Hubble Space Telescope and Python

• Space Telescope Science Institute uses Python for most new science data calibration and analysis software:
  – For Hubble Space Telescope
  – And future James Webb Space Telescope
• Using Python for over 10 years
• Involved in:
  – General science libraries:
    • Numpy (formally numarray), matplotlib, cyrano, pandokia
  – Astronomical libraries:
    • PyRAF, PyFITS, Virtual Observatory, pywcs, pysynphot
Combining overlapping HST images

Wide Field Channel of ACS consists of two CCDs that don’t overlap

Image Size
- $2 \times 4096 \times 2048$

-Most of what look like stars are actually result from cosmic rays and need to be removed

-Frequently several offset exposures are taken to cover the gap and to identify which features are cosmic rays (cosmic rays appear randomly in an image)
Final Mosaic

Multidrizzle:

- Handles mapping input pixels to the final output image (involves distortion)
- Handles changing the orientation of the image
- Identifies and removes the cosmic rays and defective pixel
Plans and Concerns

• Python use growing in Astronomy (default scripting language for new big projects).
• Much work to be done to replace existing functionality in IRAF
• Transition to Python 3 is a big issue
• Distributing Python applications is the biggest problem
  – Typically many dependencies
  – Astronomers want simple installs
  – Current system has holes, e.g.:
    • Mac OS X (many variants for installation)
    • Support for Fortran
    • Handling needed libraries (libpng, freetype2, etc.)
    • Matplotlib and scipy are not simple installs