SUMMARY of the Session on "Topics of High Intensity Accelerator Technology"

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'TOPICS of High Intensity Accelerator Technology' were discussed at one of the parallel sessions on the afternoon of Thursday, 25 October. During the four hour session, there were eight formal talks followed by questions, and one short informal discussion on stripping foils and injection 'painting' techniques. Reports relating to the eight talks are included in the conference proceedings and the afternoon programme was as shown, but with the informal discussion included between the items A-12 and A-13:

A-8 T Suzuki; Review talk on beam instability at low energy.

A-9 R J Macek; Improvements to intensity at the Los Alamos Proton Storage Ring.

A-10 G I Batskikh°, B P Murin, A P Durkin, O J Shlygin and I V Shumakov; High power 'Regotron-type' microwave generator for intensive technological accelerator.

A-11 I Yamane; Treatment of H^0 and H^- beams spilled at the stripper foil in the full energy charge exchange injection scheme.

A-12 I Yamane; Perfect matching for the two-step H^0 injection into a ring with a DBFO lattice.

A-13 T Kawakubo°, S Tazawa, Y Arakida and S Murasugi; Systems for generating double pulse magnetic fields in a kicker magnet.

A-14 Y Mori; Intense negative ion source.

A-15 S Ninomiya°; S Tazawa, Y Yoshii, M Toda and T Katori; Present status of the test RF system for the KEK PS Booster.

° = speaker

These topics cover a wide range and will be discussed separately instead of in a general context. Only brief comments are given, as the details are available in the separate reports.

I. T SUZUKI; REVIEW TALK ON BEAM INSTABILITY AT LOW ENERGY

The review talk covered the relevant beam instabilities for low energy circular accelerators. Two areas were identified as being still not fully understood and these areas are the longitudual microwave instability and the basic transverse space charge limit for a ring. For the former, the intability threshold and growth rate is usually estimated from assumed values for the total ring impedance. (It is the opinion of one of the session chairmen (GHR) that an estimate for the total ring impedance is insufficient and that estimates for the individual ring impedances are required.) For the latter, the basic transverse space charge limit is found to vary widely for different rings, with typical values for the maximum tune depression in the range 0.25 to 0.6. More elaborate space charge codes are required to study the effect in more detail.

II. R J MACEK; IMPROVEMENTS TO INTENSITY AT THE LOS ALAMOS PROTON STORAGE RING

A factor of 4.6 improvement in percentage beam loss has been achieved over the last two years, following careful experimentation and development. Miscellaneous improvements have contributed a factor of 1.4, the use of 'off-set' H° injection a factor of 1.7, the use of a 'postage stamp' stripping foil a factor of 1.5 and a change in the betatron tune a factor of 1.3. The present stripping foil has a thickness of 200 $\mu gm/cm^2$ and this gives a 9% loss of unstripped beam, which presents no problem, as it is directed to a shielded external beam dump. Average extracted proton beam currents have now reached 70 μA and, at this level, the internal loss is approximately 0.5 μA. This is considered to be an upper limit for hands-on maintenance of components, and so further improvements are needed before proceeding to higher intensity. A number of suggestions have been made for possible improvements but scheduling and funding dictate the plans and rate of progress. All wished the PSR group future success.

III. G.I. BATSKIKH ET AL; HIGH POWER "REGOTRON-TYPE" MICROWAVE GENERATOR FOR INTENSIVE TECHNOLOGICAL ACCELERATOR

A new very high power microwave generator is under development for power source evaluation in relation to a 300 mA linac, needed as a "burner reactor" for the transmutation of long lived radionuclides. Under development at the Radiotechnical Institute, Moscow, is a pulsed model at 3000 MHz to provide 3.5 MW. Performance figures have also been calculated for CW power sources at frequencies of 350, 600 and 900 MHz. Planned for the linac are the use of the 600 MHz units at a 6 MW power level and a 70-80% efficiency. Initial klystron (or magnetic) bunching is utilised and there are a number of pairs of active and passive cavities for power 'take-off'.

IV & V. I YAMANE; STUDIES OF H° AND H^- INJECTION FOR JHF

The relative advantages of H° and H^- injection have been considered for the JHF project and an optimised H° system has been evaluated in detail. There are many fewer hardware components for the H° system and the straight section requirement is thus much reduced. This led to its choice for use with the original FODO storage ring lattice. However, a new racetrack lattice has now been evaluated which allows the inclusion of both an H° and an H^- injection system. This appears a wise precaution for there is some emittance growth with the H° scheme and there also appears to be more flexibility for painting with the H^- beam. A detailed comparison of 'painting' procedures for the two schemes is next required.

VI. INFORMAL DISCUSSION ON STRIPPING FOILS AND PAINTING

Descriptions were given of the stripping foils used or proposed at PSR, INR (Moscow) and RAL. The "postage-stamp" type foil used at the PSR consists of two 100 μgm/cm^2 foils supported on a backing of 4-5 μcarbon fibre wires; the technology is a spin-off from SDI research. Foil shrinkage ultimately leads to breakage. Research at INR is directed towards the development of a different type of graphite foil, formed by glow-discharge cracking. RAL has undertaken some development for a TRIUMF foil requirement. An Al_2O_3 foil of 100 μgm/cm^2 is first made which is supported on three edges. Then the foil is separated from part of the rear support and folded to make a foil with two unsupported edges. Removing stress from the foil is very important and initial studies appear promising. Finally there was a brief discussion on the possibilities for correlating the beam distributions in the different phase planes by the choice of the 'painting' procedures.

VII. T KAWAKUBO ET AL; SYSTEMS FOR GENERATING DOUBLE PULSE MAGNETIC FIELDS IN A KICKER MAGNET

The JHF has a requirement for its storage ring kicker magnet to extract separately the two circulating proton bunches. The interval between these two extractions is approximately 100 μs. The method adopted has been the feeding of the kicker from two separate thyratrons; cathode and anode loaded systems have been compared. The cathode system was found to give mis-firing but the anode loaded system has worked successfully at half the voltage levels required for the JHF. Next, a full voltage system is to be tested.

VIII. Y MORI; INTENSE NEGATIVE ION SOURCE

The JHF I GeV linac requires a low emittance, low caesium level ion source beam to feed its injector RFQ linac. The low caesium level is to prevent contamination of the surfaces of the RFQ. A volume production source has been under study using a permanent magnet cusp field and a long lifetime LaB_6 filament operating at 1400°C only. The source has been found to give a few mA output H^- beam when no caesium is used and an increased beam by a factor of 4 or 5 for a low level of caesium. The physics of the source has been under study and laser diagnostics have been used for surface work function evaluation. Studies will continue in order to establish whether the H^- enhancement is a surface or a plasma effect. The source is found to have a low emittance at its exit, but next to be evaluated is how to preserve this low emittance in the subsequent beam transport.

IX. S NINOMIYA ET AL; PRESENT STATUS OF THE TEST RF SYSTEM FOR THE KEK PS BOOSTER

Detailed studies had been undertaken of the RF control loops, including the coupling effects due to the beam loading. It had been concluded that feed-forward beam compensation was required, and a direct beam feed-forward system had been developed. The system had been found to reduce the effect of a cavity parasitic resonant mode. Also studied had been the effect of a reduction in the cavity Q at the top operating frequency and estimates had been made of the resulting temperature gradients in the cavity ferrite.