Divertor Plasma Simulations

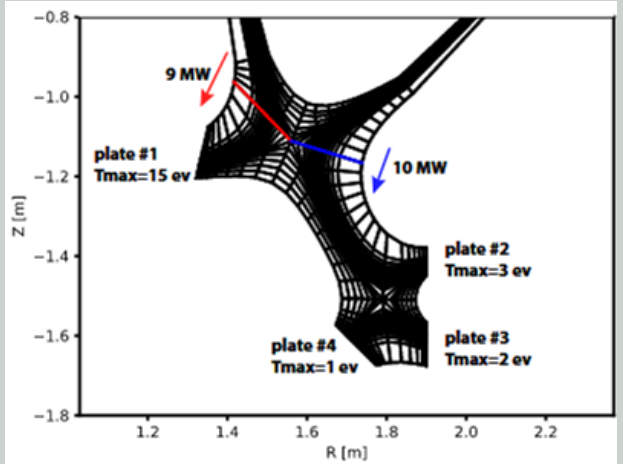
Topic Area:

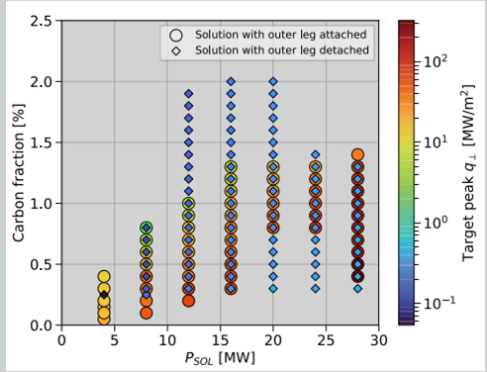
Partner	Company
Lawrence Livermore National Laboratory	Commonwealth Fusion Systems
Dr. Maxim Umansky	Dr. Adam Kuang Dr. Daniel Brunner

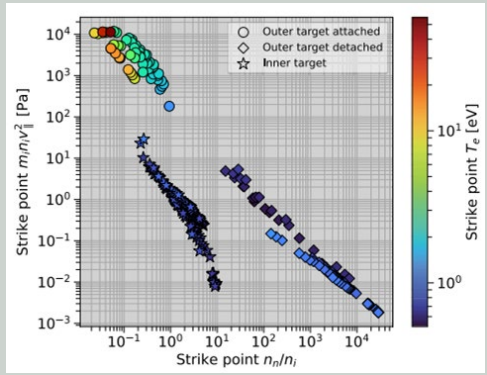
Project Summary:
Performed the first set of boundary plasma physics simulations of SPARC using UEDGE for early design scoping and benching marking of physics inputs to design.

Fusion Impact:
Simulations indicated that the X-point target outer divertor geometry at SPARC-like parameters were promising and worth the additional engineering design challenges to pursue on SPARC. In addition, simulation results flagged the risk of increased heat loads to the inner divertor with the X-point target outer divertor which had previously been overlooked.

Business/Market Impact:
Establishing benchmarked modelling workflow with comparisons to experiments on SPARC will be key for accelerating ARC design.







•*Top: X-point target strike point temperatures in SPARC. Right: Parameter scan of impurity seeding levels and input powers with vertical target divertor.*
Kuang *et. al. JPP* ***86.5*** (2020);
Ballinger *et. al. Nuc. Fus.* ***61.8*** (2021)

Period of Performance:	Federal Share:	Cost Share:
6/2020 - 6/2021	$160,000	$40,000

Divertor Component Testing

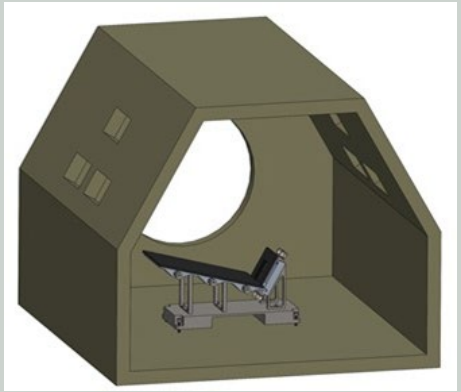
Topic Area:

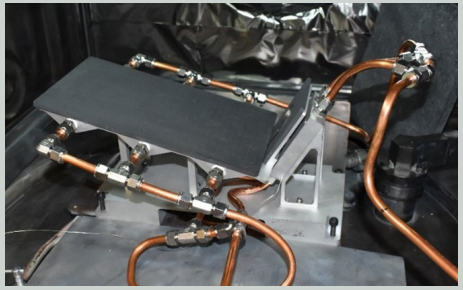
Partner	Company
Oak Ridge National Laboratory	Commonwealth Fusion Systems
Dr. Travis Gray	Dr. Adam Kuang Dr. Matthew Reinke

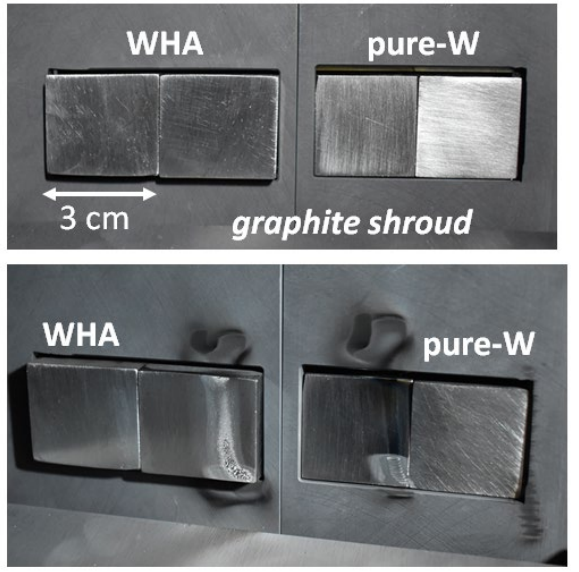
Project Summary:
Execute high heat flux testing of the base material being considered for SPARC at representative loads.

Fusion Impact:
Qualified the use of tungsten heavy alloy (WHA) - 97% W, 2% Ni, 1% Fe by weight, for use in tokamaks under higher heat fluxes than previously assessed and documented failure mechanisms relative to pure tungsten.

Business/Market Impact:
Potential cost savings to future devices as tungsten heavy alloy has significantly lower machining cost relative to pure tungsten. Material properties also enable larger components, thus reducing part count.







Left: Model and actual test stand. Top: Before and after images of the test samples.

Period of Performance:	Federal Share:	Cost Share:
3/2020 - 3/2021	$159,727	$40,000