



# **Eurographics 2006**

*State-of-the-art in Real-time, Interactive*

*Massive Model Visualization*

**Putting Theory into Practice**

(Inigo Quilez, VRcontext)

**September 2006**

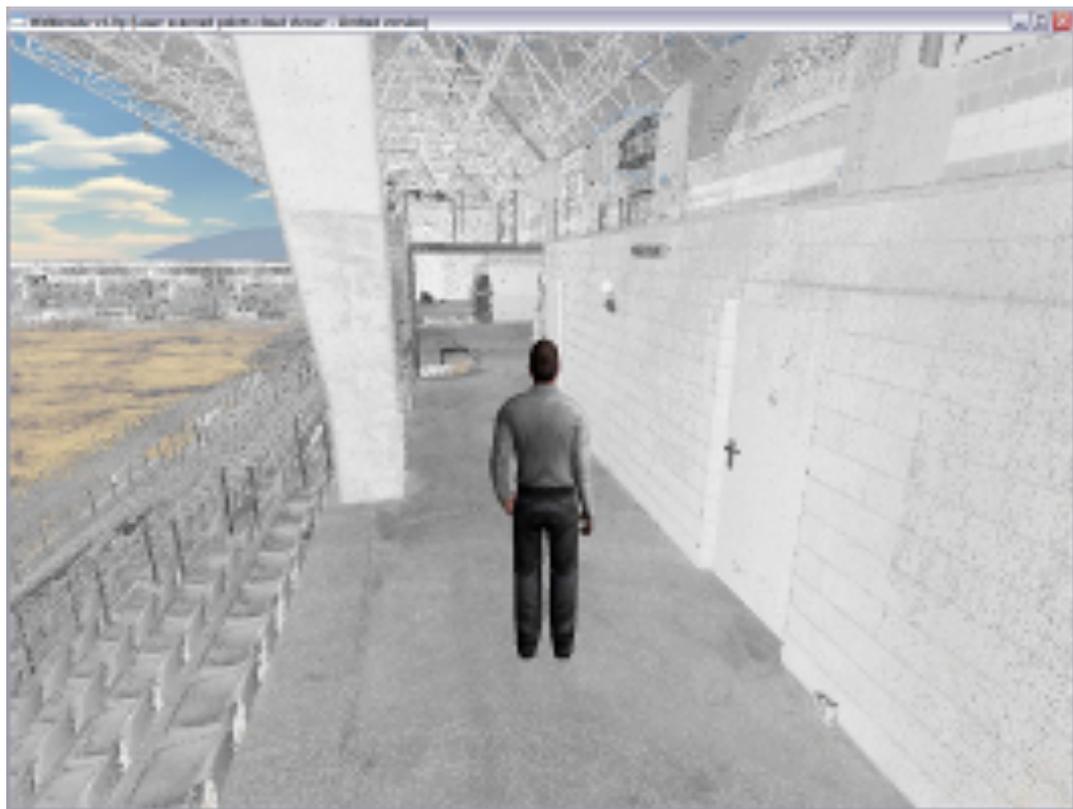
# Perspective



VR support, camera collision detection, real-time monitoring and controlling, database links, scene editing – scripting, fast model loading, moving object

# Lasser scanning - pointclouds

- About 100 billion points
- With collision detection



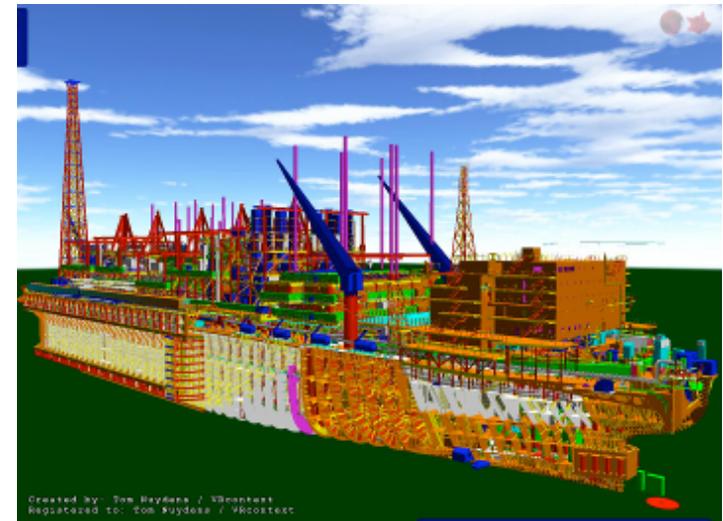
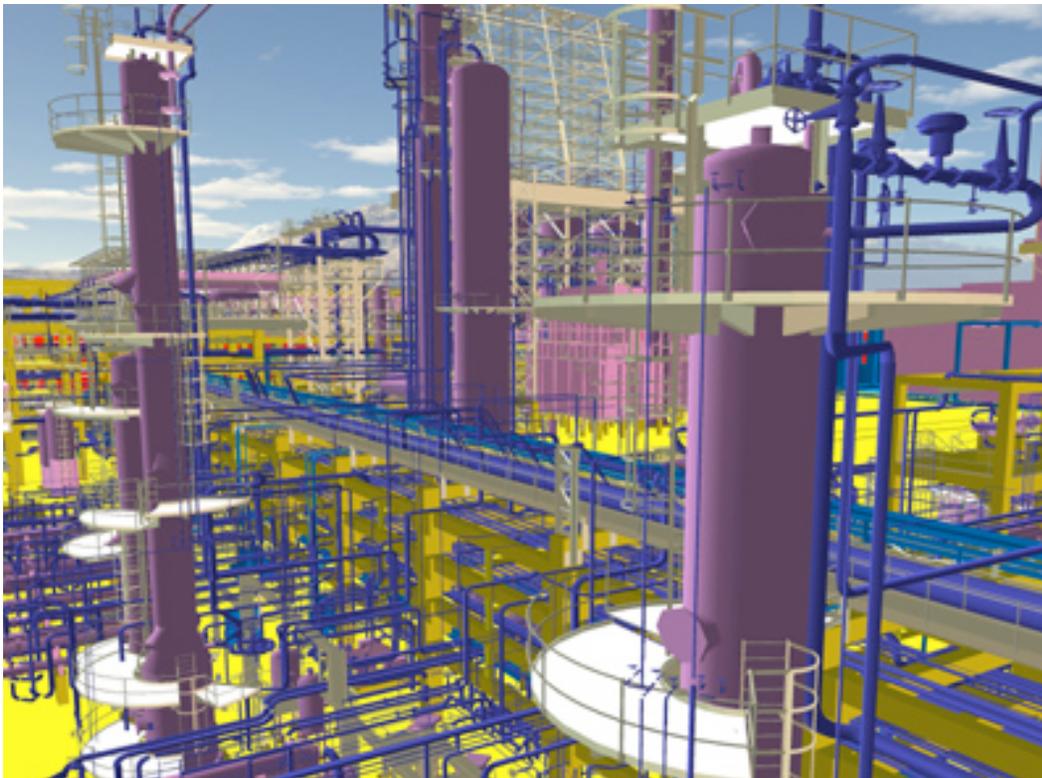
UEFA stadium, 2.5 billion points dataset – 200 scans





## CAD File

- An FPSO with more than 1 billion polygons
- A refinery with 4 million objects (>1 billion polygons)
- A nuclear reactor room with more than 1 million primitives



# Problems



- 1. Most real data is bad formed
- 2. About data set size  
gamming technology are unsuitable for massive models
- 3. About quality  
massive model rendering techniques are not design for quality
- 4. Other practical problems
- 5. Somehow incorrect assumptions on the research



# Problems

- 1. Most real data is bad formed
- 2. About data set size  
gamming technology are unsuitable for massive models
- 3. About quallity  
massive model rendering techniques are not design for quallity
- 4. Other practial problems
- 5. Incorrect assumptions on academic research

# 1. Most real data is bad formed



- CAD models:
  - T junctions
  - incorrectly oriented geometry
  - not orientable geometry
  - duplicated geometry
  - clashes
- Laser scanned point clouds
  - noise
- GIS
  - less than optimal triangulation

# Problems



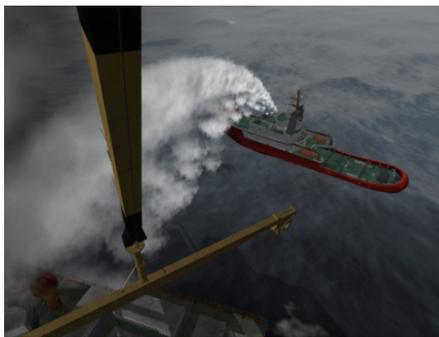
- 1. Most real data is bad formed
- 2. About data set size  
gamming technology are unsuitable for massive models
- 3. About quality  
massive model rendering techniques are not design for quality
- 4. Other practical problems
- 5. Somehow incorrect assumptions on the research

## 2. Data set size



- Game technology and most scientific visualization techniques cannot do
  - Shadows
  - Advanced (global) lighting

## 2. Data set size (demo)





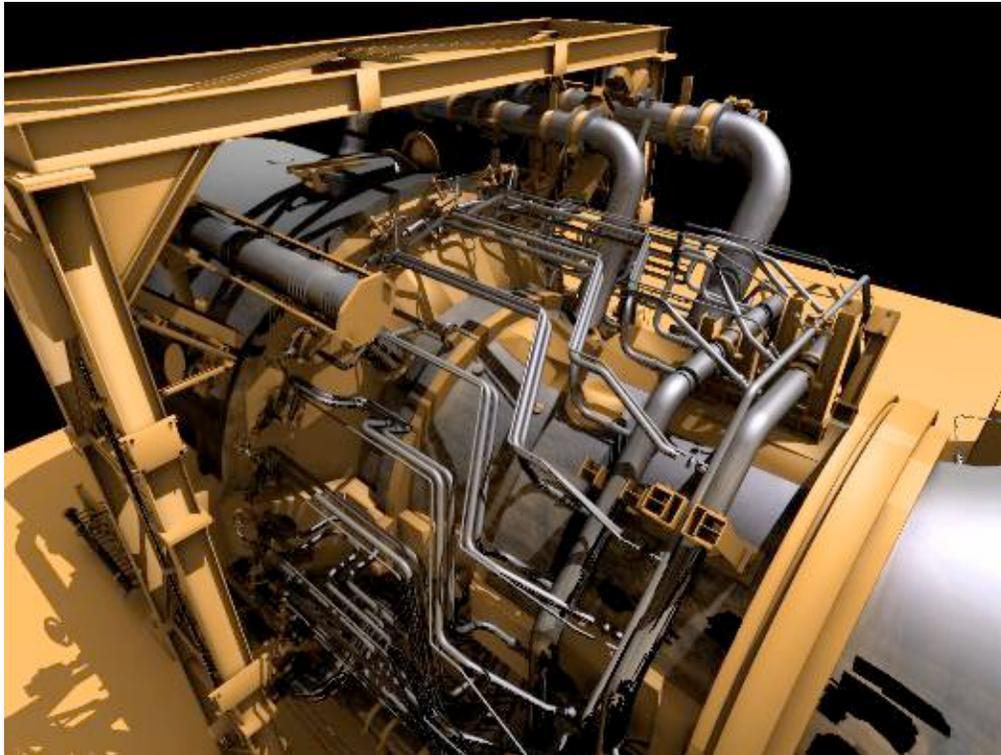
# Problems

- 1. Most real data is bad formed
- 2. About data set size  
gamming technology are unsuitable for massive models
- 3. About quality  
massive model rendering techniques are not design for quality
- 4. Other practical problems
- 5. Somehow incorrect assumptions on the research

### 3. Raytracing – the solution for quality...



- It scales well with polycount
- Shading effort is the minimum possible

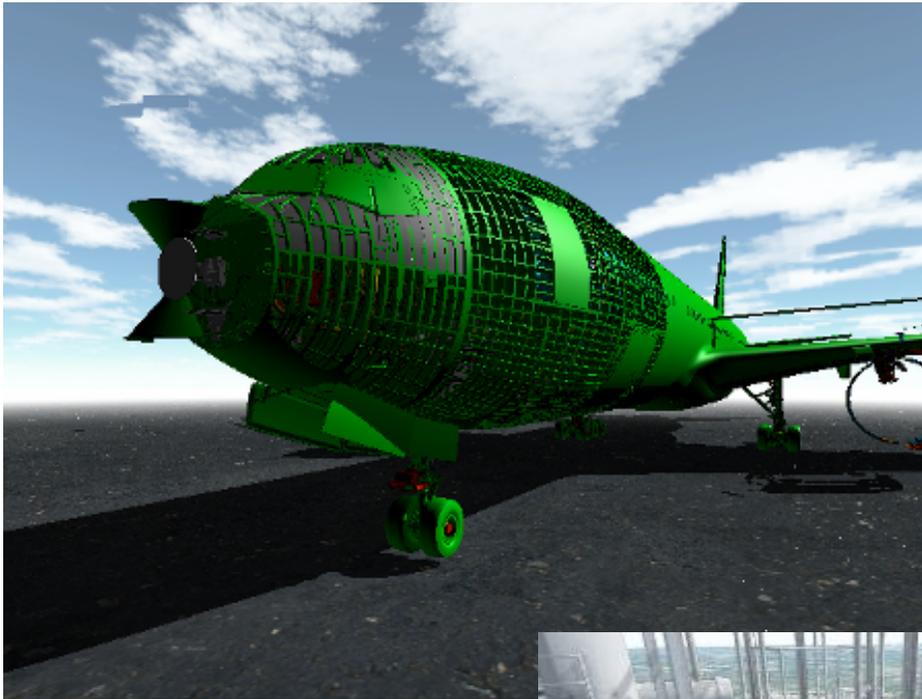


7 million polygons + AO



5 million polygons

**... with massive models. Or may be not?**



# Problems



- 1. Most real data is bad formed
- 2. About data set size  
gamming technology are unsuitable for massive models
- 3. About quality  
massive model rendering techniques are not design for quality
- 4. [Other practical problems](#)
- 5. Somehow incorrect assumptions on the research



## 4. Other problems

- SDKs
  - how to hide our implementation, and still keep maximum performance
- Moving objects
  - the evil of most algorithms
- Document/export management
  - delta exporting, incremental precomputations affects data structures
- File formats
  - too many standards means no standard
- Virtual Reality setup
- Marketing, the money

# Problems



- 1. Most real data is bad formed
- 2. About data set size  
gamming technology are unsuitable for massive models
- 3. About quality  
massive model rendering techniques are not design for quality
- 4. Other practical problems
- 5. Somehow incorrect assumptions on the research

## 5. Incorrect assumptions

- Frame to frame coherence
- Out of core?
- Medium density model





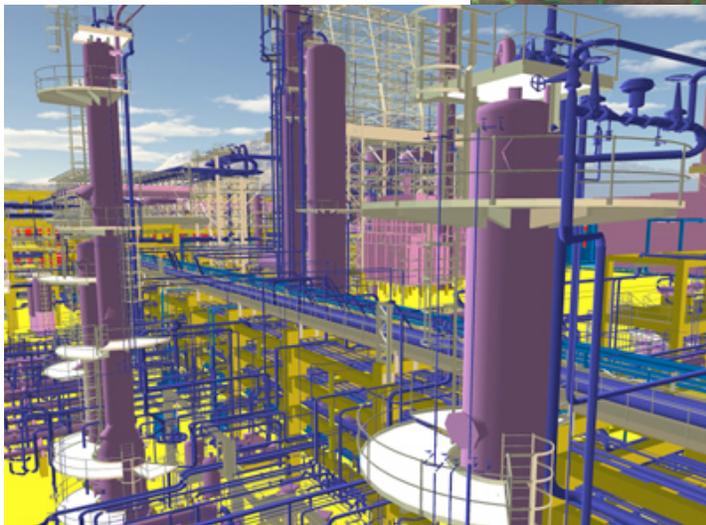
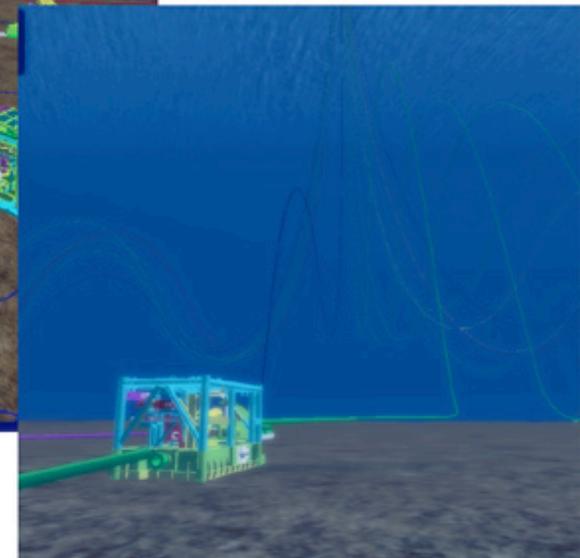
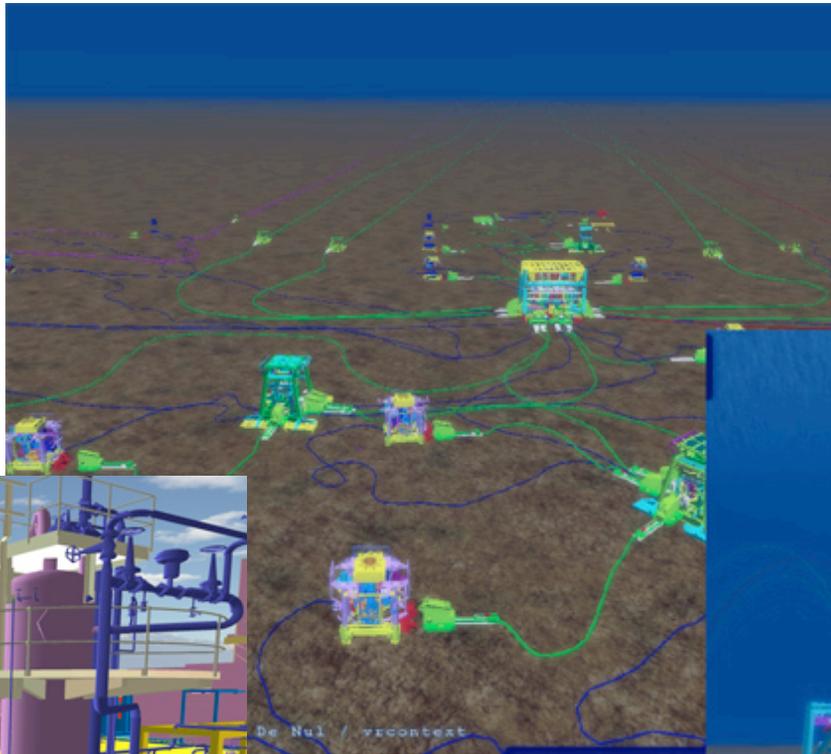
## 5. Density of the models

- High Density
  - $D > 10k \text{ t/m}^3$
  - $DR \sim 1:10^3$
- Medium Density
  - $D \sim 100-1k \text{ t/m}^3$
  - $DR \sim 1:10^5$
- Low Density
  - $D < 1\text{tri/m}^3$
  - $DR > 1:10^6$



A typical medium density model (600 million polygons)

# Low Density models



2 million objects in 5 square kilometers. Uniform density.

A low density model: 1 billion polygons in 40 square kilometers.  
Non uniform density.



## Conclusion

- Many models, not possible to tune for just one type
- Fast research often means simple solutions
- It's not clear what's the best technology, so the product has as much software engineering as pure visualization work.
- Still need to work on low density models and high quality shading.