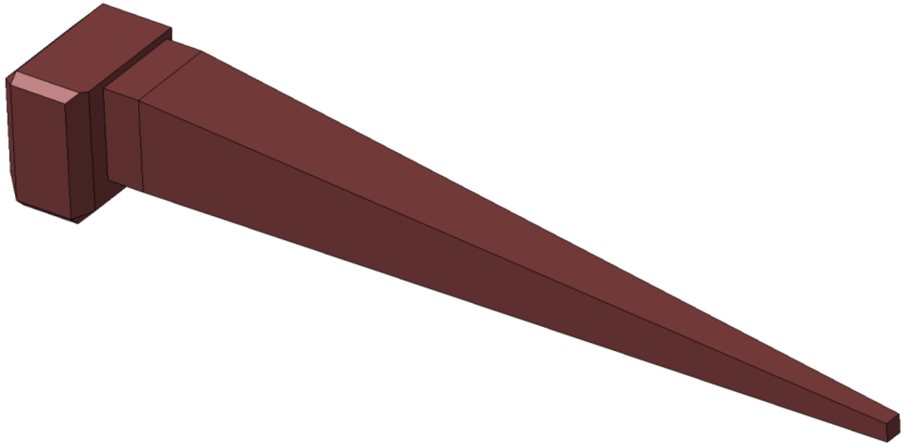
HOMs ceramics absorbers

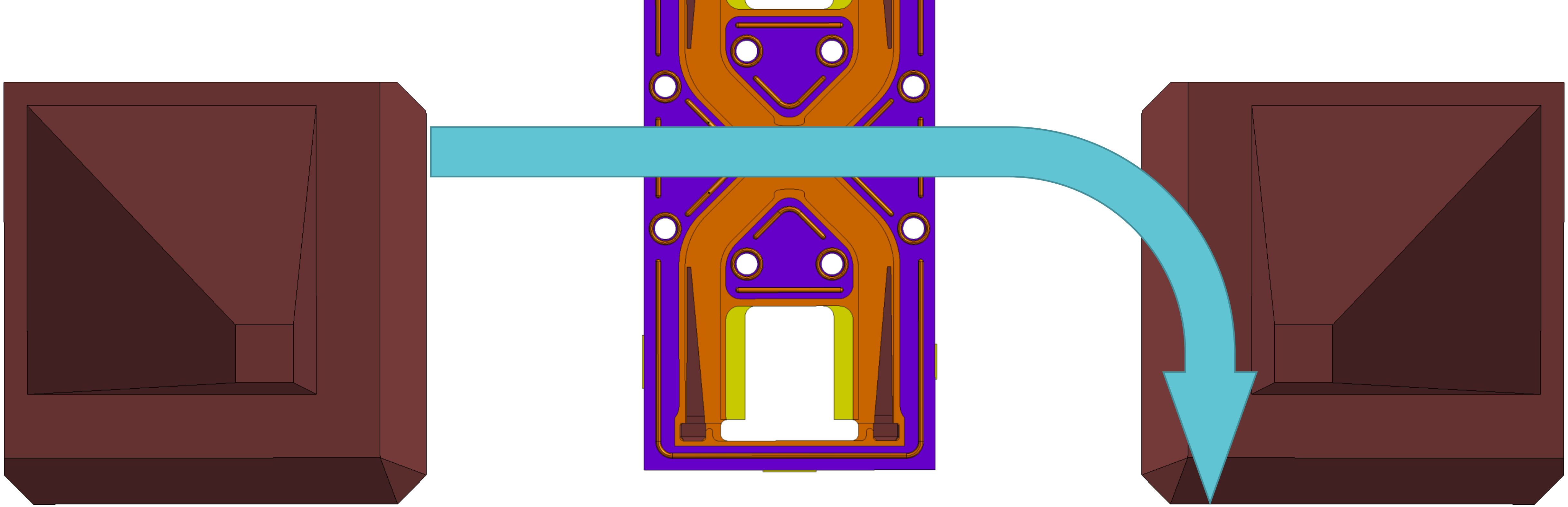
Pedro Morales

Date

HOM Loads advantages

Symmetric part





HOM material issue

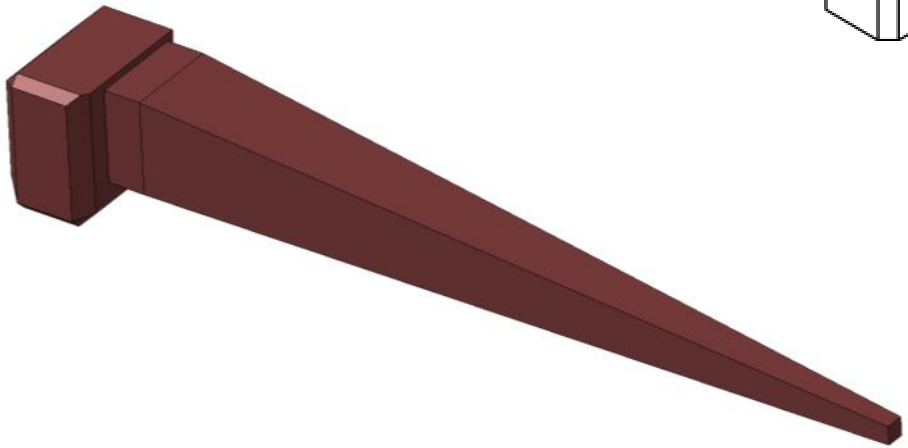
Ekasic P is no longer available in the market as it was, change of the additives and it can influence or not in the performance.

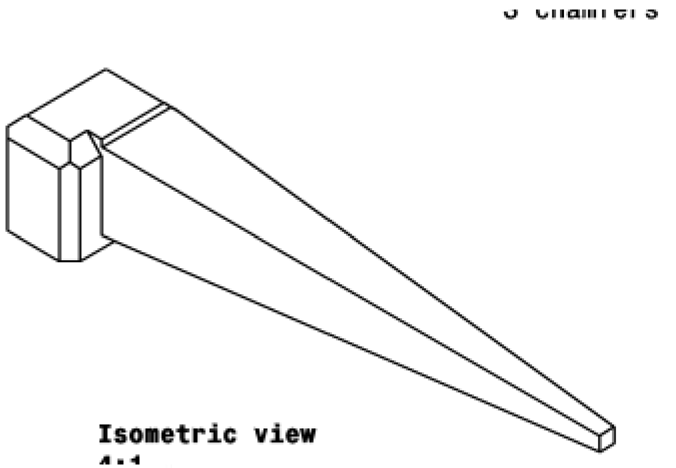
There is no data why this material is working well but it is, so for finding a substitute we have ask Ping to run some measurements and we have asked 2 different materials from different suppliers

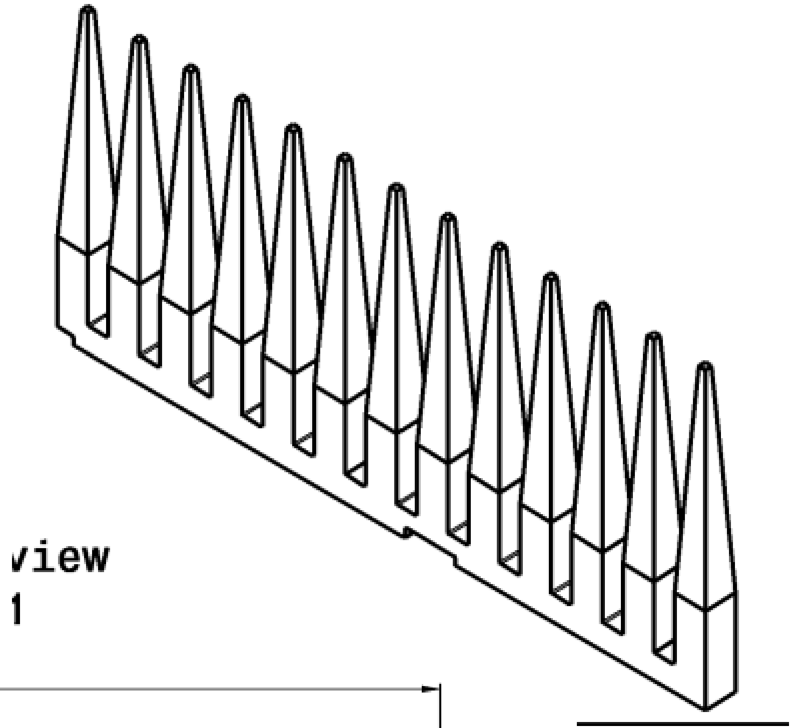
Mention, the cost surge because of the complicated shape. Can we carry out a sim of the tolerances we can accept?
I will work and a better holding method to make it simpler.

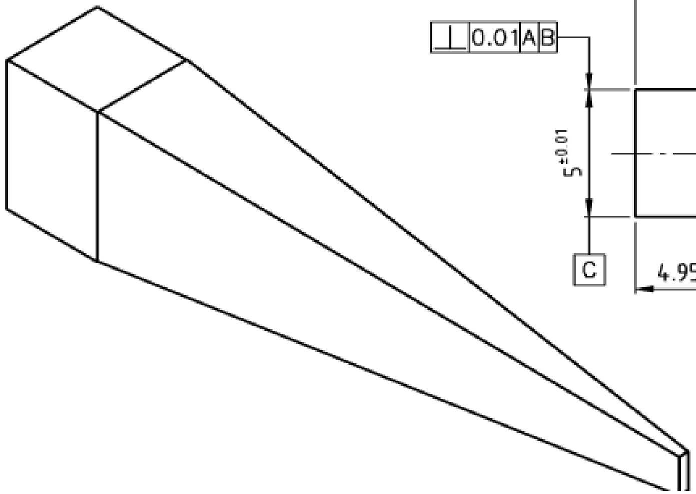
Materials		Ekasic P	Ekasic F	SC-C	Boostec
Density	g/cm3	2.76-2.89	3.15	3.12	3.2
Porosity	%	10 - 14	<2	<3	1.5
Hardness	GPa	24.5	24.5	22	22
Thermal expansion (Coef)	10e-6/K	3.8	3.8	3.3	2.2
Thermal conductivity	w/mK	110	130	120	180
Specific electrical resistance	Ohm*cm	>10e8	>10e3	10e5-10e7	10e6-10e9

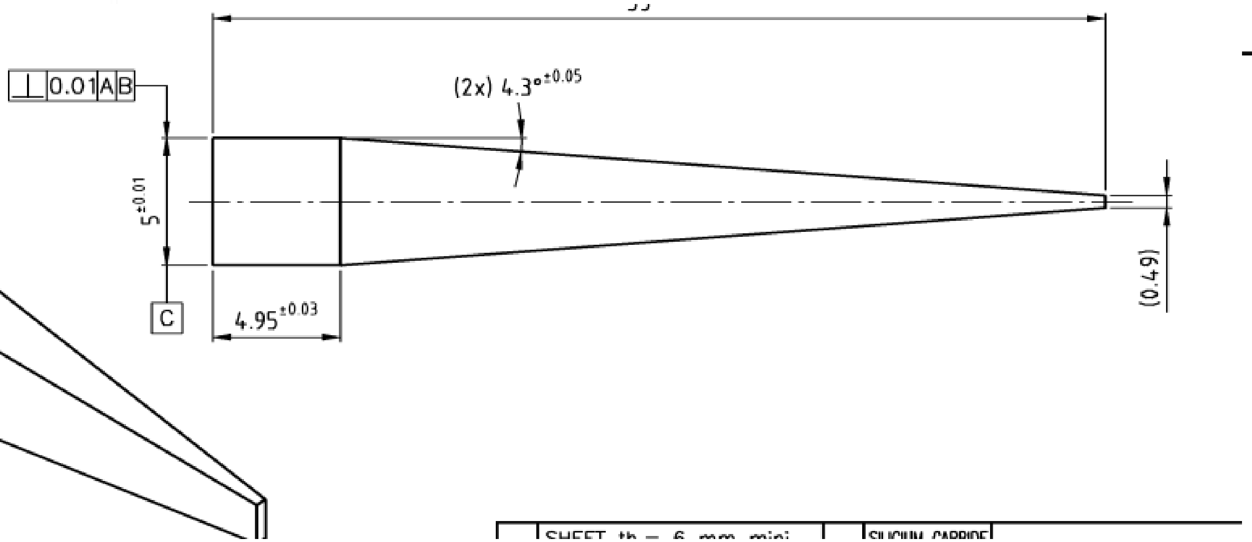
HOM Evolution











Folder

HOM References

https://edms.cern.ch/document/997123/1

https://edms.cern.ch/document/1009247/1

https://edms.cern.ch/document/1059157/1

https://edms.cern.ch/document/1211574/1

https://www.researchgate.net/publication/254469450_Analysis_of_long-range_wakefields_in_CLIC_main_Linac_Accelerating_Structures_with_Damping_Loads

CERN-OPEN-2008-019.pdf

https://indico.cern.ch/event/142416/contributions/1375573/attachments/129021/183157/gdemiche20110623-up.pdf

https://indico.cern.ch/event/72077/contributions/2074694/attachments/1036307/1476627/RF_development_meeting_13_01_10.pdf

Parameters of material definition

$20 < \varepsilon_r < 40$ // $0.2 < \tan\delta < 0.4$

ε_r = relative permittivity or real part of the permittivity
$\tan\delta$ = loss tangent or tangent delta or Dielectric loss

Reference

$15 < \varepsilon < 25$ // $\tan\delta > 0.3$

Reference

$\varepsilon < 20$ (as low as possible) // $\tan\delta > 0.3$

Reference

“Material for the loads must have ε’ in the range of 11-14 and tanδ > 0.15”

Reference

MAIN CHARACTERISTICS THAT MUST BE CONSIDERED FOR THE SELECTION OF RF ABSORBER

❖ THE ELECTRIC OR MAGNETIC LOSS HAVE TO BE HIGH AT THE HOM FREQUENCIES.

Ref.

❖ LOW DIELECTRIC CONSTANT AND PERMEABILITY AT THE HOM FREQUENCIES, TO ALLOW AN ADEQUATE PENETRATION OF THE RF FIELDS INTO THE SELECTED ABSORBING MATERIAL.

❖ GOOD THERMAL CONDUCTIVITY TO PREVENT AN EXCESSIVE HEATING OF THE MATERIAL DURING THE RF POWER DISSIPATION

❖ AT CRYOGENIC TEMPERATURES, IS NECESSARY TO EVALUATE THE THERMAL CONTRACTION

❖ A LOW OUT GASSING RATE, SO THE MATERIAL COULD BE INSIDE HIGH VACUUM SYSTEMS.

General Standard procedure to measure it:

ASTM-D150
Dielectric Constant and Dissipation Factor ASTM D150, IEC 60250 (intertek.com)

Manufacturers and material suppliers

- They don’t measure (normally) those parameters and even less in the frequency ranges we need to explore.
- Can we rely on their results given the fact that some of them are not following any procedure to measure the parameters?
- Supply ussies. Not really much availability on the market. If we foreseen this with time there is no issue there.
- Redesign of the current proposal to get something easier to machine. Keep the symmetrical advantages and the poka-yoke
- Any comments on the mechanical properties? Porosity? Ekasic P was the more porous one. Density is important? CTE bellow 5 should works.

Materials summary

Excel table

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