



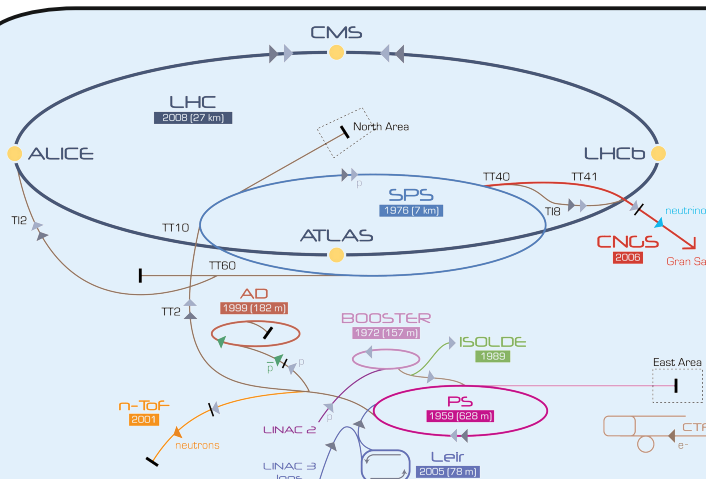
QUALITY MANAGEMENT OF CERN VACUUM CONTROLS

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ABSTRACT

The vacuum controls Section (TE-VSC-ICM) is in charge of the monitoring, maintenance and consolidation of the control systems of all accelerators and detectors in CERN. This represents 6 000 instruments distributed along 128 km of vacuum chambers, often of heterogeneous architectures and of diverse technical generations. In order to improve the efficiency of the services provided by ICM, to vacuum experts and to accelerator operators, a Quality Management Plan is being put into place. The first step was the standardization of the naming convention across different accelerators. The traceability of problems, requests, repairs, and other actions, has also been put into place (VTL). This was combined with the effort to identify each individual device by a coded label, and register it in a central database (MTF). Occurring in parallel, was the gathering of old documents and the centralization of information concerning architectures, procedures, equipment and settings (EDMS). To describe the topology of controls components, the data structure is being defined, for later implementation (Layout-DB). Once complete, the quality and efficiency of ICM services can only improve, and appropriate performance indicators will be in place to display them.



NAMING

The vacuum controls architecture and equipment have a rich history spanning several decades: several versions of the same equipment, from different generations, coexist in the same machine; the very same equipment may have different names across accelerators, although being absolutely interchangeable.

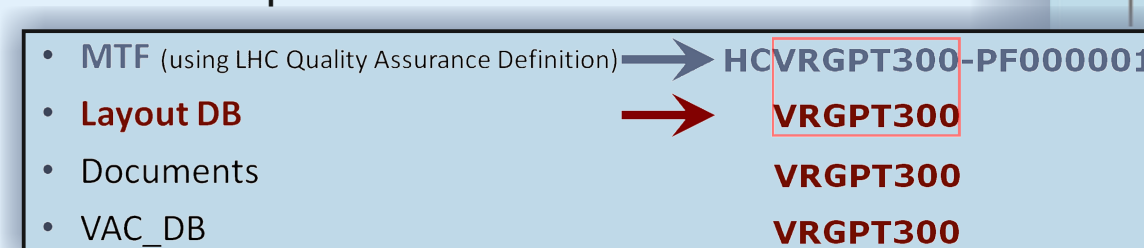
The creation of a common codification for control equipment across different accelerators has been the second step in the ICM QM-Plan:

2010: list all types of equipment used in vacuum controls started to be identified

2012: create an inventory with 275 codes (equipment type names), defining the rules for coding the types of vacuum controls equipment, independently of the machine.

Controller	CPS	SPS	LHC	VAC_DB	NEW
TPG300	VGC	VRGC	VRGP	VRCG	VRGPT300
Volotek	VGCD	-	VRGA	VGHC	VRGPK

The deployment of the new names, while preserving the correspondence with the old names, is in progress on the machines and in VAC-DB.



VRGC	Gauge controller - Crate
VRGP	Gauge controller - Pressure gauge controller
VRGPA001	Gauge controller - Pressure gauge controller - AGP101 controller - Pfeiffer-Balzers - For membrane piezo gauge
VRGPB001	Gauge controller - Pressure gauge controller - IKG 011 controller with Analog display - Pfeiffer-Balzers
VRGPC001	Gauge controller - Pressure gauge controller - VIONIC controller
VRGPD001	Gauge controller - Pressure gauge controller - IM 51/IM510 G controller - Leybold
VRGPE001	Gauge controller - Pressure gauge controller - Gauges controller [Local] (VRJGE) - Box for VGR/PM controls + VRGP local patch-panel to ND100 cable
VRGPF001	Gauge controller - Pressure gauge controller - IMG 070 controller - Pfeiffer-Balzers
VRGPG001	Gauge controller - Pressure gauge controller - PKG 044 controller with Analog display - Pfeiffer-Balzers
VRGPH001	Gauge controller - Pressure gauge controller - PKG 100 controller with digital display - Pfeiffer-Balzers
VRGPK001	Gauge controller - Pressure gauge controller - VOLETEK controller - VGC1000
VRGPS001	Gauge controller - Pressure gauge controller - VGI Power Supply - Ref. LEP 680 4209 (Obsolete)
VRGSP002	Gauge controller - Pressure gauge controller - VGI Power Supply - SH Electronic, Output 2x10V/5A, Burndy 12 M on cable, Burndy 8 F on box
VRGSP003	Gauge controller - Pressure gauge controller - VGI Power Supply - Type VIONIC, black box, Burndy 12 M and Burndy 8 F on face
VRGSP004	Gauge controller - Pressure gauge controller - VGI Power Supply - Type VOLETEK, stainless steel box, Burndy 12 M and Burndy 8 F on face
VRGPT	Gauge controller - Pressure gauge controller - Vacuum - Pressure gauge controller - TPG - Pfeiffer-Balzers
VRGPT251	Gauge controller - Pressure gauge controller - TPGs controller - Pfeiffer-Balzers - Serie 251 - TPG251
VRGPT252	Gauge controller - Pressure gauge controller - TPGs controller - Pfeiffer-Balzers - Serie 252 - TPG252
VRGPT256	Gauge controller - Pressure gauge controller - TPGs controller - Pfeiffer-Balzers - Serie 256 - TPG256
VRGPT261	Gauge controller - Pressure gauge controller - TPGs controller - Pfeiffer-Balzers - Serie 261 - TPG261
VRGPT262	Gauge controller - Pressure gauge controller - TPGs controller - Pfeiffer-Balzers - Serie 262 - TPG262
VRGPT300	Gauge controller - Pressure gauge controller - TPGs controller - Pfeiffer-Balzers - Serie 300 - TPG300 (hosts VRMT cards)
VRV	Interlock crate

ICM QUALITY MANAGEMENT

Tracking of Actions

Target:
-Requests
-Reports

Examples:
-Cabling
-Installation
-Repairs

Assets Management

Target:
-ID (serial #)
-Behavior
-Lifetime

Examples:
-Manufacturing steps
-Measurements
-Radioprotection
-Changed location

Docs Management

Target:
Technical knowledge

Examples:
-Procedures
-Activity Reports
-Various information

Topology

Target:
-Location
-Function
-Configuration

Examples:
-Position
-Settings
✓Interlock Levels
✓Cables
✓Profibus Addresses

LINKED

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Action: Worksheets generated

LINKED

Vacuum-controls Tracking Log (VTL) is in production since Jan-2013.

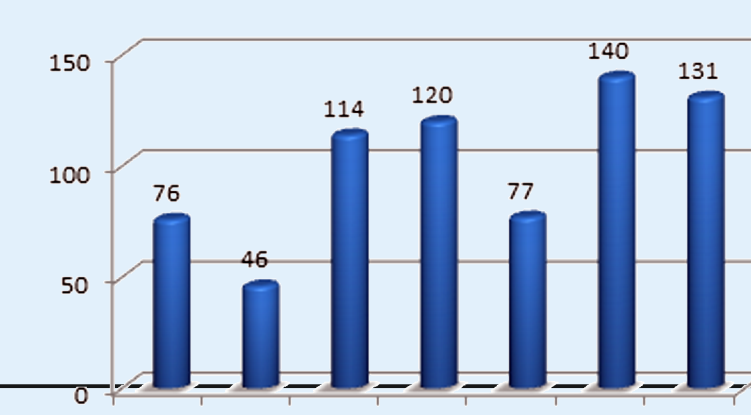
Managed by tickets, all requests and reports are organized by categories:

Equipment Layout, Software, Hardware, Other;

And by machines:

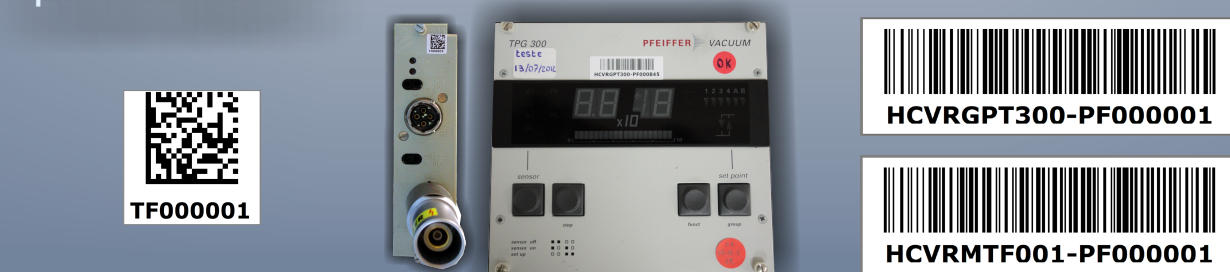
LHC, SPS, CPS, AD, CLEX, ISL, LIN4, Labs, Other.

Creation of a new issue in VTL: no need to know who the contact persons are: the link-person and his substitutes are automatically selected according to the subject and are notified.



End of Aug-2013: some 700 issues had been created.

MTF (Manufacturing and Test Folder)
Each individual ICM device can now be referenced by a unique "part-identifier".
Each individual device must carry a label with the coded "part-identifier".

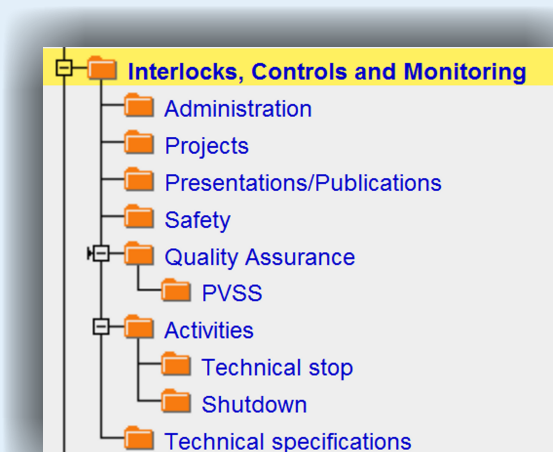


Dec-2012: 10 000 labels had been applied to equipment (LHC, labs and storages areas)

Aug-2013: increased to nearly 13 000; more than 50% of the total labels (23 000) to be applied to all ICM equipment.

EDMS (Engineering & Equipment Data Management Service) is a Product Lifecycle Management platform, based on two commercial applications: Agile PLM, (by Oracle) and Infor EAM (by Infor).

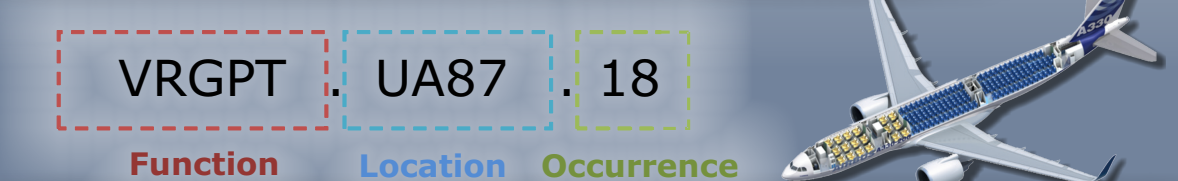
Since 2011, large effort has been done to gather old documents and centralize all information on hardware & software architectures, and on procedures for equipment tuning or repair.



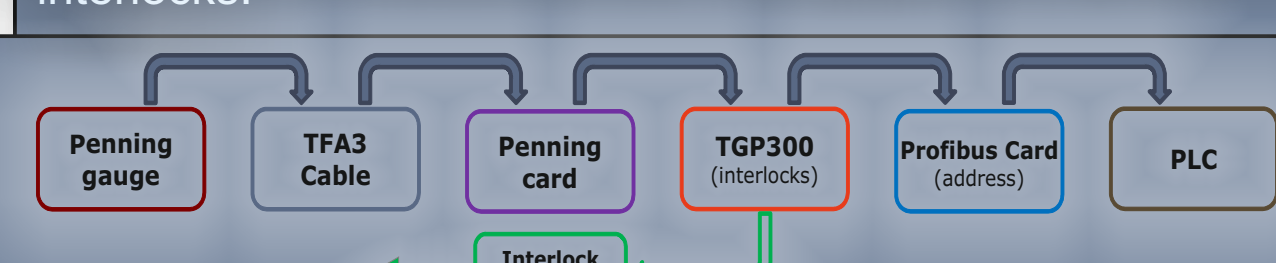
To standardize the repository folder, the EDMS context TE-DEP-VSC-ICM was created.
By Aug-2013, more than 210 documents have been created (76% use the ICM context).

The Layout-DB is an Oracle database which models the topographical structure of all CERN accelerators. Each accelerator component is assigned a "Functional Position".

The Functional Position symbolizes a place reserved for a given function, within a system (magnetics, powering, cryogenics, vacuum, etc.) of the accelerator; it is defined by a function, a location and an occurrence number



The relationships, connections and hierarchies between those Functional Positions may be described to any level of detail, providing all of the information needed to follow the topology of the entire chain of acquisition, control and interlocks.



TIMELINE

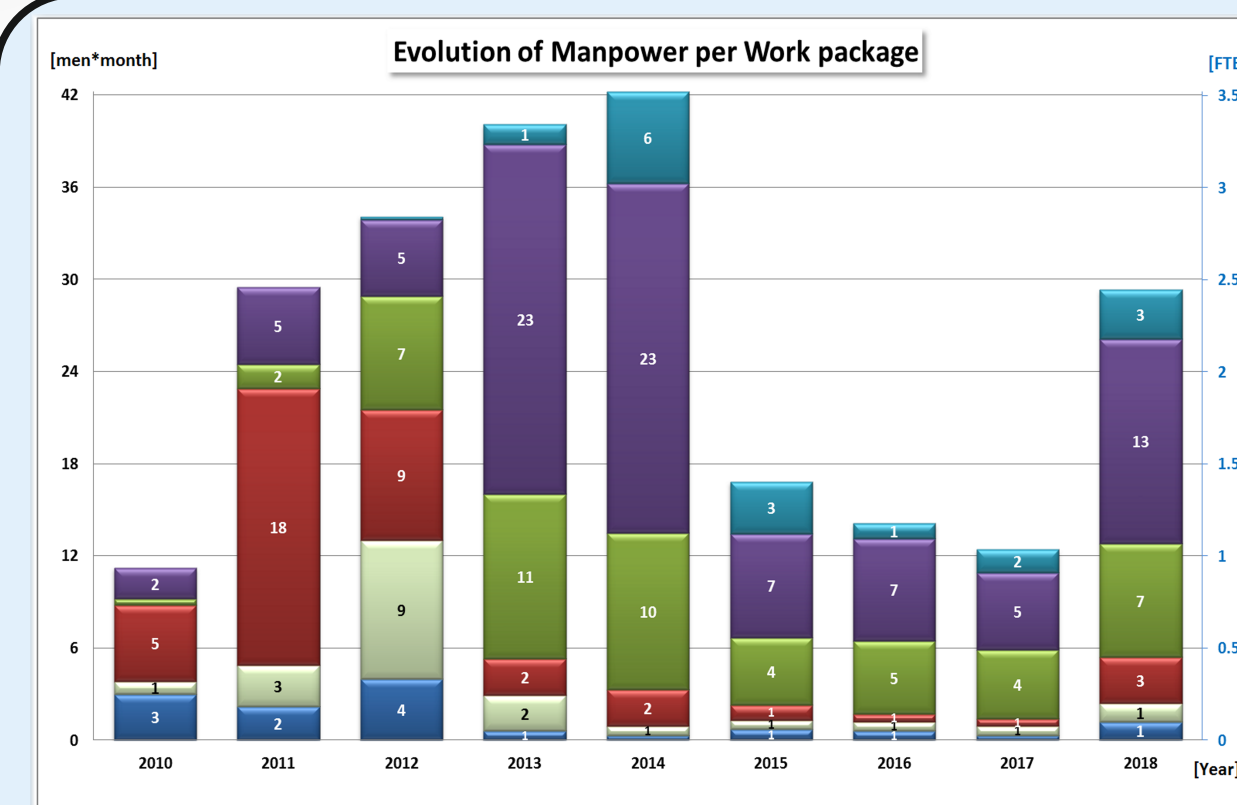
2010 - 11
QM-Plan: definition of the requirements;
Information: collection and centralization;
VAC-DB and SCADA: ergonomics & productivity improvements;

2012 - 14
Implementation: naming convention; tracking and information treatment: development and commissioning; collect and update detailed information; extensive labeling of assets; modifications and consolidations; manpower increased

2018

LS2 (second LHC Long Shutdown): various QM actions; deploy and commission VAC-UNICS framework on LHC and its injectors; manpower increased.

2015 - 17
ICM QM in production; upload data to DB; migrate VAC-DB to Layout-DB; first version of the VAC-UNICS framework



RESOURCES

The total estimation for the entire project is 230 men-month, corresponding to 2.7 FTE per year, in average over 8 years, with up to 3.5 FTE during the preparation and LS1 years.

CONCLUSION

This document describes the main aspects of the Quality Management Plan, being put into place within the vacuum controls Section (TE-VSC-ICM). Several methods & tools have been defined, and are progressively being implemented & used.

The ICM QM-Plan relies on standard applications, widely used and supported at CERN, and it is perfectly in line with the recommendations of the CERN Maintenance Management Project.

