(Introduction to)
The CAOS Problem-Solving Environment
&
The Software Package CAOS
+
AO Simulations...

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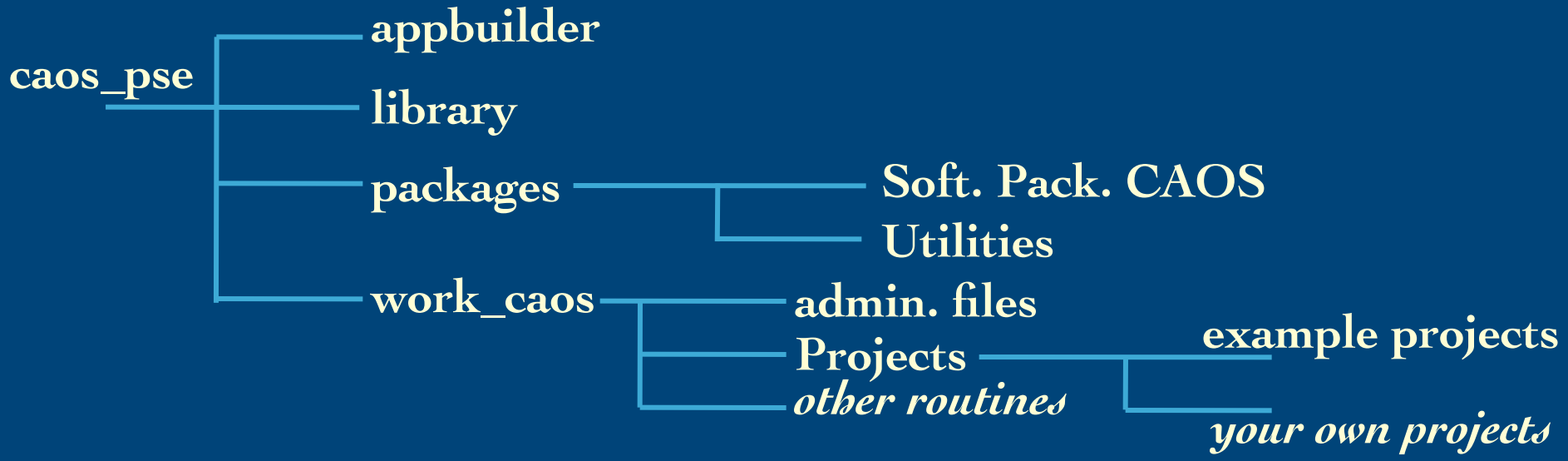
The CAOS "PSE"...

- CAOS means Code for *Adaptive Optics* Systems.
- "PSE" means Problem-Solving Environment.
- It is written in IDL, and based on a modular structure.
- It is composed of a global interface (the CAOS Application Builder), a library of utility routines (the CAOS Library), and some scientific packages (the Software Packages).
- a Software Package is a set of modules dedicated to a given

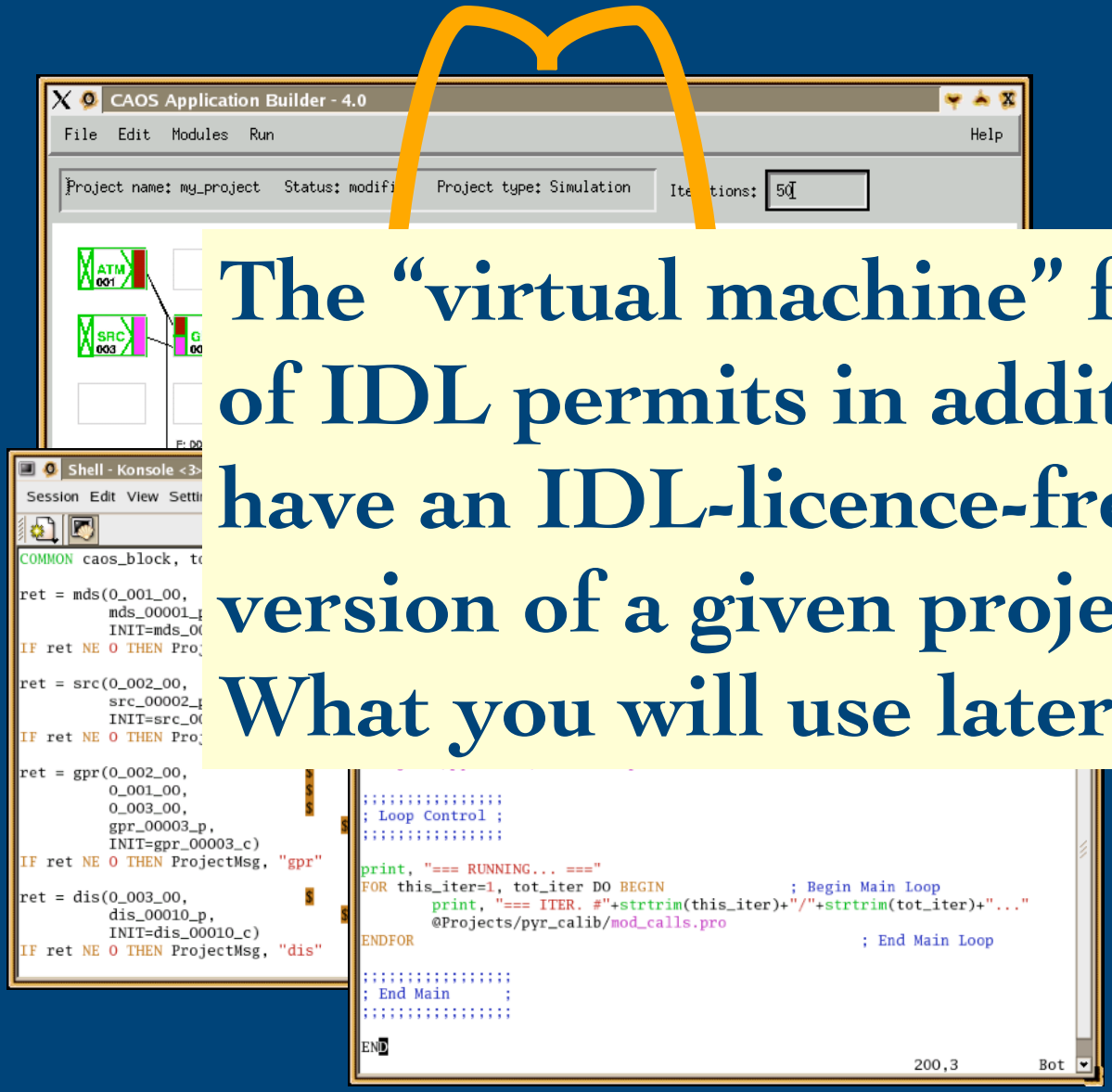
CAOS Problem Solving Environment -1

CAOS Problem Solving Environment -2



somewhere else: astrolib, *some other library*

CAOS Application Builder



The "virtual machine" feature of IDL permits in addition to have an IDL-licence-free version of a given project... What you will use later on.

It is essentially a **worksheet** where the user can place small modules, them with to form a

project is can be generating the IDL code which implements the simulation program.

CAOS PSE: availabilitv

All (*public!*) parts of the CAOS PSE are available for download:

http://lagrange.oca.eu/caos/

Current status of the dedicated mailing-lists (as on september 2016):

- Soft. Pack. CAOS: 117 subscribers,
- Soft. Pack. AIRY: 30 subscribers,
- Soft. Pack. SPHERE: 23 subscribers,
- Soft. Pack. PAOLAC: 3 subscribers.

End-to-end AO modeling with the Software Package CAOS -1

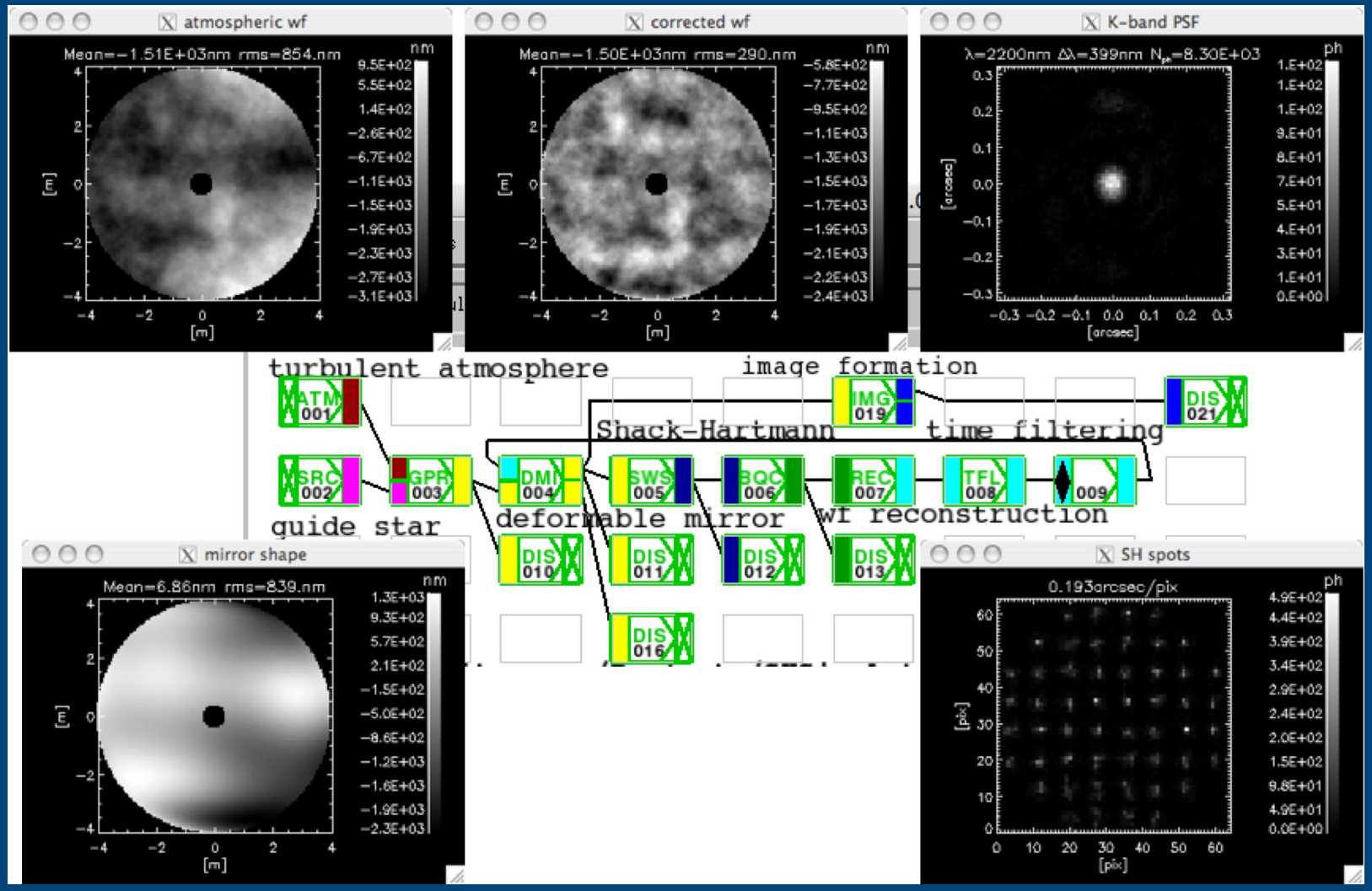
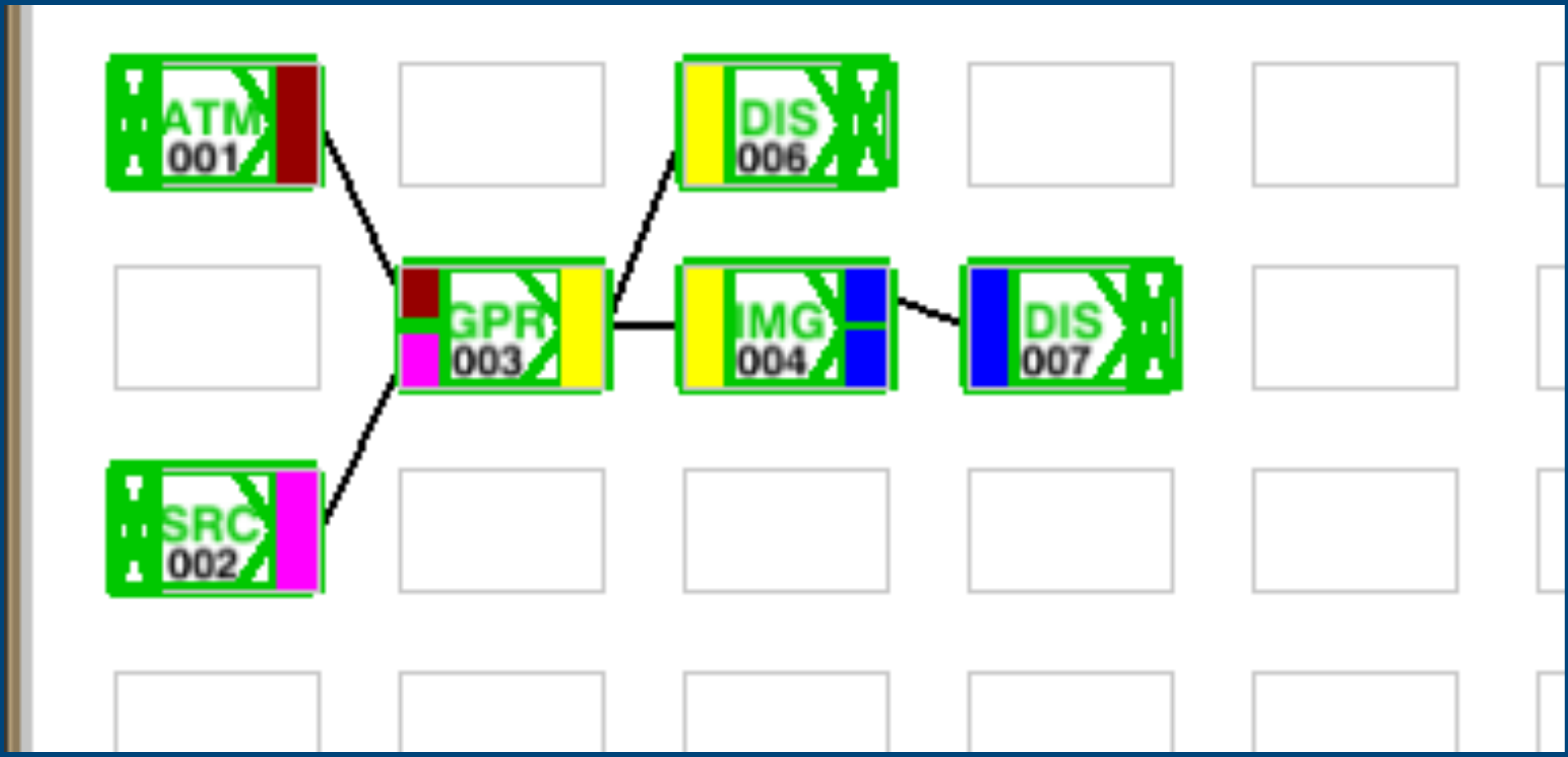


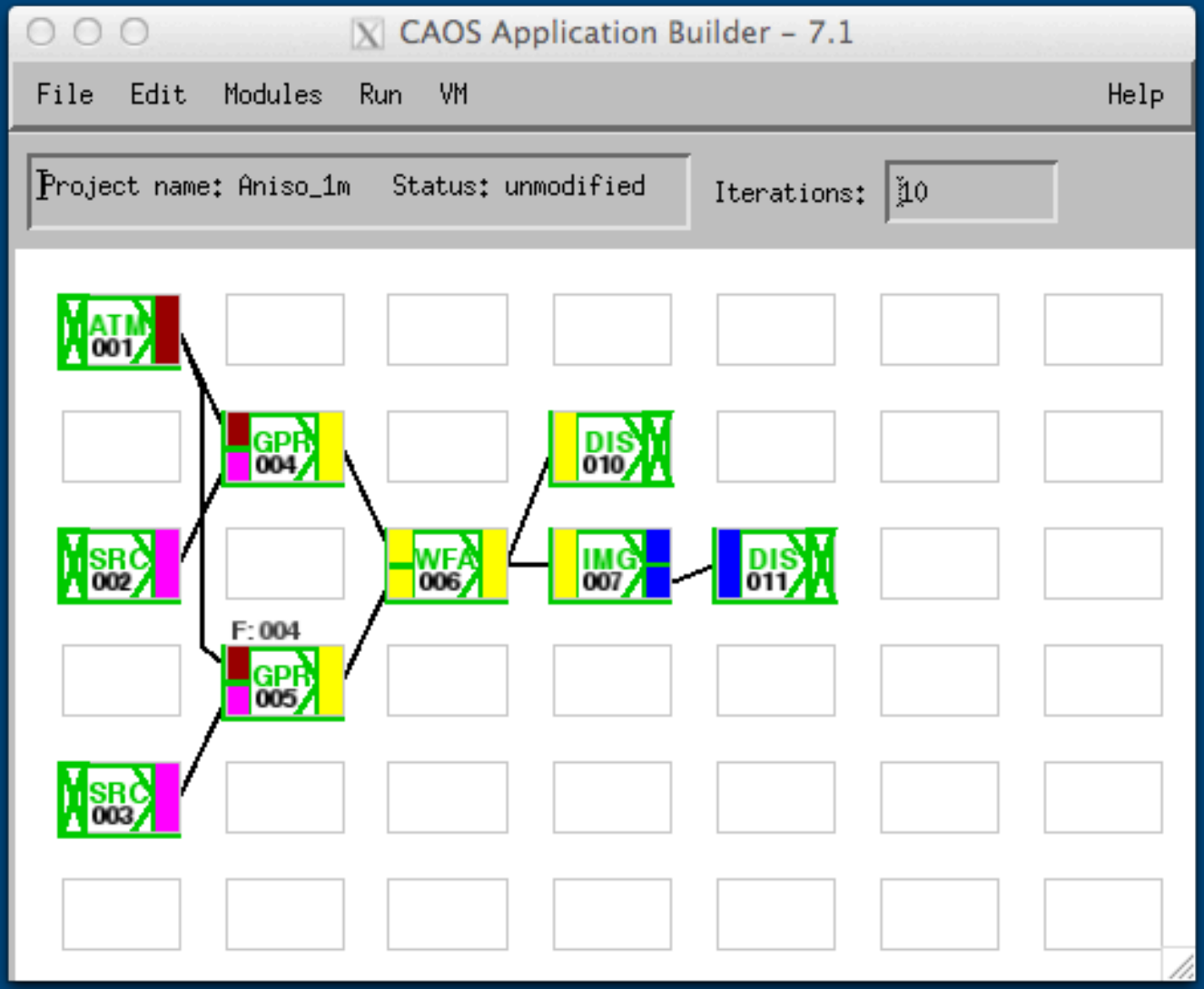
Table 1. The 31 modules of the **Software Package CAOS**, version 7.0.

Module	Purpose
Optical turbulence & image formation	
ATM - ATMosphere building	-builds the turbulent atmosphere (FFT+subharmonics, Zernike) (see also utility PSG - Phase Screen Generation)
SRC - SouRCe definition	-characterizes the guide star/observed object
GPR - Geometrical PRopagator	-propagates light from source to telescope through atmosphere
IMG - IMaGing device	-forms an image of the observed object (+detector noises)
Wavefront sensing	
PYR - PYRamid wavefront sensor	-simulates the pyramid wavefront sensor
SLO - SLOpe computation	-computes the slopes from the pyramid signals
SWS - Shack-Hartman Wavefront Sensor	-simulates the Shack-Hartmann (SH) wavefront sensor
BQC - Barycentre/Quad-cell Centroiding	-compute the signals from the SH spots centroiding calculus
IWS - Ideal Wavefront Sensing	-applies "ideal" wavefront sensing (see text)
TCE - Tip-tilt CEntroiding	-computes and reconstructs tip-tilt
Wavefront reconstruction, control & correction	
REC - wavefront REConstruction	-reconstructs the wavefront
TFL - Time-FiLtering	-applies time-filtering after wavefront reconstruction
SSC - State-Space Control	-applies state-space control
DMI - Deformable MIrror	-simulates the behavior of a deformable mirror (DM)
TTM - Tip-Tilt Mirror	-simulates the behavior of a tip-tilt mirror
Calibration	
CFB - Calibration FiBer characterization	-defines a fiber to be used for calibration purpose
MDS - Mirror Deformation Sequencer	-generates a sequence of DM modes or influence functions
SCD - Save Calibration Data	-saves the calibration data (interaction matrix+set of deformates)
Wide-field AO	
AVE - signals AVEraging	-averages measurements from various wavefront sensors
COM - COMbine measurements	-combines measurements from various wavefront sensors
DMC - Deformable Mirror Conjugated	-corrects at different conjugated altitudes
Other modelling modules	
LAS - LASer characterization	-defines laser projector characteristics
NLS - Na-Layer Spot definition	-characterizes the Sodium-layer behavior
IBC - Interferometric Beam Combiner	-combines the light from two apertures
COR - CORonagraphic module	-simulates various coronagraphs (Lyot, Roddier&Roddier, FQPM)
AIC - Achromatic Interfero-Coronagraph	-simulates the Achromatic Interfero-Coronagraph
BSP - Beam SPlitter	-splits the light beam
Other utility modules	
WFA - WaveFront Adding	-adds or combines together wavefronts
ATA - ATmosphere Adding	-adds or combines together atmospheres
IMA - IMage Adding	-adds or combines together images
STF - STructure Function	-calculates the structure function and compares to theory

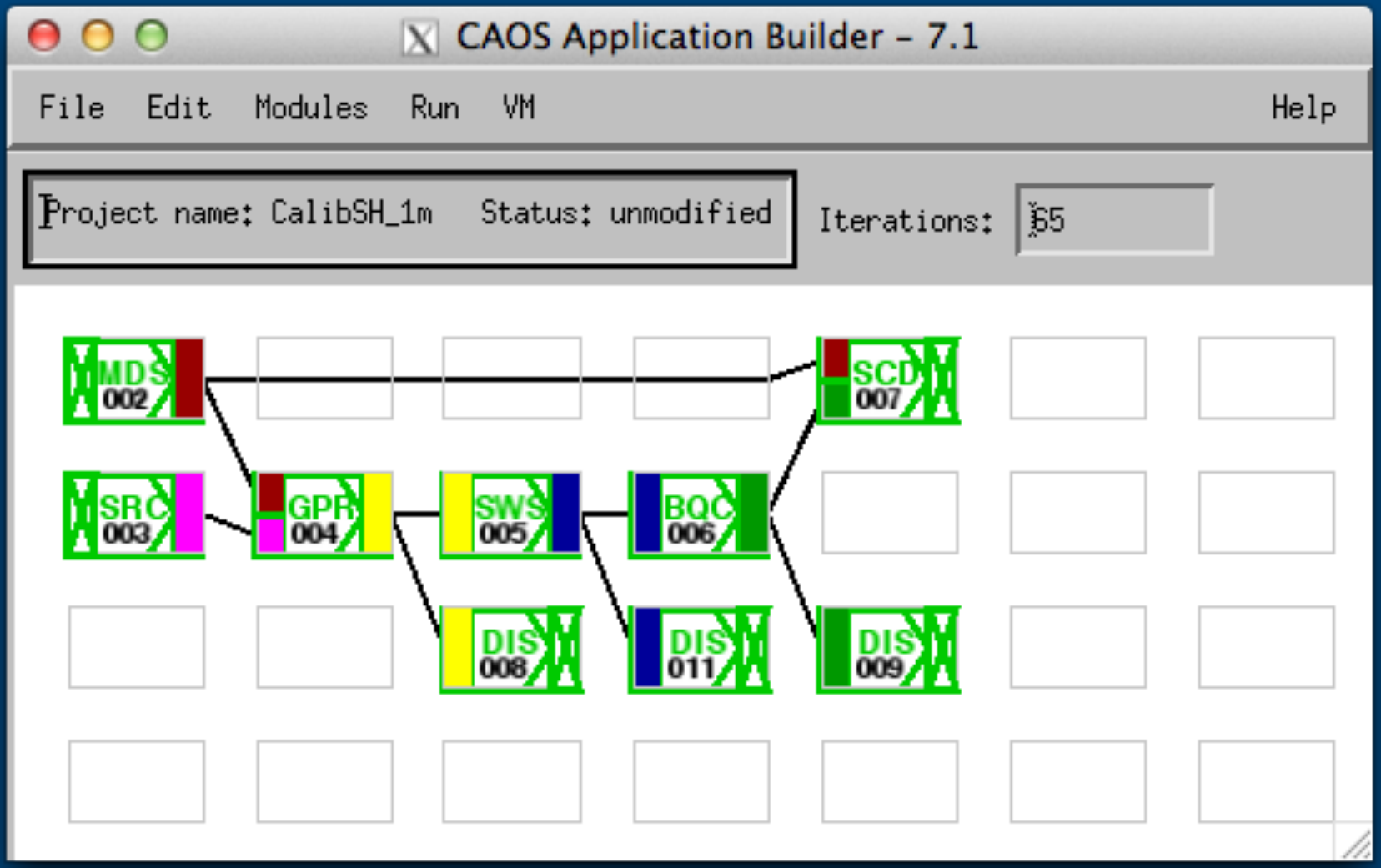
Imaging through the turbulent atmosphere: loss of resolution !



Imaging through the turbulent atmosphere: anisoplanatism !



End-to-end simulation of a complete AO system: calibration



End-to-end simulation of a complete AO system: running...