ISBN: 978-3-95450-193-9 doi:10.18429/JACoW-ICALEPCS2017-TUPHA102

NEW BEAM PERMIT PROCESS FOR THE PROTON SYNCHROTRON COMPLEX

R. Valera Teruel, F. Chapuis, J. L. Duran Lopez, C. Gaignant, T. Krastev, E. Matli, K. Pater, A. Patrascoiu, F. Pirotte, R. Steerenberg, M. Tavlet, A. Wardzinska, CERN, Geneva, Switzerland

Abstract

Injecting beams in CERN facilities is subject to the CERN safety rules. It is for this reason that the Beam Permit approval procedure was improved by moving away from a paper-based workflow to a digital form. For each facility, the Beam Permits are signed by the various responsible specialists (Access systems, safety equipment, radiation protection, etc…). To achieve this, CERN's official Engineering Data Management System (EDMS) is used. The functionality of EDMS was extended to accommodate the additional requirements, whilst keeping a user-friendly web interface. In addition, a new webpage within the CERN OP-webtools site was created with the purpose of providing a visual overview of the Beam Permit status for each facility. This new system is used in the CERN Control Centre (CCC) and it allows the Operations team and all people involved in the signature process to follow the Beam Permit status in a more intuitive, efficient and safer way.

INTRODUCTION

Safety Permits

A Safety permit is a safety procedure that accompanies the major milestones in the lifecycle of a beam facility. It considers the activities and operations foreseen for a particular stage and their associated hazards.

It is a signed document composed by a checklist signed off by the corresponding responsible persons. It constitutes permission to carry forward.

This quality assurance process aims to ensure that proper consideration is given to the risks of a particular activity and an operation.

Safety permits follow the principle of quality assurance in terms of traceability and archiving.

This standardised process shall be applied at an appropriate level to the lifecycle of a beam facility that best suits the needs of that facility [1].

Examples of existing safety permits:

- Beam permit (e.g. CERN beam facilities).
- Hardware permit (e.g. PS Complex).
- Powering permit (e.g. LHC).
- Laser permit (e.g. AWAKE).
- RF permit (e.g. LIGHT).
- Source permit (e.g. GIF++).
- Cool-down permit (e.g. LHC).
- Irradiation permit (e.g. MEDICIS).

EDMS

The Engineering and Equipment Data Management Service has served the High Energy Physics Community for over 15 years. It is CERN's official PLM (Product Lifecycle Management), supporting engineering communities in their collaborations inside and outside the laboratory. EDMS is integrated with the CAD (Computer-aided Design) and CMMS (Computerized Maintenance Management) systems used at CERN providing tools for engineers who work in different domains and who are not PLM specialists.

The functionality of EDMS is focused on support for engineering and quality assurance processes, collaborative aspects of work and long term data preservation [2].

Main features of EDMS are:

- Structured data.
- Lifecycles.
- Version control.
- Collaborative work.
- Fine-tuned access rights.
- Personalization.

OP-Webtools

This web portal was created about ten years ago with the idea of giving a single access point to services used in the daily operation of CERN's accelerators, like beam documentation, shift planning etc. Since then it grew in scope and number of applications providing a solid framework for a rapid development of web applications.

BEAM PERMITS IN EDMS

At the beginning of 2015, The CERN Beams Operations group (BE-OP) decided to move Safety Permits from paper (annex A) to a digital system. Some possibilities were on the table. As CERN already had some document management application services, the creation of a new tool was discarded. The last two candidates to harbour Safety Permits were EDH (Electronic Document Handling System) and EDMS. The Beams Departmental Safety Officers (BE DSO) in agreement with the BE-OP group leader decided eventually to use EDMS as the new tool for Safety Permits management. The simplicity and flexibility to introduce the requested process in the system made the choice easy. Once the decision was taken, the first Safety Permit was created in EDMS.

First documents were based on the basic approbation process used in EDMS (old method) where documents went through three steps ("In Work", "Engineering

ISBN: 978-3-95450-193-9 doi:10.18429/JACoW-ICALEPCS2017-TUPHA102

Check" and "Released"). All signatures were inserted by adding comments while the documents were in "Engineering Check" status. Once the facilities were approved by all signatories, the documents were moved to "Released" and the Safety Permits were approved.

At the beginning of 2016, a new prototype was presented with the aim to improve the process and adapt EDMS to the Safety Permits needs (annex B). This new prototype contains a workflow that follows the logic of the Safety Permits process with descriptive names for each status, a new access right structure for the various stages of the process and a new way to sign off foreseen activities (not available in EDMS at that moment).

Once the prototype was accepted, the EN-ACE-EDM section (which is responsible for the maintenance of EDMS) created a personalized release procedure per facility based on the new system for almost all beam permits of the PS Complex. New features in EDMS were created such as "Actions" linked to status (they contain the signature of the specialist), a new notification system (informing a group of people about changes in the process) and an Application Programming Interface (API) for giving read access to the new tool used by the Operations group. In addition to that, a new overview panel where everyone with read access rights can follow the signature process and all comments in a simple way has been implemented. Moreover, two new ways to contact people involved in the signature process and some visual improvements to clarify the status of each action during the process were added.

BEAM PERMITS IN OP-WEBTOOLS

Once first Beam Permits were using this new method in EDMS (annex C), BE-OP requested the creation of a new tool in the existing OP-Webtools portal (used already by the Operations team) with the aim to have a main view of all Beam Permits from a fix display installed in the PS Complex island of the CERN Control Centre.

To create this new tool, a new API was provided by the EDMS team to supply read access to EDMS data. Once it was developed, it became possible to retrieve "Actions" and "Status" from EDMS Beam Permits, creating an interactive panel (annex D) that contains a summary of all Beam Permits organized thanks to a colour-code according to the actions. Also, the tool provided a direct link to the full view of the document in EDMS.

If the service becomes slow or unavailable a warning is displayed on the page telling the user that the information on the screen is outdated. Detailed information about the workflow of each document can be accesses by clicking on the corresponding button and is displayed in a pop up window.

Following the development of the new tool, operators have the means to acquire the status of each Beam Permit in an efficient way, reducing the time needed to introduce Beam in each facility and reducing the risk of misunderstandings.

RESULTS

Twelve beam permits and five hardware permits of the PS Complex have been in operation since 2017 run, using the new system with very good results. The process has been much clearer for specialists and operators and it has been easier for other CERN staff to follow the workflow for each facility.

Some issues arose during the testing phase and thanks to the continued effort for the improvement of EDMS, all problems were solved before moving it from the test phase to production.

In summer 2017, the new experiment BASE in the Antiproton Decelerator facility started using a similar workflow adapted to secondary beam areas (areas receiving secondary particles as protons collide with a fix target with the aim to produce antiprotons that are finally sent to the experiment) with positive feedback.

PROJECT STATUS

There have been some meetings with the BE DSO team, the safety link persons of the PS Complex, the EN-ACE-EDM section and the BE-OP group leader to check if the current system could be improved for the next year in terms of the process workflow given to each area, new features that could be added to EDMS and the Beam Permits webpage in OP-Webtools, always trying to make it as easy and efficient as possible for the user, keeping all necessary safety aspects.

Existing Beam Permits of the PS Complex will keep the same workflow and just some minor modifications will be made such as adding some "Actions" (signatures) to some Beam Permits and renaming one of the statuses for the next year.

In terms of software, some new features have been requested by BE-OP to EN-ACE-EDM. It includes visual improvements of EDMS, new tools to manage Beam Permits and other features like a new automatic notification system that will save time for future Beam Permits implementation, configuration and maintenance.

There are also some improvements that are being done in the OP-Webtools side with the aim to give more information about Beam Permits to operators while keeping the fast and simple overview of the Beam Permits.

A wikipage with information related to this new method is available [3]. It is used by CERN staff members as a guide and it helps them to be informed about new improvements on the system.

TECHNOLOGIES USED

EDMS

EDMS is based on Oracle Agile e6 PLM, which is a commercial PLM solution with an integrated file server. The core of EDMS is the Oracle database, with the business logic implemented in PL/SQL. In order to interface with the native Agile functionality, an EDMS Action

ISBN: 978-3-95450-193-9 doi:10.18429/JACoW-ICALEPCS2017-TUPHA102

Broker was developed – a Java application which handles data modification actions.

The web interface was recently completely redesigned and rewritten in order to improve the user experience. On the client side, a library based on GWT – GXT is used. The client – server communication is done with asynchronous calls (GWT-RPC) allowing for partial page refresh and more fluid navigation. The Java server side is very thin, the services provide essentially gateways to the PL/SQL modules which contain the actual logic. In order to speed up and standardize the development of the Java code for calling the PL/SQL stored procedures, a maven plugin was developed, which generates the DTO (Data Transfer Object) and DAO (Data Access Object) classes basing on a mapping provided in an XML dialect. The server also deals with standard aspects of a web application such as authentication, session validation, cross service exception handling and logging.

Apart from the web interface, there are other entry points to the system. EDMS provides a SOAP web service API allowing for programmatic input and output of data. These are used mostly for integration with other systems.

OP-Webtools

The Beam Permit web application, like many other OP-Webtools applications, is implemented with a client-server architecture where the front-end, developed with the AngulaJS framework, communicates asynchronously with the back-end server via http by means of a RESTful API.

The back end doesn't use any framework, but uses custom developed PHP classes to implement the REST API.

EDMS provides a SOAP API for system integration. Authentication is done by sending user's credentials in the http header of each request. Using SOAP directly from the client would mean either force the user to type in his/her credential at every request or expose them by hard coding them in the web client's code.

None of these solutions is acceptable, therefore a web server is used to encapsulate the SOAP requests and safely store the user's password. The response is then parsed as a JSON object and wrapped with RESTful http headers, before being sent to the browser.

The front-end application queries the server at regular intervals to check the status of the Beam Permit documents and updates the interface accordingly.

The service runs on a dedicated web server running Windows Server 2012 R2 + IIS8.5. The persistence layer is using Oracle database to store data between sessions. Both services are maintained by the IT department.

Running on a standard CERN web service frees us from the burden of hardware and software updates, security patches and maintenance. It also comes with other services like Single Sign On (SSO) for authentication.

CONCLUSION

After the first test using this new method for the PS Complex, we have learnt not just about the new process itself with all advantages but also about the way to organize our planning for next years.

In the near future, other Safety Permits will be implemented for the Super Proton Synchrotron (SPS), the Large Hadron Collider (LHC) and the experimental areas linked to them (they use the old EDMS method). The rest of the facilities of the PS Complex will integrate the new process. New facilities such as the new Linear Accelerator 4 (LINAC 4) will use the new process from the start.

New features and improvements will be developed in EDMS and the Beam Permits webpage. A future implementation into the CCC Access Systems will be studied.

For the 2018 run, we are working on the improvement of the system thanks to a continued communication among the BE-OP group, the BE DSO and the EN-ACE-EDM section with the aim to cover all aspects (safety, infrastructure, operation…) for each current and future facility using the new method and the possibility to improve and adapt each system to the new needs.

ACKNOWLEDGEMENT

The author wishes to thank CERN BE DSO, BE-OP and EN-ACE-EDM members for the helpful discussions and valuable comments, and their general contribution to this project.

REFERENCES

[1] Safety Permits for Beam Facilities. https://edms.cern.ch/document/1536514

[2] The Evolution of CERN EDMS. https://edms.cern.ch/document/1500331

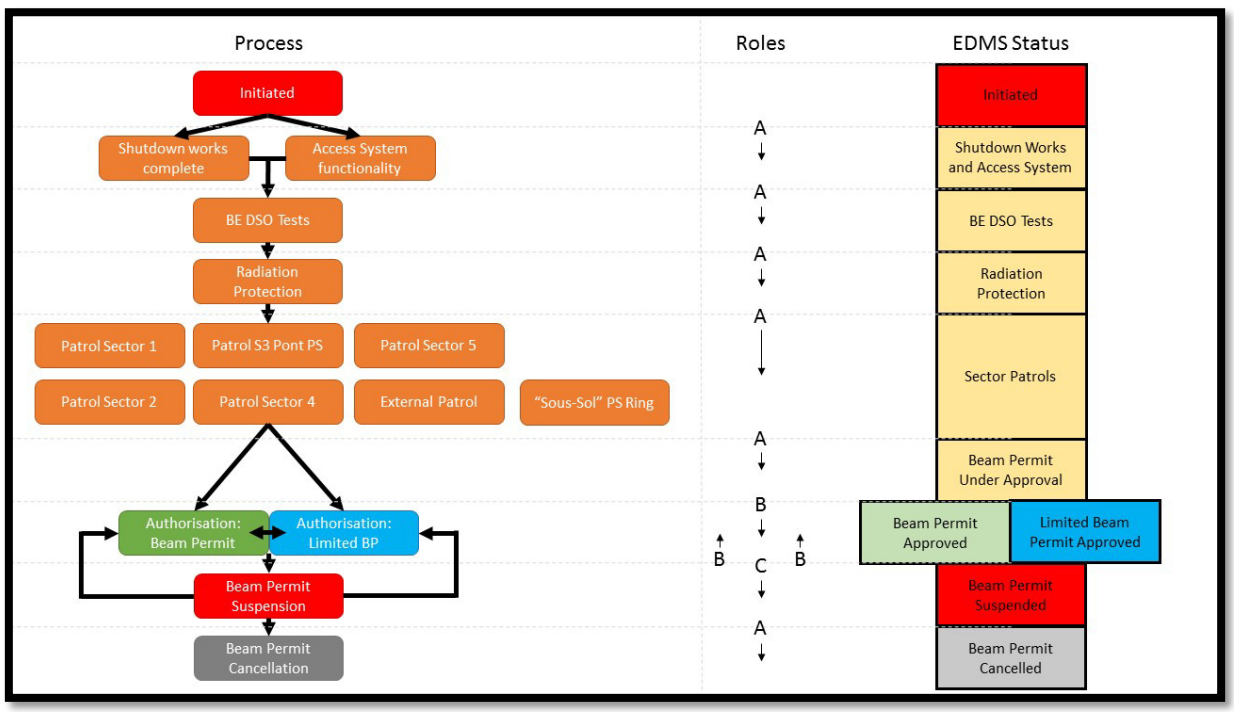
[3] Confluence Beam Permits Wikipage (from CERN network). https://wikis.cern.ch/display/PSOP/Beam+and+Hardware+Permits

ISBN: 978-3-95450-193-9 doi:10.18429/JACoW-ICALEPCS2017-TUPHA102

ANNEX A:
BEAM PERMIT TEMPLATE (PS RING ZONE)

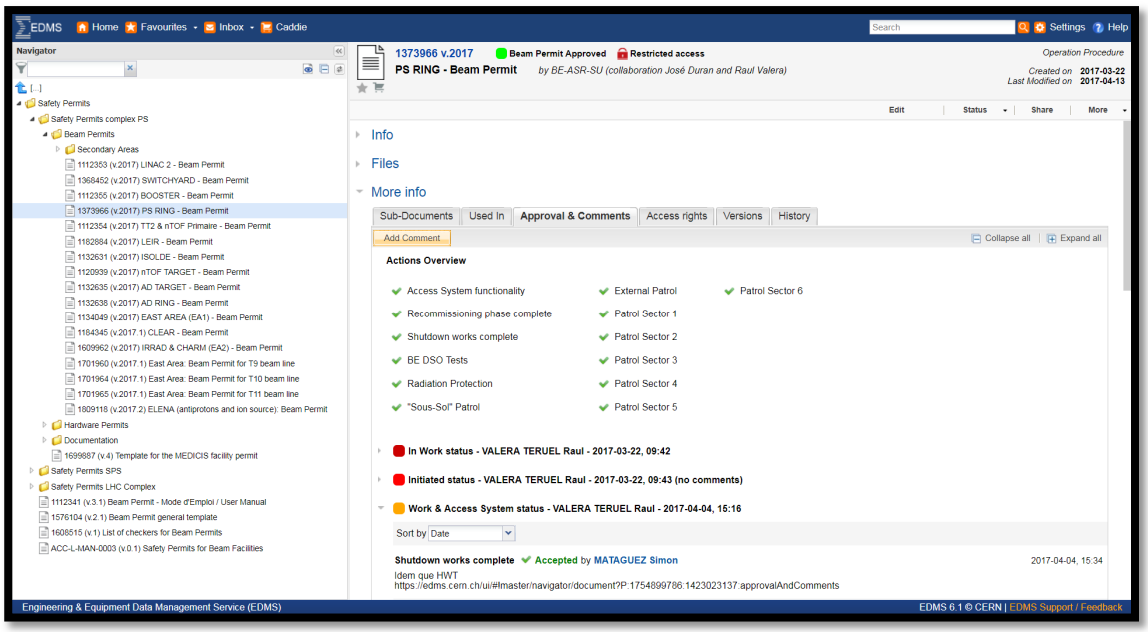
BEAM PERMIT 2017	ZONE : **PS-RING**
Please note any exceptions or additional remarks as comment with your signature in EDMS.	**Person and Group for signature**
1 - All shutdown works complete: The Machine Facility Coordinator attests that : - All shutdown works have ended, **including in outside areas** - The integrity of the infrastructure is preserved, in particular all shielding blocks and ventilation doors are in place to his/her best knowledge. - Any new or modified shielding have been reported to - and validated by - the BE-RSO.	Machine Facility Coordinator Group: EN-ACE
2 - Recommissionning phase complete: The Recommissionning Coordinator attests that : - The integrity of the infrastructure, including outside areas, and in particular all shielding, walls, fences and ventilation doors, is preserved. - Any new or modified shielding have been reported to - and validated by - the BE-RSO. - The equipment groups in charge of EIS-b have tested their equipment and made them available for operation with beam.	Recommissionning Coordinator Group: BE-OP
3 - Access system Functionality: The access system for the machine/zone is fully operational. All safety and control functions are operational. Any non-conformity, bypass or strap of EIS must be properly reported, as comment associated to the EDMS signature. The "electronic signature" of the control software (if applicable) of the access system will also be refered in the EDMS comment.	Access system responsible person Group: BE-ICS-AC
4 - Patrol: The area is patrolled according to BE-OP patrol procedures : EDMS 1373969(v2), EDMS 1374071, EDMS 1374009, EDMS 1773179 and EDMS 1373968. This patrols includes checking the cleaning and tidiness of the areas, the integrity of access barriers, radiation shielding, and ventilation doors, but first of all the absence of any person in the zone.	Patrol leader or Shift Leader on duty in CCC Group: BE-OP
5 - BE-DSO tests: The purpose of the DSO tests is to validate the correct operation of the safety functions of the access system and of all "EIS". The DSO test is done according to procedure EDMS 1146640. (The DSO tests are usually performed after completion of the steps above, as well as after having collected the information from the equipment groups responsible for EIS, as well as from EN-CV where appropriate.)	DSO, DDSO, RSO or DRSO Group: BE-ASR-SU
6 - Radiation protection: The RP responsible person attests that: - A visual inspection of radiation shielding has been performed when and where appropriate. - RP sign posting is in place. - Radiation monitoring system (measurement, alarm functions and alarm transmission) is operational. Limitations on beam operation can be expressed in accordance with reduced shielding.	RP-AS Section Leader or designee Group: HSE-RP
7 - Final Authorisation for Beam At this point the machine is operational for beam. The BE-OP group leader (or the relevant CSAP chairman, or the project leader for commissioning machines) accepts the machine for operation within the range of the restrictions that have been made in writing.	BE-OP Group Leader or deputy Group: BE-OP
Beam Permit suspension by any qualified person Reason for suspension (including possible reference documents) will be mentioned by the requestor, when changing the status to "Suspended", as a comment on EDMS.	**Beam Permit reactivation** Actions undertaken to resume the safe situation will be given as a comment on the EDMS Beam Permit. The reactivation will be approved by the requestor of the suspension and the final approver of the Beam Permit.	**Beam Permit cancellation** The reason for cancellation (during the run or at the end of the run) will be given as a comment when changing the status of the Beam Permit to "Cancelled" in EDMS. The next Beam Permit will be created in EDMS as version n+1.

ANNEX B:
BEAM PERMIT PROCEDURE (PS RING ZONE)



ISBN: 978-3-95450-193-9 doi:10.18429/JACoW-ICALEPCS2017-TUPHA102

ANNEX C:
EDMS BEAM PERMIT (PS RING ZONE)



ANNEX D:
BEAM PERMITS WEBPAGE IN OP-WEBTOOLS