Superconducting magnets at CERN are being tested in one of the largest testing facilities around the world known as SM18.

This unique infrastructure requires a well-designed and optimized quality assurance and control system to follow-up, monitor and trace all ongoing activities. In 2017 we created Carpenter, a fully customized management system to improve work organization. In addition to its main functionality of quality control for tested items and assemblies, the system enables also to store all relevant test results which can be later used for automatic test report generation. Carpenter uses a web interface for easy access and database for storage. Since January 2018, Carpenter system is fully operational at SM18 and it is being introduced to other superconducting magnet test facilities.

**CONCEPTUAL DESIGN**

- Support for different test stations
- Different items and assemblies to be tested
- Many test setups and variety of testing procedures
- Users with different privileges
- Life cycle of tested item
- Travel around a testing facility
- All types of data to store:
  - manual input
  - automatically uploaded
  - software loaded

**Technical assumptions**

- Web based system with easy access and sharing options
- System notifications and communication tools
- Data stored in a relational database

**MAIN FUNCTIONALITIES**

- **Quality Assurance**
  - Communication efficiency and effectiveness via feedback loops (email and SMS) between the test participants and those responsible externally from the group.
- **Quality Control**
  - Show what we are doing to interested people in real-time.
  - Internal/external users follow-up of activities at SM18.

**PLAYGROUND**

- **Warehouse**
  - Here are the items waiting for a setup or testplan. It is also possible from here to register new coming items and later to check them.
- **Lounge**
  - The place where items next while the first few checks are done. Once they are put on an insert or a testbench, they move to the Sandbox.
- **Sandbox**
  - The main attraction of the Playground. All the test stations have their representation here, with the items or cryomodules that are occupying them. Station colour represents the actual temperature condition - warm or cold, testplan progress is also visible from here.

**FREQUENT FLYERS & TRAVEL INFORMATION**

Additional modules allow for:

- Filtered data mining and automatic reporting
- Creating logbook-type reports
- Yearly reporting about test station occupation
- User access and privileges administration

**DEVELOPMENT & DEPLOYMENT TIMELINE**

- **2 main developers (+ beta-testers)**
  - First beta version: 1.5 months @ 100%
  - First working version: 4 months @ 30%
  - Maintenance during 2018 ~ 10%
- **To deploy Carpenter in a new place**
  - Detailed test procedure & workflow
  - Test object properties, test result data
- **Estimated time required**
  - By local engineer: 1-2 weeks full time
  - Database and website installation: 1 week full time
  - Maintenance: ~10%
- **Other groups that will adopt Carpenter**
  - GSF/SuperFIS - already deployed
  - Freia (HL-LHC cooperation) in Uppsala University
  - Interest from other groups testing HL-LHC magnets

**UNDER THE HOOD**

- HyperText Preprocessor (or simply PHP)
- A general-purpose programming language originally designed for web development.
- The standard PHP interpreter, powered by the Zend Engine. This software released under the PHP License. PHP has been widely ported and can be deployed on most web servers on almost every operating system and platform, free of charge.
- PHP is used by 78.9% of all websites with a known server-side programming language.

https://cern.ch/sm18-carpenter