Linac Construction for China Spallation Neutron Source

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CSNS
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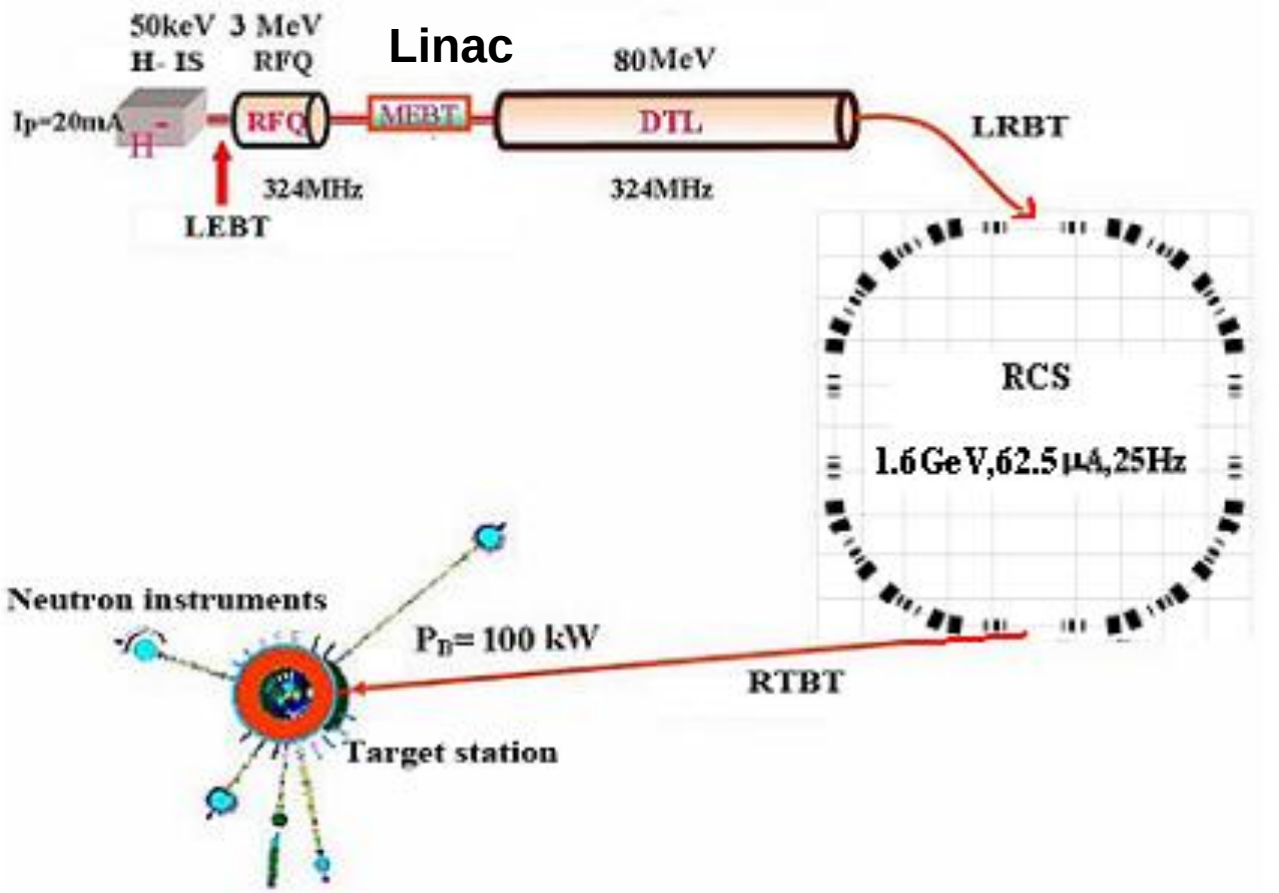
Project Overview

CSNS Facility Layout

- The phase-I CSNS facility consists of an 80-MeV H^- linac, a 1.6-GeV RCS, beam transport lines, a target station, and 3 instruments.



Budget

- Baseline--- the largest big-science project in China
  - 1.7B CNY(~US$250M) from central government for project construction
  - 0.5B CNY and land from Guangdong/Dongguan local government for additional supports
- R&D
  - 35M CNY (received) from CAS for R&D 1
  - 40M CNY (received) from Dongguan government for R&D 2 (included in 0.5B CNY additional supports)
- Operation
  - 0.14B CYN per year from central government

Artificial bird view of the CSNS campus at Dongguan site.

May 2009: before land breaking

Aug 2011: land was prepared

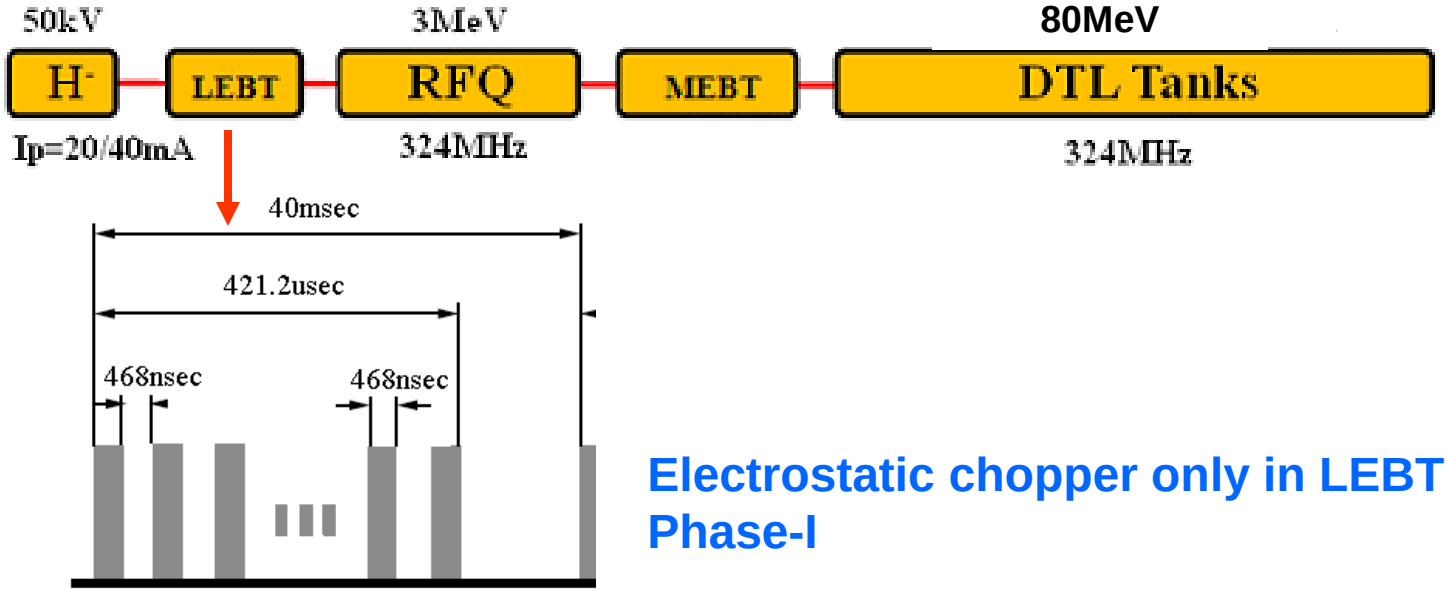
Land preparation (upper: before; bottom: now)

Construction of China Spallation Neutron Source (CSNS) has been launched in September 2011. And it is scheduled to complete the project in the March 2018.

Aug 2012: Base construction of the linac tunnel (left) and RCS building (right)

CSNS Design & Development

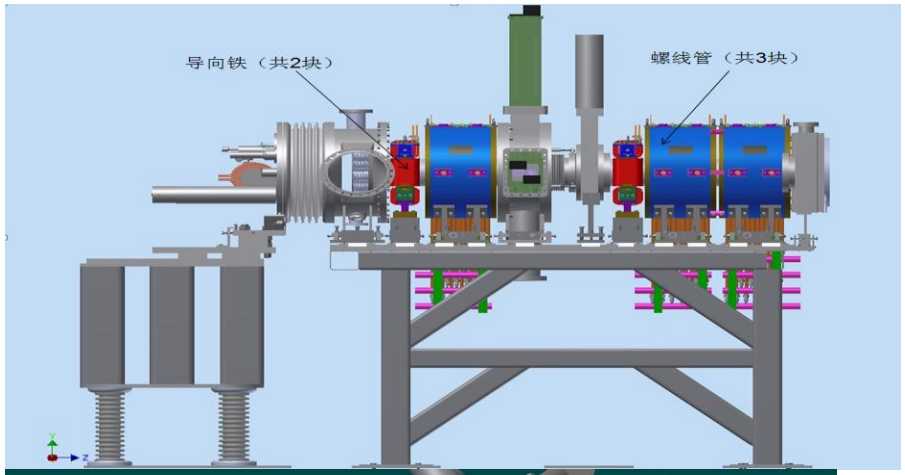
- **Linac design :**

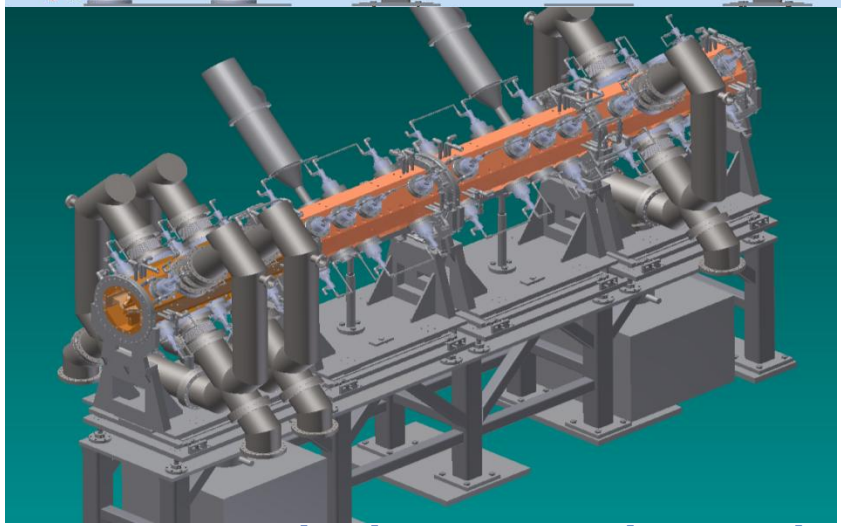


Electrostatic chopper only in LEBT in Phase-I

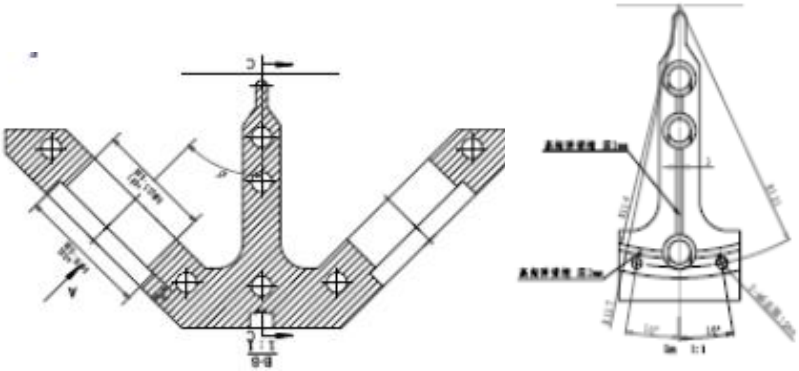
	Ion Source	RFQ	DTL
Input Energy（MeV)		0.05	3.0
Output Energy(MeV)	0.05	3.0	80
Pulse Current (mA)	20/40	20/40	15/30
RF frequency (MHz)		324	324
Chop rate (%)		50	50
Duty factor (%)	1.3	1.05	1.05
Repetition rate (Hz)	25	25	25

Front-end





A Penning H- ion source and a three-solenoids LEBT with space charge neutralization. Pre-chopper is mounted at the entrance of the RFQ with a beam rise time of 15ns.

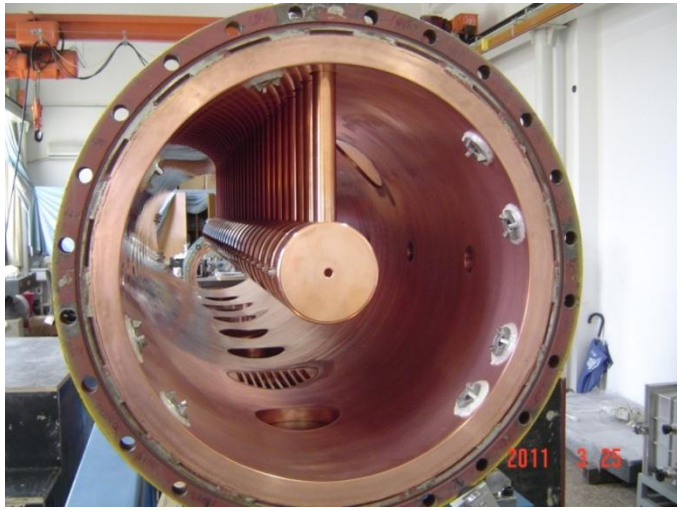


324MHz RFQ cavity is resonantly coupled by two segments and each segment is divided into two modules (left). Each module is composed of two major vanes and two minor vanes with cooling-water channels (right).

DTL

Tank parameters of CSNS DTL

Tank number	1	2	3	4
Output energy (MeV)	21.67	41.41	61.07	80.1
Length (m)	8.51	8.56	8.78	8.8
Number of cell	64	37	30	26
RF driving power (MW)	1.35	1.32	1.32	1.34
Total RF power (MW)	1.91	1.92	1.92	1.93
Accelerating field (MV/m)	2.86	2.96	2.96	3.0
Synchronous phase (degree)	-35 to -25	-25	-25	-25



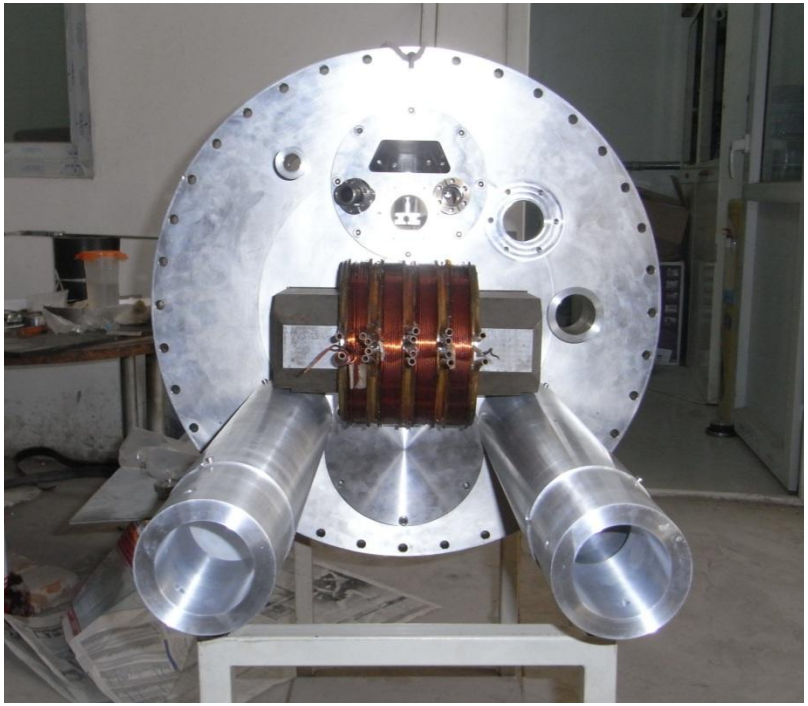
- The total RF power with a 30mA beam in a tank is about 2MW. Each tank is fed by a 2.5MW klystron.
- FFDD lattice is used.

A prototype DTL has been fabricated for the technology development and cold measurement.

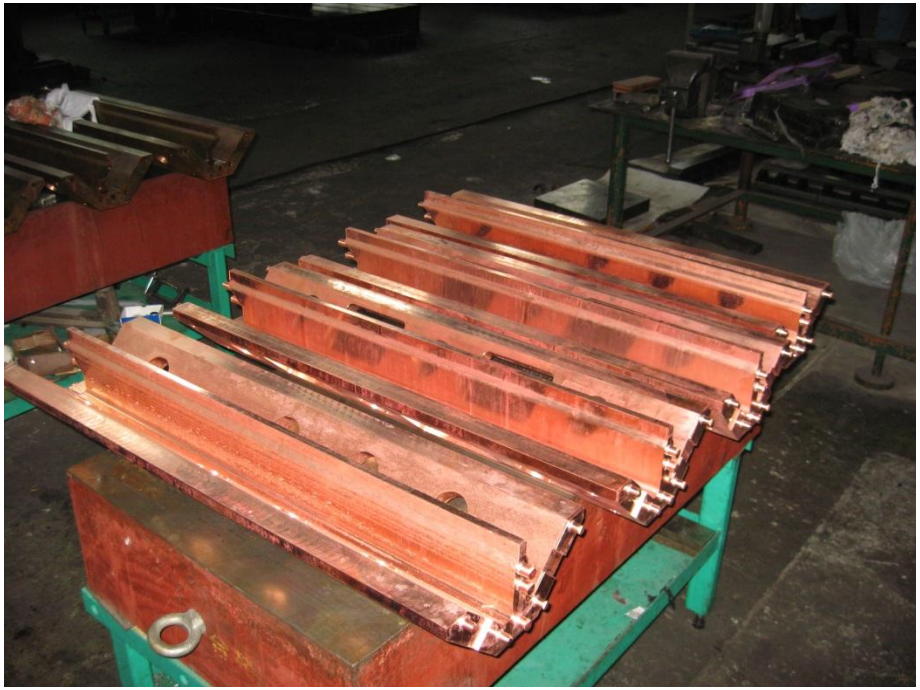
Linac Construction

Front end

- **The Ion source is in assembly and the RFQ cavity are under fabrication.**



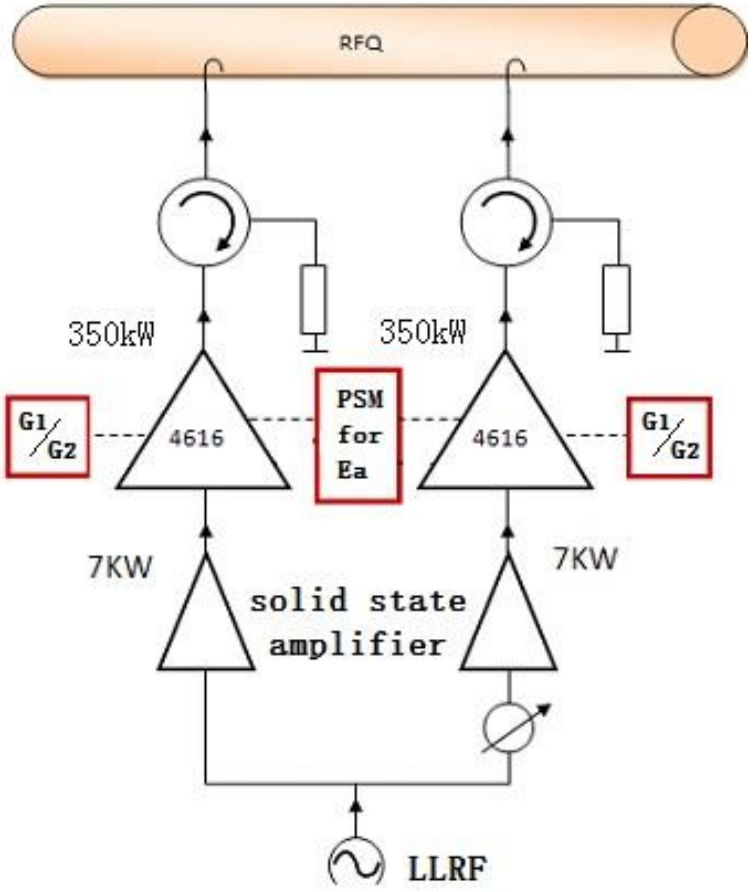
H- ion source has been fabricated and now under assembly.



Major and minor vanes under fabrication: cooling water channels have been drilled and the ends have been plugged.

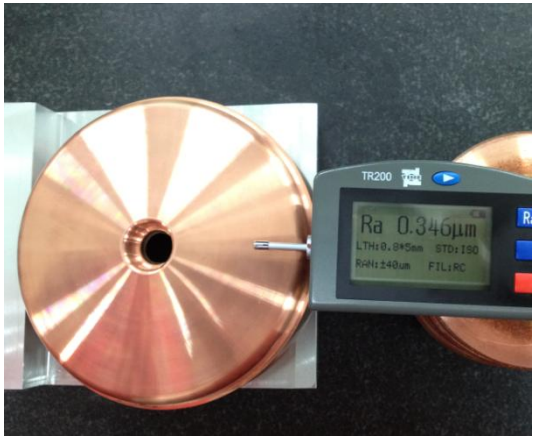
RFQ RF power source

- One of the RFQ power sources of tetrode 4614V4 has been set up. It can reach the output power 400 kW with a pulse length of 700ms at 25 Hz.



DTL

- **DTL tank and drift tube fabrication has been started**



The tank is made of carbon steel and the inner surface is copper-plated, with a thickness of 0.15mm after polishing. Full copper drift tube has very good surface machining.

A new rotating-coil measurement system so as to reach a high accuracy of 0.006mm and high efficiency in the measurement of the magnetic center.

Thank you