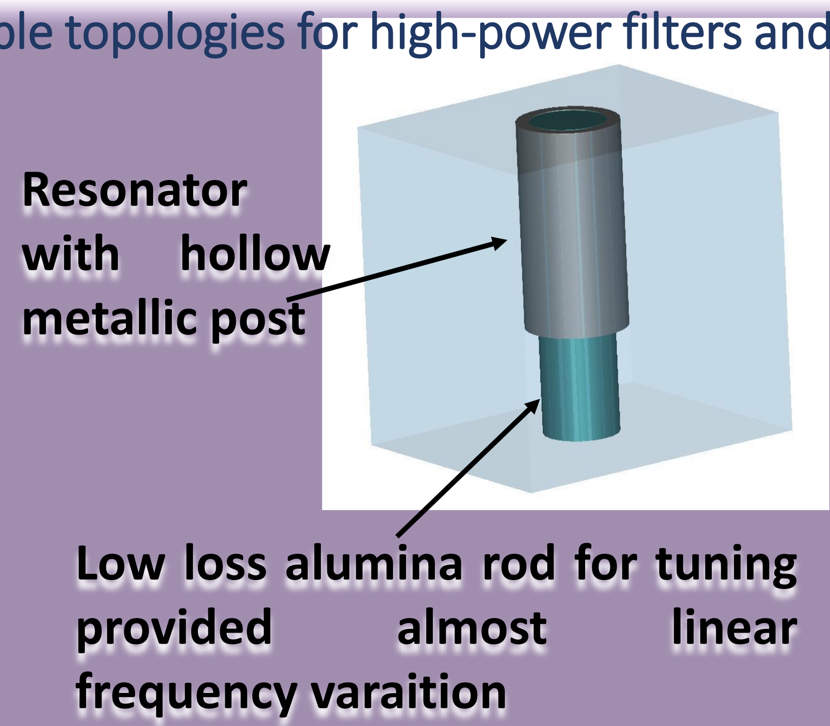
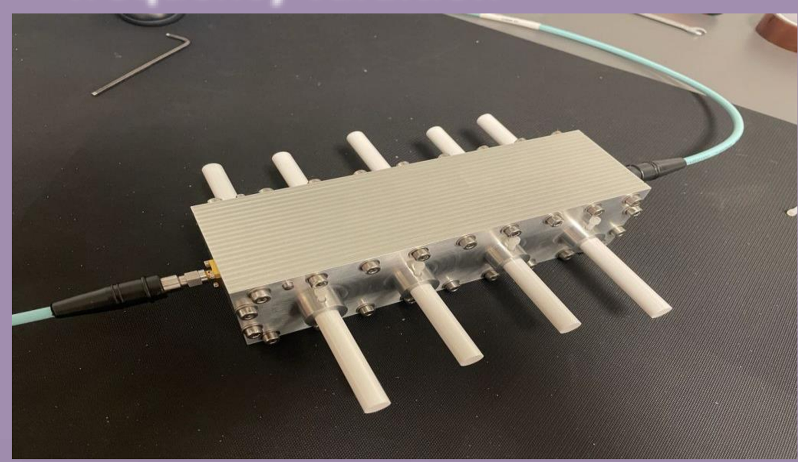
Work Package 4: High-Power Technologies for Large Platforms

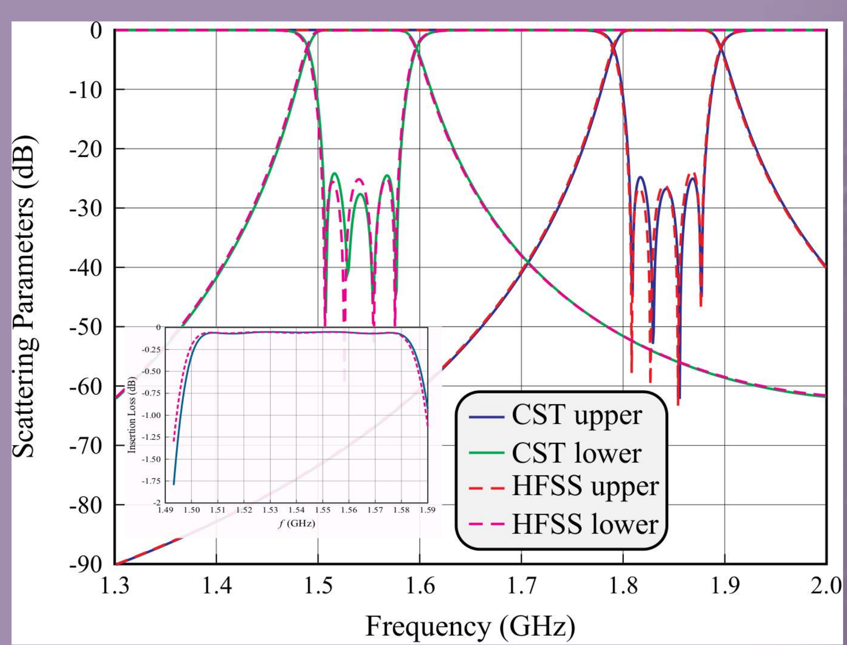
ESR4 Synthesis and design of reconfigurable topologies for high-power filters and multiplexers

- Explored/studied reconfiguration capability with several potential topologies.
- Realized the solution of using low-accuracy, computer-controlled actuators to implement remotely controlled tuning with dielectric tuners.
- Established the almost linear relationship of resonant frequency and dielectric tuner depth. Hence, the prediction of the filter center frequency is greatly simplified.
- A fully reconfigurable filter prototype has been fabricated using the CNC milling technique with 5 micron accuracy.



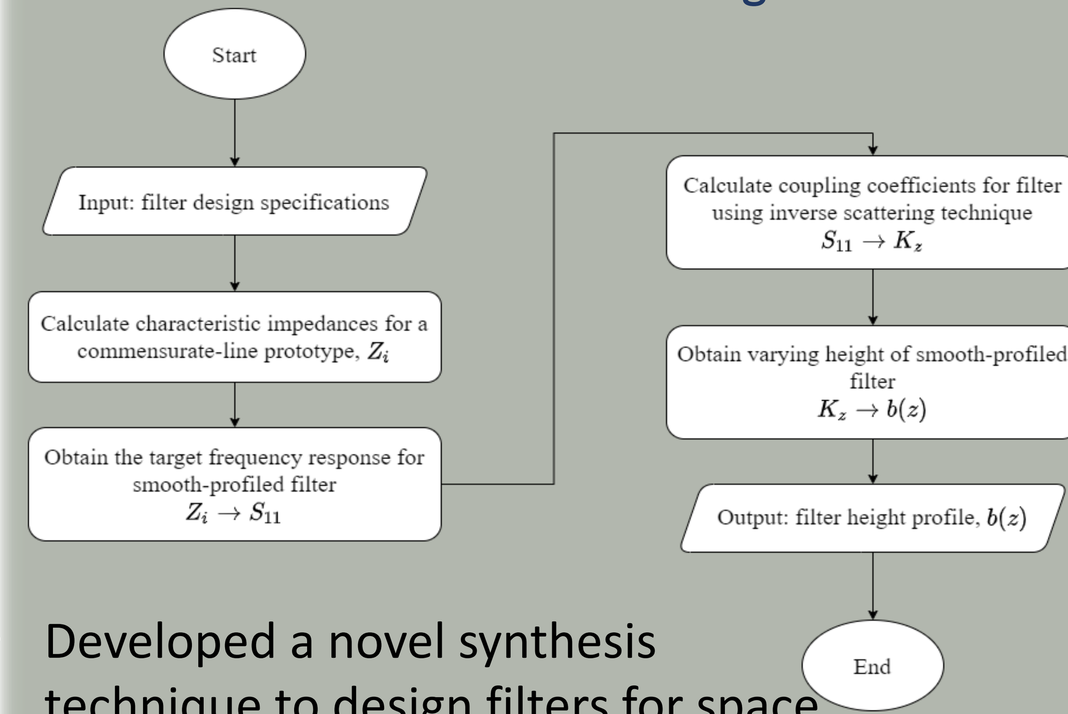


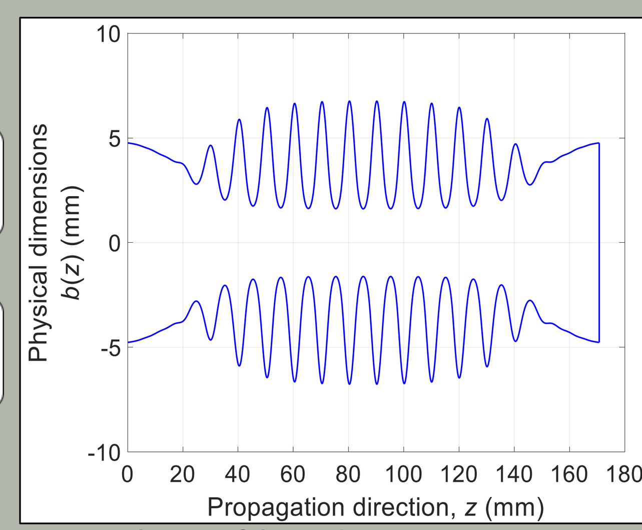
4.6: Fabricated Prototype using CNC milling



4.3 Achieved frequency tuning range of 300% while maintaining the constant absolute bandwidth and return loss level. The simulations have been carried out with the losses and tolerance considerations.

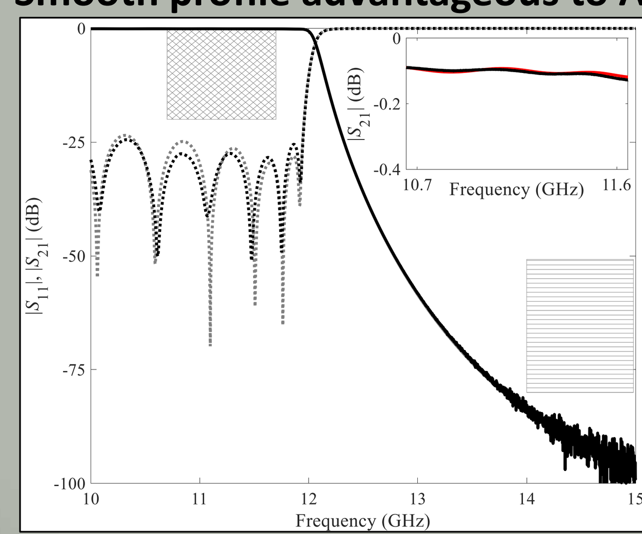
ESR3 New design techniques for telecommunication payloads of space systems suitable for additive manufacturing in the context of large platforms



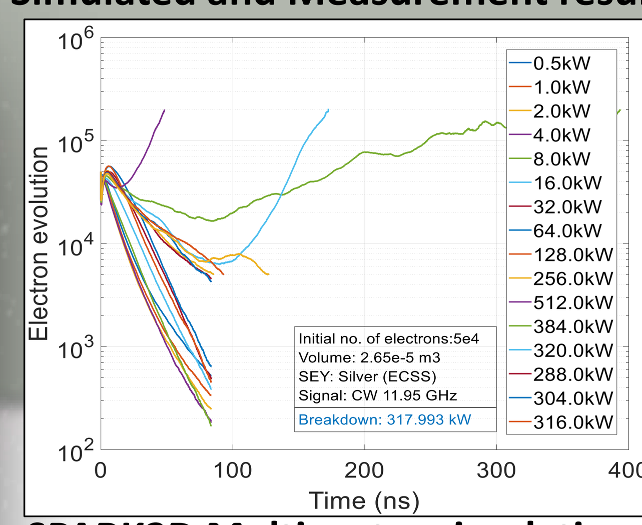


Smooth profile advantageous to AM

- Developed a novel synthesis technique to design filters for space application capable of handling high-power.
- The rectangular waveguide filter so designed has a smooth profile which is advantageous for fabricating with Additive Manufacturing (AM).
- The final prototype was fabricated using DMLS – an additive manufacturing technique to fabricate directly in metal.

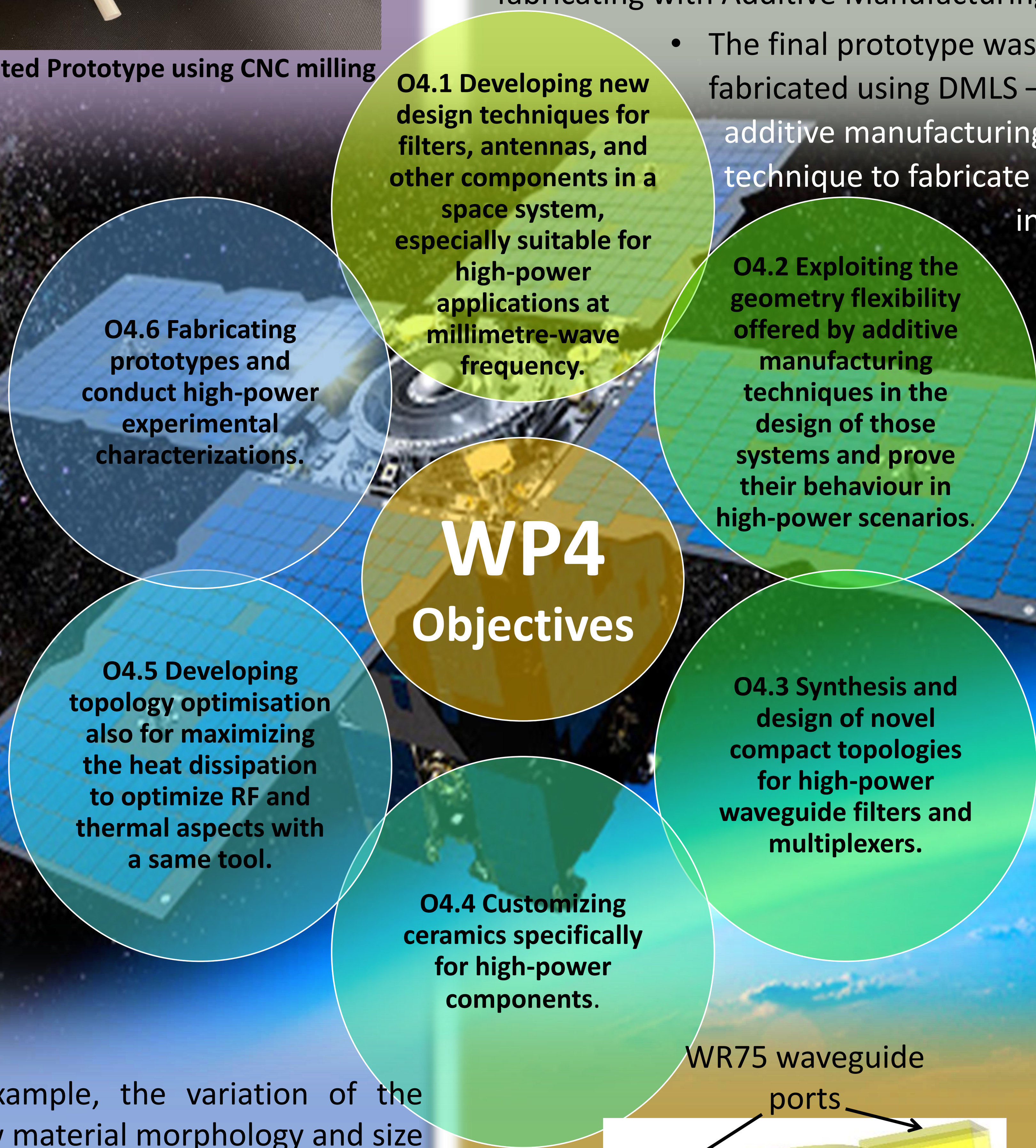


Simulated and Measurement results



SPARK3D Multipactor simulation

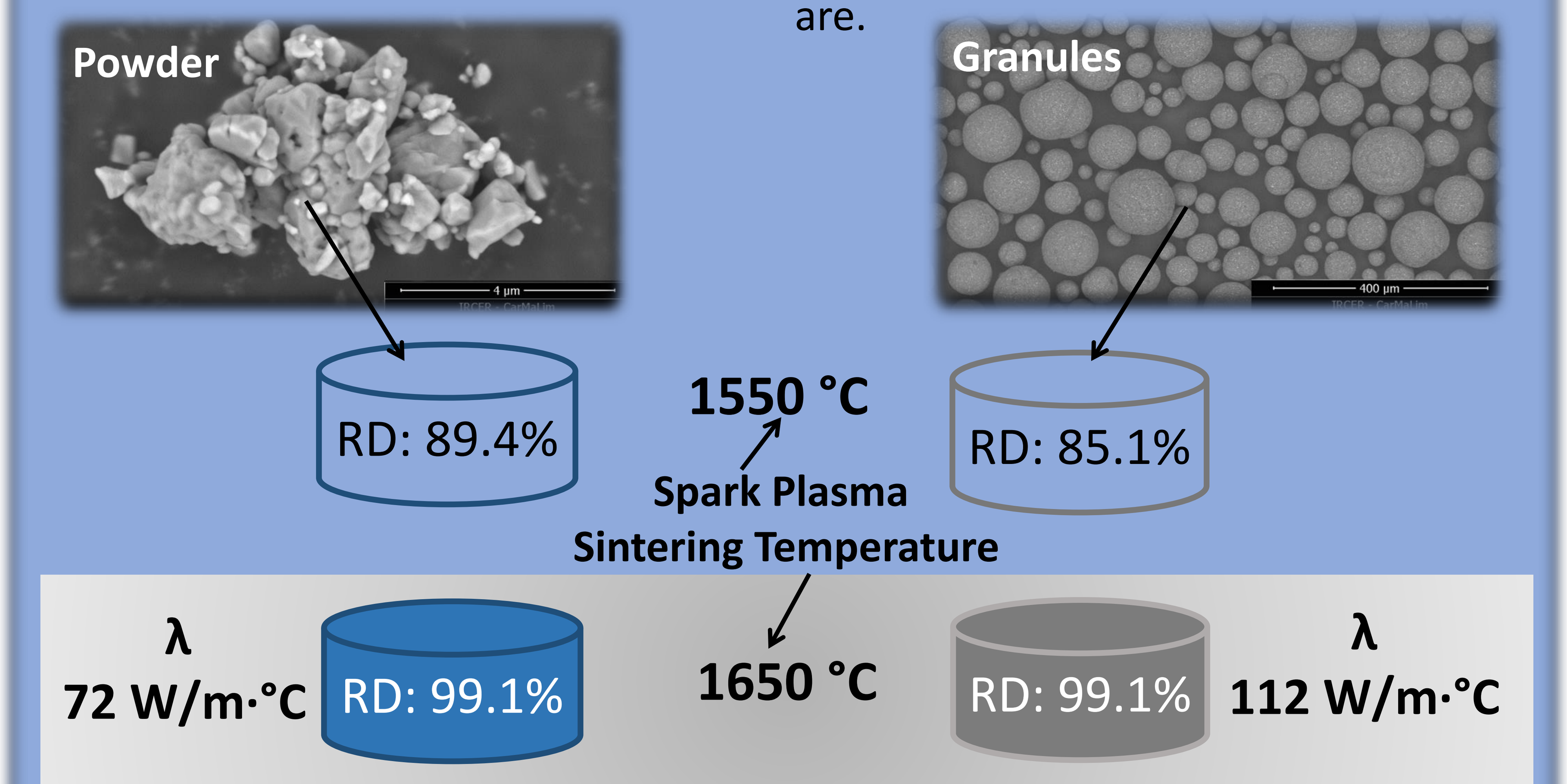
Fabricated prototype using DMLS



ESR14 Advanced materials for high power Components

Ceramic customization means tailoring the material properties accordingly with its intended use. The material properties required for high-power RF applications are related to both the relative density of the material and their microstructure (grain size and secondary phases). Regarding the first item, it is worth optimising the densification process during manufacturing. Final density does not only depend on the chemistry, morphology and aggregate size of the initial powders, but also on the processing parameters.

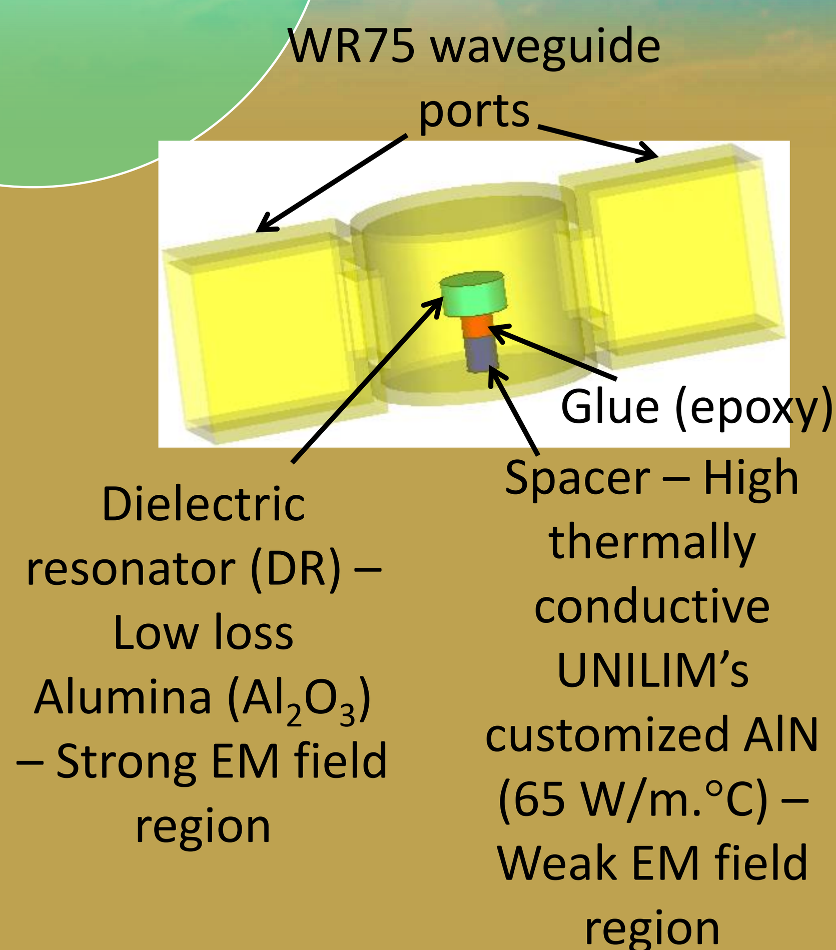
As an example, the variation of the initial raw material morphology and size impact the Relative Density (RD) and the thermal conductivity (λ) of the sintered specimens (see below). Therefore, the optimisation of the sintering temperature could lead to fully dense bodies after sintering whatever the raw material properties are.



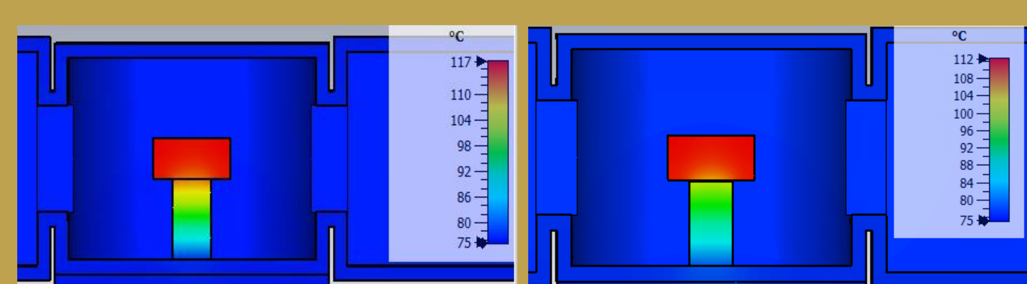
λ= thermal conductivity RD = Relative Density

ESR15 Development of topology optimization tools for RF components

It was found through Electromagnetic (EM) – Thermal coupled multiphysics analysis, that using high thermally conductive UNILIM's internally developed Aluminum Nitride (AlN) ceramic in weak EM field regions allows better dissipation of RF loss generated heat in high-power devices used in space.



Simulated temperature profiles at 12.5 GHz with 75°C ambient temperature and 100 W input power



The temperature gradient within the high-power RF device is minimized for a better power handling capability. A 5°C decrease in maximum temperature is achieved through using UNILIM's customized AlN.

TESLA

Advanced Technologies for future European Satellite Applications

This project has received funding from the European Union's Horizon 2020 research and innovation programme under the Marie Sklodowska-Curie grant agreement No. 811232. However, the content of this poster reflects the opinion of its authors and does not in any way represent the opinions of the European Union. The European Commission is not responsible for any use that may be made of the information the poster contains.