Solar system objects
oo

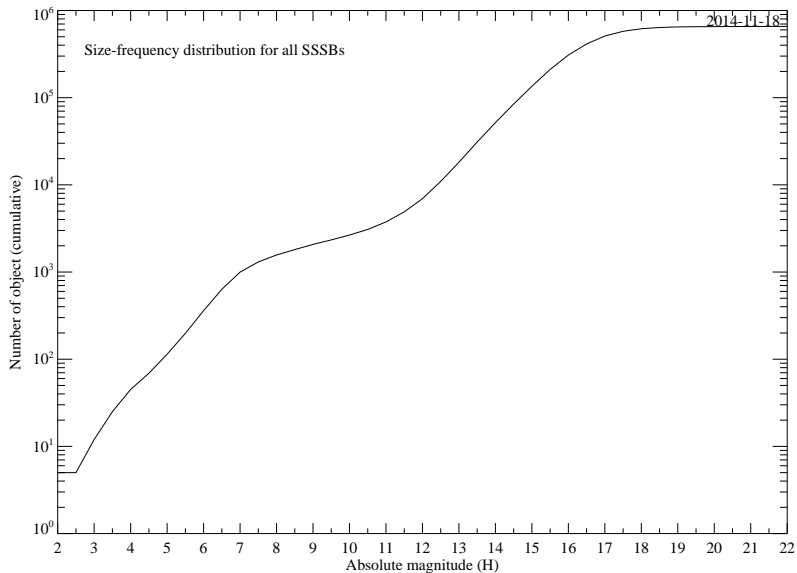Expected Gaia discoveries
oooo

Alert flow

Pipeline
oooo

The Gaia Fun SSO pipeline

B. Carry[1]
W. Thuillot[1]
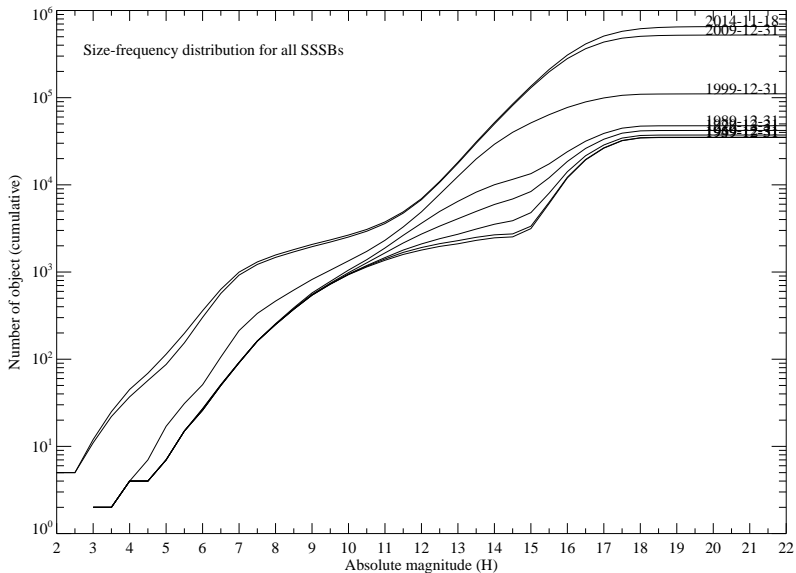**P. David**[1]
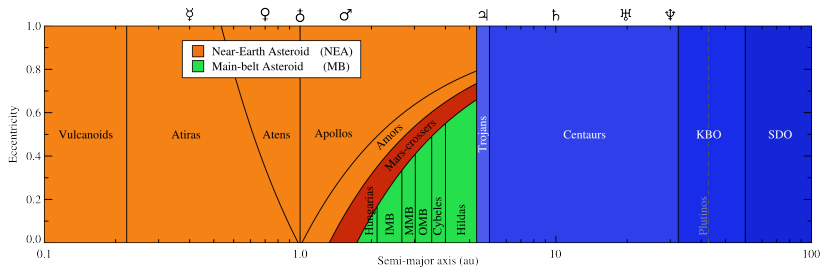**J. Berthier**[1]

[1]IMCCE, Paris Observatory

SSO completeness?

Size-frequency distribution for all SSSBs

2014-11-18

SSO completeness?

SSO populations

Solar system objects
oo

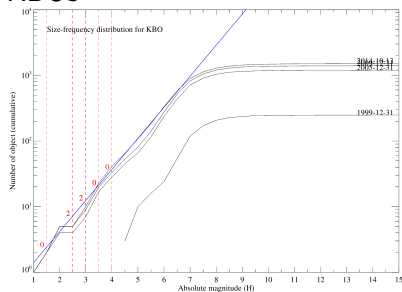Expected Gaia discoveries
●ooo

Alert flow
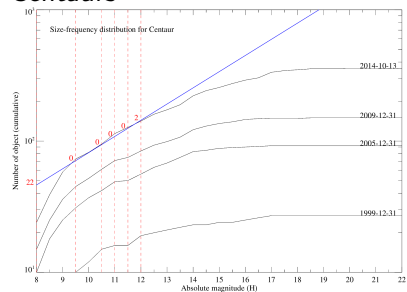
Pipeline
oooo

Evaluating the number of discoveries

- Each population is described by its quartiles:
  - Semi-major axis: Q25, Q50, Q75
  - Eccentricity: Q25, Q50, Q75
  - Inclination: 0°

- Considered heliocentric distances:
  - Perihelion
  - Aphelion
  - Average distance

- Gaia observing geometry is dictated by solar elongation
  - Average: 90°
  - Low elongation: 45°
  - Large elongation: 135°

▶ Conversion from limiting apparent magnitude to H

KBOs & Centaurs

KBOs

Centaurs

Elongation: 90°

Solar system objects
○○

Expected Gaia discoveries
○○●○

Alert flow

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Main-Belt Asteroids

Size-frequency distribution for MB

2014-10-13
2009-12-31
2005-12-31
1999-12-31

Number of object (cumulative)

Absolute magnitude (H)
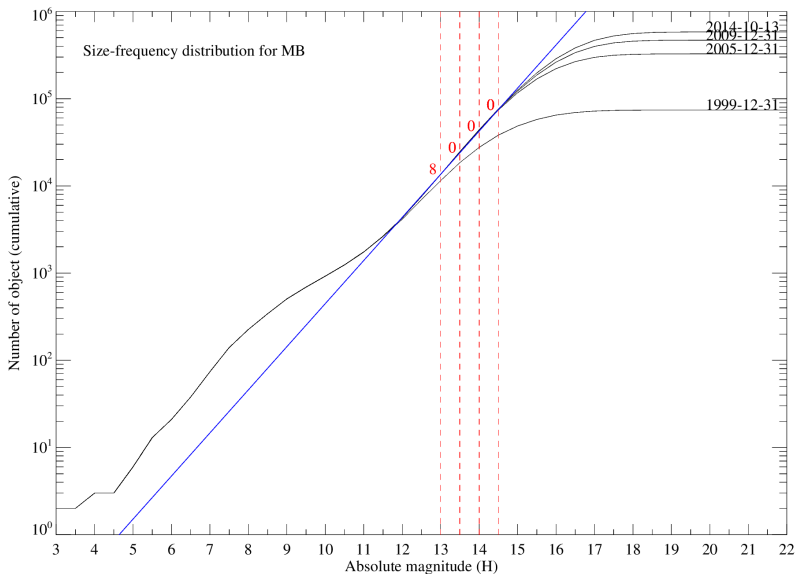
Elongation: 45°

Main-Belt Asteroids

Size-frequency distribution for MB

Elongation: 90°

Solar system objects
oo

Expected Gaia discoveries
ooo●

Alert flow

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Near-Earth Asteroids

Size-frequency distribution for NEA

Elongation: 90°

Solar system objects
○○

Expected Gaia discoveries
○○○●

Alert flow

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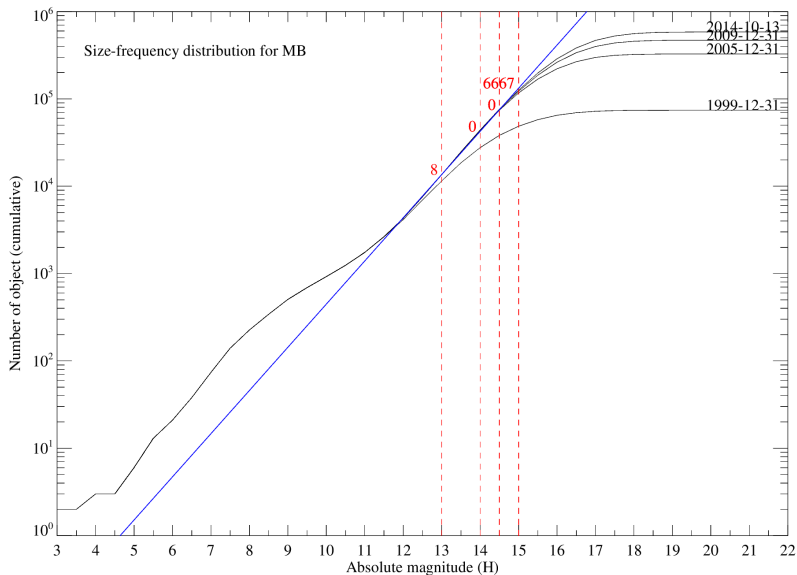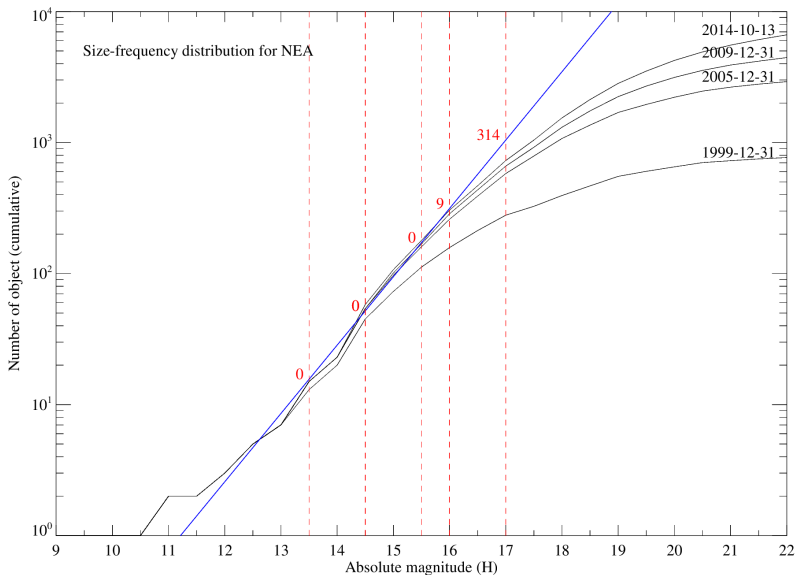
Near-Earth Asteroids

Elongation: 45°

Solar system objects
○○

Expected Gaia discoveries
○○○●

Alert flow

Pipeline
○○○○

Near-Earth Asteroids

Size-frequency distribution for NEA

870+

2014-10-13
2009-12-31
2005-12-31

859

314

1999-12-31

0

5

Number of object (cumulative)

Absolute magnitude (H)

Elongation: 135°

Solar system objects
oo

Expected Gaia discoveries
oooo

Alert flow

Pipeline
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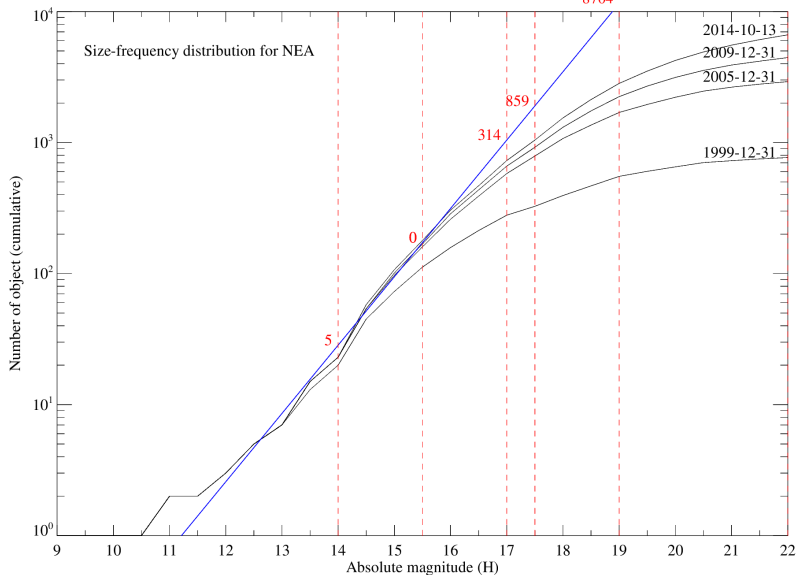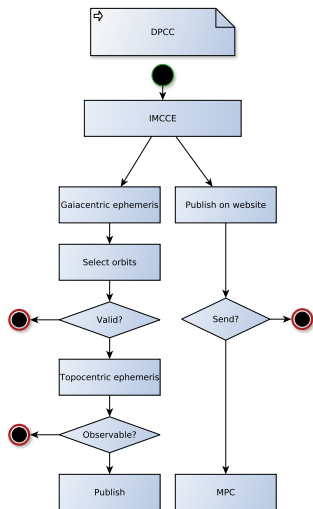
Gaia FUN SSO alerts

- Strong differences among populations
  - Almost no KBO and Trojans
  - Many MBAs
  - NEAs and possibly Centaurs

- Baseline expectation
  - MBA: 30k to 50k
  - NEA: 500
  - ▶ 100 new objects a week, 2 being NEAs

- Discoveries from the ground are not stopping
  - Possible pool of discoveries constantly reduces
  - Numbers here are **maximum** discovery estimates
 - ▶ Expect less real discoveries

Solar system objects
oo

Expected Gaia discoveries
oooo

Alert flow

Pipeline
oooo

Gaia FUN SSO Pipeline

1. Observational report $\rightarrow$ MPC

2. Validation of orbits

3. Selection of orbits

4. Topocentric ephemeris

5. Publication

Solar system objects
oo

Expected Gaia discoveries
oooo

Alert flow

Pipeline
oooo

Gaia FUN SSO Pipeline
1. Transmission to MPC
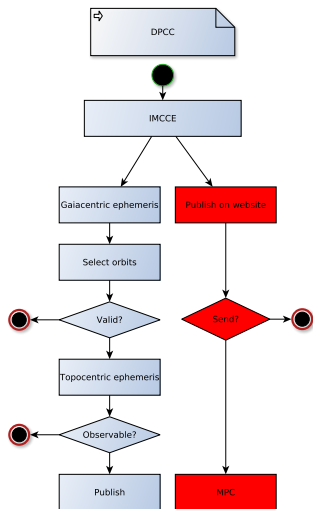
1. **Observational report $\rightarrow$ MPC**

2. Validation of orbits

3. Selection of alerts for observers

4. Topocentric ephemeris

5. Publication

Solar system objects
oo

Expected Gaia discoveries
oooo

Alert flow

Pipeline
●ooo
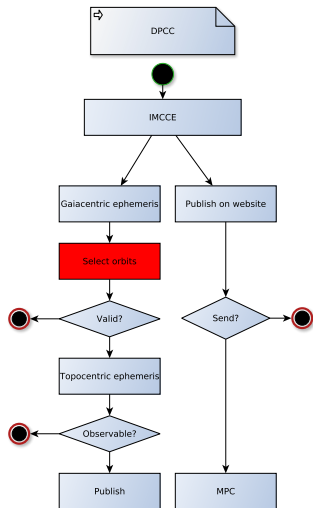
Gaia FUN SSO Pipeline

2. Preliminary ephemeris
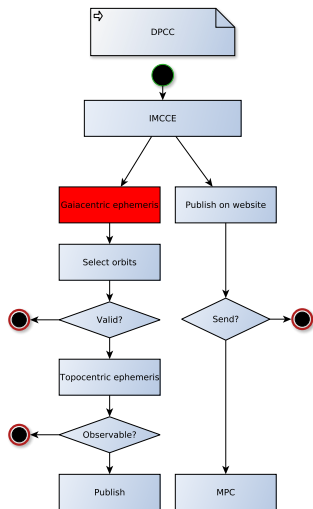
1. Observational report $\rightarrow$ MPC

2. **Preliminary ephemeris**

3. Selection of alerts for observers

4. Topocentric ephemeris

5. Publication

Solar system objects
oo

Expected Gaia discoveries
oooo

Alert flow

Pipeline
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Gaia FUN SSO Pipeline
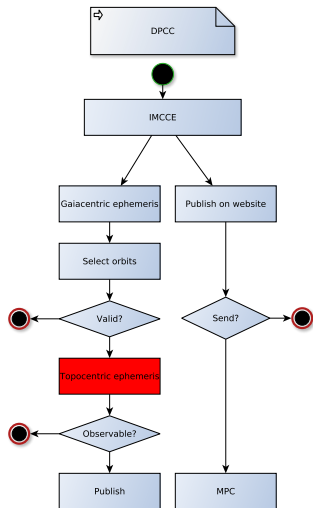## 3. Selection of orbits

1. Observational report $\rightarrow$ MPC

2. Preliminary ephemeris

3. **Selection of alerts for observers**

4. Topocentric ephemeris

5. Publication

Solar system objects
oo

Expected Gaia discoveries
oooo

Alert flow

Pipeline
oo●o

Gaia FUN SSO Pipeline

4. Topocentric ephemeris

1. Observational report $\rightarrow$ MPC

2. Preliminary ephemeris

3. Selection of alerts for observers

4. **Topocentric ephemeris**

5. Publication

Solar system objects
oo

Expected Gaia discoveries
oooo

Alert flow

Pipeline
ooo●

Gaia FUN SSO Pipeline

5. Alert released

1. Observational report → MPC

2. Preliminary ephemeris

3. Selection of alerts for observers

4. Topocentric ephemeris

5. **Publication**