



Additional Topics for LHC

R. Assmann and F. Schmidt, CERN

Tevatron Accelerator Studies Workshop

Fermilab

13-14.01.2010



Boundary Conditions

- End of 2011 (~2 years)
- Maximum 3 months
- No guarantees nor any promises
- NOvA (fully approved) in direct conflict with these studies since they need to modify recycler
- Planning will need several iterations with Fermilab
- New hardware difficult to install
- Interests:
 - Tevatron team: Theme: better understanding and wrap-up
 - BNL: electron lens
 - CERN: to do tests we would not dare at the LHC



Topics 13th

■ Crystal Collimation

- T-980 at the Tevatron
- Antiproton Channeling

Nikolai Mokhov (Fermilab)

Richard Carrigan (Fermilab)

■ Other collimation schemes

- Hollow e-beam Collimation
- APEX @ BNL

Giulio Stancari (Fermilab APC)

Fulvia Pilat (BNL)

■ Beam-Beam Compensation

- TEL Activities at FNAL
- Electron Lens Ideas from BNL

Alexander Valishev (Fermilab)

Christoph Montag (BNL)

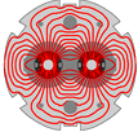
■ Miscellaneous Proton-Only

- 120/150 GeV Stretcher
- Space-Charge Compensation with Electron Column
- Flat Bunches

Michael Syphers (Fermilab)

Giulio Stancari (Fermilab APC)

Chandra Bhat (Fermilab)



Topics 14th

■ Miscellaneous Collider Topics

- 1/2 Integer Working Point Alexander Valishev (Fermilab)
- Dynamic Aperture Mei Bai (BNL)
- Additional Topics for LHC Ralph Assmann , Frank Schmidt (CERN)

■ Miscellaneous

- Smorgasbord of Ideas Vladimir Shiltsev (FNAL)
- Electron Cloud Xiaolong Zhang (Fermilab)
- Plasma Wakefield Acceleration with Proton/Pbar Drivers Wei Lu (UCLA)



Why tests for LHC at TEVATRON?

- Even as LHC is now available: LHC is not a test bed and machine development time in LHC must be limited.
- Many CERN beam tests for LHC being done at SPS. However, SPS not very close to LHC: Tevatron much better.
- Tevatron: low diffusion beams, super-conducting magnets, collisions and beam-beam effects. All not in SPS!
- Strong CERN interest:
 - Use Tevatron for developing and advancing generic R&D (crystal collimation, hollow e-beam lens, e-beam lens BB compensator, ...)
that can then later be used in LHC.
 - Tests with limited risk could be done with last Tevatron beam.
- Still must realize limitations:
 - Difference in beam parameters, machine layout, hardware etc...
 - Require case-by-case analysis if Tevatron experiments are efficient for addressing LHC problems.



General Remarks

- We are collaborating on some topics between CERN and Fermilab. Our support for these studies is a priori clear.
- For additional tests:
 - Do not expect that we already bring a list of CERN requests for Tevatron beam time. Some preliminary ideas later...
 - We are here at the moment mainly as observers, to understand possibilities and boundary conditions.
 - This meeting was already very useful for us to get more detailed information on the scope of this.
- Take our remarks as preliminary comments and ideas.
- We will go back to CERN and discuss there. List of CERN requests for mid-spring 2010. Update with 2010 beam experience in autumn 2010.
- Total period of ~1-2 weeks of Tevatron beam for CERN?



Comments on Already Proposed Experiments

- Very impressive and important list presented by you.
- Can only reconfirm CERN/LHC support for several discussed topics (not exclusive, not in order of priority):
 - Beam-beam compensation, head-on and LR (if possible).
 - Studies for luminosity leveling (dynamic beta squeeze).
 - Flat bunch scheme, if possible.
 - Collimation efficiency improvement with bent crystals.
 - Indestructible beam scraper with hollow e-beam lens → only LHC scraper solution pursued at the moment.
- Fits well the goal to develop longer term innovative solutions for the LHC and its performance upgrades!
- Priorities will depend on lessons learnt and issues from first LHC run.



Additional CERN Studies

- Transverse resistive impedance from collimators: measure tune shift versus collimator position. (2 shifts)
- Studying BB resonances using the AC dipole. (3 shifts)
- Generate harmonic transverse perturbation in collision and measure emittance growth for a given frequency. (2 shifts)
- IBS benchmarking. Measure emittance growth versus time for various intensities. (3 shifts)
- Cross a resonance to split the beam and then study the beam-beam interaction between a split and an unsplit beam or two split beams. (3 shifts)
- Measure equilibrium beam distribution by full scraping for reference comparison with LHC (low Tevatron intensity). (2 shifts)
- Test cryogenic beam loss monitors. (done during scraping)
- Backup ideas:
 - Installing the KEK crab cavity in the Tevatron if not approved the SPS.



Next steps of follow-up

- Review and provide all details for CERN's proposed program of experiments
- Provide this revised list by April 2010
- ~July 2010 Fermilab will officially propose this experimental proposal. Hopefully with a firm commitment!
- End of the year finalize the program in view of experience with the LHC running