Isotope Production at LANL

Meiring Nortier

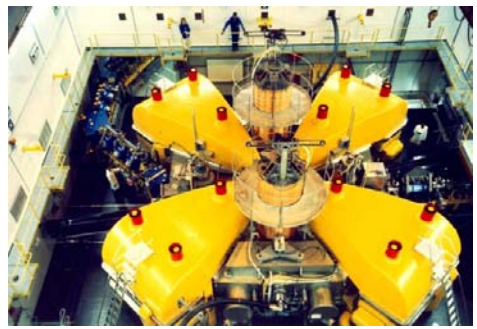
IPF Timeline

- 2000 – 2003: Construction
- 2004: Commissioning
- 2005 – Present: Routine productions

Intermediate Energy Production Facilities - Worldwide

- LANL, USA – 100 MeV
- BNL, USA – 200 MeV
- INR, Russia – 160 MeV

- iThemba, South Africa – 66 MeV
- PSI, Switzerland – 72 MeV
- TRIUMF, Canada – 500 MeV, 70 MeV

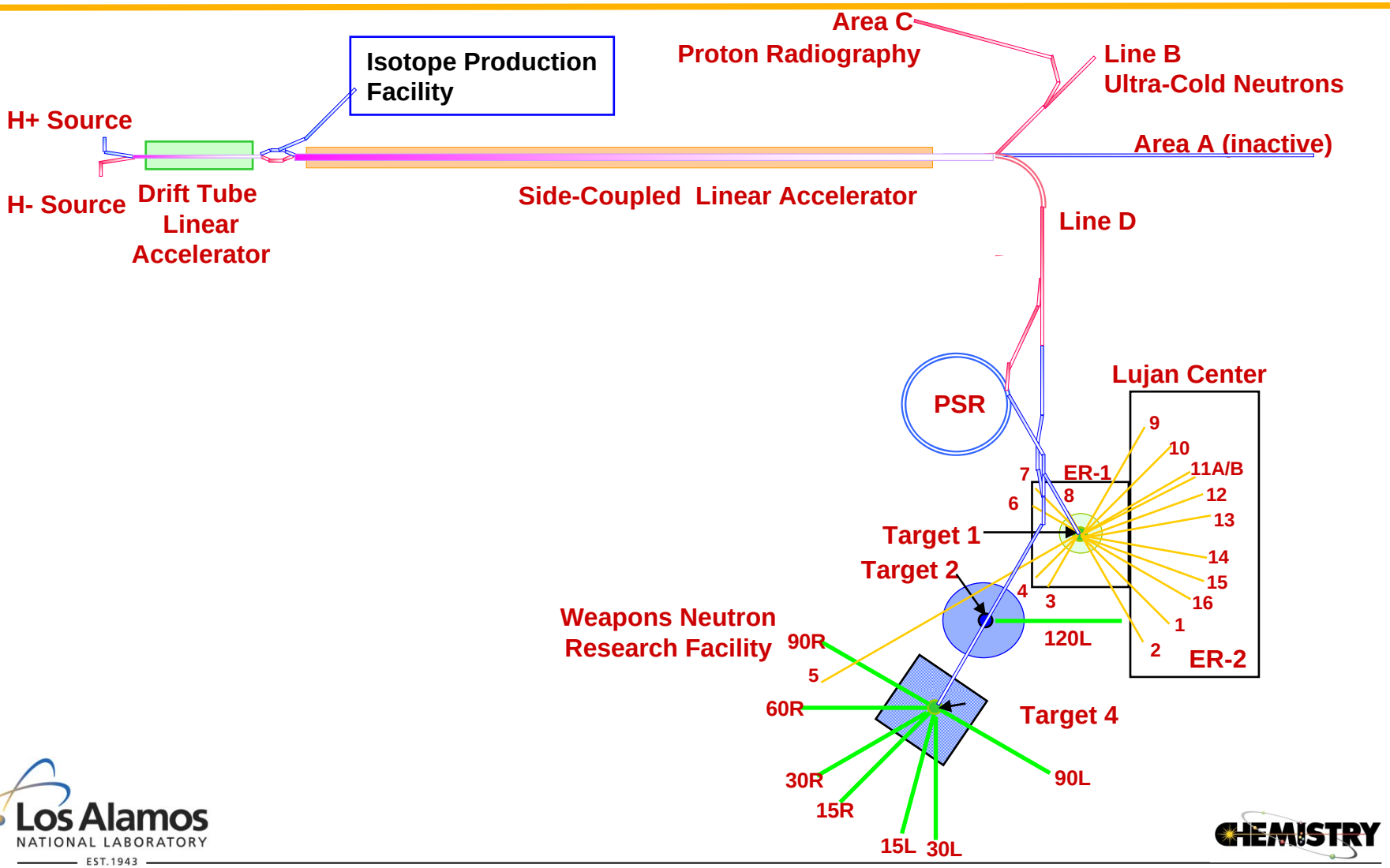


New Facilities

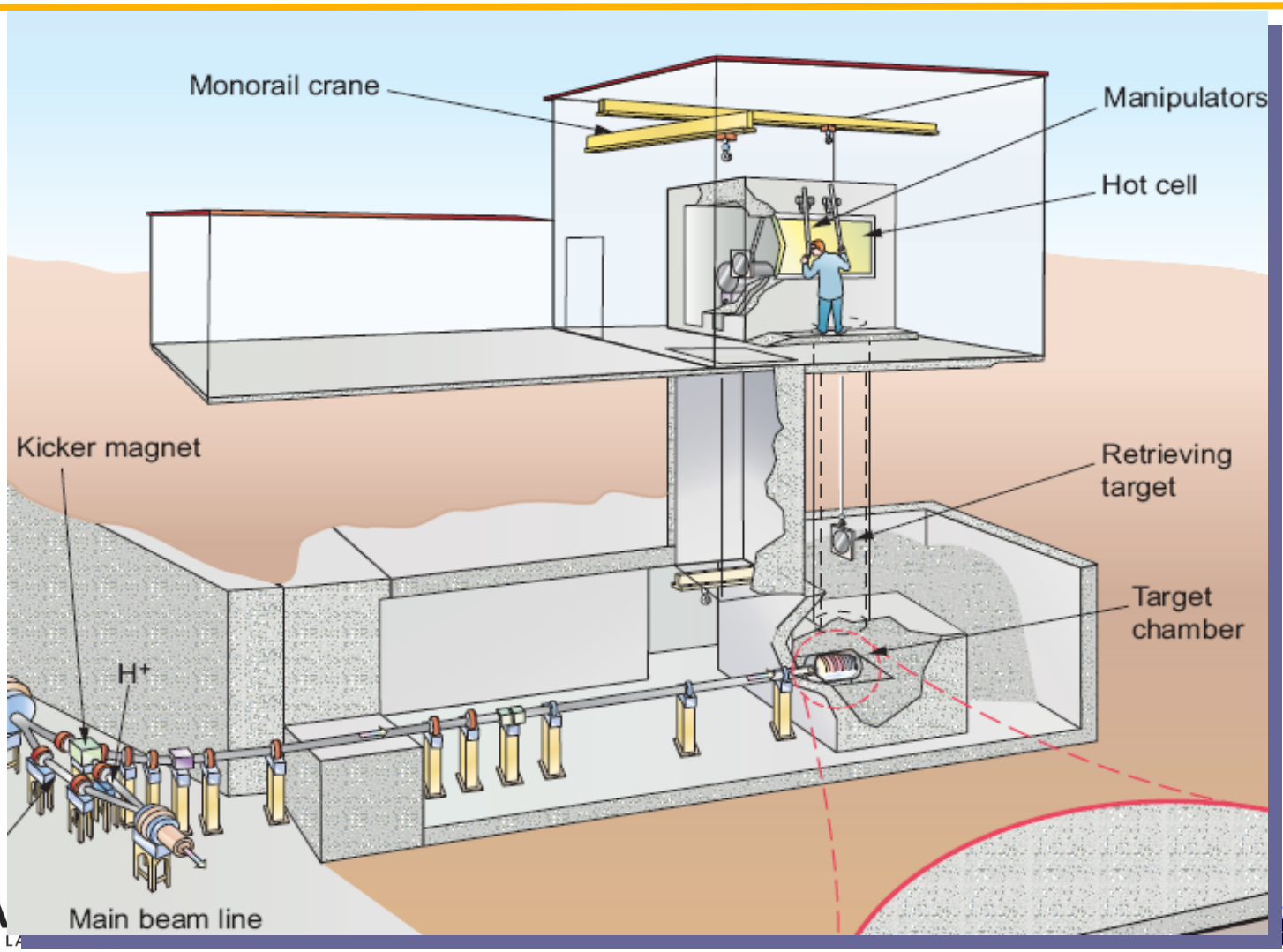
Nantes, France - 70 MeV Cyclotron

Daejeon, Korea – 100 MeV LINAC

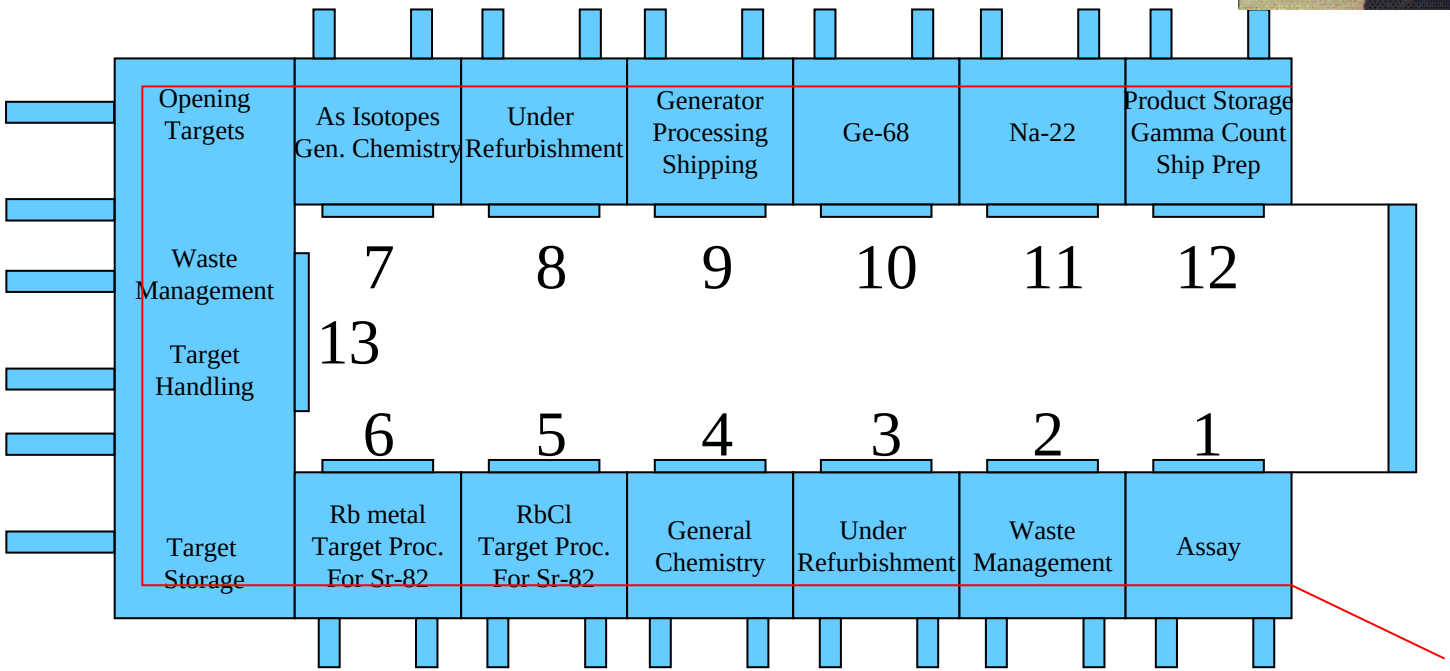
LANL Accelerator Complex Overview



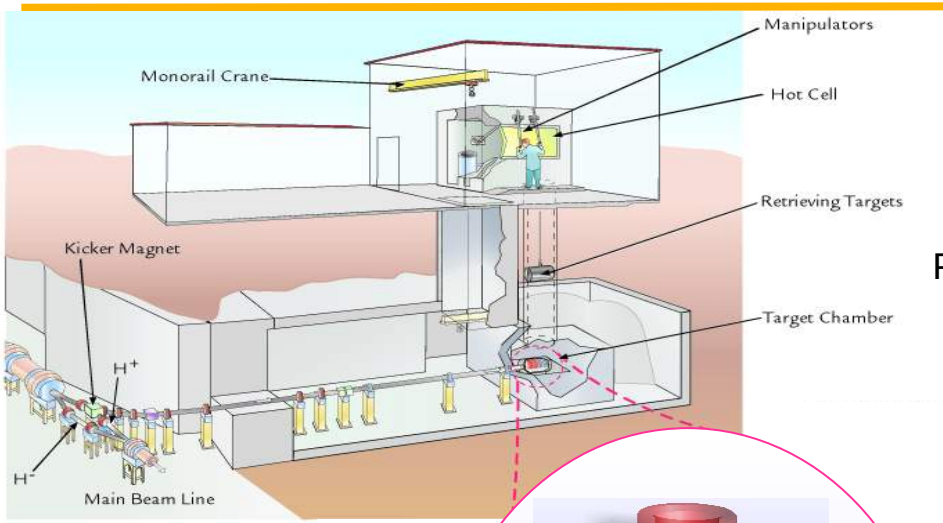
IPF Overview

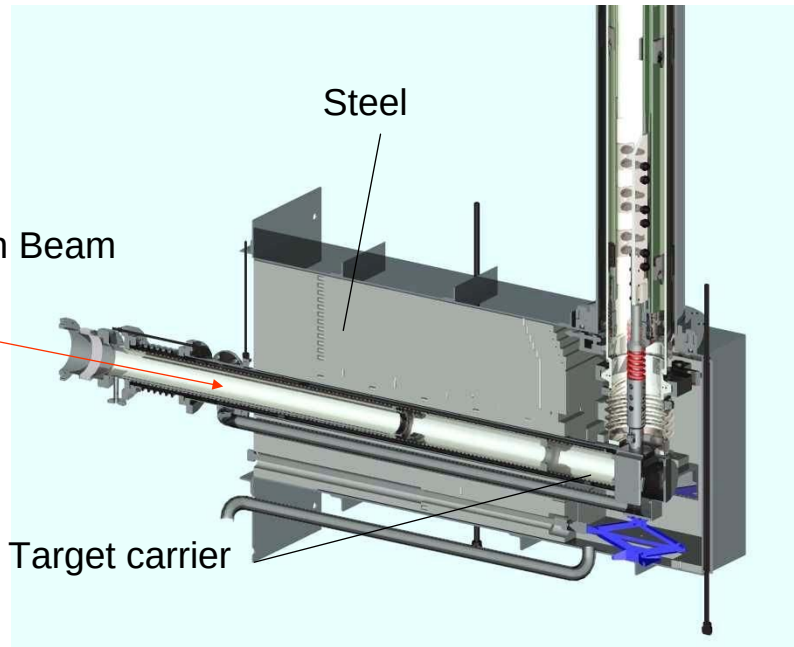


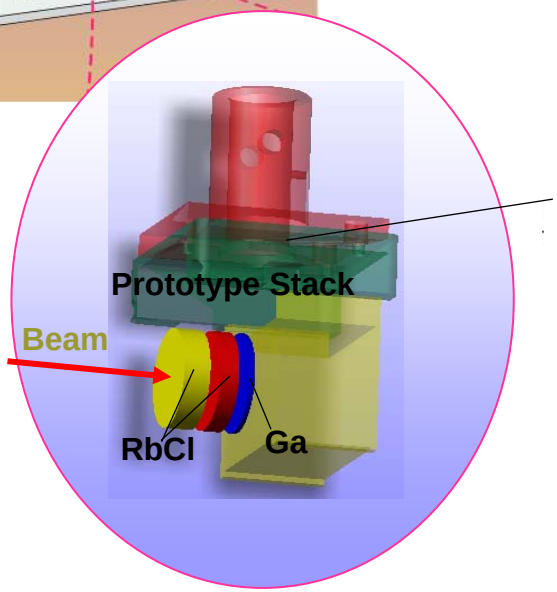
Hot Cells at TA-48



IPF Targets



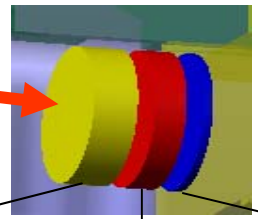


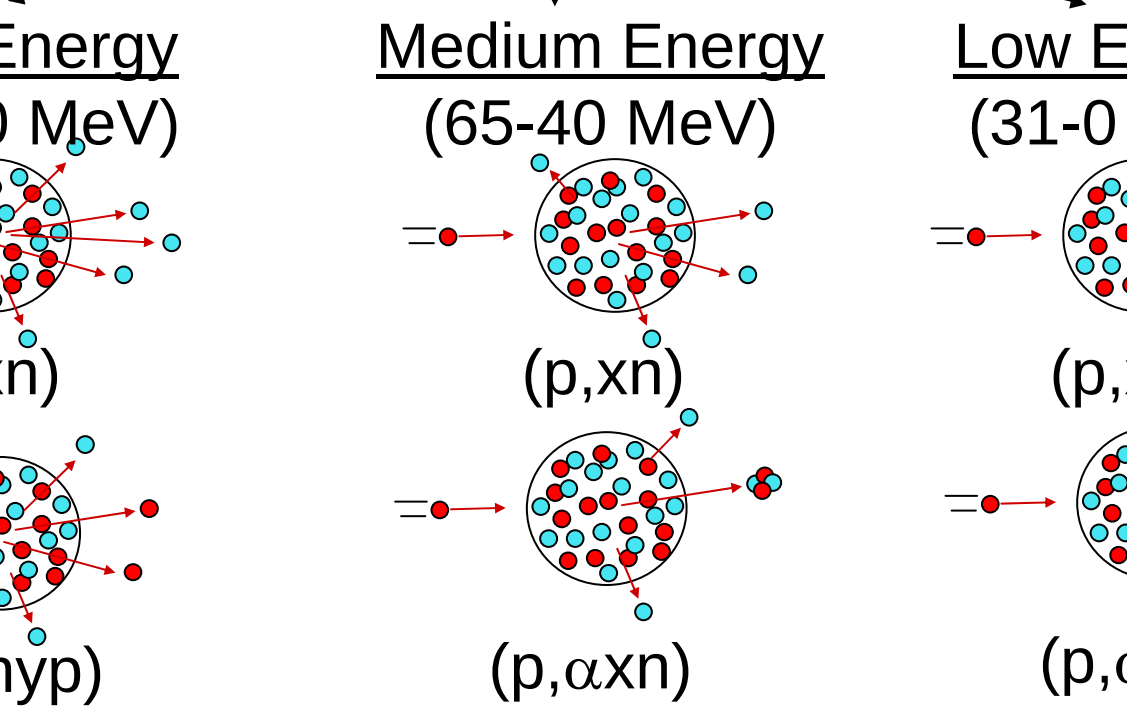


- **Targets are irradiated with 100 MeV protons.**
- **Production occurs simultaneously in 3 energy ranges**

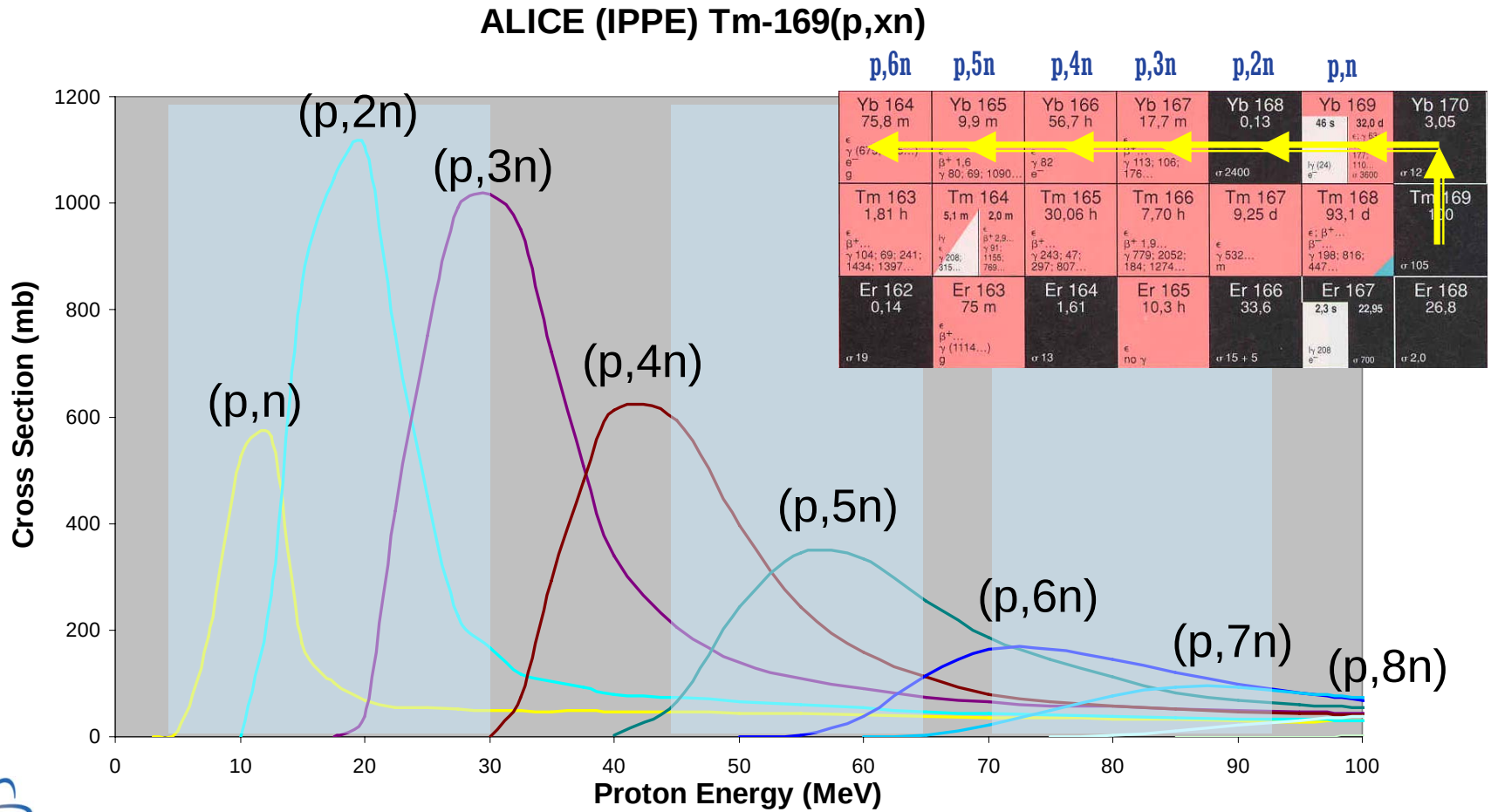
Major nuclear reactions utilized

Beam (100 MeV)

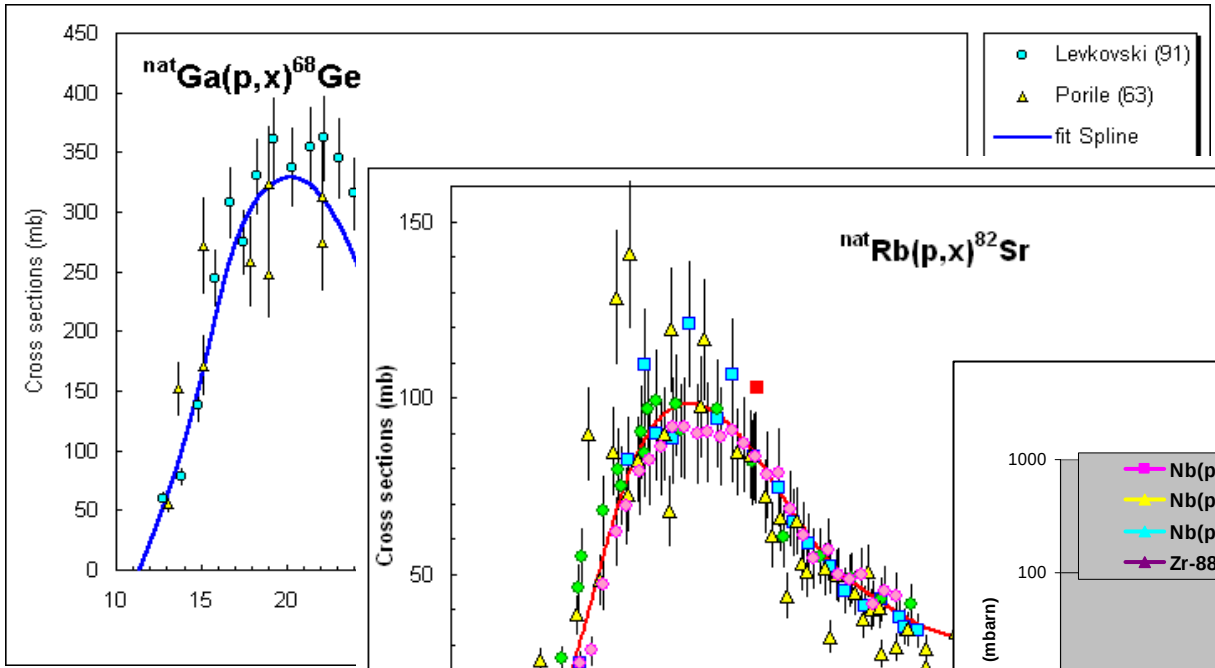


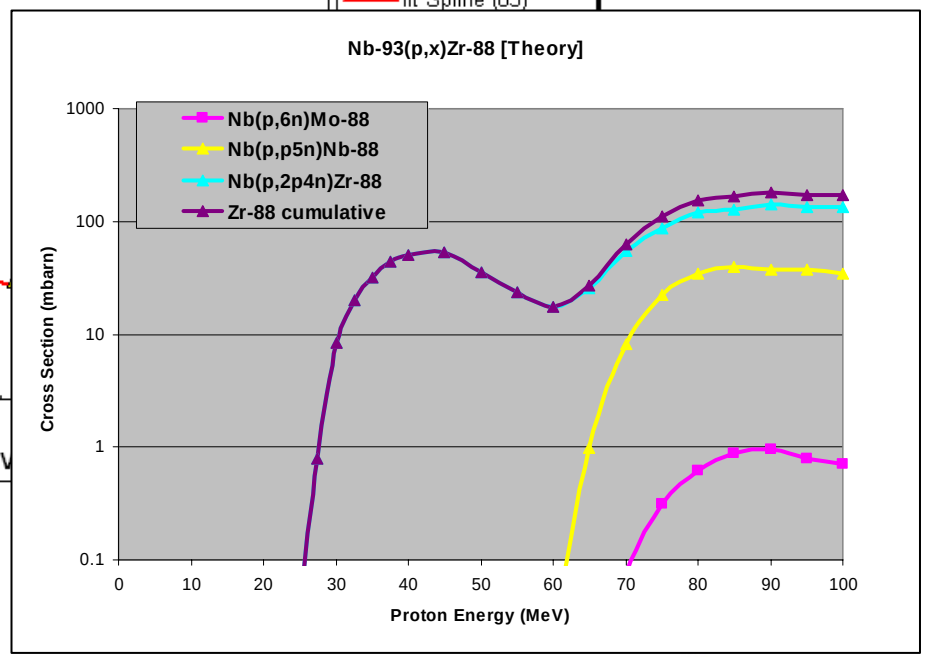


Understanding and controlling PRODUCTION RATES

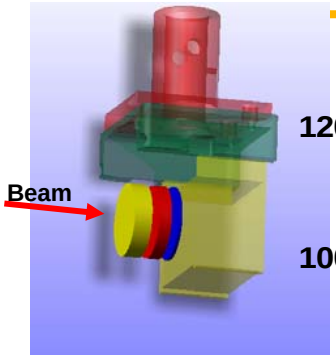


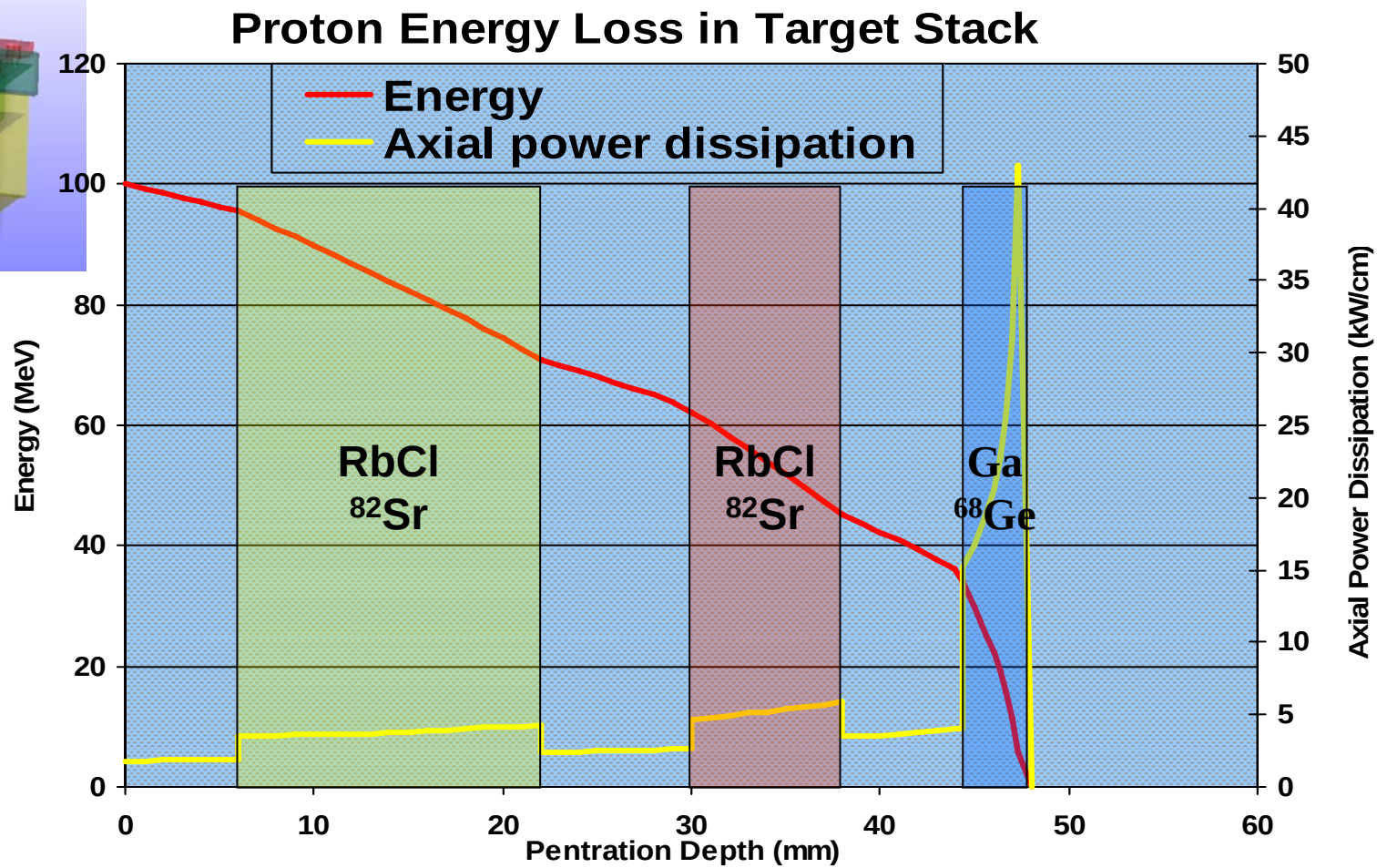
Understanding PRODUCTION RATES
Availability of Excitation Function Data





Energy control – Heat generation

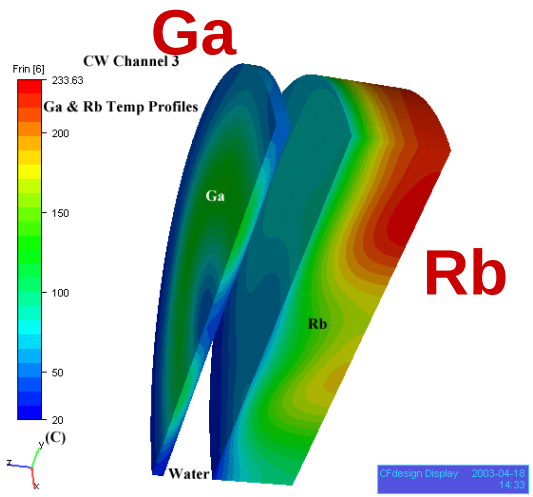


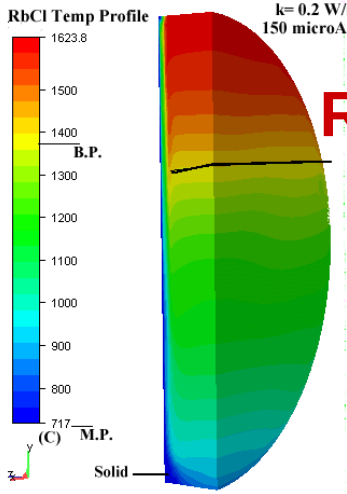


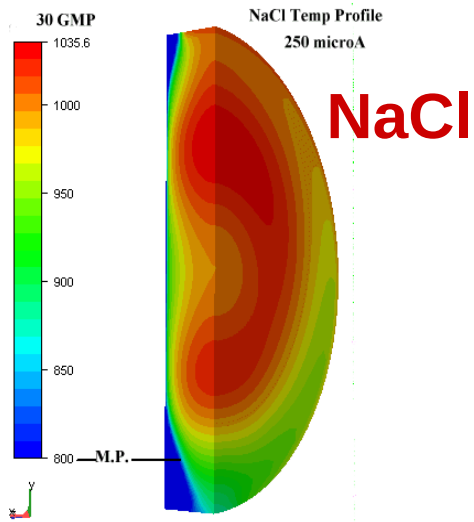
Isotopes produced since 2005

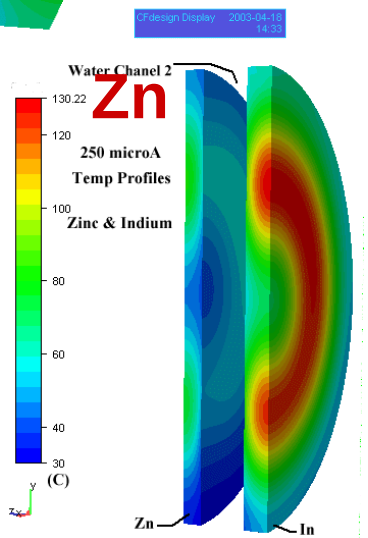
Isotope	Half-life	Main Use
^{22}Na	2.7 y	Positron source in positron beam applications
^{68}Ge	270 d	Positron emitter used in calibration sources for every PET scanner in clinical use
^{73}As	80.3 d	Tracer for toxicology studies
^{82}Sr	25.5 d	Parent of ^{82}Rb used in cardiac perfusion studies with PET
^{88}Zr	83.4 d	Parent of ^{88}Y used as a tracer surrogate for ^{90}Y bio-distribution studies in oncology
^{109}Cd	1.26 y	Low-energy gamma emitter for use in X-ray fluorescence (XRF) spectrometry

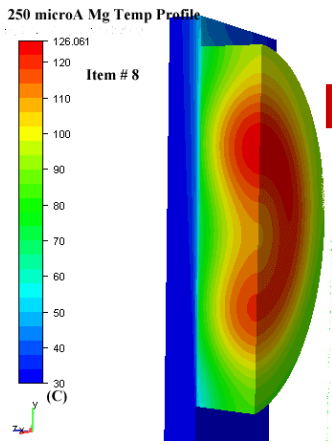
Predicting Target Temperature Distribution





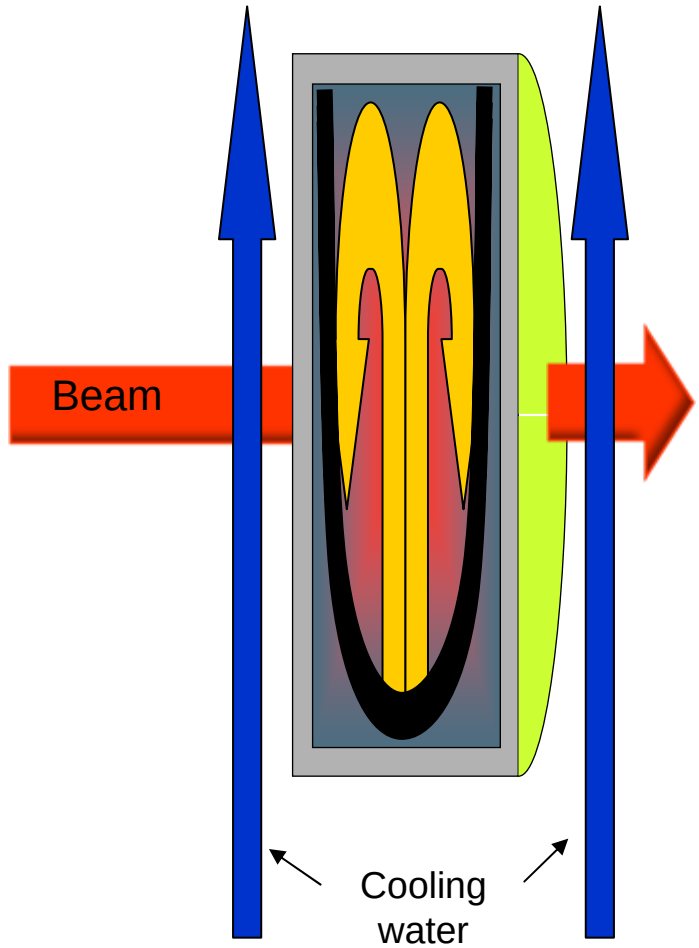






Understanding Target Thermal Processes

- **Complex coupled problem**
- **Material properties are highly dependent on temperature**
- **Solid Target thermal path involves**
  - Conduction
  - Heat transfer coefficient (water film)
- **Molten Target**
  - Buoyancy forces that drive convection
  - Heat transfer coefficient (inside)
- **Partially molten Target**
  - **Volume and shape of the melt**



Comments

- **When directed by the National Isotope Program, the LANL Isotope Program is ready to respond to the radioisotope needs of the user communities.**
- **The production facility is capable of producing SMALL and LARGE quantities of a very wide variety of accelerator isotopes for R&D, clinical and commercial application.**
- **The facility is well positioned to highlight the synergism between the Isotope Program and the Nuclear Physics Program.**
  - One example is the measurement of excitation functions up to 200 MeV to fill in some of the gaps in the nuclear cross section data available from the National Nuclear Data Center (NNDC).