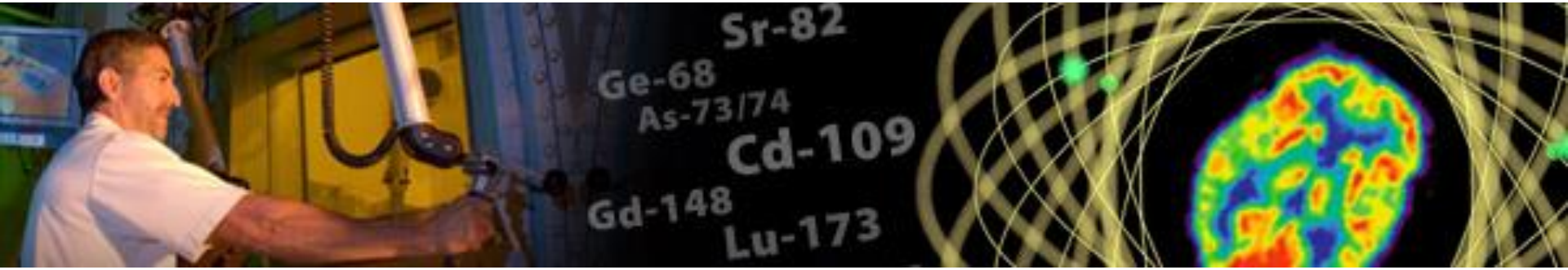
U.S. DEPARTMENT OF ENERGY

Isotope Program
U.S. Department of Energy

The DOE Isotope Program Perspective on Nuclear Data



Workshop for Applied Nuclear Data Activities (WANDA 2021)

Connecting the humans behind the nuclear data

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Dr. Ethan Balkin

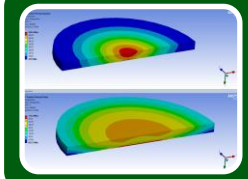
Program Manager for Isotope R&D

Office Isotope R&D and Production, Office of Science, U.S. Department of Energy

DOE Isotope Program & Nuclear Data

Produce and/or distribute radioactive and stable isotopes that are in short supply; includes by-products, surplus materials and related isotope services

Maintain the infrastructure required to produce and supply priority isotope products and related service



Conduct R&D on new and improved isotope production and processing techniques which can make available priority isotopes for research and application. Develop workforce.

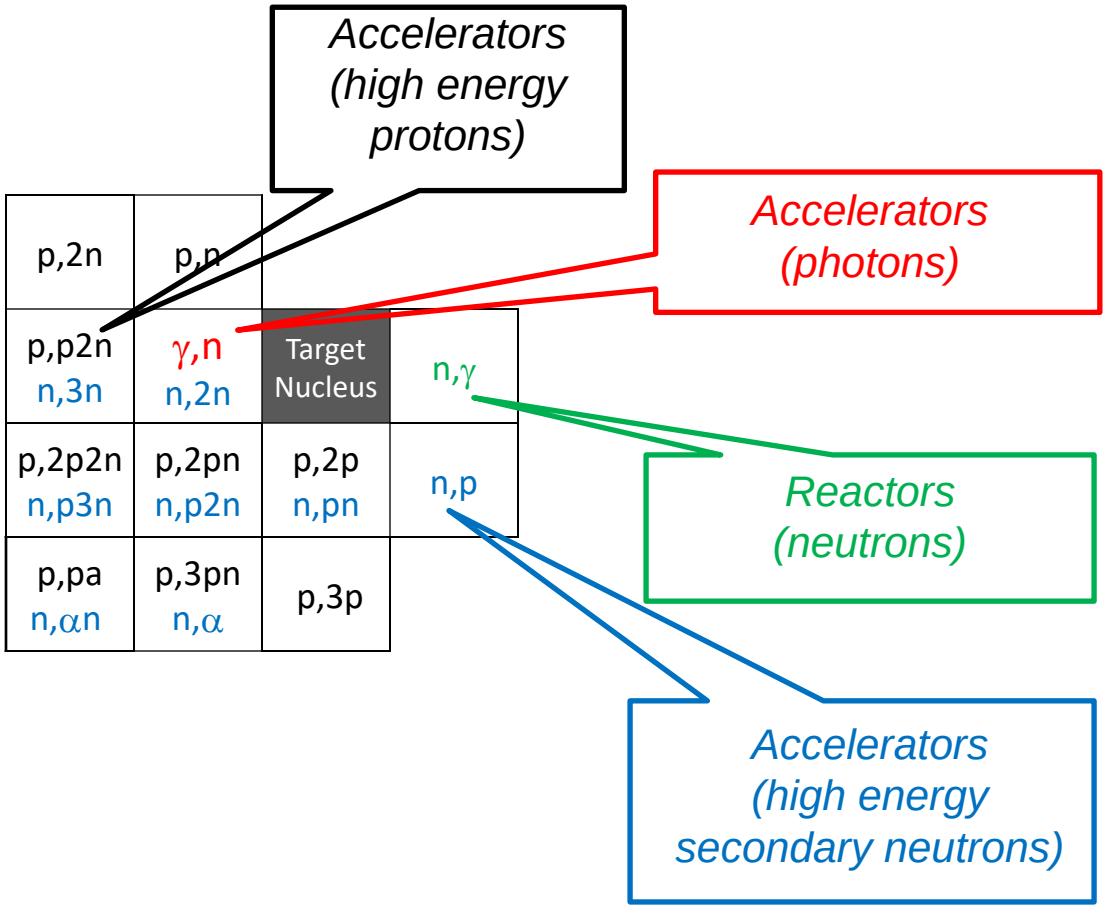
DOE IP is both a producer and consumer of nuclear data.

Briefly:

1) **We produce isotopes in short supply**
2) **We develop novel, cutting edge, approaches to isotope production (often the only producer globally)**
3) **As the facilities we utilize are upgraded or newly commissioned (FRIB), we need to be able to optimize production**
4) **This means we need a lot of new and updated nuclear data**

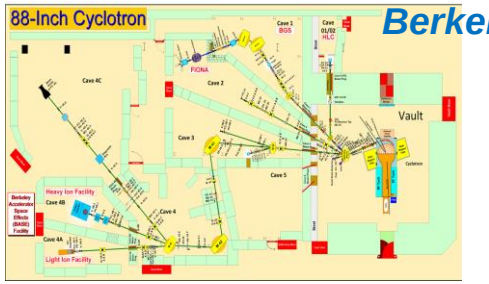
Programmatic Needs

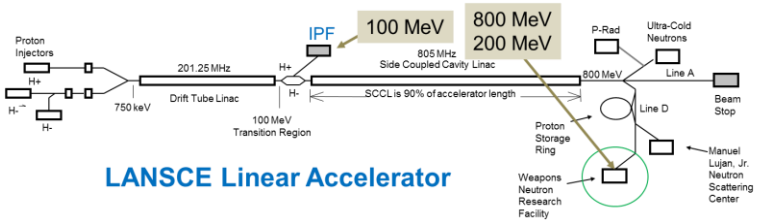
- **Cross sections for reactor production**
  - **Effective cross sections**
  - **Excitation functions**
- **Energy resolved cross sections for accelerator production with**
  - **High energy protons**
  - **High energy neutrons**
  - **Photons**

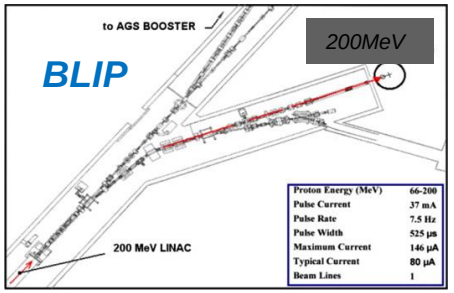


DOE IP Nuclear Data Initiative

- **Expanding measurement capability to multiple facilities to better cover proton energy ranges up to 200 MeV**
  - **Berkeley (<60 MeV) - includes Faraday cup style chamber for monitor reaction measurements**
  - **LANL – IPF (40-100 MeV) – includes new low beam current measurement capability for monitor reaction measurements (100 nA with 1% accuracy)**
  - **BNL – BLIP (100-200 MeV)**







Ongoing Measurements

- **High Energy Protons**
  - Th+p for production of therapy isotopes ^{225}Ac, ^{227}Th and ^{223}Ra
  - ^{nat}Sb,^{121}Sb+p for production of ^{119}Te/^{119}Sb, a promising Auger e-emitter for therapy
  - La+p for production of ^{134}Ce/^{134}La (PET analogues for ^{225}Ac and ^{227}Th)
  - Fe+p, Cu+p for production ^{52g}Mn, ^{54}Mn, ^{48}Cr, ^{55}Co, ^{58m}Co, ^{57}Ni
  - Nb+p for ^{93}Nb(p,4n)^{90}Mo as monitor reaction
  - As+p for production of ^{72}Se – generator for ^{72}As (PET imaging isotope of the ^{72}As/ ^{77}As theranostic pair)
- **High Energy Neutrons**
  - Production of ^{193m}Pt, ^{64}Cu/^{67}Cu, ^{47}Sc, ^{77}As via (n,p)
- **Photonuclear**
  - ^{48}Ti(γ,p)^{47}Sc, ^{196}Pt(γ,n)^{195m}Pt
- **Low energies**
  - ^{232}Th(p,x)^{229}Th for production of ^{229}Th/ ^{225}Ac
  - ^{238}U(p,xn) and ^{235}U(d,xn)$^{235\text{-}237}$Np for Production of ^{236g}Np

Cross-Cutting Needs & Session Challenges

- **The need for reliable evaluated nuclear data is true across all user communities**
  - **<u>Neutron induced reactions for isotope production</u>**

- **Isotope Production is not limited to neutron induced reactions**
- **At best charged particle data is old**
- **Many times it is non-existent**
  - **<u>Charged particle Evaluated Nuclear Data File or ChENDF</u>**
    - Evaluated Reliable Resource
    - Underpinned by predictive codes

Summary

- **DOE IP has, and will continue to have, significant nuclear data needs requiring investment from it's R&D portfolio.**
- **Our investments have a direct impact on the products and services that we are able to provide.**
- **Pathways exist for programs to partner with us to accelerate and/or add scope to our ongoing activities.**


Thank You!