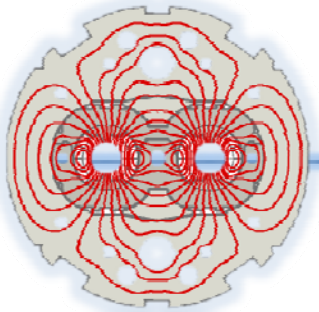


Installation Progress

Francesco Bertinelli – TE/MSC

5 March, 2009

(20 minutes)

On behalf of - and with several contributions from – the IC teams

[Separate presentations: Magnet Situation, VAC, consolidations (QPS, DN200), QC splices]

Tunnel status of 3-4 in W10/2009

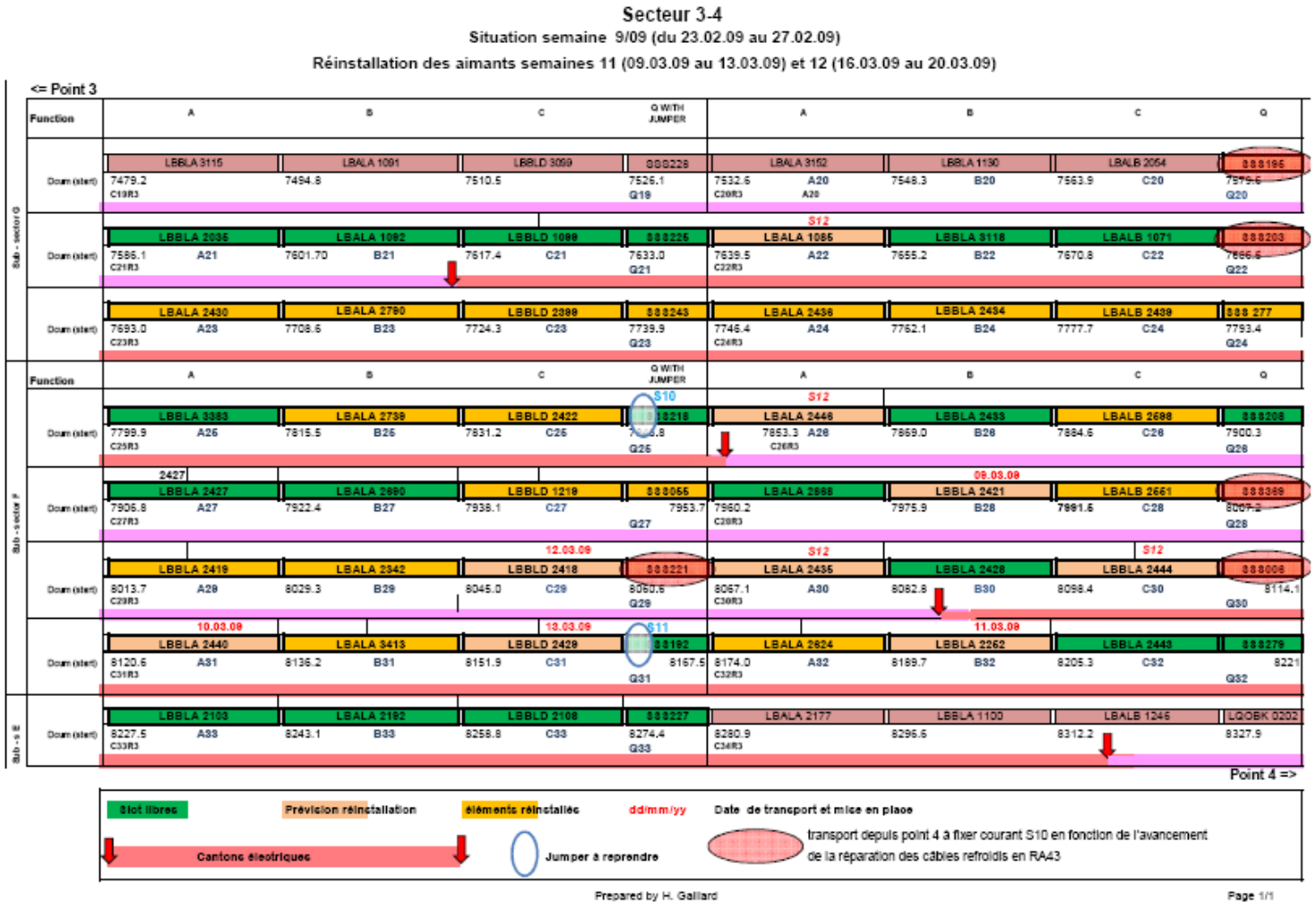
Magnets for 3-4: status 3 March (Week 10-2009)

	Disconnected	Reinstalled	
MB	39	15	38%
SSS	14	3	21%

IC work to be done in 3-4 (not exhaustive): status 3 March (Week 10-2009)

	W bellows		PIMs cut		PIMs welded		BB disconnected	BB soldered	M cu
	fully opened	partial opening	V1	V2	V1	V2	M1, M2, M3	M1, M2, M3	M1, M M3
Within Zone-D (Q19R3 to Q33R3 include	57		55	57	7	7	57	3	57
Outside D-zone (replace all QQBI PIMs, cleaning soot and MLI)									
Towards Point 3	35		15	30	0	0	1	0	1
Towards Point 4	31		28	28	0	0	0	0	2
Outside D-zone (for DN200 work only)									
Towards Point 3		7							
Towards Point 4		51							
Total done/ongoing	181		98	115	7	7	58	3	60
	85%		46%	54%			27%		28%
Total present	212		212	212			212		212

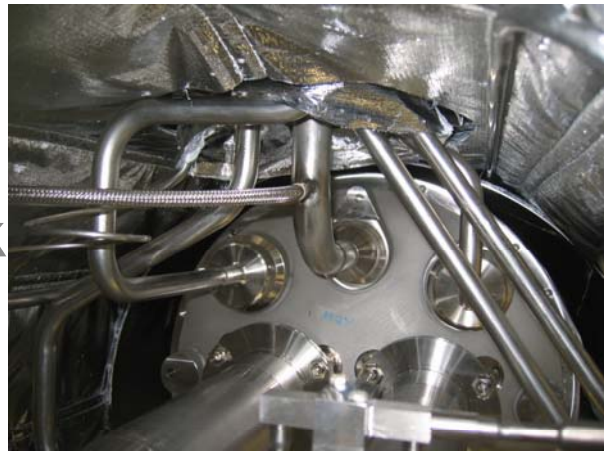
3-4 Reinstalled magnets status



Courtesy H. Gaillard

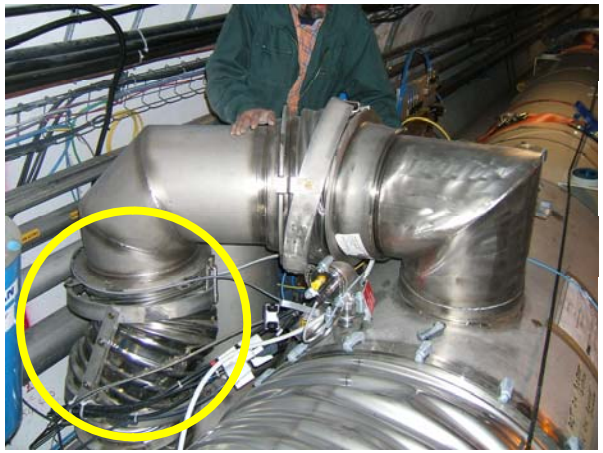
Shutdown / Consolidation activities

- 1-2 and 5-6: ongoing since warmup W02 and W03
  - RF ball test: 3 PIMs with buckled RF f
- 1-2:
  - removed MB2334 (B16R1) 100 nΩ
  - 50 nΩ Q31R1-Q31L2 (4 IC checked US
- 6-7: warmed up to remove MB2303 (B32R
- 5-6:
  - 3 connection cryostats
  - He level guards in arc SSS
- Stand Alone helium level gauges (3 week
- 1R and 5L: triplets copper braid
- Pressure relief nozzles (arc and LSS)



QRL service modules: jumpers

- First diagnostic:
  - Q23, Q27 & Q31 bellows deformed from displacement
  - Q25 collapsed bellows from inner pressure

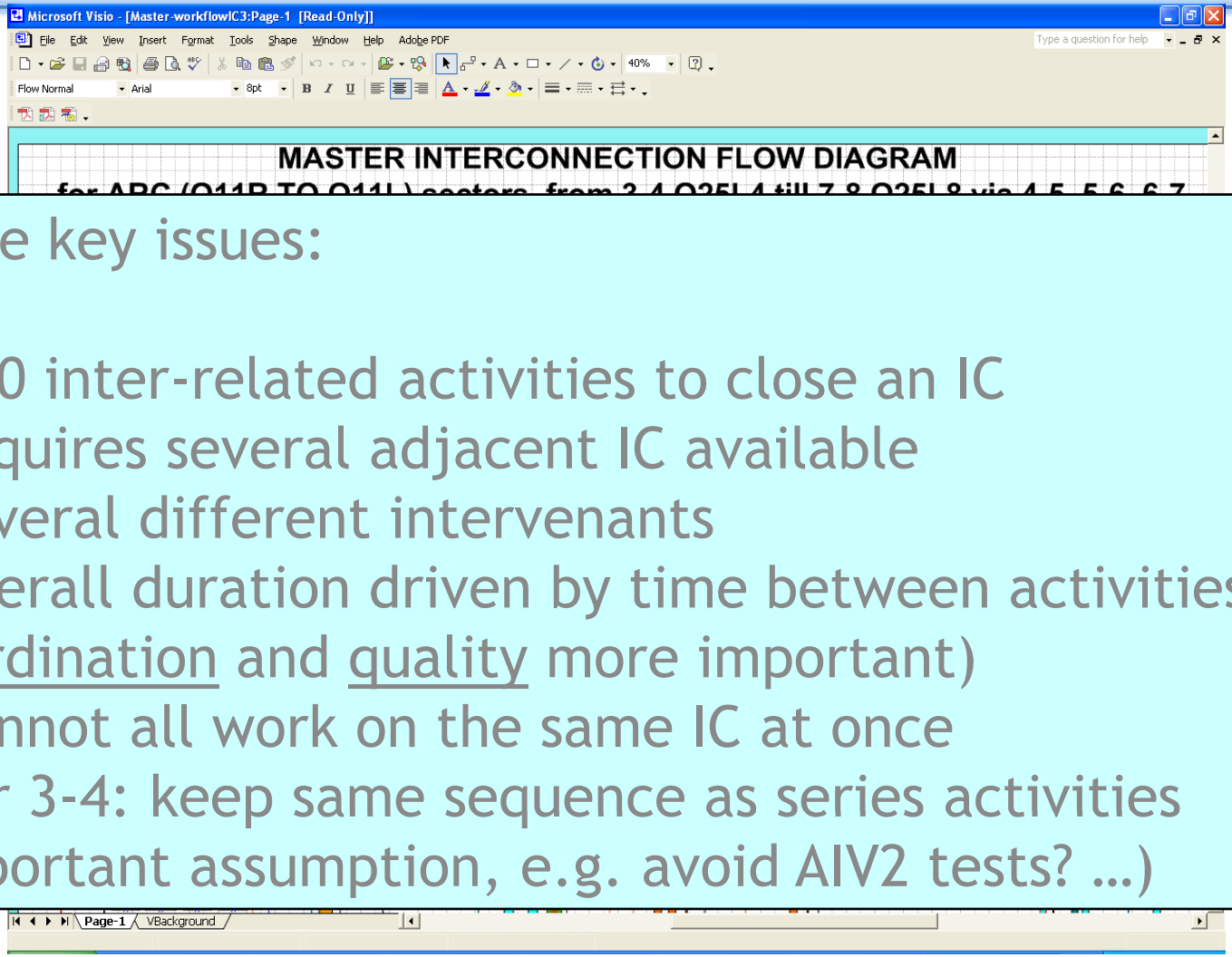


- Second diagnostic, more detailed:
  - Some internal bellows damaged
  - some 80K vacuum barriers collapsed due to external over pressure
  - Some soot in QRL piping

- In situ repair ongoing:
  - W06: Q23,
  - W07: Q27,
  - W08: Q25,
  - W09: Q31

Courtesy O. Pirotte

IC work: a complex chain of activities

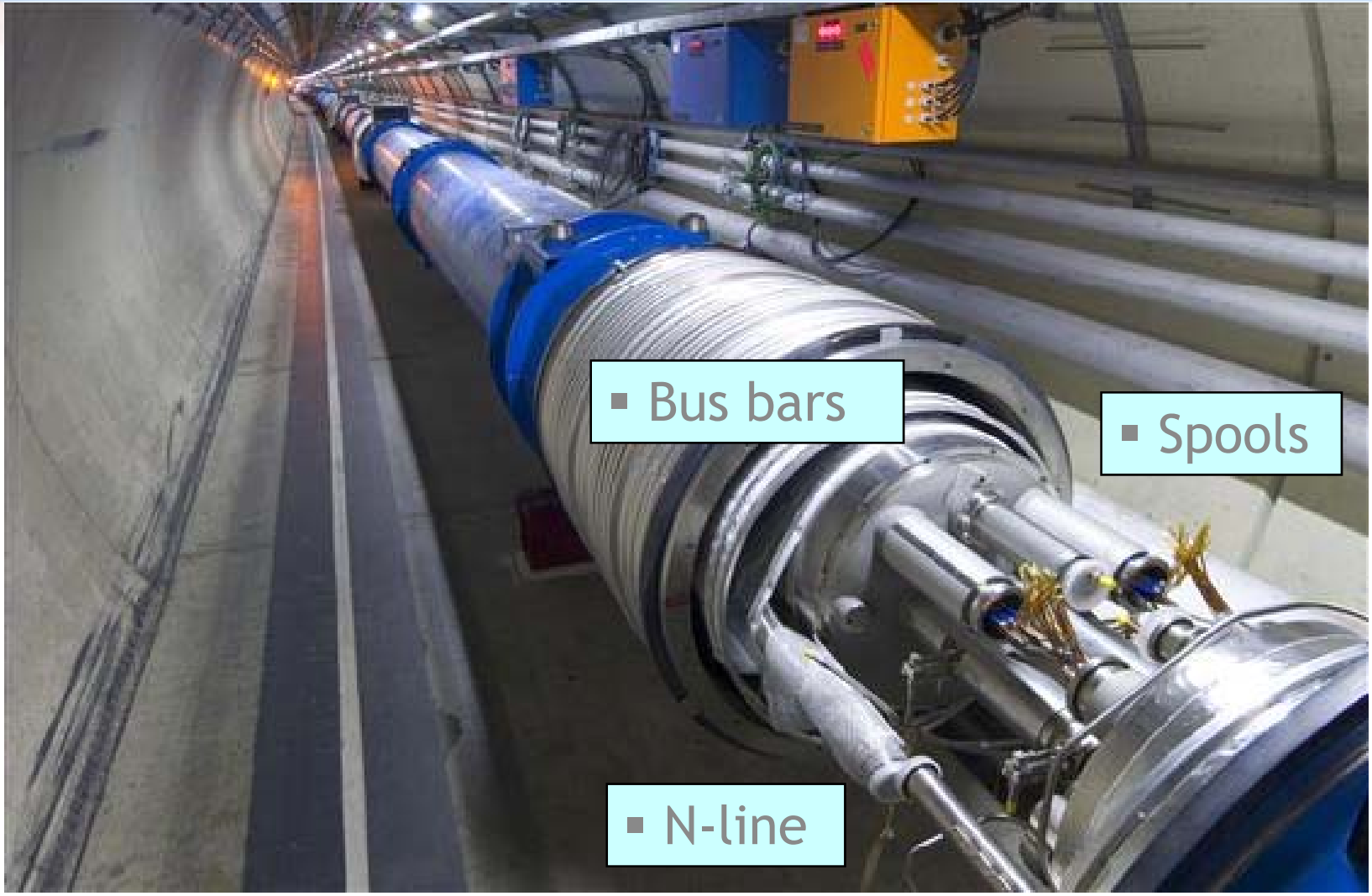


Some key issues:

- ~40 inter-related activities to close an IC
- requires several adjacent IC available
- several different intervenants
- overall duration driven by time between activities (i.e. coordination and quality more important)
- cannot all work on the same IC at once
- for 3-4: keep same sequence as series activities (important assumption, e.g. avoid AIV2 tests? …)

Courtesy P. Fessia

Example: electrical connections



Courtesy CERN photo

IC sequence & terminology

	"IC half-cell"			SSS Q30		MB A31		MB B31		MB C31		
	IC name		QBQI		QQBI		QBBI.A		QBBI.B		QBQI	
1	Magnet ready for installation			W15						W15		
2	Magnet transported			W15						W15		
3	Survey positioning / check			W16						W16		
4	QC: start IC		W16		W16				W16		W16	
5	BB: Busbar Brazing		W17		W16		W16		W16		W17	
6	QC: BB		W17		W16		W16		W16		W17	
7	insulate BB		W17		W16		W16		W16		W17	
8	US: ultrasonic welding spools		W17		W16		W16		W16		W17	
9	insulate spools		W19		W16		W16		W16		W19	
10	ELQA: PAQ		W17									
11	Insert N-Line		W18									
12	Cable N-Line		W18								W18	
13	ELQA: HVQN		W18									next half cell
14	ELQA: AIV1		W19									next half cell
15	US weld N-line		W19								W19	
16	ELQA: MPAQ	all D-area	W19									all D-area
17	ELQA: AIV2		W20									next half cell
18	insulate N-line board		W20								W20	
19	ELQA: MHVQN	all D-area	W20									all D-area
20	TIG weld 139 N-line flange		W21								W21	
21	TIG weld M to N		W21								W21	
22	Cryo thermometers	W21	W21						W21	W21	W21	
23	Final QC-IC certification		W22		W22		W22		W22		W22	
24	Close W bellows		W23		W23		W23		W23		W23	

- W15 to W23, with no slack

IC 3-4 Detailed Planning

Microsoft Excel - 3-4_Plan_DRAFTc.xlsx [Read-Only]

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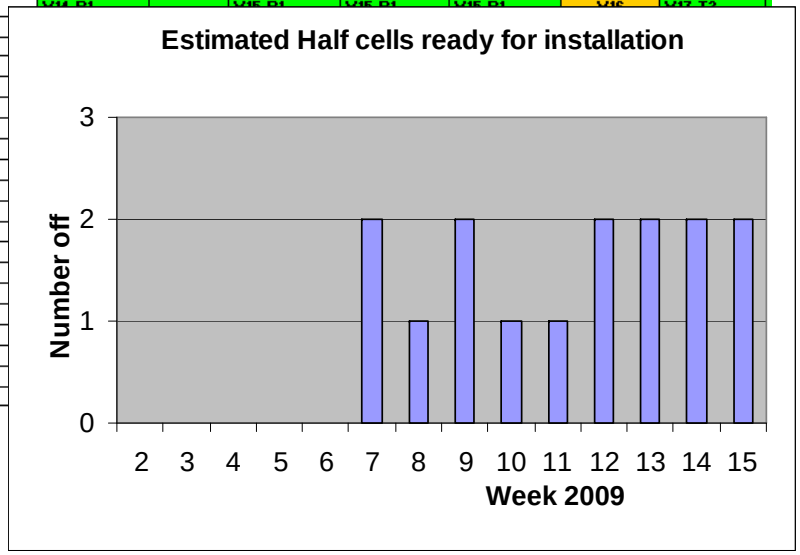
G1 AVAILABILITY

	DCUM RING START	mag.down	Inter. number	mag. up	REAL AVAILABILIT	Weld V1	VAC test V1 V2	RF Te	Weld E lin	VAC tes	Sold. Main Bus bars	Visual Inspection and US measu	Ins. Main bus bars	Us weld spool	Insulate spool	PAQ	weld Y lin
2	7495	3115	QBBLA19R3	1091					DONE		DONE	DONE	DONE	DONE	DONE		DONE
3	7510	1091	QBBLB19R3	3099					DONE		DONE	DONE	DONE	DONE	DONE		DONE
4	7526	3099	QBQI.19R3						DONE								
5	7533		QQBI.19R3	3152					DONE								DONE
6	7548	3152	QBBLA20R3	1130					DONE								DONE
7	7564	1130	QBBLB20R3	2054					DONE								DONE
8	7580	2054	QBQI.20R3	0195													
9	7586	0195	QQBI.20R3	2035	V14	V14-T3	V15		V14-T3	V15	V14-B1		V15-B1	V15-B1	V15-B1	V16	V17-T2
10	7602	2035	QBBLA21R3	1092		V14-T3	V15		V14-T3	V15							
11	7617	1092	QBBLB21R3	1099		V14-T3	V15		V14-T3	V15							
12	7633	1099	QBQI.21R3	0225		V14-T3	V15		V14-T3	V15							
13	7640	0225	QQBI.21R3	1085	V13	V13-T1	V15		V13-T1	V15							
14	7655	1085	QBBLA22R3	3118		V13-T2	V15		V13-T2	V15							
15	7671	3118	QBBLB22R3	1071		V13-T2	V15		V13-T2	V15							
16	7686	1071	QBQI.22R3	0203		V13-T2	V15		V13-T2	V15							
17	7693	0203	QQBI.22R3	1236	V9	V9-T1	V10		V9-T1	V10							
18	7709	1236	QBBLA23R3	2193		V9-T1	V10		V9-T1	V10							
19	7724	2193	QBBLB23R3	1109		V9-T1	V10		V9-T1	V10							
20	7740	1109	QBQI.23R3	0233		V9-T1	V10		V9-T1	V10							
21	7746	0233	QQBI.23R3	1241	V7	V7-T1	V10		V7-T1	V10							
22	7762	1241	QBBLA24R3	2055		V7-T1	V10		V7-T1	V10							
23	7778	2055	QBBLB24R3	3110		V7-T1	V10		V7-T1	V10							
24	7793	3110	QBQI.24R3	0199		V7-T1	V10		V7-T1	V10							
25	7800	0199	QQBI.24R3	1132	V8	V8-T1	V10		V8-T1	V10							
26	7816	1132	QBBLA25R3	1084		V8-T1	V10		V8-T1	V10							
27	7831	1084	QBBLB25R3	3096		V8-T1	V10		V8-T1	V10							
28	7847	3096	QBQI.25R3	0219		V8-T1	V10		V8-T1	V10							
29	7853	0219	QQBI.25R3	1242		V14-T2	V15		V14-T2	V15							



- Based on detailed surface planning
- regular delivery of half cells

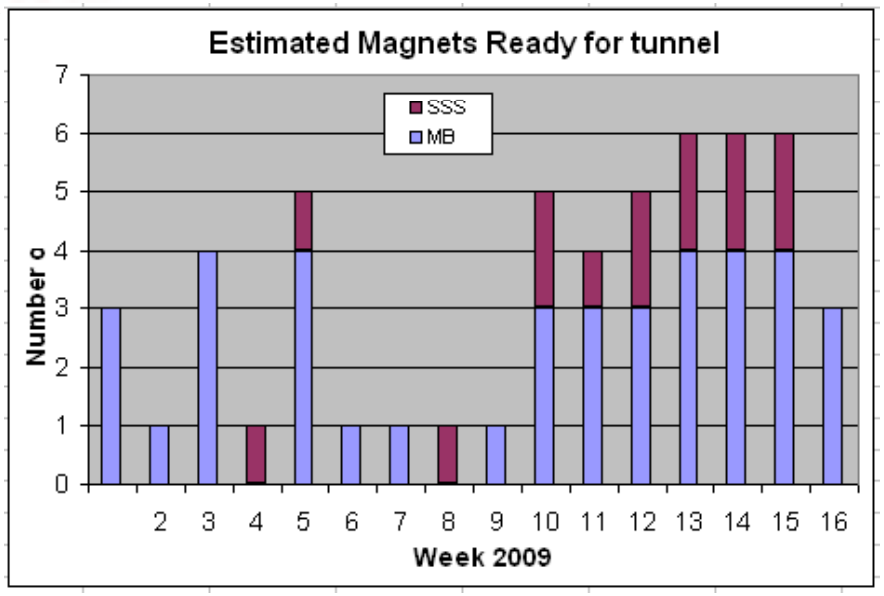
Courtesy A. Musso

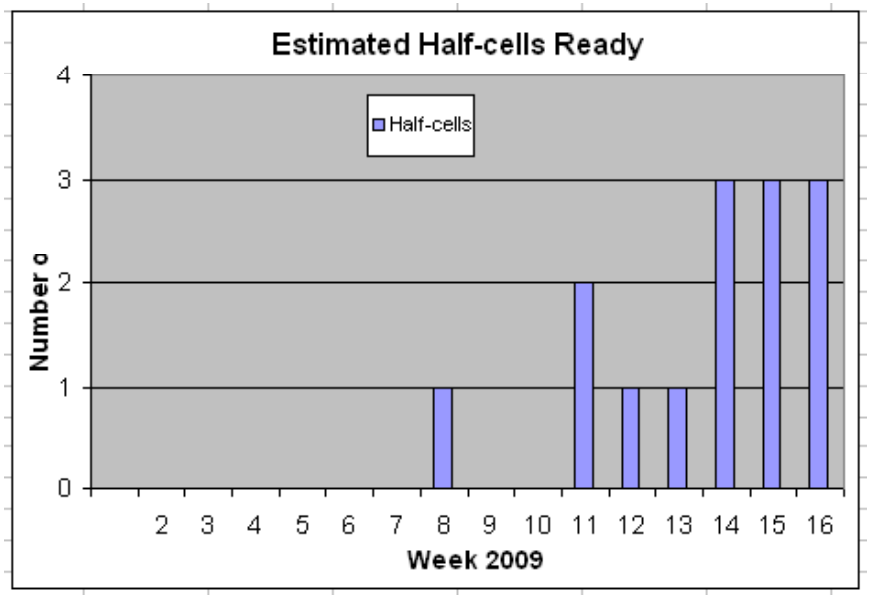
IC 3-4 Detailed Planning: assumptions

- Sequence defined: MEB and chain of surface activities
  - last magnets «ready for installation» W15
  - sequence and timing to be respected
- resources (production and QC) from surface move to tunnel by W15 (i.e. momentarily stop/slow down surface activity)
- avoid coactivity conflicts (shutdown, transport, AUG, lifts, Flohe..)
- no holidays (Easter, May …): is this realistic?
- ignore experience on delays (e.g. humidity for PAQs, Cu/Sn/Ag pollution of some TIG welds, leaks with W closing …)
- no (more) extra work (… additional sectors …)

➢ Closing of W bellows: earliest plan for W23
- but no vacuum subsectors made available earlier

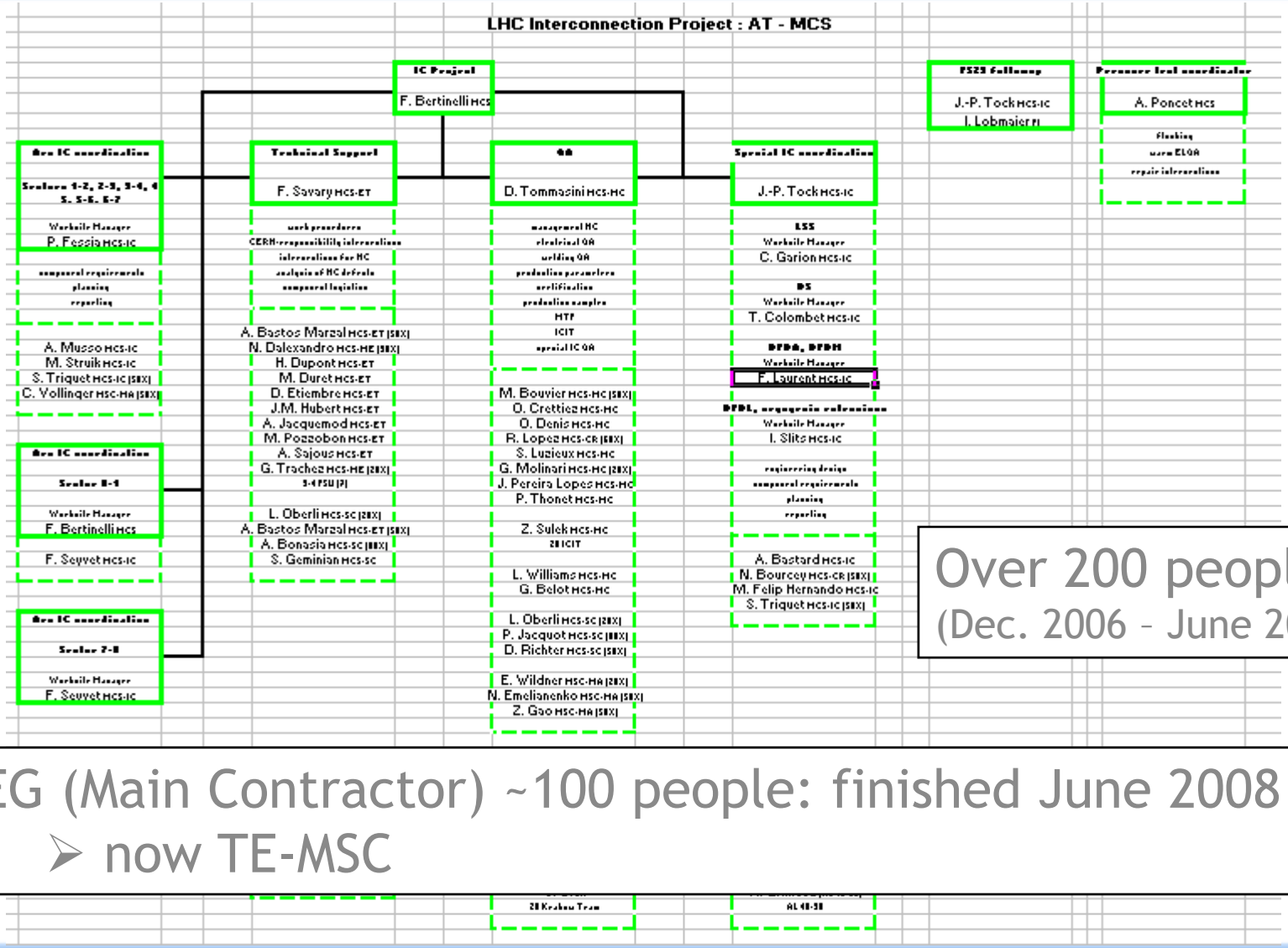
Updated IC 3-4 situation W10





- magnets are not readily interchangeable (different types, field quality)
- small improvements through slot changes have been discussed

IC Resources for series production



Over 200 people
(Dec. 2006 – June 2007)

IEG (Main Contractor) ~100 people: finished June 2008

- now TE-MSC

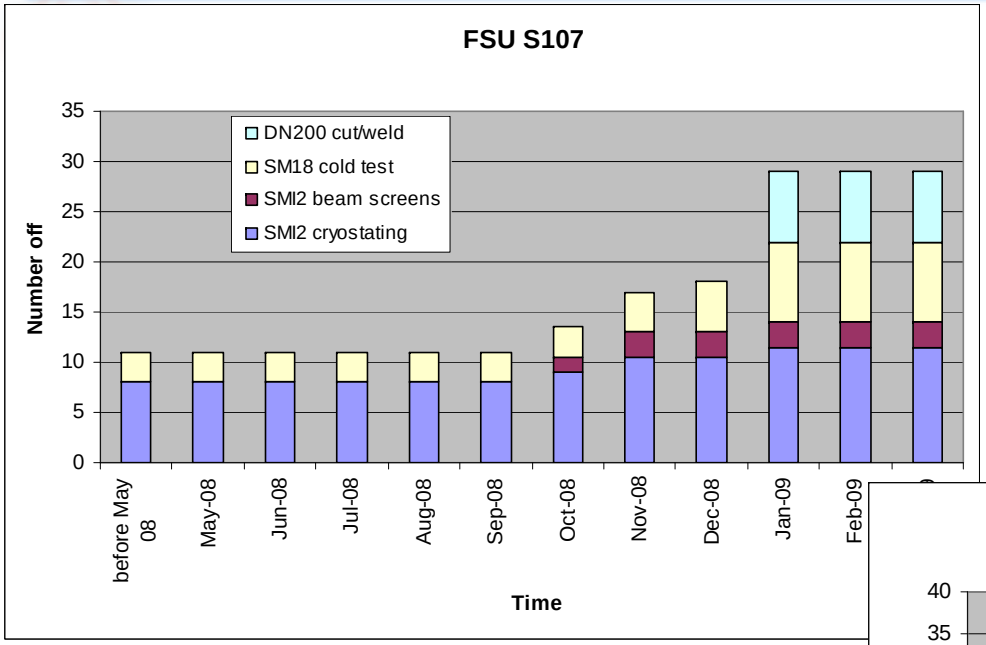
IC Resources today

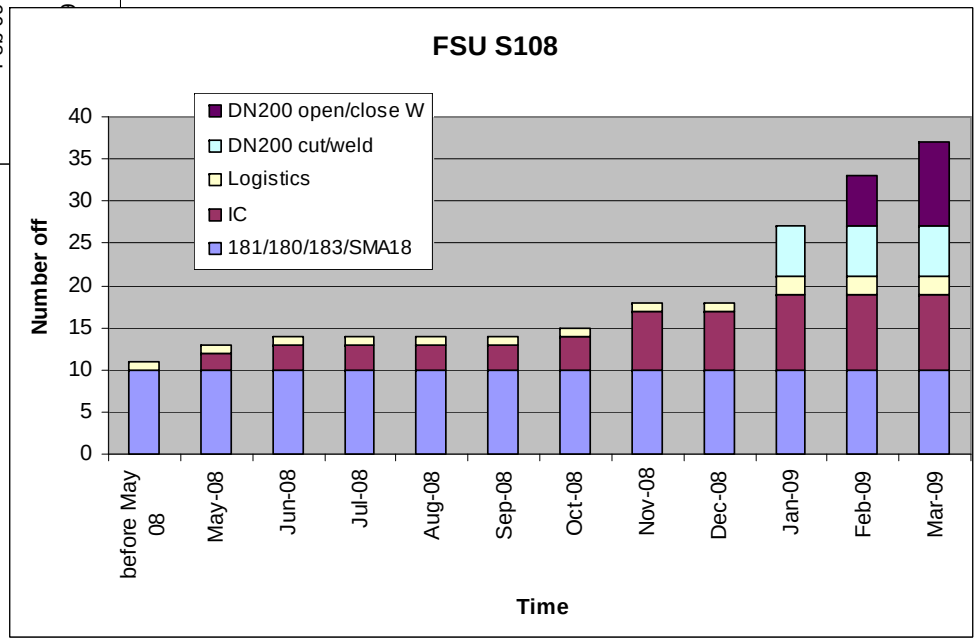
- EN-HE & EN-MME: transport and installation
- BE-ABP-SU: Survey
- TE-MSC: all dedicated sections and ~50% from other sections
- TE-MPE: ELQA
- TE-VSC: leak testing
- TE-CRG: QRL repair
- EN-MME: special welding
- Collaboration TE-MSC-Krakow: ICIT & ELQA
- Collaboration PH-ATLAS-Dubna (for DN200 pressure relief nozzles)
- FSUs

« Can you use/integrate more new resources? »

➢ we already have

FSU resources increase





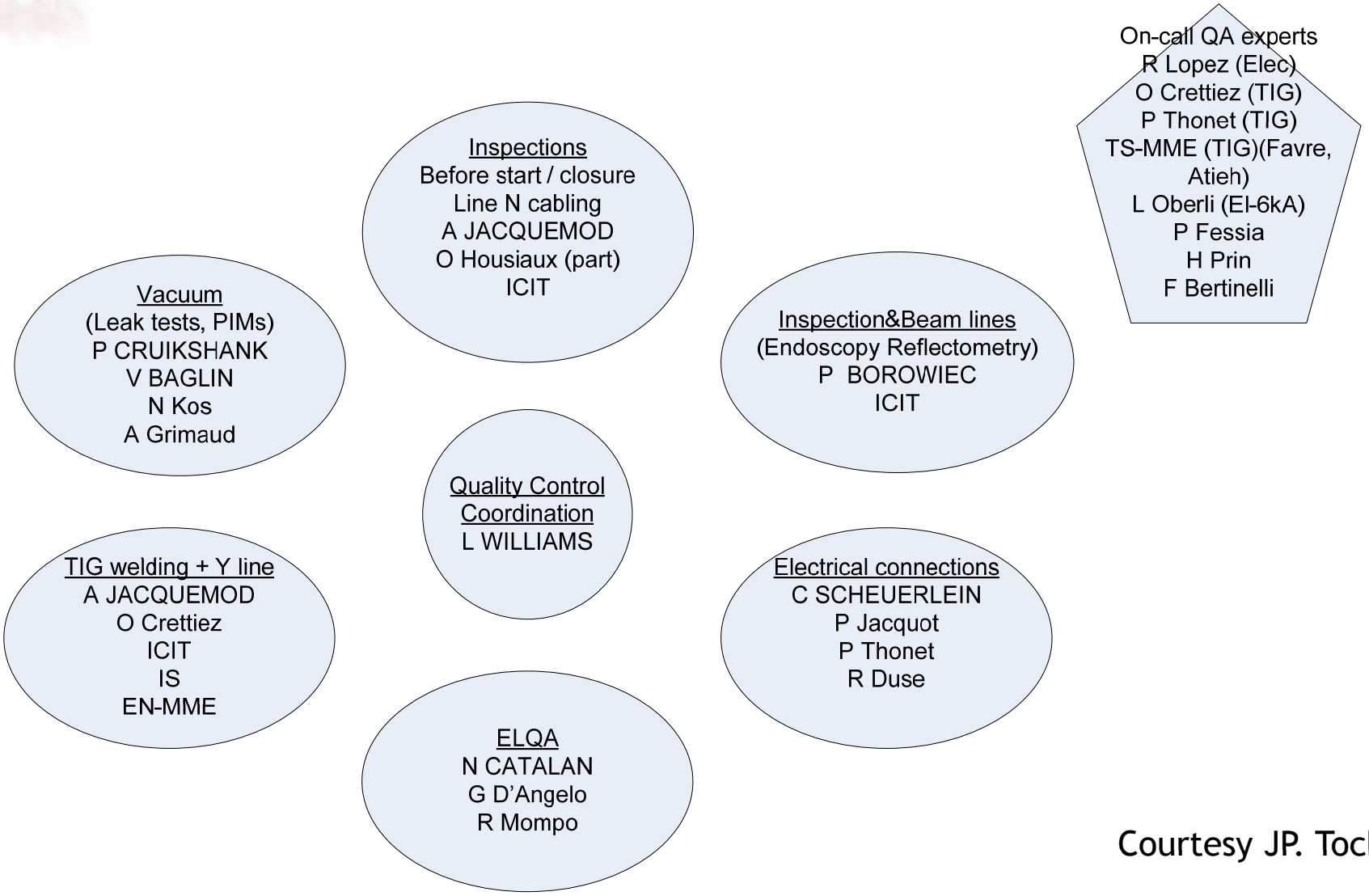
- very reactive but …
- need to be integrated (e.g. minimum 1 week for access authorisations)

IC Quality Control

- Many new intervenants collaborating (and of course many left ...), organisational changes etc.
  - Please accept and help towards this
- Quality-Quality-Quality:
  - no paranoia, but need to at least do “as good as before” and better where we know what to improve: let’s not be complacent (“it has always been done like this ...”)

From first TE-MSC Group Meeting 15 Jan 2009, F. Bertinelli

Organisation of IC Quality Control



Courtesy JP. Tock

Organisation of IC work, coordination and QC

Quality Control Responsible:

Worksite Manager (Engineer in Charge):

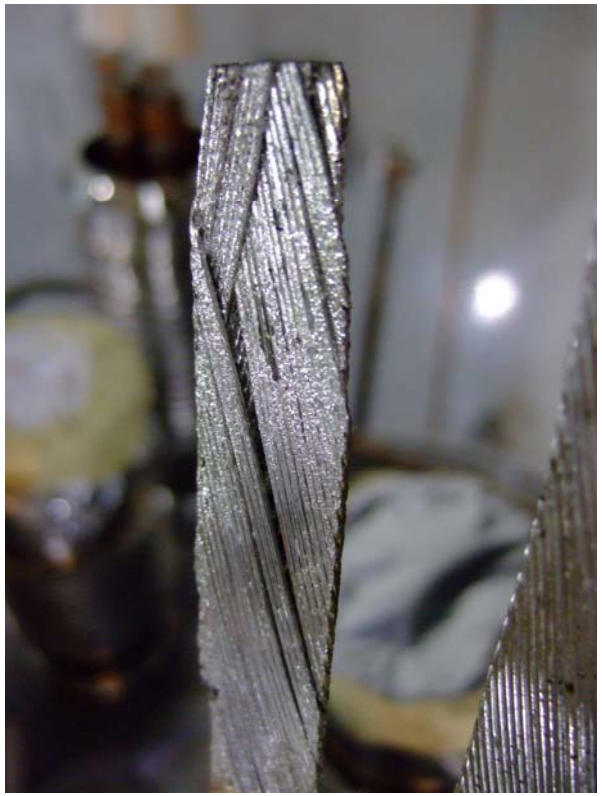
Quality Control Coordinator:

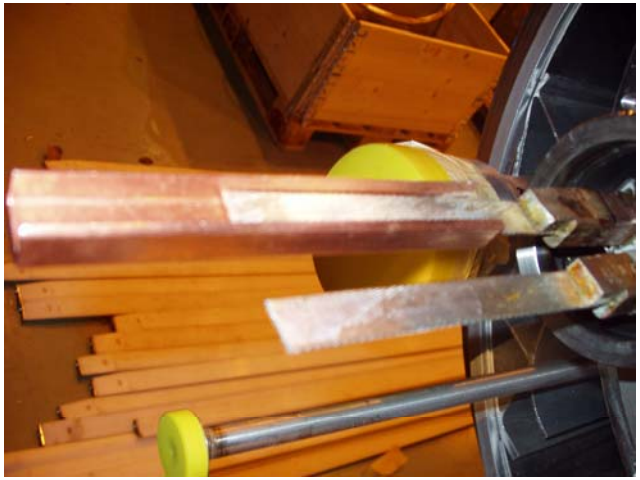
Operators/workers and their supervision:

- Before starting work, requests authorisation from Worksite Manager;
- Informs himself of the general environment constraints of the work to be done;
- Performs visual control before starting work: in case of NC informs Worksite Manager immediately;
- Ensures traceability of work done (when, where, equipment, tooling) and reports on it regularly;
- performs first visual control of work done: in case of NC informs Worksite Manager immediately

IC QC extending to surface

- 13 kA cable stabilisation: avoid twisting of strands
  - ➢ standardise tooling, procedures, cleaning
- Cable straightness: check with dedicated gauge
  - ➢ merge surface and IC activities, production and QC: a healthy effect





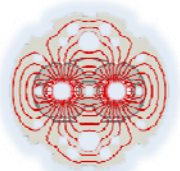
Courtesy C. Scheurlein

Conclusions on 3-4 i/ii

- ✓ Where do you stand today?
  - IC work starting W07 (next week)
  - main current effort: to finish qualifying machines and people, organising coordination while satisfying shutdown requests in other sectors
- ✓ Is quality under control?
  - Yes, technique is sound (no showstoppers), but …
  - still risky/weak (organisation and routine not smooth, e.g W04 and W05 for surface activities)
  - … but why did 19 September incident happen?
  - so no paranoia, but keep this in mind

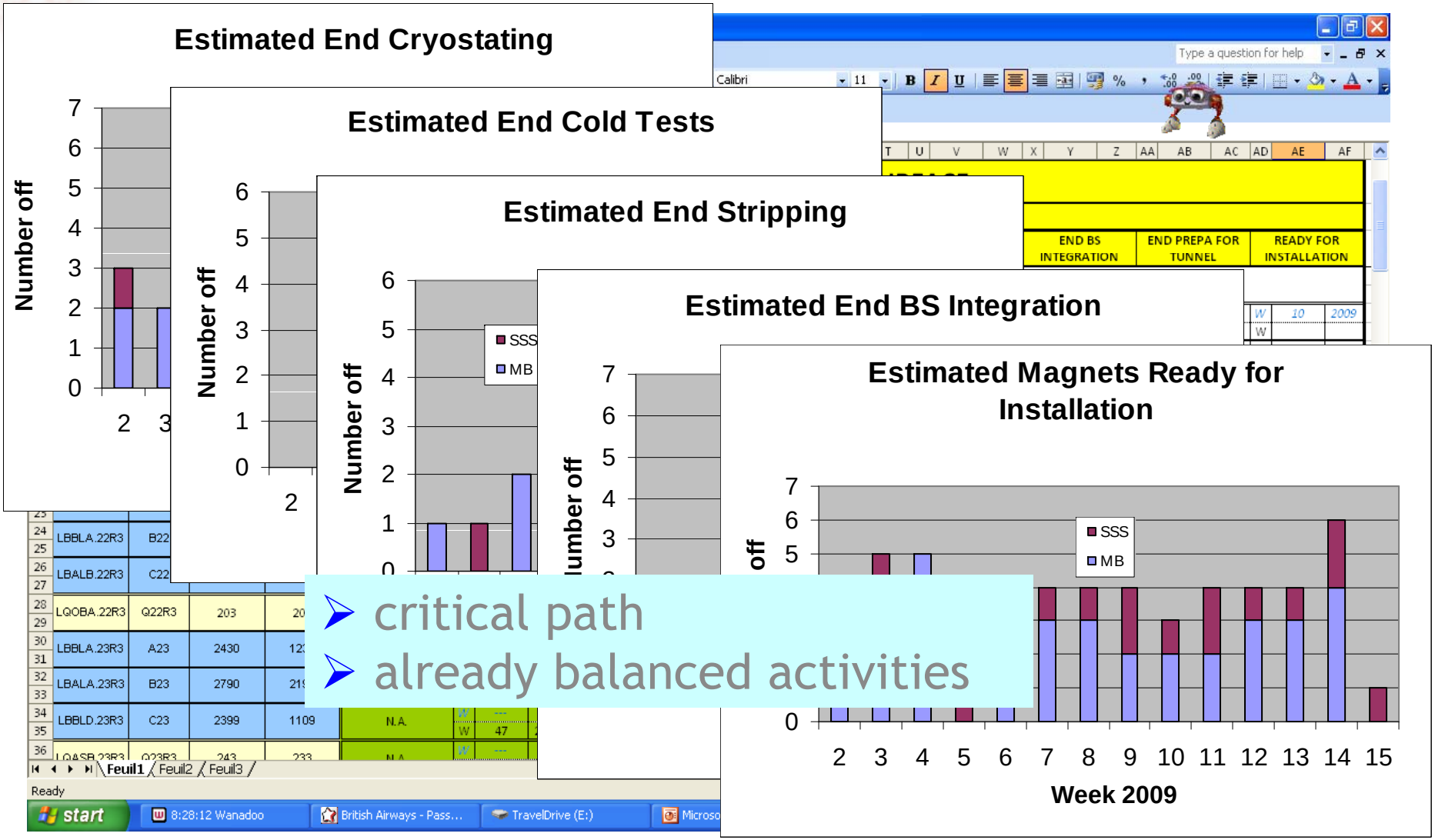
Conclusions on 3-4 ii/ii

- ✓ When do you finish?
  - Plan for W23 (close W bellows), but …
  - are we comfortable? No, see quality, no slack, holidays
  - 4 extra weeks more realistic (more will create further complications with Summer months …)
- ✓ (How) can you go faster?
  - No, see quality above, don't take chances
  - can extra resources help? Difficult, little time for integration: possibly yes in few special cases (ad-hoc needs e.g. QC and specific individual profiles)
  - flexibility measures will help (coactivity, holidays, longer hours, …)



Thanks for your attention

Surface magnet planning



- critical path
- already balanced activities