Rudolf Thermer – Mechanical Engineer

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Core Competencies

- **Development and design of prototypes and custom machines**
  22 years of experience in the development and design of complex, mechatronic custom machines and systems in research (Paul Scherrer Institute, Oak Ridge National Laboratory) and industry (Komax AG).
- **Partial project lead**
  Experience in planning, coordinating, monitoring and controlling of a project.
- **Ability to work in multidisciplinary and international teams**
  In research, in addition to other technicians, I also worked with physicists, chemists, biologists or medical professionals. In the international environment, communication was mostly in English.
- **Pronounced hands-on mentality**
  This ability is pronounced because I was first allowed to learn a trade in an apprenticeship and then had the chance to work my way up from a technical all-rounder to a specialized, experienced engineer.
- **Physics and mathematics**
  The analytical and physical way of thinking, acquired in the part-time studies of Physics, helps me in various tasks to find solutions in a systematic manner. Furthermore, I could develop a quick perception and mathematical skills for the calculation of machine components and design structures.

Work Experience

Oak Ridge National Laboratory — **Oak Ridge, Tennessee**
Instrument engineer, Second Target Station / Sub project manager — April 2021 – Present

- Development of designs of new neutron beamline instruments which contain mechatronic systems. Special features of these systems include a high degree of repeatability in positioning, the use of radiation-hardened components and the use of motion components in low and high vacuum. Many of the systems also include safety-related functions.
  Examples:
  1. *Development of conceptual and preliminary designs of fail-safe neutron beam shutters with heavy and light beam blockers.*
  2. *Development of a preliminary design of an end station and a specific neutron beam shutter with additional options for beam attenuation and beam monitoring in the quite intense kinetics reflectometer (QIKR).*
  3. *Preliminary design development of a motion system for the CHESS and PIONEER (beamline) polarizer vacuum box which translates between V-cavity polarizer and neutron guide.*
  4. *Preliminary design development of a radial neutron collimator motion system for PIONEER, used in ambient air, and CHESS, used in vacuum. This includes the development and design implementation of adjustable collimator mounts.*
  5. *Conceptual design suggestion for the development of a rotational neutron detector arm frame and a sample positioning setup for ambient air measurements in BWAVES.*

6. *Advice on motion systems in other projects like CUPID Optics Elevator or BUNKER Maintenance Shield.*

- Perform Engineering Calculations to ensure safety and component performance.
  Examples: Engineering calculations had to be performed in all projects. I had to perform a finite element static analysis of an assembly, drive system calculations (drive torques, required RPM of motors, gearbox ratios) as well as calculations of machine elements (gears, guides, bearings, etc.).

- Sub project management: management and supervision of design work.
  Examples: Design work for Steerable optics in beam testing.

- Development, design and testing of experimental equipment and systems containing mechatronics.
  Examples: Further development and testing of a parallel kinematic positioning unit for the alignment of neutron mirrors with an accuracy in the micrometer range.

- Specification of products manufactured externally and consultation for in-house and external departments.
  Examples:
  1. *Specification of a mineral casting filling of a girder at a specialized company (RAMPF Group).*
  2. *Product specification (preparation of manufacturing and assembly drawings), consultation and order placement with internal manufacturing specialist for external workshop fabrication (steerable optics in beam testing project).*

- Initiation and follow-up of production orders and acceptance of safety-related parts.
  Examples:
  1. *Mineral casting filling of a girder.*
  2. *External fabrication of steerable optics components for in-beam testing.*

- Technical support for the assembly and implementation of components, systems as well as their commissioning.
  Examples: Installation of an externally fabricated positioning system in a test lab at ORNL (steerable optics).

Komax AG (Automated Wire Processing) **Kussnacht SZ, Switzerland**
Development engineer / Sub project manager January 2018 – March 2021

- Sub-project management for customers and internal development projects.
  Examples: A successful implementation of a "Lambda 4" plant with eight process stations; Optimization of different cable gripper units and a supplier module of a cable ring winding system in cooperation with software developers, the service department and suppliers.

- Development and creation of assemblies, parts and drawings in conformity with production standards and drawings, within the scope of customer and development projects, using CREO direct and Agile PDM.
  Examples:

1. *Development and design of a knee lever locking mechanism for the cable bundle transfer in the cable ring winding unit.*
2. *Optimization of several process stations in "Lambda 8" platforms such as sleeve module, cable pull-out, cable centering unit for a vision station, concept elaboration and implementation of various control switches in different process stations and the cable winding unit.*
3. *Redesign of a previously incorrectly laid out 360° vision module.*
4. *Development of a detailed concept for the alignment of crimp contacts in a machine type "Omega".*

- Supporting the assembly and commissioning of the created assemblies in the workshop.
  Examples: This happened continuously in all projects. The machines were developed in close cooperation with process engineers, production engineers, assembly and maintenance specialists.

- Collaboration on equipment and plant documentation, as well as spare parts catalog for assigned projects.
  Examples: Collaboration on "Lambda 4" plant documentation and spare parts catalogue; Creation of an assembly plan for the cable ring winder module.

Paul Scherrer Institute **Villigen AG, Switzerland**
October 2001 – December 2017

Machine Engineering Department
Mechanical engineer January 2015 – December 2017

- Management and monitoring of design projects, procurement of documents, scheduling, coordination and monitoring of tests.
  Examples: All the development projects, mentioned in the first bullet point of the period 2007-2015, were already managed by myself. In my projects, I had to schedule and coordinate various specialists and also monitor their contributions. This also included arranging tests, whose execution had to be supervised by me. The various specialists included purchasing managers, manufacturing specialists (work preparation), fabrication mechanics, assembly specialists, electricians and other engineers involved.

- Development, design and overall processing of experimental equipment and systems with a focus on mechatronic systems and micromechanics.
  Examples:
  1. *Continuous Angle Multiple Energy Analysis (CAMEA) spectrometer (SINQ): development, design and commissioning of a rotary table with duplex worm gear for precise clearance adjustment.*
  2. *Free Electron Laser FEL Photonics: Concept and preliminary design development of a multi reservoir injector for the injection of protein crystals into the X-ray pulses beam. Prior to the design phase, a special nozzle injection system has been tested and successfully developed. There were no projects in micromechanics.*

- Same tasks as in the period 2007 – 2015.

Machine Engineering Department
Mechatronics engineer / Design engineer May 2007 – January 2015

- Development and design of experimental equipment and systems, which include mechatronic systems.
  Examples:
  1. *Mu to E Gamma (MEG), particle physics experiment (Muon Source): development, design and commissioning of an instrument for the precise magnetic field measurement of the superconducting COBRA magnet.*
  2. *Small Angle Neutron Scattering (SANS) experiment (SINQ): development, design and commissioning of a sample table for the positioning of different sample setups, including a cryomagnet, with seven degrees of freedom.*
  3. *High-resolution powder diffractometer for thermal neutrons (HRPT SINQ): development, design and commissioning of a sample stage with a very compact lift table and cross table. This design uses specially developed, non-magnetic linear guides made of tungsten carbide.*
  4. *Synchrotron Light Source (SLS) PX beamlines: development and design of a Parallel kinematic Robot Inspired Goniometer (PRIGO II) for a sample positioning with high repeatability in an X-ray beam. The design uses specially developed flexure joints for achieving high positioning repeatability.*
  5. *Energy and environment (ENE) research division: development, design and commissioning of an ablation target holder, for a pulsed laser experiment in ultra-high vacuum (UHV). The design uses linear piezo stages for a very high positioning accuracy.*

- Theoretical and conceptual processing of technical problems; selection of suitable methods, components, calculation methods, manufacturing processes and product functionalities taking into account safety and environmental factors.
  Examples: It was the culture to discuss ideas in advance. Not infrequently, this led to a synthesis of different ideas that resulted in a successful concept. My practical experience in manufacturing technology, which I acquired in my earlier work as a laboratory technician and above all through my apprenticeship training, has been of particular help to me in finding good concepts and designing in a factory-oriented and economical manner. Engineering calculations had to be performed in all projects. I had to perform FEA static analyses of critical parts, drive system calculations (drive torques, required RPM of motors, gearbox ratios) as well as calculations of machine elements (gears, guides, bearings, etc.).

- Preparation of specifications for products manufactured externally as well as technical advice for internal and external centers.
  Examples: The internally and externally manufactured components for my designs were typically specified by my technical drawings. In some cases, drawings were also sent to us by the manufacturer for cross-checking. One example of many was a duplex worm gear, which I predefined in a drawing and which was further elaborated and specified by the manufacturer in a solution proposal. Then, this worm gearbox had to be assembled according to instructions from the manufacturer and me. The assembly specialists were instructed accordingly.

- Release and monitoring of production orders; performing acceptance tests on parts relevant to safety.
  Examples: As a sub-project manager and design engineer, I had to send my drawing packages, after a final design approval, to the work preparation department. After a thorough discussion of the drawings and review of all documents, production and assembly were triggered there. I was the main person responsible for ensuring that the work was carried out on schedule and that the required quality standards were met. Accordingly, I was also responsible for all acceptance tests in my projects (FAT & SAT).

- Technical support during fabrication and assembly of components and systems.
  Examples: There was always close cooperation with manufacturing and assembly, as all instruments were designed and built from scratch (rare R&D environment).

- The assembly, optimization and commissioning of mechatronic systems; programming, calibration and performance of tests and preparation of reports.
  At the beginning of my time in the mechanical engineering department (2007 – 2010) I was mainly employed in the laboratory. My tasks there were:
  1. *Evaluation of a suitable laser interferometer (differential interferometer) and measurement environment (a temperature and humidity controlled laminar flow box) in cooperation with the federal institute of metrology (METAS) in Bern. This was later used to measure various mechatronic systems developed by us.*
  2. *Measurement (testing) of various high-resolution micromechanical positioning systems, such as the nano-converter, a flexure-based planar structure that attenuates linear motion amplitudes by a large constant reduction factor between 20 and 1000. The measurements were performed with a laser interferometer in micrometer range.*
  3. *Measurement of the positioning repeatability and accuracy of diverse motion systems for synchrotron beam experiments (x-ray diffraction analysis) using capacitive sensors. The measurements were carried out in the micrometer range.*
  4. *Different measurements and tests (shutter speeds, long time reliability) of beamline components (beam stoppers, attenuators, beam detectors) for the neutron beam facility SINQ and proton therapy facility PROSCAN.*

  For all these tasks I created the measurement setup, the program for the motion sequence and the data acquisition (LabVIEW, PLC, C++). The calibration of encoders and measurement equipment was part of the job. For each measurement, a test report had to be prepared as well.

Department Spallation-Neutron Source
Mechatronics Technician / Lab assistant October 2001 – May 2007

- Conception, development, design (using AUTOCAD / INVENTOR) and optimization of experimental equipment and plants with mechatronic systems. Assignment of suitable methods, components, calculation methods, manufacturing processes and product functionality, taking into account safety, environmental and economic aspects.
  Examples:
  1. *SINQ Target Irradiation Program (STIP I, II and III): Development, design and construction of disassembly devices for irradiated sample containers, suitable for use in hot cells (operable with manipulators and with separate controls outside the cell).*

The necessary components were self-made (using milling machine, lathe, boring mill, etc.).

2. *MEGAPIE spallation source target: Development and manufacturing of various holders and tools for cutting the irradiated beam window of the T91 calotte in a hot cell. Strips were sawn from the calotte and used for further fabrication of tensile specimens using an electrical discharge machine (EDM).*
3. *Concept and design development of a testing device for mechanical tests in liquid lead-bismuth-eutectic up to 450°C together with the design engineering department.*
4. *Development, design and construction of a three-point flexural test fixture in close cooperation with a scientist. Design and fabrication or modification of different sample fixtures (grippers, supports).*

- Mechanical processing of metals; Electrical and control technology.
  Examples: See first bullet point above.

- Assembly, optimization and commissioning of mechatronic systems: programming, calibration, testing, reporting.
  Examples: Development of a remote controlled feeding system for radioactive samples for tensile tests. Stepper motor driven linear guides and pneumatic lifting, turning and gripping units were used together with the necessary proximity switches and encoders. I also designed and manufactured individual parts for this.

- Development of specifications for externally manufactured products, as well as technical advice to internal and external centers.
  Examples: For the SINQ Target Irradiation Program (STIP II and III) I had to specify and organize the fabrication of special sample containers, as well as the fabrication of various material samples (tensile, flexural fatigue, TEM / SP) and their packaging into these containers.

- Release and monitoring of production orders; Acceptance of safety-relevant parts.
  Examples: Release of a production order for a three-point flexural test fixture (see first bullet point). For other examples, see also previous bullet point.

- Preparation of samples in hot cells
  Examples: I used the devices for disassembling the irradiated sample containers that I had developed for STIP I, II and III for use in a hot cell. After the samples were removed from the containers, I had to identify, sort and package them appropriately. This work was done remotely using manipulators and a special telescope for the hot cell. Similarly, as part of the MEGAPIE project, I used the fixtures and tools I developed to produce tensile specimens from the irradiated beam window of the T91 calotte in the hot cell. These samples also had to be identified and packaged appropriately.

- Maintenance of the group's experimental facilities in the hot lab.
  Examples: Maintenance of the remote specimen feeding system for tensile tests (lubrication, cleaning, adjustment, replacement of defective proximity switches, etc.).
  Fabrication, modification, installation and adjustment of diverse sample mounts in testing machines.
  Organizing the maintenance and calibration of the tensile testing, impact testing and 3-point bend testing machine. This work was performed by a certified specialist.

- Decomposition of the MEGAPIE spallation source target in the ZWILAG hot-cell, support of the design department with hot cell expertise and testing of the devices in inactive tests and in the hot-cell.
  Examples: Through my hands-on work experience with hot cells, building and operating equipment to handle samples using manipulators, I was a consultant and tester on the project. During the tests, I operated cranes, manipulators and power manipulators. Many handling tests led to changes in work procedures and designs. Finally, I also instructed the ZWILAG team in the procedures and handling.

- Radiation protection officer in the test group.
  Examples: I received my radiation protection training at the PSI Education Center. For material experiments with radioactive samples or for hot cell operations (cell decontamination), I had to perform dose calculations for the group. These calculations were always cross-checked by the responsible radiation protection officers.

Education

Open University, England (part-time) 2010 – 2017
BSc (Honors) Natural Sciences – Physics

Main area of study: applied mathematics, mathematical physics, fluid mechanics, quantum physics, and electromagnetism.
Final assignment: “An investigation of the physical factors required for HT-superconductors to meet commercial MRI field requirements and thus avoid the need for cryogenic helium.”

Aargau Secondary School for Adults, Switzerland (University Preparatory) 1995 – 1998
School Diploma: Matura Type C – Natural Sciences.

Asea Brown Boveri, Baden Switzerland 1991 – 1994
Apprenticeship as Technical Draftsman
Certificate of Proficiency

Languages: German – mother tongue, English – fluently (o & w), Czech – fluently (o & w).

Qualifications

CAD: Dassault CATIA V5, Solidworks, PTC Creo Parametric, Creo Elements.
Data management: Enovia VPM, Oracle PLM, Windchill PLM.
Programming: C++.
MS Office: Word, Excel, Power Point, One-Note.
MS Teams, MS Project.

Memberships

International Society of Neutron Instrument Engineers (ISNIE).
American Society of Mechanical Engineers (ASME).