1. PROJECT CODE ALICE	ALICE TASK DESCRIPTION			

2. EDMS ID.	3. TASK NO. TPC200416_001	4. PAGE 1 OF 26

5. DISCREPANCY REPORT SHEET(S) NUMBER(S)

6. CATEGORY INFRASTRUCTURE	7. PART NAME	8. SERIAL NUMBER

9. APPLICABLE DOCUMENTS

ST0995575, ST1055859, ST0867738

10. TASK TITLE TPC re-installation in LS2

11. OPER SEQ. NO.	12. OPERATIONS (Print, Type, or Write Legibly)	13. NOTE QA/PE
	SCOPE The purpose of the present document is to provide information and guidelines for the re-installation of the TPC from the cleanroom in SXL2 to its final position inside the spaceframe in the cavern. **WARNING** **This procedure requires working in a radiation supervised area, lifting operation and working at height. All Safety regulation and procedures must be followed**	

14. ORIGINATOR Antonio Lafuente, Yannick Lesenechal	15. TASK PROJECT ENGINEER

16. ALICE PROJECT ENGINEER Corrado Gargiulo	17. QUALITY-SAFETY ENGINEER Elisa Laudi and Klaus Barth
18. ALICE INTEGRATION Antonio Lafuente Mazuecos	19. ALICE TECHNICAL COORDINATOR Arturo Tauro

20. TASK CLOSED ACCEPTANCE SIGNATURE	21. DATE

APPROVAL *(Printed or Typed and Signed)*

Alice Task Sheet

	ALICE TASK SHEET	3. TASK SHEET NO	TPC200416_001
	CONTINUATION PAGE	5. DISCREPANCY NO.	

11. OPER SEQ. NO.	12. OPERATIONS (Print, Type, or Write Legibly)	13. NOTE QA/PWE
1.	Open this Task Sheet	
2.	Preliminary operations in the cavern	
2.1	Re-install transfer rails	
2.1.1	Pre-install scaffolding around the suspended transfer rails	
2.1.2	Bring and secure reinforcing pieces of the transfer rails	
2.1.3	Verify there is no potential interference between TRD patch panels and rail reinforcing ribs	
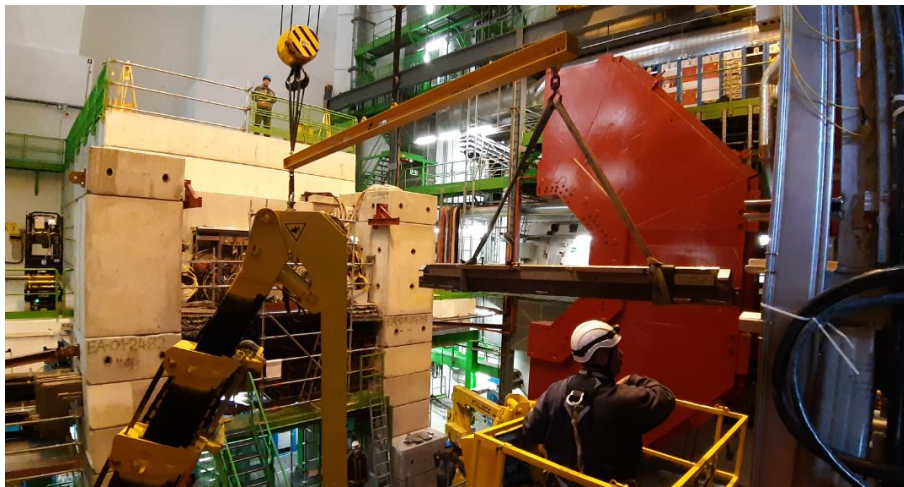
ALICE TASK SHEET
CONTINUATION PAGE

3. TASK SHEET NO   TPC200416_001

5. DISCREPANCY NO.

11. OPER SEQ. NO.	12. OPERATIONS (Print, Type, or Write Legibly)	13. NOTE QA/PWE

2.1.4	Place nacelles LV 165 or LV 156 centred in front of Spaceframe to ease the re-installation of rails (e.g. handing over material)	
2.2	Prepare shield block receiving platform in front of L3 in accordance to drawing ALIP2A_1386AA	
2.3	Remove I-bars from backframe (if they are installed)	
2.4	Install extensions in the C-side of the spaceframe	
2.5	Install scaffolding around shielding block platform. Access could be also enabled by means of ladders provided people remain secured with a harness	
2.6	Install scaffolding around low-beta platform and remove unnecessary fences. Clear O-side wing of low-beta platform to ease lifting jig change of crane operations	

ALICE TASK SHEET

CONTINUATION PAGE

5. DISCREPANCY NO.

| 11. OPER SEQ. NO.	12. OPERATIONS (Print, Type, or Write Legibly)	13. NOTE QA/PWE
3.	Preliminary operations on surface	
3.1	Connect TPC to gas bubbler	
3.2	Secure TPC to Delphi frame	
3.3	Instrument TPC with inclinometers and accelerometers as per EDMS report 1771639. Note they remained plugged with an extension cord during the whole transport operation.	
3.4	Install I-bars on C-side. Verify consistency with alignment strategy in planning	
3.5	Descent of Delphi frame base to cavern and transfer to its location	
3.5.1	Transfer Delphi frame base from SXL2 to SX2	
3.5.2	Lower DELPHI frame base to the bottom of the shaft with special care at the shield plug level where there are only ~15cm of clearance. It can also be lowered disassembled to facilitate the transport	
3.5.3	Transfer from crane PR709 to crane PR774	
3.5.4	Receive the DELPHI frame base on its support and align in accordance to metrology report 2331865 v.1 "ALICE - ALIGNMENT OF DELPHI FRAME JACKS IN FRONT OF L3 MAGNET - Measurement of February 19th, 2020 Note that the as a result of the experiment's inclination the taller feet should be facing the TPC	

ALICE TASK SHEET
CONTINUATION PAGE

3. TASK SHEET NO

TPC200416_001

5. DISCREPANCY NO.

11. OPER SEQ. NO.	12. OPERATIONS (Print, Type, or Write Legibly)	13. NOTE QA/PWE
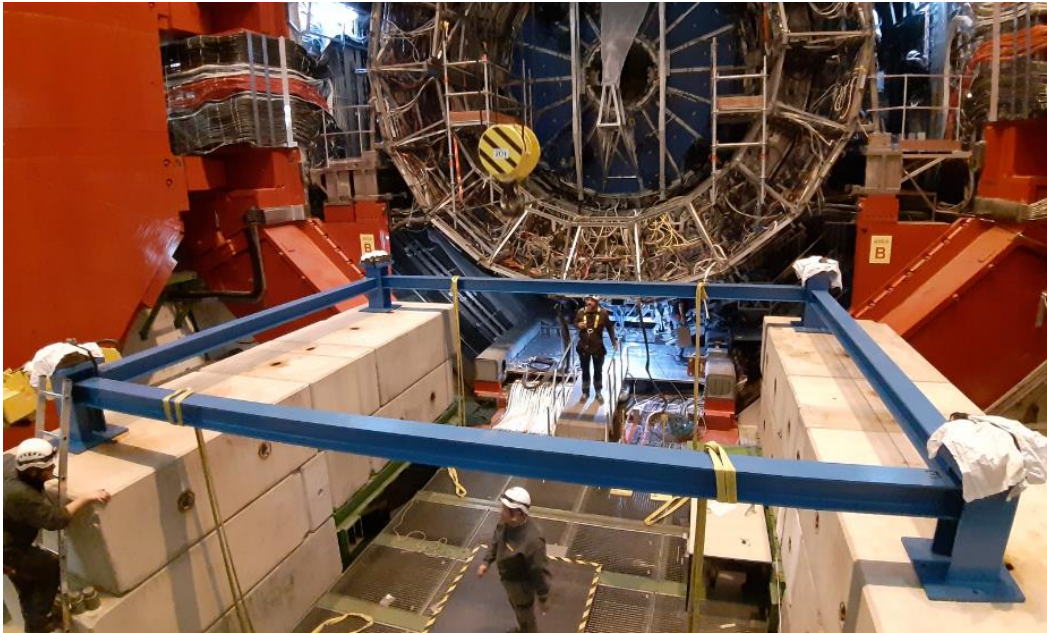
| 3.5.5 | Confirm position via survey |
| 3.5.6 | Secure DELPHI frame with chemical bolts |

3.6	Verify Delphi frame lifting jig status and prepare it for use in front of clean room before truck arrives
4.	Empty parking area the day before the transport
5.	Prepare SX2 hall for TPC passage
	These steps must be done as close as possible to the transport days since it involves removing all fences securing the shaft and cutting out the ventilation in the cavern

ALICE TASK SHEET
CONTINUATION PAGE

3. TASK SHEET NO

TPC200416_001

5. DISCREPANCY NO.

11. OPER SEQ. NO.	12. OPERATIONS (Print, Type, or Write Legibly)	13. NOTE QA/PWE
5.1	Dismount ALTEAD cages to allow passage of Delphi frame to shaft in SX2	

Dismount cages
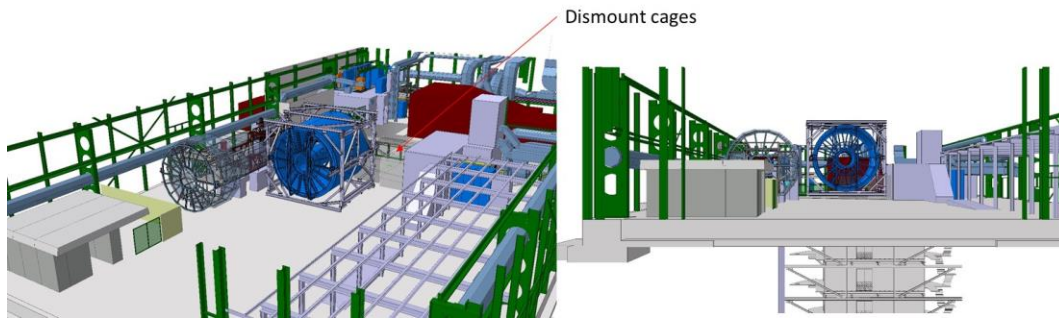
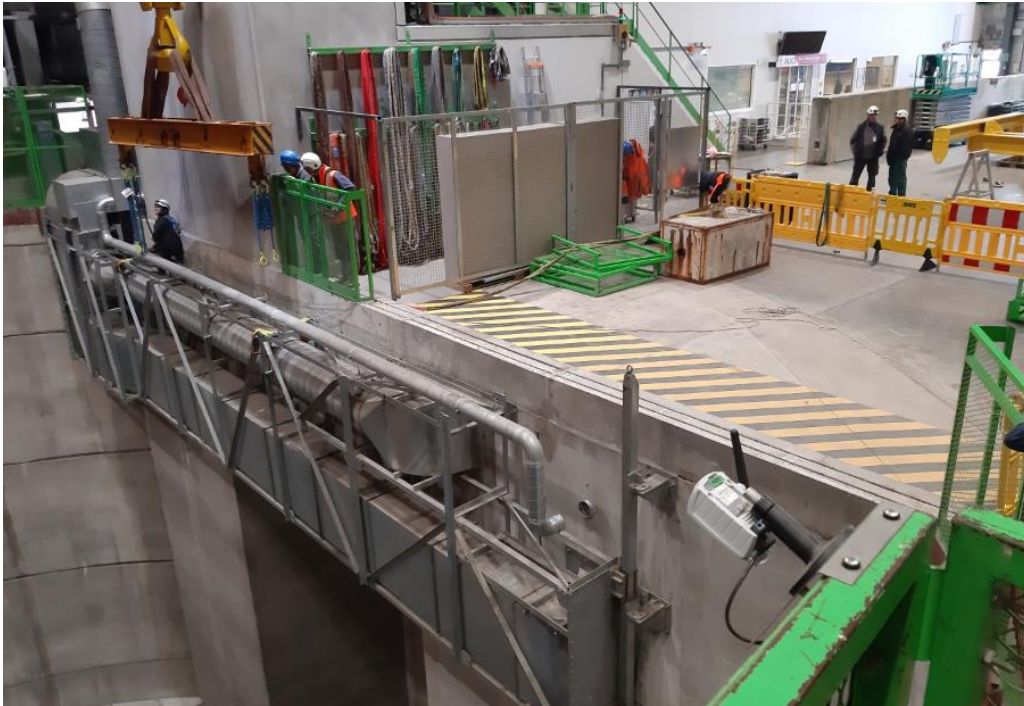|		
5.2	Install blocks and harness attachment points to allow the operators to secure themselves while removing ventilation duct	

ALICE TASK SHEET
CONTINUATION PAGE

3. TASK SHEET NO

TPC200416_001

5. DISCREPANCY NO.

11. OPER SEQ. NO.	12. OPERATIONS (Print, Type, or Write Legibly)	13. NOTE QA/PWE
5.3	Remove fences and ventilation pipes at the top of SX2 shaft to allow enough clearance for DELPHI frame transport in accordance with <u>EDMS #875209</u>	
	Note that while the duct is not in place there will not be proper ventilation in several areas of the cavern and, for this reason, should be reinstalled right after Delphi frame is descended. This activity should be coordinated with LHC TC since there could be constraints on the accesses to the tunnel	
6.	Prepare TPC for transport between SXL2 and SX2

Note that for the transport a special truck form Frederici featuring an adjustable loading platform is needed | |

ALICE TASK SHEET
CONTINUATION PAGE

3. TASK SHEET NO	TPC200416_001
5. DISCREPANCY NO.	

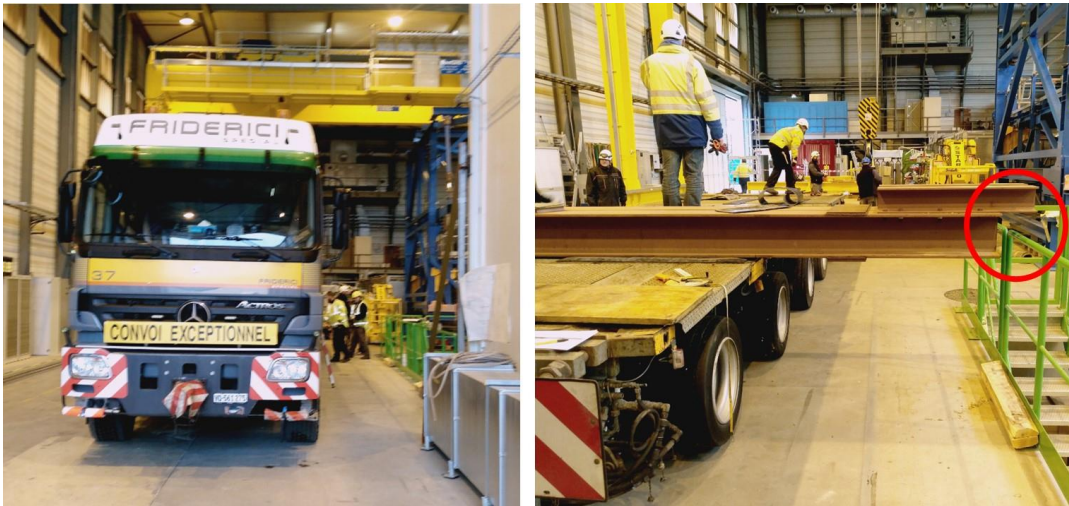| 11. OPER SEQ. NO.	12. OPERATIONS (Print, Type, or Write Legibly)	13. NOTE QA/PWE
6.1	Open Cleanroom roof	
6.2	Prepare nacelles LV259 and LV224 to connect Delphi frame lifting jig	
6.3	Clear SXL2 and SX2 IMPORTANT! Remember to remove the fixing screw for the clean room bracket 	
6.4	Back truck into SXL2 loading area. The truck platform should clear the piscine fence to avoid any potential clashes during Delphi frame handling operations 	
6.5	Mount red beams on truck	
6.5.1	Place rubber pads in all interfaces between beams and truck and beams and Delphi frame	
6.5.2	Verify distance between two beams is consistent with Delphi frame position and that they are centred	

ALICE TASK SHEET CONTINUATION PAGE	3. TASK SHEET NO	TPC200416_001
	5. DISCREPANCY NO.	

11. OPER SEQ. NO.	12. OPERATIONS (Print, Type, or Write Legibly)	13. NOTE QA/PWE
6.5.3	Secure beams with ratchet straps and check no clashes will exist with Delphi frame 	
6.6	Transfer Delphi frame onto truck This step involves progressively transferring the load from the crane to the truck with milimetric control	
6.6.1	Install Delphi frame lifting jig	
6.6.2	Verify that centre of mass of DELPHI frame is centred with respect to lifting point	
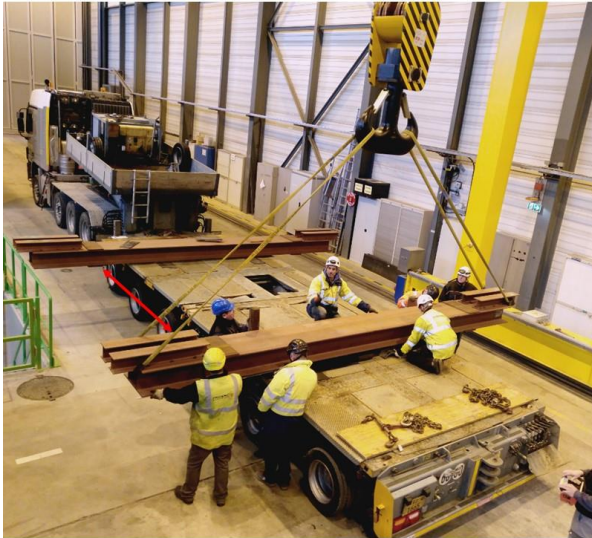
ALICE TASK SHEET CONTINUATION PAGE	3. TASK SHEET NO	TPC200416_001	
	5. DISCREPANCY NO.		

11. OPER SEQ. NO.	12. OPERATIONS (Print, Type, or Write Legibly)	13. NOTE QA/PWE
6.6.3	Lift Delphi frame and remove support pads to avoid interference when posing it on the support beams	
6.6.4	Bring Delphi frame to lowermost position	
6.6.5	Bring Delphi frame above beams 	
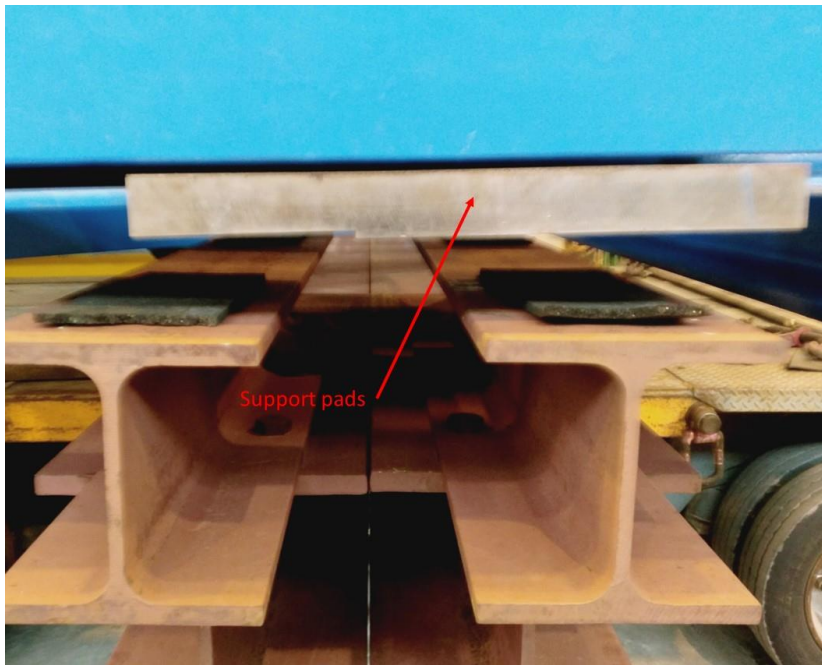
ALICE TASK SHEET CONTINUATION PAGE	3. TASK SHEET NO TPC200416_001 5. DISCREPANCY NO.

11. OPER SEQ. NO.	12. OPERATIONS (Print, Type, or Write Legibly)	13. NOTE QA/PWE
6.6.6	Transfer the load of the Delphi frame to the red beams by monitoring the weight dial in the crane. This can be done with the crane milimetric control or the platform height adjustment in the truck	
6.6.7	Secure Delphi frame to red beams with help of ratchet straps. New fixation points have been added with respect to those of the pictures	
6.7	Uninstall Delphi frame lifting jig	
6.8	Transport Delphi frame transport jig before truck arrives to receive Delphi frame	

ALICE TASK SHEET

CONTINUATION PAGE

3. TASK SHEET NO	TPC200416_001
5. DISCREPANCY NO.	

11. OPER SEQ. NO.	12. OPERATIONS (Print, Type, or Write Legibly)	13. NOTE QA/PWE
6.9	Protect Delphi frame with plastic cover in case of rain. Be aware of wind as well	
7.	Transfer DELPH frame from SXL2 to SX2 following the trajectory below and with special attention to narrow passages This trajectory was optimized to avoid unlevelled areas and it is especially important whenever the TPC is being transported 	
7.1	Prepare nacelles LV259 and LV316 in SX2 to allow connection and disconnection of Delphi frame lifting jig	
7.2	Transfer nacelle LV 224 from SXL2 to the low beta platform	
7.3	Install hydraulic feet	
7.4	Monitor TPC non-guiding slider and correct if necessary	

ALICE TASK SHEET
CONTINUATION PAGE

TPC200416_001

5. DISCREPANCY NO.

11. OPER SEQ. NO.	12. OPERATIONS (Print, Type, or Write Legibly)	13. NOTE QA/PWE

7.5	Monitor inclination as per EDMS report 1771639 and verify that instruments remained plugged with an extension cord during the whole transport operation	
8.	Transfer DELPHI frame to SX2 crane	
	Mount Delphi frame transport jig in crane PR709 and remove end-of-stroke crane limit to allow the jig installation on the frame while on the truck.	
8.1	Back truck into SX2	
8.2	Connect transport jig to Delphi frame with help of nacelles LV259 and LV316	
8.3	Remove securing straps from Delphi frame	
8.4	Transfer load from truck to crane. Load transfer while involve milimetric control if the TPC is being transported	

ALICE TASK SHEET

CONTINUATION PAGE

3. TASK SHEET NO

TPC200416_001

5. DISCREPANCY NO.

11. OPER SEQ. NO.	12. OPERATIONS (Print, Type, or Write Legibly)	13. NOTE QA/PWE

8.5   Unload Delphi frame in SX2 hall. Load transfer while involve milimetric control if the TPC is being transported

8.6   Remove hydraulic feet

8.7   Remove plastic cover

ALICE TASK SHEET

CONTINUATION PAGE

11. OPER SEQ. NO.	12. OPERATIONS (Print, Type, or Write Legibly)	13. NOTE QA/PWE
9.	Descent DELPHI frame to cavern	
9.1	Remove cheval ladders to make space for elevating platforms	
9.2	Re-install Delphi frame lifting jig	
9.3	Secure TPC to Delphi frame	
9.4	Transfer load to crane. Load transfer will involve milimetric control	
9.5	Bring Delphi frame down to the cavern. During this operation the access to the As-de of the UX25 craven and to the CRs should be blocked	
9.5.1	Prepare receiving blocs on low beta platform, dismount barriers and prepare a second nacelle LV 191 to allow de-installation of the lifting jig Since it is unclear where the Delphi frame will land, receiving blocks should be preferably light to be easy to move by hand. They should also be under 40 cm tall which is the clearance we have between Delphi frame and low beta platform	
9.5.2	Verify gas flush system for TPC is running to compensate for any undesirable air back flow resulting from pressure variations. This step must be agreed with TPC team Note this step is only needed if TPC is loaded on the DELPHI frame and especially critical when the TPC is lowered. It was never done during its extraction during LS2	
9.5.3	Descend Delphi frame with specially attention at the shield plug level where there is only 15cm of clearance. Bringing the TPC to the cavern will be done at the cranes's low speed. Using the crane at low speed all the way down will most likely require a few stops because of crane operation constraints. This will then allow time to compensate for pressure differences. Additional stops can be made if needed and must be agreed with TPC team	

ALICE TASK SHEET CONTINUATION PAGE	3. TASK SHEET NO TPC200416_001
	5. DISCREPANCY NO.

11. OPER SEQ. NO.	12. OPERATIONS (Print, Type, or Write Legibly)	13. NOTE QA/PWE
9.5.4	Remove lifting jig and prepare it for crane change Note that the initial plan of parking in the O-side was not possible (only possible during the original installation since low beta platform wall was lower) so the jig had to be brought up back again, disassembled, lowered by pieces to the O-side of low-beta platform and re-assembled on a temporary parking place over the Delph frame base. 	
9.5.5	Re-install ventilation duct and restore normal access to the cavern	
9.6	Move Delphi frame to its final location in front of spaceframe	
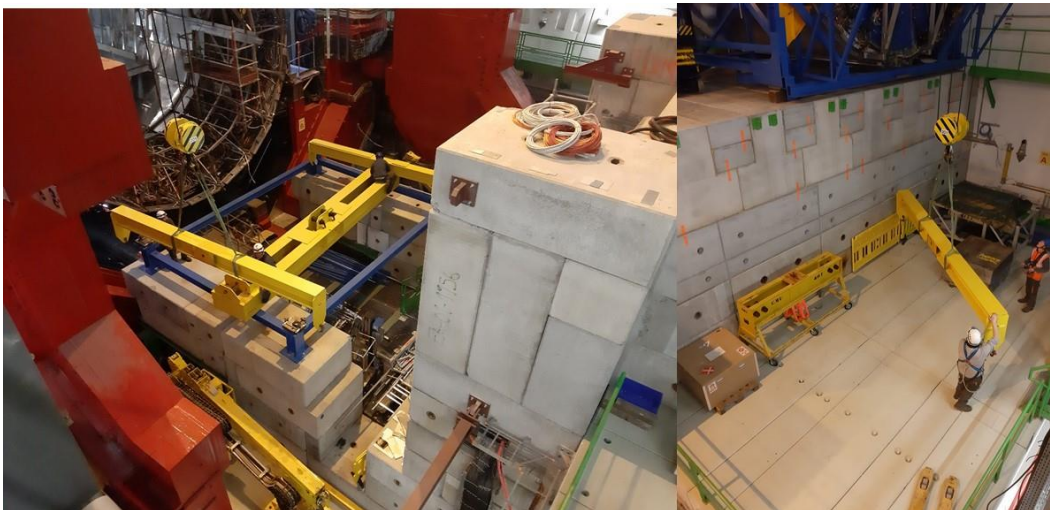
ALICE TASK SHEET

ALICE TASK SHEET
CONTINUATION PAGE

3. TASK SHEET NO   TPC200416_001

5. DISCREPANCY NO.

11. OPER SEQ. NO.	12. OPERATIONS (Print, Type, or Write Legibly)	13. NOTE QA/PWE
9.6.1	Remove any remaining low-Beta platform barriers and survey tripods. Secure nacelle LV 191 on magnet side	
9.6.2	Transfer jig from parking place to PR774.	
	Since you cannot reach the jig from the parking place with the merging jig installed it was taken with only one of the hooks to a temporary location over the base where the merging jig could be re-installed	

1400 mm

Note end-of-stroke limits must be removed at this stage in addition to using short slings since the gap left if very narrow

ALICE TASK SHEET
CONTINUATION PAGE

5. DISCREPANCY NO.

11. OPER SEQ. NO.	12. OPERATIONS (Print, Type, or Write Legibly)	13. NOTE QA/PWE

9.6.3 Transfer load to crane. This will involve the use of milimetric control

9.6.4 Re-install Delphi frame support pads previously dismounted for transport

9.6.5 Prepare nacelles LV 165 and LV 156 on both sides of Delphi frame base to ease the dismounting of the lifting jig

9.6.6 Transport the DELPHI frame above its support in front of TPC with special attention to narrow passages. This will involve a 90 degree turn once it is still over the low beta platform.

Ensure correct orientation of DELPHI frame with reinforcing straps towards TPC

ALICE TASK SHEET
CONTINUATION PAGE
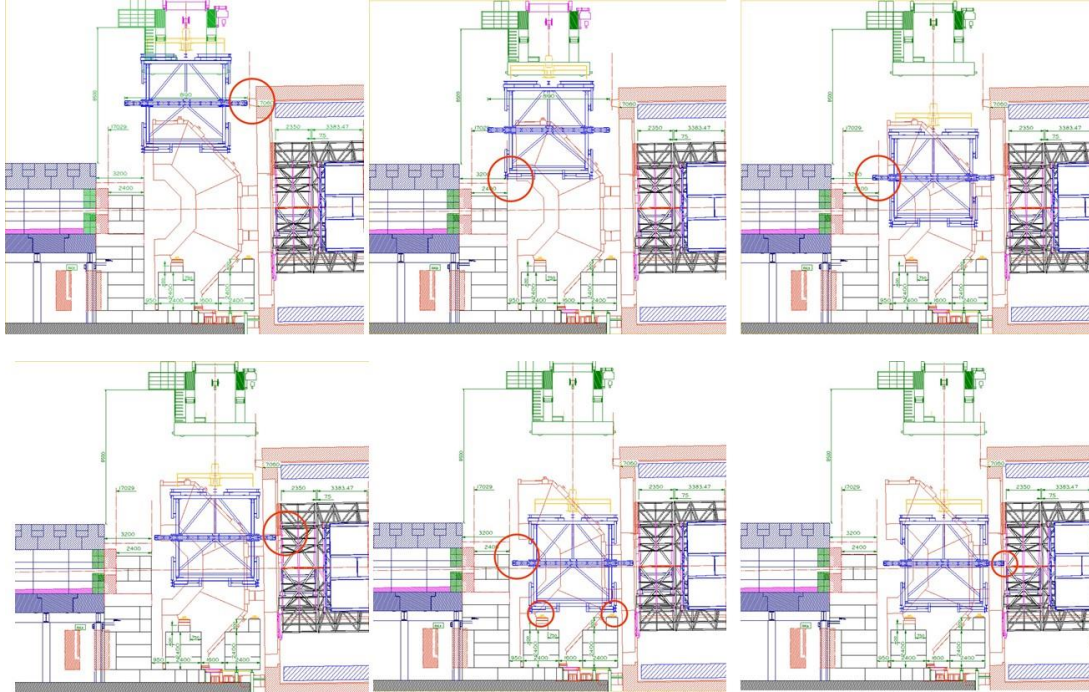
11. OPER SEQ. NO.	12. OPERATIONS (Print, Type, or Write Legibly)	13. NOTE QA/PWE
9.6.7	Receive Delphi frame on its support and pre-align with help of survey. Re-install low-beta platform fences and survey tripods	
9.6.8	Remove Delphi frame lifting jig	

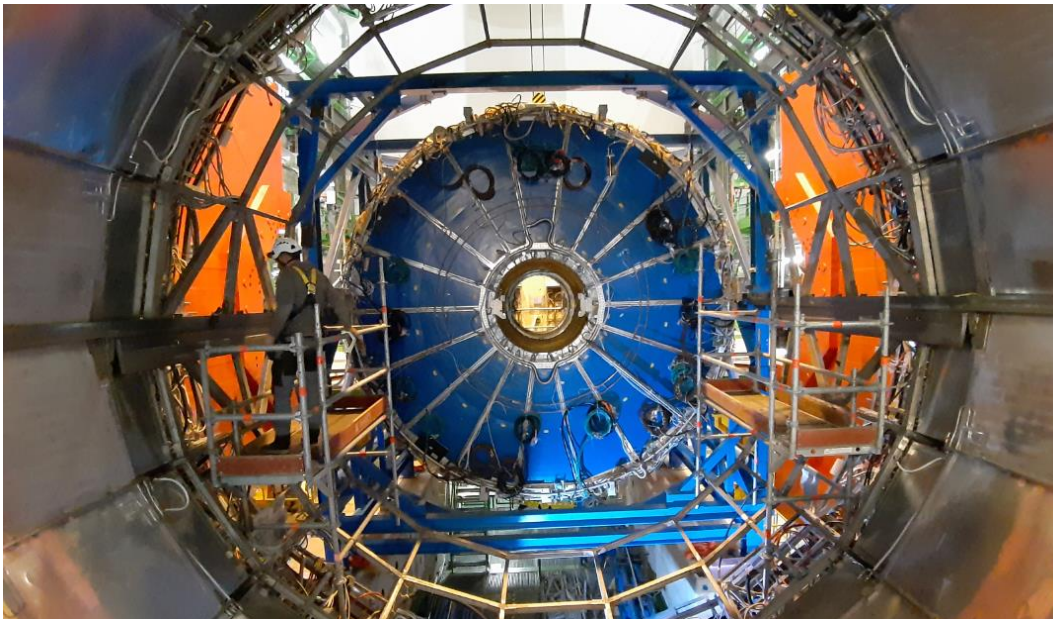**ALICE TASK SHEET**

CONTINUATION PAGE

3. TASK SHEET NO

TPC200416_001

5. DISCREPANCY NO.

11. OPER SEQ. NO.	12. OPERATIONS (Print, Type, or Write Legibly)	13. NOTE QA/PWE
10.	Complete installation of transfer rails	
10.1	Lower the rails to its final position	

ALICE TASK SHEET
CONTINUATION PAGE

3. TASK SHEET NO	TPC200416_001

5. DISCREPANCY NO.

11. OPER SEQ. NO.	12. OPERATIONS (Print, Type, or Write Legibly)	13. NOTE QA/PWE
10.2	Engage the transfer rail in the spherical seat and tighten the locking screws at both sides	

Locking screw

Spherical seat
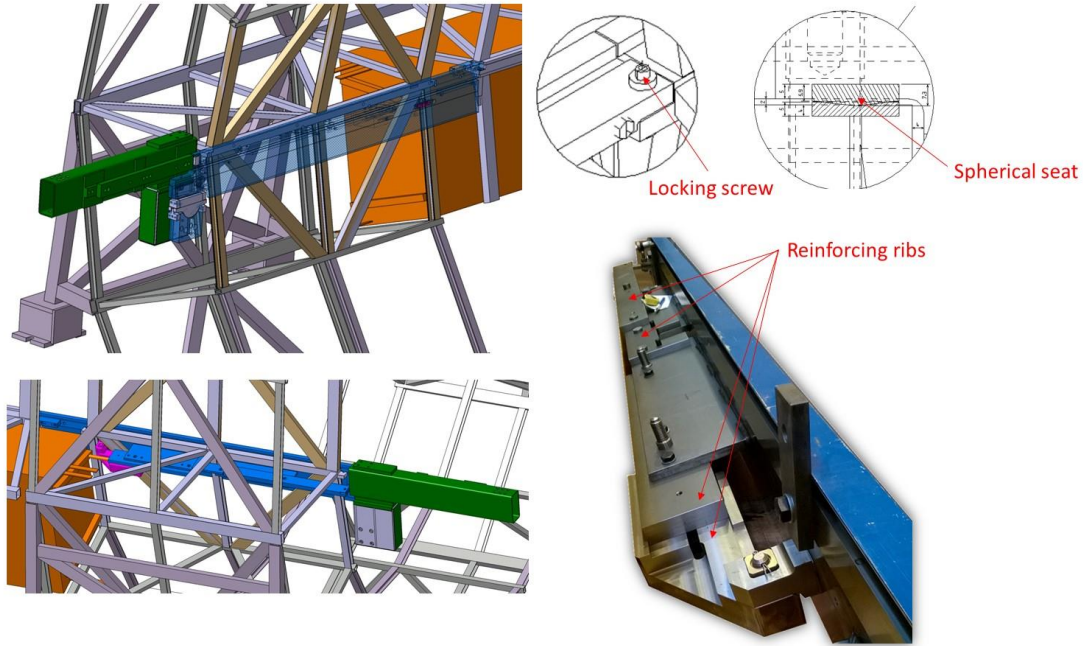
Reinforcing ribs

10.3	Perform final alignment	

10.4	Install reinforcing sections interlocking with the corresponding openings in the transfer rails	
10.5	Shim the assembly	

ALICE TASK SHEET

CONTINUATION PAGE

3. TASK SHEET NO	TPC200416_001
5. DISCREPANCY NO.	

11. OPER SEQ. NO.	12. OPERATIONS (Print, Type, or Write Legibly)	13. NOTE QA/PWE
	Note that due to a clash with the babyframe the last reinforcing rib on each side had to be machined and hence need to be shimmed on each installation	
11.	Remove scaffolding from transfer rails to enable transition of TPC from Delphi frame to Spaceframe	
12.	Push TPC to final position	
12.1	Verify rails condition by inspecting with an endoscope	
12.2	Remove unneeded parts of Omegas platform and install auxiliary platforms	
12.3	Pre-compress TPC	
12.3.1	Verify that dedicated support, strap and dynamometer are properly installed between the feet of the TPC (not the SSW)	
12.3.2	Ensure there is nothing blocking the rails	
12.3.3	Preload to the nominal value of 350 kg per side both at the same time. This value can be increased if the TPC does not move up to a nominal value of 780kg	
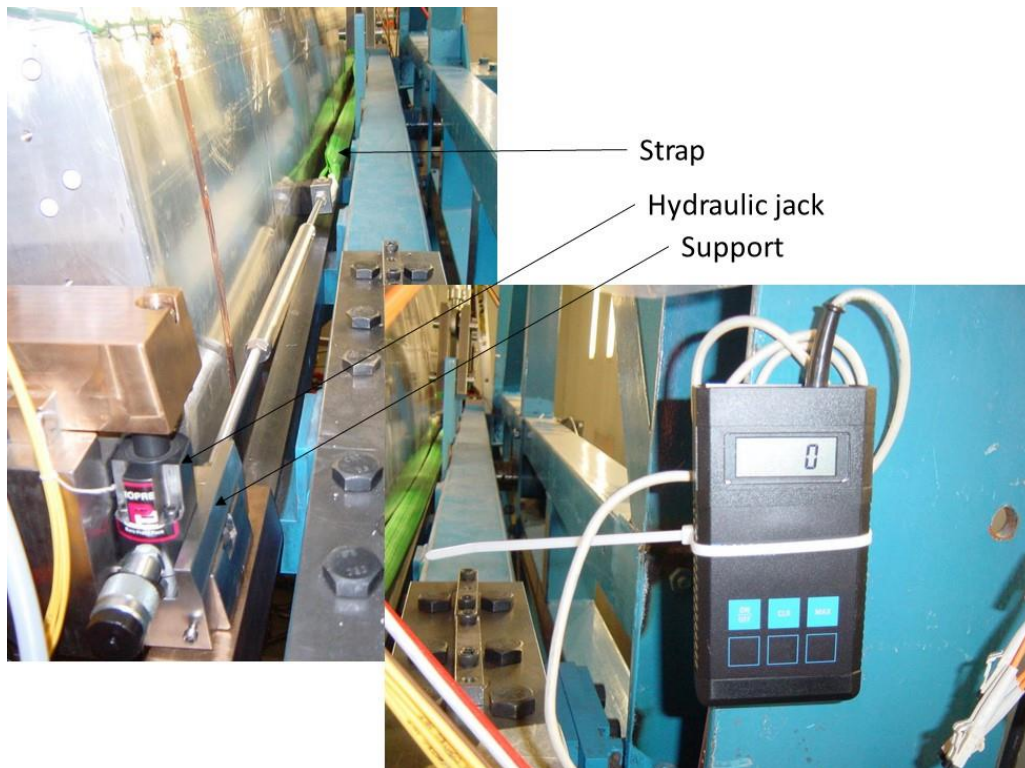
Strap
Hydraulic jack
Support

ALICE TASK SHEET

CONTINUATION PAGE

3. TASK SHEET NO	TPC200416_001

5. DISCREPANCY NO.

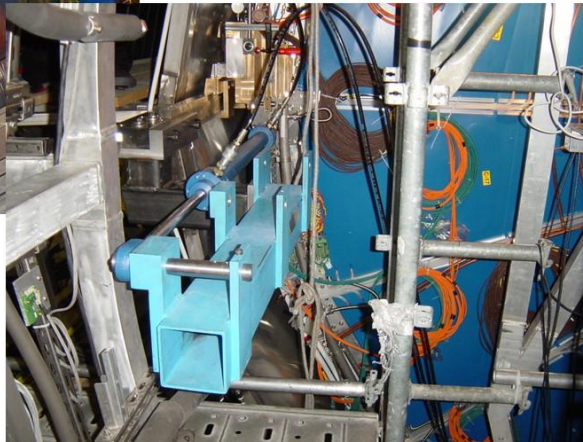| 11. OPER SEQ. NO.	12. OPERATIONS (Print, Type, or Write Legibly)	13. NOTE QA/PWE

12.4 Prepare pulling hydraulics

Note that two set of different extensions may be needed here respectively for the last stretch of the transfer to the Delphi frame or the back frame

Pulling block

12.4.1 Install pulling block

12.4.2 Install hydraulic jack and connect it to pulling block

12.4.3 Connect to pump in parallel

12.5 Prepare lifting hydraulics

This system is used to allow the TPC to accommodate any rotations resulting from rail misalignments while it slides

12.5.1 Fix hydraulic jacks to TPC feet. Only two are needed in the pulling side

12.5.2 Connect to pump in parallel

12.5.3 Lift hydraulic jack until the supporting screw disengages

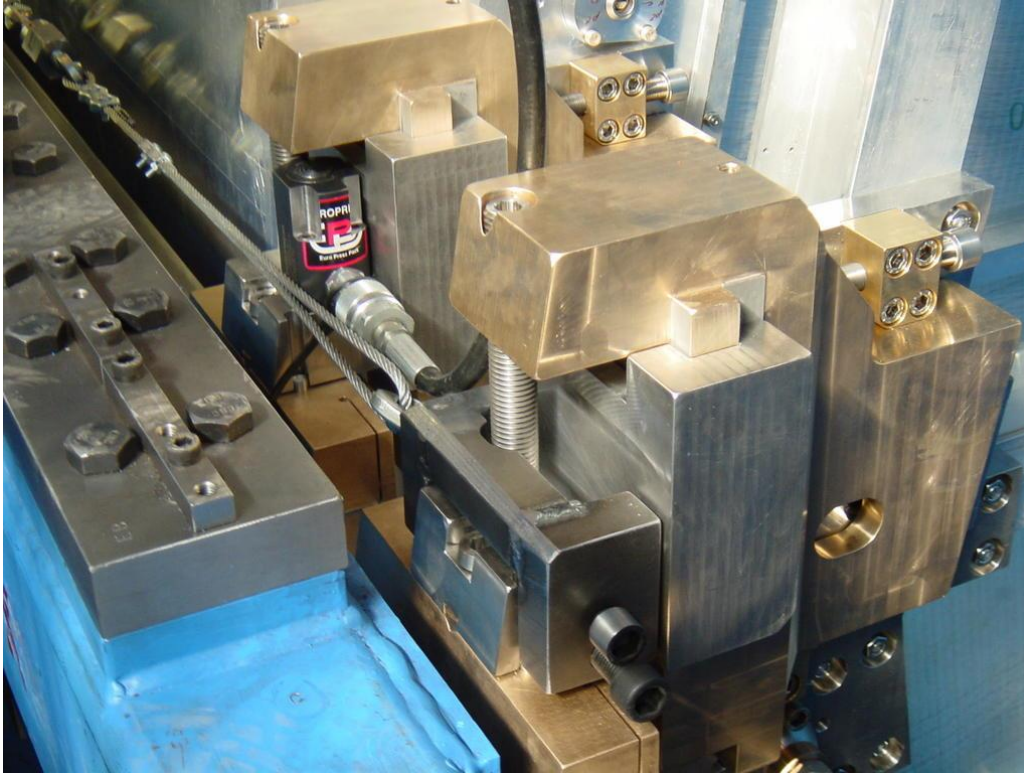**ALICE TASK SHEET**

CONTINUATION PAGE

3. TASK SHEET NO

TPC200416_001

5. DISCREPANCY NO.

11. OPER SEQ. NO.	12. OPERATIONS (Print, Type, or Write Legibly)	13. NOTE QA/PWE
12.6	Pull TPC to parking final position	
	Note that during this step the slider and lifting hydraulic gaps should be carefully monitored. In addition, the passage should be kept clear from obstacles and the TPC drift volume pressure controlled. Spaceframe deformations should be monitored throughout the process and the gaps of the O-side slider controled	
13.	Perform TPC alignment	
14.	Bring TPC back to parking position following procedure TPC171117_001_TPC_Extraction_v2 (EDMS 2366764)	
15.	Remove gas flush system and connect TPC to back-up line via extension ducts. Leave TPC connected to back-up line while in parking position and install filters for TPC gas insulation volumes	
	Note that TPC is connected to the back-up line because it has a simpler line routing (1 inlet/1 outlet) and that longer lines are needed to accommodate the displacement of the TPC from the Spaceframe onto the Delphi frame	

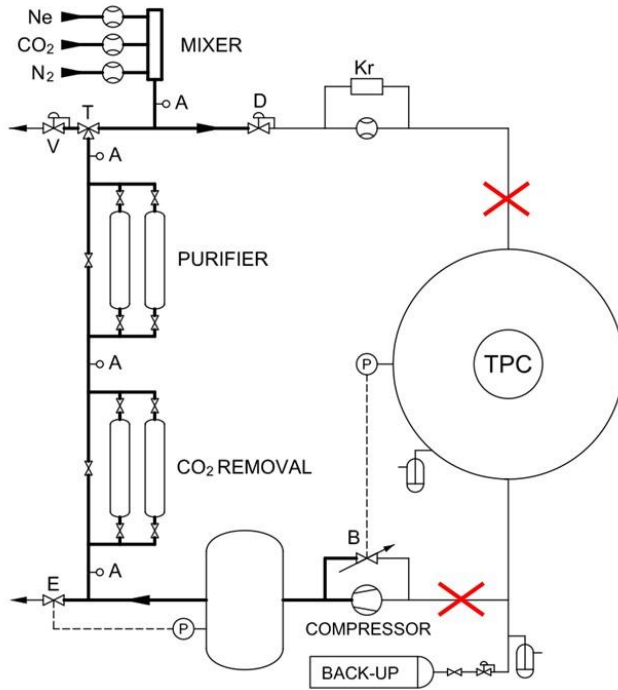**ALICE TASK SHEET**

CONTINUATION PAGE
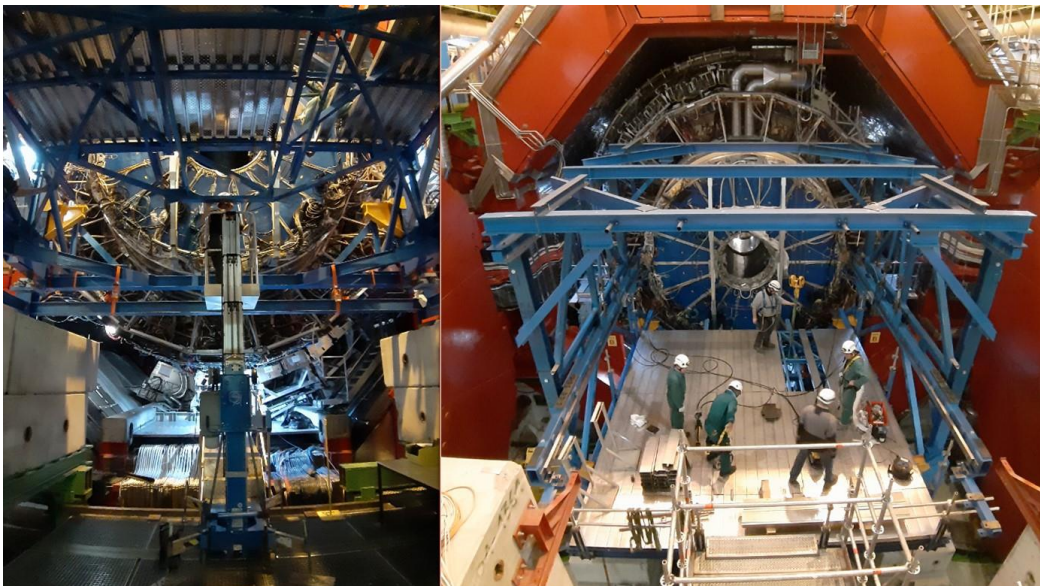
5. DISCREPANCY NO.

11. OPER SEQ. NO.	12. OPERATIONS (Print, Type, or Write Legibly)	13. NOTE QA/PWE

16.   Re-install Delphi frame platform to allow for ITS re-insertion

16.1   Install platform with help of LV 238

16.2   Connect PP0 scaffolding with Delphi frame platform to enable easy access
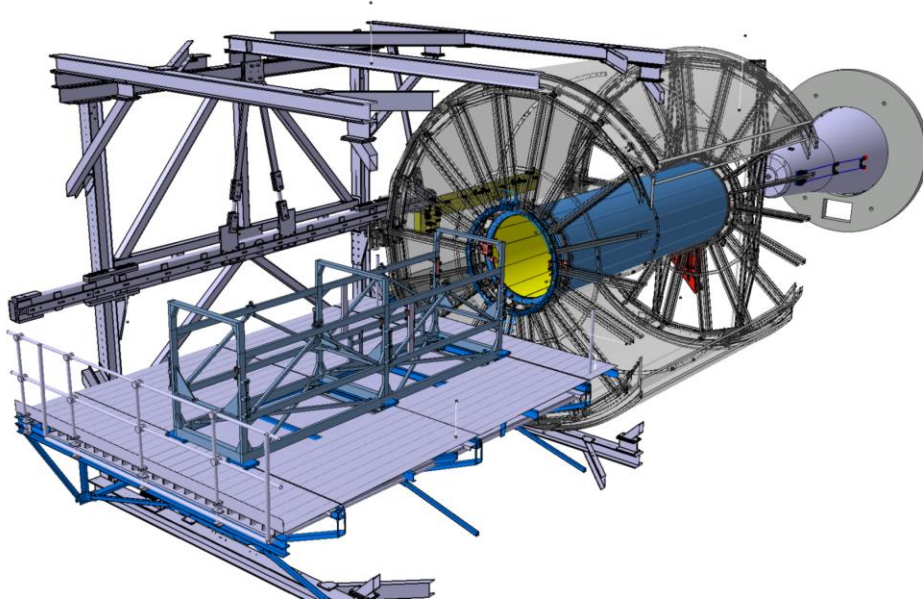

ALICE TASK SHEET

ALICE TASK SHEET

CONTINUATION PAGE

3. TASK SHEET NO	TPC200416_001
5. DISCREPANCY NO.	

11. OPER SEQ. NO.	12. OPERATIONS (Print, Type, or Write Legibly)	13. NOTE QA/PWE
17.	Install, pre-align and fix ITS table	
18.	Close this task sheet	