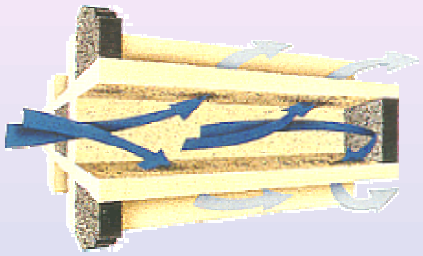
CATWALL



Wall-Flow Particulate Filter Simulation

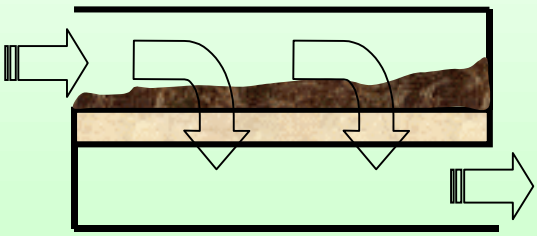
➢ Multi-Purpose Modeling

CATWALL simulates filter operation as regards:

- ✓ filtration efficiency, particle deposition
- ✓ pressure drop
- ✓ heat transfer
- ✓ thermal regeneration
- ✓ catalyst/fuel additive assisted regeneration

INPUT (as functions of time)

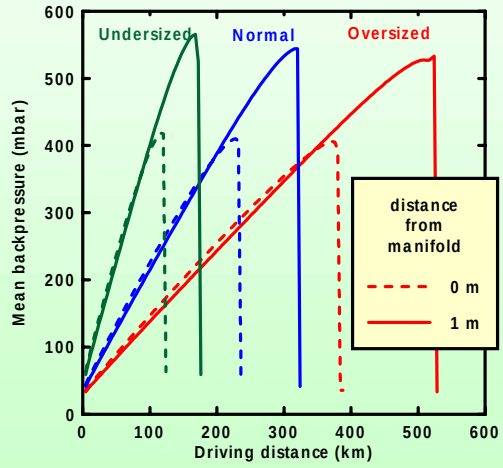
- ✓ Exhaust flow rate
- ✓ Exhaust temperature
- ✓ Exhaust oxygen
- ✓ Particulate concentration & size
- ✓ Filter geometry & material



OUTPUT (as functions of time)

- ✓ Pressure drop
- ✓ Filtration efficiency
- ✓ Temperature profiles
- ✓ Soot layer profiles

Filter backpressure until regeneration as function of filter size and position



➢ "Real Time" Simulation

Unlike other devices, filter performance is tested in long duration driving, to assess the mean backpressure levels as well as regeneration behavior. *CATWALL* is able to simulate filter transient behavior of the filter in long driving cycles (equivalent to 500 km city driving) in reasonable CPU time.

➢ Optimization Parameters

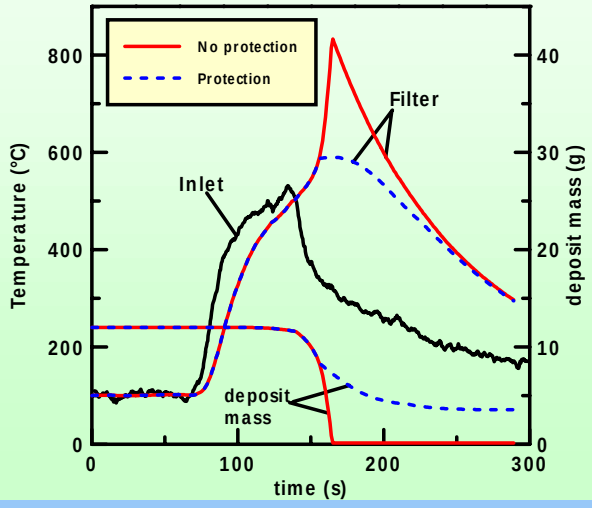
Design of diesel filters is complicated due to the concurrent optimization of contradicting design parameters. *CATWALL* is a powerful design tool, allowing optimization of the following parameters:

- ✓ filter material (cordierite, SiC, metal etc.)
- ✓ filter positioning
- ✓ filter geometry (volume, cell density, wall thickness)
- ✓ fuel additive type and dosimetry
- ✓ filter regeneration techniques
- ✓ filter protection techniques

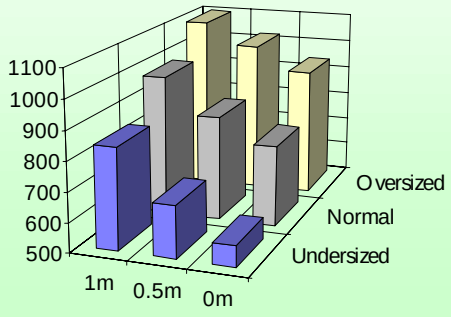
➢ Regeneration Modeling

Filter regeneration behaviour is critical to overall performance. *CATWALL* is capable of predicting the evolution of the catalytic regeneration process, with accurate prediction of temperature gradients (critical for filter safety).

Simulation of regeneration evolution with and without active filter protection



Maximum filter temperature during regeneration as function of filter size & distance from manifold

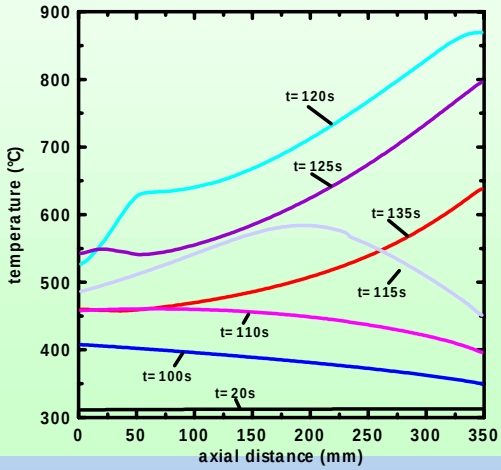


➢ Additive Dosimetry

Selection of the most suitable fuel additive is a highly complicated task. Mathematical modeling supports the solution of difficult problems, like:

- ✓ additive type selection
- ✓ additive concentration in fuel
- ✓ "smart" additive dosimetry

Filter temperature profiles during catalytic regeneration



➢ Sizing & Positioning

Common applications of *CATWALL* relate to filter size and positioning optimization.

➢ Fuel Penalty Minimization

Filter size and material together with the regeneration frequency affect overall fuel penalty. *CATWALL's* backpressure model computes fuel penalty effects of different designs

➢ Filtration Efficiency

CATWALL computes particulate collection as function of particle size and filter geometry. In conjunction with the flow model, the soot layer profile along the filter may be predicted.

Filter temperature during catalytic regeneration as function of fuel additive concentration