

**Computational *F*luid *D*ynamics team
supports CERN development**

CERN May 19th 2011

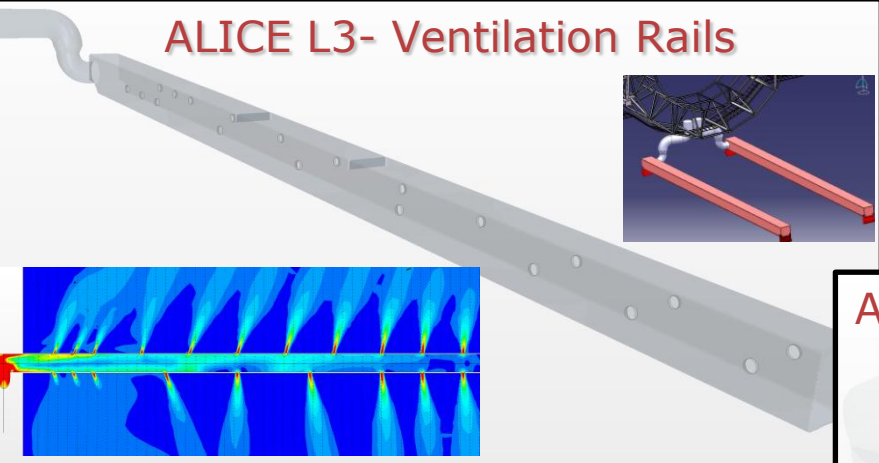
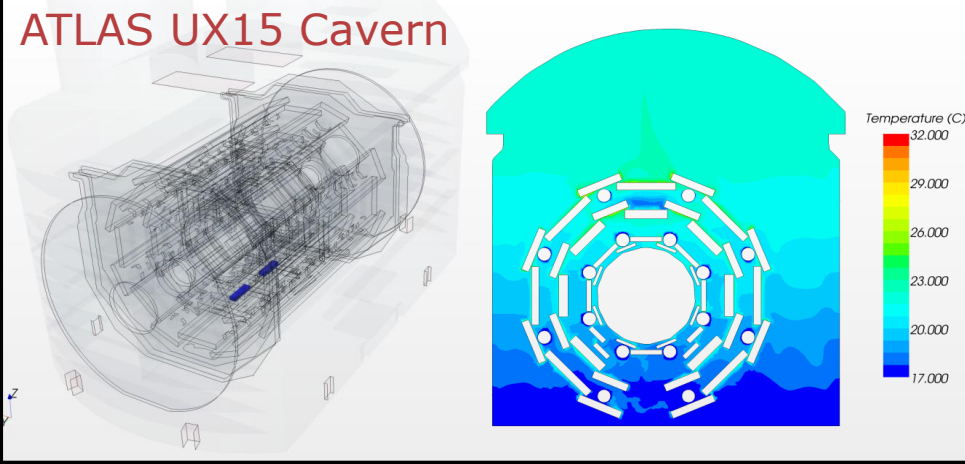
Who are we?

- The CFD activity started in EN/CV group around **1993**. From that on a group of young engineers (technical students, fellows, project associates, UPAS, trainee programmes) took over this activity spending short to medium periods at CERN.
- In 2003 when the TS department was created, the Cooling and Ventilation Group decided to structure this activity into a **formal team** inside the Detector Cooling Section.
- Nowadays, the team counts with an average of **three-four members** spending between one and five years in the team.
- The team uses STAR-CD and STAR-CCM+, in the last year we moved all our news project to STAR-CCM+ and, in the next future, to OpenFOAM.

CFD is useful in many fields at CERN

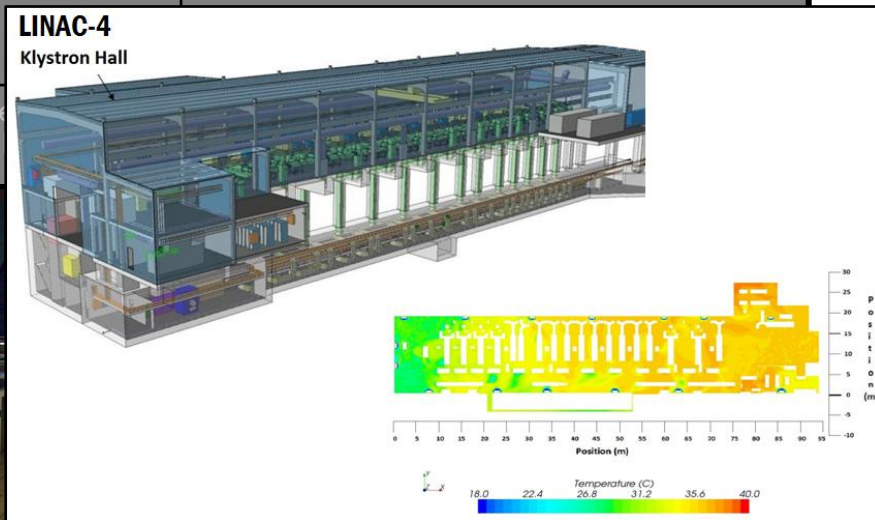
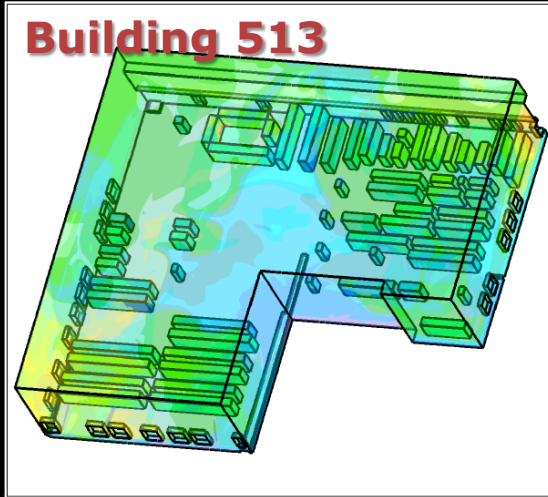
<p>Natural and forced convection heat transfer</p>	<p>ATLAS 3D HX15 and muon chambers cooling, ALICE Muon, ALICE L3 ventilation</p>	<p>Some chamber need an additional cooling source: a thermal screen will be implemented. Definition of the ventilation scheme of new L3 rails.</p>
<p>Air cooling</p>	<p>RF-Cavity cooling, CNGS Horn and Reflector air cooling analysis, LINAC4 ventilation, Bdg 513 ventilation of the grid computer room.</p>	<p>Cavity geometry design has been modified. Additional gaps in the shielding walls, trenches on the target chamber floor. Number and position of ventilator diffuser has been optimized. Server Rack cold corridors has been closed.</p>
<p>Water cooling</p>	<p>SPS magnet cooling analysis</p>	<p>Exact definition of the heat power evacuated by cooling water and air.</p>
<p>Safety</p>	<p>CNGS tunnel: flow analysis in case of decay tunnel cap rupture. The Globe: fire effect simulation, transient temperature distribution.</p>	<p>Special duct installation to resist to high pressure and move the high speed point in a safe zone of ECA4 cavern.</p>
<p>Gas distribution</p>	<p>ATLAS Inner Tracker CO₂ and N₂ flow analysis. Flushing time estimation before cooling</p>	<p>Definition of the inlet points position and the time to complete the flush.</p>
<p>Pollutant dispersion</p>	<p>ISOLDE activated gas decay, HirRadMat activated gas flashing time.</p>	<p>Define the time needed to flash the tunnel before human access.</p>
<p>Humidity distribution</p>	<p>CMS Tracker flow analysis.</p>	<p>Reduction of inlet points from 8 to 1.</p>

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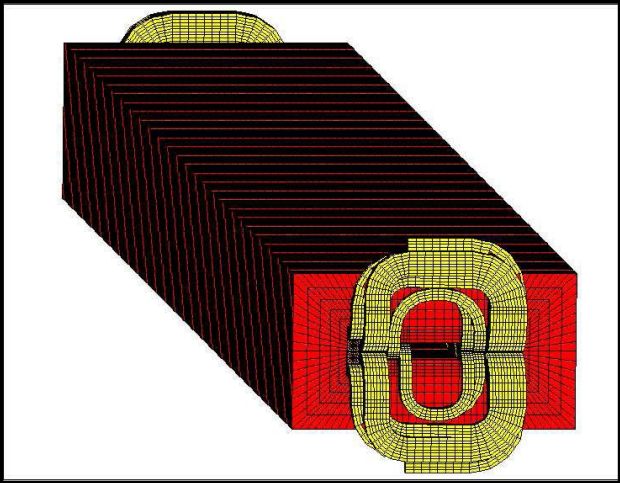
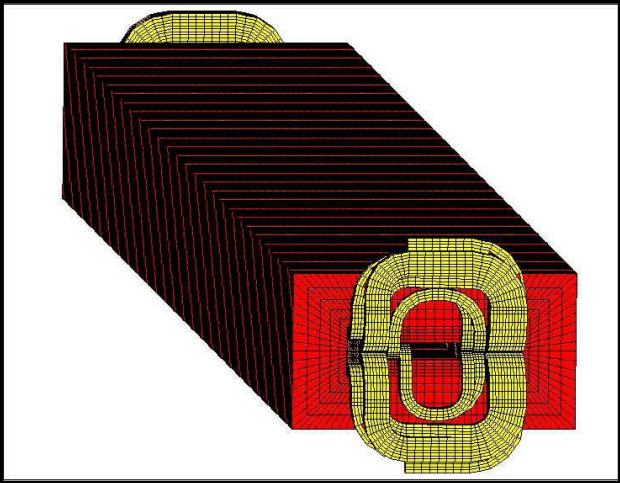
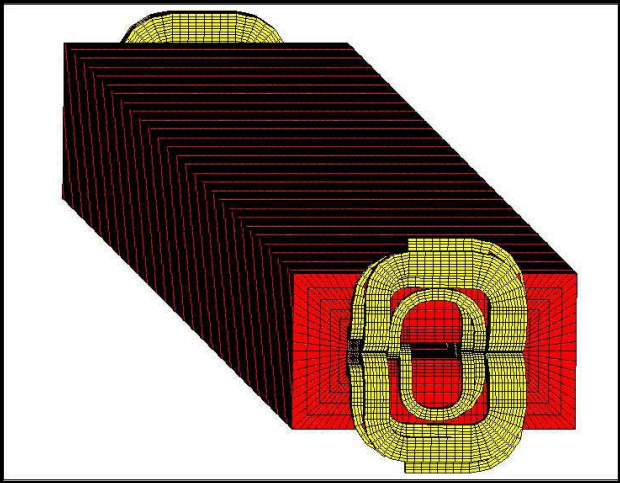
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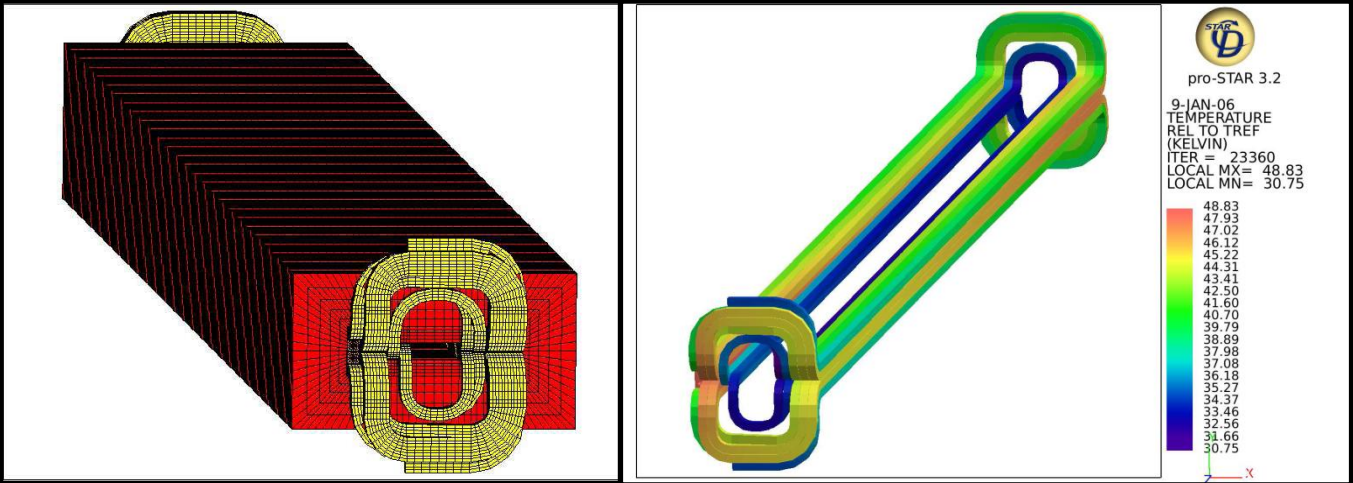
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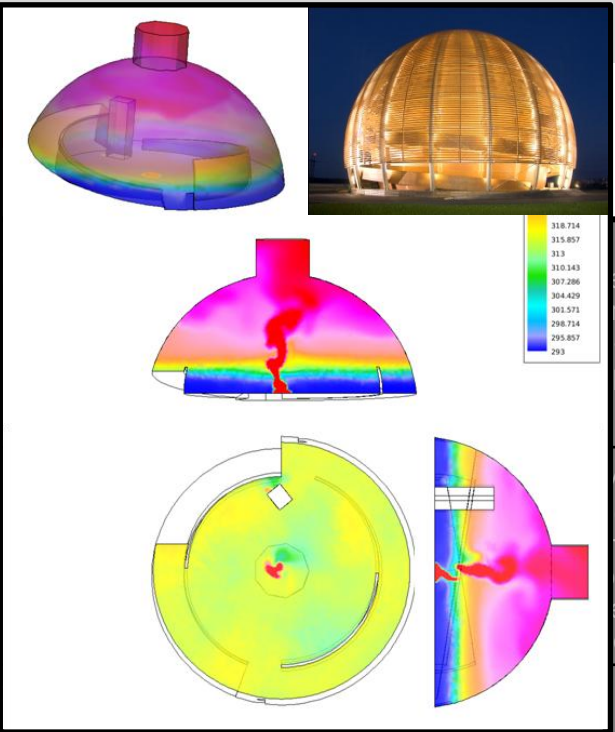
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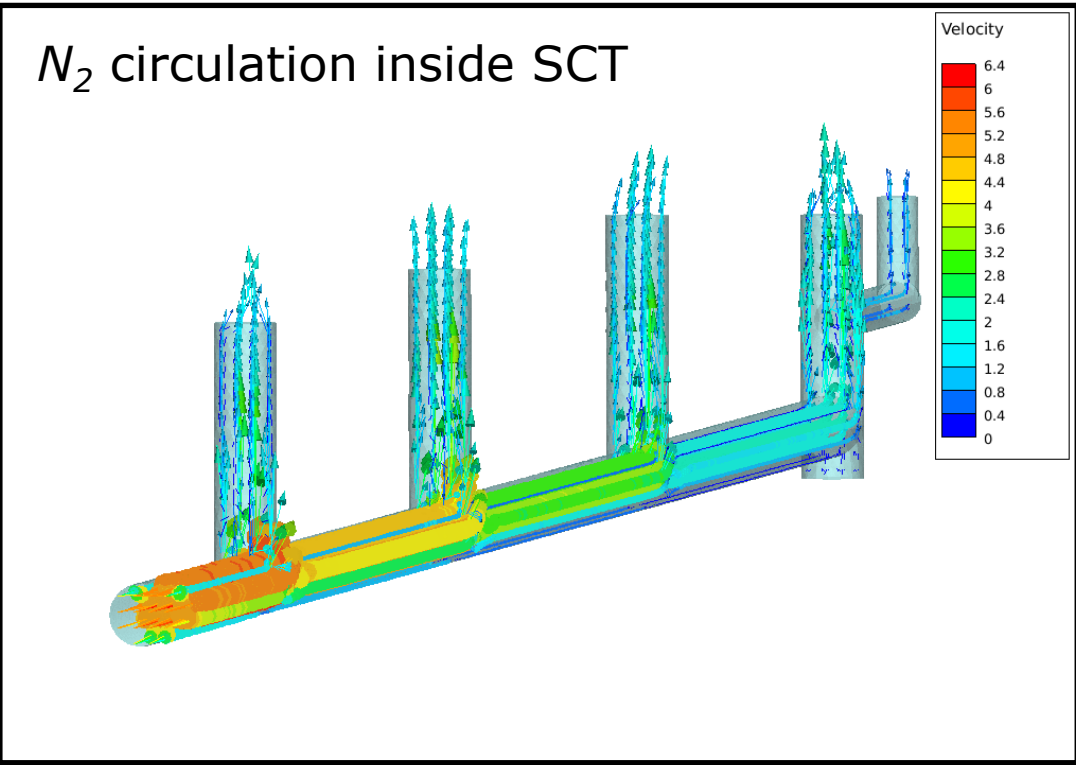


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CFD N₂ circulation inside SCT



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Water cooling
Safety

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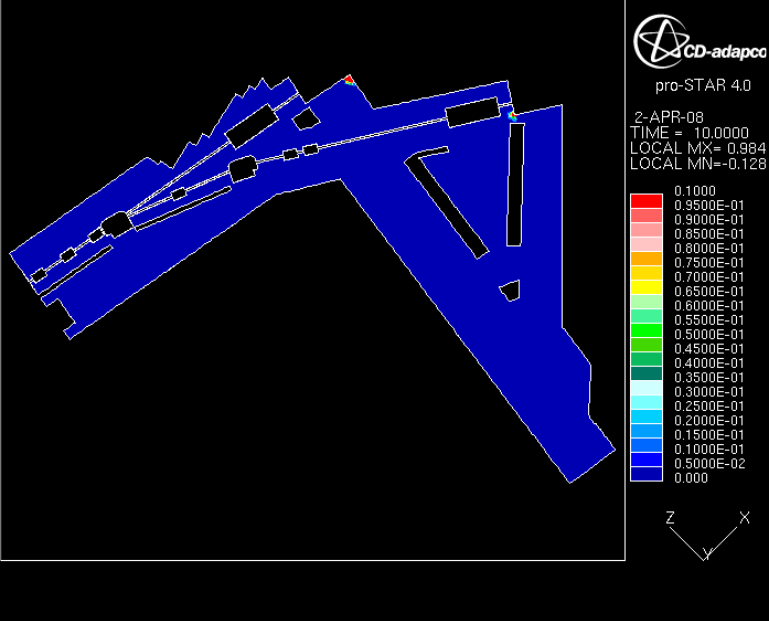

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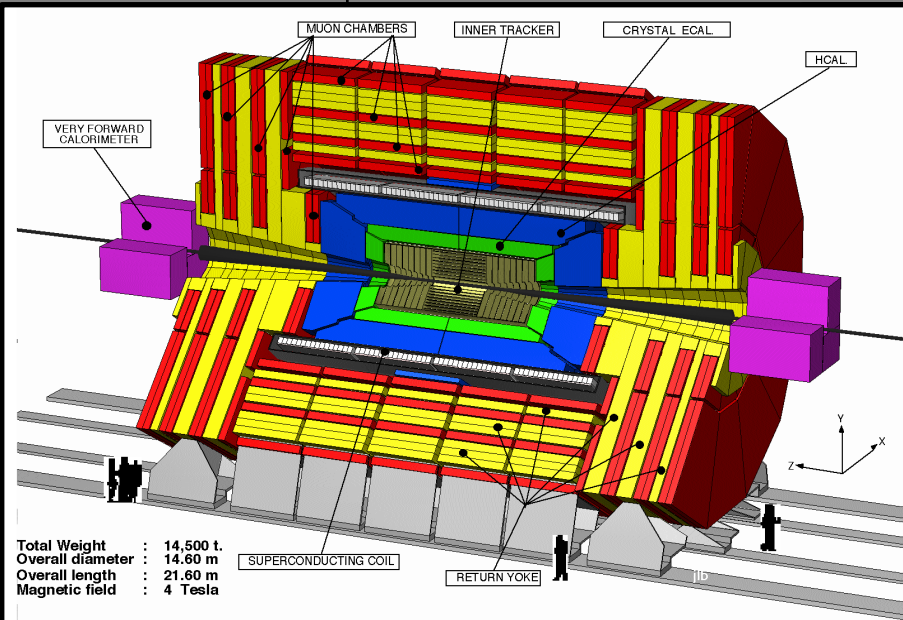
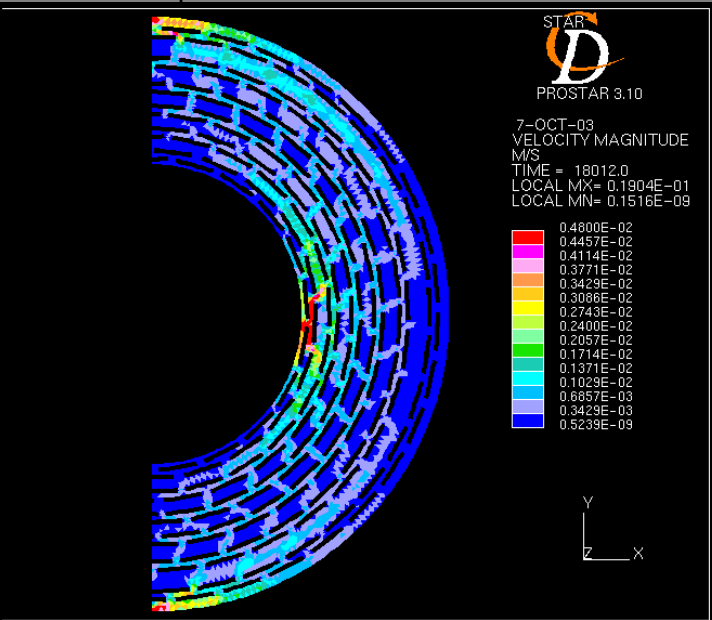
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<p>Air</p> <p>Water</p> <p>Safety</p> <p>Gas</p>	 <p>Total Weight : 14,500 t Overall diameter : 14.60 m Overall length : 21.60 m Magnetic field : 4 Tesla</p>	 <p>STAR PROSTAR 3.10 7-OCT-03 VELOCITY MAGNITUDE M/S TIME = 18012.0 LOCAL MX= 0.1904E-01 LOCAL MN= 0.1516E-09</p> <p>0.4800E-02 0.4457E-02 0.4114E-02 0.3771E-02 0.3429E-02 0.3086E-02 0.2743E-02 0.2400E-02 0.2057E-02 0.1714E-02 0.1371E-02 0.1029E-02 0.6857E-03 0.3429E-03 0.5239E-09</p>
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What we do?

- Mission of the team is to give support to LHC machine and detectors performing CFD studies during the prototype, design, development and operation phases of their components
- Resources
- Example studies:
 - CAST
 - Assessment of measurement uncertainty
 - RF Cavity cooling
 - Numerical prototyping aiding the design
- CFD evolution at CERN

