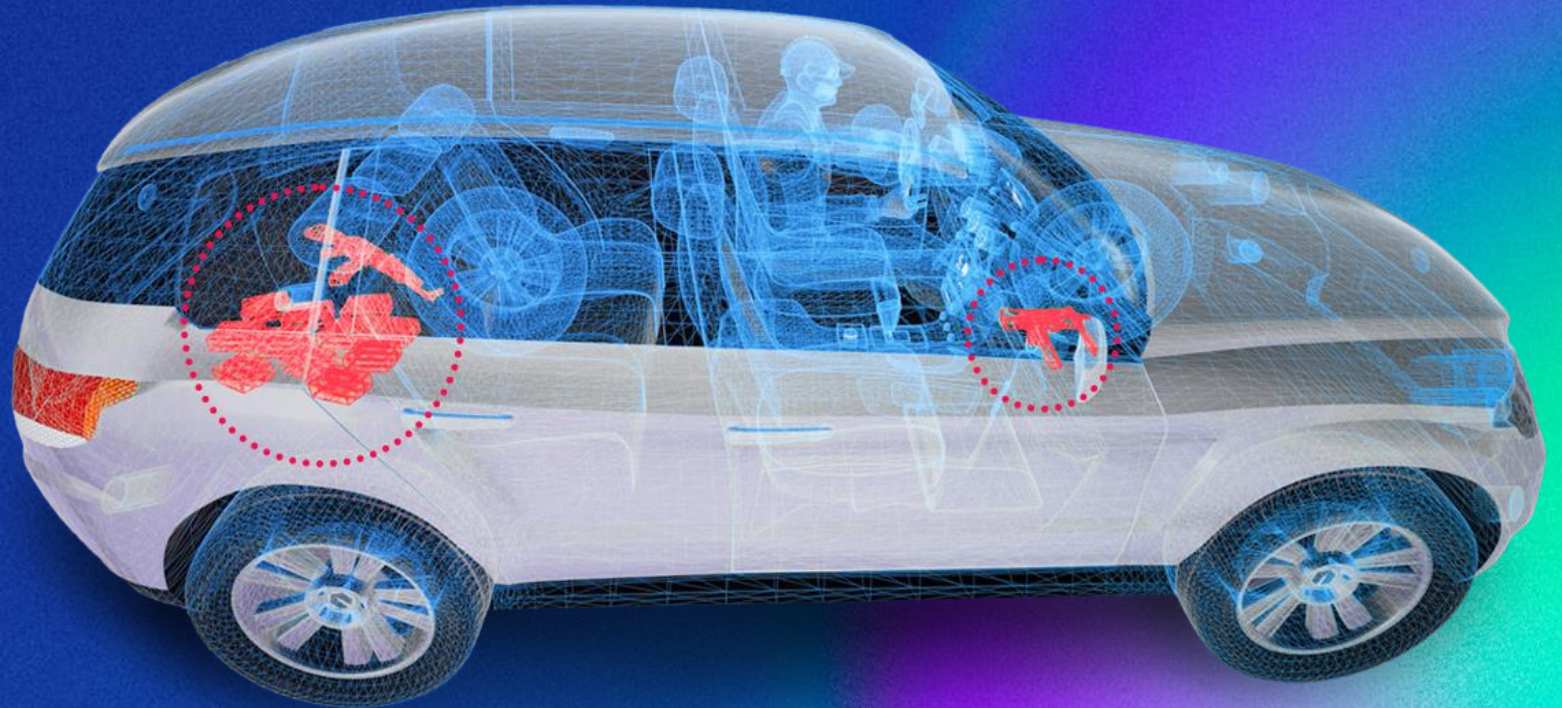


# GSCAN

## The story of GScan

Technology of the future, now



<https://gscan.eu/>

<https://www.linkedin.com/company/gscan>

Summer School of Physics Students  
July 2022

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The problem:

We are eager to know what is the inside of things!



The X-ray photo, Wilhelm Röntgen,  
Würzburg, Germany, 1895

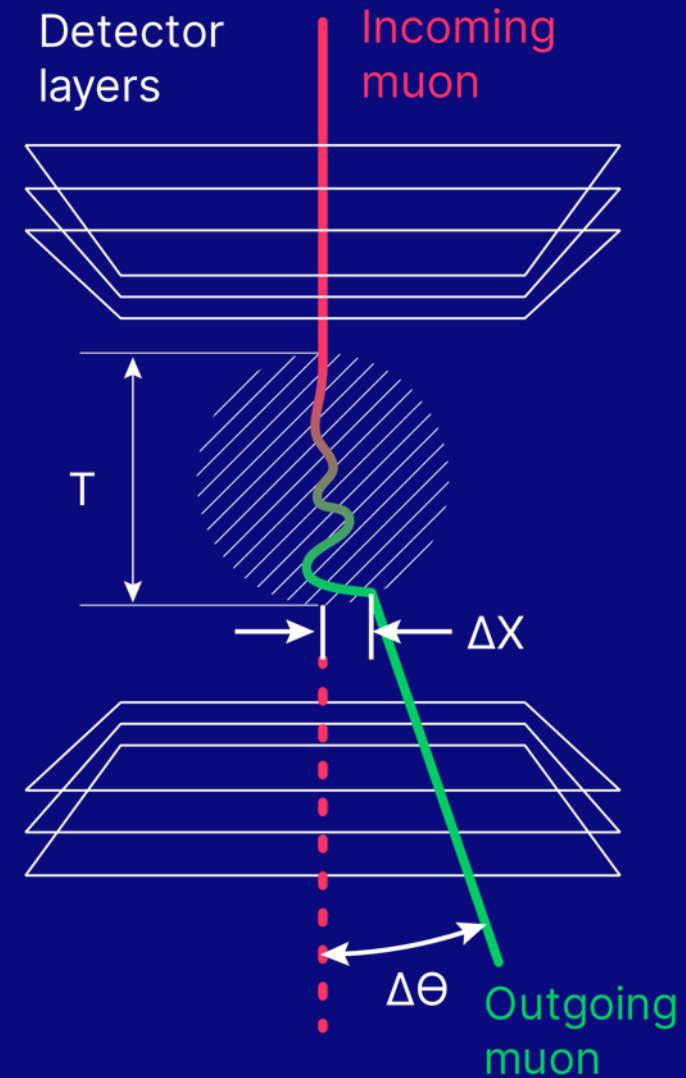
Probably one of the most influential photo in  
history

We are eager to know what is  
**the inside of things!**

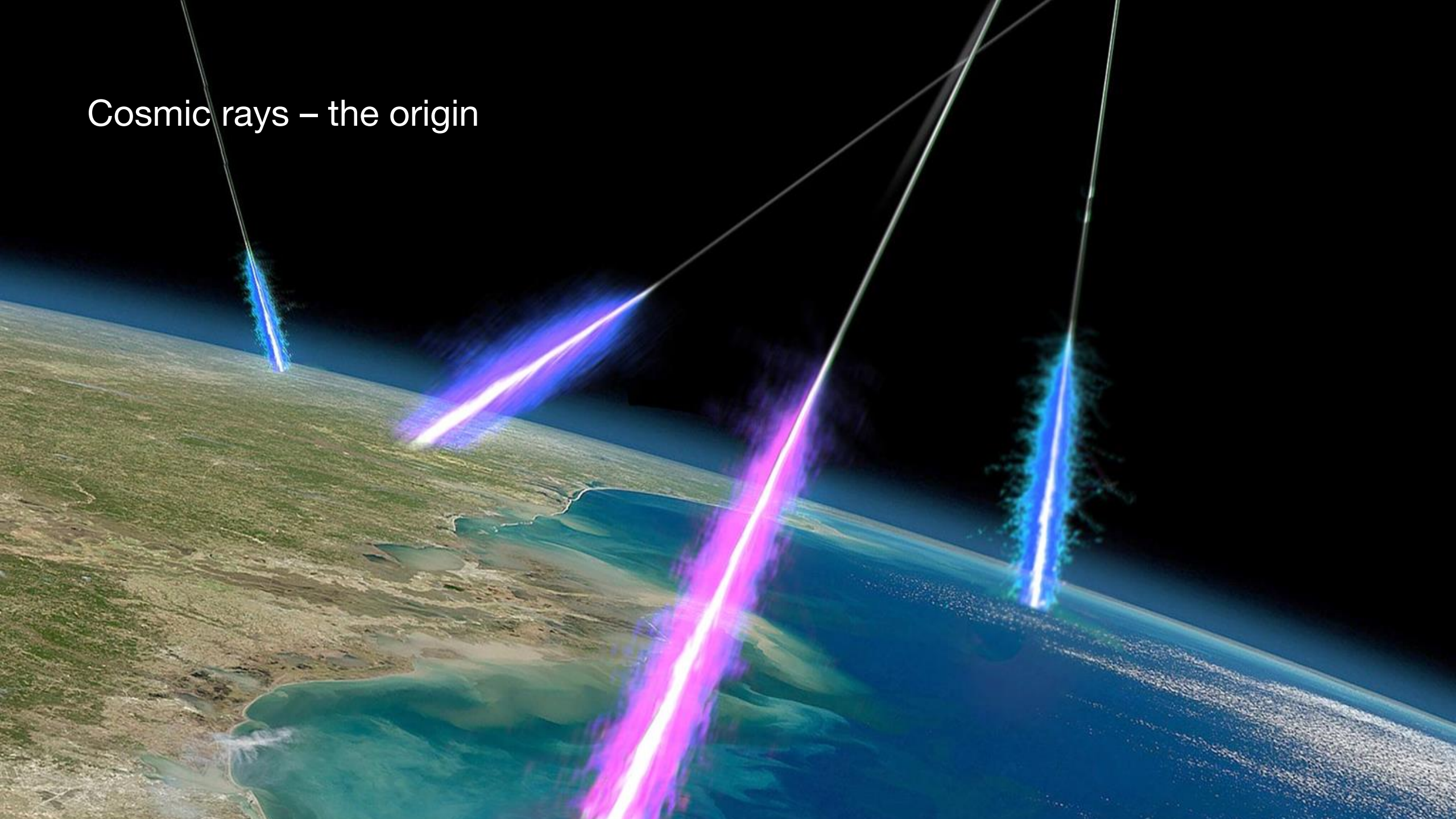
### 3 Principles of muon tomography

1. Measuring incoming natural flux of atmospheric particles: muons, electrons, positrons
2. Scattering of the particles in the object
3. Measuring exiting particles after the scattering
4. Reconstruction of the object and its materials using the scattering data

Technical description of our prototype system:  
<https://arxiv.org/abs/2102.12542>

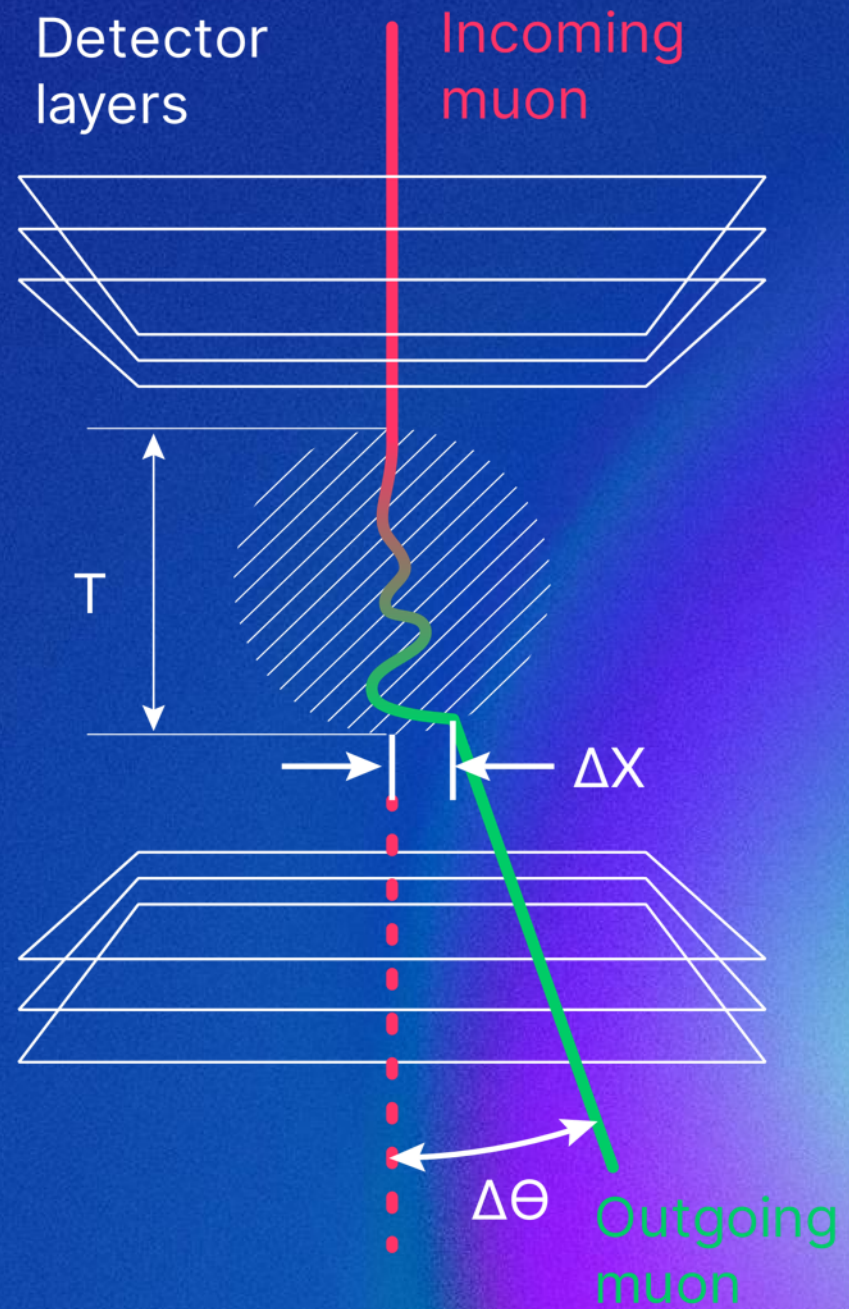
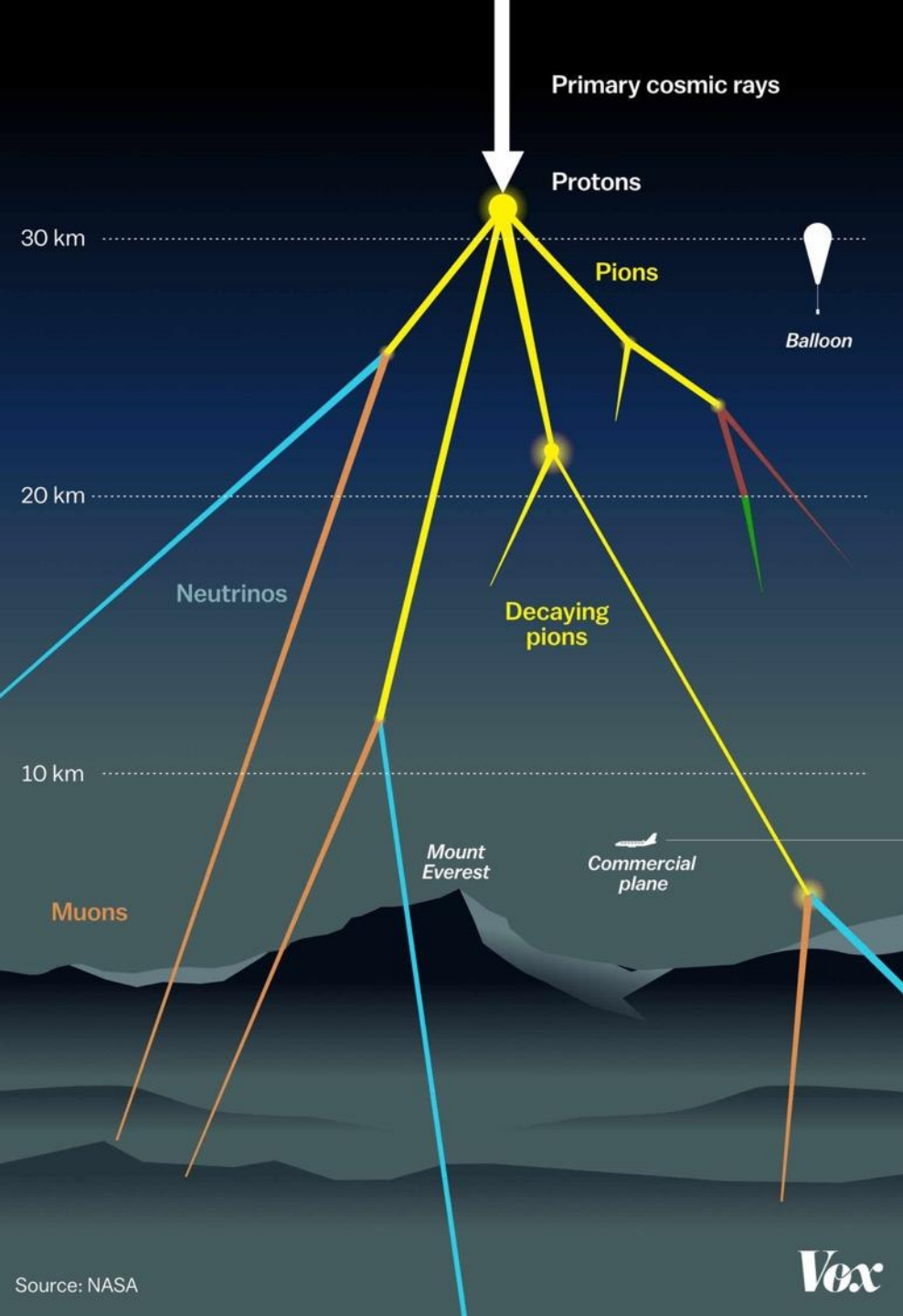


Cosmic rays – the origin



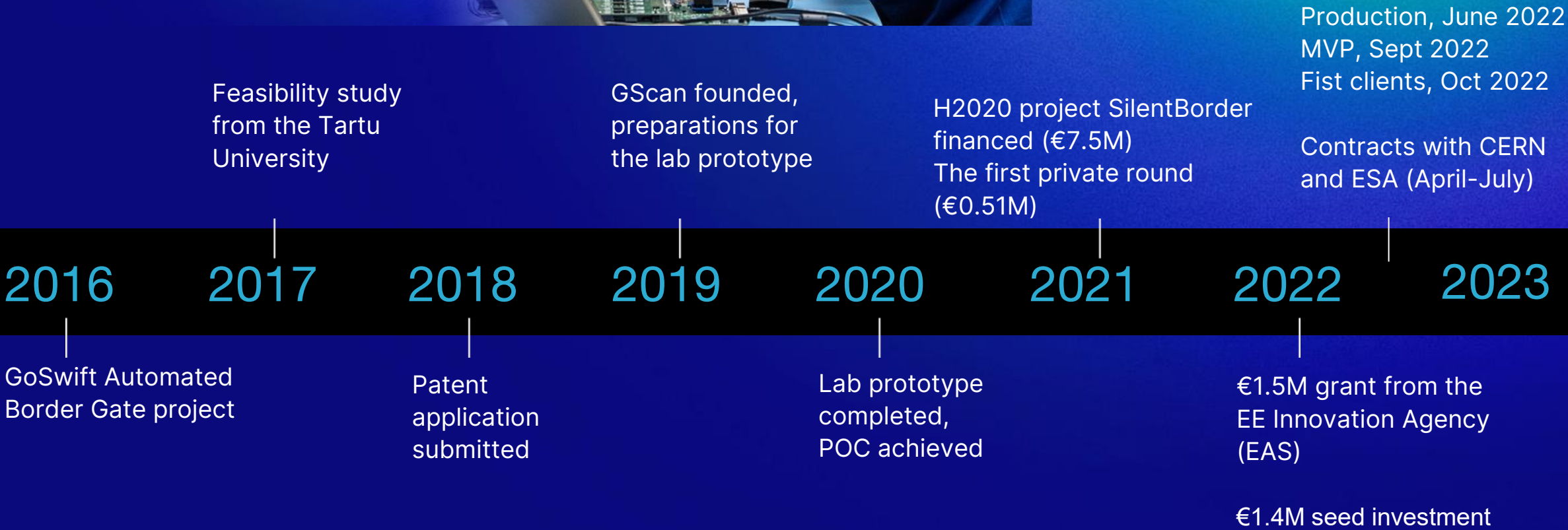
# Cosmic rays – the origin





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# Timeline



## 8 Prototype $\mu$ FLUX system

Commissioned: **May 2020**

Tests completed: **August 2020**

Main result:

**99+% efficiency to classify materials** (water, plastics, wood, light and heavy metals etc)

Technical description:

<https://arxiv.org/abs/2102.12542>







## Atmospheric ray tomography for low-Z materials

Andi Hektor, GScan & KBF1

In collaboration with G.Anbarjafari, A.Anier, E.Avots, A.Georgadze, E.Ersoy, M.Kiisk, M.Kutateladze, T.Lepp, M.Mikkor, M.Mägi, V.Pastsuk, H.Plinte, S.Suurpere

<https://arxiv.org/abs/2102.12542>

25/11/2021

Muographers 2021, Ghent

COLLEGE OF MEDICINE AND HEALTH

# Muon tomography for clinical imaging: preliminary modelling-based results

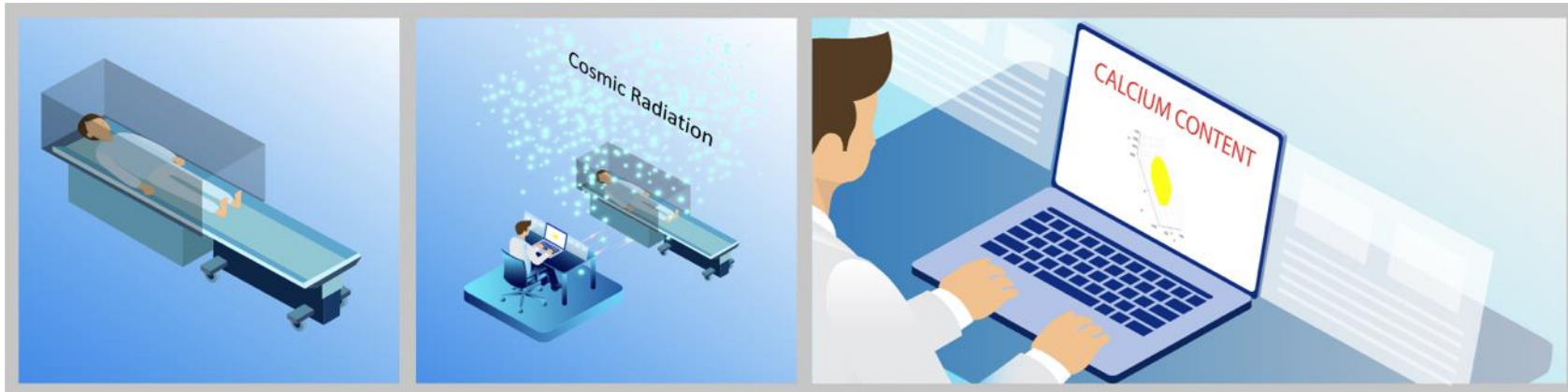
Jörg Tiit<sup>1,4</sup>, Egils Avots<sup>1</sup>, Märt Mägi<sup>4</sup>, Christina Hrytsiuk<sup>4</sup>, Andi Hektor<sup>1,4</sup>,  
Madis Kiisk<sup>1</sup>, Eduardo Cortina Gil<sup>2</sup>, Andrea Giammanco<sup>2</sup>, **Karen Knapp<sup>3</sup>**,  
Jack Spencer<sup>3</sup>

1. *GScan OÜ, Estonia*
2. *Université Catholique de Louvain, Belgium*
3. *Medical Imaging, University of Exeter, Exeter UK*
4. *KBFI, Tallinn, Estonia*

*K.M.Knapp@exeter.ac.uk*

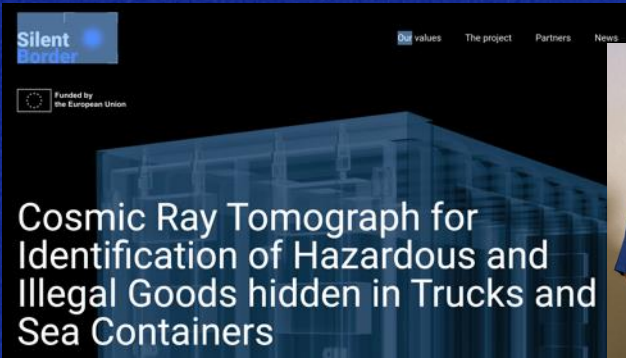
# CosmoMed project

To provide an understanding of a cosmic-ray based tomographic system's theoretical capability of detecting osteoporosis



*An example of the UHAR system measuring the calcium concentration in the human bones exploiting cosmic radiation.*

# GSCAN



Rakendusuringute programm



Busy year of GScan  
May 2021 - May 2022



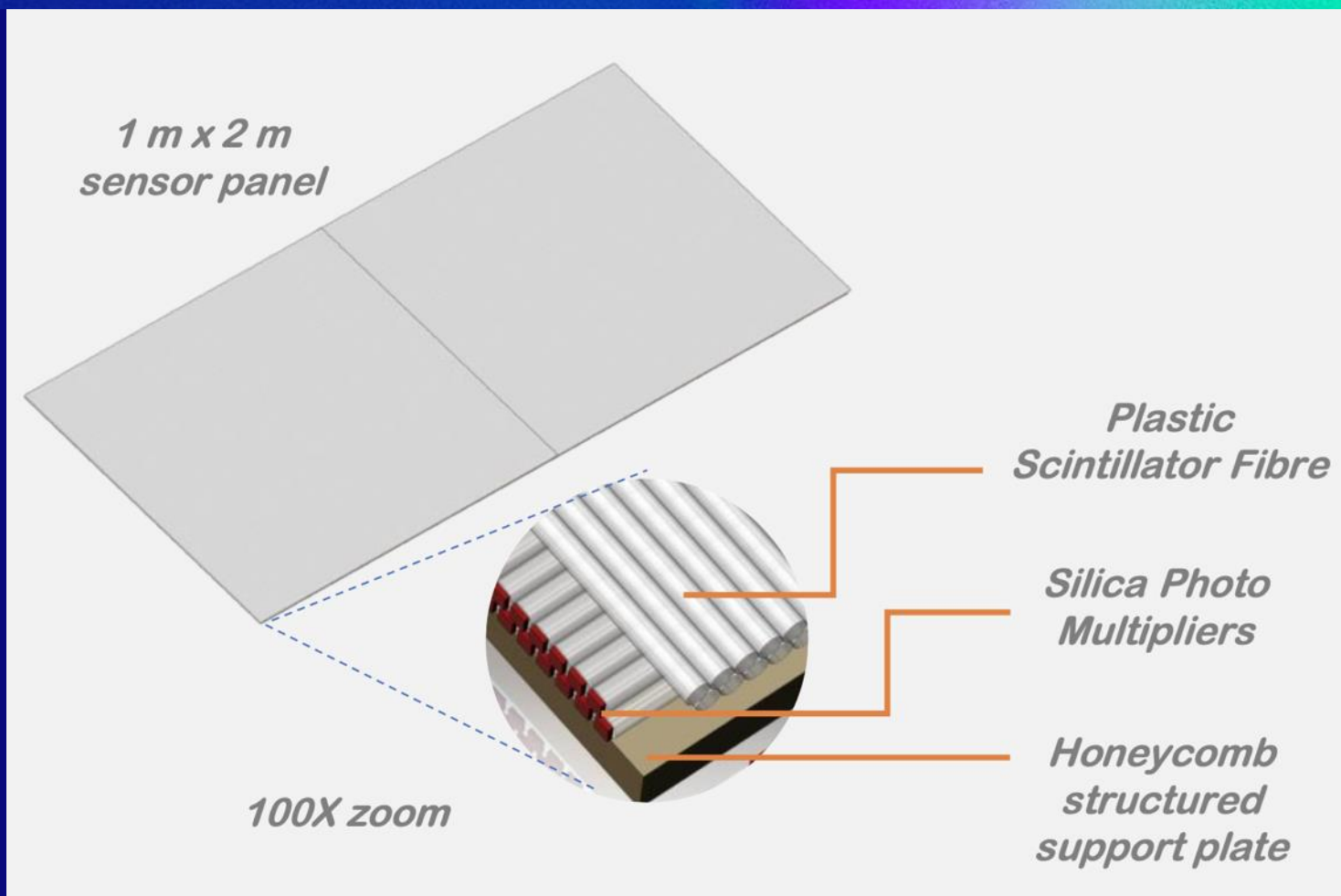
13

# Modules for $\mu$ FLUX<sup>TM</sup> products (May-June 2022)

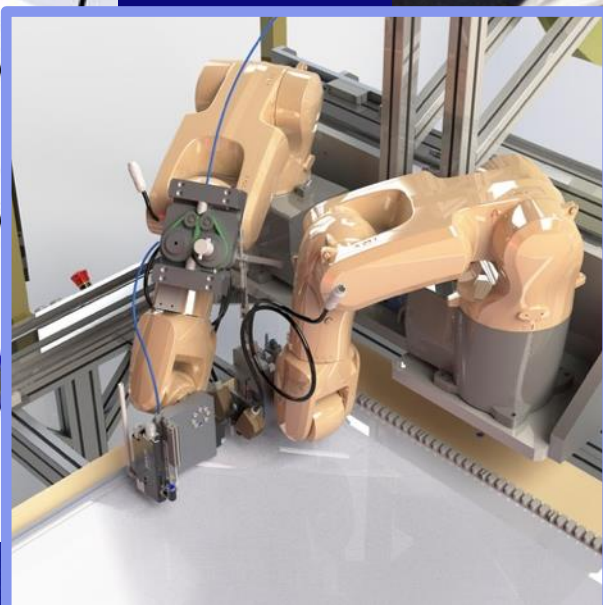
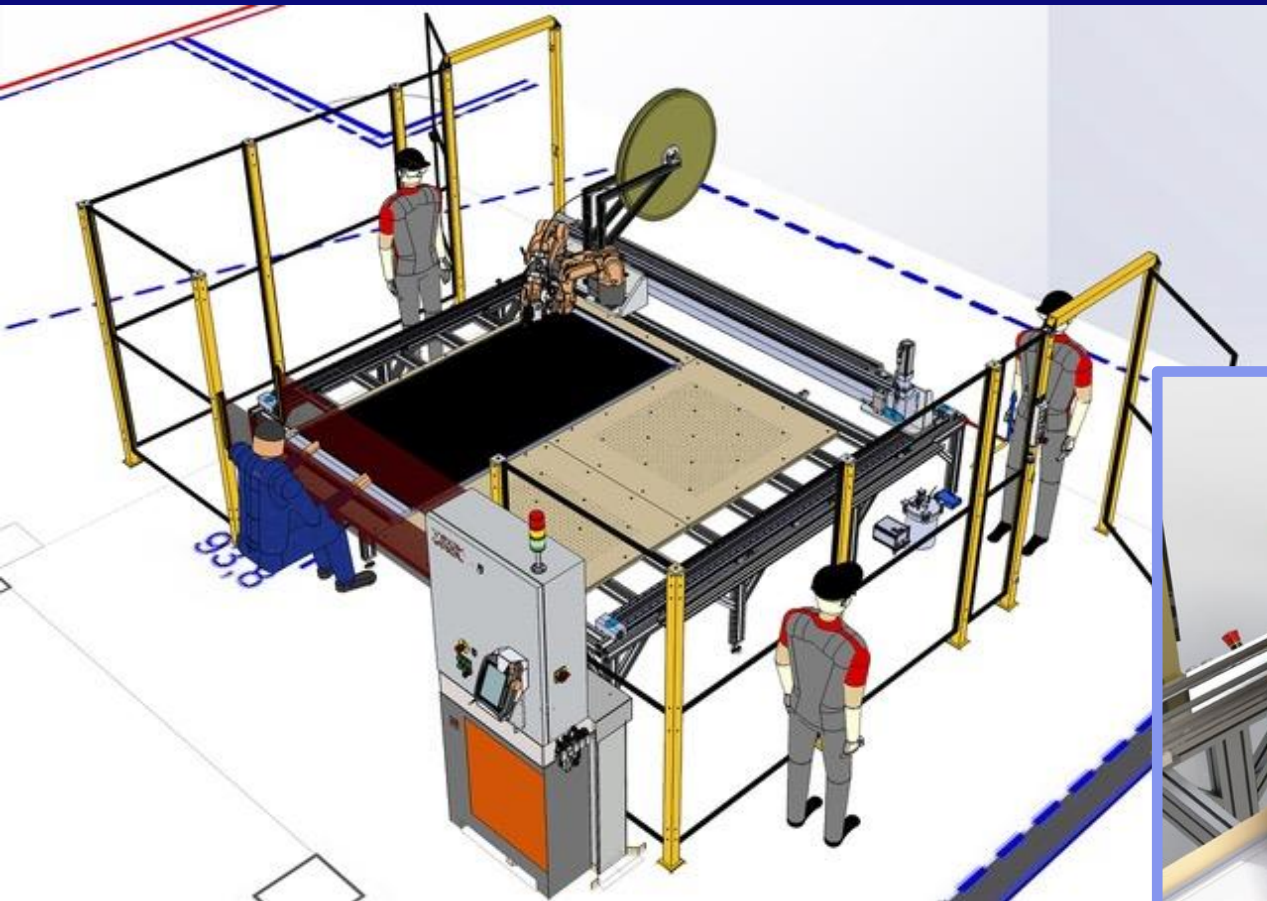
## Key product:

### industrially produced detector module (hodoscope)

- **Dimensions:** 1m × 2m × 0.3m
- **Detector tech:** Plastic Scintillator Fibre (PSF), Silica Photo Multipliers (SiPM)
- **Production tech:** Robotic production line (some manual steps)
- **Price (Bill of Materials):** €50k/m<sup>2</sup>
  - R&D target (end of 2023): €25k/m<sup>2</sup>
  - Long term (2025): €10k/m<sup>2</sup>



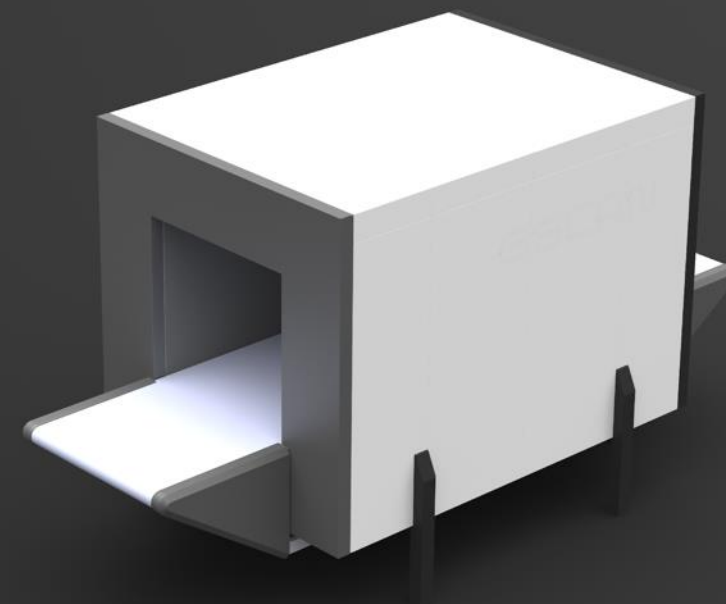
# 14 Production line of the modules (April-May 2022)



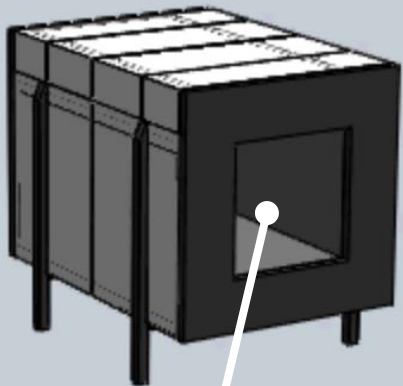
# muonFLUX Small™, Oct 2022

Pilot customer: the **Estonian Customs**, parcel company **Omniva AS** (LOI signed, the lead of €0.5M sales contract in 2022)

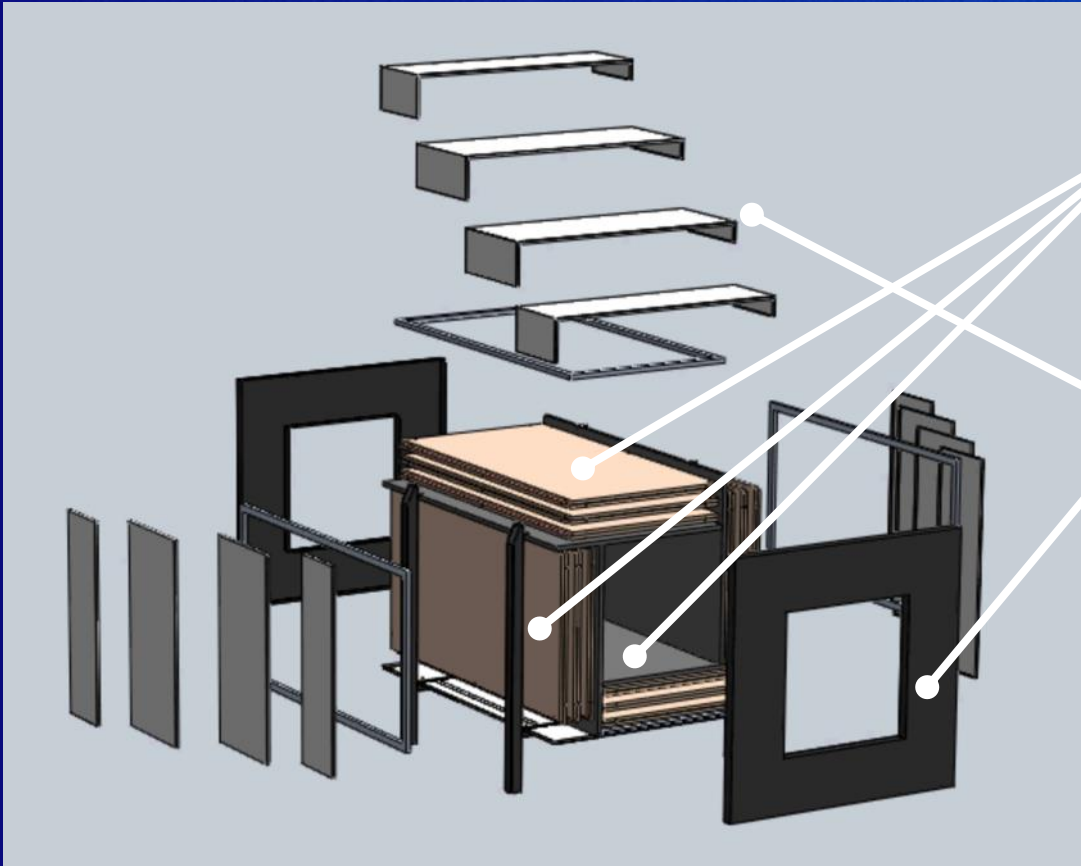
- **The interrogation volume:**  $1 \times 1 \times 1.2 \text{ m}^3$
- **Markets:** customs, parcel delivery, airports, security gates
- **First clients beyond the pilot:** Finnish & Latvian Customs
- **Price:** €0.5M (Bill of Materials: €0.25M)
- **Technical description:** constructed by the four sensor modules ( $1 \times 2 \text{ m}^2$ )



16 muFLUX Small™, Oct 2022



Interrogation chambre



4 standard unit detector modules (hodoscopes)

Covering, light materials



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# muonFLUX Medium™, 2023

- **The interrogation volume:** ca  $3 \times 2.5 \times 6 \text{ m}^3$
- **Markets:** Aviation containers, borders & customs, security gates
- **Timeline:** the second half of 2023
- **Technical description:** the 20 modules supported by light construction frames
- **First clients:** negotiations with Singapore Air Cargo & SATS



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# muonFLUX Large™, 2024

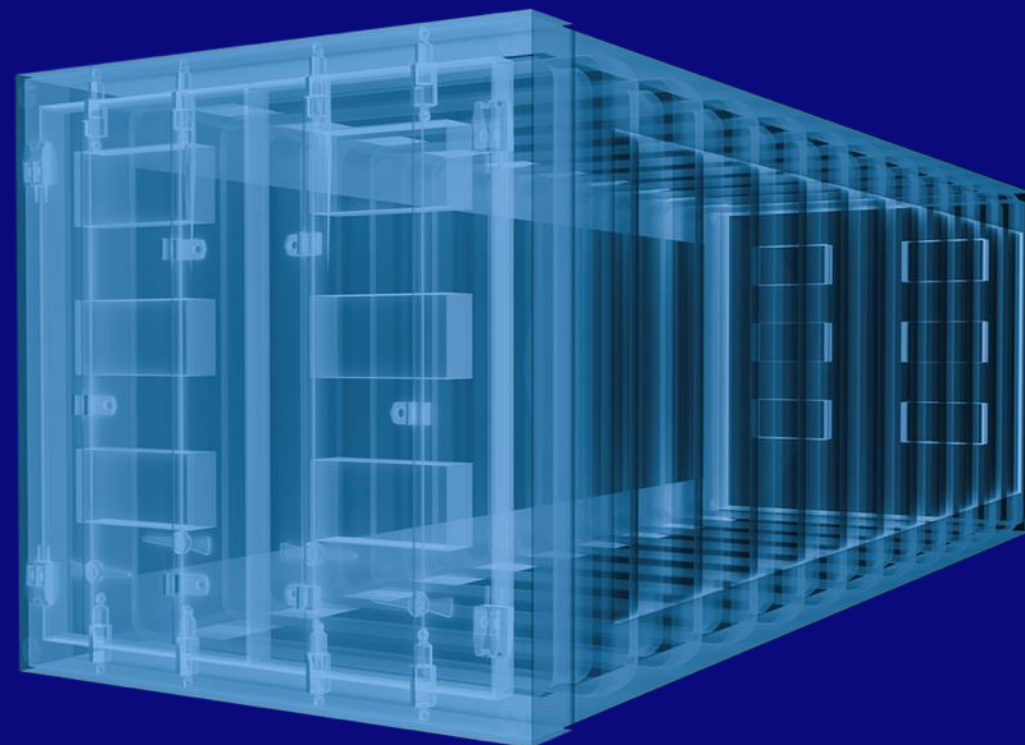
## The first pilot contract signed!

Project **SilentBorder** by the European Union (€7.5M, 2021-25)

- Large scanner for trucks and sea containers
- Modular design
- Delivery: 2025
- Price: €10M

Further details: <https://silentborder.eu>

**Partners:** GScan, Tartu U, German Aerospace Centre (DLR), CAEN (Italy), Uni of Sheffield (UK), UCLouvain (Belgium), SGS (Switzerland); Estonian, Finnish and Turkish Customs



# muonFLUX™ Special, 2024

The first pilot projects are coming (€2.5M)

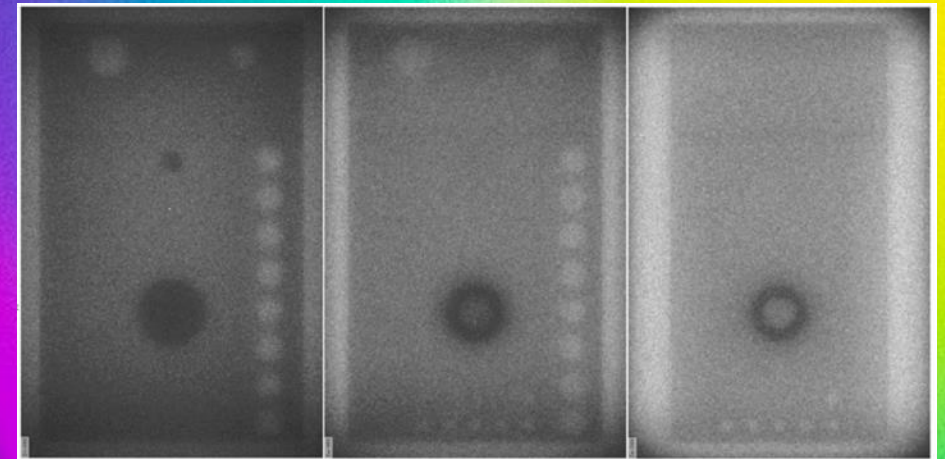
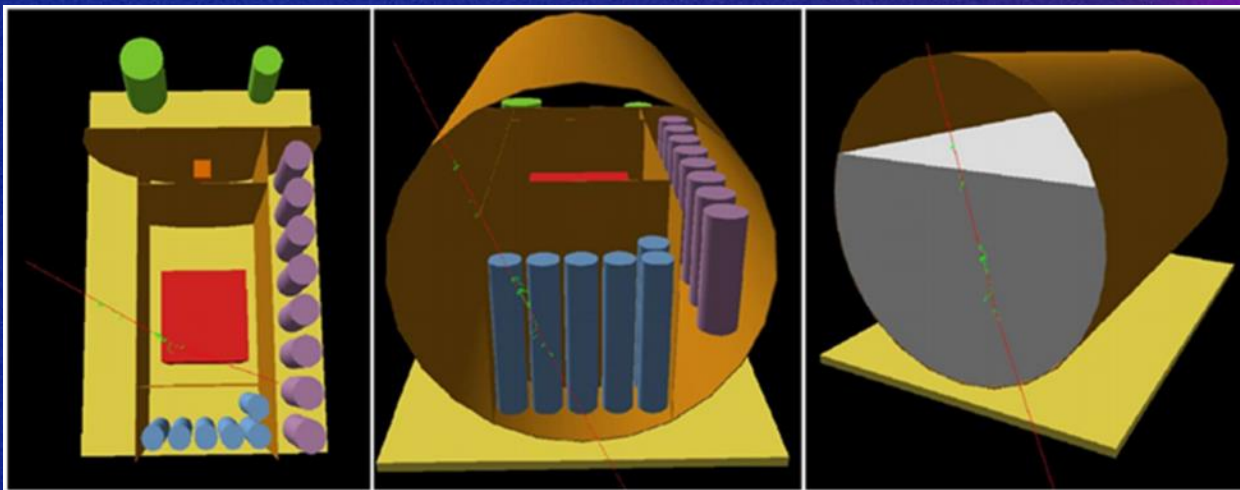
- **Markets:** Non-Destructive Inspection/Testing (NDI/NDT) for bridges, wind turbines, power plants etc
- **Timeline:** First system ready in Autumn 2022
- **First clients:** Energy & nuclear sector
- **Price:** modular system, the prices starting €0.5M



# GScan

## R&D projects and future directions

- Two abandoned Soviet military reactors in Estonia
- Cylindrical steel “submarines” (9 & 7 m) half-filled with concrete and some radioactive objects
- Can muon tomography help? Yes



2 hours exposure (8x12 m<sup>2</sup>) --> some days with 2 m<sup>2</sup> area hodoscopes

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## Our team (Oct 2021)

Business + sales + industry + detectors + AI



Thank you! Questions?

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gscan.eu