ULIS
a portable neutron device for explosives and chemicals detection

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Philippe Le Tourneur, Jean Luc Dumont,
Corinne Groiselle, Jean Sébastien Lacroix, et al
EADS Sodern

Outline

1 – ULIS and neutron interrogation introduction
2 - Sodern analyzers
3 – API, explosives, Sodern
4 – ULIS system, the new tube, some lab results
5 – MMI, Conops
6 - conclusion

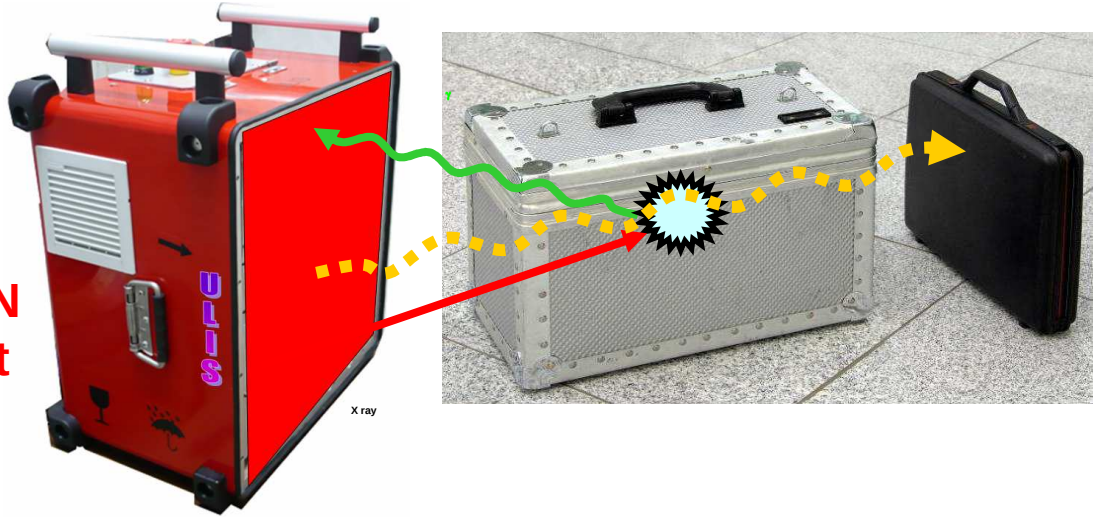
ULIS

Unattended
Luggage
Inspection
System

Bomb squad officer in operation

all-in-one portable equipment to identify threats (radiological, explosive and chemical devices) or illicit material trafficking (drugs…) in unattended parcels, luggage or cars

ULIS : a XN instrument



X ray screen

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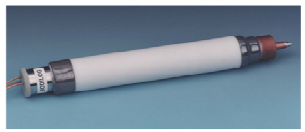
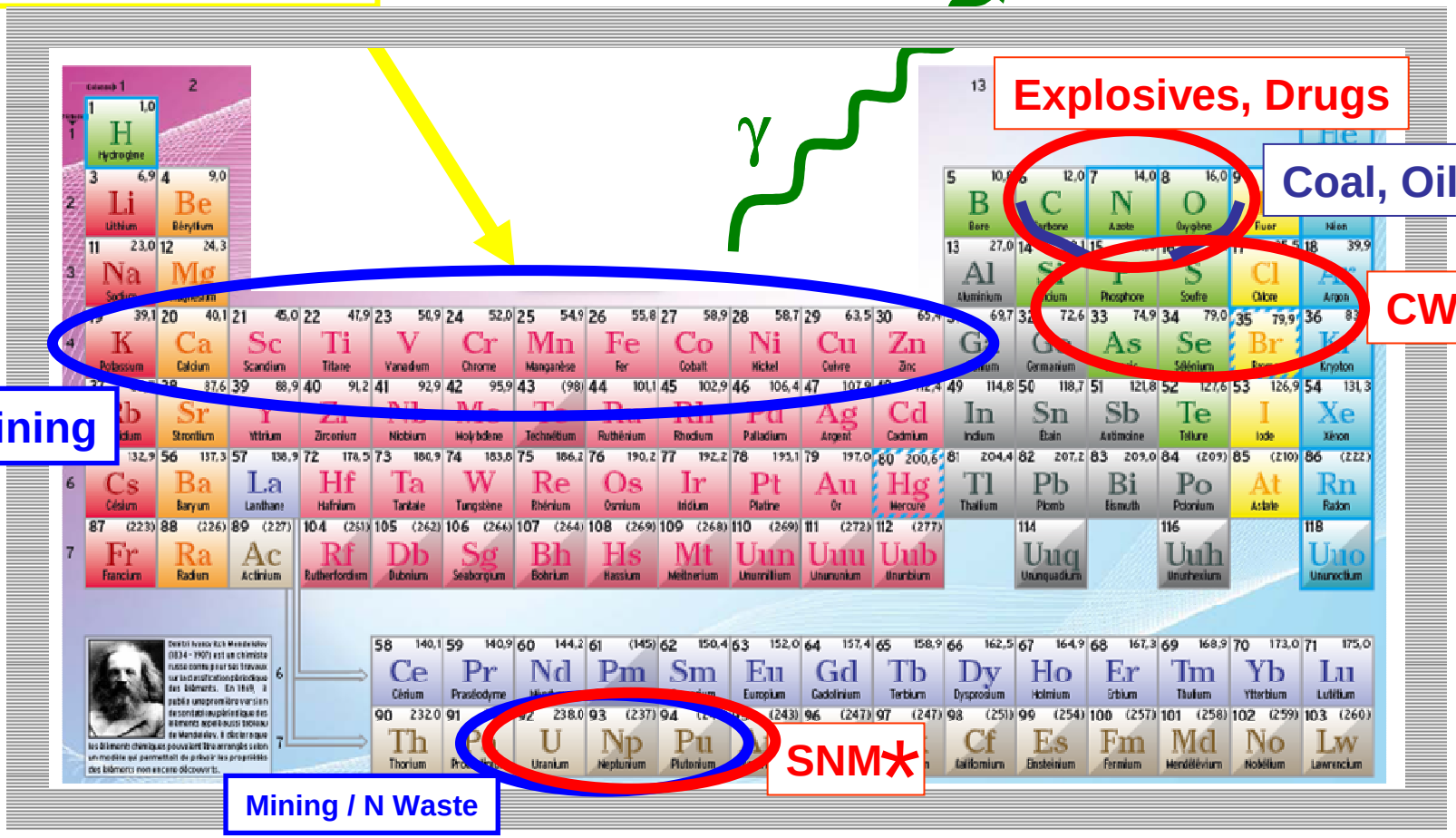


NEUTRON SOURCE

ULIS applications
CNA applications

γ detector



* Ulis option

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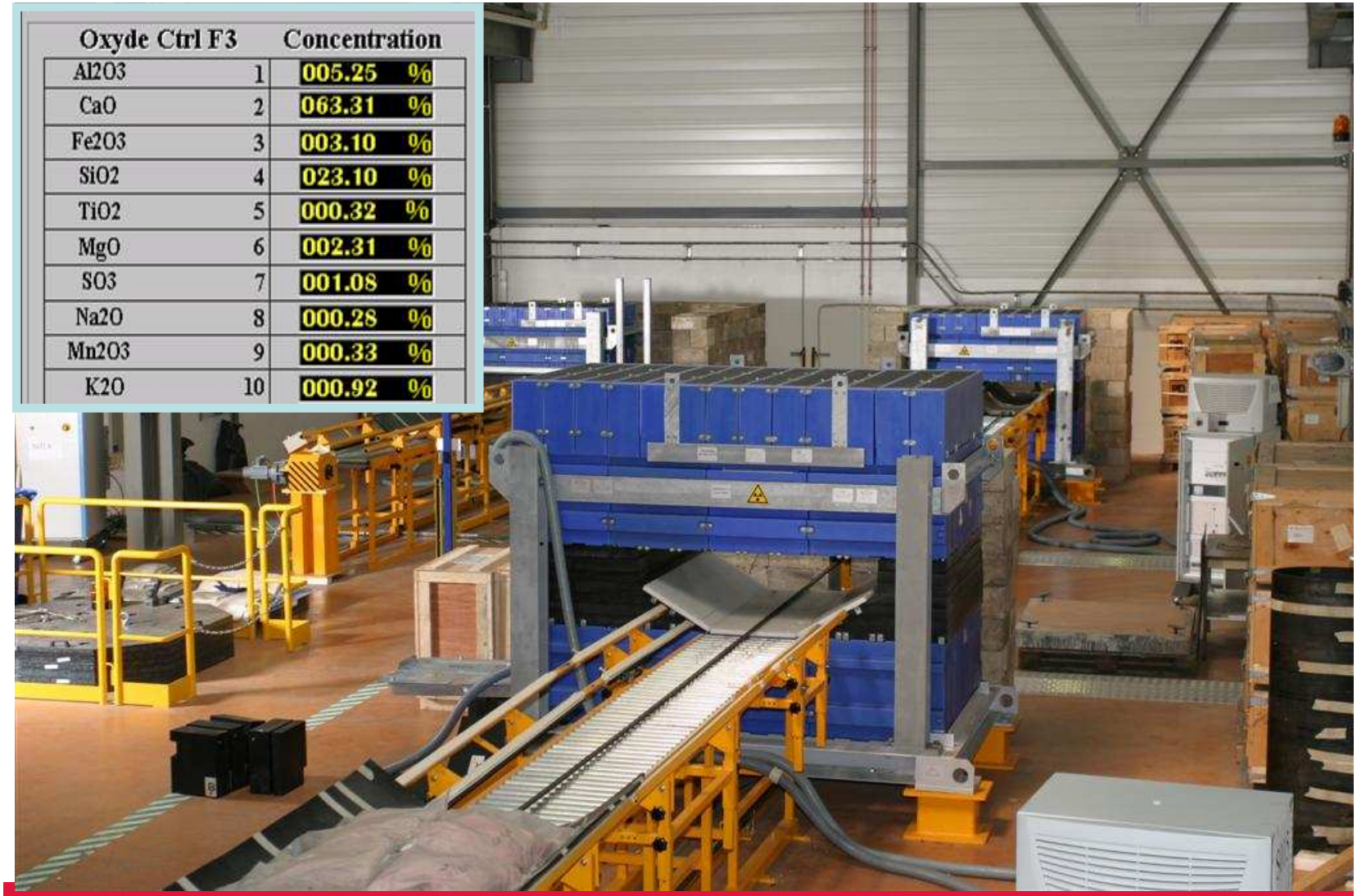
Controlled Neutron Analyzer (CNA) for cement, coal and mining industry

Oxyde Ctrl F3		Concentration
Al2O3	1	005.25 %
CaO	2	063.31 %
Fe2O3	3	003.10 %
SiO2	4	023.10 %
TiO2	5	000.32 %
MgO	6	002.31 %
SO3	7	001.08 %
Na2O	8	000.28 %
Mn2O3	9	000.33 %
K2O	10	000.92 %



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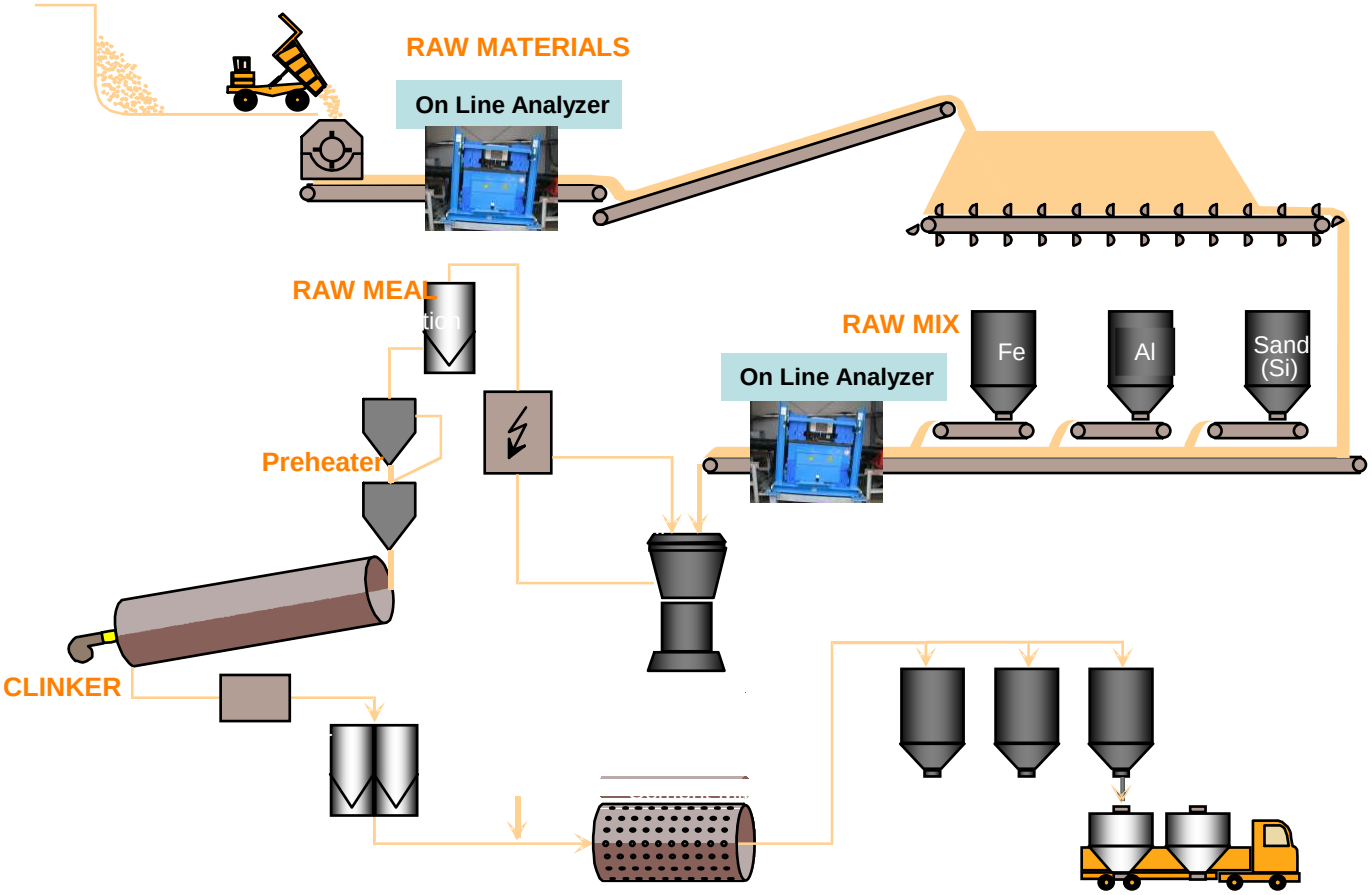
RAW MATERIAL ANALYSER

DWAALBOOM CEMENT PLANT (South Africa)

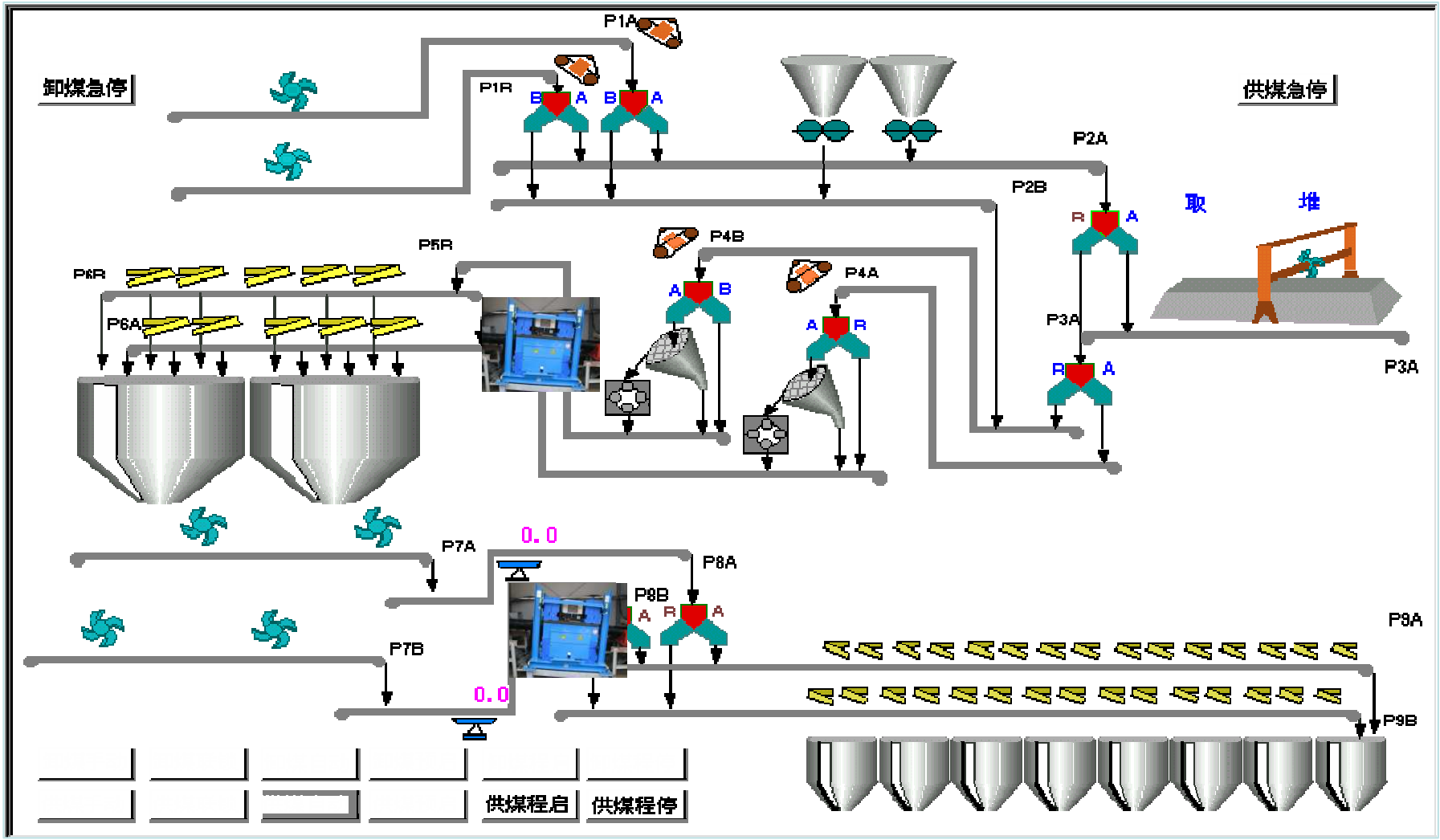
COAL
CHINA

Nickel
Ore
New Caledonia

Cement : 2 possible locations and missions

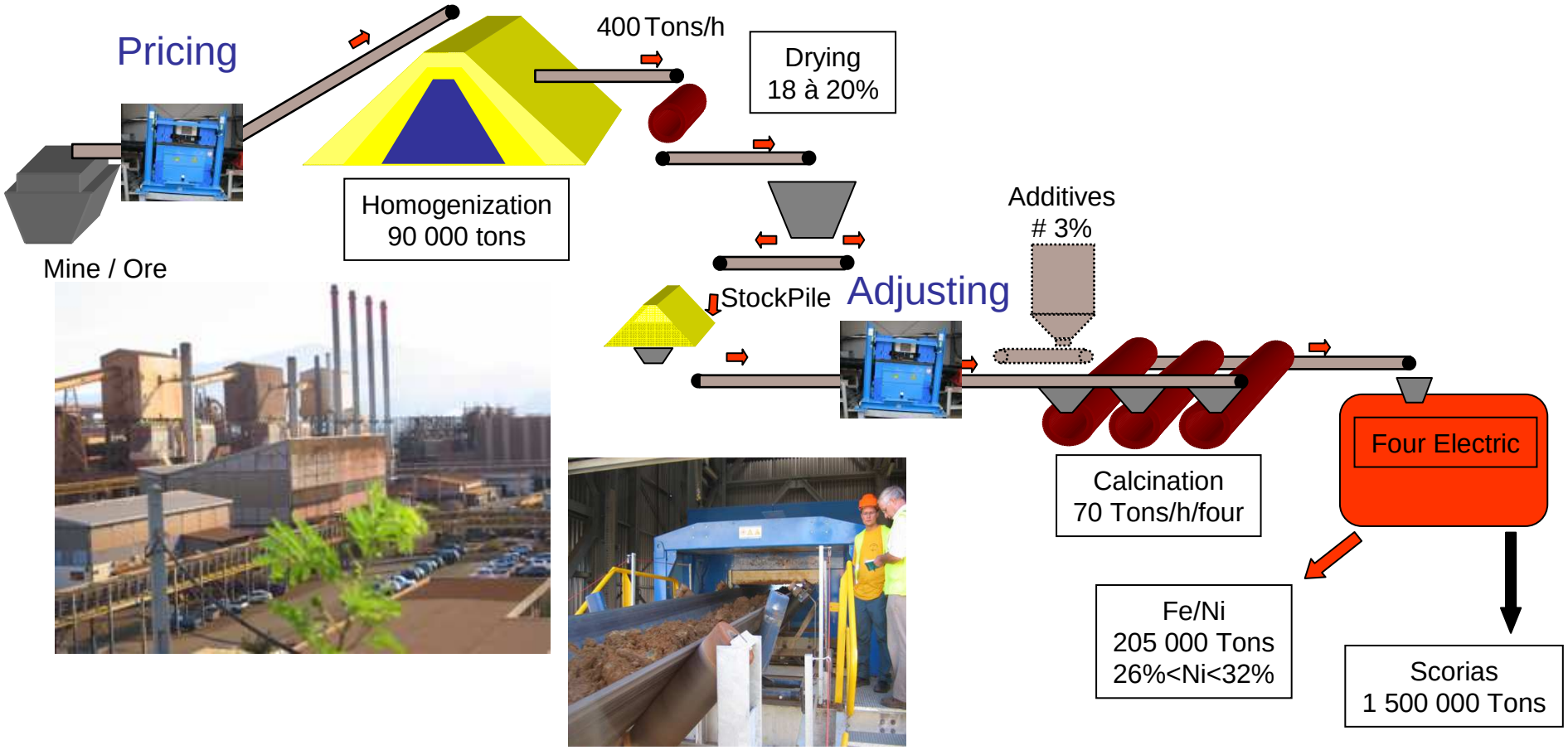


Coal Plant: sorting or blending



Minerals (Cu, Ni, Fe, …)

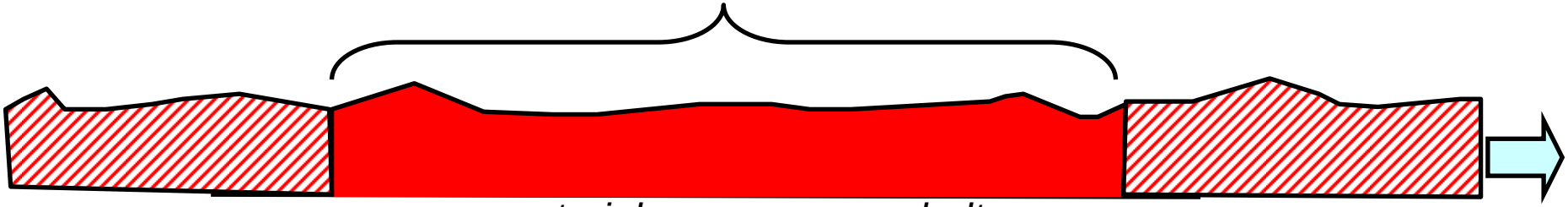
Exemple: SLN ERAMET Nickel transformation plant in Noumea



HOMELAND SECURITY APPLICATIONS ARE FAR MORE CHALLENGING THAN MINING ONES

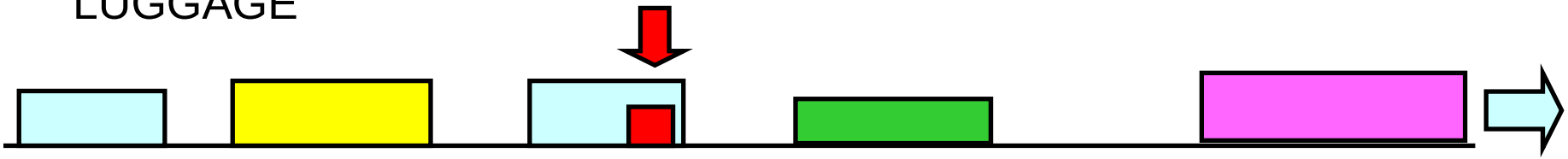
- **MINING APPLICATION**

  MEASURING THE ***AVERAGE*** COMPOSITION OF THE RAW MATERIAL



raw material on a conveyor belt *(typical sample size : tons)*

- **EXPLOSIVE SCREENING OF LUGGAGE**
  - MEASURING ***EACH SUBPART*** COMPOSITION OF EACH PIECE OF LUGGAGE



luggage on conveyor belt *(typical sampel size : ½ kg)*

- More signal needed ; - Spatial resolution needed

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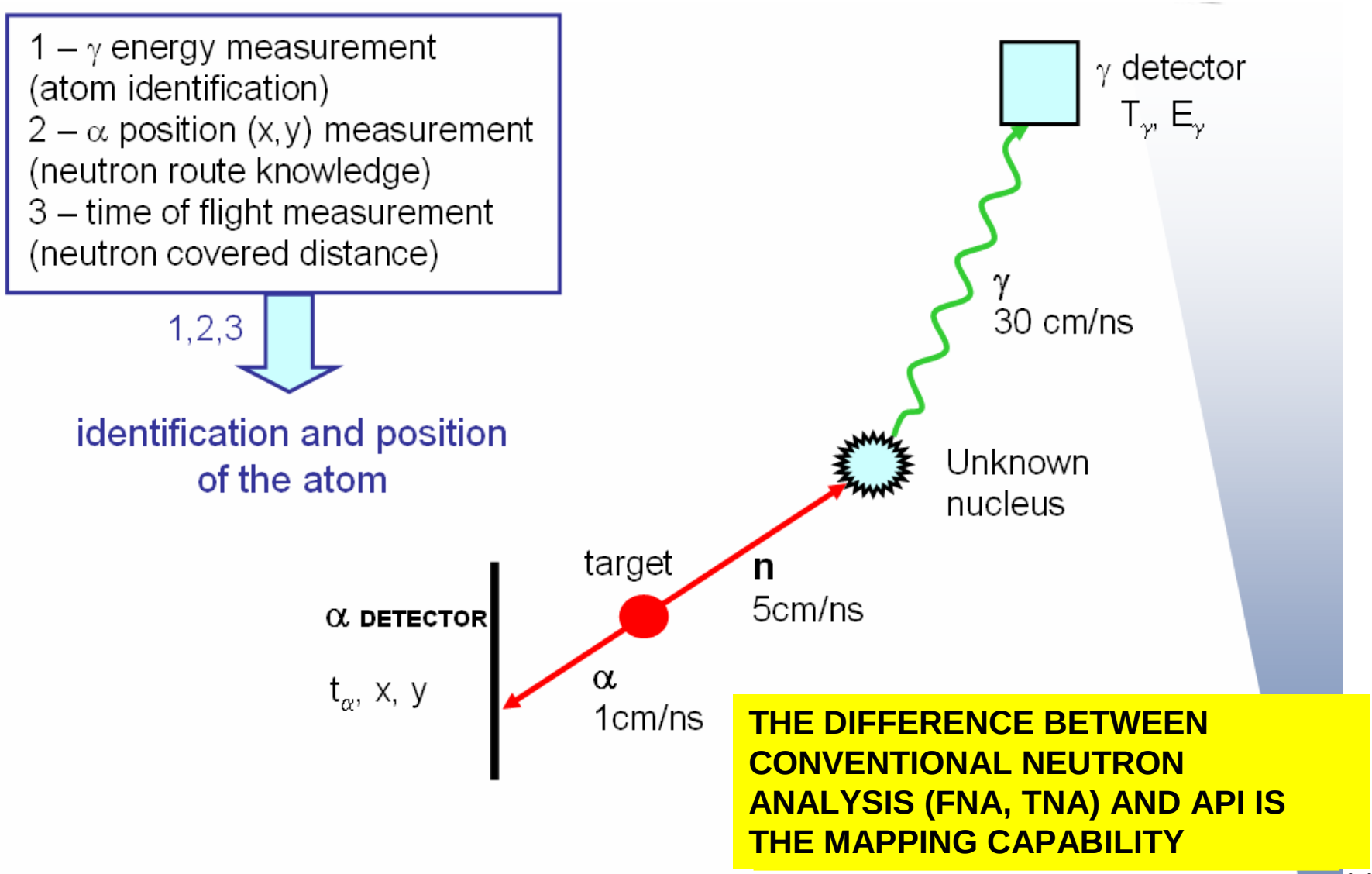
Associated Particule Imaging (API)



2003
First APT

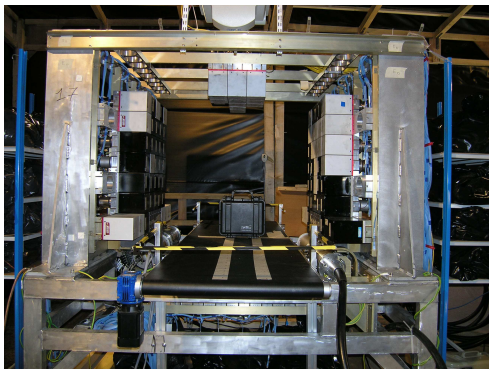
(Thanks to INFN)

2007
Euritrack Proto With 10 European partners

(EU funding)

2004
Landmine detection field demo

(DGA project)



2008
Luggage screening demo

(EADS and CEA funding)

2006
Landmine neutron sensor 2nddemo

(DGA project)

2009
ULIS
Portable system

(EADS CTO, DGA, NRA Funding)

The permanent goal : explosives

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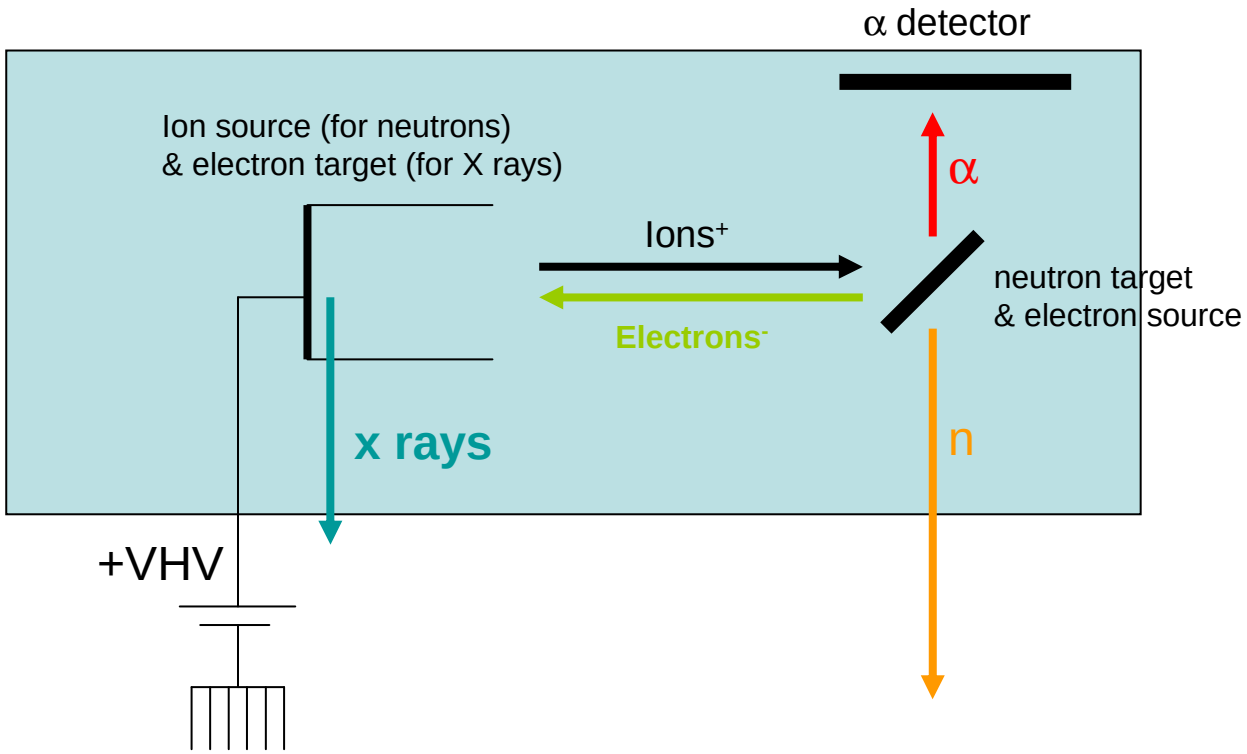
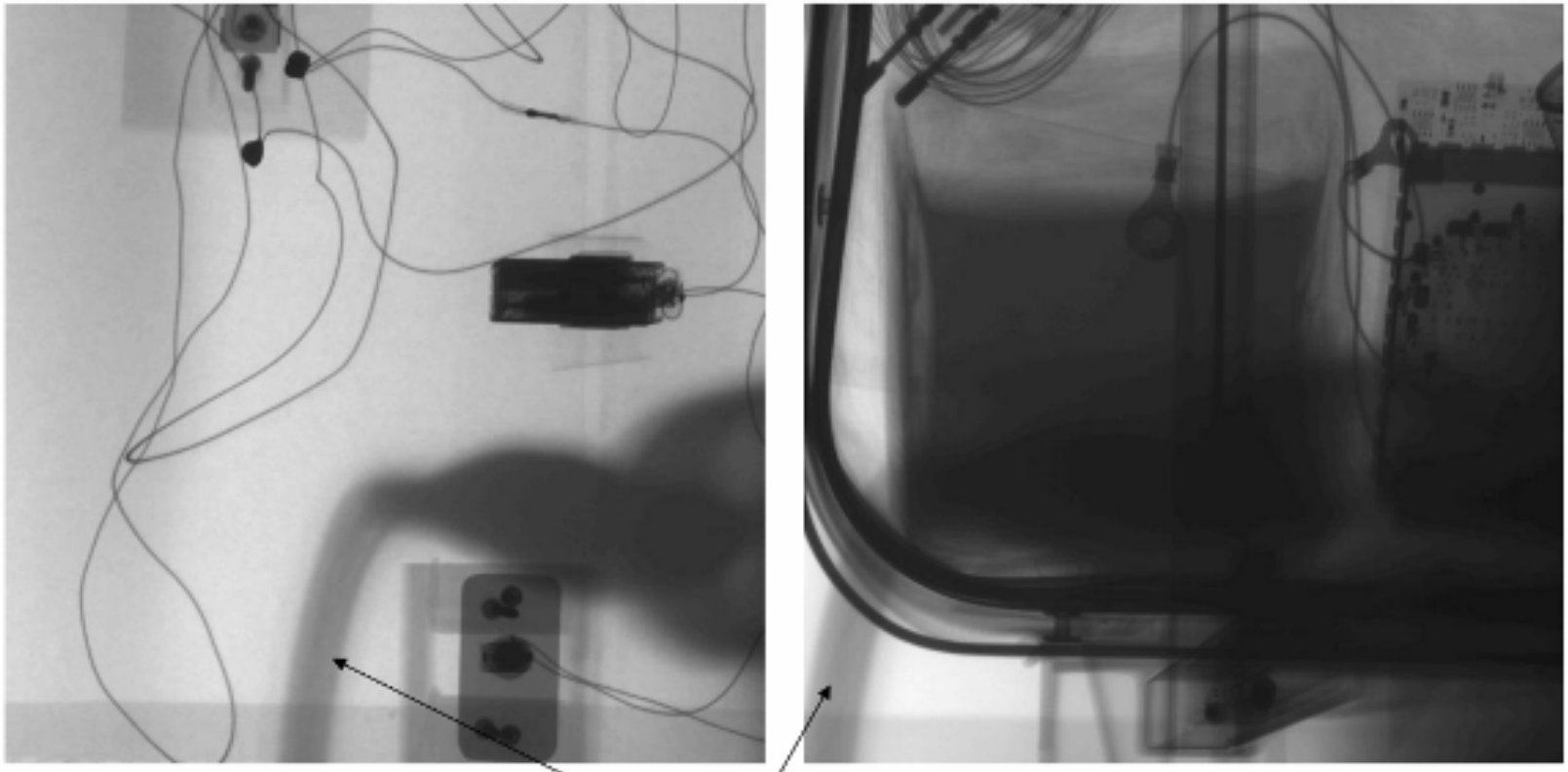
Xn tube principle

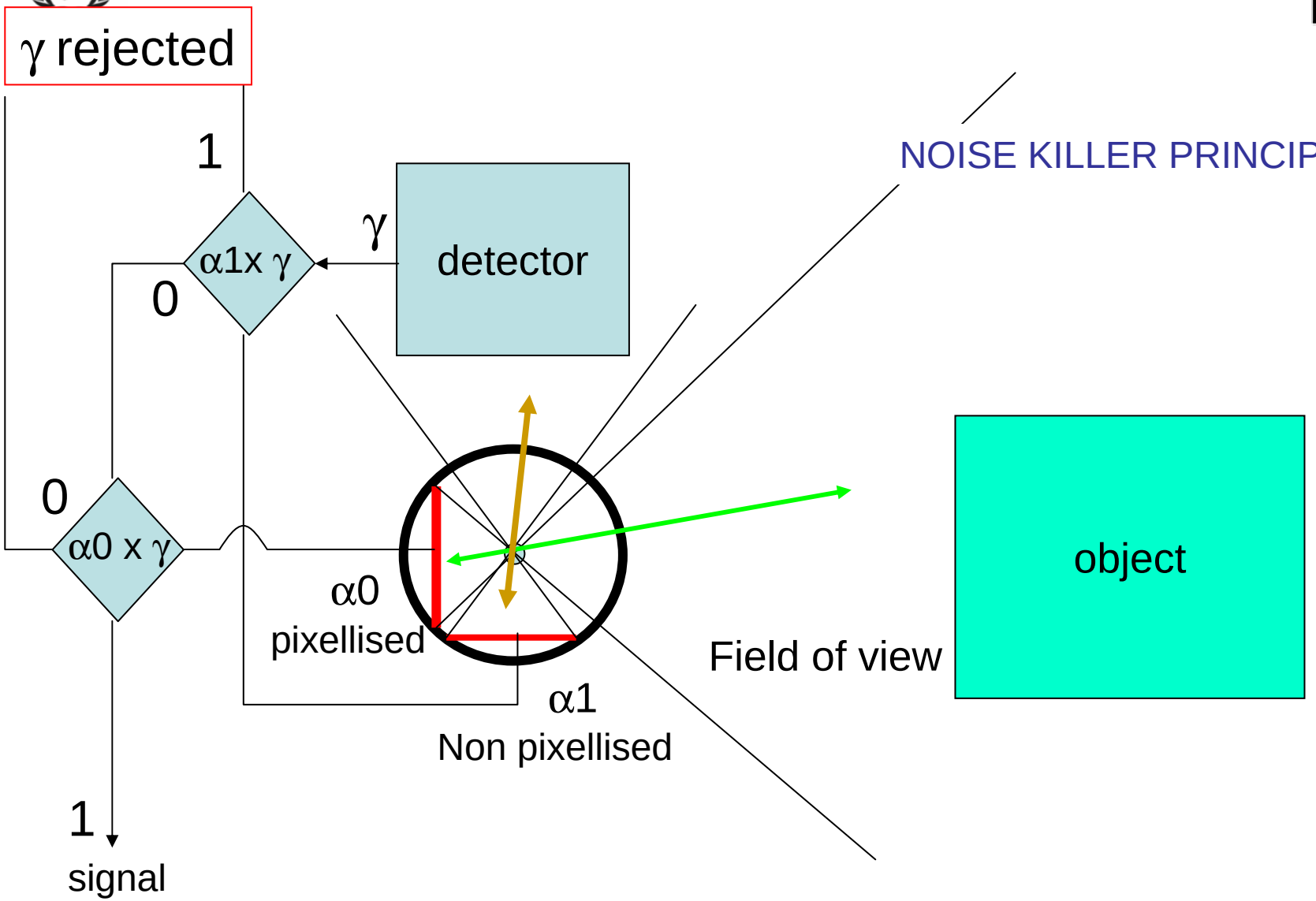


TPA17 X ray images (90 kV ; 100 µA ; 20 seconds) – left : IED in a parcel – right : TNT simulant in a suitcase



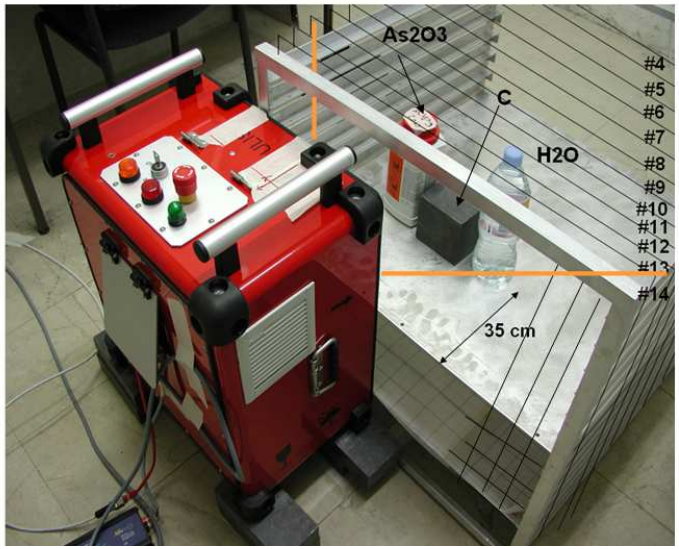
X rays and neutrons are emitted one after the other

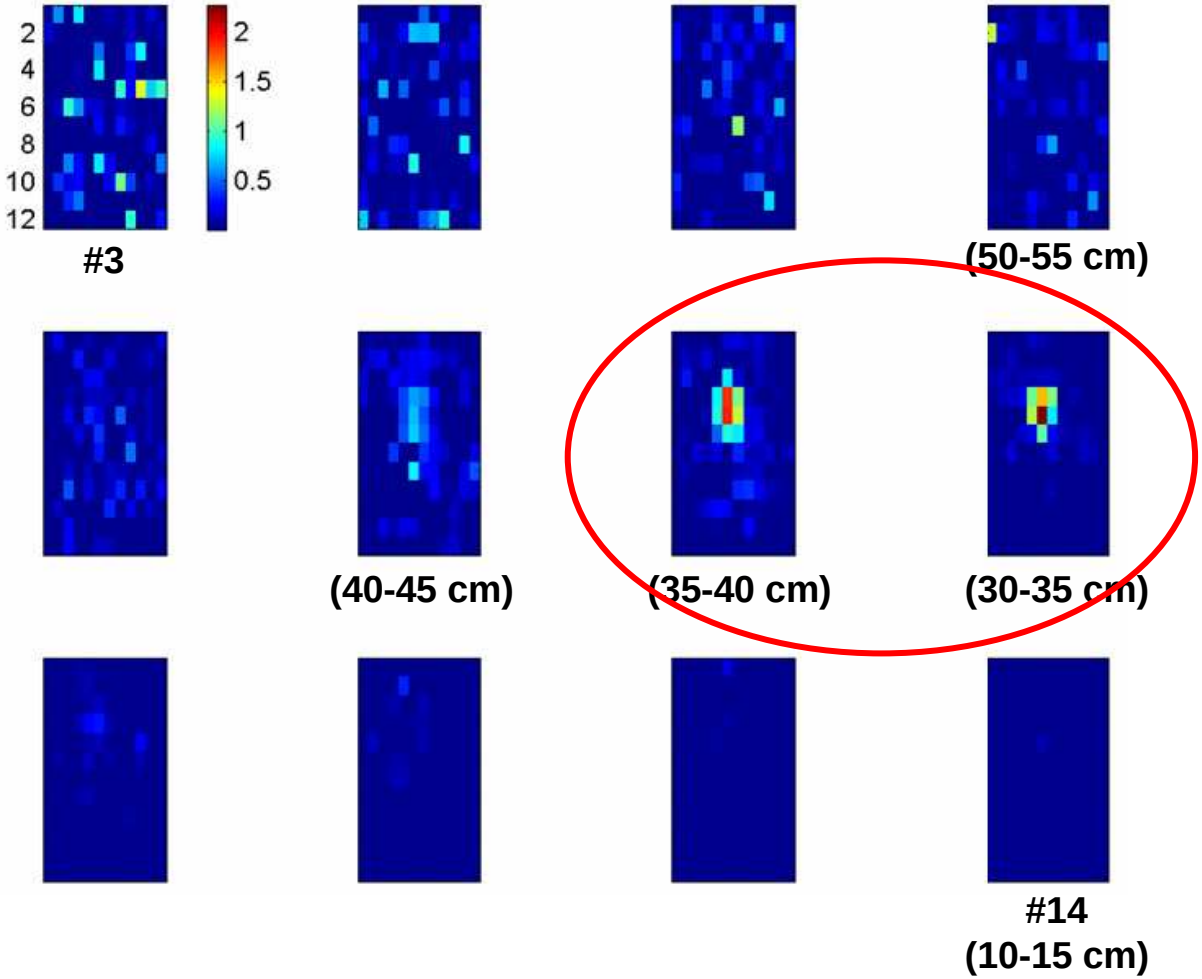
X ray detector : Vidisco

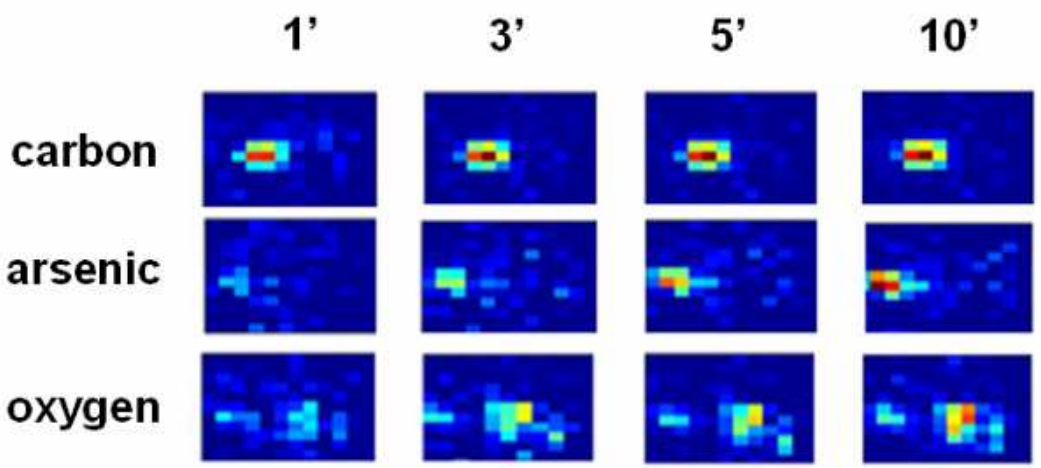

γ rejected
1
α1x γ
γ
detector
0
NOISE KILLER PRINCIPLE
0
α0 x γ
α0
pixellised
object
Field of view
α1
Non pixellised
1
signal

Spectral results filtered by C respons in the slices #3 to #14 (from 10 cm to 70 cm from ULIS)

Acquisition time : **1 minute**
One dectector
Neutron flux : **3 10^7 n/s**
Arbitrary unit
125 cm^3 voxels

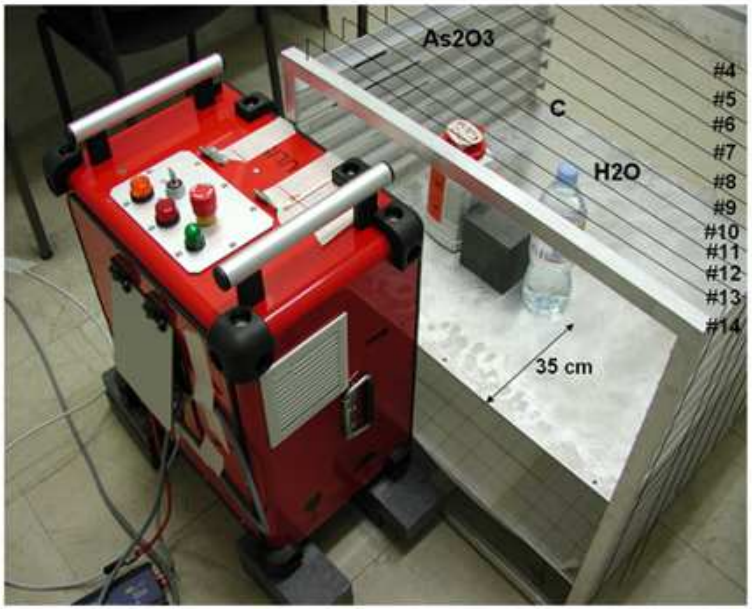






Mapping of the slice #9

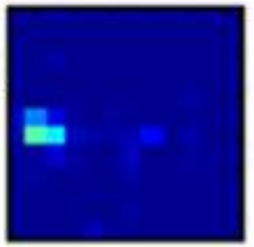
ULIS
With 3 objects
in front of it
1 kg As2O3
1 kg C
1kg H2O
(left to right)



Slice #9

Arsenic x Chlorine

Arsenic x Oxygen



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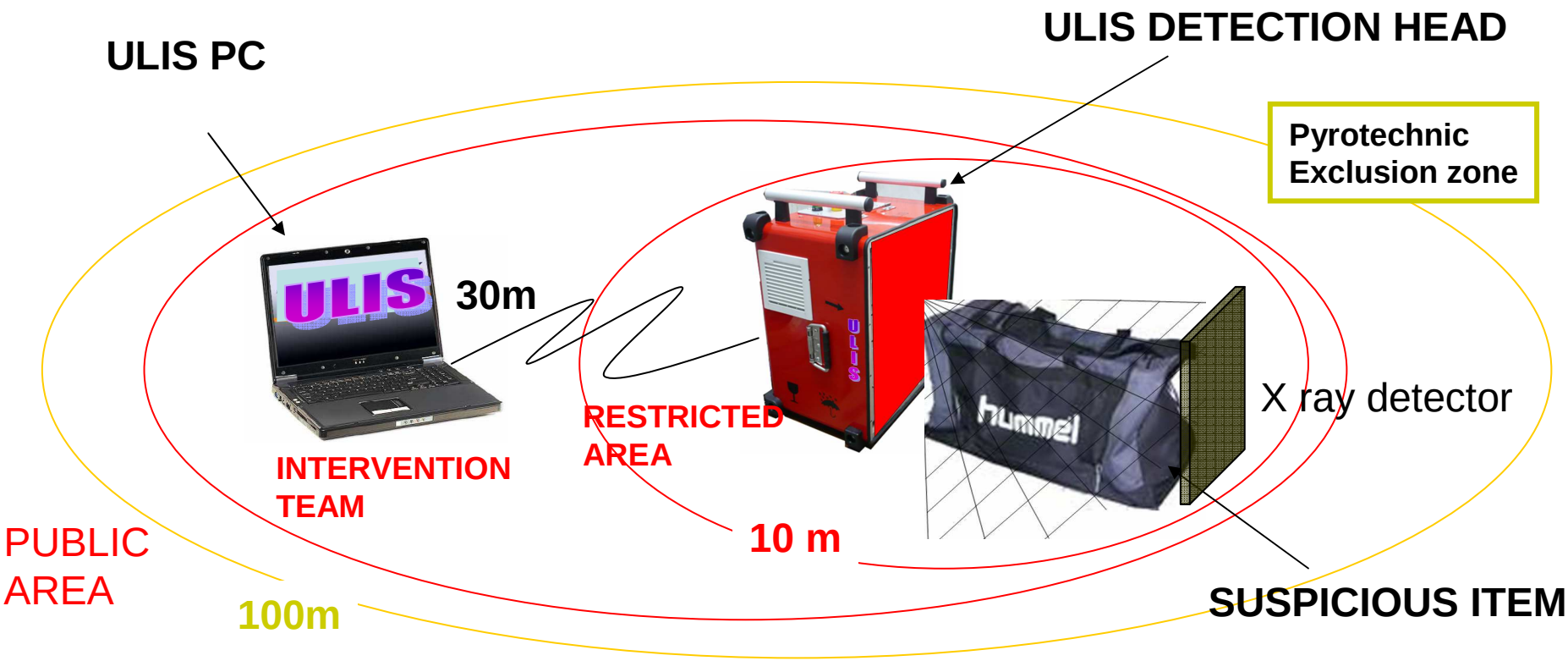
ULIS CONCEPT OF OPERATION (EXAMPLE)



-THE ULIS EXCLUSION ZONE IS INCLUDED IN (USUAL) PYROTECHNIC EXCLUSION ZONE IN CASE OF SUSPICIOUS ITEM INSPECTION
-THE RESTRICTED AREA SIZE DEPENDS ON ALLOWED DOSERATE ON OPERATORS (10 m means about 10 µSv/h)

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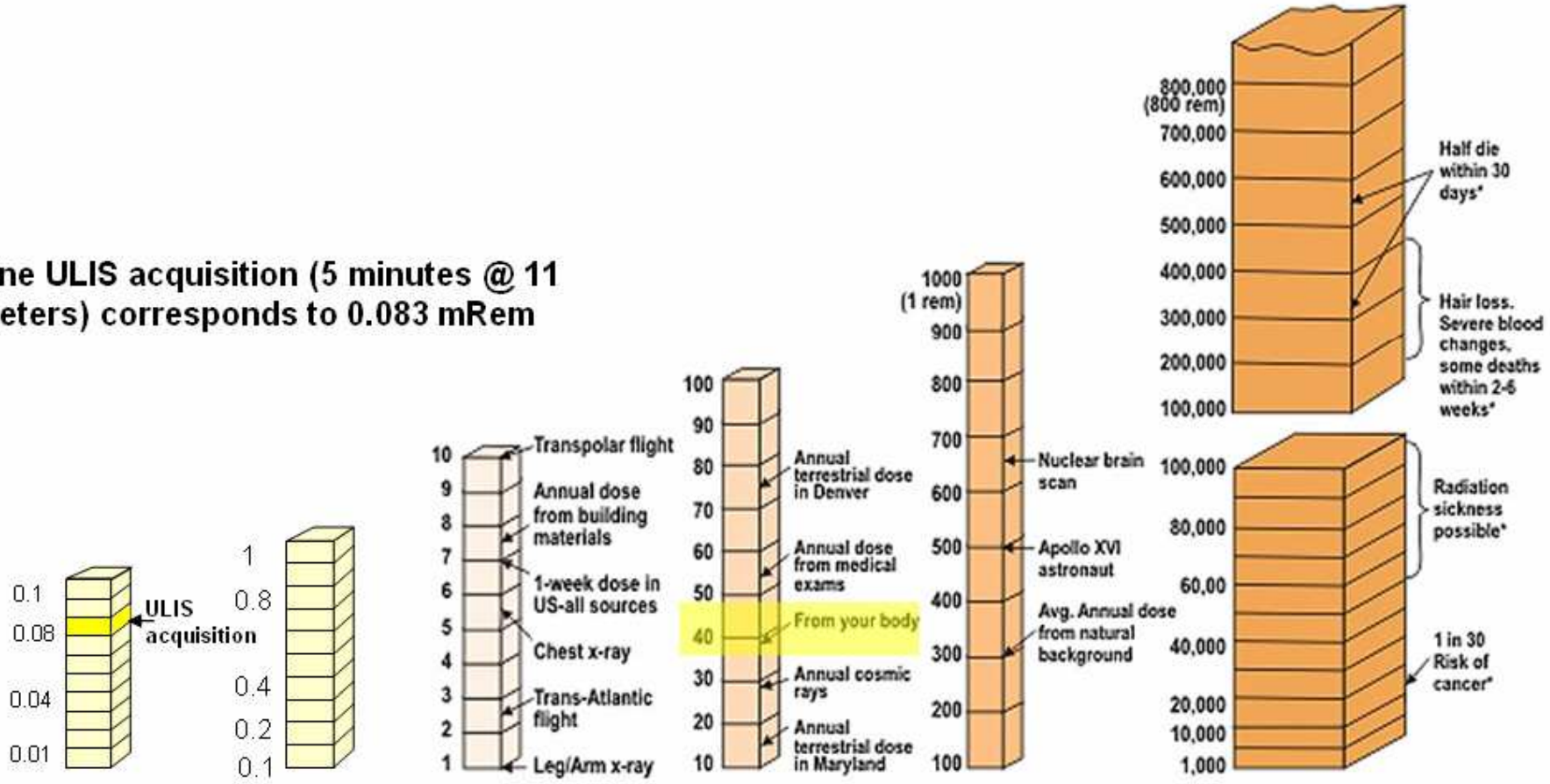
Radiation Doses in Perspective (in millirem)

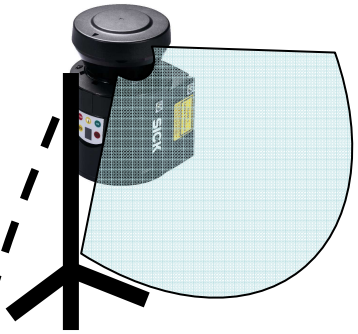
Source : NRC web site www.nrc.gov/images/about-nrc/radiation/factoid2-lg.jpg

One ULIS acquisition (5 minutes @ 11 meters) corresponds to 0.083 mRem



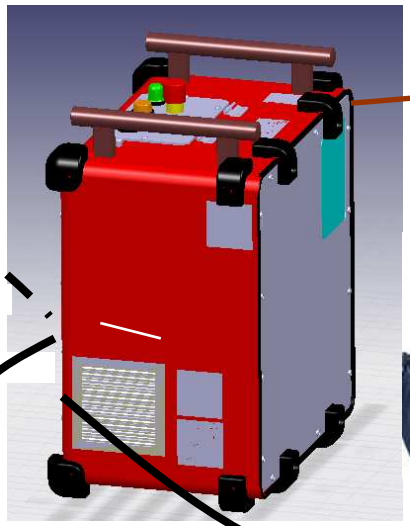
* Doses received over short time period (hours to days) at high dose rates are "acute" doses.

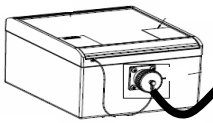
Electronic (IR) intrusion detection (option)



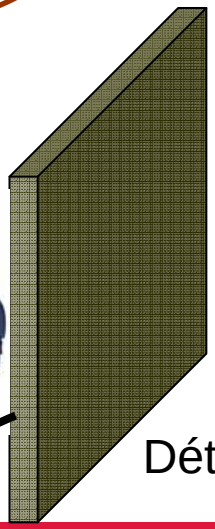
ULIS Control Command

Tête de détection



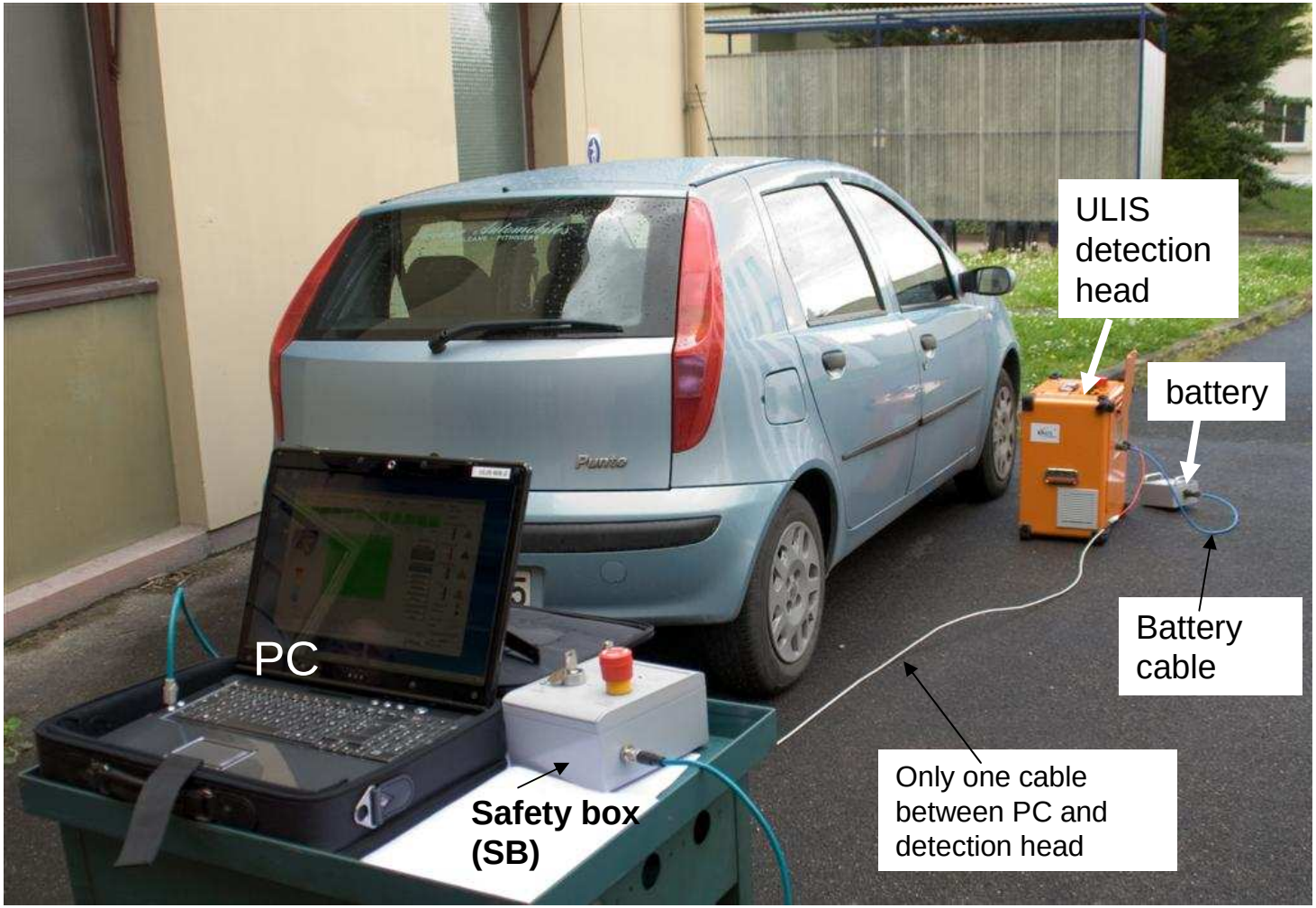


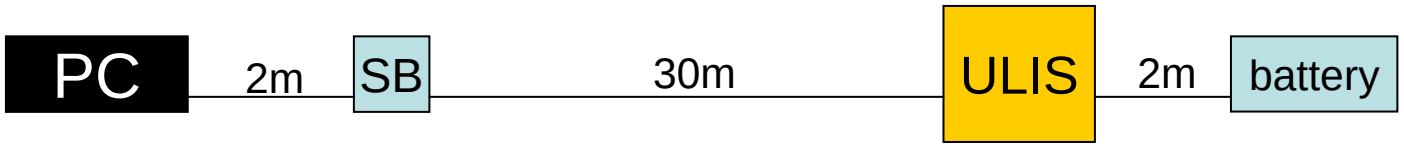
Batterie



Détecteur X (option)

Bagage suspect





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STATUS OF THE PROJECT

- 3 TPA17 tubes manufactured
- 2 ULIS prototypes manufactured (1red, 1 orange)
- Decision algorithms, MMI works, tests lab on progress
- Field tests scheduled in June …

prospects

- SNM detection : could be envisioned by adding specific detectors (already possible for the electronics) and by pulsing the tube
- Containers : several associated Ulis-like modules coud may be do some part of the job ?
- IEDS and landmine :


300 kgs
(2006)
Less than 10 kgs
(2010 ?)
www.iedrobot.com

Thank you for your attention