Fulldome graphics: Adventures on the Fringe

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Introduction

- 2004: Concept of a spherical mirror for full dome projection. One projector, one spherical mirror, one computer.
  - Currently being used in a number of standard planetarium style installations, both inflatable and fixed domes.
  - Benefits from recent affordable HD resolution projectors.
- Examples of some of the more unusual and exotic dome environments. eg: vision/medical research, gaming, art.
- Cosmology gallery, the largest dome in Australia.
- Navigable movies, concept and examples.
- iSPhere: Next project?

Inflatable domes using spherical mirrors

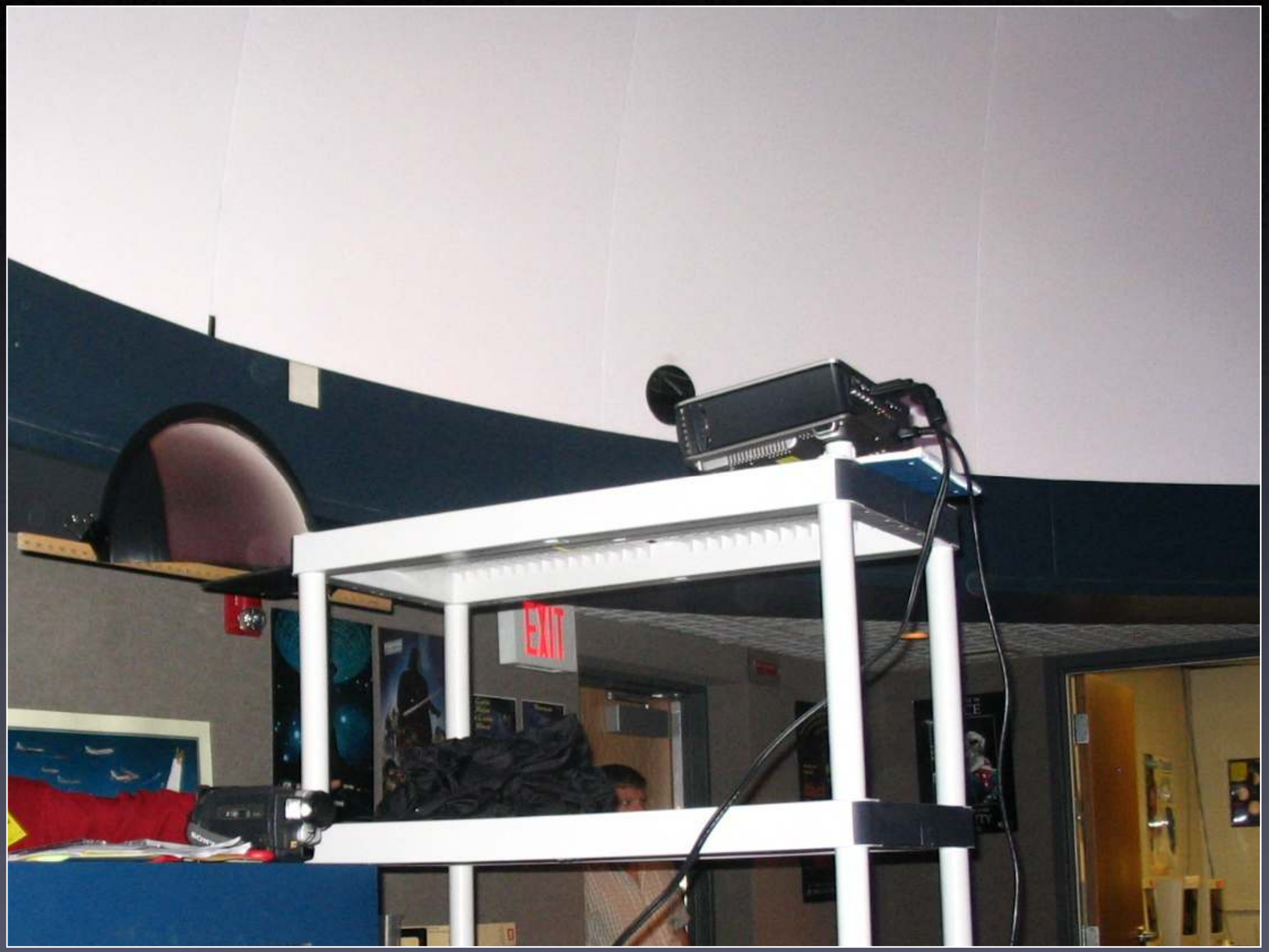
Graphite digital art gallery (ACM Siggraph), Dunedin (5m)

Australia, USA, Mexico, UK, Thailand, Netherlands, Italy, Germany, ...

Basic configuration

Adelaide planetarium demonstration 2005

Jury rigs from across the world

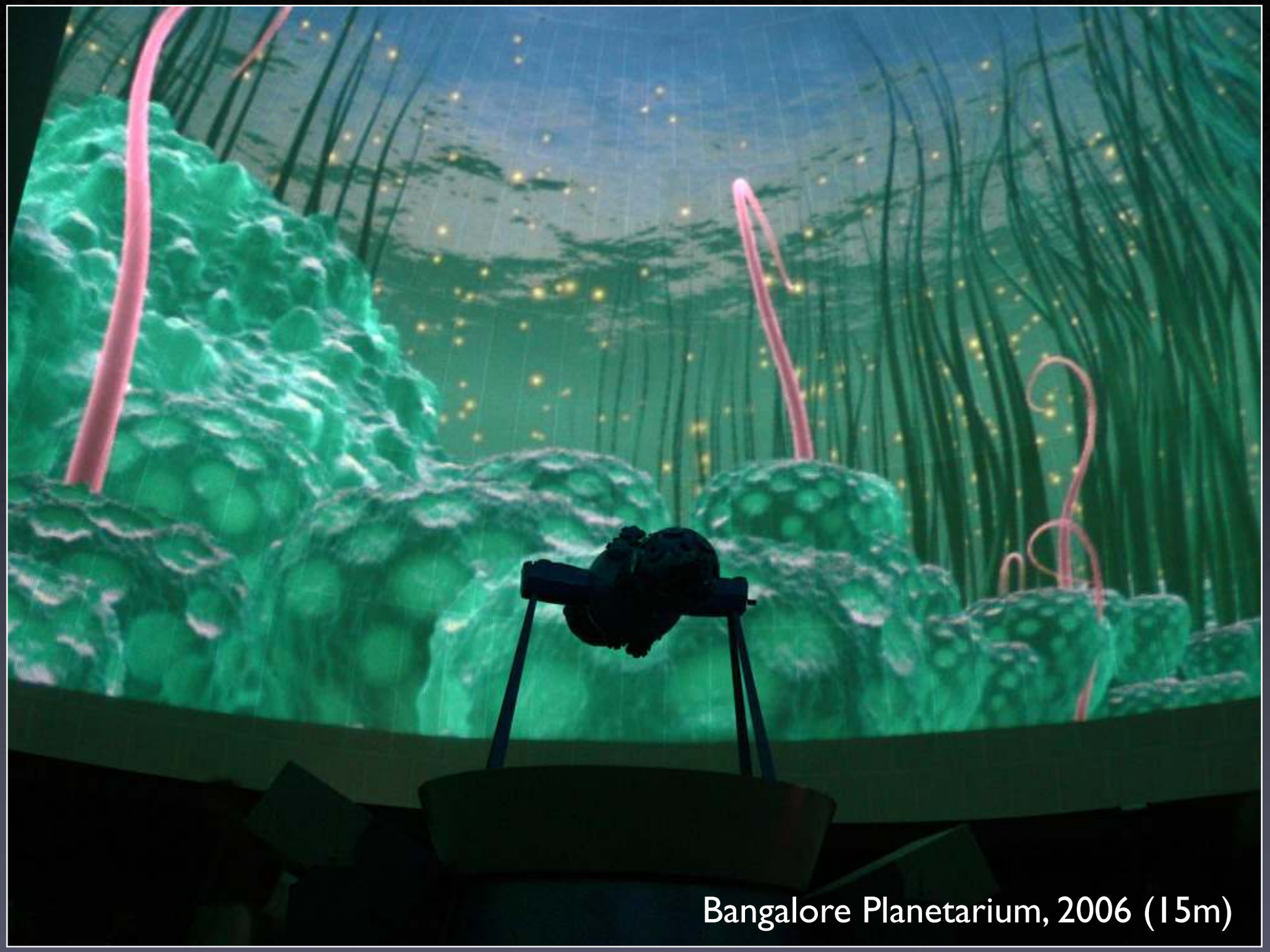


Mueller planetarium, Nebraska

Mexico City

Courtesy Alfredo Arrache Vértiz

Living in harmony with Zeiss



Largest planetarium with a fixed spherical mirror system.

Spherical mirror vs fisheye (I'm not biased)

Pro

- Low cost.
- Projector / optics independence.
- Frees up the middle of the dome.
- Less light loss compared to fisheye.
- Larger dome coverage compared to truncated fisheye.

Con

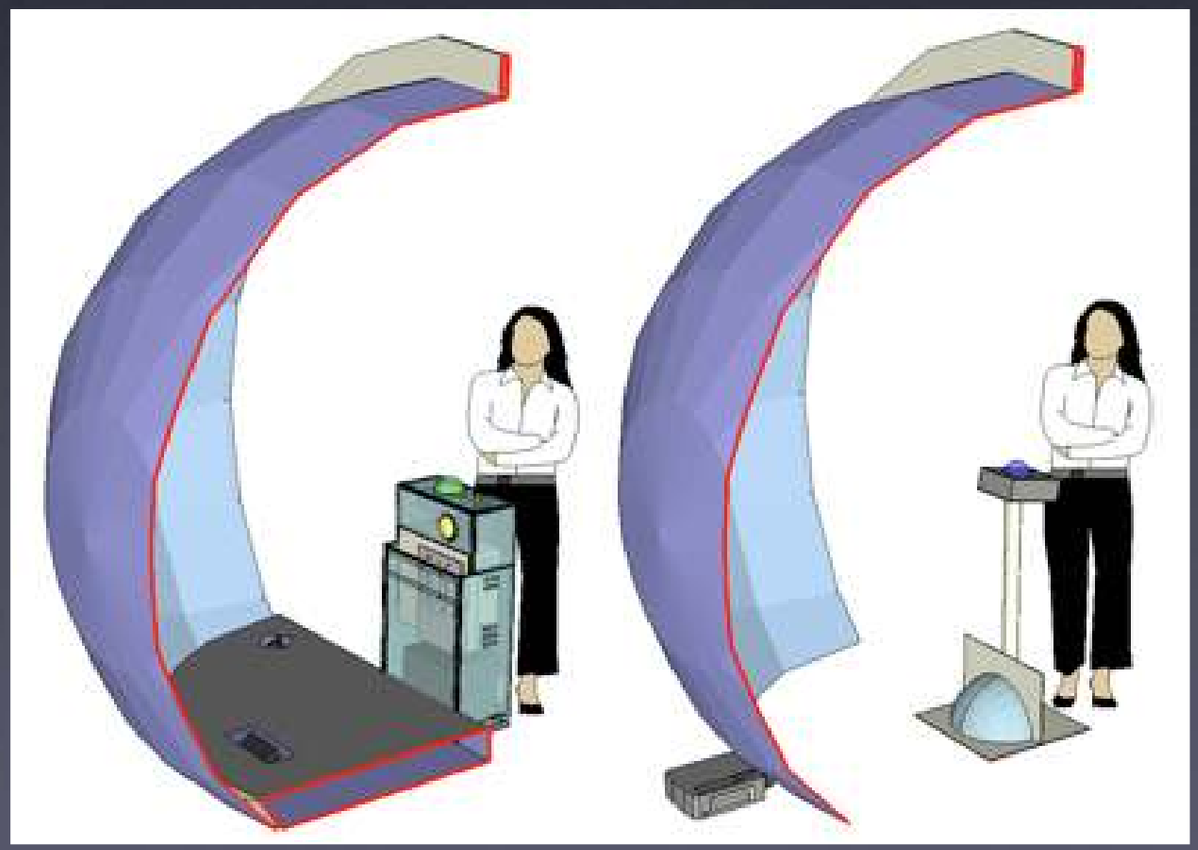
- Resolution on the dome is a slightly lower (on average) than truncated fisheye for the equivalent projector resolution.
- Mirror is (currently) more delicate than a fisheye lens.
- Software tools are less developed (improving with time).

Alternative dome environments employing spherical mirror projection

- Upright single person domes - “iDome” (iCinema, UNSW)
  Similar in concept to the original VisionStation dome.
- Domes for animals - “what the!”
  Vision and medical research.
- Domes and rectangular rooms for immersive gaming.
- Cosmology Gallery - Bucky ball.

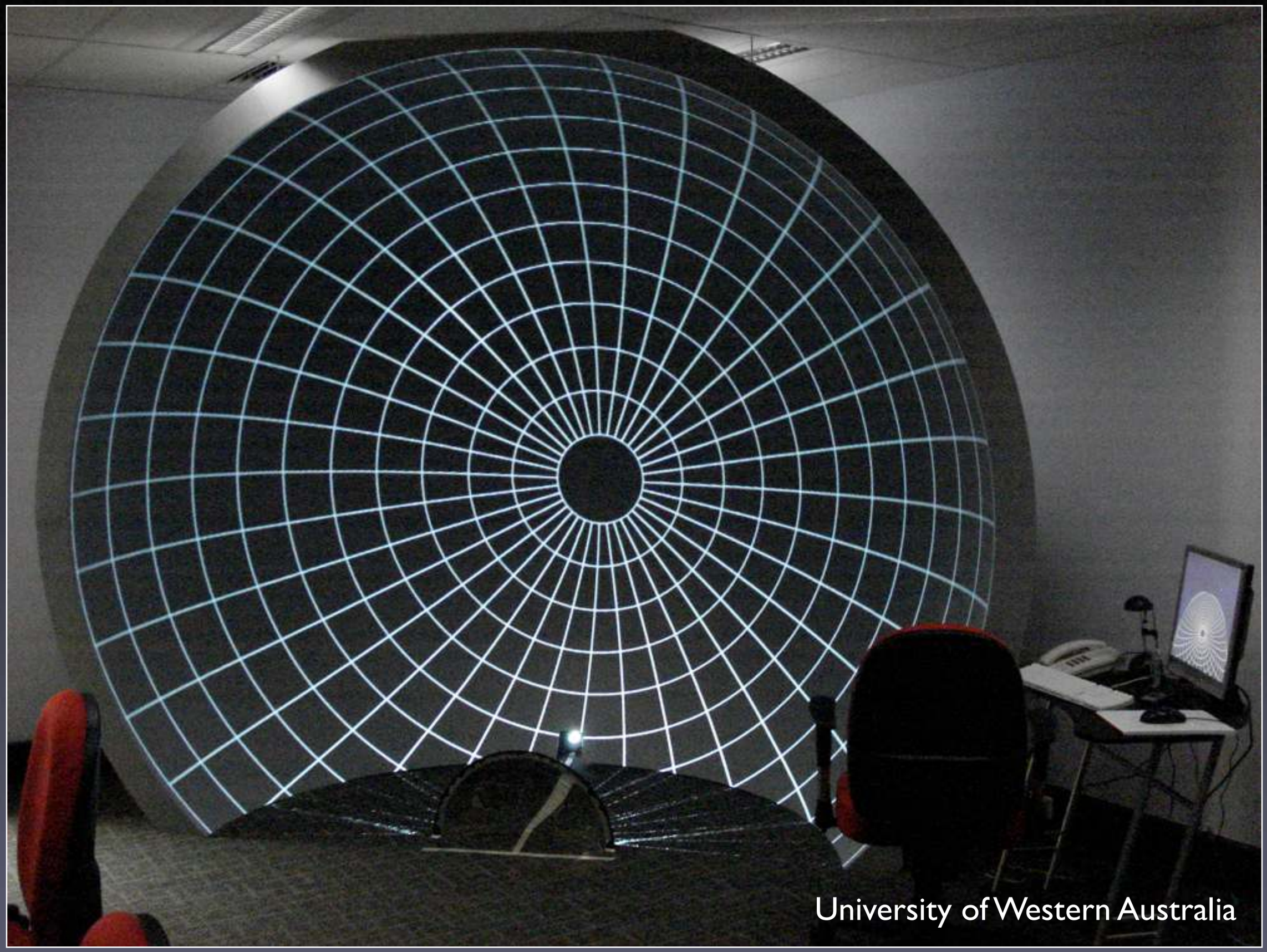
iDome - Immersive Environments

- Upright version of a planetarium dome.
- Typically intended for a single person, or at most up to half a dozen.
- Spherical mirror frees up the center of the dome from having a large projector and fisheye lens.

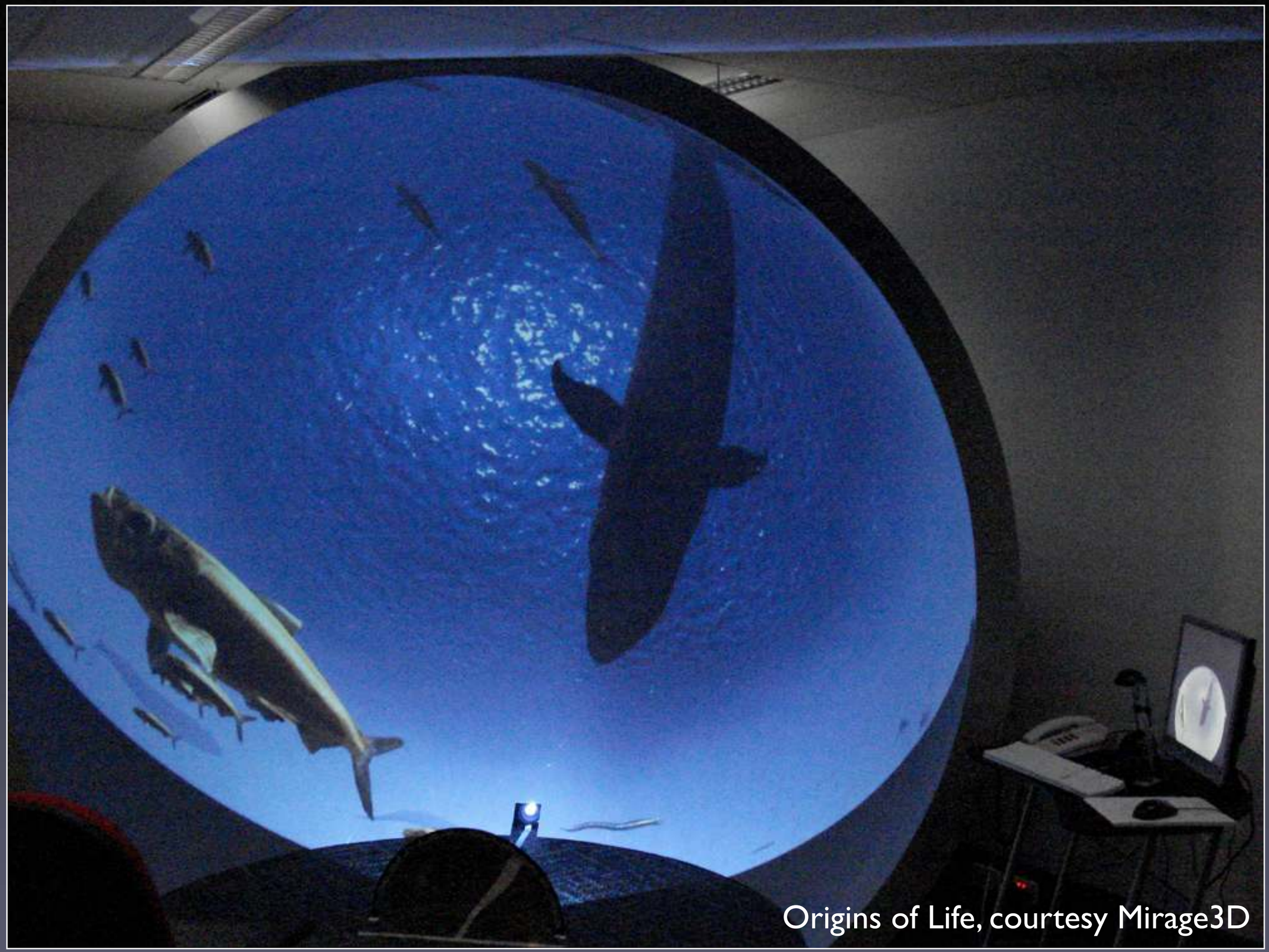


Courtesy, iCinema (UNSW)

Hardware arrangement - 3m diameter



Example: Movie playback



Origins of Life, courtesy Mirage3D

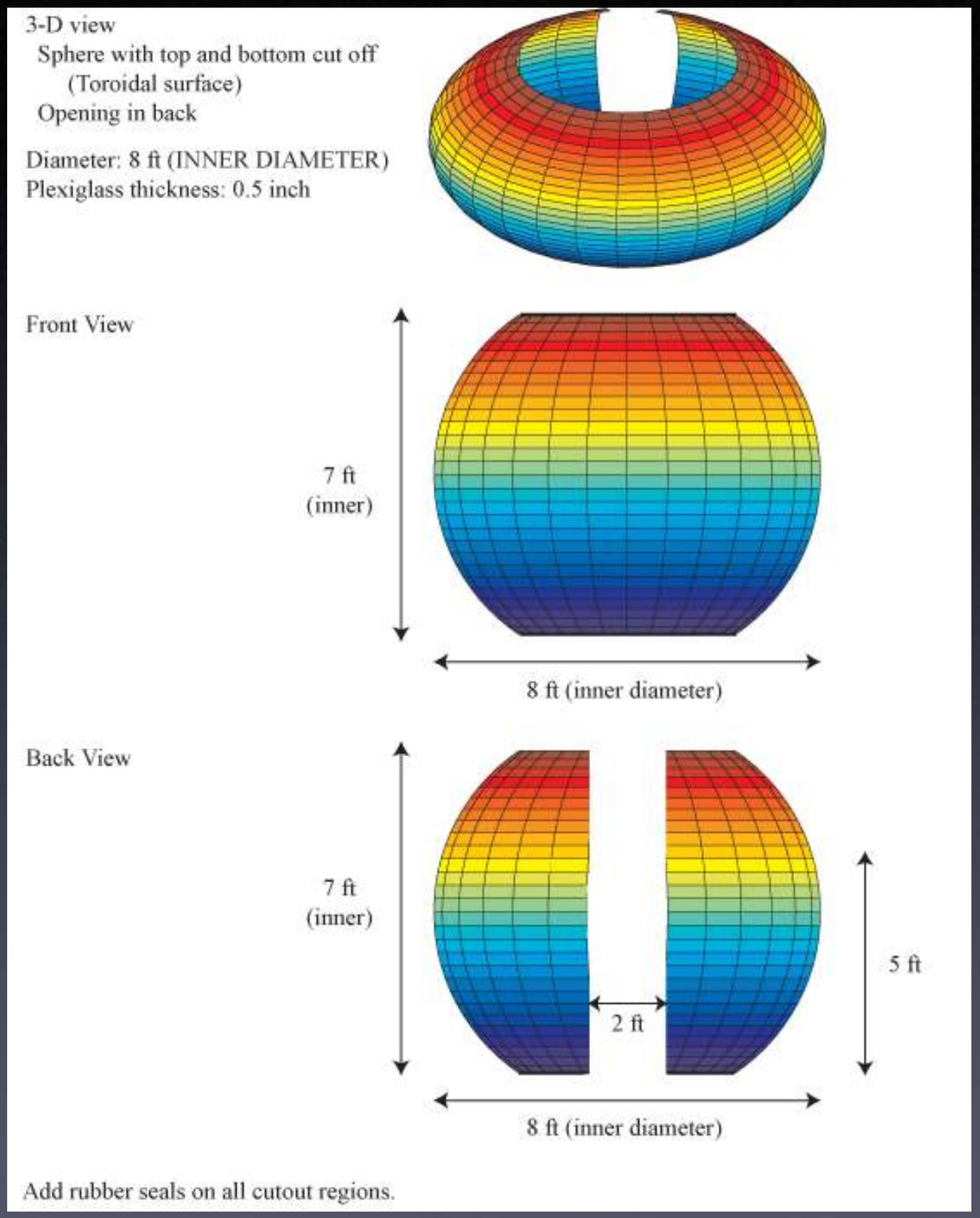
Example: Visualisation (interactive)

Cosmology simulation

Example: Virtual Heritage

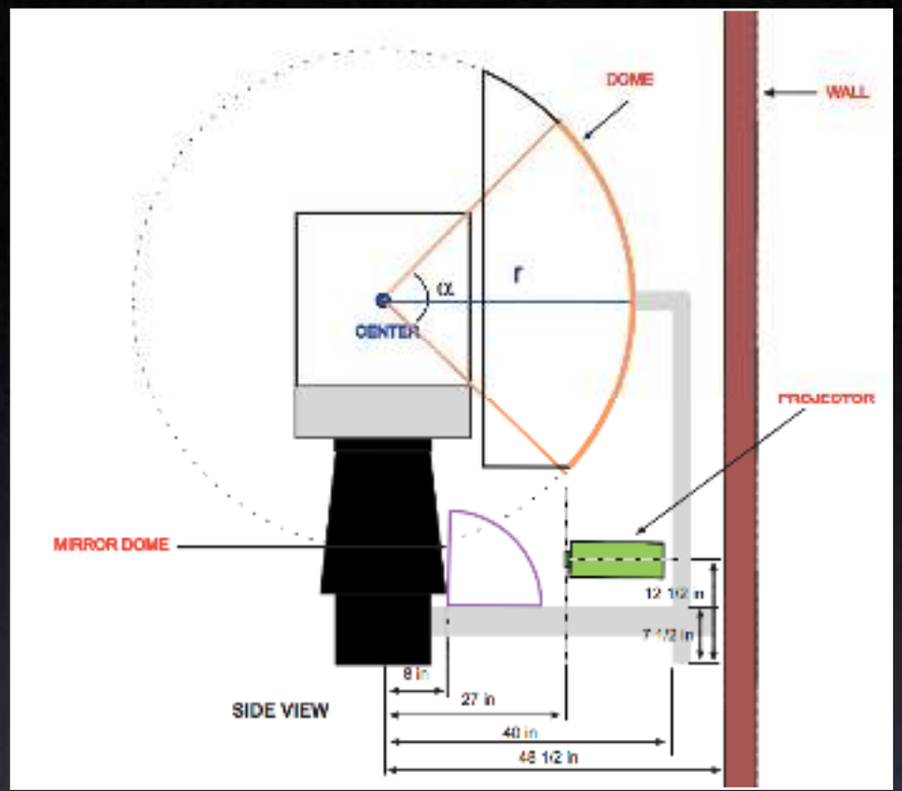
Place Hampi, Courtesy iCinema

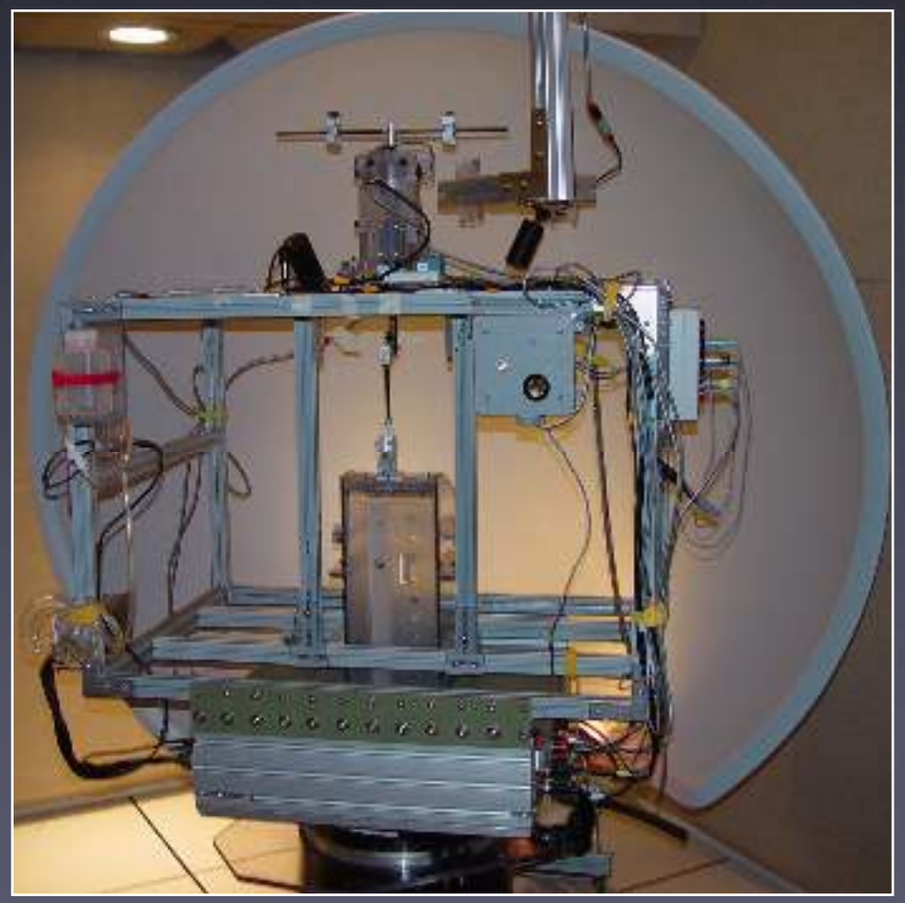
Monkey dome



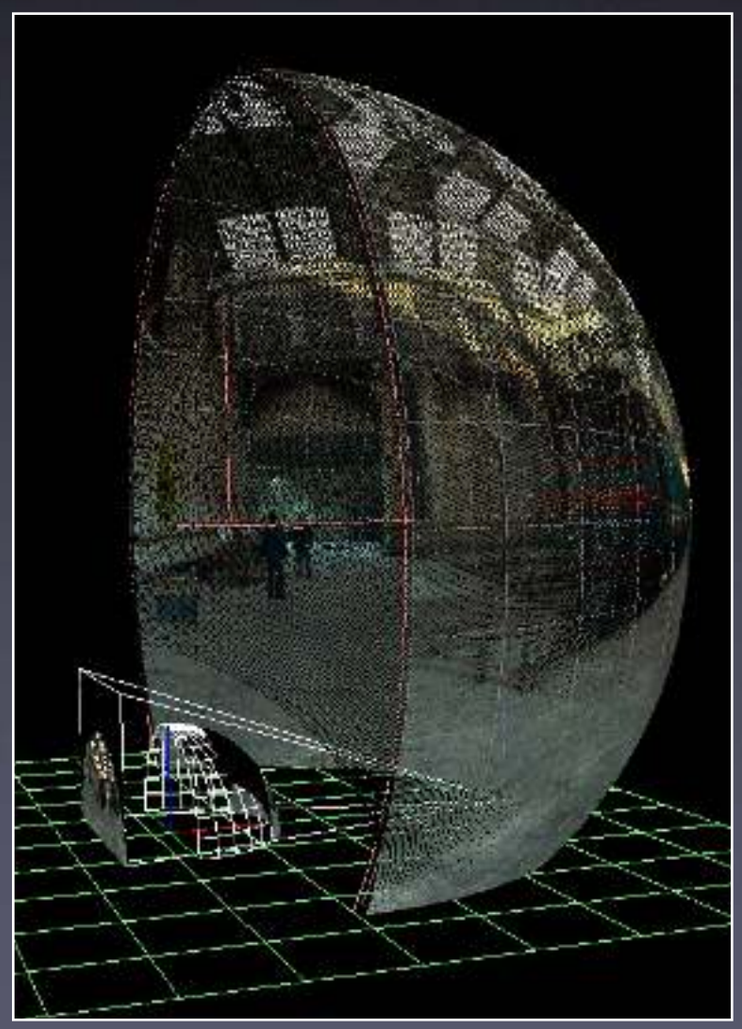
Courtesty Neeraj Gandh, University of Pittsburgh

University of Rochester Medical Center





Immersive gaming

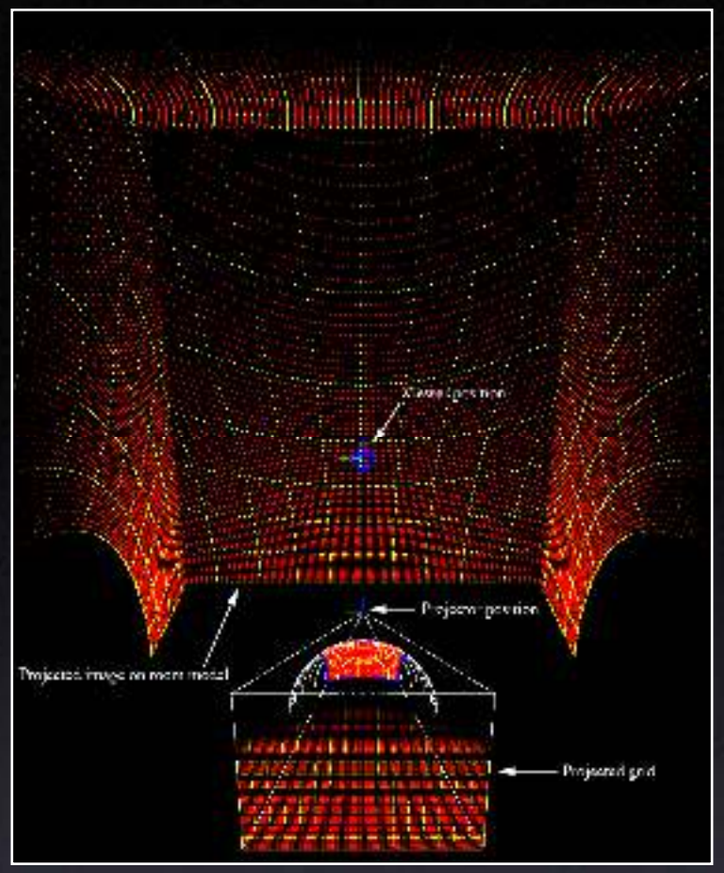


Software being developed is equally applicable to horizontal domes

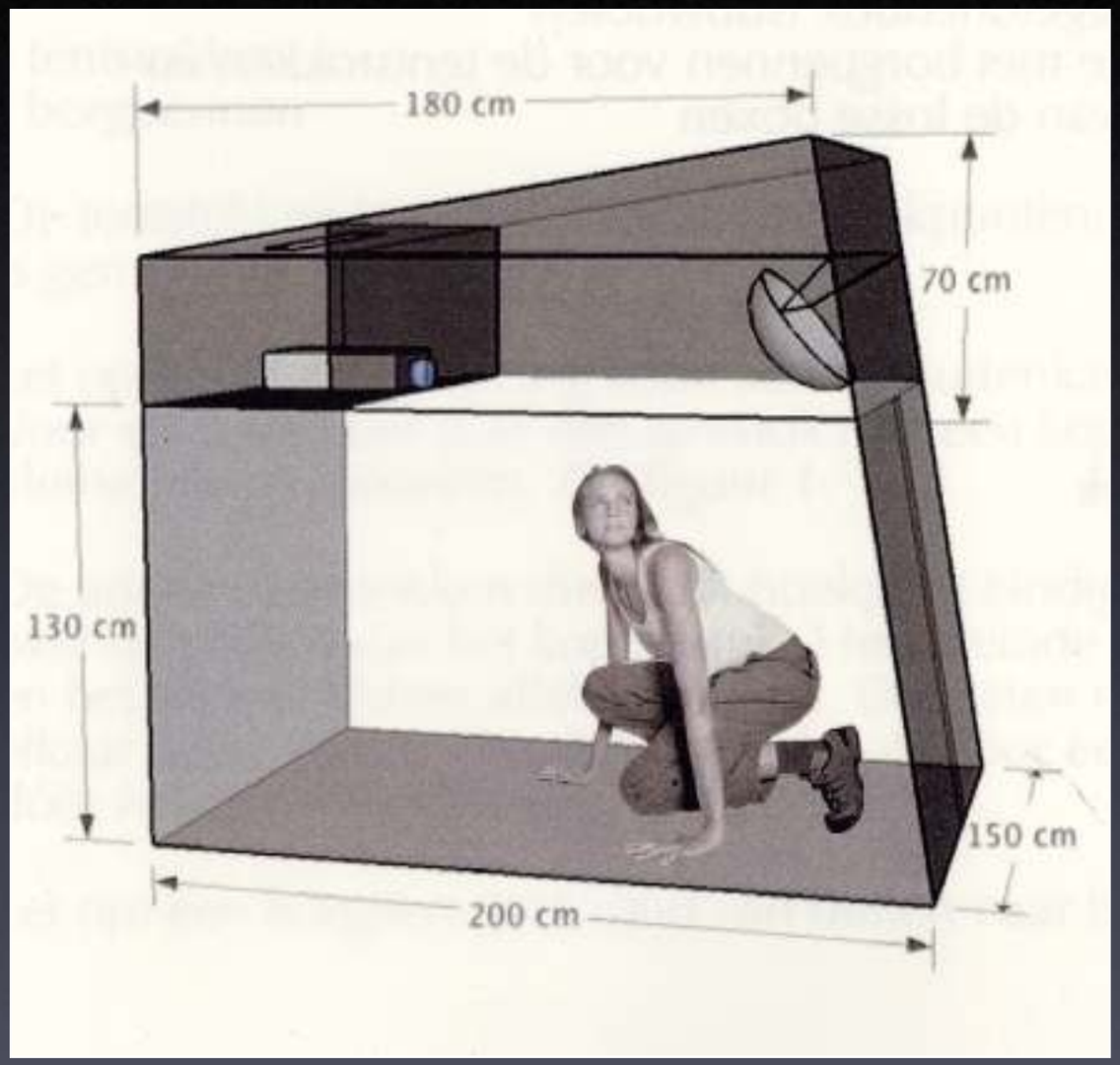
Game: Halflife2. Images courtesy Erik Champion

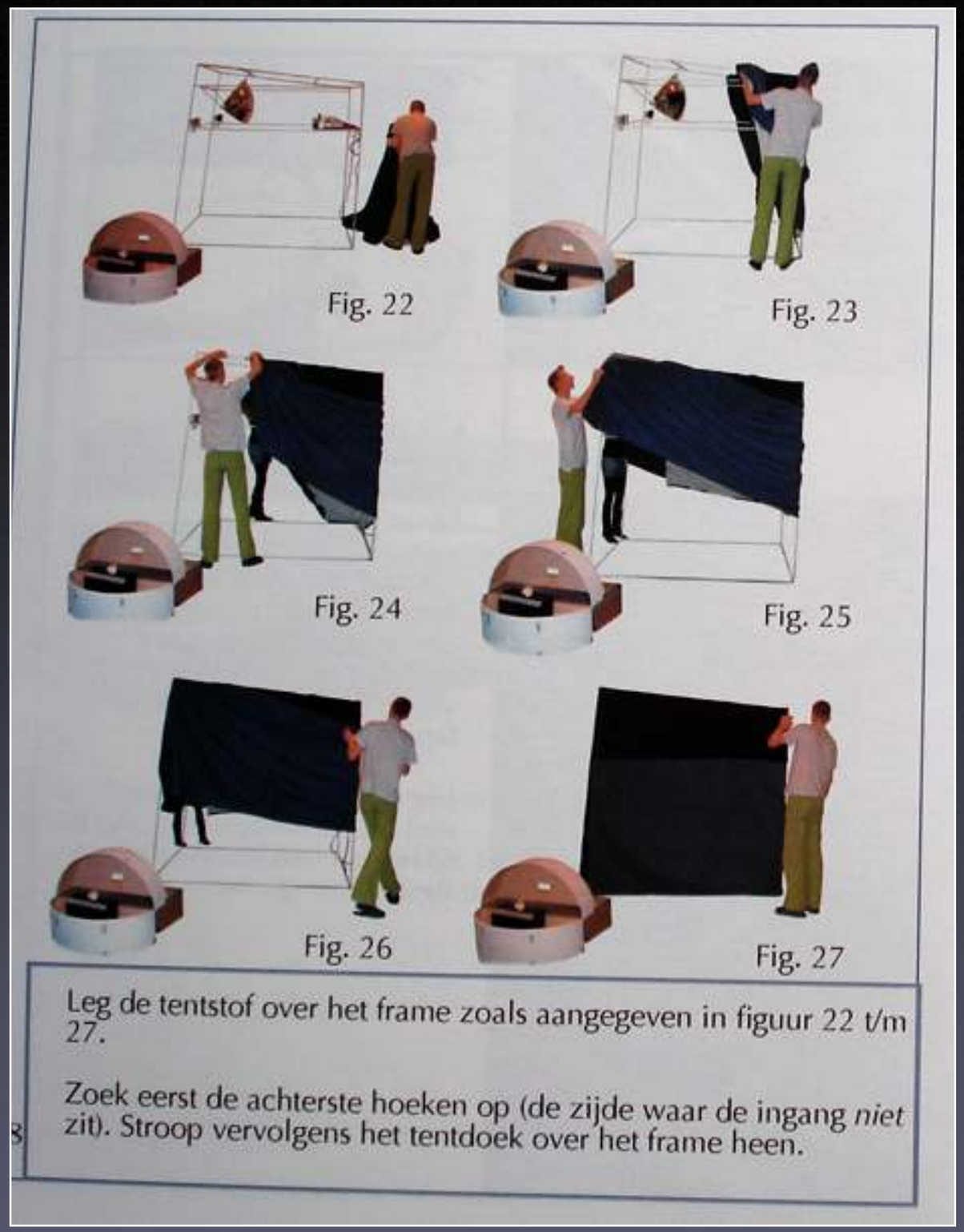
Rectangular rooms

- Spherical mirror based software can warp fisheye and other image projections to any shaped space.
- Planetarium in your bedroom.



Immersive booth





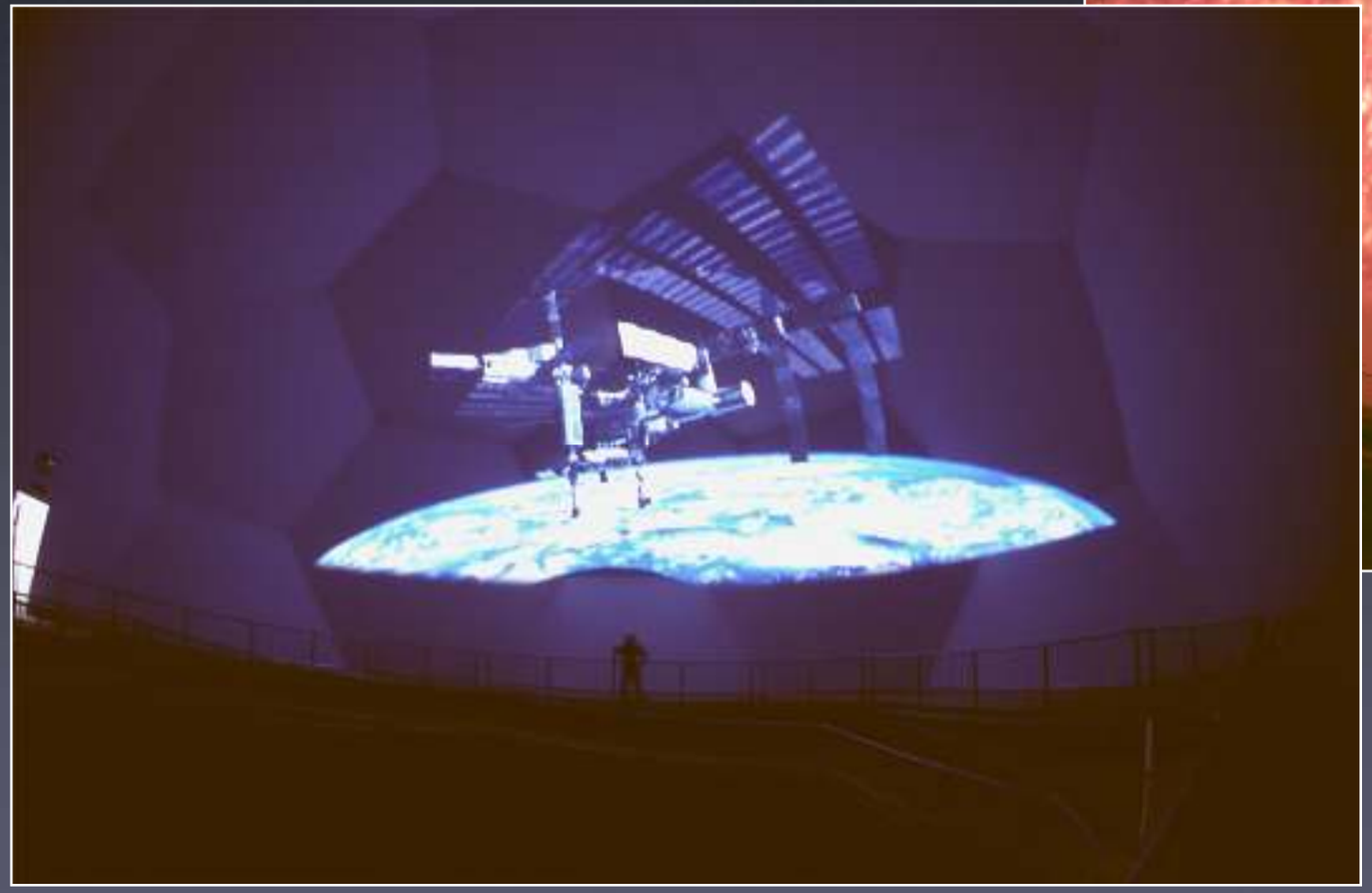
Courtesy Nina Hieschberg

Cosmology Gallery

- Located at the Gravitational Discovery Centre, Gin Gin.
- Bucky ball structure (carbon 60), 20m diameter.
- Largest projection dome in Australia!
- Dome is above an 8m high gallery space.

High Def projection testing December 2006

Oasis in space



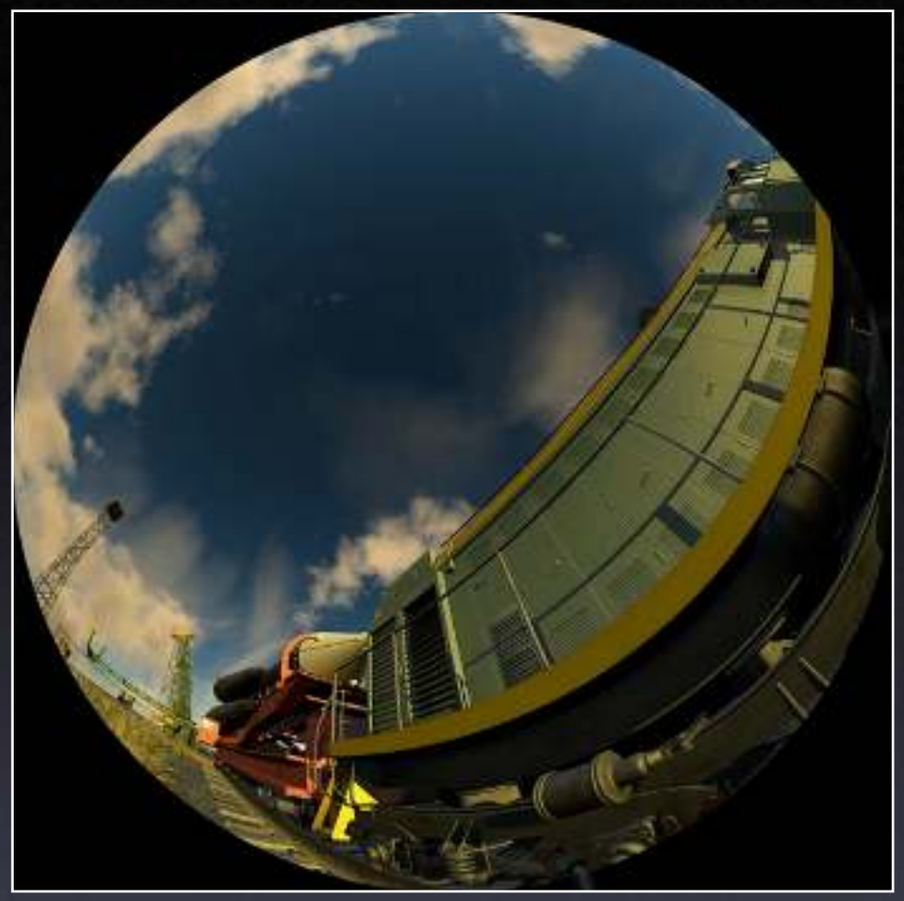
Interactive Cosmology

Big

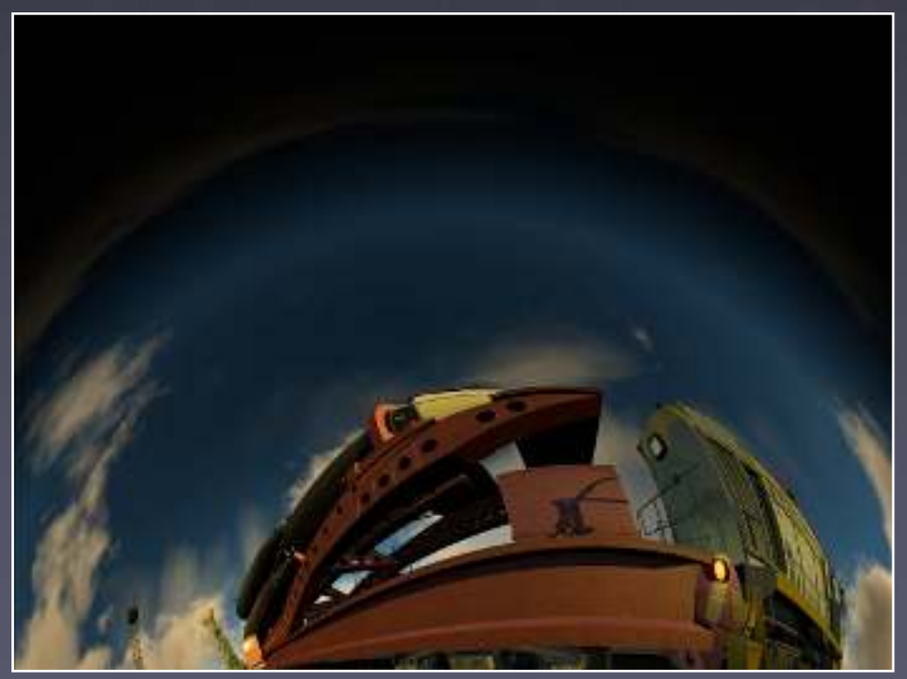
Navigable movies

- Interactive cinema.
- Movies that contain a wider field of view than the final projection. As the movie plays the viewer is able to change the view. The movie can be experienced differently each time it is watched.
- Initially developed for movie mapping performed on the fly.
- Visualisation applications.
- Source projections: spherical, fisheye, cylindrical, perspective, stereoscopic.
- Destination projections: fisheye, cylindrical, perspective and warped versions of the above for the spherical mirror.

Example 1: Rotating/zooming fisheye movies



Sample frames from "Dawn of the Space Age" (Courtesy of Mirage3D)

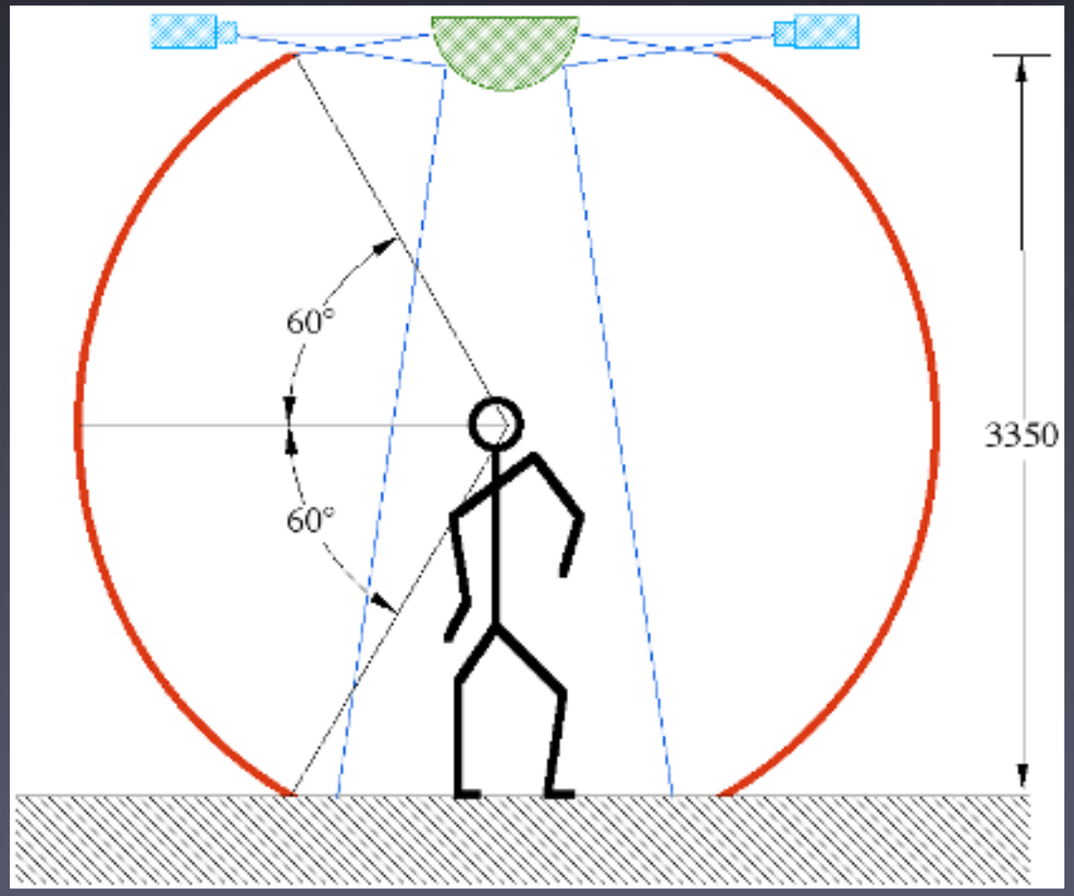


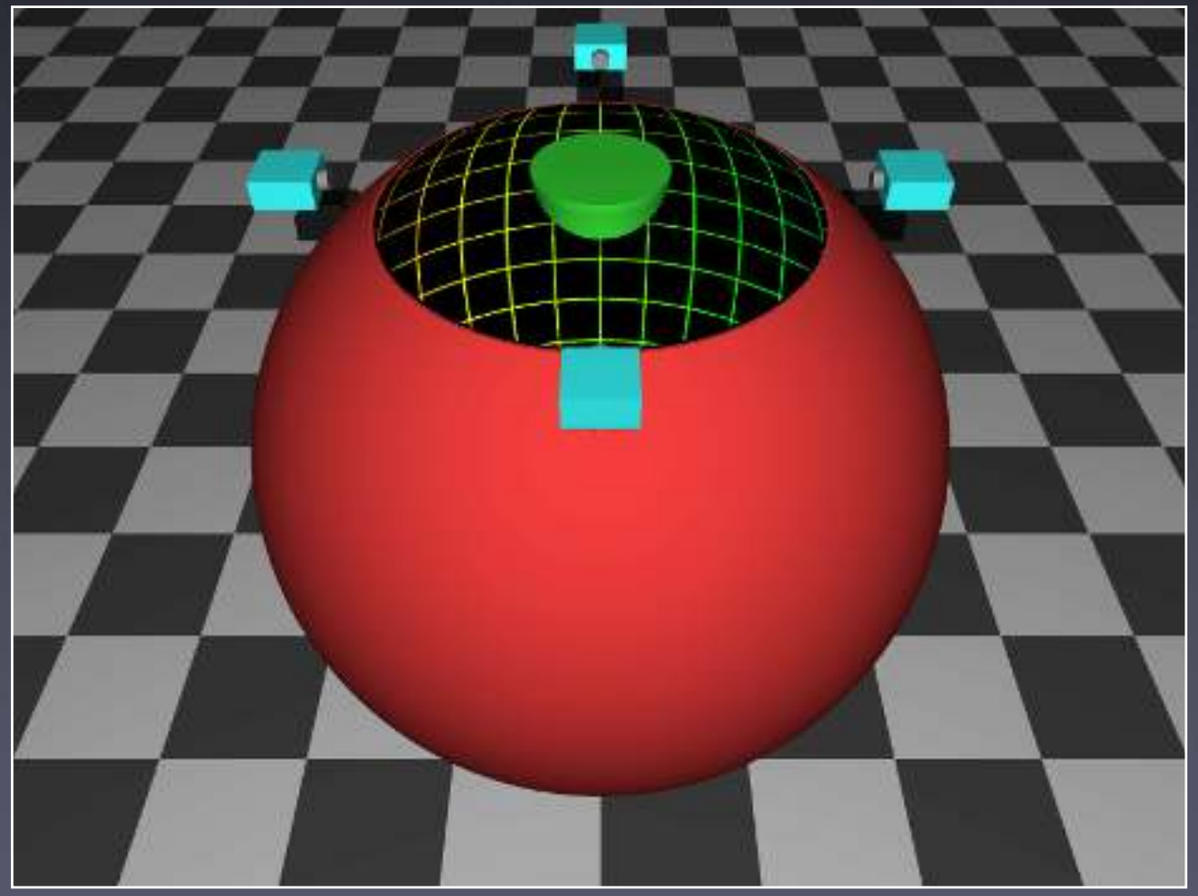
Example 2: Exploring a spherical movie

360 degrees x 240 degrees, 30 fps

iSphere

- Wider field of view than “just” a hemisphere!
- 4 x HD (1920x1080) projectors.





Questions?

- Advances in spherical mirror projection for hemispherical domes
  - Interactive calibration tool.
  - Realtime/interactive warping movie player.
  - Offline image warping and transformation tools.
  - Coding examples for interactive applications based upon 3 different techniques: vertex shader, multipass texture, geometric distortion.
  - Uptake by software developers: Stellarium (now), Celestia and Starry Night (soon?).
  - Third party developers of opensource applications.
  - Miscellaneous interactive applications by myself.
- Growing installation base of diverse users.