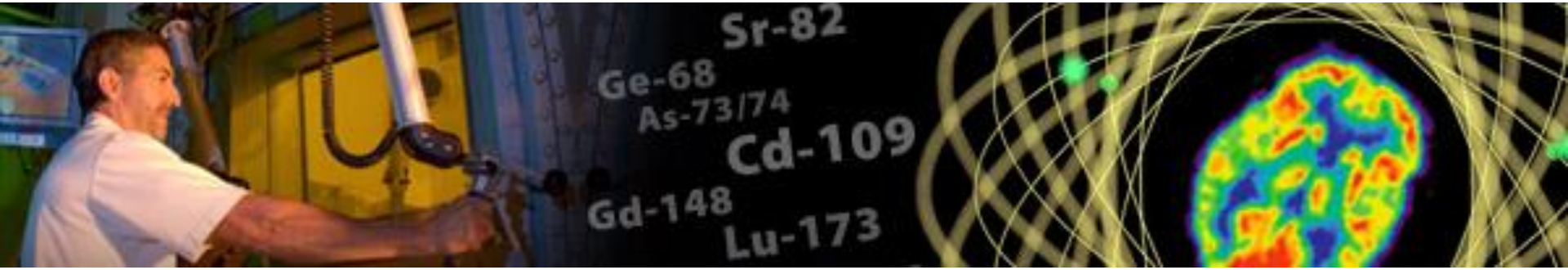
Isotope Program
U.S. Department of Energy

DOE Isotope Program Update



Workshop on Applied Nuclear Data Activities (WANDA)
March 4, 2020

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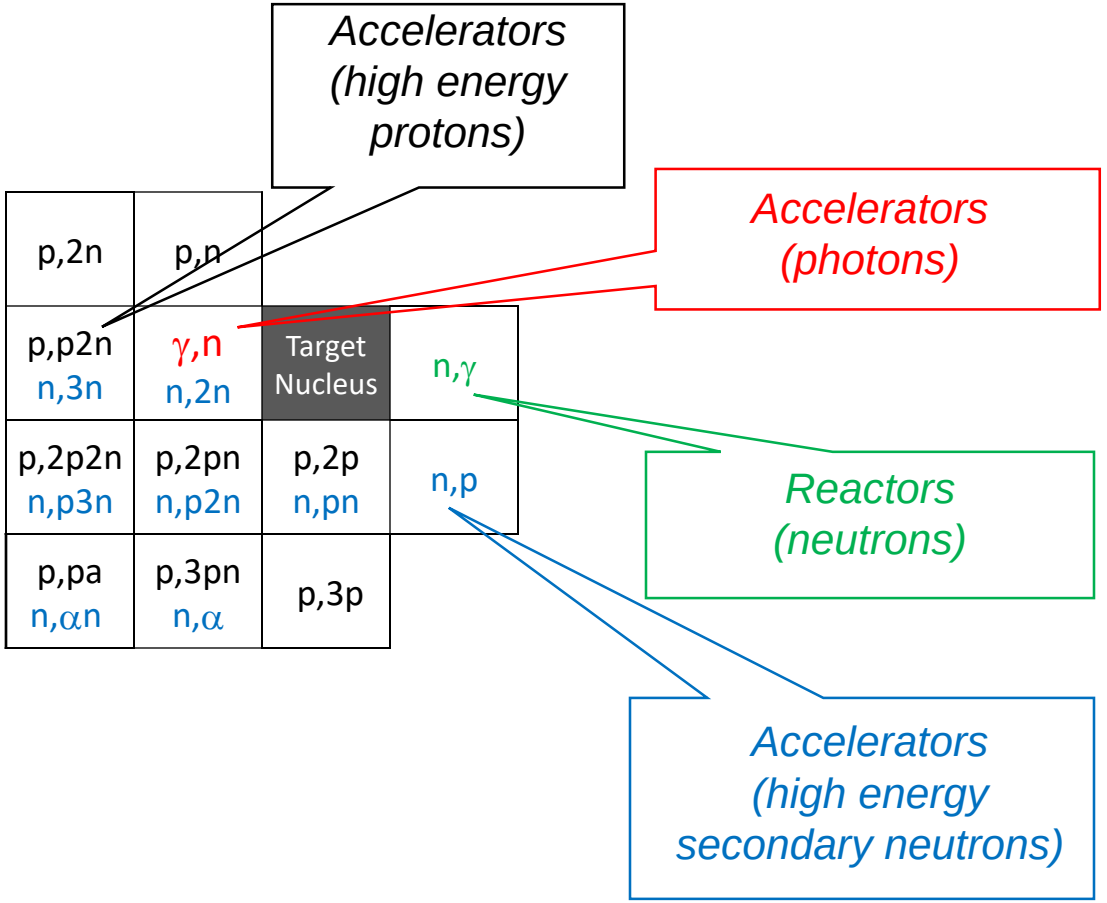
Office of Nuclear Physics, Office of Science, U.S. Department of Energy

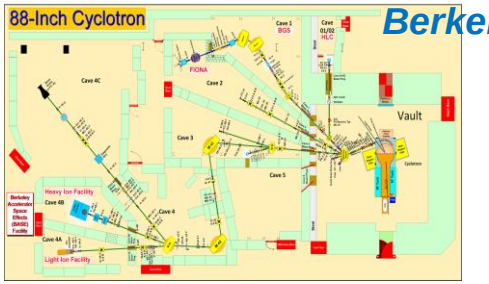
Cross Section Needs Are Extensive

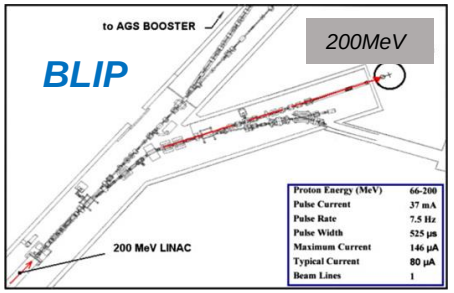
- **Cross sections for reactor production**
  - **Effective cross sections**
  - **Excitation functions**
- **Energy resolved cross sections for accelerator production with**
  - **High energy protons**
  - **High energy neutrons**
  - **Photons**



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)**





Recent and 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

Setting the Stage for This Morning

"The success of an experiment aimed to obtain reliable nuclear data with low uncertainties depends on several factors, one of them being the quality of the used target. The number of studied nuclear reactions, involving radioactive targets, has been constantly increasing during the last two decades. In many cases, the manufacturing and handling of such highly radioactive components is, due to the high-dose rate and activity, very challenging. Additionally, the normally available amounts of material are limited and the requirements from the experimental side are very complex. Therefore, tailormade target designs are nowadays a precondition for high-quality results in the nuclear data field."

-St. Heinitz, et.al. (CHANDA Workshop 2015)

Discussion on target fabrication techniques:

- **What works and more importantly, what doesn't?**
- **Why?**
- **What capabilities exist and at which institutions:**
  - **National Labs?**
  - **Universities?**
- **Where is the knowledgebase located currently?**

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.**
- **Decisions are forthcoming from the FY2019 FOA.**
- **Pathways exist for programs to partner with us to accelerate and/or add scope to our ongoing activities.**
- **From a funding perspective, the answers to targetry issues may exist within the community and that information should be shared.**


Thank You!