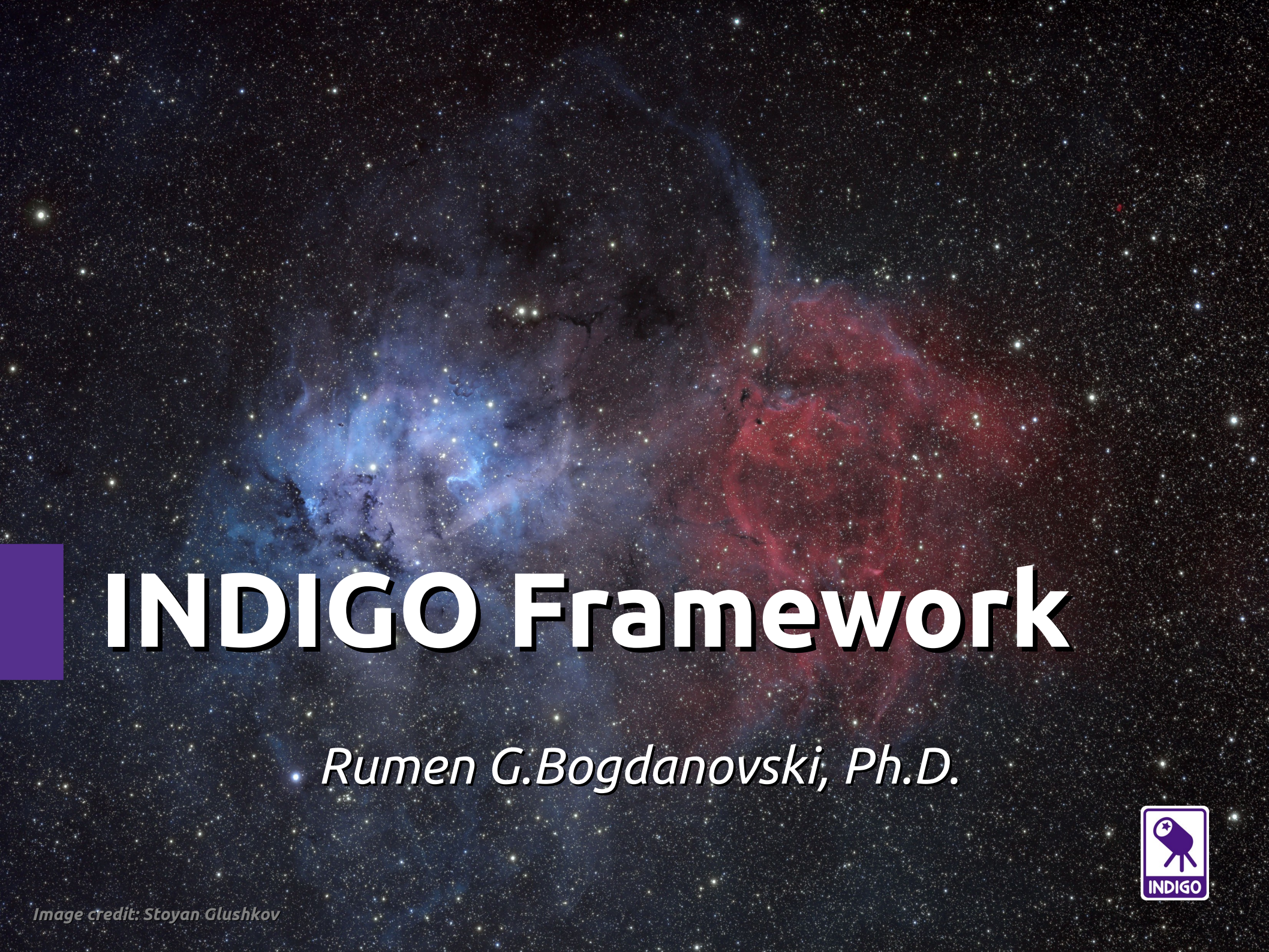


INDIGO Framework

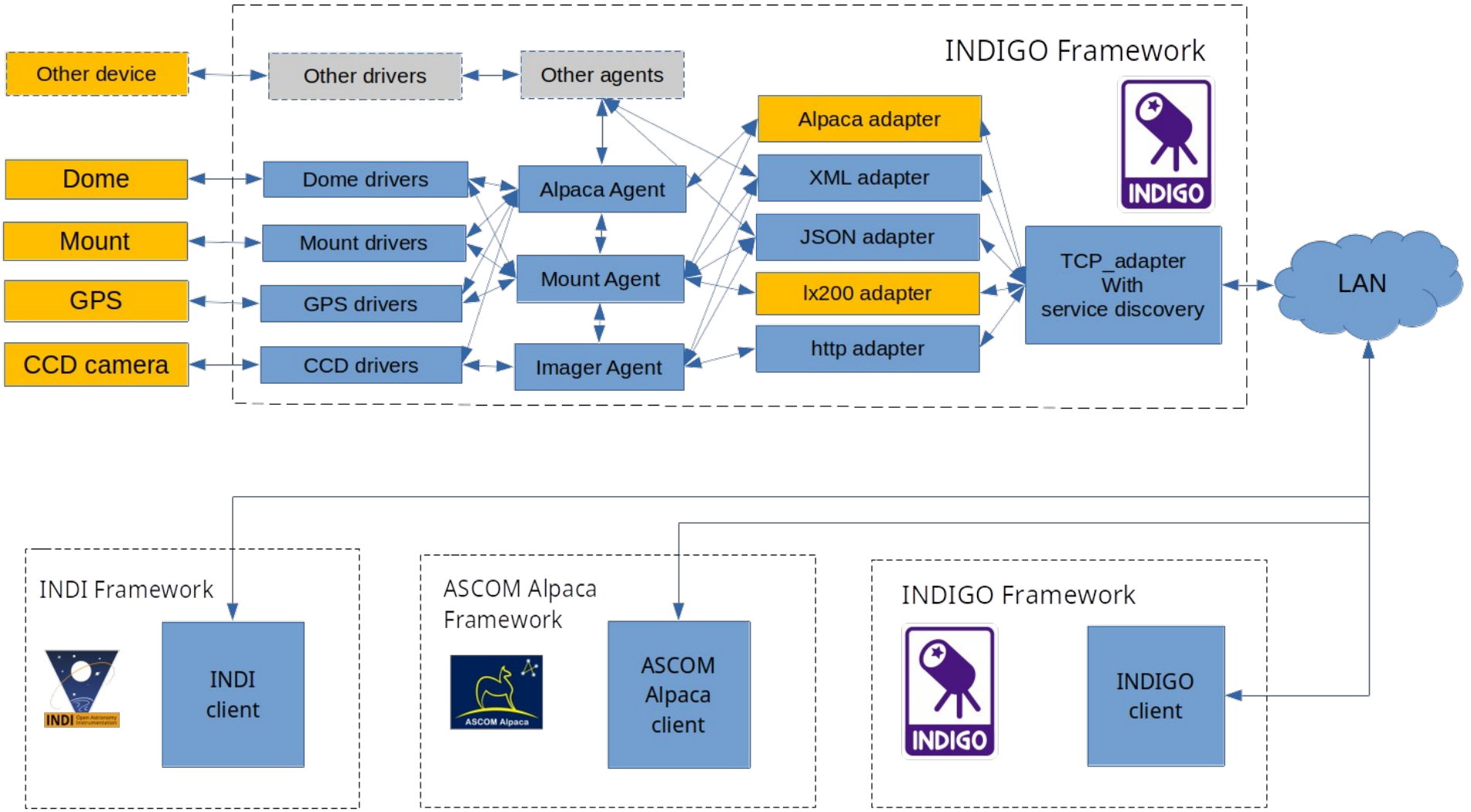
Rumen G.Bogdanovski, Ph.D.

Image credit: Stoyan Glushkov

What is INDIGO?

- INDIGO is a software framework for controlling Astronomical equipment via a **software bus**
- A set of **properties** are defined for each device - **mandatory**, **optional** and **device specific**
- The communication between different entities attached to the bus is achieved by **INDIGO messages** which contain property events – **definition**, **update** and **deletion**
- One can think of the properties as both **variables** and **routines**. Variables as they may store values like the width and height of the CCD frame or routines like start 1 second exposure.

INDIGO Architecture



Notes:
- INDIGO uses a software data bus – arrows show the logical data flow, not the hard communication lines.
- Clients will run their native frameworks.

INDIGO Drivers

- **Dynamic drivers** – fast communication, can be dynamically loaded and unloaded
- **Static Drivers** – can be used to be linked in one monolithic application, fast communication
- **Executable drivers** – old style drivers, these drivers can be loaded in INDI and this is how INDIGO can load INDI drivers, orders of magnitude slower communication.

INDIGO Agents vs Drivers

- Agents are high level drivers that provide application business logic
- Agents can communicate between each other
- Agents can access the devices through the device drivers
- Drivers translate INDIGO messages to device specific commands and provide unified interface to all devices
- Drivers are simple, only capable of basic operations no complex business logic
- Inter driver communication is possible through the agents

INDIGO Device Classes

Main

- **Mount**
- **Camera**
- **Guider**
- **Focuser**
- **Filter Wheel**
- **Dome**
- **GPS**
- **Adaptive Optics**
- **Field Rotator**

Auxiliary

- **AUX Joystick**
- **AUX Shutter**
- **AUX Power Box**
- **AUX SQM**
- **AUX Dust Cap**
- **AUX Light Box**
- **AUX Weather Station**
- **AUX GPIO**

INDIGO Agents

- **Imager agent**
- **Guider Agent**
- **Mount Agent**
- **Scripting Agent**
- **Astrometry Agent**
- **ASTAP Agent**
- **Auxiliary Agent**
- **Alpaca Agent**
- **Snoop Agent** *(obsolete)*
- **Lx200 Agent** *(obsoleted by Mount agent)*

INDIGO Server

- Provides network access to the devices
- Provides Access Control to the devices
- Can connect to another servers and reexport their devices
- Provides mDNS / Bonjour service discovery
- Can load and unload drivers
- Can operate headless – client can connect program it and disconnect then connect and download the data.

INDIGO Clients

- Clients can connect to INDIGO server and can control the remote devices
- Clients can load the drivers themselves and control the locally attached devices
- INDIGO clients can act like INDIGO servers
- INDIGO clients can provide a UI to control the infrastructure.
- INDIGO clients can detect INDI servers and automatically switch to the legacy communication mode.

Why INDIGO if INDI, Alpaca and ASCOM are here?

- ASCOM is windows only, **INDIGO is multi platform**
- **INDIGO is all about speed**, it is several times faster than ASCOM, Alpaca and INDI

  By default INDIGO uses shared memory for communication on a single host which is many times faster than the pipes used by INDI and multiple data copies used by ASCOM.

  Over the network INDIGO uses binary data transfer (optionally compressed) winch is several times faster than the text encoded binary data used by INDI and Alpaca.

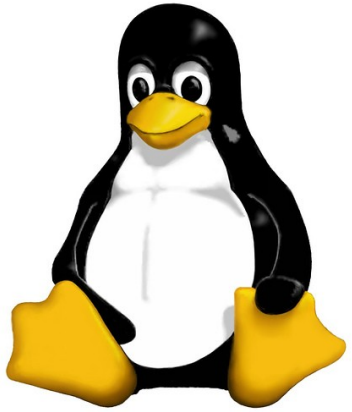
Why INDIGO if INDI, Alpaca and ASCOM are here? (continued)

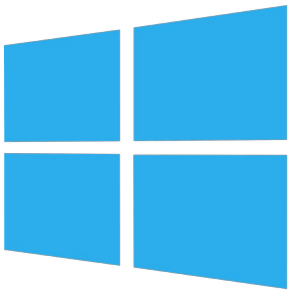
- INDIGO has **agents** and all the business logic can be run on the server *(no other platform provides this)*
- INDIGO provides **service discovery** – no need to enter server address *(unlike INDI)*
- INDIGO supports **hot plug for USB devices** *(unlike INDI)*
- INDIGO **can work without a server** like ASCOM and with server like INDI and Alpaca

Why INDIGO if INDI, Alpaca and ASCOM are here? (continued)

- INDIGO can be extended with **INDIGO Script**, based on ECMA Script *(no other platform provides this)*
- INDIGO can operate in **headless mode** – clients needs to upload the plan and later to connect to collect the data *(no other platform provides this)*
- INDIGO provides **device access control** *(no other platform provides this)*
- INDIGO is **free and open source**, released under the very permissive and vendor friendly INDIGO license

INDIGO Supported Platforms





intel

intel

intel

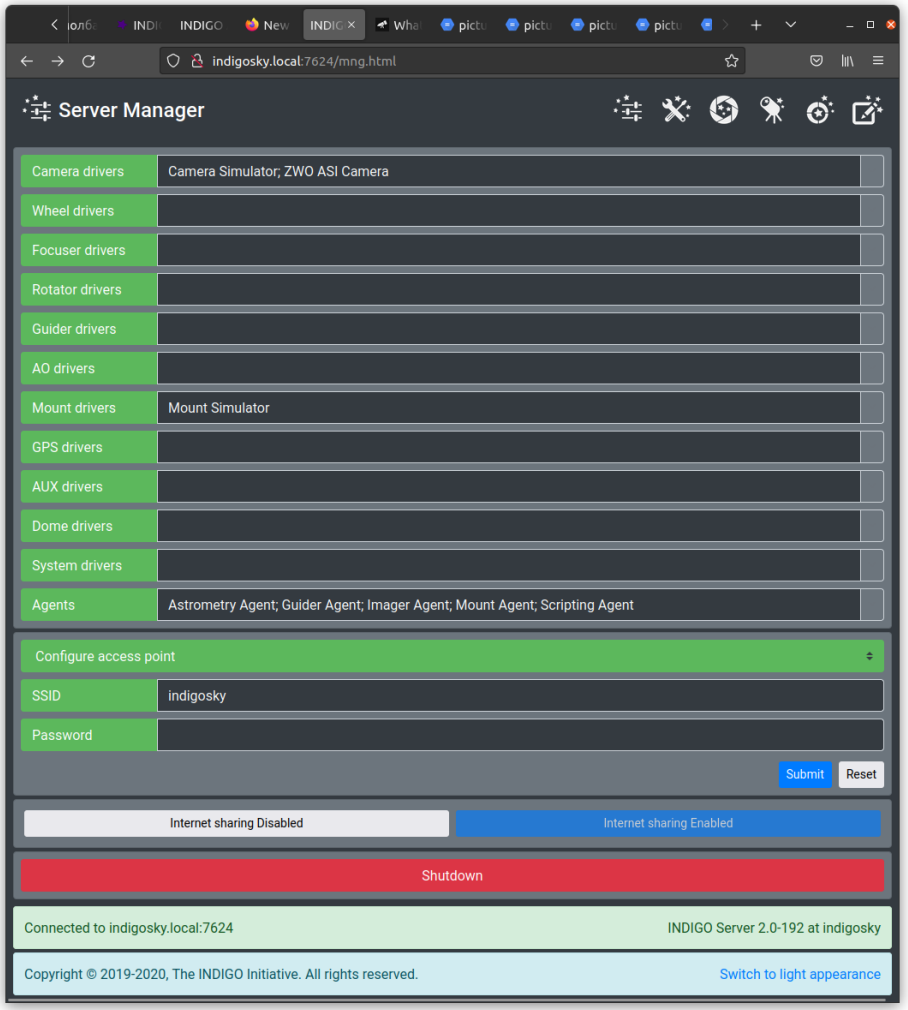
ARM

M1

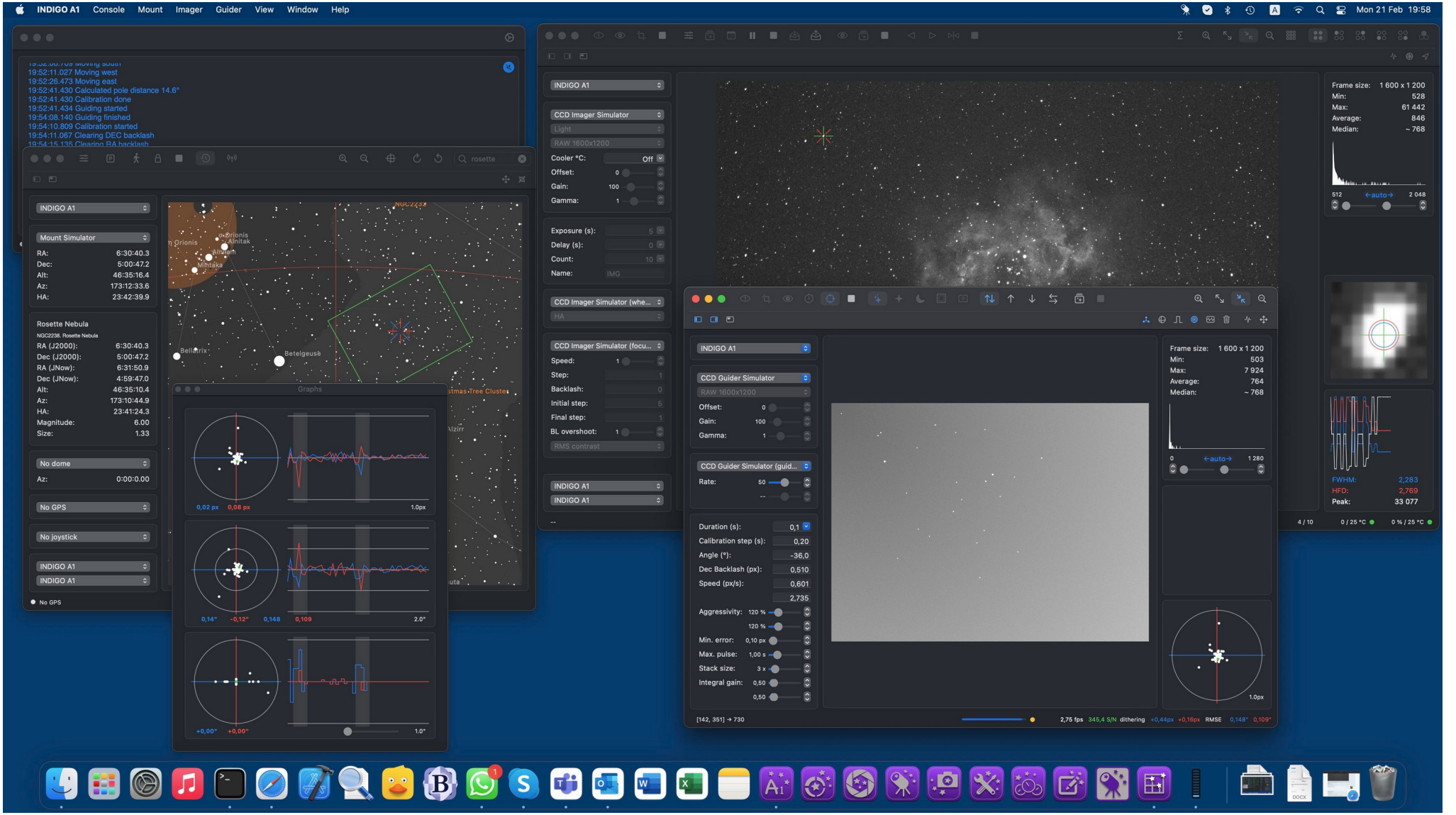
*Client only

INDIGO Sky

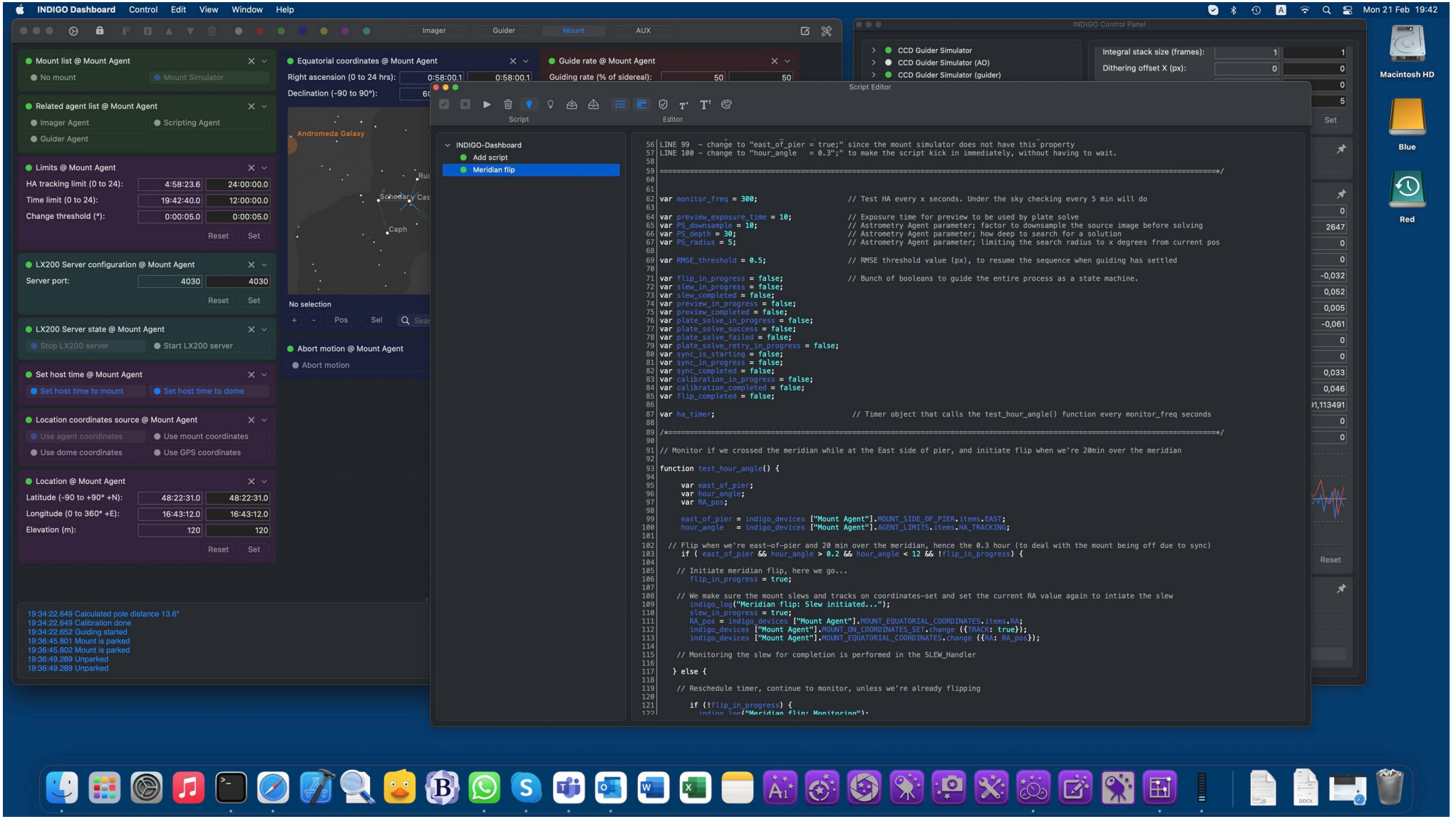
INDIGO Sky is a free Integrated OS image for Raspberry Pi



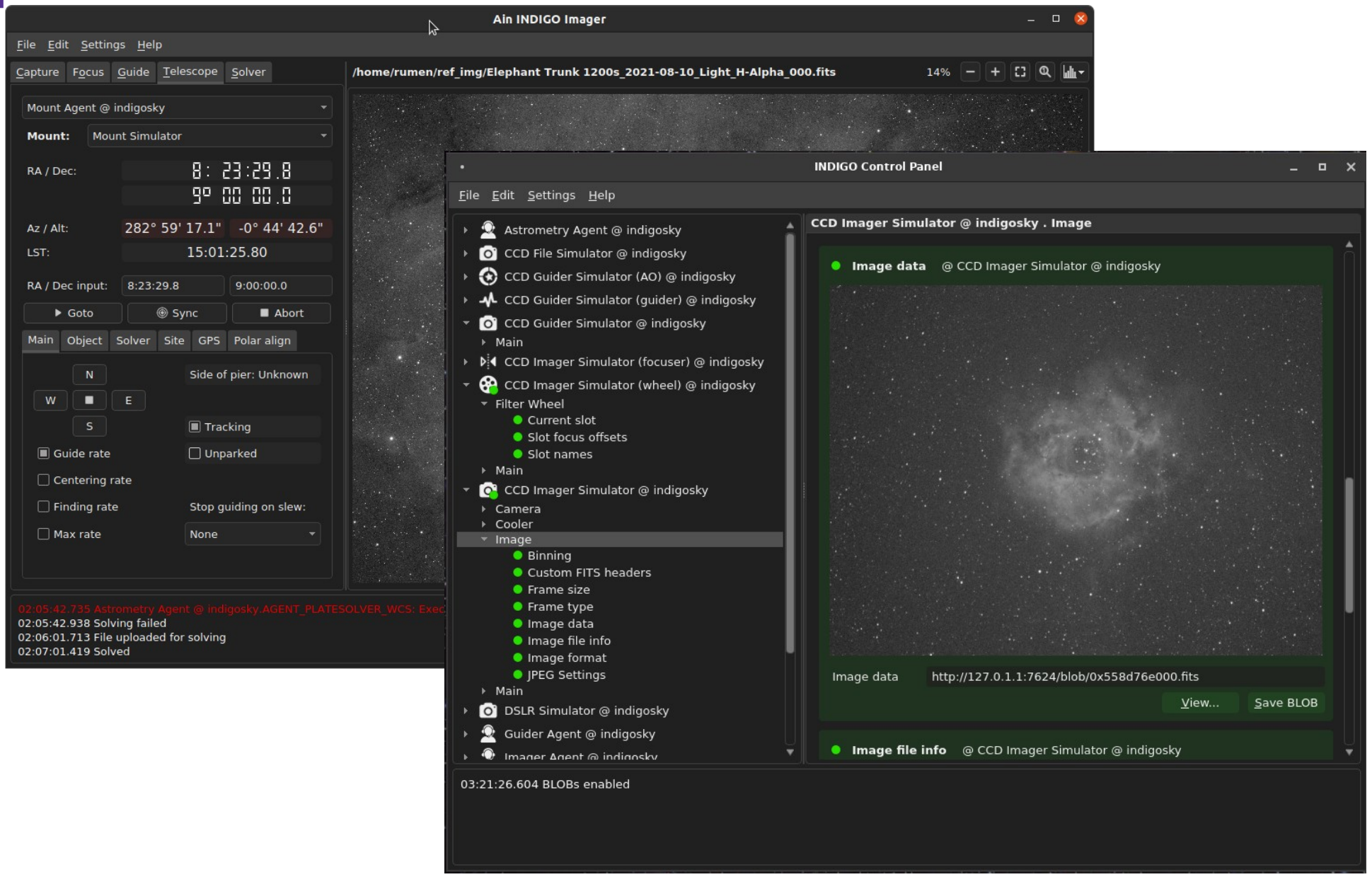
INDIGO MacOS Apps



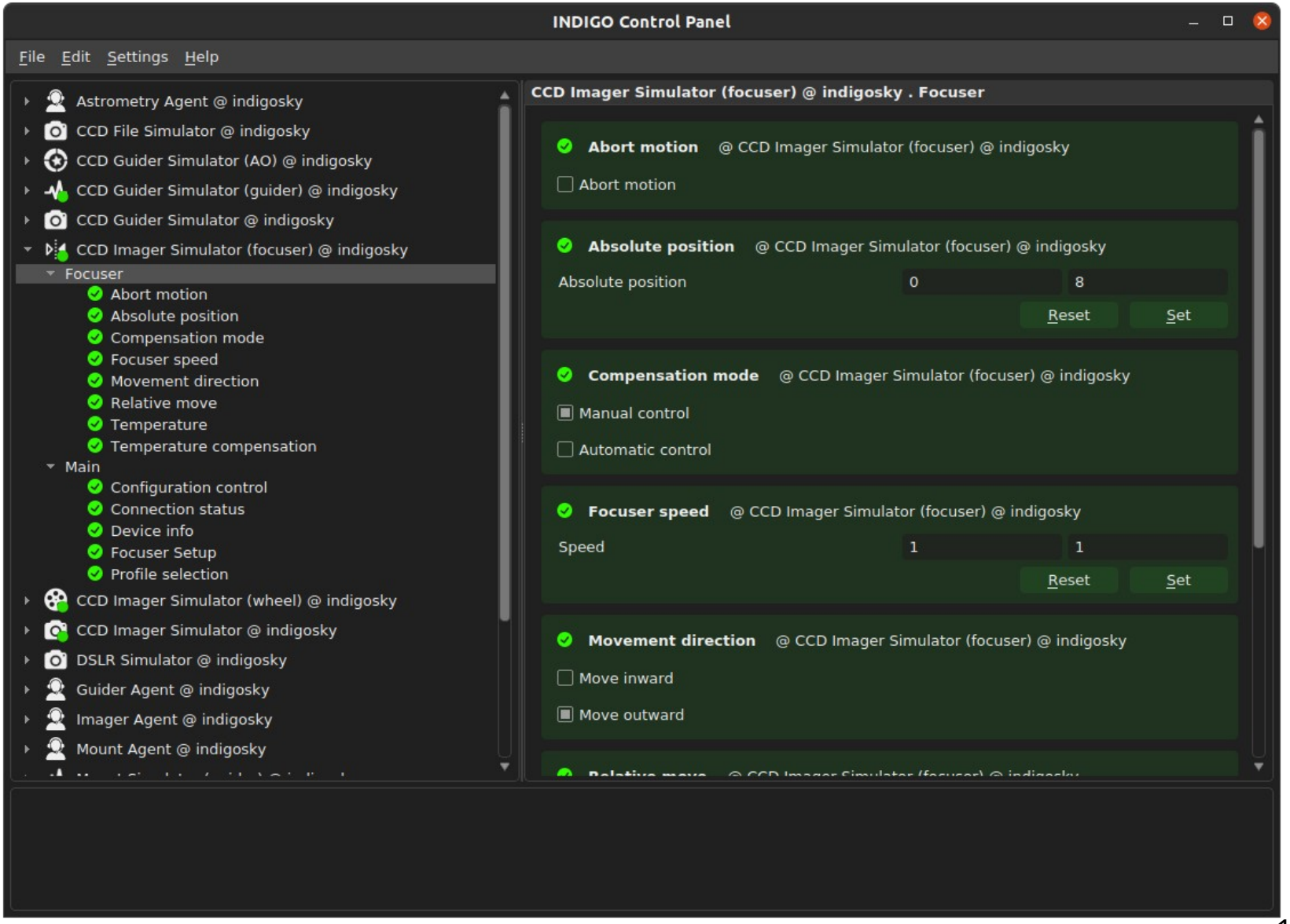
INDIGO Dashboard and Script Editor



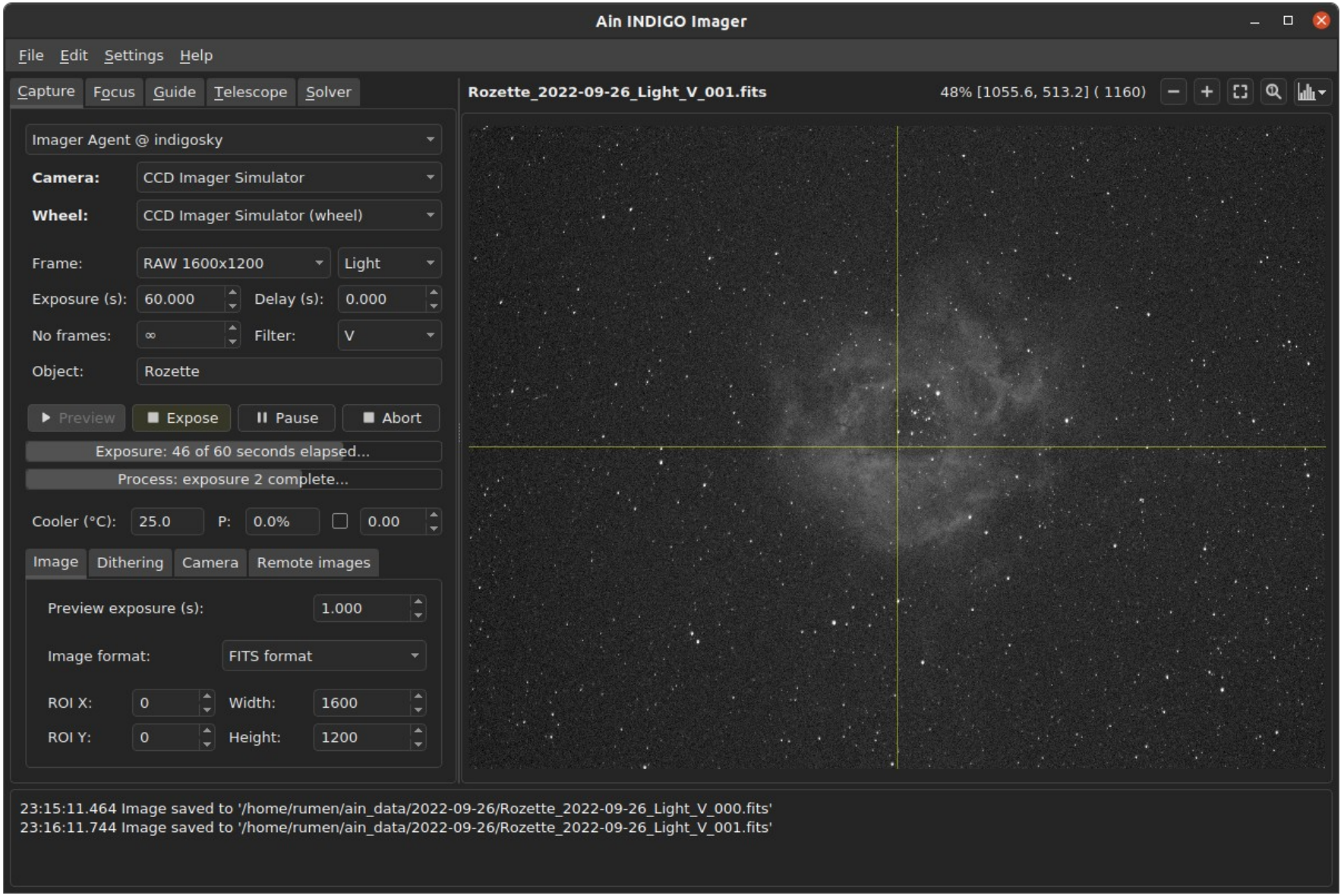
Linux and Windows apps



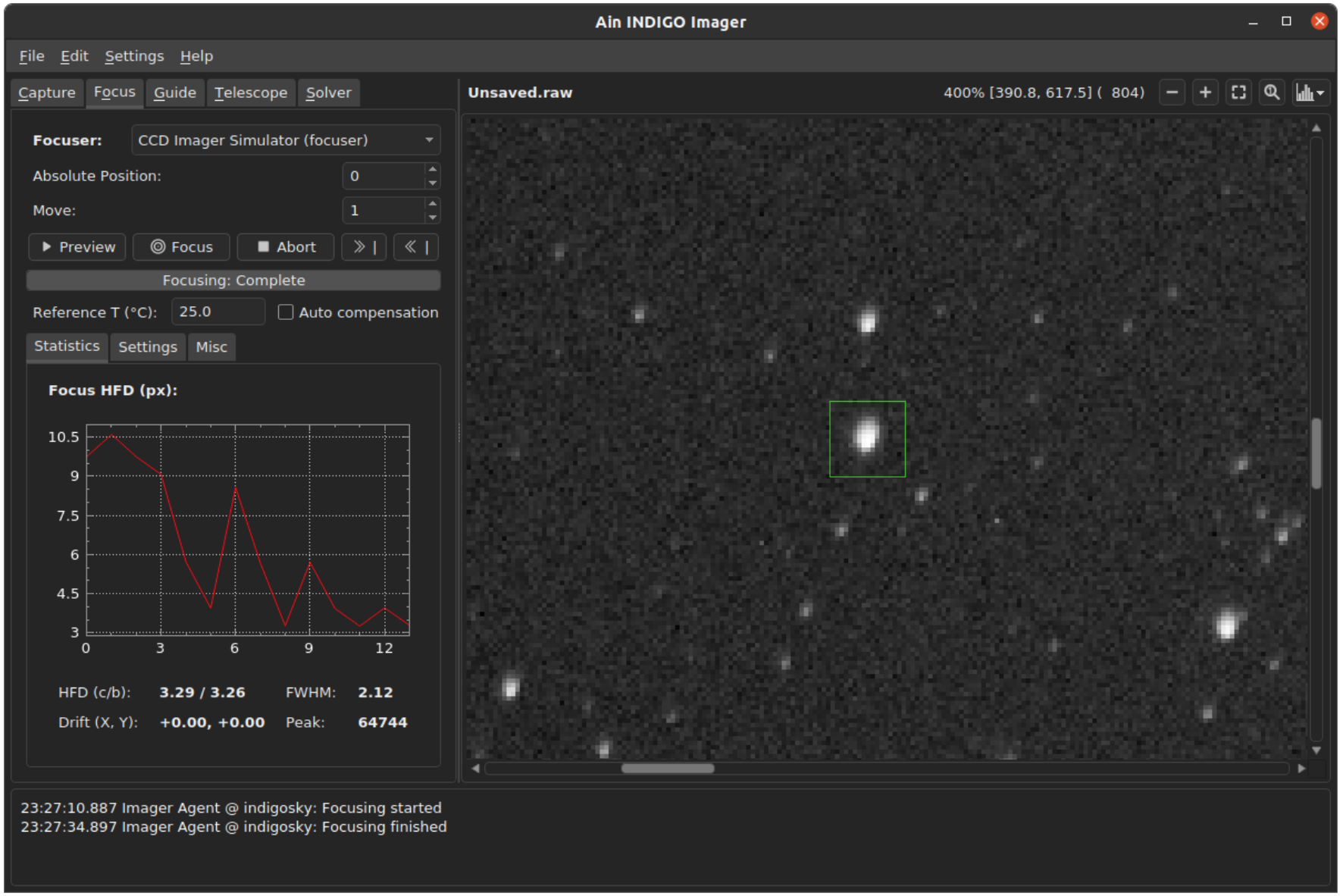
INDIGO Control Panel



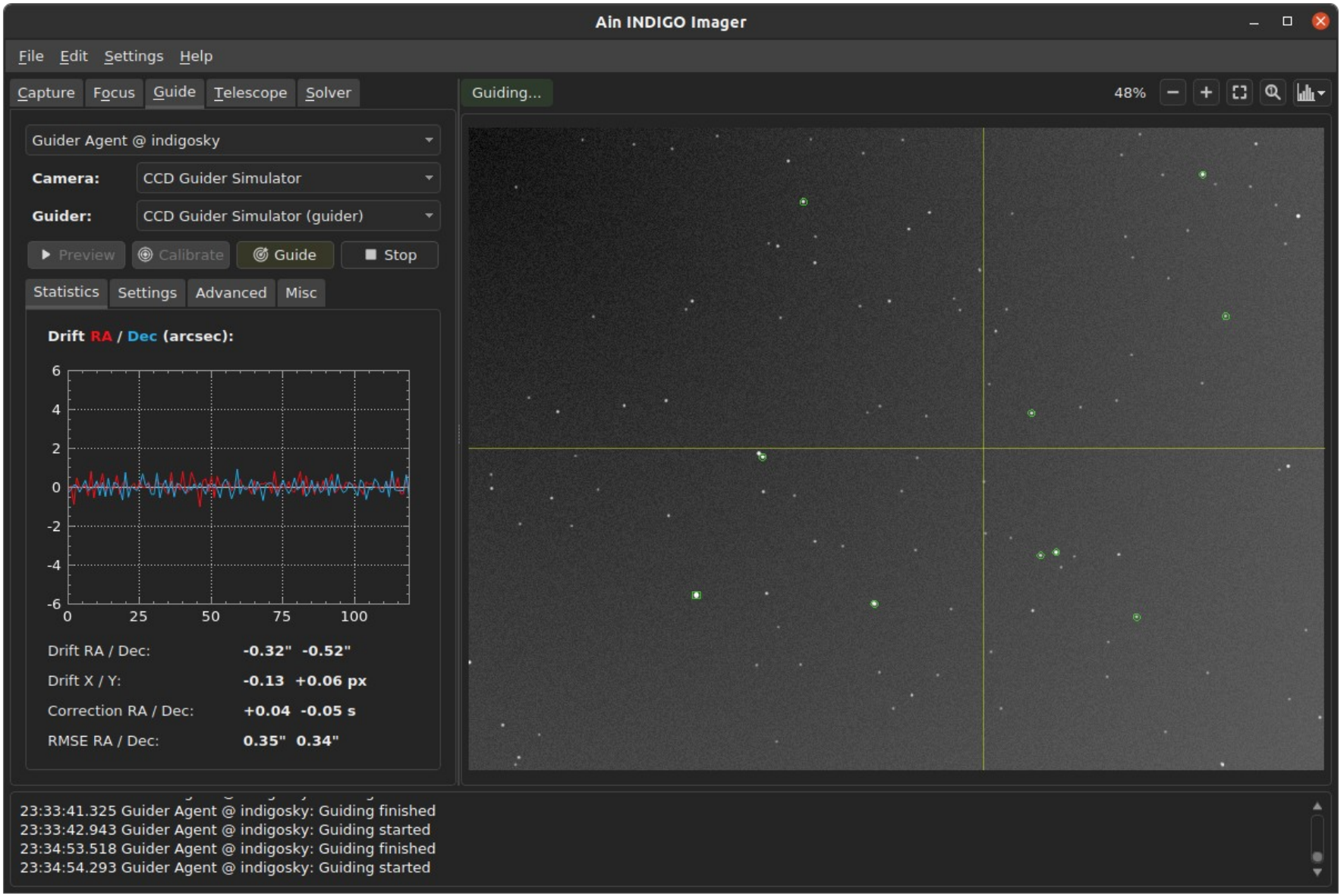
Ain Imager - Capture



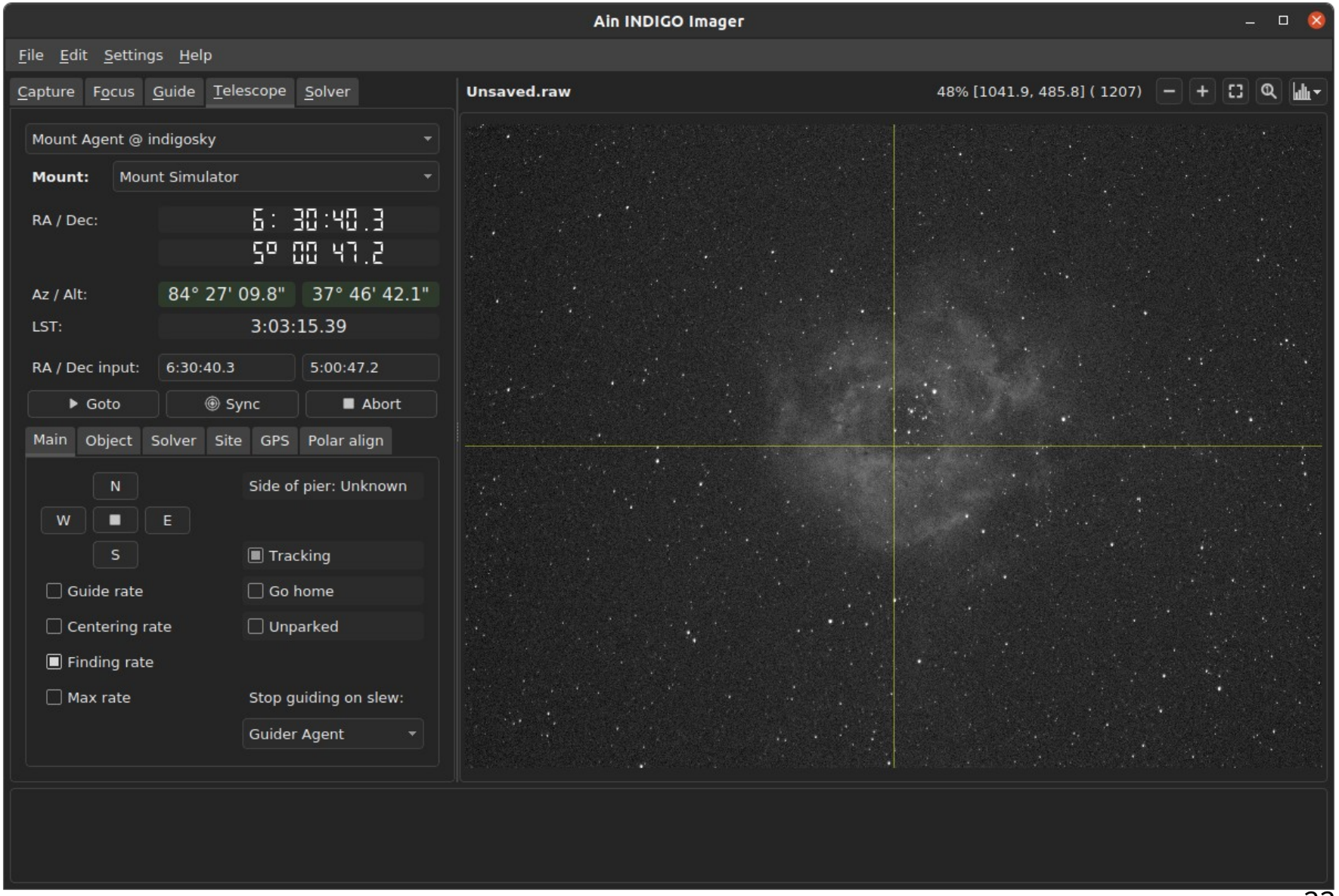
Ain Imager - Focusing



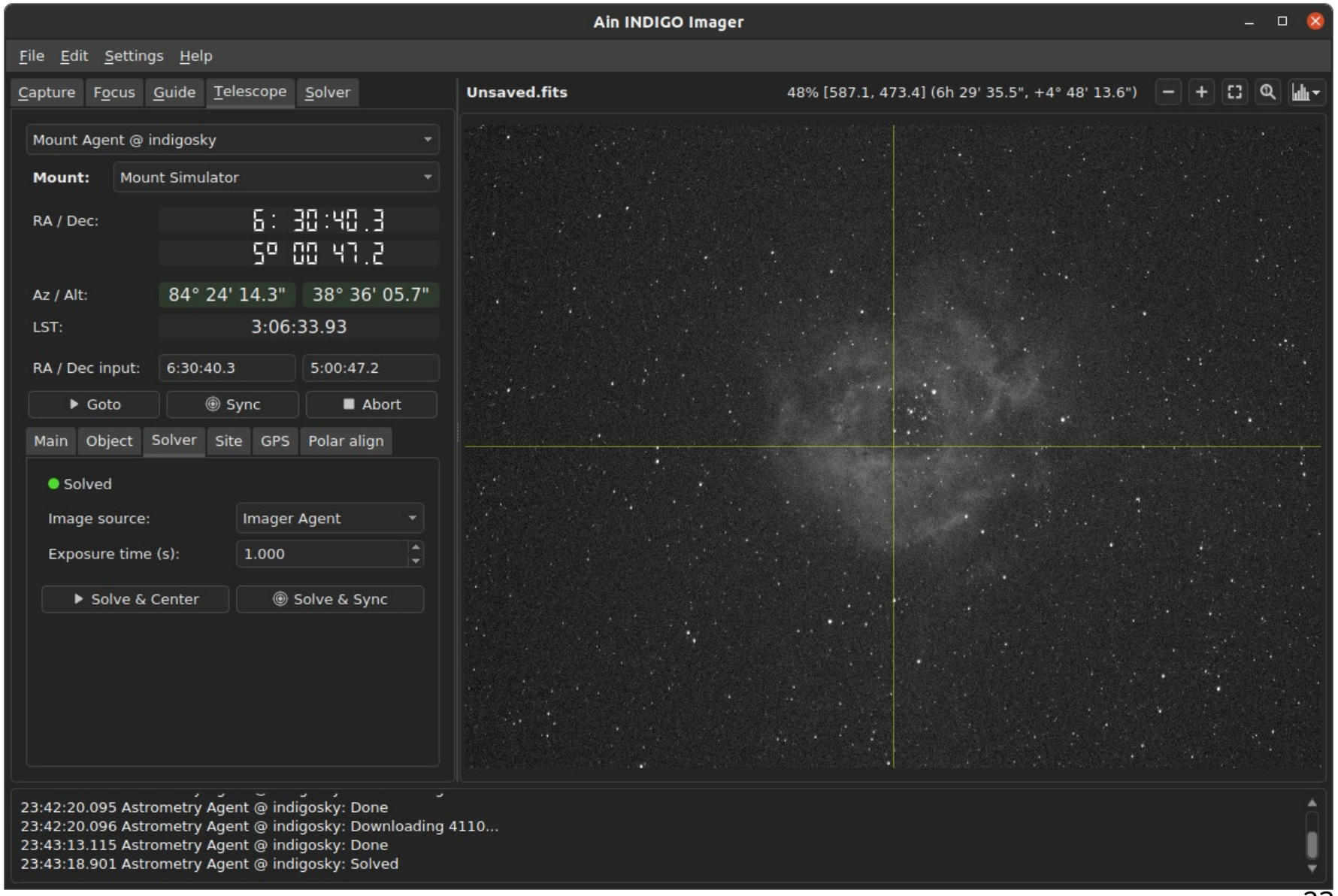
Ain Imager – Auto guiding



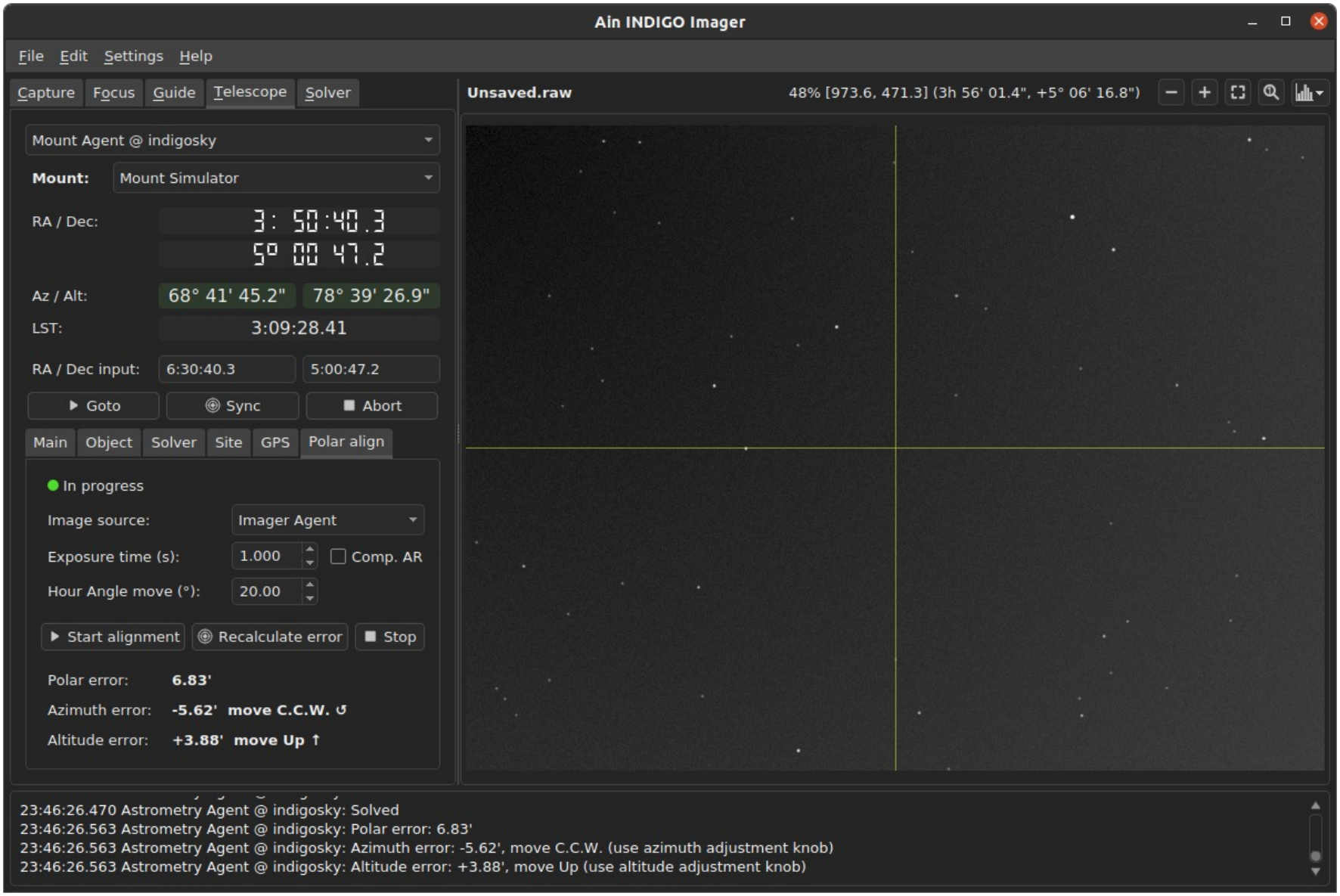
Ain Imager – Telescope Control



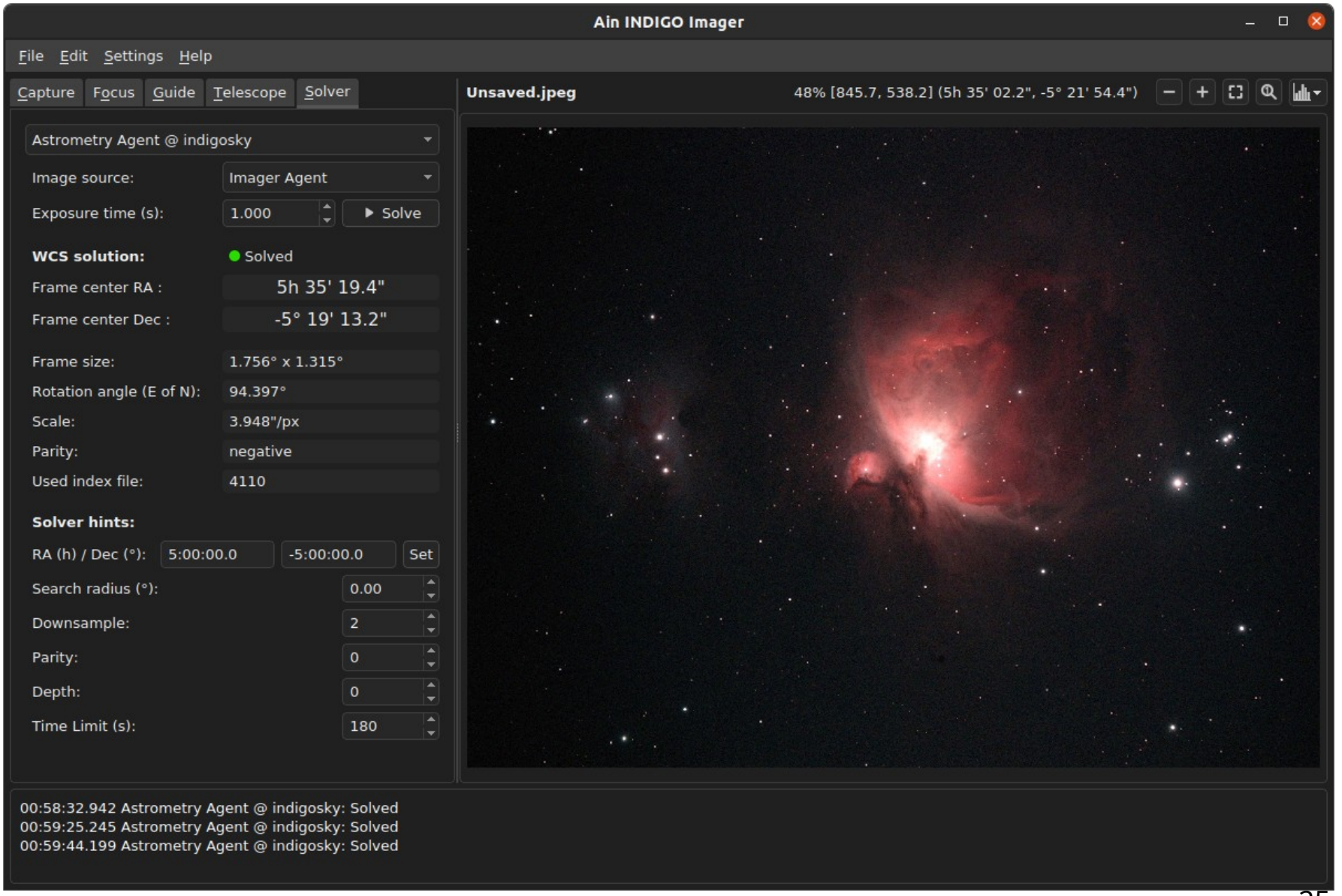
Ain Imager – Telescope (Solver)



Ain Imager – Telescope (P. Align)



Ain Imager – Solver



Third Party INDIGO Apps

- **PixInsight** – replaced INDI with INDIGO
- **APT** – uses INDIGO framework
- **MountWizzard4** – native INDIGO
- **CCDCiel**
- **PHD2**
- **Ekos** - can use INDIGO server in legacy mode

What can INDIGO control?

INDIGO

Who uses INDIGO?

- Several thousands amateur astronomers and astro-photographers around the world, running telescopes from 50mm to 90cm
- Several professional observatories including Calar Alto (Spain), Osservatorio Astronomico G. V. Schiaparelli (Italy), Astronomical Observatory at Skalnate Pleso (Slovakia).

Thank you!