

***Euclid*: Quick Data Release (Q1) – A photometric search for ultracool dwarfs in the Euclid Deep Fields★**

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ABSTRACT

We present a catalogue of 5306 new ultracool dwarf (UCD) candidates in the three Euclid Deep Fields in the Q1 data release. They range from late M to late T dwarfs, and include 1200 L and T dwarfs. A total of 546 objects have been spectroscopically confirmed, including 329 L dwarfs and 26 T dwarfs. We also provide empirical *Euclid* colours as a function of spectral type. Our UCD selection criteria are based only on colour ($I_E - Y_E > 2.5$). The combined requirement for optical detection and a stringent signal-to-noise ratio threshold ensure a high purity of the sample, but at the expense of completeness, especially for T dwarfs. The detections range from magnitudes 19 and 24 in the near-infrared bands, and extend down to 26 in the optical band. We discuss *Euclid*'s capability to identify UCD candidates based on its photometric passbands. The average surface density of detected UCDs on the sky is approximately 100 objects per deg², including 20 L and T dwarfs per deg². This leads to an expectation of at least 1.4 million UCDs in the final data release of the Euclid Wide Survey, including at least 300 000 L dwarfs, and more than 2600 T dwarfs, using the strict selection criteria from this work.

Key words. catalogs – brown dwarfs

1. Introduction

Ultracool dwarfs (UCDs), comprising the lowest-mass stars, brown dwarfs, and free-floating planetary-mass objects, rep-

resent a continuum of properties linking stellar and planetary physics. Their formation mechanisms remain vigorously debated: with questions surrounding whether they form like stars, via the gravitational collapse and fragmentation of molecular clouds, or like planets, through disc instabilities or core accretion followed by ejection (Whitworth 2018; Miret-Roig et al.

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2022; Palau et al. 2024). Despite their intrinsic faintness, they are abundant, making up a significant fraction of the Galaxy’s population. Yet, their census remains incomplete, particularly at the faint and metal-poor ends. Building large, homogeneous catalogues and developing robust photometric and astrometric diagnostics to distinguish UCDs from background contaminants are therefore crucial steps towards constraining their formation pathways. In turn, this will shed light on the broader processes of star and planet formation, helping to advance our understanding of the lowest-mass end of the initial mass function.

The advent of major wide area imaging and spectroscopic surveys from the ground and from space, at optical and infrared wavelengths, has enabled the discovery of hundreds of UCDs. Traditionally, these faint ultracool objects are first identified by photometric selection criteria using large survey catalogues (e.g. Sloan Digital Sky Survey (SDSS; York et al. 2000), Two-Micron All-Sky Survey (2MASS; Cutri et al. 2003; Skrutskie et al. 2006), Deep Near Infrared Survey of the Southern Sky (DENIS; Epchtein et al. 1997), UKIRT Infrared Deep Sky Survey (UKIDSS; Lawrence et al. 2007), Wide-field Infrared Survey Explorer (WISE; Wright et al. 2010), VISTA Hemisphere Survey (VHS; McMahon et al. 2013), Panoramic Survey Telescope and Rapid Response System (Pan-STARRS; Chambers et al. 2016), and the Dark Energy Survey (DES; Abbott et al. 2021)), and later confirmed spectroscopically (e.g. Kirkpatrick et al. 1999, 2000; Luhman 2014; Martín et al. 1999, 2010; Reylé 2018). For example, dal Ponte et al. (2023) extended the catalogue of Carnero Rosell et al. (2019) and identified almost 20 000 UCD candidates brighter than $z \leq 23$ in DES. On the other hand, the Ultracool Sheet¹ (Best et al. 2024) – the growing literature compilation of confirmed UCDs and imaged planets – contains more than 4000 objects, as of December 2024.

The *Euclid* space mission (Euclid Collaboration: Mellier et al. 2025) is a wide-field space telescope equipped with high-precision optical and near-infrared imaging and slitless spectroscopy. It is designed to observe distant galaxies to explore the composition and evolution of the dark Universe. At the same time, its high sensitivity and wide coverage enable the identification of thousands of new UCDs. This is made possible primarily by its sensitive Near-Infrared Photometer and Spectrometer (NISP, Euclid Collaboration: Jahnke et al. 2025), which observes wavelengths that are otherwise partially obscured by Earth’s atmosphere, such as water absorption bands. This spectral range also reveals key molecules in UCD atmospheres, such as methane. *Euclid*’s high sensitivity makes it possible to detect fainter objects than in previous wide-field surveys. The depth provided by the Q1 data allows us to probe about 3 magnitudes deeper at optical and near-infrared wavelengths than previous ground-based surveys. The limiting sensitivity in the optical is 26.7 (Euclid Collaboration: Mellier et al. 2025), and 24.4 (5σ point source) in the near-infrared, and this enables the detection of faint, free-floating planetary-mass objects. For example, the first scientific results of *Euclid* were derived from the Early Release Observations (ERO; Cuillandre et al. 2025), which included the photometric identification of new UCDs in the Sigma Orionis open cluster (Martín et al. 2025) and the LDN 1495 region of the Taurus molecular clouds (Bouy et al. 2025). Owing to the young age of these regions, such objects have likely planetary masses, down to a few Jupiter masses. Upon completion of the wide (Euclid Wide Survey, EWS) and deep (Euclid Deep Survey, EDS) surveys that will take over 5

years, it has been predicted that *Euclid* will have detected the largest ever number of UCDs, most of which will be present only in the near-infrared images (Solano et al. 2021). The resulting large catalogue will help us better understand the populations of UCDs and their formation scenarios, and help us refine the models of their interiors and complex atmospheres.

This work presents the first study to assess the potential of *Euclid*’s passbands to identify UCDs in its observations. By exploring the UCD parameter space using photometric data from the *Euclid*’s first Quick Data Release, Q1 (Euclid Quick Release Q1 2025), we evaluated its capability to detect UCDs on a large scale, comparing it with the spectroscopic search and analysis from Dominguez-Tagle et al. (2025) and Mohandasan et al. (2025). Our goal was to understand both the strengths and limitations of the photometric data in identifying UCDs. Since the depth of the Q1 matches that of the planned EWS, this study provides a direct estimate of the expected UCD yield in the final EWS at the end of the mission – representing a crucial step towards understanding the final survey’s potential.

To ensure high reliability, we searched for UCDs detected in both near-infrared and optical bands. The resulting catalogue has a relatively low contamination rate at the cost of completeness. Fainter detections in the near-infrared EDF observations will be examined in a follow-up study and in future repeated observations, which will probe even deeper.

This paper is structured as follows. In Sect. 2, we present the *Euclid*’s Q1 data along with known UCDs from the literature, which are included in this dataset and used as benchmarks. We describe the extraction of point sources from the *Euclid* catalogue in Sect. 3. Section 4 details the selection process for candidate UCDs in our dataset. In Sect. 6, we examine the properties of our candidate UCD catalogue, their spectral types and empirical colours, the catalogue’s limitations, and the expected number of UCD detections in the future *Euclid* observations. Finally, we draw our conclusions in Sect. 7. We provide lists of spectroscopically confirmed benchmark sources and T dwarfs, as well as our main photometric UCD candidates, in Appendix A.

2. Data

In this paper we utilise the three catalogues of the EDFs from the Q1 data release. They cover a total area of 63 deg², distributed approximately as follows (see Euclid Collaboration: Aussel et al. 2026): EDF Fornax (EDF-F), 12 deg²; EDF North (EDF-N), 23 deg²; and EDF South (EDF-S), 28 deg². This data release includes only the first visit of these fields, but they will be continuously observed many times during the lifetime of the mission, which will deepen the detection limit by another 2 magnitudes.

We exploited the merged catalogue (MER) that consists of photometric and morphological information of 39 million objects detected in all three fields. They were observed with two instruments, VIS (magnitude I_E , Euclid Collaboration: Cropper et al. 2025), with one wide visible filter, and NISP, with three photometric filters that give magnitudes Y_E , J_E , and H_E . All four filters are broader than the standard ground-based photometric passbands; their widths range from 0.3 to 0.56 μm . Together, they cover wavelengths from about 0.5 to 2 μm , with almost no gaps. The passbands² have the following central wavelengths: 0.67 μm in I_E ; 1.08 μm in Y_E ; 1.37 μm in J_E ; and 1.77 μm in H_E (Euclid Collaboration: Schirmer et al. 2022).

¹ <https://zenodo.org/records/13993077>

² Available at e.g. the Spanish Virtual Observatory’s website.

The MER catalogue provides magnitudes computed in a few different ways. In this work, we adopted aperture photometry computed within twice the full width at half maximum (FWHM), with magnitudes expressed in the AB photometric system. Our choice of flux type from the MER catalogue follows the work of Mohandas et al. (2025), where the authors discuss the optimal flux measurement for point-like sources, and compare the magnitudes with ground-based photometry.

Reference UCDs in *Euclid* fields Anticipating the first *Euclid* observations, Zhang et al. (2024) analysed the existing optical and infrared photometric catalogues to search for the UCDs in the EDFs. They used Pan-STARRS release 1, 2MASS, and the AllWISE survey (Cutri et al. 2021) to search for late M, L, and T dwarfs. Their photometric selection criteria were based on the work of Carnero Rosell et al. (2019), but generalised and less strict. They found 360 M, 152 L, and three T candidate dwarfs in the three EDFs. From this sample they selected eight UCD candidates of different spectral types and obtained spectra with EMIR the Espectrógrafo Multiobjeto Infra-Rojo (EMIR; Garzón et al. 2022) at the Gran Telescopio Canarias (GTC), and the Very Large Telescope (VLT)/Xshooter, which confirm their UCD nature.

3. Selection of point sources

The most common objects in *Euclid*'s catalogue are extragalactic. They are clearly extended when they are close enough, although they appear point-like when very distant. Fortunately, in our parameter space of choice, there is negligible overlap between the point-like galaxies and stars, and especially substellar objects (see Sect. 6.2). To isolate the point-like sources, we performed a series of simple morphology and data quality filters using measurements already available³ in the Q1 tables. Our criteria were stringent, leaving out some marginal objects, such as young UCDs, which might appear extended due to a potential circumsubstellar disc and infalling material. Our goal was to produce a catalogue that is as free of contaminants as possible, rather than aiming for completeness. Our selection was defined with the help of the benchmark ultracool objects from Table A.1.

The most restrictive requirements were applied to the morphology of the sources, since most of the objects in *Euclid*'s catalogue are galaxies. Due to POINT-LIKE_PROB (probability between 0 and 1 that the source is point-like) being available only for a subset of sources, due to the strong priority placed on purity in the MER catalogue (Euclid Collaboration: Romelli et al. 2026), we designed our own filters that are a little less restrictive and reach fainter magnitudes. To isolate point-like objects, we used the ELLIPTICITY and MUMAX_MINUS_MAG parameters. ELLIPTICITY is defined as $1 - B/A$, where A and B are the semi-major and semi-minor axes of an elliptical object, respectively, and are computed directly by SourceExtractor (Bertin & Arnouts 1996). MUMAX_MINUS_MAG is a proxy for the better-known SPREAD_MODEL parameter (Mohr et al. 2012; Desai et al. 2012; Bouy et al. 2013), and is directly used for star-galaxy separation. It is defined as the difference between the peak surface brightness above the background (MUMAX in mag arcsec⁻²) and the magnitude (Euclid Collaboration: Romelli et al. 2026). Essentially, it compares the concentration of the light at the peak and the total magnitude. This difference distinguishes extended and point

sources very efficiently, as is demonstrated in Fig. 1. We limited this parameter to values between -3.25 and -2.65 mag arcsec⁻², and ELLIPTICITY to < 0.2 .

The distribution of FWHM ranges from about $1''.1$ to $1''.5$ for the majority of sources. Because one of the benchmarks is an outlier in this parameter (its det_quality_flag is 386, which means bad data quality) and lies beyond that limit, we formally introduced a $FWHM < 1''.5$ filter to exclude it. This filter removed fewer than 1% of sources from the entire sample.

Saturated, blended, and contaminated sources, and those with similar problems, were excluded with the DET_QUALITY_FLAG smaller than 3. To limit ourselves only to the measurements of high quality, we eliminated all catalogue entries with a signal-to-noise ratio (S/N; defined as flux/flux error) of less than 4. This is the most restrictive selection criterion, which consequently shifts the completeness by 1–1.5 mag, and the limiting magnitude by several magnitudes, as is demonstrated in Fig. 2. The completeness limit in our resulting point-source catalogue, after all applied cuts, is 23.5 for the near-infrared bands and 24.5 in the visible, as is shown in Fig. 3. We imposed such a strict constraint in order to produce as clean a sample as possible, at the expense of the fainter sources, which will be explored in a follow-up work. We applied this filtering only to the I_E , Y_E , and H_E bands that are essential for our UCD science. The J_E data remained unfiltered, because our UCD selection criteria, described below, are not based on the J_E magnitude. This means that some of our sources might have bad pixels in the J_E band, but since this magnitude is not used, it does not affect our results.

We present the set of filters that we use in Table 1. This simple but effective filtering resulted in a catalogue of 688 957 point sources, representing just under 2% of the initial sample.

We estimated magnitude and colour error bars for the point source catalogue by sampling 1000 flux values from a normal distribution centred on the measured flux, using the flux error as the standard deviation. These sampled fluxes were then converted to magnitudes, and the 16th and 84th percentiles of the resulting distribution were taken as the lower and upper bounds of the uncertainty.

Extinction estimation We found an apparent relative offset between the EDF-N and the two southern fields in our $I_E - Y_E$ versus $Y_E - H_E$ diagrams. This is shown, for example, in Fig. 4, where we plot data from EDF-N and EDF-S. The difference is particularly noticeable in the densest regions, representing solar-like stars. The relative offsets of EDF-N with respect to EDF-S are 0.04 in $I_E - Y_E$ and 0.02 in $Y_E - H_E$. This might be coming from differences in interstellar extinction. While the EDFs were carefully selected to be extinction-free, the average estimated⁴ $E(B - V)$ in the northern field (0.056) is more than 3 times higher than in EDF-S (0.017). This corresponds to median extinction values of $A_{I_E} = 0.13$, $A_{Y_E} = 0.06$, and $A_{H_E} = 0.03$ in EDF-N, and $A_{I_E} = 0.08$, $A_{Y_E} = 0.02$, and $A_{H_E} = 0.009$ in EDF-S. They are typically 2–3-times larger in EDF-N, depending on the wavelength. This difference could produce the relative offsets that we detected in the data.

However, the reddening values are upper limits, and the actual values for the UCDs, which are very close to us, are smaller. Additionally, the offsets between EDF-S and EDF-N are

³ The documentation is available online in the Euclid SGS Data Product Description Document.

⁴ Reddening in *Euclid* was estimated from the Planck dust map (Planck Collaboration XI 2014), which is two-dimensional, providing only upper limits for objects within our Galaxy (see Euclid Collaboration: Romelli et al. 2026, for more details).

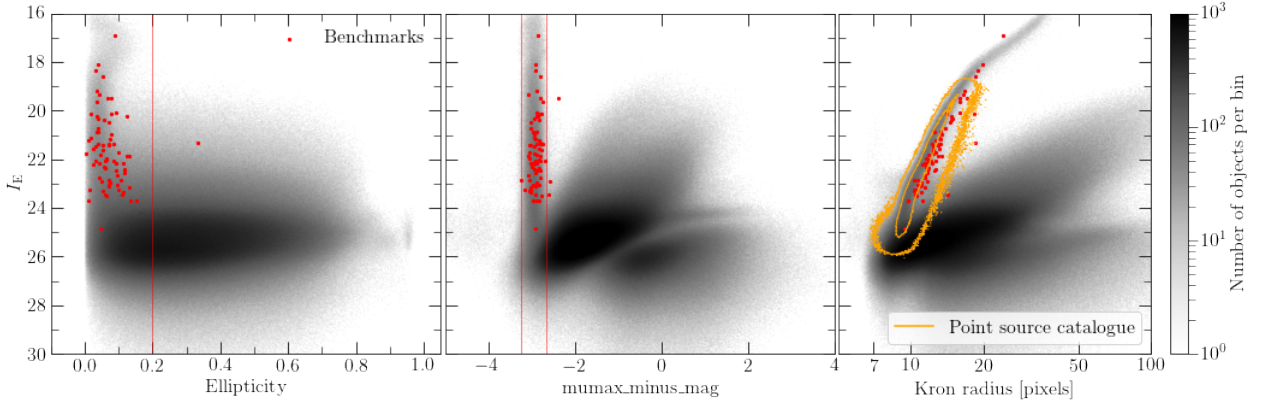


Fig. 1. Morphological filters differentiate between extended sources and point sources. The filtering criteria (red lines for ELLIPTICITY and MUMAX_MINUS_MAG) are based on the benchmark UCDs (red dots; Zhang et al. 2024). Grey dots are sources from the entire *Euclid* catalogue. The right panel shows that while KRON_RADIUS is not used in the procedure, it correlates well with luminosity for the point sources.

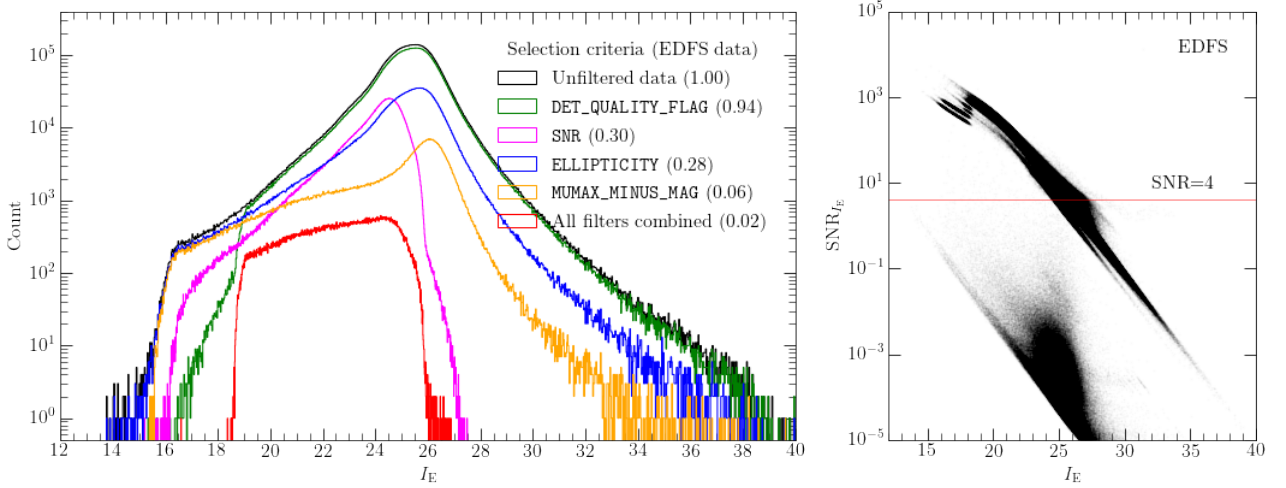


Fig. 2. Magnitude distributions and signal-to-noise characteristics of the point-source catalogue. Left: Magnitude distributions for each point-source selection filter (we do not plot the FWHM filter). The most limiting is the S/N requirement that raises the completeness and detection limits to ensure a high quality of the point-source catalogue. Right: Signal-to-noise ratio as a function of luminosity. A cut at $S/N = 4$ is imposed.

much smaller than the typical error bars for individual UCDs (± 0.12 and ± 0.06 , respectively). For this reason, we did not apply any corrections.

4. A catalogue of photometric UCD candidates

We visualise our point-source catalogue in a colour-colour diagram in Fig. 5. We followed Martín et al. (2025) and chose a combination of $I_E - Y_E$ and $Y_E - H_E$ that brings out the UCDs most clearly. The use of the optical band helped us to construct a high-quality catalogue of UCDs with minimal contamination, but at the expense of completeness, especially for the reddest objects (T dwarfs). We provide more details about this topic in Sect. 6.2.

The data in our chosen parameter space form a shape that resembles a bluebottle⁵ with the main body, sail, and tentacles. Therefore, we have named this colour-colour plot the ‘bluebottle’ diagram. Its central sequence starts with white dwarfs

below $I_E - Y_E < 0$, continues with stars, and ends in the cool tip with UCDs at $I_E - Y_E \gtrsim 2.5$. To identify the region occupied by UCDs in Fig. 5, we overplotted the known UCDs from Zhang et al. (2024) that have been spectroscopically confirmed by Dominguez-Tagle et al. (2025) using *Euclid* spectra. For clarity, Fig. 6 shows an expanded area of the bluebottle diagram, including the cool tip and the spectroscopically confirmed UCDs. They perfectly overlap with the bluebottle, and demonstrate that this parameter space encompasses UCDs from late M dwarfs down to late T dwarfs.

We used the spectroscopically confirmed UCDs as a guide in our candidate UCD selection. Figure 6 shows that the typical $I_E - Y_E$ colour of the M8 dwarfs is about 2.5. We therefore used the $I_E - Y_E > 2.5$ criterion to select the photometric UCD candidates in this work. Such a cut isolated 5306 objects, with the reddest $I_E - Y_E$ colours ranging between 2.5 ($\sim$ M8) and 5.0 (late T dwarfs). According to their colour distribution, shown in Fig. 7, we expect to find about 1200 L dwarfs with $I_E - Y_E > 2.9$. Additionally, we report a list of 13 candidate T dwarfs. One of them has been previously identified (Zhang et al. 2024), and the rest are new. Seven of them

⁵ The bluebottle is a stinging marine animal, similar to a jellyfish, from the genus Physalia.

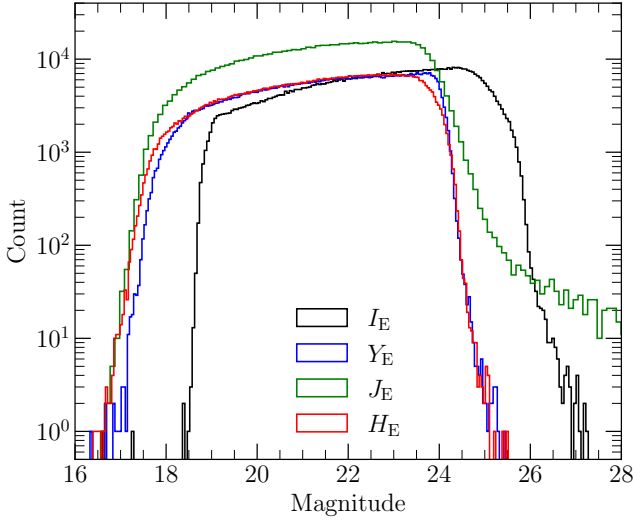


Fig. 3. Magnitude distributions in the point-source catalogue. Completeness limits are approximately 23.5 for the NISP bands and 24.5 for VIS. The filtering procedure was not applied to the J_E band, since it was not used in the candidate selection from the colour-colour diagram.

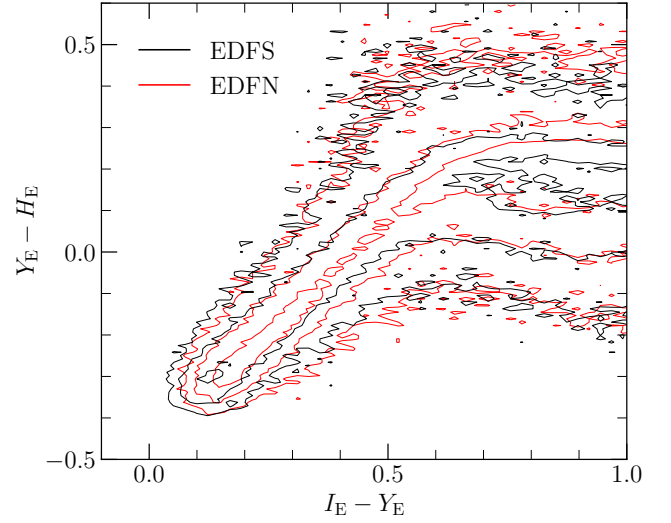


Fig. 4. *Euclid* colour-colour diagram. The offset between EDF-N and EDF-S is most prominent in the solar-like region at $0.1 < I_E - Y_E < 0.4$.

Table 1. Filters applied to isolate point sources.

Parameter	Value
ELLIPTICITY	<0.2
MUMAX_MINUS_MAG	-3.25 to -2.65 mag arcsec ⁻²
FWHM	<1''5
S/N (I_E , Y_E , and H_E)	>4
DET_QUALITY_FLAG	<3

have been spectroscopically confirmed using *Euclid* spectra, as is shown in figure 7 in Dominguez-Tagle et al. (2025). These objects are listed in Table A.2, as well as in the main UCD catalogue. The number of T dwarfs is relatively small. This is because they are intrinsically faint, and due to our selection biases, discussed in more detail in Sect. 6.2. In Table A.3 we provide the main result of this work, a list of 5306 photometric UCD candidates. Of these, 546 have been assigned spectral type following the procedure from Dominguez-Tagle et al. (2025).

The ATMO models in Fig. 8 predict that early Y dwarfs are expected to be found in the horizontal band below the main blue-bottle body, with $Y_E - H_E$ colours roughly between -1.5 and -0.5. A typical $I_E - Y_E$ colour of a Y0 dwarf is around 5, while we can expect objects with masses below $\sim 20 M_{\text{Jup}}$ at $I_E - Y_E \approx 2.5$. There are a number of objects in this region in the figure. We manually inspected their spectra (although they are not available for all objects) and could not confirm any Y dwarfs. On the other hand, based on the colours of known Y dwarfs (e.g. Kirkpatrick et al. 2024), we expect Y dwarfs to have $I_E - Y_E$ colours that are even redder than T dwarfs, and $Y_E - H_E$ colours that are bluer than T dwarfs, i.e. we expect them to extend the T dwarf sequence towards the bottom right in the bluebottle diagram. There are no objects in our catalogue with such colours.

The absence of detected Y dwarfs is likely due to our strict filtering criteria. Namely, the absolute I_E magnitude of an Y0 object at 10 Myr is around 26.2, which is

already beyond the completeness limit (see Fig. 3). Conversely, Dominguez-Tagle et al. (2025) performed an independent search for UCDs in the entire *Euclid* spectral database, and did not find any Y dwarfs. This might be due to the fact that in the Q1 data release, spectra are only available for $H_E < 22.5$ objects. This will change in the forthcoming data releases. In the future, a development of search criteria based only on NISP, supplemented with the ground-based photometry, might yield a detection of Y dwarfs in *Euclid*, as is discussed in Sect. 6.2.

5. A catalogue of spectroscopically confirmed UCDs

To assess the nature of the selected candidates, we examined the available spectra for these objects (Euclid Collaboration: Jahnke et al. 2025; Euclid Collaboration: Polenta et al. 2026). Out of 5306 candidates, 4682 have spectra in the *Euclid* Q1 release (almost 90%). We conducted both a visual spectroscopic analysis and a comparison with the template library, as is described below.

5.1. Manual tagging

Manual tagging was done in the following way. As a first step, we filtered out spectra for which more than 20% of flux points have QUALITY < 0.2, as well as spectra with a mean quality below 0.5. This removed 255 objects from further consideration. To identify additional outliers, we computed the Mahalanobis distance, M (Bishop 2006), selecting spectra with $M > 30$, which eliminated another 210 objects. These 465 outliers are labeled with ‘O’ in Table A.3.

While these criteria are to some extent subjective, they are necessary to exclude severely degraded or noisy spectra that would hinder further analysis. Visual inspection of the flagged outliers revealed 16 objects that exhibit features characteristic of the UCD spectra, despite being partially corrupted.

To emphasise the spectral morphology, we removed local spikes and applied cubic spline smoothing (full details of the

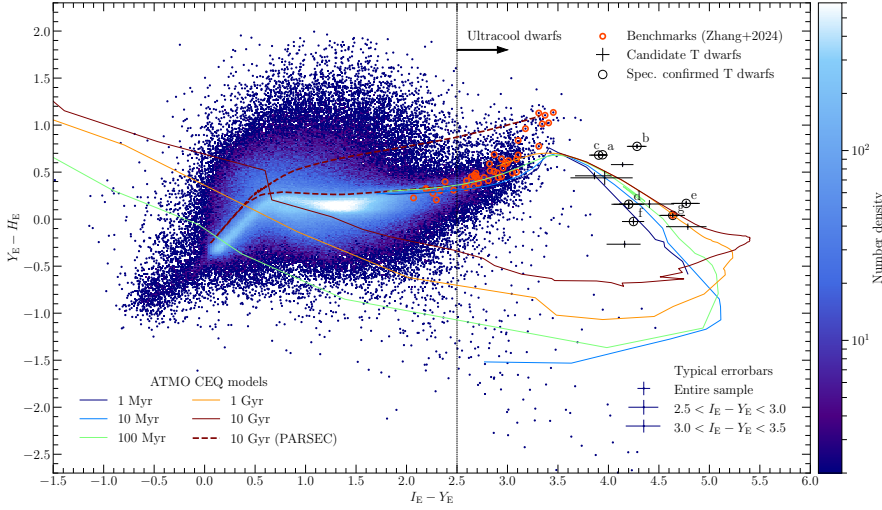


Fig. 5. Bluebottle diagram of point sources. The central sequence starts with white dwarfs below $I_E - Y_E < 0$, continues with stars, and ends in the cool tip with UCDs at $I_E - Y_E \gtrsim 2.5$. Their nature is confirmed with the benchmark UCDs from Zhang et al. (2024). We overplotted both the new photometric candidate T dwarfs from this work (symbols with error bars), and those that were spectroscopically confirmed (open circles), as listed in Table A.2. ATMO models (Phillips et al. 2020) indicate the UCD parameter space, while the PARSEC model traces main sequence and evolved stars with redder $Y_E - H_E$.

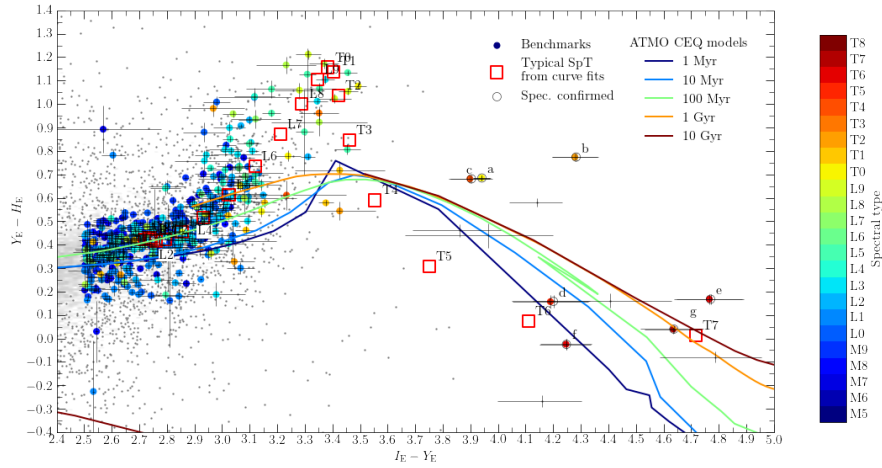


Fig. 6. Zoom into the cool tip of the bluebottle diagram showing the benchmark objects (coloured dots with error bars). The spectral types are from Dominguez-Tagle et al. (2025). We overplotted typical positions for each spectral type from the curve fits (red squares) and ATMO models for a range of ages.

denoising procedure will be presented in a forthcoming publication). The cleaned spectra were then used in the analysis.

We performed a visual comparison of each denoised spectrum against a set of spectral type templates (Burgasser 2014; Burgasser & Splat Development Team 2017). Based on similarity to the templates and the presence of spectral features typical for UCDs in the Euclid NISP red-grism wavelength range (the shape of the H_2O absorption bands starting from $1.33\,\mu\text{m}$, K I doublet at $1.25\,\mu\text{m}$, H band continuum shape around $1.6\,\mu\text{m}$), we assigned each spectrum to one of the following classes:

- C1: Spectra that clearly match UCD templates;
- C2: Spectra that exhibit some UCD features but do not match any template closely;
- C3: Spectra that contain a visible signal but lack UCD-specific features;
- C4: Spectra that are too noisy or corrupted to be classified.

This information is available in Table A.3. There are 496 objects in the C1 category, and 615 in C2. It is possible that many more UCDs are present in our photometric candidate list, but their spectra are currently too noisy or unavailable. In the future, once repeated observations of the EDFs become available, we expect to confirm many more additional candidates. Figure 9 shows that nearly all objects brighter than $I_E = 22$ belong to the C1 class, and that we detected objects with some UCD features (class C2) nearly down to the I_E detection limit. The contamination rate is negligible for $I_E < 22$, and likely remains low until $I_E = 24$

where extragalactic objects start to dominate, as is shown in Fig. 1. A contamination estimate based on the number of objects classified into classes C1, C2, and C3 shows that the contamination rate, defined as $N_{C3}/N_{C1+C2+C3}$, where N_{C3} and $N_{C1+C2+C3}$ are the numbers of objects in these classes, is 67%, consistent with the sharp increase seen at the faint end in Fig. 1. This is, however, a conservative estimate, as the classification into C1-C4 groups was performed manually, and some spectra assigned to the C3 class may still correspond to UCDs whose spectra are simply too heavily degraded for their nature to be confirmed.

5.2. Spectral typing

We considered objects from categories C1 and C2 for spectral classification. This was done by a comparison with the SpeX standard templates (Burgasser 2014; Burgasser & Splat Development Team 2017). We used two different methods, which are described in Dominguez-Tagle et al. (2025). The first method used χ^2 minimisation over the full wavelength range. The second one was based on minimising the residual from the difference between the spectra and the standard templates over four wavelength ranges defined by the NISP wavelength range and the telluric absorption bands (i.e. only present in the templates). The spectral type (SpT) was obtained after weighting each method by the quality of the spectrum (see Dominguez-Tagle et al. 2025 for further details).

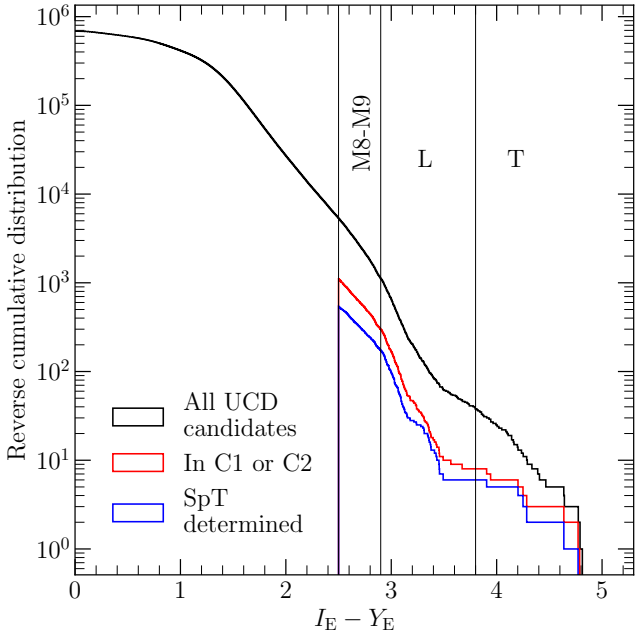


Fig. 7. Reverse cumulative distribution, showing how many objects are redder than the selected colour. There are 5306 objects redder than 2.5, which correspond to late M dwarfs, and 1200 objects redder than 2.9, which roughly correspond to L0 dwarfs. The red curve corresponds to objects whose spectra exhibit UCD features, whereas the blue line corresponds to objects with assigned spectral types.

The typical uncertainty of the SpT is ± 1 subtype. A colon ‘:’ was added to the spectral subtypes with larger uncertainty, and a ‘p’ for peculiar spectra. Objects with very low S/N were not classified.

In total, 546 spectra had sufficient quality to allow for a reliable determination of spectral types beyond M7. A total of 26 of them are T dwarfs, 329 are L dwarfs, and the rest are late M dwarfs. This means that 10% of our UCD candidates are spectroscopically confirmed and have their SpT determined. The remaining objects from the C1 and C2 groups exhibit some spectral features consistent with UCD classification, for example the water drop at ~ 1.35 microns, but the data quality is too limited for definitive spectral typing. We include spectral types in Table A.3.

A comparison with Dominguez-Tagle et al. (2025), who published the SpT of 178 UCDs, reveals 27 objects with SpT that are not in our candidate list. Six of them were found by the spectral index search described in that paper. The remaining 21 are confirmed candidates from Zhang et al. (2024). A close inspection shows that these 21 objects do not meet our point-source and quality requirements (mostly due to low S/N; Sect. 3) or have $I_E - Y_E < 2.5$. This comparison highlights the importance of conducting both photometric and spectroscopic searches independently, particularly because the latter led to the discovery of five T dwarfs that were not identified through photometry alone (Dominguez-Tagle et al. 2025).

6. Discussion

In this section, we describe the photometric properties of UCDs that have their spectral type determined (Sect. 6.1). Then, we address the contamination rate and the detection limitations of

the sample in Sect. 6.2, and the prospects for detecting metal-poor UCDs in Sect. 6.3, compare the dataset with the UCD candidates from the literature (Sect. 6.4), and end with the estimated numbers of future UCD detections in the EDS and EWS, based on the results of this work.

6.1. Empirical photometric sequence

We determined the typical *Euclid* colours for each UCD spectral type and compared them with the ATM0 models used in this work (Phillips et al. 2020). Although our catalogue does not contain any widely studied brown dwarf, its large size allowed us to rely on statistical analysis for late M and L objects. We applied the same analysis to the T dwarfs as well, but the results were less robust due to their scarcity.

Figure 10 shows the relations between the spectral types and the colours. The $I_E - J_E$ relation is well behaved, which is important since UCDs are brightest in the J_E band. Although $I_E - J_E$ would thus be a preferable selection criterion to $I_E - Y_E$, the main limitation remains the inclusion of the optical band. For consistency with Martín et al. (2025), we therefore retain $I_E - Y_E$.

Some spectral types exhibit greater scatter in colour than others. The spread is particularly pronounced for L6–T2 objects, especially in the NISP colours ($Y_E - J_E$, $Y_E - H_E$, and $J_E - H_E$). This increased scatter is consistent with the known variability during the L–T transition, which is attributed to changes in cloud opacity at near-infrared wavelengths (Radigan et al. 2014; Radigan 2014). Consequently, we observed a discrepancy between the data and the ATM0 models in Fig. 6 for late L and early T dwarfs. For this reason, we excluded L6–T2 objects with $Y_E - H_E < 0.8$ from this analysis, as Fig. 6 indicates that their typical $Y_E - H_E$ colour is greater than 0.9. Additionally, we excluded a small number of photometric outliers whose colours differ by more than 1 magnitude from the typical values of objects with similar spectral types, despite using a sigma-clipping approach in the fit. We provide more detail about this discrepancy in Sect. 6.2.

We fitted a polynomial to each spectral type–colour relation, where spectral types were encoded numerically (e.g. 70 for L0, 75 for L5, 80 for T0, etc.). The order of the polynomial varies depending on the colour, selected to best capture the shape of the relation while avoiding overfitting. To reduce edge artefacts commonly introduced by polynomial fitting, we included a small number of M5 and M6 objects at the lower end of the spectral type range.

Using these polynomial fits, shown in Fig. 10, we derived a typical colour for each spectral type, as is listed in Table 2. The resulting $I_E - Y_E$ versus $Y_E - H_E$ relation aligns well with the bluebottle diagram up to the tip of the sequence ($I_E - Y_E \sim 3.4$), but begins to break down for T dwarfs. This discrepancy is likely due to the limited number of T dwarfs in the current dataset, and we expect it to improve with future *Euclid* data releases.

6.2. Limitations and contamination of the catalogue

Here we discuss the detection limits of the instruments, the quality of the sample, and the contamination of the UCD catalogue with evolved stars and extragalactic objects. The most discriminating parameter in our search for UCDs was the $I_E - Y_E$ colour, which is based on the measurements of two different instruments. Their sensitivities differ: the NISP instrument detects objects with magnitudes between 19 and 24; and the VIS range is broader and extends about 2 magnitudes deeper in our point source catalogue (Fig. 11). Since the UCDs are very red (e.g.

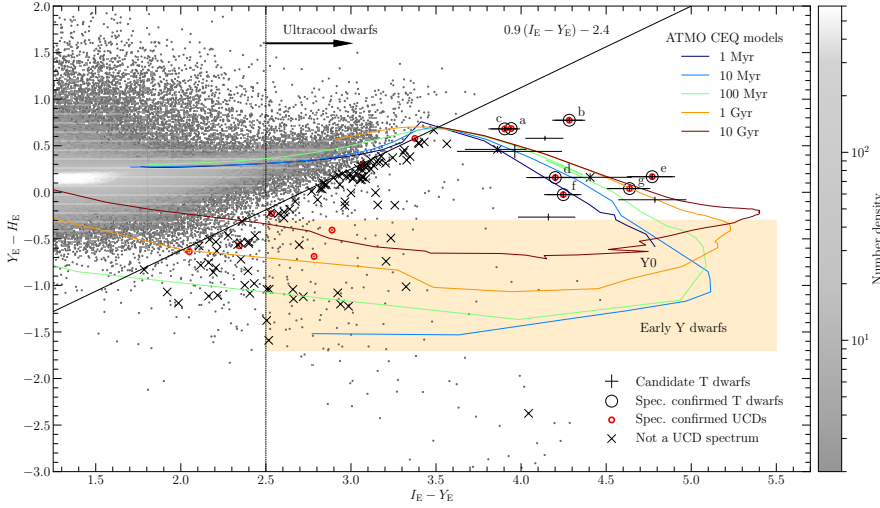


Fig. 8. Bluebottle diagram focused on the UCDs. Models predict that early Y dwarfs are located in a horizontal band below the main bluebottle body. While there are many photometric candidates found there, none of them have been spectroscopically confirmed. We manually inspected the available spectra of the objects below the black line and found that most of them are not consistent with UCDs (black crosses). Apart from the T dwarfs, only seven other objects show UCD (or stellar) spectra.

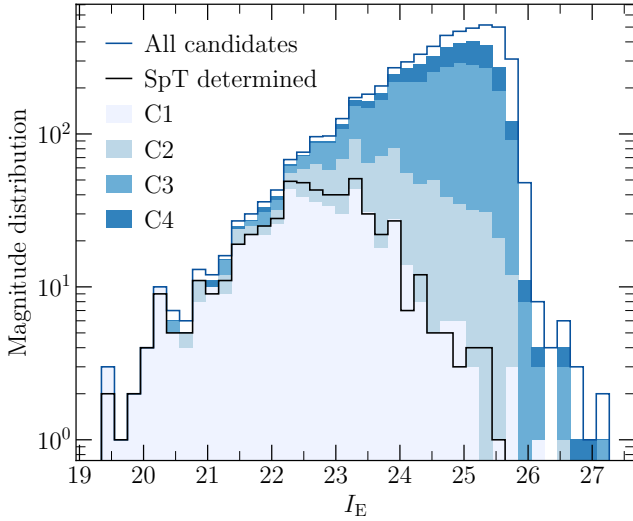


Fig. 9. Magnitude distribution of the candidate UCDs with spectra (stacked histogram). Spectral types could be determined for 50% of the entire sample, limited by the S/N of the spectra. While spectral typing is limited at low S/N, spectroscopic confirmation is still possible nearly down to the VIS detection limit.

Table 2. Empirical *Euclid* colours for different spectral types.

SpT	$I_E - Y_E$	$I_E - J_E$	$I_E - H_E$	$Y_E - J_E$	$Y_E - H_E$	$J_E - H_E$
M7	2.65	2.97	3.09	0.29	0.39	0.11
M8	2.72	2.97	3.08	0.30	0.42	0.12
M9	2.74	2.99	3.09	0.30	0.43	0.13
L0	2.74	3.02	3.12	0.29	0.42	0.12
L1	2.76	3.07	3.18	0.30	0.42	0.12
L2	2.80	3.13	3.25	0.30	0.42	0.12
L3	2.85	3.20	3.36	0.32	0.45	0.14
L4	2.93	3.29	3.48	0.35	0.52	0.18
L5	3.02	3.38	3.62	0.38	0.61	0.24
L6	3.12	3.49	3.78	0.43	0.73	0.32
L7	3.21	3.60	3.95	0.49	0.87	0.41
L8	3.29	3.73	4.13	0.55	1.00	0.48
L9	3.35	3.86	4.30	0.61	1.10	0.54
T0	3.38	3.99	4.47	0.67	1.16	0.56
T1	3.40	4.12	4.61	0.72	1.14	0.52
T2	3.42	4.26	4.72	0.75	1.04	0.41
T3	3.46	4.39	4.78	0.76	0.85	0.25
T4	3.55	4.51	4.79	0.74	0.59	0.03
T5	3.75	4.63	4.72	0.68	0.31	-0.20
T6	4.11	4.74	4.57	0.56	0.08	-0.38
T7	4.72	4.83	4.31	0.38	0.01	-0.41

the T dwarfs can surpass $I_E - Y_E = 4.5$), their luminosities in the optical are low. For example, a T dwarf with $Y_E = 24$ would be fainter than $I_E = 28$. For this reason, our catalogue of UCD candidates only contains NISP sources brighter than $Y_E \approx 22.5$. The advantage of this limitation is the higher quality of the sample and a higher percentage of objects for which good-quality spectroscopy is available.

We left the photometric selection of the faint NISP sources for our follow-up work. On the other hand, Dominguez-Tagle et al. (2025) complemented our current catalogue with a spectroscopic search for UCDs, which is not limited by the VIS instrument. They searched for substellar objects in the entire spectroscopic database in *Euclid*, and found 27 UCD spectra of objects that are not in our candidate list because they did not meet our filtering criteria, mostly due to a poor S/N. Similarly, Mohandas et al. (2025) used spectroscopic templates to

search for UCDs and confirmed 33 new objects, ranging from spectral types M7 to T1.

As is discussed in Sect. 6.1, approximately 75% of objects in the L–T transition region exhibit colours that deviate significantly from those expected for their spectral types, particularly in the near-infrared. Due to the known variability and changes in cloud opacity during this transition, these objects can display L-like colours despite having T-type spectra, as is shown in Fig. 6. As a result, our photometric selection revealed only 13 T dwarf candidates – seven of which have been spectroscopically confirmed – since only those appear within the bluebottle parameter space where T dwarfs are expected to lie. In addition to photometry, incorporating spectroscopic searches will thus be crucial for future efforts to identify extremely low-mass UCDs (including planetary-mass objects), which models predict

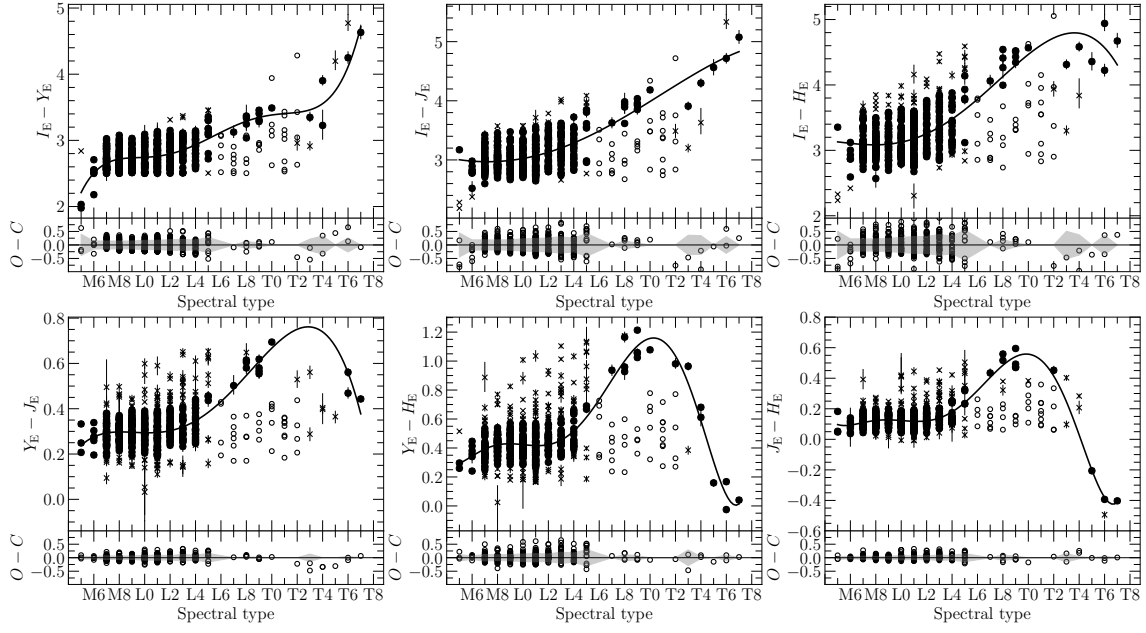


Fig. 10. Typical colours for each spectral type. Black dots represent individual objects, crosses mark objects rejected during the sigma-clipping fitting, and open circles indicate objects excluded from the fit due to suspected variability. The black line shows a polynomial fit to the relation. The grey area in the $O - C$ plots represents the standard deviation of the residuals.

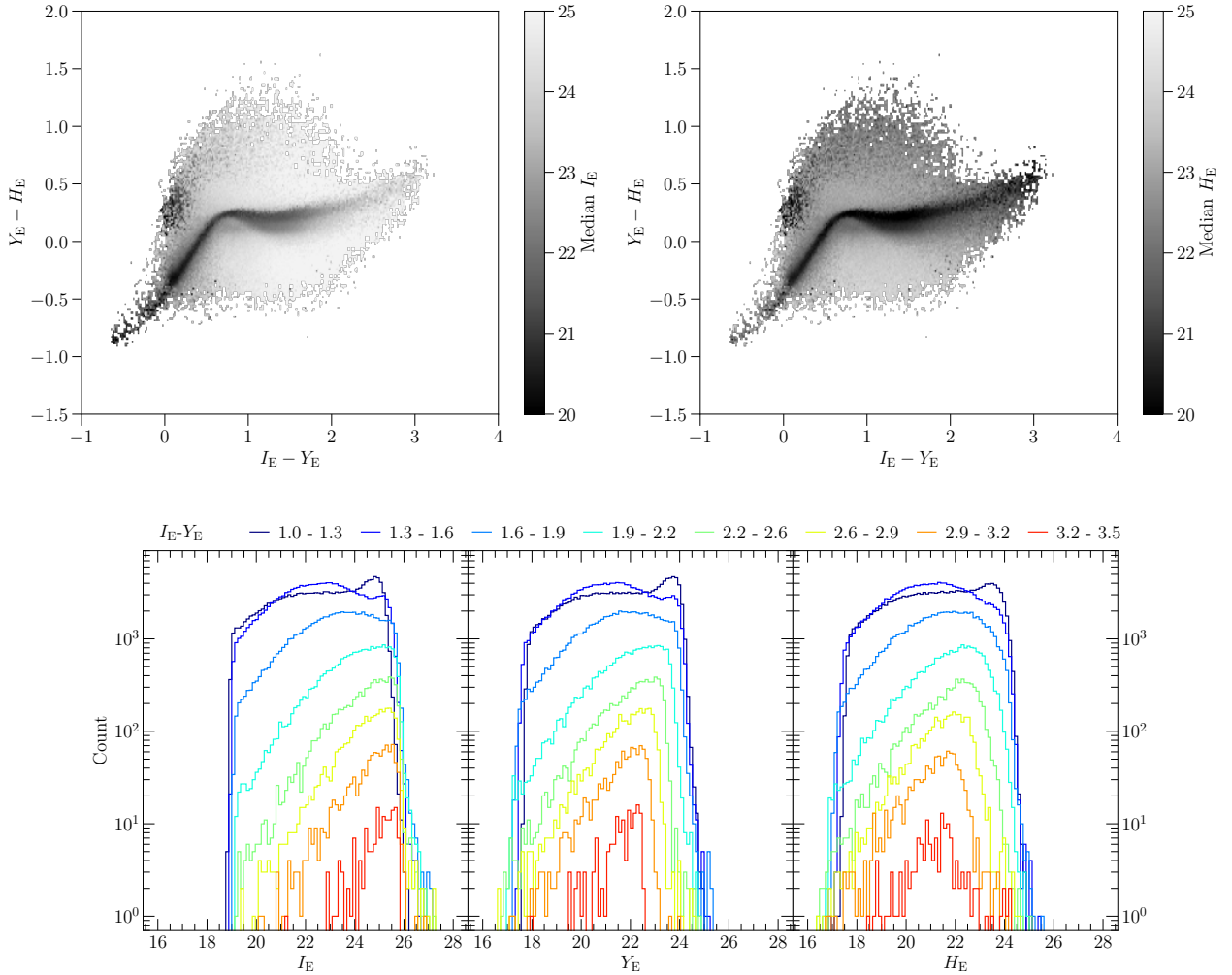


Fig. 11. Completeness for the colour bins in the bluebottle diagram. Despite its very high sensitivity, VIS is the most limiting instrument for the detection of UCDs in *Euclid*. The top panels show a group of bright objects at $\approx(0, 0)$, which are quasars.

to overlap with the blue end of the bluebottle diagram with their $I_E - Y_E$ colours between ~ 0 and 1.5 (see Fig. 5).

Our UCD catalogue consists of candidates with good S/N, as is explained in Sect. 3. The median values are 10, 24, and 37 for the I_E , Y_E , and H_E bands, respectively. As is shown in Fig. 12, there is also a variation of S/N with the $I_E - Y_E$ colour, due to the aforementioned detector sensitivity bias. However, the quality criteria in the preparation of the point-source catalogue were relatively relaxed. We requested `DET_QUALITY_FLAG` < 3, which keeps objects with binary flags 1 (bad pixels or contamination by close neighbours) or 2 (blended sources) in the catalogue. Our experience with the benchmarks showed that UCD objects with bad pixels are typically outliers in the bluebottle diagram, often found far away from the main body. The ‘tentacles’ are one such example; the majority of the benchmark objects (rejected for other reasons) with bad pixels were found there. Because a filter on bad pixels would reject candidates with otherwise adequate morphology and S/N, and a relatively large fraction of the (rejected) benchmarks were affected by this issue, we decided to ignore the bad pixel flags, with the hope that at least some of those objects then meet our UCD selection criteria in the bluebottle diagram. We manually checked the majority of the tentacle objects, and many of them had photometric issues (bad pixels, spikes from nearby bright stars, etc.). Since the tentacles extend into the region where we expect extreme UCDs (e.g. Y dwarfs) according to the ATMO models (e.g. Fig. 5), we opted for a relaxed filtering that would not exclude potential good UCD candidates. The issue with bad pixels will be mitigated with repeated *Euclid* observations of the EDFs in the future.

The majority of objects in the Q1 catalogue are extragalactic sources. Fortunately, these objects occupy a different part of the bluebottle diagram than substellar objects, as is shown in Fig. 13. Our cross-match with the Simbad database placed galaxies (e.g. Gaia Collaboration 2020, Straatman et al. 2016, Balestra et al. 2010, Cameron et al. 2011, and Le Fèvre et al. 2004), quasars (e.g. Tie et al. 2017, Gaia Collaboration 2020, and Xue et al. 2016), other active galactic nuclei (AGNs; e.g. Shim et al. 2013, Abbott et al. 2021, and Poulain et al. 2020), and supernovae (Gaia Collaboration 2020, Cappellaro et al. 2015, Cappellaro et al. 2005, and Lunnan et al. 2013) on the extragalactic branch that overlaps with the bluebottle ‘knee’ (late K and early M dwarfs), but extends above the stellar main sequence. On the other hand, Tu et al. (2025) report the photometric and spectroscopic similarity in the near-infrared between the L- and T-type brown dwarfs, high-redshift galaxies, and ‘little red dots’ (a recently discovered new type of object hypothesised to represent faint and/or highly reddened AGNs at high redshift; Matthee et al. 2024). They found good agreement between their candidate brown dwarf spectra and the models, and realised their extragalactic nature only when their inferred distances placed them more than a few kiloparsecs away. While our spectroscopic classification indicates a contamination rate of up to 67% beyond $I_E = 24$ (Sect. 5), this value should be considered an upper limit due to the low quality of spectra at such faint magnitudes. A more reliable contamination estimate will only be possible after future repeated visits of the EDFs, when proper-motion measurements become available.

The 10-Gyr PARSEC isochrone (Bressan et al. 2012; Pastorelli et al. 2020) shows that the asymptotic giant branch (AGB) reaches the cool tip of the bluebottle diagram (late L dwarfs; see Fig. 5). However, since the lifetime of the AGB stars is only a few million years (e.g. Ventura et al. 2018), these stars are very rare. It is thus unlikely that our sample of UCD candidates is contaminated with such evolved stars.

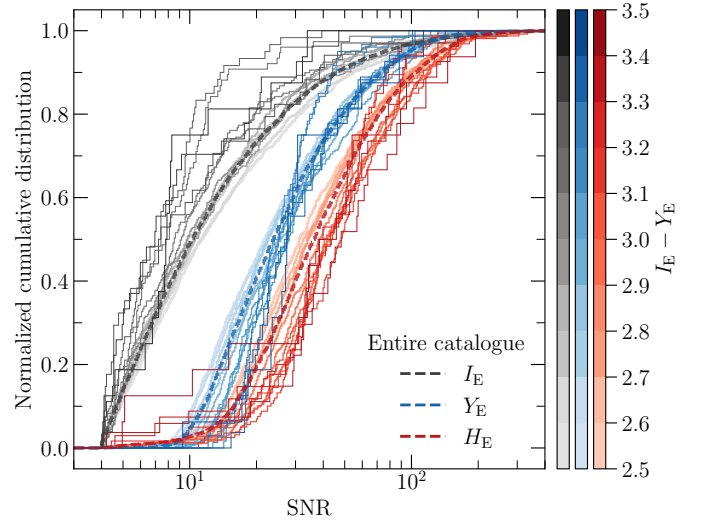


Fig. 12. Signal-to-noise ratio (S/N) distribution for I_E , Y_E , and H_E channels in the ultracool catalogue. The median S/N values are 10, 24, and 37, respectively. Dashed lines are distributions for the entire catalogue of ultracool candidates. Solid lines trace the variation of the S/N distribution with the $I_E - Y_E$ colour. In NISP, redder (cooler) objects tend to have higher S/N on average, while in the VIS band, the opposite is true and the difference between the red and blue is more pronounced.

6.3. Metal-poor ultracool dwarfs

Our UCD selection is based on the $I_E - Y_E$ colour of the solar-metallicity objects. To investigate how this criterion affects the detection of metal-poor UCDs, we prepared a set of solar-metallicity and metal-poor models in the following way.

The public ATMO2020 isochrones are available only for solar metallicity. To explore the variation in the expected theoretical distribution in the $Y_E - H_E = f(I_E - Y_E)$ diagram of ultracool objects with decreasing metallicity, we turned to the Sonora Bobcat grid of cloudless models (Marley et al. 2021).

For $[\text{Fe}/\text{H}] = -0.5$ and 0.0, for all values of temperature in the grid (200 to 2400 K) and for three values of the surface gravity ($\log g [\text{cm s}^{-2}] = 3, 4, \text{ and } 5$), we computed *Euclid* equivalent magnitudes in each of the filters ($X = I_E, Y_E, \text{ or } H_E$) by evaluation of the integral

$$X_E = \int_{\lambda_{\min}}^{\lambda_{\max}} F(\lambda) R_X(\lambda) d\lambda, \quad (1)$$

where $R_X(\lambda)$ is the transmission profile of a *Euclid* filter (provided by the Filter Profile Service, Rodrigo et al. 2024), $F(\lambda)$ is the Sonora spectral flux expressed as a wavelength-dependent quantity, and $\lambda_{\min}$ and $\lambda_{\max}$ are the end wavelengths of the Sonora spectrum.

We compare the models in Fig. 14. They more or less overlap in the parameter space of M and L UCDs. We therefore cannot trace metal-poor objects in that part of the bluebottle diagram. On the other hand, the models predict considerably bluer $Y_E - H_E$ colours for T dwarfs. There is one candidate T dwarf (OBJECT_ID = -603476608509828998) that lies below the rest of the sample, but it has not yet been spectroscopically confirmed to be a UCD.

6.4. Comparison with the Dark Energy Survey

Known UCDs in the literature are generally much brighter than our candidates. However, the cross-match with more than 19 000

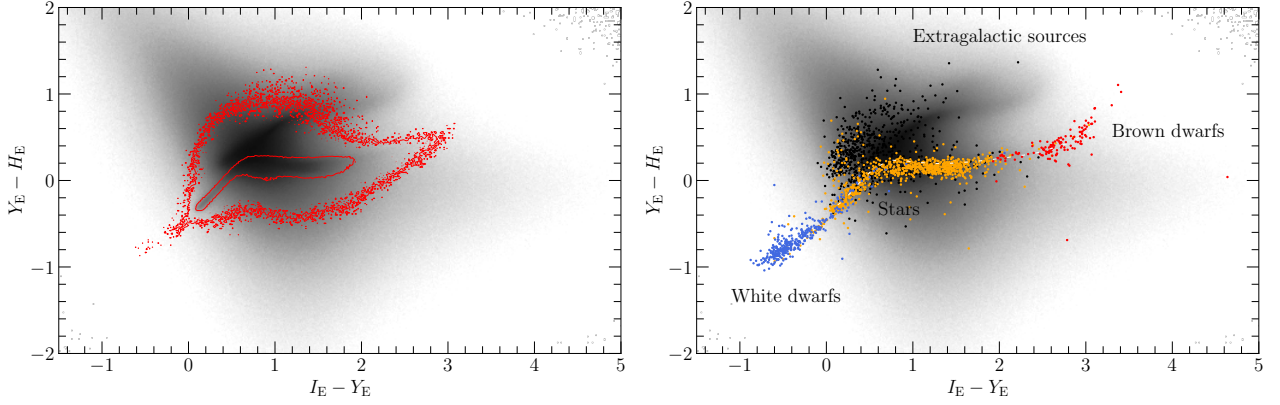


Fig. 13. Contamination with extragalactic sources is negligible in the UCD parameter space of the bluebottle diagram. Both plots show a distribution of the entire (unfiltered) Q1 catalogue. Left: Red contours mark the shape of the bluebottle diagram. Right: Objects in common between *Euclid* and Simbad: black dots are QSOs, AGNs, supernovae, or galaxies; and yellow dots are stars. Brown dwarfs (red dots) are from Zhang et al. (2024).

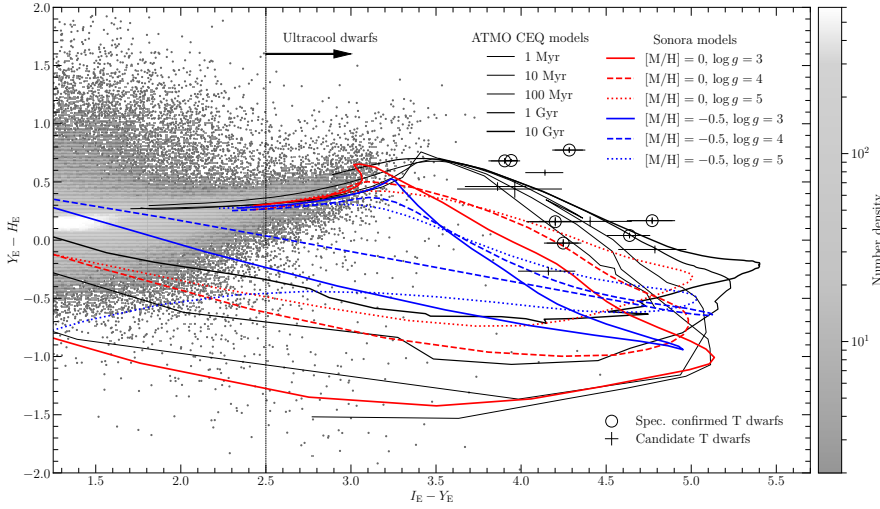


Fig. 14. Bluebottle diagram with the ATMO and Sonora models. The latter are provided for two sets of metallicities: solar (red curves); and $[M/H] = -0.5$. While we cannot isolate metal-poor M and L dwarfs, the models predict a notable colour spread with metallicity for T dwarfs in this diagram.

photometric candidate UCDs from the Dark Energy Survey (DES; dal Ponte et al. 2023) yielded UCD candidates in common in EDF-S and EDF-F. In total, there are 188 DES candidates in the Q1 sky regions. We found *Euclid* counterparts for 125 of them; 56 do not meet our filtering criteria. The remaining 7 were not found within the 1 arcsec cross-matching radius, and might potentially have high proper motions. Most of the 125 objects in common have their spectra available in *Euclid* and belong to the C1 and C2 groups; many of them have their spectral types determined. A relation between I_{DES} and I_E was used to convert the DES magnitudes into the *Euclid* system and directly compare their distributions. Figure 15 shows that most of them have magnitudes between $I_E = 22$ and 25, which is about the detection limit in DES. This distribution lies in the fainter half of the C1 and C2 groups and strengthens the case that these objects are true UCDs, as the candidates were selected photometrically using two independent methods and surveys.

6.5. Expected detections of UCDs in the forthcoming *Euclid* data releases

This work demonstrates the potential of *Euclid* to systematically detect numerous field UCDs. While they cover the EDF

regions, the Q1 catalogues have essentially the same depth of data as the planned EWS. The results of this paper can therefore be directly used to estimate the number of expected ultracool detections over $14\,000\text{ deg}^2$ of the sky that *Euclid* is going to visit, and which corresponds to about one third of the entire celestial sphere.

Our detection of 5306 candidate UCDs in 63 deg^2 of Q1 data gives an average⁶ density of approximately 100 UCDs per deg^2 , and 20 L and T dwarfs per deg^2 . For comparison, the density in DES that detected 20 000 UCDs in 5000 deg^2 is four objects per deg^2 (and about three L and T dwarfs per deg^2 ; dal Ponte et al. 2023). The density in the Galactic plane would be larger, but these regions will not be observed by *Euclid*. We can therefore expect to detect about 1.4 million UCDs in the final data release of the EWS. Of these, about 300 000 are expected to be L and T dwarfs. Similarly, we can anticipate the detection of more than 2600 T dwarfs with the method used in this paper. These are lower limits, since the present catalogue is not yet complete and does not fully utilise the potential of the data.

⁶ The depth of the images varies across the field due to dithering (e.g. *Euclid* Collaboration: McCracken et al. 2026).

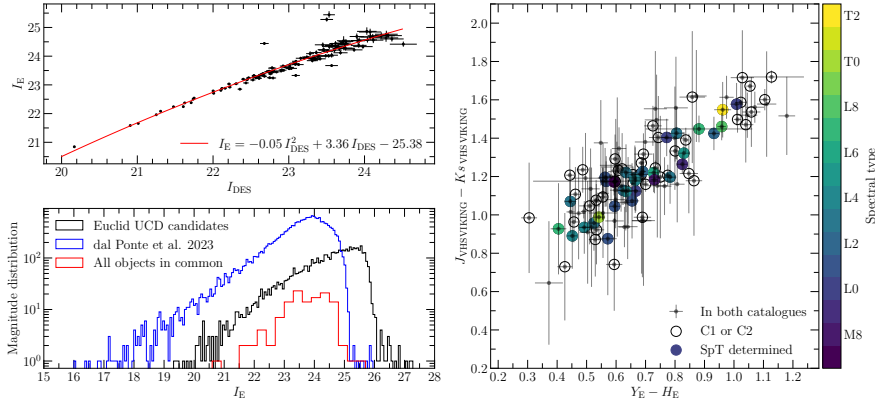


Fig. 15. Cross-match with the photometric UCD candidates from the Dark Energy Survey (dal Ponte et al. 2023). We found 125 objects in common. Left: Relation between I_E and I_{DES} . It is used to translate the DES data onto the *Euclid* scale and compare the magnitude distributions. Because DES covers about 100 times larger area of the sky than Q1 (EDF-N is not covered), the objects shared between the two surveys tend to fall within the magnitude range where most of the overall objects are found – between magnitudes 22 and 25. Right: A correlation between the $Y_E - H_E$ and $J_{VHS VIKING} - K_{s VHS VIKING}$ colours (available in the dal Ponte et al. 2023 catalogue). A tight relation supports a reliable cross-match. More than 60% of them were spectroscopically classified into C1 and C2 groups (black circles), and 25% have a spectral type determined.

These overall numbers are consistent with theoretical predictions. For example, Solano et al. (2021) estimated that *Euclid* was going to photometrically detect around 1 million objects in the NISP bands in the EWS. However, they estimated that the J_E band, which was not used in our study, is the most sensitive to UCDs. It should be able to observe and detect about 2 million L dwarfs, 1 million T dwarfs, and a select number of Y dwarfs in the thin disc, as well as many objects in the thick disc, and even some halo objects. Conversely, the estimates for the VIS detector were about 100 times lower.

This particular catalogue of UCDs from the Q1 data release is based only on one visit of the EDFs, while *Euclid* is going to repeatedly observe them during the lifetime of the mission, and thus increase the detection limit by approximately 2 mag in each band. Our catalogue will therefore be improved in future, both for new and deeper observations, and the UCD selection methods.

7. Conclusions

This work presents a first catalogue of 5306 photometric UCD candidates in the deep fields of *Euclid*’s Q1 data release. It includes approximately 1200 L and T dwarf candidates. Out of the full sample, 546 candidate UCDs were spectroscopically confirmed; 26 of them are T dwarfs and 329 are L dwarfs. The catalogue is limited to objects with high-quality photometry and prioritises low contamination over completeness. Future work will call for a complementary search that explores fainter sources in the NISP data.

We provide empirical $I_E - Y_E$, $I_E - J_E$, $I_E - H_E$, $Y_E - J_E$, $Y_E - H_E$, and $J_E - H_E$ colours for each UCD spectral type. A comparison with the metal-poor Sonora Bobcat models shows that we cannot easily isolate metal-poor L dwarfs in the bluebottle diagram (i.e. the $I_E - Y_E$ versus $Y_E - H_E$ colour-colour diagram). However, metal-poor T dwarfs are expected to have colours different from their solar-metallicity counterparts.

We assessed *Euclid*’s capability to identify UCD candidates based on its photometric passbands, in comparison with the spectroscopic detections reported by Dominguez-Tagle et al. (2025). We outline the strengths and limitations of the photometric approach for selecting UCD candidates. As the analysis is based on the Q1 data release – which reaches the same depth as the planned *Euclid* Wide Survey – our results provide a

direct projection of the number and types of UCDs expected to be detected over the full 5-year mission.

Data availability

Full Tables A.1 and A.3 are available at the CDS via <https://cdsarc.cds.unistra.fr/viz-bin/cat/J/A+A/711/A37>.

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Appendix A: Tables

In Table A.1 we present the 60 UCDs from Zhang et al. (2024) that have been spectroscopically confirmed by Dominguez-Tagle et al. (2025) using *Euclid* NISP data. These are used as benchmark objects in this paper. In Table A.2 we list the seven confirmed T dwarfs and six candidates. In Table A.3 we list the main result of this paper, namely our catalogue of photometrically selected UCD candidates.

Table A.1. Benchmarks

<i>Euclid</i> ID	RA [deg]	Dec [deg]	I_E	Y_E	<i>Euclid</i> magnitude		H_E	e	r_K	m	Flags	I_E	Y_E	S/N	J_E	H_E	SpT	gaia_id
						J_E												DR3
2694793520643016275	269.47935	64.30163	20.322 ^{+0.004} _{-0.003}	17.500 ^{+0.011} _{-0.009}	21.724 ^{+1.247} _{-0.683}	16.912 ^{+0.014} _{-0.014}	0.04	14.88	-2.94	0000	0000	287	102	0	72	M9	1439948156047469696	
2690347233671769139	269.03472	67.17691	19.841 ^{+0.002} _{-0.002}	17.579 ^{+0.005} _{-0.005}	17.391 ^{+0.005} _{-0.005}	17.305 ^{+0.005} _{-0.004}	0.08	16.43	-3.01	0000	0000	450	217	225	251	M7	1633596239873107328	
2662576498671790183	266.25765	67.17902	20.112 ^{+0.003} _{-0.003}	17.302 ^{+0.005} _{-0.004}	16.993 ^{+0.004} _{-0.004}	16.892 ^{+0.003} _{-0.003}	0.08	18.27	-2.76	2222	2222	350	240	246	338	M9:	1634299343198545664	
2718940376640395469	271.89404	64.03955	20.236 ^{+0.003} _{-0.004}	18.167 ^{+0.007} _{-0.007}	17.978 ^{+0.005} _{-0.004}	17.941 ^{+0.004} _{-0.005}	0.04	14.77	-2.88	0000	0000	316	154	234	236	M8	2161076944616819200	
2712636910639406462	271.26369	63.94065	20.353 ^{+0.009} _{-0.008}	18.162 ^{+0.008} _{-0.009}	18.304 ^{+0.348} _{-0.241}	17.836 ^{+0.005} _{-0.006}	0.01	12.47	-3.01	0000	0000	125	131	4	191	M8:	2161096735825572352	

Notes. Columns: e , ellipticity; r_K , Kron radius; and m , `MUMAX_MINUS_MAG`. The entire table is available only in electronic form at the CDS.

Notes. Columns: e , ellipticity; r_K , Kron radius; and m , $MUMAX_MINUS_MAG$. The entire table is available only in electronic form at the CDS.

Table A.2. Photometric T dwarf candidates

Obj	<i>Euclid</i> ID	RA [deg]	Dec [deg]	I_E	Y_E	<i>Euclid</i> magnitude	H_E	C	SpT	Comments
a	2748094058670347269	274.80941	67.03473	23.319 ^{+0.029} _{-0.031}	19.378 ^{+0.008} _{-0.009}	18.980 ^{+0.007} _{-0.006}	18.693 ^{+0.006} _{-0.005}	C1	0.0	T0, Spec. confirmed
b	2710066793674540980	271.00668	67.45410	24.606 ^{+0.080} _{-0.075}	20.322 ^{+0.016} _{-0.016}	19.884 ^{+0.011} _{-0.011}	19.548 ^{+0.009} _{-0.010}	C1	T2	...
c	2657163304658383990	265.71633	65.83840	24.402 ^{+0.074} _{-0.071}	20.498 ^{+0.015} _{-0.015}	20.101 ^{+0.013} _{-0.012}	19.817 ^{+0.007} _{-0.009}	C1	T4p	Also in Dominguez-Tagle et al. 2025
d	-571056342502790814	57.10563	-50.27908	25.053 ^{+0.143} _{-0.137}	20.852 ^{+0.021} _{-0.022}	20.487 ^{+0.017} _{-0.016}	20.694 ^{+0.018} _{-0.016}	C2	T5:	...
e	-519971822278279190	51.99718	-27.82792	24.843 ^{+0.139} _{-0.124}	20.073 ^{+0.016} _{-0.017}	19.512 ^{+0.010} _{-0.010}	19.906 ^{+0.013} _{-0.013}	C1	T6	...
f	2664850113649936423	266.48501	64.99364	24.684 ^{+0.089} _{-0.086}	20.436 ^{+0.019} _{-0.017}	19.967 ^{+0.015} _{-0.016}	20.461 ^{+0.017} _{-0.016}	C1	T6:	Also in Mace et al. 2013
g	-597913643476826162	59.79136	-47.68262	24.845 ^{+0.119} _{-0.104}	20.207 ^{+0.013} _{-0.013}	19.764 ^{+0.007} _{-0.008}	20.168 ^{+0.011} _{-0.010}	C1	T7	Also in Zhang et al. 2024
...	-642403482473544180	64.24035	-47.35442	25.265 ^{+0.197} _{-0.178}	20.478 ^{+0.017} _{-0.017}	19.965 ^{+0.012} _{-0.012}	20.558 ^{+0.016} _{-0.018}	C2	...	...
...	-627596072497929093	62.75961	-49.79291	25.809 ^{+0.290} _{-0.239}	21.846 ^{+0.042} _{-0.043}	21.468 ^{+0.028} _{-0.028}	21.407 ^{+0.030} _{-0.028}	C3	...	...
...	-60347660850828998	60.34766	-50.98290	24.947 ^{+0.168} _{-0.136}	20.786 ^{+0.018} _{-0.017}	20.991 ^{+0.018} _{-0.016}	21.053 ^{+0.019} _{-0.019}	C4	...	...
...	-596778559467349804	59.67786	-46.73498	24.598 ^{+0.105} _{-0.086}	20.458 ^{+0.016} _{-0.014}	20.171 ^{+0.027} _{-0.186}	19.877 ^{+0.011} _{-0.010}	C3	...	...
...	-538097404291216597	53.80974	-29.12166	25.158 ^{+0.158} _{-0.133}	21.296 ^{+0.024} _{-0.023}	20.959 ^{+0.016} _{-0.015}	20.836 ^{+0.015} _{-0.014}	C4	...	...
...	-509106704279650699	50.91067	-27.96507	25.415 ^{+0.280} _{-0.216}	21.010 ^{+0.022} _{-0.022}	20.937 ^{+1.297} _{-0.707}	20.849 ^{+0.018} _{-0.018}	C3	...	...

Notes. Three objects are also identified in the literature (Dominguez-Tagle et al. 2025, Mace et al. 2013, and Zhang et al. 2024), as noted in the comments. Column C lists spectral classes. Spectral types are from Dominguez-Tagle et al. (2025).

Table A.3. Photometric UCD candidates in the Q1 data release

<i>Euclid</i> ID	RA [deg]	Dec [deg]	I_E	Y_E	<i>Euclid</i> magnitude		H_E	e	S/N		flags	F_{dq}	C	SpT	Pec
					J_E				I_E	Y_E	J_E				
-670049939478214513	67.00499	-47.82145	23.266 ^{+0.037} _{-0.034}	20.272 ^{+0.018} _{-0.017}	19.954 ^{+0.014} _{-0.015}	19.856 ^{+0.013} _{-0.013}	0.06	31	66	72	84	0000	0	C1	L1: 0
-669812280475874160	66.98123	-47.58742	24.871 ^{+0.185} _{-0.171}	21.925 ^{+0.134} _{-0.118}	21.712 ^{+0.037} _{-0.038}	21.549 ^{+0.031} _{-0.033}	0.14	6	9	30	34	0000	0	C3	... 0
-669674147474105903	66.96741	-47.41059	24.399 ^{+0.111} _{-0.097}	21.565 ^{+0.034} _{-0.031}	21.232 ^{+0.024} _{-0.026}	21.052 ^{+0.022} _{-0.020}	0.10	11	32	42	53	0000	0	O	... 0
-669289912474470806	66.92899	-47.44708	23.739 ^{+0.045} _{-0.046}	20.942 ^{+0.022} _{-0.023}	20.595 ^{+0.014} _{-0.016}	20.447 ^{+0.014} _{-0.013}	0.16	24	49	69	83	0000	0	C3	... 0
-669256064476668171	66.92561	-47.66682	23.587 ^{+0.038} _{-0.038}	20.489 ^{+0.016} _{-0.015}	19.944 ^{+0.012} _{-0.012}	19.557 ^{+0.009} _{-0.008}	0.08	29	69	92	122	0000	0	C1	L2: 0
-669217677477463960	66.92177	-47.74640	25.587 ^{+0.249} _{-0.208}	22.805 ^{+0.087} _{-0.081}	22.502 ^{+0.065} _{-0.062}	22.425 ^{+0.059} _{-0.057}	0.13	5	13	18	19	0000	0	C2	... 0
-669177240477553807	66.91772	-47.75538	24.239 ^{+0.078} _{-0.066}	21.701 ^{+0.046} _{-0.040}	21.489 ^{+0.033} _{-0.030}	21.400 ^{+0.030} _{-0.026}	0.05	15	25	36	37	0000	0	C4	... 0
-668967766476426796	66.89678	-47.64268	25.559 ^{+0.256} _{-0.206}	23.042 ^{+0.100} _{-0.105}	22.658 ^{+0.070} _{-0.063}	22.500 ^{+0.055} _{-0.054}	0.14	5	11	16	19	0000	0	C3	... 0

Notes. Columns: e , ellipticity; F_{dq} is a detection quality flag; C is a spectroscopic class; and SpT, spectral type determined by Dominguez-Tagle et al. (2025). Pec is assigned a value of 1 for objects showing a significant mismatch between their spectral type and the expected $Y_E - H_E$ colour. Flags are also available for each band separately (for saturation, bad pixels, etc.). The entire table is available only in electronic form at the CDS.