
CERN

Injection of the Linac4 H^- beam without stripping foil

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Introduction

- One of the first steps during PSB beam commissioning will be to **optimize the steering of the beam** correctly onto the H^0/H^- dump **in the new PSB injection region**.
- For this purpose, injection without foil has to be used, which will require **masking of some BIS interlocks**
  - This has already successfully been tested during the Half-Sector Test
  - Pre-requisite: presence of at least one PSB Supervisor

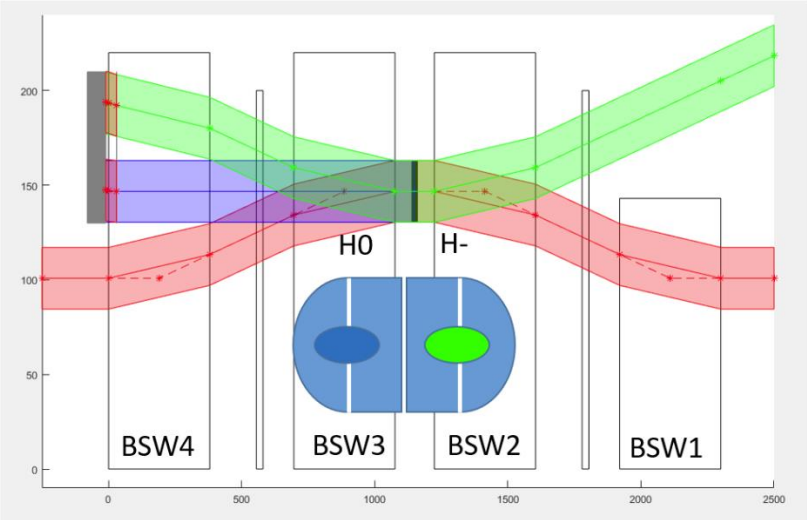

Figure 4: Injected H^- and circulating proton beams in the PSB.

Injection Without Foil

- Steering of the injected beam onto the H^0 and H^- dump (BSW3/4 OFF or ON).
  - Adjust the angle of the injected beam
  - Calibrate the H^0/H^- monitor and determine interlock thresholds

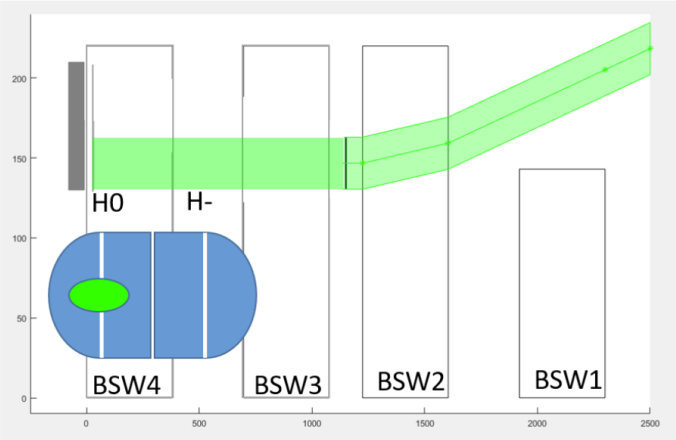

Figure 2: Injected H^- beam in the PSB up to the H^0 plate of the H^0/H^- monitor.

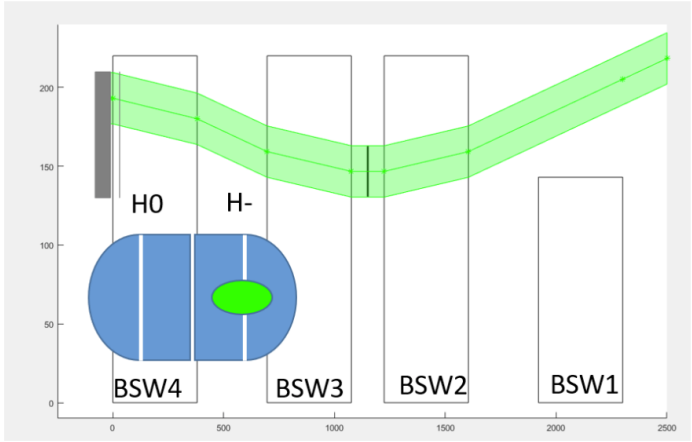

Figure 3: Injected H^- beam in the PSB up to the H^- plate of the H^0/H^- monitor.

Procedure (1)

1) Insert the Linac4 beam stoppers
2) Program a supercycle with around 1 measurement cycles in 10 cycles (fill up with ZERO cycles).
3) Press the control room button that enables the External Condition '**I_BCD_CHANGE**' (inhibits the change of supercycle).

For commissioning of ring 3 (equivalent procedure for other rings):

4) In the Cruise Control application **set the number of turns to 1** for ring 3 and to zero for the other rings. Check that the tail clipper acquisition BIX.TAILCLIPPER/Acquisition#acqCNano is ≤ 275001000 [ns].
5) Program the chopper table to produce the final length of the beam (~**200 ns** as starting point)
   - It is planned to inject only 1 turn with <500 ns pulse length for this purpose. Slightly higher intensities would be useful for the calibration of the H^0/H^- monitor, and **with a peak Linac4 current of 25 mA one could inject up to 4 turns (without chopping)** to match the H^0/H^- dump specifications (see EDMS 1293512 for H^0/H^- dump design and EDMS 1891923 for the calculation of the deposited beam power limit).
     - Remark: in case of a stripping foil failure the dump core could survive 5 consecutive shots of a 40 mA Linac4 beam with 100 µs pulse length.

Procedure (2)

6) **Mask the BIS input #10 (Injection Foil Status** #3) on PSB-3 BIC (for ring 3).
   - Requested to be RBACed (PSB supervisor egroup)
7) **Mask the BIS input #9 (BI3.BSW)** on PSB-3 BIC (for ring 3) in case the pulses of BSW3 and BSW4 have to be disabled.
   - Requested to be RBACed (PSB supervisor egroup)
8) Make sure that the IC **BLM interlock threshold** of the BLM installed besides the H^0/H^- dump (BI34.BLMIB.1L1.E3) is set to a level that will cut the beam if more than one turn is injected by mistake (unmaskable PSB-1 user_input channel #5). The **number of allowed bad shots has to be set to 1**.
9) Make sure that the **interlock threshold of the H^0/H^- monitor** is put to a value that will cut the beam (PSB-1 user_input channel #3).
10) Set the foil position of the foil loader in ring 3 to 'no foil' and disable if needed the pulses of BSW3 and BSW4.

Important remarks:

- Both the BLM and the H^0/H^- monitor thresholds will first need to be calibrated and set.
- Mitigation: SIS will constantly check the foil position in each ring; if one of the foil holders (there is one installed per ring) is in 'no foil' or 'invalid' position AND >1 turn is injected (BIX.TAILCLIPPER/Acquisition#acqCNano is >275001000), the full beam will be cut through a FALSE SIS user_permit of the Choppers BIC. (During calibration of the H^0/H^- monitor this SIS task needs to be masked if >1 turn is injected and unmasked afterwards).

EDMS 2370098

PROCEDURE

Injection of the Linac4 H⁻ beam without Stripping Foil during Commissioning

ABSTRACT:

One of the first steps during PSB beam commissioning will be to steer the beam correctly onto the H^0/H^- dump in the new PSB injection region. For this purpose, it will be necessary to mask some BIS interlocks to allow sending the full H^- pulse for one ring onto the corresponding H^0/H^- dump. This procedure lays out the different steps to follow and to return to the nominal operational conditions.

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DOCUMENT SENT FOR INFORM.

R. Steerenberg

Comments from Jan were addressed:

- It was clarified in the abstract and on page 4 that only a low-intensity beam will be sent (see current presentation).
- BIS masking is RBACed (footnote added).

Can the document be approved?

Engineering Check status - BARBET Vincent - 2020-05-19, 16:21

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UYTHOVEN Jan (TE-MPE) Last modified on 2020-06-12, 12:02 | Created on 2020-06-12, 12:00

Good clear procedures.
Two questions below.
Procedure will be discussed at the MPP on 26/6/2020 after which the MPP position relative to this procedures can be given.

Comment page 4:
In the text is says "... one of the
first steps will be to select the ¿no foil¿ position of the stripping foil loader and send a
very low-intensity H- beam directly onto the H0/H- dump. " while in the abstract is says " ..it will be necessary to mask some BIS interlocks to allow sending the full H- pulse.. ". It might be good to clarify this on page 4.
A bit more information on the intensity used and possible damage by the used intensity to the dumps and other equipment will be useful.

Comment page 4:
For the masking of the injection foil status to the BIS, is this RBAC-ed and which role is required? The same question for the other BIS inputs which need to be masked.