



TDIS alignment findings and next actions

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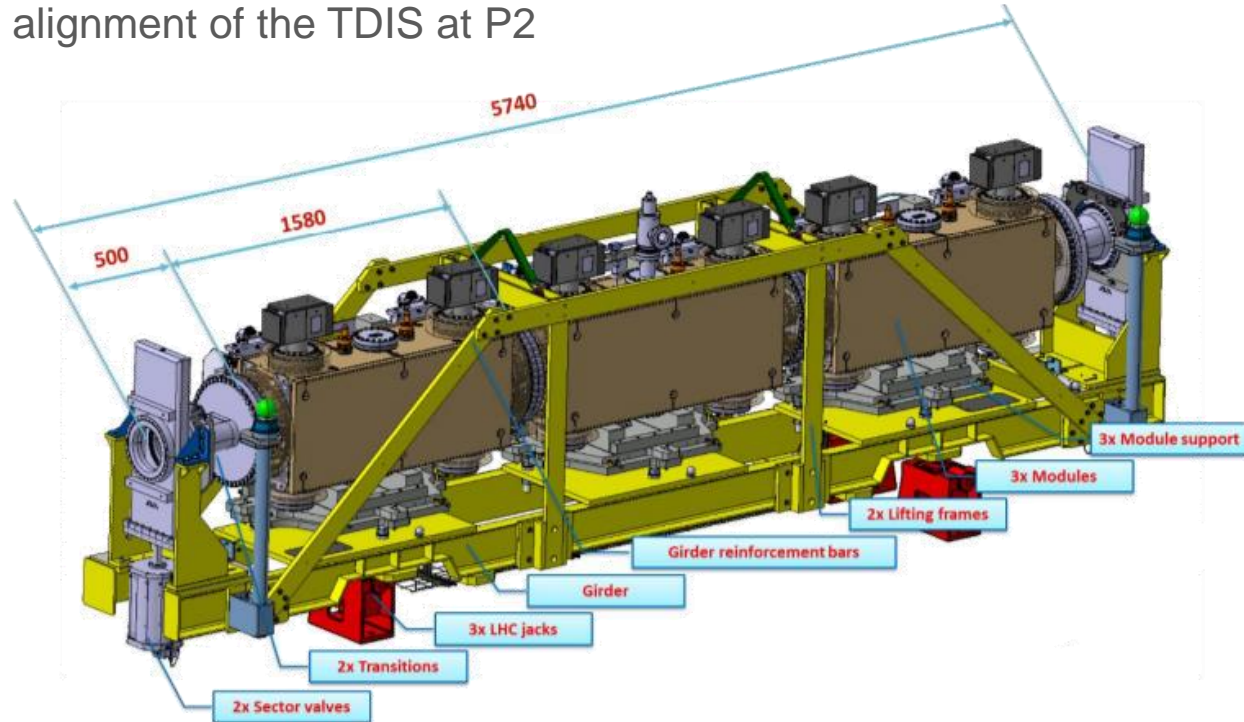
TDIS alignment findings and next actions

Agenda

- TDIS P2 – alignment non-conformities
- TDIS P8 – update about on-surface alignment / tunnel set-up
- TDIS alignment reports' content

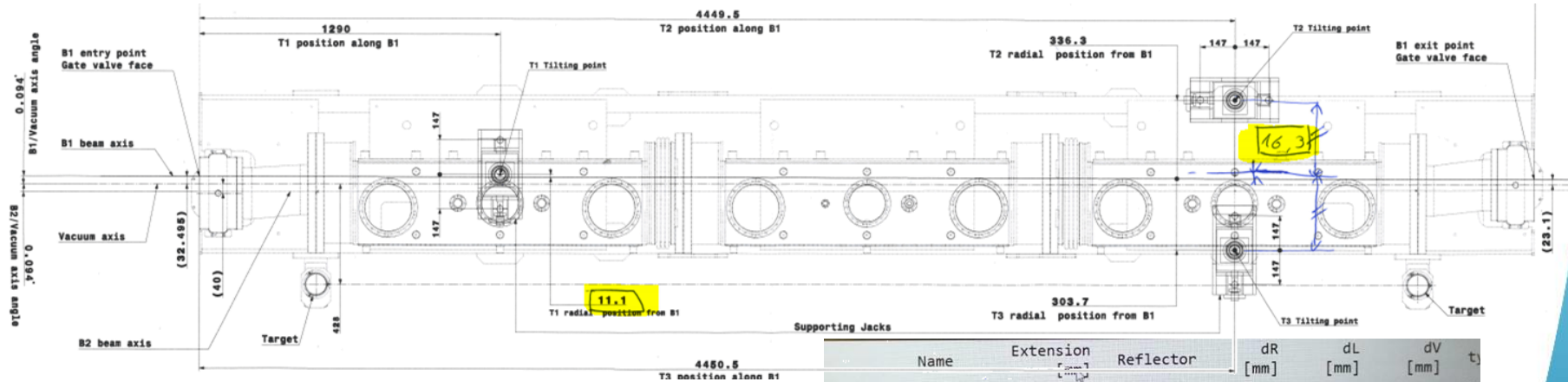
TDIS alignment findings and next actions

- TDIS P2 – alignment non-conformities (NCR: [EDMS 2407349](#))
- On the 17/08 the survey team found the jacks' stroke ($\pm 10\text{mm}$) was insufficient to allow a correct alignment of the TDIS at P2



TDIS alignment findings and next actions

- TDIS P2 – alignment non-conformities (NCR: [EDMS 2407349](#))
- Jacks' end-stops were reached (towards passage side) but the TDIS was between 10mm (upstream side) and 15mm (downstream) away from the its target position

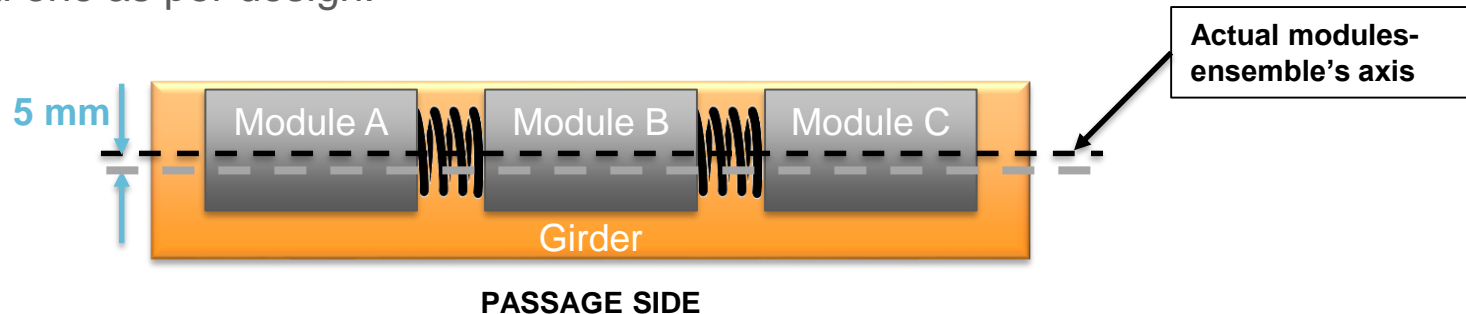


Data provided by Cyril Cadiou

Name	Extension [mm]	Reflector	dR [mm]	dL [mm]	dv [mm]	tj
LHC.NID.4L2-06.	0.00	RRR1.5_1	-	-	-	No
LHC.NID.4L2-05.	0.00	RRR1.5_1	-	-	-	No
LHC.NID.4L2-04.	0.00	RRR1.5_1	-	-	-	No
LHC.TDIS.A4L2.E	0.00	RRR1.5_1	-10.16	1.81	0.34	Q
LHC.TDIS.A4L2.S	0.00	RRR1.5_1	-15.31	1.80	-0.13	Q
LHC.NID.4L2-03.	0.00	RRR1.5_1	-	-	-	No
LHC.NID.4L2-02.	0.00	RRR1.5_1	-	-	-	No
LHC.NID.4L2-01.	0.00	RRR1.5_1	-	-	-	No

TDIS alignment findings and next actions

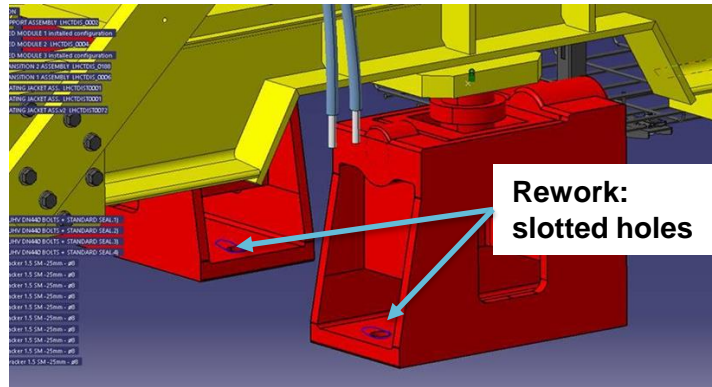
- TDIS P2 – alignment non-conformities (NCR: [EDMS 2407349](#))
- Data analysis revealed the 3 modules were not correctly aligned with respect to the girder. At present there is a **5mm-offset** between the 3-modules-ensemble's axis and its theoretical one as per design:



- However, even if the modules were correctly positioned it would not suffice to reach the required position => **Another issue must underlie** (jacks misalignment? incorrect references taken for alignment? actual Integration geometry not matching design?)

TDIS alignment findings and next actions

- TDIS P2 – alignment non-conformities (NCR: [EDMS 2407349](#))
- Were the jacks not properly positioned, EN/STI-TCD would propose to rework them in order to allow its radial displacement towards the passage side:



Screenshot provided by Luca Gentini

TDIS alignment findings and next actions

- TDIS P8 – update about on-surface alignment / tunnel set-up
 - TDIS tanks linked by means of bellows => assembly stiff to torsion. When one module is displaced relatively to the girder the other two modules are also displaced and elastically deform the girder.
 - To avoid the issue the girder's reinforcement structure has been installed prior to the alignment phase (instead of after, as it was done for TDIS P2). That minimises girder torsion during modules displacement.

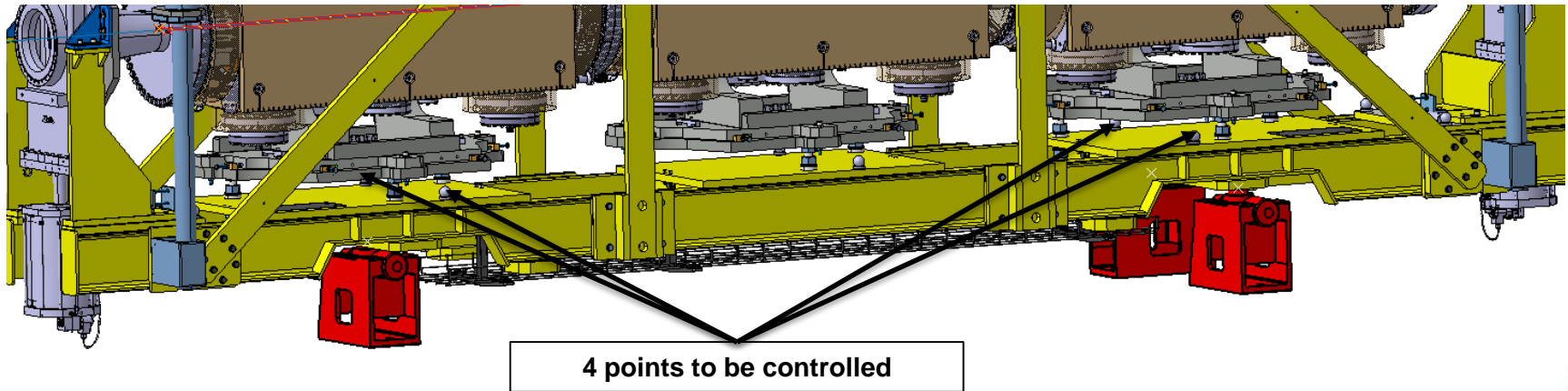
➤ **TBC**

TDIS alignment findings and next actions

- TDIS P8 – update about on-surface alignment / tunnel set-up
 - As for the vault rails position offset in P8 (NCR: [EDMS 2398865](#)): in view of the small deviation (0.2mm) EN/HE confirmed the installation should be doable w/o “pallonier”
 - Once the source of the TDIS P2 in-tunnel alignment issue is identified a swift assessment of the situation at P8 is necessary in case a fix is also required so the installation planning is not affected.

TDIS alignment findings and next actions

- TDIS alignment reports' content
 - EN/STI-TCD expects from EN/SMM-ASG a report for each TDIS unit containing:
 1. Data of girder's coordinate system (defined by 4 points as shown below)

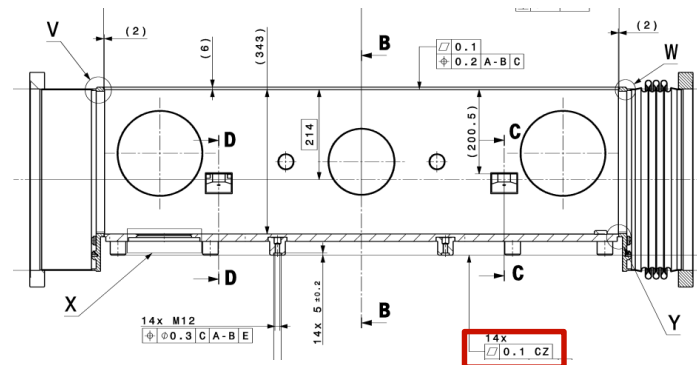
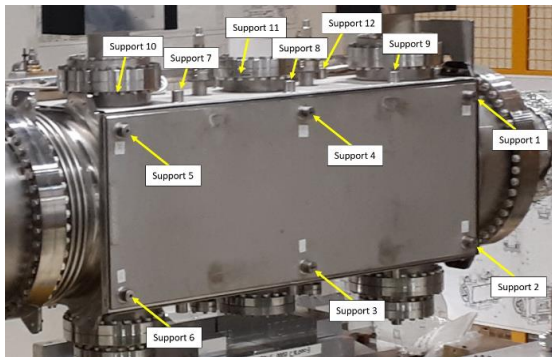


TDIS alignment findings and next actions

- TDIS alignment reports' content
 - EN/STI-TCD expects from EN/SMM-ASG a report for each TDIS unit containing:
 2. Data of each module's coordinate system :

Item	Object to define/control	Means/Aux. elements
1	Plane A* (x3)	Defined by centres of laser tracker balls positioned on supports 1 to 6 acc. to figure
2	Plane B* (x3)	Defined by centres of laser tracker balls positioned on supports 7 to 12 acc. to figure
3	Module axis (x3)	Defined by centres of the two DN440 flanges

*It must be verified that the 0.1mm-flatness spec is met

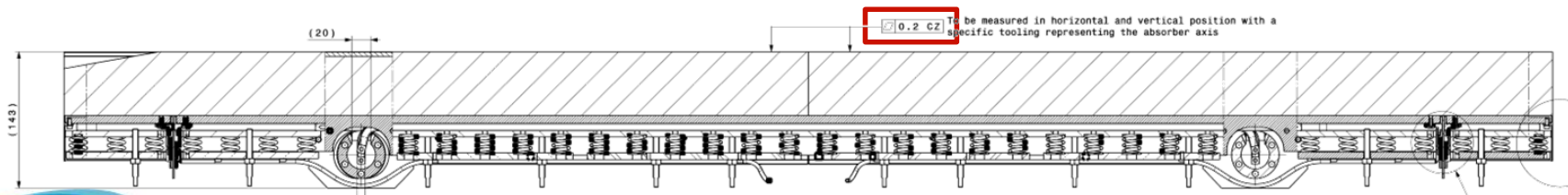


TDIS alignment findings and next actions

- TDIS alignment reports' content
- EN/STI-TCD expects from EN/SMM-ASG a report for each TDIS unit containing:
 3. Data of each jaw:

Item	Object to define/control	Means/Aux. elements
1	Jaw axis @0mm	Defined by the intersection of the theoretical plans offset the nominal distance from plans A and B (292mm and 355.5mm respectively) to the jaw axis as per design
2	Jaw's OUT mechanical end-stop position (x2)	Actual mechanical end-stop position value @55mm-stroke. This is set by TCD and ASG together and is the absolute reference to know the actual jaw position at all times
3	Jaw flatness*	Only the extremities of the jaw are reachable to measure the flatness

*It must be verified that the 0.2mm-flatness spec is met

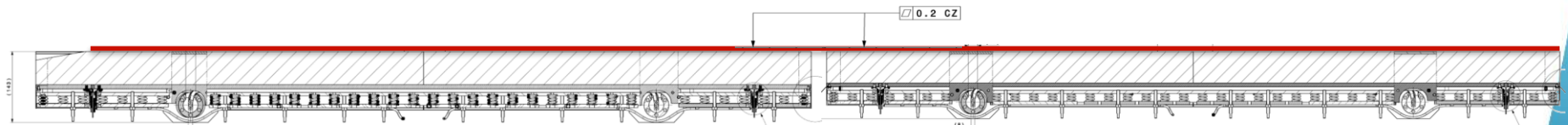


TDIS alignment findings and next actions

- TDIS alignment reports' content
 - EN/STI-TCD expects from EN/SMM-ASG a report for each TDIS unit containing:
 4. Data of 3 modules' alignment on girder:

Item	Object to define/control	Means/Aux. elements
1	Alignment between modules' A plane	The alignment accuracy is imposed by the required alignment b/w graphite jaws (see description below). It is required also to cross-check the relative position of the modules wrt girder matches drw LHCTDIS_0001 (TDIS P2)/LHCTDIS_0236 (TDIS P8)
2	Alignment between jaws	It shall be indirectly calculated based on previously collected data. It must be ensured that the actual alignment allows reaching a 0.2mm-flatness b/w graphite jaws*

*Verify that by displacing the jaws axes it is possible to attain a 0.2mm flatness over the entire length of graphite jaws:



TDIS alignment findings and next actions

- TDIS alignment reports' content
- EN/STI-TCD expects from EN/SMM-ASG a report for each TDIS unit containing:
 5. Reference to an ASG-owned document detailing the **on-surface/in-tunnel TDIS alignment procedure**.

TDIS alignment findings and next actions

- Conclusions
 - The root cause of TDIS P2 alignment issue shall be identified to implement the right solution asap and move on with TDIS P8 survey activities on surface
 - Girder's reinforcement structure must always be in place before proceeding to modules alignment
 - TCD and ASG shall agree on data to be included on alignment reports which shall be jointly assessed to avoid further issues in the future
 - A written TDIS alignment procedure issued by ASG is requested



Thanks for your attention

2020/08/31 ([Indico link](#))