… wrapping it up …

Thank you to all the speakers for the very well prepared and clear talks.

Special thanks for sticking to the agreed times, allowing time for answering the questions from the committee and the audience.

Lot of this work done in parallel to other important work…

Proposed Technical Work Plan

Fastest Possible Readiness for Nominal Intensity

- Technical design for **modified dispersion suppressors** in IR3/7. Design & build new cryostat for missing dipole. ➔ CERN.
- Start R&D on "**cryo-collimators**" for modified dispersion suppressors.

WP's A
No need for major testing, beam experience.

- Continue R&D on **advanced, low impedance materials** for LHC collimators. ➔ CERN, FP7.
- Continue R&D, prototyping and testing of **phase II secondary collimators**, in-jaw pick-ups and various jaw materials. Construct 30 plus spares. ➔ CERN/FP7, SLAC/LARP.
- Install **HiRadMat facility** for beam verification of advanced designs, following conceptual design ➔ CERN, SLAC.

WP's B
Continue to be ready for 2013/14. Needs major testing and beam experience.

- Start R&D, prototyping and testing on **hollow e-beam lens** for LHC scraping. ➔ FNAL, CERN.

WP's C
R&D and beam testing required.

- Minor modifications of **collimation in experimental insertions**.

WP's D

Work Packages A

WP1 Modifications SC dispersion suppressor (CERN)

WP2 Collimator for cryogenic region (CERN, GSI)

- *Benefits:* **Gains more than factor 10 (15-90) for cleaning efficiency.**
  - Fixes problem of losses in SC dispersion suppressor both for ions and p.
  - Improves lifetime of SC magnets.
  - Requires no civil engineering nor new SC magnets.
  - Less sensitivity to imperfections.
- *Difficulty:* **Requires modification of SC regions around IR3 and IR7.**
- *Risks:* None.
- *Beam experience:* **Not required**, even LEP2 collimation had this function.
- *Timeline:* New work but help from FP7 (GSI/FAIR). Conceptually can start immediately. Install 2011/12? Ready for 2012 run if priority is put?

Work Packages B

WP3 Advanced Secondary Collimators (CERN, LARP/SLAC, FP7-ColMat)

WP4 HiRadMat Test Area (CERN, SLAC, FP7)

- *Benefits:* **Improved operational efficiency, impedance, lifetime.**
  - Provides possibility to set up collimators at high intensity, as Tevatron.
  - Improves operational efficiency with faster collimator setup.
  - Reduces impedance. Reduces tertiary halo.
  - Improves lifetime for warm magnets and secondary collimators.
- *Difficulty:* Potential damage with accidents (asynchr. beam dump).
- *Risks:* **Damage in the LHC** from unexpected features.
- *Beam experience:* **Required.** Both tests in test area (shock) and LHC.
- *Timeline:* Started. Tests in HiRadMat in 2011? Tests in LHC 2012? Produce 2013? Install 2013/14? Ready for 2014 run if no further delays?

Work Packages C

WP5 Hollow e-Beam Lens Scraper (FNAL, CERN).

- *Benefits:* **Active halo control and reduced peak loss rate.**
  - Provides possibility to actively control and remove halo by scraping, like in Tevatron.
  - Reduces peak loss rates (spikes in beam loss).
- *Difficulty:* **Effectiveness of hollow region.**
- *Risks:* Due to low diffusion speed, none for the machine. Effectiveness of scraping to be assessed.
- *Beam experience:* **Required.** Both tests in SPS and LHC useful.
- *Timeline:* New work but FNAL interested. Tests in SPS in 2011? Tests in LHC 2012? Ready for operational use in 2012 or in 2013?

Work Packages D

WP6 Experiments (CERN)

- *Benefits:* **Address issues and lessons in experimental regions.**
  - Fix ion luminosity limit in IR2.
  - Optimize simultaneous protection and signal acceptance issues in various IR's.
- *Difficulty:* None.
- *Risks:* None.
- *Beam experience:* **Required** to know all issues. Modification to dispersion suppressor do not require beam experience (dispersion well-known).
- *Timeline:* After first beam experience, except potential cryo-collimators around IR2.

See talk D. Macina

Suggested Milestones I

- 2009 Review conceptual design, go ahead, refined WP's.
  Start WP's cryogenic collimation and hollow e-beam lens.
  Continue other WP's.

- 2010 **SPS:** Beam test of collimator with in-jaw pick-ups (presently under construction), if we can install.
  Study results on in-jaw pick-up with Darmstadt/TEMF.
  LHC: Review beam experience with phase I collimation system.

- 2010/11 **TT60:** HiRadMat test facility installation.

- 2011 WP cryogenic collimation completed and hardware constructed.
  HiRadMat: Beam tests of advanced secondary collimators.
  HiRadMat: Material tests with beam shock impact.
  SPS: Beam tests of the hollow e-beam lens scraping.

- 2011/12 **LHC:** Modify SC dispersion suppressors around IR7 and IR3.
  LHC: Install collimators into the space created.

Suggested Milestones II

- 2012: **LHC:** Ready for nominal intensity.
  LHC: Parasitic beam tests of advanced secondary collimators.
  LHC: Parasitic tests of the hollow e-beam lens.
  Construction decision for phase II secondary collimators, decision for materials and concept (taking into account LHC beam experience, e.g. frequency of erroneous beam hits).

- 2013 **LHC:** Reduced beam tails and lower peak loss rate with scraping.
  Construction of phase II secondary collimators.

- 2013/14 **LHC:** Installation of advanced secondary collimators.

- 2014 **LHC:** Collimation with ultra-high efficiency, fast and non-destructive collimator setup and safe halo scraping.

Schedule for Discussion

(ambitious and result-oriented "wish" schedule)

Year	Milestone
2009	Conceptual solution presented. Start/continuation of serious technical design work on all work packages (delays will shift all future milestones).
2010	Review of lessons with LHC beam. Technical design review.
2011	HiRadMat test facility completed and operational.
2012	Cryogenic collimation installed and operational ➔ nominal intensity in reach. Production decision for phase II secondary collimators.
2013	Hollow e-beam lens operational for LHC scraping.
2014	Phase II completed with installation of advanced secondary collimators ➔ Ready for nominal & ultimate intensities.