Introduction.

This document briefly summarizes the activities performed during the ESPRESSO instrument intervention between May 1st and May 17th, 2022 and changes observed in the instrument performance. The activities were performed in the context of the cryostats repair and detectors activities, aimed at improving the instrument stability and overall performance. Here a summary of the main activities done:

- Repair and reassembly of the blue and red cryostats, including fixing all temperature sensors, decoupling the mechanical link between the cold finger and the detector mount, adjustment and verification of the temperature control loops. These activities were performed mainly to improved the stability, particularly on the blue side.

- Replacement and validation of the Front End Boards in the NGC systems, addressing the quantization issues noticed especially in the fast readout mode, and implementing the correct synchronization in the NGCs systems

- Fix and validate read-out noise performance, especially in the blue detector.

Post-intervention results.

1) Spectral format change.

After the intervention a small shift of the line and orders position was found, in both x- and y- direction (cross-dispersion and dispersion direction, respectively) and in both the red and blue detectors. Figures 1 and 2 show and example of the position of a ThAr line in the red and blue detectors, before and after the intervention. As can be seen the centroid of the lines in the red detector have moved by around -0.5 [pix] and -1.1 [pix] in x- and y-direction, respectively. Similarly, it can be seen an absolute shift in the blue detector of around +1.6 [pix] and -1.6 [pix] in the x- and y- direction, respectively. Given that these shifts are relatively small, the current version of the pipeline (version 2.4.3) was able to properly reduce the new HR1x1 and HR2x1 data. However, for the HR4x2 and MR4x2 mode the pipeline crashes when computing the FP wavelength calibration. This will be fixed in the new pipeline version.

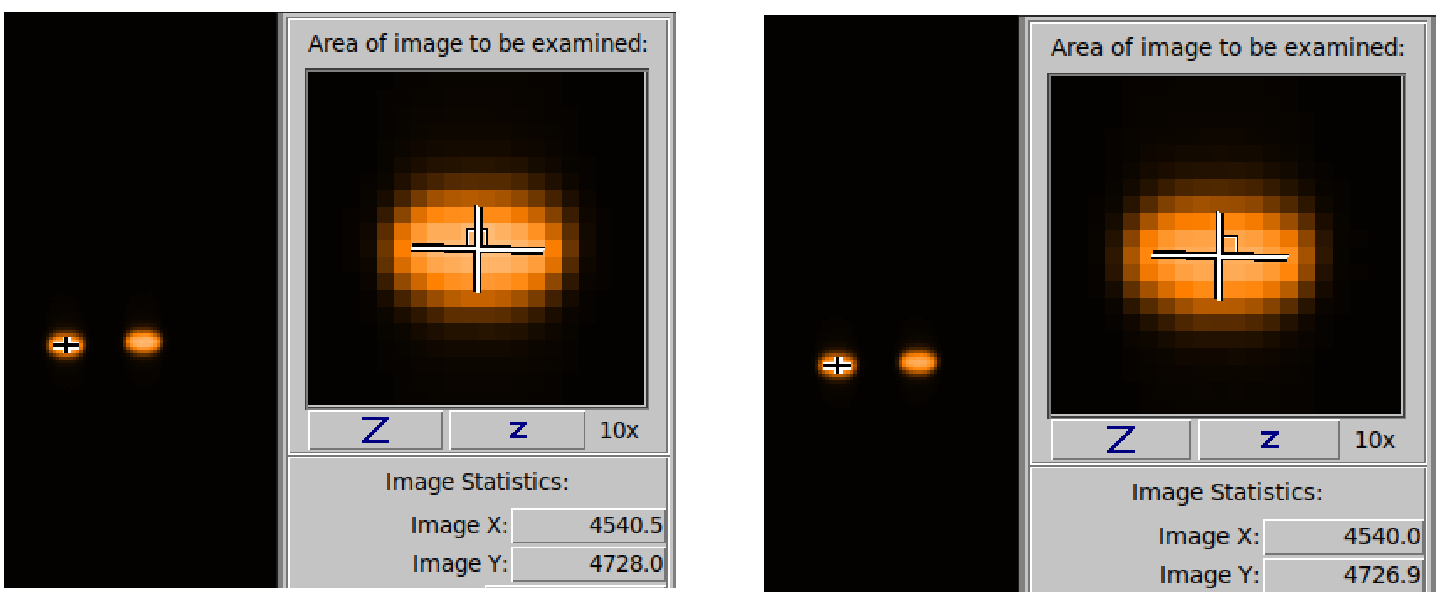

Figure 1: Position of a ThAr line in the red detector. Image taken before (left) and after (right) the intervention.

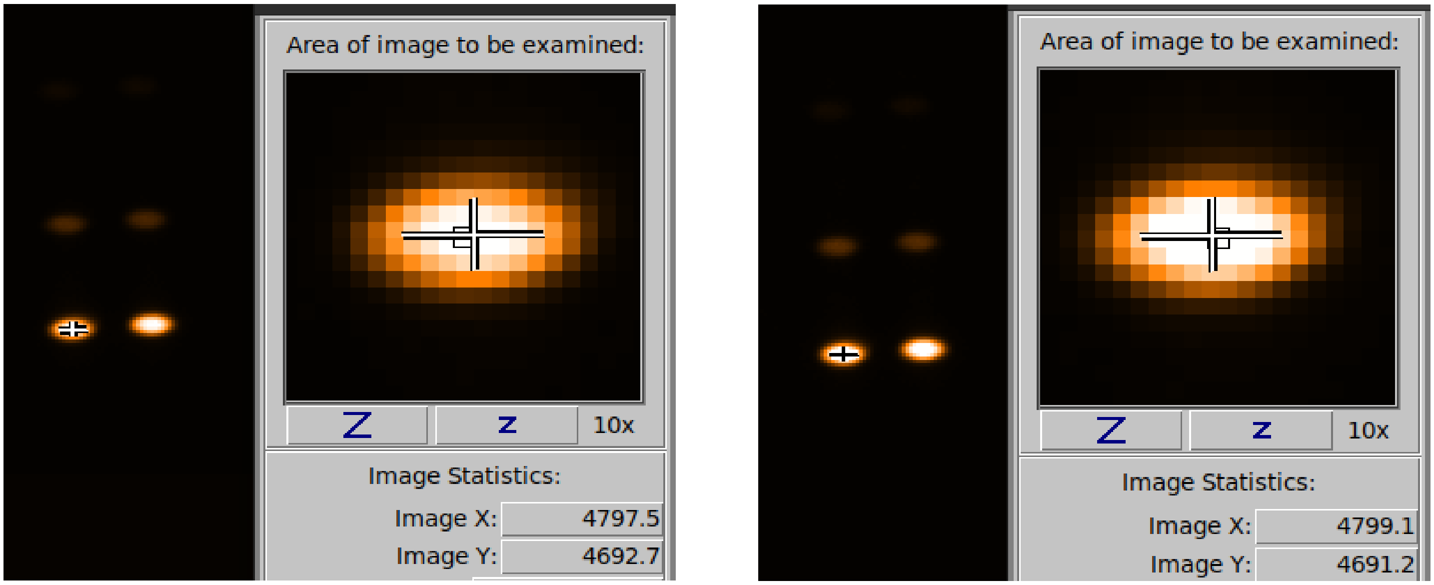

Figure 2: Same as Figure 1, but for the blue detector.

2) Internal stability.

To assess the internal instrument stability several Fabryt-Perot (FP) sequences were obtained, which were used to compute the instrumental drift. Figure 3 show the evolution of the spectral drift in the red and blue detector between May 23rd – May 26th while the instrument was still reaching a full thermal and pressure stability. Similarly, Figure 4 shows a short sequence of drift obtained on April 27th (before the intervention) and May 30th, after the instrument reached a high stability level. As can be seen the stability in the blue drastically improved after the intervention.

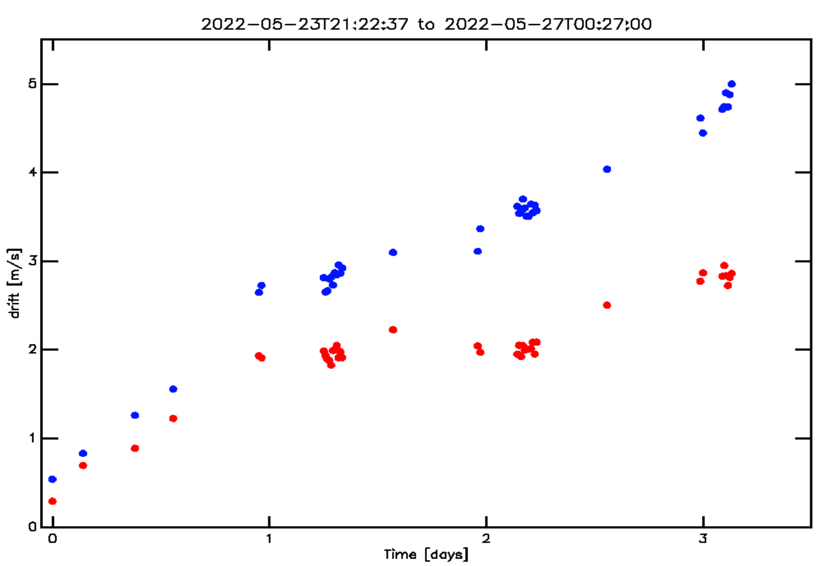

Fig 3: Spectral drift as a function of time from the FP-FP sequence, for the red and blue detectors (red and blue dots, respectively). The sequence contains data taken between May 23 and May 26. The values correspond to the mean drift of the 2 slices.

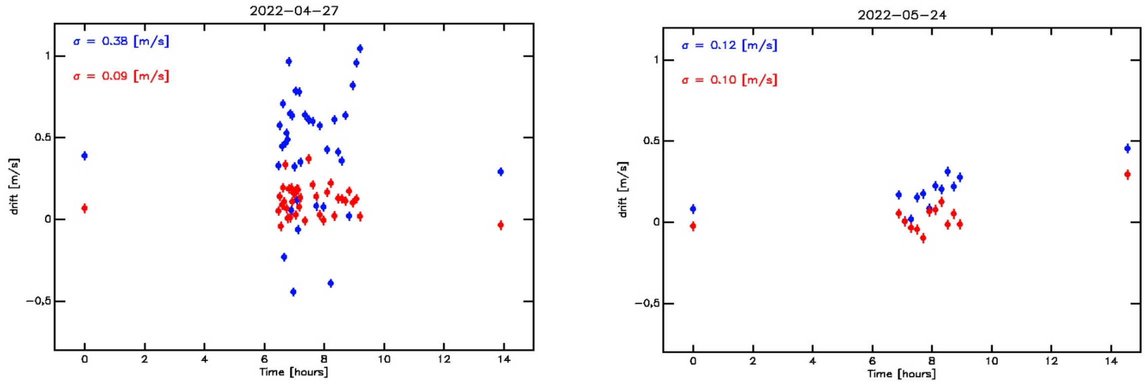

Fig 4: Same as Figure 3, but before (left panel) and after (right panel) the intervention.

2) On-sky performance.

To assess the on-sky stability, several spectra of the radial velocity standard star HD85512 were collected before and after the intervention. Figure 5 shows the resulting RVs for the HR1x1 and HR2x1 modes. As can be seen there is no obvious RV offset between pre- and post-intervetion data. However further data and a more detailed analysis is mandatory will to properly characterize any potential (chromatic) offset.

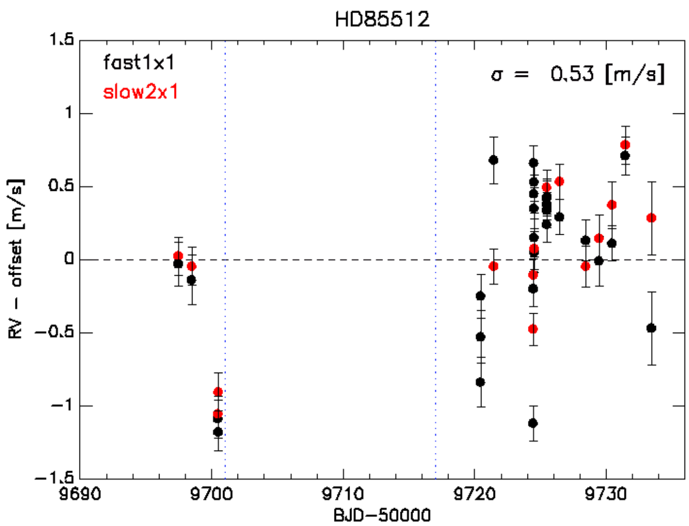

Figure 5: Radial velocity variations of HD85512 as a function of time, for the HR fast_1x1 and slow_2x1 read-out modes (black and red dots, respectively). The blue dotted lines mark the beginning and end of the intervention.