

# The Online Observation Quality System for the ASTRI Mini-Array

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The ASTRI Mini-Array (MA) is an INAF project aiming to construct and operate an experiment to study gamma-ray sources emitting at very high energy in the TeV spectral band and to perform intensity interferometry observations. The ASTRI MA consists of an array of nine innovative dual-mirror Imaging Atmospheric Cherenkov Telescopes (IACTs). Each telescope will be equipped with the new ASTRICAM Silicon photomultiplier Cherenkov camera managed by a fast read-out electronics specifically designed and managed by the Cherenkov Camera Software Supervisor. Furthermore, the ASTRI-MA will also perform intensity interferometry observations of a selected sample of bright sources being each telescope equipped with a Stellar Intensity Interferometry Instrument SI<sup>3</sup>. The ASTRI MA's nine telescopes will be distributed at one hundred meters of distance from each other at the Teide Astronomical Observatory, operated by the Instituto de Astrofísica de Canarias (IAC), on Mount Teide (2400 m a.s.l.) in Tenerife (Canary Islands, Spain) and INAF will operate it by on the basis of a host agreement with the Instituto de Astrofísica de Canarias (IAC).

The ASTRI MA must be operated remotely, and no human presence is foreseen on-site during observations. A data centre will be installed on-site to have computing power close to the telescopes. The Online Observation Quality System (OOQS) aims to perform the data quality check in real-time during the observations and inform the specific ASTRI MA sub-systems if anomaly conditions are detected within the data. With this workflow, it is possible to take automated corrective actions or notify the Operator if the data acquired by the telescopes do not respect the quality standards.

The OOQS system architecture comprises the following software components: OOQS Master, OOQS Manager, Cherenkov Camera Data Quality Checker SI<sup>3</sup> Data Quality Checker. The first two components are implemented with the Alma Common Software (ACS).

The OOQS is controlled by the Central Control System, part of the ASTRI MA Supervisory Control and Data Acquisition system (SCADA) that starts and stops OOQS instances for each telescope through the OOQS Master component. The OOQS Master ACS component is the interface between the Central Control System and the OOQS. It can manage the components' life cycle and monitor them during the operations. The quality checks on the data are performed by the data quality software (CCDQC or SI<sup>3</sup>DQC) that receives the input data from the Array Data Acquisition System (ADAS) through the Redis Pub-Sub service, following the Publish–Subscribe paradigm. The results of these quality checks are saved into the Quality Archive and can be visualised by the Operator through a web Operator Human Machine Interface (HMI). During the quality check analyses, the software can detect anomaly conditions that are sent to the OOQS Manager that forwards them to the Alarm System and the Central Control System.

The OOQS software is under version control with the Git software, and the repository is stored in the Gitlab instance hosted by the INAF ICT department. A continuous integration (CI) pipeline is implemented following the DevOps principles using the Gitlab CI features to build and test the OOQS software when the source code is updated. The CI pipeline is executed in a container where all the required software and libraries are installed. The execution of the pipelines is performed in a remote server configured as a Gitlab Runner.