LESSONS LEARNED FOR QUALITY ASSURANCE IN THE MEGAPIE PROJECT

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Quality assurance (QA) is a continuing issue at PSI in general and for large projects such as MEGAPIE in particular. In order to profit optimally for future projects one should try to learn from the past and to make the experience gained productive and accessible. MEGAPIE takes advantage of earlier projects like RHESSI and does its best to hand over some heritage to new undertakings like PROSCAN and UCN. In the first part, a very brief summary highlights some points found to be important at the rather special crossing point between safety and scientific demands on one side, and technology and industry boundary conditions on the other. In the second part, advantages and expected improvements are described that can be gained realising scientific projects by observing a "Project Reference Model".

INTRODUCTION

MEGAPIE poses some severe requirements on quality assurance due to its potential risk for people, for the environment and for PSI facilities [1]. This fact has been stressed repeatedly by the Technical Advisory Committee of the project as well as by the Swiss federal nuclear safety commission (Eidgenössische **K**ommission für die **S**icherheit von Kern**a**nlagen KSA) in their report to the licensing authority BAG (**B**undes**a**mt für **G**esundheit).

Especially in an international collaboration, where most delicate parts like the liquid metal target itself and the ancillary systems are designed and manufactured in very different places spread over half of Europe, it is of utmost importance that, in the end, one is sure that everything has been carried out correctly. In the case of MEGAPIE, this means that it is safe to switch on the beam for irradiation in SINQ.

In this context, special care is taken to make use of experience gained and to further accumulate even more. This is an obvious thing to do in order to improve the overall efficiency during the course of a project from the conceptual design stage through the design to the production, operation and final disposal. A certain level of professionalism in the field of quality assurance becomes more and more a mandatory requirement by authorities and partners in projects involving high technology.

QUALITY ASSURANCE FOR MEGAPIE

Nobody wants to produce paper for the sake of it and it is clear to the authors that if something is done only for meeting some prescribed QA rule, nothing is gained for the quality of a product. More important are the people doing the real work and their motivation to deliver good results. It is a challenge for any big project to allow a wide range of contributors with diverse cultural backgrounds work together successfully.

No set of rules can take care of the whole range of possible constellations and contexts. Even if a procedure has proven valuable in one setting, it must be subject to critical reflection before it can be transferred to a new task: flexibility is a must. This holds especially true in a high performance research

institute like PSI and where basically everything built falls into the prototype category.

Nevertheless, many project stages and requirements are common to literally all projects and the authors believe that some lessons, to some extent specific to PSI, can be learned. Here are some salient issues:

- Besides other prerequisites for the project kick-off, a so-called project configuration should be available. Such a document references the quality to be achieved. This means for instance: What type of reviews an item must pass and which product standards have to be applied or must be fulfilled. This task needs a lot of know-how, because it will meet the essential slogan: *"As little as possible, as much as necessary"*
- It is important to establish clear communication structures at an early stage. This includes trivialities such as formats for documents which allow unambiguous referencing.
- Having the key persons of a project scattered over the PSI area is definitely less easy and more time consuming than being together within calling distance. MEGAPIE often has to cope with this issue.
- Codes and design rules must be applied. It does not matter too much whether in a particular case a result is deemed satisfactory because it complies with one or the other applicable rule, but it is important that some established and traceable criteria are taken as a reference.

- Before final production or procurement can start, a review board must convene and check that “everything is clear and ready”. It is found most useful to everybody involved to insist on this very strict milestone:

Readiness for Manufacturing “RFM”

- Decisions on designing, manufacturing and assembly of critical components, such as the MEGAPIE target, have to be taken carefully, irrespective of whether the work is done at PSI or somewhere else. If such a task is performed externally, the qualification process of the supplier and his subcontractors must meet very high standards to prevent any delegation of the work back to PSI. MEGAPIE has some experience in this respect.

During the ongoing work in MEGAPIE, a lot of experience has been collected on different levels. It is not possible to mention and explain them all here, but the lessons learned would be worth collecting for use in upcoming projects. Similar experience is gained in the other ongoing project PROSCAN and is just developing along the same lines in the newest project UCN. Looking at these general facts leads one to some thoughts about possible improvement.

IMPROVEMENT FOR THE FUTURE

For over 35 years, scientific projects have been realised at PSI. The collected experience and know-how from this time span and from the successfully finished projects such as: Upgrade program of meson production targets M and E, SINQ, SLS and RHESSI, are one of the treasures of PSI. Facing this fact and looking more closely at the list of issues above, the impression arises that what had been done in one project perfectly, was not duly carried over to the next one.

Investigation shows that the links between successfully concluded projects and new projects often are rather weak. Thus, the real potential for improvement exists in this link. Why do we not put these collected treasures into a so-called:

Project Reference Model?

Available as a template, such a model would guide the saving of know-how, which can be used immediately for upcoming new scientific projects. Instead of starting from scratch with organisational and quality assurance issues, PSI invests directly into the continuous improvement process in order to always be at least one nose length ahead of its competitors in publishing new and excellent results. Such a reference model, combined with a good team, will facilitate the successful realisation of challenging projects with respect to time, cost and quality!

Fig. 1: The goal of PSI QA by realising scientific projects: *“Being at least one nose length ahead!”*

REFERENCES

[1] P. Ming, *MEGAPIE and Quality Assurance*, PSI Scientific and Technical Report 2002, Volume VI, p. 94-95

MEGAPIE (**Mega**watt **Pi**lot Target **E**xperiment) is an initiative launched by Commisariat à l’Energie Atomique, Cadarache (France) and Forschungs-zentrum Karlsruhe (Germany) in collaboration with Paul Scherrer Institut (Switzerland), to demonstrate, in an international collaboration, the feasibility of a liquid lead bismuth target for spallation facilities at a beam power level of 1 MW. Such a target is under consideration for various concepts of accelerator driven systems (ADS) to be used in transmutation of nuclear waste and other applications world wide.
Link: **http://megapie.web.psi.ch/**

PROSCAN the further development of the unique PSI spot scanning technique to treat cancer tumors with protons.
Link: **http://proscan.web.psi.ch/**

RHESSI **R**euven Ramaty **H**igh **E**nergy **S**olar **S**pectroscopic **I**mager (RHESSI). This NASA satellite has the primary mission to explore the basic physics of particle acceleration and explosive energy release in solar flares.
Link: **http://hesperia.gsfc.nasa.gov/hessi**

SINQ The spallation neutron source SINQ is a continuous source - the first of its kind in the world - with a flux of about 10^{14} n/cm^2/s.
Link: **http://sinq.web.psi.ch/**

SLS The **S**wiss **L**ight **S**ource (SLS) at the Paul Scherrer Institut is a third-generation synchrotron light source. With energy of 2.4 GeV, it provides photon beams of high brightness for research in materials science, biology and chemistry.
Link: **http://sls.web.psi.ch/**

UCN **U**ltra **C**old **N**eutron is the name of the newest project at PSI and his source will deliver ultra cold neutron densities of more than 1000 per cm^3 in a typical experiment.
Link: **http://ucn.web.psi.ch/**