

Visualizing the Inner Structure of N-Body Data using Splatting and Skeletonization

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Agenda

- [Background

- N-Body Simulation

- Volume Rendering

- Skeletonization

- [What I'm Going to Do

- [Architectural Overview

N-Body Simulation

— [Calculate forces acting between high number (N) of bodies

— [Many different techniques

— [Result is position, velocity, and acceleration of each body

GRAPEcluster

- [RIT has a 32-node cluster of machines containing GRAPE accelerator boards
- [GRAPEs operate at ~ 1 TFlops and can handle up to 0.5 million bodies



<http://grapecluster.cs.rit.edu>

Volume Rendering

- [Volume = 3d structure with values at points called voxels

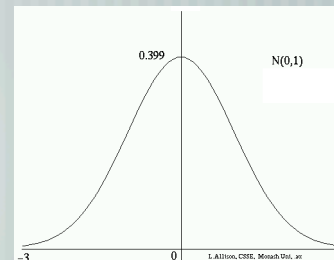
- [Rendering maps voxel value to opacity and color

 - This is the classification step

- [Many techniques, but I will deal with Splatting

Volume Splatting

- [Throw each voxel at the image plane, like a snowball
- [Voxels leaves a gaussian circle
- [Size, opacity, and color depend on the voxel value and distance from image plane
- [Can work back-to-front or front-to-back with different blending functions



Volume Splatting, cont.

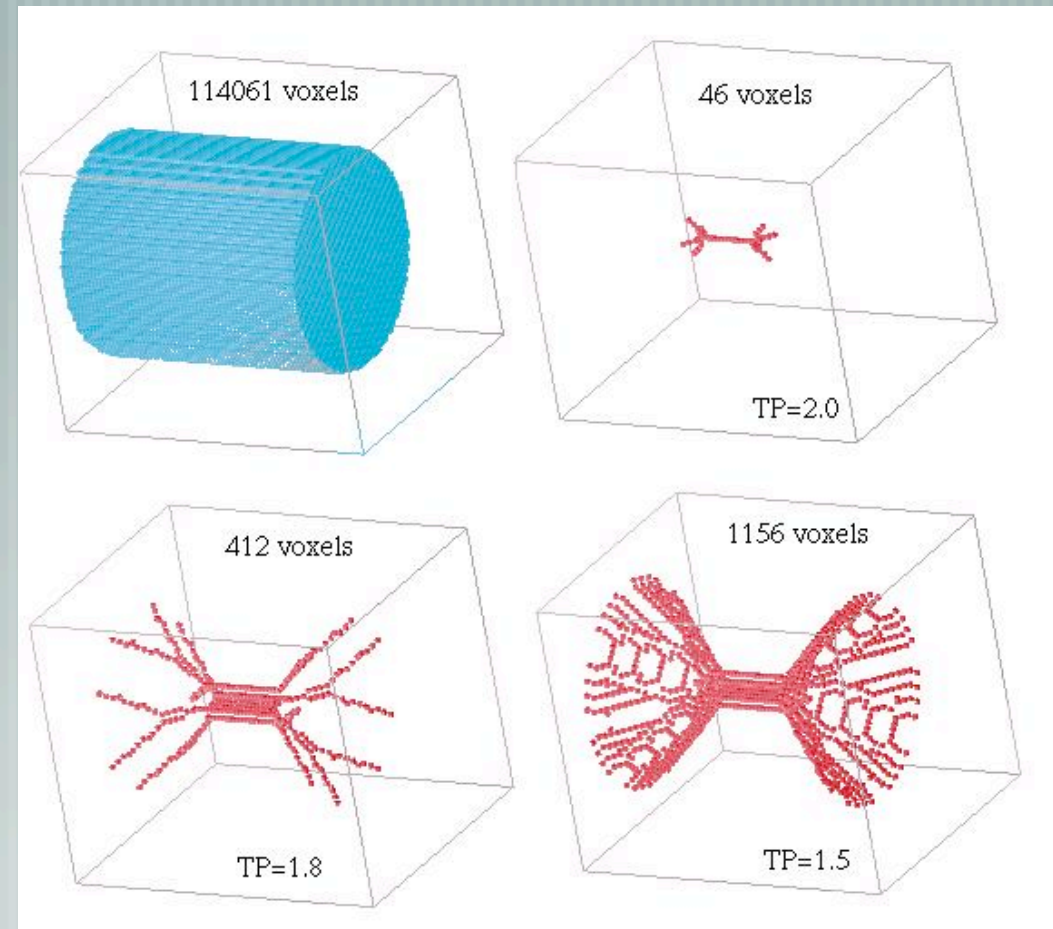
- [This is “regular” splatting

- [Hierarchical splatting will also be implemented

- [Allows lower resolution rendering for interactive manipulation and higher quality resolution for final rendering

Skeletonization

Skeleton = Medial Surface



Skeletonization, cont.

— [Compute distance from voxel to boundary

— [Discard voxels below a weighted threshold

— [Yields skeleton that is not necessarily connected

— [Connect voxels using a minimum spanning tree

What I'm Going to Do

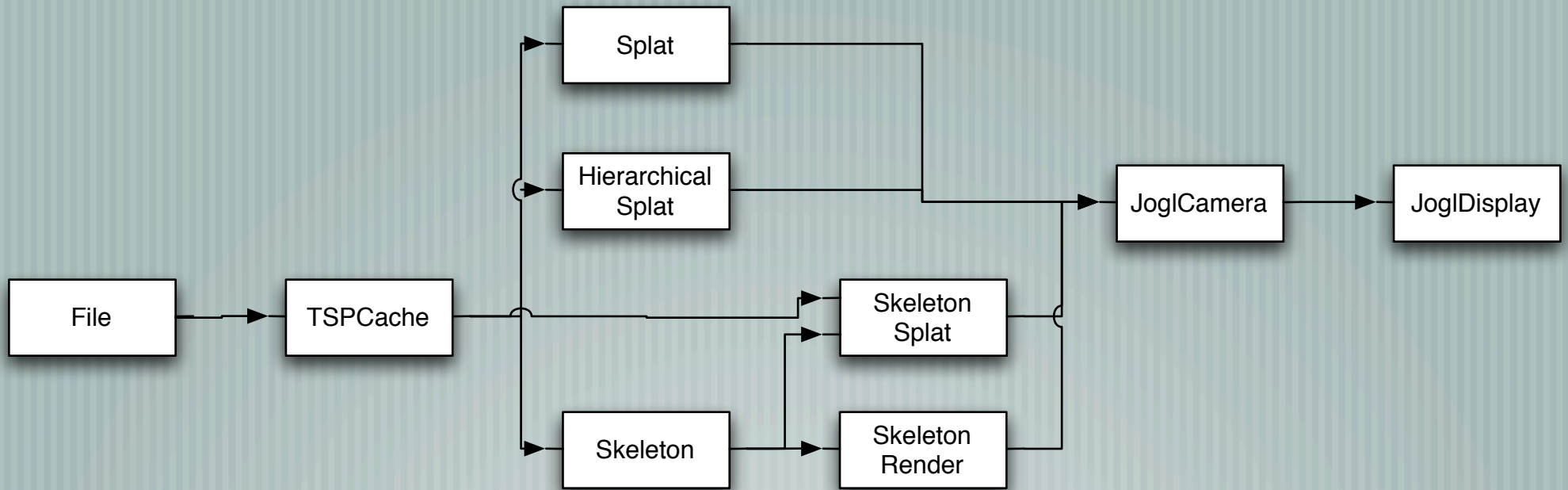
— [Extract skeleton from a n-body dataset

— [Use skeleton to accelerate splatting

— [Voxels close to skeleton will be rendered with higher resolution

— [Or voxels close to skeleton will be rendered first

Architectural Overview



Questions?

<http://www.cs.rit.edu/~erd4819>