

2.5.2.2 Testing Safety Envelope Procedure for Coherent Electron Cooler (CeC) Testing at Low Power (≤ 1 W) in RHIC

1. Purpose

- 1.1. This procedure assigns responsibility for maintaining the safety envelope for CeC low-power testing at IP2 and for implementing additional controls in Section 5 of this procedure. Low power testing safety relies on the implementation of the [OPM 2.5.2 RHIC Accelerator Safety Envelope](#) and these additional controls. Additional controls for low-power testing are described in the [USI for CeC Low-Power Testing](#).

CAUTION:

OPM 2.5.2 defines a set of limits for CeC commissioning or operations **BUT DOES NOT DEFINE LIMITS** for low-power testing. **Low-power testing limits are**

- Electron kinetic energy shall be limited to 25 MeV
- The electron beam power in all conditions shall be limited to 1 W averaged over 1 hour
- Simultaneous operation with RHIC may only occur with electron beam in the abort gap
- If electron beam is not injected into the abort gap, then hadron beam in Blue ring will be prohibited
- If electron beam is not injected into the abort gap, then no more than 12 ion bunches in Yellow ring with nominal intensity not exceeding 10^9 ions per bunch and total intensity of 12×10^9 ions

- 1.1 Additionally, the RHIC Collider and experiments are limited by ESH requirements established by the C-A Radiation Safety Committee (RSC), the C-A Accelerator Systems Safety Review Committee (ASSRC), and the C-A Experimental Safety Review Committee (ESRC). When applicable, C-A safety-committee requirements are documented in RSC, ASSRC, and ESRC Checkoff Lists in the Main Control Room (MCR). These Checkoff Lists, when applicable to the CeC PoP Experiment low power testing, must be completed before allowing beam in CeC PoP Experiment.
- 1.2. A variation beyond the boundaries of the additional controls described in this procedure shall be evaluated as a Reportable Occurrence. Notifications of occurrences shall be made according to [C-A OPM 10.1](#).

2. Responsibilities

- 2.1. The C-A Department Chairman must approve all changes to this procedure.

2.2 The following individuals have responsibilities for each of the low-power testing controls as specified in Section 5 of this procedure:

- 2.2.1 C-AD Associate Chair for ESSHQ
- 2.2.2 C-AD ESSHQ Division Head
- 2.2.3 C-AD On-Duty CeC PoP Experiment Shift Leader
- 2.2.4 C-AD Access Controls Group Leader
- 2.2.5 C-AD Training Manager

3. **Prerequisites**

None

4. **Precautions**

None

5. **Procedure**

CAUTION:

1. In all cases, if personnel at CeC Low-Power Testing come across an Unreviewed Safety Issue (e.g., unreviewed CeC modification, operations outside the safety envelope, etc.), then startup or restart of the activity requires DOE approval. Contact the C-AD ESSHQ Associate Chair or Division Head for assistance.
2. If CeC Low-Power Testing is shut down by C-AD management for safety reasons, then contact the C-AD ESSHQ Associate Chair or Division Head for assistance with requirements for restart of the activity.

5.1 CeC PoP Experiment Low-Power Test Beam Control

- 5.1.1 The C-AD Training Manager must ensure laser operators; MCR operators and CeC PoP Physicists have completed training requirements for CeC PoP Testing.
- 5.1.2 The on-duty CeC PoP Experiment Shift Leader must ensure control of the beam power at or less than 1 W through the setting of the photocathode drive laser, pulse energy and repetition rate. These settings must be under configuration control.
- 5.1.3 The on-duty CeC PoP Experiment Shift Leader must ensure control of electron kinetic energy to less than or equal to 25 MeV.
- 5.1.4 The on-duty CeC PoP Experiment Shift Leader must ensure control of the electron beam power in all conditions to less than or equal to 1 W averaged over 1 hour.

- 5.1.5 If electron beam is not injected into the abort gap, then the on-duty CeC PoP Experiment Shift Leader must ensure simultaneous testing with CeC beam occurs only with ion beam circulating in Yellow RHIC ring
 - 5.1.6 If electron beam is not injected into the abort gap, then the on-duty CeC PoP Experiment Shift Leader must ensure hadron beam in Blue ring will be prohibited during testing with CeC PoP Experiment beam
 - 5.1.7 If electron beam is not injected into the abort gap, then the on-duty CeC PoP Experiment Shift Leader must ensure no more than 12 ion bunches in Yellow ring with nominal intensity not exceeding 10^9 ions per bunch and total intensity of 12×10^9 ions.
 - 5.1.8 If low-power tests occur during simultaneous operation with RHIC, then the on-duty CeC PoP Experiment Shift Leader must ensure electron beam is injected only into the abort gap.
 - 5.1.9 During the low-power testing period, the on-duty CeC PoP Experiment Shift Leader must confirm a collision of hadron beam circulating in Blue RHIC ring with a single electron bunch from CeC accelerator does not affect hadron beam
- 5.2 Radiation Shielding
- 5.2.1 Before each RHIC run, beam or other radiation producing operations (e.g. RF testing), the CeC PoP Experiment Shift Leader or his designee must verify that all shielding (e.g. shield blocks in or around penetrations, etc.), are properly in place and configuration controlled.
- 5.3 Access Controls during Operations with Beam or RF Cavity Testing
- 5.3.1 The Access Controls Group Leader must ensure that the relevant Access Controls System (ACS) configuration control and maintenance is in accordance with [C-A OPM 4.91](#). This means that relevant portions of the ACS must be functional if they are preventing exposure to CeC PoP Experiment beam-testing radiation or CeC PoP Experiment RF-generated x-rays inside enclosures, and the ACS must remove beam, or turn off RF, when excessive beam loss or x-ray dose occurs.
- 5.4 RHIC ASE
- 5.4.1 The on-duty CeC PoP Experiment Shift Leader must ensure the relevant portions of the RHIC ASE procedure, [OPM 2.5.2 Accelerator Safety Envelope Credited Controls and Supports for RHIC](#), are implemented during CeC PoP Experiment low-power testing.

6. Documentation

6.1 RSC CeC Low Power Testing RSC Checkoff List

7. References

7.1 [C-AD SAD with Associated USIs.](#)

7.2 [Accelerator Safety Envelope for RHIC.](#)

7.3 [OPM 2.5.2 Accelerator Safety Envelope Credited Controls and Supports for RHIC](#)

7.4 [C-A-OPM 10.1, “Occurrence Reporting and Processing of Operations Information”.](#)

7.5 [C-A-OPM 1.10.1, “Procedure for Identifying Unreviewed Safety Issues”.](#)

7.6 [C-A-OPM 4.91, “Configuration Management Plan for the C-A Access Controls System”.](#)

7.7 [CeC Low-Power Testing USI](#)

7.8 [OPM 11.1 Policy for Conduct of Operations for the RHIC Experiment Shift Leaders](#)

7.9 [OPM 2.42 Liaison Engineer, Physicist; Project Engineer and Physicist; Systems Engineer; Liaison Scientist: Roles and Responsibilities for Modifications](#)

8. Attachments

None