Status of the BI Work Package in the LIU-PSB frame

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Thanks to the contributions of BI group and the Linac4 commissioning team
Outline

HST commissioning:
- Preliminary results
- Teething issues

BI readiness for EYETS 16-17:
- Linac4 connection to PSB
- 2GeV PSB upgrade

Summary
Linac 4 and the new L4Z, L4T lines

**PSB half-sector test installation**
- Two BTVs
- A set of Ti plates facing the dump for measuring stripping efficiency
- Two FBCTs
- Two BLMs: 1 Diamond + 1 IC

**H⁻ stripping foil unit**
- One BTV for stripping foil observation, lifetime, beam size, and emittance growth measurements
- Aqn syst for measuring stripped electrons
- One IC
October 4th: beam to DTL

October 25th: H⁻ beam at 160.7 MeV

October 26th: 160 MeV H⁻ to HST
L4Z line: BTV screen

The BTV was operational from Day 1

Foil observation through BTV/VLC apps

Screen L4T.BTV0126 going “correctly” IN

Screen IN

Stripping foil IN

Image to camera

Screen OUT

Stripping foil IN

Image to camera

Screen OUT

Stripping foil OUT

Screen IN

Courtesy: S. Burger
L4Z line: BTV teething issues

Oct 13th
First beam on L4T.BTV0126 (saturated)

Oct 17th
Tunnel access for OD filter replacement

Beam on L4T.BTV0126 with correct filter setting

Screen L4T.BTV0126 going “correctly” IN

Screen L4T.BTV0126 going “abnormally” IN

Foil #3 issue 1st of November 2016:
• Foil and Screen IN for beam position measurement for ~ 2 min
• Foil was found damaged after screen taken OUT.
  → Stripping efficiency unchanged: 92%
  → Heating from stripped electrons?
  → Secondary electrons on foil?
  → Screen taken OUT with beam creates particles shower that damages the foil?
  → Mechanical issue between BTV and SF?
Still under investigation. BTV now in SIS: beam is cut when the screen is moving.

→ Probable cause: the spring system that ensures the 90° correct positioning is somehow stuck
  → But the screen movement seems safe
Nevertheless: a limited use is requested.
→ Need to open vacuum to repair.

Courtesy: S. Burger
L4H line: Two operational BTVs

L4H.BTV1052 HST Stripping Foil: 1st beams on Oct 26th

Foil observation
First beam on L4H.BTV1052 (saturated)
Beam with correct OD filter settings

L4H.BTV1077 HST Dump: 1st beams on Oct 27th

First beam on L4H.BTV1077

Courtesy : S. Burger
L4Z: Stripping foil current

N.B.:
- Oasis signals are inverted (positive is negative, negative is positive)
- Stripped electrons (87keV, range in C=\~50\,um) are not stopped in the stripping foil (1\,um)

Positive signal: secondary electron emission (?)
Negative signal: secondary electrons from BTV absorbed in the foil (?)

1\textsuperscript{st} installed VME DAQ: FESA and show the same polarity inversion.

Todo:
- Compute the amount of secondary emission e- from BTV to SF and induced heating
- Check signal polarities and the fact that a quick test on HST SF (3mA, 5us) always (BTV IN or OUT) show a negative signal
- Fully test and commission VME DAQ

1-Nov-2016 --- \~10mA. \~80\,\mu s
L4T and L4Z BCTs

- L4T.BCT0107: upstream the stripping foil
- L4Z.BCT0273: ~1.8m away from the Linac4 dump

BCT273 up to 30% more than BCT107
- Back scattered p (edms#1263477, p. 9)?
- \(\pi^+\) from the dump?
- BCT readings?
- Under investigation

L4T.BCT0107: -2.756 mA
L4Z.BCT0273: -2.729 mA

L4T.BCT0107: -13.804 mA
L4Z.BCT0273: -15.996 mA

Courtesy: JC Allica Santamaria
L4Z: To be commissioned

- **H0/H- current meas. plates**
  - With pencil beam

**Diamond BLM**
- Aqn with OASIS.
- **Operational.** Need to create beam losses to see signals.
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- HST commissioning:
  - Preliminary results
  - Teething issues

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- Summary
Readiness for EYETS 16-17

BR.BCTI in 8L1: injection efficiency with Linac4

- Electronic board prototype is being commissioned with a BCT mock-up, without its magnetic shielding.

- Four output channels to cover the intensity dynamic range in the Linac4 era

- This will impact the new interlock system which was initially based on 2 output channels → To be discussed with OP

Courtesy: P. Odier
BR.BCTDC

- Low frequency crosstalk from other rings (~1%): understood

Beam on ring 2: 800 E10 charges --->
perturbation on ring 4: 6 E10 charges
1 MHz noise from BOR induced some distortion in the modulator box.

Beam on ring 2: 800 E10 charges --->
perturbation on ring 4: 2 E8 charges lost within the noise, after filtering.

- New electronics validated on Ring 4
- Green light from BI specialist to upgrade other rings.

Courtesy: P. Odier
Readiness for EYETS 16-17

BTMS: Ring trajectory

- Low intensity resolution measured to 0.6mm with 8E9 charges. There is room for improvement.
- “Shaved beams”, with gain change during the cycle: on-going
  1. Either change the input signal to the PLL from the beam to an Frev signal during the gain switching and then back to the beam. This could imply a loss of data for 10-20ms. Additional timings being implemented.
  2. Another solution would be to keep df =0, during the gain switching

- Decreasing signal along the cycle: not observed in most recent acquisitions.
- Front end hybrid and LNA: in production
- No showstopper for installation
Readiness for EYETS 16-17

Tune pick-ups

- ECR: *draft, 2nd iteration*
- Drawings: *controls process completed*
- Production: *Q2 2017 for mechanical parts*
Flat ICs in L3 sections

- **ECR:** Draft. *In the integration team’s hands*
- **TS3:** a couple of FICs installed in 4L3 for beam tests (signal amplitudes…)
- **32 FICs to be installed in all PSB L3 sections**

Courtesy: C. Zamantzas
Summary

HST beam commissioning
- Beam instrumentation ready from Day1.
- Some BTV teething issues solved
- Some puzzling questions remains: BCTs, SF meas.
- To be commissioned: diamond BLM and $H^0/H^-$ plates

BI for EYETS 16-17: no showstopper
- BR.BCTI for watchdog: finalize interlock system with 4 channels
- BR.BCTDC: low freq crosstalk solved.
- BTMS: gain switching scheme to be tested
- Tune PUs: mech parts expected by Q2 2017.
THANK YOU FOR YOUR ATTENTION!

LHC Injectors Upgrade