Report from Coll. Board (A. Wolski) and CM conclusions

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CERN
HL-LHC project coordinator

The HiLumi LHC Design Study is included in the High Luminosity LHC project and is partly funded by the European Commission within the Framework Programme 7 Capacities Specific Programme, Grant Agreement 284404.

Role of the Collaboration Board

- The HiLumi LHC Collaboration Board exists to ensure that partners are able to work together effectively to achieve the goals of the project.
- Membership consists of one representative from each partner, plus the Project Co-ordinator and his deputies.
- The CB reviews progress with the project, and makes decisions on action required to address any issues, or respond to changes in circumstances etc.

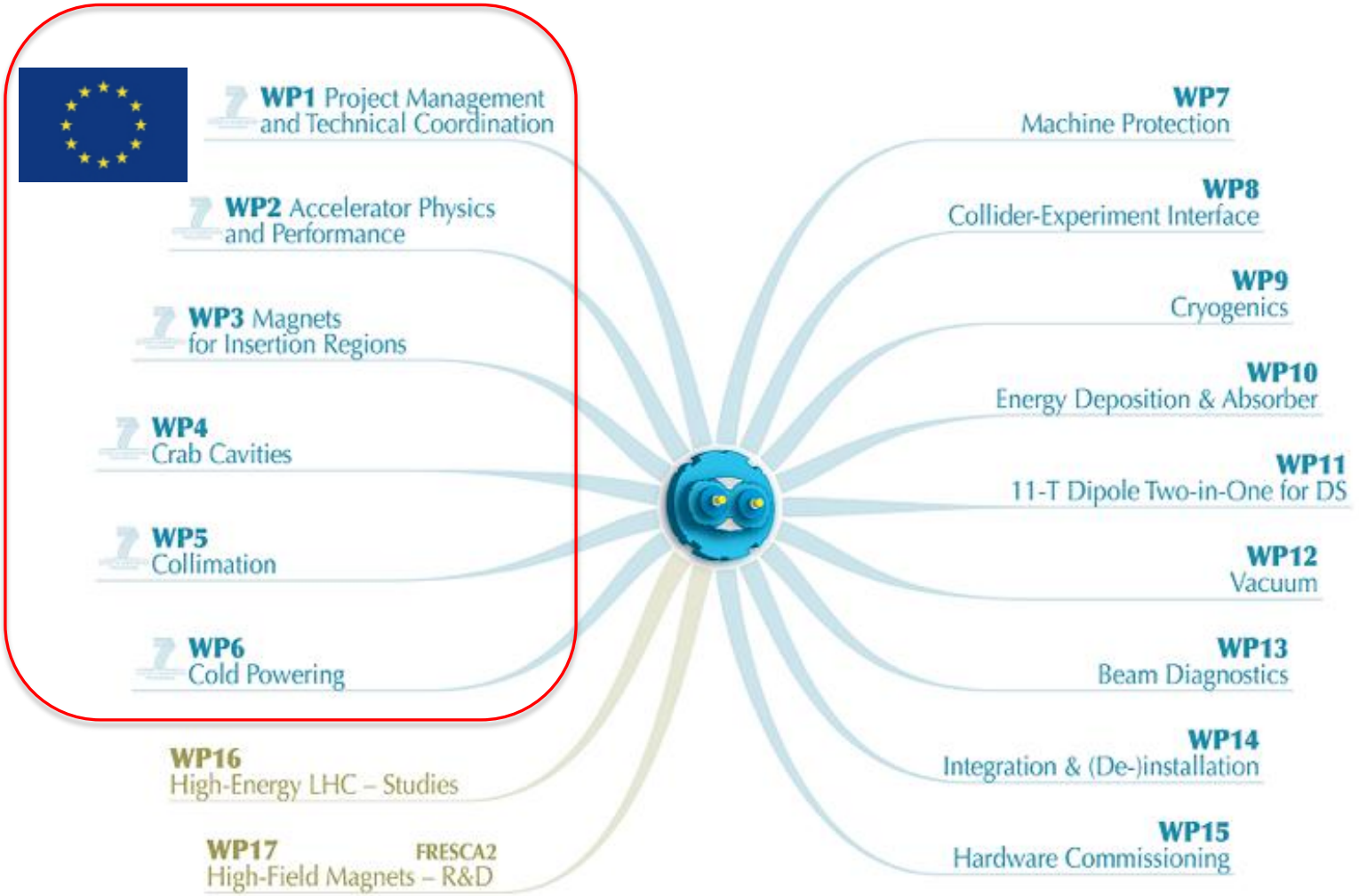
Agenda for 2nd CB Meeting, 15 Nov 2012

16:30	Welcome address.	*Umberto Dosselli*
16:40	Approval of minutes of the 1st CB meeting, and agenda for 2nd CB meeting.	*Andy Wolski*
16:50	Confirmation of appointment of WP Co-ordinators.	*Lucio Rossi*
16:55	HiLumi LHC project progress.	*Lucio Rossi*
17:15	HiLumi LHC finances.	*Agnes Szeberenyi*
17:30	Update on European Strategy for Particle Physics.	*Frederick Bordry*
17:50	US DOE position on LHC High Luminosity upgrade.	*Bruce Strauss*
18:10	Japanese position on LHC High Luminosity upgrade.	*Tatsushi Nakamoto*
18:30	Location and approx. date of next HiLumi LHC annual meeting.	*Rob Appleby*

Main Items from 2nd CB Meeting

- Appointments of Stephane Fartoukh and Stefano Redaelli as Co-ordinators for WP2 and WP5 respectively were confirmed.
- The HiLumi LHC project is making very good technical progress, with work on schedule to achieve most milestones and all deliverables.
- The overall level of resources used to date is less than would be expected from a linear profile at this stage of the project. There are some reasons for this, but the situation should be monitored.
- **The next HiLumi LHC Annual Meeting will be in Daresbury, UK, in November 2013.**

1 project – 1 structure: HL-LHC



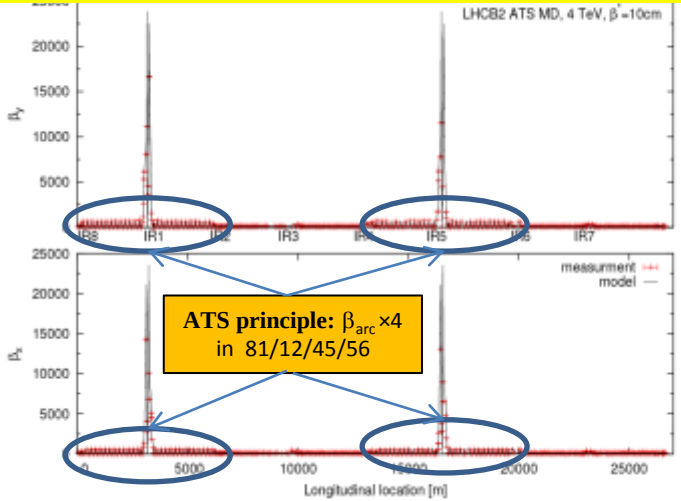
HiLumi-WP2

First HL-LHC Target Parameters established

Parameter	Nom. 25 ns	HL 25 ns	HL 50 ns
N_b [10^{11}]	1.15	**2.2**	**3.5**
n_b	2808	2808	1404
I [A]	0.56	1.12	0.89
θc [µrad]	285	590	590
β* [m]	0.55	**0.15**	**0.15**
ε_n [µm]	3.75	**2.5**	**3.0**
ε_s [eV s]	2.5	2.5	2.5
Piwinski	0.65	3.12	2.85
R red.fact.	0.84	0.31	0.33
b-b/IP[10^{-3}]	3.1	3.3	4.7
L_{peak} (no crab)	1	7.4	8.5
Crabbing	no	yes	yes
$L_{peak\ virtual}$	1	24	26
Lumi level	=	5	2.5
Pileup $L_{lev}=5L_0$	19 (27)	140	140
Eff. for 250 fb^{-1} /year (150 days)	=	**0.59**	**0.98**

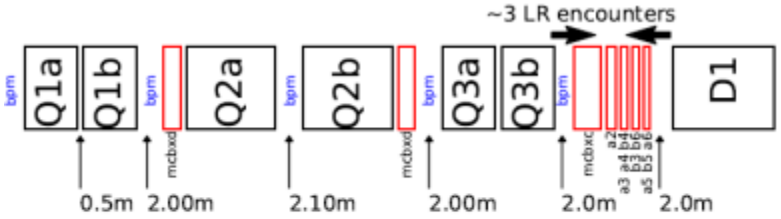
First parameter demonstrated: β*=10 cm (+20/40% β-beating)

... but IT and MS aperture missing to make it operational



HLLHCV1.0: first optics & layout of the HL-LHC ready

with 150 mm- 140 T/m Nb3Sn triplet and crab-cavities

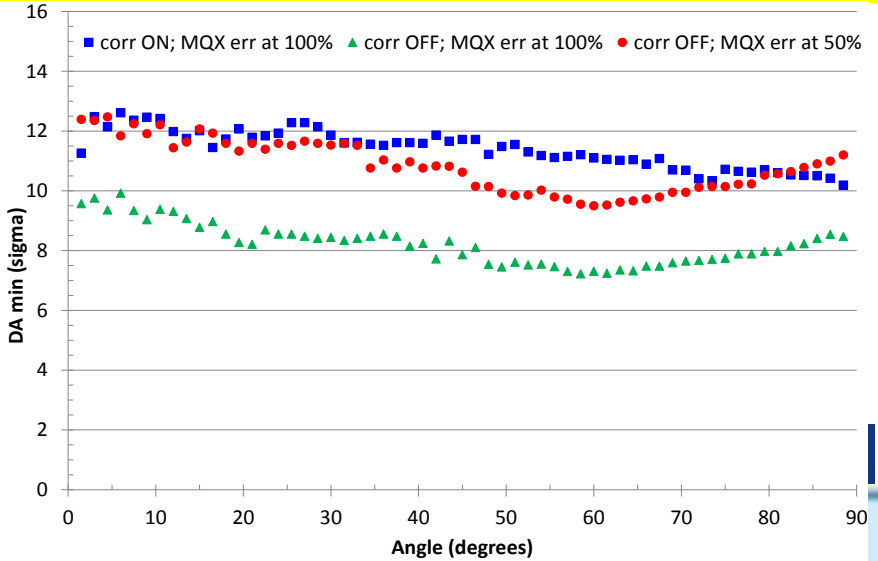


Q1/3 a/b: 3.99m, 140 T/m, 150mm
Q2 a/b: 6.76m, 140 T/m, 150mm
D1: 7.7m, 40 Tm, 160mm

MCBXD: 1.3m, 1.8Tm, h/v nested orbit corrector
MCBXC: 2.00m, 4.5Tm in xing plane(for crab) and 1.8Tm in the other plane
MQSX3: 0.67m, skew quadrupole corrector
MCSTX3: 0.50m, (b3,b6) nested correctors
MCOSSX3: 0.50m, (a3,a4,b4) nested correctors
MCDTSX3: 0.50m, (a5,b5,a6) nested correctors

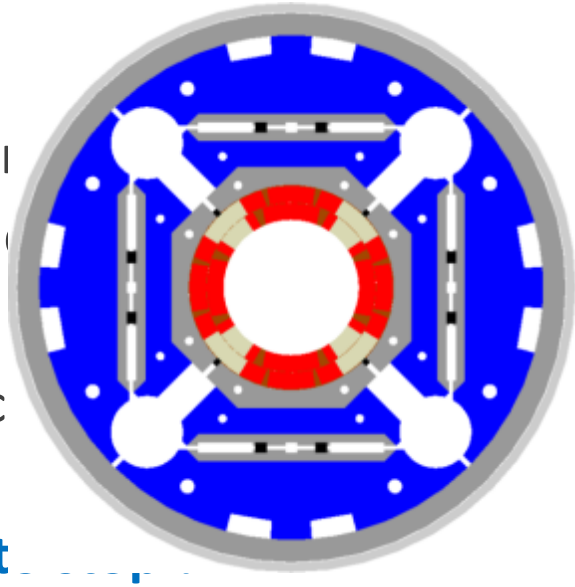
First Dynamic Aperture results extremely encouraging

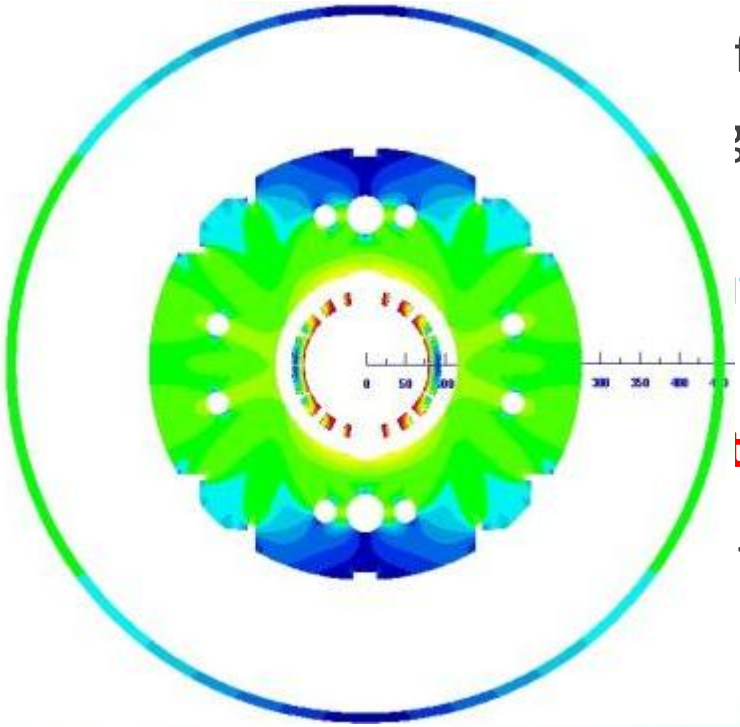
adding new IT corrector and/or tighten the expected IT field quality



WP3

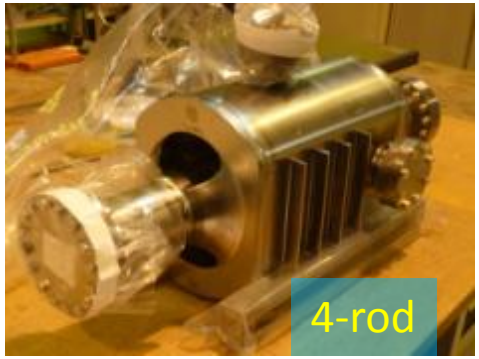
- Aperture selection: **Q1-Q3 150 mm, D1: 160 mm, Q4: 90 mm**
- Energy deposition and heat load targets
  - Targets for peak values: **40 MGy - 4 mW/cm^3**
  - Achieved with large shieding with beam scree
  - Higher temperature in the coil: 1.9+0.75 K (mi
- M for 2013
  - ght but ac
  - **t where t**
  - **tected by quenchback)**
- D 5.2 T, 7.6 m long
- Q 120 T/m, 4.5 m long

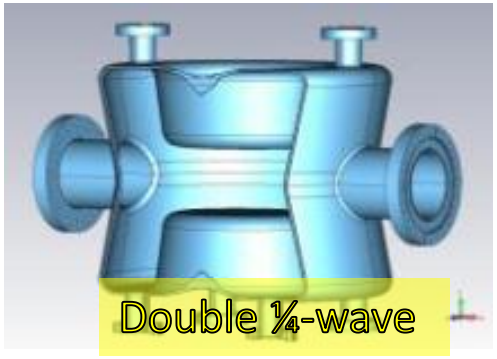




Wupi 4 – Crab Cavities

- **Progress:** Excellent progress on prototypes

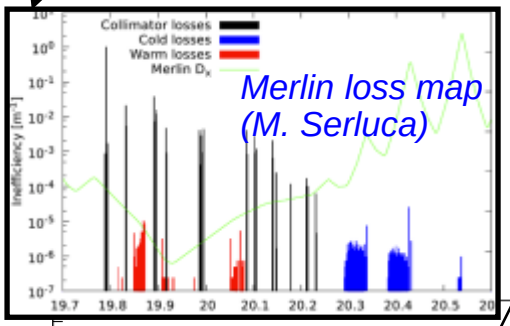


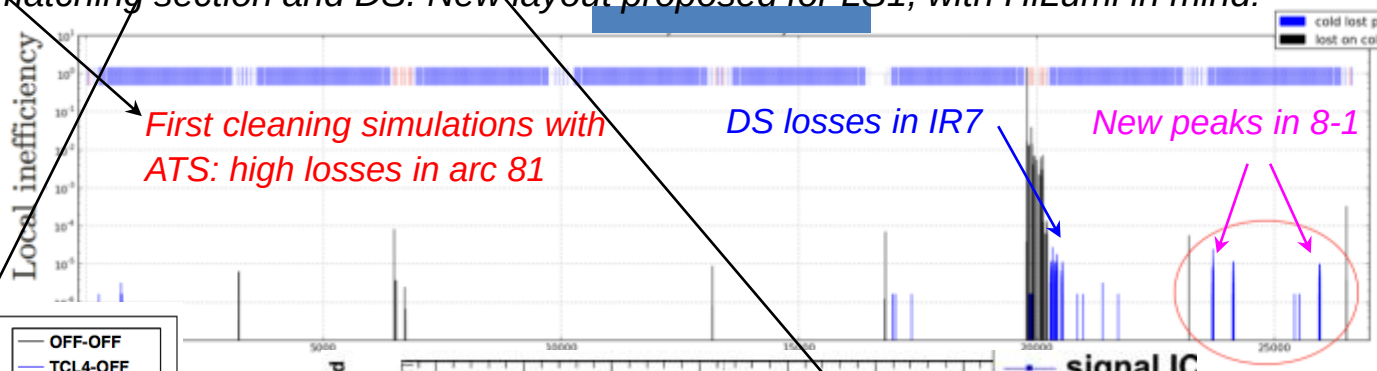


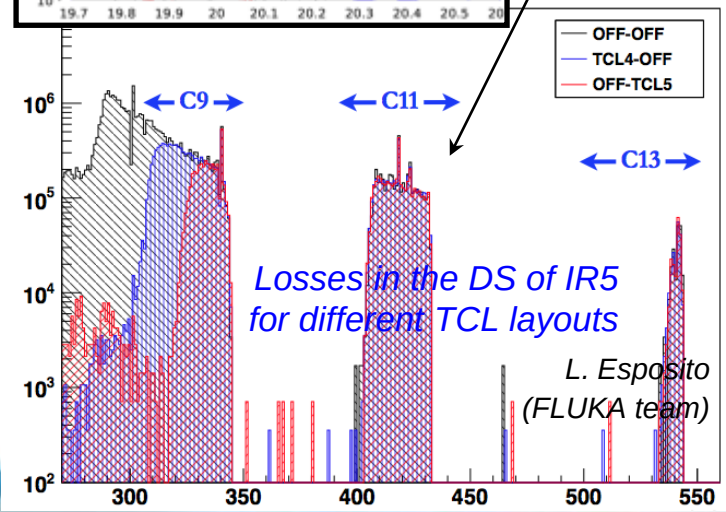
- Multipactor, HOM damping, max. fields, field homogeneity: all well under control.
- Must define exact kick voltage need – trading off against Q7+!
- Preparation of SPS tests progressing according to schedule.
- **Main concern:** Machine protection – better understanding, but still not safe!
- This was a very productive workshop!

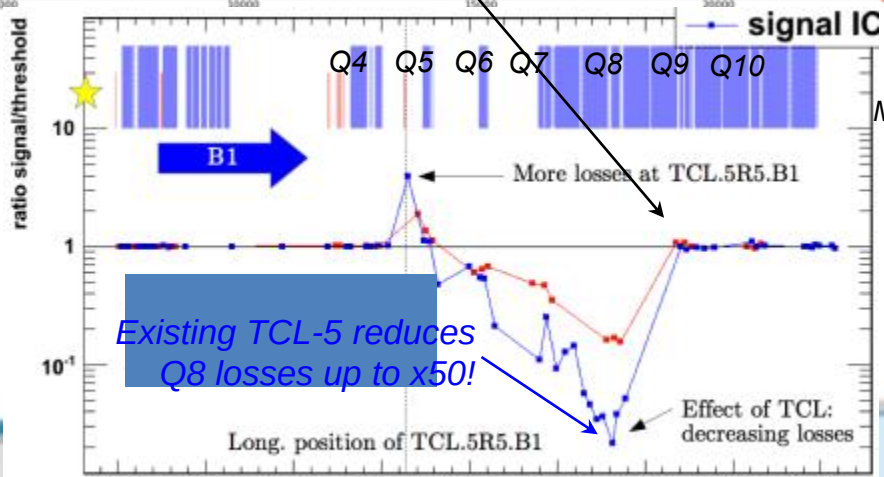
Summary of WP5 activities

- Setup the **Collimation Upgrade Specification meeting** to steer the WP5 activities
  - → *15 meetings in 2012 - Regular and active participation of all WP5 partners + CERN teams.*
- Performed **simulations of collimation cleaning for HL optics** (ATS at β^*=15 cm)
  - → *First simulations indicate high losses in the arcs used for telescopic squeeze!*
  - → *Simulations with Merlin code advanced well: detailed benchmarking with SixTrack ongoing.*
- Participation to **LHC operation** and **MDs**
  - → *Beam measurements for code benchmarking (TCL scans at 4 TeV, failure scenarios).*
  - → *Improved models for β^* reach from collimation: proposed 35-50cm after LS1!*
- Triggered study for new **TCL layout IR1/5** for implementation in LS1*(profited from WP10 models)*
  - → *Improve losses in matching section and DS. New layout proposed for LS1, with HiLumi in mind!*







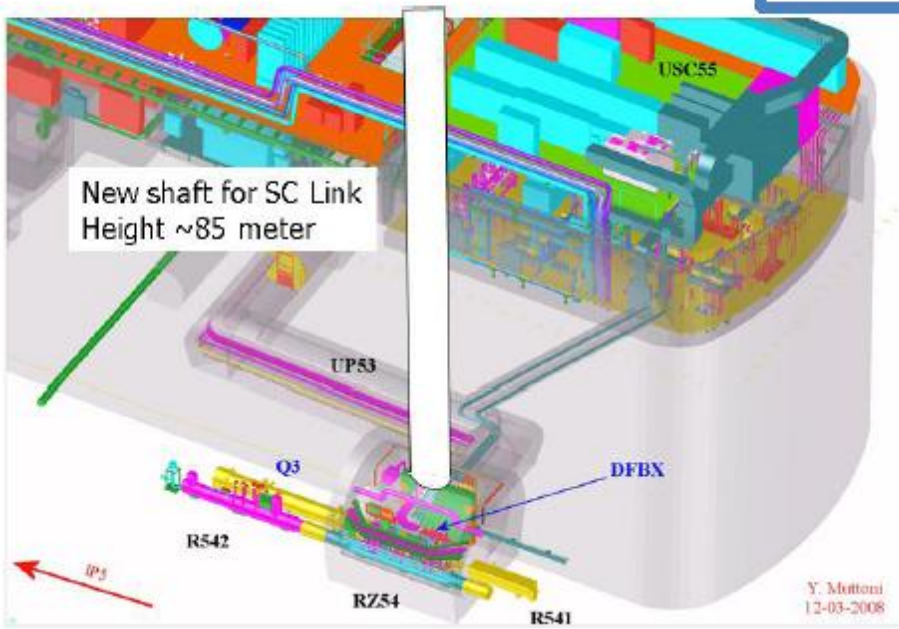


A. Marsili(collimation team)

WP6

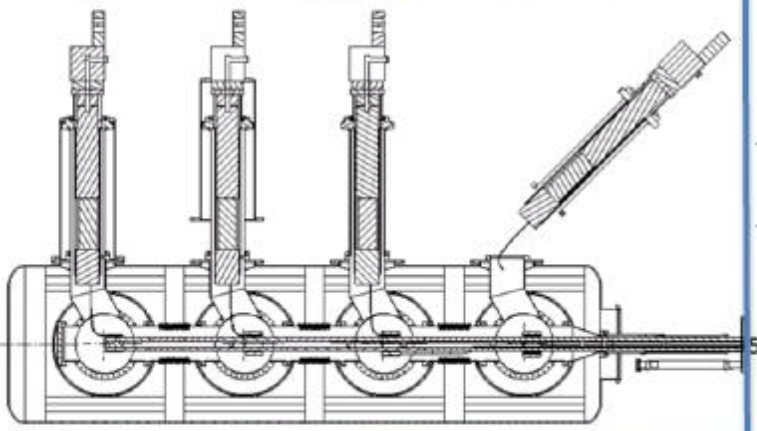
SC Link at CERN: 20 m length, up to 20 kA

Integration studies : P5 L

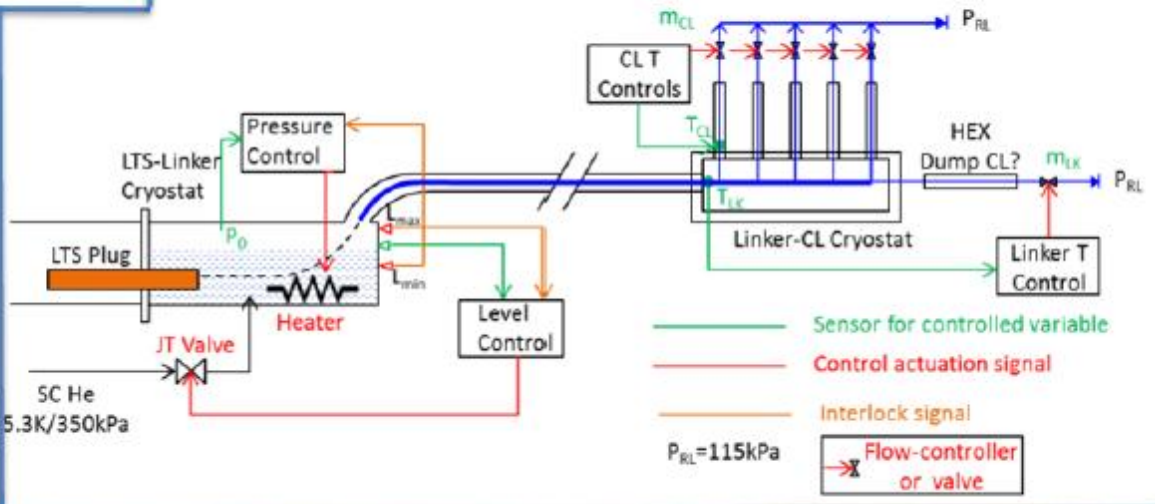


Evaluation of beam effect on MgB_2 with ^{10}B, ^{11}B and ^{nat}B

LHC distribution feed-box



Baseline cryogenic flow-scheme for LHC SC links

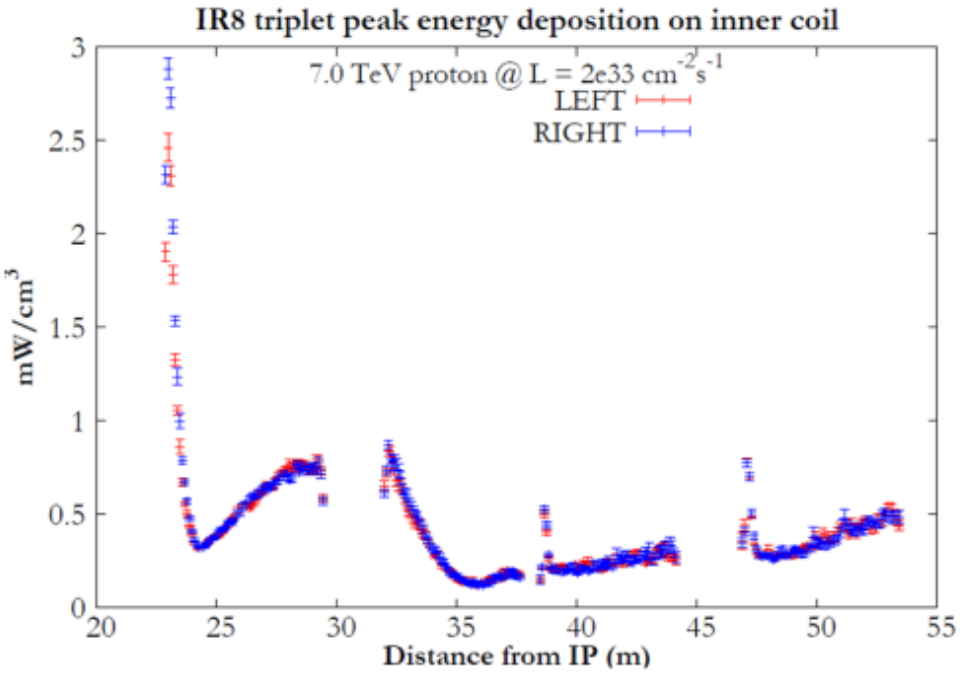


WPs beyond PF7

- WP7 (Mach. Protection)
  - Start analysis CC protection
- WP8 (Collider-Experiment Int.)
  - **30 NOV Workshop**
  - **Close and close colalbroation with Detector: Commong Engineer office**
- WP9 (Cryogenics)
  - SPS cryogenic zone (Coldex) under revamping
  - Work for SC link and P4 well progressing and evalution of e-clouds margin with HL

Technical Progress (incomplete …) - 7

- WP10 (Energy depo)
- Very fuitful EU-USA collaboration
- Support to **all studies**
- Leading role in IP8 study for LHCb upgrade: no need of TAS for 2e33 of luminosity



Technical Progress (incomplete …) - 8

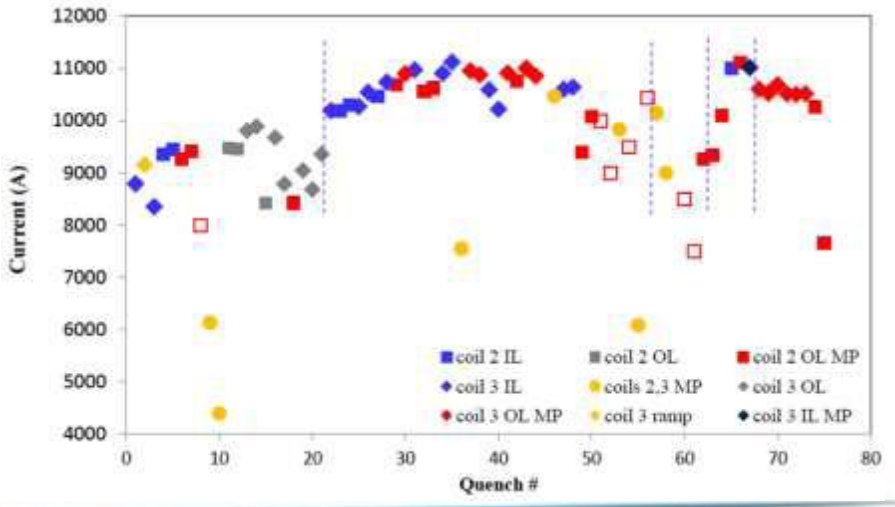
- WP 11 (11 T dipole)
- 2 m long single bore: test in June/July 2012

  10.4 T at low dI/dt,

  95% of the goal, coil damage recognized

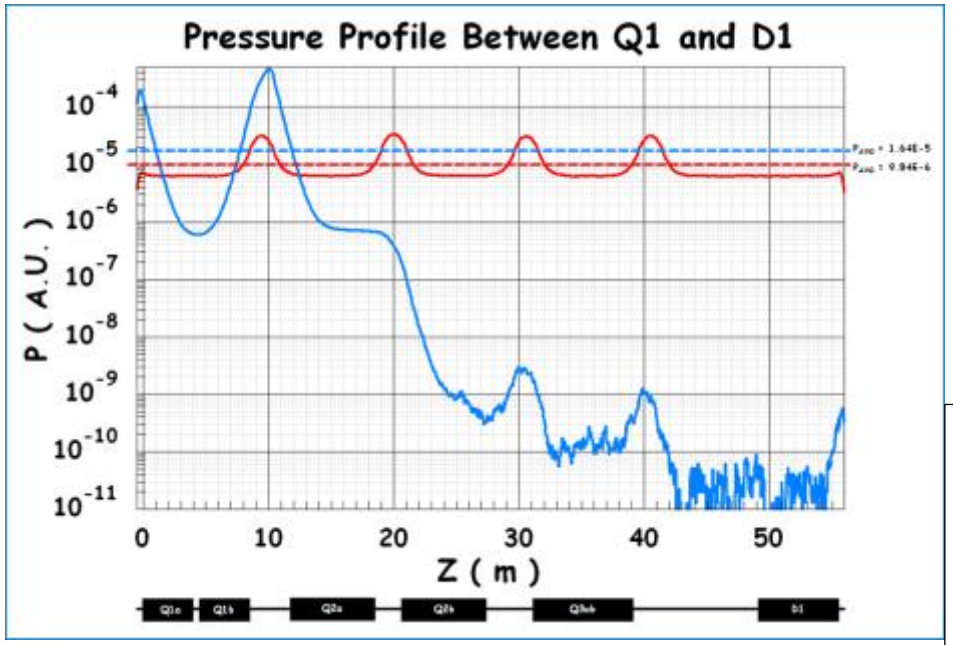
  new 1 m single bore to test in February

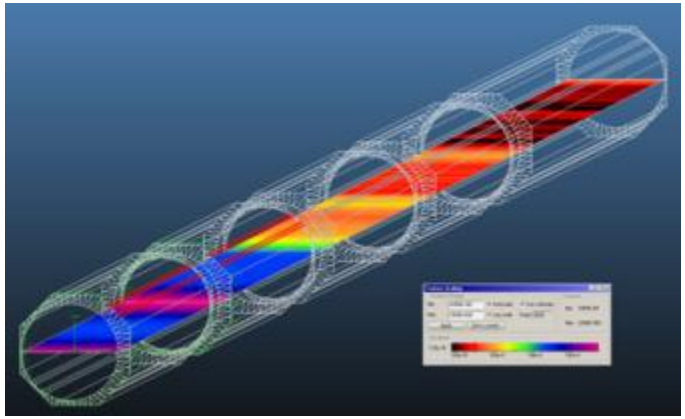
  Then one 2 m single bore in 2013 and after the 2in1



Technical Progress (incomplete …) - 9

- WP12 (Vacuum)
- Careful study undergoing (for molecular flow and Synchr.Rad.): no issue for the moment





The integrated flux along the ~ 7700 mm-long orbit is F=2.84E+17 ph/s, and the integrated power is P=0.88 W, for the nominal HiLumi current of 860 mA.

Even for a SR-induced outgassing yield η(molec/ph)= 1.0E-4 the corresponding gas load Q_{SR} is Q_{SR}=1.158E-6 mbar·l/s, giving an average pressure rise of ~1.1E-11 mbar, well below the pressure limit of 6.7E-10 mbar.

Technical Progress (incomplete …) - 10

- WP13 (Beam Diagnostic) just starting (B-B wore compensator and e-lens under study with Collimation
- WP14 (de)Installation and Integration : STARTED
- WP15 HWC

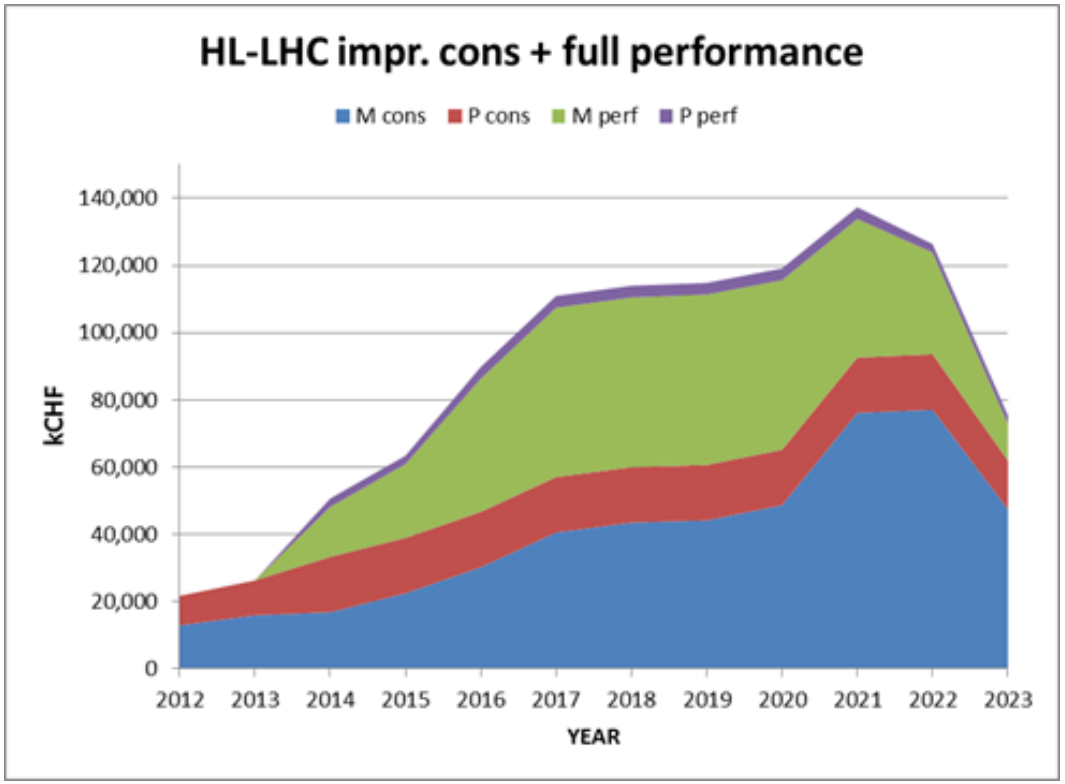
- WP16 (HE-LHC Study): Begins in 2013,
  - FP7-Eucard2 – WP10 approved: start in May 2013
- WP17 : High Field Magnet (technology R&D and 130 mm – 13 dipole for Test station) under FP7 Eucard WP7.

HiLumi: Two branches (with overlap)

- **Enhanced Consolidation upgrade (1000-1200 fb^{-1})**
  - Magnet rad. damage and enhanced cooling
  - Cryogenics (P4, IP4,IP5) with separation Arc from RF and from IR
  - Collimation
  - R2E & mitigation radioact.
  - SC links (in part)
  - QPS and Machine Prot.
    - Kickers
    - Interlock system
- **Full performance upgrade (3000 fb^{-1})**
  - Maximum low-β Quads aperture
  - Crab Cavities
  - HB feedback system (SPS)
  - Advanced collimation systems
  - E-lens (?)
  - SC links (all)
  - R2E and remote handling for 3000 fb^{-1}

High Luminosity LHC

Preliminary budget estimate



	Improving Consolidation	Full performance	Total HL-LHC
Mat. (MCHF)	476	360	836
Pers. (MCHF)	182	31	213
Pers. (FTE-y)	910	160	1070
TOT (MCHF)	658	391	1,049

Global context

- July 2012: Two documents for the EU strategy:
  - CERN-ATS-2012-236
    High Luminosity Large Hadron Collider - A description for the European Strategy Preparatory Group
  - CERN-ATS-2012-237
    High Energy LHC - Document prepared for the European HEP strategy update
- EU strategy : very encouraging
- CERN managemenrt support: strong
- USA and JP: very good and preparing proposals for substantial in-kind contribution.

Wonderful place, very nice weather
Excellent INFN-LNF and CERN organization
130 registered particitpants (80 expected)

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