



清华大学天文系

Department of Astronomy, Tsinghua University

Updates of KMTNet Photometry Pipeline And Systematic Reanalysis of History Events

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Andrew Gould @MPI&OSU, Kyu-Ha Hwang@KASI, and all KMTNet members

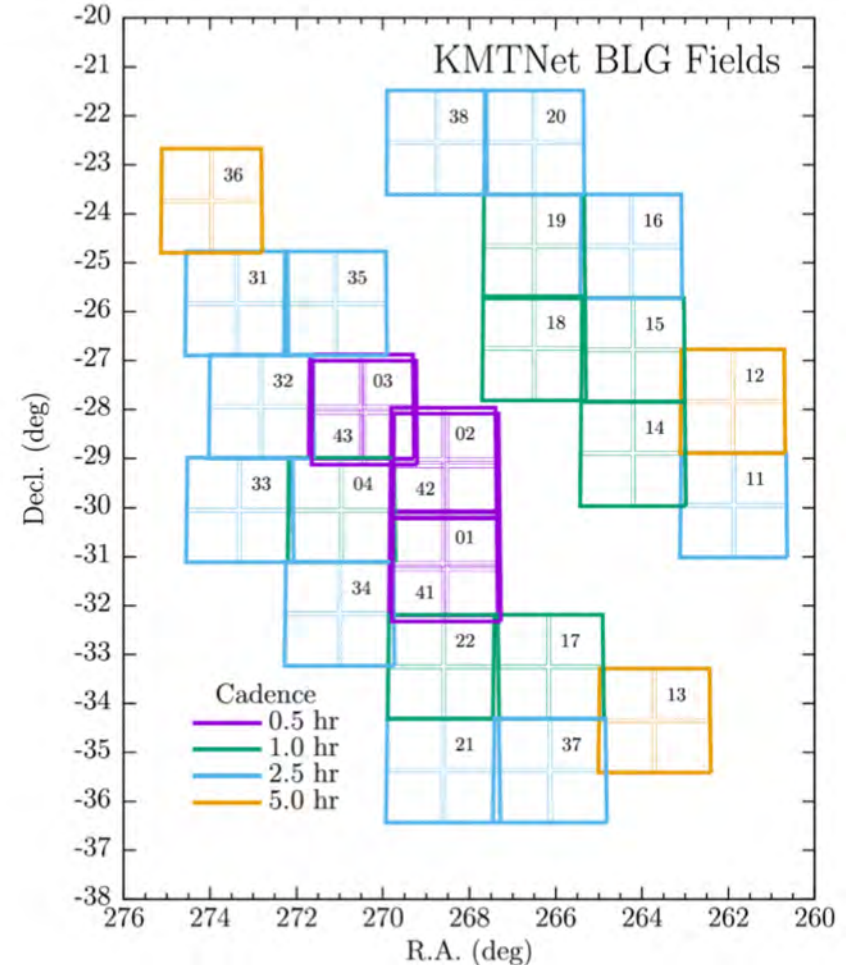
2024.01.31

26th Microlensing Conference @ Livermore, CA, USA

KMTNet (The Korea Microlensing Telescope Network)



Three 1.6m 4deg² telescopes
Nearly continuous observations



~96 deg² towards Galactic bulge
~12 deg² prime field (≤ 15 min cadence)

Are There Missing Planets?

(Planetary events) / (All events) rate of a KMTNet-like survey

Zhu et al. (2014) simulation: **2.9%**

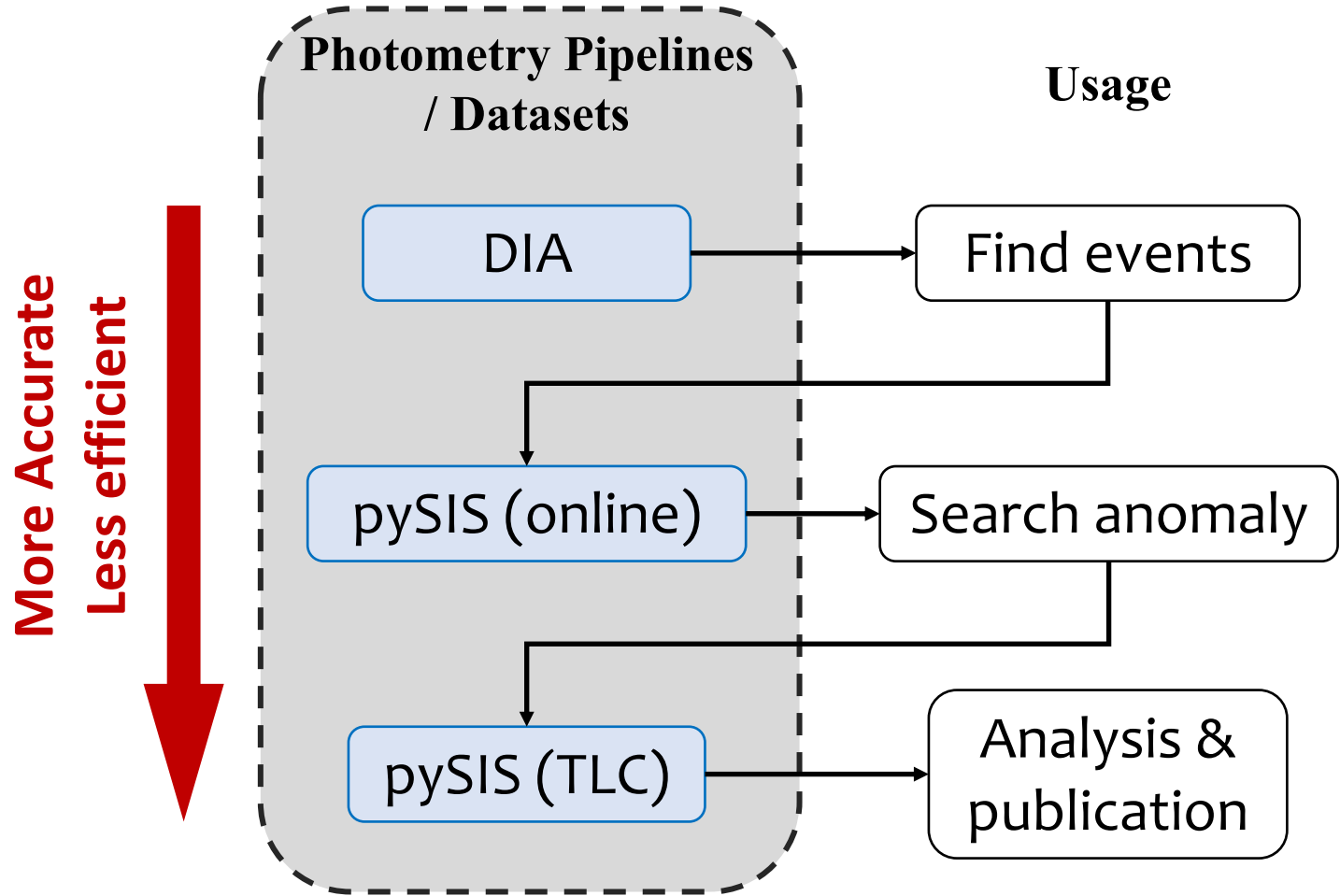
Current KMTNet observation: **1.0~1.5%**

Systematics?

Are there missed planets?

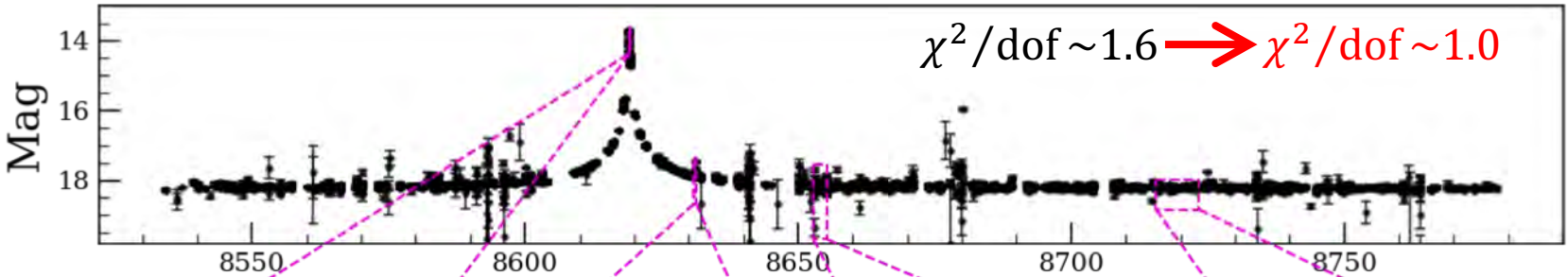
How many?

KMTNet workflow

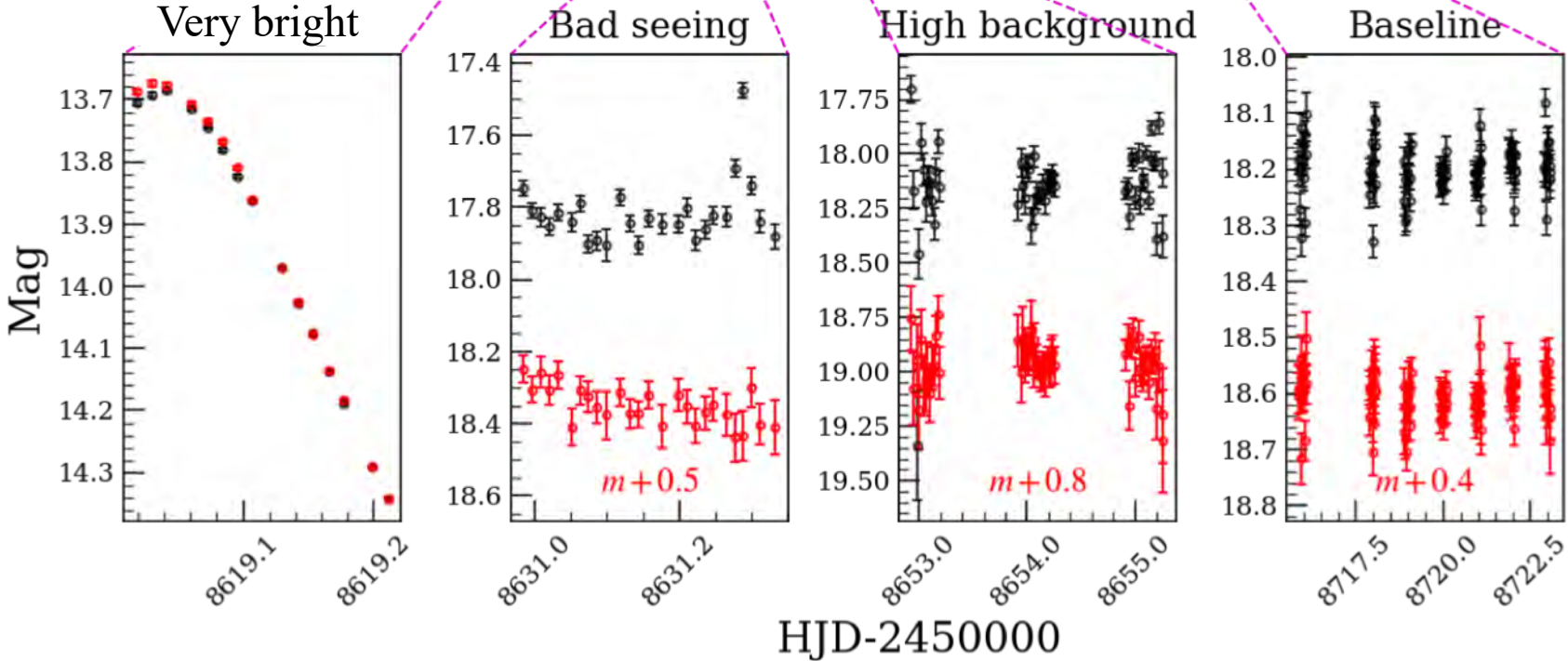


Updates on the TLC Pipeline

Light curve (kb190505)



~ Poisson noise level for $I > 15.5$



Photometry becomes

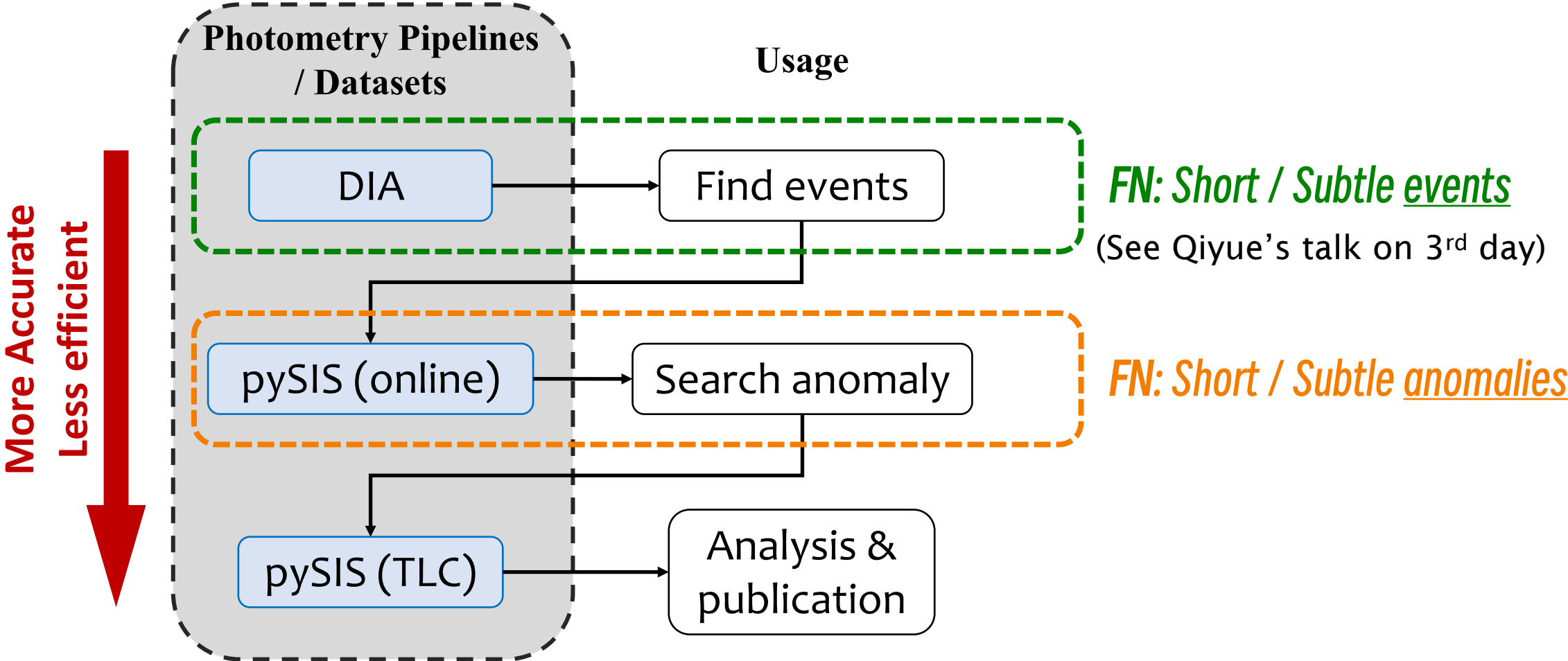
- More stable
- More accurate

Old

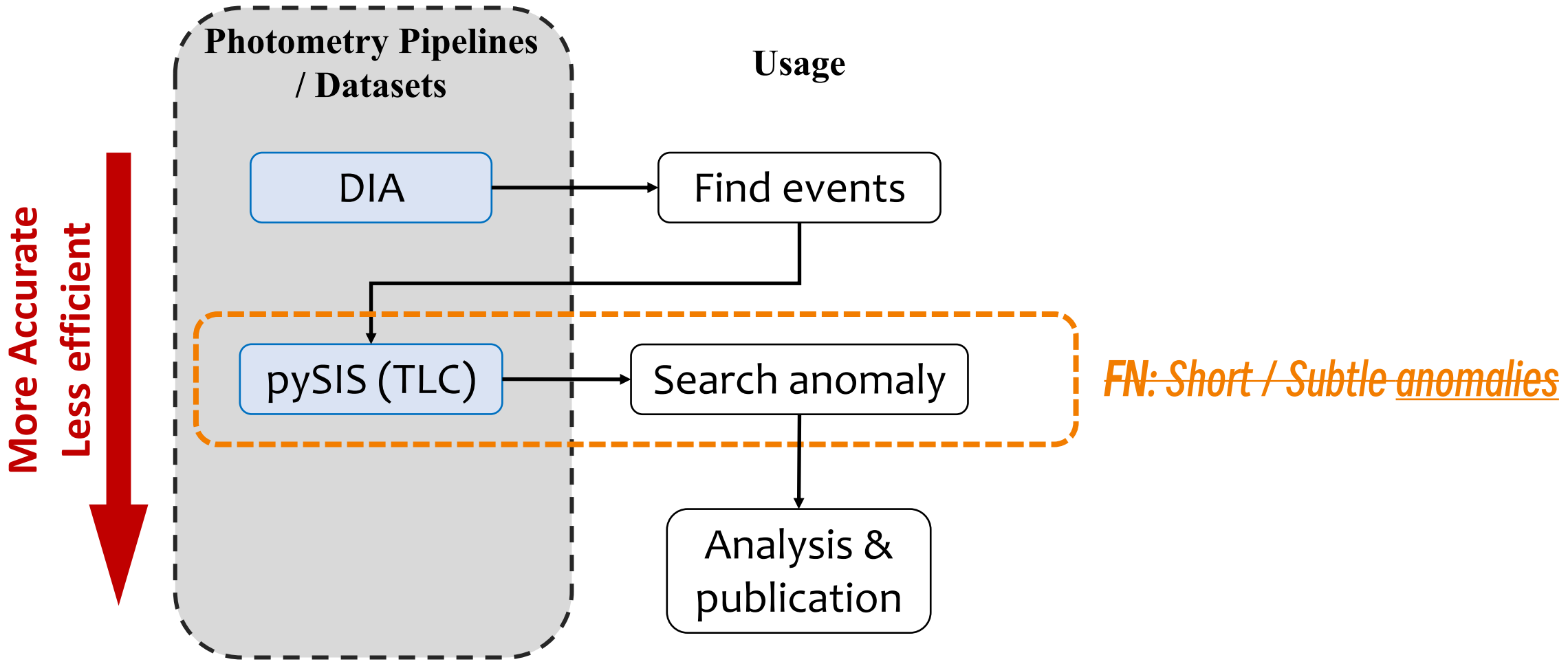
New

Detailed updates:
 Yang et al. (2024)
 arXiv:2311.04876

KMTNet workflow



KMTNet workflow



GOAL 1: Recover false negative anomalies in known events
GOAL 2: Estimate how many planets are missed in the whole dataset

Systematic Reanalysis: Sample Selection

Sample selection: **Giant source events**

Advantages:

- **Bright**
=> provide accurate photometry
- Relatively **sensitive** to planets
- **Sensitive** to very wide caustics

Systematic Reanalysis: Sample Selection

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Criteria

- 2016 - 2022 season

- $I_{\text{cat}} - A_I < 16$
- $I_{\text{source}} - A_I < 16$

Giant source

- $I_{\text{base}} < 17$
- Prime fields

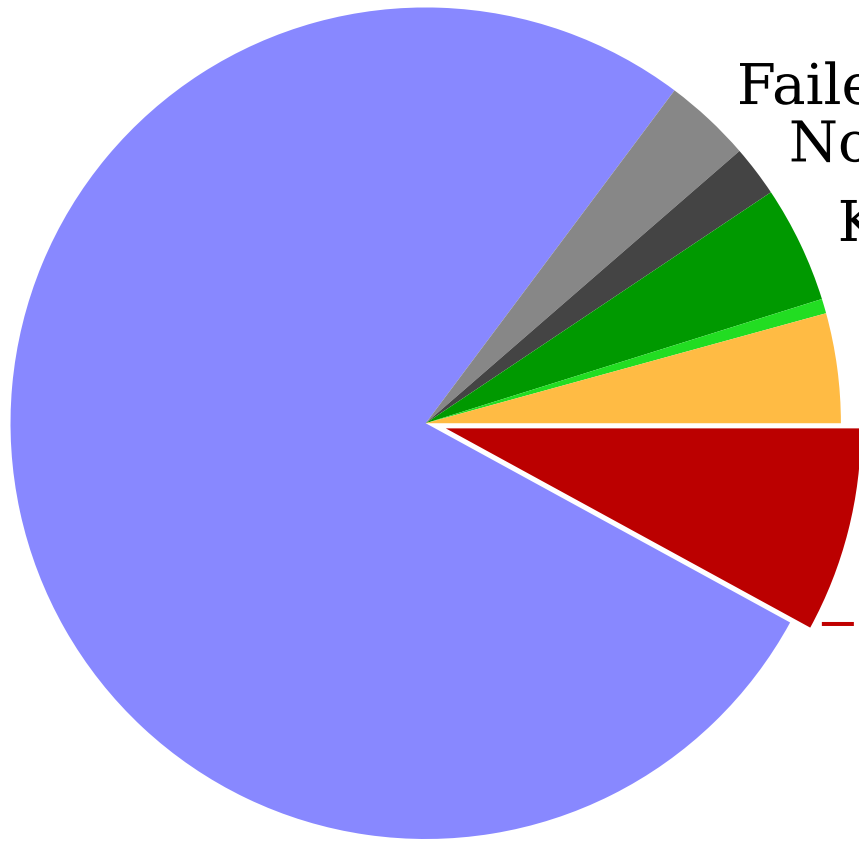
High SNR

Total events: **352**

Anomaly Search: Results

Total: 352

No anomaly
(272)



Failed (12)

Not mlens (7)

Known binary (16)

Known planet (2)

Parallax (15)

New anomaly (28)

(preliminary model)

Unclear (2)

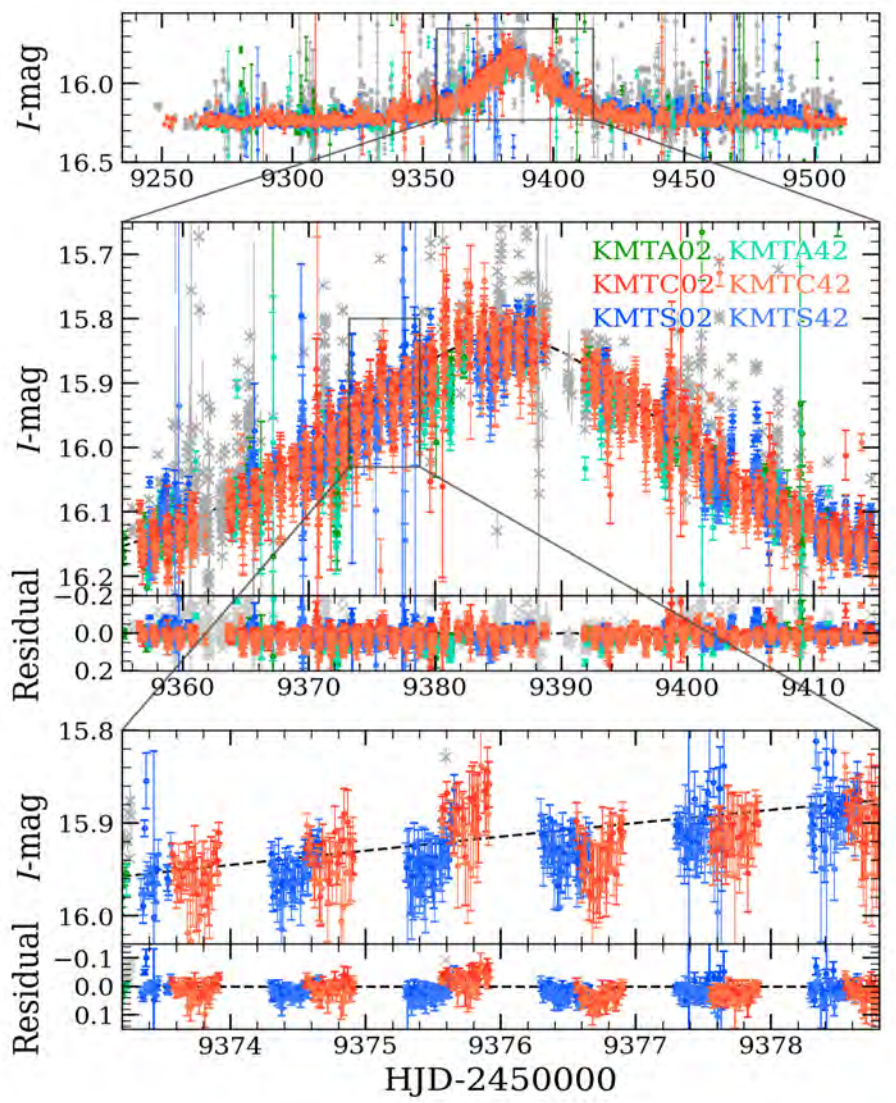
Binary
(18)

Finite Source
(4)

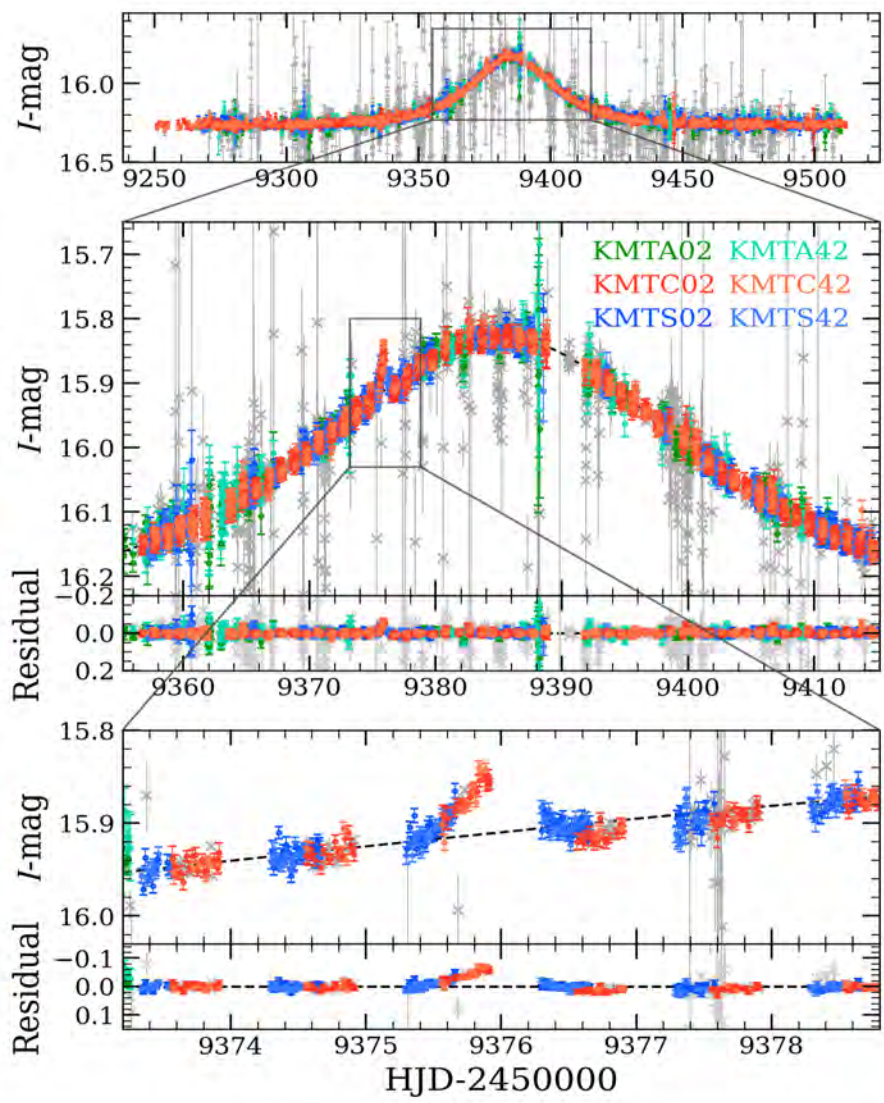
Planet-like
(4)

Implications

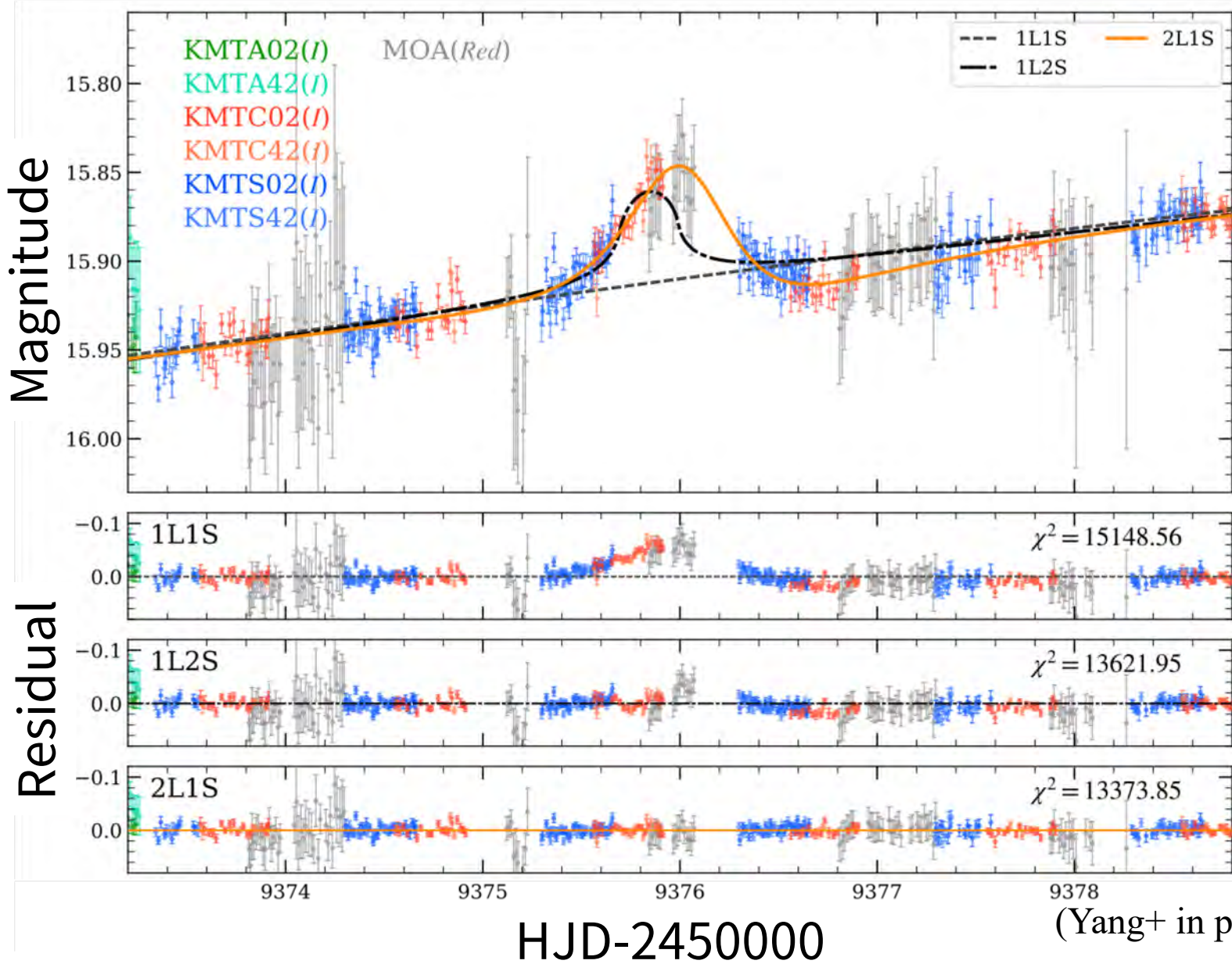
Online



TLC



New Anomaly: KMT-2021-BLG-0736

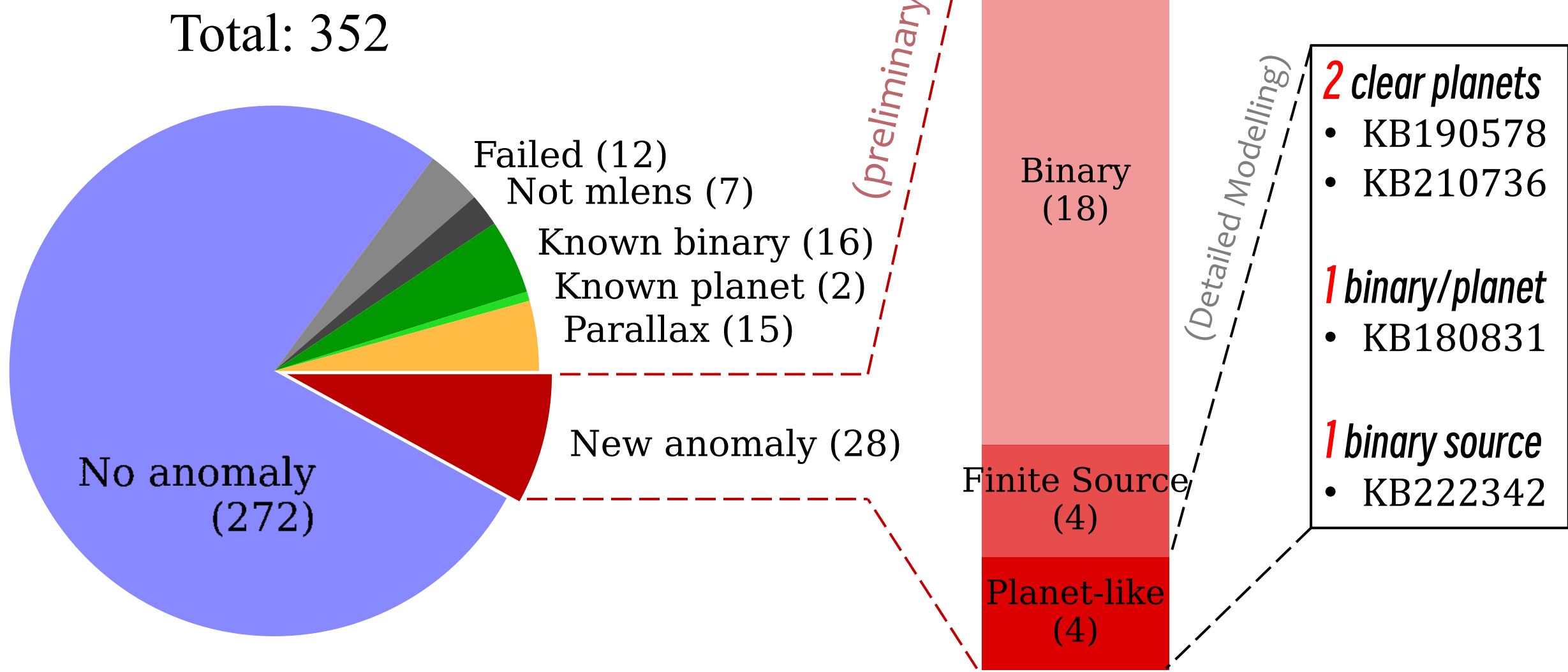


Planet parameters:
 $\log s = 0.194$
 $\log q = -4.0$

=> Clear planet

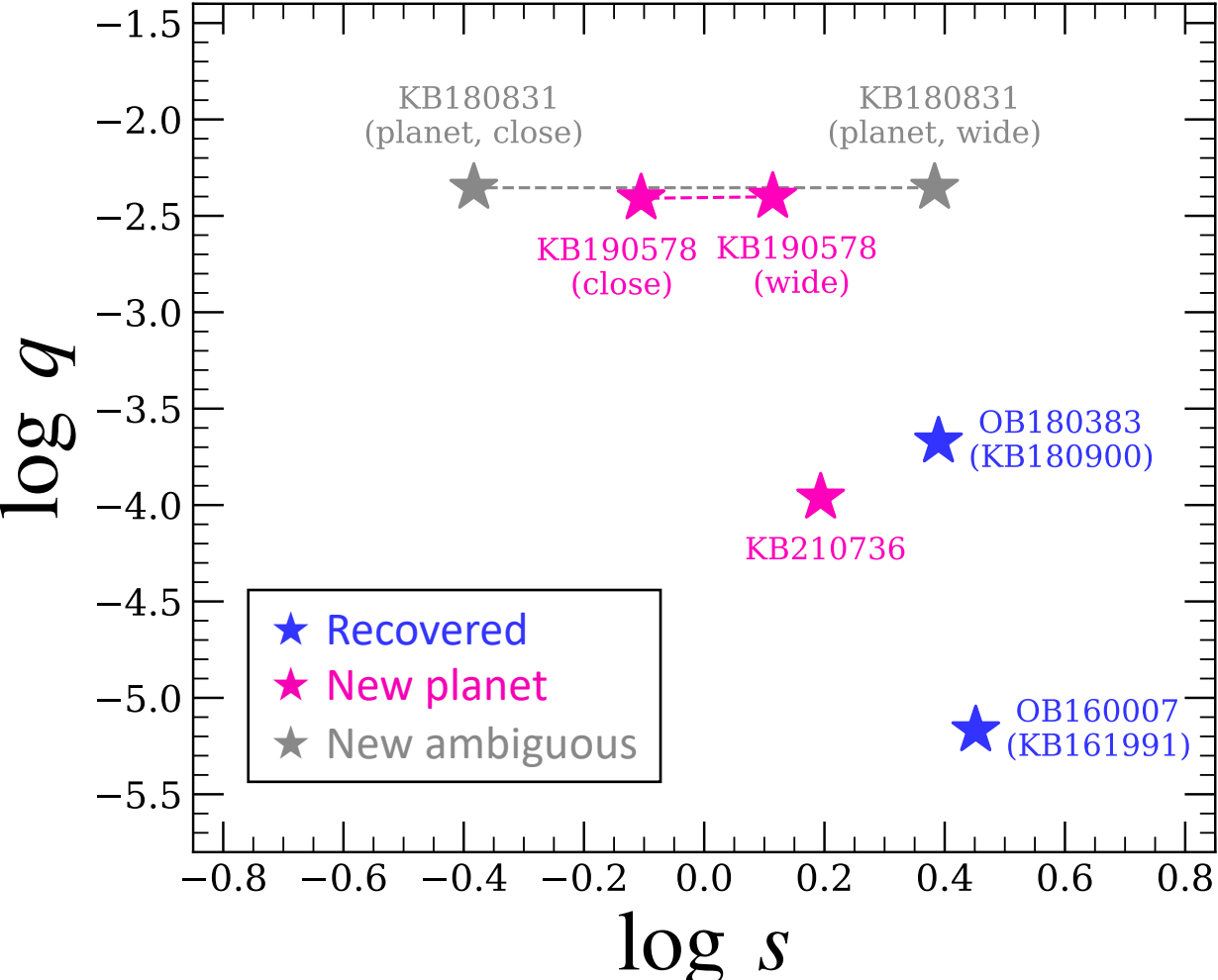
(Yang+ in prep.)

Anomaly Search: Summary



Implications

GOAL 1: Recover false negative anomalies in known events
GOAL 2: Estimate how many planets are missed in the whole dataset



4 new planet-like anomalies

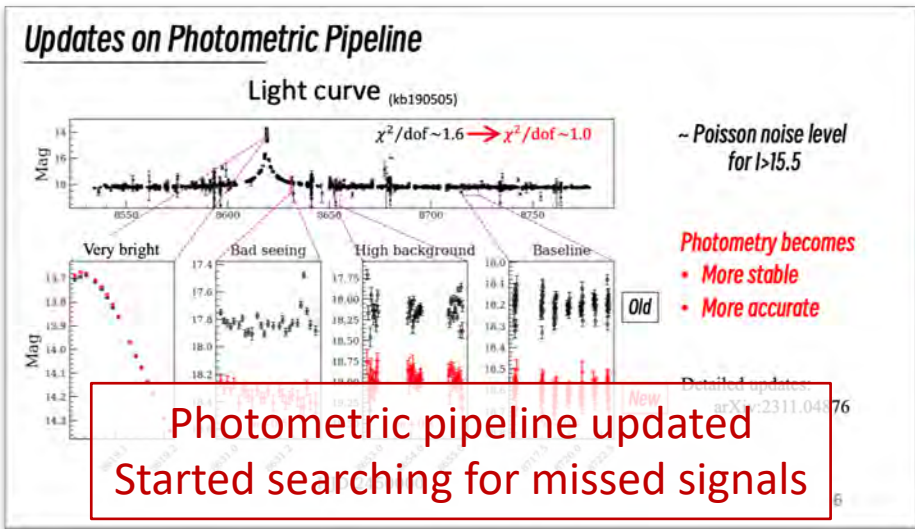
2x (clear) planet number:

$$2/352 \Rightarrow 4/352$$

2x planet sensitivity?

In progress

Summary



Photometric pipeline updated
 Started searching for missed signals

