Present status of Chinese Spallation Neutron Source project

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Chinese Spallation Neutron Source

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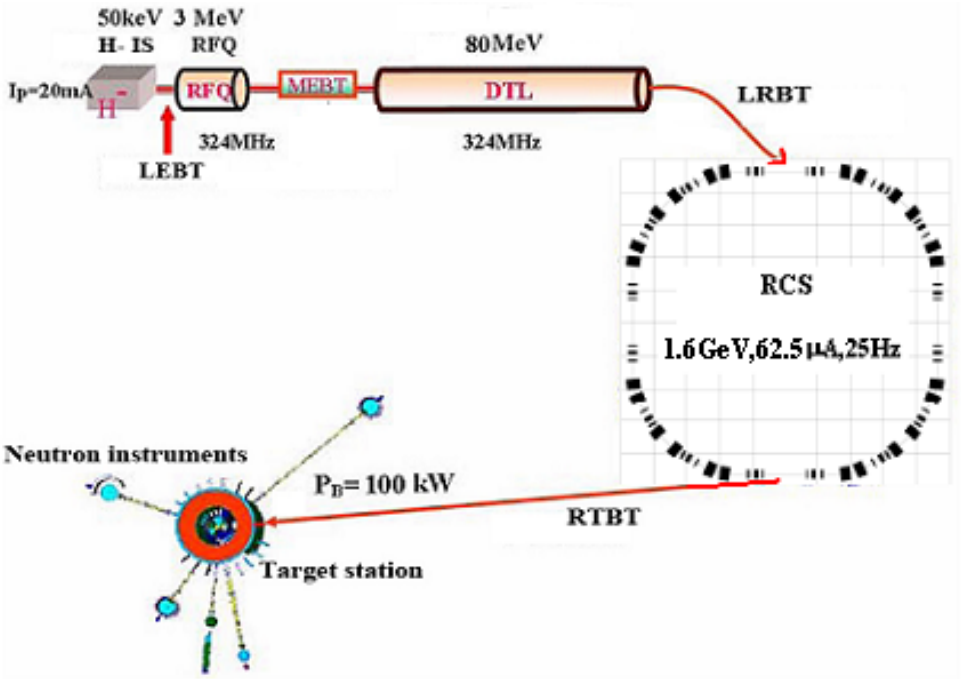
SNS
CHINESE ACADEMY OF SCIENCES

Outline

- Project Overview
- Progress of Accelerator
- Progress of Experimental System
- Summary

Project Overview

CSNS Facilities



The facility comprises:

- an 80-MeV H- linac
- a 1.6-GeV proton rapid cycling synchrotron (RCS)
- beam transport lines
- a solid tungsten target station
- 3 initial instruments for the pulsed spallation neutron applications.

- The accelerator is designed to deliver a beam power of 100 kW with the upgrade capability to 500 kW by raising the linac output energy and increasing the beam intensity.

Key Milestones

Feb. 2001	idea of CSNS discussed
June 2005	proposal approved in principle by the central government (CD0)
Jan. 2006	prototyping R&D started
April 2010	site preparation start
Feb. 2011	feasibility study report approved (CD-1)
May 2011	preliminary design report approved (CD-2)
Sept. 2011	construction started (CD-3), component fabrication started
Oct. 2014	Frontend and LRBT started installation in Linac tunnel
Mar. 2016	preliminary design adjustment report approved
Sept. 2017	first beam on target
Mar. 2018	project complete/operation start (6.5 years from start)

- **Change of the site**

May 2009

May 2010

- **Change of the site**

May 2011

May 2012

- **Change of the site**

May 2013

May 2014

- **Change of the site**

May 2015

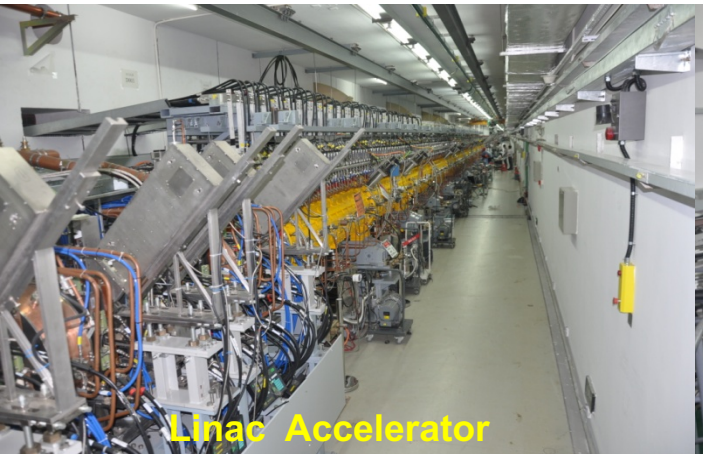
May 2016, The main civil construction is finished.


中国散裂中子源工程进展照片（2016.10）
October, 2016

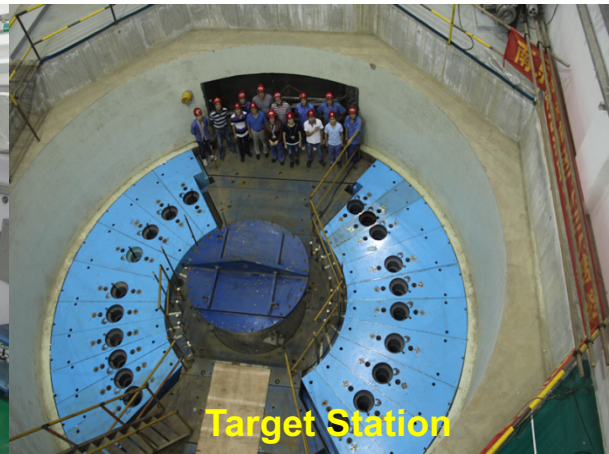
Birds View of CSNS in October, 2016

Main Progress

- ✓ **Main Civil Construction: finished, all the buildings have been put into use.**
- ✓ **Conventional facilities : almost completed, in service for commissioning.**
- ✓ **Accelerator Installation: almost completed.**
- → **Accelerator Commissioning:**
  - Linac accelerator DTL-1 beam commissioning succeeded.
  - RCS ring commissioning will start in the end of this year.
- → **Target Station and Instruments:**
  - Target Station installation finished about 80%.
  - The beamline bases and scattering chambers of 3 Instruments had finished. Installation of GPPD started.


Linac Accelerator


RCS Ring


Target Station

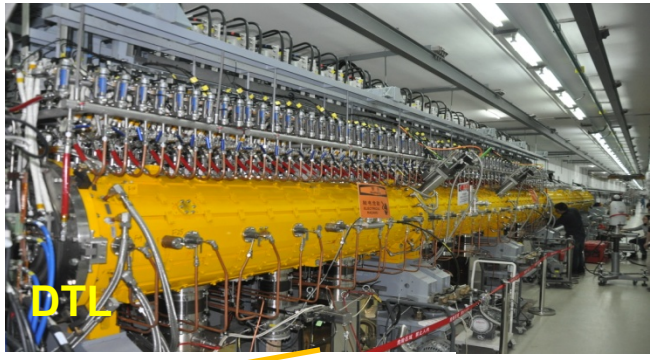
Progress of Civil Construction

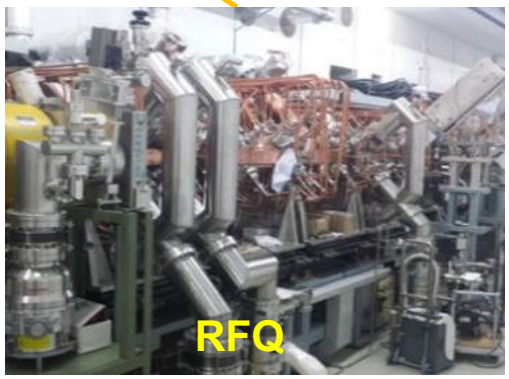
Main Civil Construction is finished. The remaining work will be done in this year.

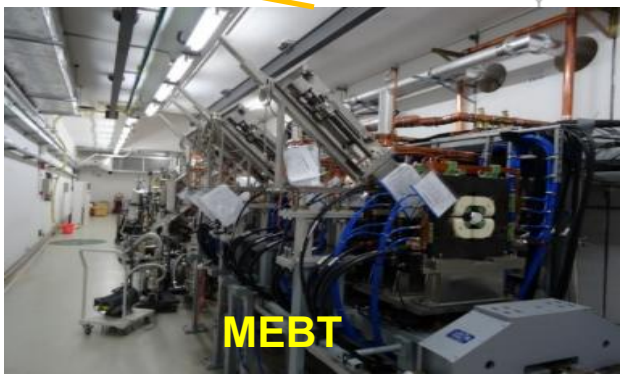
Progress of Accelerator

Accelerator

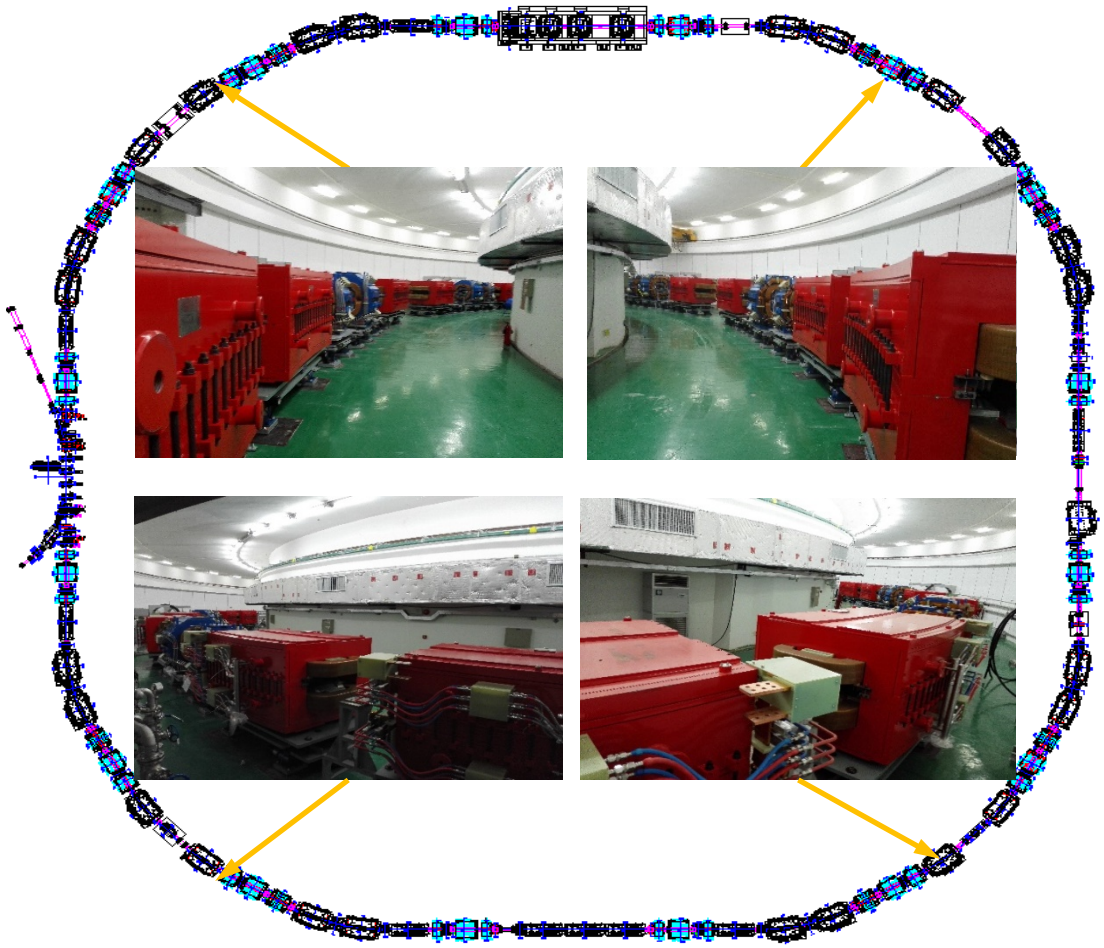
- **Linac Accelerator Installation: major parts of the linac has been installed.**







- **RCS Installation: all magnets of RCS ring have been positioned in the tunnel.**
- **RCS Commissioning: will start in the end of this year.**



RCS Ring Injection Area Installation

RCS RF-cavity Installation

RCS Collimator Installation

RCS Extraction Area Installation

Mass production

All drift tubes have been installed

Mass production of RCS kicker power supplies

Installed collimators in RCS tunnel

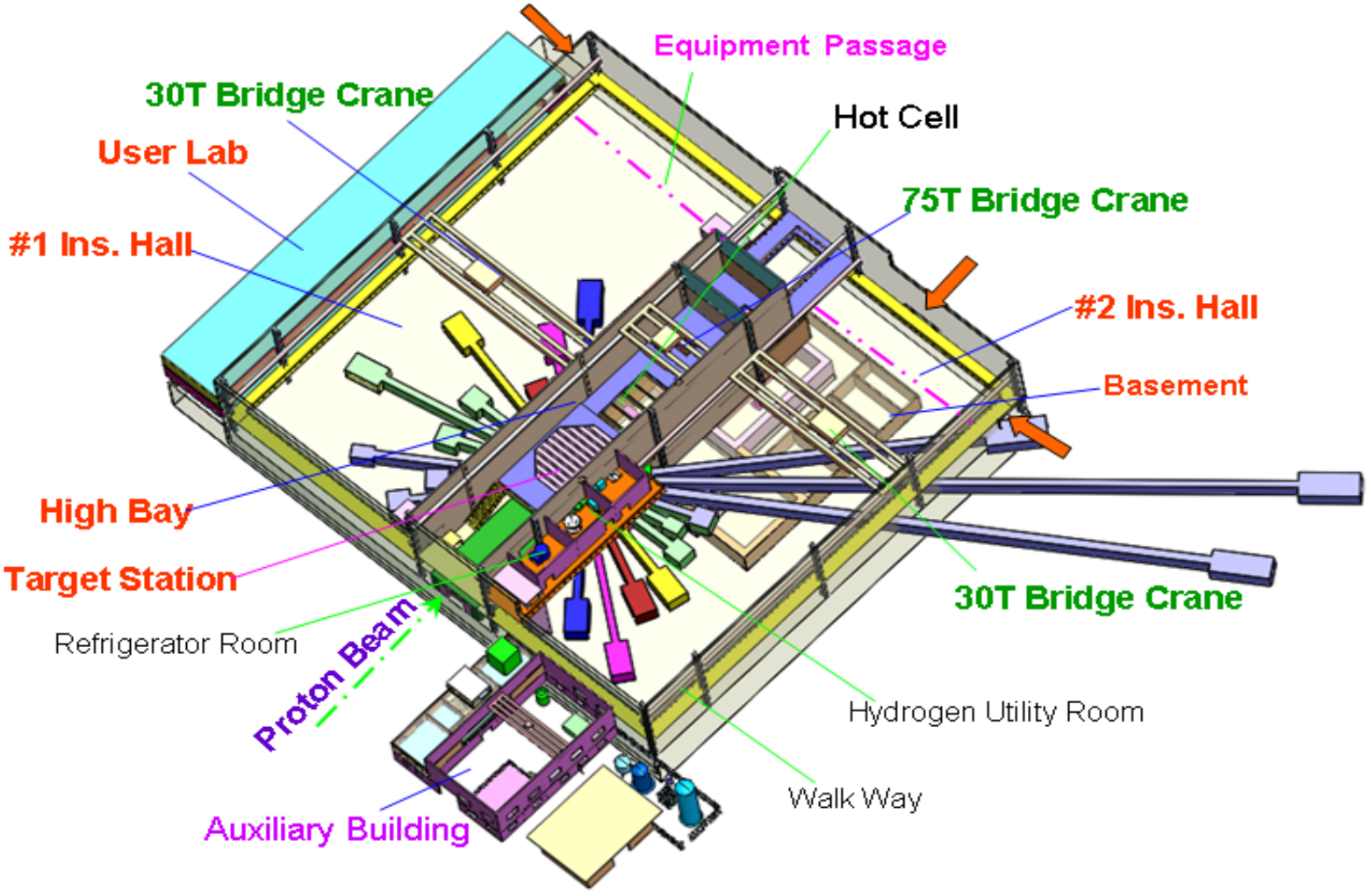
Beam commissioning

In Jan. 18, 2016, 18mA/21.67MeV/50us/1Hz beam was obtained, which exceeds the design goal of beam current of 15mA. the beam reached the end of the first DTL tank with peak current of 18mA at 21.67 MeV, with transmission rate of 100%.

Progress of Experimental System

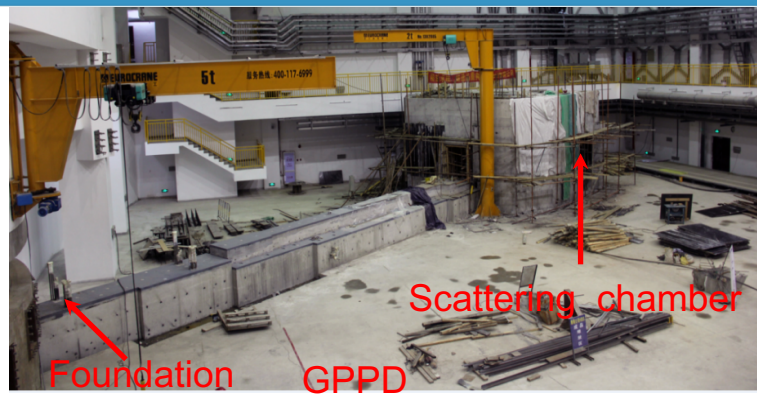
Target Station

- High neutron production: 1.6GeV proton beam, W(Ta) target , heavy water cooling…
- Optimization for 100 kW, but keeping upgrade capacity to 500 kW



Building and civil construction

- Building for the target station and neutron instruments has finished.
- Concrete foundation of three dayone instruments has been poured. Movable shielding blocks are being made.

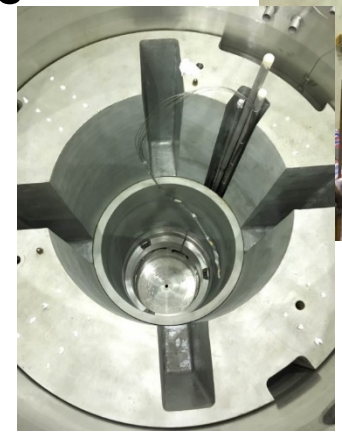


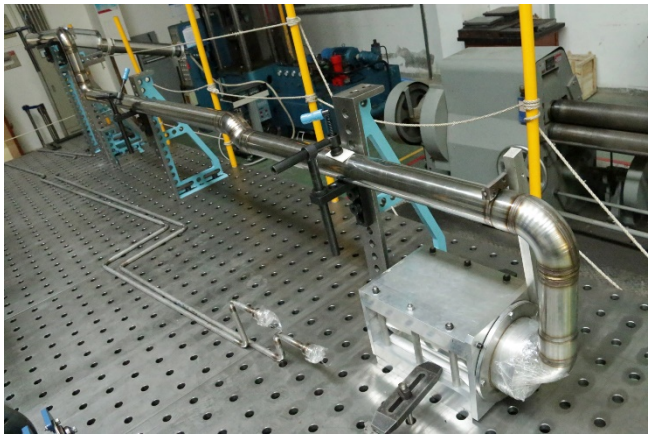
Target system

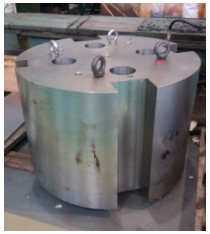
- Fabrication of target and its trolley finished, all tests were completed in the factory in July, 2016.
- The rails and movable shielding block installed. Installation of target system will be finished in December, 2016.

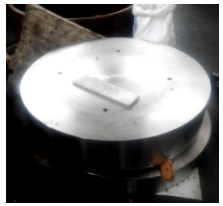
Moderators and MR plug

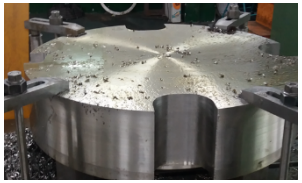
- Helium vessel is totally ready for MR plug.
- Three moderators and all other components of MR plug just finished in the end of October, 2016. Tests and assemble will be done soon.
- In-site installation and test-run are expected to start in December, 2016.

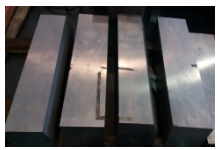


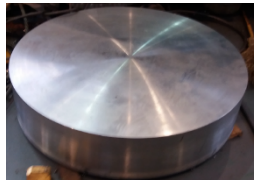






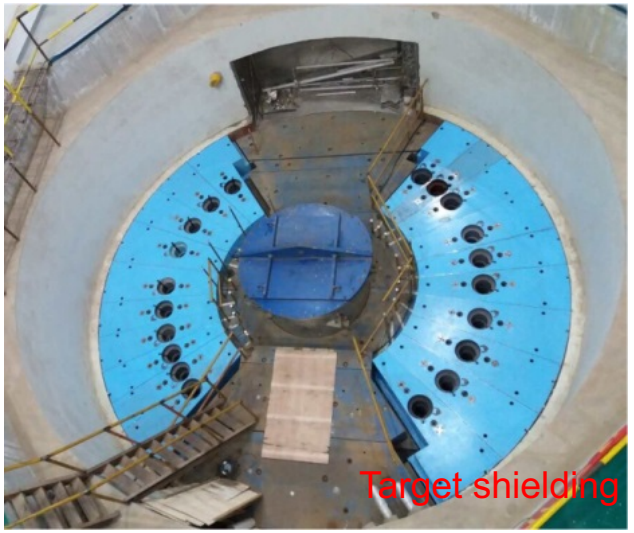




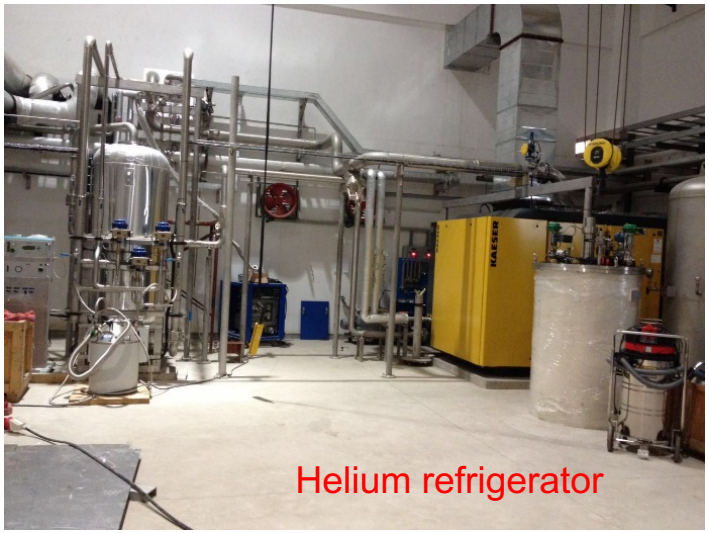


Shielding, cooling system

- Steel shielding blocks and shutters have been installed.
- Helium refrigerator finished installation and commissioning, with 2300 W@20 K achieved in August, 2016.
- Most of water cooling equipment installed.


Target shielding

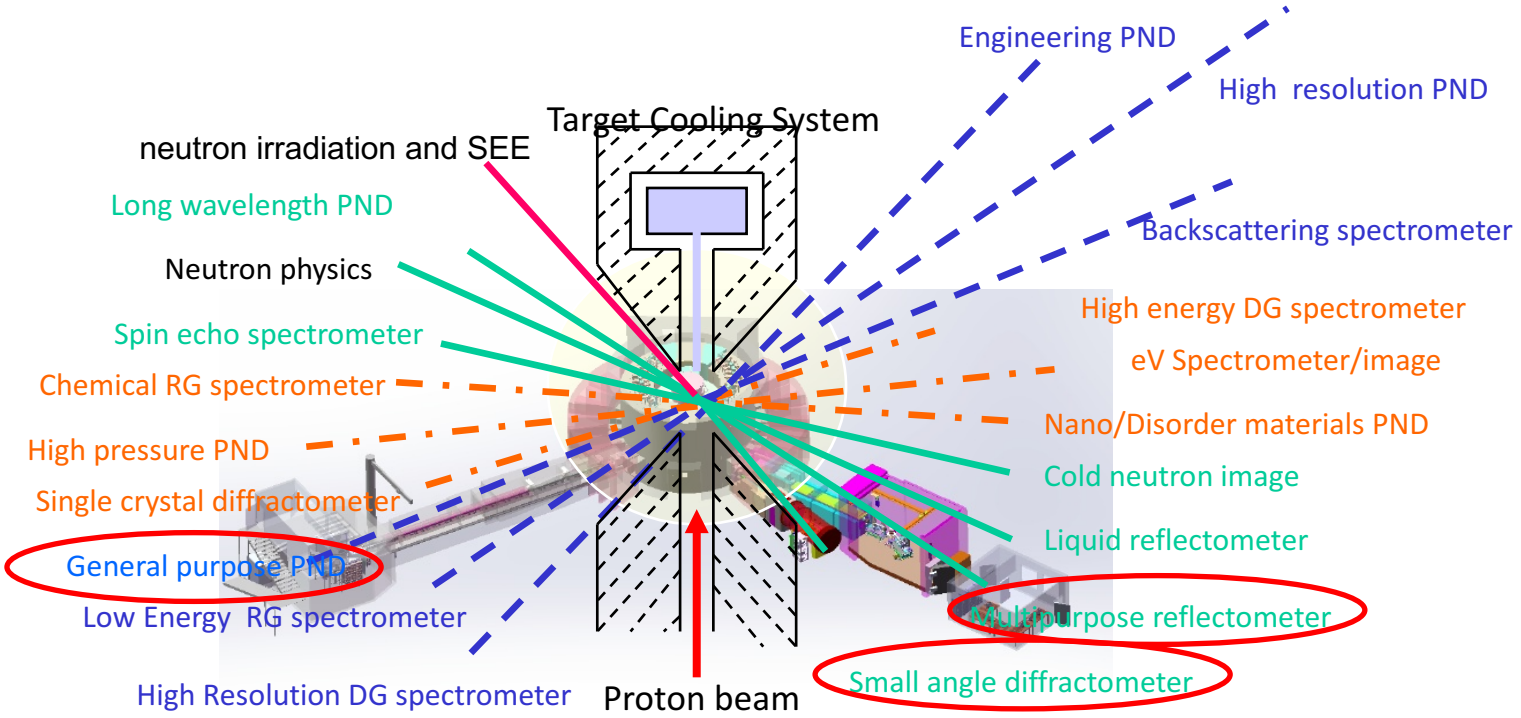

pipeline cleaning


Helium refrigerator


Water cooling equipment

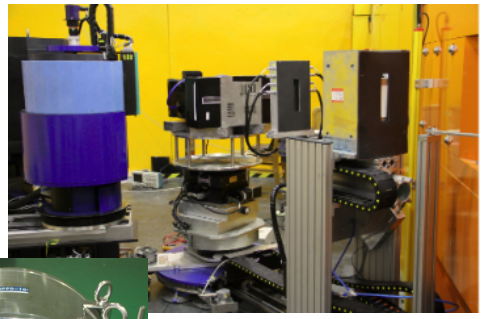
Instruments

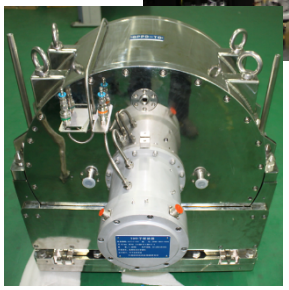
- 20 beam lines
- 3 initial instruments in Phase I:General purpose PND(GPPD), Multipurpose reflectometer(MR), Small angle diffractometer(SANS).

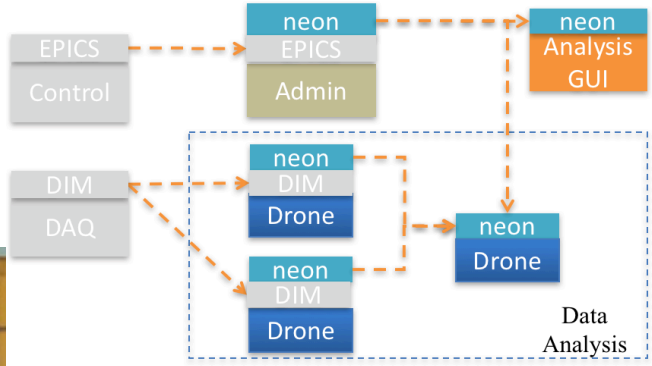


Neutron instrument

- **Beamline concrete base & scattering chambers has been poured. Most components have been fabricated.**
- **Software of instrument control is ready for integration.**
- **Data management in the whole process is framed, most of online and offline data analysis softwares are developed.**







Regional cooperation for more instruments

Hongkong Univ.'s consider to build two spectrometers: material sciences and life sciences at CSNS

Inst. of Chemical Physics of CAS considers to build spectrometer in CSNS for in situ characterization of Catalyst

South China Univ. of Sciences and Technology signed MoU with CSNS, and build a spectrometer

Dongguan Institute of Technology is interested in building spectrometers in CSNS

China Neutron Scattering Society

- China Neutron Scattering Society was established March 2013, as a branch of China Physical Society:
  - Inst. of Physics, CAS;
  - Chinese Inst. of Atomic Energy;
  - IHEP, CAS;
  - > 20 Universities…..
- The mission of China Neutron Scattering Society:
  - Promote neutron scattering sciences and application, as well as the neutron instrumentation R&D
  - Training users and students
  - Road map of neutron scattering sciences and facilities in China
  - International cooperation and exchanges
  - ……

Users and collaboration

- **Conference and workshop**
  - The 4th National Conference on Neutron Scattering will be held at Southern University of Science & Technology, Shenzhen, in Nov. 4-6, 2016.
  - The 2st ISIS training course will be held at CSNS in Nov.7-9, 2016.
  - The workshops on the three day one instrument were held at CSNS to discuss the scientific field and the potential experiments that will be carried out when the instruments finish the commissioning.

- **More than 10 young staff visit ISIS to learn how to design, install, commission, and operate a spallation neutron source.**

Summary

- **Main civil construction finished. All the buildings have been put into use.**
- **Conventional facilities almost completed and was in service for commissioning.**
- **Accelerator installation almost completed and commissioning began. Target station installation finished about 85% and instruments installation began.**
- **We optimize the installation procedure to keep the date of the first neutron beam (Sept. 2017).**
- **Great efforts to promote the user community and to prepare the day-one experiments.**

Thank you very much !