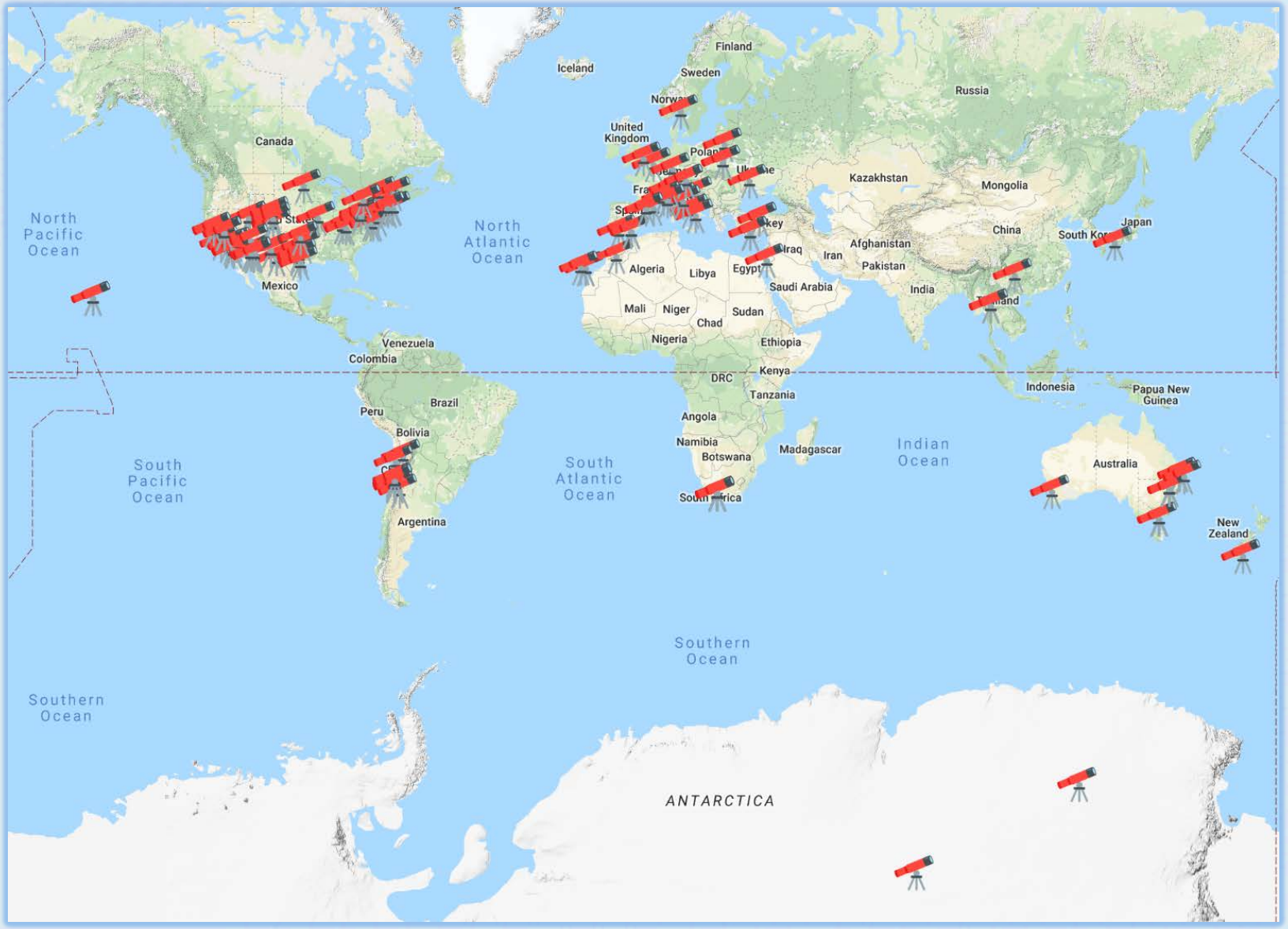
TFOP SG1
Ground-based Time-series Photometry: Goals, Status, Results and Your TESS Paper

Karen Collins
CfA/SAO
karen.collins@cfa.harvard.edu

TFOP SG1 Team

- SG1 Team is ~200 members strong
  - *Professional astronomers*
  - *Student astronomers*
  - *Citizen astronomers*
  - *Ground-based transit surveys*

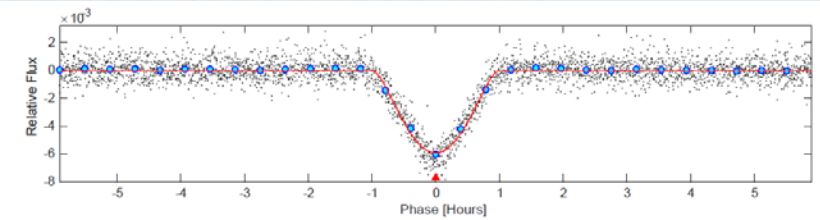


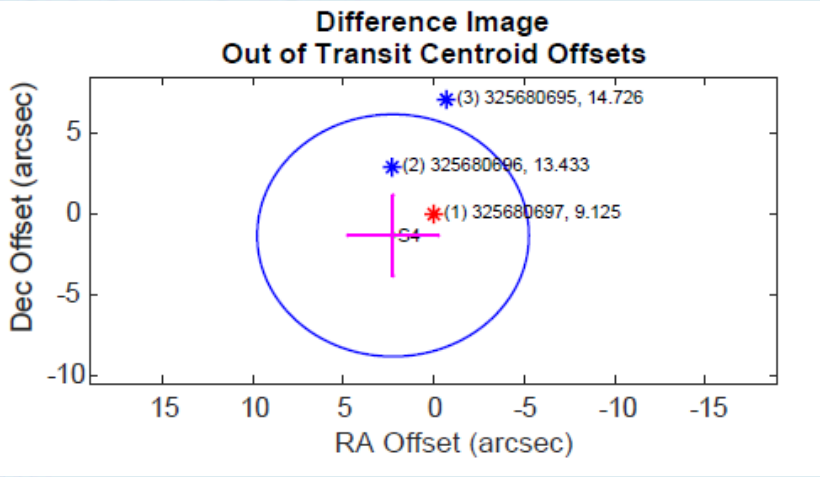
TFOP SG1 Goals

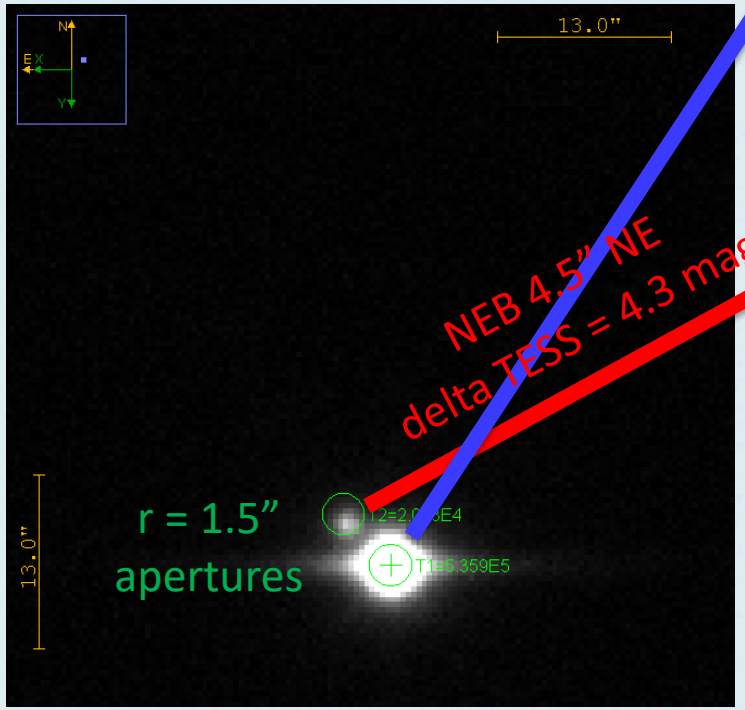
- Goals:
  - *Identify photometric false positives*
  - *Confirm events on-target*
  - *Refine ephemerides*
  - *Measure TTVs*
  - *Measure transit depths to confirm TESS deblending factor*
  - *Verify transit depth achromaticity*

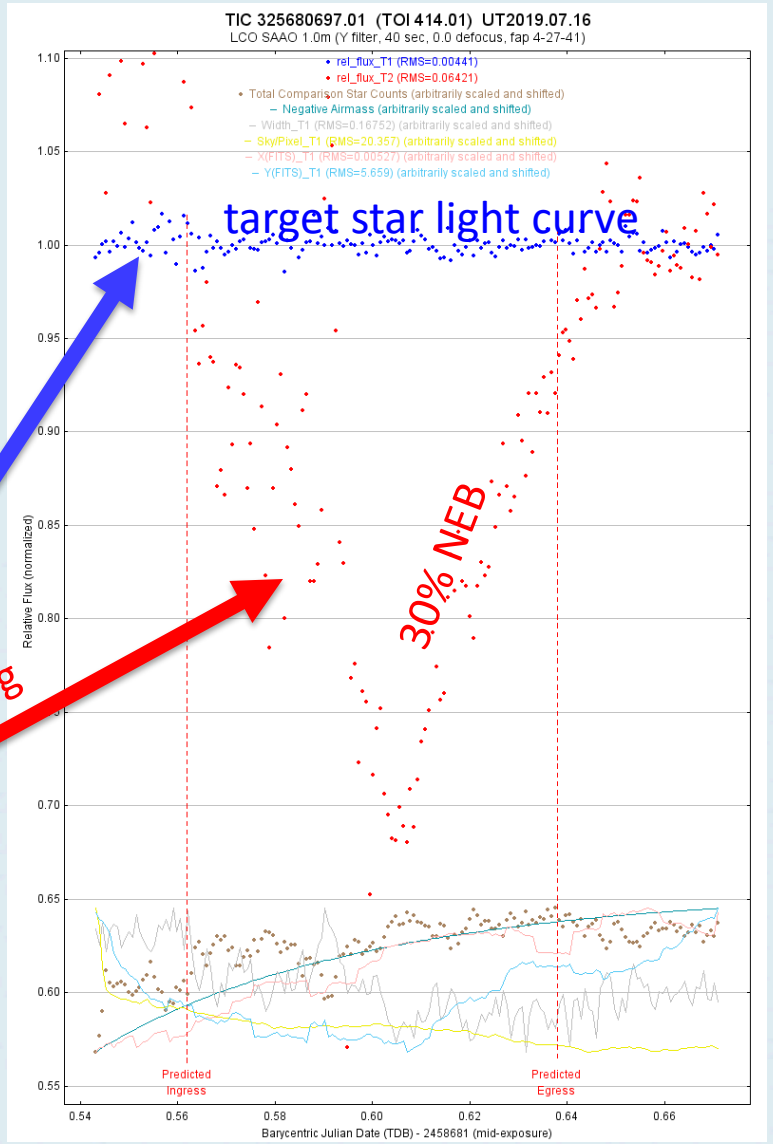
NEB Search

- Search stars within 2.5 arcmin of target for nearby EBs (NEBs)
- If found 1st time => SG1 disposition **PNEB**
- If found 2nd time => SG1 disposition **NEB**





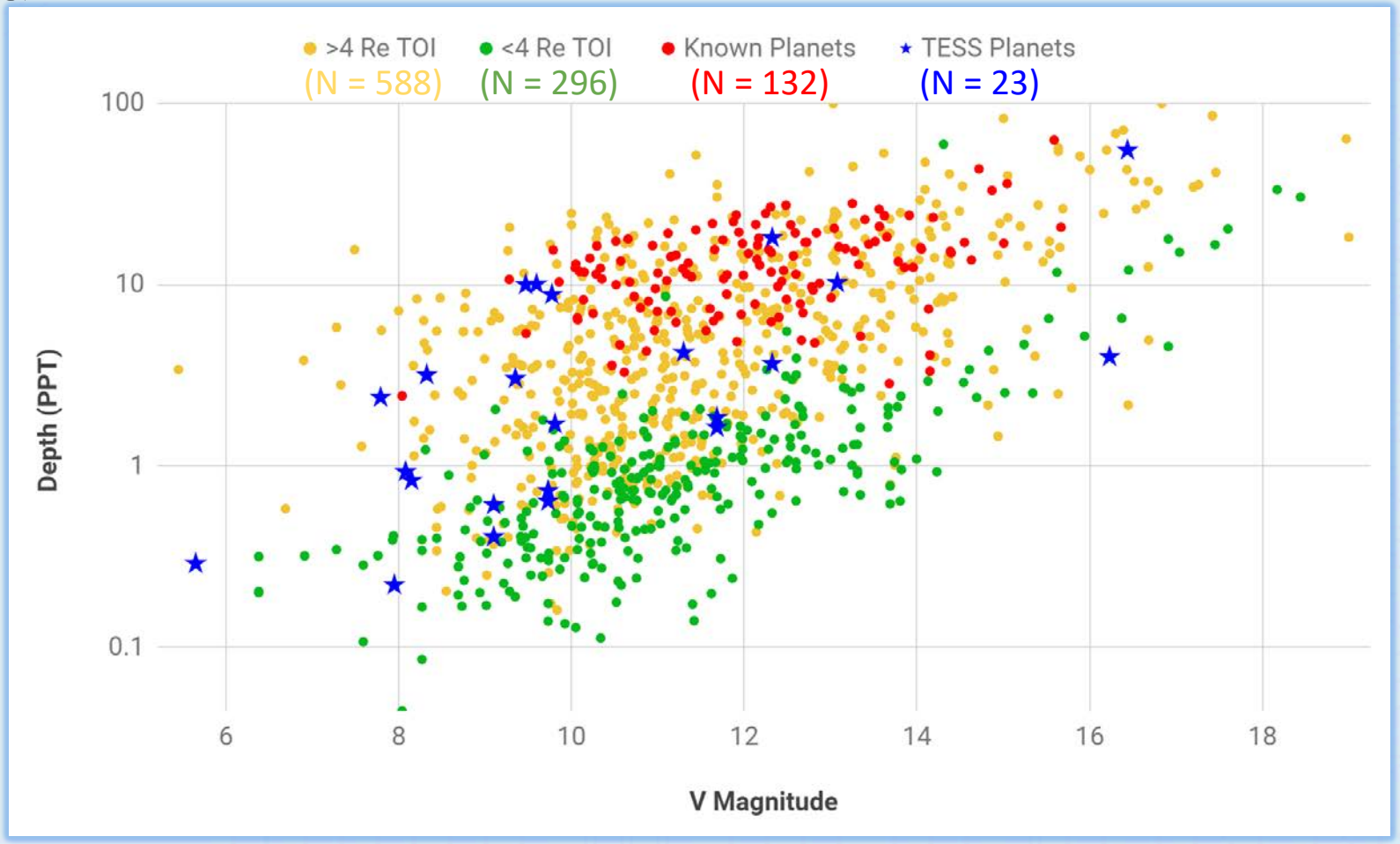




SG1 Dispositioning Process

SG1 Goals are dependent on transit depth

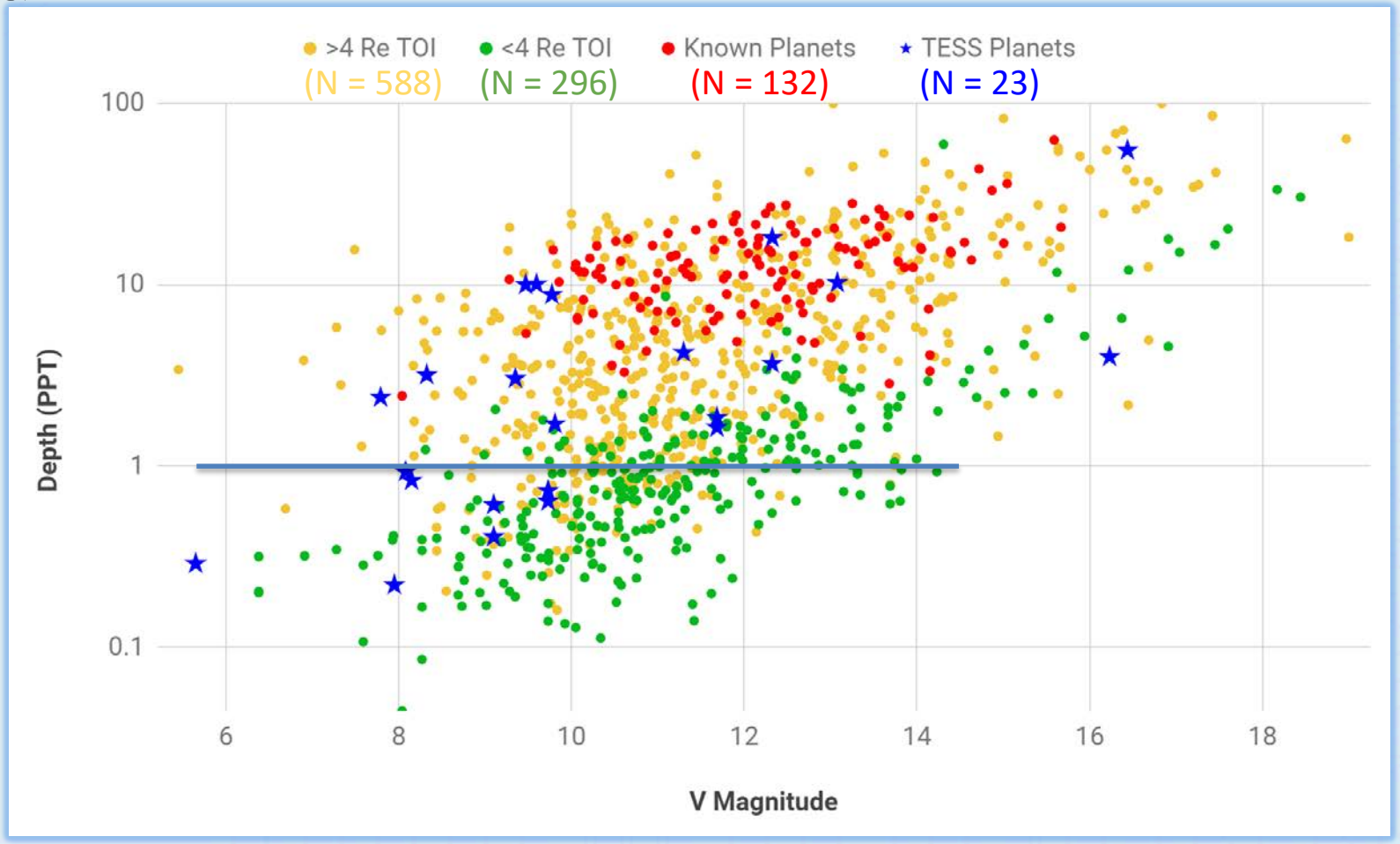
- Ground-based sensitivity general threshold
  - *~1000 ppm (1 ppt or ~1 mmag)*
- 40% of <4 R_E TOIs > 1 ppt
- 75% all TOIs > 1 ppt
- Can also contribute at < 1 ppt



SG1 Dispositioning Process

SG1 Goals are transit depth dependent

- Ground-based sensitivity general threshold
  - *~1000 ppm (1 ppt or ~1 mmag)*
- 40% of <4 R_E TOIs > 1 ppt
- 75% all TOIs > 1 ppt
- Can also contribute at < 1 ppt

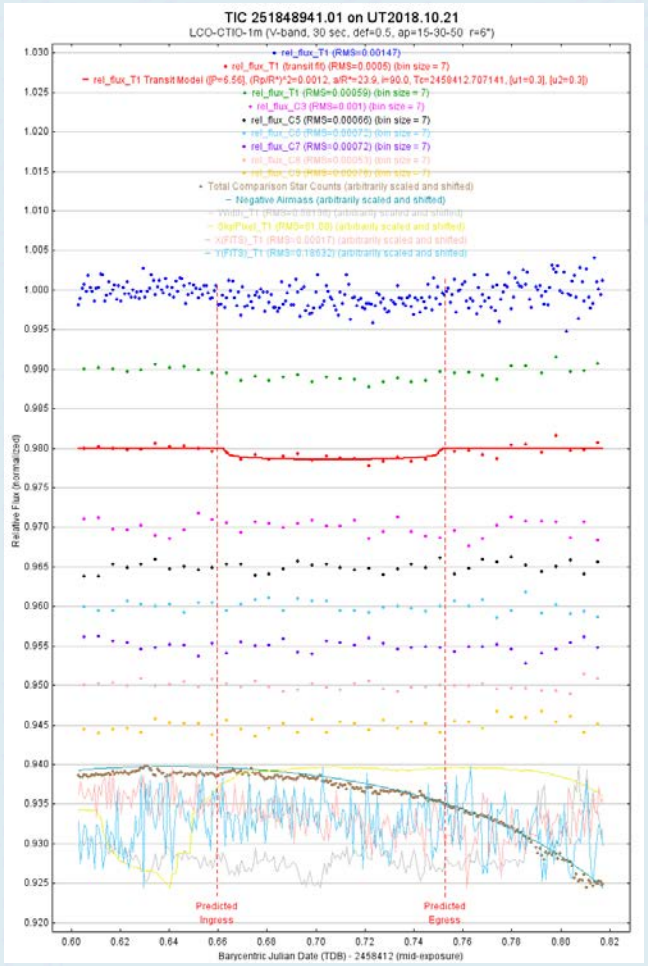


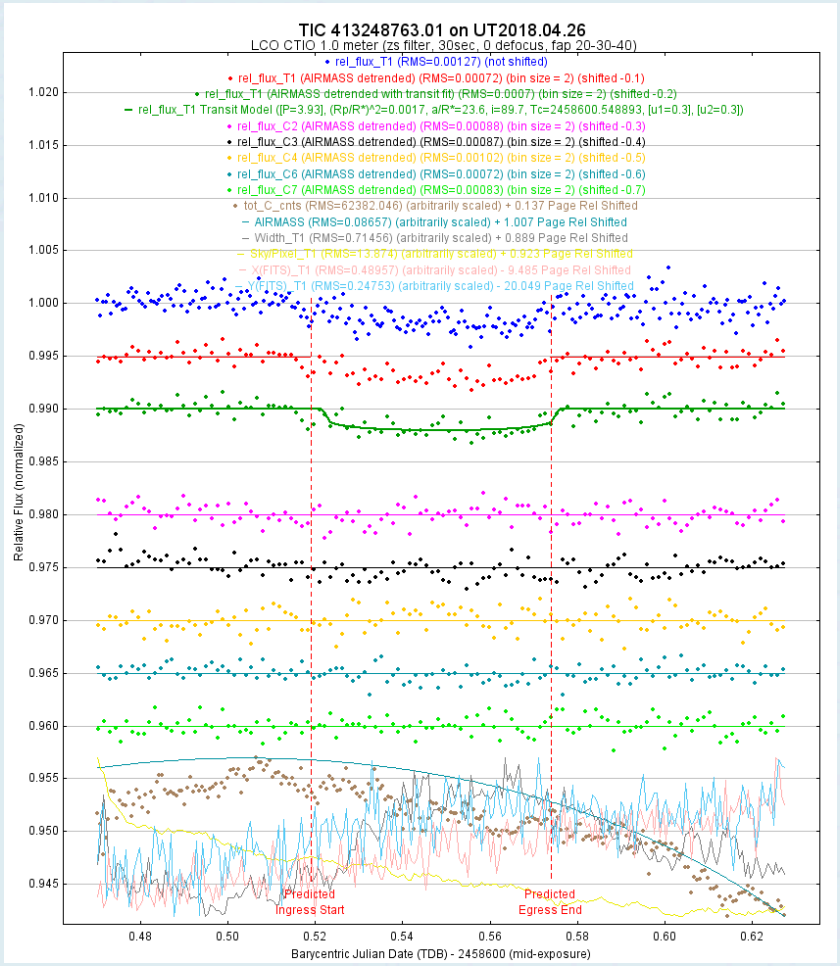
SG1 Dispositioning Process

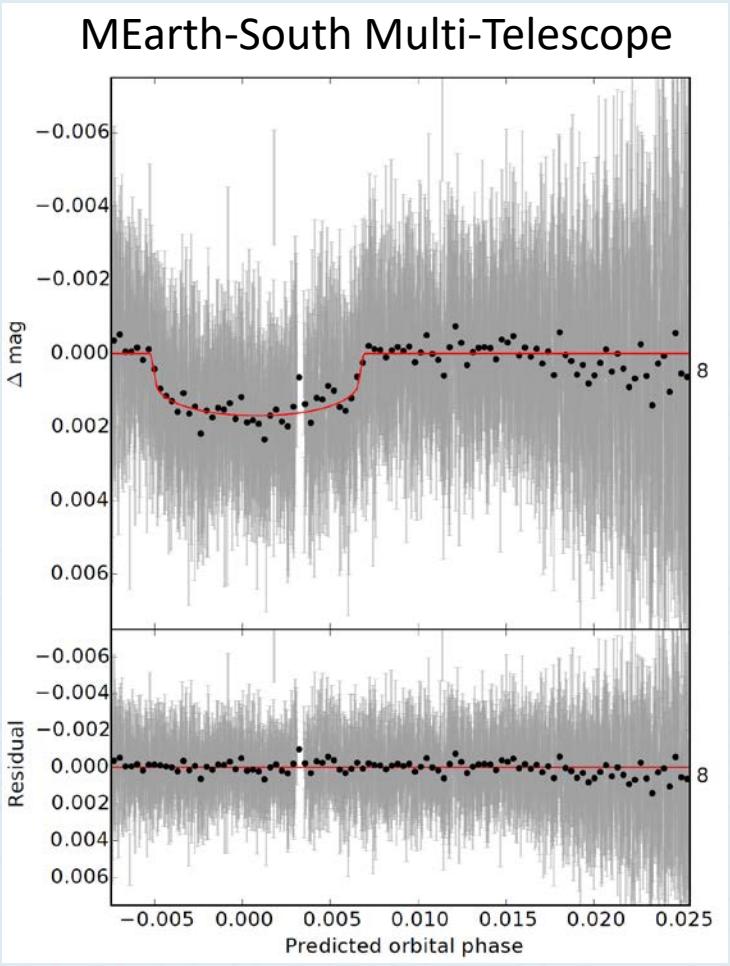
- For transit depths > 1 ppt
  - *Primary goal is to confirm transit on target*
    - *Confirmed and no follow-up aperture contamination*
      *=> **VPC** = Verified Planet Candidate (SG1 disposition)*
    - *Confirmed but follow-up aperture is contaminated with known nearby star*
      *=> **VPC-***
    - *Confirmed off target*
      *=> **NEB** = nearby eclipsing binary*
  - *Secondary goal is a depth chromaticity check*
    - *No significant filter dependent depth*
      *=> **VPC+***
    - *Significant filter dependent depth*
      *=> **BEB** = blended (in the follow-up aperture) EB false positive*

VPC Examples

Transits detected on target => **VPC** disposition (often with 1-2” apertures)





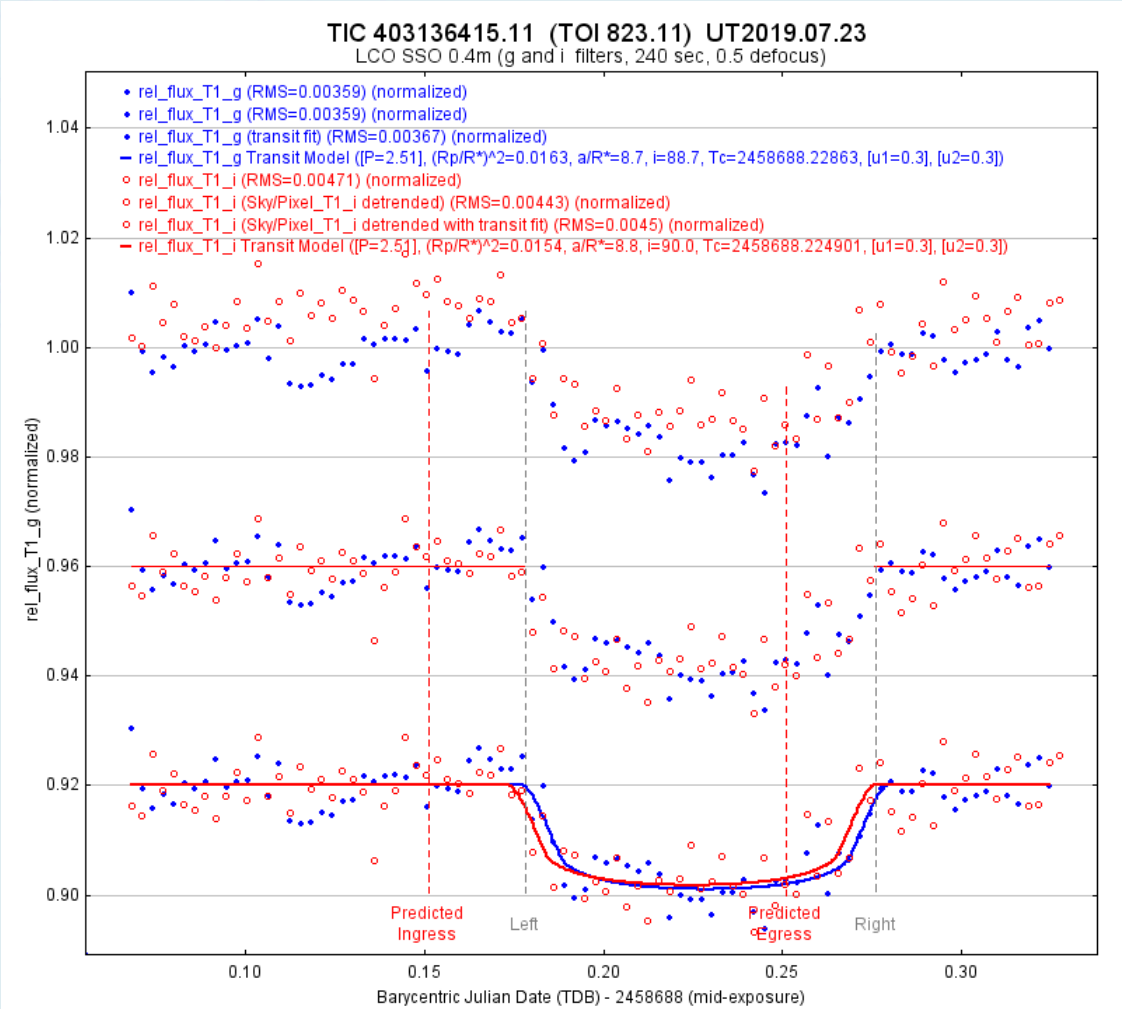


Credit: Kevin Collins, Vanderbilt University/George Mason University

Credit: Jonathan Irwin

VPC+ Examples

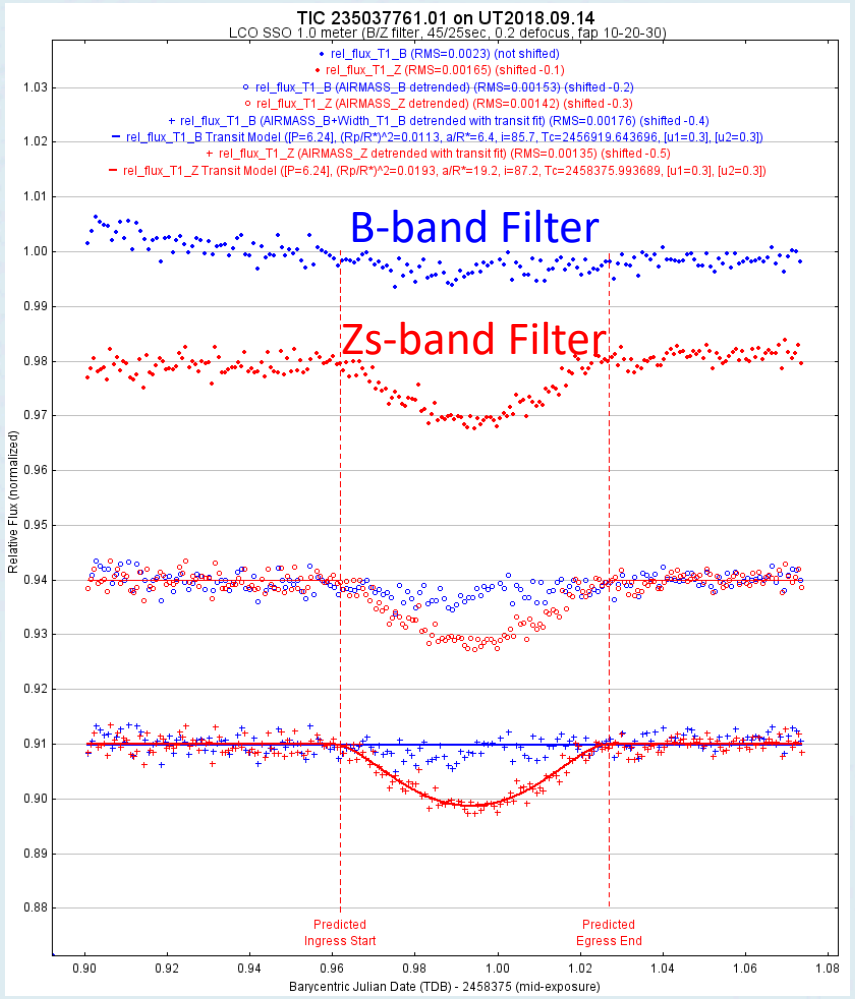
Achromatic Transits detected on target => **VPC+** disposition

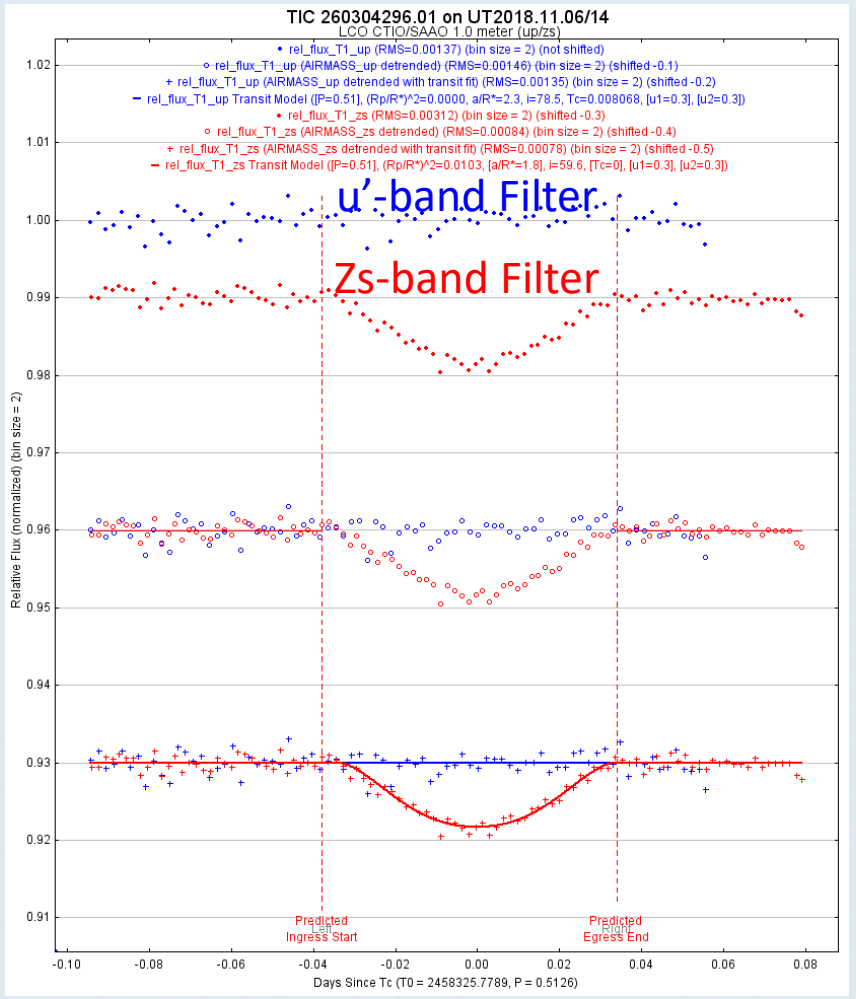


Credit: Dennis Conti, Citizen Astronomer

BEB Examples

Examples of strong chromaticity detections => **BEB** False Positive

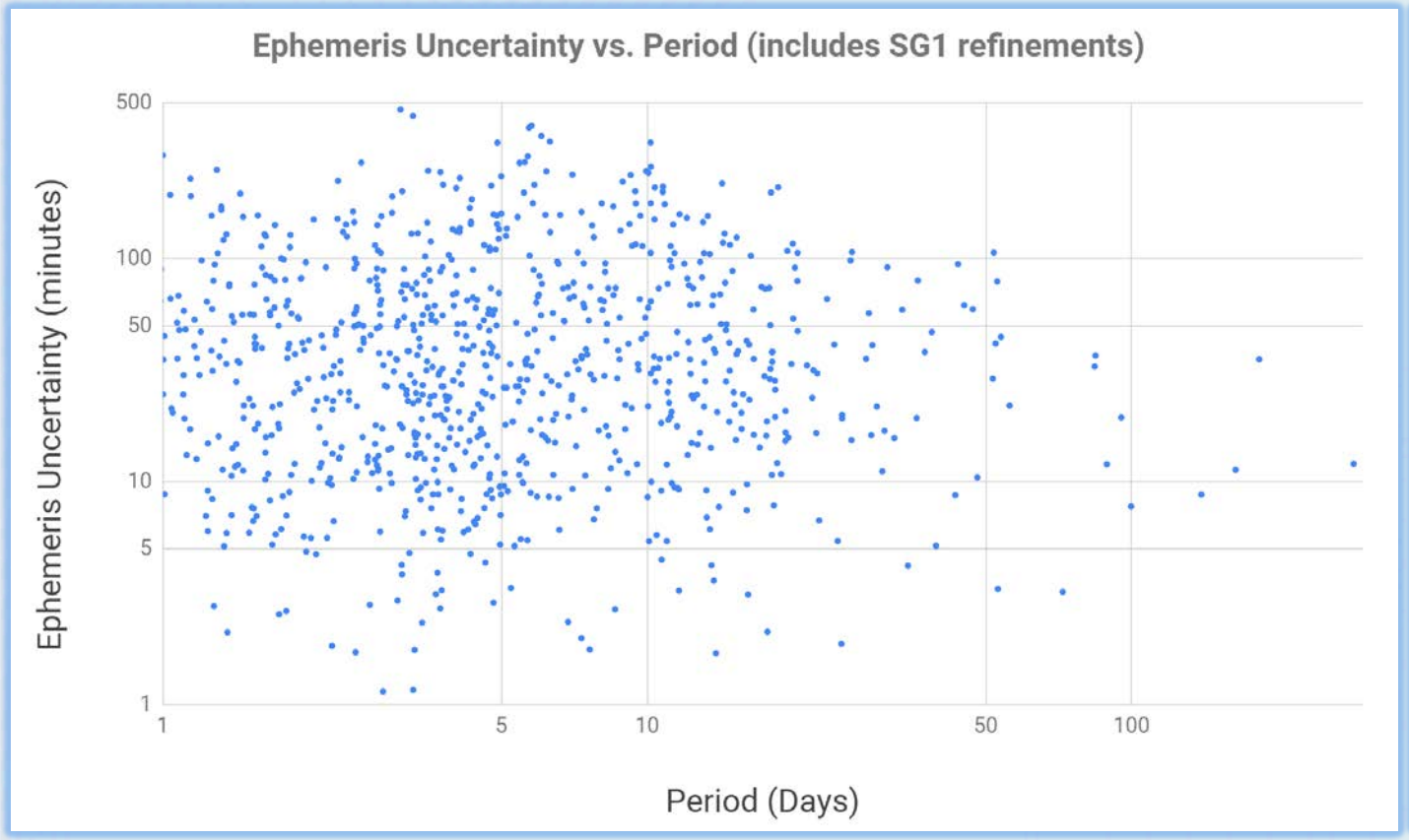


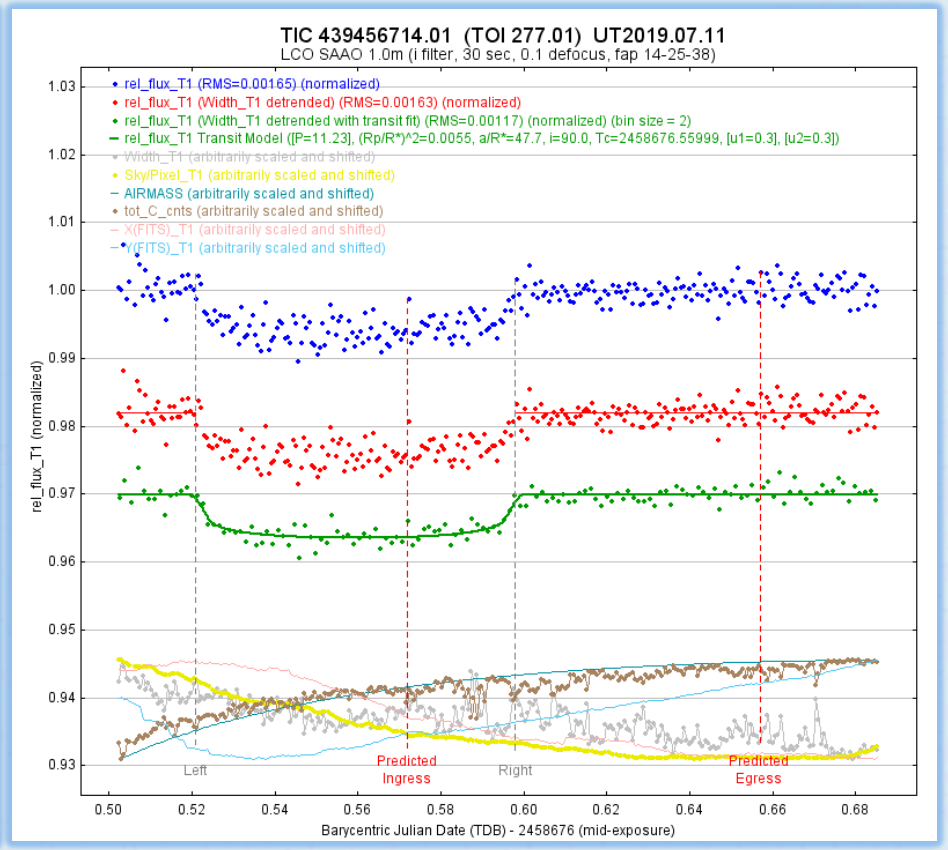


Credit: Kevin Collins, Vanderbilt University

Ephemeris Refinement

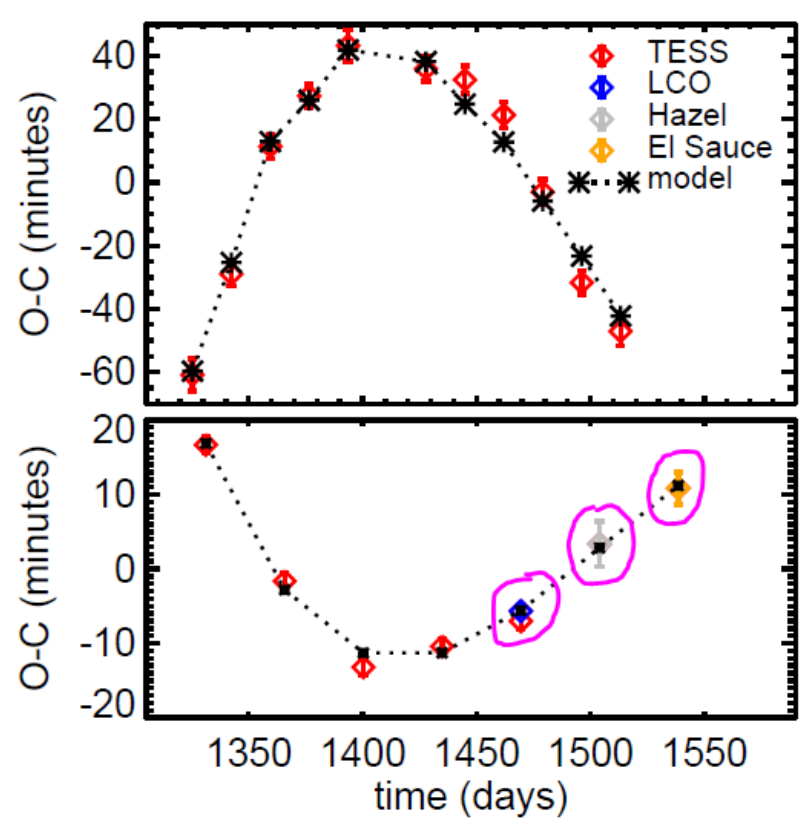
- Several TOIs already have > 2-hour uncertainty
- Ephemeris is refined with each SG1 observation
- Uncertainty generally reduced by ~90%
- Chart below includes SG1 refinements

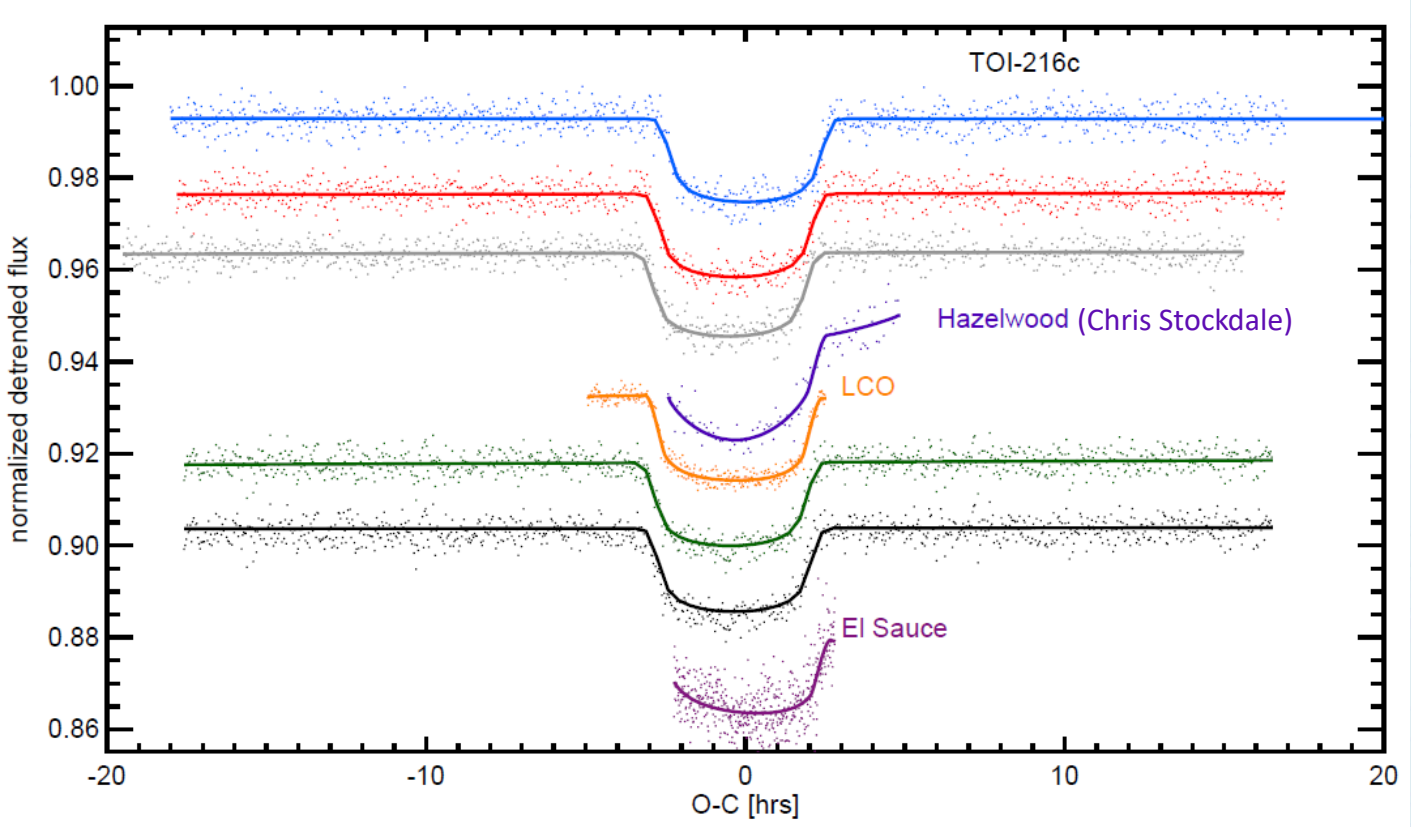




TTV Detections

- TOI-216b and TOI-216c system
- SG1 citizen astronomers contributed to TTV measurements





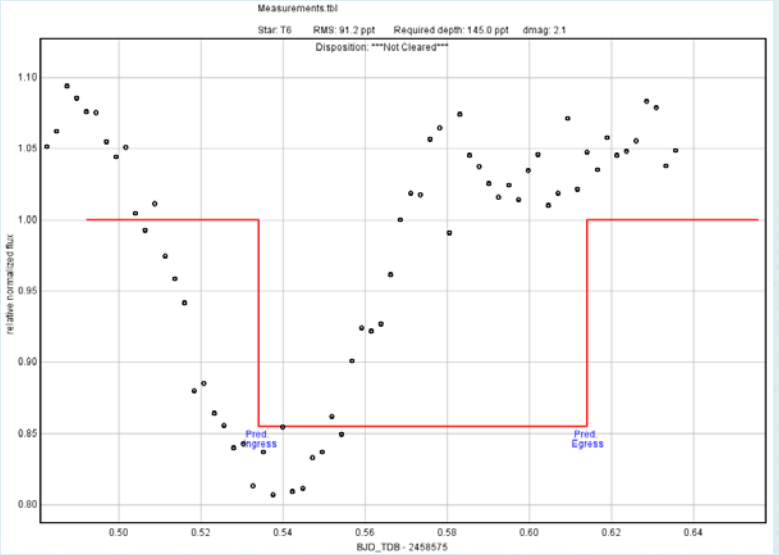
Dawson et al. 2019

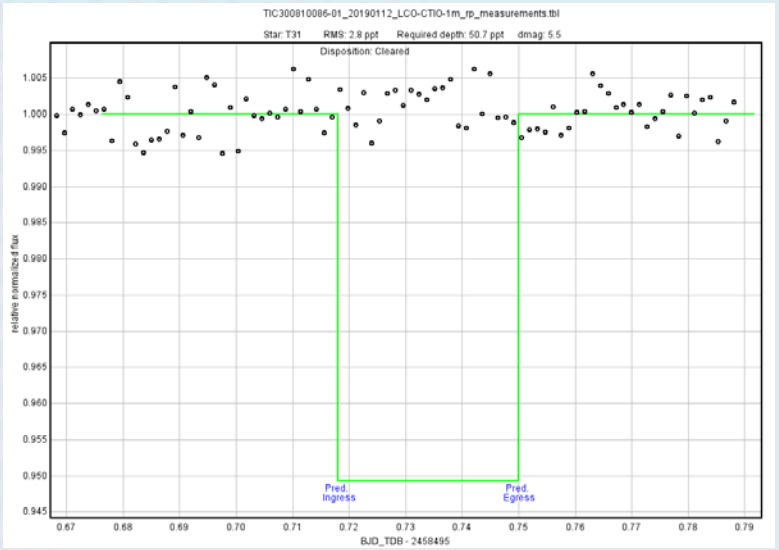
SG1 Dispositioning Process

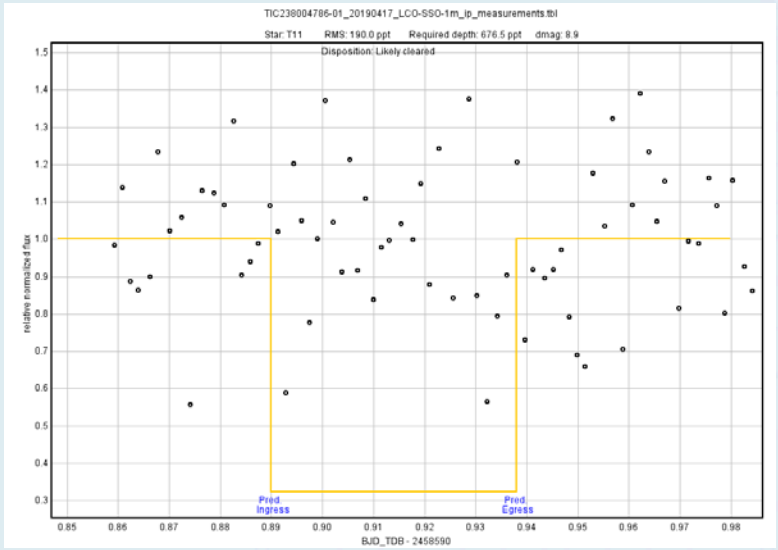
- For transit depths < 1 ppt
  - *Primary goal is to check all Gaia DR2 star locations within 2.5 arcmin of the target for NEBs*
    - *Confirmation of no NEBs (no Gaia stars blended in target PSF)*
      *=> **CPC** = Cleared Planet Candidate*
    - *Confirmed but target star PSF is contaminated with known nearby star*
      *=> **CPC-***
    - *Confirmed off target (1st time)*
      *=> **PNEB** = possible nearby eclipsing binary*
    - *Confirmed off target (2nd time)*
      *=> **NEB** = nearby eclipsing binary*

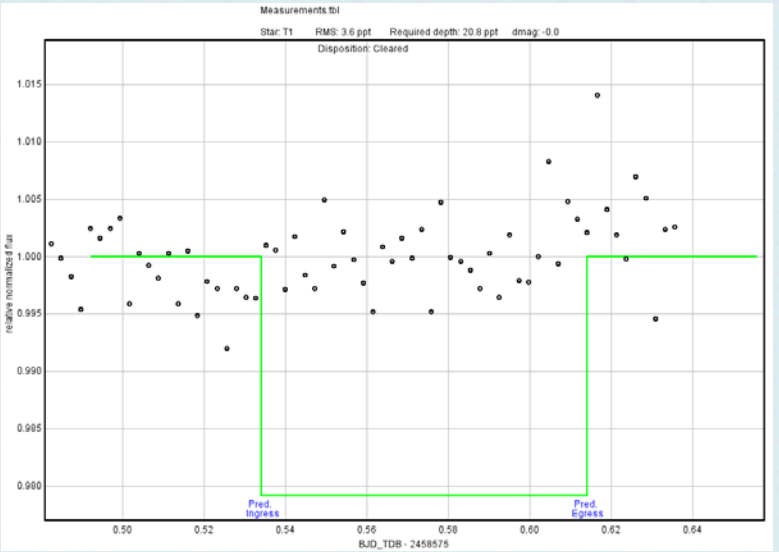
NEB Check

- Light curves of all stars within 2.5 arcmin of target are available on ExoFOP-TESS
- Box transit models show depth needed to produce TESS detection









SG1 TOI List Google Sheet

- Any TFOP member can request access (send me your google affiliated email address)
- Contains all SG1 TOIs
  - *All Mission TOIs*
  - *Various special request candidates*
- Current SG1 priority
- Current SG1 disposition
- Observing history
- Current ephemeris uncertainty

- NOTE: all confirmed FPs are listed on ExoFOP-TESS

Target	TIC	TOI	Pipe-line	Sec-tor	Priority	Dis-po s-ition	Vmag	Depth (ppm)	P	Durat ion (hrs)	Rp (R_E arth)	Publication Status	N Obs	Comments	Cur Eph Unc (min)
25375553.01	25375553	143.01	SPOC	S1	5	KP	10.251	6939	2.3109	3.422	17.6		0	WASP-111	11
393940766.01	393940766	148.01	QLP	S1	3	VPC	12.398	5950	4.8661	3.215	9.7		4	Peter Nelson observed a full transit on 20180914 in V and found a tentitive detection of the transit on target. Bob Massey observe a full transit on 20180914 in V and found a deeper transit, but with 14 ppt RMS. Fran and the TRAPPIST-South team observed a full transit on 20180928 in z' with an r=4.5" aperture. A ~5 ppt event was detected on target. No Gaia stars are contaminating the follow-up aperture. TG Tan observed an inconclusice ingress on 20181121 in V. The next observation should be a full transit in g'/B to check for a chromatic depth.	92
260985861.01	260985861	149.01	QLP	S1	5	VPC	10.727	5082	3.3402	4.077			4	Giovanni Isopi and Franco Mallia observed an ingress on 20181001 and found an apparent on-time ~3 ppt ingress on target in an r=8" aperture. That depth should be considered a rough fit and possibly consistent with the TESS depth. No obvious potential NEBS were found down to ~ dmag~7.5. See Giovanni's dmag + RMS analysis for details. Howie Relles also observed this TOI and with in-transit and partial egress coverage. There is an apparent egress starting at about the right time and with a depth of at least 5 ppt. Fran and the TRAPPIST team observed a full transit on 20181114 in Rc and found a 5 ppt ~on-time event. Chris Sockdale observe in egress+50% and found an apparent ~10 ppt evnt on target (but depth is uncertain). Gaia reports this system has two almost equal brightness neighbors that are separated by 1" and with dmag=0.1, so the depth would be ~twice what is reported by TESS. Gaia does not give a radius for either star. A SOAR speckle image on ExoFOP confirms the 1" neighbor. Retired as a VPC, but note that the target is two stars.	65
271893367.01	271893367	150.01	QLP	S1	5	VPC+	11.39	7386	5.8576	5.818	15.0	Kossakowski TOI-150b TOI-163b In Prep Canas non-TESS TOI-150.01 Accepted	3	Kevin Collins reduced an LCO-CTIO-1m egress + 60% on 20181109 in Zs and found a 6.6 ppt event on time and on target with an r=5.84" aperture which is not contaminated by any Gaia stars. Howie Relles observed the same partial event in ip from an LCO-CTIO-1m and found a ~6 ppt event on time and on target within a 19.5" aperture. Fran observed a full transit with meridian flip in u' on 20181219 and found a ~5 ppt event on target using a 4.6" aperture. The meridian flip and short post-egress baseline could make the model depth uncertain and alternate models give 6.5 and 7.5 ppt. Phil Evans observed a full in B on 20190130 in B and found a 6 ppt event on target in a 7.35" aperture. No more observations needed.	40
261136679.01	261136679	144.01	SPOC	S1	5	P	5.65	249	6.2666	3.093	1.9	Huang Pi Mensae b Accepted	0	HD 39091 (pi Mensae), RV confirmed planet pi Mensae b (Huang et al. 2018).	94
62483237.01	62483237	139.01	SPOC	S1	1	CPC	10.55	1367	11.0584	2.137	2.7		1	Kris Helminiak observed a full transit in V on 20181031 using deep exposures that saturated the target star. One potential 80 ppt NEB was found at his T5 (73", PA=108, dmag=6.93), but is apparently too faint and shallow to have caused the TESS detection. The next observations should check to see if the potential NEB returns, but otherwise this field has been cleared. Also, attempt to confirm the event on target.	101
382302241.01	382302241	151.01	QLP	S1	5	NEB	11.794	1714	1.5978	1.490	3.6		1	Kevin Collins reduced an LCO full transit observation on 20180914 in Z-band an found no event on target and . However, the dmag = 4.58 star 27" to the NNE (PA=17 degrees) shows a 175 ppt (peak depth) event, which if fully blended in the TESS aperture would produce a 2.5 ppt event. The NEB is probably not fully blended, so the TESS detected depth of 1.7 ppt seems reasonable.	95
403287048.01	403287048	152.01	QLP	S1	5	NEB	11.948	3667	7.0078	2.680	8.1		1	Chris Stockdale observed a full transit on 20181006 in Rc and found a convincing 100 ppt NEB with dmag=3.7 that is 43" WNW of the target. The duration, timing, and depth in the NEB are consistent with the 3.7 ppt event detected by TESS on the brighter target star. The neighbor star is TIC 403287050 at RA=332.332031 (22:09:19.687) and Dec=-62.330091 (-62:19:48.33) and has Tmag=14.7 and Vmag=15.345. Gaia gives Teff=5841+/-400 and Rstar=1.20+/-0.15. Using the lower end of the planet radius, Rp=35.85 Re, so this TOI is an NEB rather than an NPC (nearby planet candidate). Retired as an NEB.	199
220518305.01	220518305	156.01	QLP	S1	5	SB1	10.721	18638	14.1489	3.765	21.8		0	Warm Jupiter candidate with a period of about 14 days. Avi's CHIRON RV data show this target to be an EB. Expired as SB1.	58
231081369.01	231081369	153.01	QLP	S1	5	BEB	12.217	6340	7.6323	1.656			5	Chris Stockdale observed an ingress plus 50-75% on 20180921 in Rc and found no NEBs down to dmag~5.5 and found no clear detection of the predicted 6 ppt transit on target within a scatter of ~4 ppt. Chris Stockdale observed a near full transit on 20181014 in Rc resulting in a 4.2 ppt event on target in an r=6" aperture. An alternate interpretation of the light curve is sinusoidal variations given the pre-ingress OOT variations. No obvious NEBs were found	62
389525208.01	389525208	154.01	QLP	S1	5	NEB	10.493	5000	6.7471	2.343	41.3		1	Phil Evans observed a full transit on 20180915 in Rc and found a mid-transit 80 ppt flux decrement in Rc in a dmag=3.9 (Vmag=14.7) star 21" to the NW (PA=297). Retired as NEB.	44

SG1 TOI List Totals

TFOP SG1 TOTALS	TOTAL	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12	S13
Total SG1 TOIs (excludes KPs and STPCs)	865	54	170	49	59	74	89	89	107	99	39	18	18	0
Level 1	296	12	47	28	27	28	33	22	33	41	12	6	7	0
TOIs with 1+ Observations	445	46	132	33	30	29	32	26	53	37	20	6	1	0
Level 1	141	11	39	16	12	8	8	13	13	12	6	3	0	0
TOIs with 0 Observations (excludes KPs and STPCs)	420	8	38	16	29	45	57	63	54	62	19	12	17	0
Level 1	155	1	8	12	15	20	25	9	20	29	6	3	7	0
SG1 Retired (excludes KPs and STPCs)	241	40	59	17	22	19	16	13	32	16	6	1	0	0
Level 1	72	8	15	11	8	5	6	6	8	4	1	0	0	0
SG1 Active	624	14	111	32	37	55	73	76	75	83	33	17	18	0
Level 1	224	4	32	17	19	23	27	16	25	37	11	6	7	0
Total SG1 Observations	1106	186	349	83	51	61	60	85	89	65	39	12	1	0
Total SG1 Submitted Observations	1081	186	349	83	51	61	60	85	89	65	39	12	1	0
Level 1	366	54	119	42	18	16	16	36	26	24	10	5	0	0
Total Pending Observations	25	0	0	0	0	0	0	0	0	0	0	0	0	0
Planets (excludes KPs)	27	9	12	0	2	1	0	1	1	1	0	0	0	0
P (Confirmed Planet)	22	8	8	0	2	1	0	1	1	1	0	0	0	0
Level 1	9	2	5	0	2	0	0	0	0	0	0	0	0	0
VP (Validated Planet)	5	1	4	0	0	0	0	0	0	0	0	0	0	0
Level 1	4	1	3	0	0	0	0	0	0	0	0	0	0	0
KP (Known Planet)	132	20	24	10	13	1	16	11	4	10	13	10	0	0
Elevated to Other SGs	223	27	72	18	7	12	15	15	23	19	10	5	0	0
VPC+ (SG1 Verified Achromatic PC)	36	10	8	3	1	1	0	4	2	3	2	2	0	0
Level 1	11	2	2	2	0	0	0	1	0	2	1	1	0	0
VPC (SG1 Verified PC on target)	108	11	38	6	2	7	7	5	12	12	6	2	0	0
Level 1	23	2	7	2	1	1	0	2	3	3	1	1	0	0
VPC- (SG1 Verified PC w/contaminated aperture)	5	0	1	0	0	0	0	1	1	1	1	0	0	0
Level 1	1	0	1	0	0	0	0	0	0	0	0	0	0	0
CPC (SG1 Cleared PC - no NEBs)	39	3	14	7	1	2	3	4	2	2	1	0	0	0
Level 1	32	3	10	5	1	1	3	4	2	2	1	0	0	0
CPC- (SG1 Cleared PC outside target PSF)	4	0	0	2	0	0	1	0	1	0	0	0	0	0
Level 1	3	0	0	2	0	0	1	0	0	0	0	0	0	0
PPC (SG1 Promising PC)	31	3	11	0	3	2	4	1	5	1	0	1	0	0
Level 1	15	1	5	0	3	1	1	1	1	1	0	1	0	0
Not Elevated to Other SGs	472	4	63	22	31	46	62	66	54	69	24	13	18	0
PC (still a Planet Candidate)	453	2	55	22	31	46	59	65	52	67	24	12	18	0
Level 1	165	0	14	13	14	20	23	11	20	31	9	3	7	0
PNEB (Possible NEB)	1	0	0	0	0	0	0	0	1	0	0	0	0	0
Level 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
STPC (Single Transit PC)	18	2	8	0	0	0	3	1	1	2	0	1	0	0
Level 1	3	0	2	0	0	0	1	0	0	0	0	0	0	0
False Positives	160	16	31	8	19	15	15	8	30	12	5	1	0	0
NEB (Nearby EB)	63	3	9	1	13	6	9	3	15	4	0	0	0	0
Level 1	22	1	0	1	6	3	3	3	4	1	0	0	0	0
NPC (Nearby PC)	12	3	3	1	1	1	1	0	1	1	0	0	0	0
Level 1	1	0	0	0	0	1	0	0	0	0	0	0	0	0
BEB (chromaticity)	21	2	8	3	1	1	1	2	1	1	0	1	0	0
Level 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BD (confirmed Brown Dwarf)	2	0	0	0	0	0	0	1	1	0	0	0	0	0
Level 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
EB (too deep)	14	0	7	3	2	0	1	1	0	0	0	0	0	0
Level 1	1	0	0	0	0	0	1	0	0	0	0	0	0	0
SB1 (too large RV)	32	5	2	0	2	6	1	1	6	5	4	0	0	0
Level 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SB2 (multi-lined)	9	2	2	0	0	0	1	0	3	0	1	0	0	0
Level 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
FA (false alarm)	7	1	0	0	0	1	1	0	3	1	0	0	0	0
Level 1	5	0	0	0	0	1	1	0	3	0	0	0	0	0

- Chart linked on TESS Wiki
- 865 (L1=296) SG1 TOIs (excluding KPs and STPCs)
- 1100+ (L1=375+) SG1 submitted observations
  - *~60% LCO observers*
  - *~40% from non-LCO observers*
- ~50% of TOIs have 1+ observations
- ~20% FPs

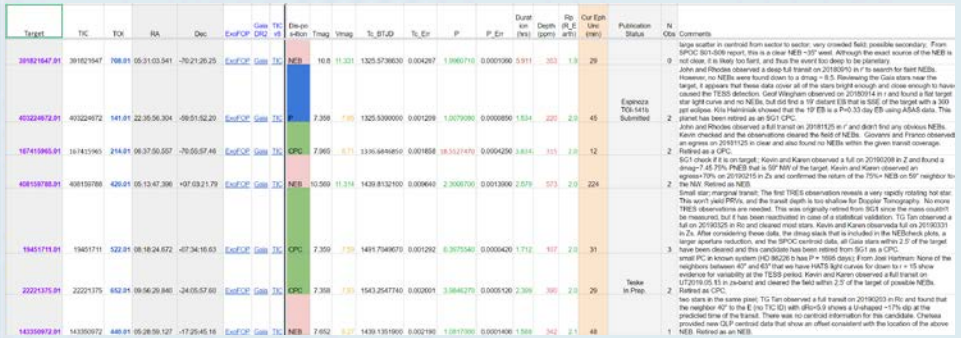
- See SG1 Related Posters:
  - *Poster 5 – McLeod et al.*
  - *Poster 7 – Narita et al.*
  - *Poster 9 – Waalkes et al.*
  - *Poster 11 – Fukui et al.*
  - *Poster 12 – Kielkopf et al.*
  - *Poster 19 – Palle et al.*
  - *Poster 54 – Kafka et al.*

SG1 Data and Your TESS Paper

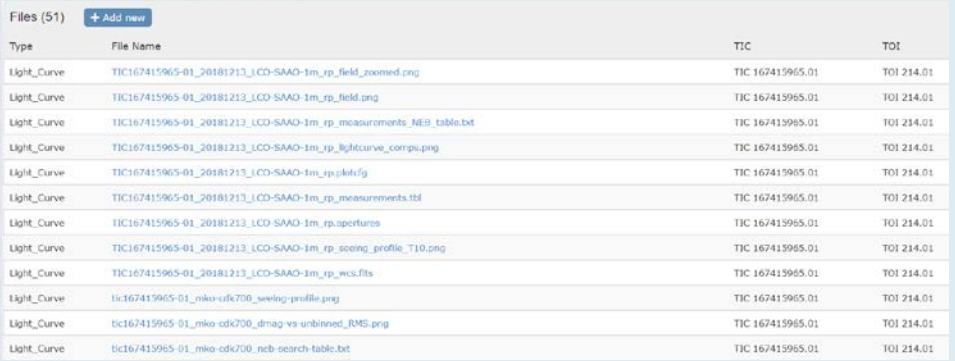
- Interested in a specific TOI?
  - *Let me know early on and I can boost SG1 priority*
- Recommend including constraints from follow-up in paper
  - *Size of follow-up aperture (in arcsec) used to confirm event on target*
  - *FWHM of stars in follow-up imagery*
  - *Include light curves in global model*
    - *Reduce ephemeris uncertainty by up to ~90%*
    - *Verify TESS deblending factor via follow-up depths*
    - *Verify achromatic transit via multi-band follow-up*
    - *TTV constraints*
- TOIs with depths less than ~1.0 ppt
  - *The CPC status rules out NEBs*
- We can help write SG1 observations and data reduction section and provide interpretation
- TFOP observers that contributed useful data, including ruling out of a false positive, should be offered coauthorship, even if you later confirmed the planet mass with RVs.
  - *Check ExoFOP-TESS and SG1 Google Sheet*
  - *Ask me to help identify appropriate SG1 coauthors*

Lead Author Resources for SG1 Observations

- SG1 TOI List
  - *Open to all TFOP members*
  - *Email karen.collins@cfa.harvard.edu for access*



- ExoFOP-TESS
  - *Access to all SG1 reduced data files*
  - *Must be TFOP member to access 1-year prop. data*
  - *REMEMBER TO LOGIN TO SEE ALL FILES!*



Files (51) + Add new

Type	File Name	TIC	TOI
Light_Curve	TIC167415965-01_20181213_LCO-SAAO-1m_rp_field_zoomed.png	TIC 167415965.01	TOI 214.01
Light_Curve	TIC167415965-01_20181213_LCO-SAAO-1m_rp_field.png	TIC 167415965.01	TOI 214.01
Light_Curve	TIC167415965-01_20181213_LCO-SAAO-1m_rp_measurements_NEB_table.txt	TIC 167415965.01	TOI 214.01
Light_Curve	TIC167415965-01_20181213_LCO-SAAO-1m_rp_lightcurve_corrps.png	TIC 167415965.01	TOI 214.01
Light_Curve	TIC167415965-01_20181213_LCO-SAAO-1m_rp.plotcfg	TIC 167415965.01	TOI 214.01
Light_Curve	TIC167415965-01_20181213_LCO-SAAO-1m_rp_measurements.tbl	TIC 167415965.01	TOI 214.01
Light_Curve	TIC167415965-01_20181213_LCO-SAAO-1m_rp.apertures	TIC 167415965.01	TOI 214.01
Light_Curve	TIC167415965-01_20181213_LCO-SAAO-1m_rp_seeing_profile_T10.png	TIC 167415965.01	TOI 214.01
Light_Curve	TIC167415965-01_20181213_LCO-SAAO-1m_rp_wcs.fits	TIC 167415965.01	TOI 214.01
Light_Curve	tic167415965-01_mko-cdk700_seeing-profile.png	TIC 167415965.01	TOI 214.01
Light_Curve	tic167415965-01_mko-cdk700_dmag-vs-unbinned_RMS.png	TIC 167415965.01	TOI 214.01
Light_Curve	tic167415965-01_mko-cdk700_neb-search-table.txt	TIC 167415965.01	TOI 214.01

- SG1 Author Information (link on TESS Wiki Publication page)

2	Pedro J.	Amado	pja@iaa.csic.es	\author{0000-0002-8388-6040}{Pedro J. Amado} \affiliation{Instituto de Astrofísica de Andalucía-CSIC, Glorieta de la Astronomía s/n, Granada, E-18008, Spain}	Observatorio de Sierra Nevada, Granada, Spain
3	David	Baker	**dbaker@austincollege.edu**	\author{0000-0002-2970-0532}{David Baker} \affiliation{Physics Department, Austin College, Sherman, TX 75090, USA}	Adams Observatory, Austin College
4	Khalid	Barkaoui	khalid.barkaoui@doct.uliege.be	\author{Khalid Barkaoui} \affiliation{Astrobiology Research Unit, Université de Liège, 19C Allée du 6 Août, 4000 Liège, Belgium} \affiliation{Oukaimeden Observatory, High Energy Physics and Astrophysics Laboratory, Cadi Ayyad University, Marrakech, Morocco}	TRAPPIST-South, TRAPPIST-North and SPECULOOS-South Observatory
5	Zachary	Bates	zbates@gmu.edu	\author{Zachary Bates} \affiliation{George Mason University, 4400 University Drive, Fairfax, VA, 22030 USA}	GMU
6	Daniel	Bayliss	d.bayliss@warwick.ac.uk	\author{0000-0001-6023-1335}{Daniel Bayliss} \affiliation{Department of Physics, University of Warwick, Coventry CV4 7AL, UK}	
7	Serge	Bergeron	astrosberge3@gmail.com	\author{Serge Bergeron} \affiliation{American Association of Variable Star Observers, 49 Bay State Road, Cambridge, MA 02138, USA}	Astrosberge Private Observatory, Canada
8	Zach	Berta-Thompson	zach.bertathompson@colorado.edu	\author{0000-0002-3321-4924}{Zachory Berta-Thompson} \affil{Department of Astrophysical and Planetary Sciences, University of Colorado, Boulder, CO 80309, USA}	
9	Lorenzo	Betti	zernolotibet@yahoo.it	\author{Lorenzo Betti} \affiliation{Osservatorio Polifunzionale del Chianti (OPC), 50021 Barberino Val d'Elsa, Firenze, Italia} \affiliation{Università di Firenze, Via Sansone 1, 50019 Sesto Fiorentino (FI)}	Osservatorio Polifunzionale del Chianti - OPC
10	Alfredo	Biagini	alfredo.biagini93@live.it	\author{Alfredo Biagini} \affiliation{Osservatorio Polifunzionale del Chianti (OPC), 50021 Barberino Val d'Elsa, Firenze, Italia} \affiliation{Università di Firenze, Via Sansone 1, 50019 Sesto Fiorentino (FI)}	Osservatorio Polifunzionale del Chianti - OPC
11	Valerio	Bozza	valboz@sa.infn.it	\author{0000-0003-4590-0136}{Valerio Bozza} \affiliation{Dipartimento di Fisica "E.R. Caianiello", Universita' a di Salerno, Via Giovanni Paolo II 132, 84084 Fisciano, Italy} \affiliation{Istituto Nazionale di Fisica Nucleare, Sezione di Napoli, Via Cintia, 80126 Napoli, Italy}	Salerno University Observatory
12	Carolyn	Brown	carolyn.brown@usq.edu.au	\author{0000-0001-6649-4531}{Carolyn J. Brown} \affiliation{University of Southern Queensland, Centre for Astrophysics, Toowoomba QLD 4350, Australia}	Minerva-Australis
13	Quentin	Changeat	quentin.changeat.18@ucl.ac.uk	\author{Quentin Changeat} \affiliation{University College London, London, United Kingdom}	LCO network, Warrambungle Observatory, IC Astrono
14	Heena	Chotani	hchotani@gmu.edu	\author{Heena Chotani} \affiliation{George Mason University, 4400 University Drive, Fairfax, VA, 22030 USA}	GMU
15	Jake	Clark	jake.clark@usq.edu.au	\author{0000-0003-3964-4658}{Jake T.\ Clark} \affiliation{University of Southern Queensland, Centre for Astrophysics, Toowoomba QLD 4350, Australia}	Minerva-Australis

- SG1 Instrumentation Specs (link on Wiki Publication page)

Felipe	Murgas	fmurgas@iac.es	Teide Observatory	Telescopio Carlos Sánchez (TCS) - MuSCAT2 instrument	Spain	La Laguna, Tenerife	28.2999988	-16.50583131	2390	Atlantic/Canary - Canary Islands	
Pere	Guerra	peroguerra@gmail.com	Observatori Astronòmic Albanyà	OAA	Spain	Albanyà, Girona	42.30722222	2.71138889	242	Europe/Madrid	Meade ACF
Pablo	Lewin	pablotwa@earthlink.net	The Maury Lewin Astronomical Observatory		USA	Glendora, CA	34.14208	-117.87211	226	America/Los Angeles/Western	Aplanatic, flat field Schmidt-Cass
Nikolay	Mishevskiy	nikastro@ukr.net	Private Astronomical Observatory (Ananjev L33)		Ukraine	Ananjev, Odessa st.	47.73619	29.954611	100	Europe/Kiev	Reflector Newton
Phil	Evans	phil@astrofizz.com	El Sauce		Chile	Coquimbo Province	-30.47111	70.765	1600	America/Santiago	CDK
Gregor	Srdoc	gregorsrdoc@gmail.com	Kotizarovci Observatory		Croatia	Viskovo	45.384516	14.411265	410	Europe/Zagreb	SCT
Jonathan	Swift	jswift@thacher.org	Thacher Observatory		USA	Ojai, CA	34.466806	-119.177361	495	America/Los Angeles/Western	Planewave Corrected Dall-Kirkham
Harvey	Patashnick	hdpatashnick@gmail.com	Patashnick Voorheesville Observatory	PVO	USA	Voorheesville, NY	42.64	-73.94	126	America/New_York - Eastern	Newtonian Cassegrain
Richard	Schwarz	rpschwarz@comcast.net	Patashnick Voorheesville Observatory	PVO	USA	Voorheesville, NY	42.64	-73.94	126	America/New_York - Eastern	Newtonian Cassegrain
Franco	Mallia	francomallia@tin.it	Campo Catino Astronomical Observatory	RC80	Italy	Guarcino (FR)	41.822083	13.32916	1500	Europe Central Time	Ritchey-Chretien
Emanuele	Pace	e.pace@osservatoriochianti.it	Osservatorio Polifunzionale del Chianti	RC80	Italy	Barberino val d'Elsa (FI)	43.523099	11.244836	455	European Central Time	Ritchey-Chretien
Emanuele	Pace	e.pace@osservatoriochianti.it	Osservatorio Polifunzionale del Chianti	RC80	Italy	Barberino val d'Elsa (FI)	43.523099	11.244836	455	European Central Time	Ritchey-Chretien
Franco	Mallia	francomallia@tin.it	Campo Catino Astronomical Observatory	TIE14	USA	Rodeo, NM	31.90722	-109.02111	1420	America/Denver - Mountain (most areas)	RC
Franco	Mallia	francomallia@tin.it	Campo Catino Astronomical Observatory	T17	Australia	Siding Spring	-31.2733	149.071	1122	Australia/Sydney	RC
Tiffany	Lewis	tiffanylewisphd@gmail.com	Wise Observatory	Jay Baum Rich (C28)	Israel	Mitzpe Ramon	30.596	34.763	875	Asia/Jerusalem	Centurion 28, by AstroWorks, USA