Cryogenic & radiopure substrate

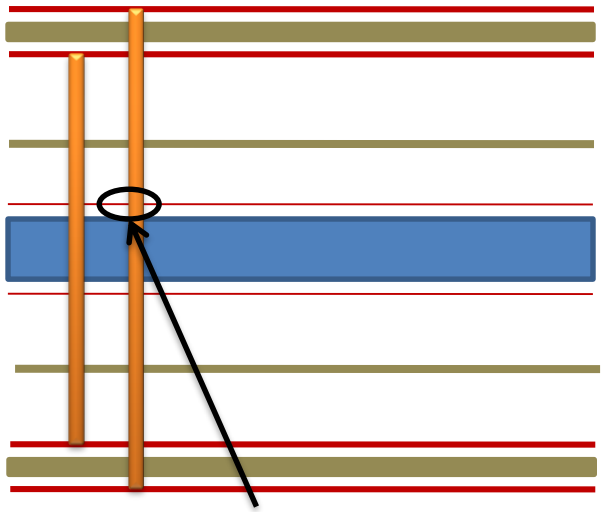
Requirements:

- Low CTE
- High Radiopurity:
  - ~ few mBq/m² for Uh/Th chains and for ^{40}K
- Rigidity <-> thickness 0.5 – 0.7 mm
  - mBq/m² -> few mBq/kg

Material	CTE [ppm/K]	Uh/Th [mBq/kg]	40K [mBq/kg]
Silicon	3-5	Very low	Very low
Synthetic Fused Silica	0.5	5-20	-
Selected FS	0.5	0.05	-
Copper (oxygen free/e-deposited)	16	Low	<1
FR4	12-14	Very High	Very High
Nylon	50-90	-	-
PTFE/Teflon	120	0.1-10	<5
Polyimide/Kapton	20	1-10	<10
Arlon NT	5-7	100	1000

Supposing you do not want to use Arlon 55NT

(good CTE but not radiopure)



0.1 - 0.2 mm polyimide PCB with 18-35 um copper traces

50 um polyimide PrePreg

0.5 mm Fused silica with copper flush < 1 um

50 um polyimide PrePreg

0.1 - 0.2 mm polyimide PCB with 18-35 um copper traces

Mask the conductive layer

The Fused Silica will provide the mechanical rigidity

- LOW CTE 0.5 ppm/K & High Young Modulus 72 Gpa
- The copper flush on FS provide good adhesion to PrePreg
  - The thin film copper flush simplify the production
- Can be procured radiopure

The Polyimide will provide PCB technology

- HIGH CTE 2.7 ppm/K & High Young Modulus 3 Gpa
- Pyralux proven to be radiopure

The CTE is defined by the FS
BUT delaminating may be an issue

<u>Test ongoing in the next months</u>

If you do not want components on both sides

0.1 - 0.2 mm polyimide PCB with 18-35 um copper traces

50 um polyimide PrePreg

0.3 Copper layer