

THE VLT DELAY LINE RAILS ALIGNMENT SYSTEM BY FOGALE NANOTECH

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FOGALE nanotech developed for ESO a system to align the VLT. This system has been successfully tested during the installation and alignment of the Coudé Rotating Platform of the 8.2 m VLT telescope.

A. Alignment System of the Delay Line.

The **Figure 1** proposes a solution for the alignment of the carriage of the Delay Line based on the use of a stretched wire and a water level system that materialise the spatial reference. A sensor (WPS-2D) located on the carriage measures the two lateral positions. One inclinometer and a laser telemeter allow also the characterisation of the other degrees of freedom : the rotation around the longitudinal direction and the position of the carriage along the 66 m track. Each sensor delivers an analogic output signal that allows to visualise, in real time, the carriage positions. This information is used to apply correction on the rail alignment as shown in **Figure 2**.

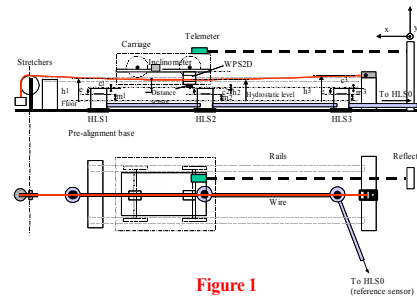
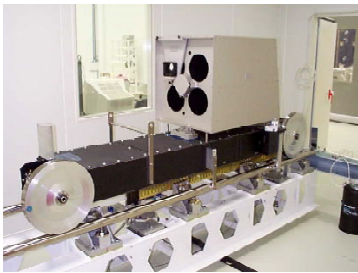


Figure 1

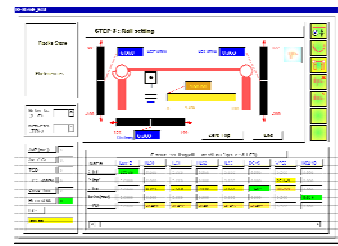


Figure 2

B. Test of the VLT Delay Line Alignment system on the Coudé Rotating Platform.

Each VLT telescope is equipped with one Coudé Rotating Platform that provides a circular flat surface for the mounting, alignment and access to optical instrumentation.

The Coudé Rotating platform allows optical equipment to be rotated (Tracking Mode) and positioned around the telescope azimuth axis within specified tolerances.

Platform alignment

During the installation of the two first Coudé Rotating Platforms, part of the alignment system developed by **FOGALE nanotech** for the Delay Line has been used.

Picture 1 gives the first step of the installation of the platform. The circular beam is adjusted in 12 points using the water levelling system (HLS). One HLS is located in a reference plate that gives the absolute horizontal position, the second HLS is located on the rail where the vertical position is adjusted within an accuracy of few hundredths of millimetre to achieve the perfect balance between the two sensors.

The second step is to align the circular rail on the top of the pre-aligned beam. **Picture 2** shows how the rail is aligned : 4 HLS are connected together and are placed on a rail section. The vertical position is adjusted with edges and clamps to have the balance between the 4 HLS within about 10-micron accuracy.

The last step is to check of the alignment when platform is mounted on the rail. Four HLS are located at 4 referenced points on the top of the platform as shown in **Picture 3**. The platform is rotated and the vertical displacement of each point is measured. The Table 1 gives the final results of these measurements. HLS1 and HLS4 were placed at 2550 mm from the rotation axis and HLS2 and HLS at 850 mm from the axis. The maximum displacement is about 65 μm for the external sensor and 30 μm for the two central sensors. That gives tilt amplitude (PtP) of about 7 arcsec in RMS.

Ref #	0°	30°	60°	90°	120°	150°	180°	210°	240°	270°	300°	330°
HLS1	0	1	9	-8	-8	-15	-34	-21	-63	-42	-50	-24
HLS2	0	-9	1	9	8	21	-9	-12	-13	7	9	6
HLS3	0	-6	-2	11	9	25	15	13	32	30	39	15
HLS4	0	16	-6	-13	-12	-14	40	39	67	23	23	13

Table 1 Vertical relative displacements of the Coudé Rotating Platform measured in four reference points. All values are given in μm with a measurement accuracy of $\pm 5 \mu\text{m}$.



Picture 1



Picture 2



Picture 3

Picture 1 : Alignment of the lower track of the VLT Coudé Rotating platform. The HLS sensor located in the center gives the absolute reference plane, the HLS on the track measure the vertical displacement to be applied to the track.

Picture 2 : Alignment of a section of the circular rail of the VLT Coudé Platform. Four HLS measure the vertical position of the rail.

Picture 3 : Alignment check of the VLT Coudé Platform. Four HLS measure the vertical displacement while the platform is rotated.