

# Developing Tools For Adaptive Optics

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Tool Maker

Laboratory for Adaptive Optics

# Adaptive Optics Laboratory

## - Goals for the LAO -

- Focus on MCAO and ExAO
- Develop adaptive optics techniques for extremely large ground-based telescopes
- Develop and build planet finder instruments using “extreme” adaptive optics techniques
- Test and evaluate new components and technologies as they become available
- Provide a laboratory where students and postdocs can become trained in adaptive optics hardware and software

# Typical LAO User Scenario

- Not a typical instrument architectures or environment -
- Users will range from students to PI's (and so will their expertise)
- A PI may need to modify or change any part for their specific needs
  - They will want to change HW and SW
  - They will want to add and incorporate new HW and SW
  - The architecture of the test-bed and its support structure must still remain intact
- The degree to which any user will be effective at their task will be a measure of how easy it is to learn and use

# LAO Tool Characteristics

- We Need to Provide: -

- Easily recognized and usable paradigms for controlling the major elements
  - Cameras
  - Saving and restoring state
  - Saving data
- Basic integrated functionality in our internal tools, but **not** duplicate entire existing programs
- Easy access to all standard or common tools and libraries a PI might use (IRAF, DS9, Stitch, Lick, FFTW, Arroyo, Matlab, IDL ...)
- Ability to easily integrate with external tools IRAF, DS9, Stitch, IDL, Matlab ...
- Ability to easily integrate new external libraries, modules, or programs

# Tools in the LAO

- Provides a Rich Environment for AO Investigation -

What tools would you want already installed and working, if you came to the LAO?

- Stable
- Repeatable
  - CVS, Configuration support for HW and SW
- Powerful
  - Rich in support structure: Logging, control, automation
  - Capable of multiple simultaneous experiments
- Flexible
  - Reconfigurable, Modular
- Easy to use
  - Well documented, simple and flexible interface
- Easily usable by students and PI's

# Typical LAO Tool

- Four Components -

This Stuff Makes it Work

- Optical Bench - (Motors,  
Controls and Sensors)

This Stuff Makes it Usable

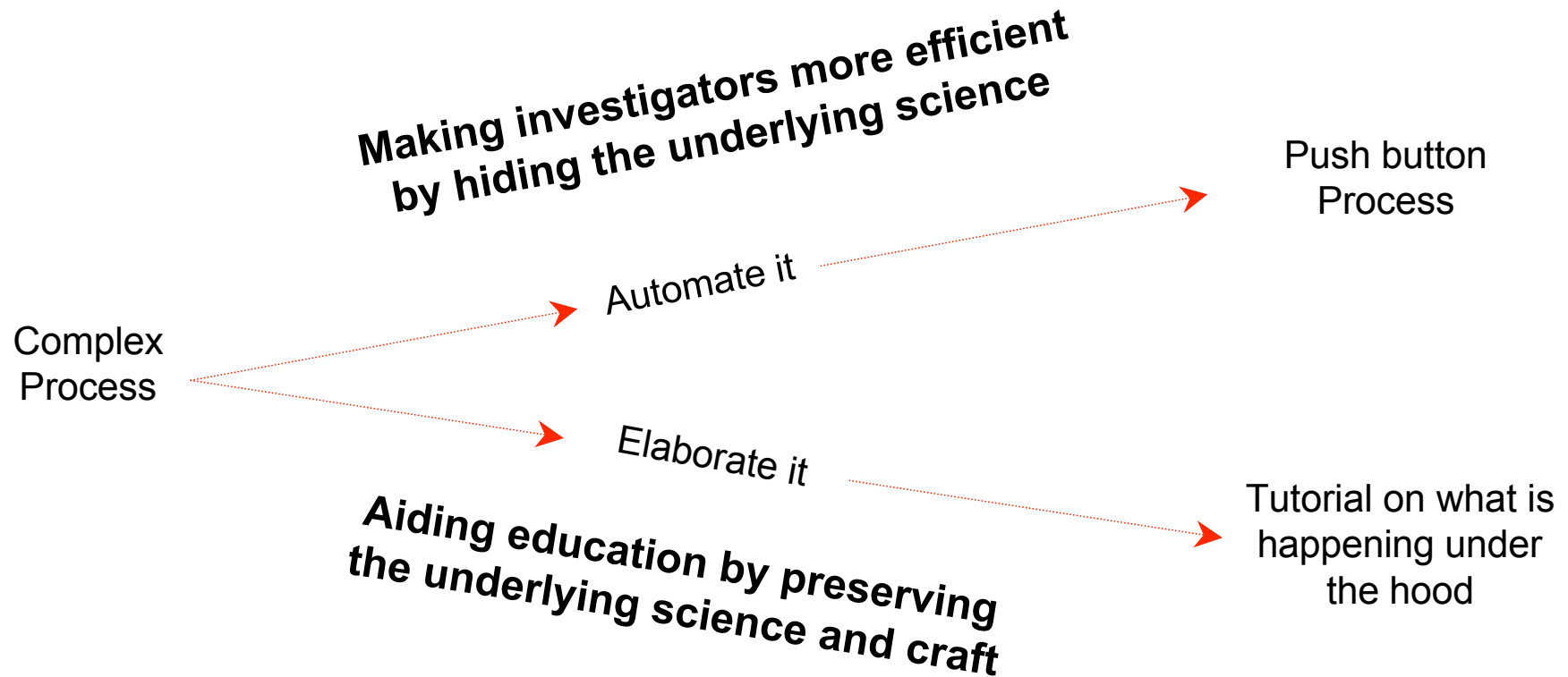
- Dashboard -  
(The User Interface)

- Pipe Line -  
(Data Processing)

- Documentation -  
(A key component)

# Laboratory Automation

- Two Goals -

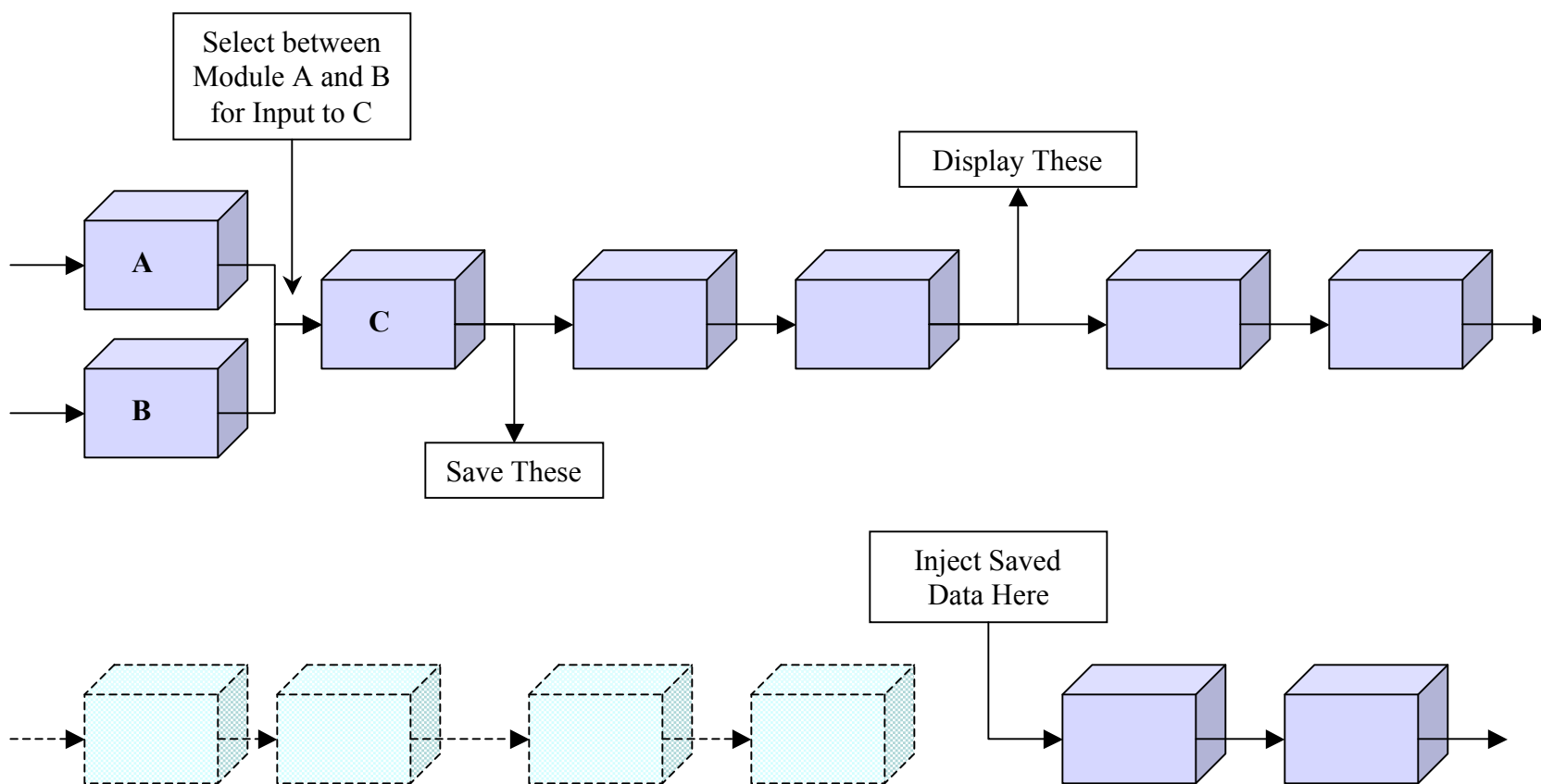


# The LAO Tools

- You don't need a huge processor -

- Our pipe line will use Arroyo and FFTW
- Data interface will be through FITS
- Easy to configure
  - As modular as the HW
  - Easily compare different algorithms
  - Investigate scalability
- Easy to save and restore configurations
- Easy to interface to
- Support multiple simultaneous users
- Support a rich set of standard tools and libraries
  - Arroyo, FFTW, DS9, IRAF, IDL, Matlab ...
- Easy interface from the pipe line to any of these through a robust set of API's and standard interfaces

# We Need the Ability to Reconfigure and the Ability to Instrument

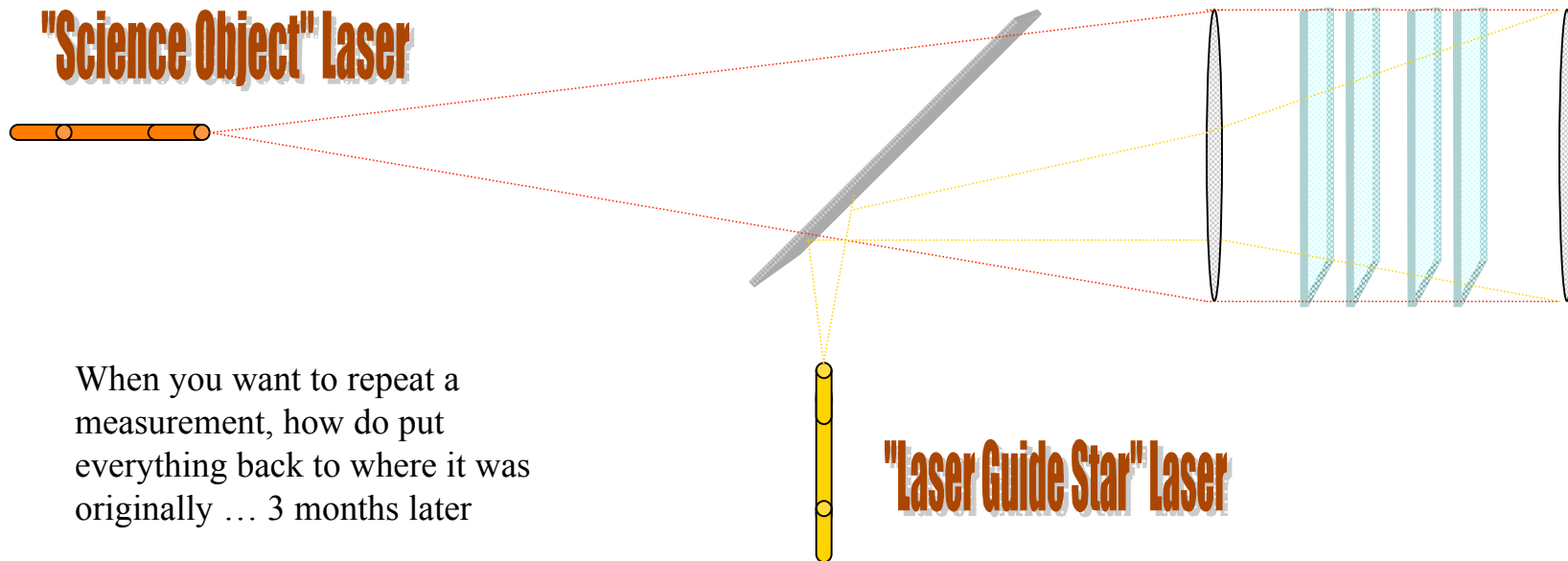


# Laboratory Automation

- Controlling Motors, Atmospheric Simulation, Etc -

When you have finished a measurement, how do you know where everything was ... 3 months later

"Atmosphere Simulation"  
- Phase Plates -



When you want to repeat a measurement, how do you put everything back to where it was originally ... 3 months later

# Laboratory Automation

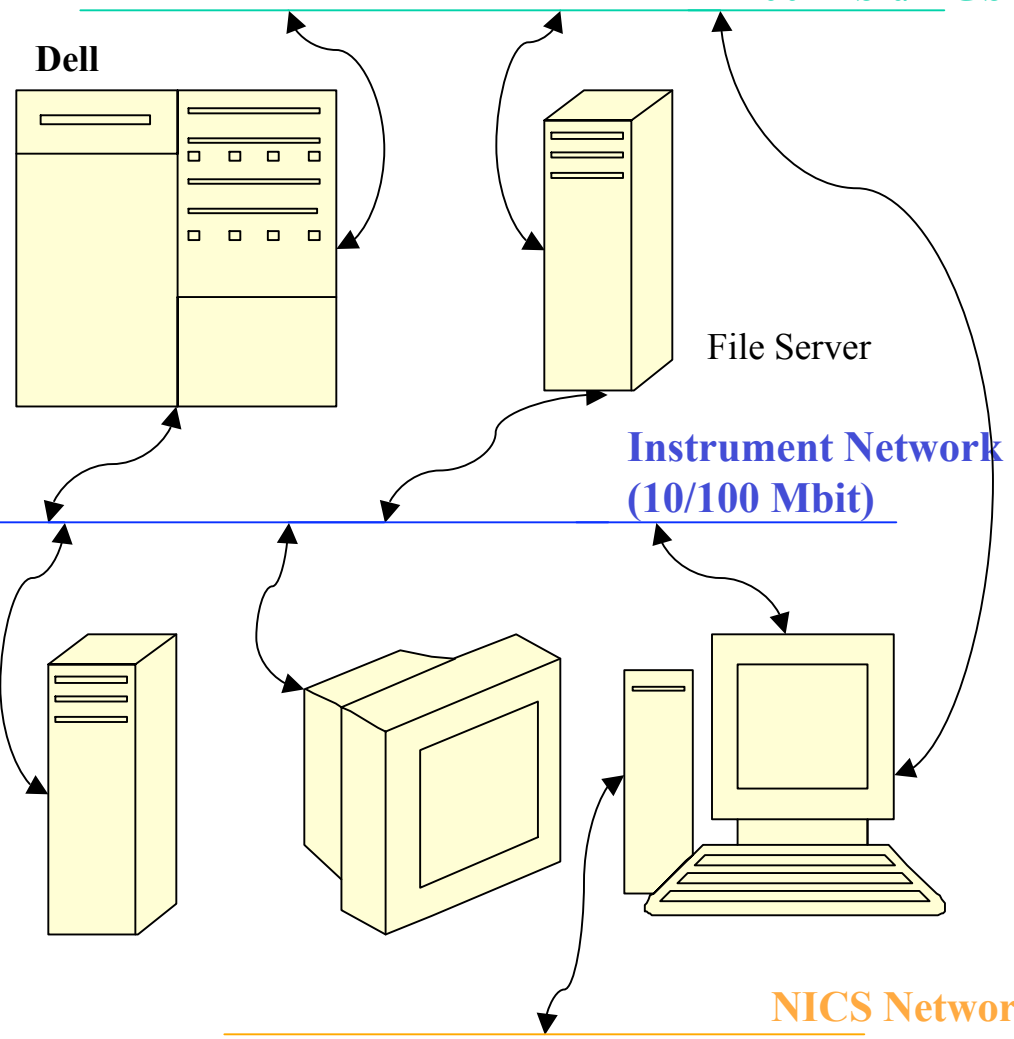
- Communications and I/O -

Data Network  
100 Mbit/1 Gbit

This is our setup, but you don't need to take it to this extreme to use our tools

“Real-Time” or  
“Instrument” Activities  
(Pipeline, DM's, WFS's)

Control and  
Monitoring  
(Atmospheric  
Simulation  
Guidestars,  
Dashboard)



# User Interface

- One of the keys to success -

- The key to a powerful, easy to use interface is to have a strong underlying infrastructure on which you can build.
  - If you have that, you can do anything.
- It must be easy to use and to learn
- It controls
  - Display of data
  - Operation of the tool
  - State display
  - Configuration
  - Instrumentation
- It is user configurable