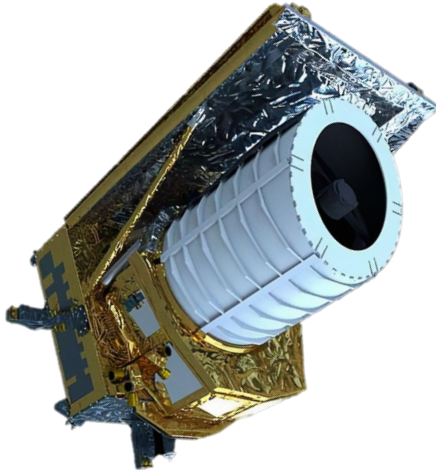




Euclid view of the Low Surface Brightness Universe

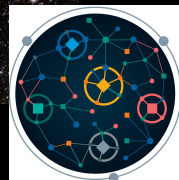
Paola Dimauro, Javier Román, Mathias Urbano,
Jesús Vega Ferrero, Steven Bamford,
Jean-Charles Cuillandre, Fernando Caro,
Pablo Sanchez Alarcon,
and LU-DET team

with the ESA support
Sandor Kruk, Bruno Altieri, Kristin Remmelgas





- **Depth**
- **Spatial resolution**
- **Wide Field of View**



Targets for the LSB Datalabs project



Dwarf Galaxies

Extended galaxies

Intra-Cluster Light

Resolved SED

Tidal features/mergers

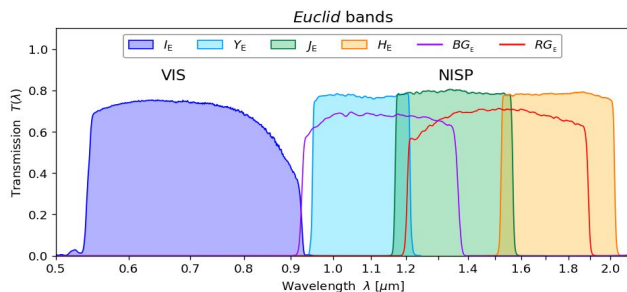
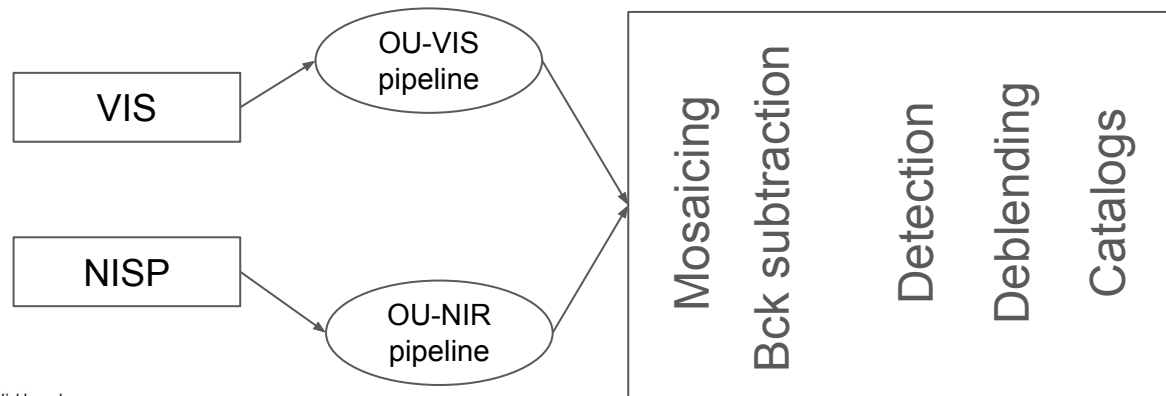
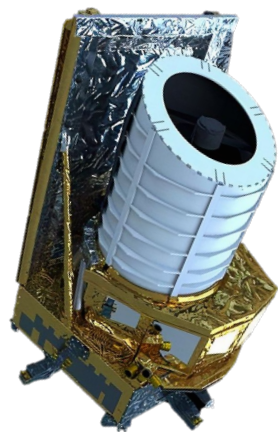
Morphology

Ultra Diffuse galaxies



The Euclid Consortium Pipeline

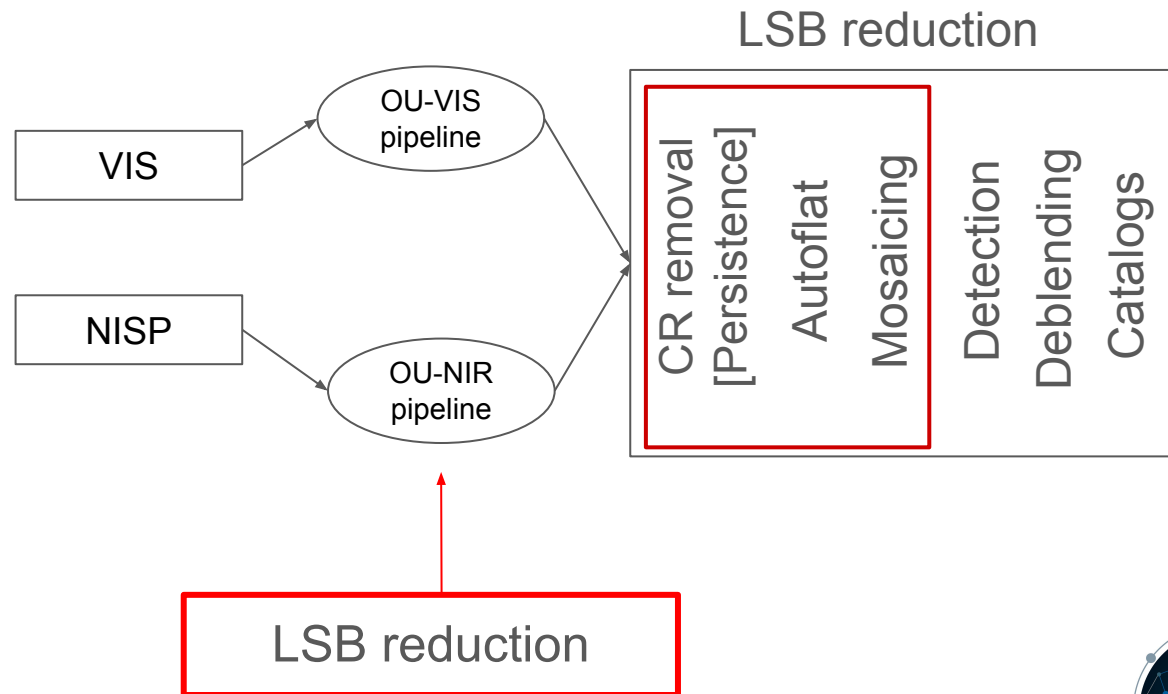
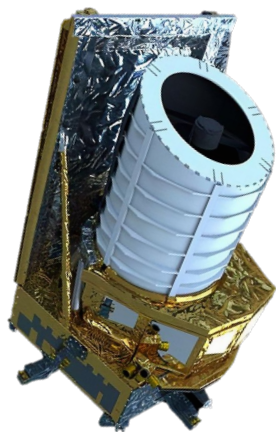
Official Euclid Pipeline optimised for the main Science goal of Euclid: cosmology



Euclid view of the Low Surface Brightness Universe - Euclid LSB project

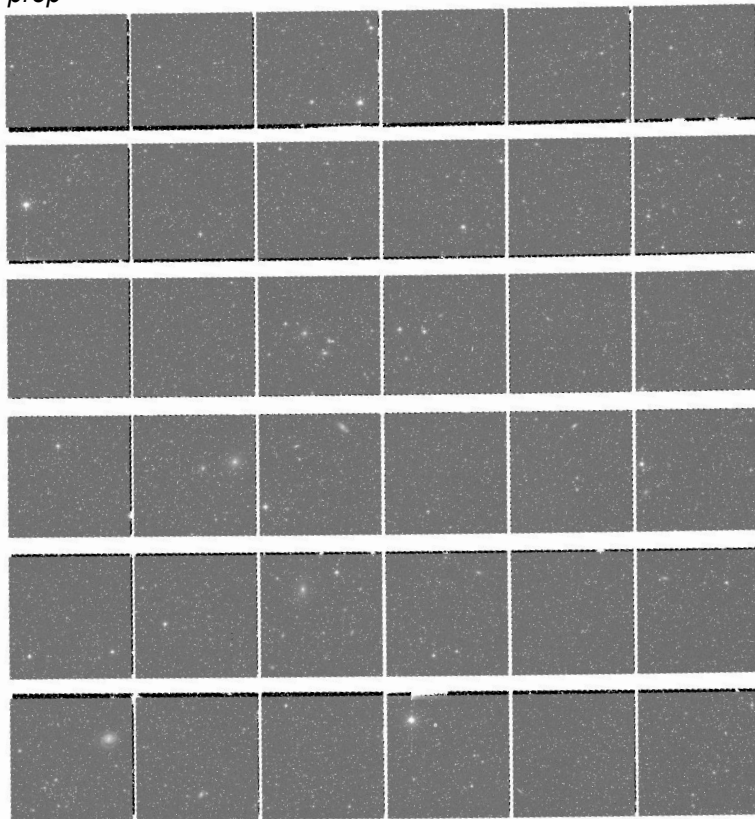


The Low Surface Brightness Project



The LSB reduction

Dimauro 2025 *in prep*



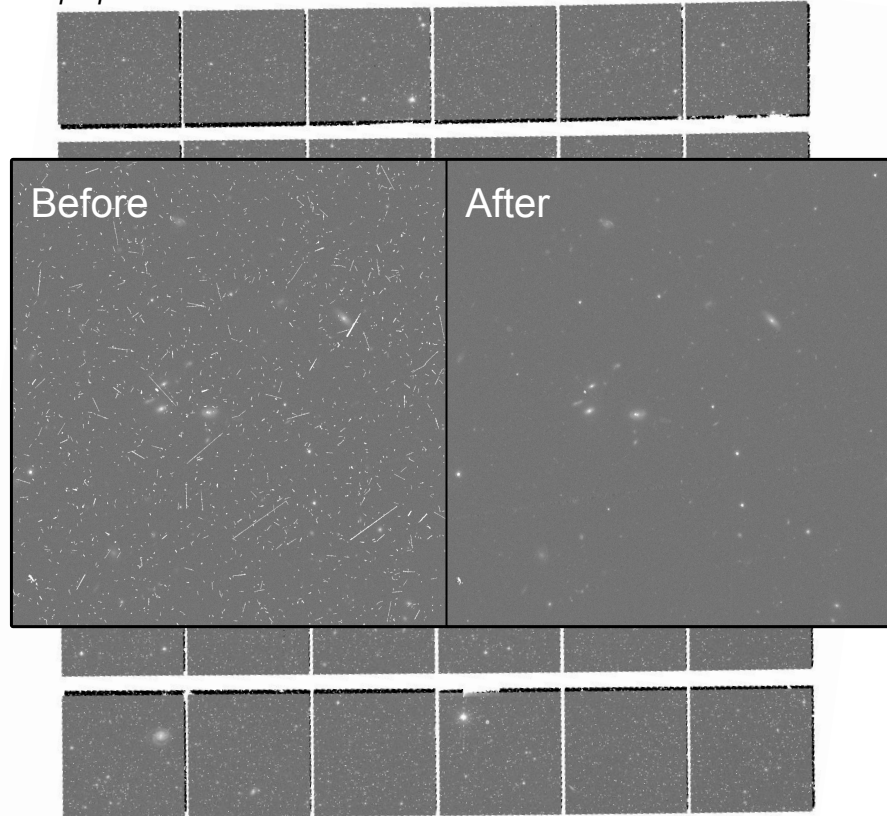
VIS

- Cosmic rays removal
- LSB friendly background
- Stacking and mosaicing



The Low Surface Brightness Project

Dimauro 2025 in prep



VIS

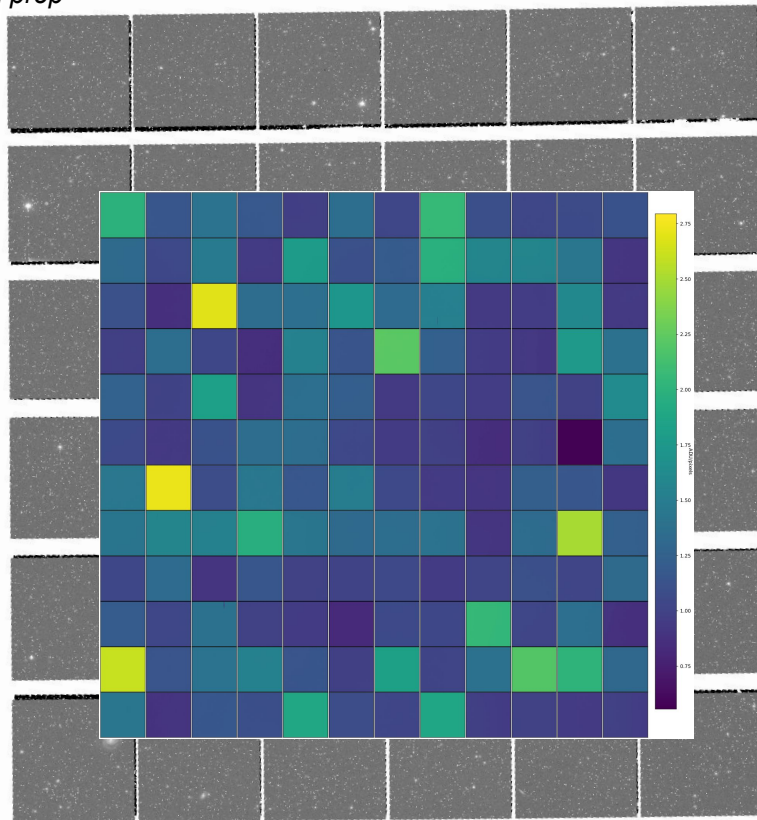
- Cosmic rays removal
- LSB friendly background
- Stacking and mosaicing

DeepCR: Deep learning code that is optimised to detect and replace Cosmic Rays.
(Keming Zhang & Joshua Bloom 2020)



The LSB reduction

Dimauro 2025 in prep



VIS

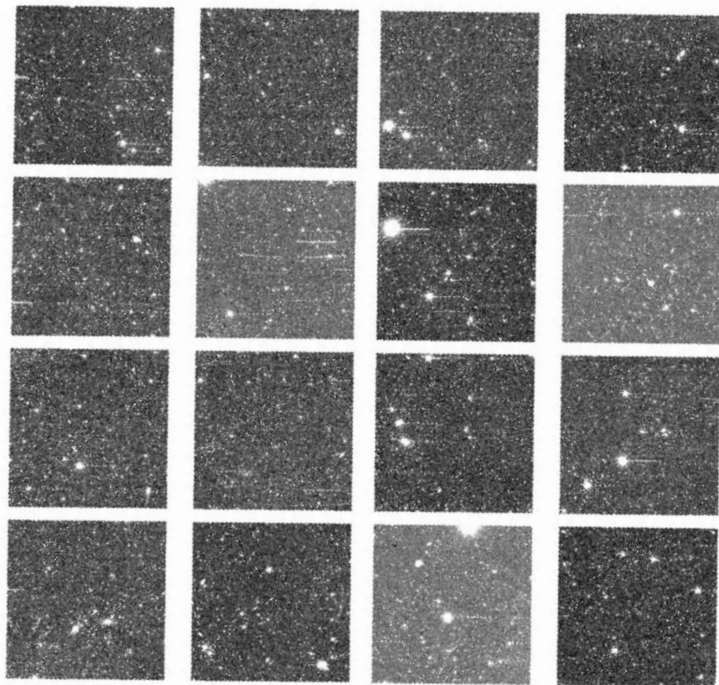
- Cosmic rays removal
- LSB friendly background
- Stacking and mosaicing

We calculate mean pixels value quadrants, using around 40 exposures per quadrant, optimally masked. We chose the exposure to be used following the pointing path of the telescope



The LSB reduction

Dimauro 2025 *in prep*



NISP

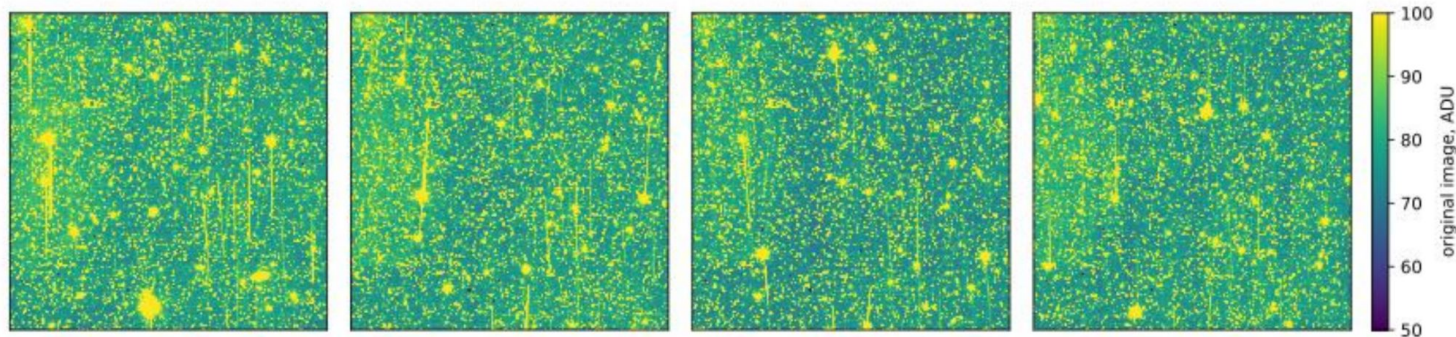
- Persistence correction
- LSB friendly background
- Stacking and mosaicing

Steven Bamford
correction model



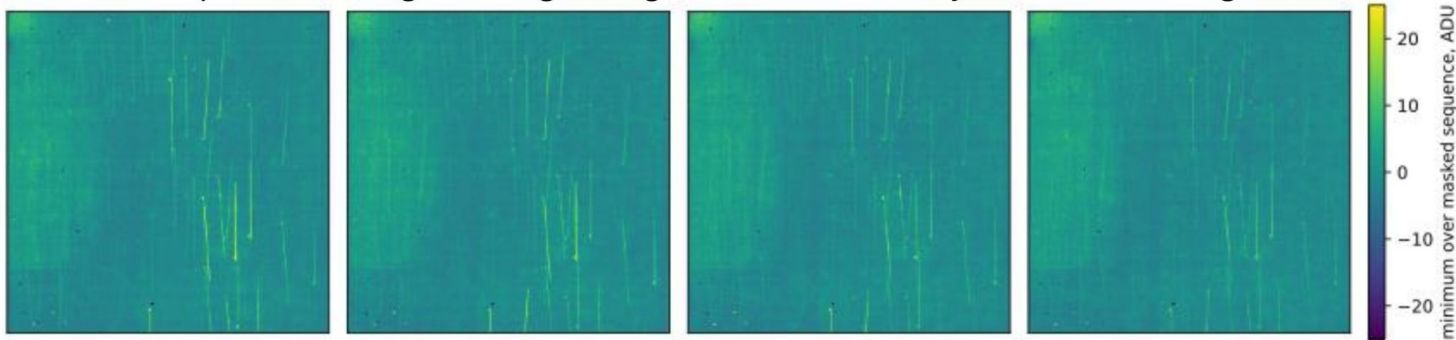
The LSB reduction

original target image



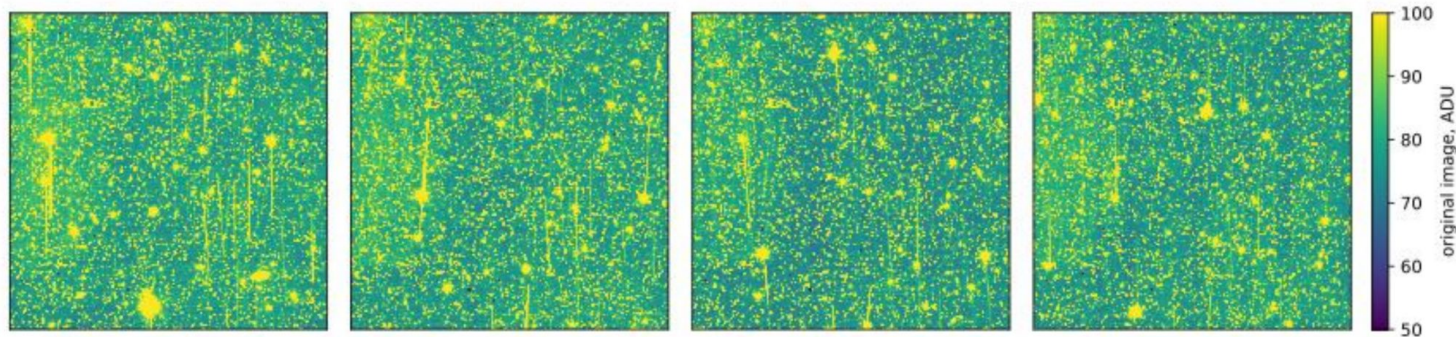
minimum over masked image sequence

- estimate of persistence signal in target image, but will have decayed over intervening time

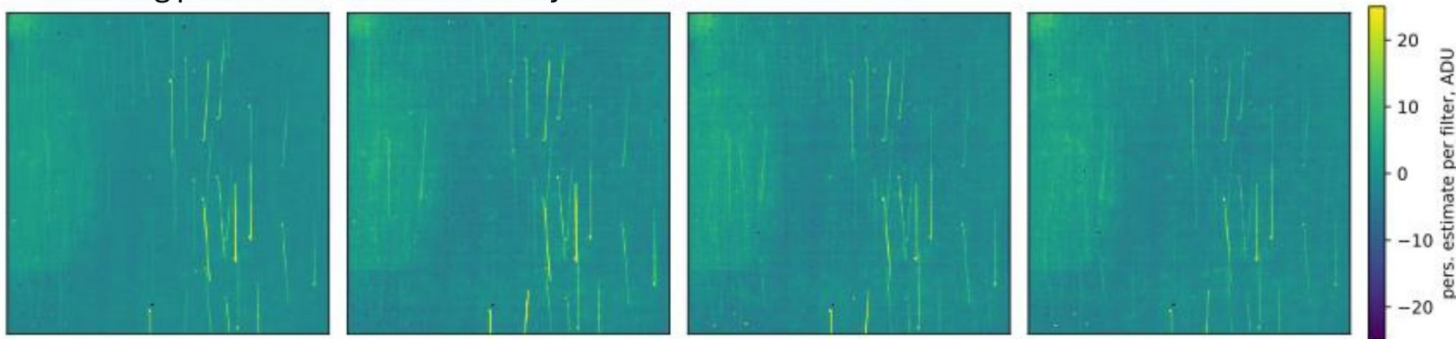


The LSB reduction

original target image

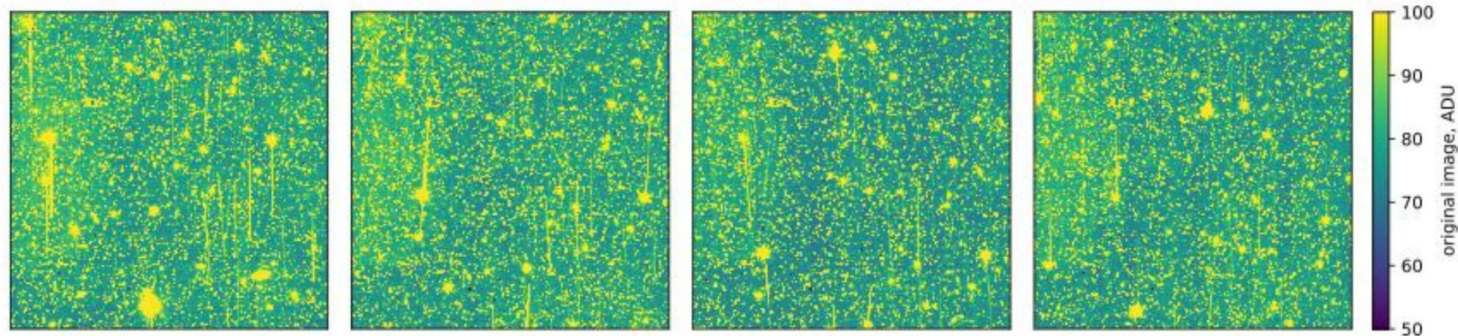


minimum scaled to target by elapsed time
- assuming power law with fixed decay constant

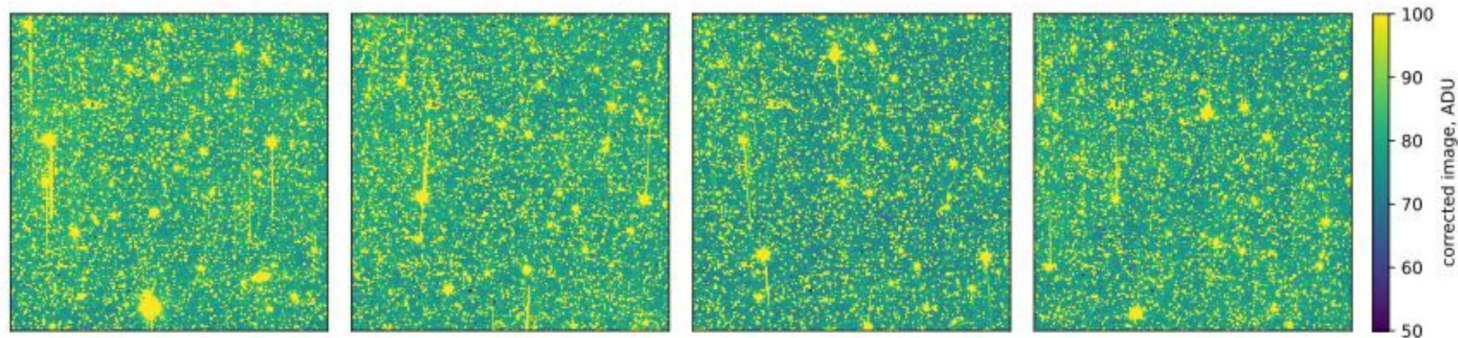


The LSB reduction

original image

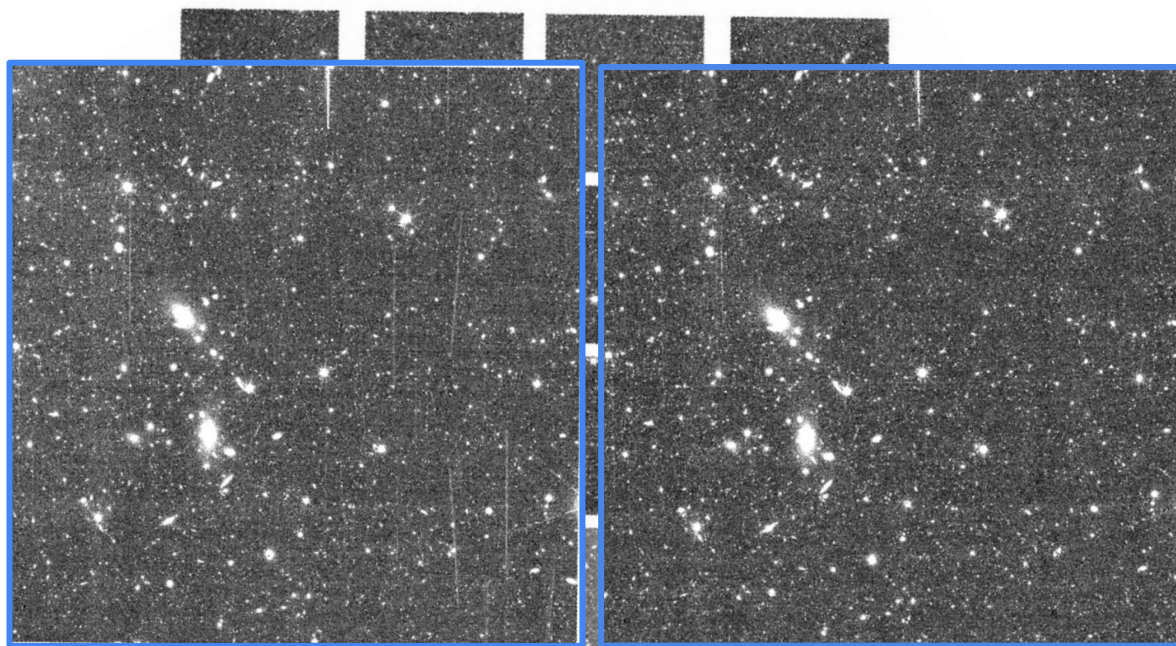


corrected image, older features removed, newer features attenuated



The LSB reduction

Dimauro 2025 in prep



Before

After

NISP

Persistence correction

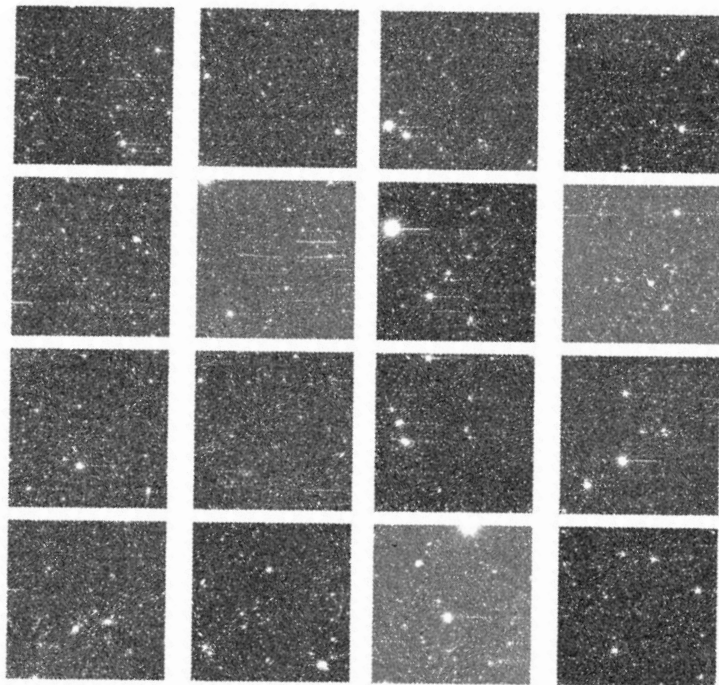
Autoflat correction

Stacking and mosaicing



The LSB reduction

Dimauro 2025 *in prep*



NISP/VIS

- Persistence correction
- Autoflat correction
- Stacking and mosaicing

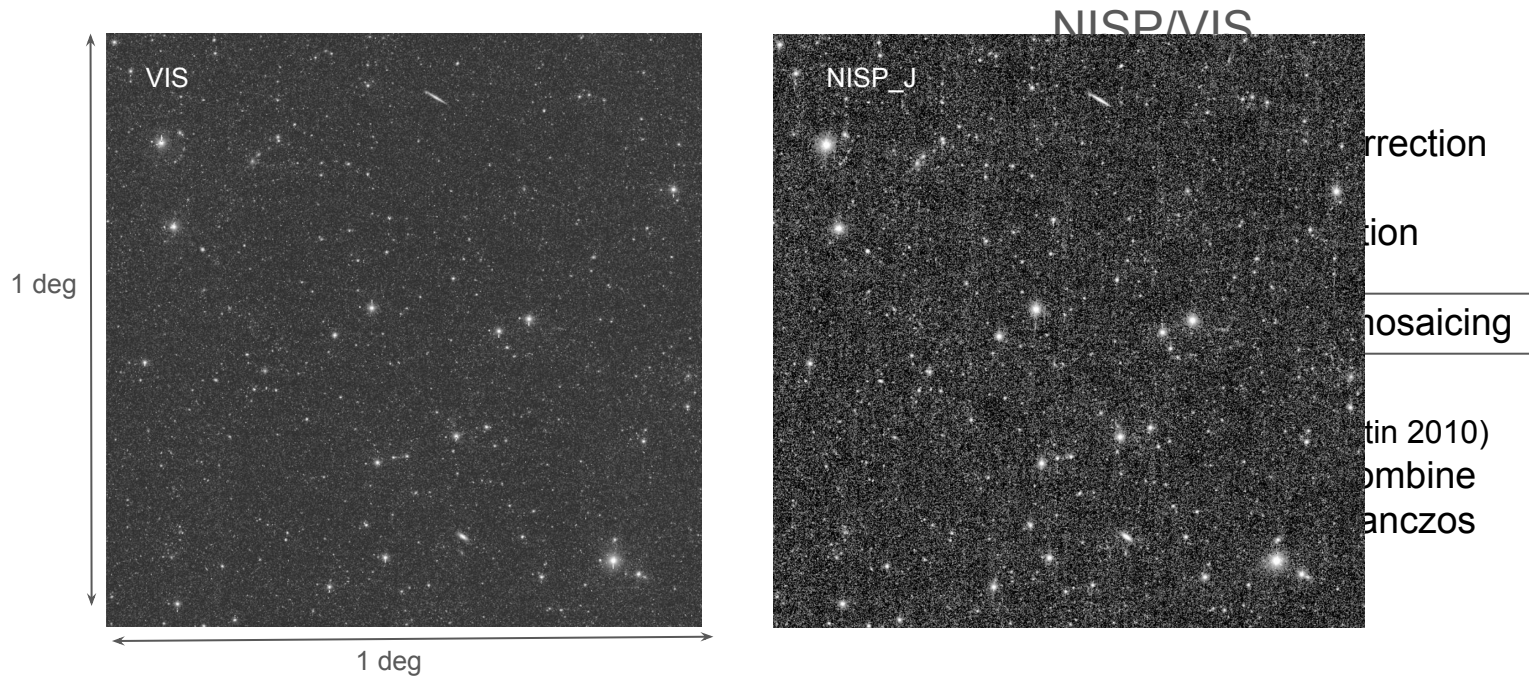
SWarp (Bertin 2010)

- Median combine
- Bilinear/Lanczos



The LSB reduction

Dimauro 2025 *in prep*

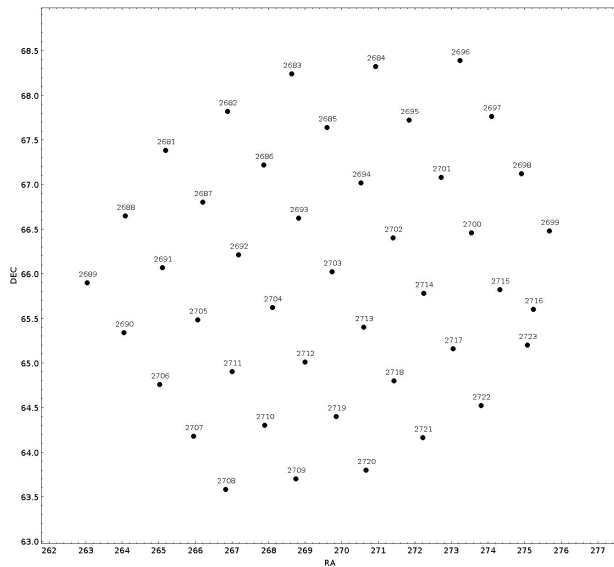


The LSB reduction

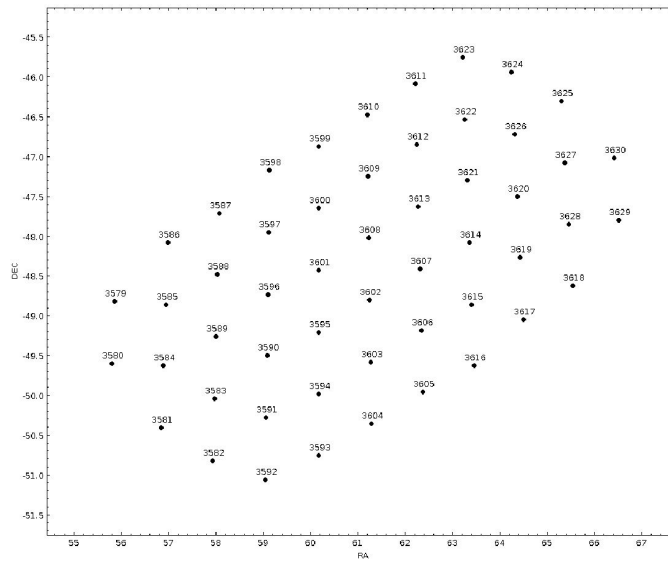
Dimauro 2025 in prep



Euclid EDF-N



Euclid EDF-S

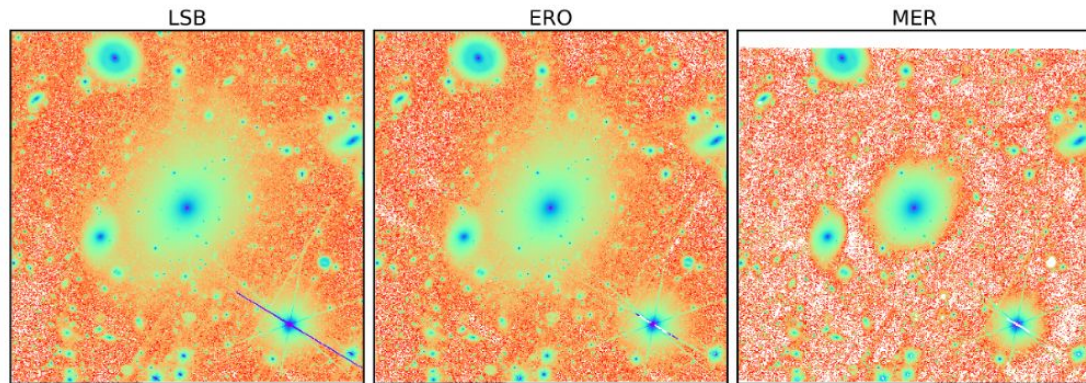
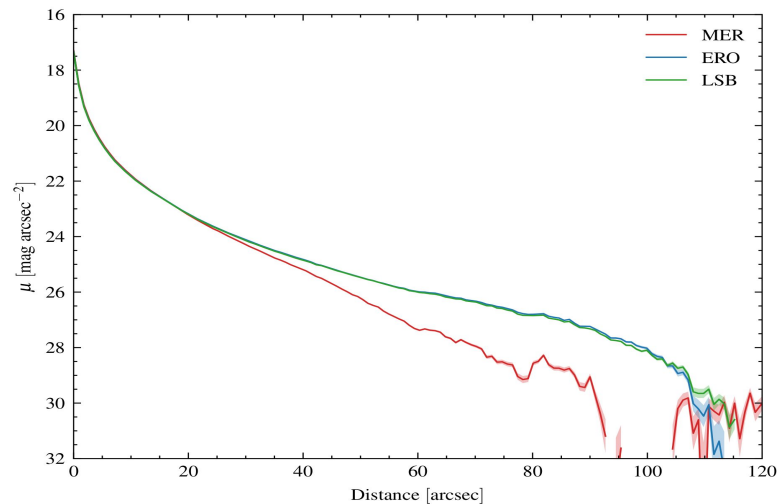
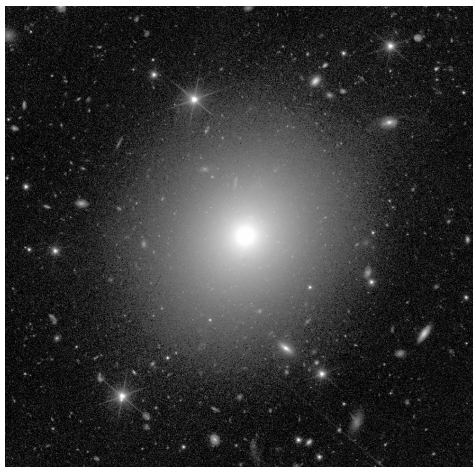


The $1^\circ \times 1^\circ$ mosaics are centered in the telescope pointings from which they take their name ID



Examples: Elliptical galaxy

Dimauro 2025 in prep

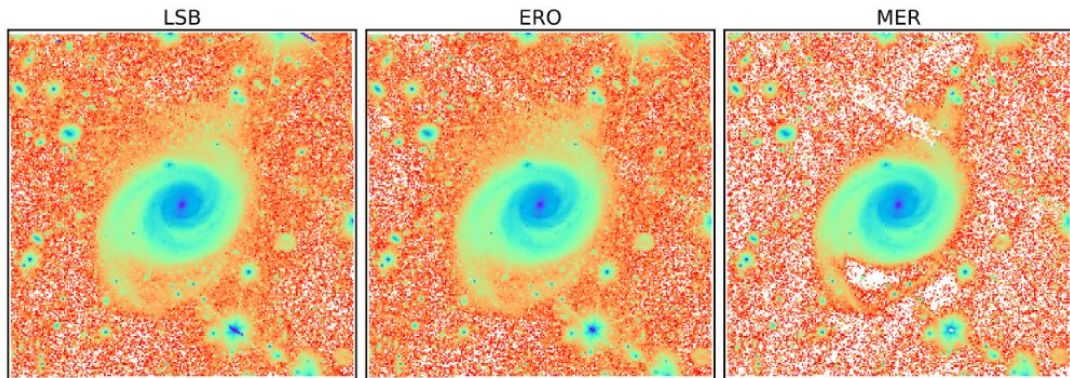
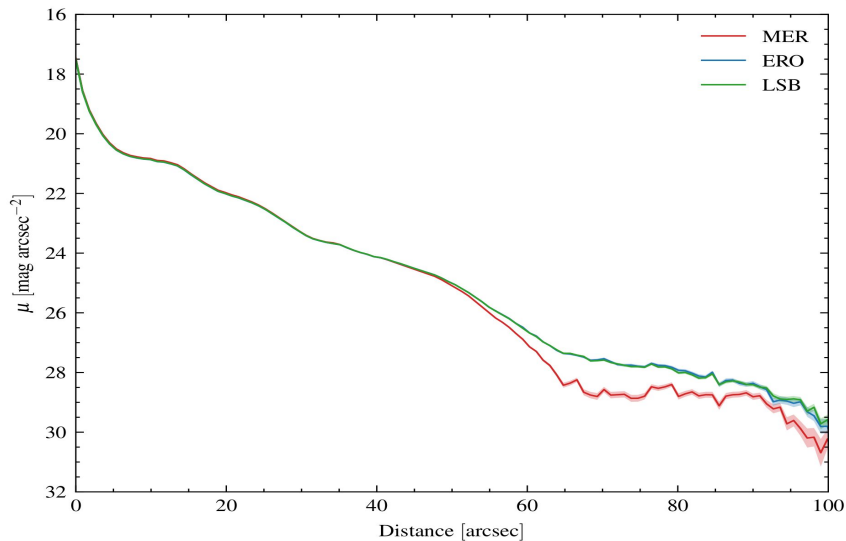
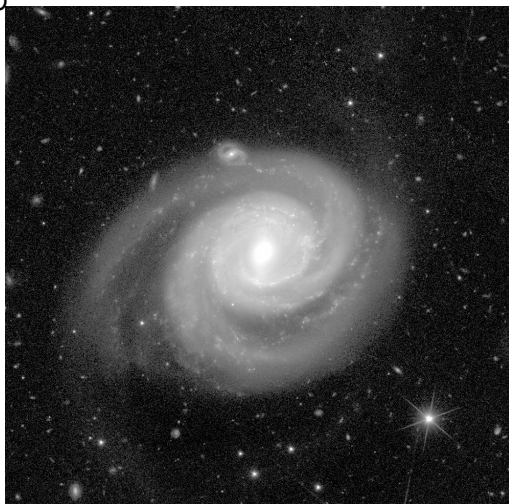


In the range between few arcsecond to 2 arcminutes the LSB reduction reaches results that are comparable to the ERO pipeline



Examples: Spiral galaxy

Dimauro 2025 in prep

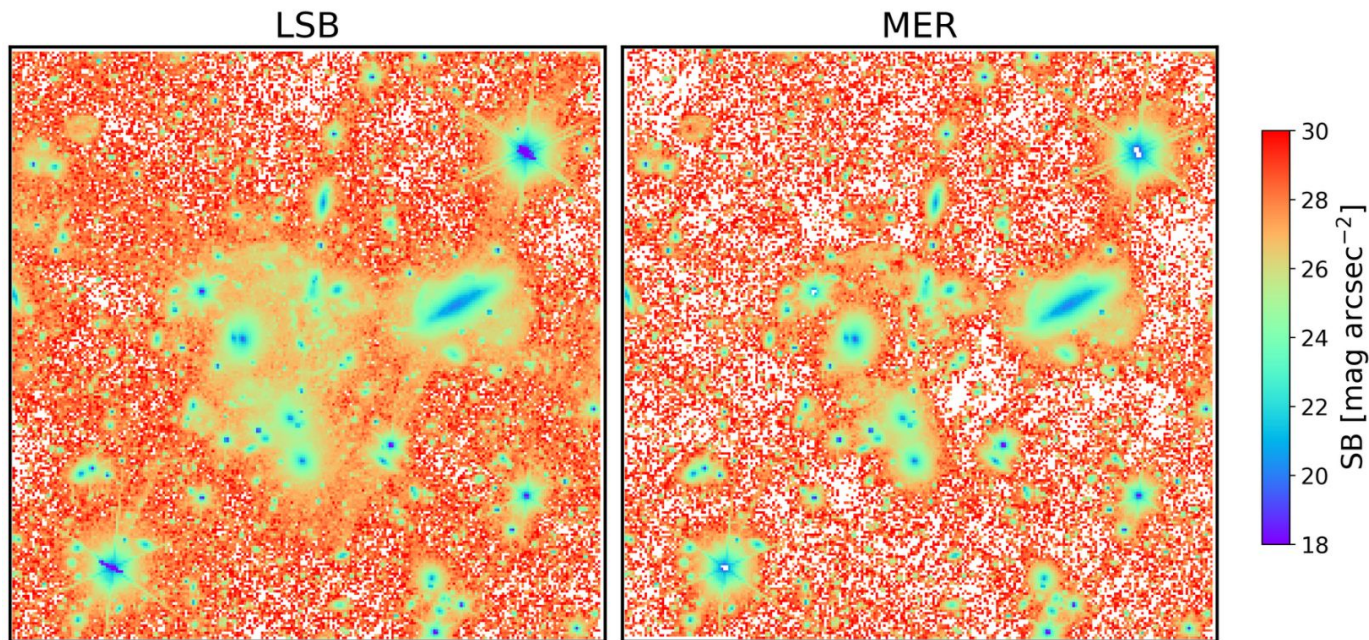


In the range between few arcsecond to 2 arcminutes the LSB reduction reaches results that are comparable to the ERO pipeline



Examples: Intra-Cluster Light

Dimauro 2025 *in prep*



Astronomy & Astrophysics manuscript no. output
July 1, 2025

©ESO 2025

***Euclid* Q1 Data Release**

Optimized Pipeline for the Low Surface Brightness Universe

Euclid Collaboration: P. Dimauro et al ^{★5,7}

(Affiliations can be found after the references)

...

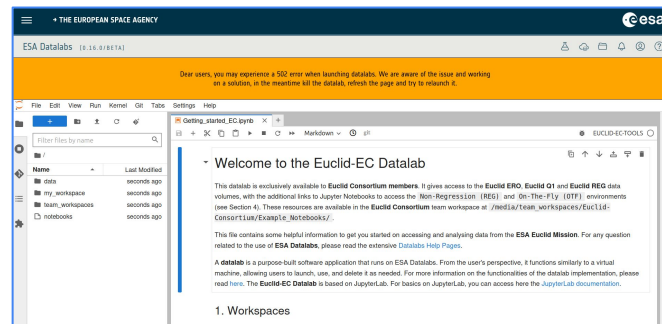
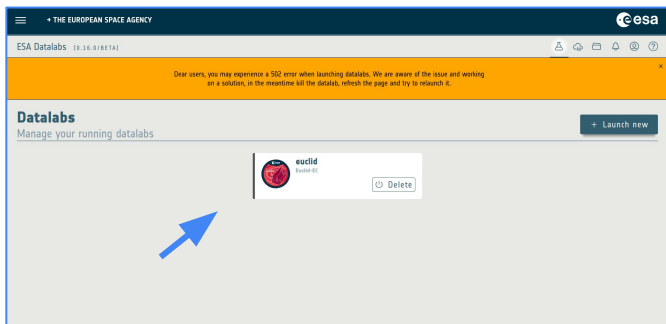
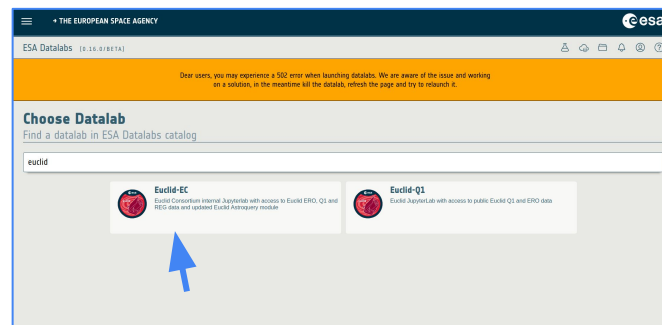
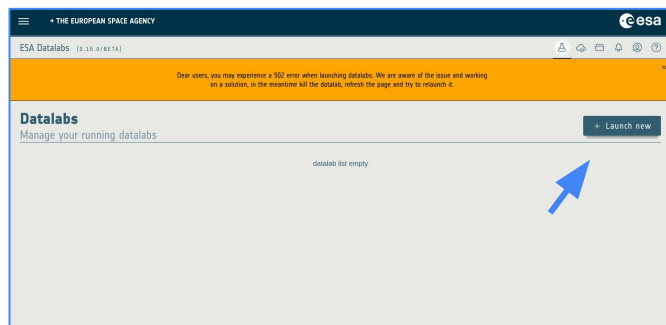
ABSTRACT

ciao ciao00000 ciao ciao

Key words. Galaxies:photometry, Galaxies:Low Surface Brightness, Methods:data reduction



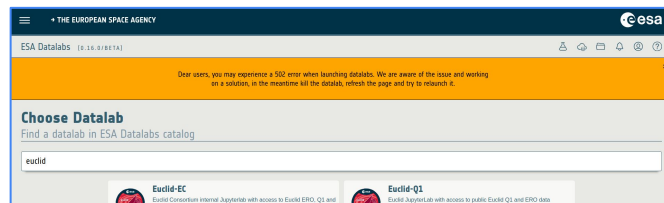
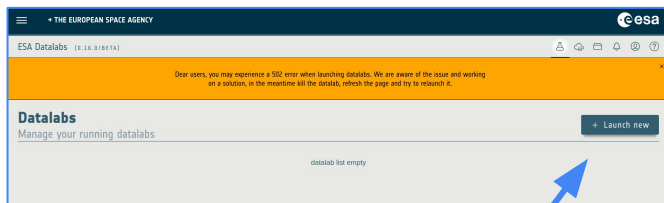
How to use Datalabs



Euclid view of the Low Surface Brightness Universe - Euclid LSB project



How to use Datalabs



Useful paths:

Q1 Euclid data: `/data/euclid_q1/`

LSB data: `/team_workspaces/Euclid-Consortium/data/LSB_reduction`

Hands-on notebook: `/team_workspaces/Euclid-Consortium/data/LSB_reduction/LSB_notebook.ipynb`

