

# The Future of Geographical and Scenario Based Fire & Gas Mapping

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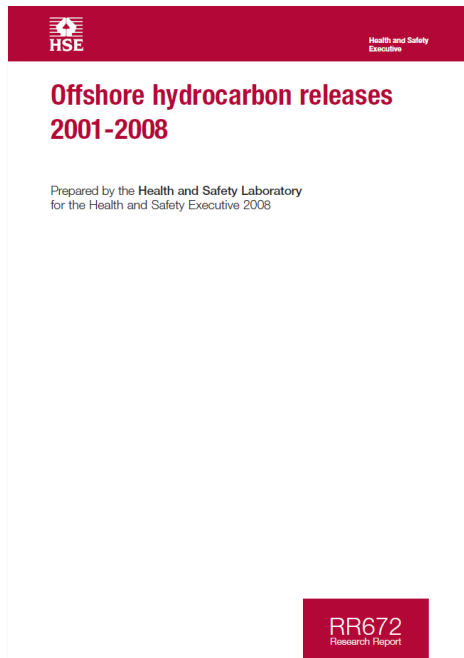
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# What is Fire and Gas Mapping?

- The science of positioning flame and gas detectors.

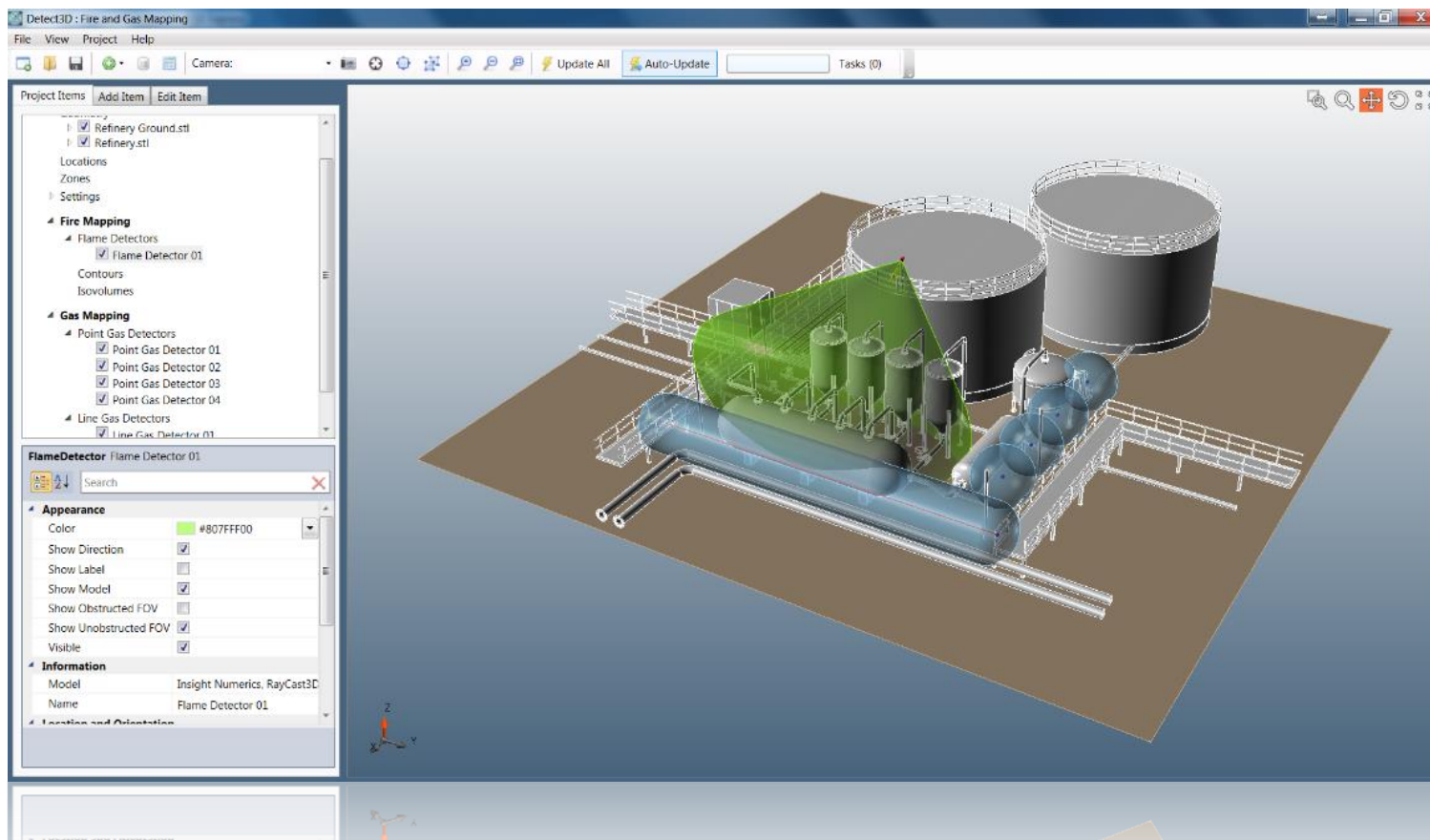
## Why is it important?



- Gas releases occur on old AND NEW platforms.
- On new platforms, the most likely source is mechanical failure, particularly flanges.
- For older platforms, it is pipe corrosion.
- ~100 major and significant gas releases per year in the UK alone.
- 1/3 of Major and 2/3 of Significant gas releases...
- ..are not detected by the gas detection systems.

# Introduction to Detect3D

- Detect3D is a modern, Windows-based software product for Fire and Gas (F&G) Mapping analysis.



**Detect3D**

Fire and Gas Mapping. Optimized.

Slide 3

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# Who Uses Detect3D?



## Detect3D

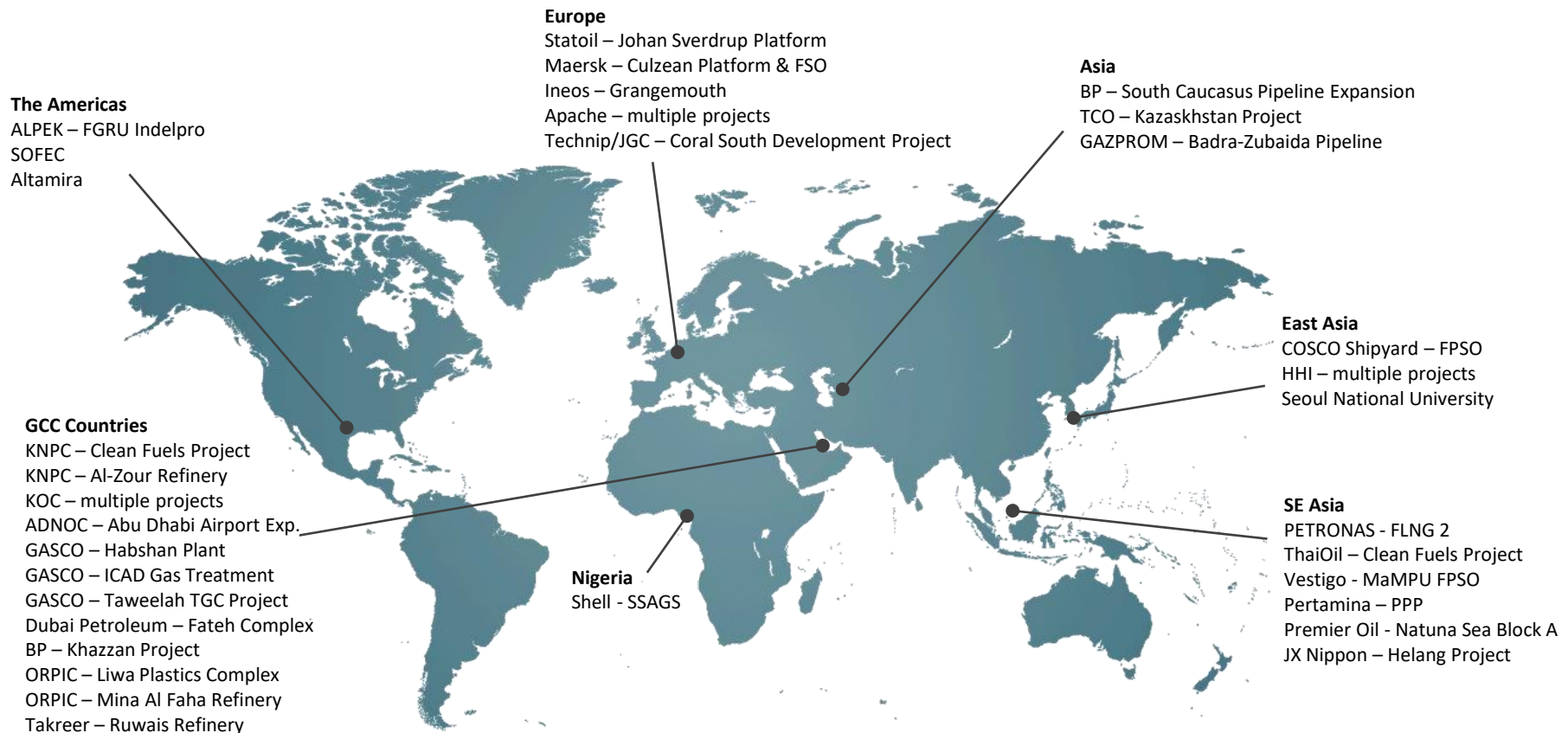
Fire and Gas Mapping. Optimized.

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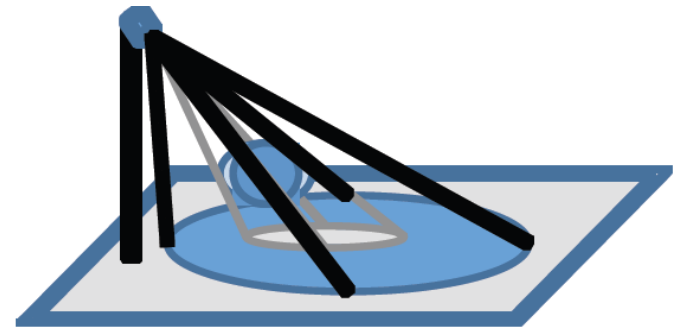
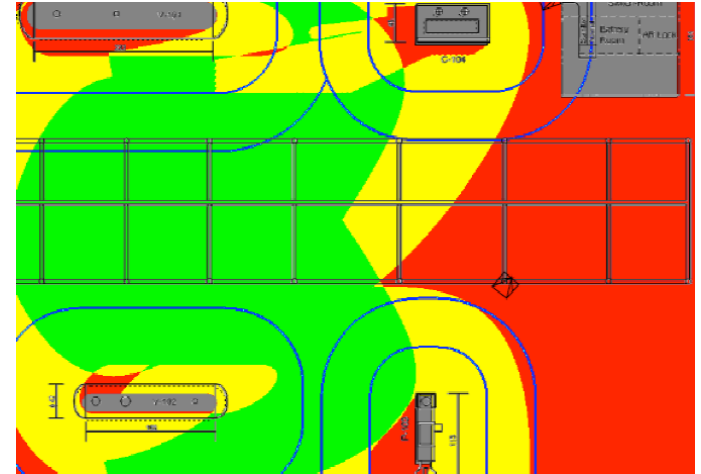
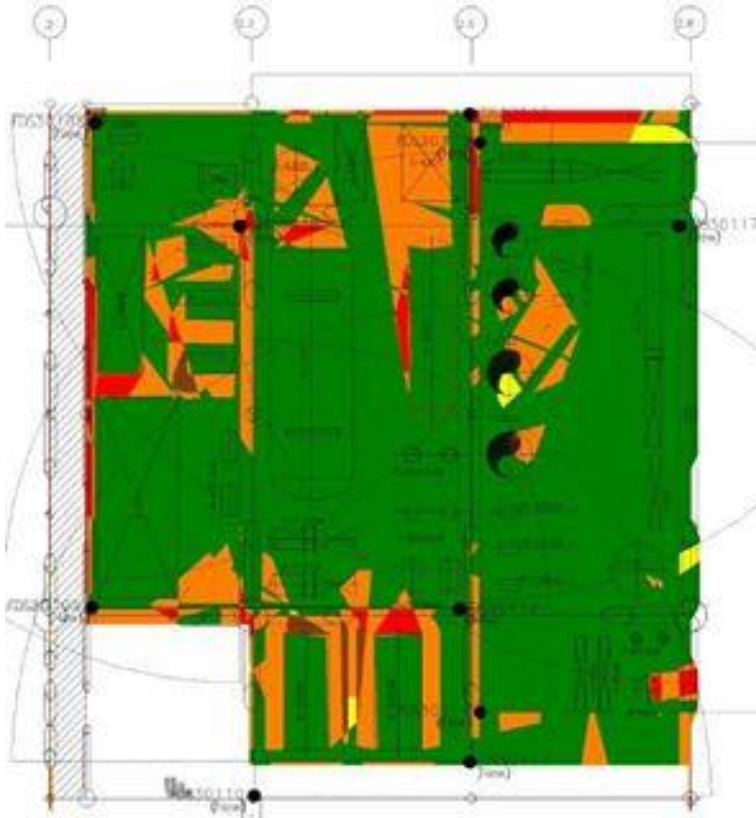
# Where is Detect3D used?

- Detect3D has been used on projects worldwide for BP, Shell, Petronas, ADNOC, GASCO, Maersk, Apache and many more.



# The Past...

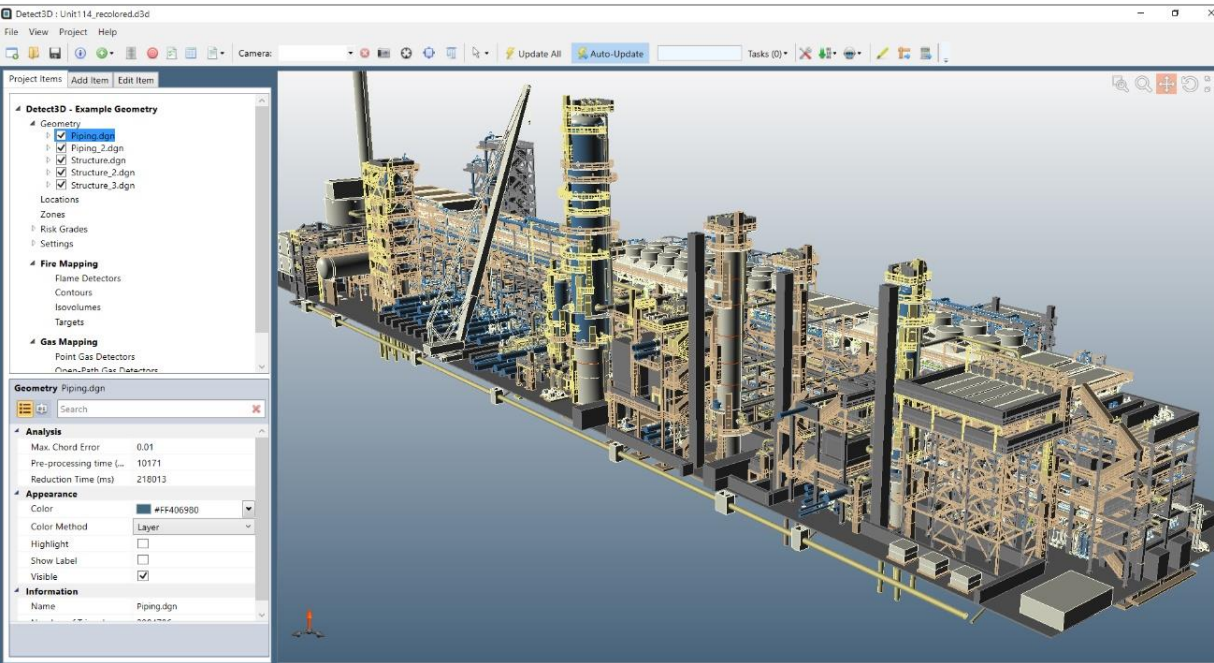
- Fire and Gas Mapping, when performed, used simple 2D techniques and software.





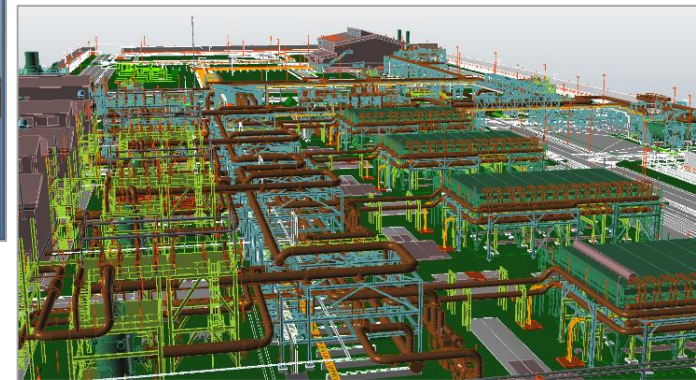
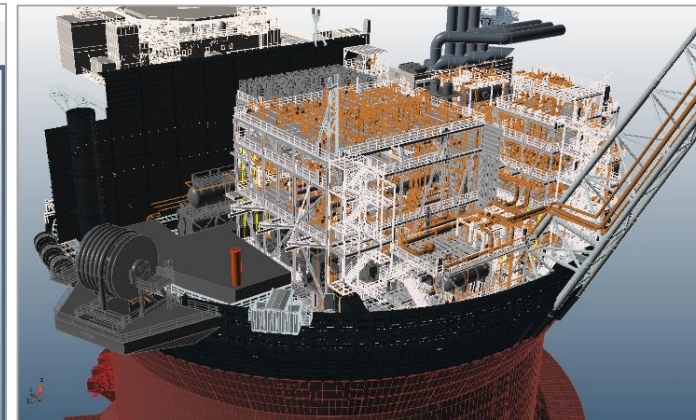
# The Present...

- Integration with 3D CAD



**Above**

Screenshot of Detect3D showing a typical CAD file for an onshore site.

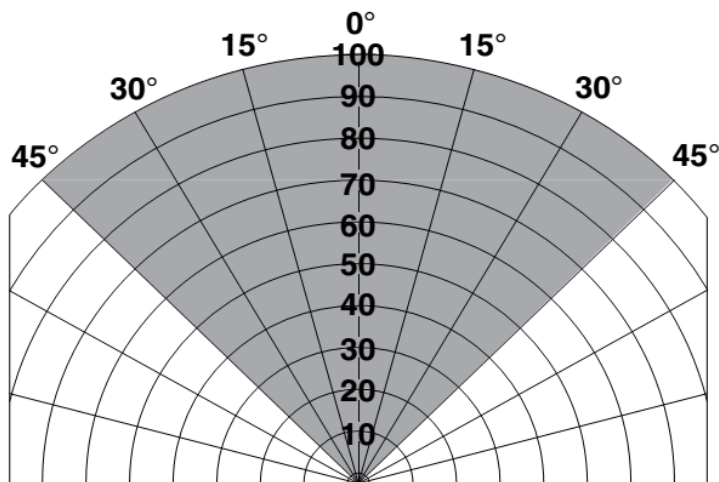


**Right**

Further examples of CAD used in Detect3D for 3D F&G Mapping projects.

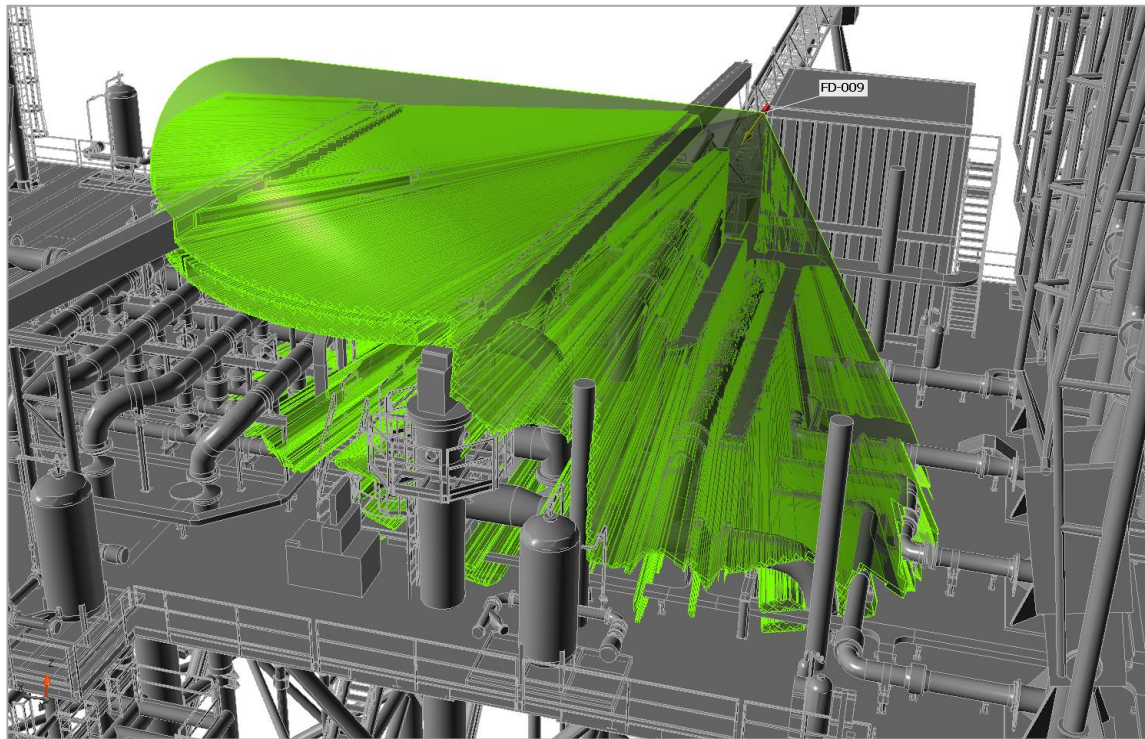
# The Present...

- Fire mapping uses ray casting to accurately calculate the detectors Field of View...



**Above**  
Manufacturer's data for a flame detector FOV

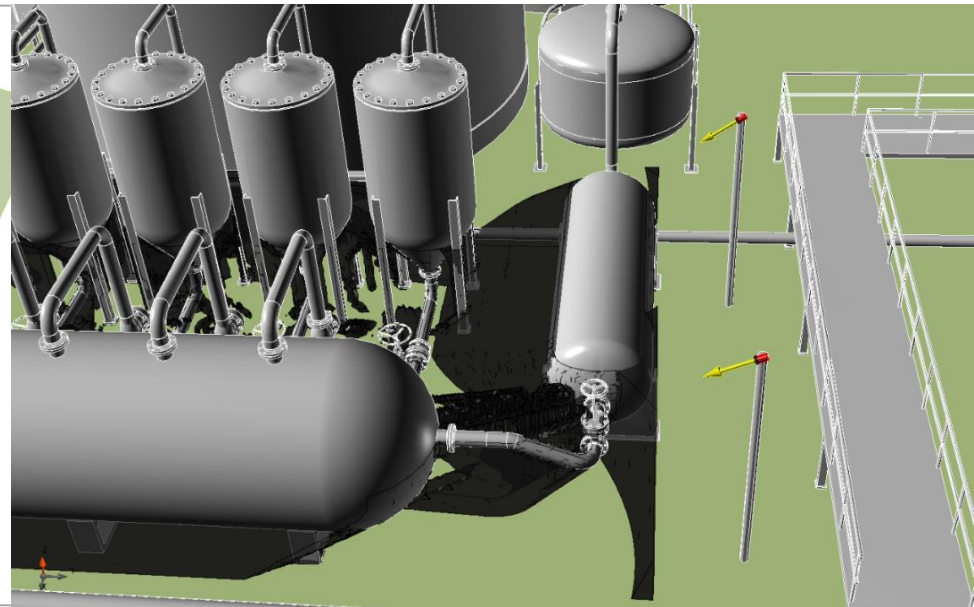
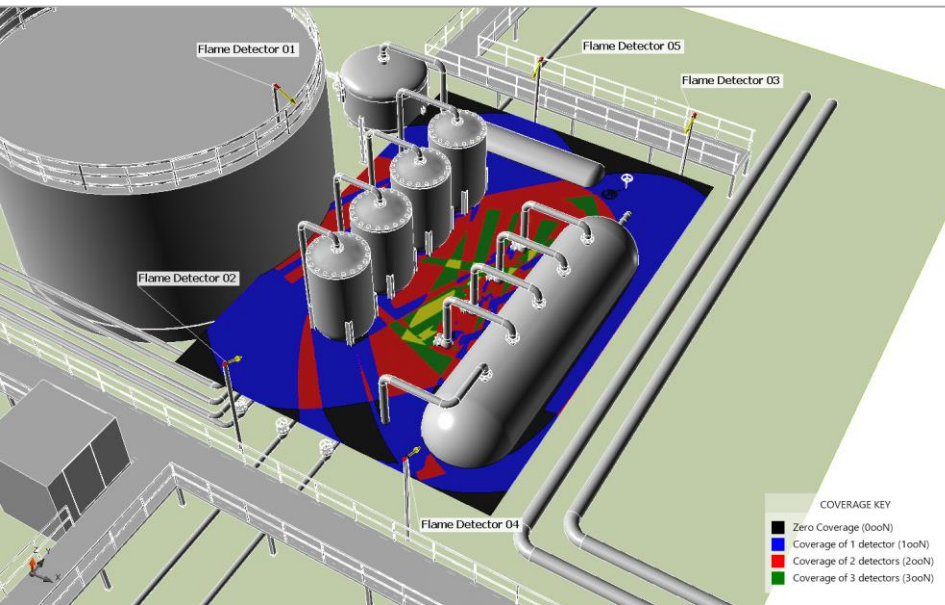
**Right**  
An obstructed FOV (green) calculated by Detect3D





# The Present...

- ...to arrive at coverage statistics and visualization.



**Left**

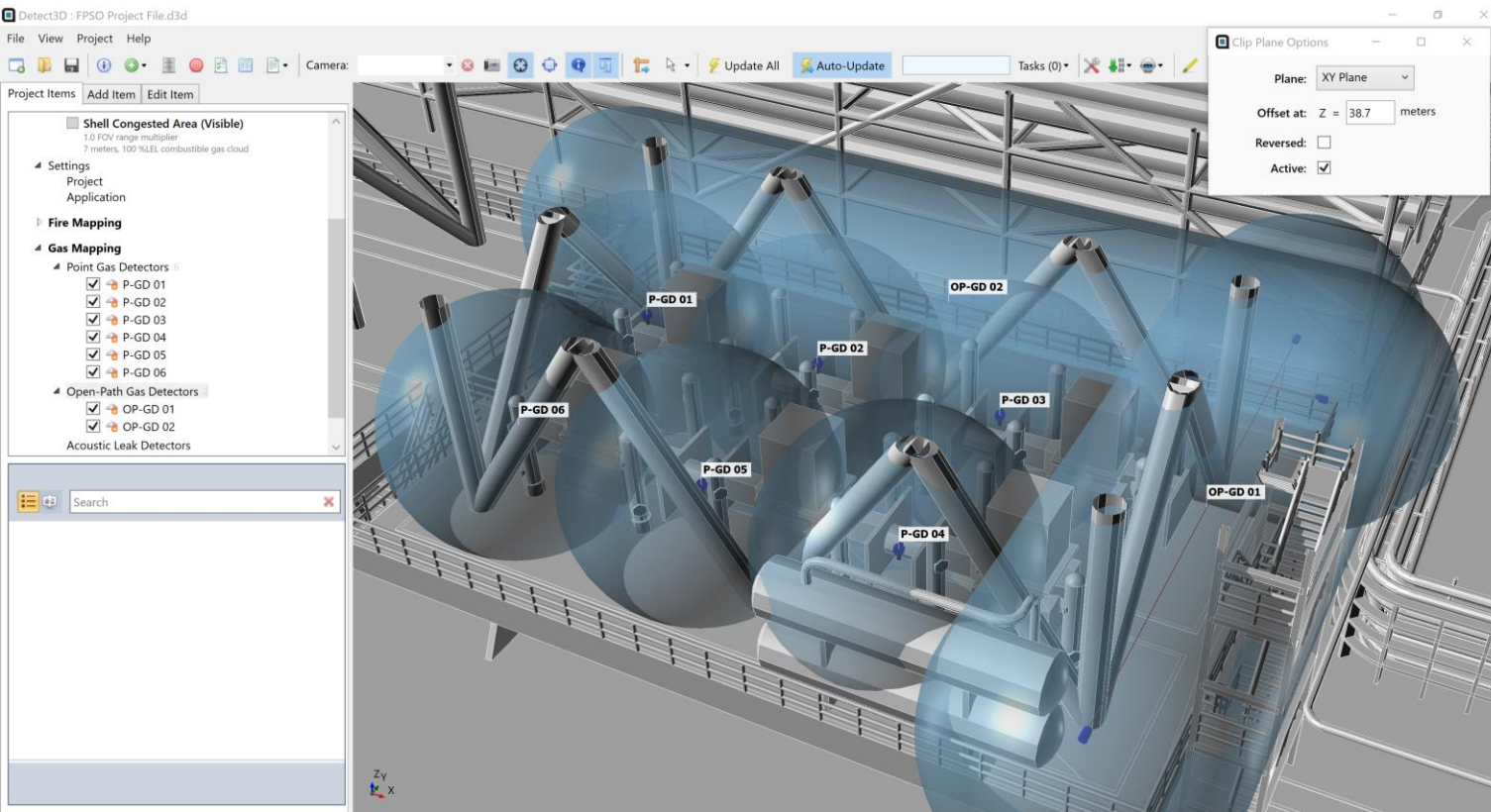
Coverage contour at 2 meters above ground level.

**Right**

Zero Coverage Isovolume

# The Present...

- The coverage of gas detector layouts is calculated based on the “design gas cloud” approach popularized by the UK HSE, BP and Shell.



## Left

Point gas & open path gas detectors highlighted on a FPSO deck. The blue spheres indicate the “field of influence” of the detector, depending the gas cloud size required for the coverage assessment.

Multiple gas cloud sizes can be used for the gas mapping evaluation.

Cut plane view

# Detect3D

Fire and Gas Mapping. Optimized.

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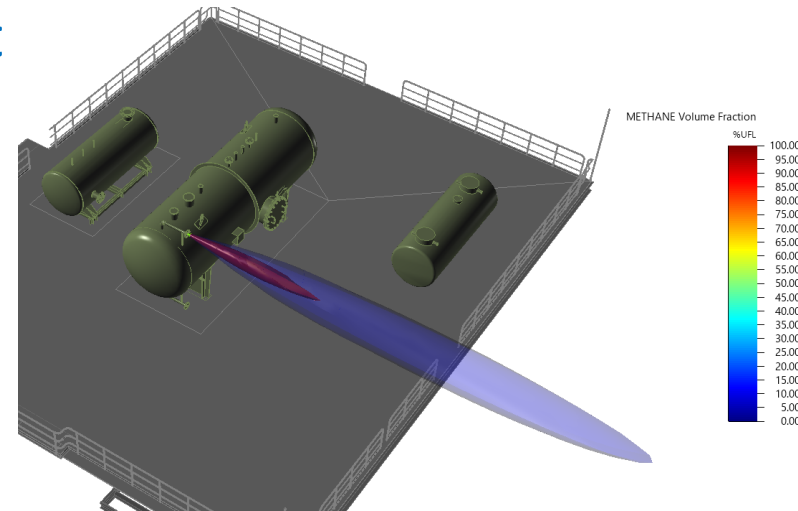
# Room for Improvement?

- The geographic method:
  - Provides acceptable results for F&G Mapping based on years of experience and research.
  - Is accepted by many authorities.
  - Does not account for any physical effects such as wind speed, with direction, gas cloud, fire.
- Why not replace the geographical method with scenario based modeling that account for all physical effects?
  - 8 wind directions, 3 wind speeds
  - 50 leak locations
  - 4 leak directions, 3 hole sizes
  - $8 \times 3 \times 50 \times 4 \times 3 = 14,400$  scenarios!



# Scenario based methods

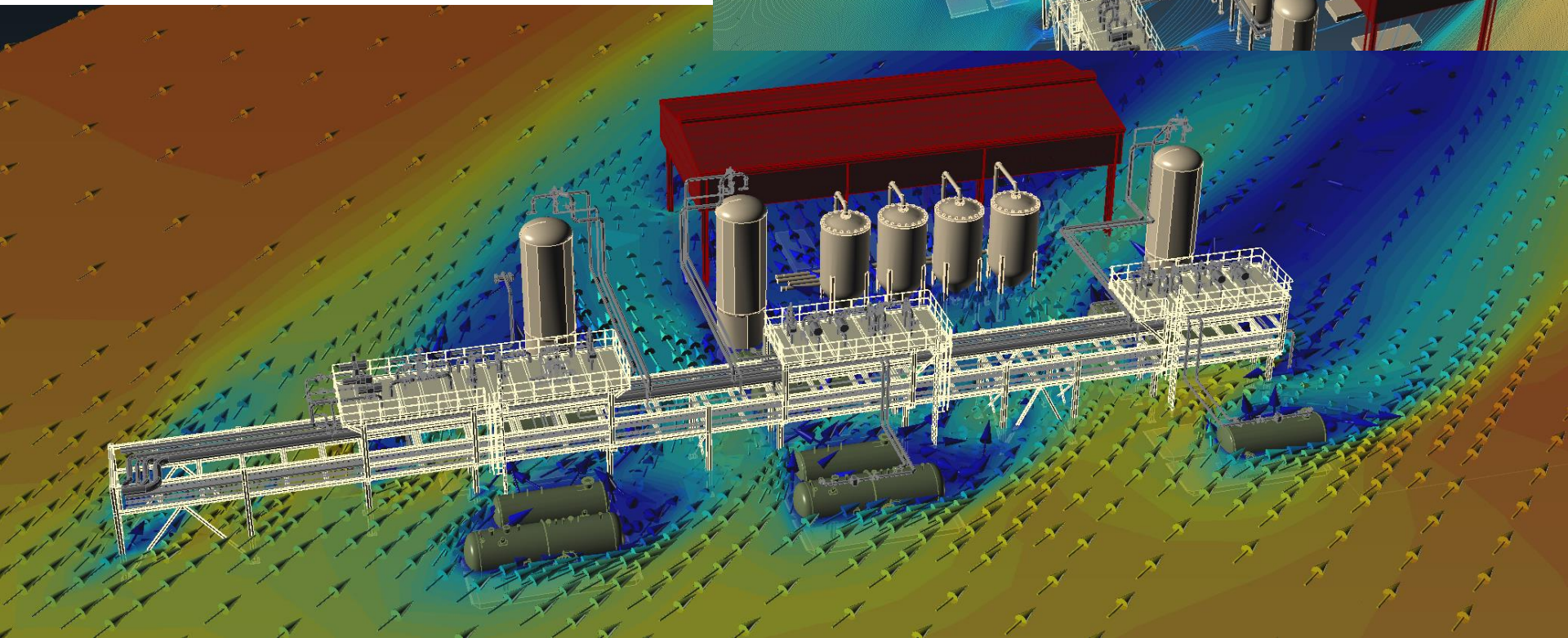
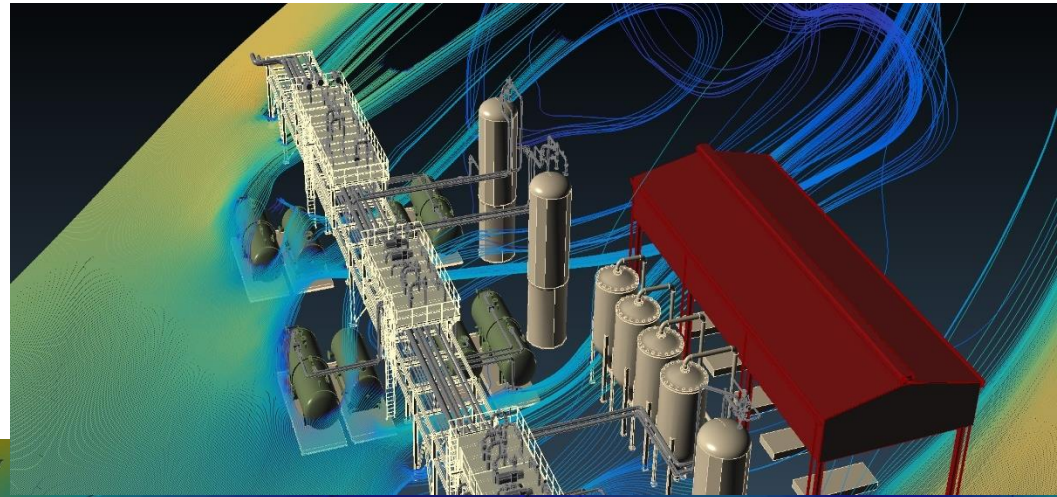
- We have >10,000 scenarios per module – can we use simple dispersion models?
  - Only part of the physical environment is included.
  - Is an inaccurate scenario based analysis better than a geographical assessment?
- Let's use CFD!
  - Costs are high – just reroute the cost to more detectors?
  - No established methodology.
  - No industry testing or JIP to support a full CFD method.
  - Higher analysis costs...but more detectors!



# New CFD software tool

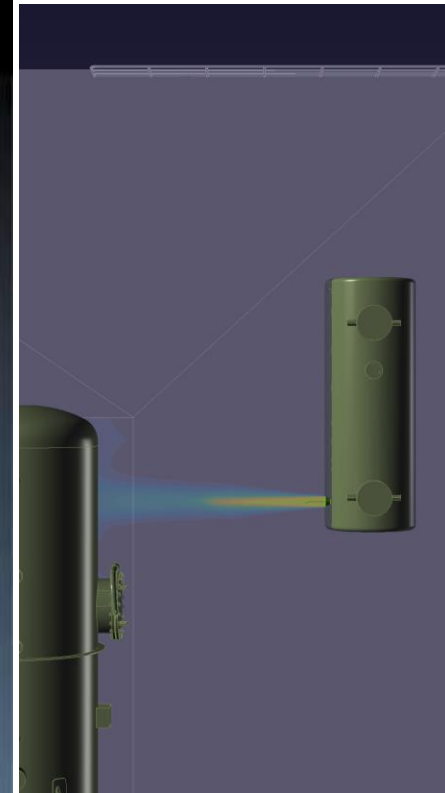
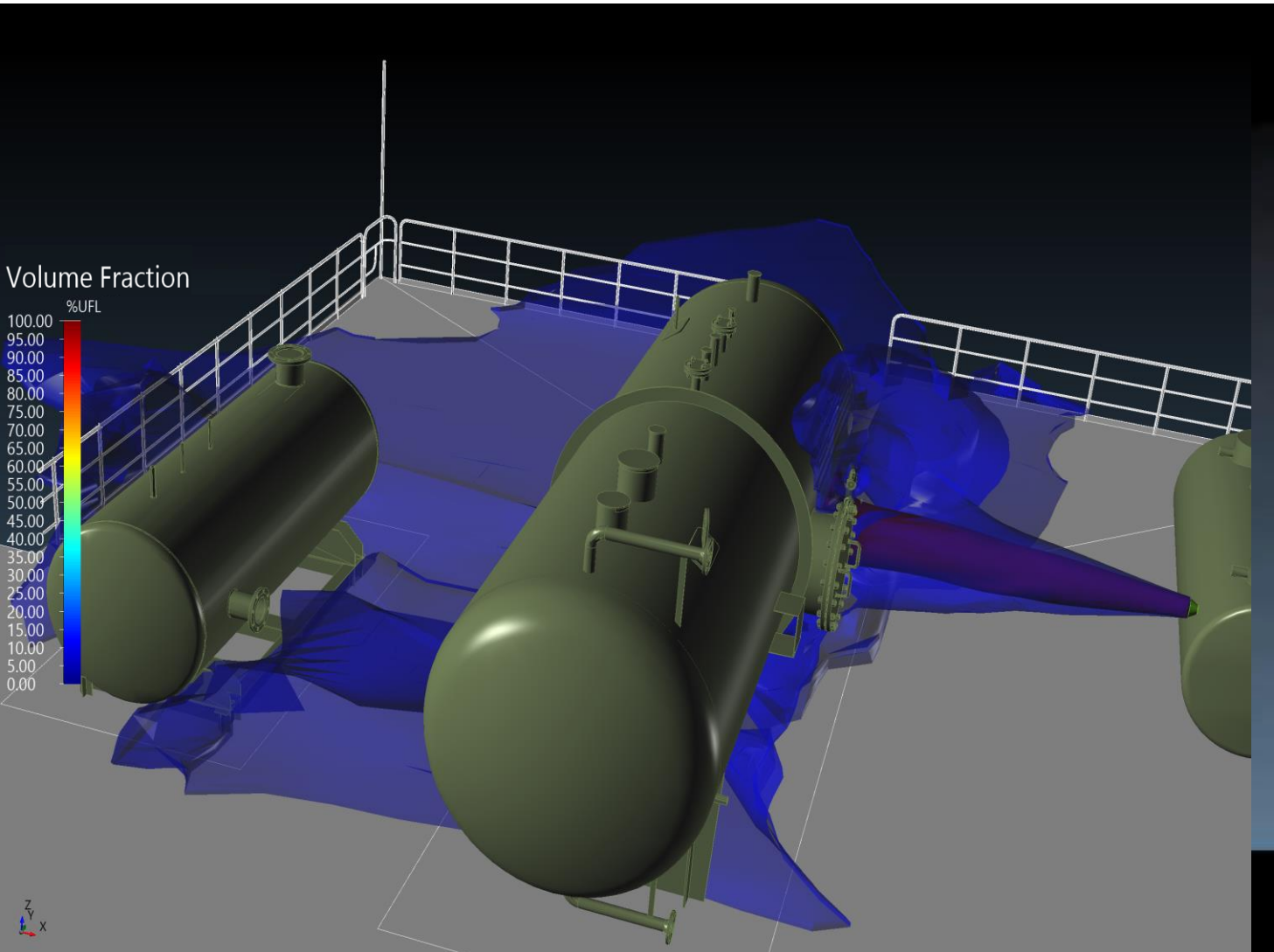


- Initially for ventilation and dispersion
- Fire and explosion modelling to follow-up in 2018



# CFD – a way forward

- Detect3D will have a CFD capability from in:Flux (2018)
- In:Flux to be released formally by November 2017



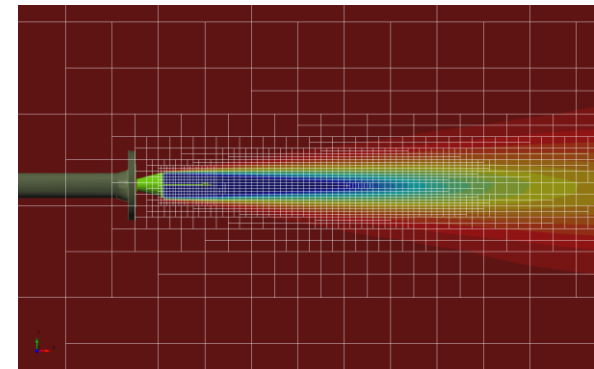
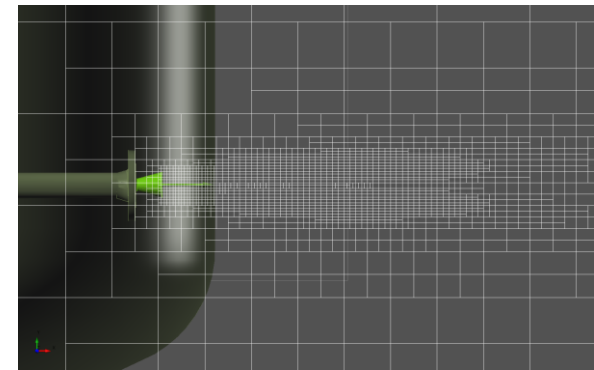
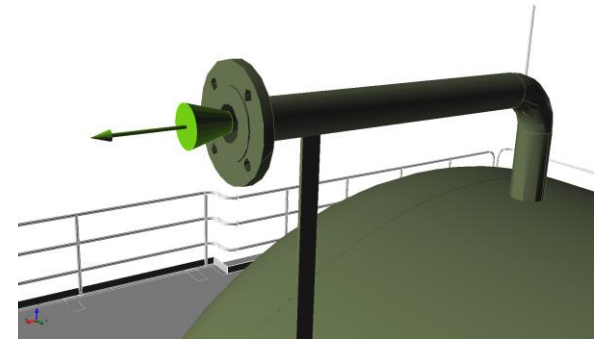
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# CFD – a way forward

- The most likely way forward is to use a combination of geographical and scenario based modeling, based on the strengths of each method.
- Use geographic method in highly congested environments.
- Use scenario based methods to address weaknesses of the geographic method, particularly:
  - Detection at a distance, e.g.  $H_2S$  / toxic gas detection using open-path detectors at a site perimeter.
  - Assess detection time.
  - Calculate detector alarm settings.
  - Better assessment of technologies – point vs open path vs acoustic.



# The Future

- Progress in Fire and Gas Mapping technology will be focused on CFD simulations of gas and fire scenarios.
- There are many unanswered questions:
  - How many scenarios are necessary?
  - How can we validate the layout?
  - What is the relative detector count for scenario and geographic coverage?
  - Is CFD feasible, or necessary, for flame detection mapping?
- We need a joint industry effort to research these questions, involving oil majors, regulators, universities, consultancies and software companies.
- The technology is developing fast and the industry needs to keep pace.

# Questions?

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