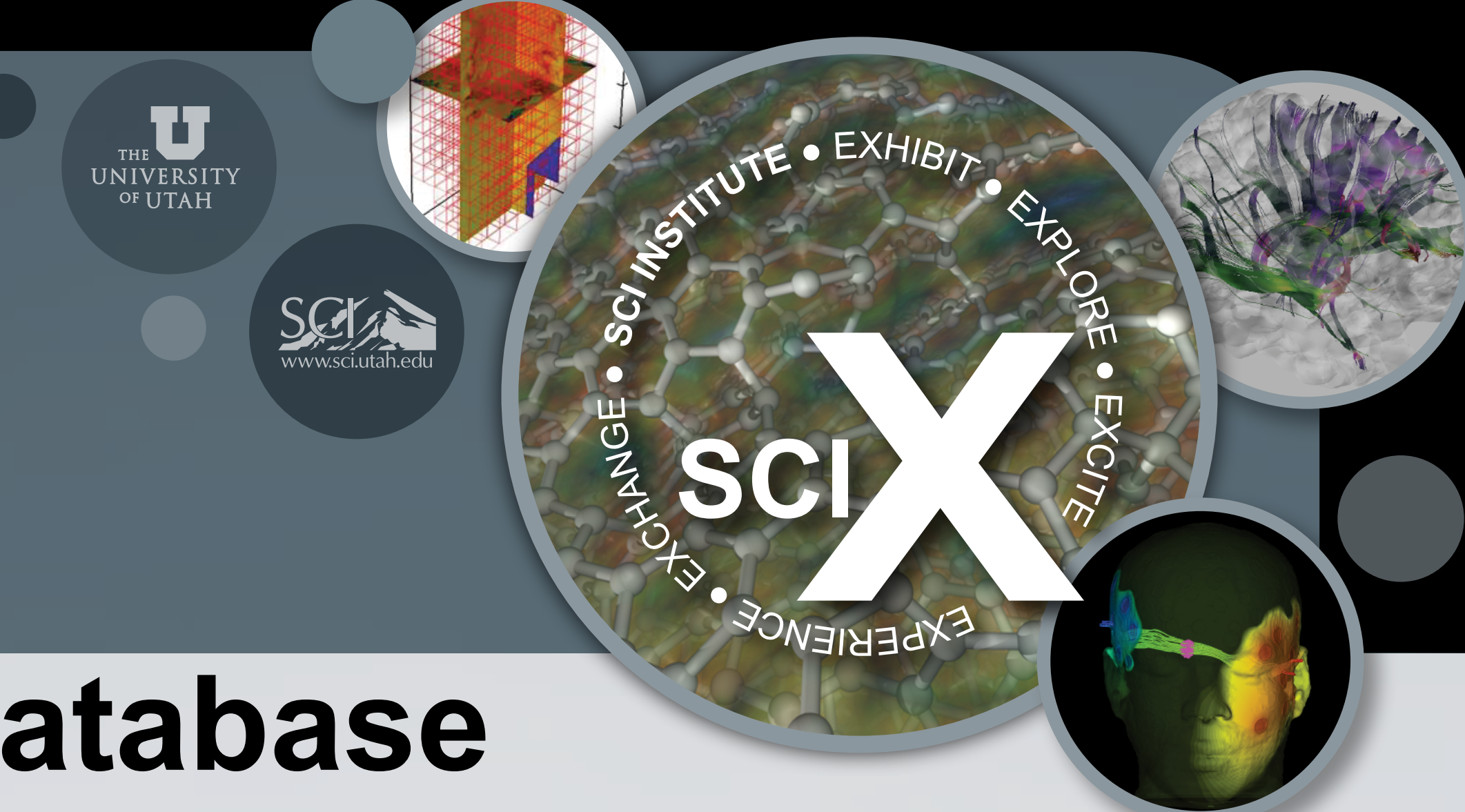# Data Tools for ECGI: ECG Forward/Inverse Toolkit and EDGAR Database
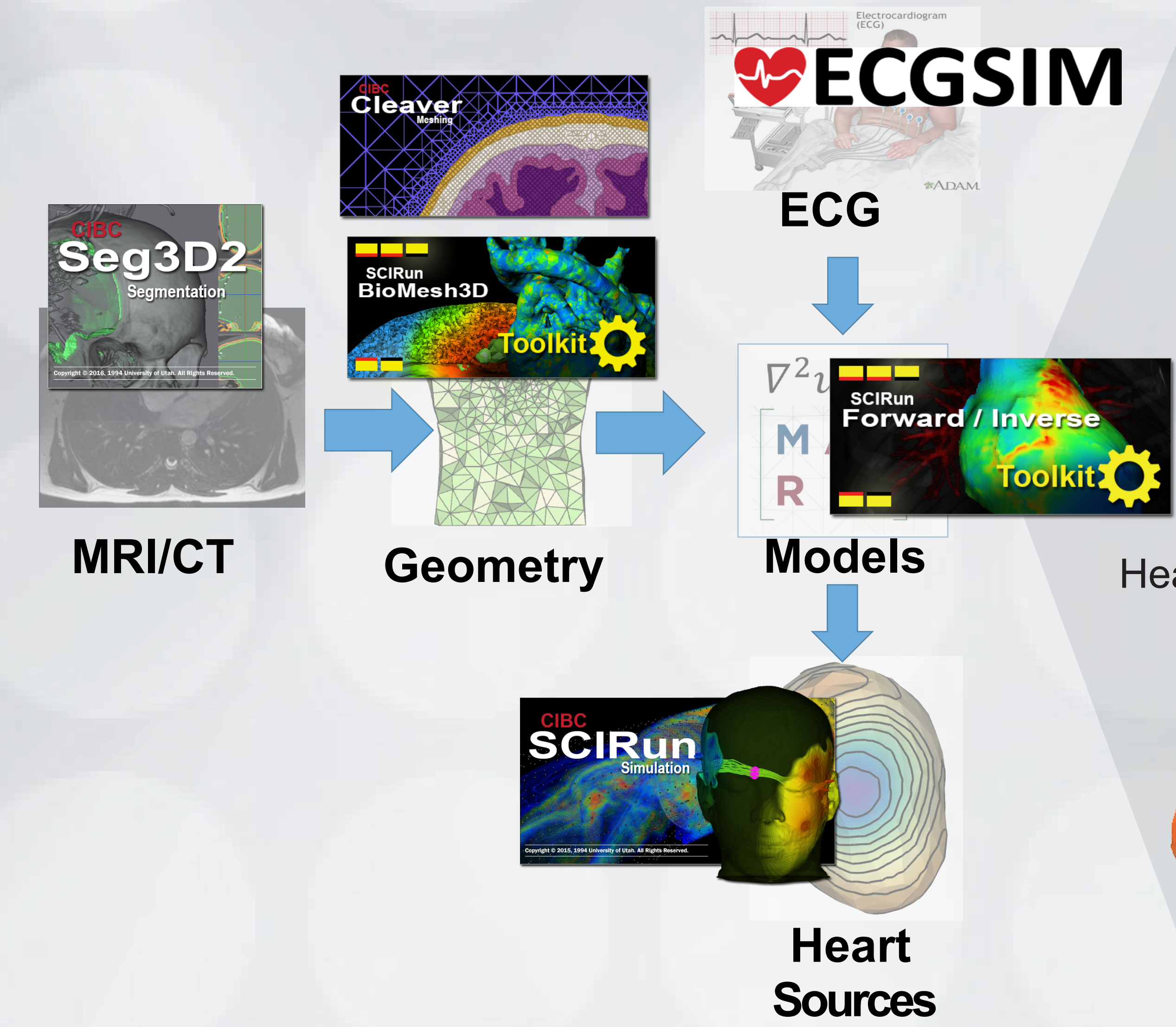
Computational Electrocardiology Group

ECG Forward/Inverse Toolkit
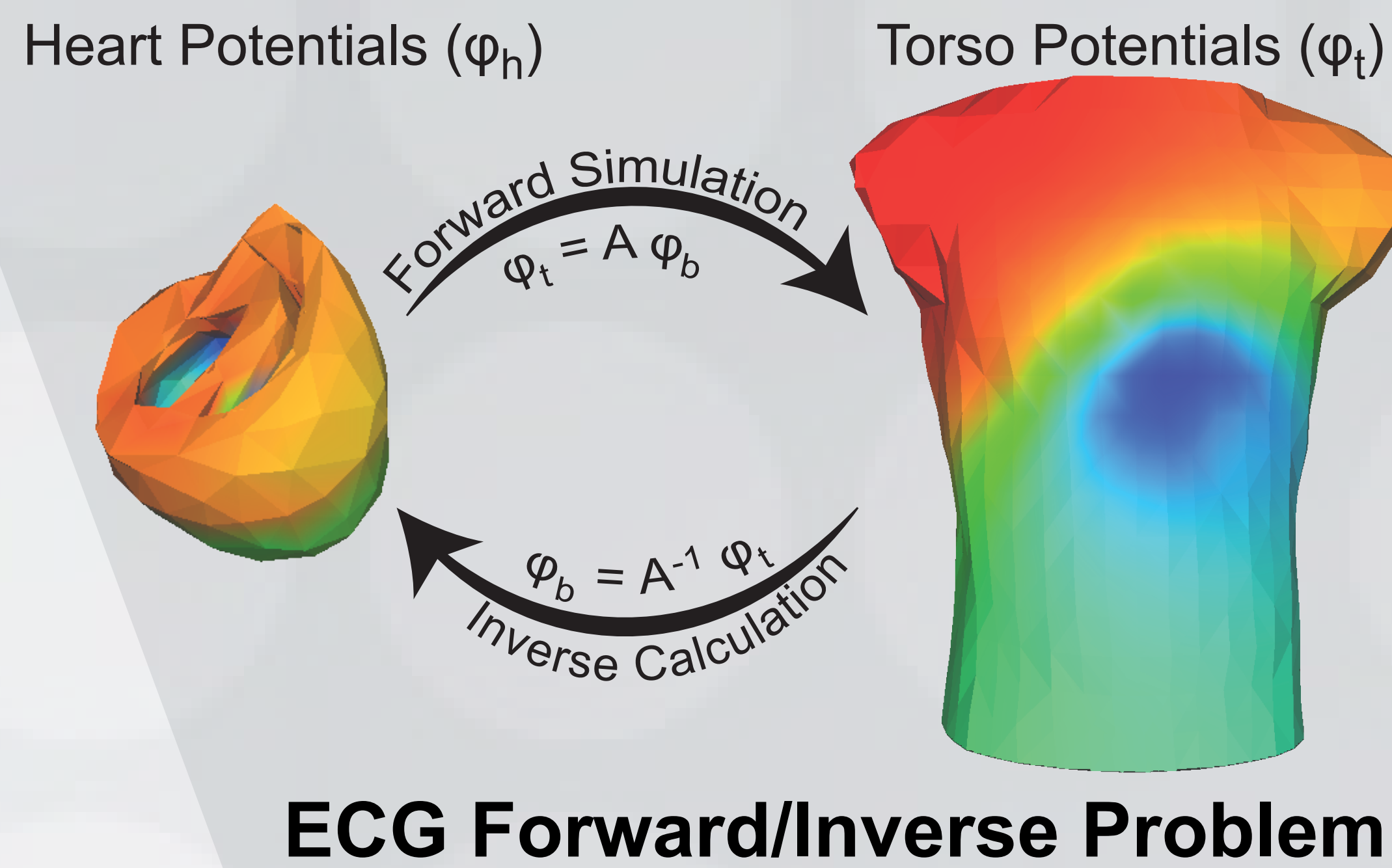
Toolkit for computing forward and inverse problems in electrocardiology

Software for ECG Modeling

ECGSIM

MRI/CT → Geometry → ECG → Models → Heart Sources

Cleaver
Seg3D2 Segmentation
SCIRun BioMesh3D Toolkit
SCIRun Forward / Inverse Toolkit
SCIRun Simulation

Tools in the Forward/Inverse Toolkit

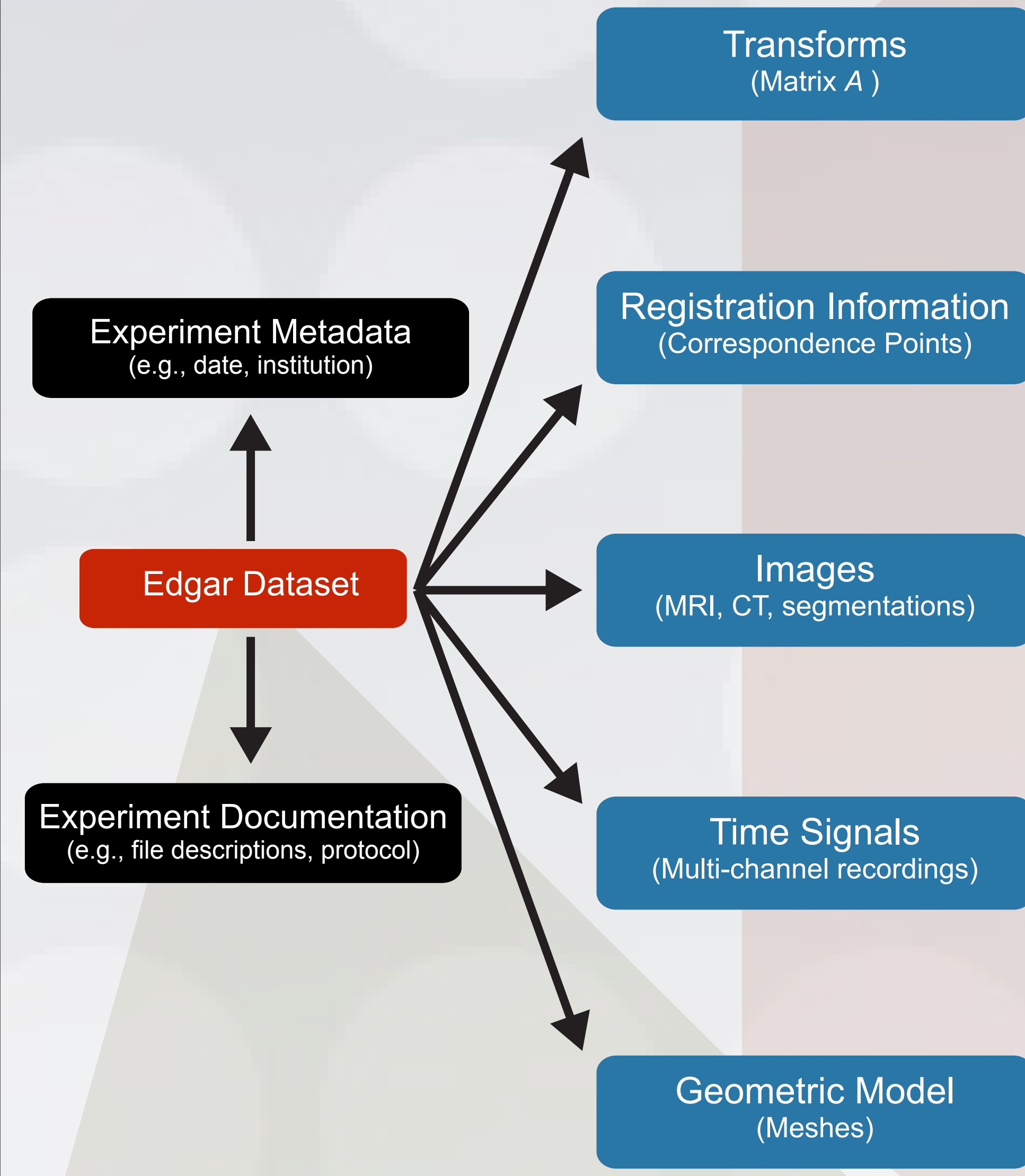|	Forward	Inverse
Potentials	FEM BEM	Tikhonov, Tikhonov SVD, Truncated SVD, Isotropy (Greensite), Gauss-Newton, Wave-Based, Total Variation, Spline
Activation Times	BEM (Through ECGSim)	Gauss-Newton, Non-Neg Transmembrane Potential

ECG Forward/Inverse Problem

Heart Potentials (φ_h) → Torso Potentials (φ_t)

Forward Simulation $\varphi_t = A\,\varphi_b$

Inverse Calculation $\varphi_b = A^{-1}\,\varphi_t$

ECG Forward/Inverse Toolkit Examples

scirun.org

PVC Localization

Ischemia Localization

Ischemia ECG Prediction

9.4 mV, 4.5 mV, -0.31 mV, -5.2 mV, -10 mV

thorax

standard_12

time bar at: 261 ms

EDGAR Database

EDGAR - Experimental Data and Geometric Analysis Repository

Data Organization

Experiment Metadata (e.g., date, institution)

Edgar Dataset

Experiment Documentation (e.g., file descriptions, protocol)

- Transforms (Matrix A)
- Registration Information (Correspondence Points)
- Images (MRI, CT, segmentations)
- Time Signals (Multi-channel recordings)
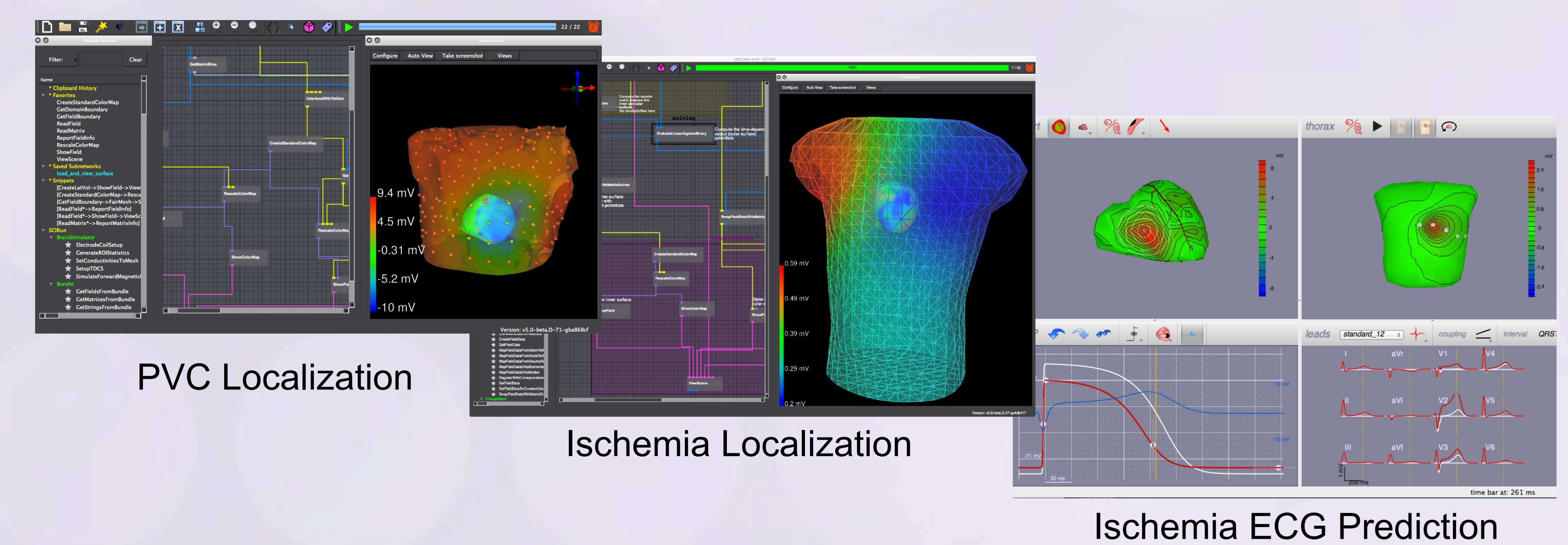- Geometric Model (Meshes)

$$\begin{pmatrix} a_{11} & a_{12} & \dots & a_{1n} \\ a_{21} & a_{22} & \dots & a_{2n} \\ a_{31} & a_{32} & \dots & a_{3n} \\ a_{41} & a_{42} & \dots & a_{4n} \\ a_{51} & a_{52} & \dots & a_{5n} \\ \vdots & \vdots & \dots & \vdots \\ a_{d1} & a_{d2} & \dots & a_{dn} \end{pmatrix}$$

Transforms

Correspondence Points (Measured)
Correspondence Points (Mesh)
Registered Geometries

Registration Information

Images

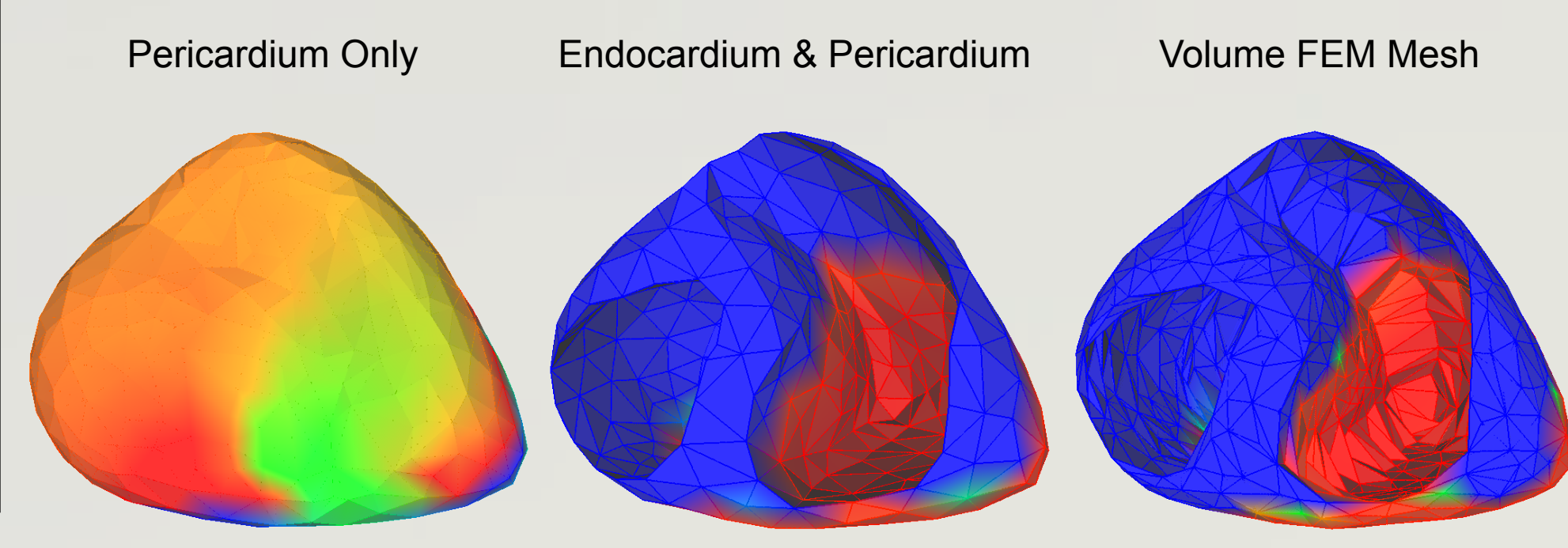Geometric Models

Time Signals
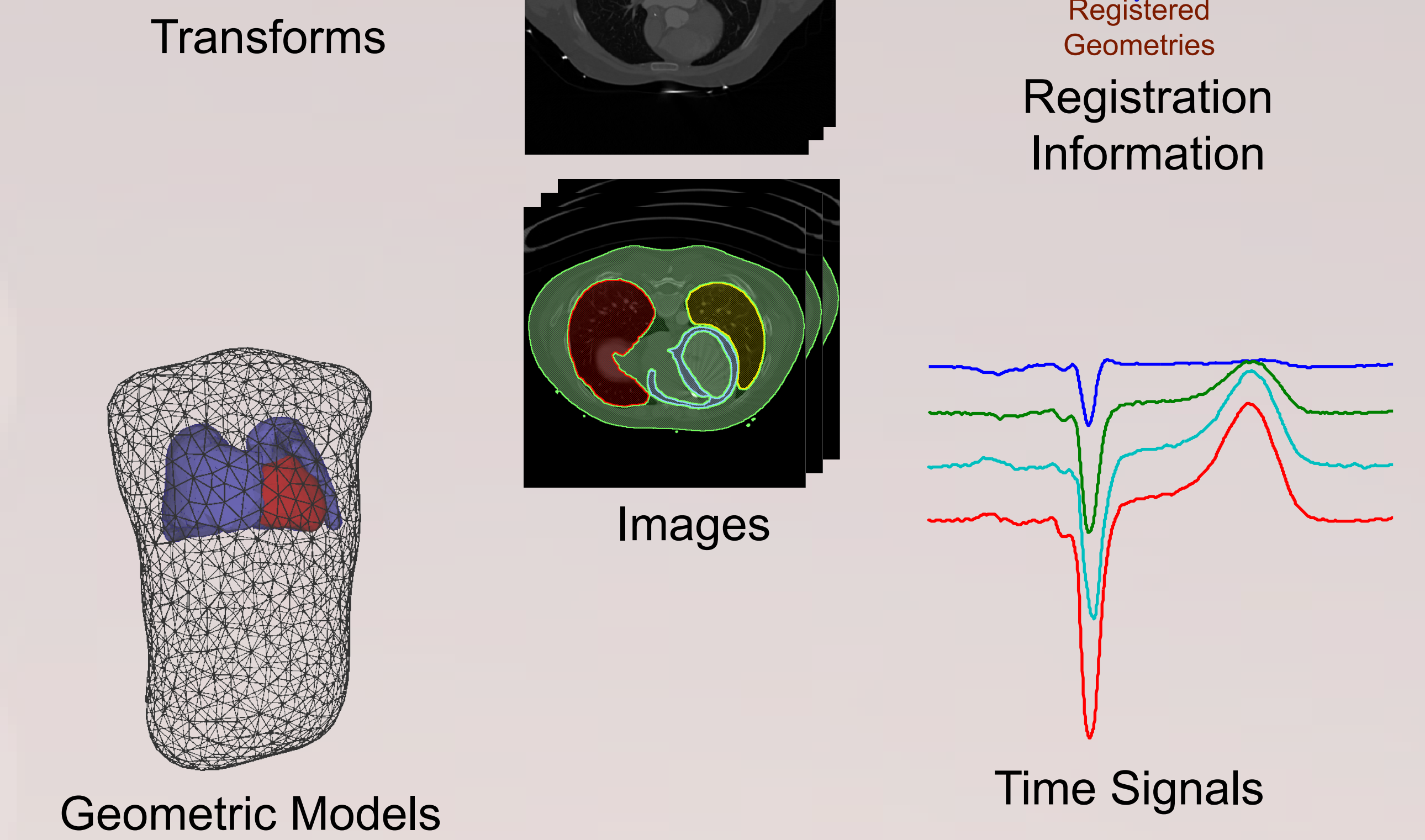
Example Data Types

Example Dataset

KIT Dataset
- EP on Pericardium
- EP on Peri and Endocardium
- TMV on Peri and Endocardium
- TMV Throughout Heart Volume
- Clinical BSPM of PVC and Paced Beats

1. Sep Center
2. LV Lat
3. LV Apex
4. LV Ant
5. RV Post
6. RV Ant
7. LV Lat Epi
8. LV Lat Endo

KIT: Karlsruhe Institute of Technology
EP: Extracellular Potential
TMV: Transmembrane Voltage

Pericardium Only   Endocardium & Pericardium   Volume FEM Mesh

EDGAR Interface

edgar.sci.utah.edu

the EDGAR Time Signal Catalog

Instructions:
First time users must create an account.
If you already have an account, login.

Login Form
Username
Password
Remember Me
Log in
Create an account
Forgot your username?
Forgot your password?

The "Experimental Data and Geometric Analysis Repository", or EDGAR is an Internet-based archive of curated data that are freely distributed to the international research community for the application and validation of electrocardiographic imaging (ECGI) techniques. The EDGAR project is a collaborative effort by the Consortium for ECG Imaging (CEI, ecg-imaging.org), and focused on two specific aims. One aim is to host an online repository that provides access to a wide spectrum of data, and the second aim is to provide a standard information format for the exchange of these diverse datasets.

Show All Data   Human Cardiac Mapping   Human Pacing Site   InSitu Animal   Torso Tank

Scientific Computing and Imaging Institute

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