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PROTONS FOR PREVESSIN

Summary of meeting No. 9, May 27th, 1976.

Present

O. Barbalat, F. Bonaudi, D. Dekkers, B. de Raad, P. Faugeras, D. Fiander, J. Gareyte, B. Godenzi, W. Hardt, H. Koziol, A. Krusche, P. Lefèvre, D. Möhl, G. Nassibian, G. Plass, K.H. Reich, C. Steinbach, E.J.N. Wilson, C. Zettler.

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1. MULTIPULSE FILLING OF THE SPS

D. Fiander introduced the interim report of the PS Multipulsing Working Group (PS/AE/Note 76-11). This report covers:

- The possible transfer schemes (2 x 5 turns, 3 x 3 turns, 5 x 2 turns, 10 x 1 turn by fast extraction).
- The problems of PS cycle time reduction (0.65 or 0.6 sec seems a natural limit which would be very expensive to exceed).
- Radiation damage and reliability problems.
- Preliminary cost estimates (8 to 12 MFr.)

B. de Raad thanked the PS group for their excellent work.

a) Cycle time reduction

PS is encouraged to proceed with these studies and to present as soon as possible a complete design proposal for approval by the CERN Management. In 2 years from now, when the North Area will come into operation a typical SPS cycle might have an intermediate flat top at 200 GeV, with fast and slow extraction for the RF separated beam and the counter experiments in the West Area, and a flat top at 400 GeV with slow extraction to the North Area, followed by fast slow extraction to the neutrino experiments. To satisfy simultaneously all these different experiments it will be necessary to increase the SPS intensity at least to several times 10^{13} protons per pulse.

The counter experiments will have a strong demand for a long flat top. For a flat top at 400 GeV of a duration in excess of the "standard" length of 0.7 sec it is necessary to allow some waiting time in between cycles in order to keep the average power dissipation in the SPS main rectifiers to within the permissible limit. For instance, with a flat top of 1.5 sec at 400 GeV and (for simplicity) without an intermediate flat top at 200 GeV the SPS cycle lasts 5.6 secs but we would need a waiting time between cycles of 1.2 sec leading to a total cycle time of 6.8 secs. In this situation the intensity per pulse of the SPS can be increased a factor 3 by multipulsing the CPS and filling the SPS 3 times with a 3 turn continuous extraction, without any loss in SPS repetition rate, the latter being determined by the SPS thermal dissipation. Out of the 6.8 secs repetition time there would be 6.8 - 3 x 0.6 = 5 secs available for 25 GeV physics ISR which would allow 2 standard cycles of 2.4 secs. The average number of protons available for 25 physics and ISR is then reduced by only about 10% compared to the present situation during SPS operation. It is clear that many variants of SPS flat top duration, waiting times and filling schemes can be considered and optimised but as a general rule it can be stated that the PS must be able to accelerate to the largest possible number of protons per unit of time in order to be able to serve efficiently all its different customers.

Submittal of a proposal for a reduction of the PS complex cycle time is however dependent on tests and discussions on power delivery with the SIG. Compatibility with ISR has also to be checked.

The power swing of the magnet of the PS Booster is about 11 MW which is almost negligible compared to the nearly 200 MW power swing of the SPS magnet rectifiers which are supplied by a special 380 kV line connected to a strong point in the EdF grid in Genissiat consequently one can be confident that there will be no objections from EdF against supplying the PS Booster via the existing 220 kV cable between Lab.II and Lab.I. If SIG would be reluctant to agree to the increase power swing of the PS Booster, they could not reasonably object if CERN proposes that the PS Booster is supplied by EdF.

b) Selection of a transfer scheme

In terms of a total project amount of ≈ 10 MFr. the cost differences between the various schemes are small (less than 1 MFr). Filling with 3 PS cycles raises no significant hardware problems. For schemes involving more than 3 PS cycles work is required on the PS ejection system, one needs new injection kickers for the SPS (a design with 2 sets of modules which could be fed in series or in parallel and which can cope with any of the filling schemes discussed above is under study), and an RF trapping scheme adapted to shorter gaps. Beyond $5 \cdot 10^{13}$ p/p even the 3 SPS cavities (2 installed, 1 ordered) would not suffice and a second SPS RF system would be needed.

It was felt that the selection of a scheme was somewhat premature. Much depends on the progress of the SPS running-in, the improvement prospects of the peak intensity per PS pulse and the demands of the physics program. Various tests and machine study

sessions will hopefully be performed on the SPS before the end of the year and should give a clearer picture. It was however stated that a project can be submitted without having to select the particular transfer scheme.

c) Reliability

Since multipulsing will involve increased radiation damage to PS components and increased stressing of some elements the project includes the rebuilding of the TIK and the acquisition of additional spares. It was stated that if the uncertainty on kicker lifetime is such that doubt exists now on TIK reliability, it should in any case be replaced or upgraded independently of this project and included in the general PS reliability programme.

d) Conclusion

The 3 aspects of selection of transfer scheme, cycle time reduction and PS reliability are rather decoupled, technically. One should not however undertake any one of them without consideration of the others.

G. Plass proposed to present in Autumn 1976, a balanced proposal covering a 2 - 3 years programme, taking into account the various constraints. One would aim at making most of the financial committment in 1977, possibly even some in 1976.

2. FAST CYCLING BOOSTER

Another way to increase the SPS intensity is to build a fast cycling Booster. This project is however of another order of magnitude both in cost and in time scale compared with PS multipulsing. E.J.N. Wilson suggested to update the existing design and discuss it at a future meeting. This was accepted provided that it does not delay the present work on multipulsing.

3. SPS RUNNING-IN

B. de Raad gave a brief summary of the results of the first running-in sessions. They are very encouraging, the basic elements (magnets) are all right and the weakness of third and fourth order resonance gives the potential for acceleration of high intensity beams with large transverse emittance.

In order to allow PS people to follow better the progress of SPS running-in it was agreed that the SPS Secretariat would send a copy of the SPS Commissioning reports for the PS notice board.

O. Barbalat

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