



W20 RADIATION-RESISTANT NMR PROBE

Normal NMR probes of various configurations are in general not radiation-resistant, as electronic components have to be mounted either inside the probe or at a short distance from it.

The NMR probe presented here is believed to be novel in as far as the distance between probe and electronics is concerned.

Use for the Synchro-
cyclotron

NMR probes are used to monitor the magnetic field of the main magnet and beam line magnets.

Method

The probe consists of a set of Helmholtz coils and the proton resonance capsule (H_2O) with its pick-up coil. The signal is transmitted via an odd $\frac{1}{4}\lambda$ coaxial resonator, connected to the pick-up coil. The tuning and detection circuits are connected to the other end of the resonator. The resonator itself is made of radiation-resistant coaxial cable.

Example

Proton resonance in a 15 kG field is detected behind a $\frac{5}{4}\lambda$ resonator (2.10 m).

Advantages

- 1) Resonator length permits lodging of the electronics in a protected and/or accessible place.
- 2) One probe covers a vast band of field values. Probe tuning consists of $\frac{1}{2}\lambda$ frequency jumps and/or resonator length adjustments with the associated coupling adjustment.
- 3) According to this technique a proton resonance probe for the 25-50 kG range can be constructed, because the pick-up coil is no longer the limiting factor.

Disadvantages

- 1) For one given resonator length the band is narrow; moreover, the longer the resonator the narrower the band.
- 2) Low noise immunity for the resonators' $\frac{1}{2}\lambda$ frequencies. To overcome the latter, a differential detector with high common mode rejection is used.

(Cont.)

Construction

The shown probe is constructed in a housing of polyimide. The capsule is H₂O. It has been tested in fields between 2 and 20 kG with proper retuning and resonator length adjustment.

Pick-up coil: 12 turns, 0.14 mm \emptyset

Helmholtz coils: 2 \times 100 turns, 0.14 mm \emptyset .

Further information can be obtained from K. Gase, MSC Division, CERN.