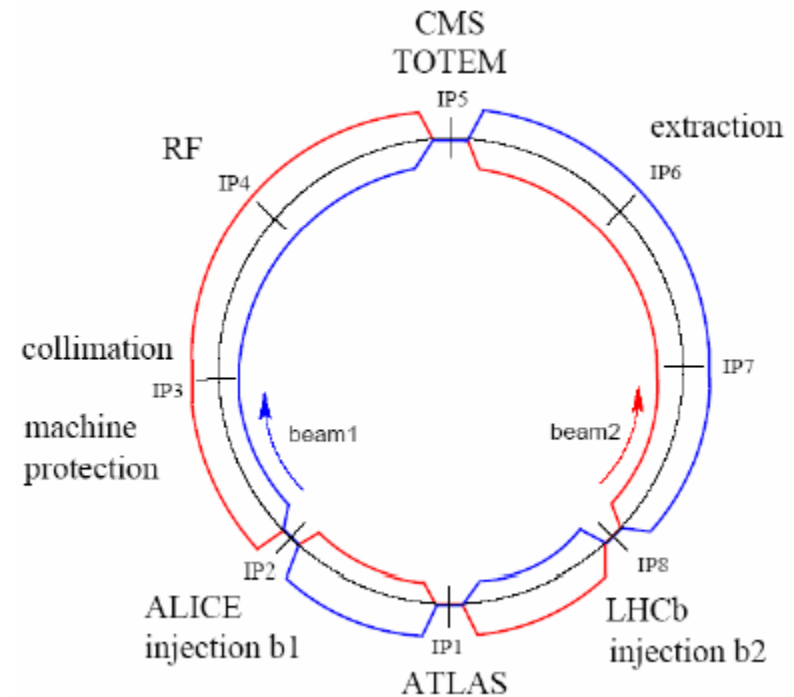

BC and Orbit definition for TTC (ring1, ring2, etc...)

RF signals definition

- 2 rings
 - 1 RF system / ring
 - independent
 - During the acceleration ramp, can be driven at different frequencies (p-Pb collisions)
 - the 2 RF are converging and are equal to a reference value F_{∞} during physics
 - For observation during the acceleration ramp, the **2 RF are provided** to AB/BDI and experiments.



Protons:

Injection: @ 450 GeV: 400.78879 MHz

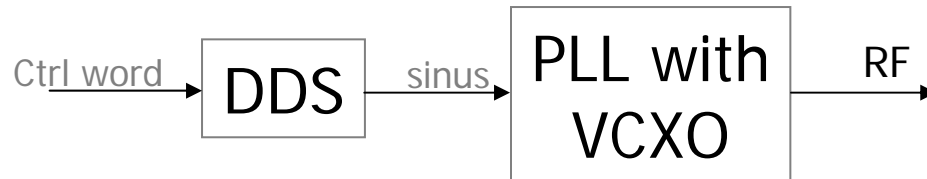
Flat top: @ 7000 GeV: 400.78966 MHz

Lead ions:

Injection: @ 450 GeV equivalent: 400.78406 MHz

Flat top: @ 7000 GeV equivalent: 400.78964 MHz

RF signals generation



- RF tracks the raising magnetic field during the ramp
- Generated with a DDS: Direct Digital Synthesizer
 - Ideal for phase-continuous frequency
 - Spectrum of the sine output is not clean (spurious)
 - Filtering expected from the VCXO, but still a concern
- 2 options for the F_{∞} (3rd RF link):
 - Can be transmitted as well to the experiments
 - Take **one of the ring** as a reference: preferred solution of AB if the spectral purity of the DDS generated RF is not a problem for the beam lifetime (potential emittance blow-up)
 - If it is too noisy, use a **fixed reference frequency**, generated by a pure commercial synthesizer. Once at top energy, before the physics starts, re-synchronizing of the 2 rings with this reference. (like during test beams). More complex.

Frev/Orbit generation

- $\text{Frev} = \text{RF frequency} / 35640 = 11.246 \text{ kHz at } 7 \text{ Tev}$
- Frev resynchronized onto the RF (400.78xx MHz) before the injection of the 1st SPS batch into the LHC
- Remains present and locked until beam dump
- One Frev per bunch frequency

At the TTC level

- Will be delivered to the TTC system:
 - 3 pairs of:
 - Bunch frequency: 40.078xx MHz
 - Orbit signal: 5ns wide pulse, 11.246 kHz
 - Signals from ring1, ring2, and ...
 - A copy of one of the rings, or...
 - A fixed reference frequency (set for each run according to its type)
- Signals artifacts (reminder):
 - Nothing during access, after beam dump, during shut-down or repair
 - Orbit may not be present during SPS/LHC resynchronization (several millisecond)
 - During physics the RF guaranties a clean, stable, non-interrupted BC and Frev