

Scientists lend us their data...

- Lots – can be hundreds of GB, even TB
 - Different forms for each project
 - Lists of points in space
(galaxy collision: gas, stars, dark matter)
 - Regular 3-D grids with values at each cell
(tornado, ocean flow: motion, pressure, ...)
 - Adaptive Mesh (AMR): overlapping grids, power-of-2 resolutions, appearing & vanishing as physics needs them
(hierarchical galaxy merger)
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Scientists lend us their data...

Often visualization needs different approach than scientists would make to answer their own questions. Negotiate.

- “We'd like to make a 60-second animation, so can you save at least 1800 timesteps this time?”
- We don't want to see the edge of the sim. box, or do we?



We create derived data ...

- In simplified forms, small enough for interaction
 - AMR grid boxes, subsampled particles, ...
- For designing choreography
- For exploring data, seeking features to present



g1=grid g2=times g3=100map5b g4=Cnwshear

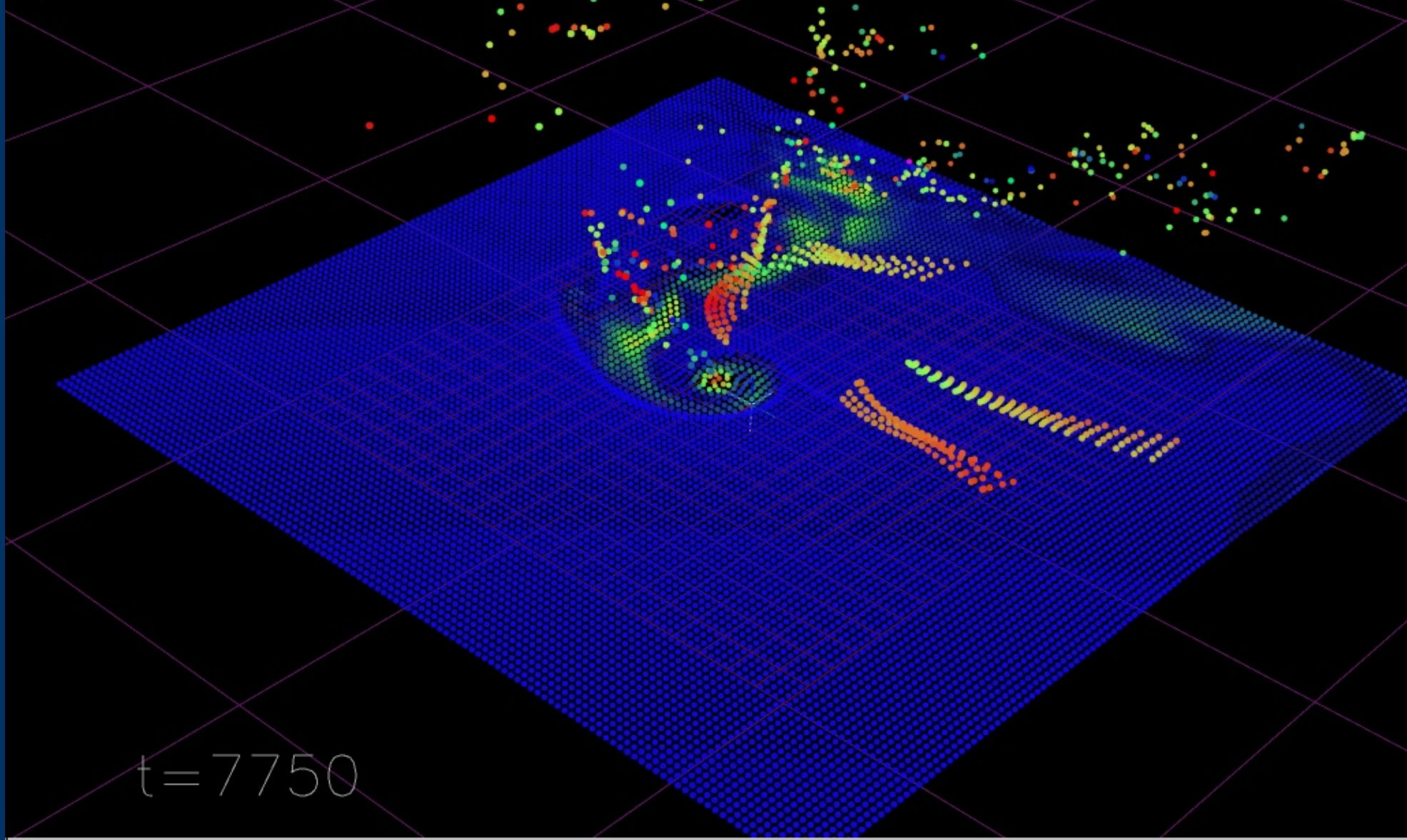
T 55 trip back [Progress Bar] [Navigation Buttons] feed

+ 0 1.0000 [Slider]

Path... Play att [0] [0]

```
# step 0
color QR
# coloring-by 13(QR) 0.. 0.00974102 mean 0.000324]
```

Cmd: color QR

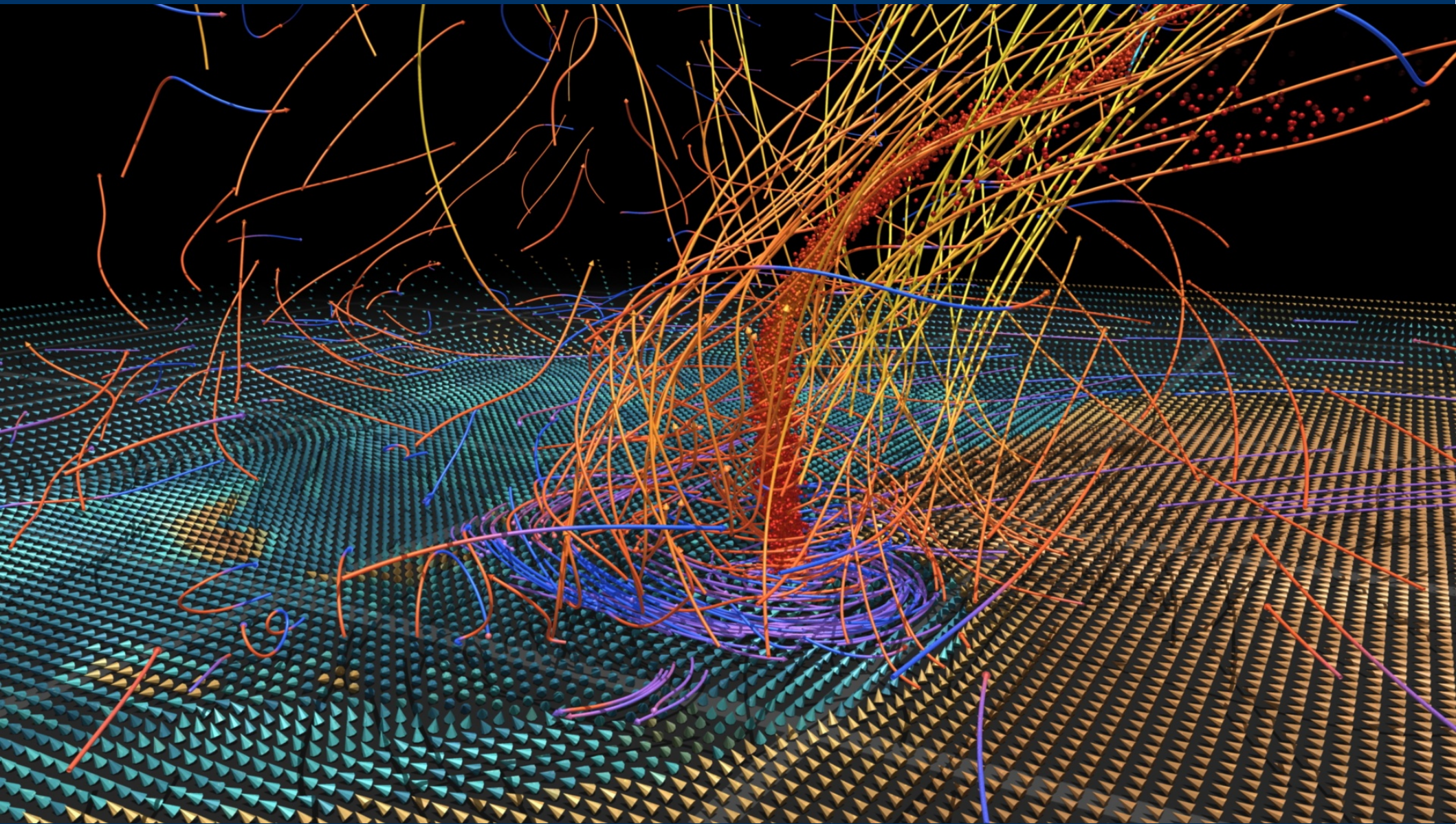


t=7750

We create derived data ...

- To make features visible
 - Tracers show how the wind is blowing
 - Isosurfaces show clouds, unusually warm ocean water, ...
- To interpolate simulation data to animation time
- Or just to turn the source data into forms our rendering tools can read.





Scientists give advice ...

- “look for the storm's rear-flank downdraft and trace from there”
- “find air that goes through the tornado core and follow it back in time to see how it got there”
- “use data from this paper on classifying active galactic nuclei, and here's what they mean...”

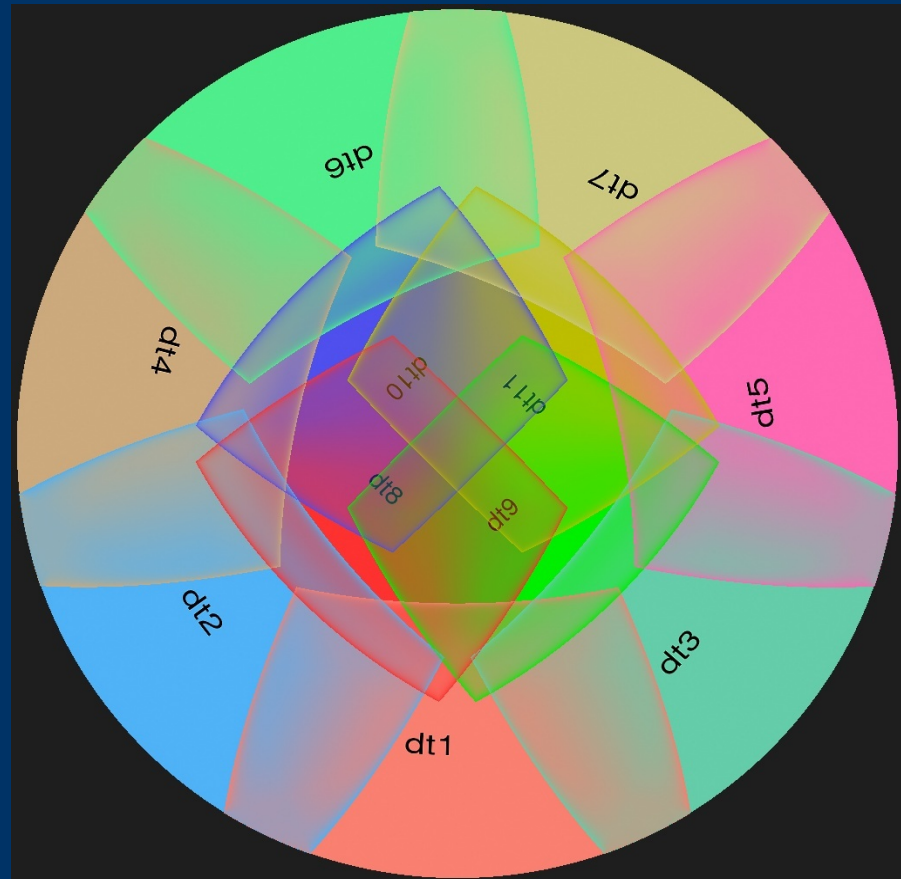


Not just for a flat screen...

The fly's eye: stitch several views, all from same point but in different directions, into dome master all-sky form.

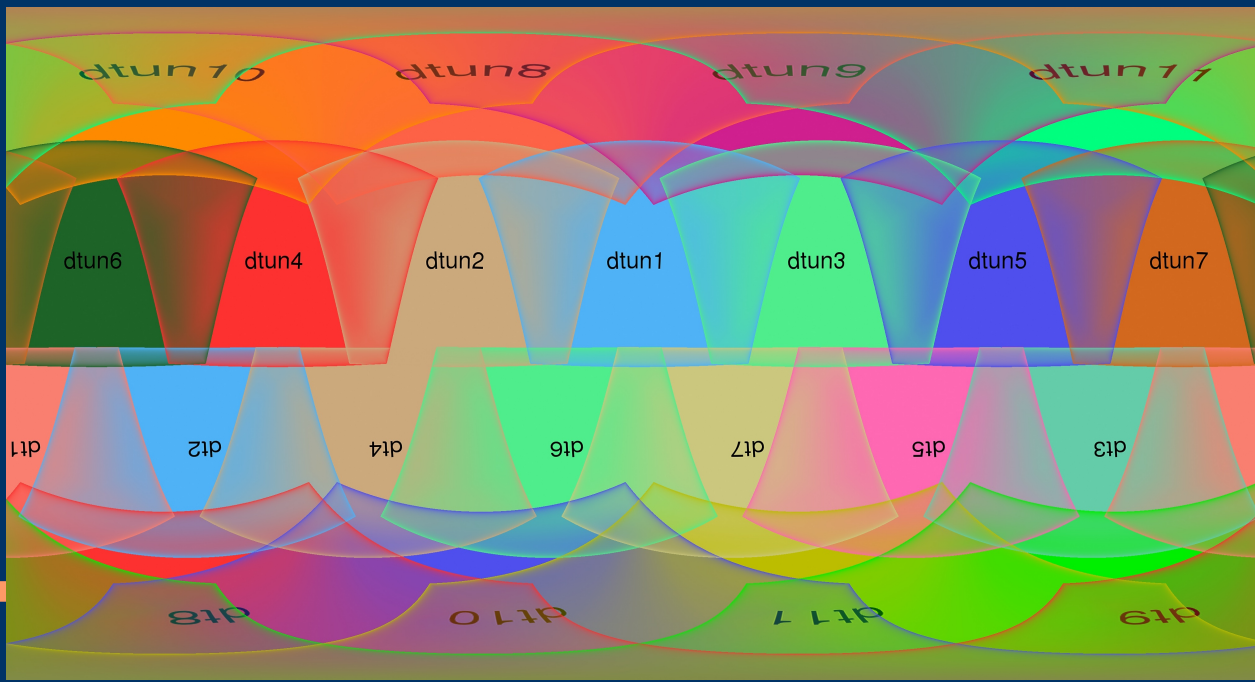
Where tiles overlap, blend imagery to reduce artifacts.

Or, extract a tile from a dome-master.



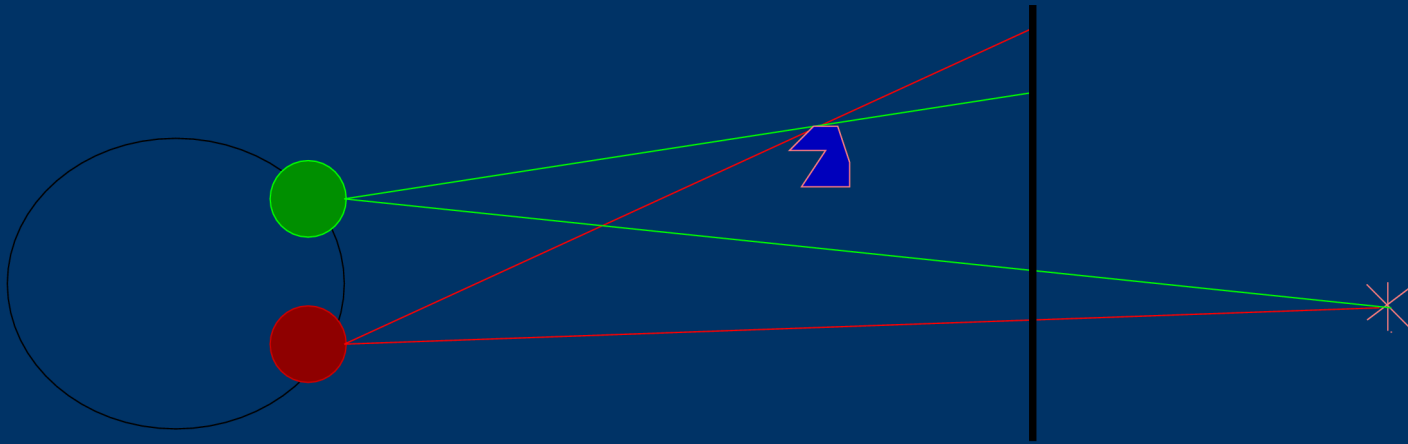
Dome stitching...

- ... in other forms too, like this all-sphere map.
- Some renderers (e.g. Star Renderer) only do planar projections. And it suffers from edge artifacts so we *need* to blend.
- None generally available when we started this, so wrote our own stitcher.



Stereoscopic Rendering

- Two views from slightly different viewpoints
- Views differ by a shear, *not* a rotation!
- Ideally, how virtual camera sees virt. screen should match how viewer sees real screen.
- But stereo vision is pretty forgiving if you avoid conflicting cues and extreme convergence.



Stereoscopic Rendering

Choosing virtual eye separation?

- Depends on distance to nearest objects...
- ... and tolerable convergence angle ($\sim 1-2^\circ$)
- May vary enormously with time in multiscale scenes
- Can tie to scale of flight path!



Stereo display hardware

- Simple passive stereo
- À la geowall.org !
- 2 projectors, 2 polarizing filters, 1 screen, lots of low-cost glasses

- Ours uses JVC HD projectors
- Circular polarizers
- And Visbox packaging



Stereo display hardware



Stereo display hardware

Driven by...

- Uncompressed 1920x1080 (HD) stereo movies from ...
- A Mac or a Linux PC equipped with ...
- A RAID disk array of 8-12 drives

When we built ours, CPUs couldn't decompress HD at 30 fps. Not so today!
