A Retrieval System for Radioactive Target Materials at the NIF

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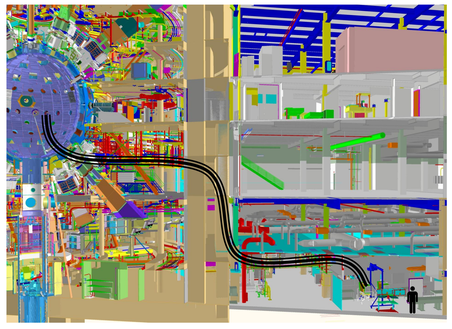
Abstract

Currently, solid radioactive material collection from the NIF target chamber is performed via the DIM. The retrieval process takes several hours to complete. To decrease this time for short lived radioisotopes, the Target Materials Retrieval System (TMRS) is being designed to move a radioactive sample from the target chamber to the counting station in less than 50 seconds, using a closed-loop helium filled RaPToRS system. The TMRS consists of three components: the retrieval apparatus, RaPToRS and the counting station. Starting at 0.5 meters from TCC, the sample will move from the vacuum chamber, travel through 60 meters of 10 centimeter diameter RaPToRS tubes, reaching speeds of 10 m/s. The sample will then arrive at the counting station, where it will be robotically placed in front of a gamma ray detector. The use of helium will decrease background gamma radiation produced by activated N_2 normally found in a pressurized air system.

The National Ignition Facility
Livermore, CA

Proposed Path for TMRS

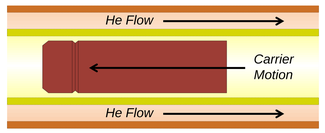


TMRS Overview

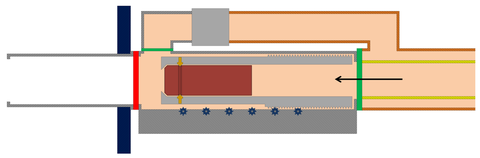
- TMRS – Target Materials Retrieval System
- Consists of three main parts:
  - Insertion Apparatus
  - RaPToRS System
  - Counting Station
- Helium filled closed system
- Able to move sample from TCC to HMMA in under 50 s
- Intended to be installed at port D105
  - Clearance is not ideal
  - May be moved to equatorial plane

Modified RaPToRS System

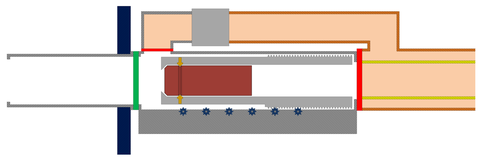
- Rapid Pneumatic Transportation of Radioactive Samples
- Currently operating at US Naval Research Lab
- Modifications for the NIF include:
  - Coaxial transport tube to facilitate a closed He system
    - Inner tube – moves carrier
    - Outer tube – moves return He
  - Specialized sample carrier
  - Alignment/orientation guide
  - Flexible tubing for ease of routing



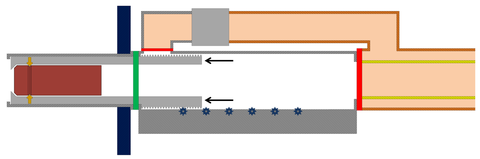
1. Carrier enters → Locked in place



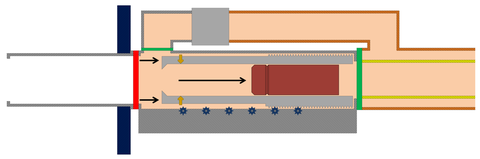
2. Valves close → System pumped down



3. Carrier inserted → Shot fired

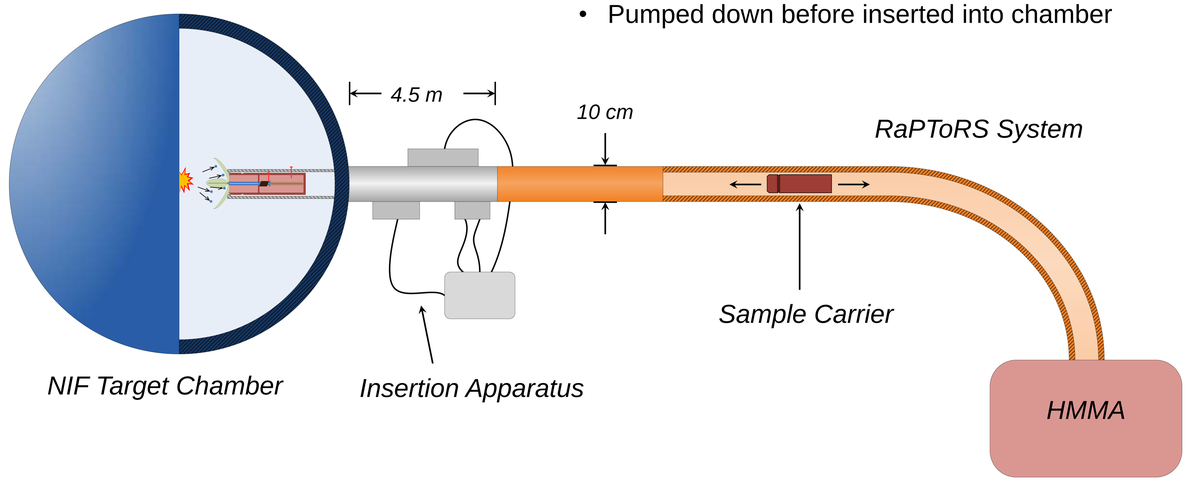


4. Carrier retrieved → RaPToRS engaged → Sent to HMMA



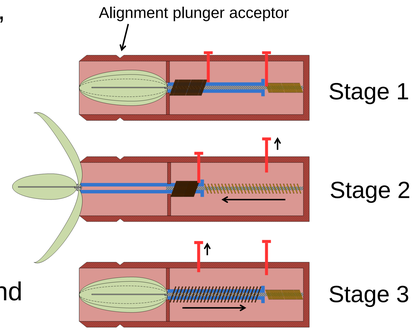
Insertion Apparatus

- Will extend 4.5 m into target chamber
- Possibilities for drive mechanism
  - Direct He flow
  - Belt/chain drive
  - Wheel drive
- Pumped down before inserted into chamber



Carrier Concepts

- Complex sample carrier will be required, unlike current RaPToRS carriers
- Must remotely deploy sample
  - Pneumatically or electrically controlled pins
- Alignment mechanism needed for insertion and counting
  - Guide grove within tube (rotational)
  - Plungers in counting station and insertion apparatus (linear)
- Sample form may include “clamshell”, “umbrella” or static designs



Counting Station

Carrier approaches → Oriented correctly → Inserted to counting station