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C-A OPERATIONS PROCEDURES MANUAL

6.1.10 ALARA Strategies for Tuning During Proton Operations

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Attachments

Hand Processed Changes

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Approved: _____ *Signature on File* _____
Collider-Accelerator Department Chairman Date

P. Ingrassia

6.1.10 ALARA Strategies for Tuning During Proton Operations

1. Purpose

- 1.1 The purpose of this procedure is to instruct C-A MCR staff in the use of ALARA (As Low As Reasonably Achievable) triggers when tuning during high intensity (AGS XCBM >5TPPP) proton operations. When a trigger threshold is exceeded, an alarm will appear on the Alarm Display Task (ADT) and a response will be required by the on-duty MCR Operations crew to reduce beam losses.
- 1.2 The scope of this procedure is that it is intended to be an ALARA procedure and not a Radiation Safety Procedure.
- 1.3 Definitions:
 - 1.3.1 Eight intervals in the accelerator cycle shall be watched:
 - Booster Injection
 - Booster Acceleration
 - Booster Extraction through AGS Injection
 - AGS Acceleration (includes capture and transition)
 - SEB Extraction
 - SEB Transport
 - FEB Extraction
 - FEB Transport
 - 1.3.2 The method of measuring the loss during each interval is specified in [C-A-OPM-ATT 6.1.10.a](#) "Measurement of losses during the Accelerator Cycle". C-A-OPM-ATT 6.1.10.a may be changed according to paragraph 2.2.
 - 1.3.3 ALARA watchdog software will display loss values for each interval and generate alarms when thresholds are exceeded. Losses will be averaged over ten pulses when determining whether a loss threshold has been exceeded.
 - 1.3.4 Scaling shall be employed in the software so that loss during each interval is equated to the number of "full energy" protons that would produce the same activation. The constants are defined in C-A-OPM-ATT 6.1.10.a "Measurement of losses during the Accelerator Cycle". The constants will be tabulated in the Temporary Procedure called for in paragraph 5.1.2.

2. Responsibilities

- 2.1 The Operations Coordinator (OC) is responsible for the execution of this procedure.
- 2.2 Liaison Physicists for the Booster, AGS, SEB, and FEB are responsible for:
 - 2.2.1 determining acceleration, extraction and transport loss limits for setting threshold values to activate alarms in the MCR,
 - 2.2.2 changing acceleration, extraction and transport loss limits as operations evolve,
 - 2.2.3 determining appropriate instrumentation for the determination of losses during each interval and the “timing” of the intervals, and
 - 2.2.4 determining the value of the scaling constants required in paragraph 1.3.4.
- 2.3 The MCR Group Leader is responsible for
 - 2.3.1 verifying that the alarm threshold values determined by the Liaison Physicists are incorporated in the appropriate watch dog program, and
 - 2.3.2 issuing and maintaining a Temporary Procedure to contain and track the evolution of the loss limits and scaling constants determined by the Liaison Physicists.
- 2.4 Water Systems technicians are responsible for maintaining gas in the loss monitor systems.

3. Prerequisites

- 3.1 Periodic review of the Accelerator, SEB, and FEB alarm activation thresholds (triggers).
- 3.2 Watchdog software displays each of the seven watched quantities and generates alarms when threshold values are exceeded.
- 3.3 Beam current transformers and loss monitors, used to determine operating efficiencies and losses, undergo a verification by the Main Control Room personnel at start-up.

- 3.3.1 Current transformers are calibrated at startup by the appropriate instrumentation group engineer and during beam operations at the discretion of the appropriate Liaison Physicist.
- 3.3.2 Loss monitor gas systems shall be checked weekly by the mechanical services technicians.

IF a loss monitor gas system is without gas or is otherwise malfunctioning, THEN the technician shall report the trouble to his supervisor and to the on duty Operations Coordinator.

Note:

Changing operating conditions include, for example, overall performance improvements or an inability to adjust the machine(s) to satisfy the "a priori" setting for alarms.

4. Precautions

- 4.1 Failure to execute this procedure correctly may result in excessive physics program beam loss and equipment activation.

5. Procedure

- 5.1 Review of Accelerator, SEB, and FEB loss thresholds.
 - 5.1.1 Before the start of "high intensity proton operations", Liaison physicists for the Booster, AGS, SEB/FEB, shall review the threshold triggers for their area(s) of expertise.
 - 5.1.1.1 An initial value shall be determined for the loss threshold for the watched quantities called for in C-A-OPM 6.1.10.a.
 - 5.1.2 The MCR Group Leader shall issue a Temporary Procedure, valid for one year that tabulates the latest loss threshold triggers and scaling constants. The content of the procedure will be based on determinations of the Liaison Physicists,
 - 5.1.2.1 The Temporary Procedure shall make provision for the appropriate Liaison physicist to make changes to threshold values and scaling constants based upon changing operating conditions.
 - 5.1.2.1.1 Changes to trigger values shall be made after the

appropriate liaison physicist consults with the Chairperson of the ALARA Committee, the Chairperson of the Radiation Safety Committee, or the C-A ESHQ Associate Chair and the change is agreed upon.

5.1.2.2 The Temporary Procedure shall require the Operations Coordinator to make an entry into the Operations Coordinators Log whenever a trigger value change has been authorized as per paragraphs 5.1.2.1 and 5.1.2.1.1.

5.1.2.3 The MCR Group Leader shall ensure that the latest ALARA trigger values are in the database for the ALARA watchdog program.

5.2 Operations response to Accelerator, SEB, or FEB loss alarms.

5.2.1 IF a High Loss alarm appears on the Alarm Display, THEN the Operations Coordinator shall initiate the following:

5.2.1.1 IF an Accelerator High Loss alarm is received THEN determine when in the cycle the loss is occurring.

5.2.1.2 IF an SEB or FEB Loss alarm is received, THEN determine where the loss is occurring.

5.2.1.2 Reduce the beam input to the affected area or process.

5.2.1.2.1 Reducing the beam intensity may mask the loss mechanism. The OC is authorized to continue high loss operations for 30 minutes after the alarm is first received in order to determine the cause of the problem.

5.2.1.3 Correct the problem.

5.2.1.4 IF the problem is not corrected within 30 minutes, THEN reduce the intensity to the affected area and contact the appropriate Liaison physicist for instructions.

5.2.1.4.1 IF a Liaison physicist is contacted for help then the OC shall record, in the OC log, the instructions the Liaison physicist will give.

5.2.1.4.2 With the help of the Liaison physicist, the OC shall determine whether there will be a negative impact

on the environment, or the safety and health of workers, a negative impact on the physics program, or a negative impact on accelerator equipment if prolonged high loss operation is permitted.

5.2.1.4.3 Authorization for prolonged high loss operation, with an alarm present, shall come from a department level manager and be documented in the OC logbook.

5.2.1.4.3.1 The appropriate Liaison Physicist shall inform (via e-mail) the ALARA Committee Chairperson, the RSC Chairperson and the C-A ESHQ Associate that high loss operation will be permitted.

5.2.1.4.4 To assess ESH impact the OC may call on appropriate Department ESHQ Personnel for assistance.

5.2.1.4.5 IF prolonged high loss operation is authorized, THEN the appropriate Liaison physicist shall authorize a change in the threshold for the "loss" alarm as per paragraph 5.1.2.1.1

6. **Documentation**

6.1 Liaison physicist instructions to the OC shall be recorded in the OC logbook whenever the instructions are given in response to a high loss alarm in section 5.2.

7. **References**

None

8. **Attachments**

8.1 [C-A-OPM 6.1.10.a "Measurement of Losses During the Accelerator Cycle"](#).