Dynaxion Security

Neutron-Based Security Screening Technology

For a safer world

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Dynaxion

Dynaxion - Short introduction

- Dynaxion is a young, high-tech startup within High Tech XL at HTC Eindhoven.
- Dynaxion develops a new-generation scanning solution for material identification for security purposes – parcels, suitcases.
- Dynaxion makes use of a unique (patented) particle accelerator technology from CERN (Switzerland) – based on neutron generation.

VIDEO:

https://youtu.be/nEUsIxT32u8

Dynaxion

So What? Who Cares?

- Space: Illicit and dangerous good detection (in trade & travel)
- Solution: Neutron-based scanner producing energy spectra for atomic level information
- Results: (*expected*)
  FAR, False Alarm Rate *close to 0*
  FN, False Negatives *close to 0*
  Aiming for < 20 grams
  Easily penetrating through metal
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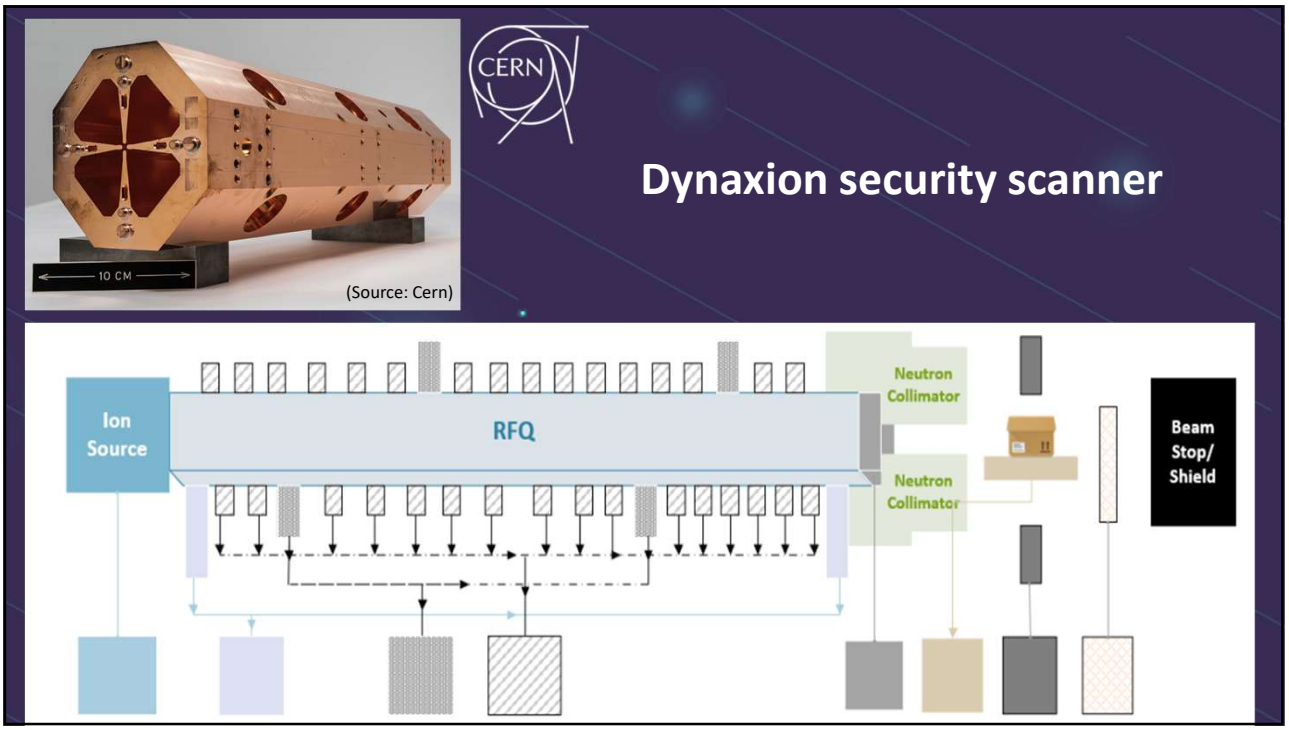


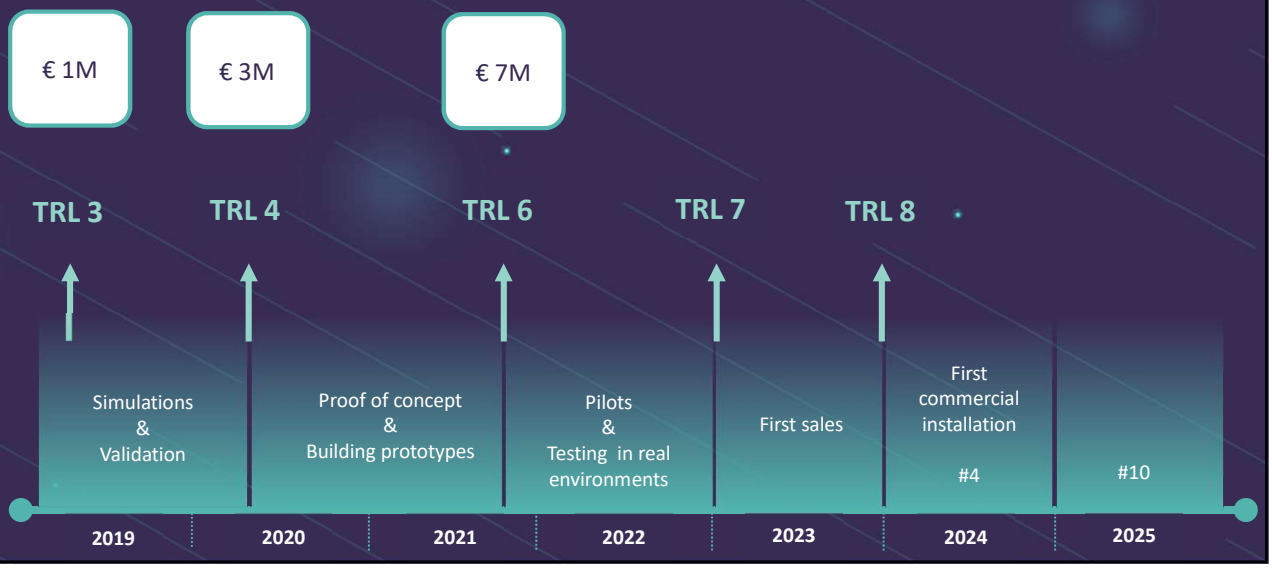
Scanning technologies comparison

	X-ray	CT X-ray	Dynaxion
False alarm rate	High	Medium	Low to 0
Undetected items	High	Medium	Low to 0
Material identification	✗	✗✓	✓ Cocaine (Energy (MeV)) Milkpowder (Energy (MeV))
No human involvement	✗	✗	✓

Dynaxion customer benefits

- Identification in stead of discrimination
  - Based on material composition; not density and image
- Distinction between milkpowder or cocaine, syrup or nitroglycerine, sweets or xtc.
- Dynaxion will save cost and time
  - Current screening methods require human involvement, dogs, opening of goods, etc.
- Dynaxion increases safety and security
  - Dynaxion scans ‘everything’; drugs, explosives, weapons, radio active material, smuggle wear, dangerous goods

Roadmap and required funding



How to make it happen

- Build a consortium of (technology) partners
  - Many potential stakeholders
- Find funding (or investors) for the first stage
  - Government, subsidies, grants, etc.
  - 1 Million Euro required
- Find investors to fund prototypes and pilots
  - Reward versus risk
  - 3 + 7 Million Euro required

Dynaxion Summary

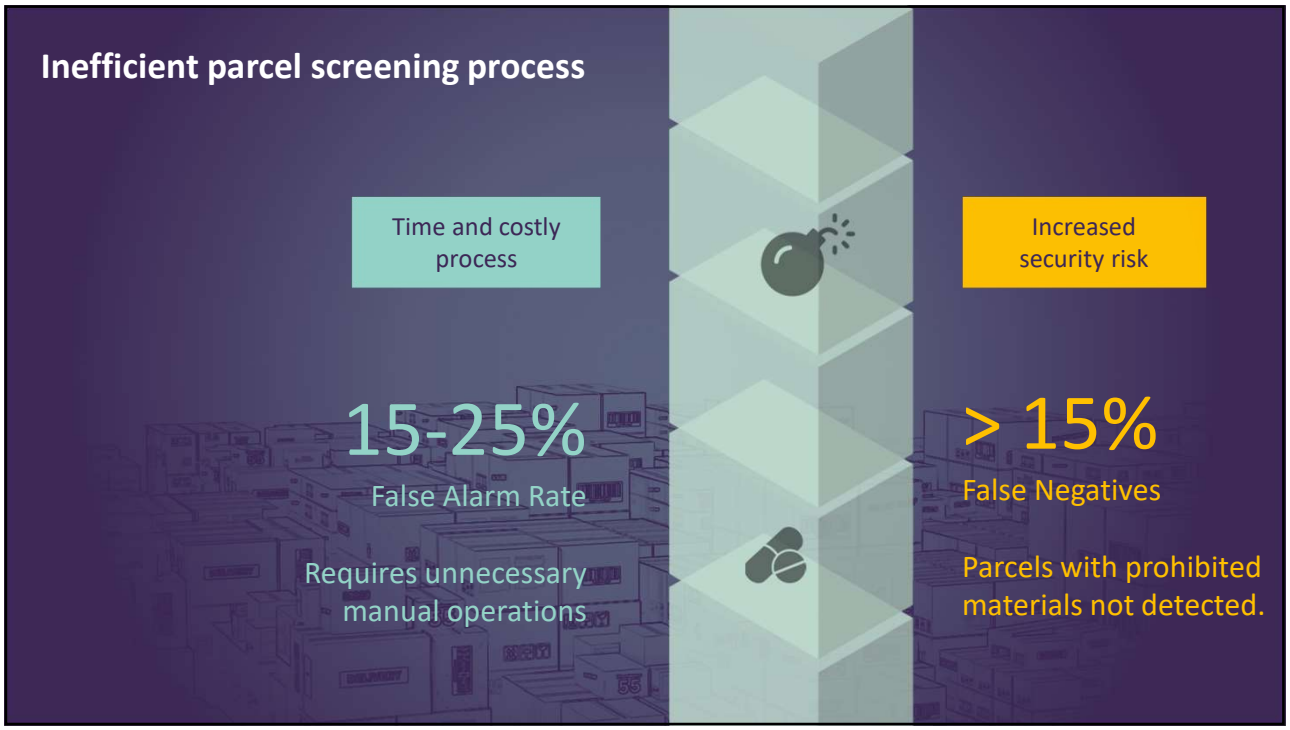
- Great potential
  - *Drugs, explosives*
    - *'Anything', even when hidden*
  - *Highly accurate*
  - *Automatic, non-invasive*
- Great challenge
  - *Early stage; Pre Proof of Concept*
  - *Highly complex system*
  - *Funding and investors required*
  - *Long horizon*

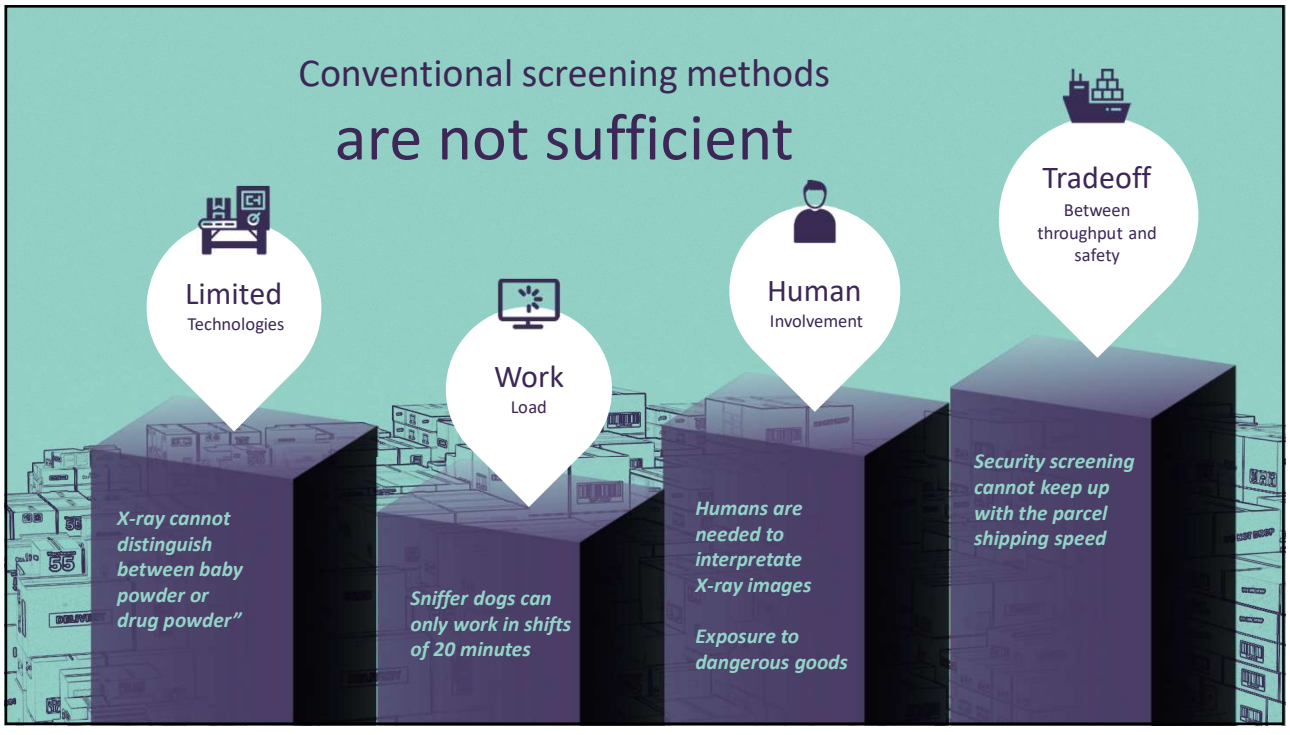
Dynaxion Security

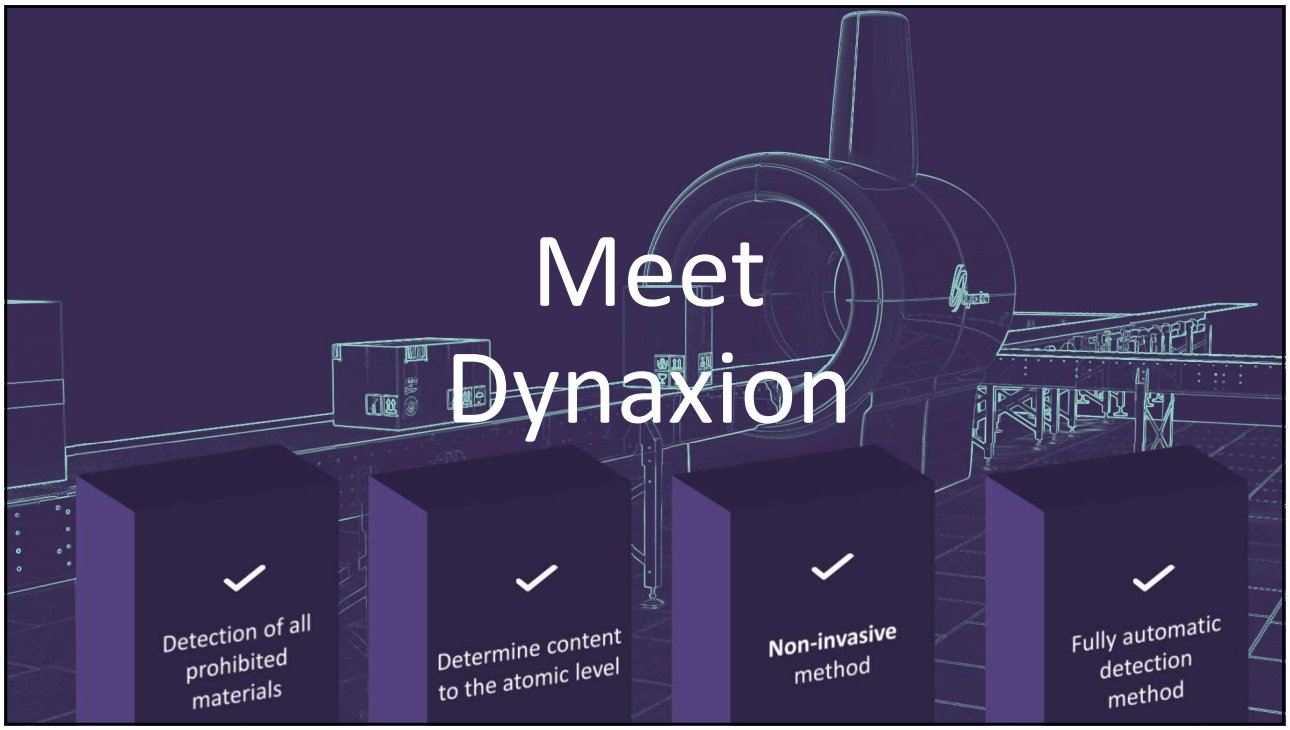
Security Screening Technology

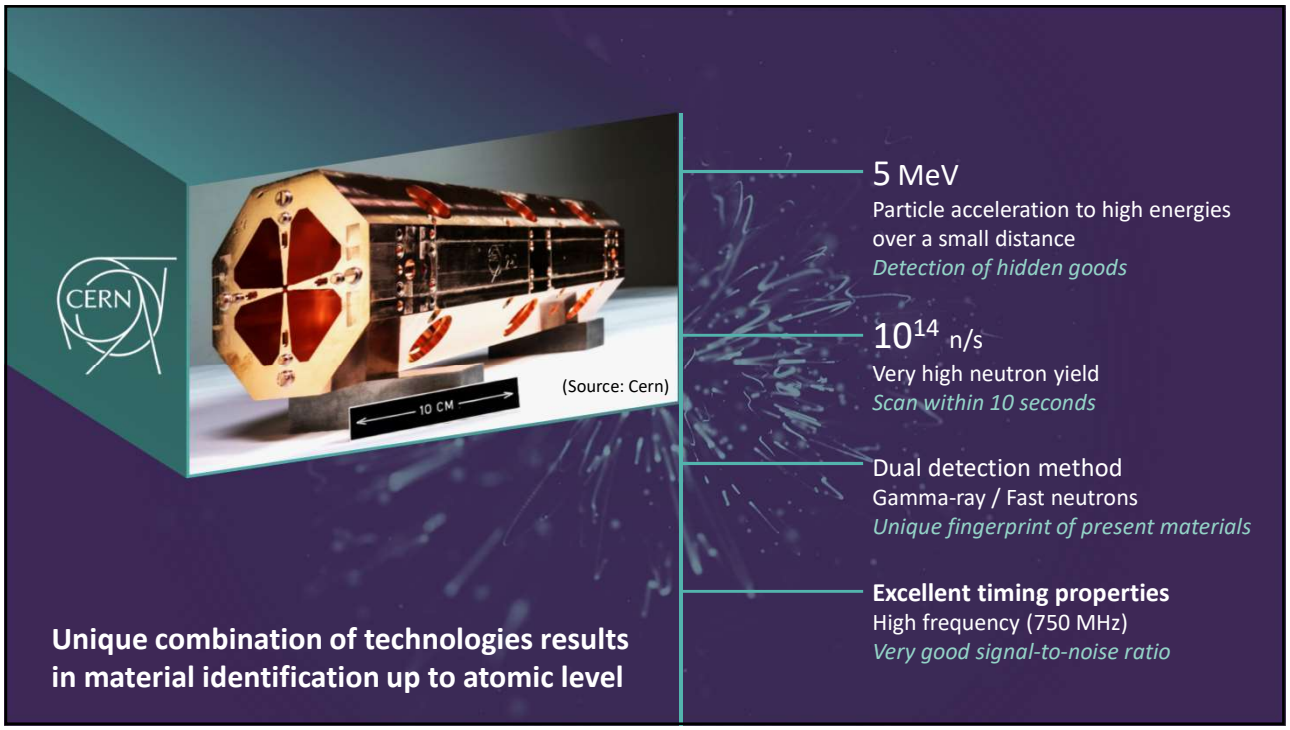
For a safer world

Back-up sheets


Inefficient parcel screening process
Time and costly process
Increased security risk
15-25%
False Alarm Rate
Requires unnecessary manual operations
> 15%
False Negatives
Parcels with prohibited materials not detected.


Conventional screening methods
are not sufficient
Limited
Technologies
X-ray cannot distinguish between baby powder or drug powder"
Work
Load
Sniffer dogs can only work in shifts of 20 minutes
Human
Involvement
Humans are needed to interpretate X-ray images
Exposure to dangerous goods
Tradeoff
Between throughput and safety
Security screening cannot keep up with the parcel shipping speed


Meet
Dynaxion
Detection of all prohibited materials
Determine content to the atomic level
Non-invasive method
Fully automatic detection method


CERN
10 CM
(Source: Cern)
5 MeV
Particle acceleration to high energies over a small distance
Detection of hidden goods
10^14 n/s
Very high neutron yield
Scan within 10 seconds
Dual detection method
Gamma-ray / Fast neutrons
Unique fingerprint of present materials
Excellent timing properties
High frequency (750 MHz)
Very good signal-to-noise ratio
Unique combination of technologies results in material identification up to atomic level

Neutron generation

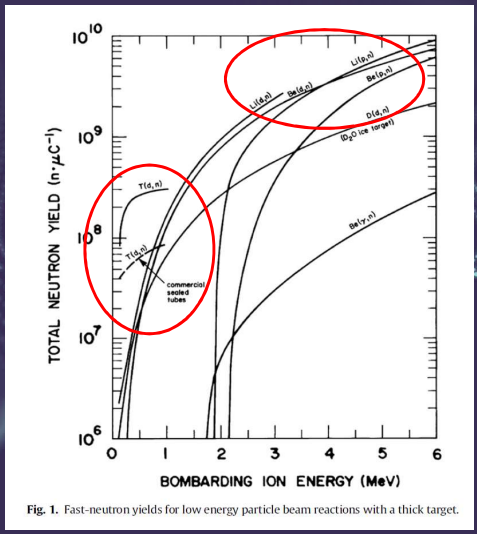
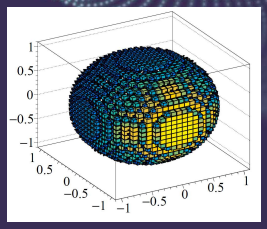
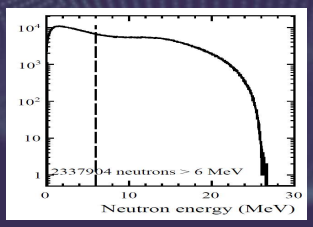


Fig. 1. Fast-neutron yields for low energy particle beam reactions with a thick target.

- Production two orders of magnitude higher than conventional D/T generators
- Higher neutron energy
- Forward directed neutrons





Technology Specification - preliminary

Features

- Inspection time per parcel: 10 sec
- Automatic analysis process based on AI
- Detected materials:
  - Explosives (TNT, C4, …
  - Drugs
  - Batteries (Lithium)
- Detection level: <20 gram material

Overall Specifications

Weight: 500 kg
Dimensions: 3x3x2 meter
Maximum parcel size: 80x60x60 cm
Power consumption: 100 kWatt
Vacuum level: 10-7 Pascal
System lifetime: 7 Years
Uptime: 99.9%
Operation hours: 24/7

Neutron Generation

High neutron yield: 10e14 n/s
Neutron energy: 100keV-20 MeV
Acceleration energy: 5 MeV
Ion acceleration: Deuterium
Deuteron current: 10 uA
Target material: Li/Be or equivalent
Target lifetime: 10.000 hours
Bunching efficiency: 40-50%
Tunability neutron energy: fine

Detection System

Combined gamma-ray & neutron detection system
Gamma-ray detector: LaBr3:Ce or CeBr3
Neutron detector: ZnS:Ag
Timing resolution: ~ 1 ns
Detection efficiency gamma-rays: >20%
Detection efficiency neutrons: >7%
Count rates: >1M/s