Status of CFEPS, Kuiper Belt Science with CFHTLS Very Wide

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(Please look at the notes. All informations are there)

Status of CFHTLS-VW
Kuiper Belt (1)

Sem.	Time (hrs)	
03A	16.3	
03B	16.3	
04A	19.6	
04B	37.4	
05A	43.0	Ramp down begins
05B	22.2	
06A	18.7	
06B	(~25)	Already have 9
07A	(~10)	
07B	(~4)	

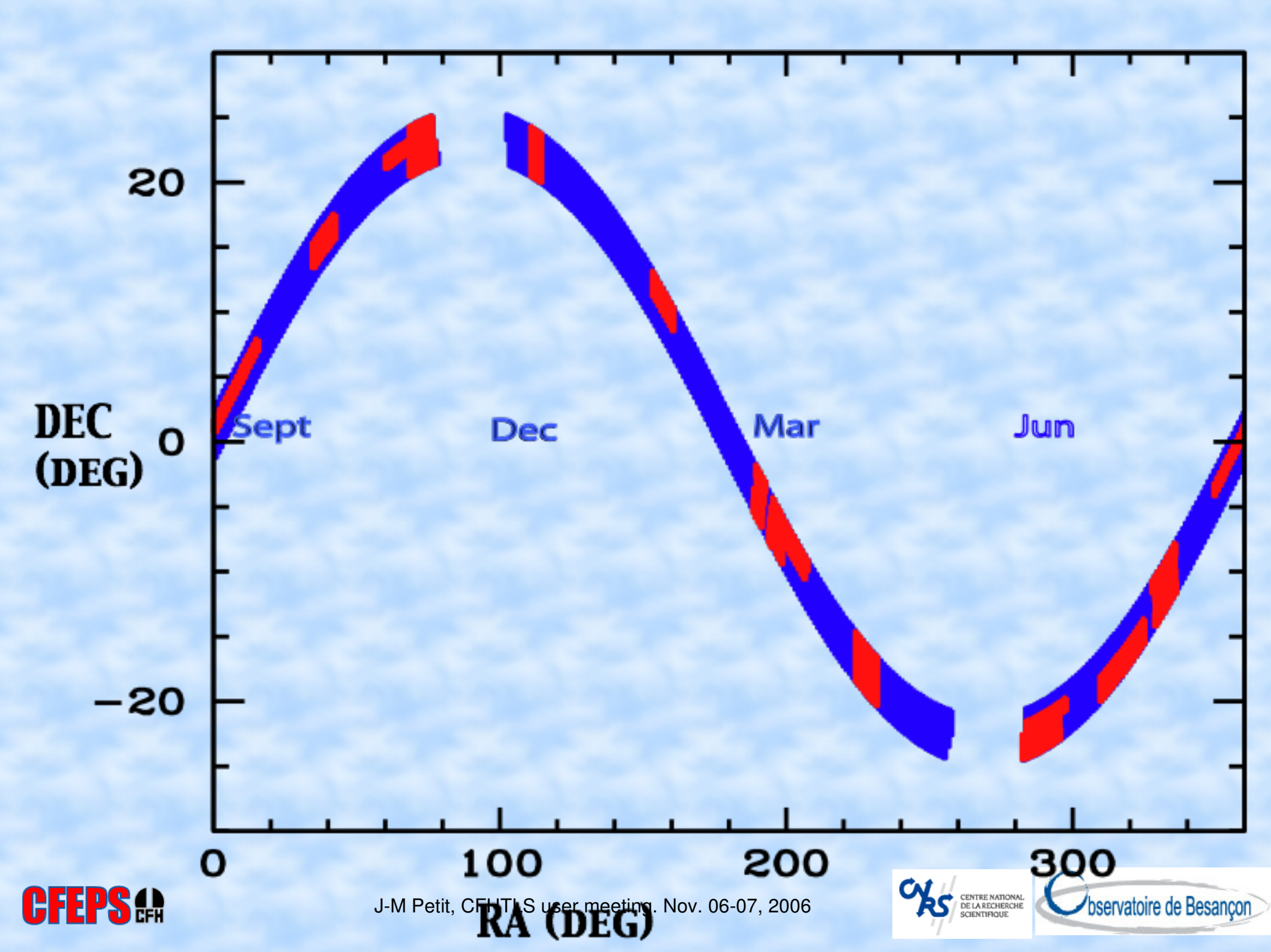
- About 25 hrs of VW remain to be observed, or 4 nights.
- As of Sept. 2006 VW has completed Discovery/Checkup and 1st year recoveries
- Now doing 2nd year recoveries (on targeted patches). Requirement is about 50% the exposure time required for discovery/nailing.

Status of CFHTLS-VW
Kuiper Belt (2)

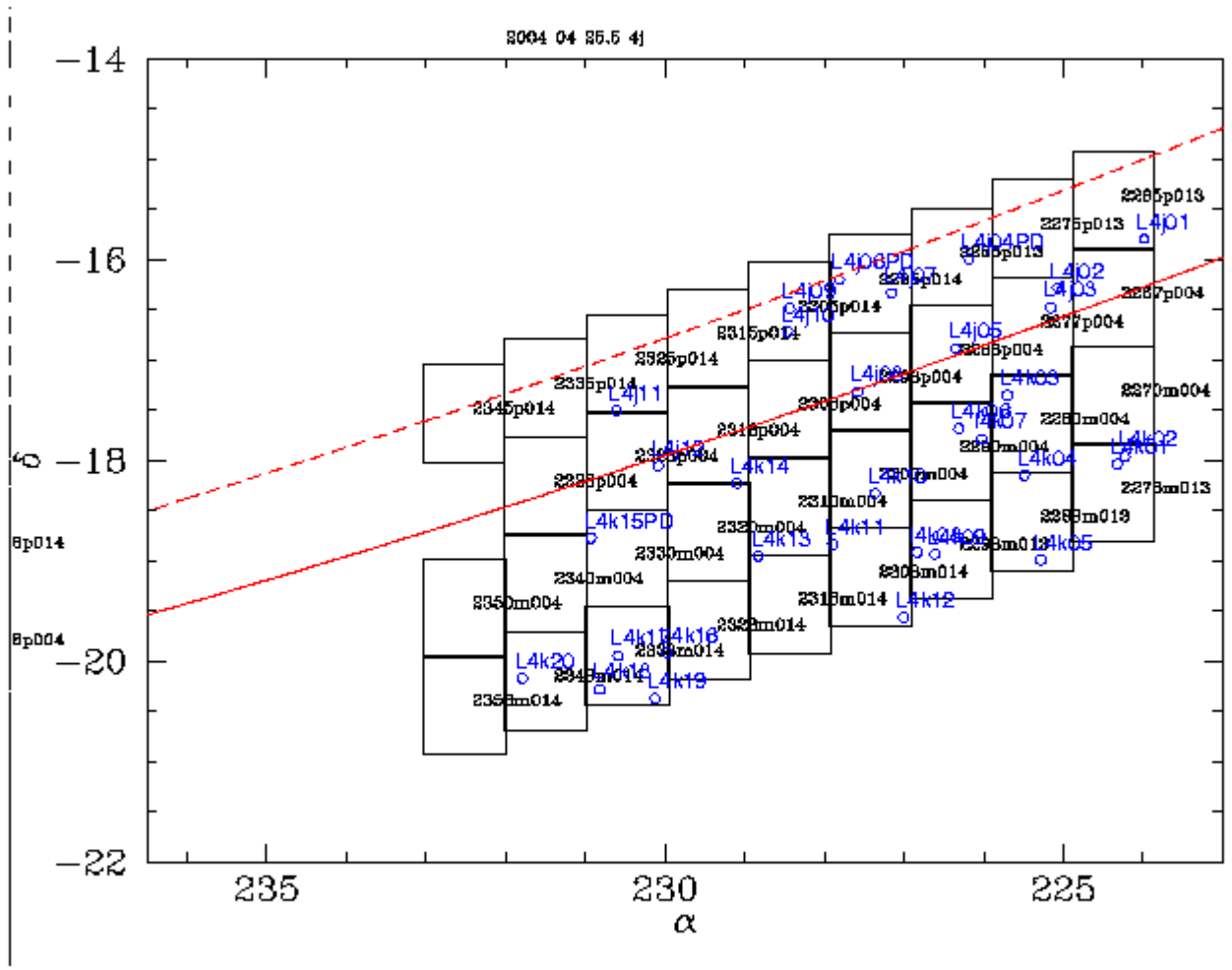
- Very Wide (ecliptic): initially supposed to have 22% of the time
- ~400 sq.deg. of discoveries close to the Ecliptic
  - compare with 1300 sq.deg. in the initial plan
- ~310 sq.deg. of good, fully useable data: correct time sequence, away from the galactic plane
  - currently over 400 objects discovered in CFHTLS
  - 250 characterised objects

Status of CFHTLS-VW
Kuiper Belt (3)

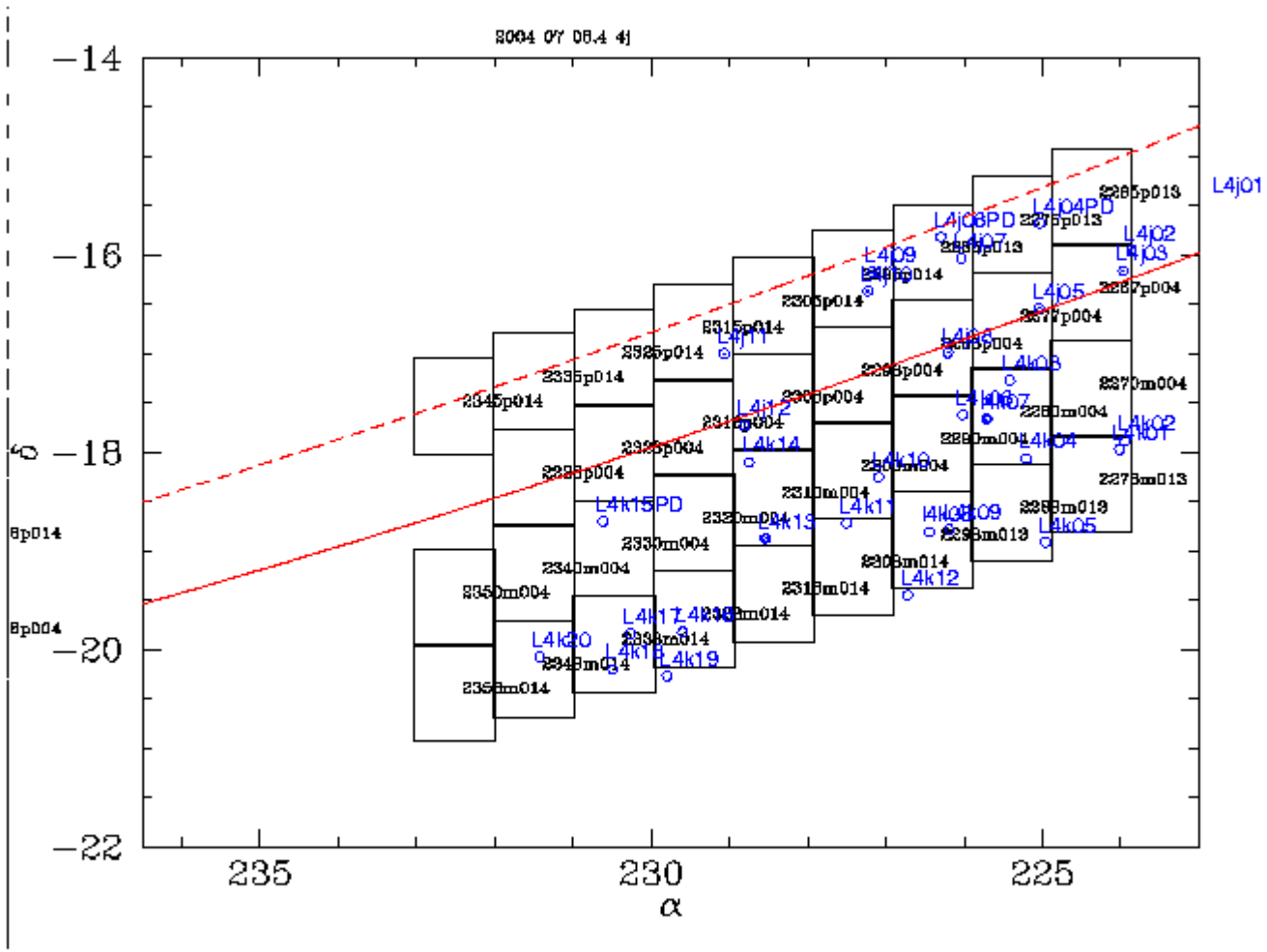
- Patchy coverage:
  - small amount of sky covered
  - creates a lot of problems for object tracking
  - so we are far behind in processing the data
- Still the largest fully characterized survey for KBOs up to now
- But is it worth it ?
  - Compare with a Large Programme spanning 4 semesters
  - 4 nights/semester for discovery and follow-up
  - same results as for 2003 CFHTLS discoveries and follow-up
  - far less effort


20
0
−20
DEC
(DEG)
Sept
Dec
Mar
Jun
0
100
200
300
RA (DEG)

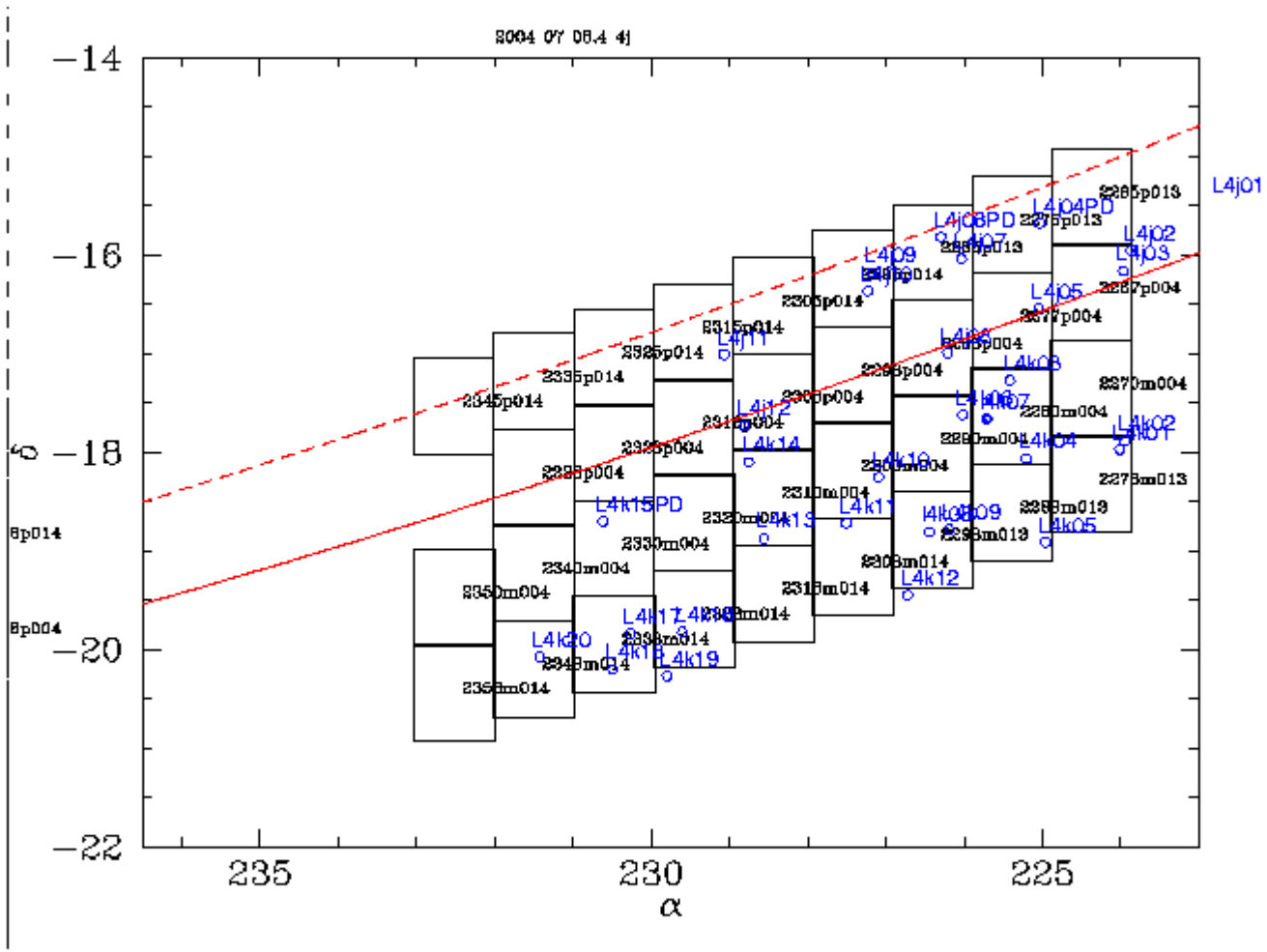
Discovery, 2 blocks



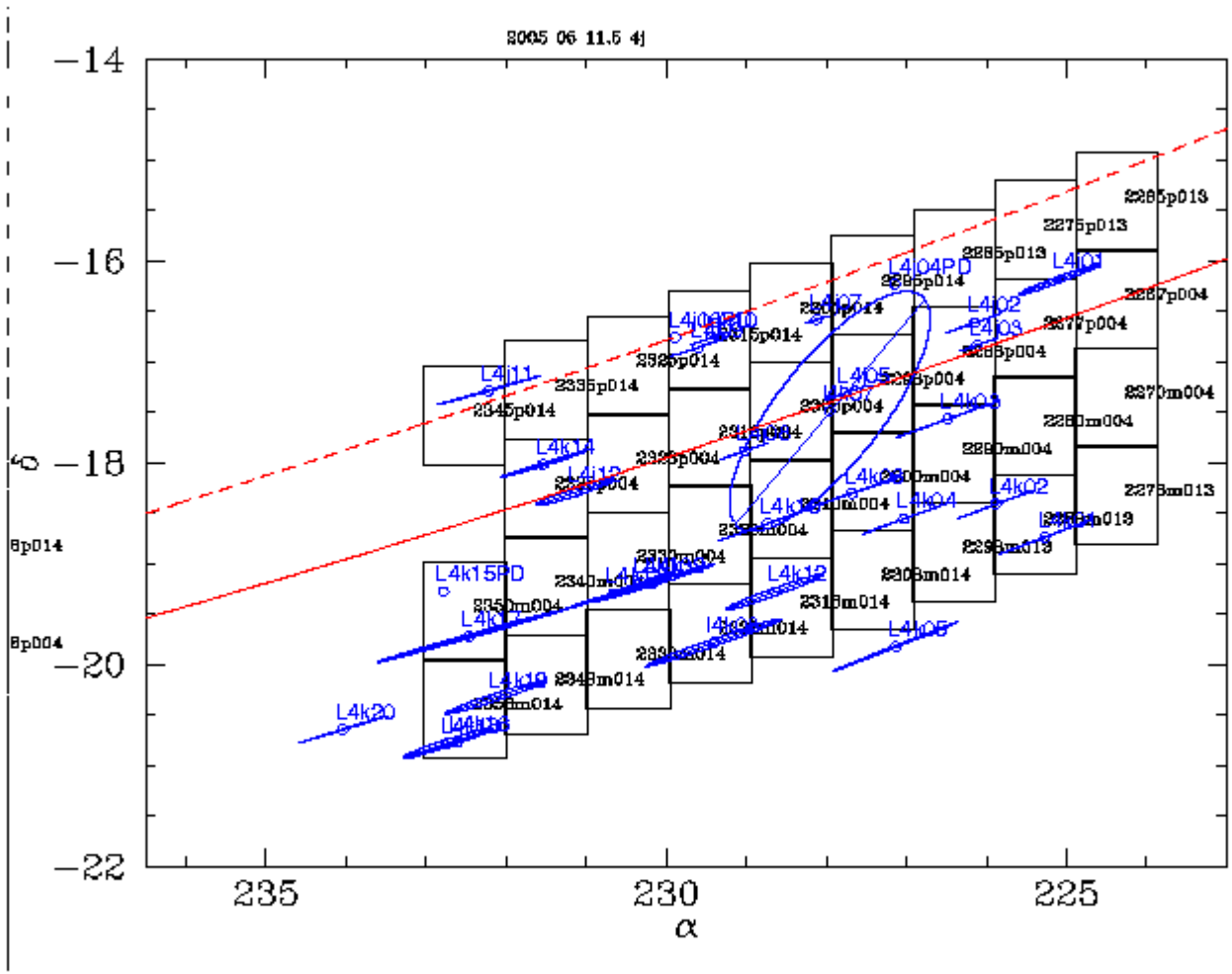
Before checkup



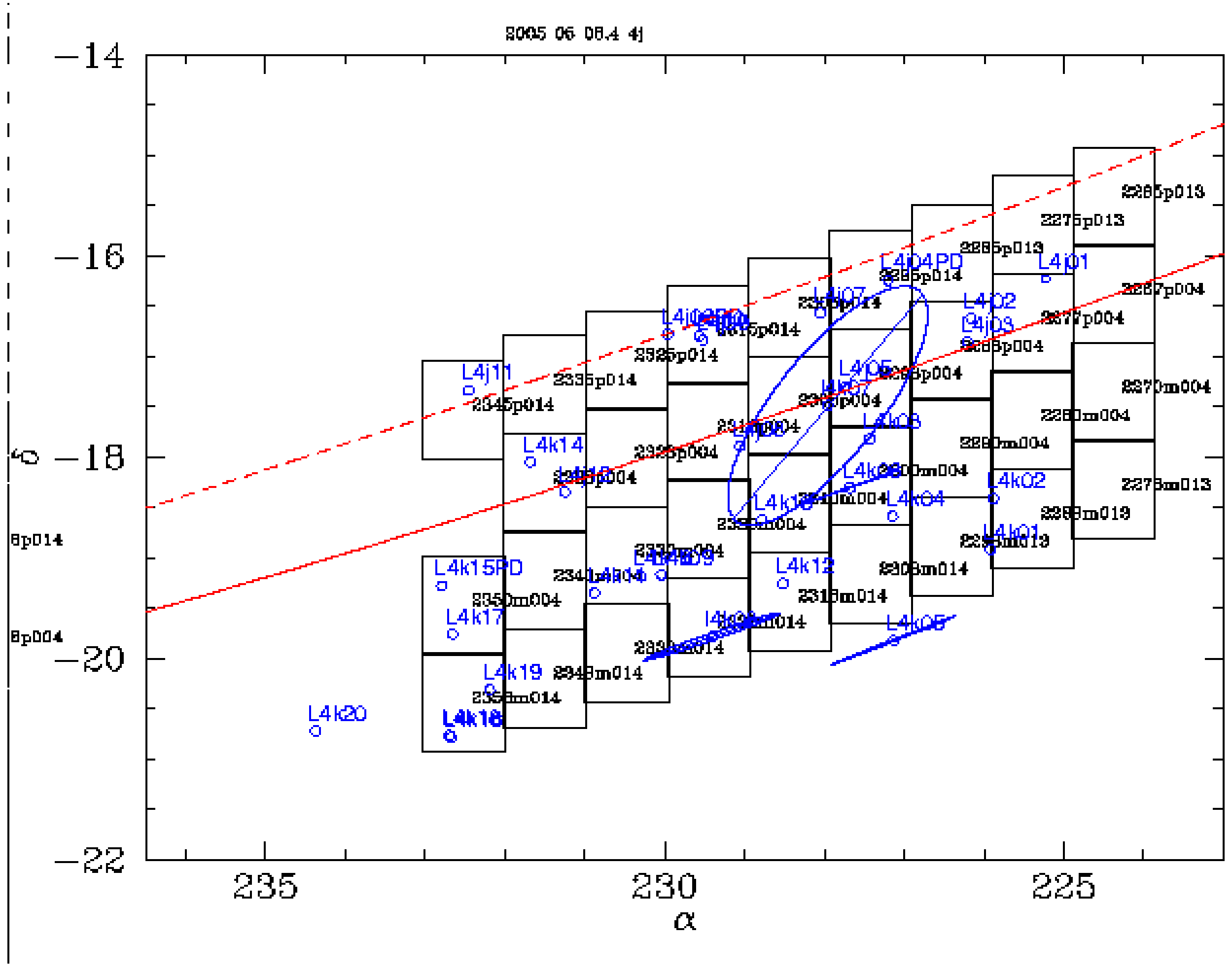
After checkup



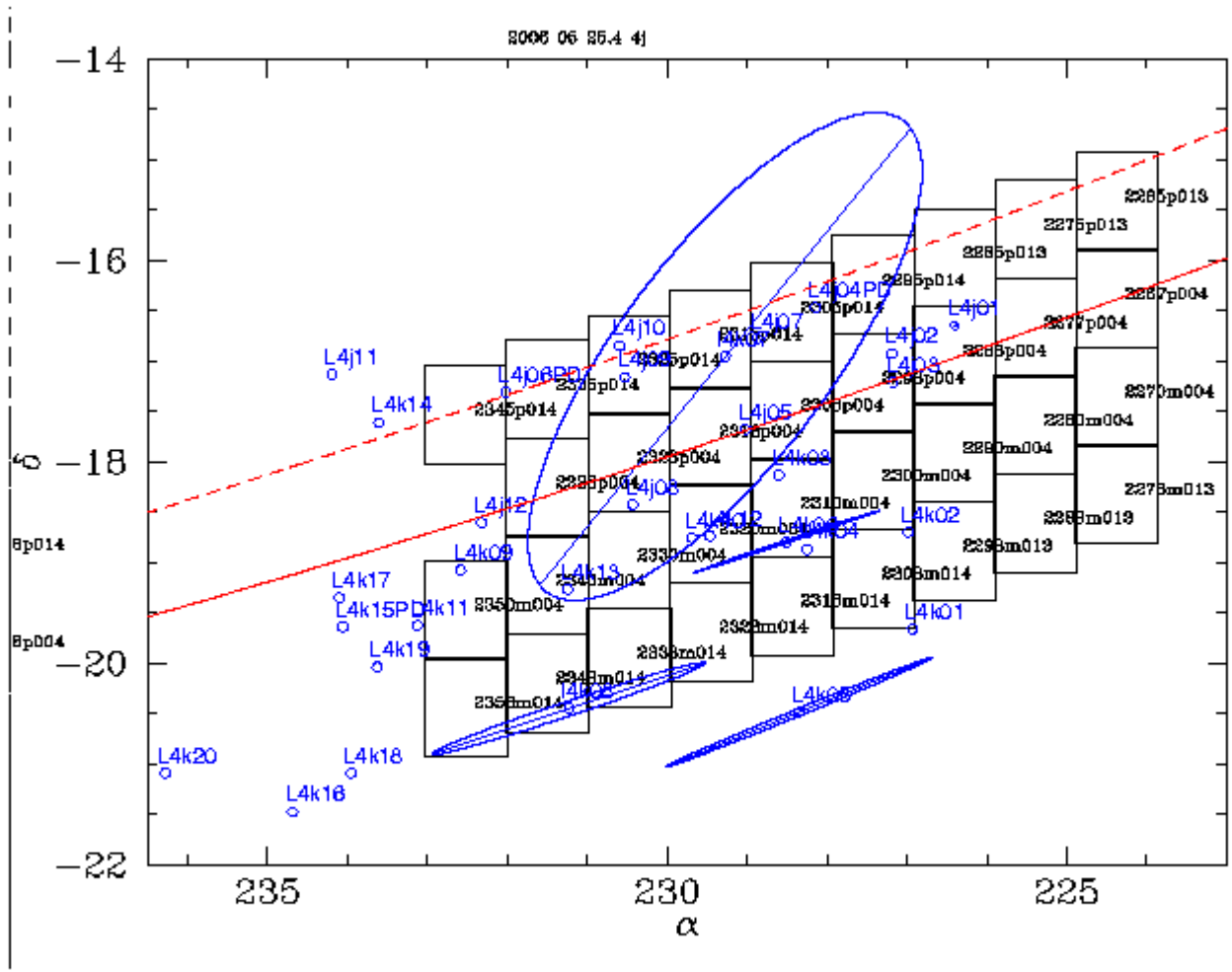
Before 1 year



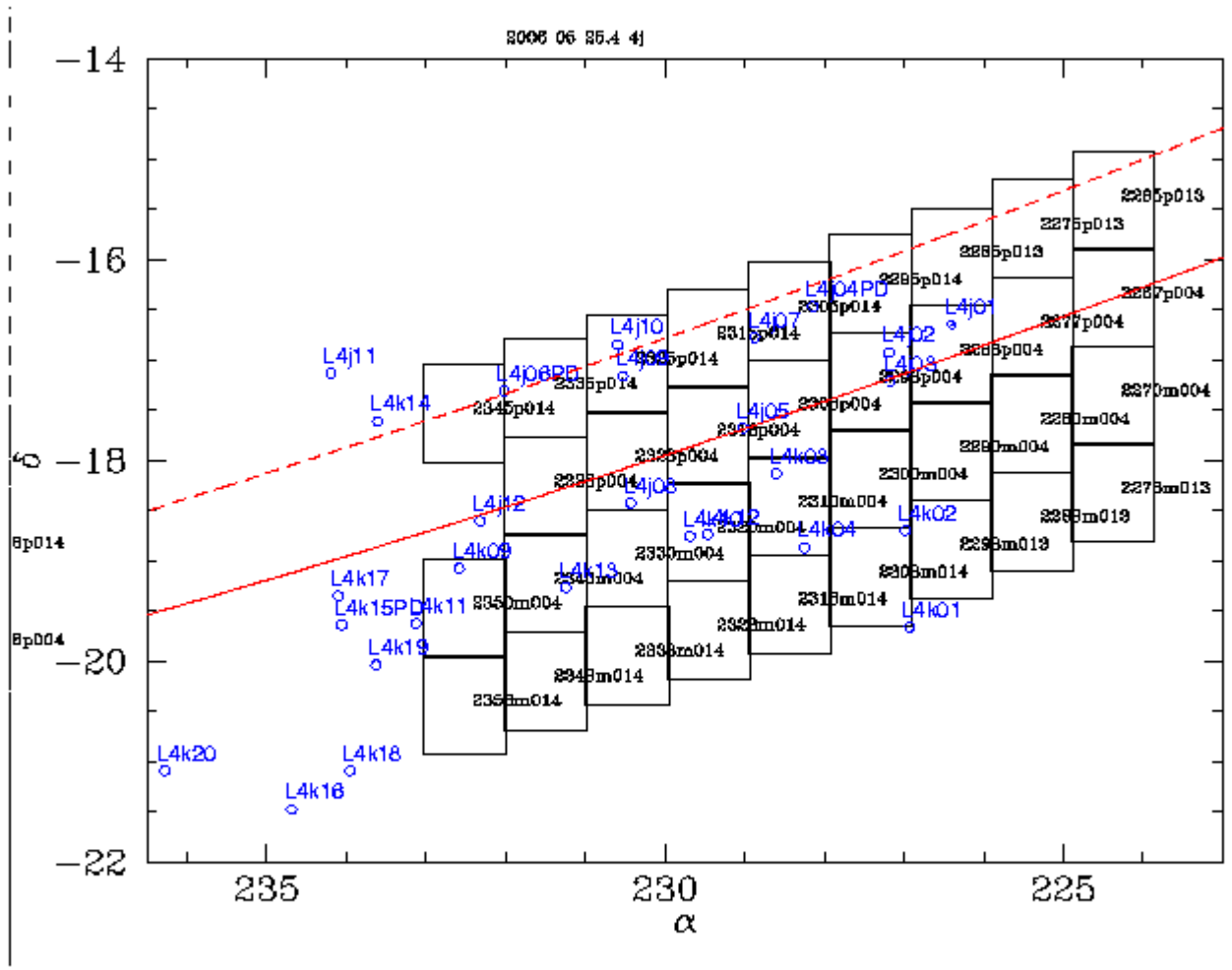
After 1 year



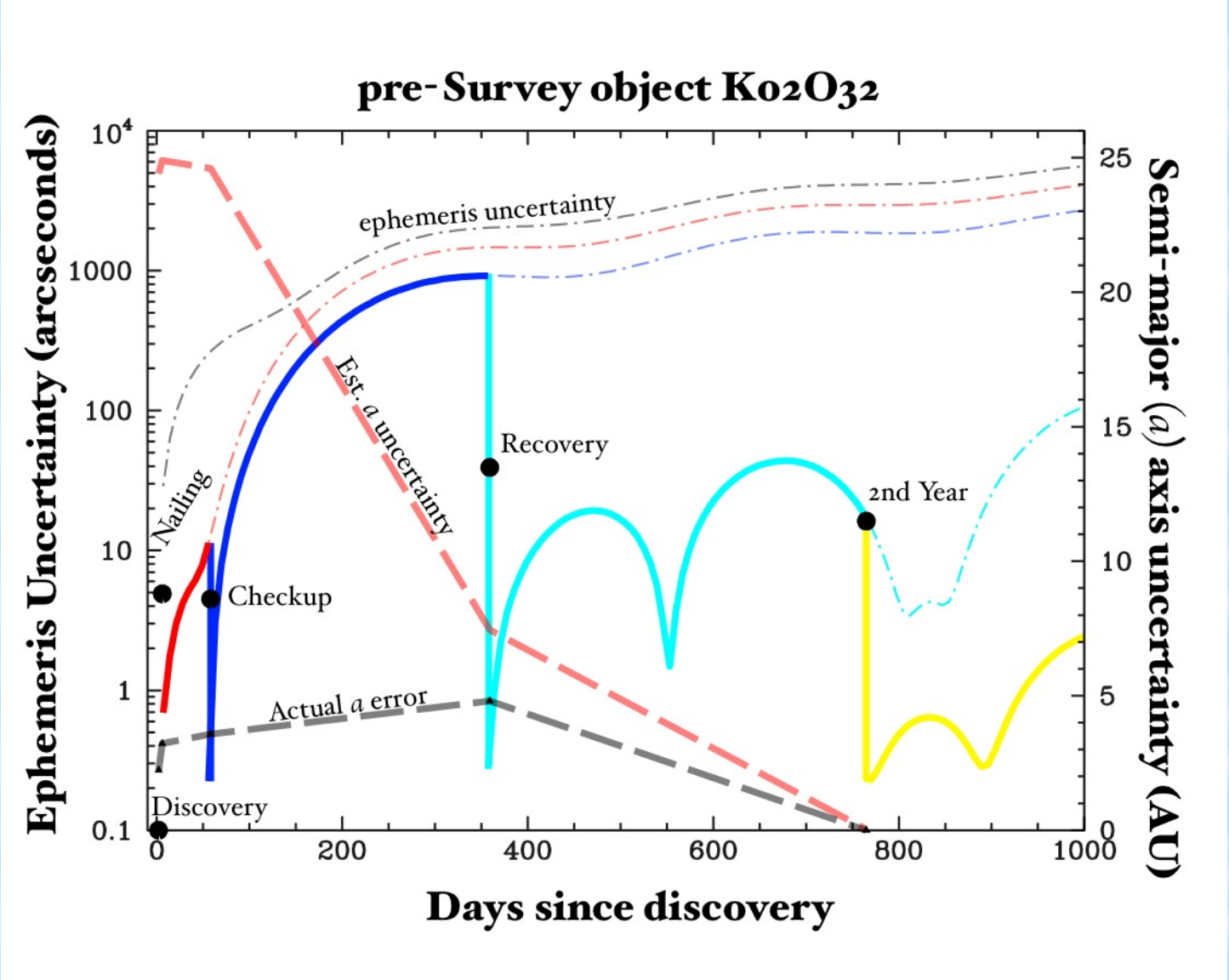
At 2 years


2006 06 25.4 4j
−14
−16
−18
−20
−22
δ
235
230
225
α
L4j11
L4k14
L4j10
L4j07
L4j02
L4j05
L4j12
L4k09
L4k17
L4k15PD
L4k11
L4k19
L4k13
L4k12
L4k02
L4k01
L4k20
L4k18
L4k16

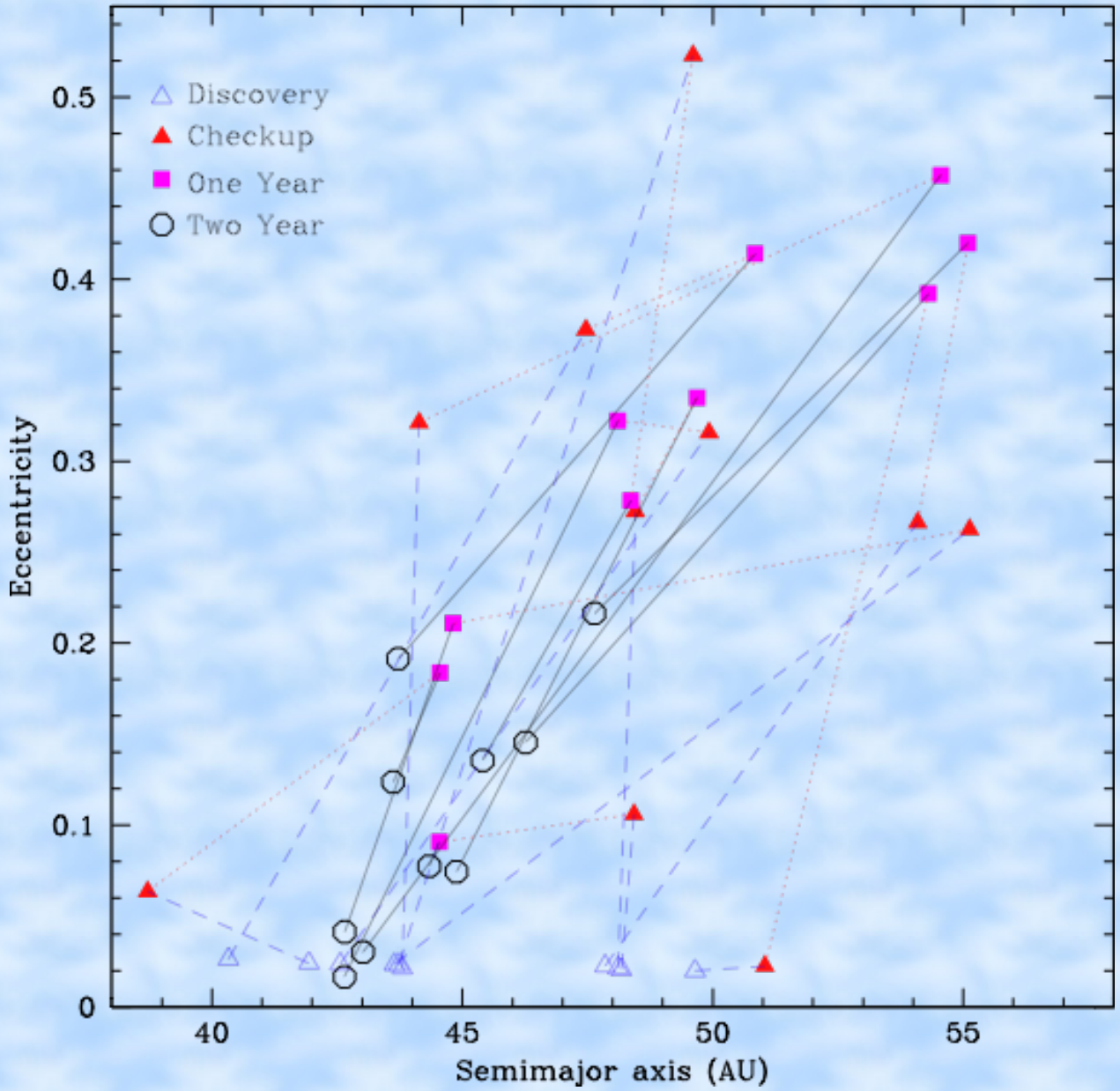
Keeping the « Tracked » objects

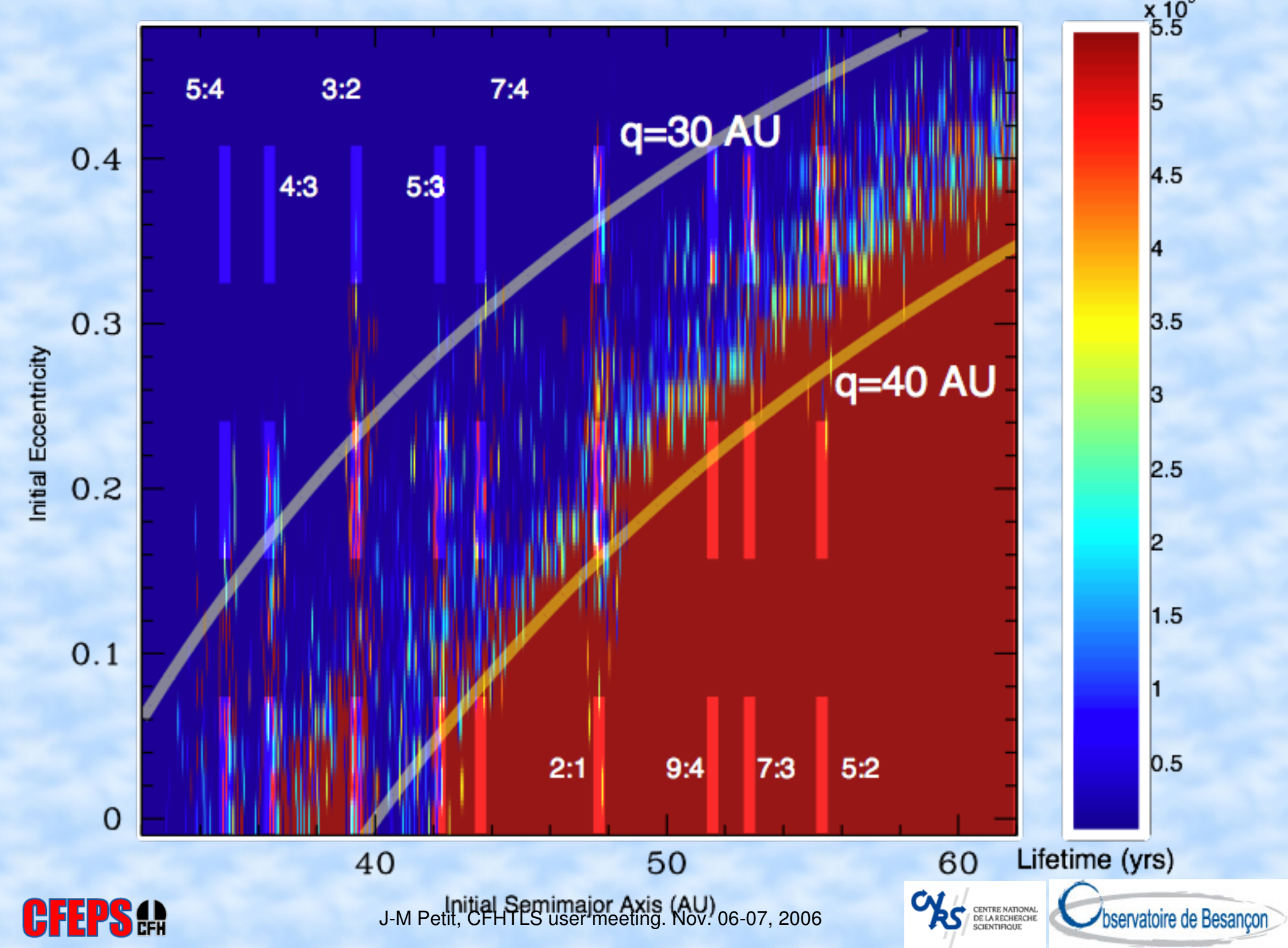


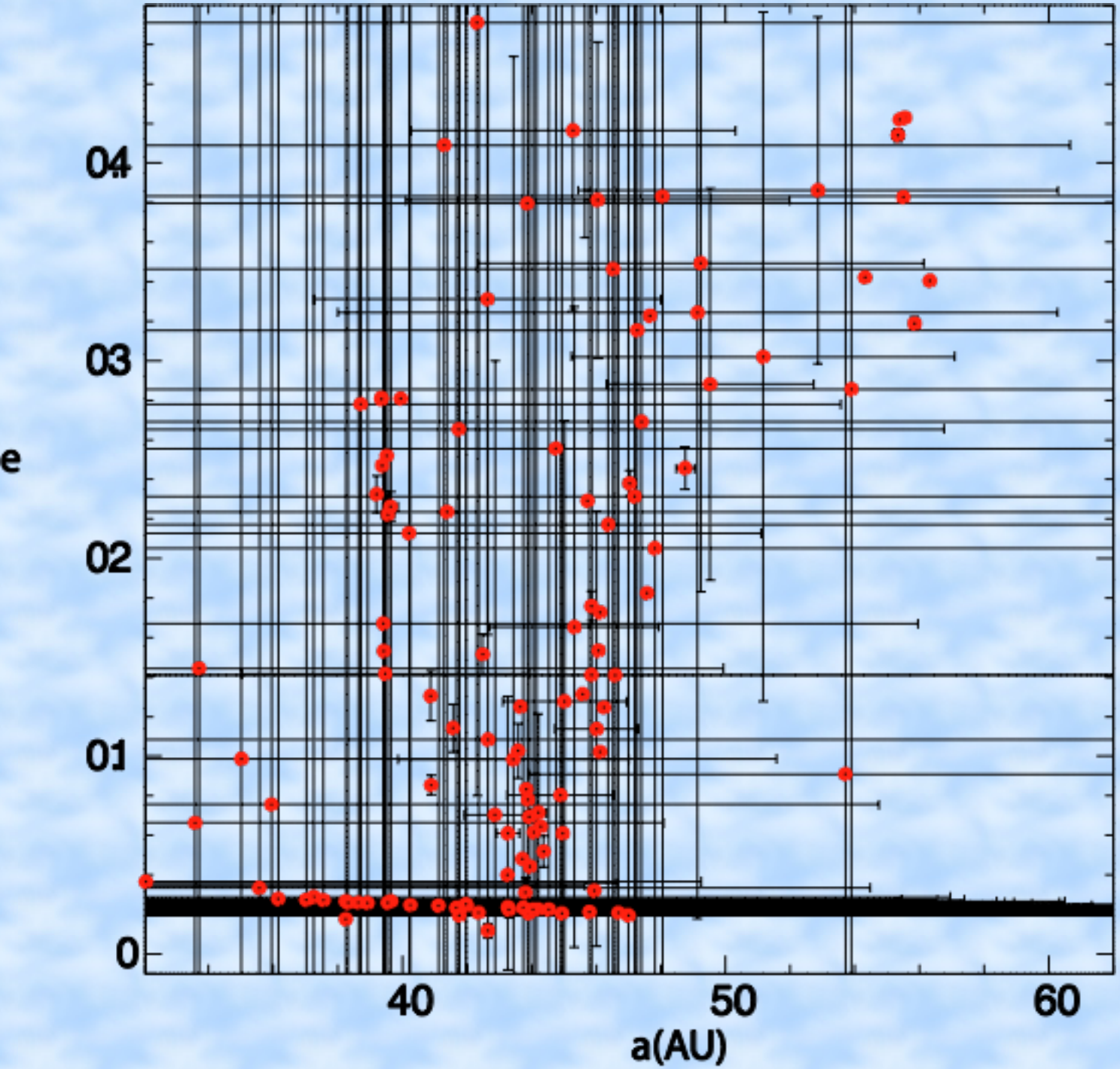
Because of this....



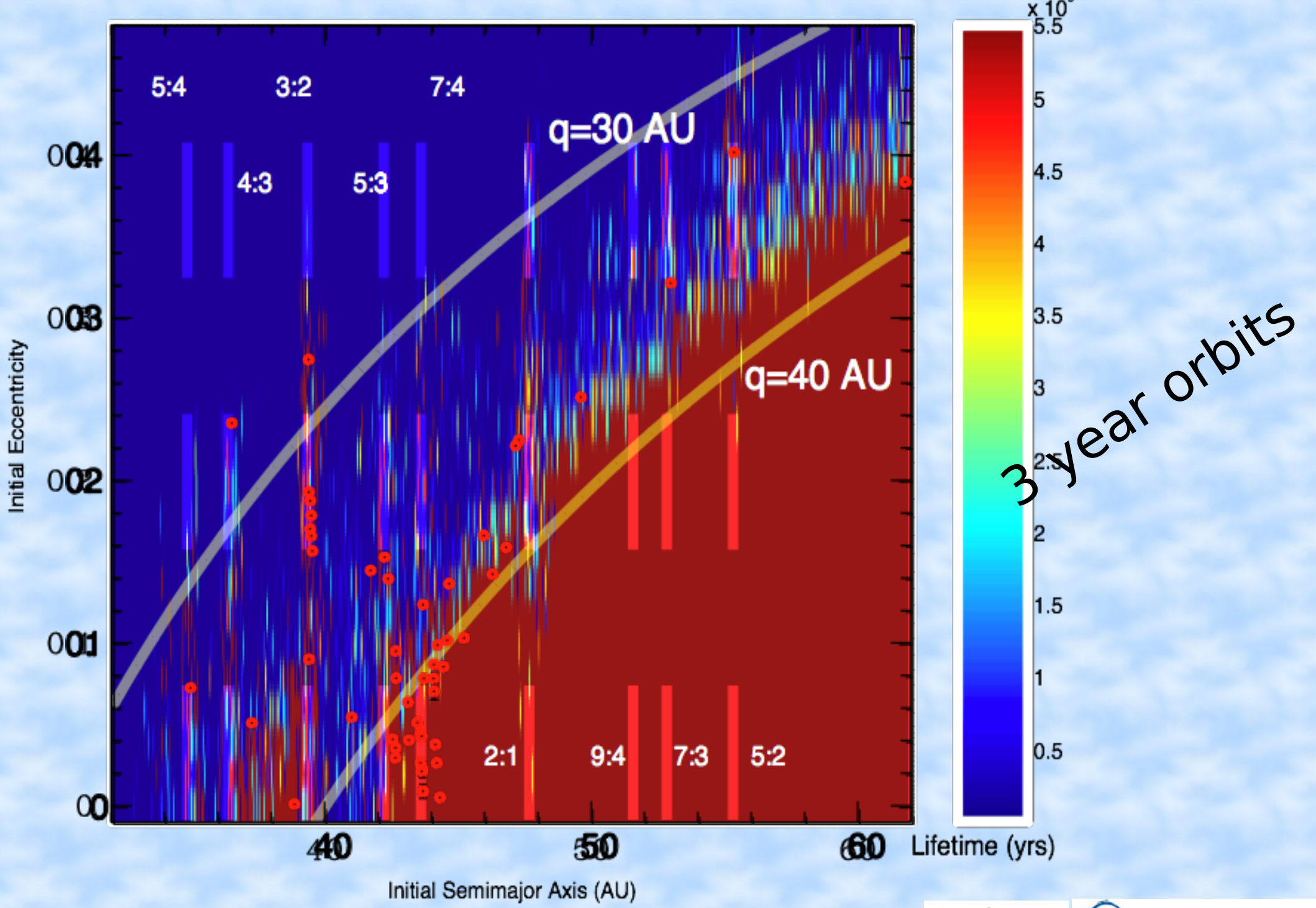
Noticed, [as expected]




5:4
3:2
7:4
4:3
5:3
q=30 AU
q=40 AU
2:1
9:4
7:3
5:2
0.4
0.3
0.2
0.1
0
Initial Eccentricity
40
50
60
Initial Semimajor Axis (AU)
x 10^6
5.5
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
Lifetime (yrs)

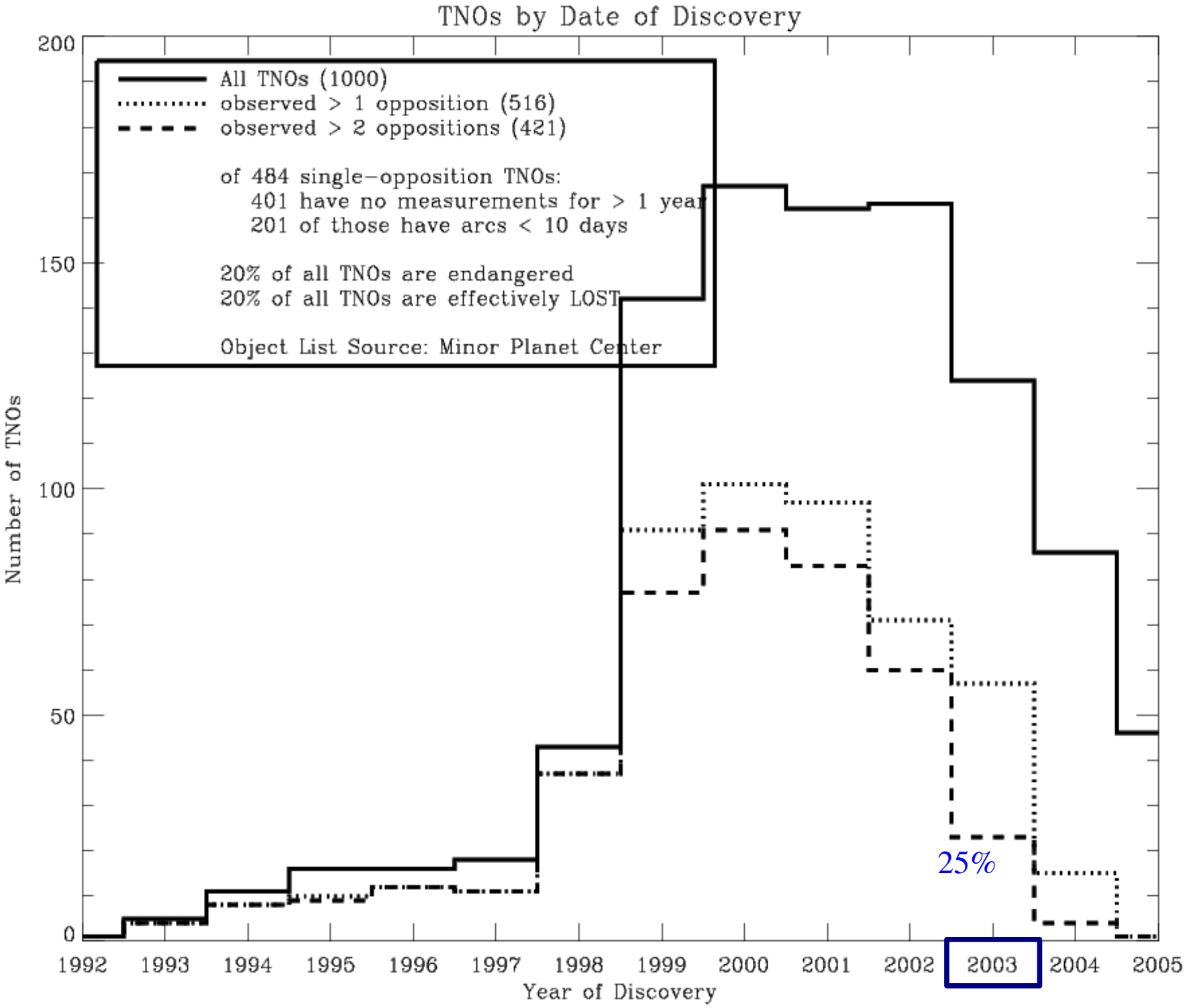


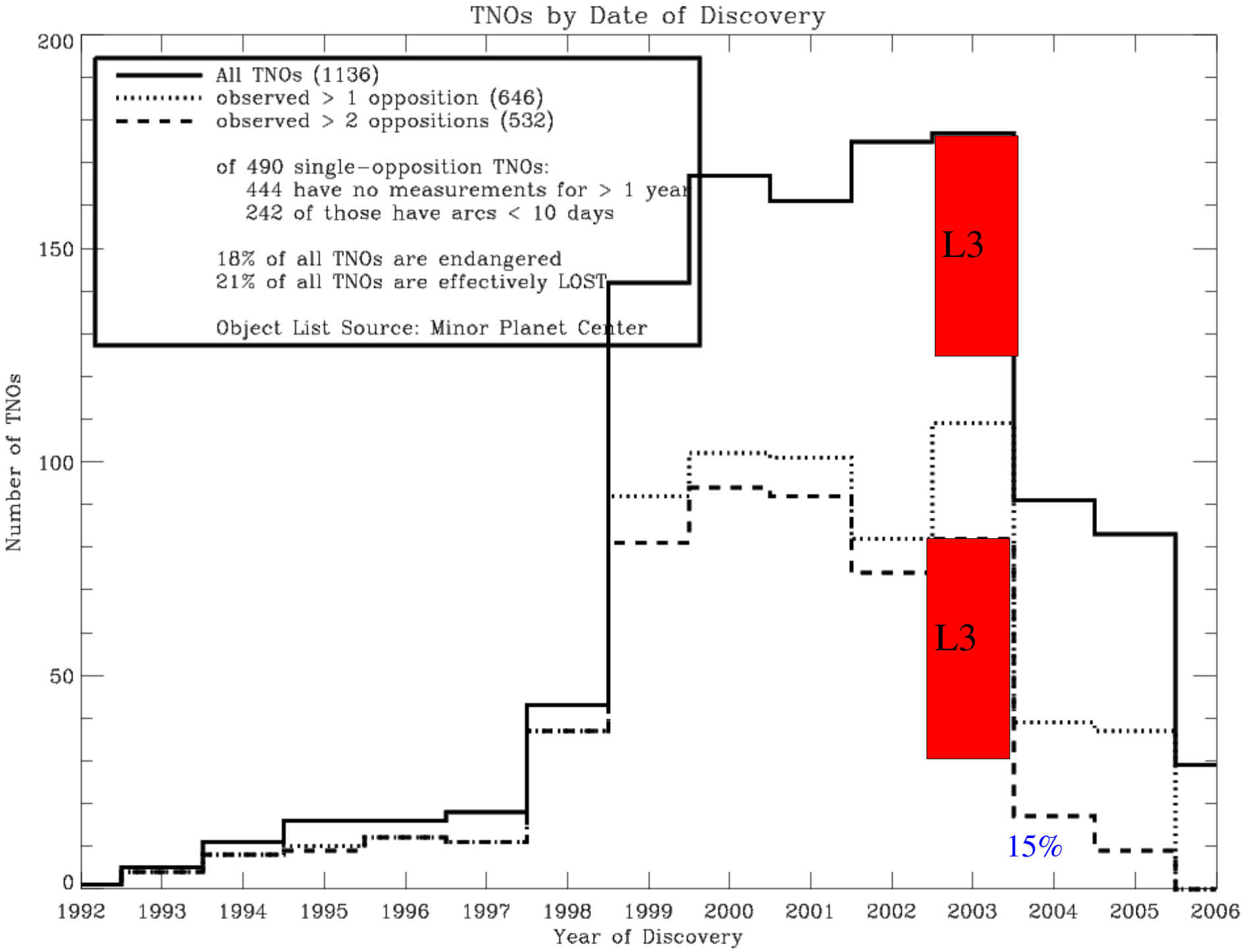
1 year orbits

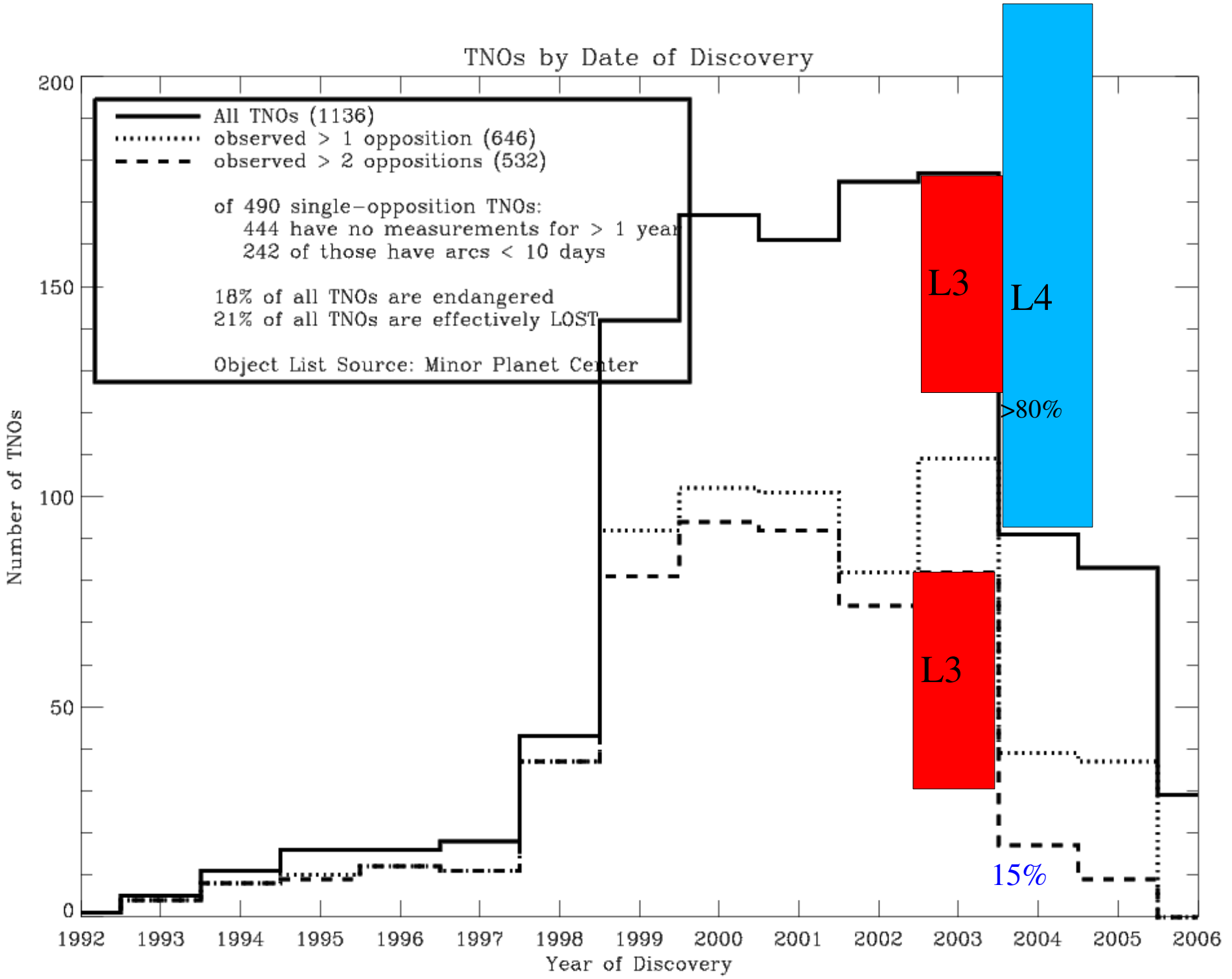

5:4
3:2
7:4
q=30 AU
4:3
5:3
q=40 AU
2:1
9:4
7:3
5:2
Initial Eccentricity
Initial Semimajor Axis (AU)
Lifetime (yrs)
x 10^6
3 year orbits

CFEPS L3 release

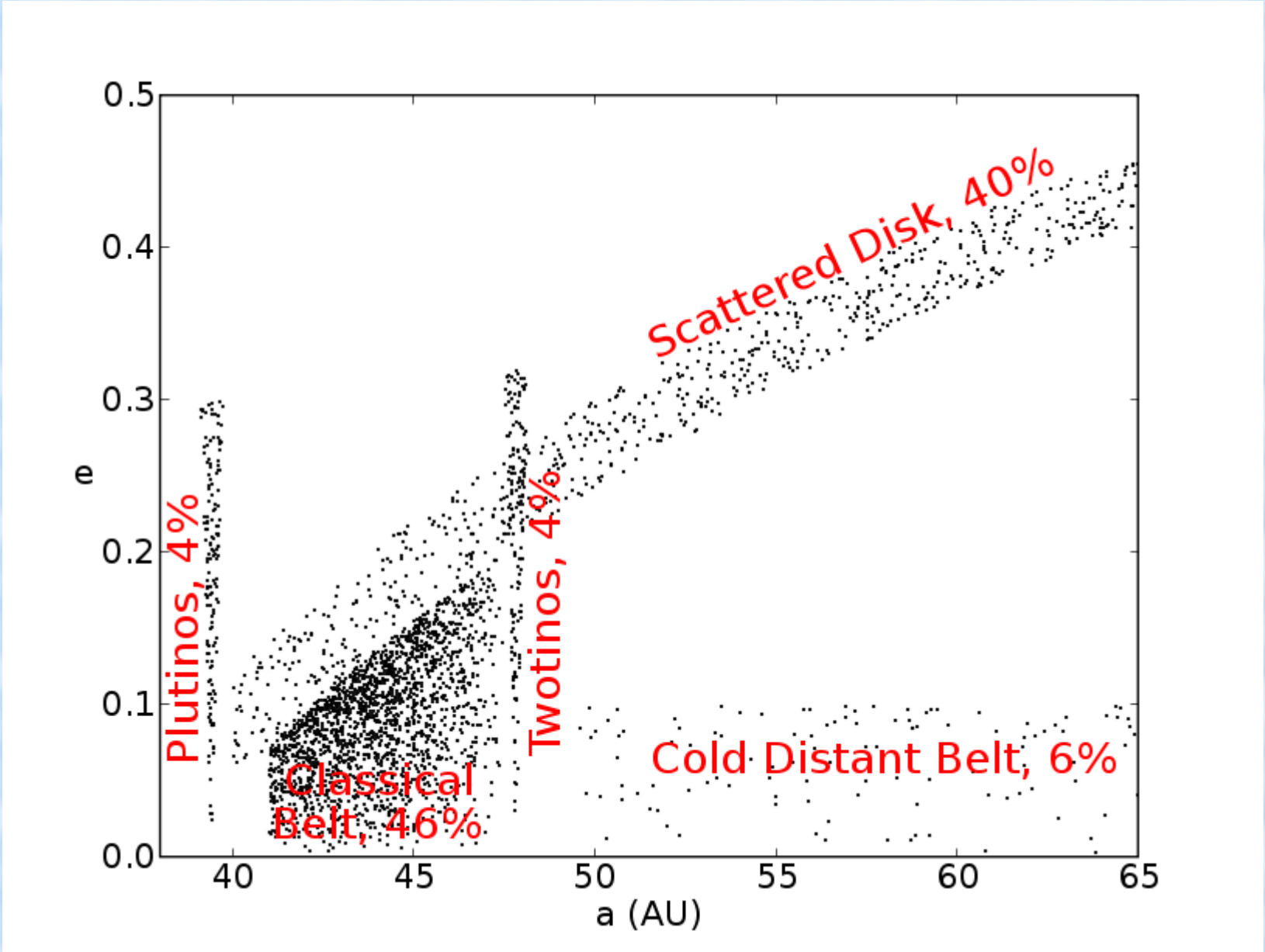
- Fully characterized and tracked sample from 2003
  - 94 fields
  - 79.14 sq.deg.
    - MegaCAM coverage: 0.9 sq.deg.
    - some overlap
    - chips failure on some blocks
  - 74 discovered objects
  - 55 objects with accurate orbit
- Full characterization of discovery efficiency with:
  - magnitude
  - rate of motion


TNOs by Date of Discovery
All TNOs (1000)
observed > 1 opposition (516)
observed > 2 oppositions (421)
of 484 single−opposition TNOs:
401 have no measurements for > 1 year
201 of those have arcs < 10 days
20% of all TNOs are endangered
20% of all TNOs are effectively LOST
Object List Source: Minor Planet Center
Number of TNOs
Year of Discovery
0
50
100
150
200
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
25%

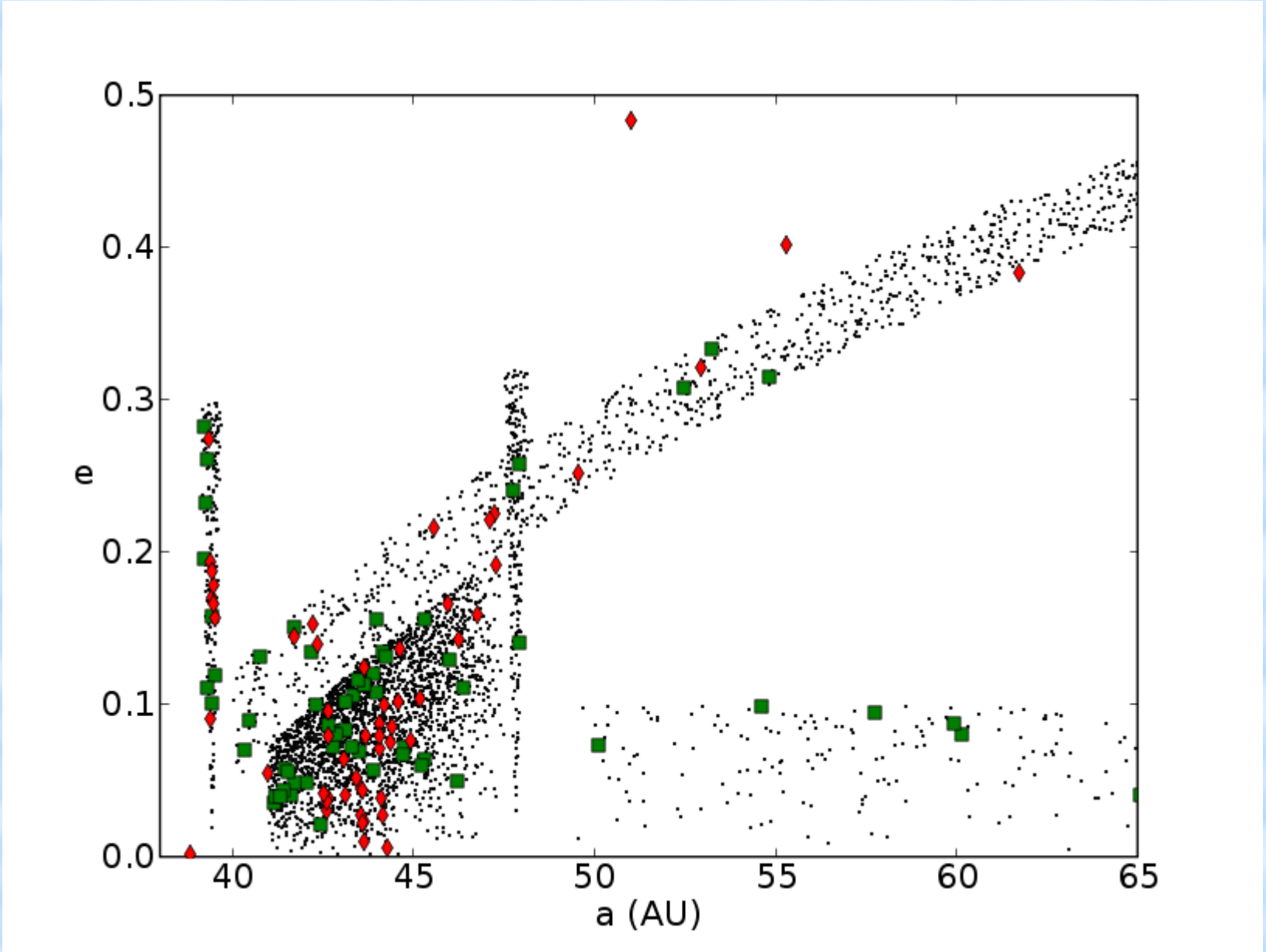

TNOs by Date of Discovery
All TNOs (1136)
observed > 1 opposition (646)
observed > 2 oppositions (532)
of 490 single-opposition TNOs:
444 have no measurements for > 1 year
242 of those have arcs < 10 days
18% of all TNOs are endangered
21% of all TNOs are effectively LOST
Object List Source: Minor Planet Center
L3
L3
15%
Number of TNOs
Year of Discovery
0
50
100
150
200
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006


TNOs by Date of Discovery
All TNOs (1136)
observed > 1 opposition (646)
observed > 2 oppositions (532)
of 490 single-opposition TNOs:
444 have no measurements for > 1 year
242 of those have arcs < 10 days
18% of all TNOs are endangered
21% of all TNOs are effectively LOST
Object List Source: Minor Planet Center
L3
L4
>80%
L3
15%
Number of TNOs
Year of Discovery
0
50
100
150
200
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006

Toy model of the Kuiper Belt



CFEPS 2003 objects and Model detections

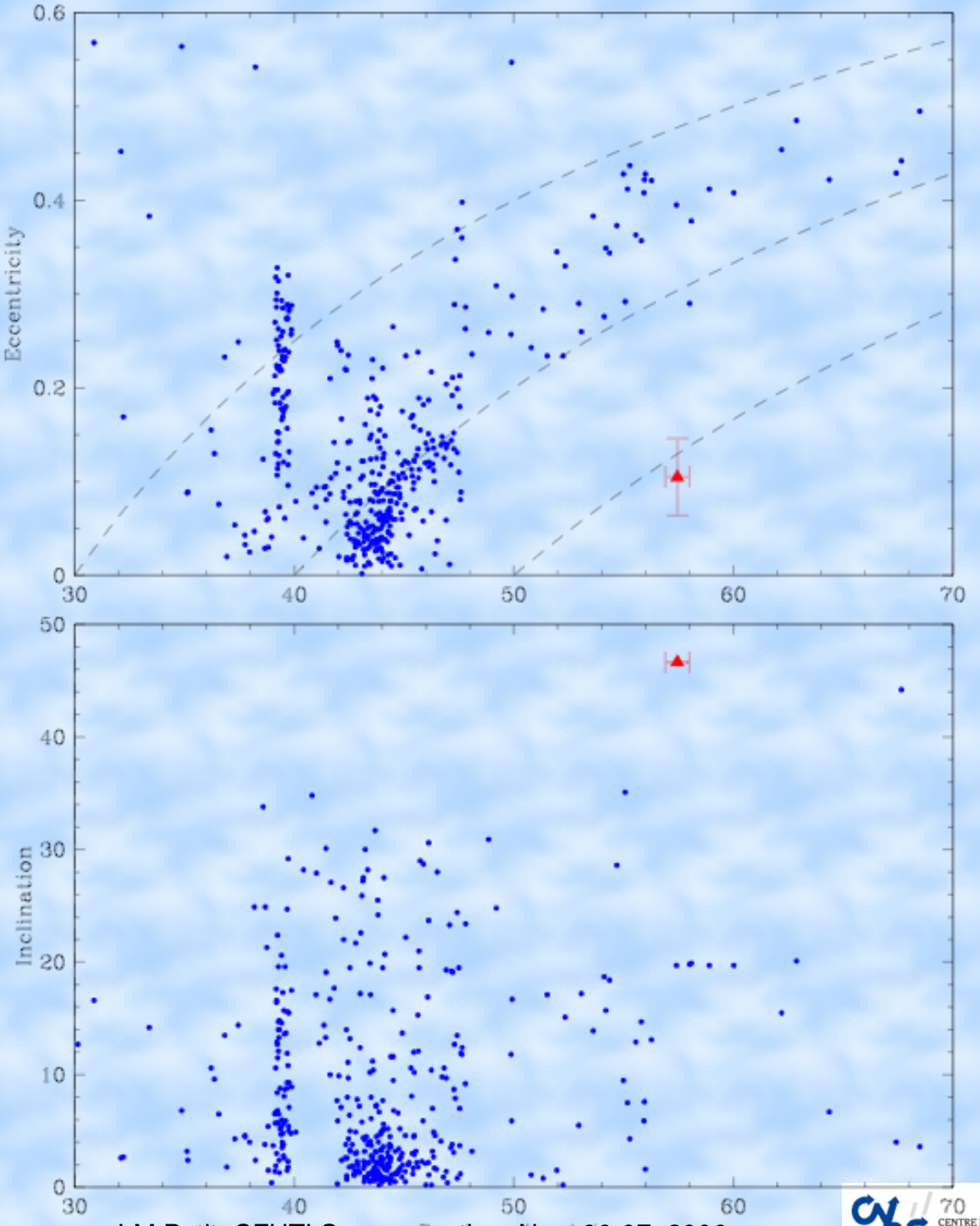


Simulating the survey

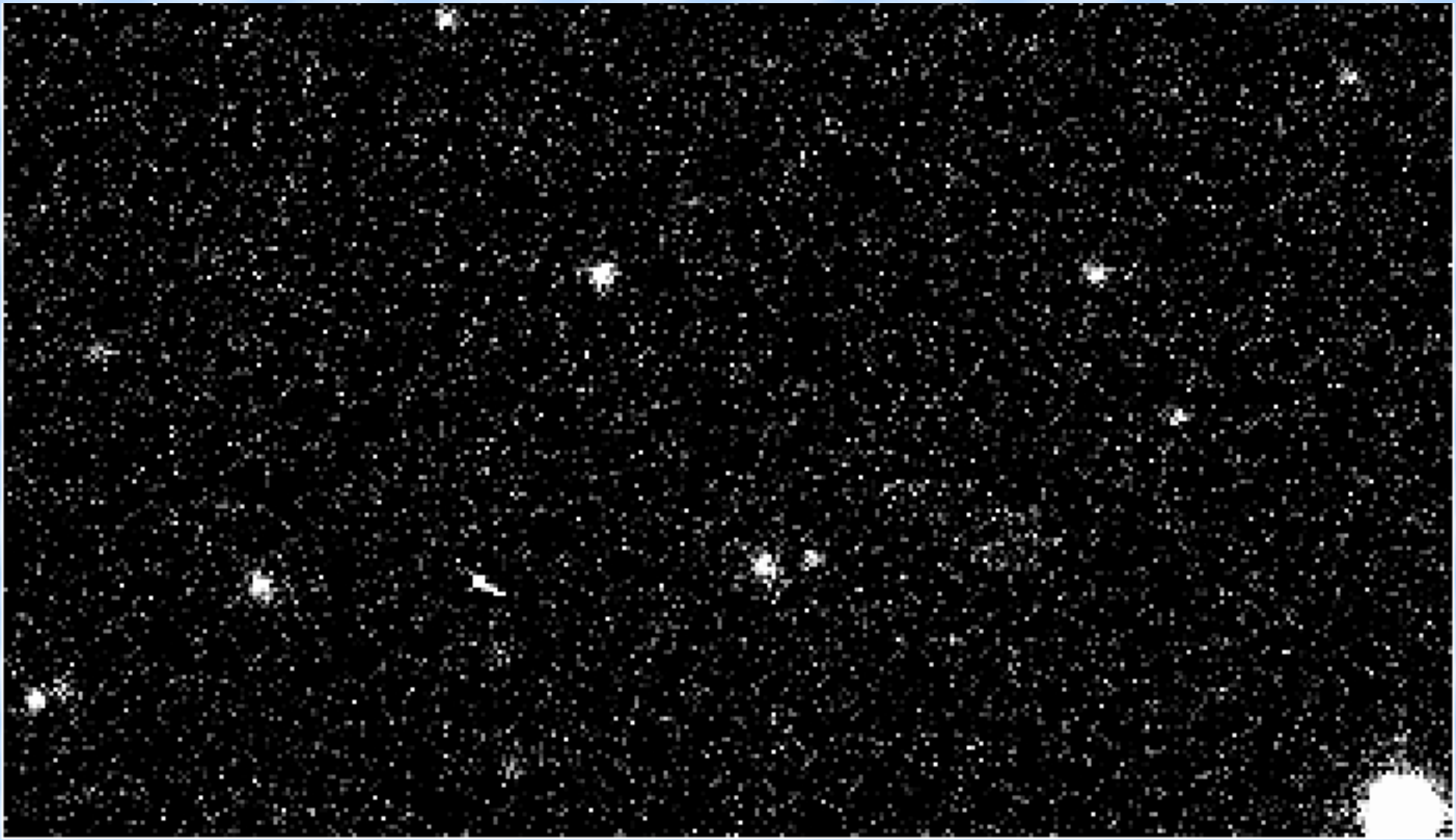
- We can now, for the first time, test for models
  - very many parameters
    - no satisfactory statistical measure of the model quality
  - so we estimate the quality of the models on 1D distributions
    - risk of degeneracy between different parameters
- Not enough detected objects to really decide between models
- We'd need between 4 (accepted CFHTLS-VW) and 10 (initially proposed projet) times more objects than what we'll have at the end of the survey to really test the models
- We don't have a *standard model* for the parameters of which we want to determine yet another digit
  - we are in a more interesting position: trying to determine the correct model -> hard to quantify how many obs are needed

Other preliminary results

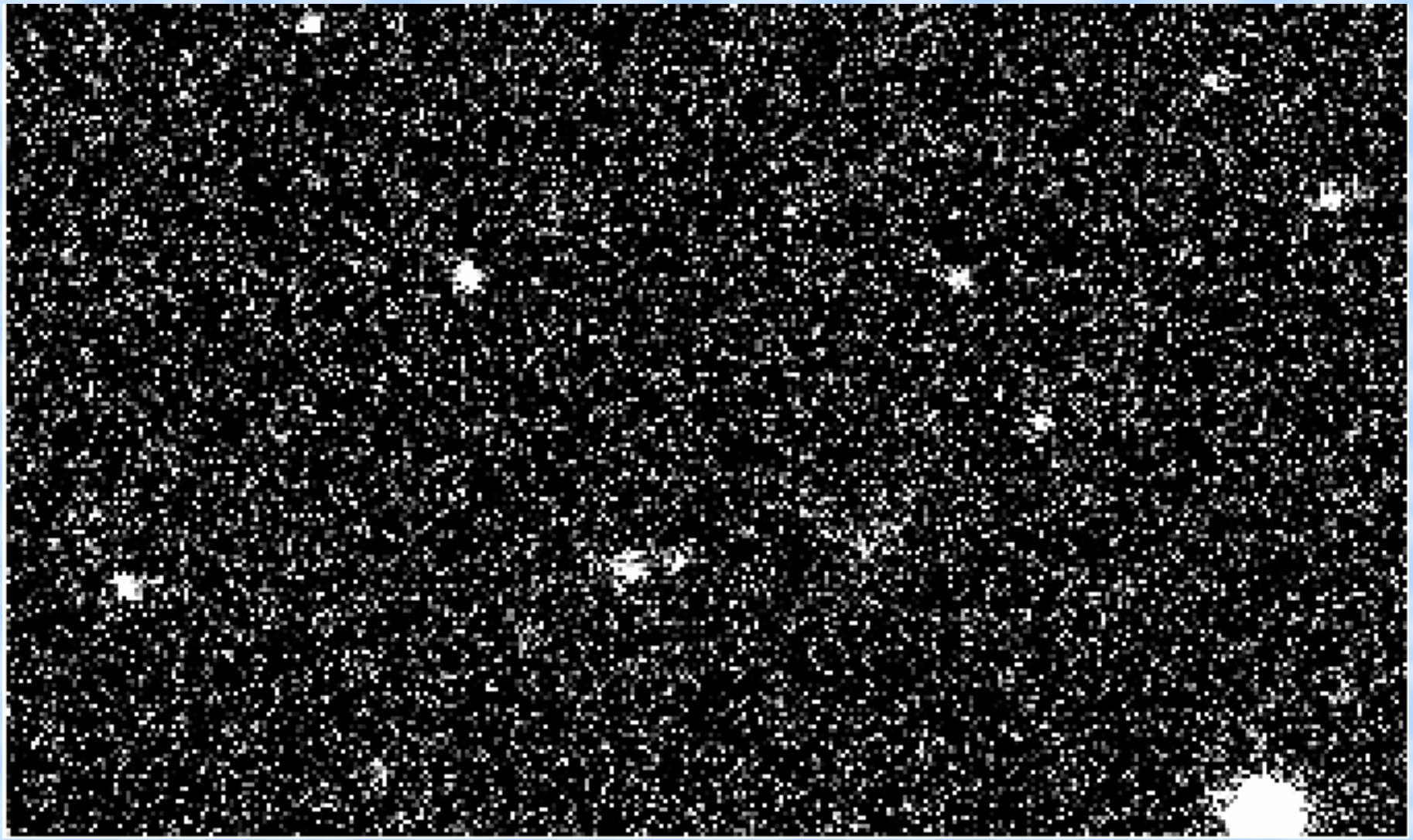
- Brightest object of the survey, by far: at high ecliptic latitude
- First distant object on quasi-circular orbit
- Dicovery of a temporary troyan
  - stability ?
  - thick trojan disk ?
- Discovery of a new well-separated binary
- Luminosity Function: slope = 0.7, m_0 = 23.6


Eccentricity
0.6
0.4
0.2
0
30
40
50
60
70
Inclination
50
40
30
20
10
0
30
40
50
60

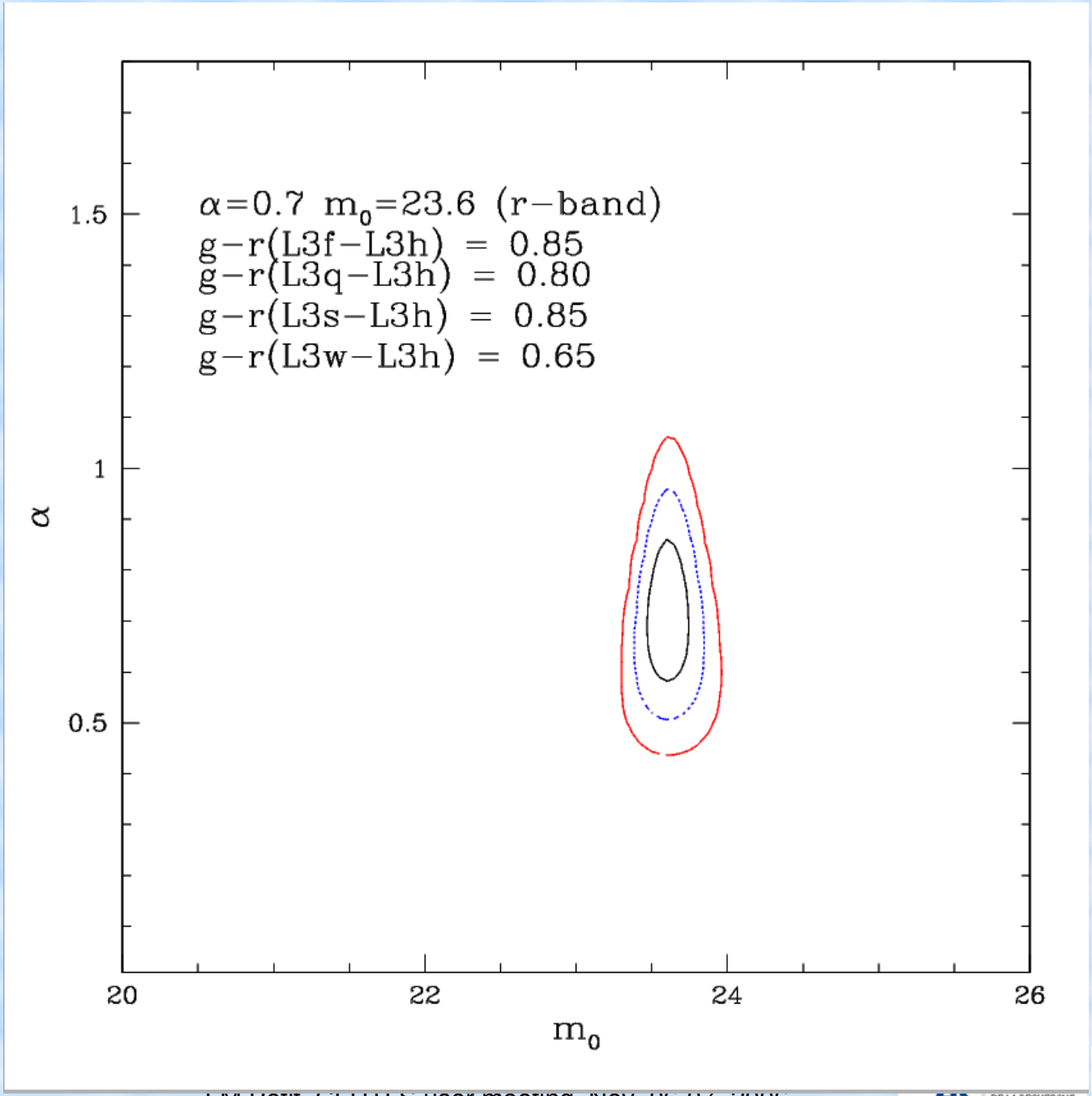
A new large separation binary



A new large separation binary



Luminosity Function of 2003 objects



Thanks QSO Team

- More quantitative results will appear in the coming paper presenting the 2003 data release of CFEPS
- Stay tuned !