

# Wins International Workshop Security of Radioactives Sources Mexico City , Mexico

Wednesday 23 October 2019

- **Nuc-Track Solution** for tracking and safeguard of radioactive sources

- **Other innovative technologies** for improving Security of Radioactive sources

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## French Nuclear Program

**39 000**  
radioactive  
sources  
used in  
France

**4 000**  
high-activity  
Sources

**900 000**  
movements  
a year

Many  
Gamma-ray  
projectors

**France is one of the world's  
most nuclear powered country**

**75% of its electricity  
derives from nuclear energy**

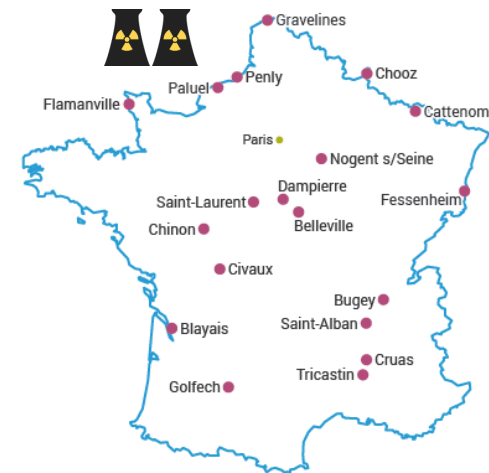
With **58** nuclear reactors in **19** power  
plants having a total capacity of **63.2**  
Gwe,

France is the **2<sup>nd</sup>** largest producer of  
nuclear energy in the world

- Long experience in the use of Radioactive sources on French soil
- Organization through French regulation bodies (MTES, ASN, IRSN,...)
- Permanent improvements and innovations



Nuclear Power Plants in France



Source: World Nuclear Association

# The nUC-track Project Partners



Specialist of Nuclear and CBRN topics operating in France and Internationally



**Nuclear Industry**

**Defense**

**Security**

In partnership with large groups :

- Research and Development
- Consulting



Delivering Engineering Services for Complex Projects with high levels of constraints

**12 000 EMPLOYEES WORLDWIDE**

**50 Years of Experience in Nuclear**

**1st Independent Nuclear Engineering Company in the World**



Industry



Infra



Nuclear



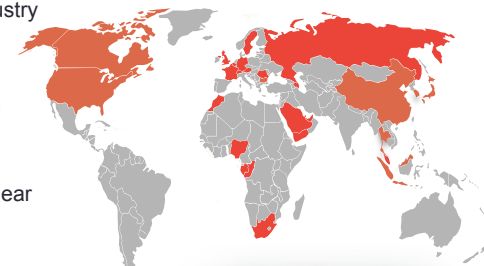
Power generation



Life Sciences



Oil&Gas



## OUR GLOBAL SECURITY APPROACH

**Physical Security**

**Cyber Security**

**Functional Security**



## Aid & Support



### Collaborative Project

The Nuc-Track project is approved by two French competitiveness clusters:

#### Nuclear Industry Cluster



#### Paris Region Systems & ICT Cluster



#### Pôle Paris Région Systèmes et TIC

The Nuc-Track project is supported by the French government:

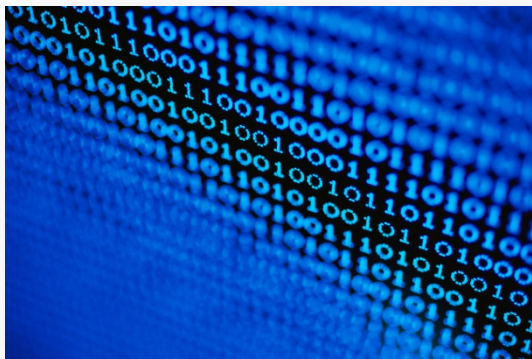


## The **NUC-track** Security Project

- ▶ Real time surveillance of radioactive sources during all phases of the cycle :  
**Storage, Transport and Use**
- ▶ Protection against various threats (theft, human error, malicious act) following a risk reduction pattern.

The **Nuc-Track project** provides :

- a **solution for protecting radioactive sources**, especially in transport situations, when such sources are most vulnerable.
- an accurate **traceability** of all the sources' movements and whereabouts.
- an efficient **answer to a national security concern**. This sensitive issue will lead to the implementation of new domestic laws aimed at tightening the sources security.



# Radioactive sources



## Radioactive Sources examples for different applications

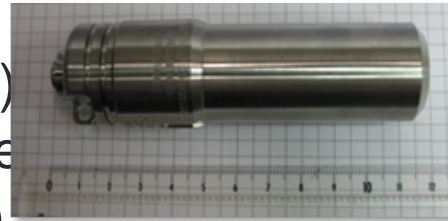
### - Gammagraphy, Radiography

- **Ir192** (74 days half life)
- **Co60** (5.2 years half life)
- **Se75** (120 days half life)
  
- Up to **4.4 TBq** for the most common source



### - Oil Well logging :

- **Cs137** ( 30 years half life)
- **Am/Be** (432 years half life)
- **Cf252** (2.6 years half life)
  
- Up to **63 GBq** for the most common source



Source scellée de 192 Ir pour gammagraphie (activité max. : 4,9 TBq).



## Radioactive Sources examples for different applications

### - Medical :

- Teletherapy : **Co60 Cs137**
- Curietherapy : **Ir192 Cs137**
- Blood Irradiator : **Cs137 Co60**

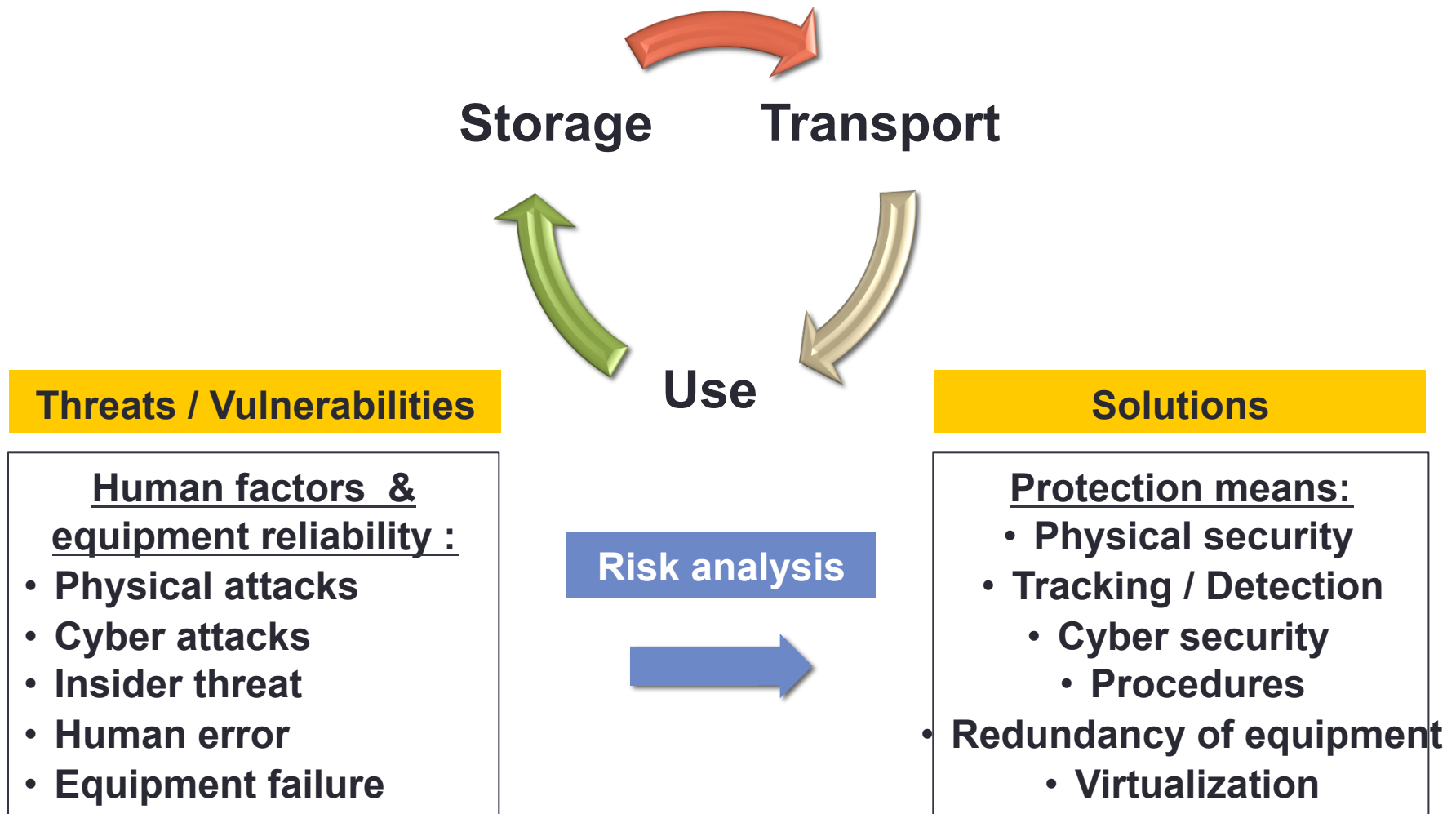
Activities up to **220 TBq**



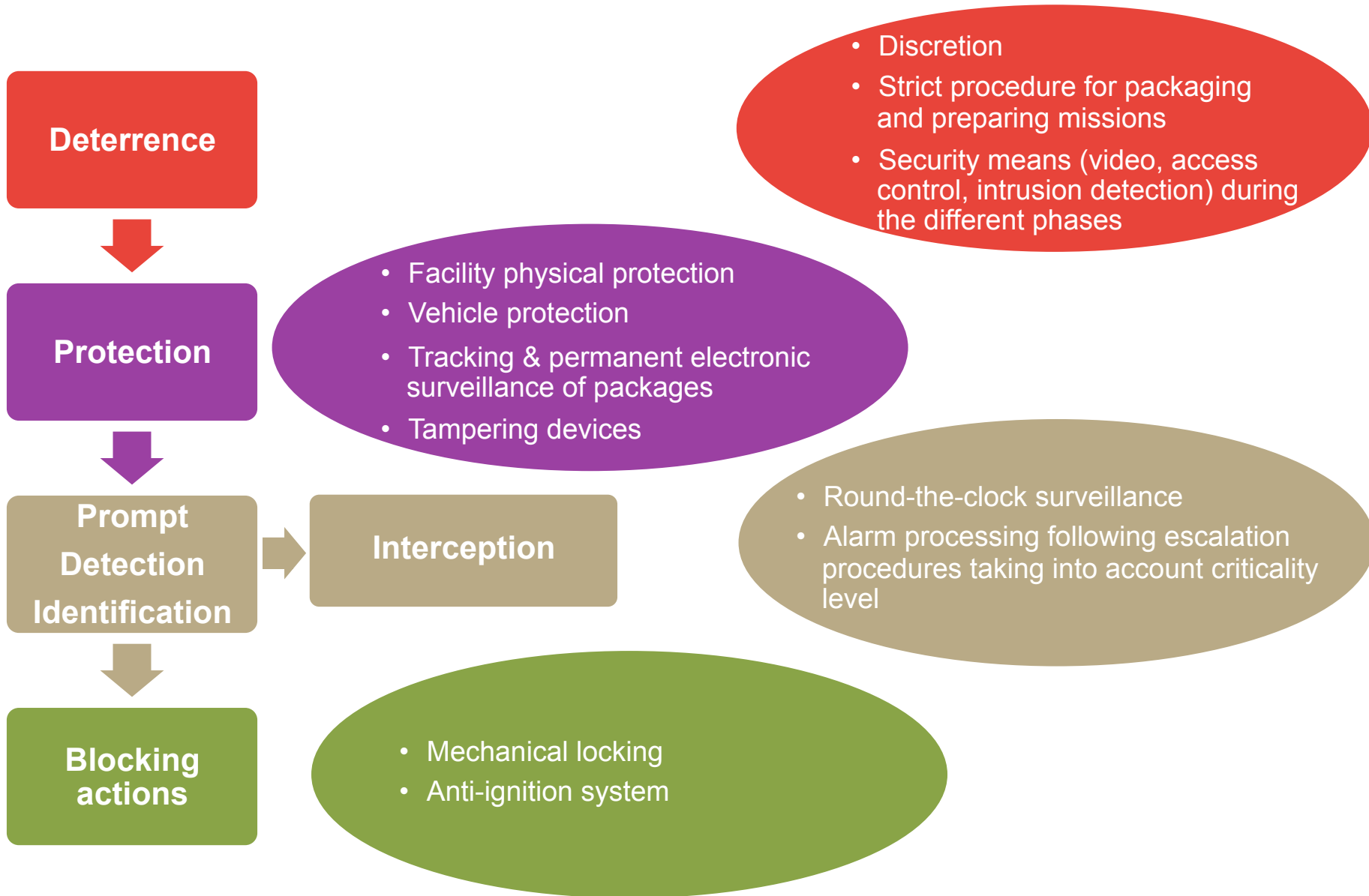


## Global security : an holistic approach

The system security level is defined by the weakest link of the chain



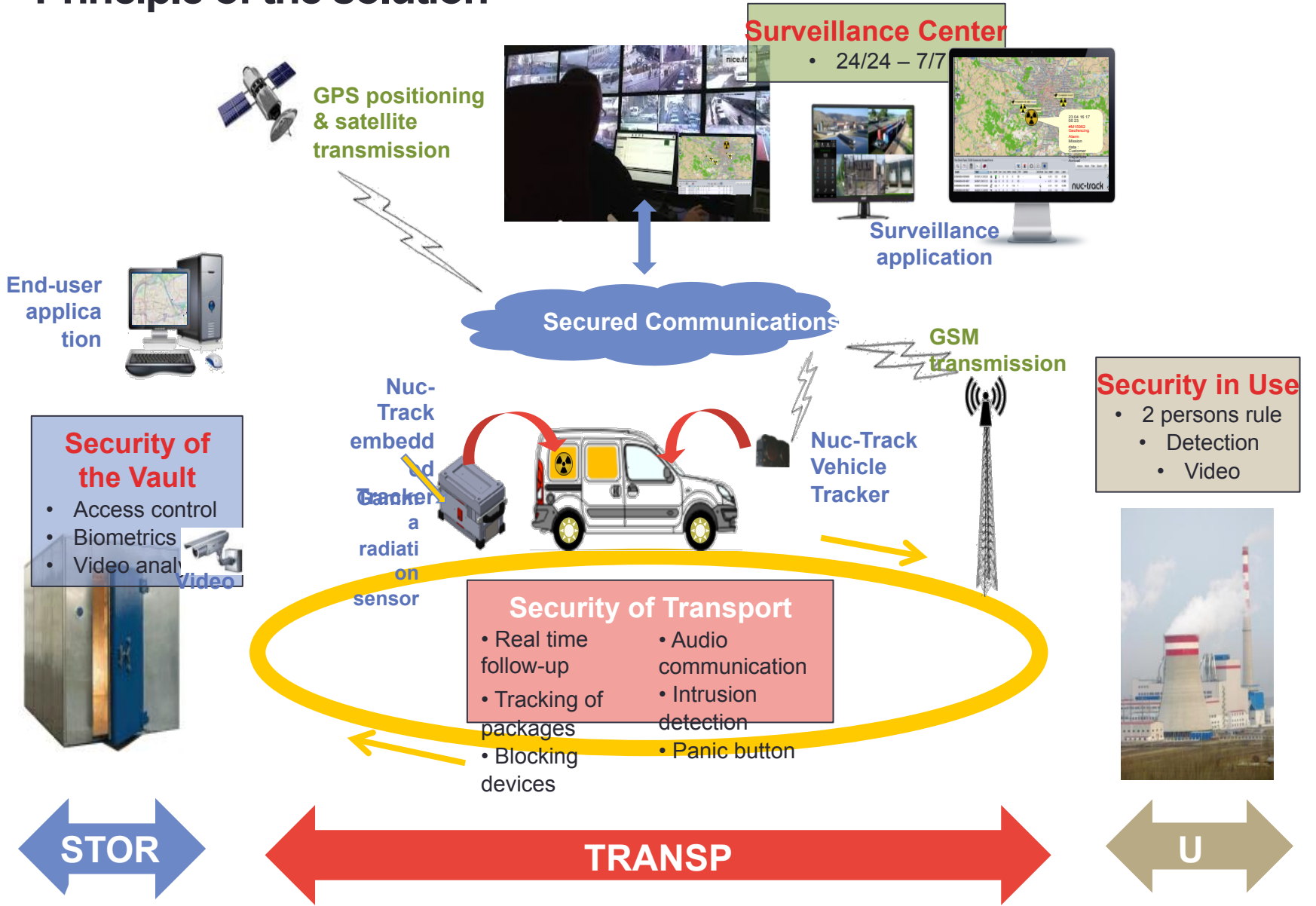
## Strategy : a Combination of Technologies & Procedures



# Nuc-Track Solution



# Principle of the solution



## The **nUC-track** components

A modular solution consisting of embedded components and software



### **Nuc-Track embedded Tracker**

Autonomous ruggedized **Black-box** fixed to the radioactive source packaging and embedded with several components (positioning GPS, GSM or satellite transmission, innovative sensor control and gamma radiation, and a Battery).



### **End-user application**

- Data base management for radioactive sources
- Mission planning

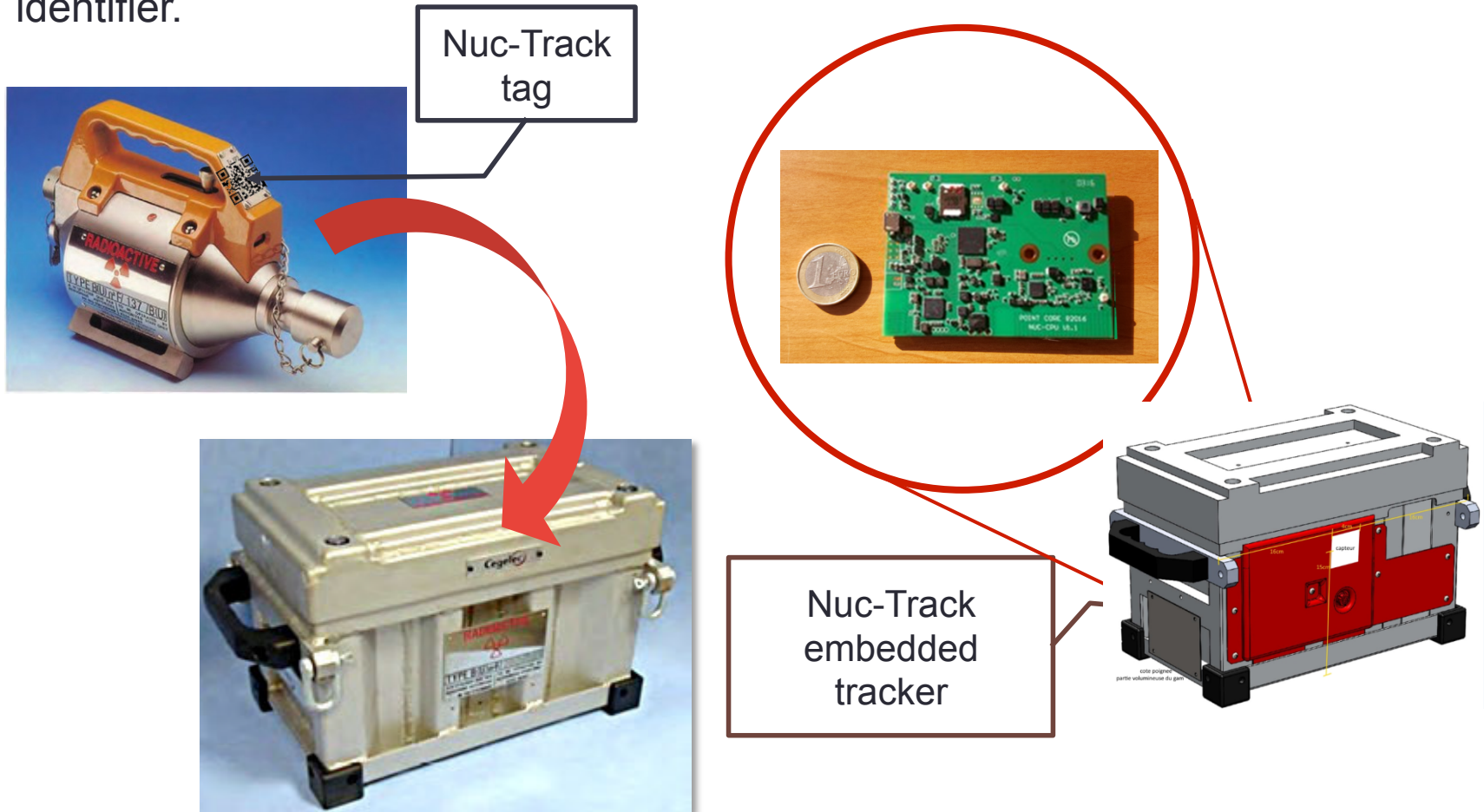


### **Surveillance Center application**

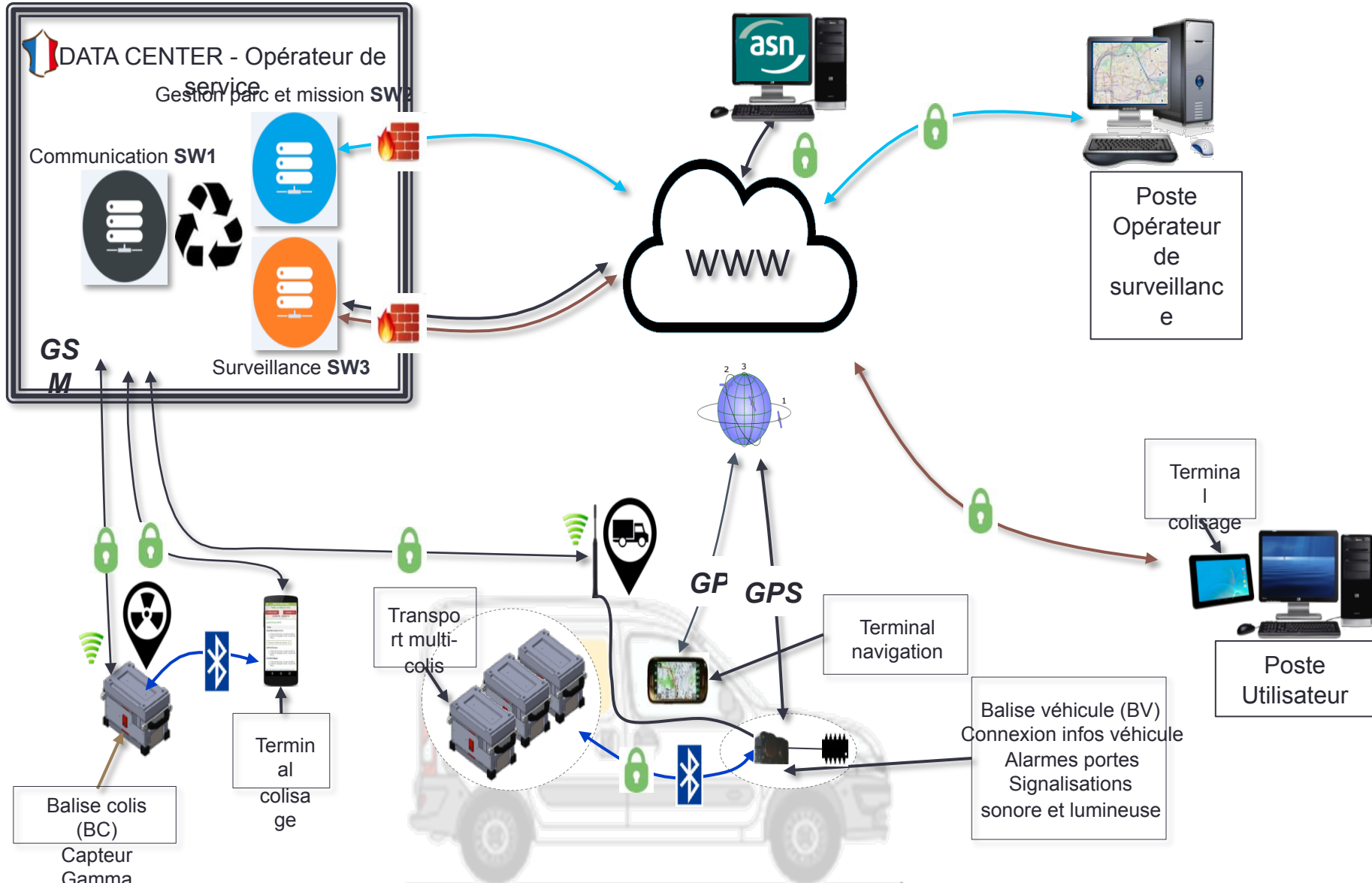
- A 24 hours a day monitoring service to follow-up the transport mission,
- A global supervisory system to manage alarms and the linked instructions,
- An intuitive man-machine interface based on a GIS solution,
- In addition, possibility to manage storage & use phases with physical security as video, access control or intrusion detection,
- Option of a SIEM for cyber security purposes

## Example of gammagraphy packaging used in France

The device which contains the source is identified by a unique serial number printed on a Q/R code label. This device is inserted in a transportation box. This packaging is equipped with the Nuc-track tracker embedding a unique identifier.



# General Architecture







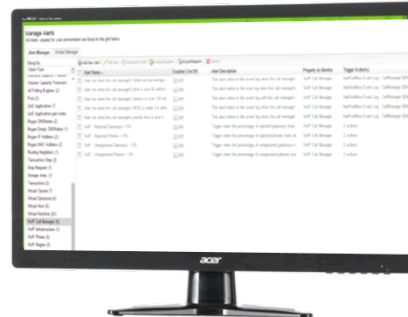
## End-user Interface

The end-user application software includes two main functionalities :

- **Data base management** of the radioactive sources
  - Inventory of sources
  - Real time status of equipment
  - Regulatory requirements
  - Reporting
- **Mission planning**
  - Mission configuration
  - Downloading mission data to terminal
  - Transmission to Surveillance center
  - Reporting



# Surveillance Center MMI



- **GIS & Alarm management system:**
  - Operator log & procedure management
  - Traceability
  - Reporting
- **Audio communication**
- **Video surveillance**
- **SIEM** (Security Information and Event Management)

# Deployment

- Nuc-Track solution could be deployed on a large scale :
- First step in France :
  - starting next year
- Second Step : In Europe and in many other countries
  - After the deployment in France

## Overall Summary

**The *Nuc-Track solution* is a security tool providing response to crucial security issues through a global approach:**

- *Continuous security during all operational phases,*
- *Monitoring of the source's packaging,*
- *Insider threat mitigation insured,*
- *Cyber security embedded,*
- *Scalable solution to accommodate small or large fleets of sources,*
- *Easy traceability and reporting of all source movements,*
- *Complies with code of conduct and guidelines to improve radioactive sources security.*

# NUC-track

# Other technologies improving the security of radioactive sources



**NuVISION**  
A PORTABLE SPECTROMETRIC  
GAMMA IMAGING SYSTEM



- **NuVISION solution** disruptive innovation providing :

A real time imaging together with:

- Location of the source
- Gamma dose rate
- Identification of the source



*NuVision Gamma Imager. Non-contractual photographs*

NuVISION is a compact portable spectrometric gamma camera based on CZT semiconducting detectors and coded aperture AND Compton imaging capabilities. The aim is to provide end-users with a complete portable and sensitive system allowing them to not only detect but also measure a dose rate in H\*(10), localize the source and identify the radioisotope, thanks to excellent spectrometric ability on a wide energy range (20-1400keV). (from Am-241 to Co-60). Additionally, the processing speed allows to perform real-time imaging and to observe mobile sources.

### BENEFITS

- User-friendly, portable device
- No cable needed, fully independent and autonomous
- Real-time imaging
- Specially designed to work in nuclear plants and nuclear cycle facilities
- Combines sharp image quality and 360° field of view
- H\*(10) dose rate estimation
- Capable of identifying radiation energies

### KEY FIGURES

1.5% Energy Resolution at 662keV

3 kg Light weight handheld camera

50 nSv/h Sensitivity in less than 1min. for 137Cs

# NuVision

**Detected isotopes**

<b>AM-241</b>	
DR [ $\mu\text{Sv/h}$ ]:	4.7
Conf. [%]:	920.2
<b>BA-133</b>	
DR [ $\mu\text{Sv/h}$ ]:	2.6
Conf. [%]:	146.4

**Energy window**  
 0 1421  
 Default window  
 Count rate of en. window [imp./s] 3673.8

**Measurement details**

Acquisition time [s]:	231.3
Dead time [%]:	4.5
Total counts:	811694
Total count rate [imp./s]:	5159.0
Total dose rate [ $\mu\text{Sv/h}$ ]:	8.7
Spectrum residual [%]:	30.9

**Battery (97%)**



**A combination of this new tool  
together with specific procedures :**

Will bring quite a revolution for :

Improving Security of radioactive sources during :

- **Storage phase** (fix installed version))
- **In Use phase** (mobile version (3kg))

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