QUALITY-SAFETY MANAGEMENT AND PROTECTIVE SYSTEMS FOR SPES

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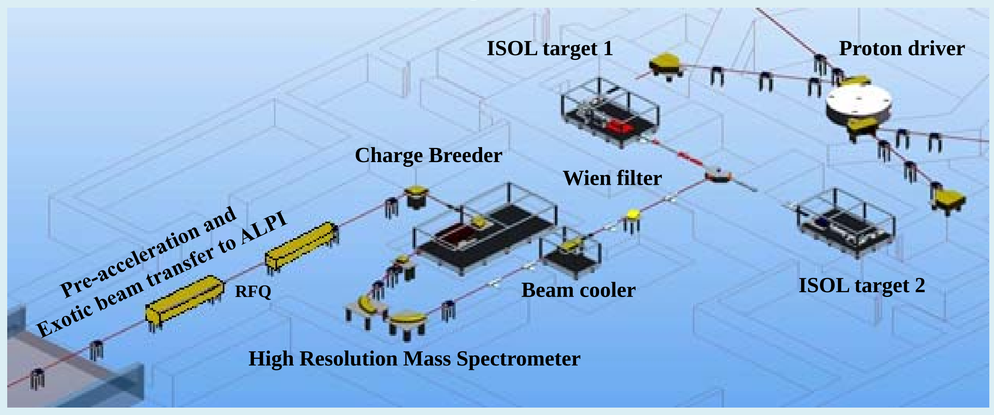
The realization of a nuclear facility for the production of radioactive ion beams requires a deep study of the safety aspect: an high degree of reliability must be achieved to prevent hazardous situations for operators, population, and the surrounding environment.
For the INFN SPES project, a *Quality and Safety Management System* (**QSMS**) is going to be realized. In this work we will present its general structure, functions and goals. We will then focus our attention on the Access Control and Dose Monitoring Systems which are the key features of the SPES *Protective System* in the framework of the QSMS.

The Project SPES

SPES (*Selective Production of Exotic Species*) is a **INFN** project for the realization of a Radioactive Ion Beam facility at Legnaro National Laboratory (LNL).
The radioactive beams production method is based on the **ISOL** technique (*Isotope Separation On Line*).



SPES Layout

Primary beam	***Proton***
Proton driver	***Two exit port Cyclotron***
	Energy 15-70 MeV
	Max Current 0,750 mA
Target	***UCx***
Fission rate	***10^{13} fission/s***

The QSMS of SPES

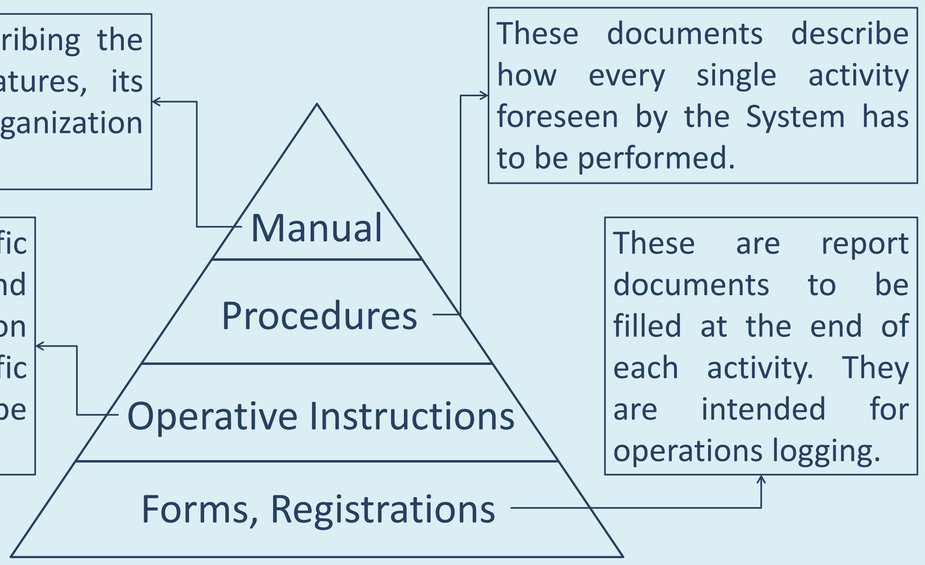
Reference International Standard
ISO 9001:2008 for QUALITY
OHSAS 18001:2007 for SAFETY

The **QSMS** is a managing tool for handling all the following phases of the SPES lifecycle:

- **Design**;
- **Realization**;
- **Operation**;
- **Maintenance**;
- **Disposal**.

Every stage will be analyzed to identify the activities that should be controlled to guarantee safety and quality for the SPES facility.

Documents of the QSMS are hierarchically organized according to a pyramidal scheme.



A specific procedure will be written as regards the **Risk Analysis**: a detailed identification of the hazards and a consequent evaluation of all the risks is needed to optimize both plant design and safety systems.

The management of the data flow foreseen by the SPES QSMS will be realized through a custom **software** composed of 2 parts:

1. a Relational Database Management System (RDBMS) for data collection;
2. an interface that allows users interaction with the data stored in the database. To allow easy distribution of the software and multi-platform support, a web-based application has to be preferred.

To realize this project a dedicated website will be realized on proper LNL servers using the standard Apache/PHP/MySQL open source platforms.

The SPES Protective System

The SPES **Protective System** will have the function to detect potentially dangerous conditions for people and the environment, when such a state is detected it will have to execute a sequence of actions that will restore a safe state.

The Radiological Protective System (**SSR**) has to avoid/reduce the risks of:

- irradiation and contamination of people both when SPES is running and when it is off (activated materials may still be present in the plant site);
- any case of uncontrolled sprinkling of radioactive material outside the SPES complex.

SSR will be made up by three elements:

- an Access Control System (**SCA**) for gates, doors, rounds, for emergency buttons and for the enable control signal to the primary proton driver;
- a People Monitoring System (**SMP**), to enable/disable people access to different areas;
- a Radiation Monitoring System (**SMR**), to control radiation monitors and related data.

SPES **SSR** (Radiological Safety System)

SCA (Access Control System)	**SMP** (People Monitoring System)	**SMR** (Radiation Monitoring System)
• doors and gates • rounds in the controlled areas • emergency buttons • enable signal to extract the primary proton beam	• badge management and check (DB) • lights, sounds • surveillance cameras	• radiation monitor management • radiation data acquisition and storage • primary beam monitoring • air quality monitoring

The whole SCA system will be redundant at least at level 2: two parallel systems will acquire the same signals and produce the final enable/disable output for the primary beam accelerator.
In particular, a first system will be based on safety-oriented PLC architecture, while a second one, minimal but highly reliable, will be made of embedded (“custom”) not-programmable logic cards (for example with FPGA based logic modules).