

CISC Consortium & Cryogenic Modeling

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CFD Simulations

- The goals of cryogenic modeling performed through Computational Fluid Dynamics (CFD) simulations are
 - Guide the design of the DUNE cryostat and cryogenic system
 - Provide input on how changing the boundary conditions impact the fluid and gas flow in the cryostat
 - *Guide the design of the liquid argon instrumentation devices (in terms of location, no. of devices etc.) — CISC Consortium scope*
- Validation of CFD modeling with data *is critical* for calibration and physics as temperature and impurity modeling impact drift parameters such as electron lifetime, drift velocity, fiducial volume etc.

CFD Simulations: Division of Scope

- *LBNF/Cryostat team*: Producing CFD simulations for cryostat/cryogenics system design (E. Voirin)
- *CISC Consortium*: Producing CFD simulations needed for guiding instrumentation designs (e.g. purity monitors, and thermometers)
 - SDSU team S. Gent & G. Michna (faculty) and A. Propst (graduate student) have done extensive studies to understand how various cryogenic models would impact flow mechanics, heat transfer, and impurity concentrations of cryostats
 - A full report of their work is here: <https://docs.dunescience.org/cgi-bin/private/ShowDocument?docid=6017>
 - This work has helped the CISC consortium greatly in finalizing locations for the instrumentation devices and penetrations on the cryostat
- *Agreement that both groups will interface/communicate as needed to ensure same boundary conditions are used in simulations*

CFD Simulations: Future path

- The CISC consortium has formed a focused effort to understand future CFD simulations needs with a goal to finalize the instrumentation designs for the TDR timeline
 - leads: *J. Stewart & A. Hahn*
- CISC Milestones
 - *Feb 2018*: Produce a list of needed CFD simulations
 - *March 2018*: Coordinate CFD activities b/n various groups
 - *Nov 2018*: Complete needed CFD studies (full report)
- The SDSU faculty/student team has been a very productive team and will nicely complement existing Fermilab-based CFD efforts