

# Improving the latencies of the NEO discovery process

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CENTER FOR

ASTROPHYSICS

HARVARD & SMITHSONIAN

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**MPC** - The global clearinghouse for all information about asteroids, comets and other relatively small bodies like moons.

Cambridge, MA, USA  
Staff: 13

IAU, NASA -> PDS-SBN functional subnode

Services: orbits, observations, ephemeris, publications (MPEC, MPS, MPC, MPO), services+

## Near-Earth Asteroids Discovered

THIS MONTH:	6
THIS YEAR:	2967
ALL TIME:	30798

## Minor Planets Discovered

THIS MONTH:	6
THIS YEAR:	25175
ALL TIME:	1251628

## Comets Discovered

THIS MONTH:	0
THIS YEAR:	51
ALL TIME:	4434

## Observations

THIS MONTH:	306216
THIS YEAR:	35.0 million
ALL TIME:	370.5 million

NEO discovery and follow-up

**NEO Confirmation Page:** [https://www.minorplanetcenter.net/iau/NEO/toconfirm\\_tabular.html](https://www.minorplanetcenter.net/iau/NEO/toconfirm_tabular.html)

Volume (2022) : 5700+ NEOCP candidates -> ~3000 NEO discoveries

# Sar2593 -> 2022 EB5

## Near-Earth Object Confirmation Page

49 NEO candidates

**Sar2593**

2022-03-11T19:32:42 (received)

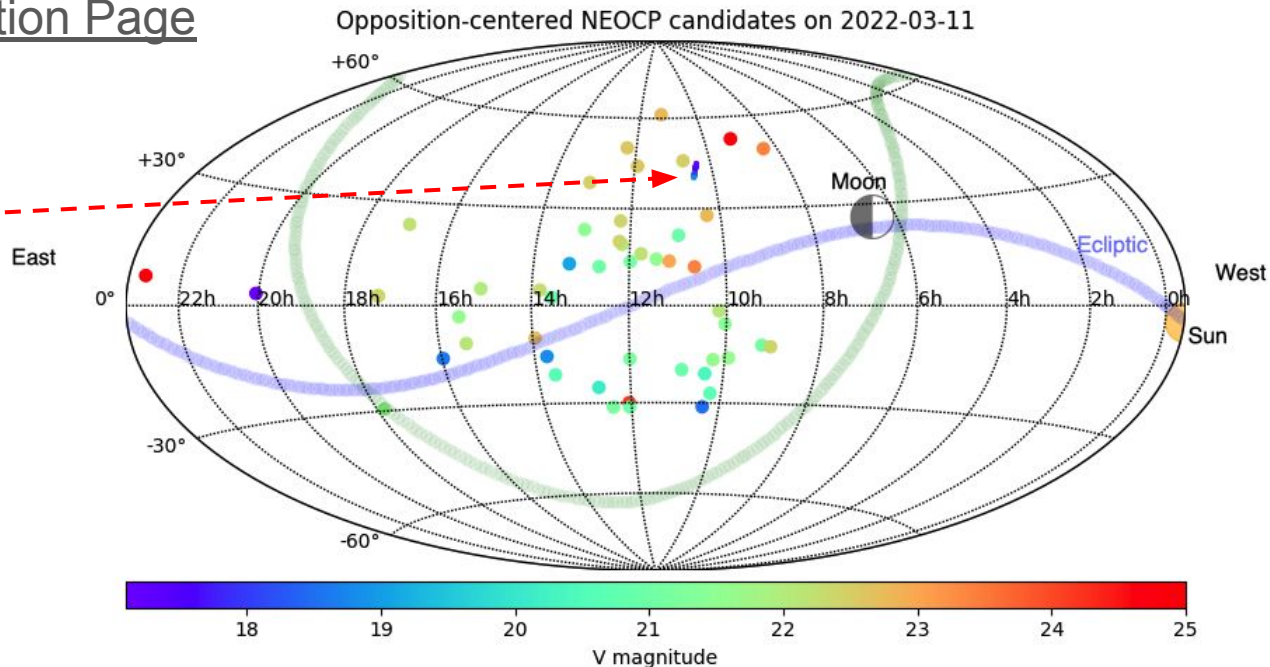
2022-03-11T19:36:01 (autoack)

2022-03-11 19:38:08 (NEOCP)

1-minute arc !

21 deg/day motion

Digest2 = 100



Sar2593	C2022 03 11.80848	10 29 48.21	+39 52 09.6	17.6	Ro	K88	(19:24:12 UTC)
Sar2593	C2022 03 11.80874	10 29 47.88	+39 52 28.9	17.6	Ro	K88	
Sar2593	C2022 03 11.80900	10 29 47.52	+39 52 49.1	17.7	Ro	K88	
Sar2593	C2022 03 11.80926	10 29 47.15	+39 53 08.5	17.7	Ro	K88	(19:25:00 UTC)

Once per hour (\*\*:20:00 UTC)

~2000 variant orbits for each NEOCP candidate, Unperturbed orbits

- 1) Select those with  $\text{MOID} < 0.001 \text{ AU}$
- 2) Compute ephemeris for the following 7 days, geocentric, flag  $\text{min\_dist} > 0.001 \text{ AU}$
- 3) If any encounter  $< 6 \text{ Earth\_radii}$ , accumulate... = INTERNAL warning
- 4) EXTERNAL warning:  $\text{arc} > 0.0437$ ,  $\text{tracklets} > 1$

First warning for **Sar2593**,

1928 out of 1929 orbits had close approach of  $< 6 \text{ Earth\_Radii}$  in next 7 days (all of the orbits  $< 1 \text{ E.R.}$ )

## Follow-up

trkid	obscode	obs_end_point	received	neocp	mag	arc(min)
00000GPDV	K88	20:03:09	20:09:16	20:16:40	16.8	38
00000GPIPi	K88	20:10:28	20:18:03	20:23:45	16.6	46
00000GPKeN	K88	20:19:58	20:28:19	20:33:54	16.4	55
00000GPKeO	G02	19:57:33	20:33:20	20:35:48	16.9	33
<b>SCOUT</b>	<b>WARNING</b>	<b>EMAIL</b>				
00000GPKeP	K88	20:25:22	20:33:43	20:37:47	15.3	61
00000GPKeQ	K88	20:30:24	20:38:54	20:41:52	16	66
00000GPN8y	K88	20:41:43	20:48:34	20:51:52	15.5	77
00000GPN91	K88	20:47:39	20:53:29	21:02:21	15.2	83
00000GPN92	K88	20:53:16	21:05:05	21:12:29	14.7	89
<b>IMPACT</b>	<b>21:22</b>	<b>UTC</b>				
00000GPN94	246	21:10:24	21:16:05	21:24:21	0	106
00000GPN95	595	20:33:31	21:20:55	21:26:00	15.3	69
00000GPN9O	N88	21:04:12	21:55:50	22:00:04	0	100

22:23 UT - MPEC issued:

MPEC E178: 2022 EB5 [a=2.82,e=0.68,i=10.4,H=32.1]

# C8FF042 -> 2022 WJ1

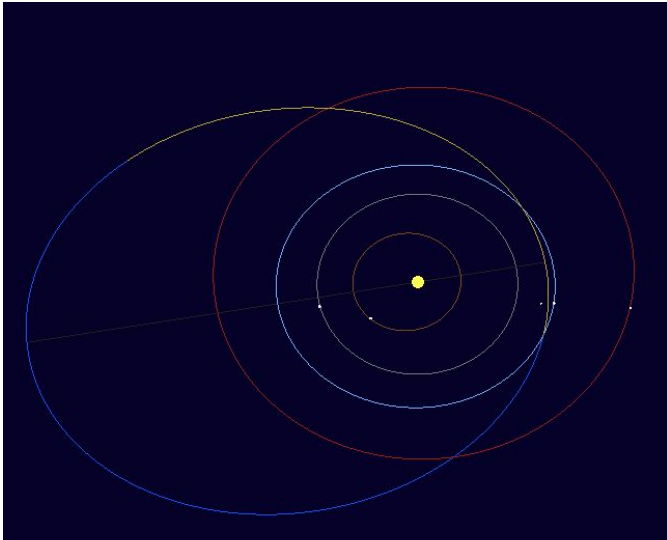
Nov. 19, 2022

discovered by CSS (D. Rankin)

05:17:39 (tracklet end) -> 05:26:52 (autoack-MPC received) -> 05:31:27 (on NEOCP)

8 different obscodes, 15 tracklets , impact: 08:27 UTC

Photo by R. Weryk



# NEOCP Processing times

[https://minorplanetcenter.net/iau/delays/neocp\\_delay.html](https://minorplanetcenter.net/iau/delays/neocp_delay.html)

## Current processing status

Last updated at 2022/12/04 23:14:33 UTC

<b>Autoack</b>	Idle	
<b>NEOCP + NEWNEO</b>	Idle	
<b>ID pipeline</b>	Running 14 minutes	
<b>Unprocessed ID submissions</b>	373	
<b>NEWNEO</b>	Executed -0 min	Last Processed -158 min
<b>NEOCP</b>	Executed -0 min	Last Processed -37 min

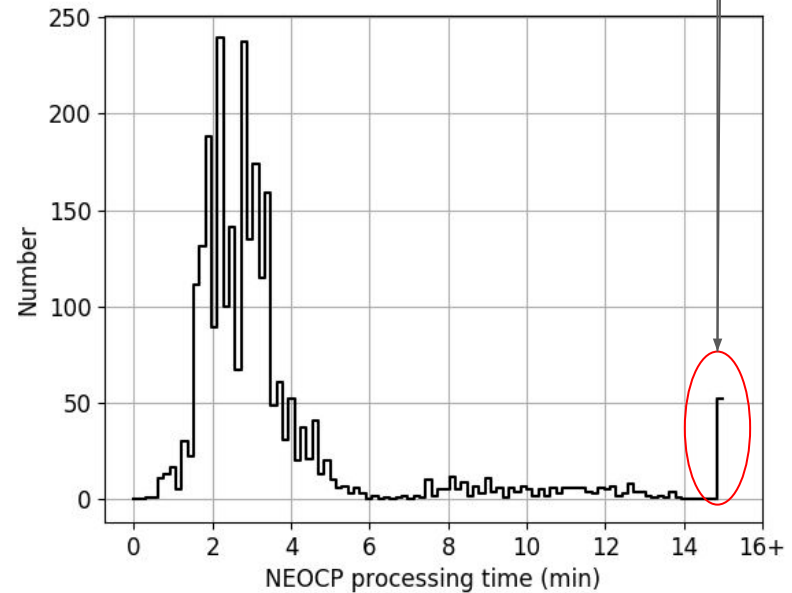
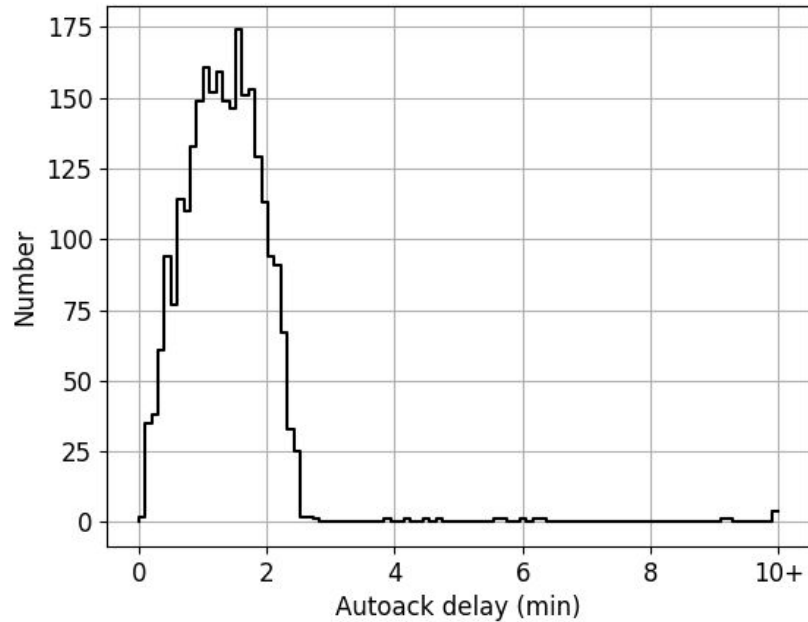
## DISCOVERY TRACKLETS

Last updated at 2022/12/04 23:15:02 UTC

NEOCP desig	trksub	trkid	date	obscode	submission delay (min)	autoack delay (min)	NEOCP delay (min)
<a href="#">C0EXZ05</a>	C0EXZ05	00000H0QXK	2022 11 28.255215	V00	20.2	1.4	2.5
<a href="#">C8KJF82</a>	C8KJF82	00000H0qjO	2022 12 01.321949	G96	23.1	2.4	2.4
<a href="#">Sar2649</a>	Sar2649	00000H13aL	2022 12 01.922140	K88	26.4	1.8	3.3
<a href="#">C8KJGX2</a>	C8KJGX2	00000H0qjR	2022 12 01.320068	G96	28.1	2.1	2.5
<a href="#">C8KJAQ2</a>	C8KJAQ2	00000H0qjN	2022 12 01.315856	G96	29.7	2.6	2.5
<a href="#">C8KJ3X2</a>	C8KJ3X2	00000H0qjK	2022 12 01.312589	G96	29.8	2.2	3.5
<a href="#">C8KGNC2</a>	C8KGNC2	00000H0qiu	2022 12 01.274051	G96	29.9	2.5	2.4

# NEOCP Processing times

Current delays: \_\_\_\_\_





## Autoack pipeline (MPC receiving and ack protocol)

1-min cronjob , single-threaded, sequential -> 1-min cronjob single-threaded, NEO prioritized

## NEOCP and NEWNEO pipelines

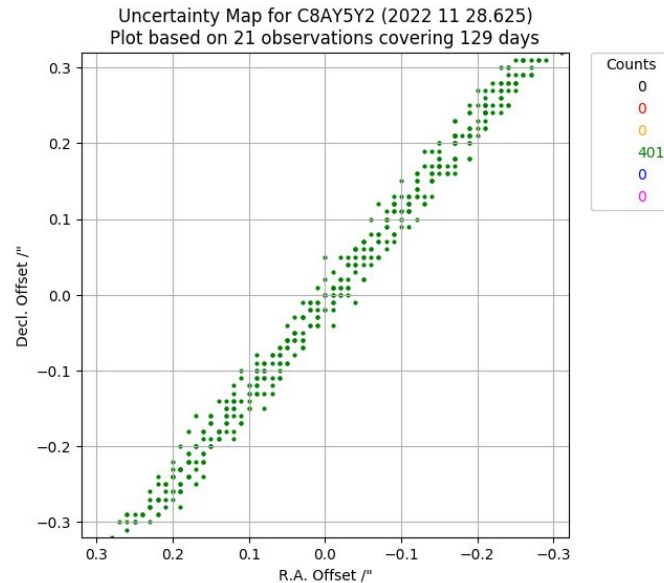
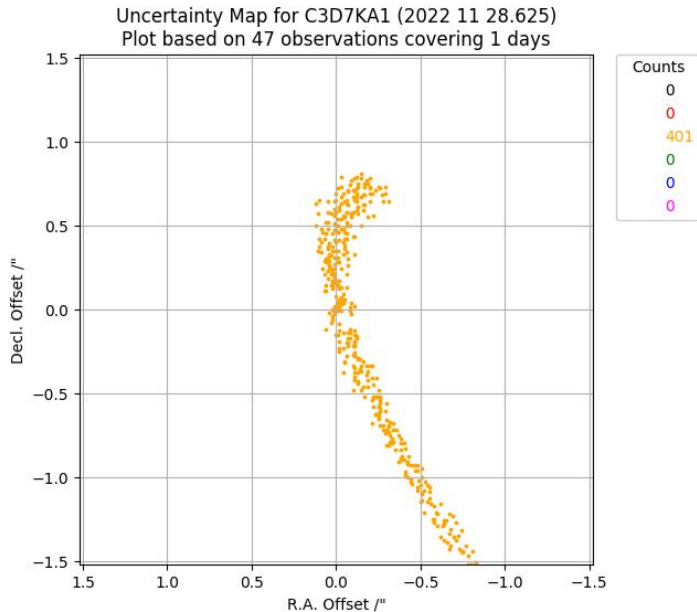
2-min cronjob, sequential -> 1-min cronjob, parallelized

## Close-encounter warnings

Immediate when new tracklet arrives

## Fully perturbed orbits for some objects:

- Very short arcs, but many observations (small, nearby NEOs): Arc: > 1.0 day, > 8 tracklets
- Very long arcs (precoveries, comets): Arc: > 30 days, > 3 distinct nights



Revisited and updated services:

- Ephemeris Service - uncertainties, maps
- NEAObs: NEA Observation Planning Aid
- Observable List Customizer
- MPChecker

# Identifications pipeline

Public engagement - find linkages between ITF tracklets, new orbits, orbit extensions, NEOCP, automation

~167,000 submissions; 83,000 new orbits

22 NEOs found in 2022

<https://minorplanetcenter.net/mpcops/documentation/identifications/>

# Faster MPC pipelines

Parallelization and multi-core processing (slurm)

Getting ready for future surveys and data volume: Rubin Observatory and NEO Surveyor - (unexpected volume from TESS, 4 ATLAS telescopes or occasional high-volume backlogs from large surveys)

-> orbit computing, data ingestion, databases and distribution at AWS

-> source code on Github



**kubernetes**

