First neutron beam produced: A great milestone for China Spallation Neutron Source

September 6 2017

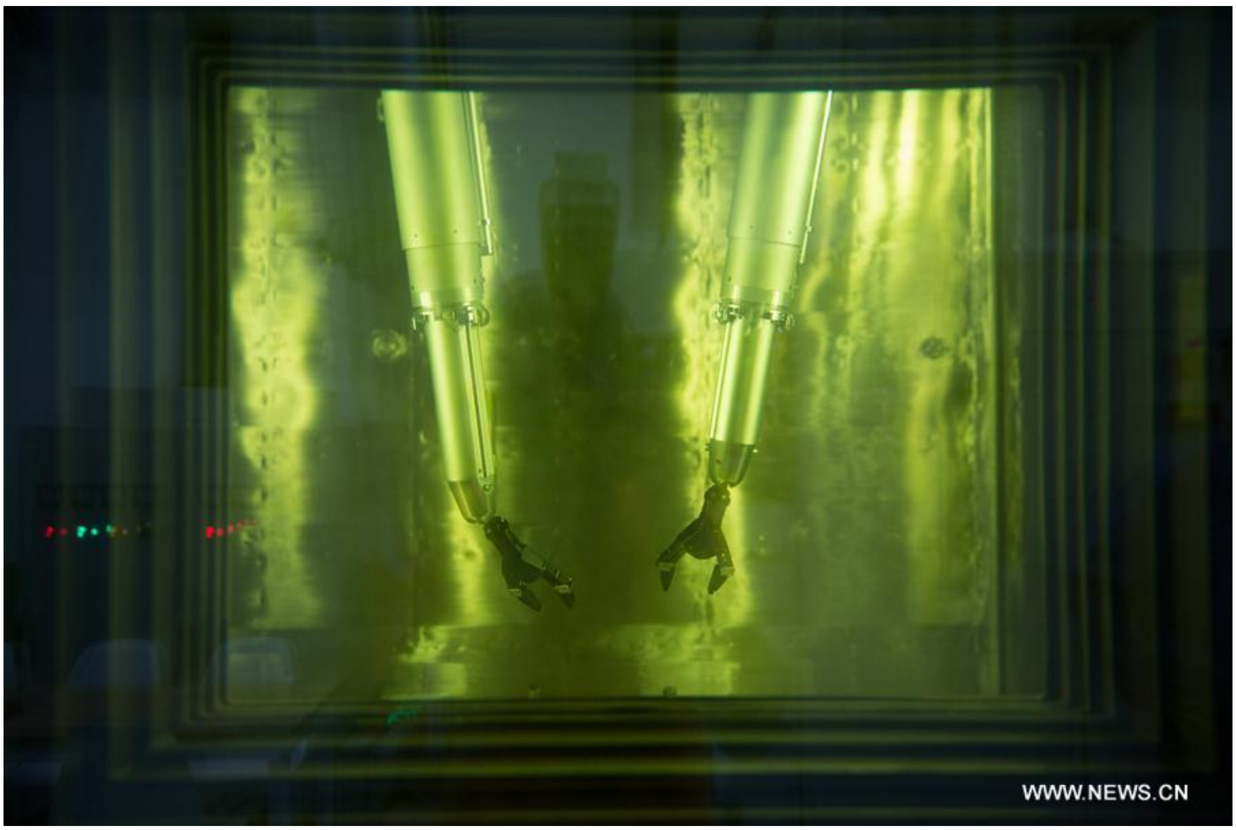


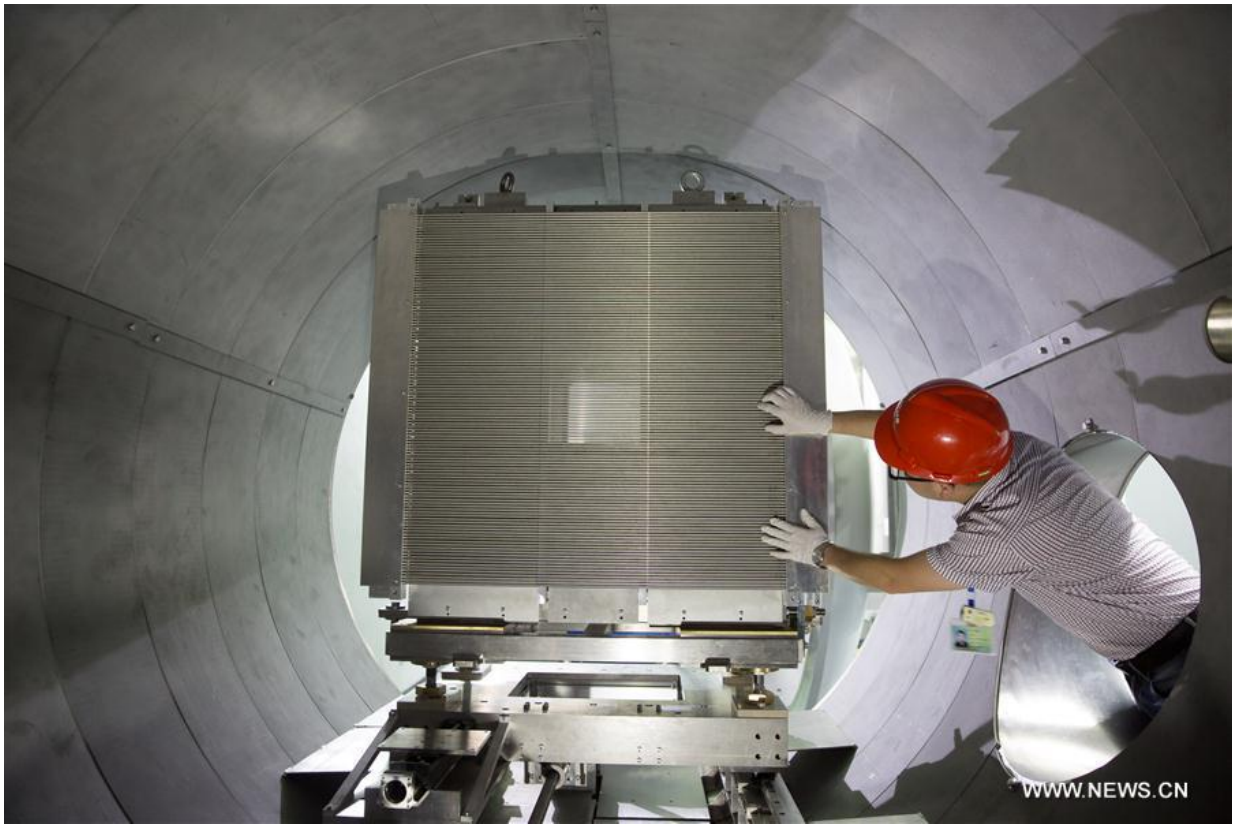
Photo taken on Sept. 1, 2017, shows mechanical arms at the hot cell for the China Spallation Neutron Source (CSNS) in Dongguan, south China's Guangdong Province. Credit: Xinhua News Agency

Researchers produced a neutron beam at the China Spallation Neutron Source (CSNS) for the first time on August 28. The achievement is a milestone for the CSNS project as it marks the completion of main construction and the start of the test operation phase. The national CSNS facility, located in Dongguan, Guangdong Province, should be fully completed and open to domestic and international users by 2018, as scheduled.

At 10:56 a.m., a proton beam pulse from the accelerator collided with the tungsten target for the first time, after Professor CHEN Hesheng, CSNS project manager, gave the order from the target and instrument control room. Two neutron detectors at the No. 6 and No. 20 beam lines, corresponding to two types of moderators, measured the neutron spectrum, indicating the successful production of the neutron beam.

The idea of building CSNS was first proposed at the Xiangshan Science Conference in February 2001, according to CHEN. CSNS, now under the direction of the Institute of High Energy Physics of the Chinese Academy of Sciences (CAS), has relied on CAS throughout its development.

"The Chinese Academy of Sciences has given CSNS a lot of support since 2006. We worked with more than 100 organizations all over the country, especially in producing equipment for the accelerator, target and instrument systems. We managed to overcome many technical problems and, as a result, our equipment localization rate is over 96% and much of it has reached a world-leading level," CHEN said.



Engineers debug a neutron instrument for the China Spallation Neutron Source (CSNS) in Dongguan, south China's Guangdong Province, Sept. 1, 2017. Credit: Xinhua News Agency

The CSNS team has spent nearly six years on this project and witnessed many significant moments. The groundbreaking ceremony was held in October 2011. In October 2014, the H? ion source, the first piece of accelerator equipment, was installed in the linac tunnel. In July 2017, a proton beam was successfully accelerated to 1.6 GeV in the rapid cycling synchrotron (RCS) - preparing the way for the successful beam production on August 28.

To produce the neutron beam, the tungsten target was bombarded with a proton beam, which drove neutrons from the nuclei of the target atoms.

This results shows that the design, fabrication, installation and commissioning of the accelerator and target station systems are complete, with a high level of quality and reliability.

CSNS, the world's fourth pulsed spallation neutron source, has a wide range of applications in research areas like materials science, the life sciences, physics, the chemical industry, new energy and so on. CSNS will serve as a high-level scientific research platform, help improve national sustainable development, and serve the strategic needs of national security.

CSNS will also become a large research center in Guangdong Province. "It is certain that CSNS, as a world-class comprehensive research base, will make great contributions to scientific innovation in the Guangdong-Hong Kong-Macao Greater Bay Area," said CHEN in a recent speech.

CSNS is composed of a linac with modest but upgradable energy of 80 MeV, a rapid cycling synchrotron (RCS) of 1.6 GeV, two beam lines, a target station with a solid tungsten target, and three instruments for the first phase. The three instruments are: a General-Purpose Powder Diffractometer (GPPD); a Small-Angle Neutron Scattering instrument (SANS); and a multi-purpose reflectometer (MR). The GPPD is used to study the crystal and magnetic structures of materials. SANS is a very important neutron technique used for probing structures from around one nanometer to more than 100 nanometers. It has a wide variety of applications ranging from polymers to nanoparticles. The MR is used to study the surface and interface structure of materials by analyzing reflected neutrons from the sample.

Provided by Chinese Academy of Sciences

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