

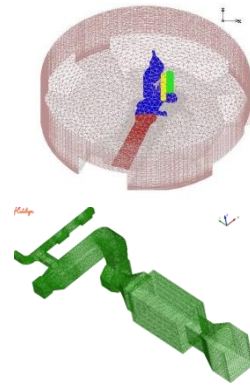
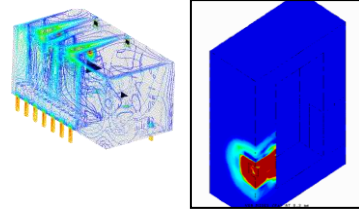
ANALYSIS & 3D CFD MODELLING FOR HVAC / FIRES / EXPLOSION INCLUDING SENSOR MAPPING & SOURCE DETECTION

fluidyn-VENTIL

SOFTWARE FOR MODELLING HVAC, FIRES, EXPLOSION

NUMERICAL PLATFORM FOR 3D CFD AND FEM SIMULATIONS OF BUILDINGS, RAIL/ROAD TUNNELS & MINES

- HVAC (Heating, Air conditioning & Ventilation) by modelling air and pollutants flow
- Fires & explosions temperature & pressure with structural integrity damage assessment
- Consequence Modelling for Chemical, Biological, Radiological and Nuclear (CBRN) attacks
- Emergency Planning and Response in case of accidental leaks or CBRN attacks
- Design validation and optimisation of ventilation systems



CAD, MESH GENERATION, GUI (PRE & POST PROCESSOR)

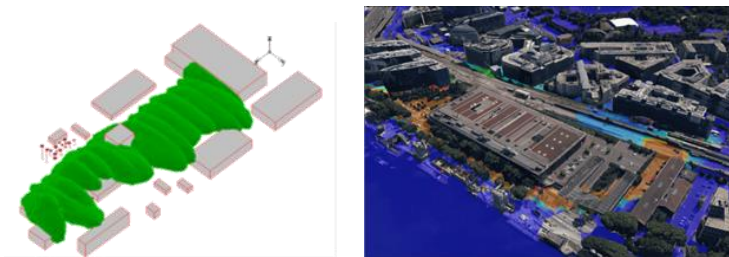
Model preparation and results analysis is done by

- A user-friendly interactive CAD interface, for importing and redefining geometries
- Predefined geometrical entities for rooms, passage ways, moving objects (cars, trains, others,)
- Automatic mesh & data generation for each kind of applications
- Predefined venting conditions (forced, natural), extraction, mining, blowing;
 - Database of pollutants source terms: hazardous gases for dispersion, smoke, pool evaporation, mine dust

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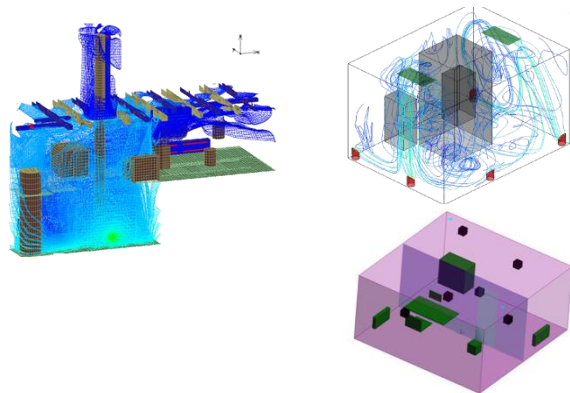
SENSOR MAPPING & SOURCE DETECTION

- Optimize spatial positions of sensors for quick real time detection of leak sources
- Real time alert of the consequences of toxic or flammable gas/ aerosol spread
- Source identification from sensor data and inverse modelling
- Results from real-time can be used for consequence assessments



VENTILATION & POLLUTANTS REMOVAL IN BUILDINGS

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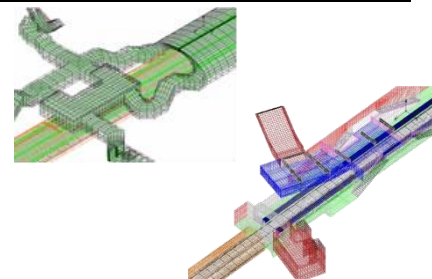
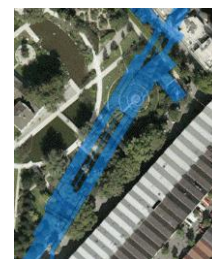


- Public/ industrial buildings, hospitals, parkings
- Toxic/flammable agents- gas, aerosols, pathogens
- Radon, radioactive particles decay progenies
- Pollutant sensor positioning & source detection
- Effect of sun, indoor vegetation, shadow of buildings
- Air conditioning network, pathogens barriers
- Weather dependent air intake & exhaust control
- Coupled external air flow model by fluidyn-Panache

fluidyn-VENTUNNEL

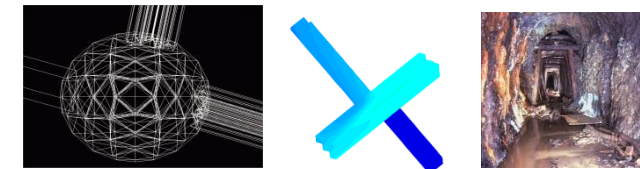
VENTILATION IN ROAD TUNNELS, RAIL STATIONS

- 3D AC network flow with blowers, extractors
- Piston pressure wave due to train or vehicular movement
- Pollution data for cars & trucks EU standards
- Standard fires data (cars, trucks, hazardous goods..)
- Ventilation and extraction for emergency and nominal
- Visibility, gas leak, smoke dispersion & mixing, toxicity



VENTILATION IN COAL/URANIUM MINES

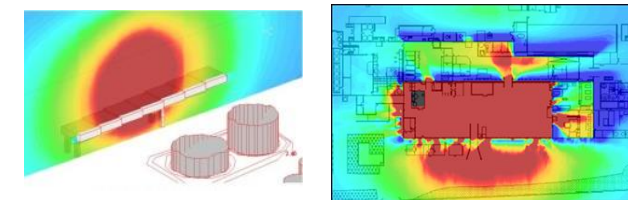
- Ventilation forecasting for evolving mining network and underground storage sites
- Emergency extraction expected for smoke, methane, dust
- Radioactive particles, radon, smoke, humidity dispersion
- 3D network for ducted flow with blowers, extractors
- Visibility, gas leak, smoke dispersion
- Effects of moving trucks, wagons



fluidyn-PANFIRE, VENTFIRE

FIRE RADIATION & PROPAGATION

Radiation from standing fires -PANFIRE



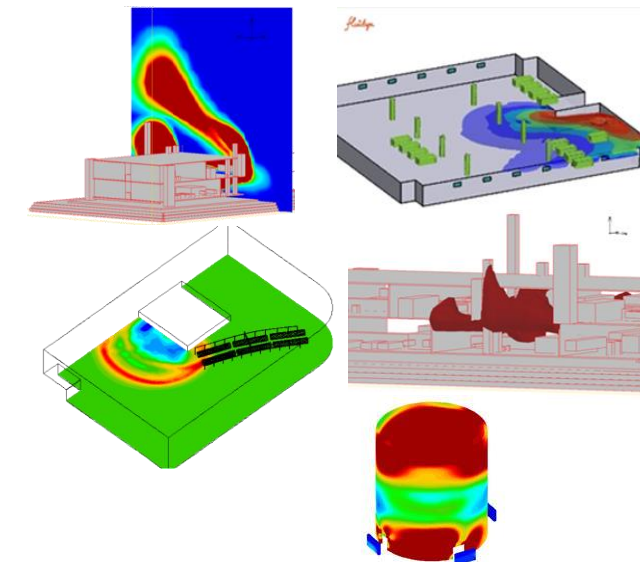
- 3D radiation model from maximum flame heights
- Flame height & radiation calculation with 3D view factors
- 3D hilly terrain with obstacles
- Pool fires data base for CH products
- Solid material fires: organic compounds, wood & plastics
- Material library with more than 400 solids, liquids
- Effect of airflow & sprinklers on flame height & radiation

Fire & smoke propagation in buildings - VENTFIRE

- 3D Finite volume combustion models for propagation
- Multiple models fire models: BML, EDC, EBU, etc.
- Pool & jet fires data base for CH products
- Atmospheric airflow conditions with fluidyn-Panache
- Mitigation devices- firewalls, sprinklers, blowers/ exhausts
- Flames & smoke movement with thermal radiation
- Smoke movement & visibility
- Fire source detection & detector position optimization

Structural integrity & heat damage - VENTSTRESS

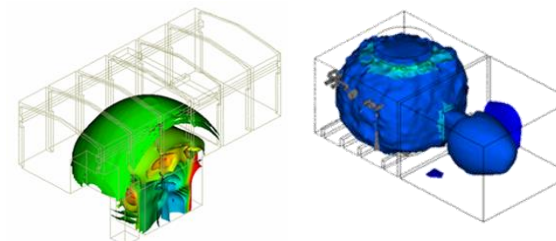
- Finite element implicit model coupled strongly with fire
- Transient heat conduction & thermal stress/strain
- Structural integrity loss & collapse
- Reinforced concrete models for various standards
- Advanced model for RCC concrete
- Concrete spalling & reinforcement bars heat exposure
- Building integrity loss time estimate



GAS & SOLID EXPLOSIONS

fluidyn-VENTEX

Deflagration /detonation modelling - VENTEX



- Gas, dust/aerosol deflagration with semi-implicit solver
- High explosives ignition & detonation explicit density based solver
- Hydrogen, solid propellants deflagration /detonation
- Data base for combustibles and high explosives
- Extractor equivalent of pipes/equipments for turbulence & flame speed
- Pressure wave propagation in anisotropic media
- Domino explosions after the initial
- User plug in subroutines for initial & boundary conditions etc.

Structural integrity of buildings - VENTSTRESS

- Structural explicit high strain rate FEM solver coupled with VENTEX explosion solvers
- Obstacles density variation effect on flame acceleration
- Projectile impact load
- Concrete spalling due to pressure load
- Reinforcement bars break-up due to shear loads
- Safe time estimate for building integrity

