NIC-FPS Critical Design Review

Instrument Control and Software

Stéphane Béland

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CASA-ARL

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Overview

- Requirements
- Block Diagram
- Motor Control
- Temperature and Pressure
- Remote Communication
- Instrument Control Software
- Data Reduction
- Observing Procedures

Requirements

- **Remote motor control**
  - 6 moving mechanisms (4 at cryo temp, 2 at ambient)
  - 2 or 4 switches per mechanism (micro or magnetic switches)
- **Remote temperature and pressure monitoring**
  - Monitor several locations inside dewar (60-300K)
  - Monitor dewar pressure (10^{-3} to 10^{-7} Torr)
- **Remote communication**
  - Standard protocol (Ethernet, RS232)

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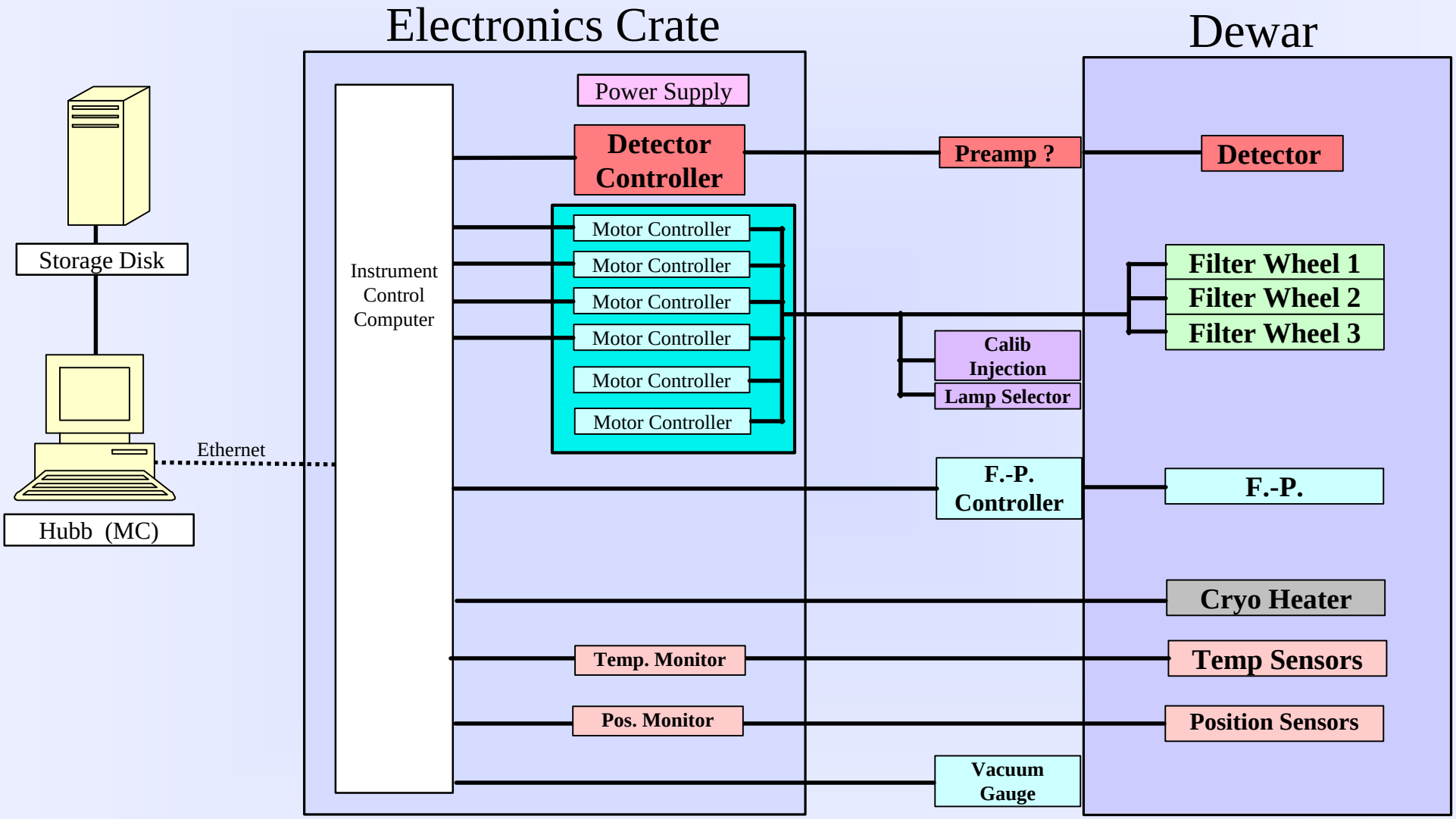


Remote Motor Control

- Serial RS232 6 axis motor controller (Phytron IXEa for 6 motors $9300)
- 4 cryogenic stepper motors (Phytron VSS.42.200.2.5 $1700 each)
- 2 ambient temperature stepper motors (Phytron ZSS.42.200.1.2 $200 each)

Remote Temperature and Pressure

- Temperature Sensors
- Serial RS232 temperature monitor (Lakeshore 218 $1200)
- Serial RS232 pressure monitor (Varian eyeSYS mini-BA $960)

Remote Communication

- Ethernet from Master Controller (MC) to Instrument Control Computer (ICC)
- RS232 from ICC to instrument devices (Lantronix ETS16P $930)

Instrument Control Software

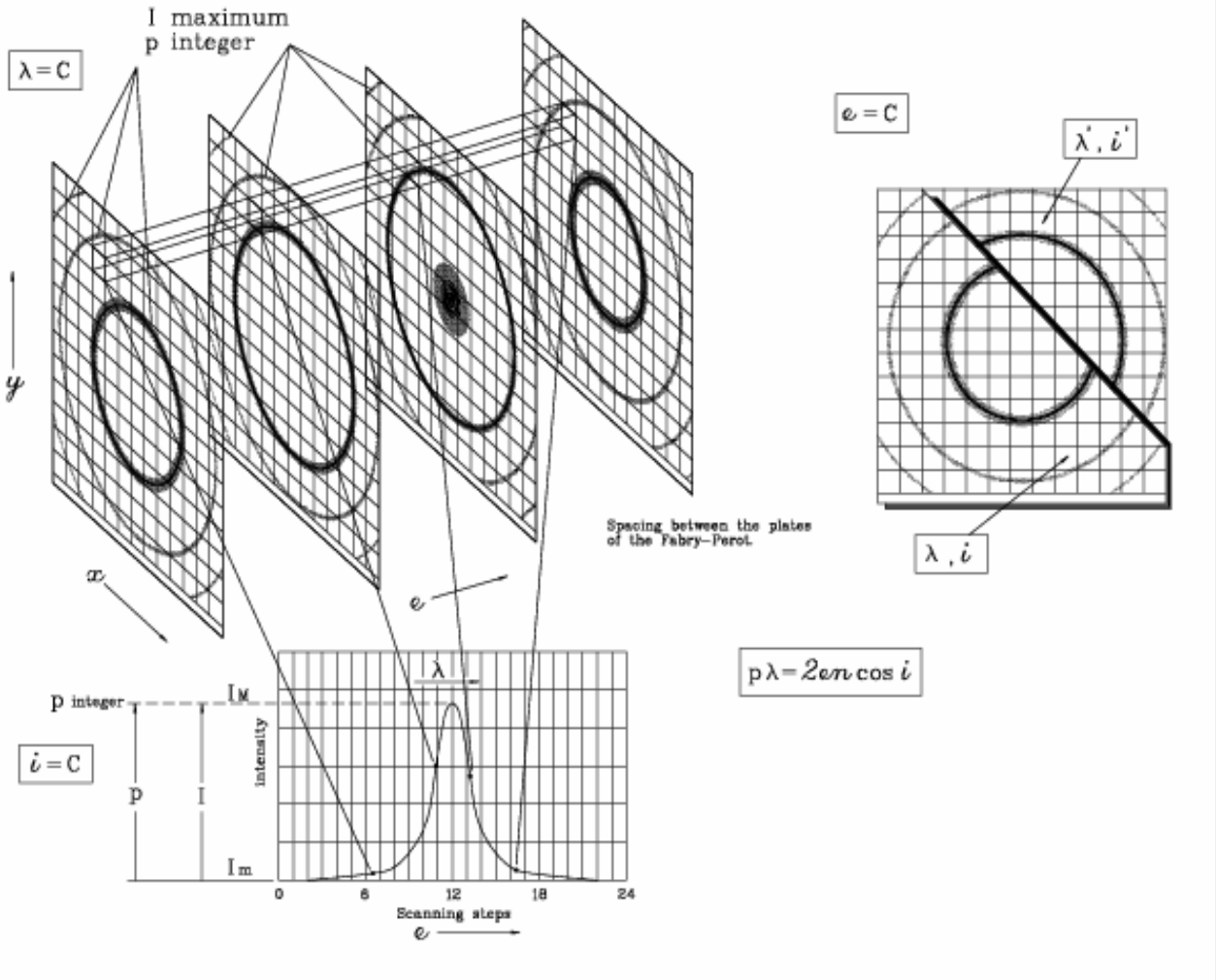
- Provide user-friendly control of all aspects of the instrument
  - filter wheels, optical path, shutter control, camera focus, calibration lamps/mirrors
  - Fabry-Pérot spacing
- Maintain and inform user of status of instrument
- Software under version management
- Documentation will be provided
- **Adhere to ARC standards (using new Python Instrument Control Interface & scripts)**
- Observing scripts: F-P scanning, Co-adding images, Multiple Sampling Readout (to beat down read noise), Exposure Time Calculator, …

Data Reduction Software (Imaging Mode)

- Detector (non-destructive) read out: Reset, Reference Frame, Integration, Raw Frame
- Co-add N frames: in controller or computer memory or post processing with referencing
- Flat field for each filter position (internal, “dome”, or sky)
- Bad pixel map
- Cosmic ray cleaning
- Geometric distortion map
- IRAF or IDL or ??
- Assuming average 10sec exposure and 50% duty cycle over 10 hours (2MB per image)
    - 3.6GB per night of unprocessed data

Data Reduction Software (Fabry-Perot Spectroscopic Mode)

- Standard image processing
- Generate phase map
- Extract spectrum:
  - any region, any sampling
- Standard spectro. reduction
  - wavelength calibration
  - photometric calibration
- IRAF or IDL or ??
  - IRAF routines available



Observing Procedures

- Imaging Mode:
  - Adjust focus (filter change, mode change)
  - Take flat fields for every filter to be used during observations
- Fabry-Perot Spectroscopic Mode:
  - Adjust focus (filter change, mode change)
  - Adjust/verify etalon's parallelism at setup
  - Measure etalon's finesse at setup (maybe)
  - Measure etalon's scanning constant (Wavelength / Binary Coded Values)
  - Perform wavelength calibration (lamps or OH lines) at spacing to be used during observations
  - Take flat fields at every combination of spacing and filter to be used during observations (White Light Cube)
  - Calibration Stars