The National Nuclear Data Center

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Nuclear Science and Technology

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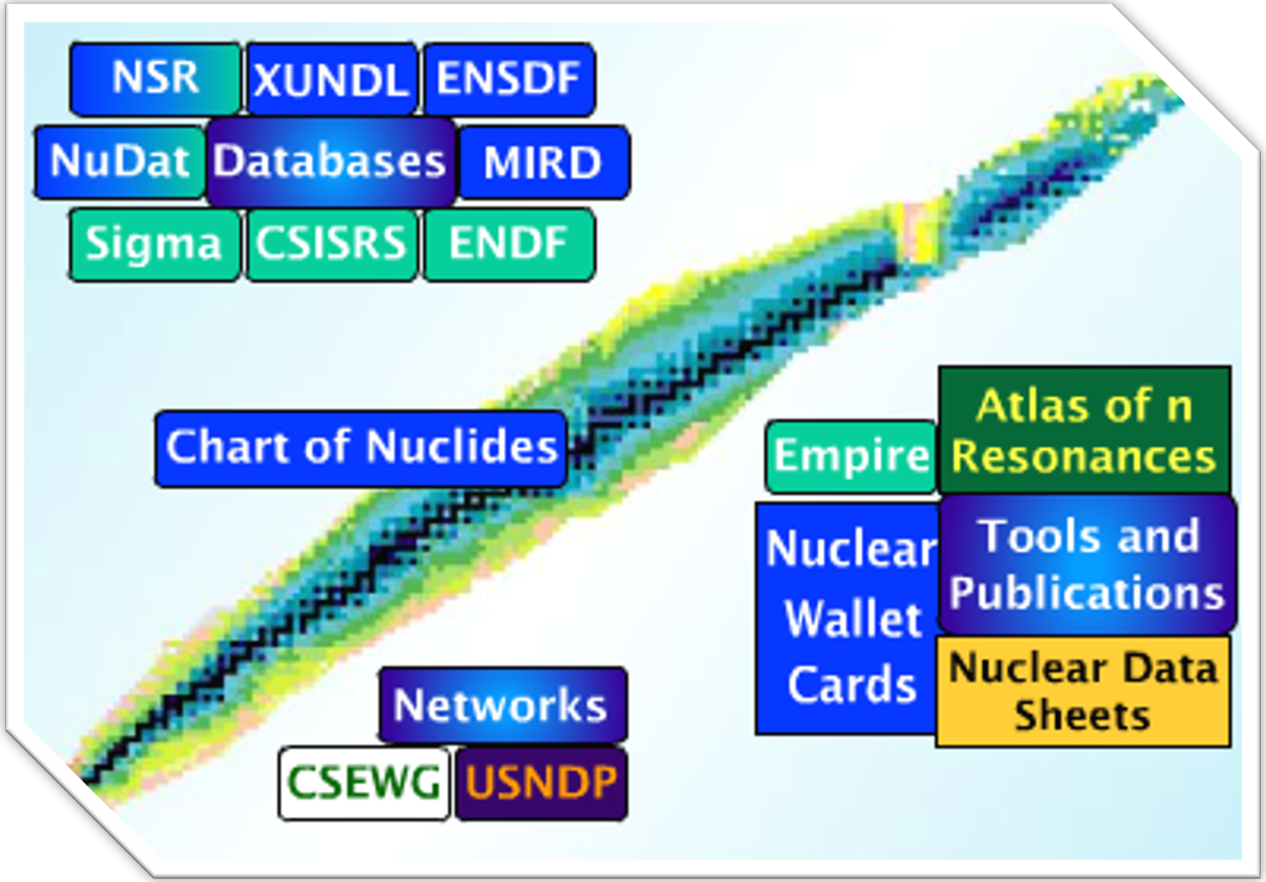
Our Mission

www.nndc.bnl.gov

- To provide current, accurate, authoritative data for workers in pure and applied areas of nuclear science and engineering
- Accomplished primarily through the compilation, evaluation, dissemination, and archiving of extensive nuclear datasets
- Also address gaps in the data



4.5 million database retrievals per year

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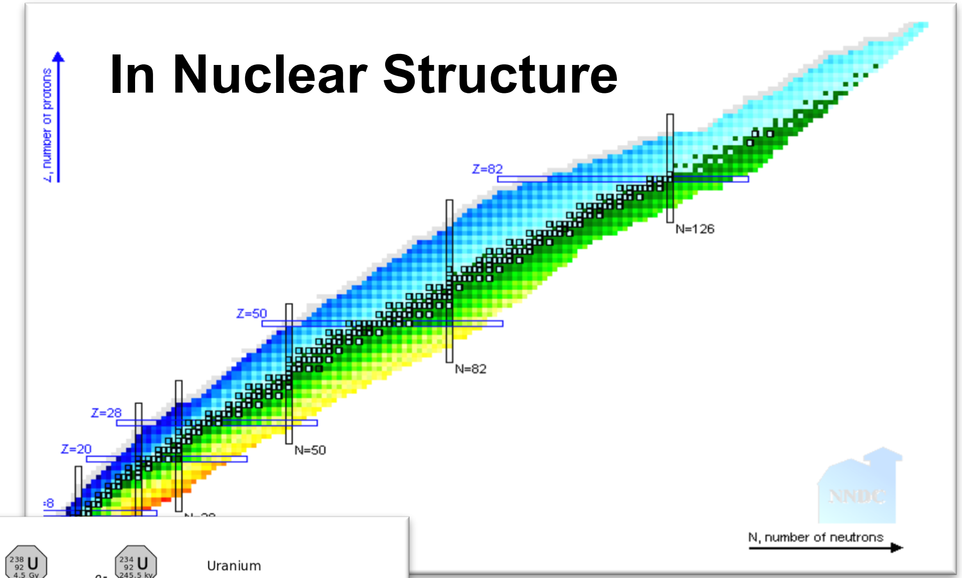
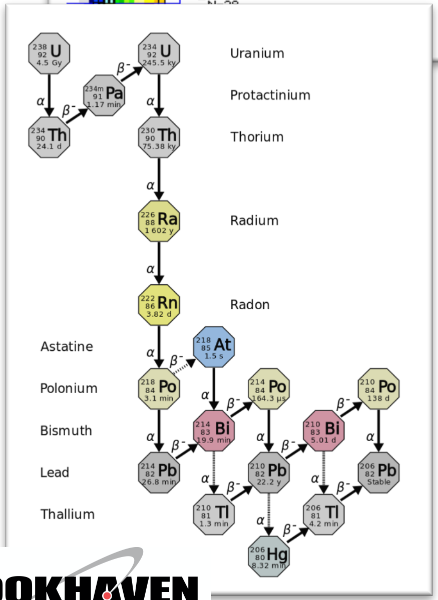
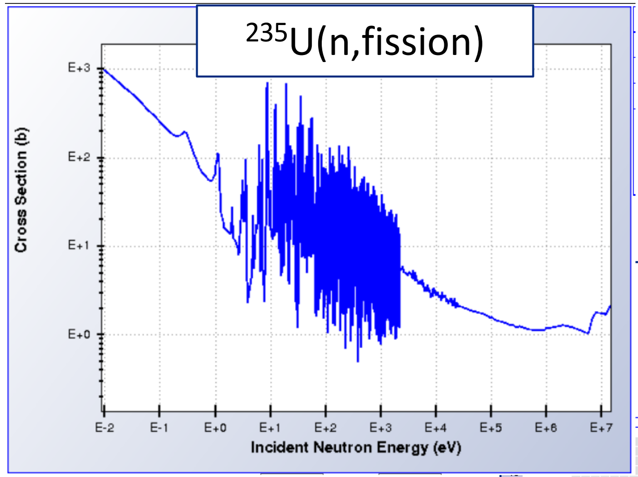
Maintain two Major US Nuclear Physics Databases

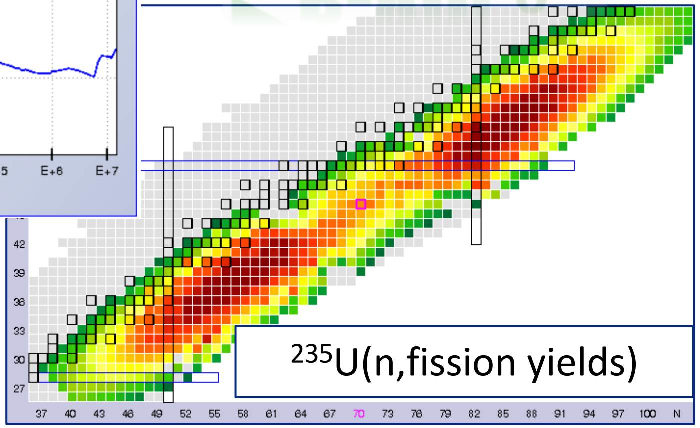




- 3,300 nuclei have been produced and studied
- For decay –
  - Half-lives
  - Energies and Intensities of all emitted radiation
  - Branching ratios

In Nuclear Reactions





Data needed in many applications, for instance:

- Design, operation and decommission of nuclear reactors
- GEANT and MCNP transport modeling
- SCALE, FLUKA, ORIGIN
- New version coming 2023

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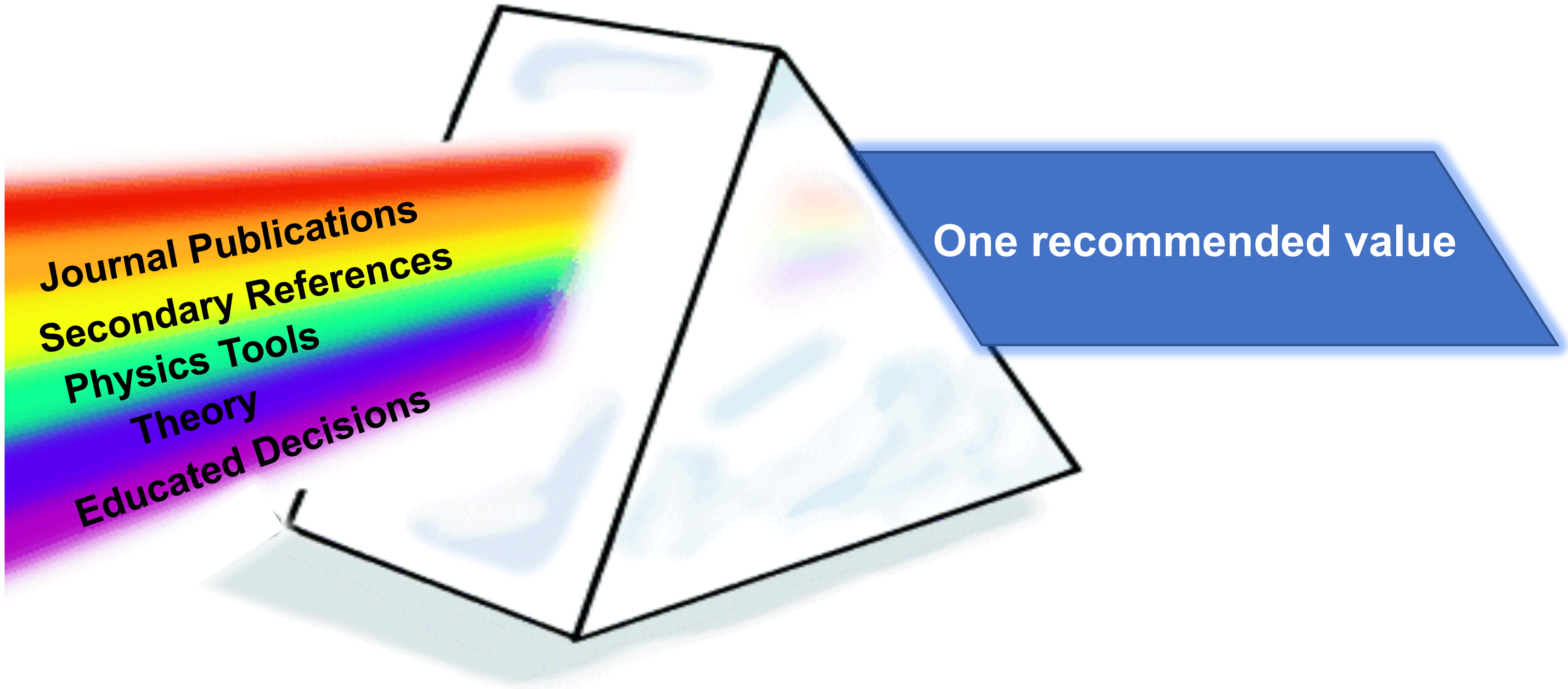
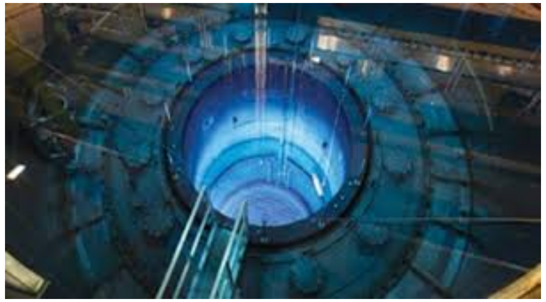
Evaluated Nuclear Data

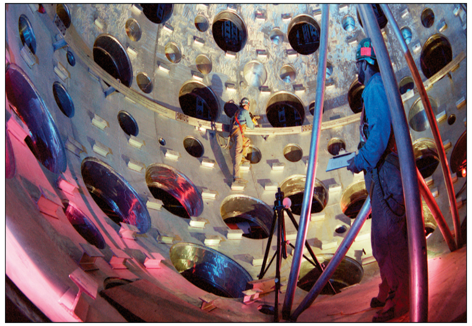


- Nuclear Physics has rich 100+ year history
- Data Center and major libraries in existence for more than 60 years
- 100’s of new publications (1000’s of new measurements) added each year

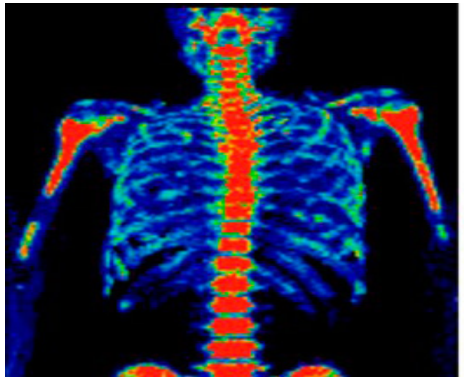
Users of Nuclear Data Libraries



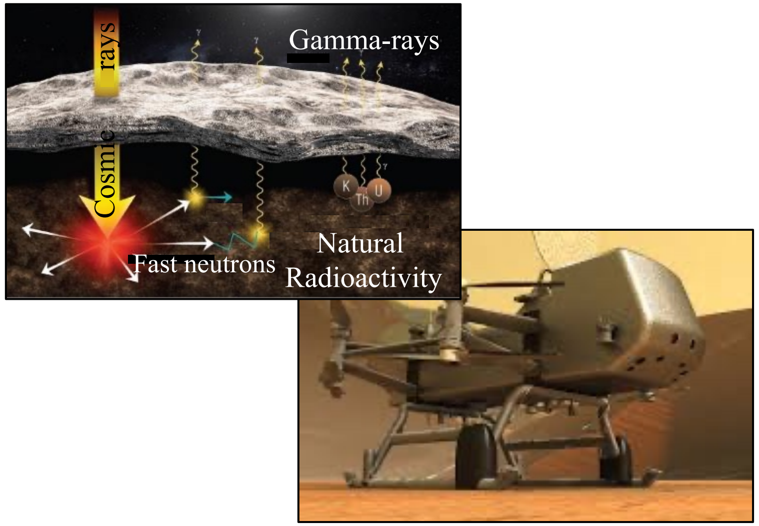
Nuclear Energy



Stockpile Stewardship

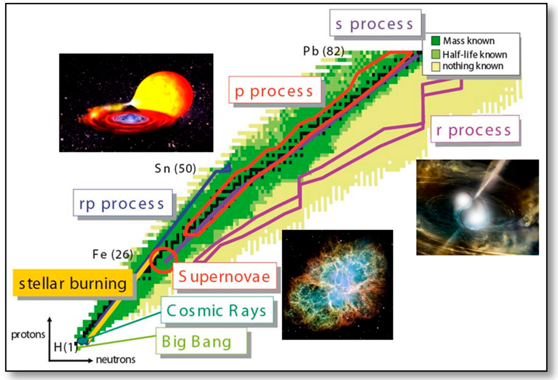


Nuclear Medicine

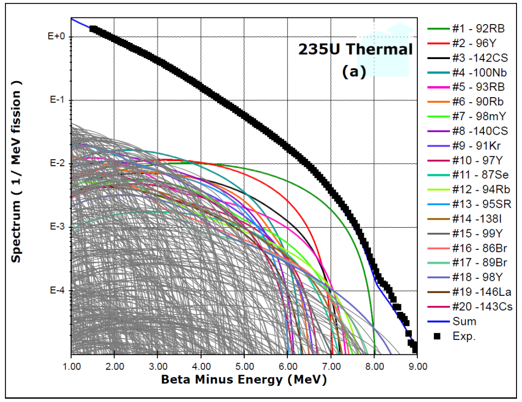


Space Exploration

Homeland Security



Astrophysics



Reactor Antineutrinos

FRIB

Fundamental Science

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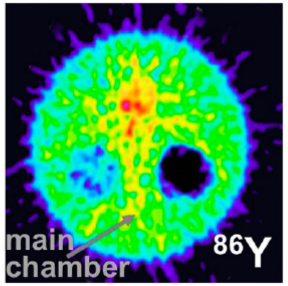
Experiments to Fill in the Gaps

Article

The Beginning and Development of the Theranostic Approach in Nuclear Medicine, as Exemplified by the Radionuclide Pair ^{86}Y and ^{90}Y

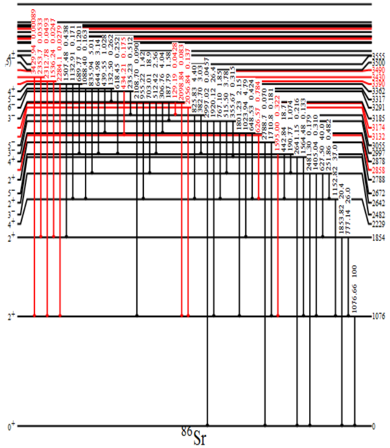
Frank Rösch [1,*], Hans Herzog [2] and Syed M. Qaim [3]

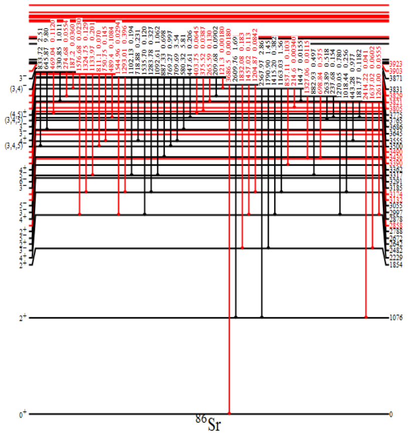


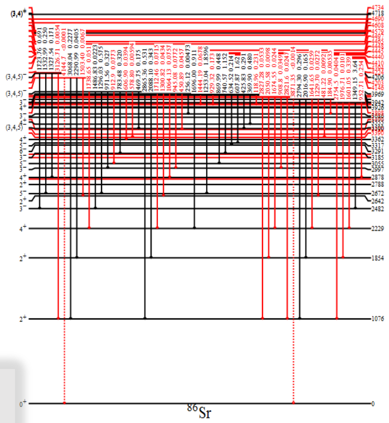
^{86}Y – a new PET imaging isotope

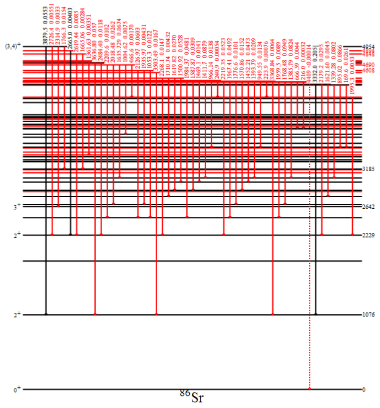
Pharmaceuticals **2017**, *10*, 56; doi:10.3390/ph10020056

Results of a new high-precision gamma-ray spectroscopy experiment









Confirmed
New

Identified over 100 new transitions

511-keV intensity decreases by 15% !

PHYSICAL REVIEW C **102**, 034316 (2020)

State-of-the-art γ-ray assay of ^{86}Y for medical imaging

A. C. Gula,[1,2] E. A. McCutchan,[2] C. J. Lister,[3] J. P. Greene,[4] S. Zhu,[2,4] P. A. Ellison,[5] R. J. Nickles,[5] M. P. Carpenter,[4] Suzanne V. Smith,[6] and A. A. Sonzogni[2]

August Gula –

- Two term SULI student at NNDC
- Now pursuing PhD at Notre Dame in Nuclear Physics

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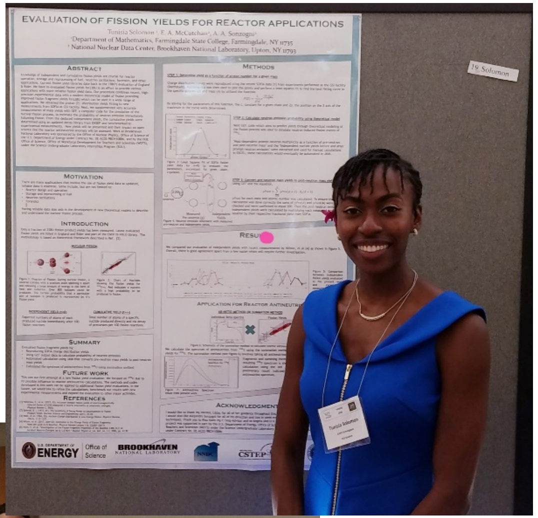
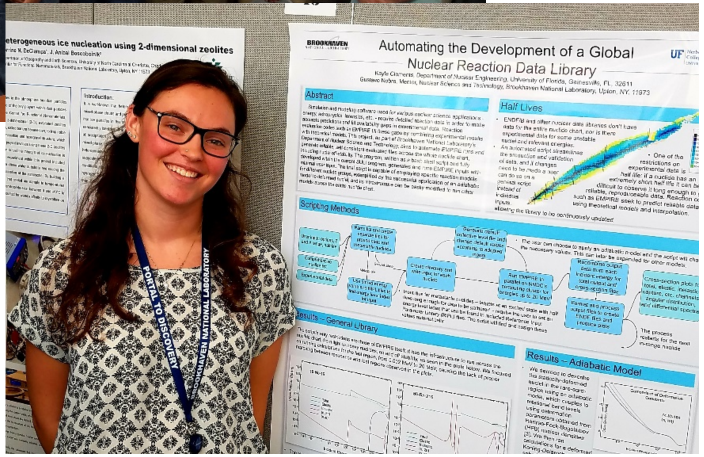
Very active internship program – covering wide range of topics

- Data Science
- Data Visualization
- Forensics
- Machine Learning
- Medical Isotopes



- Criticality Safety
- Nuclear Structure
- Nuclear Reactions
- Fission
- Reactor Antineutrinos



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Materials Characterization for Nuclear Energy at the National Synchrotron Light Source II

Lynne Ecker
Deputy Department Chair
Nuclear Science and Technology

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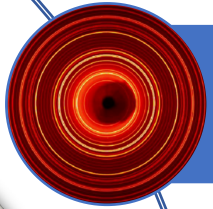
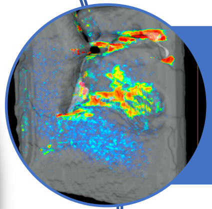
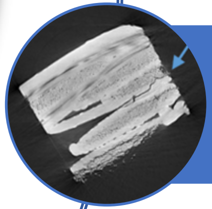
Radioactive Materials Characterization at the National Synchrotron Light Source II



Diffraction



Spectroscopy

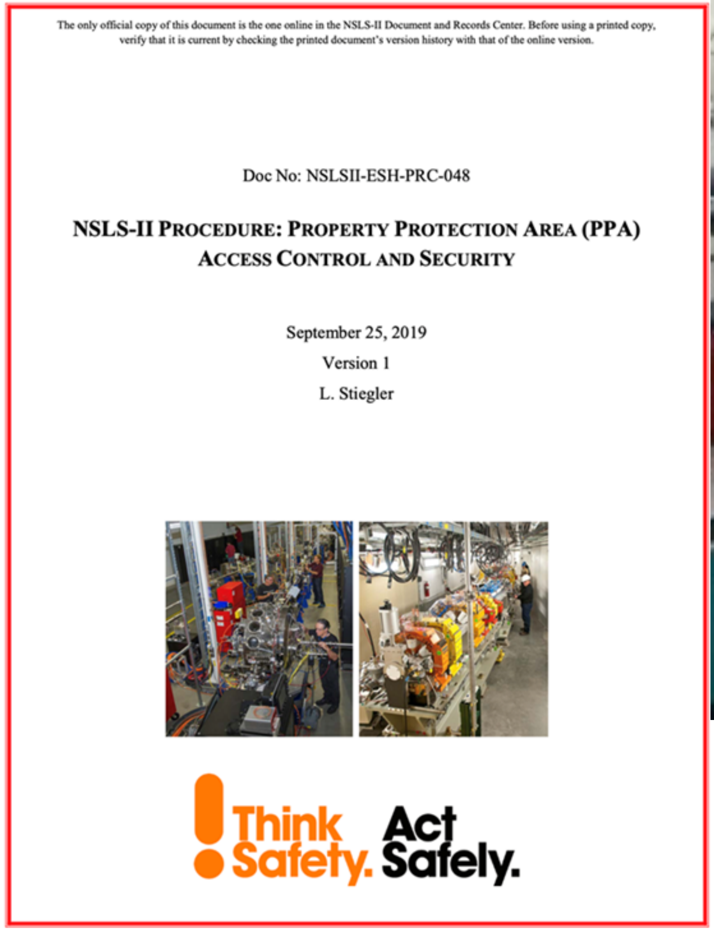


Imaging

In situ Testing

High throughput capabilities enable fast, unmanned sample manipulation of radioactive samples

- Special Nuclear Materials
- Robot allows hundreds of measurements in a day
- High throughput for better statistics
- Unmanned operation of radioactive samples
- Access through NSUF



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ACCESS CONTROL AND SECURITY

September 25, 2019

Version 1

L. Stiegler

Think Safety. Act Safely.

Robot at the X-ray Powder Diffraction Beamline (XPD), NSLS-II

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Vision: Materials in a Radiation Environment Facility

MRE will be an external facility for synchrotron imaging, spectroscopy and diffraction of radioactive materials with provision for particle accelerators

- Up to three independently operating branch beamlines
- *In situ* characterization capabilities (P, T, stress, electric field)
- Radioactive samples: fuel, dispersibles, transuranics, nondestructive, minimal sample preparation, bulk samples for real interfaces

Lower the barrier to access the synchrotron for the entire nuclear material science community

Accelerating Isotope Production: Ensuring the Nation’s Isotope Supply is Secure

Cathy S. Cutler
Director of Medical Isotope Research & Production Program
Collider Accelerator Department

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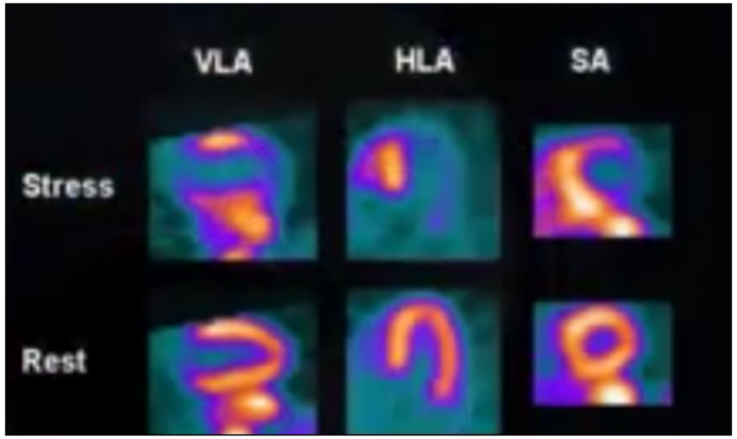
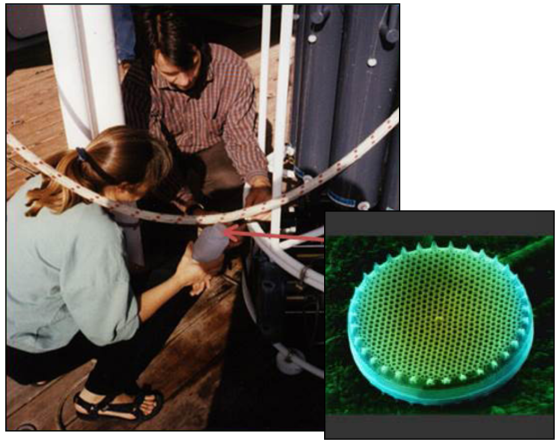
Applications – Accelerator Isotopes

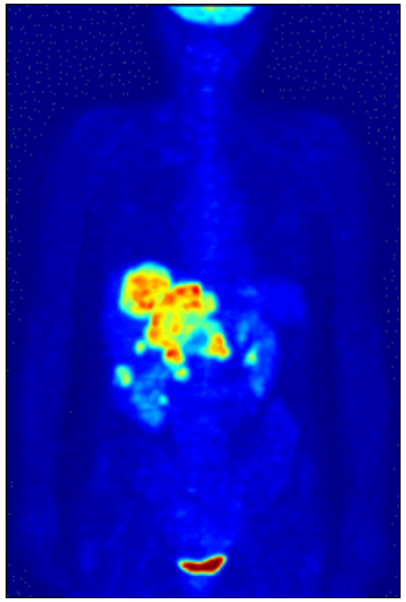
Sr-82/Rb-82:
Generator - cardiac imaging



Si-32:
Environmental applications



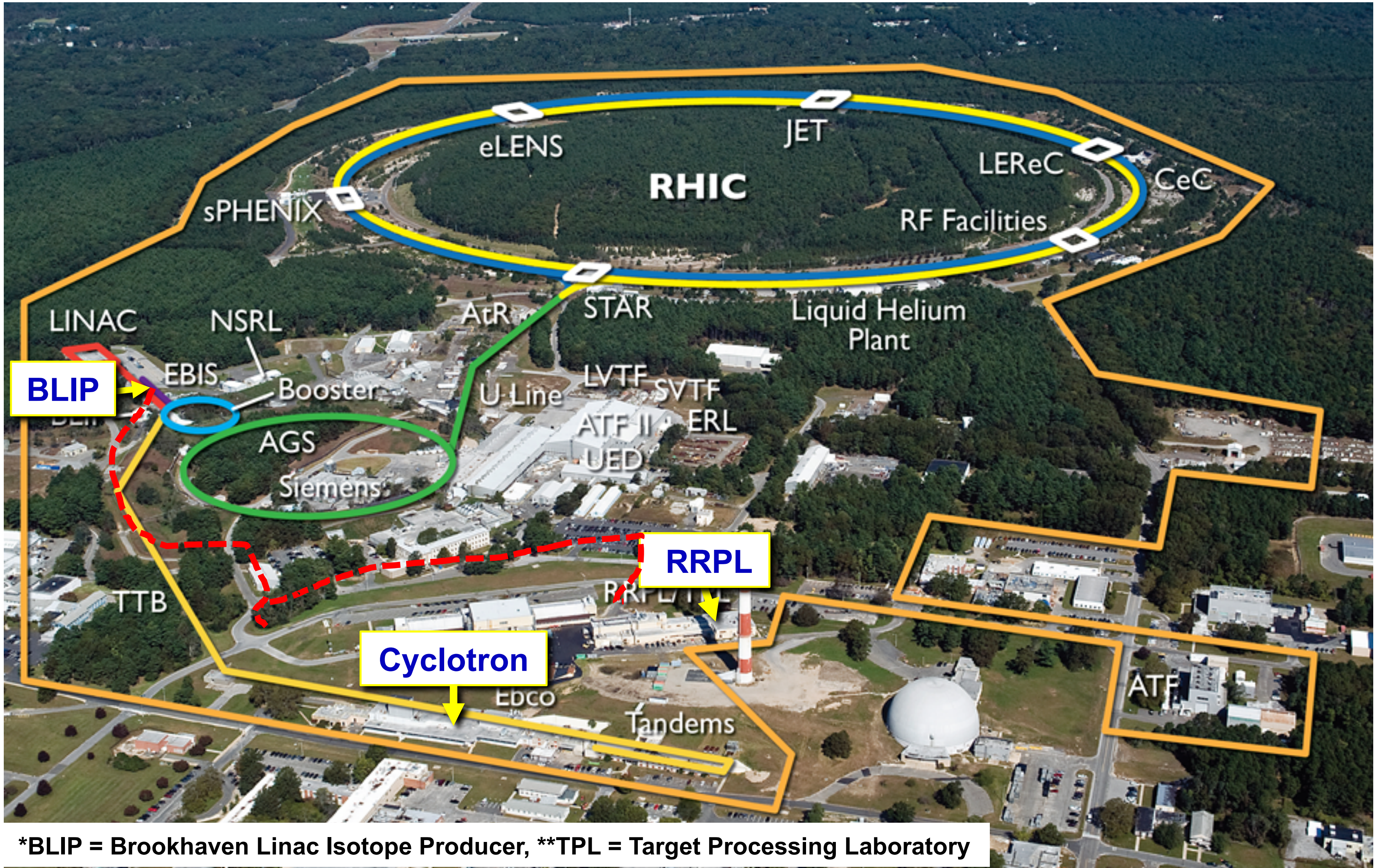
Ge-68/Ga-68:
Generator - cancer imaging



Na-22:
Source for PET imaging

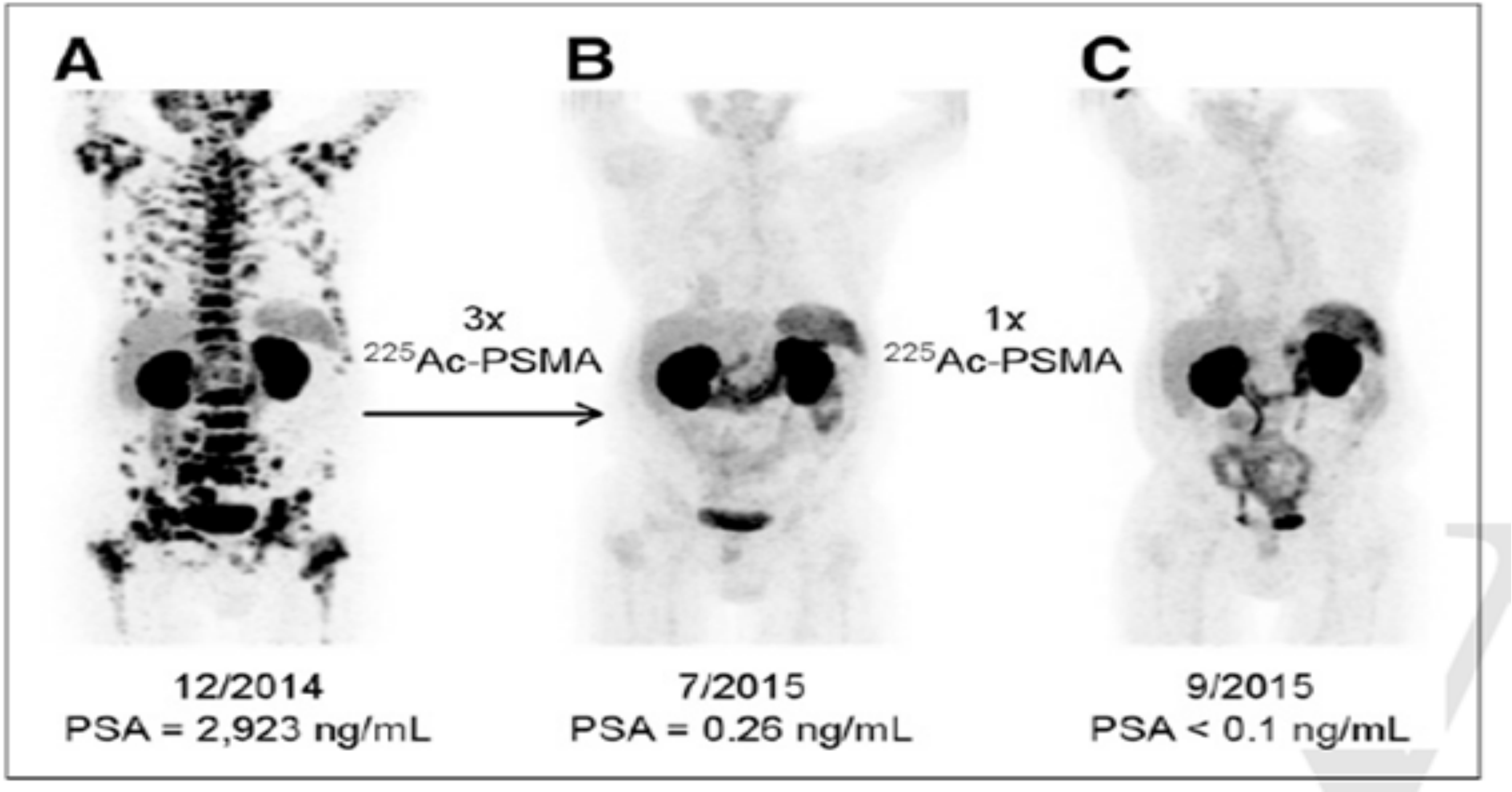
Cd-109:
X-ray fluorescence source

BNL Isotope Program - Aerial View of Integrated Accelerator Facilities



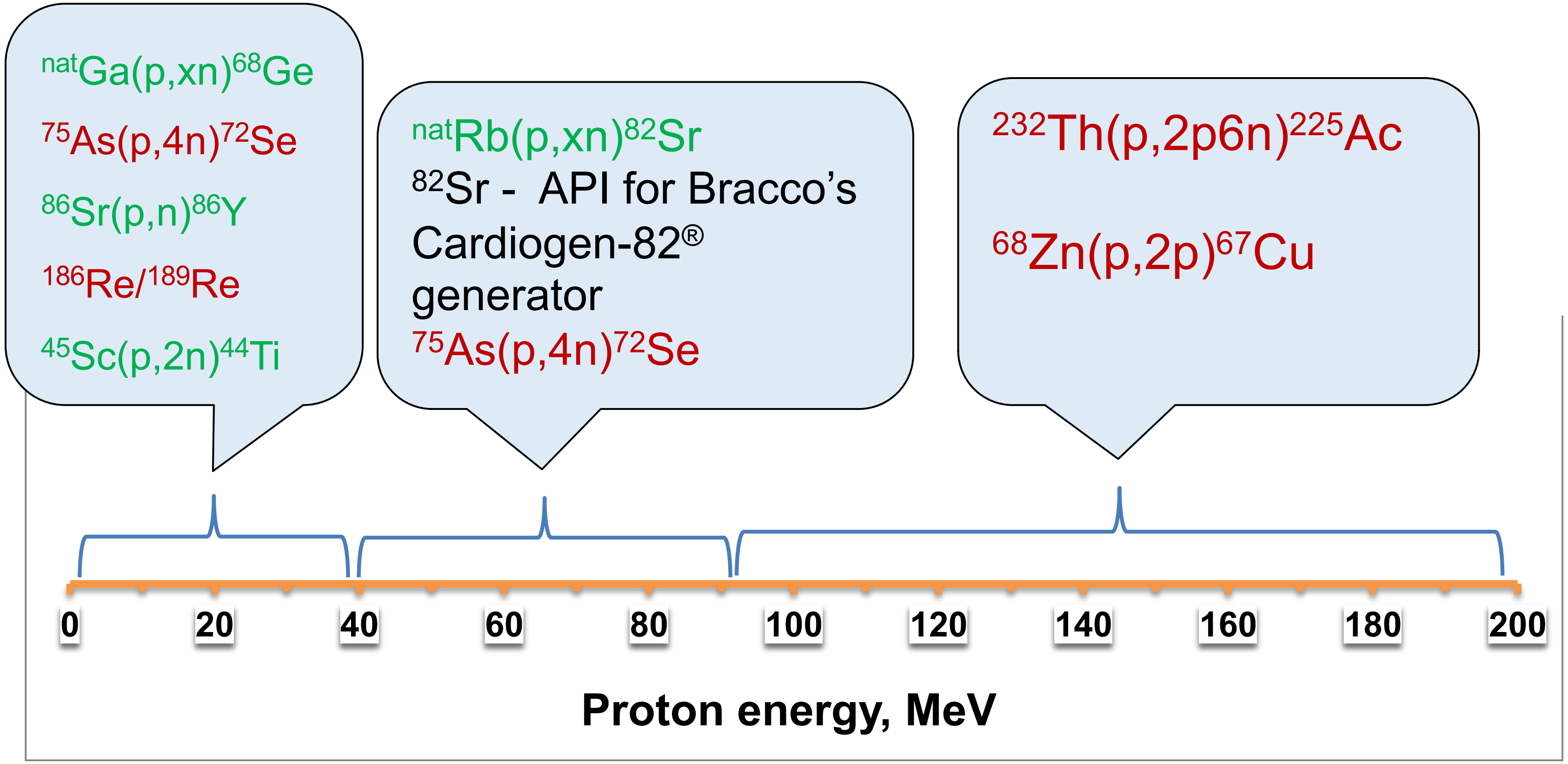
*BLIP = Brookhaven Linac Isotope Producer, **TPL = Target Processing Laboratory

Prostate Cancer Therapy



J. Nucl. Med., 2016; 57 (12); 1941 DOI: 10.2967/jnumed.116.178673 C. Kratochwil

Opportunities for isotope production and R&D at BLIP



Future Vision Large Improvements

- Increase proton energy and current to enable expanded isotope production
- Multiparticle ion LINAC for delivering beams of deuterons, alphas, and lithium for producing radionuclides that we can’t make with protons such At-211, Pt-193, Pt-195, etc.
- New building with new target stations and new hot cells
- Decoupling of the facilities so that it can be run separately

Summary

- BNL production capacity will cover large range of proton energies (13-650 MeV)
- Increase in proton energies will also offer Fast neutrons with high flux for production, fission studies, radiation damage studies
- High Intensity Multiparticle low ion Linac that no one else has.
- These capabilities could enable BNL to produce all foreseeable isotopes
- New facility with new hot cells that will allow for high levels of production under either order

MIRP Group