

"Issues Effecting the Efficiency of Beam Commissioning"

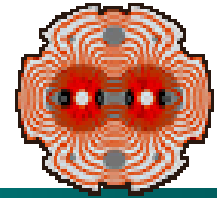
(Discussions and Decisions)

Chamonix XIV, January 2005

Steve Myers



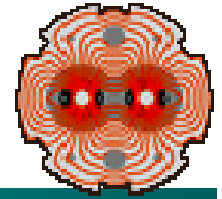
1 Overview beam Commissioning



- Estimated 2 months (highly ambitious!) from 1st turn to 1st collisions (was 3 months in Chamonix 13)
- BPMs can give intensity and position (1 beam) at the same time



1 Overview of Commissioning

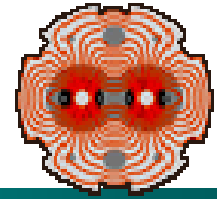


■ Beam Instrumentation

- ⌘ Design office support continuation needed
- ⌘ Instrumentation needs applications software: need for coordinated effort on applications
- ⌘ **BLM understanding of measured signals is non-trivial**
- ⌘ **Systems commissioners to be nominated**
- ⌘ Beam synchronized timing (BST) needed for full functionality of the BI equipment



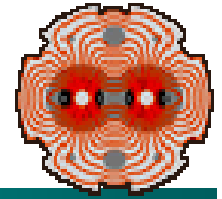
2 Scheduling LHC Operation



- 32 weeks operation, 16 weeks shutdown, 4 weeks MCO
 - ◆ Operation periods of 25 days beam, 3 days technical stop
 - ◆ ↪ 140 days of physics per year
- 6 weeks testing for Machine Check-out !!!
- Beam Scrubbing for electron cloud
 - ◆ Confidence in obtaining $SEY < 1.3$
 - ◆ No limitation with 75ns operation
 - ◆ 25ns OK for $N_b < 3 \cdot 10^{10}$ p
 - ◆ Before scrubbing $N_b < 8 \cdot 10^{10}$ p limited by cooling capacity
 - ◆ Scrubbing needed for $N_b > 5 \cdot 10^{10}$ p
 - ◆ **Scrubbing should be scheduled before shutdown for vacuum reasons, ??? radiation**



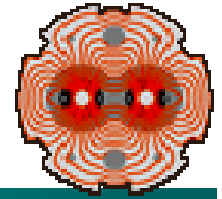
2 Scheduling LHC Operation



- “Requirements” from the experiments (wish-list!)
 - ◆ Initially pile-up events 1-2
 - ◆ 4fb^{-1} allows discovery of SM Higgs
 - ◆ 1fb^{-1} allows discovery of supersymmetry
 - ◆ LHCb dipole polarity to change on each run!
 - ◆ ALICE: reduce luminosity by increased beta
 - ◆ 75ns useful but 2 weeks enough!
 - ◆ 3 experiments taking data for lead ions
 - ◆ TOTEM, LHCf, etc.....



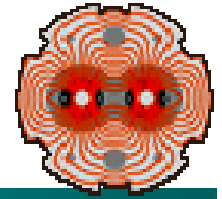
2 Scheduling LHC Operation



- My Summary of Experimental Requirements
 - ⌘ Energy range 0.9—7.0Tev
 - ⌘ Luminosity range $10^{25} - 10^{34}$
 - ⌘ Magnet settings: variations of polarities and settings
 - ⌘ Particles, protons and ions and ...\
 - ⌘ No. of bunches 10 – 2880
 - ⌘ Beta values: complete range
- ◆ Performance improvement in colliders is best achieved by repeating the same beam conditions run after run.
- ◆ **We need a greatly reduced prioritized list of operating conditions...LHCC/LHC Physics coordinator/JE**



2 Scheduling LHC Operation

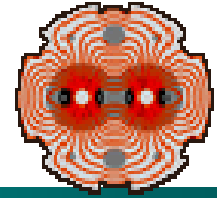


■ Ion Operation

- ⌘ Early ion scheme 1-3 weeks set-up, 4 weeks physics
- ⌘ Pilot ion run is a possibility if ion injectors are ready (because optics conditions are identically useable)



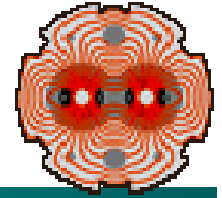
5 Other issues



- Lead Ion Injector Complex Commissioning
 - ⌘ electron cooling delivered 16th Dec 2004
 - ⌘ ECR source will be delivered from CEA Grenoble end Jan 2005
 - ⌘ LEIR conversion to be finished by Aug 2005
 - ⌘ Commissioning by Mar 2006
 - ⌘ First beams in LHC possible in April 2008



5 Other issues

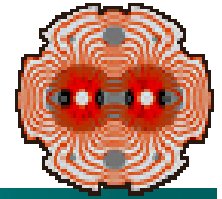


- Detector equipment affecting beam operation
 - ⌘ Magnets and compensators in all insertions
 - ⌘ ZDC, VELO, RP IR5/IR1
 - ⌘ **MPWG already involved, proposal soon**
 - ⌘ **Who controls what? Answer CCC**
 - ⌘ **Protection of detectors, beam dump?**

- Experiment-Machine Interface and signal transfer
 - ⌘ ATLAS lumi monitor (LUCID) useful for operations
 - ⌘ Beam condition monitor from experiments
 - ⌘ Possible background problems for ALICE/LHCb



8 Machine Protection (1.5)

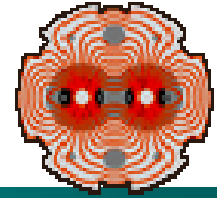


■ Overview

- ⌘ Beam dump 3 turns after Beam Interlock signal
- ⌘ Beam presence needs to have machine settings included
- ⌘ **Fast BCT monitor****
- ⌘ ? Ions needs some additional studies wrt Machine protection



8 Machine Protection (1.5)



- BDI for machine protection (in addition to BLM)
 - ◆ Excellent progress
 - ⊕ **Beam position interlock in IP6 for beam dump**
 - ⊕ **Interlock for protection against asynchronous beam dump**
 - ⊕ **Protection against oscillations and fast orbit changes**
 - ⊕ **BCT fast interlock**

- Commissioning aspects of machine protection
 - ⊕ Awareness of machine protection is now at the highest level
 - ⊕ Fast losses, limits need to be verified by experiments (simulations)
 - ⊕ Must be “safe” from the start
 - ⇒ Formal, pre-testing, HW commissioning,
 - ⇒ Same system as in SPS
 - ⊕ Sector test invaluable