General info on the Euclid DM

Overview of the OU-MER Data Model

What you need to know to work with OU-MER data products

- Current version of the Euclid DM: 10.1.2
- Official DM XML schema: ST_DataModel
- Official DM FITS definition: ST_FitsDataModel
- Data Product Description Document: DPDD

- `DpdMerBksMosaic`: Background-subtracted mosaics, one for each input band
- `DpdMerDetectionMosaic`: Mosaics used to perform the object detection: VIS and NIRSTACK
- `DpdMerSegmentationMap`: Map showing the connected pixels of the objects detected on the corresponding detection mosaics (VIS+NIR)
- `DpdMerFinalCatalog`: Final merged catalogs with photometric and morphological information

The Euclid DataProduct: XML schema

In Euclid a DataProduct (Dpd) is a combination of XML and FITS files:

- the FITS file contains the actual data
- the XML container wraps the FITS file an contains the metadata needed by the Euclid Data Product System (DPS)

> **Note**
>
> The XML schema defines the database table used to store the Dpd in the archive

All the Dpds share a common generic Header and have a specific Data container.

XML Header

All the Euclid products have a common `Header`, containing some metadata:

▶ Header

Most of this information is usefull at SGS level, but the `DataSetRelease`, for instance, is a good way to query the product you need.

```
<DataSetRelease>DR1_R1</DataSetRelease>
```

> **Note**
>
> Usually, the SGS circulate internally the `DataSetRelease`. The latest releases of interest are:
>
> - Q1_R1
> - REGREPROC2_R1
> - DR1_R1

The Data container

The information related to the specific product is in the `Data` container:

▶ Data

To query products, some usefull `Header` fields are:

```
<DataSetRelease>Q1_R1</DataSetRelease>
<ManualValidationStatus>UNKNOWN</ManualValidationStatus>
```

and dealing with `Data`:

```
<TileIndex>101547135</TileIndex>
<PatchIdList>98</PatchIdList>
<ObservationIdList>4877 ... 4981</ObservationIdList>
<ProcessingMode>DEEP</ProcessingMode>
```

> **Warning**
>
> Usually it's better to filter out INVALID products:
>
> **ManualValidationStatus != INVALID**

Each proper FITS table is referenced in the dedicated data container:

MER Final Catalog

```
<DataStorage format="mer.finalCatalog" version="0.10">
    <DataContainer filestatus="PROPOSED" checksumMethod="MD5" checksumValue="44c4dd43d06091a697dc5839abc758f2">
        <FileName>EUC_MER_FINAL-CAT_TILE101547135-D287B9_20250517T074604.847830Z_00.00.fits.gz</FileName>
    </DataContainer>
</DataStorage>
```

MER DEEP bands Catalog

```
<DeepFieldPhotometryCatalogStorage format="mer.deepFieldPhotometryCatalog" version="0.4">
    <DataContainer filestatus="PROPOSED" checksumMethod="MD5" checksumValue="2e0b3a21b5280c4202f7693e2032242a">
        <FileName>EUC_MER_FINAL-DEEP-PHOTO-CAT_TILE101547135-D287B9_20250517T074604.847830Z_00.00.fits.gz</FileNa
    </DataContainer>
</DeepFieldPhotometryCatalogStorage>
```

> **Important**
>
> The DeepFieldPhotometryCatalogStorage is created **only in DEEP mode**

MER Morphology Catalog

```
<MorphologyCatalogStorage format="mer.finalMorphologyCatalog" version="0.4">
    <DataContainer filestatus="PROPOSED" checksumMethod="MD5" checksumValue="e10c1961915247c69eefdcc56e4bc433">
        <FileName>EUC_MER_FINAL-MORPH-CAT_TILE101547135-790AFB_20250517T074603.604694Z_00.00.fits.gz</FileName>
    </DataContainer>
</MorphologyCatalogStorage>
```

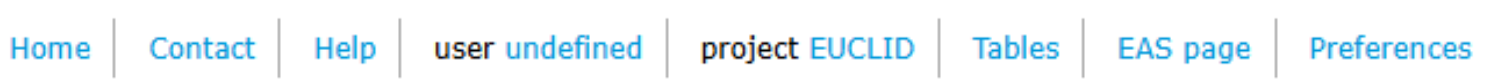
MER Cutout Catalog (currently used by SIR only)

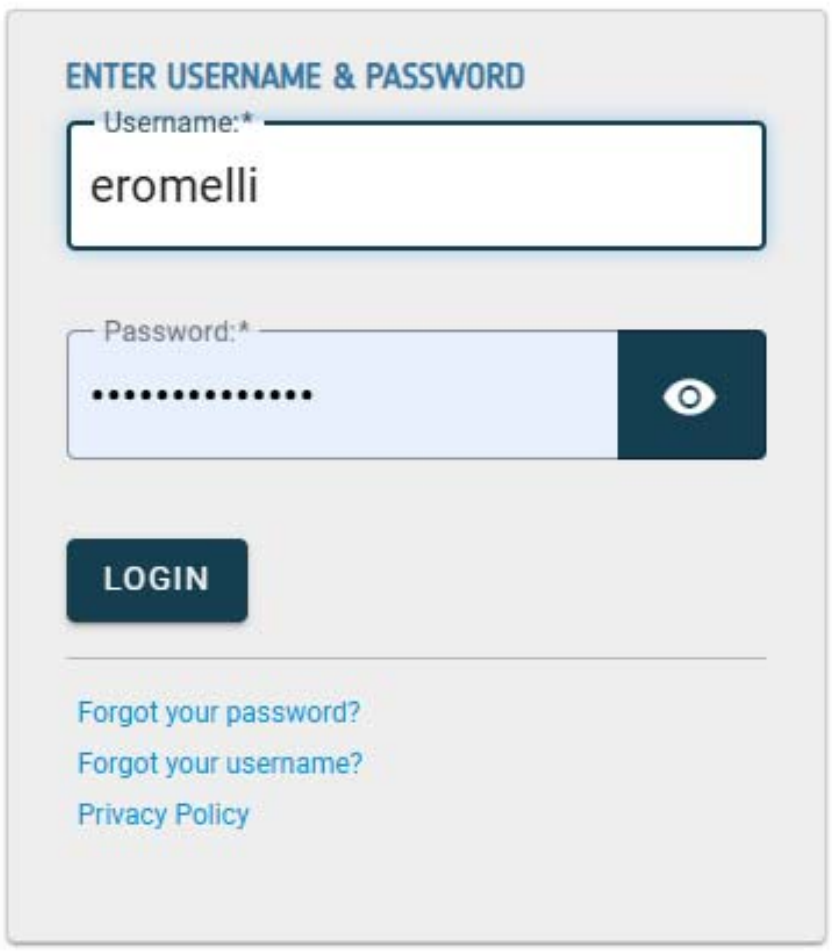
```
<CutoutsCatalogStorage format="mer.cutoutsCatalog" version="0.9">
    <DataContainer filestatus="PROPOSED" checksumMethod="MD5" checksumValue="654603cbd9983bf42bd61def90d3d6bb">
        <FileName>EUC_MER_FINAL-CUTOUTS-CAT_TILE101547135-E85516_20250516T162817.927745Z_00.00.fits.gz</FileName>
    </DataContainer>
</CutoutsCatalogStorage>
```

How Euclid DataProducts look like on the DBView

Whoever has access to the DPS can navigate Euclid Dpds via the DBView web interface.

DBView uses the usual COSMOS crdentials (i.e. the username and password used for any EC service)





> **Warning**
>
> After nearly 24h DBView logs you out!
>
> **Always check to be correctly logged in before querying fot data products**

The query form related to the MER catalog can be accessed through the Table list:

`Tables` → `MER data products` → `DpdMerFinalCatalog` (Search the Table list)

> **Important**
>
> What the user visualise on DBView reflects the XML schema

- DpdMerFinalCatalog
  - Data
    - CatalogVariant
    - IslandLabel
    - MocOrder
    - ProcessingMode
    - TileIndex
    - CalblockIdList
    - CalblockVariantList
    - CatalogDescription
    - CutoutsCatalogStorage
    - DataStorage
    - DeepFieldPhotometryCatalogStorage
    - FirstObservationDateTime
    - InnerNUNIQIndex
    - LastObservationDateTime
    - MorphologyCatalogStorage
    - ObservationIdList
    - PatchIdList
    - ProcessingSteps
    - QualityParams
    - ReferenceObservationDateTime
    - SpatialCoverage
    - SpectralCoverage
  - Header
    - AutomatedValidationStatus
    - CreationDate
    - Curator
    - DataSetRelease
    - EuclidPipelineSoftwareRelease
    - ExpirationDate
    - ManualValidationStatus
    - PipelineDefinitionId
    - PlanId
    - PPOId
    - PpoStatus
    - ProdSDC
    - ProductNotifiedToBeChecked
    - ProductType
    - Published
    - Purpose
    - SoftwareName
    - SoftwareRelease
    - ToBePublished
    - ProductId
  - Parameters
  - QualityFlags

Important

The DBS has two differnet projects for tests and operations

Official data produced in operation (Q1, RR2 and DR1) are in **EUCLID**

Products produced in test runs are in **TEST**

The MER catalog

The DpdMerFinalCatalog contains 3 (4 in DEEP mode) FITS data containers.

The main MER final catalog (photometry):

- `EUC_MER_FINAL-CAT_TILE<tile_id>-<uuid>_<date-time_stamp>_00.00.fits.gz`
  - HDU #1: `EUC_MER__FINAL_CATALOG`

The DEEP photometry catalog:

- `EUC_MER_FINAL-DEEP-PHOTO-CAT_TILE<tile_id>-<uuid>_<date-time_stamp>_00.00.fits.gz`
  - HDU #1: `EUC_MER__DEEP_FIELD_PHOTOMETRY_CATALOG`

The morphology catalog:

- `EUC_MER_FINAL-MORPH-CAT_TILE<tile_id>-<uuid>_<date-time_stamp>_00.00.fits.gz`
  - HDU #1: `EUC_MER__FINAL_MORPHOLOGY_CATALOG`

The cutout catalog:

- `EUC_MER_FINAL-CUTOUTS-CAT_TILE<tile_id>-<uuid>_<date-time_stamp>_00.00.fits.gz`
  - HDU #1: `EUC_MER__CUTOUTS_CORNERS`

> **Note**
>
> File names must comply with the EC SGS naming conventions

> **Important**
>
> The Euclid SGS provides its own definition for NULL values:
>
> - I: 32767
> - J: 2147483647
> - K: 9223372036854775807
> - F: NaN
> - D: NaN

Photometry

Most valuable columns

In the main (photometry) table we provide:

- `OBJECT_ID`
- `RIGHT_ASCENSION`
- `DECLINATION`
- `SEGMENTATION_MAP_ID`: the ID that you find in the segmentation map

> **Warning**
>
> Objects ID are computed starting from RA and DEC.
>
> **It is possible to have negative objects IDs**.

For each source we provide the total flux within a Kron elliptical aperture:

- `FLUX_DETECTION_TOTAL`

> **Note**
>
> The total flux is measured on VIS, unless the source is a NIR-only. In that case we measure on a stack of the three NIR bands

In addition to total fluxes, MER measures photometry in three different flavours:

▶ PSF-matched aperture photometry (APHOT)
▶ Template-fitting photometry (TPHOT)
▶ Sersic-fitting photometry (sourceXtractorPP)

> **Important**
>
> The details on how to play with MER photometry are described in the Photometry Cookbook

> **Note**
>
> All fotometries come with their relative error: FLUXERR_[band]_[method]

Other important quantities in the MER catalog:

- `FLUX_VIS_PSF`: a PSF fitting run done by TPHOT. VIS-only
- `SEGMENTATION_AREA`: segmented area of the source
- `SEMIMAJOR_AXIS`
- `POSITION_ANGLE`
- `ELLIPTICITY`
- `KRON_RADIUS`
- `FWHM`: FWHM (in arcsec) used in APHOT run.
- `GAL_EBV`: estimated galactic E(B-V) at the source centroid according to the reference Planck map

Flags, filters, selections

To filter sources and play with source selections, we provide a set of columns:

- `VIS_DET`: a flag telling if the object has been detected in VIS. `VIS_DET` = 0 means **NIR-only detection**
- `DET_QUALITY_FLAG`: quality flag, see first table in the Photometry Cookbook
- `SPURIOUS_PROB`: probability between 0 and 1 that the source is spurious
- `POINT_LIKE_PROB`: probability between 0 and 1 that the source is point-like
- `GAIA_ID`: the associated GAIA source id

> **Important**
>
> The proper Star/Galaxy classification is done by OU-PHZ

Photometry DEEP

> **Note**
>
> Some EXT bands are fed to MER only in DEEP mode.

We run the same photometry methods on DEEP-only EXT bands.

Columns corresponding to WIDE bands are always present in the MER catalog main FITS table.

Camera	Band
Euclid*	I_E, Y_E, J_E, H_E + NIR_STACK
DECam*	g, i, r, u, z
MegaCam	r, u
JPCam	g
Pan-STARRS*	i, z
HSC*	g, z
Rubin/LSST	g, i, r, u, z

A second FITS table is produced only in DEEP mode, containing the DEEP-only EXT bands.

Camera	Band
Subaru	19 bands from IA427 to IA586
VISTA	H, J, Y, KS
MegaCam	USTAR, UPRIME
UKIRT	J, H, K
IRAC	CH1, CH2
HSC*	r, r2, i2, Y
GALEX	FUV, NUV

> **Note**
>
> *: band currently available in Q1 (WIDE only) and DR1 (WIDE+DEEP) releases

Morphology

Most valuable columns

The morphology catalog, provided in a separate FITS table, share with the main photometry catalog the object ID:

- `OBJECT_ID`

MER measures morphology in three different flavours:

▶ Non-parametric morphology (CAS)
▶ Parametric (Sersic)
▶ Machine Learning (zoobot)

> **Note**
>
> The current internal MER selection keeps only a small percentage (< 2%) of the zoobot estimates

> **Important**
>
> More details on how to play with MER morphology are described in the Morphology Cookbook

Cutouts

Most valuable columns

> **Note**
>
> Currently, the cutout catalog is used only by OU-SIR

The cutout catalog, provided in a separate FITS table, share with the main photometry and morphology catalogs the object ID:

- `OBJECT_ID`

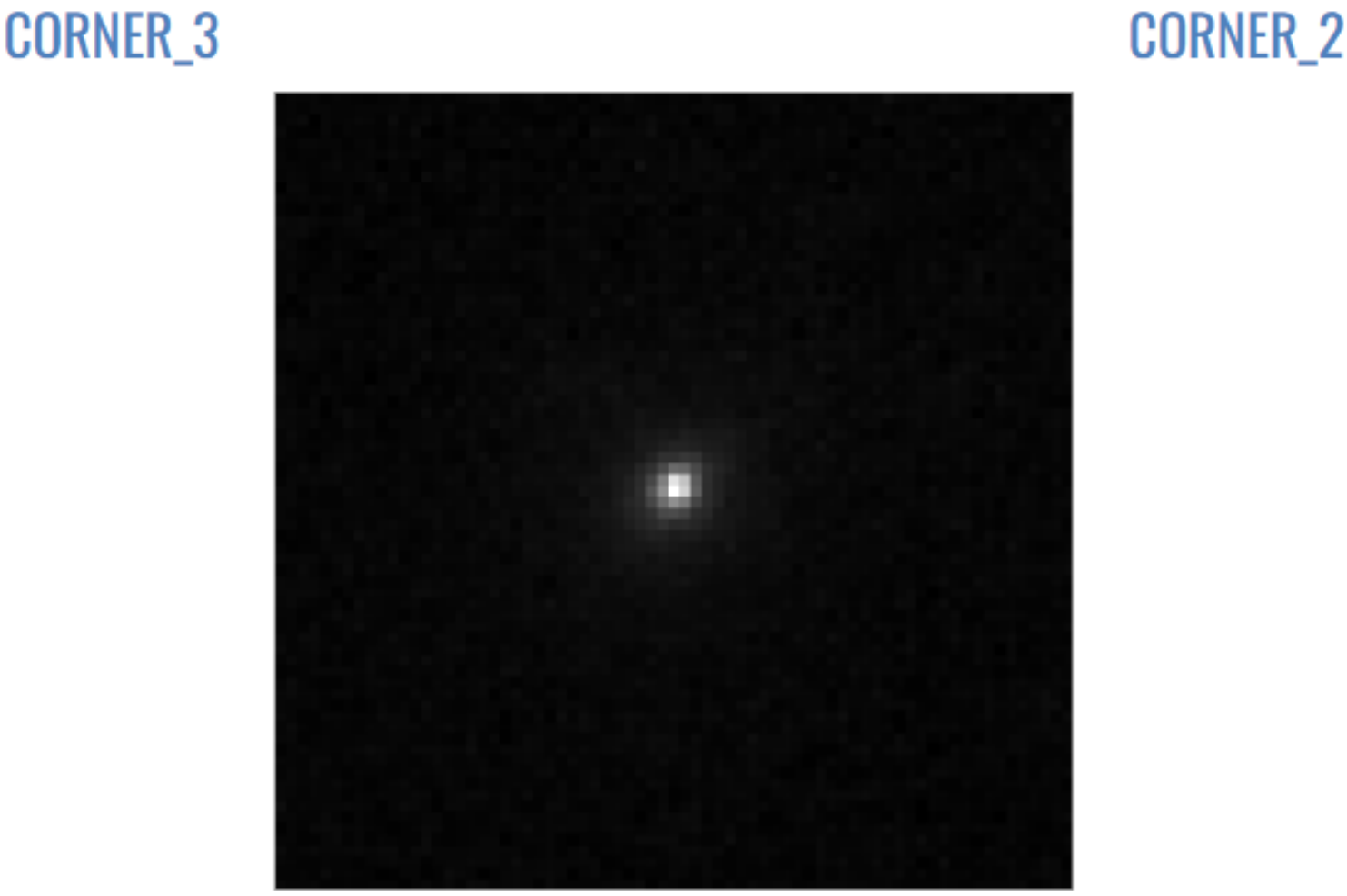
It hinerits some basic information from the photometry catalog

- `RIGHT_ASCENSION`
- `DECLINATION`
- `SEMIMAJOR_AXIS`
- `POSITION_ANGLE`
- `FLUX_DETECTION_TOTAL`
- `PARENT_ID`

and provides the corner postisions of source cutouts:

▶ From TPHOT
▶ From MER_Deblending

Note that the corners are 0-based indexed, starting from the lower-left corner, counter-clockwise:



Note

DBL_CORNER_* are the cutout corners as computed by the MER_Deblending step.

CORNER_* are the cutout output by TPHOT. TPHOT stamps are slightly wider than the ones we get from MER_Deblending (TPHOT dilates the cutouts)

Find MER products on the Science Archive System

Euclid data are distributed to people ouside the SGS (with no access to the DPS) via the Science Archive System (SAS).

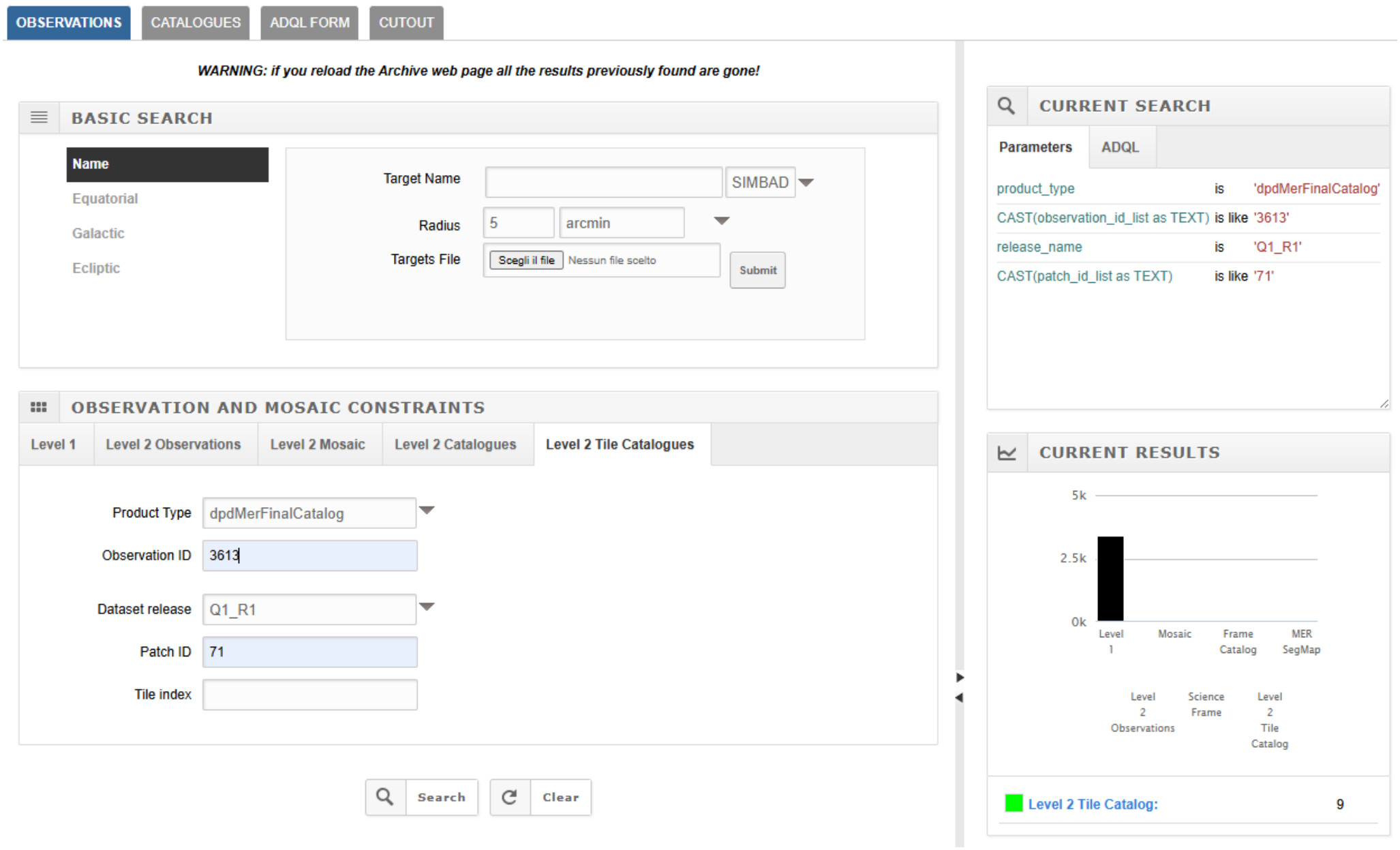
SAS offers a web interface to query the archive.

> **Note**
>
> A complete description of the SAS features can be found in the SAS Public User Guide

Retrieving data per observation

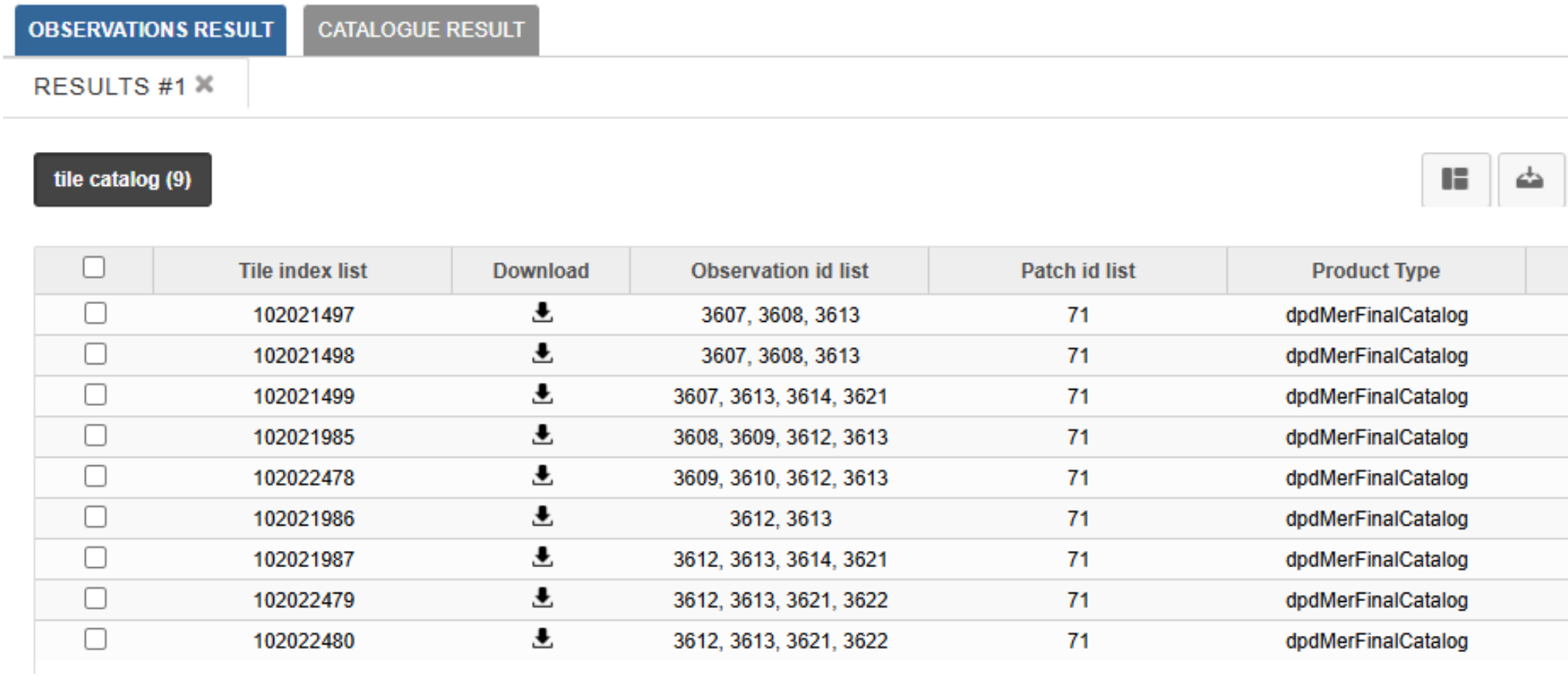
Under `OBSERVATIONS` the MER products can be queried via:

- Dataset Release
- Patch ID
- Observation ID
- Tile ID



> **Note**
>
> Remember to look for “Level 2 Tile Catalogues”

The result of this query is a list of the MER product per tile:



Through the “Download” column, it is possible to download individual catalogs, per tile, as (compressed) FITS files.

> **Warning**
>
> The SAS interface allows the user to look for Dataset Release = Q1_R2.
>
> MER completed its processing during the first processing release of Q1.
>
> **It is expected to not have MER data for Q1_R2**

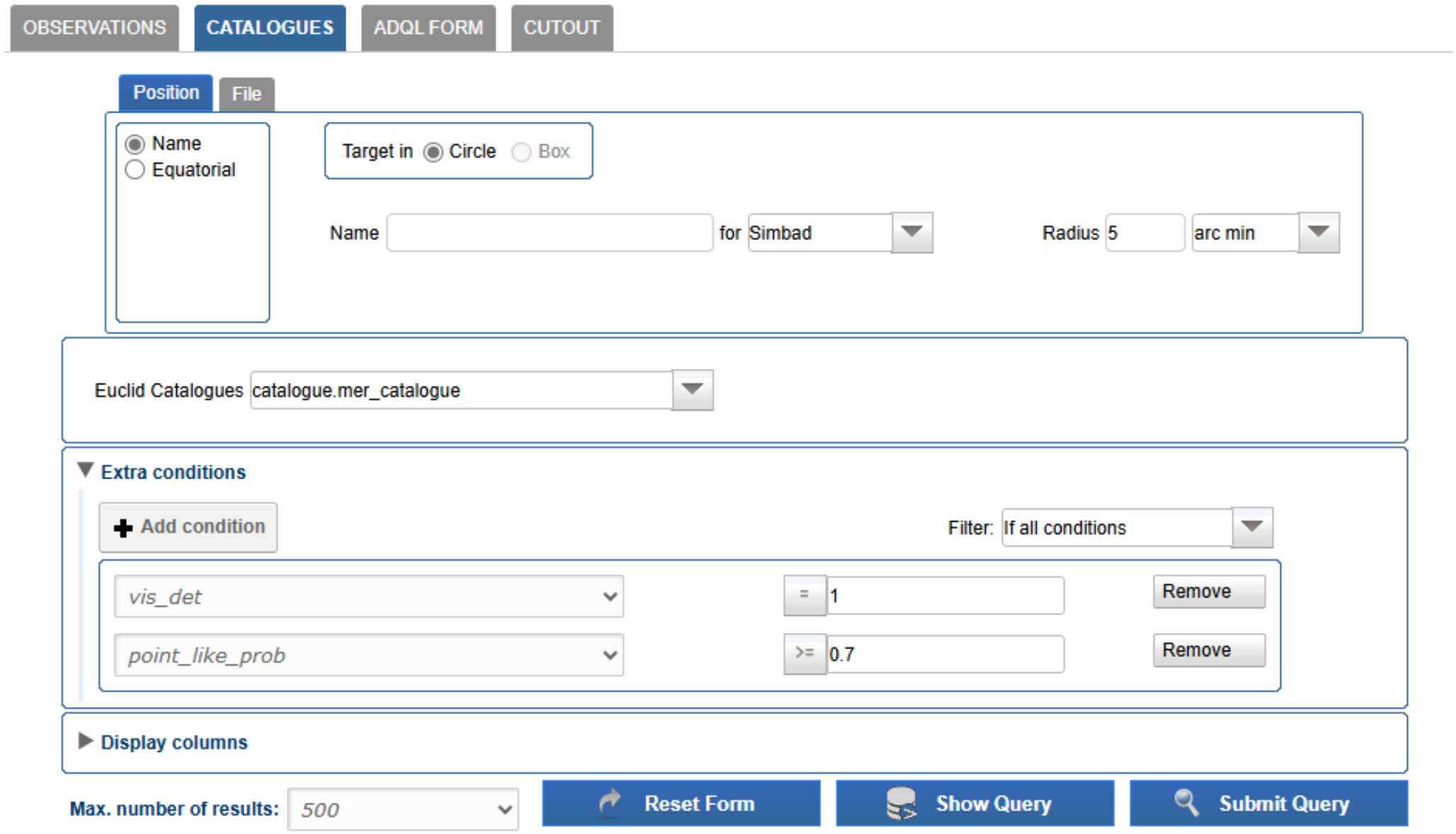
Navigate the full SAS table

Under `CATALOGUES` the MER results are queried as a database table.

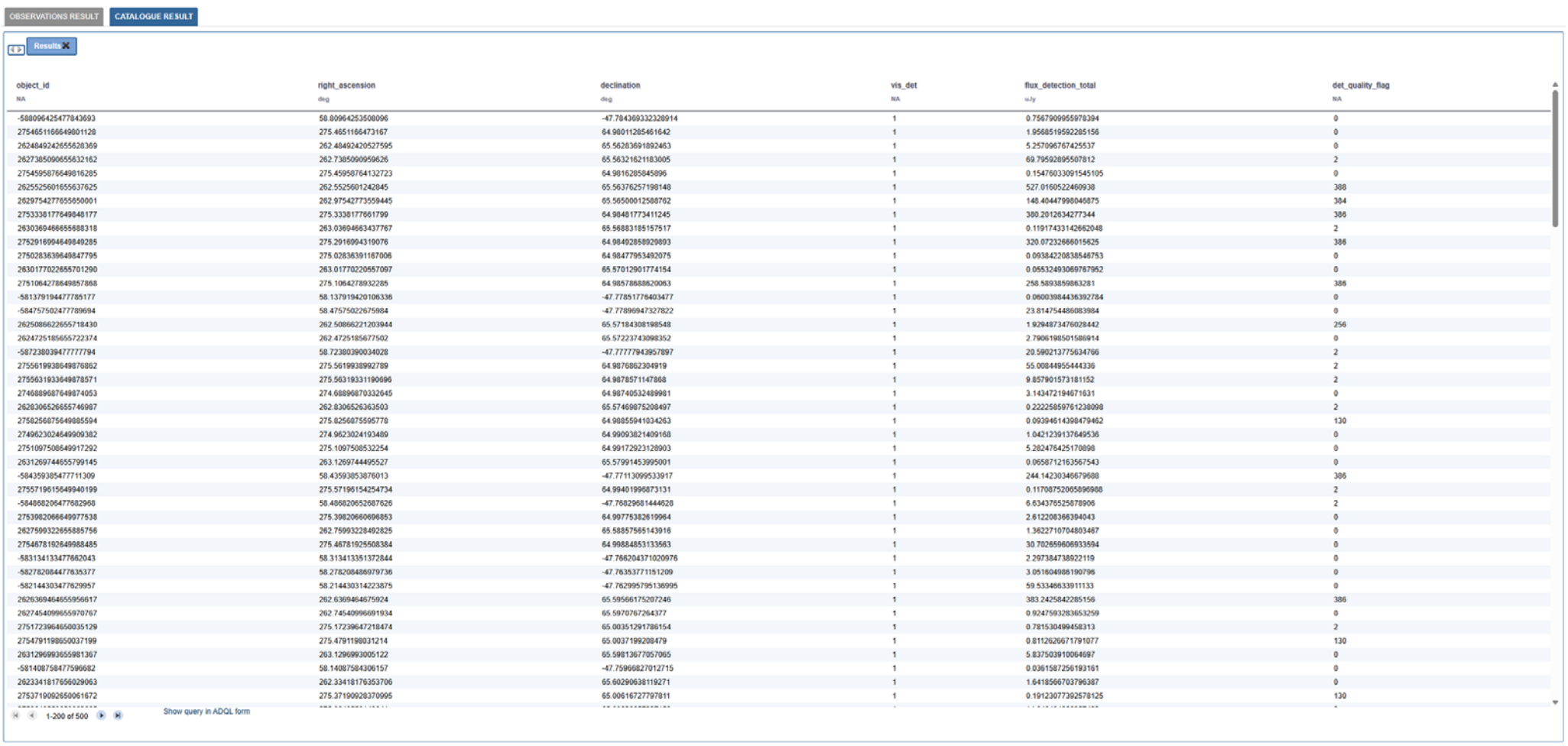
The structure of the table in the SAS database reflects the definition of the MER **FITS data model**.

In the SAS GUI:

- select `catalogue.mer_catalogue` in the “Euclid Catalogues” field
- Set the condition to implement the query
- Select which columns to be shown



Once the selection criteria are set, it is possible to show the matching results:



object_id	right_ascension	declination	vis_det	flux_detection_total	det_quality_flag
NA	deg	deg	NA	uJy	NA
-588096425477843693	58.80964253508096	-47.784369332328914	1	0.7567909955978394	0
2754651166649801128	275.4651166473167	64.98011285461642	1	1.9568519592285156	0
2624849242655628369	262.48492420527595	65.56283691892463	1	5.257096767425537	0
2627385090655632162	262.7385090959626	65.56321621183005	1	69.79592895507812	2
2754595876649816285	275.45958764132723	64.9816285845896	1	0.15476033091545105	0
2625525601655637625	262.5525601242845	65.56376257198148	1	527.0160522460938	388
2629754277655650001	262.97542773559445	65.56500012568762	1	148.40447998046875	384
2753338177649848177	275.3338177661799	64.9848177341245	1	380.2012634277344	386
2630369466655688318	263.03694663437767	65.56883185157517	1	0.11917433142662048	2
2752916994649849285	275.2916994319076	64.98492858929893	1	320.07232666015625	386
2750283639649847795	275.02836391167006	64.98477953492075	1	0.09384220838546753	0
2630177022655701290	263.01770220557097	65.57012901774154	1	0.05532493069767952	0
2751064278649857868	275.1064278932285	64.98578688620063	1	258.5893859863281	386
-581379194477785177	58.137919420106336	-47.77851776403477	1	0.06003984436392784	0
-584757502477789694	58.47575022675984	-47.77896947327822	1	23.814754486083984	0
2625086622655718430	262.50866221203944	65.57184308198548	1	1.9294873476028442	256
2624725185655722374	262.4725185677502	65.57223743098352	1	2.7906198501586914	0
-587238039477777794	58.72380390034028	-47.77777943957897	1	20.5902137756347656	2
2755619938649876862	275.5619938992789	64.9876862304919	1	55.00844955444336	2
2755631933649878571	275.56319331190696	64.9878571147868	1	9.857901573181152	2
2746889687649874053	274.68896870332645	64.98740532489981	1	3.143472194671631	0
2628306526655746987	262.8306526363503	65.57469875208497	1	0.22225859761238098	2
2758256875649885594	275.8256875595778	64.98855941034263	1	0.09394614398479462	130
2749623024649909382	274.9623024193489	64.99093821409168	1	1.0421239137649536	0
2751097508649917292	275.1097508532254	64.99172923128903	1	5.282476425170898	0
2631269744655799145	263.1269744495527	65.57991453995001	1	0.0658712163567543	0
-584359385477711309	58.43593853876013	-47.77113099533917	1	244.14230346679688	386
2755719615649940199	275.57196154254734	64.99401996873131	1	0.11708752065896988	2
-584668206477682968	58.466820652687626	-47.76829681444628	1	6.634376525878906	2
2753982066649977538	275.39820660696853	64.99775382619964	1	2.612208366394043	0
2627599322655885756	262.7599322849282	65.58857565143916	1	1.3622710704803467	0
2754678192649988485	275.46781925508384	64.99884853133563	1	30.702659606933594	0
-583134133477662043	58.313413351372844	-47.766204371020976	1	2.297384738922119	0
-582782084477635377	58.278208486979736	-47.76353771151209	1	3.051604986190796	0
-582144303477629957	58.214430314223875	-47.762995795136995	1	59.53348633911133	0
2626369464655956617	262.6369464675924	65.59566175207246	1	383.24258422851562	386
2627454099655970767	262.74540996691934	65.5970767264377	1	0.9247593283653259	0
2751723964650035129	275.17239647218474	65.00351291786154	1	0.781530499458313	2
2754791198650037199	275.4791198031214	65.0037199208479	1	0.8112626671791077	130
2631296993655981367	263.1296993005122	65.59813677057065	1	5.837503910064697	0
-581408758477596682	58.14087584306157	-47.75966827012715	1	0.0361587256193161	0
2623341817656029063	262.33418176353706	65.60290638119271	1	1.6418566703796387	0
2753719092650061672	275.37190928370995	65.00616727797811	1	0.19123077392578125	130

or retrieve the proper query (SQL):

```
SELECT TOP 500 mer_catalogue.object_id,mer_catalogue.right_ascension,mer_catalogue.declination,mer_catalogue.seg
FROM catalogue.mer_catalogue
WHERE (catalogue.mer_catalogue.vis_det=1 AND catalogue.mer_catalogue.point_like_prob>=0.7)
```

Warning

At the moment SAS let query on:

- mer_catalogue
- mer_cutouts

MER morphology catalogs and DEEP catalogs are not yet ingested into SAS