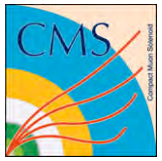


Status of cabling

CMS week – 20.6.2006

Fabio Montecassiano

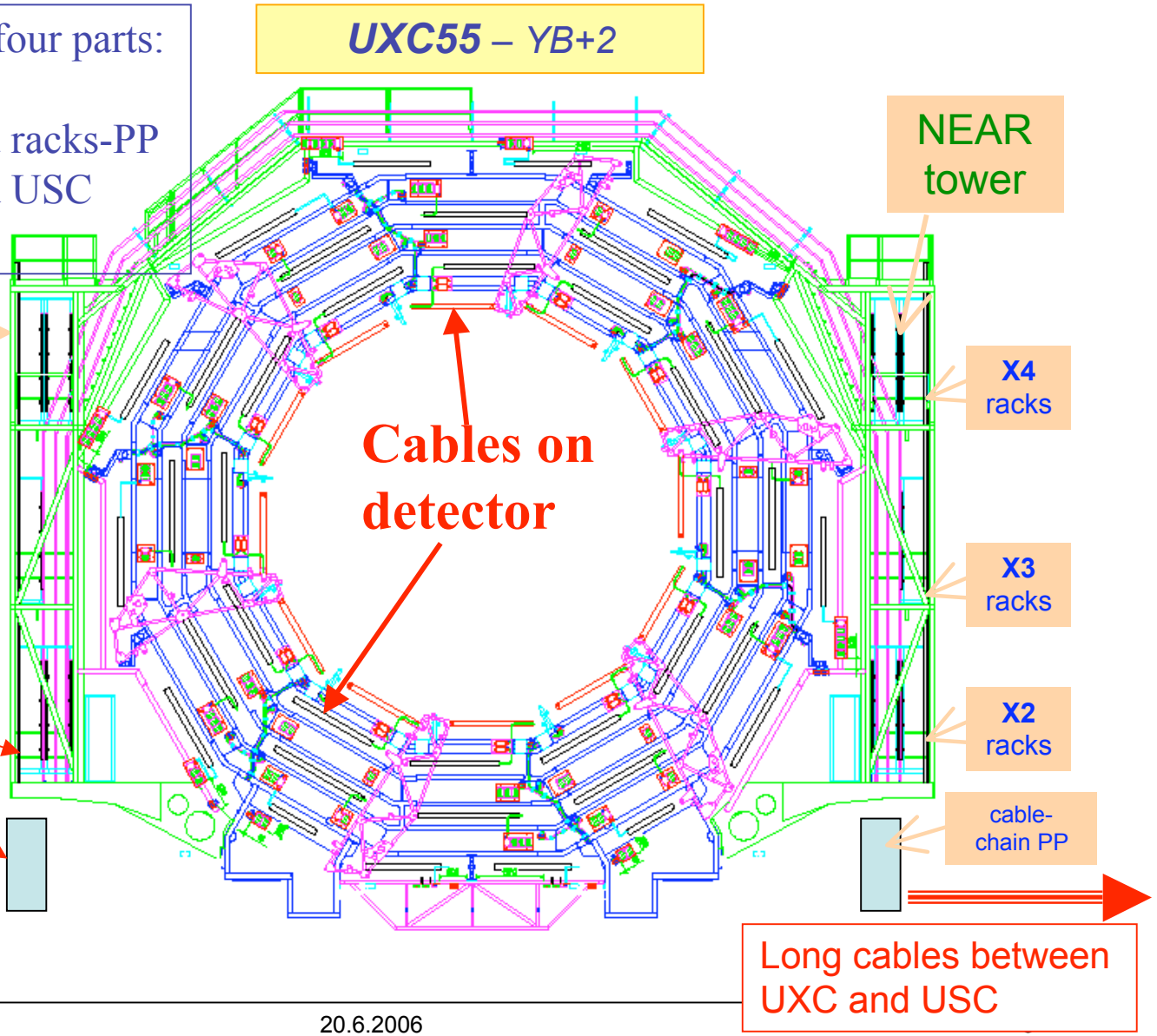
INFN PD

Contents

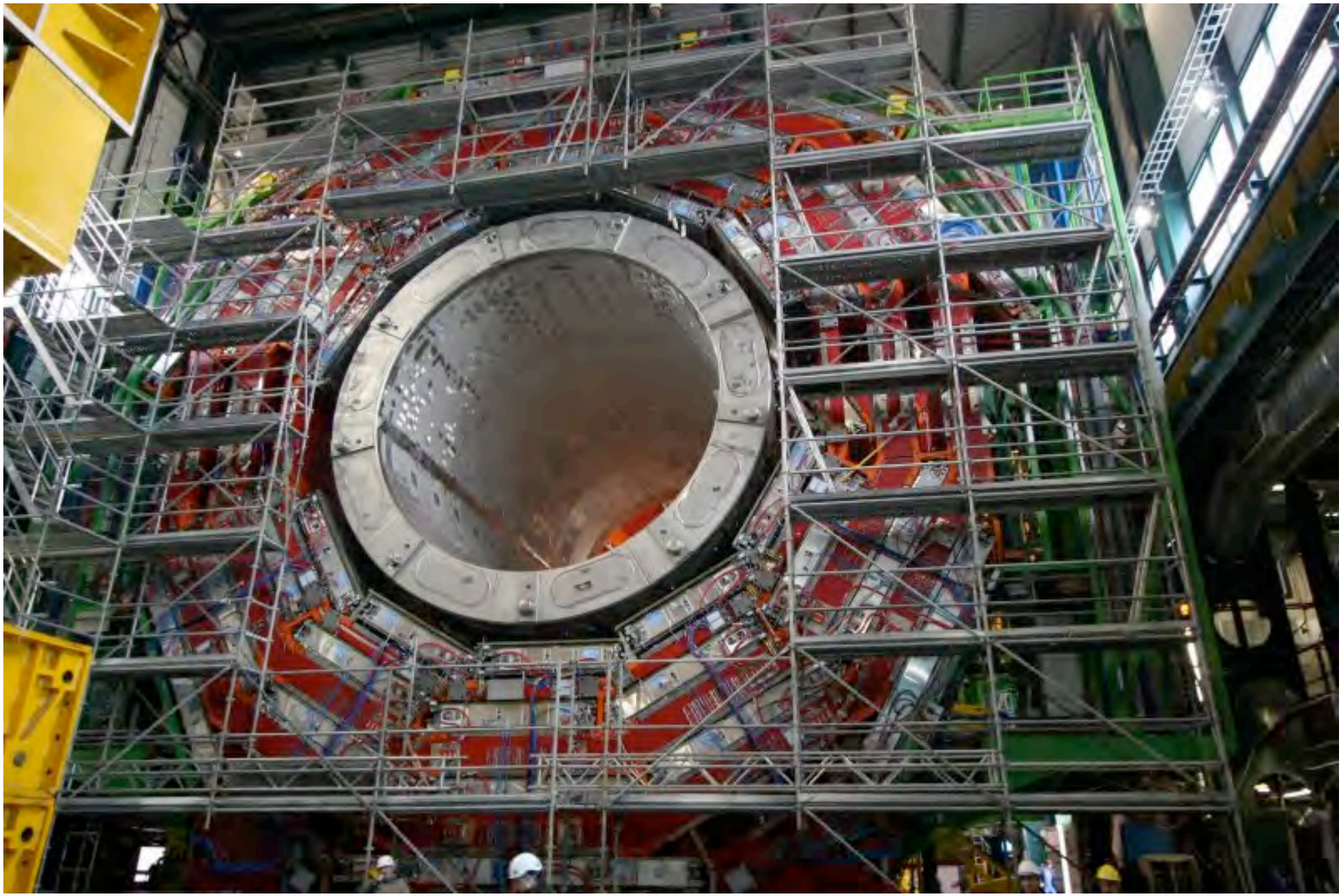
- What was done
  - Status of cables installation
  - Still to do on YB+2 and YB+1
  - Cables between UXC55 and USC55
    - Examples of installation dwg released on EDMS
- Present Activities
  - Cables-chain patch panels
  - YB0 and Negative wheels
- Conclusion

Cabling - overview

Cabling can be divided in four parts:
- cables from detector
- cables between racks and racks-PP
- cables between UXC and USC
- cables in USC

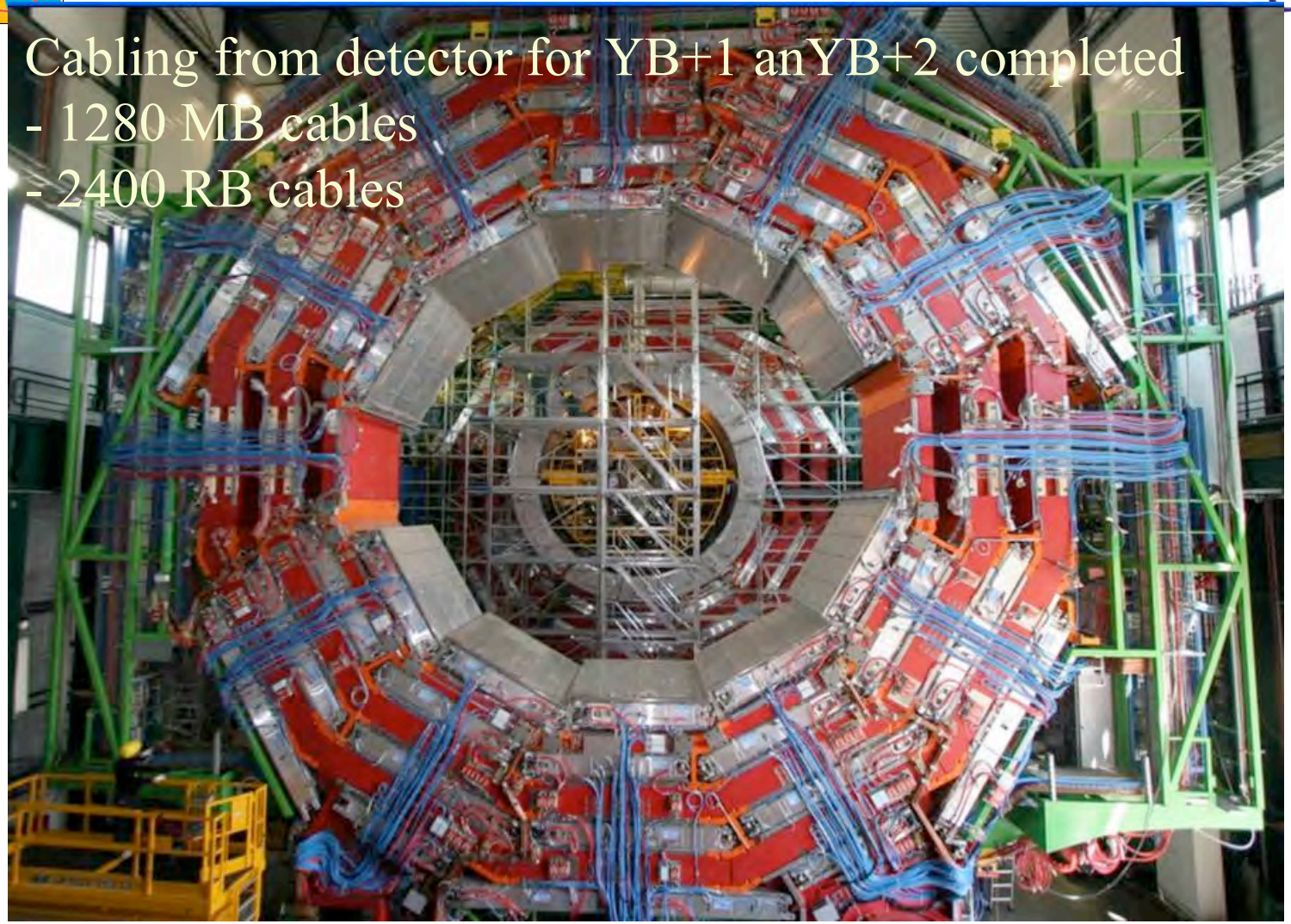


YB+1 as it was in March 06



What has been done since March

Cabling from detector for YB+1 anYB+2 completed
- 1280 MB cables
- 2400 RB cables



YB+1 *June 2006*

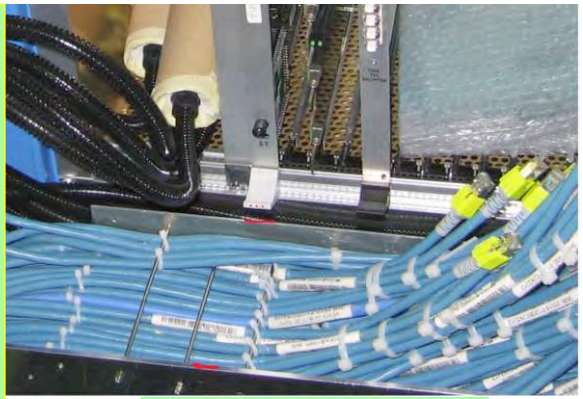
Cabling of racks

- It's not a simple task to finalize the cabling of the **Sector Collector crates** due to the high cables density. Paolo and CIEMAT technicians are working on this.

DT has 1 tr-ro rack per wheel with 2 crates and 2 cables support, 2U tall, as showed by the pictures.
Each **cable support** houses all the TR/RO/DCS and optical cables for half wheel (6 sectors):

- 50 x RO cables d=8mm
- 50 x TR cables d=8mm
- 25 ttc fibres d=3mm → inside tubes
- 25 sc cable d=5mm
- 6 multicable veto d=8.6mm

about 160 cables in 2 U



Front view

back view

- We have to improve the clarity of labels by adding new simplified ones with the minimal required information in order to identify the cable and is connector.

Still to do on YB+1, YB+2

Reported during the AR 06

- Cables from detector:

  SXC55 - after MTCC : small details at detectors side (i.e. some broken connector, few carters for RPCs, some label) according to the Quality Control made by D. Colonna.
  - About 1 day per wheel of sub-detector's technicians

  SXC55 - only YB+1 - after MTCC: move X3 and X4 NEAR racks in the final position and cabling
  - About 2 days of sub-detector's technicians and cern cabling team

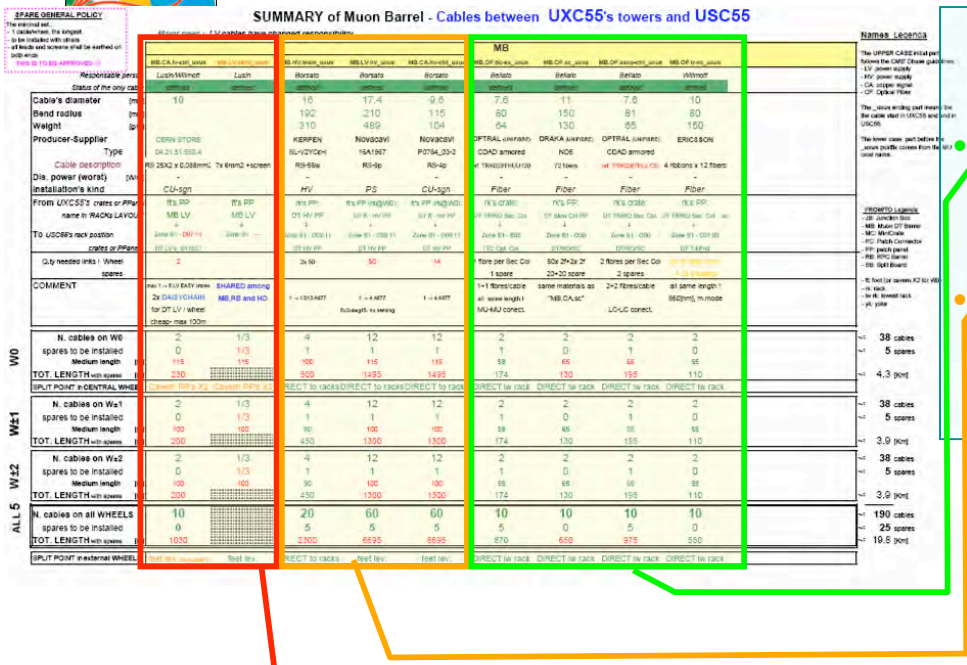
  SXC55 : After MTCC - before lowering - un-cabling the radial part of S1 and S7 and recovering cables
  - About 1 day per wheel of cern cabling team

  UXC55: finalizing the radial cabling of S1 and S7.
  - About 2 days of cern cabling team. Work underground

  UXC55: installation of spare cables for DT and RPC. These are few cables (12+8/wheel) which will let us to recovery from the first fault just pulling out them from the cables-trays and installing the radial part.
  - About 2 days of cern cabling team. Work underground

- Cables between Racks and PP:
  - **Routing design and cutting lengths under work:**
    - About 40 MB cables
    - About 150 RB cables and fibers
    - LV cables routing still under discussion with S. Lusin/S. Akthar
    - All cables procured excluding the LV cables which could be bought trough the CERN store.
  - **installation of cables rack-rack and rack-PP**
    - SXC55/UXC55 - after MTCC: Installation of about 300 cables RACK-RACK & Rack-PP (Better if done in SX5 but can be also done in UXC55 as scaffolding is not mandatory).
      - About 2 days per wheel cern cabling team

Cables between UXC55 and USC55



Cutting lengths all released except YB0 which is still under study. About external wheels:

- Optical cables almost all delivered at cern
  The last family (sc) should arrive in these days.
- HV system cables under production.
  EB estimation is within 1st week of July

LV long cables are under the responsibility of LV coordinator and still under discussion. These are very urgent because cable-chains in USC55 are almost ready to house pipes and cables.

A new proposal using cables already available from DT HV system is **under discussion.** ***These cables are already tested and accepted by TIS.***

Cables between UXC and USC

- i.e. about lengths and installation of HV

Many documents was released in EDMS for production and installation

MB.HV.main_uxus - lengths and installation

Introduction

These cables supply the high voltage from the main system CAEN SY1527 - modules A876 placed in counting room USC55 to the remote modules A877 hold on the UXC55's towers.
The HV system for MB Drift Tubes is fully independent from any other as it has its own LV supplies and control cables.
See also the EDMS documents for *MB.LV.hv_uxus* (**CMS-G-RR-0244**) and for *MB.CA.hv-ctrl_uxus* (**CMS-G-RR-0245**).

There are a total of 20 *MB.HV.main_uxus* cables plus 5 spares installed among the 5 wheels and USC55. Each DT HV rack inside the UXC55's towers (2 per tower -one at X3 level and the other at X4 level) is connected directly to the counting room by 1 cable.
There will be 1 spare per wheel installed up to the FAR tower - without the connector at this side and just below the tower without enter inside - ready for both FAR and NEAR sides.

As the installation will be done before the wheel will go down and not having any splitting point on the Patch Panels of the Cable chains, then the 2 tails/tower, about 15-20m length each one, have to be stored somewhere waiting for the wheel.
Also the spare cable has to be stored.
We expect a total of about 4x15m+40m=100m to be stored.

KERPEN
HIGH VOLTAGE CABLE SL-V2YCEH
6 kV (DC) / 70°C

MB.HV.main_uxus is an HV cable56 wires AWG 26/7 - shielded. Full data-sheet at **CMS-GS-TR-0003**

UX-US length

From Int. Office the lengths [bottom back **S1D11**]-->[bottom PP frame] for both "*MB.HV.main_uxus* " are:

20 cables Ø 16 mm MB.HV.main_uxus
10 Sources 1 Destination S1D11 10 Routes

		m
YB2	Near	56.2
	Far	72.1
YB1	Near	55.1
	Far	70.8
YB0	Near	
	Far	
YB-1	Near	58.7
	Far	74.6
YB-2	Near	60
	Far	75.9

YB0 is still under working

Routing by S. Bally - CERN - Apr 06

Rack inside USC55 - 2

(Here racks are viewed from front)

The ux-us lengths specified by Integration Office begin from the farthest corner in the back of the rack S1D11.

The cables "MB.HV.main_uxus" always begin from the Patch Panel - front side of the rack. They go towards the bottom of the rack and they enter inside the 4U free at base. There are in total 20 + 5 spares to be installed. The length of the tail inside the rack depends on patch panel position by adding the follows parts

- rack width 0.4+0.2 [m]
- down up to the base: Unit*44.45 [mm]
- front-back: 1 [m]

The totals computed are in the table A.
Spares cables, 1 per wheel, have to be stored below the rack leaving a tail with the length specified by the table B, needed to reach the farthest connector.

These are the minimal lengths of tails, an extra lengths below each rack of about 0.5m is requested.

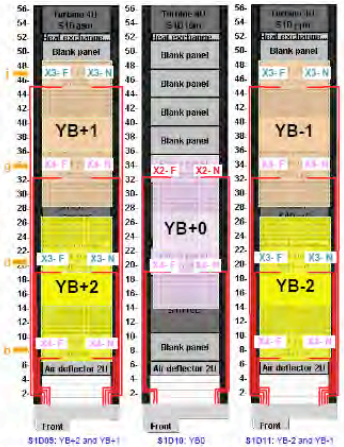
Crate	Tail [m]
b	2
d	2.6
g	3.2
j	3.8

Table A

Wheel	crate	Tail [m]
YB+2	S1D09d	2.6
YB+1	S1D09j	3.8
YB0	S1D10g	3.2
YB-1	S1D11j	3.8
YB-2	S1D11d	2.6

Table B

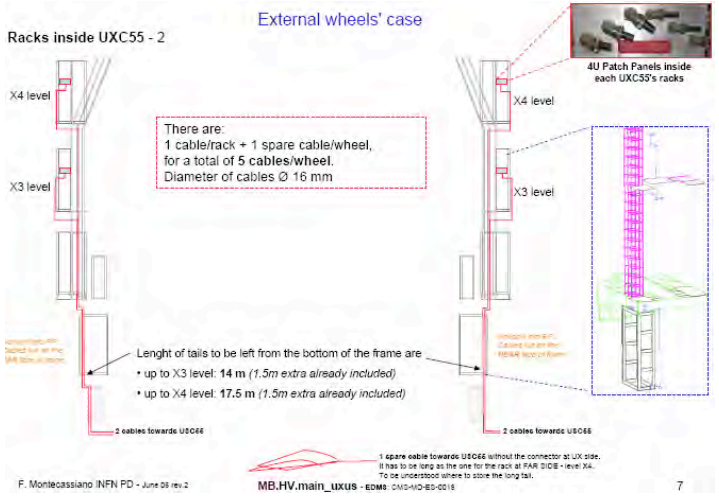
[REMARK] lengths of tails have to be verified before installation!



F. Montecassiano INFN PD - June 06 rev.2 MB.HV.main_uxus - EDMS: CMS-MO-ES-0016 4

Racks inside UXC55 - 2

External wheels' case



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Cables between UXC and USC

- i.e. about lengths and installation of HV - 2

UXC55							USC55				Length components						
							Assign		Cable enters from		UXC55 assigned rack | Patch Panel Frame Bottom (1m safety added)	Patch Panel Frame Bottom | S1D11 Bottom Farest Corner at back	S1D11 Bottom Farest Corner at back | USC55 assigned Rack	inside rack			
W	tower	level	rack/Frame	Top/Bot	Fr/Ba	tray	Rack	crate	Top / Bottom	Front/ Back	Tray nr.					TOTAL	L cut	Remark
2	N	X3	X3J22	BOT	BACK	2	S1D09	d	BOT	FR	13.7	56.4	1.2	2.6	73.9	74	
2	N	X4	X4J22	BOT	BACK	2	S1D09	b	BOT	FR	17.4	56.4	1.2	2	77	77	
2	F	X3	X3A22	BOT	BACK	2	S1D09	d	BOT	FR	13.7	72.1	1.2	2.6	89.6	90	
2	F	X4	X4A22	BOT	BACK	2	S1D09	b	BOT	FR	17.4	72.1	1.2	2	92.7	93	
2	*F*	*X4*	*X4A22*	BOT	BACK	2	*S1D09*	*d*	*BOT*	*FR*	17.4	*72.1*	1.2	*2.6*	93.3	94	*spare without connector at UX side*
1	N	X3	X3J12	BOT	BACK	2	S1D09	j	BOT	FR	13.7	55.1	1.2	3.8	73.8	74	
1	N	X4	X4J12	BOT	BACK	2	S1D09	g	BOT	FR	17.4	55.1	1.2	3.2	76.9	77	
1	F	X3	X3A12	BOT	BACK	2	S1D09	j	BOT	FR	13.7	70.8	1.2	3.8	89.5	90	
1	F	X4	X4A12	BOT	BACK	2	S1D09	g	BOT	FR	17.4	70.8	1.2	3.2	92.6	93	
1	*F*	*X4*	*X4A12*	BOT	BACK	2	*S1D09*	*j*	*BOT*	*FR*	17.4	*70.8*	1.2	*3.8*	93.2	94	*spare without connector at UX side*
0	N	X2	X2N33	BOT	BACK	2	S1D10	g	BOT	FR	?	48.8	0.6	3.2			**NOT RELEASED!**
0	N	X4	X4J02	BOT	BACK	2	S1D10	d	BOT	FR	?	48.8	0.6	2.6			**NOT RELEASED!**
0	F	X2	**X2F32**	BOT	BACK	2	S1D10	g	BOT	FR	?	**87.1**	0.6	3.2			**NOT RELEASED!**
0	F	X4	X4A02	BOT	BACK	2	S1D10	d	BOT	FR	?	**87.1**	0.6	2.6			**NOT RELEASED!**
0	*F*	*X4*	*X4A02*	BOT	BACK	2	*S1D10*	*g*	*BOT*	*FR*	?	***87.1***	0.6	*3.2*			**NOT RELEASED!**
-1	N	X3	X3V12	BOT	BACK	2	S1D11	j	BOT	FR	13.7	58.7	0	3.8	76.2	77	
-1	N	X4	X4V12	BOT	BACK	2	S1D11	g	BOT	FR	17.4	58.7	0	3.2	79.3	80	
-1	F	X3	X3S12	BOT	BACK	2	S1D11	j	BOT	FR	13.7	74.6	0	3.8	92.1	93	
-1	F	X4	X4S12	BOT	BACK	2	S1D11	g	BOT	FR	17.4	74.6	0	3.2	95.2	96	
-1	*F*	*X4*	*X4S12*	BOT	BACK	2	*S1D11*	*j*	*BOT*	*FR*	17.4	*74.6*	*0*	*3.8*	95.8	96	*spare without connector at UX side*
-2	N	X3	X3V22	BOT	BACK	2	S1D11	d	BOT	FR	13.7	60	0	2.6	76.3	77	
-2	N	X4	X4V22	BOT	BACK	2	S1D11	b	BOT	FR	17.4	60	0	2	79.4	80	
-2	F	X3	X3S22	BOT	BACK	2	S1D11	d	BOT	FR	13.7	75.9	0	2.6	92.2	93	
-2	F	X4	X4S22	BOT	BACK	2	S1D11	b	BOT	FR	17.4	75.9	0	2	95.3	96	
-2	*F*	*X4*	*X4S22*	BOT	BACK	2	*S1D11*	*d*	*BOT*	*FR*	17.4	*75.9*	*0*	*2.6*	95.9	96	*spare without connector at UX side*

L cut

20 cables
and 5 spares to be installed

CEILING= 1 m

	m
YB+2	428
YB+1	428
YB0	
YB-1	442
YB-2	442

Cables between UXC and USC

- i.e. about lengths and installation of OF

Length for **MB.OF.seco-ctrl_uxus**

Cable description

MB.OF.seco-ctrl_uxus controls the Sector Collector crates placed inside UXC55.

There are 2 optical cables + 1 spare per each wheel. Each cable brings 2+2 fibres with LC-LC connectors. For each wheel, those cables run together and have the same starting and ending rack. Details inside rack are specified further.

The lengths of these doesn't need to be all equals. There will be few meters to be stored as the design is very balanced. The difference between the worst length and the best one is **4** [m].

As the installation will be done before to lift down the wheel without any split point at the level of Patch Panels of the Cable chains, then a small extra length, about 1m, should be stored some where between the rack inside UXC55's tower and the cable-chain. Where to store the rest of the extra L it is still under discussion. The proposal from Int. Office to put it in a volume close to the UXC55's wall looks good. To be discussed.

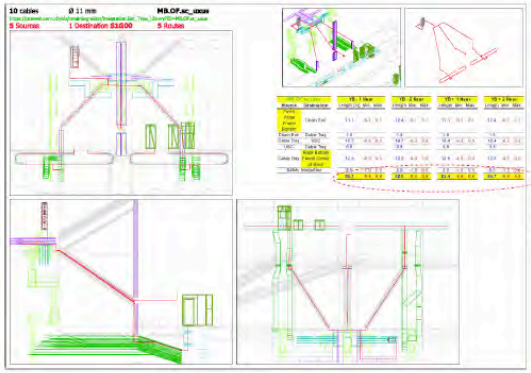
F. Montecassiano April 06

EDMS: CMS-G-RR-0249

Length for **MB.OF. seco-ctrl_uxus**

UX-US length

From the studies of Int. Office the lengths [bottom back **S1G00**]-->[bottom PP frame] for both "*MB.OF.sc_uxus*" and "*MB.OF.seco-ctrl_uxus*" are:



YB+2: 54.7 m [b. back S1G00]
YB+1: 53.4 m [b. back S1G00]
YB-1: 50.7 m [b. back S1G00]
YB-2: 52.0 m [b. back S1G00]

YB0 is not computed but it will be surely shorter then the external wheels

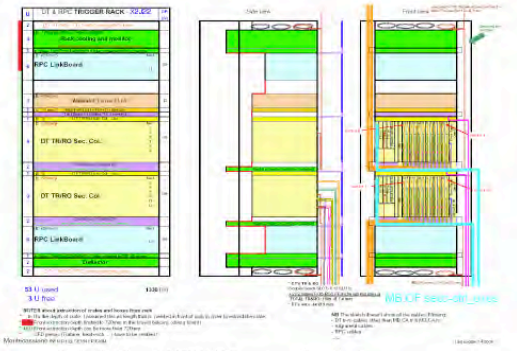
Routing by S. Bally - CERN - Apr 06

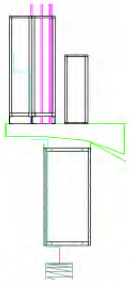
F. Montecassiano April 06

EDMS: CMS-G-RR-0249

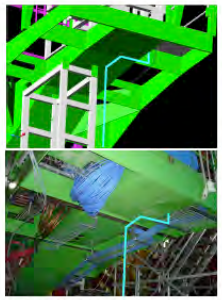
Racks inside UXC55 - 1

The picture shows the 2 tails (cyan colored) ending inside the "DT TR/RO Sec. Col." crate (2x 9U yellow background)





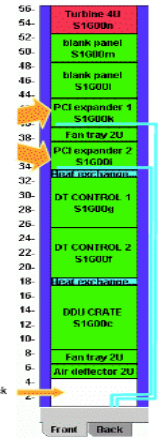
Front view of **X2** level



As viewed from bottom.

UXC55 rack

PCI expanders are the controllers of the remote SECTOR COLLECTOR crates placed in UXC55

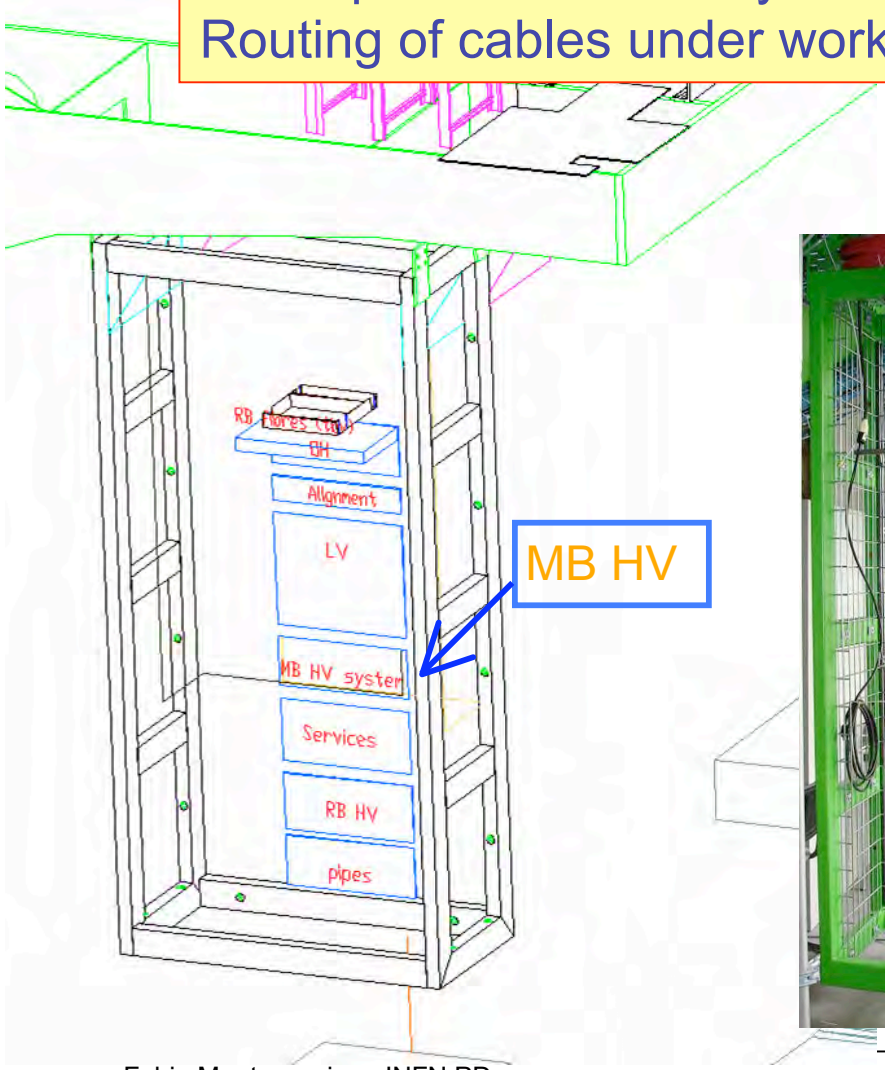


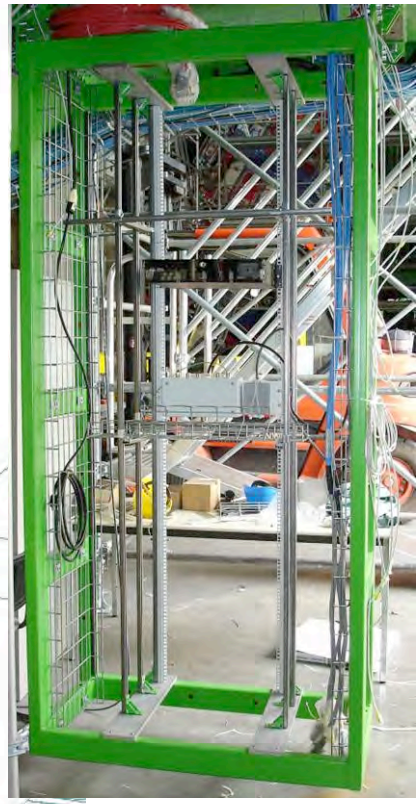
Fibres come from the bottom back of the rack through these free U

USC55 rack

Cable-chain patch panel

Patch panels internal layout has been finalized.
Routing of cables under working



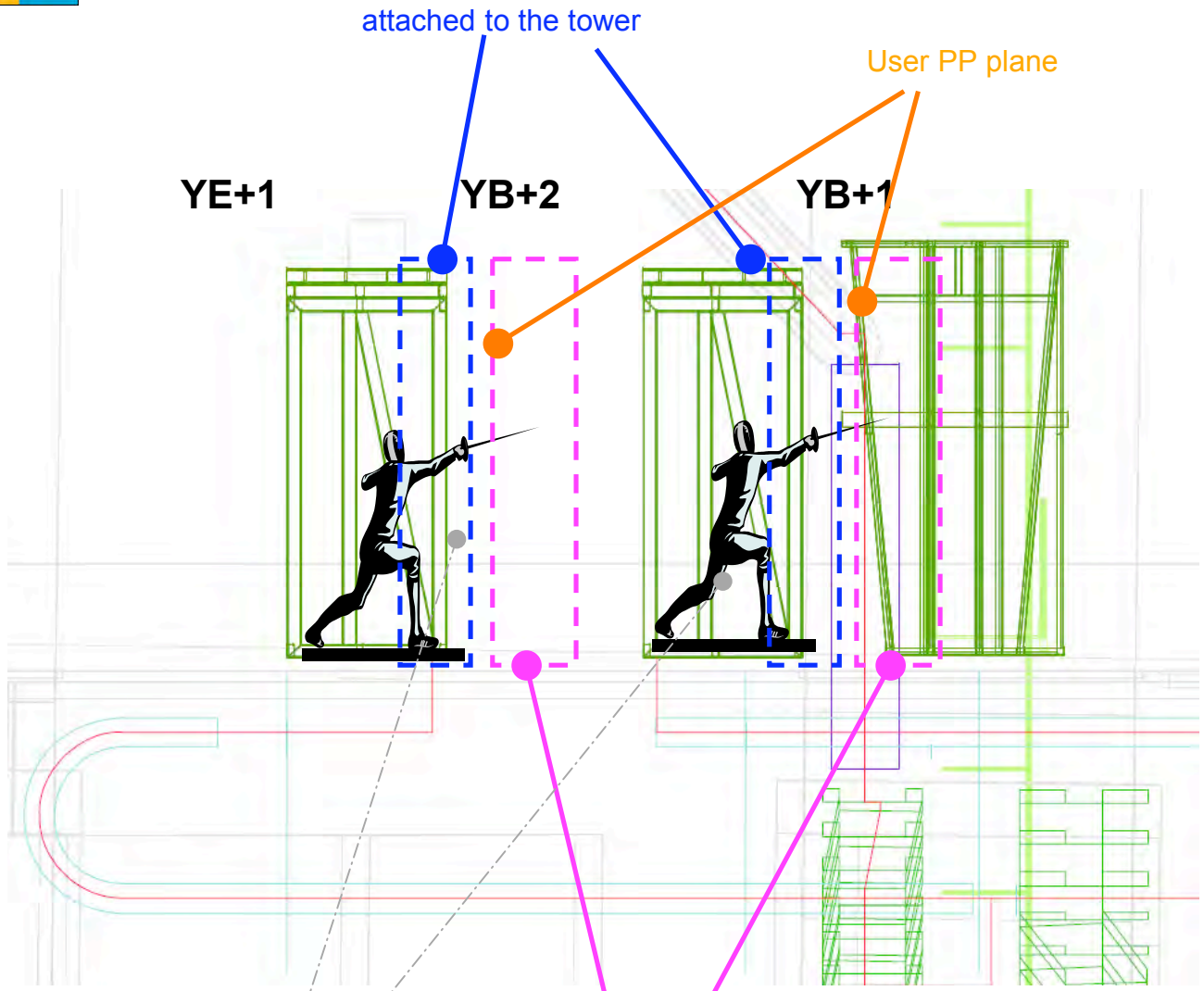


YB1 & YB2 - NEAR side 's cable-chain patch panel (x>0)

Position	Patch Panel name	Type of cables	Hight [U] (width 19")	Logical	Resonsible person
52	Free to cross	HV,LV,sgn,fiber	5	Reserve	
47	reserved		5		
42	RB fibres		2	Barrel area & Fibres	K. Dorobia
38	HO	sgn, fibres	4		P. de Barbaro
34	Align	LV, sgn, fibres	2		E. C. Alamillo
30	RB LV MB LV HO LV	LV, sgn	5	HV, LV & sgn cables	S. Lusin (D. Piccolo, C. Wilmott M. Pegoraro, S. Akhtari)
23	AC power in	220AC 1-phase			
19	MB HV system	LV, sgn	3		E. Borsato L. Modenese
14	Services	220AC, sgn	5		A. Gaddi / ESS
8	RB.HV	HV	4.5		D. Piccolo
3	pipes	-	4		D. Dattola
			Tot. 52		

Cable-chain patch panel

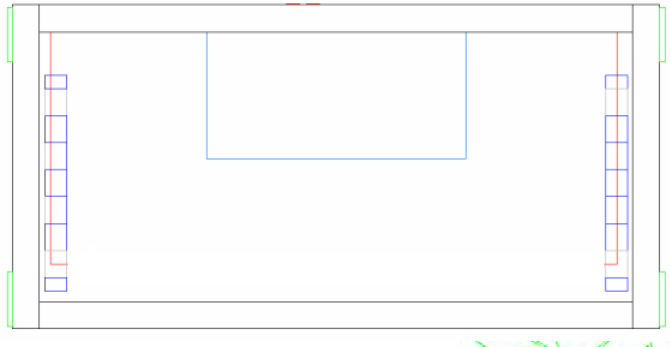
users access



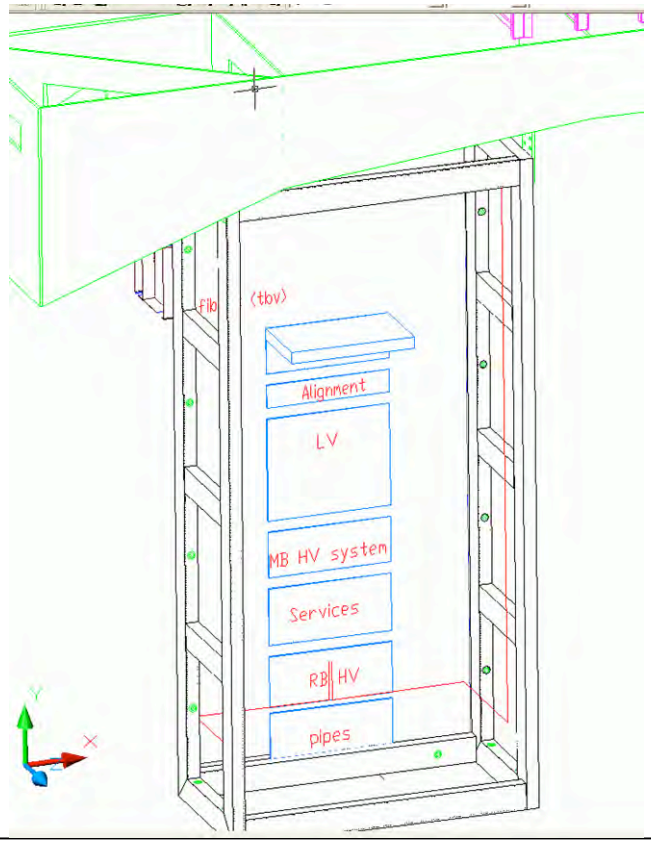
Cable-chain patch panel

i.e. of routing inside the tower frame - cable RB.HV

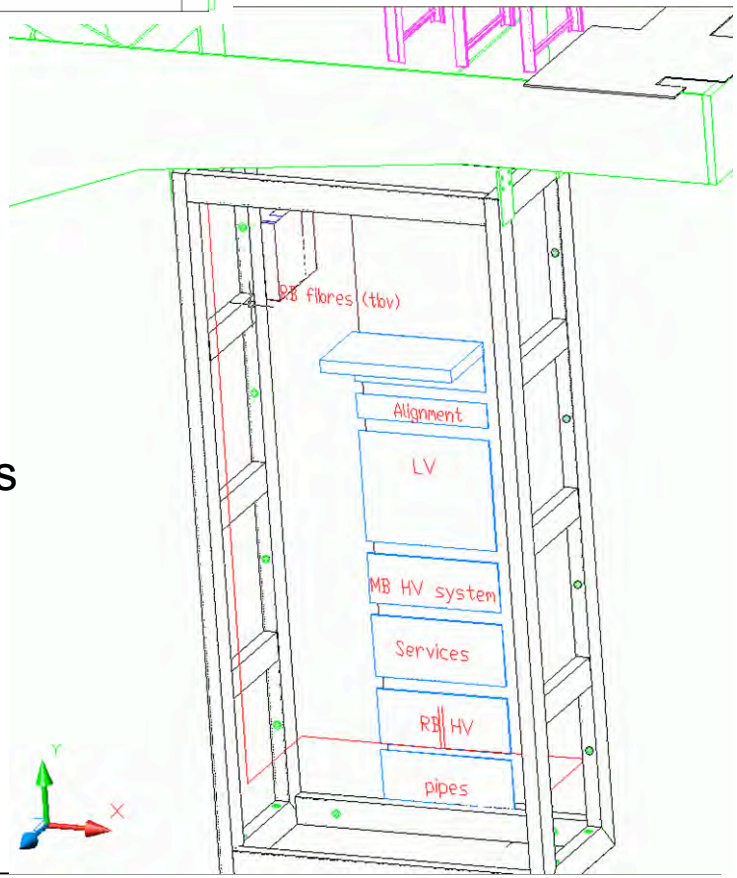
3 sectors each frame's side, about 25+25 cables to be installed in 2x (5x4) cm2



TOP view



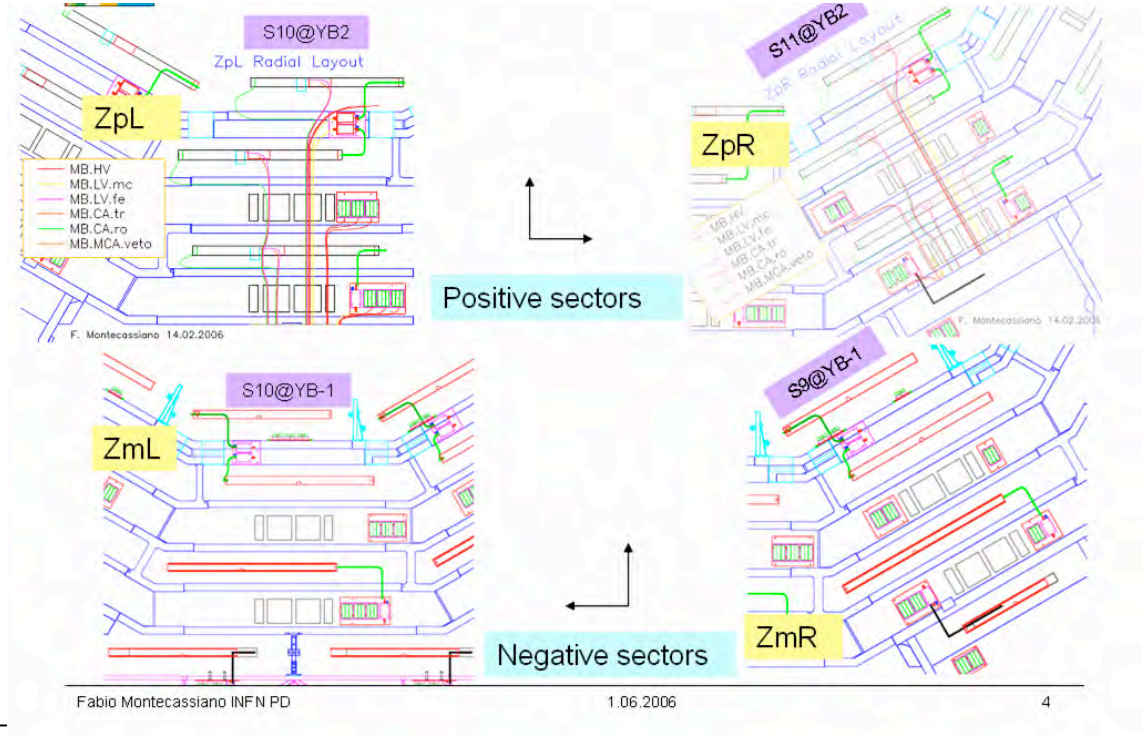
Front views



Present activity
Negative wheels and YB0

- Cutting lengths calculation
  - We need to calculate radial lengths for negative wheels and peripheral lengths for YB0. Under working by Fabio and Danilo.
  - a test on the negative radial layout will be done after the MTCC, when the detector will be opened. We will use real cables on YB-2
  - Peripheral lengths under working by Domenico and Mirco
  - **We foresee to finalize all lengths within July.**

Negative radial layout are not completely symmetric respect to the *positive* ones



Cable production strategy

- As the production is a long activity they were begun on a statistical base
  in order to maximize the quantity of cables already available in july.
  1) **Production of a batch of cables for about 1 wheel on a statistical base**.
     This is already done for MB cables and under production for RB.
     Obviously there is not any guarantee that all these cables will fit the YB0 lengths
  2) **Developing of RADIAL layout for Z neg. extracted sectors** (ZmL & ZmR)
     This is the present activity. It take times to be done because negative sectors aren't symmetrical to the positive ones (see prev slide).

     Once the radial layout will be ready it will be possible to calculate the cutting lengths for YB-1 and YB-2 (expected for the beginning of July).
     Then a new production will be launched with regards what already produced in 1)
     At this point we will have cables which fit the 2 negative wheels, from which we could pick up what needed for YB0.

Cable production strategy

3) **Developing and calculation of peripheral lengths for YB0**

(Dattola, Montecassiano, Rampazzo)

Once the peripheral lengths will be finalized it will be possible to calculate the cutting lengths for YB0.

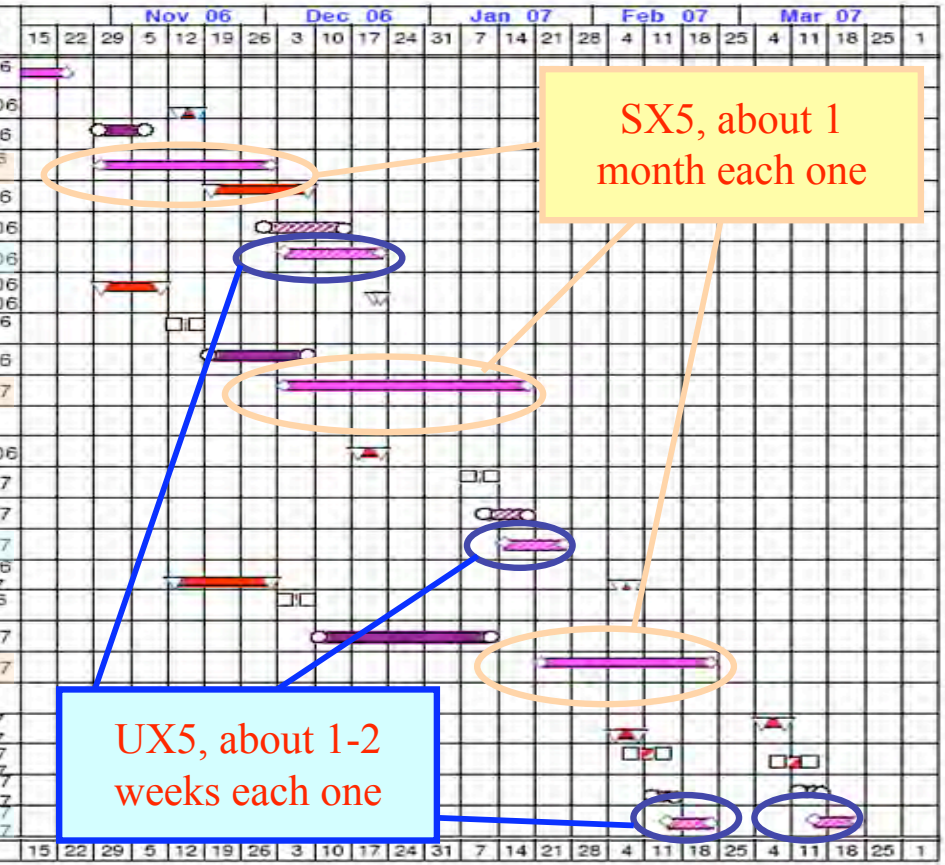
We hope to complete the calculation within July. Then we will know what is really needed for YB0 and prepare the 'application list' - the map among length and position of cable - which are needed in order to organize cables for an efficient installation, grouping them by sector.

Further we will be able to complete the production

Cabling installation windows

We will have time windows of about one month per wheel (critical)
In order to make the best use of the time window we will have
to produce, to label and to organize all the cables as soon as possible

	Activity Name	Start Date	Finish Date
1	YB Opens	7/7/06	10/23/06
2	YB0 Install 2 MB4/9-11	11/14/06	11/17/06
3	YB-0 Commissioning S04,S05	10/30/06	11/7/06
4	YB-0, YB+0 Cabling in parallel	10/30/06	12/1/06
5	UX YB+2, YB+1 Sectors 1,7 (16 Chambers)	11/20/06	12/8/06
6	UX YB+ 2,+1 Functionality Test	11/30/06	12/15/06
7	UX YB+2 , +1 Cabling	12/4/06	12/22/06
8	YB-1 Installation , 8 sectors (27 +2 chambers)	10/30/06 12/21/06	11/10/06 12/22/06
9	YB-1 Connections HV, LV, Cooling	11/13/06	11/17/06
10	YB-1 Commissioning	11/20/06	12/8/06
11	YB-1 Cabling	12/4/06	1/19/07
12	UX5 YB0 Installation and Cabling		
13	UX YB0 Sectors 1,7 (8 Chambers)	12/18/06	12/22/06
14	UX YB0 Connections HV, LV, Cooling	1/8/07	1/12/07
15	UX YB0 Functionality Test	1/11/07	1/19/07
16	UX YB0 Cabling	1/15/07	1/26/07
17	YB-2 Installation , 8 sectors (31 +2)	11/13/06 2/6/07	12/1/06 2/8/07
18	YB-2 Connections HV, LV, Cooling	12/4/06	12/8/06
19	YB-2 Commissioning	12/11/06	1/12/07
20	YB-2 Cabling	1/22/07	2/23/07
21	UX5 YB-1,YB-2 Installation and Cabling		
22	UX YB-1, YB-2 Sectors 1,7 (16 Chambers)	3/5/07 2/5/07	3/9/07 2/9/07
23	UX YB-1 YB-2 Connections HV, LV, Cooling	2/8/07 3/8/07	2/14/07 3/14/07
24	UX YB-1, YB-2 Functionality Test	3/12/07 2/12/07	3/16/07 2/16/07
25	UX YB-1, YB-2 Cabling	3/15/07 2/15/07	3/23/07 2/23/07



Status about developing - Radial layout

MB fibers access

Understanding how to access to minicrates below the carters is the 1st priority in developing the ZmL and ZmR layouts.

After collecting the needed models from the various sources I made a proposal to the DT experts:

RED carters (LV fe connection):

* must be removable after the full cabling work

ORANGE carters (fibres access):

* have to be modified cutting an hole for fibres access (24 carter/Wheel)
* must be removable.

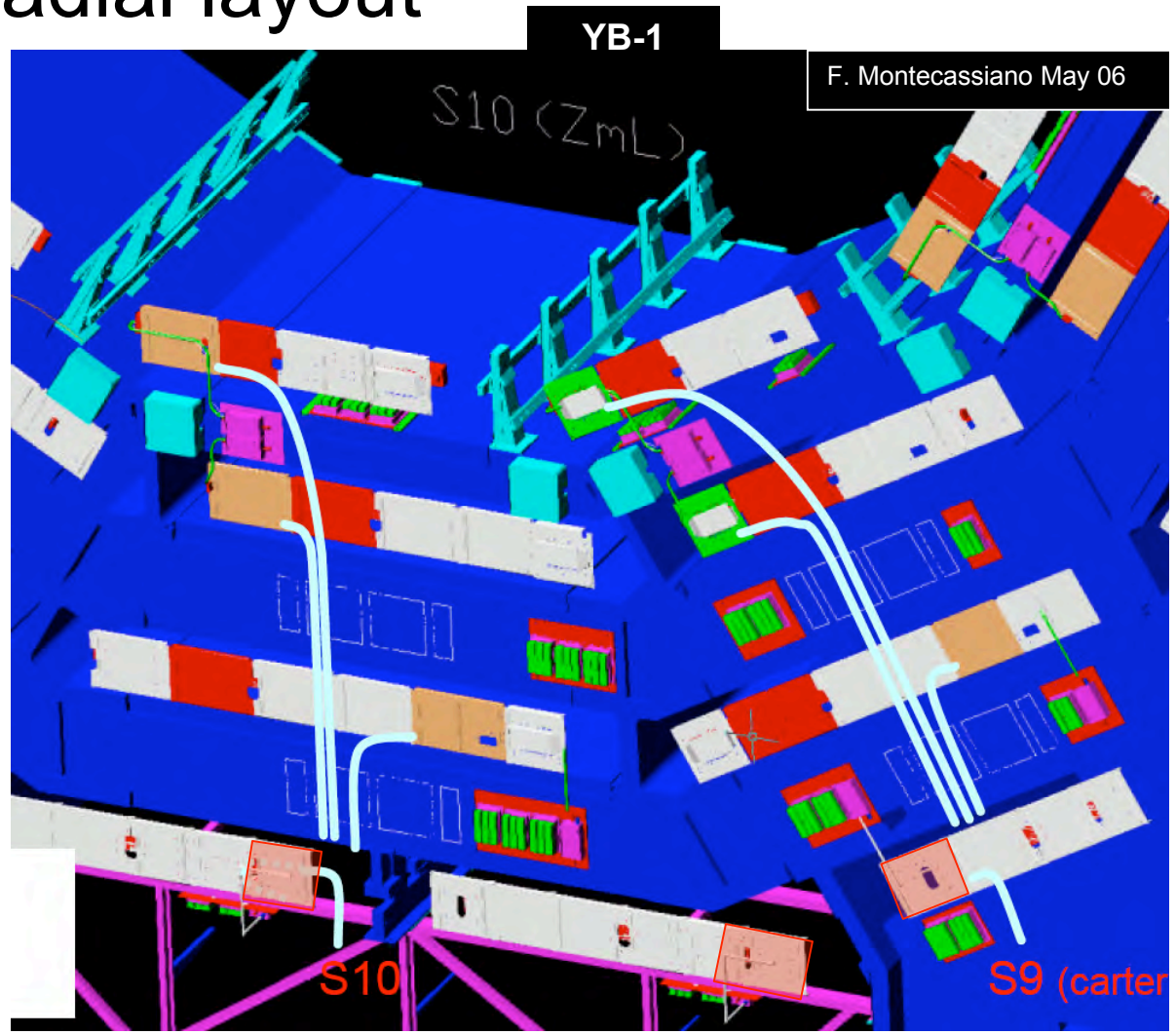
GREEN carters (fibres access):

* doesn't need any modification.
* must be removable.

WHITE carters:

* none special care

"MB.MCA.veto" cables ruoting and "MB.CA.sc (long)" will descend from the fibers routing.



under working: design each single cable/group of cables on the radial trays

Status about cables production- 19.06.06

MB cables

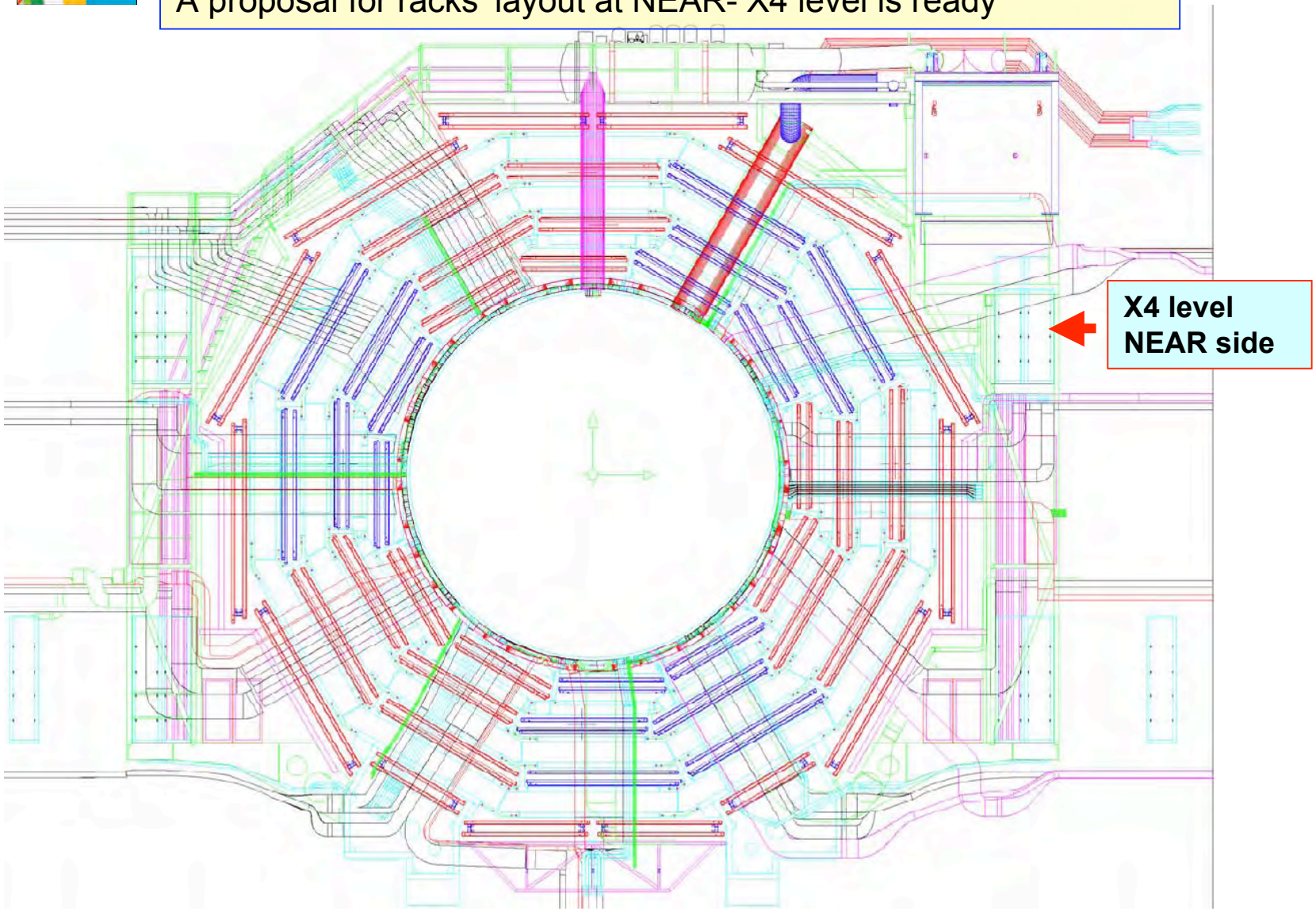
	MB.HV	MB.LV.mc	MB.LV.fe	MB.MCA.veto (1 multicable per sector)	MB.CA.sc (short daisy among DT chambers)	MB.CA.sc (long up the rack)	MB.OF.sc	MB.OF.ttc-ex	MB.CA.tr & MB.CA.tr
Producer	*Ext. firm*	*CIEMAT*	*IHEP*	*IHEP*	*IHEP*	*IHEP*	*Ext. firm*	*Ext. firm*	*Ext. firm*
Priority (1= higher)	*3*	*4*	*1*	*1*	*1*	*1*	*2*	*2*	*5*
Needed for 1 Wheel	136	50	50	12	44	12	62	74	100+100
Cables at cern *"ready to be installed"*	360	60	66	11	30	9	80	80	554
Under study (point 2)			YB-1 YB-2	YB-1 & YB-2 done	**Full done**	YB-1 YB-2	YB-1 YB-2	YB-1 YB-2	
Under production for the followings wheels				YB-1 & YB-2 (Q..ty available: 24 multicables)	YB0 YB-1 YB-2				
remark	To be shorted			IHEP is leaving ...					

RB cables

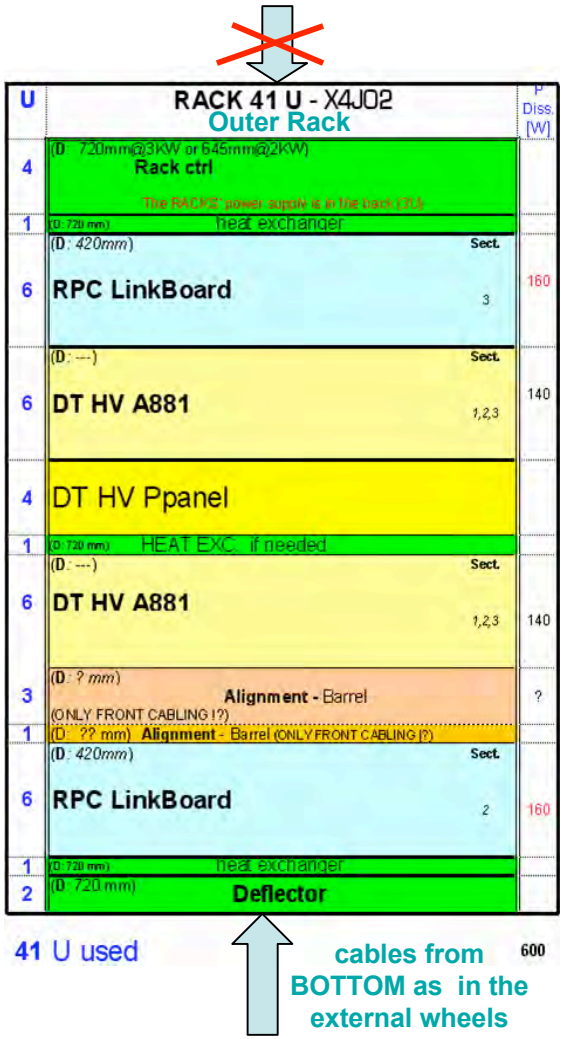
RB cables are produced by an external firm under the control of Davide Piccolo.
1 wheel of cables under production now. First batch of sgn cables (440 pieces) already done.
LV cables should arrive soon. HV to be done.

YB0 - Status about racks layout

A proposal for racks' layout at NEAR- X4 level is ready



YB0 racks at X4 level - proposal



Outer rack

- No removable unit is needed
- 2 Link Board crates in the outer rack with **all cables PERMANENT !**
- Bottom crate as in the external wheels,
- NO cables on the TOP
- Back cabling on vertical ladders
  - OUTER corner (far X4J01): Cables for HV sys
  - INNER corner (near X4J01): Cables for RPC Link board **TOP** crate
- Front cabling on vertical ladders
  - OUTER corner (far X4J01): Signal cables and fibres
  - INNER corner (near X4J01): LV and Power cables

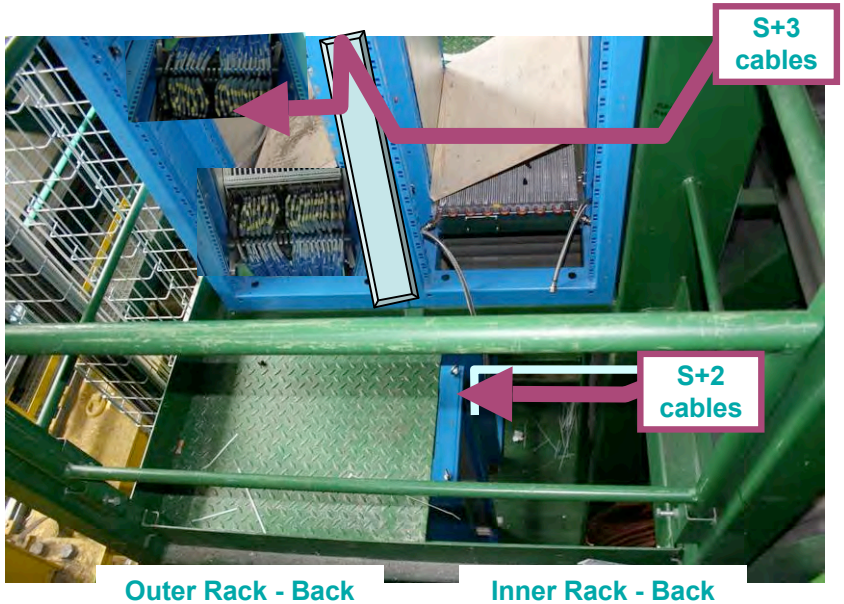
Inner rack

- The removable unit contains only parts for services' rack
- I'm verifying if we can avoid it

- This proposal has to be verified and accepted by all users
- COOLING of the racks is critical!

No space to store extra L near the racks
This make difficult the cabling as cables must have the right L to be plug

YB0 racks at X4 level - proposal



Outer Rack - Back Inner Rack - Back

Outer Rack - Front Inner Rack - Front

Conclusions

- Cabling of YB+2 and YB+1 has been successfully done
- Cabling between racks and PP under study
- Long cables between USC55 and UXC55 already at CERN or under production
- Routing layout and cutting lengths for YB0 and negative wheels are under development.
  - Cables for one wheel have been ‘statistically’ produced
  - Lengths of the YB0's cables in hands within July