



Nimrod

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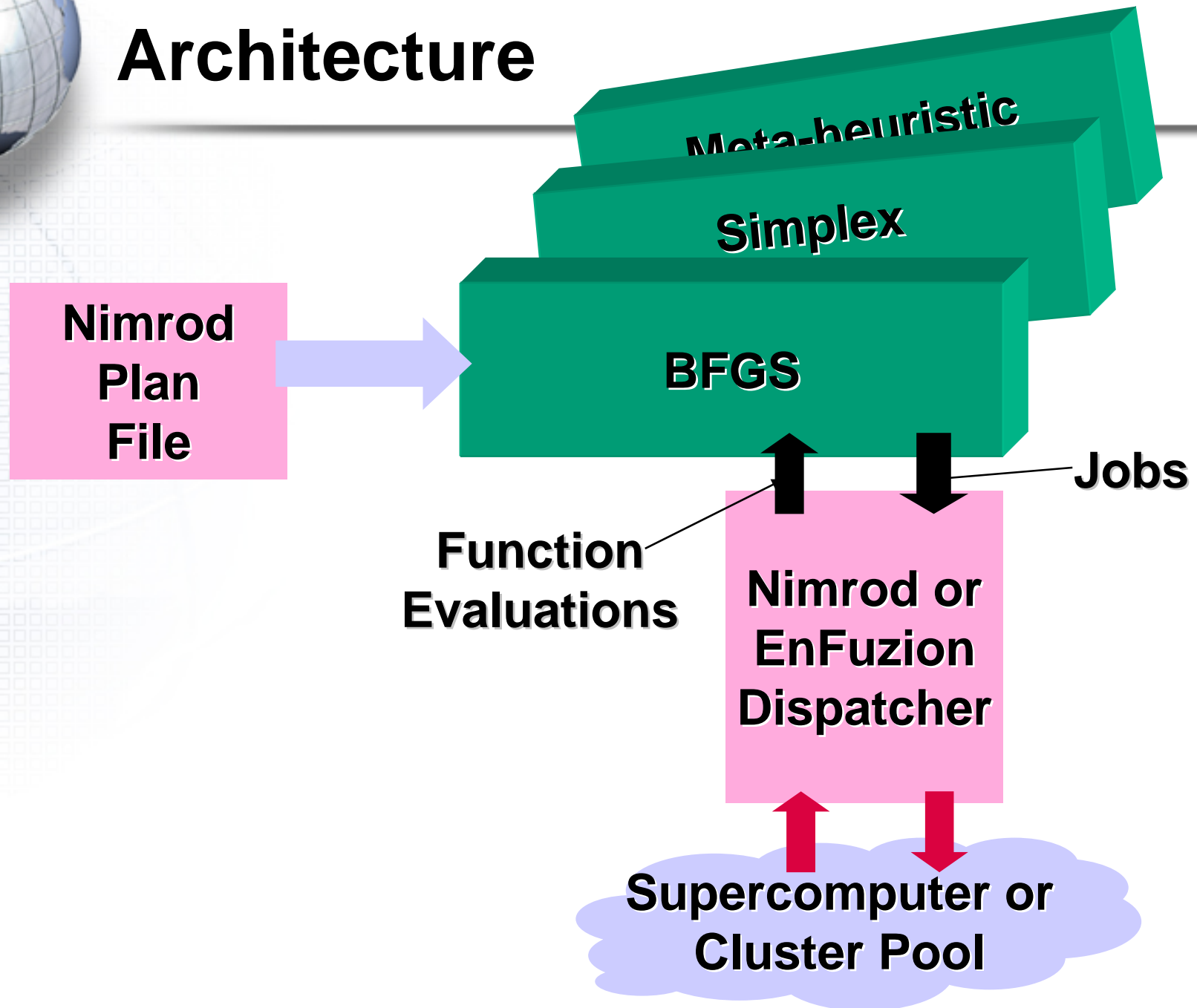


Nimrod/O – Design Goals

- Nimrod allows exploration of design scenarios
 - Search by enumeration
- Search for local/global minima based on an objective function
 - How do I minimize the cost of this design?
 - How do I maximize the life of this object?
- Objective function evaluated by a computational model
 - Computationally expensive

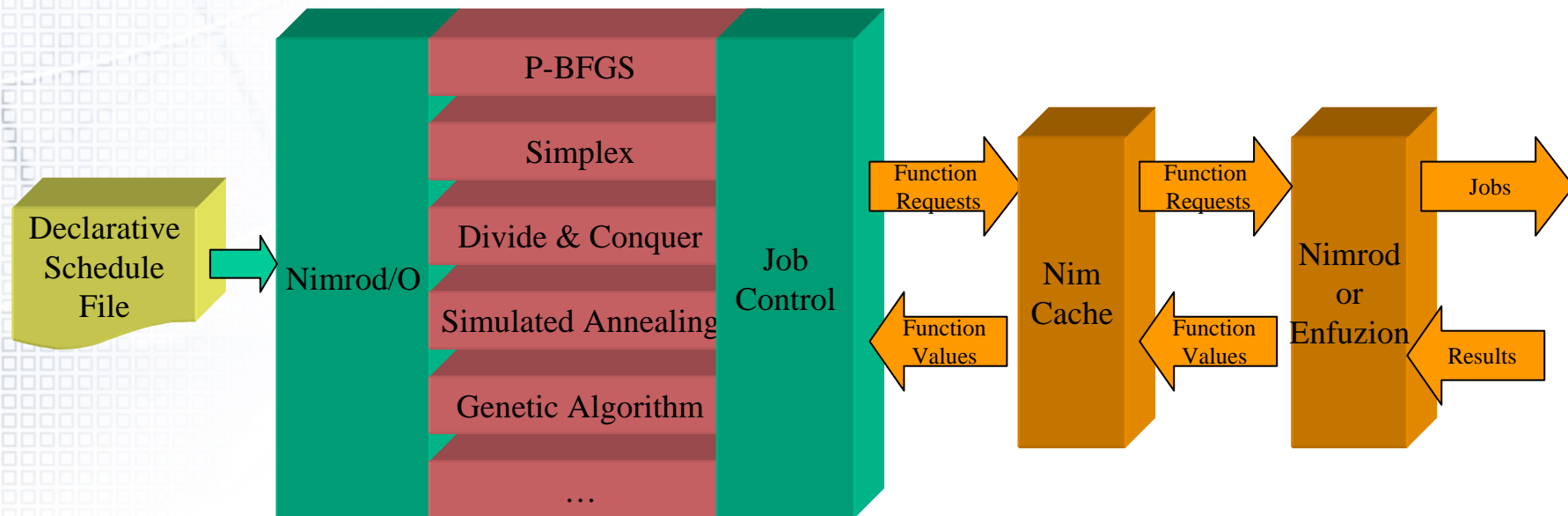


Architecture





Architecture in a little more detail ..





Nimrod/O Schedule File

```
parameter press float range from 1000 to 1010
parameter temp float range from 0 to 40
parameter fred integer range from 15 to 45

hard constraint {log(fred) >= 3} or {fred*temp + press < 2000}

task main
  copy root:~/projs/* node:..
  node:execute ./model $press $temp $fred > final.objfn
  copy node:final.objfn output.$jobname
endtask

method annealing
  starts 10
    tolerance 0.000
    scope 0.10
    cooling factor 0.99
    chain length 40
    concurrency 16 anticipating likeliest states
  endstarts
endmethod
```



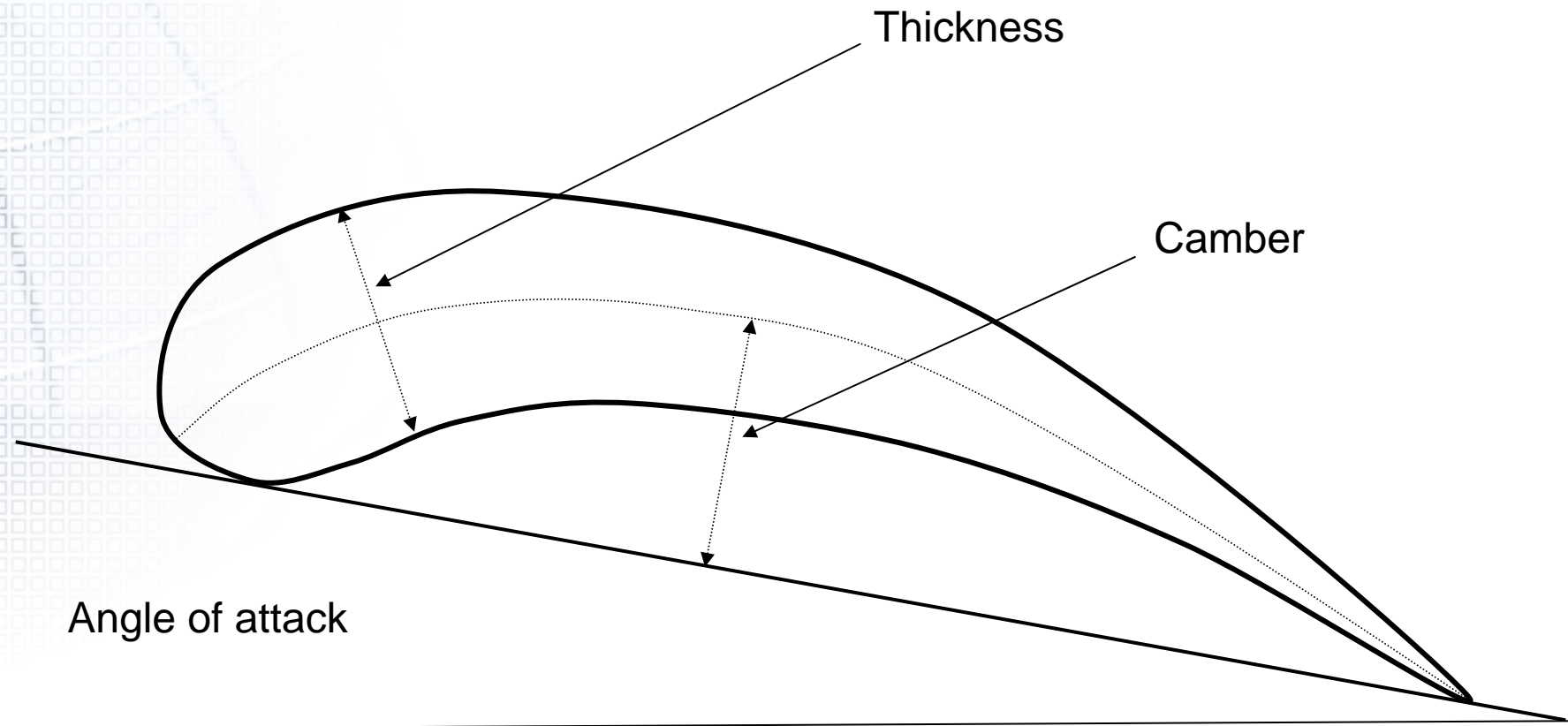
An aerofoil case study

with Clive Fletcher, UNSW

- Simple two-dimensional aerofoil was modelled using a FLUENT simulation
- The aerofoil mesh generated by GAMBIT
 - 28089 nodes
 - 49426 elements, made up of 43090 triangular elements and 6336 quad elements.
- Optimization to the design of an aerofoil,
 - maximise the ratio of lift to drag.
- Complete enumeration infeasible because the number of simulations required is excessive

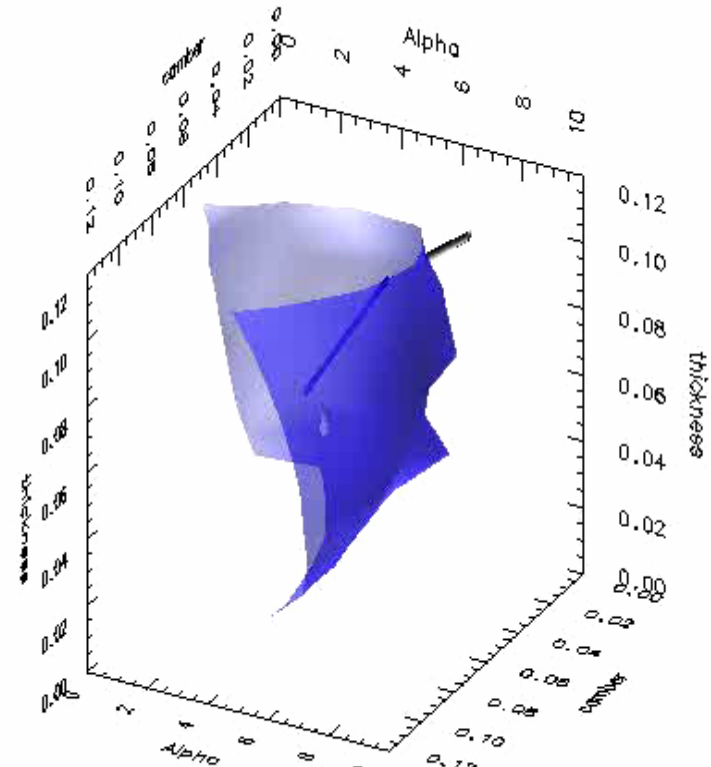
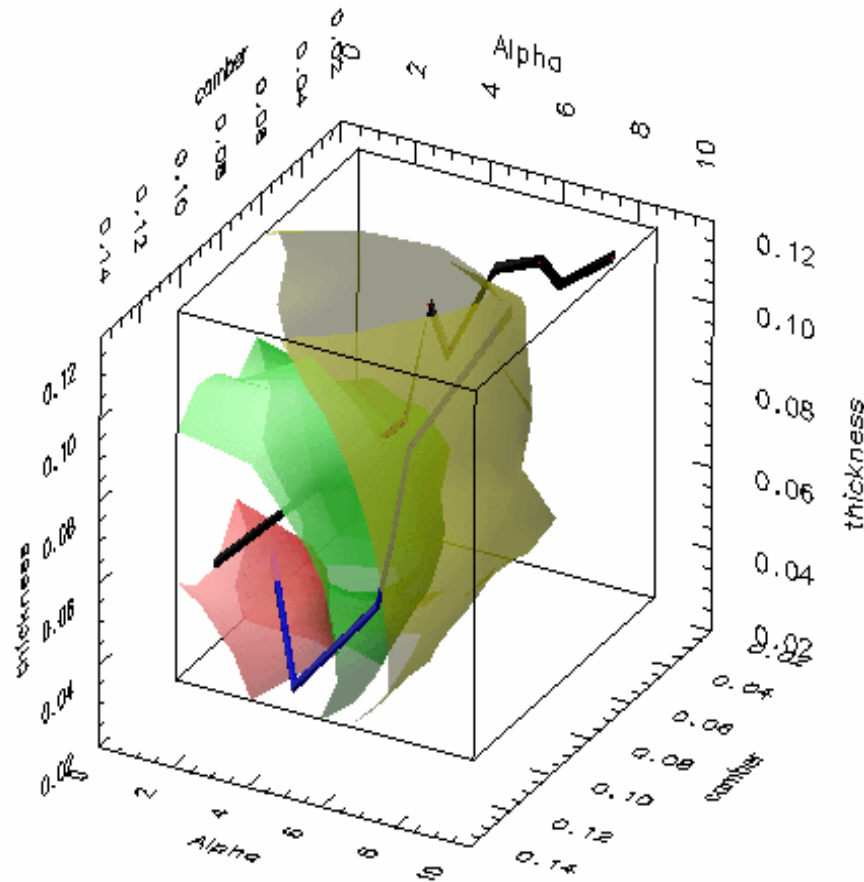


The wing



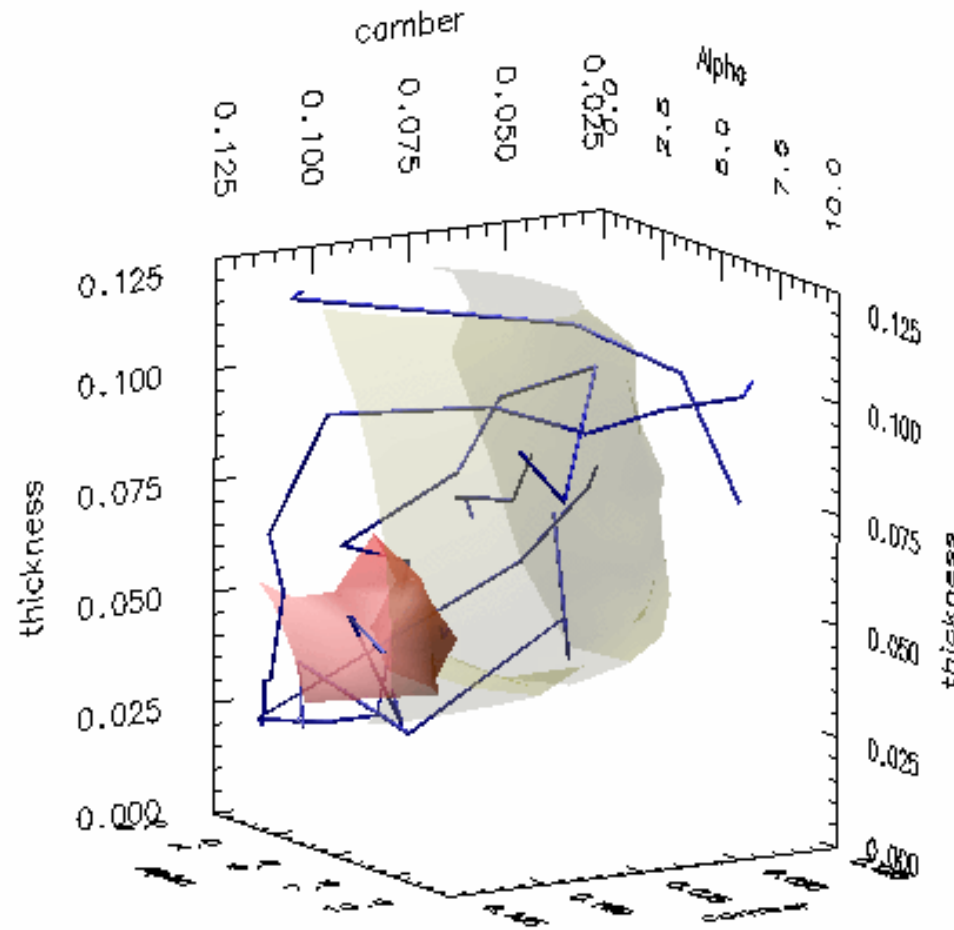


Results ...



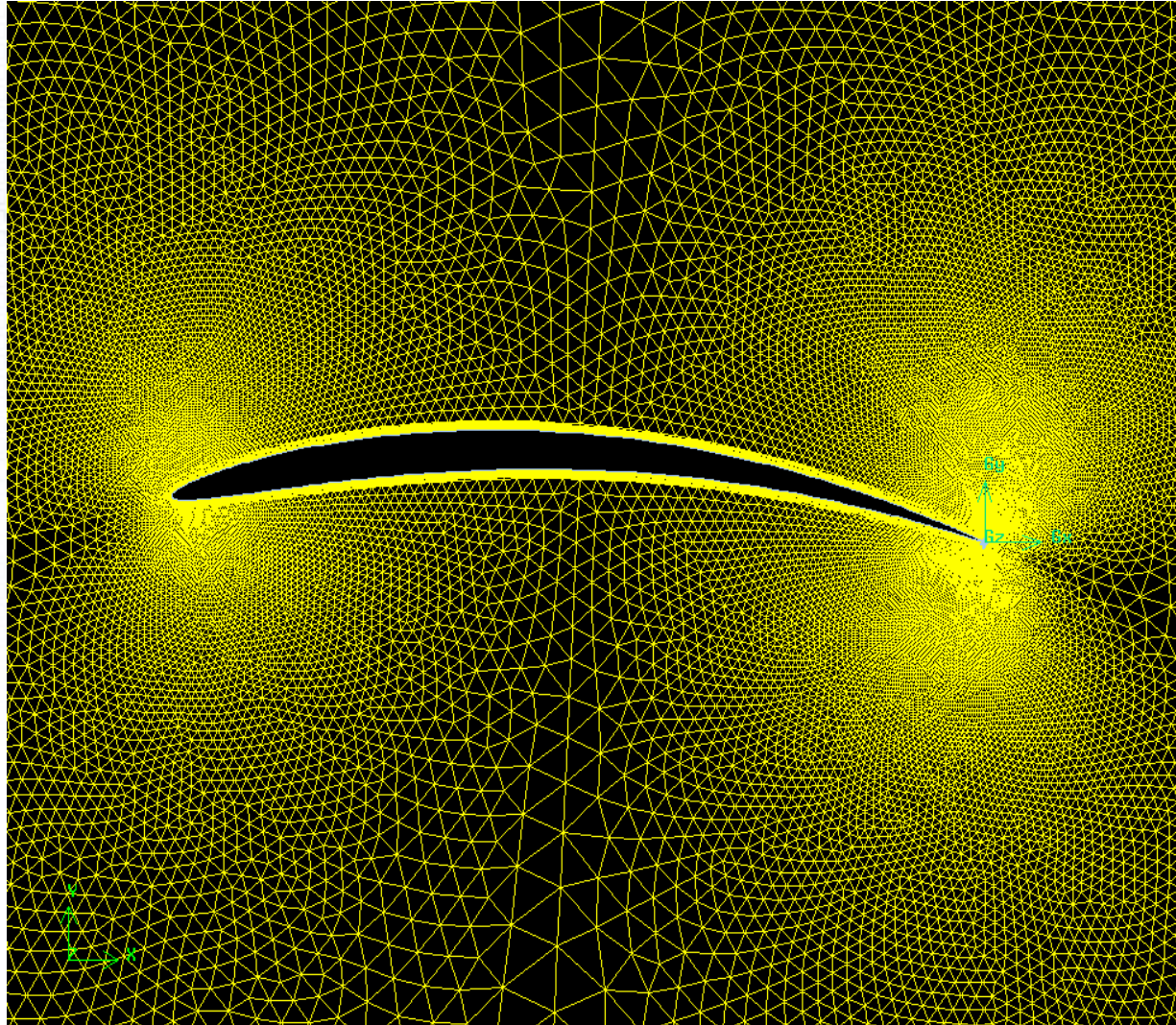


Multiple searches



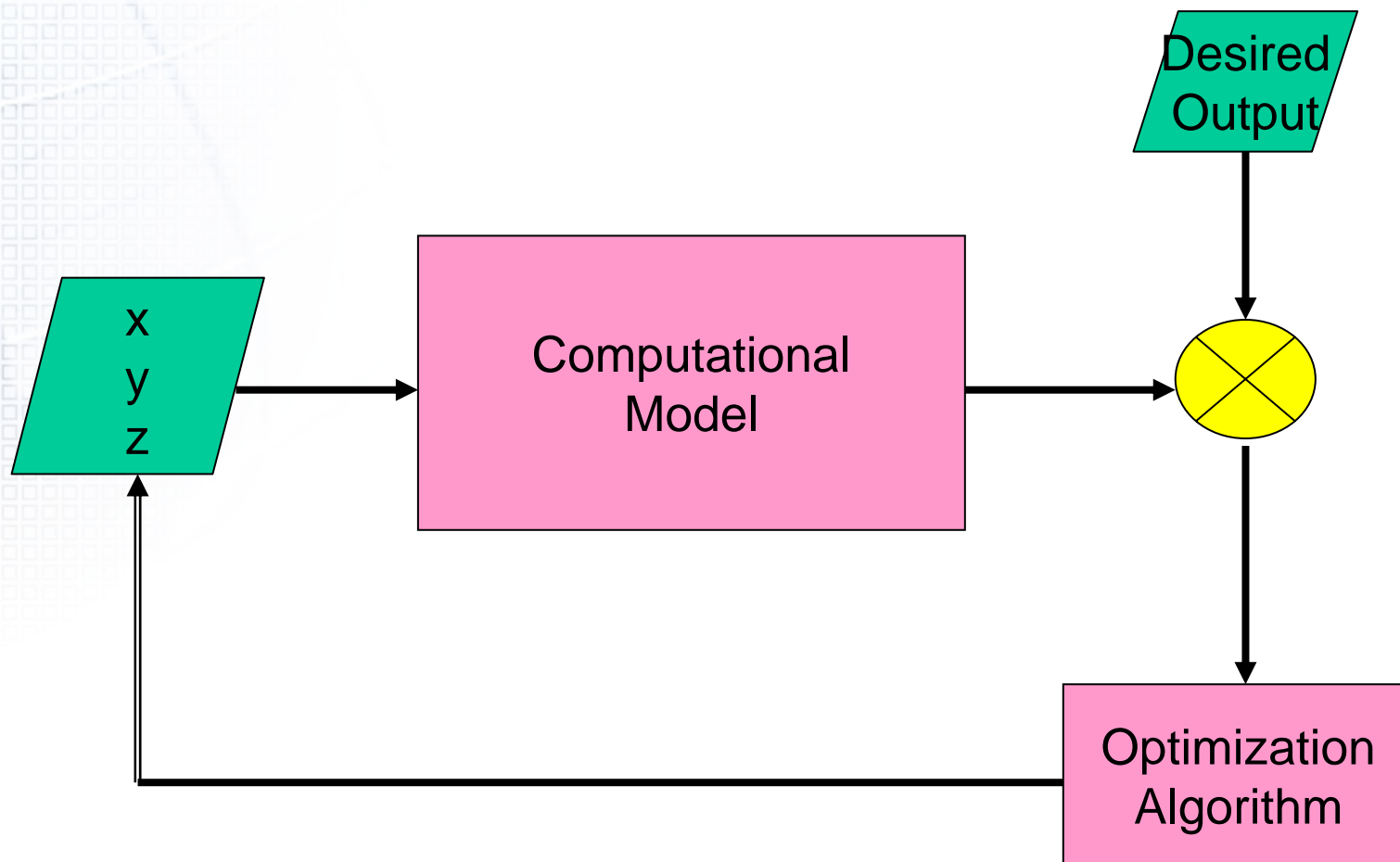


Dynamic Behaviour ...





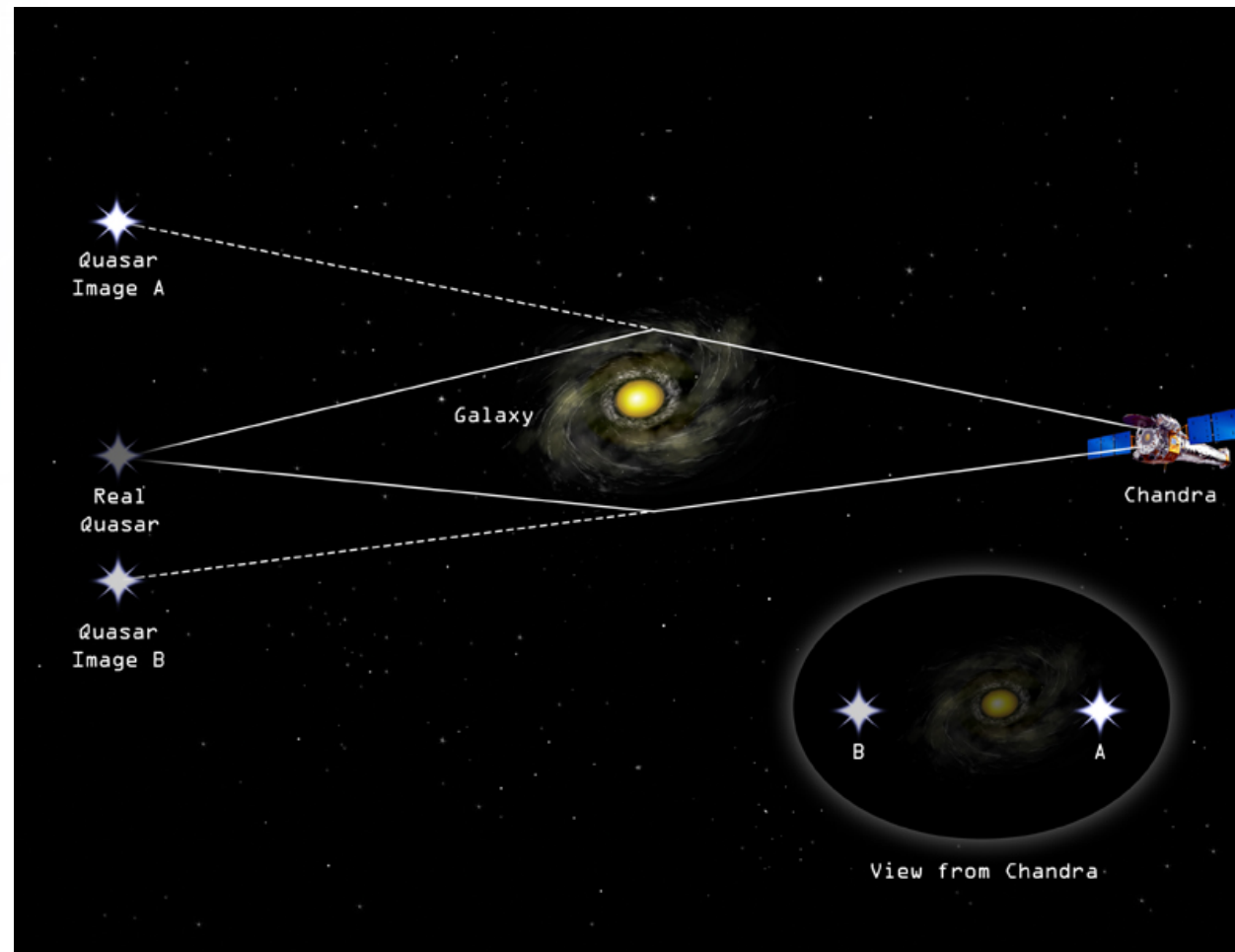
Inverse Problems





Gravitational Lens Project

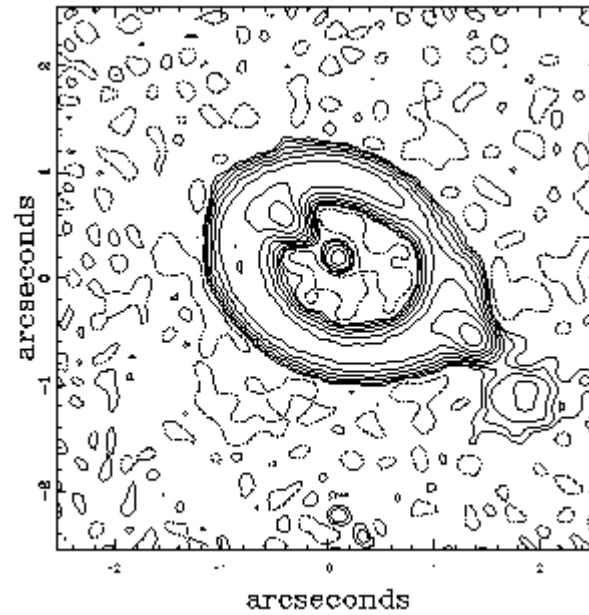
with Randall Wayth, University of Melbourne





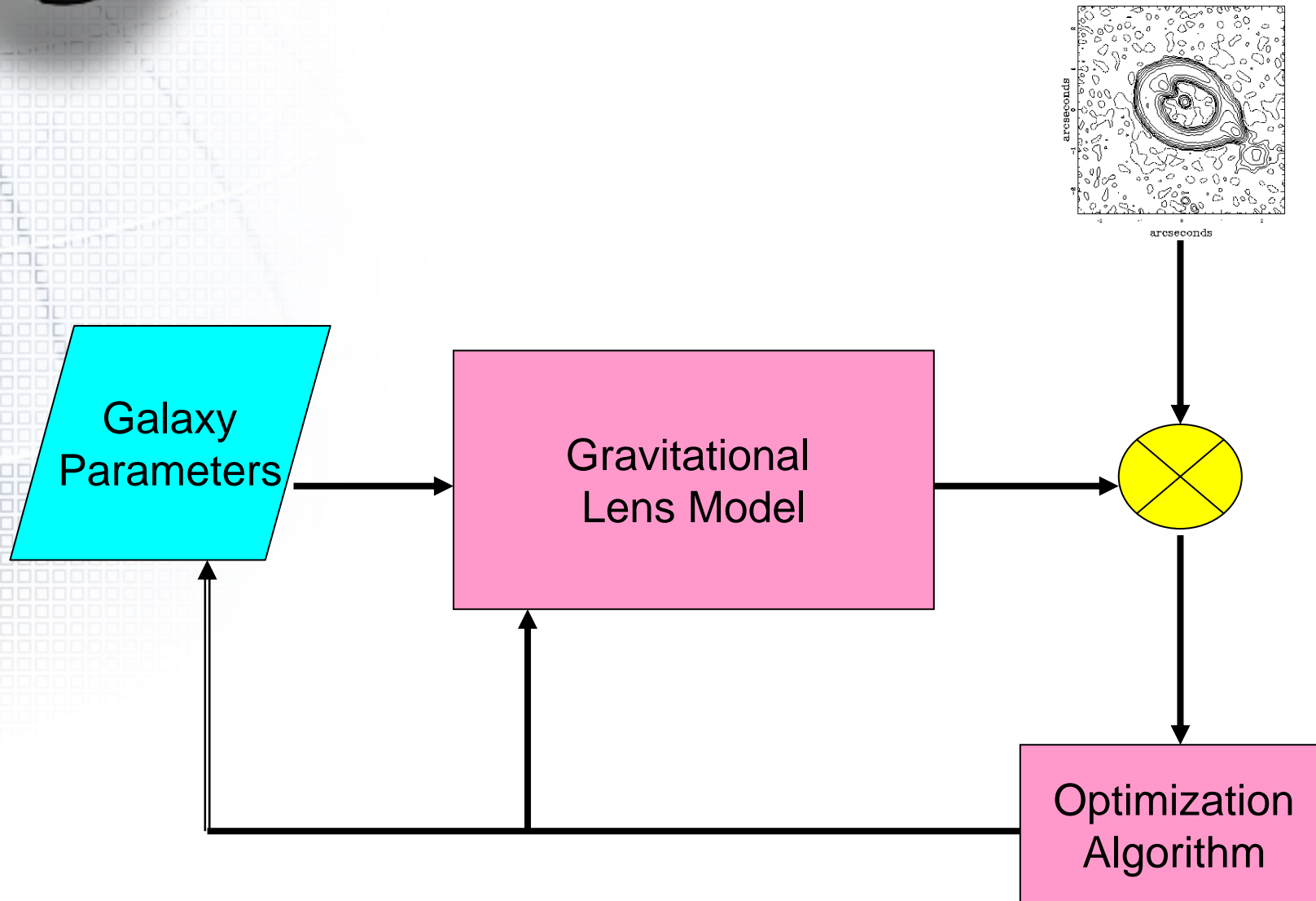
Gravitational Lens Project

An Einstein ring





Gravitational Lens project



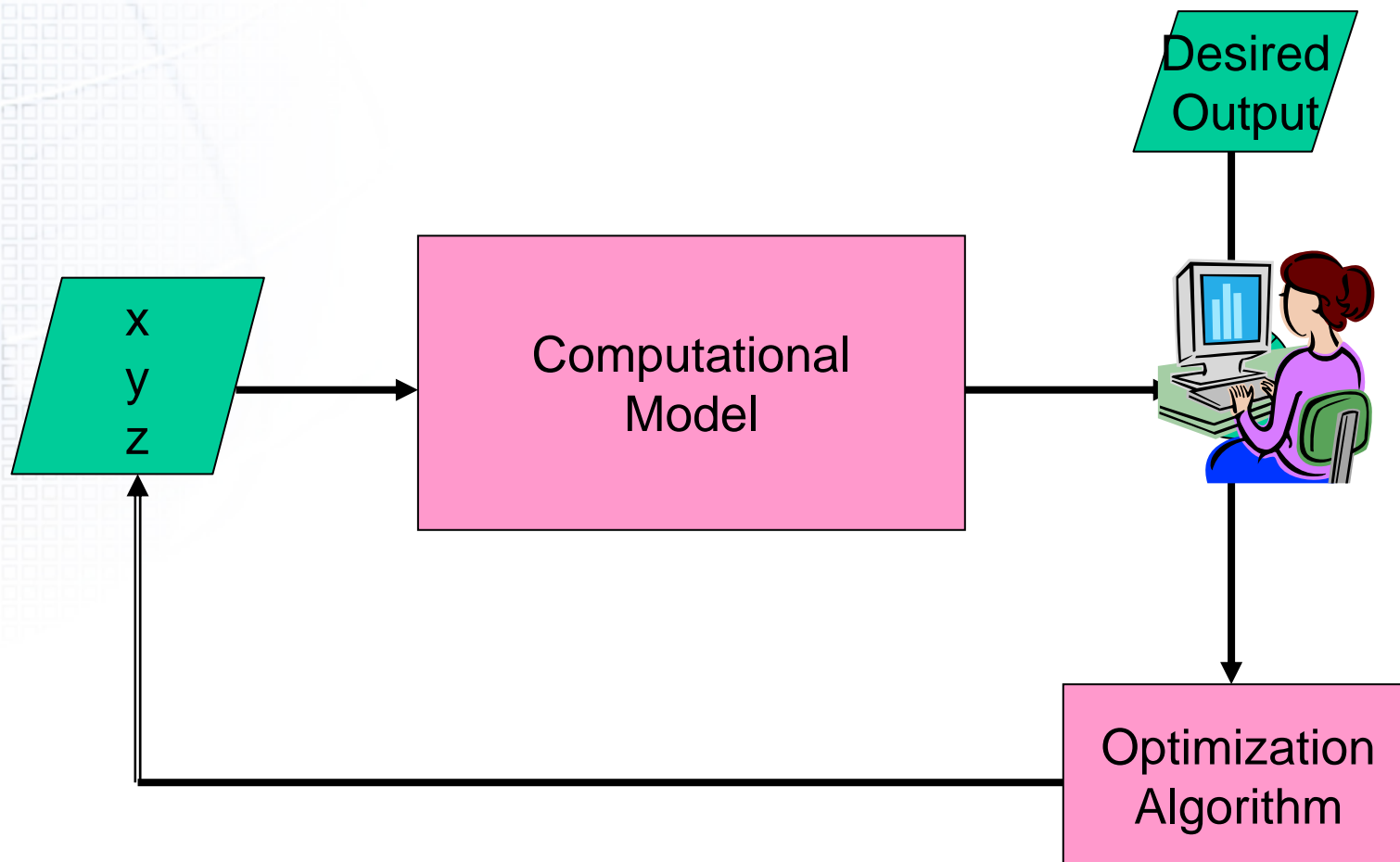


Nimrod/OI

- Same as Nimrod/O except
 - Evaluation of the cost function is interactive
 - Subjective cost function instead of objective one
 - Useful when users have trouble defining an objective cost function deterministically.
 - Needs a search algorithm that works with rankings
 - Simplex
 - Genetic Algorithm



Inverse Problems



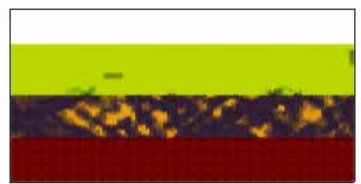
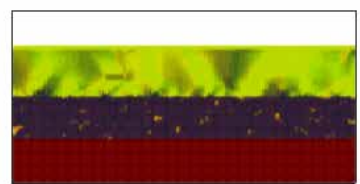
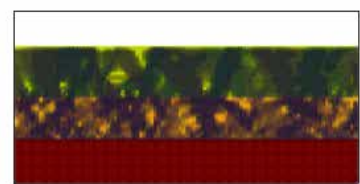


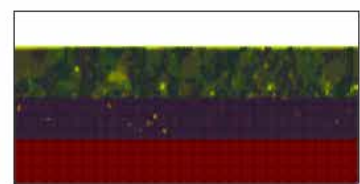


Geological Extension Model

with L. Moresi , F. Boschetti, C. Wijns
Monash, CSIRO

- Multi-layer crustal model under extension
- Modelled using Ellipsis
- Six unknown parameters
- Produces video of the process
- Uses expert assessment of results

Ranking: ExtensionModel/NimrodOI/Rankings.Op.Batch1

| | | |
|---|--|---|
|  <p>Current Rank: Rank me next</p> |  <p>Current Rank: Rank me next</p> |  <p>Current Rank: Rank me next</p> |
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Nimrod/O bead demonstration