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DAT Requirements

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Caltech

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Abstract

We summarize the WBS L2 Data Management subsystem (DAT) requirements. This includes performance of the post-processing system, size of on- and off-site storage systems, performance of a metadata database, and interfaces requirements.

# Introduction

The Data Management subsystem (DAT) is responsible for receiving data from the Radio Camera Processor (RCP) and converting it into science ready data products served to the public archive (ARC). DAT is composed of a post-processing computing system, an on-site storage system, a database to store metadata, and an off-site redundant data store.

The post-processing system is co-located with the RCP computing system will run a set of pipelines on a compute cluster to generate the output science-ready products. RCP and the post-processing system share a data storage system and both have access to the metadata database. The off-site storage system is in a physically distinct location to ensure reliable backup. ARC holds and processes another off-site copy of a subset of data products to be served to the public.

Here, we define the requirements for the DAT subsystem, as motivated by the science requirements and science reference document.

# Requirements

Table 1. Requirements table

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| System Requirement | Baseline | Baseline notes | Descope | Descope notes | Desirement | Desirement notes | Science Req Reference |
| Sustained receiving of output of RCP | Record >98% of 14290 image channels per 10.3 min = 23 GB/s | Receiving happens within RCP node in baseline. |  |  |  |  | ScR-0013, ScR-0026,  ScR-0027,  ScR-0028 |
| Distributed storage on RCP nodes | Save 3 days of field images on RCP node | DAT processing before mosaicking requires some latency and tolerance to field-based failures/reobservations |  |  |  |  | ScR-0013, ScR-0026, ScR-0027, ScR-0028 |
| On-site storage system read/write speed | 2.8 GB/s write and read simultaneously. | Centralized storage can receive compressed mosaics |  |  |  |  | ScR-0002, ScR-0014 |
| On-site centralized storage system size | 30 PB | Able to hold a 4-month epoch of compressed mosaics for all channels. |  |  |  |  | ScR-0014, ScR-0015, ScR-0026,  ScR-0027,  ScR-0028 |
| Off-site storage system size | 30 PB | Able to hold a 4-month epoch of compressed mosaics for all channels. |  |  |  |  | ScR-0014, ScR-0015, ScR-0026,  ScR-0027,  ScR-0028 |
| Post-processing cluster node/core count | For recording rate of 2.8 GB/s, 5\*2.8=14 nodes required for stream processing | Streaming post-processing 5x faster than a rate-limiting step of 1 GB/s |  |  |  |  | ScR-0008, ScR-0011, ScR-0013, ScR-0017,  ScR-0018,  ScR-0019,  ScR-0020,  ScR-0021,  ScR-0022,  ScR-0023, ScR-0024 |
| Post-processing server memory | Read/process/write 2x2.2 GB/mosaic-channel | For stacking and source detection/extraction |  |  |  |  | ScR-0008, ScR-0011, ScR-0013, ScR-0017,  ScR-0018,  ScR-0019,  ScR-0020,  ScR-0021,  ScR-0022,  ScR-0023, ScR-0024 |
| Data state database speed, reliability, and size | 3 Gigarow database, >99% uptime, peak write rate of 1000 rows/s | Number of image chan-pols plus other outputs |  |  |  |  | ScR-0013,  ScR-0014 |
| Astrometrically-correct, artifact-free mosaicking of images | ScR-0008 requires 95% sky covered within 1.1x thermal noise limit |  | ScR-0008 requires 90% sky covered within 1.1x thermal noise limit |  |  |  | ScR-0001,  ScR-0008,  ScR-0023,  ScR-0024 |
| Bright source sidelobes below noise in individual channel images | Deconvolution of Stokes I MP images |  |  |  | Deconvolution of Stokes I MP and NL images |  | ScR-0001 |
| Astrometrically-correct, artifact-free stacking of images | ScR-0008 requires 95% sky covered within 1.1x thermal noise limit |  | ScR-0008 requires 90% sky covered within 1.1x thermal noise limit |  |  |  | ScR-0001,  ScR-0008,  ScR-0023,  ScR-0024 |
| Slow radio transient discovery | Fewer releases or no special treatment for transient identification outside of 3 public data releases |  |  |  | Deep, first epoch will be used in quick-look image subtraction algorithm via on-site pipeline. Preserve Stokes I field images for intra-field transient detection. |  | ScR-0005,  ScR-0014,  ScR-0015 |
| Extraction of HI image cubes from stacks | 1e7 galaxies covering 10,000 spaxels each | Using a priori catalog of sources |  |  | Detect HI on full, stacked mosaics | Big change in storage volume to find “dark” HI sources | ScR-0035 |
| Extraction of polarized image cubes from image stacks | 1e7 sources covering 3x3x605 poxels | 20 microJy Stokes I | 1x1 |  | Extended source detection and extraction |  | ScR-0033,  ScR-0034 |
| Fiber bandwidth from site to off-site data store | 100 Mb/s average |  | No fiber backhaul; disks shipped off site |  | 1 Gb/s average |  | ScR-0014, ScR-0015, ScR-0026,  ScR-0027,  ScR-0028 |
| PSF calculation for sidelobe identification in public archive processing | PSF calculated and provided at fixed grid of points in mosaic | PSF should identify sidelobes of 100 mJy sources that are >5sigma in Stokes I continuum image | One PSF per field |  | PSF calculable on demand at any point in field or mosaic image |  | ScR-0033,  ScR-0034,  ScR-0035 |
| Scales for source recovery (via convolution in the image plane) | PSF, 10”, 30”, 1’, 3’, 10’ |  |  |  |  |  | ScR-0031 |