Attitude control and pointing recontruction requirements for PICO

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Sampling requirements

- Rule of thumb: less than 1/3rd of the beam
- Better sampling allows more accurate beam measurement and pointing reconstruction.
- Best to ensure adequate sampling for each precession by design.
- Gaps in the density of data points can be filled-in on average by consecutive precessions, but it is not guaranteed.
- Holes are a problem for computing E and B maps or spectra from incomplete Q and U maps
- Sampling requirements can possibly be relaxed for high frequency channels, but this remains TBC.
- PICO channels at CMB and at high frequencies:
  - 10.7' at 75 GHz
  - 3.6' at 220 GHz
  - 1.1' at 800 GHz

Cross-scan sampling per precession

$$\frac{(360 \times 60)\sin\alpha}{\theta_\perp} = \frac{T_{\rm prec}}{T_{\rm spin}}$$

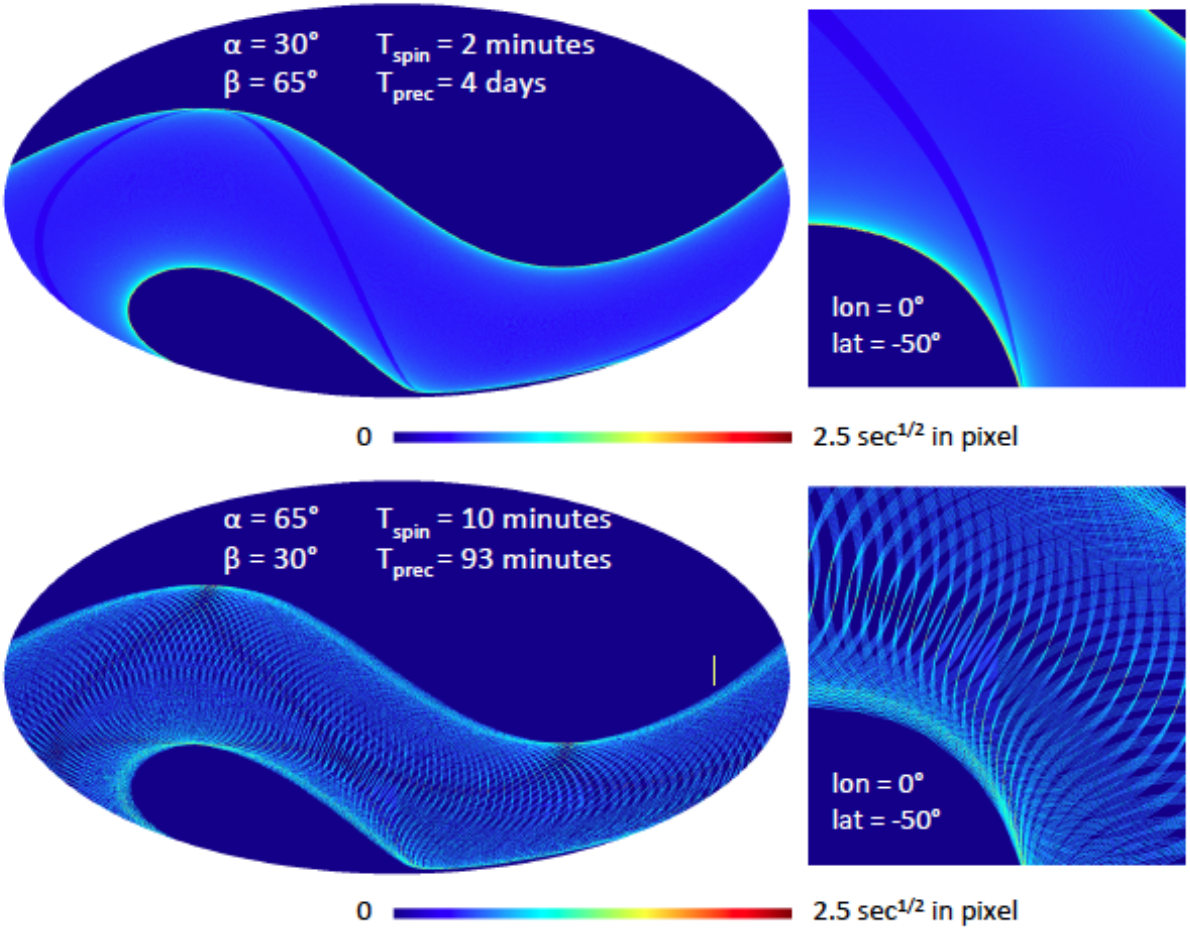
- For T_{prec}/T_{spin} = 600 and α=30° we get

$$\theta_\perp = 3'$$

- This does not allow for measuring the beam of most PICO channels at each precession, nor for doing a continuous map at nside>512

Consecutive precessions

- May not fill the gaps, unless the ratio of the precession to spinning period is adjusted with precision (which may be impractical)…



Requirements

- Real time attitude control: requirement on the attitude of the *spacecraft* (frame attached to the star sensors): a fraction of the beam (≈1/3rd), at least for CMB channels (?). Typical number: 1'

- Requirement on the knowledge of the direction of PICO beams in the frame of the spacecraft: no strong requirement, about 1° should be fine, with variations over calibration periods less than the final reconstruction requirement below.

- Requirement on the pointing reconstruction (post-analysis): better than Planck, i.e. 1-2" or better.

- Simulations needed to demonstrate feasibility of the pointing reconstruction and the impact of errors.