#### Isotope Production Beamline Commissioning

Revision Number: 1

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Estimated Time to Perform: 1 Days

Document filename: Isotope Beamline Comm. and foil exp, CW 5 kW 32 MeV beam

Procedure Overview

1. Expose gallium-71, vanadium, and nickel foils to 100 W of CW or pulsed beam.
2. Demonstrate 5 kW of beam to a cooled graphite surrogate crucible.

Hazards

1. Radiation activation of the target
2. Pinch hazards of the target removal system.

Prerequisites

1. LERF accelerator checked out and able to run 160 µA 32 MeV beam to the 1X target with no losses indicated on the beam loss monitors.
2. All isotope beamline elements installed and aligned.
3. Isotope beamline diagnostics installed and checked out using hot checkout procedures.
4. All flow and temperature diagostics must be checked out and functional. Flow interlocks must have been verified to trip the MPS back to tune beam.
5. Target system installed and operational but without any gallium. A set of foils taped to a block of graphite will be the first target. The tungsten converter must be in place.
6. ERR must have occurred and all action items must have been addressed.
7. The target hutch must have all shielding installed (both water and iron) and must be closed before operation. Shielding configuration must be signed off by the RadCon group.
8. Beam authorization must be given by the head of acceleration operations for CW beam with 5 kW of beam power. Authorization should be slightly greater than this so that the power can vary up and down a bit.

Beam tests

# Recover setup to 1X target

* 1. If necessary, restore the settings from pulsed commissioning 32 MeV, January 2021 run and cycle all magnets.
  2. Turn on tune beam and adjust the drive laser and cavity 3 phase and laser power to get 11.1 pC charge (52 µA, 400 mV on the BCM) and the correct spots on ITV0F04 and ITV0F06.
  3. Verify that the beam is centered in the injector cryounit, the 0F05, 0F06 the ITV0F01 viewer, and the 1F03, 1F04, 1F05, and 2F01 quadrupole triplets.
  4. Put all the 1F and 2F quads on loop.
  5. Verify that the zone 2 cavities are properly crested using the 1X01 viewer.
  6. Verify that the beam loss is negligible on all BLMs when their voltages are set to at least -1000 V and the current is less than 160 microamps (<560 mV) during the macropulse. If necessary, use the laser buncher gang phase or the 0F quads to reduce losses.
  7. Verify that the spot size and positions and the BPM positions with 208 microamps of beam (600 mV on the injector beam current monitor) are the same as those recorded in the pulsed beam commissioning setup.

# Run 1.5% duty cycle beam to the 1X foil target

* 1. Withdraw all viewers and verify that all vacuum valves are open and magnets are on loop.
  2. Verify that the BLMs are unmasked and that the losses are negligible when running 208 microamps pulsed tune beam (use the AMS to monitor the BLM signals during the macropulse).
  3. Set up strip tools for the vacuum in the 1F, 2F and 1X regions and the current from the gun and BCM.
  4. Switch to beam mode 7 (CW beam capable) and slowly increase the duty cycle while monitoring the vacuums in the 1F and 1X beamlines. When 1.5% duty cycle is reached (1 msec at 60 Hz), verify that the vacuum levels are fine.
  5. Allsave this configuration “100 W beam to 1X dump at 32 MeV”.
  6. Run for 60 minutes. Shut down the beam.
  7. Wait for 60 minutes. Do a controlled access shutdown.
  8. Have Radcon survey the radiation levels around the 1X dump and recover the foils. They will transport the foils to the Radcon lab in a lead pig via a golf cart.

# Surrogate crucible tests

* 1. Radcon will install the graphite surrogate crucible in place of the graphite block with the foils. Close up the hutch and exit the vault. Go to Beam Permit.
  2. Bring tune beam back up again with 156 µA (5600 mV on the BCM) and verify that the spot sizes and positions are the same as for the 156 µA setup.
  3. Withdraw all viewers and verify that all vacuum valves are open and magnets are on loop.
  4. Verify that the BLMs are unmasked and that the losses are negligible when running 156 microamps pulsed (use the AMS to monitor the BLM signals during the macropulse).
  5. Set up strip tools for the vacuum in the 1F, 2F and 1X regions and the current from the gun and BCM.
  6. Allsave the configuration as “CW beam to 1X dump at 32 MeV”
  7. Switch to beam mode 7 (CW beam) and slowly increase the duty cycle while monitoring the vacuums in the 1F and 1X beamlines. When 6% duty cycle is reached, verify that the vacuum levels are fine. Lower the current to 3 µA and go CW. Raise the CW current to 156 µA (560 mV on the BCM).
  8. Run for 20 minutes or until temperatures have equilibrated, whichever is longer.
  9. Shut down the beam. Wait for at least one hour.
  10. Have someone from the RCG remove the graphite surrogate crucible. Look for evidence of damage and take photos. Send the photos and temperature data to ERR committee.

# Backout procedure

* 1. Restore the settings from the last allsave that reached the 1X dump or the settings from September 18, 2020.
  2. Perform a weekend shut-down procedure.

# Task complete.