Summary of the 3rd IPHI/SPL Collaboration Meeting

CERN – 28 & 29 April 2003

Editor . R. Garoby

Abstract

The third IPHI/CERN collaboration meeting took place at CERN on April 28 and 29, 2003, as foreseen in October 2002. In addition to the usual goals of reporting and analysing the progress of the various tasks, an important aim was to agree on the modification of the Memorandum of Understanding and to define the procedure leading to its signature.
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1. PRELIMINARY REMARKS

The third IPHI/CERN collaboration meeting took place at CERN on April 28 and 29, 2003, as foreseen in October 2002 [1]. The agenda is given in Annex 1 and the list of participants in Annex 2.

In addition to the usual goals of reporting and analysing the progress of the various tasks, an important aim was to agree on the modification of the Memorandum of Understanding and to define the procedure leading to its signature.

2. OUTCOME

All laboratories involved in the collaboration suffer from decreasing resources. In such a context, it is especially worthwhile to underline the quality of the talks and the important advances that have been presented [2].

2.1. Status and planning

2.1.1. Progress since last October (R. Garoby)

Starting from the on-going activities already supported in the frame of the IPHI-CERN collaboration, efforts have been invested since last October to coordinate better the development of other components of pulsed high proton linacs inside Europe. This has lead in particular to the preparation of the HIPPI Joint Research Activity which has been proposed for support inside ESGARD by the 6th Framework Programme of the European Union. The proposed 5 years JRA will accelerate the R. & D. for beam dynamics and accelerating structures (both normal and super-conducting), and ultimately give an ideal basis for the selection of optimum technological solutions for the energy range from 3 to 200 MeV.

At CERN, a working group has been created, inside the AB division, to analyse the user needs and the possibilities of evolution of the proton beams at CERN. Summary and recommendations will be published at the end of 2003.

The design of the beam dumps has now seriously begun, and their progress will be presented during the present meeting. The CERN controls group has been made aware of our goals and will start to participate, although initially at the consultancy level.

Means are being defined to improve communication between the multiple teams.

2.1.2. Status of the IPHI programme (P.Y. Beauvais)

The status of the IPHI programme has been the subject of a detailed report. Since the adoption of 3 MeV as the output energy last October, the diagnostic line has been redesigned as well as the beam dump for the CW beam at Saclay. A noticeable outcome of the
corresponding investigation (confirmed by a similar conclusion independently drawn by a CERN team in the mean-time) is that Copper can safely be used without risk of activation. The move of people and equipment at Saclay has mobilised the efforts of CEA contributors. The preparation of sub-systems is progressing well compared to the construction of the RFQ itself, which has suffered from the bankruptcy of the initial contractor (SICN), complicated by the change of the final energy. The CERN brazing workshop is now an integral partner. Efforts are being deployed to re-gain the delay and maintain the delivery of the IPHI equipment at CERN during the year 2006.

2.2. Progress of the technical developments

2.2.1. Beam instrumentation, beam dump, diagnostic line… (P. Ausset)

A broad range of beam instrumentation will be necessary to characterise the performance of the IPHI set-up. These beam diagnostics were presented (DCCT, Faraday cup, wire scanner, fluorescence based measurements, B.P.M.s, …). Taking into account the evolution of the IPHI energy, a new beam diagnostic line has been designed to transport safely the 3 MeV proton beam accelerated by the RFQ. Moreover, a new and less expensive high power beam dump is now under design.

2.2.2. Low & High level RF, Controls… (M. Desmons, P.Y. Beauvais)

Matching the hardware and experience available, a self excited loop will be used for the control of the field in the RFQ. Completion and delivery is expected by the end of 2003. Two klystrons are needed to accelerate 100 mA of beam up to 3 MeV in IPHI. One klystron will provide up to 920 kW through two RF windows. The second klystron will be connected to a third window, and will deliver only a maximum of 460 kW. In the process of adapting the CERN HV transformer to 15 kV, damage was observed on the low voltage windings which had to be also replaced. The first tests of the high voltage power supply are scheduled for January 2004. Controls were described, using SILHI as an approximate model of the future IPHI installation. EPICS is being used. For historical and economical reasons, heterogeneous hardware and software are employed. Differences with the solutions implemented at CERN amply justify the involvement of a CERN accelerator controls expert at an early stage.

2.2.3. H- source, Chopper line hardware and beam dynamics, Beam dumps, Halo measurement … (T. Steiner, A. Lombardi, L. Bruno, M. Hori, F. Caspers)

Work has just started on the development of a prototype ECR H- source at CERN. H- ions have recently been obtained for the first time, without RF. Beam dynamics in the chopper line has been studied in more details. The chopper represents an aperture restriction. The estimated loss amounts to 30 W in the test stand, which could be reduced with an iris. The engineering lay-out of the chopper line is now refined, and all equipment can be accommodated. Once equipped with the time-resolved profile measurement device, this set-up will be very useful for halo studies, as proposed in HIPPI. The beam dump for the chopped beam, which until recently was just a place-holder in the lay-out of the chopper line, has now been studied and the bases for a sound engineering design have been worked out. The space needed and the technological choices have been defined. A detailed technical design is about to begin.
To fully characterize the chopped beam at 3 MeV, a gated time-resolved spatial profile monitor is being developed. This instrument will be able to measure halo. Based on secondary electron emission by a screen inserted in the beam path, it will use a micro-channel plate and pulsed high voltage to achieve the required dynamic range. The detector should be completed in April 2004 and tested with a UV laser in the AD experimental hall. First tests with beam can be planned at Saclay, as soon as beam will be available from IPHI. The chopper itself is progressing, and Moly-mangan printing technology is now considered as the solution of choice. A test procedure has been defined to check without beam the operation of the combined low and high frequency chopper drivers. The basic principle was demonstrated in the laboratory.

2.3. Memorandum of Understanding

An up-to-date official document is clearly necessary, recapitulating the present goals and means of the IPHI/CERN collaboration. After discussion, the decision has been taken to prepare it as an “additional clause” to the existing MoU. It will specify that:

- the IPHI RFQ is meant to be installed at CERN after having been properly characterised in CW mode with beam at Saclay. The detailed list of equipment that will be delivered to CERN will be the subject of a separate document, to be approved by the “Technical Committee” of the collaboration.
- this transfer to CERN is presently planned to take place at the end of 2006.
- CERN takes responsibility for brazing the RFQ sections. This includes commitments in planning to be defined in detail by the people in charge in a separate document, and to be approved by the “Technical Committee”.

M. Jacquemet, Y. Terrien and M. Lieuvin will prepare a draft of the “additional clause” to be discussed in the IPHI steering committee meeting of the 14th of May and sent to CERN immediately after.

The members of the “Technical Committee” have to be nominated by the directors of the different laboratories in the near future. The first meeting will take place at CERN on the 13th of June, to finalise:
- the detailed list of equipment to be delivered to CERN,
- the precise terms of the CERN commitment to the planning of brazings.

P.Y. Beauvais will re-circulate his proposal for the detailed list of equipment, asking for corrections and comments.

CEA and IPNO specialists will negotiate with S. Mathot (CERN) for the terms of the CERN commitments for brazing.

3. FOLLOW-UP

The next Collaboration meeting is tentatively planned for October 2003 in Orsay (IPNO).
REFERENCES

ANNEX 1: Agenda of the 3rd IPHI/CERN Collaboration meeting

Monday April 28

**Morning [PS Auditorium (Bdg.6 / 2nd floor)]**

<table>
<thead>
<tr>
<th>Topic</th>
<th>Speaker</th>
<th>Duration</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall progress and expectations</td>
<td>R. Garoby</td>
<td>20’ + 10’</td>
<td>9h30 – 10h00</td>
</tr>
<tr>
<td>Status of IPHI construction; updated plans and schedule</td>
<td>P.Y. Beauvais</td>
<td>30’ + 10’</td>
<td>10h00 – 10h40</td>
</tr>
<tr>
<td>Coffee break</td>
<td></td>
<td></td>
<td>10h40 – 11h10</td>
</tr>
<tr>
<td>3 MeV RFQ matching section, instrumentation, beam dump</td>
<td>P. Ausset</td>
<td>40’ + 10’</td>
<td>11h10 – 12h00</td>
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<tr>
<td>Lunch</td>
<td></td>
<td></td>
<td>12h00 – 14h00</td>
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</tbody>
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**Afternoon [PS Auditorium (Bdg.6 / 2nd floor)]**

<table>
<thead>
<tr>
<th>Topic</th>
<th>Speaker</th>
<th>Duration</th>
<th>Time</th>
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<tbody>
<tr>
<td>Discussion on M.o.U. content and definition of steps towards signature</td>
<td></td>
<td></td>
<td>14h00 – 16h00</td>
</tr>
<tr>
<td>Coffee break</td>
<td></td>
<td></td>
<td>16h00 – 16h30</td>
</tr>
<tr>
<td>Status of development of H- at CERN</td>
<td>T. Steiner</td>
<td>20’ + 10’</td>
<td>16h30 – 17h00</td>
</tr>
<tr>
<td>RFQ tuning, low level RF, RF power</td>
<td>M. Desmons</td>
<td>20’ + 10’</td>
<td>17h00 – 17h30</td>
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Tuesday April 29

**Morning [PS Auditorium (Bdg.6 / 2nd floor)]**

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<thead>
<tr>
<th>Topic</th>
<th>Speaker</th>
<th>Duration</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>IPHI controls</td>
<td>CEA</td>
<td>20’ + 10’</td>
<td>9h00 – 9h30</td>
</tr>
<tr>
<td>Results of chopper line beam dynamics study</td>
<td>A. Lombardi</td>
<td>20’ + 10’</td>
<td>9h30 – 10h00</td>
</tr>
<tr>
<td>Conceptual design of chopper and 3 MeV dumps</td>
<td>L. Bruno</td>
<td>20’ + 10’</td>
<td>10h00 – 10h30</td>
</tr>
<tr>
<td>Coffee break</td>
<td></td>
<td></td>
<td>10h30 – 11h00</td>
</tr>
<tr>
<td>Conceptual design of halo measurement device</td>
<td>M. Hori</td>
<td>20’ + 10’</td>
<td>11h00 – 11h30</td>
</tr>
<tr>
<td>Status of chopper developments</td>
<td>F. Caspers</td>
<td>20’ + 10’</td>
<td>11h30 – 12h00</td>
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<tr>
<td>Lunch</td>
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<td>12h00 – 14h00</td>
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**Afternoon [Laboratories and workshop]**

<table>
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<tr>
<th>Topic</th>
<th>Speaker</th>
<th>Time</th>
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</thead>
<tbody>
<tr>
<td>Visit to brazing workshop (Bdg.112)</td>
<td>S. Mathot</td>
<td>14h00 – 15h30</td>
</tr>
<tr>
<td>Visits and presentation of chopper and driver hardware</td>
<td>F. Caspers, M. Paoluzi</td>
<td>15h30 – 16h30</td>
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ANNEX 2: Participants to the 3rd IPHI/CERN Collaboration meeting

CEA-Saclay
P.Y. Beauvais, P. Debu, M. Desmons, M. Jacquemet, Y. Terrien

CERN:
+ C. Wyss

IPNO:
P. Ausset, M. Lieuvin