Superconducting Magnet System for AGOR Cyclotron Project

MAGNETS FOR FUSION

MAGNETS FOR HIGH ENERGY PHYSICS

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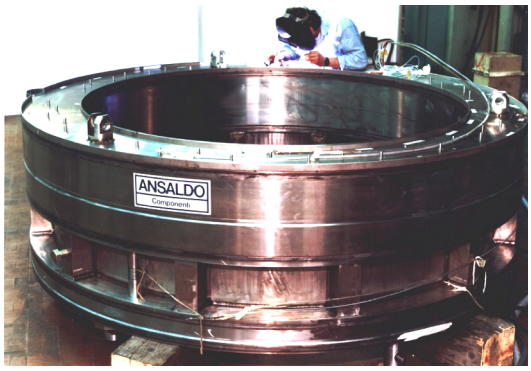
The AGOR superconducting cyclotron was manufactured in 1991. The system is able to accelerate both light and heavy ions at central field strengths ranging from 1.7 T to 4.07 T.
The magnetic field is generated by a set of four superconducting coils (ϕi = 2,120; ϕe = 2,600 mm), wound in NbTi, contained in a thick stainless steel support structure designed to allow the remote alignment of the coils while they were assembled in the cyclotron yoke. The closure weld of the coil case was conducted over a thickness of about 30 mm using an automatic welding machine and a special press to pre-compress the system. The cryostat was then leak tested to be better than 10^{-8} mbar·l/s, the test method implied the use of a hood filled with He gas around the cryostat vessel while making the vacuum inside the cryostat itself, a mass-spectrometer measured the He leaking in. The coils are all VPI impregnated. The cooling system is structured as a thermo siphon, a liquid helium bath is in direct contact with the coil's surface on their outer perimeter whereas special fibre-glass spacers allowed for the coolant to circulate in between the turns. The coils are housed in a split cryostat, shaped in such a way that room temperature access is provided to most of the mid-plane. Dimensional checks were made using laser tracking equipment. The AGOR cyclotron is today in operation at the KVI laboratories in Holland.



S.C. coils during assembly of the cold mass

Maximum field on conductor	4.07 T
Stored energy	57.18 MJ
Type of winding	2+2 solenoids (ϕi = 2,120 h_1 = 80 ϕe = 2,600 h_2 = 240 mm)
Nominal current	900 A + 1,800 A
Conductor	Rutherford Nb-Ti+Cu
Cooling	liquid helium bath
Total weight	36,000 Kg

Machining of the cold mass after seal welding

AGOR cryostat during factory cold test