



EIDORS

# EIDORS: community-based extensible software for EIT

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# What is the problem?

EIT Research has seen much re-inventing the wheel

- Hardware / Imaging SW built from scratch

Problem because:

- Difficult to advance far when rebuilding
- Difficult to compare results



EIDORS

# Goal: software community



**Project:** Electrical  
Impedance and  
Diffuse  
Optical  
Tomography  
Reconstruction  
Software





EIDORS

# Why Walruses?

1. EIT images blobby objects in aqueous media; Walrus, a fat, blobby animal that lives in water.
2. Walrus is EIDORS logo
3. Walruses are much funnier than a talk about software architecture.



Images credit: [www.biosbcc.net](http://www.biosbcc.net)

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EIDORS

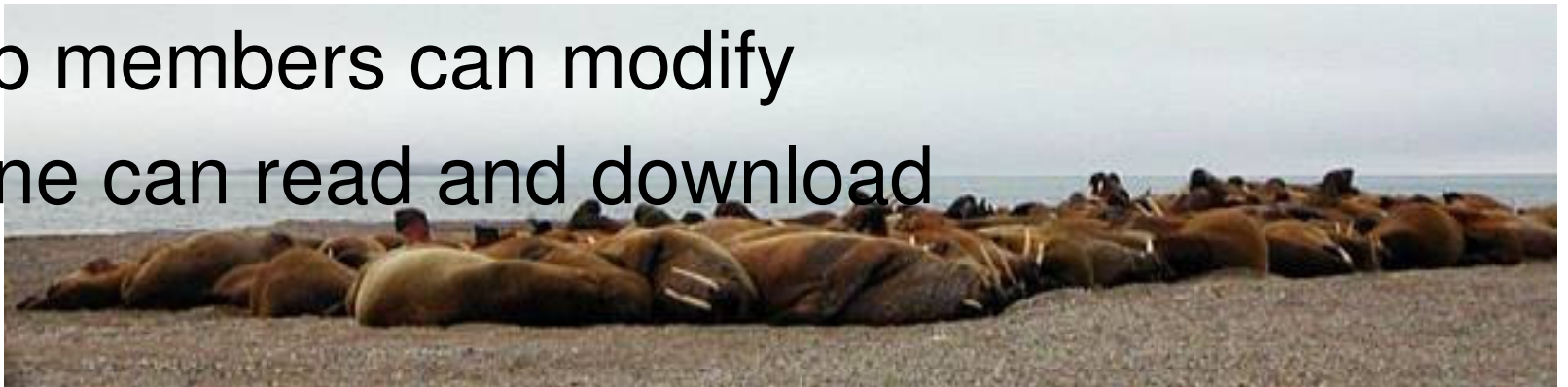
# EIDORS Features

## **Open-source:**

- License: GNU General Public License.
- Free to use, modify, and distribute modifications.
- May be used in a commercial product

## **Hosted on Sourceforge.net**

- Software is available for download (version 2.0)
- CVS access to latest developer versions
- Group members can modify
- Anyone can read and download






# Web Site

**EIDORS-3D - Microsoft Internet Explorer**

File Edit Address <http://eidors3d.sourceforge.net/docs.html> Go

 **EIDORS-3D: *Electrical Impedance Tomography and Diffuse Optical Tomography Reconstruction Software***

**EIDORS-3D: Documentation**

EIDORS-3D is based on the thesis of Nick Polydorides at UMIST. Current documentation is his thesis and an associated paper in Measurement Science and Technology.

- **Andy Adler and William R B Lionheart**  
*EIDORS: Towards a community-based extensible software base for EIT*  
VI Conf. Electrical Impedance Tomography, London, UK, 2005
- **Nick Polydorides and William R B Lionheart**  
*A Matlab toolkit for three-dimensional electrical impedance tomography: a contribution to the Electrical Impedance and Diffuse Optical Reconstruction Software project* Meas. Sci. Technol. 13 No 12 (December 2002) 1871-1883

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Walrus

Release Version

Developer Version

This Paper



# Features

## Language independence:

- Octave (octave.org, ver $\geq$  2.9)
- Matlab (version  $\geq$  6.0).

## Usage examples:

- new software is based on demos.
- simple and more complex usage examples.

## Tests:

- Software is intrinsically difficult to test.
- Numerical software is probably more difficult
- Implement of regression test scripts





# Features

## Pluggable code base:

- Object-oriented: *Packaging* and *Abstraction*.
- Don't use the Matlab OO framework
- Instead, EIDORS designed as "Pluggable" software using function pointers.







# Features

## Automatic matrix caching:

- Save computationally expensive variables
  - ie Jacobian , Image priors.
- Caching complicates software
- Caching managed in `eidors_obj`





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# Example 1: Simulate data

```
param= mk_circ_tank(8, [-1::25:1], 16, 3); Create FEM geomtery

params.stimulation= mk_stim_patterns( ... Set curr & meas
                                16, 3, '{ad}','{ad}', { }, 10); patterns

params.solve= 'np_fwd_solve'; Use N.P.'s solver

mdl_3d = eidors_obj('fwd_model', params); Create fwd_model

img_bkgnd= eidors_obj( ... Create
    'image', 'homog background', ... background
    'elem_data', homog_conductivity, ... image
    'fwd_model', mdl_3d );

homg_data=fwd_solve(img_bkgnd); Calc simulation data
```



# Example 2: Solve

```
My_Inv.solve= 'np_inv_solve';  
My_Inv.reconst_type= 'differential';  
My_Inv.fwd_model= mdl_3d;
```

```
My_Inv.image_prior.func= 'tikhonov_image_prior';  
My_Inv.hyperparameter.func = 'aa_calc_noise_figure';  
My_Inv.hyperparameter.noise_figure = 2.0;
```

```
My_Inv= eidors_obj('inv_model', My_Inv);
```

```
solve_img= inv_solve( My_Inv, data1, data2);
```

**Use functions  
from different  
algorithms**

**Create inv\_model**

**Solve Image**



# Features

## Generalized data formats:

- EIT has a wide variety of stimulation, measurements
- general EIT data format : *fwd\_model*
  - electrode positions
  - contact impedances
  - stimulation and measurement patterns.

## Interface software for common EIT systems:

- Load data from some EIT systems
- Please contribute







EIDORS

# getting started

- Download
  - Run examples
- Join Mailing list  
`eidors3d@listserv.umist.ac.uk`
- Sign up as developer at:  
`sourceforge.net`
- Contribute your code

