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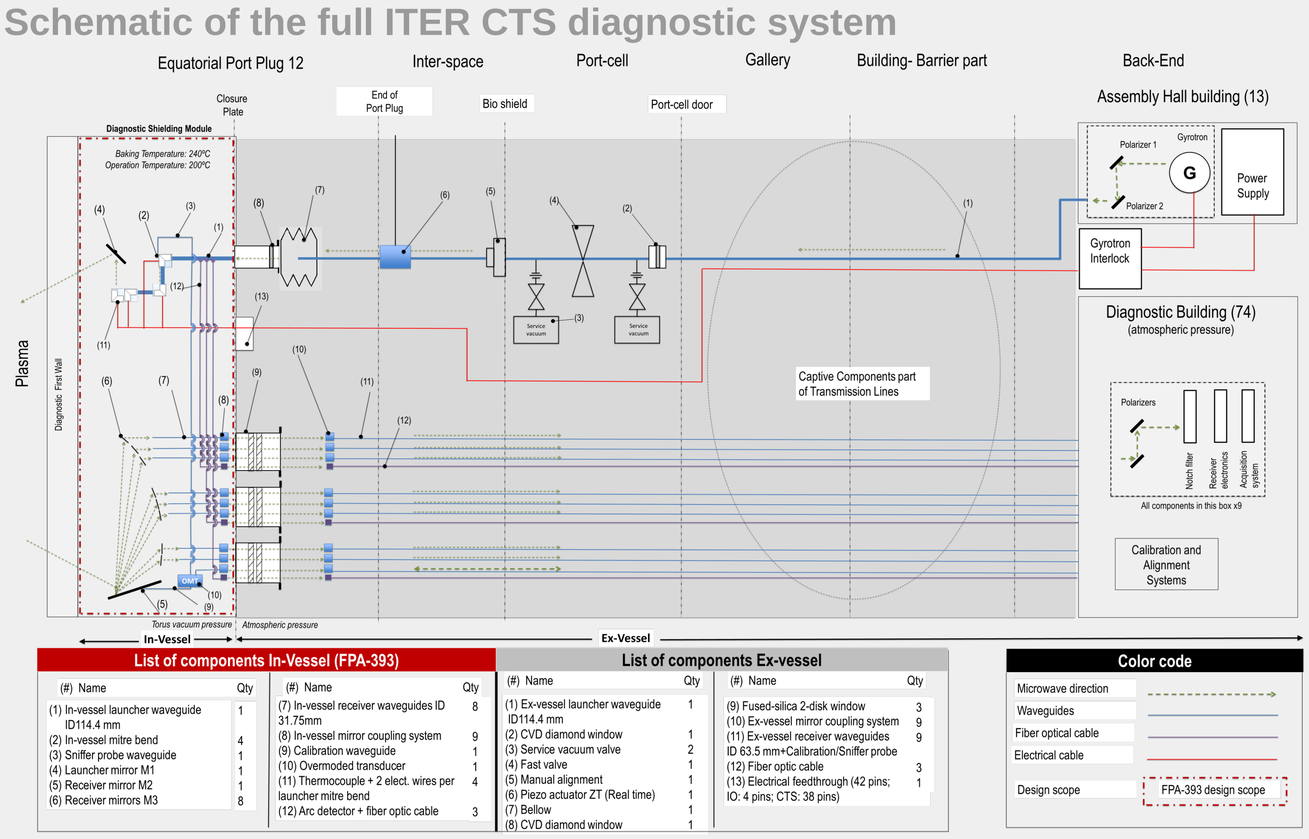
Abstract

Microwave diagnostics will play an increasingly important role in burning plasma fusion energy experiments like ITER and beyond. The Collective Thomson Scattering (CTS) diagnostic to be installed at ITER is an example of such a diagnostic with great potential in present and future experiments. The ITER CTS diagnostic will inject a 1 MW 60 GHz gyrotron beam into the ITER plasma and observe the scattering off fluctuations in the plasma – to monitor the dynamics of the fast ions generated in the fusion reactions.
Delivery of complete design of the ITER CTS diagnostic is expected by 2019 including performance and engineering analysis etc..

Schematic of the full ITER CTS diagnostic system



List of components In-Vessel (FPA-393)

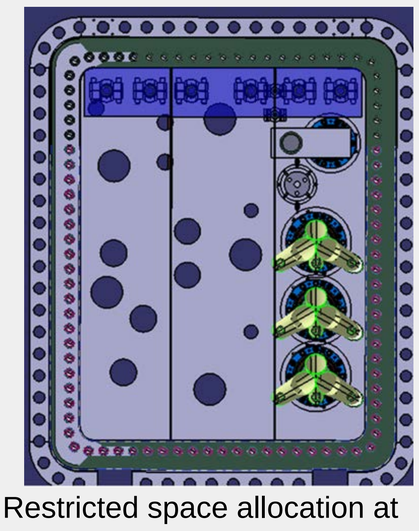
(#)	Name	Qty
(1)	In-vessel launcher waveguide ID114.4 mm	1
(2)	In-vessel mitre bend	4
(3)	Sniffer probe waveguide	1
(4)	Launcher mirror M1	1
(5)	Receiver mirror M2	1
(6)	Receiver mirrors M3	8
(7)	In-vessel receiver waveguides ID 31.75mm	8
(8)	In-vessel mirror coupling system	9
(9)	Calibration waveguide	1
(10)	Overmoded transducer	1
(11)	Thermocouple + 2 elect. wires per launcher mitre bend	4
(12)	Arc detector + fiber optic cable	3

List of components Ex-vessel

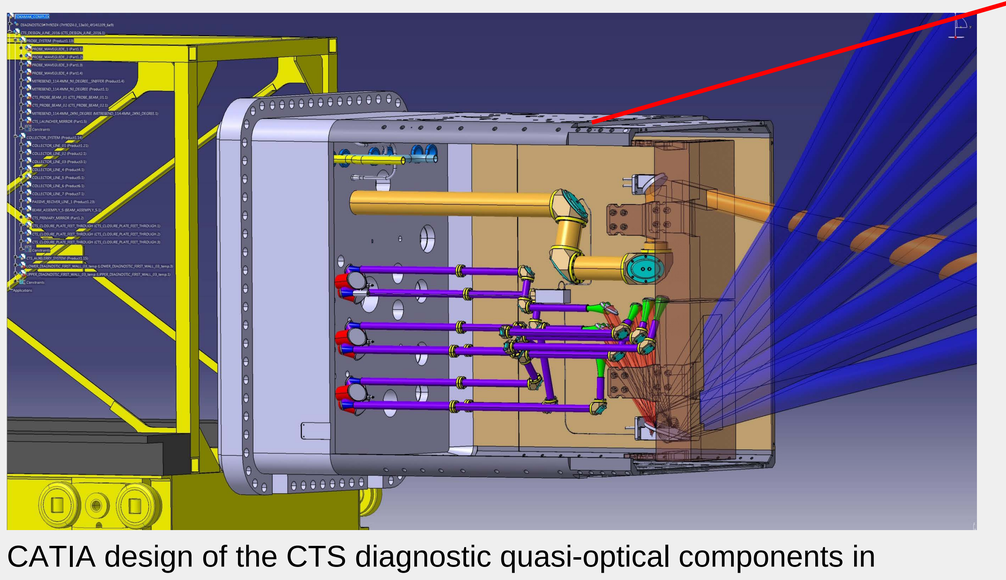
(#)	Name	Qty
(1)	Ex-vessel launcher waveguide ID114.4 mm	1
(2)	CVD diamond window	1
(3)	Service vacuum valve	2
(4)	Fast valve	1
(5)	Manual alignment	1
(6)	Piezo actuator ZT (Real time)	1
(7)	Bellow	1
(8)	CVD diamond window	1
(9)	Fused-silica 2-disk window	3
(10)	Ex-vessel mirror coupling system	9
(11)	Ex-vessel receiver waveguides ID 63.5 mm+Calibration/Sniffer probe	9
(12)	Fiber optic cable	3
(13)	Electrical feedthrough (42 pins; IO: 4 pins; CTS: 38 pins)	1

Color code

Microwave direction	
Waveguides	
Fiber optical cable	
Electrical cable	
Design scope	FPA-393 design scope



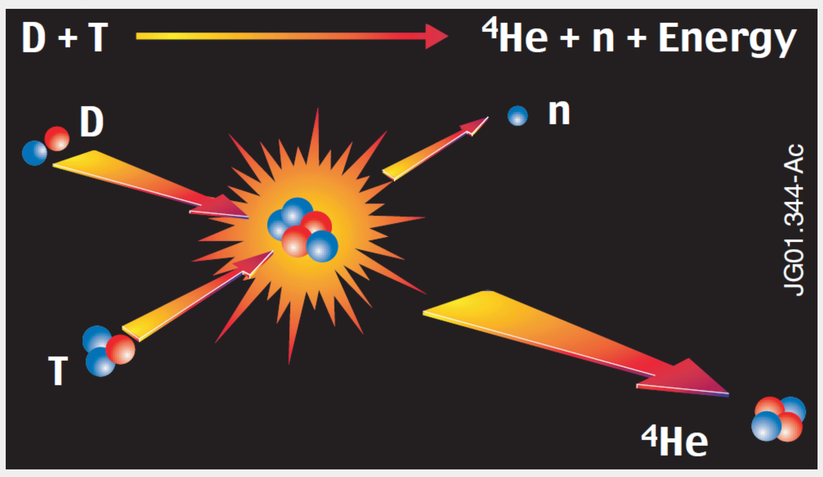
Restricted space allocation at the port plug closure plate.



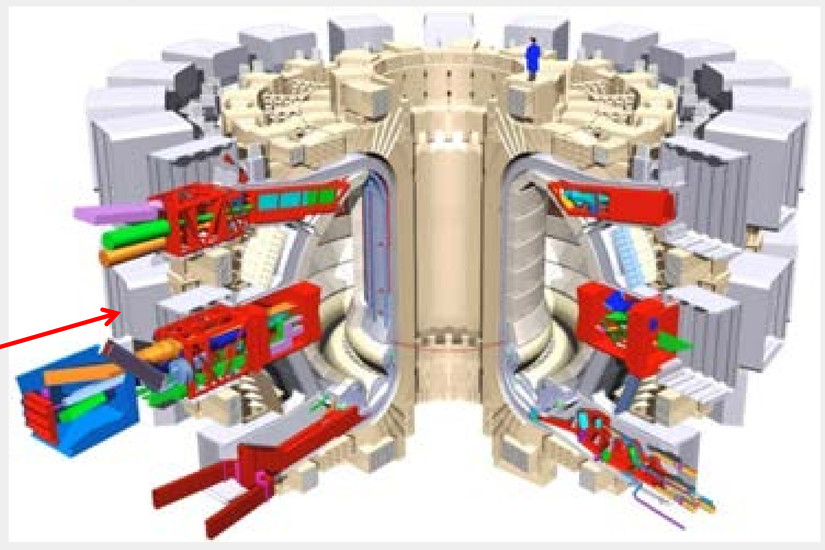
CATIA design of the CTS diagnostic quasi-optical components in equatorial port plug #12.

Fusion Energy

Fusion energy is the energy source of the Sun and the stars.
Copying the Sun in a power plant on Earth the most viable process would be:



- Fuel would be derived from sea water and lithium
- Fuel supply for a billion+ years
- 25 g of D and T = lifelong energy supply for you
- Secure power plants
- Only waste is the reactor vessel itself
- No long-lived radwaste (~100 years = hands on)



ITER is the next step experimental reactor aiming at producing 500 MW fusion power while heating by 50 MW. Built in France by EU, US, China, Russia, Japan, India and South Korea. Ready in 2025, Cost ~15 G Euro.

European Fusion Energy Roadmap predicts fusion energy to the grid around the year 2050.

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