AMMW 2013

CERN Vacuum Controls

Quality Management

Fabien ANTONIOTTI
TE-VSC-ICM
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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

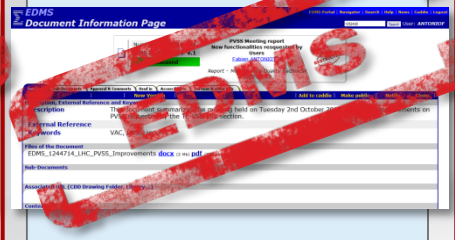
Tracking

- 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

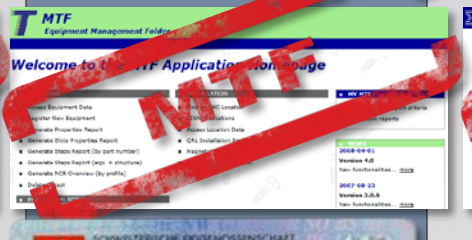
ICM QUALITY MANAGEMENT

Actions

Tracking

Assets

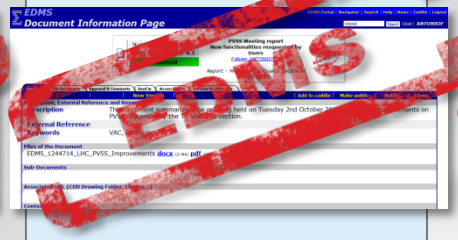
Tracking



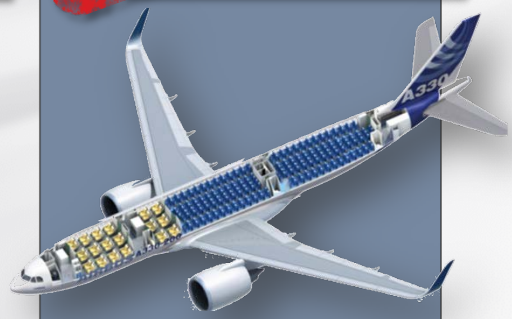
Identity of Asset

Documentation

Management



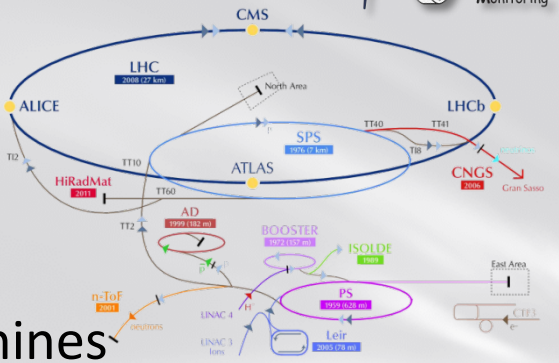
Topology



Place available for a given type of object = Functional Position

Standardization: Naming Convention

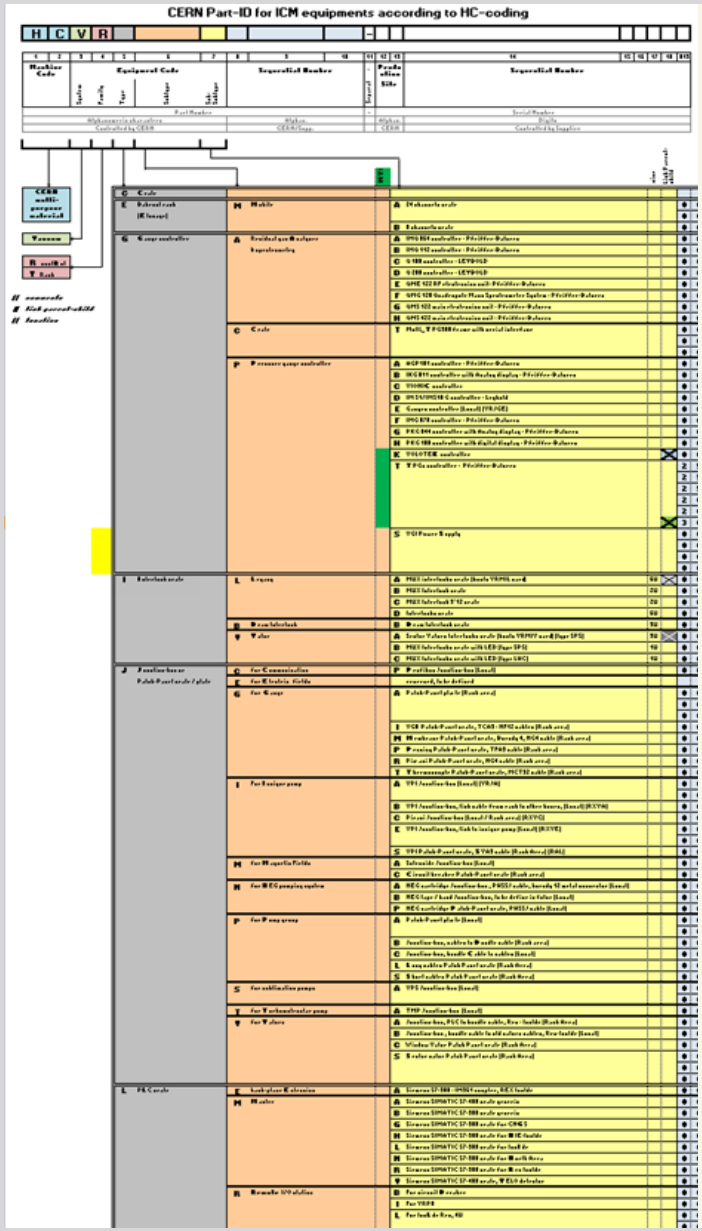
- Essential for **VTL, MTF, EDMS, Layout DB**
- Is the **1st step** towards homogenization:
  - Each machine had a ≠ naming convention…
  - But objects are **interchangeable** between machines



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

- **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) → **HCVRGPT300-PF000001**
  - **Layout DB** → **VRGPT300**
  - Documents → **VRGPT300**
  - VAC_DB → **VRGPT300**

Standardization: Naming Convention

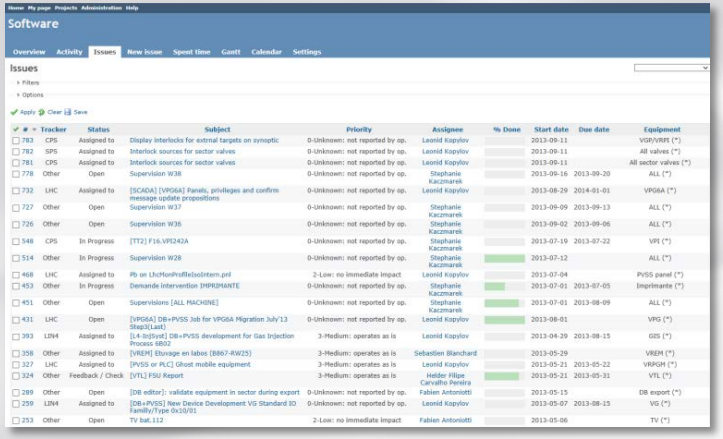


- VRGC Gauge controller - Crate
  - VRGCT001 Gauge controller - Crate - Multi_TPG300 frame with serial interface - 3x TPG space available with relay connectors, PS, Ref. EDA-01673 / AT-680-4263-000
  - VRGCT002 Gauge controller - Crate - Multi_TPG300 frame with serial interface - 2x TPG space available with BURNDY relay connectors, LHC
  - VRGCT003 Gauge controller - Crate - Multi_TPG300 frame with serial interface - 3x TPG space available with BURNDY relay connectors, REX Isolde
- 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/P/M controls + VPGF 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 - VOLOTEK controller - VGC1000
  - VRGPS001 Gauge controller - Pressure gauge controller - VGI Power Supply - Ref. LEP.680.4209
  - 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}

Tracking Issues and Actions: VTL

Vacuum-controls Tracking Log

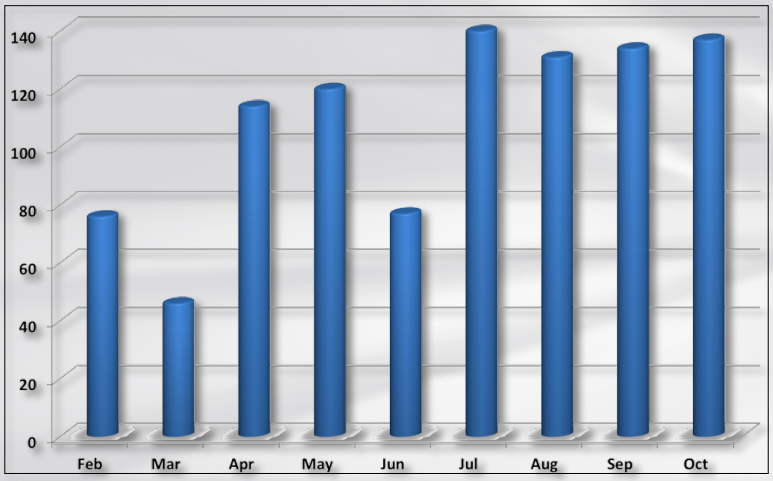
http://cern.ch/VTL



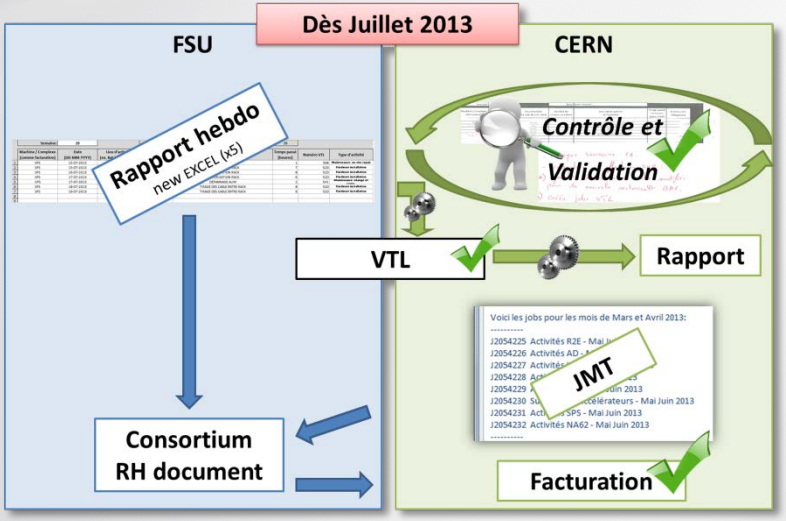
- **In production** since Jan-2013
- Stores all requests, managed by tickets
- To avoid **spamming** phone-calls/mails
- Implemented using **REDMINE** application:
  - Based on programming language **RUBY**
  - is a **Web interface** to a **MYSQL** Database
  - **Robust** & **customizable**
  - **Widely 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)



Asset Tracking: MTF

Manufacturing and Test Folder (Infor EAM)

http://mtf.cern.ch

Campaigns started Jan-2012:

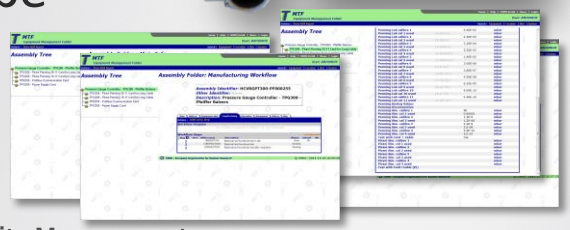
- **Labeling** with **Part-ID**:
  - Using specific/technical labels from Brady™
    - 1D: **Code 128** (38.10 x 12.70 mm)
    - 2D: **Datamatrix** (9 x 9 mm)

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)

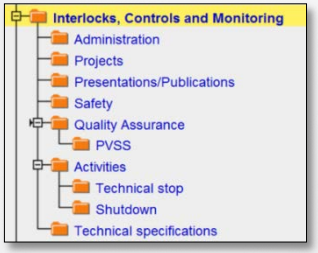


Document Management: EDMS

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

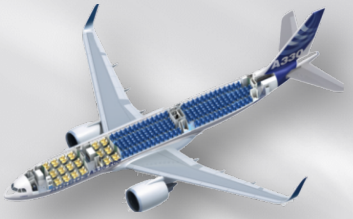


Topology: Layout Service

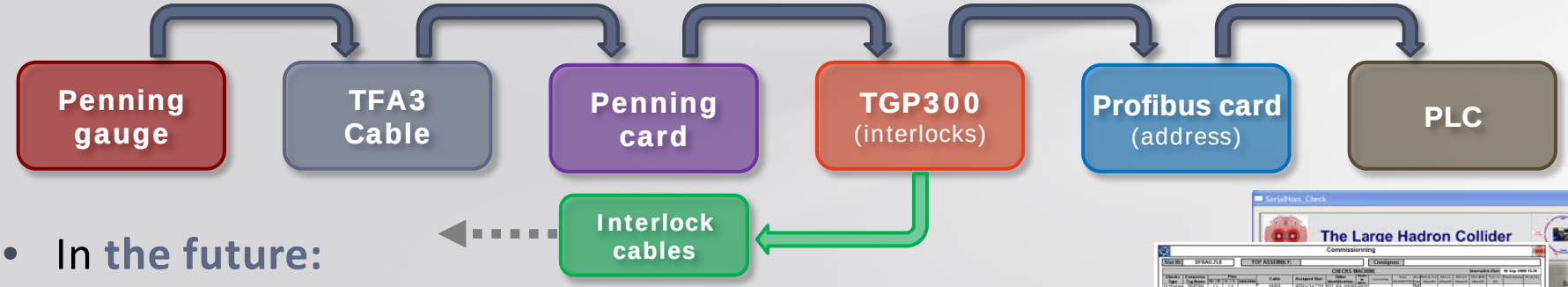
http://layout.web.cern.ch

Controls settings: Controls Configuration Service

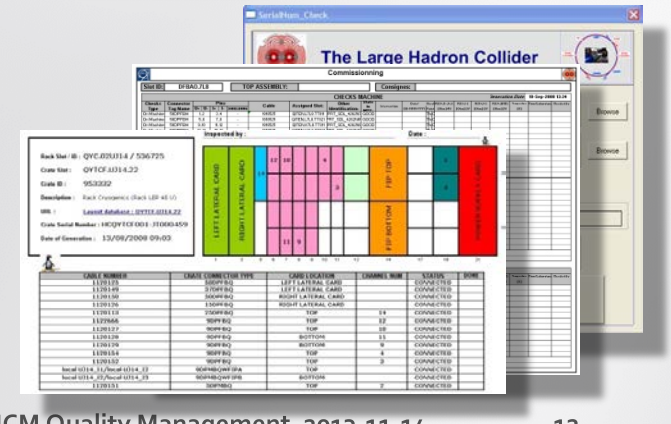
https://cern.ch/service-co-config



- 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

Manual Actions
Links

ICM
QUALITY MANAGEMENT

VTL | MTF | EDMS | LAYOUT DB & CCDB

LINKED

Repair request for a TPG300

Actions
ex: measurements

Problem found
TPG300 replaced

Comment
"NCR#9999999 initiated"

Close the case

LINKED

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"

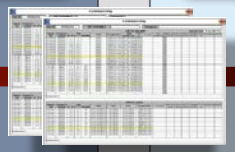
Documents?
NCR, procedures?

NCR#9999999
created and linked

NCR#9999999
closed

LINKED

Chain?
Hierarchy, Settings?



Worksheets generated

MTF link updated

VAC DB synchronization

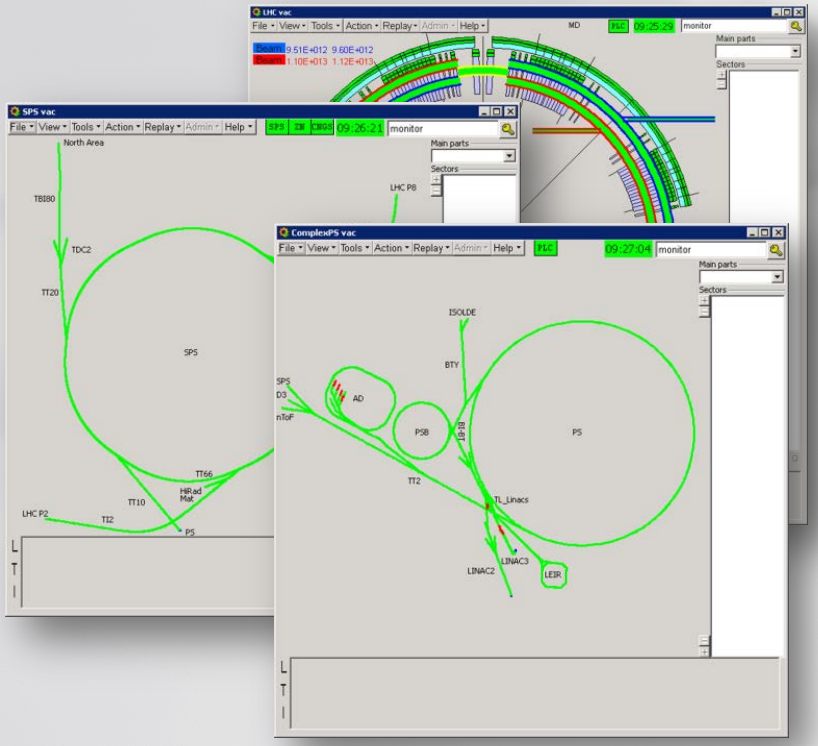
PLC files

PVSS files

Standardization: SCADA

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)

Timeline

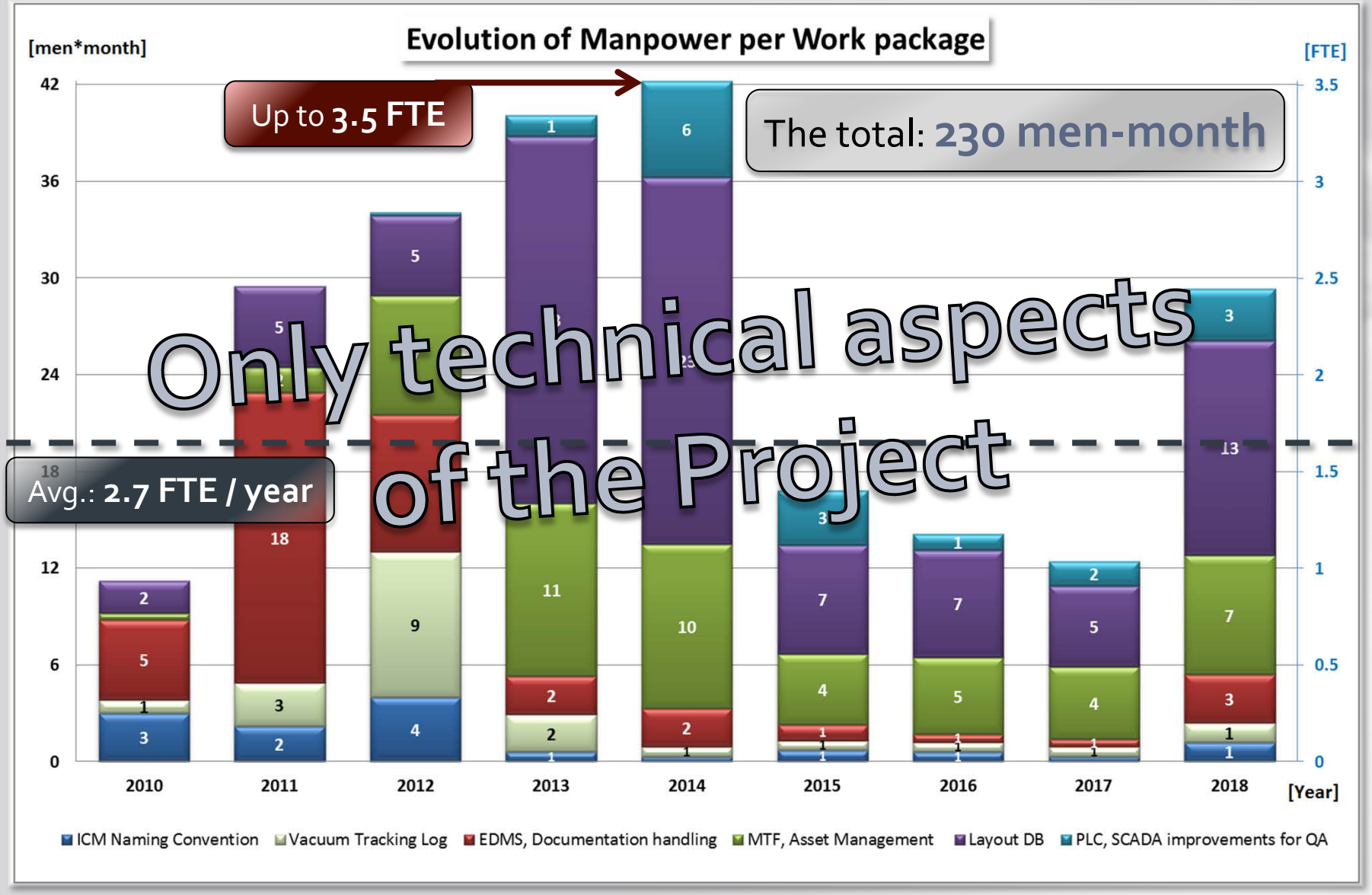
2010 – 11
- QM-Plan: definition of the requirements
- Information: collection and centralization
- VAC-DB and SCADA: ergonomics & productivity improvements

2012 – 14
- Implementation: naming convention
- Tracking and information treatment: development and commissioning;
- Collect and update detailed information
- Extensive 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


Evolution of Manpower per Work package
[men*month]
[FTE]
Up to 3.5 FTE
The total: 230 men-month
Avg.: 2.7 FTE / year
Only technical aspects of the Project
42
36
30
24
18
12
6
0
3.5
3
2.5
2
1.5
1
0.5
0
2010
2011
2012
2013
2014
2015
2016
2017
2018
[Year]
ICM Naming Convention
Vacuum Tracking Log
EDMS, Documentation handling
MTF, Asset Management
Layout DB
PLC, SCADA improvements for QA

Resources

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 !

AMMW 2013

Contact: fabien.antoniotti@cern.ch

References:

- F. Antoniotti et al, "Quality Management of CERN Vacuum Controls", EDMS#1317779, ICALEPCS13, S. Francisco, Oct-2013
- 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