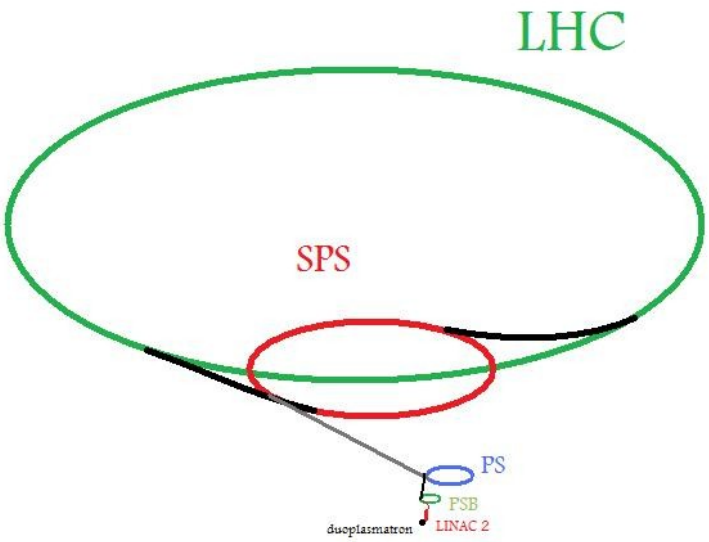
LHC Clock



40 MHz clock used to define crossing rate (nominal bunch crossings every 25 ns)

Tuned exactly to beam orbit frequency, no matter state of accelerator

- Phase: bucket 1 passing through RF cavity in P4
- Stable collisions: nominal 40.079 MHz
- At injection: lower beam energy = lower speed = lower orbit frequency
- 86.8 Hz variation during course of ramp (550 Hz for Pb)

Each beam has its own clock

Phase of clock with respect to beam constant from run to run

CMS Bunch Clock

"CMS clock" comes from:

- LHC clock, when LHC in stable beams
- Constant 40.079 MHz oscillator otherwise

Switch from one to the other involves only single phase shift, easily absorbed

Why CMS needs both:

- LHC clock: precise information on position of beam. We need to know exactly when the bunches are coming
- Oscillator: stable 40.079 MHz clock. When LHC not in stable beams but CMS taking global cosmics run, CMS still needs stable clock not tied to beams for stable operation

Why BCM1F RHU Needs Both (At Once)

- TTC signals sent according to CMS clock (whether directly from LHC or oscillator)
  - CMS clock input needed to decode received signals – avoid errors
- RHU histograms: integer number of orbits
  - Orbit by definition according to LHC clock
- During injection/ramp, BCM1F provides background numbers – needs to take both clocks at same time

--> Both will be inputs to RHU