Plans for Scrubbing Run and MDs in 2017: first recollection

G. Iadarola for the e-cloud team
Main goals:

- **Condition Sector 12** that has been exposed to air (it could be back to post-LS1 levels)
- **Recover from EYETS de-conditioning** in the other sectors (as observed in 2016) → should be quick
- Assess **scrubbing efficiency of long bunch trains** (288 b/injection)

Proposed strategy:

- Use **standard 25 ns scheme** (to have longer trains from the PS)
- **Ramp-up** the number of bunches (and number of bunches per injections) following machine protection constraints and other encountered limitations
  - Hopefully reach ~2700b
- **Accumulate electron dose with long bunch trains** to assess the effectiveness, in particular on the arc beam screens

Possible limitations:

- **Beam degradation (stability)** at the beginning
- **Heat load transients in S12** (perhaps?)
- **Pressure rise** in the **MKI areas** (especially MKI2D, exchanged before 2016 ion run and never conditioned with high intensity beams)
• Mostly the **usual setup** to have **25 ns beams** at injection:
  o Beam preparation in the **injectors: standard** production scheme, up to 288 bpi, \( \sim 1.2 \times 10^{11} \) p/bunch, availability of BCMS beams desirable but not mandatory
  o **ADT commissioning** (same as for 2016 operation: damping time<50 turns, high bandwidth settings)
  o **Setup of the injection for 25 ns trains** (standard production up to 288b/injection) \( \rightarrow \) if needed, we could have a second iteration during the scrubbing before moving to longer trains (as in 2015)
  o **Cryogenics feedforward** should be operational
    o **Tunes, chromaticities** and **coupling** should be under control (as in 2016) \( \rightarrow \) Laslett tune shift correction
• **Abort gap keeper adjusted for 288b/injection** (different from optimal setting for physics with BCMS beams)
Expert support needed during the scrubbing

- **Vacuum:** to monitor pressures in newly installed elements (from EYETS)
- **Kicker:** for threshold management during conditioning of MKI2D (as done in 2016)
- **Cryogenics:** feed-forward tuning (when increasing the intensity per injection)
- **TDI (?):** any special guideline? Do we keep partial retraction as in 2016? Any interest to do parasitic tests during the scrubbing?
**Scrubbing: diagnostics**

- **Heat load** logging $\rightarrow$ no big changes w.r.t. 2016
  - New instrumented cell in S12 should be added in the logging

- **Stable phase** measurements
  - In the past we were relying on Juan's script
  - Long term plan is to move to *Longitudinal ObsBox*, will it be available (with logging) by the scrubbing run?

- **ADT ObsBox** triggered at injection
  - Need **online script** to monitor first $\sim$30k turns as done in 2016 (very useful to debug when having dumps on injections)
  - Scrubbing Run could be a good occasion to test ObsBox triggers, if available

- **Emittance measurements**:
  - BSRT should be calibrated at 450 GeV
  - **Wire scanner**: what is the intensity limit to fly the wires? Should we have a short injection at the beginning of the filling schemes (e.g. 144b)?
Status

- Doublets **could not be used in 2016** due to limitations from the SPS beam dump.
- In 2015, due to strong transverse instabilities, it was possible to **accumulate only trains of 24 doublets** (up to ~250 doublets in total) → enough to prove e-cloud enhancement.
- This scheme becomes interesting only if it is possible to store significantly **more bunches** (>1000 doublets) and in **longer trains** (48-72 doublets/train).

Main goals:

- Identify optimal settings to **stabilize the beam** ($Q'$, octupoles, ADT) profiting of e-cloud tunes and accumulated scrubbing in 2015-17.
- Assess **the achievable beam intensity**.
- In case of positive outcome, we could think of **longer test period** to probe the **scrubbing efficiency** (in 2017 or later).

Losses observed in 2015 on trains of 72b.
Preparation

- Doublets to be prepared in the injectors (single trains of 24, 48 and 72 doublets)
- **Intensity: ~1.6e11 p/doublet** (and lower for studies)
- Some **time consuming setup** needed right before:
  - Reconfiguration and validation of thresholds on interlocked BPMs in IR6
  - SPS-to-LHC transfer checks
  - Orbit measurement to be “gated” on 12b train with non-split bunches
  - What about SPS-BQM and IQC?
- **To be rolled back** after the MD

**Expected overhead** of the order of 1 shift → convenient to do all studies in a **single MD** session of ~24h including setup and rollback
A fill with **50 ns bunch trains with high bunch intensity** (2012 like, ~1.7e11 p/bunch), possibly with **full machine** would allow:

- Getting a **crosscheck of heat load models** (impedance, synchrotron radiation)
- Provide a **beam based calibration of the heat load measurements** (complementary to the one usually done with electric heaters)

- Interest in this test for **other studies** (open questions from 2012, e.g. halo repopulation, beam-beam effects, instabilities).
- Are the **experiments** interested in taking data in this regime (pile-up > 100)?
- What are the **requirement for intensity ramp-up**?

![Graph showing heat load measurements for different fills and bunch trains.](image-url)
MDs: other 25 ns beam variants

- Optimized **combined scheme with 8b+4e** (8b4e and BCMS mixed in the SPS) → improved backup for HL-LHC

![Beam 2 diagram](image)

- If **trains of 320 bunches (4x80b)** are available compare heat load and stable phase measurements against 288 bpi

![80 bpi diagram](image)
Thanks for your attention!