BGC: experimental programme for 2024

S. Mazzoni with inputs from O. Sedlacek, S. Jackson, A. Topaloudis, D. Butti

BGC collaboration meeting, CERN, 12-13 December 2023

BGC in 2023: where we stand

- **First year of operation of BGC:**
  - 70 h of data during Pb ion run (injection, top, SNR, systematic studies)
  - 10 h of data with protons
- **Demonstrated horizontal average beam size (emittance) measurement for Pb over whole fill.**
- **Protons: signal observed, ‘checks out’ with other instruments**

- **Manual gas injection: get OK from CCC > perform injection sequence > turn off when finished**
- **Basic software and control: turn on gas + intensifier in DC mode > acquire and save images > postprocess**
- **Since beginning of Pb run: UCAP node (more later)**

What function for the BGC in the LHC?

- **BGC can provide an accurate, average transverse beam profile:**
  - For Pb (and other heavy) ions: presently the only instrument that can measure at injection and during ramp. LHC OP already expressed interest (LBOC 7 November)
  - For protons: provide an independent measurement for redundancy and calibration of other BI systems (BSRT, WSs). Provide a measurement during energy ramp (SNR?) would fill a void
  - Possibly, with upgrade, train-specific average measurement (microsecond gate operation) (needed?)

- **Necessary to complete systematic studies for protons**

- **Necessary to make BGC more operational:**
  - automatic gas injection during setup or beam injection, stop after dump
  - adopt a CERN standard for process, publish and log results

Software - Current status

- **Acquisition**
  - Generic FESA BTVDC device for image acquisition
    - No problems with current system
  - Asynchronous and continuous measurement
- **Controls**
  - Generic FESA devices for I/O Control (VMOD, BStepMotorVME, Breleino)
    - Set up by hardware experts in BI-PM
    - Settings not managed – If they are lost, no restoration
    - Relies on hardware expert
- **Post-processing**
  - Current UCAP node applies (basic) post-processing of images
    - Averaging of images, fitting, scaling of image, etc. - publishing @ 1 Hz
    - Flexibility of UCAP development lifecycle means UCAP has been ideal for R&D
- **Calibration procedures**
  - Performed during YETS and TS
    - No need to calibrate during beam-time
  - Calibration settings currently hard-coded into UCAP code
- **Logging**
  - Summarised measurements logged to NXCALS (only profiles, no raw images)

Software – From R&D to Operations

- **Instrument likely to be used until LS3 so worth investment**
- **Preferred option for Operational software is always a FESA device**
  - Stable and documented release mechanism (version control, Smooth Upgrades, etc.)
  - General support from BI-SW (not just 1 specialist)
    - Common code structure means most staff from BI-SW can potentially help
  - Intrinsic settings management (LSA)
  - … but new features are slower to roll-out
- **Preferred option for R&D is always UCAP**
  - Quick software development lifecycle
  - Little constraints apart from lack of SETtings
    - Though UCAP will now introduce SET functionality (so no need to deliver every time configuration changes)
  - Historically less stable than FESA devices
  - Less support from BI-SW
- **Consider both models for Operations?**
  - UCAP software maintained to test and develop new (ad hoc) features
  - New features fed into new Operational FESA class at defined times.
    - Need to be sure that what can be achieved in Python can be easily replicated in FESA
    - Clear operational specifications

Hardware

- **Optics:**
  - worth changing magnification ? At present far from the 1:1 design magnification but SNR for protons not fully studied. Proposal: wait until completion of proton studies. IN addition: continuity with 2023 operation
  - during YETS: re-perform optical resolution study with target (better illumination of target)

- **Image Intensifier:**
  - presently in DC mode using (obsolete) ‘VMOD’ card. During 2024: possible upgrade of gain control timing

home.cern