AMMW 2013

CERN Vacuum Controls

Quality Management

Fabien ANTONIOTTI
TE-VSC-ICM
2013-11-14
Outline

- Quality Management
- Strategy: Targets and Tools
- Standardization: Naming Convention
- Tracking Issues and Actions: VTL
- Asset Tracking: MTF
- Document Management: EDMS
- Topology: Layout Service & Controls Settings: Controls Configuration Service
- Processing an issue
- Timeline & Resources
- What else?
Quality Management

• Target:
  • to ensure that a work/product/service is consistent with expectation
  • to provide the means to achieve it

• How:
  • Homogenization: **Naming Convention**, methods & tools
  • **Centralization** of information: actions, documentation, devices settings
  • Preservation of knowledge
  • Maintaining systems **up-to-date**
Strategy: Targets and Tools

ICM QUALITY MANAGEMENT

Actions
- Tracking
  - Target:
    - Requests
    - Reports
  - Examples:
    - Cabling
    - Installation
    - Repairs

Assets
- Tracking
  - Target:
    - ID (serial #)
    - Behavior
    - Lifetime
  - Examples:
    - Manufacturing steps
    - Measurements
    - Radioprotection
    - Changed location

Documentation
- Management
  - Target:
    - Technical knowledge
  - Examples:
    - Procedures
    - Activity Reports
    - Various information

Topology
- &Ctrls Management
  - Target:
    - Location
    - Function
    - Configuration
  - Examples:
    - Position
    - Devices Settings
    - Interlock Levels
    - Cables
    - Profibus Addresses
    - Alarms
Strategy: Targets and Tools

ICM
QUALITY MANAGEMENT

Actions
Tracking

Assets
Tracking

Documentation
Management

Topology

Place available for a given type of object = Functional Position

Identity of Asset

Fabien ANTONIOTTI, CERN - TE-VSC-ICM
Standardization: Naming Convention

- Essential for VTL, MTF, EDMS, Layout DB
- Is the 1st step towards homogenization:
  - Each machine had a ≠ naming convention...
  - But objects are interchangeable between machines

<table>
<thead>
<tr>
<th>Controller</th>
<th>CPS</th>
<th>SPS</th>
<th>LHC</th>
<th>VAC_DB</th>
<th>NEW</th>
</tr>
</thead>
<tbody>
<tr>
<td>TPG300</td>
<td>VGC</td>
<td>VRGC</td>
<td>VRGP</td>
<td>VRCG</td>
<td>VRGPT300</td>
</tr>
<tr>
<td>Volotek</td>
<td>VGCD</td>
<td>-</td>
<td>VRGA</td>
<td>VGHC</td>
<td>VRGPK</td>
</tr>
</tbody>
</table>

- 275 new codes (names) created: mostly inspired from VAC LHC usage
- Now integrated in Accelerators Naming Portal (EDMS1149103)
- For coherent/uniform use in:
  - MTF (using LHC Quality Assurance Definition)
  - Layout DB
  - Documents
  - VAC_DB
### Standardization: Naming Convention

<table>
<thead>
<tr>
<th>VRGC</th>
<th>Gauge controller - Crate</th>
</tr>
</thead>
<tbody>
<tr>
<td>VRGCT001</td>
<td>Gauge controller - Crate - Multi_TPG300 frame with serial interface - 3x TPG space available with relay connectors, PS, Ref. EDA-01673 / AT-680-4263-000</td>
</tr>
<tr>
<td>VRGCT002</td>
<td>Gauge controller - Crate - Multi_TPG300 frame with serial interface - 2x TPG space available with BURNDY relay connectors, LHC</td>
</tr>
<tr>
<td>VRGCT003</td>
<td>Gauge controller - Crate - Multi_TPG300 frame with serial interface - 3x TPG space available with BURNDY relay connectors, REX Isolde</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>VRGP</th>
<th>Gauge controller - Pressure gauge controller</th>
</tr>
</thead>
<tbody>
<tr>
<td>VRGPA001</td>
<td>Gauge controller - Pressure gauge controller - AGP101 controller - Pfeiffer-Balzers - For membrane piezo gauge</td>
</tr>
<tr>
<td>VRGBP001</td>
<td>Gauge controller - Pressure gauge controller - IKG 011 controller with Analog display - Pfeiffer-Balzers</td>
</tr>
<tr>
<td>VRGPC001</td>
<td>Gauge controller - Pressure gauge controller - VIONIC controller</td>
</tr>
<tr>
<td>VRGPD001</td>
<td>Gauge controller - Pressure gauge controller - IM 51/IM510 G controller - Leybold</td>
</tr>
<tr>
<td>VRGPE001</td>
<td>Gauge controller - Pressure gauge controller - Gauges controller [Local] (VRJGE) - Box for VGR/P/M controls + VPGF local patch-panel to ND100 cable</td>
</tr>
<tr>
<td>VRGPF001</td>
<td>Gauge controller - Pressure gauge controller - IMG 070 controller - Pfeiffer-Balzers</td>
</tr>
<tr>
<td>VRGPG001</td>
<td>Gauge controller - Pressure gauge controller - PKG 044 controller with Analog display - Pfeiffer-Balzers</td>
</tr>
<tr>
<td>VRGPH001</td>
<td>Gauge controller - Pressure gauge controller - PKG 100 controller with digital display - Pfeiffer-Balzers</td>
</tr>
<tr>
<td>VRGPK001</td>
<td>Gauge controller - Pressure gauge controller - VOLOTEK controller - VGC1000</td>
</tr>
<tr>
<td>VRGPS001</td>
<td>Gauge controller - Pressure gauge controller - VGI Power Supply - Ref. LEP.680.4209</td>
</tr>
<tr>
<td>VRGPT</td>
<td>Gauge controller - Pressure gauge controller - Vacuum - Pressure gauge controller - TPG - Pfeiffer-Balzers</td>
</tr>
<tr>
<td>VRGPT251</td>
<td>Gauge controller - Pressure gauge controller - TPGs controller - Pfeiffer-Balzers - Serie 251 - TPG251</td>
</tr>
<tr>
<td>VRGPT252</td>
<td>Gauge controller - Pressure gauge controller - TPGs controller - Pfeiffer-Balzers - Serie 252 - TPG252</td>
</tr>
<tr>
<td>VRGPT256</td>
<td>Gauge controller - Pressure gauge controller - TPGs controller - Pfeiffer-Balzers - Serie 256 - TPG256</td>
</tr>
<tr>
<td>VRGPT261</td>
<td>Gauge controller - Pressure gauge controller - TPGs controller - Pfeiffer-Balzers - Serie 261 - TPG261</td>
</tr>
<tr>
<td>VRGPT262</td>
<td>Gauge controller - Pressure gauge controller - TPGs controller - Pfeiffer-Balzers - Serie 262 - TPG262</td>
</tr>
<tr>
<td>VRGPT300</td>
<td>Gauge controller - Pressure gauge controller - TPG300 (hosts VRMT cards)</td>
</tr>
</tbody>
</table>
In production since Jan-2013
Stores all requests, managed by tickets
To avoid spamming phone-calls/mails
Implemented using REDMINE application:
  • Based on programming language RUBY
  • is a Web interface to a MYSQL Database
  • Robust & customizable
  • Widely used by Universities
  • cost-free
This is not a document/file repository (use rather EDMS, MTF, etc.)
What about SharePoint and JIRA?
Using VTL

- **Automatic Notification** according to the subject to the contact persons (and their backups)
- Currently **1 000+ issues** created 600+ using Industrial support (**FSU**)

- **Analysis** of the FSU activities:
  - requests
  - weekly **planning**
  - validation of weekly **reports**
  - checks of **typical execution times**
  - **performance** evaluation
  - **verification of invoices**
    (FSU weekly reports imported in VTL by script)
Campaigns started Jan-2012:

• **Labeling with Part-ID:**
  - Using specific/technical labels from Brady™
    - 1D: **Code 128** (38.10 x 12.70 mm)
    - 2D: **Datamatrix** (9 x 9 mm)

Ongoing in LHC, Labs, Storage: **~13 000 labels** (> 50% of ICM total ~23 000)

• **Chain verification**: Measurements, Calibrations & Updates
  → All TPG300 in LHC: 1 500+ items tested & identified (2 700 labels)

• **MTF Implementation**:
  - Definition of proprieties & steps for each device type
  - Imported information/data for **~4 500 assets** (~30% of ICM total ~15 000)
Engineering Documentation Management System

http://edms.cern.ch

- Is a Product Lifecycle Management platform
- Based on a commercial product: Agile PLM (Oracle)
- Engineering / equipment data and documentation (drawings, CAD, procedures, NCR...) are:
  - Safeguarded & Organized
    - Access Rights & Visibility: collaborative, sharing & protecting work
  - Verified
    - Approval Processes & Versioning
  - Retrievable on the long-term
    - Knowledge transfer between generations
- Since 2011: large effort to collect/produce docs & store them in EDMS
- New context TE-DEP-VSC-ICM created
- By Oct-2013: more than 210 documents created
  - 76% use the ICM context
Already now for LHC, **Layout views** are directly used in **VAC DB** to produce the configuration files for PLCs & PVSS.

We are now working on the definition of:

- **Functional positions**: eg. "VRGPT.UA87.0108" or "VGPB.A4R8.R"
- ** Relationships/connections/hierarchies** between Functional Positions
- **Settings** of the controls devices, attached to the FP, e.g. alarms, middleware...
- **Level** of details in the control chain

In the future:

- **UNICOS** specifications will be produced directly from Layout DB and CC DB combined
- **Applications** to extract and format the information will be available
Using QM tools

ICM QUALITY MANAGEMENT

Repair request for a TPG300
Actions ex: measurements
Problem found TPG300 replaced
Comment “NCR#9999999 initiated”
Close the case

Identity, History HCVRGPT300-CR000001
Request RP check on HCVRGPT300-CR000001
HCVRGPT300-CR000001 replaced by HCVRGPT300-CR000002
Status “For repair” HCVRGPT300-CR000001
Repaired (Jobs) Status “Stored”

Documents? NCR, procedures?
Chain? Hierarchy, Settings?

NCR#9999999 created and linked
NCR#9999999 closed
MTF link updated

VAC DB synchronization
PLC files
PVSS files

Wearsheets generated
Standardizations:

- **SCADA Data-Servers**: in 2012, migration from Windows to Linux & physically moved into the CCR building
- **SCADA application**:
  - updated from version 3.6 to 3.8
  - integrated and operational in the CCC (CERN Control Centre)
  - new functionalities incorporated (e.g. MOON by EN-ICE)
- **Tracking**:
  - Software Versioning service (SVN) used since 2012
  - all improvements & changes listed and sent to the users
  - most important actions described in detail and recorded in EDMS

Collaborations & Exchanges with:

- other Groups at CERN and outside Institutes
- **EN-ICE** (SCADA support)
- **BE-CO** (Data-Servers support)
- **IT security team** (“TN Disco test” held on March 2013)

Next Steps:

- SCADA to be upgraded to **WinCC®-OA 3.11**
- SCADA archiving to be moved to an external and independent **Oracle server**
- preparation to a full convergence towards the **CERN UNICOS framework**, tailored for vacuum (partnership between VSC-ICM, GSI and Cosylab, launched by EN-ICE)
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 labelling of assets
• Modifications and consolidations
• Manpower peak

2015 – 17
• ICM QM in production
• Finalize structure
• Upload data to DBs (MTF & Layout & CCDB)
• Migrate VAC-DB to Layout-DB
• First version the VAC-UNICOS framework

2018
• LS2 (second LHC Long Shutdown): consolidation & upgrades
• Deploy and commission VAC-UNICOS framework on LHC and its injectors
• Manpower peak
Resources

The total: 230 men-month

Up to 3.5 FTE

Evolution of Manpower per Work package

Avg.: 2.7 FTE / year

Only technical aspects of the Project
The **human factor** is important:

- all the activities are concerned by Quality Management
- needs an **underlying attitude** and **philosophy of work**

**Essential activities perceived as time-consuming/tedious:**

- information retrieval & recording
- equipment labelling
- tracking of actions (detailed and accurate)

The **QM plan** may be **delayed** / compromised due to lack of:

- guidance
- motivation
- understanding
Conclusion

• Well advanced:
  ✓ Homogenization: Naming Convention, methods & tools
  ✓ Centralization of information: actions, documentation, devices settings
  ✓ Preservation of knowledge
  ✓ Simple but efficient to maintain system up-to-date

• Still to be done:
  • Labeling of assets (< 50 %)
  • Asset data importation into MTF (~70 %)
  • Definition of templates with keywords (NCRs, Jobs)
  • Definition of vacuum controllers in Layout DB
  • Renovation and definition in Controls Configuration DB

• Key points:
  • Common/standard applications already widely used/supported at CERN
  • Information availability, openness, transparency
  • According/Conforming to the CERN MMP recommendations

Everybody is involved in some way in aspects contributing to the improvement of QA
Thank you for your attention!

Contact: fabien.antonio@cern.ch

References:

- F. Antoniotti et al., “Developments on the SCADA of CERN Accelerators Vacuum”, EDMS#1317778, ICALEPCS13, S. Francisco, Oct-2013
- F. Antoniotti, “Quality Management Plan in Vacuum Controls section”, EDMS#1310709