FIBRECOAT

Metal Coated Fibres for Space Radiation Shielding in Composites

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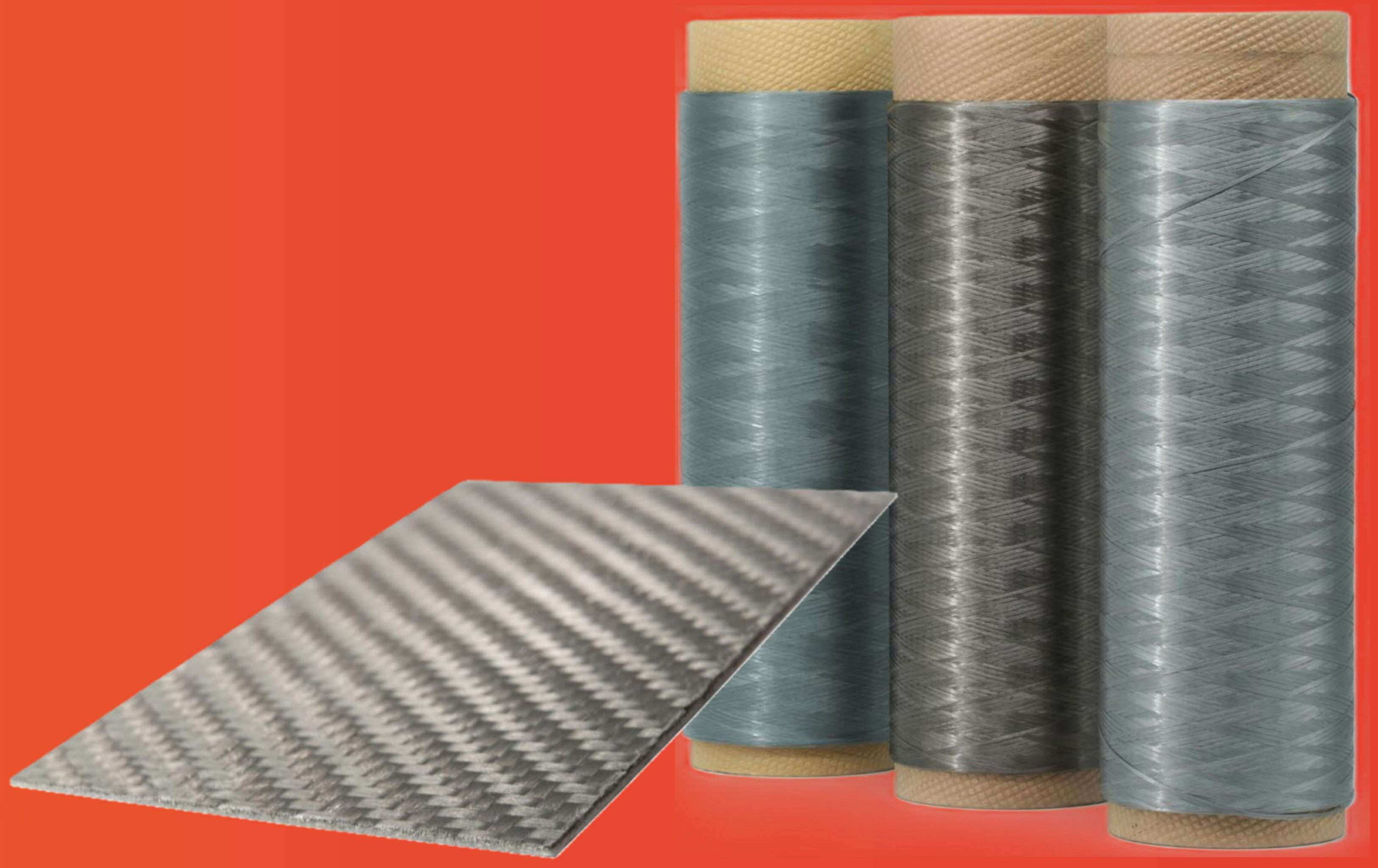
RADSHIELD 2026, 17.06.2026, ESA/ESTEC



With funding from the:
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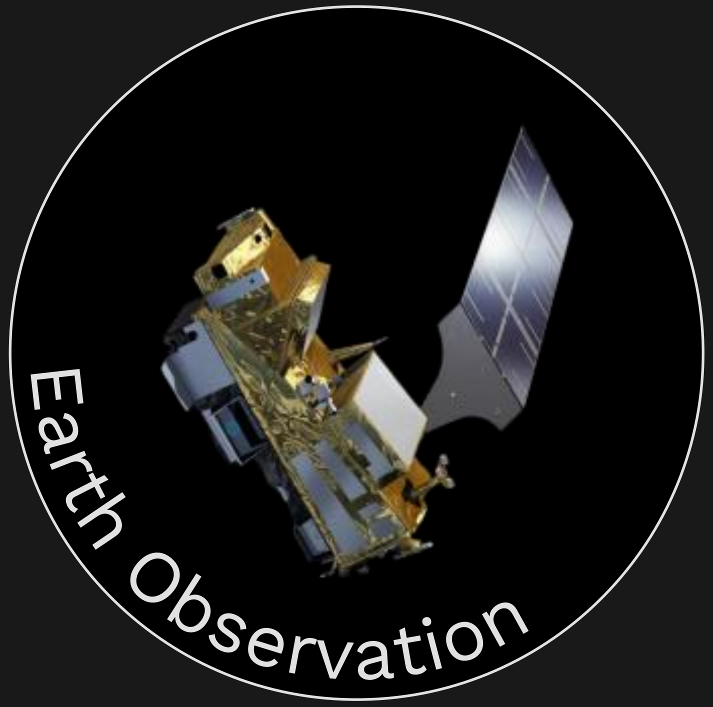
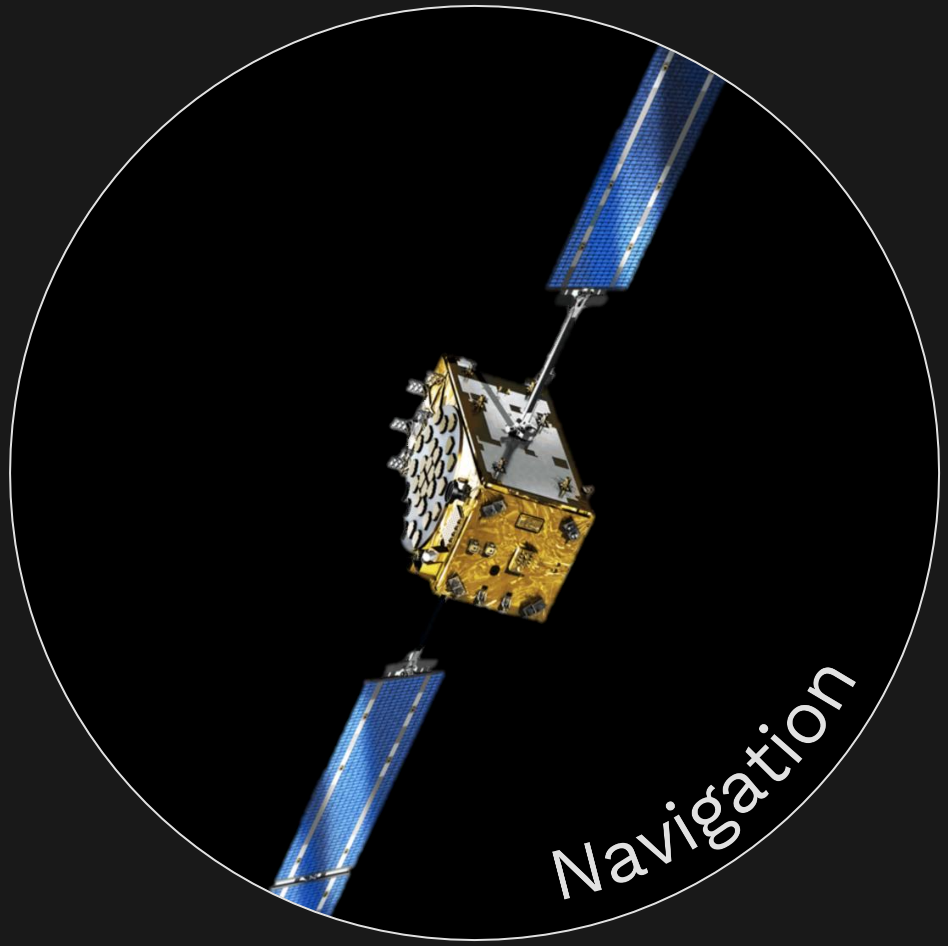
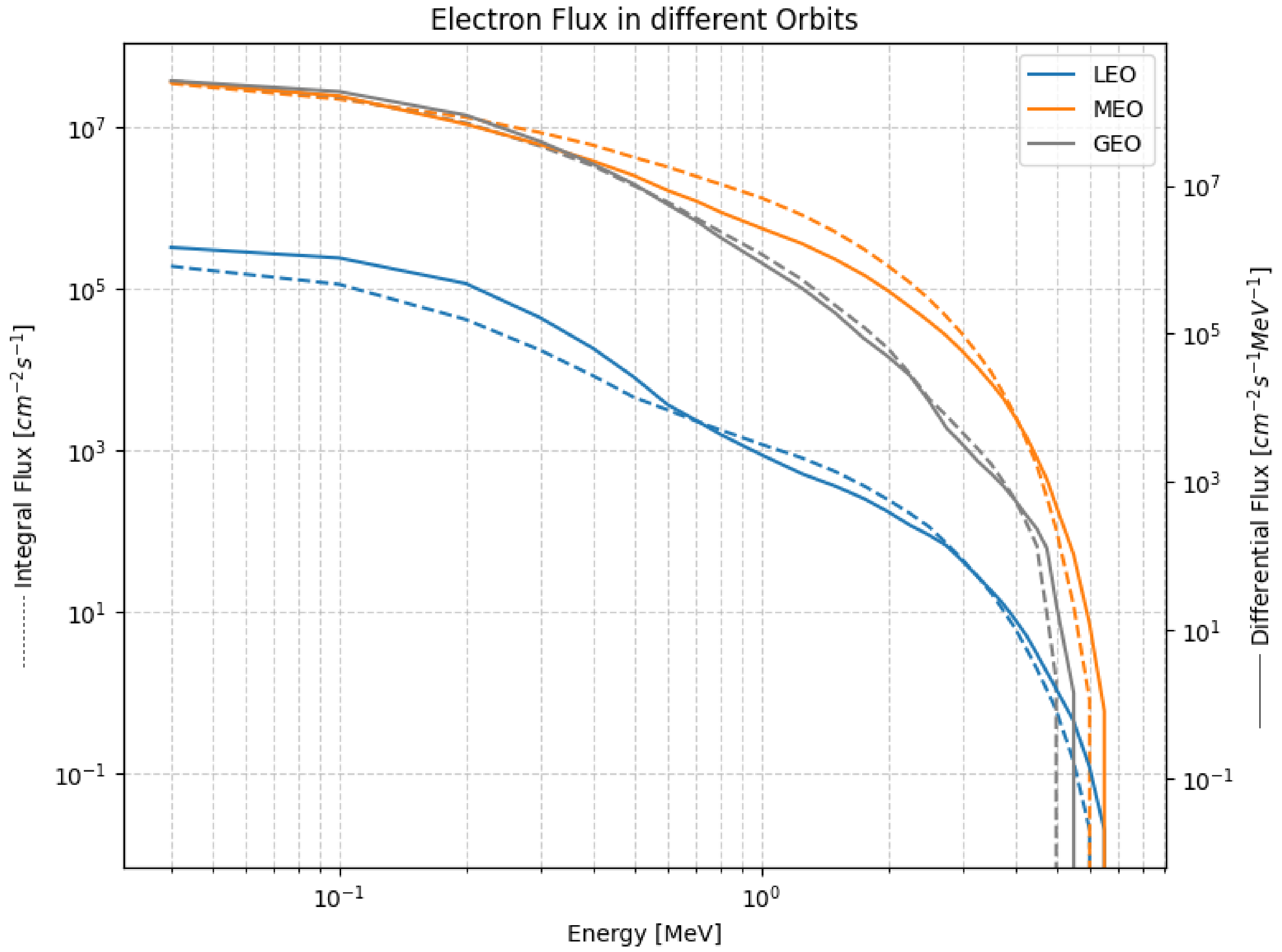
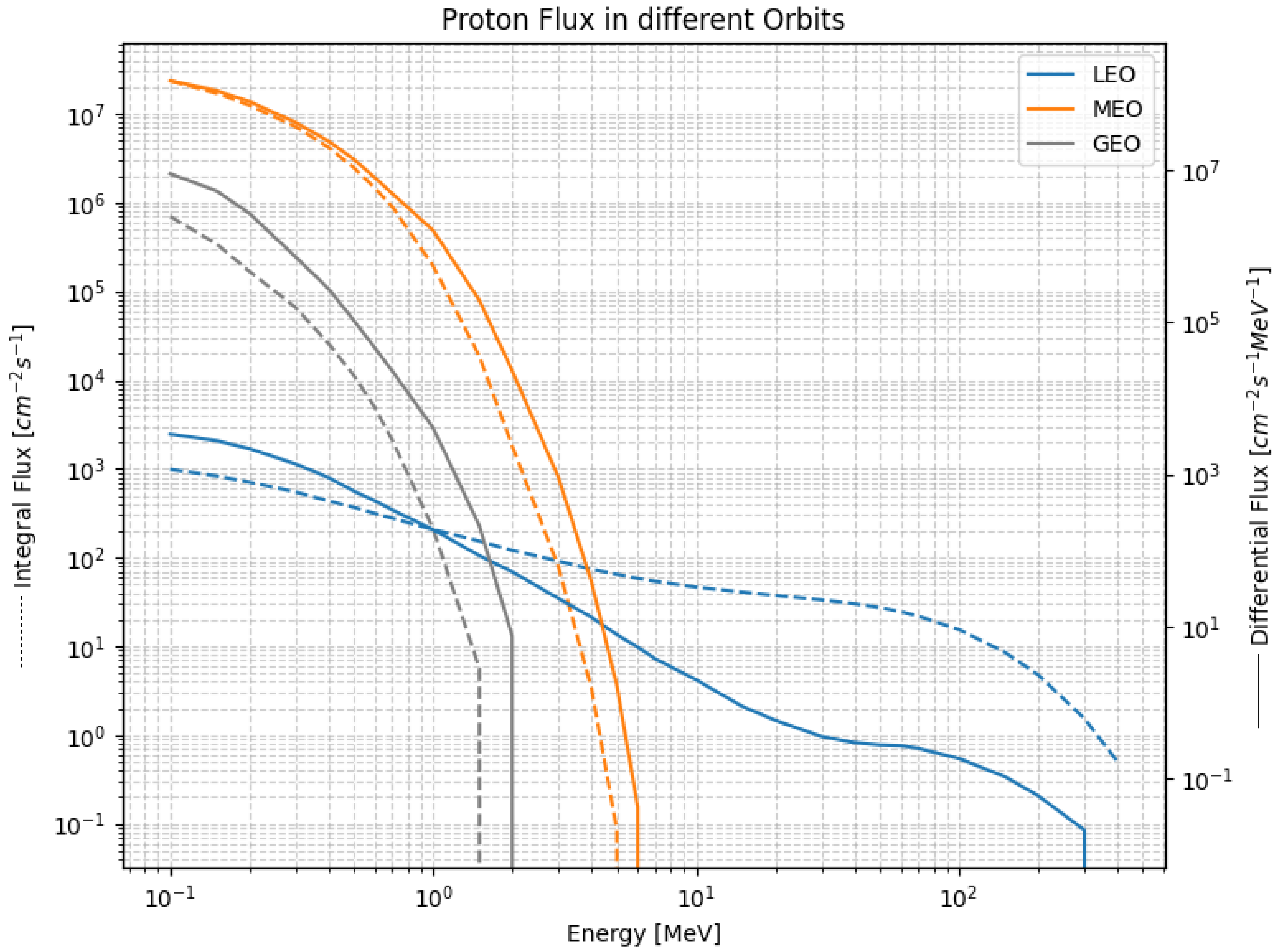
Spaceflight needs Resilience





Comparing Orbital Environments

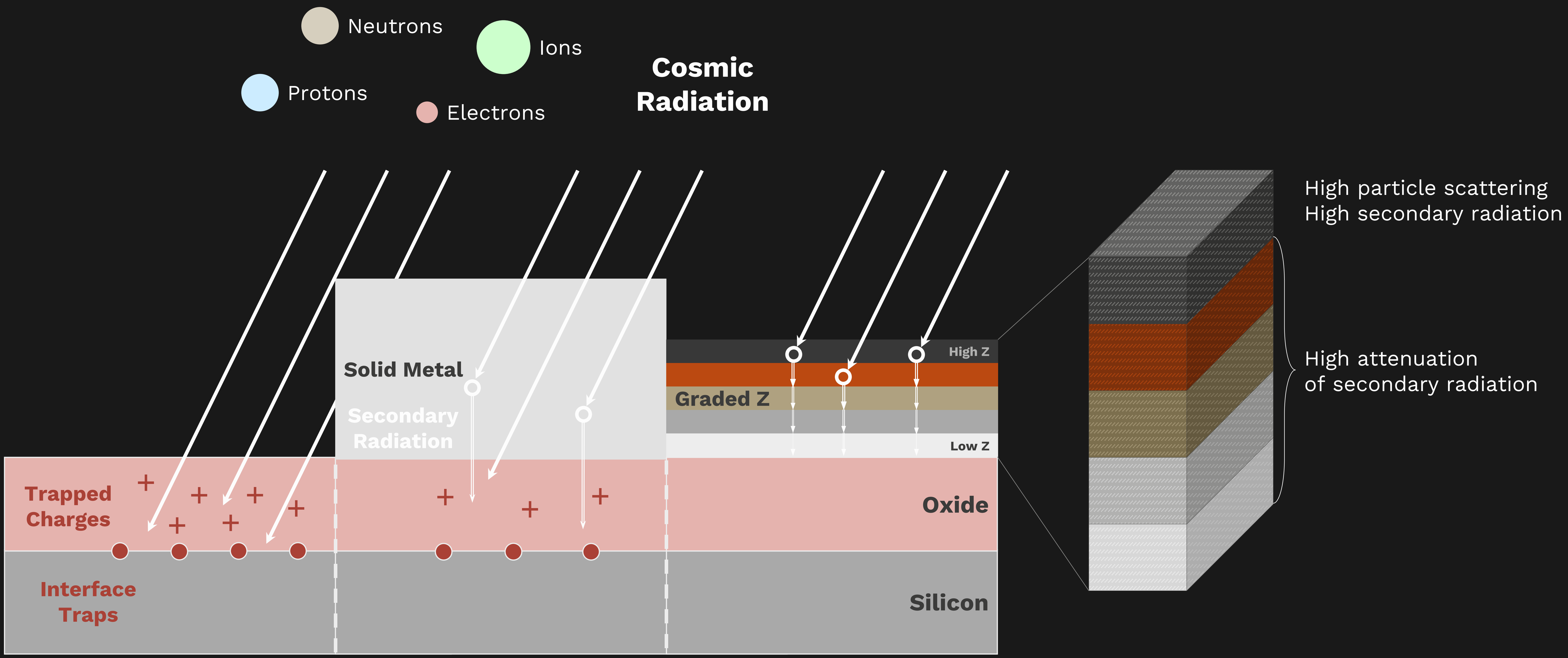




Radiation Species and Effects

Radiation Species	Interaction	Mitigation strategy	Best shielding material
Photons (X, γ)	Photoelectric effect, Compton scattering and pair production	Generate low energy electrons that can be absorbed	High-Z (Pb, W, Bi)
Electrons (β^-)	Ionisation and Bremsstrahlung	Minimize Bremsstrahlung, distribute energy	Low-Z (Al, polymers)
Protons	Ionisation and nuclear reactions	Slow with few secondaries or let pass	Low-Z (H-rich)
Neutrons	Scattering and displacement	Slow down and capture	Low-Z + absorbers (B, Li)
Heavy ions	Ionisation tracks and cascades	Minimize fragementation	Low-Z (H-rich)

Composite Radiation Shield

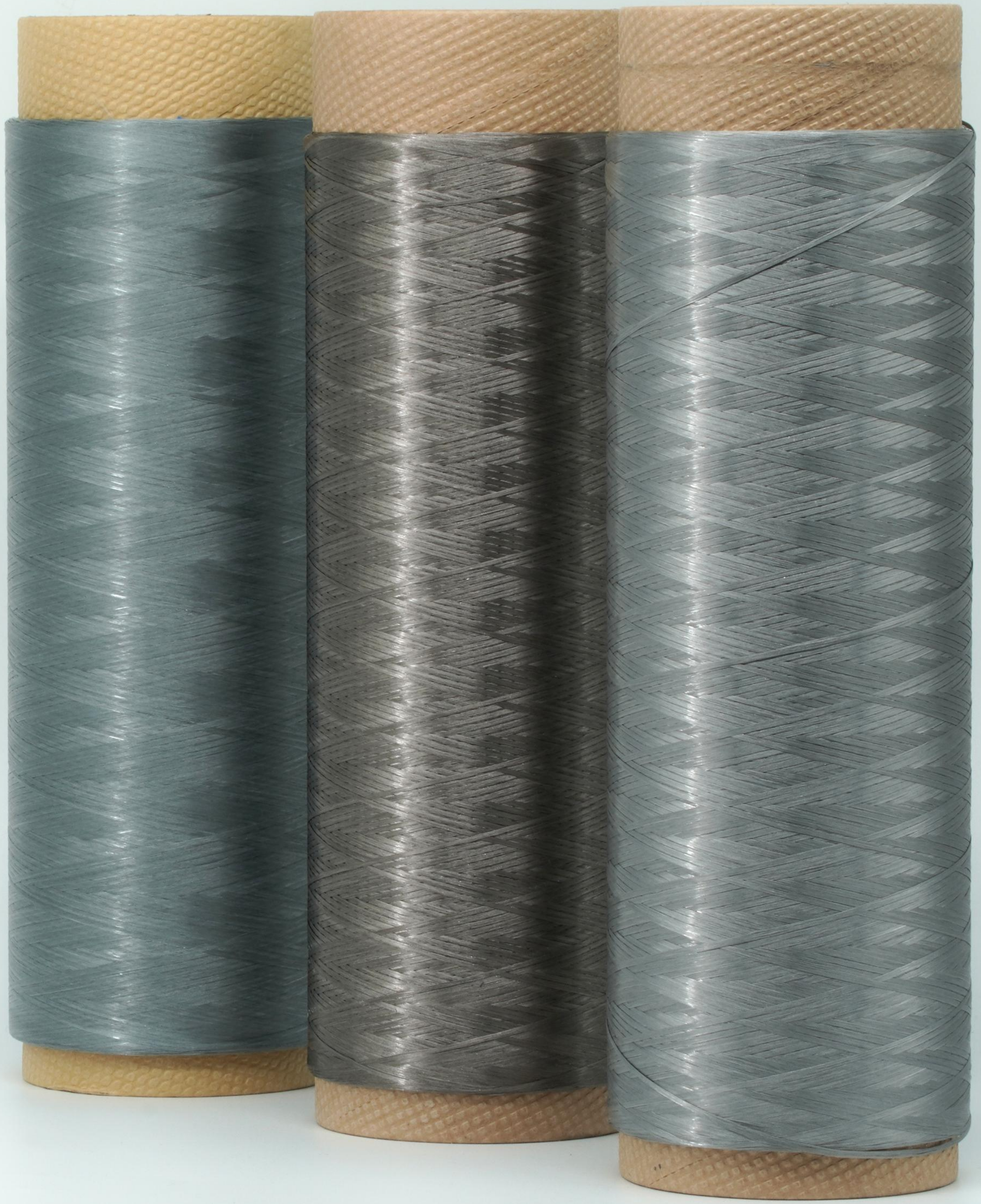


What do we need?

- Processable and combinable material format
- Combination of high-Z and low-Z materials
- Process and material needs to be qualified/qualifiable

- (Modularity to optimize for different environments)
- (Additional functionality, e.g. heat transfer, EM shielding)

Metal-Coated Fibres for Spacecraft

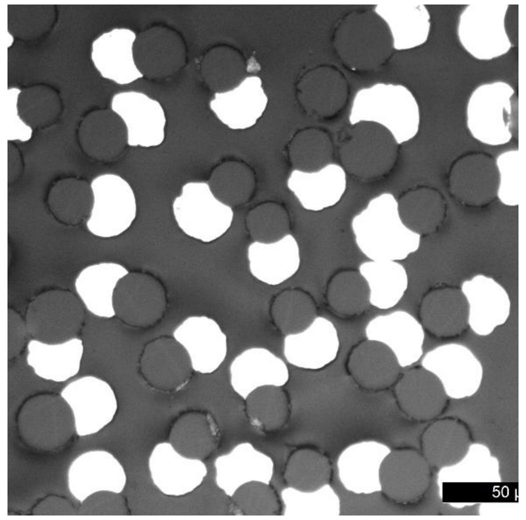


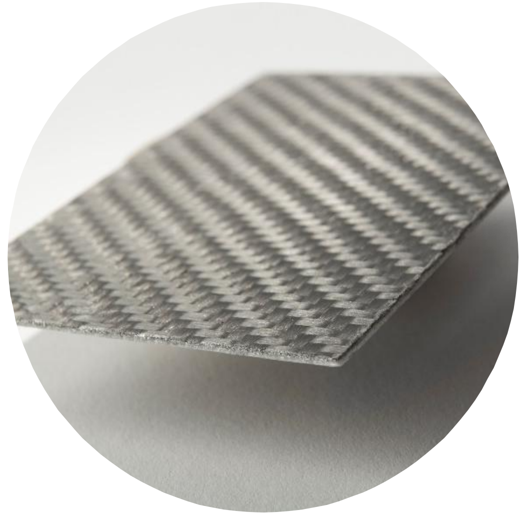
MetalCoat Fibres

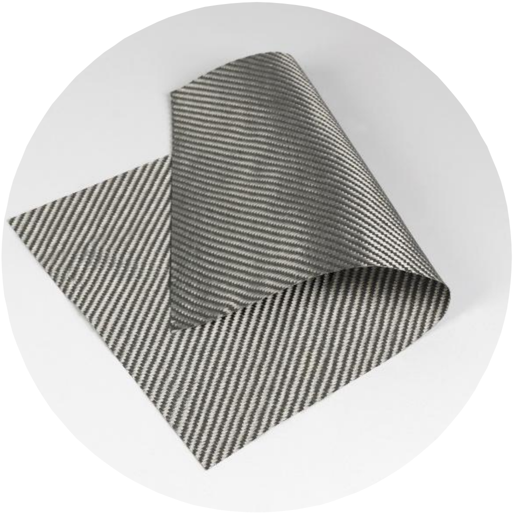
Coated filament, 50v% metal

New metal coated glass or basalt fiber
with high stiffness and metal properties

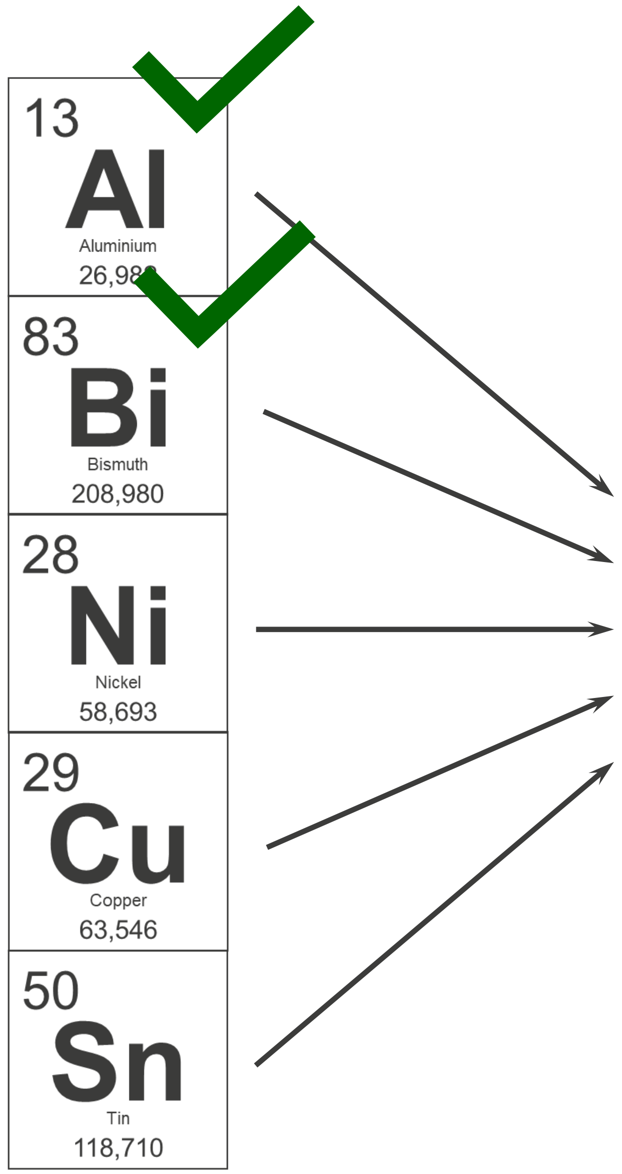
- Multifilament yarn with individually coated filaments
- Continuous, homogeneous sheath
- Strong chemical bond between glass and metal
- Adding multiple functions into composite structures



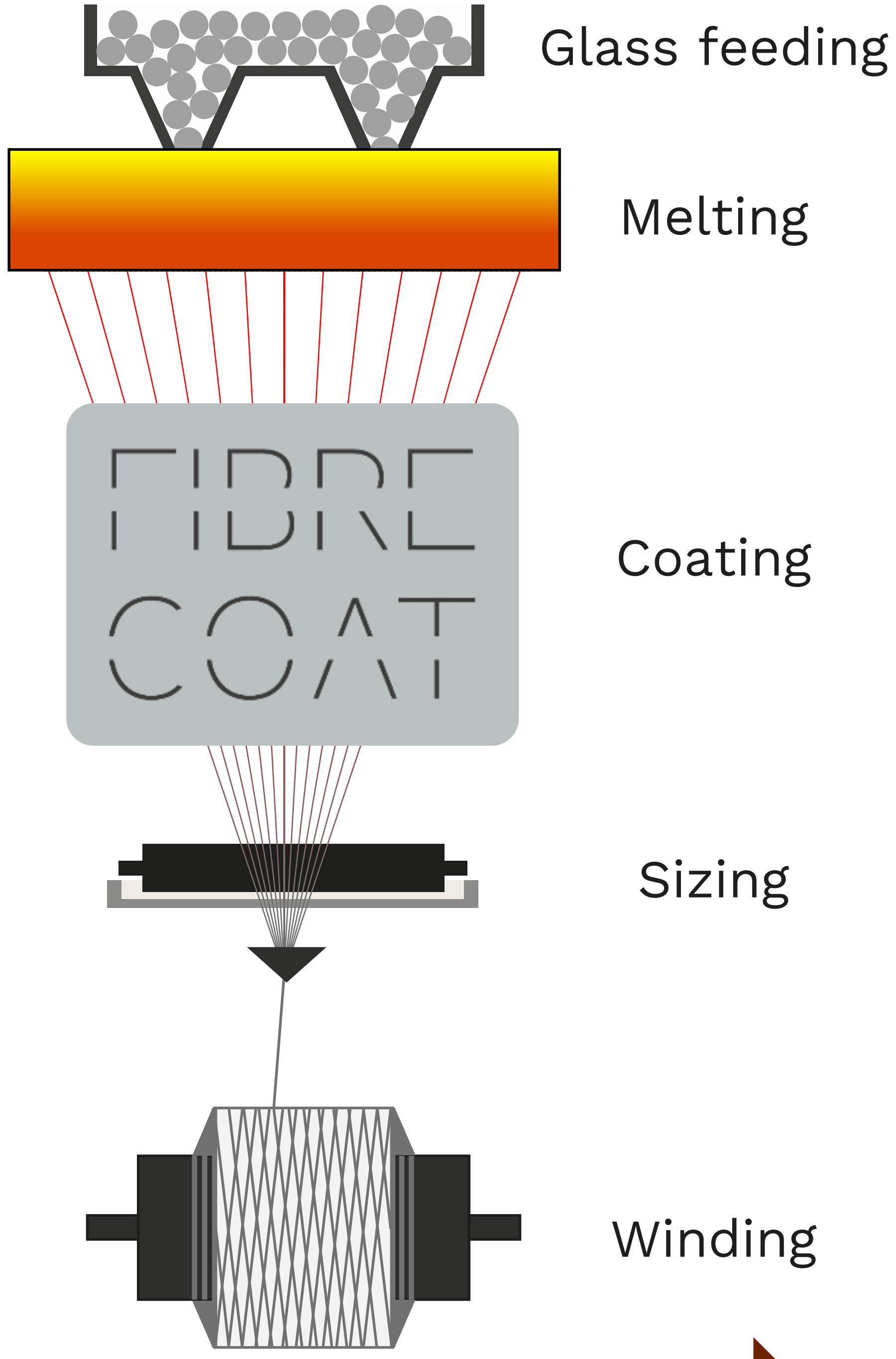




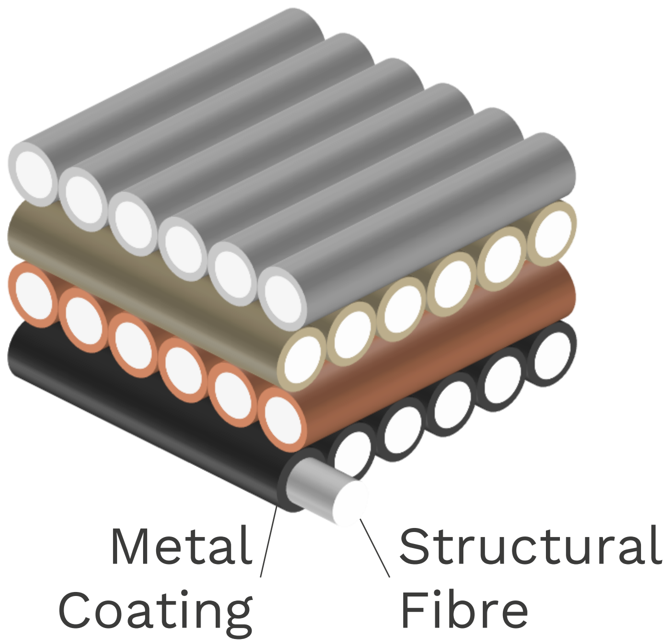
The Fiber Radiation Shield Solution



New Coatings



Fibre Spinning



- ❑ Excellent workability
- ❑ Structural integrity
- ❑ Metal properties

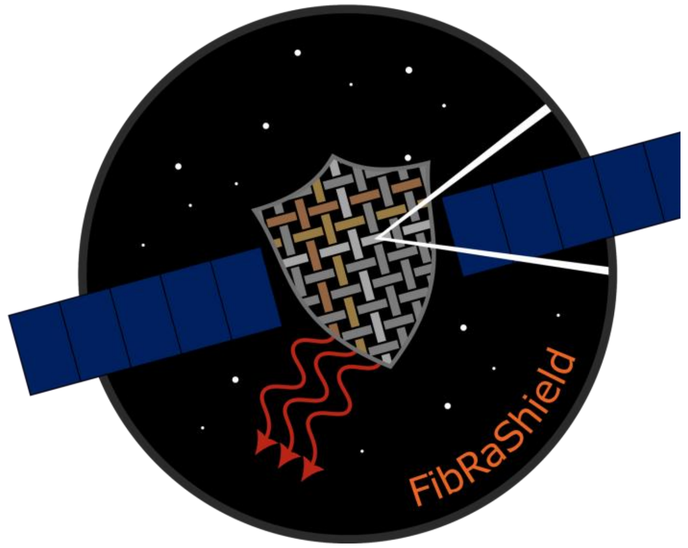
Fabric Production

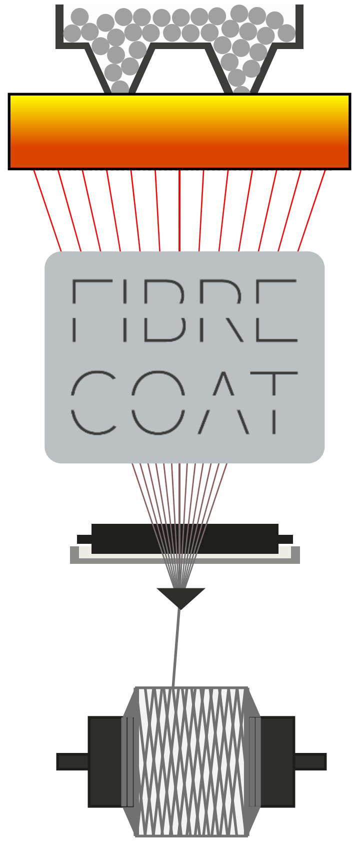
- ❑ Modular design
- ❑ Functional optimization
- ❑ High performance shield

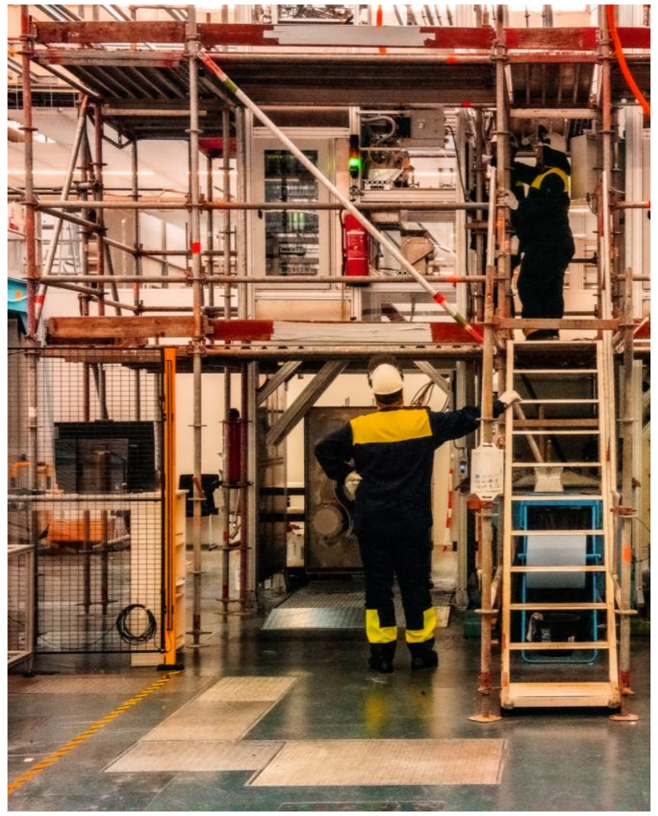
Shield Development

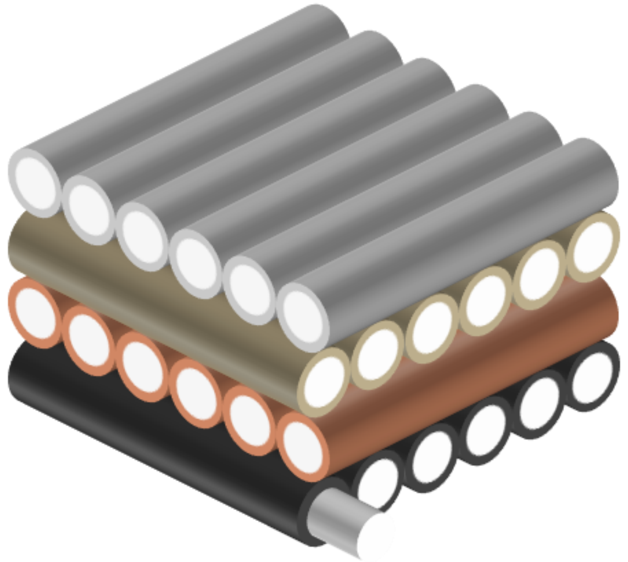
With funding from the:
Federal Ministry of Research, Technology and Space

FibRaShield Project









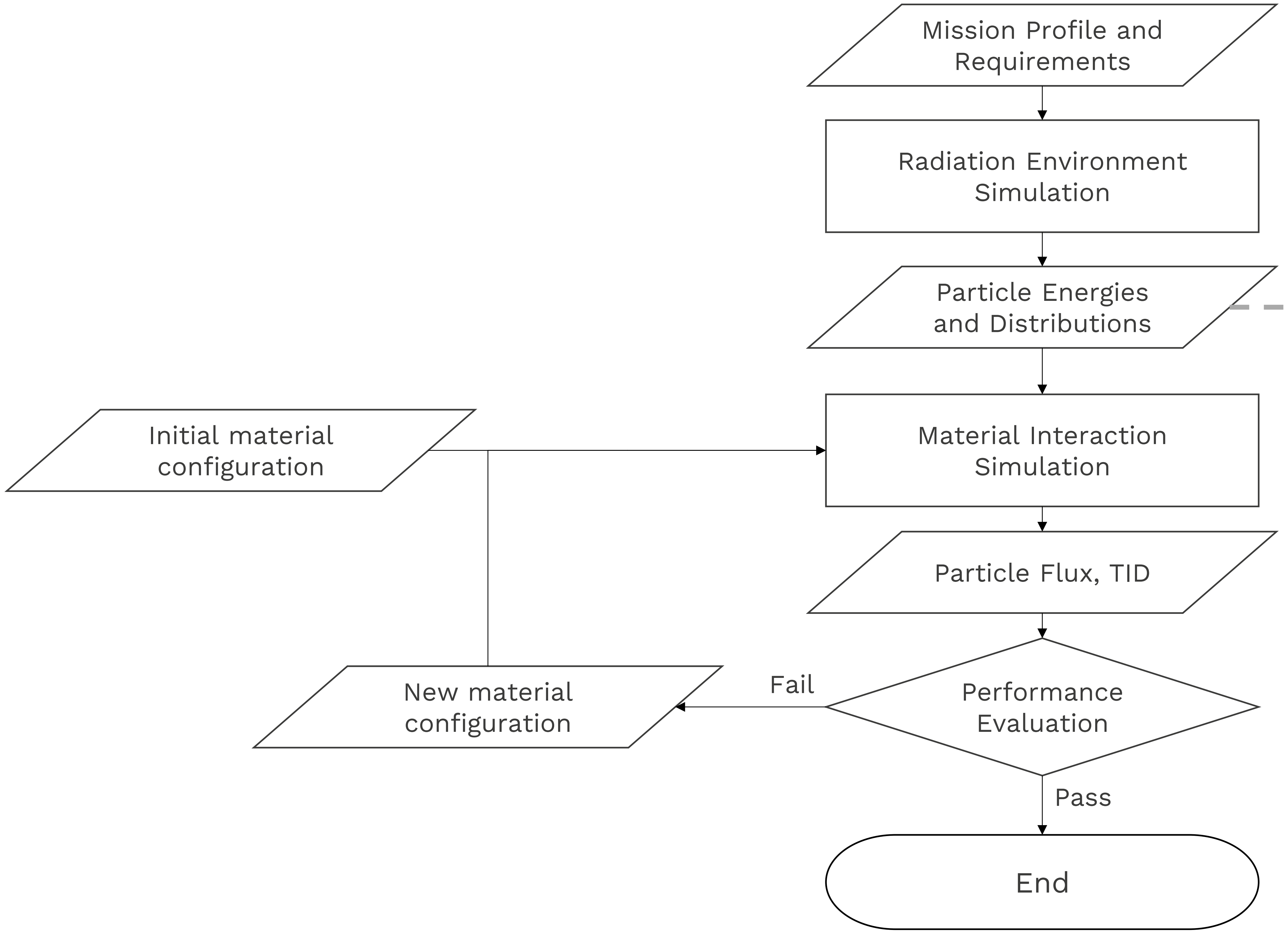
SPENVIS
The Space Environment Information System

GEANT4
A SIMULATION TOOLKIT

Simulation → Material selection, Layer Configuration → **Lab-Scale Trials** → Process window → **Process Scaling** → Woven Fabrics → **Composite Manufacturing**

Lab-Scale Trials, **Process Scaling**, **Composite Manufacturing** → **Lab Analysis and Qualification**

Simulation Philosophy



MULASSIS	GEANT4
Based on GEANT4	Developed at CERN
Planar Slab geometry with infinite dimension in-plane	Complex, finite geometries
Simple implementation	High physical fidelity
Limited data output	Steep learning curve (Slow computing)

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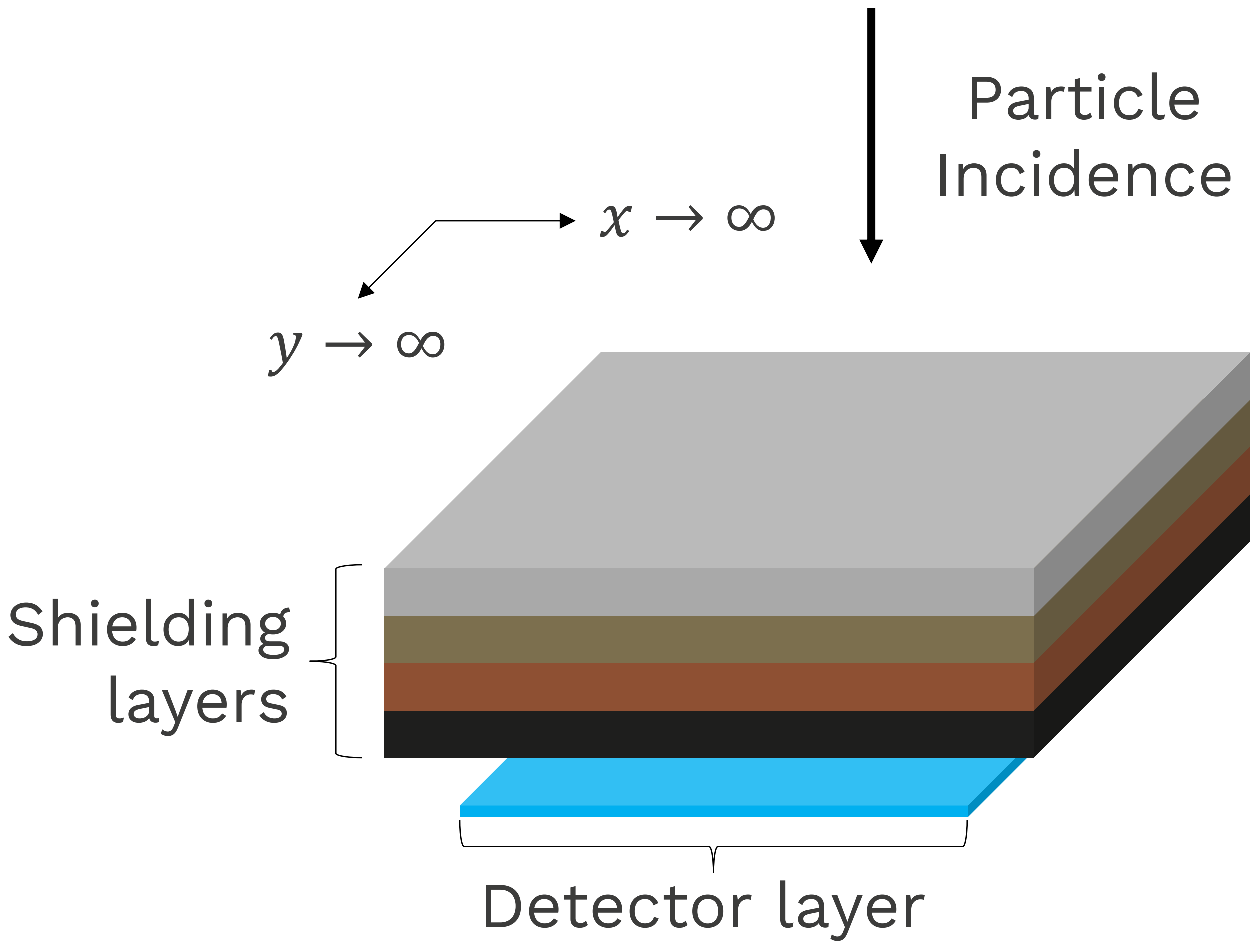
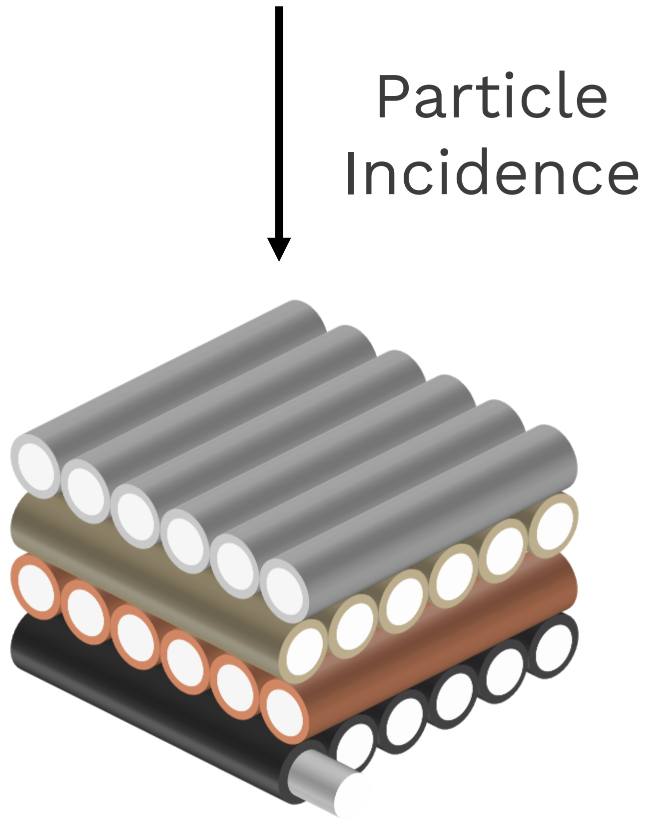
Comparing Simulation Geometries

MULASSIS



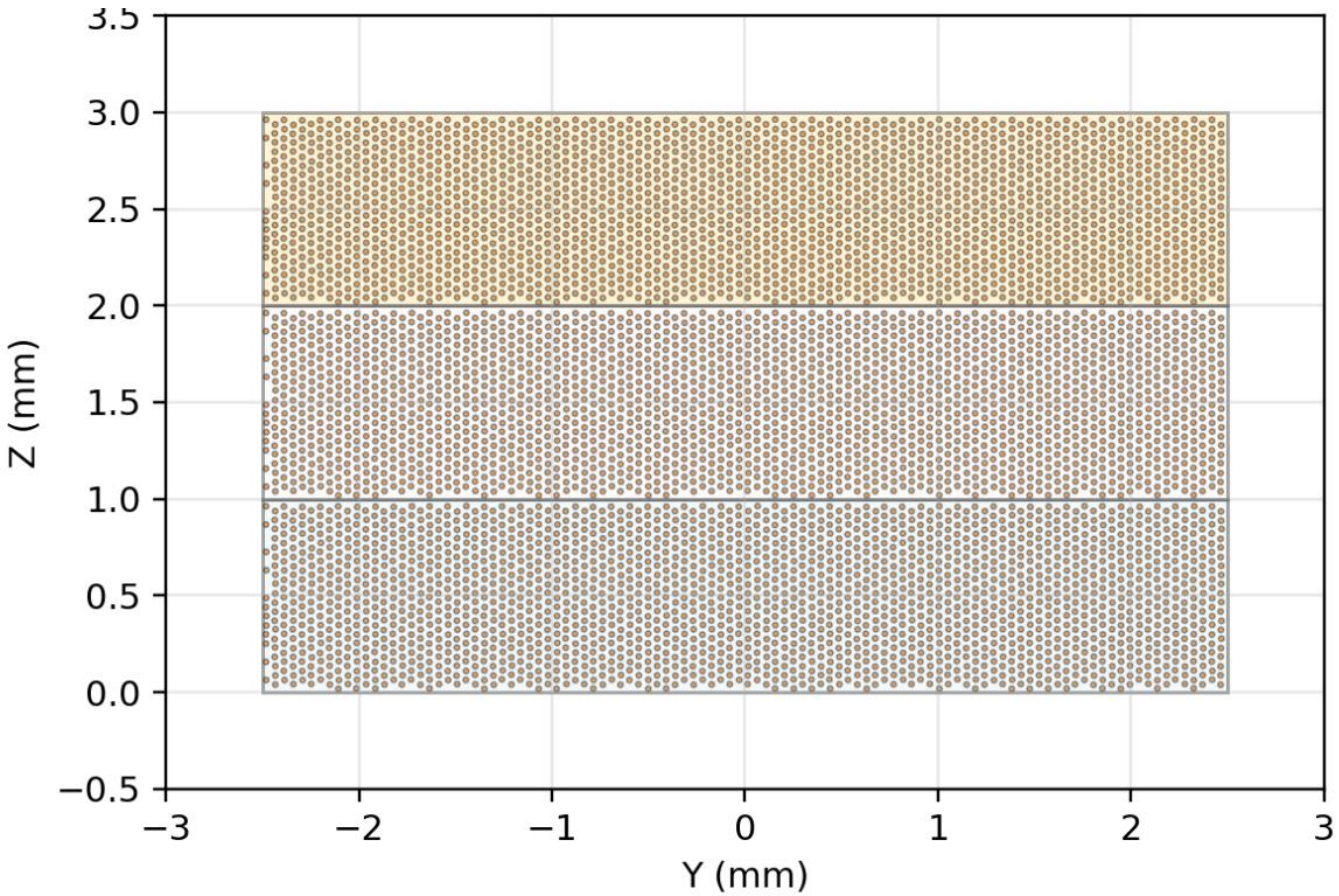
Planar slab
infinite extension in-plane

FibRaShield



Layered UD Tape RVE
Bounded in 3D

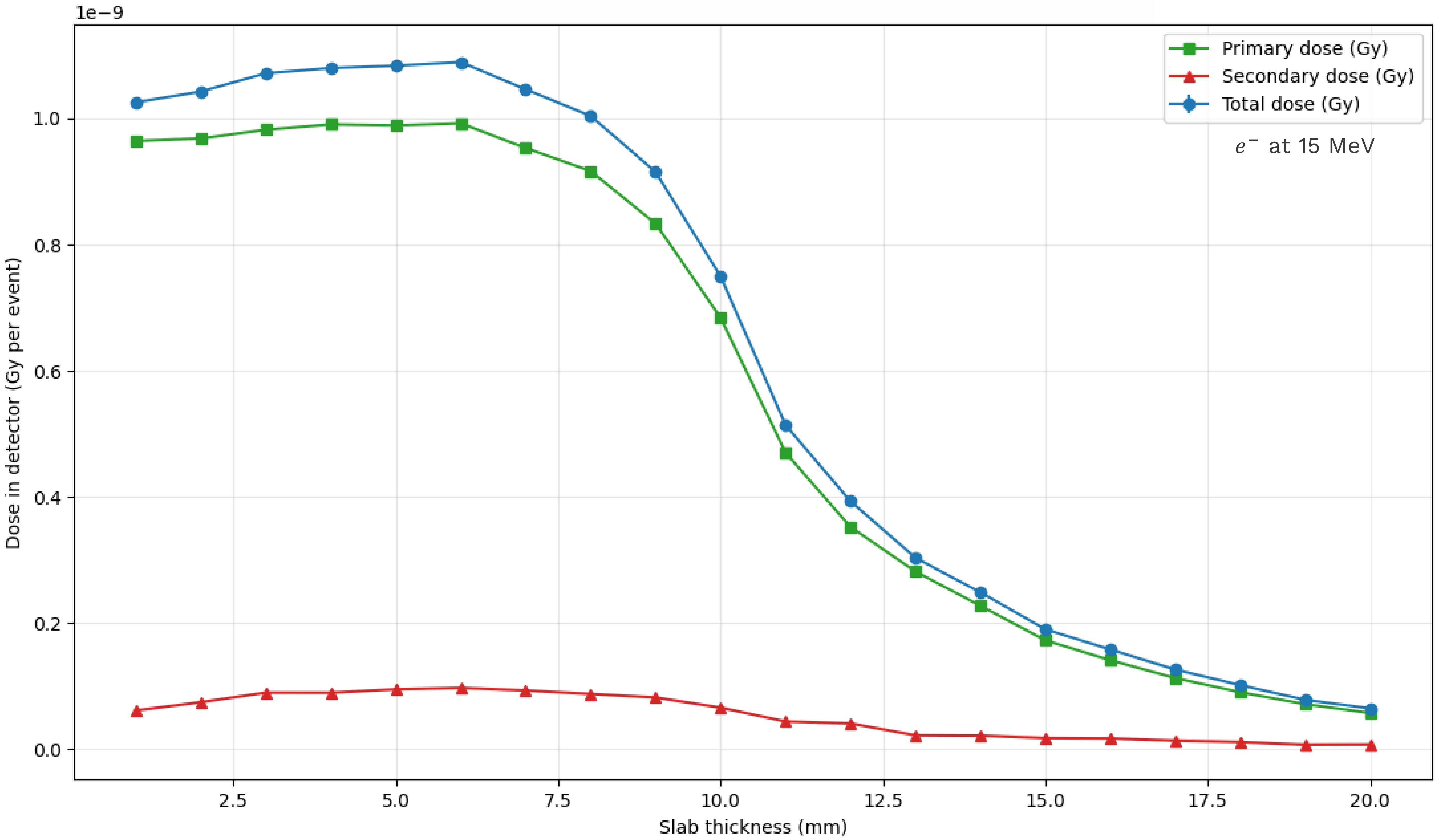
The RVE Element



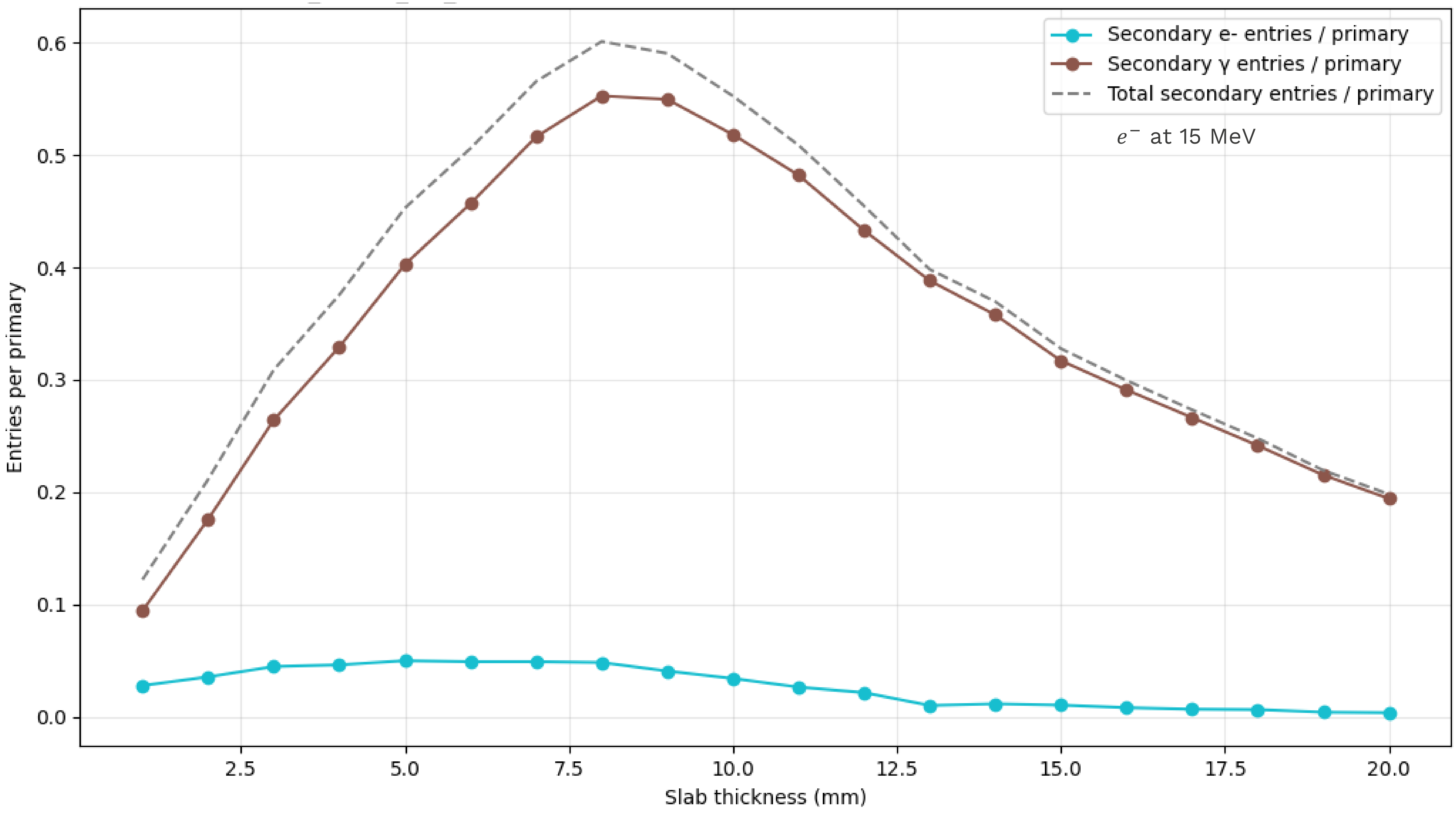
RVE Properties:

- Fibre Volume Fraction
- Fibre Materials
  - Core
  - Coating
- Matrix material
- Layering

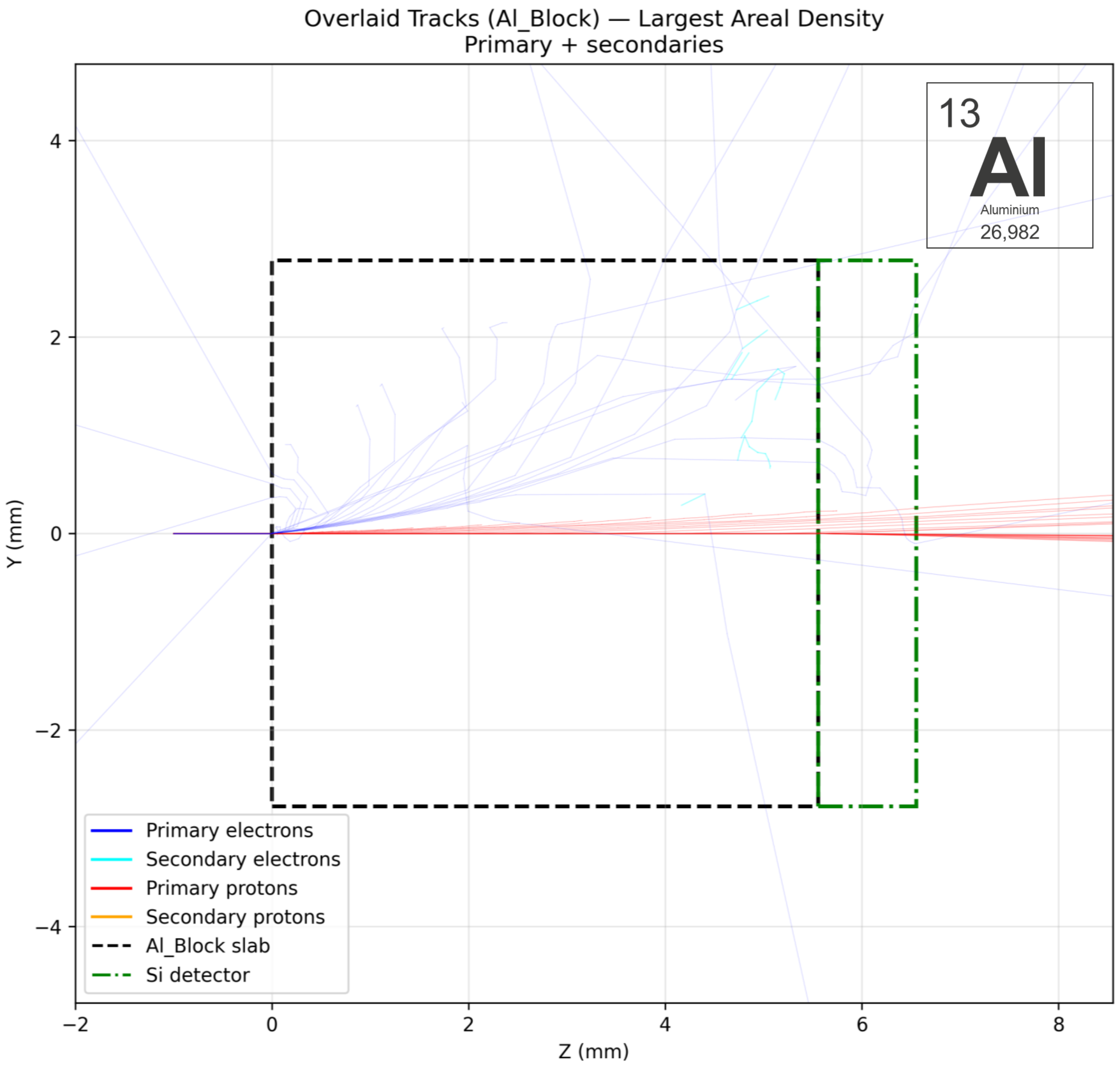
Determining Total Ionising Dose

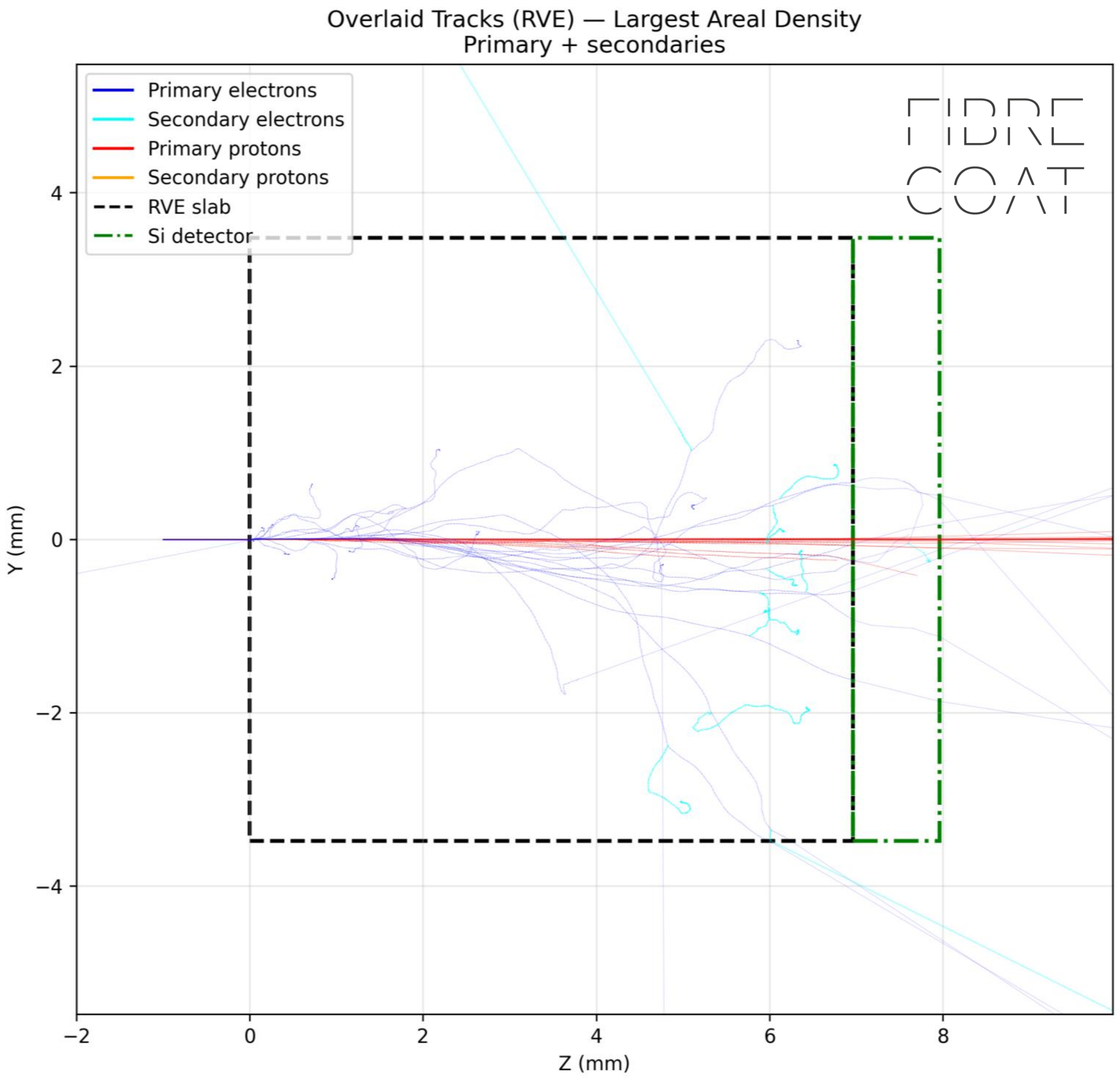


Primary and Secondary Particle Entries in Detector



Considering particle tracks

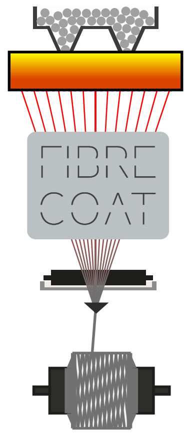




FibRaShield Timeline

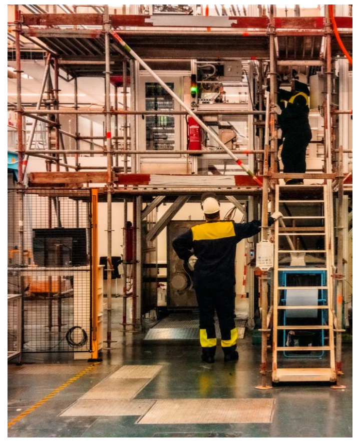
Simulation

Material selection
Layer Configuration



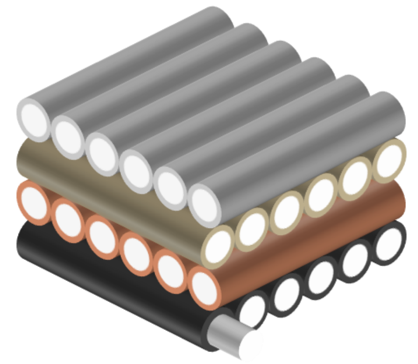
Lab-Scale Trials

Process window



Process Scaling

Woven Fabrics



Composite Manufacturing

Lab Analysis and Qualification

2026

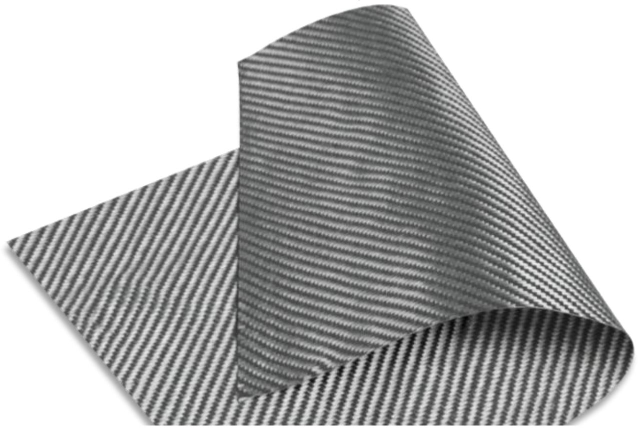
2027

PicoSat In-Orbit Demonstration
BisCoat in LM-PEEK

Available now: Bismuth Composite

Bismuth coated e-glass:
-Fibres for winding/pultrusion

-Woven textile for layups



Currently being woven by C.Cramer

BisCoat features:
In simulations of BisCoat composite up to 25% weight savings in electron-rich orbits compared to aluminium.

-Processability like glass fibre

-50v% means 80w% Bismuth (of fibre)

-Thinner shielding!

-Compatible with thermoplasts and thermoset polymers

-Compatible with other structural fibres

-Already qualified and integrated for one LEO mission, launch planned 2026

How to apply BisCoat for your mission?

With shared orbit data FibreCoat can simulate the radiation environment – this is used to do a case study of BisCoat vs Aluminium shielding

Material data for mechanical, thermal, radiation and other simulation available

Sample material as yarn, chopped fibres or woven available.

Prototyping as a service or design and processing support possible

PicoSat In-Orbit Demonstration
BisCoat in LM-PEEK

LOFITH COMPOSITES

FIBRE COAT

Talk to our Space Team!

FIBRECOAT

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