



# OBSERVATOIRE AUTOMATISÉ

DU NOMADE AU POINT FIXE

V3 – 11/2023

ARNAUD DUPONT



1. Pourquoi ? Pour quels objectifs ?
2. Quelles Besoins ?
3. Quelles Solutions ?
4. Les résultats
5. Le retour d'expérience
  - a. Contraintes : fiabilité, formation, maintenance,

# OBJECTIFS

- Peu d'intérêt pour le visuel → Astrographie
- Passer un cap qualitatif
- « nomade » = réglages difficiles à optimiser,
- Fatigue, rester au chaud
- Faire de la science !
- Défi technique, Partage



◀ Mes Objectifs : automatisation complète et faire de la science !

# BESOINS (1/2)

- Un espace protégé de la pollution lumineuse, à moins d'une heure de route
- Un local
- Un réseau fiable et sécurisé
- Un ensemble d'équipements électriques, mécaniques, matériels et logiciels commandables à distance

# BESOINS - SERVICE(2/2)

- Piloter le système à distance (Arrêt /Marche) : piloter des relais, positionner des détecteurs,
- Prises de vues, Scénario de prise de vue => mise au point, résistances
- Surveiller la météo
- Surveiller l'équipement

Exemples :

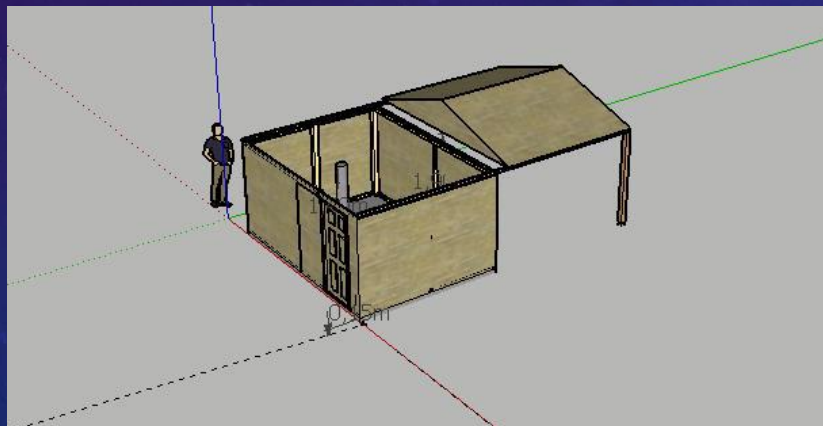
[Association AIP -](#)

[Nicolas Outers](#)

[Jérôme Rudelle](#)

# SOLUTIONS – UN ESPACE

- Un terrain à louer chez un ami
- À 40 km de Portet sur Garonne
- Une vue dégagée au Sud,
- Un ciel Magnifique



# SOLUTIONS – DU MATÉRIEL (1/É)

- Une caméra principale – monochrome ou couleur
- Un porte-oculaire de qualité
- Une caméra de guidage et sa lunette
- Un cache + écran à flat
- Un moteur de mise au point
- Bonus : roue à filtre



# SOLUTIONS – DU MATÉRIEL (2/2)

- Une monture (EQ6 –Pro – modifié Kit courroies Rowan), et un tube (Newton Skywatcher – 200/800 Carbone)



# SOLUTIONS -DE L'INFORMATIQUE (1/2)

- Un Raspberry Pi : économique, petit
  - ==> le point d'entrée
- Une station météo : AAG Cloudwatcher, et SOLO



# SOLUTIONS -DE L'INFORMATIQUE

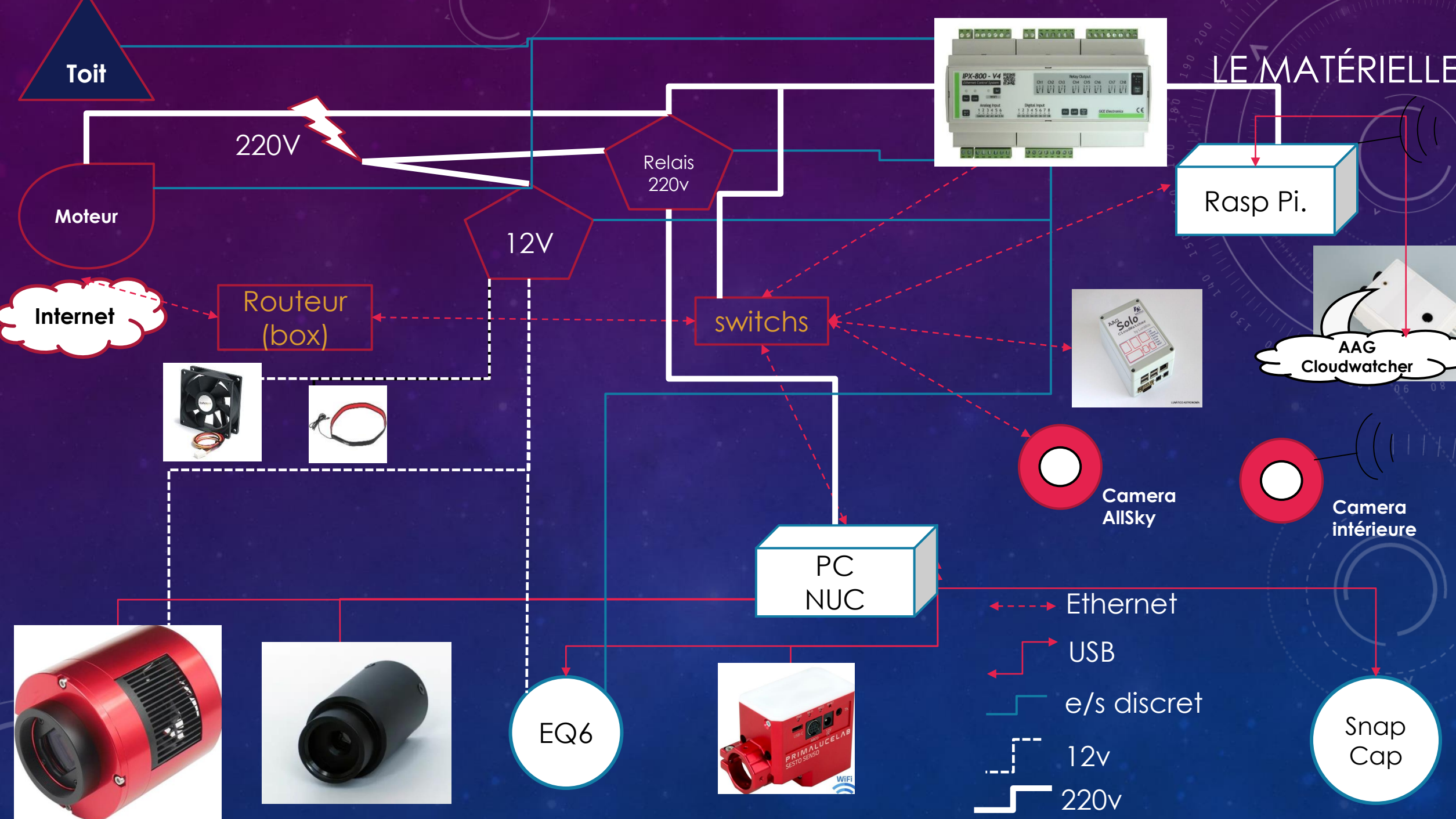
- Un serveur domotique (Relais, entrées numériques...)



- Un PC pour les piloter tous !



# LE MATÉRIELLE



Toit

220V

Relais 220v

12V

Moteur

Internet

Routeur (box)

switchs

Rasp Pi.

AAG Cloudwatcher

Camera AllSky

Camera intérieure

PC NUC

Ethernet

USB

e/s discret

12v

220v

EQ6

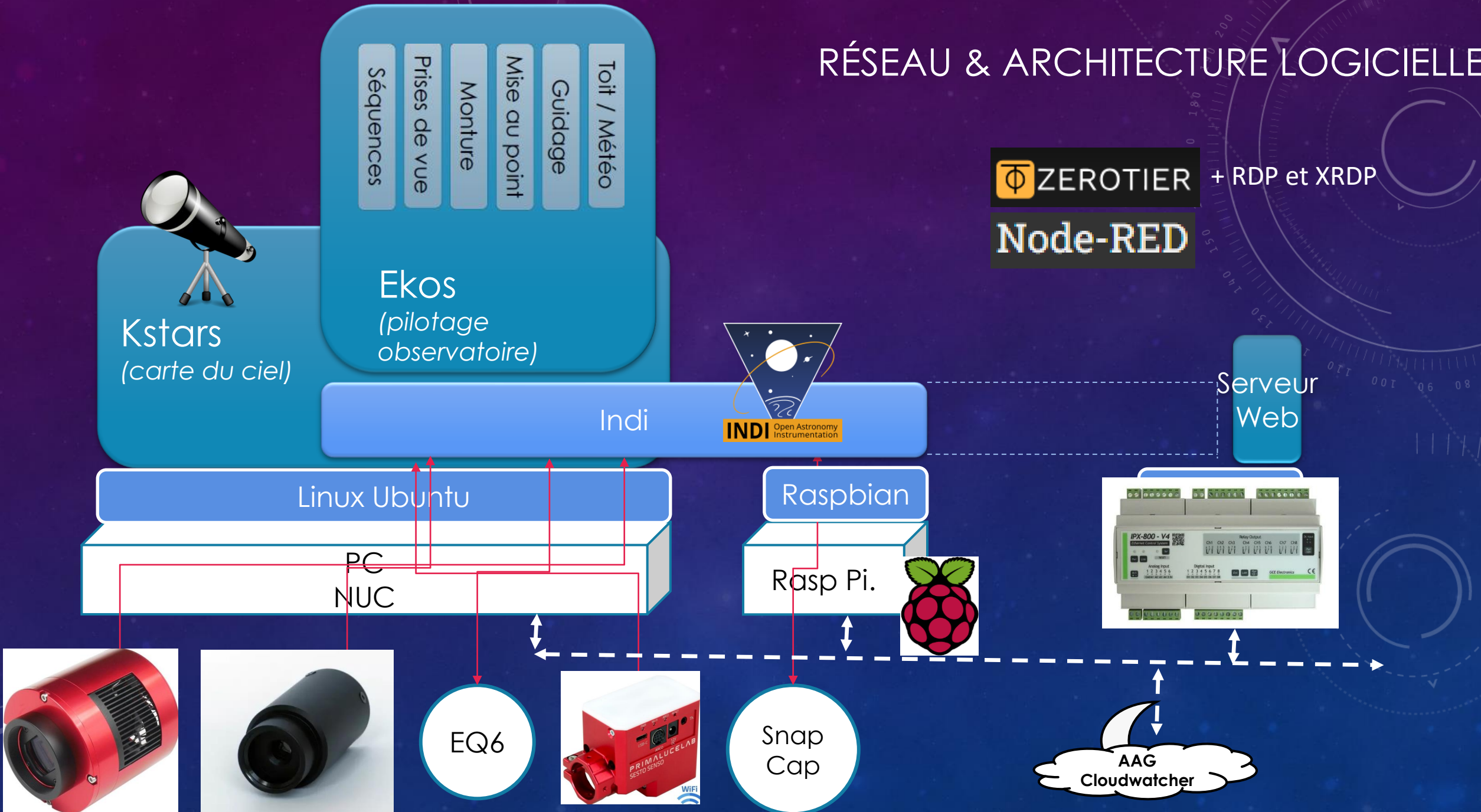
Snap Cap



# SOLUTIONS – UN POINT FIXE !



# RÉSEAU & ARCHITECTURE LOGICIELLE

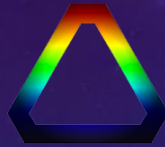


# SOLUTIONS –ALTERNATIVES

- The Sky Pro (~1500 €)



- Prism (~400 €)



- NINA (Open Source)



# SOLUTIONS – KSTARS / EKOS

The screenshot displays the KStars software interface. The main window shows a star chart with a grid of stars and constellations. A control panel on the right side is titled "Mount Control – KStars". It features a 3x3 grid of directional arrows (up, down, left, right) and a central "STOP" button. Below the grid are checkboxes for "Reverse", "Up/Down", and "Left/Rig", and a zoom level of "600x". The panel also displays coordinates: RA: 00h 56m 50s, AZ: 214° 50', DE: 24° 34' 20", AL: 68° 21' 1", HA: +00h 53m 36s, and ZA: 21° 38' 1". There are input fields for "Target:" with a "Click Find I..." button, and fields for "RA:" (HH:MM:SS) and "DE:" (DD:MM:SS). Below these are radio buttons for "Type:" (RA/DE, AZ/AL, HA) and "Epoch:" (JNow, J2000). At the bottom of the panel are buttons for "GOTO", "SYNC", "PARK", and "UNPARK". The status is "Tracking".

Activities KStars nov. 23 22:34

KStars

File Time Pointing View Tools Data Observation Settings Help

LT: 22:34:43 jeudi 23 novembre 2023

IC 4733

Uranus

EQ Mod Mount

M 15 [3,0m]

W

Mount Control – KStars

Reverse  Up/Down  Left/Rig

600x

RA: 00h 56m 50s AZ: 214° 50'

DE: 24° 34' 20" AL: 68° 21' 1"

HA: +00h 53m 36s ZA: 21° 38' 1"

Target: Click Find I...

RA: HH:MM:SS

DE: DD:MM:SS

Type:  RA/DE  AZ/AL  HA

Epoch:  JNow  J2000

GOTO SYNC

PARK UNPARK

Status: Tracking

Canens, Haute-Garonne, France

2023-11-23T21:34:39: [WARNING] Caution: Parameter Temperature (C) value (5.06) is in the danger zone!

22h 39m 48s, +43° 26' 58" (J2000)

• [www.indilib.org](http://www.indilib.org)

# SOLUTIONS – KSTARS / EKOS

The screenshot shows the Ekos software interface with the following panels:

- Timeline:** A horizontal bar chart showing the sequence of operations: Job, Mount, Flip, Guide, Align, Focus, and Capture. The 'Focus' operation is highlighted in yellow.
- Statistics:** A graph showing RA/DEC drift over time. The x-axis represents time from 20:10:29 to 21:40:29. The y-axis represents RA/DEC drift. The graph shows a significant increase in drift after the 'Focus' operation.
- Details:** A table showing the results of the capture operation.

Job	Mount	Flip	Guide	Align	Focus	Capture
0	0	0	0	0	0	0
2000	2000	2000	2000	2000	2000	2000
4000	4000	4000	4000	4000	4000	4000
6000	6000	6000	6000	6000	6000	6000

RA/DEC	HPR	SNR	RA	DEC
20:10:29	1.20	0.56:50	-0.96	4° 34' 18"
20:40:29	1.51	0.56:50	-0.96	4° 34' 18"
21:10:29	1.51	0.56:50	-0.96	4° 34' 18"
21:40:29	1.51	0.56:50	-0.96	4° 34' 18"

Guide	ra	dec	ra puls	dec	drift	rms	sky
Mount	ra	dec	az	alt	sjde	ha	00:54
Capture	hfr	stars	median	ecc	temp	rms	dist

Details	Capture	Date	Interval	Clock	Duration	Filter	GuideRMS	Exposure
successful	successful	23.11.2023	5386.052	5567.807	21:40:15	21:43:17	181.8	181.8
Filter	Filter	Filter	Filter	Filter	Filter	Filter	Filter	Filter
GuideRMS	GuideRMS	GuideRMS	GuideRMS	GuideRMS	GuideRMS	GuideRMS	GuideRMS	GuideRMS
Exposure	Exposure	Exposure	Exposure	Exposure	Exposure	Exposure	Exposure	Exposure

The screenshot shows the Ekos software interface with the following panels:

- Capture Settings:** A panel with various settings for the capture operation, including exposure, count, format, type, frame, size, binning, and file settings.
- Sequence Queue:** A table showing the status of the capture sequence.

Status	Filter	Count	Exp	Type	Bin	ISO/Gain
1 Complete	--	20/20	180,00...	Light	1x1	120.0

Capture Settings	Exposure	Count	Format	Type	Frame	Size	Binning	File Settings
Exposure	180,000000	20	Raw 16 bit	Light	X: 0 Y: 0	W: 4144 H: 2822	H: 1 V: 1	Target: Moreau
Count	Count	Count	Count	Count	Count	Count	Count	Directory: /home/spiritchaser/Images/astro
Format	Format	Format	Format	Format	Format	Format	Format	Format: /%t/%T/%t_%T_%e
Type	Type	Type	Type	Type	Type	Type	Type	Save: Locally
Frame	Frame	Frame	Frame	Frame	Frame	Frame	Frame	Remote: /home/pi
Size	Size	Size	Size	Size	Size	Size	Size	Tools: Darks, Limits, Scripts
Binning	Binning	Binning	Binning	Binning	Binning	Binning	Binning	Progress: Expose (-/-): --:--:--
File Settings	File Settings	File Settings	File Settings	File Settings	File Settings	File Settings	File Settings	total remaining: --:--:-- Avg. Download: 1,10 sec

• [www.indilib.org](http://www.indilib.org)

# SOLUTIONS – KSTARS / EKOS

The screenshot displays the Ekos software interface for a KStars profile. The main window is titled "Ekos - LaNine\_local\_gpsloc Profile — KStars". The interface is divided into several sections:

- Top Bar:** Contains various icons for tools and functions.
- Left Panel:** Contains controls for the telescope and solver.
  - Train:** Primaire
  - Solver Control:** Buttons for "Capture & Solve", "Load & Slew...", and "Stop".
  - Solver Action:** Radio buttons for "Sync", "Slew to Target", and "Nothing".
  - Telescope Coordinates (JNow):** RA: 00:56:50, DE: 24:34:15, Accuracy: 30, Settle: 1500.
  - Solution Coordinates (JNow):** RA: 23:23:22, DE: -18:13:41, Err: 583119 arcsec, RA:29368 DE:-582379, Pix: 2.33, PA: 8.77, FOV: 80.4' x 54.8', R: 1.00x, FL: 820.0 (820.0), F/: 4.1 (4.1).
  - Plate Solve Capture Options:** Exp: 3,10, Bin: 2x2, Gain: 120,0, ISO: [blank], Filter: use current.
  - Solver Mode:** Radio buttons for "StellarSolver" and "Remote".
- Main View:** A dark image showing the star field with a grid overlay. A "Show HiPS Overlay" button is visible.
- Bottom Panel:** Contains a "Solution Results" table and a "Polar Alignment" graph.
  - Solution Results Table:**

	RA	DEC	Obj Name	~	dRA
1	23:06:21	126:45:54	None	✓	99219.870"
2	23:06:21	76:48:13	None	✓	108010.668"
3	00:26:42	27:59:01	(2000 OT43)	✓	50666.287"
4	22:48:59	-18:13:28	(1997 SX)	✗	
5	22:37:46	-18:13:28	Kolya (1973 SS4)	✗	
6	23:13:29	-18:13:28	(1998 YX)	✓	25335.161"
7	23:27:52	-18:13:37	Moreau (1950 DS)	✓	29367.802"
  - Polar Alignment Graph:** A plot of dDE (arcsec) vs dRA (arcsec). The y-axis ranges from -300000 to 200000, and the x-axis ranges from -300000 to 300000. A yellow crosshair is centered at the origin.
- Log:** A scrollable log at the bottom showing system messages such as "Mount is synced to solution coordinates." and "Solver completed after 6.05 seconds."

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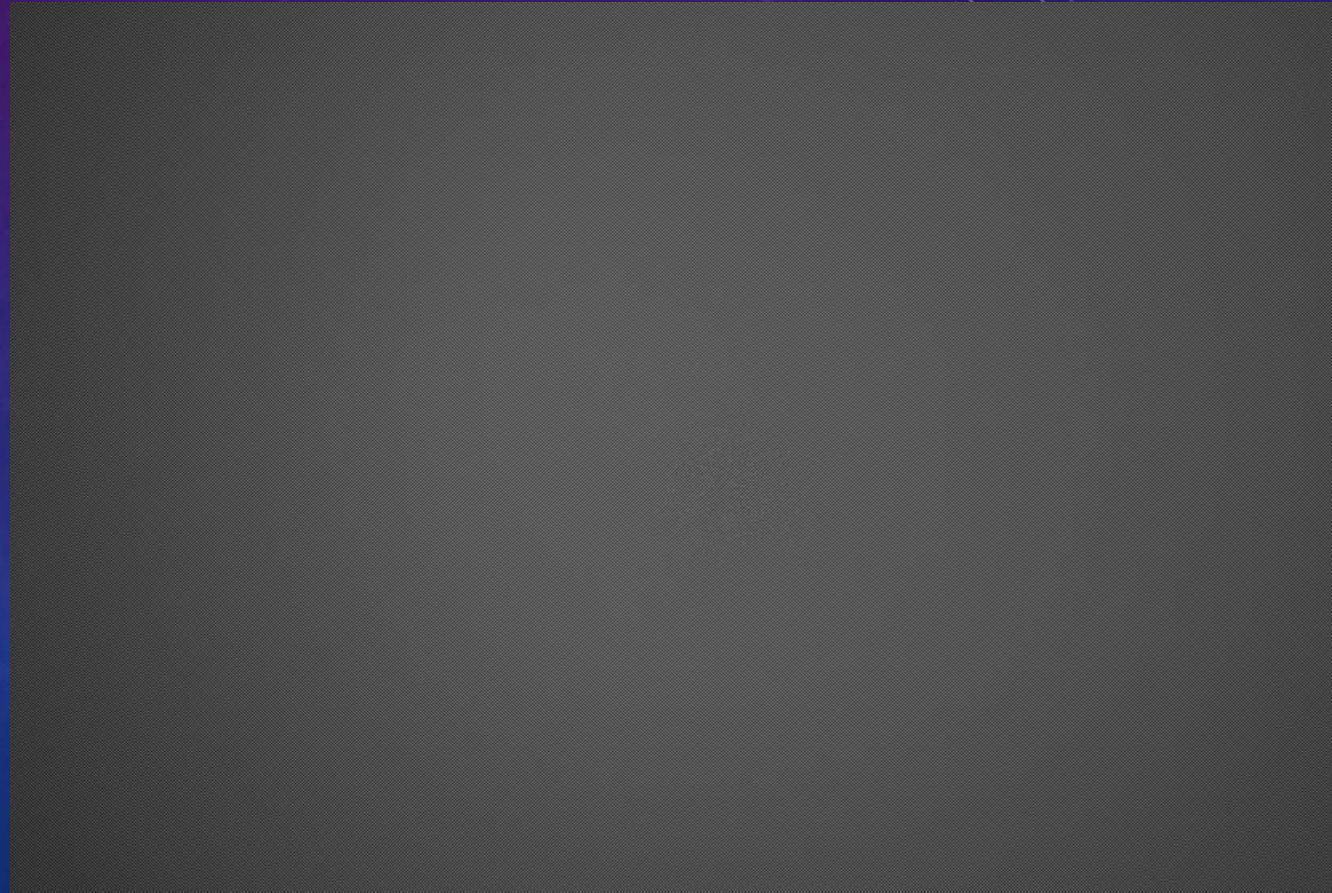
# LES RESULTATS - PHOTOS

- NGC 6992
- Pose Brute : 180 s
- T = -15c



# LES RESULTATS - PHOTOS

- Capacités à prendre des clichés techniques
  - Dark – bruit thermique
  - Flat – Vignetage
  - Bias – bruit de lecture



# LES RESULTATS - PHOTOS

- NGC 6992
- 208 \* 180''  
10h24 min.
- Flat, Dark Flat,  
Dark.
  - Clichés : 3j



# LES RESULTATS - PHOTOS

- M8 – La Lagune
- Traitée



# LES RESULTATS - PHOTOS

- C/2022 E3 ZTF
- 62 \* 30''

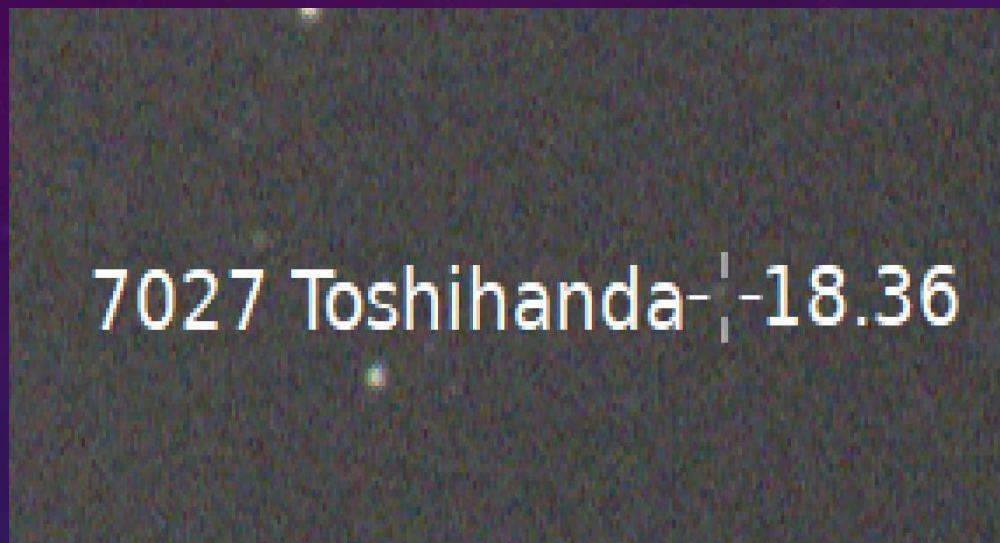


# LES RESULTATS - PHOTOS

- M13 / NGC 6207 (1,5 arcmin)
- Synthèse :



# LES RESULTATS – OBS. M05



```
COD XXX
CON A. Dupont [obs_lanine@pm.me]
OBS A. Dupont
MEA A. Dupont
TEL 200 mm f/4 reflector + CMOS
COM Long. 1 19 53.8 E, Lat. 43 12 54.4 N, Alt. 337m, Google Earth
COM Observatoire de la Nine, Canens, Occitanie, FRANCE
NUM 39
ACK NEW SITE XXX - batch 001 - 2023-06-03 10:50:15 GMT+2
AC2 obs_lanine@pm.me
NET Gaia-DR3
```

K0658	FB2023	02	16.93857	05	40	40.67	-02	26	40.9	19.0	B	XXX
K0658	FB2023	02	16.92570	05	40	40.31	-02	26	41.9	19.0	B	XXX
K0658	FB2023	02	16.91541	05	40	40.13	-02	26	44.0	19.0	B	XXX
K0658	FB2023	02	17.84573	05	41	06.38	-02	24	58.4	19.0	B	XXX
K0658	FB2023	02	17.92423	05	41	08.65	-02	24	48.5	19.0	B	XXX
K0658	FB2023	02	17.88332	05	41	07.43	-02	24	53.3	19.0	B	XXX
01271	B2023	05	25.95442	13	16	31.15	+01	04	11.3	16.1	B	XXX
01271	B2023	05	25.96496	13	16	30.95	+01	04	11.1	16.1	B	XXX
01271	B2023	05	25.98183	13	16	30.65	+01	04	11.1	16.1	B	XXX
01271	B2023	05	26.95907	13	16	13.73	+01	04	02.0	16.1	B	XXX
01271	B2023	05	26.97735	13	16	13.40	+01	04	01.7	16.1	B	XXX
01271	B2023	05	26.99844	13	16	13.06	+01	04	01.5	16.1	B	XXX
01828	B2023	05	25.95442	13	18	45.81	+00	39	45.6	16.8	B	XXX
01828	B2023	05	25.96496	13	18	45.65	+00	39	47.1	16.8	B	XXX
01828	B2023	05	25.98183	13	18	45.38	+00	39	49.3	16.8	B	XXX
01828	B2023	05	26.97314	13	18	30.25	+00	42	00.3	16.9	B	XXX
01828	B2023	05	26.97735	13	18	30.17	+00	42	00.8	16.9	B	XXX
01828	B2023	05	26.99844	13	18	29.86	+00	42	03.4	16.9	B	XXX
02682	B2023	05	25.95442	13	16	12.12	+01	17	21.4	17.0	B	XXX
02682	B2023	05	25.96496	13	16	11.90	+01	17	20.2	17.0	B	XXX
02682	B2023	05	25.98183	13	16	11.59	+01	17	19.1	17.0	B	XXX
02682	B2023	05	26.95907	13	15	54.69	+01	16	01.9	17.0	B	XXX
02682	B2023	05	26.97735	13	15	54.35	+01	16	00.0	17.0	B	XXX
02682	B2023	05	26.99844	13	15	53.98	+01	15	58.4	17.0	B	XXX
03727	B2023	05	26.01460	18	33	34.39	-01	49	40.5	16.3	B	XXX
03727	B2023	05	26.04202	18	33	33.70	-01	49	38.7	16.3	B	XXX
03727	B2023	05	26.06943	18	33	33.00	-01	49	37.6	16.3	B	XXX
03727	B2023	05	27.03502	18	33	08.41	-01	48	47.4	16.3	B	XXX
03727	B2023	05	27.05398	18	33	07.87	-01	48	46.8	16.3	B	XXX
03727	B2023	05	27.07294	18	33	07.37	-01	48	45.3	16.3	B	XXX
C5625	FB2023	05	26.97314	13	17	16.64	+00	58	21.3	18.5	B	XXX
C5625	FB2023	05	26.99422	13	17	16.61	+00	58	13.6	18.5	B	XXX
C5625	FB2023	05	26.97735	13	17	16.57	+00	58	19.4	18.5	B	XXX
C5625	FB2023	05	25.95442	13	17	15.88	+01	04	07.9	18.5	B	XXX
C5625	FB2023	05	25.94810	13	17	15.94	+01	04	09.8	18.5	B	XXX
C5625	FB2023	05	25.98605	13	17	15.78	+01	03	57.1	18.5	B	XXX
01036	B2023	05	17.87164	11	57	39.95	-01	56	27.5	15.1	B	XXX
01036	B2023	05	17.86035	11	57	40.13	-01	56	33.0	15.1	B	XXX
01036	B2023	05	17.85186	11	57	40.25	-01	56	37.2	15.1	B	XXX

# OBSERVATOIRE - RETEX

- Difficultés :
  - Fiabilité du matériel / Logiciels
    - Déformation du bois : position hiver/été, besoin important d'entretien - peinture
    - Usure rapide des composants : batteries de l'onduleur
    - Fiabilité/Limite des composants : détecteurs numériques, toit, caméras
    - Beaucoup d'interfaces => pas compatibles (images caméras)
    - Impact climatique : grandes chaleurs (informatiques)
    - Logiciels ont aussi des faits techniques (bugs !)
  - Formation
    - Limite des logiciels : maîtriser les processus complexes,
    - Améliorer les fondamentaux : mise en station, collimation...
- ➔ Atteindre l'Automatisation complète (prog. Sur plusieurs jours) est complexe et couteuse (en temps et argent)

# OBSERVATOIRE LA NINE - RETEX

- Une aventure à poursuivre et à continuer à améliorer, ouverte à la collaboration !

Merci de votre attention !

Des questions ?

