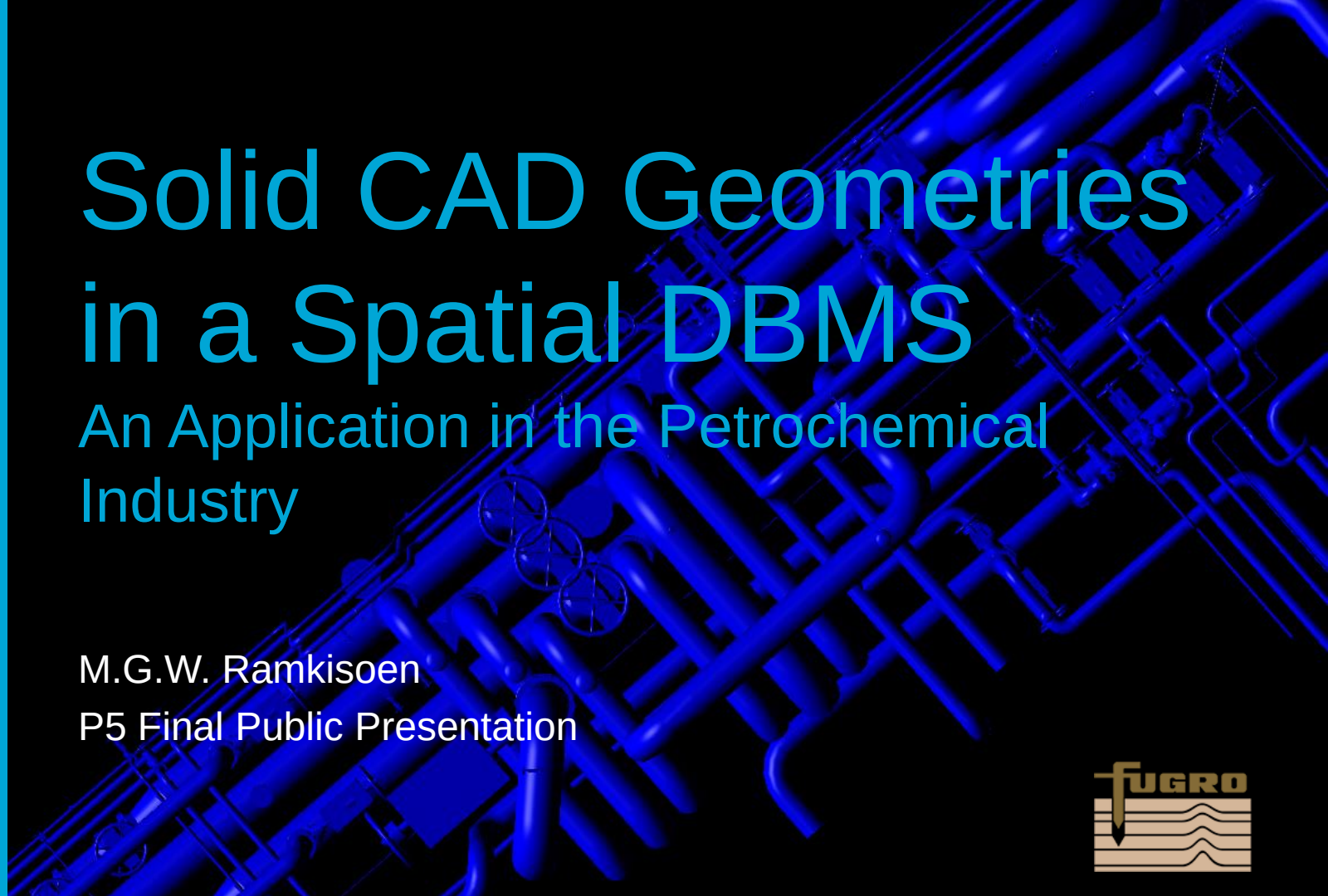
Solid CAD Geometries in a Spatial DBMS

An Application in the Petrochemical Industry

M.G.W. Ramkisoen

P5 Final Public Presentation



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P5 Final Public Presentation

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Company Supervisor:	Ir. M. Kodde

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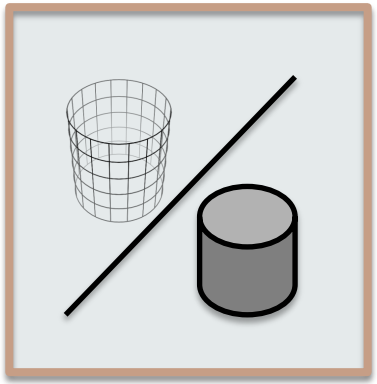
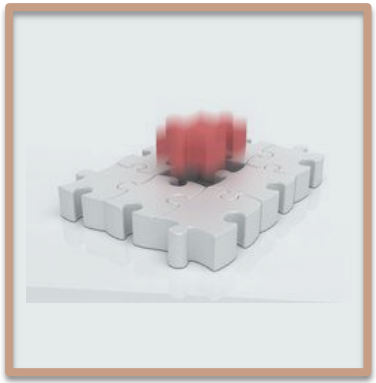
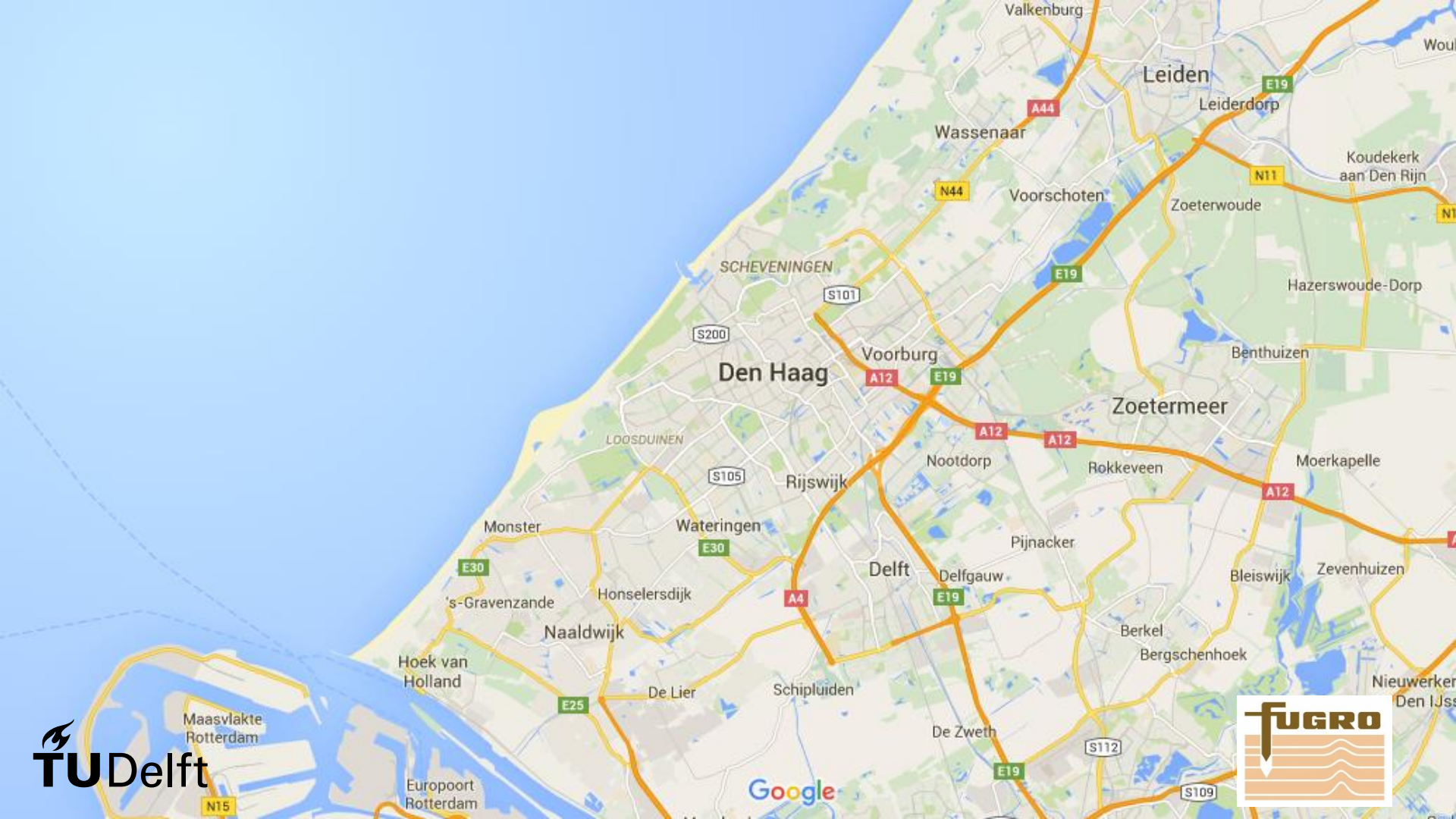
Content







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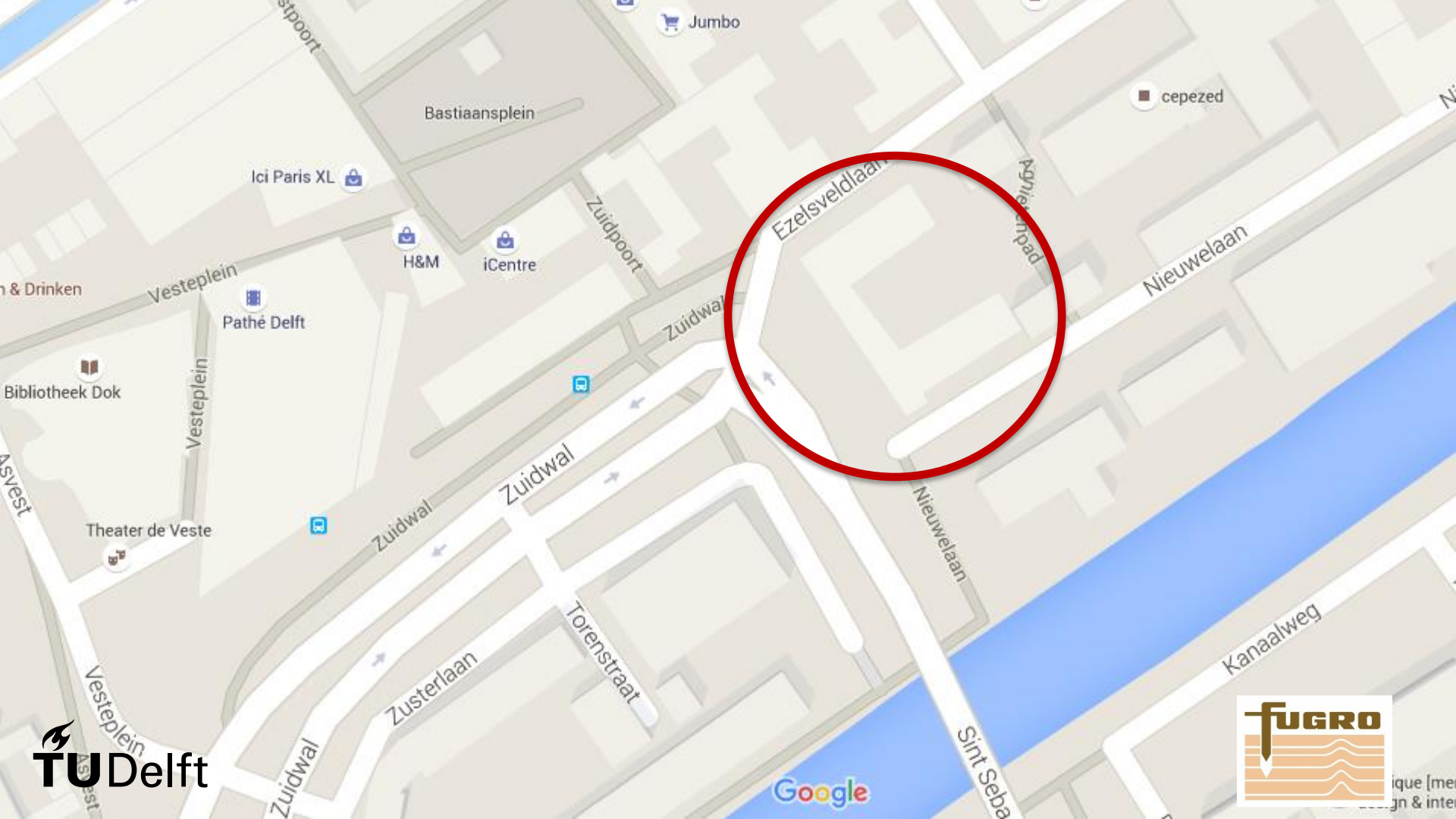
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Introduction

- There is a need for a 3D representation of our living environment.

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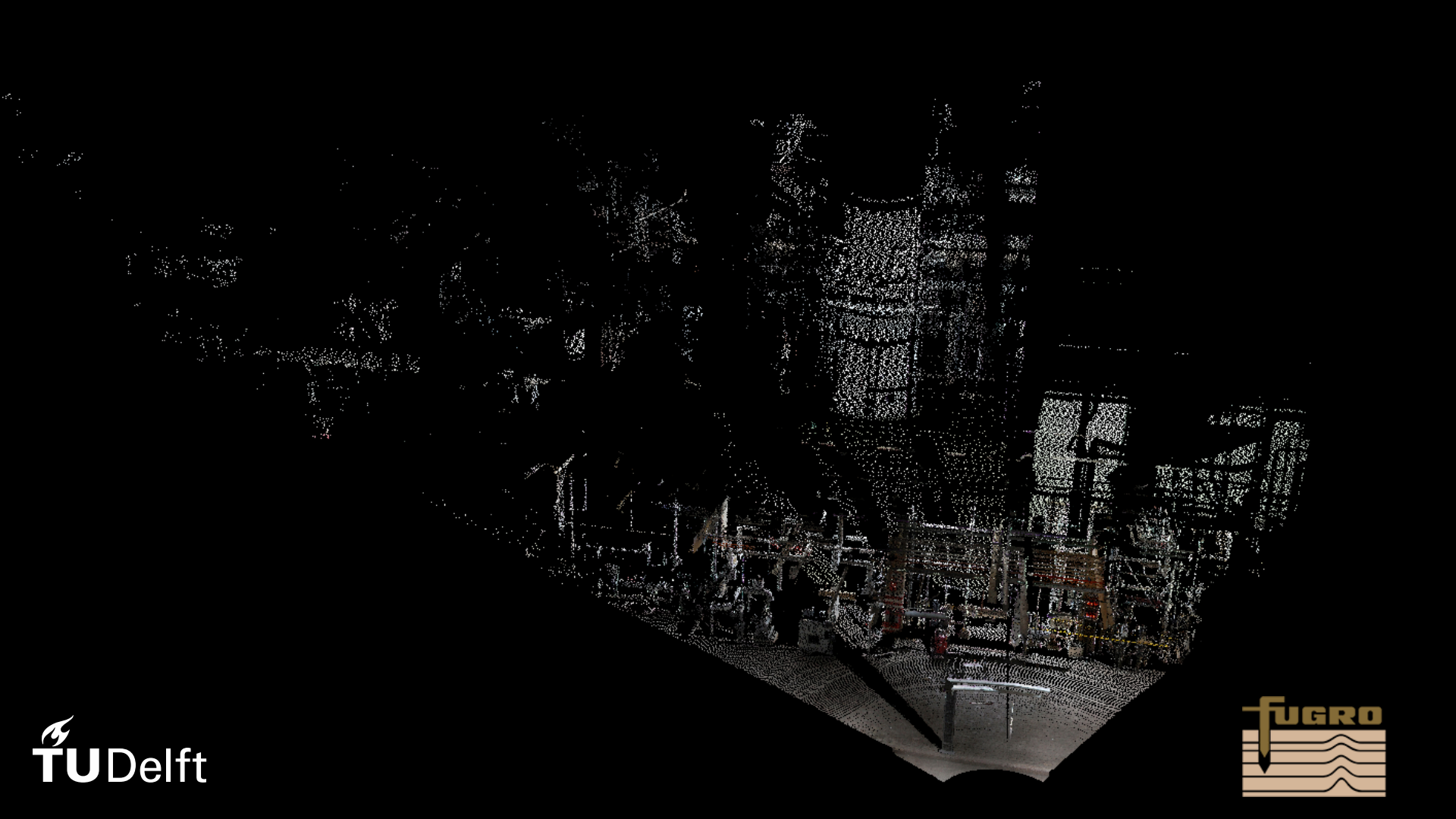
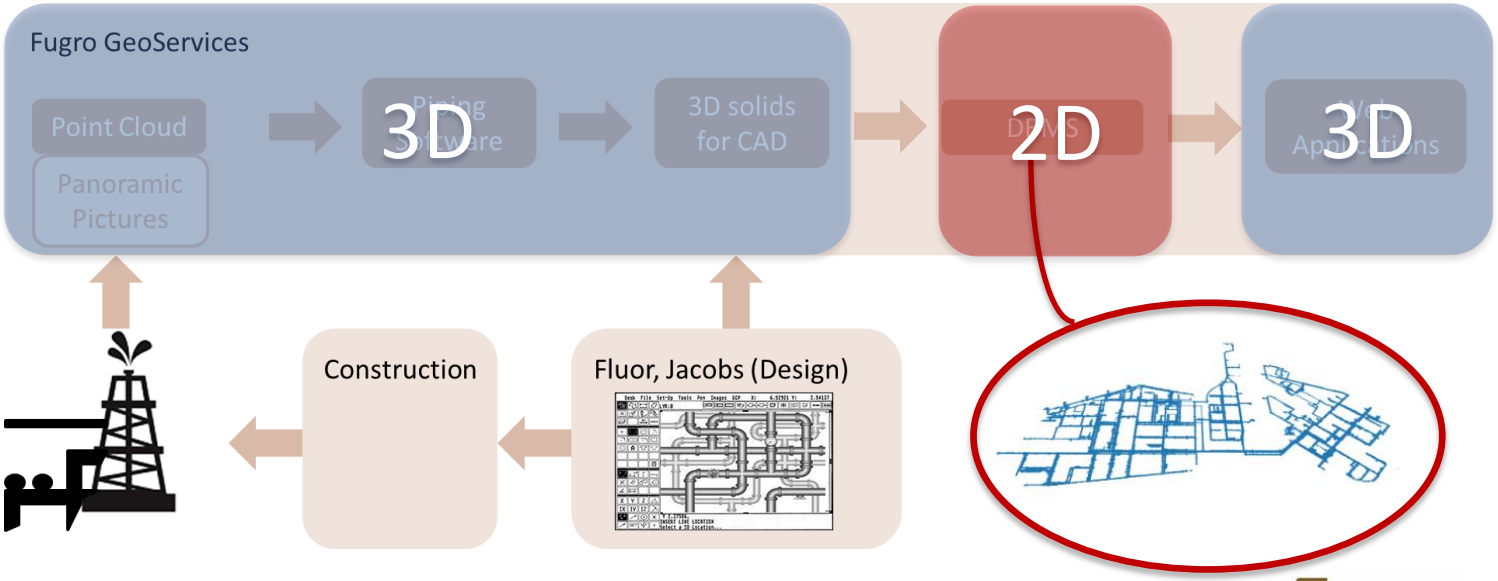
Petrochemical Industry



Introduction



Intermezzo

A **DBMS**, Database Management System, is a software which handles all access to the database (Date, 1975) and controls the storage & retrieval, addition/deletion, data definition and journaling of data, which consists out of a kernel code (for managing memory and storage), repository data (data dictionary) and a query language (enables to access the data) (Ashdown & Kyte, 2014; Chorafas, 1983).

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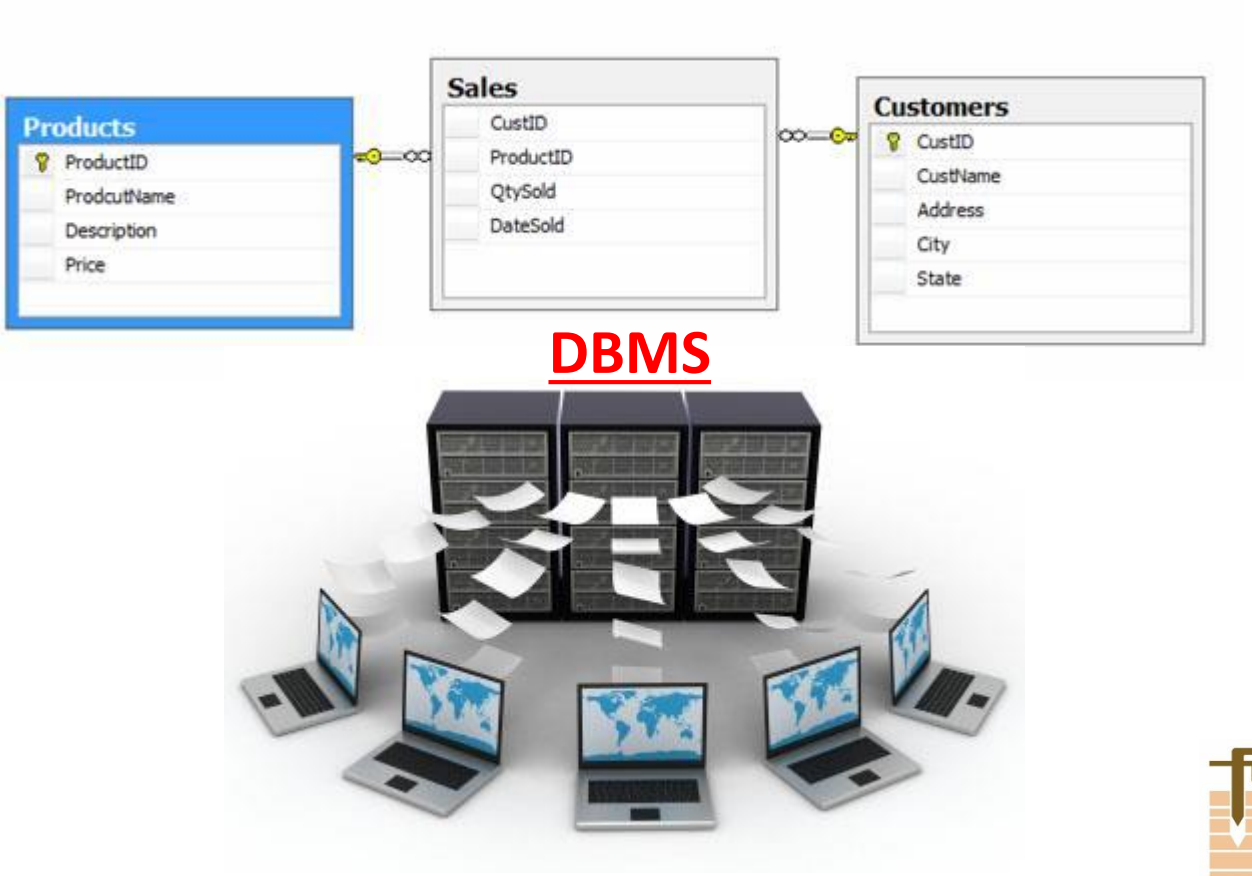
Intermezzo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Sales
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DBMS


Search for Locations, Sc
2D
Layer Options
3D View: Photo realistic
Show Laser Scans
Show Roser Keys
3D Model Layers
Demolition
Existing
New
Future
Others
Current scan
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Show Coordinates
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EX
ZONE 0
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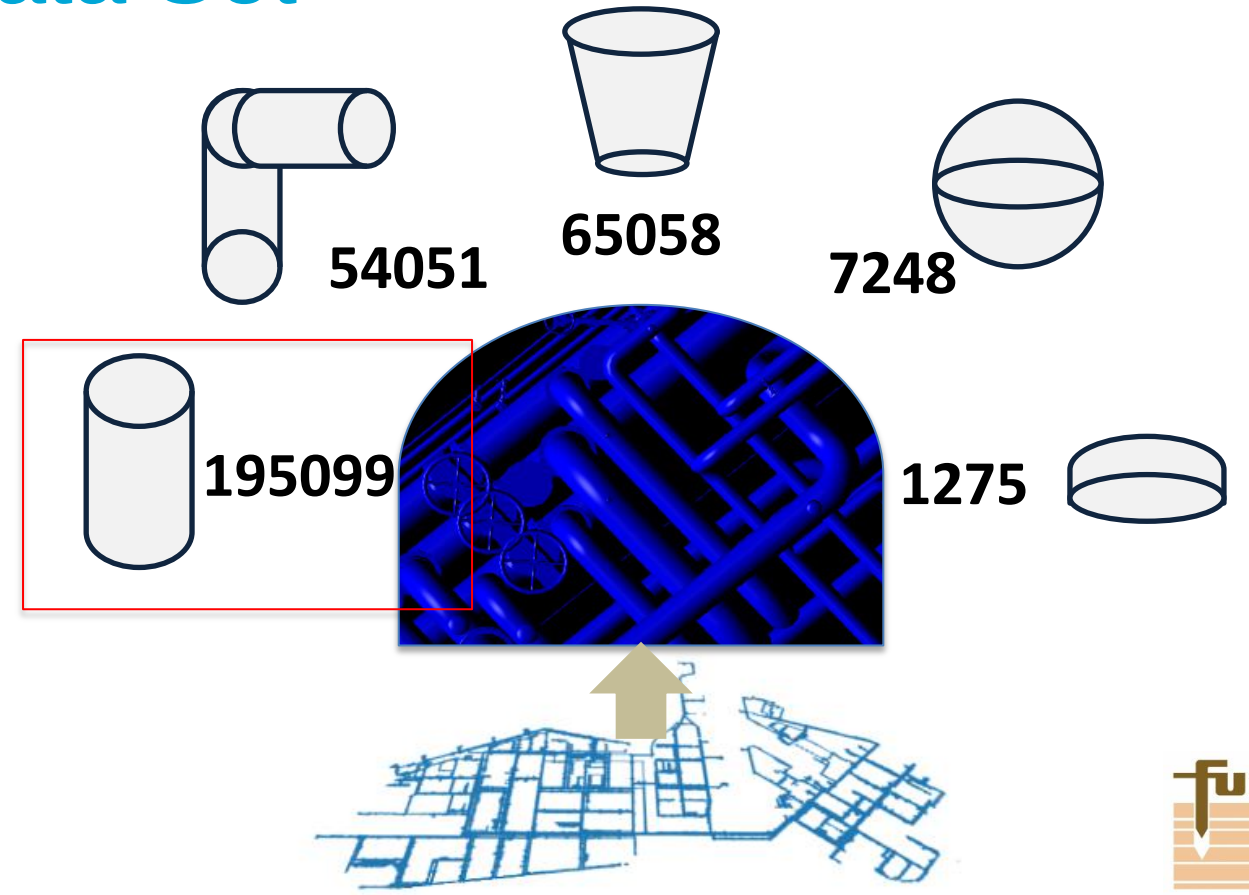
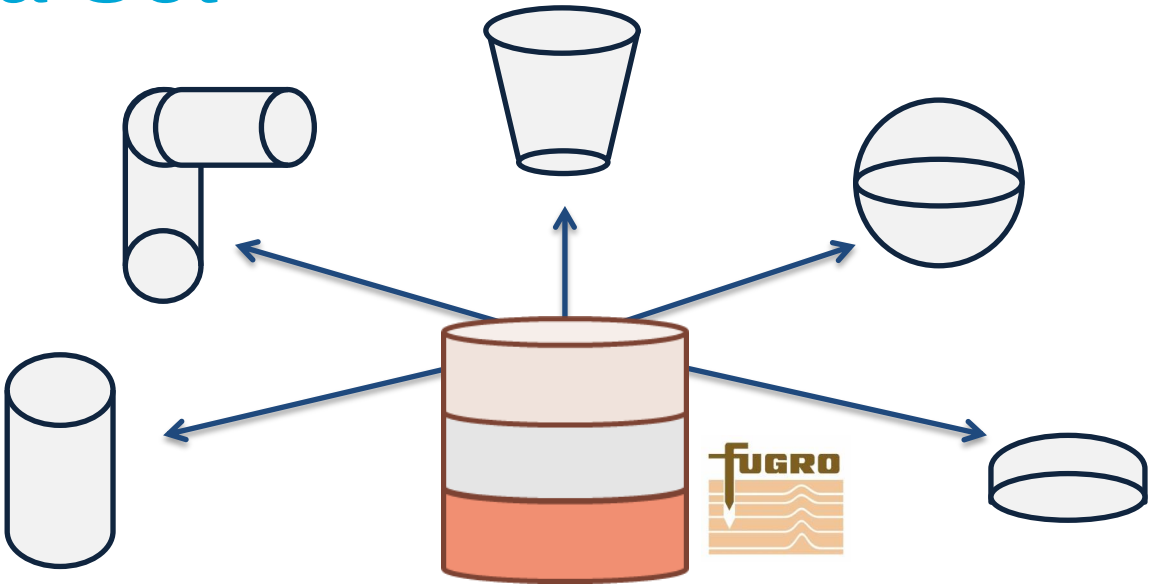
Data Set



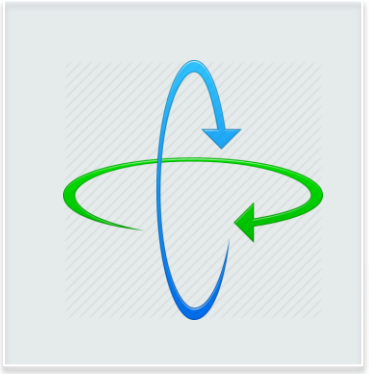
Data Set



2D DBMS

Data Set

Data Set



Data Set

- Research Question:

  How is it possible to store and visualize **solid geometries** in a spatial **DBMS** suitable for the **petrochemical industry**?

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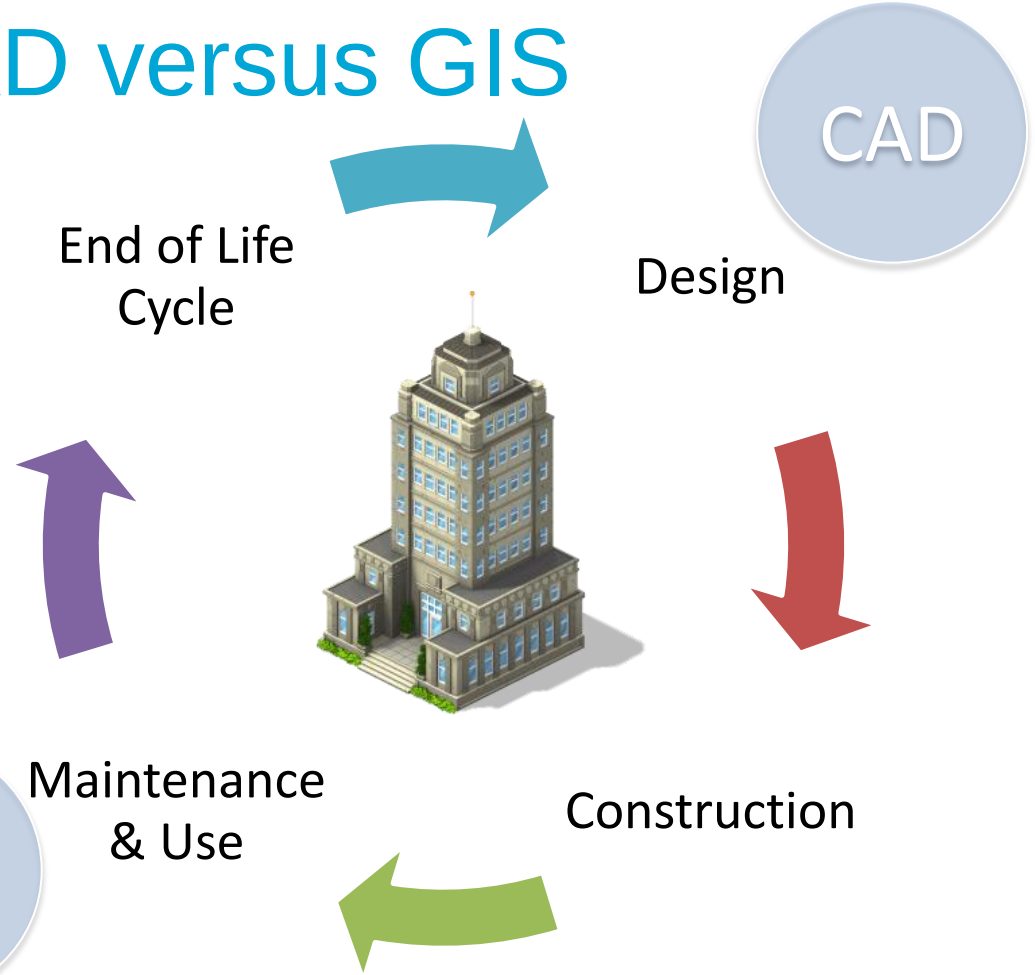
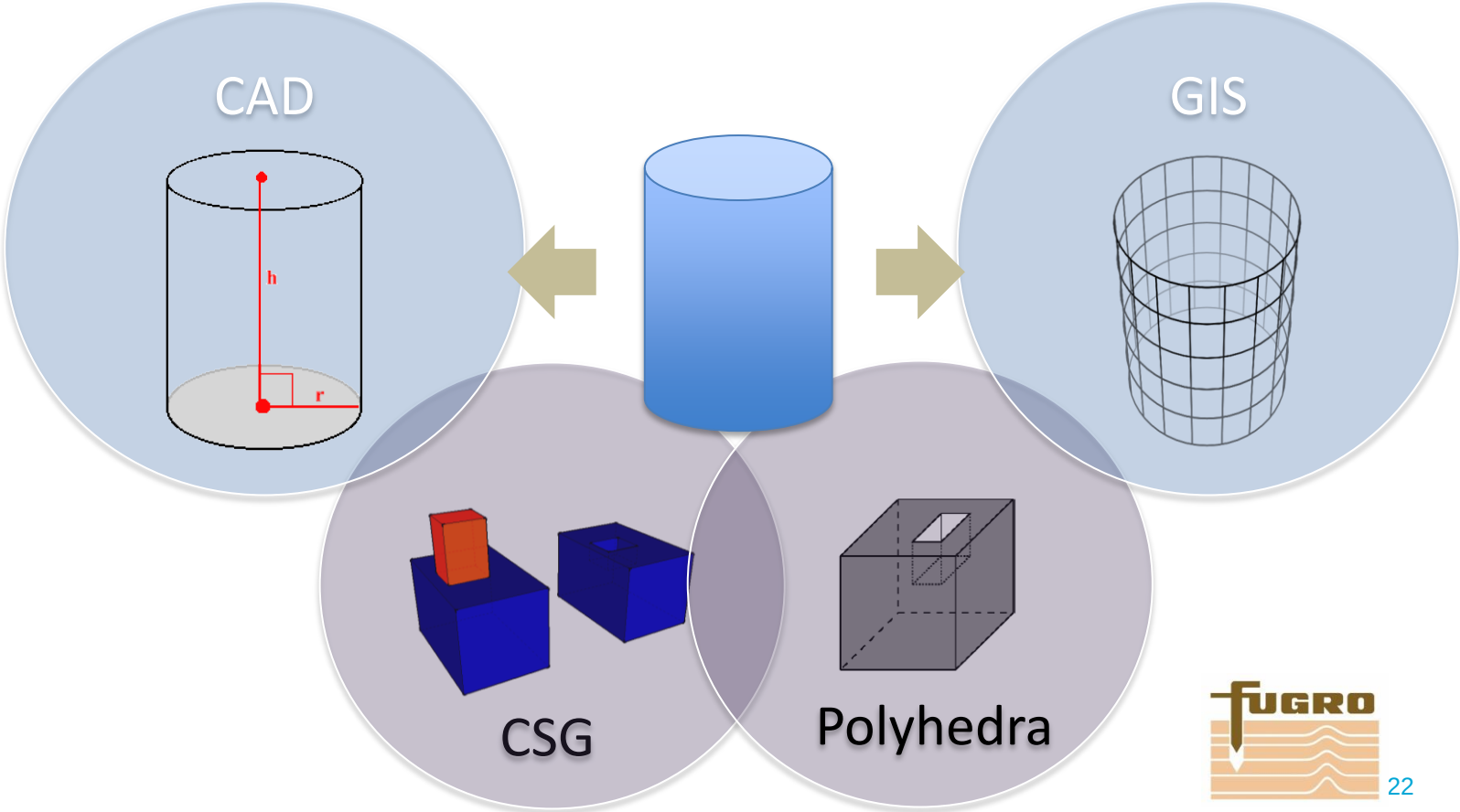
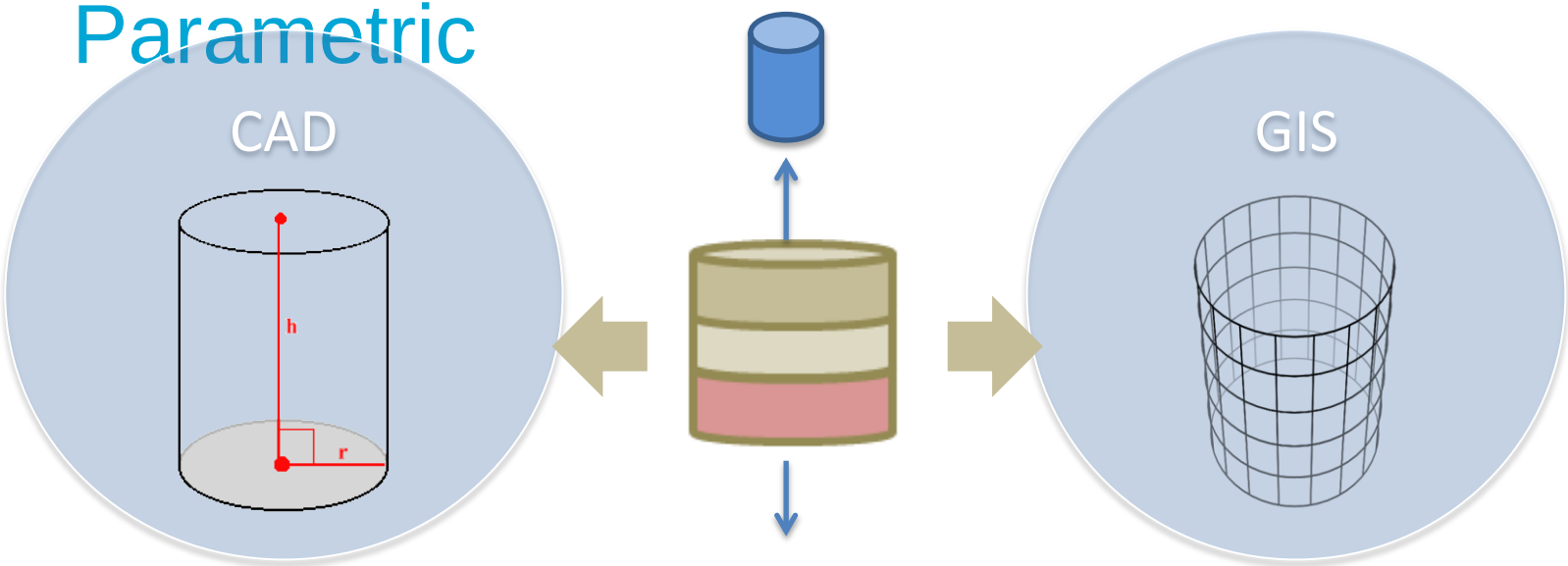
CAD versus GIS



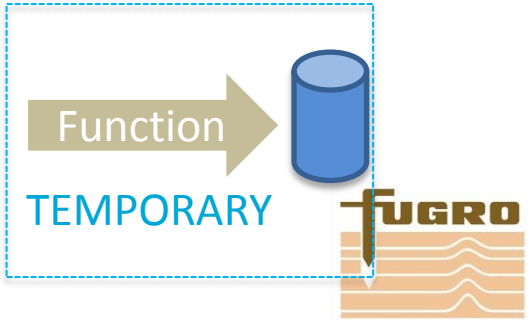
CAD versus GIS



3D Parametric versus 3D Non-Parametric



- Radius
- Starting Point
- Ending Point



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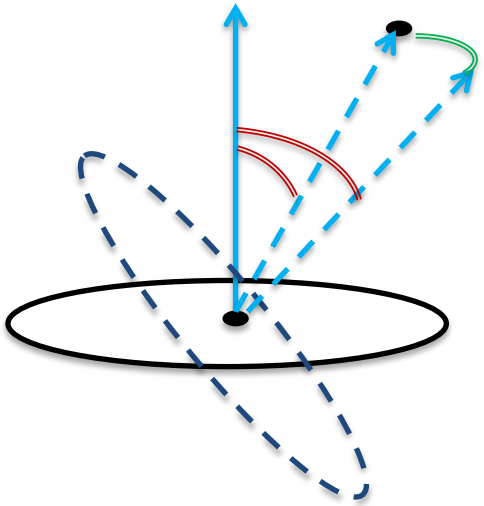
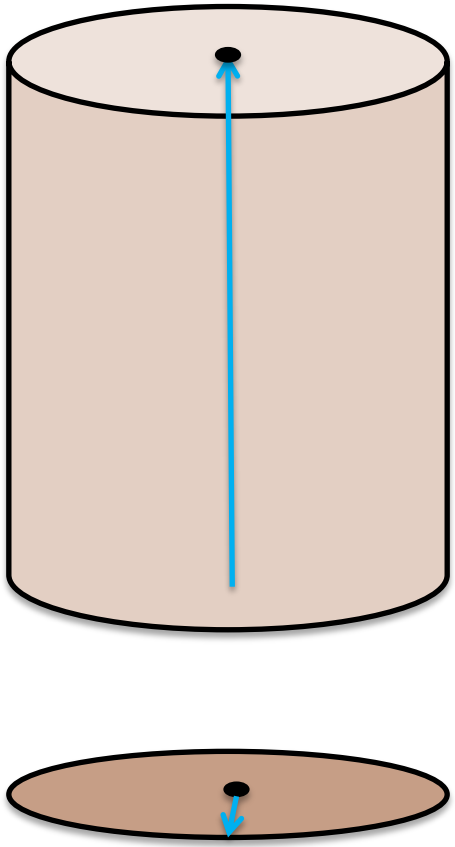
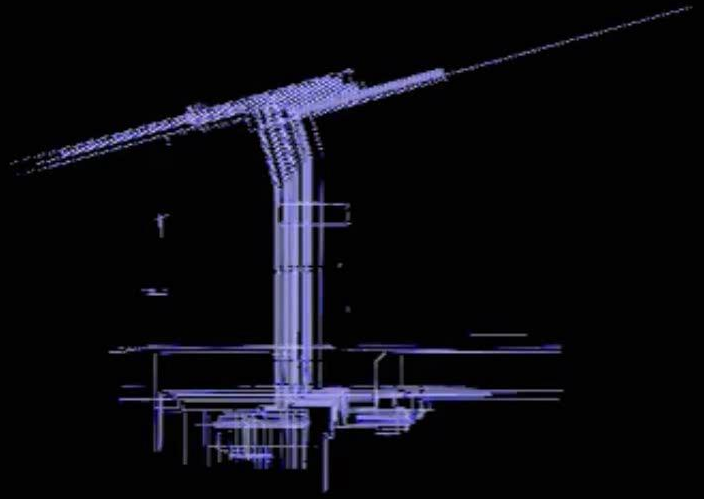
3D Parametric versus 3D Non-Parametric







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X3D

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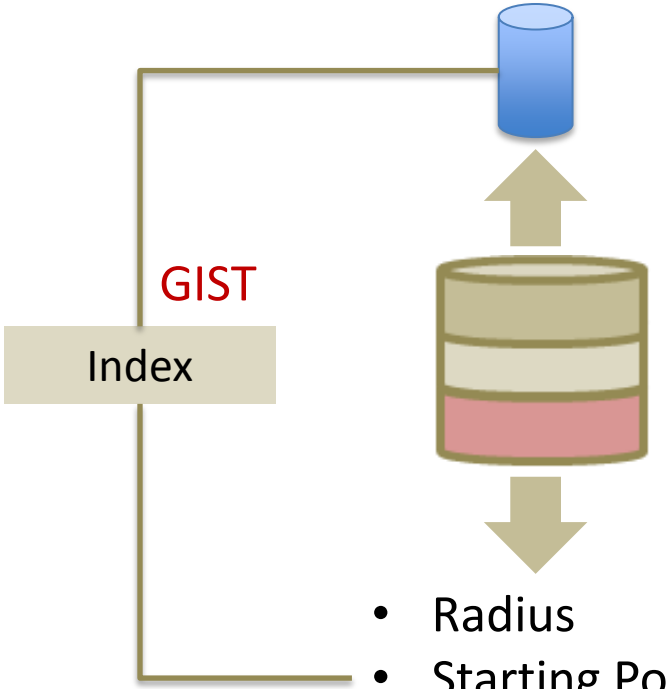
3D Parametric versus 3D Non-Parametric

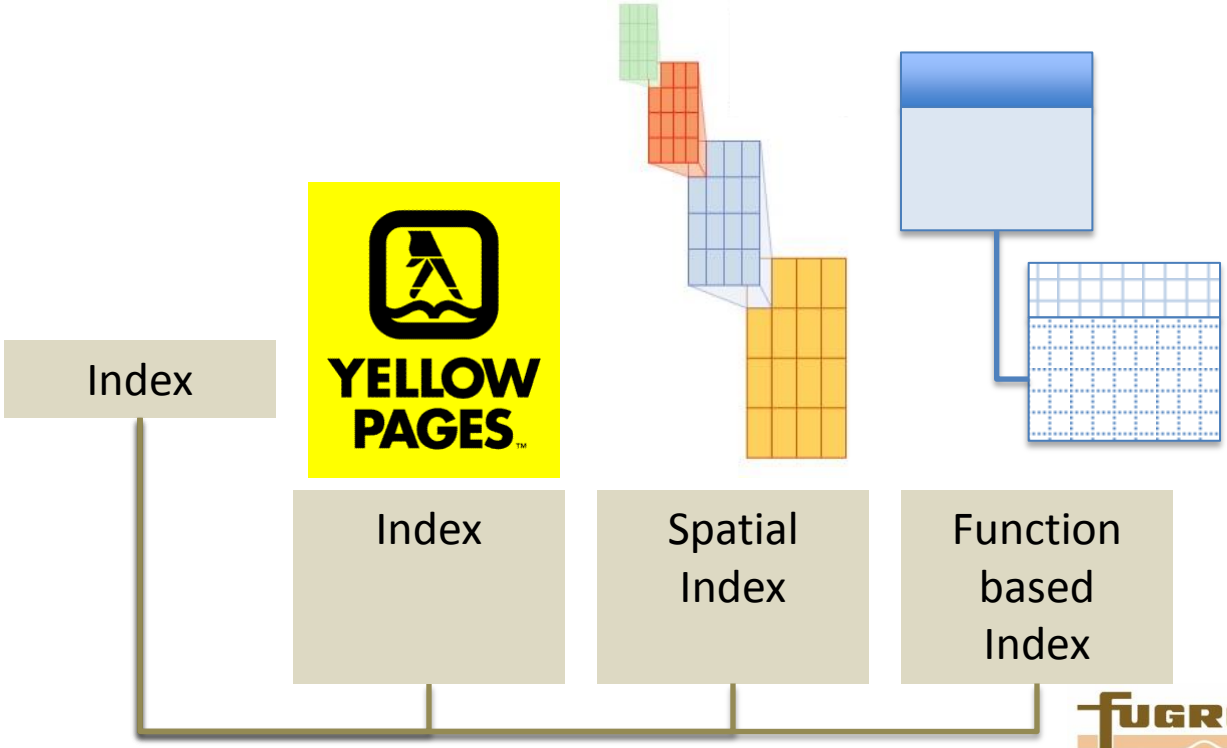


Performance Optimization

- Radius
- Starting Point
- Ending Point

Non-Spatial

Intermezzo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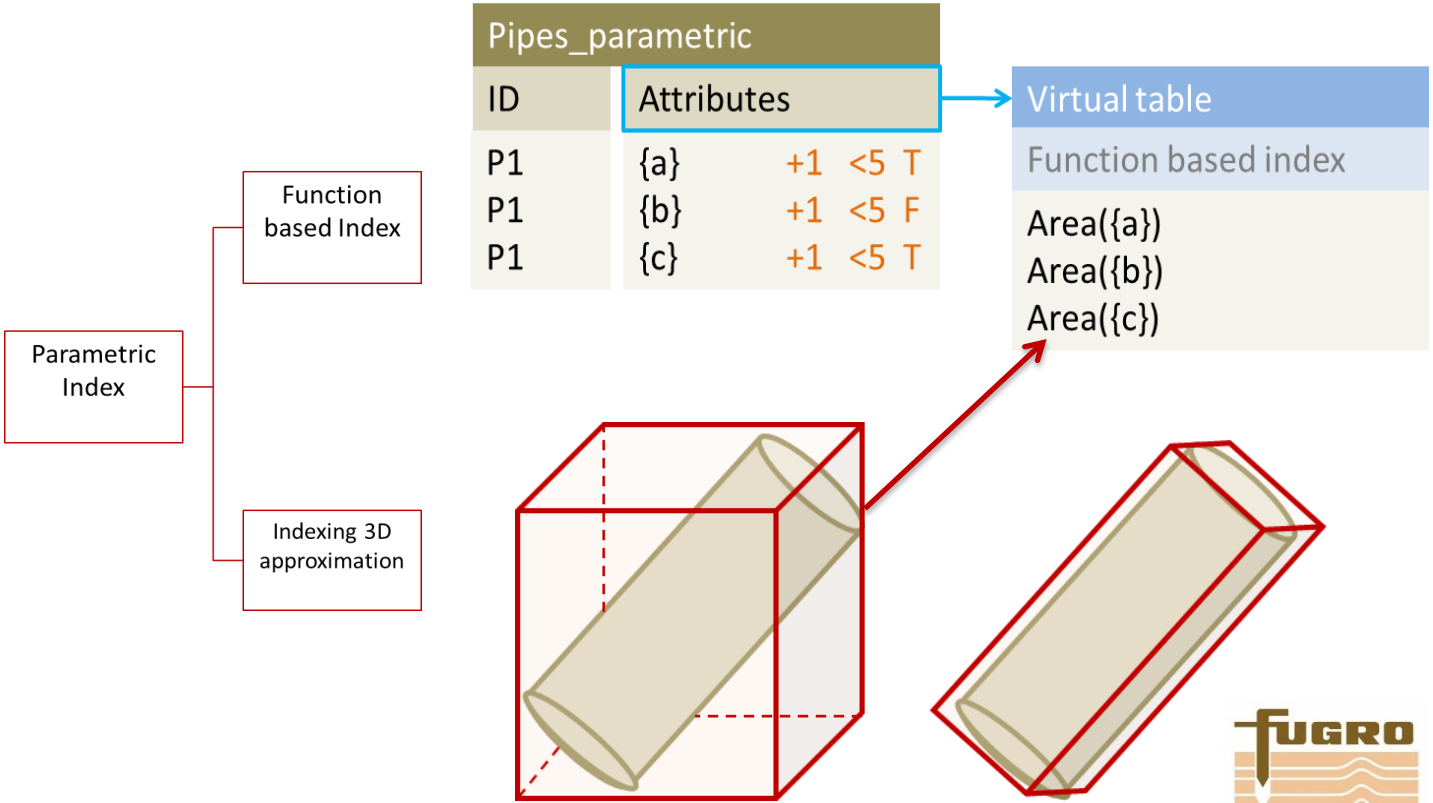
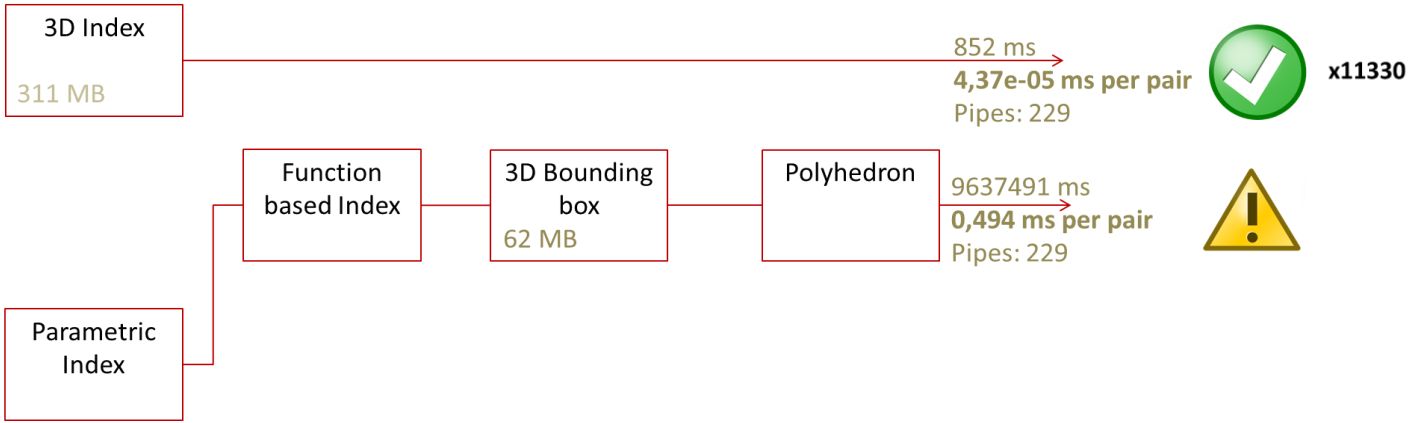
YELLOW PAGES
Index
Spatial Index
Function based Index

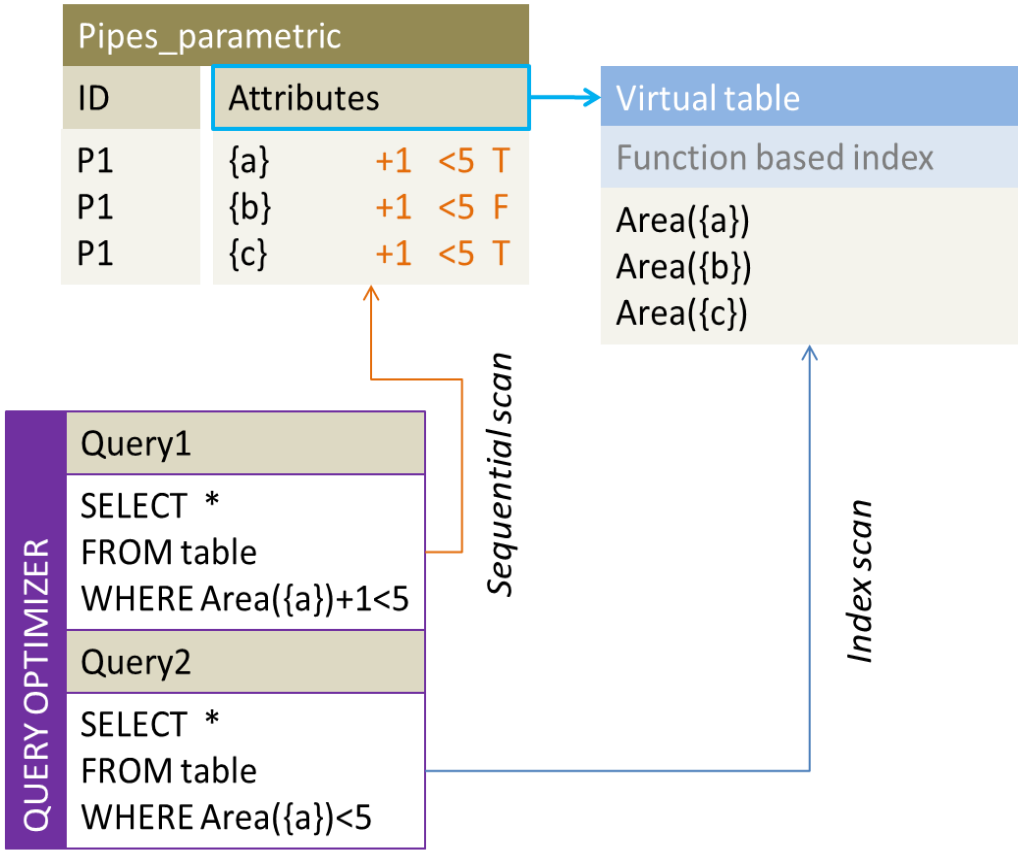
3D Parametric versus 3D Non-Parametric



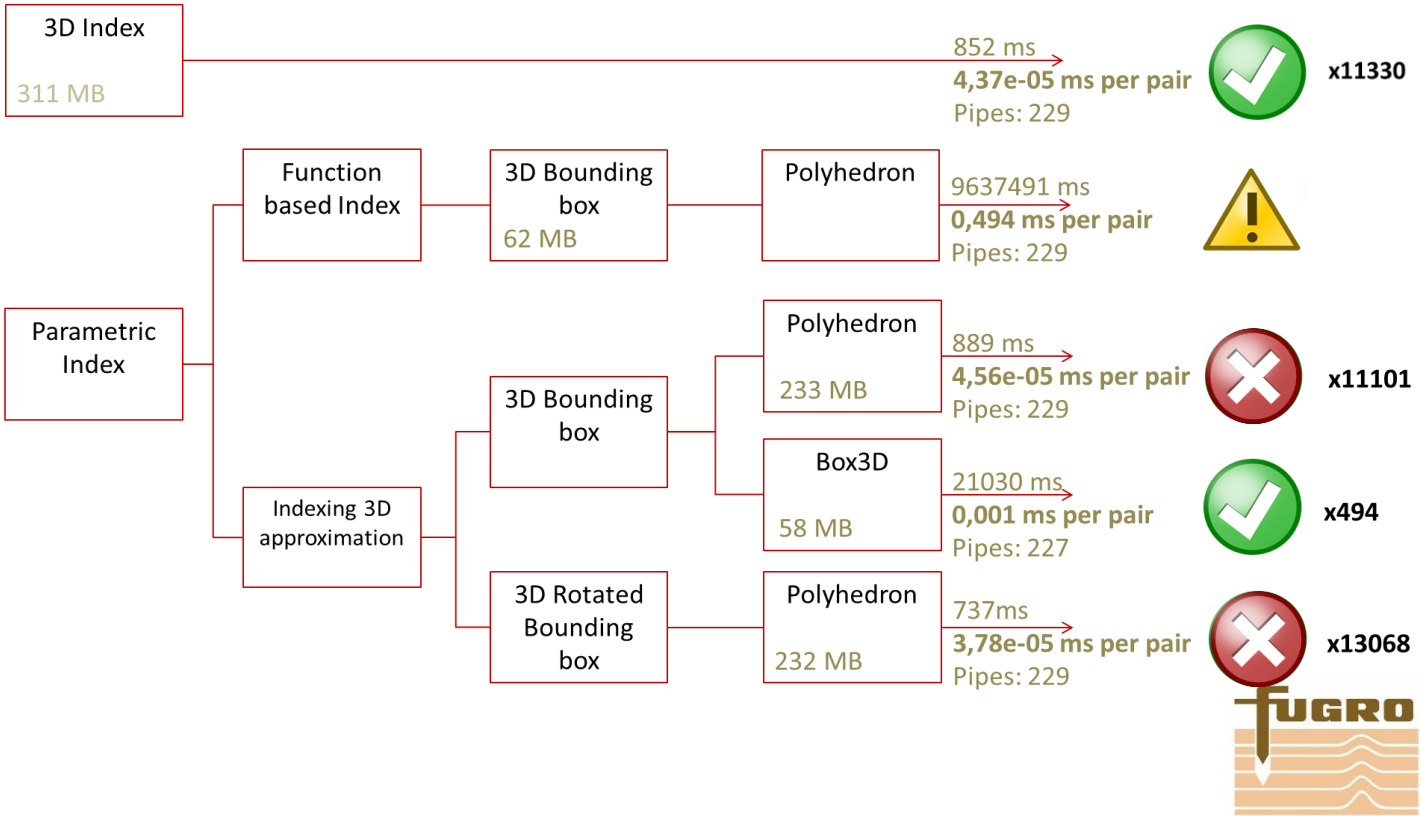
3D Parametric versus 3D Non-Parametric



3D Parametric versus 3D Non-Parametric

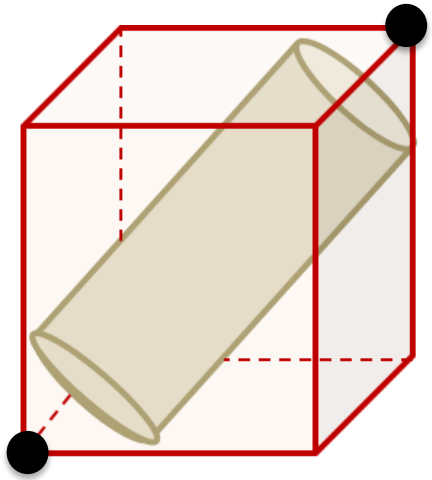


3D Parametric versus 3D Non-Parametric



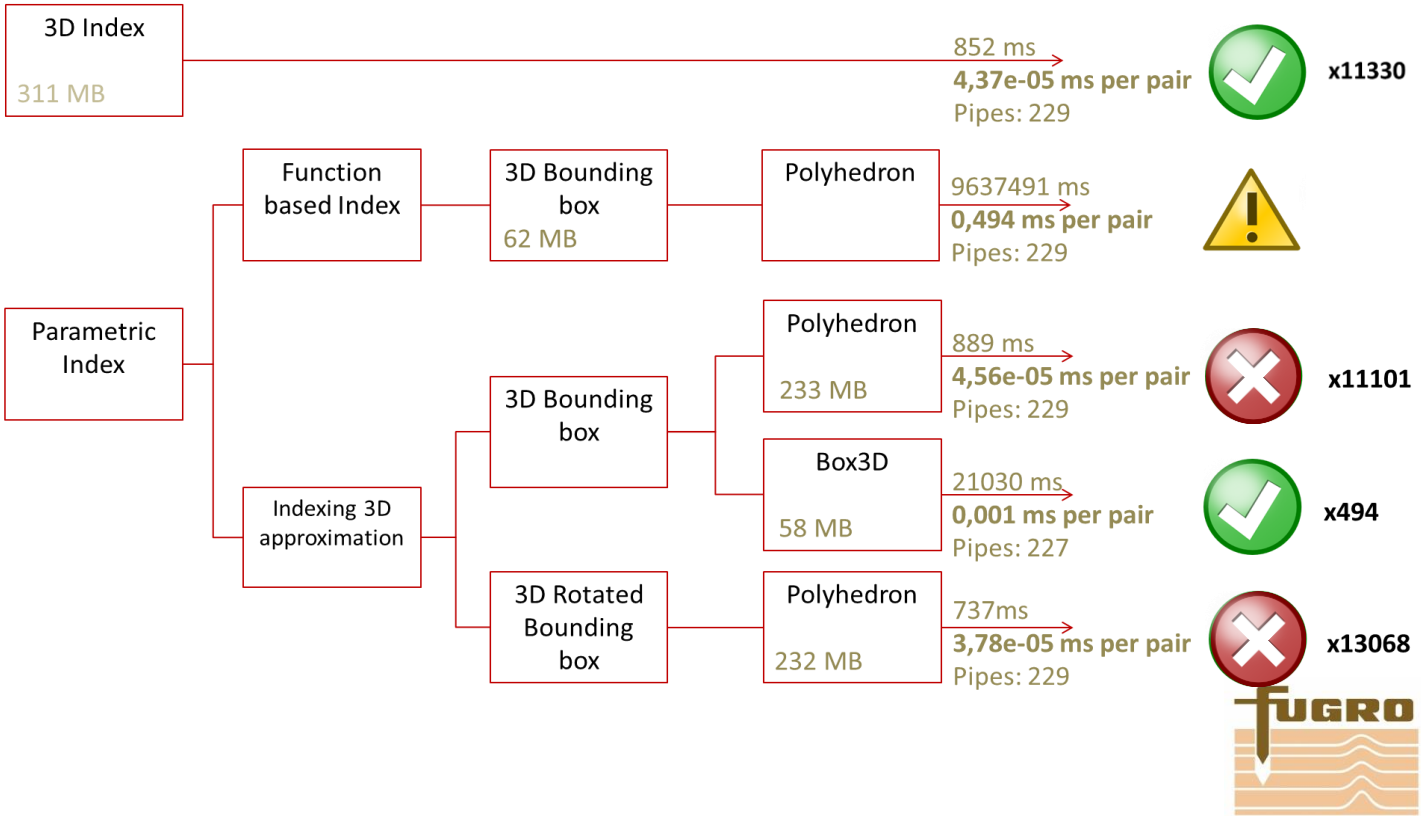
Intermezzo

- **Box3D** geometry: PostgreSQL data type



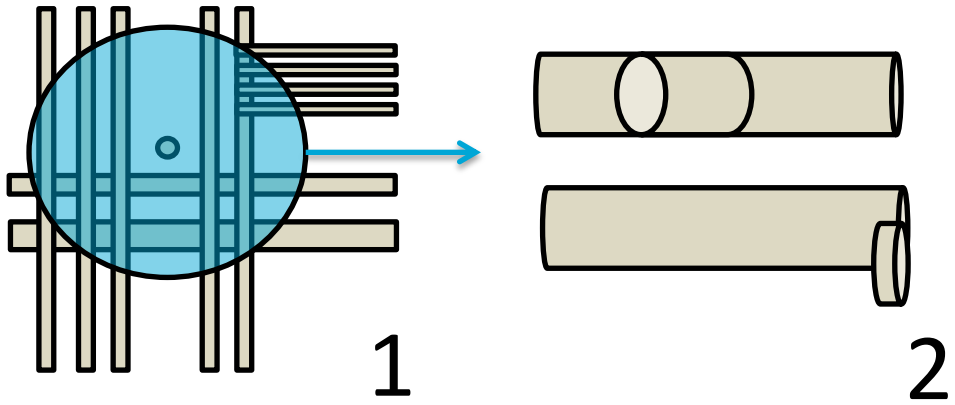
```
BOX3D(220227 150406 1045,220268 150415 1045)
```

3D Parametric versus 3D Non-Parametric



Scalability of the Data Set

- Performance Comparison



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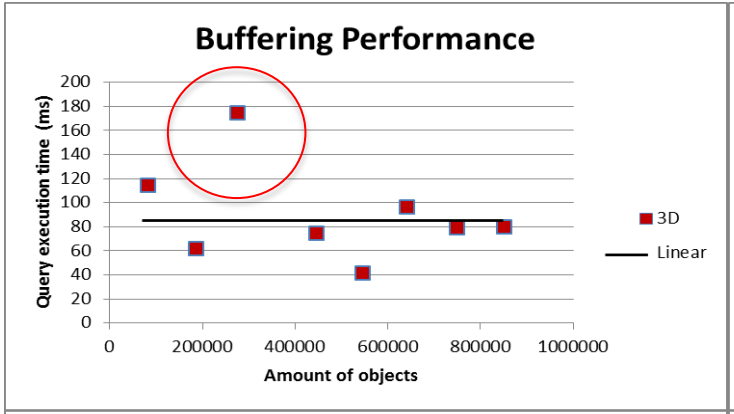
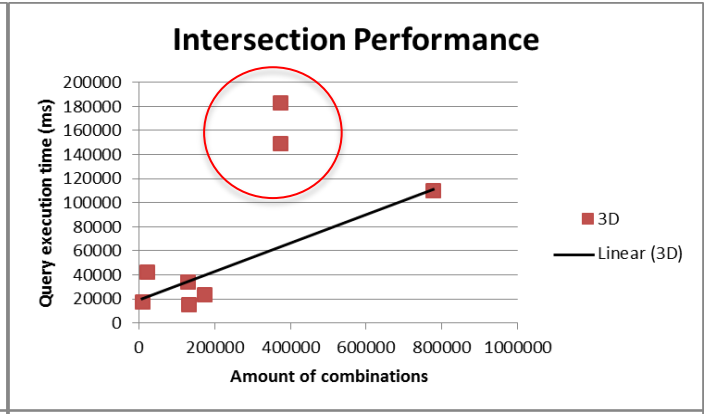
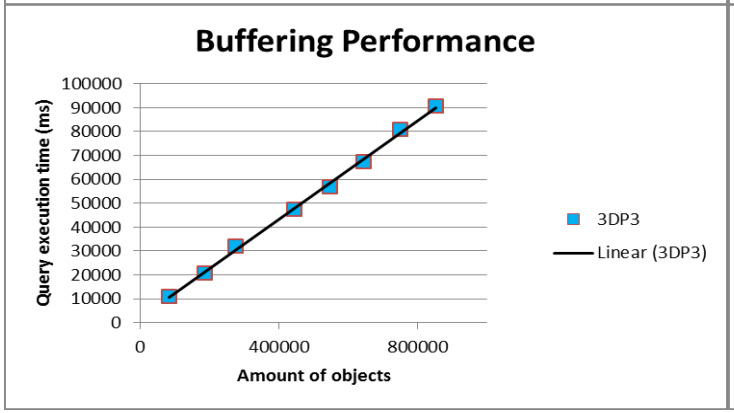
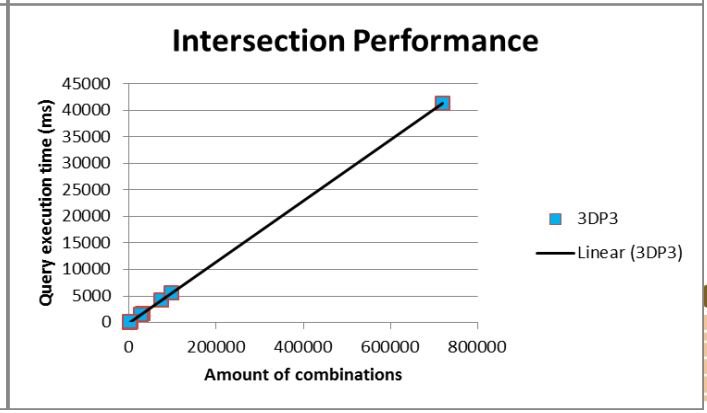
Scalability of the Data Set



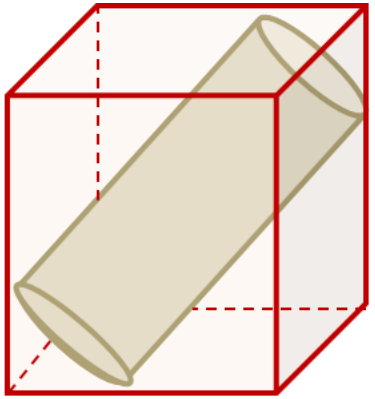


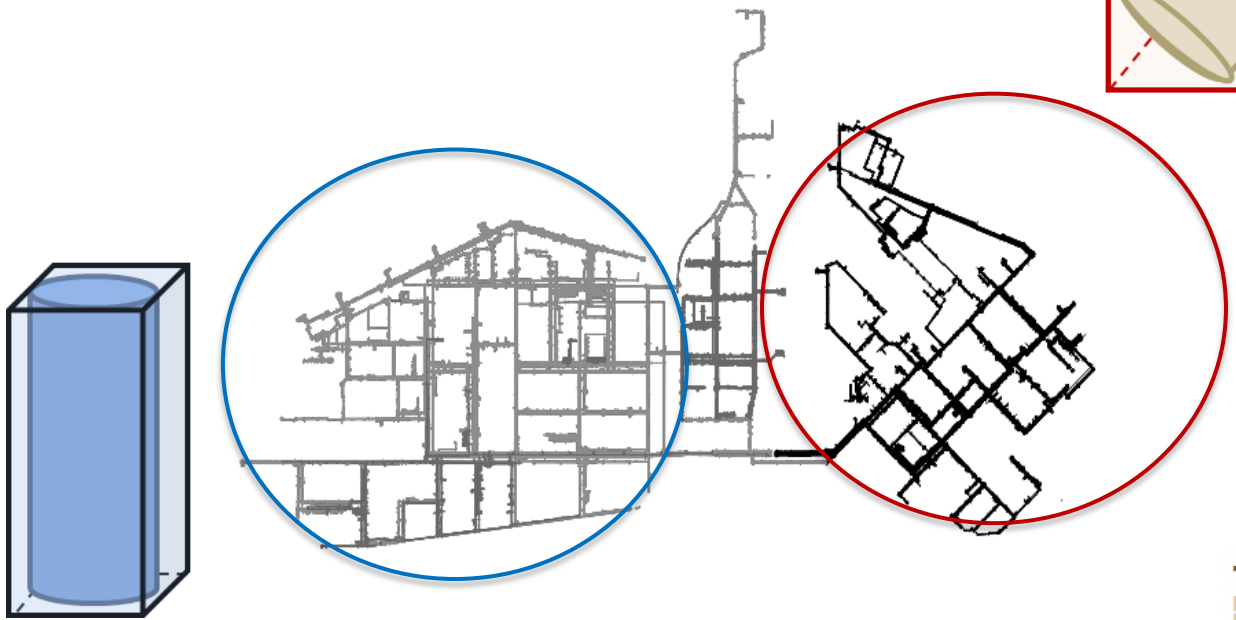




Scalability of the Data Set

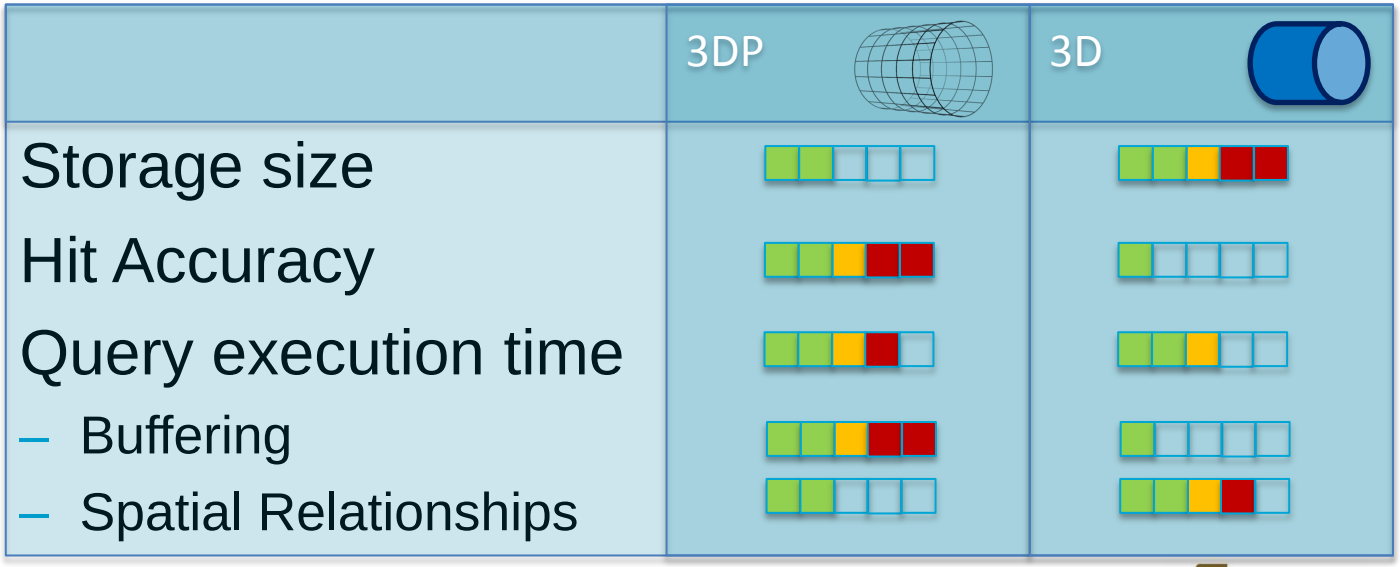
- Outlier explanation





Scalability of the Data Set

- Results:



Conclusion

How is it possible to store and visualize solid geometries in a spatial DBMS suitable for the petrochemical industry?

- X3D for visualization
- Storage:
  - 3D parametric DBMS
  - 3D non-parametric DBMS
    - Polyhedra

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Discussion

- 3D non-parametric:
  - Ready to implement
  - Good performance
  - Big storage is trade off
- 3D parametric:
  - Minimizes storage space, but:
    - Reconstruction function
    - 3D spatial relationship functions
    - Enable **Box3D** Indexing
    - Cast **Box3D** to Polyhedron

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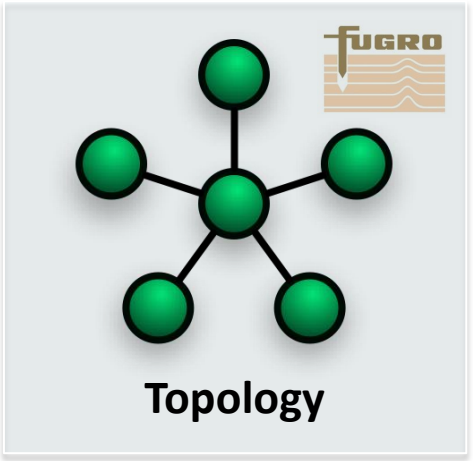
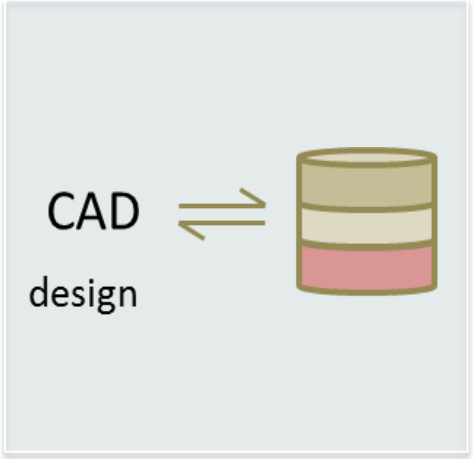
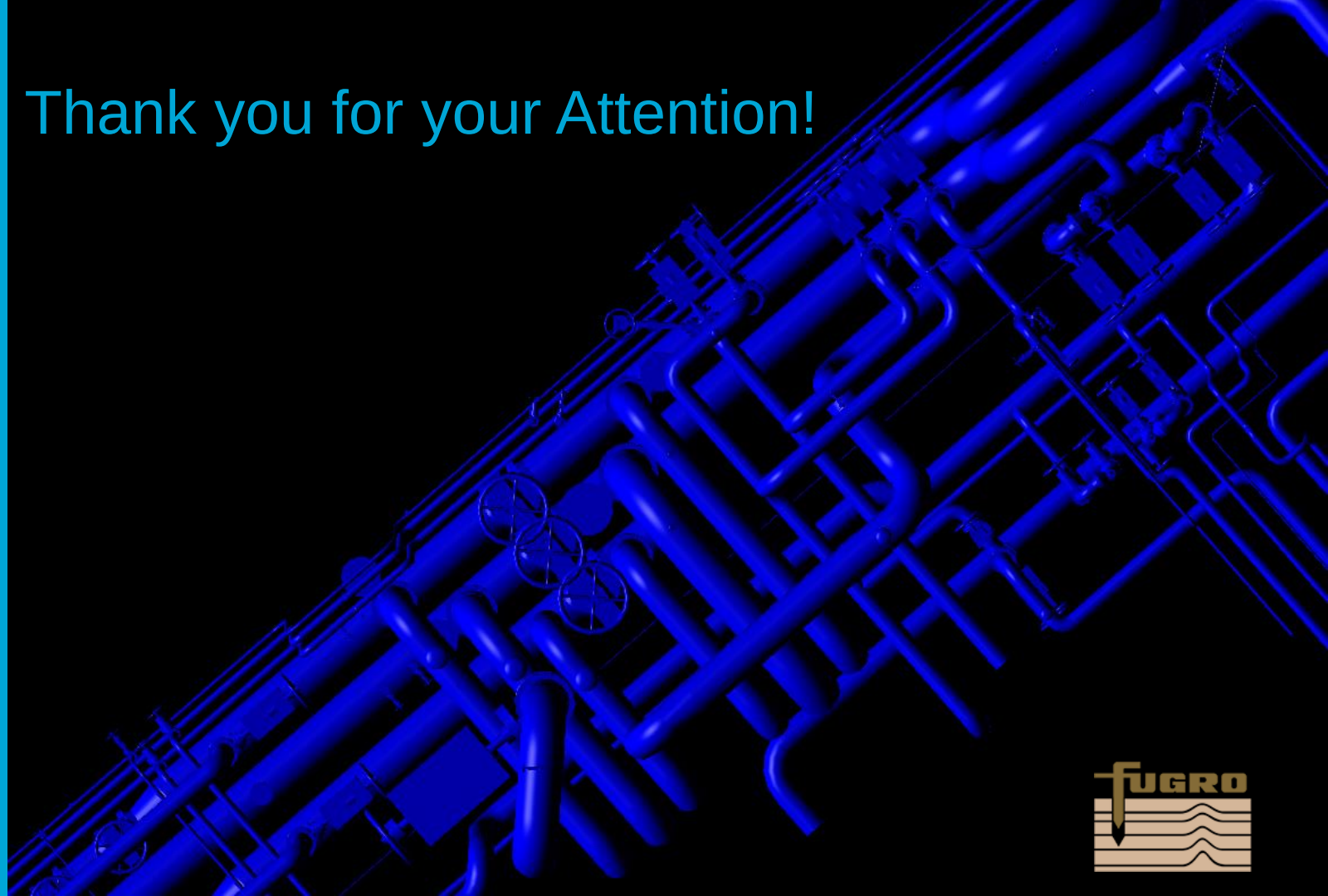
Future Work





Thank you for your Attention!



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