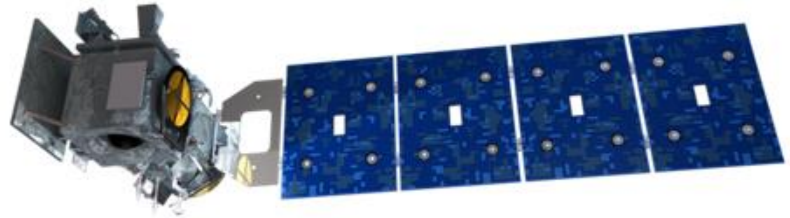
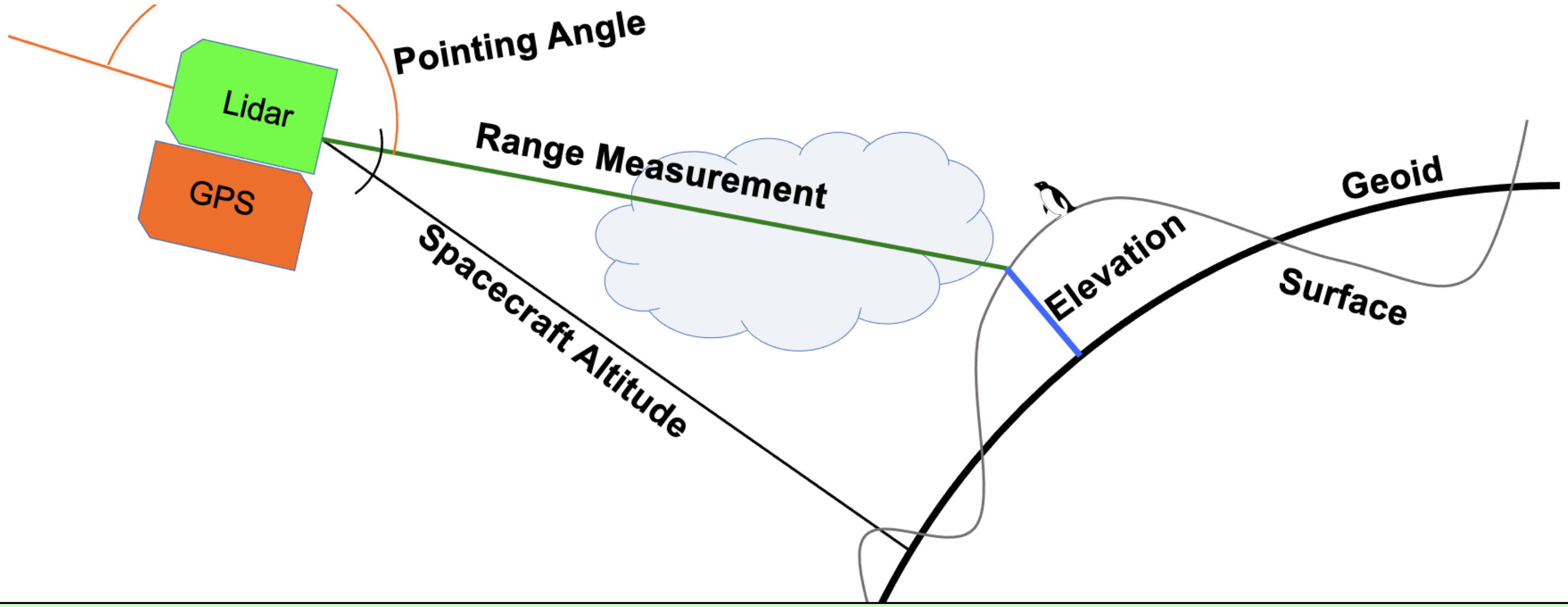
Project Science Office Update

ICESat-2 Applications Workshop
3 June 2024



Measurement Concept



We want to measure **elevation**

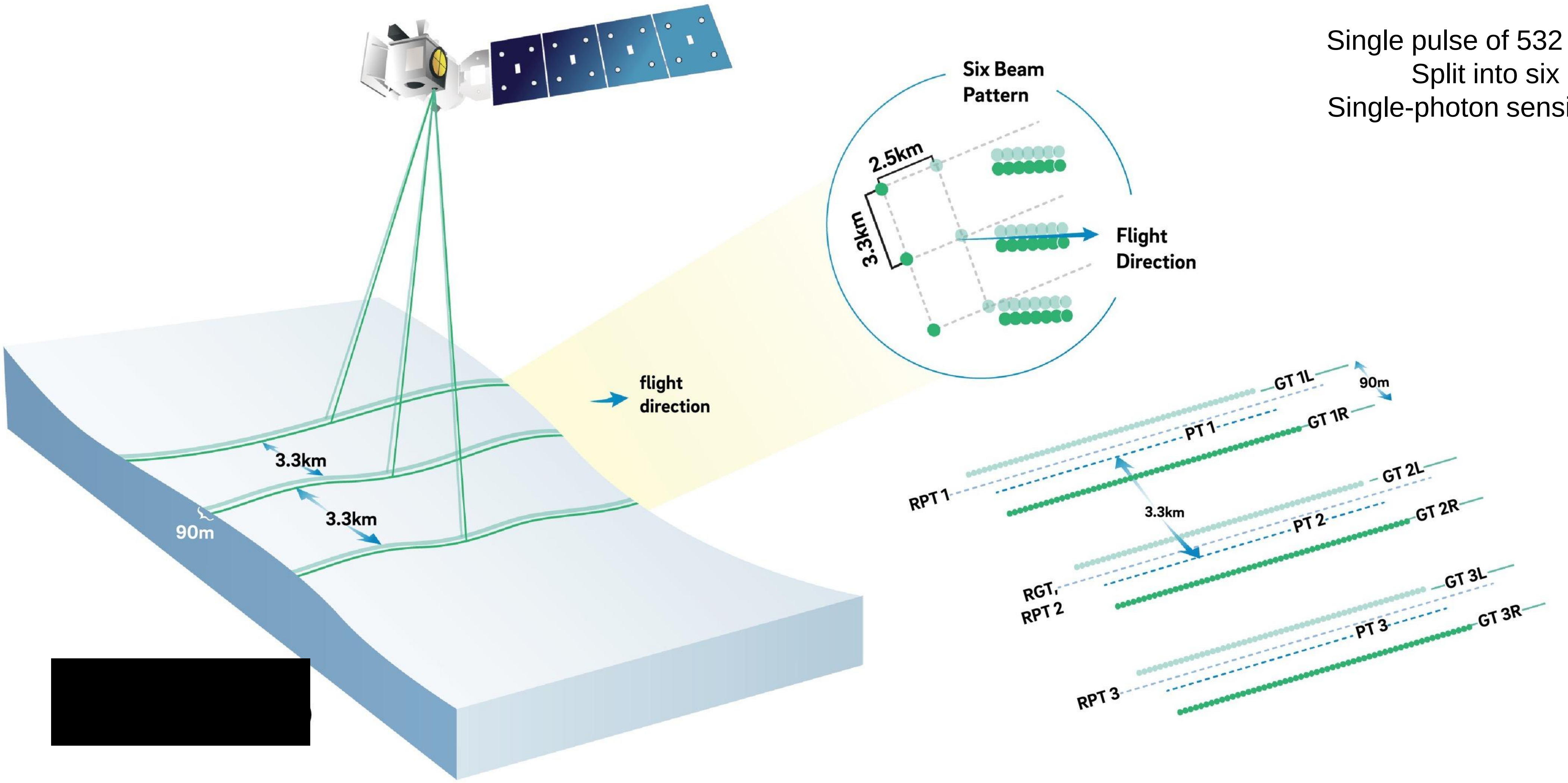
Lidar measures **range (time of flight)**
Spacecraft measures **absolute pointing angle**

GPS measures position in orbit

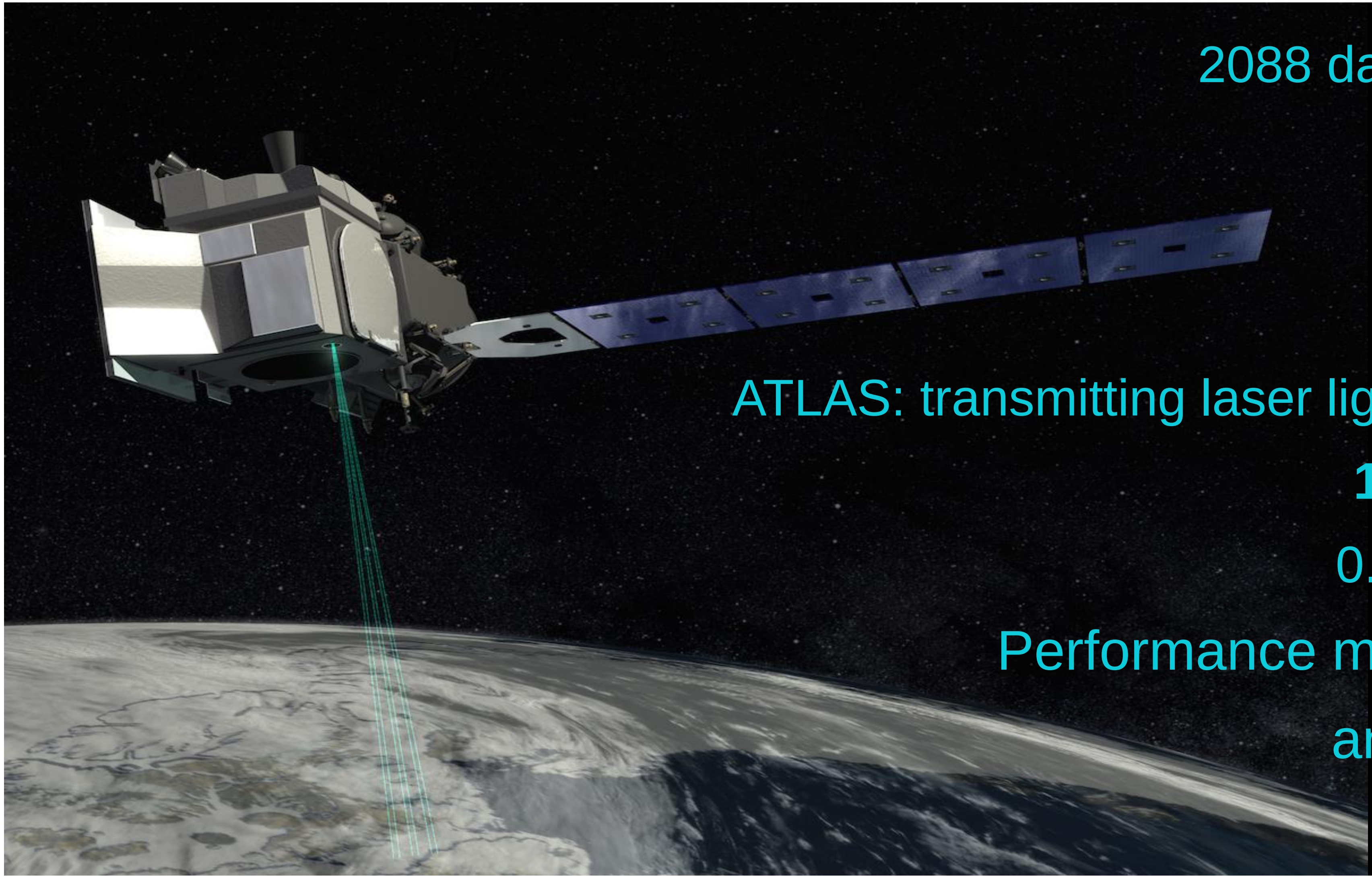
Ground processing puts the pieces together

Measurement Concept

Single pulse of 532 nm laser light
Split into six beams
Single-photon sensitive detection



Current Status



2088 days on-orbit since launch

ATLAS: transmitting laser light since 1 October 2018

1.75 Trillion laser pulses

0.7 m along-track spacing

Performance metrics remain nominal, and within requirements

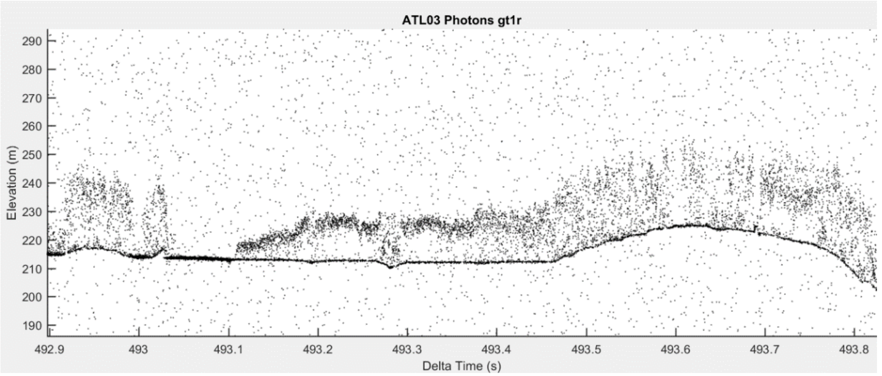
By the numbers

- 2,088 days on orbit
- Spacecraft remains operating ~~nominally and within requirements~~
- 1,729,259,800,000 shots (through March 8, 2024)
- 22,105,699,529,360 photons (through Oct. 26, 2023)
- 8,142,167,207,508 signal photons
- 501 papers published to date
  - 132 papers in 2023
  - 93 papers in 2024 so far

ICESat-2 Data

The ATL03 data product

- Contains
  - Latitude, longitude, and elevation for photons telemetered from ATLAS
  - Photon classifications for different surface types
  - Tides and atmospheric corrections
  - Instrumental parameters
- Advantages:
  - Every photon is there, and every parameter
- Disadvantages:
  - Same as advantages: This is a large and complex product
  - ~15 Trillion photons and counting
- Use it if:
  - You want to understand where other products come from
  - You want to look at surfaces at a smaller scale than that resolved on higher-level products
  - You have lots of storage space and lots of time
  - You love working in AWS!



ICESat-2 Data

- Aggregate photons over either a fixed length scale, or fixed number of ATL03 signal photons
  - E.g land and vegetation (ATL08: 100m or 20m); land ice (ATL06: 40m)

- Atmospheric profiles over the lowest 14 km of the atmosphere in 30m bins (ATL04 and 09)
  - Identify cloud layers

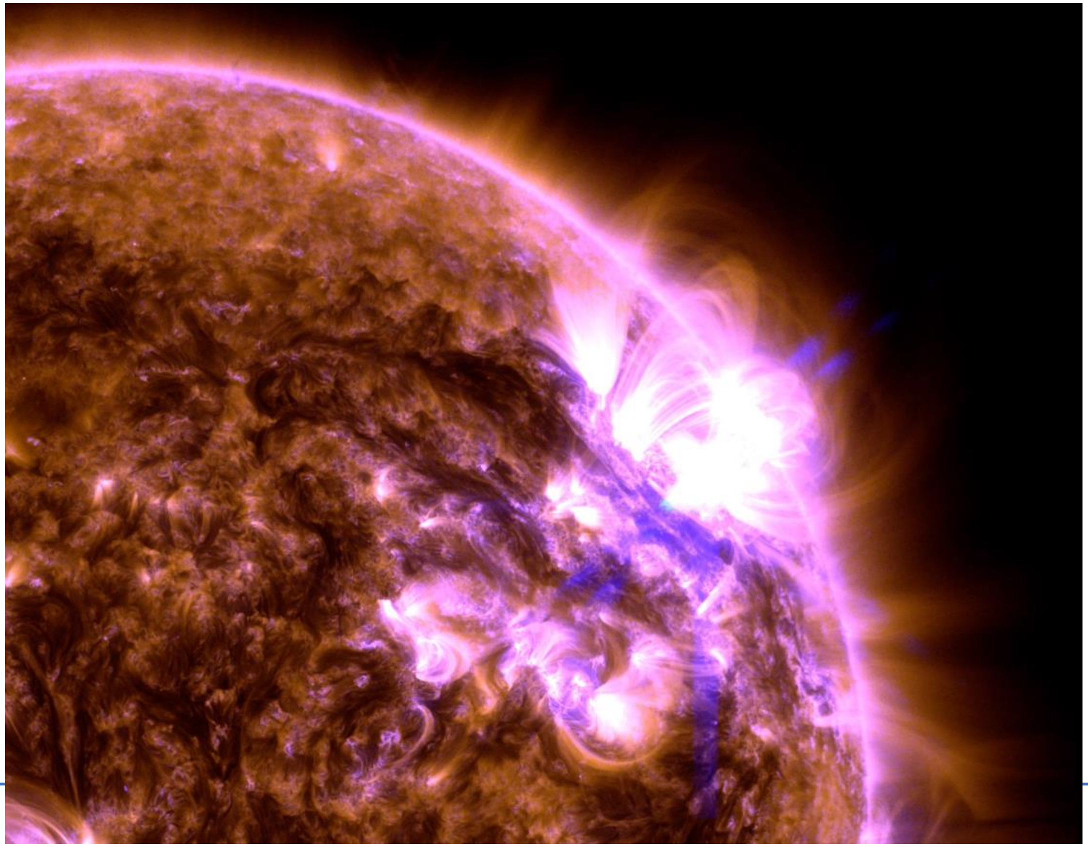
- Signal photons are used in surface-specific algorithms. Level-3a
  - Land and vegetation (08), ocean (12), land ice (06), sea ice (07, 10), and inland water (13)
  - All are available through the National Snow and Ice Data Center (nsidc.org)

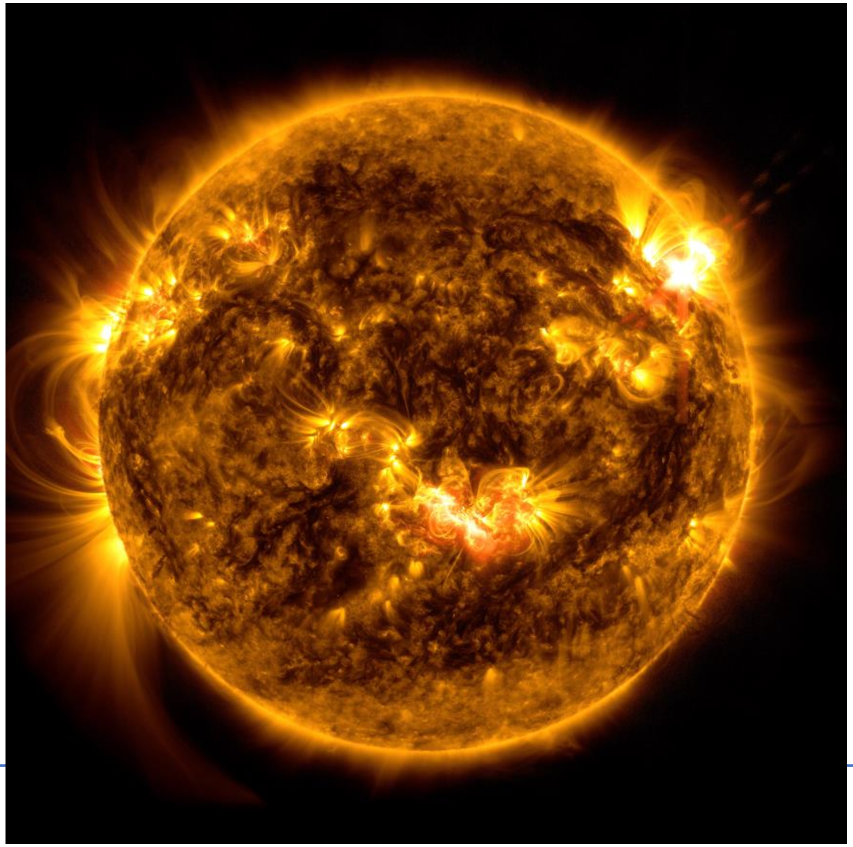
- Gridded products combine many along-track data granules. Level 3b
  - Gridded sea ice freeboard (ATL20)
  - Gridded atmospheric profiles (ATL16 (weekly) or ATL17 (monthly))
  - Gridded sea surface height (ATL19)
  - Gridded ice sheet elevation and change (ATL14 and 15)

Current Status

May 8th

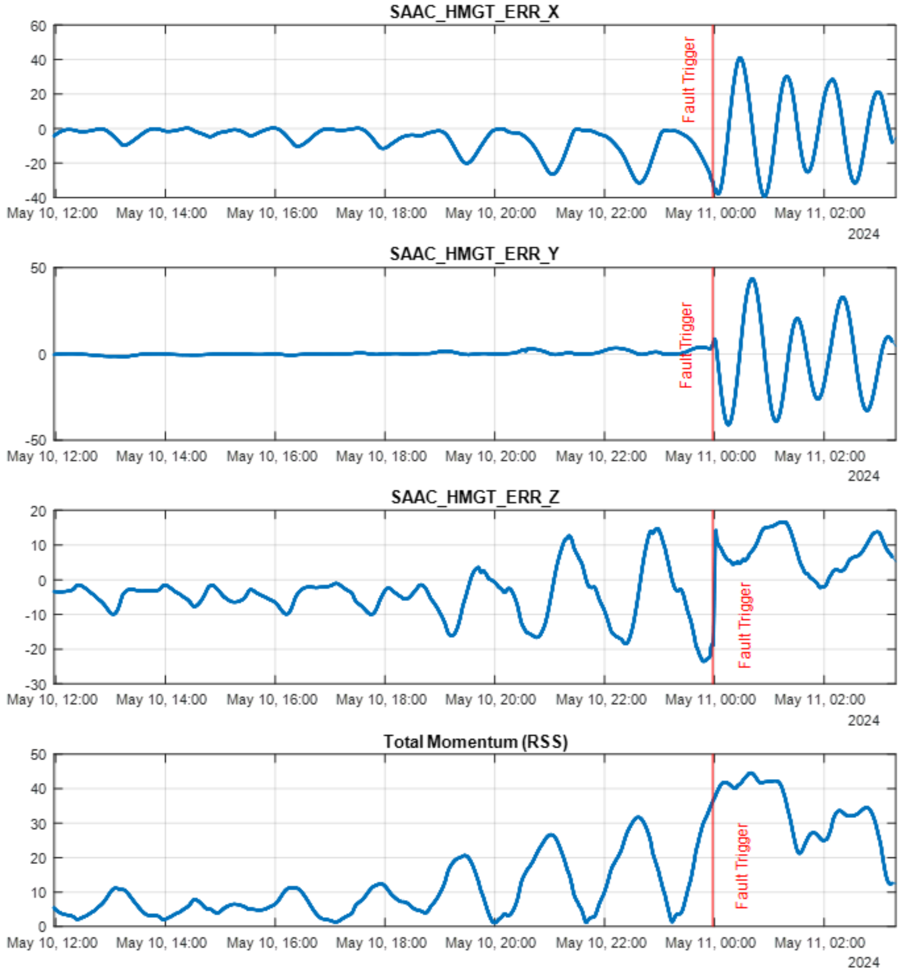
Most powerful solar storm since May 1989!





Current Status

- Additional drag from the storm caused system to exceed momentum threshold in attitude control system.
- Safehold from 10 May through about 15 May.
- Team is revisiting that threshold, but to be fair, this storm was the strongest in 23 years.



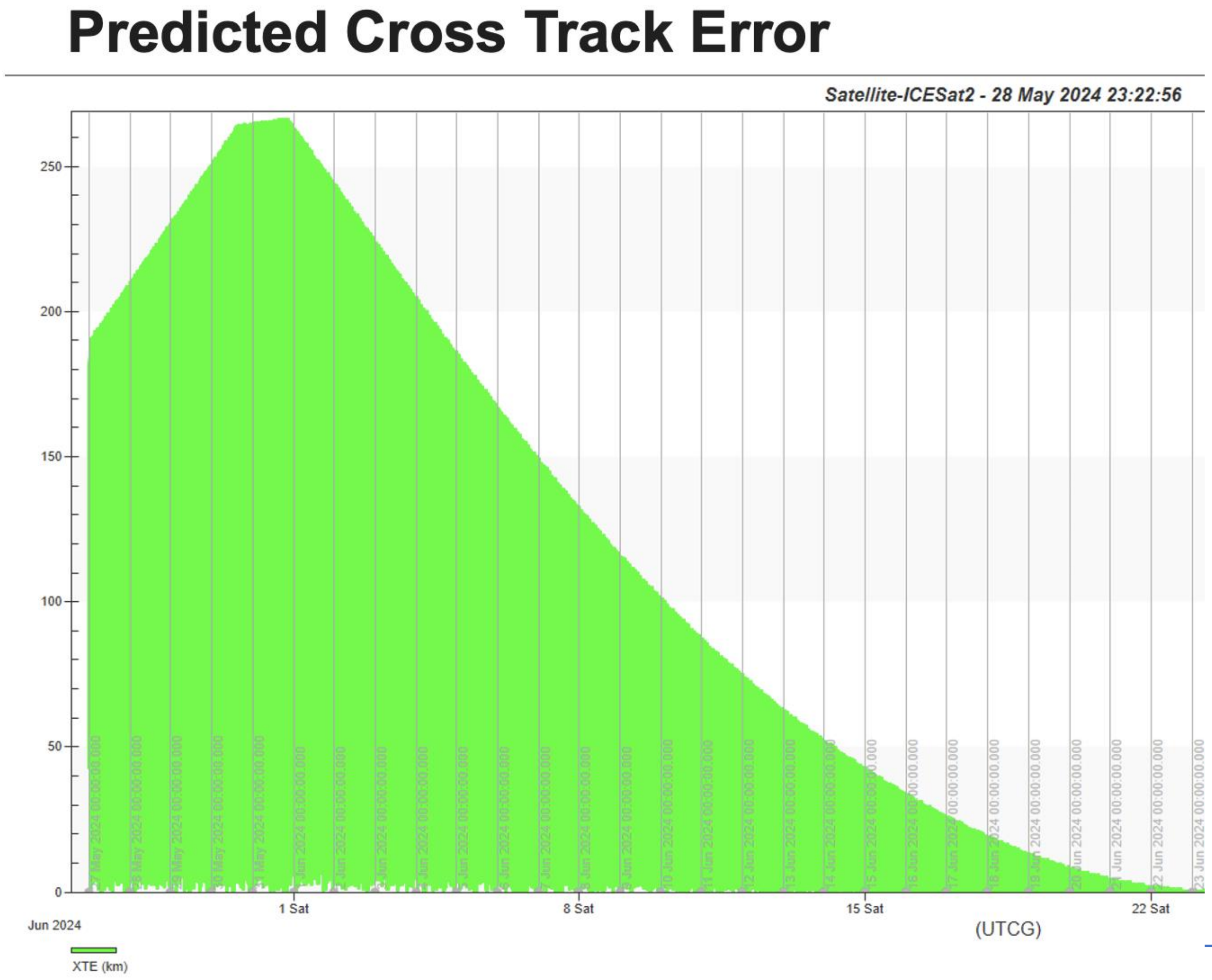
Current Status

Position requirement is +/- 4 km about the Reference Ground Track.

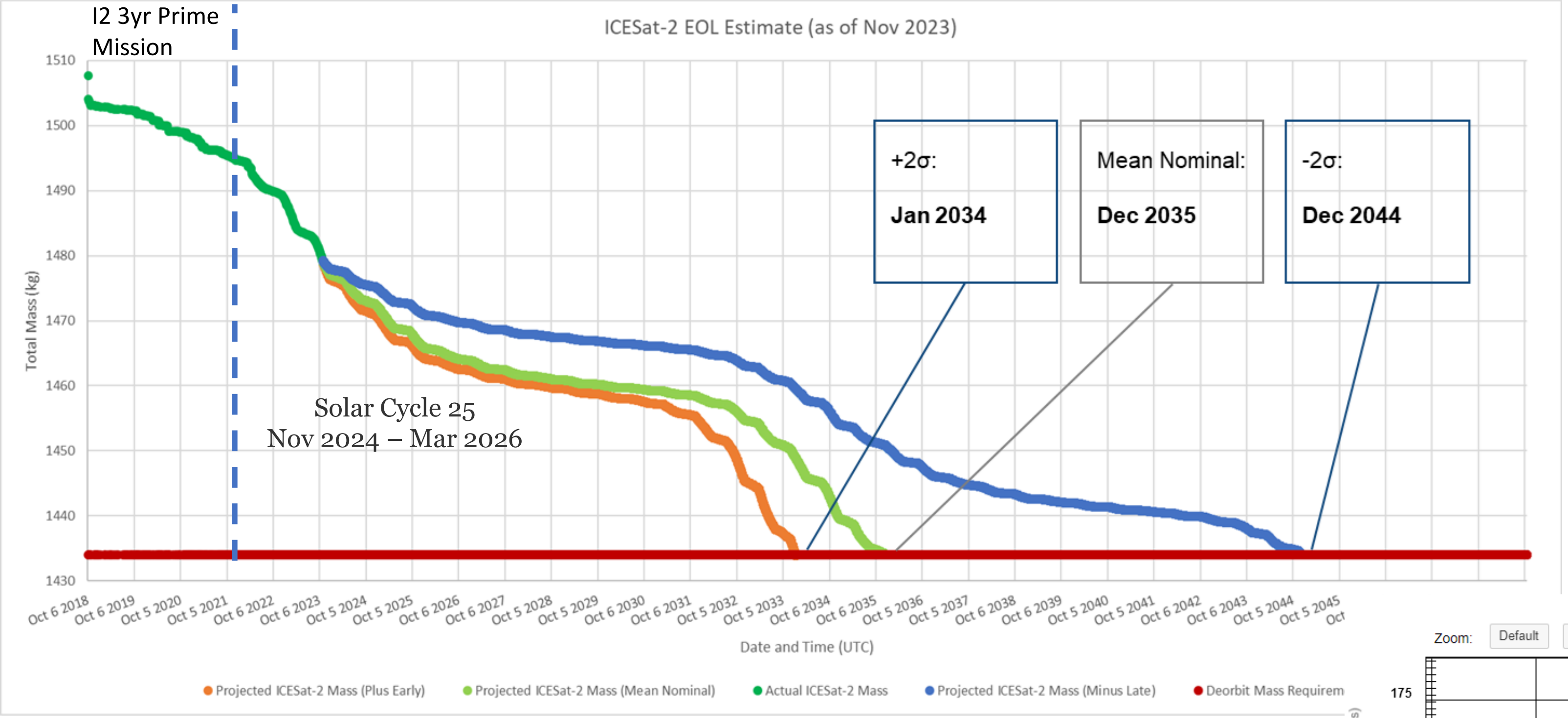
As of Monday 27 May, we were about… 180km off and drifting. Mostly due to being too low by 6km!

FDS is planning two sizeable maneuvers this week. One to stop going the wrong direction (down), one to push us back in the right direction.

Should be back to science by ~20 June.



Outlook



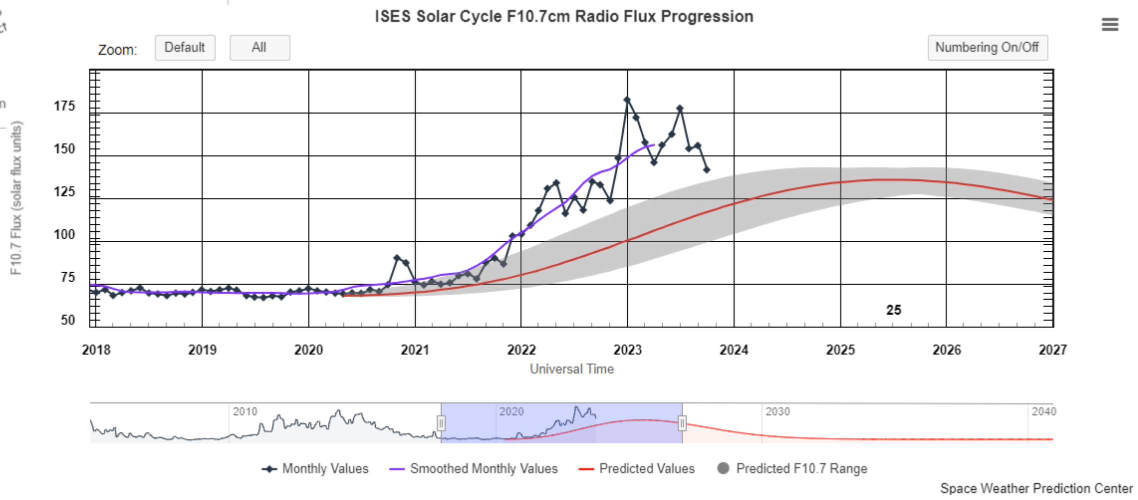
Mean Nominal EOL:

was: Jan 2036

now: Dec 2035

+2 sigma:

Jan 2034



We will be revisit these outlooks in the coming months

Outlook

- Rosy? Greeny? It looks ~~pretty good~~!
- Joint meeting with CryoSat-2 and spin-up of collaborative projects
  - September 23-27 in Iceland: https://www.cryo2ice-symposium.org/
  - Cryo2Ice final adjustment to Arctic alignment
- Onward to Release 007!
  - Beam-to-beam height offset corrections in ATL03g and ATL03
  - Pitch and range combined solution
- Reminder: for field campaigns or specific tracks of interest please let us know at least 3 weeks in advance to ensure operation in science mode

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