

OPERATION OF THE ANKA SYNCHROTRON RADIATION SOURCE UNDER A STANDARD QUALITY MANAGEMENT SYSTEM

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Abstract

ANKA (Angströmquelle Karlsruhe) is a state-of-the-art synchrotron radiation facility at the Forschungszentrum Karlsruhe (FZK). Based on a 2.5 GeV electron storage ring it delivers photons from the infrared to the X-ray range. Five straight sections are available to accommodate insertion devices. The facility will be operated by a for-profit company, ANKA GmbH. In compliance with its mission, commercial services to customers will represent the majority of the overall activity, complemented by providing beam time to research users. Nine beamlines have been installed, eight will be operated by ANKA GmbH, one by the Max-Planck-Institute for Metals Research, Stuttgart. Three lithography beamlines for X-ray based production of microstructures will be jointly operated by ANKA GmbH and FZK's Institute for Microstructure Technology IMT, which is certified under ISO 9001. Current plans for the application of standard quality management procedures are presented.

1. INTRODUCTION

The synchrotron radiation (SR) source ANKA is located inside the premises of Forschungszentrum Karlsruhe (FZK), a member of the Helmholtz Society. Construction and commissioning of the accelerators and beamlines is under the responsibility of a special project group of FZK and will be completed in 2001 and finally, ownership of the entire facility will be transferred to ANKA GmbH in April 2001. This company is organised as a for-profit, commercial entity and will operate the facility for private-sector customers. Access to academic institutions will be co-ordinated by the Research Group Synchrotron Radiation (Forschungsgruppe Synchrotronstrahlung, FGS), a newly established organisation within FZK.

2. THE SYNCHROTRON RADIATION SOURCE

The main technical parameters of the synchrotron radiation source ANKA are summarised in Table 1 [1]. Nine beamlines have been installed, eight will be owned and operated by the ANKA GmbH and one by the Max-Planck-Institute for Metals Research in Stuttgart (see Fig. 1). In addition, two front-end beamlines serve for beam diagnostics. Three beamlines for X-ray based production are jointly operated by ANKA GmbH and the Institute for Microstructure Technology, IMT at FZK. IMT is certified under a strict ISO 9001 Quality Management System (QMS) and will also apply this system to these three beamlines housed in a clean-room, including scanners and ancillary equipment.

Table 1: Technical parameters characterising the synchrotron radiation source ANKA

Injection energy	0.5 GeV
End energy	2.5 GeV
Max. electron beam current	400 mA
Storage ring circumference	110.4 m
Horizontal emittance ($D_x=0.5$)	46 nmrad
Bending magnet deflection radius	5.559 m
Bending magnet magnetic field	1.5 T

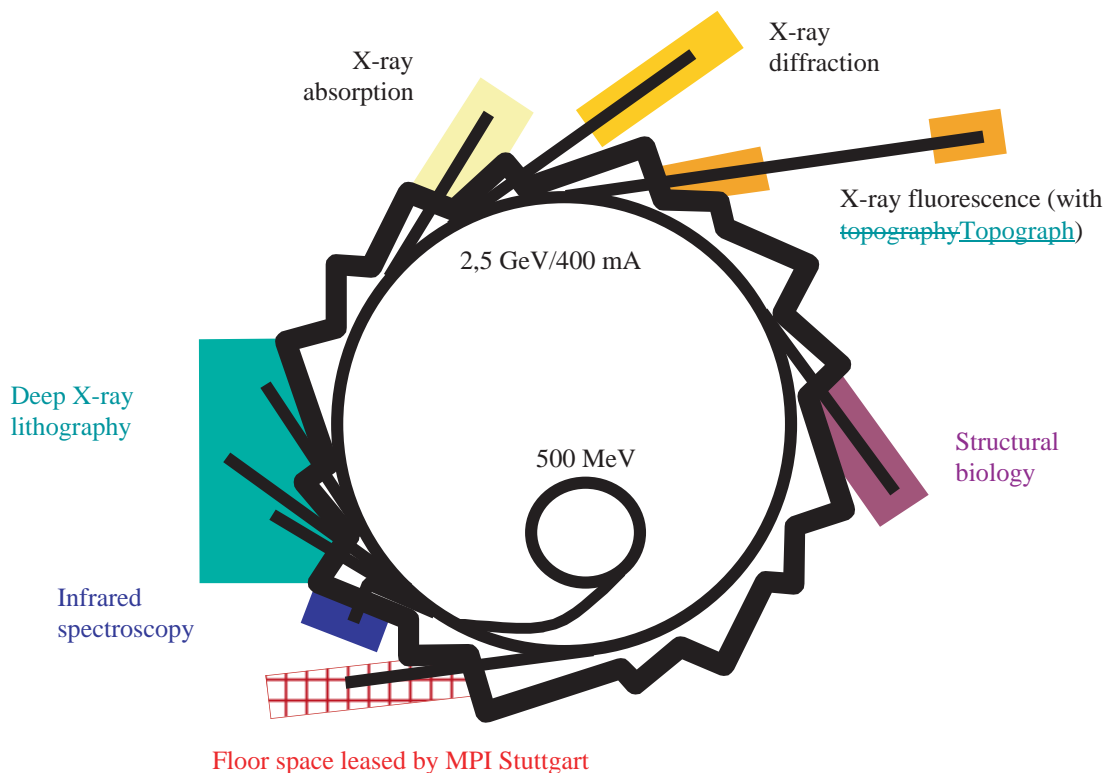


Fig. 1: Schematic view of the facility with beamlines for LIGA-based production and SR-based physical and chemical analysis.

3. QUALITY MANAGEMENT SYSTEM AT THE INSTITUTE FOR MICRO-STRUCTURE TECHNOLOGY AT FORSCHUNGSZENTRUM KARLSRUHE



The institute for microstructure technology IMT, conducts applied research and development in the field of micro-structure technology, compliant with the rules and goals of the FZK. It is operated under a DIN EN ISO 9001 and 9004 certified quality management system (QMS) since 2000 [2]. The tasks of IMT span the large range from conception and design of new devices and systems to the development of series production of components. The micro-structured components and technologies may be transferred to industrial or public customers including fabrication of samples and manufacturing of components in pilot production. IMT is organised into seven divisions, three for research and development, one for micro-systems production, one for marketing, sales, and administration and finally one for quality assurance. The quality management rules are summarised in the Quality Management Handbook (QMH), which is

authorised by the institute director. The QMH is complemented by a large set of additional documents describing procedures, processes, task, specifications, plans, etc. The responsibilities of the leading staff and of the divisions are defined in the QMH. Compliance with the quality management rules is compulsory for all IMT personnel.

4. QUALITY MANAGEMENT SYSTEM FOR ANKA GMBH

Synchrotron radiation laboratories have reached a degree of maturity, where stability of the electron source, quality of the photon beam, predictability of the schedule, service, and cost-efficient operation are mandatory requirements for long term success. In particular, facilities like ANKA GmbH serving paying customers must embrace well-proven concepts such as ‘customer satisfaction’. Producing goods or providing services that satisfy the specifications of a customer provides a definition for quality. In the private sector, quality is of overwhelming importance and has led to standard quality management systems such as DIN EN ISO 900X. Nowadays companies manufacturing goods or providing services must be certified for compliance with such a norm in order to stay credible and competitive. With the widespread success of quality management systems in industries it is a straightforward idea to implement such a system also at a synchrotron radiation facility.

The management of ANKA GmbH has decided to develop a QMS for the facility by 2002. The final objective is certification of ANKA GmbH. More important, however, is establishing the system as such, as well as implementing and applying it. The success of this effort will critically depend on the acceptance of the QMS by ANKA’s employees. ANKA GmbH will strongly benefit from the experience at IMT over the past 3 years with establishing ISO 9001 at the institute, which is one of the main partners of ANKA. Furthermore, the documentation for the technical systems of ANKA will focus up-front on QMS requirements. Continuous education and training of the ANKA GmbH employees will allow for efficient and reliable operation. Clear and well-documented procedures and responsibilities will be the basis for the ANKA GmbH organisation. The QMS will be implemented step-by-step, starting with the three beamlines for X-ray lithography. Ultimately, it will cover all procedures conducted at ANKA. The goals are customer satisfaction, in particular:

- Delivery of a beam of perfect quality with high reliability (beam availability, spectral quality, position accuracy, beam stability)
- Safety management, high safety standards for personnel, customers and academic users, evaluation of failure modes
- Environmental management, define, implement, operate, control, publish
- Conduction of production processes with tight tolerances under auditing control
- Conduction of analytical services, transparent and traceable for the customers
- On-time delivery
- Cost-effective operation

As far as radiation safety is concerned, strict procedures had to be followed since commencing operation of the accelerators and beamlines. The operation rules are defined in legal texts and radiation safety instructions. An officer responsible for radiation safety and the interaction with the local governmental bodies assures compliance.

5. CONCLUSIONS

The implementation of a standard quality management system at the synchrotron radiation source ANKA is driven by the main goal of supplying high-quality services to customers from industries and to academic users. A company culture with well educated and highly motivated employees is a major

prerequisite for reaching this goal. The very positive experience gained at the Institute for Microstructure Technology of FZK encouraged us to continue along this route.

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