Info LMC and LCS

- Essentially clear: Collimation Working Group will continue as **LHC Collimation Study Group (LCS),** reporting as one of several sub-meetings to the new LHC Machine Committee (LMC). See web site:
  https://espace.cern.ch/lhc-machine-committee
- Third name since 2001: Beam Cleaning Study Group (BCSG) ➔ LHC Collimation Working Group (CWG) ➔ LHC Collimation Study Group (LCS). Will keep our numbering…
- My idea: Center ALL LHC collimation-related discussions in this one meeting. Centralize several smaller meetings (phase II, controls) to this meeting.
- Challenges ahead: Commission LHC collimation system, understand beam-loss related performance limitations, propose and implement improvements.

Conceptual Review Phase II Collimation

- Despite very tight manpower we found the time to work out a **conceptual solution for reaching nominal and ultimate intensities in the LHC**. Many thanks to all of you who helped.
- Now: **Have solution reviewed and start technical design work, if our proposals are supported.**
- What this review is: Collect and present solutions for all known problems (p, ions, experiments). Present a conceptual solution and readiness for starting technical design work.
- What this review is not: Detailed decision on technical choices e.g. for jaw material of phase II secondary jaws. Presentation of technical designs, costs, assessment of resulting work for the super-conducting ring.
- Following along our **project plan**, as discussed in AB and the LHC project and as sent to the DG in 2007.

Project Plan July 2007 (sent to DG)

Deliverables

The work for phase 2 collimation has four major deliverables which are listed below with the target dates for completion in brackets:

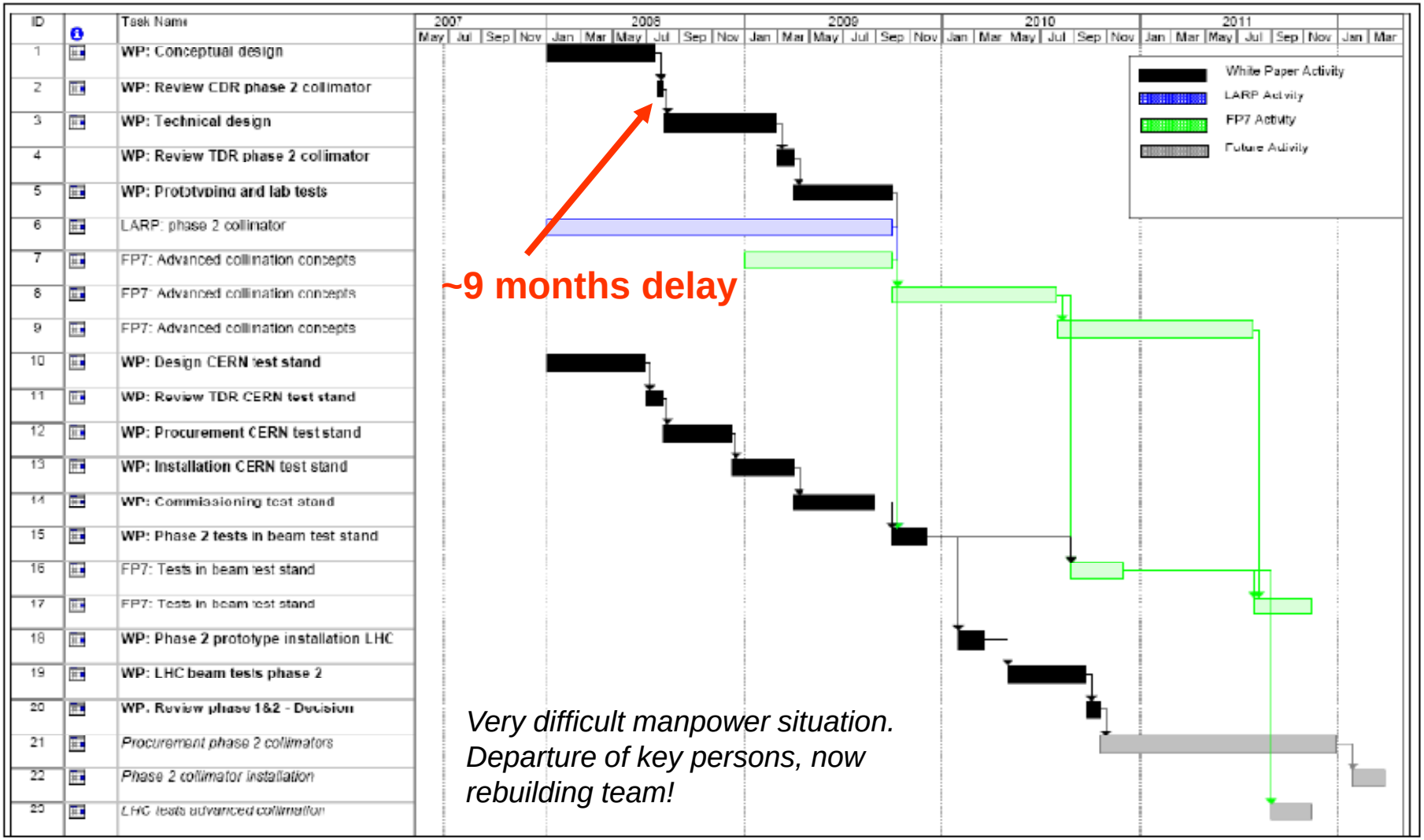
Deliverable 1: Conceptual and technical design of phase 2 collimators (3/09).

Deliverable 2: Phase 2 prototypes, tested and ready for installation (9/09).

Deliverable 3: Beam test stand (450 GeV) for collimators operational (8/09).

Deliverable 4: Beam qualification (test stand and LHC) of phase 2 collimators (10/10).

Project Plan July 2007 (sent to DG)



The Review Meeting

- Our goal: *"We will present a possible solution for an order of magnitude improvement in cleaning efficiency, reduced LHC impedance, faster set up and extended radiation resistance. In particular, the proposed solution should allow supporting nominal LHC beam intensities for the LHC baseline assumptions."*
- Review dates and locations:
  - **April 2, 09h00 - 12h00: Conceptual Description Phase II Collimation**
    building 30-7-018 - AT Auditorium
  - **April 2, 14h00 - 18h00: Expert detailed discussions, questions to experts**
    building 30-7-018 - AT Auditorium
  - **April 3, 08h30 - 10h00: Summary discussion and conclusion**
    40-5-A01

Our Draft Solution I

- Equip existing phase II secondary collimator slots with **advanced collimators** (use is complementary with existing phase I collimators, e.g. only in stable physics):
  - Phase II jaws equipped with beam position sensors for fast, deterministic jaw setup.
    ➔ faster setup and better protection (jaws centering on beam can be monitored)
  - Jaw material not decided in review but several parallel paths are being followed: metallic, composite materials, ceramic materials, low impedance solutions, …
    ➔ lower impedance, a little bit better efficiency, higher radiation robustness to collimators / downstream equipment, better UHV.
  - Advanced prototypes from CERN/SLAC employ innovative materials and new technologies which have inherent risks (e.g. extend of damage).
    ➔ Must be tested with beam before production decision!
  - Can contemplate interim system: phase I metallic collimators in slots for phase II collimators? Gains early experience and interim improvements in case of surprises!
    ➔ Construction can start immediately (minimal risk if money is no issue).
  - This review: Ask for endorsement of ongoing technical design work. Ask for support for prototyping and beam tests (SPS, HiRadMat).

Our Draft Solution II

- Use **hollow e-beam lens for LHC scraping** at high energy and high intensity:
  - Non-hollow e-beam lens used every day at Tevatron for beam scraping in the abort gap.
  - Only solution for scraping the LHC beams below 5 sigma!?
  - Fermilab convinced of concept and interested to work (design adaptation for LHC, construction, installation, commissioning) with us if budget available.
  - This review: Propose start of technical design work for hollow e-beam lens scrapers for the LHC.

Our Draft Solution III

- **Modify layout of dispersion-suppressors around IR3 and IR7 and install collimators into the cryogenic regions for improving cleaning efficiency:**
  - Must violate 2002 constraint of not touching the SC regions of the LHC.
  - Shift (longitudinal and transverse) several magnets to generate space for collimators before dispersive losses (using and relocating space of missing dipole).
  - In this case:
    - We can gain one order of magnitude in cleaning efficiency.
    - We reduce sensitivity to alignment errors in SC machine aperture (gain another factor 3-11!?).
    - We increase lifetime of SC magnets (lower radiation damage).
  - Nominal and ultimate intensities are the achievable.
  - This review: Propose start of technical design work on dispersion suppressors (implications for such a solution) and collimators for this environment (cryogenic collimators with GSI, warm collimators with transitions, …).

Draft of charge to committee

- Review the conceptual solution of LHC collimation (phase II) for nominal/ultimate beam intensities.
- Assess the urgency for phase II of LHC collimation.
- Assess if the various components of the proposal are technically coherent and their benefits well justified.
- Assess the international sharing of collimation R&D work (CERN, SLAC, FP7).
- Advise on priorities and readiness for starting technical design work.
- Assess if all collimation problems or solutions have been adequately addressed, including needs for the experiments.
- Advise on the collimation work schedule and the need for interim collimation solutions, taking into account the required evolution of LHC performance.

Draft Committee

- F. Willeke (BNL)
- N. Phinney (SLAC)
- M. Seidel (PSI)
- 1-2 particle physicists (being looked at by Massi F.)
- + ??? (representatives from CERN accelerator sector management, to be discussed with Steve Myers)

Draft Program I

9h00	tbd		Welcome and Review Charge
9h10	R. Assmann	CERN, BE	Overview Collimation Solution (Phase II)
9h50	T. Markiewicz	SLAC	Status Phase II Hardware SLAC
10h10	A. Bertarelli	CERN, EN	Status Phase II Hardware CERN
10h30			Coffee
11h00	J. Jowett	CERN, BE	Modified Collimation Layout & Optics (incl. remarks on special ion problems)
11h20	E. Metral	CERN, BE	Collimation driven impedance
11h40	T. Weiler	Uni Karlsruhe	Improved Proton Collimation Efficiency
12h00	G. Bellodi	CERN, BE	Improved Ion Collimation Efficiency
12h20			Lunch

Draft Program II

12h20			Lunch
14h00	F. Cerruti	CERN, EN	Energy Deposition
14h30	tbd	CERN, PH	Requirements from Experiments
14h50	tbd	CERN, SC	Radiation Aspects (combine with FLUKA talk?)
15h05	A. Ryazanov	Kurchatov Inst.	Radiation Hardness Measurements
15h20	J. Smith, V. Shiltsev	FNAL, SLAC	Hollow e-beam lens for LHC scraping
15h35	W. Scandale, N. Mokhov	CERN, FNAL	Crystals as Primary Collimators
15h50	I. Efthymiopoulos	CERN, EN	HiRadMat as Test-bed
16h05			Coffee
16h20	R. Assmann	CERN, BE	Wrap-Up Collimation Plan for Discussion
16h20			General Discussion
18h00			Adjourn

Session chairmen etc to be figured out…

Last Slide

- Comments very welcome…