**Scrubbing Run**

- **Do we need a scrubbing run after a Christmas stop?**
  - Yes! At the beginning of 2016 the beam was unstable with trains of 144 b., we needed 24 h to recover an SEY that was sufficient to start the ramp-up **with trains of 72 b.**

- **Impact of opening S12:**
  - For what we know from LS1 we have to assume that the **SEY could be reset**
    - Need to start soft (short 25 ns trains)
  - Nevertheless scrubbing should be **more efficient than in 2015** since:
    - **Beam quality** should improve quickly since only 12.5% of the arcs start from higher SEY and we have better knowledge on how to stabilize the beams
    - **Cryogenics** in much better shape: better feed-forward, relaxed interlocks
    - Taking this into account **7 days** seems to be a reasonable request
  - It will be **interesting to see** if recovery will be quicker (before LS1 the accumulated dose was much lower), and if the thermal cycle will have any effect on the behavior of S12 with respect to the others

- **What beams to use:**
  - **Standard beams, long trains:** 25ns, 288 bpi, 1.25e11
  - 4x80b if available

- **Doublet beams:**
  - Difficult to **recover them in the injectors** by the time of the scrubbing run
  - And we should take them **when the 2016 situation is recovered** (including S12)
  - We could **start in MD** (but reasonably we need ~24h) and **request further time** if it looks promising (especially if we save some time from the initial scrubbing)
Options for physics – filling schemes

- From discussions with injectors and physics coordinators:
  - **Gaps** MKI: 800 ns, MKP: 200 ns, **abort gap keeper** adapted to train length (all seen in 2016)
  - Limits per injection: **288 bpi standard, 144 bpi BCMS**

**Standard beam:** 25ns_{2760b}_2748_2494_2572_288bpi_13inj_800ns_bs200ns

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**BCMS:** 25ns_{2556b}_2544_2205_2308_144bpi_20inj_800ns_bs200ns

Only 7.4 % less bunches, but many more gaps (53 instead of 38)
Options for physics – heat load estimates

- We assume **same situation as end-2016:**
  - This might be **optimistic while S12 is recovering** (1-2 months based on 2015 experience)
  - We hope that the 288b filling schemes can give us more margin but we have no quantitative indication in that direction...
- Usual recipe to estimate the **effect of the filling scheme** (30b rise-time after 800ns gap, 20b rise time after the 200 ns gap) → might underestimate a bit for the nominal beam
- **Bunch intensity dependence:** linear with an intensity threshold at 0.4 p/bunch (observed in MD, and in long fills)

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Heat load [W/hcell]</th>
<th>N bunches within 160 W/hcell</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>BCMS</strong> 2556b 1.25e11 p/bunch</td>
<td>171</td>
<td>2380 (7% less than full)</td>
</tr>
<tr>
<td><strong>Standard</strong> 2760b 1.25e11 p/bunch</td>
<td>204</td>
<td>2155 (22% less than full)</td>
</tr>
</tbody>
</table>
Nominal configuration will give us important answers for the long term strategy

- Little conditioning observed in 2016 → for HL-LHC we need to do better!
- We need to see if a **period of operation with long trains** can achieve significant **further conditioning** (~2 months could be a reasonable request)
- But it could take time (months) to fill the machine, especially if we stick to 1.25e11 288bpi, and S12 is slowing us down
- **Instabilities in stable beams** cannot be excluded (can we still increase Q’ to 22 if needed, even having ~9σ separation?)

BCMS provides better performance on the short-medium term (Run 2) – see Fanouria

- Even in absence of heat load limitations, **integrated luminosity is slightly better** for BCMS
- With the **heat load limitations on number of bunches** the difference becomes ~30%
- **Intensity ramp-up** will most likely be **significantly faster** (2016-like), and it will be easier to deal with S12 recovery if needed
- But most likely we will not see more conditioning than in 2016 → not much impact on Run 2 performance, but heat loads will come back as a performance limitation for Run 3 and HL-LHC
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Overhead of changing between the two

It would be ideal to be able to change from one to the other “on the fly”, and probe both regimes. What forbids us to do it?

- Not the \( \beta^* \) choice! (\( \beta^* \geq 32 \) cm should be compatible with both, see Roderick)
- Abort gap keeper and MKI pulse settings, due to this we cannot even have 288bpi at 450 GeV if we go for BCMS! → but in 2016 change required ~1 shift, and used MD block as validation (to my memory, tbc.)
- Crossing angle setting → According to Jorg’s talk at LSWG “crossing angle knob” is proved in MD. The open question is whether we can have TCT settings compatible with both angle values? (e.g. 155 urad and 180 urad for \( \beta^* = 33 \) cm)
  → As discussed many times, this has other advantages (loss management at start of collision, adiabatic exploration of beam-beam limits, anti-leveling...)
- Did I forget something?