US Contribution
The US is responsible for the ion cyclotron (IC) transmission lines and impedance matching system, including R&D, design, and fabrication.

Overview
The ion cyclotron system heats the ions and electrons in the plasma with a high-intensity beam of electromagnetic fields. Generators produce high-power radio frequency waves that are carried along multiple transmission lines to antennas located in the vacuum vessel, which launch the heating fields into the plasma. The US ion cyclotron transmission lines will provide efficient power (20 MW) transfer from 40–55 MHz between the radio frequency sources and the plasma heating antennas.

The system will include coaxial transmission lines and a matching/tuning system to minimize power transfer losses. The pressurized lines can transmit up to 6 MW per line. In total, approximately 1.5 km of line connects 8 sources to 16 antenna feeds.

1st Plasma Scope
Perform R&D and design for the full system, and procurement and testing for the components of the IC transmission lines needed for commissioning the high power sources.

Status
Completed Final Design Review for First Plasma hardware. Prototypes in fabrication.
Key Vendors

- Cincinnati Fan (Mason, OH)
- Comet (San Jose, CA)
- Dielectric Communications (Raymond, ME)
- Mega Industries, LLC (Gorham, ME)

Technical Description

- Transmission line operational frequency range: 40-55 MHz
- Transmission line connects 8 RF sources to 16 antenna feeds
- 1.5 km combined length, 30 cm diameter transmission lines through three buildings
- Transmission lines guide up to 12 MW peak between the matching system and the antenna
- Power coupled to plasma per antenna: 10 MW (upgrade, 20 MW)
- Maximum pulse length: 3600 s, 25% duty cycle (1 hour on, 3 hours off)
- Provide fast arc detection, real-time processing of a multivariable state-space impedance control system to enable maximum radio frequency power transmission to the plasma.