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Optics & OMT for Band 2+3 (Phase A)

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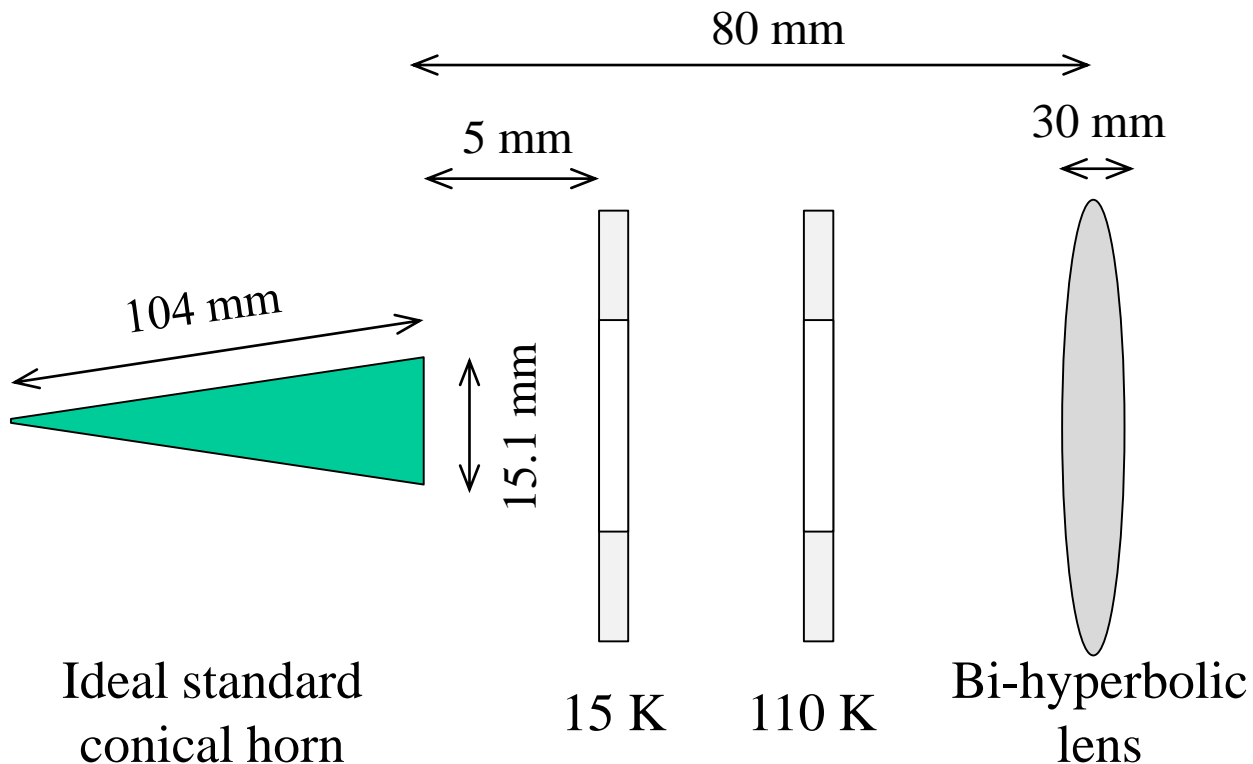


Content

- Results of phase A.
 - Refractive Optics.
 - OMT.
- Proposals for phase B.
 - Refractive Optics.
 - OMT.

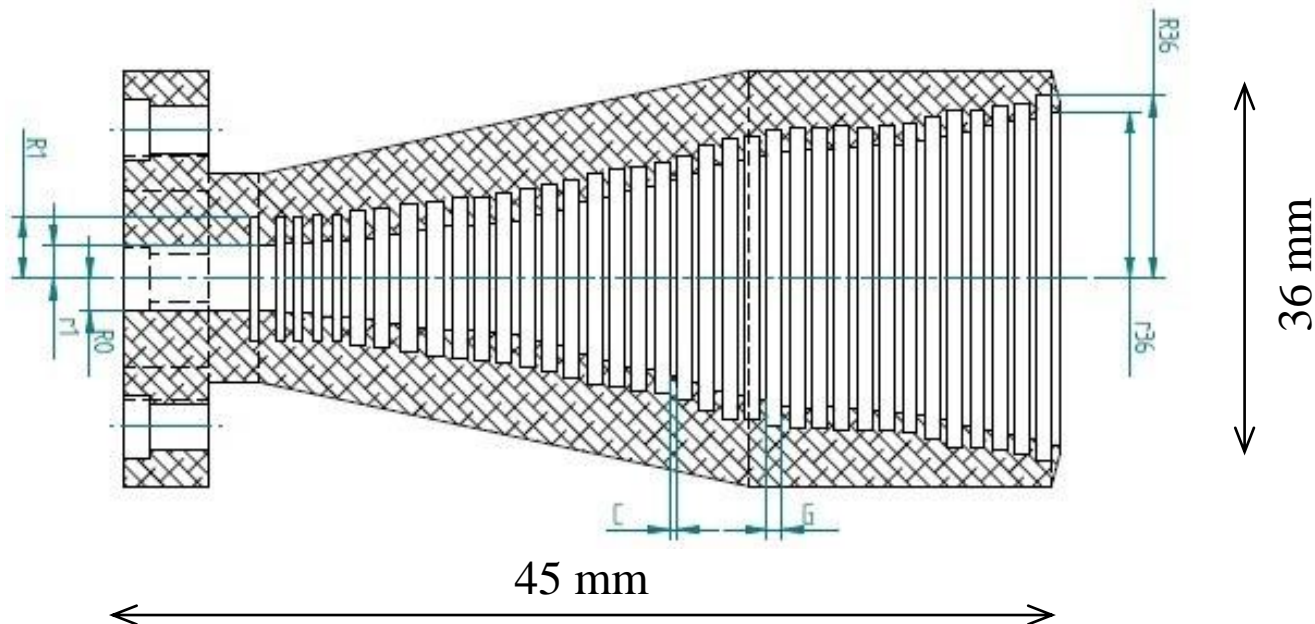
Results of Phase A

- Refractive Optics.
 - Quasioptical analysis
 - Frequency independence.
 - Minimize truncations.



Results of Phase A

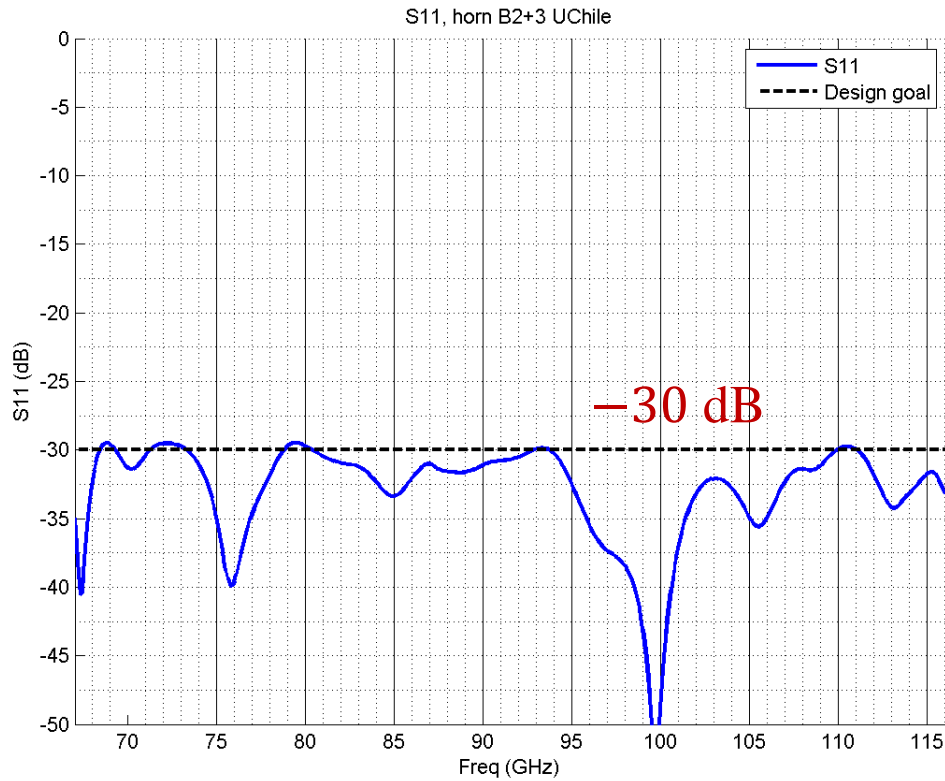
- Refractive Optics.
 - Horn design
 - Match the properties of the ideal Gaussian beam.
 - Optimized profile.
 - Corrugations number and size limited by mechanical considerations (fabrication by lathe).



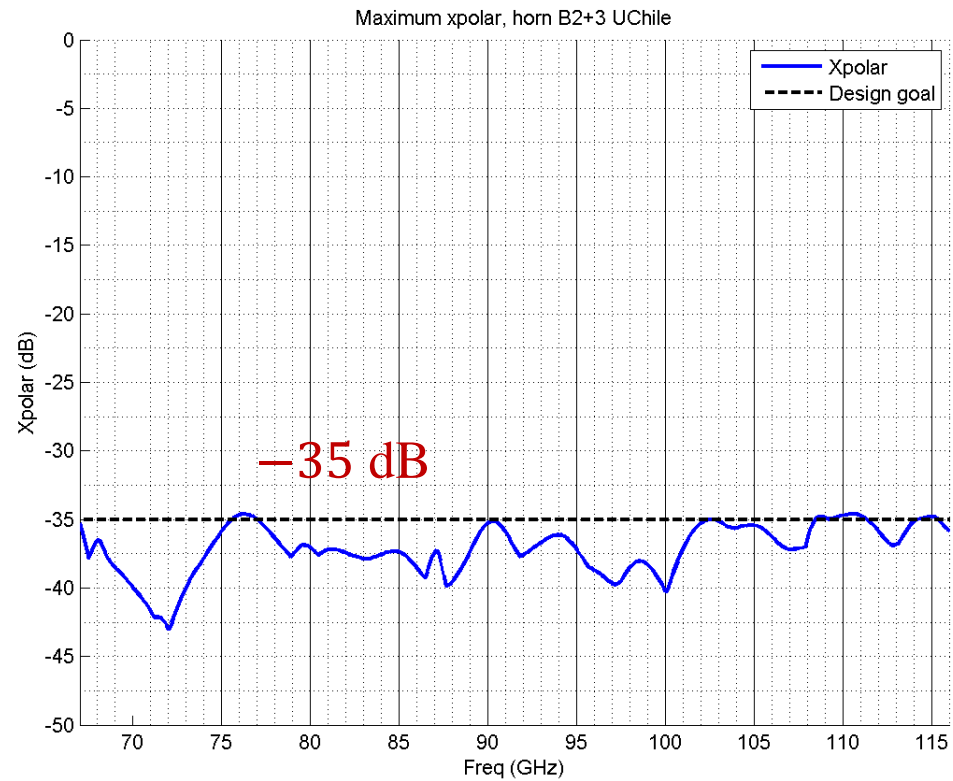
Results of Phase A

- Refractive Optics.
 - Horn simulations

Reflection loss

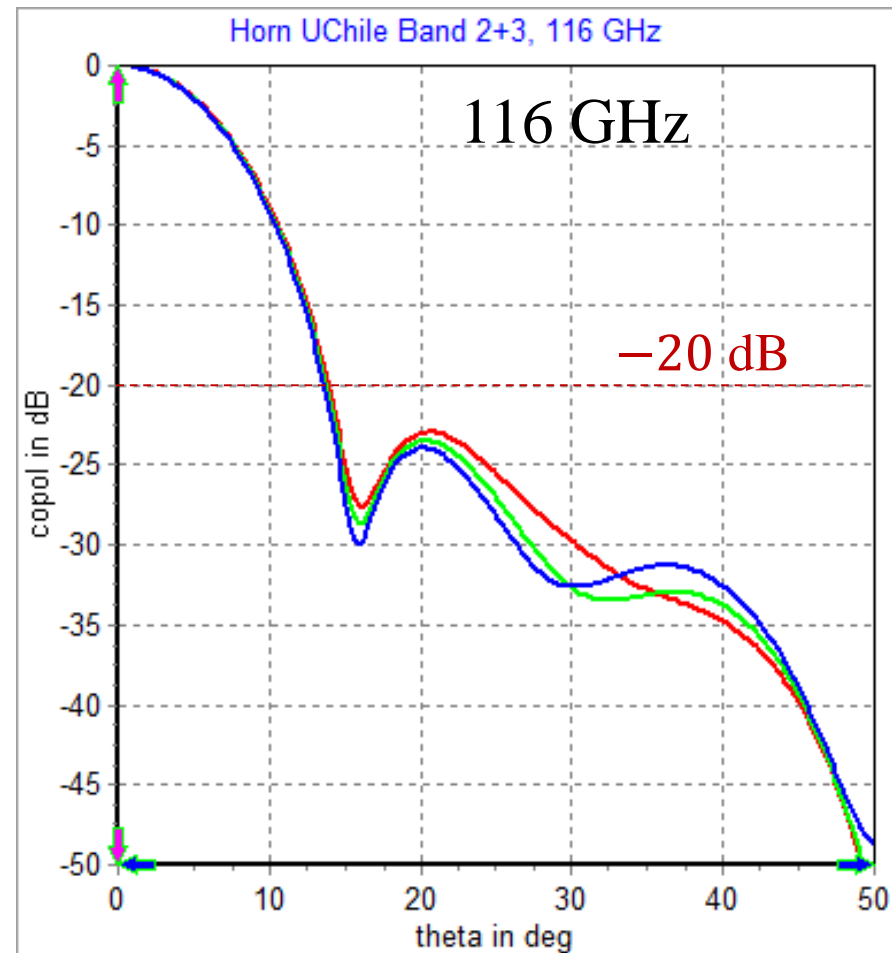
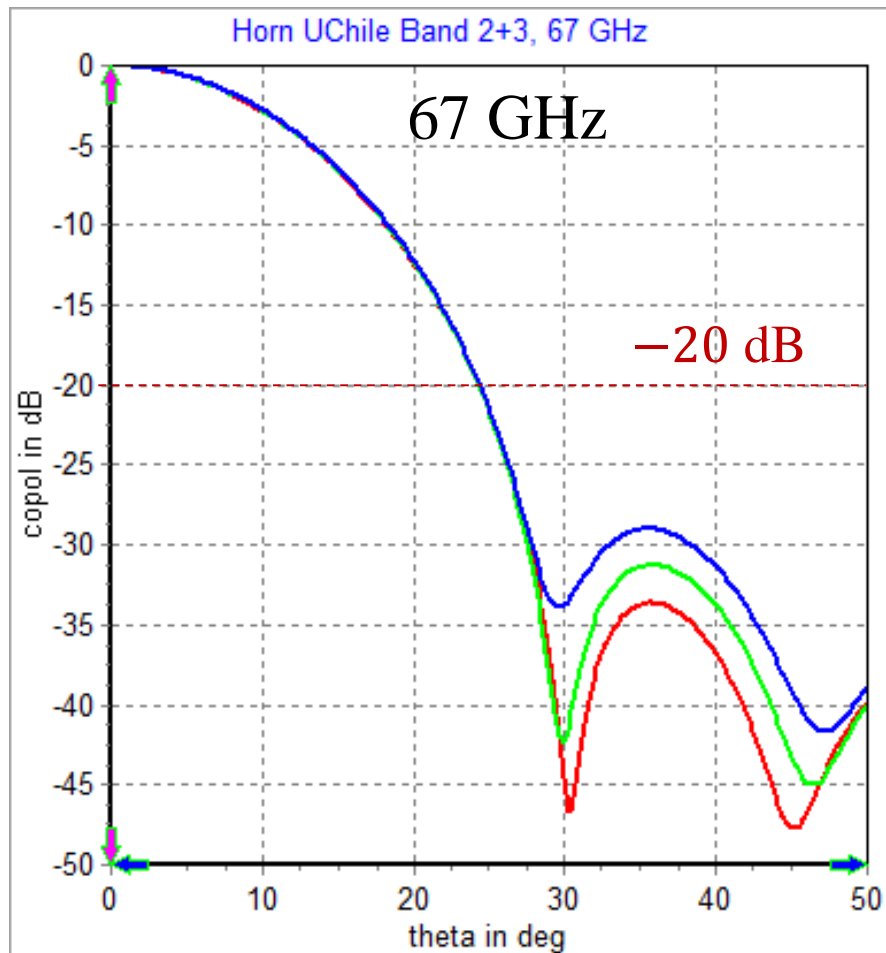


Max X-polar



Results of Phase A

- Refractive Optics.
 - Horn simulations



Results of Phase A

- Refractive Optics.
 - Horn simulations -- Tolerance Analysis

	Nominal	Width corr. variation		Depth corr. variation		General corr. variation	
		$\pm 50\mu\text{m}$	$\pm 10\mu\text{m}$	$\pm 50\mu\text{m}$	$\pm 10\mu\text{m}$	$\pm 50\mu\text{m}$	$\pm 10\mu\text{m}$
Max. S_{11} (dB)	-30	-19	-26	-25	-29	-17	-26
Max. Xpolar (dB)	-35	-28	-32	-32	-32	-18	-31
Max. diff. BW ($^{\circ}$)	0	0.6	0.2	0.3	0.1	0.4	0.2
Max. diff. PCL (mm)	0	4.4	1.7	2.5	0.5	2.8	1.8

Results of Phase A

- Refractive Optics.
 - Horn construction
 - First prototype using split-block technique.



Results of Phase A

- Refractive Optics.
 - Lens
 - Fresnel bi-hyperbolical lenses.
 - Designed by A.G. and fabricated at external company.

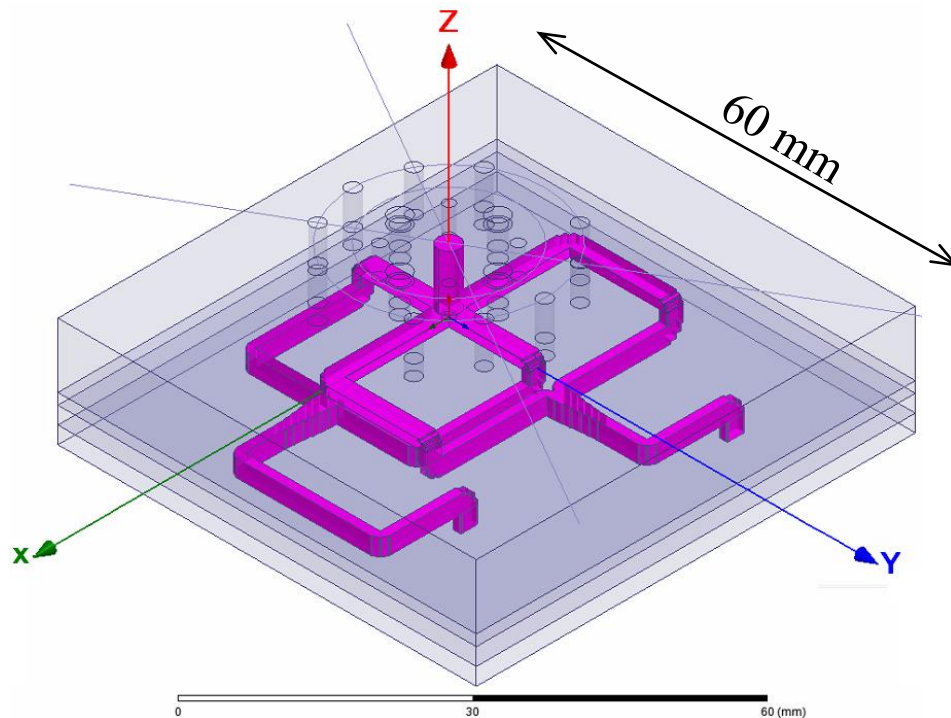


Results of Phase A

- OMT.

- Design

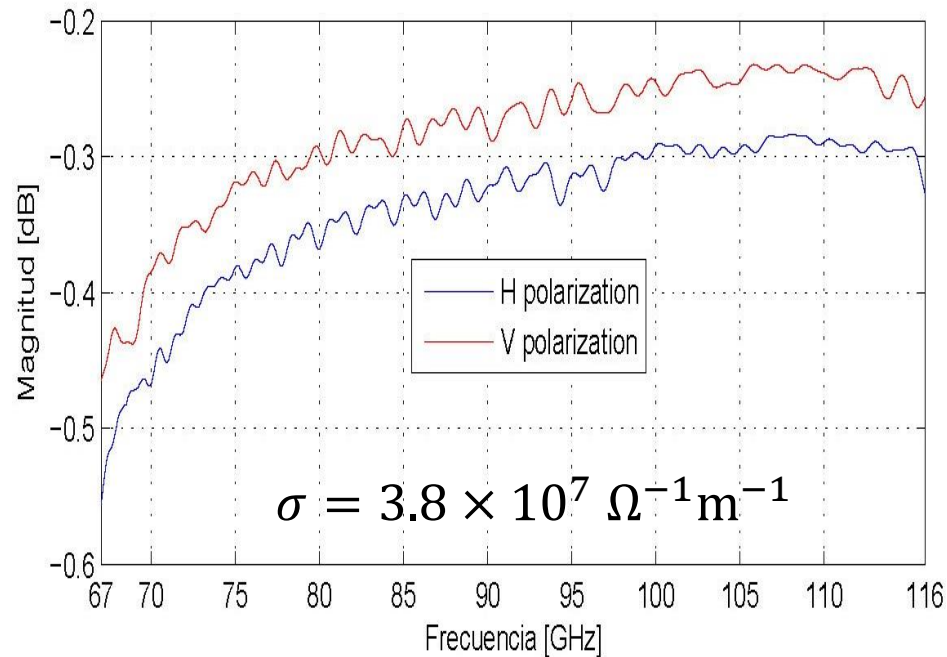
- First attempts with double ridge did not achieve bandwidth.
 - Turnstile junction allows to cover entire bandwidth.
 - Length was maximized to avoid trapped modes.



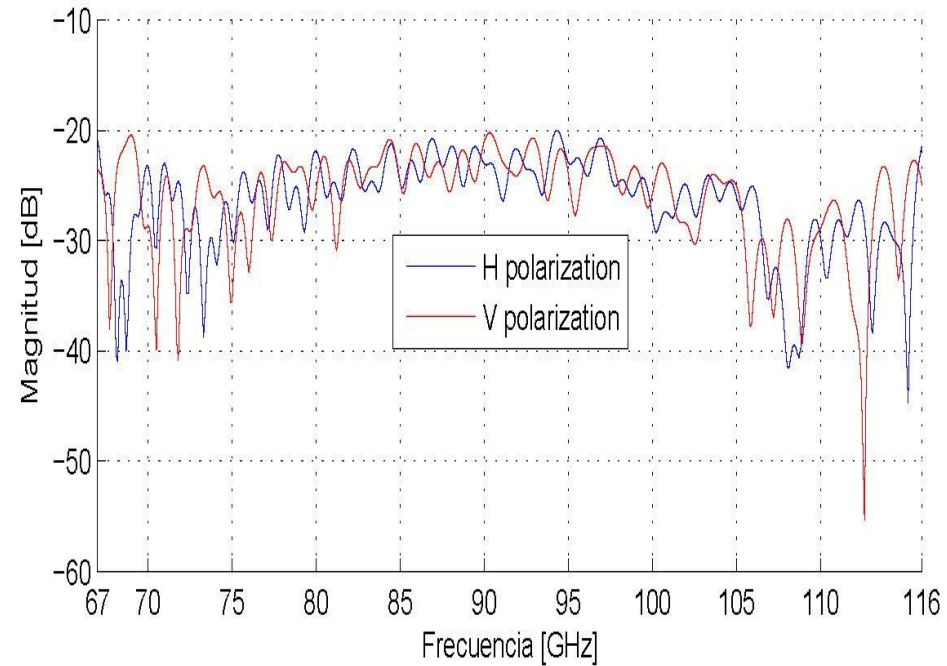
Results of Phase A

- OMT.
 - Simulations

Transmission



Reflection at input port

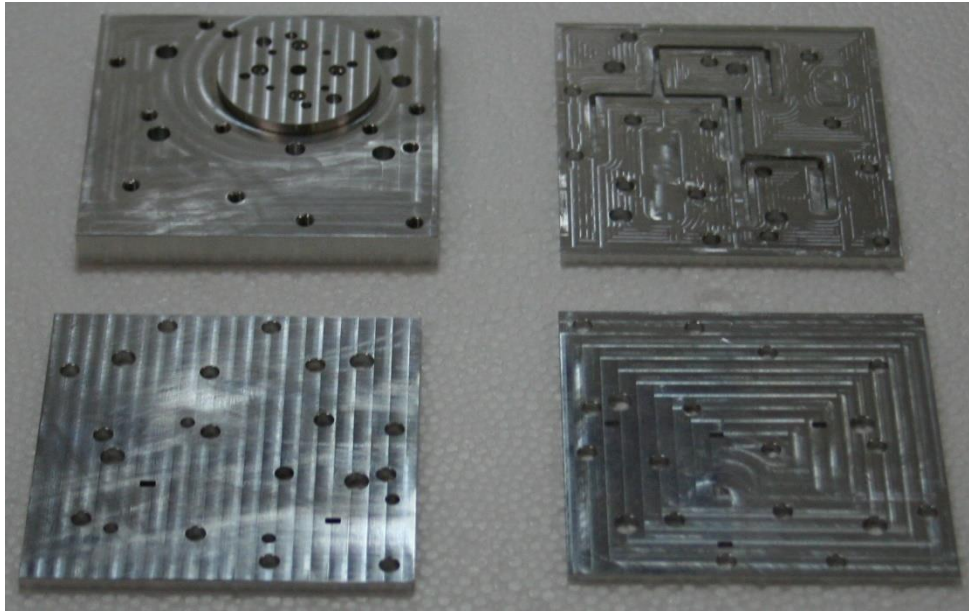


Results of Phase A

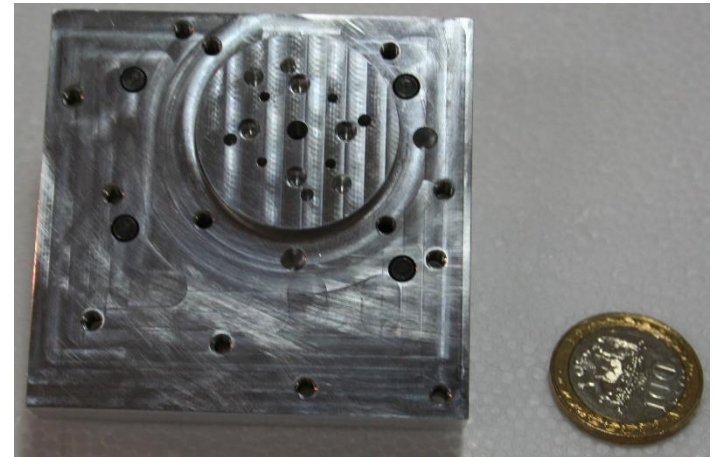
- OMT.
 - Construction

Four slabs

(one of the machined on both sides)



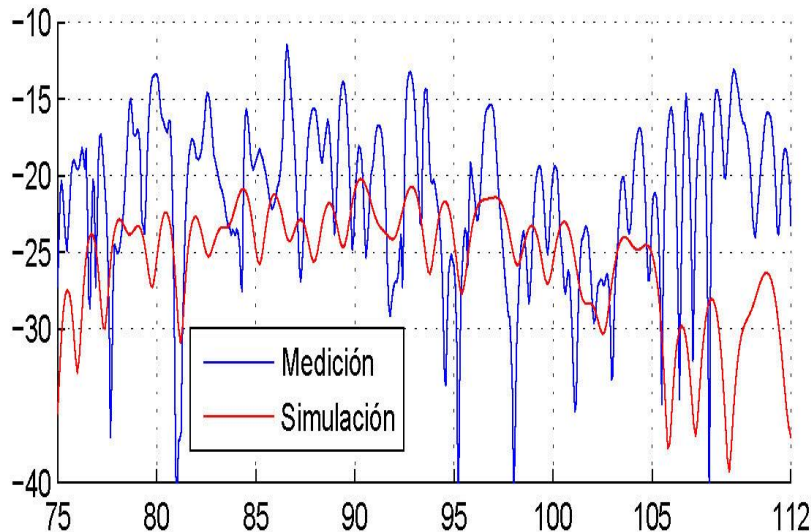
OMT assembled



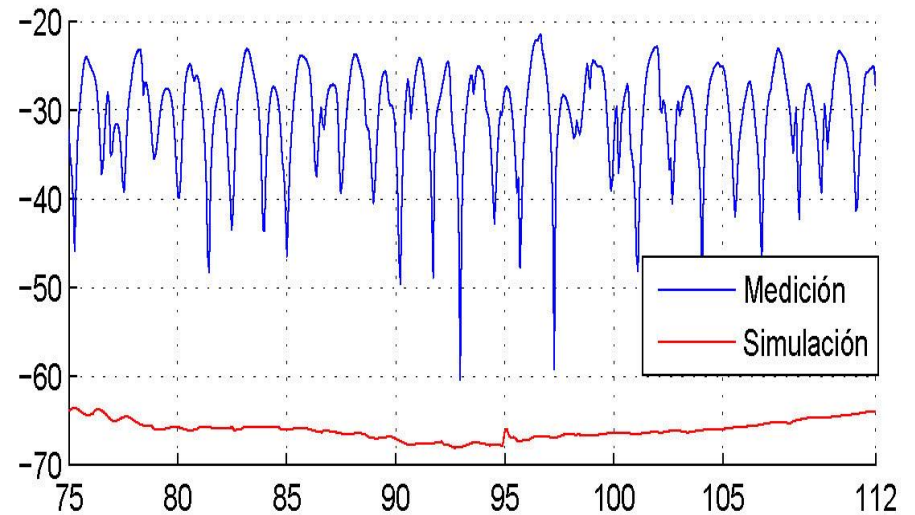
Results of Phase A

- OMT.
 - Measurements
 - Home-made scalar analyzer (still to be completed).

Reflection at output port



Isolation



Proposals for Phase B

- Refractive Optics.
 - Optical system
 - Study other configurations
 - Starting from Band-3 solution.
 - It will require new horn and lens.
 - Horn
 - Demonstrate construction with lathe
 - Single block
 - Block + rings for the first corrugations
 - Measurements
 - Extend frequency coverage of beam-pattern setup.

Proposals for Phase B

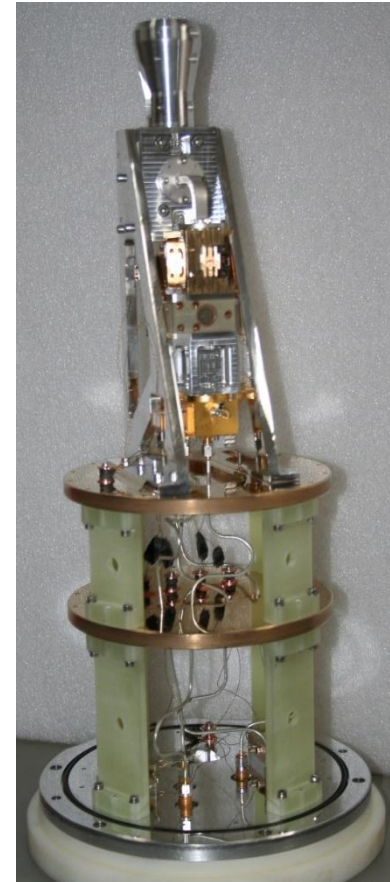
- OMT.
 - Design
 - Reduce electrical path.
 - Study trapped modes.
 - Construction
 - Study other materials
 - From B9 experience, Cu-Te has lower losses.
 - Measurements
 - Improve measurement system.

Proposals for Phase B

- Receiver
 - Prototype receiver in a cartridge



ALMA test cryostat



B1 prototype receiver