Agenzia Spaziale Italiana

MER Processing Function

The Euclid cataloguing pipeline

6° Meeting Euclid Italia - Roma – 19th January 2023

Erik Romelli
On behalf of OU-MER Team

The OU-MER Team

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M. Castellano	T. Vassallo (SDC-IT)	Y. Feng	L. Maurin	
E. Merlin	M. D. Lepinzan (SDC-IT)	J. G. Carpio (SDC-DE)	R. Cabanac	
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F. Caro			M. H. Company	
P. Dimauro			H. Bretonnière	

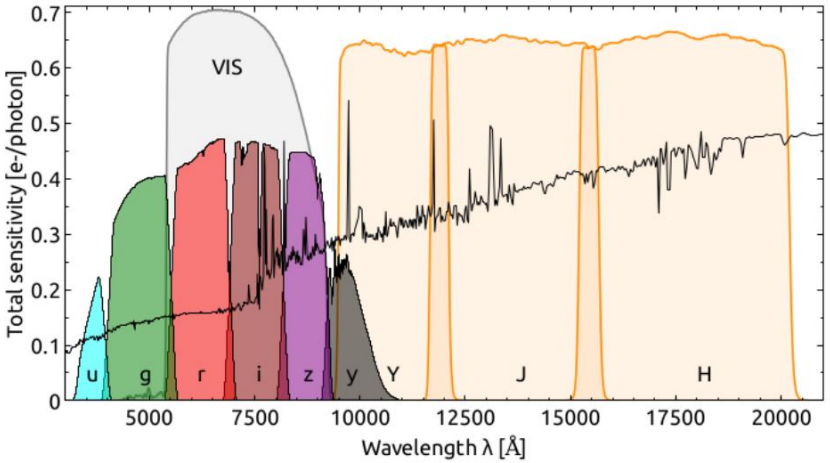
https://euclid.roe.ac.uk/projects/mer_pf/wiki

What is OU-MER?

MER is the cataloguing unit of the Euclid SGS

Input:

- VIS (VIS reduced data)
- NIR (NISP-P reduced data)
- EXT (External ground based data)



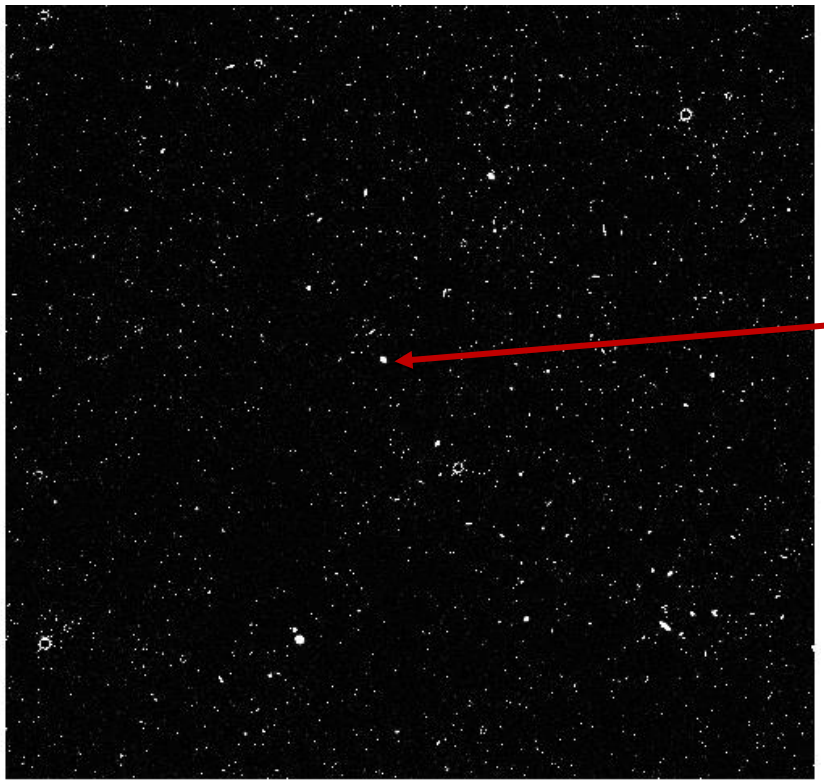
Output:

- Multi-band photometric catalogue

<u>MER is in charge of the creation of the official list of sources</u>

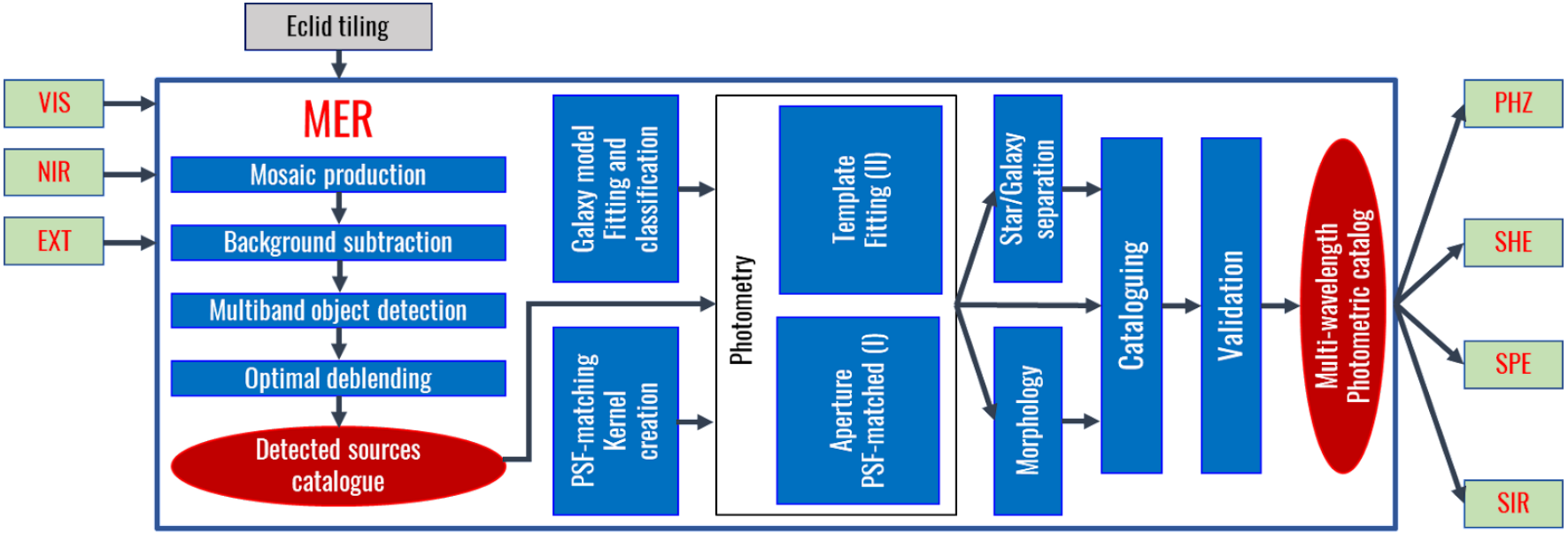
What is OU-MER?

MER is in charge of the creation of the official list of sources!

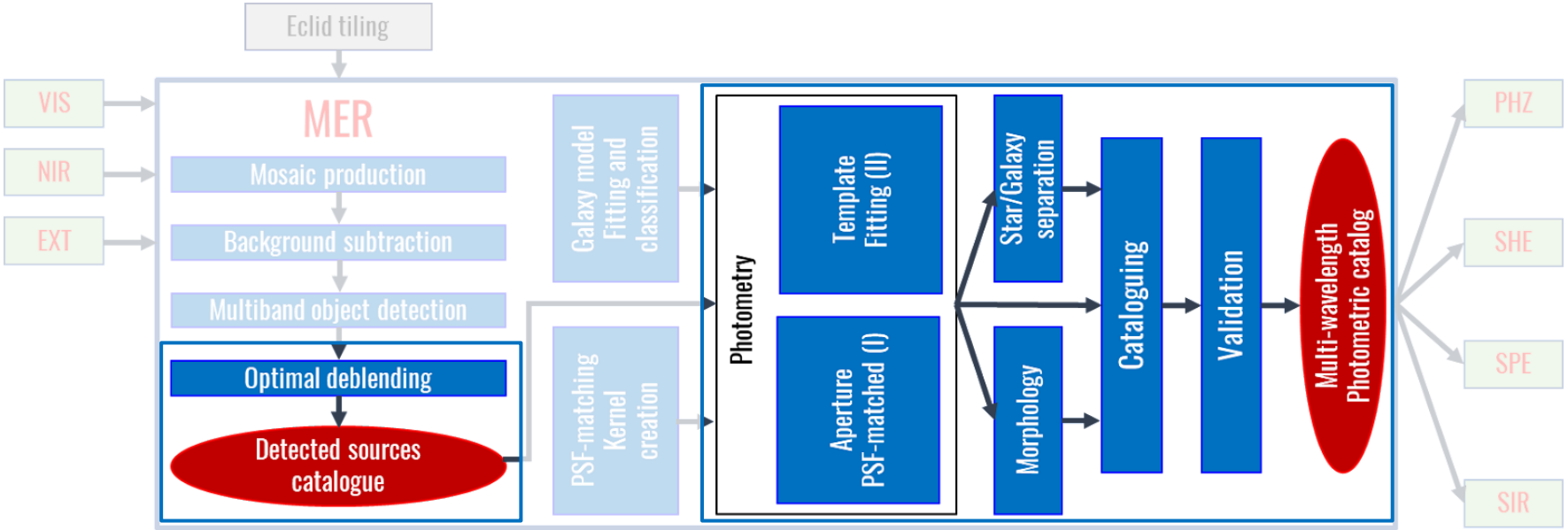


- Euclid unique ID
- Coordinates (RA, DEC)
- Fluxes (VIS, Y, J, H, u, g, r, i, z)
- Morphology
- Flags

MER-PF Pipeline



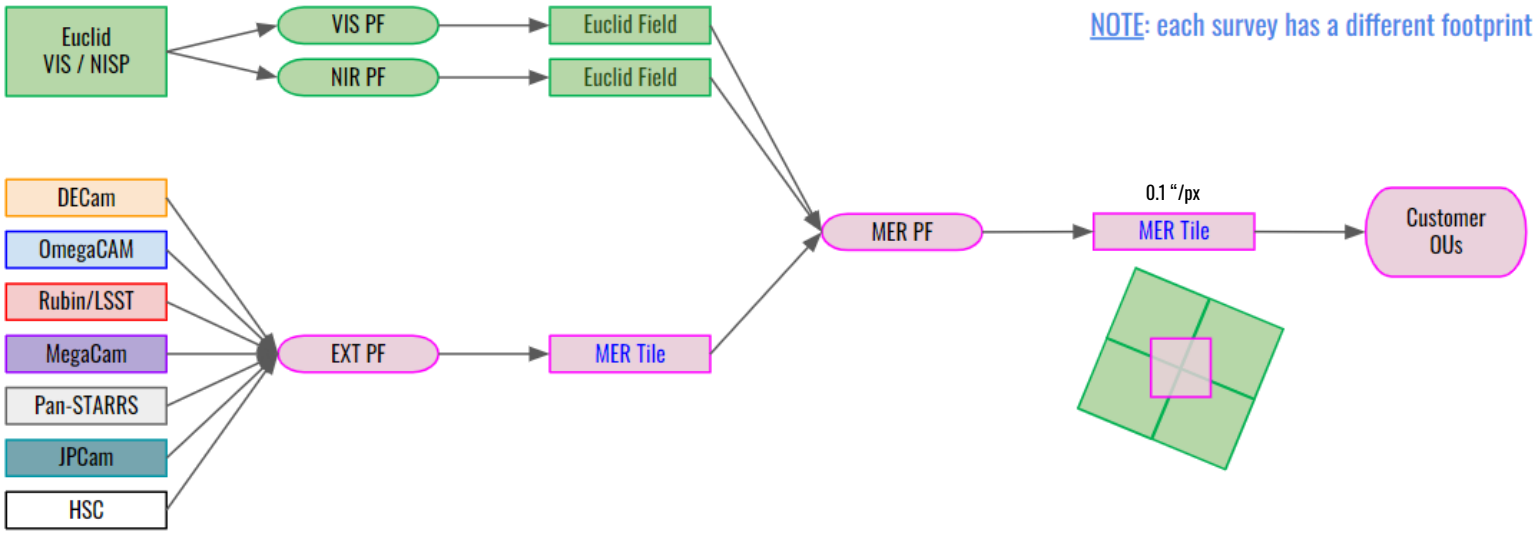
MER-PF Pipeline



Tiling

MER must process the whole survey area -> chunks

VIS/NISP and EXT surveys have different observing patterns



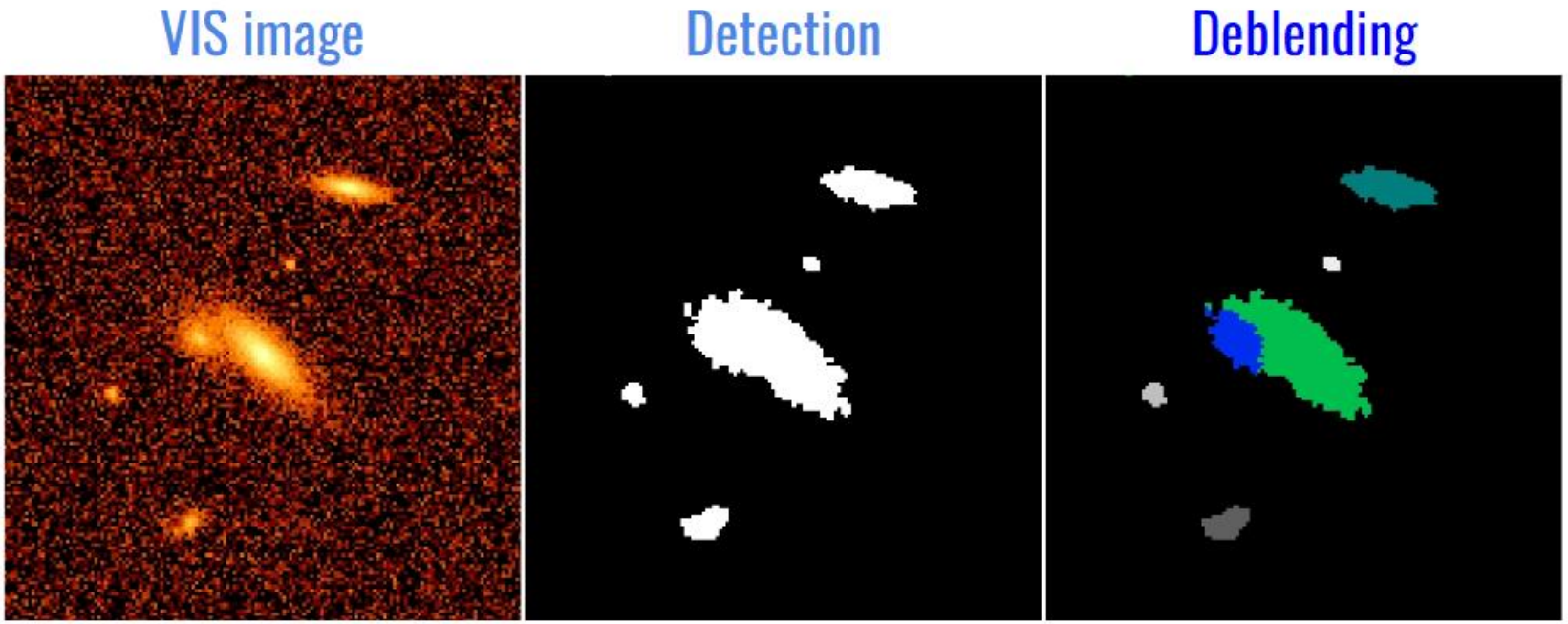
- Adjacent tiles have an overlap to ensure full coverage of extended (< 1') sources
- Each tile has an outer region (Mosaics) and a core area (Catalogs & Segmaps)

https://euclid.roe.ac.uk/projects/mer_pf/wiki/Tiling#Tiling

M. Kuemmel, **T. Vassallo**, Y. Feng

Deblending

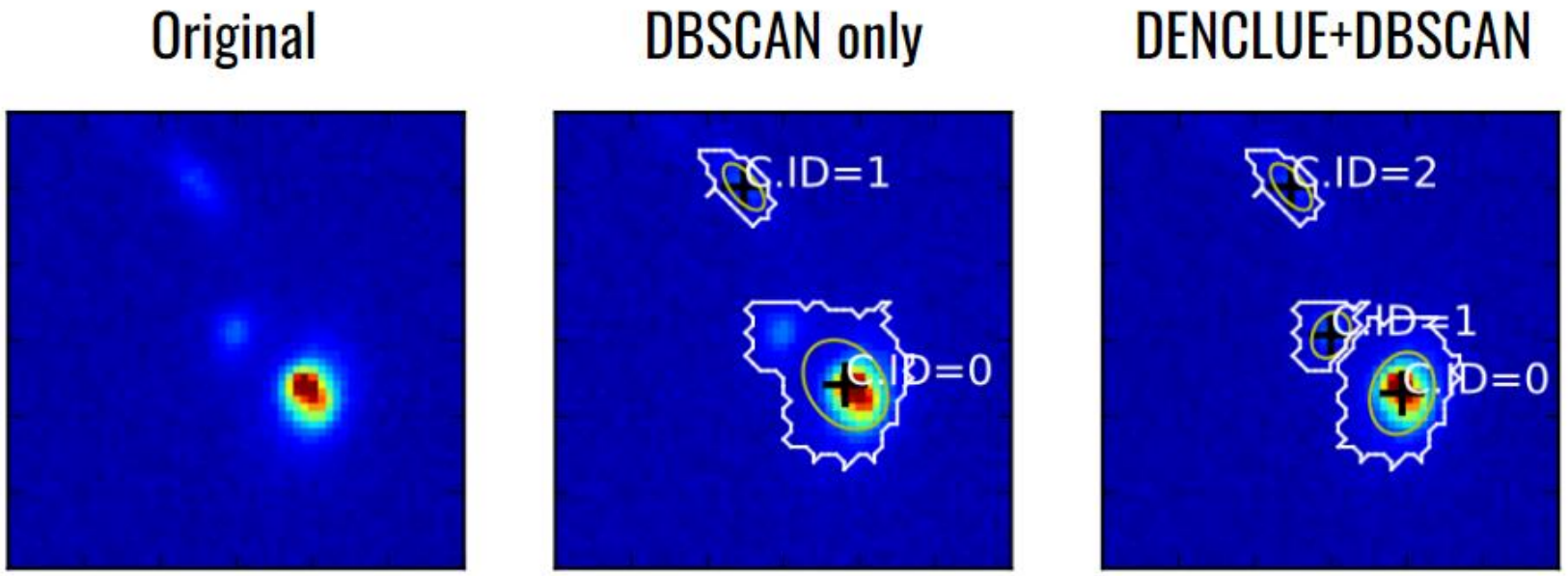
Deblending is the process of separating blended objects to recover the correct flux from each object



Deblending in MER

In summary

ASTErIsM (Tramacere *et al.* 2016)
https://doi.org/10.1093/mnras/stw2103



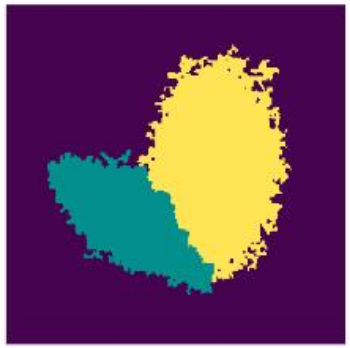
M. Castellano, E. Romelli, F. Caro, T. Vassallo, A. Tramacere

Deblending assessment

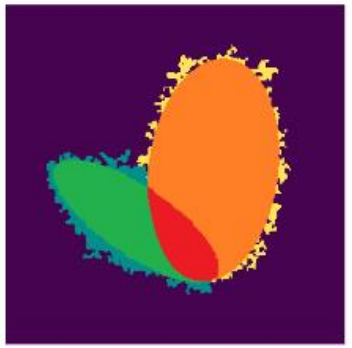
Comparison with True Universe simulation

Ideal Segmap (from TU catalog)

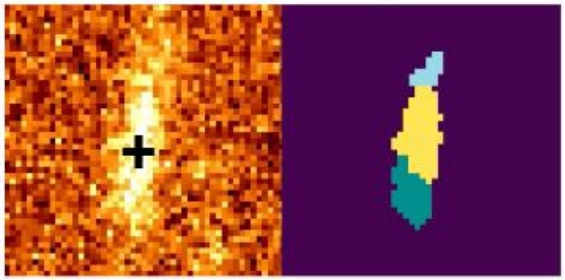
MER Segmentation Map



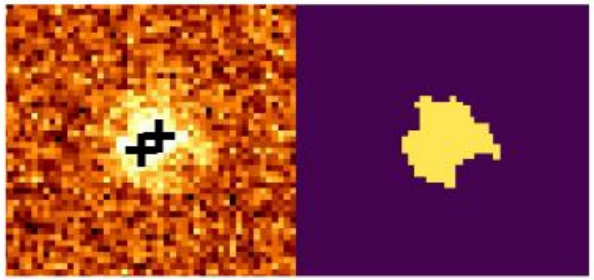
Comparison



Over-Deblending

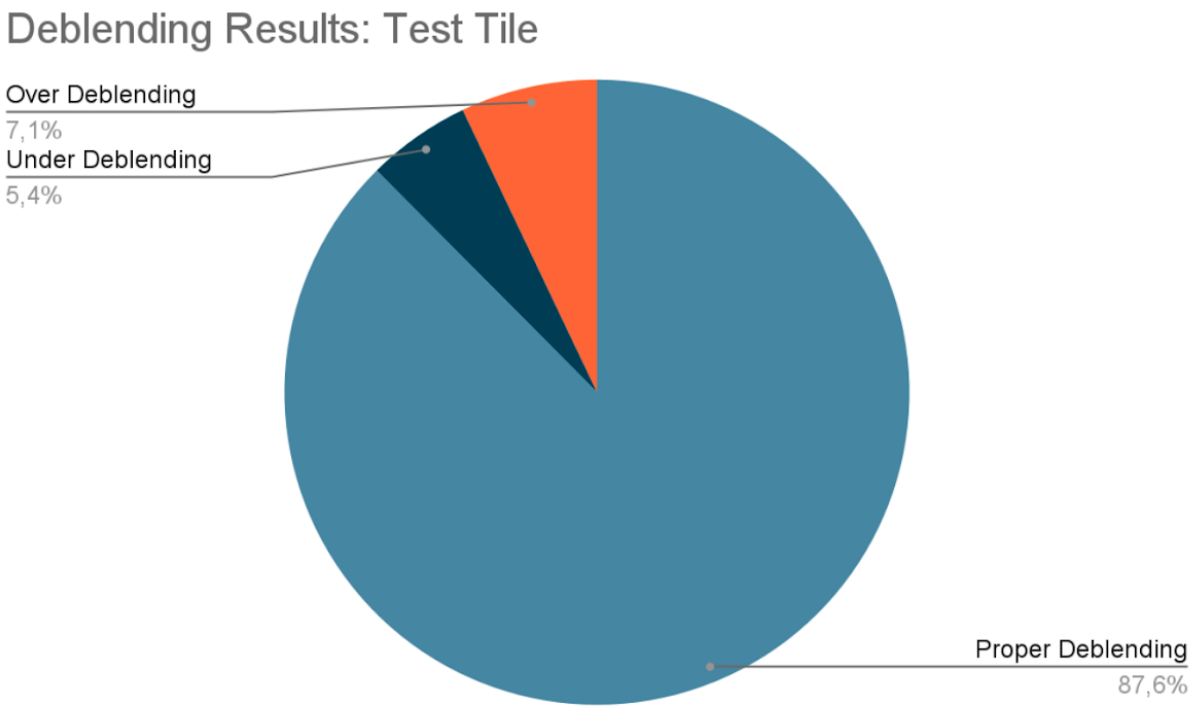


Under-Deblending



M. Castellano, F. Caro

Deblending assessment



Under Deblending (5.4%)
4+ → 1: 1.55%
3 → 1: 15.02%
2 → 1: 83.43%

Over Deblending (7.1%)
1 → 2 : 93.74%
1 → 3 : 5.37%
1 → 4+: 0.89%

M. Castellano, F. Caro

Photometry

Estimate the fluxes (magnitudes) of all the detected galaxies and stars in all bands

- Forced photometry on positions of detected/deblended sources

TWO METHODS:

1. **A-Phot *(Merlin +2019)*: Aperture Photometry**
   Measure total magnitude in the detection band, and robust colors

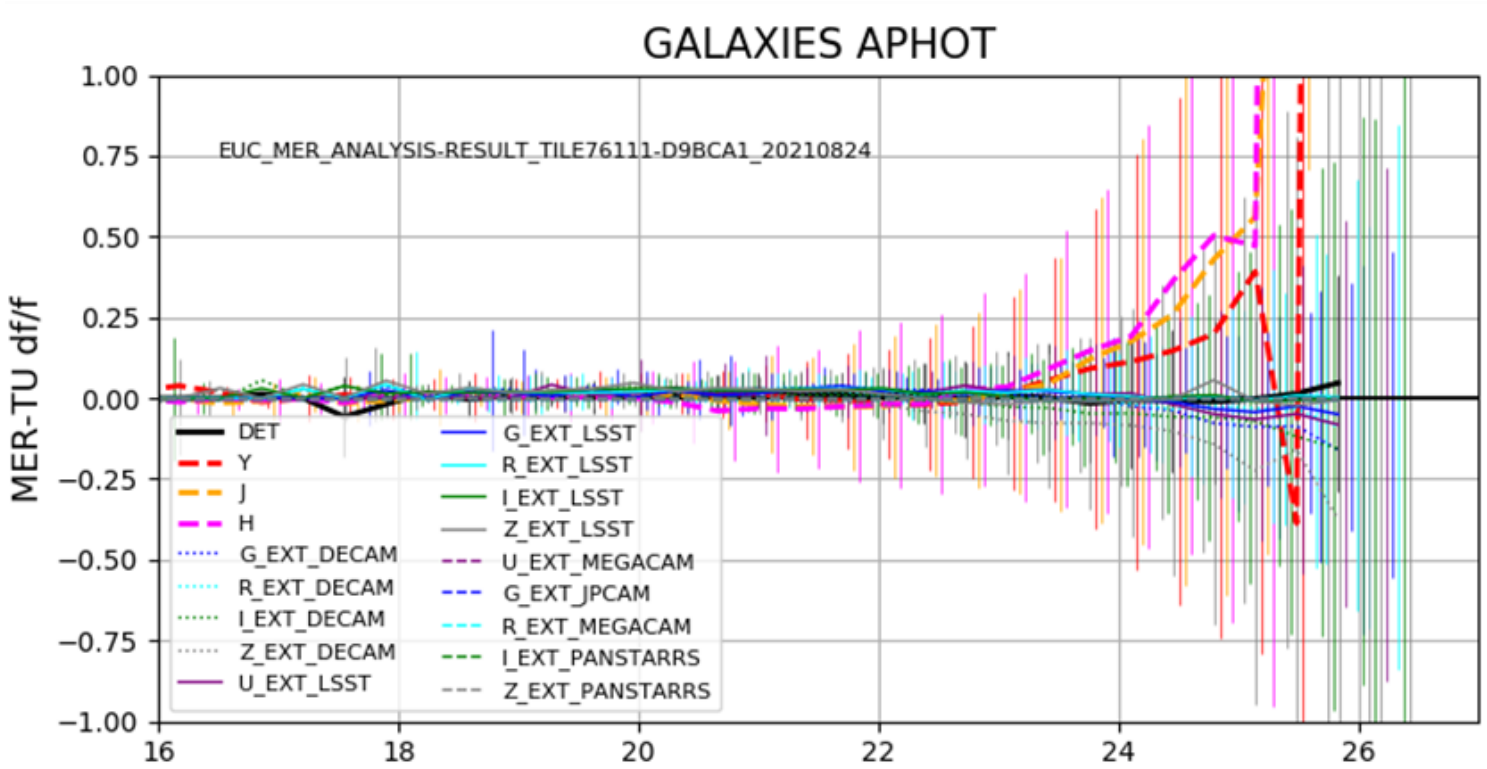
2. **T-Phot *(Merlin +2015,2016)*: Template Fitting Photometry**
   Estimate total magnitudes minimizing resolution/blending issues

http://www.astrodeep.eu/a-phot/
http://www.astrodeep.eu/t-phot/

E. Merlin, S. Galeotta, T. Vassallo, J.G. Carpio, L. Maurin, E. Romelli

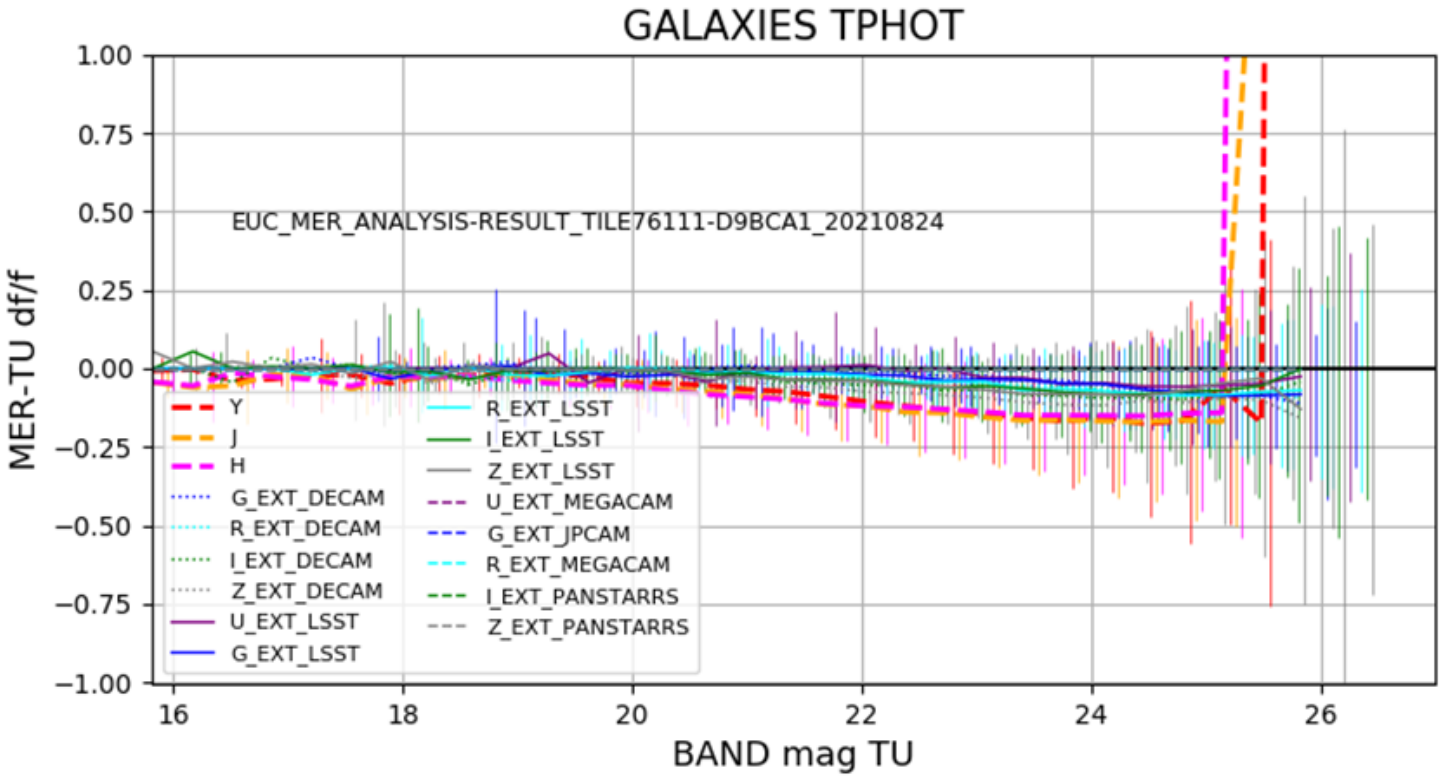
Photometry

A-Phot



Photometry

T-Phot



Morphology

Up to now:

- **C** - Concentration
- **A** - Asymmetry
- **S** - Clumpiness
- GINI
- M20
- Ellipse parameters from Deblending step:
  - A_IMAGE (semi-major axis)
  - ELLIPTICITY
  - POSITION_ANGLE

R. Cabanac, **E. Romelli**, M.H. Company, M. Walmsley

Morphology

Up to now:

- **C** - Concentration
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From now on (new DM 9.1):

- SEMIMAJOR_AXIS
- KRON_RADIUS
- ELLIPTICITY
- POSITION_ANGLE

+ Dedicated morphology catalog:

- CAS parameters + GINI & M20
- Sersic fitting
- Sersic+Disk
- ML statistics (M. Walmsley, M.H. Company)

MER_MorphoPatch under development @SDC-IT-DEV
E. Romelli, **T. Vassallo**

R. Cabanac, **E. Romelli**, M.H. Company, M. Walmsley

OU-MER Deliverables

- **DpdMerBksMosaic**

  Background-subtracted mosaic

- **DpdMerDetectionMosaic**

  Mosaic used to perform the object detection

- **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

OU-MER towards the PV

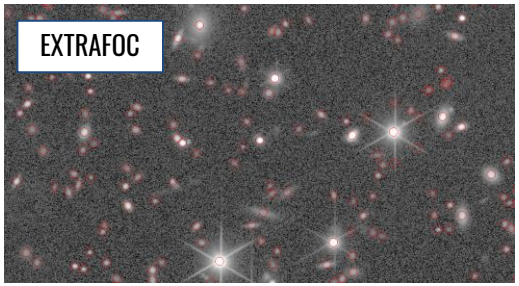
- PVRH #1

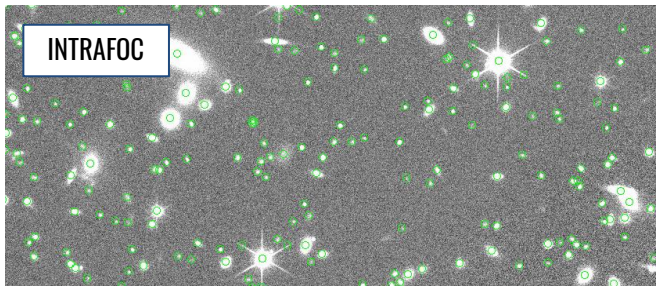
  No important issues on our side

- PVRH #2

  Critical: Phase diversity (CALBLOCK-PV-008 and CALBLOCK-PV-025)

  Problems should be expected in detection and deblending





  Critical: SIR runs on MER catalogs

OU-MER documentation

- MER-PF Redmine

  https://euclid.roe.ac.uk/projects/mer_pf/wiki

- OU-MER Cosmos Wiki Page

  https://wiki.cosmos.esa.int/euclid/index.php/EC_SGS_OU_MER

- Our Data Model (to be updated to DM 9.1)

  https://euclid.esac.esa.int/msp/dpdd/live/merdpd/merindex.html

- 13 Technical Notes. Complete list here:

  https://wiki.cosmos.esa.int/euclid/index.php/EC_SGS_OU_MER#Technical_notes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A