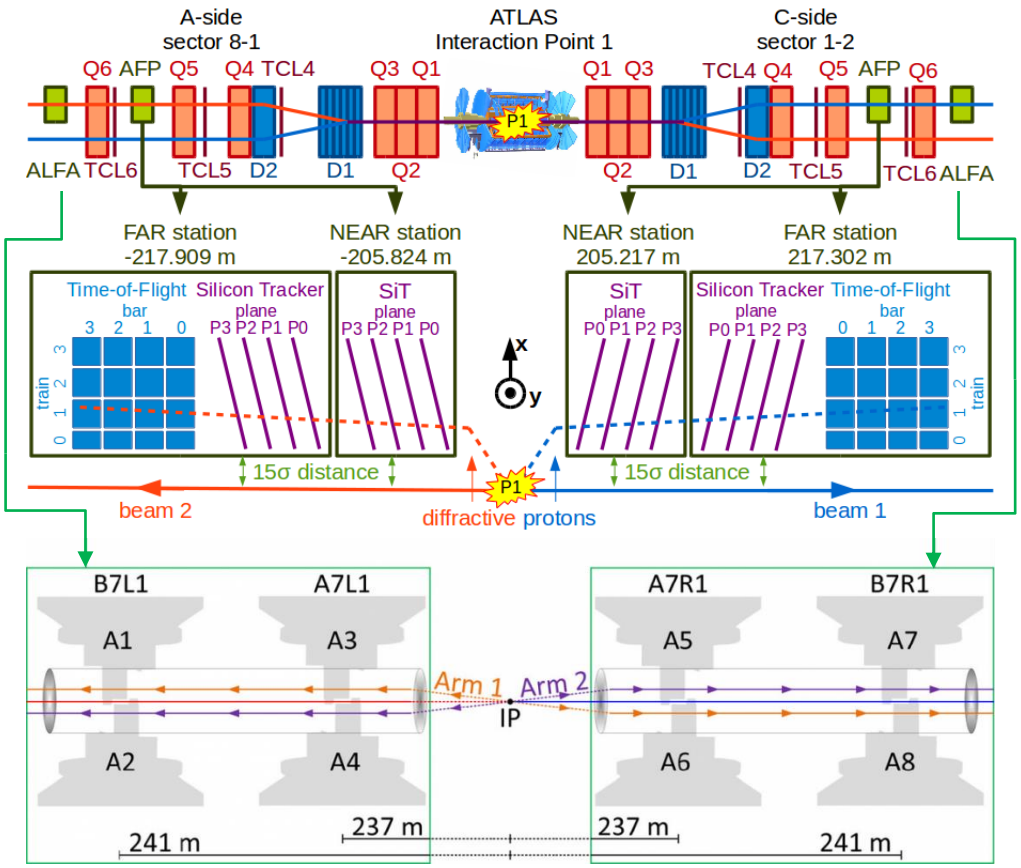
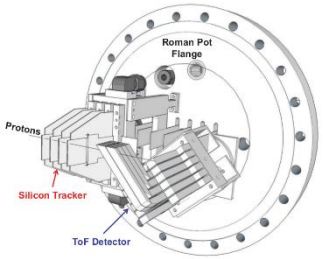
Readjustment of anti-collision switches for ALFA

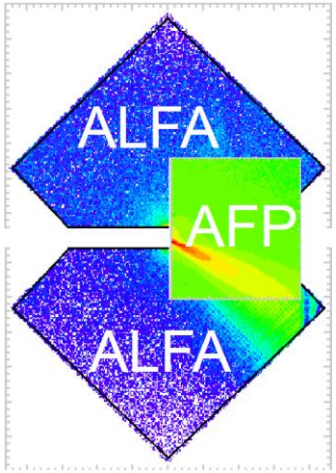
237th Machine Protection Panel Meeting (LHC)

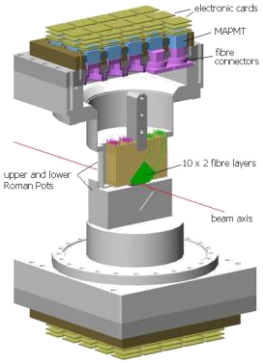


Marko Milovanovic

09.06.2023.

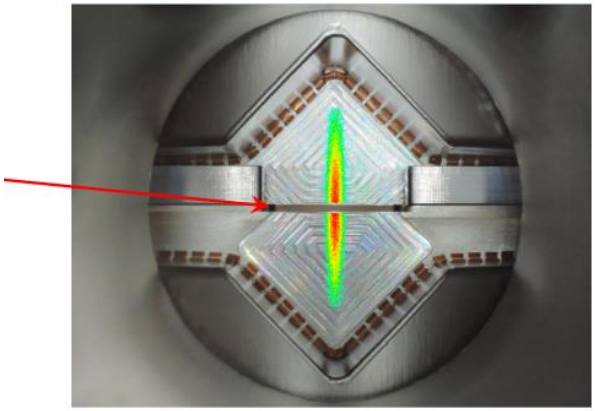


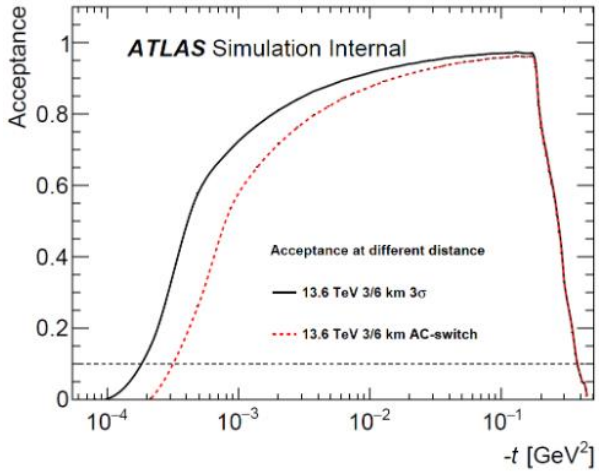




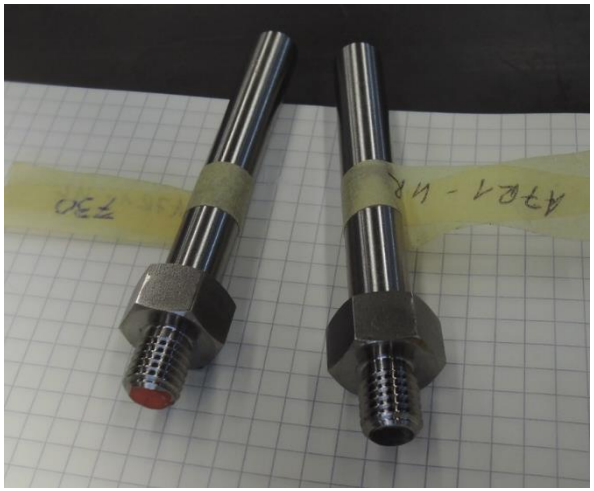
Motivation (*by Hasko Stenzel*)

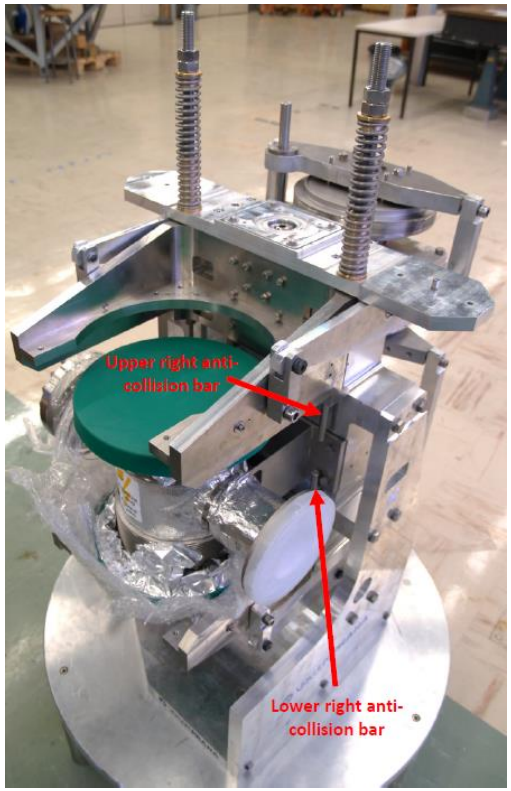
- Vertical distance of the between the detectors to the beam is a key parameter in detector performance
- According to simulations, the most optimum distance for this run would be 3 σ_y (1 $\sigma_y \approx$ 100 µm) => opening of 600 µm.
- The stations are equipped with an anti-collision safety system, which stops the RP movement when the opening is about ~1mm (700 µm distance between the pots + ~200-300 µm between the AC bars).
- At this distance, the acceptance is significantly degraded.
- Wanted to re-adjust the anti-collision switches during TS1 (reduce to 100-200 µm between the AC bars) to improve acceptance for this final ALFA run.
- In the meantime, we tested the current adjustment of AC-switch positions by means of moving the pots until their activation and monitoring the Resolver/LVDT values.
- Also checked with past distances at 2.5km and spotting potential improvements.

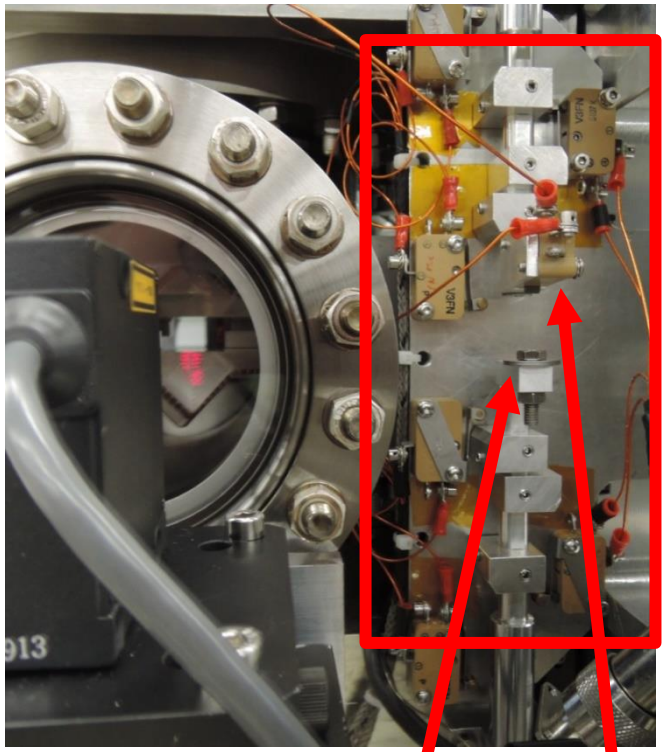




Reminder #1: Shortening of AC steel bars (*by Karlheinz Hiller*)







AC steel bars:

- Hardware stop if touching
  –> pots are ejected by motor overload
- Safety measure if AC-switch fails
- Margin reduced by machining
  from ~ 1.5mm to ~ 0.7 mm distance

AC switches:

- Standard protection against collision
- Adjusted to ~ 1mm
- Better precision by shims

AC-switch
no precision component !!!

Reminder #2: distances of AC-switch & bars (*by Karlheinz Hiller*)

Station A7R1	OUT switch	OUT stopper	HOME out	HOME in	IN stoppper	IN switch	OUT-IN stopper/mm
Upper RP	0.850	41.786	39.320	38.670	-3.017	-0.950	45.110
Lower RP	-0.950	-41.870	-40.720		3.060	0.310	45.775
	AC switch	AC bars					
	0.970	0.730					
Station B7L1							
Upper RP	0.675	#0	-1.975		#9118	-1.060	45.590
Lower RP	0.485	#0	1.200	2.000	#9006	0.685	45.030
	1.000	0.700					
Station A7L1							
Upper RP	1.170	#0	-2.250		#9053	-1.090	45.265
Lower RP	-0.895	#0	1.860		#9030	1.020	45.150
	0.940	0.650					
Station B7R1							
Upper RP	1.560	#0	-2.540		#9018	-0.850	45.090
Lower RP	-0.620	#0	1.570		#9011	0.740	45.055
	1.050	0.800					

- AC-distances about 1mm, steel bars react after 200 – 300 µm more movement
- This is the bare minimum, presented and accepted in LS1 at MPP meetings

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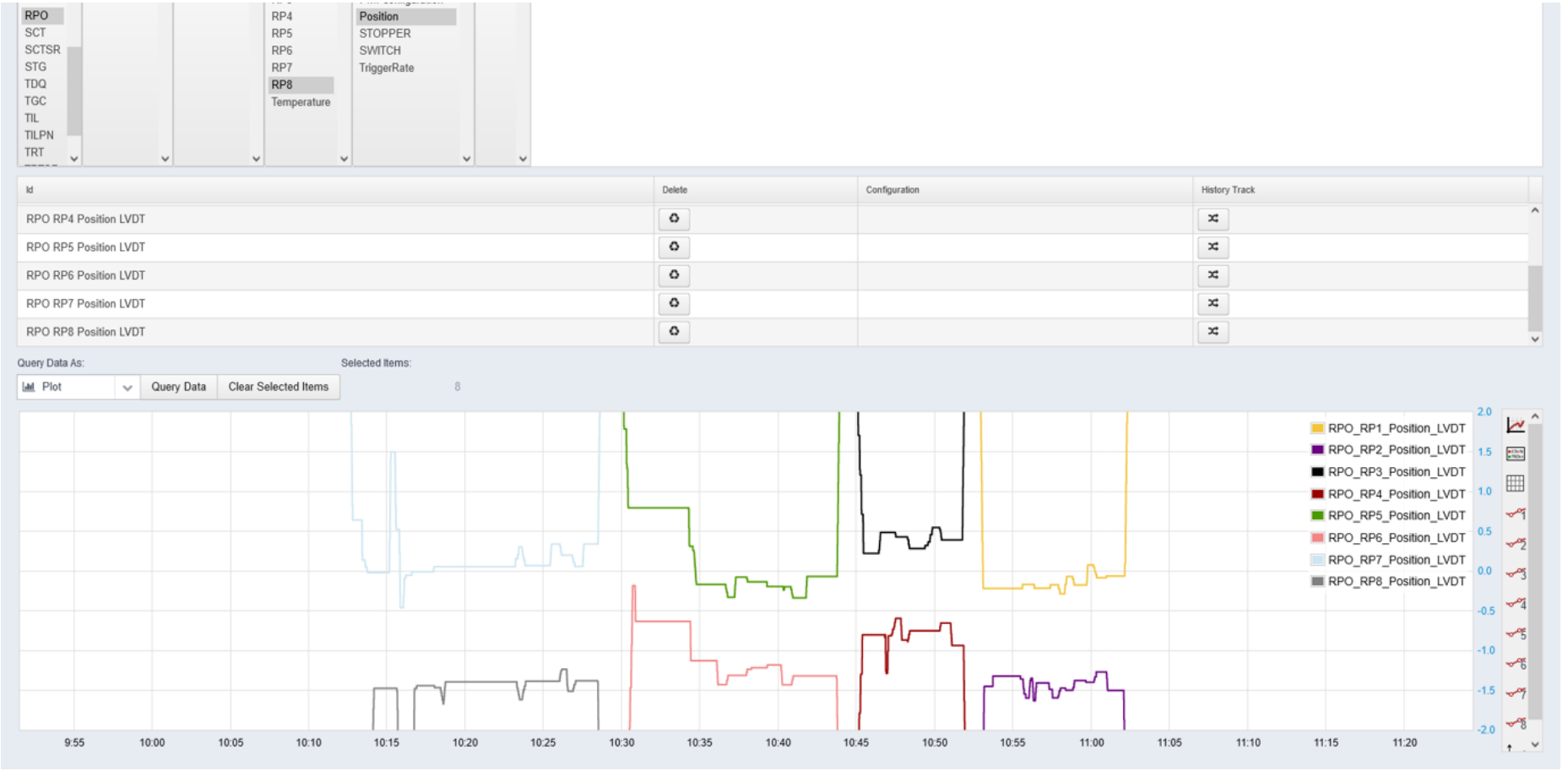
Checked LVDT values of distances (*by Karlheinz Hiller*)



AC-distances in Run2 and now (*by Karlheinz Hiller*)

Station	AC-distance Run2	Steel bars Run2	Gap	AC-distance 2023	AC-Target	Potential Reduction
B7L1	1.00	0.70	0.30	1.17	0.95	-0.20
A7L1	0.94	0.65	0.29	1.03	0.95	-0.10
A7R1	0.97	0.73	0.24	0.98	0.95	OK
B7R1	1.05	0.80	0.25	**1.44**	1.00	-0.45

- Too large distance for station B7R1, room for ~ 0.45 mm reduction.
- Other stations are basically fine, may be room for 0.1 – 0.2 mm reduction.
- **The striking criterion for any AC-distance is a minimum gap of at least 0.2 mm to the steel bars.**
  Reasoning: although we trust the LVDT calibration within 0.1 mm in absolute scales, and an overall offset cancels in the distance, one can not be 100% sure that the distance error from LVDT values is not > 0.1 mm.

Proposal for an adjustment (*by Karlheinz Hiller*)

- Move the pots in AC-distance.
- Measure the gap by gauges … to my mind the smallest unit is 50 µm .
- If the gap is > 0.3 mm try to reduce it.
- Since the adjustment within 50 µm is very, very difficult with the given mechanics stop the activity if the gap is between 0.2 and 0.3 mm.

In case of people wants more reduction please discuss with MPP …

For AC-distance of 1 mm the distance between detectors is about:

- 1.0 mm(AC-distance) + 0.1 mm(safety before AC touch) + 2 x (0.35-0.45 mm) (window + gap) = **1.8 – 2.0 mm .**
- The detector distances of the 2.5 km data were in the range **1.7 – 2.0 mm**, consistent with expectations for 3/6 km.

> Following any re-adjustment, BIS revalidation would be re-done during TS1.

Backup

Backup slides.