# Projected Imminent Impactor Discovery Performance of Current and Future Ground-Based Telescopes, Including ESA's Flyeye Network

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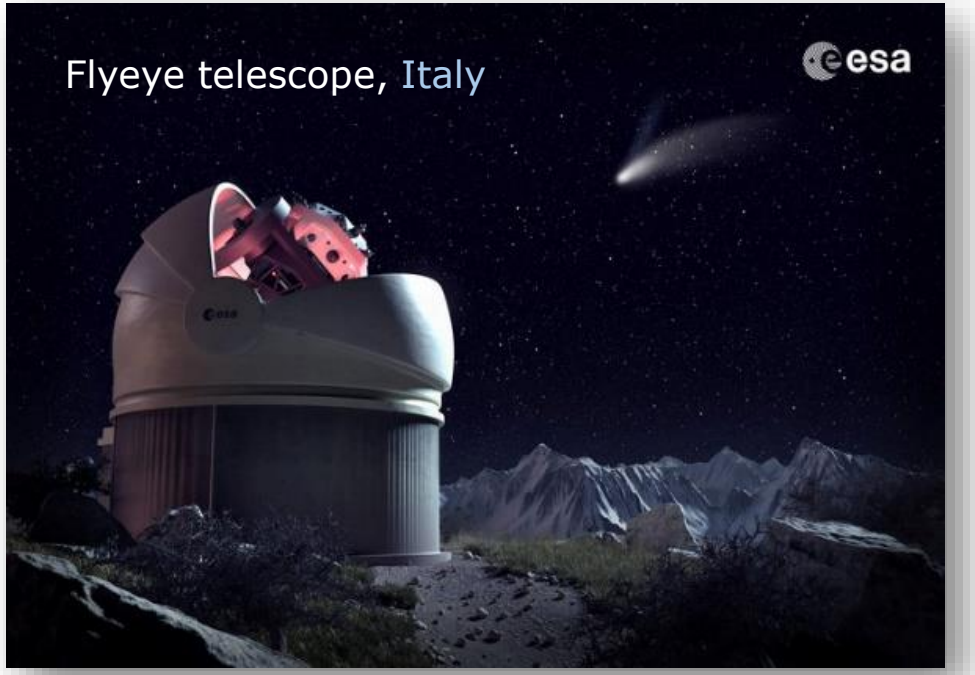
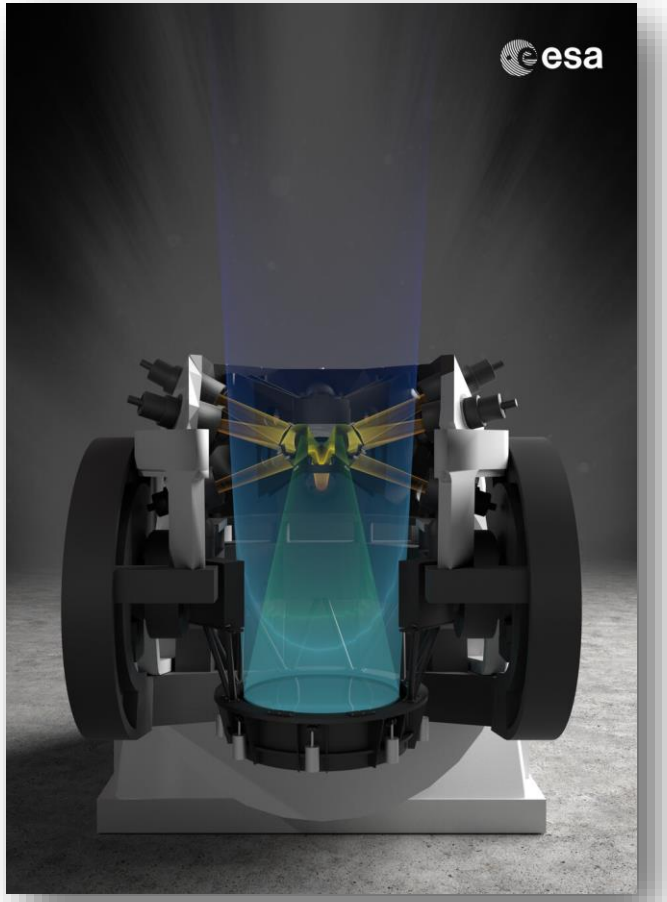
# FLYEYE TELESCOPE

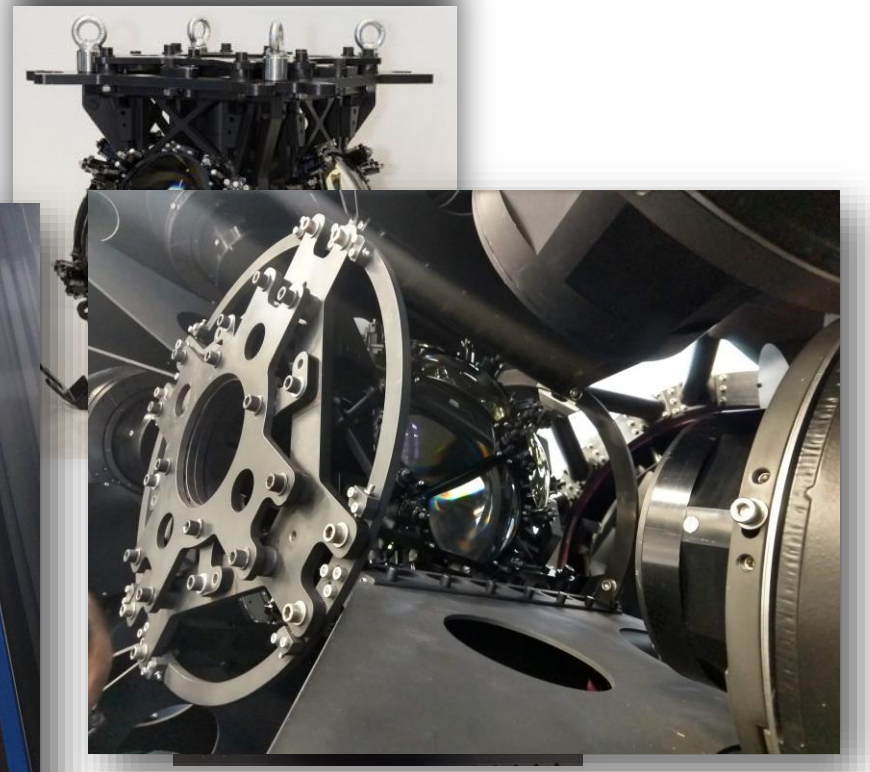



**ESA is building a survey** *dedicated to discovering smaller asteroids in a direct collision course with Earth.*




*The Flyeye telescope will be a 1-metre class telescope with 16 cameras and a* ***6.7°x6.7°*** *field of view.*
*It will be able to perform a* **complete scan of the observable sky down to V=21.5 every 2-3 nights.**
*Funding to build other large field of view telescopes.*

# FLYEYE TELESCOPE

# Current Surveys Discovering new imminent impactors

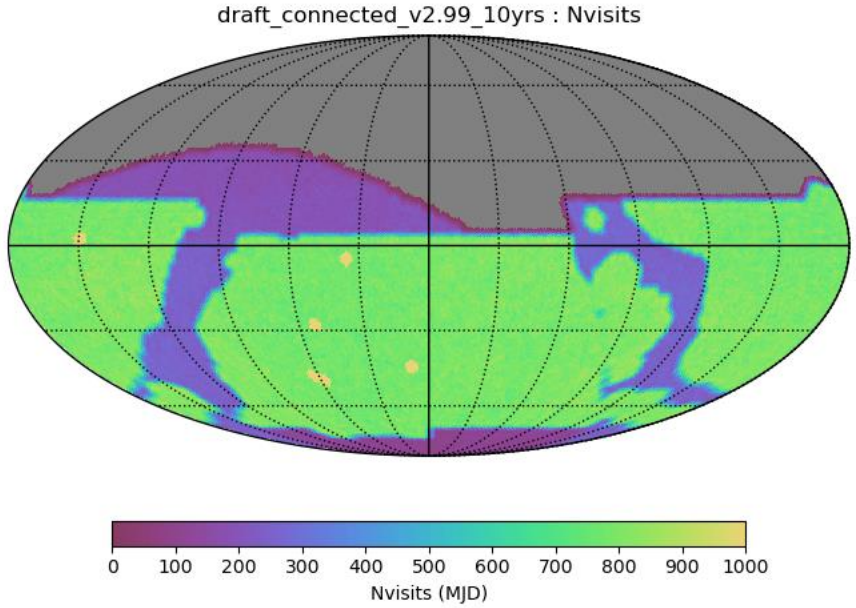



**Survey telescopes automatically scan the sky every night looking for new asteroids.**

*Right now most surveys are in the United States, funded by NASA.*

# LSST

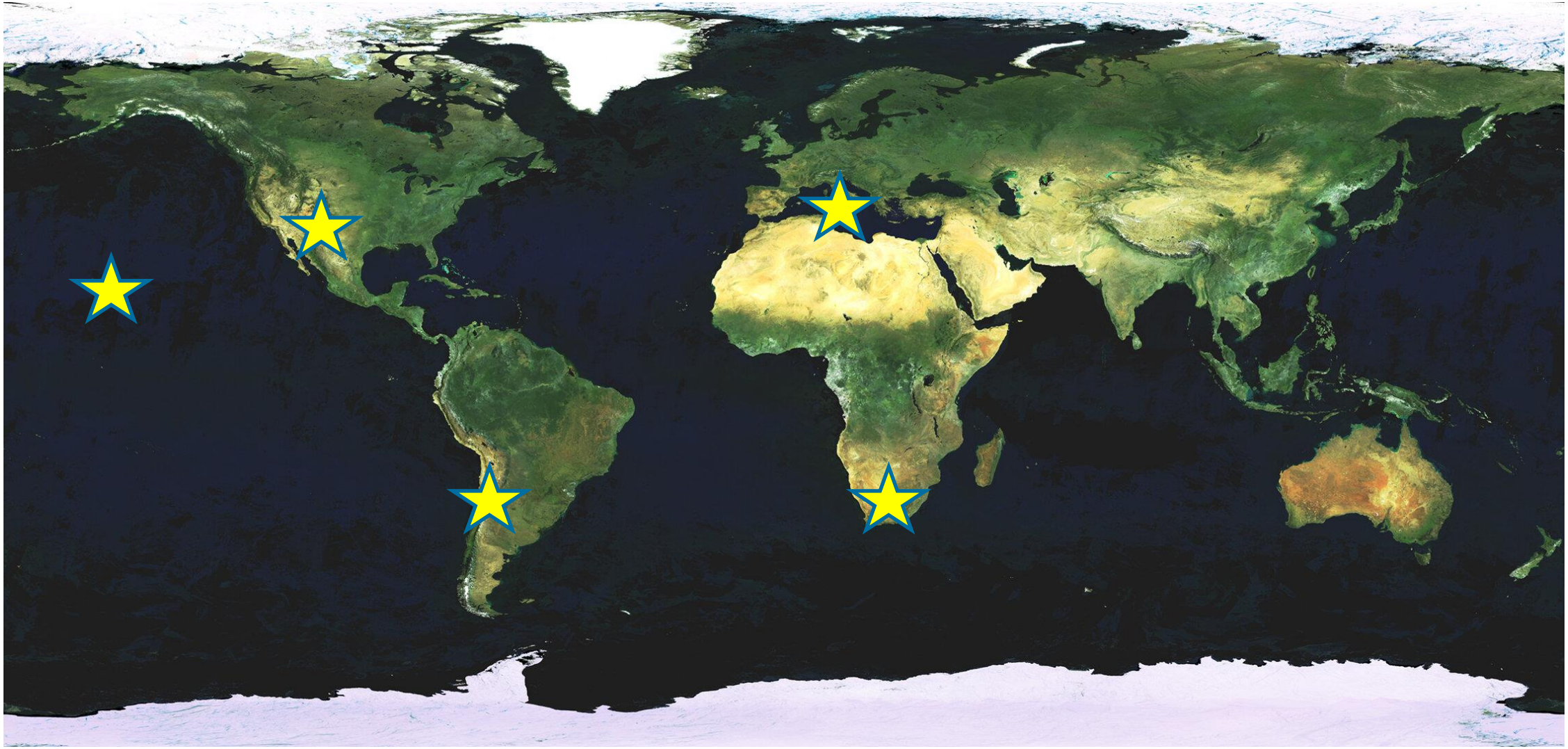
- 6-band survey: ugrizy
- Predicted depth for single visit: ~24.7 mag in *r.*
- Number of visits per night: ~1000
- Main observation plan: at least 18,000 square degrees to a uniform depth
- First light: 2024





Distribution of the number of visits on the sky for the (latest, 2020) baseline main survey, draft_connected_v2.99_10yrs. Credit: Lynne Jones, LSST.

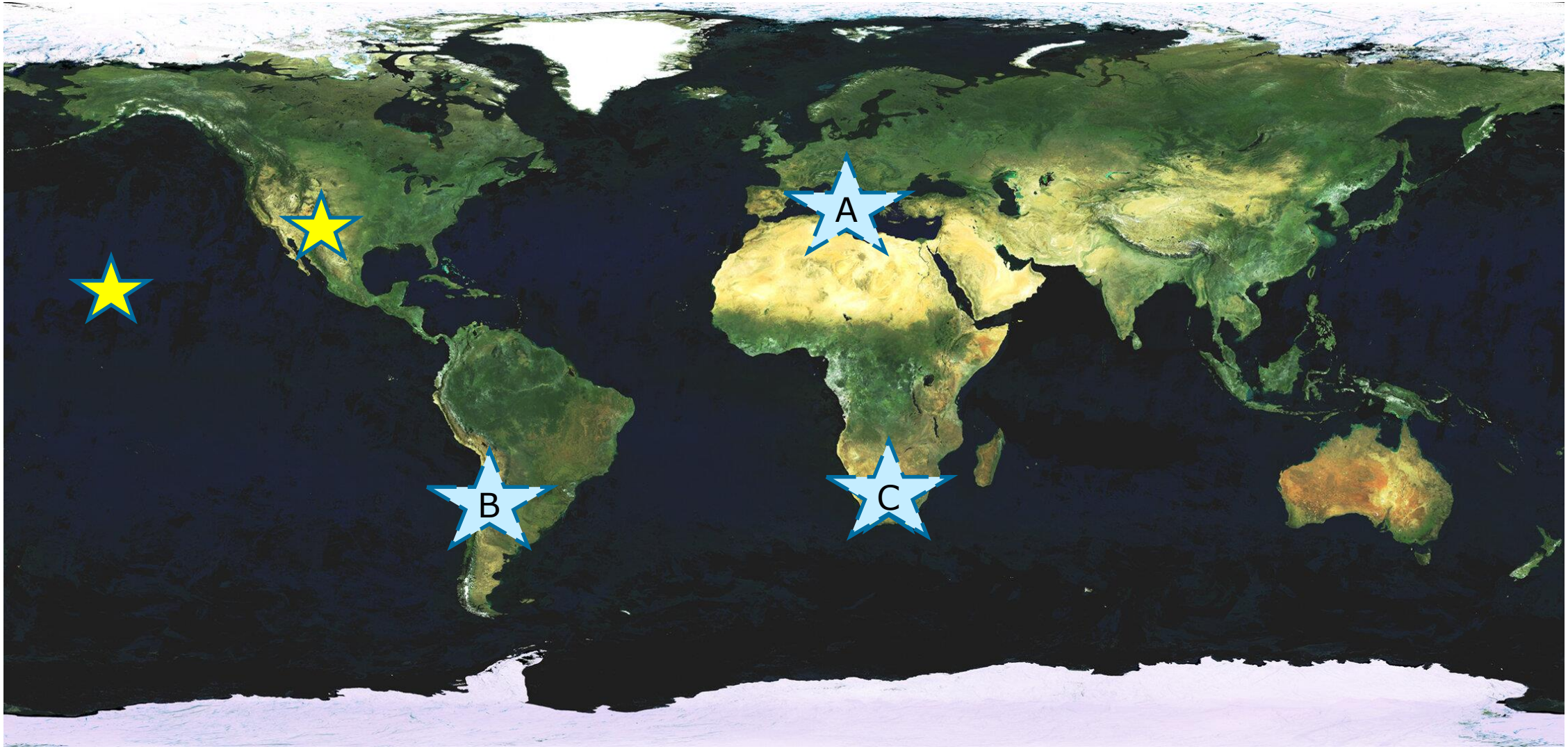
# Locations of current and planned survey telescopes



# Questions to be Answered:

- Will LSST detect the majority of iminent impactors in the Southern Hemisphere? Is it worth building more survey telescopes in the South?
- If majority of survey telescopes are in the Northern Hemisphere, is it worth building more survey telescopes in the North?
- Does longitude affect detection rate?

# Ideal Location for Flyeye 2 ?



# THE EXPERIRIMENT:

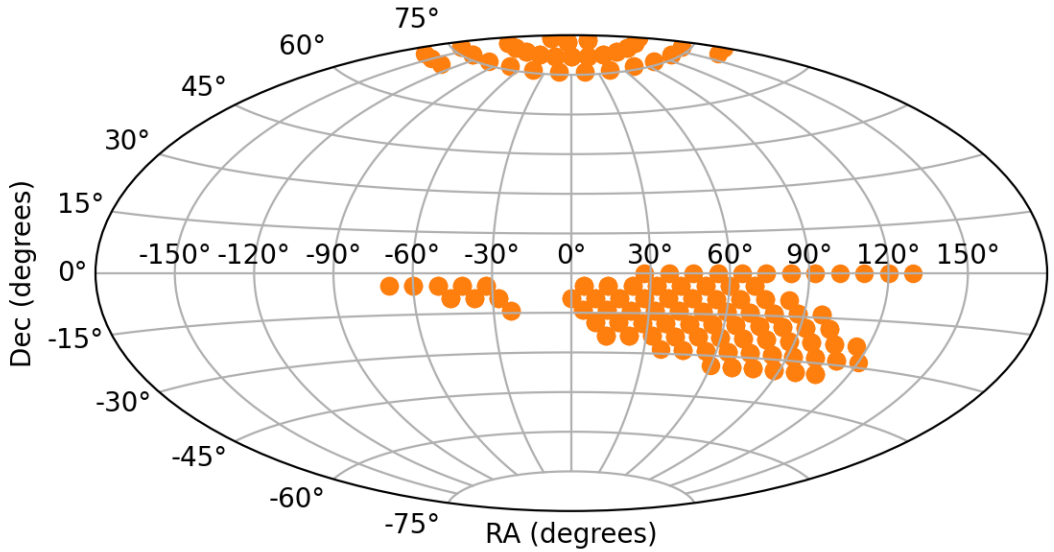
- Take a set of 3000 H=25 impactors (Chesley, private comm.)
- Offset impact date so they all hit in the same year, 2020.
- Simulate which impactors would be detected in one year by each of the current surveys.
- Simulate which impactors would be detected by Flyeye 1 and LSST.
- Simulate which impactors whould be detected by the above surveys plus Flyeye 2 in locations **A**, **B** and **C**.

# Observing Strategies

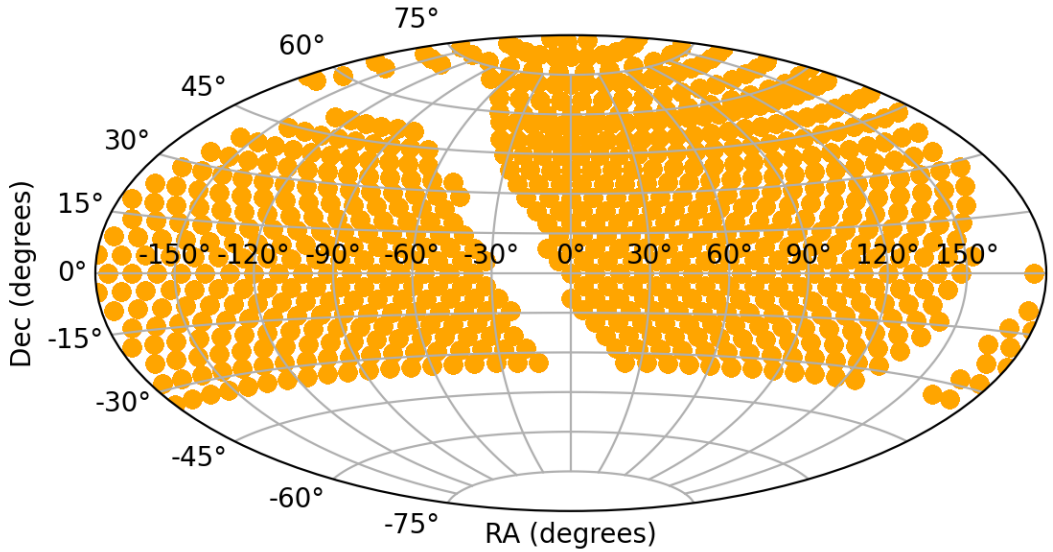
- For existing surveys, take past pointings, available from MPC.
- For LSST, take one year of pointings from simulated survey.
- For Flyeye, an observing strategy is simulated. Simulated strategy covers tesselation grid of Flyeye pointings and cycles through every point visible in the sky. The same field is revisited 4x with a ~30 minute interval. Altitude limit: 15 degrees. The Galactic Plane is omitted. Lunar phase is not considered.

# Simulated Flyeye Nightly Observing Strategy

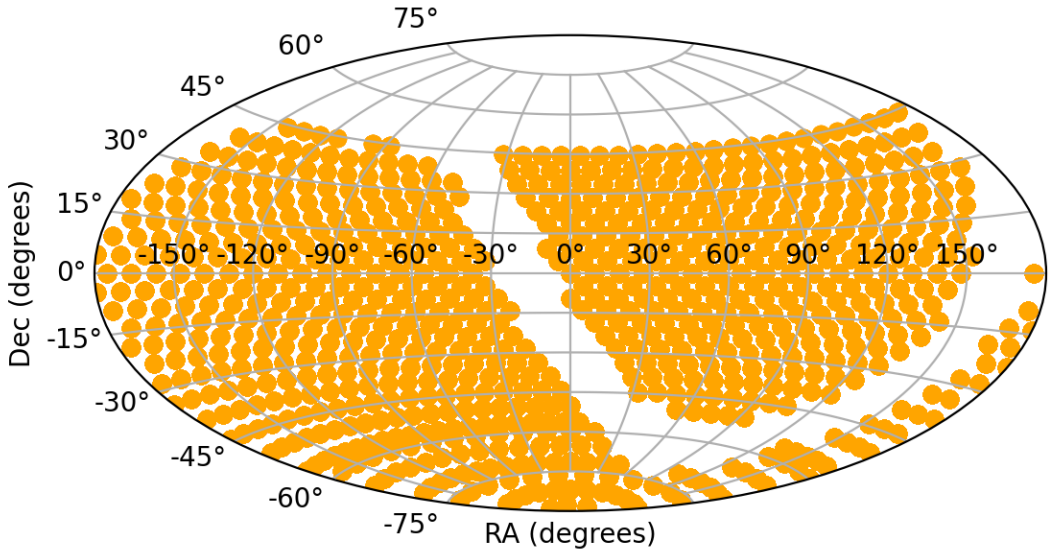
Mufara



# Simulated Flyeye Yearly Observing Strategy

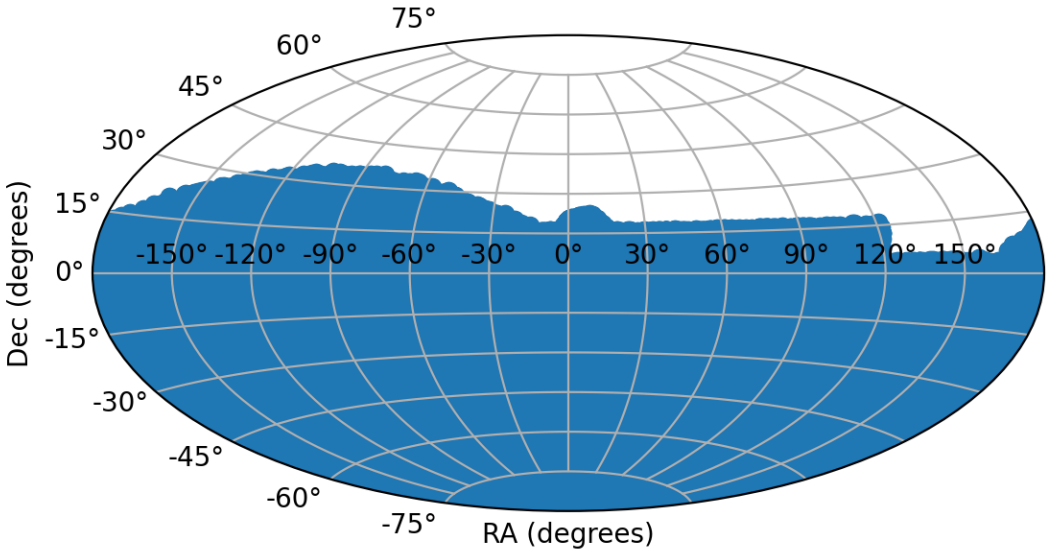



North



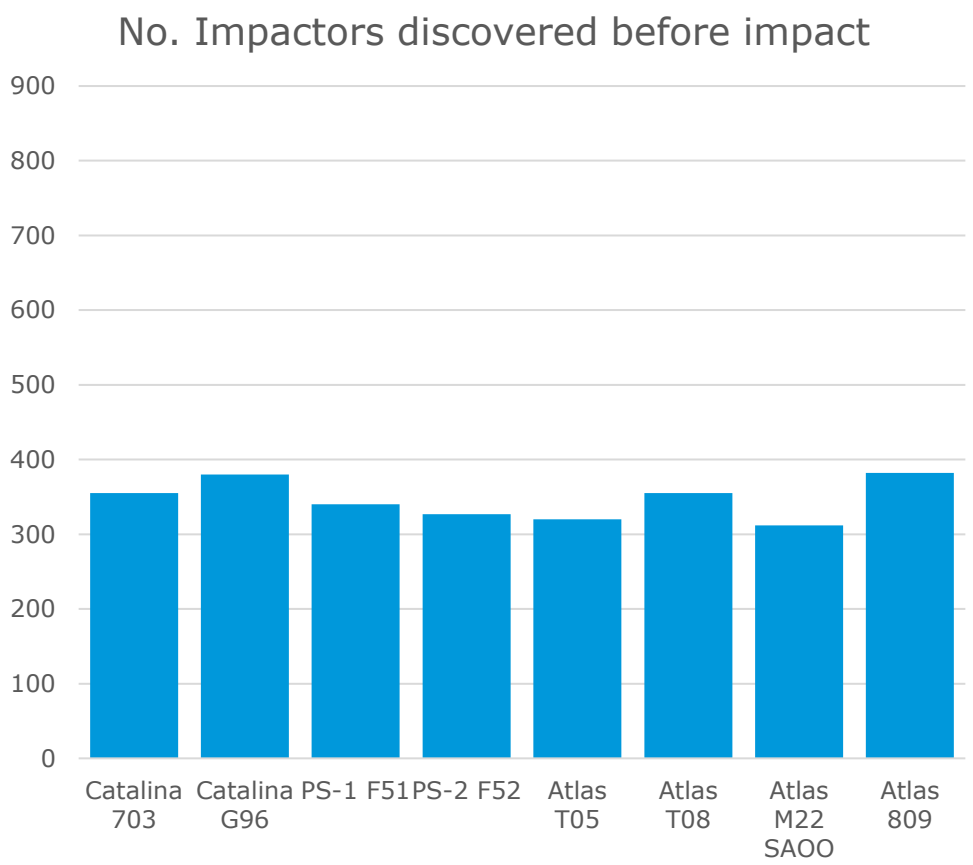

South

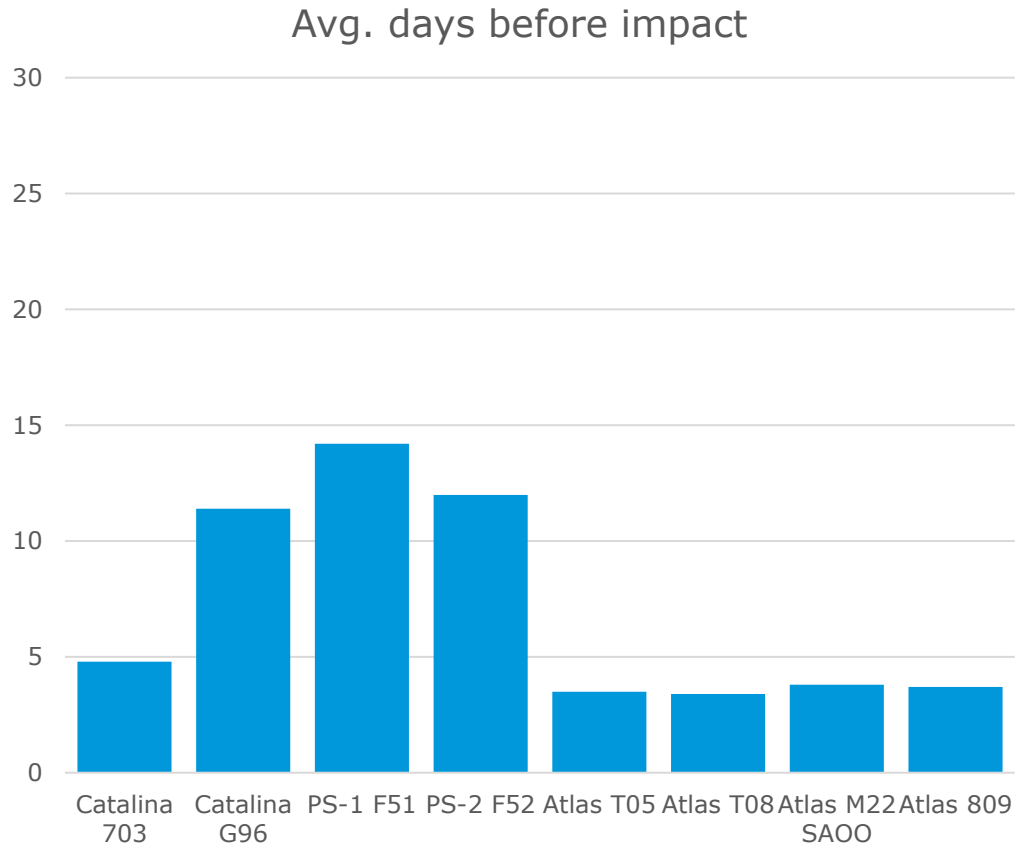
# LSST Observing Strategy



# RESULTS

# Impactors: Existing telescopes

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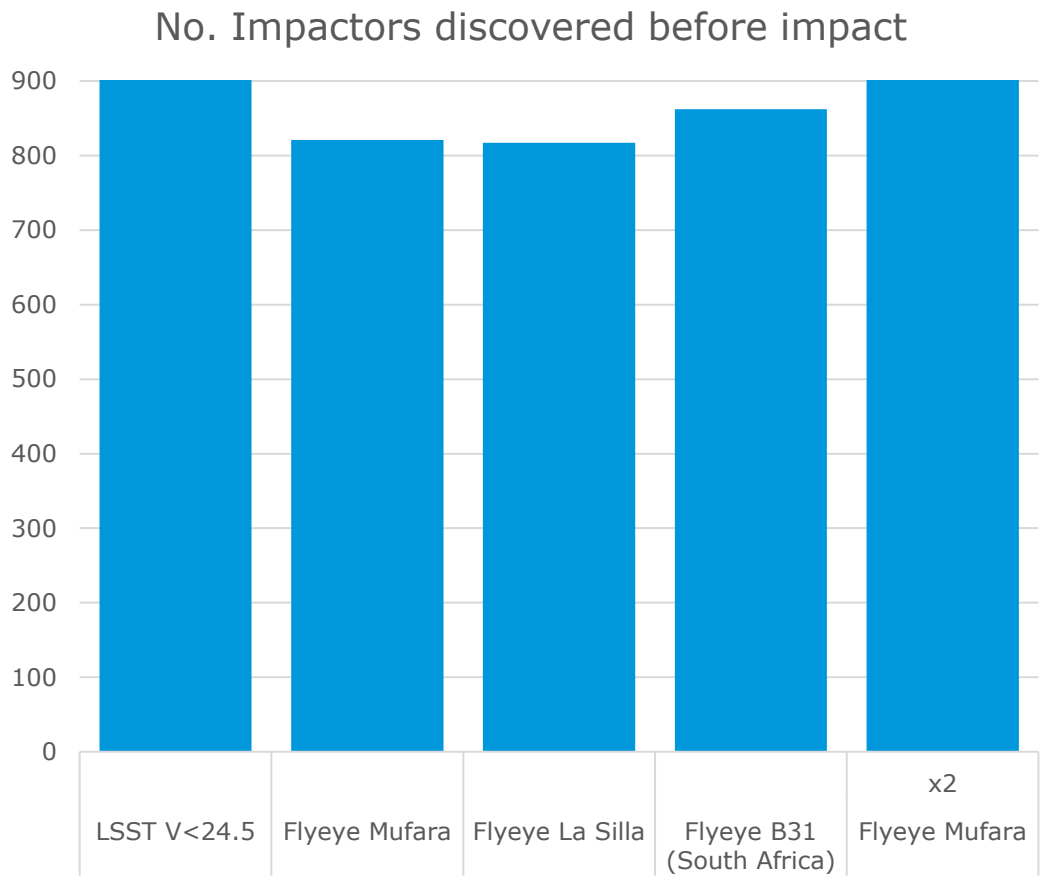
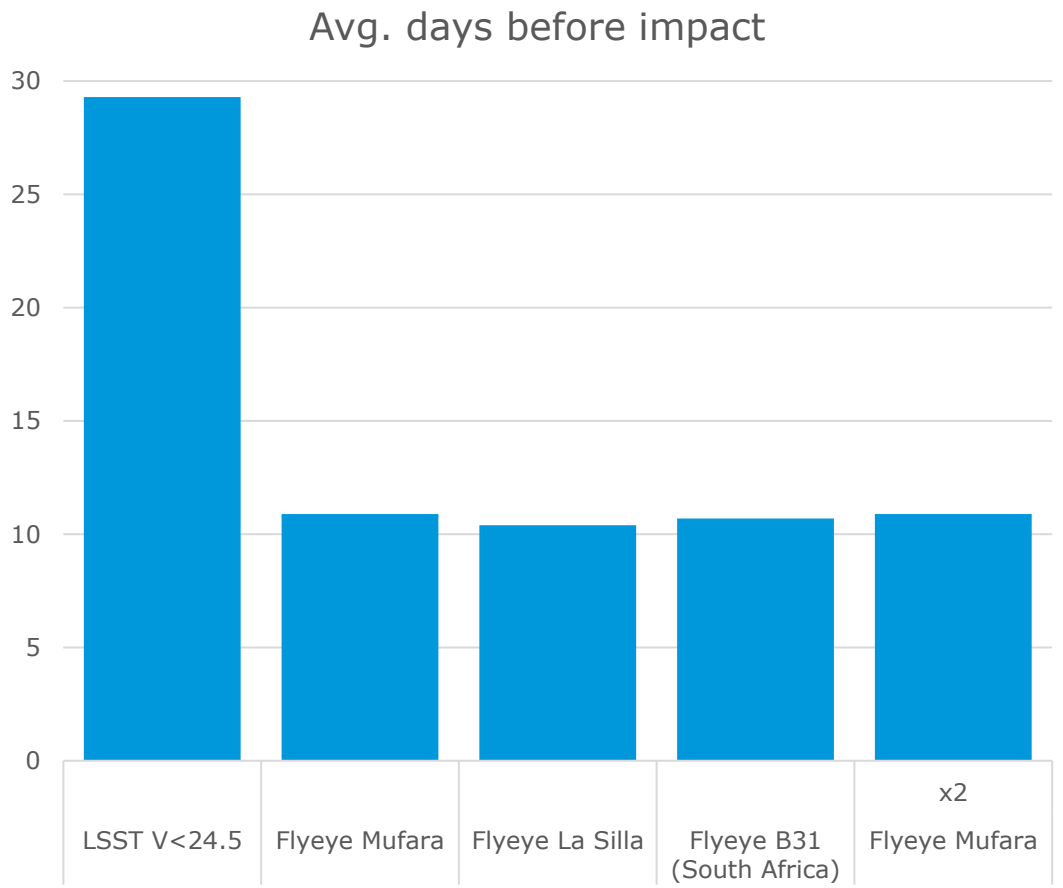
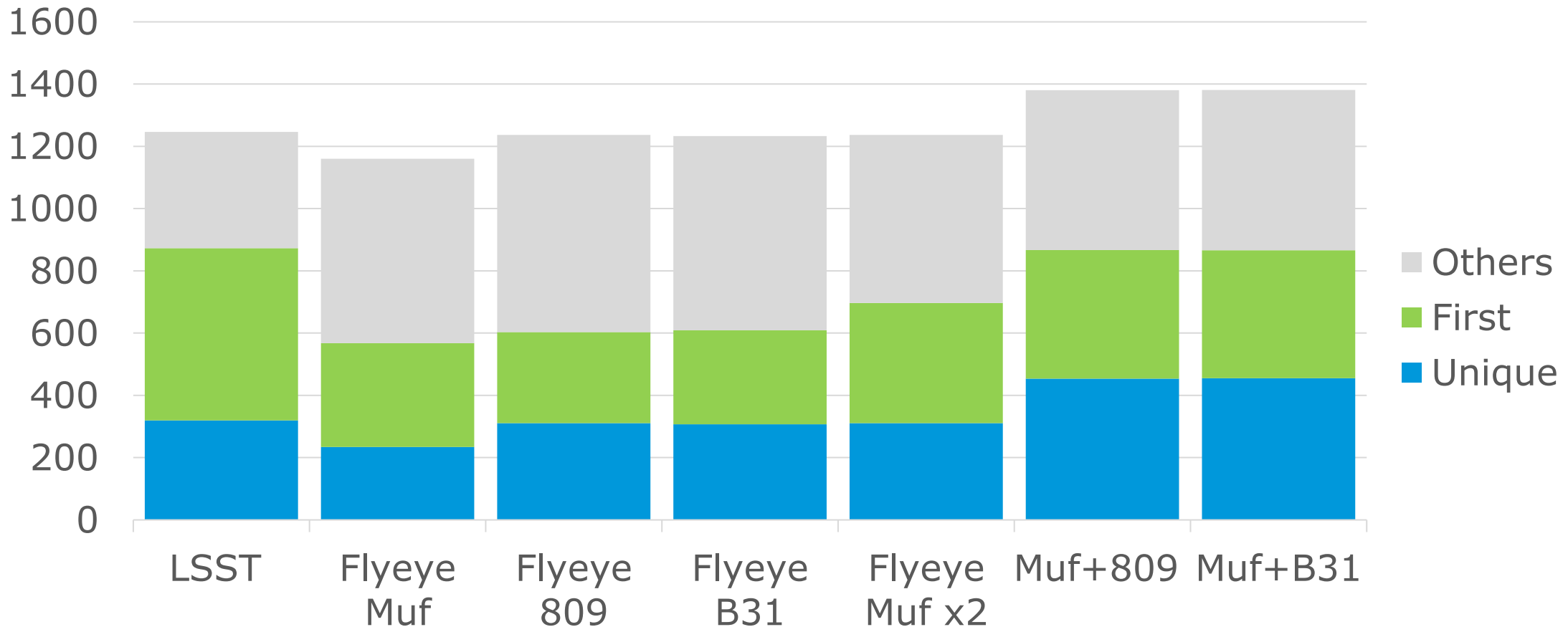
# Predictions for Flyeye Telescope

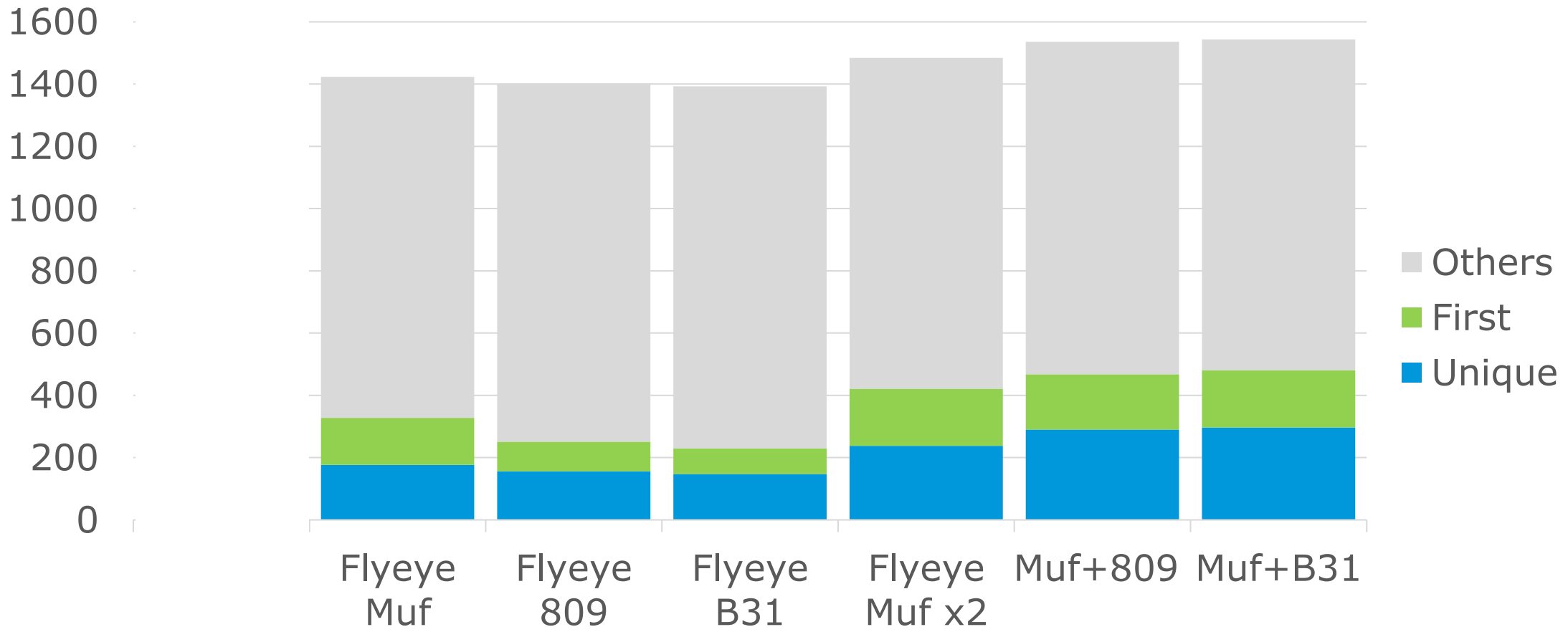


# Impactors Detected by Individual Telescopes



# Impactors Detected After LSST



# Conclusions & Future work

- For H=25 objects, simulations show a **preference for the Southern hemisphere** for the ideal location for Flyeye 2.
- **No longitudinal difference** is found.
- An additional Flyeye telescope will increse the chance of detecting an impactor by **16%**, when located in the Northern Hepmisphere, **19%** in the South.
- It is expected that the implementation of **weather models will differentiate sites**.
- Future work will focus on implementing these weather models, as well as investigaing **complementary observing strategies with LSST**.