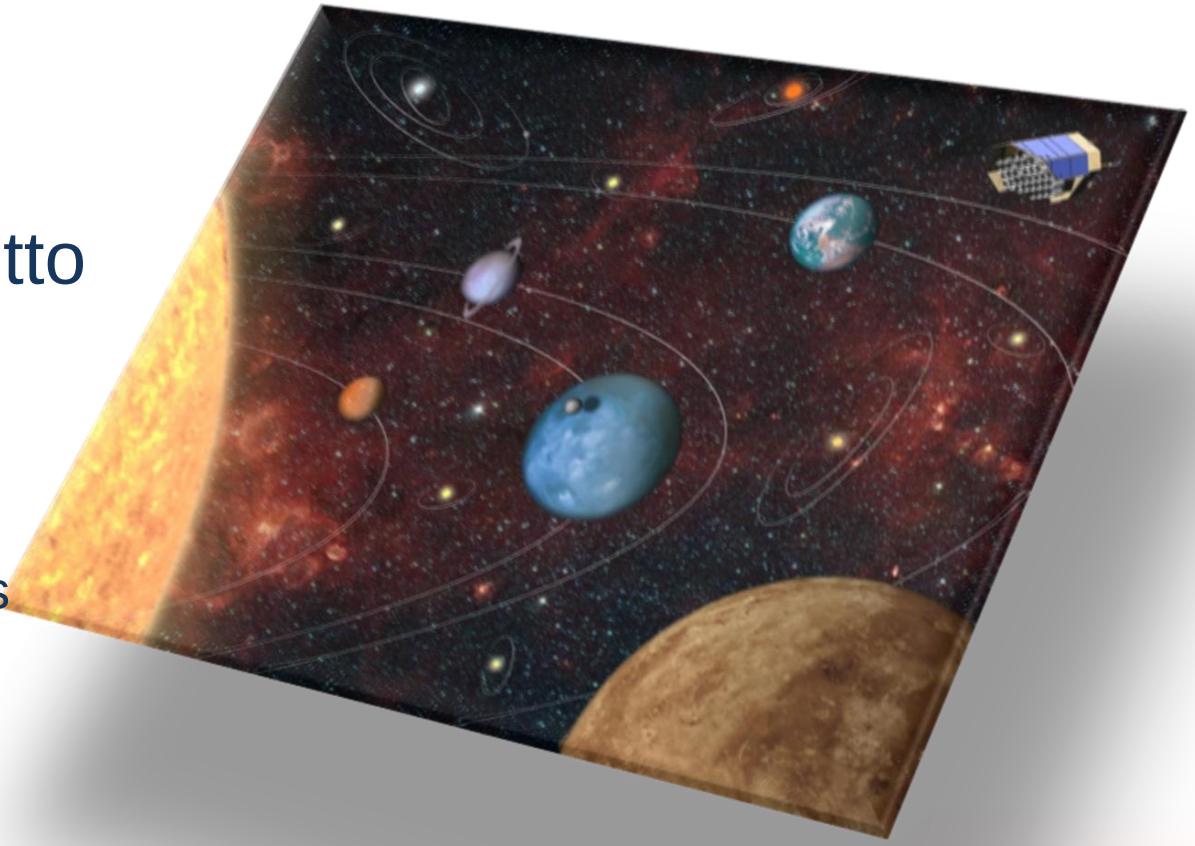
PIC general properties

Giampaolo Piotto

and the

WP130 (PSM) and

WP340 (PDC) teams



Why we need a PIC

- Because of the huge size of PLATO field (~2124 sq deg) and the consequent number of pixels ($24x4x4510^2$+ $2x4x4510x2255$ $pixel^2$, ~$0.7m^2$), it is not possible to download all raw data.

- Light curves will be produced on board for all targets. Imagettes for a small subsample of targets (all P1 targets+), will be downloaded: **We need to pre-select our targets.**

- The minimum content of the **Plato Input Catalog** (PIC) includes the positions of the targets (dwarfs and sub-giants with spectral type later than F5) around which planet transits shall be searched for, and followed-up, and their basic parameters. The list of parameters shall be agreed within the PSM.

- For each target, we also need **a table of contaminants**, to optimize photometric mask and candidate exoplanet validation (minimize follow-up costs).

- For each target, the PIC shall contain a number of parameters intended to make the validation, confirmation and follow up of the candidates easier, faster and cheaper.

PIC content from Science Requirements

- Revised science requirements, assuming two long pointing fields

	Sample 1	Sample 2	Sample 4	Sample 5	Colour sample
Stars	≥ 15,000 (goal 20000)	≥ 1,000	≥ 5,000	≥ 245,000	300
Spectral type	Dwarf and subgiants F5-K7	Dwarf and subgiants F5-K7	Cool late type dwarfs	Dwarf and subgiants F5-K	Anywhere in the HR diagram
Limit m_V	11	8.5	16	13	-
Random noise (ppm in 1 hour)	≤ 50	≤ 50	-	-	-
Observation phase	LOP	LOP	LOP	LOP	LOP

Imagettes and sampling time (from PLATO Science Requirements)

- Imagettes for all P1 and P2 targets, for >5,000 P4 targets and for >9,000 P5 targets.

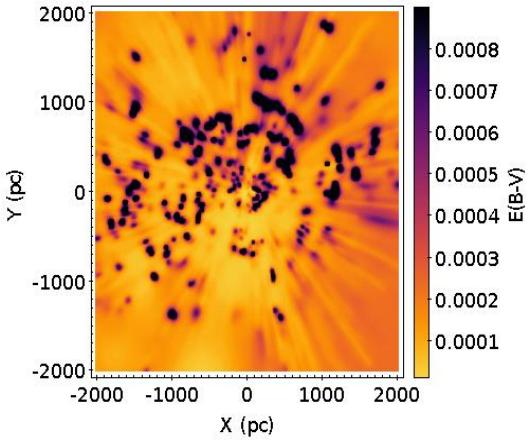
		Sample 1	Sample 2	Sample 4	Sample 5	Colour sample
Observation sampling times	Imagettes	25 s	25 s 2.5 s for a subsample	25 s for > 5,000 targets	25 s for > 9,000 targets	2.5 s
	Light-curves	-	-	-	≤ 600 s	-
	Centroid measurements	-	-	-	≤ 50 s for 5% of targets	-
	Transit oversampling	-	-	-	≤ 50 s for 10% of targets	-
Wavelength		500-1000 nm	500-1000 nm	500-1000 nm	500-1000 nm	Red and blue spectral bands

Populating the PIC: target selection

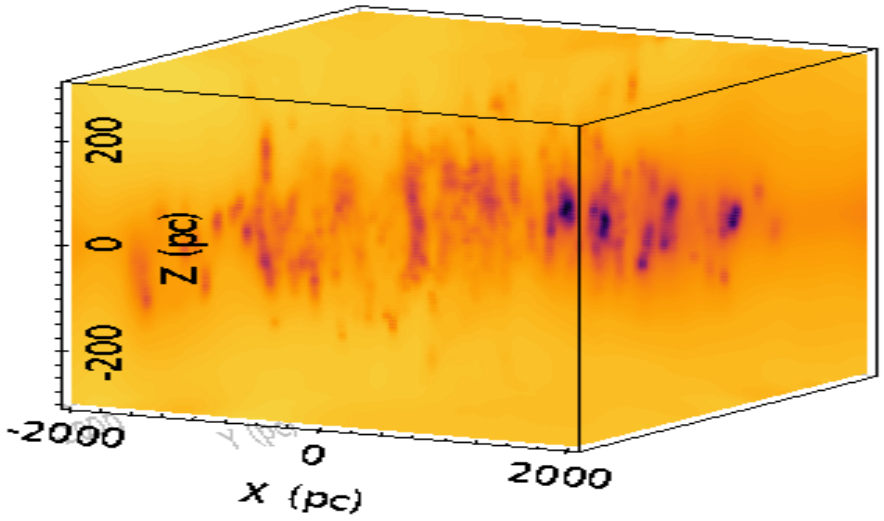
- PLATO will observe dwarfs and subgiants with $4<V<16$, SpT>F5
- In principle all possible PLATO targets are presently observed by *Gaia*.
- PIC1.0.0 is mainly based on Gaia DR2, with additions (updated parameters, and additional catalogs)
- Gaia DR2 release indeed went in the right direction, but degeneracies between temperature and reddening required additional analysis for PIC

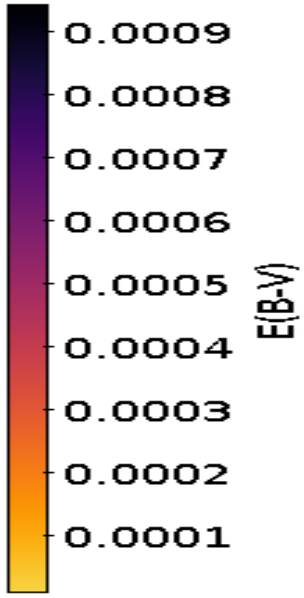
Reddening in PIC1.0.0

The reddening map presented in Lallement et al. (2018), Capitanio et al. (2017) is the result of merging individual photometric color excess measurements from broad- and narrowband photometry of close-by stars (<500 pc) with NIR DIB equivalent widths measured in individual spectra of more distant stars (500 to 1500 pc) and color excess measurements at larger distance (up to 3 kpc) based on a statistical analysis of multiband photometric data. The method used to derive the map is the method described in Tarantola & Valette 1982, RvGSP, 20, 219.



Galactic plane projection





The 3D map covers around 2 Kpc x 2 Kpc x 0.3 kpc from the Sun

PIC1.0.0 stellar parameters

In PICV1.0.0 **stellar parameters are estimated** from:

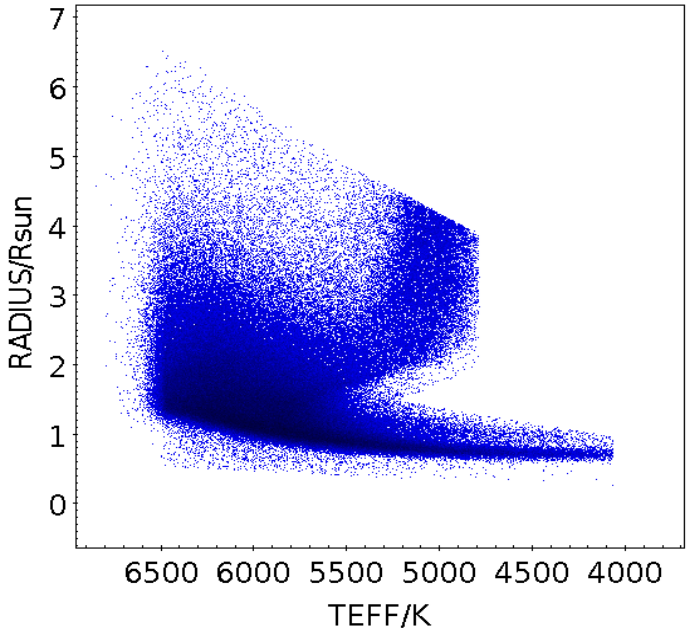
Gaia/DR2 photometry, transformed into V, B-V (using Evans et al. 2018)

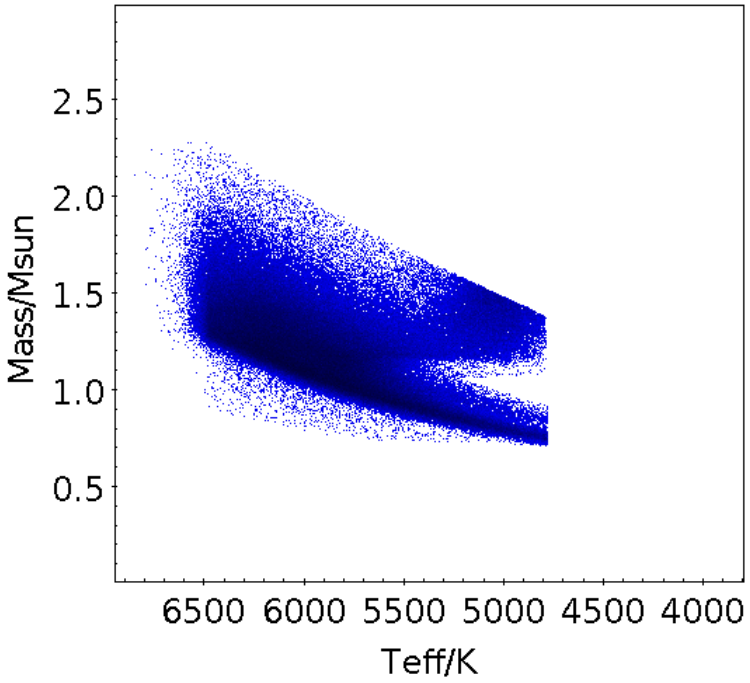
Gaia/DR2 parallaxes (using Bailer-Jones et al. 2018 distances)

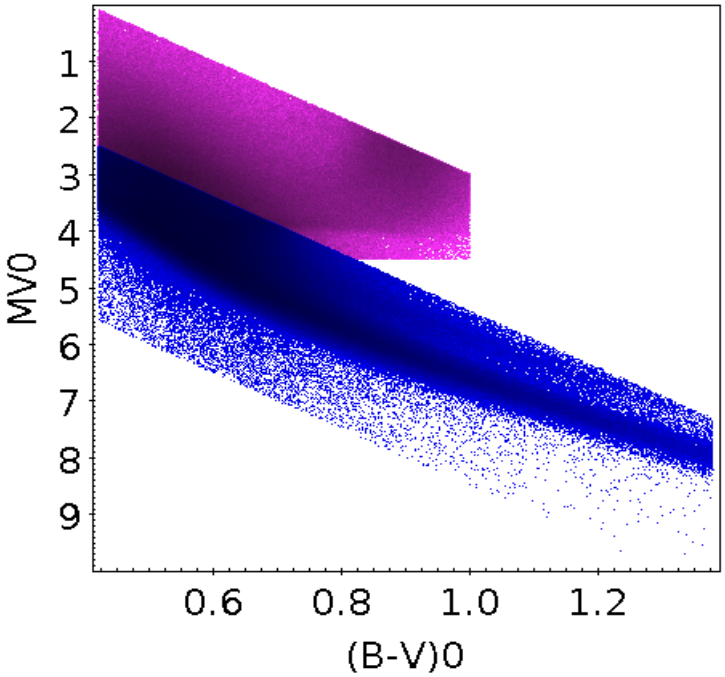
3D reddening map (using Lallement et al. 2018, Capitanio et al. 2017)

See Montalto talk

PIC1.0.0


RADIUS/Rsun
TEFF/K
7
6
5
4
3
2
1
0
6500 6000 5500 5000 4500 4000


Mass/Msun
Teff/K
2.5
2.0
1.5
1.0
0.5
6500 6000 5500 5000 4500 4000


MV0
(B-V)0
1
2
3
4
5
6
7
8
9
0.6
0.8
1.0
1.2

PIC1.0.0 CONTENT

tables

PICN1.N2.N3 contains

PICtargetN1.N2.N3
PICtargetReferenceN1.N2.N3
PICtargetSourceIdN1.N2.N3

PICcontaminantN1.N2.N3
PICcontaminantReferenceN1.N2.N3
PICcontaminantSourceIdN1.N2.N3

Target : PlatoId + characterization
Target references : references for each target and each column
Target source IDs : additional sourceIds (for each used input catalogue)

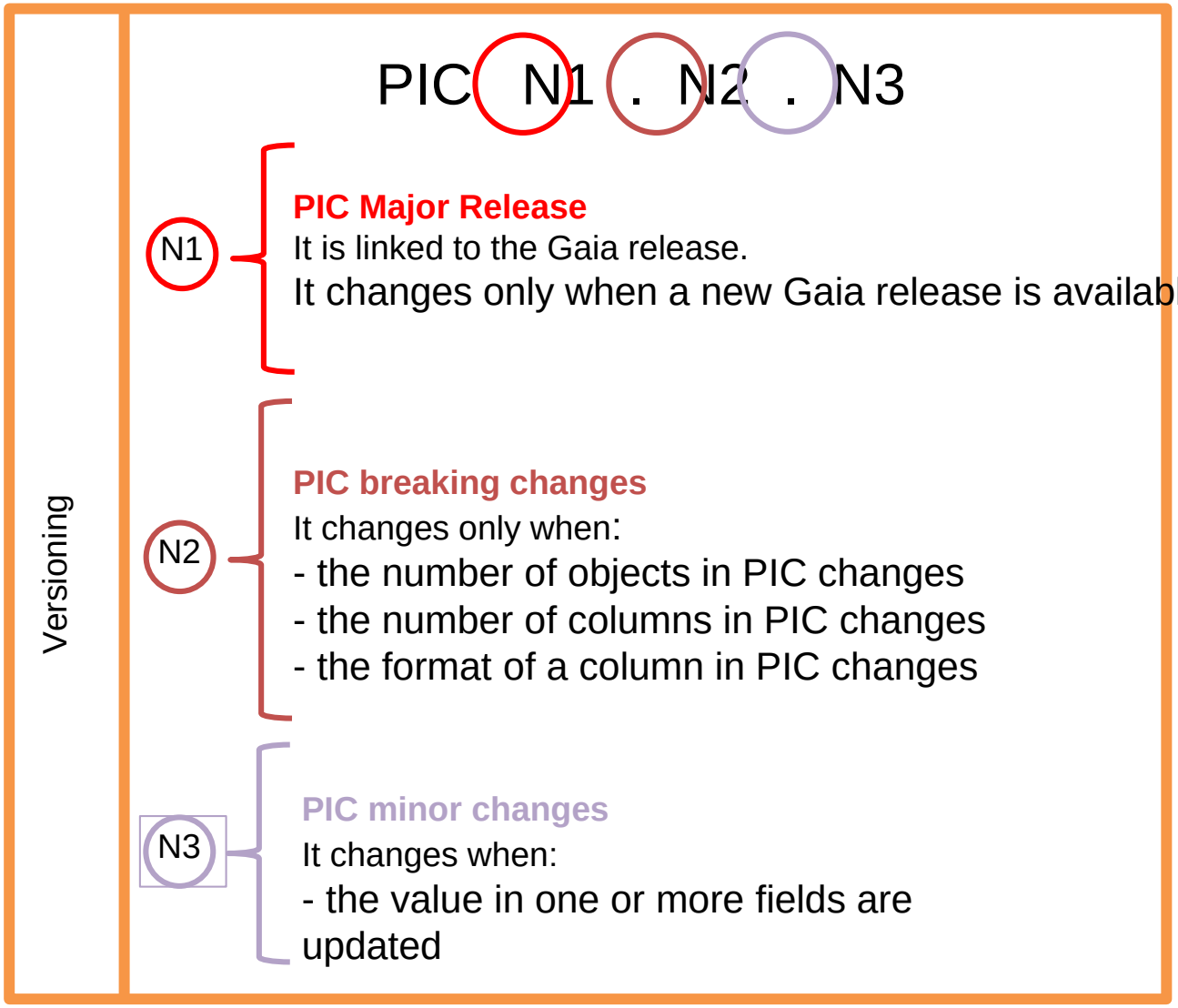
Contaminant : PlatoContId + PlatoId + characterization
Contaminant references : references for each contaminant and each column
Contaminant source IDs : additional sourceIds (for each used input catalogue)

See Marrese talk

PIC VERSIONING

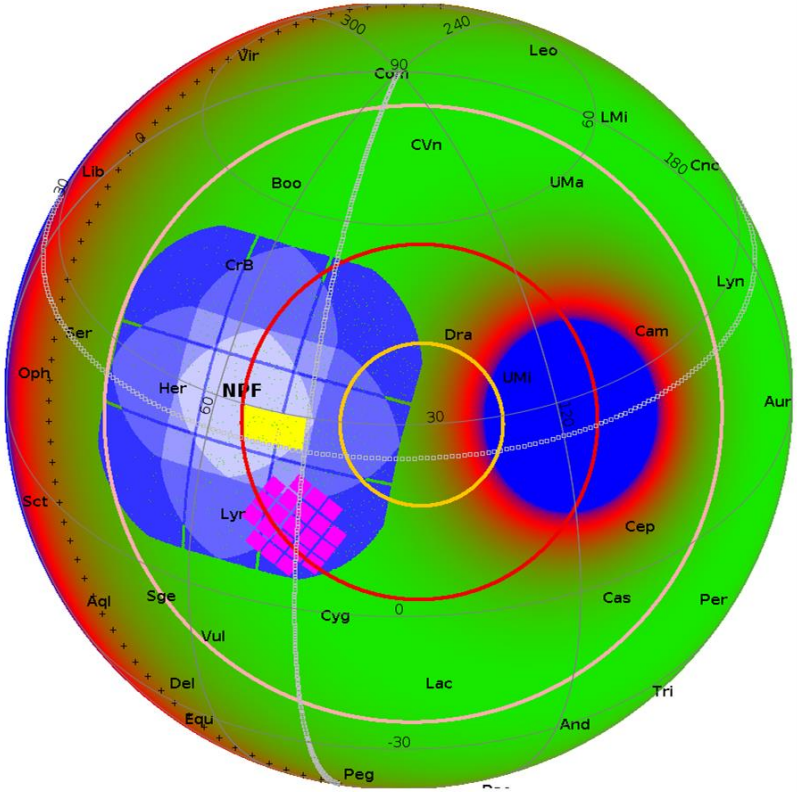
NB: PICid for a given source change only
following a major release

The column name of the PIC identifier, follows the
PIC major versioning:
PICidV1,
PICidV2, ...



See Marinoni talk

PLATO field selection



Note: *we could leave the NPF center at b~30°, moving eastward and including up to 70% of TESS CVZ (yellow circle) while fulfilling all the mentioned constraints*

The *yellow region* is the allowed region for the **NPF** center (blue FOV: present provisional pointing) if we require all the following constraints:

1) center at β > 63° (red circle): compliant with R-SCI-050

2) center at *b* > 25° (gray circle) avoids the Galactic plane and the most crowded regions

3) center at *b* < 30°: fully includes the original Kepler Field

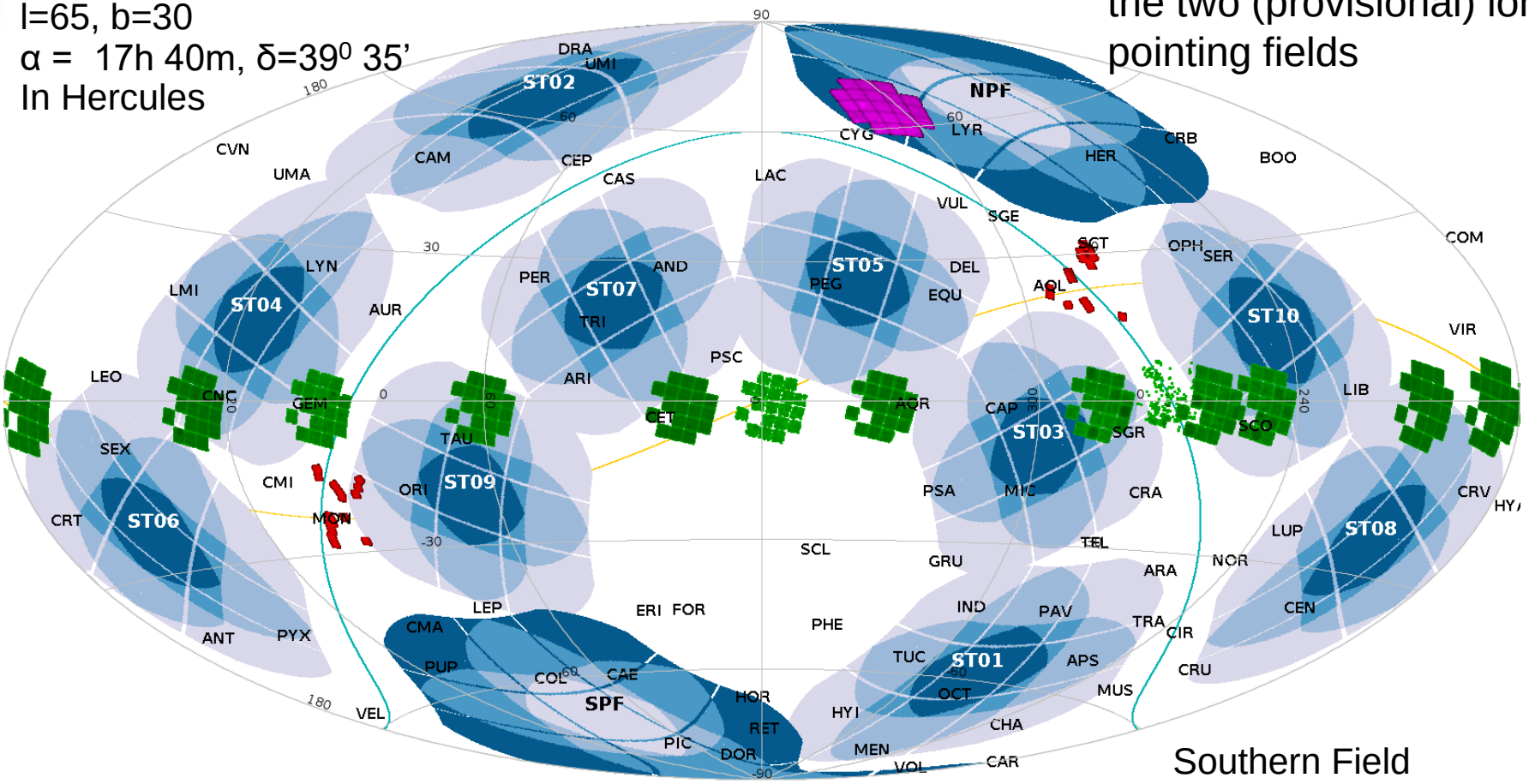
4) Every star on the FOV should be observable at least ~6 h/night above *X*~1.5 from La Palma

See Nascimbeni talk

Preliminary PLATO fields: ecliptic coordinates

Northern field
l=65, b=30
α = 17h 40m, δ=39^0 35’
In Hercules

PIC1.0.0 is delivered for the two (provisional) long pointing fields



PLATO Long pointing fields must have the center at galactic latitude |b|>67

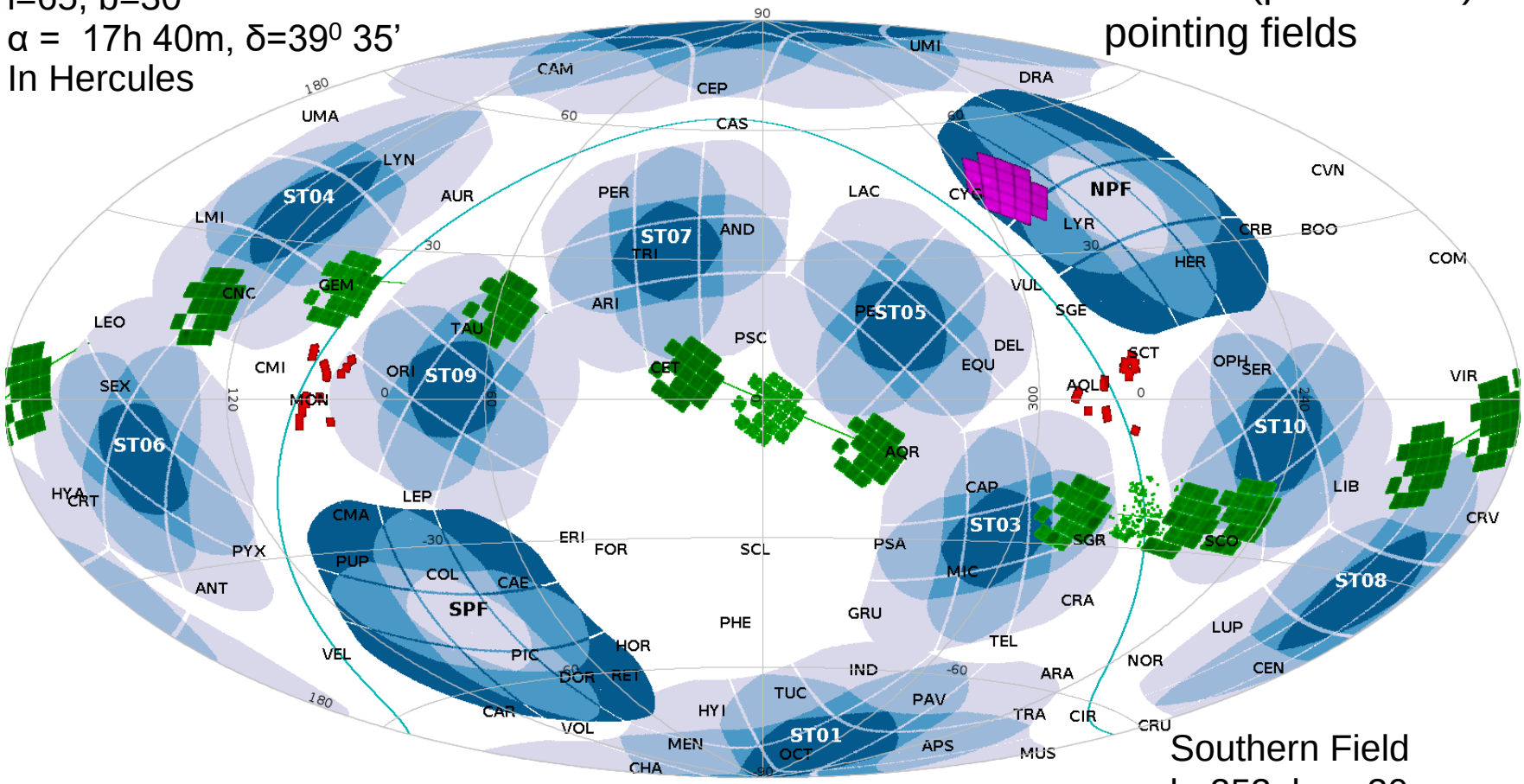
See talk by Nascimbeni and follow «Field Selection» section

Southern Field
l= 253, b = -30,
α = 5h 47m, δ = -46 26
(in Pictor)

Preliminary PLATO fields: equatorial coordinates

Northern field
l=65, b=30
α = 17h 40m, δ=39^0 35’
In Hercules

PIC1.0.0 is delivered for the two (provisional) long pointing fields



PLATO Long pointing fields must have the center at galactic latitude |b|>67

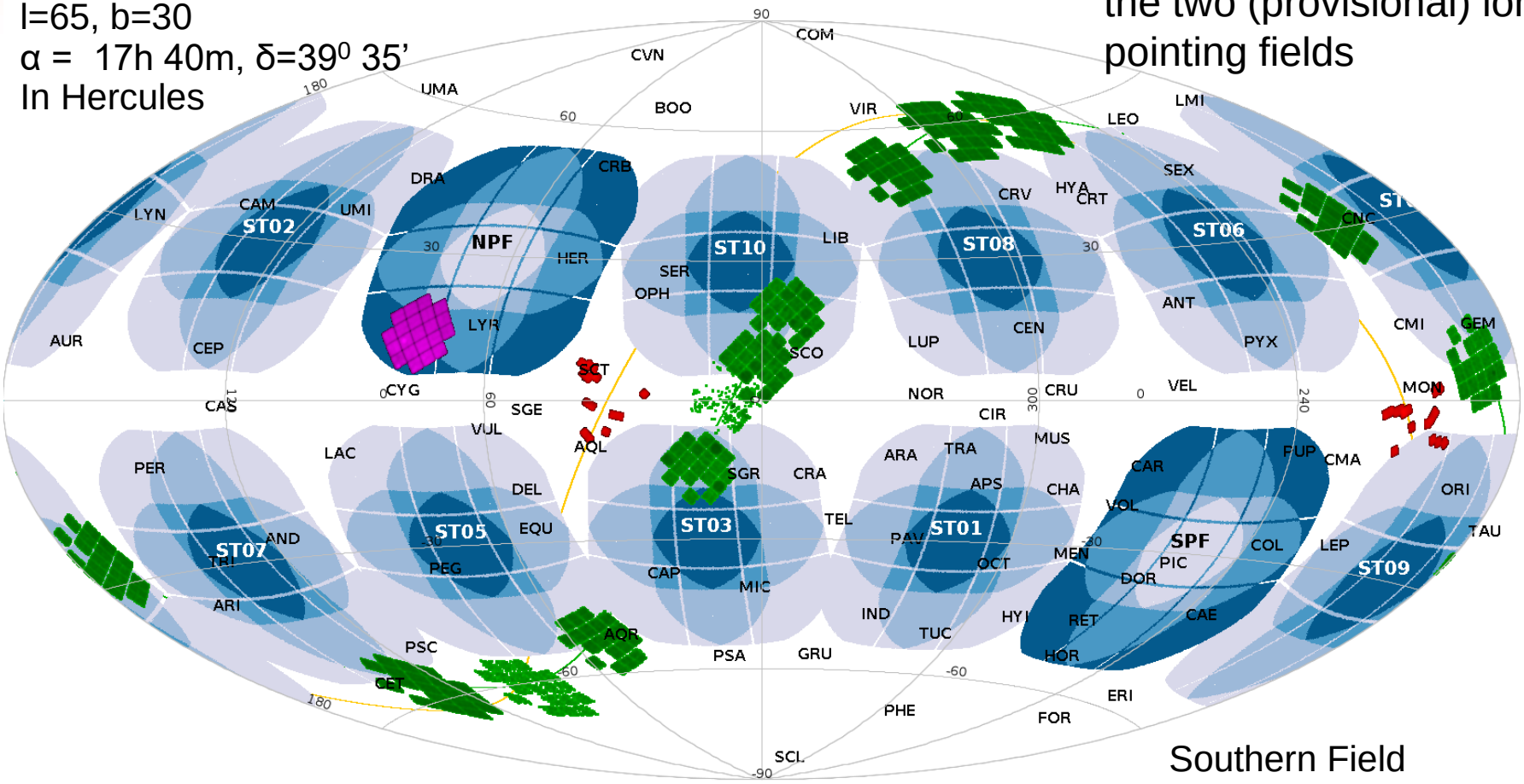
See talk by Nascimbeni and follow «Field Selection» section

Southern Field
l= 253, b = -30,
α = 5h 47m, δ = -46 26
(in Pictor)

Preliminary PLATO fields: Galactic coordinates

Northern field
l=65, b=30
α = 17h 40m, δ=39^0 35’
In Hercules

PIC1.0.0 is delivered for the two (provisional) long pointing fields



PLATO Long pointing fields must have the center at galactic latitude |b|>67

See talk by Nascimbeni and follow «Field Selection» section

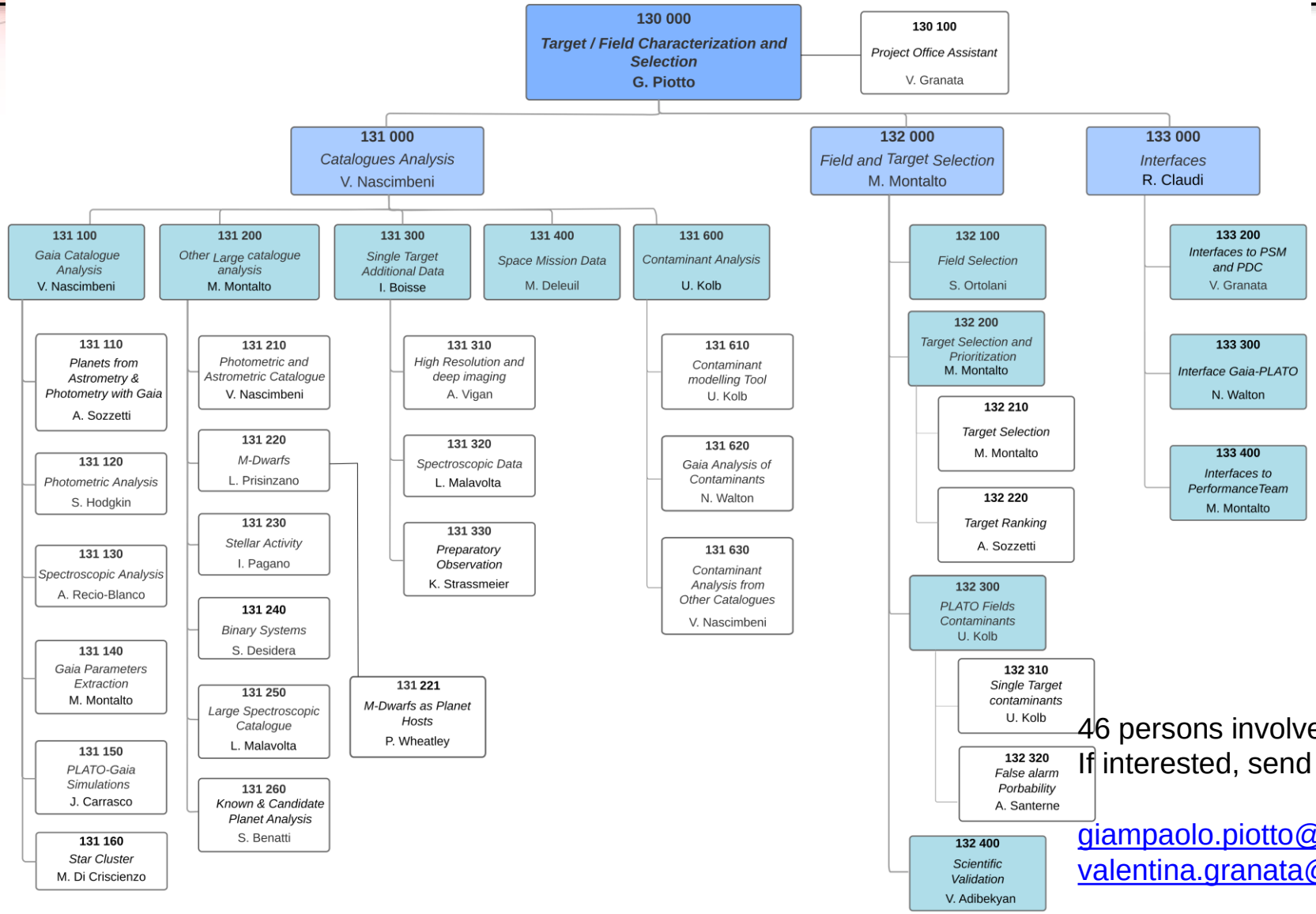
Southern Field
l= 253, b = -30,
α = 5h 47m, δ = -46 26
(in Pictor)

From PIC1.0.0 to PIC1.1.0

- PIC1.1.0 will include P4 (M dwarfs sample)
- It will correct the mismatch between PLATO samples definition (following new science requirements)
- As (B-V) color is not appropriate for the M dwarfs selection, in order to homogenize the sample selection, PIC1.1.0 will be based on (G_{BP}-G_{RP}) color.
- PIC1.1.0 will include an extension of the range of validity of temperature dependent extinction coefficients
- PIC1.1.0 will be based on an improvement of extinction maps.
- **PIC1.1.0 will be delivered at the end of 2019**
- We are preparing a paper for peer review journal presenting the PLATO Input Catalog. At paper acceptance, the PIC (all sky) will be delivered to the community. PIC for the PLATO fields including expected S/N will be reserved to PLATO Consortium members

See Montalto and Prisinzano talks

WBS130
PSM branch of PIC preparation

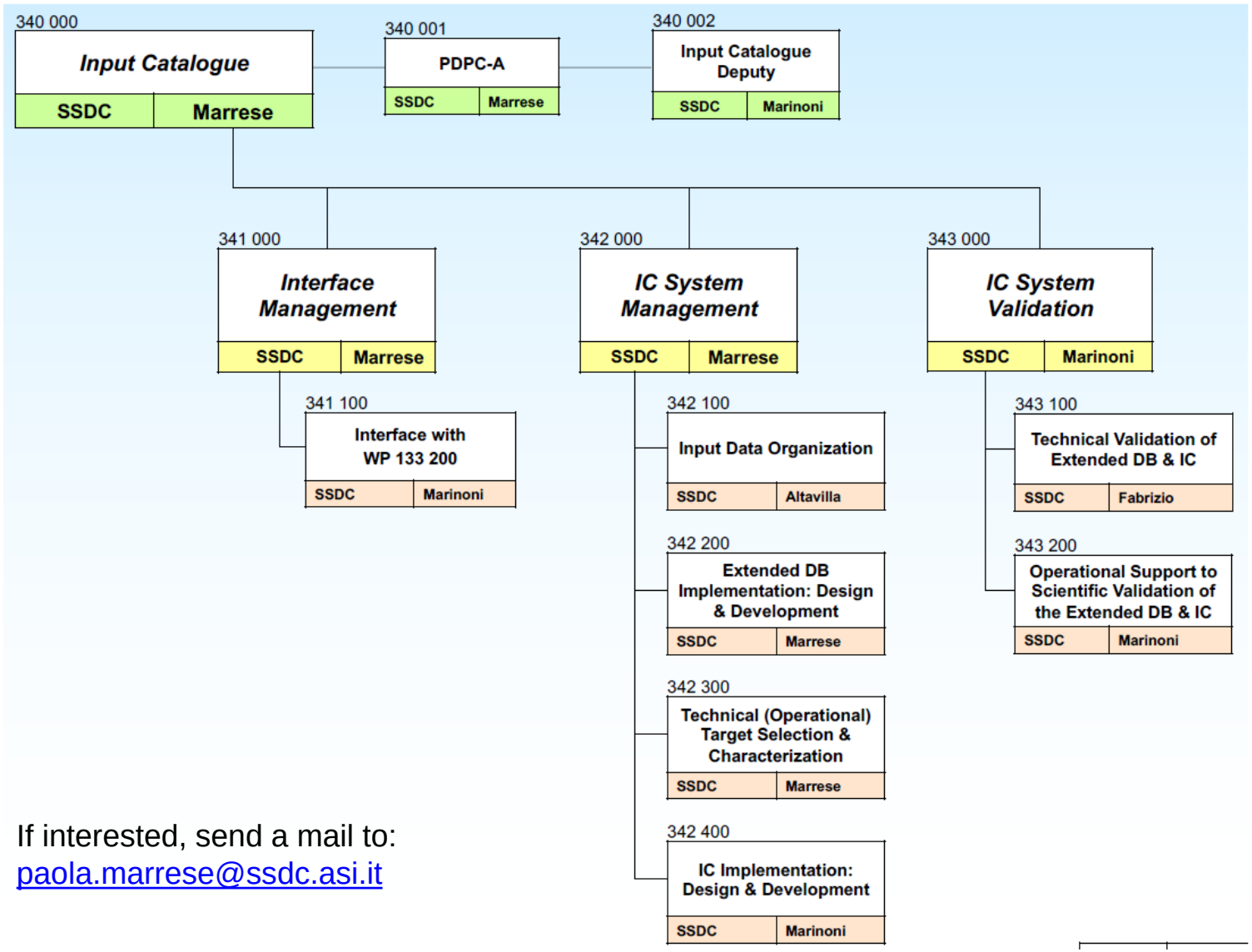


46 persons involved
If interested, send a mail to:

giampaolo.piotto@unipd.it
valentina.granata@unipd.it

https://warwick.ac.uk/fac/sci/physics/research/astro/plato-science/research/researchareas/pic/

WBS340
PDC branch of PIC preparation



If interested, send a mail to:
paola.marrese@ssdc.asi.it

How to get PIC1.0.0

PIC1.0.0 in the two long (preliminary pointing fields) is available to PLATO community for internal use and tests. It is delivered with an explanatory document on the column contents, and a document describing the target selection criteria, and the target parameter estimate.

PIC1.0.0 is for internal (PLATO Consortium) use

In order to have the PIC, you have to be member of the PLATO consortium, and sign the non-disclusure agreement (available from the PLATO Science Management – PSM- office, psmoffice@warwick.ac.uk)

If you are interested in having a copy of PIC1.0.0 , please send a mail to: pdcoffice@mps.mpg.de
(and in cc to: psmoffice@warwick.ac.uk, Heike.Rauer@dlr.de giampaolo.piotto@unipd.it and paola.marrese@ssdc.asi.it)

Contact people

Information on the PIC and on PIC deliveries and delivery policies can be asked to :

giampaolo.piotto@unipd.it
paola.marrese@ssdc.asi.it
valentina.granata@unipd.it
psmoffice@warwick.ac.uk
pdcoffice@mps.mpg.de