

CERN ATS Seminar on 21/06/2022: <https://indico.cern.ch/event/1166787/>

Computational Fluid Dynamics (CFD) Team Supporting CERN

by Francesco Dragoni, Rahul Shukla, Iñigo Martin Melero (CERN)

Number of participants: 17 (in presence) and 42 (webcast)

F. Dragoni opened the talk with an introduction on the Computational Fluid Dynamics (CFD) team, part of the EN-CV group. The team is small (4-5 people) but highly skilled and able to provide advanced numerical solution to complex problems in the CFD domain. Software used by the CFD team as well as the hardware available have been presented in details. Main available calculation methods are described focusing on the capability of simulating complex situations including large buildings thanks to the integration with the CAD.

R. Shukla presented a CFD case study about the *HL-LHC URx5 Gallery – HVAC system*: results of this complex simulation allowed optimizing the Air Handling via installation of some Unit in order to keep temperature under control (main source of extra heat being newly installed power converter as well as large electric racks).

I.M. Melero presented another case study about CO₂ leak assessment for USA15 2PACL Systems. This work has been requested by the ATLAS collaboration in order to assess the impact and distribution of CO₂ gas in case of different leak scenarios.

Q&A Session:

- Question about invoicing of the activities of the team. F. Dragoni confirmed that the CFD team does not invoice his activities. They are able to tackle up to 8-10 projects per year depending on the complexity of the tasks.
- Question about open software in the CFD domain. Dragoni answered that open software exist however, given the complexity of the problems faced in the accelerators domain (also in terms of geometry and dimension of the models), the suites used at CERN are more suitable.
- Question about typical errors and accuracy of CFD simulations vs FEM simulations. Dragoni answered that level of errors and accuracy targeted in CFD simulations are in the order of 5% ÷ 10%, similar to typical FEM simulations.
- Question about experimental identification of parameters: when is it necessary and how is it done? Dragoni and Shukla answered that results of a complex CFD simulation clearly depend on reliable data in terms of heat input, temperatures, flow rates...as well as relevant data about roughness. Typically, at CERN we can rely on installed probes but in some cases special measurement campaigns are necessary in order to obtain reliable CFD results.

Alessandro, Elias, Michele, Thierry (and the speakers)