Meerkat Asteroid Guard
ESA's imminent impactor warning service

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Introduction

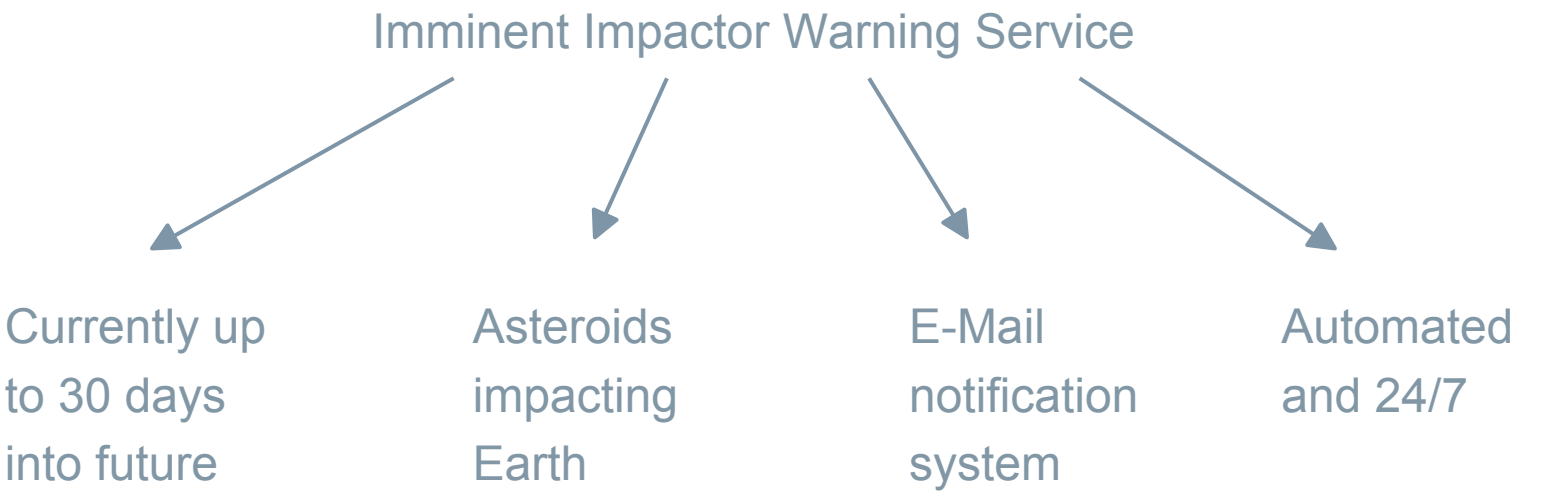
Motivation:

- Knowing about impactors in advance:
  Aegis (old AstOD) for long-term, Meerkat for imminent
- (Finding scientifically interesting objects: e.g. IEOs)

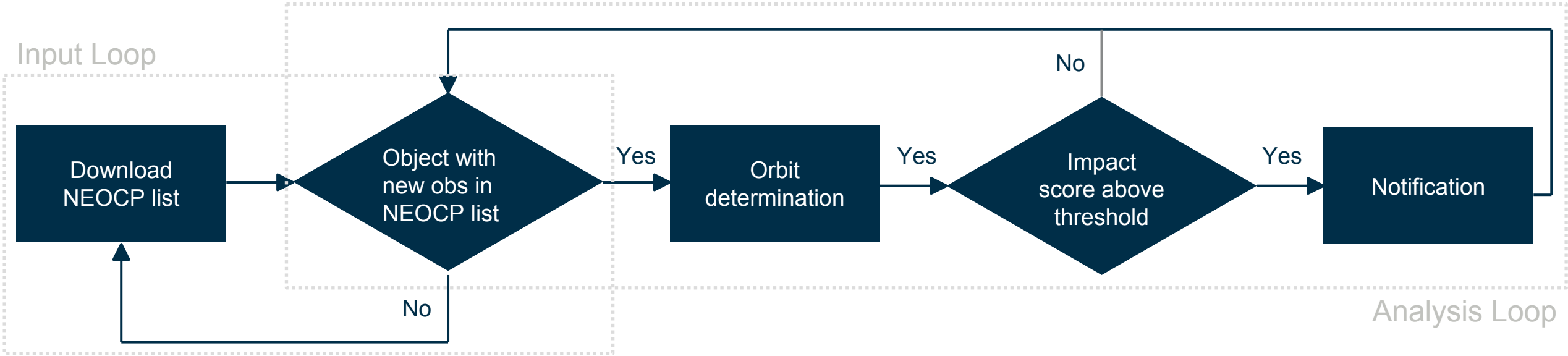
Goals [1]:

- Independent system
- Clear and quick threat assessment
- Reduce time for scheduling follow-up observations

Introduction



Simplified system architecture / Input loop



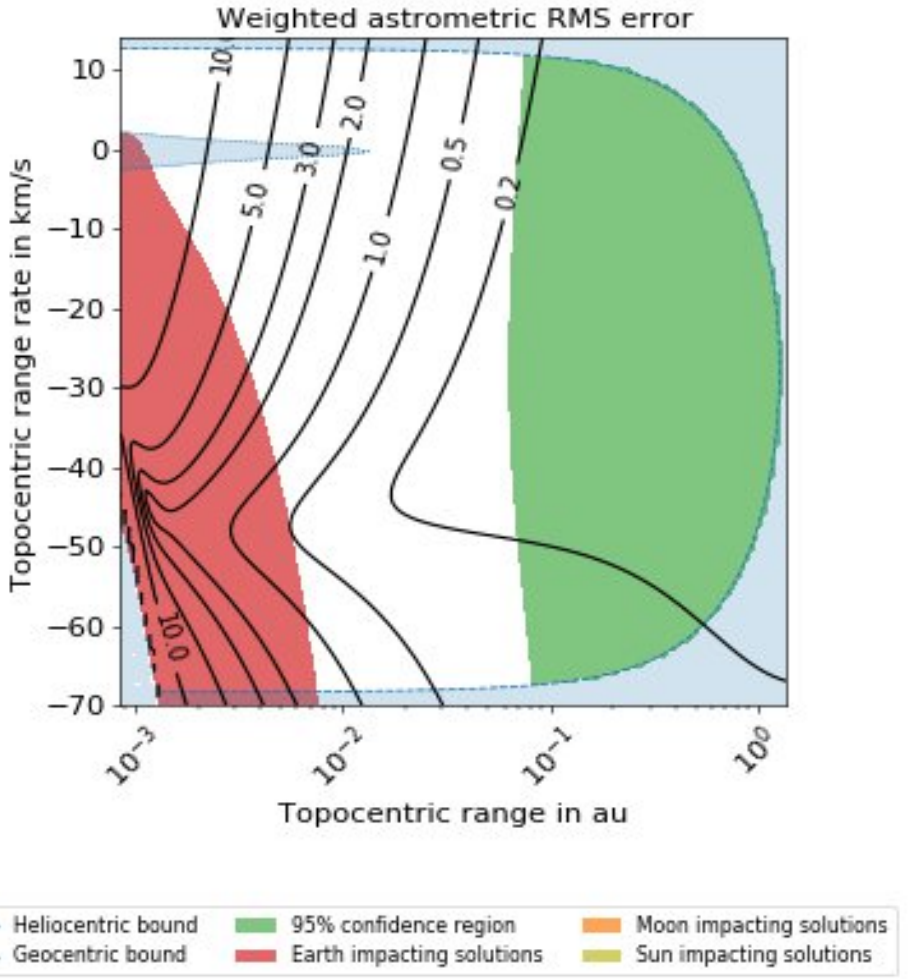
Input: MPC (Minor Planet Center)

- NEOCP (NEO Confirmation Page) list
- Tracklets

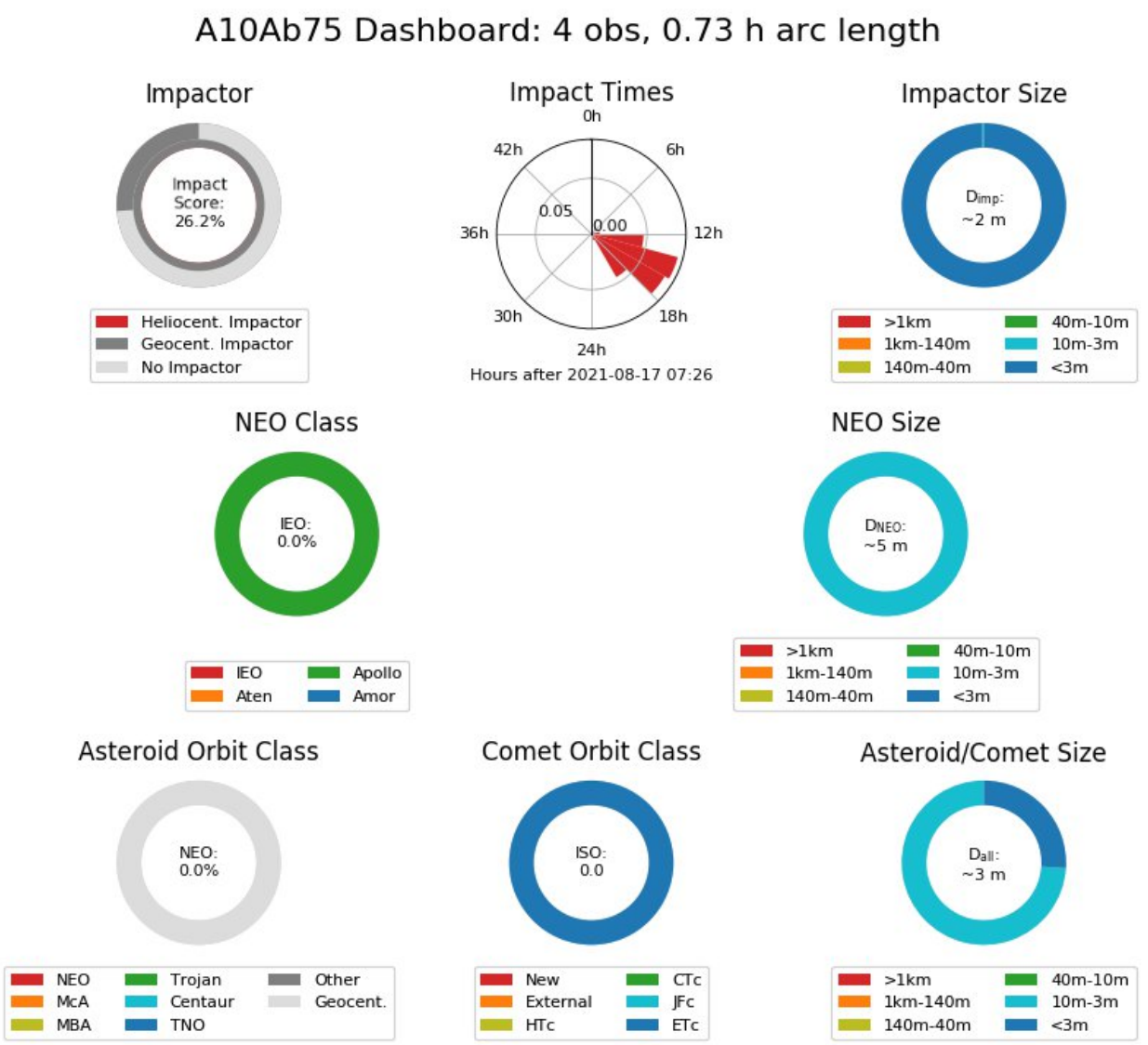
Analysis loop

Orbit determination: Systematic Ranging [2,3,4]

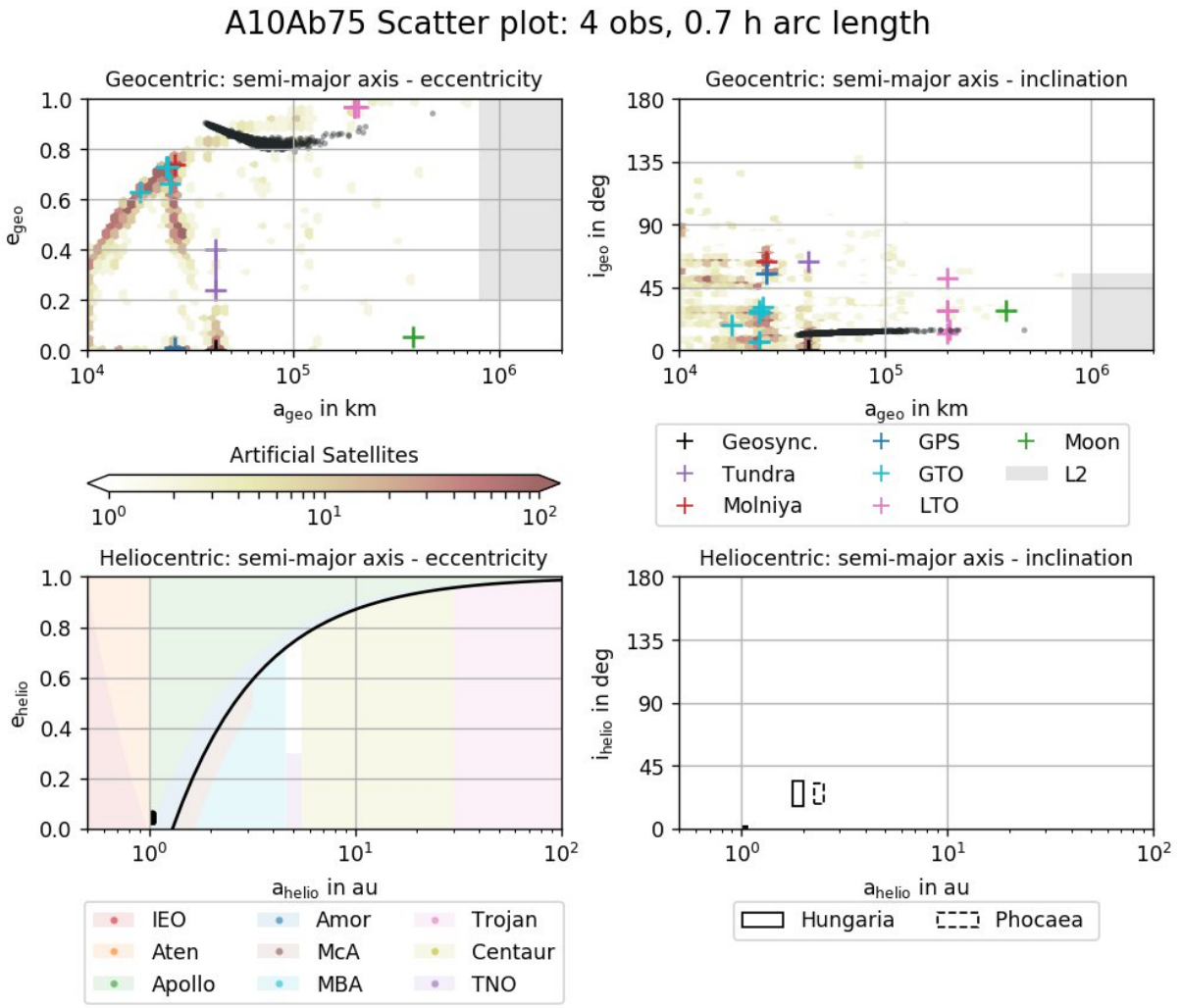
- 160 x 160 grid
- Uniform prior distribution



Threat assessment: Dashboard plot

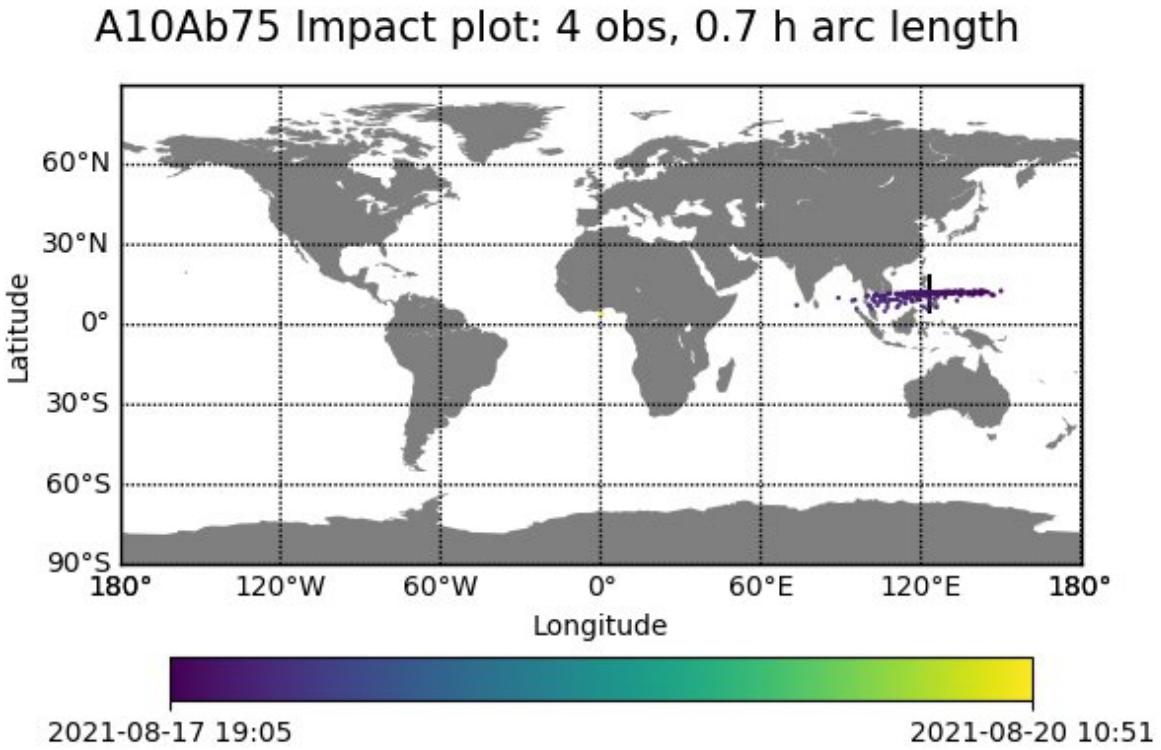


Threat assessment: Scatter plot



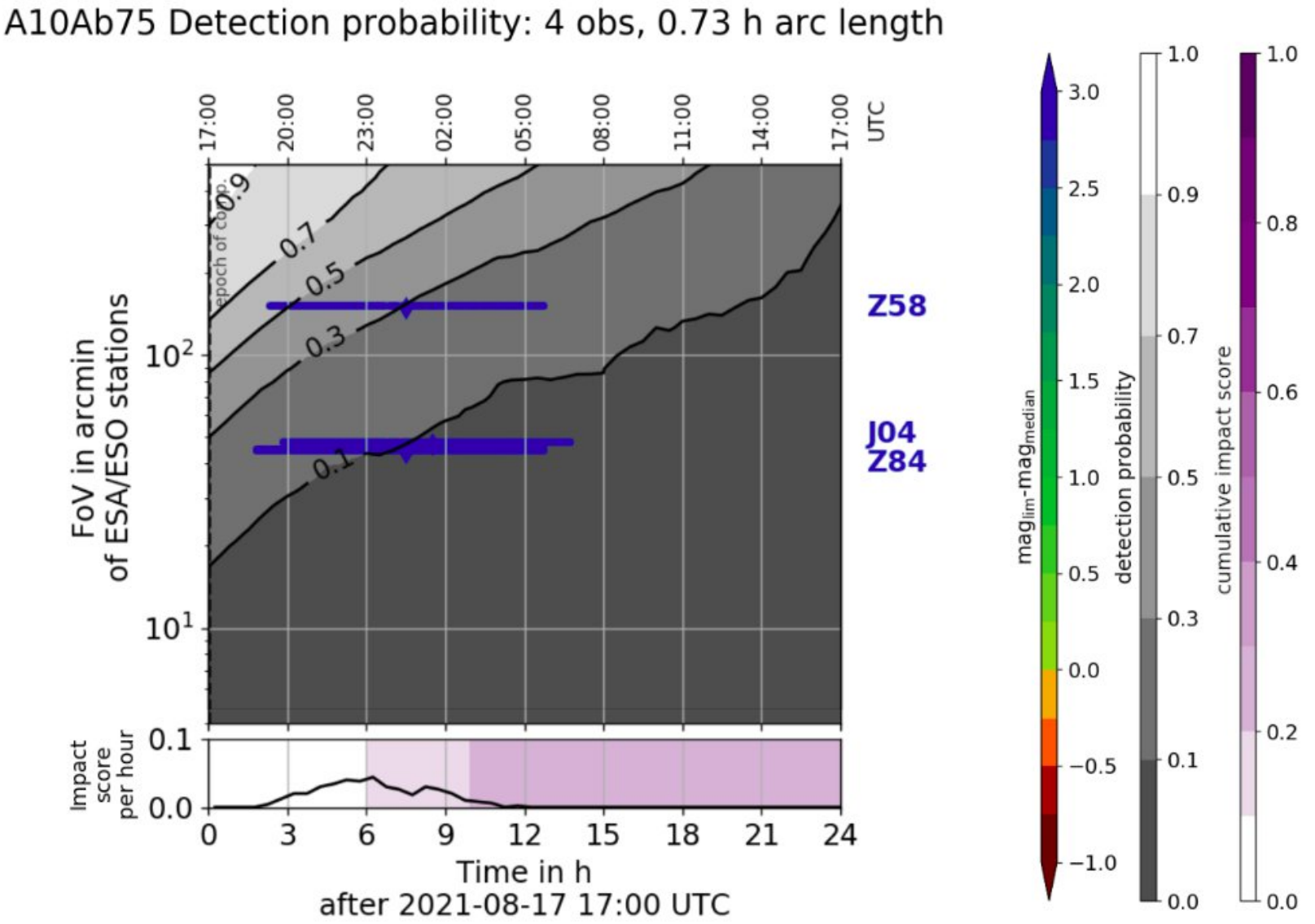
First observation: 2021-08-17 06:42:42, Last observation: 2021-08-17 07:26:19,
Number of observations: 4

Threat assessment: Impact plot

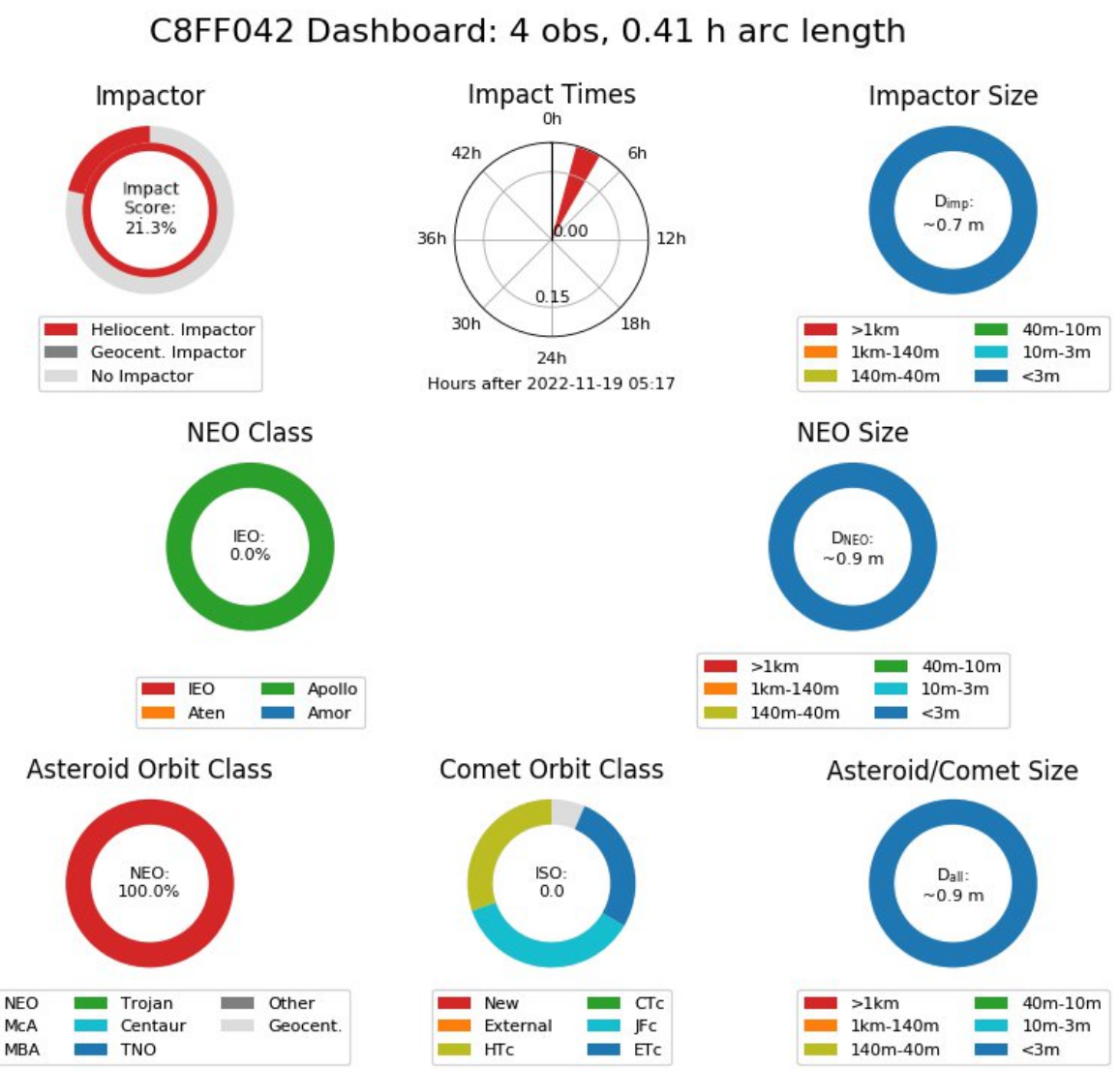


First observation: 2021-08-17 06:42:42, Last observation: 2021-08-17 07:26:19,
Number of observations: 4,
Median Longitude: 123.25deg, Median Latitude: 11.84deg

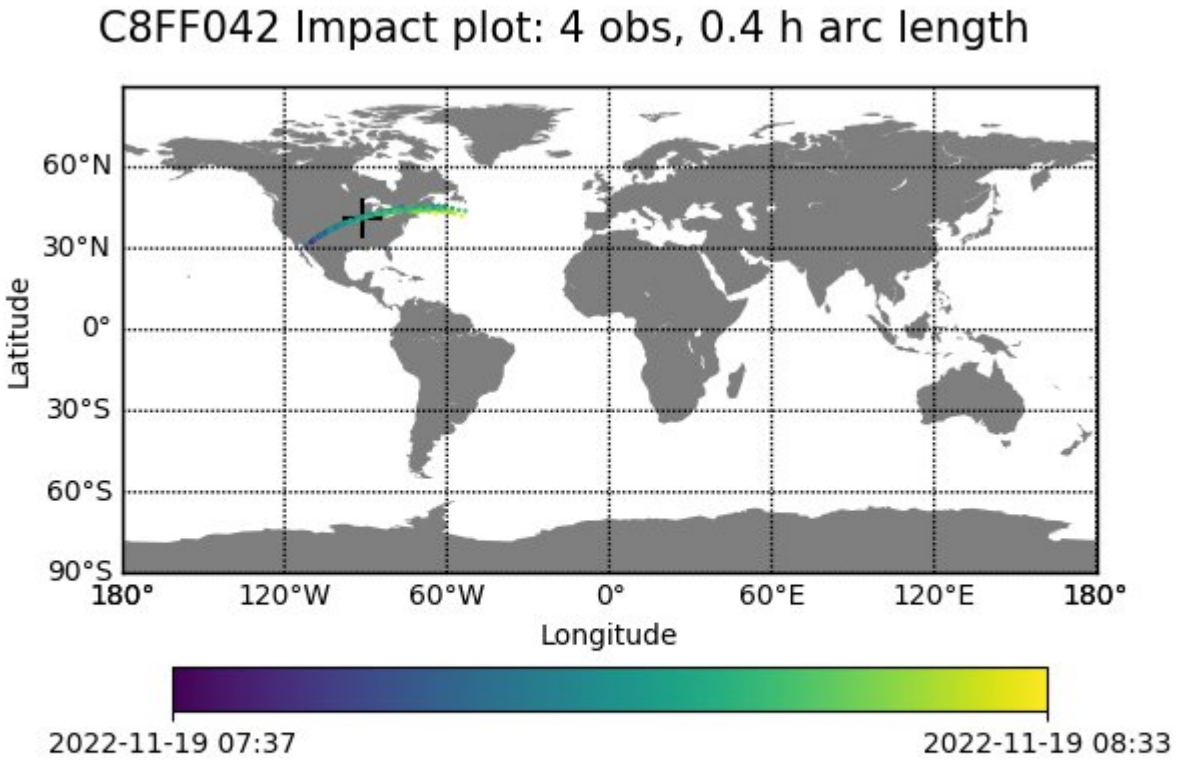
Reduce time for scheduling follow-up observations



Example: C8FF042

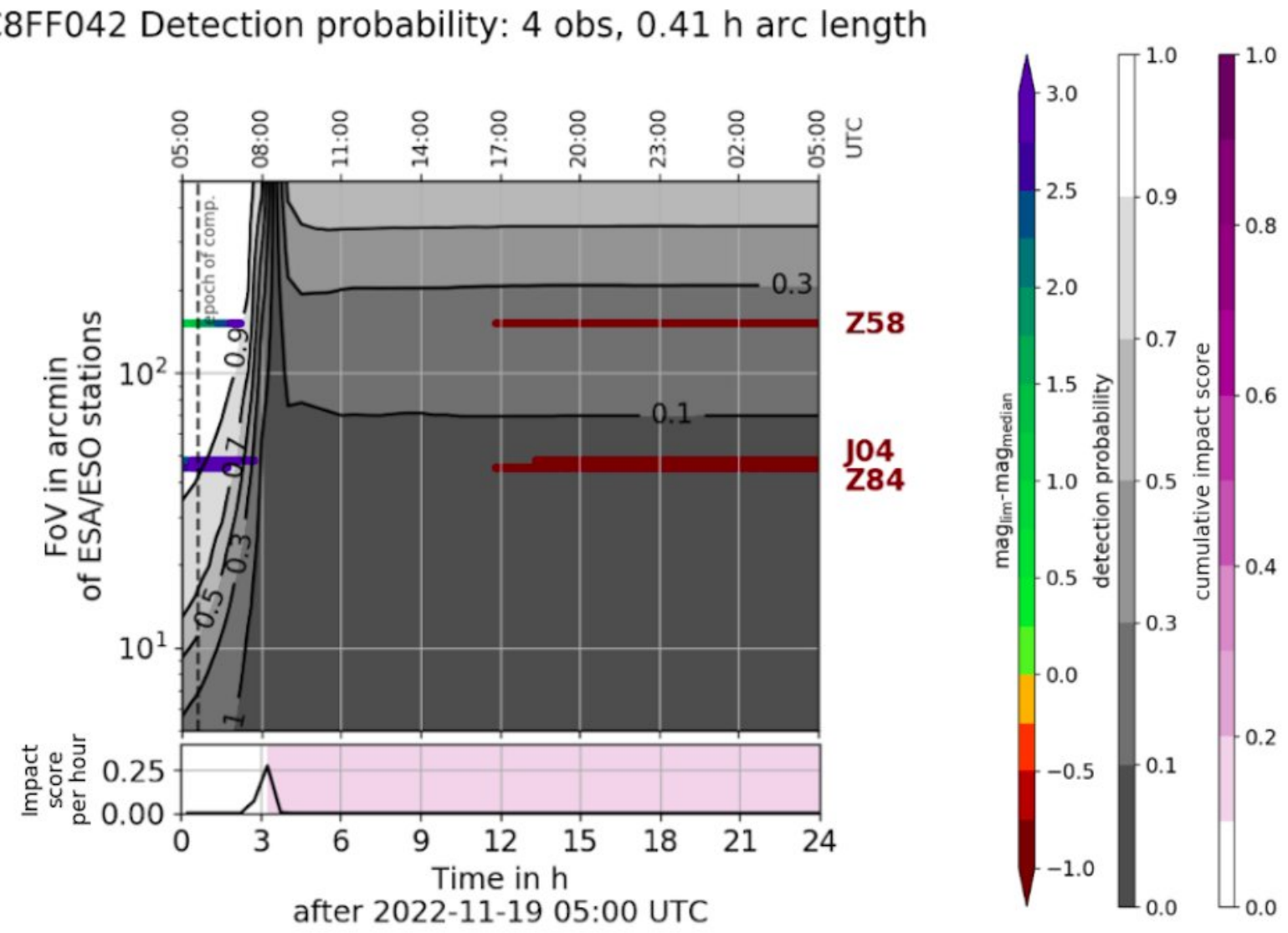


Example: C8FF042



First observation: 2022-11-19 04:53:01, Last observation: 2022-11-19 05:17:39,
Number of observations: 4,
Median Longitude: -91.5deg, Median Latitude: 41.48deg

Example: C8FF042



E-mail notification

E-Mail Notification:

- Warning. New or updated objects above threshold:
  - Impact score > 1%
  - DCA < 7 Earth radii
- All-Clear. Drop below threshold after warning
- Removed. Removed after warning

E-Mail Plot:

- Score dashboard plot
- Systematic ranging plot
- Sample scatter plot
- Impact plot

E-mail notification

E-Mail Content:

- Scores
- Impact data
- Observations
- Current (median) data

Object: C8FF042

Scores:

- Imp: 0.21256
- GEOImp: 0.00000
- NEO: 1.00000
- GEO: 0.00000

Impact data:

- 95% early TImp: 2022-11-19 07:46 UTC
- 95% late TImp: 2022-11-19 08:29 UTC
- Weighted mean TImp: 2022-11-19 08:09 UTC
- 95% large H: ~34.44 mag
- 95% low H: ~33.26 mag
- Weighted mean H: ~33.68 mag
- 95% low d: ~0.5 m
- 95% large d: ~0.8 m
- Weighted mean d: ~0.7 m

Observations:

- NObs: 04
- ObsArc: 0.411 h
- LastRA: 24.46 deg
- LastDec: -0.73 deg
- LastV: 19.16 mag

Current (median) data:

- Epoch: 2022-11-19 05:30:00 UTC
- RA: 24.70 deg
- Dec: 0.71 deg
- Unc: 14.49 arcmin
- Rate: 79.02 arcsec/min
- V: 19.15 mag

To subscribe to Meerkat automatic mailing list, please send an email to neocc@esa.int

References

[1] Frühauf, M., Micheli, M., Oliviero, D. & Koschny, D. (2021, April 26–30). Meerkat Asteroid Guard imminent impactor warning service of the European Space Agency [Poster session]. 7th IAA Planetary Defense Conference, Vienna, Austria.

[2] Frühauf, M., Micheli, M., Santana-Ros, T., Jehn, R., Koschny, D., & Ramírez Torralba, O. (2019). A systematic ranging technique for follow-ups of NEOs detected with the Flyeye telescope. In 1st NEO and Debris Detection Conference

[3] Chesley, S. R. (2004). Very short arc orbit determination: The case of asteroid 2004 FU 162 . In Proceedings of the International Astronomical Union, 2004. IAUC197 (pp. 255–258)

[4] Farnocchia, D., Chesley, S. R., & Micheli, M. (2015). Systematic ranging and late warning asteroid impacts. Icarus, 258,18–27