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3. The final SHINE target list

After the simulations described above, the SHINE list is composed of 800 stars rank ordered following the proposed scheme for two bins of masses Bin-1 (early-type; $\geq 1.5\ M_\odot$) and Bin-2 (low-mass $\leq 1.5\ M_\odot$) as summarized in Table 2. For operational reasons linked to the scheduling of the observations, we choose to have four priority classes, which we labeled P1 (highest priority), P2, P3, and P4 (lowest priority), rather than individual priorities that are different for each target. We considered the relevance of members of nearby young MGs, aiming at a complete sample of members, and considering the lower errors in stellar age compared to isolated objects and the better availability of information in the literature. For this reason, in a few cases we overruled the priority ranking resulting from simulations to have well-defined distance limit for MG members in the first two priority bins. We also limited the number of Sco-Cen targets to fulfill observational constraints. Overall, 200 targets were included in each bin, as detailed below.

P1 sample.
– all the known members of nearby young MGs (β Pic, Tucana, Columba, Carina, TW Hya, Argus, AB Dor) within 60 pc;
– the known members of the youngest groups (those listed above except AB Dor, which is significantly older) between 60 to 80 pc and the two early-type members of η Cha cluster;
– the first 40 Sco-Cen stars from ranking of the simulation performed using the 50 au outer cutoff;
– the remaining stars to achieve the planned size of the sample (about 20 stars) taken from the ranking of the 15 and 30 au simulations, taking stars alternatively from the two lists sorted according to planet detection probabilities.

P2 sample.
– all the known members of nearby young MGs (β Pic, Tucana, Columba, Carina, TW Hya, Argus, AB Dor) in the distance range between 80 to 100 pc;
– the known members of AB Dor MG from 60 to 80 pc;
– a handful of stars whose membership status in the above MGs is controversial in the literature;
– the next 40 Sco-Cen stars from ranking of the simulation performed using the 50 au outer cutoff;
– the remaining stars to achieve the planned size of the sample taken from the ranking of the 15 and 30 au simulations, taking stars alternatively from the two lists sorted according to planet detection probabilities.

P3 sample.
– the next 40 Sco-Cen stars from ranking of the simulation performed using the 50 au outer cutoff;
– the remaining stars to achieve the planned size of the sample (160 stars) taken from the ranking of the 15 and 30 au simulations, taking stars alternatively from the two lists sorted according to planet detection probabilities.

P4 sample.
– the next 40 Sco-Cen stars from ranking of the simulation performed using the 50 au outer cutoff;
– the remaining stars to achieve the planned size of the sample (160 stars) taken from the ranking of the 15 and 30 au simulations, taking stars alternatively from the two lists sorted according to planet detection probabilities.
We also selected bright targets to be observed with short observations in case of bad weather conditions or short gaps in the schedule (labeled P5 targets). They include known binary systems of specific interest for orbit determinations (Rodet et al. 2018) and stars with known RV planets to look for stellar companions (Hagelberg et al., in prep.). They are not intended to be deep enough to allow us the detection of planetary companions and will not be considered in this paper.

Table 2. Priority distribution of the SHINE sample.

Priority	Early-type	Solar and low-mass
P0	Special targets	
P1	20 MGs + 40 ScoCen	120 MGs + 20 field
P2	20 Field + 40 ScoCen	50 MGs + 90 field
P3	20 Field + 40 ScoCen	140 Field
P4	20 Field + 40 ScoCen	140 Field
P5	Bad weather backup or filler	

3.1. New targets added after the original definition

After evaluating of the actual on-sky performances of SPHERE, the results of which showed a reasonably good performance on stars as faint as $R \sim 12$ (Beuzit et al. 2019, see their Fig. 7), the original sample was complemented starting from ESO period P98 (April–September 2016) with about 50 M-type objects proposed as members of young moving groups. The targets were assigned to priority bins P1 and P2 following the distance limits for individual groups, as defined above.

3.2. Special targets

A number of special targets were identified and promoted to higher priority for observation, defined as P0 priority. The science motivation for special priority is related to the known presence of planets or brown dwarfs, amenable to detailed characterization studies (e.g., Bonavita et al. 2017; Lagrange et al. 2019), stars with spatially resolved disks, especially when the disk properties suggest the presence of planets (e.g., PDS 70 Keppler et al. 2018; Mesa et al. 2019), or stars with long-period RV planets potentially detectable with SPHERE (Zurlo et al. 2018).

Other targets were promoted as P0 during the survey, thanks to results of observations of other components of the SPHERE-GTO (DISK program) or discoveries by other groups (e.g 51 Eri after planet detection, Macintosh et al. 2015). Targets that were not included in the original statistical sample, as defined above, are not considered in this paper as their inclusion would considerably bias the overall frequency of substellar objects. This is, for instance, the case of PDS 70 not originally selected given its distance, but observed in the context of a SHINE follow-up of the DISK program. Only targets included in the original statistical sample are kept for the present analysis. Nevertheless, some bias is still present, as the increase in priority implied a greater probability of being actually observed. This is further discussed in Paper III (Vigan et al. 2021).

Table 3 lists the targets in the F150 sample promoted to P0, the original priority class, the motivation for the priority upgrade, and the reference to individual papers based on SHINE data, if any. η Tel and CD-35 2722 were not flagged as special objects in spite of the previously known BD companions.

4. The F150 sample

The aim of the present series of papers is to present a preliminary statistical analysis from the first half of targets observed in the

Table 3. Stars in the SHINE statistical sample observed as special targets (highest priority).

Target	Priority	Remarks	Discovery paper	SPHERE paper
β Pic	P1	Known planet and disk	Lagrange et al. (2009)	Lagrange et al. (2019)
HR 8799	P1	Known planet	Marois et al. (2008)	Zurlo et al. (2016)
HD 95086	P1	Known planet	Rameau et al. (2013b)	Chauvin et al. (2018)
Fomalhaut	P2	Known planet and disk	Kalas et al. (2008)	–
FomalhautB	P3	Companion to P0 star	–	–
PZ Tel	P1	Known brown dwarf	Biller et al. (2010)	Maire et al. (2016)
HIP 107412	P4	Known brown dwarf	Milli et al. (2017)	Delorme et al. (2017); Grandjean et al. (2019)
51 Eri	P1	Known planet	Macintosh et al. (2015)	Samland et al. (2017); Maire et al. (2019)
AB Pic	P1	Known brown dwarf	Chauvin et al. (2005b)	–
TYC 8047-0232-1	P1	Known brown dwarf	Chauvin et al. (2005a)	–
HIP 78530	P1	Known brown dwarf	Lafrenière et al. (2011)	–
HD 61005	P1	Known disk	Hines et al. (2007)	Olofsson et al. (2016)
HR 4796	P1	Known disk	Schneider et al. (1999)	Milli et al. (2017, 2019)
AU Mic	P1	Known disk	Liu (2004)	Boccaletti et al. (2015, 2018)
HD 30477	P1	Known disk	Soummer et al. (2014)	
TWA 7	P1	Known disk	Choquet et al. (2016)	Olofsson et al. (2018)
HD 141943	P2	Known disk	Soummer et al. (2014)	Boccaletti et al. (2019)
ζ Lep	P2	Known disk	Moerchen et al. (2010)	
ρ Vir	P1	Known disk	Booth et al. (2013)	–
HIP 71724	P3	Known low-mass comp.	Hinkley et al. (2015)	–
HIP 73990	P3	Known low-mass comp.	Hinkley et al. (2015)	–
HD 115600	P3	Known disk	Currie et al. (2015)	–
HD 377	P2	Known disk	Choquet et al. (2016)	–

Notes. The original priority in the selection of the statistical sample, the motivation for priority upgrade, and the references to discovery papers and individual SPHERE papers are listed. SAM stands for sparse aperture masking (e.g., Tuthill et al. 2006).

SHINE survey. The resulting sample is then necessarily incomplete. The optimal observing procedure for ground-based direct imaging surveys requires the target to be observed at meridian to maximize field rotation. A dedicated program to optimize the scheduling of an extended list of targets over individual nights or runs and even full semesters considering the actual time allocation has been built and is routinely used to prepare the SHINE observing nights (Lagrange et al. 2016). As a result, the actual targets included in the schedule is a compromise between the scientific priorities, the constraints of meridian passage, and the maximization of the number of targets to be observed.

To build the sample considered in the present paper, we included targets observed until February 2017 (the first 2 yr of the survey), considering only the targets that are part of the statistical sample, as defined in Sect. 3. Targets observed in poor conditions (not validated following quantitative criteria of achieved contrast with respect to the expected level considering stellar magnitude and declination) were removed. Details on data reduction are provided in Paper II (Langlois et al. 2021).

We also removed targets identified as new close visual binaries from SPHERE observations in order to be homogeneous with the original selection of single stars or members of wide binaries[7]. The new binaries will be presented in a dedicated paper (Bonavita et al. 2021).

We removed four targets (HIP 37288, HIP 39826, HIP 64792 = GJ504, HIP 82588) which resulted to be older than 1 Gyr from the revised age analysis described in Sect. 5.9. Finally, we removed four targets (HD 100546, TW Hya, MP Mus, and EP Cha) because of the presence of gas-rich disks. Planets may still be forming in these disks, but are probably heavily obscured by disk features. The case of HD 100546, formally in our sample, is probably the best example of this (Sissa et al. 2018).

The sample built as described above is then formed by 150 targets, listed in Table 5, together with available broadband photometry in several filters.

5. Updated stellar properties

The target parameters were determined using the methods and procedures described in Desidera et al. (2015). A major improvement is the availability of *Gaia* DR2 astrometric parameters (Gaia Collaboration 2016, 2018). As a result, all the targets have trigonometric parallaxes.

5.1. Distance and proper motion

Trigonometric parallaxes and proper motions were mostly taken from *Gaia* DR2. For two very bright stars not included in *Gaia* DR2 (Fomalhaut and β Leo), we used the HIPPARCOS results derived by van Leeuwen (2007) (hereafter VL07). For an additional 13 very bright stars (V< 5), the VL07 errors are smaller than the *Gaia* DR2 values. We adopted VL07 parallaxes and proper motions for these targets; they are listed in Table 6, together with other kinematic parameters.

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[7] In some cases the physical link between the central star and the companion remains to be demonstrated, but the chance of background objects is small because of the bright magnitude of the candidates. Details will be presented in Bonavita et al. (2021). Cases of very low-mass star companion candidates were analyzed with special care. A common proper motion test was performed, and stars with moderately bright background objects were kept in the F150 sample.

5.2. Radial velocity

Radial velocity (RV) is a key input for the kinematic assignment (membership to groups) and for checking multiplicity. RV measurements were mostly taken from the literature (sources listed in Table 6). We obtained new RVs for 32 stars from spectra available in public archives. For 31 stars observed with HARPS we exploited the reduced spectra and RVs provided by the instrument pipeline available on the ESO archive[8]. The mean value was adopted when multiple epochs were available[9]. For one star (HIP 69989) we took the RV from public observations obtained with SOPHIE, available in the archive of the Haute Provence Observatory (Moultaka et al. 2004)[10].

5.3. Multiplicity

As discussed above, objects with known stellar companions (mass >75 $M_{\rm Jup}$) within 6 arcsec (approximate size of IRDIS field of view) were removed from the sample, including the previously unknown binaries discovered by our observations. The multiplicity search was based on the SPHERE images themselves, *Gaia* DR2, and other recent literature, including the evaluation of RV variability.

We opted to be conservative in the removal of targets due to binarity, aiming at avoiding spurious rejections in our sample. For this reason, a few stars with low-amplitude RV variability or indication of multiplicity derived only from the $\Delta\mu$ signature[11] were kept in the sample. RV variability of up to 1–2 km s^{-1} may be linked to stellar activity for our very young targets (e.g., Carleo et al. 2018; Brems et al. 2019) or to pulsations for early-type stars (e.g., Lagrange et al. 2009), or, when combining data from different instruments, due to zero-point offsets. The $\Delta\mu$ signature has instead some ambiguity in terms of physical mass and orbital parameters responsible for the dynamical signature. We also checked non-coronagraphic images taken with SPHERE at the beginning and end of the observing sequence, looking for the presence of stellar companions (Engler et al. 2020). Some ambiguous cases are discussed individually in Appendix A. It should be noted that several targets in our sample lack RV monitoring, making the rejection of spectroscopic binaries incomplete.

In order to have a more complete view of the properties of the targets in the sample, we also looked for companions at projected separations larger than 6 arcsec from our targets (outside the IRDIS field of view). They are listed in Table 10. Dedicated checks using *Gaia* DR2 have been performed to confirm the physical association of previously known companions and to look for new ones through the evaluation of the parallax and proper motion of individual objects. Forty-one targets are found to have companions outside the IRDIS field of view. In two cases (HIP 95270/η Tel and Fomalhaut/Fomalhaut B) we observed both components of the system. Two stars, namely HN Peg and β Cir, have brown dwarf companions at wide separation. For MG members, especially for the well-populated Sco-Cen groups, there is some ambiguity between very wide binaries and co-moving members of the associations. We opted to be conservative and then inclusive in Table 10, requiring tight common proper motion and parallax values (within 2 mas/yr and 1 mas, respectively). We note some cases of extremely wide binaries in our sample, with separation even larger than the typical limit for bound objects adopted in the literature (~20 000 au, Abt 1988; Allen et al. 2000). However, at young ages the occurrence of multiple systems at wider separations is expected (Caballero 2009). Among the extremely wide multiple systems not previously noted in the literature we mention HIP 22226 + 2MASS J04463413-262755 (the latter being itself a close binary) at a projected separation of about 50 000 au.

The presence of wide companions, an important environmental property of our targets, is also a useful resource for age dating systems when complementary diagnostics can be applied to the individual components, depending on their spectral types.

5.4. Kinematics and moving group membership

We exploited the updated kinematic data, particularly the high-accuracy parallaxes and proper motions from *Gaia* DR2, to evaluate the membership of our targets in young moving groups. We derived the space velocities U, V, W following prescriptions by Johnson & Soderblom (1987), and we exploited the BANYAN Σ tool[12] (Gagné et al. 2018a). Unambiguous assignment to groups or field can be made for nearly all targets thanks to the improved kinematics data and group definition. There are a few cases of different membership assignment with respect to the literature, mostly a few exchanges between Tuc-Hor and Columba and Carina or between Sco-Cen subgroups. A few targets classified in the literature as members of AB Dor MG have low membership probability according to BANYAN Σ. However, their properties (lithium, activity, rotation; see below) are fully consistent with those of confirmed members. Targets worthy of individual discussion are included in Appendix A.

5.5. Chromospheric and coronal activity

X-ray luminosities for all the targets were derived from the ROSAT All Sky Catalogs (Voges et al. 1999, 2000) using the calibration by Hünsch et al. (1999); 89 stars in the sample have detected X-ray emission. Chromospheric emission was retrieved from the literature or measured by us on archive HARPS spectra as in Desidera et al. (2015). Overall $\log R'_{\rm HK}$ is available for 46 stars. Both quantities are reported in Table 7. These indicators have limited dependency on stellar age below the Pleiades age (for G–K stars). Therefore, low weight was assigned to these indicators to quantify the age of very young stars, while for older objects we relied on the Mamajek & Hillenbrand (2008) calibrations. The possibility of old active stars misclassified as young being tidally locked binaries or because of the occurrence of some kind of accretion of angular momentum is unlikely, considering the complementary age diagnostics (e.g. lithium) and the search for close binaries.

5.6. Lithium

The equivalent width of the available age-sensitive diagnostic Li 6707 Å was gathered from the literature and included in Table 7, to be used as an age diagnostic.

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[8] `http://archive.eso.org/wdb/wdb/adp/phase3_spectral/form`

[9] In a few cases the RVs available on the ESO archive were obtained with different masks for the same star. In these cases we adopted the value obtained from the mask that is closer to our adopted spectral type.

[10] `http://atlas.obs-hp.fr/sophie/`

[11] Proper motion difference between *Gaia* DR2 and other catalogs such as *Gaia* DR1, HIPPARCOS, and *Tycho*2.

[12] `http://www.exoplanetes.umontreal.ca/banyan/banyansigma.php`

5.7. Photometric variability and rotation period

In our sample 103 stars have spectral type later than A. They are all young, and exhibit clear evidence of magnetic activity and photometric variability. The last property is exploited to make measurement of the stellar rotation period and of the level of magnetic activity.

As the first step in our rotation period study, we explored the literature for all 103 stars and found existing measurements of the rotation period for 64 stars (62%). As the second step we explored the public photometric time series archives of all 103 stars and found (mostly in the TESS archive) suitable data for rotation period search for 58 stars (56%). Finally, we planned and collected our own photometric time series data for the remaining targets lacking suitable data and measured the rotation period for six of them. Observations were carried out at the Remote Observatory Atacama Desert (ROAD) in Chile, the Perth Exoplanet Survey Telescope Observatory (PEST) in Australia, and the York Creek Observatory (YCO) in Tasmania.

As the results of our study we obtained the rotation period for 101 of the 103 late-type stars in F150. They are reported in Table 7, together with amplitude of the photometric rotational modulation.

5.7.1. Gyrochronology

Ages from rotation were estimated comparing the observed rotation period with that of stars of similar colors in groups or clusters of known age, considering those compiled by Desidera et al. (2015) and more recent literature results (e.g., Rebull et al. (2016) for the Pleiades and Messina et al. (2017) for β Pic MG). The ambiguity in rotation age due to the non-monotonic evolution of the rotation (minimum period reached close to the zero age main sequence, ZAMS) can usually be eliminated by considering additional indicators such as the Li equivalent width (EW) and the position on the color-magnitude diagram (CMD) because very young stars that are in the acceleration phase are above the ZAMS. The number of targets involved in these ambiguities is small, considering the large fraction of members of moving groups, especially at young ages. The additional ambiguity represented by the small fraction of very fast rotators ("C" sequence in the nomenclature by Barnes 2007) is more subtle. As the majority of these fast rotators are found in binary systems (e.g., Messina et al. 2017), which are rejected in our study, and considering the low fraction of such targets in well-studied clusters and the help of the other age diagnostics, we expect a very limited impact on our age classification.

5.7.2. Period search methods

We followed the approach outlined in Messina et al. (2010, 2011), to search for the stellar rotation period of our targets.

Briefly, the period search was carried out by computing the Lomb−Scargle periodogram (LS; Press et al. 2002; Scargle 1982; Horne & Baliunas 1986) and the CLEAN algorithm (Roberts et al. 1987). The false alarm probability (FAP) that a peak of given height in the periodogram is caused by statistical variations was computed through Monte Carlo simulations, by generating 1000 artificial light curves obtained from the real light curve, keeping the time sampling but permuting the magnitude values (see, e.g., Herbst et al. 2002). We considered only rotation periods that were measured with FAP <0.01%. Only a very few targets with FAP in the range 0.01–1% had their rotation periods confirmed by independent measurements, for example from the literature.

When data from more observation seasons (or sectors in the case of TESS) were available, we computed LS and CLEAN periodograms for each season(sector); the most accurate results were reported as adopted values, and they are shown in Figs. A.1–A.85. We followed the method used by Lamm et al. (2004) to compute the errors associated with the period determinations (see, e.g., Messina et al. 2010 for details). To derive the light curve amplitude, we fit the data with a sinusoidal function whose period is equal to the stellar rotation period. As a result of our photometric analysis we obtained our own rotation period measurements and photometric variability amplitudes for 82 of the 103 target stars: 76 from data of one or more public archives and 6 from our own photometry. We confirmed 44 previously known rotation periods. Finally, we adopted the rotation periods retrieved from the literature for 18 targets (of which 8 periods were retrieved from Messina et al. 2010, 2011, 2017). We produced plots for all the photometric time series (either new or from archives) analyzed in this work. These plots are available in Figs. A.1–A.85.

5.8. Isochrone fitting

Isochronal ages were derived using the models by Bressan et al. (2012) and the web interface PARAM[13]. For this determination, we used the V-band magnitude listed in Table 5, the effective temperature listed in Table 8, the parallax listed in Table 6, and adopted solar metallicity. The effective temperatures were obtained through Casagrande et al. (2010) for late-type stars, using the combination of colors adopted in Desidera et al. (2015), and through the Mamajek tables Pecaut & Mamajek (2013) for early-type stars. A few cases of ambiguities between pre-main sequence and post-main sequence evolution (see, e.g. Bonnefoy et al. 2018) are discussed individually in the Appendix. The availability of other indicators allows us to solve the ambiguity between the two alternatives. In addition to the systematic uncertainties in the stellar models, possible biases of the isochrone method are linked to photometric variability of most of the late-type targets and to the possibility of unrecognized binaries. The first item is included in the error bar of the input parameters. For the second item, the sensitivity of our SPHERE observations to stellar companions, especially those bright enough to bias the photometry, allows us to rule out cases at separations larger than a few tens of mas. For closer companions we inspected the available data for spectroscopic binaries, although a significant fraction of the targets lack suitable RV monitoring. Finally, after *Gaia* DR2, parallax is no longer the dominant source of uncertainty for isochrone age determination.

5.9. Adopted ages

The primary age method adopted in this work is the group membership because the age of an ensemble is usually better determined than any individual measurement. For bona fide members the group age was adopted. The ages for the MG and their errors are those described in Bonavita et al. (2016) and were also adopted by Vigan et al. (2017). They are summarized in Table 4[14]. The Bonavita et al. (2016) MG ages were mostly taken from Bell et al. (2015). The main motivation for this choice is to ensure the best homogeneity for the whole list of targets as

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[13] Version 1.3 available at `http://stev.oapd.inaf.it/cgi-bin/param_1.3`

[14] In our sample there are no members of Octans, Octans-Near, Carina-Near, or Pisces-Eridanus MG, and is why these groups are not included in Table 4.

Table 4. Adopted MG ages.

Group	Age (Myr)	Min (Myr)	Max (Myr)
TW Hya (TWA)	10	7	13
η Cha OC (ETAC)	11	8	14
Upper Scorpius (US)	11	4	12
Lower Centaurus-Crux (LCC)	16	12	20
Upper Centaurus-Lupus (UCL)	17	15	20
β Pic (BPIC)	24	19	29
Columba (COL)	42	35	50
Tuc-Hor (TUC)	45	35	50
Carina (CAR)	45	35	50
Argus (ARG)	50	40	70
AB Doradus (ABDO)	149	100	180

no comparable studies were published in the following years. For groups not included in Bell et al. (2015), we checked (using indirect methods such as lithium and rotation) that our adopted age ranking is correct. Improved ages for individual groups have been published (e.g., Miret-Roig et al. 2020, for β Pic MG), but adopting them without revision for other groups would imply inconsistencies in the relative ages, which we want to avoid, We have started to work on comprehensive updates of the MG ages in the perspective of the final analysis of the SHINE sample.

We recognize that there are indications for a significant age spread in some of these groups, such as the Sco-Cen association (Pecaut & Mamajek 2016). However, a common age is adequate for the statistical purposes of this series of papers. In addition, the errors associated with the age determination for individual stars are usually comparable or even larger than the age dispersion of the groups. Finally, possible members with ages that are somewhat discrepant from the bulk of an association are often subject to a dedicated analysis as typically their kinematic membership probability is lower (see, e.g., the case HD 95086 discussed in Appendix A). For late-type bona fide members, lithium, rotation, and secondary rotation-activity indicators are typically consistent with the age assigned to the MGs.

For field objects, the age determination is based on isochrone fitting for early-type stars (spectral type earlier than mid-F), while for late-type stars (spectral type later than mid-F) it is based on indirect methods (lithium, rotation, chromospheric activity, X-ray emission), complemented by isochrone fitting and kinematic evaluation when applicable. The indirect estimates are based on comparison with the locus of members of nearby moving groups and open clusters, as done in Desidera et al. (2015).

For stars with ambiguous membership to groups, we opted for a conservative approach. In the case of objects with probable membership, we adopted the group age but extended the possible range of values (minimum and maximum values in Table 9) to include the values resulting from the analysis based on other methods, applied depending on the spectral type of the star. Object with a low probability of membership were considered field objects, adapting the age limits to the group age in the adopted range.

The adopted ages are listed in Table 9. Further details on individual targets are provided in Appendix A.

5.10. Stellar masses

Stellar masses were derived using the PARSEC isochrones Bressan et al. (2012) models and the PARAM interface (see above). As done in Desidera et al. (2015) for the objects with ages derived from moving group membership or indirect methods, we restricted the allowed age range for the determination of the stellar mass, assuming uniform prior in the selected age range. This allowed us to consider, among the overlapping isochrones within the error bars of the input parameters, only those consistent with the age estimate. This effect is small but not negligible (typically a few hundredths of a solar mass). For stars with M spectral type the resulting stellar masses appear rather low. This is likely due to issues in the atmospheric models for cool objects in the PARSEC tracks (Chen et al. 2014b). Therefore, for these stars we derived the stellar masses from the models by Baraffe et al. (2015) for the appropriate age of the star. The masses are listed in Table 8.

5.11. Presence of disks

We also checked in the literature for the presence of dusty disks surrounding the stars in the sample. Of the 150 objects, 73 show infrared (IR) excesses, interpreted as the clear presence of dust in the system. Twenty-nine of these were detected and spatially resolved with instruments such as HST/NICMOS, VLT/SPHERE, Gemini/GPI, *Herschel*/PACS, and ALMA (see Table 8). Disks identified as double-belts from SED fitting (Chen et al. 2014a) have a special flag in Table 8. Finally, seven objects were classified as potential disk hosts since the IR excesses were only marginally detected, while in two cases there are indications that the observed emission is likely associated with contaminants (background sources). The absolute frequency of stars with disks in our sample, in particular those with spatially resolved disks, appears higher than typically found in the literature. The priority enhancement for some stars with disks described in Sect. 3.2 is certainly one of the reasons for such a high occurrence. Our selection of well-isolated objects (single stars or components of wide binaries) with broad dynamical room for extended disks is another likely reason[15]. It should be considered that our flag includes the detection of IR excess at any wavelength, then including a large variety of disk temperatures and configurations. Finally, while our original selection criteria do not concern the presence of disks, it is also possible that some indirect bias is at work. This may happen if stars with IR excess were more carefully scrutinized for youth and membership in moving groups and then more likely to be included in our target list. This may be the case for a few individual targets; however, most of the main sources of our original target compilations (e.g., Torres et al. 2006; Wright et al. 2004) are completely unrelated to the presence of IR excesses or resolved disks, so we think this bias is minor, if present at all.

6. Sample properties

6.1. General properties of the sample

Figures 2–4 show the distributions for some of the key astrophysical parameters for our F150 sample. Figures 5–8 show the cumulative distributions along with the comparison with the GPIES sample (Sect. 6.2).

The bumps in the age distribution are due to the large fraction of members in young MGs. The median age value is 45 Myr, with 90% limits of 11 and 450 Myr. The adopted ages are typically similar to those originally considered in the sample

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[15] The frequency of stars with detected IR excess is much lower (below 10%) in the sample of 78 new binaries detected in the whole SHINE survey (Bonavita et al. 2021).