Database for layout between D1 and D2 LSS R5

Pablo Santos Díaz – Vincent Baglin

OUTLINE

- LHC database - tooling
- Hi-Lumi Vacuum layout between D1 and D2.
- Draft Hi-Lumi Vacuum layout
- Conclusions & next steps.

LHC database

LHC database - tooling

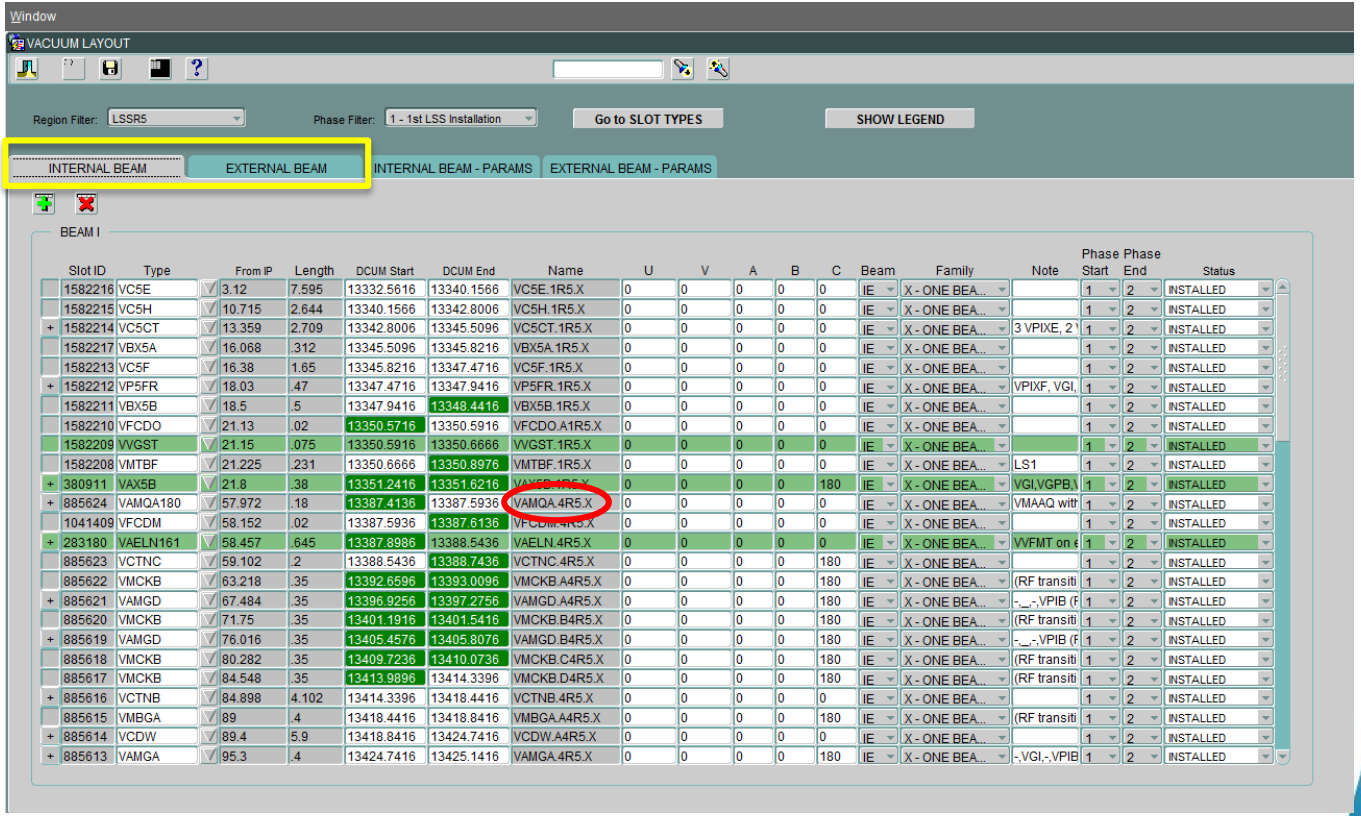
- Slot view of VAC forms

→ is possible to check the ring regions and add or remove equipment.

- Slot → component's position in the ring.
- Slot type → component name.

- Example

→ VAMQA.4R5.X

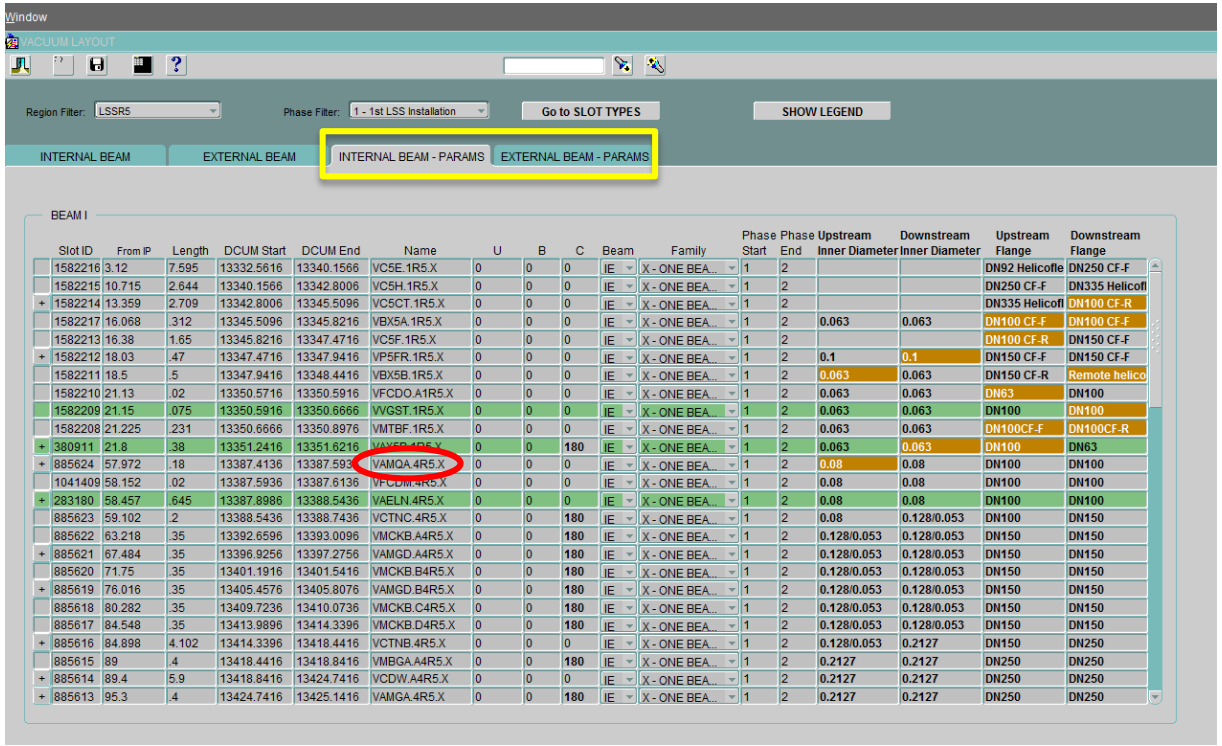


Slot ID	Type	From IP	Length	DCUM Start	DCUM End	Name	U	V	A	B	C	Beam	Family	Note	Phase Start	Phase End	Status
1582216	VC5E	3.12	7.595	13332.5616	13340.1566	VC5E.1R5.X	0	0	0	0	0	IE	X - ONE BEA...		1	2	INSTALLED
1582215	VC5H	10.715	2.644	13340.1566	13342.8006	VC5H.1R5.X	0	0	0	0	0	IE	X - ONE BEA...		1	2	INSTALLED
1582214	VC5CT	13.359	2.709	13342.8006	13345.5096	VC5CT.1R5.X	0	0	0	0	0	IE	X - ONE BEA...	3 VPIXE, 2 '	1	2	INSTALLED
1582217	VBX5A	16.068	.312	13345.5096	13345.8216	VBX5A.1R5.X	0	0	0	0	0	IE	X - ONE BEA...		1	2	INSTALLED
1582213	VC5F	16.38	1.65	13345.8216	13347.4716	VC5F.1R5.X	0	0	0	0	0	IE	X - ONE BEA...		1	2	INSTALLED
1582212	VP5FR	18.03	.47	13347.4716	13347.9416	VP5FR.1R5.X	0	0	0	0	0	IE	X - ONE BEA...	VPIXF, VGI,	1	2	INSTALLED
1582211	VBX5B	18.5	.5	13347.9416	13348.4416	VBX5B.1R5.X	0	0	0	0	0	IE	X - ONE BEA...		1	2	INSTALLED
1582210	VFCDO	21.13	.02	13350.5716	13350.5916	VFCDO.A1R5.X	0	0	0	0	0	IE	X - ONE BEA...		1	2	INSTALLED
1582209	VVGST	21.15	.075	13350.5916	13350.6666	VVGST.1R5.X	0	0	0	0	0	IE	X - ONE BEA...		1	2	INSTALLED
1582208	VMTBF	21.225	.231	13350.6666	13350.8976	VMTBF.1R5.X	0	0	0	0	0	IE	X - ONE BEA...	LS1	1	2	INSTALLED
380911	VAX5B	21.8	.38	13351.2416	13351.6216	VAX5B.4R5.X	0	0	0	0	180	IE	X - ONE BEA...	VGI,VGPB,\	1	2	INSTALLED
885624	VAMQA180	57.972	.18	13387.4136	13387.5936	VAMQA.4R5.X	0	0	0	0	0	IE	X - ONE BEA...	VMAAQ with	1	2	INSTALLED
1041409	VFCDM	58.152	.02	13387.5936	13387.6136	VFCDM.4R5.X	0	0	0	0	0	IE	X - ONE BEA...		1	2	INSTALLED
283180	VAELN161	58.457	.645	13387.8986	13388.5436	VAELN.4R5.X	0	0	0	0	0	IE	X - ONE BEA...	VVFMT on s	1	2	INSTALLED
885623	VCTNC	59.102	.2	13388.5436	13388.7436	VCTNC.4R5.X	0	0	0	0	180	IE	X - ONE BEA...		1	2	INSTALLED
885622	VMCKB	63.218	.35	13392.6596	13393.0096	VMCKB.A4R5.X	0	0	0	0	180	IE	X - ONE BEA...	(RF transiti	1	2	INSTALLED
885621	VAMGD	67.484	.35	13396.9256	13397.2756	VAMGD.A4R5.X	0	0	0	0	180	IE	X - ONE BEA...	-,_-,VPIB (F	1	2	INSTALLED
885620	VMCKB	71.75	.35	13401.1916	13401.5416	VMCKB.B4R5.X	0	0	0	0	180	IE	X - ONE BEA...	(RF transiti	1	2	INSTALLED
885619	VAMGD	76.016	.35	13405.4576	13405.8076	VAMGD.B4R5.X	0	0	0	0	180	IE	X - ONE BEA...	-,_-,VPIB (F	1	2	INSTALLED
885618	VMCKB	80.282	.35	13409.7236	13410.0736	VMCKB.C4R5.X	0	0	0	0	180	IE	X - ONE BEA...	(RF transiti	1	2	INSTALLED
885617	VMCKB	84.548	.35	13413.9896	13414.3396	VMCKB.D4R5.X	0	0	0	0	180	IE	X - ONE BEA...	(RF transiti	1	2	INSTALLED
885616	VCTNB	84.898	4.102	13414.3396	13418.4416	VCTNB.4R5.X	0	0	0	0	0	IE	X - ONE BEA...		1	2	INSTALLED
885615	VMBGA	89	.4	13418.4416	13418.8416	VMBGA.A4R5.X	0	0	0	0	180	IE	X - ONE BEA...	(RF transiti	1	2	INSTALLED
885614	VCDW	89.4	5.9	13418.8416	13424.7416	VCDW.A4R5.X	0	0	0	0	0	IE	X - ONE BEA...		1	2	INSTALLED
885613	VAMGA	95.3	.4	13424.7416	13425.1416	VAMGA.4R5.X	0	0	0	0	180	IE	X - ONE BEA...	-,VGI,-,VPIB	1	2	INSTALLED

LHC database - tooling

- Internal beam parameters

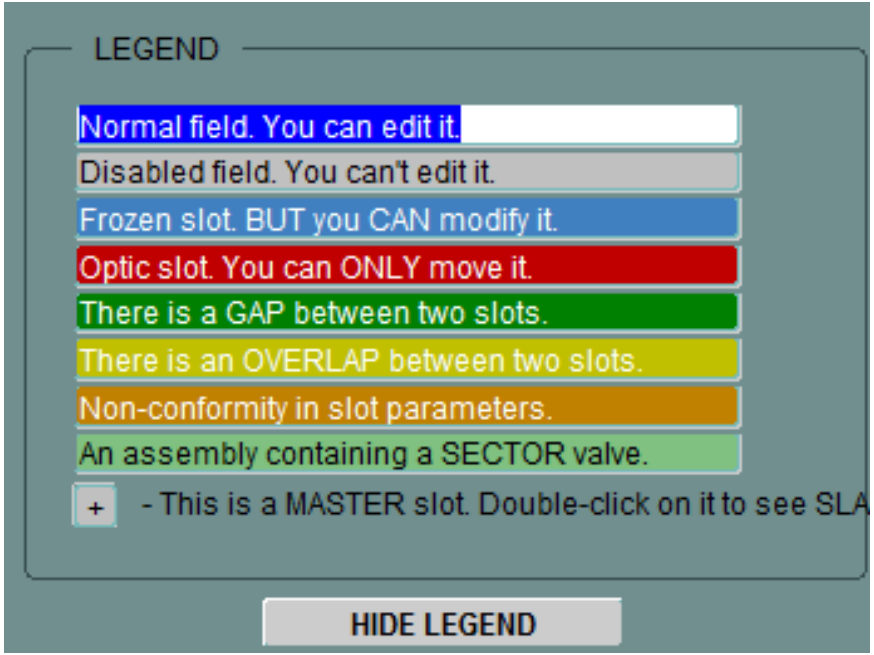
→ to match upstream and downstream inner diameter and flanges.



Slot ID	From IP	Length	DCUM Start	DCUM End	Name	U	B	C	Beam	Family	Phase Start	Phase End	Upstream Inner Diameter	Downstream Inner Diameter	Upstream Flange	Downstream Flange
1582216	3.12	7.595	13332.5616	13340.1566	VC5E.1R5.X	0	0	0	IE	X - ONE BEA...	1	2			DN92 Helicofle	DN250 CF-F
1582215	10.715	2.644	13340.1566	13342.8006	VC5H.1R5.X	0	0	0	IE	X - ONE BEA...	1	2			DN250 CF-F	DN335 Helicofl
1582214	13.359	2.709	13342.8006	13345.5096	VC5CT.1R5.X	0	0	0	IE	X - ONE BEA...	1	2			DN335 Helicofl	DN100 CF-R
1582217	16.068	.312	13345.5096	13345.8216	VBX5A.1R5.X	0	0	0	IE	X - ONE BEA...	1	2	0.063	0.063	DN100 CF-F	DN100 CF-F
1582213	16.38	1.65	13345.8216	13347.4716	VC5F.1R5.X	0	0	0	IE	X - ONE BEA...	1	2			DN100 CF-R	DN150 CF-F
1582212	18.03	.47	13347.4716	13347.9416	VP5FR.1R5.X	0	0	0	IE	X - ONE BEA...	1	2	0.1	0.1	DN150 CF-F	DN150 CF-F
1582211	18.5	.5	13347.9416	13348.4416	VBX5B.1R5.X	0	0	0	IE	X - ONE BEA...	1	2	0.063	0.063	DN150 CF-R	Remote helico
1582210	21.13	.02	13350.5716	13350.5916	VFCDO.A1R5.X	0	0	0	IE	X - ONE BEA...	1	2	0.063	0.063	DN63	DN100
1582209	21.15	.075	13350.5916	13350.6666	VVGST.1R5.X	0	0	0	IE	X - ONE BEA...	1	2	0.063	0.063	DN100	DN100
1582208	21.225	.231	13350.6666	13350.8976	VMTBF.1R5.X	0	0	0	IE	X - ONE BEA...	1	2	0.063	0.063	DN100CF-F	DN100CF-R
380911	21.8	.38	13351.2416	13351.6216	VVGF.1R5.X	0	0	180	IE	X - ONE BEA...	1	2	0.063	0.063	DN100	DN63
885624	57.972	.18	13387.4136	13387.593	VAMQA.4R5.X	0	0	0	IE	X - ONE BEA...	1	2	0.08	0.08	DN100	DN100
1041409	58.152	.02	13387.5936	13387.6136	VFCDM.4R5.X	0	0	0	IE	X - ONE BEA...	1	2	0.08	0.08	DN100	DN100
283180	58.457	.645	13387.8986	13388.5436	VAELN.4R5.X	0	0	0	IE	X - ONE BEA...	1	2	0.08	0.08	DN100	DN100
885623	59.102	.2	13388.5436	13388.7436	VCTNC.4R5.X	0	0	180	IE	X - ONE BEA...	1	2	0.08	0.128/0.053	DN100	DN150
885622	63.218	.35	13392.6596	13393.0096	VMCKB.A4R5.X	0	0	180	IE	X - ONE BEA...	1	2	0.128/0.053	0.128/0.053	DN150	DN150
885621	67.484	.35	13396.9256	13397.2756	VAMGD.A4R5.X	0	0	180	IE	X - ONE BEA...	1	2	0.128/0.053	0.128/0.053	DN150	DN150
885620	71.75	.35	13401.1916	13401.5416	VMCKB.B4R5.X	0	0	180	IE	X - ONE BEA...	1	2	0.128/0.053	0.128/0.053	DN150	DN150
885619	76.016	.35	13405.4576	13405.8076	VAMGD.B4R5.X	0	0	180	IE	X - ONE BEA...	1	2	0.128/0.053	0.128/0.053	DN150	DN150
885618	80.282	.35	13409.7236	13410.0736	VMCKB.C4R5.X	0	0	180	IE	X - ONE BEA...	1	2	0.128/0.053	0.128/0.053	DN150	DN150
885617	84.548	.35	13413.9896	13414.3396	VMCKB.D4R5.X	0	0	180	IE	X - ONE BEA...	1	2	0.128/0.053	0.128/0.053	DN150	DN150
885616	84.898	4.102	13414.3396	13418.4416	VCTNB.4R5.X	0	0	0	IE	X - ONE BEA...	1	2	0.128/0.053	0.2127	DN150	DN250
885615	89	.4	13418.4416	13418.8416	VMBGA.A4R5.X	0	0	180	IE	X - ONE BEA...	1	2	0.2127	0.2127	DN250	DN250
885614	89.4	5.9	13418.8416	13424.7416	VCDW.A4R5.X	0	0	0	IE	X - ONE BEA...	1	2	0.2127	0.2127	DN250	DN250
885613	95.3	.4	13424.7416	13425.1416	VAMGA.4R5.X	0	0	180	IE	X - ONE BEA...	1	2	0.2127	0.2127	DN250	DN250

LHC database - tooling

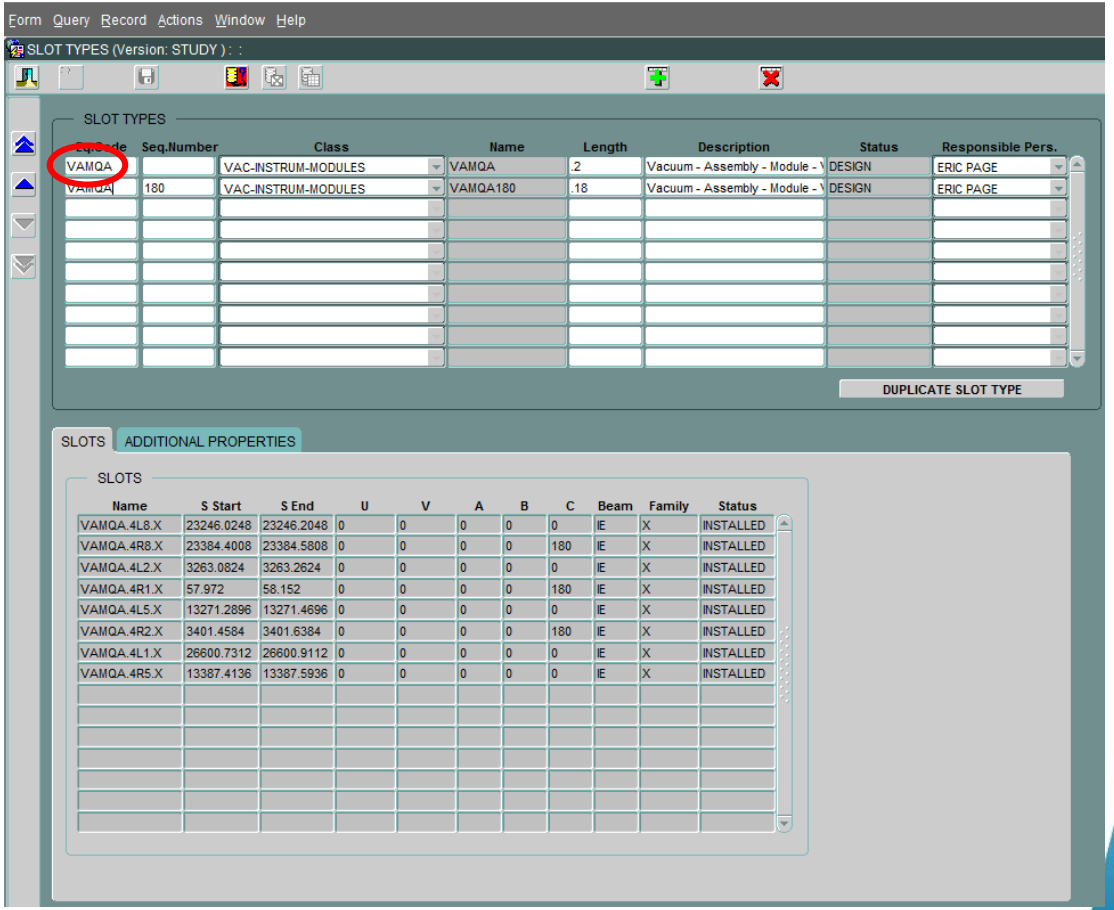
- Legend



LHC database - tooling

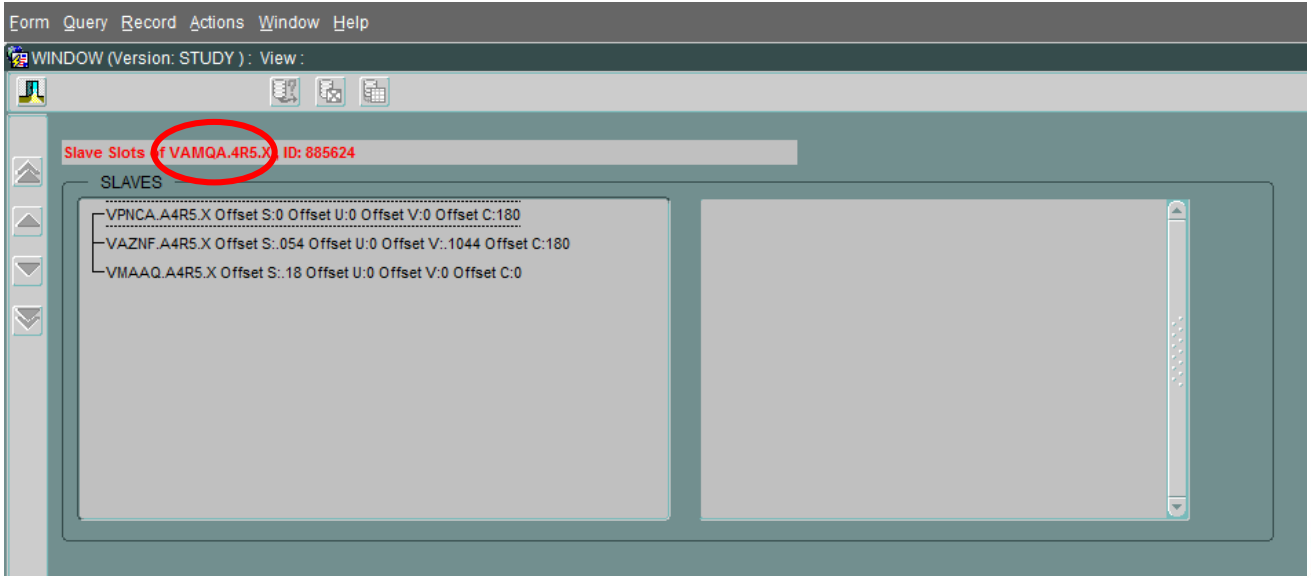
- Slot type view

→ is possible to check and modify the equipment, where it is installed and its characteistics.



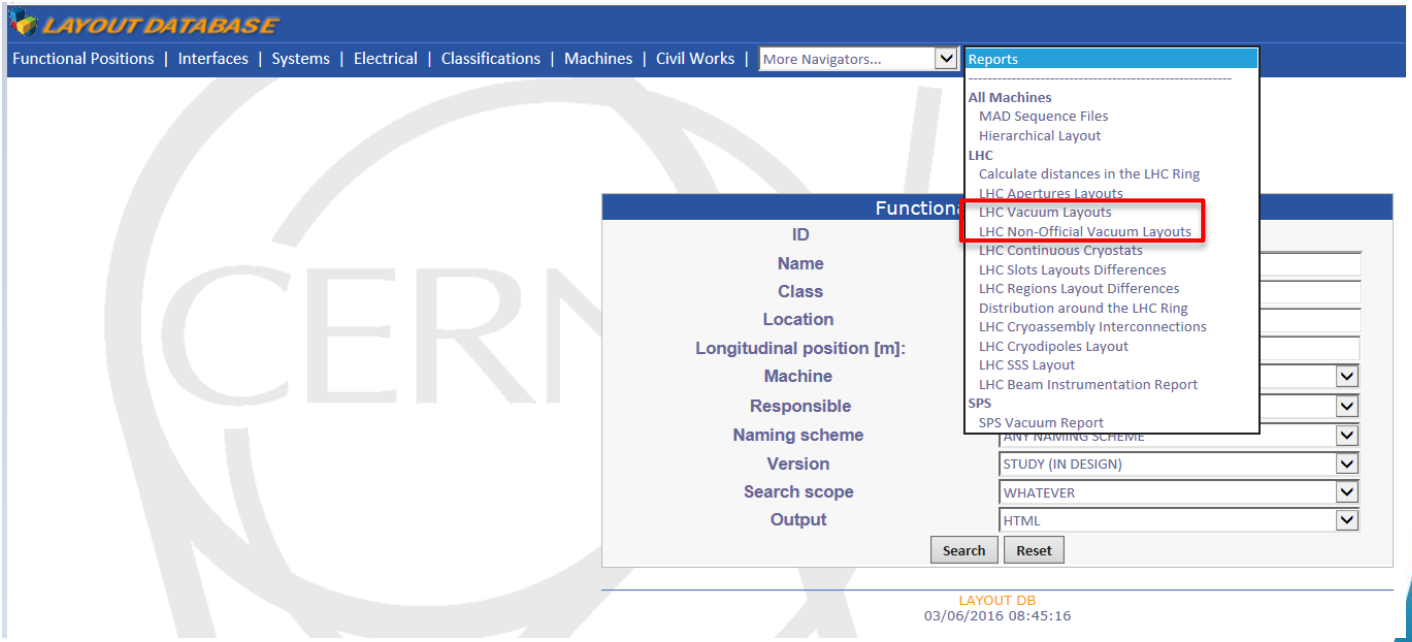
LHC database - tooling

- Read only information about children.



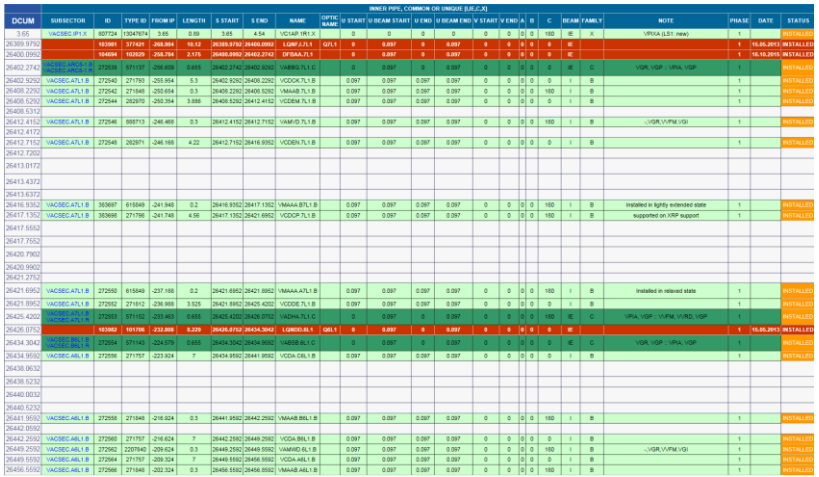
LHC database

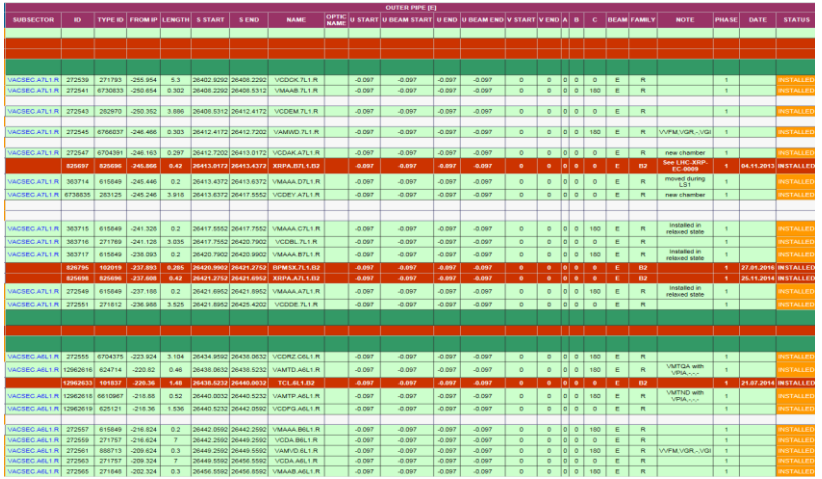
- When the tool is complete:
  1. Synchronization to have LHC Non-Official Vacuum Layout.
  2. Synchronization to have LHC Vacuum Layout.



LHC database

- LHC Vacuum layout → excel file and mock up could be automatically generated.

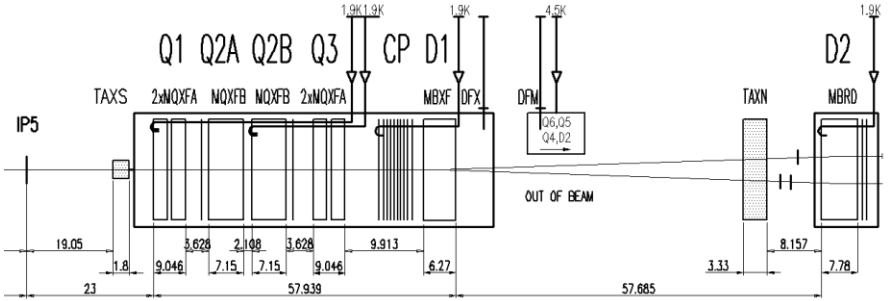




Hi-Lumi Vacuum layout between D1 and D2

Hi-Lumi Vacuum layout between D1 and D2

- Inputs:
  - HL-LHC Long straight sections Right of Point 5 (LHCLSXH _0013)*
    - Courtesy of Blanca Vazquez de Prada
  - Layout of HL-LHC insertions IR5 (LHCLSXGH__0007-v0)
  - TCTPV mock-up (ST0735828)
    - Courtesy of Nicolas Joannon
  - Aperture and distance between beams**
    - Courtesy of Riccardo De Maria (21/04/2016)
  - Double beam collimators (TCTPH and TCLX)



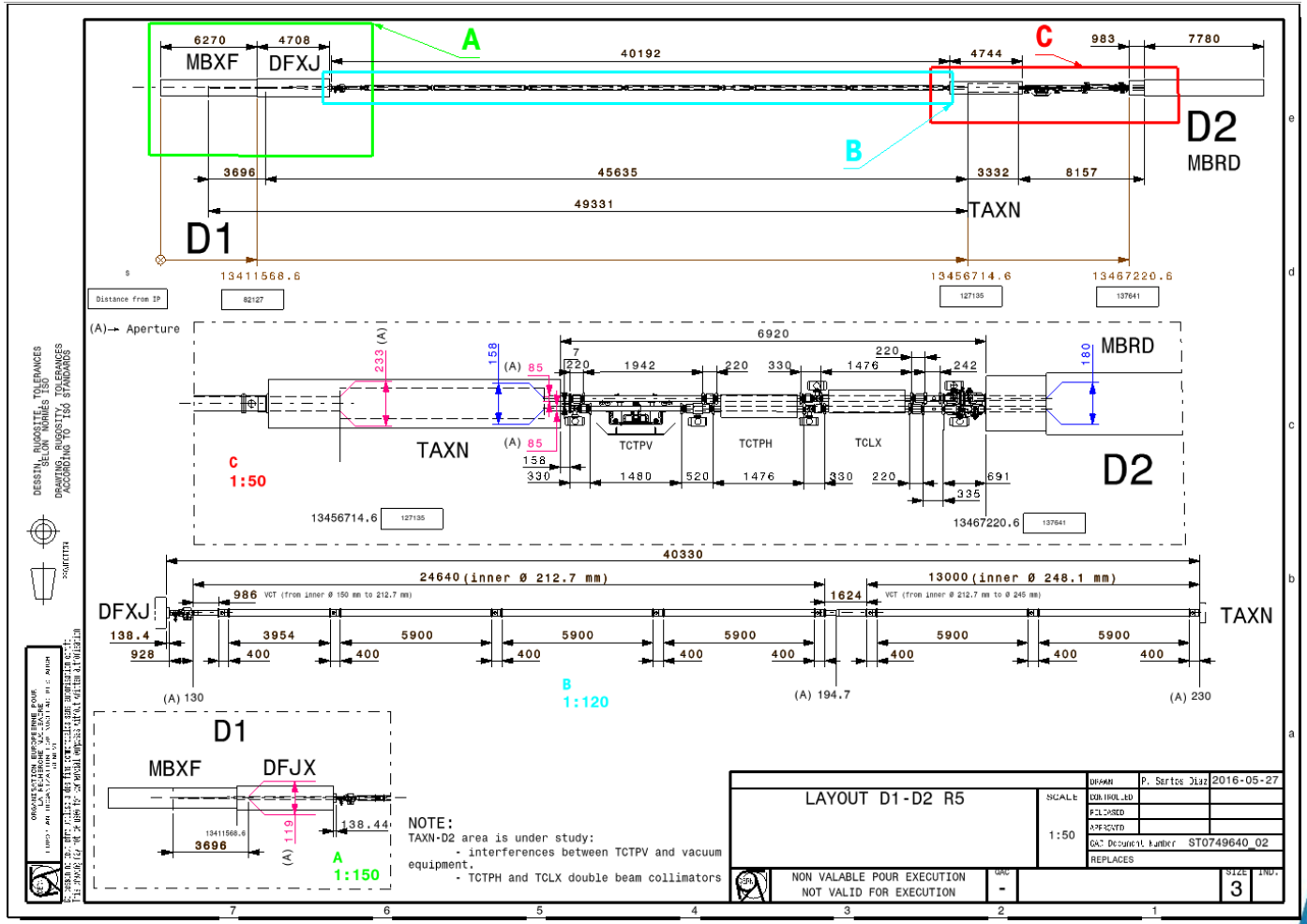
Element	S [m] - magnetic length	Separation [mm]	Aperture [mm]
End D1 (MBXF)	80.939	0	119
Start TAXN	127.135	148	85
End TAXN	130.467	158	85
outside D2 (MBRD)	137.624	180	85
Start D2 (MBRD)	138.624	188	87
End D2 (MCBRD)	146.404	188	87
Start Q4 (MCBYY)	175.685	194	72.41
End Q4 (MQYY)	179.515	194	72.41
Start Q5 (MQY)	205.79	194	57.8
End Q5 (MCBY)	209.19	194	57.8
Start Q6	225.99	194	45.1
End Q6	230.79	194	45.1
Start Q7	260.004	194	44
End Q7	267.171	194	44

*From END Q4 to the rigth not symmetric any more Left/Right 1/5

*In work

**Beam separation and beam aperture are not definitive

- All Components mechanical axis aligned with the beam.
- Quick flanges everywhere between D1 and D2 except in connections between:
  - DFXJ-VAB* → to be defined by project.
  - Left TAXN* → to check feasibility.
  - Right TAXN* (to avoid staggered flanges)
  - VAB-D2*→ to be defined by project.
- TCTPH and TCLX: double beam collimators.
- Only 5th axis in TCTPV.
- Different BPM length close to D2 → to be check with BE
- Vacuum equipment included.
- VCTY inside TAXN.

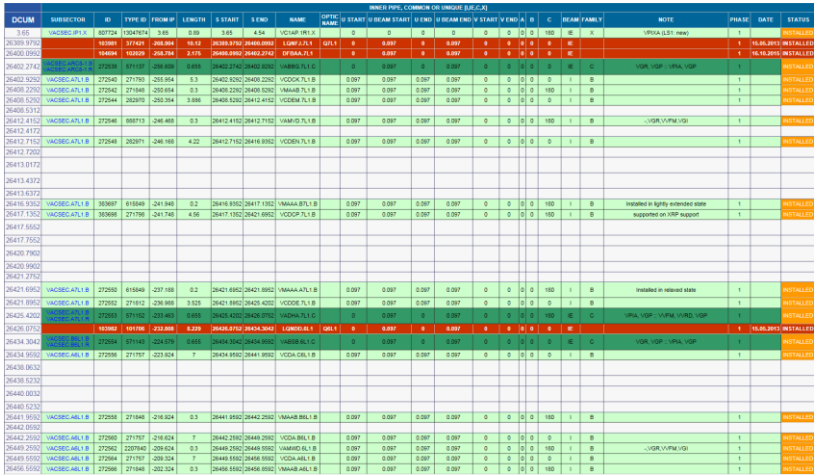


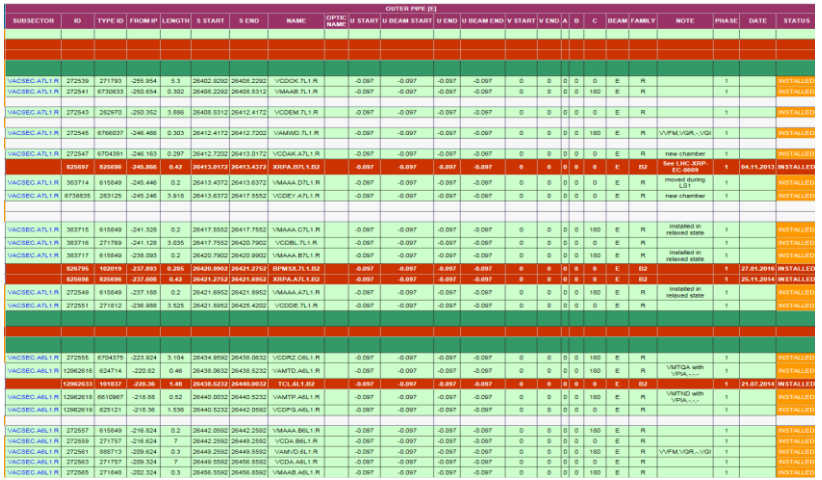
*Endorse low probability

Draft Hi-Lumi Vacuum layout

Draft Hi-Lumi Vacuum layout

- The layout proposed for Hi-Lumi is similar to LHC excel file but with more information.





Draft Hi-Lumi Vacuum layout

- Information to be completed in the excel file:

  - DCUM → equipment number
  - Vacuum subsector
  - SLOT_ID → position in the ring
  - SLOT_TYPE ID → component name
  - Distance FROM_IP
  - Equipment LENGTH
  - S_START
  - S_END
  - Equipment NAME
  - VAC/OPTIC NAME
  - TSEL_NAME
  - *BEAM_APERTURE_START*
  - *BEAM_APERTURE_END*
  - BEAM → interior, exterior or both beams
  - FAMILY → beam 1, beam 2 or both beams
  - PHASE
  - DATE

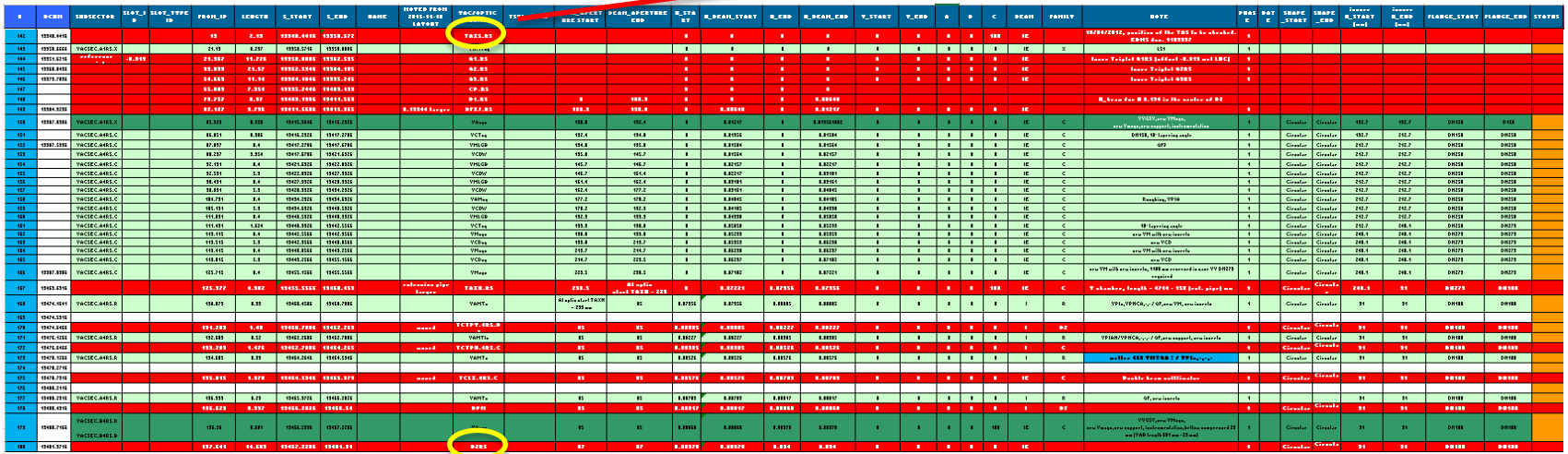
  - Position and orientation equipment:
    - U_START
    - U_END
    - U_BEAM_START
    - U_BEAM_END
    - V_START
    - V_END
    - A → rotation in beam axis
    - B → rotation in U
    - C → rotation in V
  - *SHAPE START* → inner chamber shape
  - *SHAPE END* → inner chamber shape
  - INNER DIAMETER START → inner chamber diameter
  - INNER DIAMETER END → inner chamber diameter
  - FLANGE START → DN chamber flange
  - FLANGE END → DN chamber flange
  - STATUS

Underline fields are new, compared to LHC database

Draft Hi-Lumi Vacuum layout

- Following the vacuum layout proposed before, the excel file is completed:
  - Optical layout given by database manager.
  - Inner pipe, common or unique (I,IE,C,X):
    → To be checked.

TASX R5



D2 R5

Draft Hi-Lumi Vacuum layout

- Outer pipe (E):
  - → To be checked.

SUBSECTOR	check length	check DCUM	FROM_IP	LENGTH	S_START	S_END	NAME	TSEL_NAME	MOVED FROM 2015-11-10 LAYOUT	VAC/OPTIC NAME	BEAM_APERTURE START	BEAM_APERTURE END	U_START	U_BEAM_START	U_END	U_BEAM_END	V_START	V_END	A	B	C	BEAM	FAMILY	NOTE	PHASE	DATE	SHAPE_START	SHAPE_END	inner Ø_START [mm]	inner Ø_END [mm]	FLANGE_START	FLANGE_END	STATUS
VACSEC.A4R5.B			130.879	0.22	13460.4586	13460.6786				VMTxy	At optic and TAXN - 2x85 mm	85	0.0722117	0.07221	0.079889554	0.07989	0	0	0	0	0	E	B	QF, new inserts	1		Circular	Circular	91	91	DN100	DN100	
VACSEC.A4R5.B			131.099	1.942	13460.6786	13462.6206				VCDxy	85	85	0.07989	0.07989	0.08280	0.08280	0	0	0	0	0	E	B		1		Circular	Circular	91	91	DN100	DN100	
VACSEC.A4R5.B			133.041	0.22	13462.6206	13462.8406				VAMTxy	85	85	0.0828006	0.08280	0.08313	0.08313	0	0	0	0	0	E	B	VPIAN/VPNCA,-,-,-/QF, new inserts	1		Circular	Circular	91	91	DN100	DN100	
			133.261	1.378	13462.84	13464.22				TCTPH.4R5.C	85	85	0.08313	0.08313	0.08280	0.08280	0	0	0	0	0	IE	C	double beam collimator	1		Circular	Circular	91	91	DN100	DN100	
VACSEC.A4R5.B			133.041	0.33	13464.2186	13464.5486				VAMTxy	85	85	0.08280	0.08280	0.08598	0.08598	0	0	0	0	180	E	B	VPIAN/VPNCA,-,-,-/QF, new inserts	1		Circular	Circular	91	91	DN100	DN100	
			135.159	1.476	13464.55	13466.02				TCLX.4R5.C	85	85	0.08598	0.08598	0.08819	0.08819	0	0	0	0	0	IE	C	double beam collimator	1		Circular	Circular	91	91	DN100	DN100	
VACSEC.A4R5.B			136.635	0.22	13466.0246	13466.2446				VMTxy	85	85	0.08819	0.08819	0.08817	0.08817	0	0	0	0	0	E	B	QF, new inserts	1		Circular	Circular	91	91	DN100	DN100	
			136.623	0.242	13466.24	13466.49				BPM	85	85	0.08817	0.08817	0.08853	0.08853	0	0	0	0	0	E	B1	ECR LHC-LJ-EC-0037	1		Circular	Circular	91	91	DN100	DN100	
VACSEC.B4R5.R VACSEC.B4R5.B			136.865	0.734	13466.4866	13467.2206				VAB	85	85	0.08853	0.08853	0.08970	0.08970								VVGSV, new VMxyz, new Vmxyz, new support, instrumentation, bellow compressed 23 mm (VAB length 728 mm - 24 mm)	1		Circular	Circular	91	91	DN100	DN100	
			137.641	14.69	13467.22	13481.91				D2R5			0.08970	0.08970	0.094	0.094											Circular	Circular			DN100	DN100	

Draft Hi-Lumi Vacuum layout

- Should Hi-Lumi DB be included inside LHC DB?
  - Is important to have different equipment names for equipment installed in LHC and in Hi-Lumi.

    → from this point of view Hi-Lumi database should be included in LHC database.
- When should be done the tooling?
  - ASAP → to generate excel file, aperture table and mock-up automatically and avoid mistakes.
- Is required more information inside the DB?
  - Components material.

CONCLUSIONS

- ***Tool allow automatic generate a excel file and mock up.***

- ***Hi-Lumi layout between D1 and D2 LSS R5*:**

  - **TCTPH and TCLX double beam collimator.**
  - **VCTY inside TAXN.**
  - **Quick flanges everywhere between D1 and D2 except connections between:**
    - **→ DFJX-VAB → to be defined by project.**
    - **→ Left TAXN → to be checked feasibility.**
    - **→ Right TAXN (to avoid staggered flanges).**
    - **→ VAB-D2 → to be defined by project.**

- ***Draft Hi-Lumi layout to be discuss:***

  - **Similar to LHC database.**
  - **Should be Hi-Lumi database included inside LHC database?**
    - **→ Yes, to have different names in both databases.**
  - **Is required more information?**
    - **→ components material**
  - **When should be done the tooling?**
    - **→ ASAP. To generate excel file and mock up automatically.**

NEXT STEP(S)

- **Define Hi-Lumi database.**
- **Define which information need to be included in the database.**
- **Define tooling database.**
- **Complete database between D2 and Q7.**

THANK YOU FOR YOUR ATTENTION!!!