

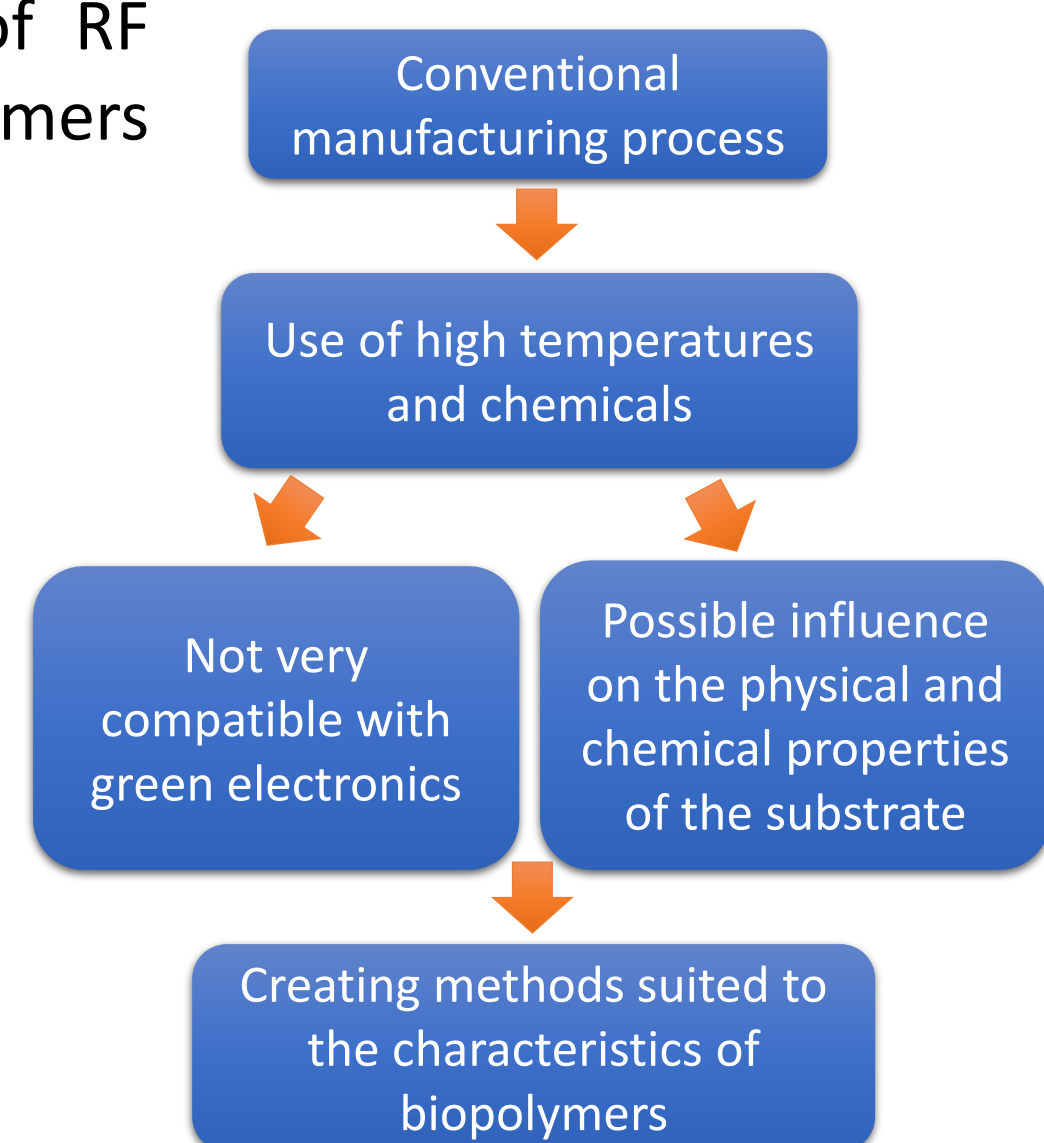
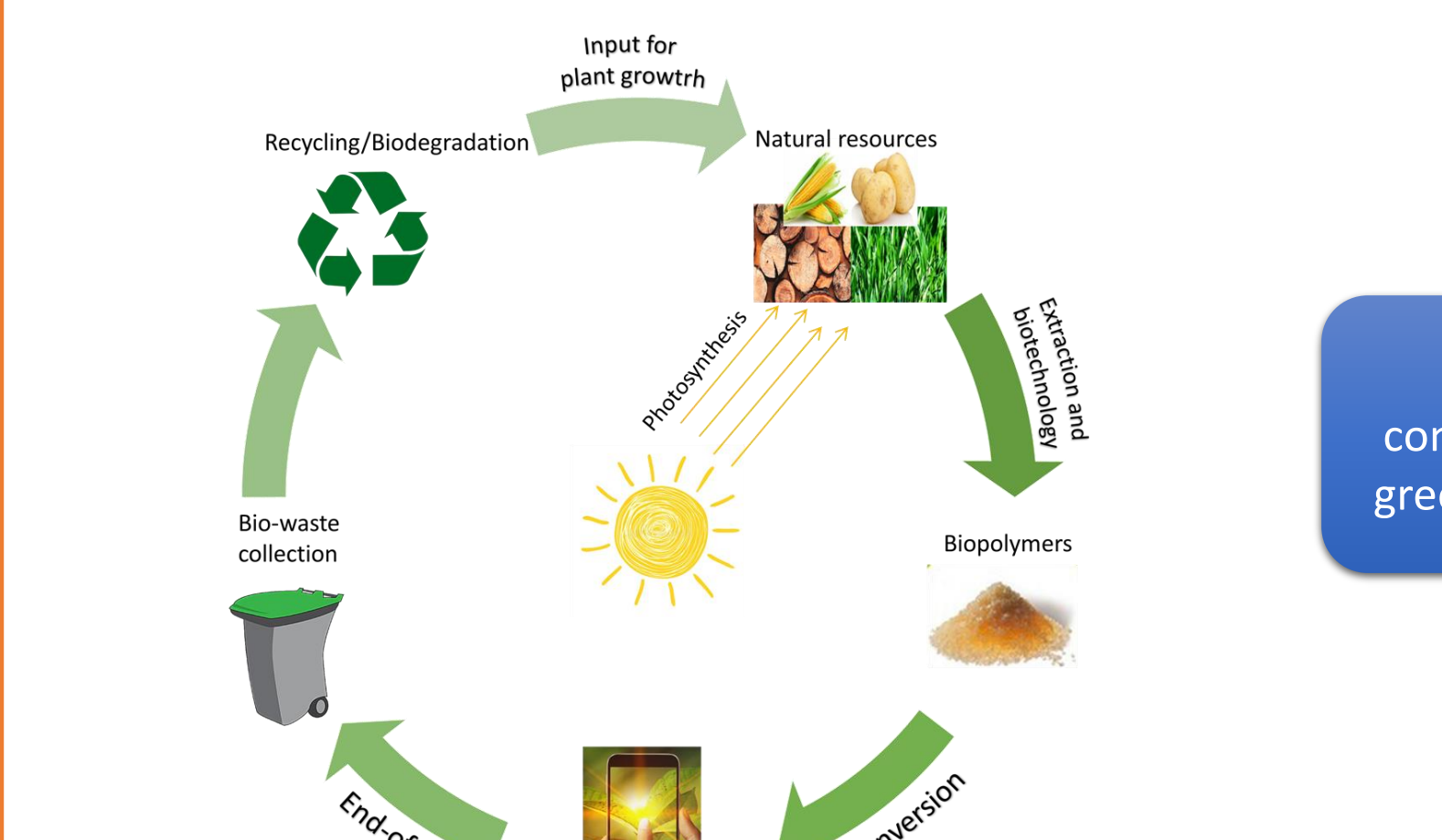
# MITEC group:

« Microtechnology and Instrumentation for Thermal and Electromagnetic Characterization »

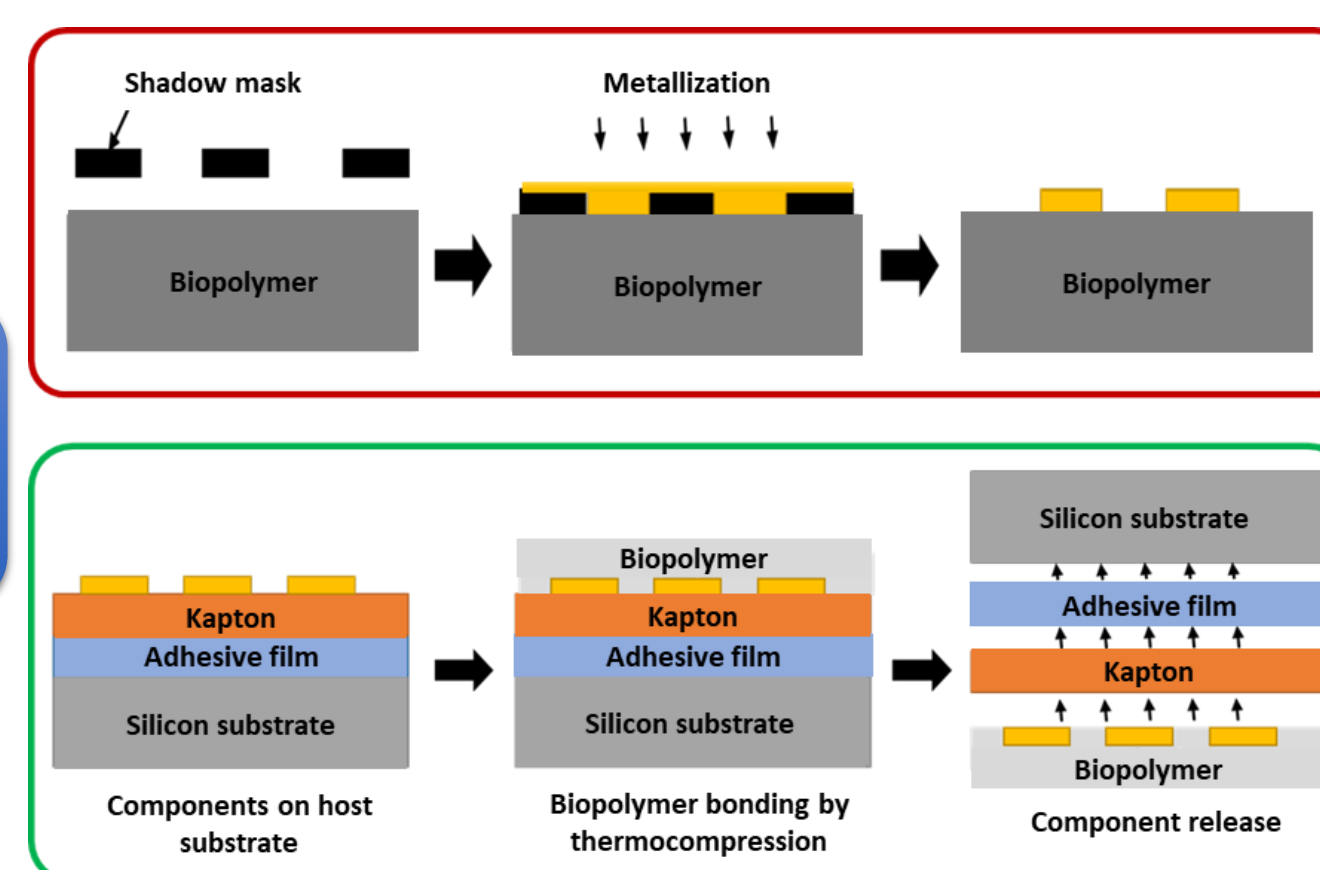
**Permanent Staff :** G. Boussatour (MCF), P.Y. Cresson (MCF), L. Dubois (MCF), D. Glay (MCF), T. Lasri (PR)

## Towards green and flexible RF electronics

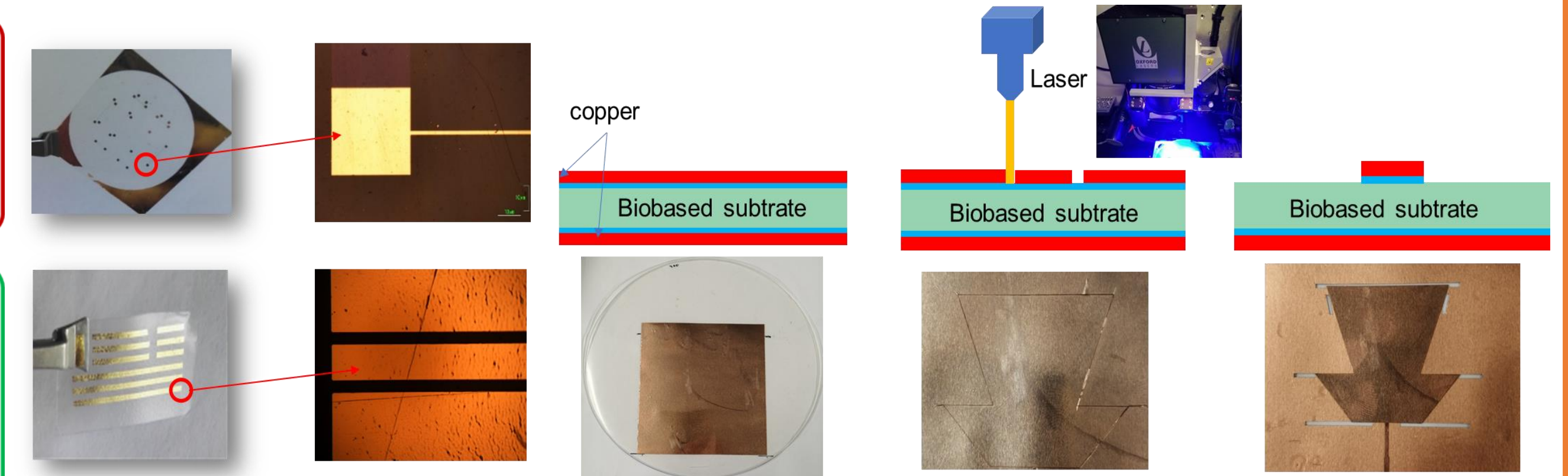
Need to reduce the ecological footprint of RF technologies → move from traditional polymers to bio-based polymers



Implementation of new micro-fabrication methods:  
**Shadow mask, Transfer technique, Laser**



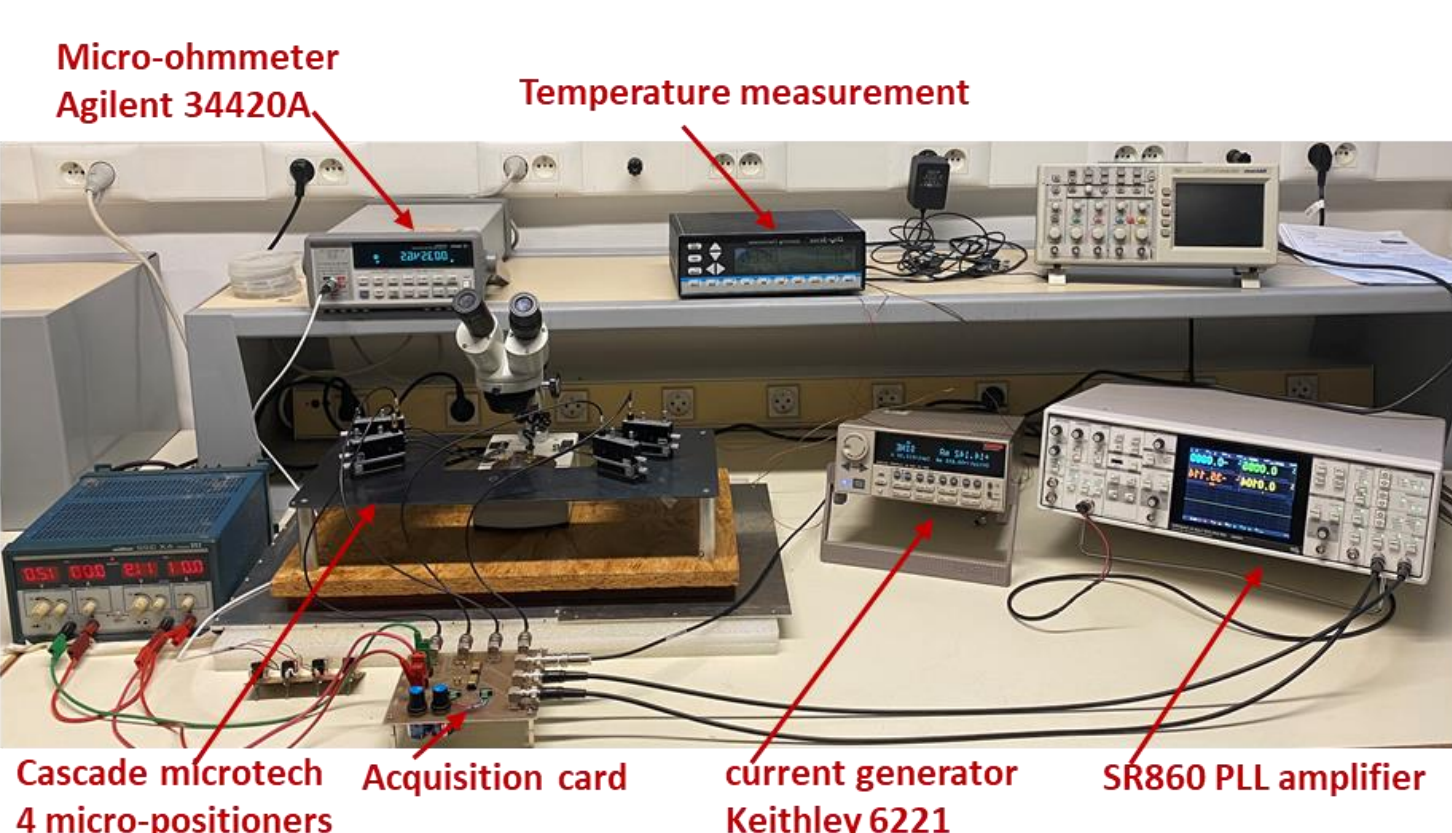
Example of a process based on the use of laser and adhesive copper



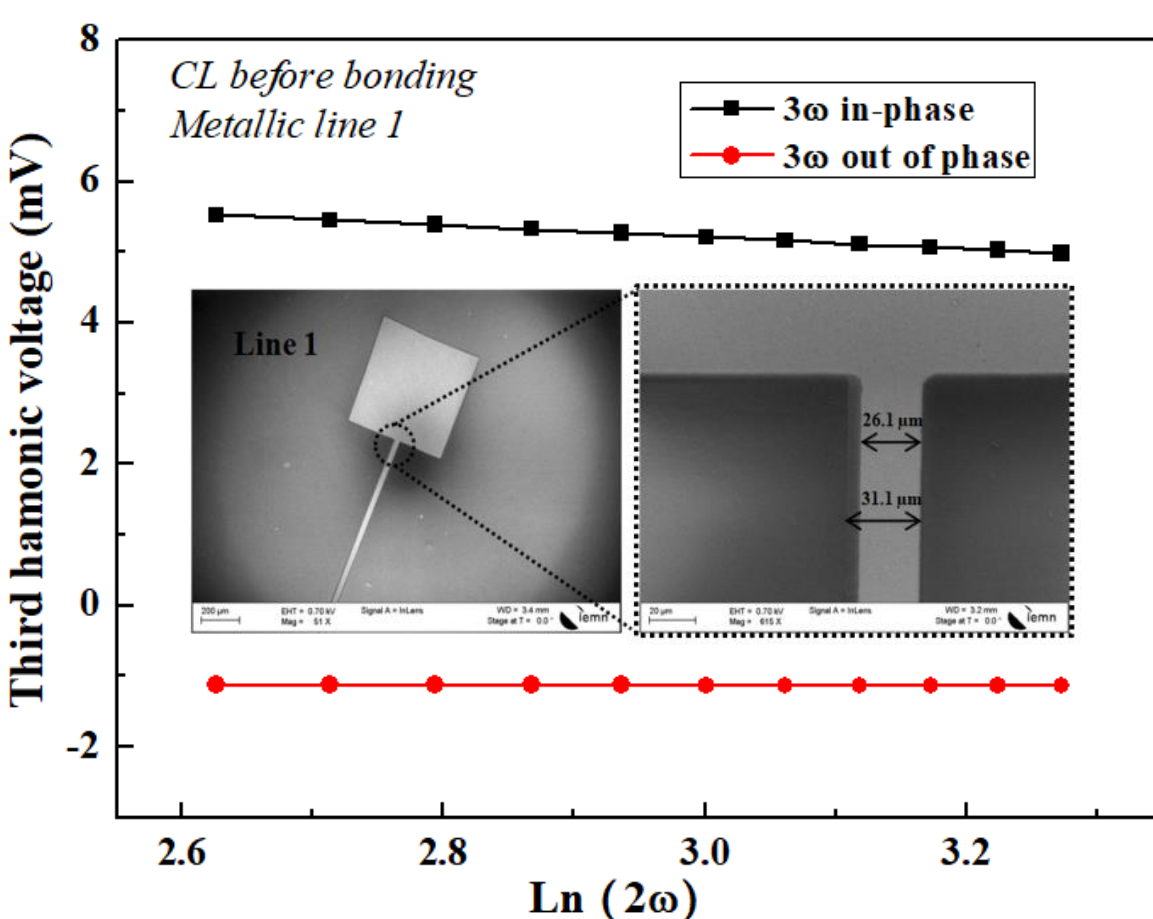
## Measurement of the thermal conductivity of materials

### The 3-Omega Method

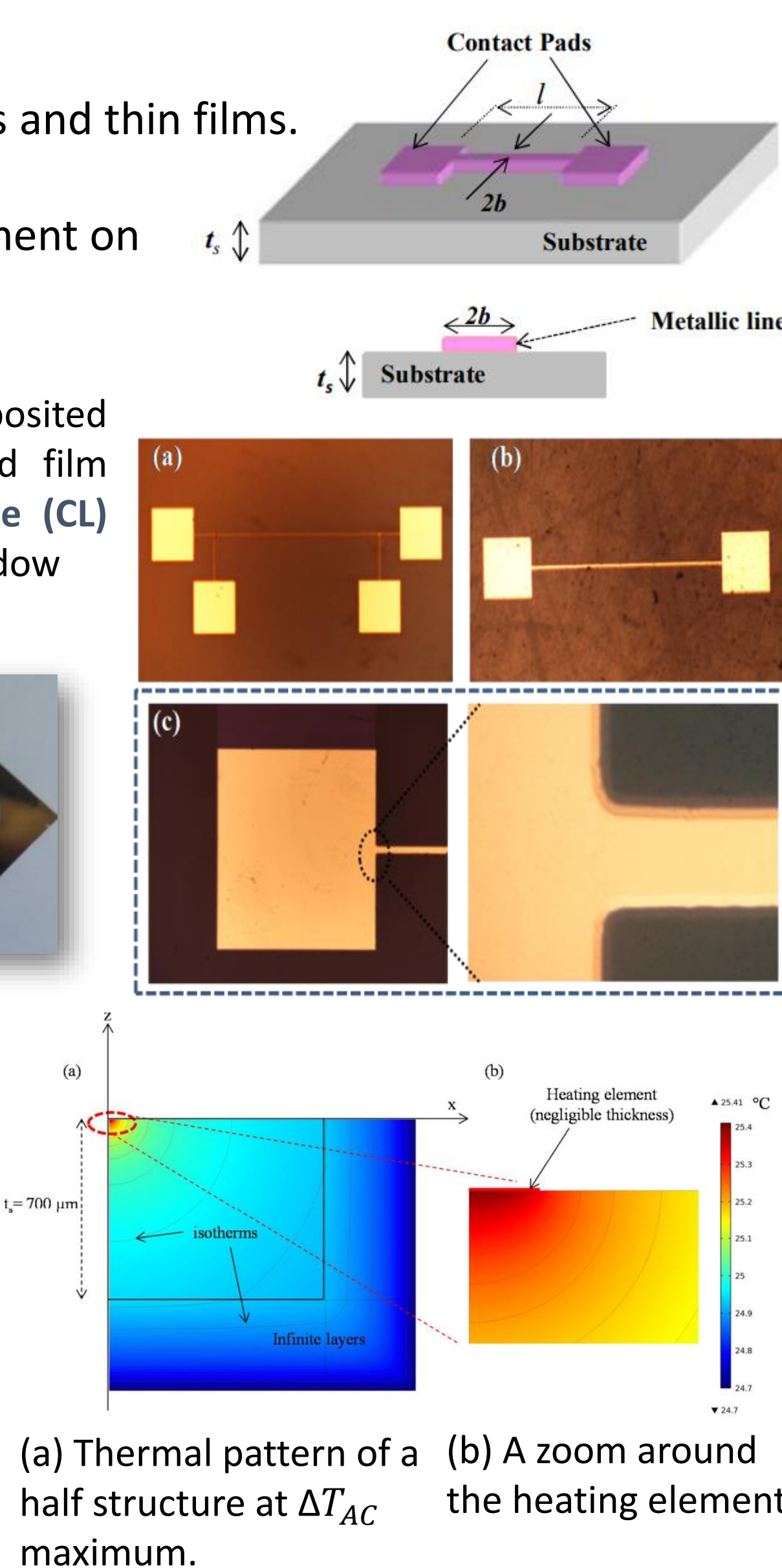
- ✓ Designed for measuring thermal conductivity in substrates and thin films.
- ✓ Uses an electro-thermal technique.
- ✓ Involves the deposition of a metallic thermo-resistive element on the sample surface.



Metallic line deposited on the biobased film Cellulose Laurate (CL) by using the shadow mask method



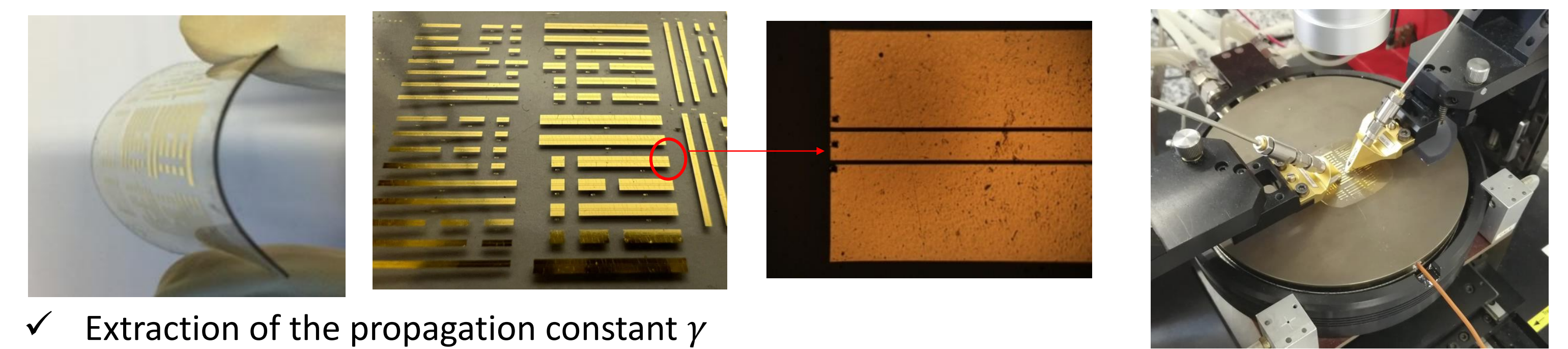
Thermal conductivity values are obtained using inverse simulation methods developed in MATLAB® (analytical method) or COMSOL® (numerical method)



## Measurement of the dielectric properties of materials

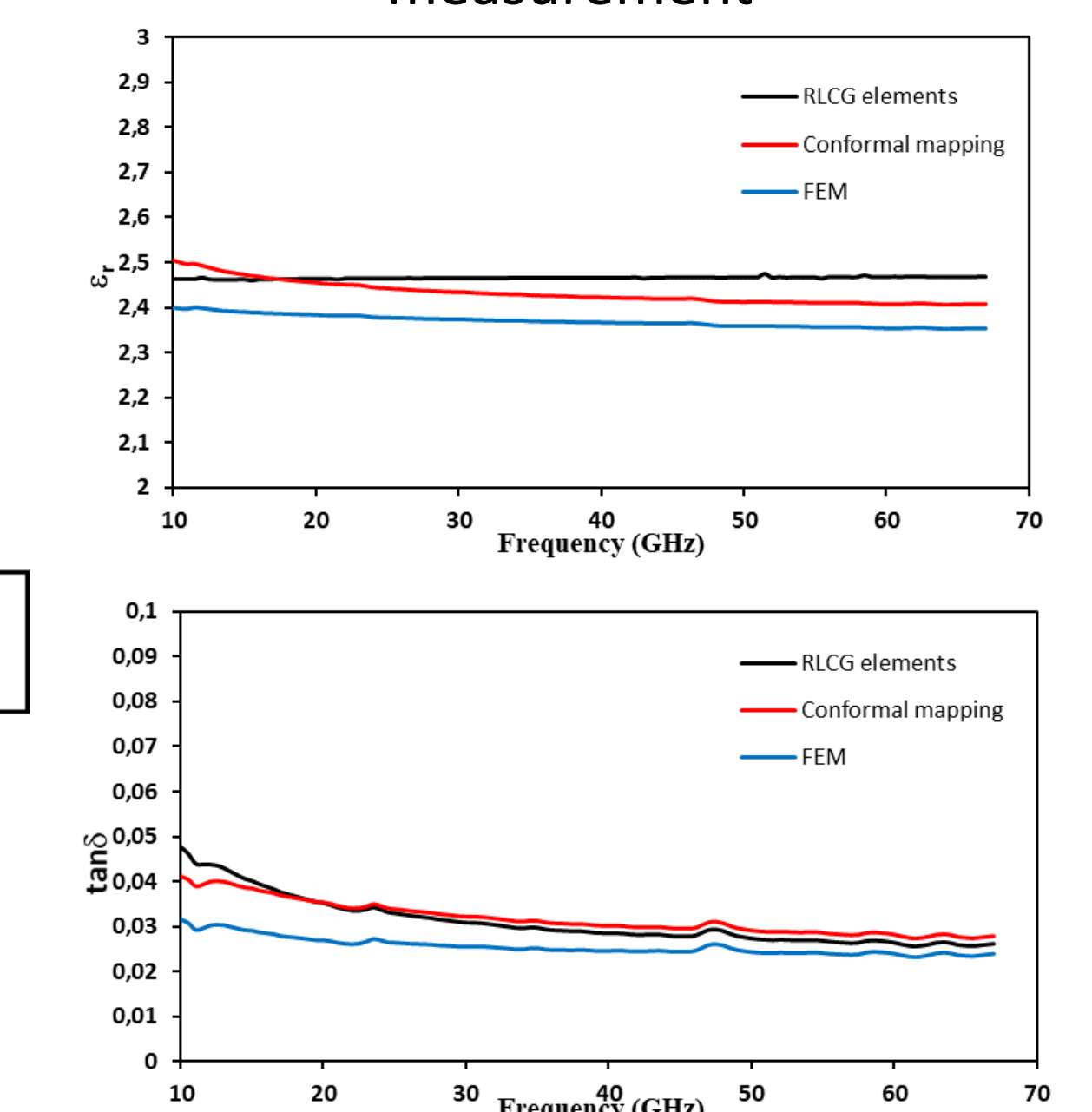
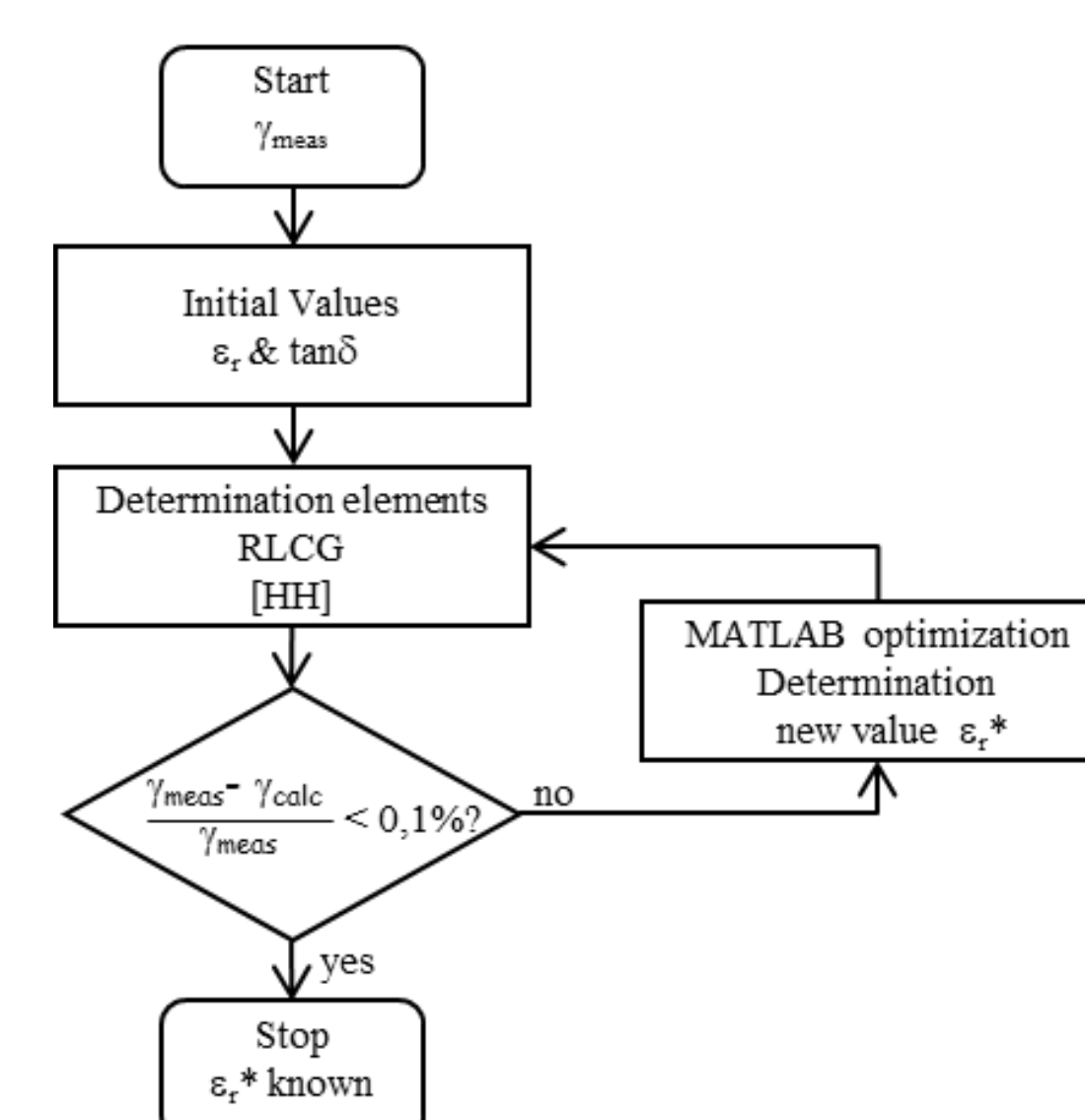
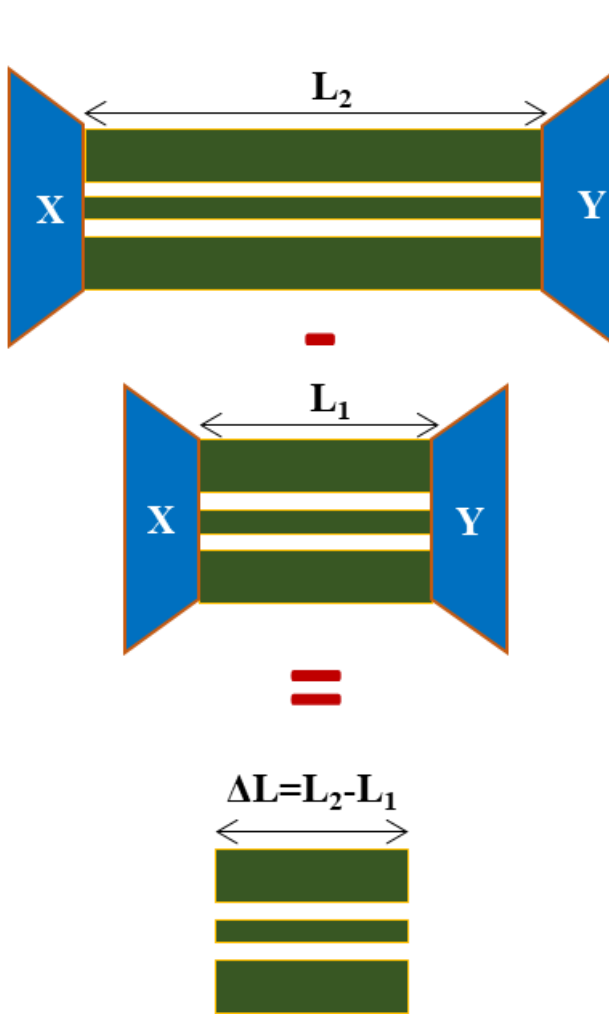
Extraction of the dielectric permittivity ( $\epsilon_r$ ) and the dielectric loss ( $\tan\delta$ ) from S-parameter measurements of coplanar lines.

- ✓ Realization of two CPW lines on a biobased substrate Cellulose Laurate (CL)



- ✓ Extraction of the propagation constant  $\gamma$
- ✓ Inverse simulation and determination of  $\epsilon_r$ ,  $\tan\delta$

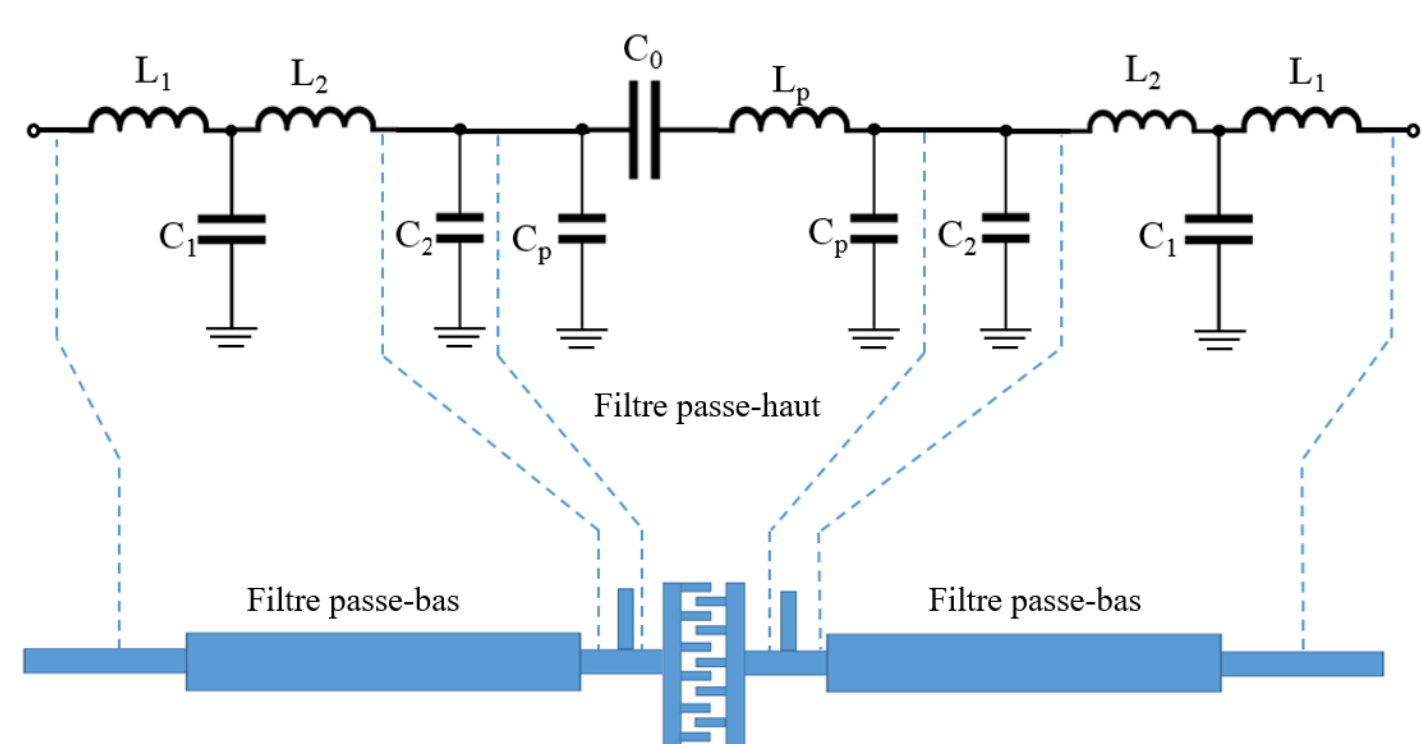
### Two lines method



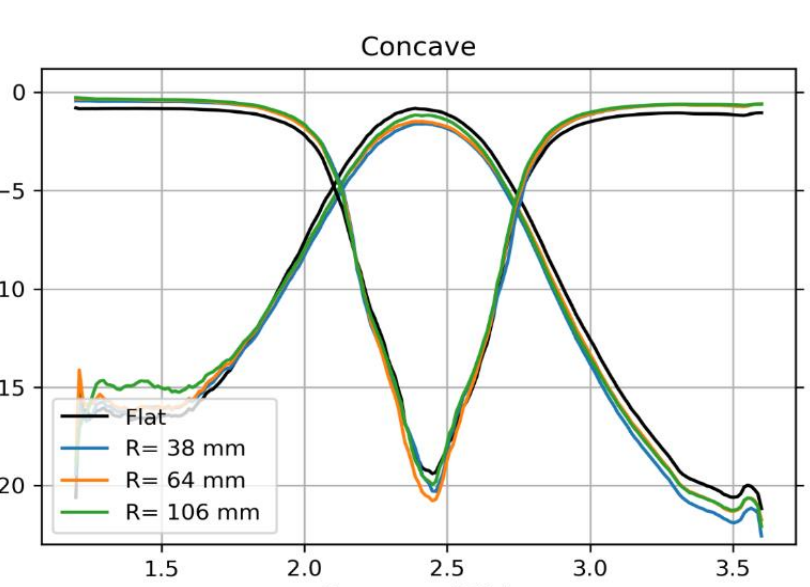
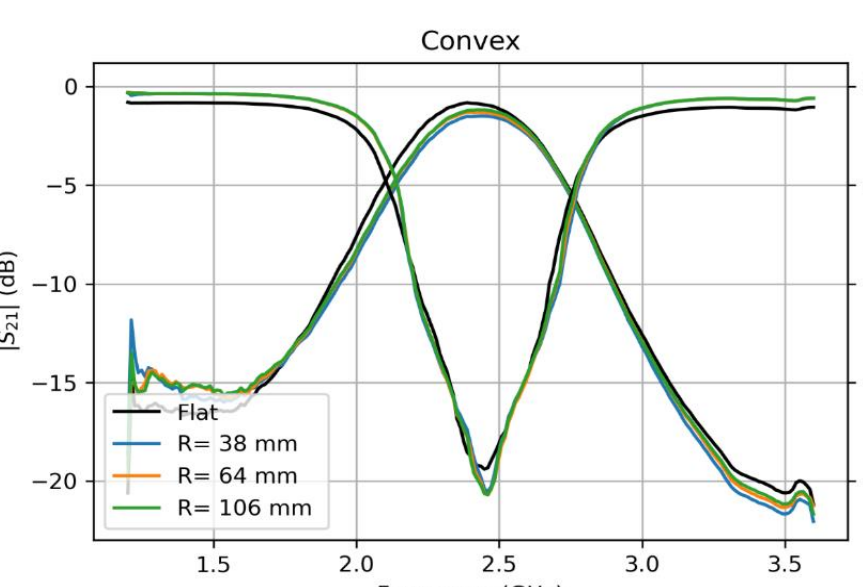
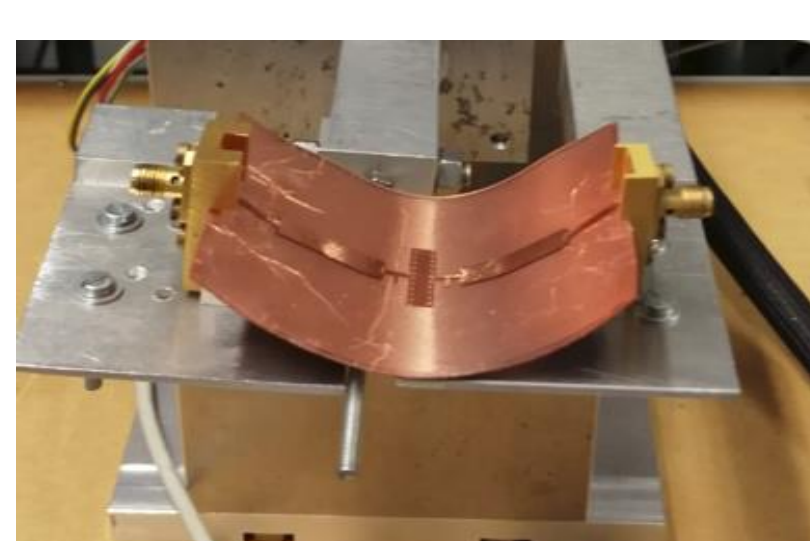
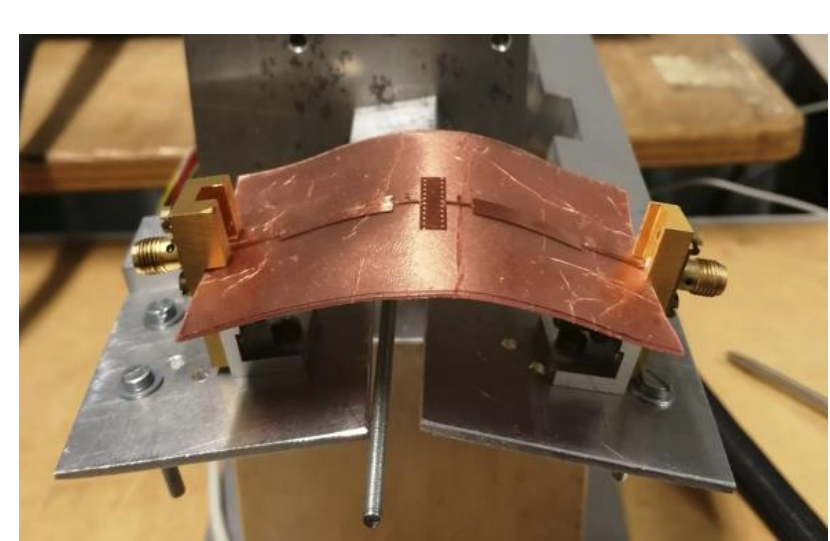
## Fabrication of RF devices on a biobased material (CL)

### Demonstrator 1 = 2.45 GHz bandpass filter

- ✓ Interdigitated capacitor
- ✓ Two stubs
- ✓ Two transmission lines
- ✓ No vias included
- ✓ Size = 61x25 mm<sup>2</sup>

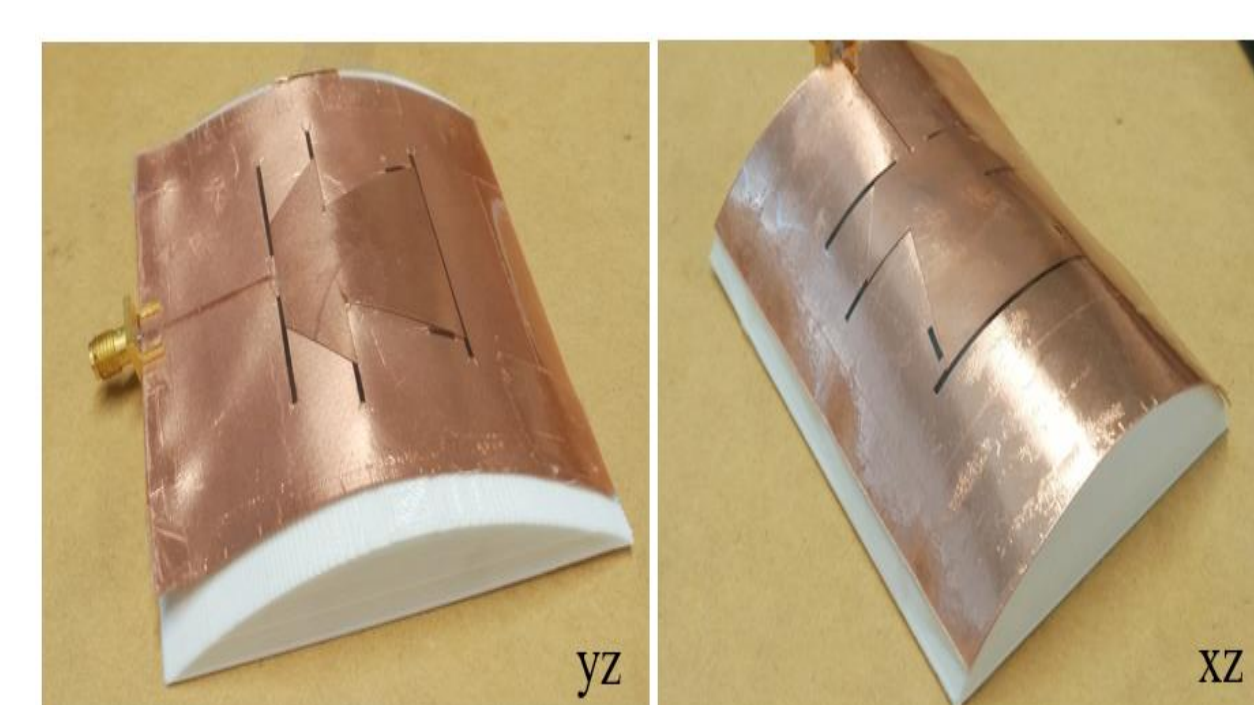


Influence of the bending on the filter performance

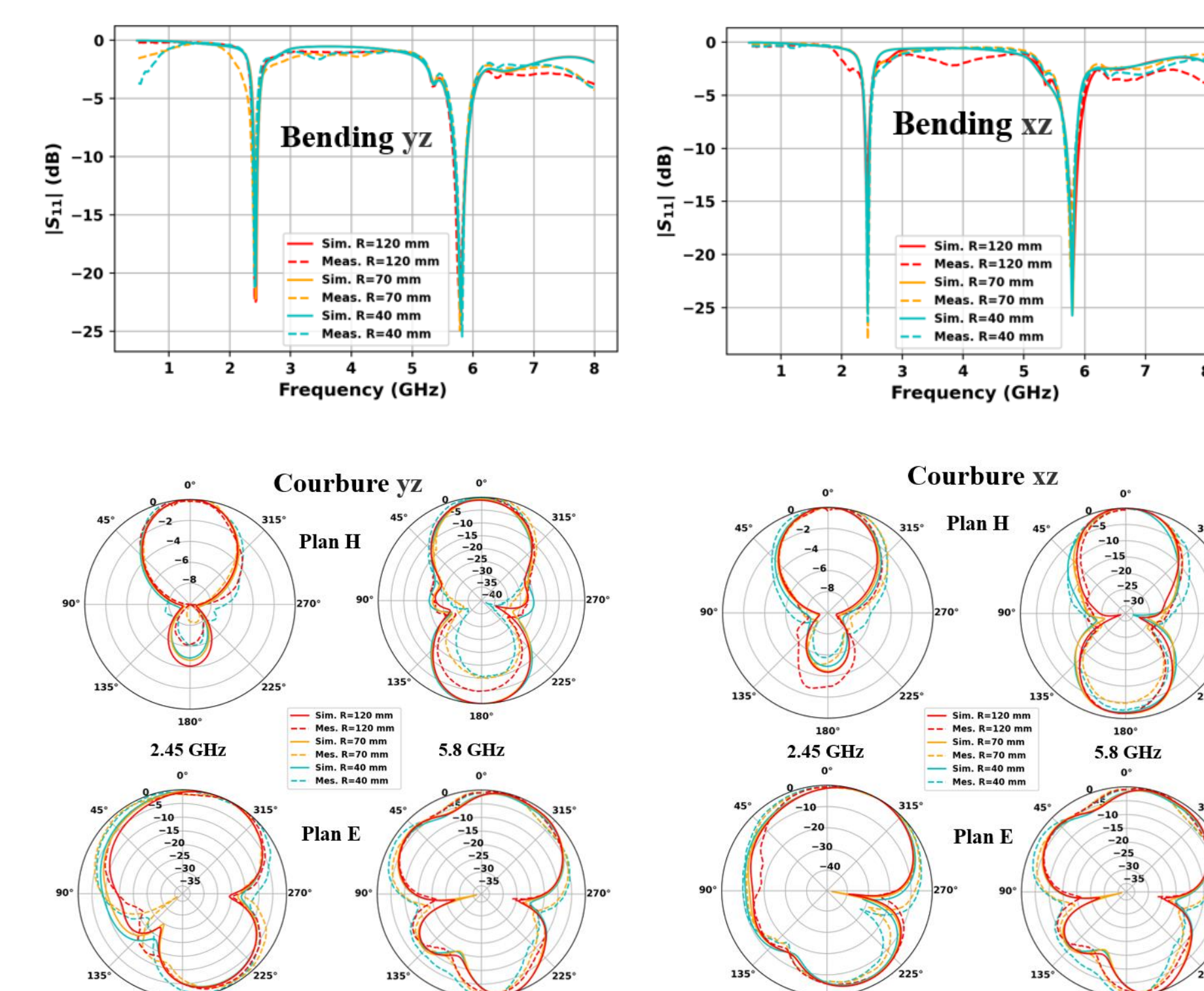


### Demonstrator 2 = Dual band antenna (2.45GHz/5.8GHz)

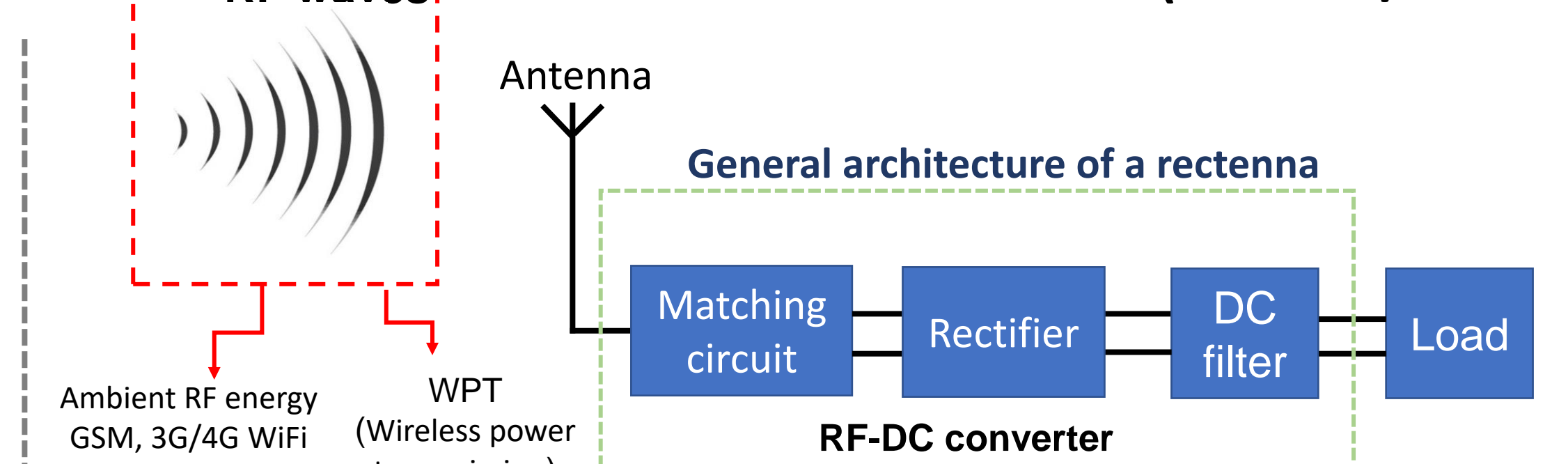
- ✓ Antenna for WBAN (Wireless Body Area Network) applications.
- ✓ The size of the antenna is 58x54 mm<sup>2</sup>



Influence of the bending on the antenna performance

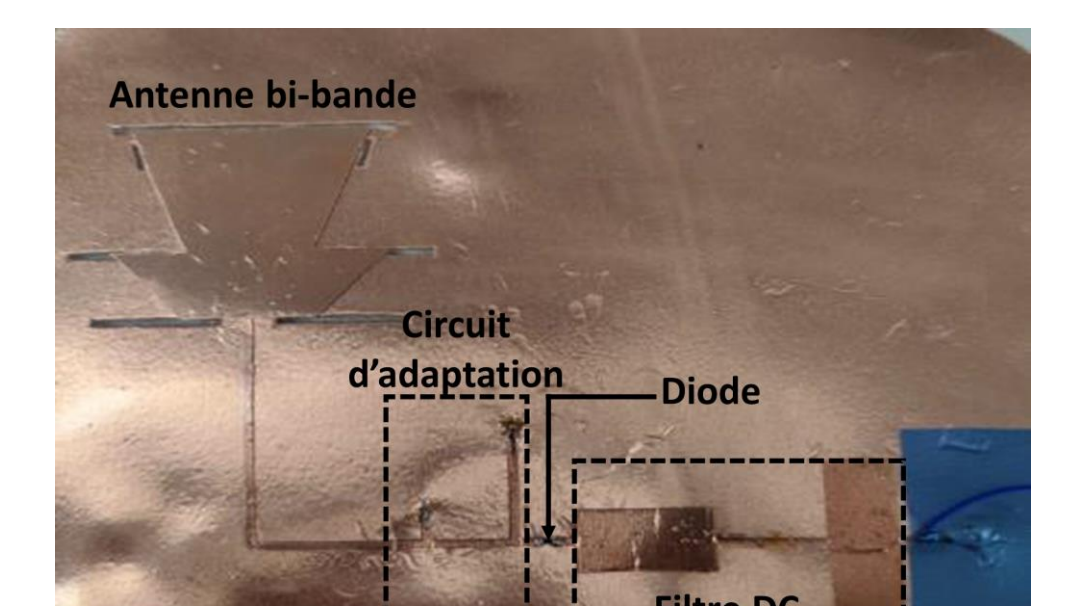
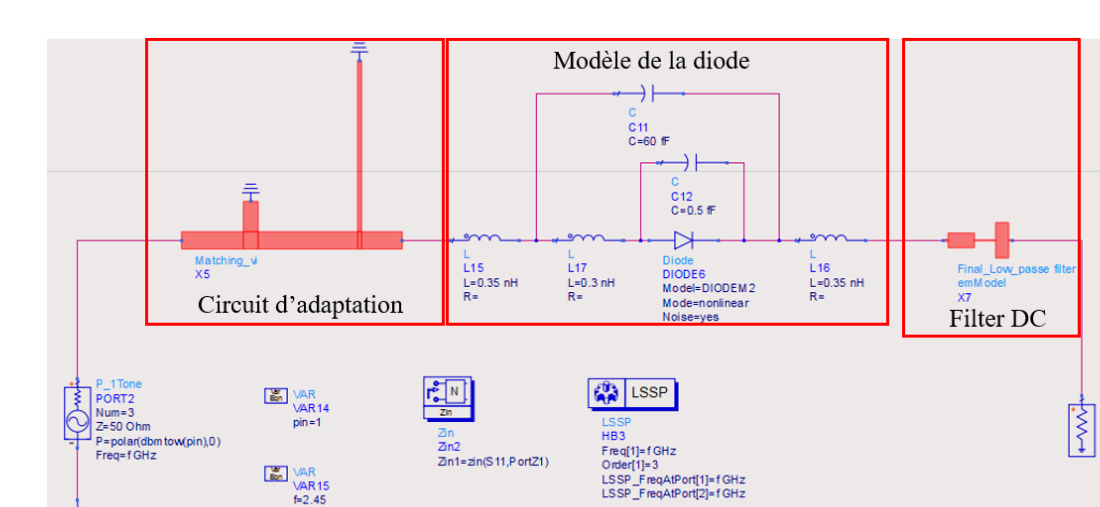


### Demonstrator 3 = Rectenna (2.45GHz/5.8GHz)



Fabrication of an EM energy harvesting system (rectenna) at 2.45 and 5.8 GHz.

### ADS schematic of the RF-DC converter



- ✓ Maximum voltages recovered: 195 mV at 2.45 GHz and 109 mV at 5.8 GHz (for an incident power of 20 dBm)

