Longitudinal and RF MDs 2012

P. Baudrenghien for the LHC RF team

Longitudinal studies

▸ **Loss** of **Landau damping** during ramp

  ▸ Single-bunch, different long. emittances, ramp

  ▸ Measurements of longitudinal dipole and quadrupole oscillations. Measurements of transverse emittance evolution in parallel

  ▸ 6 h

▸ Measurement of **longitudinal broad-band impedance**

  ▸ Single-bunch, different intensities, 450 GeV

  ▸ Measurement of dipole and quadrupole oscillation frequencies to derive impedance

  ▸ 6 h

▸ **Longitudinal stability** for **batch**

  ▸ Several batches, vary long. emittance/capture voltage, 450 GeV

    ▸ Measure damping of dipole oscillations at injection

  ▸ Increase cavity impedance at fundamental (reduce fdbk gain)

    ▸ Measure the onset of coupled-bunch instabilities

  ▸ 2 x 8 h

Leftover 2011

Leftover 2011

Road to higher intensity

Improvements of present operation

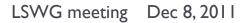▶ **Longitudinal blow-up studies**

> Reduced heating?
> Effects of IBS during filling reduced

- ▶ 2 or more equally spaced batches, 144b, ramp
- ▶ Alternative longitudinal blow-up & batch per batch blow-up at injection
- ▶ 2 x 8h

▶ Commissioning of the longitudinal damper acting via the main accelerating cavities

> Reduced capture losses (25 ns)
> Damps dipole oscillations at injection?
> (enough BW?)

- ▶ Batch(es) 144 b, 450 GeV
- ▶ 2 x 8h

The road to higher intensity

▶ **Voltage modulation** around one-turn

    ▶ Few batches 144b, 450 GeV then ramp

    ▶ Modulation of the voltage phase set point at frev to follow transient beam loading and minimize klystron power

    ▶ 2 x 8h

> Required to reach nominal current with 25 ns. First test required before LS1

▶ **RF feedback** optimization with circulating beam

    ▶ Few batches, 450 GeV then ramp

    ▶ inject RF noise with zero power spectral density on the Synchrotron Sidebands to measure RF fdbk response (close loop) with circulating beam

    ▶ 4h

> Required for stable operation with nominal current . First test required before LS1

p-Pb preparation

- Commissioning of the p-Pb rephasing using p
  - 1 batch 32b p in each ring, 450 GeV
  - Automate the rephasing to get collisions in the detectors
  - 2 x 4h

  Best scheduled in the second half of 2012… but at least 2 months before the p-Pb run