

CERN Courier Archive: 1968

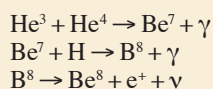
A LOOK BACK TO CERN COURIER VOL. 8, MARCH 1968, COMPILED BY PEGGIE RIMMER

NEWS FROM ABROAD

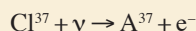
First catch your neutrino

A team of scientists from Brookhaven Laboratory, led by R Davis, has set up a large tank of cleaning liquid, 6.6 m in diameter and 14.8 m long, 1470 metres down the Homestake Gold Mine in South Dakota, to catch neutrinos. Their paradoxical purpose in going deep into the Earth is to find out what is going on deep in the Sun, surely one of the most imaginative experiments ever devised.

Nuclear physics explains solar energy generation in terms of the fusion of the lighter chemical elements, and among the interaction products is a high flux of neutrinos, estimated at over 10^{37} per second. One interaction chain, (helium $\rightarrow$ beryllium; beryllium+proton $\rightarrow$ boron $\rightarrow$ beryllium)



yields neutrinos with energies up to 14.2 MeV, just about susceptible to a reasonably high rate of detection. These are the particles that the Brookhaven team aims to catch, in the interaction



by setting up a 380 000-litre volume of tetrachloroethylene to provide the chlorine and filtering out the radioactive isotope argon-37 produced [half-life 35 days].

After long exposure in the underground laboratory, where only neutrinos can penetrate, helium gas is passed through to purge the liquid of argon. A charcoal trap cooled to almost -200°C is then used to absorb the argon. This takes about 10 hours and argon extraction efficiencies of over 90% can be achieved.

The argon is then conveyed to Brookhaven and the number of A^{37} atoms is measured in a low-level proportional counter by counting the Auger electrons, with a characteristic energy of almost 3 keV, as the A^{37} decays. This counter is located inside the 40 cm bore of an old navy gun-barrel, which acts as a shield from cosmic radiation. Made of "old" iron, these guns contain a very small level of residual radioactivity.

Theoretical calculations of the expected neutrino flux give forecasts ranging from about 6×10^6 to 21×10^6 neutrinos $\text{cm}^{-2} \text{sec}^{-1}$.

Knowing the efficiency of neutrino capture in their tank, the Brookhaven team could expect to catch from about 1.5 to 5 neutrinos per day, according to which theory was correct. Their very preliminary results seem to point to the lower end of this range with a rate of less than 2 per day.

An indication of how refined the detection technique has to be is that when A^{37} is being produced at the same rate as it decays, only about 300 atoms of A^{37} will be present in the 380 000 litres of tetrachloroethylene. Thus this unusual alliance of physics and chemistry is plucking each argon atom from over a million, million, million, million others.

● Compiled from texts on pp54–55.

CERN 37th Session of Council

The selection of the site for the proposed 300 GeV Laboratory [that became CERN Lab II] is one of the most difficult decisions ever to face the CERN Council. An enormous effort, both by experts in the nine Member States [out of 13] who are offering sites and by representatives of the Organization, has gone into compiling information, technical and social, on which to base the final decision.

The latest stage of this work has been the report of the Site Evaluation Panel consisting of three Council delegates (JH Bannier, JK Boggild, A Chavanne) from States not offering sites. An evaluation such as this cannot help but be subjective in



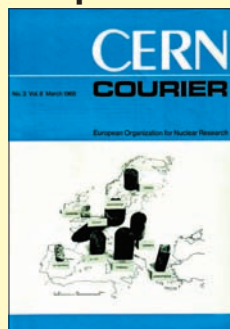
One end of the huge tank of tetrachloroethylene catching neutrinos down a South Dakota gold mine. (Image credit: BNL.)

some of its elements and practically all the States offering sites have some comment on points where they disagree with the Panel's findings. Differences of opinion are inevitable. Pressures and disappointments are unavoidable.

The spirit in which this potentially very acrimonious problem is being approached is perhaps as fine an example as could be given of what successful international cooperation, which has always been a hallmark of the European Organization for Nuclear Research, really means.

● Compiled from texts on p46.

Compiler's Note



Turning swords into ploughshares – or gun-barrels into shields in Brookhaven's case – is not an activity commonly associated with particle physics, but it does happen occasionally and a recent example demonstrates the level of co-operation and trust that can be reached in international collaboration for pure scientific research.

The huge absorber plates of the CMS endcap hadron calorimeter (HCAL) contain more than a million Second World War brass shell casements retrieved from Russian military storage. The 50-year-old shells were designed to withstand internal high stress and transport aboard 1940s navy vessels. Melted down, they provided high-quality material meeting the stringent stress requirements of the heavy HCAL endcaps. When this amount fell short of the 600 tonnes of brass needed, the US agreed, on an amicable "handshake" basis, to provide a further \$1 million in copper to complete the endcaps.

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