Status of PFC Design for FIRE

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Sandia is a multiprogram laboratory operated by Sandia Corporation, a Lockheed Martin Company,
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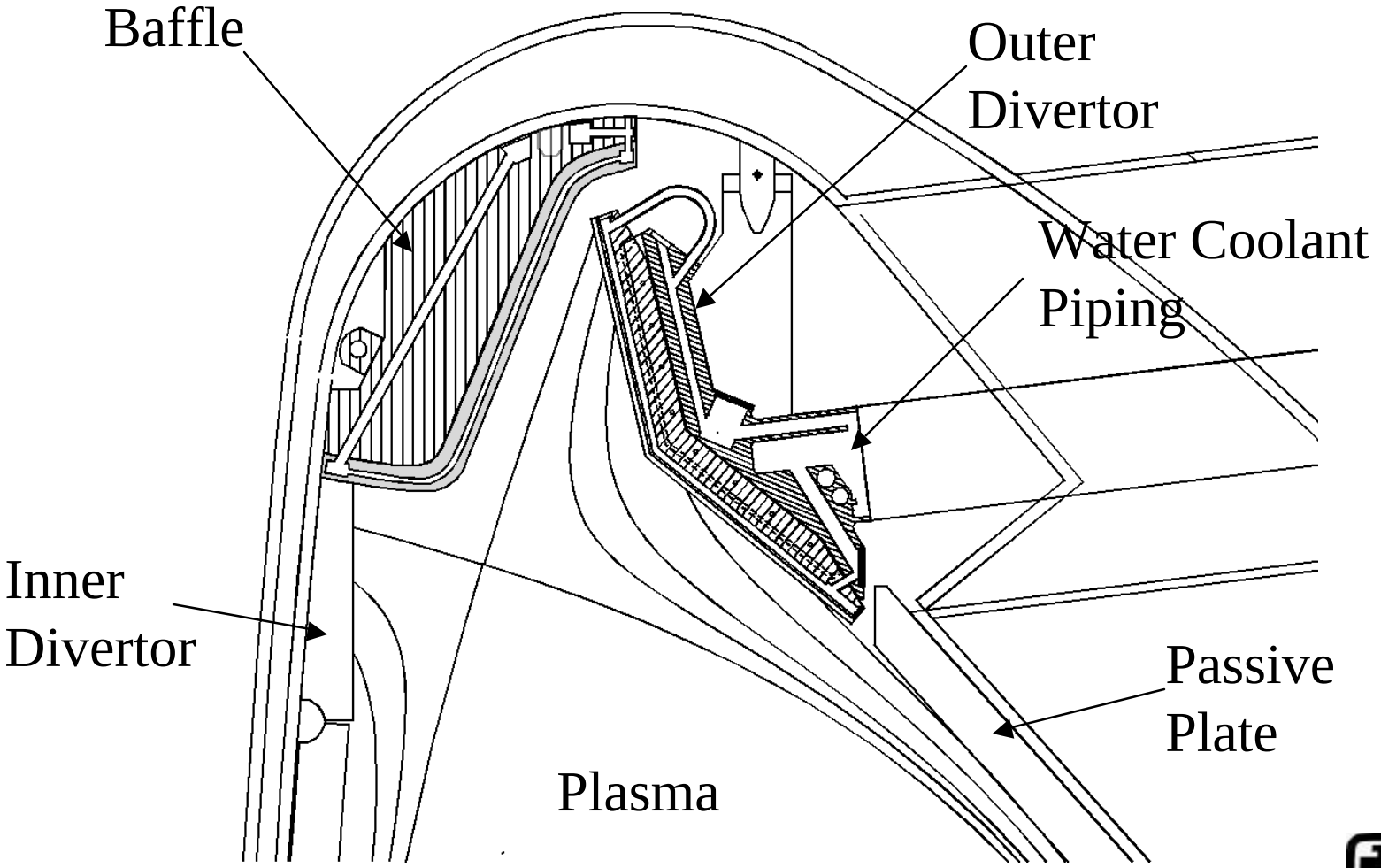
Baseline Divertor Geometry



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Impact on PFC Design

- Increasing d from 0.7 to 0.9 will shorten the depth of the inner divertor by about 10 cm (from 15 cm to 5 cm). This is a problem.
- Solution: increase the radial build (major radius)
- This would increase the aspect ratio.
- Increasing d also requires the machine to be made taller because the outer divertor leg becomes more vertical and this shortens the outer divertor.
- Increasing k increases the height of the machine linearly

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Intangibles

- **Increasing d also moves the outer strike point farther from the pumping duct. The impact on pumping has not been assessed.**
- **Increasing d forces the outer strike point more into the corner of the vacuum vessel. This restricts the room available for cooling pipes to the baffle.**
- **There are potential mounting and maintenance issues with larger d.**

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Recommendations

- **If the same performance increase can be achieved with a modest increase in k or d, the k increase is preferred from the PFC standpoint.**
- **The radial build must increase if d increases to allow room for the inner divertor.**
- **Beware of subtle effects like pumping.**
- **Limit the fusion power to 200 MW.**

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Impact of FIRE* on PFC Design

- The changes in minor radius, field, current, etc. do not have a significant effect on PFC heat loads
- The increase in plasma current to 7.7 MA will have a large impact on disruption forces.
- The forces increase by about 20%. The amount gained by connecting the divertor modules into quadrants.
- Since the divertor plates cannot be completely connected toroidally and the VDE has not been analyzed, there is a strong likelihood the divertor attachment will have to be redesigned.

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Additional Disruption Analysis Completed

- The possibility of joining divertor modules in the toroidal direction has been examined for the stationary disruption case.
- Joining the modules in four segments will reduce the eddy current forces to about 2/3 of the single module case. Enough to get the loads under control for now.
- Complete joining in the toroidal direction would eliminate the forces, but would cause maintenance difficulties (long replacement times)

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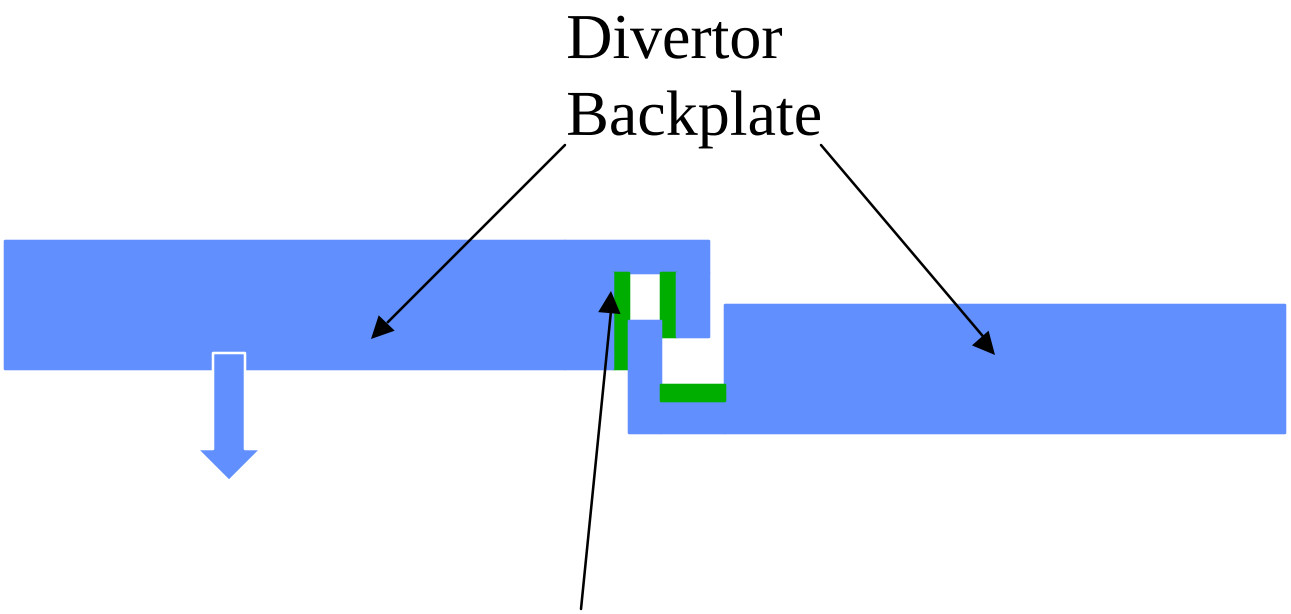
Concept For Joining Modules



Vertical Disruption Analysis

- We have received files containing the currents versus time for a VDE from Kessel.
- We will use the plasma filament representation during a disruption from TSC to perform eddy current analysis on the PFCs.
- This analysis should be complete in about 45 days.

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