

3D software workshop for Cranio Maxillo-Facial applications

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Two ways to answer our clinical research questions:

- **LONGITUDINAL**- Understand the patient specific virtual reality and time changes: the 4th dimension
- **ACROSS SUBJECTS** - Understand the disease and populational characterization of morphology: classification of individual morphology within each clinical condition

Clinical questions

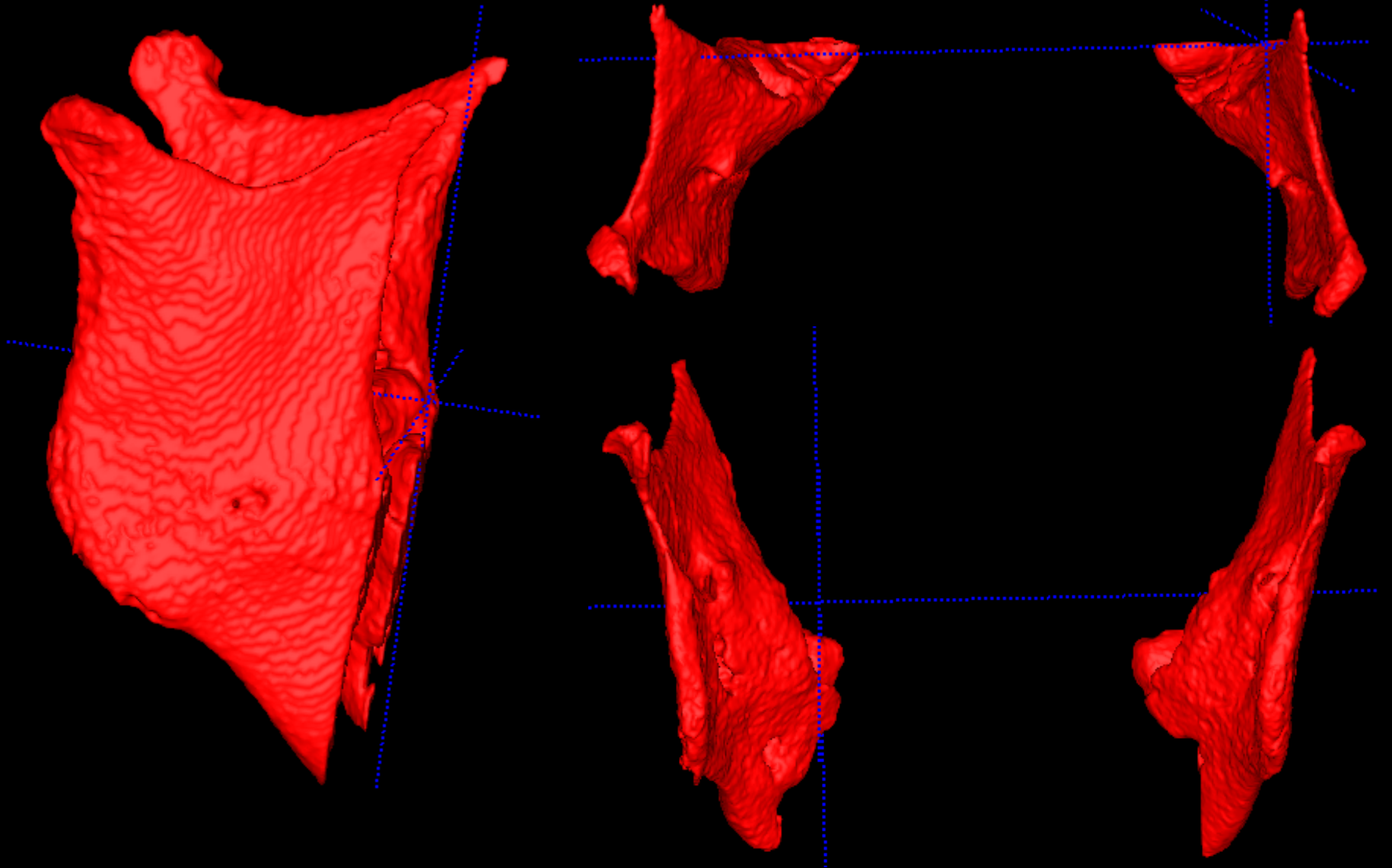
Diagnosis

Treatment Planning

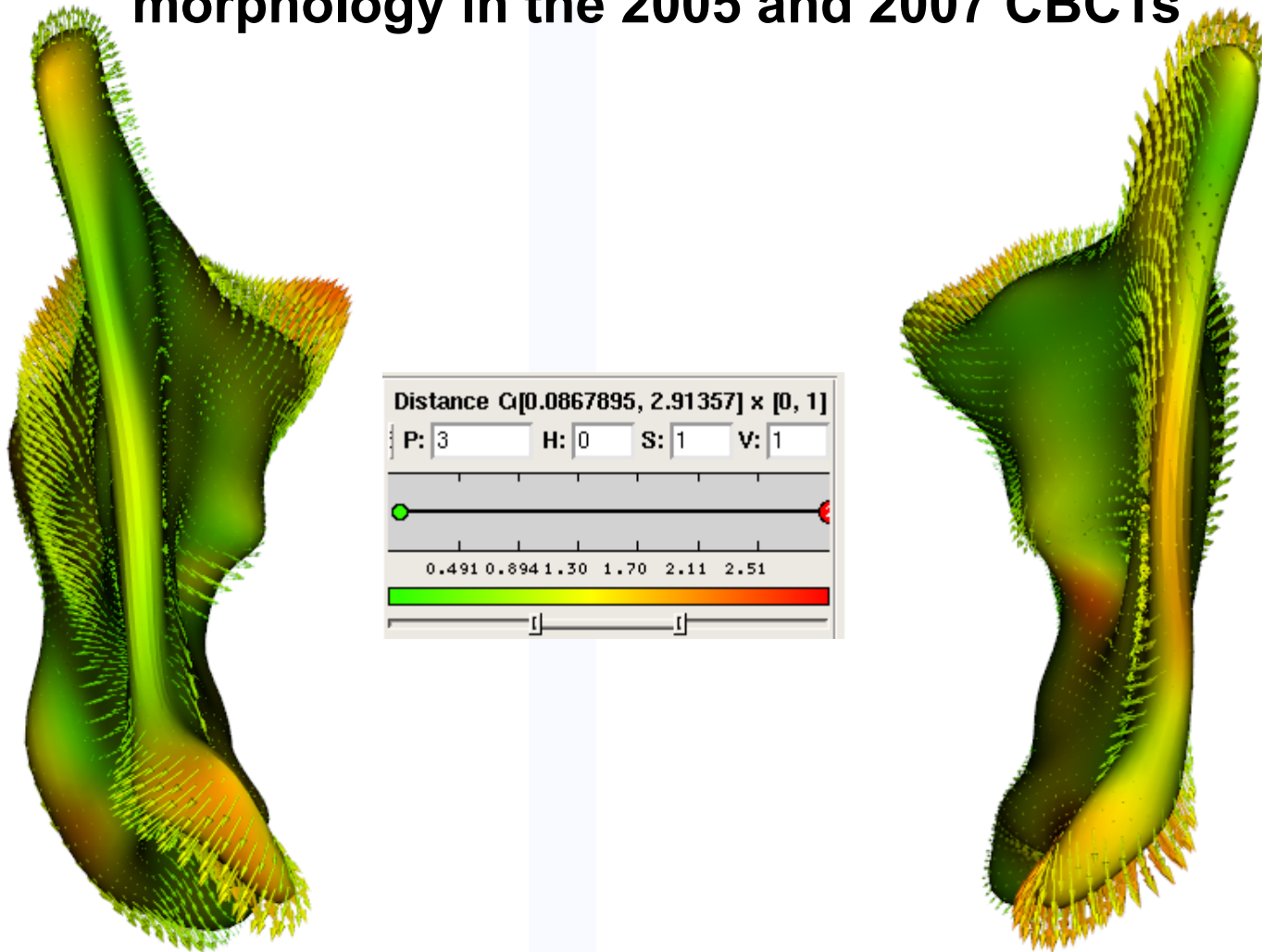
Computer simulations of growth and treatment

Treatment outcomes

CBCT 3D models – 8/05



Shape analysis showing the vectors of the differences between the ramus and condylar morphology in the 2005 and 2007 CBCTs



SPHARM+PDM software (<http://nitrc.org>)



**What clinical questions
can be answered?**

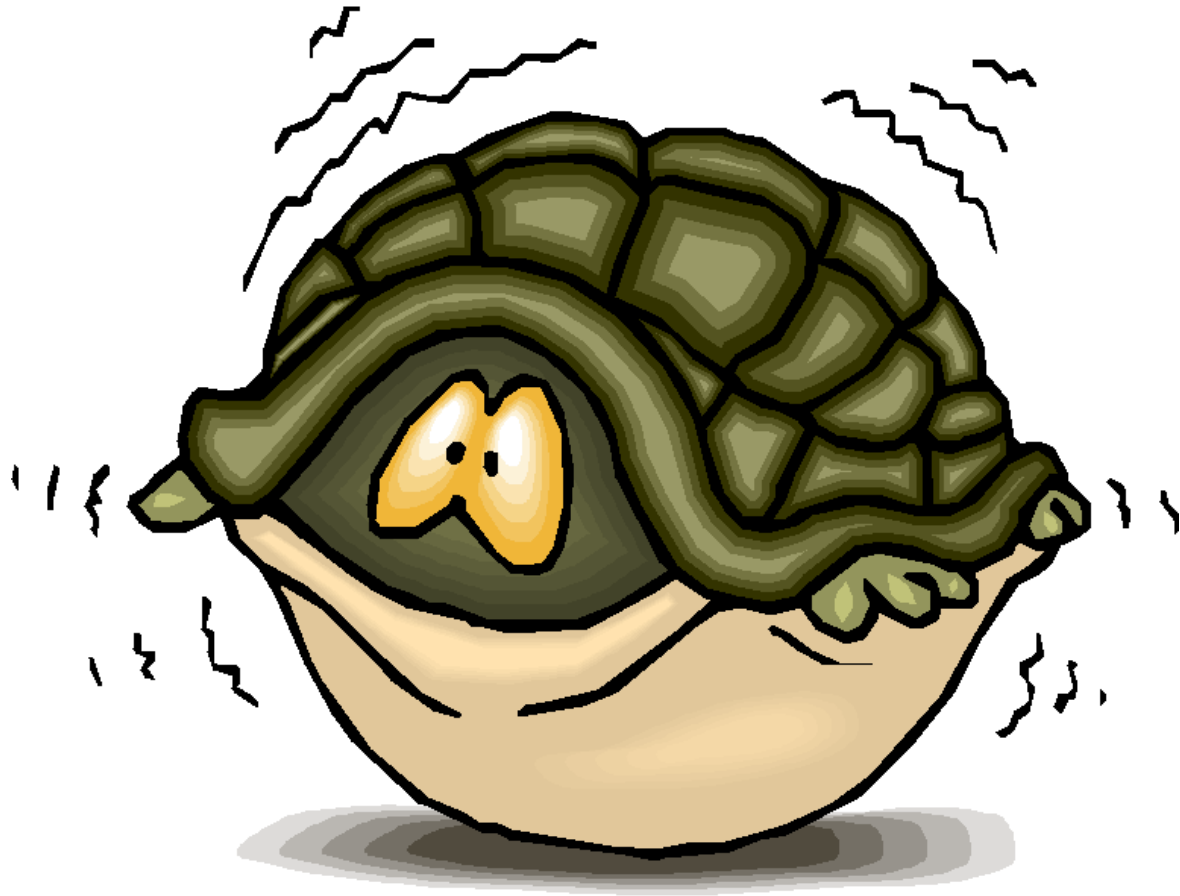
Palomo



“Opportunity to learn more about the craniofacial structures we treat and to be more scientific.”

“However, some of us might be afraid to learn how little we know.”

CONCERNS AND FEARS



Will 3D measurements **improve**
diagnosis, treatment planning and
outcomes,

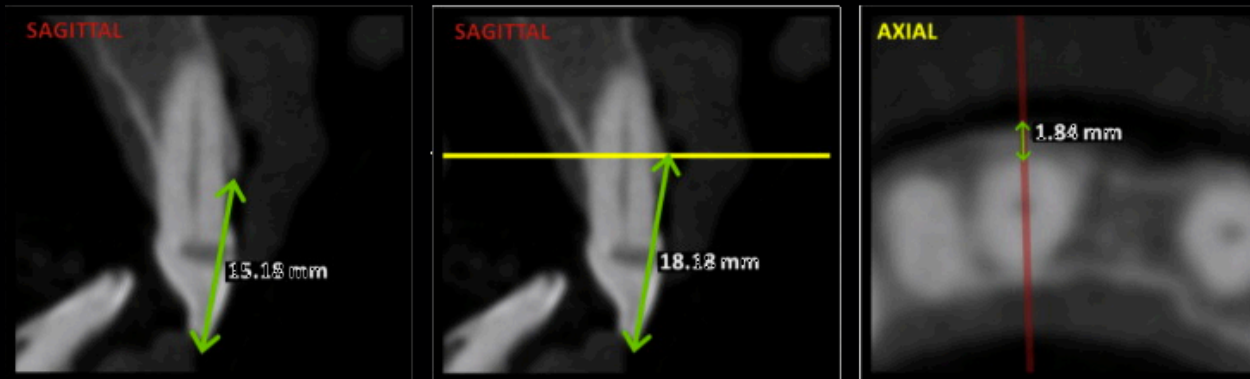
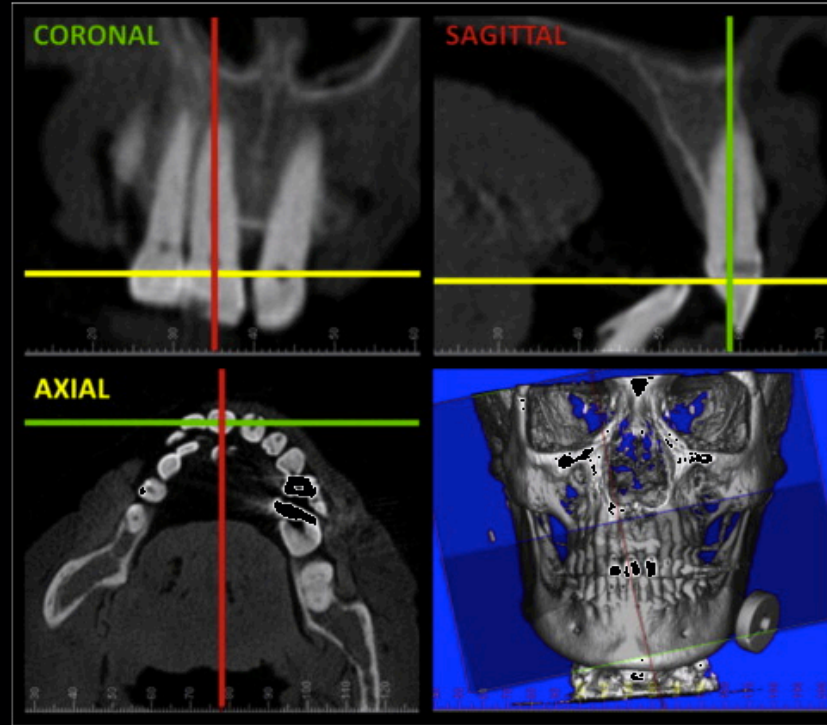
or

will it **introduce more
errors and bias** if we do not
know what we are doing?

Red Flags of Challenges in 3D Measurements

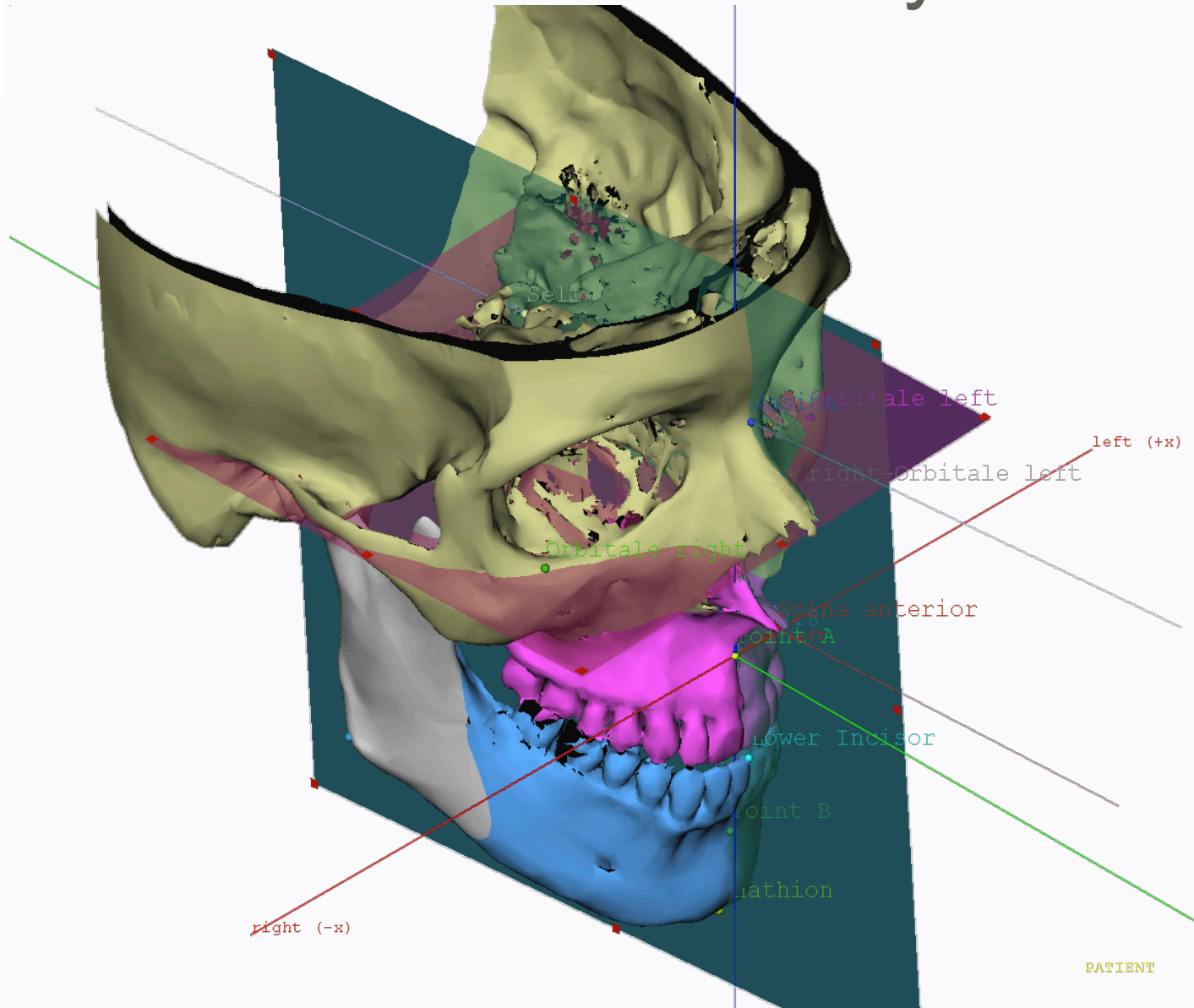


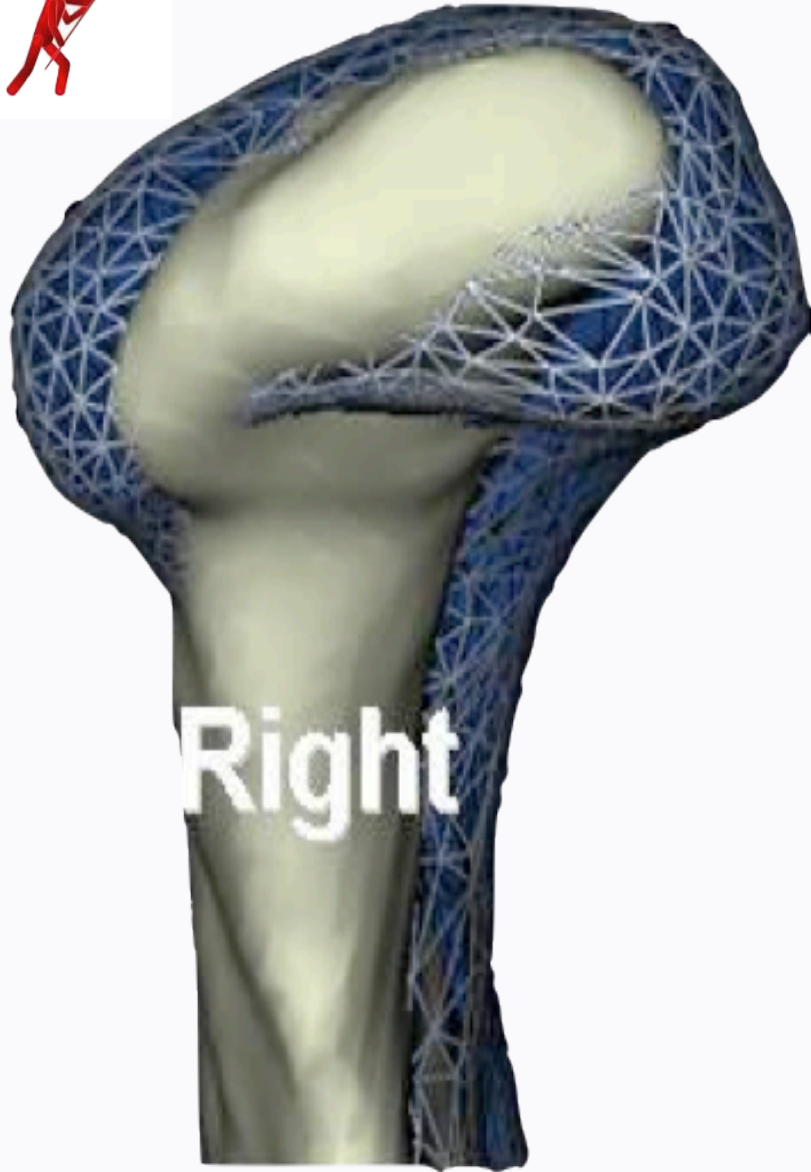
Standardization of 3D Measurements in Cross-sectional Slices



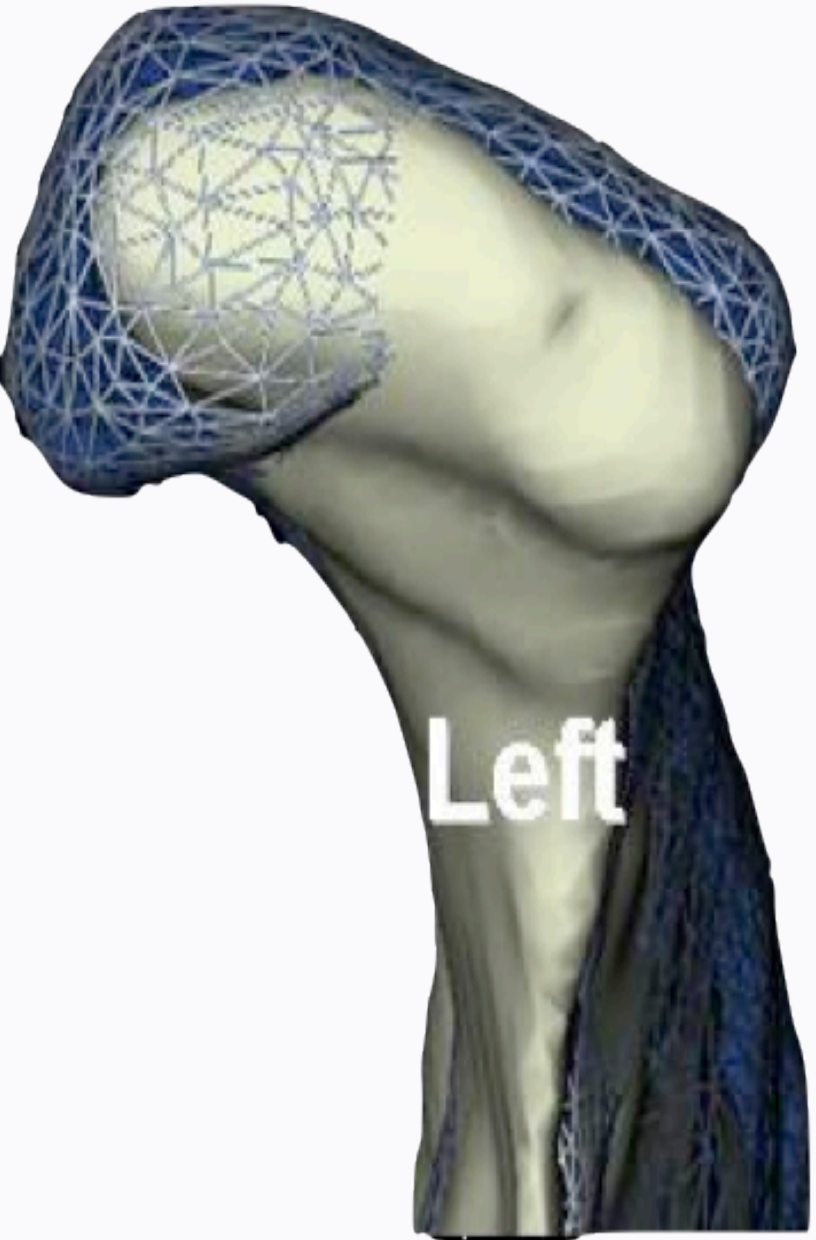


Individual Coordinate System





Right

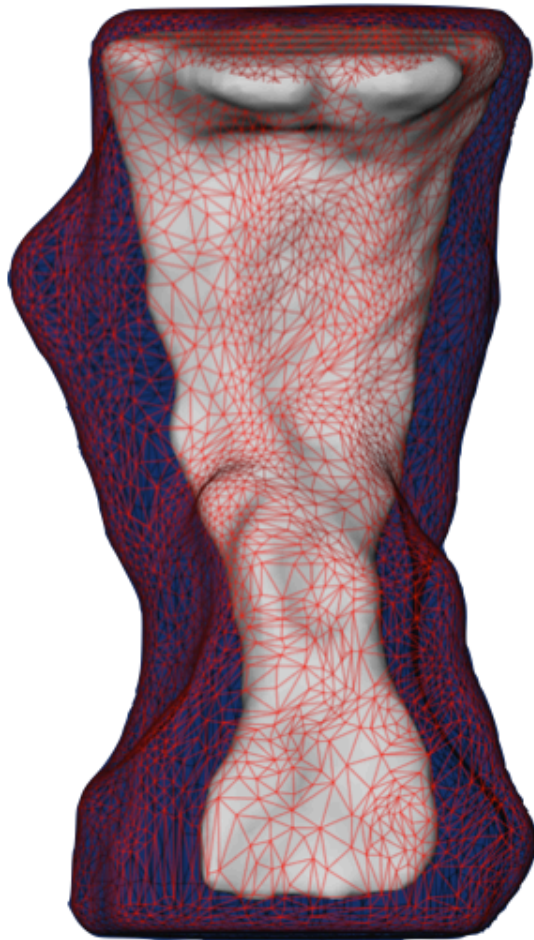


Left

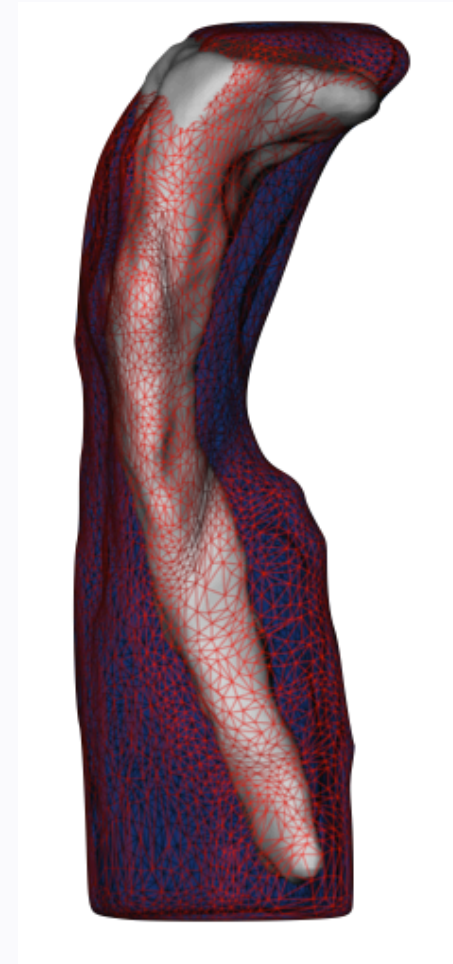


Airway measurement

CBCT: NOT for function and growth of the nasopharynx Naso-Respiratory shape is meaningless

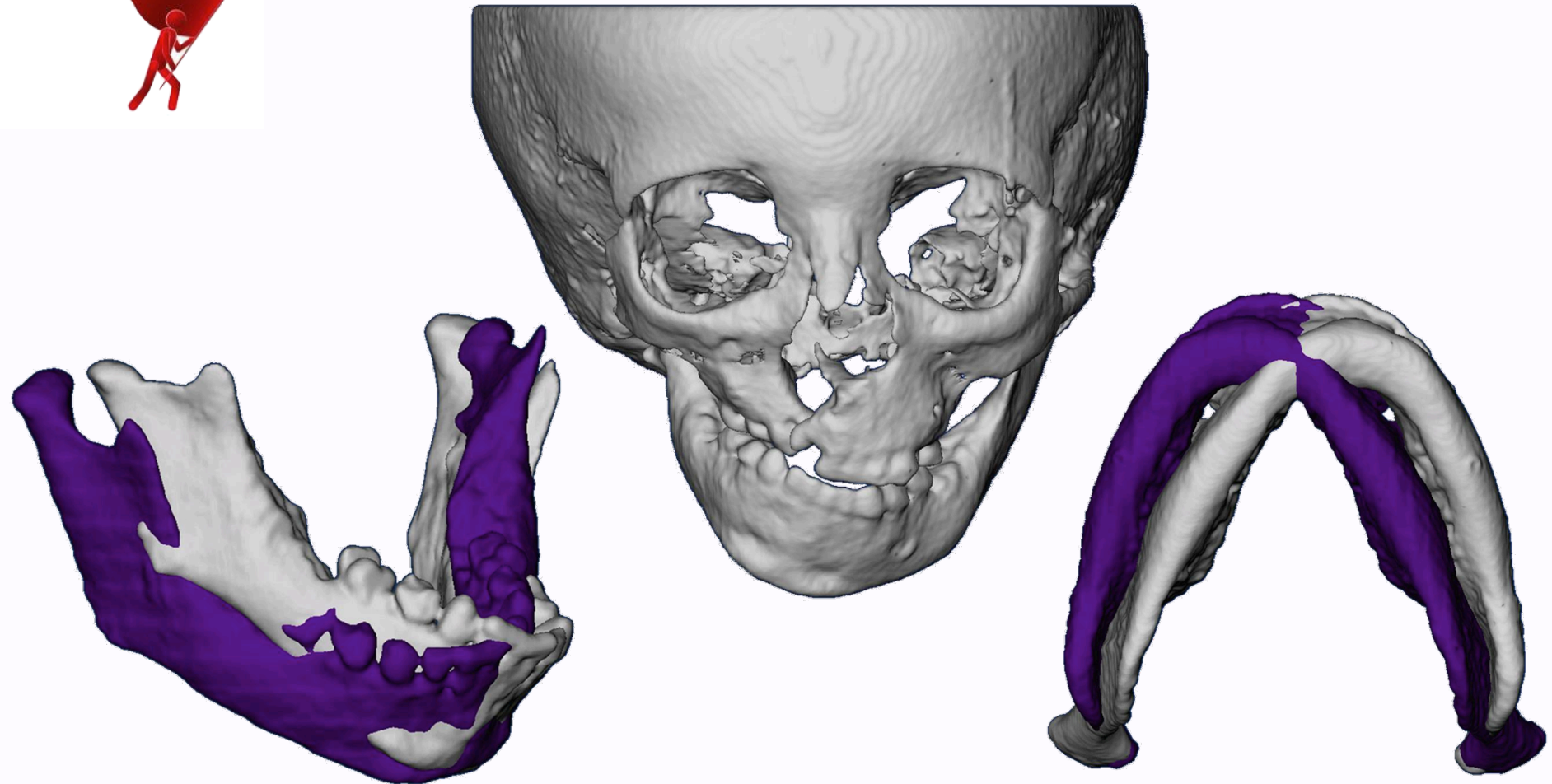


18 month
follow up
Initial

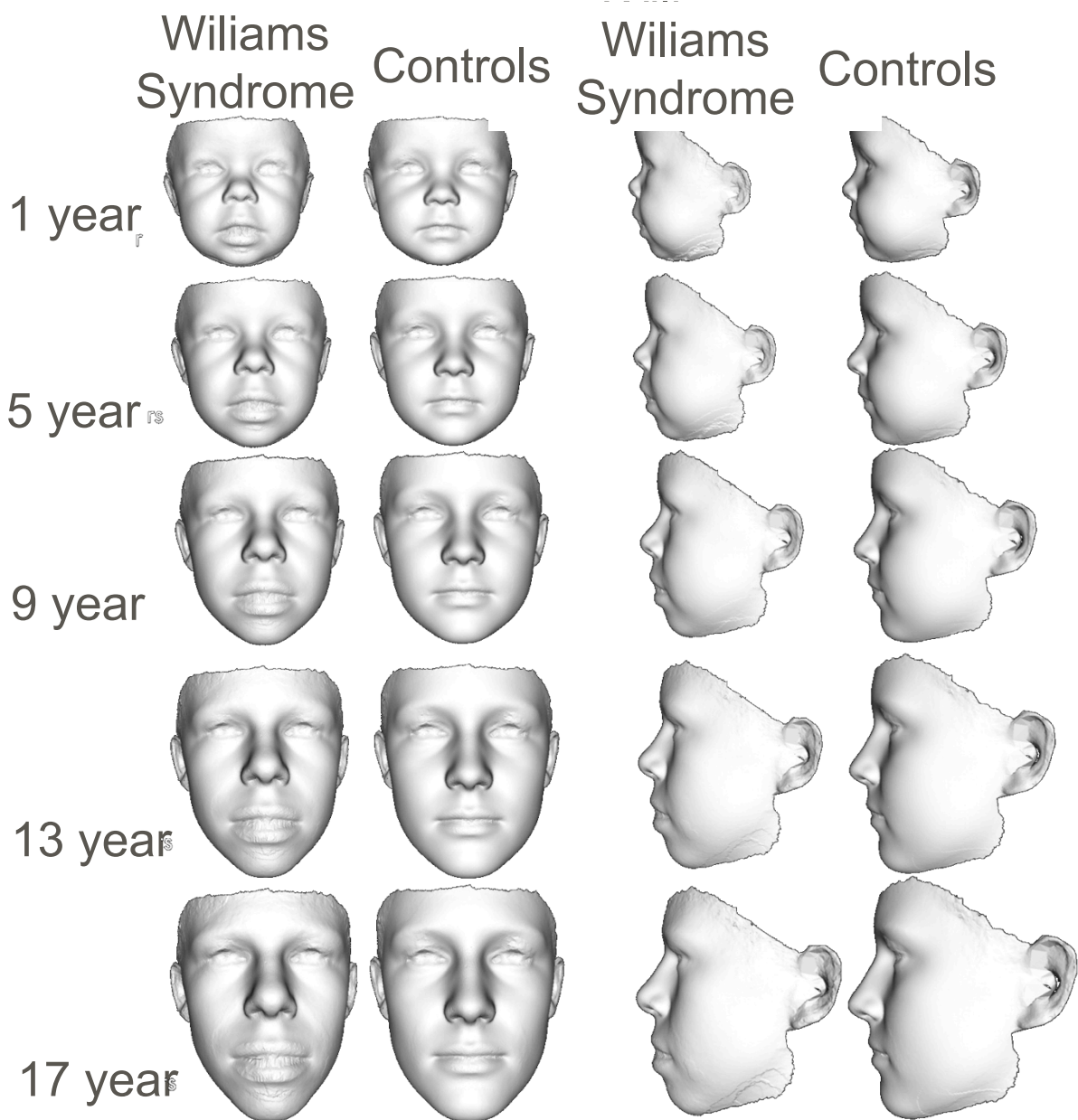


Chaves, Cevidanes, Porto, Moro, Goncalves & Conley-
To be presented at IADR 2012

Mirroring without correcting mandibular yaw and pitch deviations is misleading !



AlHadidi, Cevidane, Mol, Ludlow & Styner.
DMFR 2011; 40(6):351-7.



Average shape at each age group

Williams Syndrome= 69
 Controls n=187

Hammond, P. The use of 3D face shape modelling in dysmorphology
 Arch Dis Child 2007;92:1120-1126



How do we measure 3D morphology?

Front



Top



Left

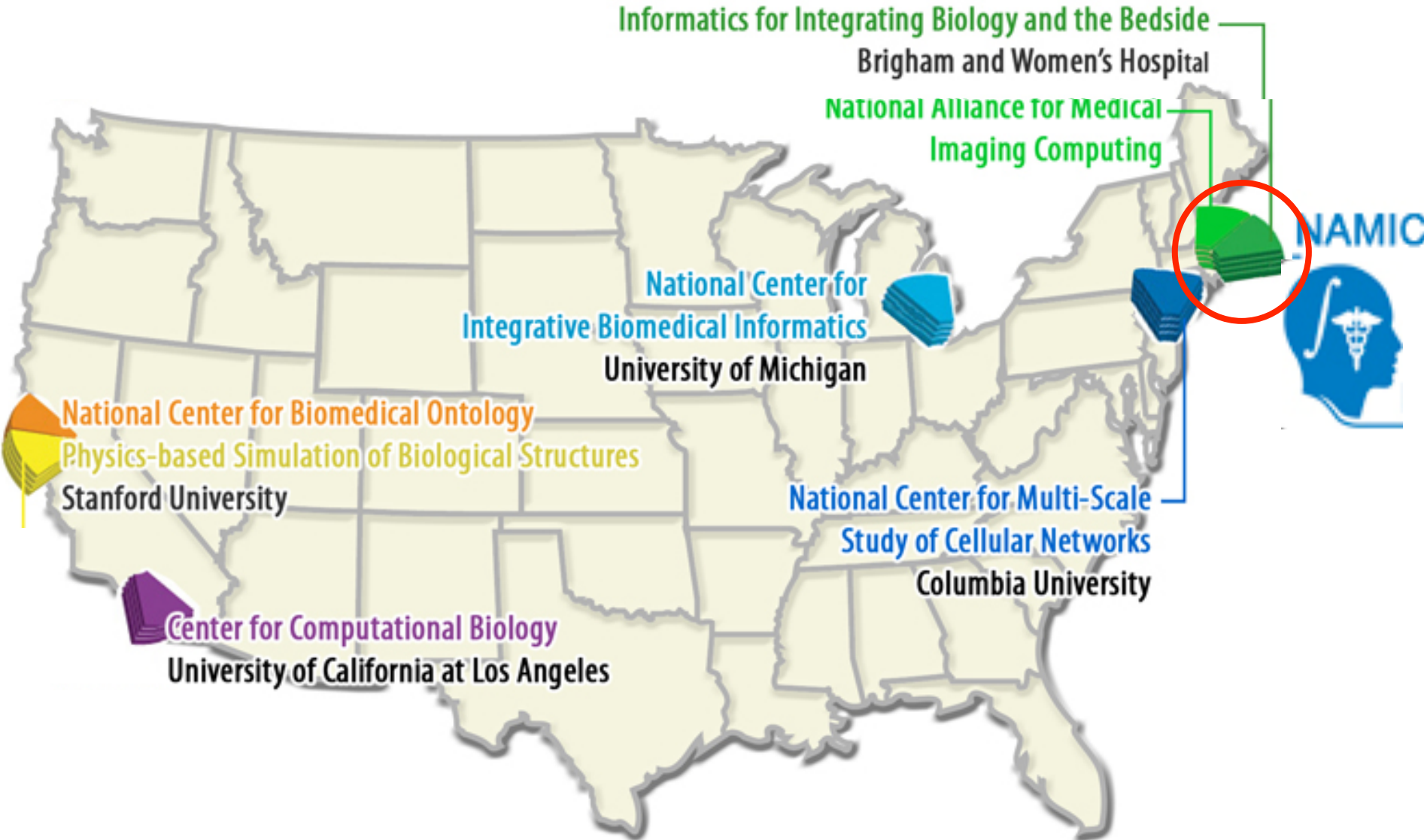


Perspective

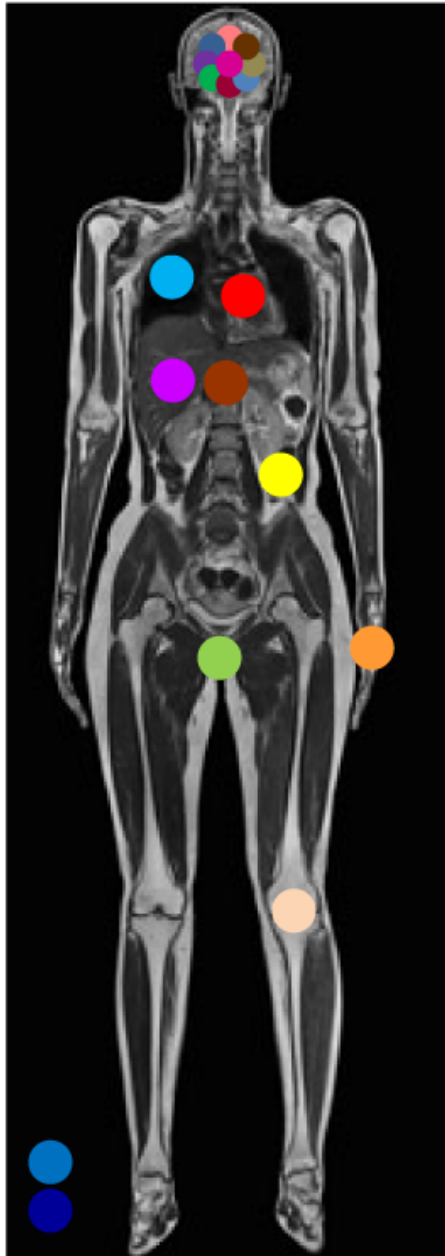


NIH Roadmap for Medical Research

National Centers for Biomedical Computing



Algorithm Core Members



- Autism
- Brain Cancer
- Depression
- Head and Neck Cancer
- Huntington's Disease
- Lupus
- Schizophrenia
- Traumatic Brain Injury
- VCFS
- Neuroimage Analysis
- Lung Disease
- Atrial Fibrillation
- Cardiovascular Disease
- Liver Cancer
- Colon Cancer
- Prostate Cancer
- Orthopedic Injury
- Neuromuscular Dynamics
- Image Informatics

- **Statistical models of anatomy and pathology**
- **Geometric correspondence**
- **User interactive tools for segmentation**
- **Longitudinal and time-series analysis**

NIH Roadmap for Medical Research National Alliance of Medical Image Computing

ITK VTK

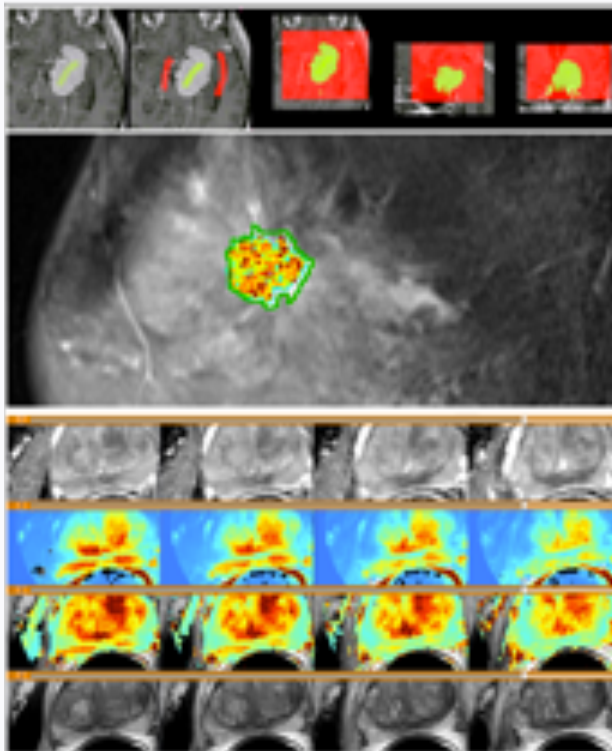


Kitware Quality Software Process

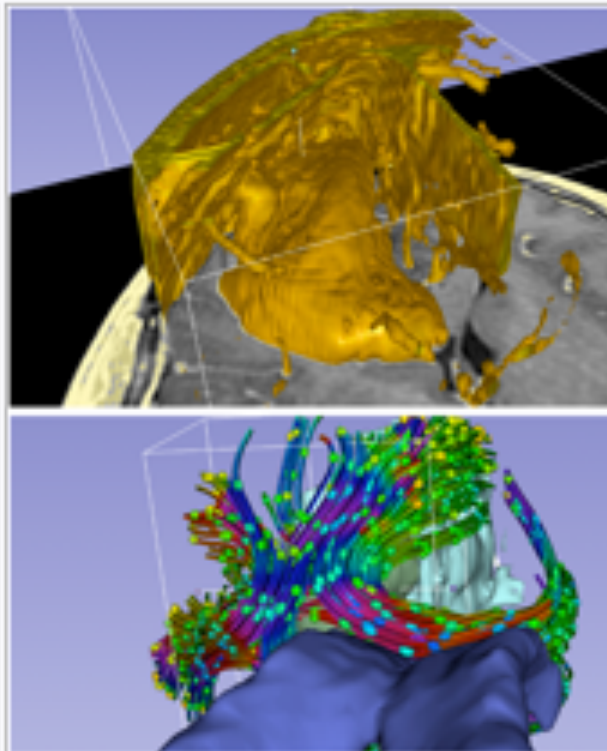


Software engineering – NAMIC , Harvard

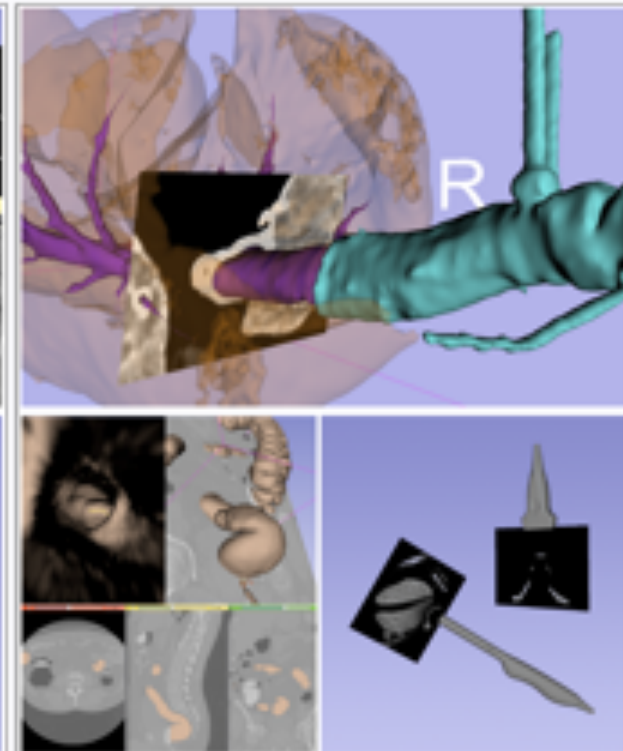
Powerful processing.



Streamlined interface.



Extensible platform.



3D Slicer *version 4.0*

www.slicer.org

Image analysis procedures- NOW

- Open image: Dicom – gipl format **ITK-SNAP**
 - Downsize **Imagine**
- Construct surface model **Intensity Segmenter/ITK- SNAP**
 - Registration **Imagine**
 - Convert surface formats **ITK-SNAP**
 - Superimpose/Overlay **Slicer**
- Quantify changes overtime **MeshValmet**

ITK-SNAP

http://www.youtube.com/watch?v=6zzlTaq8Sml&feature=youtube_gdata_player

Open Source Dental Tools- 2015 _ Hands on Workshop

- Open image: Dicom– gipl format **ITK-SNAP/Slicer**
- Downsize **Imagine/Slicer**
- Construct 3D surface models **ITK-SNAP/Slicer-Int.Seg.**
- Register **Imagine/Slicer**
- Convert Surface formats **ITK-SNAP/Slicer**
- Superimpose/Overlay **Slicer**
- Quantify ind. changes overtime **MeshValmet/Slicer**
- Quantify populational changes **MeshValmet/Slicer**