Satellite tracking using telescope

Nguyen Tien SU
Vietnam National Space Center

SAGI summer school 2024

Instructor: Mr. Duong Tuan Anh

Contents

- Why Satellite tracking?
- Why optical telescope?
- How to track?
- Results

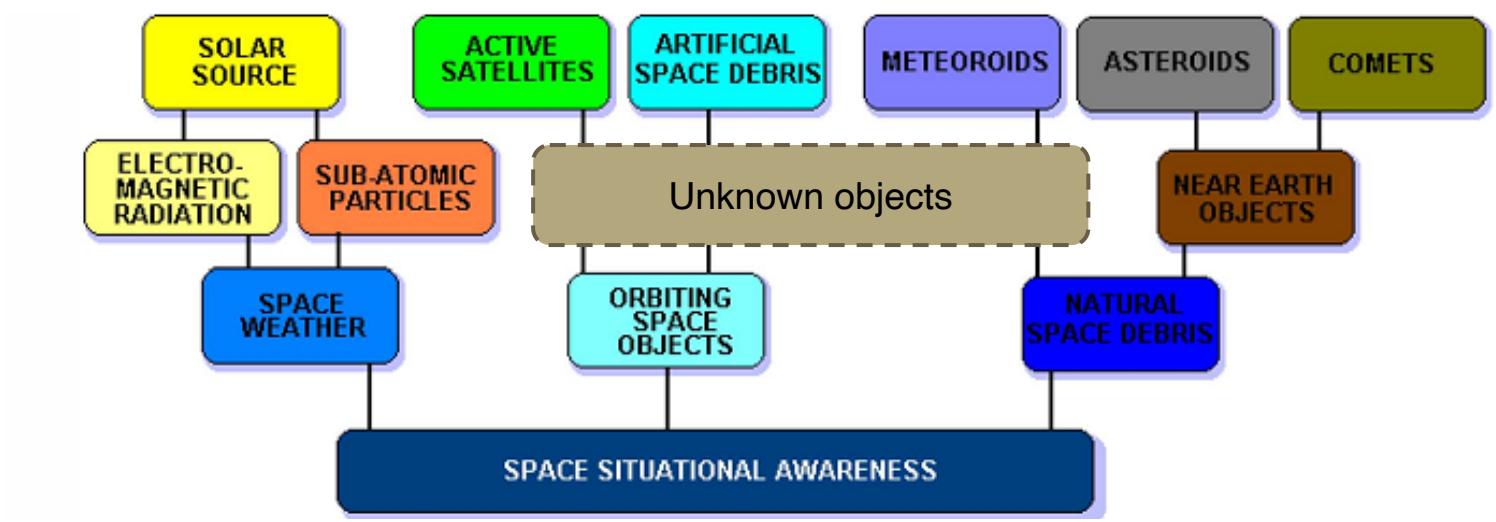
Why Satellite tracking?

Risk from objects in the Earth orbit

- Number of Artificial satellites/ space debris orbiting the Earth are increasing
- Low possibility of collision but huge damage if happened.

Risk from “unfriendly” countries

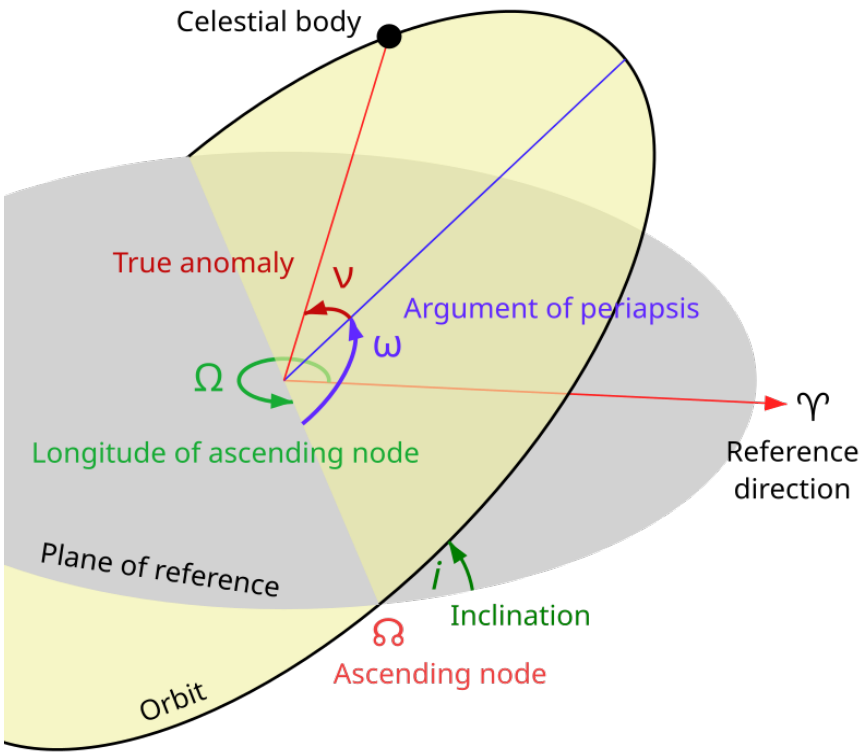
- Reconnaissance satellites can threaten a country’s security in many ways



Why optical telescope?

- Generally simple system at low cost. Suitable for amateurs.
- Existing optical telescope systems can be easily modified/upgraded in order to track the satellites in a big network
- High accuracy of satellites' position.

How to track?



6 Keplerian elements to describe an object's orbit

Requirements:

- Updated TLE of satellites
- Computerized telescope mount and telescope
- Camera
- Computer
- Control software

https://en.wikipedia.org/wiki/Orbital_elements

How to track?

Software development:

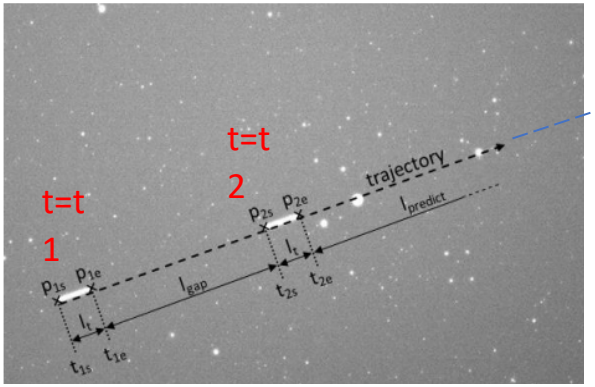
- Library for Pass prediction: **The OrbitTools Track** *with NORAD SGP4/SDP4 Implementations in C++ and C#*
- Driver for controlling telescope mount: **ASCOM**

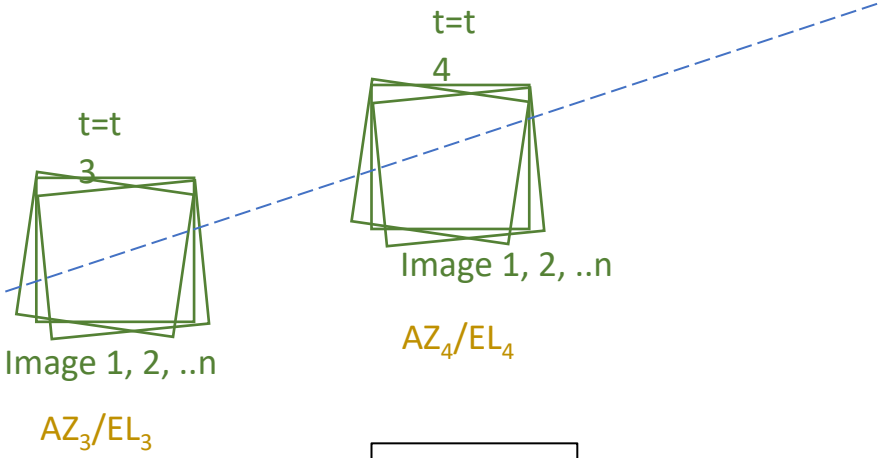
Software control:

- Setup system, align the telescope
- Filter TLE of satellite to be tracked: location, time, segment interval, number of segments,etc.
- Configure all parameters: exposure time, shooting start time, image directory, etc.

How to tracks?

Position Calculation





1st position

60s

2nd position

60s

3rd position

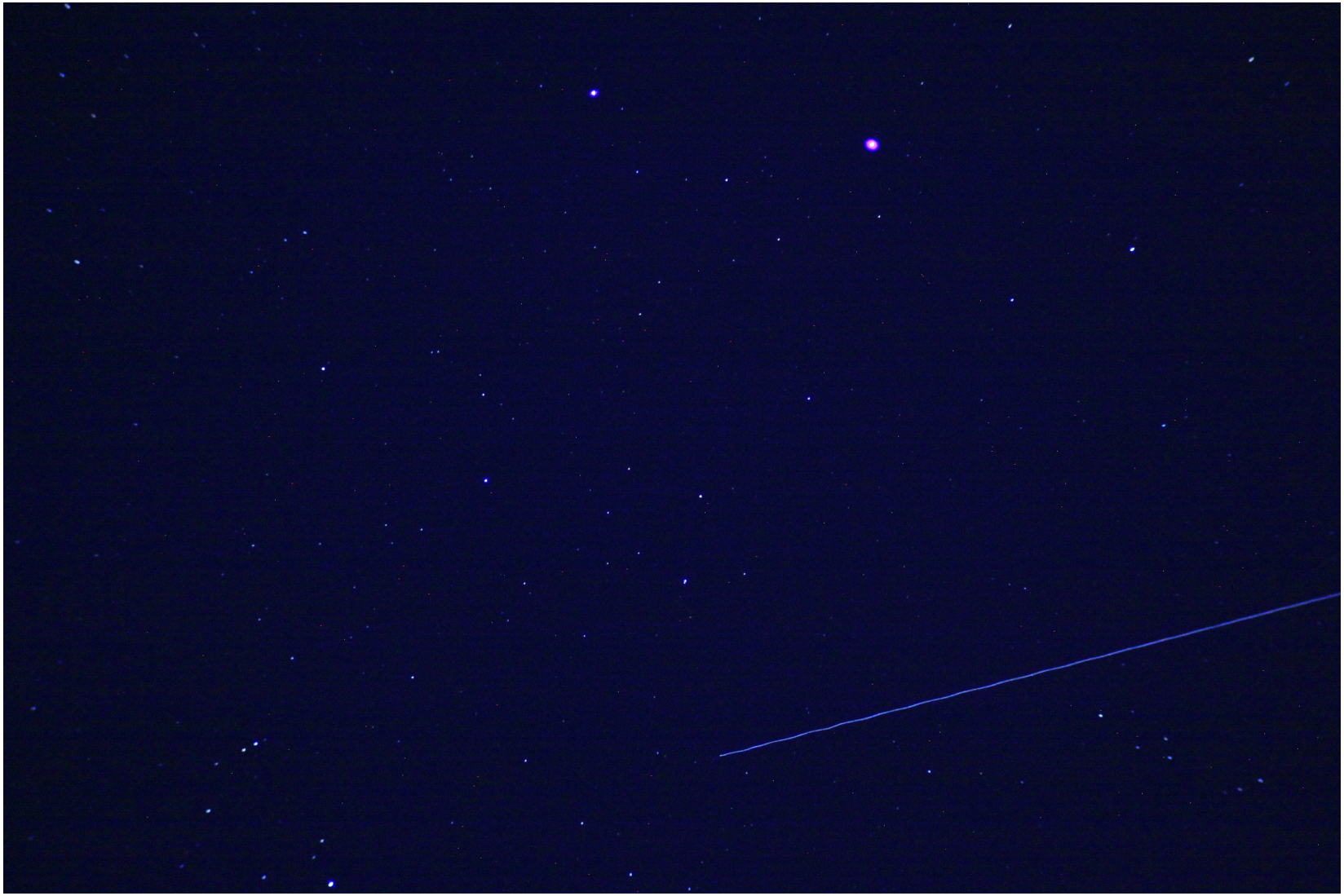
How to track?

Results

Results

Results

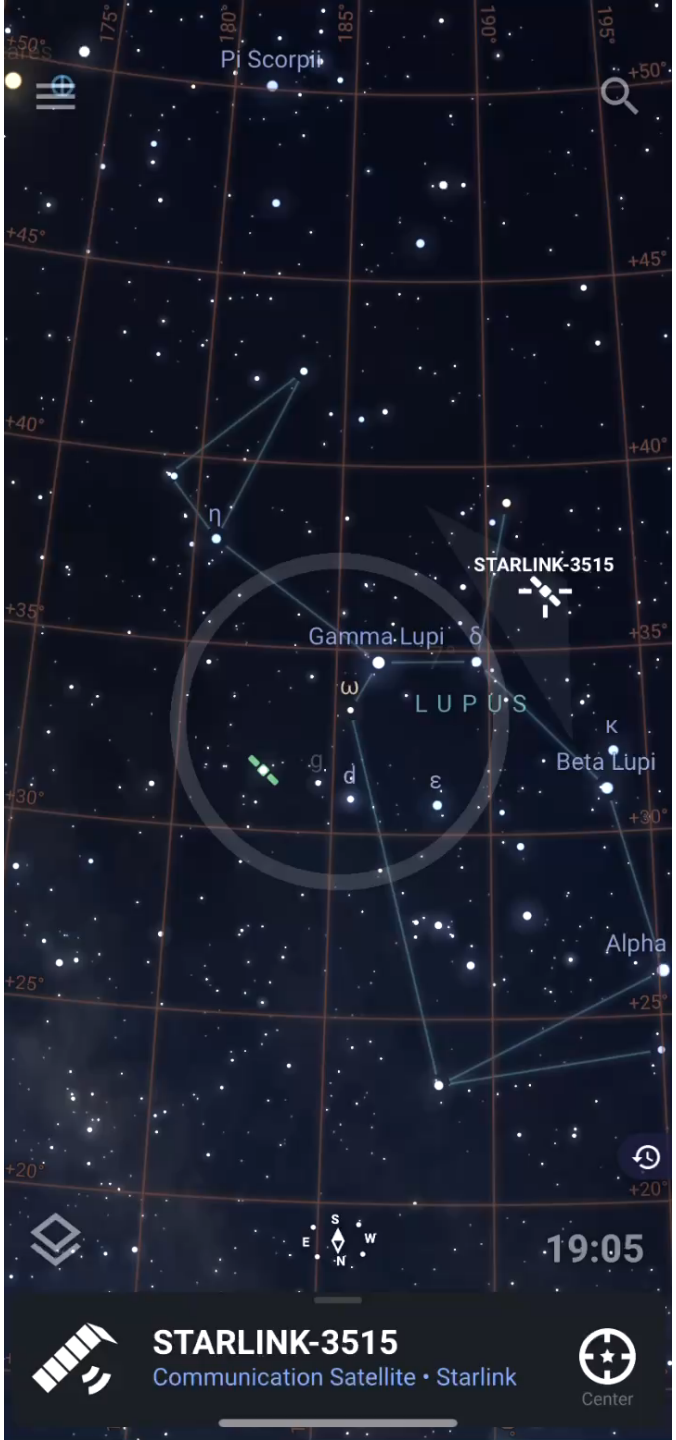
Results



Pro tips and tricks

- Start telescope alignment whenever stars are visible and finish ASAP
- Finder scope helps a lot to align the mount
- Use camera's *live view* mode to adjust focusing
- Start tracking session from *eastern* sky first as it gets darkened earlier
- After filtering observable satellites, look for upcoming satellite in Stellarium for visualizing its trajectory.
- Imaging window is quite narrow (~3h). In the summer, satellites usually are not visible after 9PM

THANK YOU!


Pi Scorpii
STARLINK-3515
Gamma Lupi
LUPUS
Beta Lupi
Alpha
19:05
STARLINK-3515
Communication Satellite • Starlink
Center