

# Lifting the veil to the CMB Polarization with the Galactic Emission Mapping Experiment @ Portugal

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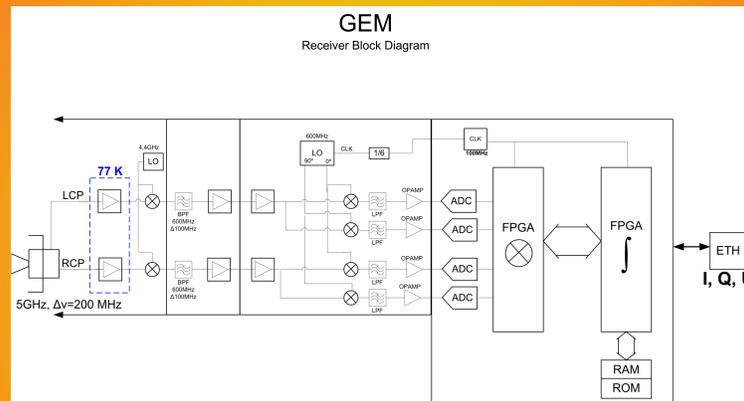
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The GEM-Portugal 9-meter Cassegrain antenna (here in its original site) will be installed in central Portugal in a quiet RFI area (long. 7°52' Lat. 40°11'). It will be subilluminated for lower side-lobe pickup and will thus operate with an effective resolution  $> \sim 0.5^\circ$ .

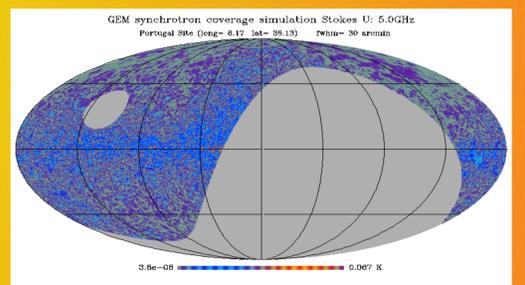
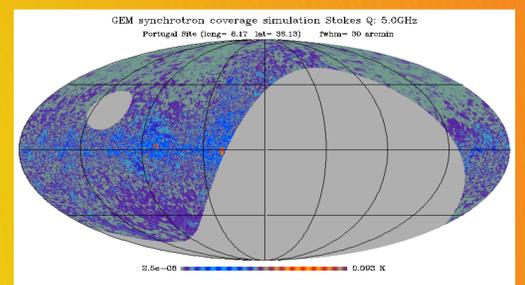
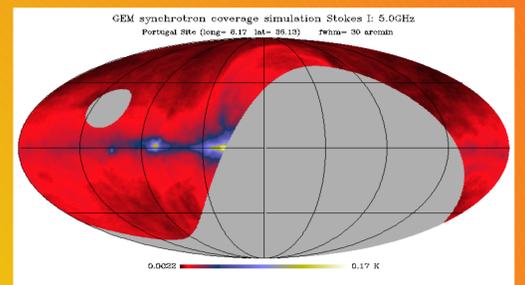
The GEM project evolved towards the mapping of the Polarized synchrotron foreground at 5,10 GHz. These frequencies do not suffer from Faraday rotation depolarization, are suitable for high frequency extrapolations and the signal is still high from ground. Since 2005, a GEM portuguese node (GEM-P) is installing a 9-m dish antenna equipped with a new low noise receiver. This receiver (after a dual 1<sup>st</sup>-stage LN cooled LNA's), feeds a digital correlator polarimeter capable of I,Q,U extraction.



Schematic block diagram of the polarimeter. Cold box is highlighted.

The correlation part is directly computed in a FPGA device (Field Programmable Gate Array) after signal digitalization and outputs I,Q,U Stokes signals:

$$\begin{aligned}
 RL &= \Re \left( E_{r_{cp}} E_{l_{cp}}^* \right) && \rightarrow \text{Stokes } U \\
 LR &= \Re \left( E_{r_{cp}, -\frac{\pi}{2}} E_{l_{cp}}^* \right) && \rightarrow \text{Stokes } Q \\
 RR + LL &= \left\langle E_{r_{cp}} E_{r_{cp}}^* \right\rangle + \left\langle E_{l_{cp}} E_{l_{cp}}^* \right\rangle && \rightarrow \text{Stokes } I
 \end{aligned}$$



I,Q,U Stokes simulated templates – using Girardino et al. 2002 synchrotron templates- after 6 months observation time (FWHM  $\sim 40$  arcmin), obtained with antenna at elev.=50° ,( $\sim 40\%$  sky).

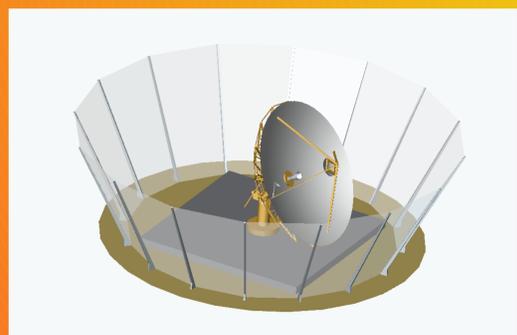
**Absolut calibration** is obtained with data from previously scanned cold spot in North sky, from White Mountain station (G. Smoot, private comm.).

**Results:** 2mK sensitivity - mid/2007.

## Web Pages:

- <http://www.av.it.pt/gem>
- <http://aether.lbl.gov/gem>
- [http://www.cea.inpe.br/~cosmo/GEM/index\\_gem.html](http://www.cea.inpe.br/~cosmo/GEM/index_gem.html)

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For low ground pickup, there will be additional high (7-m high), solid screen shields.

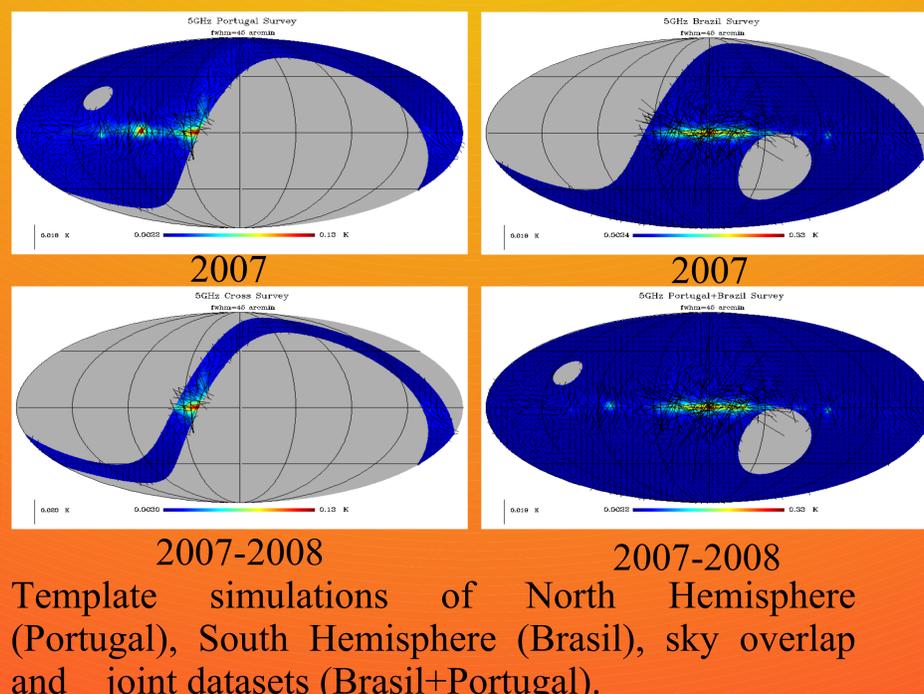
## GEM-P facts:

- Fast scan (1rpm) at constant elevation ( $\sim 50^\circ$ ).
- Tsys=14 K
- B=200 MHz
- Sample rate=0.08 sec.

$$\Delta T = \sqrt{2} \frac{T_{sys}}{\sqrt{B\tau}}$$

*Theoretical sensitivity:*

- 2 mK ; for  $\tau = 11$  days
- 1 mK ; for  $\tau = 44$  days
- 0.5mK ; for  $\tau = 180$  days



Template simulations of North Hemisphere (Portugal), South Hemisphere (Brasil), sky overlap and joint datasets (Brasil+Portugal).