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T E C H N I C A L   N O T E 4 November, 1985

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Subject: PROPOSED DESIGN OF THE PROTON DUMP FOR ACOL

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1. INTRODUCTION

The dump located in the target area will be used to stop the protons after the antiproton production target. The dump is composed of a number of steel blocks. Radiation shielding (concrete blocks) will be placed round the dump.

2. SPECIFICATION

Given by R. Sherwood in October -85.

1. Beam characteristics: 26 GeV, $2.0 \cdot 10^{13}$ ppp, 2.4 sec.

2. Required length of steel: 2.4 m.

3. Worst case: no target in place, all protons directly into the dump.

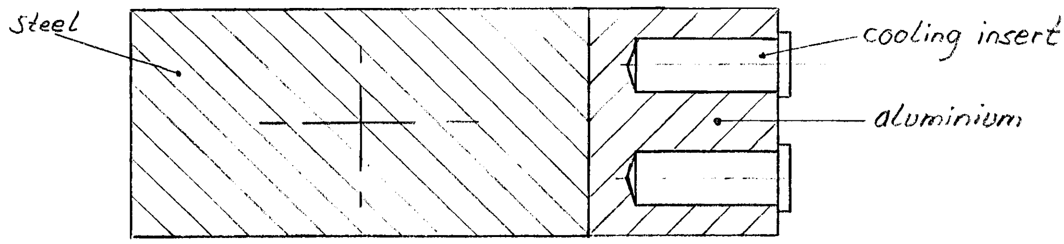
4. The energy is deposited on a ϕ20 mm area with distribution in longitudinal direction according to fig 1.

5. Remote changing of pipes in the cooling system must be possible.

3. PROPOSED DESIGN

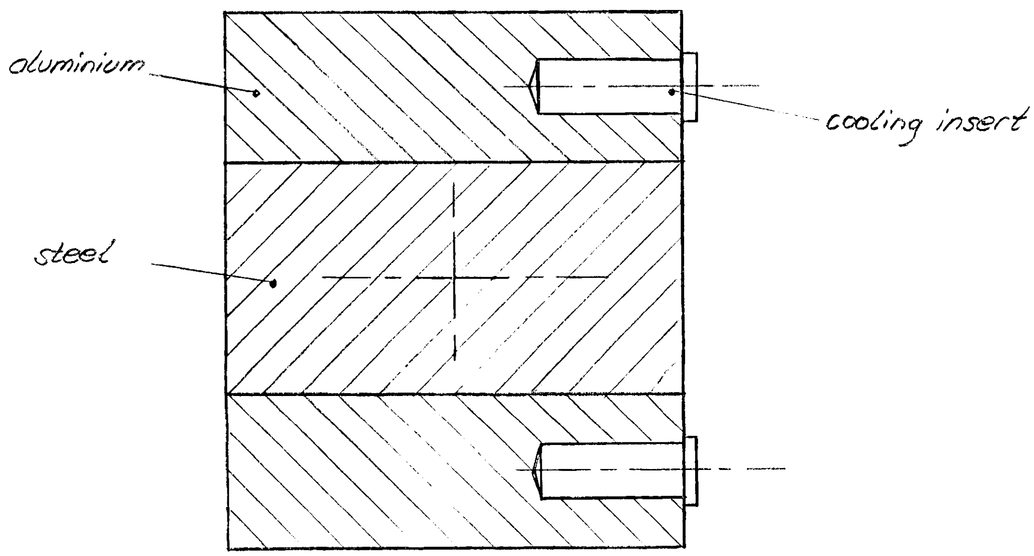
Three different designs have been studied.

The first is a design similar to the old dump in the AA. The steel blocks are cooled indirectly via aluminium blocks equipped with cooling inserts.

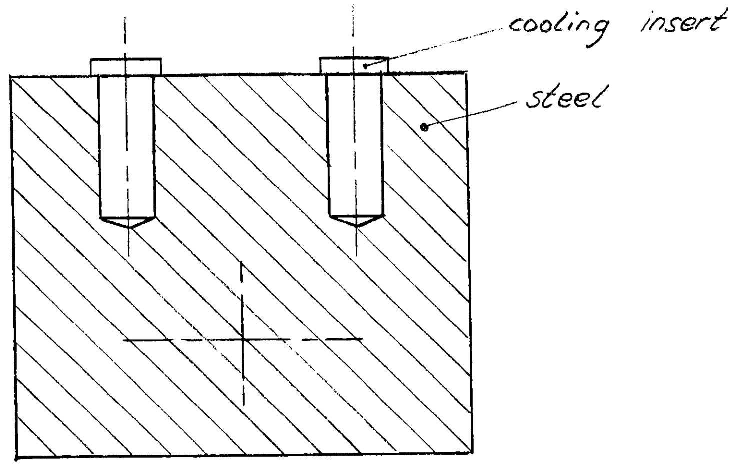


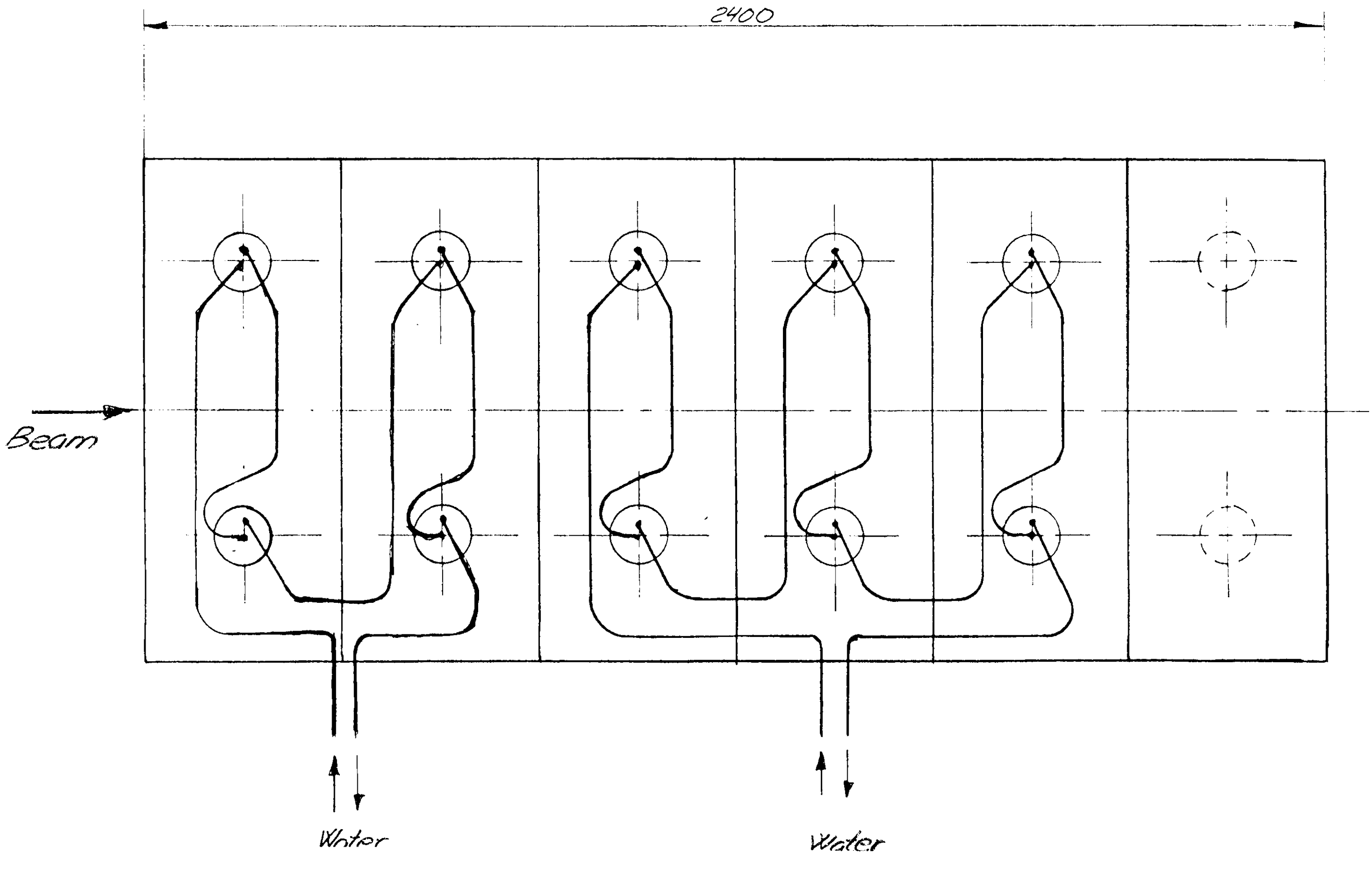
This design has to be discarded because there is not enough space in vertical direction between the dump and the dog-leg magnets.

The second design (proposal from Beriatec) also uses the principle of indirect cooling of the steel blocks, via cooling inserts in aluminium. In order to obtain good thermal conduction between the steel and the aluminium , heavy bolted joints are needed. The contact surfaces also have to be machined flat and to a low roughness.



The third design is a simpler solution with the cooling inserts put directly into the steel blocks. The dump consists of six blocks, each with a weight of about 2500 kg. Each block except the last, has two cooling inserts. The cooling system consists of two circuits.
A detailed analysis of the heat flow in the blocks and of the cooling system has been performed for this design.





4. HEAT TRANSFER ANALYSIS

This calculation shows that each block, except the last, needs two cooling inserts. No outer cooling of the last block is needed, the deposited energy is low here.
The two first blocks form one circuit and the next three the second. Each circuit consumes about 7.5 liter/min. The corresponding pressure drops are 4.3 and 6.4 bar respectively.
A finite element analysis (DOT) of the warmest block shows that the max temperature can raise to about 520 °C for the worst case (no target in place and beam offset).
The temperature distribution is shown in fig 2.

5. CONCLUSIONS

The third design has the following advantages over the second:

- we can save 6000 kg aluminium (35000 Sfr).
- no expensive machining of large contact surfaces.
- easier assembly, no bolted joints are needed.
- easier handling of the blocks.
- no heat transfer losses over the contact surfaces.

Fig.1 Energy deposition in longitudinal direction

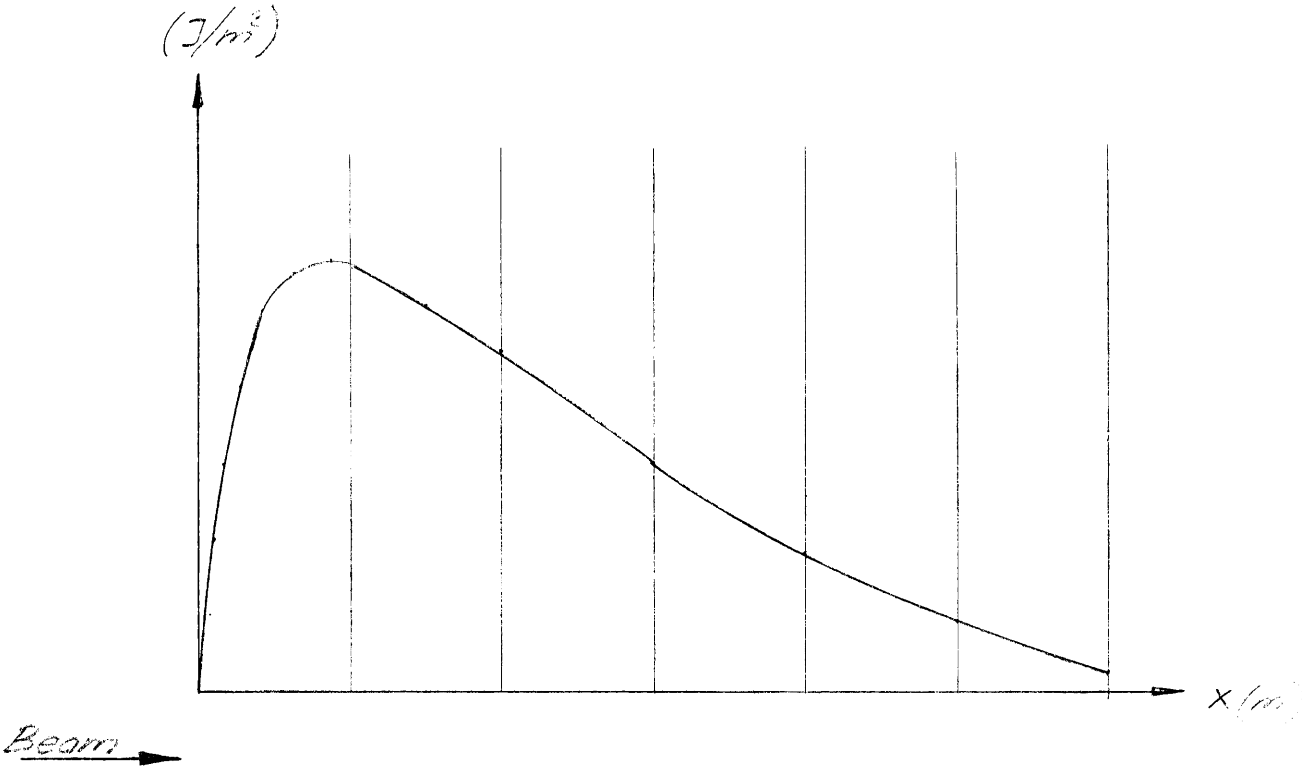
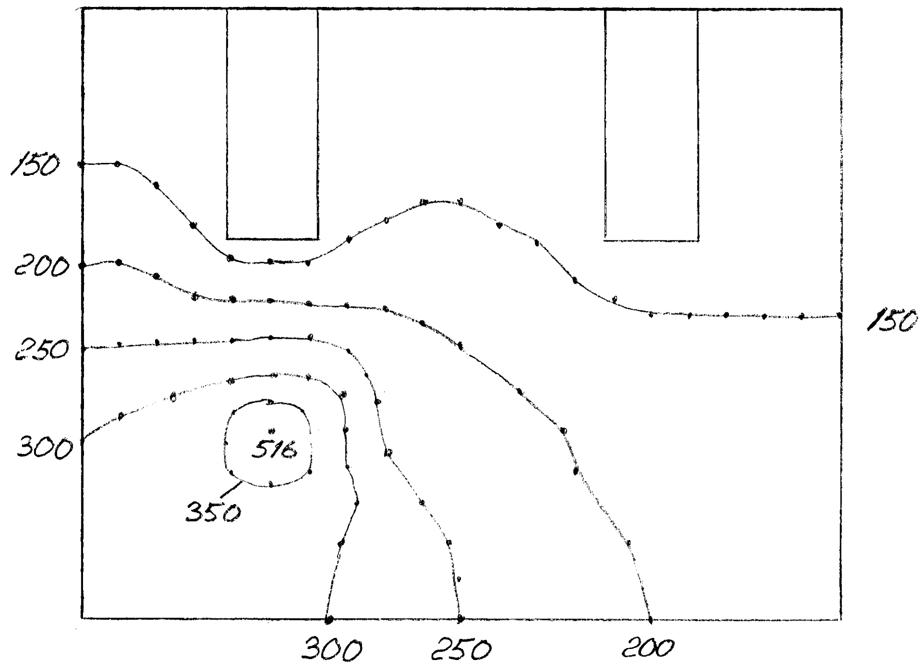


Fig. 2 Temperatures in the dump (°C)

a) Beam offset



b) Beam in center