# WEB BASED OPERATING MANUAL FOR THE 590 MEV PROTON ACCELERATOR AT PSI

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*The basic principles and procedures for the operation of the 590 MeV Proton Accelerator facility have up to now been collected in a paper based system. This essential archive of know-how has been transformed into a new operation and reference manual using standard web technology. The new tool has been placed on the PSI intranet (http://abe.web.psi.ch/kr/kochbuch).*

## THE KNOW-HOW COLLECTION "KOCHBUCH"

Starting, setup, commissioning operating and optimising the 590 MeV proton accelerator facility is a highly elaborate task. One has to take care of hundreds of different elements affecting the beam, every one having its own particularities. Magnets need several cycles of being ramped up and down for precise setting. Establishing the proper working point of RF structures depends on the appropriate temperature distribution. Low activation of machine components requires detailed knowledge, where and how the beam has to be cleaned along its path. The extremely low level of extraction losses of less than 0.7 ‰ for the high intensity proton beam of more than 1.8 mA is the result of years of practice.

This huge amount of detailed experience and ideas up to now has been collected into three baskets according to the logically separable domains:

1. The single components' documentation,
   where the main components in each section of the beam path are described, along with their standard parameter settings. Constantly updated by the specialists this is a very useful source for the expert user. However, as an overview guideline is lacking, this information is not easily accessible to a freshman.
2. The collection of Help Files
   contains a huge amount of information about the facility. The way to proceed for fine tuning at various locations many descriptions of particular characteristics and behaviour of every important component are collected in a series of small text files. These have been written as conclusions summarising the results of beam development sessions. With the large number of files the absence of an overview is even more hindering the use of this information resource by non-experts.
3. The collection of procedures
   is the part that can most easily be transferred to the new operating manual. Part of the material can be taken over to the new reference after careful inspection. Another part needs adaptation to changes having occurred and yet another part is kept to provide insight into the beam behaviour although these procedures are not used any more. Many items of this kernel part of the operating manual consist of sequences of statements similar to recipes in a cooking book. Therefore the whole operating manual is nicknamed "Kochbuch" among insiders.

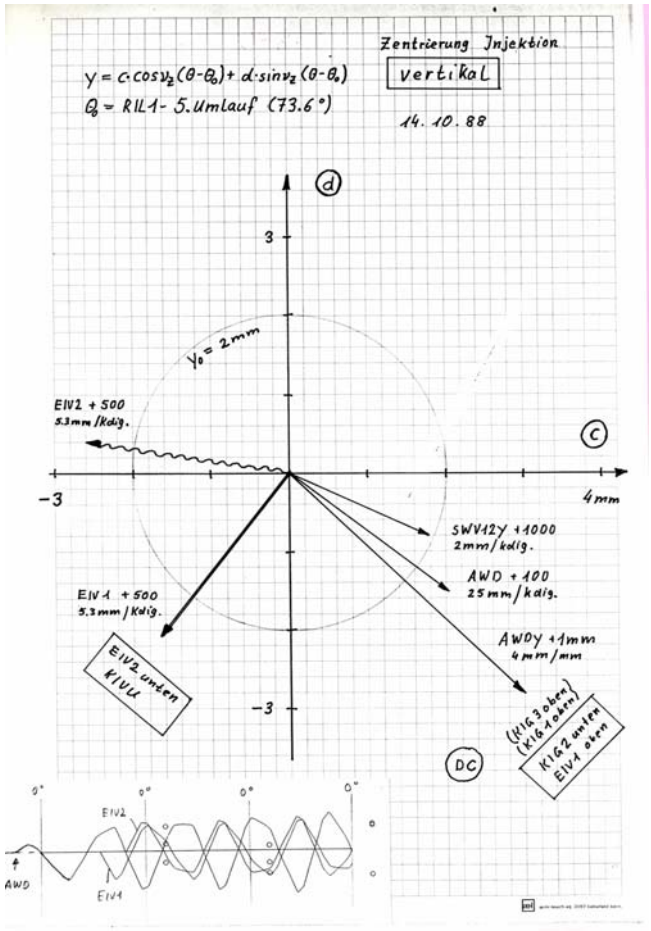


**Fig. 1:** Example of the paper based documentation: influence of injection elements to betatron amplitudes and phases.

## REVIEW OF THE EXISTING DOCUMENTATION

As a first step the existing documentation has undergone a complete review. The discrimination whether an item was transferred, modified or dropped had to be done according to today's needs, but also based on long-range experience. As an example, there exists a detailed instruction, how to thread the beam across injector 2 using the movable stop block of the current probe RIL1, slowly adapting the main magnetic field. This procedure, evolving from the time when reproducible parameter setting based on previous production runs was not available, is hardly used nowadays, but might become indispensable in case of data loss.

A recipe can as well describe a nice bit of accelerator physics: In times, where injector 2 had a flattop system, the phase deviation during the acceleration could be checked by just distorting the 3rd harmonic RF phase and observing an eventual change of the extraction radius. As injector 2 is not equipped with a flattop system any more this procedure lacks actuality, but nevertheless should not get lost.

A major part of the actualisations consisted of adapting the operator instructions to changes of the program functionalities and of the graphic user interface. This work was not a spectacular activity but had to be done carefully. An important issue is the looking at the collected information from the viewpoint of a newcomer: Is it understandable for an inexperienced person or does it contain hidden references to insider knowledge?

**TRANSCRIPTION INTO A WEB BASED SOLUTION**

The approved and actualised recipes have been transferred into a web structure. The tree of operating instruction sequences is now implemented in the PSI intranet. The careful revision that has been done allows the operators to gain confidence into the new "Kochbuch". The large amount of cross-references that could easily be implemented in the web design yields a better overview immediately. To provide a guideline and the links to the large repository of help files will require a substantial amount of further work.

So far the manual is divided into two main sections with the hints how to proceed and an appendix.

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| Section 1 | Preparatory procedures: what to do before the beam is accelerated. |
| Section 2 | Set-up and tuning: what to do in order to deliver the beam to the beam lines, reducing the losses and thereby being able to increase the beam intensity. |
| Appendix | The appendix contains the descriptions of the various procedures mentioned in the above sections. Some procedures, however, are used seldom or not regularly and cannot be integrated in a step by step instruction. |

The sections as well as the appendix are ordered according to the facility structure: from the ion source across the cyclotrons and along the beam lines, leading to the secondary particle targets. As a next step it will be illustrated with pictures and graphs.

**ACKNOWLEDGEMENTS**

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## SAUBERER STRAHLAUFBAU BIS BI1

1. Die Resonatoren müssen ungefähr zwei bis drei Stunden eingeschaltet sein, damit sich deren Betriebstemperatur stabilisiert hat.
2. RIL1 Sonde an der Konsole anwählen und ganz einfahren.
3. KIP2 langsam öffnen bis Strahl auf RIL1I4 erscheint (max. 2 μA).
4. RIL1 Sonde mit Konsolen-Knopf langsam ausfahren und Strahlstrom auf RIL1I4 durch periodisches Nachstellen von AIHS.FEIN maximal halten, bis Strahl auf RIL1 verschwindet und auf BI1 erscheint.
5. Wenn AIHS.FEIN an einem Endwert ansteht mit AIHS.SOL abtauschen (1 Digit AIHS.SOL = 10 Digit AIHS.FEIN).

## STRAHL AUF BX2 BRINGEN

1. Betriebsmode und Einstellwerte der Quadrupole und Spalten bis BX2 überprüfen.
2. Zentrierung bis BX2 und Blendendisplay BX2 starten.

**Fig. 2:** 72 MeV proton beam extraction from injector 2 as an example of a recipe.