

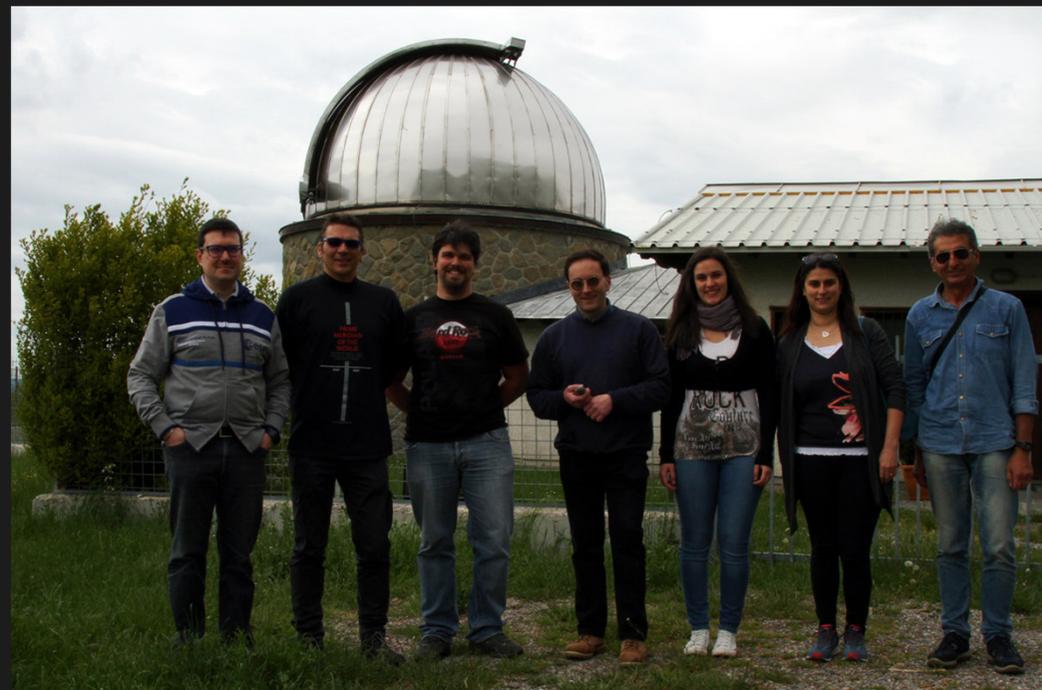
**Convegno CAAT 2016**  
**Osservatorio Astronomico "G. Forti" Montelupo (FI)**  
**11 dicembre 2016**



**Relatori Paolo Bacci & Martina Maestripietri**

# Attività osservatorio

- Operativo dal 1990
- 4000 visitatori l'anno
- Didattica: serate pubbliche Venerdì Sabato, in estate anche Lunedì
- Osservazione sole
- Serate tematiche (Luna, Saturno, Meteore)
- Conferenze con os



# Attività osservatorio

.Scuole:

. collaborazione sito web GAMP, corso astronomia, ricerca

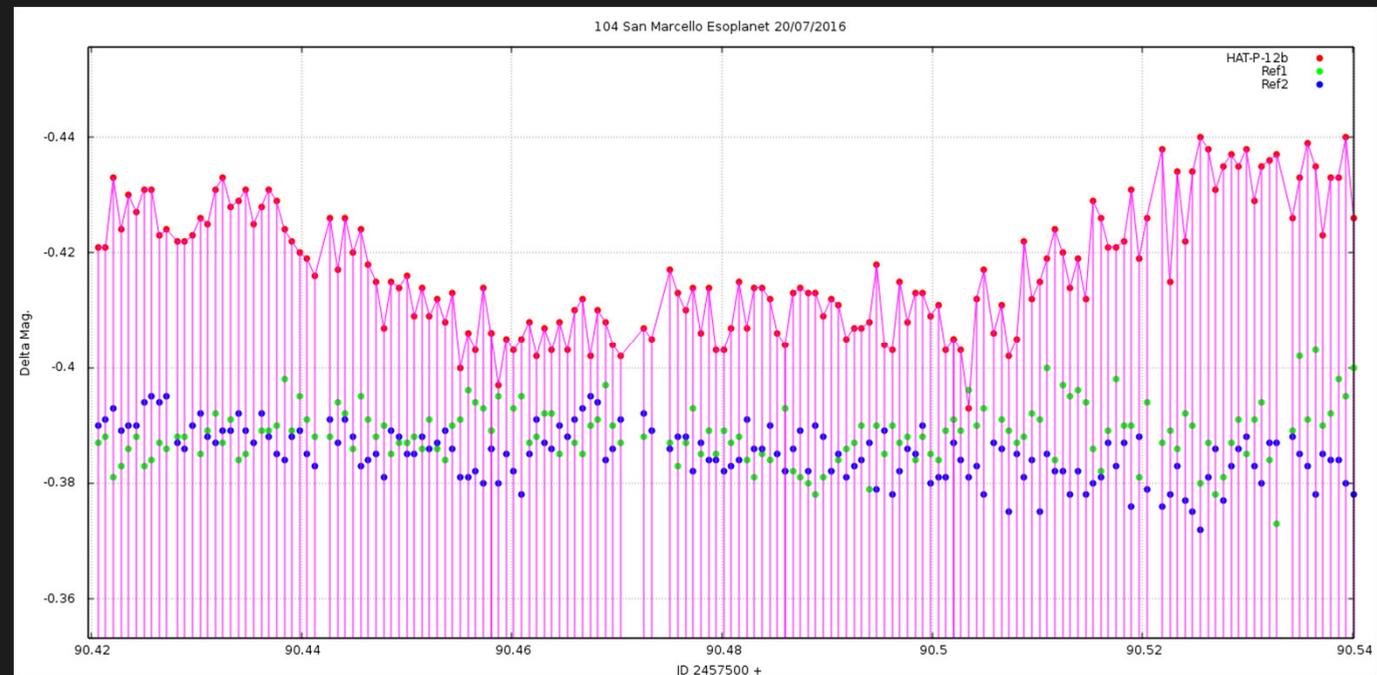
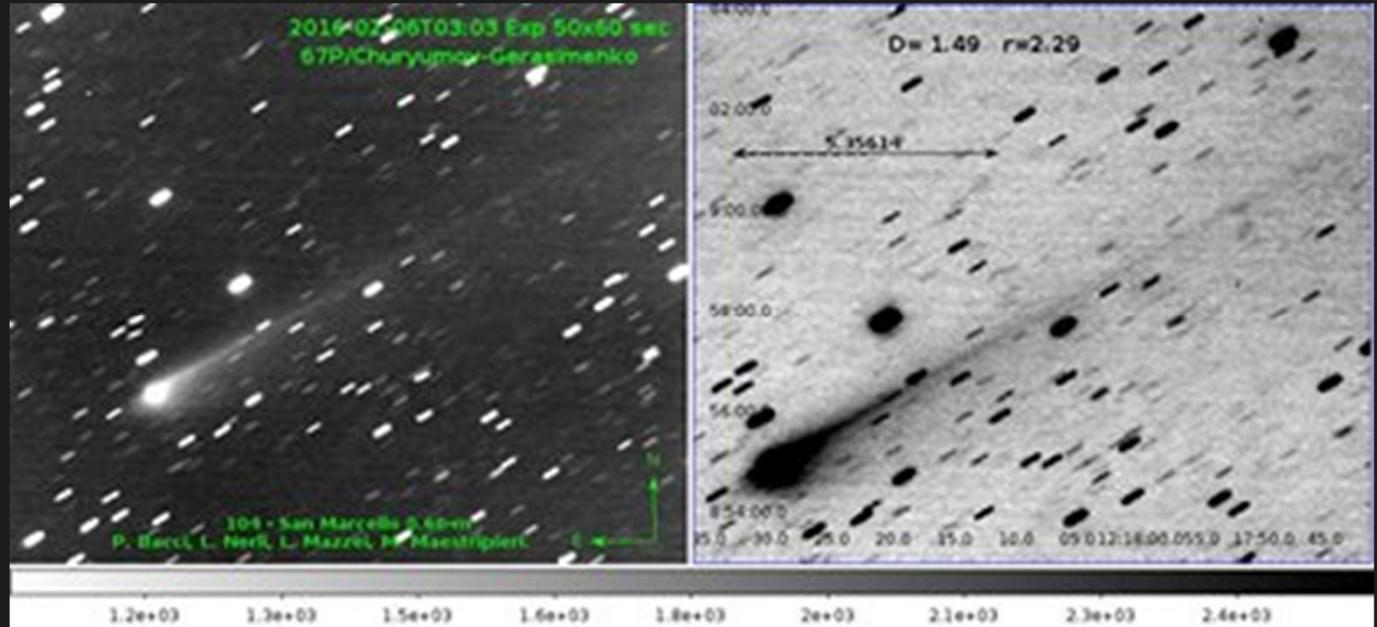
. Alternanza scuola lavoro 5 studenti - 2 scuole

. Liceo di Livorno:



# Attivita' osservatorio

- Ricerca;
- Asteroidi
- 301 scoperti
- Curve di luce
- MPEC
- Parallasse
- Meteore Video
- S
- E



# Osservatori Italiani

Attività degli osservatori italiani nel 2016 (aggiornato a Novembre)

Osservatori Italiani con codice MPC 164

Osservatori attivi **2016: 40** (24%)

Osservatori attivi 2015: 51

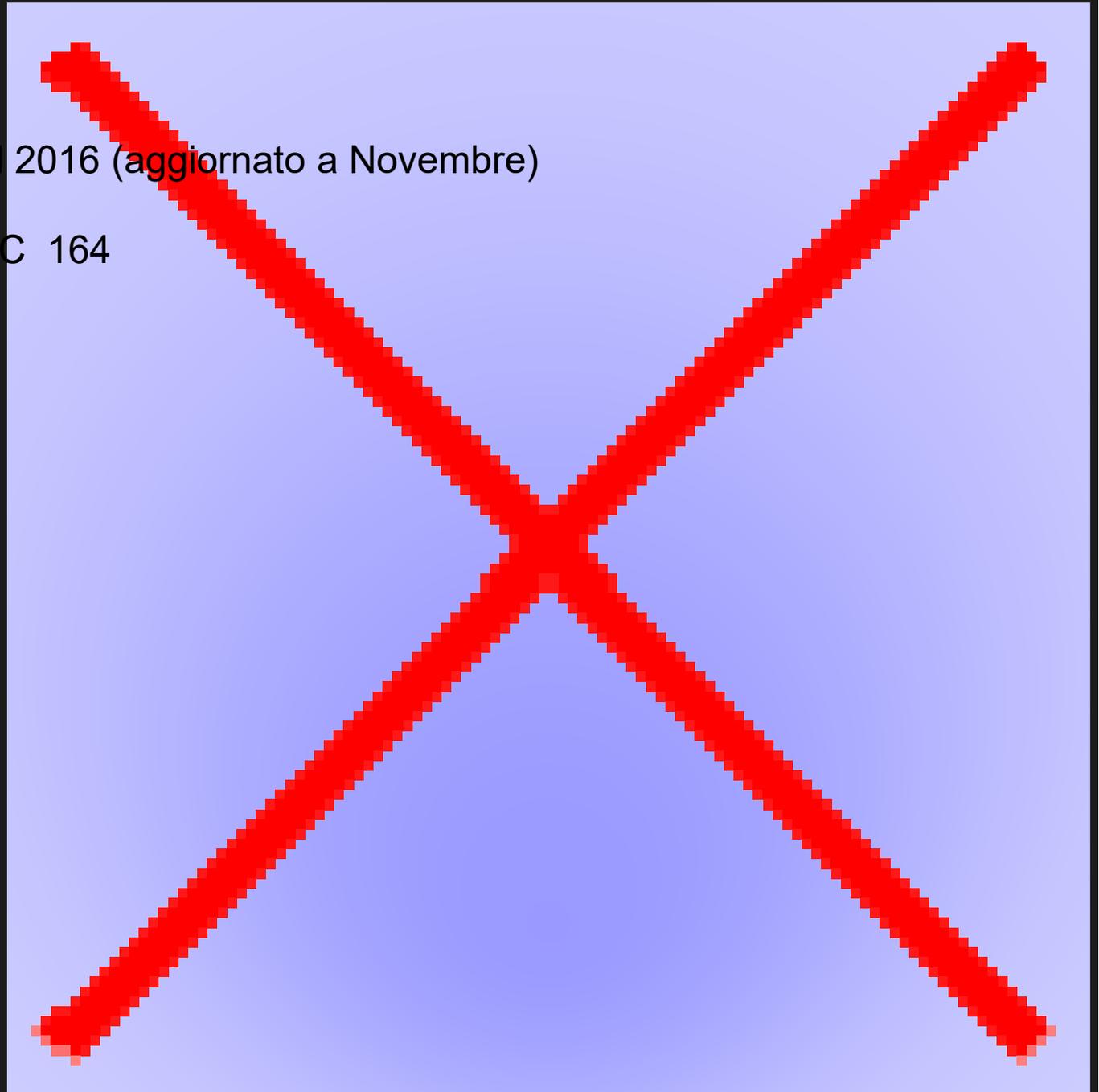
Osservatori attivi 2014: 57

Osservatori attivi 2013: 59

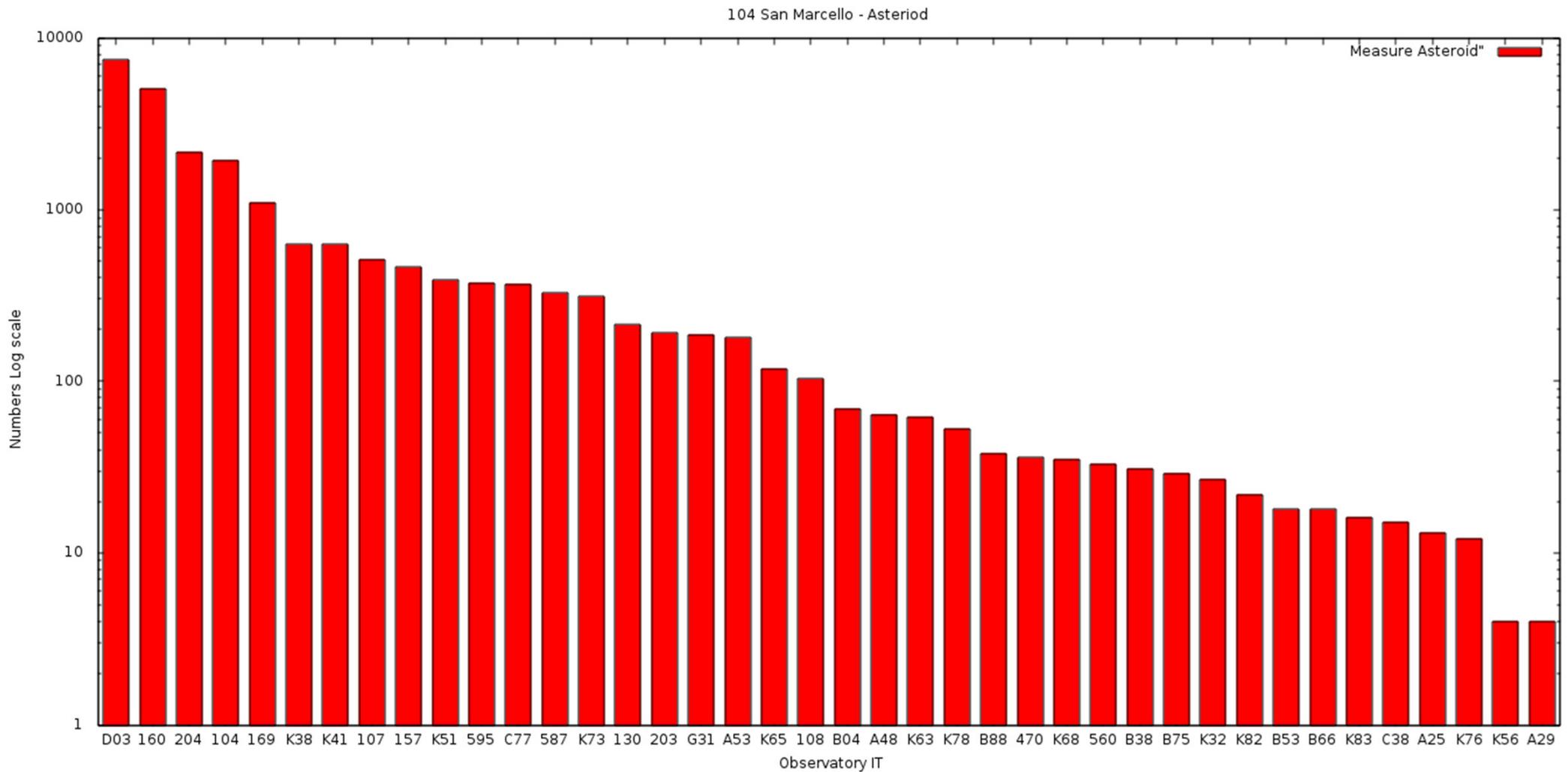
Osservatori attivi 2012: 57

Osservatori attivi 2011: 57

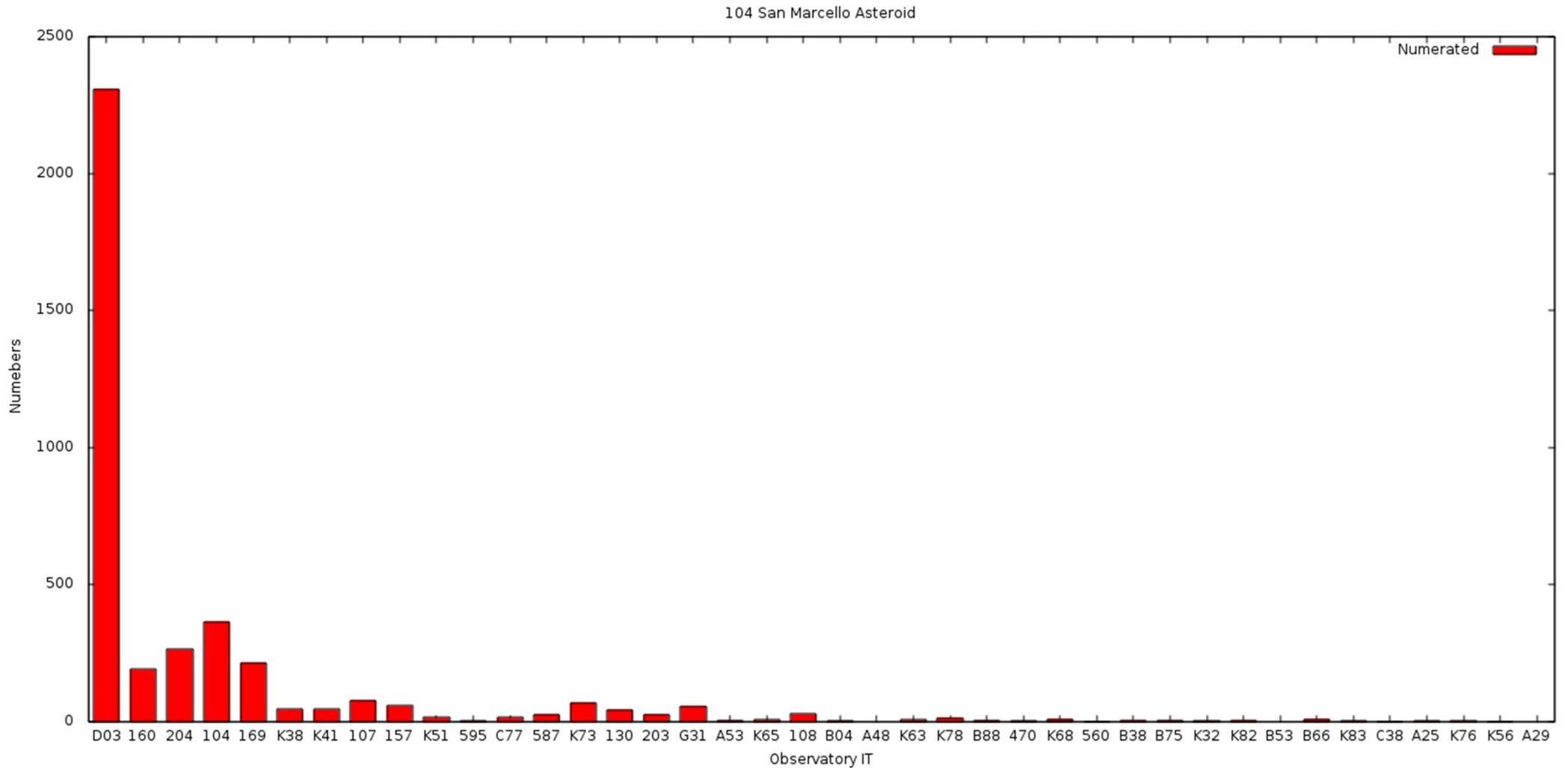
Osservatori attivi 2010: 46



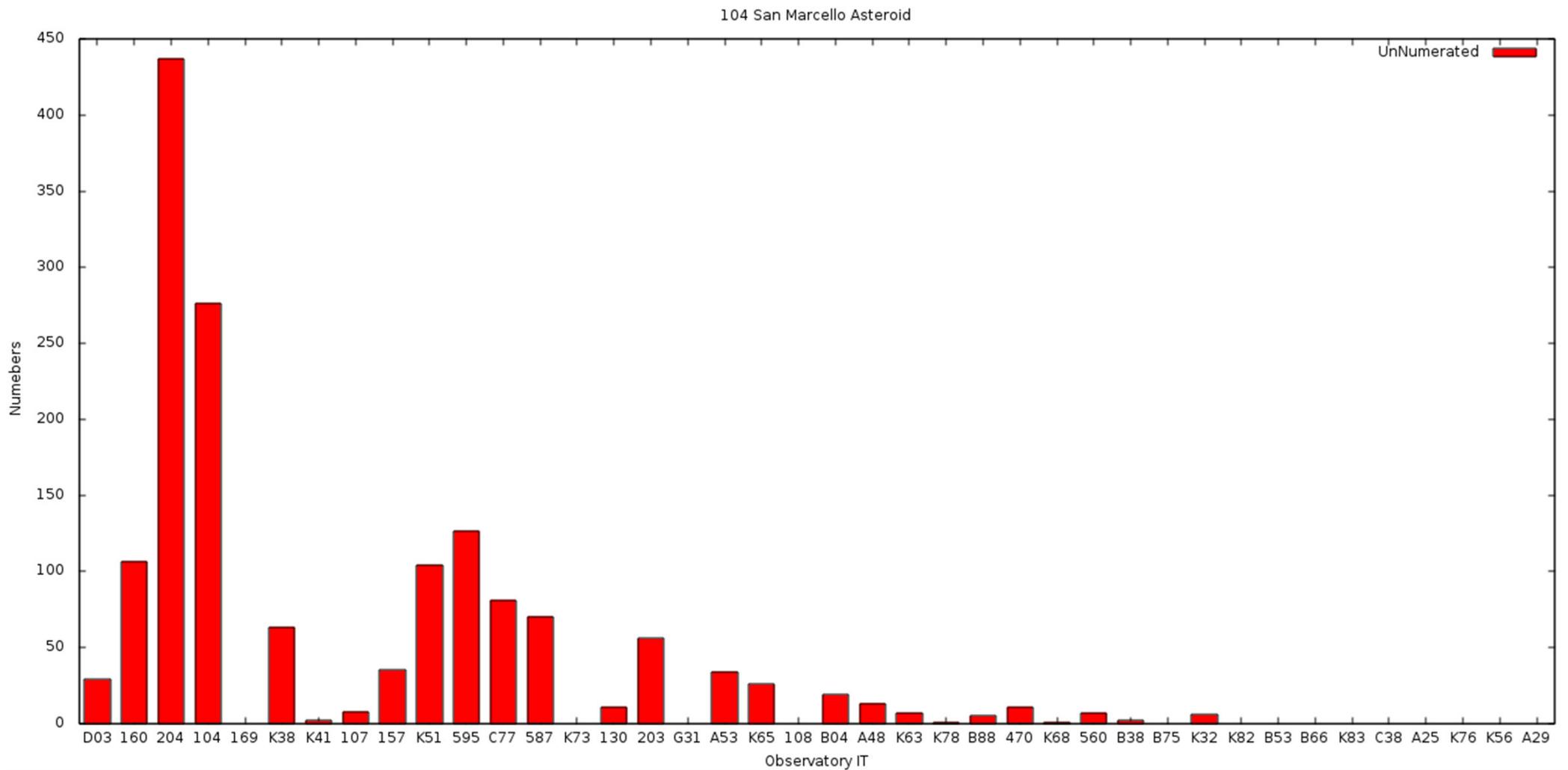
# Osservazioni asteroidi



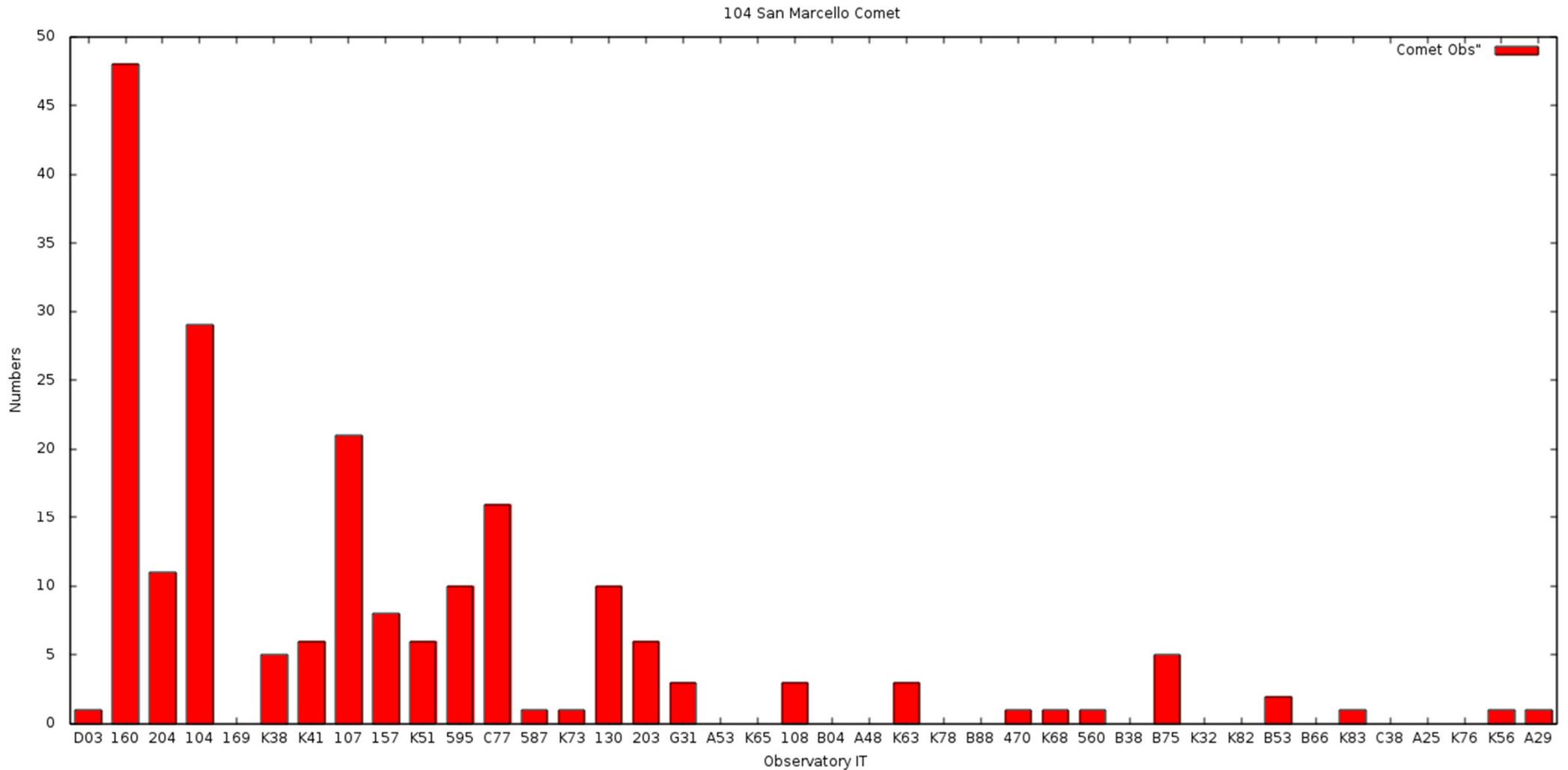
# Asteroidi Numerati osservati



# Asteroidi Non Numerati osservati



# Comete osservate



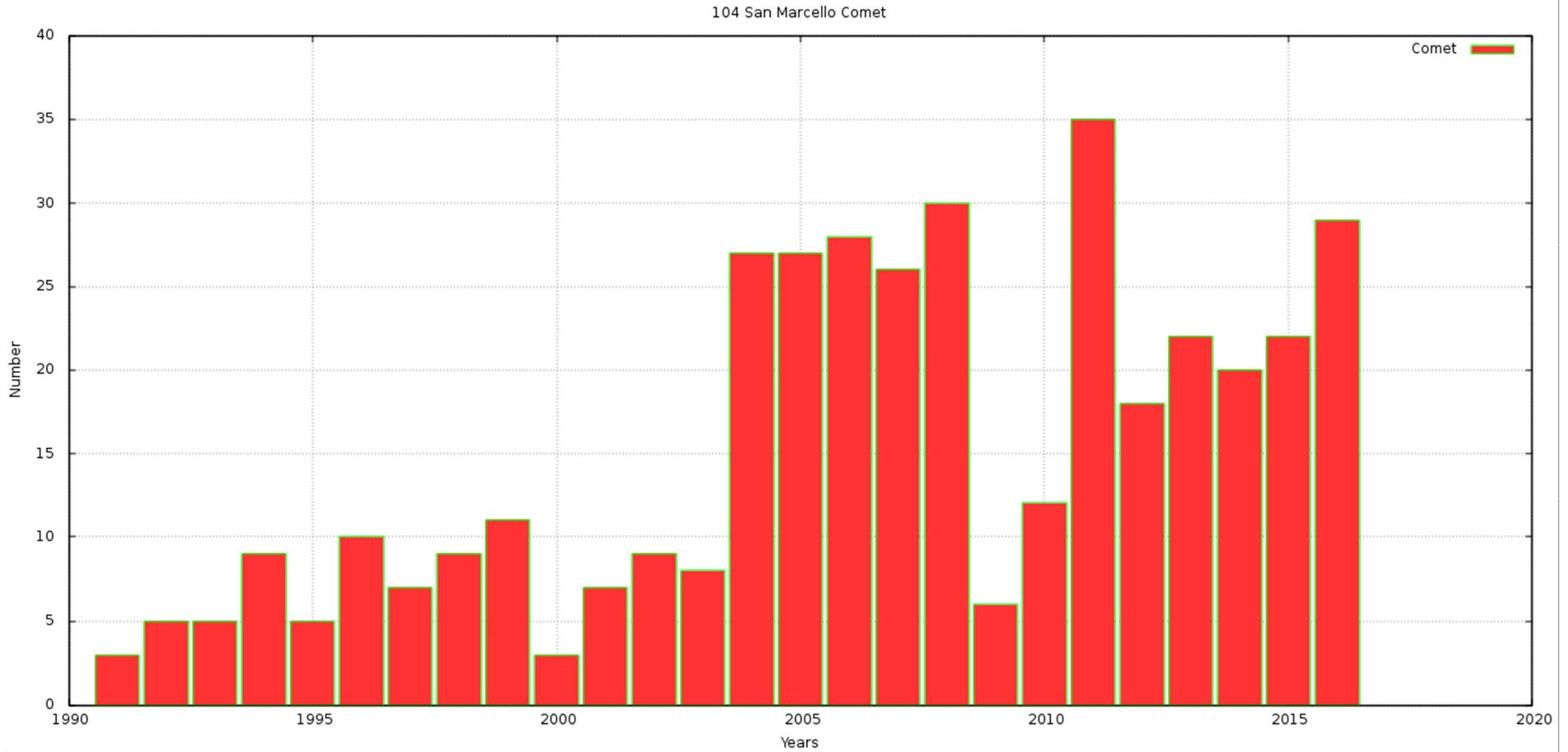
# Statistics on residuals from observations of minor planets, by observatory code

104	2016	942	802	107	28	5	0	+0.07 +/- 0.55	+0.01 +/- 0.58
107	2016	161	137	24	0	0	0	+0.07 +/- 0.52	+0.09 +/- 0.45
108	2016	9	9	0	0	0	0	-0.05 +/- 0.34	+0.25 +/- 0.45
130	2016	185	173	11	1	0	0	+0.03 +/- 0.46	-0.02 +/- 0.37
157	2016	221	221	0	0	0	0	+0.02 +/- 0.24	-0.02 +/- 0.22
160	2016	3143	2766	319	54	4	0	+0.02 +/- 0.48	-0.02 +/- 0.48
204	2016	924	900	24	0	0	0	-0.01 +/- 0.28	+0.10 +/- 0.31
470	2016	21	15	3	3	0	0	+0.05 +/- 0.74	-0.24 +/- 0.87
560	2016	33	33	0	0	0	0	-0.09 +/- 0.18	-0.03 +/- 0.23
587	2016	113	97	14	2	0	0	-0.02 +/- 0.43	+0.11 +/- 0.50
595	2016	110	100	9	1	0	0	+0.04 +/- 0.41	-0.07 +/- 0.45
A25	2016	4	1	3	0	0	0	-1.50 +/- 0.43	+0.34 +/- 0.20
A29	2016	4	4	0	0	0	0	-0.13 +/- 0.34	-0.18 +/- 0.35
A48	2016	20	20	0	0	0	0	-0.09 +/- 0.41	-0.02 +/- 0.35
A53	2016	84	71	13	0	0	0	+0.34 +/- 0.44	+0.28 +/- 0.31
B04	2016	38	34	4	0	0	0	+0.09 +/- 0.35	+0.14 +/- 0.51
B53	2016	18	18	0	0	0	0	+0.15 +/- 0.33	+0.40 +/- 0.32
B75	2016	20	14	5	1	0	0	+0.24 +/- 0.51	-0.19 +/- 0.91
B88	2016	26	16	10	0	0	0	+0.04 +/- 0.67	-0.16 +/- 0.61
C77	2016	156	144	11	0	1	0	+0.00 +/- 0.40	+0.03 +/- 0.48
D03	2016	1505	1230	252	23	0	0	+0.06 +/- 0.56	+0.03 +/- 0.55
G31	2016	186	166	16	4	0	0	+0.14 +/- 0.48	+0.14 +/- 0.42
K32	2016	10	8	2	0	0	0	+0.43 +/- 0.32	+0.29 +/- 0.53
K38	2016	305	273	17	2	13	0	-0.20 +/- 0.36	-0.37 +/- 0.73
K51	2016	141	138	3	0	0	0	-0.04 +/- 0.29	+0.17 +/- 0.24

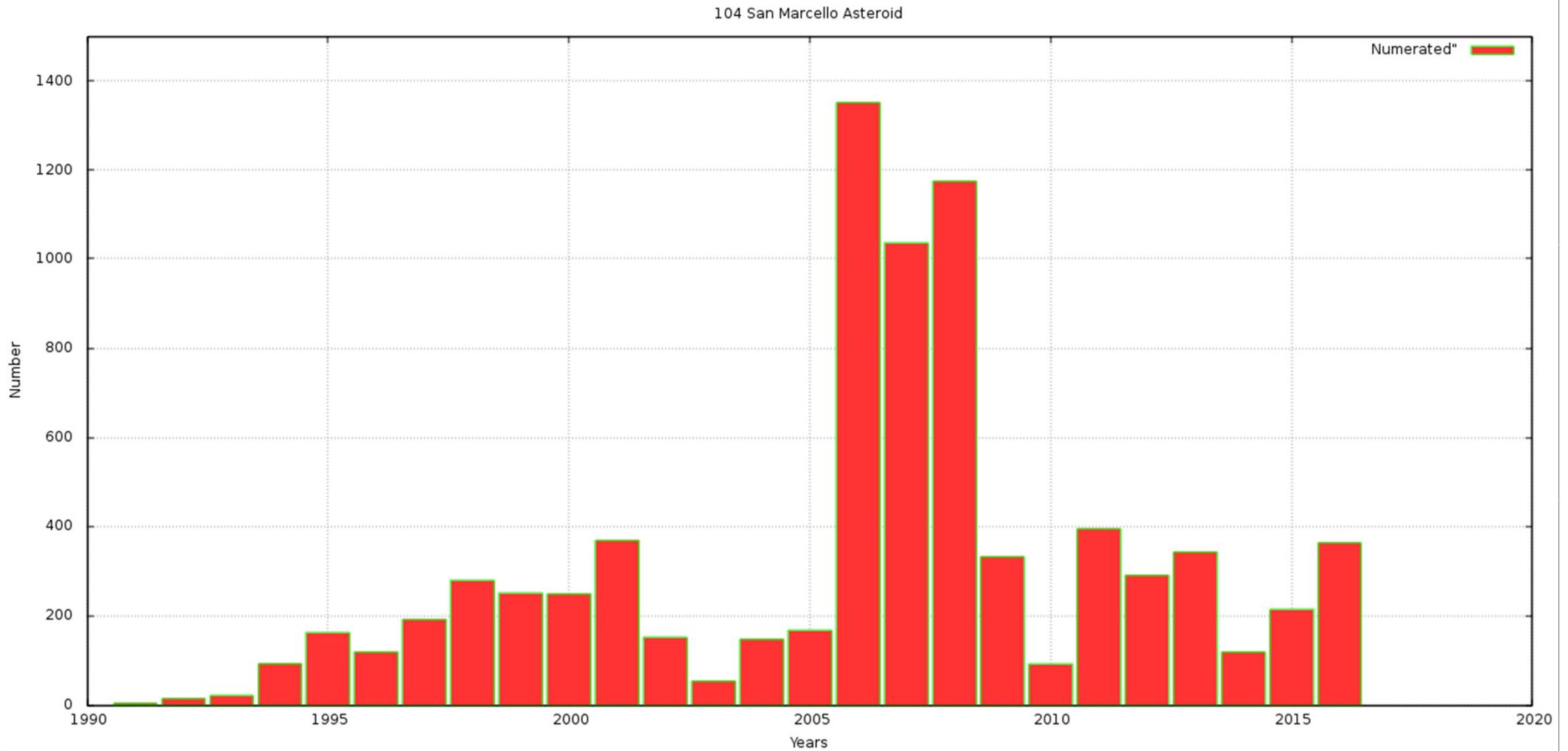
# Statistics on residuals from observations of numbered minor planets, by observatory code

104	2016	697	610	69	15	3	0	+0.07 +/- 0.51	+0.07 +/- 0.52
107	2016	49	47	2	0	0	0	+0.05 +/- 0.32	+0.14 +/- 0.33
108	2016	9	9	0	0	0	0	-0.05 +/- 0.34	+0.25 +/- 0.45
130	2016	141	137	3	1	0	0	+0.02 +/- 0.43	-0.04 +/- 0.31
157	2016	101	101	0	0	0	0	+0.03 +/- 0.24	-0.01 +/- 0.20
160	2016	2465	2229	203	32	1	0	+0.03 +/- 0.43	-0.05 +/- 0.44
204	2016	397	386	11	0	0	0	+0.01 +/- 0.29	+0.12 +/- 0.30
470	2016	3	3	0	0	0	0	-0.01 +/- 0.05	-0.29 +/- 0.04
560	2016	3	3	0	0	0	0	-0.16 +/- 0.05	-0.09 +/- 0.15
587	2016	42	37	5	0	0	0	+0.09 +/- 0.40	+0.02 +/- 0.42
595	2016	5	5	0	0	0	0	-0.05 +/- 0.36	-0.24 +/- 0.11
A25	2016	4	1	3	0	0	0	-1.50 +/- 0.43	+0.34 +/- 0.20
A53	2016	12	11	1	0	0	0	+0.28 +/- 0.30	+0.47 +/- 0.25
B04	2016	10	10	0	0	0	0	-0.10 +/- 0.23	+0.07 +/- 0.20
B75	2016	12	9	2	1	0	0	+0.23 +/- 0.59	+0.06 +/- 1.03
B88	2016	23	16	7	0	0	0	-0.11 +/- 0.55	-0.18 +/- 0.64
C77	2016	35	32	2	0	1	0	-0.01 +/- 0.48	+0.09 +/- 0.60
D03	2016	1479	1204	252	23	0	0	+0.06 +/- 0.56	+0.02 +/- 0.55
G31	2016	176	164	9	3	0	0	+0.15 +/- 0.45	+0.13 +/- 0.35
K32	2016	3	3	0	0	0	0	+0.21 +/- 0.10	-0.18 +/- 0.09
K38	2016	146	145	1	0	0	0	-0.08 +/- 0.26	-0.21 +/- 0.25
K51	2016	33	31	2	0	0	0	-0.19 +/- 0.32	+0.20 +/- 0.18

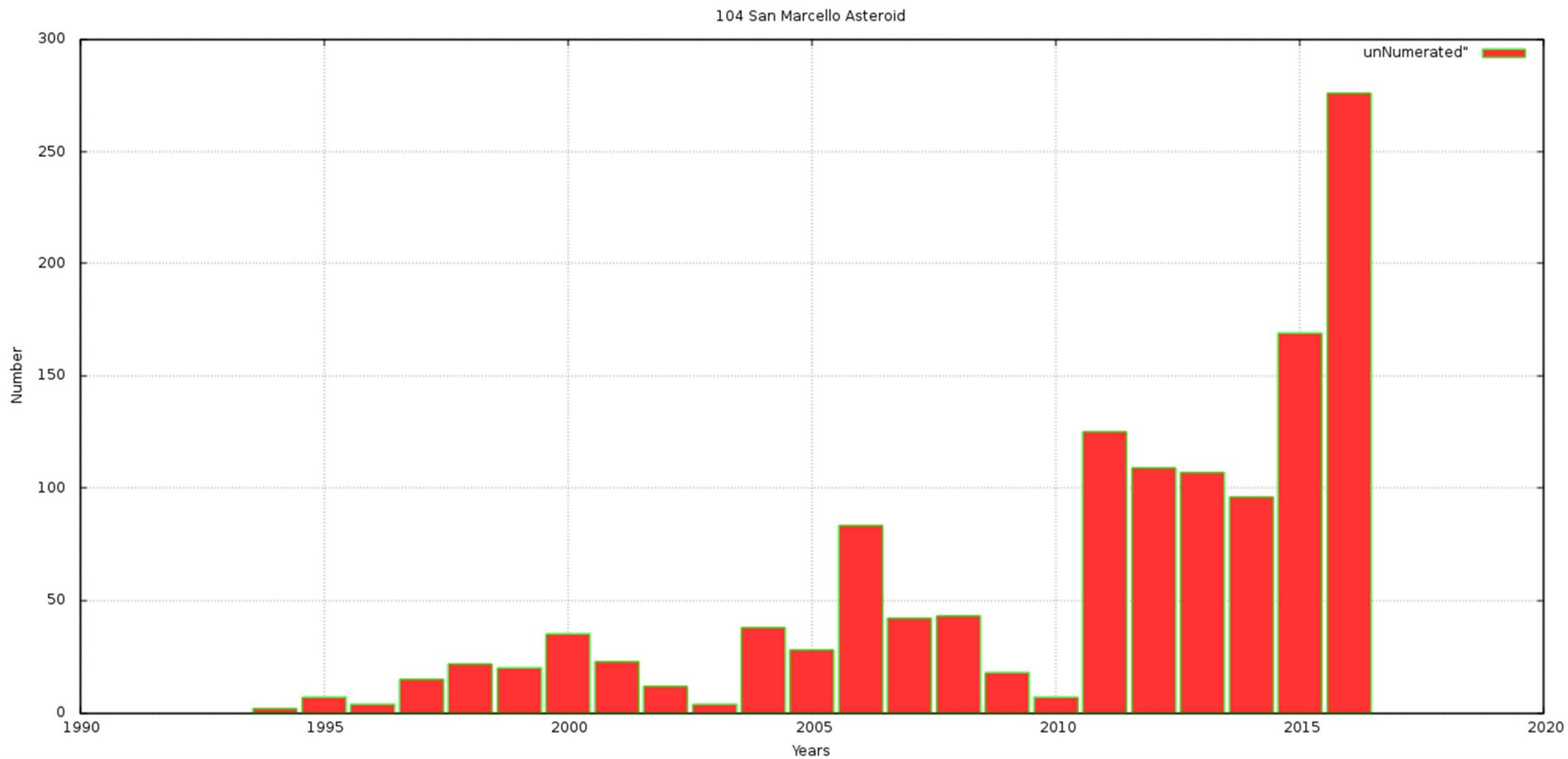
# 104 – comete per anno



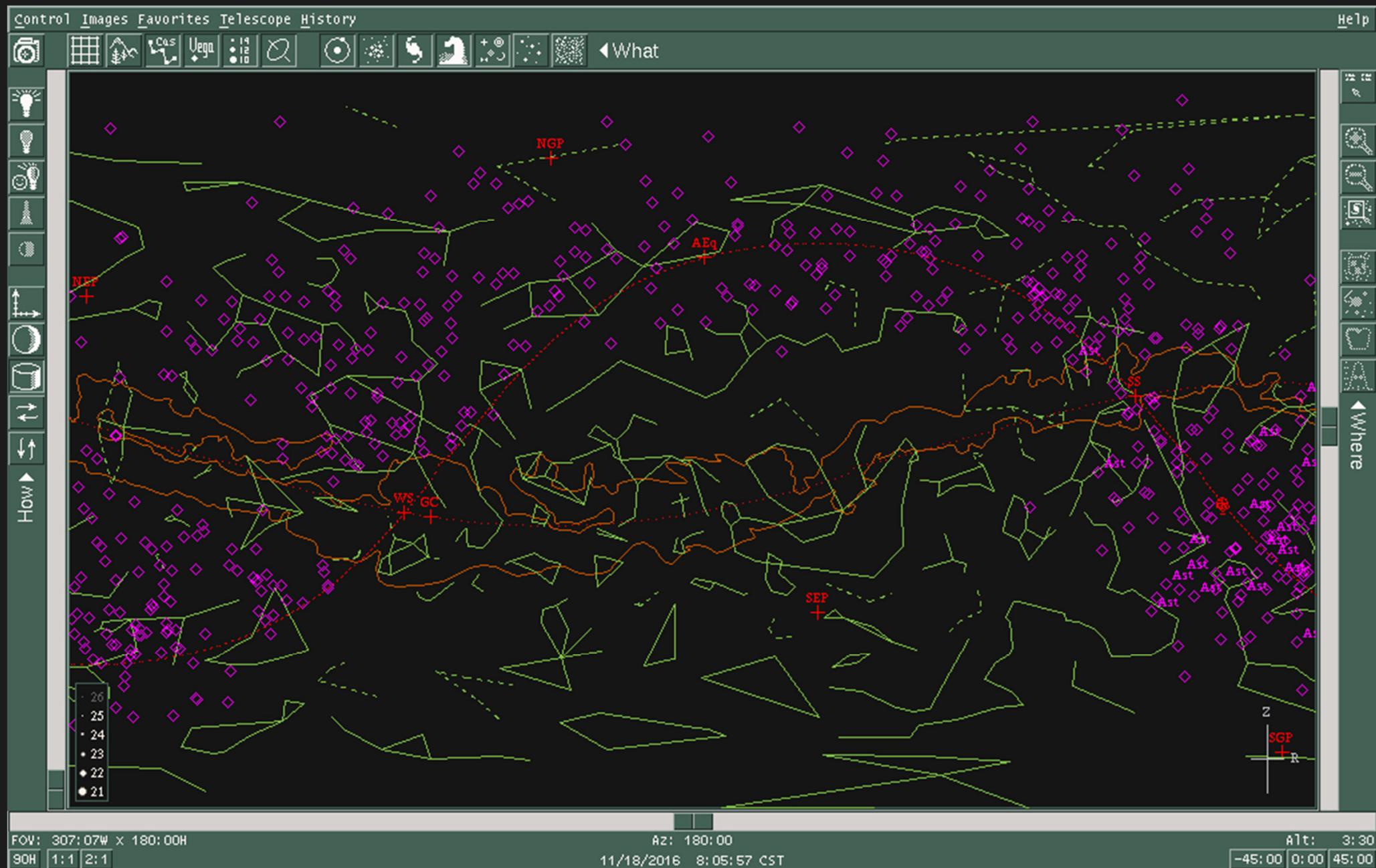
# 104 – Numerati per anno



# 104 – Non Numerati per anno



# 104 – Sky view



## 104 in numeri

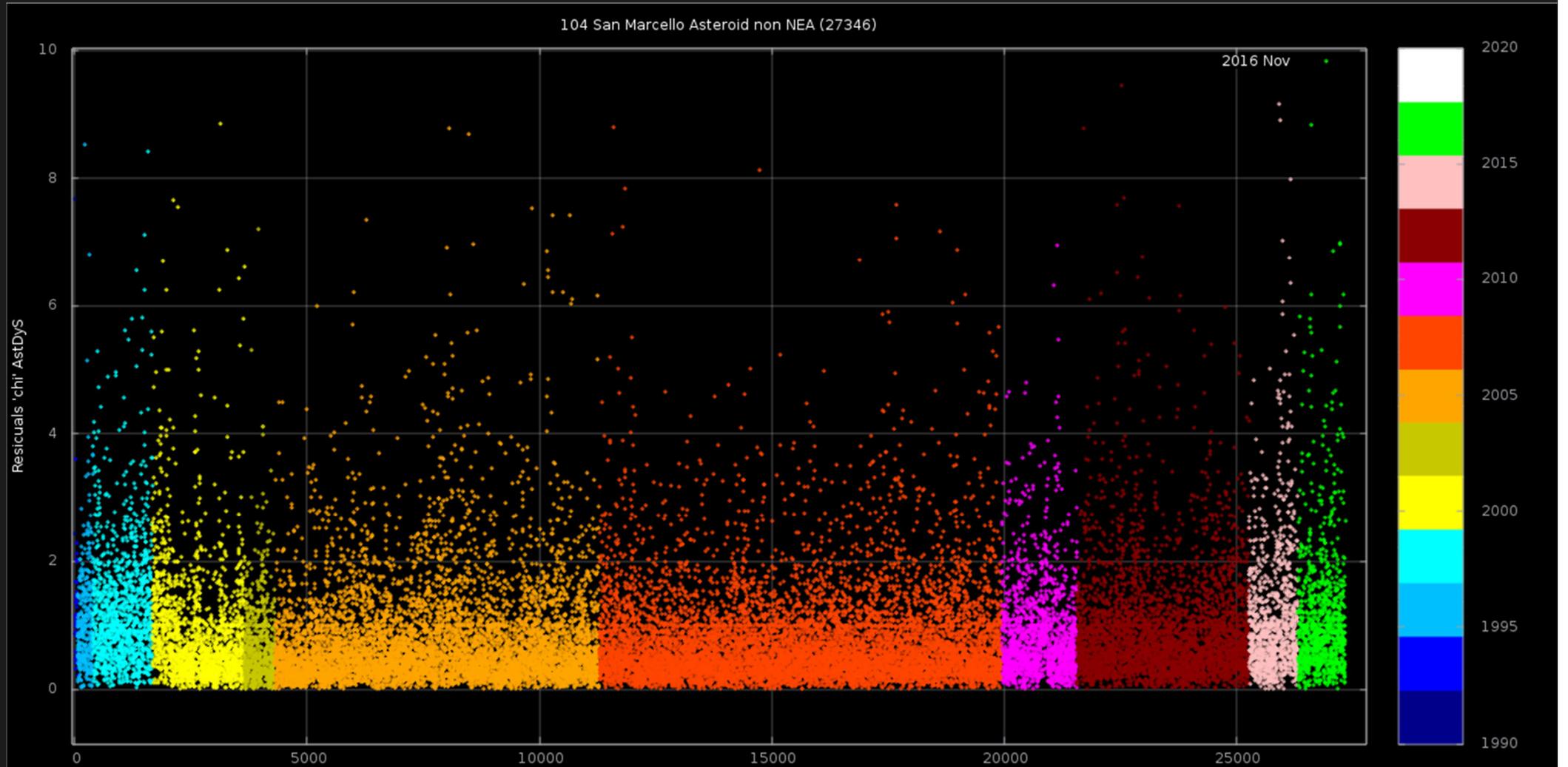
- .Misure : 1936
- .Numerati: 363
- .Non Numerati: 279
- .Comete : 29
- .Misure **NEA**: 774
- .**NEA** : 240
- .**MPEC** : 212
- .NEOCP confermati:  
193
- .MPEC Comet : 6

## PRINCIPALI RISULTATI

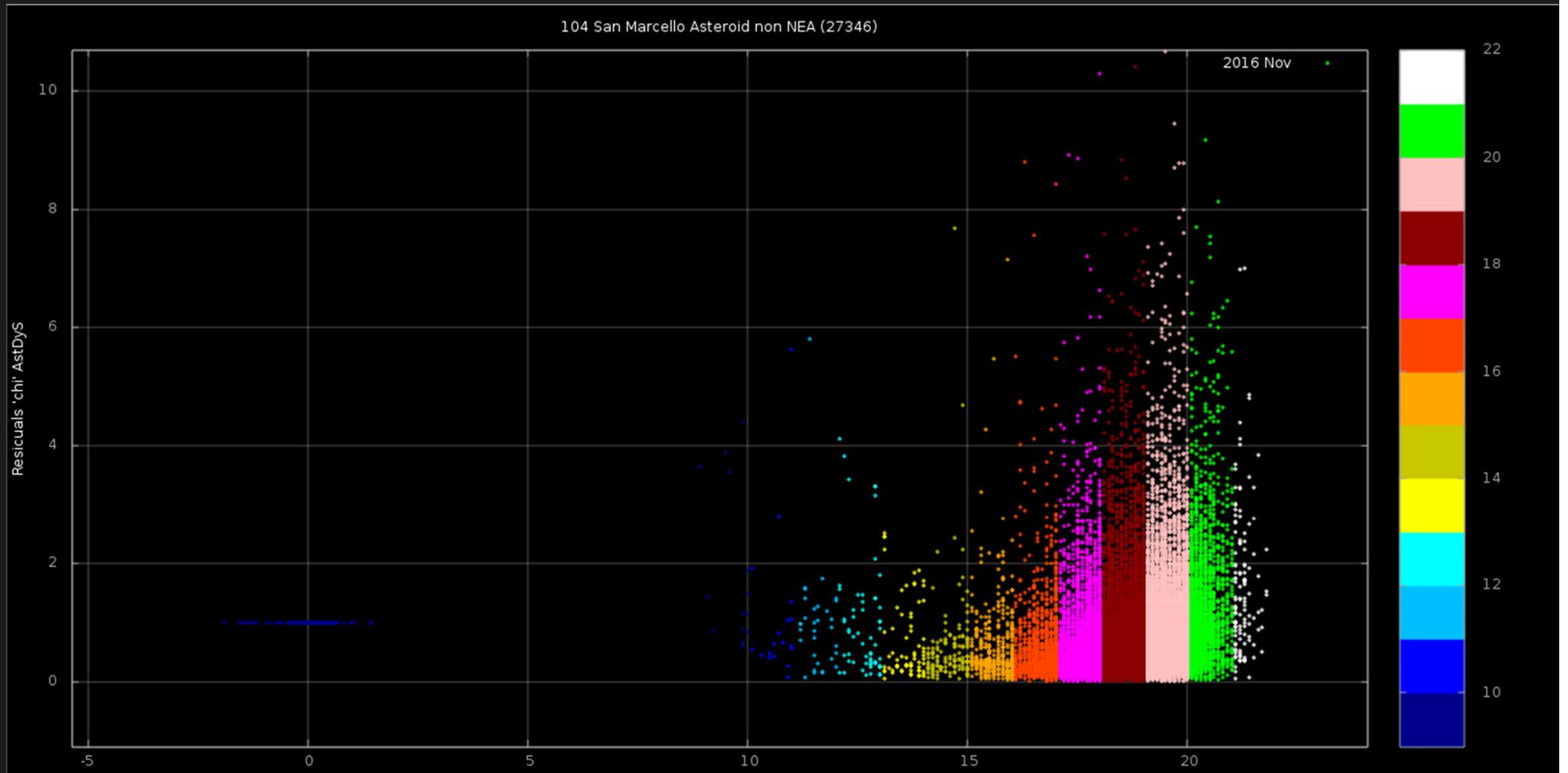
- .Balaton Asteroide Binario
- .2008 CT190 follow-up  
TNO
- . 2014 US224 **recovery**  
TNO
- .PACA\_67P 2 immagini  
nel video ufficiale
- .2016 QA2 passaggio  
radente
- .2016 SA2 velocissimo

# Residual chi vs measure

.Chi residual AstDys = sqrt( dRA + dDec )

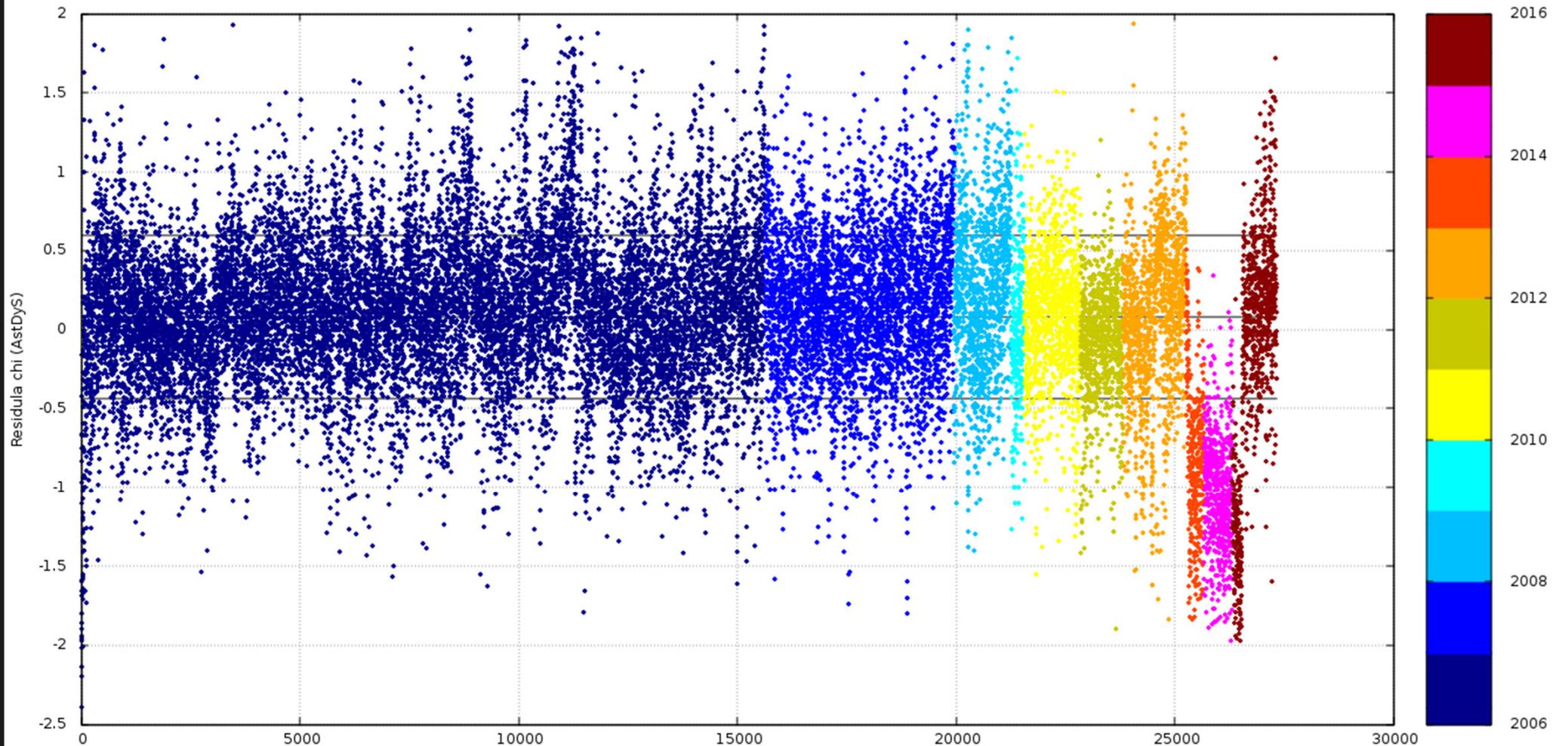


# Residual chi vs mag



# Mag Diff

104 San Marcello Asteriodi Non NEA (2016)



## NEA vicini alla Terra

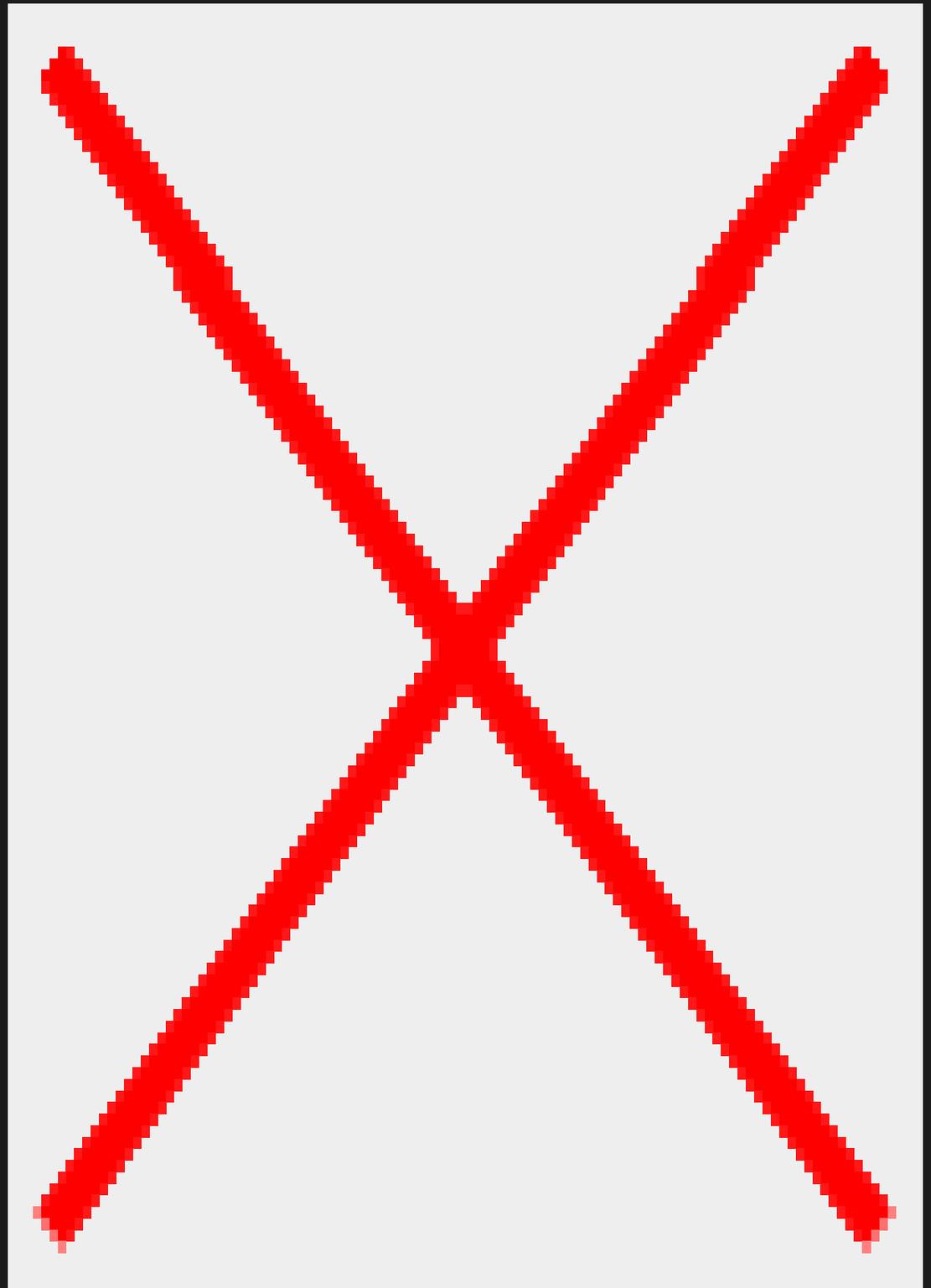
.Nel 2016 sono stati scoperti 163 asteroidi con una distanza inferiore a 0,00098 UA (3,4 LD).

.Valore medio  $H = 27,3$

.Valore medio  $LD = 1,8$

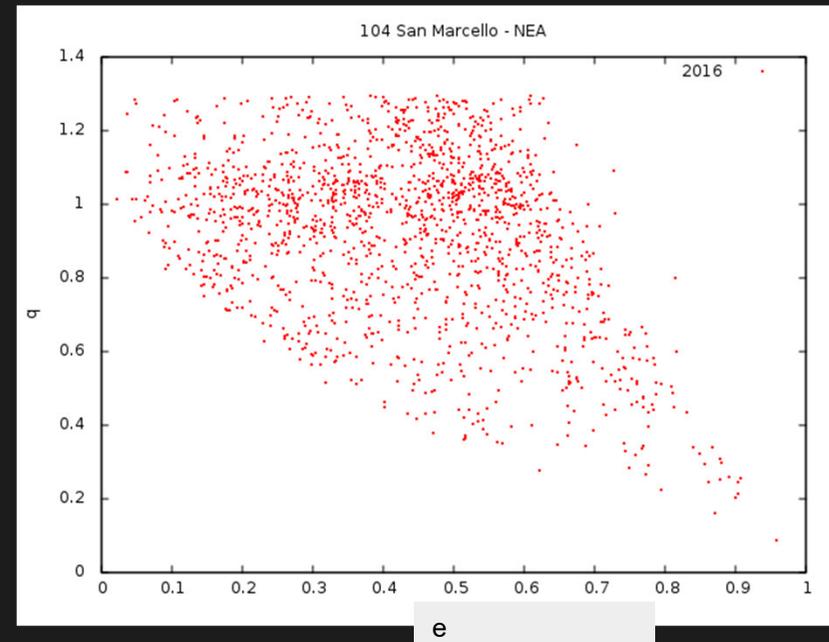
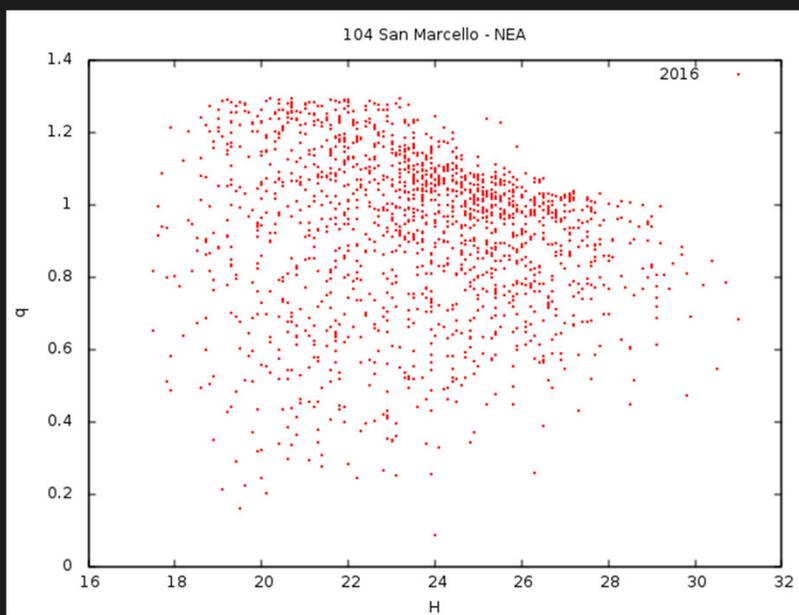
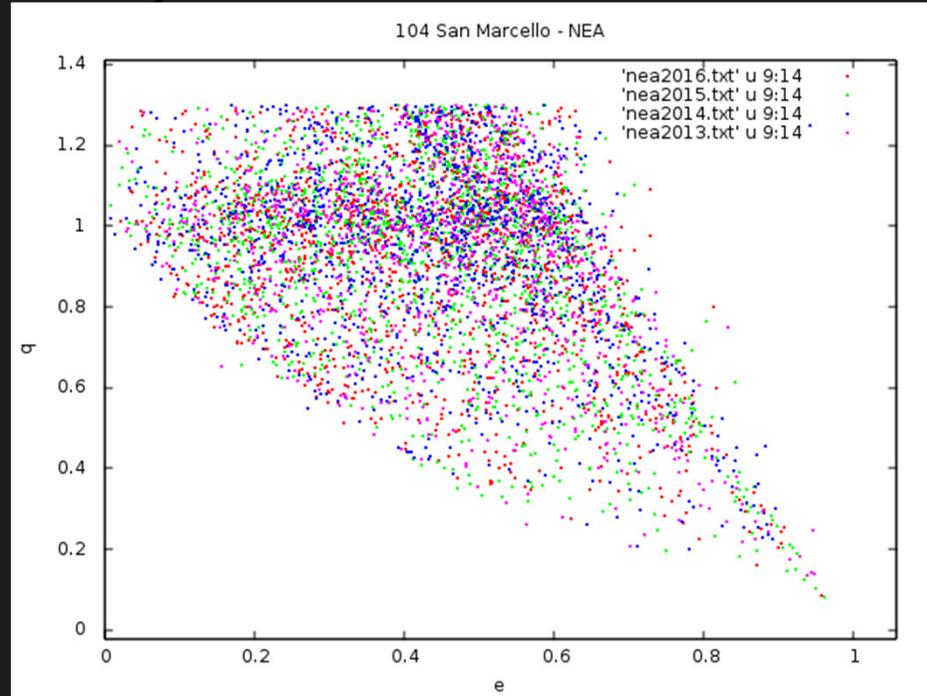
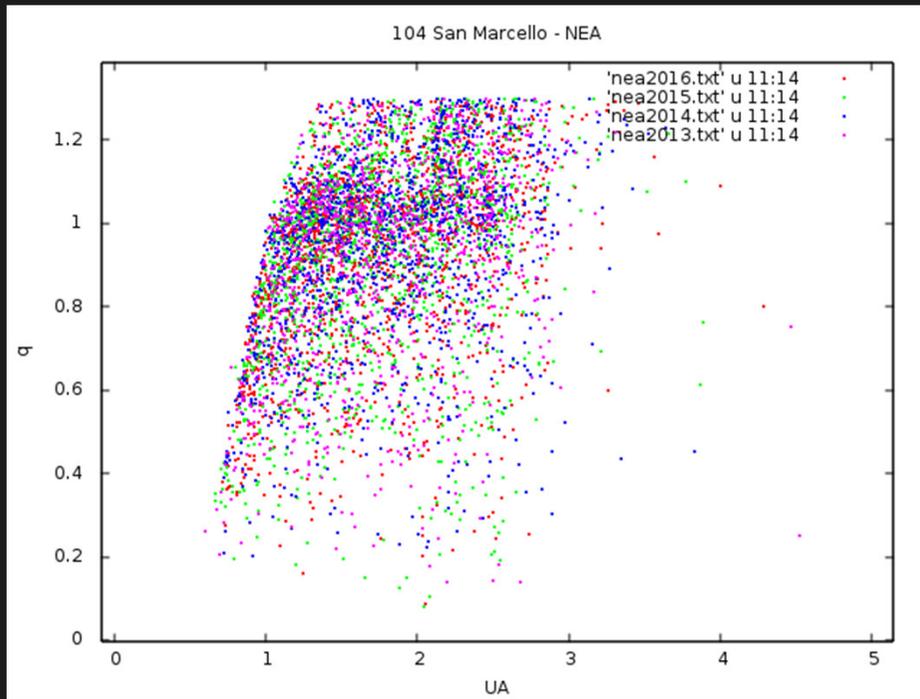
# 2016 Asteroidi vicini

- .1 UA
- .2 Km
- .3 LD
- .4 Designazione
- .5 H
- .6 Data



# NEA a vs q & e vs q

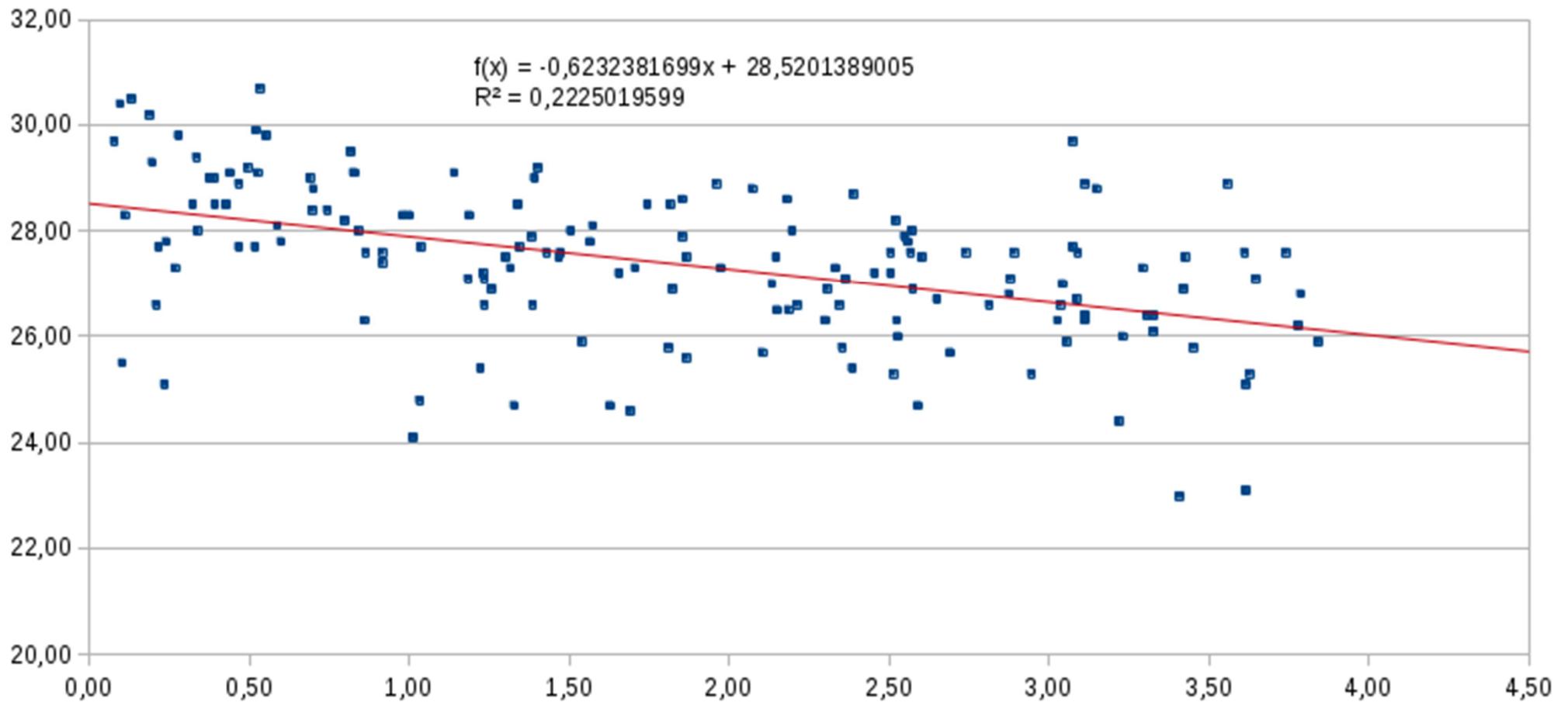
## .Distribuzione asteroid NEA per anno 2013-2016



# H vs LD (2016)

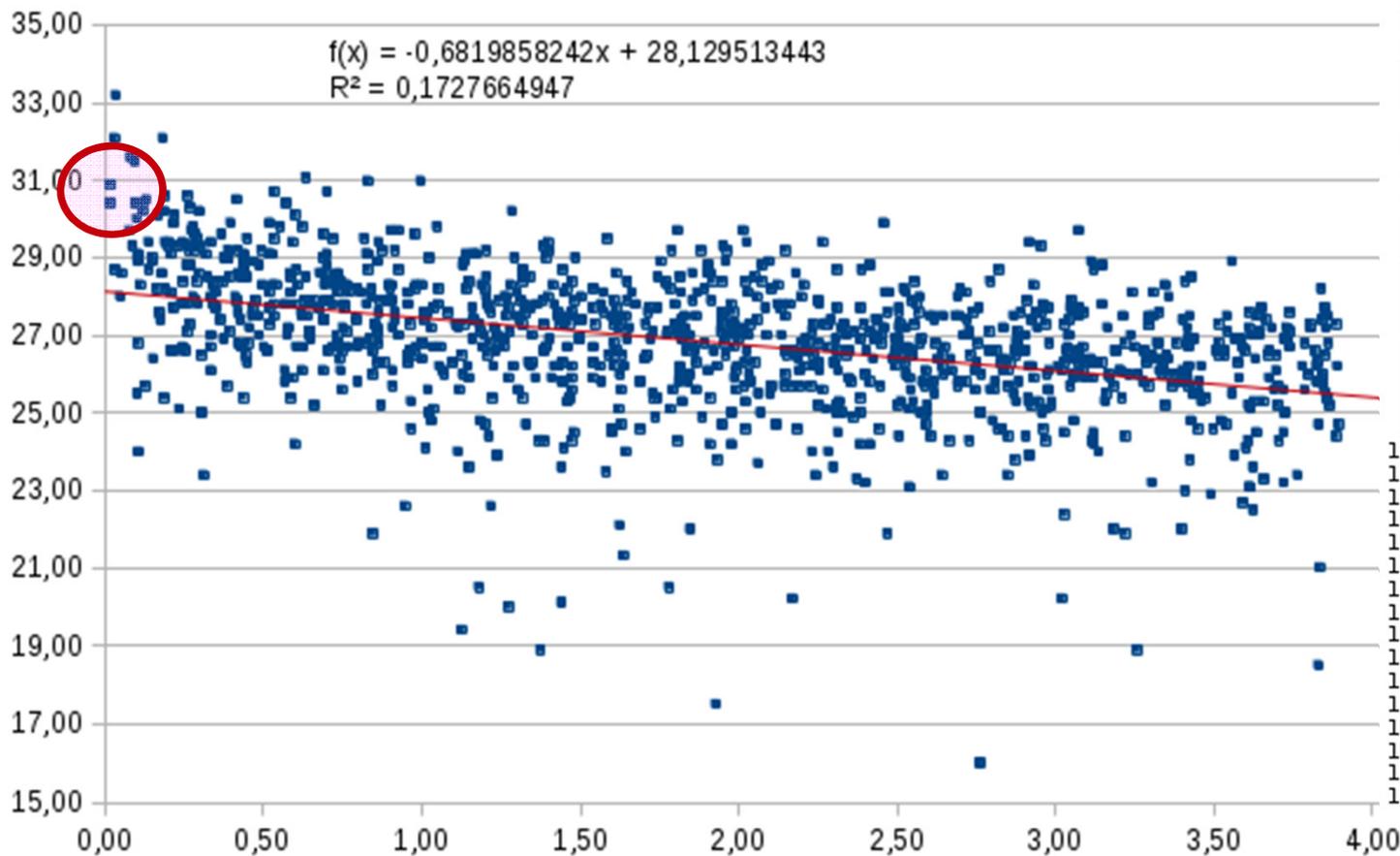
Closest Approaches to the Earth by Minor Planets

104 San Marcello



# H vs LD (tutti)

1124 Closest Approaches to the Earth by Minor Planets

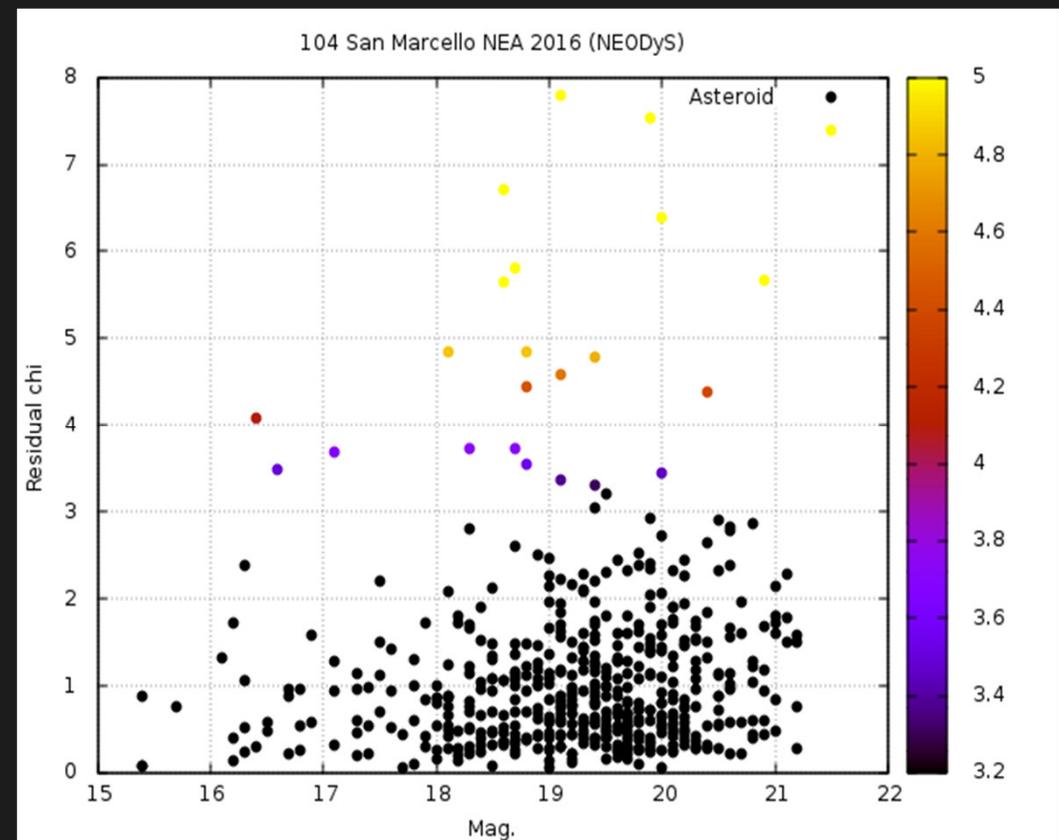
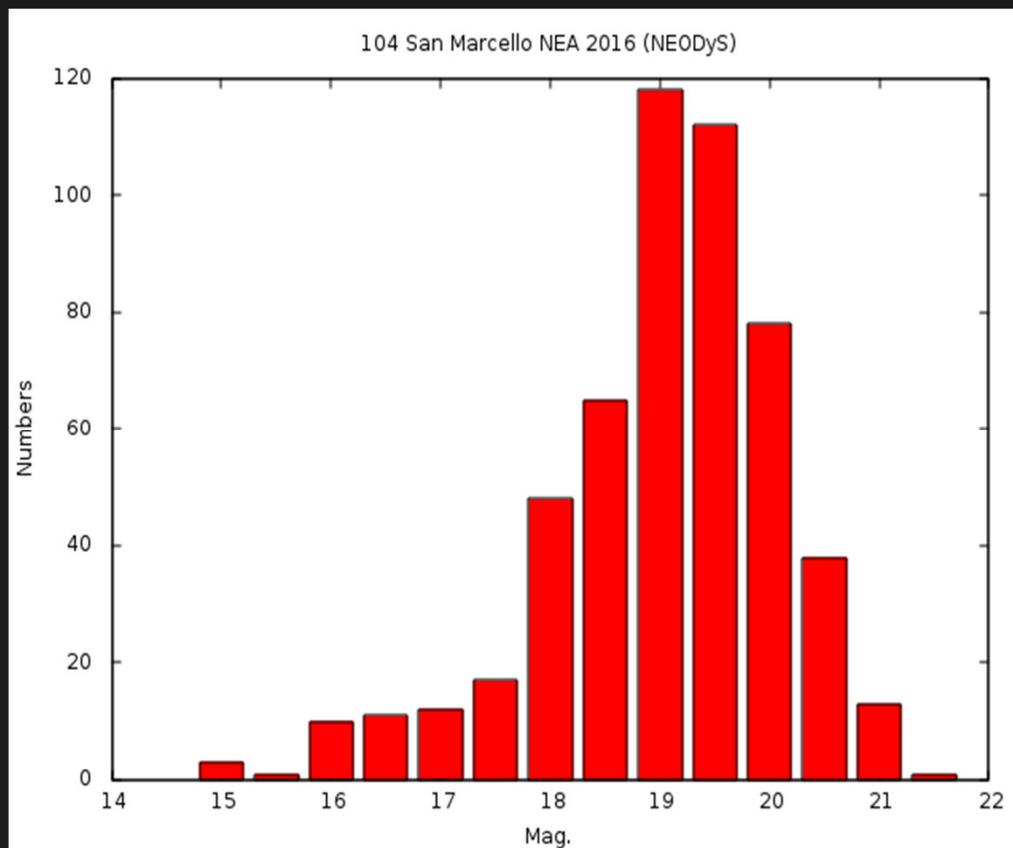


H	Albedo	H	H
-2.0	0.50 - 6700 - 14900	13.0	28.0
-1.5	3700 - 5300 - 11800	13.5	28.5
-1.0	3000 - 4200 - 9400	14.0	29.0
-0.5	2400 - 3300 - 7500	14.5	29.5
0.0	1900 - 2600 - 5900	15.0	30.0
0.5	1500 - 2100 - 4700	15.5	30.5
1.0	1200 - 1700 - 3700	16.0	31.0
1.5	940 - 1300 - 3000	16.5	31.5
2.0	750 - 1050 - 2400	17.0	32.0
2.5	590 - 840 - 1900	17.5	32.5
3.0	470 - 670 - 1500	18.0	33.0
3.5	370 - 530 - 1200	18.5	33.5
4.0	300 - 420 - 940	19.0	34.0
4.5	240 - 330 - 740	19.5	34.5
5.0	190 - 260 - 590	20.0	35.0
5.5	150 - 210 - 470	20.5	35.5
6.0	120 - 170 - 370	21.0	36.0
6.5	95 - 130 - 300	21.5	36.5
7.0	75 - 110 - 240	22.0	37.0
7.5	60 - 85 - 190	22.5	37.5
8.0	45 - 65 - 150	23.0	38.0
8.5	40 - 50 - 120	23.5	38.5
9.0	30 - 40 - 95	24.0	39.0
9.5	25 - 35 - 75	24.5	39.5
10.0	19 - 25 - 60	25.0	40.0
10.5	15 - 20 - 50	25.5	40.5
11.0	12 - 17 - 37	26.0	41.0
11.5	9 - 13 - 30	26.5	41.5
12.0	7 - 11 - 24	27.0	42.0
12.5	6 - 8 - 19	27.5	42.5
13.0	5 - 7 - 15	28.0	43.0
13.5	4 - 5 - 12	28.5	43.5
14.0	3 - 4 - 9	29.0	44.0
14.5	2 - 3 - 7	29.5	44.5
15.0	2 - 3 - 6	30.0	45.0
15.5	1 - 2 - 5	30.5	45.5
16.0	1 - 2 - 4	31.0	46.0
16.5	1 - 1 - 3	31.5	46.5
17.0	1 - 1 - 2	32.0	47.0
17.5	1 - 1 - 2	32.5	47.5

# 104 NEA NEODyS 2016

**.528** Misure di cui **194**  $\chi < 1$  (36.7 %); **23** con  $\chi > 3.2$  (4.3 %);

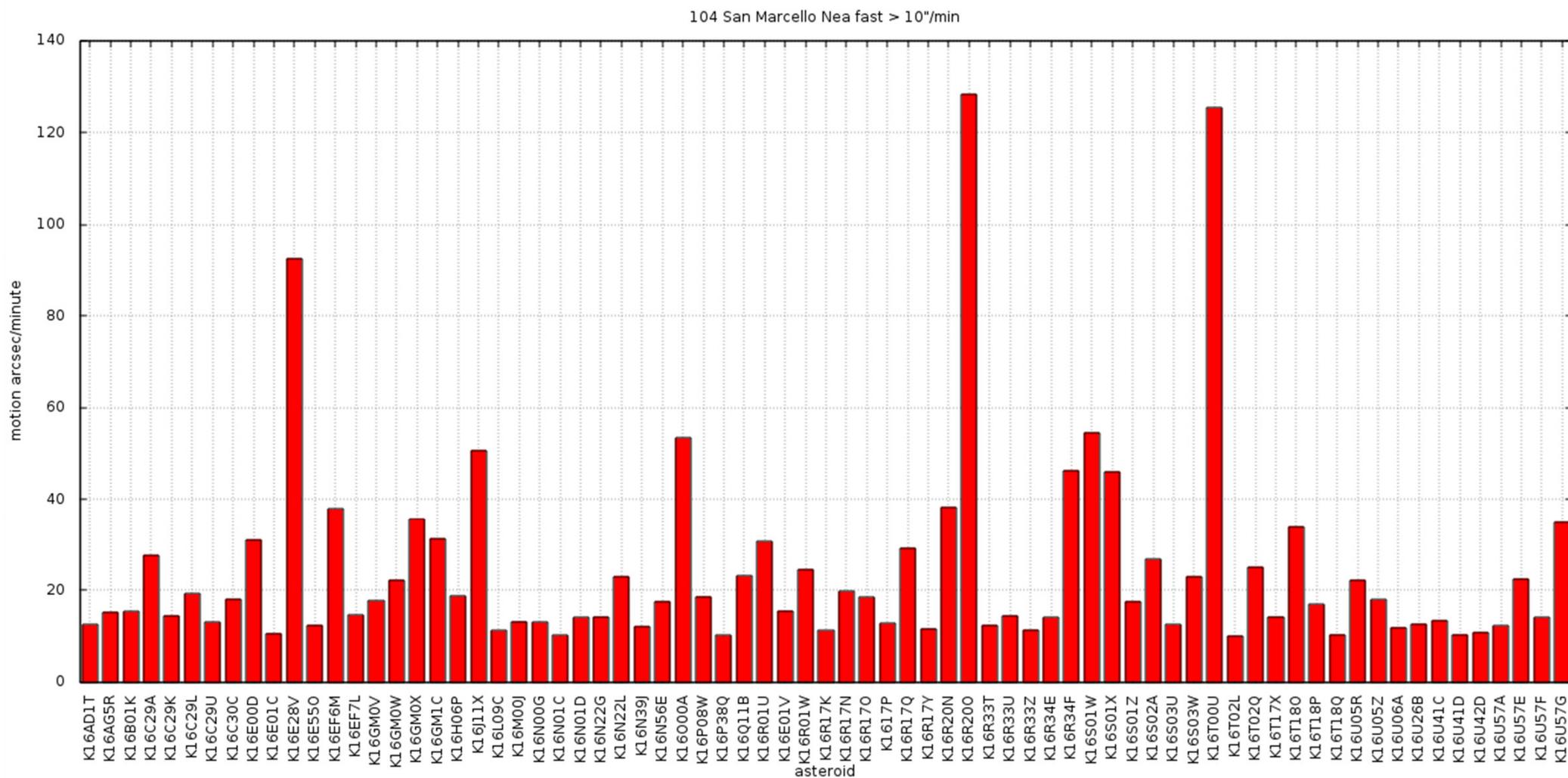
**.Magnitudine media 19.0-19.5 – Max. 15.4; Min. 21.5**



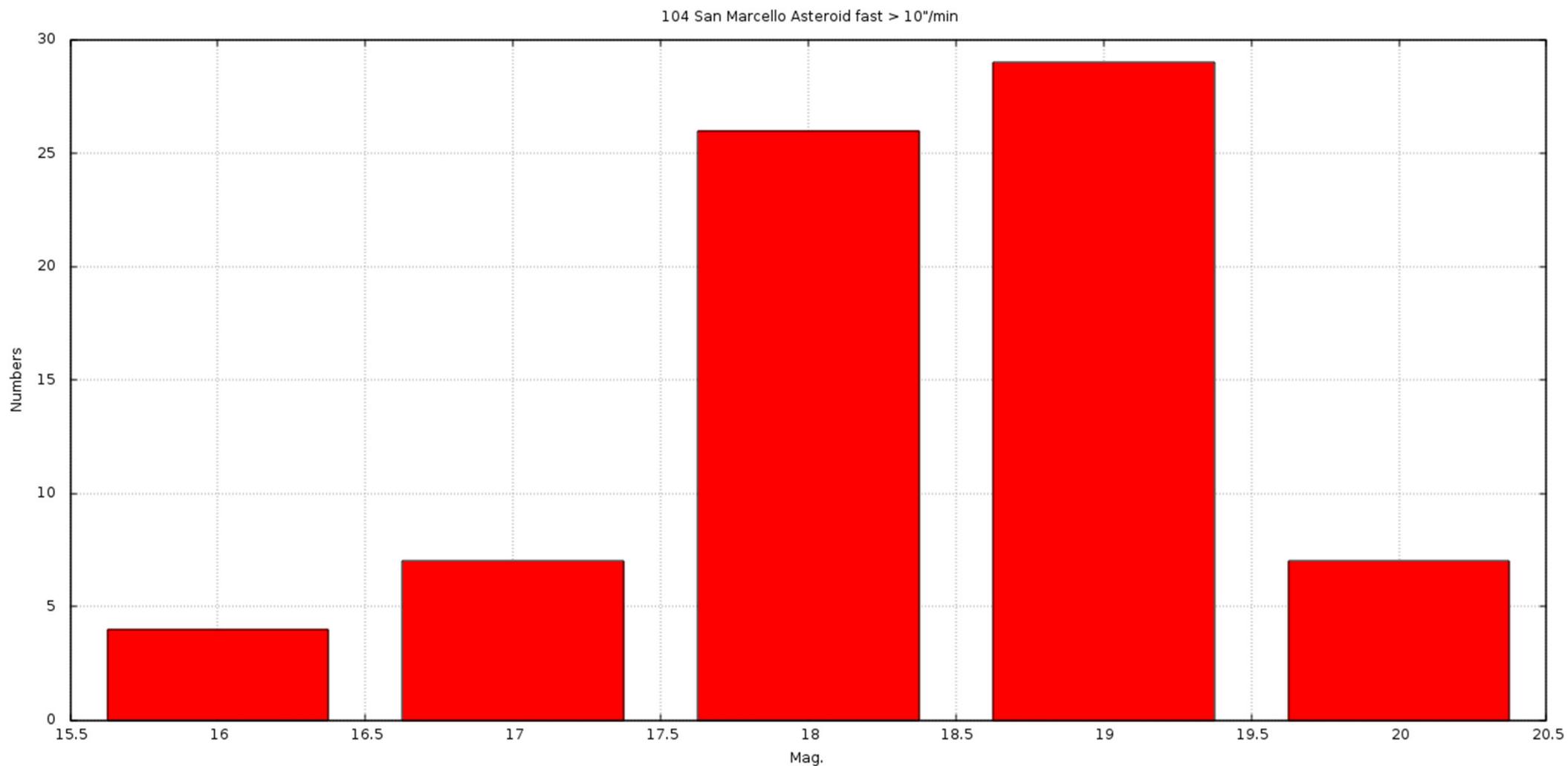
# Analisi NEA con motion >10"/min osservati da 104 nel 2016

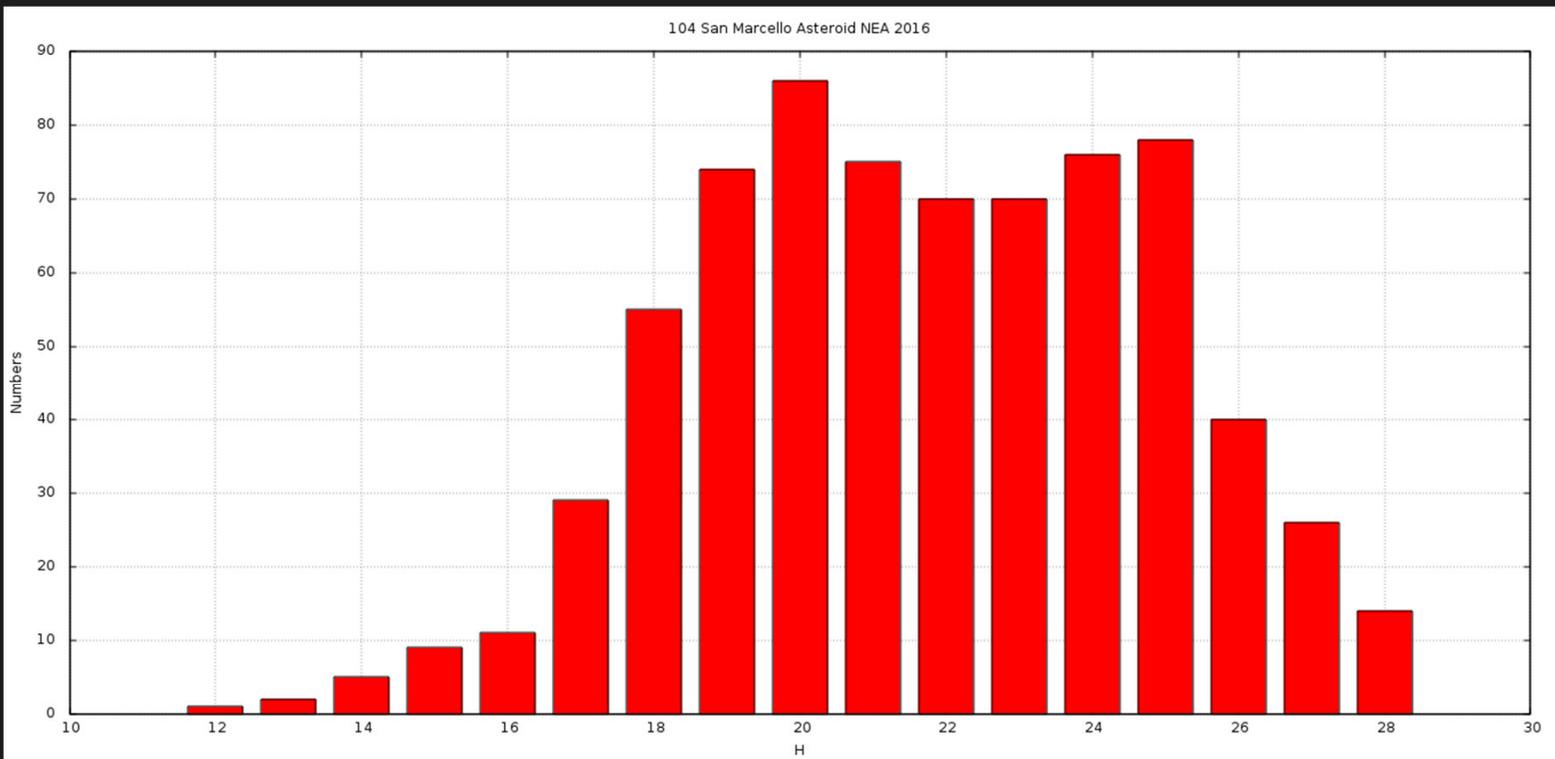
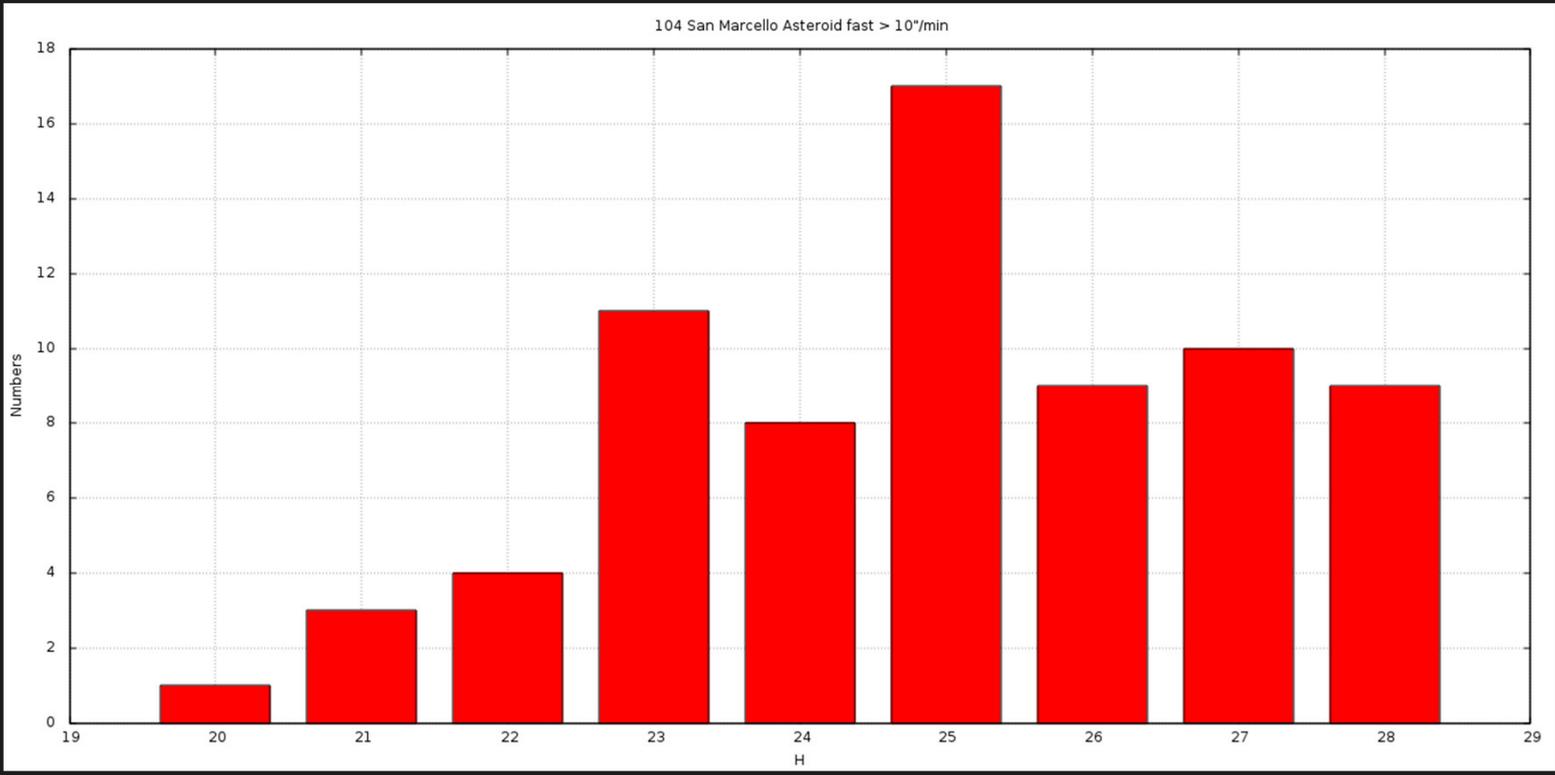
## .212 NEA osservati in MPEC

## 34,5 %



# Analisi NEA con motion $>10''/\text{min}$ osservati da 104 nel 2016 magnitudine





• 104 Asteroidi

• H

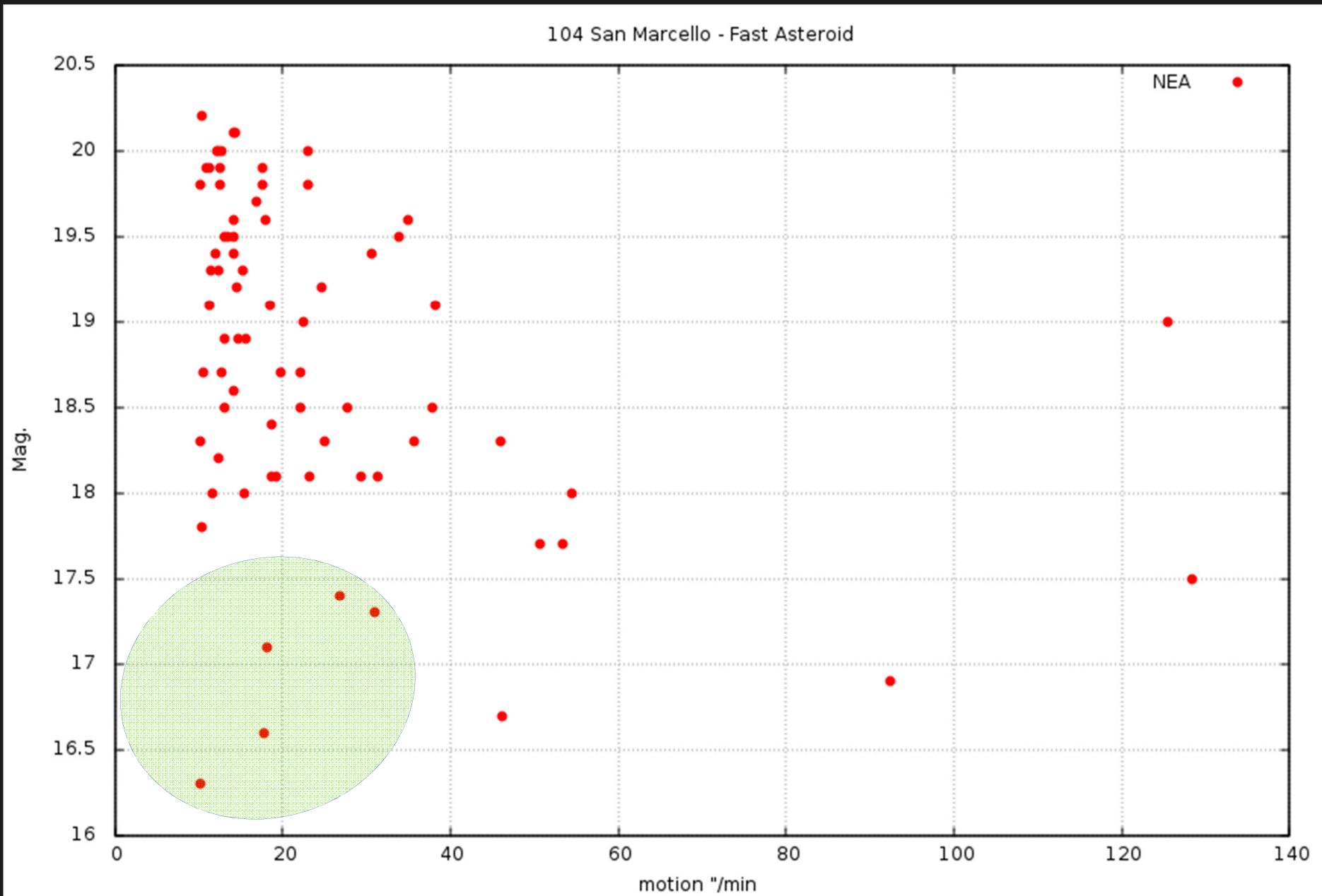
• Veloci

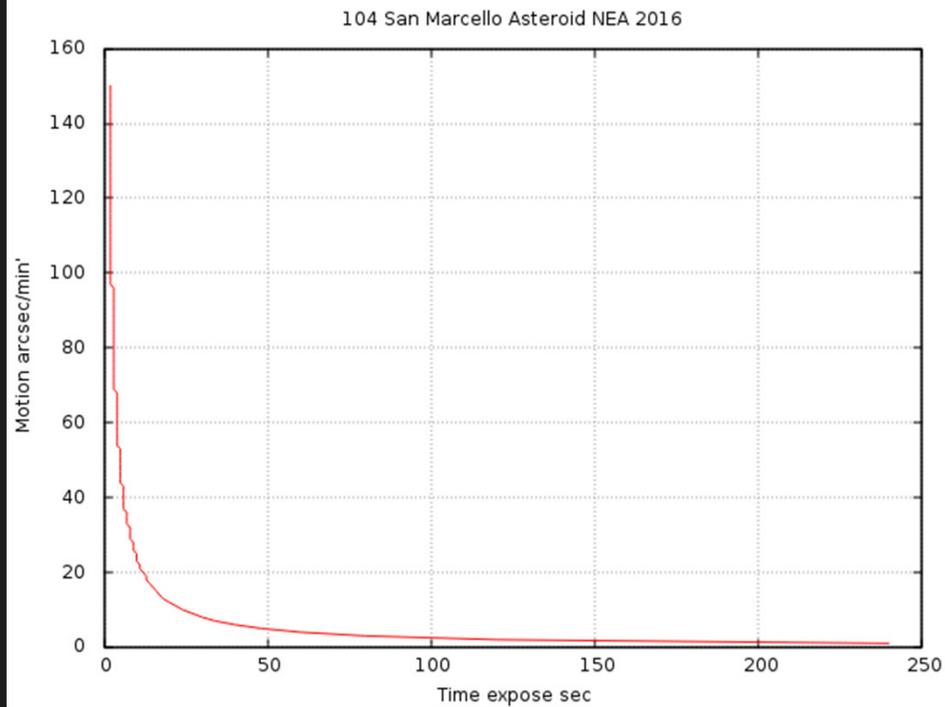
• Totali

• Anno

• 2016

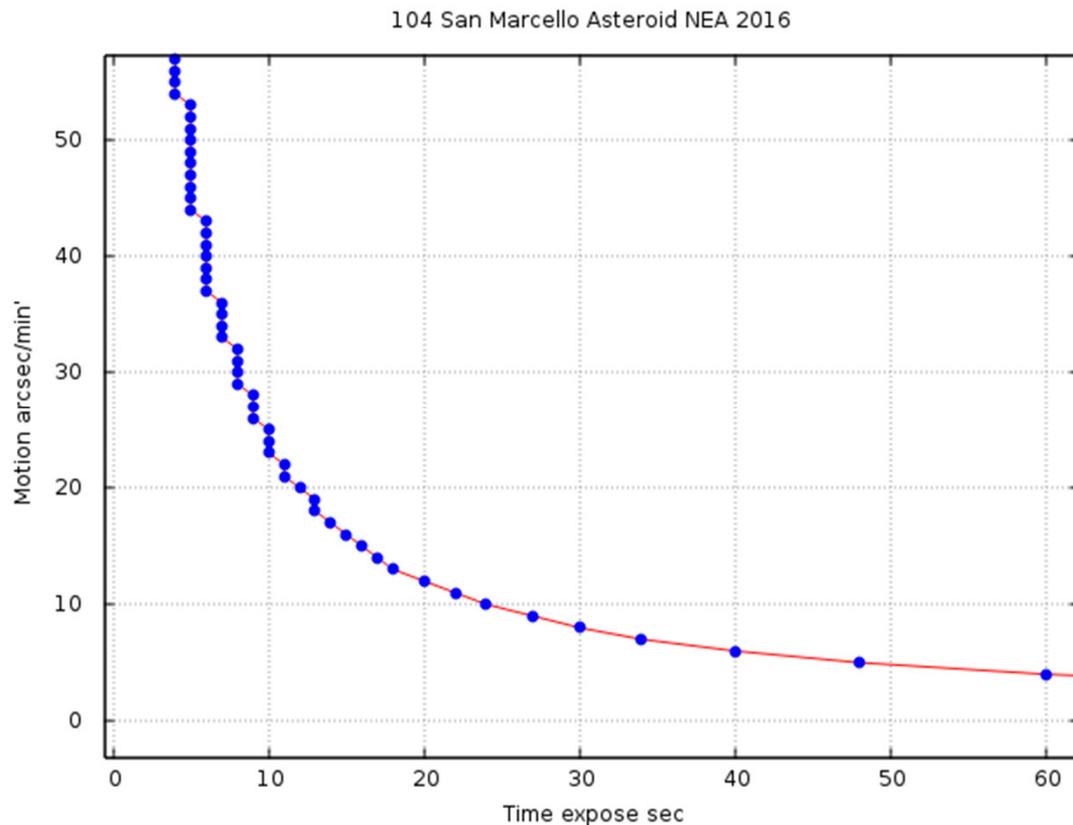
# 2016 NEA veloci ( $>10''/\text{min}$ ) osservati da 104 Motion vs Mag





# Time vs Motion

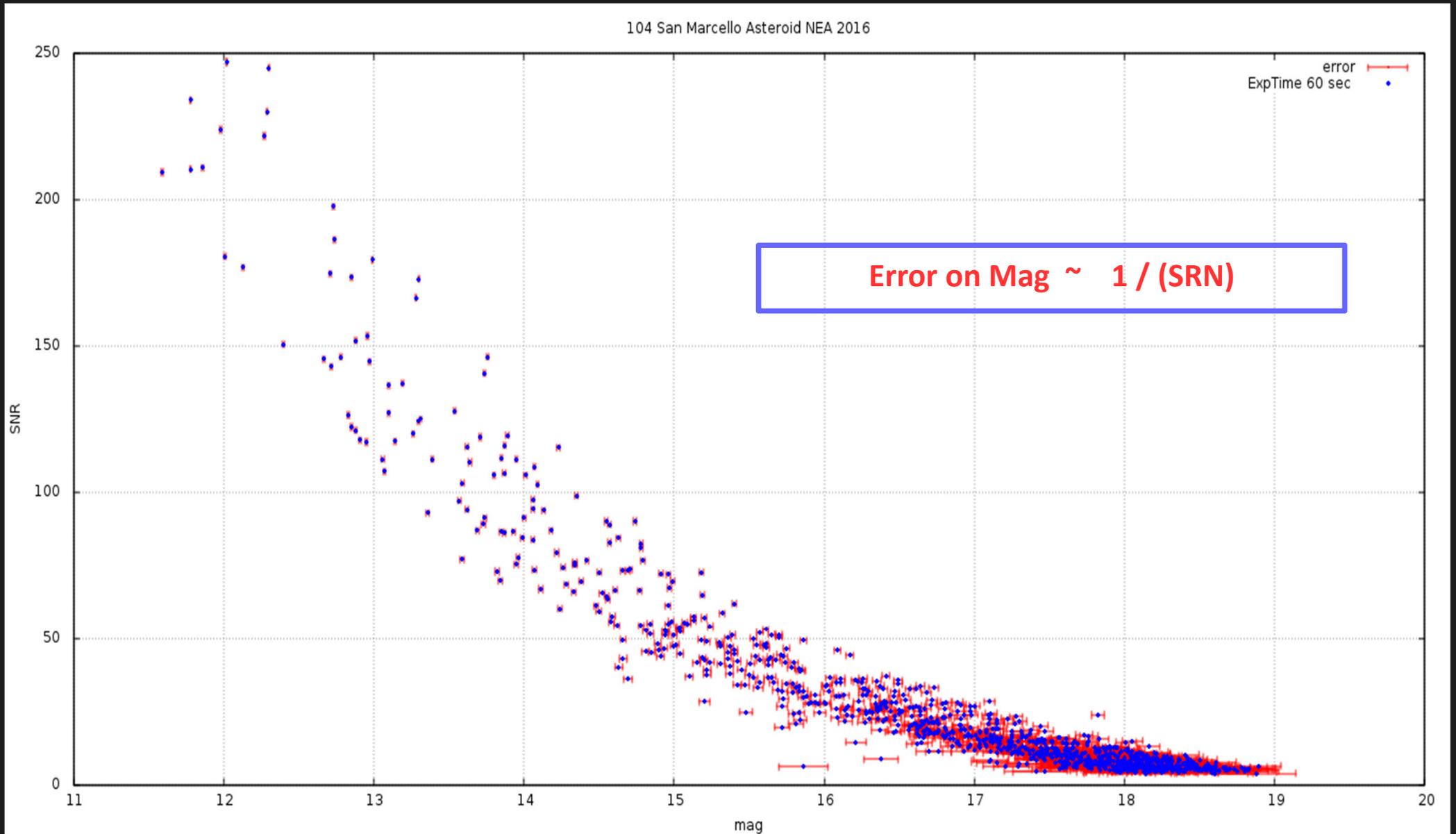
- Risoluzione 2"/pixel
- Tempo di posa



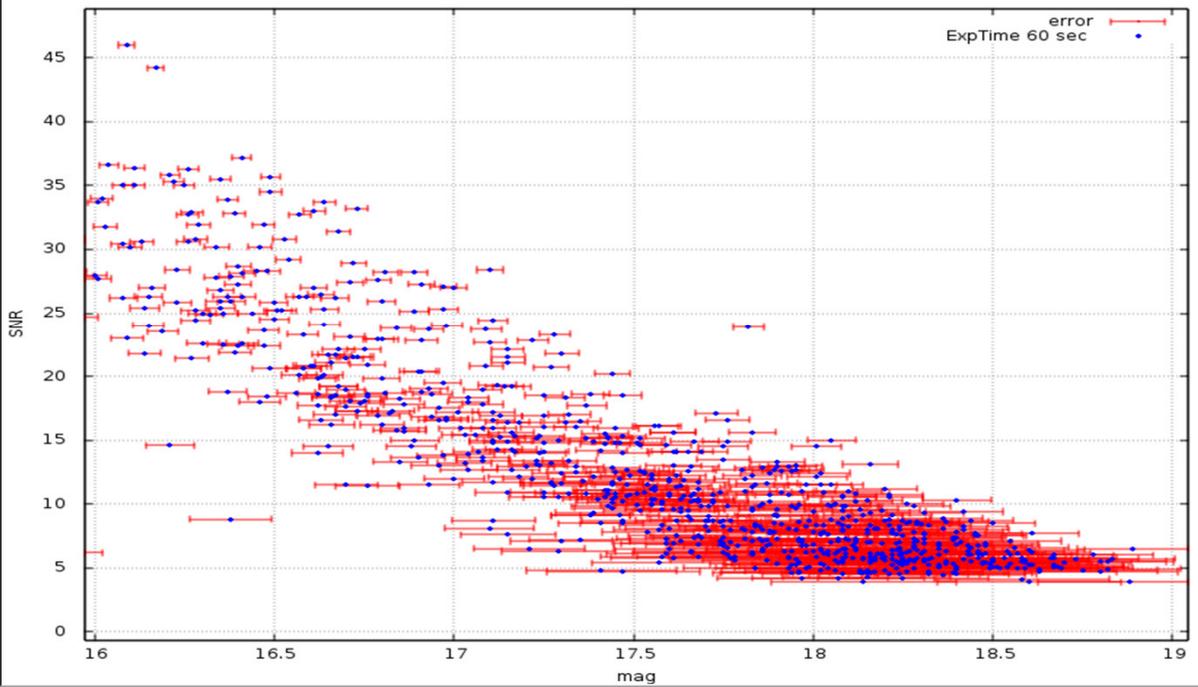
•  $2 / \text{motion ("/min)} * 120$

• Grafico esposizione vs motion asteroide

# SRN Exptime 60"



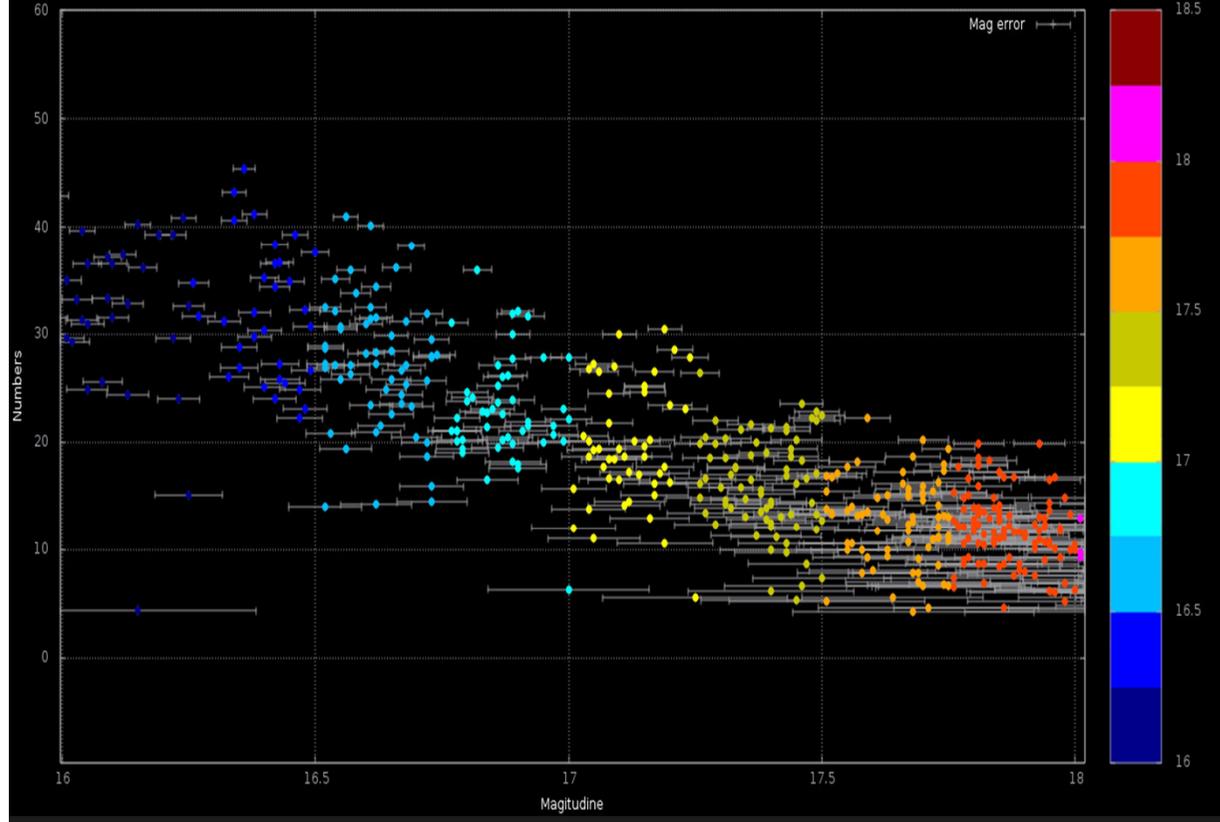
104 San Marcello Asteroid NEA 2016



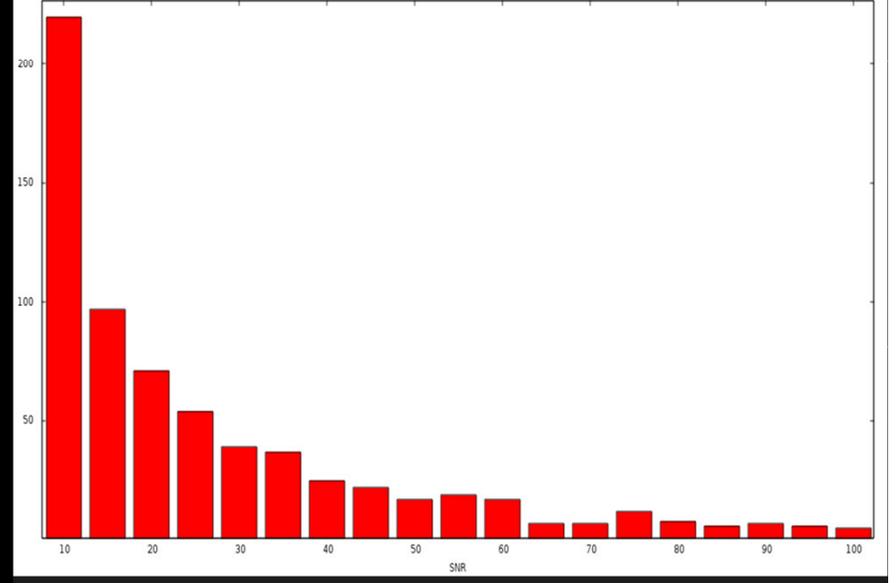
# SNR VS MAG

Analisi singola immagine da 60 secondi di  
 Magnitudine strumentale vs SNR ( astrom  
 Da 104 con un esposizione di 60" si ha pe

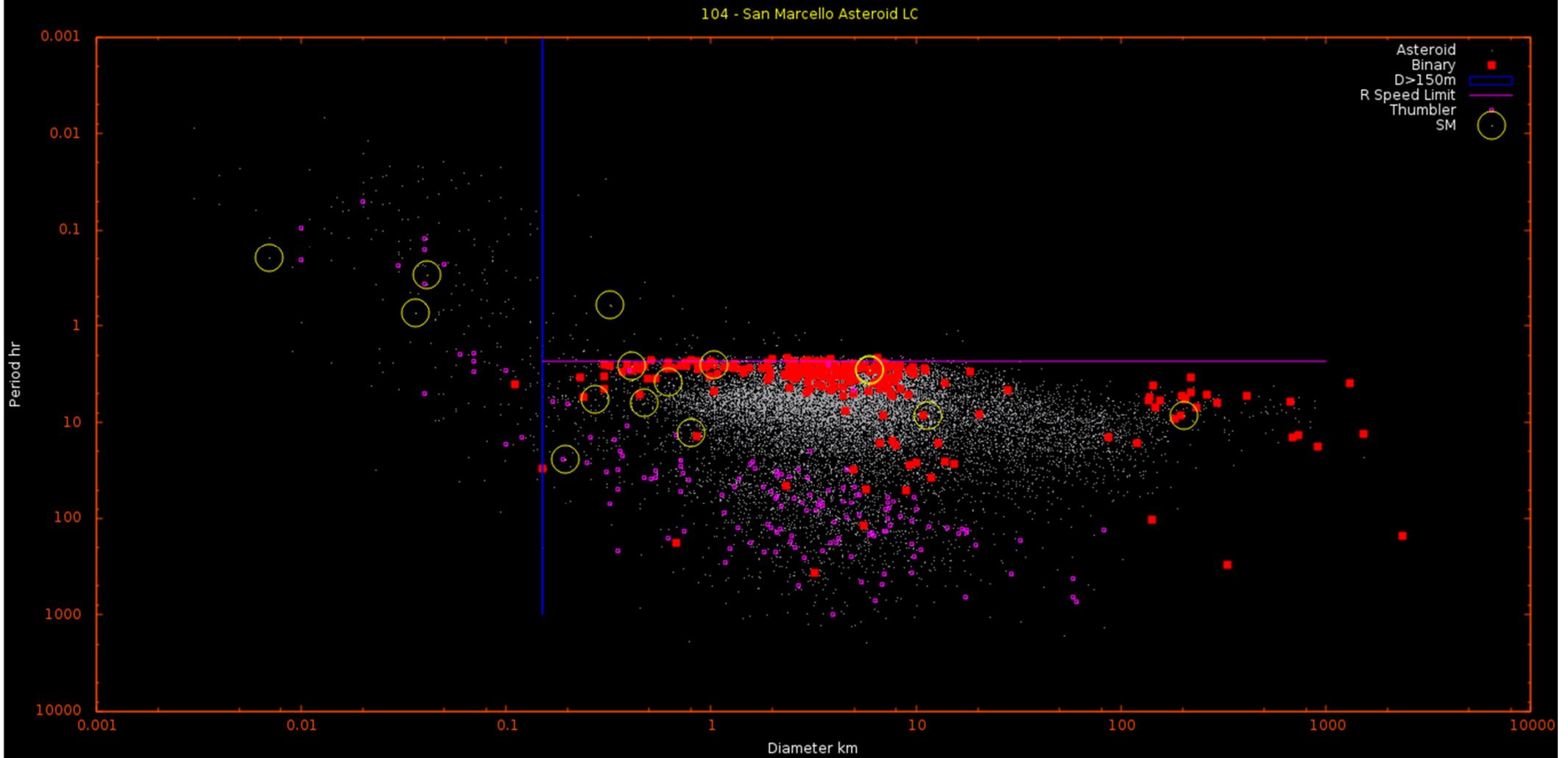
104 San Marcello 60 sec, exptime image



104 San Marcello 60 sec, exptime image

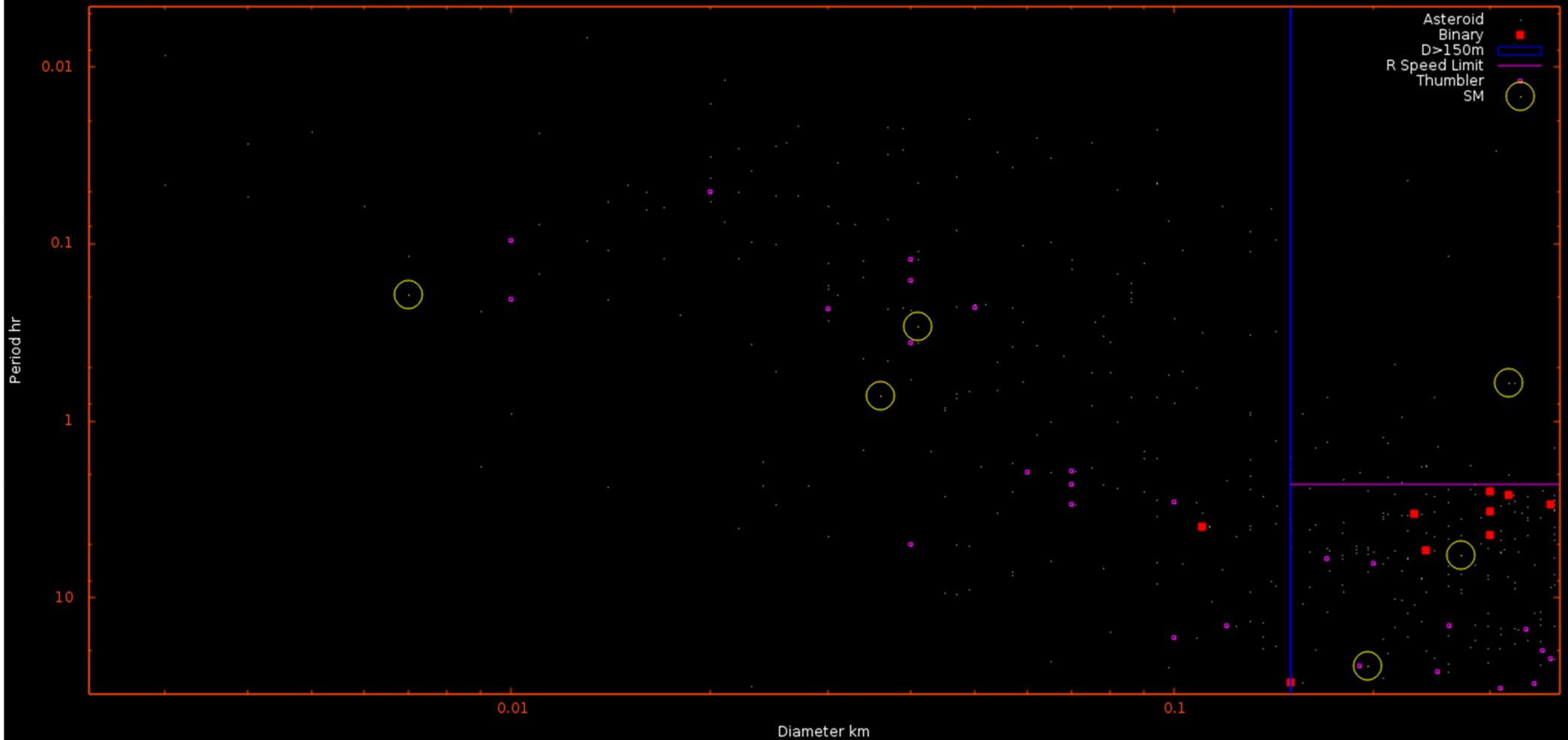


# Periodo rotazione asteroidi



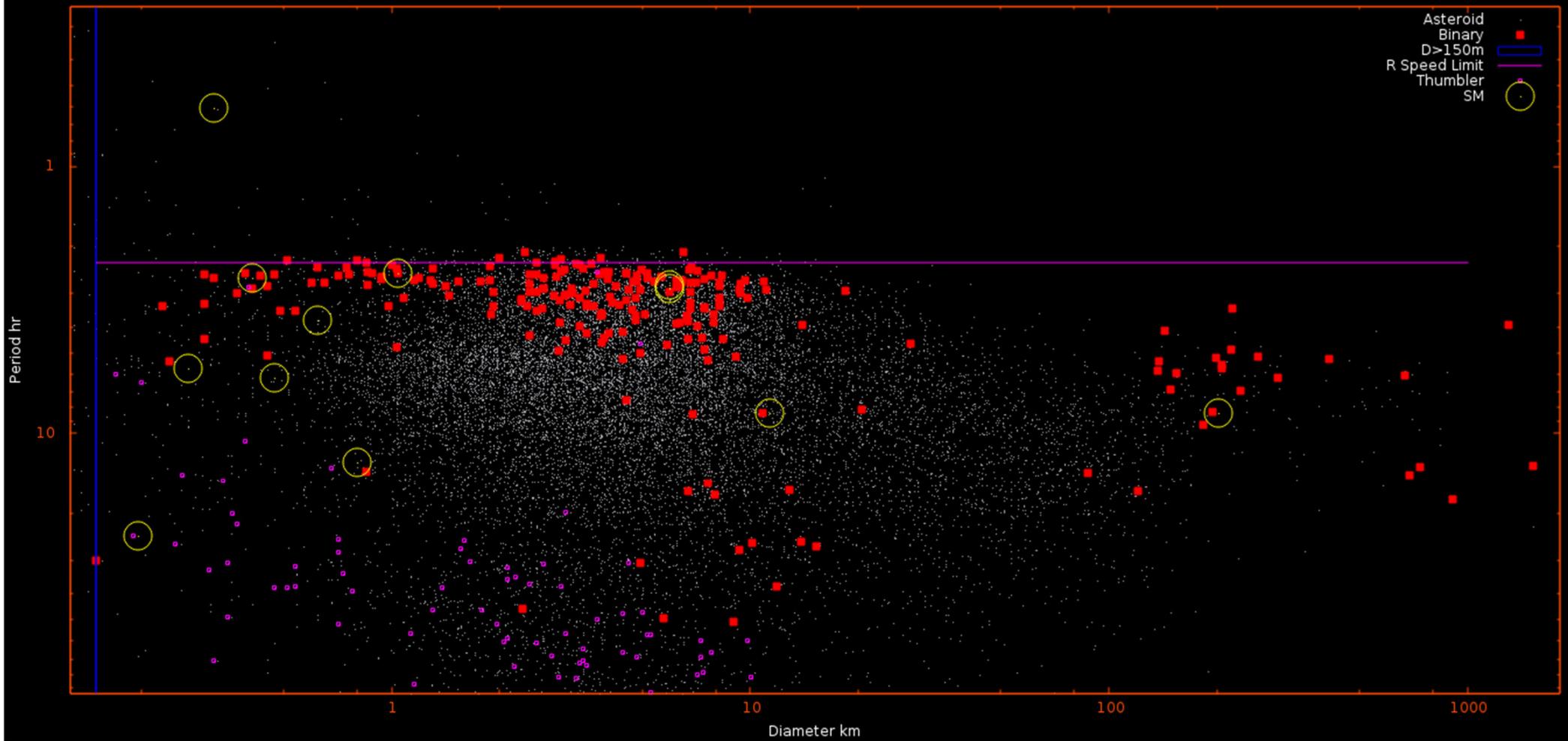
# super-fast-rotating asteroid

104 - San Marcello Asteroid LC



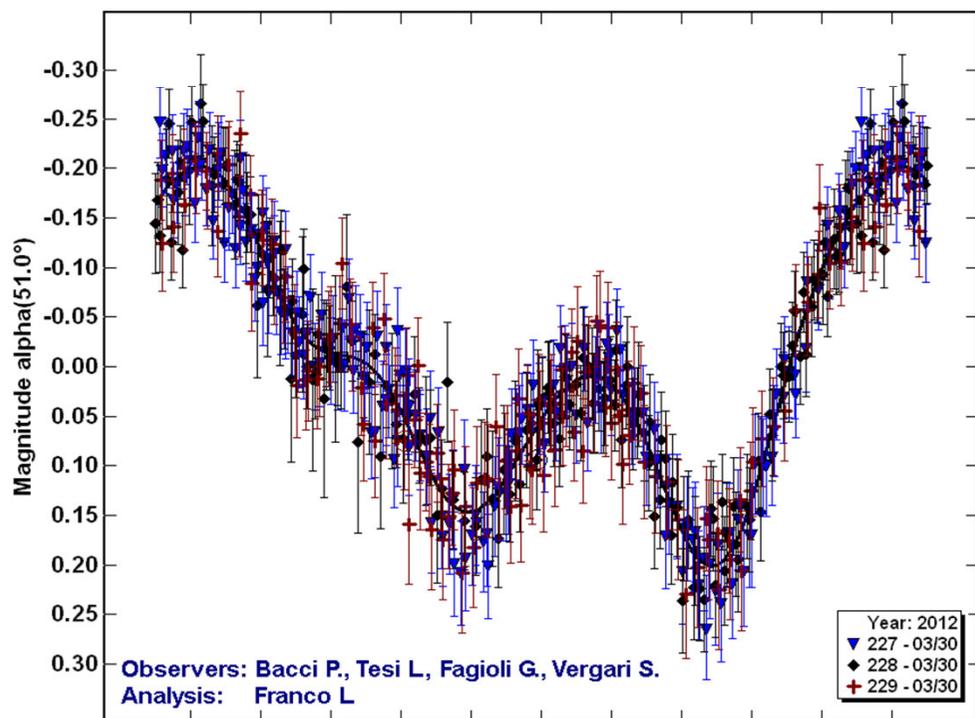
# Asteroidi Binari

104 - San Marcello Asteroid LC





**Phased Plot: 2012 EG5**



Period:  $0.2924 \pm 0.0002$  h    Amp: 0.40    JDo(LTC): 2456017.332367

# 2012 EG5

.30/03/2012 ripreso  
 l'asteroide 2012 EG5  
 0.0072 UA circa 107712  
 km dalla terra. con  
 magnitudine di circa 15.1  
 e motion tra 15-19"/min.

.H = 24

.P=0,29 h

.Amp= 0,40 mag

rotation period

rot\_per

0.29240

h

n/a

LCDB (Rev. 2016-September); Warner et al., 2009

**Published Reference List:**

[Hicks, M.; Teague, S.; Strojia, C. (2012) Astronomer's Telegram 4016. <http://www.astronomerstelegam.org>]  
 [Hergenrother, C.W.; Kwiatkowski, T.; Kysrczynska, A.; Pretka-Ziomek, H.; et al. (2012) ACM 2012, #6484.]  
 [Franco, L.; Bacci, P.; Tesi, L.; Fagioli, G.; Vergari, S. (2012) Minor Planet Bul. 39, 153.]  
 [Pravec, P.; Wolf, M.; Sarounova, L. (2012) <http://www.asu.cas.cz/~ppravec/neo.htm>]

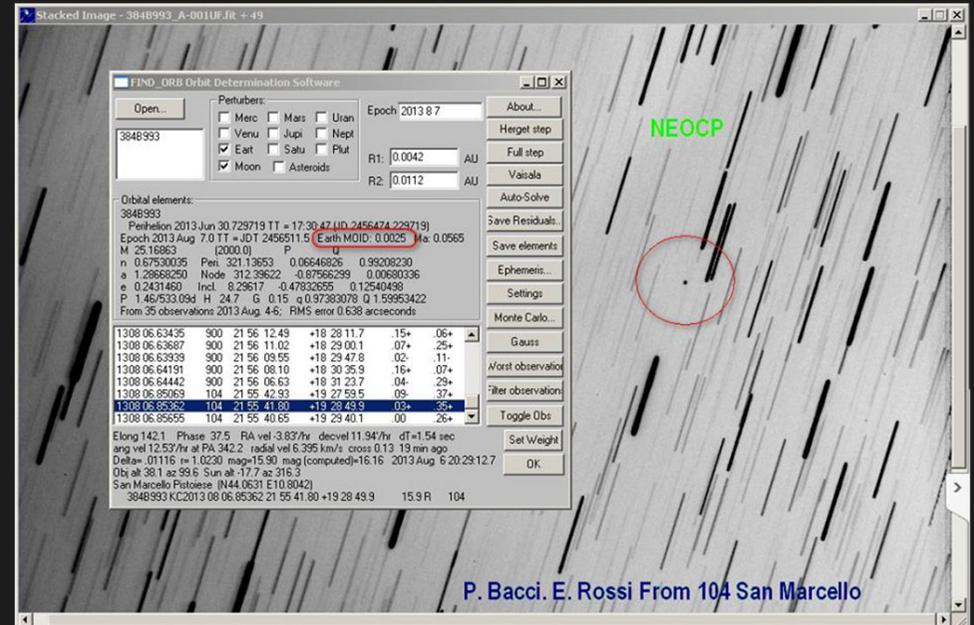
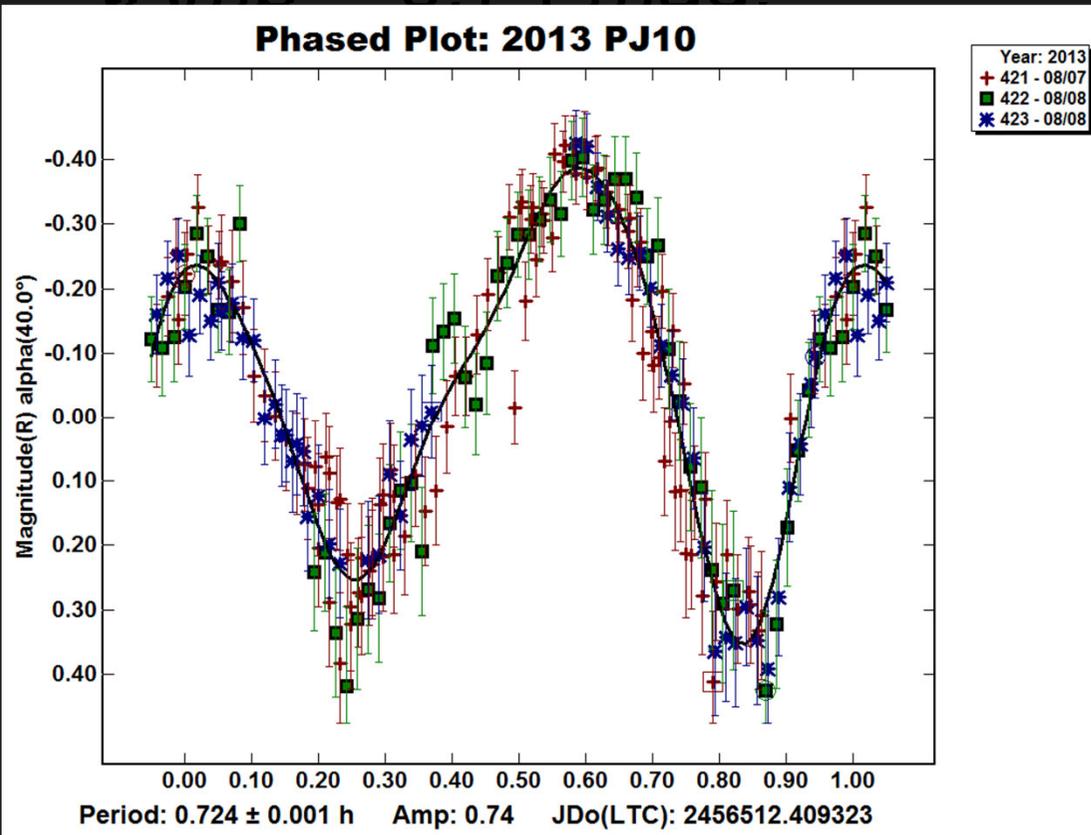
# 2013 PJ10

.H = 24

.P= 0,72 h

.Amp = 0.74 mag

.Al momento dell'osservazione l'asteroide aveva una luminosità di 17.0 mag con un motion di 5.9"/min PA 336.



rotation period	rot_per	0.724	h	n/a	LCDB (Rev. 2016-September); Warner et al., 2009
-----------------	---------	-------	---	-----	---

## Published Reference List:

[Bacci, P. (2013) <http://b09-backman.blogspot.it/2013/08/2013-pj10.html>]  
 [James, N.D. (2013) <http://www.nickdjames.com/NEO/384B993/>]

# Conclusioni

.Osservazione NEOCP e NEA Veloci

.Prima viene osservato maggiori probabilità di ritrovarlo alle effemeridi

.Maggiori osservazioni, anche ravvicinate, permettono di determinare con più precisione la distanza (parallasse)

.Se le dimensioni sono inferiori a 150 m ( $\sim H > 21$ ) ed il SNR lo permette facendo fotometria è probabile individuare il periodo di rotazione ( $> 2.2h$ )

.Se diametro  $> 1$  km indagare sul periodo di rotazione almeno per 3h potrebbe riservarci belle sorprese

FINE  
Grazie per l'attenzione

