Software

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Overview & Design Principles

Experience:
Major instruments already deployed
- 2 optical imagers (Minicam and Megacam)
- 2 fiber spectrographs (Hectospec and Hectochelle)
- 1 infrared imager (SWIRC)

Major instruments in development
- 1 imaging spectrograph (Binospec)
- 1 spectrograph and imager (MMIRS)

Telescopes
- Multiple Mirror Telescope (Arizona)
- Magellan Telescopes (Chile)

Design Principles:
- code re-use
- write once, use twice philosophy
- small configuration files

Predictive code implementation
Requirements

Device Requirements:
• Guide Camera Focus  n/a
• Calibration Slide Mirror 10 um
• ADC Prism Rotator(s) 1.0 deg
• Neutral Density Filter 0.2 deg
• Fiber Head Safety Cover 0.1 mm
• Dual-Axis Tip/Tilt Mirror 10 Hz
• Calibration Lamps (warmup) 2 hr
• Lamps Fiber Carriage 10 um

Software and Computers:
• system redundancy
• software re-use
• look-ahead design
• scheduling/reduction interoperability

Telescope:
• offloading in Alt/Az
• TCP/IP based TCS
• accounts and security regulations
• guiding user interface
Computer Systems

Computers:

HARPS-NEF Computers
• User Computer
• Devices Computer
• Spare Computer

WHT Computers
• Observer Computer
• Telescope Operator Computer

Devices:

Motor Control and Environment
• Front End, Observing devices (ADC, NDF, sky-select, fiber cover & led)
• Front End, Guiding devices (tip, tilt, focus)
• Calibration Lamps devices (power, monitoring, select stages)
• Power, Vacuum and Cooling Systems

Imaging and Guiding
• 4k by 4k imaging CCD array
• 2k by 2k guide CCD array

Telescope:
Telescope Control System
Motor Control Logical Units

Independent Units:
  Front End, Observing
  Front End, Guiding
  Calibration Lamps

Embedded Gumstix Computers:
  • 600MHz processor
  • 30MB storage + MicroSD
  • 10/100BaseT Ethernet
  • 3 serial ports
  • $300 price tag

Practical Applications
  • abstraction of motor control
  • designation for independent subsystems
  • sole-process implementation

Purpose in our Design:
  • guide system demands with 10Hz corrections
  • small package with low heat/power
  • clear command set with simple abstraction
  • easily applied to future instrumentation
Network Layout
Data Handling

FITS Header Requirements:
  • HARPS South header
  • CfA standard header

Data Retrieval And Processing:
  Detector to Devices Computer
    • EDT readout card
    • timestamp filename

  Devices Computer to User Computer
    • copy raw file to user computer directory
    • access privileges separation

  User Computer to Observer Computer
    • X11-forwarding to WHT computers
    • reduction courtesy of Geneva Observatory
    • hard copy media to observer

Data Archiving:
  • onsite archive (1 month raw, 1 week reduced)
  • hard copy media to Geneva
  • network backup from Geneva to CfA
Software Systems

Libraries and Utilities developed at CfA:
  • comm  low level communications
  • logserv quick configuration logging
  • powserv power and temperature control
  • ... and many more

Client-Server:
  msg protocol
    • native Tcl code
    • interfaces with telnet
    • built in file logging
    • ... and much more

telescope communications
  • TCP/IP server-side interface
  • protocol translation to msg interface

User Interfaces:
  • observation scheduling courtesy of Geneva Observatory
  • data reduction courtesy of Geneva Observatory
  • guiding derived from CfA guide systems
  • engineering derived from CfA engineering systems
Software Interconnect - OIC
Software Interconnect - CL
Software Interconnect - GL, IA
Software Interconnect - TVP

Overview
- Observation Request Form
- Scheduler
- Observation Instrument Control
- Calibration Lamp
- Image Reduction
- Image Archive
- Guide Loop Control
- Thermal, Vacuum, and Power

Thermal Systems Control
- Detector Coolant
- Detector Temperature Monitor and Controller
- Room Temperature Monitor
- Spectrograph Temperature Monitor and Controller
- Spectrograph Heater
- Spectrograph Temperature Sensors

Vacuum Systems Monitoring
- Vacuum Systems Server (Devices Computer)
- Pfeiffer Pressure Sensors

Power Systems Control
- Power Systems Server (Devices Computer)
- Pulizzi Power Control
- Uninterruptible Power Supplies

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Summary

Software Design:
• use existing software where practical
• adapt scheduling, reduction interfaces with G.O.
• thin configuration files for each device group

Data Acquisition and Archiving:
• standard EDT readout card
• onsite backup 1 month raw, 1 week reduced
• copies on both active computers for redundancy
• media backup to Geneva, network backup to CfA

Control Systems:
• separate devices into logical control groups
• use of Gumstix to abstract motor systems
• direct control of power, temperature, vacuum
• protocol translation to the WHT TCS