

---

## Hall D Ion Chamber Calibration Procedure

---

**Document Number:** MCC-PR-XX-XXX

**Revision Number:** Rev. 1b2; **DRAFT**

**Technical Custodian:** Mike McCaughan

**Estimated Time to Perform:** 1 hour

### Procedure Overview

---

This procedure establishes the process for determining appropriate ion chamber setpoints for CW beam delivery to Hall D. Beam-based ion chamber response data are gathered at several low-current CW test points, and because ion chamber response is largely linear with respect to beam current, higher-current setpoints are then extrapolated by plotting the data points. All Hall D ion chambers are physically located in the Hall D Tagger Vault; [Figure 1 on page 5](#) shows the ion chamber locations.

Ion chamber setpoints vary depending on beam current, beam energy, the type of physics target, and the beamline configuration. Whenever there is a significant change in at least one of these variables, new ion chamber setpoints must be entered to provide appropriate machine protection. The new setpoints can be determined using this procedure, or if existing data are available, derived from previous data sets.

### Prerequisites

---

1. The [Hall D Ion Chamber Functional Test Procedure](#) must be performed first, before this calibration procedure, if any of the following are true:
  - Since the last functional test, the Hall D ion chamber locations have changed *or* ion chamber hardware has been replaced.
  - Since the last functional test, there have been beamline changes or other hardware changes in the hall that might shield the ion chambers.
2. The Hall D amorphous radiator is out of the beamline, and the goniometer is set to an empty target/no radiator position.
3. Tune-Mode beam transport has been optimized up to the Hall D beam dump.

**NOTE:** When beam transport to the dump is optimized, Tune-Mode beam should produce very little ion chamber activity.
4. Open the *Hall D Ion Chambers – Expert* screen (**JTabs**⇒**Operations**⇒**Radcon**⇒**Hall D Ion Chambers**⇒**Expert**).



5. Ion chamber trip points in Hall D have been set to ~10% above noise level/background with beam OFF.

## Procedure Steps

---

### 1.0 Setup Steps

1. Perform an Allsave and include the comment “*Before Hall D Ion Chamber Calibration*”.
2. Make a screen shot of the *Hall D Ion Chambers - Expert* screen and attach it to a running ELog entry that includes the key words “*Starting Hall D Ion Chamber Setpoint Calibration*”.
3. Using Max Video, open ITVAD00 (the Hall D dump image) on the control room video wall, and verify that you can see the dump by turning the dump light ON and OFF.
4. Contact Hall D and ask them
  - To verify that their amorphous radiator and all other insertable devices that can intercept beam are out of the beamline, and
  - To verify their goniometer is set to an empty target/radiator position.

---

**CAUTION:** Check the Operational Restrictions for any beam-current limits. Make sure you do not exceed these limits while performing the following procedure.

---



### 2.0 Calibrating the Ion Chambers

1. Establish 3  $\mu\text{A}$  Tune-Mode beam to the Hall D dump. Is the beam visible on the dump viewer, ITVAD00?

**NOTE:** The Hall D dump viewer *does not* work with CW beam.

- YES NO** → **A.** If beam has already been centered on the dump previously using the ion chamber readbacks and other diagnostics for these same beam conditions *and* the Director of Operations has granted approval, then continue with this procedure; otherwise go to the [Hall D Beam Delivery Procedure](#) and center beam on the dump using the process described in that document before continuing with this procedure.

2. Set up 1  $\mu\text{A}$  CW to the Hall D dump.
3. Open the Hall D Ion Chamber Calibration Spreadsheet (an Open Office document) (**J**Tab**s**⇒**O**perations⇒**R**adcon⇒**H**all D Ion Chambers⇒**E**xpert⇒**C**alibrate Plot).
4. Using the spreadsheet, record the present readbacks for all Hall D ion chambers (these are the baseline values without a target). Save the spreadsheet in the present directory, including your user name and the date in the file title (e.g., Hall\_D\_Calibration\_Spreadsheet\_“username”\_mm-dd-yy.ods). You will attach the file to an ELog entry at the end of this procedure.

5. Stop beam and contact Hall D and ask them
  - To insert the radiator they will be using during physics beam delivery. In the spreadsheet, record which radiator they are using.
6. Re-establish **50 nA CW** to the dump.
7. Record *all* of the Hall D ion chamber readbacks at 50 nA.
8. Increase the beam current to **100 nA CW**.
9. Record *all* of the Hall D ion chamber readbacks at 100 nA.
10. Increase the beam current to **500 nA CW**.
11. Record *all* of the Hall D ion chamber readbacks at 500 nA.
12. If the readback for any ion chamber is >100 rad/hr., increase the trip point for that ion chamber to 1,000 rad/hr.
13. Increase the beam current to **1  $\mu$ A CW**.
14. Record *all* of the Hall D ion chamber readbacks at 1  $\mu$ A.
15. Increase the beam current to **1.5  $\mu$ A CW**.
16. If the readback for any ion chamber is >100 rad/hr., increase the trip point for that ion chamber to 1,000 rad/hr.
17. Record *all* of the Hall D ion chamber readbacks at 1.5  $\mu$ A.
18. Terminate beam to Hall D.
19. For each ion chamber, the spreadsheet creates a correlation plot of the beam current vs. the ion chamber readback. The graphed results should be very close to linear.

**NOTE:** Although the ion chamber response should be close to linear, it is typical for the rad/hr vs. beam current to *decrease* slightly as beam current increases. If the response is non-linear and *increasing*, there may be beam transport or beam position problems. Check all beam quality indications for signs of trouble. Do not proceed if there is any indication of an undiagnosed beam quality issue.
20. Referring to the spreadsheet, for each ion chamber, determine the setpoint that corresponds to the intended beam delivery current. Set each ion chamber Trip Dose Rate to the appropriate value (the spreadsheet-calculated value is already 10% greater than the anticipated trip point for the intended beam delivery current). Do this for *all* of the ion chambers.
21. Make an ELog that includes the key words “*Hall D Ion Chamber Setpoint Calibration Results*”, and attach the spreadsheet, including the plots for each ion chamber. Leave the ELog entry open for now.
22. Proceed to Section 3.0, below.



### 3.0 Testing the New Setpoints and Final Calibration

1. Verify that the ion chamber setpoints calculated in [Step 20 on page 3](#) have been entered as the actual setpoints.

2. Establish CW beam to the Hall D dump at the intended physics beam delivery current, with the physics radiator IN. Were you able to reach the desired current without an ion chamber trip?

**YES** **NO** →

Go to  
[Step 3](#)

- A. Increase the setpoint of the ion chamber that caused the trip, but limit the increase to 20% of the value shown on the spreadsheet.
- B. Attempt to re-establish CW beam at the intended physics beam delivery current. Were you able to reach the desired current without an ion chamber trip?

**YES** **NO** →

Go to  
[Step 3](#)

- C. Increase the setpoint of the ion chamber that caused the trip but limit the increase to 30% of the value shown on the spreadsheet.
- D. Attempt to re-establish CW beam at the intended physics beam delivery current. Were you able to reach the desired current without an ion chamber trip?

**YES** **NO** →

Go to  
[Step 3](#)

- E. If it was a different ion chamber that tripped, then repeat Step A, above; otherwise, contact the MCC Operations Group Leader.

---

**CAUTION:** Do not increase an ion chamber's trip point more than 30% of the value shown on the spreadsheet.

---

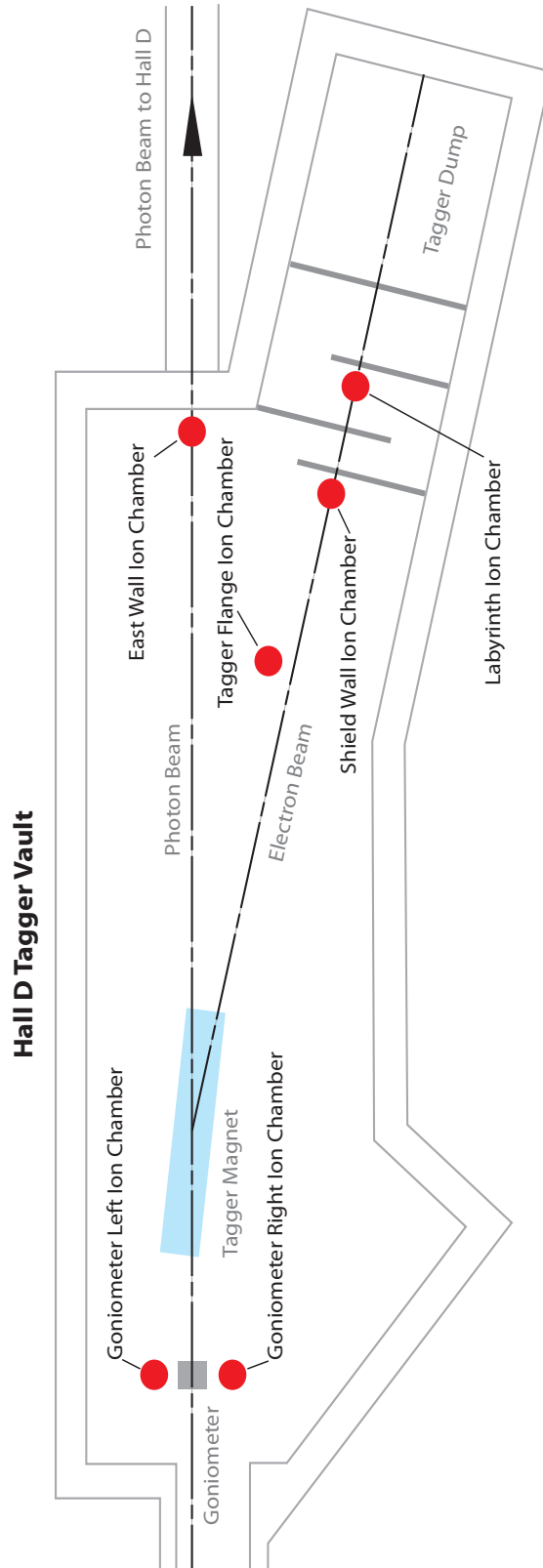


3. Add a screen shot of the *Hall D Ion Chambers - Expert* screen to your ELog entry.
4. Contact Hall D and ask them to remove the target.
5. Establish 1  $\mu$ A CW to the Hall D beam dump. Are the present ion chamber read-back values within 30% of the baseline values recorded earlier in [Step 11 on page 3](#)?

**YES** **NO** →

- A. Check for scraping and optimize beam transport.
6. Complete your ELog entry.
7. Perform an Allsave and include the comment "After Hall D Ion Chamber Calibration".
8. PROCEDURE COMPLETE.

# Appendix A - Hall D Ion Chamber Locations



NEXT PAGE

BACK 1 PAGE

1ST PAGE

Figure 1: Hall D Ion Chamber Locations