30 milliseconds before us. In this condition, with a 60 cm roof of ordinary reinforced concrete in our block-house, the radiation dose is low and we work there about 20 hours per week. We think that, at least for our chamber, which works with methyl-iodide, it is very useful to stay in the block-house, near the chamber, to see the tracks, to telephone immediately to adjust the number of beam particles going into the chamber, to adjust the light delay, the pressures, etc.. Obviously the conditions for the operator's health must be very seriously controlled but we think that two people working near the chamber might save much machine time. Furthermore, I would not like to leave a chamber alone, particularly if it works with liquids that are toxic or corrosive.

Rousset : I would like to add that the radiation dose in our block-house is about 4 times less than in the control room of the machine.

Loria : When using remote control we use polaroid pictures, in order to be sure that the chamber is working properly before entering into operation. Polaroid pictures can be of good quality, give a good indication about the chamber conditions, but are not good enough to allow physical information to be taken from them.

III.2. M. Bloch - The experimental arrangement of the Ecole Polytechnique bubble chamber BP2 at Saturne.

Our chamber is made of stainless steel and the dimensions are 35 x 25 x 20 cm^3. It is enclosed in a safety tank. Photographs are taken through the window of the safety tank, as shown in Figure 4, where the beam is represented perpendicular to the plane of the Figure.

The chamber is inside a trailer and can be transported from the Ecole Polytechnique to Saclay in the trailer. Most of the equipment is also inside the trailer, except nitrogen racks, compressor, etc...

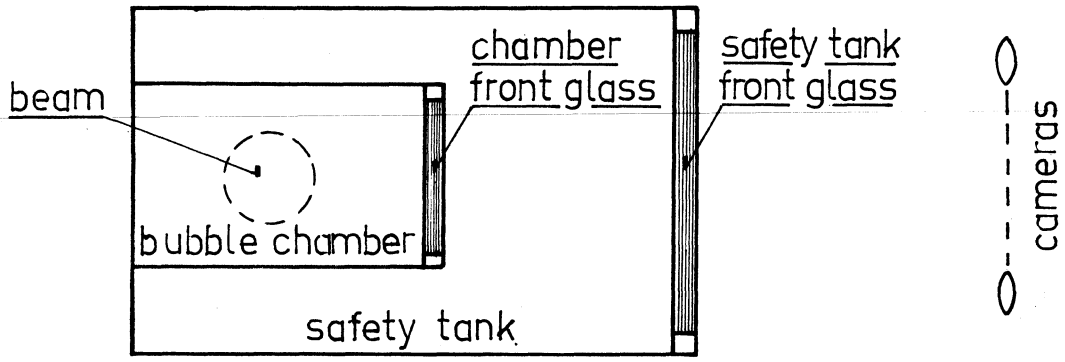
beam
chamber
front glass
safety tank
front glass
bubble chamber
safety tank
cameras

Fig. 4

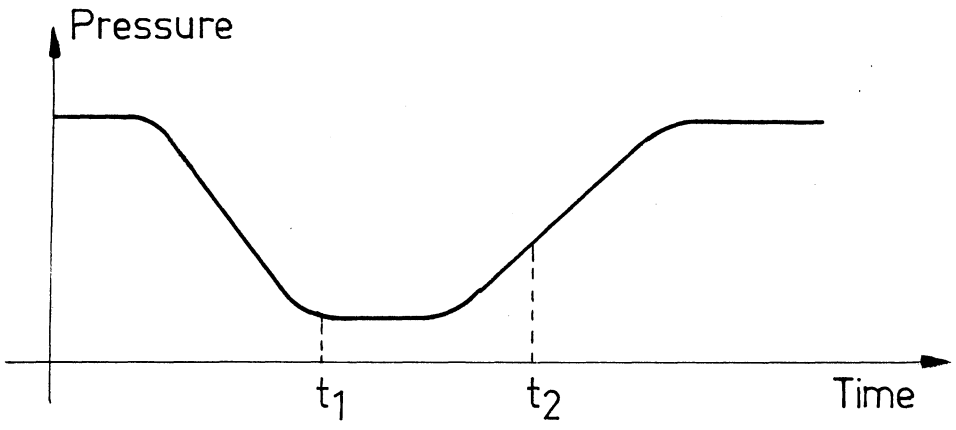
Pressure
t_1
t_2
Time

Fig. 6

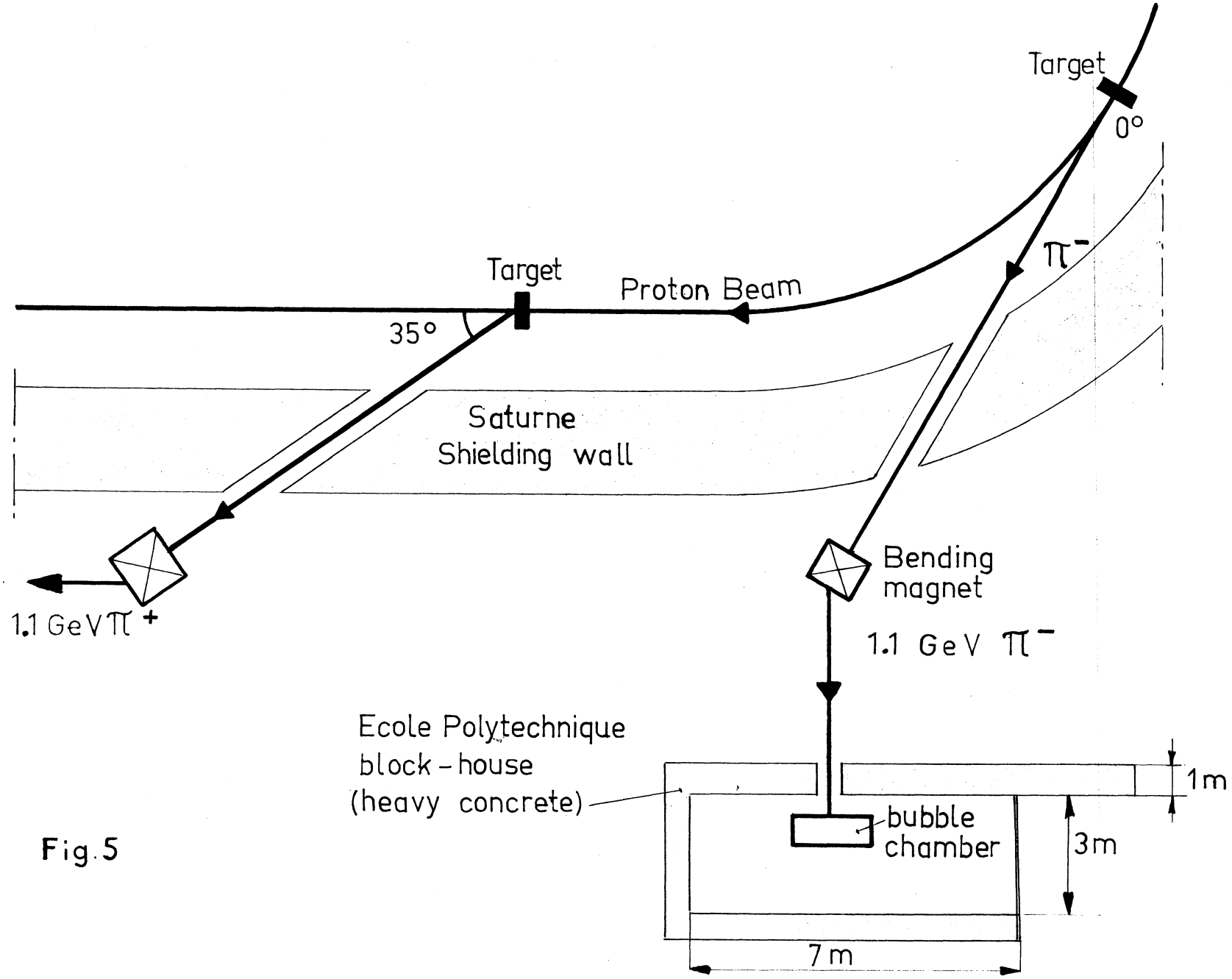

Fig.5

At the present time we are extracting negative π - meson of energy 1.1 GeV emitted at 0° from a target placed inside the magnetic field of Saturne. The π^- pass through a hole in the shielding wall, are deflected by a magnet and directed into our block-house. (Figure 5). From a second target, placed in a straight section of the machine, a beam of 1.1 GeV π^+ is extracted at an angle of 35°. This beam, which has a high ratio π^+/proton, is extracted by Dr. Rogozinski.

The block-house which we have at present has an inside area of 7 x 3 m^2 so that the trailer fits in. It is surrounded by a wall 1 m thick, made of special concrete of density 4 g/cm^3. We are working with a mixture of 50 o/o propane and 50 o/o methyl-iodide, which is very sensitive to γ-rays, and we found that a roof 60 cm thick, made of ordinary reinforced concrete is enough when we work with 10 o/o of Saturne's intensity. Perhaps in the future we shall need more shielding.

We found it very useful to watch the chamber while it is working. During the run we can look inside, count the number of tracks and see the tracks size. I do not think we would have been able to operate this chamber using remote control, especially at the early stages because with the mixture which we are using the amount of overpressure needed to compress the liquid is very critical.

DISCUSSION.

Gigli : What is the density of the mixture ?

Bloch : 1.1 g/cm^3.

Adams : Do you think you will still need a block-house when the machine is closed in on top ?

Bloch : It is difficult to answer, but in any case the building of this cover will take one year from now.

Hahn : How long is the sensitive time of the chamber ?

Bloch : About 15 to 20 milliseconds.

Hahn : How long is the time interval of the beam ?

Bloch : About 1 millisecond.

Hahn : Then you can choose how to operate in your sensitive time.

Bloch : Yes. I would like to mention the following. Let us consider a diagram of pressure versus time, (Figure 6). We could put our π-meson beam quite early, for instance at t_1 and reduce the sensitive time. But if we do so we get either no tracks or discontinuous tracks. To get good continuous tracks we must put the beam near the end of the sensitive time, say at t_2. We do not understand why. This is true also for pure propane.

Peyrou : It is also true for hydrogen.

Hahn : Therefore you have a pressure transducer ?

Bloch : We have two pressure transducers: one in the chamber and one in the nitrogen behind the diaphragm.

Hahn : Our experience is that there is a relation between Δp, the pressure change, and the bubble density.

Bloch : We have not made any systematic study of Δp, and we would be very interested if somebody could tell us something about it.

Rosegotti : What are the specific reasons to stay near the chamber ? Could the observations not be made, for instance, by television ?

Bloch : We tried television, but we could not take much information from it. Perhaps the need to stay near the chamber depends on how long one has operated it. Perhaps after operating for a period of 6 months it may be possible to know everything about how the chamber should work and how to transmit information from an oscilloscope to do remote control.

Lagarrigue : An inconvenience of television is the need for a persistent screen, because otherwise the tracks disappear too quickly and we cannot see them.

Hahn : I do not know about large chambers, but we can control our chamber of 2 litres volume by looking at the pressure pulse on a scope and at the time when the flash comes. We can also control the shape of the pressure pulse. It is also possible to set up some device to find out how many tracks are in the chamber, by using light scattered to a photo-multiplier. From some experience I think it is not necessary to have a television near the chamber but everything can be easily controlled from far away.

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