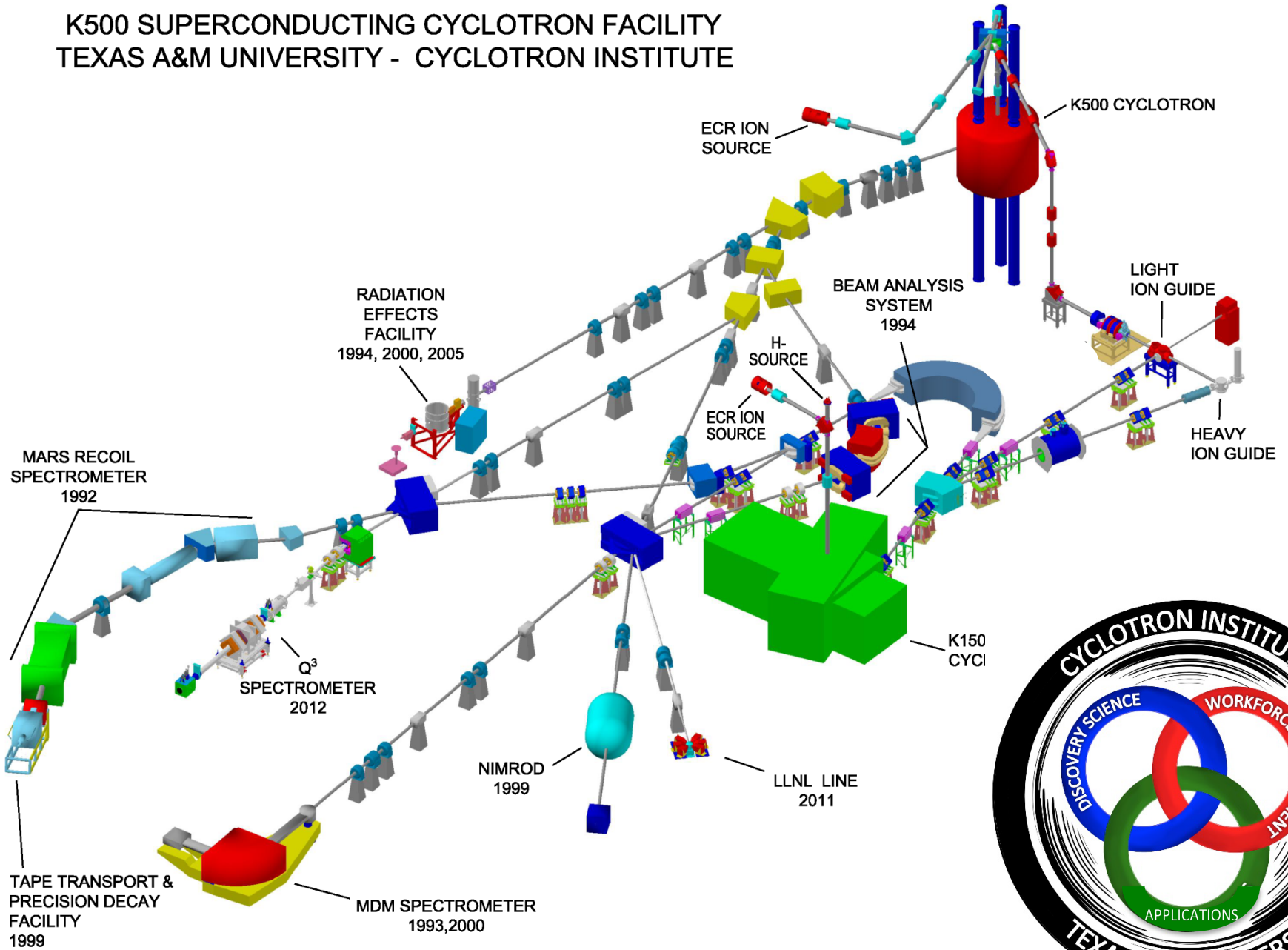


Chem Comm paper accepted (June 2020)



University Network project begins (July 2020)

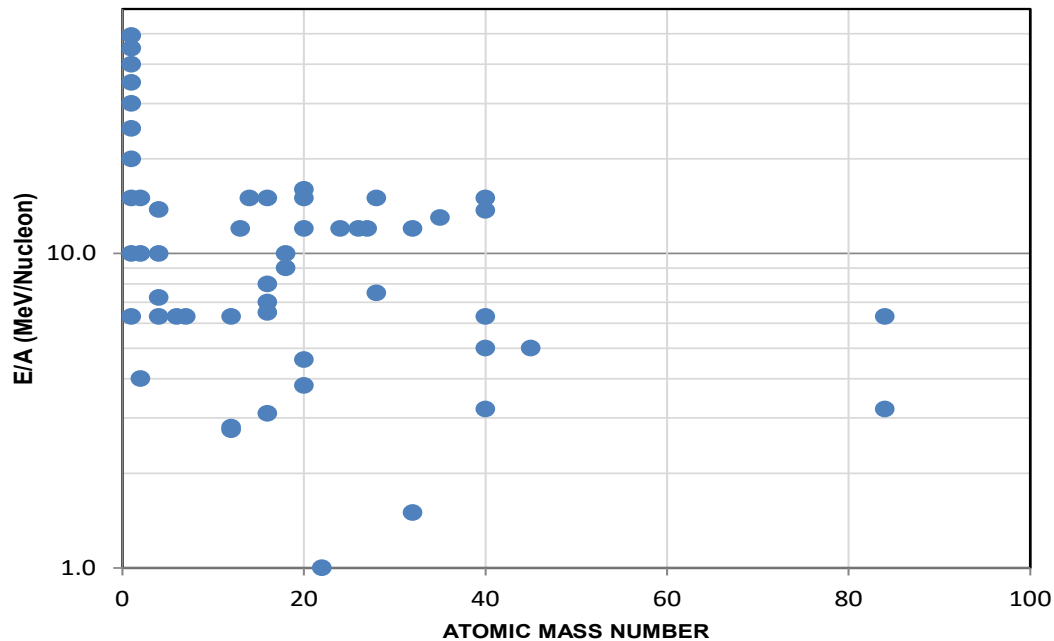
K500 SUPERCONDUCTING CYCLOTRON FACILITY TEXAS A&M UNIVERSITY - CYCLOTRON INSTITUTE



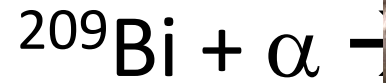
Tools: K150

- 88" Cyclotron
- H⁻ Source & ECR Source
- Protons and Heavy Ions
- High intensity

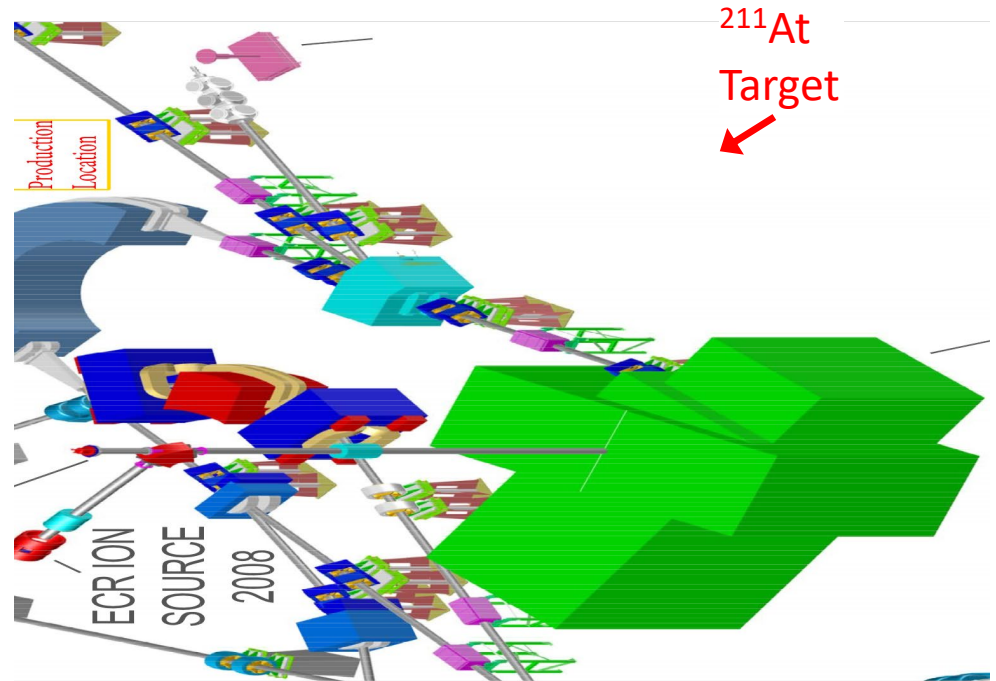
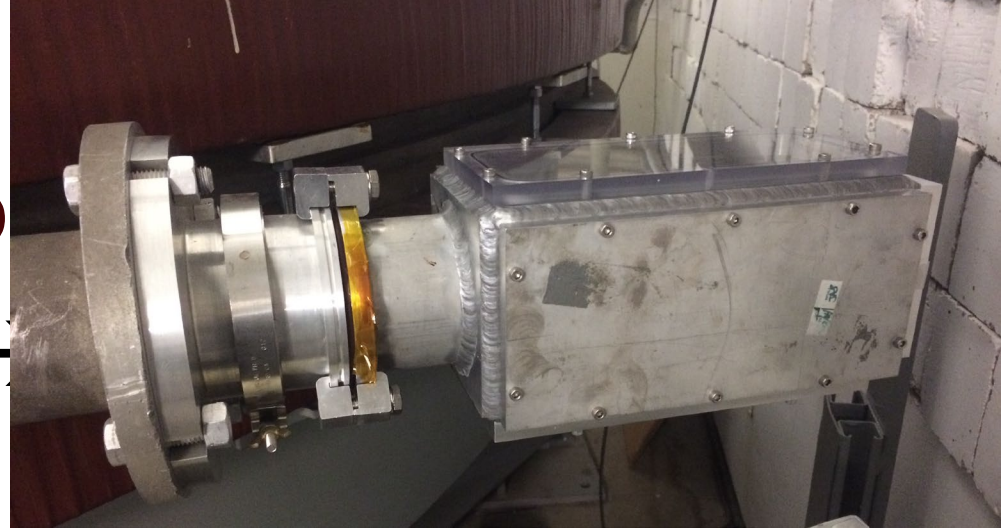
K150 CYCLOTRON + ECR



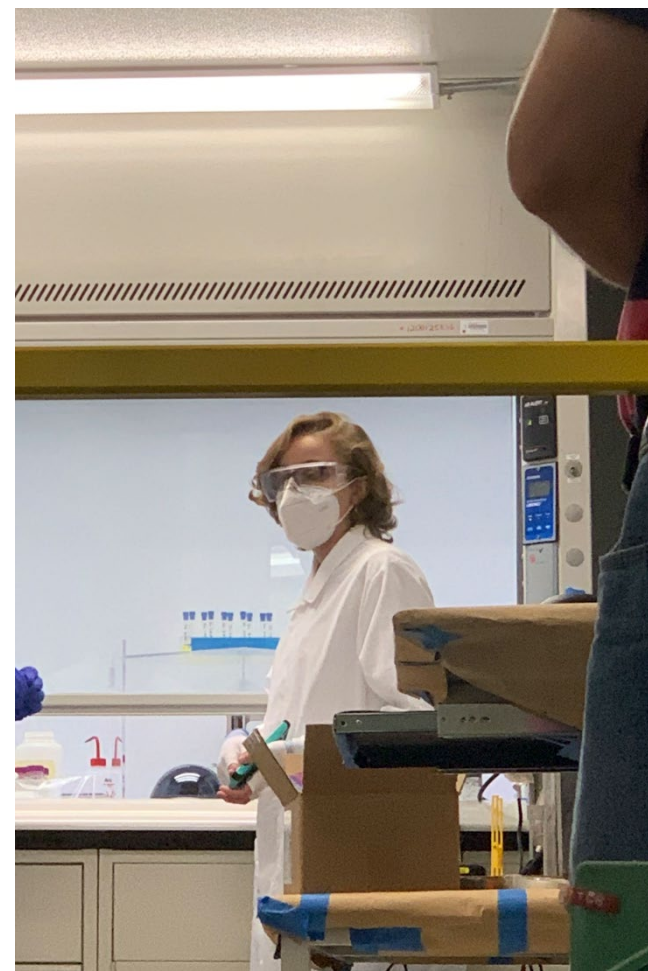
Production



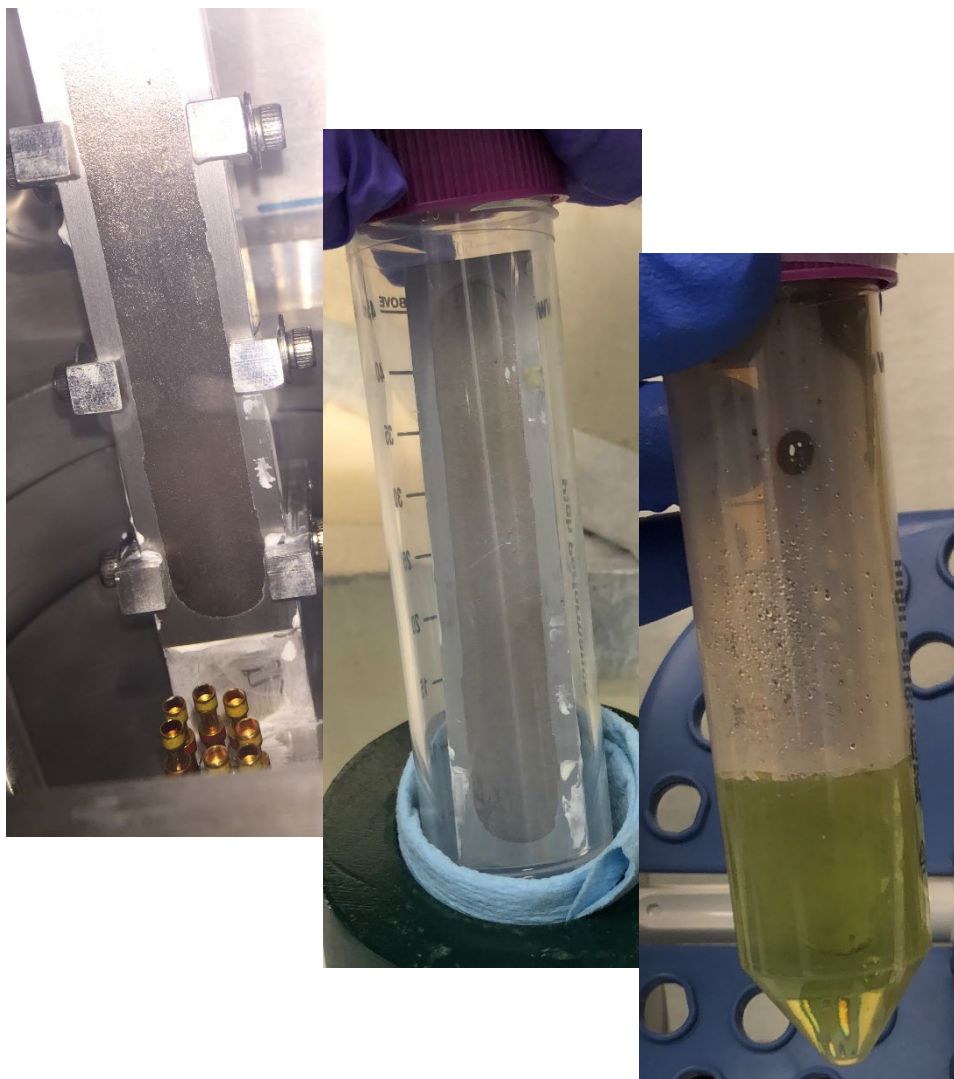
- K150 Cyclotron
- Energy: 28.8 MeV



Radiochemistry Facilities



At-211 Chemistry at Texas A&M



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

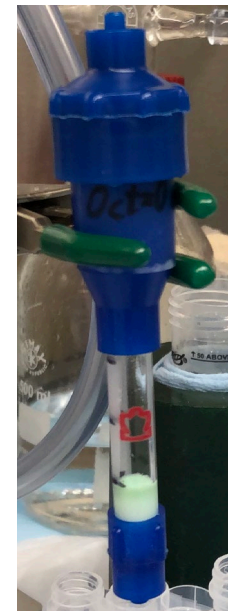


Dissolution of Target
10–16 M HNO_3

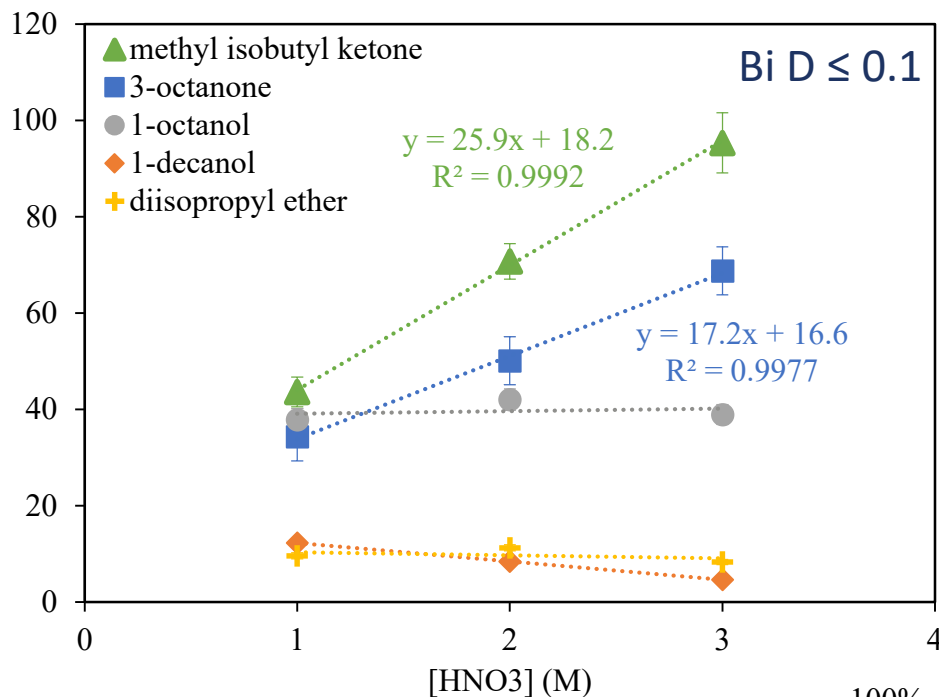


Experimental Chemistry
Separations and Fundamental

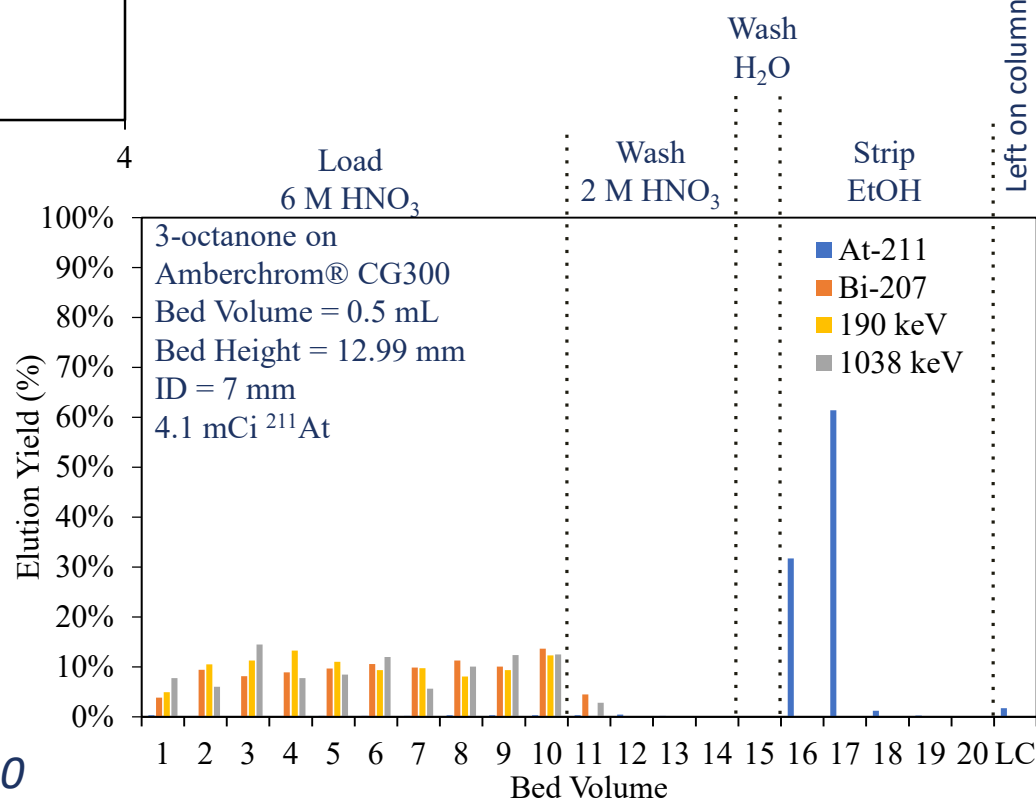
At-211 Separations



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



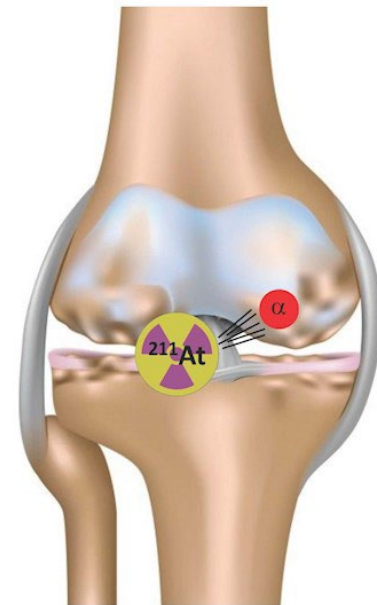
Solvent	Dielectric Constant
methyl isobutyl ketone	13.11
3-octanone	10.5
1-octanol	10.3
1-decanol	7.93
Diisopropyl ether	3.81



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

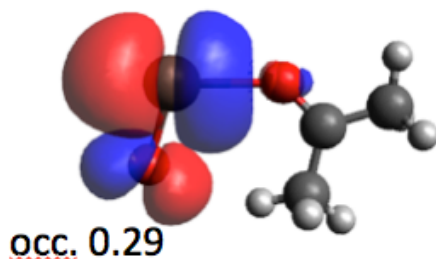
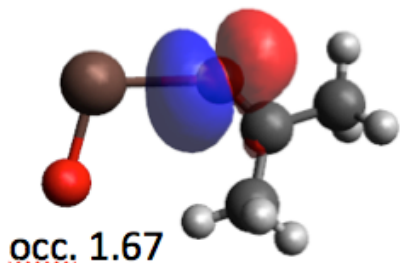
Ligand Exchange Experiments

DFT Calculations to understand the interactions

Most contributed interactions

20. O Lone pair (Donor)

34. At-O BD* (Acceptor)



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

Jon Burns, Lauren McIntosh, Evgeny Tereshatov, Gabi Tabacaru, Amy Vonder Haar, Laura McCann, Mallory McCarthy, Kylie Loftin, Andy Hannaman, Geoff Avila, Dan Menchaca M.B. Hall, X. Yang, M. Deveau, K. Barnes, H. Robles, F. Gabbai, J. Zhou

