

Remote Qualification of Monitoring Systems in the LHC tunnel

Why remote qualification

Future high radiation area

All **access** to the monitoring systems shall be **limited** to a strict minimum. The **protection** of **personnel** from **radiation** and **helium spill** is a safety priority.

Quality Assurance

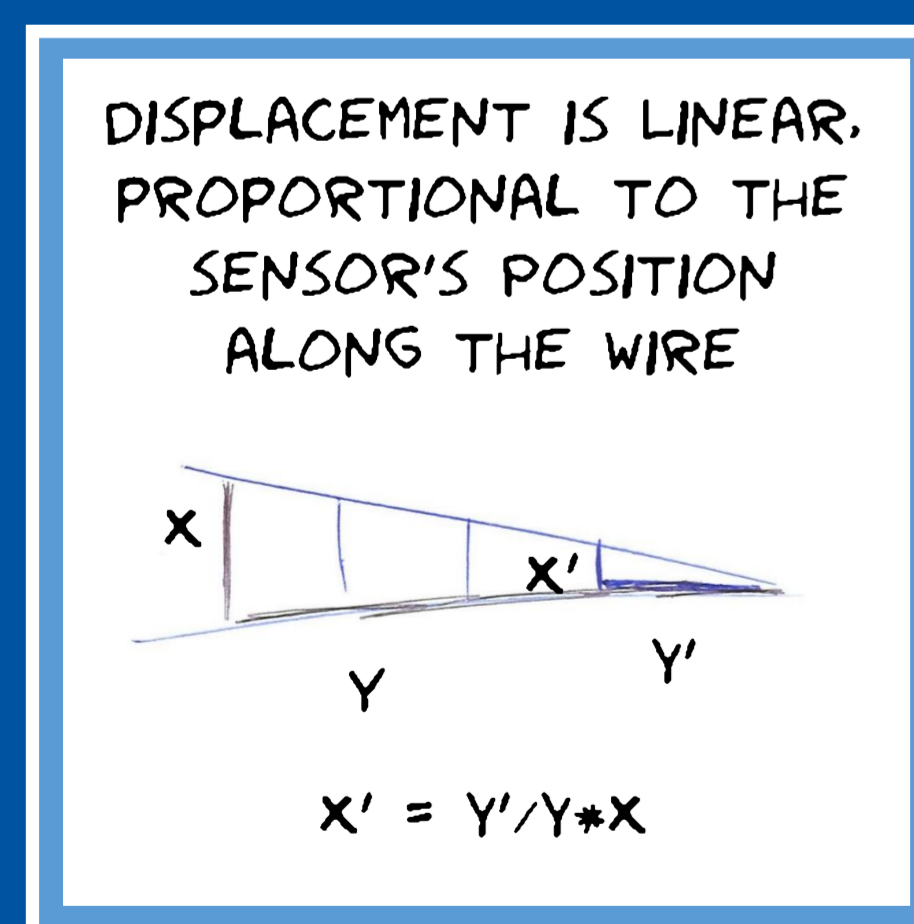
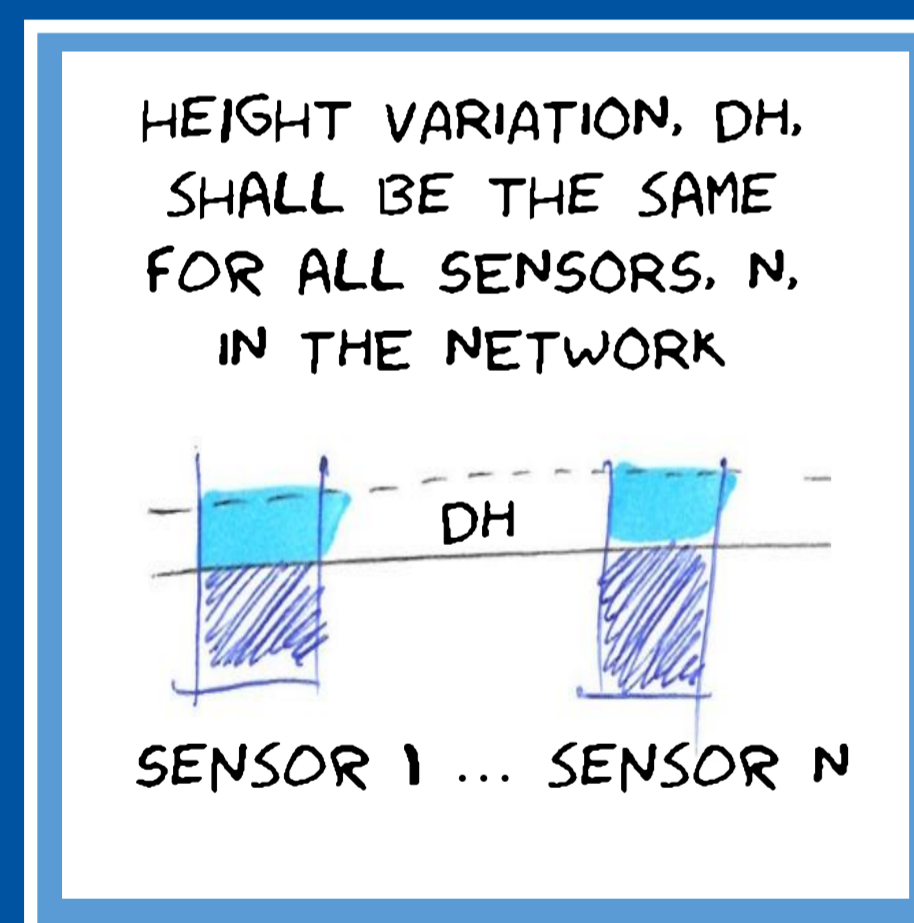
During short machine stop periods, the systems can be **validated remotely**. **Data consistency** and **system reliability** will be improved with this concept.



Systems

Hydrostatic Levelling System

... is an **equipotential surface** used for **vertical** and **tilt monitoring** between the low beta magnets on each side of the experiments and with respect to the experiments.



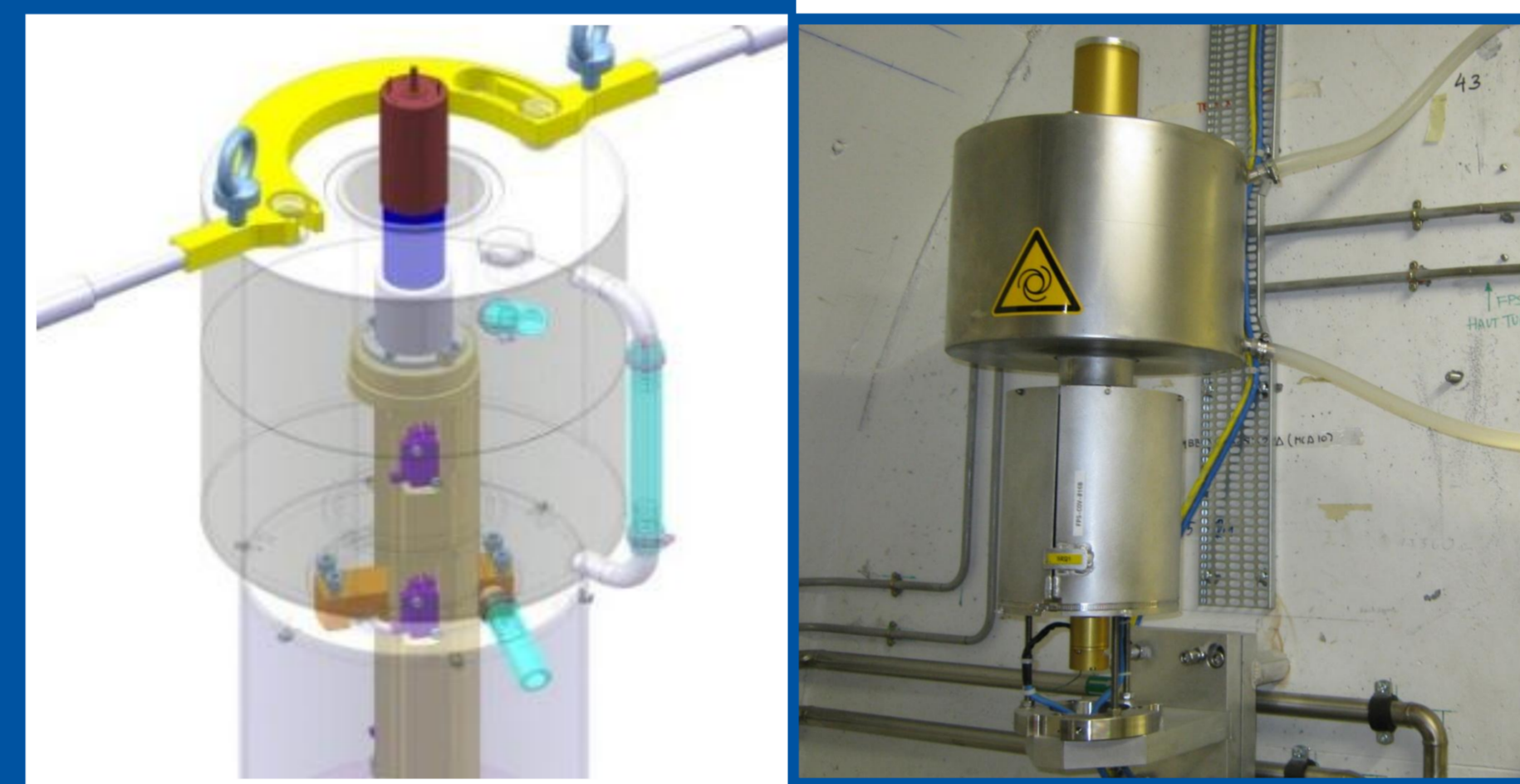
Wire Positioning System

... is used for **radial** and **vertical monitoring** along the low beta magnets. A **stretched wire** defines the **straightness reference** and is detected by the sensors.

Solutions

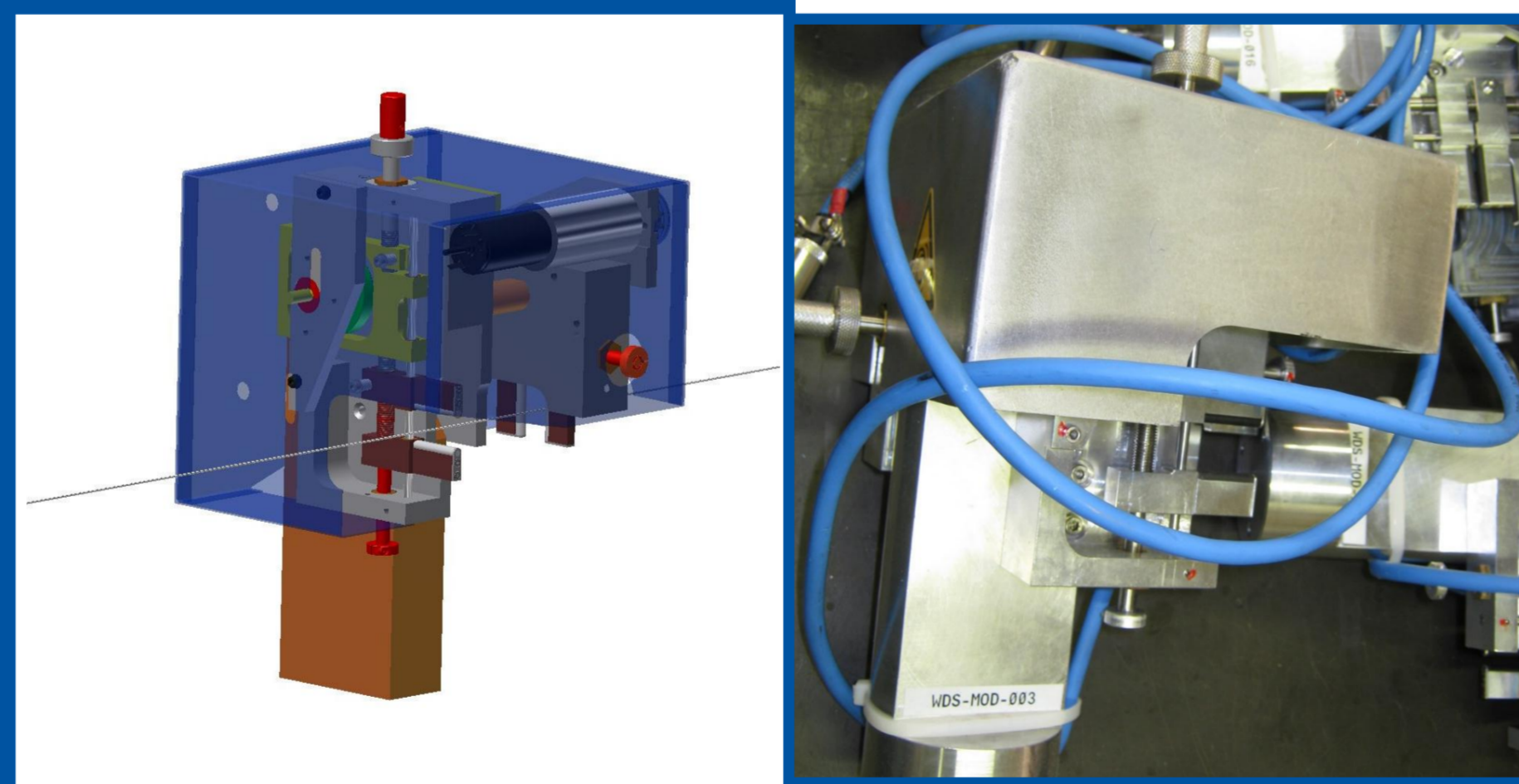
Filling / Purging Station

The station allows the **automatic variation** of the water **surface**. The **network continuity** and the **linearity** of each **sensor** can be tested.



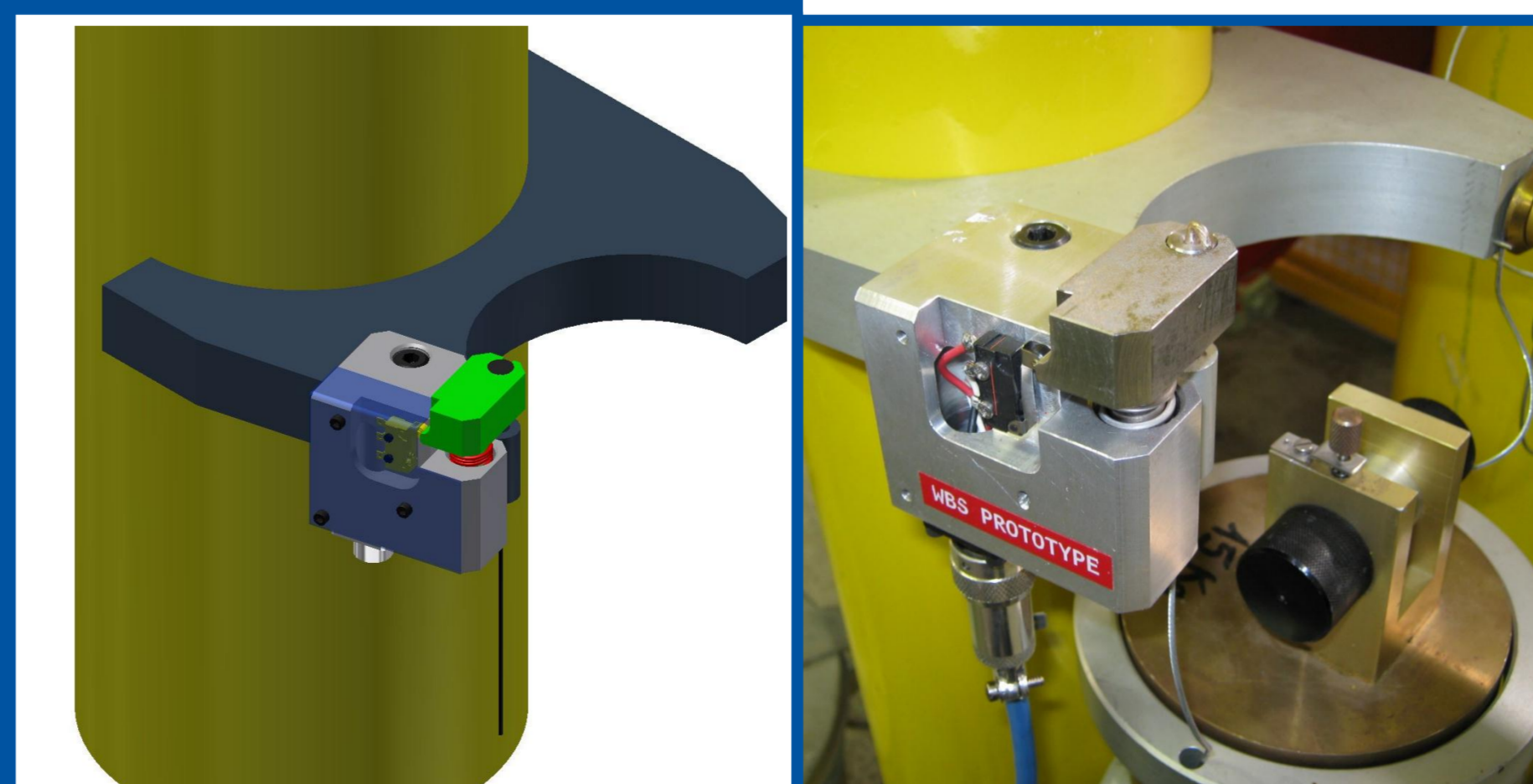
Wire Displacer System

The wire displacer **replaces** the **manual operation** of displacing the wire at the extremities in order to see if the **sensors along the wire** see the **same pro rata displacement**.

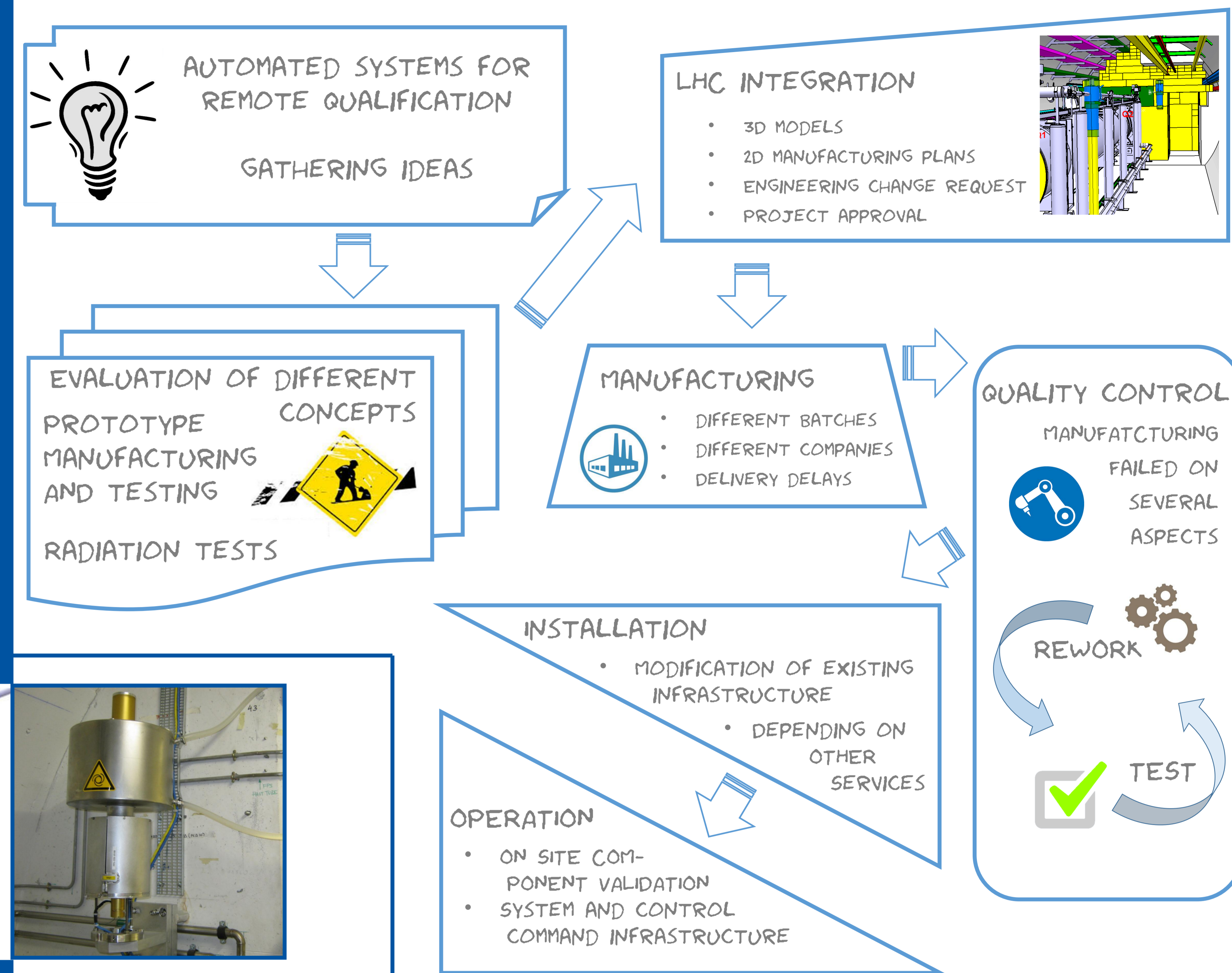


Wire Break Sensor

The sensor is based on a mechanical interface and **switch** that is **triggered** in case the weight used to stretch **the wire falls into the protective cage**.



From the idea to the installation in the LHC



Conclusion

Systems Operational

At the **end** of the LHC Long **Shutdown 1**, the **systems** are **operational** and will provide the **possibility** of **remote validation** and **diagnostics** of the installed monitoring systems.

Future monitoring systems

These **developments** are the first step for the High Luminosity **Upgrade** of the LHC in 2023.

Testing under « Final conditions »

In order to avoid any operation problem, all **tests** must be carried out under **conditions** that exactly **copy** the **future installation** situation.

The **manufacturer** shall be the **same** for **prototype** and **series** in order to minimize errors and manufacturing **quality** dispersion.

