ESA ESAC
Camino bajo del Castillo, s/n
28692 Villanueva de la Cañada
Madrid
Spain

CALL FOR EUCLID EARLY RELEASE OBSERVATION PROGRAMS

Prepared by R. Vavrek, R. Laureijs

Document Type
Reference EUCL-ESAC-PL-8-017
Issue/Revision 1. 0
Date of Issue 15/02/2023
Status N/A

APPROVAL

Title	Call for Euclid early release observation programs		
Issue Number	1	Revision Number	0
Author	R. Vavrek, R. Laureijs	Date	15/02/2023
Approved By		Date of Approval	

CHANGE LOG

Reason for change	Issue Nr	Revision Number	Date

CHANGE RECORD

Issue Number	1	Revision Number	0	
Reason for change		Date	Pages	Paragraph(s)

DISTRIBUTION

Name/Organisational Unit

Table of Contents

1. Early release observations program 5
2. Guidelines to program definition 7
2.1. ERO Program Scientist 7
2.2. Starting proposal preparation and getting support 7
2.3. Key milestones 8
2.4. Communications and outreach program definition 8
2.5. Scientific program definition 10
2.6. Example ERO catalogue and observation definition 10
2.6.1. Selected CALBLOCK-PV observations 10
2.6.2. Dedicated early observations 10
2.6.3. Dedicated early observations constraints 11
2.6.4. Example ERO catalogue 12
2.7. Proposal submission 13
3. Proposal evaluation 13
3.1. ERO Program Committee mandate and composition 13
3.2. Technical implementation group 14
3.3. Program Committee milestones 15
4. Final target selection and scheduling 15
5. Preparation of press kits and data releases 16
5.1. ERO press kits preparations 16
ERO micro-data releases 16
5.2. 16
5.3. Further usage of the ERO catalogue for communications 17
6. annex-1: technical information 18
6.1. Tile definition for large area mapping 18

6.2. Blinding star avoidance regions 18

Inclusion zone for the ERO program example target list 19

6.3. 19

6.4. Visibility calculator for ERO observing slots 20

7. annex-2: existing list of targets 21

7.1. Planned PV targets and fields 21

1. EARLY RELEASE OBSERVATIONS PROGRAM

This call solicits proposals from the Euclid Science Collaboration (ESA, EC and the ILSs) for an early release observations (ERO) program that shall consist of communication and outreach ideas and suitable astronomical objects for early showcasing and branding of Euclid. The call offers 24 hours of Euclid observing time during the Performance Verification phase and provides communications support to prepare high impact press kits. The 24 hours observing time corresponds to about 10 deg^2 of nominal survey or 20 pointings with the Reference Observing Sequence.

The deadline for proposal submission to <Euclid_ERO@cosmos.esa.int> is 15 March 2023 at 12:00 UT.

A new era in precision cosmology will start when Euclid delivers its first glimpse at the universe. The end of Euclid commissioning and Performance Verification phases 3 months after launch is the perfect time to demonstrate and publicise the mission's scientific potential and to celebrate its readiness for science.

We are looking for press-kit / communications ideas to:

- demonstrate with first images and spectra that the world's most powerful dark energy experiment is ready to begin its operations to collect and analyse data;
- highlight the unique capabilities of Euclid that will be used by multiple methods to explore how the universe has evolved throughout cosmic history;
- illustrate how excellent research and state-of-the-art engineering enable significant scientific advances in cosmology and astrophysics.

ERO target(s) shall be selected, observed and processed such that the resulting data are suitable for a press kit as well as scientific analysis. For the ERO program the outreach merit would take precedence over scientific merit.

It is noted that during the earliest mission phases, we cannot rule out serious contingencies and timely schedule updates. There is therefore no guarantee that selected and planned observations will be successfully executed.

The ERO program can be based on two resources of observations:

- **Selected CALBLOCK-PV observations**: using calibration targets or fields which have been selected and scheduled during the performance verification phase.
- **Dedicated early observations** of selected areas or a suitable sample of targets that complement the existing PV observations up to 24 hours of total time allocation.

The dedicated early observations could cover regions of the wide survey or regions outside the Region of Interest (RoI) that cannot be used for core cosmology due to the presence of large area foreground objects, like nearby galaxies or extended galactic sources. EROs shall not impair the PV program and associated calibration activities and would be restricted by constraints described in this call. ERO data taking operations must be completed before the start of the nominal survey.

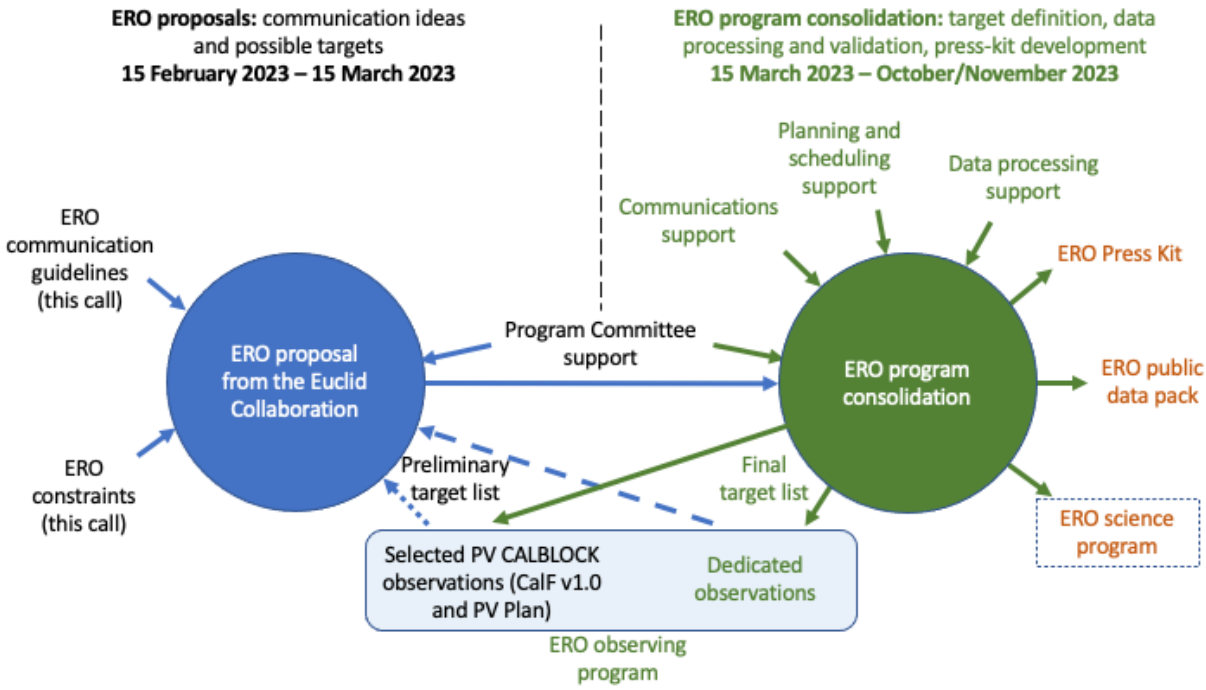


Figure 1: ERO proposal and program consolidation scheme. The final target selection and elaboration of a detailed press-kit is a collaboration between the Program Scientist, the Program Committee and the technical support group.

The target list should be robust with respect to schedule slips and proposals might therefore include example observations that will be adjusted to cope with observability constraints.

The early-release observations (ERO) programme would be selected by the ERO Program Committee including both Euclid scientists and communication specialists. The Program Committee will also support the preparation of the communication products in close coordination with the ERO program scientists.

The precise ERO release date shall be identified by the Program Committee and the release consists of a press kit, Level 1 data, and calibration products, which were used for the communication. The program scientist will recommend if higher level calibrated data products can be released. Remaining ERO data remain proprietary until the validation of scientific products is completed. Eventually, all ERO raw and calibrated data products shall be released to the public.

2. GUIDELINES TO PROGRAM DEFINITION

A proposal template is provided in a separate MS Word document available in the ERO call website from where this call was downloaded. This section provides information on the definition and submission of a proposal.

2.1. ERO Program Scientist

Each ERO programme is led by a **Program Scientist** who is coordinating the definition of scientific projects, closely involved in the planning of observations and processing of the data such that the resulting data are suitable for communication purposes as well as scientific analysis. The Program Scientist leads a dedicated group of scientific collaborators preparing the early Euclid scientific publication(s). The Program Scientist shall submit the ERO proposal and will be the contact point for further interactions.

2.2. Starting proposal preparation and getting support

The proposal preparation phase starts at 15 March 2023 by the issue of the ERO call (this document) and will last until 15 March 2023 12:00 UT, the deadline of submission. Already during this period the Program Committee can be contacted for support.

Proposals shall be submitted in PDF format by filling the template provided in the ERO call website. The template requests self-consistent information including example images of targets selected or sketches of explanatory graphics could be provided, but if needed additional data could be provided.

2.3. Key milestones

The key milestones for the Euclid ERO program definition are:

1. 15 February 2022: issue of the ERO AO (this document)
2. **15 March 2023 12:00 UT: Submission deadline for the ERO proposals** and start of evaluation process
3. 15-27 March operational/technical assessment, and identification of conflicts of interest
4. 13 April 2023 (TBC): Program Committee (PC) meeting. Ranking of proposals.
5. End of April: EST approval of proposals and ERO program.
6. End of April: Announcement of the outcome of the selection process to Program Scientists.
7. Mid May (TBC): Announcement of launch date and sky visibilities for ERO targets
8. June (TBC): Iteration between Program Scientists, the PC and the technical implementation group for final target selection, PC approval of the final target list.
9. June/July (TBC): freeze the scheduling of the ERO dedicated observations in PV program.

ERO press kit preparations shall start as early as May 2023 for approved programs, the precise timeline of ERO press releases, micro data release, and related activities are to be determined by the Program Committee until the end of the PV phase.

2.4. Communications and outreach program definition

Elaborate on the following questions:

- **Envisaged communications narrative, how do objects relate to Euclid capability / mission objective?** Focus on how your announcement provides a grand opening of the Euclid mission to the public audience. Please consider the three high level objectives in the introduction to shape an appealing narrative and related items for a press kit, the emphasis shall be on how the proposed observation demonstrate a unique Euclid capability, mission objective or scientific potential. Narratives that convey a clear message or single perspective will attract more press attention and may be picked up and relayed by media outlets.
- **What is the communications merit of the proposed astronomical object(s)?** Explain how the proposed object and its appearance in communication products fit to the narrative (for instance, imaging capability of galaxy details and shapes over cosmic scales, measurement of distances of large number of galaxies through their infrared light, measurement of large areas of sky in a very efficient way etc.)
- **What Euclid products are required (imaging, photometry, spectroscopy)?**
    - **SGS Level 2 products identified from data model.** List which standard SGS Level 2 products can be used directly for release (image stacks, filters, spectrum 1D etc.)
    - **Customized products, processing and calibration steps involved; development resources needed.** Standard SGS products may not be fully tested for some typical early release objects of interest like large nearby galaxies. Identify if standard reduced data (photometry etc.) is expected of poor/unreliable quality on the timescale envisaged for the ERO, even if the calibration data are good. If alternative pipeline steps or post-processing of standard products is required describe the process and required resources needed. Provide an approximate timeline required for the implementation of processing tools, and estimate how much time it takes to create the final communication products once ERO data have been obtained. Identify any substantial risk in this process.
- **Additional communication product ideas like special graphics efforts needed, video footage, animation, enhanced visual effects or filters on Euclid data etc.** If it helps for explaining the proposal, please draw a simple sketch.

2.5. Scientific program definition

Elaborate on the following questions:

- **Scientific rationale and uniqueness of required Euclid capabilities to achieve the science goal.** Provide a brief introduction to the immediate scientific objectives, the motivation and relevance of the planned observations.
- **Identify risks related to limited early calibration performance.** ERO data is taken during the PV phase, calibration may not yet be based on updated in-flight calibration products, and data reduction may have performance issues. The scientific goal shall be reachable under these conditions, the required precision and accuracy of data and observables may not be fully up to requirements.
- **Data exploitation and validation plan for products identified for public releases and scientific analysis.** Describe processing and validation efforts required for the generation of data products that may originate from standard ROS or non-standard PV operations and may require processing by a custom pipeline. The scientific validation plan of data products that are used for press kit preparations and envisaged for science analysis shall be explained here.
- **Is there an immediate science result that can be released in the press-kit based on an early data processing?**

2.6. Example ERO catalogue and observation definition

2.6.1. Selected CALBLOCK-PV observations

An ERO proposal could take advantage of planned performance verification observations or could request observing additional areas on the sky. Description of observations planned during the PV phase either in standard ROS or in special sequence can be found in the CALBLOCK-PV description of the Calibration Framework:
http://calibration.pages.euclid-sgs.uk/CalTQ-Framework/
The actual scheduling timeline and targets considered for CALBLOCK-PV instances is provided in the PV Plan EUCL-ESAC-PL-8-008 v0.6.

2.6.2. Dedicated early observations

The scheduling of the ERO dedicated objects shall be constrained by their visibility during the PV phase, their observability using the Reference Observing Sequence (ROS) and their absence of disturbances to the PV calibration program. The current set of applicable observing constraints is collected in Section 2.6.3, guidelines to set up the example ERO catalogue are provided in Section 2.6.4.

In 2021, the EC Survey Scientist took the initiative to solicit “glamorous” targets. The EC science working groups were asked to propose feasible cases with a one-page justification. The ECSURV group was tasked collecting the proposals, compiled a target list, and checked for observing and scheduling feasibility during PV phase. The proposers were contacted to provide more details if necessary. Even though no commitments could be made by ECSURV about the actual execution of the observations, the list of targets was created, with descriptions of the communications and scientific merit. For this call, the proposers are encouraged to resubmit their proposals according to the proposal template.

2.6.3. Dedicated early observations constraints

Observing constraints identified for the PV phase are applicable to the dedicated ERO program as well. Dedicated early observations should be executed using the nominal reference observing sequence (ROS) and should not be detrimental to the PV and core-science programme of Euclid due to for instance excessive use of slews, thermal disturbances, detector disturbances, etc. The pointing positions may not have to be confined to the Euclid Region of Interest (RoI) but they should not require pointing or guiding capabilities beyond those demonstrated for the core mission at the time of observation. The impact of background levels and stellar densities outside of the RoI shall be evaluated by the proposer. Multiple passes over the same region can be considered.

The Euclid launch date has one month uncertainty at the time of this call, it is planned in July 2023 (01/07-31/07). Considering this uncertainty and the two months duration of the PV program, the possible visibility period of ERO targets is a quite long three months period (01/08-30/10) in which the initial ERO target list shall be defined. The total sky visibility during this period reaches almost half of the full sky area, the initial inclusion zone in which observations should be planned is provided in Annex-1.

The ERO observing program shall be compliant with the following program definition requirements as well as technical and operational constraints:

ID	Type	Requirement/constraint description
1.1	Obs. mode	The ROS must be used for any ERO pointing. Standard ROS variants in default cycling rule should apply.
1.2		The ROS current best estimate point-source sensitivities at low/medium/high total background levels shall be considered nominal.
1.3		Current best estimate NISP saturation levels
2.1	Pointing request	Maximum of 6 ROS sequences could be requested. Already planned PV standard ROS observations do not count in this budget.
2.2		ROS sequences could be planned: • on individual pointings not connected, • on connected pointings to cover an area larger than the common FoV, or • repeatedly on the same FoV centre. Connected observations shall consider the standard Tile geometry (see Annex-1) as a building block for mapping larger areas.
2.3		The proposed pointing layout should fulfill its purpose for any position angle.
2.4		Pointings should avoid blinding stars for any position angle (see Annex-1)
3.1	Sample definition	The initial target list shall consider only sky areas that are visible within a three months period from 01 August 2023 to 30 October 2023 (see Annex-1)
3.2		The final target list shall be tailored to the instantaneous visibility areas of ~7848 square degrees available at each of the ERO observing days. Final visibility areas will be provided within 1 month following the launch date announcement.

2.6.4. Example ERO catalogue

At the time of the ERO proposals submission deadline the precise sky visibility in which the ERO targets can be considered will be known only with large uncertainty. Proposals can be based on a representative but not necessarily complete target list. It is not required to propose a complete collection of candidate targets from which the final ERO selection will be made.

The initial target list shall be indicative, and shall be used to demonstrate the communication objective, the science goal and the feasibility of the proposal. Approved programs may extend the target list to similar objects or fields based on the PV phase start time and time slots allocated for the ERO program.

Alternatively, proposers may provide a target list that is robust against changes in scheduling. The example target list can be oversized for the assessment of the of the program. Once the PV phase start time and time slots allocated for the ERO program become available then the pointings from this initial list have to be selected.

Example target list for ERO observing program shall provide:

- **Name or other designation or generic description of object class**
- **Right ascension and declination (J2000)**
- **Pointing layout (single ROS pointing or area to be covered with adjacent fields or dither pattern)**
- **If repetitions are needed (for increased sampling or depth)**
- **If target is covered by existing PV implementation procedures (CALBLOCK-PV-ID)**

2.7. Proposal submission

Proposal shall be submitted in PDF format before the deadline to the Program Committee e-mail address <Euclid_ERO@cosmos.esa.int>.

3. PROPOSAL EVALUATION

3.1. ERO Program Committee mandate and composition

The programs leading to a Euclid showcase shall be approved by the EST and selected by the **ERO Program Committee (PC).** The PC is responsible to advise on and approve the Euclid ERO Program: the dedicated observations and target lists, the accompanying stories and their release to the public based on the ESA communication plan.

ERO proposals are evaluated based on communications impact and technical feasibility. A review process ensures that both communications experts and scientifically knowledgeable peers provide proposal evaluations. The PC ensures that the communication objectives of the ERO program can be fully achieved. The PC is responsible for:

- Defining criteria of representative/demonstration sources that communicate what and how the Euclid mission is aiming to achieve.
- Ensuring the legacy science in the Euclid Science Collaboration is protected, and any conflict of interest is revealed and discussed with parties involved (e.g. if it is proposed that Euclid observes Big Galaxy X and the Milky Way and Resolved Stellar Population SWG do not want this to happen, it should not happen)
- Creating a ranked list of selected programs.
- Monitoring the preparation and execution of the ERO programs in close coordination with the program scientists.
- Proposing and maintaining a detailed timeline for the ERO release according to the Euclid communication plan. This includes possible topics and plans for outreach / communications events
- Facilitating and monitoring the preparation of the final products for release.

Before the PC approval, proposals are assessed for operational/technical feasibility, and conflicts of interests. For the assessment of the technical feasibility of the programs, the PC shall be supported by the technical implementation group that consists of ESA/SOC and EC/IOT members.

3.2. Technical implementation group

The technical implementation group consists of experts who shall cover the following areas:

- Instrument operations and performance: understanding the limitations and instrumental constraints affecting the communications merit and/or science merit of the program.
- Scheduling and execution of the observations: understanding the PV plan such that the ERO program does not disturb the PV plan.

- Data processing and product generation: understanding the processing needed to optimise the communications merit, and advice on timely science products for a given ERO program.

3.3. Program Committee milestones

PC decisions adhere to a two-stage process:

1. Proposals are ranked based on communications impact and technical feasibility. The PC shall advise to the EST which ERO programs shall be elaborated in detail in terms of scheduling, data processing and press kit preparations.
2. Within 30 days following the launch date announcement and based on the PC selection criteria, the PC will create a ranked list of objects that must be scheduled during the PV phase. This selection is done with support of the Program Scientist and the technical implementation group.

4. FINAL TARGET SELECTION AND SCHEDULING

The precise allocation of ERO observing days and the corresponding sky visibility will be announced around 2 months before launch, probably in May 2023. The final selection of targets will have to be carried out in iteration with the PC and the SOC PV Coordinator over a one-month period. At the end of this process, the final ERO target list and scheduling timeline will be approved by the PC. The PV coordinator is responsible for the inclusion of the selected targets in the PV plan. The program scientist will be closely involved in the planning and execution of the observation.

Sky visibility and scheduling restrictions during the PV phase are crucial for the definition of the final target list. All ERO targets must be compliant with a rigid scheduling approach: no fixed time observations could be requested, and the final target list must be observed in two or maximum three observing blocks of several hours each. This approach ensures the minimum disturbance of the ERO program on PV scheduling, and at the same time maximises the observable sky area. The SOC plans allocating at least two ERO windows around the middle and towards the end of the PV phase. With this approach the sky area visible for ERO objects

sums up to ~10000 square degrees (TBC) considering the full nominal Solar Aspect Angle (SAA) range is available for observations.

5. PREPARATION OF PRESS KITS AND DATA RELEASES

5.1. ERO press kits preparations

Guided by the ESA communications plan the date of ERO release events will be defined by the PC.

The ERO press kit would consist of images or spectra and explanatory graphics, video footage, animation and/or other enhanced visual material. The definition, preparation, and validation of components identified for press kits is organized by the Program Scientist with support of the PC and the technical implementation group. The graphical components shall be created in collaboration with the Communications Team.

Euclid data used for press kits must undergo a validation process defined by the Program Scientist and approved by the PC. In case raw or calibrated data products cannot be released to the public at the same time as “press products” then the validation process and success criteria may be customized for components used in the press kit (e.g. image quality checks, validation of statements in the text on data performance etc.).

Preparation of press kits shall start as early as possible (before launch) especially for the graphical components, and shall be completed and ready for final PC approval 14 days before the release date.

5.2. ERO micro-data releases

A micro-data release corresponds to the data sets which will be made available in the ESA Euclid Science Archive to the general public according to the approach outlines in Section 1.

The program scientists shall deliver to the SOC Archive Scientist with copy to the Project Scientist the product descriptions and references to the publications based on the ERO observations.

5.3. Further usage of the ERO catalogue for communications

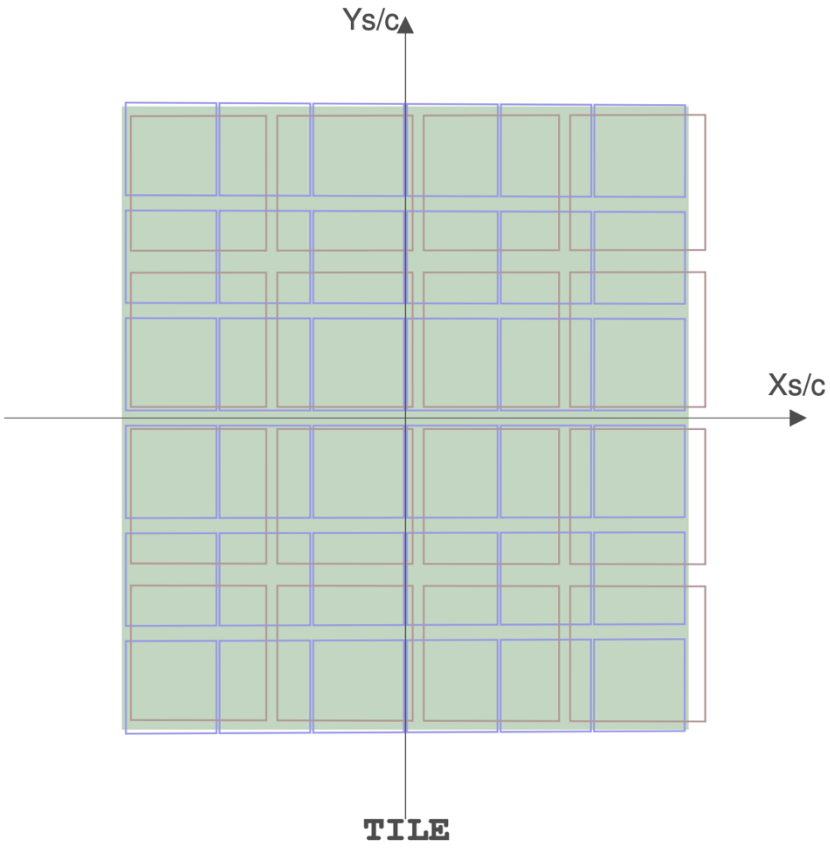
The ERO catalogue contains more objects than the ERO program will observe. The objects situated inside the Euclid Region of Interest (ROI) will likely be observed during the nominal mission and for a given Reference Survey Definition (RSD) the observation date of the target and associated program can be determined. This could become part of the communications plan covering the nominal part of the mission, giving special attention to the objects in the ERO catalogue.

6. ANNEX-1: TECHNICAL INFORMATION

We assume that technical information and expertise is available within the Euclid Collaboration. Questions about the technical details should be submitted to **Euclid_ERO@cosmos.esa.int**. Answers will be provided on a best effort basis within a few working days.

6.1. Tile definition for large area mapping

The Tile geometry shown below has been optimized to provide optimum coverage for Wide Survey ROS type observations. The size of the green area (defined by V[x] corners) shall be used to calculate the number of pointings required to cover a contiguous region on the sky with no gaps.



TILE geometry

corners	$X_{s/c}$[deg]	$Y_{s/c}$[deg]
v[0]	0.465 435	0.388 473
v[1]	0.465 435	−0.388 473
v[2]	1.172 666	−0.388 542
v[3]	1.172 666	0.388 542
center	0.819 050	0.000 000
size	0.707 230	0.776 936
area	0.5495 deg^2	

Figure 2: the Euclid tile geometry is illustrated by the green area overlayed with the VIS (blue) and NISP (red) instrument footprints. (Image credits J. Dinis / Survey Working Group)

6.2. Blinding star avoidance regions

Blinding stars are stars that are brighter than 4 mag in NISP Y-band photometry shall be avoided by the field of view. The map below shows the avoidance regions for information, the list of bright stars with corresponding avoidance radius will be published on the ERO website to support the selection of the final target list.

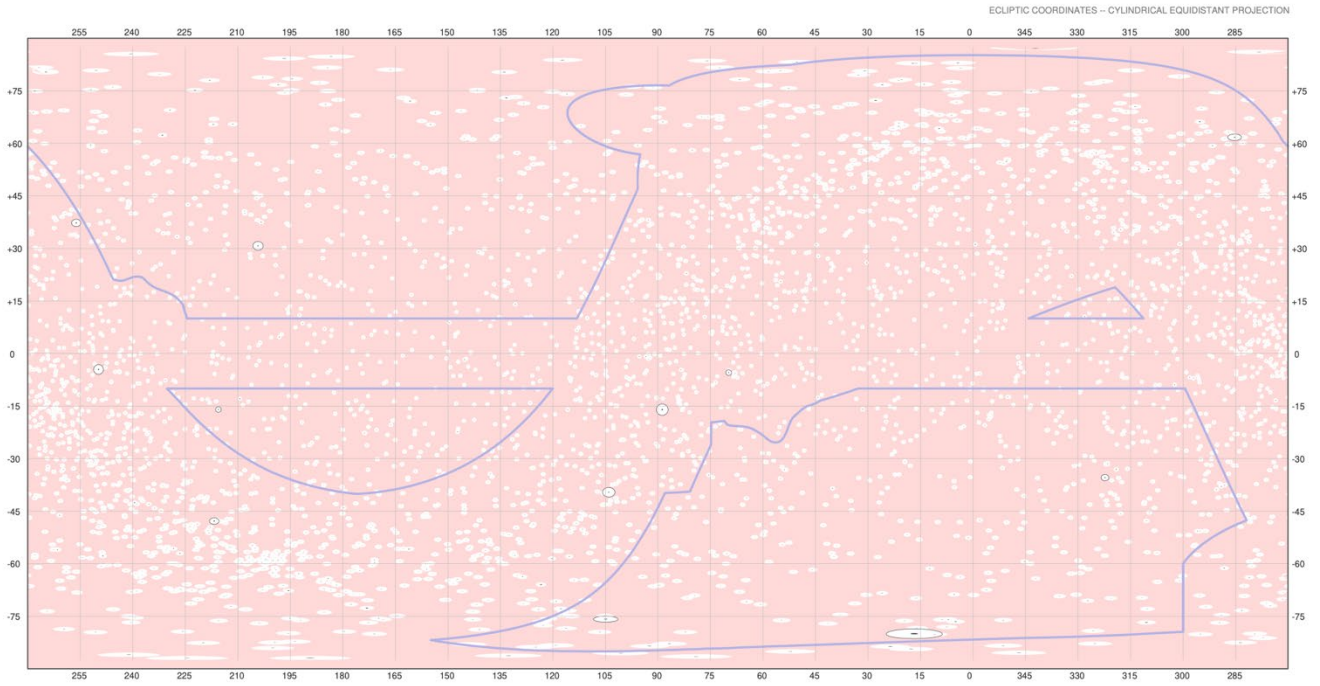


Figure 3: blinding star avoidance positions are indicated by white spots on a full-sky map in Ecliptic coordinates. (Image credits J. Dinis / ECSurv)

6.3. Inclusion zone for the ERO program example target list

Based on the current launch date uncertainty, the earliest start of the PV phase is 10/08/2023, and the latest end of PV is 30/10/2023. The map in Fig. 4. shows areas that can be considered for the selection of the example ERO target list. Regions in Ecliptic longitudes are visible between 18.5-130 degrees and 215-327 degrees aprroximatively.

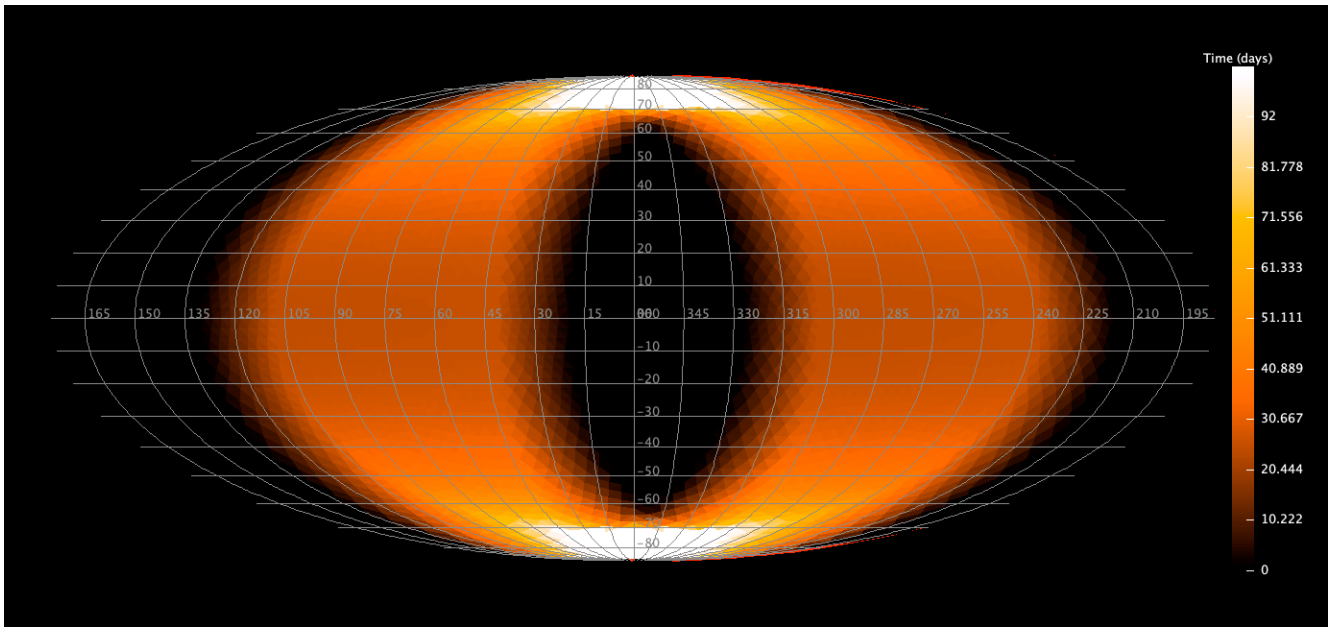


Figure 4 potential sky visibility of ERO targets in Ecliptic coordinates. The colour coding of the heat map shows the number of days a given position is visible in the period 2023-08-01T00:00:00Z-2023-11-01T00:00:00Z (Image credits: Pedro Gomez / SOC).

6.4. Visibility calculator for ERO observing slots

In mid May (TBC) the ERO slots will be published. By that time a visibility calculator will be provided on the ERO website to tailor the final target list and required pointing layout.

7. ANNEX-2: EXISTING LIST OF TARGETS

7.1. Planned PV targets and fields

Please consult the Calibration Framework for currently panned calibration targets and fields: http://calibration.pages.euclid-sgs.uk/CalTQ-Framework/

The actual scheduling timeline and targets considered for CALBLOCK-PV instances is provided in the PV Plan EUCL-ESAC-PL-8-008 v0.6.