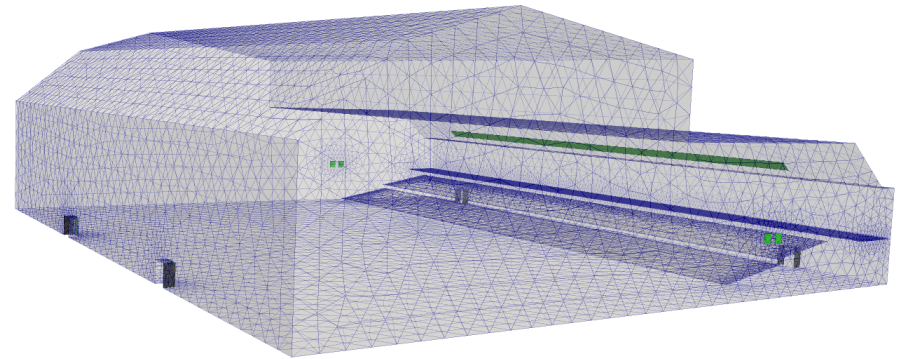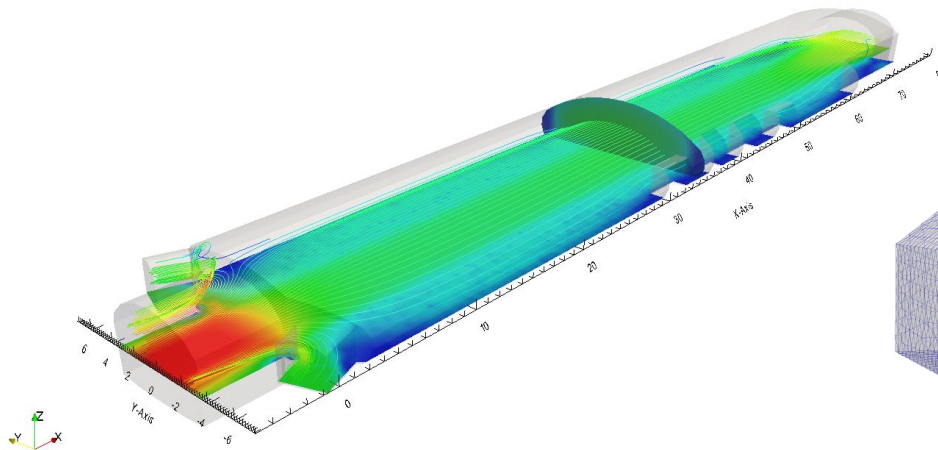# Indoor air cleaning optimization with modelling

ARIA Technologies SA
8-10, rue de la Ferme – 92100 Boulogne Billancourt – France
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Introduction

- **Increasing interest for air depollution systems**
- **Indoor depollution easier than outdoor**

- **Number of depollution systems limited by budget**
- **Depollution rate limited by the used filtering technology**
- **Then 3D modelling helps in optimizing the locations and direction of polluted air extraction and clean air outlet**

- **Emissions inventory are required but complex to establish**
- **Concentration measurements on field help to fit the emissions rates**

Case #1 : Subway station

- **IP'AIR project by SUEZ in Paris**
- **2 depollution systems in Alexandre Dumas station**
- **2 field campaigns with mobile sensors by SUEZ**
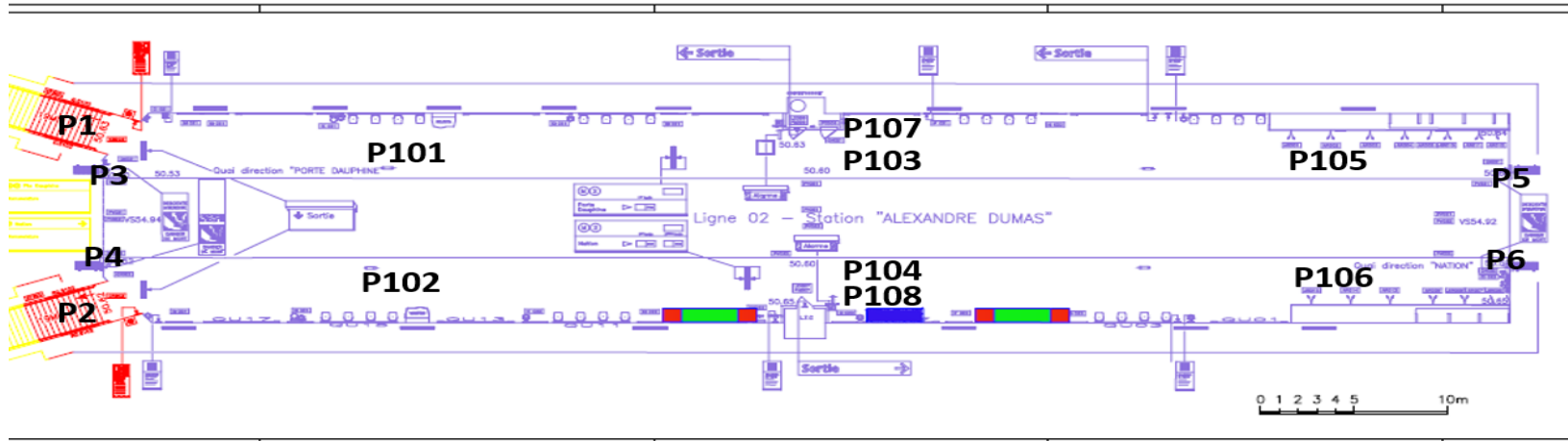- **1 static reference sensor by RATP**
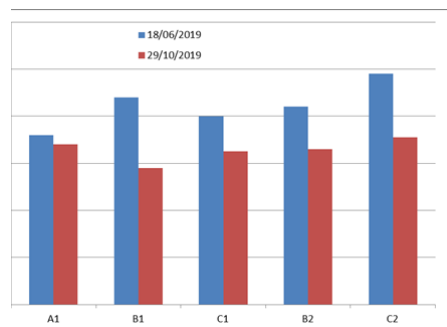

One of the two depollution systems

Reference sensor

- **PM measurements at different locations in the station**
- **Mean Velocity speed at stations opening**
- **Turbulence at different locations in the stations**
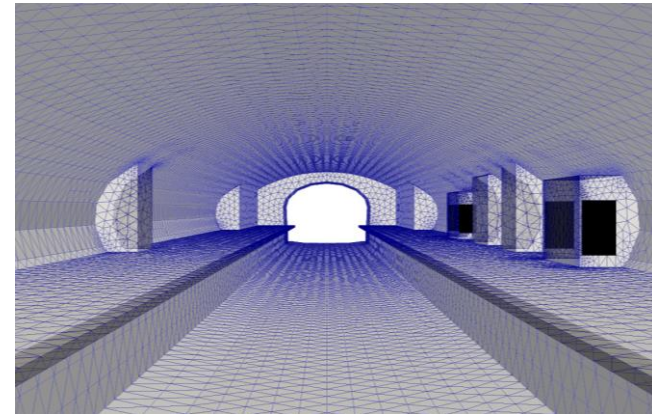

Location of measurments with mobile devices

Mean observed concentration at different points
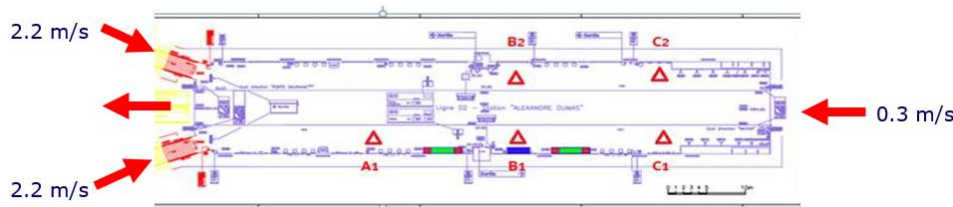
Geometry and aeraulic modelling

- **Steady state** CFD modelling with Code_Saturne : searching for a time averaged picture
- **Wind/turbulence boundary condition from observations**
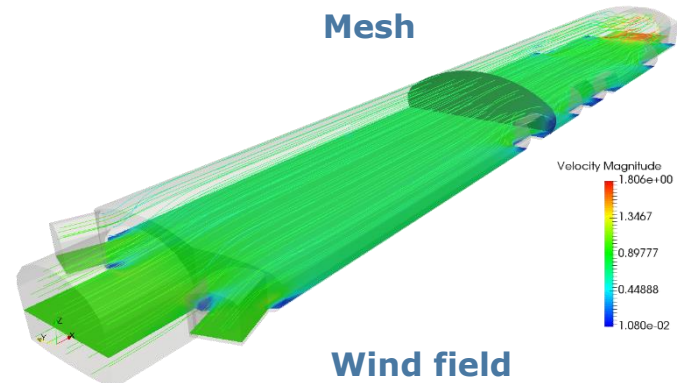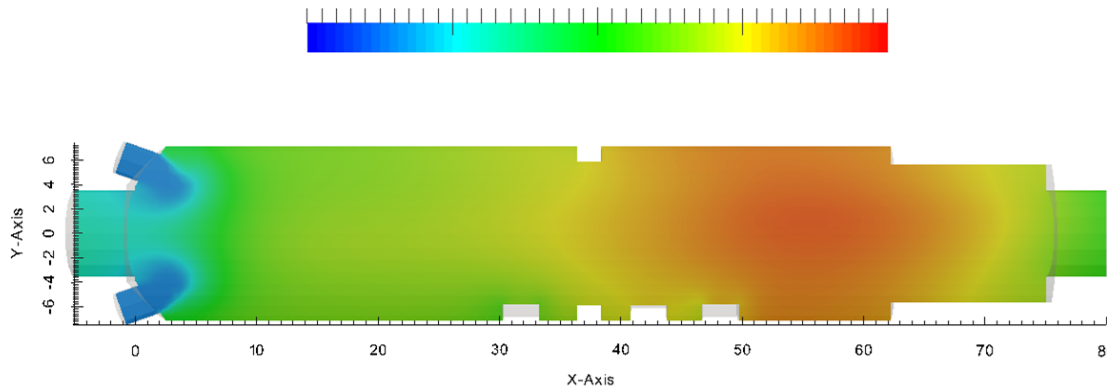- **Turbulence added for train movement effects**
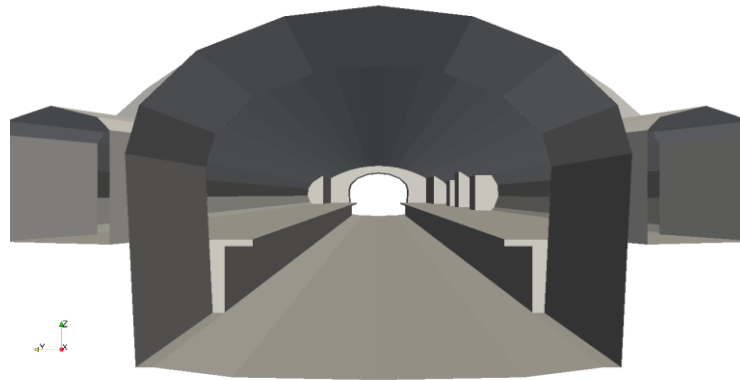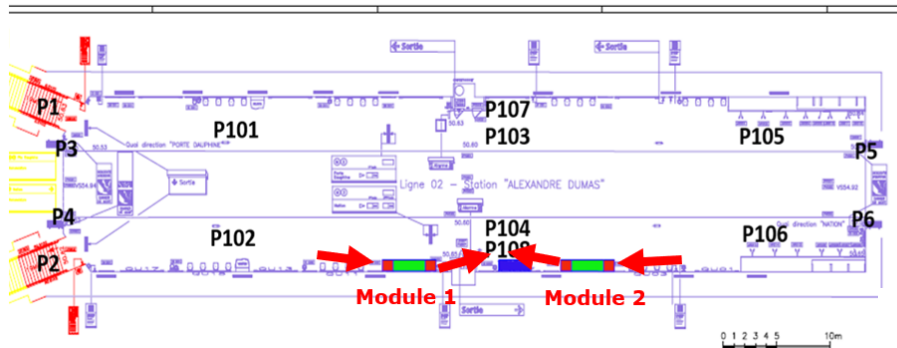

Geometry

Mesh

Boundary conditions

Wind field

Concentration and emission

- **Concentration at boundary conditions from observations**
- **Emission rates inside domain : fitting by comparison between observations and model**

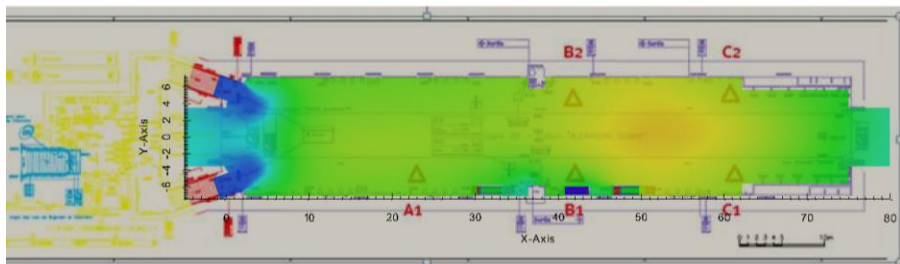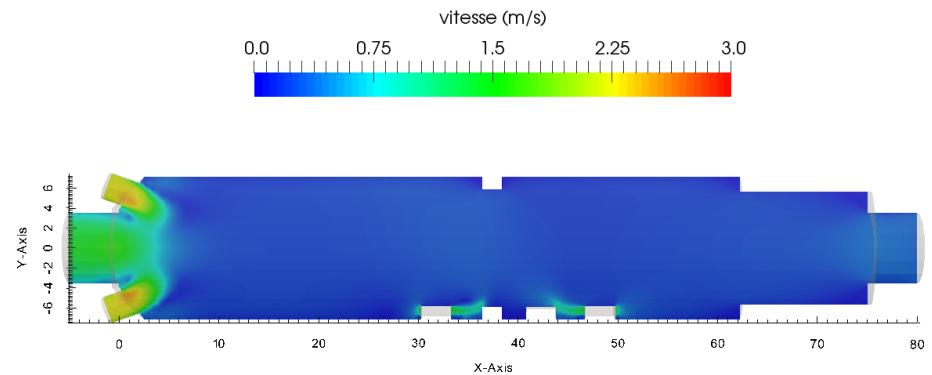**Concentration field – without depollution systems**

Depollution systems setup

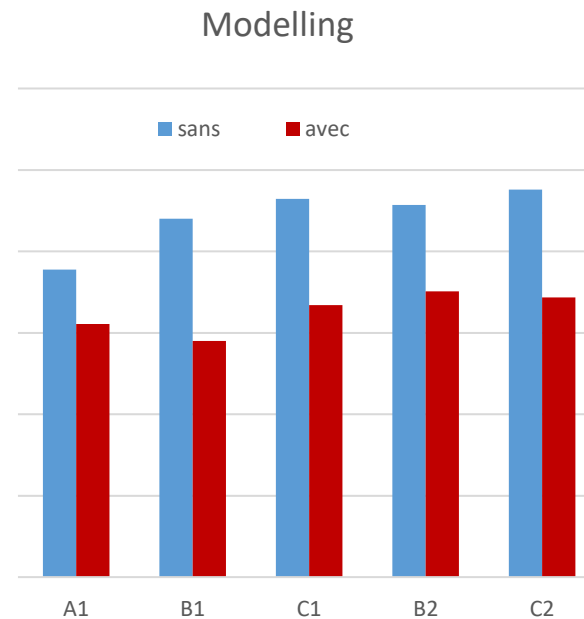**Setup choice thanks to model results (and field constrains !)**

Chosen Modules setup

Wind field

Concentration field – with depollution systems

Afterward comparison

Measurements after modules installation at different points

Verification of modelling approach for next projects !
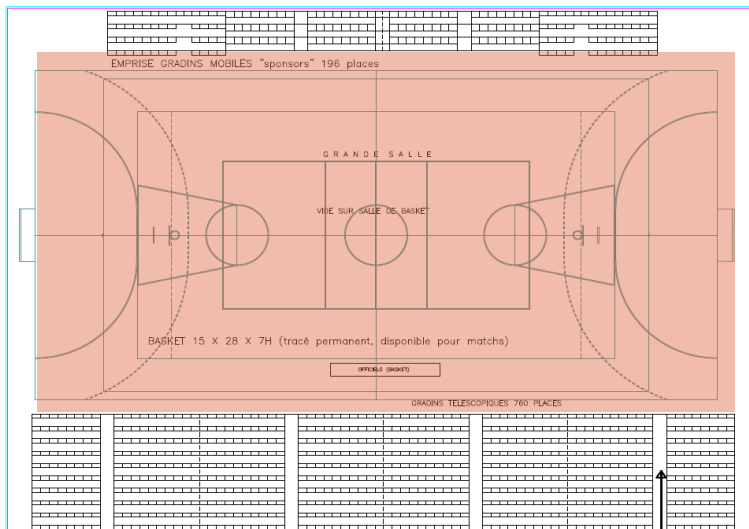

Observations

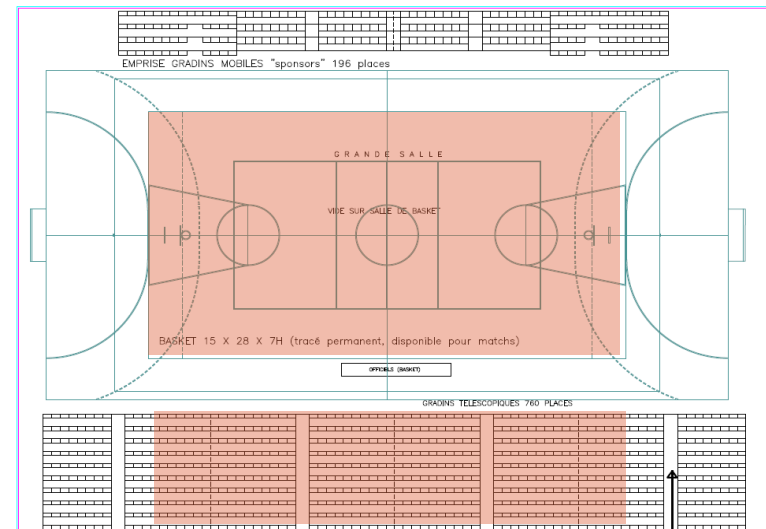Modelling
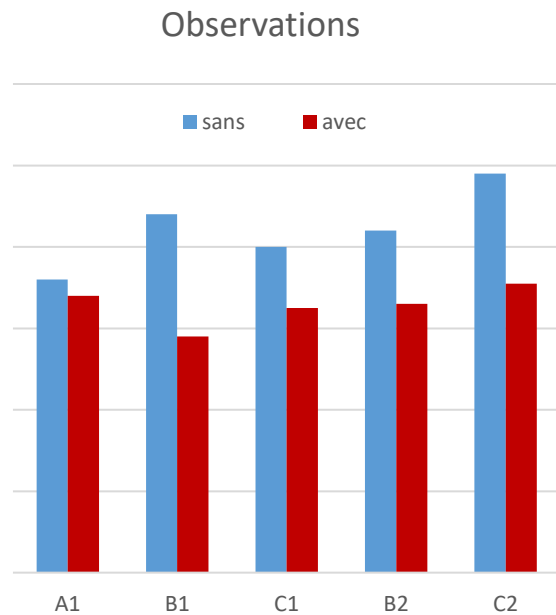
Case #2 : Gymnasium

- **Project by SUEZ**
- **No ventilation system -> Creation of a depollution system**
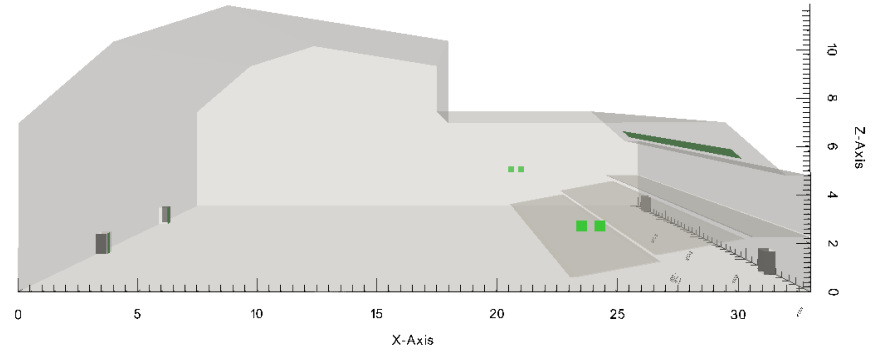- **Used by schools and for Basketball games**

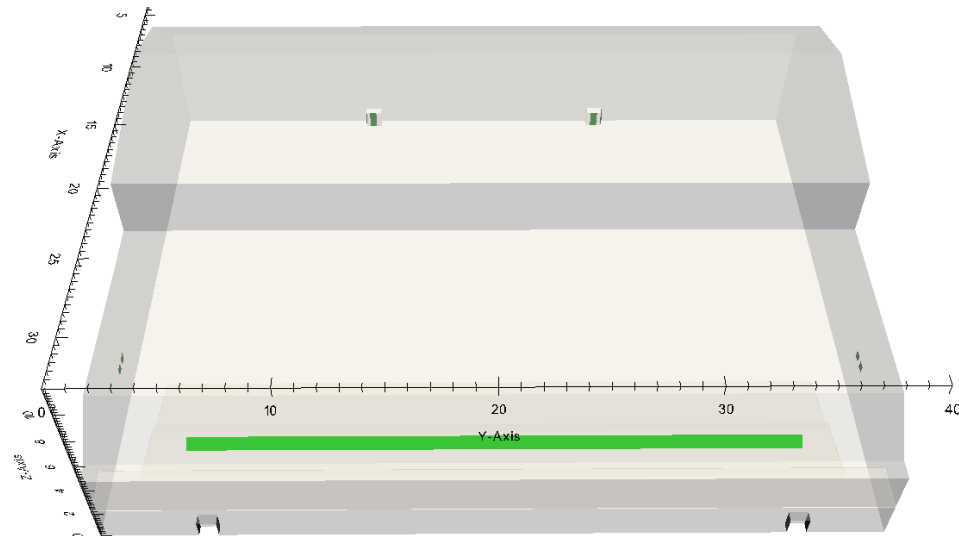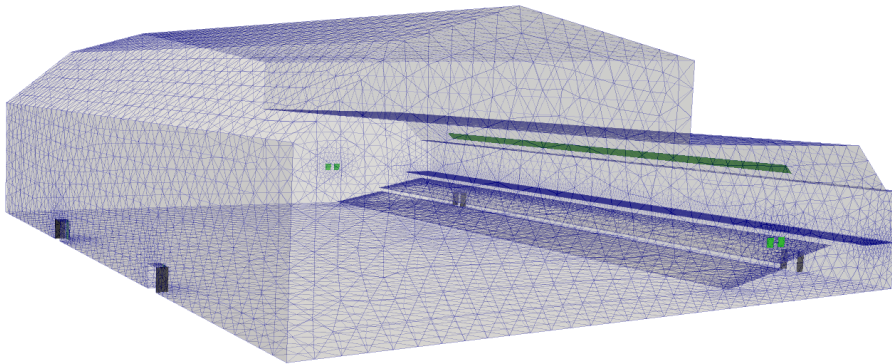**School configuration : no people on seats**

Game configuration : people on seats

Geometry and mesh

Geometry – Side view

Mesh

Geometry – Top view

Aeraulic modelling

- **Aeraulic mainly driven by depollution system**
- **Different tested extraction/outlet configurations**
- **Turbulence added for people movement effect**
- **Unsteady calculation : how long the systems should be on**

Module terrain 1   Module terrain 2

extraction   extraction

outlet   outlet

oulet   oulet

oulet tube

extraction on both sides   extraction on both sides

Module seats 1   Module seats 2

Emission modelling
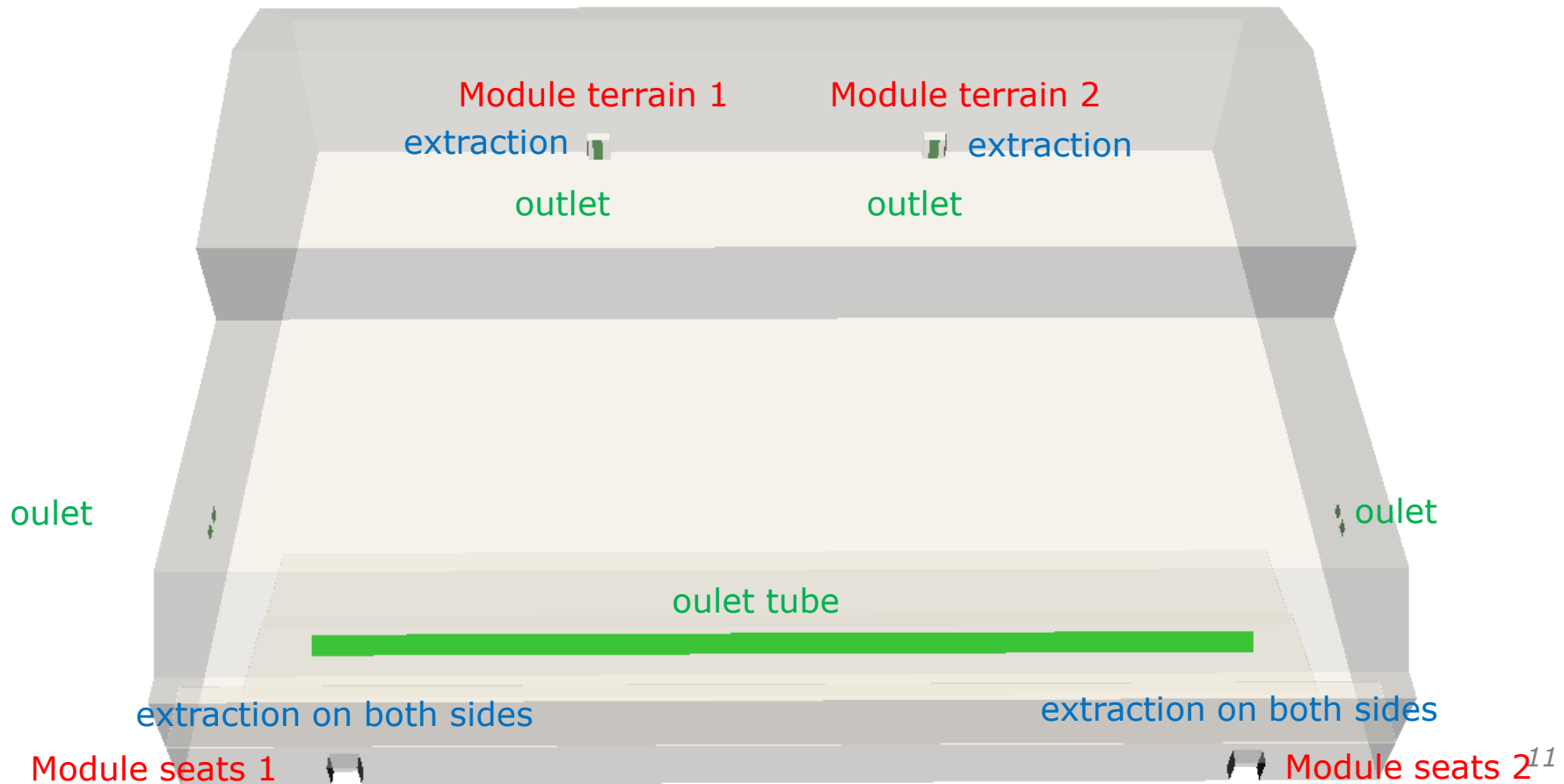
- **Location according to activity**
- **Mass rate by fitting observations and modelling**
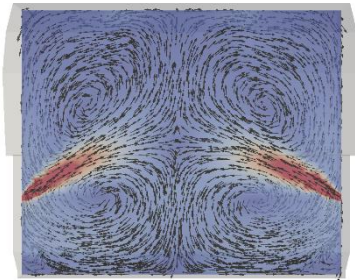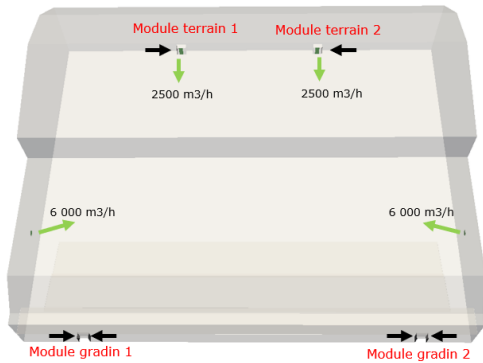- **Turbulence added for people movement effect**
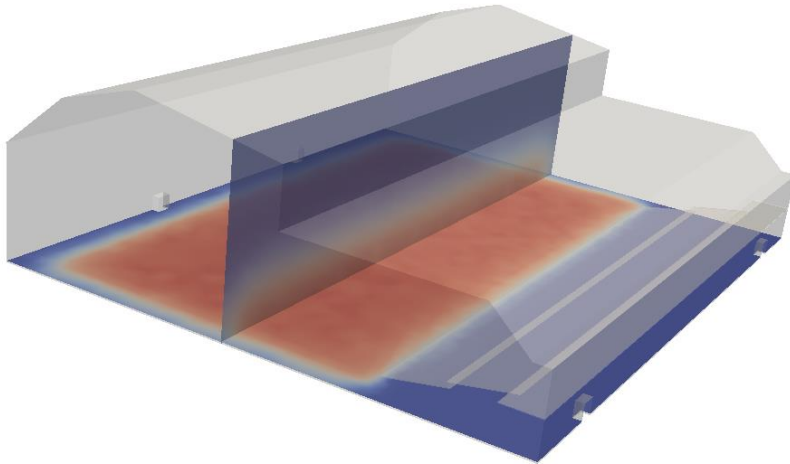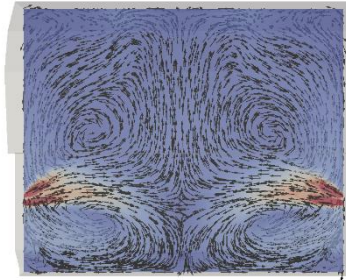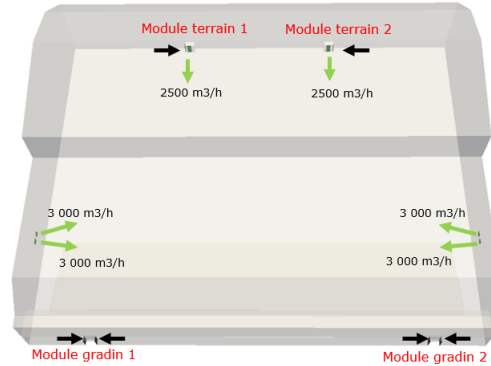

Emission in school configuration
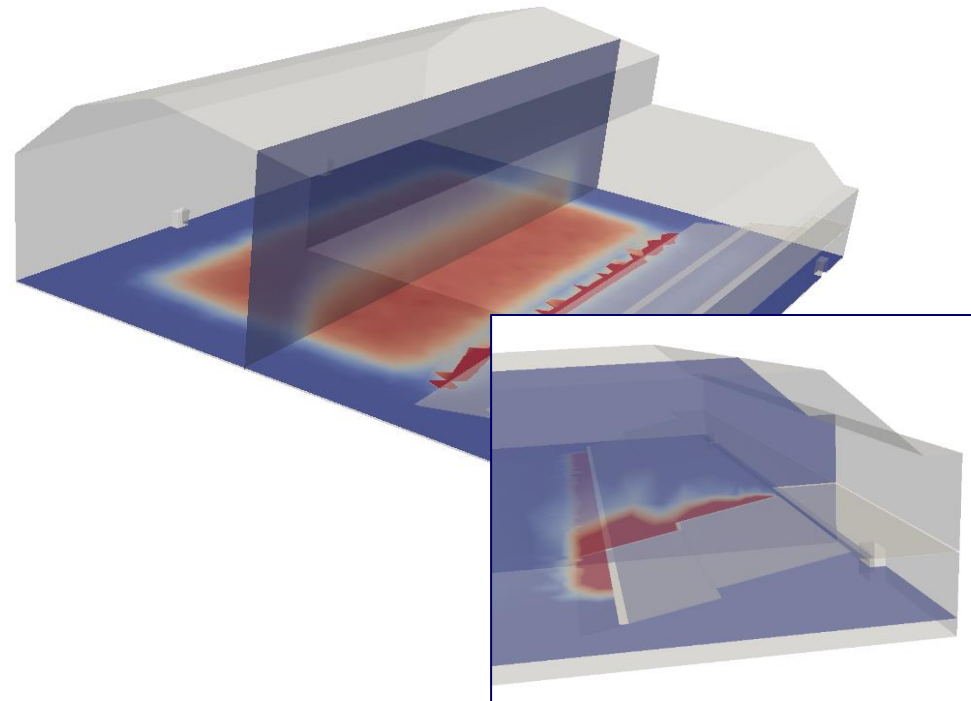
Emission in Game configuration
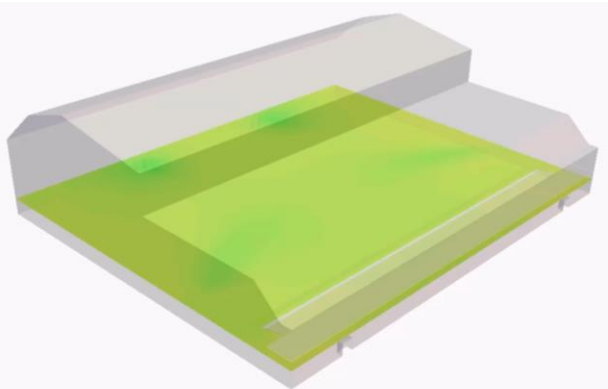
Results for different ventilation configurations
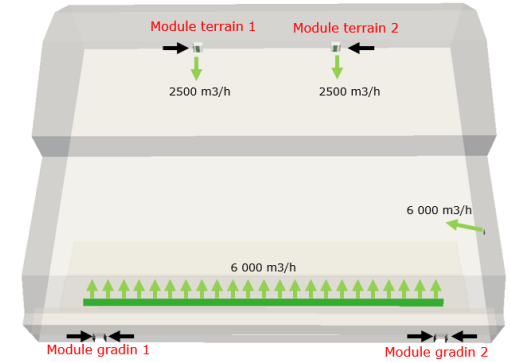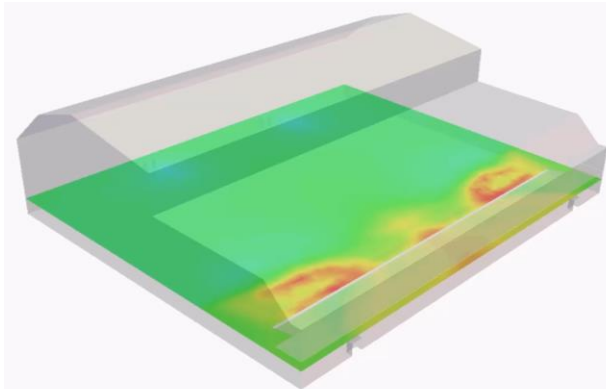

School – mono flux – afterward cleaning

Game – dual flux – Limit pollution peak

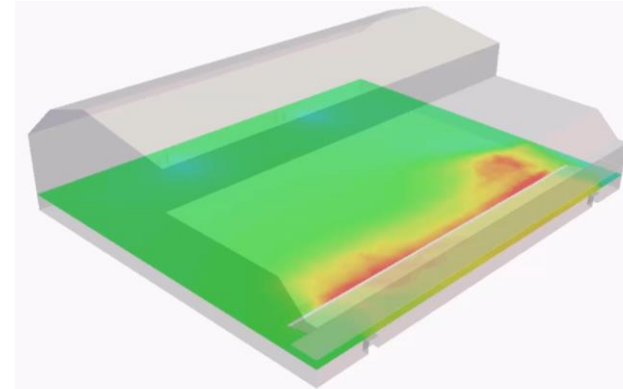Game – tube flux – Limit pollution peak

Time: 0.333334 (h)

Time: 0.166667 (h)

Time: 0.166667 (h)

Questions ?