

French Meteor Network PODET-MET

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IMCCE / Observatory of Paris

IMC 2010, Armagh
17th Sep. 2010

PODET Overview

- PODET: "**PO**le sur la **D**ynamique de l'**E**nvironnement **T**errestre"

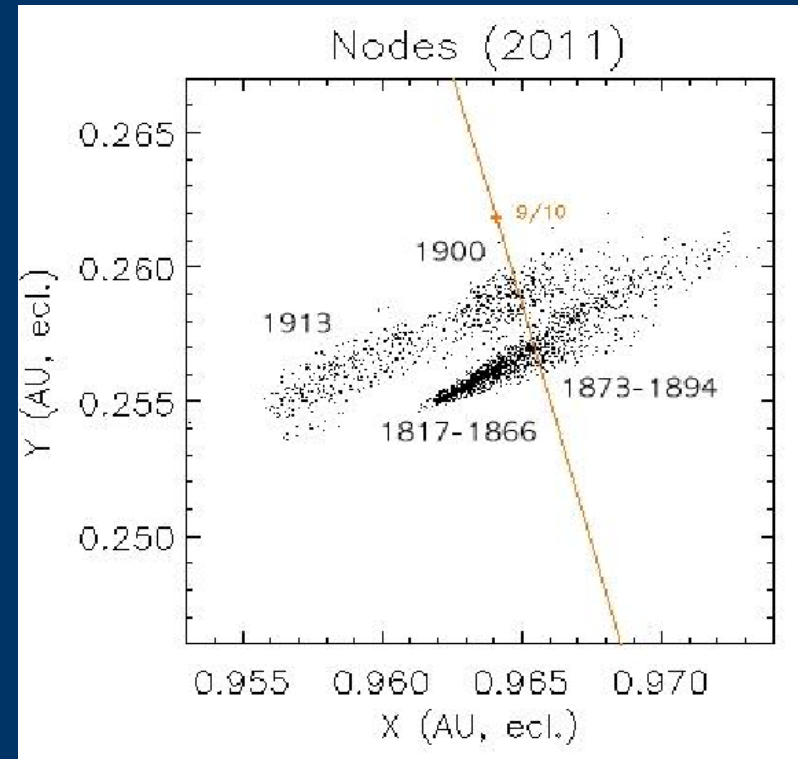
- Part of a projects' triplet:

- ◆ **MET**: Based on meteors observation
- ◆ **DEB**: Take care of Special fragments
- ◆ **AST**: Deals with near-earth asteroids



PODET-MET Objective


- To identify different trails of the meteoroid stream
- Comparison of sub-structure filaments within the meteoroid stream with the theoretical models
- Determination of parent bodies (with specific trail)



Vaubailon (2010)

NEED HIGH PRECISION DATA !!!!!

French Meteor Network

- High Precision Cameras
- All sky Camera
- Triple Stations 
- Pic Du Midi (2880 m)
- Guzet (1530)
- Sebastian (260 m)
- 95 -100 km distance between stations
- **Remote and Automated**



LH-11000 Camera

Effective Pixels : 4032 x 2688

Pixel size : 9 μm

Readout noise : $\sim 30 e^-$

Bit : 14

Canon 50 mm f1.4 lens

FOV 40 x 27 deg

Resolution \sim **0.01 deg** \sim 35 arc-sec

~ 18 m for meteor observed at 100 km



System Setup

- Canon Lens
 - LH-11000 camera
 - Camera-link Cable
 - Camera-link to GigE convertor
 - Ethernet Cable
 - PC/Laptop
- A weather proof box is being made to keep camera, lens and the cables
- A “cooling finger” will be used to cool the CCD for better results.



Technical Issues

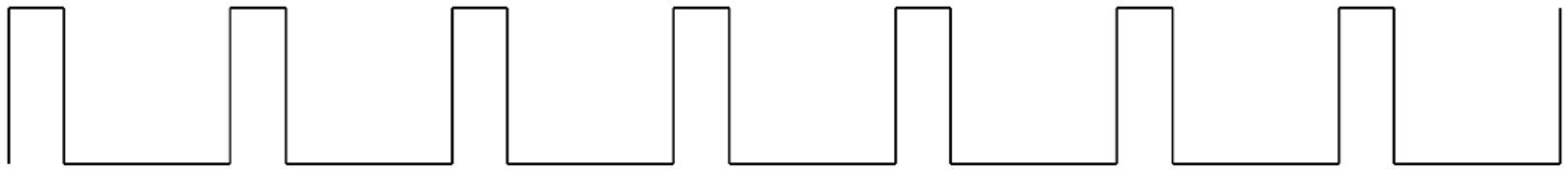
- Camera Operating Software - **BATS** (modified by the company for remote and automated operation)
 - Event/meteor detection - We are testing **Meteor Finder** (see Ivan Sauli talk 11:40 Saturday) & **SFI** (Peter Gural)
 - Automated transfer of meteor frames to IMCCE database
 - Meteor Position and Flux – ongoing research
 - Astromerty & Photometry – SPARVM (ongoing modification)
 - Multiple Station & orbit computation - SPARVM
 - Storage of results – XML (PODET format, also useful for VO)
 - Developed Java tool for double station observation (<http://tiny.cc/j9a88>)
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Electronic Shutter Process

- Min exposure = 0.8 ms; Max Exp = 52428 ms
- The READOUT time is 149 ms.
- Maximum of 6.7 frames/second

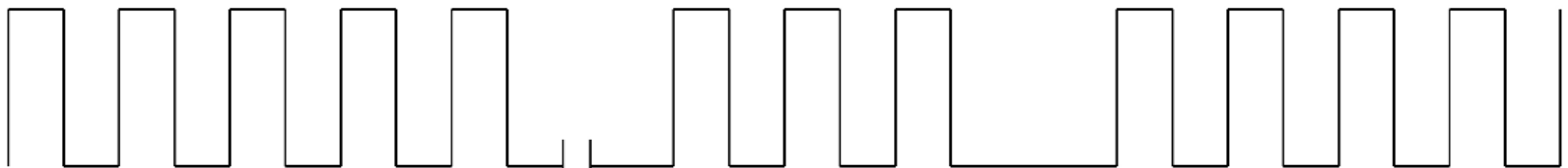
Electronic Shutter Process

signal
↔



↔
read CCD

signal
↔



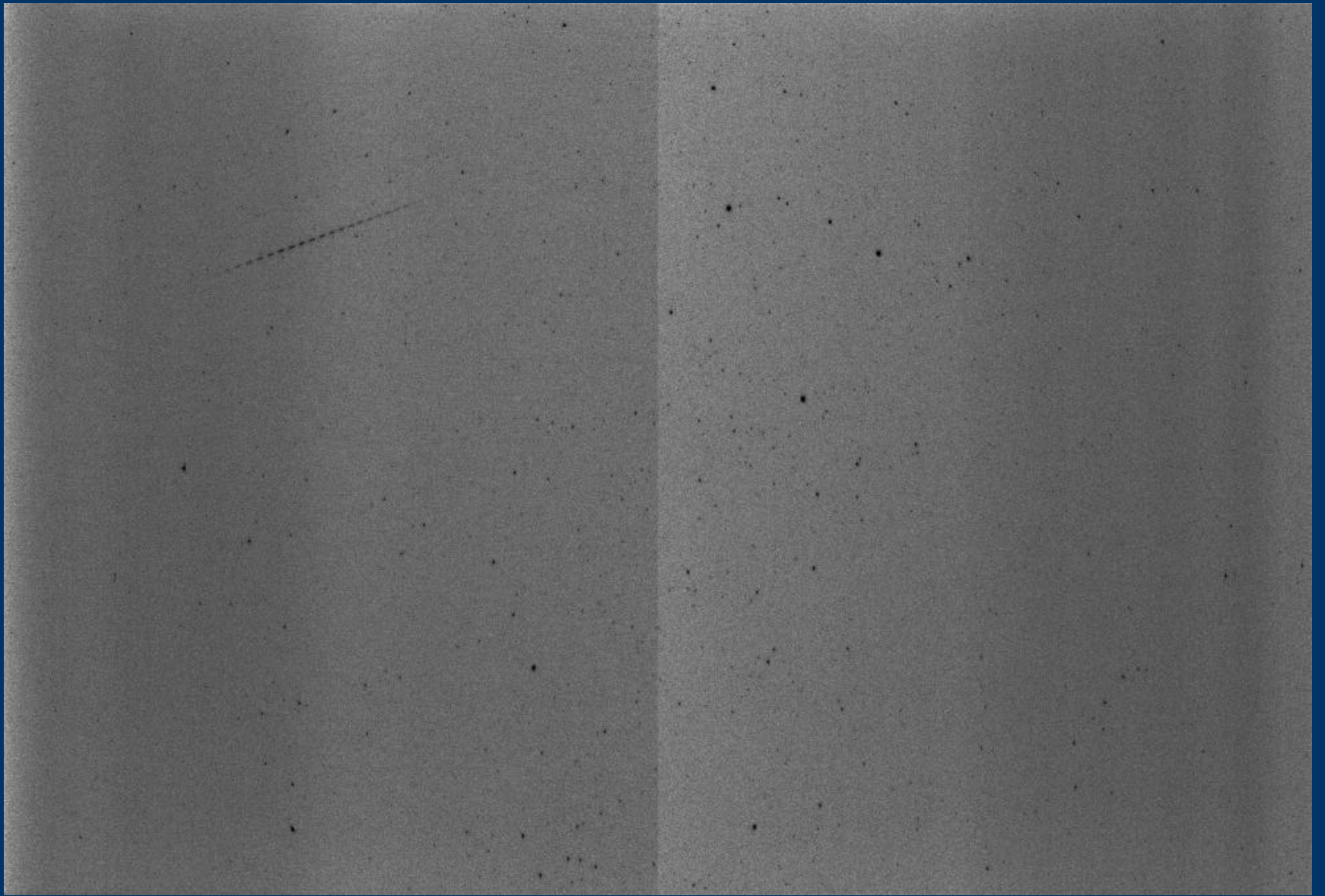
↔
break

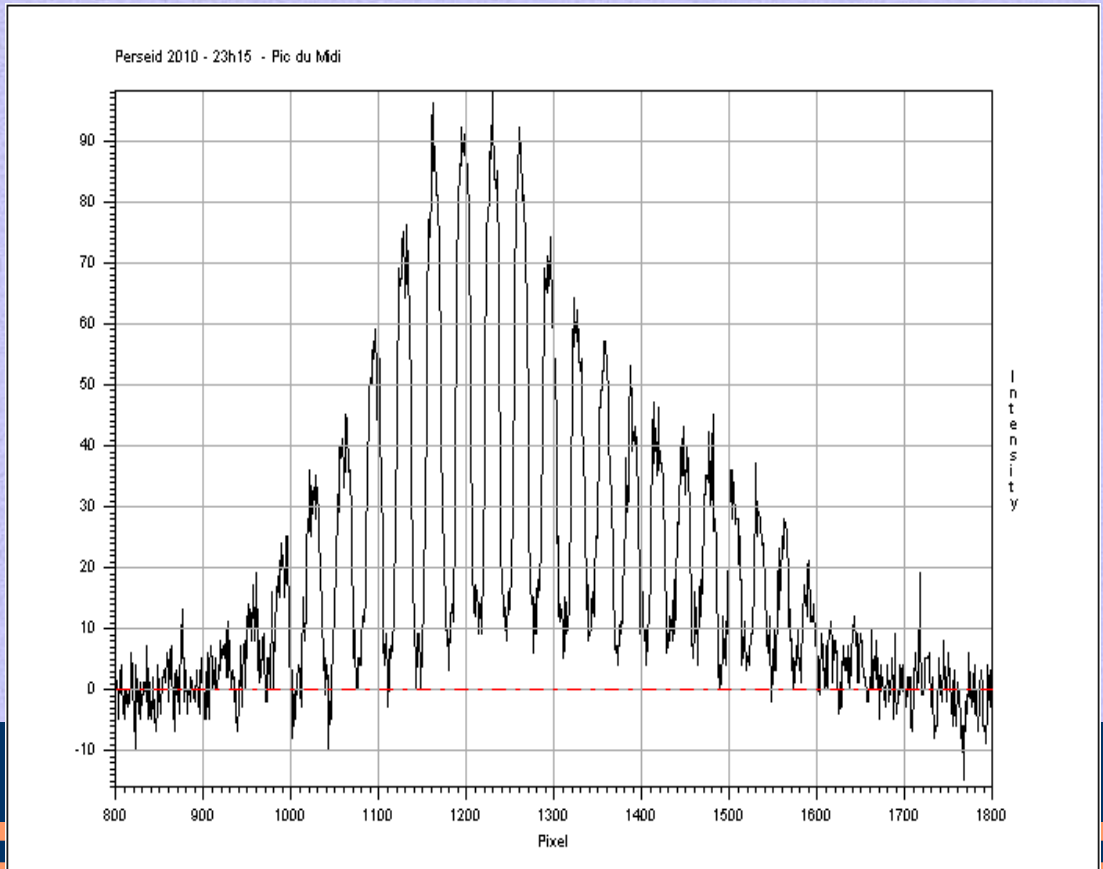
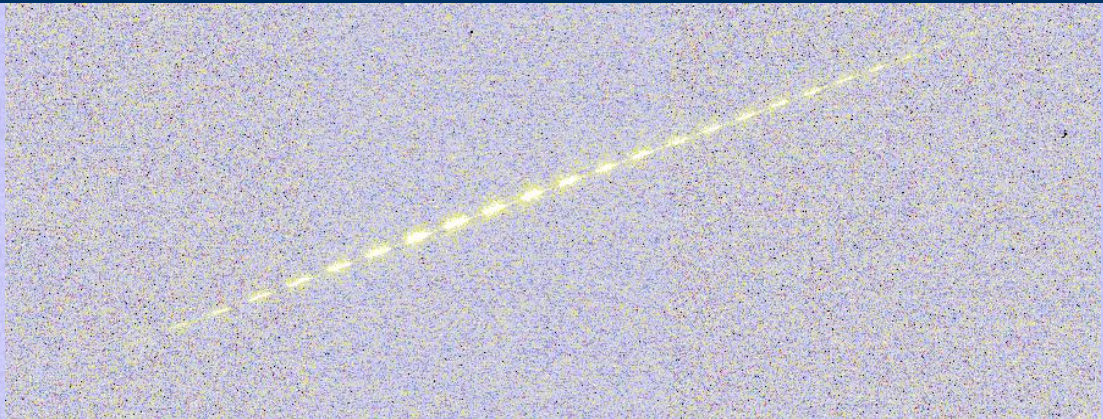
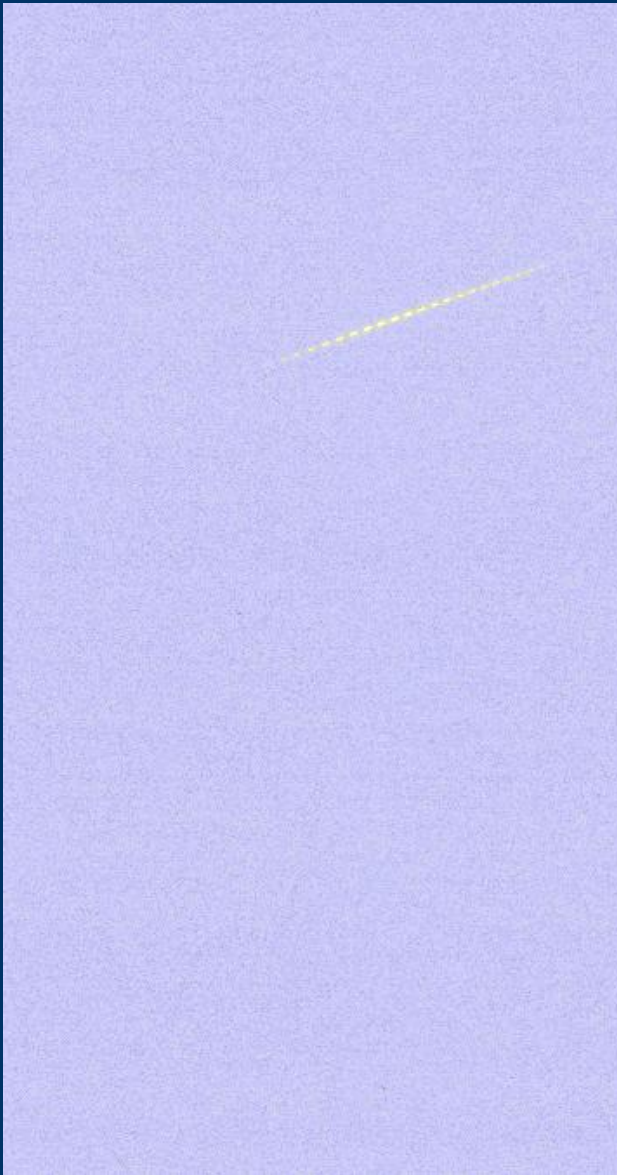
x N

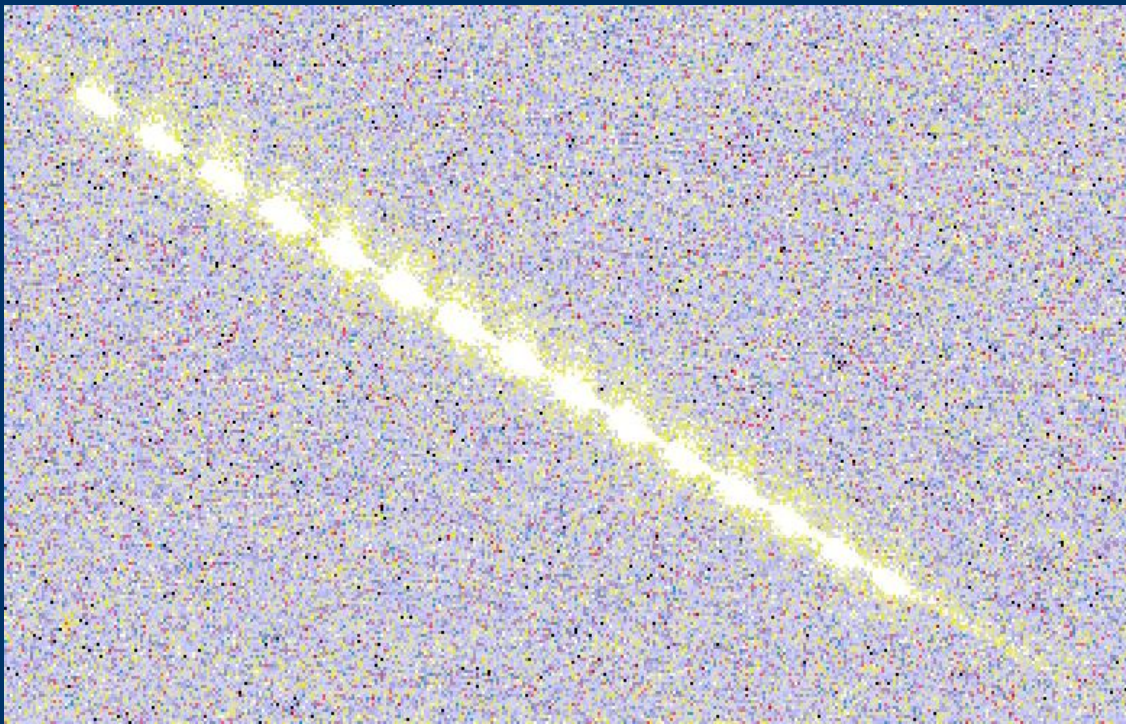
↔
read CCD

Electronic Shutter Process

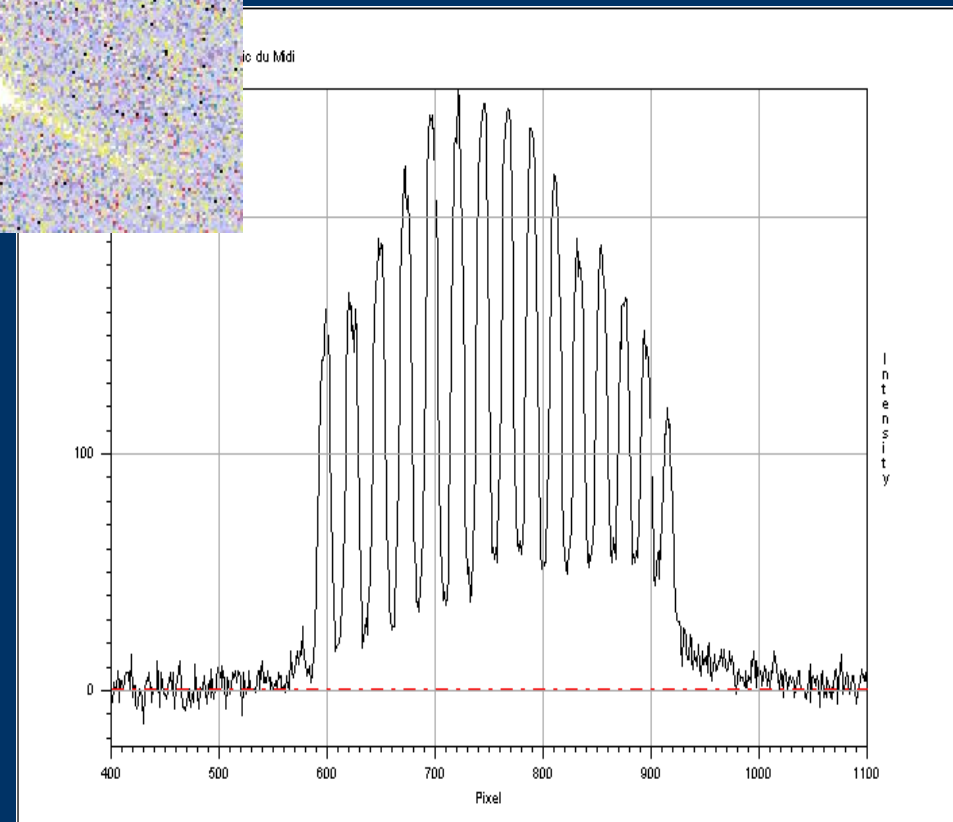
- Min exposure = 0.8 ms; Max Exp = 52428 ms
 - The READOUT time is 149 ms.
 - Maximum of 6.7 frames/second
-
- Exposure = 10 ms, Break = 10 ms, Loop = 50 cycles
 - The Readout (dead) time is 149 ms.
 - Can vary these settings for fast and slow meteors

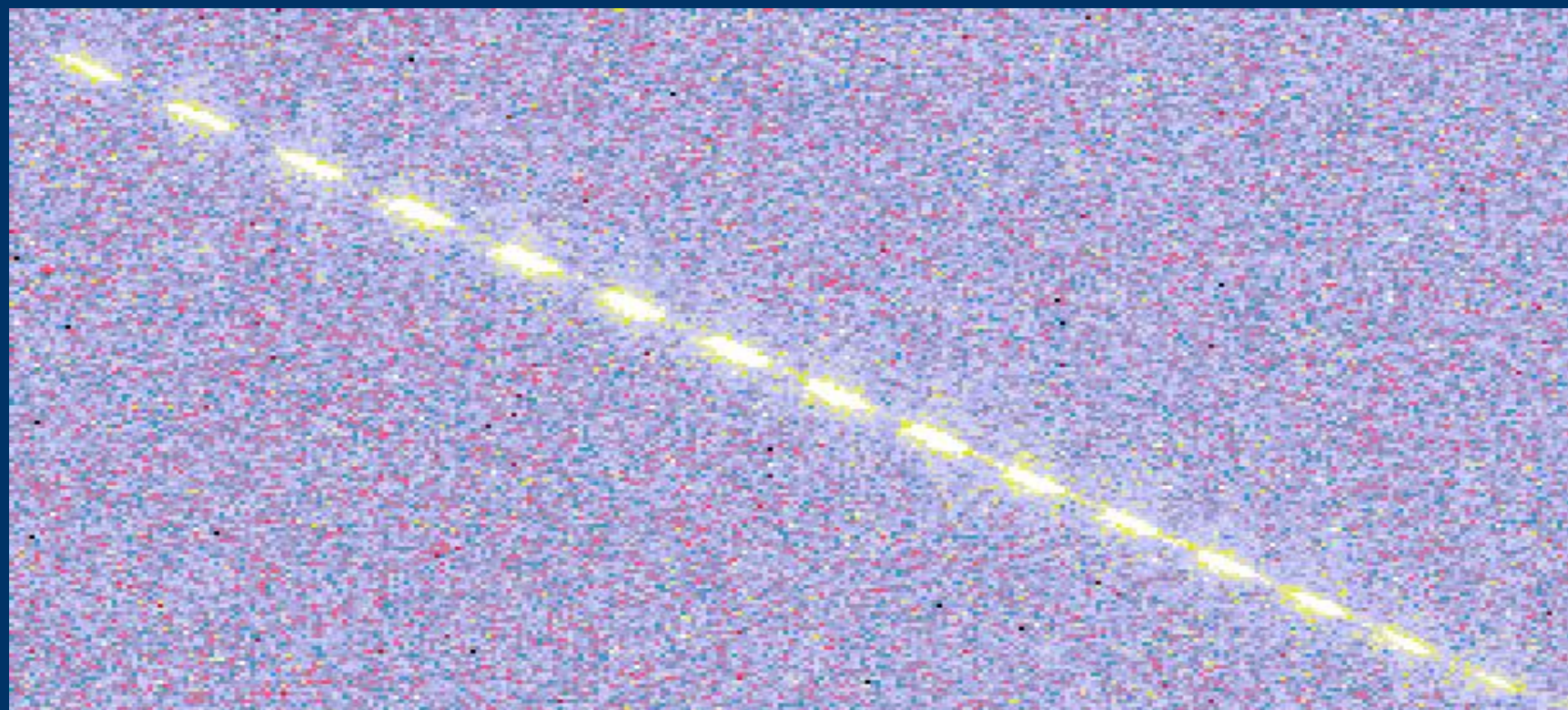




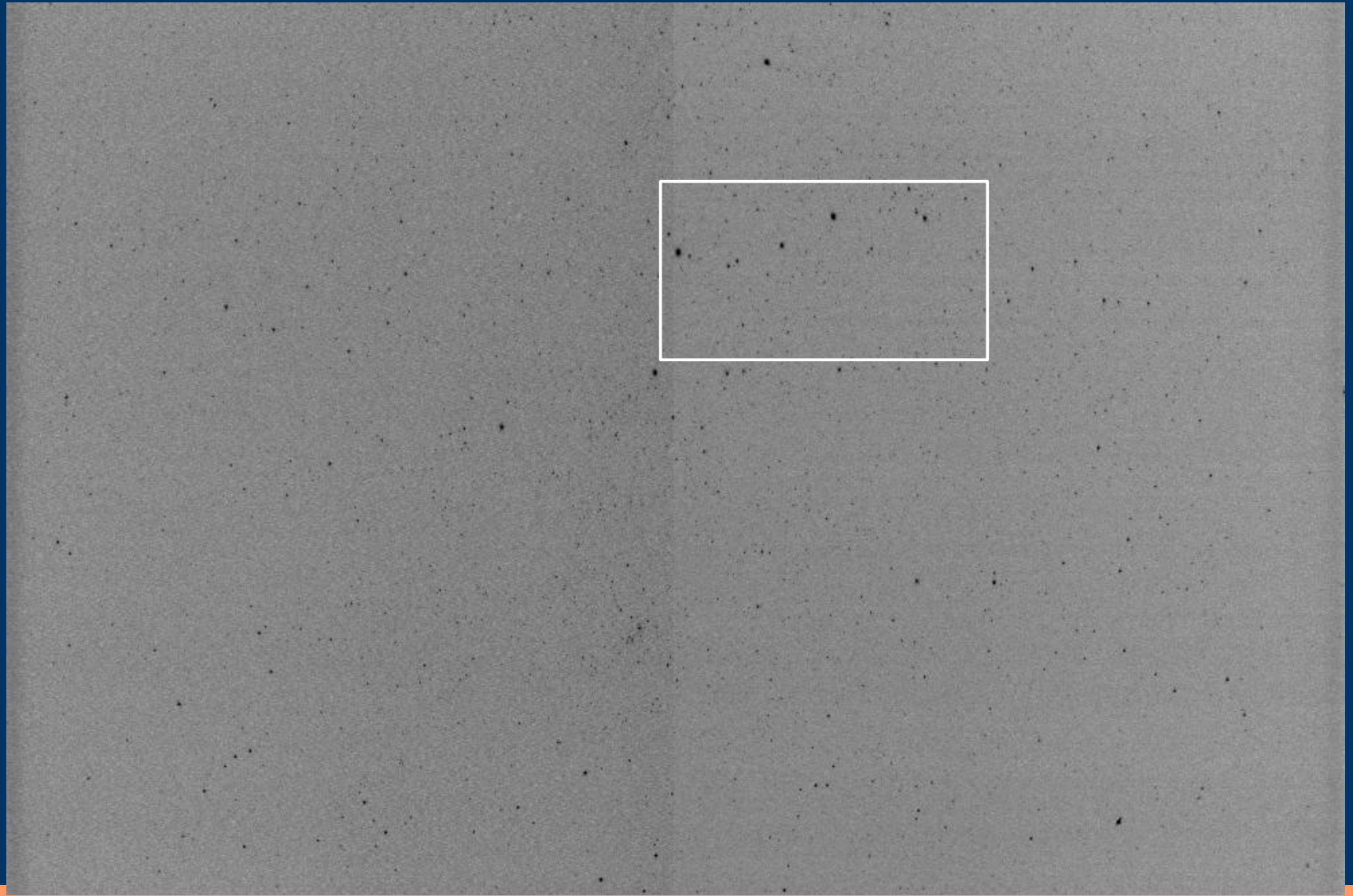


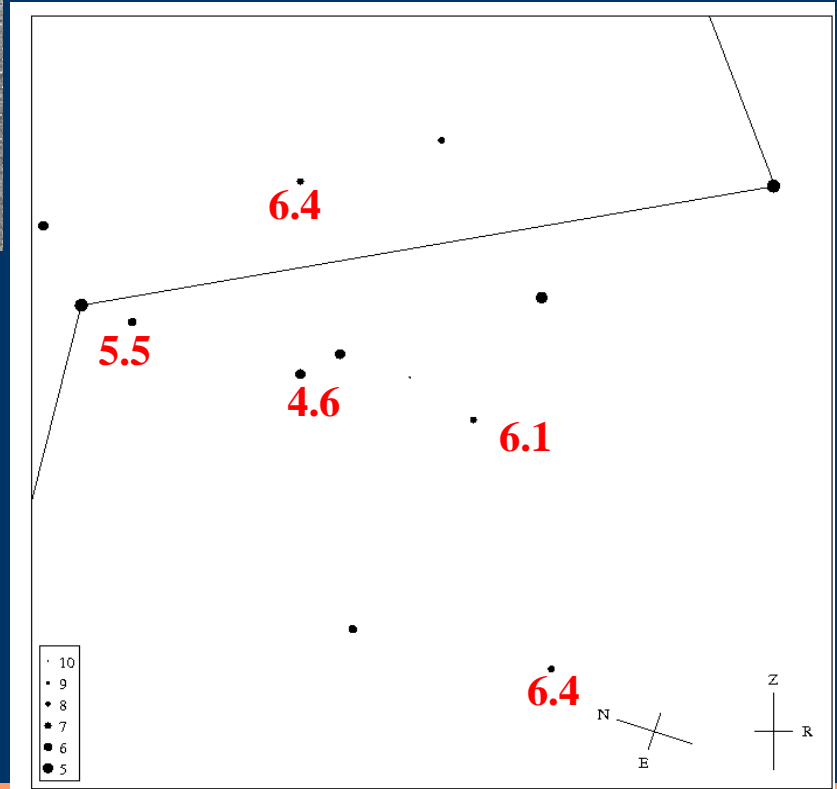
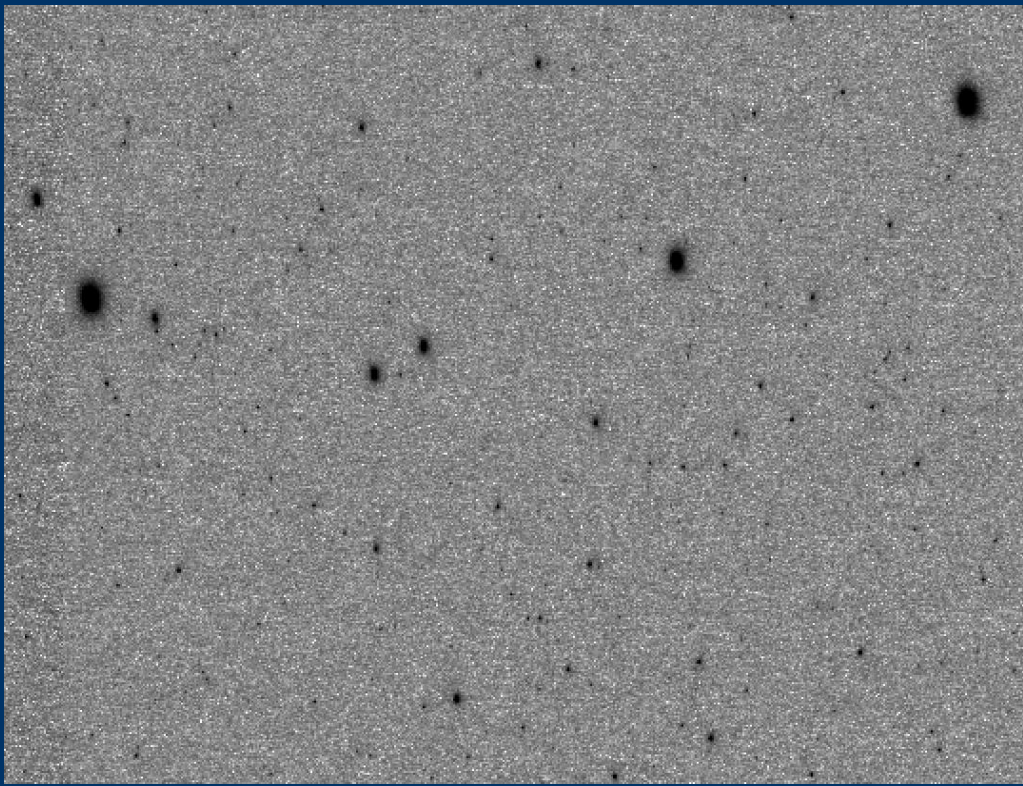
Distance between two peaks ~ 25 pix
Time difference ~ 10 ms
Angular Velocity \sim
 $25 * 0.01 \text{ deg} * 100 (1/s) = 25 \text{ deg/s}$

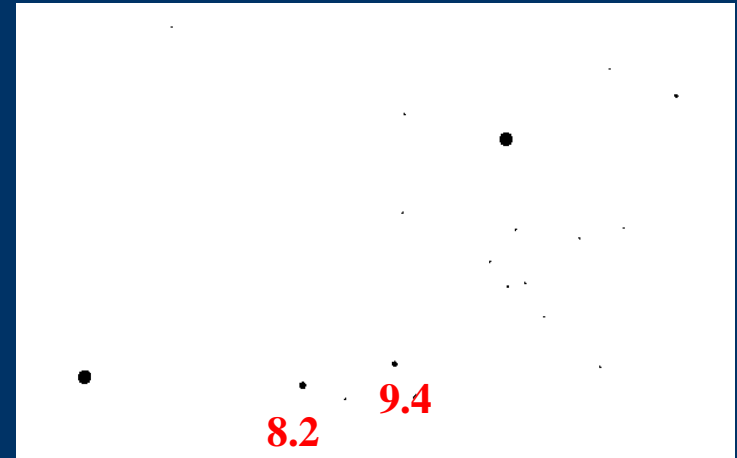
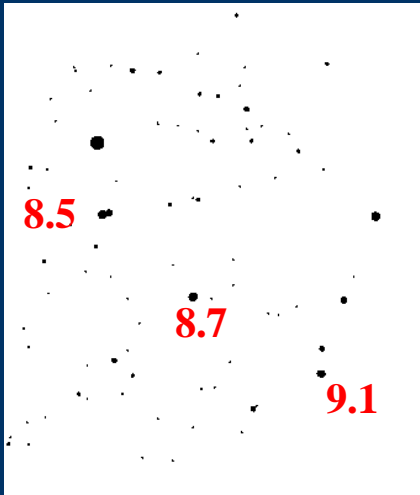




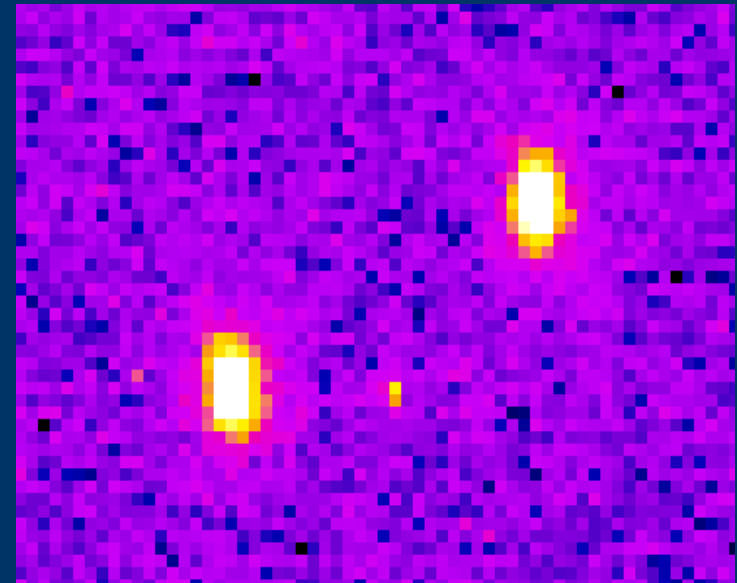
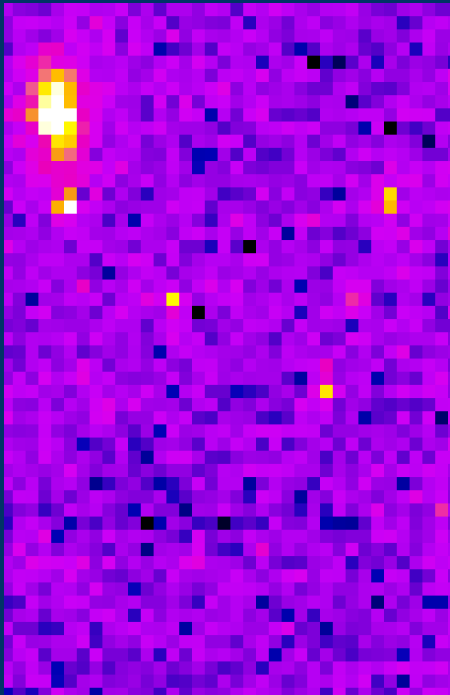
Stellar limiting magnitude

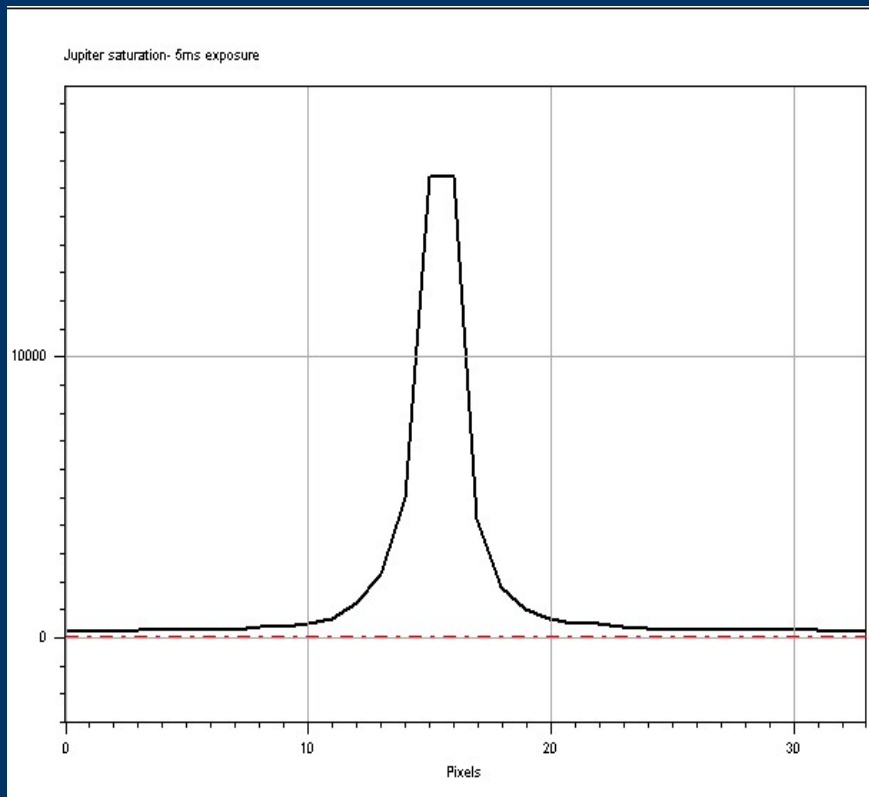






Stellar Limiting
magnitude ~ 8.0



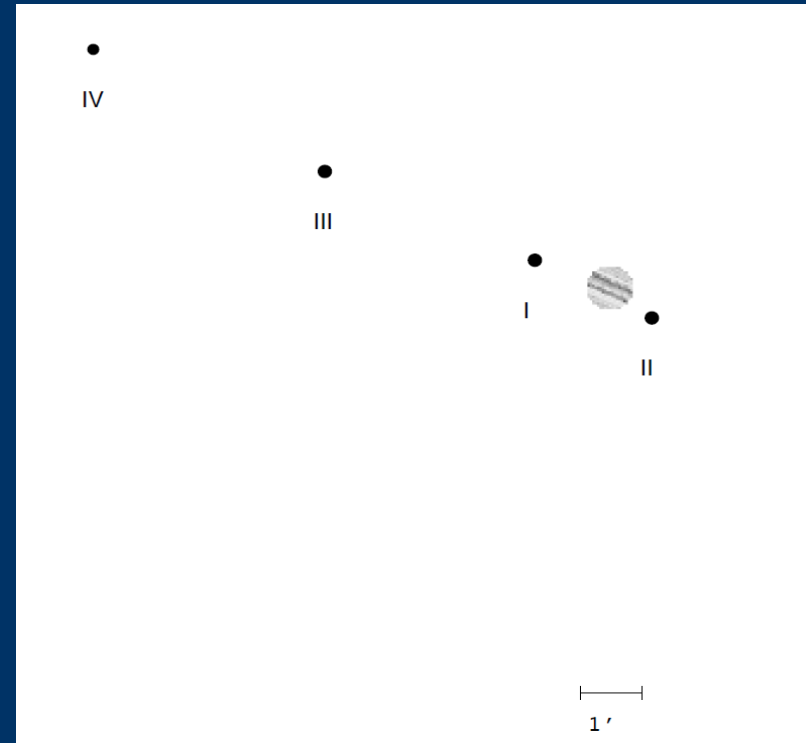
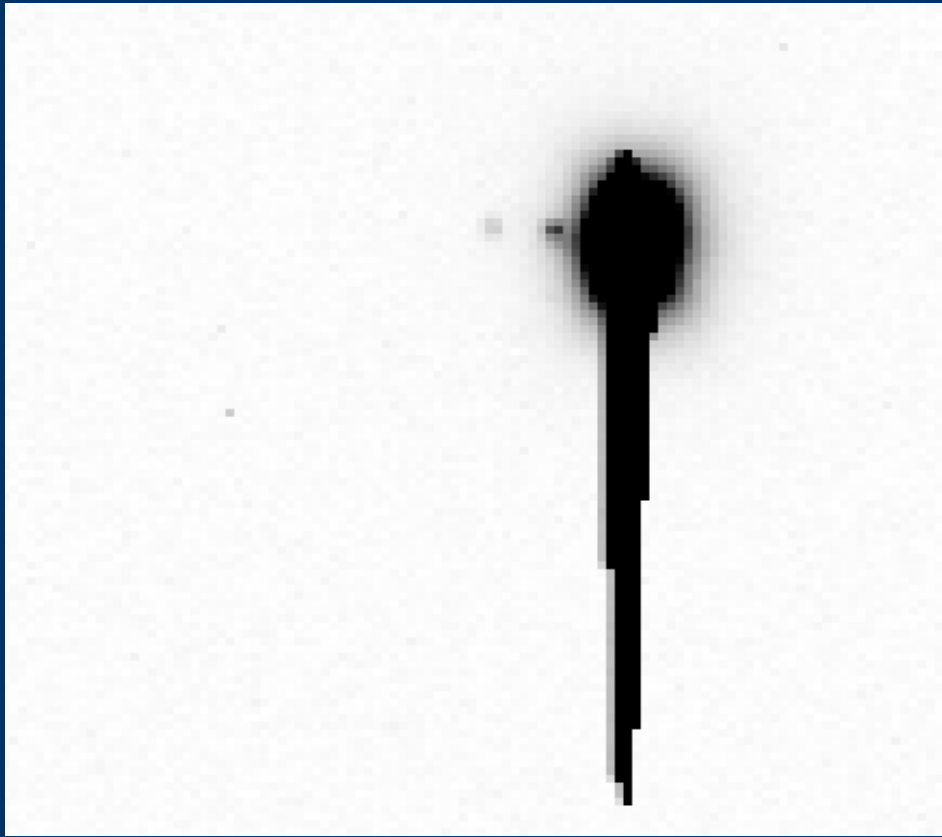


5 ms exposure



50 ms exposure

Jupiter : - 2.6 magnitude , saturates the CCD in 5ms exposure



Tag	Name	E	S	P	T	X +E	Y +S	Z +front	RA	Dec	Mag
	Jupiter								0:11:01.52	-0:26:49.8	-2.7
I	Io	1	1	0	0	-3.076	1.239	-4.894	0:10:56.65	-0:27:19.3	5.7
II	Europa	1	1	0	0	1.635	-1.152	-9.251	0:11:04.11	-0:26:22.4	5.8
III	Ganymede	1	1	0	0	-11.400	5.077	-8.299	0:10:43.45	-0:28:50.5	5.3
IV	Callisto	1	1	0	0	-20.645	10.316	12.984	0:10:28.80	-0:30:55.0	6.7

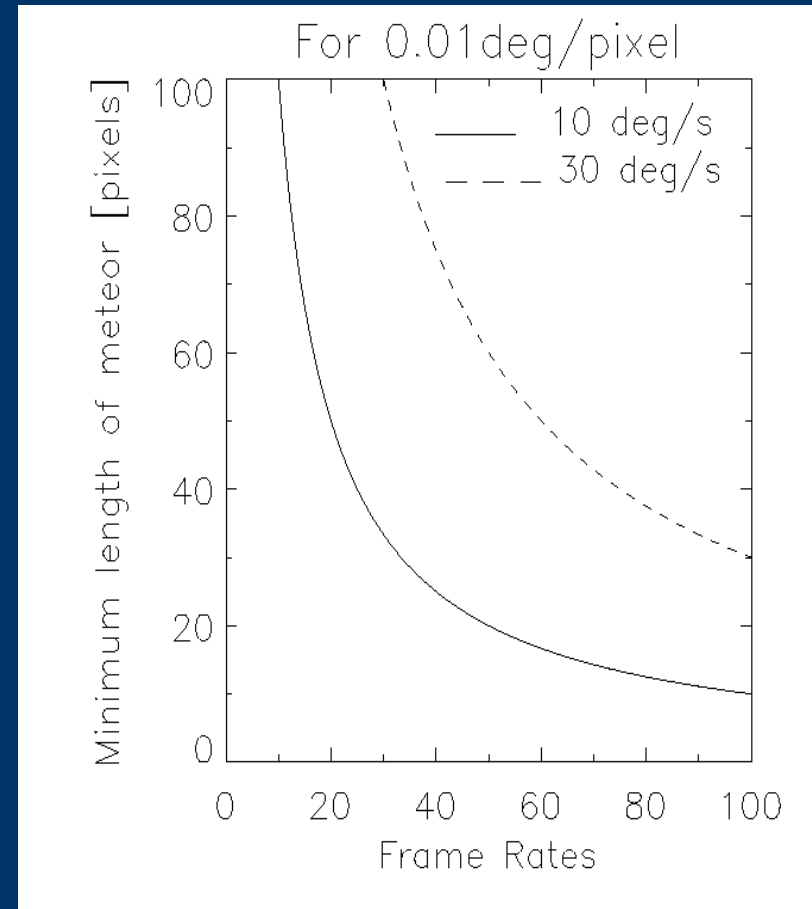


Email: atreya@imcce.fr

IMCCE group: <http://tiny.cc/g19r7>

Just buying a big CCD camera is not enough !!!

- Better **Spatial** resolution
- Higher **Temporal** resolution
- **Inverse** Relationship



Direction of meteor not taken into account



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Full HD Colour
Camera



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Cost per Station in Euros

▪ LH11000 Camera	13,400
▪ Cannon 50 mm f1.2 Lens	1,630
▪ Cameralink-GigE convertor	1,140
▪ Computer	1,100
▪ Extras* (Cables/..)	730
▪ Total	17,000

Parameter	Value
Architecture	Interline CCD; Progressive Scan
Total Number of Pixels	4072 (H) x 2720 (V) = 11.1M
Number of Effective Pixels	4032 (H) x 2688 (V) = 10.8M
Number of Active Pixels	4008 (H) x 2672 (V) = 10.7M
Number of Outputs	1 or 2
Pixel Size	9.0 μm (H) x 9.0 μm (V)
Imager Size	43.3mm (diagonal)
Chip Size	37.25mm (H) x 25.70mm (V)
Aspect Ratio	3:2
Saturation Signal	60,000 electrons
Quantum Efficiency (KAI-11002-ABA)	50%
Quantum Efficiency (KAI-11002-CBA) RGB	34%, 37%, 42%
Output Sensitivity	13 $\mu\text{V}/\text{e}$
Total Noise	30 electrons
Dark Current	< 50 mV/s
Dark Current Doubling Temperature	7 $^{\circ}\text{C}$
Dynamic Range	66 dB
Charge Transfer Efficiency	> 0.99999
Blooming Suppression	> 1000X
Smear	< -80 dB
Image Lag	< 10 electrons
Maximum Data Rate	28 MHz
Package	40-pin, CerDIP, 0.070" pin spacing
Cover Glass	AR Coated

All parameters above are specified at T = 40°C



HOTEL RESTAURANT LA METEORITE



Menu du Jour 17[€]
Salade Fraîcheuse
+
Terrine de Campagne
+
Wolff de Bismarck
+
Tête de Boeuf au Romarin
+
et aux pommes et sa glace vanille
+
douce de Fraîche moullé
+
à servir avec pommes de la Campagne
+
marrons à la crème au lait

