LOS ALAMOS NATIONAL LABORATORY
MATERIALS SCIENCE & TECHNOLOGY

Isotope Production Facility at the Los Alamos Neutron Science Center

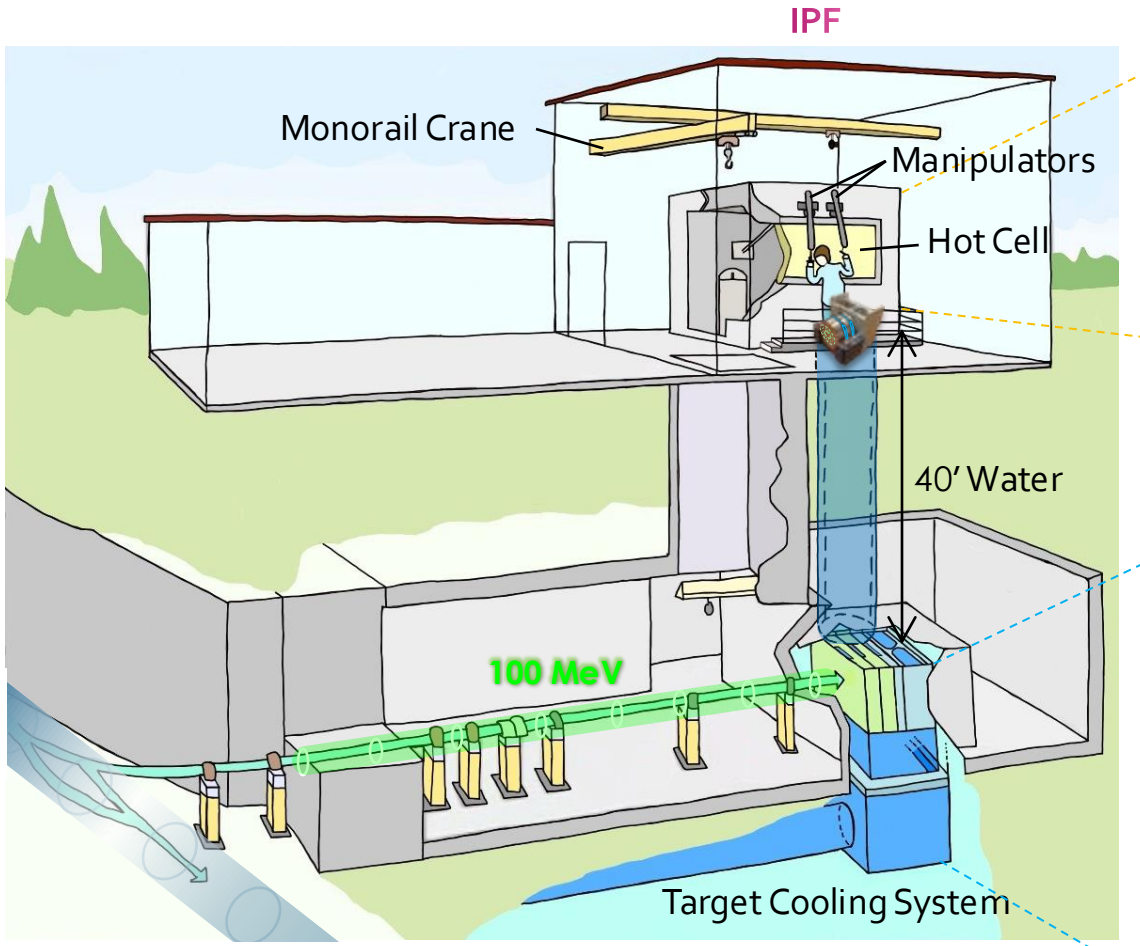
Etienne Vermeulen, Scientist
Inorganic Isotope and Actinide Chemistry

Tarik Saleh – Deputy Division Leader
Materials Science and Technology Division

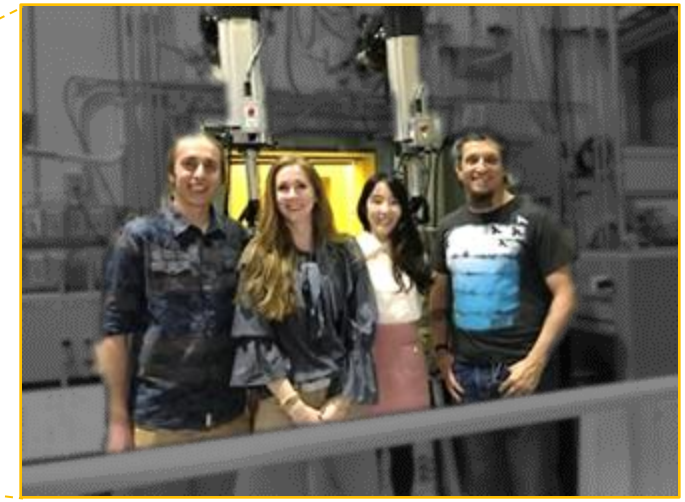
LA-UR-24-29877

LANSCE
Los Alamos Neutron Science Center

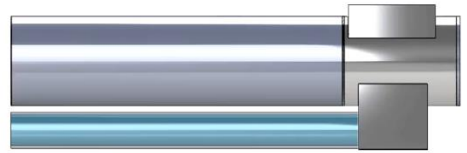
Isotope Production Facility (IPF)



In front of the Hot Cell



Target system 3D model



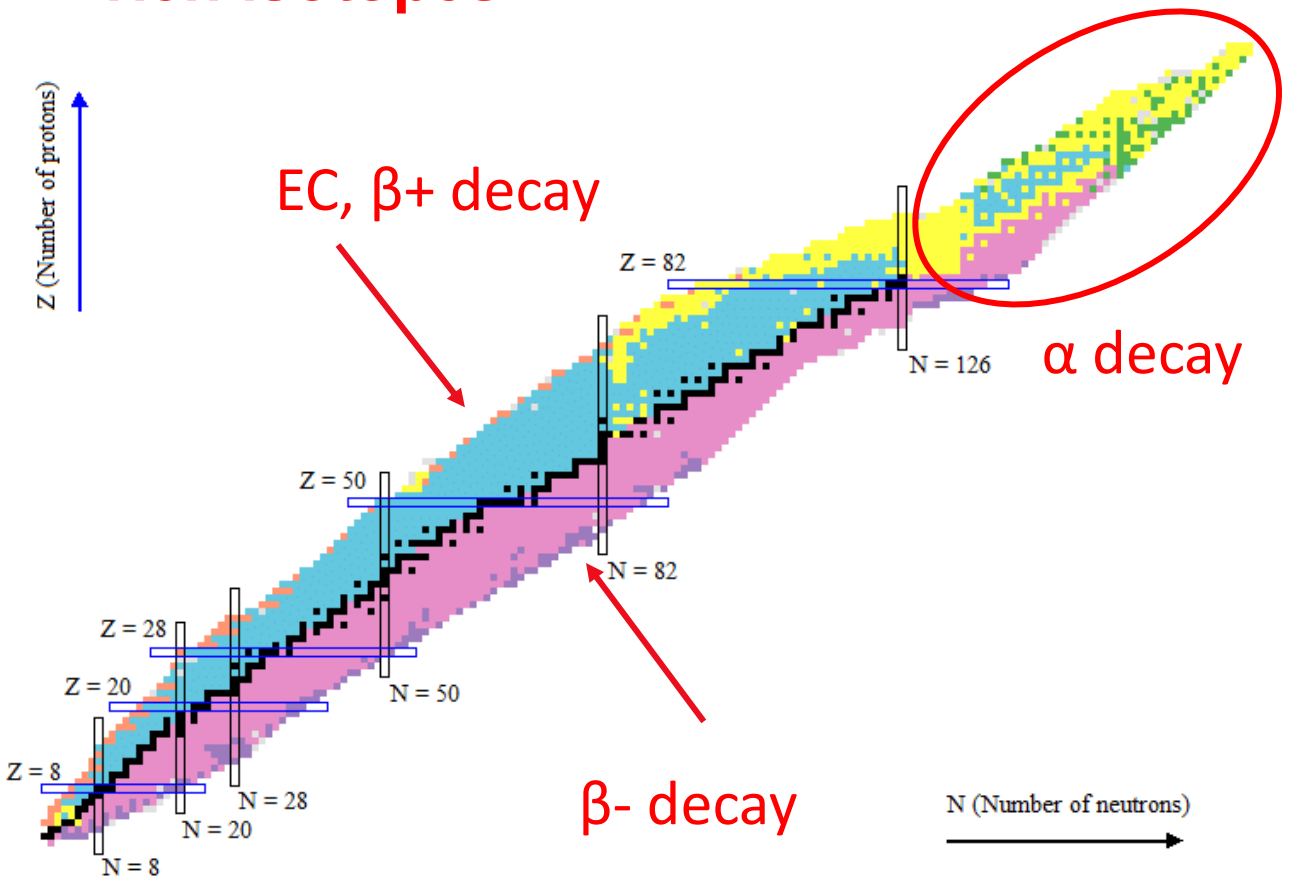
Why IPF?

- At IPF we make can make a **wide range** of radioactive isotopes that have a huge range of application spaces for many different end users.

Isotope	Half-life	Target
^{134}Ce	75.9 h	La
^{44}Ti	58.9 a	Sc
^{225}Ac	10 d	Th
^{119m}Te	4.71 d	Sb

Isotope	Half-life	Target
^{73}As	80.3 d	Ge
^{109}Cd	462.6 d	In
^{22}Na	2.6 a	Mg
^{236}Np	1.5 10^5 a	DU

IPF specializes in producing proton-rich isotopes



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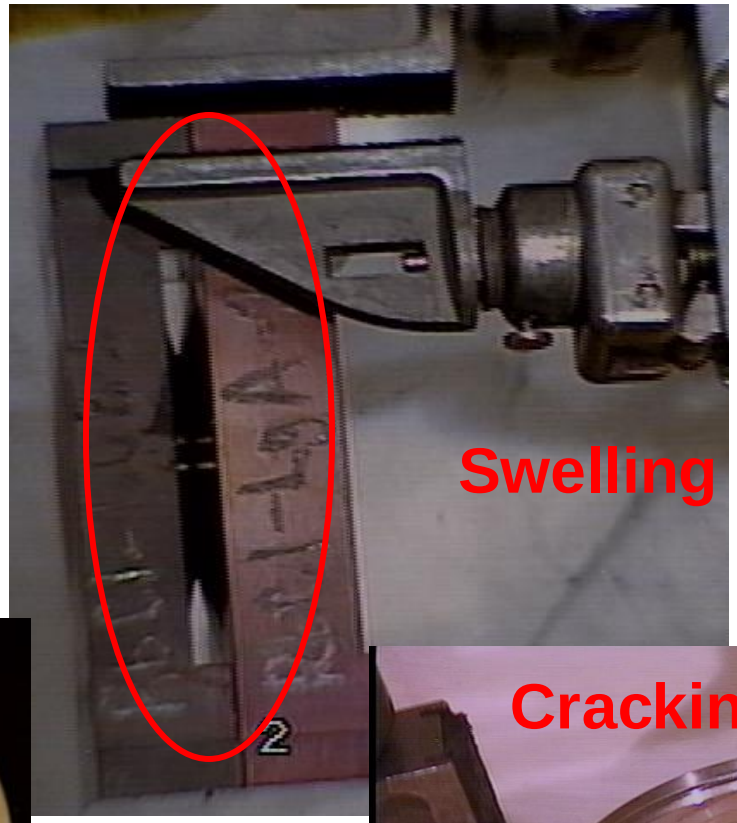
The Challenge – A Real-World Multi-Physics Problem

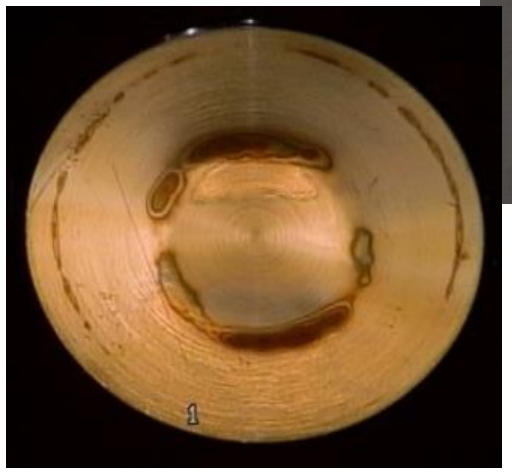
- IPF Beam Window and Target Survivability

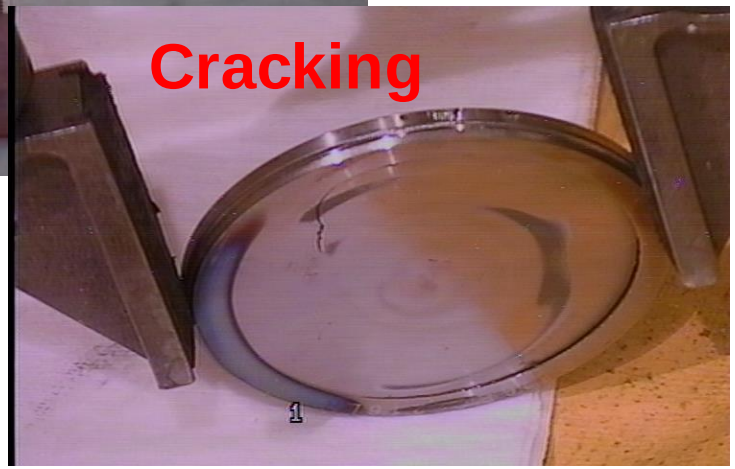
Failed IPF Beam Window

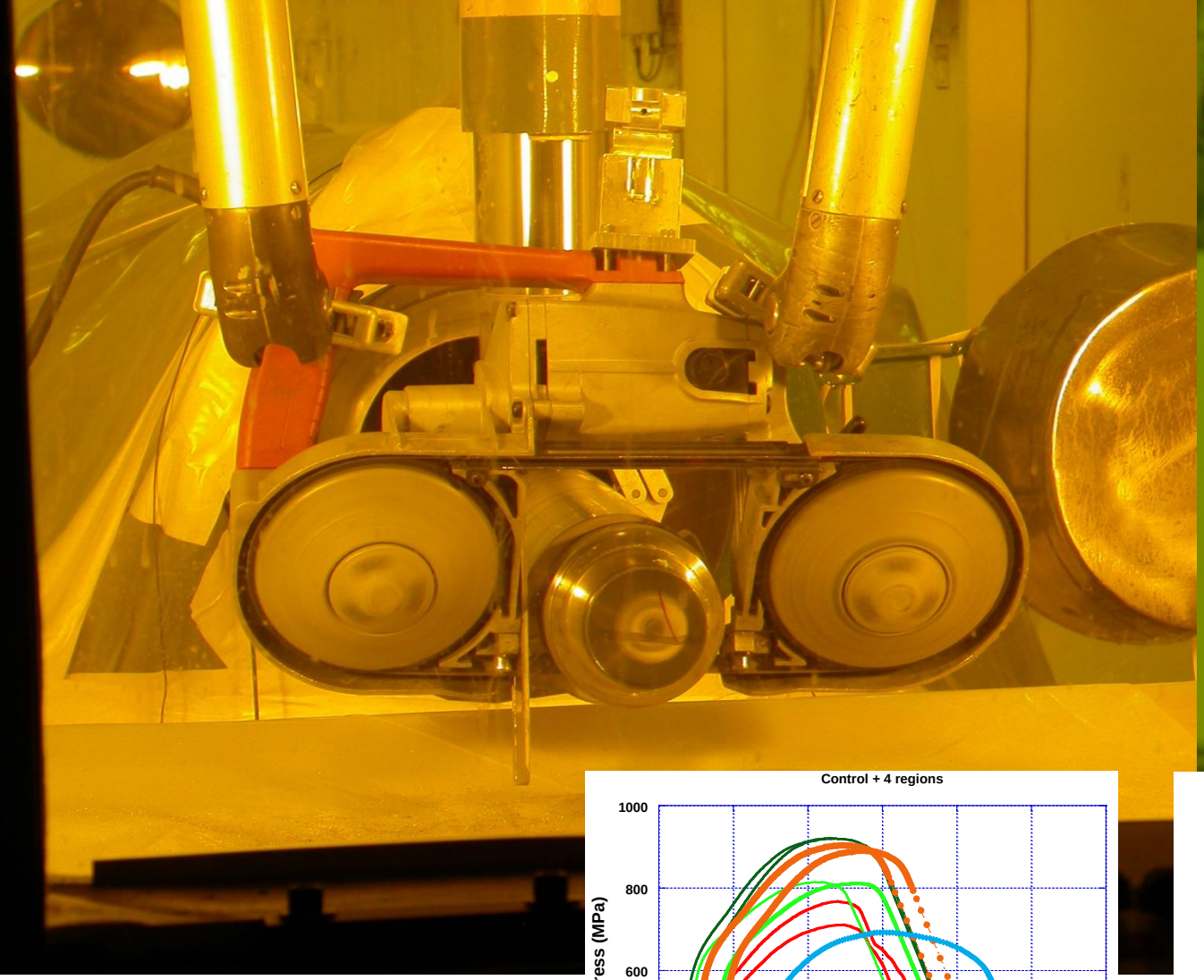


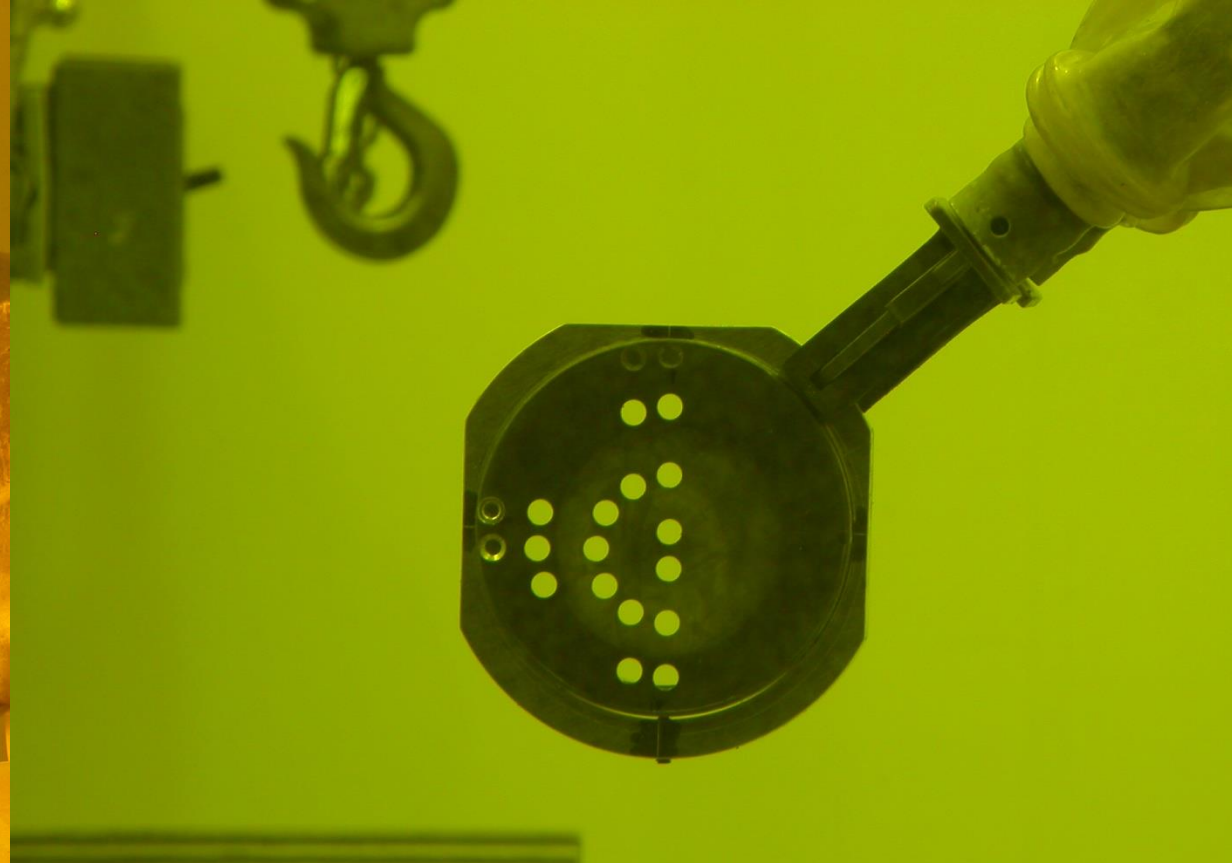
Failed Targets

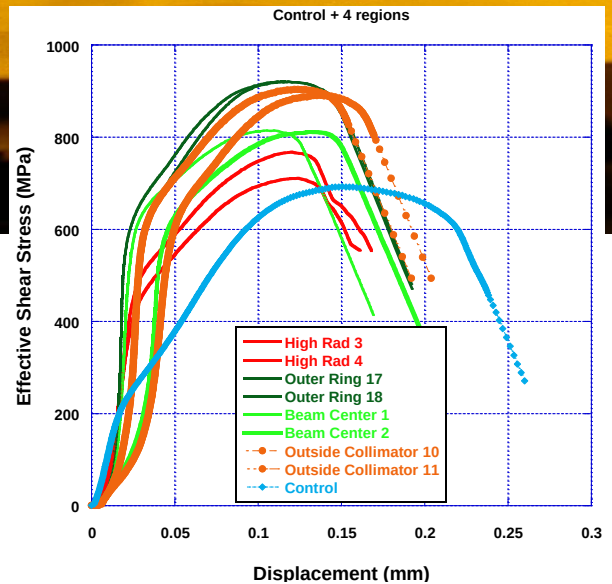
Buckling











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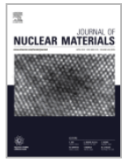
Journal of Nuclear Materials

Volume 459, April 2015, Pages 103-113



Review

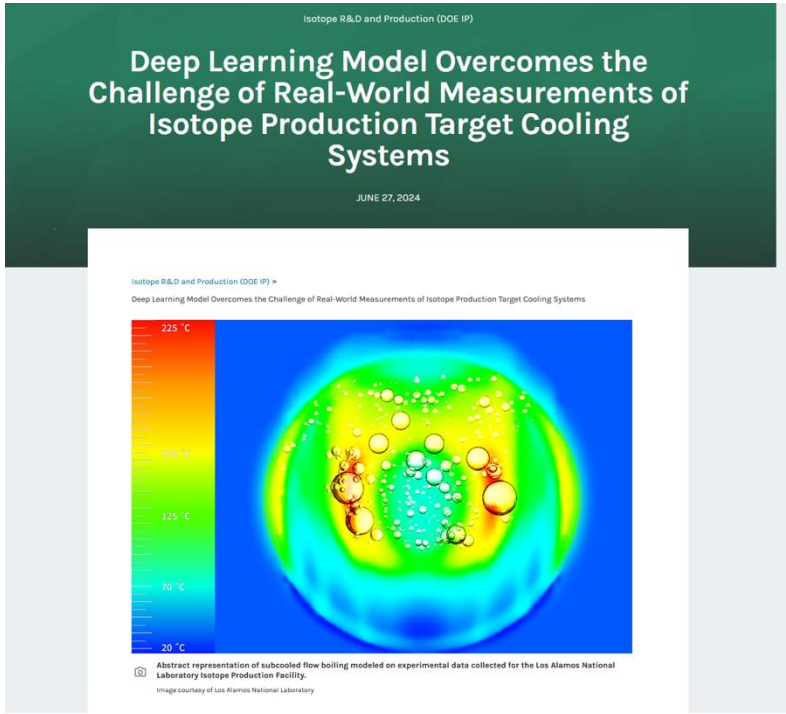
Proton irradiation damage of an annealed Alloy 718 beam window

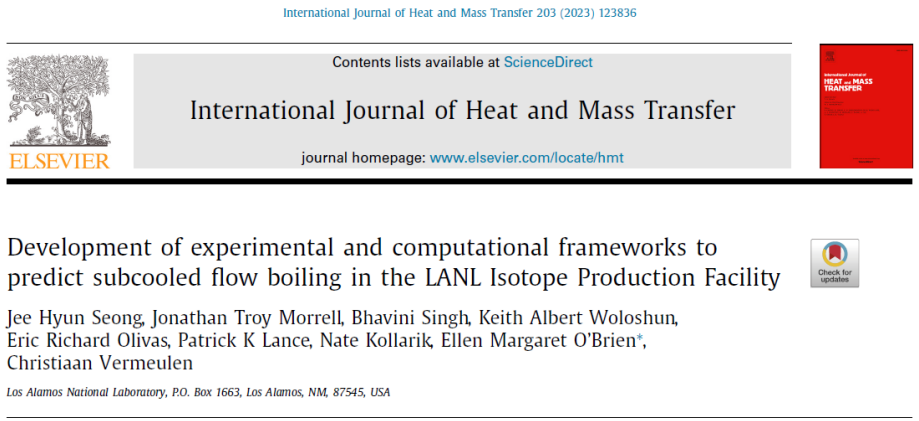
H.T. Bach [a], O. Anderoglu [a], T.A. Saleh [a], T.J. Romero [a], C.T. Kelsey [a], E.R. Olivas [a], B.H. Sencer [b], P.O. Dickerson [a], M.A. Connors [a], K.D. John [a], S.A. Maloy [a]

Understanding Cooling Capacity at IPF

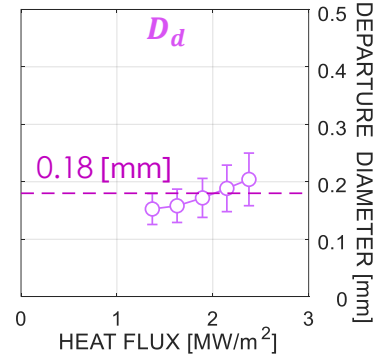
- Understanding cooling of isotope production targets at IPF:
  - Bounding parameter space for current operations
  - Input to predictive codes
  - Tool to rapidly iterate on improved cooling system designs toward future high current operations.

Work performed by J.H. Seong.

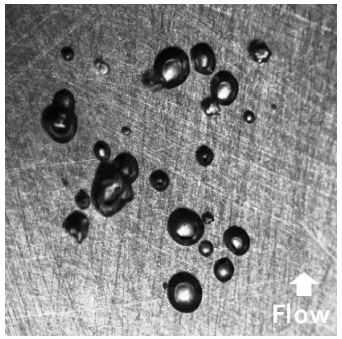




AI/ML Augmented Data Processing



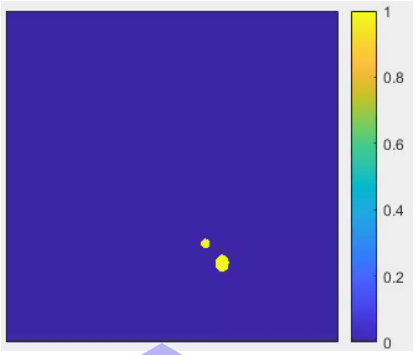
High-speed video



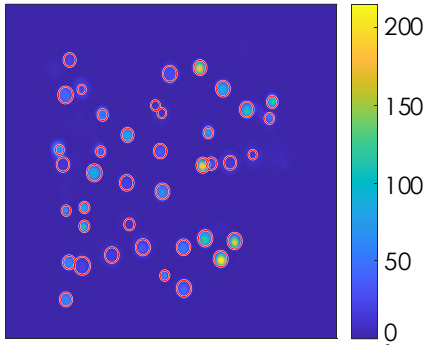
Machine learning (U-Net)

Bubble segmentation

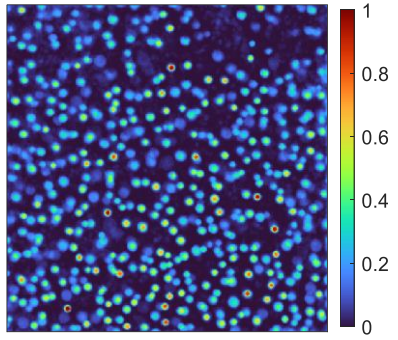
Activity Map



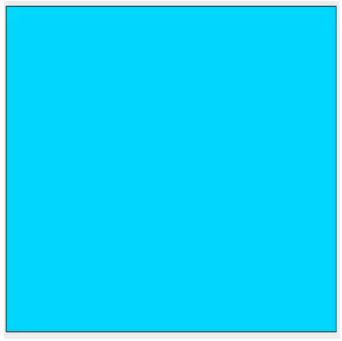
Identify nucleation sites



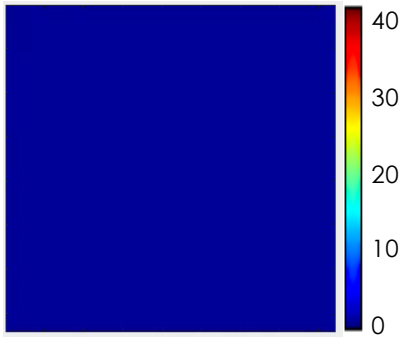
Nucleation activity map

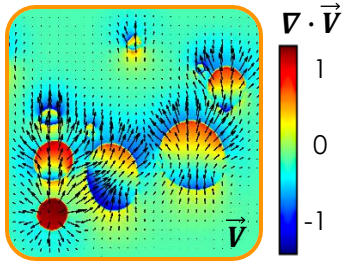


Classify individual/coalesced



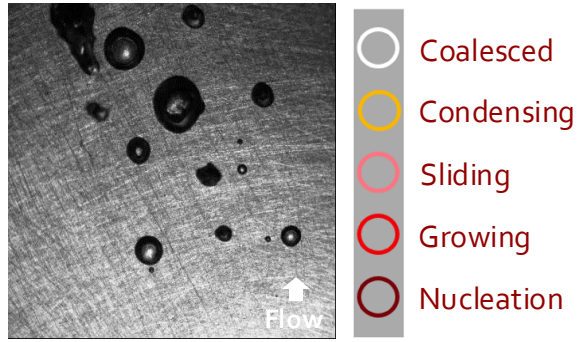
Individual bubble tracking per nucleation site





Optical flow

Bubble life-cycle identification



Boiling Parameters

- Nuclear site density, N''
- Departure diameter, D_d
- Growth time, t_g
- Wait time, t_w
- Departure frequency, f
- Lift-off diameter, D_l
- Sliding length, l_s

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