On Orbit Results of the PicSat Mission

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Lessons learned from the short-lived Picsat Mission (Jan 12, 2018 – Mar 20, 2018)

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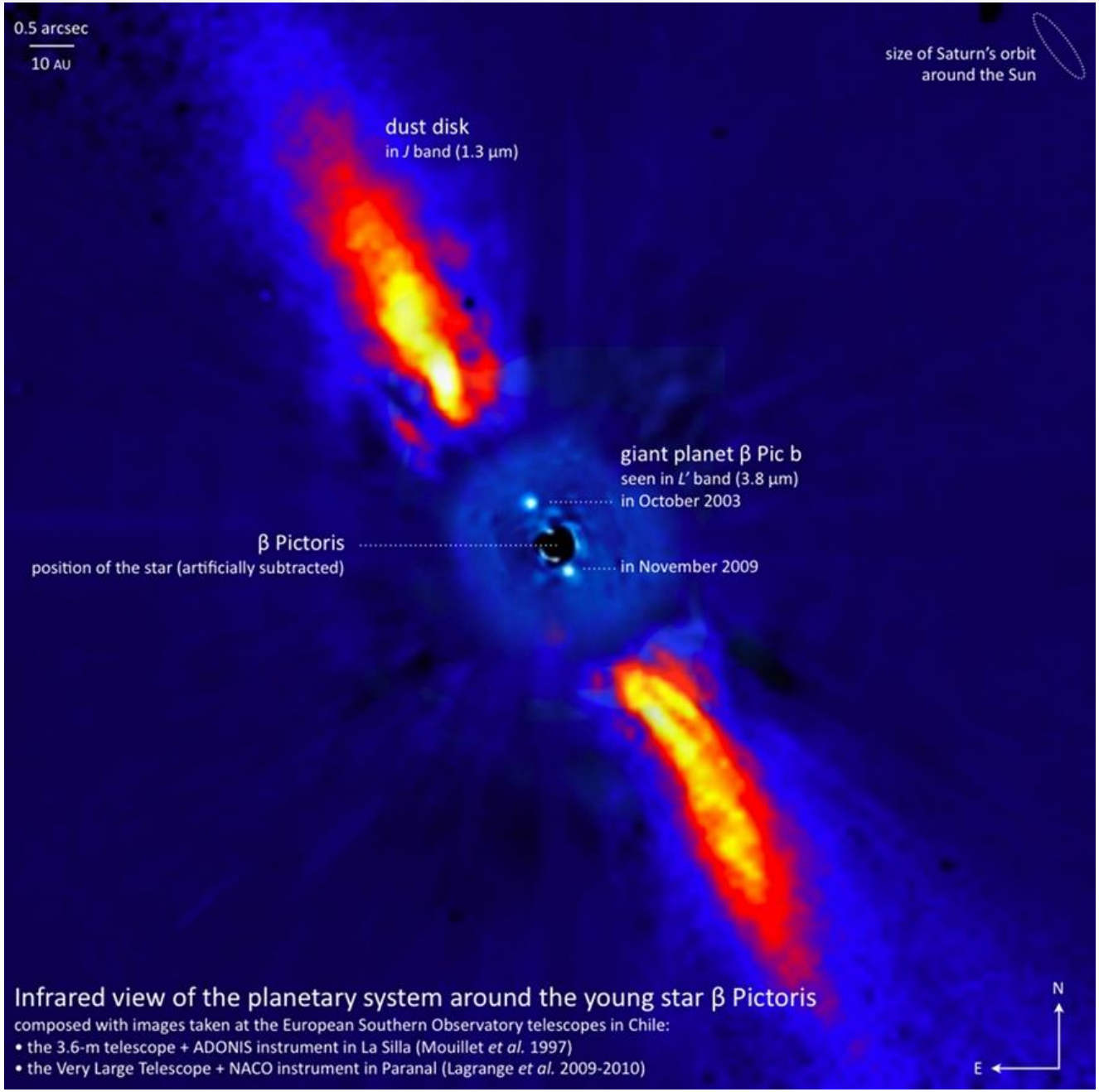
Beta Pictoris:
- bright star (Mv = 3.86)
- very young (< 20 Myr)

Science objectives: The Beta Pictoris Sytem



Science objectives

Main objective of PICSAT: constant monitoring of the photometry of Beta Pic, at ~100 ppm/hour accuracy to detect the transit (predicted for early 2018)

- Characterize the Hill Sphere
- Detect any orbitting material (rings, moons, if any)
- Inohomogeneities in the disk
- Detect exocomets in visible band

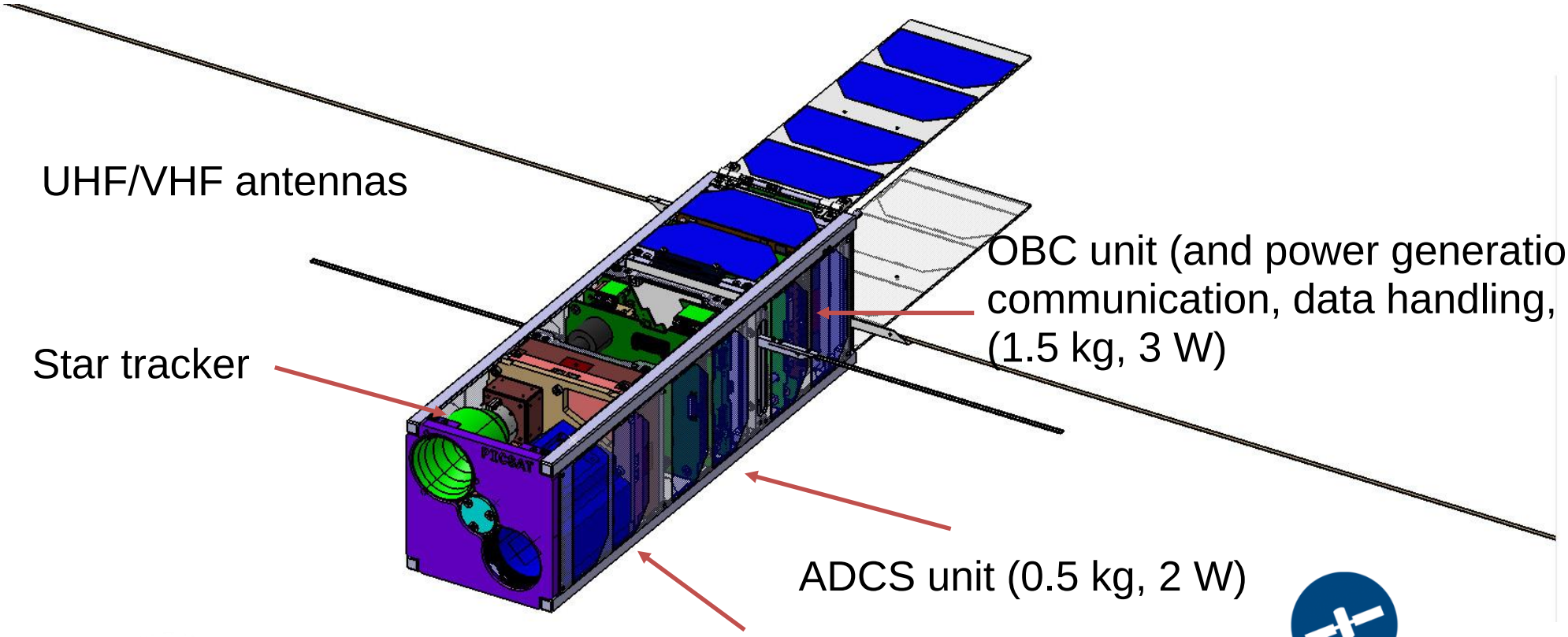
Tech demo:

- Demonstrate our ability to inject starlight in a single mode fiber

Mission overview: satellite

Innovative Solutions In Space

Solar panels
on all sides + 4 deployable units)



HYPERION TECHNOLOGIES

Mission overview: ADCS

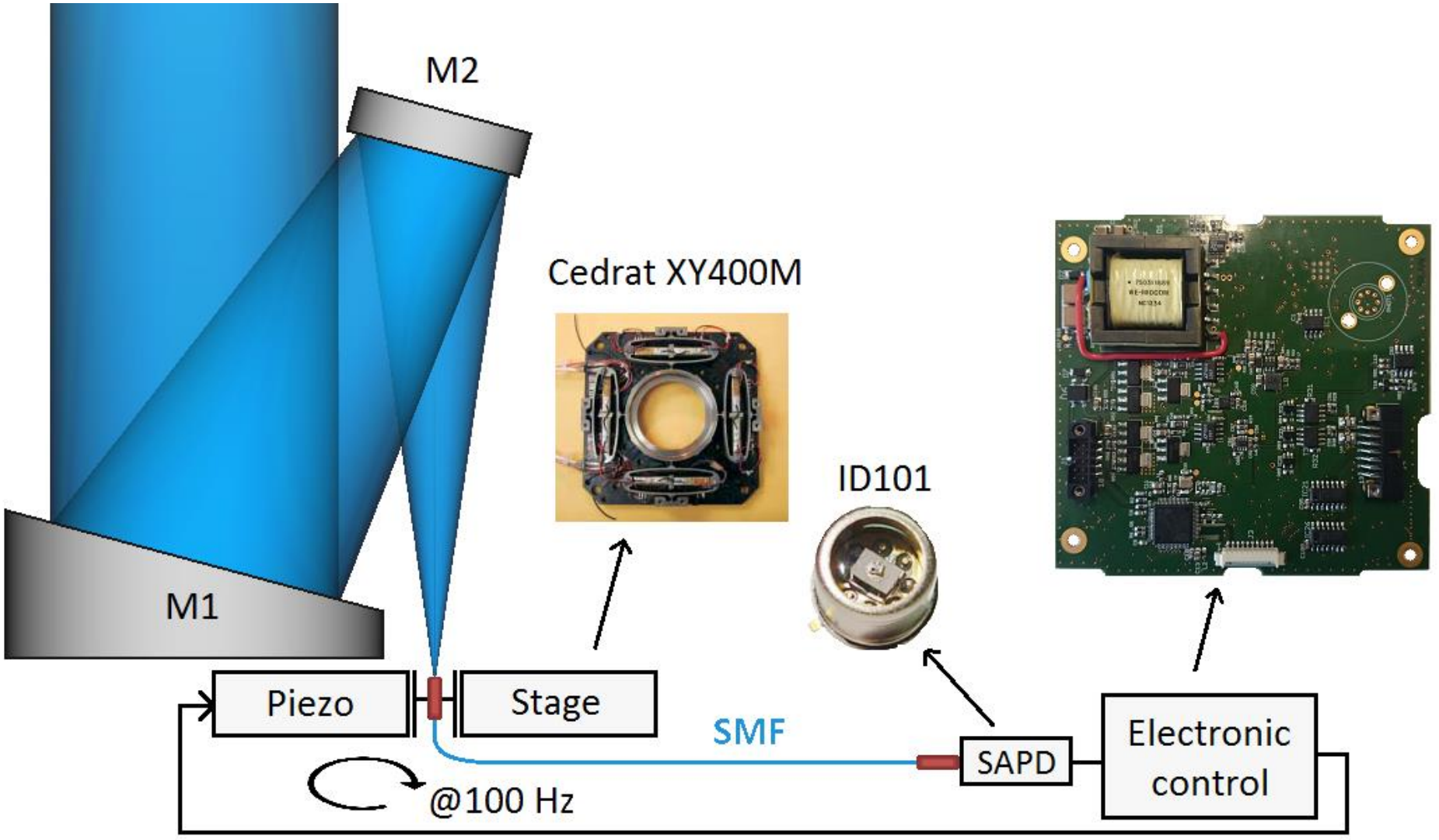
ADCS requirements from science mission:

- Detumbling (beginning of mission)
- Target pointing on beta pic (0.1 deg accuracy)
- Allocated power: 2W

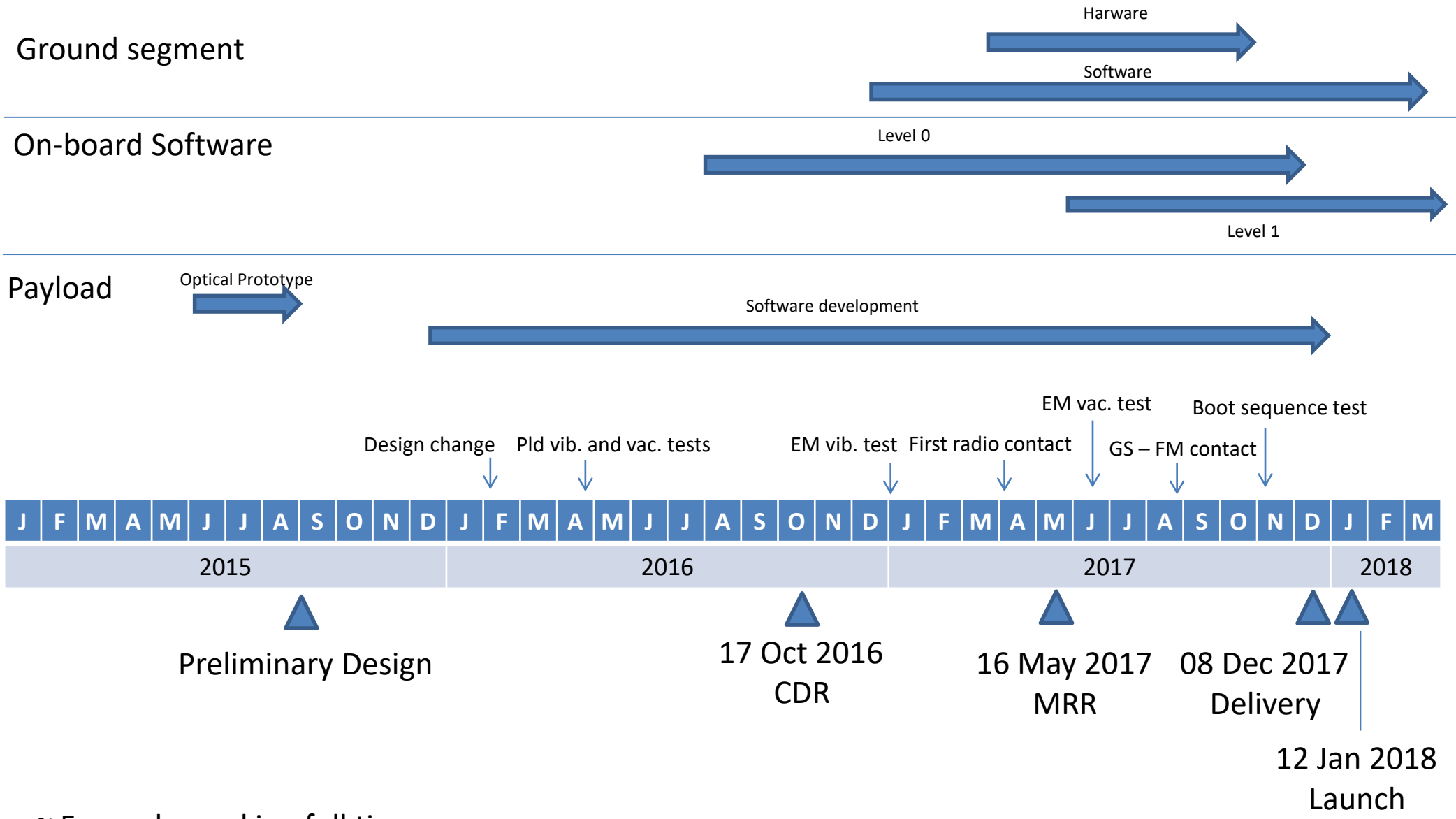
iADCS100 from Hyperion Technologies

- 3 axis control, with reaction wheels + mag. torquers
- includes built-in ST200 star tracker (30 arcsec accuracy)
- 1.4 W power consumption (nominal)
- ‘’Fully autonomous, highly integrated system’’
- ‘’Target pointing, nadir pointing, sun-pointing, de-tumble’’

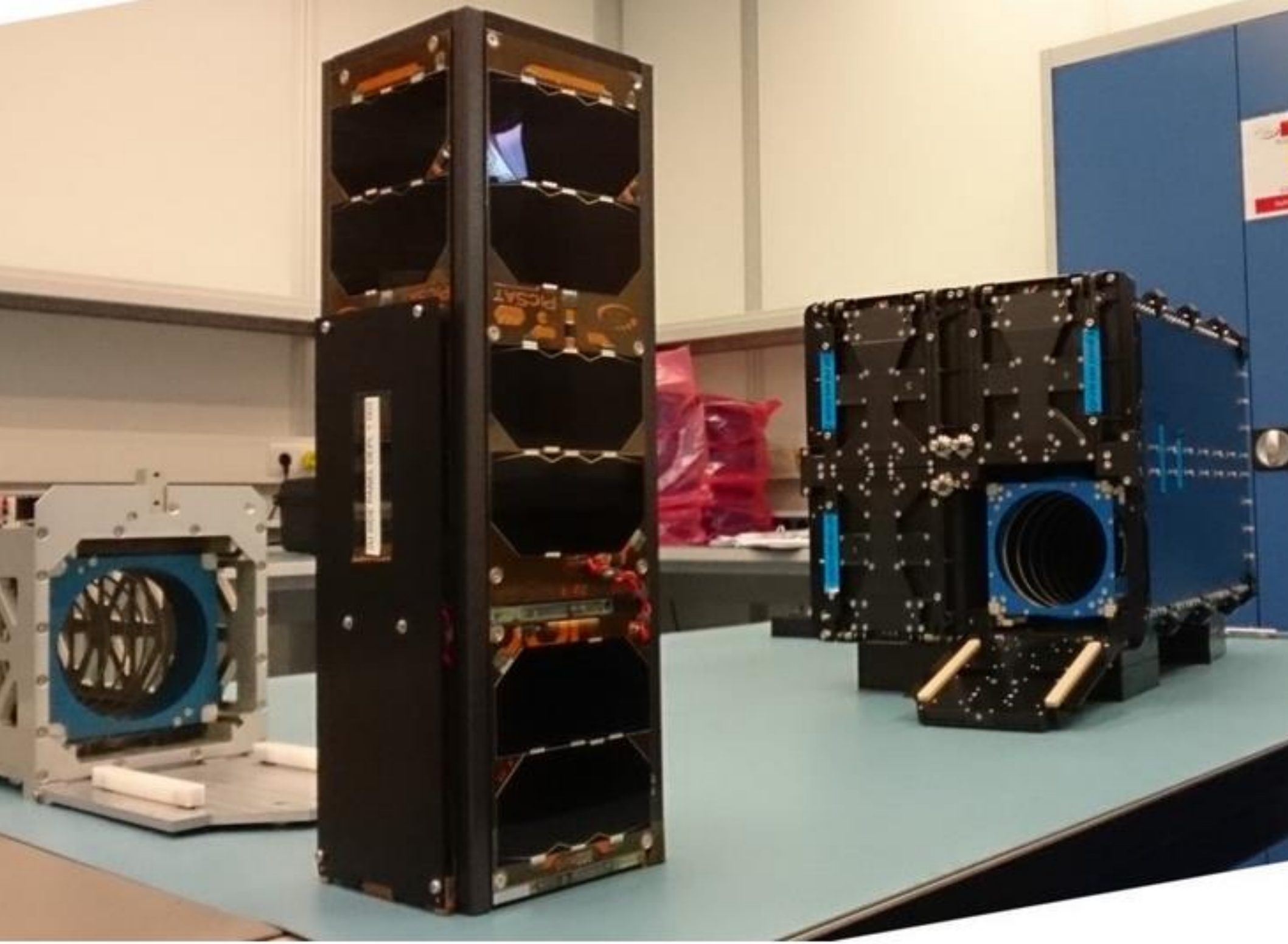
Mission overview: science payload



Mission overview: development timeline

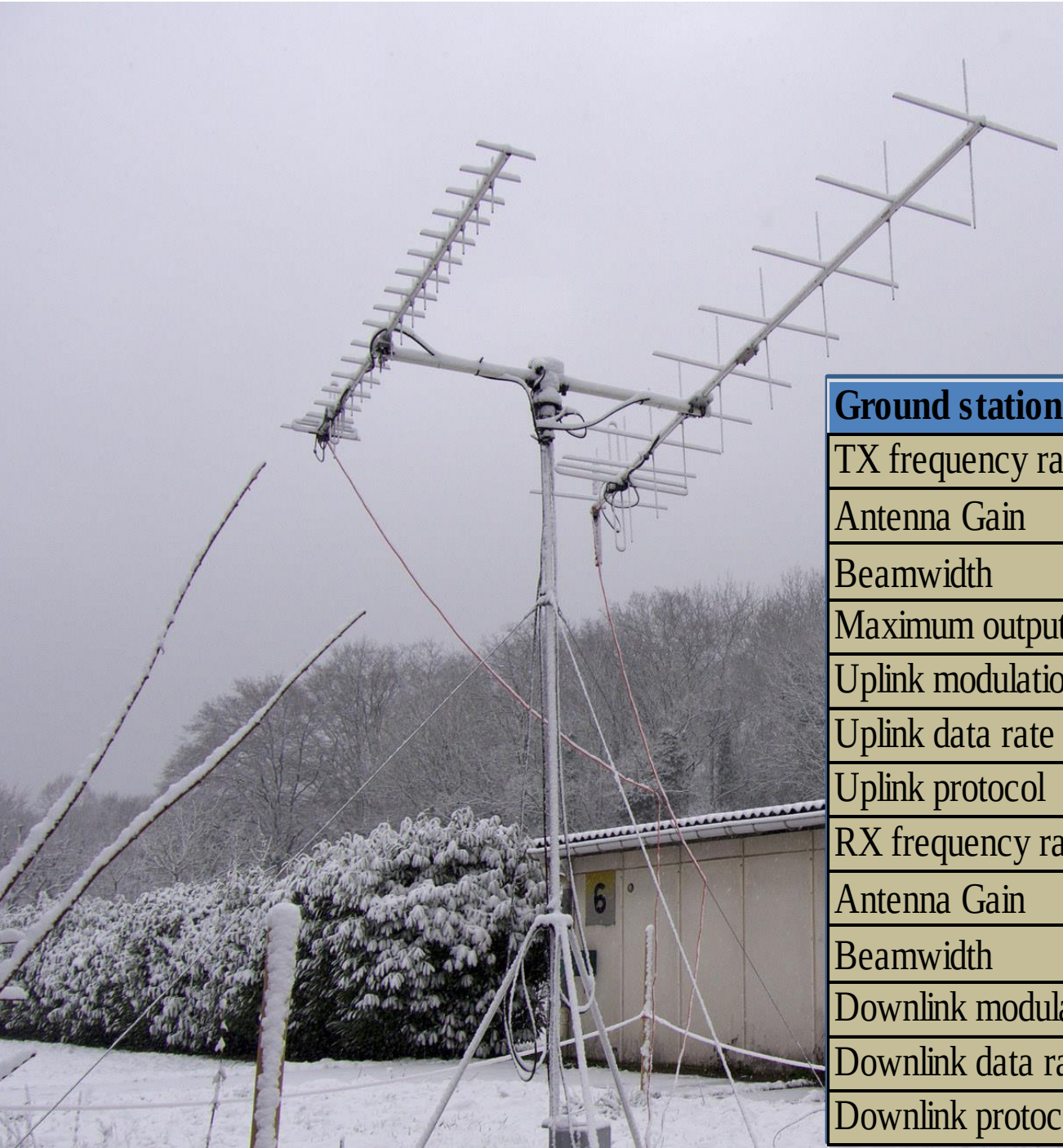


~ 5 people working full time


PCSAT

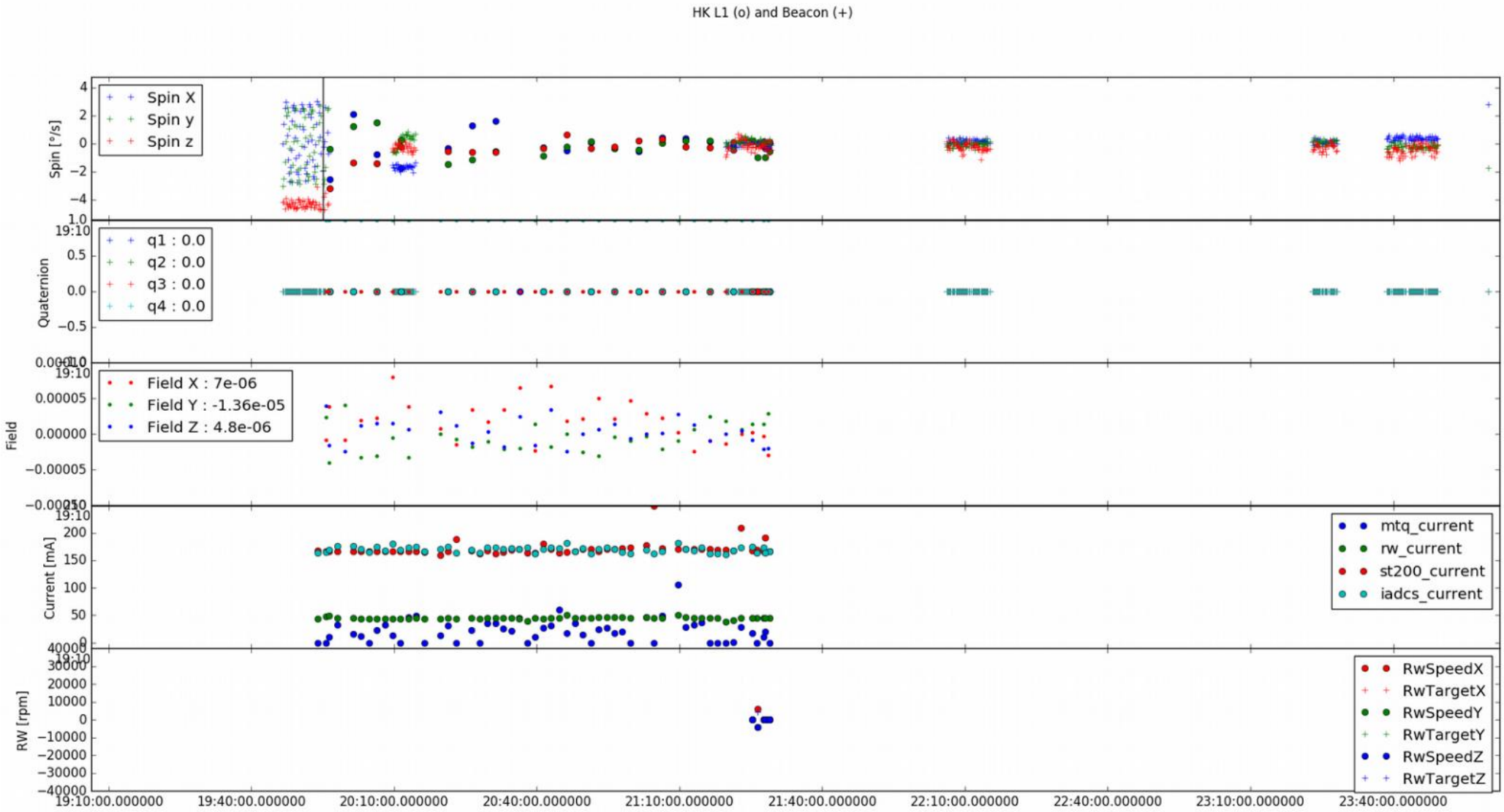
Launch on the PSLV-C40
January, 12, 2018

Operations: UHV/VHF ground station

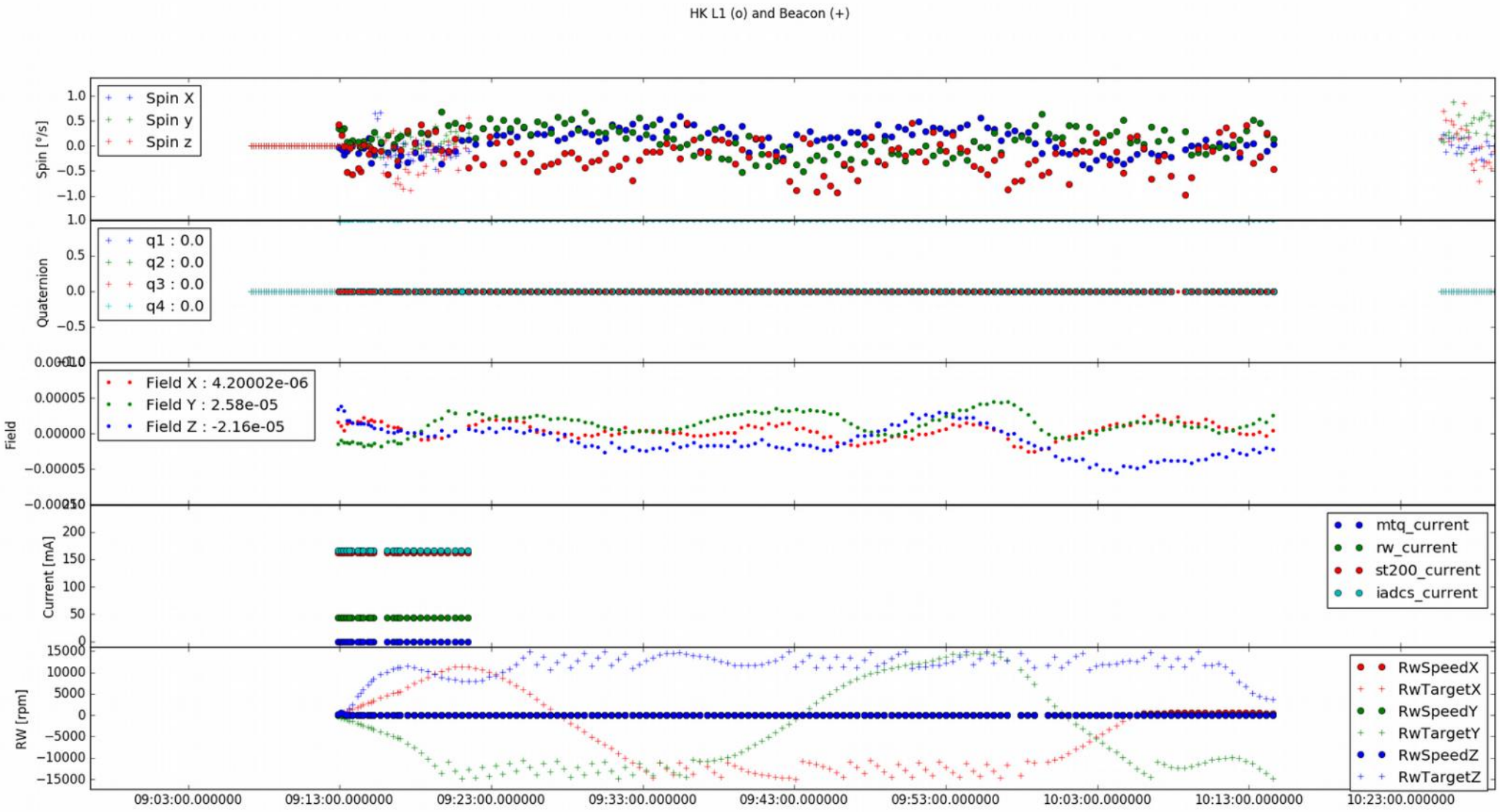


Ground station specifications	
TX frequency range	145,910 MHz (VHF)
Antenna Gain	12.3 dBi (VHF)
Beamwidth	38° (VHF)
Maximum output power	20dBW
Uplink modulation	AFSK
Uplink data rate	1200 bps
Uplink protocol	AX.25
RX frequency range	435,525 MHz (UHF)
Antenna Gain	14.1 dBi (UHF)
Beamwidth	39,7° (UHF)
Downlink modulation	BPSK - G3RUH scrambling
Downlink data rate	1.2-9.6 kbps
Downlink protocol	AX.25

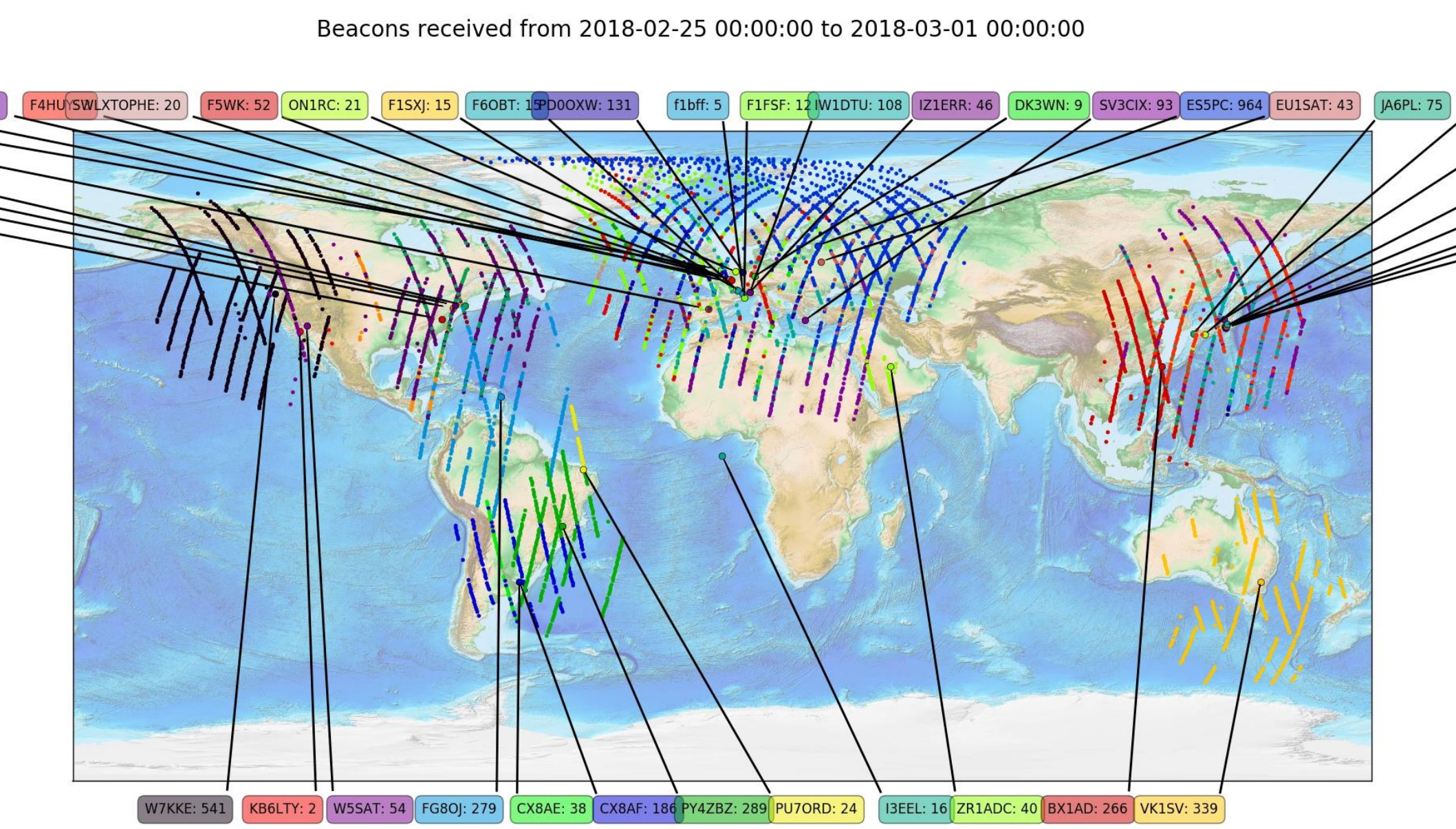
Operations: detumbling



Operations: ADCS (not) pointing



Operations: what happened on March, 20?



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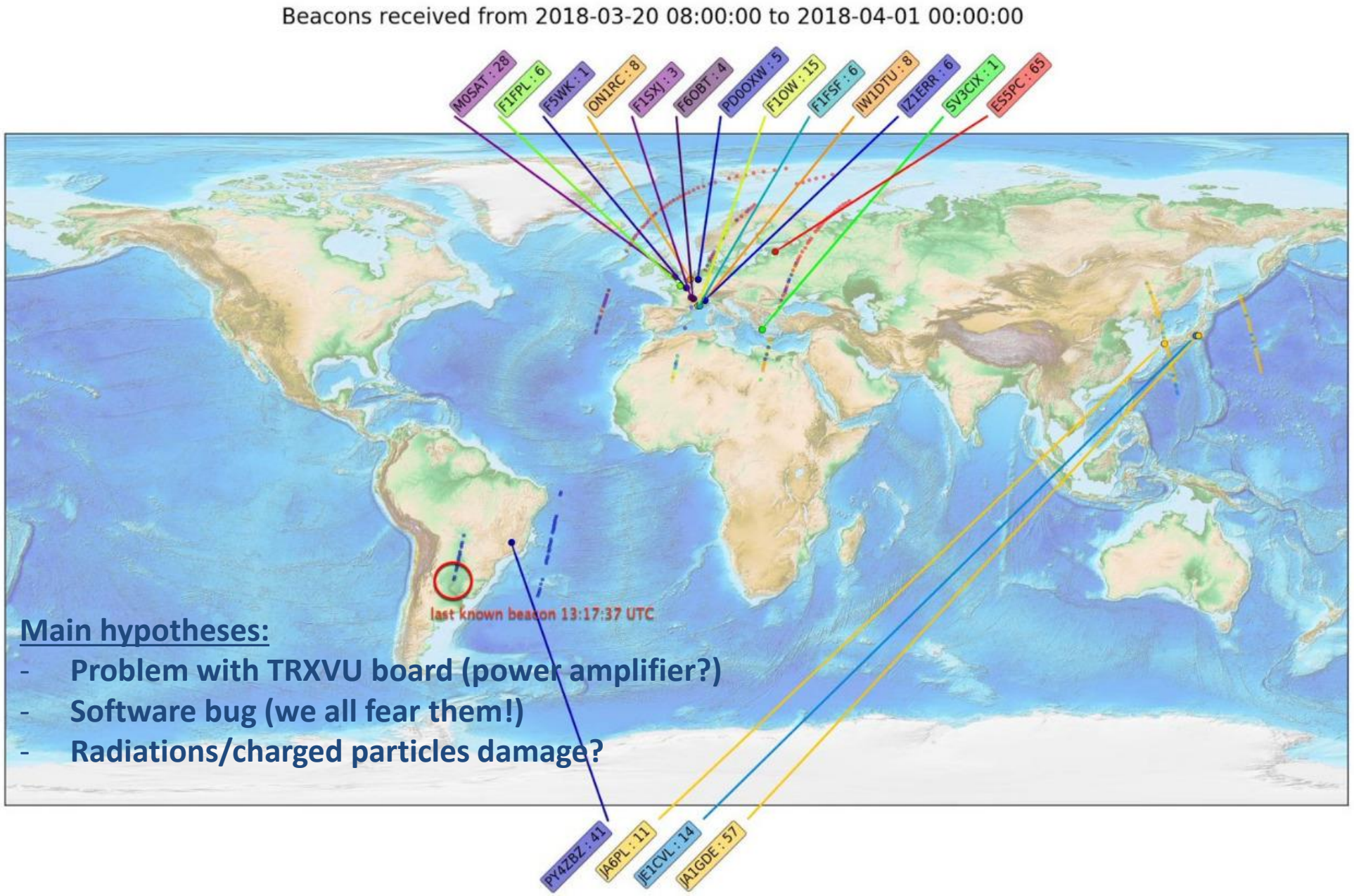


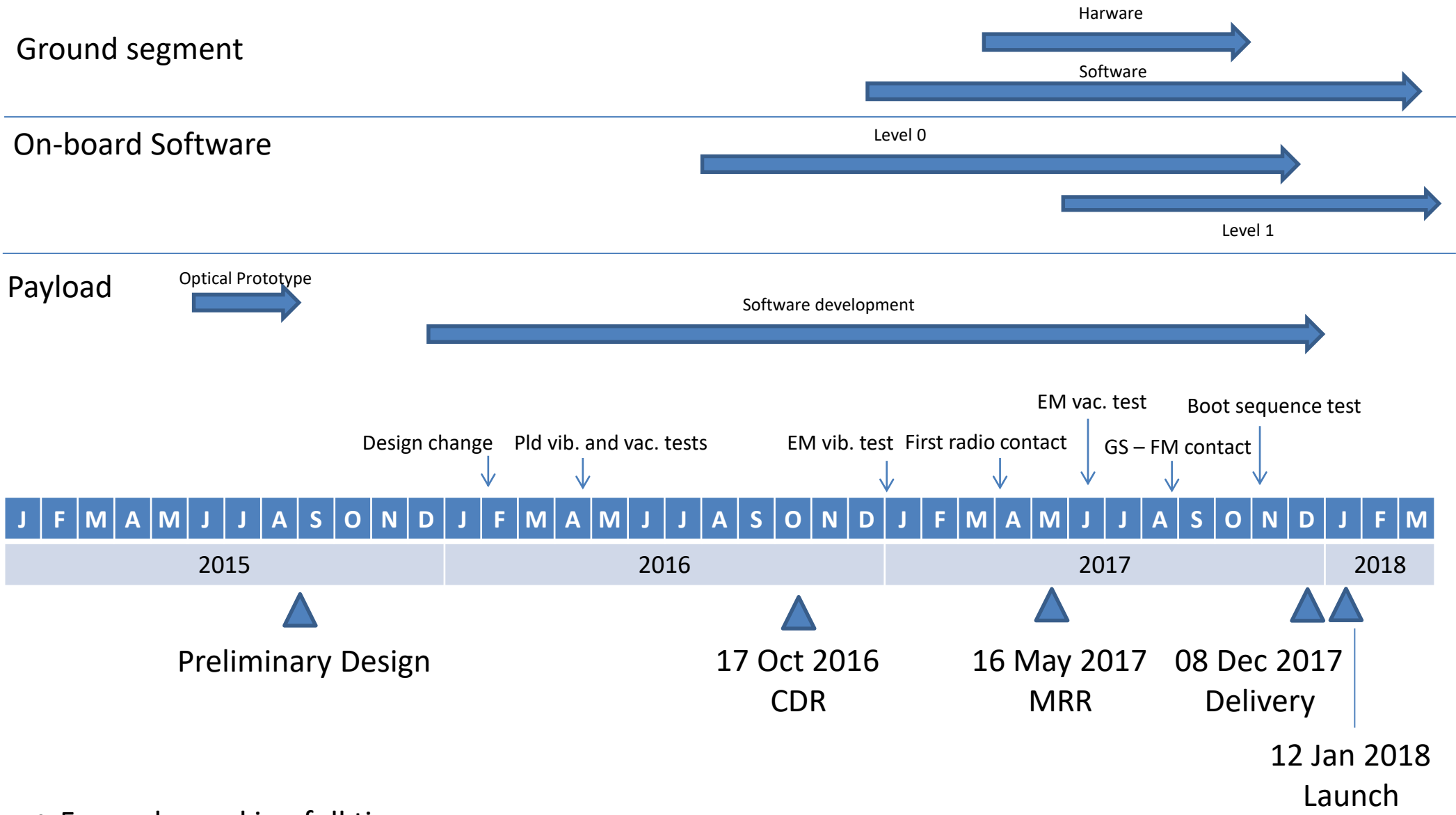
Main hypotheses:

- **Problem with TRXVU board (power amplifier?)**
- **Software bug (we all fear them!)**
- **Radiations/charged particles damage?**

Lessons Learned

- Development time, documentation, and reviews

Mission overview: development timeline



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Lessons Learned

- Development time, documentation, and reviews
- Do not underestimate the software (satellite, payload, ground segment, database, data reduction pipeline, visualization tools, etc. etc.)

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- Development time, documentation, and reviews
- Do not underestimate the software (satellite, payload, ground segment, database, data reduction pipeline, visualization tools, etc. etc.)
- How to test highly integrated systems?

Trying to test the ADCS