Development of the mouse skull

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We are developmental biologists

Our emphasis is to establish Phenotype / Genotype correlations through high-resolution volumetric imaging, statistical shape analysis and genomics.

- **Changes in development due to Fetal Alcohol Exposure (FAE) and how this affects the development of the craniofacial complex specifically.**

- Phenotypic characterization and comparison of new craniofacial mutations.

- Statistical associations between genomic regions and complex phenotypic traits (e.g. skull shape)

Imaging Modalities:

Optical Projection Tomography for embryos
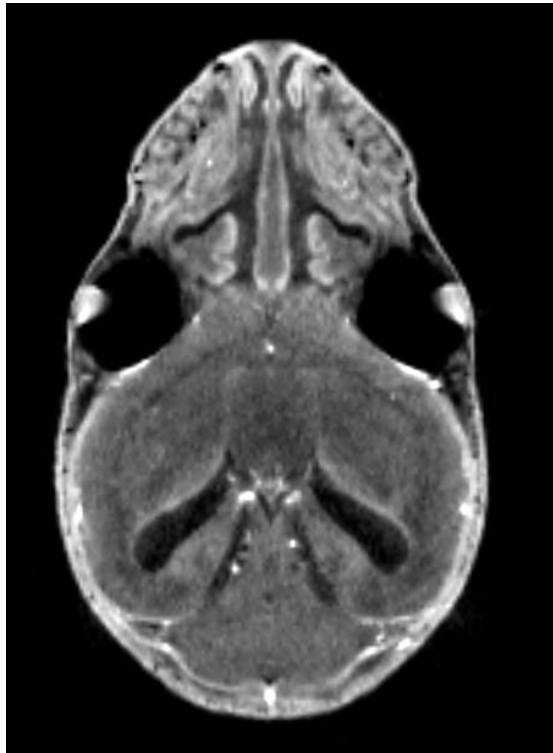
MicroCT for mineralized specimens (aka adults).
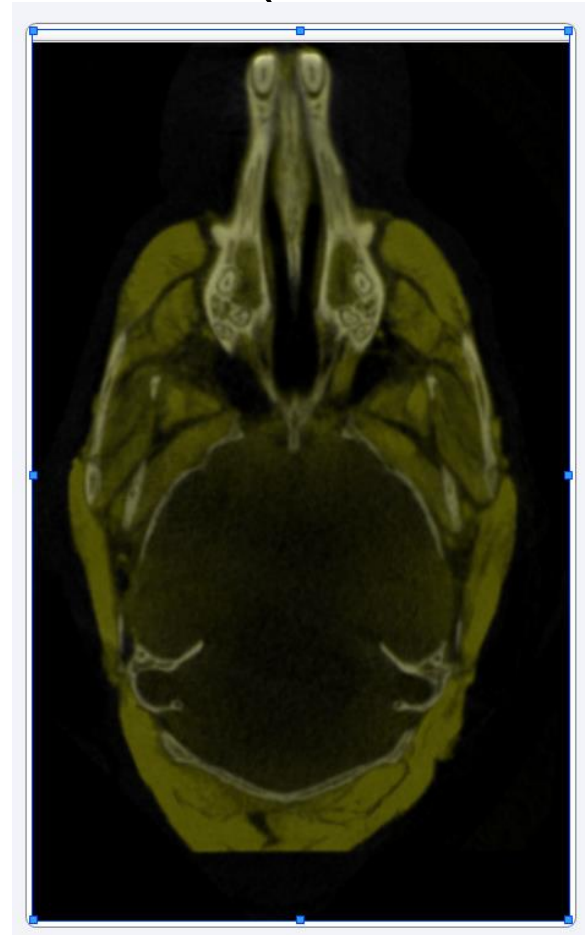
# Slicer and issues with our use cases

We use Slicer for visualization, recording coordinates of anatomical landmarks, segmentation and registration.

1. We have large datasets 1024^3 or larger with small voxel sizes around 6-35 micron range. Rendering, units, fiducial sizes/text, ScalarOpacityUnitDistance variables major issues for us.

2. Specimens moving out of FOV in the VR module when the "center" icon is used

3. Etc. we have a list on wiki..

# Also looking for collaborations for our challenges

We have large sample sizes (~500-600 OPT datasets):

1. We want to be able to quickly and accurately segments brain from these scans so that we can run coupled analysis of the face and brain phenotypes (Face is a major diagnostic feature of FAS).

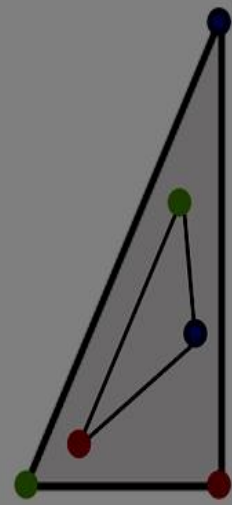2. Large scale shape changes throughout the development makes automated shape analyses challenging.
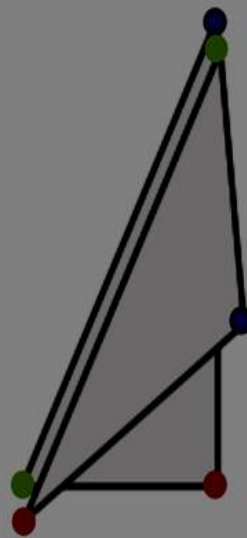

Embryos 11-18 days
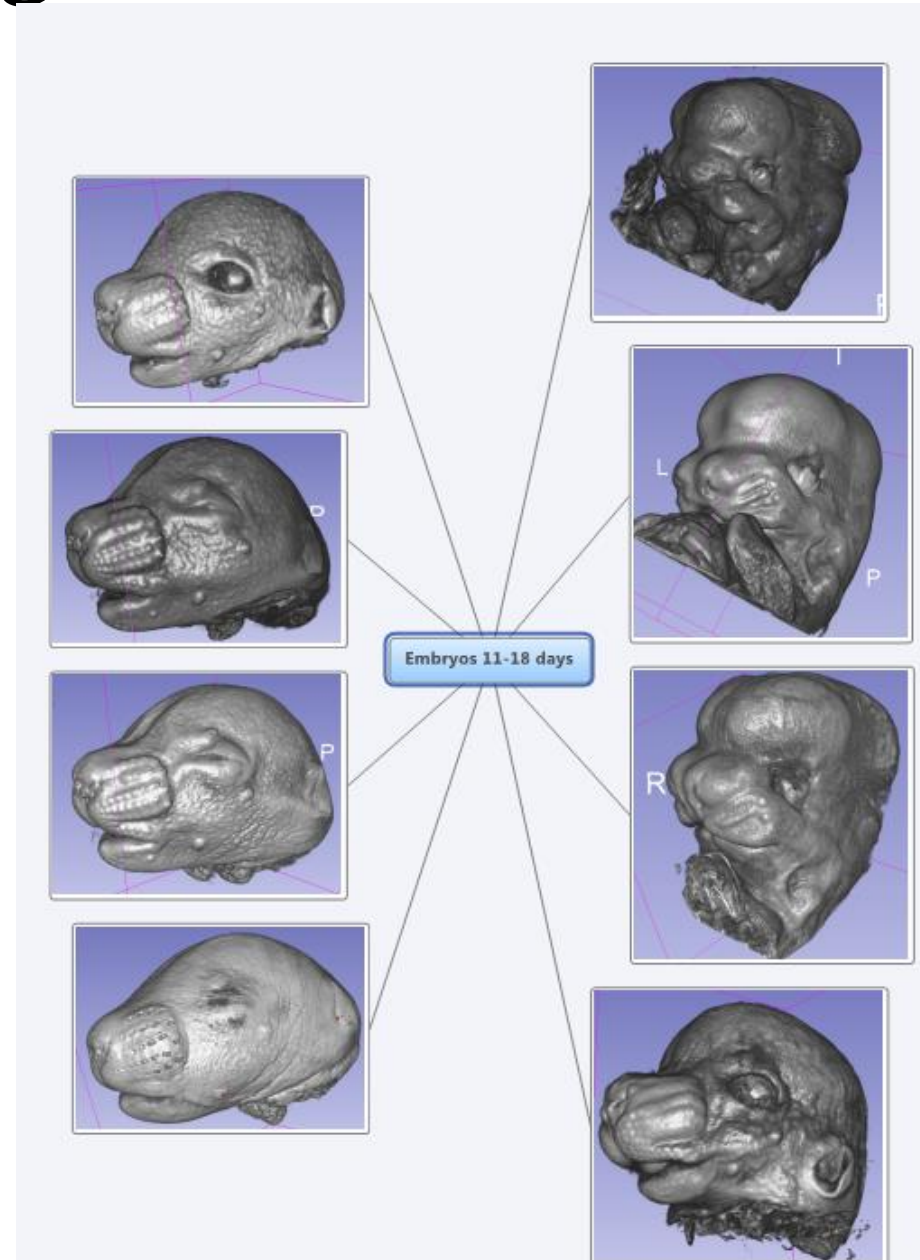
Project Week Goal: Procrustes Shape Analysis in Slicer
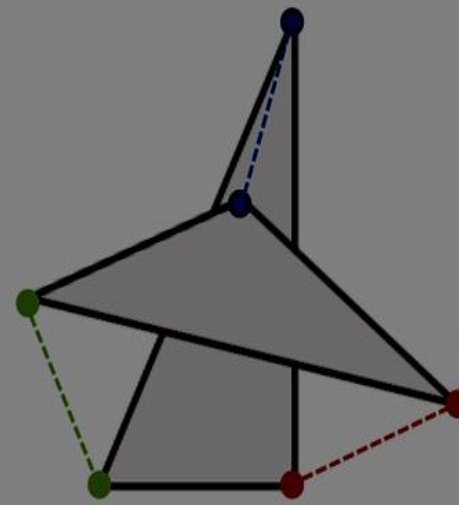
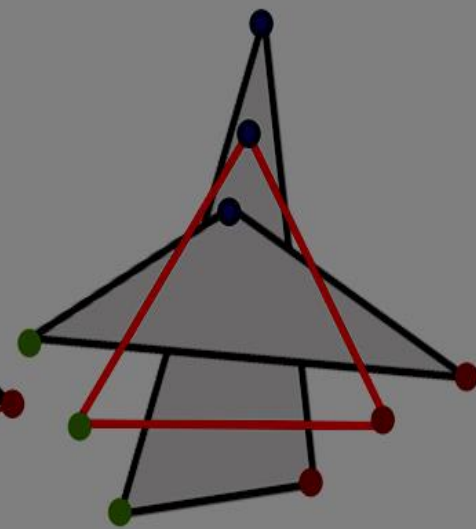## Basic Generalized Procrustes Approach
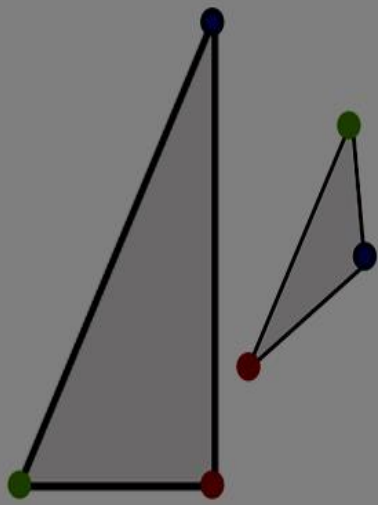
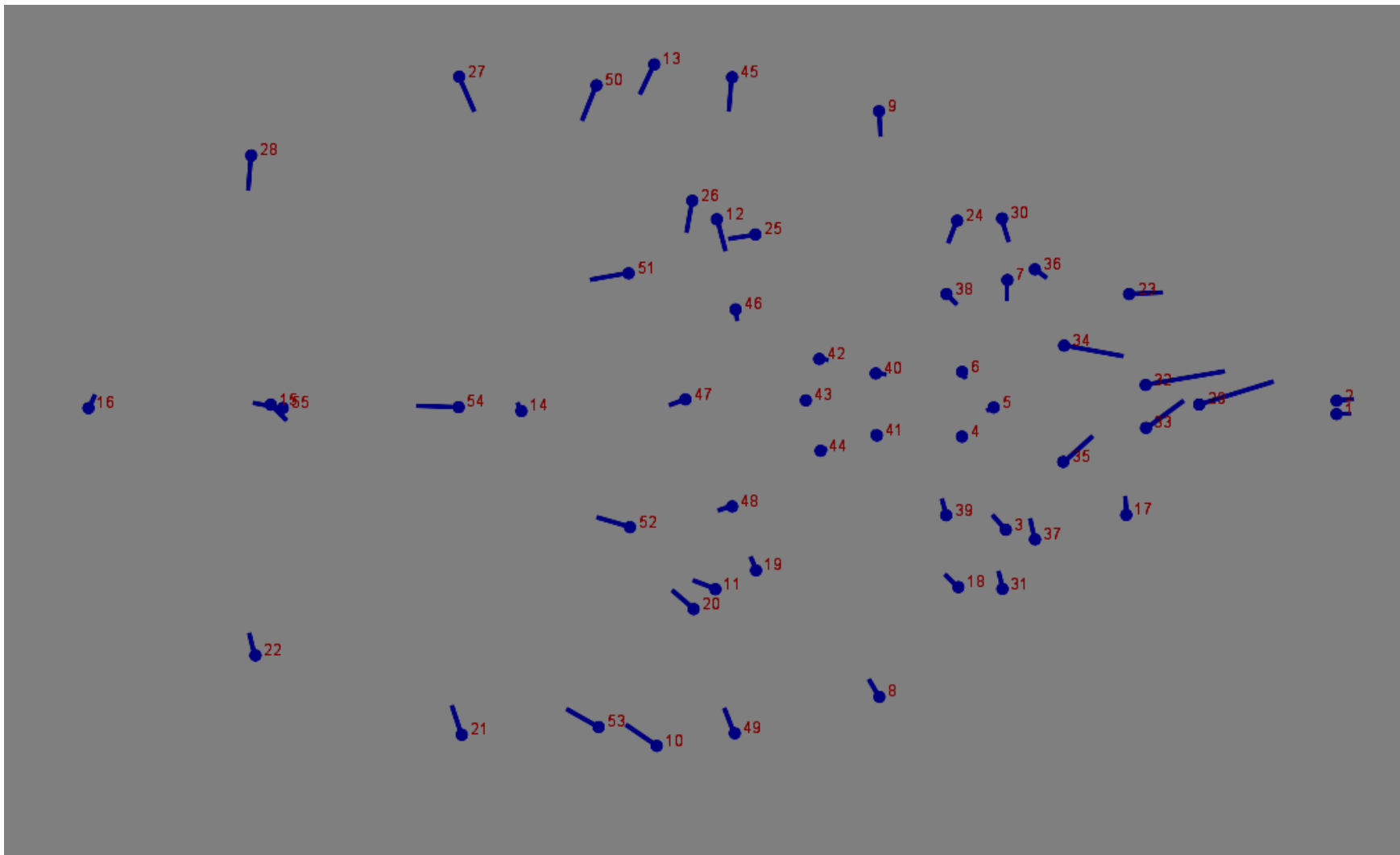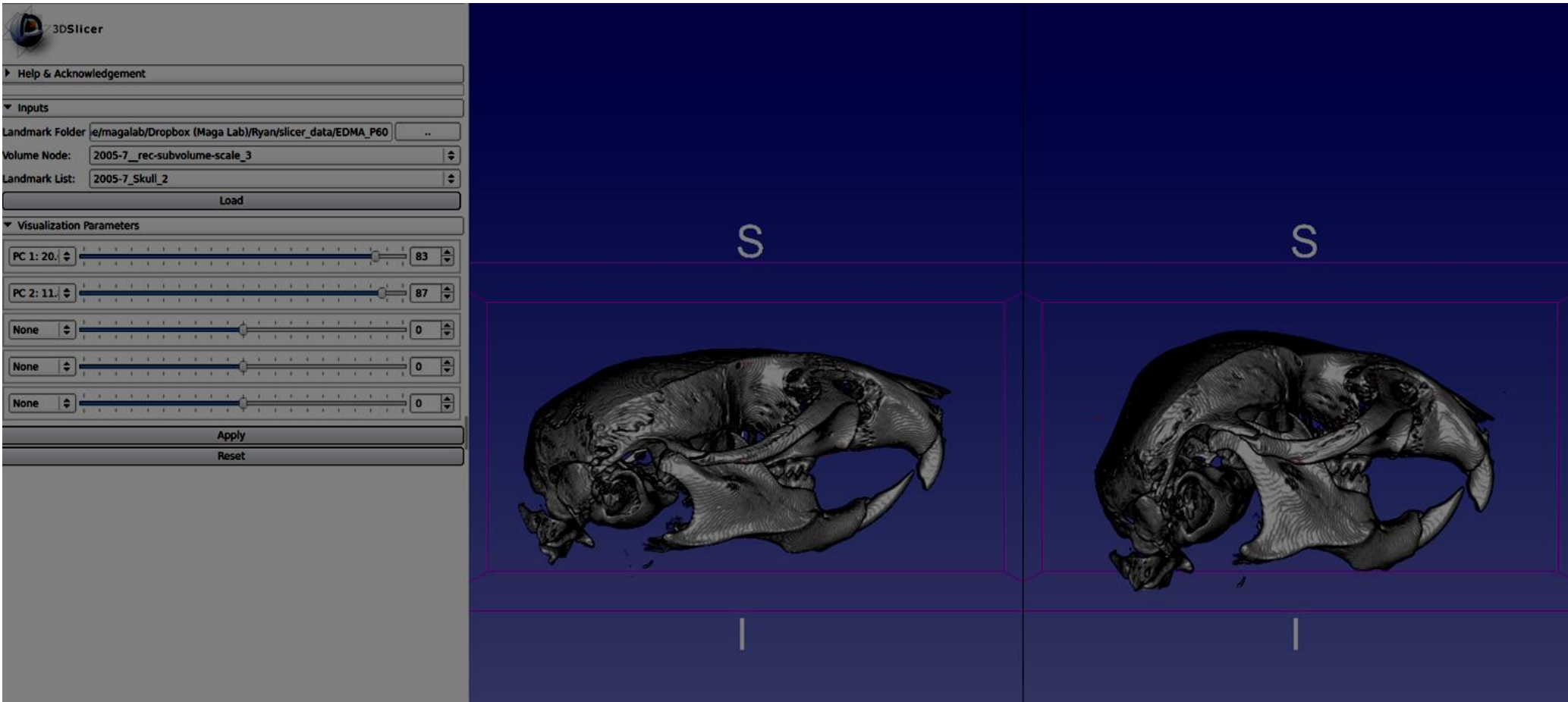Original Configurations   Superimposition   Scaling   Rotation   Iterations to minimize the difference

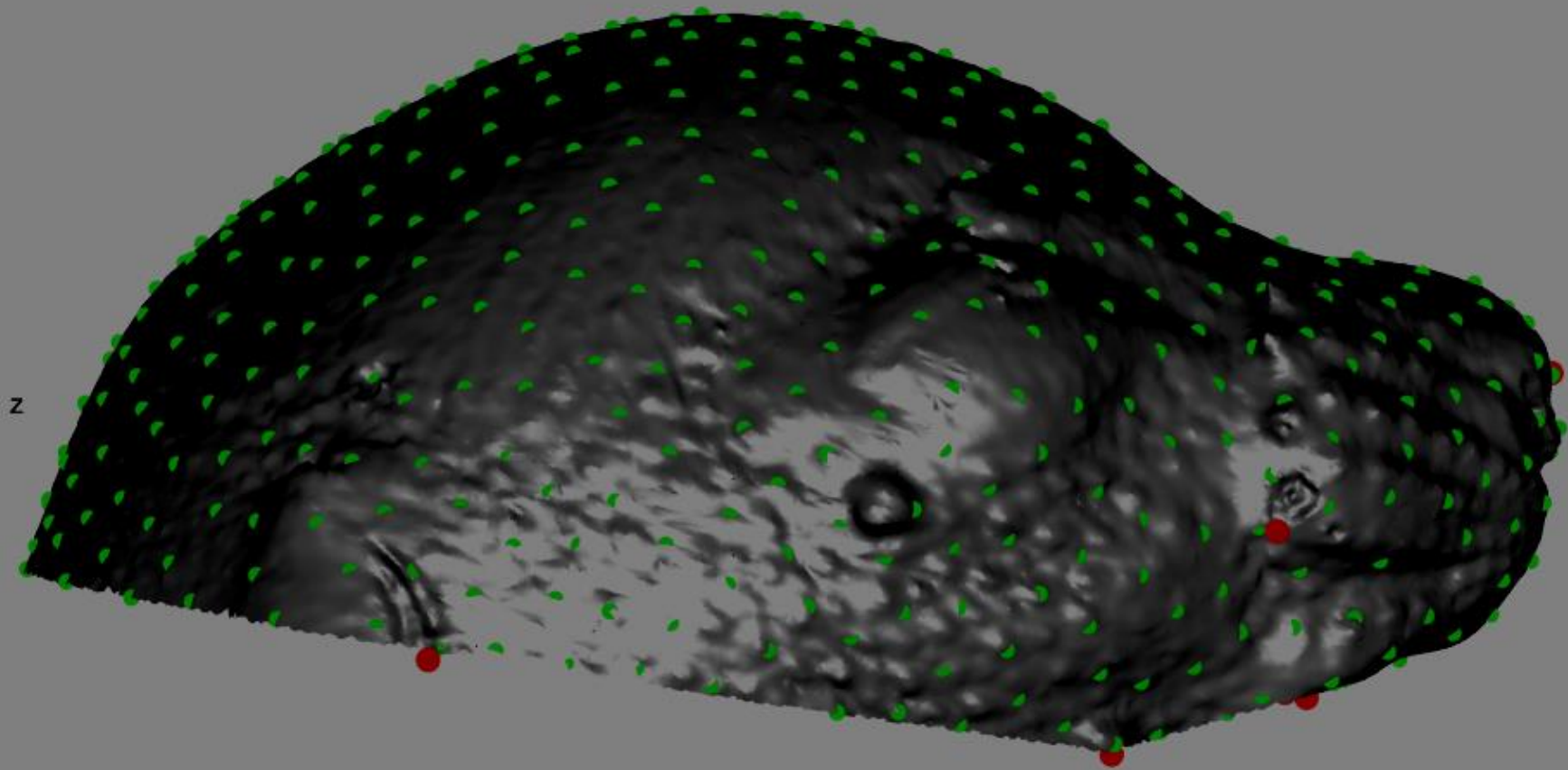# Lollipop graphs of shape variation decomposition

Currently in Slicer (on volumetric data, not meshes)
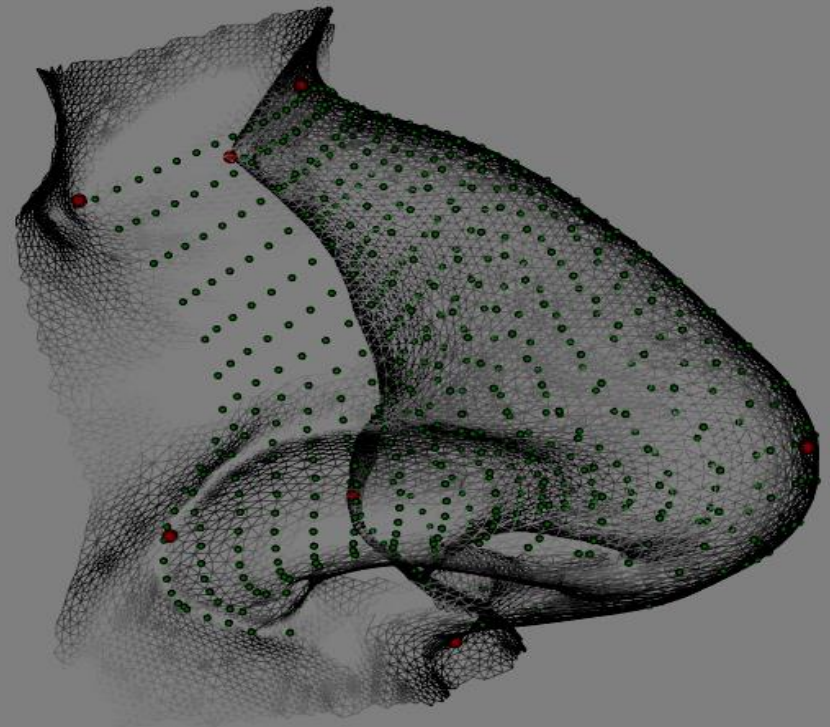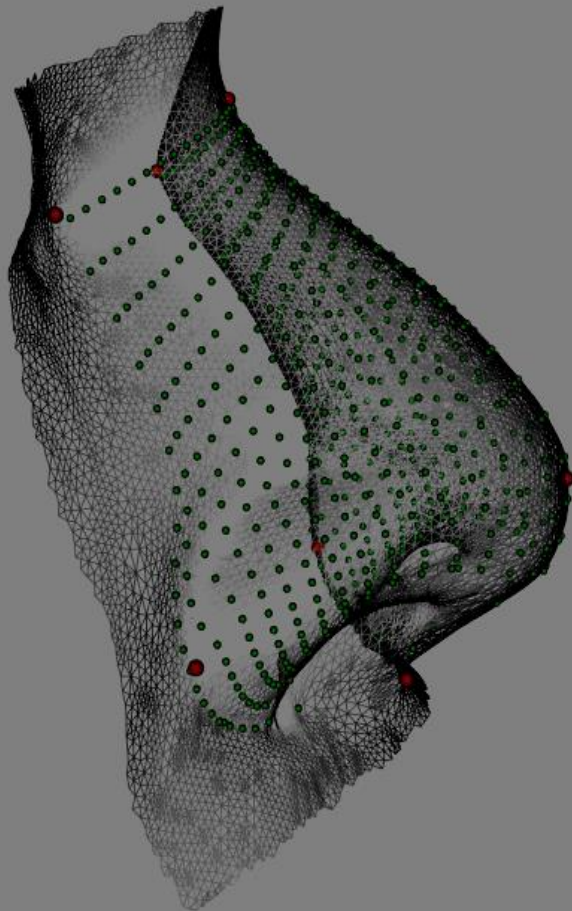
Working on implementing templates

- Generated on meshes using Poisson Disk

- Need to generalize to surface

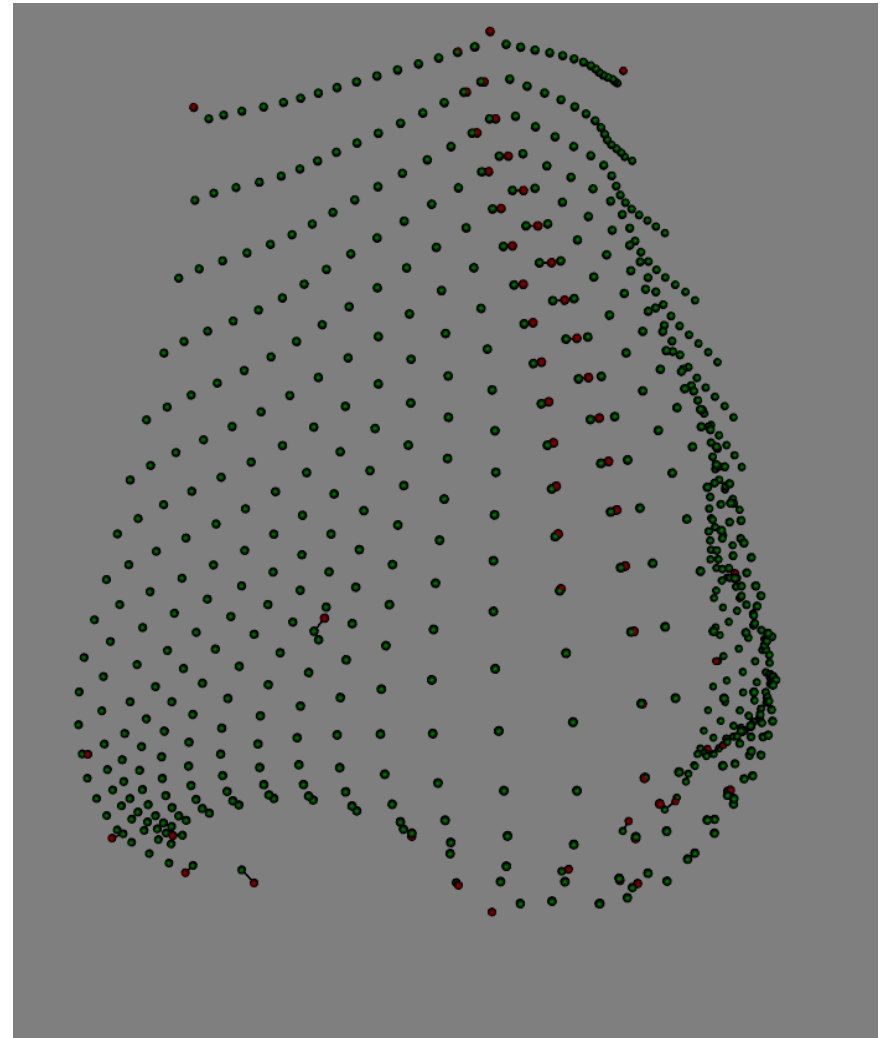# Working on implementing accurate template transfer

Sliding the template on the target.

- Goal is to minimize the bending energy between GPA aligned samples

- Difficulties include

- Finding normals and tangent planes on volumetric data
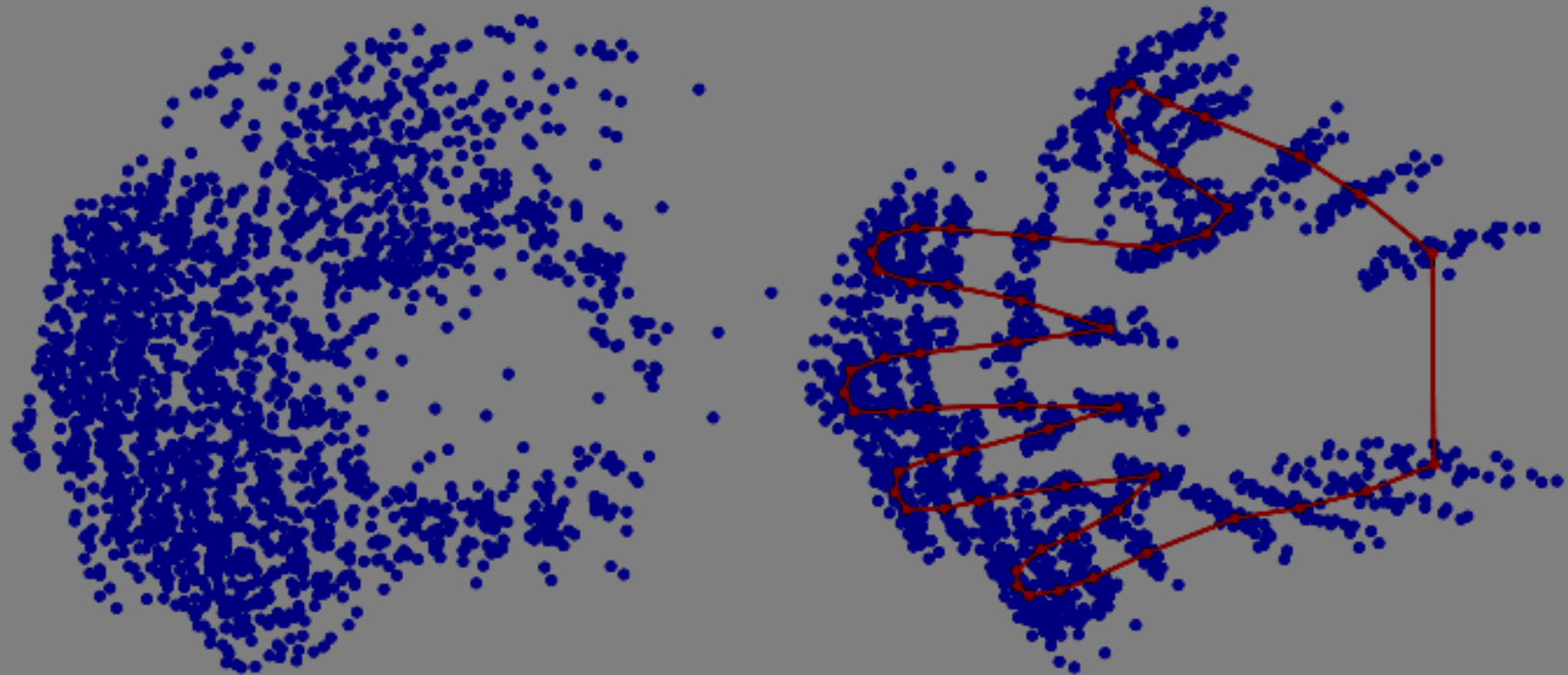
- Sliding along correct surface

Figure 7: Left: 40 unaligned annotations. Right: 40 aligned annotations with mean shape in red.

Principle Component Analysis