Previous experiences on COROT (and Kepler)

M. Deleuil
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CoRoT

FOV ~ 3.5^{o}□ (half after 2009)

26 stellar fields

Observations duration: 21 to 150 days

Observing strategy evolved

Long runs - Core Program

Short runs : stellar physics

11 ≤ r-mag ≤ 16.

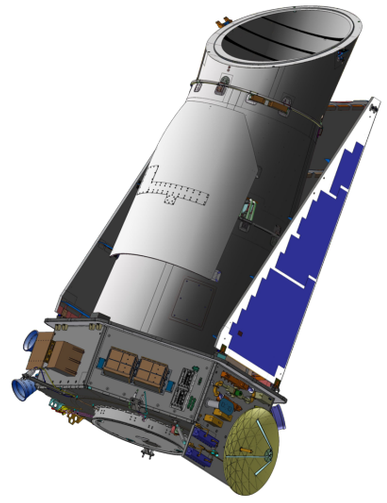
Photometric precision 700 ppm/hr

169 967 light curves

Time sampling : 512 sec or 32 sec

101 083 FGKM V and IV

Kepler



FOV ~ 105^{o}□

Same field observed for 4 years

9 ≤ Kp-mag ≤ 15

Photometric precision 80 ppm/hr

196 468 light curves

Time sampling: 30 min or 1 min

~ 100 000 dwarfs

CoRoT/Exoplanets input catalog

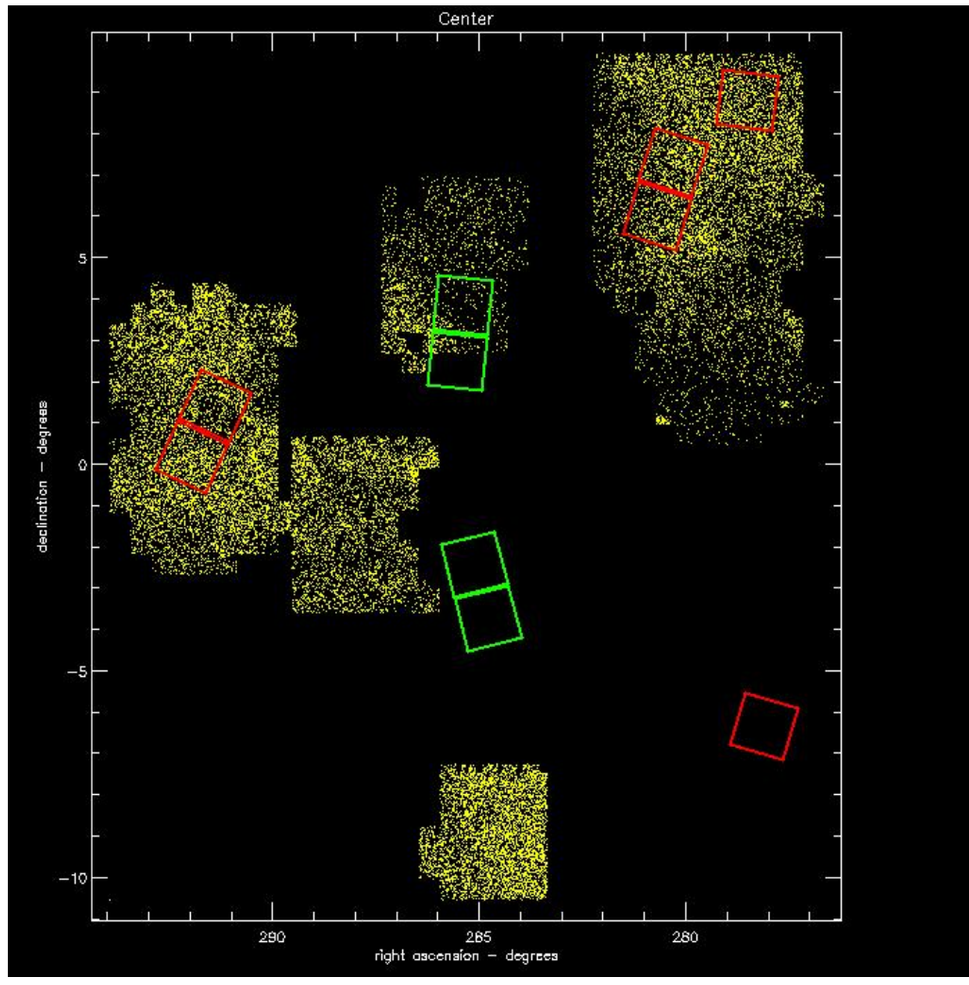
Dedicated preparatory observations -INT/La Palma - WFC (2002 - 2006)

(*U) B, V, r, i* observations

14 million stars - 209 deg^2

Completeness: R ~19 - 10 10^6 stars

Covered regions pre-selected for possible Long Runs



CoRoT/Exoplanets input catalog

Dedicated preparatory observations

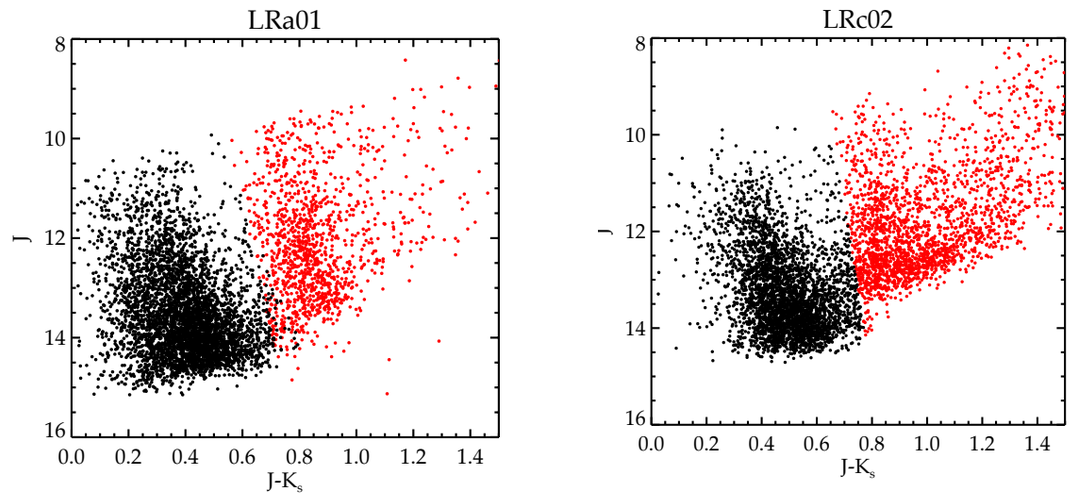
(*U) B, V, r, i* observations

14 million stars - 209 deg^2

Completeness: R ~19 - 10 10^6 stars

+

2MASS JHK, *USNO-A2*, *USNO-B1*, *DENIS*, *TYCHO and UCAC*



N.B. *2MASS* was released after 2000

CoRoT/Exoplanets input catalog

Dedicated preparatory observations

(*U) B, V, r, i* observations

14 million stars - 209 deg^2

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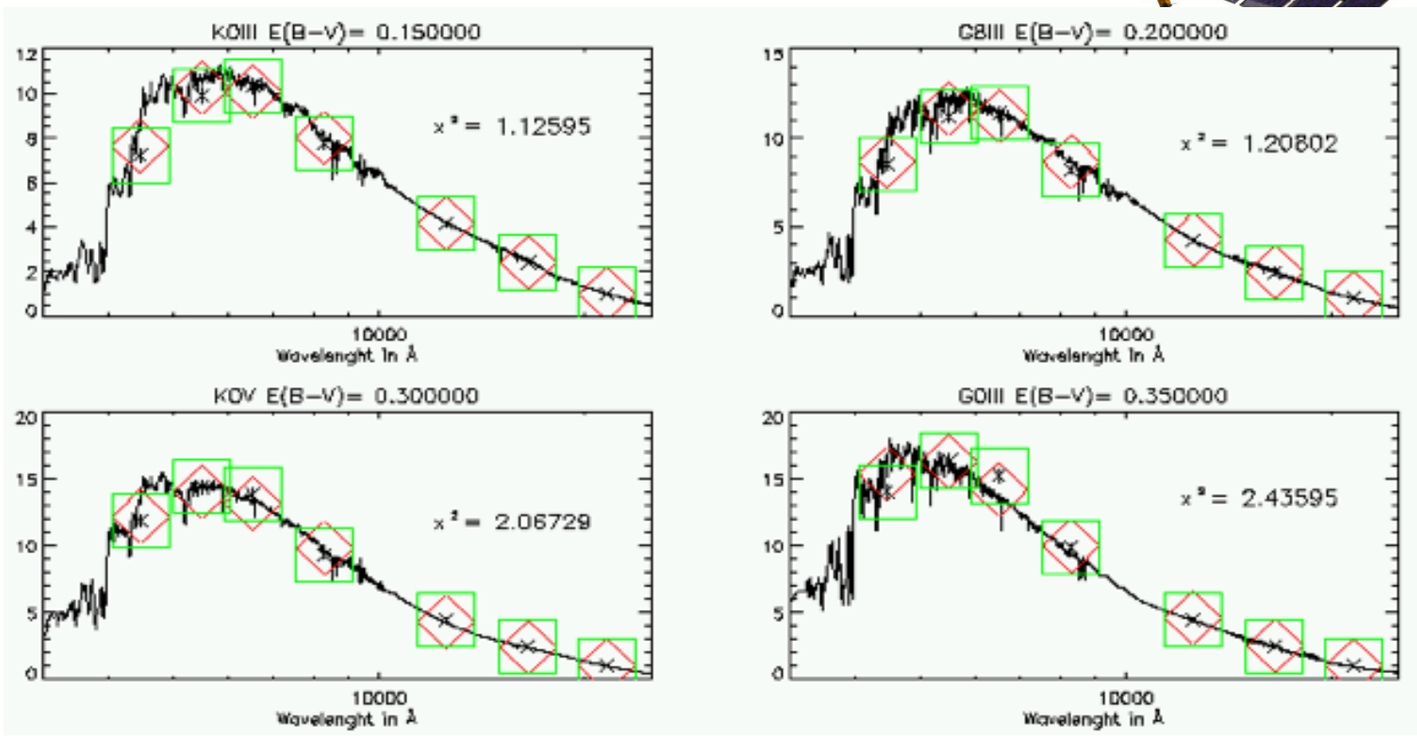


chi2 minimization

SED of 454 stellar single objects

spectral type and luminosity class + E(B-V) of all potential targets (m_r < 16)

+ coordinates & magnitudes

+ magnitudes and positions of fainter stars

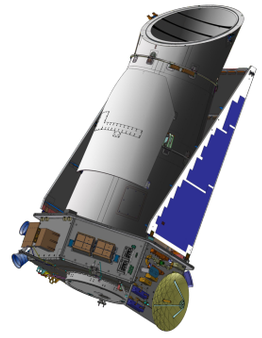
Deleuil et al., 2009 Damiani et al., 2016

CoRoT/Exoplanets input catalog

- Multiplicity of fields ➙ increased of the surface of the sky to be covered
- Exoplanet and stellar physics programs seen as 2 separated programs in the preparatory phase
  - ➙ Targets selection in short runs relied on catalogs only
  - ➙ Strong heterogeinity of the input catalog(s)
  - ➙ Added uncertainties in the input catalog
  - ➙ No information on EB or peculiar star in the fields
- No stellar radii provided - dwarfs /giants crude separation **BUT** the number of available photometric windows was much larger than even the more optimistics dwarves counts
- Spectroscopic observations for a well characterization of the dwarf population prior to the launch impossible :
  - unrealistic before Long Runs were decided
  - once the first Long Runs were fixed, proposals (multi fibers observations) rejected by ESO TACs before the launch (too risky)

➙ CoRoT spectral classification valid in a statistical way only

Kepler input catalog



g, r, i, z broad band photometry

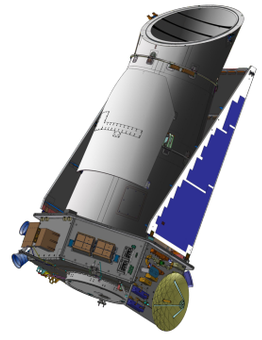
\+ intermediate-band D51 filter (centered on the Mg 1b lines - gravity sensitivity)

+ 2MASS *JHK* *(Brown et al. 2011)*

1.6×10^5 stars in a field covering roughly 150 deg^2

➞ catalog of 450 000 stars (possible targets)

Kepler input catalog



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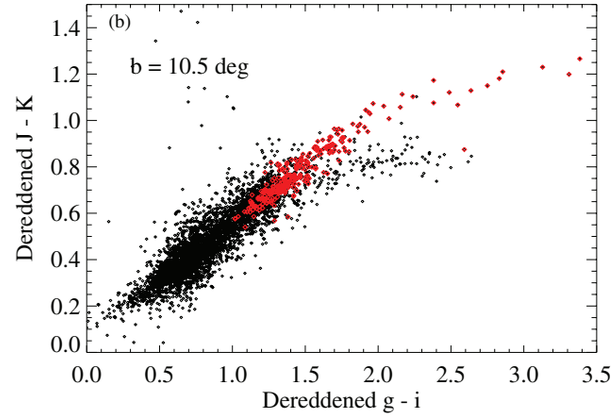


1.6×10^5 stars in a field covering roughly 150 deg^2

➞ catalog of 450 000 stars (possible targets)

synthetic colors from stellar atmosphere models - Teff , log(g), log(Z)

Priors: distributions known for stars in the Sun's neighborhood metallicity, Teff - logg, density of stars as a function of galactic latitude

maximizes the posterior probability

Apparent magnitude *Kp* and physical parameters : $R_\star$, *T*eff, log(g) and [Fe/H]

4500 K ≤T_{eff} ≤ 6500 K, classifications are reliable within about ±200 K and 0.4 dex in log(g)

Spectral classification

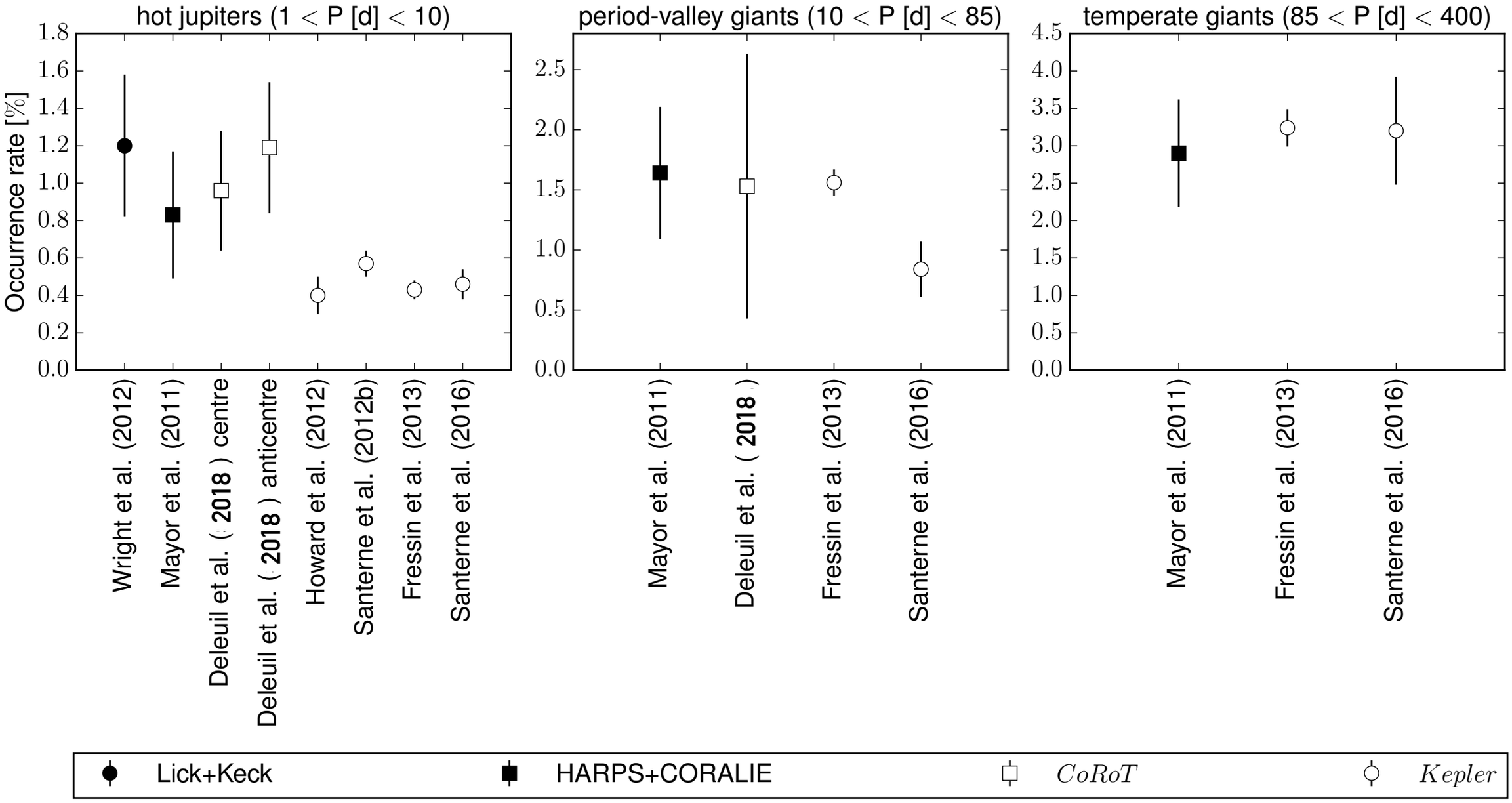
Before the launch:

- critical for a proper targets selection
    - identify GKM-type dwarfs from giants
    - good characterization of the background

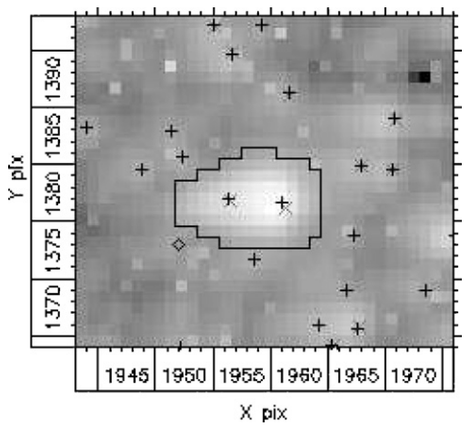
After the launch:

- critical to
    - help identifying false positives and save follow-up observing time
    - get a first accurate estimate of the planet's parameters
    - carry out reliable planet populations **occurences**

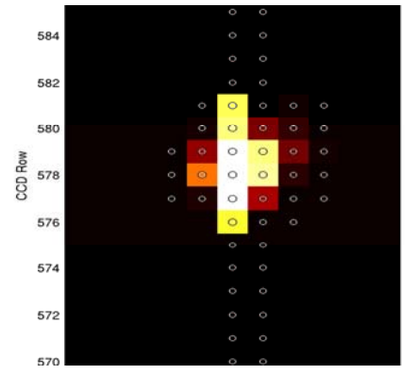
➙ homogeneity and precision required!



Occurences need : completeness estimate of detection, vetting and follow-up processes and a reliable and accurate knowledge of the stellar population that is observed



Contamination



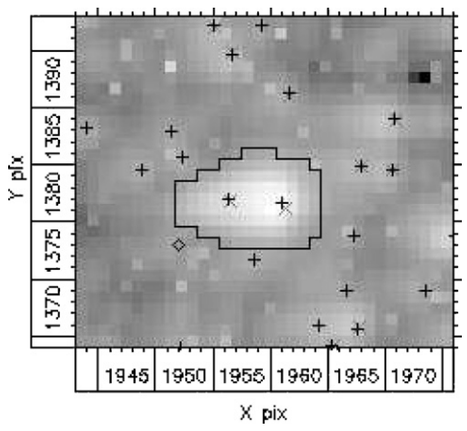
CoRoT: on-board photometry with pre-defined mask

Contamination rate taken into account for the:

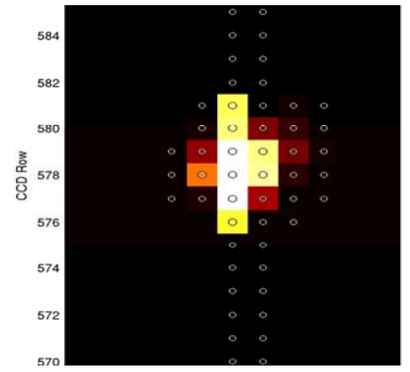
- pre-selection of CoRoT fields (very crude)
- **Targets selection** - based on generic masks

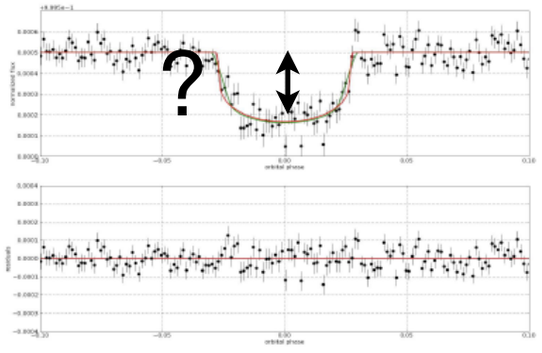
➙ key element of the Input catalog (#contaminants + contamination rate)

Kepler: stamps downloaded



Contamination

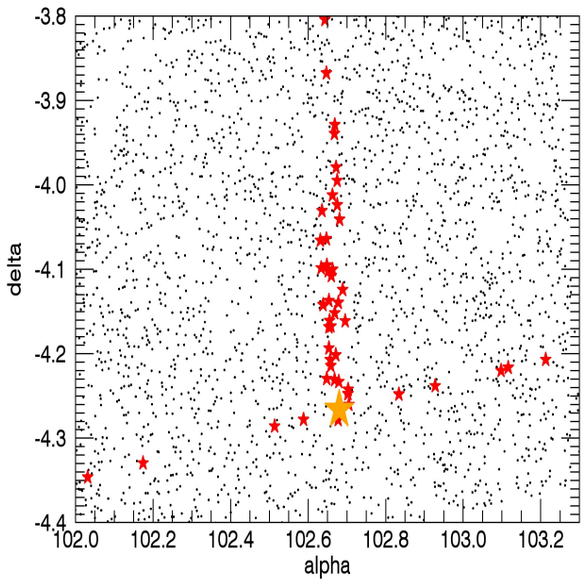


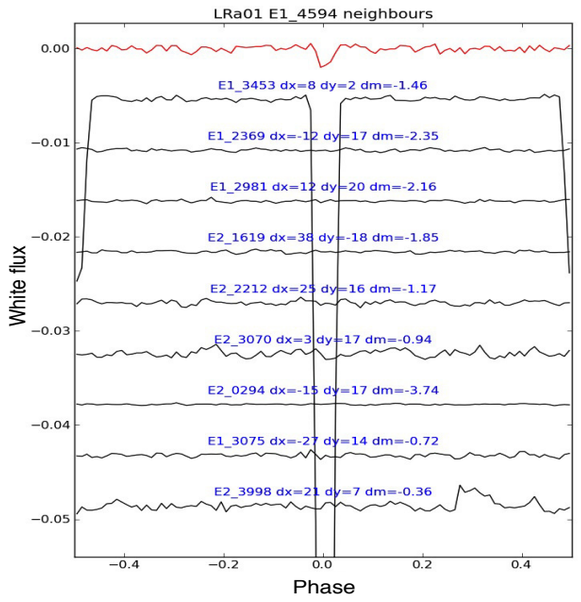


Key element of the data analysis:

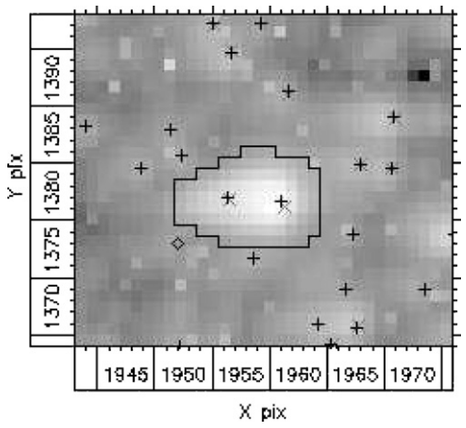
- transit depth measurement
- false positives due to:
  - BEB,
  - ghosts generated by smear effect, saturation …

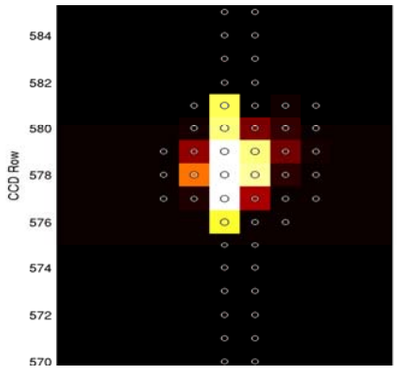
➟ require a good knowledge of the target's environement (faint and bright) and of the CCD

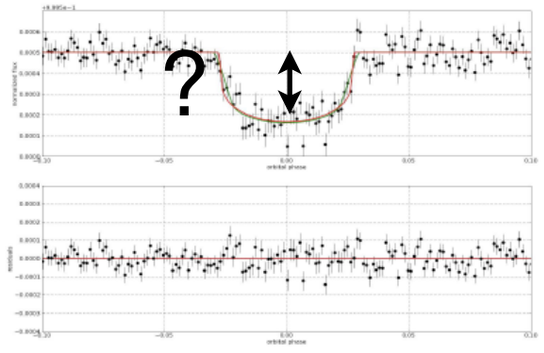




Contamination







Key element of the data analysis:

- transit depth measurement
- false positives due to:
  - BEB,
  - ghosts generated by smear effect, saturation …

➙ require a good knowledge of the target's environement (faint and bright) and of the CCD

Once in operation, new estimate done taking into account:

- the actual photometric mask used for the observation
- the in-flight measured PSFs

➙ require a proper calibration - instrument corrected image

➙ has to be estimated for every quarter

Support to data analysis

Data analysis done by the pipelines and the community will require (or welcome)

➙ any complementary information available on :

- the target's properties: its classification(s), EB, variability, activity …
- its neighboors' properties
- follow-up observations status and results

➙ summary on the "observing conditions" : how/when the target has been observed, contamination, photometric mask …

➙ summary on the data analysis and outcomes

- photometric precision
- is a planet detected?
- what are default parameters (e.g. to estimate the transit depth)

…

CoRoT - ExoDat

Datasets

- (•) CoRoT Targets
- ( ) Stars in the CoRoT eyes
- ( ) ObsCat

Criteria

Instrumental settings | Photometry | Stellar properties | Astrometry

RUN ID: LRc02 ×

CCD ID:

WIN ID: Fill Coma Separated Values

Chromatic mode: Select Some Options

▾ Output columns

Select or unselect the following fields to add or remove output columns.
If you export your search result in a CSV file, those are the columns that will be printed out.

Parameters by default | Others catalog ID | ObsCat photometry

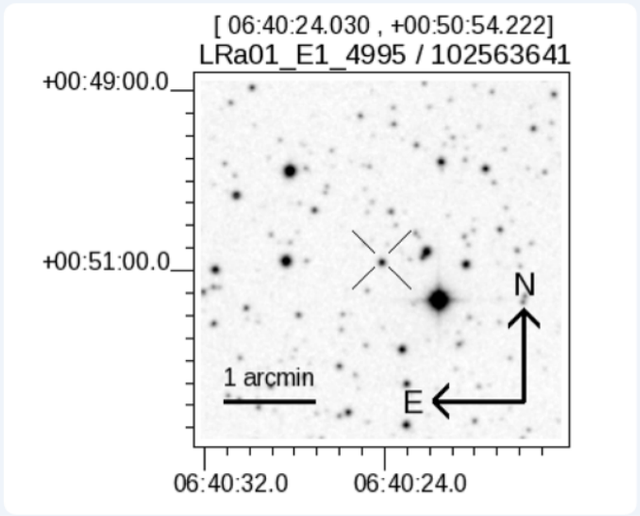
default	Instrumental settings	Photometry	Stellar properties
CoRoT ID	RUN ID	B band magnitude	Spectral type
RA (°)	CCD ID	B band magnitude error	Luminosity class
DEC (°)	WIN ID	B band magnitude origin	e(B-V)
	Chromatic mode	V band magnitude	Quality index
	CoRoT templates version	R band magnitude	Color temperature
	CoRoT template ID	R band magnitude error	Color temperature error
	X	R band magnitude origin	Contamination L0
	Y	I band magnitude	Number of contaminants
		J band magnitude	Contamination L1
		J band magnitude error	Contamination L1 error

➙ limitations: manpower!

COROT-ID : 102563641

information on the target

About the star



Cone-search : 40 arcsec around this star

Coordinates	
RA [deg] DEC [deg]	100.100127 0.848395

Magnitudes		
B	16.385±0.106	*MEAN*
V		
R	15.695±0.375	*MEAN*
I	15.27	*PPMXL*
J	14.248±0.03	*2MASS*
H	13.87±0.035	*2MASS*
K	13.683±0.046	*2MASS*

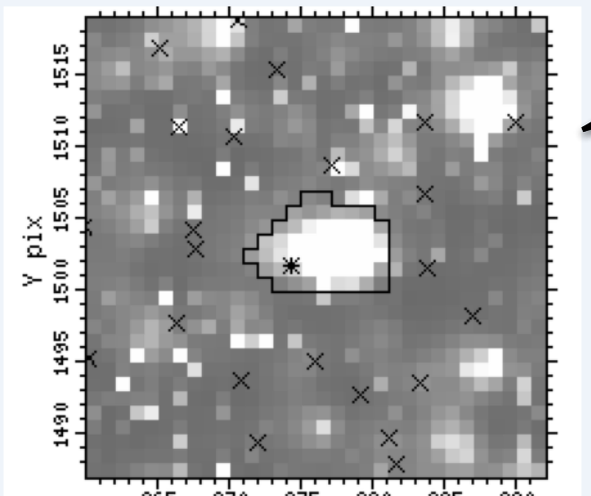
Spectral classification	
Spectral type (SED)	A7
Luminosity class (SED)	V
E(B-V) (SED)	0.7

Contamination L0	
Contamination rate	0
Numbers of contaminants	43

Catalogs references	
PPMXL	3175441872502908095
USNO-B1	0908-0099919
TWOMASS	06402402+0050542
OBS_CAT	102563641
USNO-A2	0900-03273146
CMC14	064024.0+005054
TYCHO2	
CFHT_CAT	

Observation(s)

information on how it was observed: observing mode, runs ..



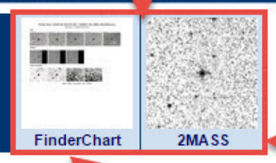
Run ID	LRc02
Ccd ID	E2
Win ID	1208
chromatic mode	COLOR
Template version	851004
Template ID	122

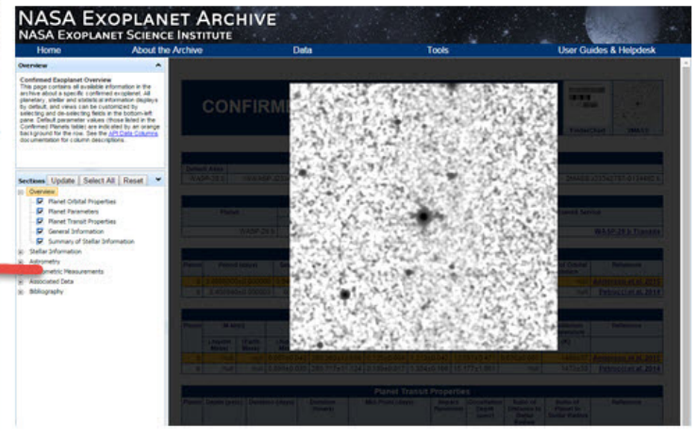
Contamination L1	
Contamination rate	0.0465
Contamination error	0.00864

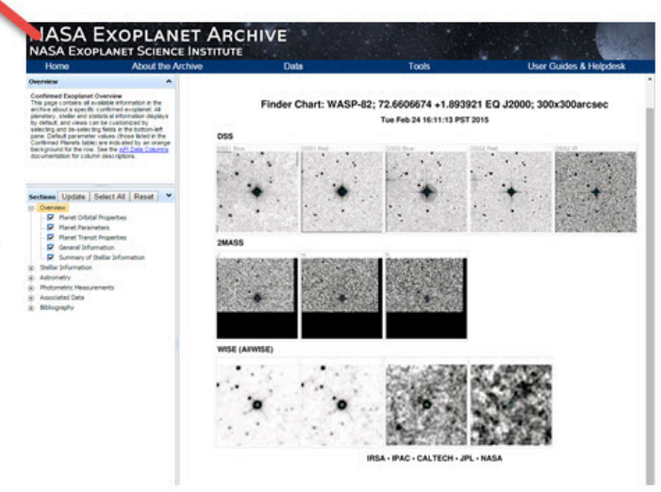
Download light curves (IAS)	
CoRoT N1 (account required)	VO FITS
	VO

NASA Exoplanet Archive

Thumbnails of IRSA FinderChart and 2MASS image (if available)







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NASA EXOPLANET SCIENCE INSTITUTE

Home | About the Archive | Data | Tools | User Guides & Helpdesk

Overview

Confirmed Exoplanet Overview
This page contains all available information in the archive about a specific confirmed exoplanet. All planetary, stellar and statistical information displays by default, and views can be customized by selecting and de-selecting fields in the bottom-left pane. Default parameter values (those listed in the Confirmed Planets table) are indicated by an orange background for the row. See the API Data Columns documentation for column descriptions.

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ctions

Update | Select All | Reset

- Overview
  - Planet Orbital Properties
  - Planet Parameters
  - Planet Transit Properties
  - General Information
  - Summary of Stellar Information
- Stellar Information
- Astrometry
- Photometric Measurements
- Associated Data
- Bibliography

Gold highlighting indicates default parameters

Version 2.2

CONFIRMED PLANET OVERVIEW PAGE

Links to other archive overview pages for the object

Object and Aliases

Default Alias	Aliases				
WASP-28 b	1SWASP J233427.87-013448.1 b	K2-1 b	WISE J233427.89-013447.9 b	EPIC 6	2787-01 4482 b

NASA Exoplanet Archive Links

Planet	Related Overviews				
	Confirmed		Kepler Pipeline		
WASP-28 b	Planet	Host			P-28 b Transits

Planet Orbital Properties

Planet	Period (days)	Semi-Major Axis (AU)	Inclination (deg)	Eccentricity	Time of Periastron Passage (days)	Longitude of Periastron (deg)	Date of Orbital Solution	Reference
b	3.4088300±0.000006	0.04469±0.00076	88.61±0.67	0	null	null	null	Anderson et al. 2015
b	3.408840±0.000003	0.0445±0.0004	87.98±1.43	null	null	null	null	Petrucci et al. 2014

Planet Parameters

Planet	M sin(i)		Mass		Radius			Density	Equilibrium Temperature	Reference
	(Jupiter Mass)	(Earth Mass)	(Jupiter Mass)	(Earth Mass)	(Solar Radii)	(Jupiter Radii)	(Earth Radii)	(g/cm^3)	(K)	
b	null	null	0.907±0.043	288.260±13.666	0.125±0.004	1.213±0.042	13.597±0.471	0.676±0.063	1468±37	Anderson et al. 2015
b	null	null	0.899±0.035	285.717±11.124	0.139±0.017	1.354±0.166	15.177±1.861	null	1473±30	Petrucci et al. 2014

Planet Transit Properties

Planet	Depth (perc)	Duration (days)	Duration (hours)	Mid-Point (days)	Impact Parameter	Occultation Depth (perc)	Ratio of Distance to Stellar Radius	Ratio of Planet to Stellar Radius	Reference
b	1.300±0.027	0.1349±0.0010	3.2376±0.0240	2455290.40519±0.00031	0.21±0.10	null	8.79±0.19	null	Anderson et al. 2015
b	null	null	null	2455290.40551±0.00102	null	null	null	0.129±0.014	Petrucci et al. 2014

General Information

Planet	Discovery			System Information			Kepler Flag	TTV Flag	Exoplanet Encyclopedia Link	Exoplanets Data Explorer Link
	Method	Year	Reference	Number of Stars	Number of Planets	Circumbinary Flag				
b	Transit	2014	Petrucci et al. 2014	1	1	0	0	0	http://exoplanet.eu/catalog/wasp-28_b/	Unavailable

Summary of Stellar Information

Right Ascension	23h34m27.88s	Declination	-01d34m48.2s
Galactic Longitude (deg)	83.86007	Galactic Latitude (deg)	1.08370
Parallax (mas)	null	Distance (pc)	410±70
RA Proper Motion (mas/yr)	null	Dec Proper Motion (mas/yr)	null
Total Proper Motion (mas/yr)	null	Radial Velocity (km/s)	24.21641±0.00043
B-band (mag)	12.50	K-band (mag)	10.732±0.024
Spectral Type	F8	Effective Temperature (K)	6150±140
Surface Gravity ($\log_{10}$(cm/s^2))	4.370±0.018	Luminosity ($\log_{10}(L_{sun})$)	null

NASA Exoplanet Archive Links

Planet	Related Overviews				Transit Service
	Confirmed		Kepler Pipeline		
KOI-753.01			KOI	Host	KOI-753.01 Transits

KOI Stellar Properties

KepID	KOI	Effective Temperature (K)	Surface Gravity ($log_{10}(cm/s^2)$)	Metallicity (dex)	Radius (R_{sun})	Mass (M_{sun})	Age (Gyr)	Provenance	Delivery
10811496	K00753.01	5648	4.57	null	.83	null	null	KIC	q1_q6_kepler_candidates
10811496	K00753.01	5853.00±102.00	4.540±0.300	null	0.8800±0.2400	0.9920±0.0460	0.4±3.1	Pinsonneault	q1_q8_koi
10811496	K00753.01	5853.00 +165.00-171.00	4.544 +0.028-0.265	-0.180±0.260	0.8680 +0.3180-0.0650	0.9610 +0.0970-0.1080	null	stellar_q1_q16	q1_q12_koi
10811496	K00753.01	5853 +158-176	4.544 +0.044-0.176	-0.18±0.3	0.868 +0.233-0.078	0.961 +0.11-0.121	null	q1_q17_dr25_stellar	cumulative
10811496	K00753.01	5853 +165-171	4.544 +0.028-0.265	-0.180±0.260	0.868 +0.318-0.065	0.961 +0.097-0.108	null	stellar_q1_q16	q1_q16_koi
10811496	K00753.01	5853 +165-171	4.544 +0.028-0.265	-0.180±0.260	0.868 +0.318-0.065	0.961 +0.097-0.108	null	stellar_q1_q16	q1_q17_dr24_koi
10811496	K00753.01	5853 +158-176	4.544 +0.044-0.176	-0.18±0.3	0.868 +0.233-0.078	0.961 +0.11-0.121	null	q1_q17_dr25_stellar	q1_q17_dr25_koi
10811496	K00753.01	null	null	null	null	null	null	null	q1_q17_dr25_sup_koi

Kepler Candidate Transit Results

KOI	Disposition	Period (days)	Semi-Major Axis (AU)	Inclination (deg)	Eccentricity	Longitude of Periastron (deg)	Epoch (BKJD)	Depth (ppm)	Duration (hours)	Impact Parameter	Ratio of Distance to Stellar Radius	Ratio of Planet to Stellar Radius	Planet Radius (Earth Radii)	Deliver
K00753.01	CANDIDATE	19.899148±2.1e-05	.14	null	0	null	175.84996±0.00031	9912	1.5428	0.71±0.43	82±22	0.0935±0.0045	8.43	q1_q6_kepler_c
K00753.01	CANDIDATE	19.899147±2.1e-05	.143	89.38	0	null	175.84996±0.00031	9041	1.5428	0.71±0.19	82±22	0.0935±0.0045	9±2.5	c
K00753.01	NOT DISPOSITIONED	19.899139805±5.92e-06	.1419	80.79	0	null	175.850425±0.00023	11662.1±79.8	1.7896±0.0139	37.4296 $^{+14.27}_{-4.785}$	232.8±76.6	36.527225 $^{+14.27341}_{-4.717459}$	3462.25 $^{+1268}_{-259.3}$	q1
K00753.01	CANDIDATE	19.89913995±1.494e-05	.1419	88.96	0	null	175.850252±0.000581	10829±171	1.7822±0.0341	0.969 $^{+5.126}_{-0.077}$	53.5±25.7	0.154046 $^{+5.034292}_{-0.042179}$	14.6 $^{+3.92}_{-1.31}$	c
K00753.01	NOT DISPOSITIONED	19.899139805±5.92e-06	.1419	80.79	0	null	175.850425±0.00023	11662.1±79.8	1.7896±0.0139	37.4296 $^{+14.27}_{-4.785}$	232.8±76.6	36.527225 $^{+14.27341}_{-4.717459}$	3462.25 $^{+1268}_{-259.3}$	q1
K00753.01	CANDIDATE	19.899139805±5.92e-06	.1419	80.79	0	null	175.850425±0.00023	11662.1±79.8	1.7896±0.0139	37.4296 $^{+14.27}_{-4.785}$	232.8±76.6	36.527225 $^{+14.27341}_{-4.717459}$	3462.25 $^{+1268}_{-259.3}$	q1_q17
K00753.01	FALSE POSITIVE	19.89913995±1.494e-05	.1419	88.96	0	null	175.850252±0.000581	10829±171	1.7822±0.0341	0.969 $^{+5.126}_{-0.077}$	53.5±25.7	0.154046 $^{+5.034292}_{-0.042179}$	14.6 $^{+3.92}_{-1.31}$	q1_q17
K00753.01	CANDIDATE	19.89913995±1.494e-05	null	null	null	null	175.850252±0.000581	null	null	null	null	null	null	q1_q17_dr2

TCE Results

Planet Number	Period (days)	Semi-Major Axis (AU)	Inclination (deg)	Eccentricity	Longitude of Periastron (deg)	Epoch (BKJD)	Depth (ppm)	Duration (hours)	Impact Parameter	Ratio of Distance to Stellar Radius	Ratio of Planet to Stellar Radius	Planet Radius (Earth Radii)	Deliver
1	19.8991±1.0443e-05	0.1433±5.013e-08	89.05±0.09876	0±0	0±0	136.052±0.000296923	1.131e+04±123.9	1.784±0.03766	0.9228±0.04291	55.672247±3.2206159	0.13074631±0.020715658	12.61±1.998	q1_q
1	19.8991±5.28256e-06	0.1419±2.511e-08	89.05±0.07922	0±0	0±0	136.052±0.000215581	1.145e+04±92.84	1.788±0.0285	0.9242±0.03522	55.64047±2.5253656	0.13242772±0.01730374	12.54±1.639	q1_q
1	19.8991±4.87766e-06	0.1419±2.319e-08	89.04±0.06945	0±0	0±0	136.052±0.000203517	1.087e+04±77.74	1.782±0.02601	0.9265±0.0297	55.113992±2.2206447	0.12948942±0.014594346	12.27±1.382	q1_q17_dr

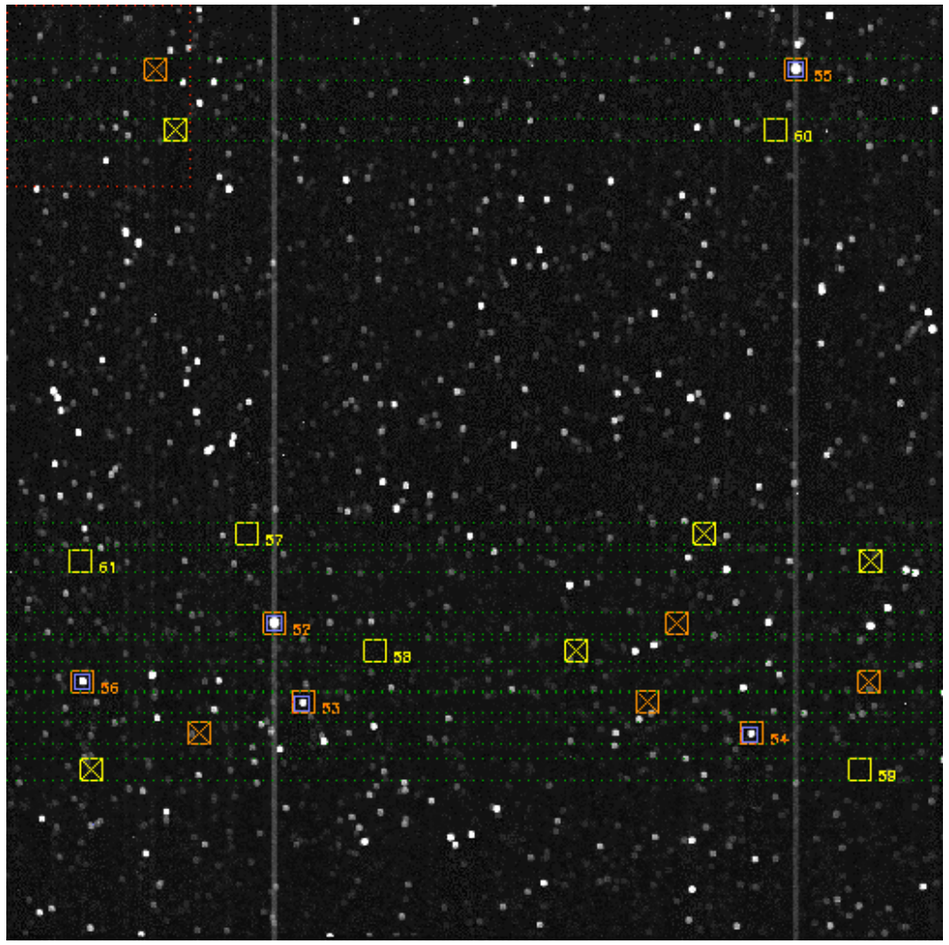
We learnt ..

The Input Catalog:

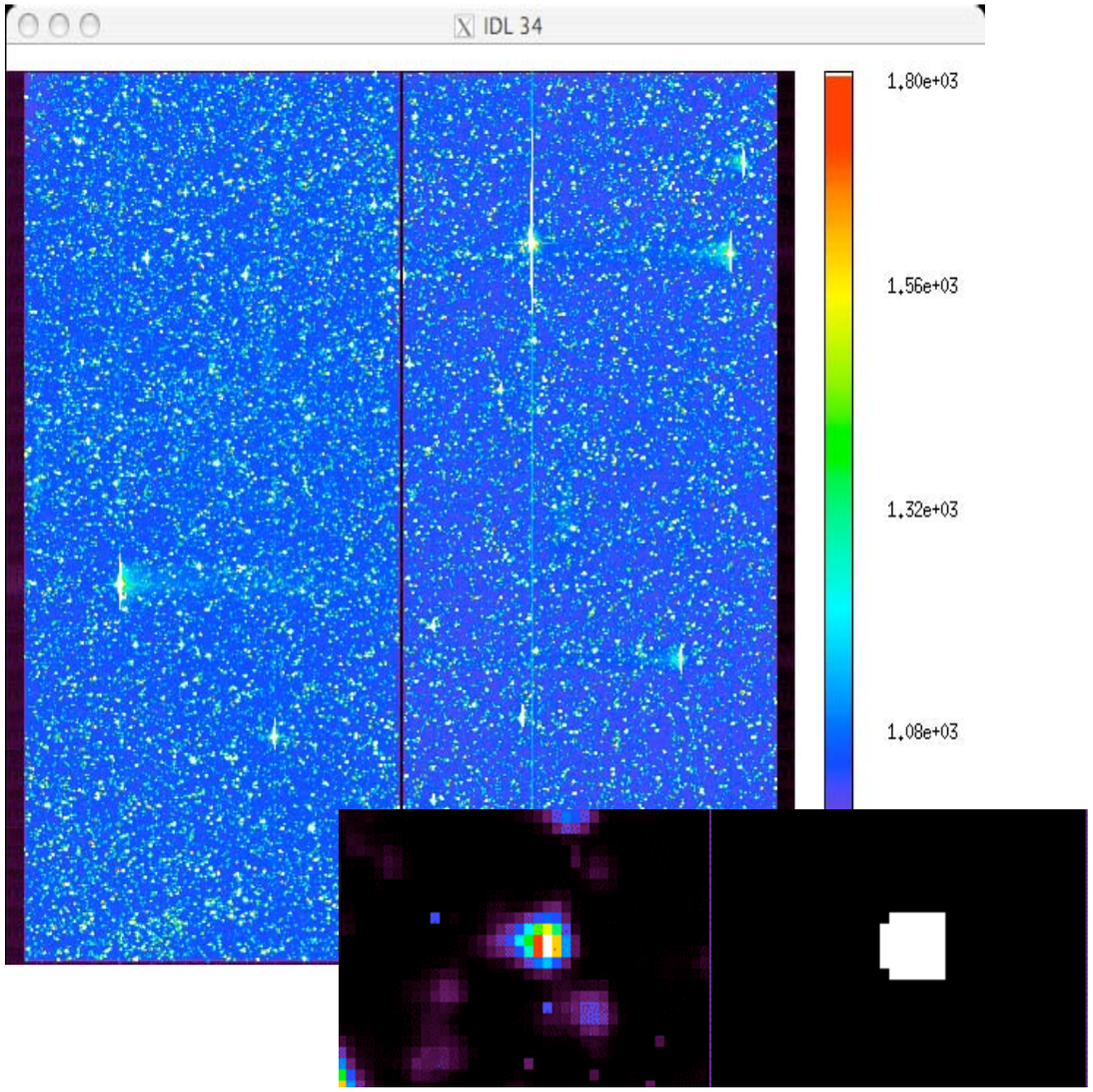
- should provide the information which is required for the targets sele magnitude, spectral types …
- should be reliable - especially in terms physical parameters. Accuracy is mandatory! Not only for planets characterization but also for statistical analyses
- A realistic estimate of the contamination is required for the targets selection. But it will have to be updated (and then accurate and precise) with the real data for correct transit depth measurements
- Dedicated ground-based observations cost a lof of efforts - should be worthy/required
- Faint stars are painful targets: false positives, poor/impossible characterization
- Selection criteria will have to be carefully prepared

➙ Complementary information from existing catalogs will help the data analysis - importance of a project DataBase to gather all available information

PLATO = mix of CoRoT and Kepler



- 10 bright stars
- 10 background windows



- 11600 faint stars
- 400 background windows

Astero & exoplanets shared the same focal plane but not the same CCDs

➙ Different magnitude ranges, different targets, different requirements, different needs ..

➙ In 2000 2MASS was released