

# IR 4 available space and incoming requests

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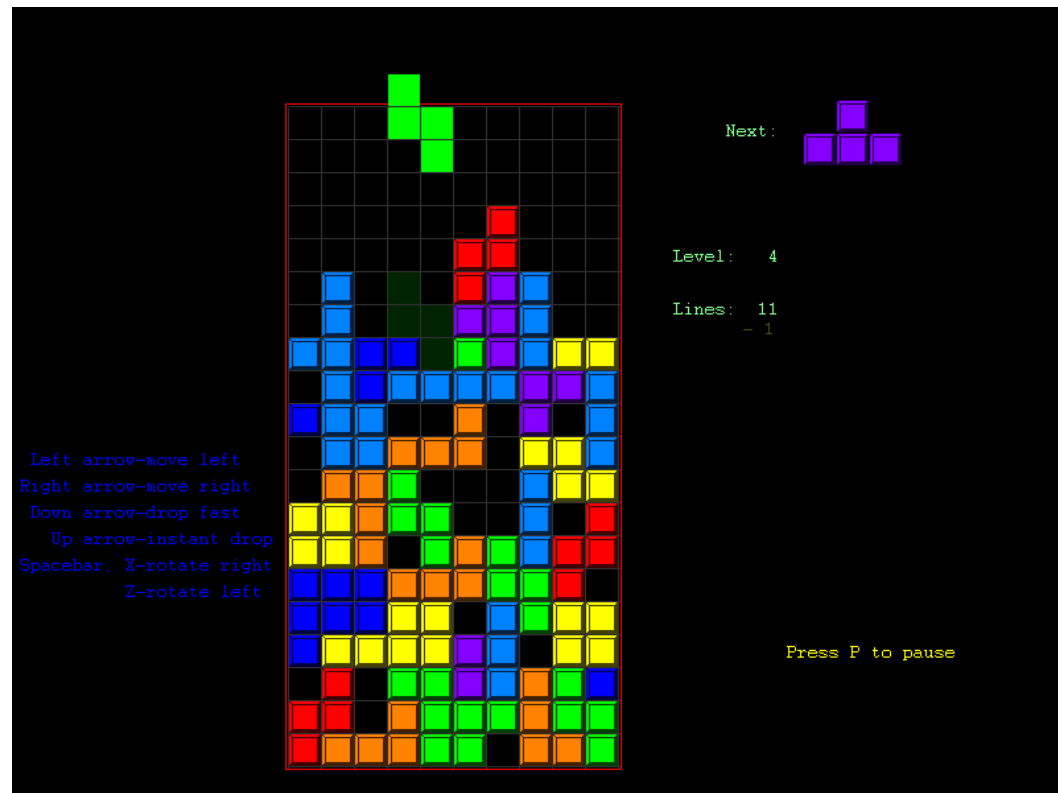
Input from

R. Calaga, W. Hofle, R. Jones, J. Jowett,

S. Redaelli and others

# Summary

- IR 4 space status on paper
- The space reservation
- The requests
- A tetris test



# IR 4 status on paper

- The status of space reservation come from the cross checks of 3 different source of information
  - The CDD lay-out drawings of the LSS
    - LHCLSX\_\_007
    - LHCLSX\_\_008
  - The extraction (under excel format) from the lay-out database of the equipment installed on each beam
  - The lay-out 2 beam drawings coming from the lay-out database
- The space reservation are not dynamically linked to these 3 sources. Therefore gap (in space and in time) could exist

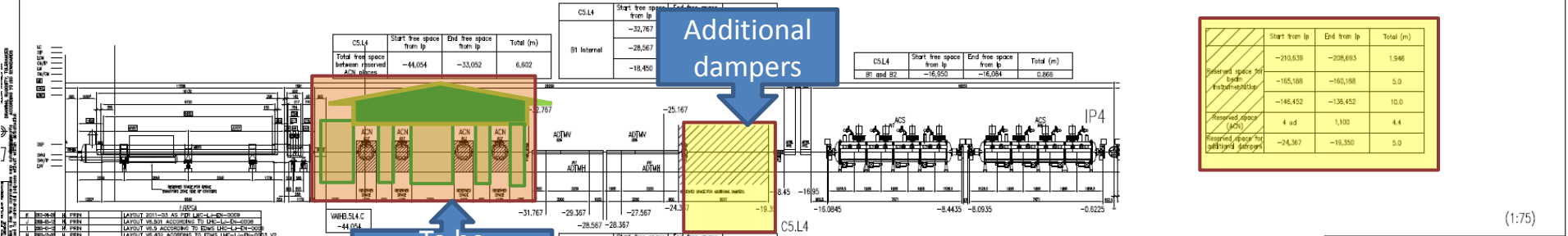
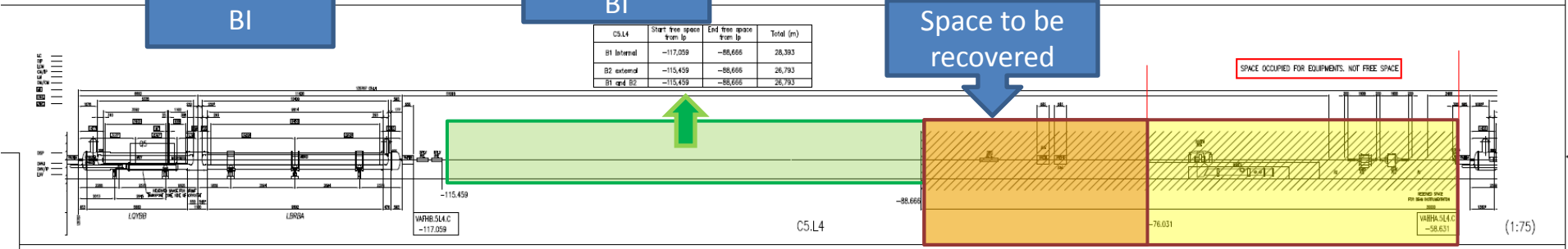
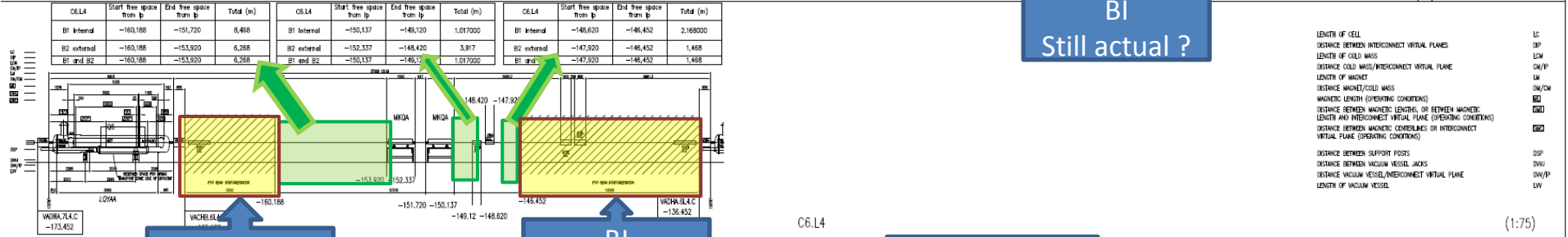
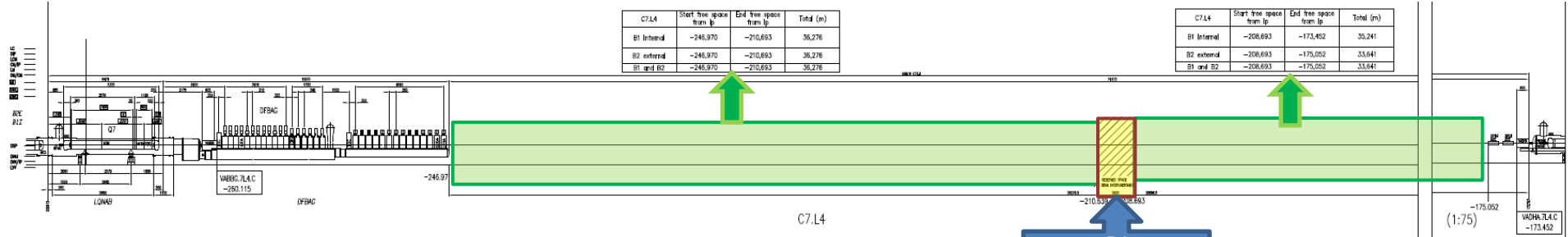
# Space reservations

- The specific content
  - Space reservations in IR 4 shall be reviewed critically as soon as possible because
    - Few of them shall be resized: i.e. BGV
    - Few of them need to be challenged:
    - Few of them are obsolete: ACN
- We need to review space reservation process for HL-LHC
  - Document: it is a good opportunity to start using functional specs
  - Approach and approval: we need to establish a formal approval in addition to EDMS like bringing them periodically in front of a body. I.E. PLC. In order to make them as most credible as possible and make the work of everyone easier they should target as best the real space to be used
  - Tracking we need to have better tool to track them and link the documents (functional spec) with the materialization of the machine. Possibly we need to introduce them in the lay-out as special type of equipment

- Excel file with space available for 1 cell

#	DCUM	space from Ip	space from IP	After element	start free space	end free space	free space	Before element	code length	start	end
CS.R4											
208	10020.963	7.6635	23.882	ACSGA_5R4.B2	10004.7447	10020.9632	16.2185	BPMVA_A5R4.B2	long	E	E
Space reserved for additional dmpers		19.350	23.882				4.5				
Space ACS		7.664	15.654				8.0				
Space reserved for BPAWT		18.450	19.050				0.6				
Free space		15.654	18.450				2.796				
		19.050	19.350				0.300				
							TOTAL free space	3.096			
218	10025.648	27.567	28.567	ADTMH_A5R4.B2	10024.6482	10025.6482	1.0	ADTMH_B5R4.B2	long	E	E
Space reserved for beam instrumentation							0.0				
Free space		27.567	28.567				1				
							TOTAL free space	1.000			
224	10029.848	31.767	32.767	ADTMH_B5R4.B2	10028.848	10029.848	1	BPMVA_B5R4.B2	long	E	E
Space reserved for beam instrumentation							0.0				
Free space		31.767	32.767				1				
							TOTAL free space	1.000			
229	10041.135	33.052	44.054	BPMVA_B5R4.B2	10030.133	10041.135	11.002	VAFH_B5R4.C	long	E	IE
Space reserved for ACN							4.4				
							TOTAL free space	6.602			
243	10058.497	58.916	61.416	BPMVA_B5R4.B2	10055.997	10058.497	2.5	BGN_5R4.B2	long	E	E
Space occupied for equipments - Not free space		58.916	61.416				2.5				
Free space							0				
							TOTAL free space	0.000			
		64.816	80.566	BGH_5R4.B2			15.75	VABH_4.B2	long	E	E
Space occupied for equipments - Not free space		64.816	76.031				11.2				
Space reserved for beam instrumentation		76.031	80.566				4.5				
							TOTAL free space	0.000			
		81.211	113.659	VABH_B2			32.448	BOSH_5R4.B2	long	E	E
Space reserved for beam instrumentation		81.211	88.666				7.5				
Free space		88.666	113.659				24.993				
							TOTAL free space	24.993			
283	10114.14	115.159	117.059	BOSH_5R4.B2	10112.24	10114.14	1.9	VAFH_B5R4.C	long	E	IE
Space reserved for beam instrumentation							0.0				
Free space		115.159	117.059				1.9				
							TOTAL				

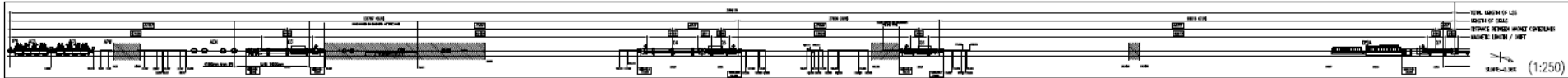
# IR 4 L



- LC LENGTH OF CELL
- DP DISTANCE BETWEEN INTERCONNECT VIRTUAL PLANES
- LM LENGTH OF COLD MASS
- DMW DISTANCE COLD MASS/INTERCONNECT VIRTUAL PLANE
- LMW LENGTH OF MAGNET
- DMW/MW DISTANCE MAGNET/COLD MASS
- MMW MAGNETIC LENGTH (OPERATING CONDITIONS)
- MMW/MW DISTANCE BETWEEN MAGNETS LENGTHS OR BETWEEN MAGNET LENGTH AND INTERCONNECT VIRTUAL PLANE (OPERATING CONDITIONS)
- MMW/DMW DISTANCE BETWEEN MAGNETS CENTERLINES OR INTERCONNECT VIRTUAL PLANE (OPERATING CONDITIONS)
- DSP DISTANCE BETWEEN SUPPORT POSTS
- DWV DISTANCE BETWEEN VACUUM VESSEL JACKS
- DWV/VP DISTANCE VACUUM VESSEL/INTERCONNECT VIRTUAL PLANE
- DWV/VV LENGTH OF VACUUM VESSEL

	Start from Ip	End from Ip	Total (m)
Reserved space for layout	-210,630	-208,663	1,946
Reserved space for layout	-185,188	-180,188	5.0
Reserved space for layout	-146,452	-136,452	10.0
Reserved space for layout	4 ud	1,100	4.4
Reserved space for layout	-24,367	-19,350	5.0

# IR 4 R

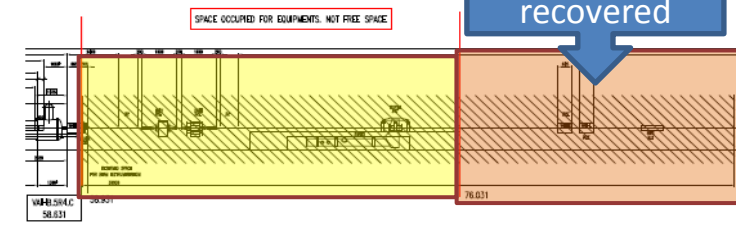
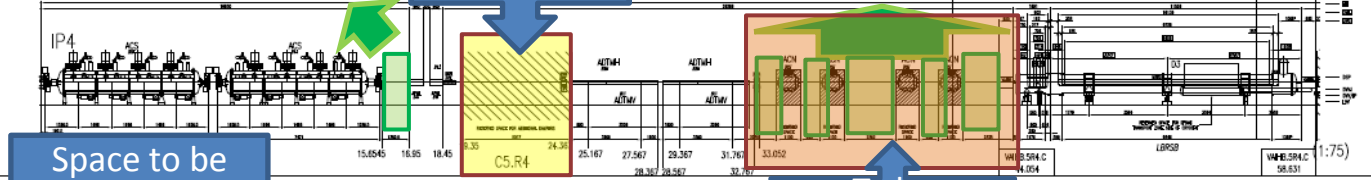


	Start from Ip	End from Ip	Total (m)
Reserved space for IP4	58,631	86,666	28.04
Reserved space for IP4	160,768	165,768	5.00
Reserved space (ADQ)	208,743	210,743	2.00
Reserved space for equipment	19,300	24,367	5.02

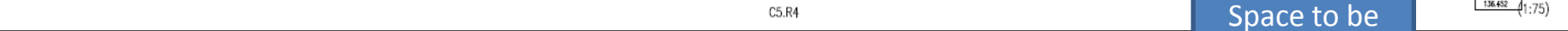
CS.R4	Start free space from Ip	End free space from Ip	Total (m)
B1 Internal	15,854	16,950	1,096
B2 external	15,450	16,350	2,396
B1 and B2	15,654	16,350	1,236

CS.R4	Start free space from Ip	End free space from Ip	Total (m)
B1 Internal	25,167	25,800	633
B2 external	25,367	25,800	433
B1 and B2	25,167	25,800	633

CS.R4	Start free space from Ip	End free space from Ip	Total (m)
Total free space between reserved ACM planes	33,052	44,054	6,802



CS.R4	Start free space from Ip	End free space from Ip	Total (m)
B1 Internal	88,666	115,359	26,693
B2 external	88,666	113,659	24,993
B1 and B2	88,666	113,659	24,993

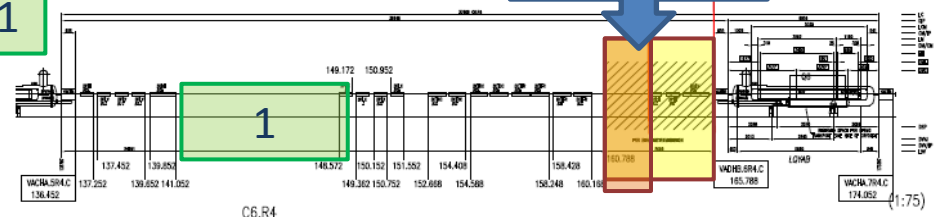


CR.R4	Start free space from Ip	End free space from Ip	Total (m)
B1 Internal	136,452	137,452	1,000
B2 external	150,752	152,668	1,916
B1 and B2	154,808	153,788	8,920

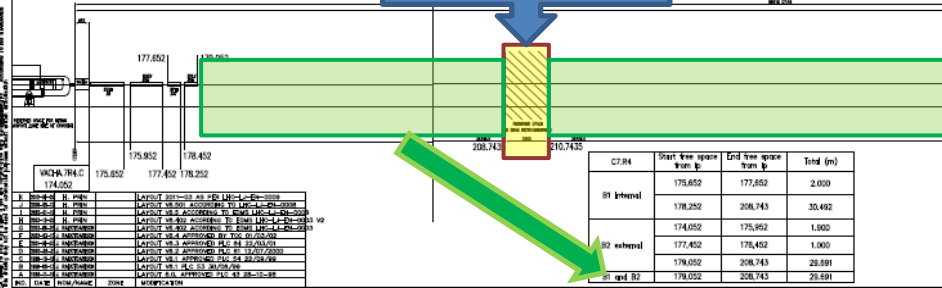
CR.R4	Start free space from Ip	End free space from Ip	Total (m)
B1 and B2	141,052	148,572	7,520
B1 and B2	151,552	152,668	1,116
B1 and B2	160,168	165,788	5,620

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CR.R4	Start free space from Ip	End free space from Ip	Total (m)
B2 External	115,159	117,059	1,900
B1 Internal	137,252	136,852	2,800
B2 External	141,052	148,572	7,520
B1 Internal	148,172	150,252	2,080
B2 External	151,552	154,588	3,036
B1 and B2	158,248	160,788	2,540



Bi Still actual ?



C7.R4	Start free space from Ip	End free space from Ip	Total (m)
B1 Internal	175,652	177,652	2,000
B2 external	178,252	208,743	30,492
B1 and B2	174,052	175,452	1,400
B2 external	177,452	176,452	1,000
B1 and B2	179,052	208,743	29,691
B1 and B2	179,052	208,743	29,691

C7.R4	Start free space from Ip	End free space from Ip	Total (m)
B1 Internal	210,743	246,470	35,727
B2 external	210,743	246,470	35,727
B1 and B2	210,743	246,470	35,727

ALL DIMENSIONS ARE AT 25°C, EXCEPT THE METRIC LENGTHS AND DISTANCES BETWEEN TRIS, WHICH ARE AT OPERATING CONDITIONS.  
DIMENSIONS TO BE DEFINED  
LAYOUT OF LSS  
LAYOUT OF C7.R4  
LAYOUT OF LSS  
CELLS C5.R4 & C7.R4  
NOT VALID FOR EXTERIOR  
HCLX 00081

# Beam instrumentation I *(guess in italics)*

Eq. name	IR side	B1	B2	Length [mm]	Position	Remarks
BGV	L	X		10000	Between Q6 and Q7	44 m reserved by ECR
BGV	R		X	10000	Between Q6 and Q7	44 m reserved by ECR
BGV	L	X		10000	Between Q6 and Q7	44 m reserved by ECR
BGV	R		X	10000	Between Q6 and Q7	44 m reserved by ECR
BSRT	L				Already installed	Bring the optical line in UA (feasible? Transport ? Civil engineering)
BSRT	R				Already installed	Bring the optical line in UA (feasible? Transport ? Civil engineering)
Extra BPM	R		X		between Q5 and Q6	Close to BPLX
Extra BPM	R		X		between Q5 and Q5	Close to BPLX



# Beam instrumentation II (*guess in italics*)

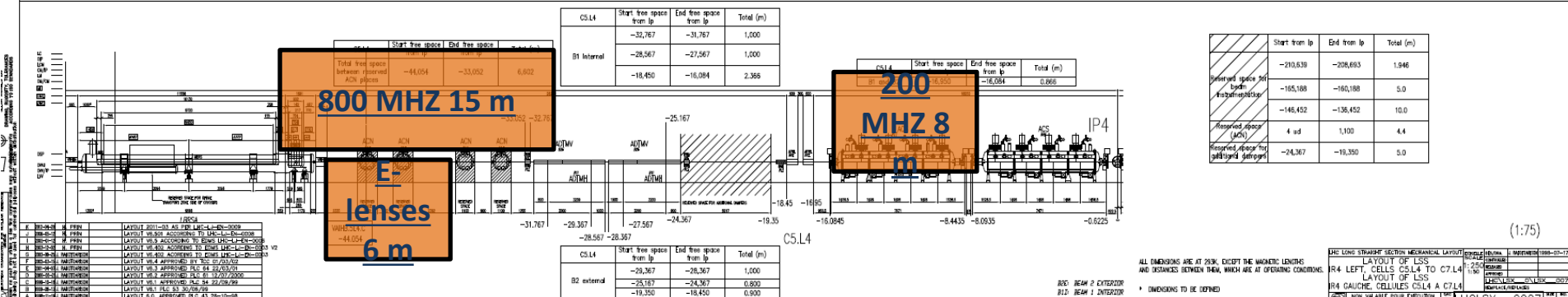
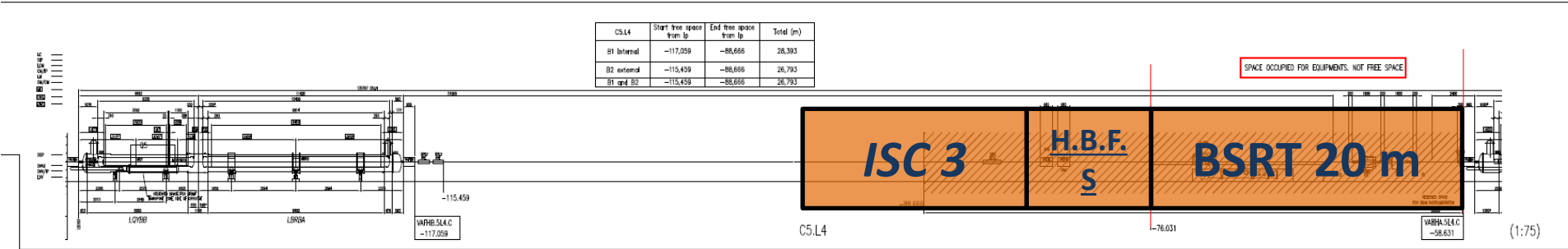
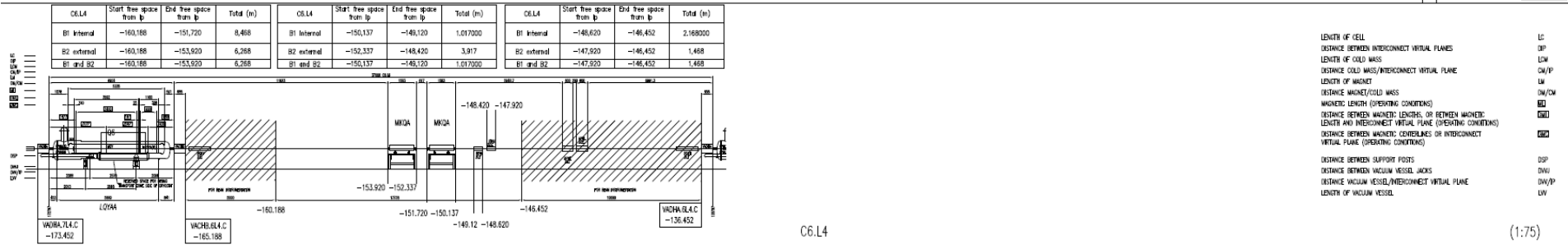
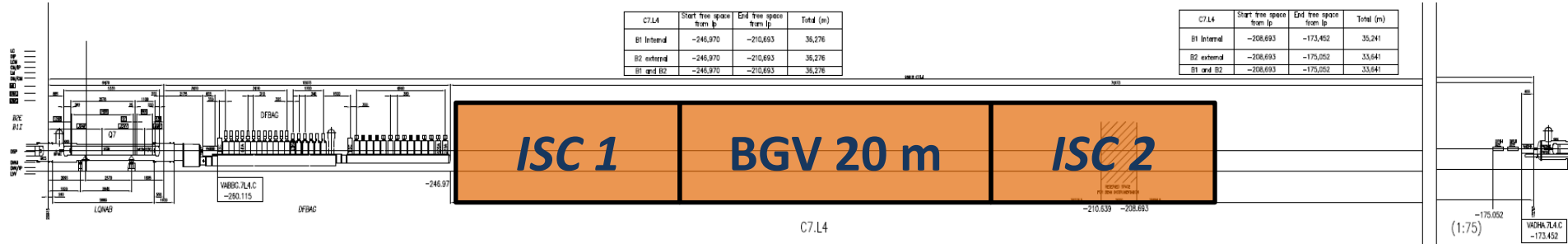
Eq. name	IR side	B1	B2	Length [mm]	Position	Remarks
Halo e lenses	L	<i>X</i>		6000	Near D3 after undulator	
Halo e lenses	R		<i>X</i>	6000	Near D3 after undulator	

# RF very preliminary estimates *(guess in italics)*

Eq. name	IR side	B1	B2	Length [mm]	Position	Remarks
800 MHz	L	<i>X</i>		15000 +/- 3000	In the area or present ACN	
800 MHz	R		<i>X</i>	15000 +/- 3000	In the area or present ACN	
200 MHz	L	<i>X</i>		8000	possibly replace one 400 MHz ACS module	
200 MHz	R		<i>X</i>	8000	possibly replace one 400 MHz ACS module	

Eq. name	IR side	B1	B2	Length [mm]	Position	Remarks
Ion stochastic cooling (ISC)	L	X		3X12000	To de defined	12000 mm for each plane, not necessarily contiguous
Ion stochastic cooling (ISC)	R		X	3X12000	To de defined	12000 mm for each plane, not necessarily contiguous
ISC pick ups		X		<i>n</i> X500	IR 2 or IR3	Connect with optical fibres to IR4
ISC pick ups			X	<i>n</i> X500	IR 5 IR 6	Connect with optical fibres to IR4
High Bandwidth Transv system	L	X		6000-7000 ?		Possible useful space also in part with less beam separation to be investigated
High Bandwidth Transv system	R		X	6000-7000 ?		Possible useful space also in part with less beam separation to be investigated

# IR 4 L, tetris



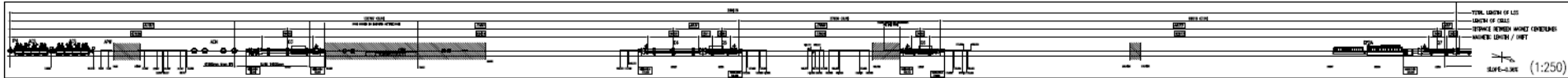
ALL DIMENSIONS ARE AT 283K, EXCEPT THE MAGNETIC LENGTHS AND DISTANCES BETWEEN THEM, WHICH ARE AT OPERATING CONDITIONS.

ROOM BEAM 4 EXTERIOR  
B.I.D. BEAM 1 INTERIOR

• DIMENSIONS TO BE DEFINED

THE LONG STRAIGHT SECTION MECHANICAL LAYOUT (1998-07-17)  
LAYOUT OF LSS  
R4 LEFT, CELLS C5.L4 TO C7.L4  
LAYOUT OF LSS  
R4 GAUCHE, CELLULES C5.L4 A C7.L4  
MINI VALVE FOUR EXTERIOR  
HOU SX 00071116

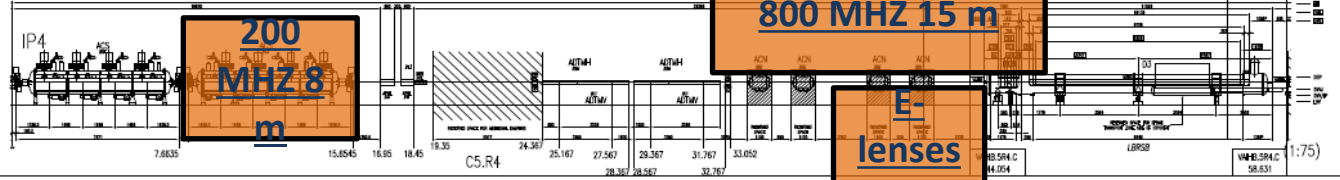
# IR 4 R, tetris



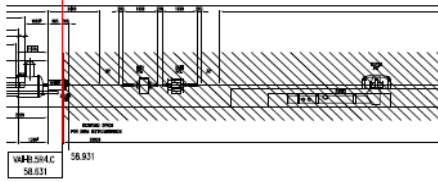
	Start from Ip	End from Ip	Total (m)
Planned space for ducts	58,631	86,666	28.04
Planned space for pipes	160,788	165,788	5.00
Reserved space (ADK)	208,743	210,743	2.00
Reserved space for equipment	4	1,100	4.40
Reserved space for piping	19,300	24,367	5.02

	Start free space from Ip	End free space from Ip	Total (m)
B1 Internal	15,854	16,950	1,096
B2 external	18,450	19,350	900
B1 and B2	15,854	16,950	1,096

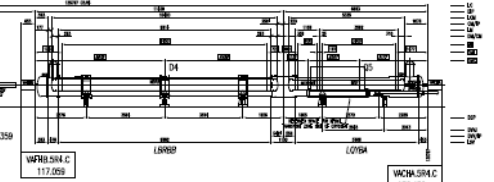
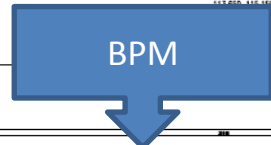
	Start free space from Ip	End free space from Ip	Total (m)
B1 Internal	24,367	25,167	800
B2 external	28,367	29,367	1,000
B1 and B2	27,567	28,567	1,000
	33,257	33,767	500



SPACE OCCUPIED FOR EQUIPMENTS, NOT FREE SPACE



	Start free space from Ip	End free space from Ip	Total (m)
B1 Internal	896	115,299	28,603
B2 external	896	113,659	24,993
B1 and B2	896	113,859	24,993



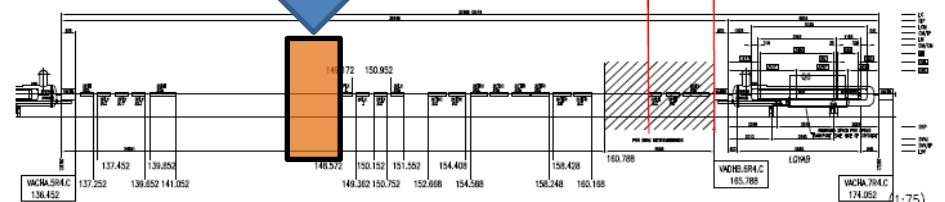
SPACE OCCUPIED FOR EQUIPMENTS, NOT FREE SPACE

- LENGTH OF CELL
- DISTANCE BETWEEN INTERCONNECT VERTICAL PLANES
- LENGTH OF COLD MASS
- DISTANCE COLD MASS/INTERCONNECT VERTICAL PLANE
- LENGTH OF WAREHOUSE
- DISTANCE WAREHOUSE/INTERCONNECT VERTICAL PLANE
- DISTANCE BETWEEN WAREHOUSE, CENTERLINES OF INTERCONNECT VERTICAL PLANE (OPERATING CONDITIONS)
- DISTANCE BETWEEN SUPPORT POSTS
- DISTANCE BETWEEN VACUUM VESSEL AXES
- DISTANCE VACUUM VESSEL/INTERCONNECT VERTICAL PLANE
- LENGTH OF VACUUM VESSEL

	Start free space from Ip	End free space from Ip	Total (m)
B1 Internal	138,452	137,452	1,000
B2 external	138,852	148,362	9,510
B1 and B2	150,752	152,668	1,916
	154,808	156,428	1,620
	160,158	160,788	630

	Start free space from Ip	End free space from Ip	Total (m)
B1 and B2	141,052	148,572	7,520
	151,552	152,668	1,116
	160,168	165,788	5,620

	Start free space from Ip	End free space from Ip	Total (m)
B2 External	115,159	117,059	1,900
	137,252	136,852	2,900
	141,652	148,572	7,520
	148,172	150,252	2,120
	157,552	154,588	3,036
	158,248	160,788	2,540



	Start free space from Ip	End free space from Ip	Total (m)
B1 Internal	178,652	177,652	2,000
B2 external	178,252	208,743	30,492
B1 and B2	177,452	178,452	1,000
	178,052	208,743	29,891
	178,052	208,743	29,891

	Start free space from Ip	End free space from Ip	Total (m)
B1 Internal	210,743	246,470	35,727
B2 external	210,743	246,470	35,727
B1 and B2	210,743	246,470	35,727

NO.	DESCRIPTION	DATE	BY	CHKD.	APPD.
1	ISSUE FOR PERMIT	2023-08-01	...	...	...
2	ISSUE FOR CONSTRUCTION	2023-08-01	...	...	...
3	ISSUE FOR OPERATION	2023-08-01	...	...	...
4	ISSUE FOR MAINTENANCE	2023-08-01	...	...	...
5	ISSUE FOR REPAIR	2023-08-01	...	...	...
6	ISSUE FOR MODIFICATION	2023-08-01	...	...	...
7	ISSUE FOR DEMOLITION	2023-08-01	...	...	...
8	ISSUE FOR AS-BUILT	2023-08-01	...	...	...
9	ISSUE FOR RECORD	2023-08-01	...	...	...
10	ISSUE FOR ARCHIVE	2023-08-01	...	...	...

ALL DIMENSIONS ARE AT 25°C, EXCEPT THE METRIC LENGTHS AND DISTANCES BETWEEN TUBES, WHICH ARE AT OPERATING CONDITIONS.  
 \* DIMENSIONS TO BE DEFINED  
 HCLSLX 000810

# Conclusions

- We need to complete equipment survey for IP4
- We need to revise the reservations
- We need to re-reserve equipment space with adequate procedure to prepare ourselves at next 10 years of changes with HL-LHC