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Four years (almost) of SwissCube operations

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Swiss Space Center
August 10, 2013
Small Sat pre-Conference Workshop.

Question

- Cubesat projects have been extremely popular in the last 10 years in many universities. These projects have a great reputation for **educational** and **technological** goals.
- Question for this presentation:

-Is it possible to to implement scientific experiments with Cubesats?

- Outline
  - **Introduction for the Swiss Space Center**
  - **Definitions**
  - **Statistics for the last decade**
  - **Zoom into SwissCube**
  - **Wrap up and dicussion**

SwissCube collaboration

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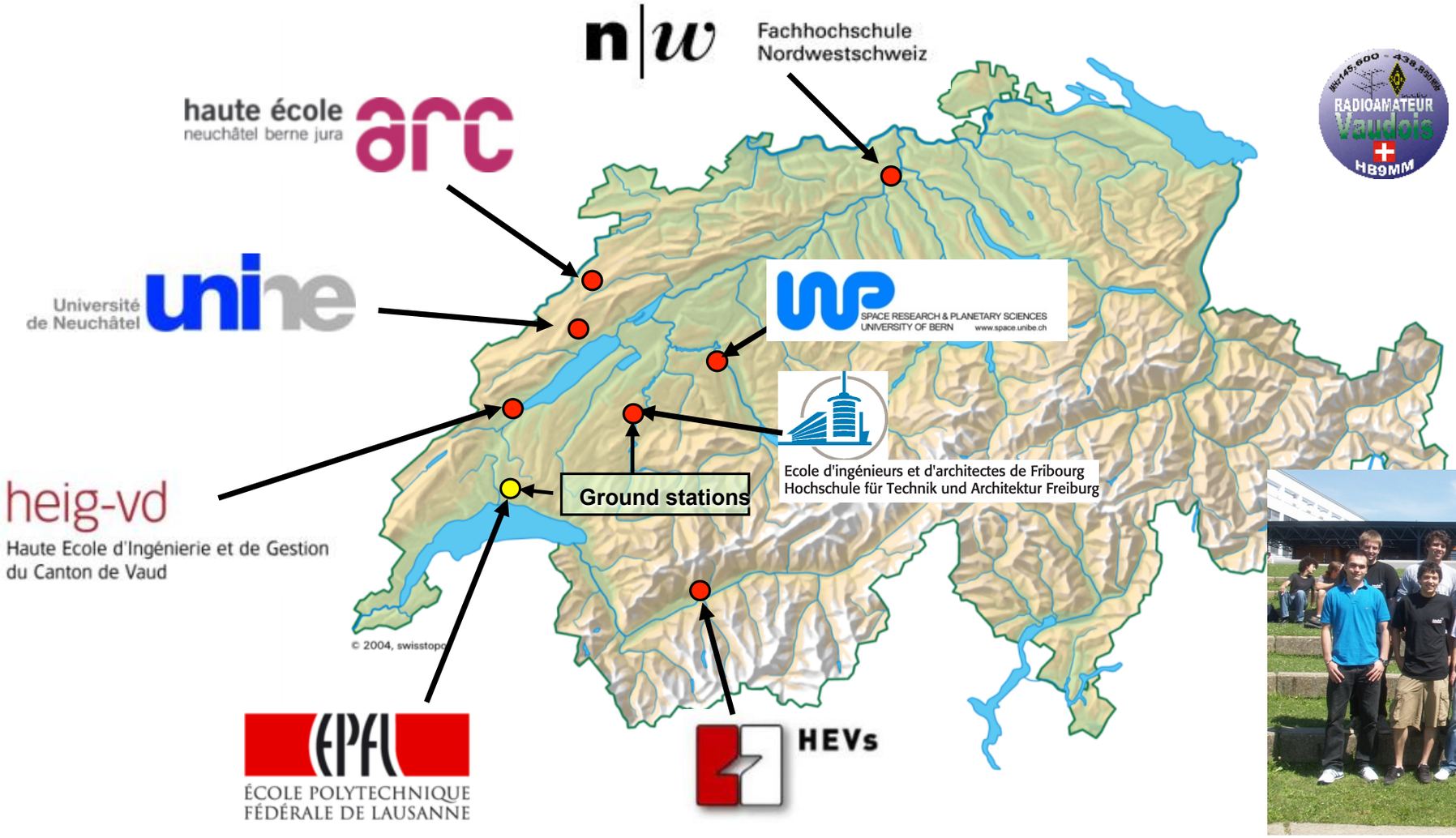

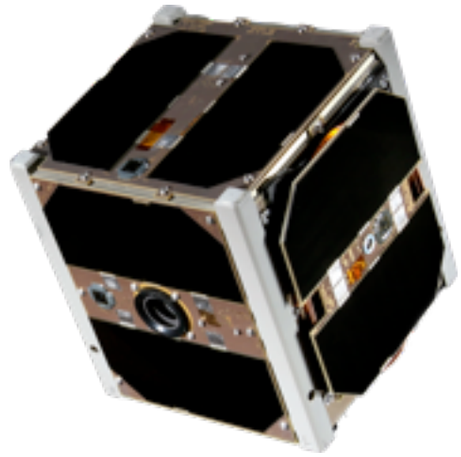

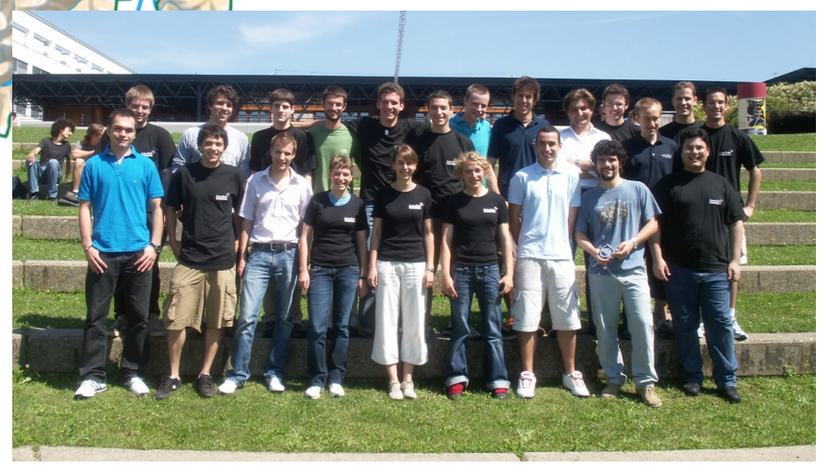

About 200 BS and MS students over 3 years (6 semesters)...
supported by laboratory staff and a good systems engineering team...
about 15 laboratories from 7 CH engineering schools and universities were involved...

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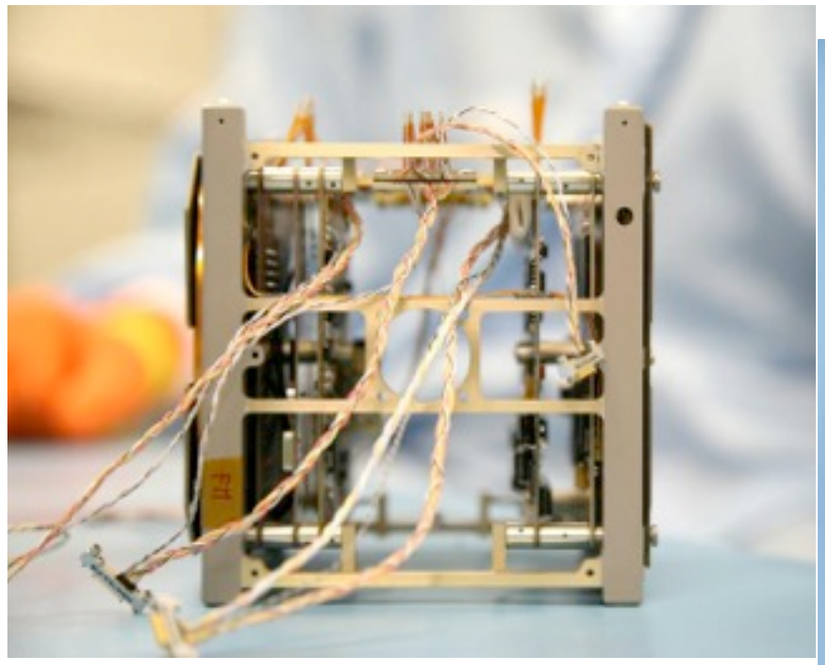
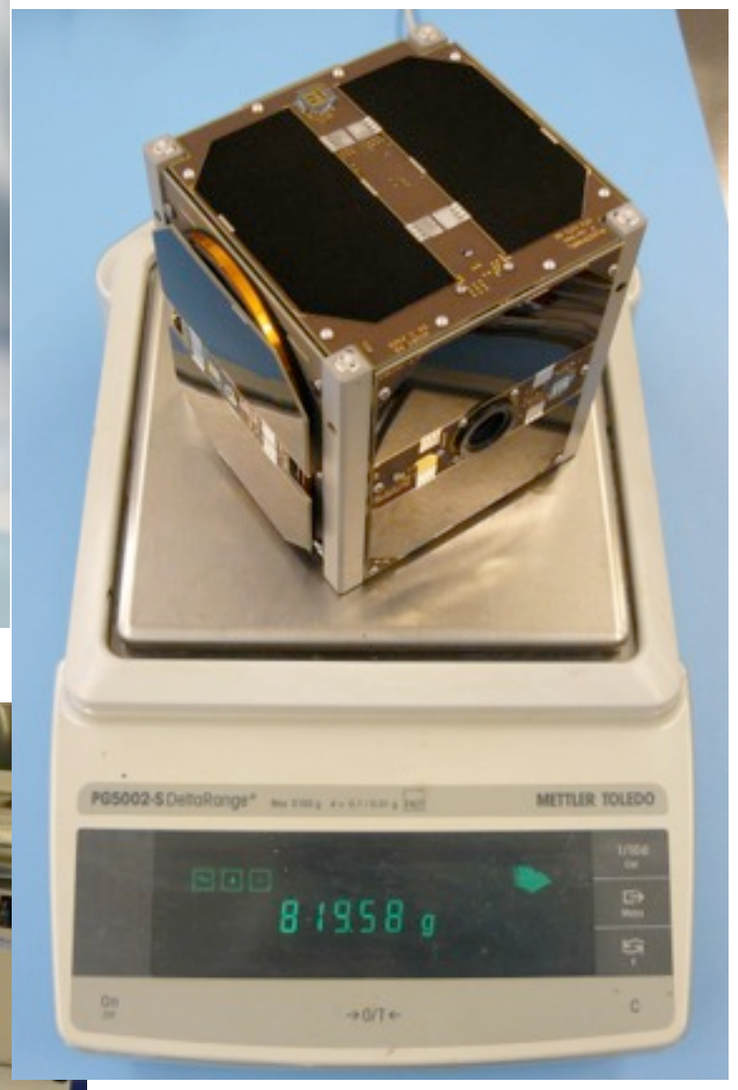
SwissCube: short presentation





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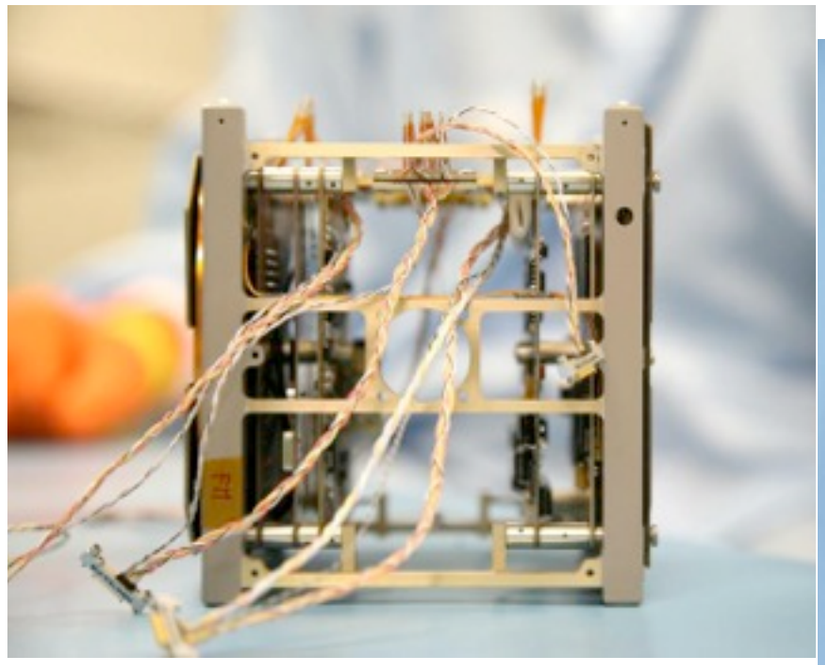
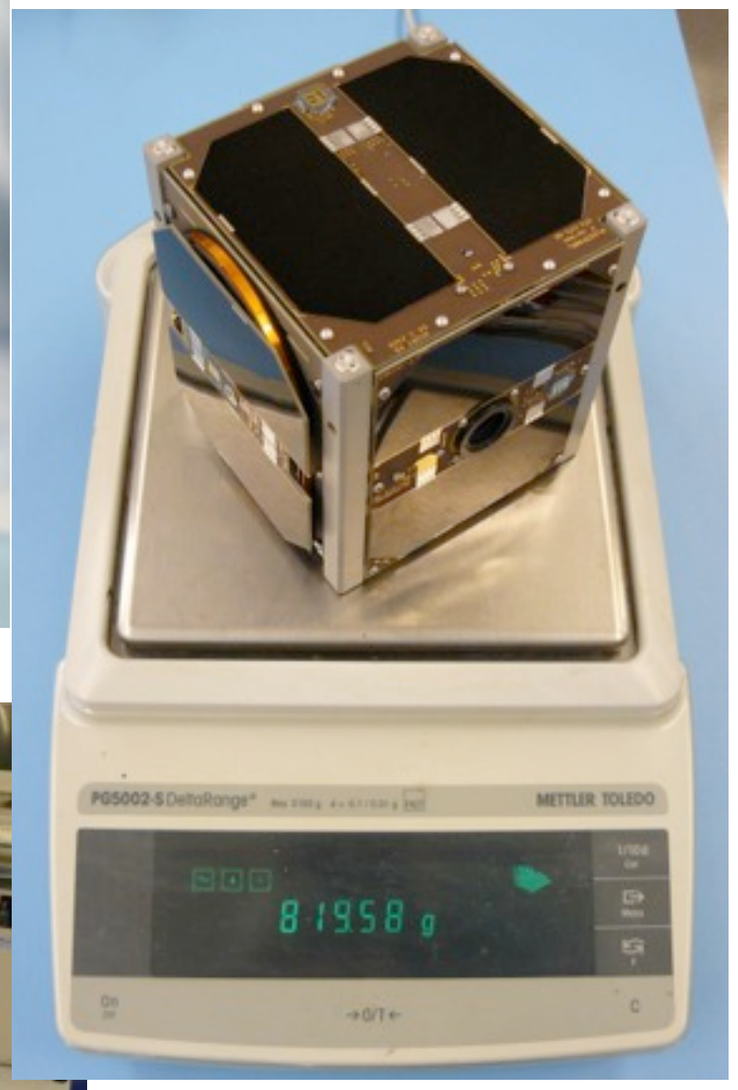
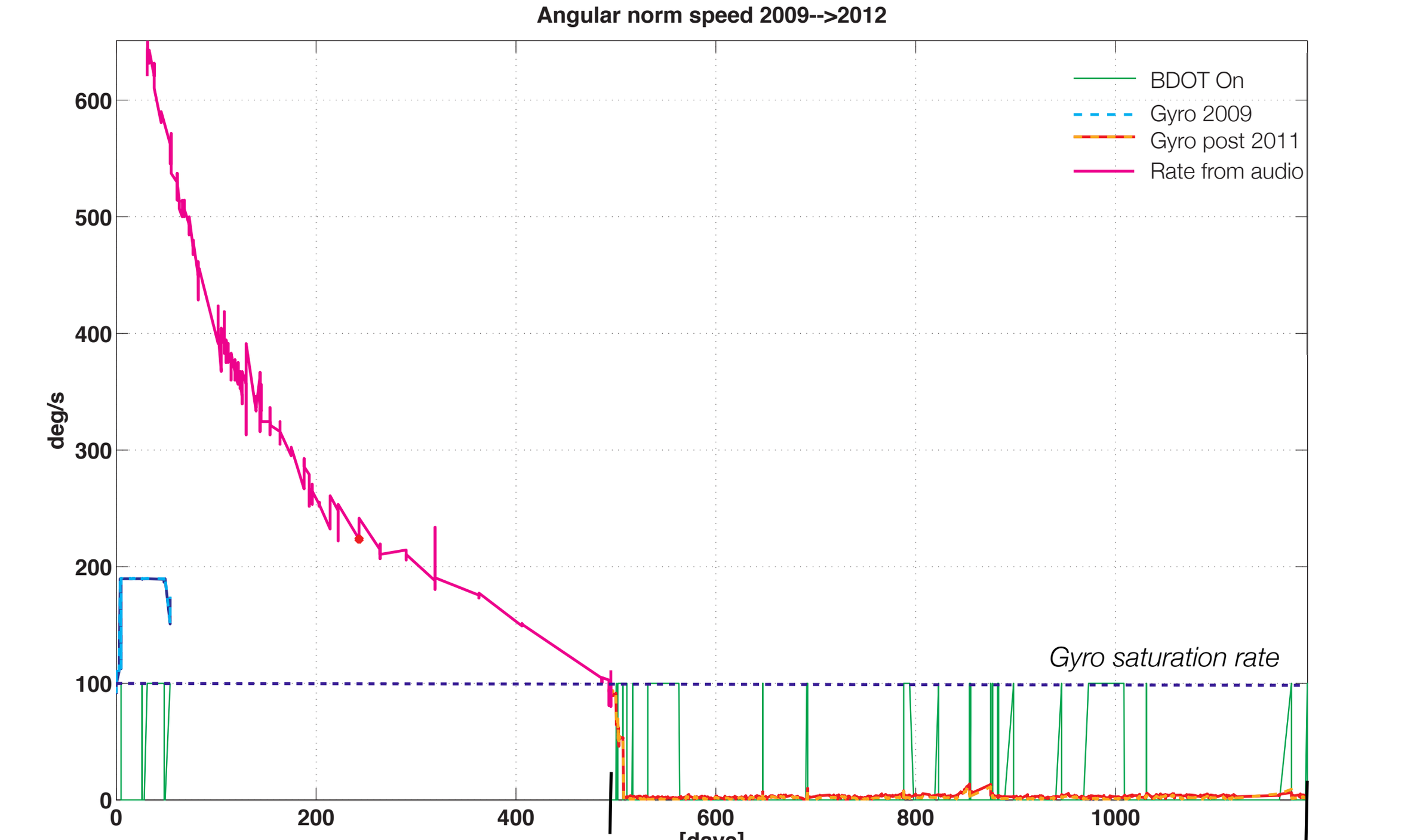
SwissCube: short presentation

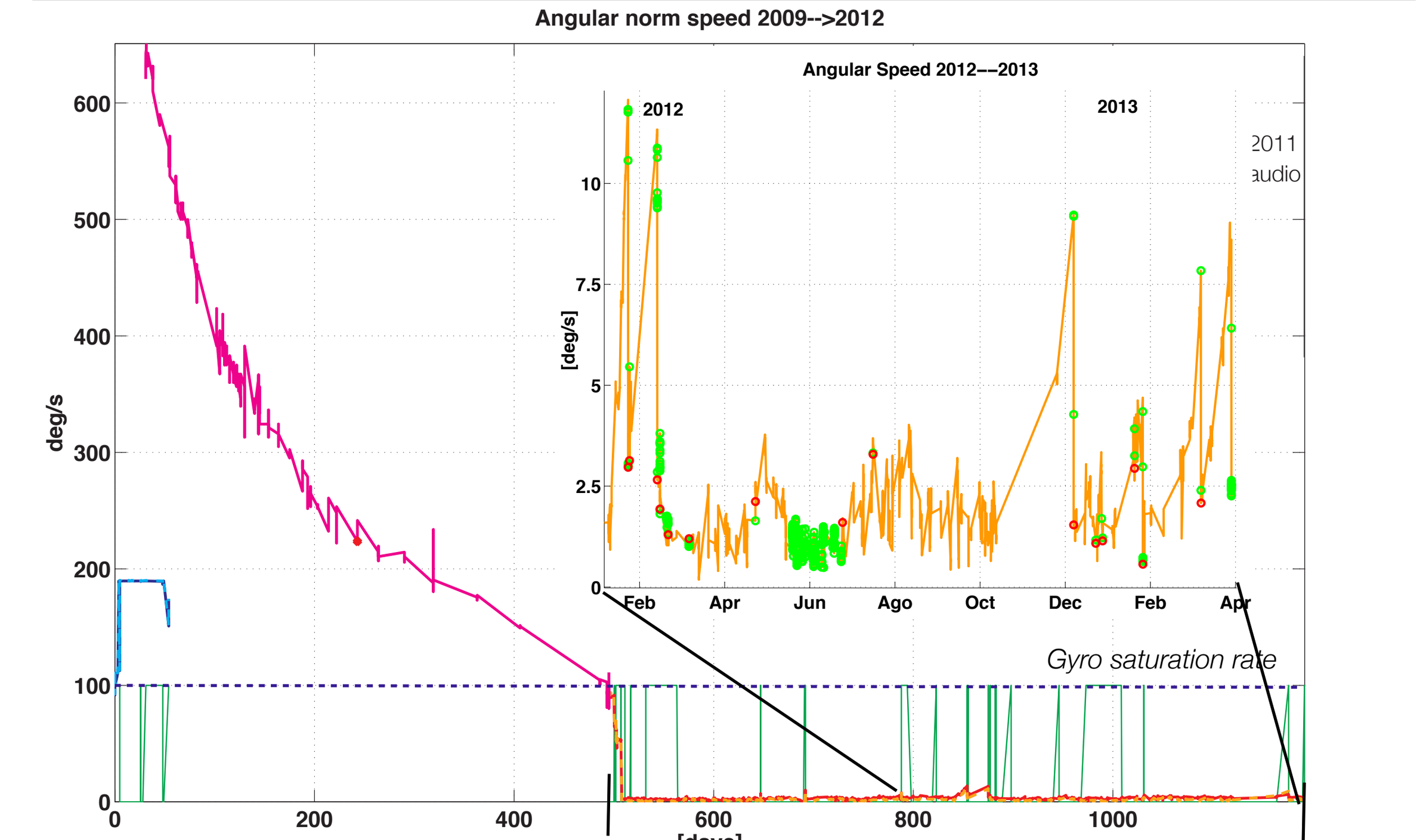




SwissCube results: AOCS



SwissCube results: AOCS



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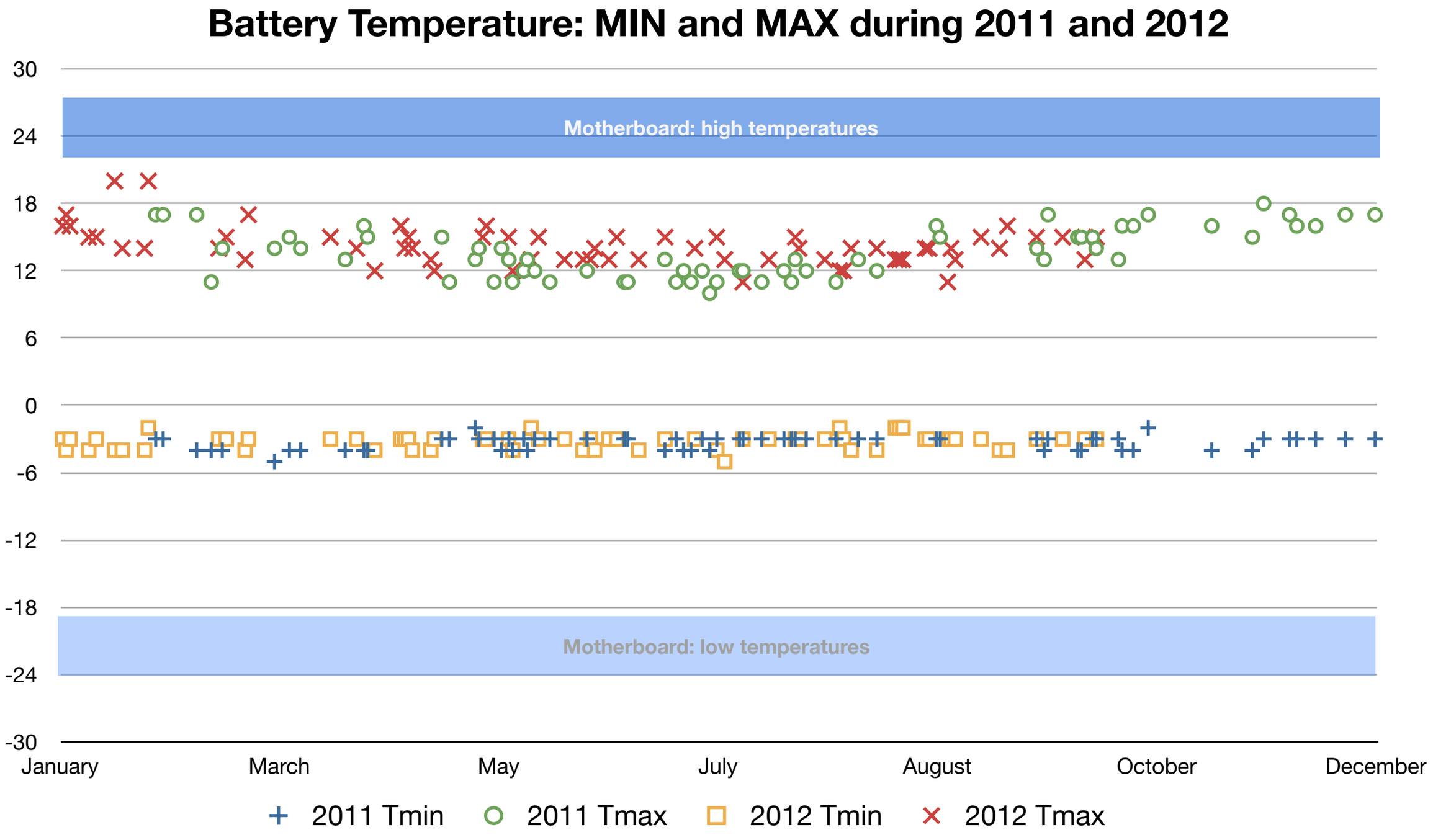
SwissCube results: EPS temperature control



SwissCube, 13-1-2012, the MOON

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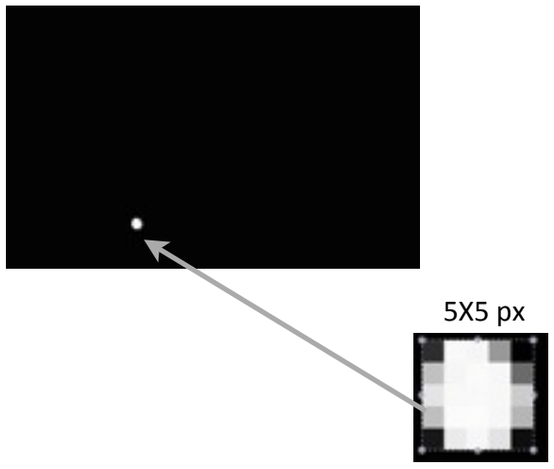
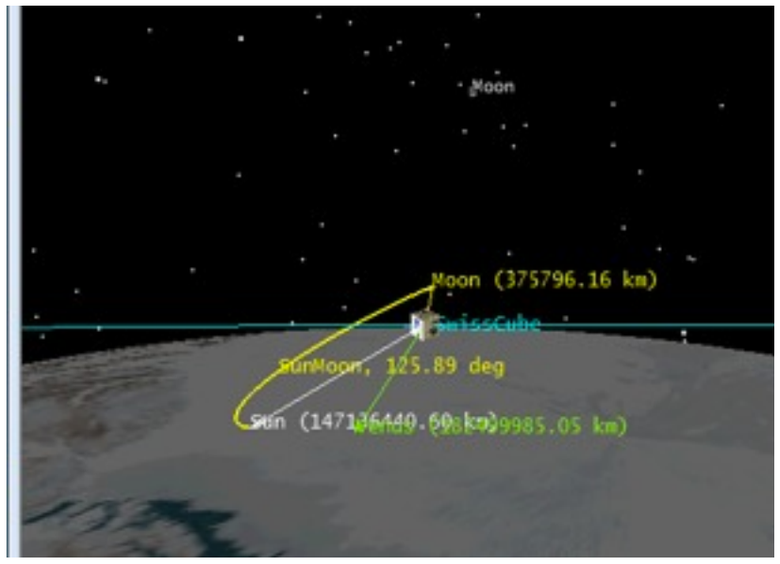
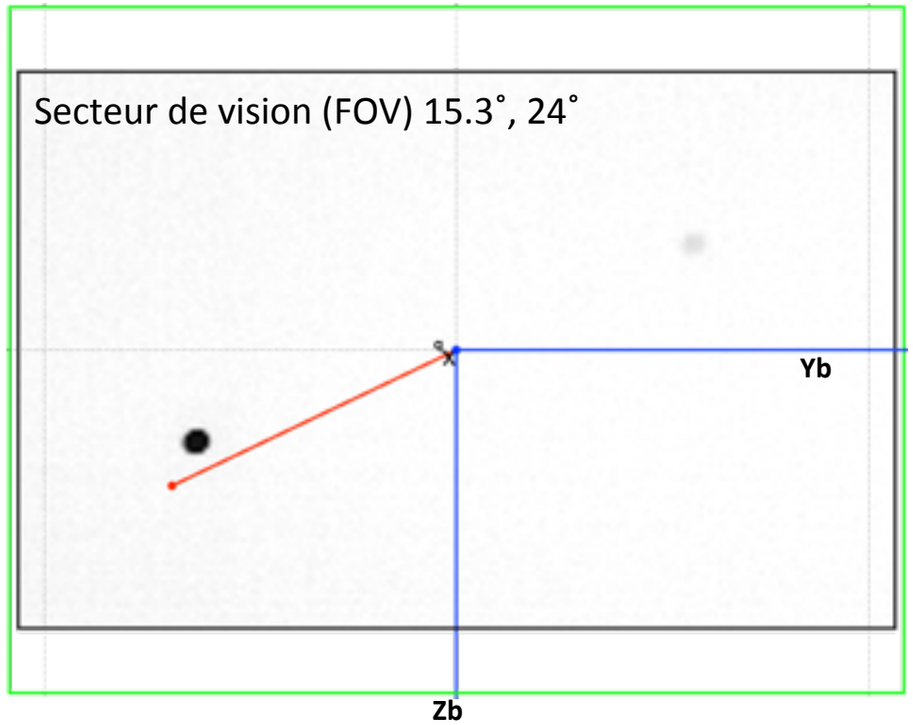
Projection: Vec-Soleil de ADCS det. Alg. (YZ-plane)

Original image







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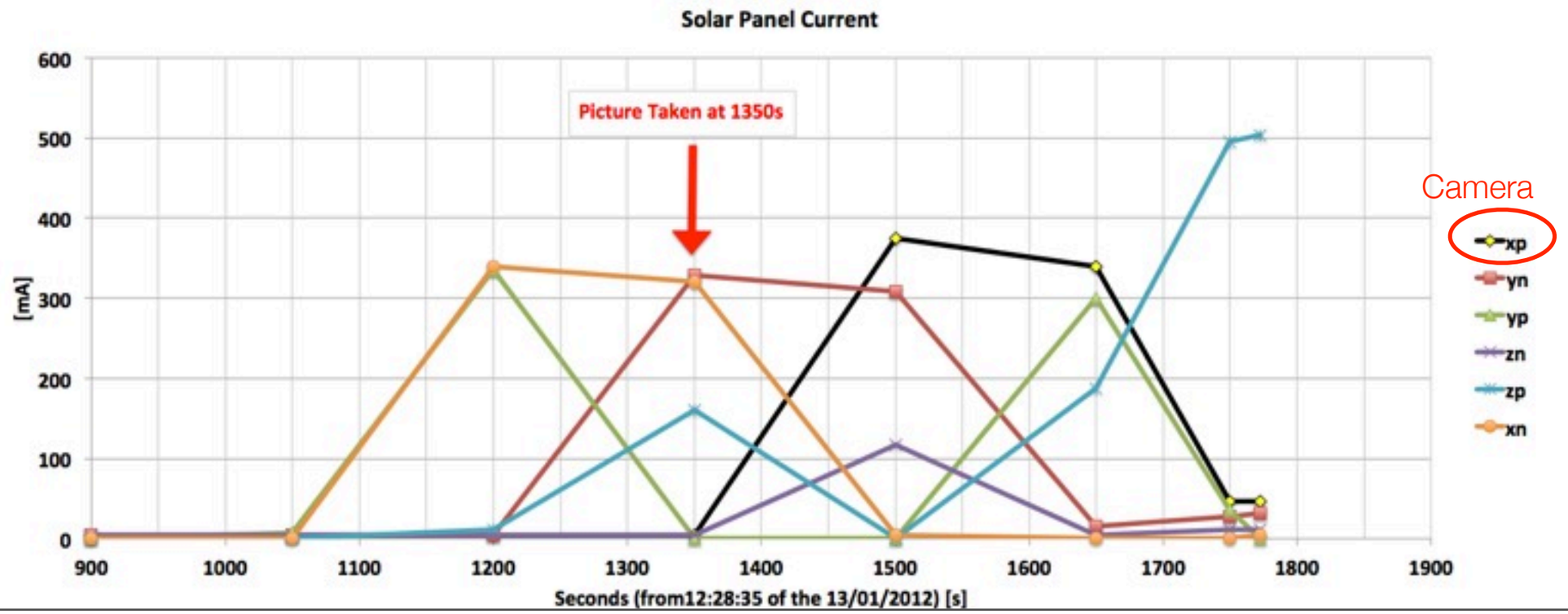
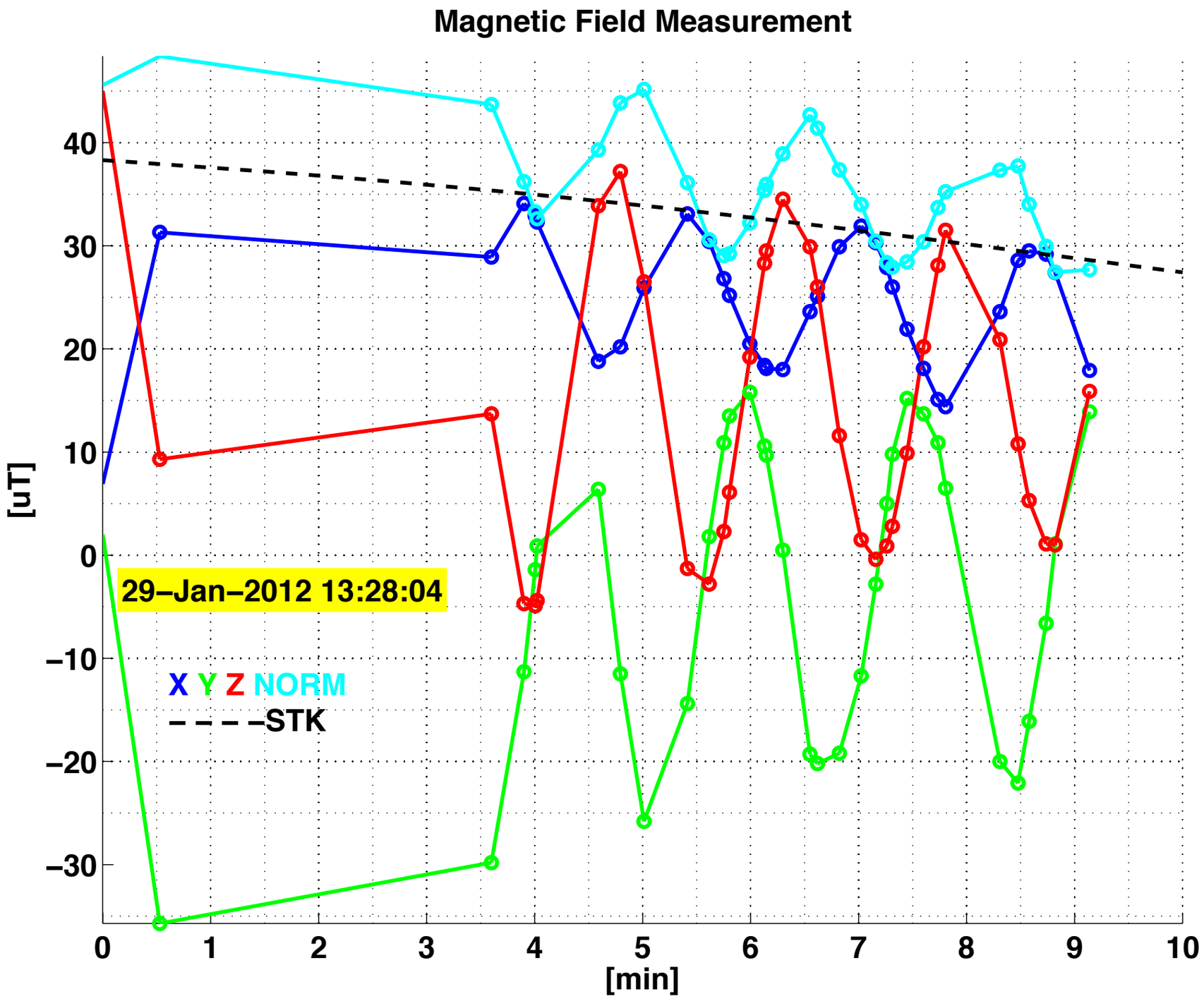
In the night, and the Sun that is coming is on the opposite face of the camera. We were able to determine pointing accuracy of the cube to 5 degrees using the Moon.



SwissCube: Magnetometer results



Reasons for magnetometer oscillations:
1) Magnetotorquers influences
2) Currents accumulated on the solar panels or on the wires generated magnetic fields.

Lesson learned: need another magnetometer to determine oscillation.

SwissCube results: what worked

as of 20:52 CST, 07 AUG 2013

- EPS: worked perfectly, satellite is still running
- COM:
  - **COM: works fine, some issues with the I^2C bus, beacon is great**
  - **antenna deployment : probably source of many problems**
    - initial rotation
    - poor uplink
- AOCS :
  - **capable of bringing S/C rotation down**
  - **sun sensors: 2 out 12 failed after 3 years**
  - **magnetometers: calibration is off on one of the axes.**
  - **gyros: work fine, but were in saturation for the first two years.**
- Payload
  - **works, but optical model is not defined, considerable reflections on the telescope structure**
- Ground Segment
  - **works perfectly, now baseline for QB50 project constellation project**
  - **satellite is now operated by a radio amateur**

Outlook and conclusions

- Swiss Space Center plans
  - **CubETH**
    - GNSS high precision measurement satellite
    - PRR scheduled for April 04, 2013
  - **Object 3**
    - 3U, 3 axis satellite for solar flare observations
  - **CleanSpace One**
- Although to date Cubesats were not great on science, the future looks quite promising
  - **technology has matured to allow more complex payloads and more complex missions**
  - **there are great ideas for science with Cubesats (ExoplanetSat, MicroMas)**

- Keys to a successful CubeSat science mission
  - **3U Cubesat**
  - **early start with the payload**
  - **testing, testing, testing**
  - **flight heritage: 3rd generation satellite (#3 in series)**

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Discussion?

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SwissCube results: AOCS effects