



SAFETY STATUS

**AN INNOVATIVE CONCEPT FOR
MAINTAINING THE SAFETY
INTEGRITY LEVEL OF
OPERATIONAL SAFETY SYSTEMS**

P. Ninin BE/ICS

KT-day 26 October 2018, CERN



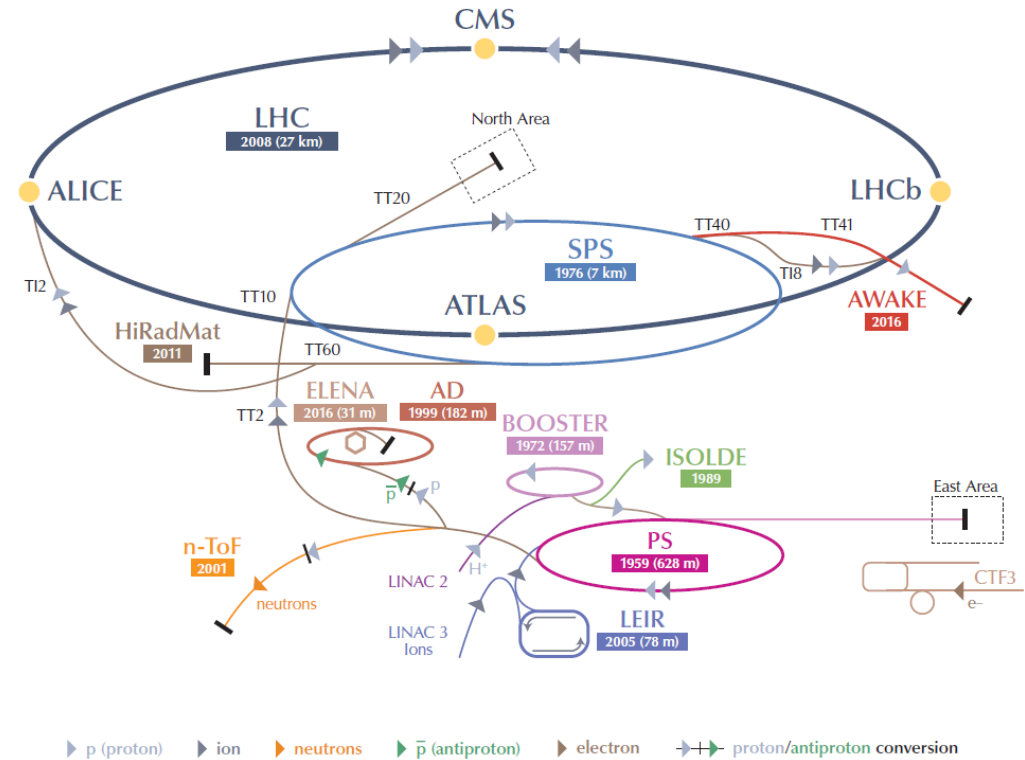
Safety Systems @ CERN

Main hazards covered :

- Radiological
- Magnetic
- Electrical
- Fire
- Oxygen Deficiency
- Gas

Huge costs:

- Infrastructures: XX Billions €
- Safety systems: XXX Millions €
- Maintenance: XX Millions €



LHC Large Hadron Collider SPS Super Proton Synchrotron PS Proton Synchrotron

AD Antiproton Decelerator CTF3 Clic Test Facility AWAKE Advanced WAKEfield Experiment ISOLDE Isotope Separator OnLine DEvice

LEIR Low Energy Ion Ring LINAC LInear ACcelerator n-ToF Neutrons Time Of Flight HiRadMat High-Radiation to Materials

SAFETY STATUS : why was it invented ?

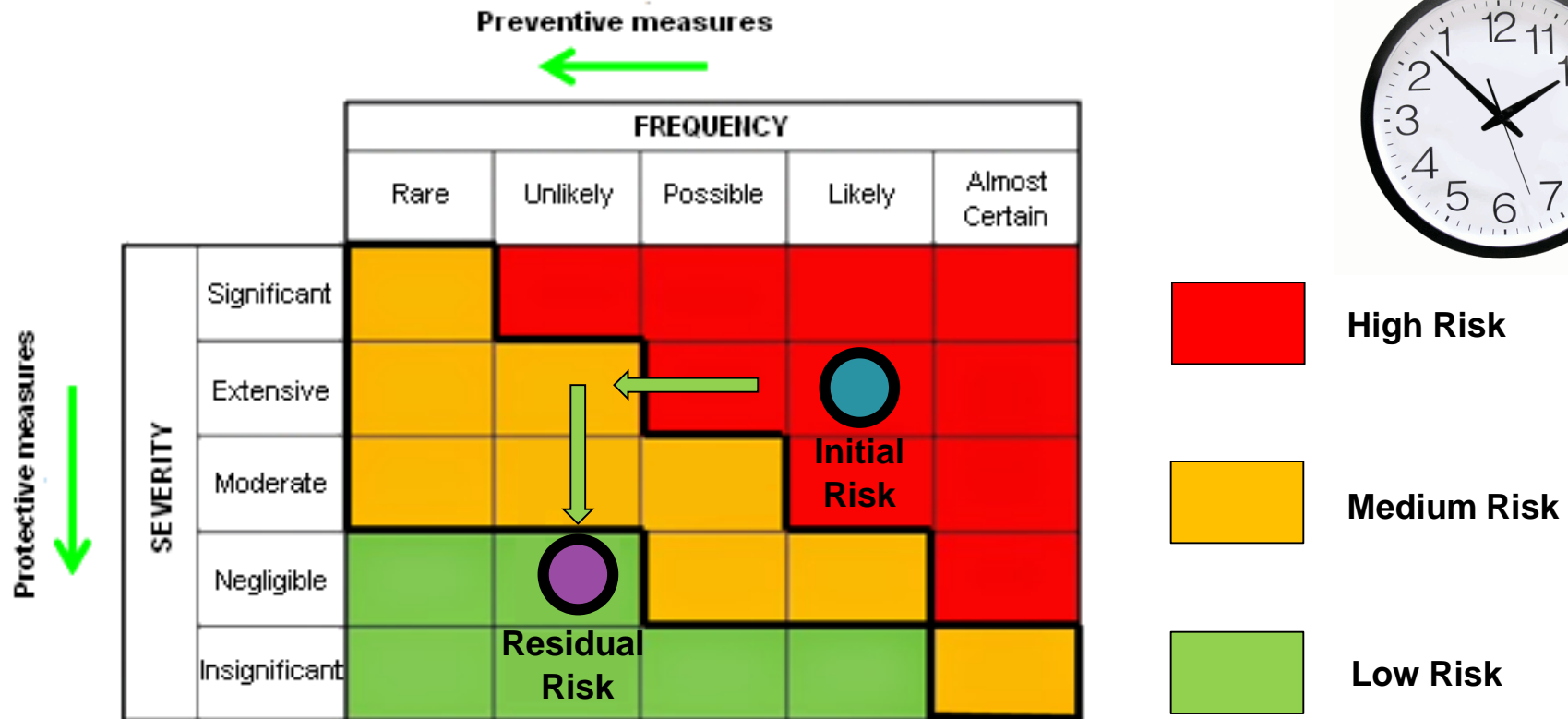
- To cope with the preservation of the performance of the Critical Systems that we are developing and the important investments done for safety.

- 15 years collaboration with



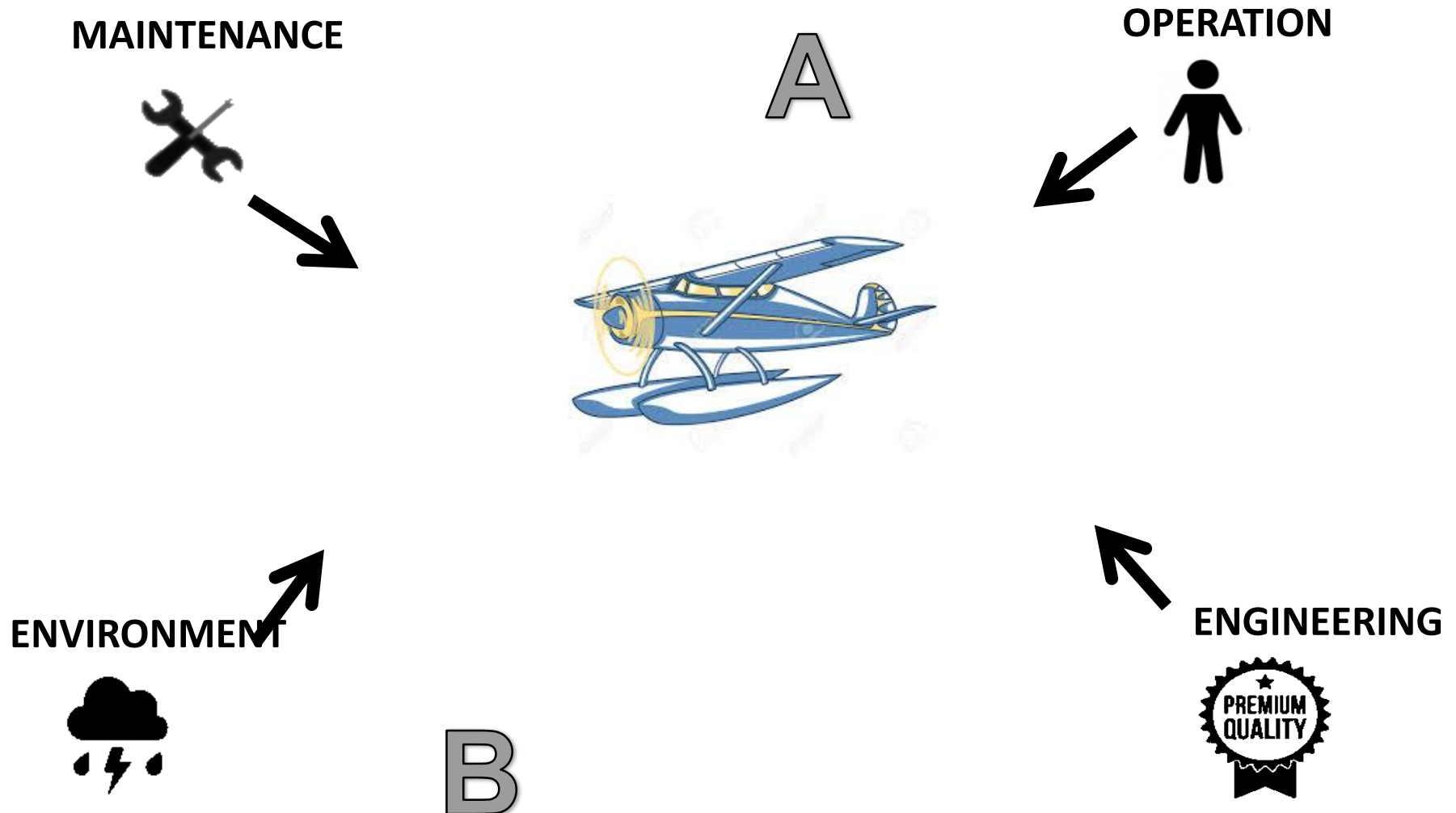
- Cyrille SALATKO, Functional Safety Head of Discipline @ assystem,
- RAMSES, Atlas SSA, Software Support for industrial controls contract,
- Industry has the same concern,
- **12 000** collaborators worldwide,
- Main sectors : **Nuclear**, Energy, Automotive, Aeronautics and Life Science. Automation, **Functional Safety**, **Security Systems**, **Cyber-security**, etc.

Theory 2 : Risk Assessment

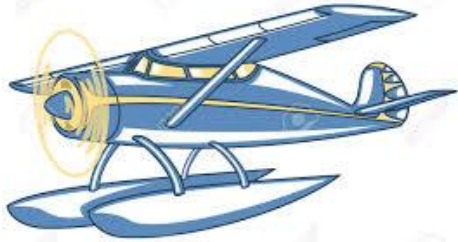


Question : Does the risk reduction of the Safety Instrumented Systems persist over time?

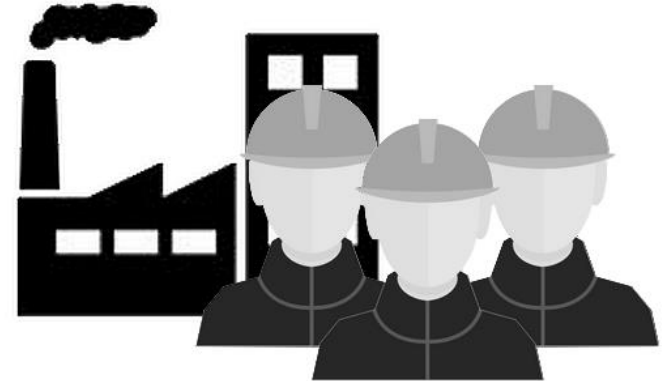
The FOUR factors influencing safety



Transposition into Safety Instrumented System



IEC Standards
61508, 61511, 61513



- Are the operators trained ?
- Are spare parts available ?
- Are the EIS by-passed?
- Is the documentation up-to-date ?
- Are the SIS components exposed to external cyber threats ?

**Many
criteria
(≈ 50 - 100)**

Safety Status Data model

OPERATION



MAINTENANCE



ENVIRONMENT



ENGINEERING



**4
Factors**

Operation HR

Maintenance HR

Cyber-security

Organizational

Operation
documentation

Maintenance
documentation

Physical security

Detailed design

Process alarms

Preventive maintenance

Utilities

Validation

By-pass
management

Corrective maintenance

External hazards

Baseline
documentation

Spare parts management

Configuration
management

Obsolescence

Technical alarms

**20
Categories**

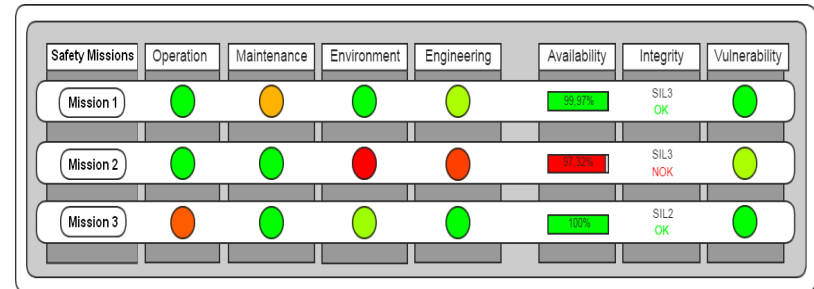
SAFETY STATUS : WHAT IS IT ?

Audit methodology

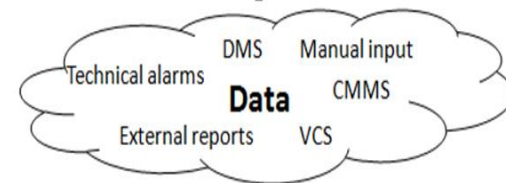


Data model and data flow

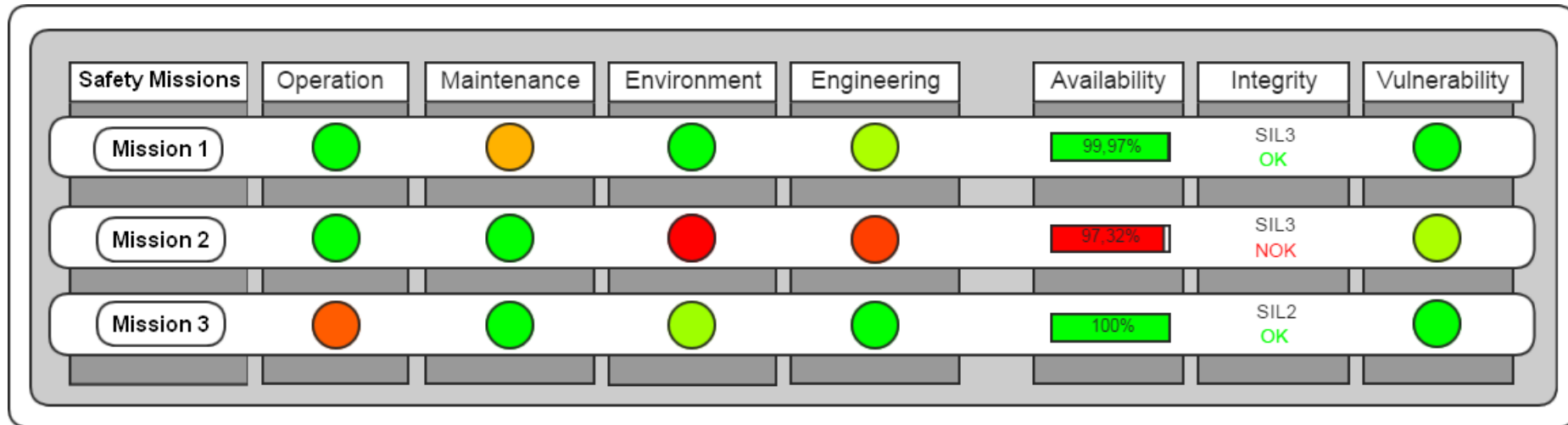
Dashboard



SAFETY STATUS
Database



Dashboard

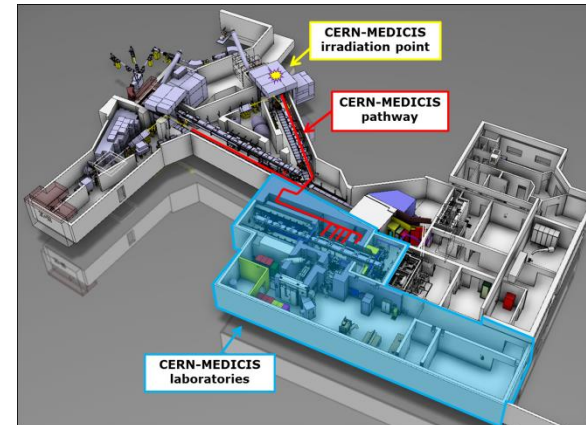


A synthesis of criteria evaluation is made and gives an indication of the “safety status” for each mission of the system

Application to CERN PPS Medicis project

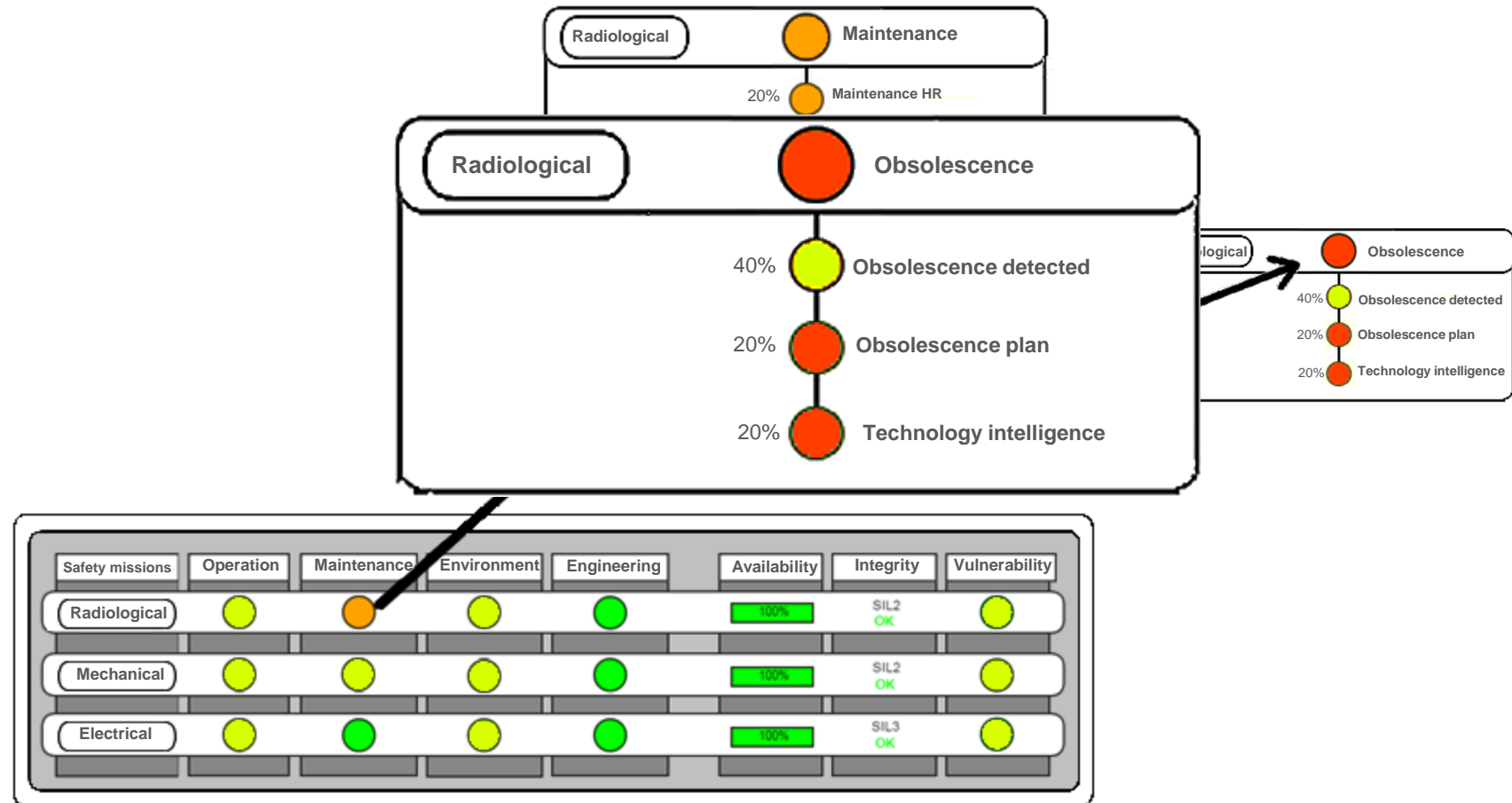


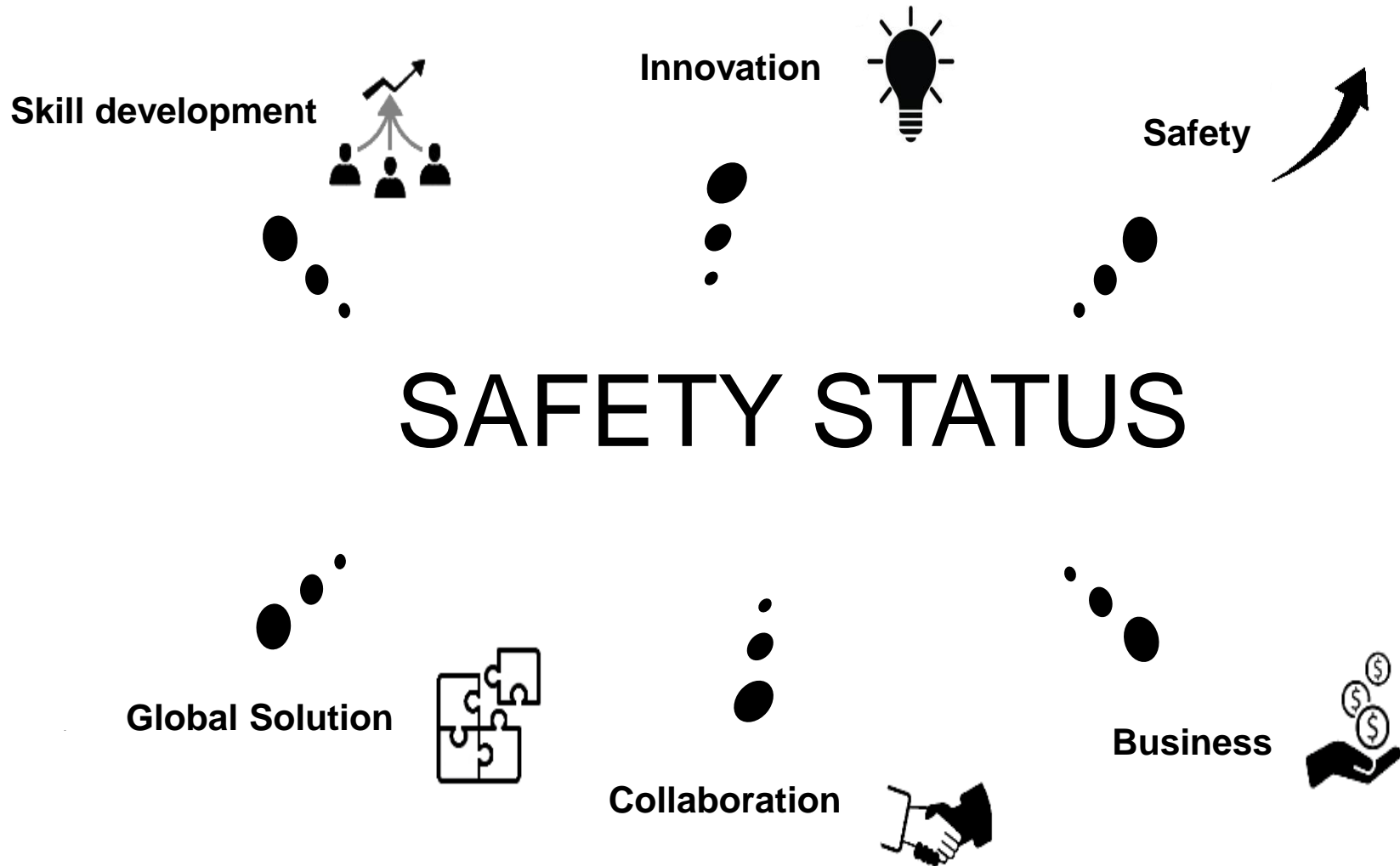
(MEDical Isotopes Collected from ISolde)



New facility constructed at CERN to produce radioactive isotopes by irradiating specific material samples by means of a particle beam. The isotopes will be used for medical research.

Safety Status overview



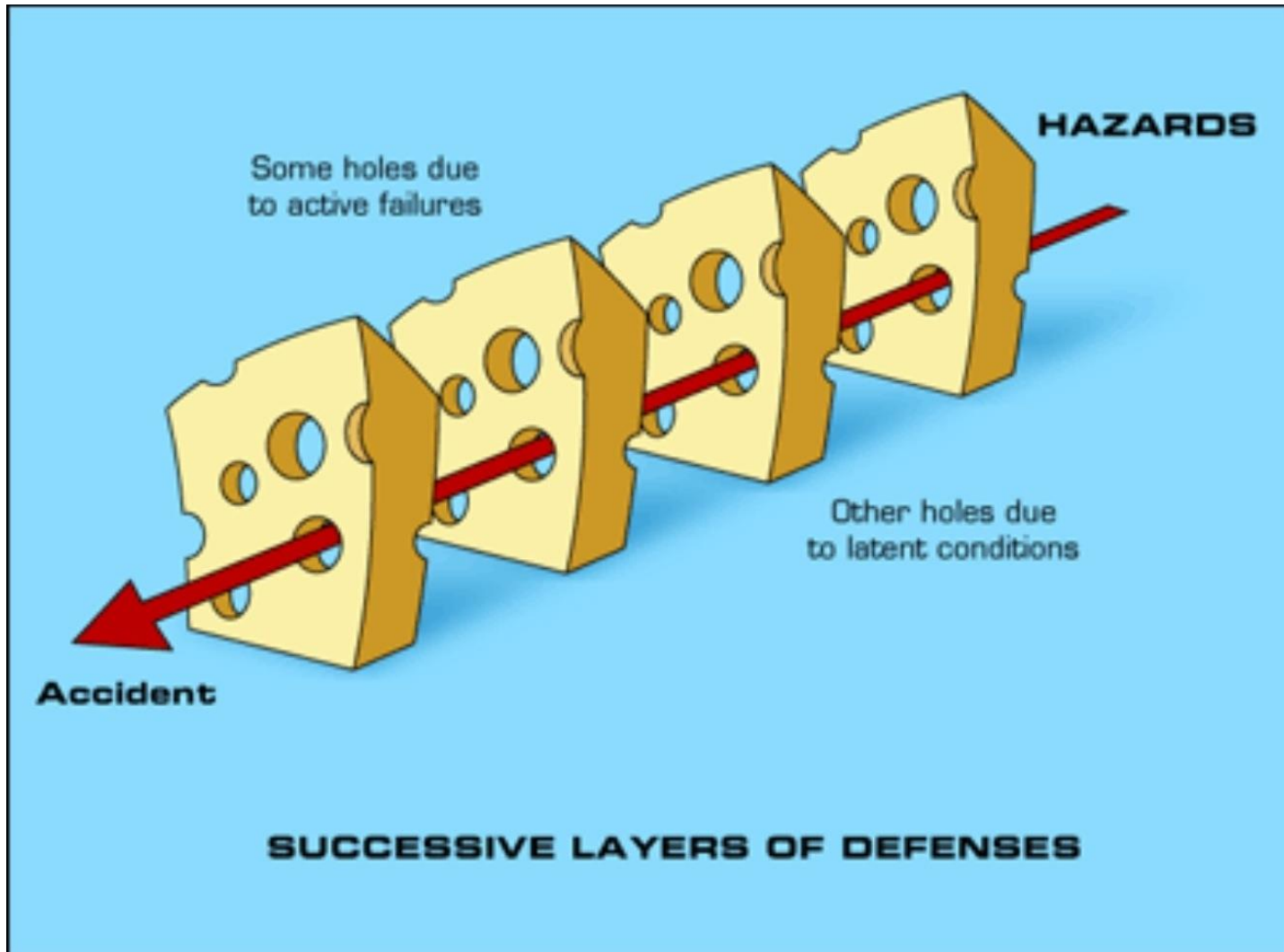


What's next ?

- Define collaboration agreement with **assystem**.
- Convert the prototype of the concept to a professional toolkit:
 - Finalize the “audit Handbook”, make it usable by any Safety Engineer.
 - V1 of the software :Dashboard, data model and interfaces
- Continue to proof it :
 - CERN : SPS Fire safety, SPS PPS, LHC PPS, PS PPS, etc
 - Assystem as a service to their numerous customers
- “Cherry on the cake” to conclude and transfer any safety project to Operation and Maintenance.

An aerial photograph of a dense forest during autumn. The trees are covered in a variety of colors, including shades of green, yellow, orange, and red, indicating the progression of the season. The canopy is thick and textured, with some darker green evergreens visible among the deciduous trees.

Thank you for your attention



Conclusion

- A response to the **monitoring of critical systems** efficiency overtime.
- An **audit methodology** to verify compliance with standards.
- An **innovative approach** dealing with functional safety but also with cyber and physical securities.