Lawrence Livermore National Laboratory

Isotopes for Nuclear Science at LLNL

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DOE Workshop on the Nation's Needs for Isotopes: Present and Future

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Lawrence Livermore National Laboratory, P. O. Box 808, Livermore, CA 94551

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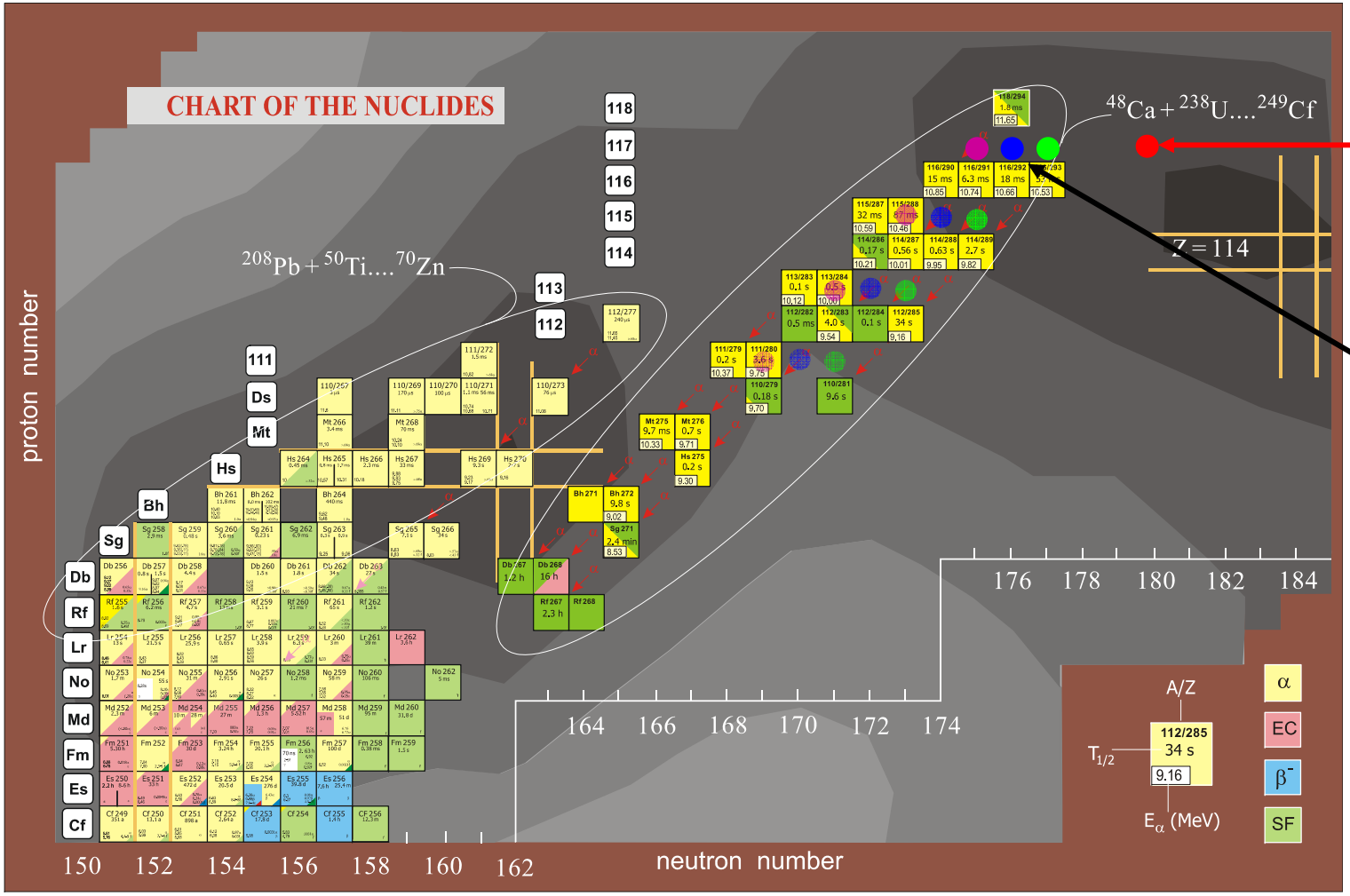
LLNL-PRES-XXXXXX

The ^{48}Ca + ^{249}Bk reaction can be used to produce element 117 for the first time, but target material is difficult to obtain



Compound nucleus

3n evap. channel

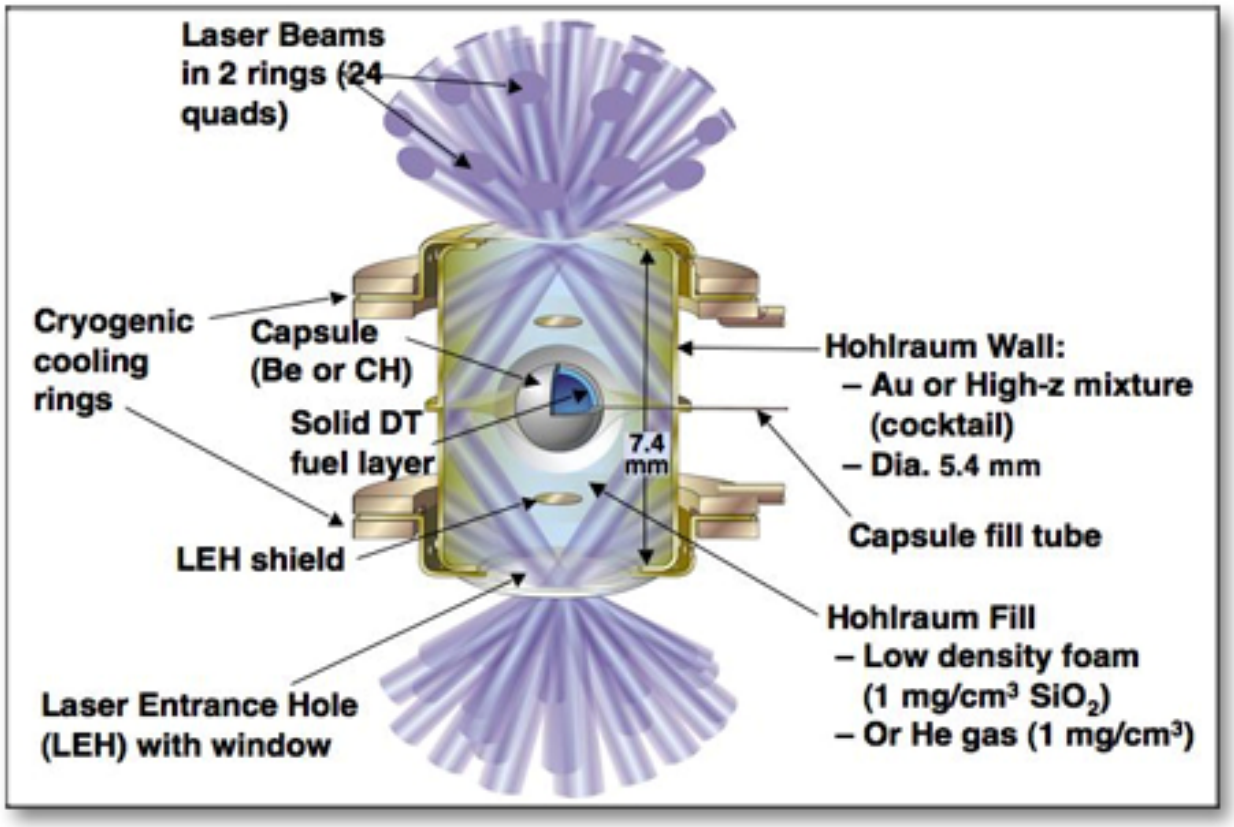
4n evap. channel

5n evap. channel

In the 5n-channel, alpha decay would produce previously studied nuclides

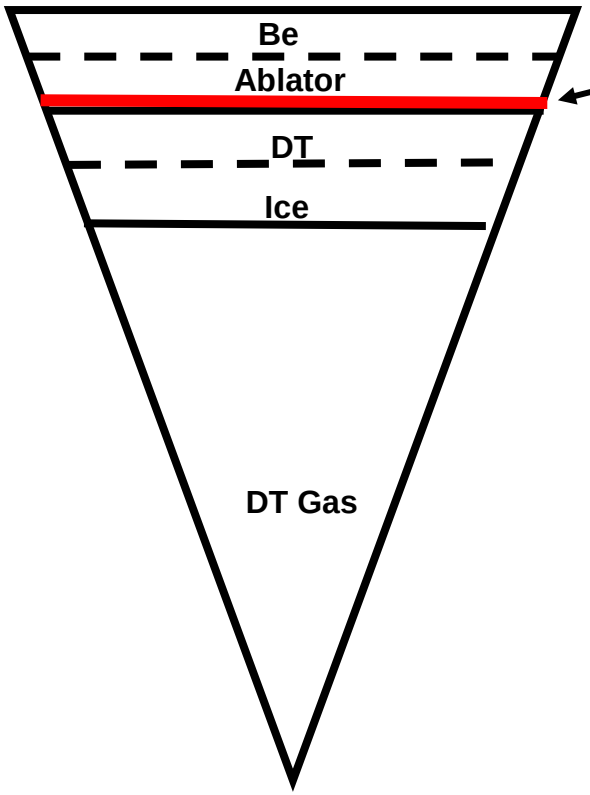
Physical Sciences

A NIF point design capsule consists of a Be/Cu ablator and cryogenically frozen DT fuel



Fusion fuel implosion efficiency is 5-15% and the hohlraum temperature is about 10 keV

To diagnose the performance of the capsule, we position a dopant in the inner part of the ablator, and monitor nuclear reactions on that dopant



Radiochemical dopant

Examples of dopants are ^{18}O, ^{79}Br, ^{127}I, ^{126}Xe, ^{65}Cu, ^{48}Ti, ^{76}Ge

- **The inner part of the ablator is not blown off during the compression phase of the implosion**
- **This location is ideally suited to investigate ablator/fuel mix and is very near the high fluence region of the capsule**
- **We have investigated spatial loadings of dopants for one asymmetry mode (P6), but signal is just as robust with symmetric loadings (for those asymmetries investigated (P6 and P4)**
- **Amounts of dopant are low enough to not affect the implosion (for this location) and are on the order of 1×10^{14} – 1×10^{15} atoms**

We also need to trace the capsule with various isotopes to determine our collection fraction

Physical Sciences

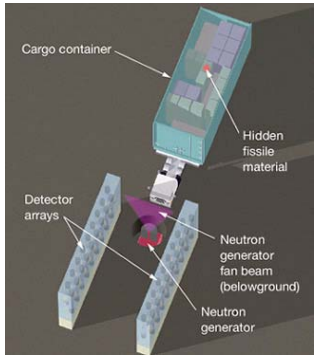
Examples of tracers are ^{22}Ne, ^{38}Ar, ^{82}Kr, ^{130}Xe

^{252}Cf is used for a variety of research and development

Applied

Basic

Testing of neutron detectors used for various applications



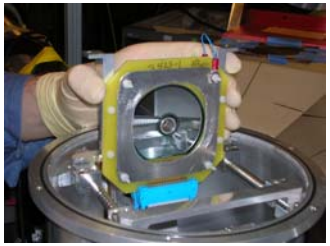
n source

γ-ray source

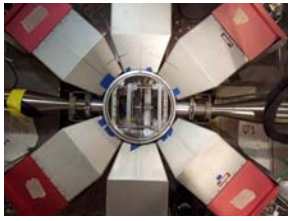
^{252}Cf

fission fragment source

α source

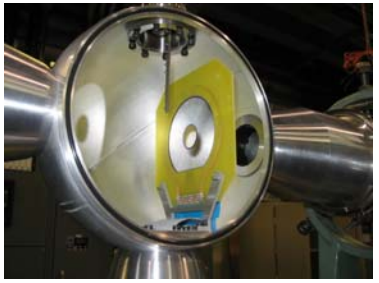


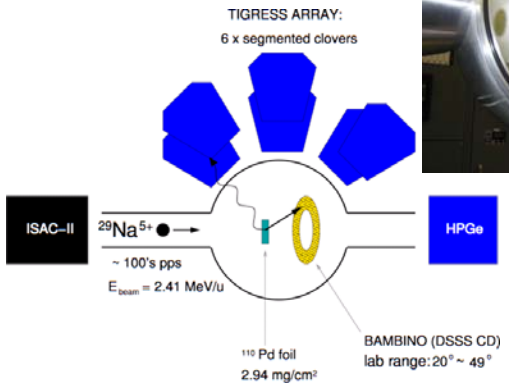
Testing of particle detectors used in surrogates experiments



High-specific activity an advantage; mass-less sources

Improving basic understanding of fission and the nuclear structure of n-rich fission fragments





Testing of particle detectors used in RIB experiments

Physical Sciences