

Gaia SSWG Workshop

May 15-16

Focal Plane Detection

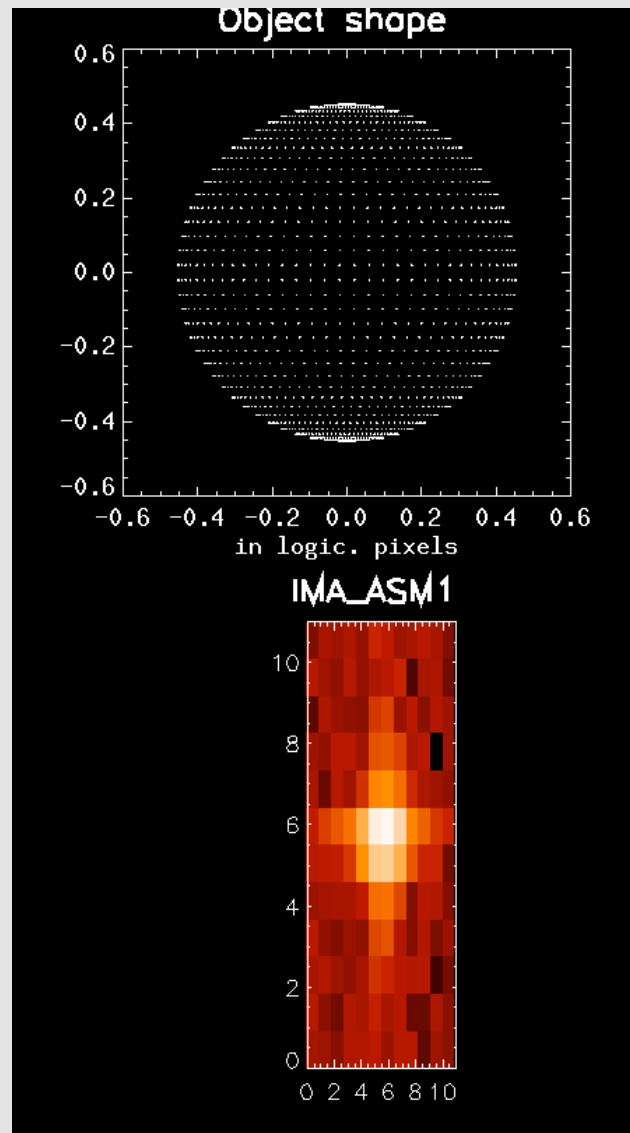
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Paris Observatory

On-board detection procedure
but not
localisation that can be obtained on ground

Focal Plane Detection

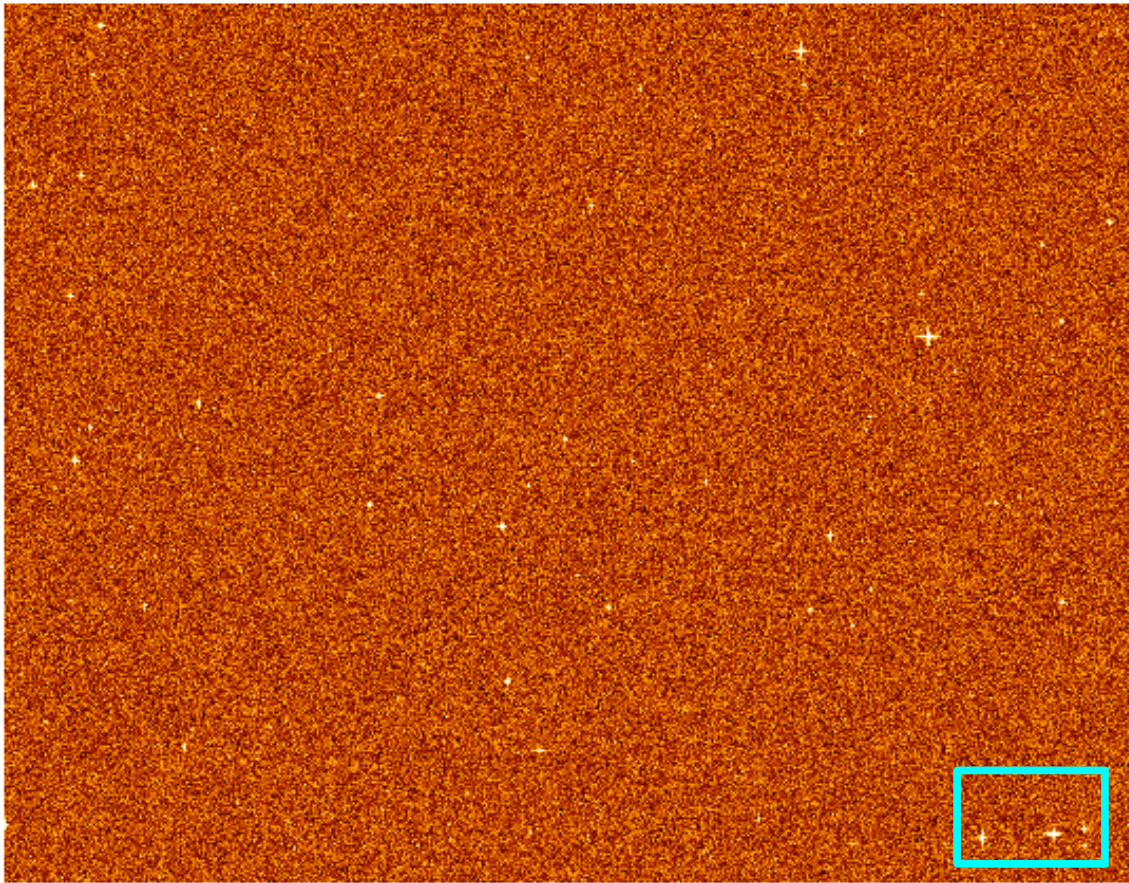
- One field \sim 1 CCD
 - input file (.cat): X, Ypos, Gmag (+ size, velocity, etc...)
 - 2600x1966 pixels
- Astrometric Sky Mapper
 - PSF $V-I=1$, no aberration
 - Convolution with size, velocity, scaling to magnitude
 - Poisson + RON (read-out noise)

Input Field



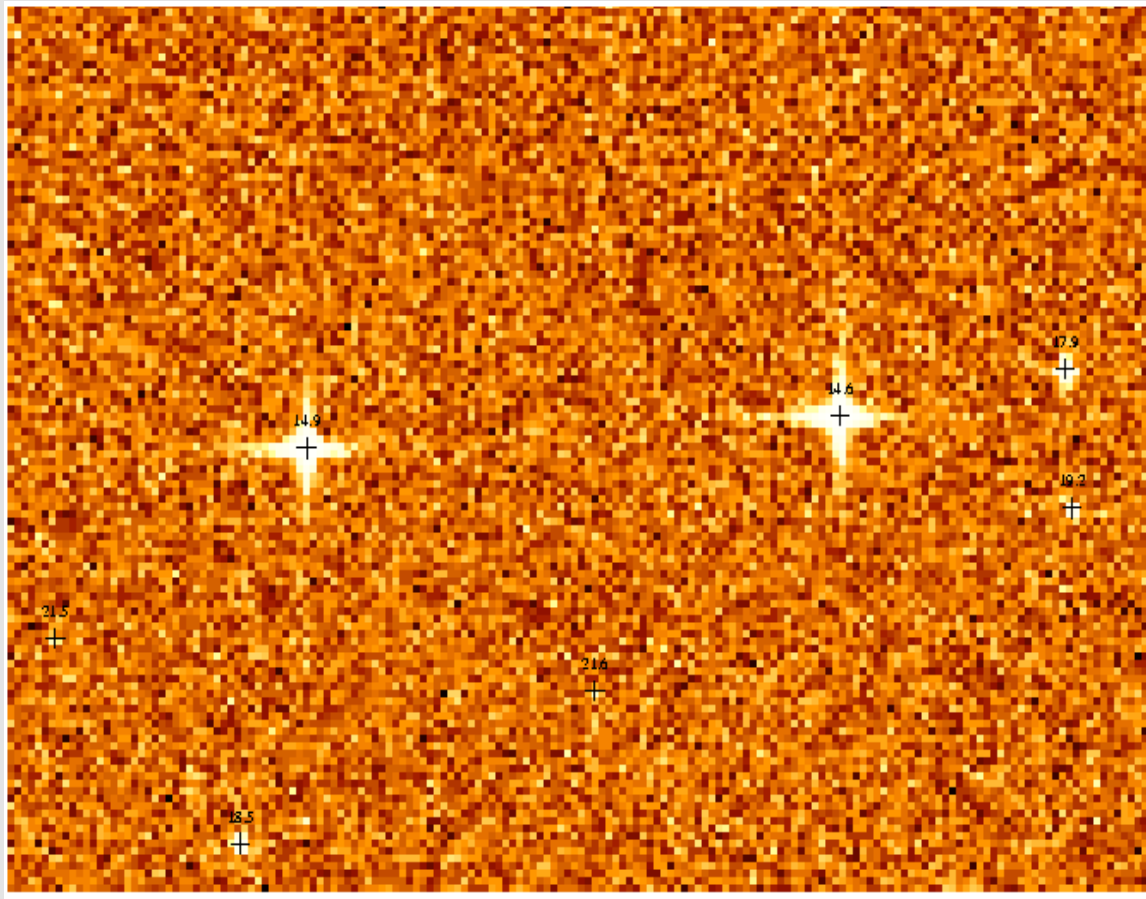
- _ Asteroid = disk
- _ 3 parameters
 - size
 - motion AL along scan
 - motion AC across scan
- _ In the following simulations:
replicate one object!

Input Field



- Visualised with square pixels !
- ASM parameters
 - 2x2 (soft) binning
 - 1.92 int. time
 - RON=8.7; gain=1

Zoom



2 Bright objects

G ~ 14

Others G ~ 18-19

Focal Plane Detection

- _ Detection algorithm considered

 - GD

- _ Test

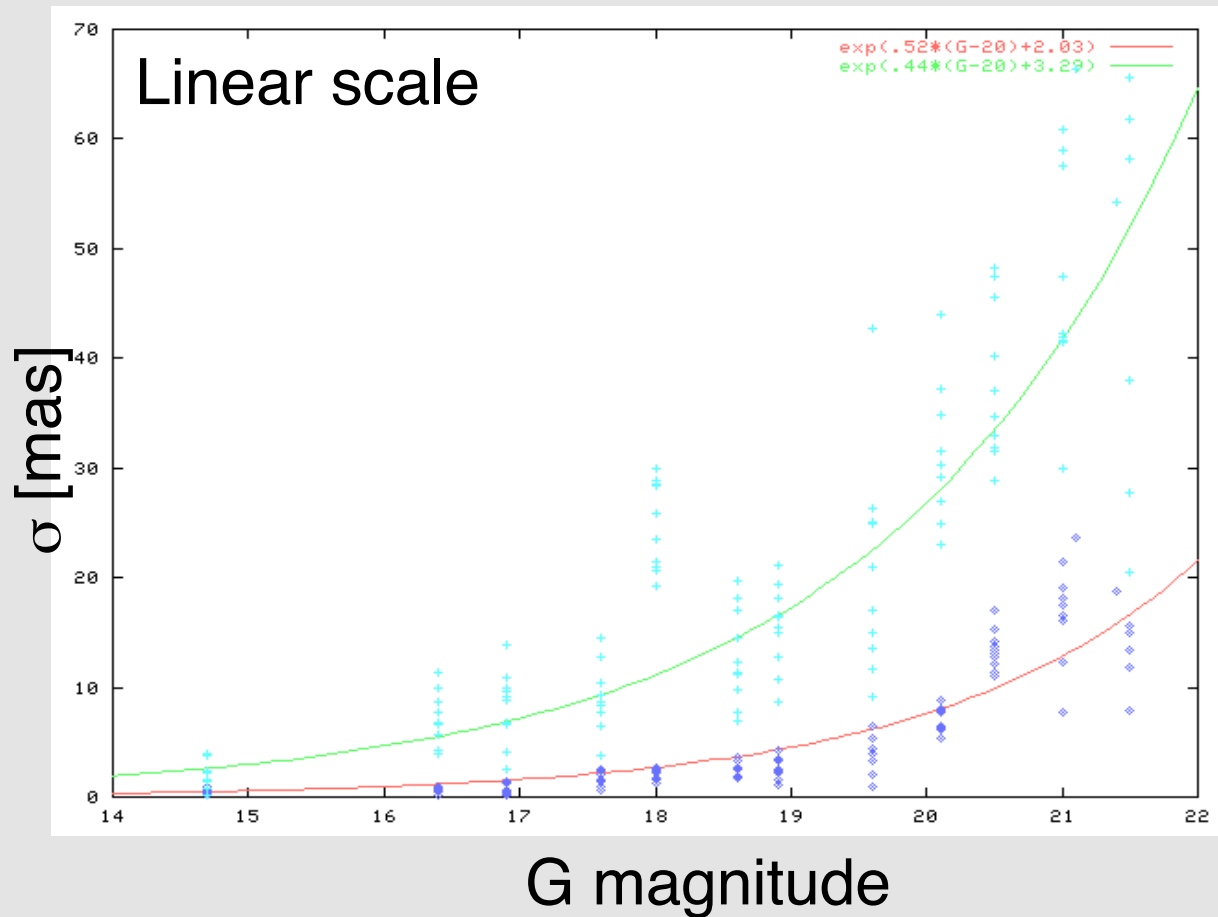
 - Comparison to values for stars

- _ Limitation of current work:



Only detection (ASM), not selection (AF1)

Focal Plane Detection



Matches fitted values for stars

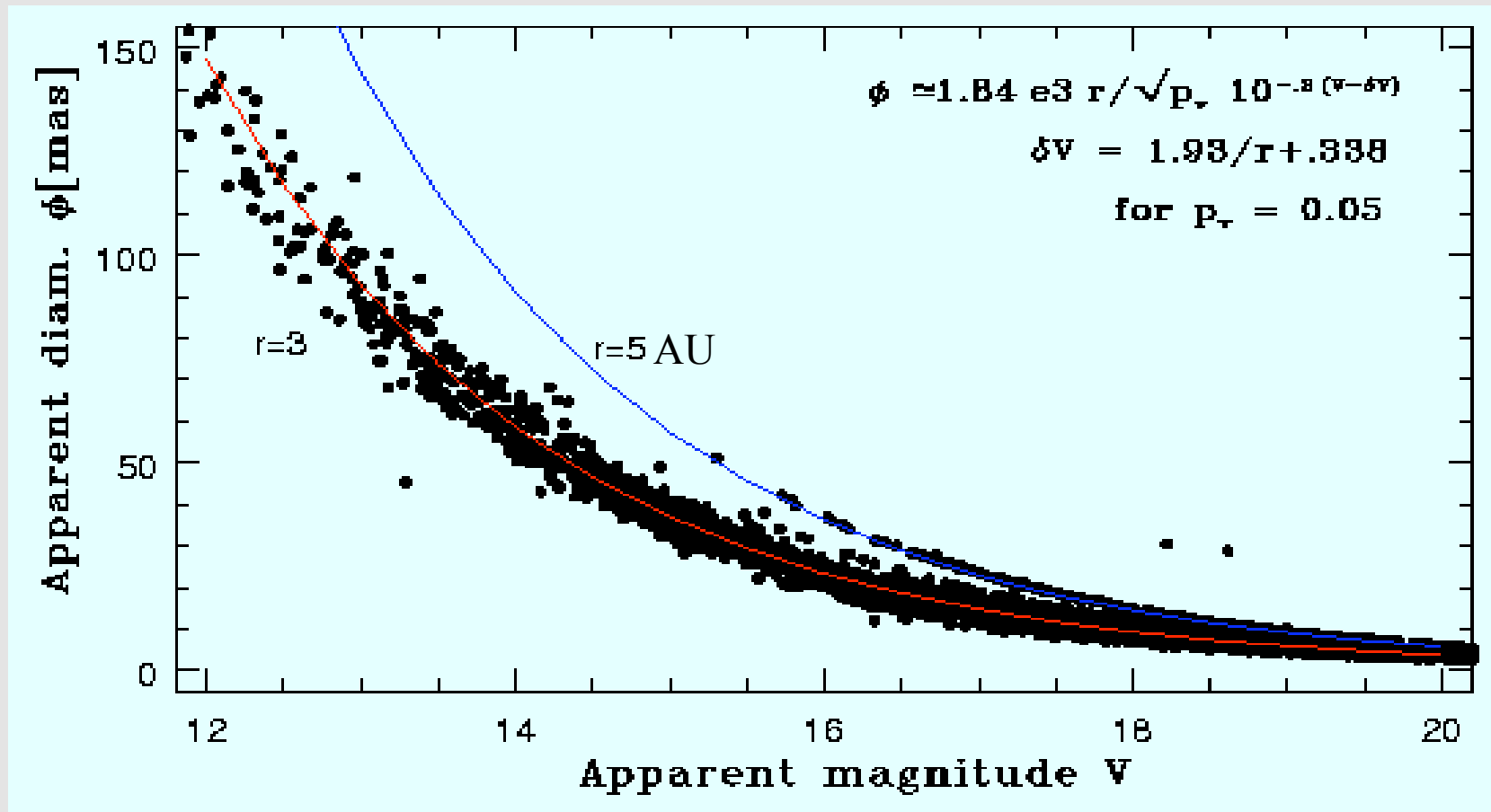
AL: ~ 10 mas @
G=20

AC: ~ 30 mas @
G=20

Statistics

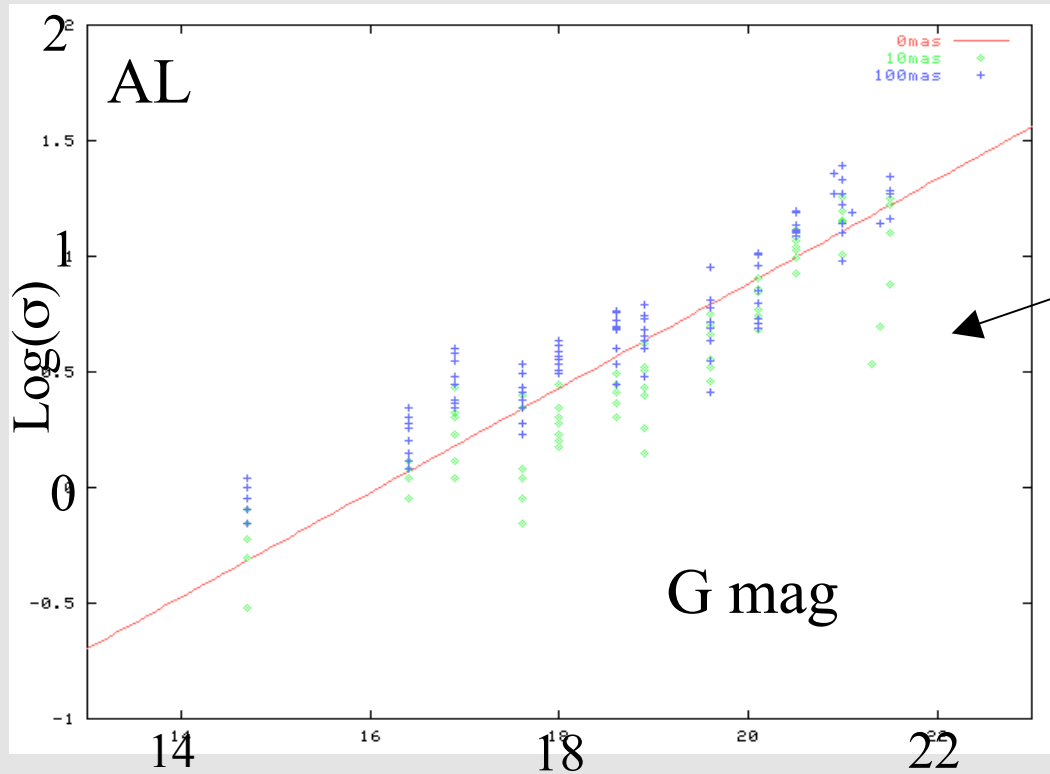
- _ Magnitude G
 - related to size & velocity (realistic)
 - **not related to size (for statistics in G)**
- _ Size
- _ Motion
 - along scan (AL) &
 - across scan (AC)

Size / Magnitude



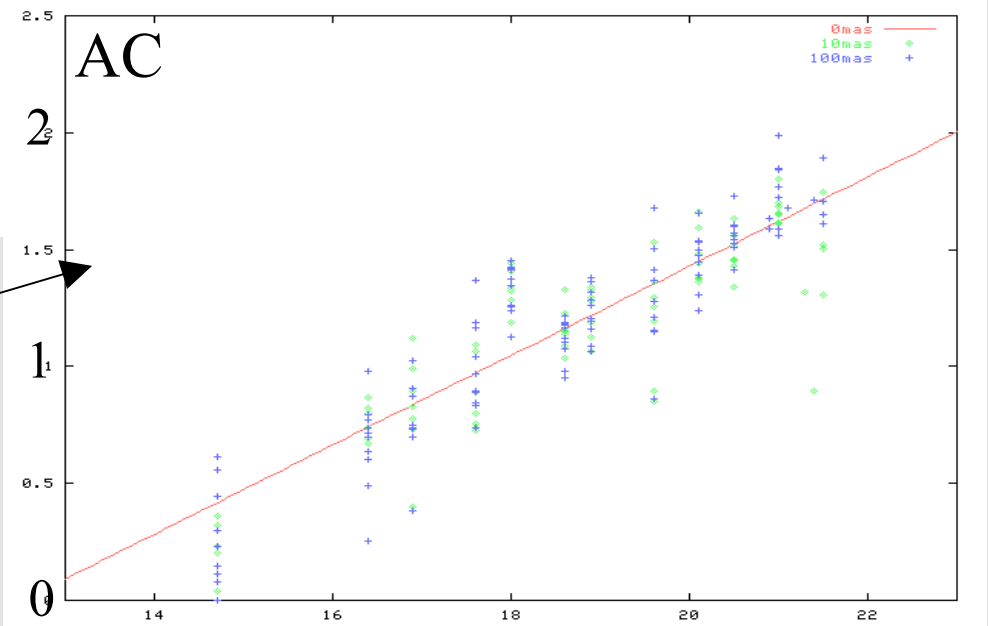
Not used in the following

Size

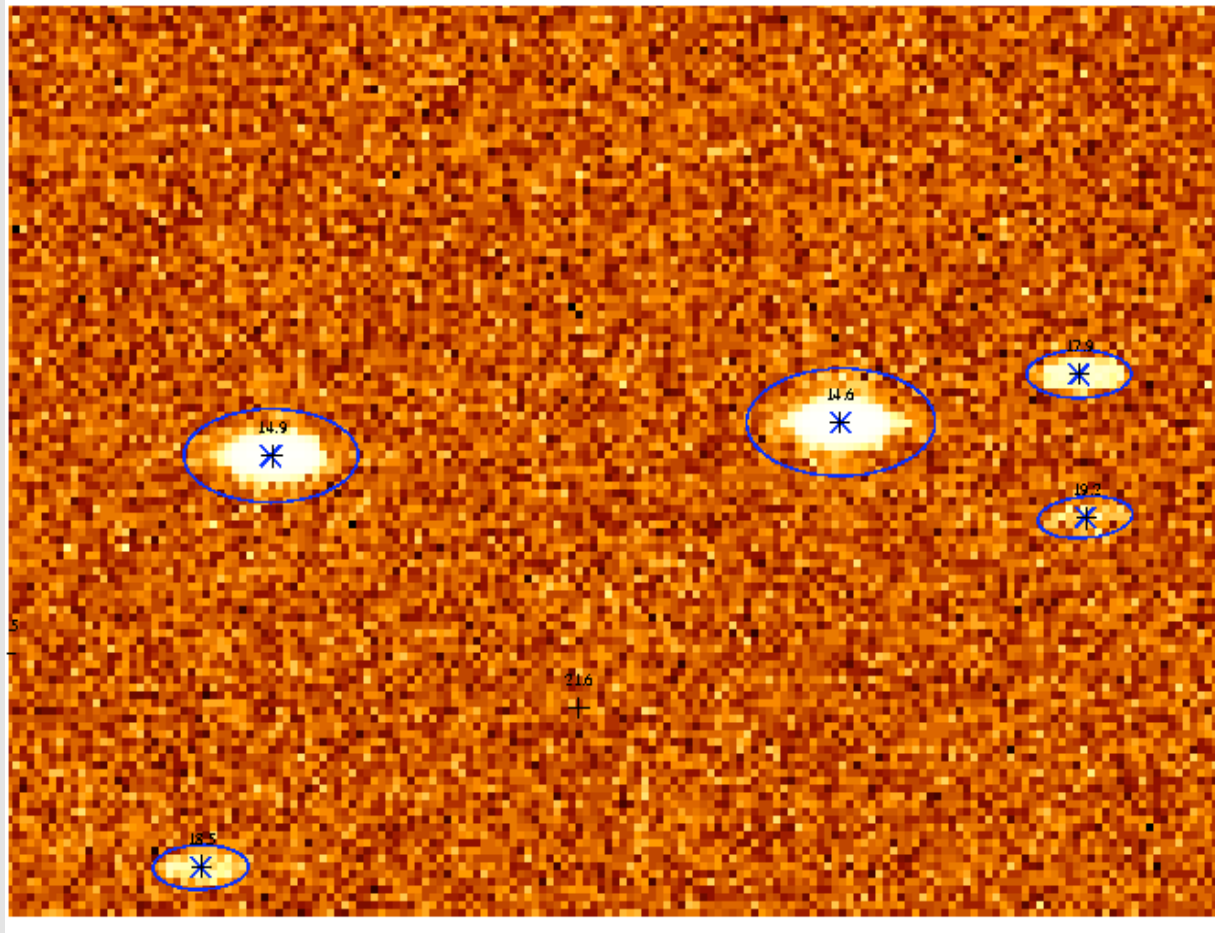


Small degradation AL factor ~ 1.5 (i.e. $10^{0.2}$) for size = 100 mas

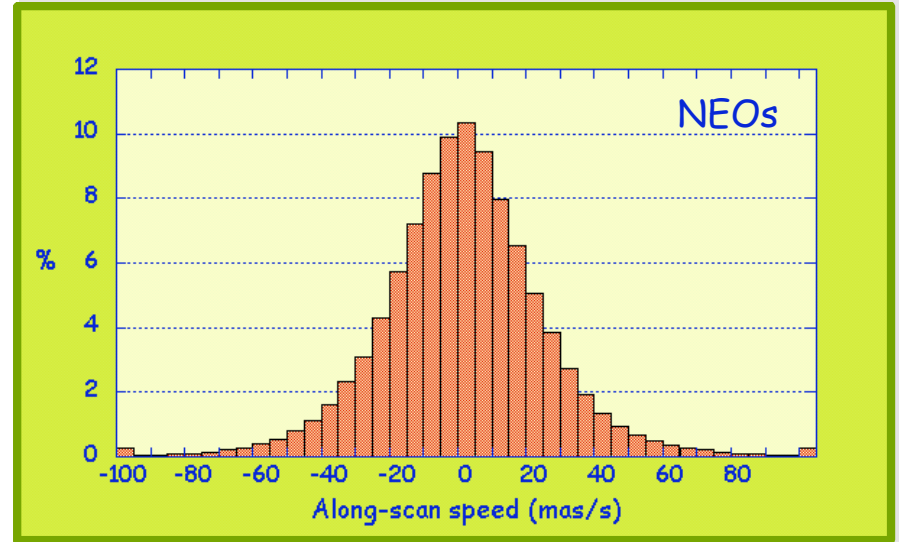
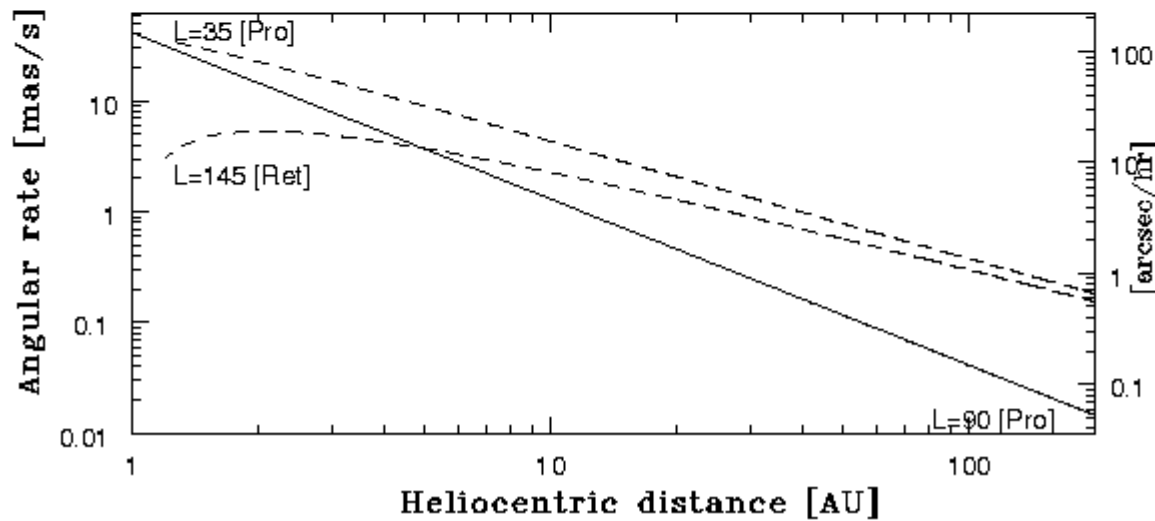
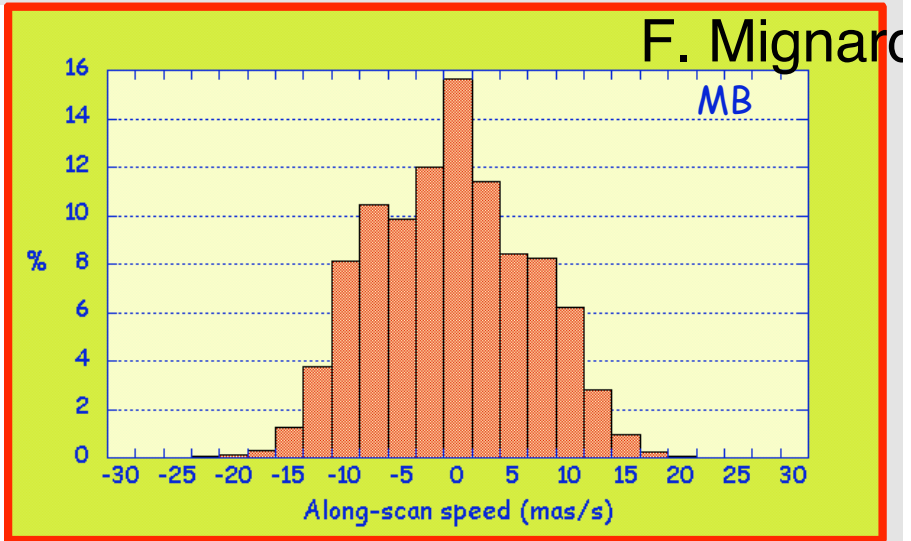
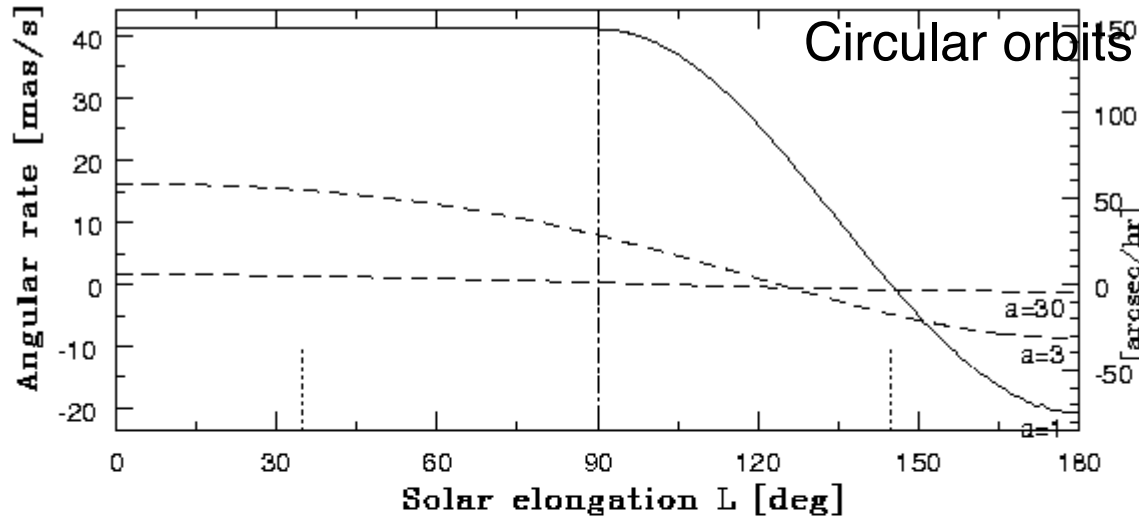
AC less sensitive



Size



Motion



Motion

_ NEO

- $V \sim 40\text{-}100$ mas/s (150 arcsec/hr)
- For $V=100$ mas/s in ASM
 - _ AL: blurring ~ 2.2 samples (4.4pix)
 - _ AC: blurring ~ 0.7 samples (1.5pix)

_ MBA

- $V \sim 10\text{-}15$ mas/s (35arcsec/hr)
- Motion less than 1 pix in ASM

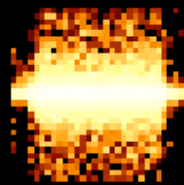
_ KBO & Centaurs

- $V \sim 0\text{-}5$ mas/s

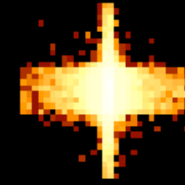
Motion

- _ Schematic, exaggerated motion (no RON)

Vel X (AL)

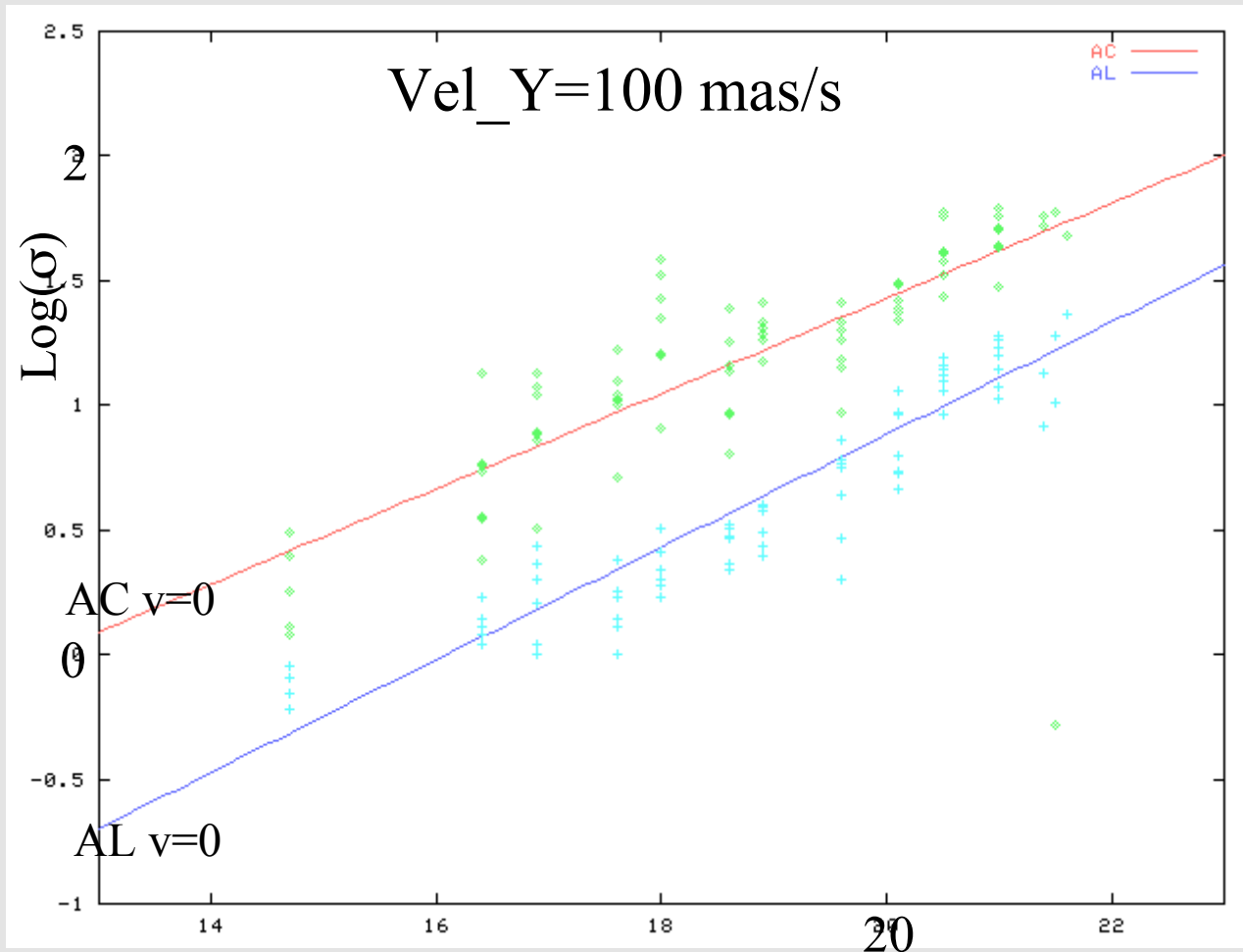


Vel Y (AC)



- _ **Reminder:** we test only effect of the **image** on detection (ASM)

Velocity – Y



ASM, i.e. 1.92 s &
binning 2x2

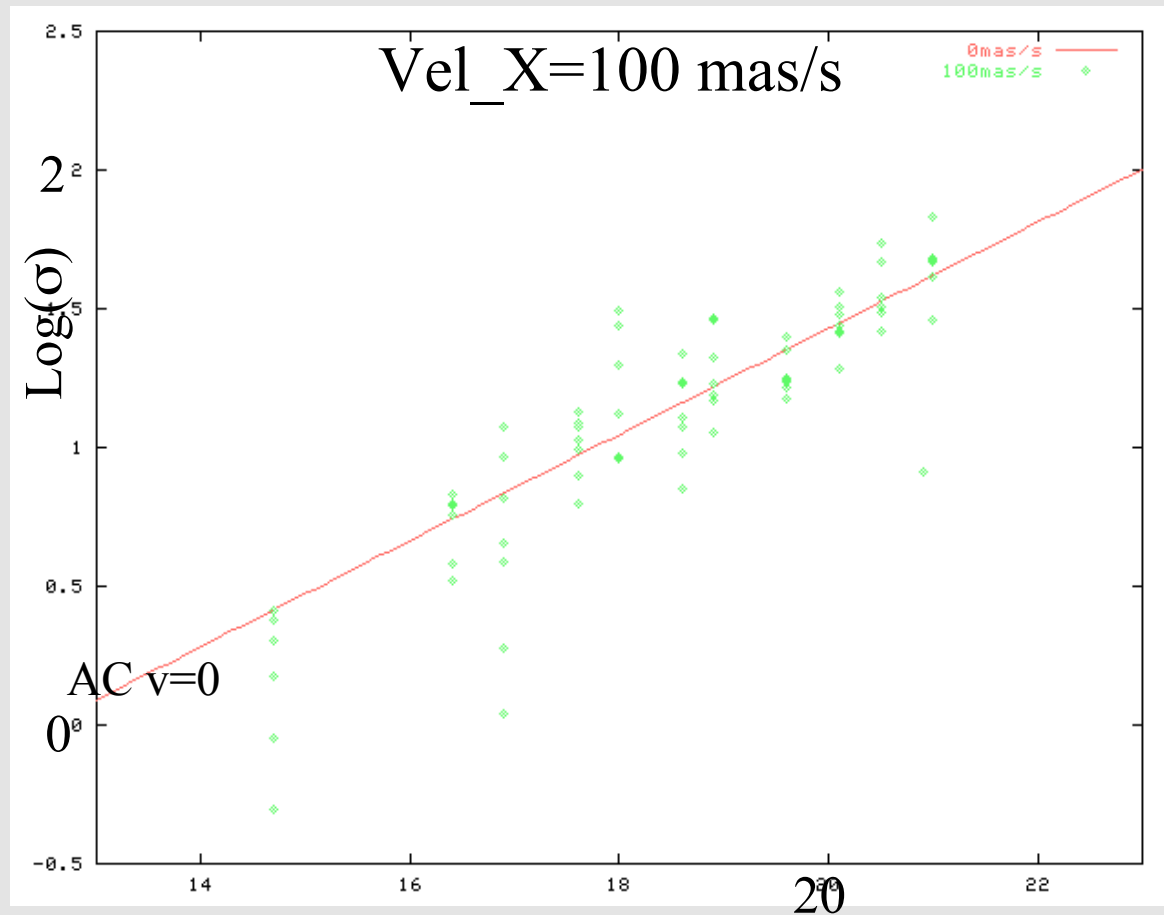
no loss in precision
in both AL & AC
for the ASM

even @ very large
angular rate of
100mas/s

Velocity – Y

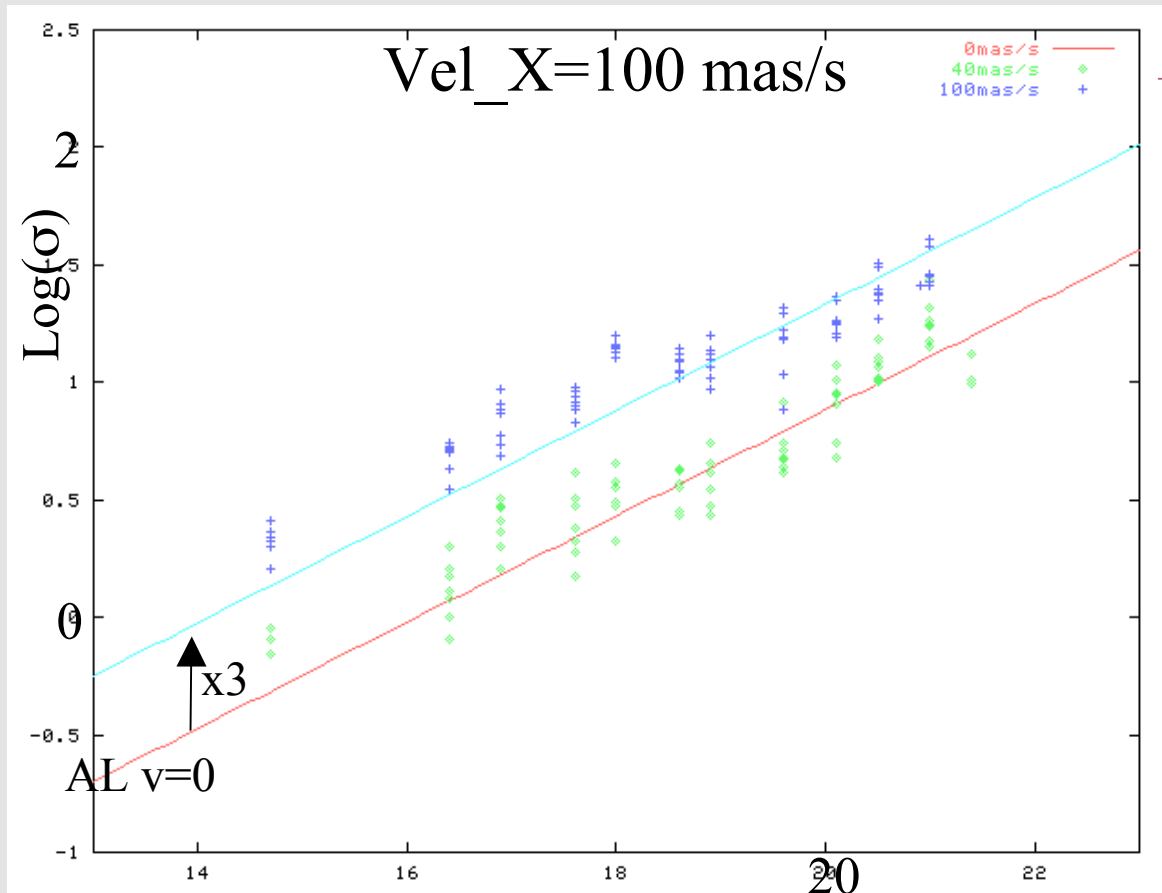
- _ Signal almost not degraded
 - @ $V_y = 100 \text{ mas/s}$
- _ Same precision as for stars
 - AL $\sim 10 \text{ mas}$ @ $G=20$
 - AC $\sim 30 \text{ mas}$ @ $G=20$
- _ Magnitude limit
 - Still complete @ $G \sim 20$

Velocity – X



No loss in AC

Velocity – X



Degradation AL

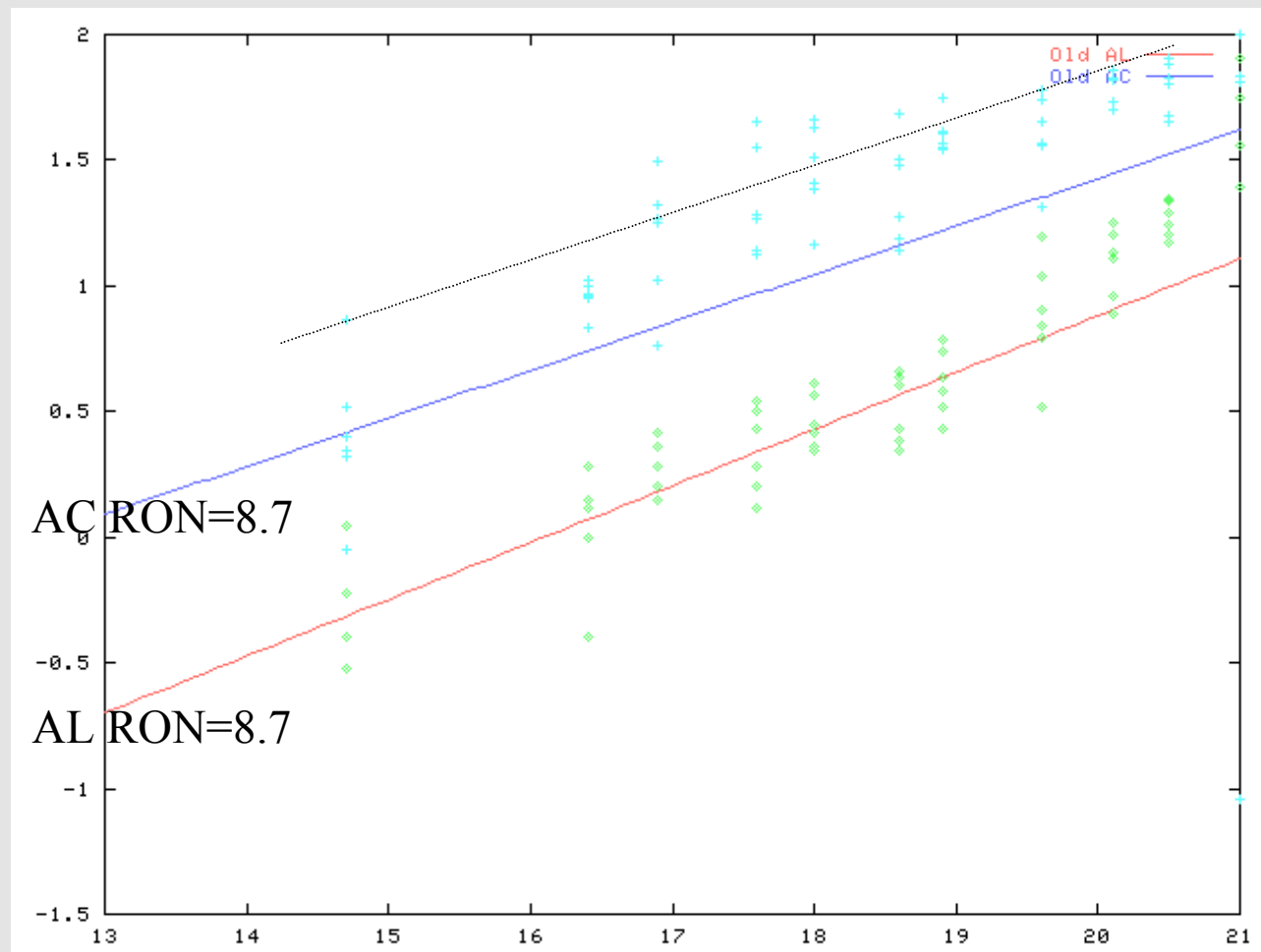
- not sensitive @ 40mas/s
- "onset" @ ~ 45 mas/s, i.e. 1 sample
- factor ~ 1.5 @ 70 mas/s
- factor ~ 3 @ 100 mas/s

Velocity – X

- _ Degraded signal
 - @ $V_x > 45$ mas/s
- _ **Lower precision in AL**
 - **For $V_x = 100$ mas/s**
 - AL ~ 25 mas @ $G=20$**
 - AC ~ 30 mas @ $G=20$**
- _ Magnitude limit
 - Still complete @ $G \sim 20$

New values

- RON=14 and gain=6
 - Loss of precision in AC (factor ~ 2.5)



Futur

- _ Implement new RON and gain
- _ Implement in GIBIS
 - put asteroids in Universe
 - opened to SSWG and others WG

- _ Selection



- here only detection ASM
- Selection in AF1
- Analyze effects on main AF (AF2—AF11)