COMMISSIONING

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Goals

- A working system at IP1 and IP5
  - Bunch by Bunch relative luminosity
  - Crossing angle
- A tool that CERN operators use

STAGES TO MAXIMUM LHC LUMINOSITY CERN EDMS 347396

Mode	Bunches	Bunch Spacing	Luminosity [$cm^{-2}\ s^{-1}$]	Interactions/ Xsing	Mean pulse height/ occupied bunch Xsing - mV
A–Collision studies with single pilot bunch beam - no crossing angle	1	N/A	2.5×10^{26} - 3.7×10^{27}	0.0006-0.092	0.04-0.53
B–Collision studies with single higher intensity bunch - no crossing angle	1	N/A	1.1×10^{29} - 4.3×10^{30}	0.27-10.71	16-611
C–Early p-p luminosity	43	2.025 μs	4.8×10^{30} - 8.4×10^{31}	0.28-4.86	15-277
	2808	25 ns	6.5×10^{32}	0.58	33
	936	75 ns	1.8×10^{33}	4.79	273
D–Nominal p-p luminosity	2808	25 ns	1.0×10^{34}	8.87	506
E–Ultimate p-p luminosity	2808	25 ns	2.3×10^{34}	20.39	1163

Pressure = 8 atm - (57 mV for each 7 TeV collision)

BRAN INSTRUMENT COMMISSIONING PLAN

- A–Collision studies with single pilot bunch beam - no crossing angle
  - Collision rate too low to use as a luminosity monitor
  - Minimize noise
  - Get baseline software and hardware ready
  - Study beam background (beam-gas, neutron ...)
- B–Collision studies with single higher intensity bunch - no crossing angle
  - Start in pulse counting mode
  - Transition to pulse height mode
  - Plan for crossing angle algorithms
  - Need sustained presence at CERN
- C–Early p-p luminosity
  - Develop deconvolution algorithms
  - May need deconvolution for this phase
  - mplement and test crossing angle algorithms
  - Can do pulse counting for most of this period
  - Develop pulse height mode algorithms
- D–Nominal p-p luminosity
  - Pulse height mode
  - Deconvolute
  - Detector needs to fully commissioned with gas flow
- E–Ultimate p-p luminosity
  - Might need to lower pressure to reduce voltage

Plan to commission detector

- Working with Bill Turner to develop plan
- Preparing simulations for a few different collision energies
  - LHC might not start at 7 GeV collisions
  - Fluka and Mars simulations available
- Will evolve based on experience and circumstance

Mode A + B-circulating beam

- Measure noise rates and compare to expected
- Measure interactions
  - beam halo with beam pipe
  - beam gas
  - collimator
- Synchronize DAQ
- Measure for occupied and unoccupied bunches
  - pulse height
  - pulse shape
- Compare to simulations

Mode C – Collisions

- Synchronize DAQ and LHC clock
- Measure counting rates as a function of measured voltage
- Determine threshold for pulse counting
- Verify bunch pattern
- Compare luminosity measurement with other detectors
- Analyze beam background
- Develop and test deconvolution algorithms
- Compare to simulations

Mode D – Nominal Luminosity

- Transition to pulse height counting mode
  - Compare to counting mode
    - Cross correlate with other luminosity detectors
    - Compare with simulation and expected fill pattern
- Implement crossing angle calculation
  - Test and calibrate with LHC beam

FY09

- Commission detector with beam
- Cross correlate with PMT luminosity system
- Integrate DAQ into LHC control system
- Compare with models

SUMMARY

- Commissioning will continue with each change in LHC operating conditions
  - Since LHC won't reach nominal luminosity, must continue commissioning BRAN in FY10
- Plan dependent on luminosity and fill pattern
- Need simulations at each LHC energy
- Need presence of personnel at CERN
- Will take effort to make BRAN part of LHC beam instrumentation