France delivers essential accelerator component to ESS

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LUND – A key accelerator component from France has been delivered to the European Spallation Source (ESS) in Lund, Sweden, as part of the French in-kind contributions to the next-generation research infrastructure. The Radio Frequency Quadrupole (RFQ) is the first accelerating structure in the ESS linear accelerator and has been designed, developed and manufactured by French in-kind partner CEA at its institute IRFU (Institute of Research into the Fundamental Laws of the Universe).

The RFQ arrived yesterday after a three-day-long journey by truck from CEA Saclay’s research institute IRFU outside Paris. France is one of the leading nations in the area of neutron research, and the delivery demonstrates the long-standing French engagement in the future success of ESS, the world’s most powerful neutron source under construction in the south of Sweden. Two of the largest research organisations in France, CEA and CNRS, are highly involved in developing technical contributions for the linear proton accelerator, the neutron scattering instruments and the integrated control systems at ESS.

“France is a leading scientific nation with great experience building and hosting large research infrastructures, and a vital and strongly committed member of ESS,” said John Womersley, ESS Director General. “The RFQ delivered from our partner CEA-IRFU is proof of the unique scientific and technological capabilities of French national research institutes and industry.”

The multi-disciplinary research facility ESS, based on the world’s most powerful neutron source, will deliver first science in 2023. ESS will provide unique research opportunities within materials research for thousands of scientists from all over the world, benefitting the development of better batteries, new medicines and more sustainable materials. 13 ESS member countries together fund and build the research infrastructure, to a large extent by in-kind contributions through technical equipment, services and personnel.

“ESS is of great importance for France as a member country with one of the largest neutron user communities in Europe. CEA-IRFU is very proud to contribute at a high level to the construction of the world’s most powerful neutron source with strong involvement in the construction of the superconducting Linac, the RFQ and the beam diagnostics,” said Anne-Isabelle Etienvre, IRFU Director. “The delivery of the RFQ is an important milestone, result of a collaborative effort with French industry.”

The collaboration between ESS and CEA-IRFU began in 2010, as part of a pre-construction agreement with France. IRFU is one of the world’s leading RFQ experts, and have delivered RFQ’s to other major research infrastructures, such as CERN and French GANIL. IRFU is one of the main in-kind contributors to ESS and will also deliver the elliptical superconducting linear accelerator structures; 30 eight-metre-long cryomodules, as well as beam instrumentation and control systems for the Accelerator.

“IRFU is one of the world leaders in RFQ design and production, so it was natural for us to set up a partnership with them,” said Mats Lindroos, ESS Head of Accelerator. “Over the years we have overcome many challenges and I am extremely satisfied to see this technical masterwork delivered at ESS today.”

ESS’ 600-metre-long linear Accelerator, the most powerful in the world, will deliver a high intensity proton beam to the ESS target wheel, where the neutrons that will be used for scientific research are generated.
The RFQ is a key component in the normal conducting part of ESS linear accelerator, that focuses, bunches and accelerates the proton beam generated in the Ion Source. The RFQ transforms the continuous proton beam to a pulsed beam, which is passed on to the following accelerator section, the Medium Energy Beam Transport (MEBT), where the beam characteristics are diagnosed and optimised before further acceleration on the way to the superconducting part of the Accelerator. The MEBT was developed by the Spanish in-kind partner ESS-Bilbao and installed during the summer.

“The RFQ is made of five sections of four brazed poles in ultra-pure copper and stainless steel of about one metre each machined with a mechanical precision of a few tens of micrometres,” said Christophe Mayri, CEA-IRFU project manager for the ESS RFQ. “The realisation of the quadrupoles took more than three years, involving more than 15 people in close collaboration with the industrial company Mecachrome.”

The full assembly and installation of the 4.6-metre-long RFQ will start this week, performed by a team from IRFU with support from the ESS Installation team. When the installation works are finalised in the autumn, extensive testing of the RFQ will follow.

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About ESS
The European Spallation Source (ESS) is a Partnership of European Nations committed to the goal of collectively building and operating the world's leading facility for research using neutrons. ESS will enable scientific breakthroughs in research related to materials, energy, health and the environment, addressing some of the most important societal challenges of our time. The main facility is under construction in Lund, Sweden, with first science results in 2023.
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About CEA
The CEA is a public research organisation working in four main areas: Defense and Security, Energy Transition (nuclear and renewable), Digital Transformation for Industry and Future Health technologies. Building on excellence in fundamental research and on recognised expertise, the CEA takes part in organising cooperation projects with a wide range of academic and industrial partners. With its 20,000 employees and large research facilities, it is a major player in European research, expanding its international presence.
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