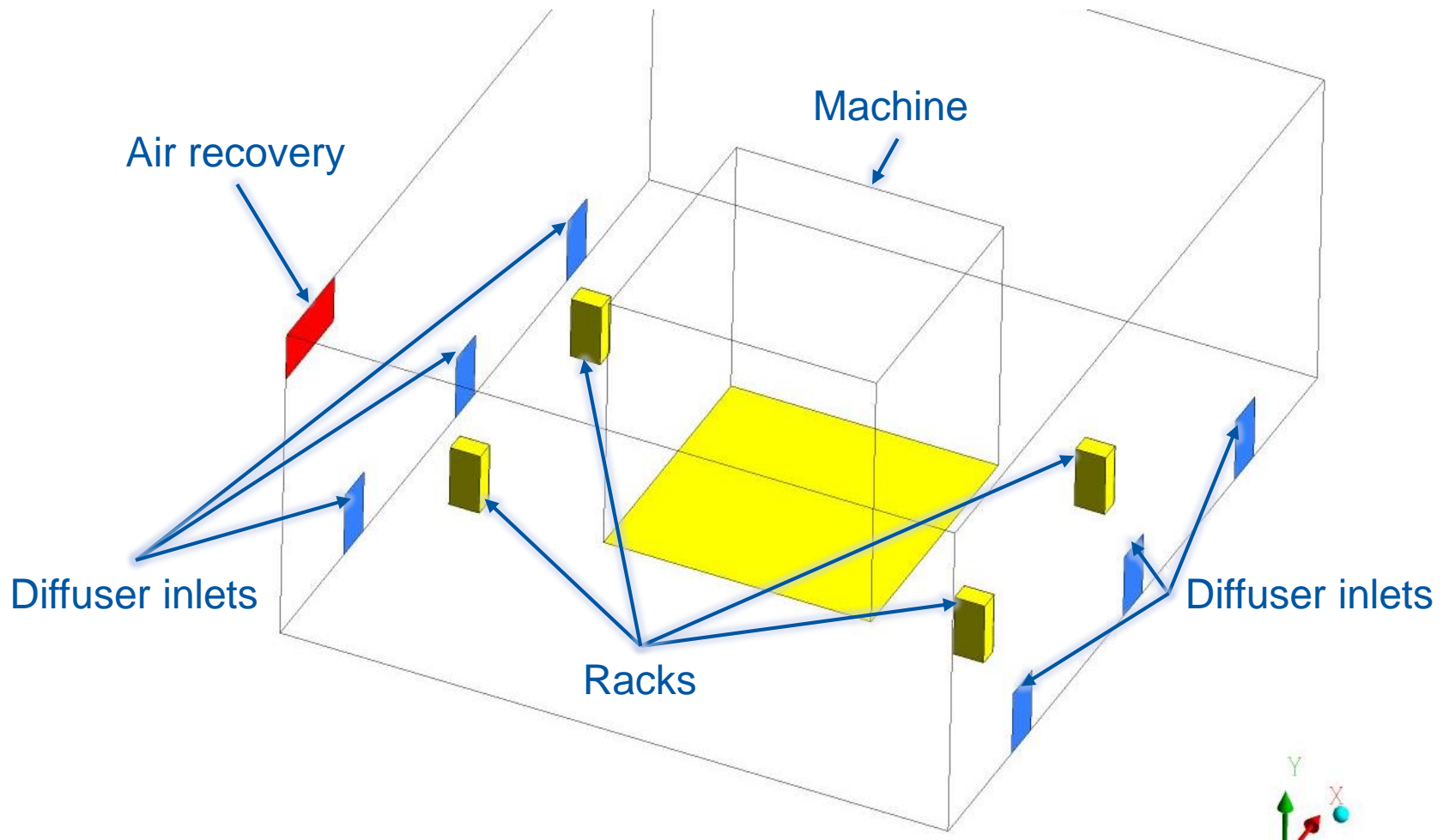


LHCb assembly hall CFD study

E. Rocco, A. Rakai – EN-CV-PJ

Geometry used for calculations



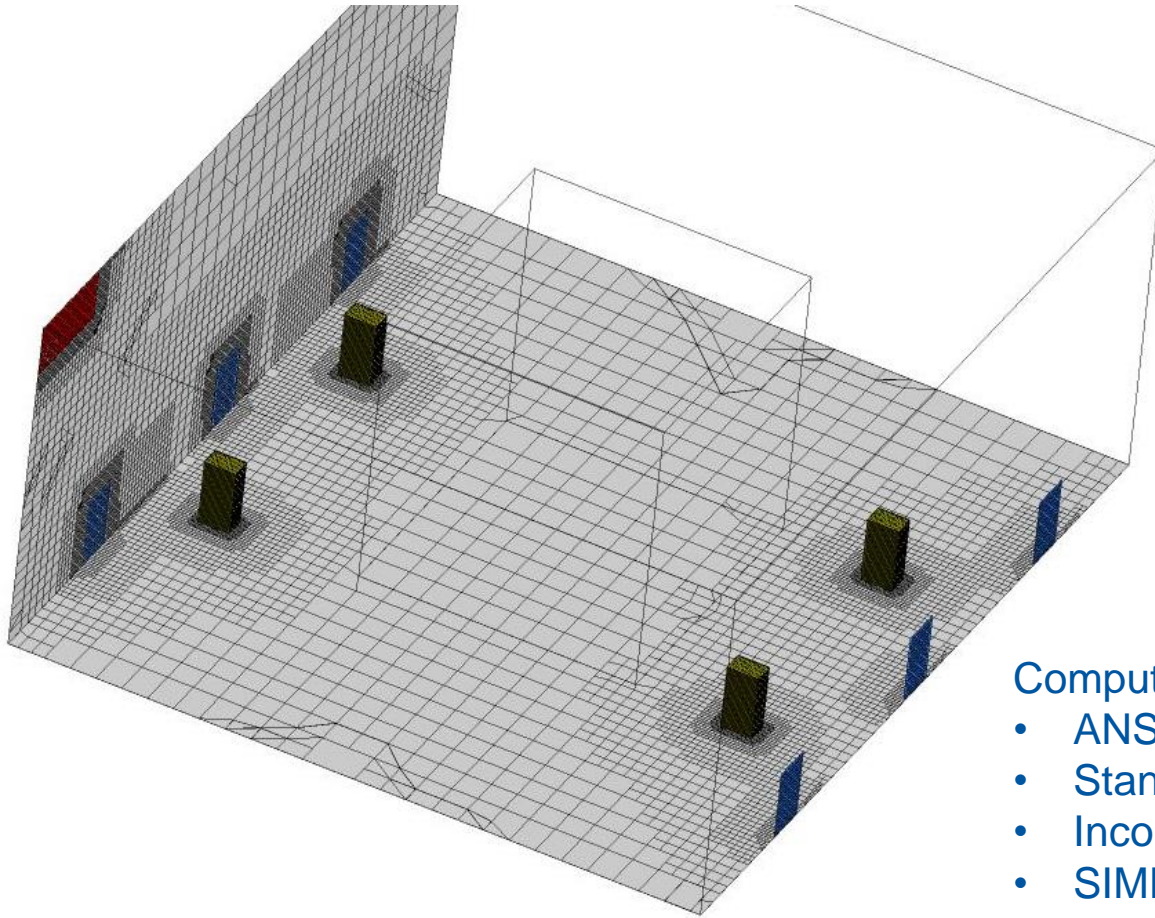
Assumptions used for calculations

- 10 kW/30 kW heat from racks
- 5 kW/20 kW heat from machine floor
- 18000 m³/h displacement ventilation at 19°C
- 6 diffusers with 0.35 m/s inlet velocity
- 4 racks with standard dimensions
- Global ΔT expected for total 30 kW heat: 5 K

$$Q = c_p \cdot m \cdot \Delta T$$

$$\Delta T = \frac{30000 \text{ W}}{6 \frac{\text{kg}}{\text{s}} \cdot 1000 \frac{\text{J}}{\text{kg} \cdot \text{K}}} = 5 \text{ K}$$

Computational mesh and details

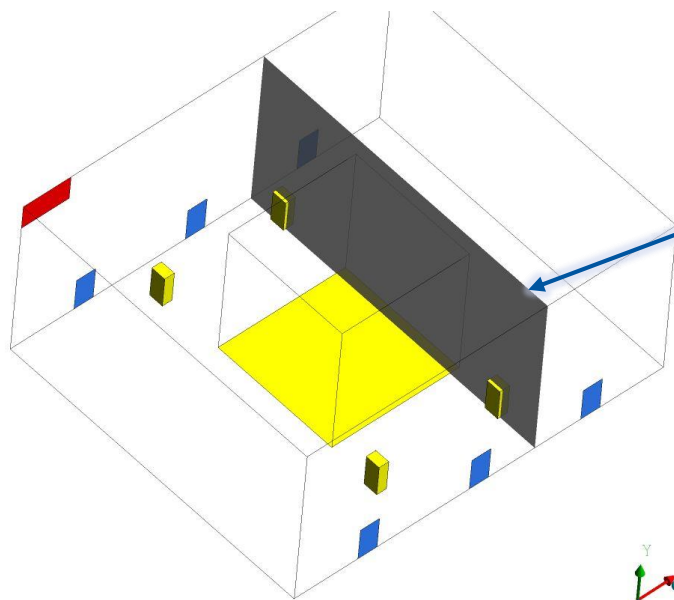


Computational fluid dynamics:

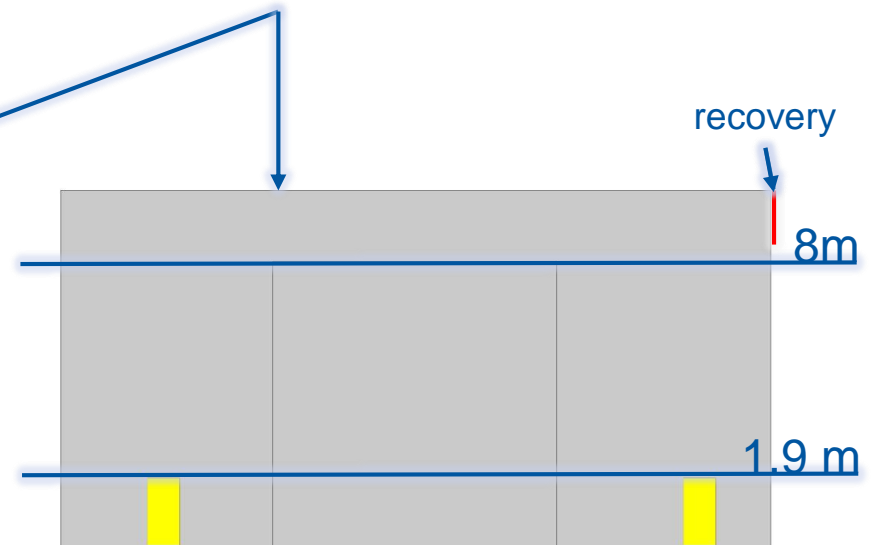
- ANSYS Fluent v17.0
- Standard k- ϵ turbulence model
- Incompressible ideal-gas model
- SIMPLE pressure velocity coupling
- Body force weighted pressure scheme

Scenarios

Scenarios	Heat from racks	Heat from machine
S1	10 kW	20 kW
S2	30 kW	0 kW
S3	10 kW	5 kW

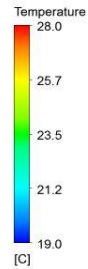
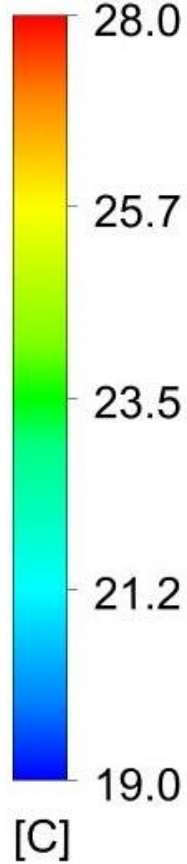


Cross section plane shown in next slide

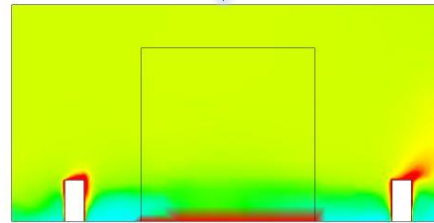


Temperature distribution

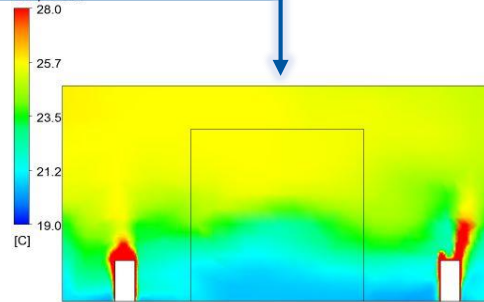
Temperature



S1: 10 kW racks, 20 kW machine



S2: 30 kW racks, 0 kW machine



S3: 10 kW racks, 5 kW machine

