Preliminary reduction and analysis of the Bucharest Observatory photographic plates: Astrometry of asteroids (1931-1933)

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A new reduction of old observations in the Gaia era, Paris, 20-22 June 2012

Bucharest Photographic Plates Archive

- The Prin-Merz double refractor (F=6 m, D=0.38 m, $35''$/mm)
- The observations were made in the -20° $\leq \delta \leq$ 70° range
- Two type of plates were used 13×18 cm, 1.25°×1.75° (26%) and 24×24 cm, 2.3°×2.3 ° (74%)
- All plates were used directly with simple or multiple exposures,the results being stellar images

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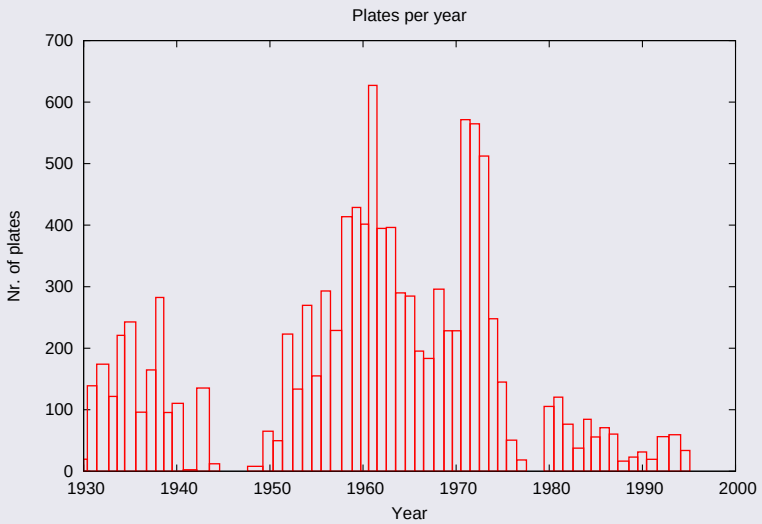

The census

- 10550 plates were obtained in the 1930 - 2000 period
- 92% of the plates obtained in the framework of astrometric programmes
- 8169 plates of 772 asteroids
- 318 plates of 52 comets
- 53 plates of Jupiter satellites, Neptune and Pluto
- 1900 plates of fundamental stars and optical counterparts of extragalactic radiosources

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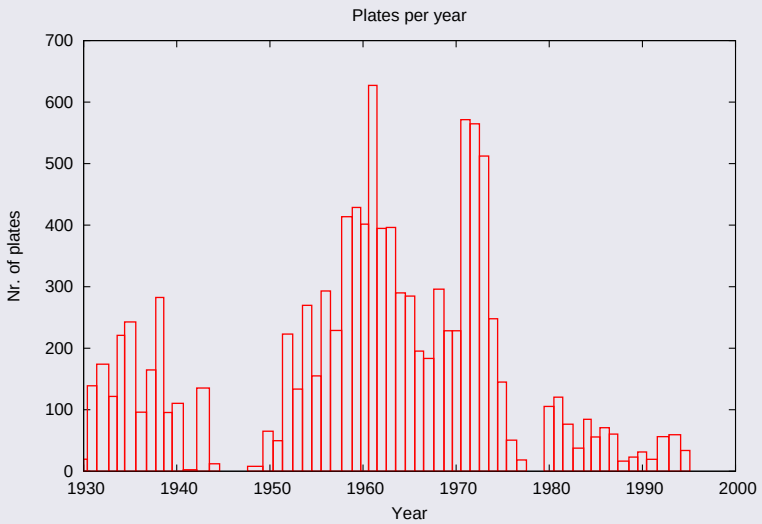

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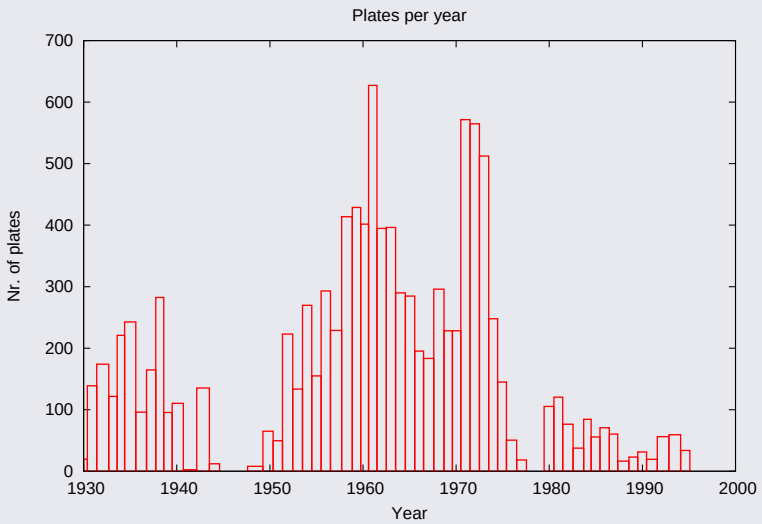

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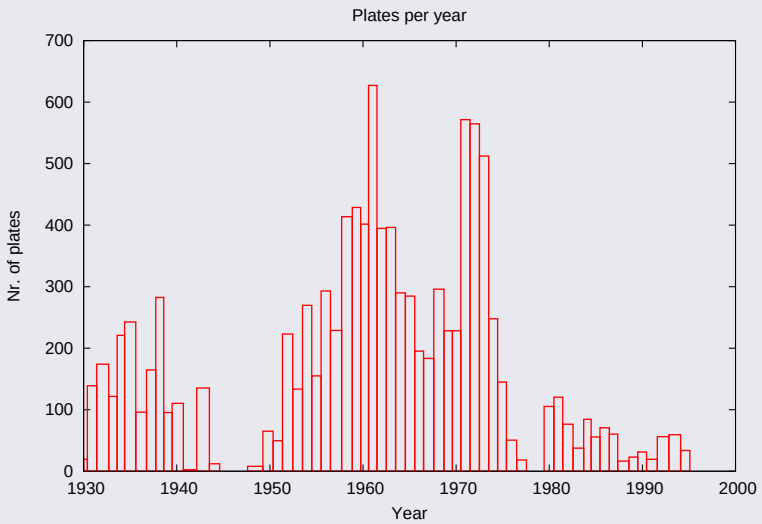

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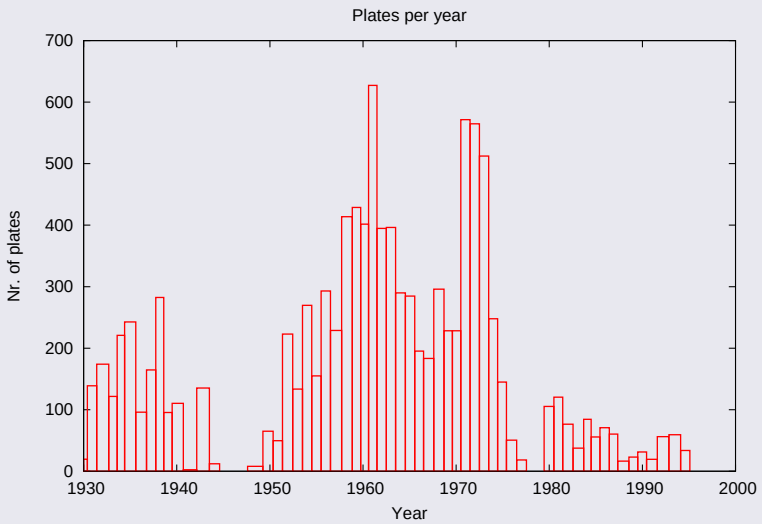

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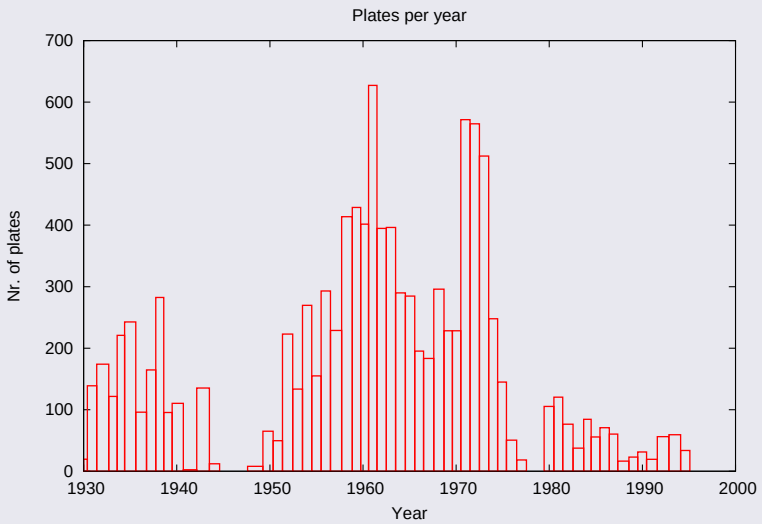

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Asteroids plates

Observations and data reduction

- Asteroids plates were obtained in the framework of two programmes *Minor Planets and the Dynamical Reference Frame* and *Precise Photographic Positions of Minor Planets*
- The main observing method was the double exposure of the plate with $T_{exp} < 10$min, $T_{stop} < 5$min between exposure
- The plates were measured on the ASCORECORD coordinatograph (reading precision 0.1μm) with both the reference stars and the minor planetes measured twice.
- 4 to 6 reference stars were used in the reduction process. The catalog used are PPM and Tycho2
- After an investigation of the whole plate archive we discovered that a series of observations were not capitalized due to the lack of accurate star catalogues containing positions and proper motions

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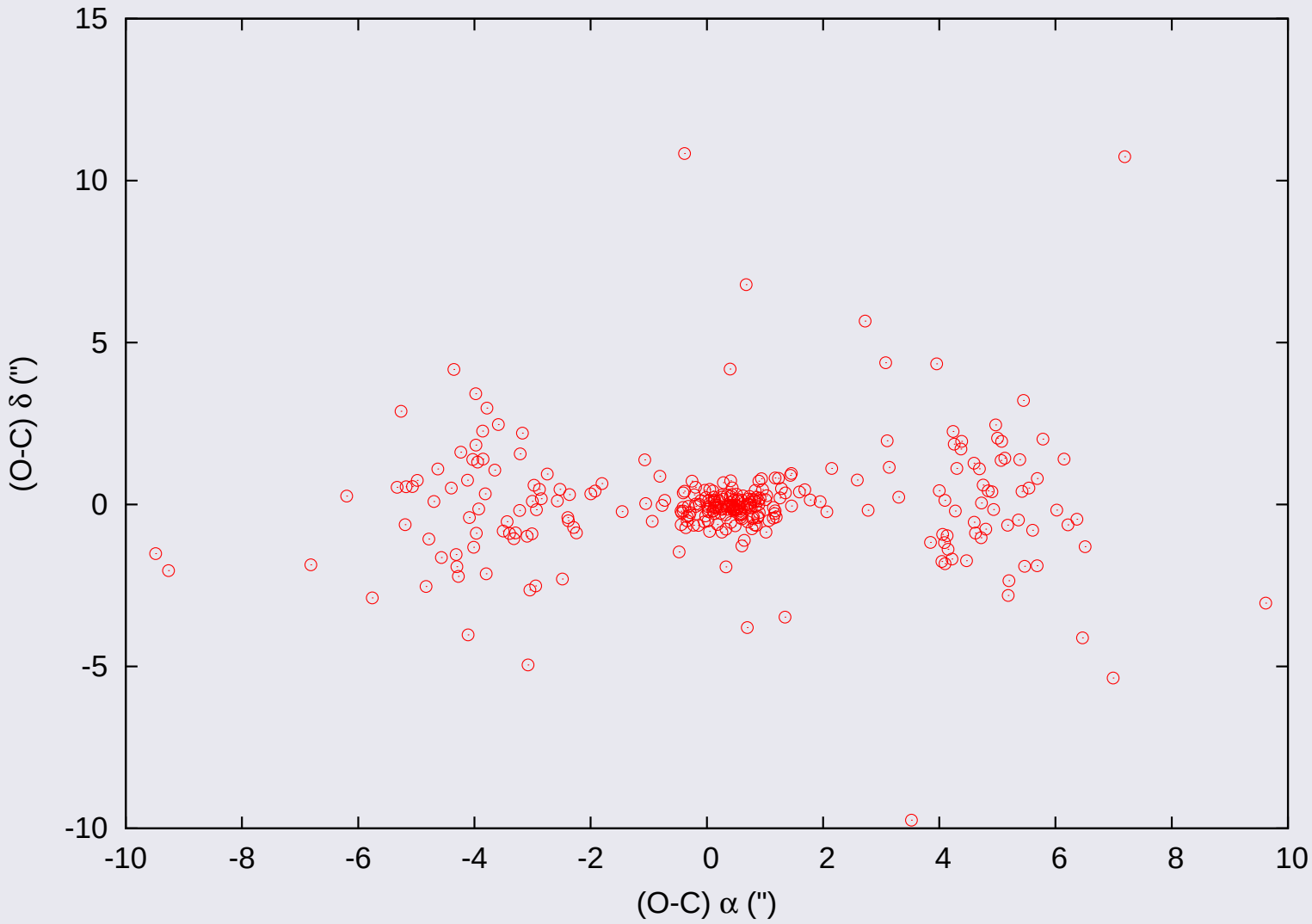
(O-C) values for 300 astrometric positions (150 main belt asteroids)



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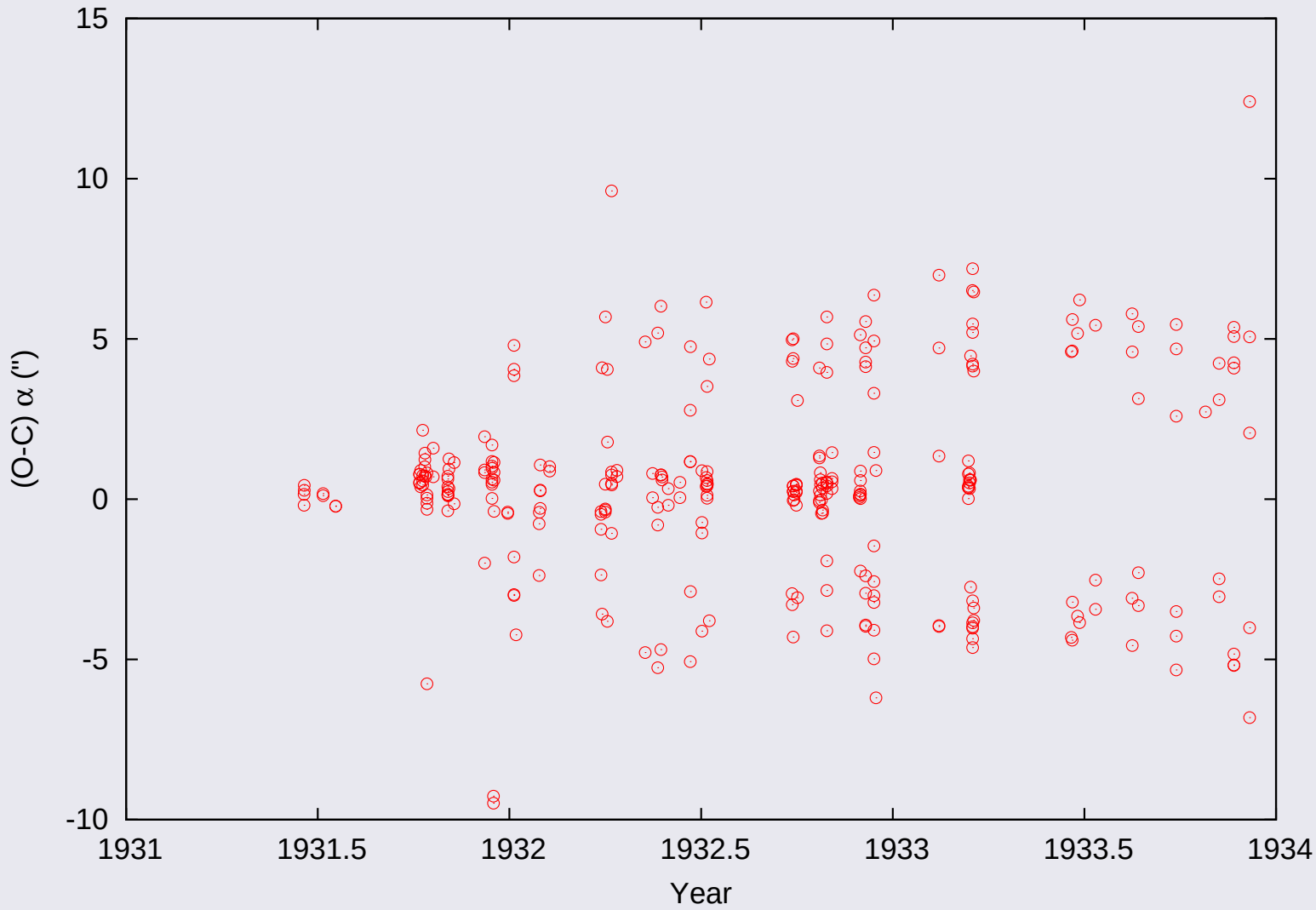
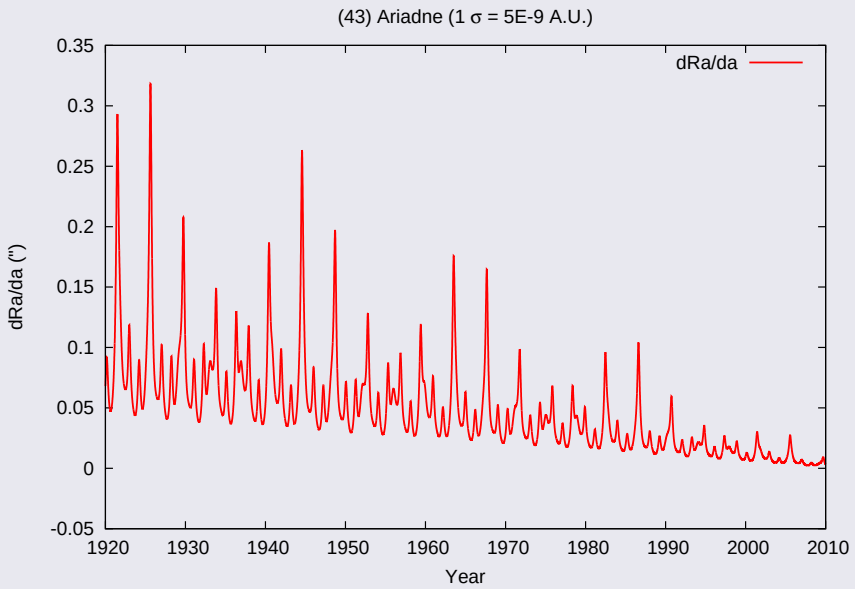
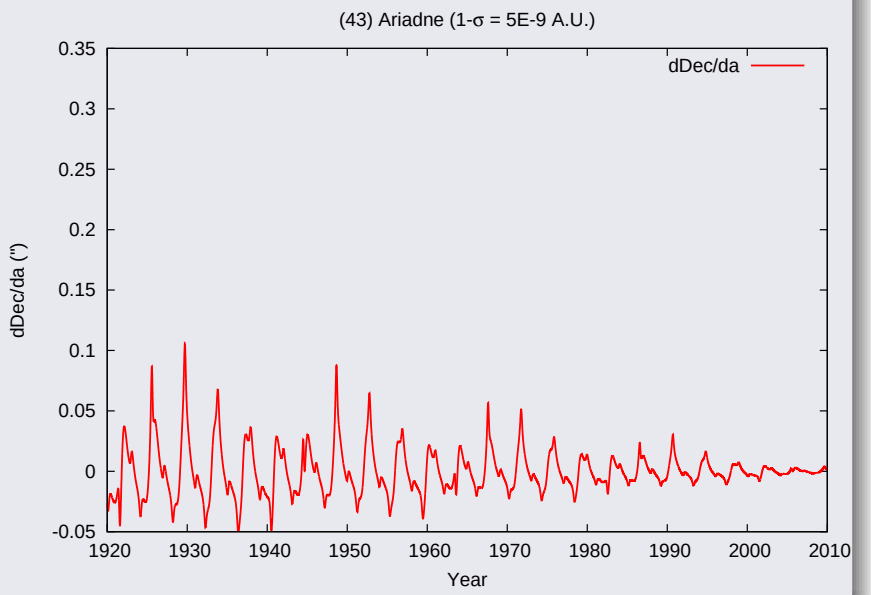


Variational equations $\frac{\partial \alpha}{\partial \mathbf{p}}(t), \frac{\partial \delta}{\partial \mathbf{p}}(t)\, \mathbf{p} \subset \{a, e, i, \Omega, \omega, M\}$





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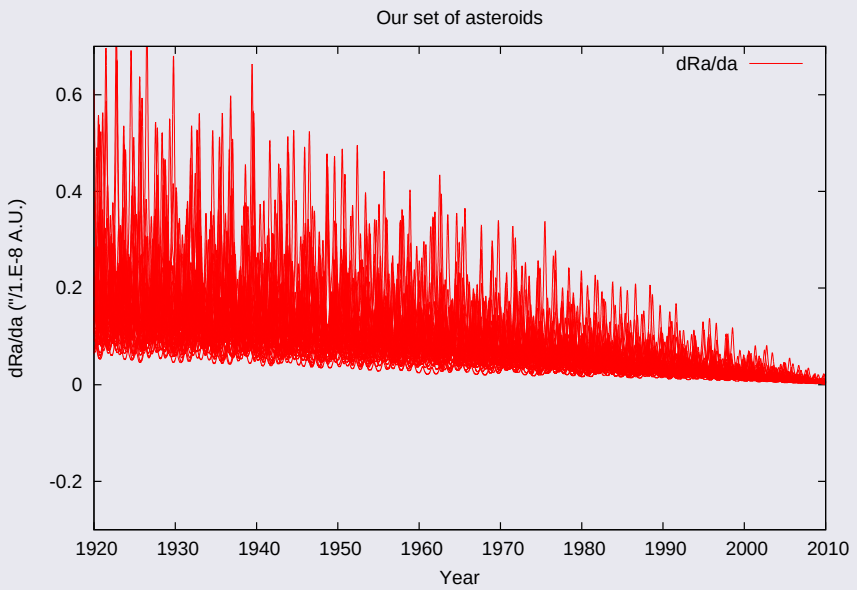
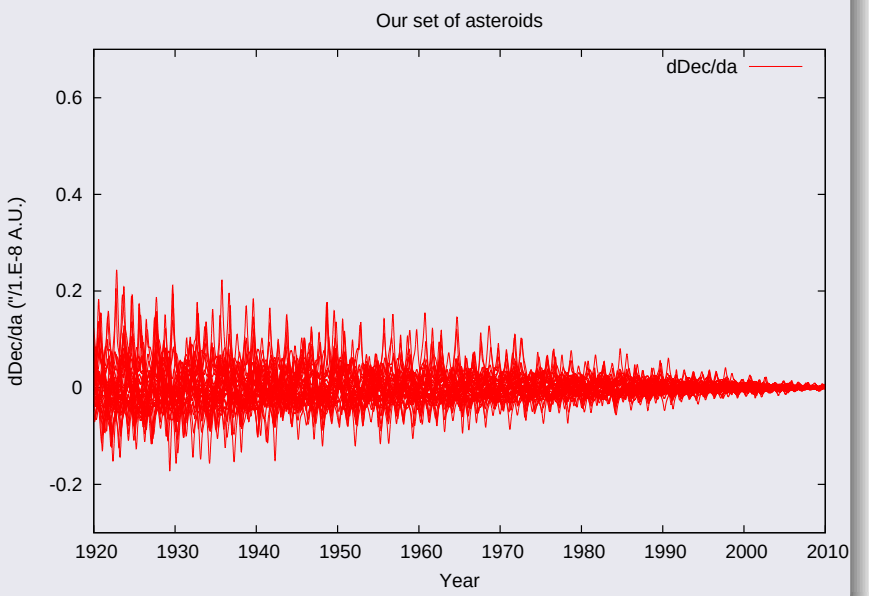
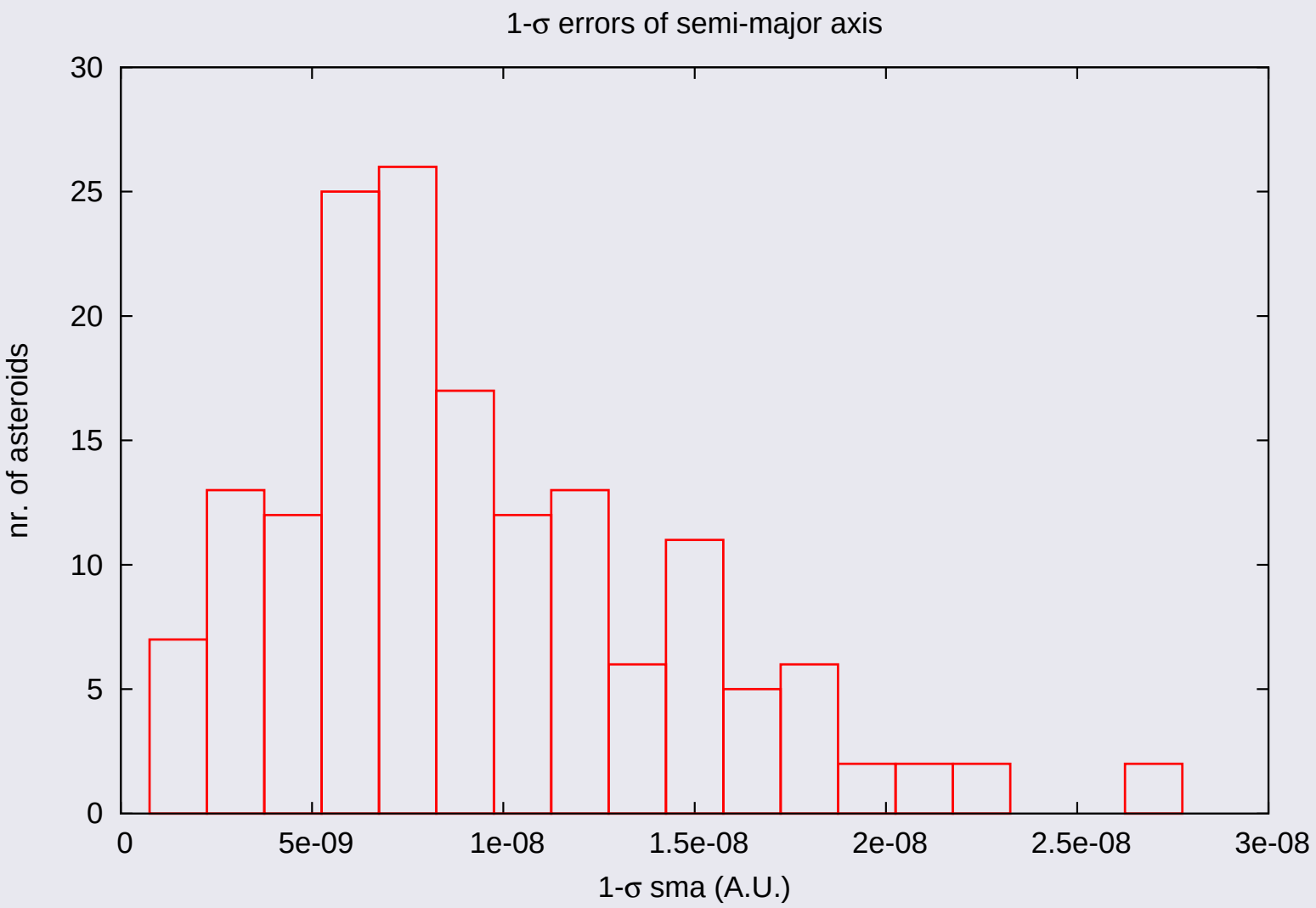
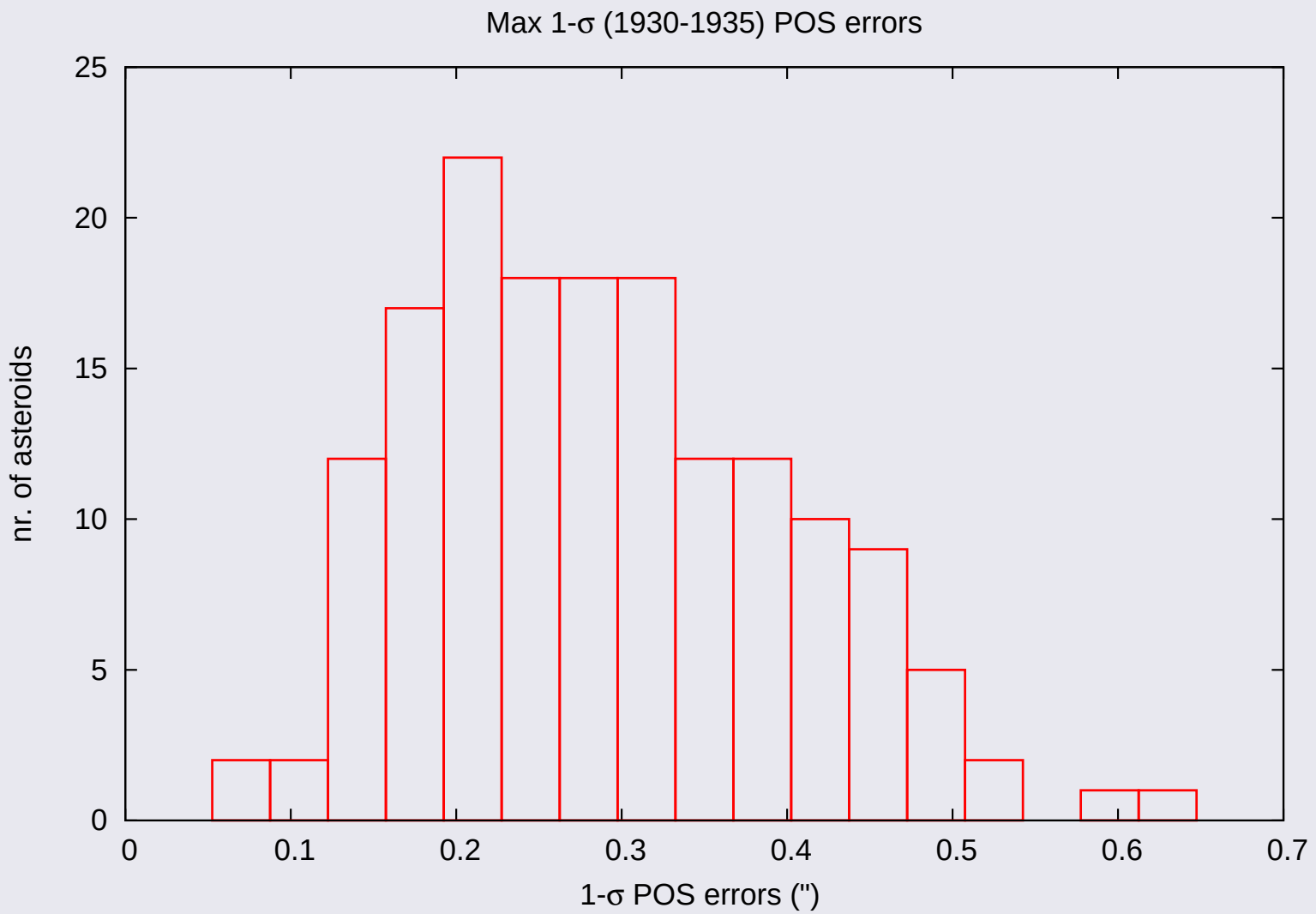




$1-\sigma$ errors of semimajor axis (AstDys)



Maximum plane-of-sky position errors



Conclusions

- A test sample of old observations and **reduction method** to evaluate the improvement obtained by using new digitization and reduction methods.
- Selection procedure should target plates with a maximum scientific values.
- For asteroids plates the ephemeris uncertainty at the epoch of observation should be included in the metadata.