



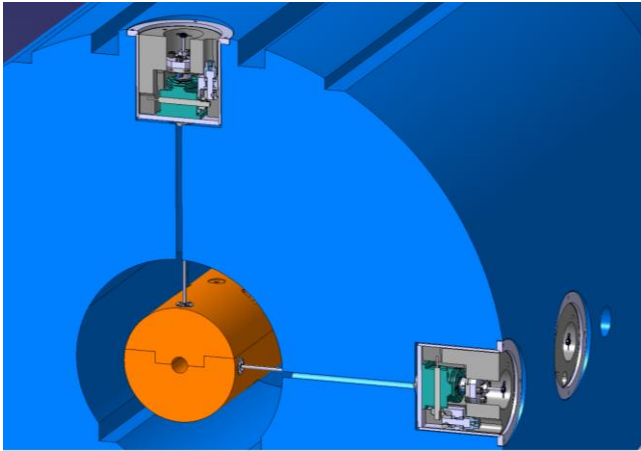
TAXS ALIGNMENT

Antonio Alonso, Dusan Soskic

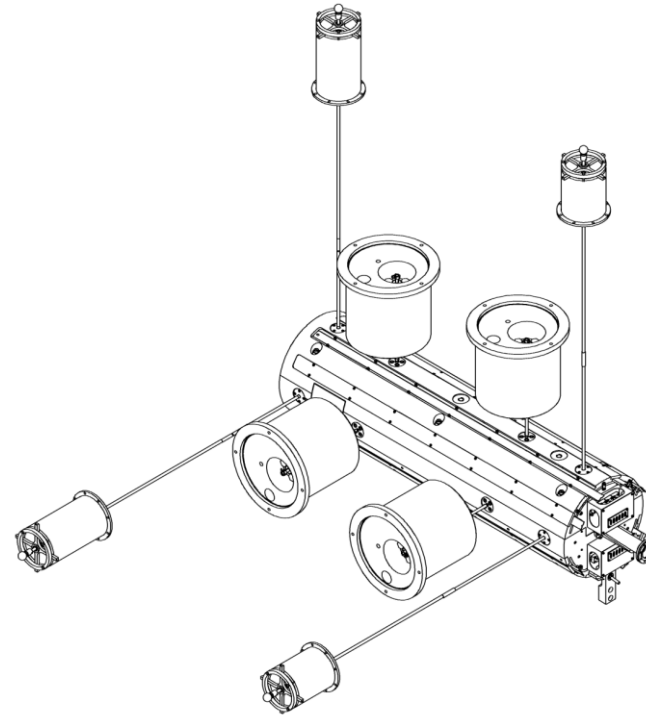
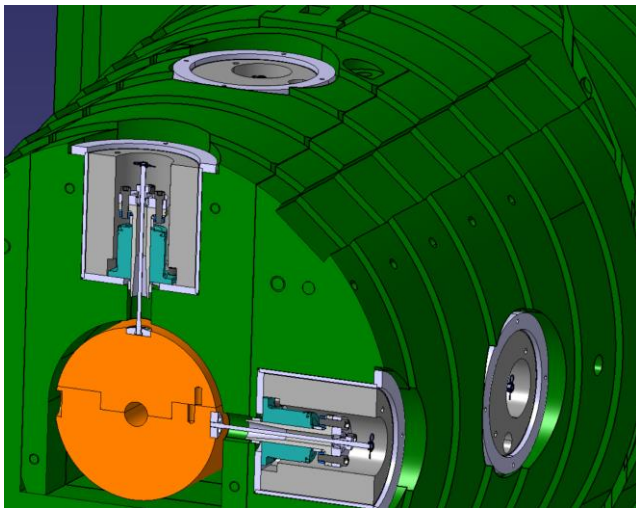


TAXS alignment system

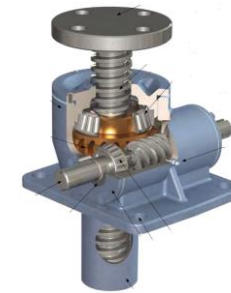
- ATLAS



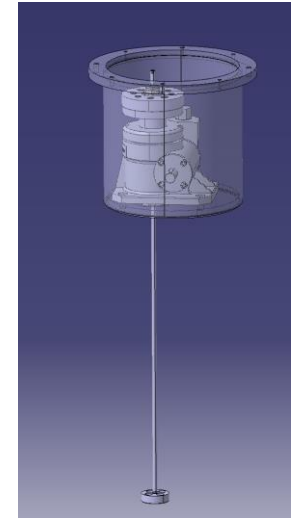
- CMS



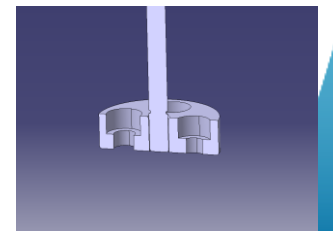
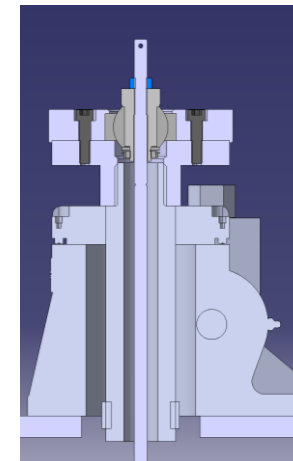
- Same concept as original TAS
- Designed by Berkeley 2000's
- Two sets of screwjacks (Horizontal +vertical)
- Range ± 5 mm



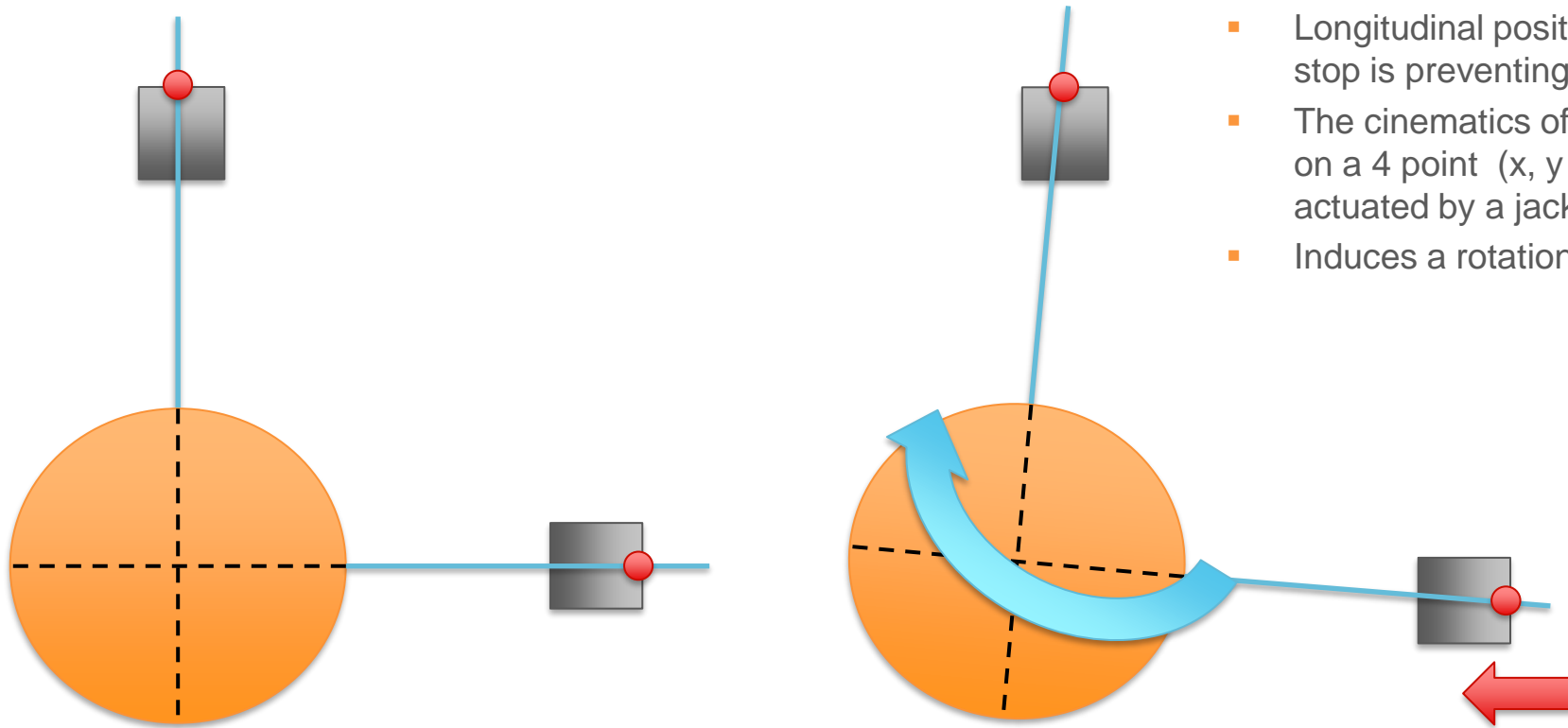
- Screwjack side, ball bearing



- TAXS side, Rigid insert

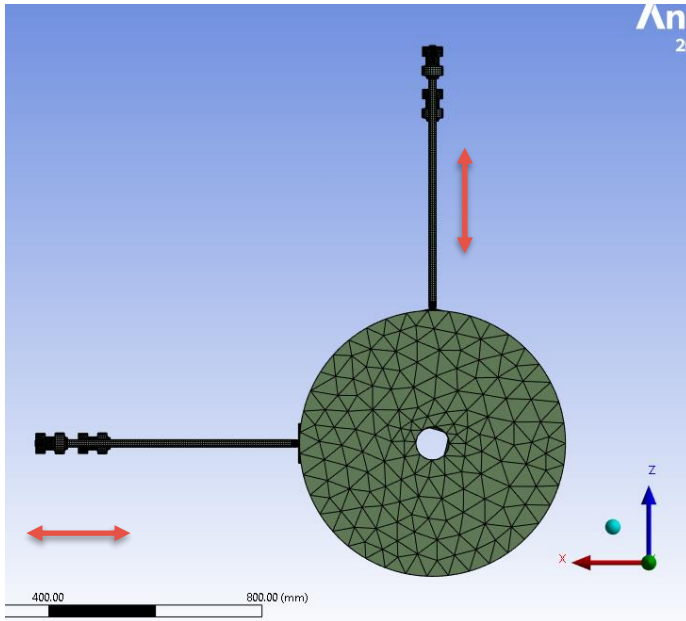


TAXS Bell Effect



- Longitudinal position (z) is fixed at installation. A z -stop is preventing further realignments.
- The cinematics of the alignments system is based on a 4 point (x, y) done through fixed bars actuated by a jack (gear- worm) system.
- Induces a rotation on the TAXS

TAXS Bell effect calculations



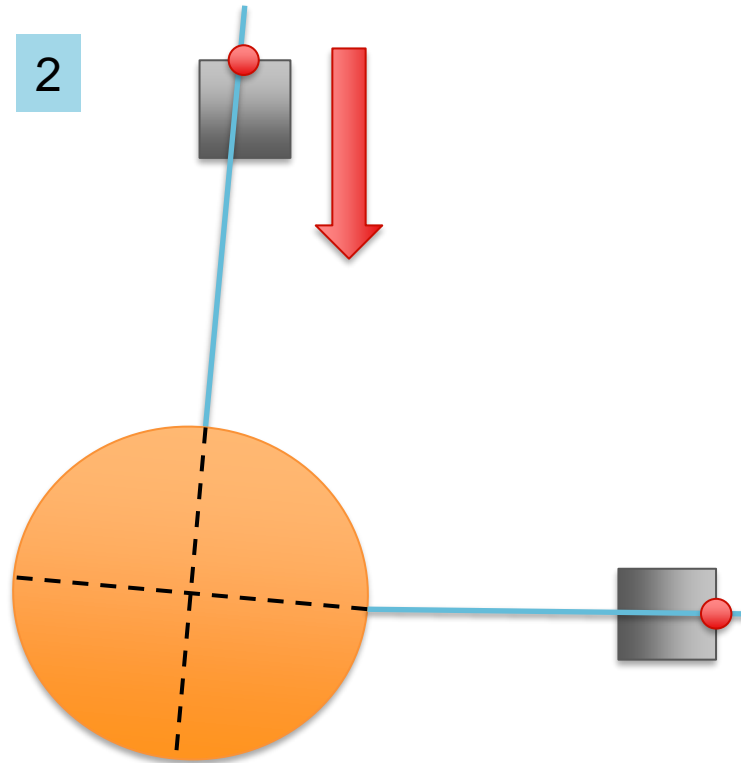
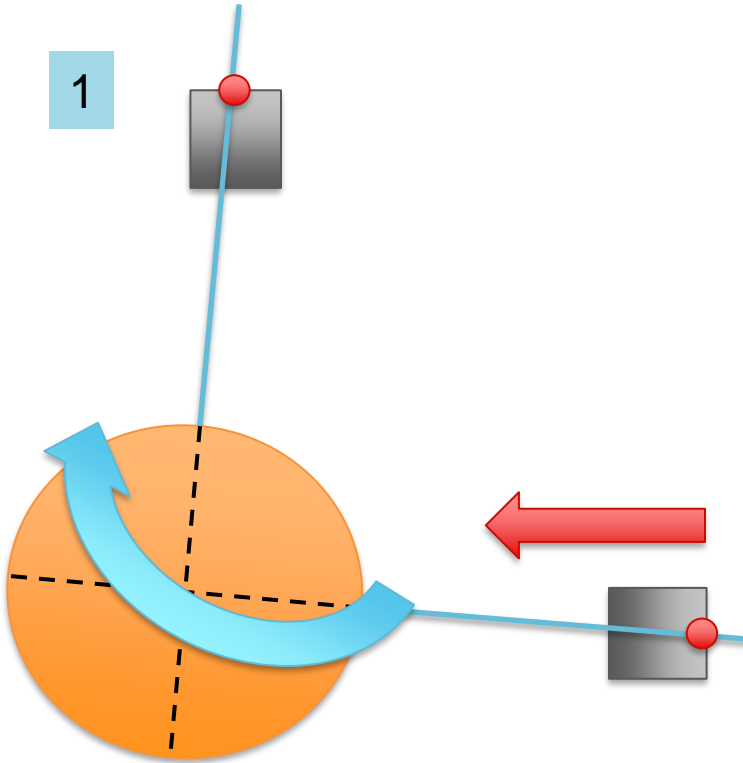
- In CMS the effect is larger than in ATLAS due to the shorter rods

ATLAS		Horizontal [mm]											rot [mrad]	
		5	4	3	2	1	0	-1	-2	-3	-4	-5		
V e r t i c a l (m m)	rot [mrad]	5	-2.39	-1.78	-1.17	-0.55	0.06	0.68	1.29	1.91	2.53	3.15	3.77	
		4	-2.55	-1.94	-1.32	-0.71	-0.10	0.52	1.14	1.75	2.37	2.99	3.61	
		3	-2.71	-2.10	-1.48	-0.87	-0.25	0.36	0.98	1.60	2.22	2.83	3.45	
		2	-2.87	-2.26	-1.64	-1.03	-0.41	0.20	0.82	1.44	2.06	2.68	3.30	
		1	-3.03	-2.42	-1.80	-1.19	-0.57	0.05	0.66	1.28	1.90	2.52	3.14	
	grad ^{0.615} [mrad/mm]	0	-3.19	-2.58	-1.96	-1.35	-0.73	0.00	0.51	1.12	1.74	2.36	2.98	grad ^{0.618} [mrad/mm]
		-1	-3.35	-2.73	-2.12	-1.50	-0.89	-0.27	0.35	0.96	1.58	2.20	2.82	
		-2	-3.50	-2.89	-2.28	-1.66	-1.05	-0.43	0.19	0.80	1.42	2.04	2.66	
		-3	-3.66	-3.05	-2.43	-1.82	-1.21	-0.59	0.03	0.64	1.26	1.88	2.51	
		-4	-3.81	-3.20	-2.59	-1.98	-1.37	-0.75	-0.13	0.49	1.11	1.73	2.35	
	-5	-3.97	-3.36	-2.75	-2.14	-1.53	-0.92	-0.29	0.33	0.95	1.57	2.19		
							grad ^{0.1625} [mrad/mm]							

CMS		Horizontal [mm]											rot [mrad]	
		5	4	3	2	1	0	-1	-2	-3	-4	-5		
V e r t i c a l (m m)	rot [mrad]	5	-3.47	-2.63	-1.79	-0.94	-0.10	0.74	1.59	2.44	3.29	4.14	4.99	
		4	-3.74	-2.90	-2.05	-1.21	0.21	0.59	1.33	2.18	3.03	3.87	4.72	
		3	-4.01	-3.16	-2.32	-1.48	0.51	0.45	1.06	1.91	2.76	3.61	4.46	
		2	-4.27	-3.43	-2.59	-1.74	0.82	0.30	0.80	1.65	2.50	3.35	4.19	
		1	-4.54	-3.70	-2.85	-2.01	1.13	0.15	0.53	1.38	2.23	3.08	3.93	
	grad ^{0.843} [mrad/mm]	0	-4.81	-3.96	-3.12	-2.28	-1.44	0.00	0.27	1.12	1.97	2.82	3.66	grad ^{0.849} [mrad/mm]
		-1	-5.08	-4.24	-3.40	-2.55	-1.71	-0.39	0.00	0.85	1.70	2.55	3.40	
		-2	-5.36	-4.52	-3.67	-2.82	-1.98	-0.78	-0.28	0.58	1.43	2.28	3.13	
		-3	-5.64	-4.79	-3.94	-3.10	-2.25	-1.17	-0.55	0.30	1.16	2.01	2.86	
		-4	-5.91	-5.07	-4.22	-3.37	-2.53	-1.56	-0.82	0.03	0.89	1.74	2.59	
	-5	-6.19	-5.34	-4.49	-3.65	-2.80	-1.95	-1.10	-0.24	0.61	1.47	2.32		
							grad ^{0.39} [mrad/mm]							

Conclusions

- Although never required/never done in the past for the alignment of the TAS, this radial bell effect could be mitigated by dual correction (Alignment in two steps: applying a precalculated vertical adjustment when adjusting the horizontal).



- More studies currently ongoing

- Thanks

Backup, status of TAS alignment

6 Results

The coordinates are given at the center of the survey target. See § 4 for point distribution and offsets of survey targets. **For the coordinate system definition, see §2.**

The precision of the measured co-ordinates is **0.5 mm in X, Y and Z-direction at one sigma level**, with respect to the ‘best’ low- β poles line in the machine. The final tolerance can be defined as 2 to 2.5 times this sigma.

The control measurement has been done with the JFS shielding and the additional plugs in TX1STM and JFS installed. At the beginning of the control measurement the permanent targets have been dismantled and replaced by RRR0.5 prisms for laser tracker.

REMARK: A new beam reference in Yphys-direction of +1.25 mm - higher than the LS1 position - has been defined in LS2.

ATLAS TAS-C measurement (closure) in UX15 (29.11.2024)							
	Position "YETS_24-25"			Nominal values		$\Delta = \text{Measured-Nominal}$	
Name	Xphys (m)	Yphys (m)	Zphys (m)	Xphys (m)	Yphys (m)	ΔX_{ph} (mm)	ΔY_{ph} (mm)
Points on reference targets							
TIGE_1	-2.7456	0.0286	-20.7161	-2.7463	/	0.7	/
TIGE_2	-2.7457	-0.0018	-19.1557	-2.7461	/	0.4	/
TIGE_3	0.0014	2.7459	-19.1860	/	2.7460	/	-0.1
TIGE_4	0.0212	2.7454	-20.7248	/	2.7461	/	-0.7

ATLAS TAS-A measurement (opening) in UX15 (27.11.2024)							
	Position "YETS_24-25"			Nominal values		$\Delta = \text{Measured-Nominal}$	
Name	Xphys (m)	Yphys (m)	Zphys (m)	Xphys (m)	Yphys (m)	ΔX_{phys} (mm)	ΔY_{phys} (mm)
Points on reference targets							
TIGE_5	-2.7445	0.0153	20.7438	-2.7452	/	0.7	/
TIGE_6	-2.7443	0.0072	19.1918	-2.7449	/	0.6	/
TIGE_7	-0.0208	2.7442	20.7510	/	2.7448	/	-0.6
TIGE_8	0.0062	2.7461	19.1822	/	2.7463	/	-0.2

Measurement on November 27th, 2024



The EDMS SU document, № ATL-J-UR-0153 (EDMS Id: 3221852), containing this report is at this address:

<https://edms.cern.ch/document/3221852>

The EDMS SU document, № ATL-J-UR-0152 v.1 (EDMS Id: 3221787), containing this report is at this address:

<https://edms.cern.ch/document/3221787>