6.2 Moon in FOV

Attitude acquisition with Moon in FOV has been performed in order to check the sensor capability to acquire the initial attitude and to maintain the tracking when the Moon enters the FOV of STR. At the time of test (April 11st 2022, 22:00), moon was 65% growing (Figure 6.2-1a)

Due to the surrounding building, it was not possible to bring the Moon in middle FOV. In addition, because the rotating table was not available (as discussed in section 5), the tilt of the Star Tracker was oriented by hands. A very stable orientation of AA-STR MK II was not possible during the acquisition.

For the above reasons, only one acquisition was possible with Moon in FOV. However, as discussed in the following, it was sufficient to demonstrate the proper working of the AA-STR MK II with the Moon in FOV.

Figure 6.2-1b shows the position of the Moon w.r.t. the building (photo taken by smartphone fotocamera).

Figure 6.2-2 shows a full frame images acquired through OHM commanding the FOTO mode with Texp= 200ms before than TC_AAM is sent. The area masked by the Moon is visible as well as the shape of the surrounding building roof.

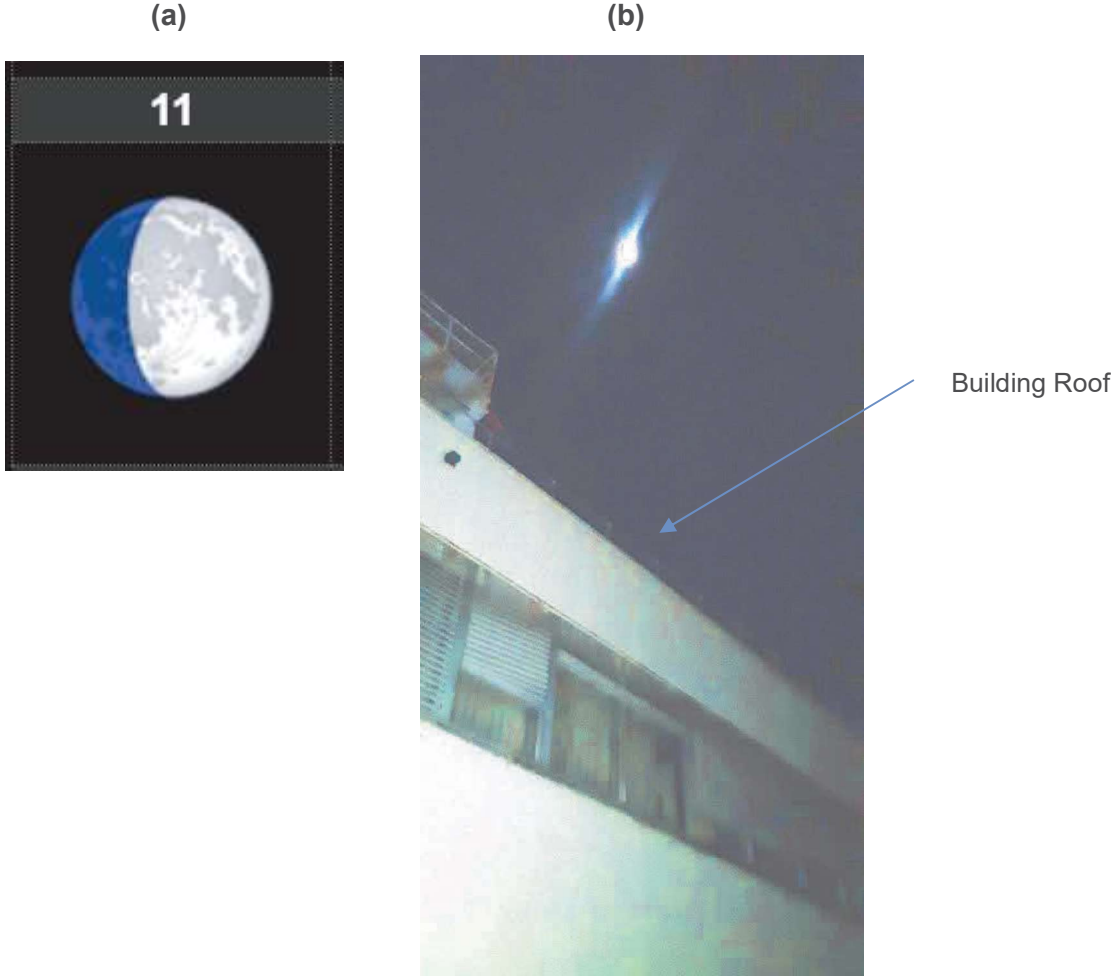

Figure 6.2-1: (a) Moon phase on April, 11st 2022; (b) Moon position w.r.t. building (smartphone's photo)

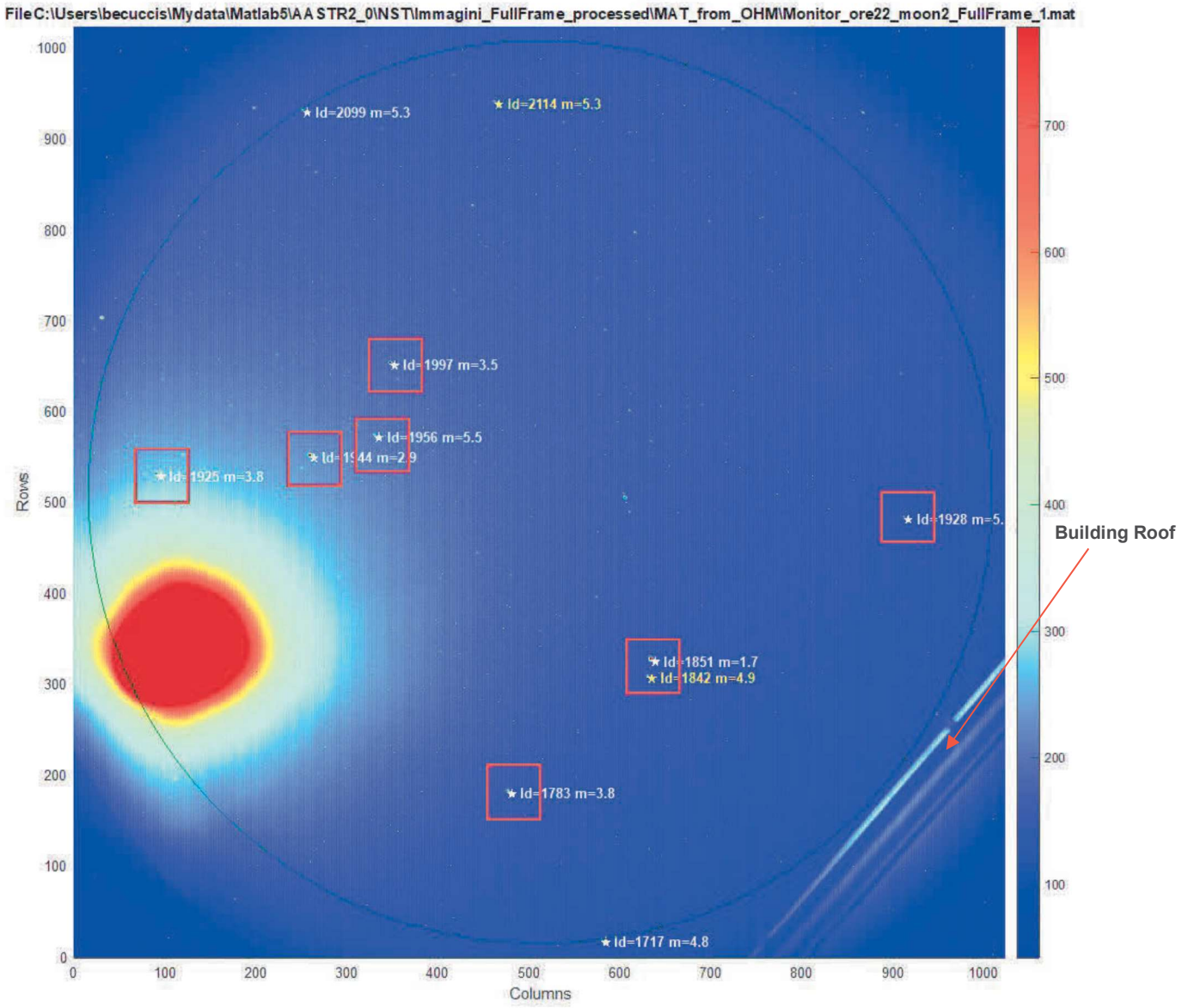

Figure 6.2-2: Full frame acquisition with Moon in FOV.

NOTE: The star positions expected in first ATM cycle are superimposed to the image. The red boxes indicate the stars tracked in first ATM cycle

Expected diameter of the Moon viewed from Earth is about 0.50 deg (corresponding to ~25 pixels).

It can be noticed that Moon spot on APS (saturated region) is about 50 rows x 50 columns of pixels, this can be justified by atmosphere effects. Its 'enlarged' shape is also due to the PSF of the optical system of STR, that is focused on the centre of the FOV and become more defocused as the edges of APS are approached.

It should be noted that Moon influence is significant in a region larger than 50x50 pixels (where DN are saturated to the maximum value of 4095):

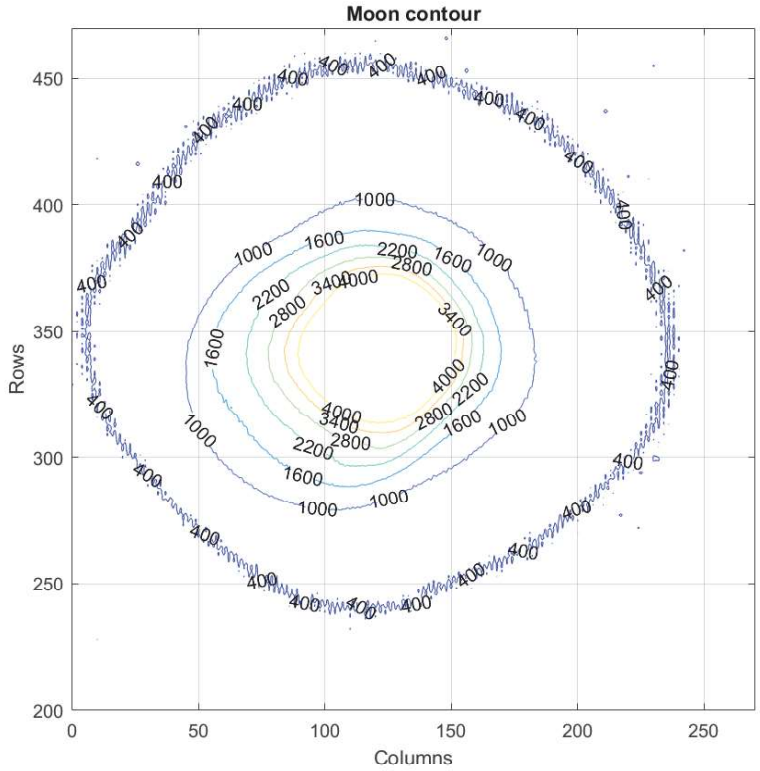

Figure 6.2-3: Zoom of Moon contour (level curve at 400, 1000, 1600, 2200, 2800, 3400 e 4000)

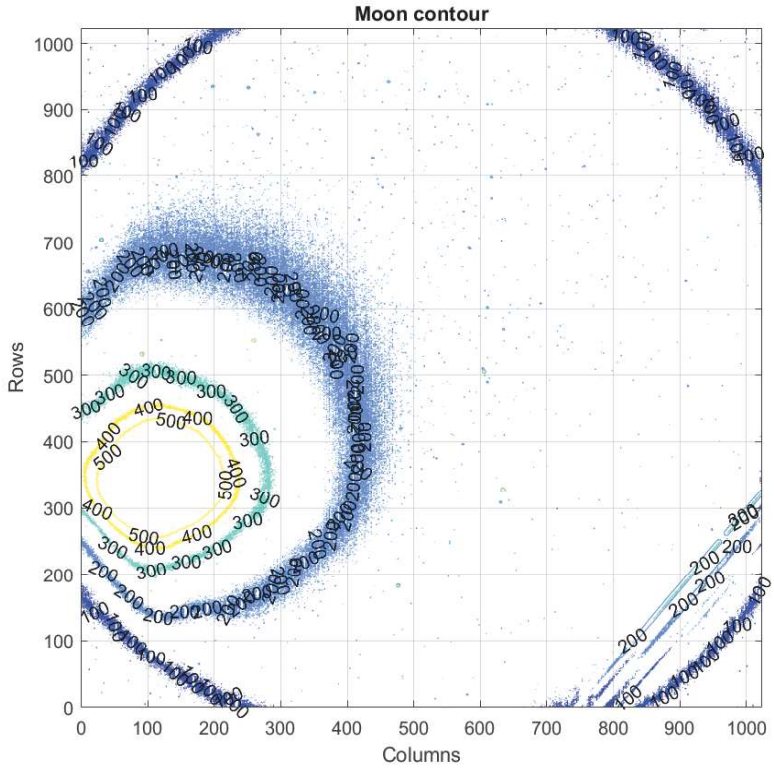

Figure 6.2-4: Signal level curve over the full FOV (at 100, 1000, 300, 400 e 500DN)

Figure 6.2-3 reports the zoom of the Moon signal in terms of signal level curve, while **Figure 6.2-4** provides the signal levels curve over the full FOV. **Figure 6.2-4** clearly states that the Moon ghost is not visible (under the noise signal).

6.2.1 Attitude acquisition and Tracking with Moon

Attitude acquisition was performed in 1.6s, and attitude tracking was maintained without any interruption (**Figure 6.2-5**) in a poor condition of star availability (9 for pattern recognition,~7 available for tracking) with Moon in FOV.

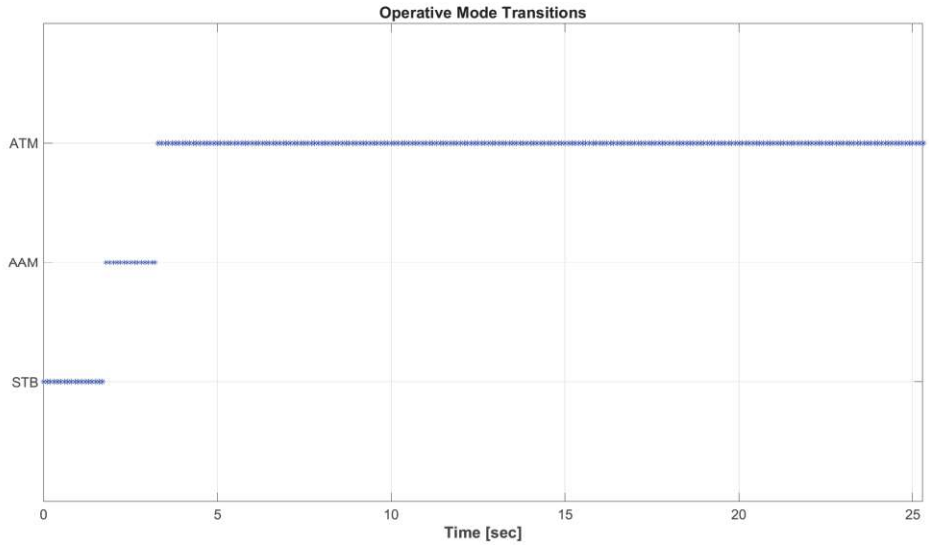

Figure 6.2-5: Operative mode transitions with Moon

The first attitude quaternion has been processed to retrieve the optical axis co-ordinates (declination right ascension and) in the J2000 reference frame: The values retrieved are:

- RA_{MEAS} = 152.00 deg
- DEC_{MEAS}= 23.47 deg
- $TILT_{MEAS}$= -176.03 deg

The measured attitude during ATM, expressed in celestial coordinates in the J2000 reference frame (Right Ascension, Declination, Tilt) is plotted in Figure 6.2-6.

Figure 6.2-7 shows the angular rate estimation.

As it can be noticed, the “unstable” orientation of the AA-STR MK II is also visible from the recording of attitude evolution and angular rate.