

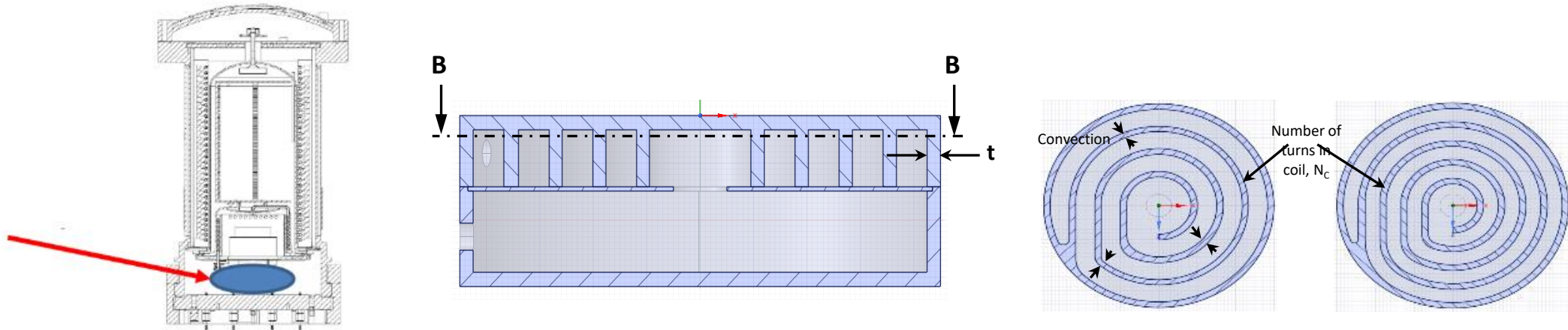


Boiler Simulation



Introduction:

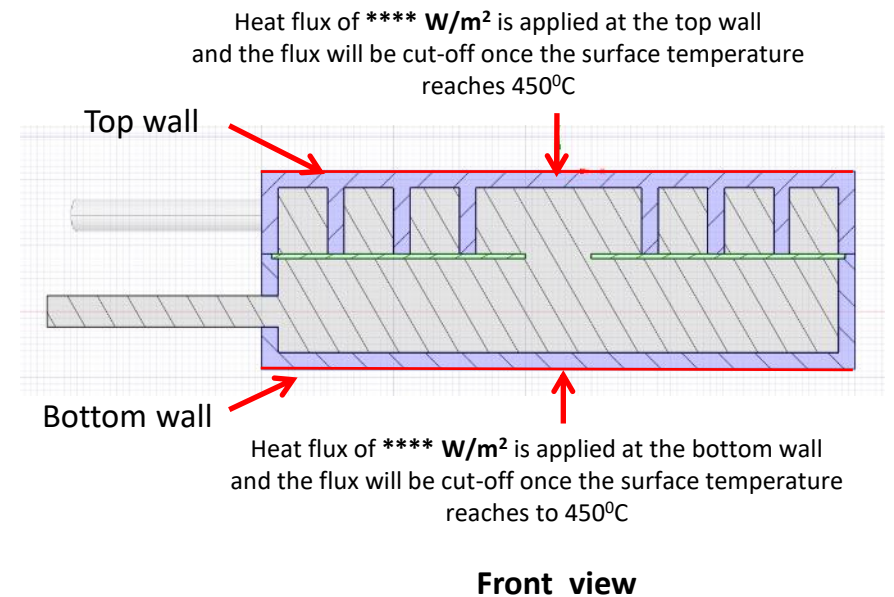
- Cleaning of Wafer is an important process in the manufacturing of Si wafers.
- To clean the Wafers, customer required to design a Boiler with Water and Nitrogen as input in Ambient temperature and pressure.
- The Objective will be to achieve outlet temperatures of 350 °C with highest Steam quality by performing CFD simulation.



Objective:

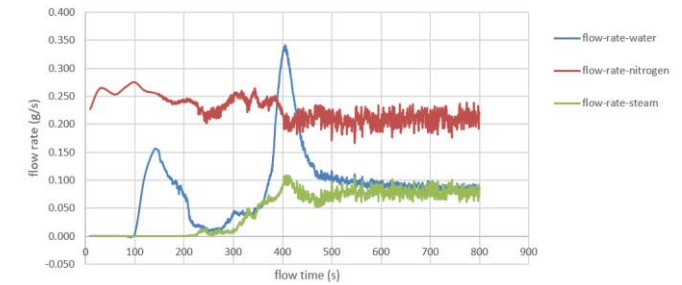
- The scope of the project is to perform a Transient coupled Thermal and CFD study of High pressure BOILER.
- The objective of this project is to optimize the design to achieve minimum 350°C of steam at outlet with superior steam quality at 15, 20 & 25atm and complete thermal mapping of the system. AES had to achieve close correlation of temperatures and steam quality with actual test results if available.
- Two models were tried, one will be the **4 helix** model **and** the second will be the **5 helix** model.
- Other parameters that were also tried are :
 - varying the flow between bottom and top segment
 - Varying the height of top and bottom segment

- 3D CAD Model was generated using solid works.
- Fluid and solid domain are meshed with hexahedral mesh using Ansys.
- Meshed model was exported to fluent for solving.
- Multiphase model is used for the analysis.
- Initial condition will be assuming that nitrogen is present in the Boiler at ambient pressure.
- Temperature dependent material properties are considered for both solid and fluid domain.
- Mass flow rate boundary condition was considered at the inlet boundary.
- Pressure outlet boundary condition was considered at the outlet boundary.
- Heat flux is supplied at the top and bottom surfaces of the solid domain. The heat flux supply & cut off is controlled through **user defined function(UDF)**.
- Between solid and fluid domain interfaces thermally coupled wall condition is used

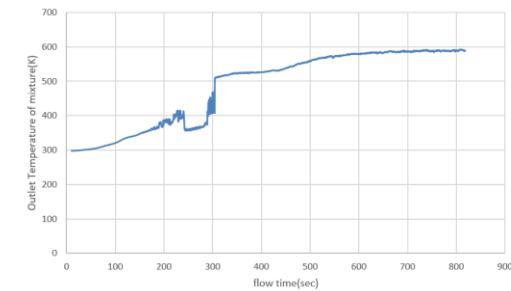


Results and Conclusion:

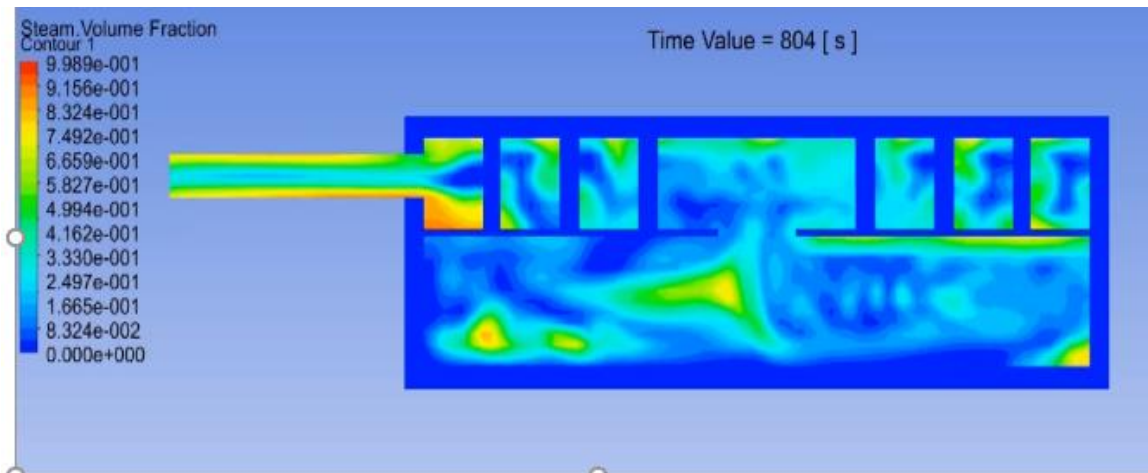
- The plot provides the mass flow rate and the static temperature at the outlet boundary of the existing model.
- Simulation is carried out for the existing model and modified design model , By using the existing model unable to achieve the required temperature at the outlet.
- Modified design model improves temperature at the outlet from 306°C to 360°C.



Mass flow rate at the outlet(g/s) vs flow time (s)



Temperature (K) vs flow time (s)



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