

XGC1 predictions of Scrape off Layer width in present and future high field spherical tokamaks

Topic Area: Modeling / simulation

Partner	Company
Princeton Plasma Physics Laboratory	Tokamak Energy
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Project Summary:

Predicting Scrape-off-Layer widths in ST40 plasmas, and validating against experimental data. Heat flux footprint predicted by XGC were compared with ST40 infrared thermography measurements, and presented at the 26th International Conference on Plasma Material Interactions.

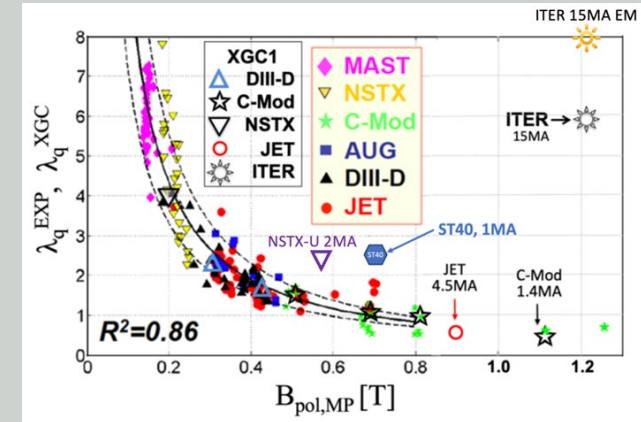
Fusion Impact:

This work helps validate XGC's capabilities for predicting the Scrape-Off-Layer width in high field spherical tokamaks, which will inform the designs of future ST pilot plants. Simulations have also been used to aid experimental interpretations.

Business/Market Impact:

Improves the confidence and de-risks the designs of plasma heat-flux handling solutions of future devices. Such predictions would not have been possible without the much needed expertise and resources provided by PPPL collaborators.

XGC simulation of ST40 discharge #10014 at 1MA has found ~2.5X enhancement of the λ_q over the predicted value by the Eich-#14 formula, as shown in the figure below. Similar to the observation from previous ITER simulations, XGC saw that the λ_q enhancement in ST40 was associated with the stronger electron-directional turbulence due to the smallness of the ion gyroradius compared to the plasma size.



Period of Performance:

Jan. 27, 2022 – July 26, 2024

Federal Share:

\$237,900

Cost Share:

\$256,000