FLUIDYN

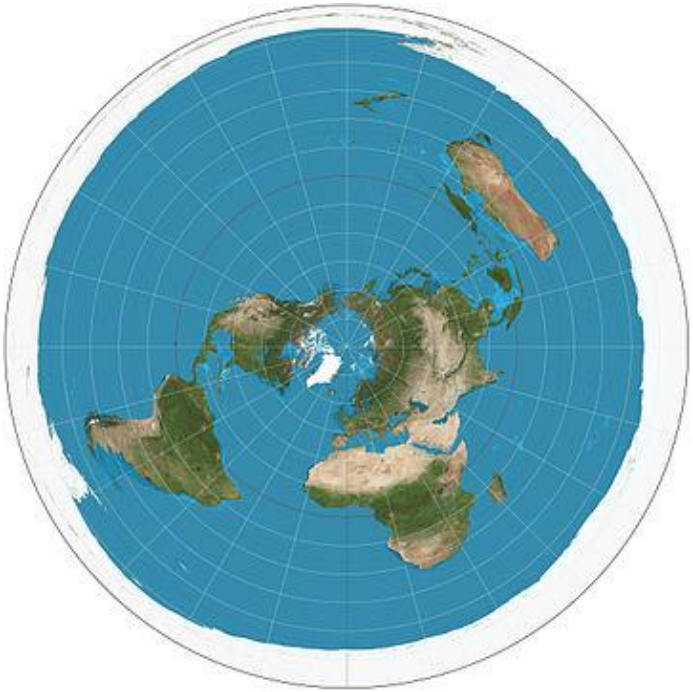
CFD and Numerical Simulation Software and Services

International Network

Technical Centers

FLUIDYN India, Bengaluru

FLUIDYN France, Paris



Commercial partners

Core Convergence, Séoul

SIMFLUID, Tokyo

CEF Ingénierie, Lyon

CS Horizons, Mexique

IGDEAS, Ankara

Fluidyn Software

Process Design And Optimization

- *Fluidyn* MP

Industrial Risk Management

- *Fluidyn* PANACHE

Environmental Impact Assessment

- *Fluidyn* PANACHE, FLOWSOL

Ventilation

- *Fluidyn* VENTIL

Environmental And Risk Simulation Tools

Air

PANACHE

- Fluidyn-PANEIA
- Fluidyn-PANROAD
- Fluidyn-PANAIR
- Fluidyn-PANNUK

Water

FLOWSOL

- Fluidyn-FLOWRIV
- Fluidyn-FLOWOIL
- Fluidyn-FLOWSED
- Fluidyn-POLLUSOL

Hazards & Risk

PANACHE/VENTIL

- Fluidyn-ASSESSRISK
- Fluidyn-PANWAVE
- Fluidyn-PANEPR
- Fluidyn-VENTEX
- Fluidyn-VENTFIRE
- Fluidyn-PANFIRE

Confined Space

VENTIL

- Fluidyn-VENTCLIM
- Fluidyn-VENTUNNEL
- Fluidyn-VENTMINE
- Fluidyn-VENTFIRE
- Fluidyn-VENTEX

Fluidyn - REALTI

Indian References

DRDE
ADRDE
ARDE
DLJ
GTRE
ADA

Reliance Industries Limited

NCCR

ncrtc national capital region transport corporation

NHSRCL National High Speed Rail Corporation Ltd.

KILBURN ENGINEERING

Indigatech

सेल SAIL

Chola MS RISK SERVICES

Eqms Since 1998

KADAM ENVIRONMENTAL CONSULTANTS

VIKRAM SARABHAI SPACE CENTRE

DEKRA

BASF We create chemistry

SANMAR

ADITYA BIRLA GROUP

ASTEC

Godrej

Gulbrandsen

PRO-SIM

HAL

thyssenkrupp

BOSCH Invented for life

DLF

ESSAR STEEL

TATA

TATA PROJECTS

HydratechIndustries

Toyota Kirloskar

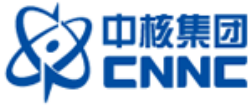
GABRIEL Gabriel India Limited

TATA CONSULTING ENGINEERS LIMITED

SDHC-SHAR

European References

Other References



Indian Academic Collaborations

IIT Kanpur

IIT Bombay

IIT Guwahati

IIT Delhi

IIT Madras

IIT-ISM Dhanbad

NIT Kurukshetra

Professional & Academic Bodies - International

AXELERA
Conjuguons chimie et environnement

SAFE CLUSTER
by Pegase & Risques

Comité 2 Industriel ITER

PLAINE COMMUNE PROMOTION

SFSP
SOCIÉTÉ FRANÇAISE DES SÉPARATIONS FLUIDES-PARTICULES

RAVI
RÉSEAU AUTOMOBILITÉ ET VÉHICULES EN ILE-DE-FRANCE
Association Régionale des Industries de l'Automobile

UPMC
SORBONNE UNIVERSITÉS

rapid

RÊVE DE SCÈNES URBAINES

PRISME
Laboratoire Pluridisciplinaire de Recherche Ingénierie des Systèmes, Mécanique, Énergétique

INSA
ROUEN

Université Joseph Fourier
GRENOBLE

UNIVERSITÉ DE VERSAILLES SAINT-QUENTIN-EN-YVELINES

IFSTTAR

CentraleSupélec

Berkeley
UNIVERSITY OF CALIFORNIA

l'X
ÉCOLE POLYTECHNIQUE
UNIVERSITÉ PARIS-SACLAY

LME EVRY

esaip
La Salle
ÉCOLE D'INGÉNIEURS

London South Bank University

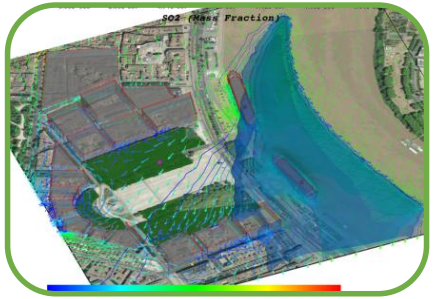
CENTRALE NANTES

The University of Nottingham

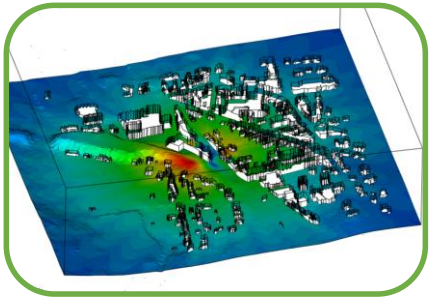
KIT
Karlsruhe Institute of Technology

POLITECHNIKA WARSZAWSKA
WARSAW UNIVERSITY OF TECHNOLOGY

Recent Envirorisk R&D Projects

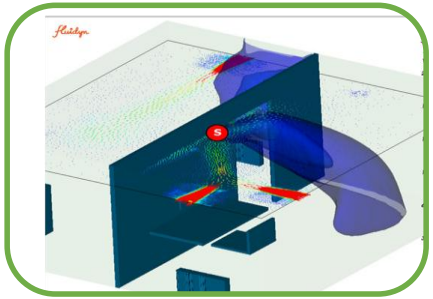


Real time impact-Bordeaux port



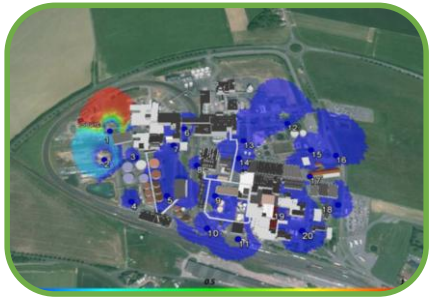
Radioactive dispersion

IRSN France

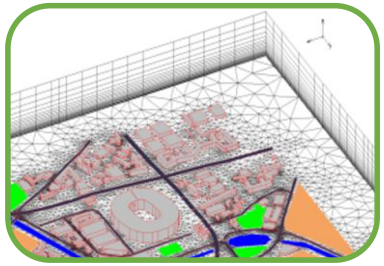


Real time Source localisation in a building

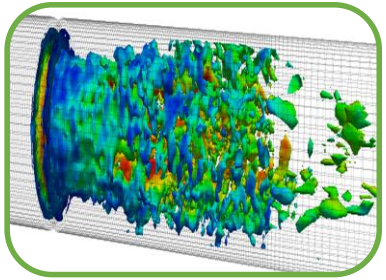
- IFSSTAR, France



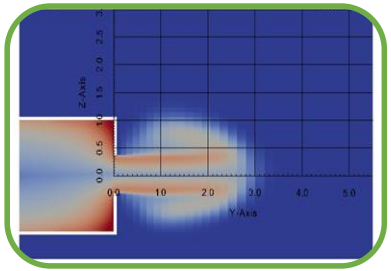
Real time source detection & dispersion forecast –DGA France



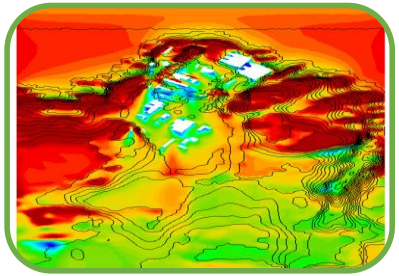
Real time forecast of traffic pollution-Paris Regional Authority



Subsea pipeline flow iduced vibrations – CITEPH, France



Explosion modeling Protocol - Industries Ministry, France



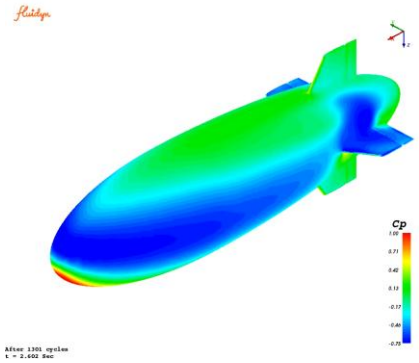
Dispersion modeling Protocol - Industries Ministry, France

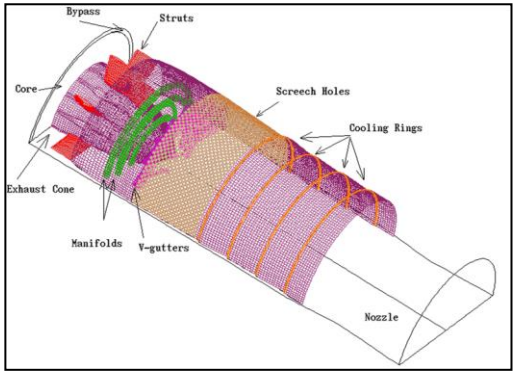
Risk Analysis Environmental Impact, Emergency Response

• Process Modelling	Fluidyn-MP (2-phase Reactive flow+Thermal+Stress analysis)
• Tank/pipe rupture, Pool formation	Fluidyn-PANWAVE
• Source term (evaporation etc)	Fluidyn-ASSESS-RISK
• Gas/ aerosol dispersion	Fluidyn-PANEPR (Accidental leak)
• Environmental Impact	Fluidyn-PANEIA (Chronic emission)
• Fire (jet or pool fire)	Fluidyn-PANFIRE (Heat radiation in 3D)
	Fluidyn-VENTFIRE (Fire/ Structure damage)
• Explosion with structural integrity	Fluidyn-VENTEX (Explosion,Structure damage)
• F&G Sensor mapping & Real time leak detection & consequences forecasting	Fluidyn-REALTI

Fluidyn - Indian Work References

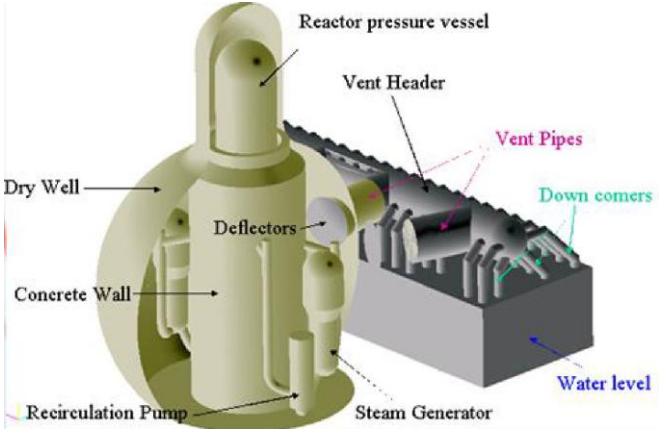
- **Aerospace**
  - Aviation ISAC: Dynamics of inflated structures
  - Vikram Sarabhai Space Centre: Cryogenic combustion, Hall Thruster
  - Satish Dhawan Space Centre (Sriharikota): Launch-pad risk & safety
- **Defence**
  - ADRDE: Airships
  - ARDE: Recoil system, Erosion
  - DLJ: RCS, IR
  - GTRE: Afterburner
  - HAL: Electronics & cooling

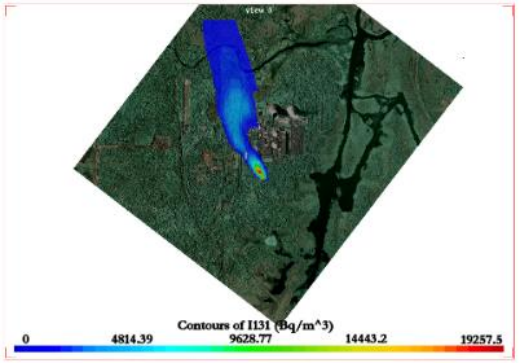


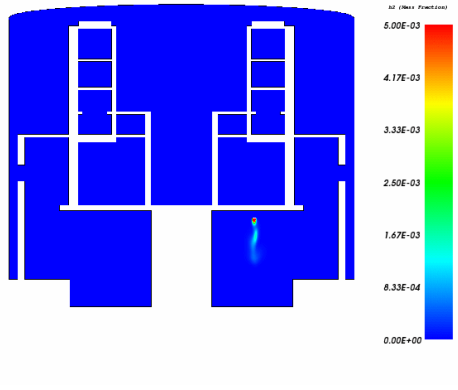


Fluidyn - Indian References

- **Nuclear**
  - NPCIL: LOCA in BWR
  - BARC: Hydrogen safety; explosion; radionuclide dispersion
  - IGCAR: FBR
  - AERB: EIA
  - IPR-ITER: TBM, MHD

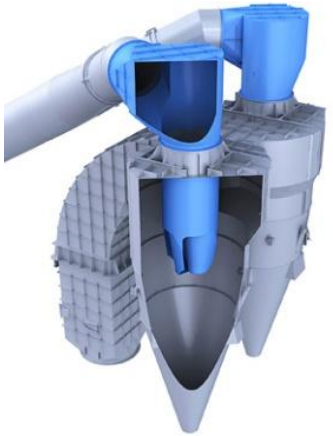






Fluidyn – Indian References

- **Petrochemical/Process**
  - BPCL: LPG Storage
  - HPCL: QRA - Underground LPG Cavern
  - RIL: EIA/QRA/FGM
  - Bosch: Burners
  - Thyssenkrupp: chlorate cells + others
- **Government Projects**
  - NCCBM: Cement plant
  - CIMFR: Coal mine safety
  - NCRTC: Delhi-Alwar line



FLUIDYN FOR BIOMEDICAL PROCESS & EQUIPMENT OPTIMIZATION

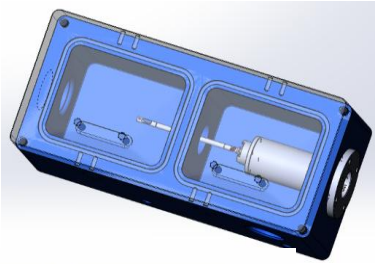
CFD Solutions for Medical Devices, Inhalation Systems and Safety Engineering

Industry Fit – Pharmaceutical Machinery & Biomedical

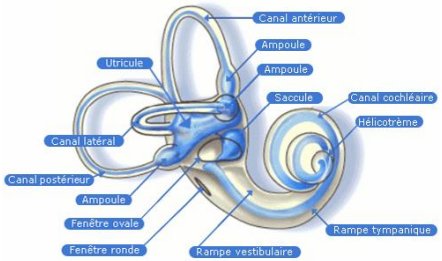
- Process and equipment optimization using CFD and multiphysics simulations.
- Fluid-Structure Interaction (FSI) modeling, aerosol dispersion and inhalation studies
- Proven work in biomedical device design and drug delivery systems.
- Customized CFD solvers for biomedical R&D.
- Applications aligned with pharmaceutical machinery – inhalers, filters, pumps and more..
- Strong R&D and academic collaboration network
- Integration with regulatory and experimental frameworks.

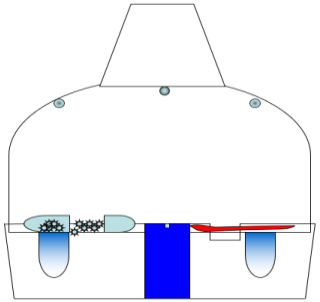
Medical Device Design Applications

In the past, Fluidyn has worked on the below Medical Device Design analysis:



- Computational analysis of Rotating Cardiac-Pump for ***Cardiovascular Systems Inc. (CSI)***
- CFD analysis of Inhalation devices for ***Alkem***
- Reciprocating cardiac pump for ***VIACOR***
- Baby nose blowing system for ***POREE-HALVIC***
- Oxygen Conservation Device – FSI with membrane mechanics
- Ventricular assist devices
- Particle/pathogen filtration devices: filters, masks
- Otoconia Mechanisms
- Check Valve – Flow and pressure analysis
- Vertigo Chair – Optimization for therapeutic motion





Patient Safety & Drug Delivery Applications

- Inhaler – Airflow and particle transport
- Aerosol Filter – Deposition and clogging analysis
- Membrane & Particle Modelling – Lagrangian and Eulerian methods

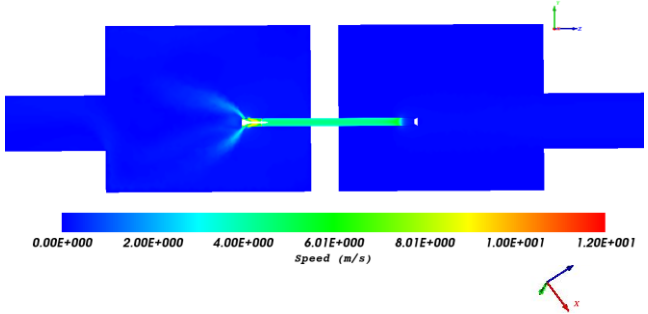
Biomedical System Optimization

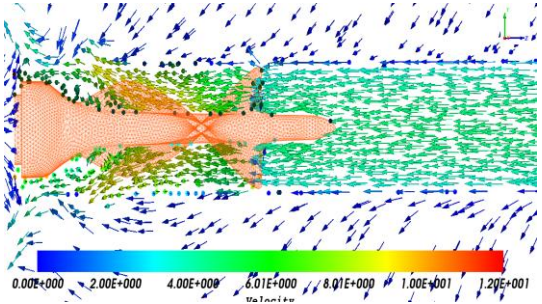
- Cyclone Separator – Swirling flow and efficiency enhancement
- Elastic Membrane Dynamics – ALE, IBM, and AMR methods

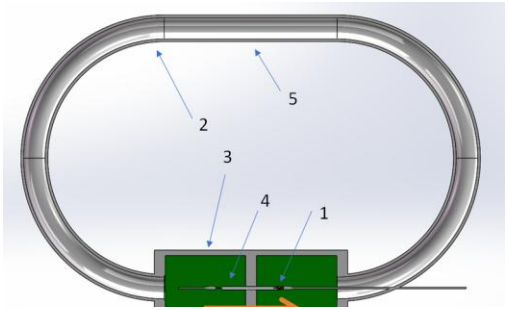
Cardiac Pump

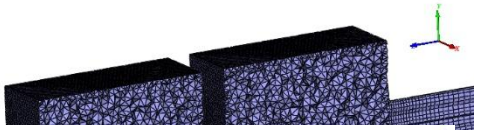
- **CFD analysis of cardiac pump flow**
- **To obtain flow rate for 70000 RPM against a 40 mmHg pump pressure head**

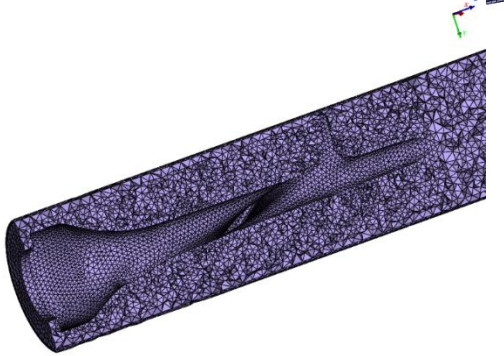
- **Rotating Frame of Reference**
- **Boundary layer mesh 2.2M**
- **Incompressible flow**



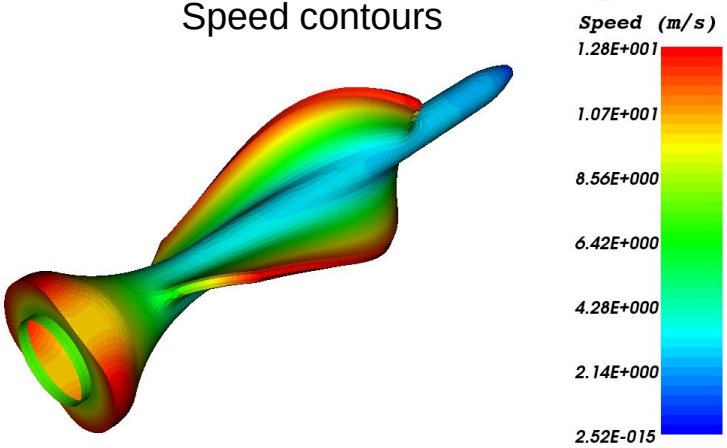








Speed contours

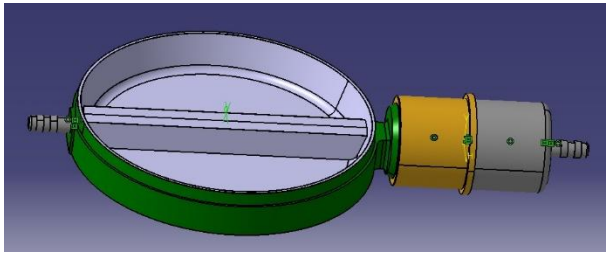


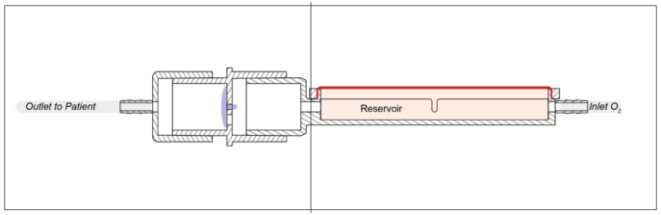
Mass flow rate at outlet	0.04146 **kg/s**

Oxygen Conservation Device

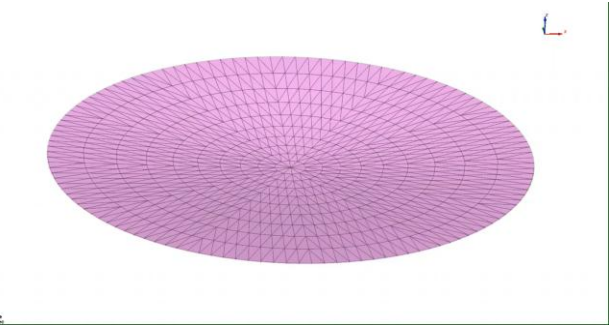
- **FSI analysis of O2 conservation device for use with nasal cannula**
- **Membrane, valve operation**

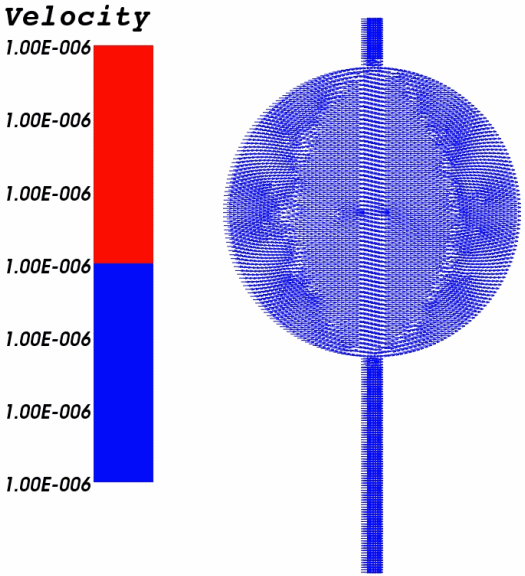
- **Unsteady fluid-structure interaction problem**
- **Large mesh movement**
- **Turbulence effects**

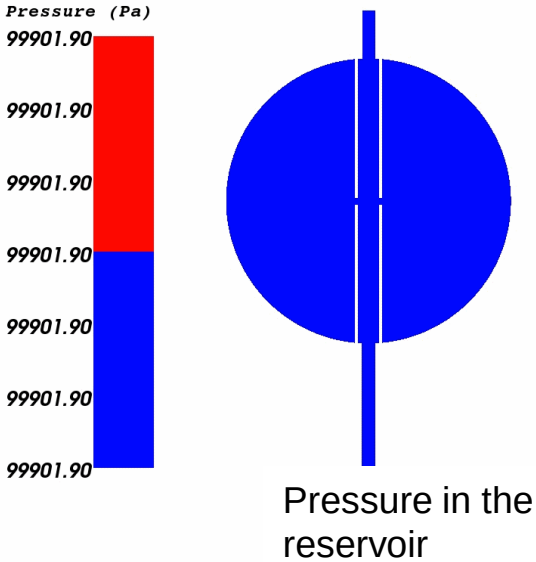




Membrane movement



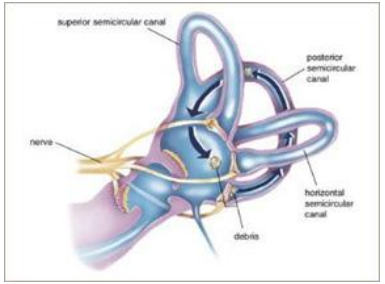


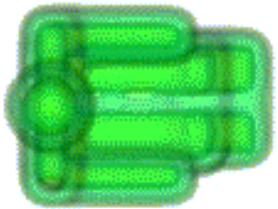


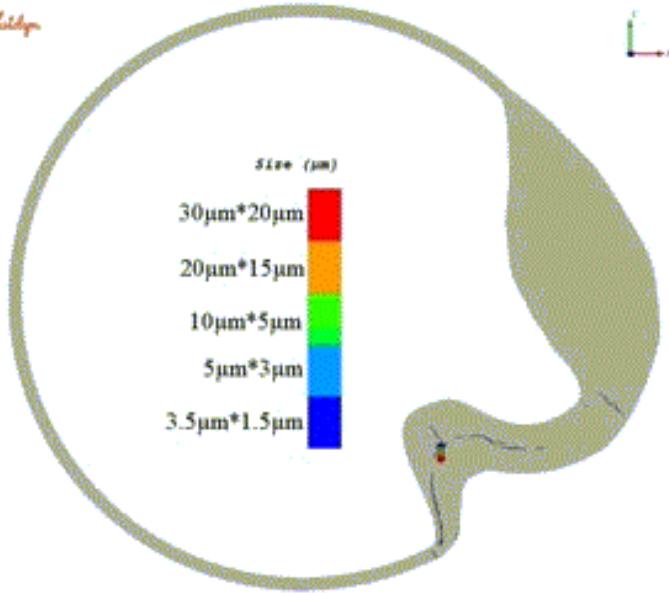
Pressure in the reservoir

Vertigo Treatment

- Rotating chair as a treatment for vertigo
- To send back the otolithe into the canal
- Medical protocol to be validated / improved

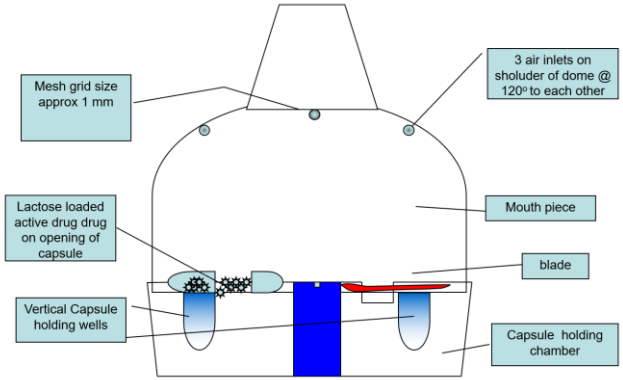


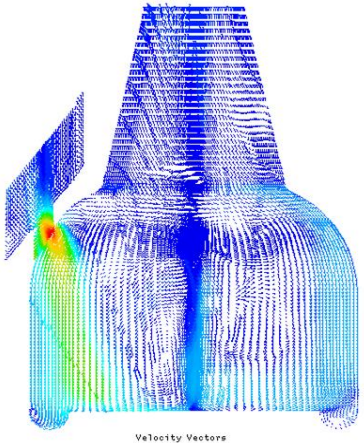




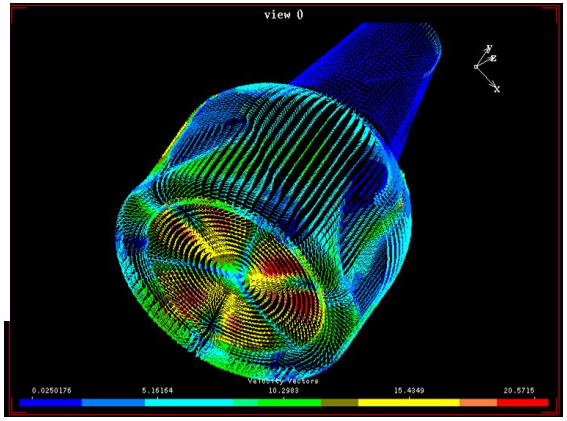
Inhaler

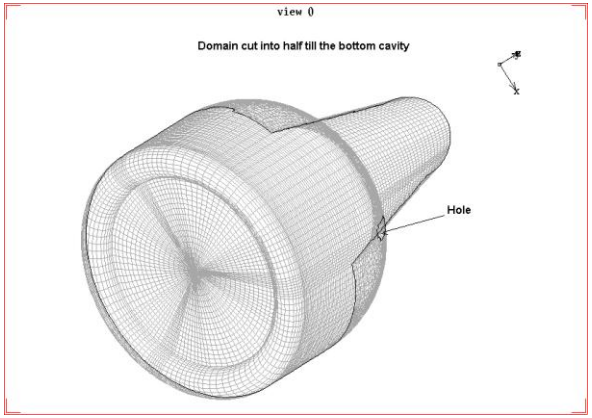
- Respiratory inhalation device
- Establish airflow rate in the mouthpiece to create a pressure drop of 4Kpa
- Transport of lactose particles





Total pressure

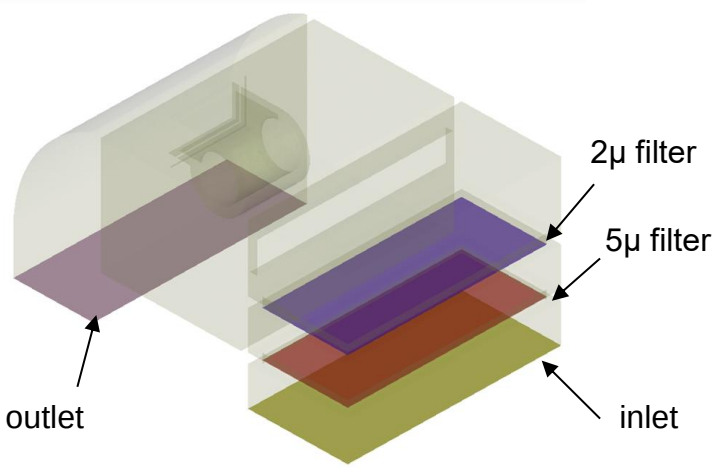




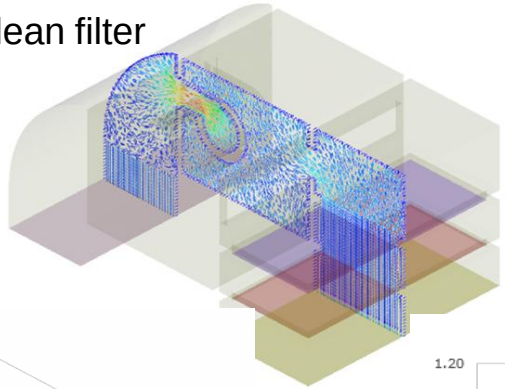
Aerosol Filter

- **CFD analysis of aerosol deposition on filters**
- **Filter clogging**

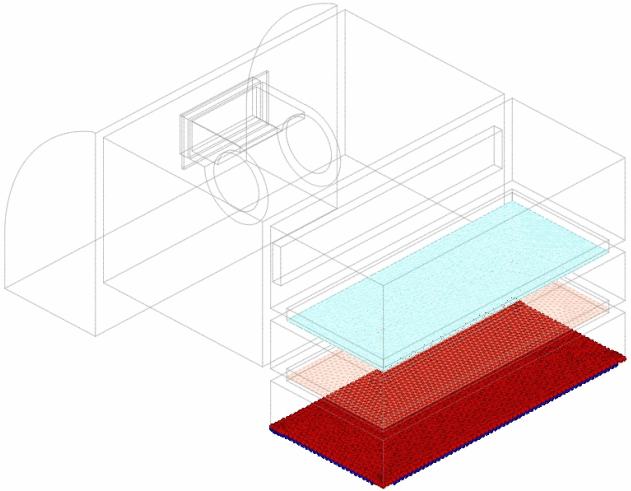
- **Unsteady problem**
- **Lagrangian model for aerosols**

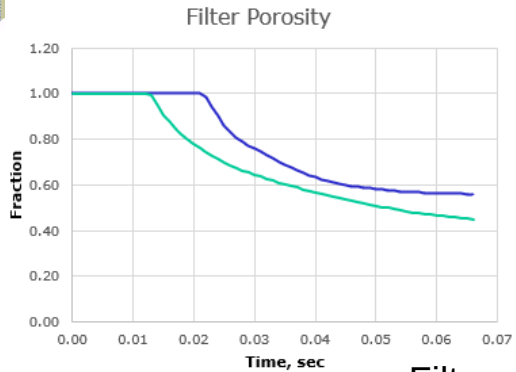


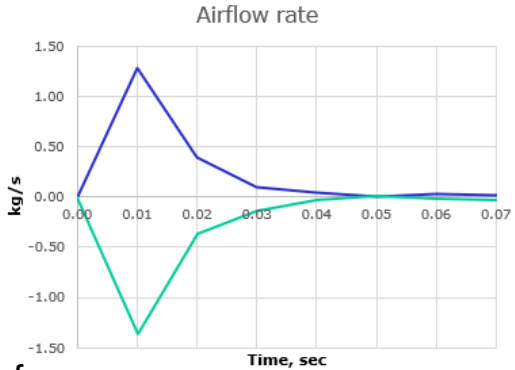
Airflow with clean filter



Aerosol deposition



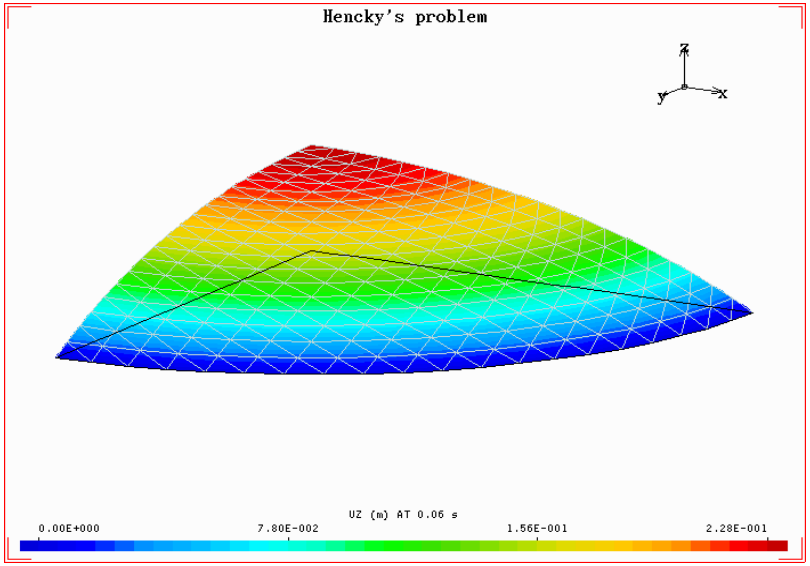


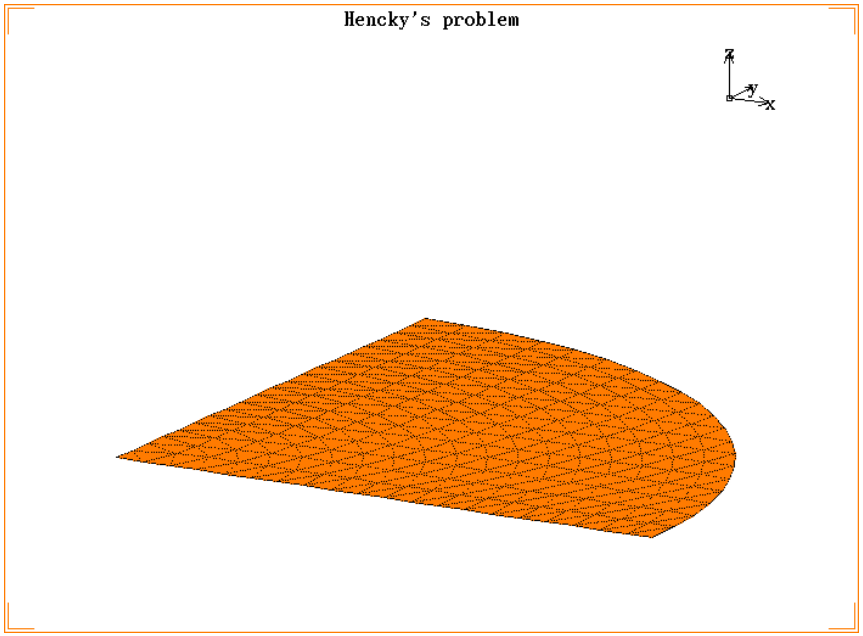


Filter performance

Circular Membrane

- Elastic thin circular membrane fixed along its edge and subjected to pressure loading.
- Explicit transient analysis.
- Validation against analytical solution due to Hencky

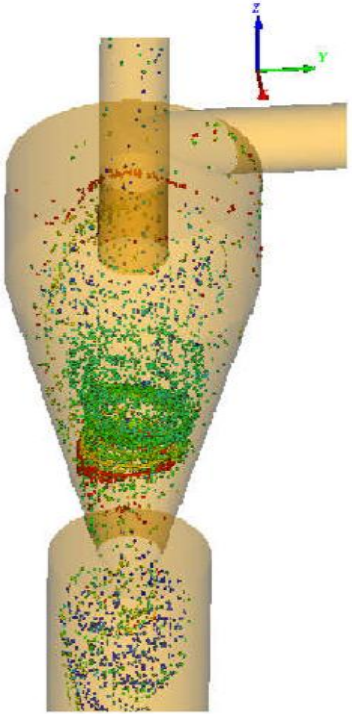




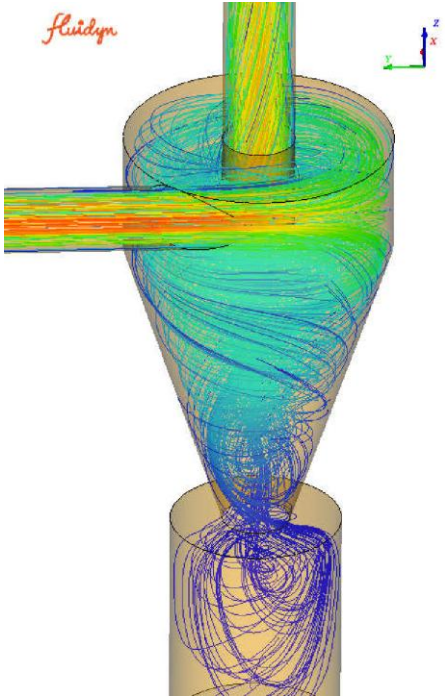
Hencky solution at the center	0.2271 m
Fluidyn-MP	0.2271 m

Cyclone Separator

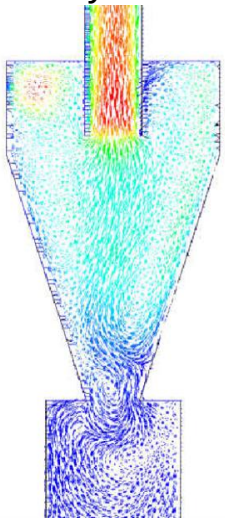
Particle tracks

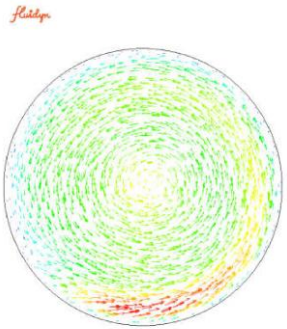


Streamlines

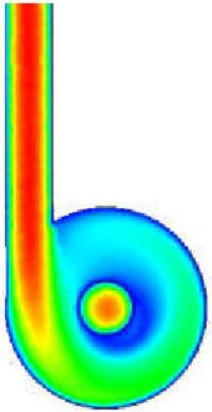


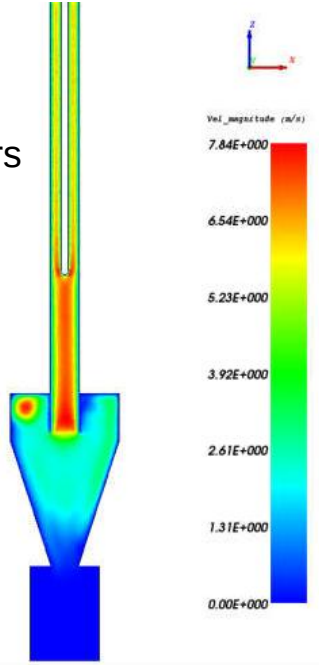
Velocity vectors





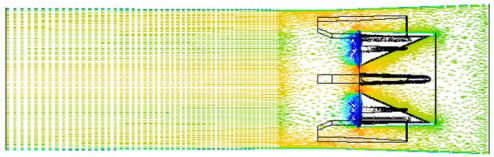
Speed contours

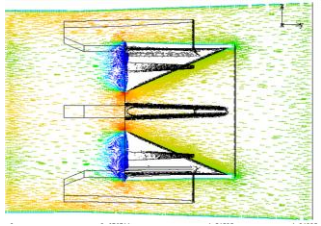




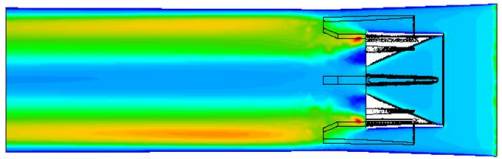
Check Valve

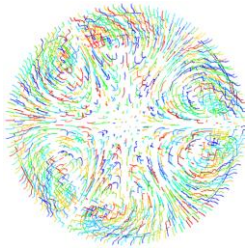
- **flow and pressure drop in check valve in fully open condition**
- **Design optimization**





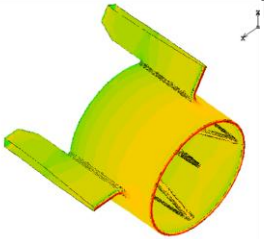
Turbulent Viscosity



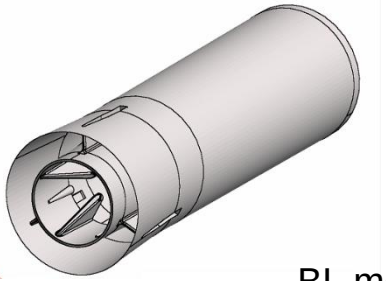


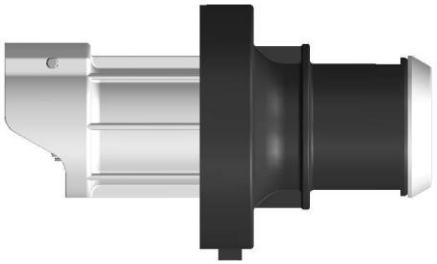
Swirling flow

Pressure

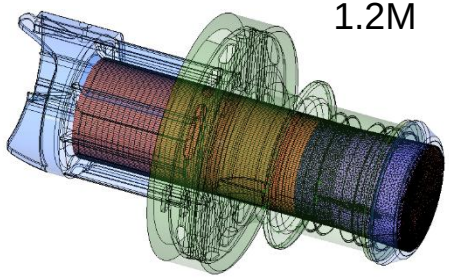


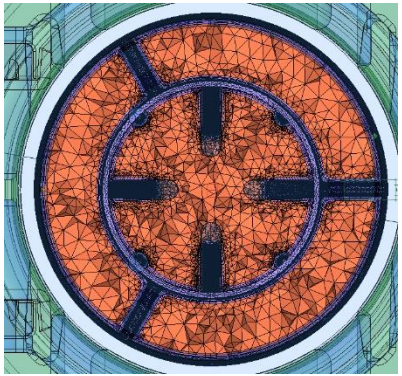
- **Steady state fluid flow analysis**
- **Fluid is treated as incompressible**
- **k- ω model will be used for turbulence modeling**
- **Isothermal flow**





BL mesh 1.2M

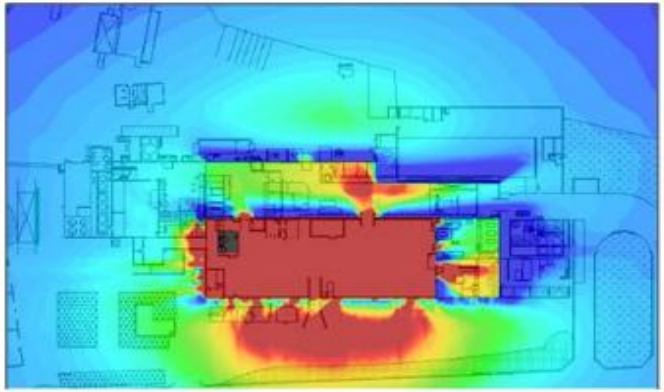


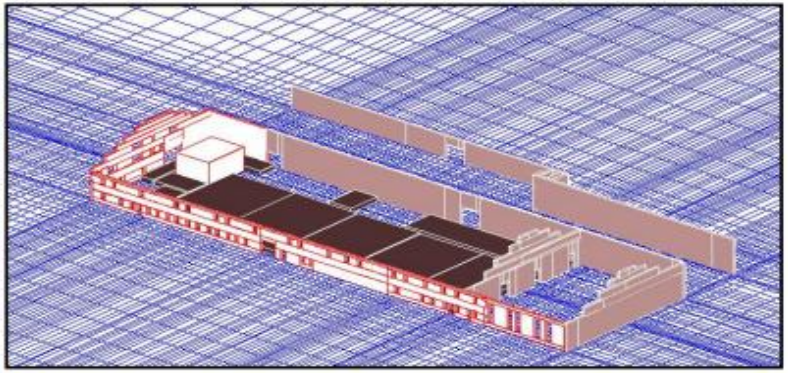


Fluidyn For Plant Risk & Safety In Chemical & Pharma Industries.

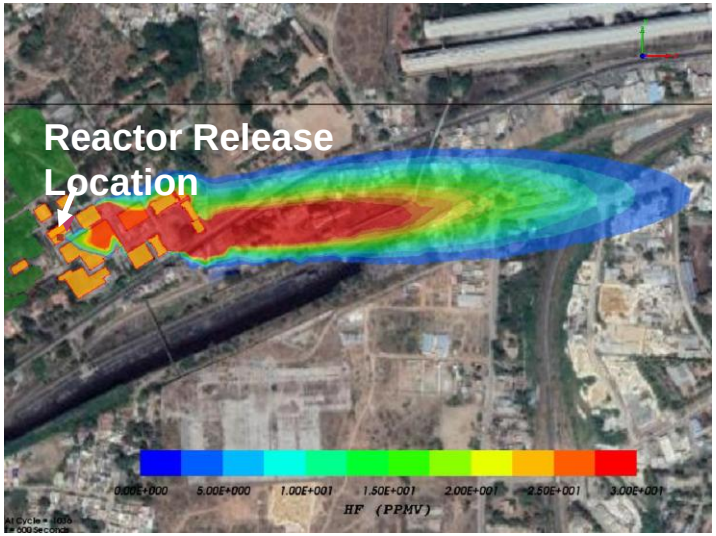
- **Comprehensive Risk Assessment** using advanced CFD simulations.
- **Fire and Explosion Analysis** – modeling of potential ignition sources, flame spread, and overpressure effects
- **Toxic Gas Release Modelling** – prediction of dispersion patterns, concentration levels, and impact zones
- **Flammable Gas Leak Simulation** – assessing release scenarios and ignition risks in confined and open spaces
- **Warehouse Safety Evaluation** – simulation of accidental leaks, fire propagation, and ventilation effectiveness
- **Emergency Response Planning** – identifying safe zones, escape routes, and mitigation strategies.
- **Process Hazard Analysis Support** – integrated modeling for safety audits and regulatory compliance

Risk Analysis for AHF Plant – Chemplast Sanmar Ltd, Tamil Nadu

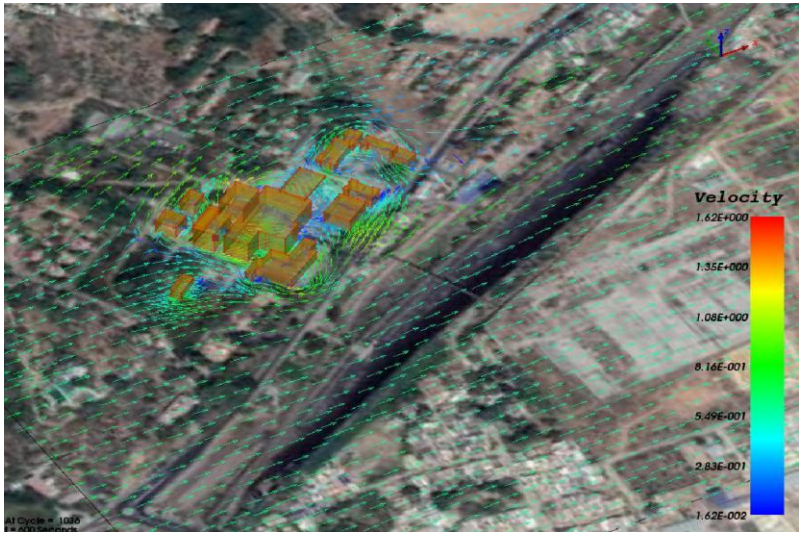




Warehouse fire radiation simulation & results



HydroFlouride IDLH reach (region in Red) after 600s



Simulated wind flow and Dispersion pattern over the site

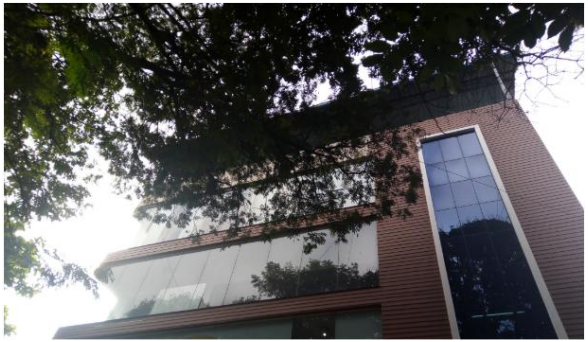
Fluidyn, In Conclusion...

- High performance goals, flexibility and usability
  - General scientific software of high precision
  - Customized software solutions.
- Fluidyn has good placement in all industrial sectors.

- Fluidyn combines expertise, regulatory understanding, and R&D capability to support partechnicaltners in the biomedical and pharmaceutical sectors.

- Our solutions enable faster innovation, improved safety, and optimized performance.

- We look forward to collaborating with CDMO/CMO/CRO companies globally.



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Thank You