

30th IADC meeting / WG1


Infrared observation potential

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- **Why infrared observation ?**
 - ◆ Try to observe satellites at dawn or during day.
 - **What is the crucial point ?**
 - ◆ Crepuscular and diurnal magnitude of the sky in V, I,J,H,K bands
 - **Conclusion for TAROT 250mm aperture telescopes**
 - **Our hopes on 1 meter class telescopes**

1-Why IR observation ?

Observe satellites at dawn or during day

LEO objects

- Dawn=best moment : good solar phase angle, no eclipse of satellite

GTO objects

- Extending the duration of night can help catch them more often

MEO objects

- Some are visible at night, others are visible during day

GEO objects

- Adding measures at dawn or during day could improve orbit computation.

2- Crucial point magnitude of sky for V,I,J,H,K bands

Diffusion of light by atmosphere : Krisciunas, Schaeffer, 1991

- Gas : Rayleigh diffusion (Allen 1976)

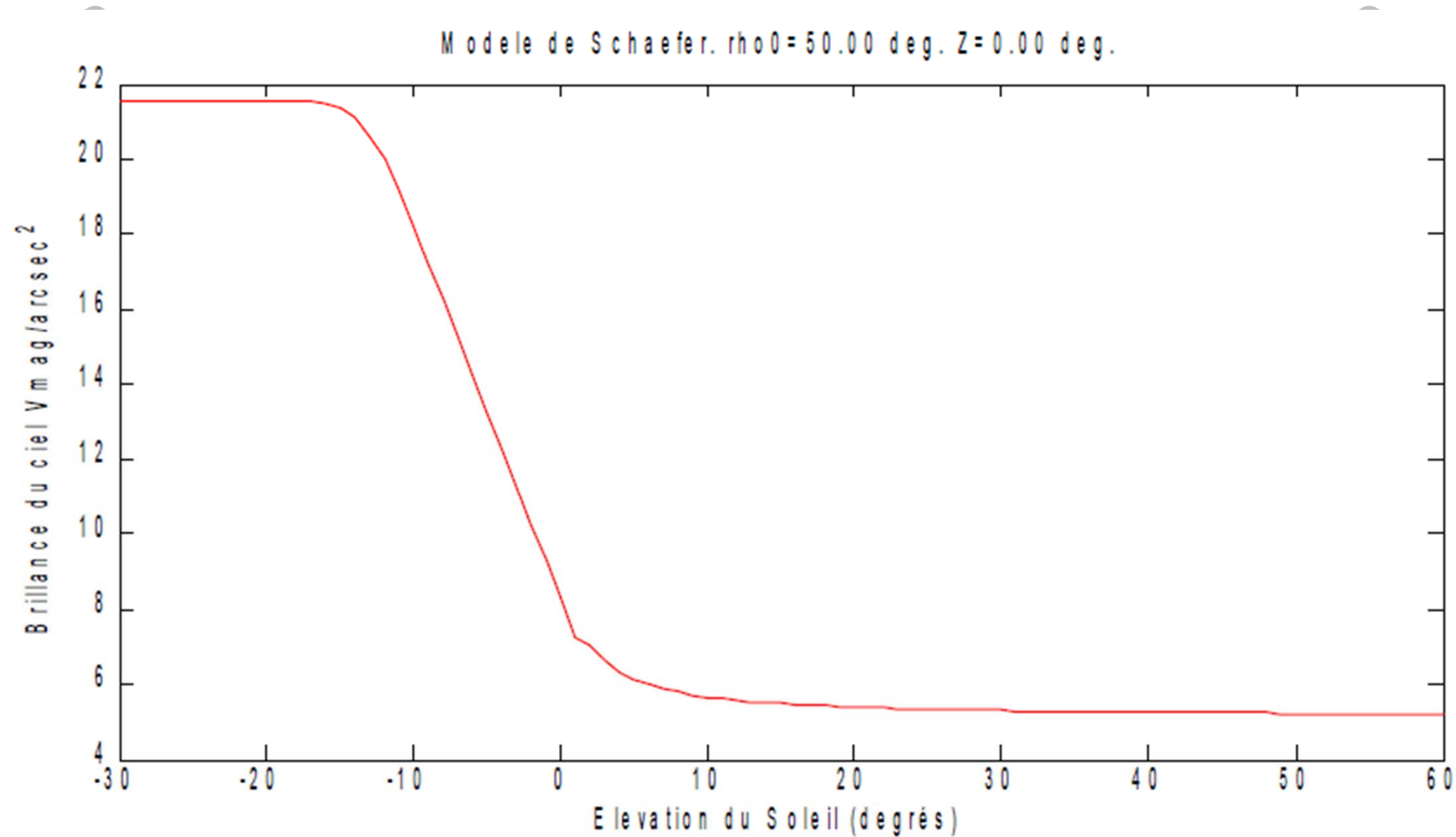
- Aerosol : Mie diffusion (Haves et Latham 1975)

- Stratospheric ozone : absorption (Schaefer 1993, Meinel et Meinel, 1983)

- Crepuscular sky brilliance : Koomen 1952

- Diurnal sky brilliance: Weaver 1947, Koomen 1952, Tousey 1948

2-V band brilliance at zenith, sun séparation = 50°



script Matlab correspondant est :

par all

3-Validation of the Vband theory using TAROT Chili

No anthropic light on the site

Day : VN filter : 1/400 band attenuation

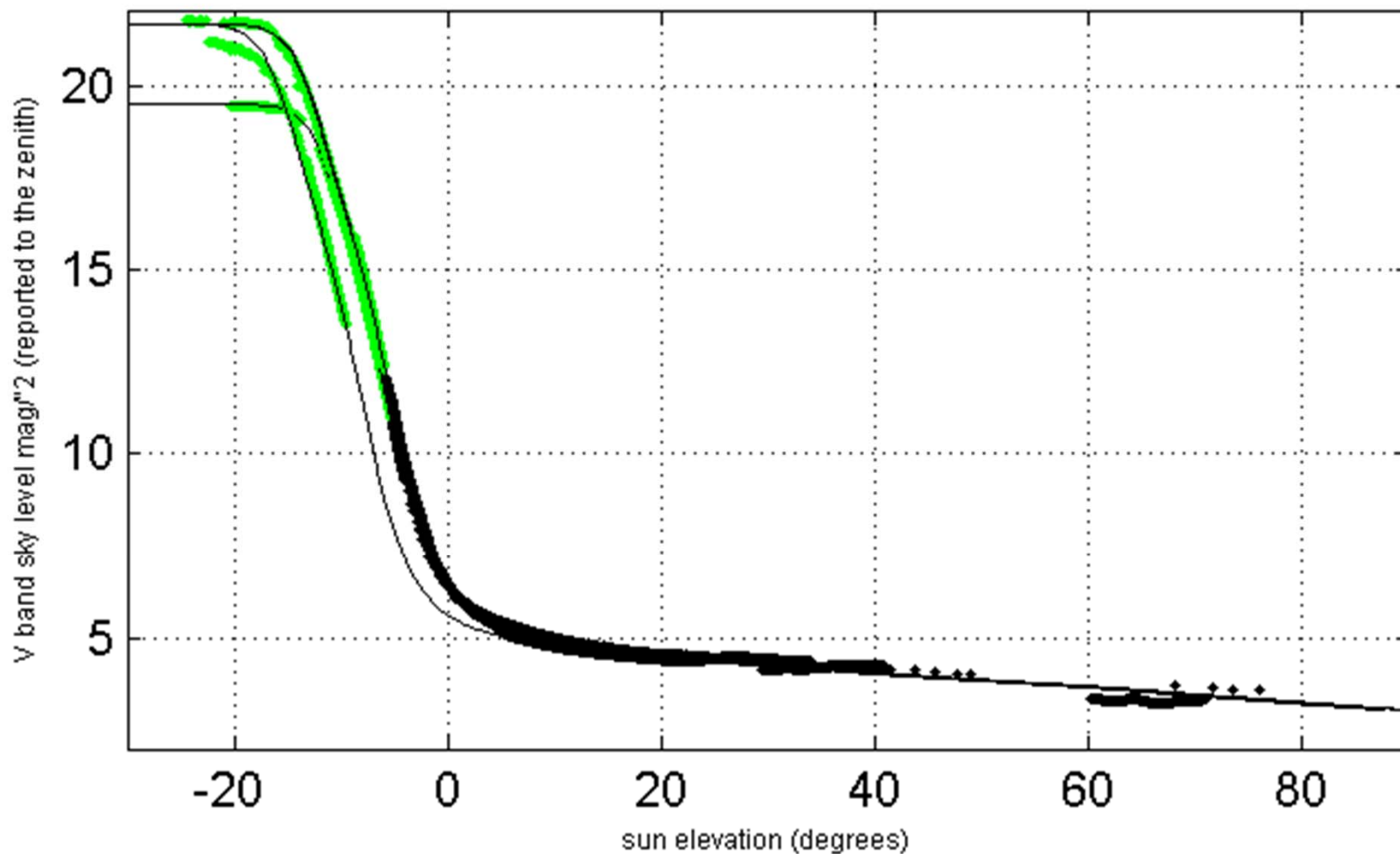
Night : V filter, I filter

Photometric calibration of each filter using stars

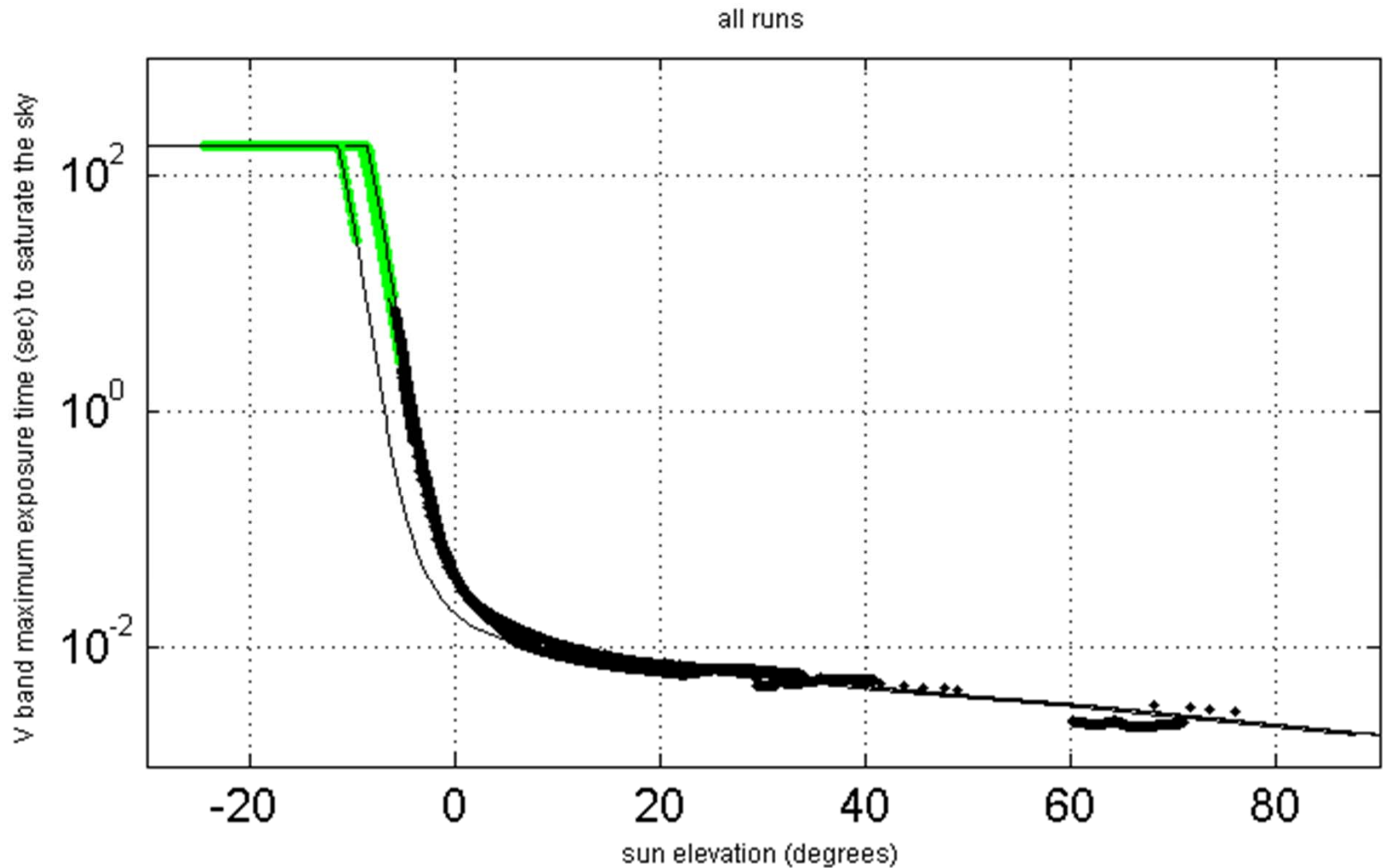
3-Measured magnitude of sky

Tarot Chili, various elevation and azimuth

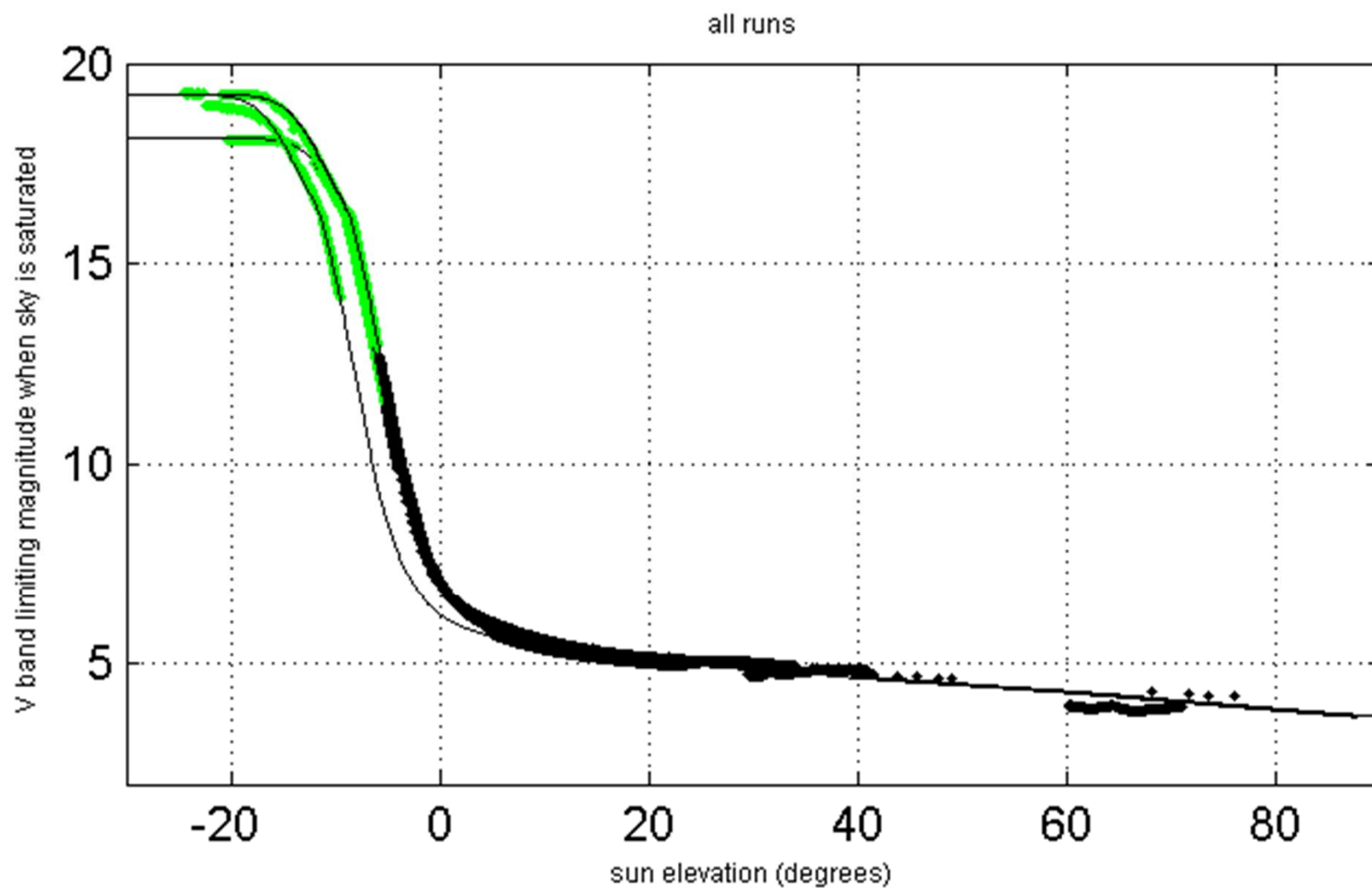
all runs



Maximum exposure time before V band saturation



3-Vband limiting magnitude on Tarot



3-Extrapolation to infrared bands

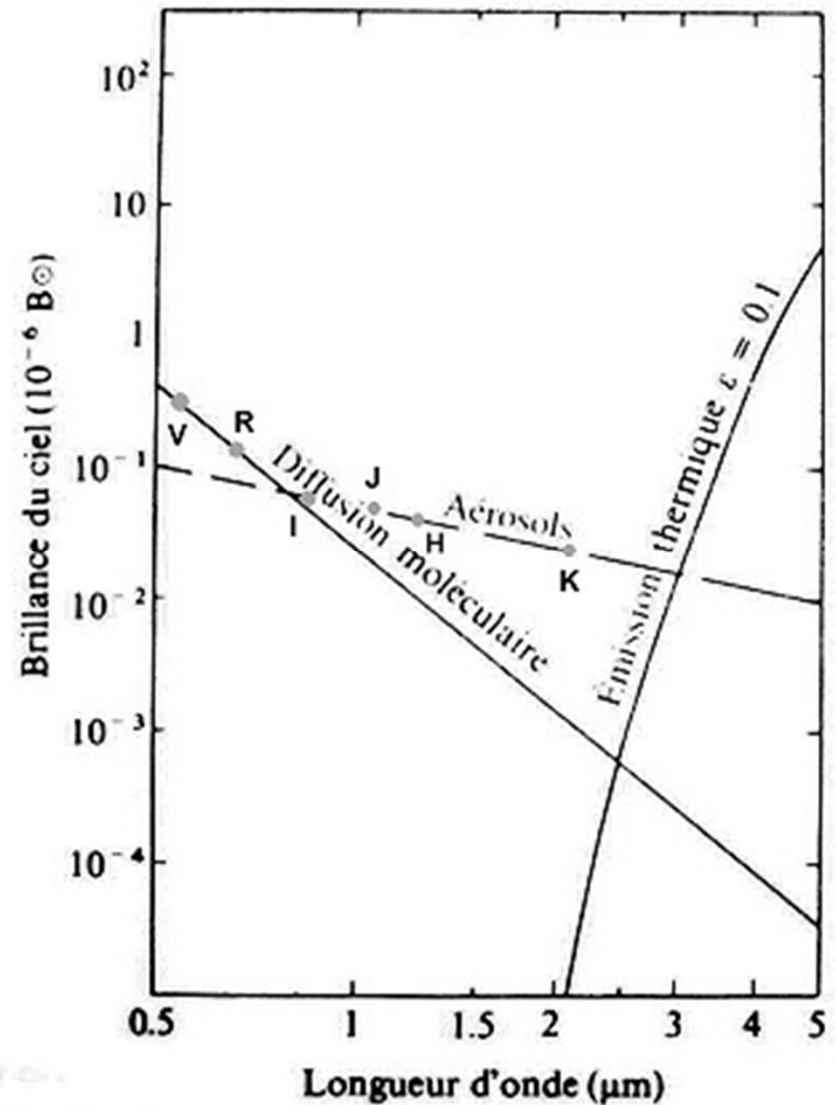
Modification of asymptotic behaviour

Night : measures from several telescopes

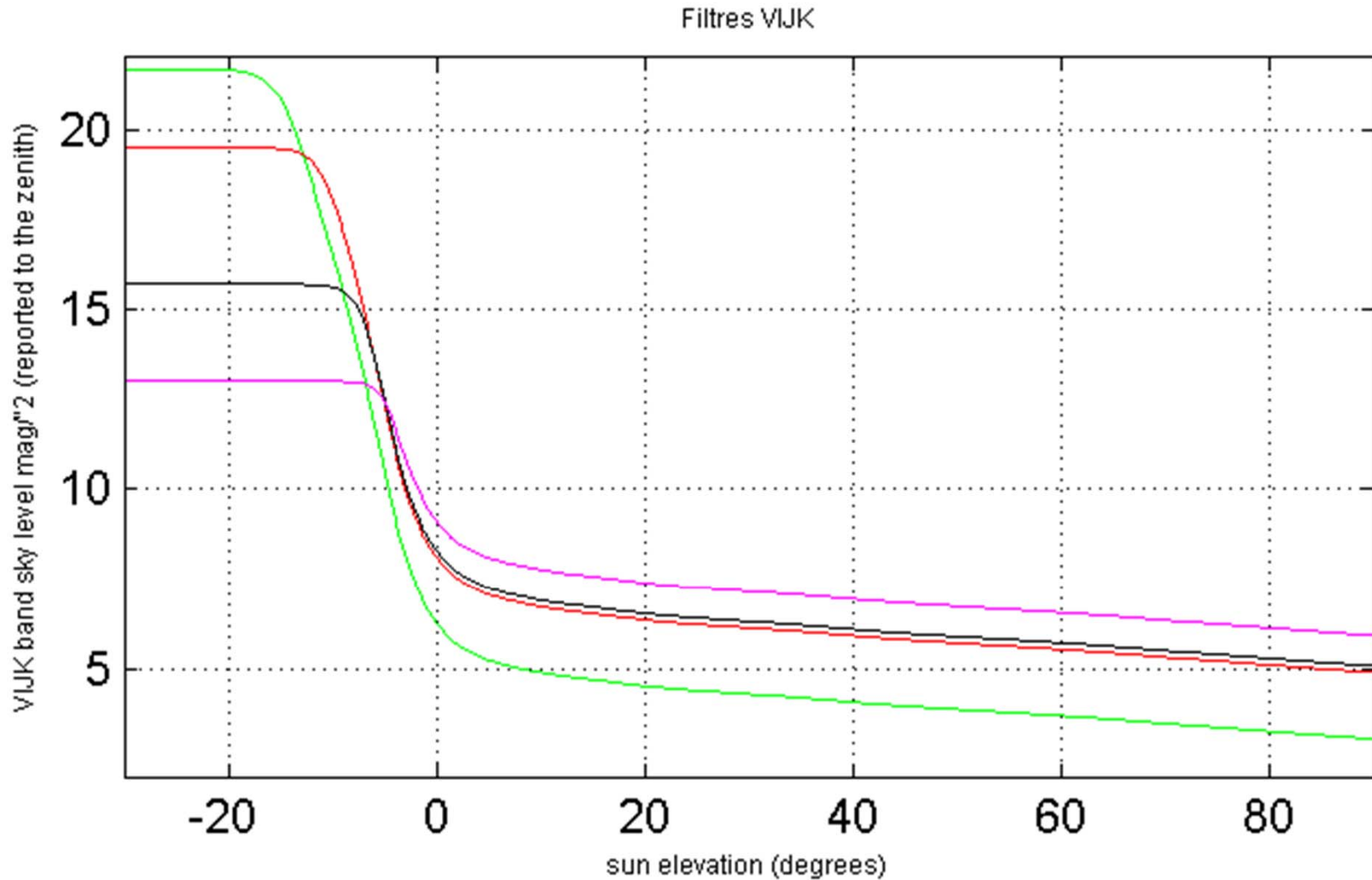
Lieu	V	R	I	J	H	K	référence
Paranal	21.61	20.87	19.71				Patat 2004
La Silla	21.7	20.8	19.5				Patat 2004
Calar Alto	21.5	20.6	18.7				Patat 2004
Hawaii				16.1	14.4	13.3	Hoapp 92
La Palma				15.5	14.0	12.6	Sanchez08
Hawaii				15.6	14.0	13.4	Sanchez08
Paranal				16.5	14.4	13.2	Sanchez08
Australie				15.7	14.1	13.5	Sanchez
La Silla	21.7	(20.8)	(19.5)	(15.7)	(14.1)	(13.0)	TAROT

3-Extrapolation to infrared bands

- Modification of asymptotic behaviour
- Day : model from Lena (1992)



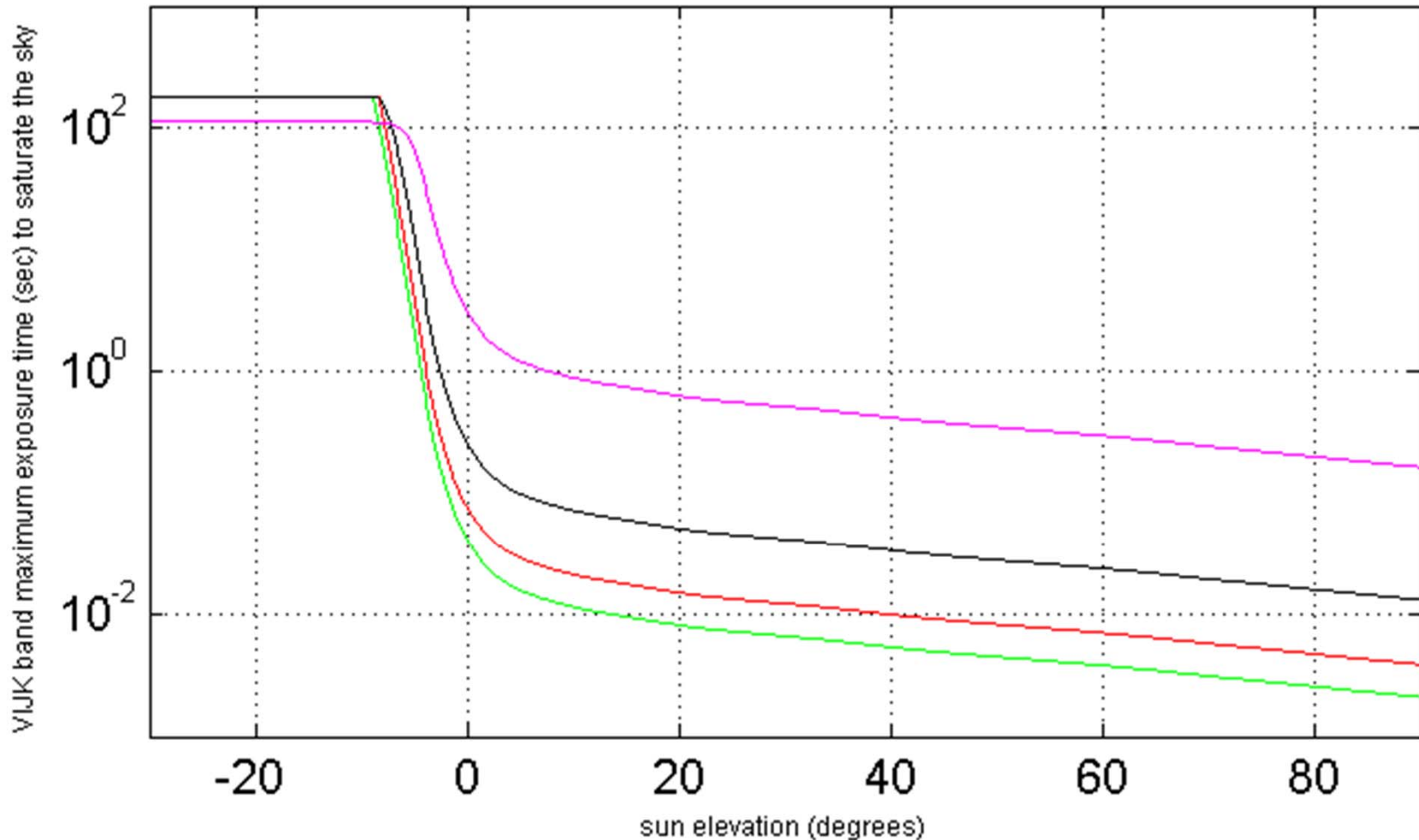
Infrared extrapolation:magnitude per square arcsecond



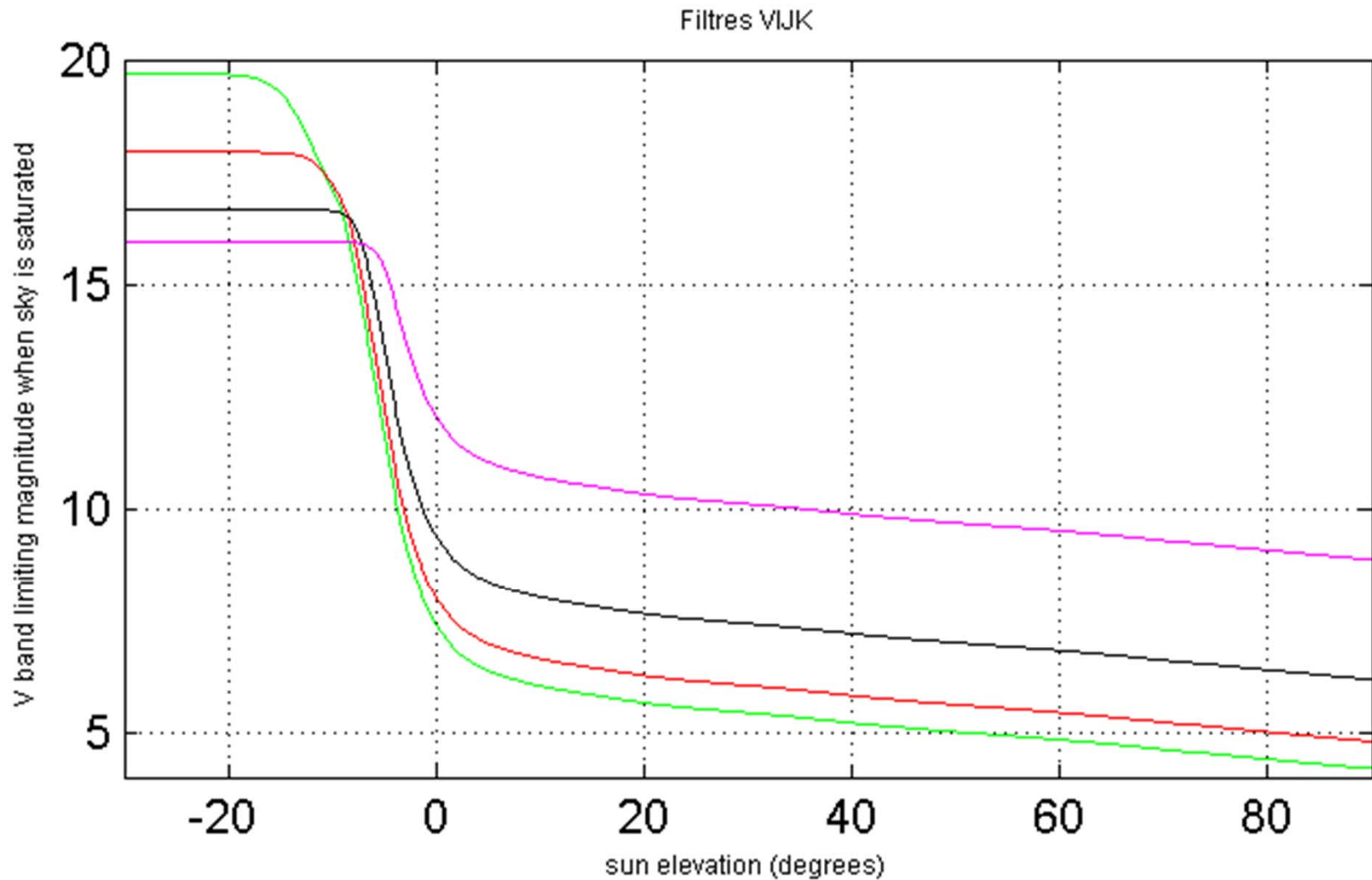
Tarot maximum exposure time

Surface and gain of IR camera considered the same as Tarot Andor camera

Filtres VIJK



TAROT limiting magnitude



4 – experiments

- Experiments on J and H cameras.
K cameras not compatible with automated telescopes.
- Infrared cameras too large for TAROT telescope
tests will take place on a 1 m aperture telescope
- First test with commercial FLIR SC645 camera
 - ✦ Cannot change the lens
 - ✦ Cannot do long exposures
 - ✦ 1/30s in a 1m telescope not sufficient for GEO satellite.
- In 2013 : tests with the Cagire camera from F-GFT – SVOM mission