Seminários de Computação Gráfica
IMPA 2011
Rio de Janeiro, Brasil

Visualizando partículas cósmicas em um domo imersivo com a Blender Game Engine

Dalai Felinto – Rio de Janeiro, Brasil

UBC – University of British Columbia

Blender Conference 2010
Amsterdam, Netherlands

Experience the Universe
Cosmic Sensation

Dalai Felinto – Rio de Janeiro, Brazil

Mike Pan – Vancouver, Canada

Martins Upitis – Riga, Latvia

Cosmic Particles Detectors

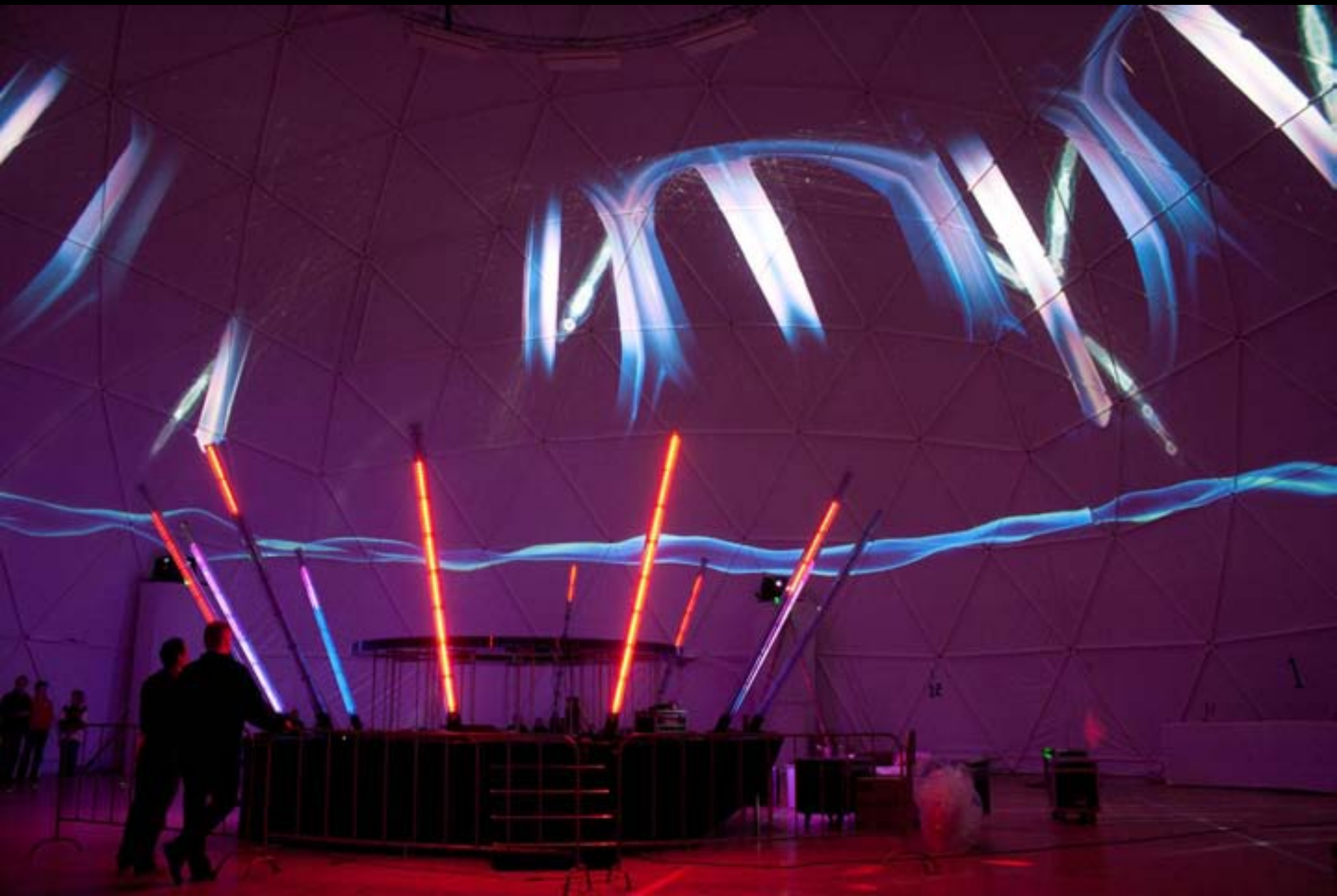
+

30 meters Immersive Dome

+

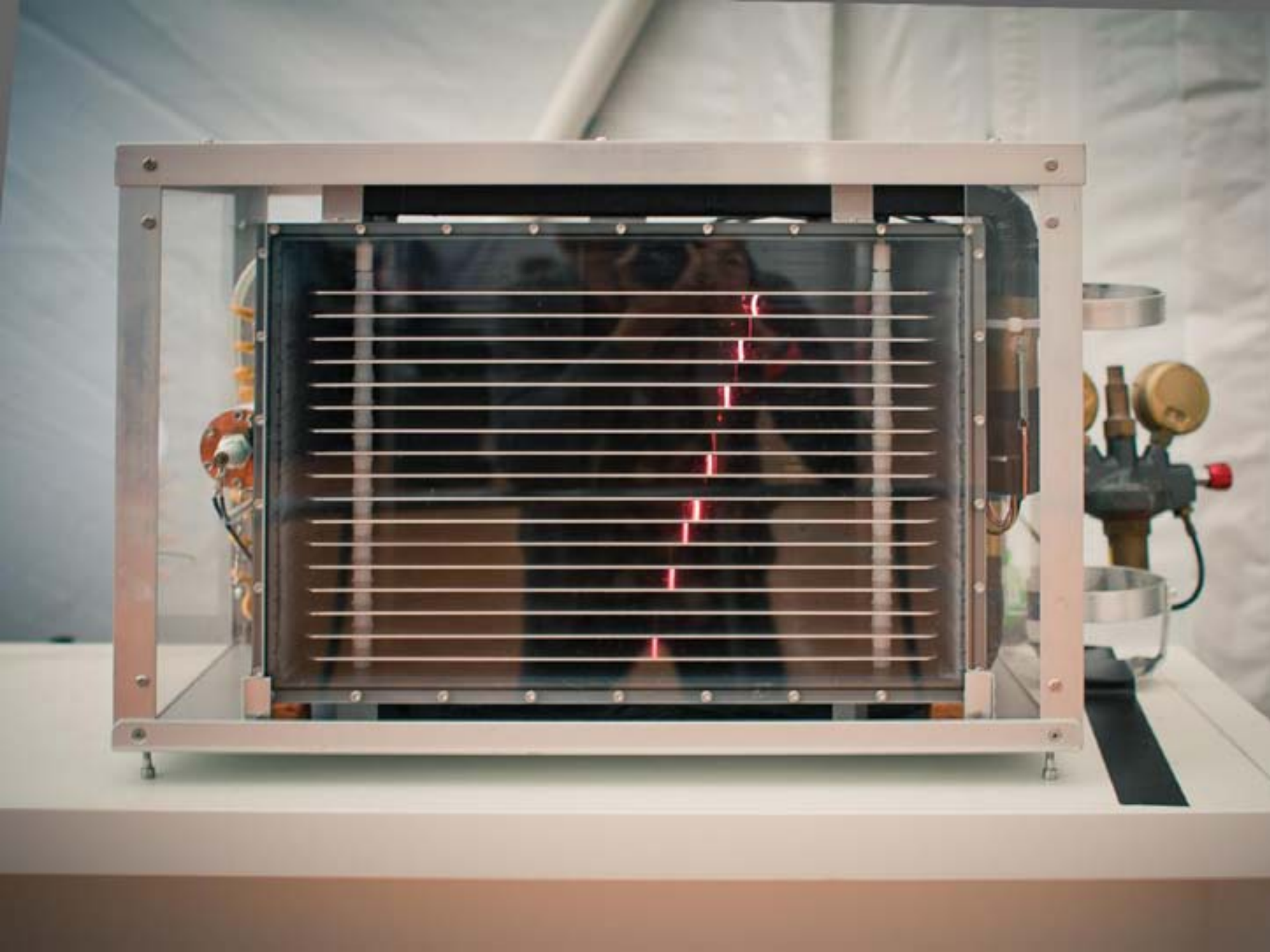
Blender Game Engine

Cosmic Sensation



Science

- Radboud University Nijmegen
- Prof. Sijbrand de Jong
- Muons
- Barney Broomer
- Academic Yearprize
- Experiment



Why ?

- "Science to the masses"
  - bringing to daily life events you wouldn't experience otherwise
- Exploring new mediums
  - realtime + fulldome

Communication

What ?

- 3 days of Silent Disco
- generated music + DJ
- generated effect light
- generated visuals

What ?

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- generated music + DJ
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3 days of Silent Disco

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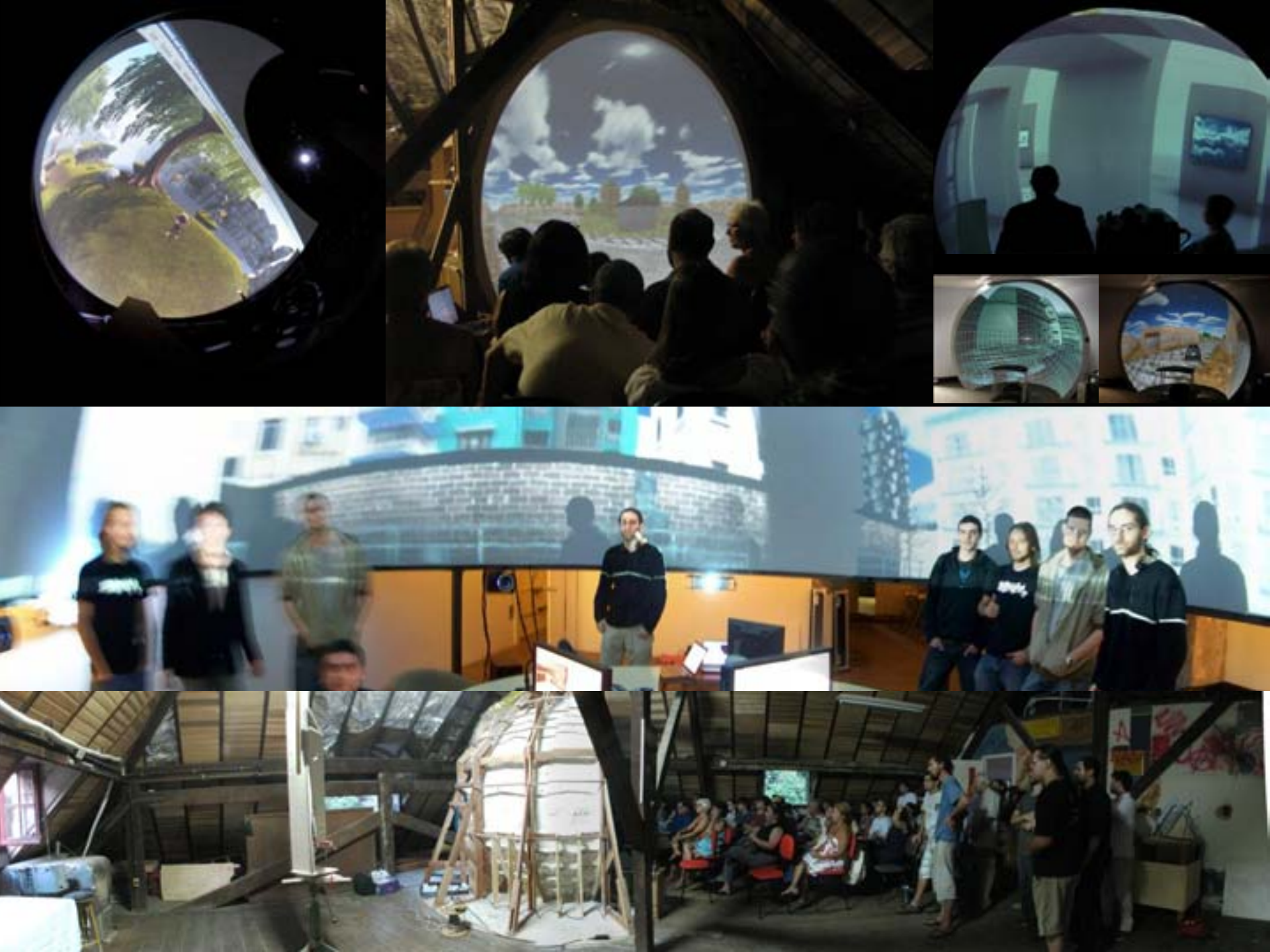
generated visuals

Immersive dome

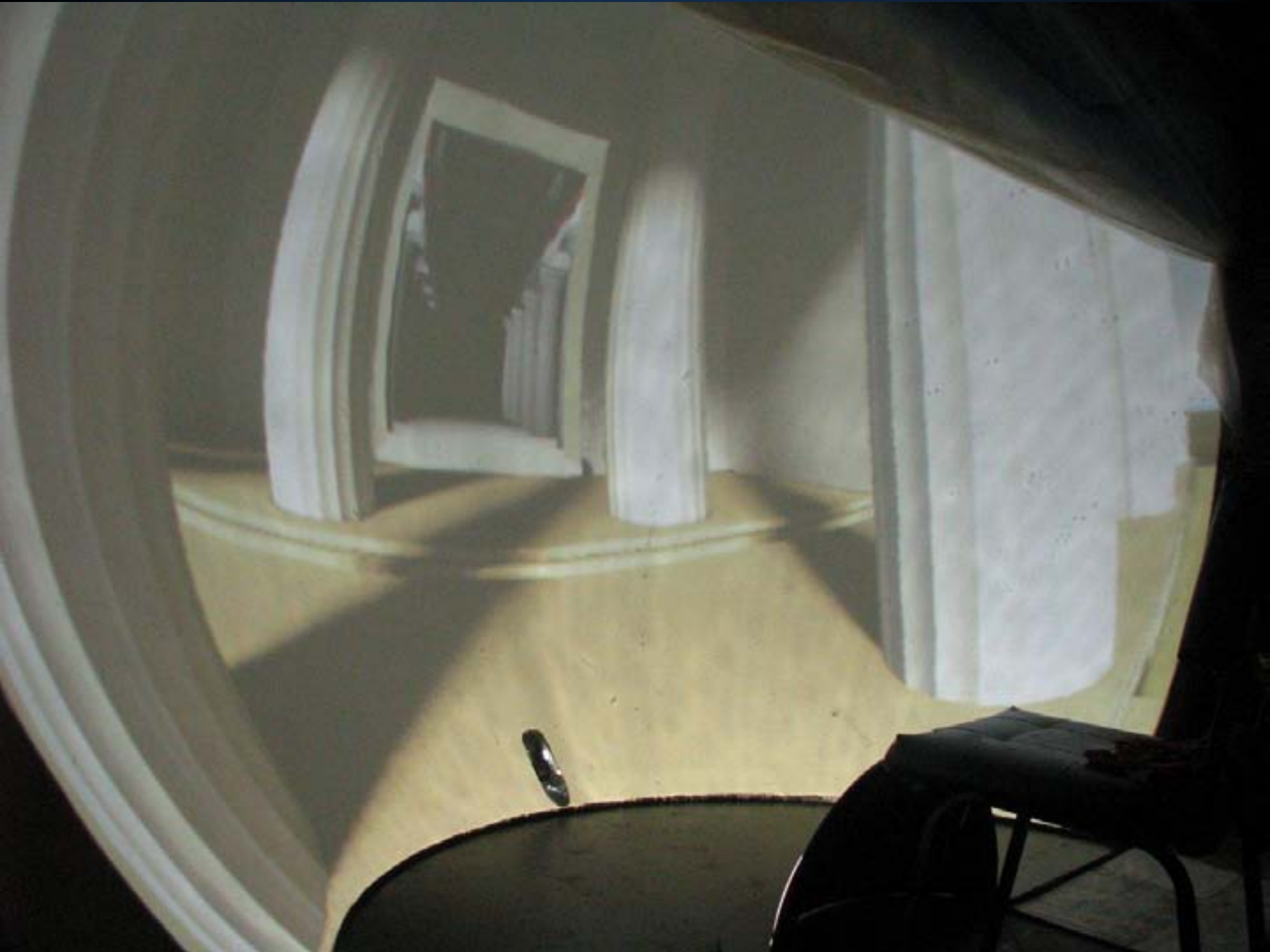


Immersive dome

- Seamless field of view, 3D surface
- Domes are cool
- Unexplored medium

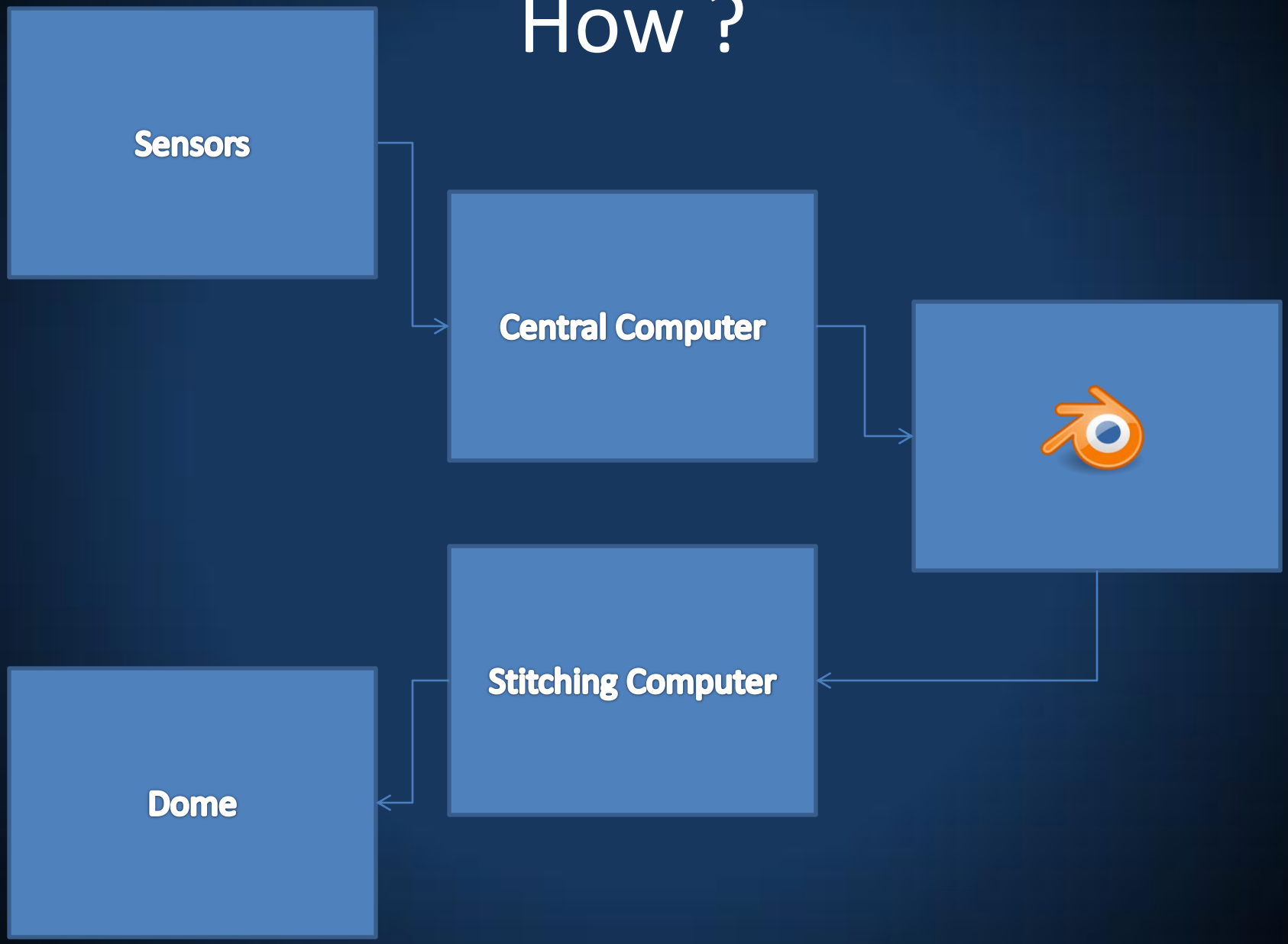
Blender Game Engine

- Realtime
- Open Source
- 3D Game Engine
- Dome compatibility



How ?

How ?



Development Process

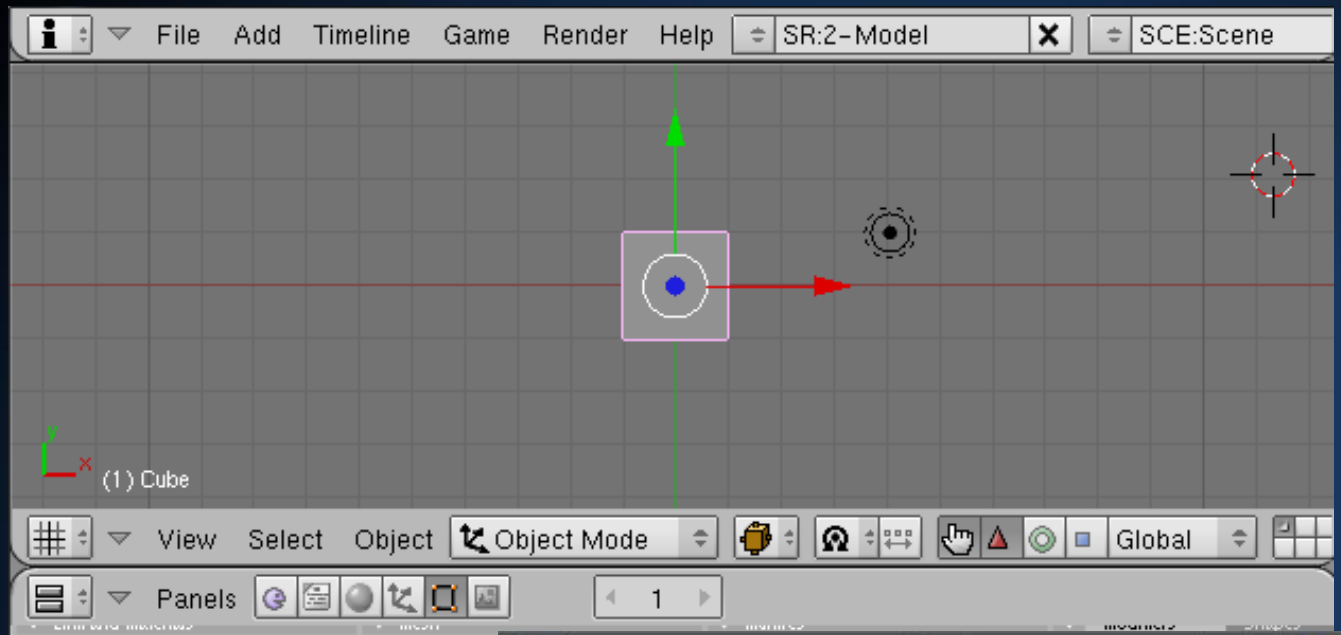
- “1 year project”
- Dome creation framework
- Art contest
- Blender 2.50

“It’s not what Blender can do for you, but what you can do for Blender.”

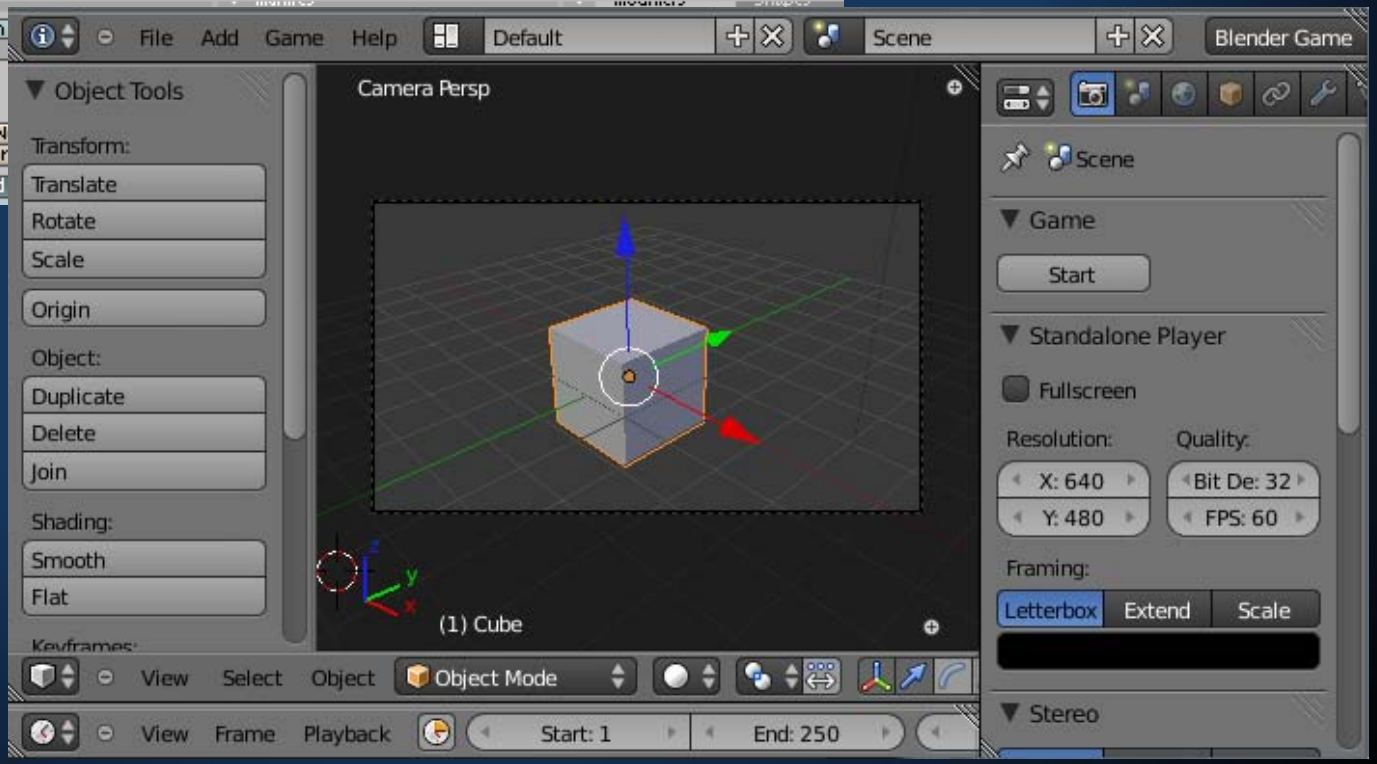
One year ago we had:

- blenderplayer not building and not working
- no proper interface for the BGE
- Bugs, bugs, bugs

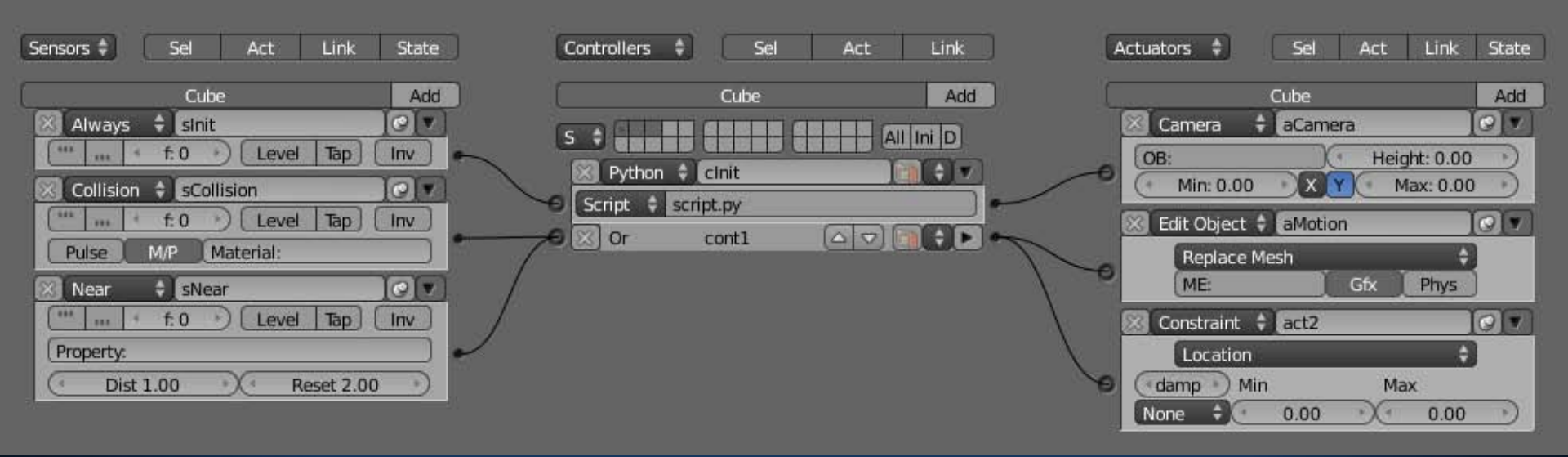
BGE was not ready yet (stable/reliable)



Blender 2.49

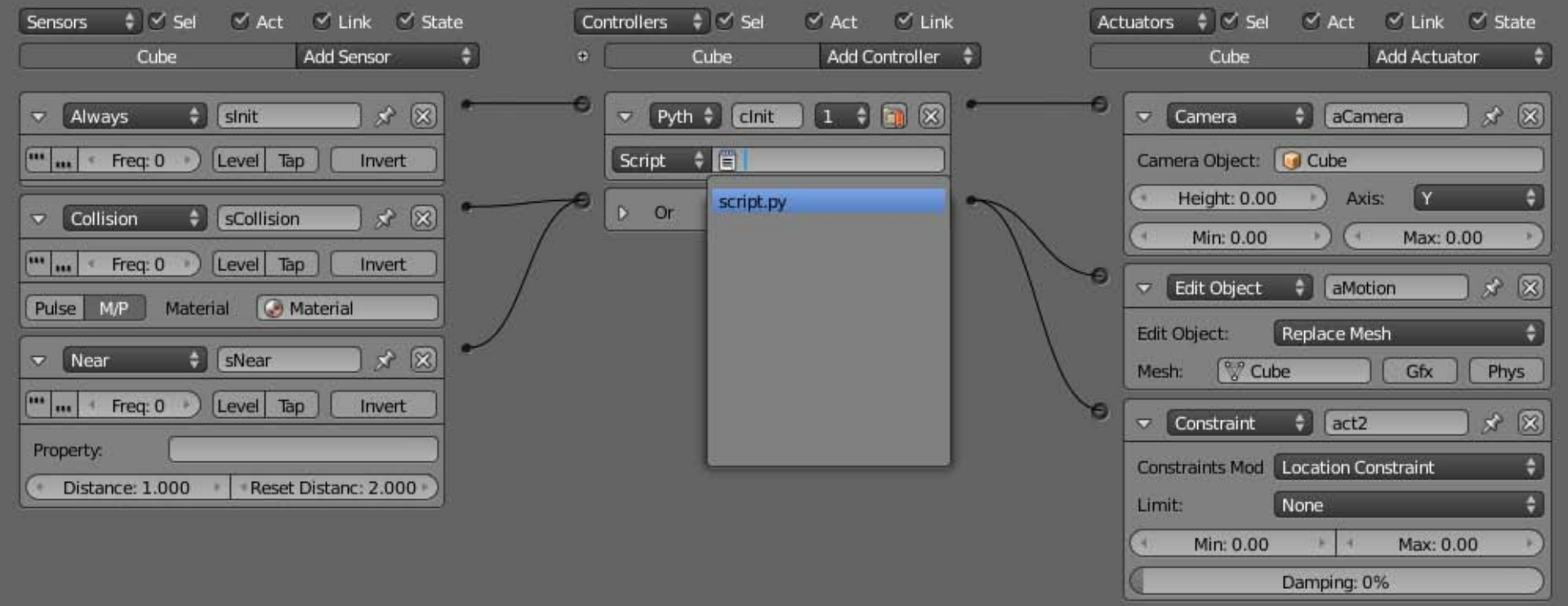


Blender 2.56beta



Blender 2.50alpha →

← Blender 2.55beta



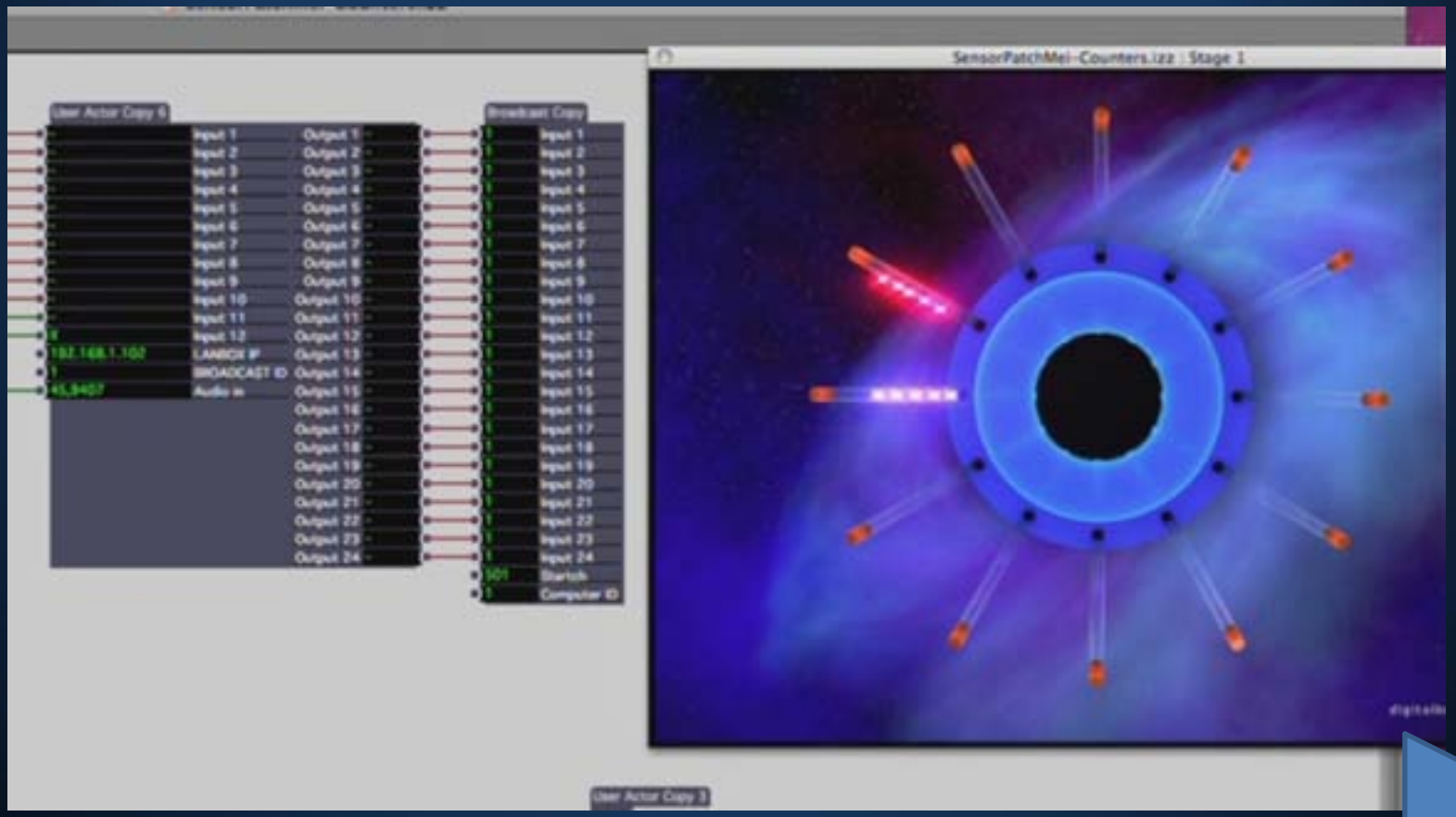
one year before the event

. . . tests, tests and more tests . . .

- Stitching tests
- OSC tests
- Performance tests
- Output tests
- Blender/BGE tests
- Content brainstorms

one year before the event

. . . tests, tests and more tests . . .

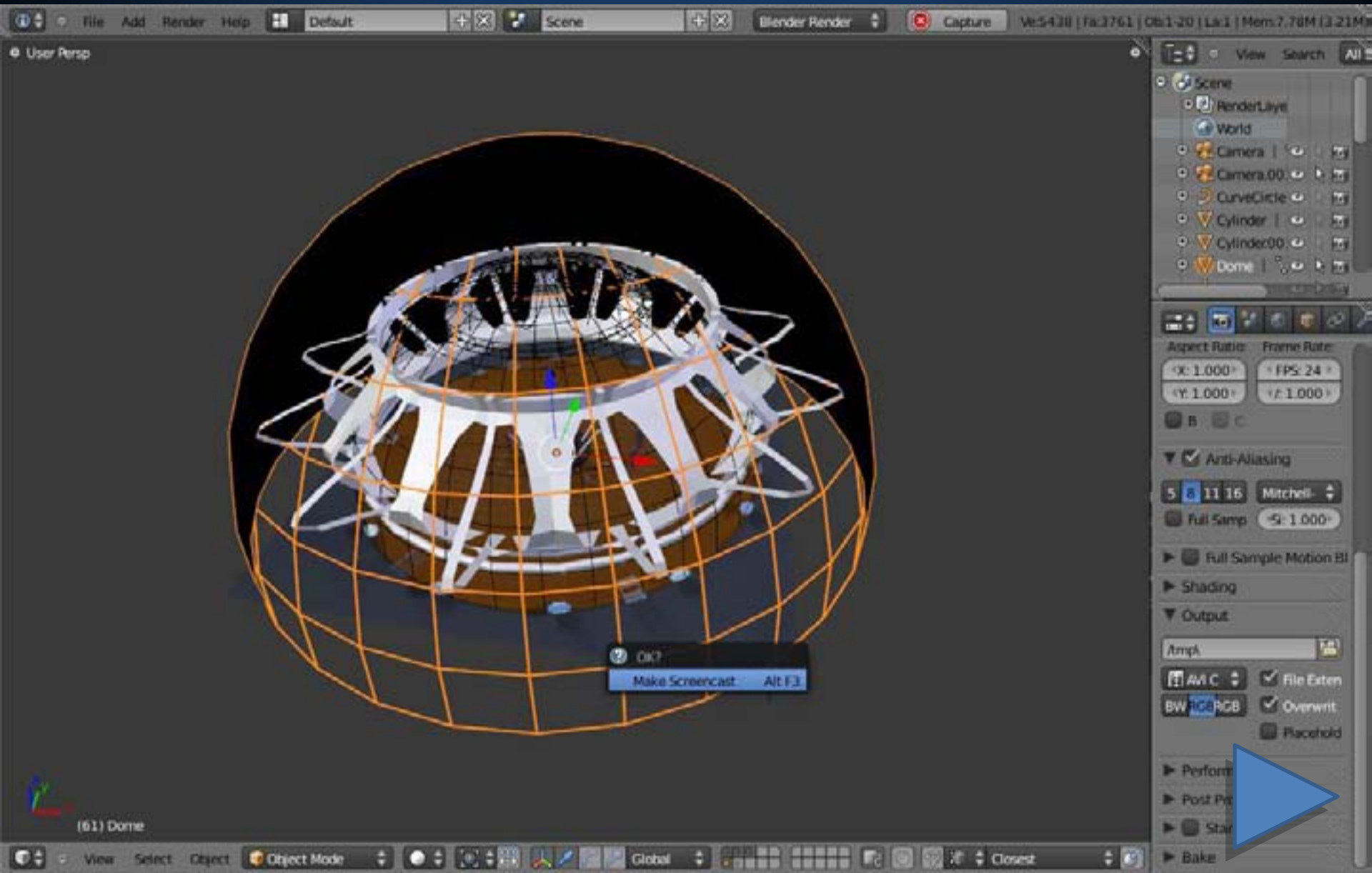


two months before the event

two months before the event

- no more art contest
- finalized a few concepts for the visuals

two months before the event



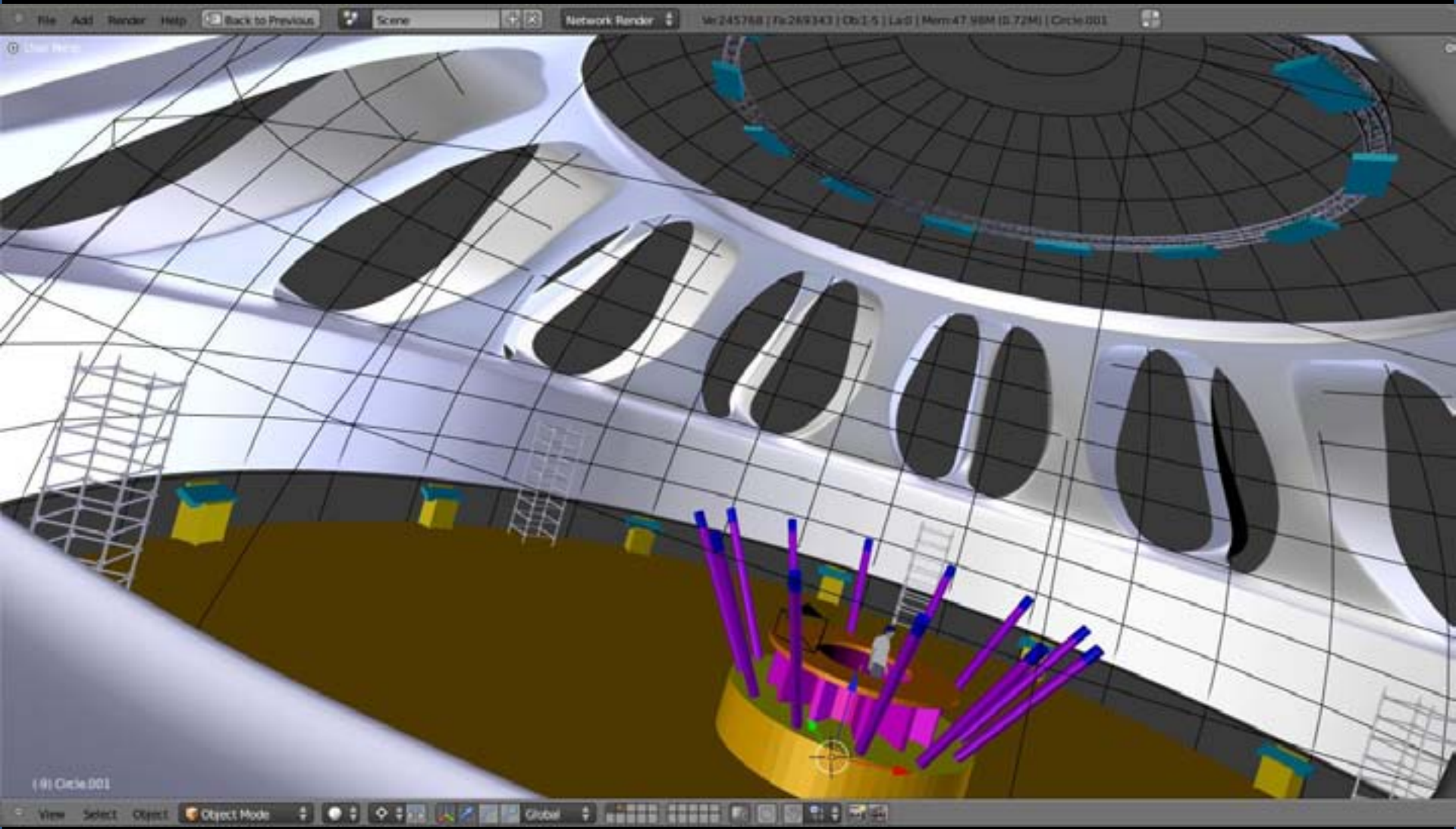
one month before the event

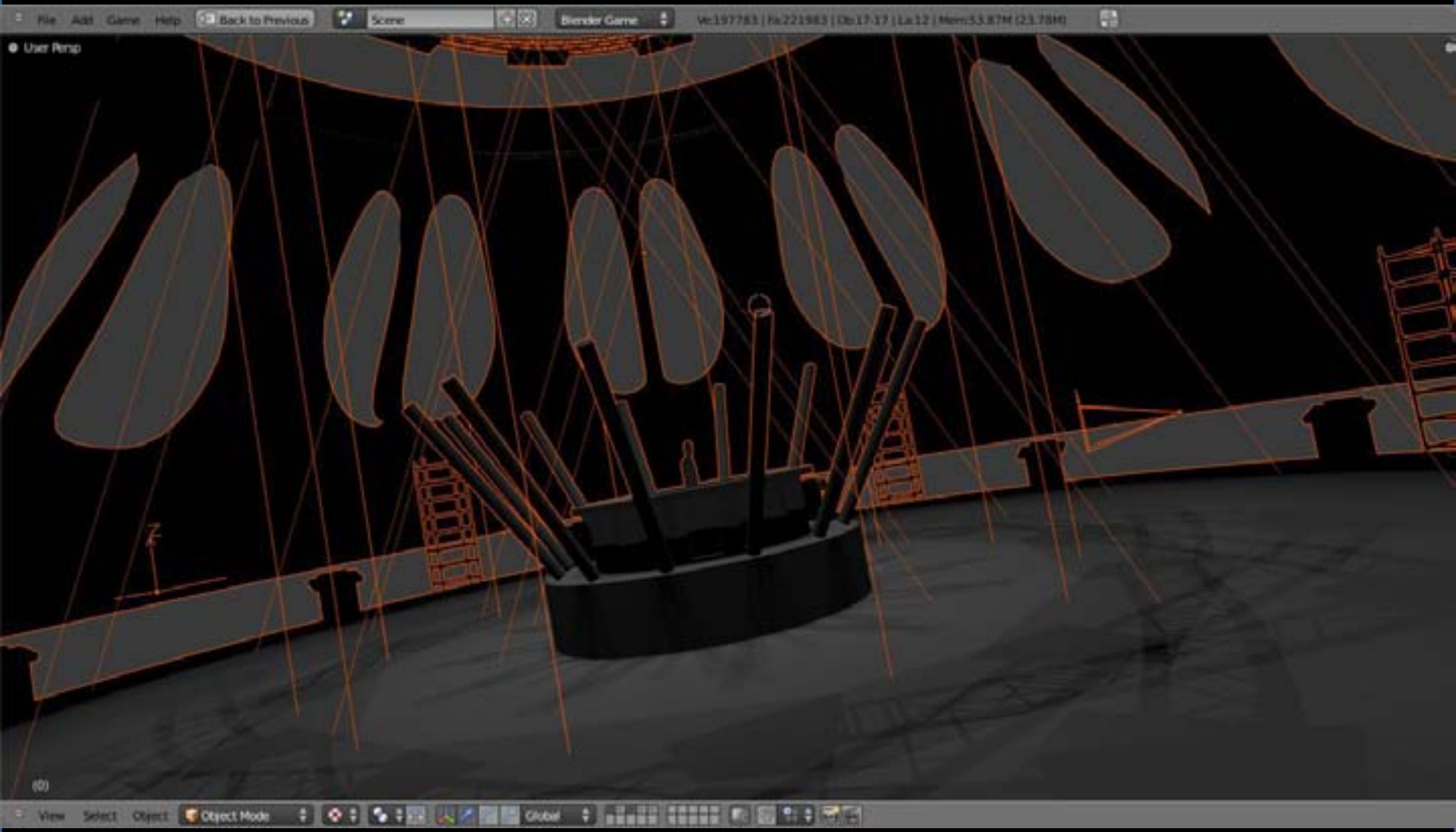
“No man is an island.”

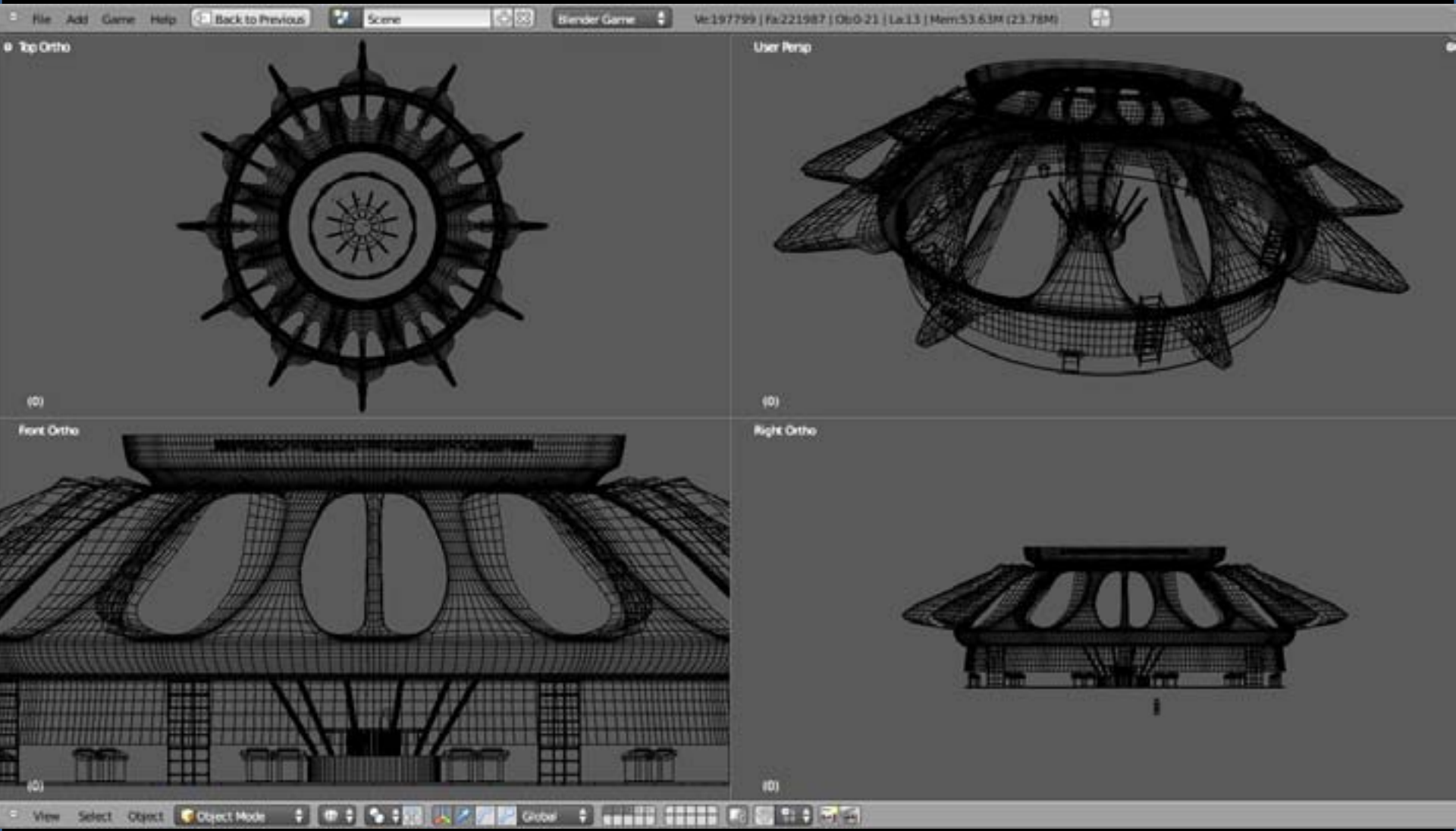
John Donne

“Less is more.”

Mies van der Rohe


File Add Render Help Back to Previous Scene Network Render
(0) Circle.001
View Select Object Object Mode Global


File Add Game Help Back to Previous Scene Blender Game
User Persp
(0)
View Select Object Object Mode Global


File Add Game Help
Back to Previous
Scene
Blender Game
Ve:197799 | Fa:221987 | Ob:0-21 | La:13 | Mem:53.63M (23.78M)
Top Ortho
User Persp
Front Ortho
Right Ortho
View Select Object
Object Mode
Global

ten days before the event

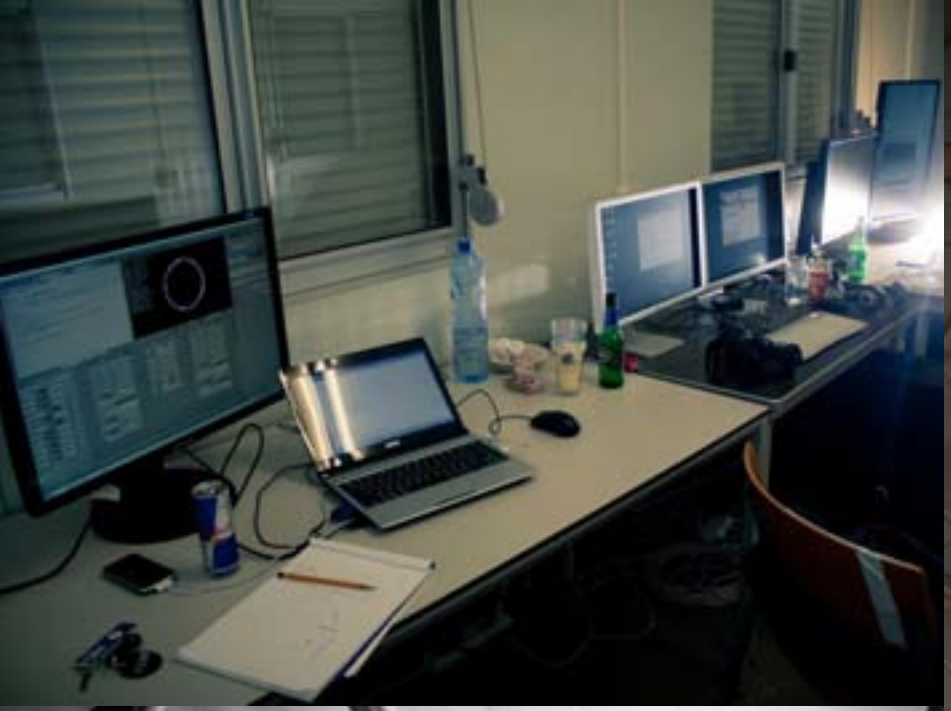
- entire team flew to Holland to collaborate on site.

- **artwork:** creation, production

- **coding:** optimization for this particular setup + small patches

4
Ankunft 13 : 30
Abfahrt 13 : 31
RE 1 10120
Aachen
Horrem · Düren
H

Johannes Gietl · Johannes Meng · Johannes Nebauer · Johannes Schwarz
John Meyer · John Nyquist · John Robbins · John Stephenson · John Urquhart Ferguson
Jonathan Duez · Jon Stace · Jon Tejnung · Jonas Elmer · Jonathan Asquier
Jonathan Sully · Jonathan Ferguson · Jonathan Gasnier · Jonathan Love
Jörg Müller · Jonathan Teixeira · Jonathan Thomas · Joost Horward
Jorge Reinhard · Jorge Bernal Martínez · Jorge Bertholdo
José Cruz · José David Sánchez Pagá · José Gómez Martínez · Jose Gregorio
Josh Faulkner · Joshua Matthews · Joshua Smith · Josef Bandl · Josef Sieß · Joseph Eagar
Julian Ceipek · Julian Wingert · Julien Dambron · Josselin Costanzi · Jozef Uhl'ár
Julio Garay · Julio Iglesias · Julis Tuomisto · Julien Duroure · Julien Garcia
Karl Wagner · Karthik Subramaniam · Kasper Holst · Kay Garbrecht
Keith Pearson · Keith Tobin · Kelly Rowe · Ken Hughes · Ken Hursh · Ken Loge
Kevin Werner · Kiernan Holland · Kip Gir · Kjell Magne Fauske · Kode Rosenb
Lance Flavell · Lari Mikala · Lars Brubaker · Lars Koenzen
Laurent Baysse · Laurent Bibard · Laurent Davene · Laurent Marches
Leonardo Della Pietra · Leonardo Jones · Lesa Shole Wright
Lionel Chauvin · Ljubenir Bozic · Lluc Romani · Logan M
Luc Chambaud · Luca Bottari · Luca Cugia · Luca
Lucas Vella · Luio Toscolo Mezzopan · Ludovic G
Luke Ferrell · Luke Longbloed · Luke Titley · Luya Tshimbalang
Magnus Proebster · Magnus Wesan · Maik Ludwig · Mal D
Manuel Armando Sánchez Rocha · Manuel Grau · Manuel Hossfeld
Marcel Büchler · Marcel Jäger · Márcia Fredianelli
Marco Alice · Marco Amato · Marco Antonio Real Adame · Marco Bosc
Marco Moser · Marco Rostani · Marcos Bitetti
Marek Schmidt · Mariano Velasco



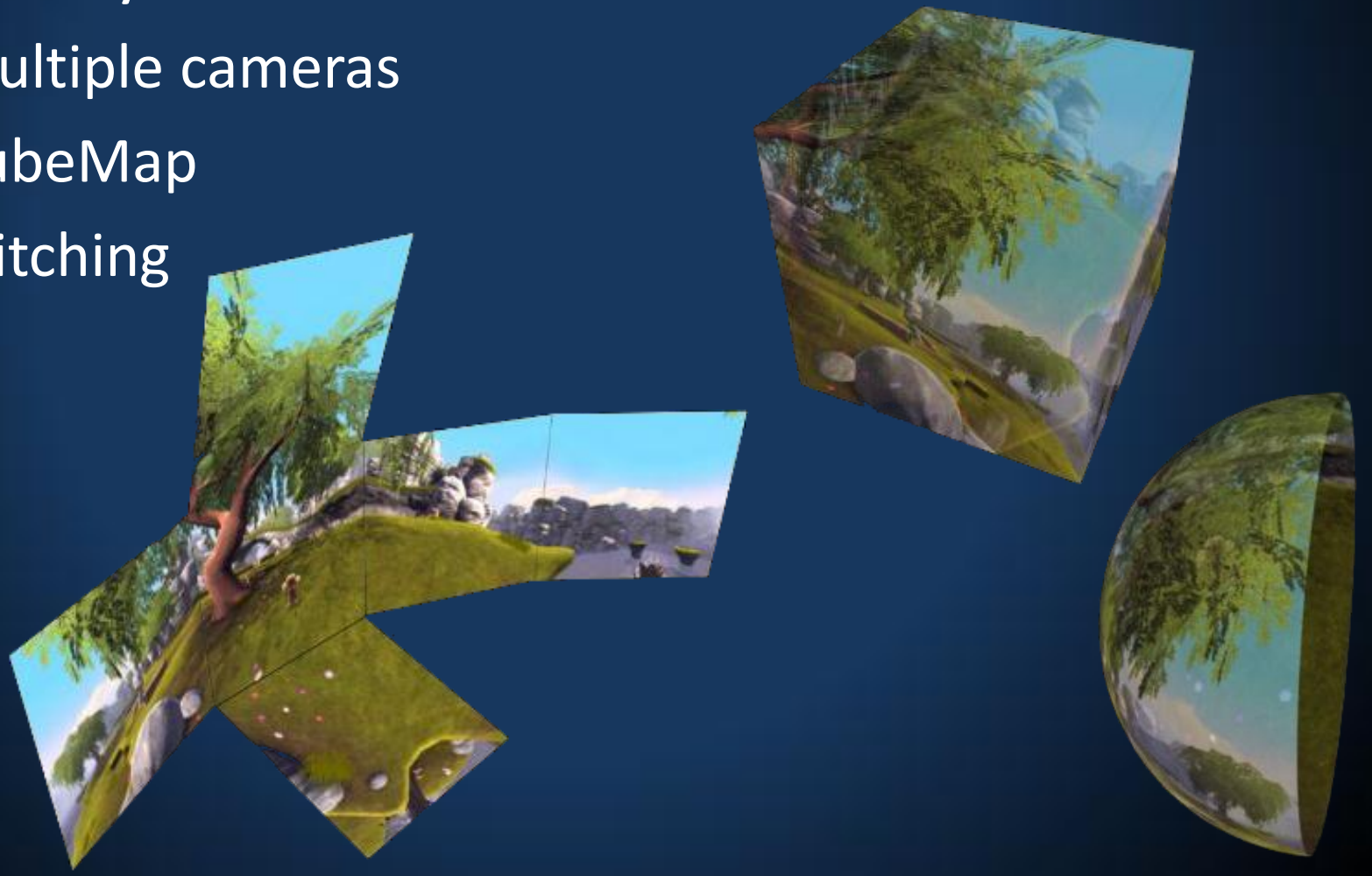
wings

the event

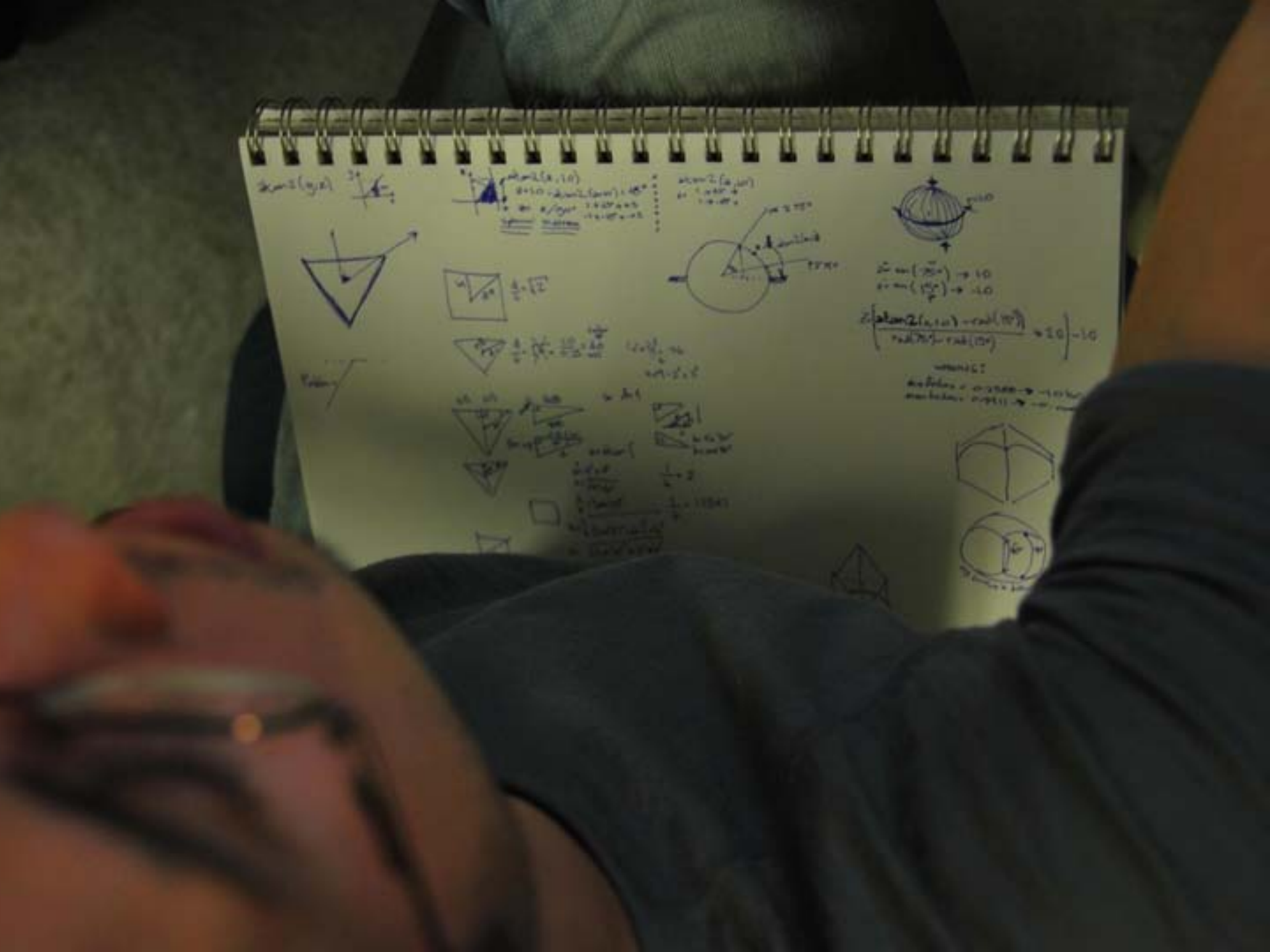
Part II: Code

"Previously at Blender Conference ..."

- Multiple cameras
- CubeMap
- Stitching



Challenge: 4K x 1K @ 60fps



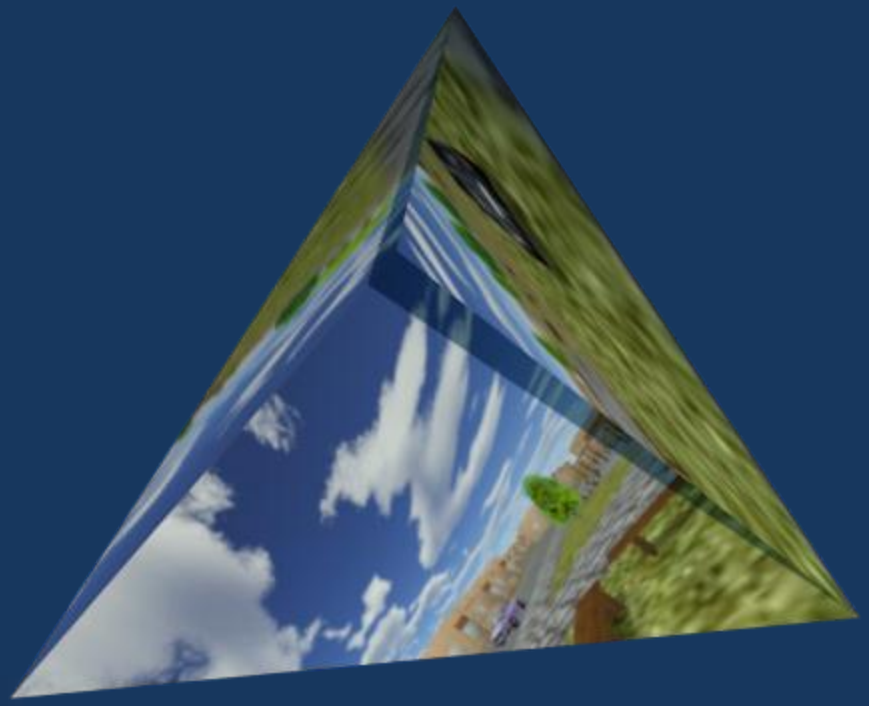
optimizations

- speed and resolution and no compromise
  - "to make the optimum geometry to accommodate the maximum of valid pixels"
  - performance is proportional with the number of render cameras
- FBO
- off-axis frustum
- pyramid solution - 3 cameras - 120deg.

Implemented Solution

Vertical F.O.V. x 2 = cos (120)

Future Solution



buffersize = vertical F.O.V. / sqrt (2)

Part III: Logic

- Particle Sensors sends data to Isadora as MIDI sequence
- Blender reads the data from Isadora via OSC/Socket (Python)
- Blender emits a virtual muon for every muon the sensor detect.
- Also has manual keyboard control for 'Vjing' (adjustable parameters)

Part IV: Art

- Concept
- Production
- Graphic Techniques
- Extra: Mini-Game

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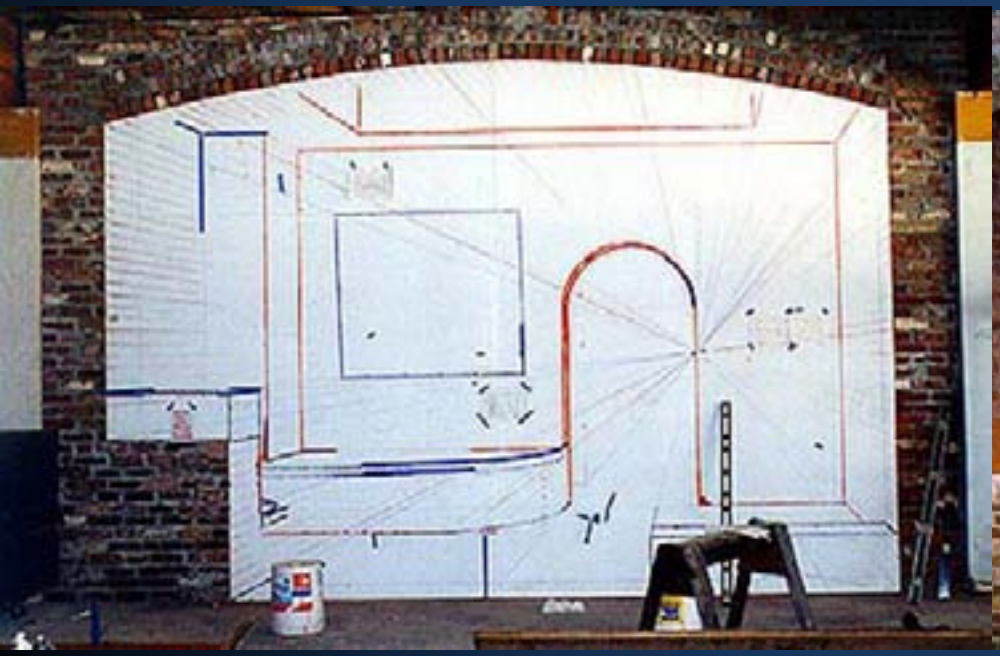
Concept

- make it look 3D
  - depth and perspective



Concept

- Invisible as Muons
- Visible as Muons

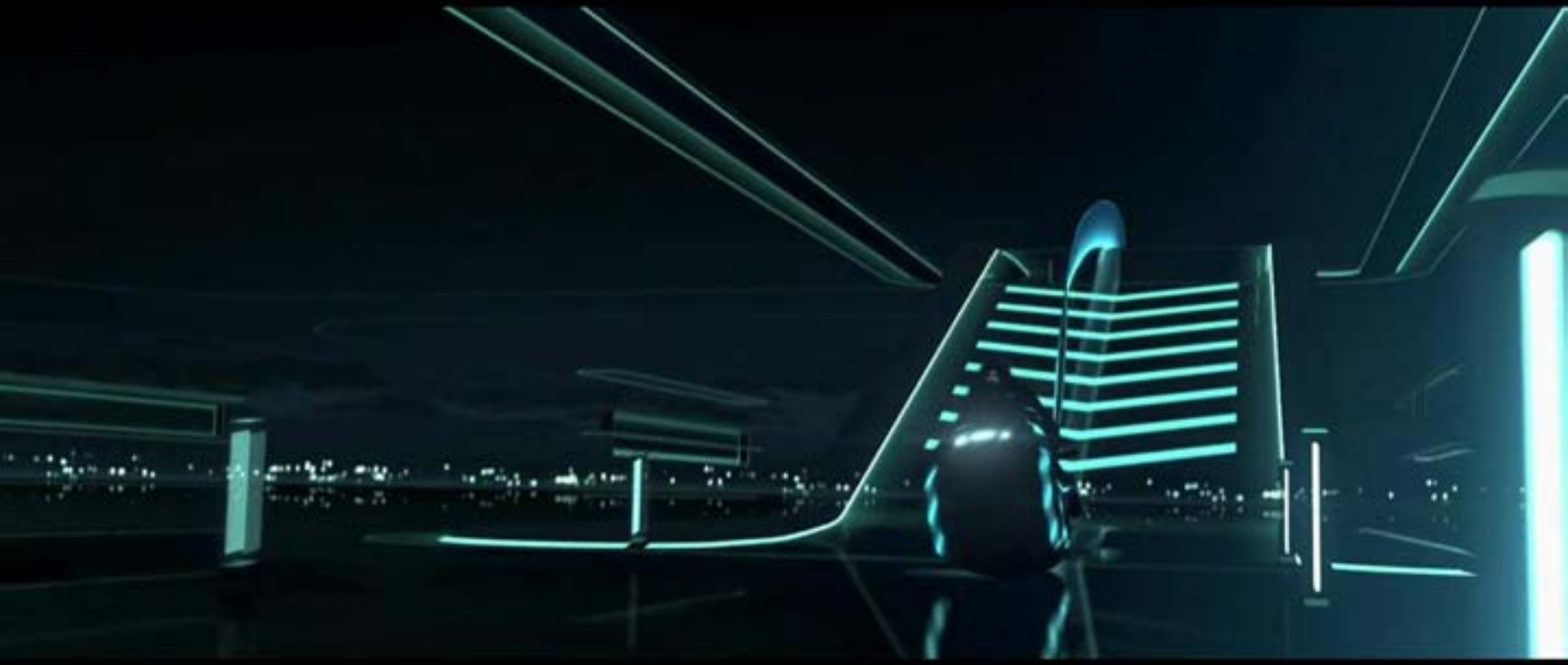
Concept

- limitations of the dome system
  - It has to be dark
  - scale
  - It is not a Fulldome

Concept

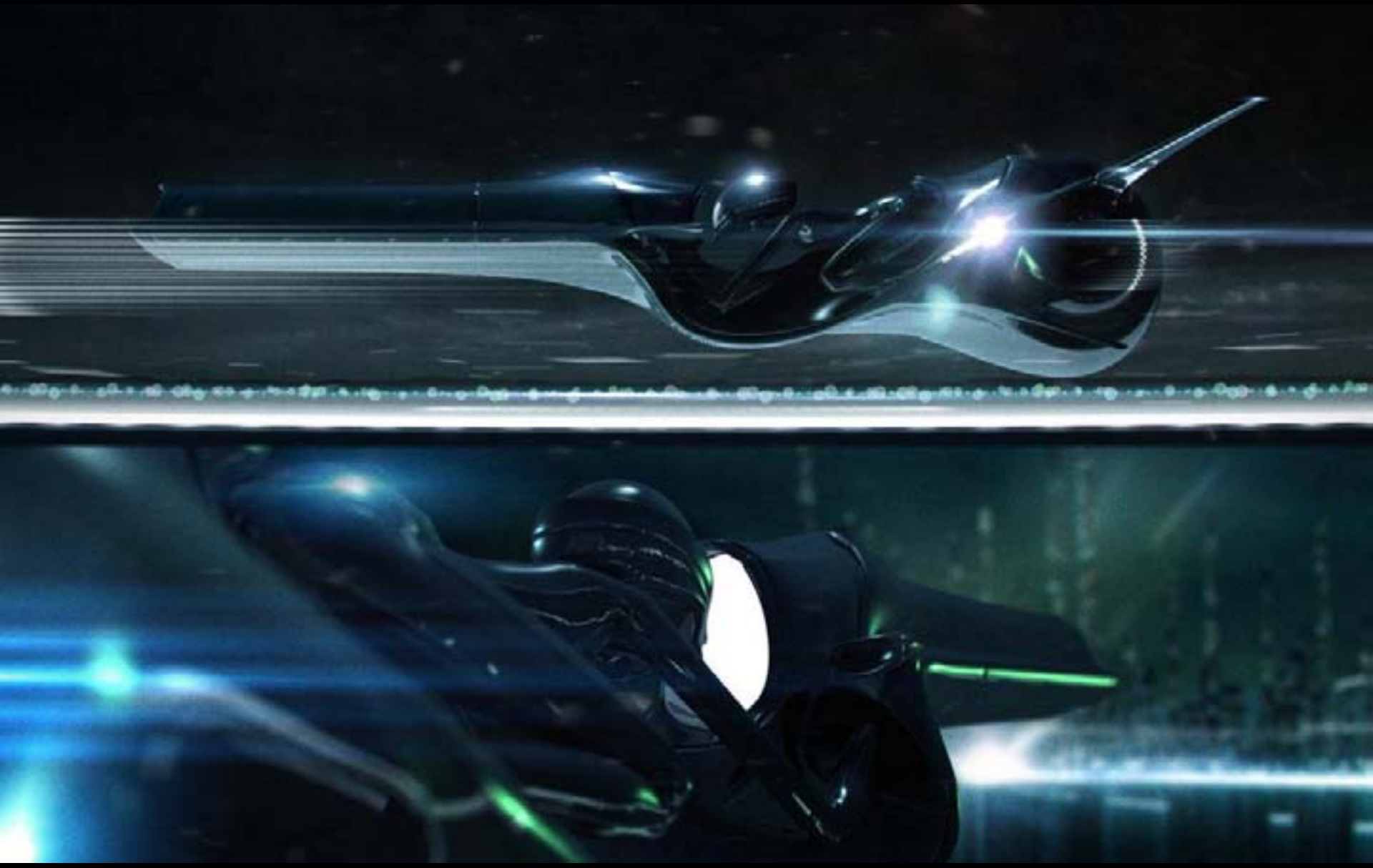
- Inspiration
  - Tron Legacy
    - neon lights
    - glossy dark glass effect
    - dark background
    - high-tech

Concept - Inspiration



Tron Legacy

Concept - Inspiration



Tron Legacy

Production

“Production is that part where we take all the plans and rip them in tiny parts to build something completely different.”

Production

- Iterative process
- the final product is quite different from the initial concept.
- some logic bricks, 1000 lines of python, 500 lines of GLSL shaders, no audio

Production

Graphics Techniques

- Platform
- Particles
- Water wave
- Post processing

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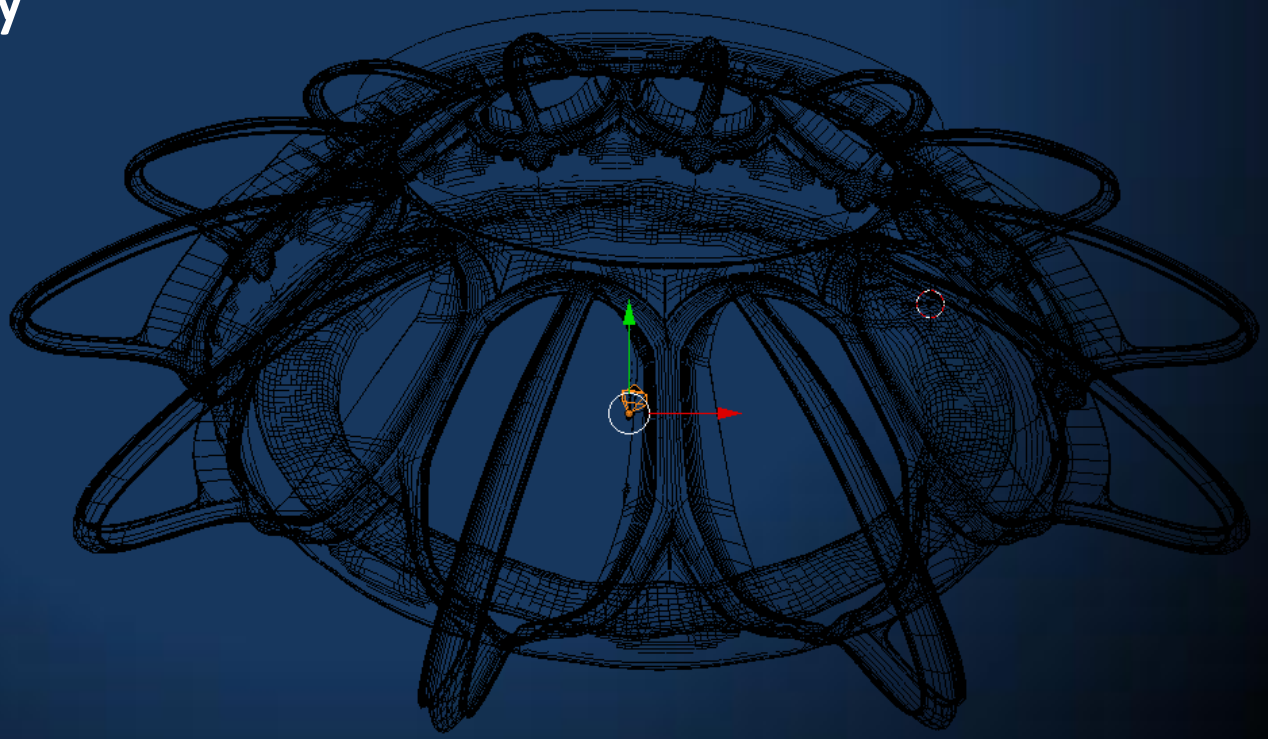
Platform

- Light Attenuation
- 3D Geometry



Graphics Techniques

- Platform
- Particles
- Water wave
- Post processing

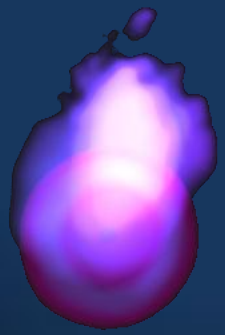
Particles

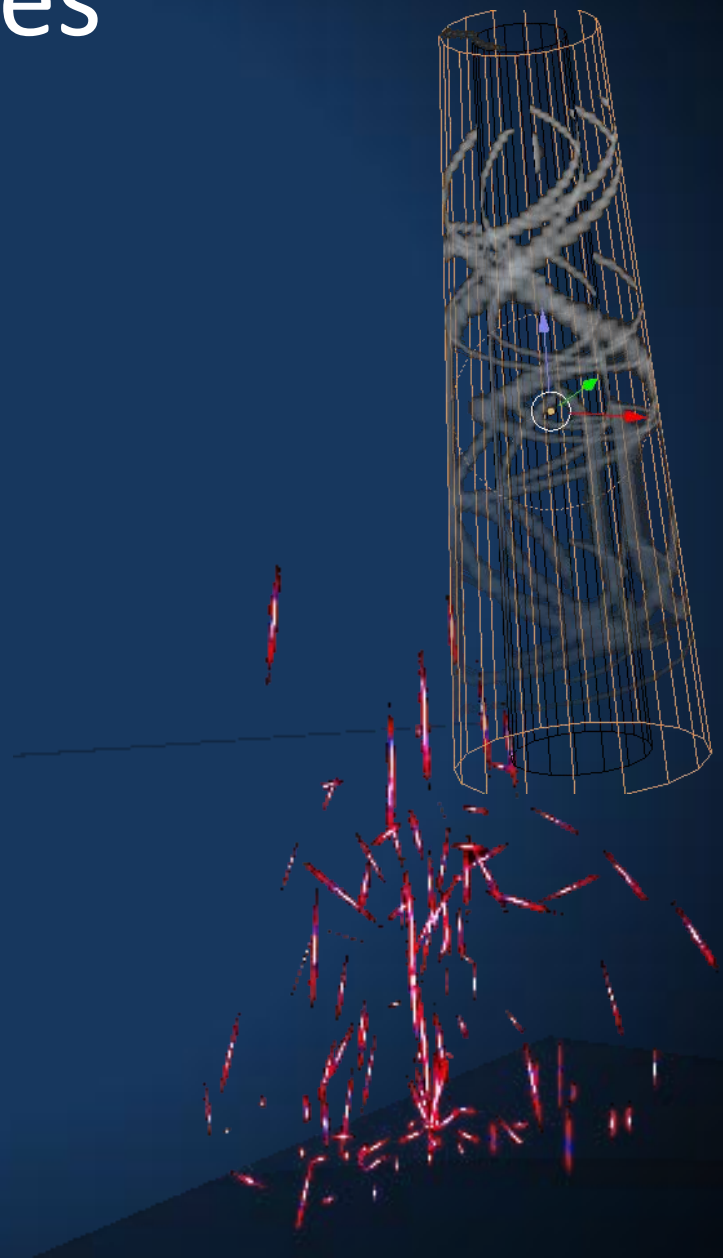
- Stretch of particles along velocity vector

```
linV = Vector(obj.worldLinearVelocity)
obj.alignAxisToVect(linV, 2)
obj.localScale = [1, 1, 1 + linV.length]
```

- Spiral particles

- Node based material





Graphics Techniques

- Platform
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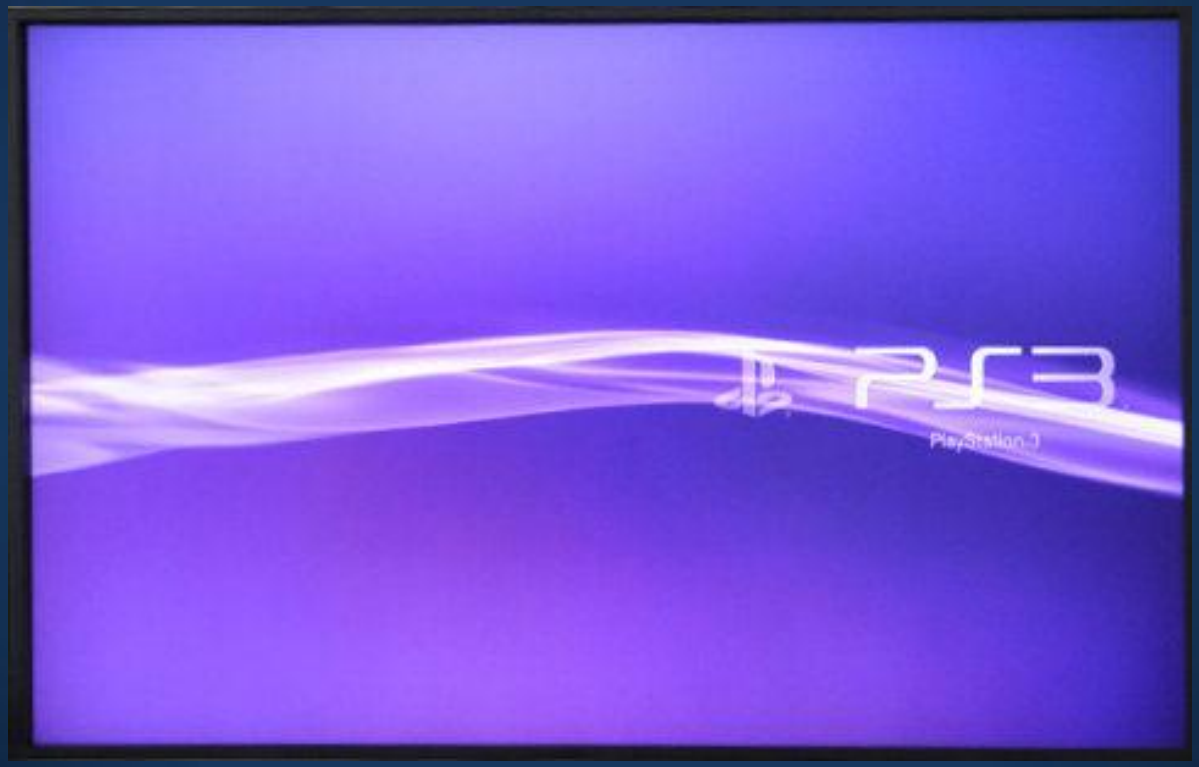
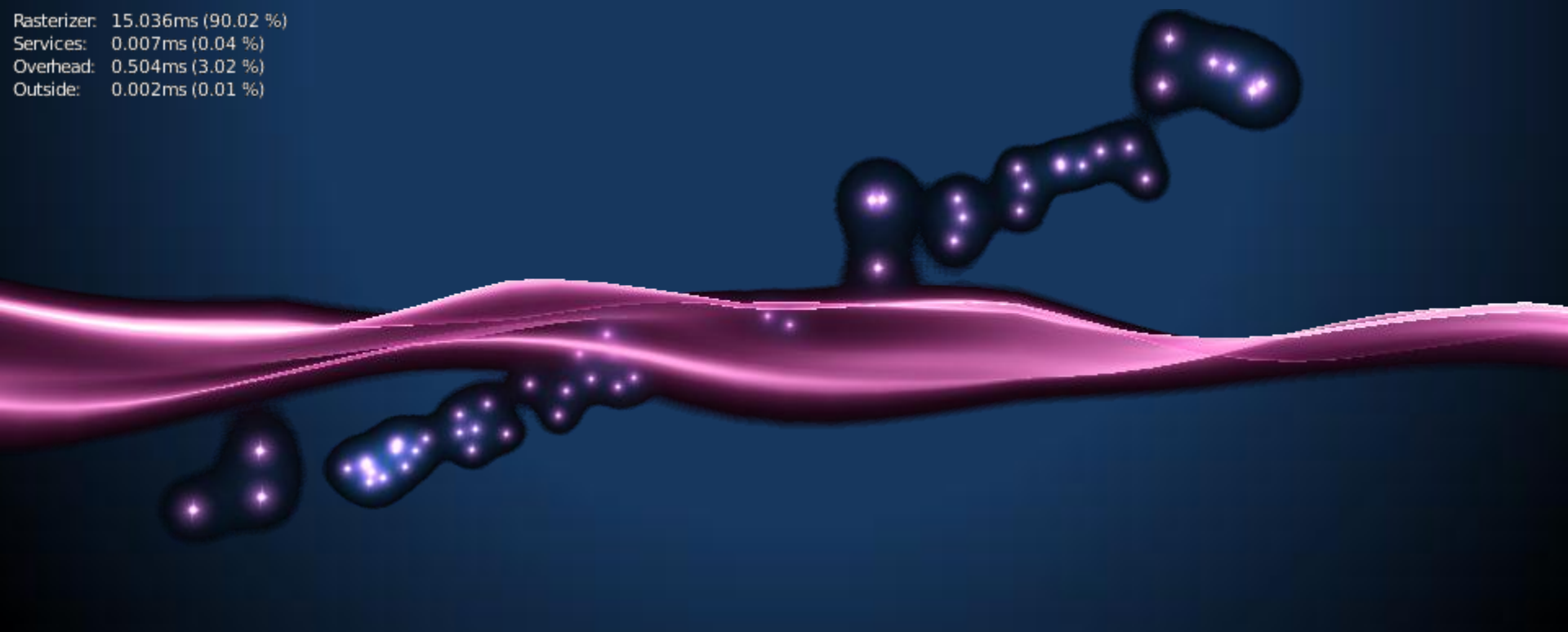
Water Wave

(a.k.a. PS3 effect)



Water Wave

- Shader, Shader and more Shader



Graphics Techniques

- Platform
- Particles
- Water wave
- Post processing

Post Processing

- Hue
- Sharpness
- Brightness
- Saturation
- Gamma

Extra: Mini-Game

Le Grand Finale

Part V: Post Mortem

- Limiting performance with large number of object (particles)
- Amazing engine for rapid prototyping.
- It was an experiment and a learning experience.
- Made patches specific for this project, but probably will never be accepted in trunk (too hacky or too specific).
- Completely burnt out at the end of the project :(

You should read more

You should read more

“Mastering Blender Game Engine”
Mike Pan, Dalai Felinto
CENGAGE

To be released after Blender 2.6
Available for pre-sale

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Dalai Felinto – www.dalaifelinto.com
Mike Pan – www.mikepan.com
Martins Upitis - artmartinsh.blogspot.com

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