



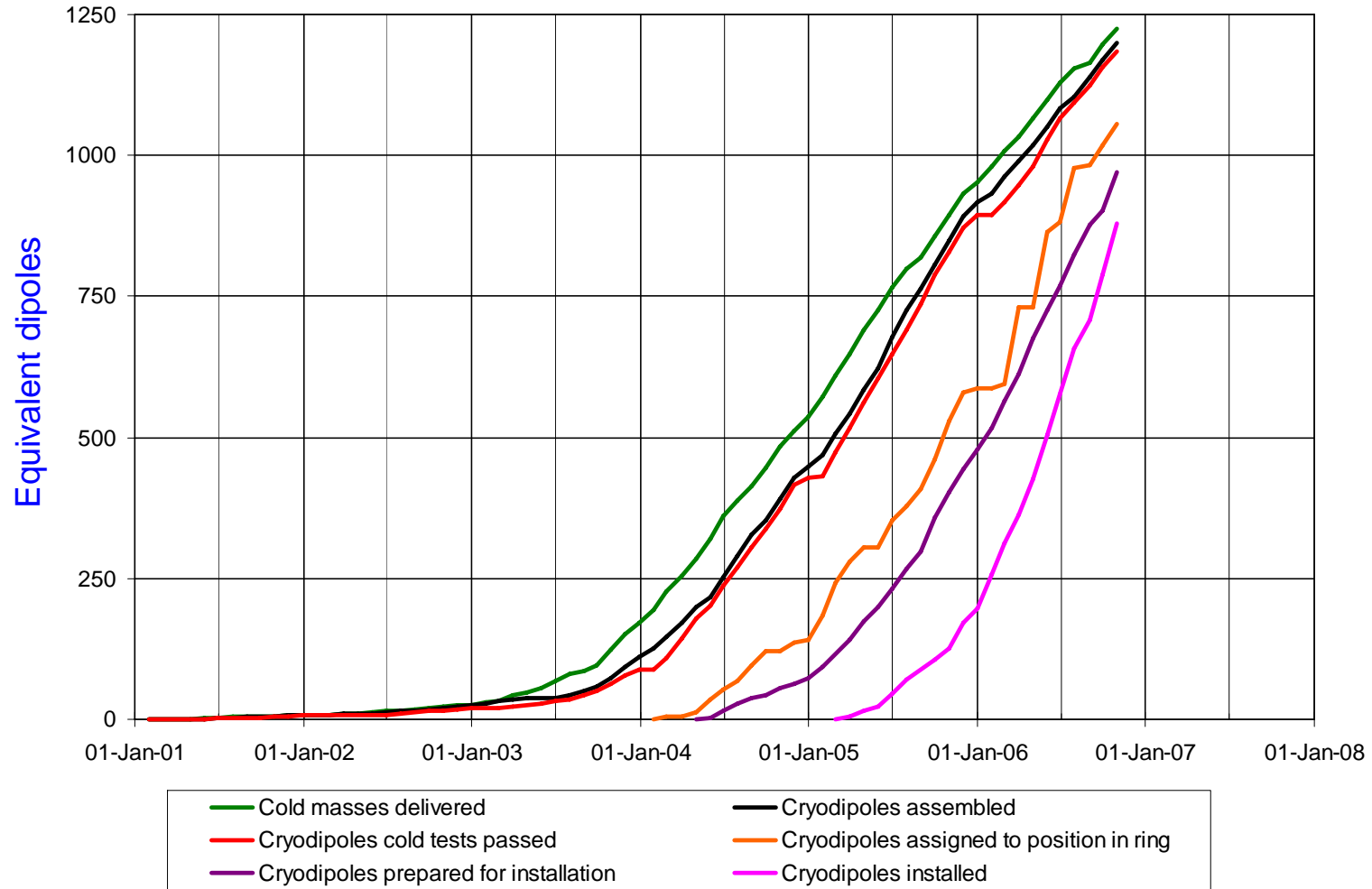
LHC status report

Ph. Lebrun

LHC Committee
CERN, 15 November 2006



Cryodipole overview



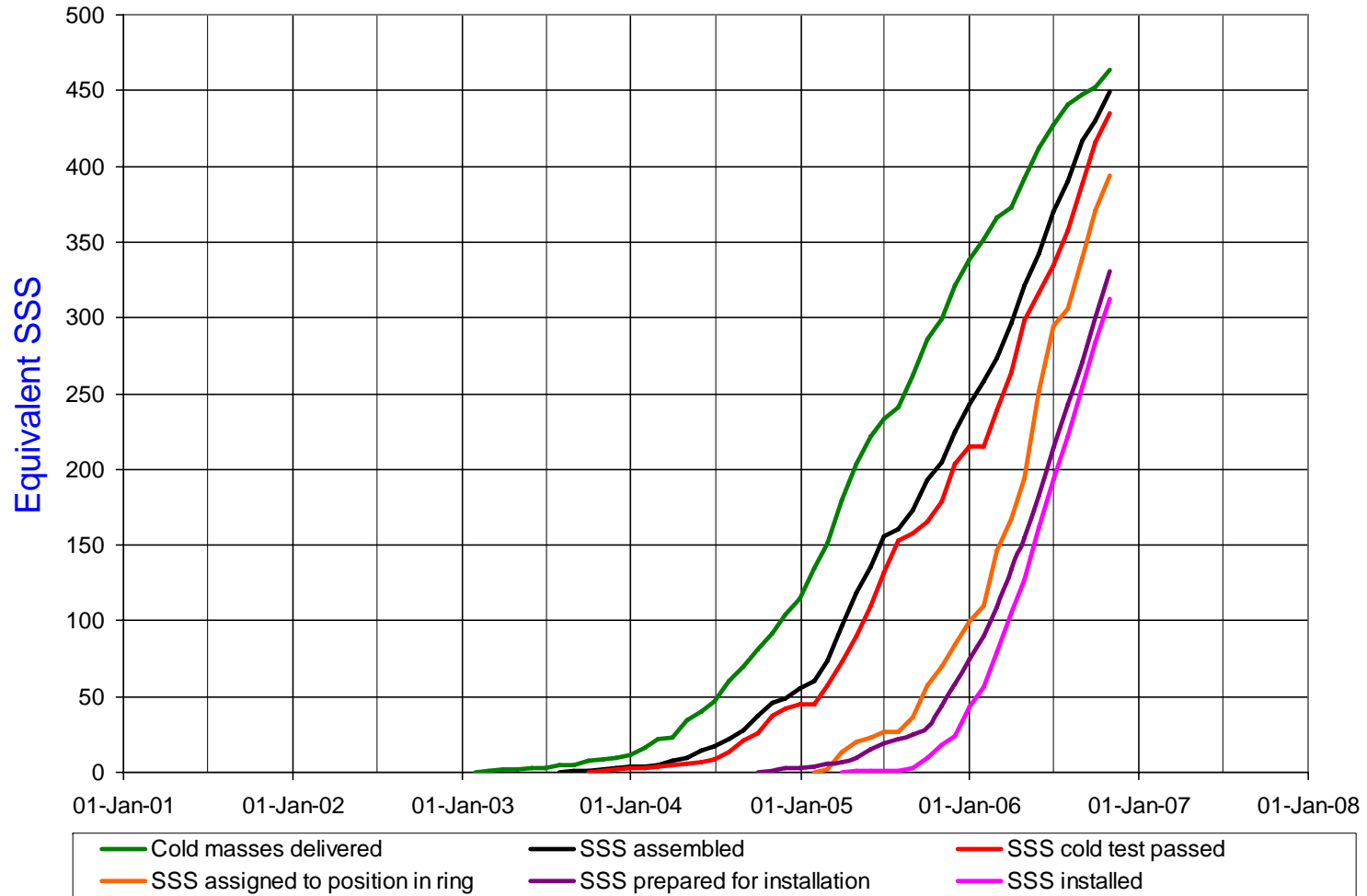


The 416th magnet from Alstom-Jeumont leaving Belfort on 7 November 2006



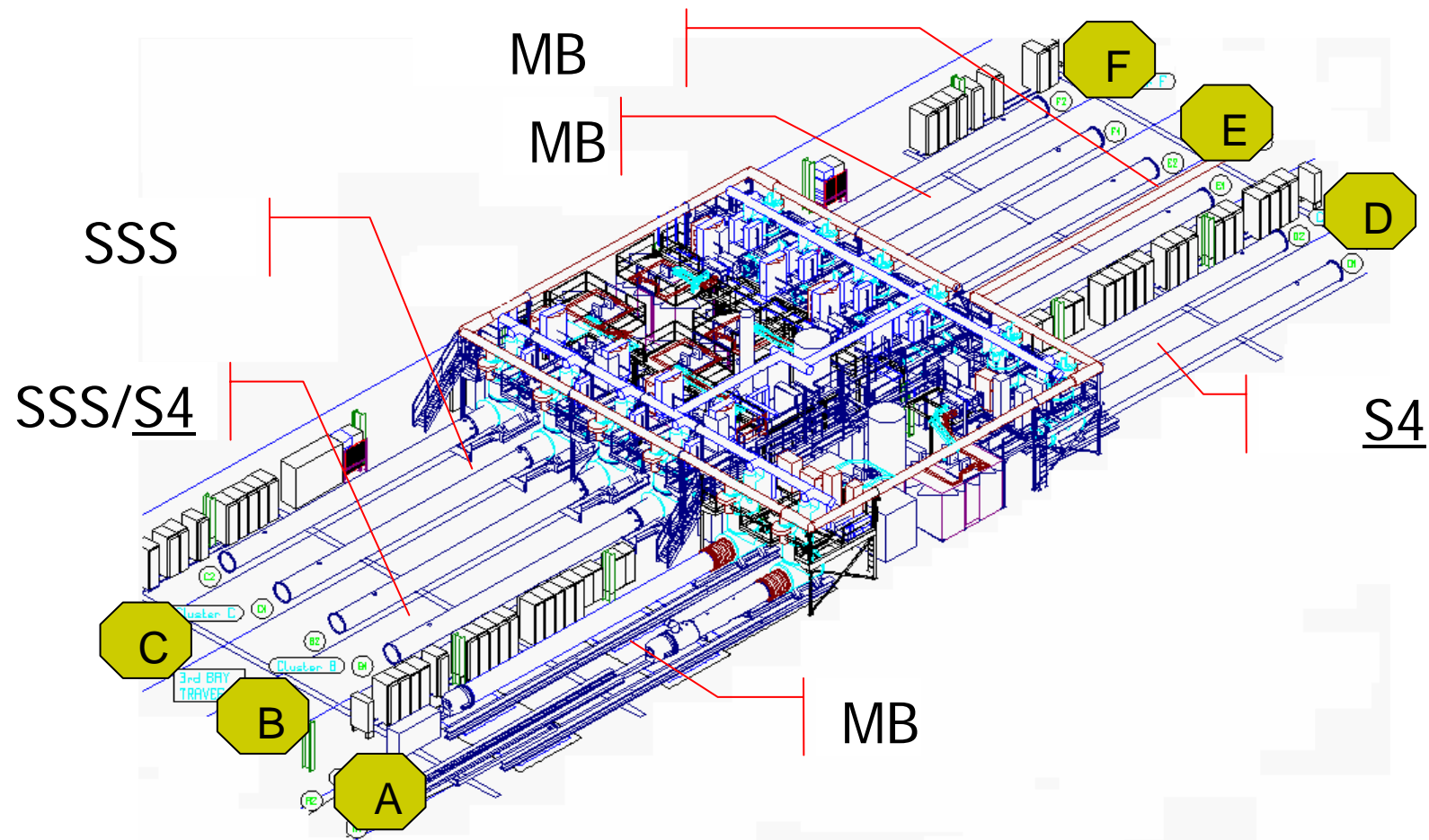


SSS overview



Magnet test station

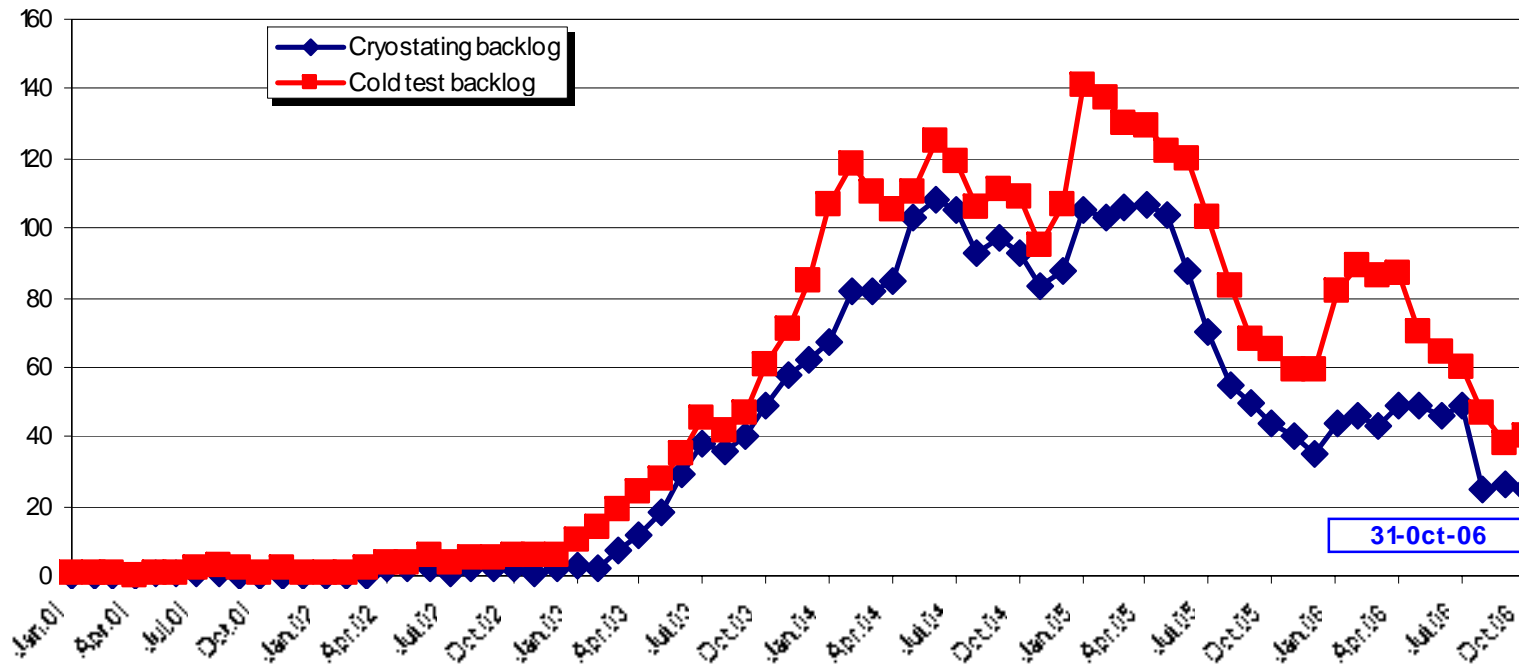
Allocation of the 12 Test Benches in 2006





Cryodipole backlogs resorbed

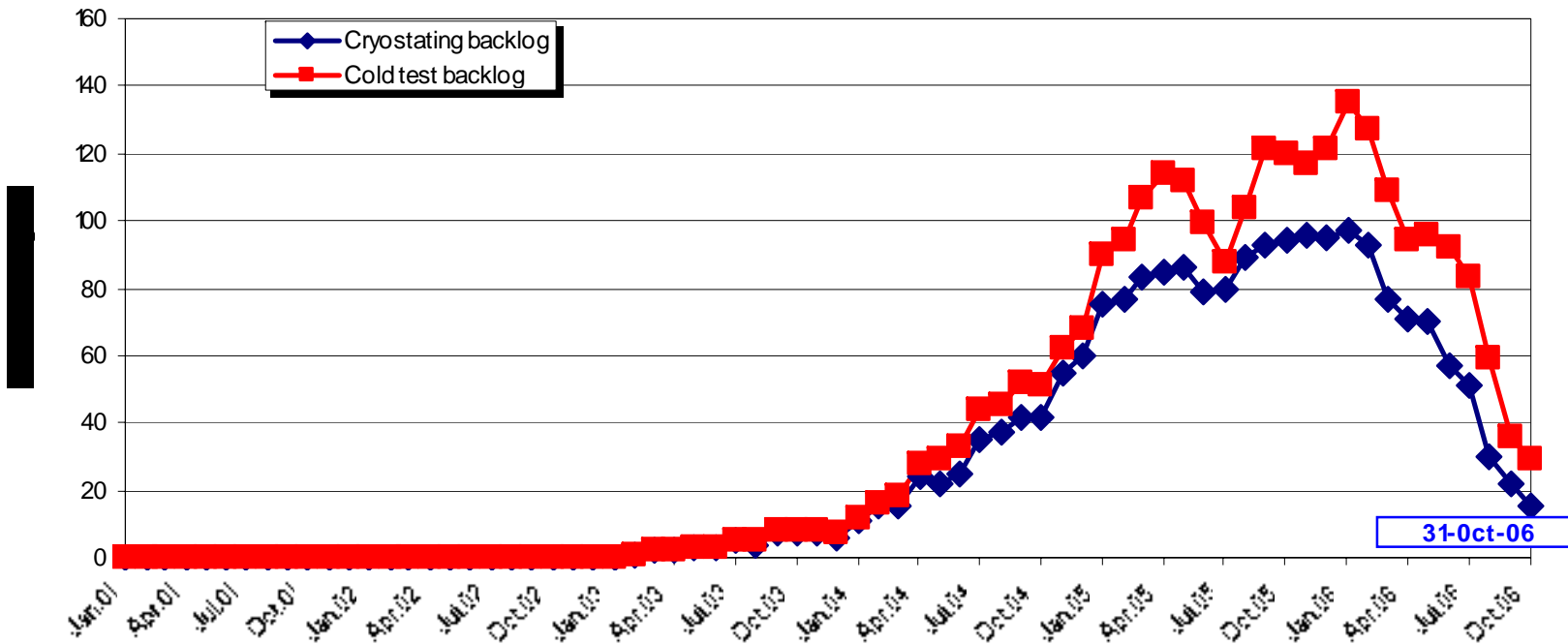
LHC dipole cryostating & cold testing backlogs





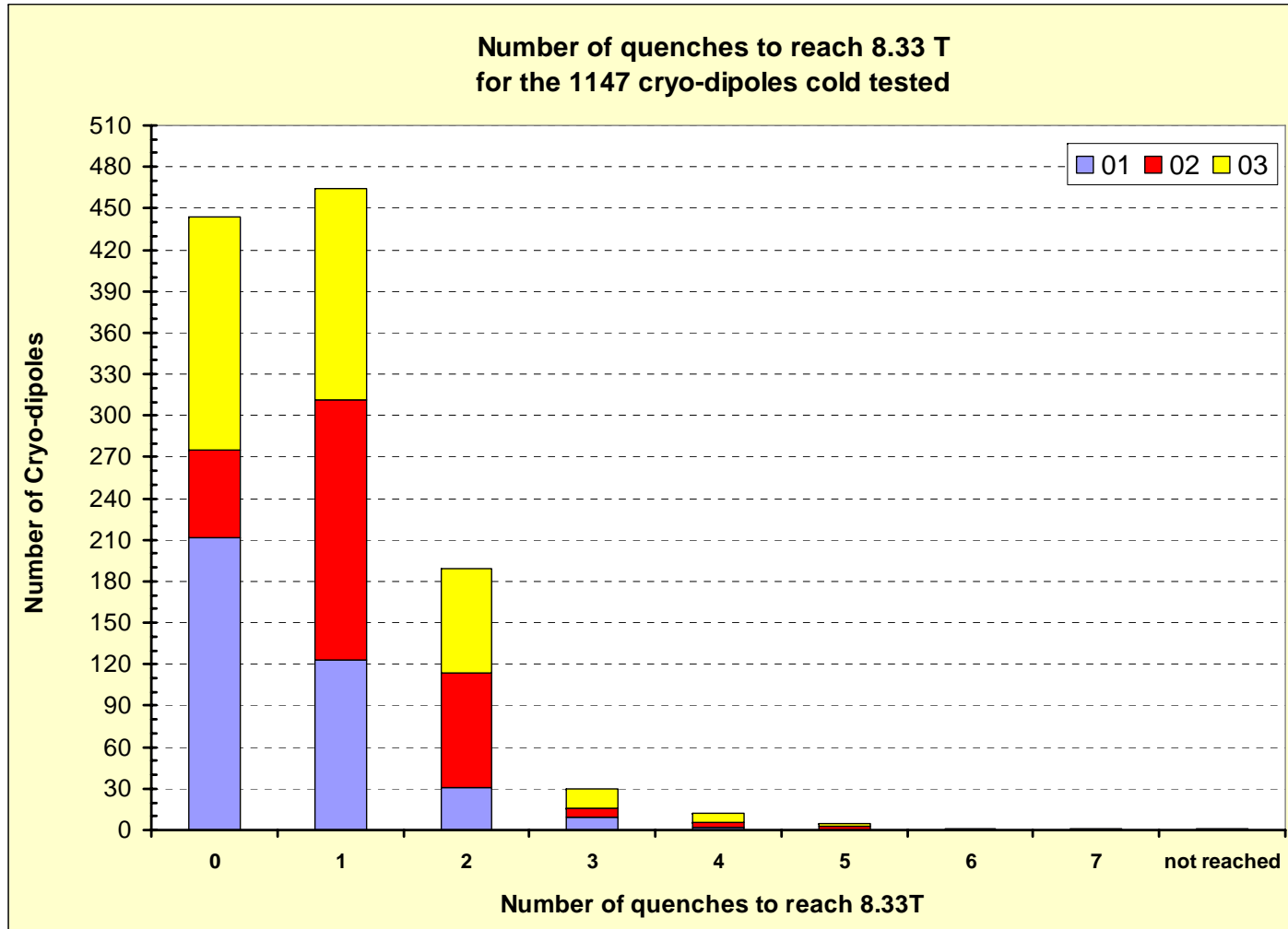
SSS backlogs resorbed

LHC SSS cryostating & cold testing backlogs



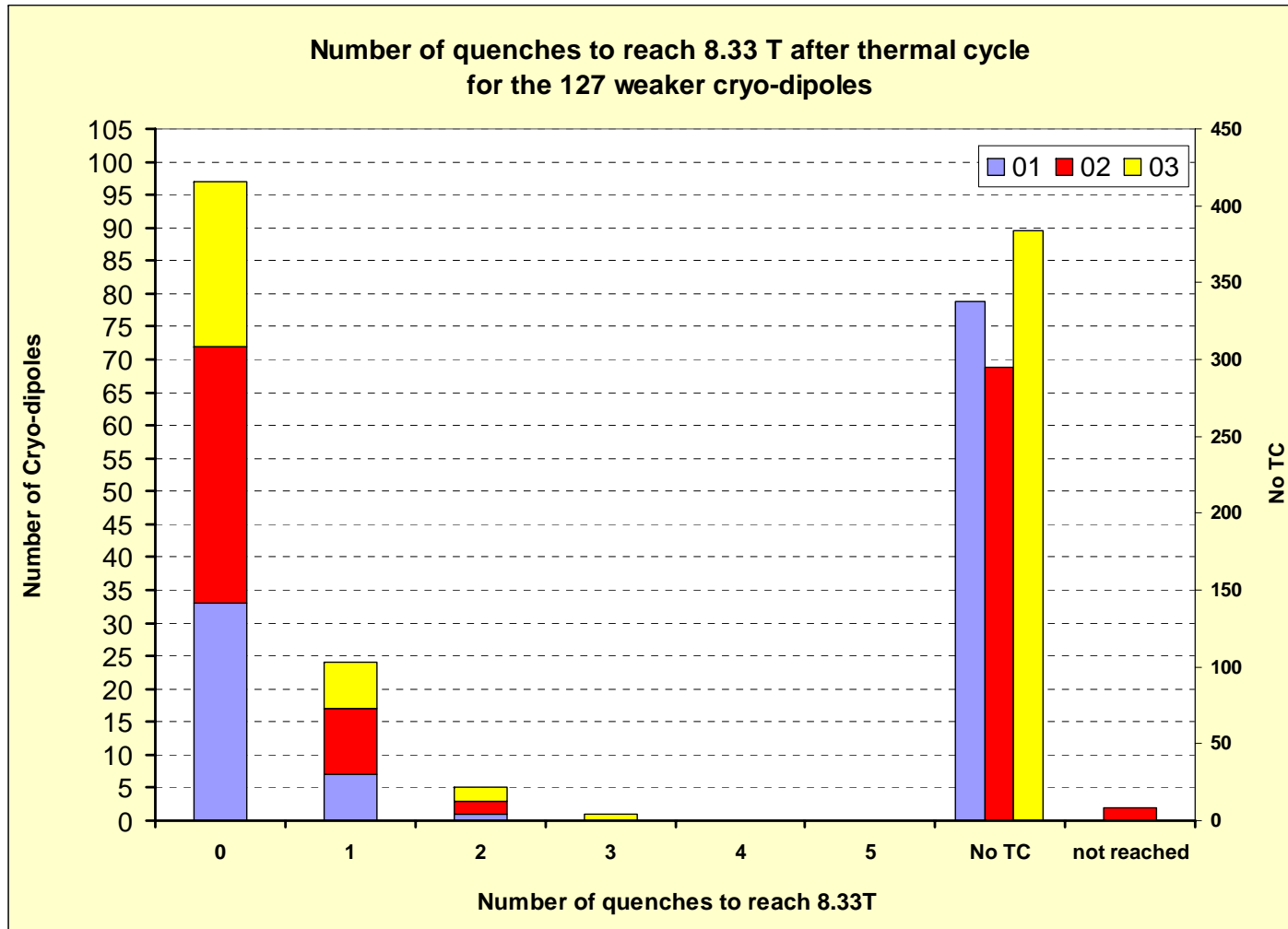


Dipole quench performance



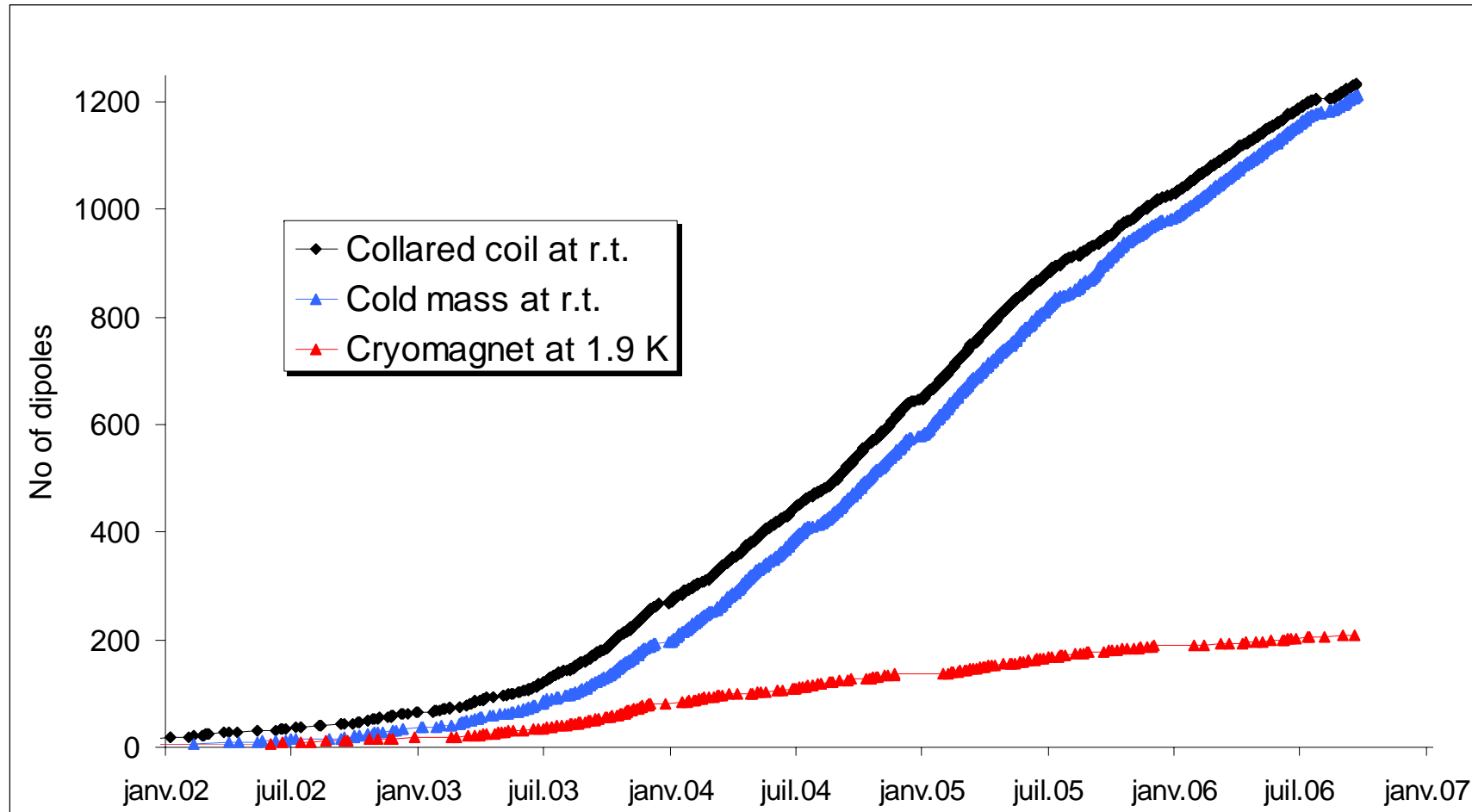


Dipole quench performance



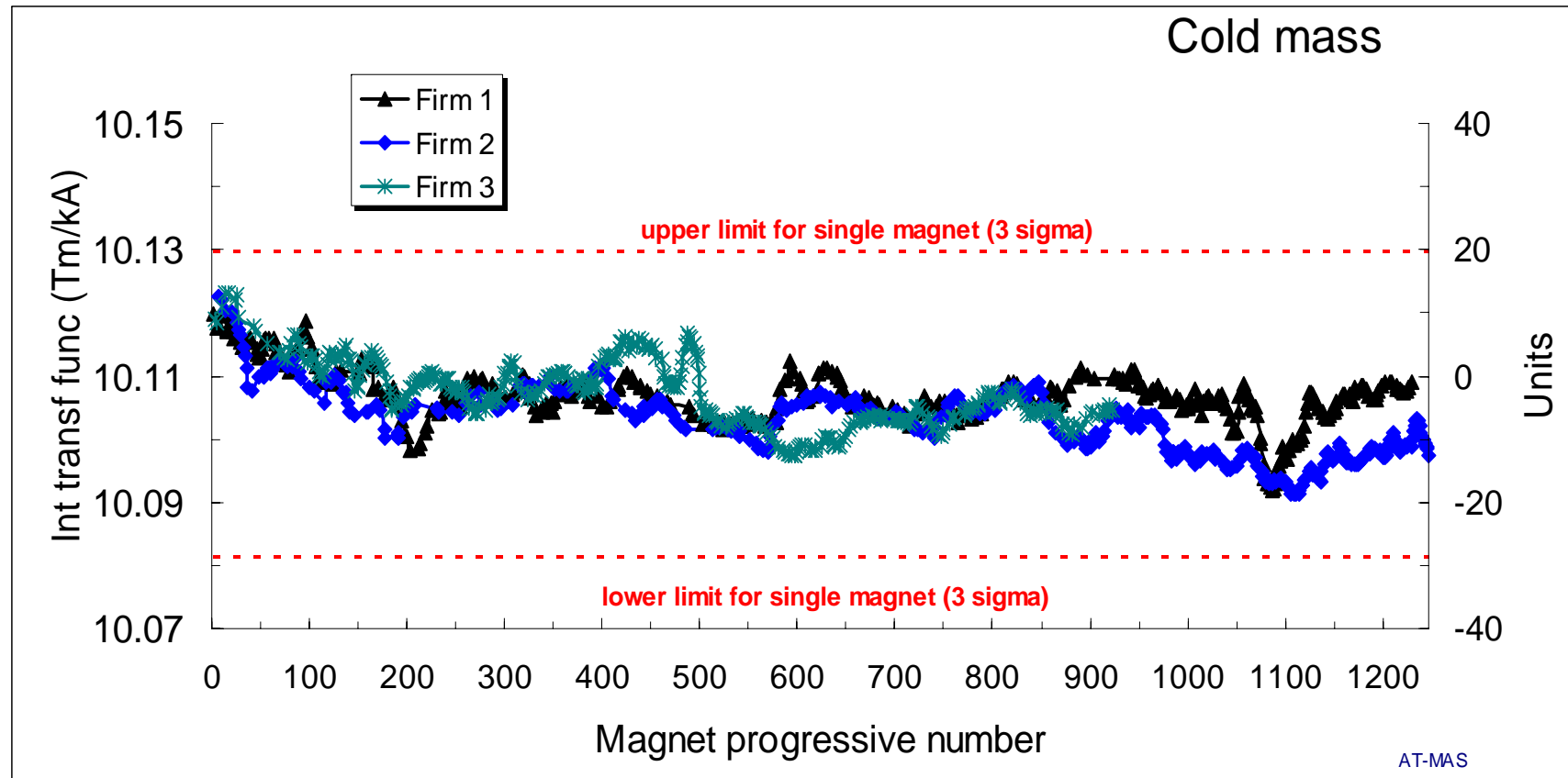


Magnetic measurement of dipoles



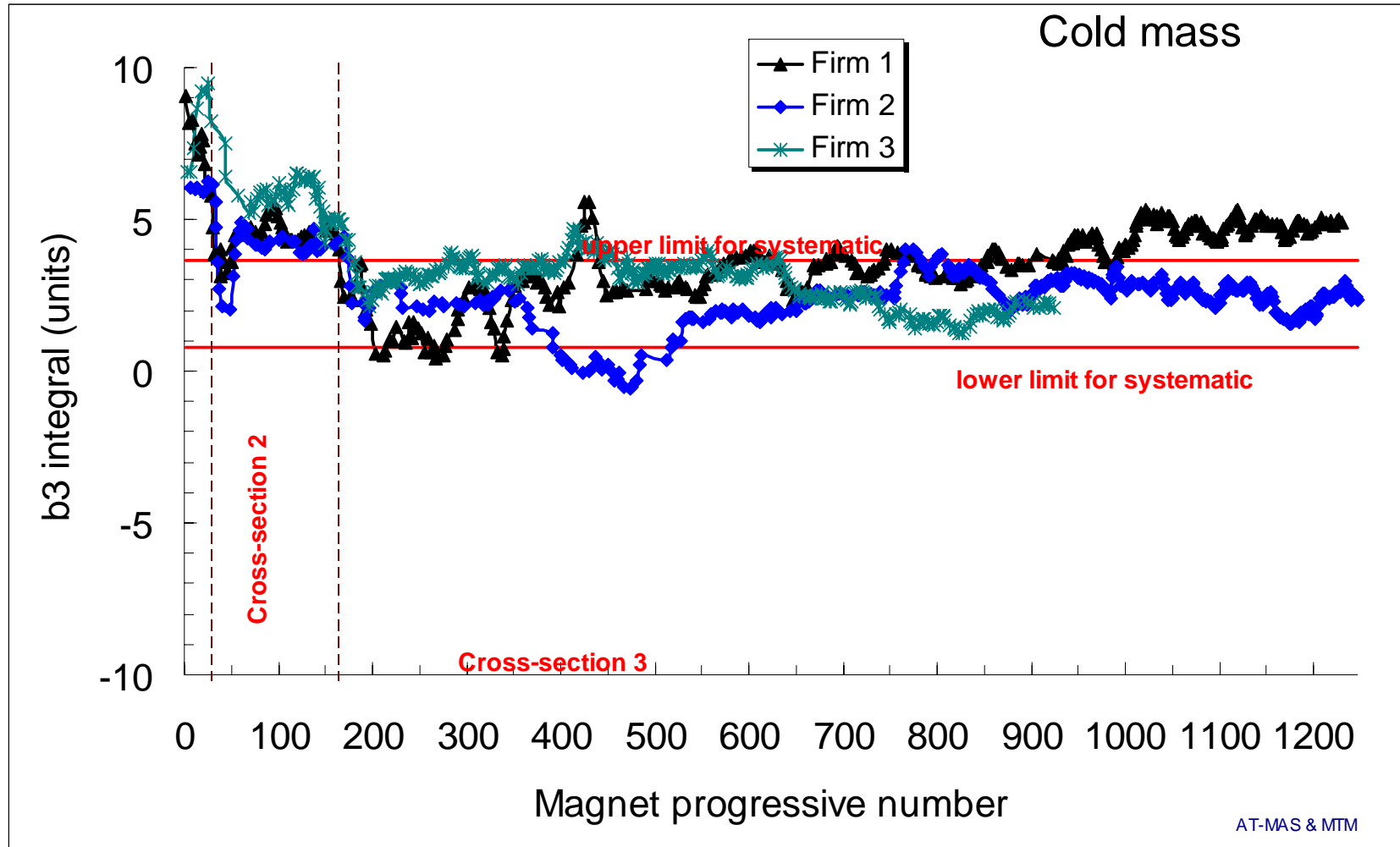


Dipole field strength





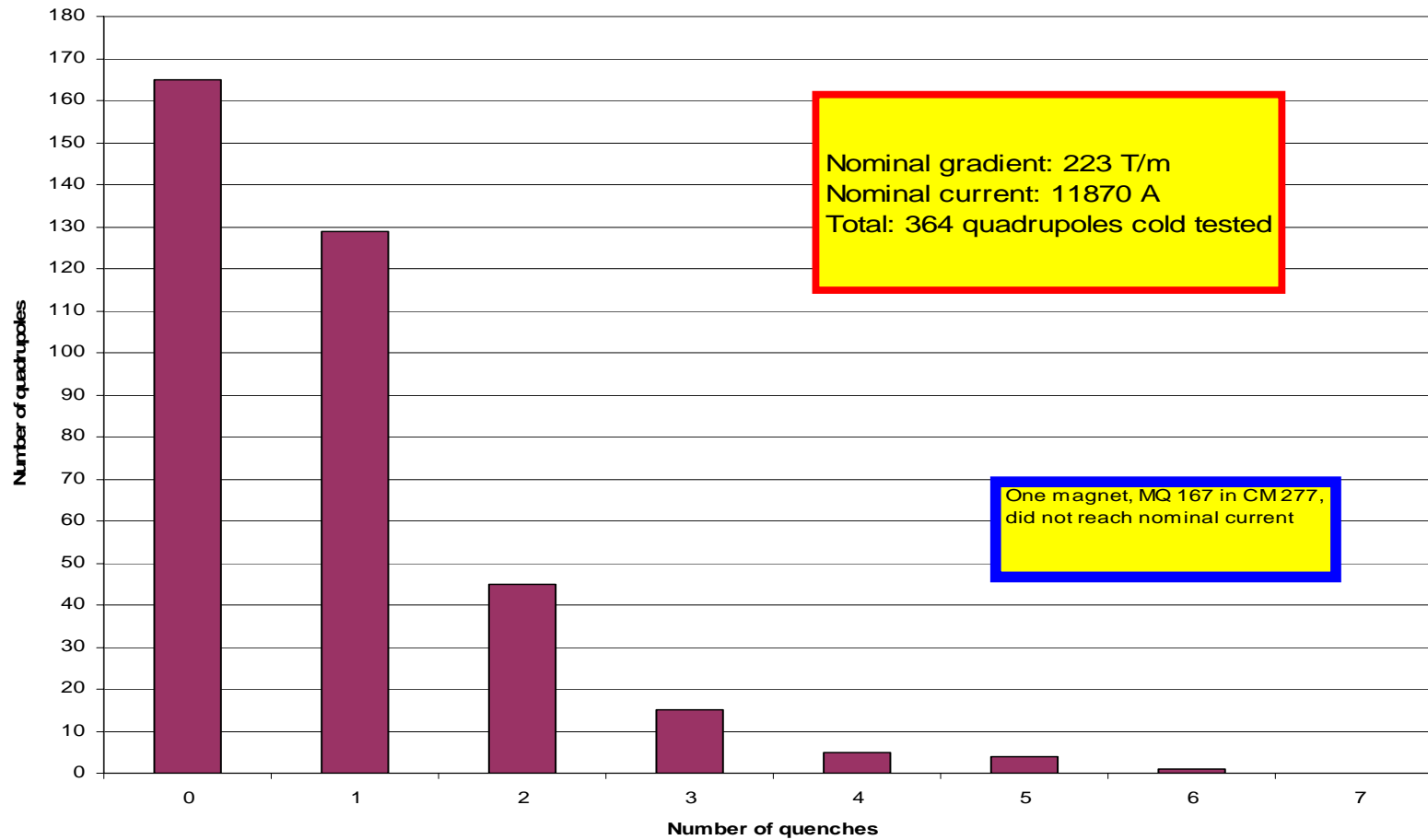
Dipole field quality: b3





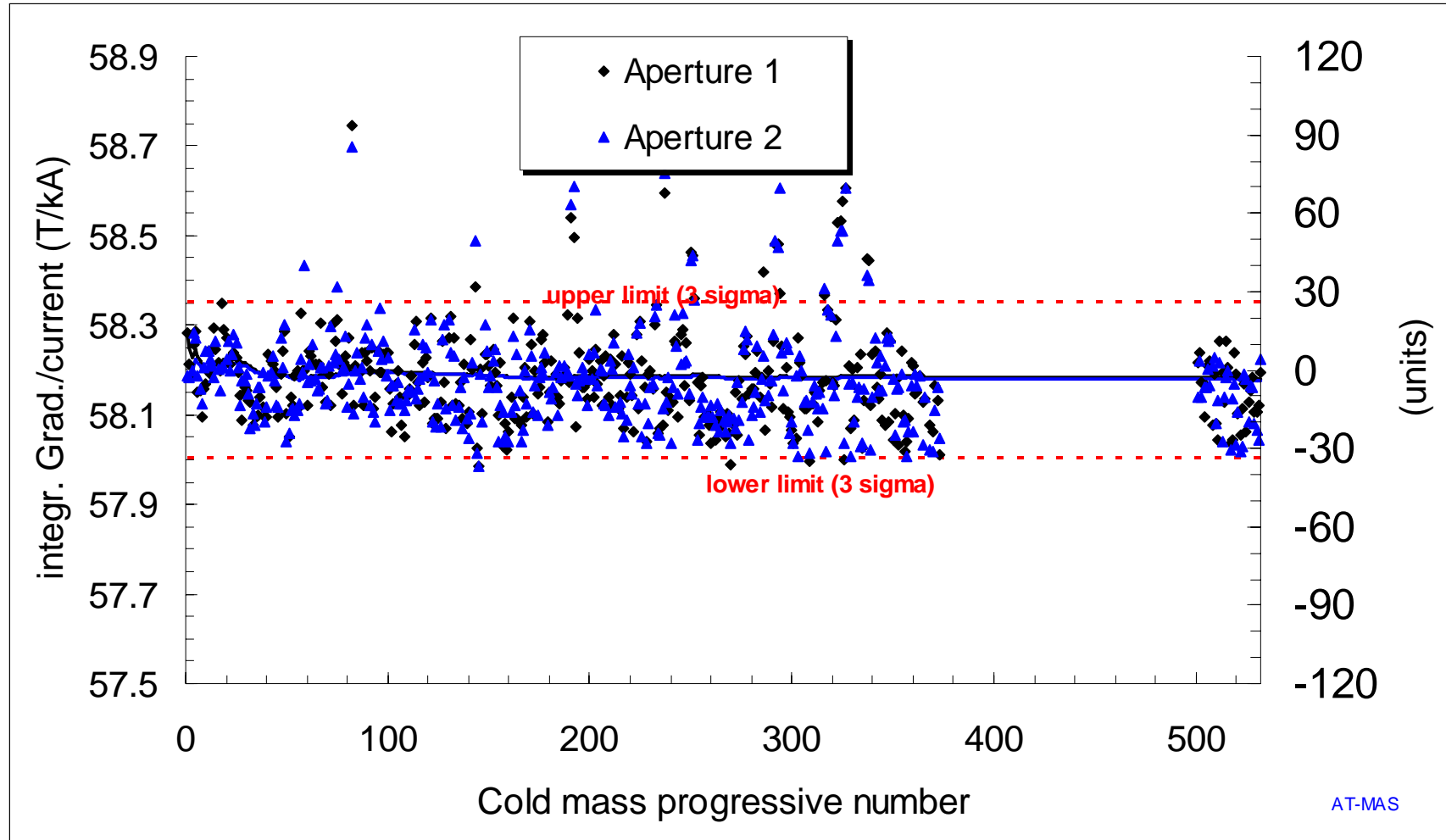
Quadrupole quench performance

Number of quenches to exceed 12'000A,
bare quadrupoles (24) and quadrupoles (340) tested in SSSs



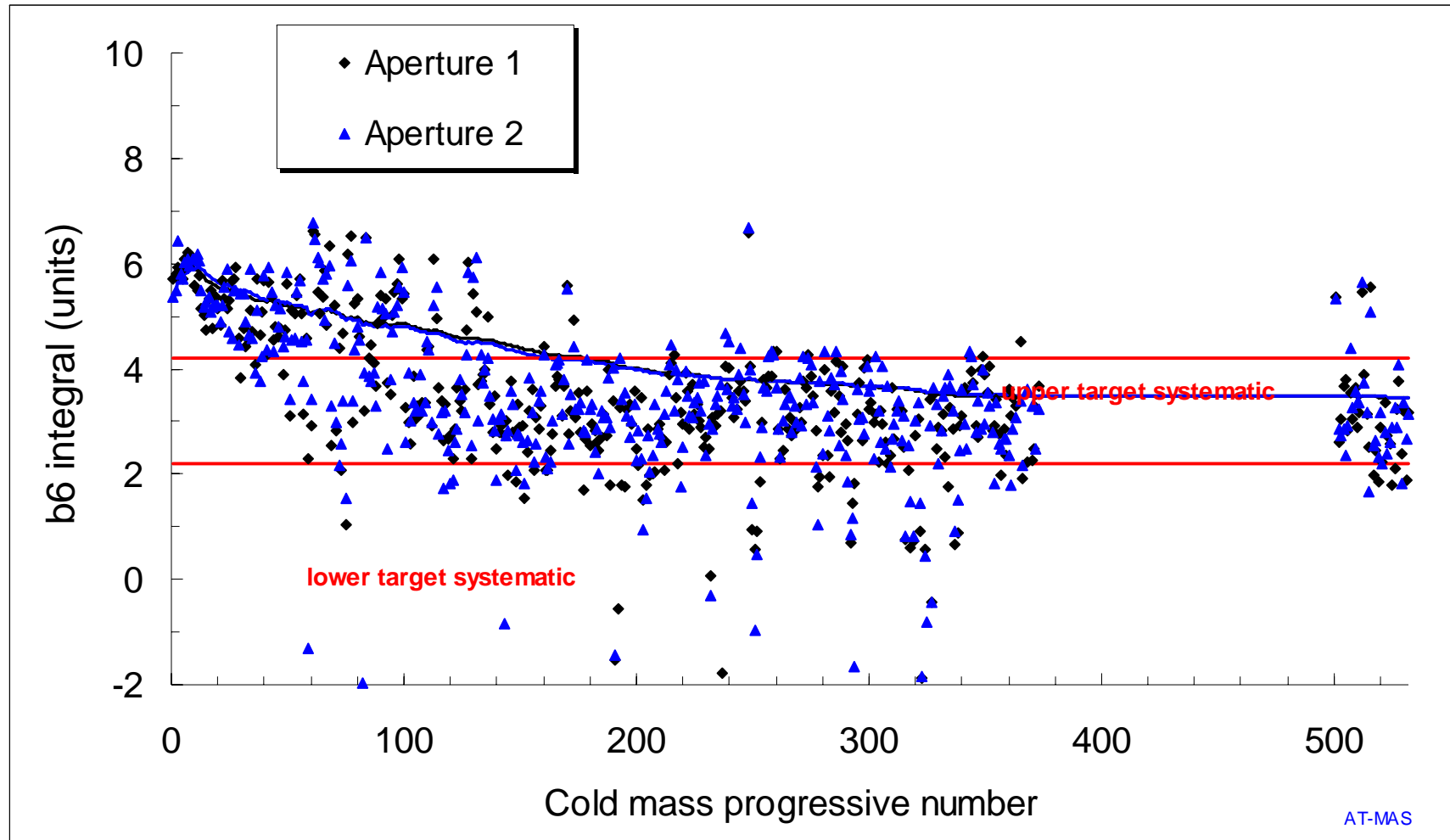


Quadrupole focusing strength



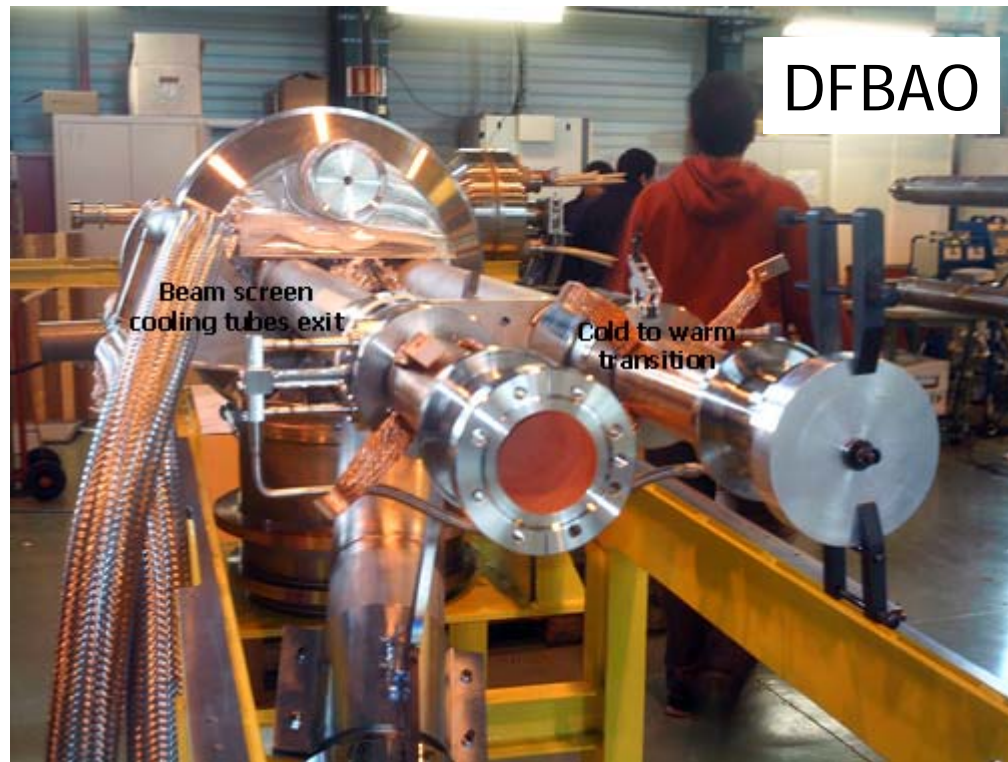


Quadrupole field quality: b6



Final preparation in SMI2

- Main dipoles
- Arc & dispersion suppressor SSS
- Special SSS, including cold-to-warm transitions
- Arc Termination modules



SMI2: main activities

- Preparation of the cold bores & beam screens
 - Weld beam screen components onto one extremity
 - Wash & dry the cold bore
- Assembling the beam screen into the cold bore
 - Insert the beam screen into the cold bore
 - Weld the beam screen components onto the other extremity
- Global tests
 - Leak check of “V lines”
 - Geometrical control of “V lines”
- Final preparation for the LHC tunnel
 - Endoscopic check of beam lines
 - Preparation of extremities for interconnection
- Cold-to-warm transitions for stand-alone magnets





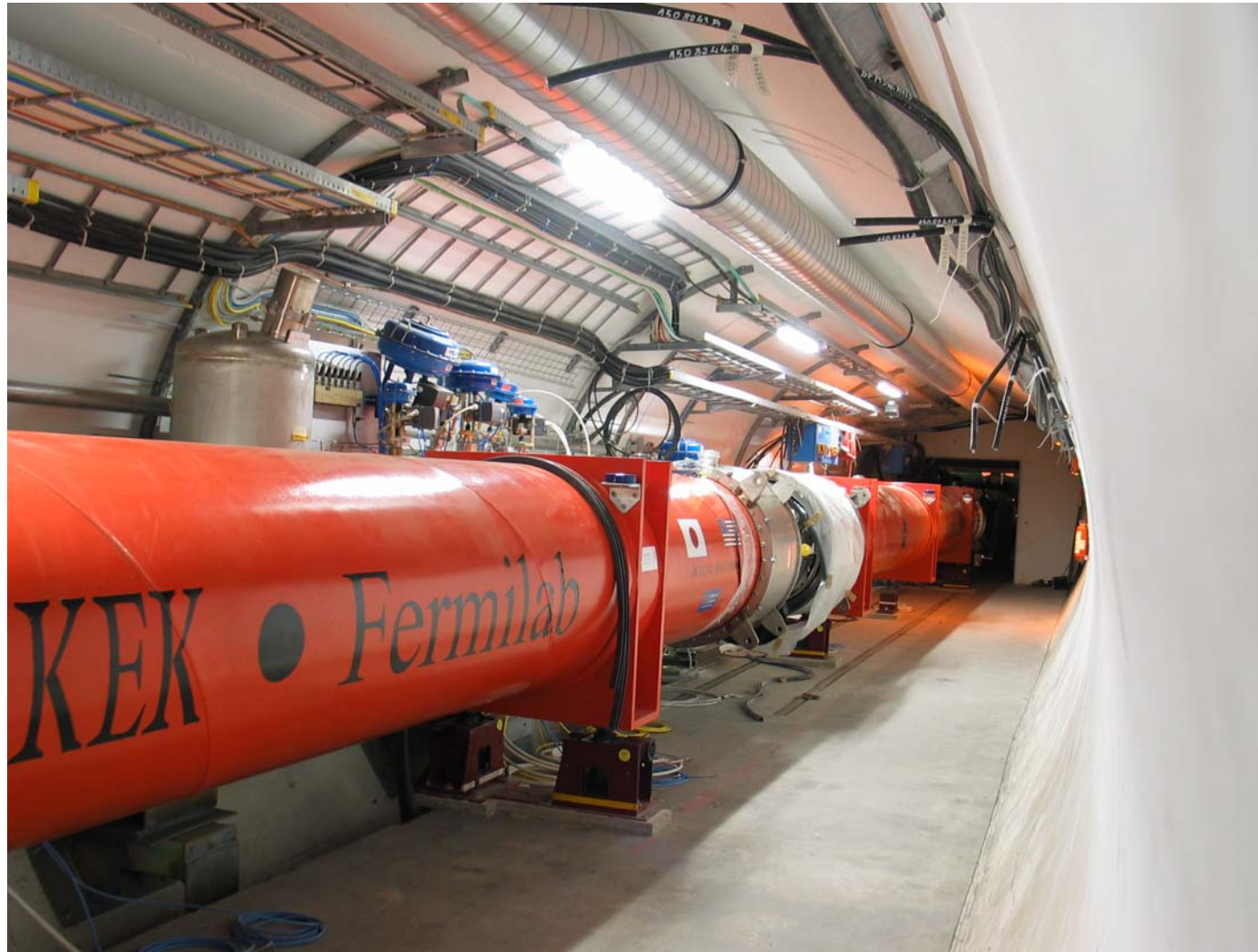
Magnet installation status

	R					L					Total				
	Cryo-magnets			DFB + others	Total	Cryo-magnets			DFB + others	Total	Cryo-magnets			DFB + others	Total
	In Arc		LSS			In Arc		LSS			In Arc		LSS		
	Dipoles	SSS		Dipoles	SSS	Dipoles	SSS								
Secteur 1-2					0					0					0
Secteur 2-3	20	2	1		23	55	10		1	66	75	12	1	1	89
Secteur 3-4	77	24		1	102	77	27	4	4	112	154	51	4	5	214
Secteur 4-5	77	28	4	5	114	77	27	7	3	114	154	55	11	8	228
Secteur 5-6	77	27	4	4	112	76	24	1		101	153	51	5	4	213
Secteur 6-7	73	18			91	7	14			21	80	32			112
Secteur 7-8	77	28	1	3	109	77	27	8	7	119	154	55	9	10	228
Secteur 8-1	77	28	8	5	118	77	27	7	5	116	154	55	15	10	234

LHC	924	311	45	38	1318
Cryo-magnets	1280				

Prepared by tilkei TS-IC 14/11/2006

Inner triplet at Point 5

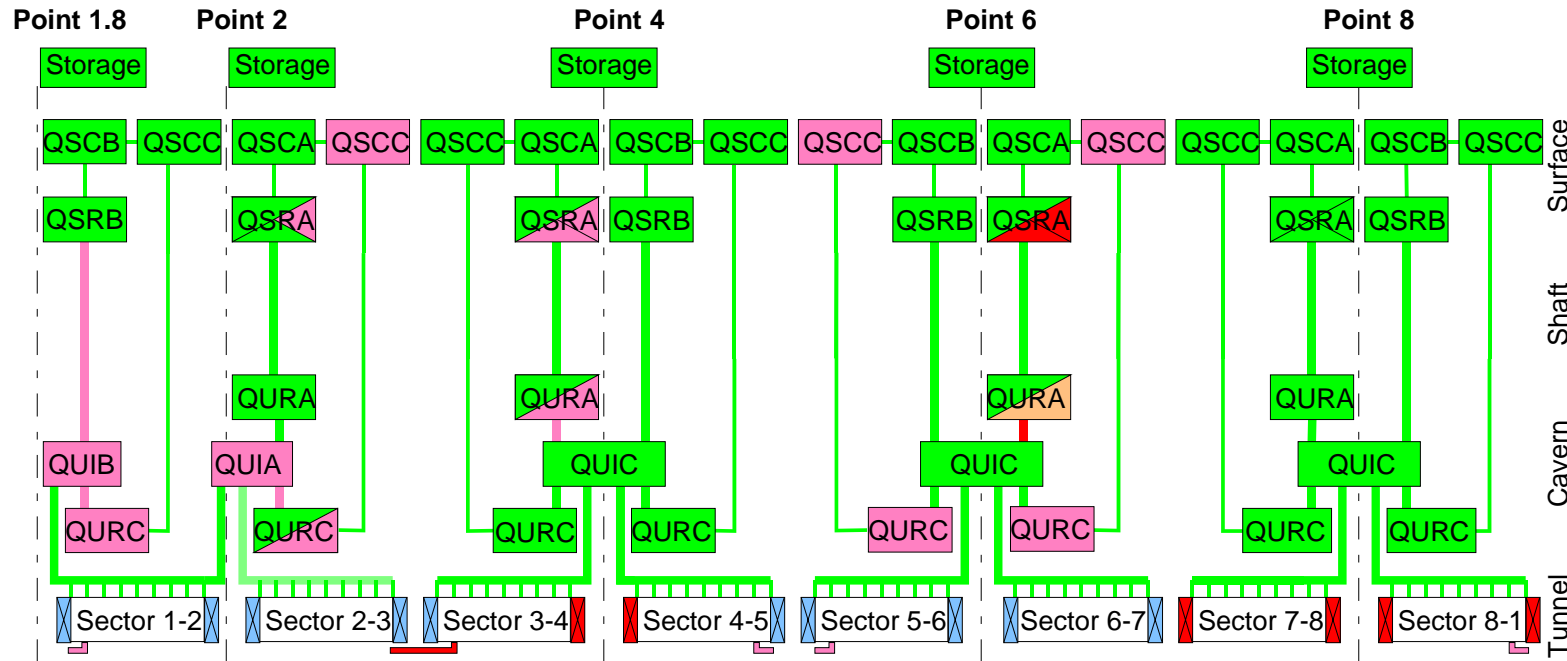


Q1 at point 5





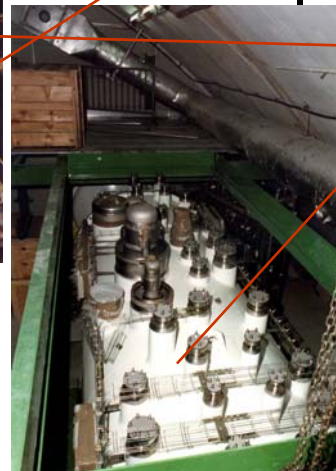
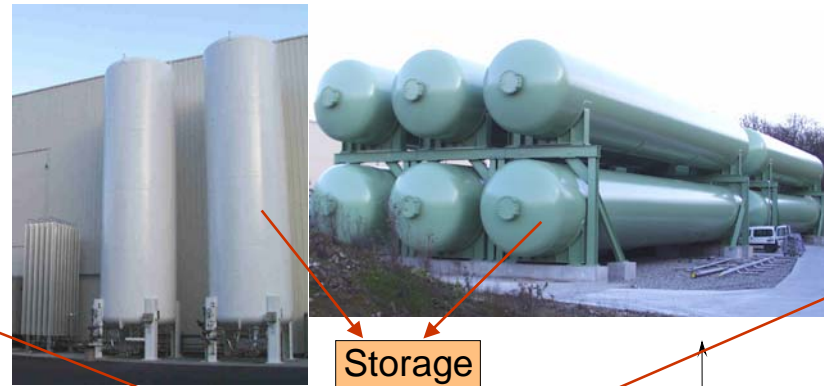
Cryogenics overview



Legend		
Cryogenic Distribution Line	QSC_(A,B,C): Warm Compressor Station	Electrical Feed Box
Under commissioning	QSR_(A,B): Surface 4.5 K Refrigerator Cold Box	Superconducting Link
Under fabrication	QURA: Underground 4.5 K Refrigerator Cold Box	
Under definition	QURC: 1.8 K Refrigeration Unit Cold Box	
	QUI_(A,B,C): Cryogenic Interconnection Box	
	Delivered / Under installation	Ordered (Contract placed)



Cryo infrastructure & 4.5 K refrigerators



Storage

QSCC QSCA QSCB QSCC

QSPA QSRB

QURA

QUIC

QURC

QURC

or 7-8

Sector 8-1

Surface

Shaft

Cavern

Tunnel

PhL

CC 15 November 2006

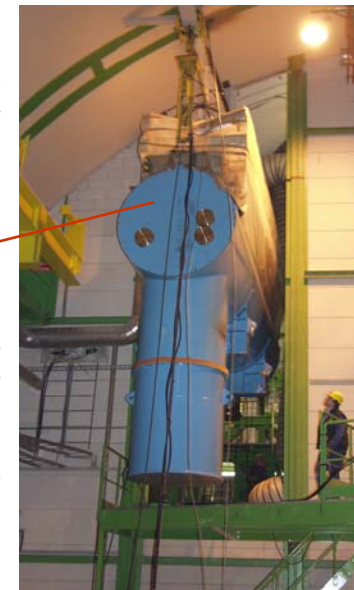
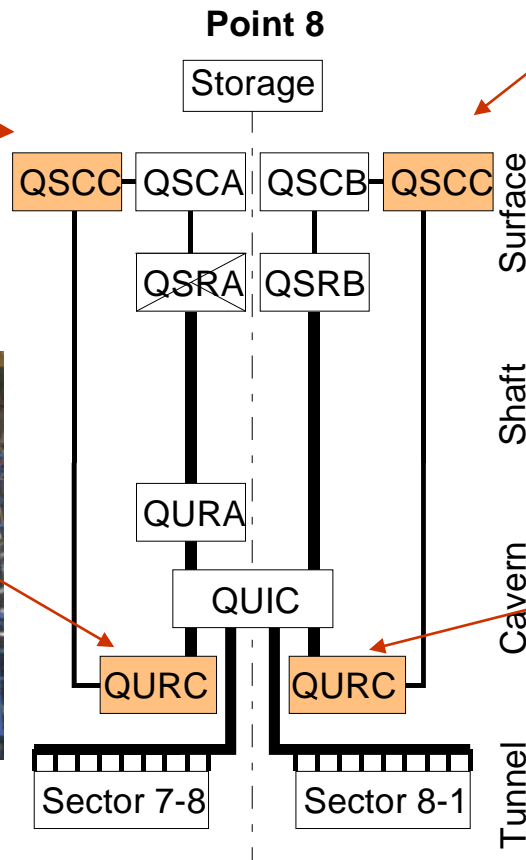
Refrigeration units at 1.8 K



Air Liquide



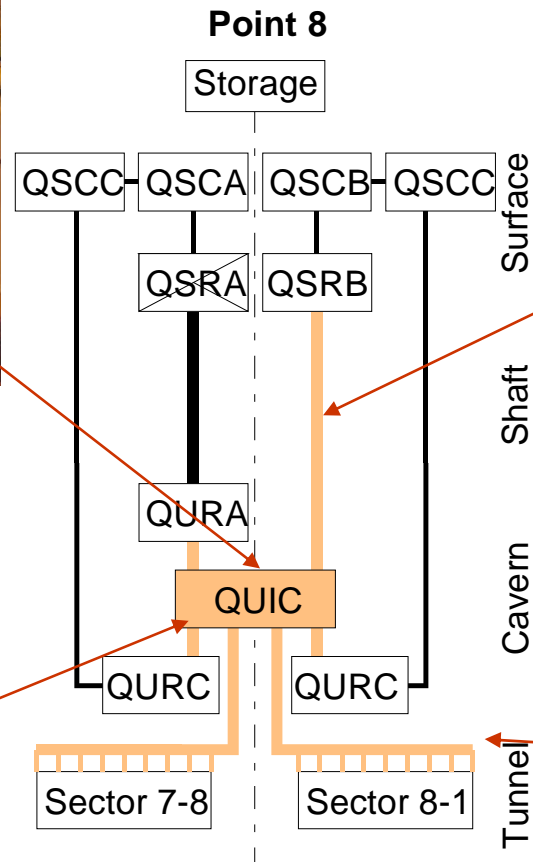
IHI Linde



LHCC 15 November 2006



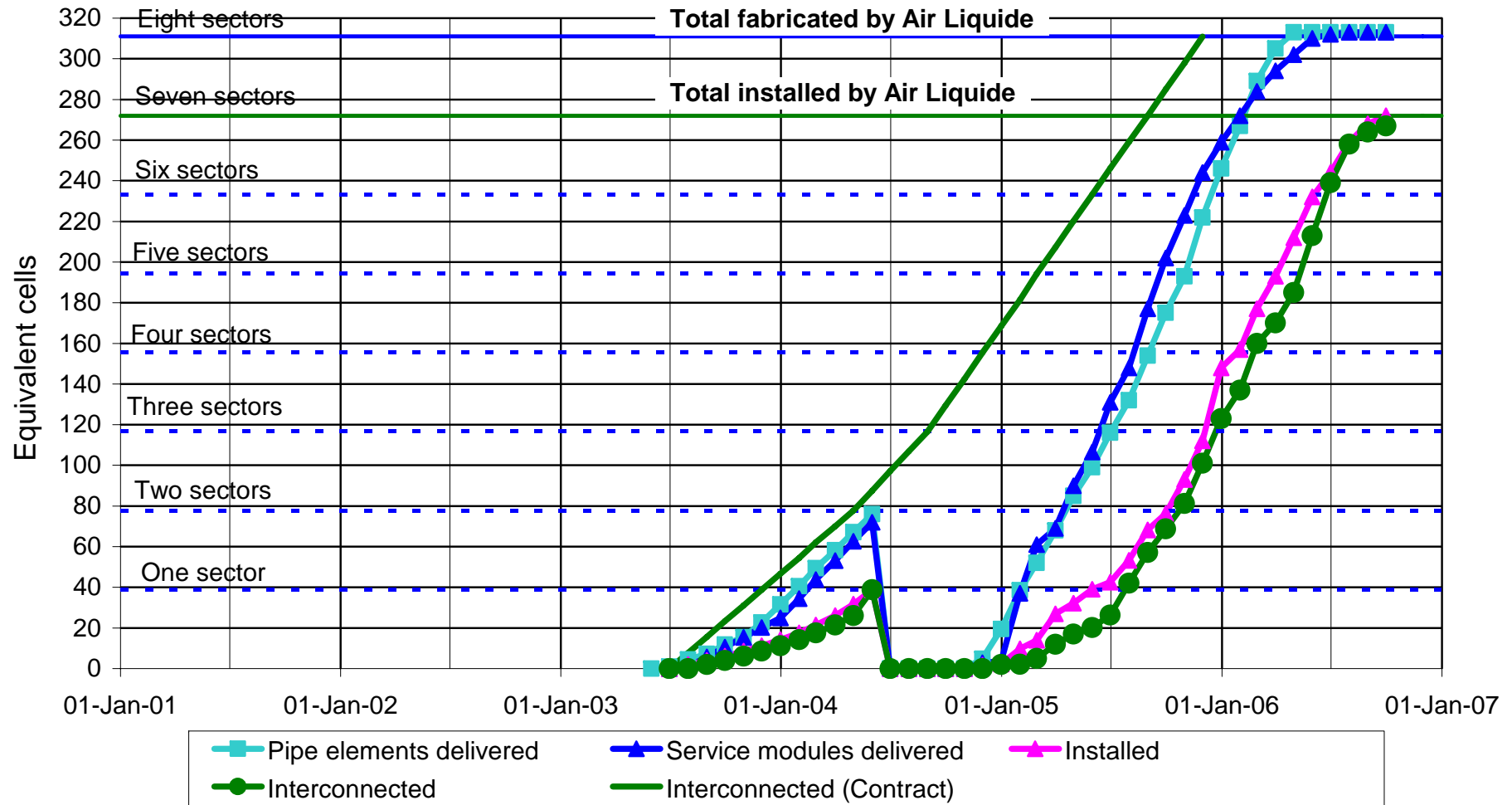
Cryogenic distribution



LHCC 15 November 2006

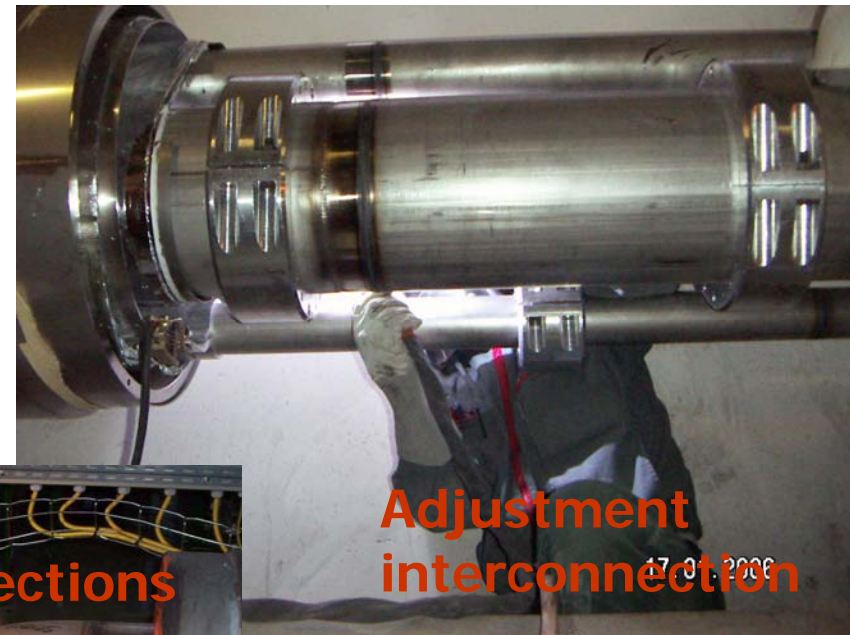
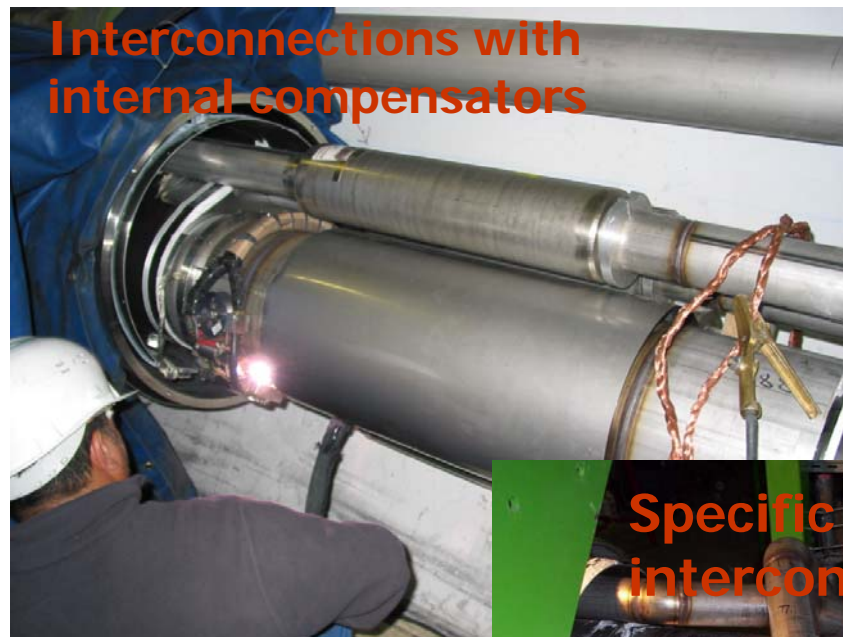


QRL history



QRL installation: welding

- Per sector of 3.3 km
 - 2100 internal welds made by automatic orbital welding
 - 700 external welds made manually



T12 to main tunnel junction





QRL installation completed

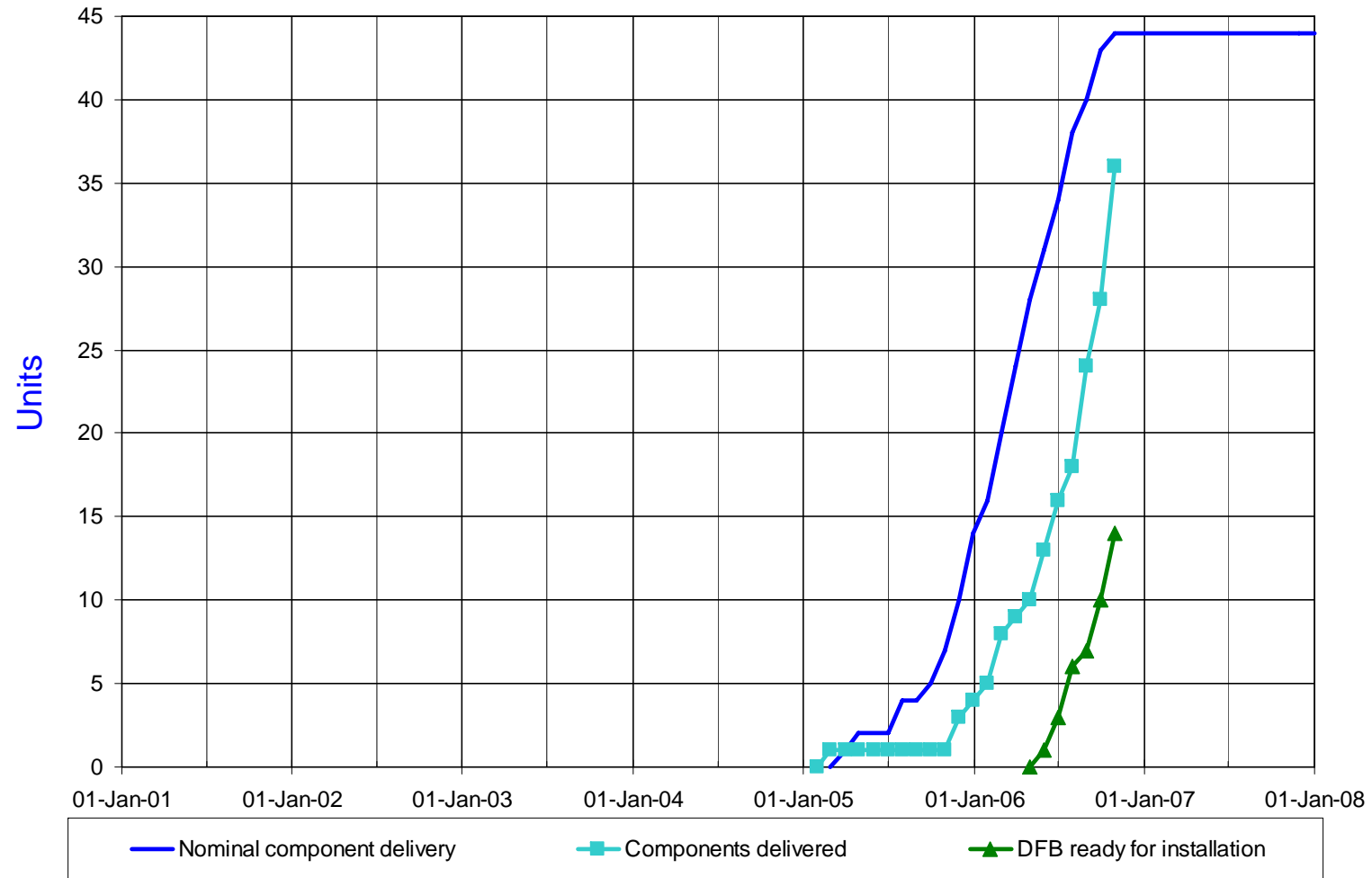
Last sector tested 28 October 2006

INSTALLATION - ALL SECTORS (EDMS # 681375)											Progress [%]	
Week 43											External supports	Elements
JR	A	B	C	D	E	F	G	H	I			
Sector 8-1	5	5	5	5	5	5	5	5	5	5	100	100
Sector 4-5	5	5	5	5	5	5	5	5	5	5	100	99.6
Sector 3-4	5	5	5	5	5	5	5	5	5	5	100	100
Sector 5-6	5	5	5	5	5	5	5	5	5	5	100	100
Sector 6-7	5	5	5	5	5	5	5	5	5	5	100	100
Sector 2-3	5	5	5	5	5	5	5	5	5	5	100	100
Sector 1-2	5	5	5	5	5	5	5	5	JR 1.8	5	100	98.3
<i>Installation progress (except 7-8)</i>											100	99.7

Installation of external supports ¹	Welding of internal headers ²	Welding of external compensators ³	Pumping and leak tightness test at 3 bar ⁴	Leak tightness test successfully performed ⁵
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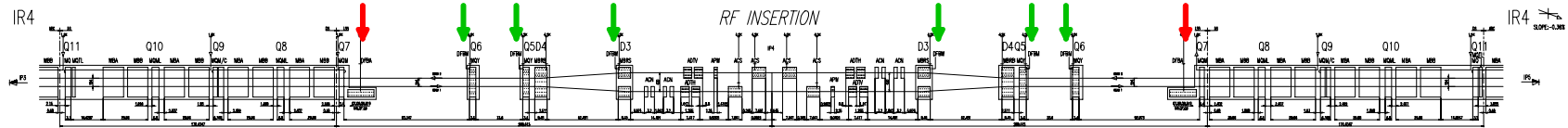
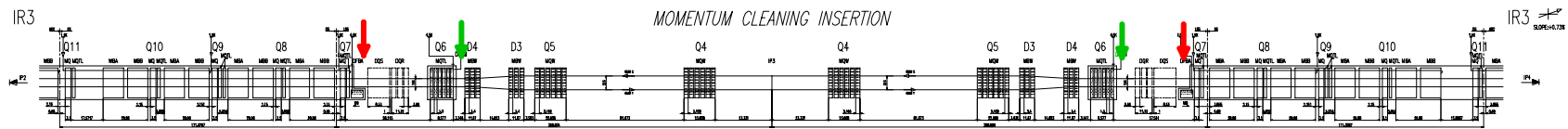
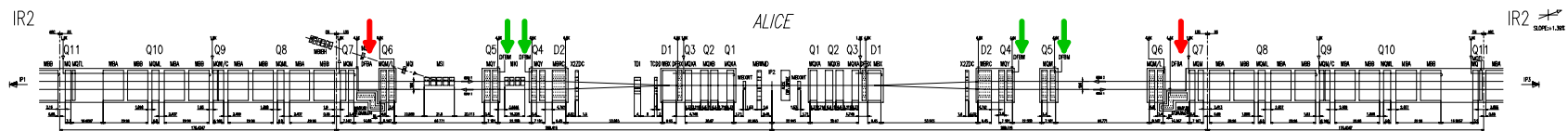
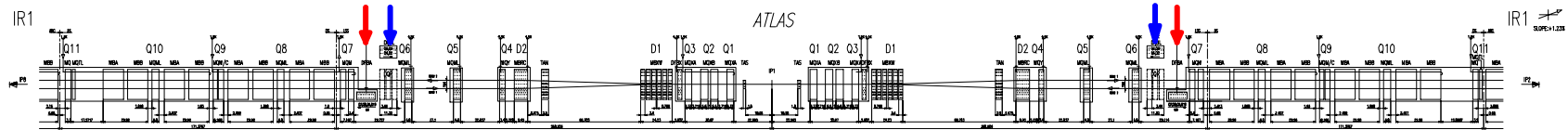


Electrical feed boxes DFB

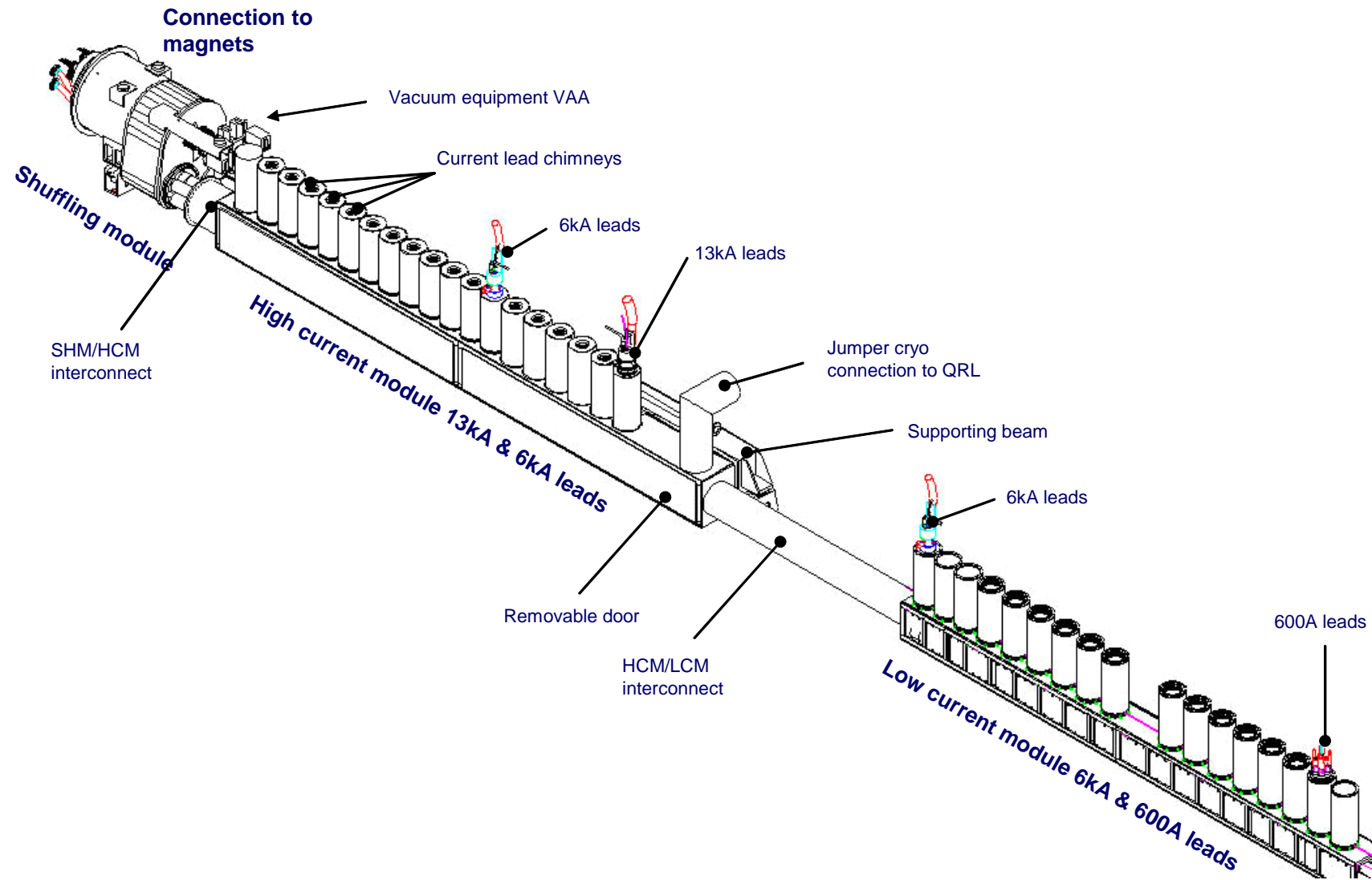




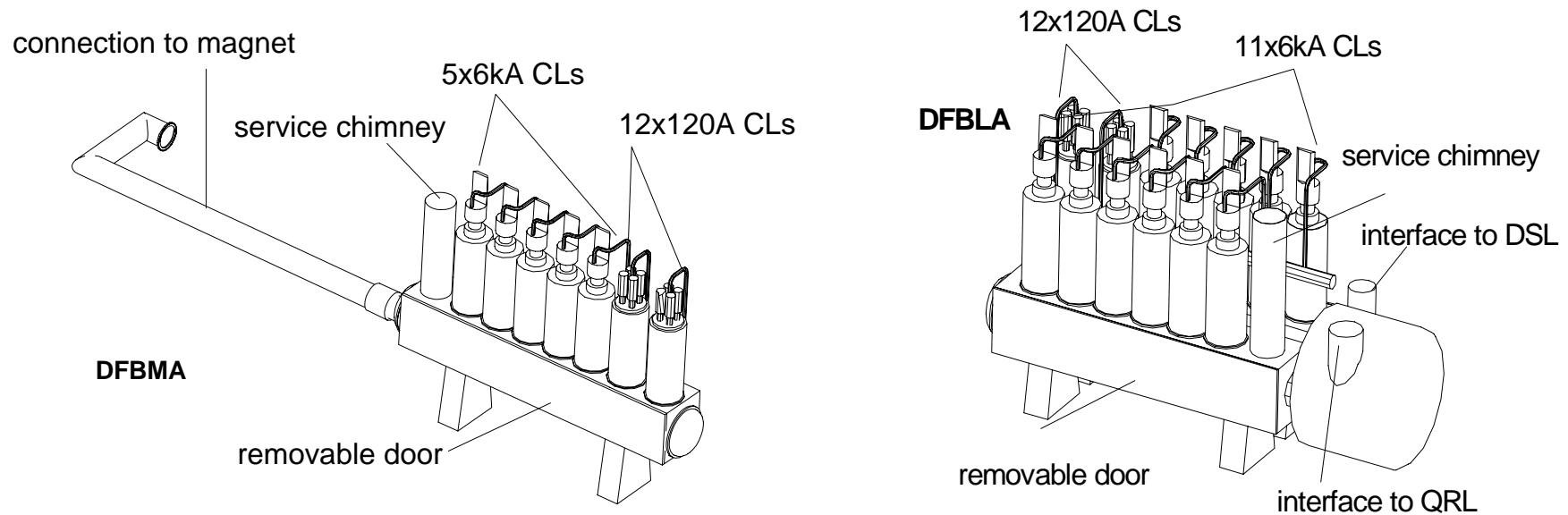
Location of electrical feed boxes



16 boxes DFBA



23 boxes DFBM & 5 boxes DFBL



DFBA installation

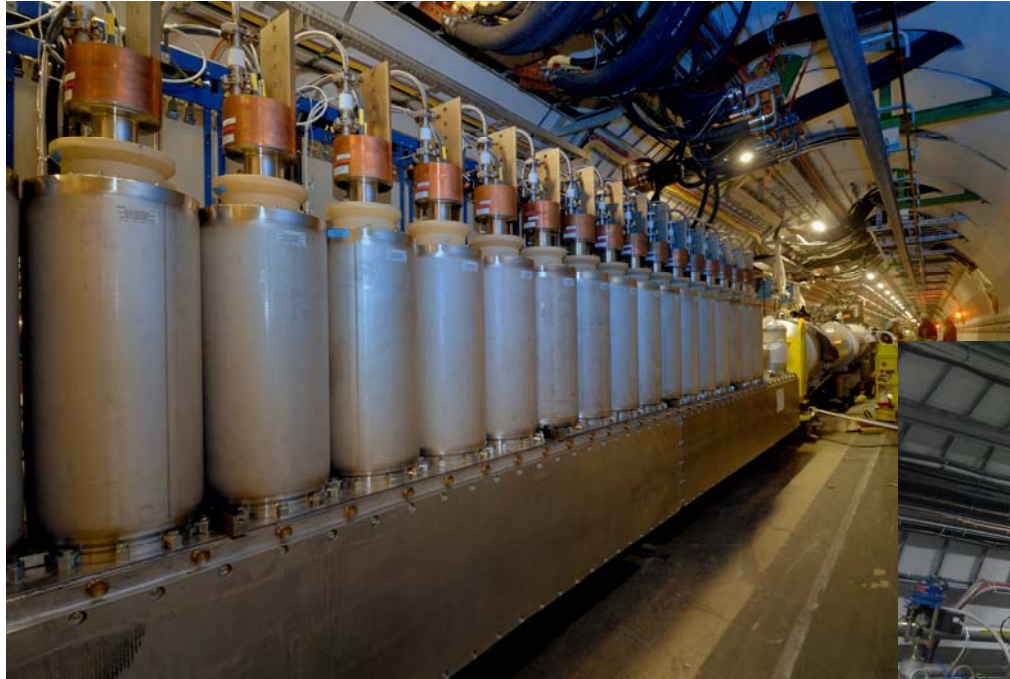


DFBAO-HCM leaving assembly hall 183

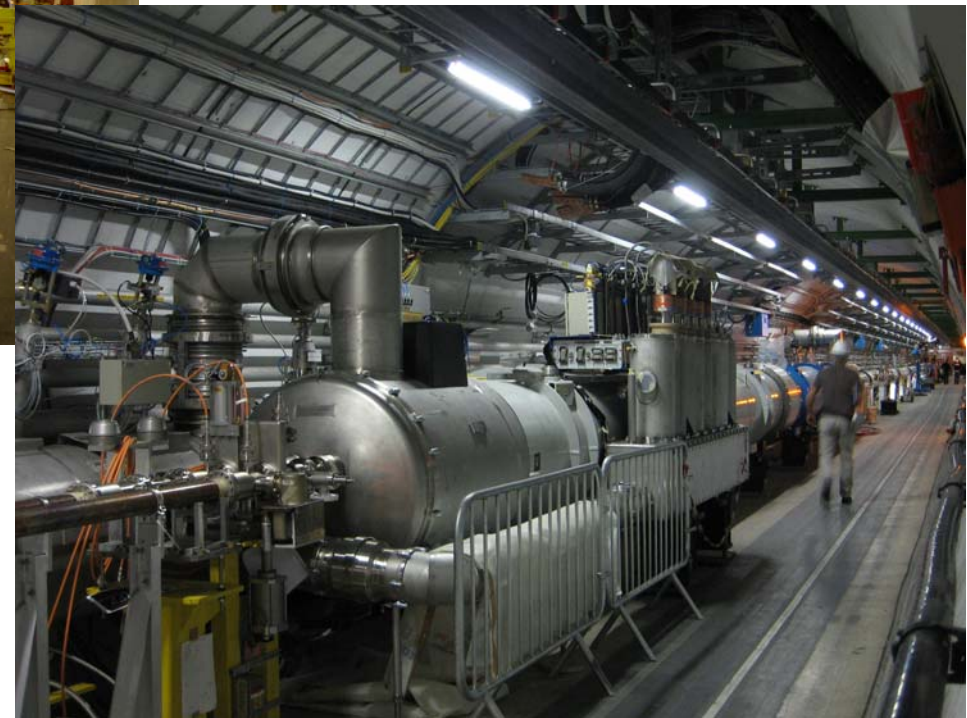


DFBAO-HCM lowered at point 2

DFB interconnection in tunnel



DFBAO in sector 7-8



DFBMA in sector 7-8



DFB overview

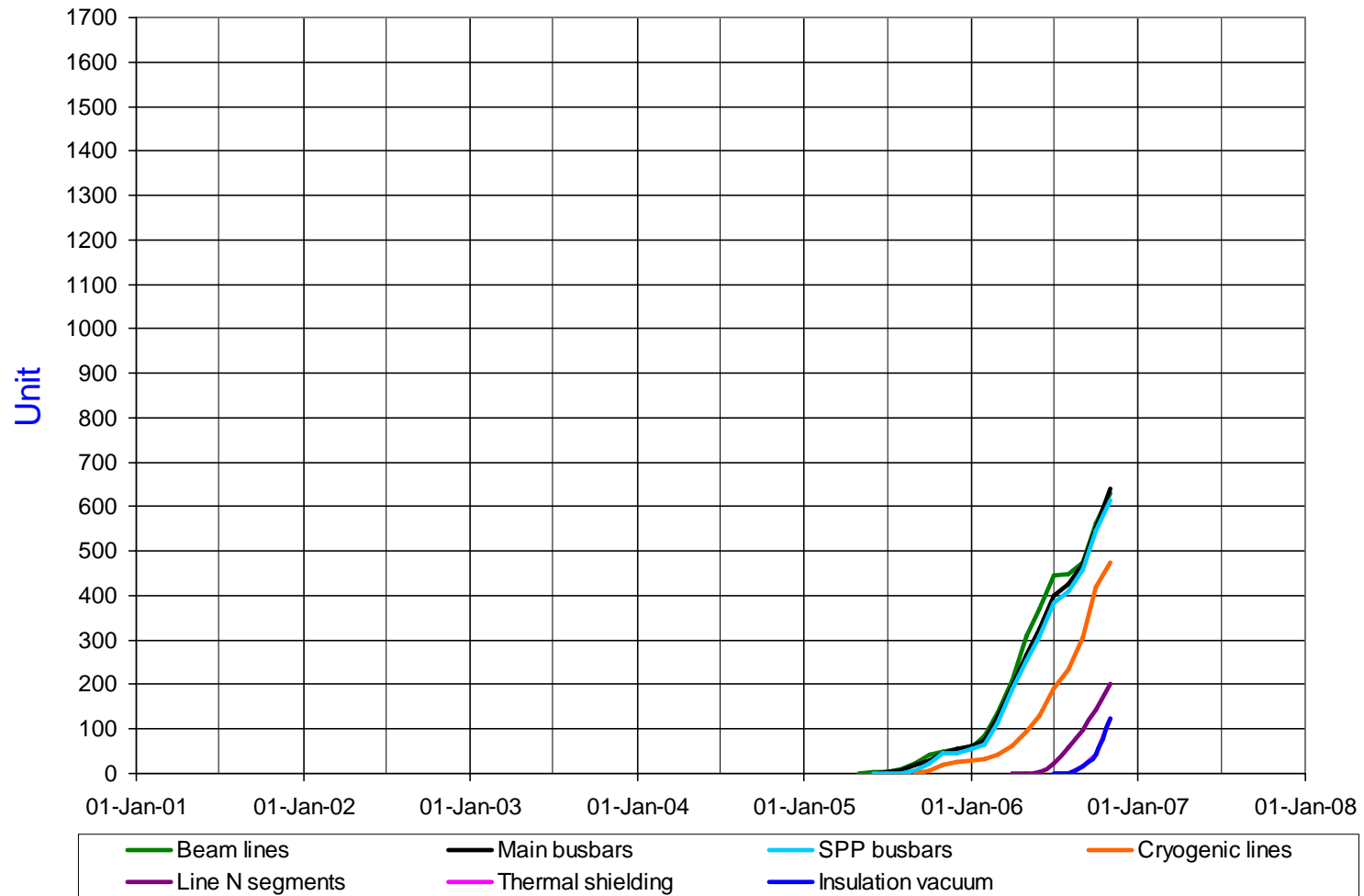
IP	RR/UJ	Q4	Q5	Q6	Q7/MB	ARC	Q7/MB	Q6	Q5	Q4	RR	IP
7				DFBMH	DFBAN	7-8	DFBAO		DFBMC	DFBMA		8
8		DFBMB	DFBMI	DFBMJ	DFBAP	8-1	DFBAA	DSL	DSL	DSL	DFBLA	1
4		DFBMK	DFBML	DFBMG	DFBAH	4-5	DFBAI				DFBLD	5
3	DFBLC			DFBMD	DFBAF	3-4	DFBAG	DFBMG	DFBMF	DFBME		4
5	DFBLE				DFBAJ	5-6	DFBAK		DFBMM	DFBMM		6
2		DFBMB	DFBMC		DFBAD	2-3	DFBAE	DFBMD				3
6		DFBMM	DFBMM		DFBAL	6-7	DFBAM	DFBMH				7
1	DFBLB	DSL	DSL	DSL	DFBAB	1-2	DFBAC		DFBMC	DFBMA		2

Production of comp.	IHEP comp. delivered	Components kit ok	Assembling module	Modules assembled	Leak & pressure tests	Leak & pressure tests ok	ELQA	ready for transport	Transported to LHC	Connected	NC
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Report date:14 Nov 06

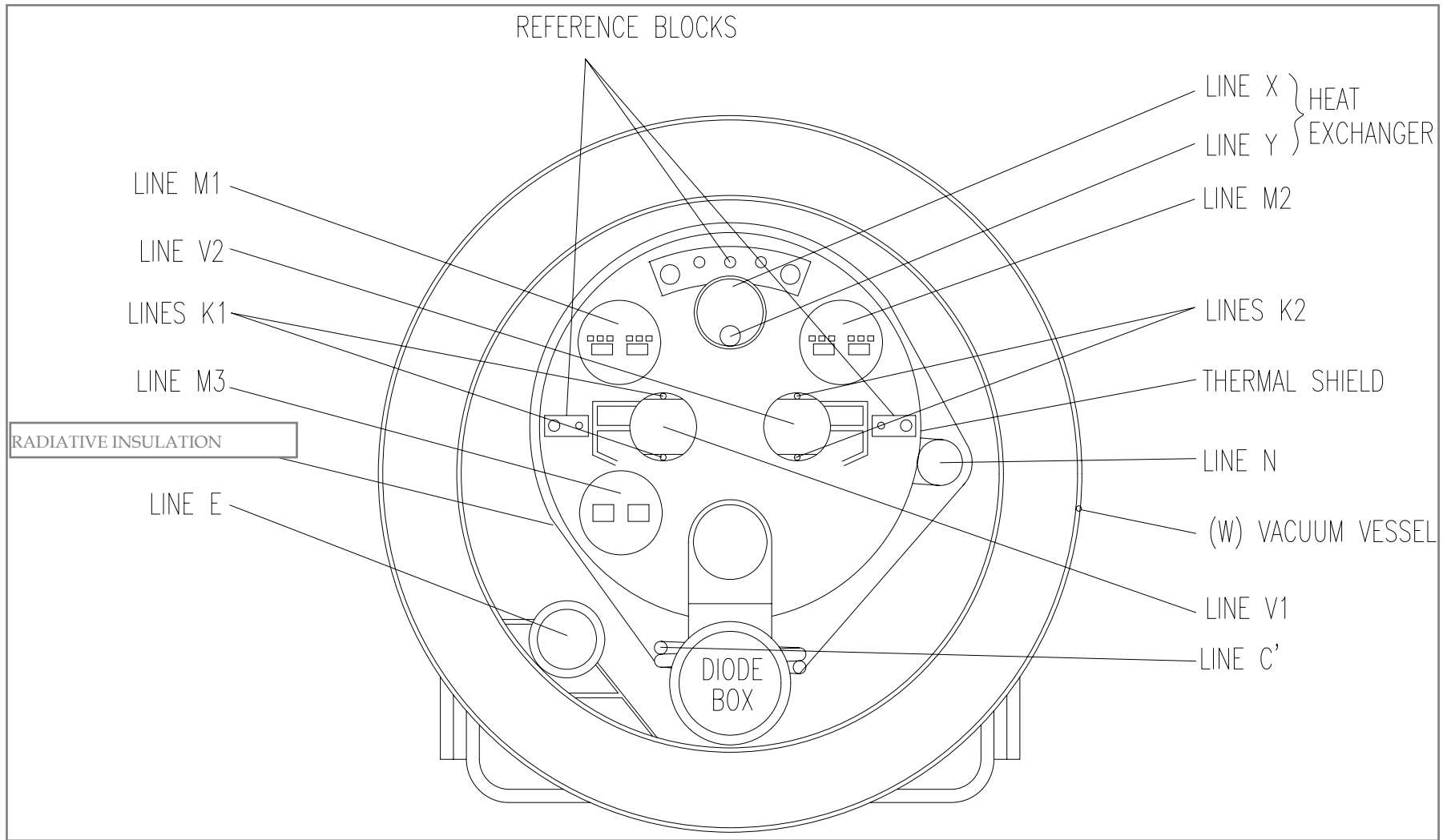


Interconnections in tunnel Overview



Interconnections

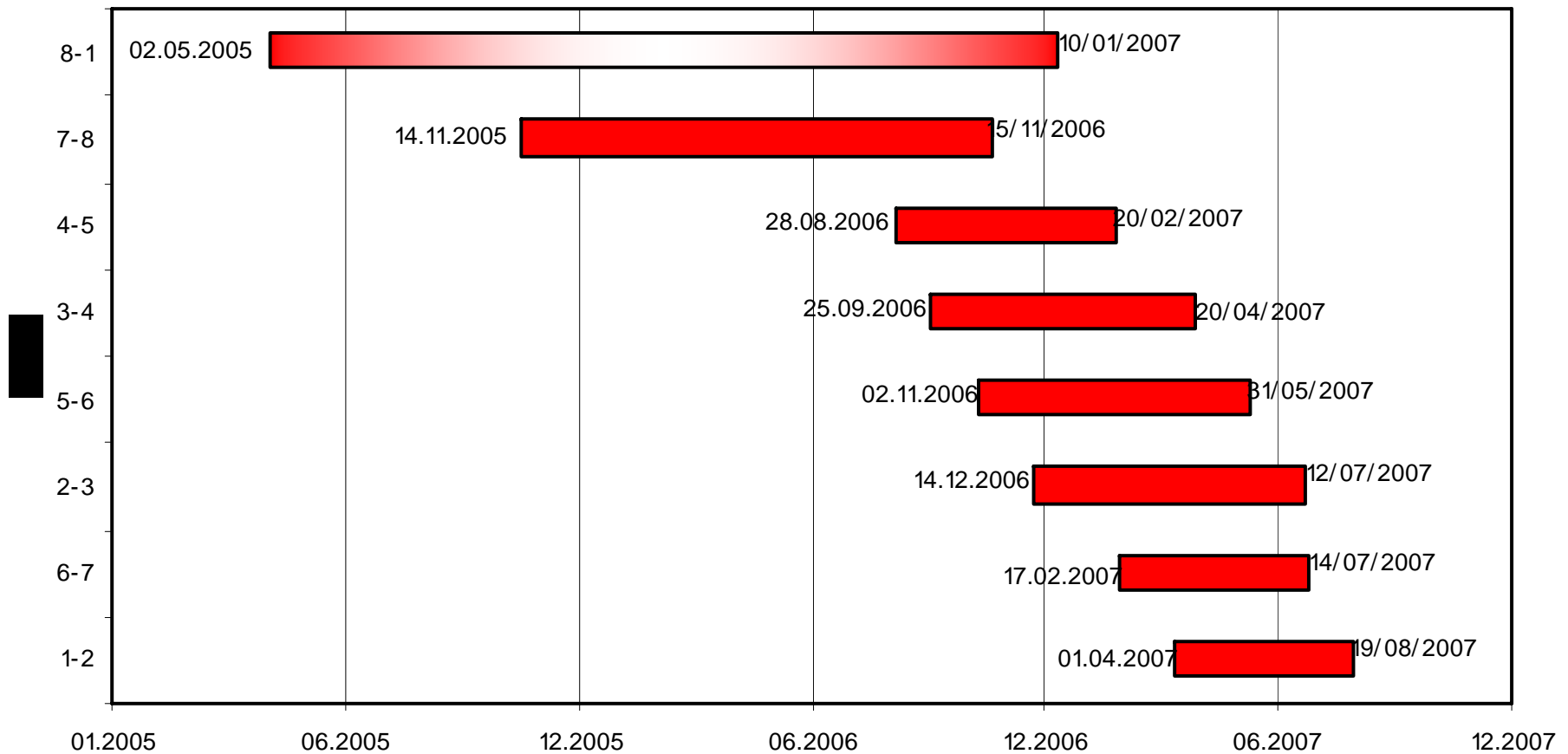
Identification of lines





Interconnections

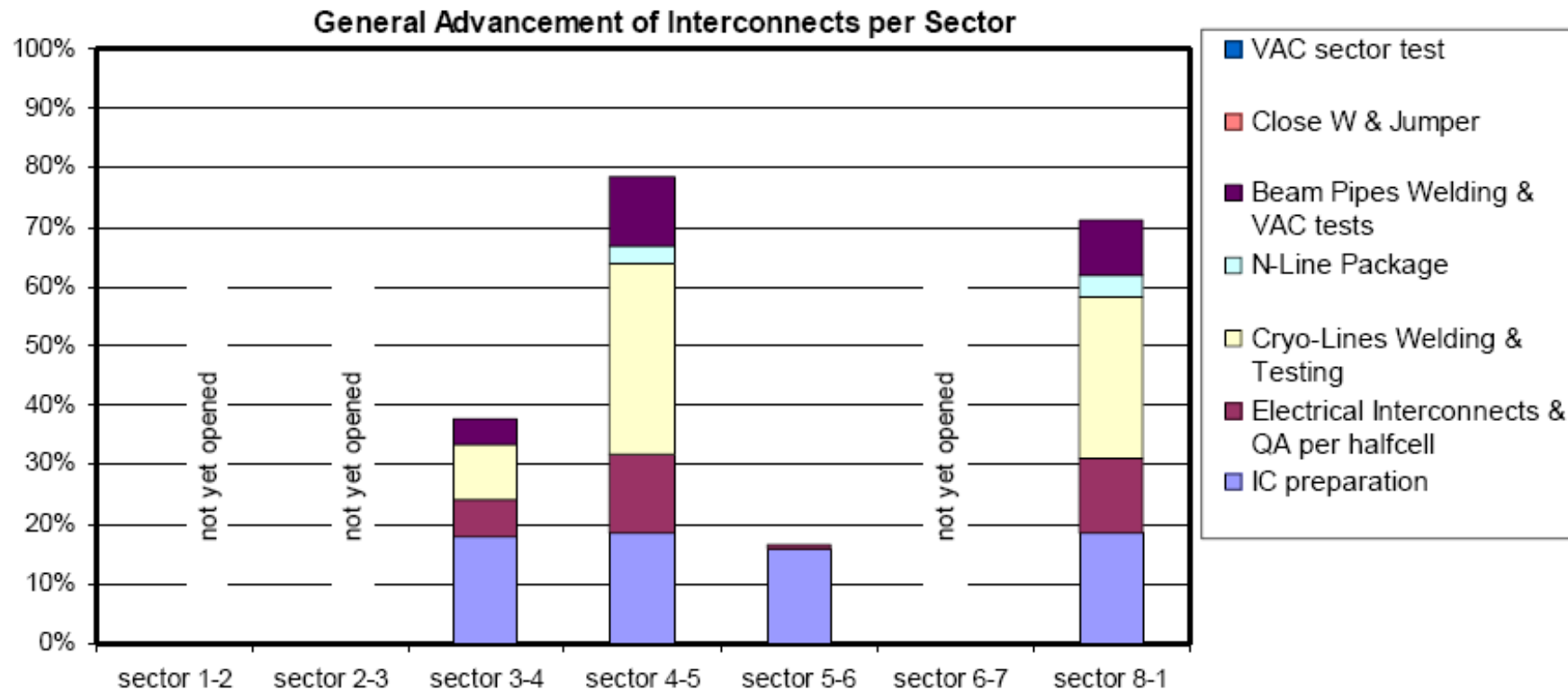
Revised schedule September 2006





Interconnections

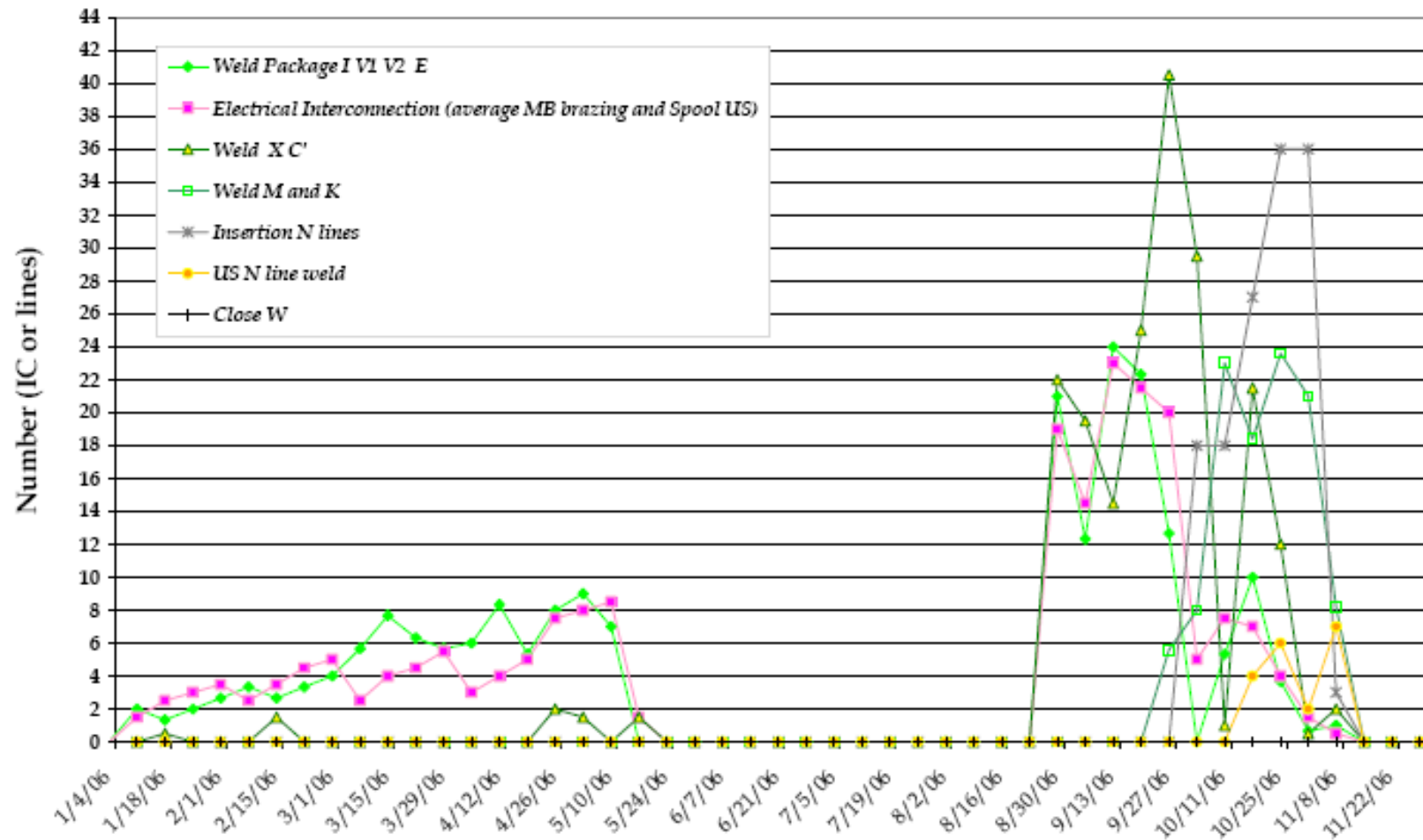
Overview « nominal » sectors





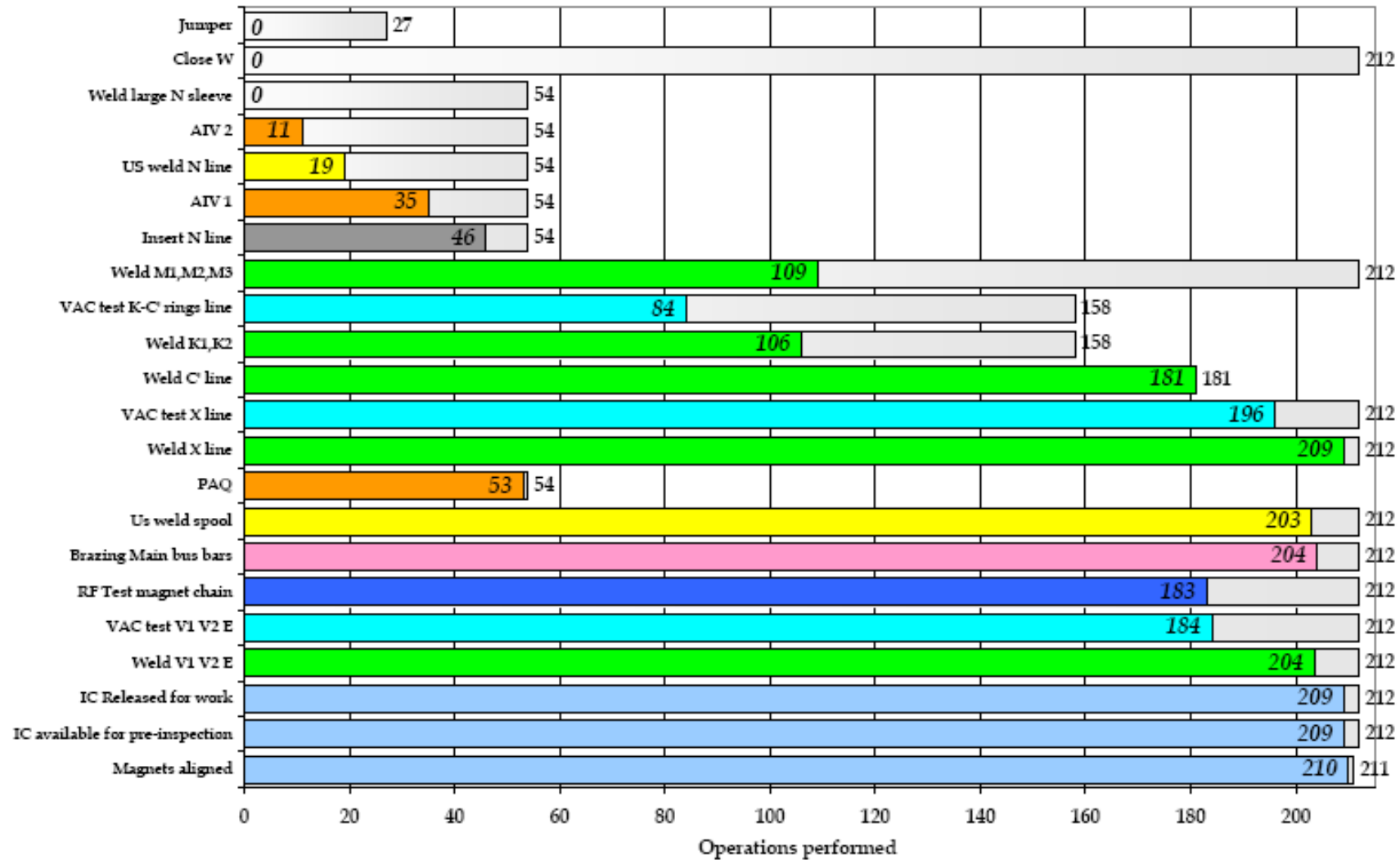
Interconnections sector 4-5

Weekly rates





Interconnections sector 4-5 Snapshot week 44

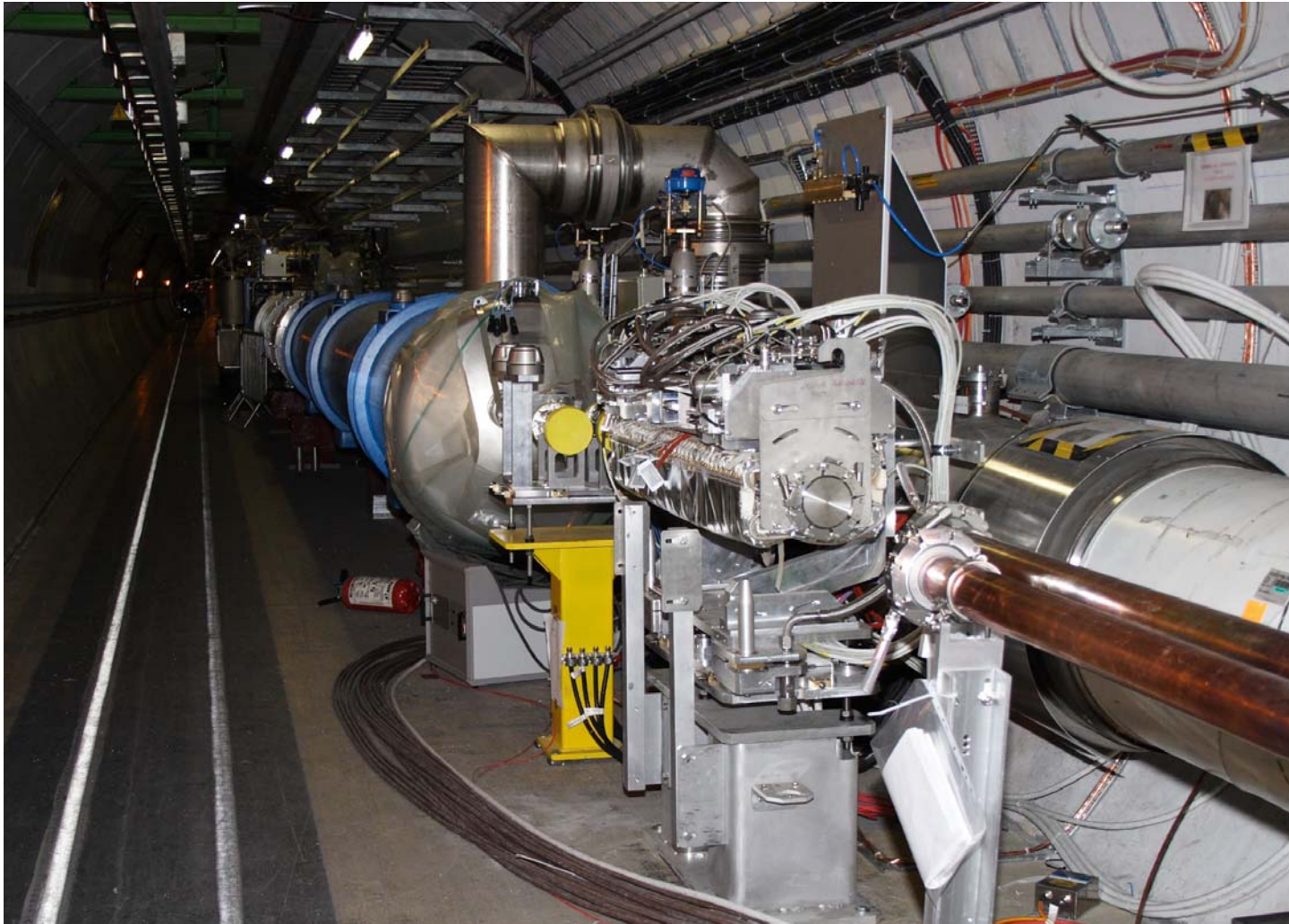




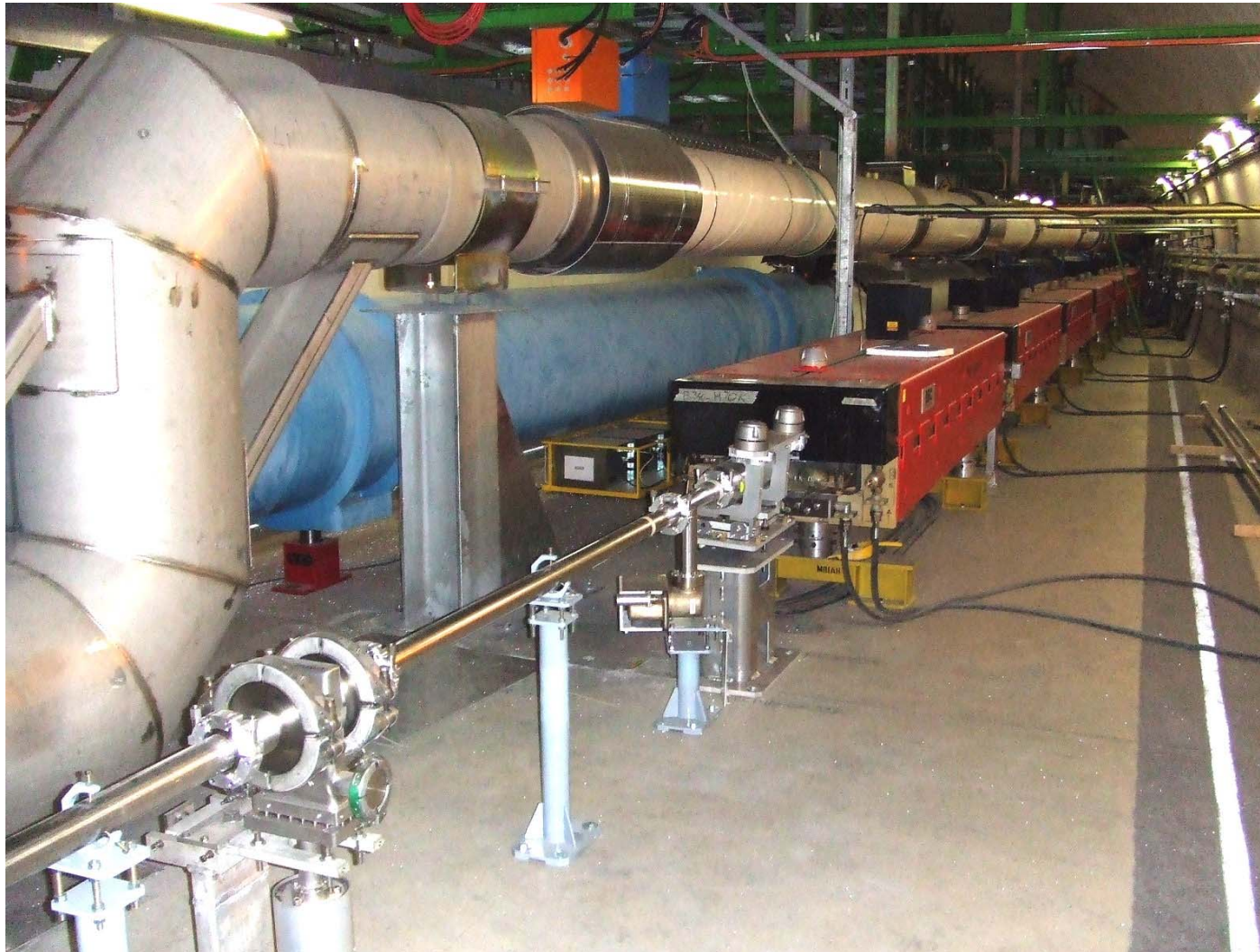
Closure of sector 7-8 10 November 2006



First collimators installed

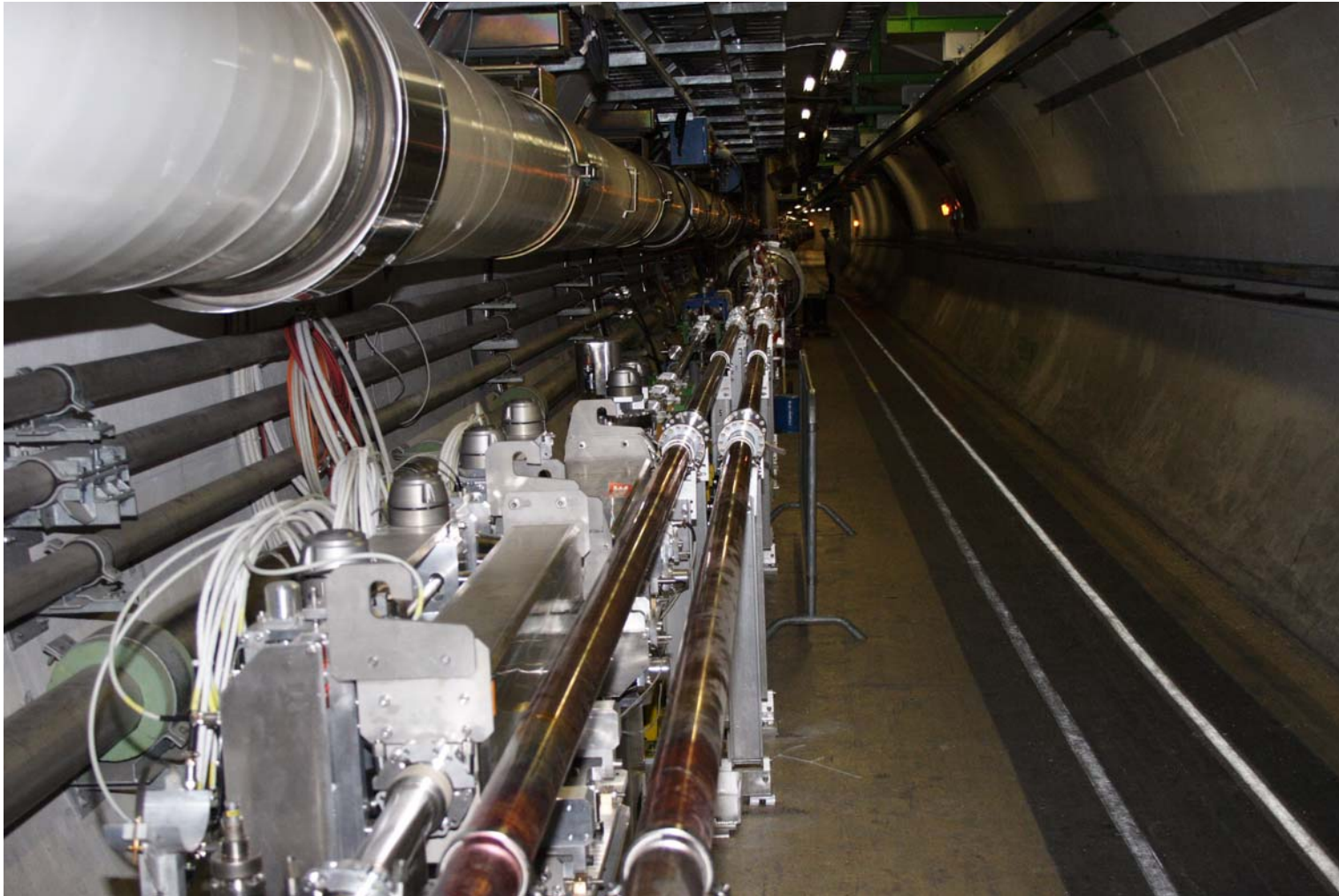


T18 injection line

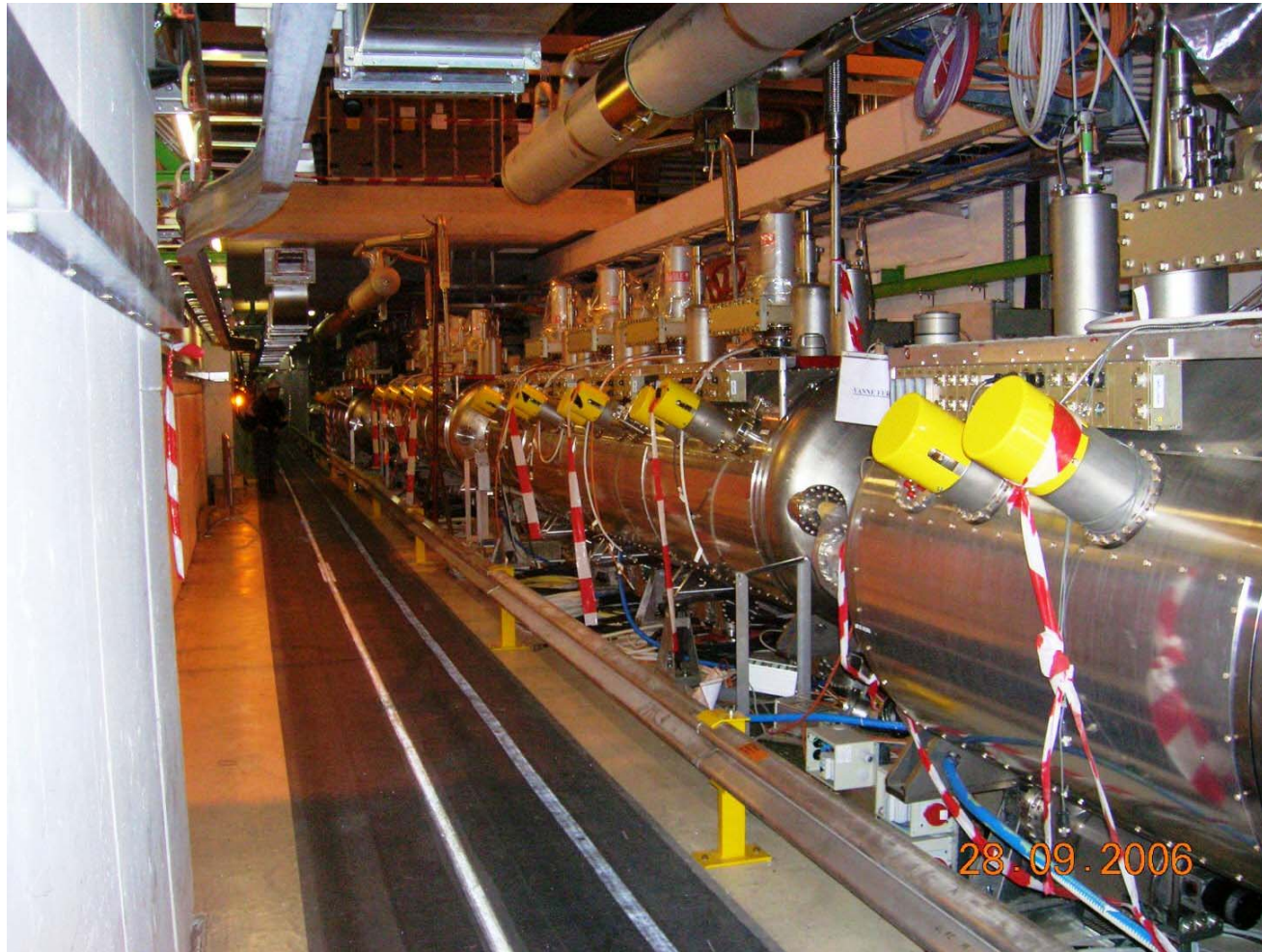




T18 line junction to machine LSS



RF modules in UX45 « tunnel »



UX45 general view



UX45 klystron area





Major milestones ahead

Last magnet delivered	November 2006
Last magnet tested	January 2007
Last magnet installed	March 2007
Machine closed	August 2007
First collisions	November 2007



Conclusions

- All magnets for the LHC ring will be
 - delivered by end November 2006
 - cryostated and cold tested by end January 2007
 - installed by end March 2007
- All reserve magnets will be delivered and cryostated by end Feb 2007
- Field quality & quench performance are consistently good
- Final preparation of magnets in SMI2 remains limiting path
- QRL completed, quality good
- DFB production rates now OK, schedule remains critical
- Collimator industrial production problems will result in reduced installed scheme in 2007, no consequence for 450 GeV run
- Interconnections are now the big scene
 - First sector completed on 10 November 2006
 - Activities ongoing in 4 sectors in parallel
 - Cruise rate achieved/exceeded in « nominal » sectors
- Next major milestone is cooldown and commissioning of sector 7-8
- Full commitment to close LHC by Aug 2007 and establish colliding beams before end 2007