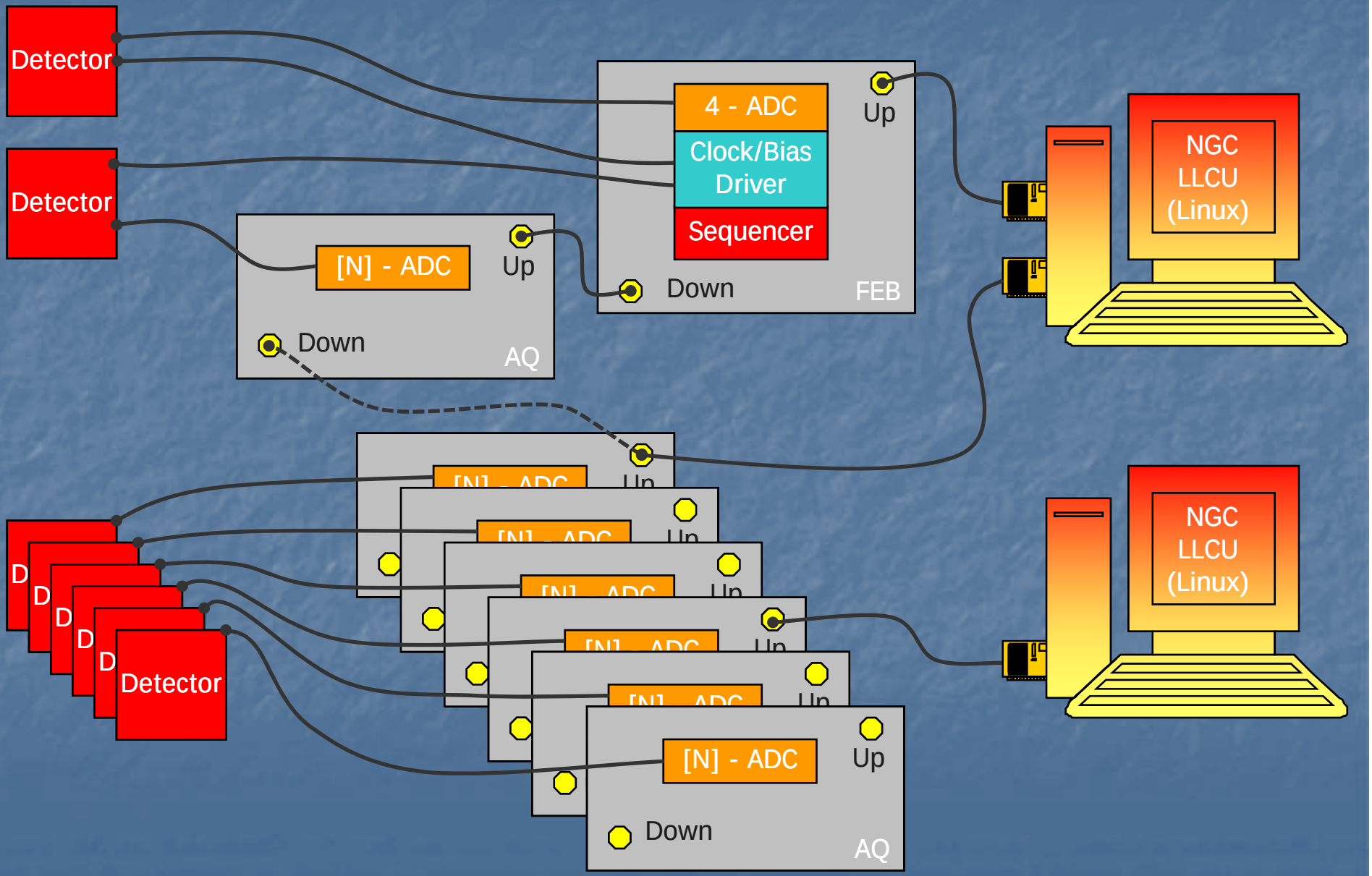
ESO New General detector Controller (NGC)

Base Software

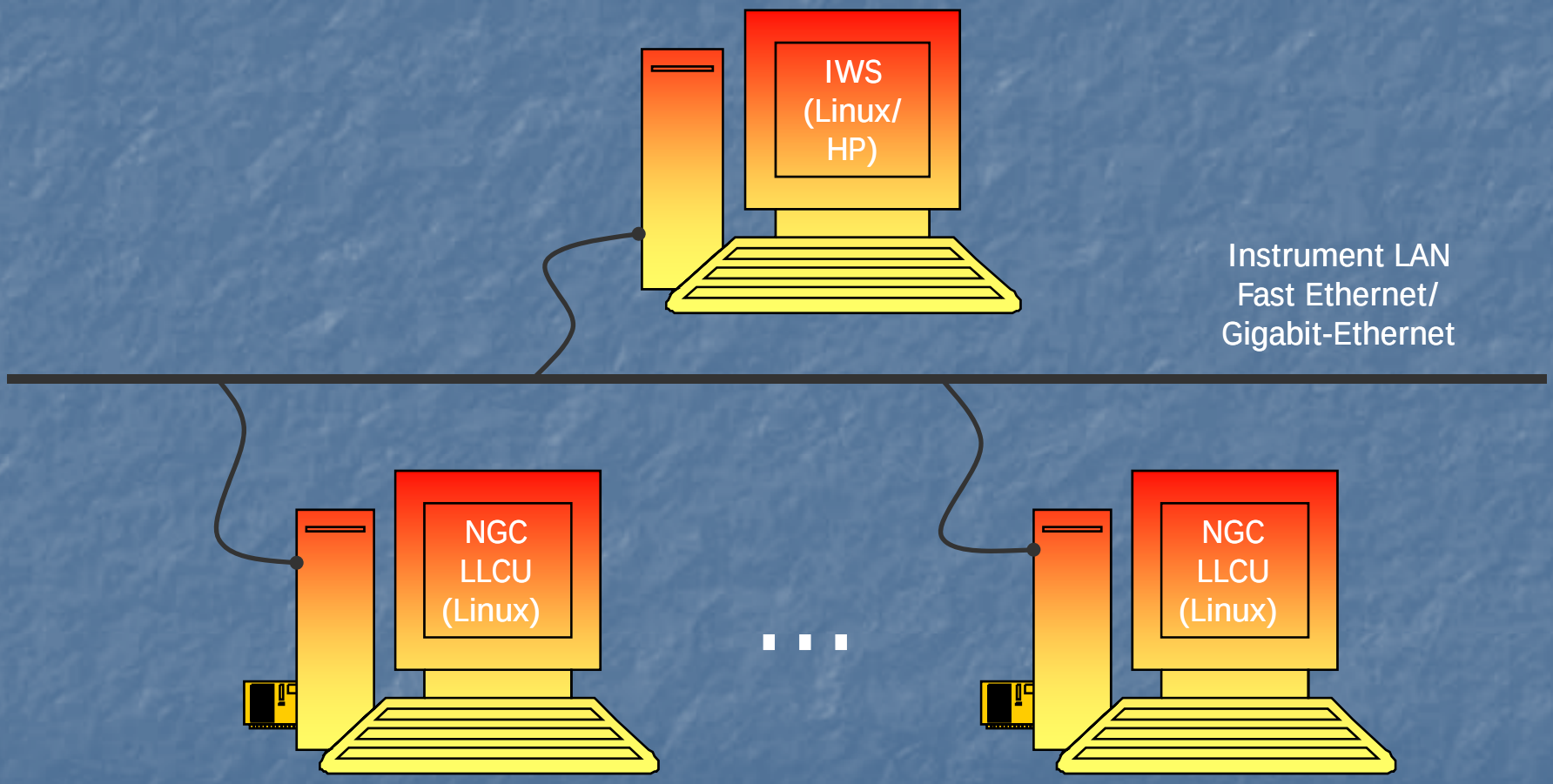
And

Infrared Detector Control Software

The System

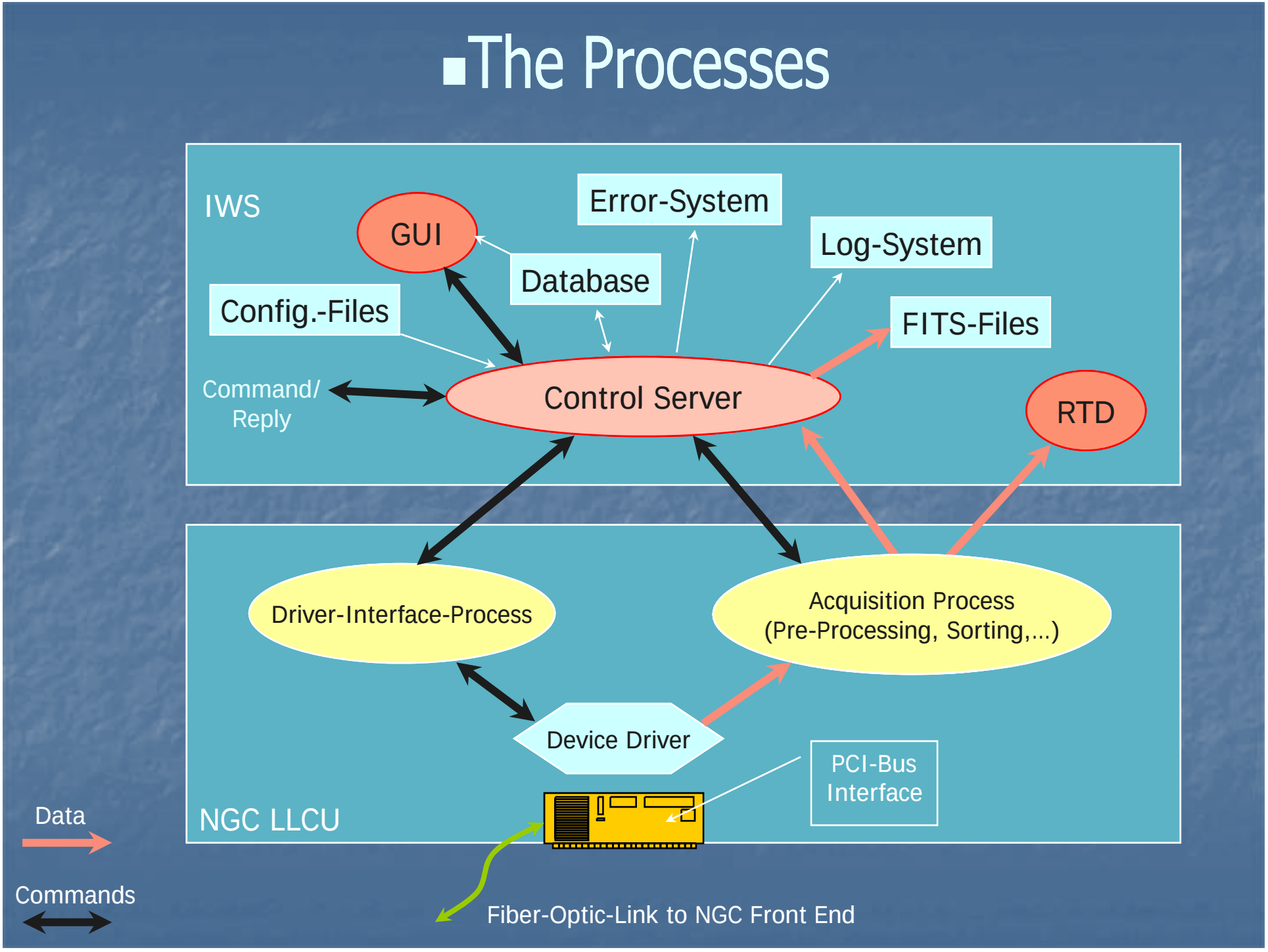

Detector
Detector
4 - ADC
Clock/Bias Driver
Sequencer
Up
Down
FEB
[N] - ADC
Up
Down
AQ
NGC LLCU (Linux)
D
D
D
D
D
Detector
[N] - ADC
Up
Down
AQ
NGC LLCU (Linux)

Computing Architecture

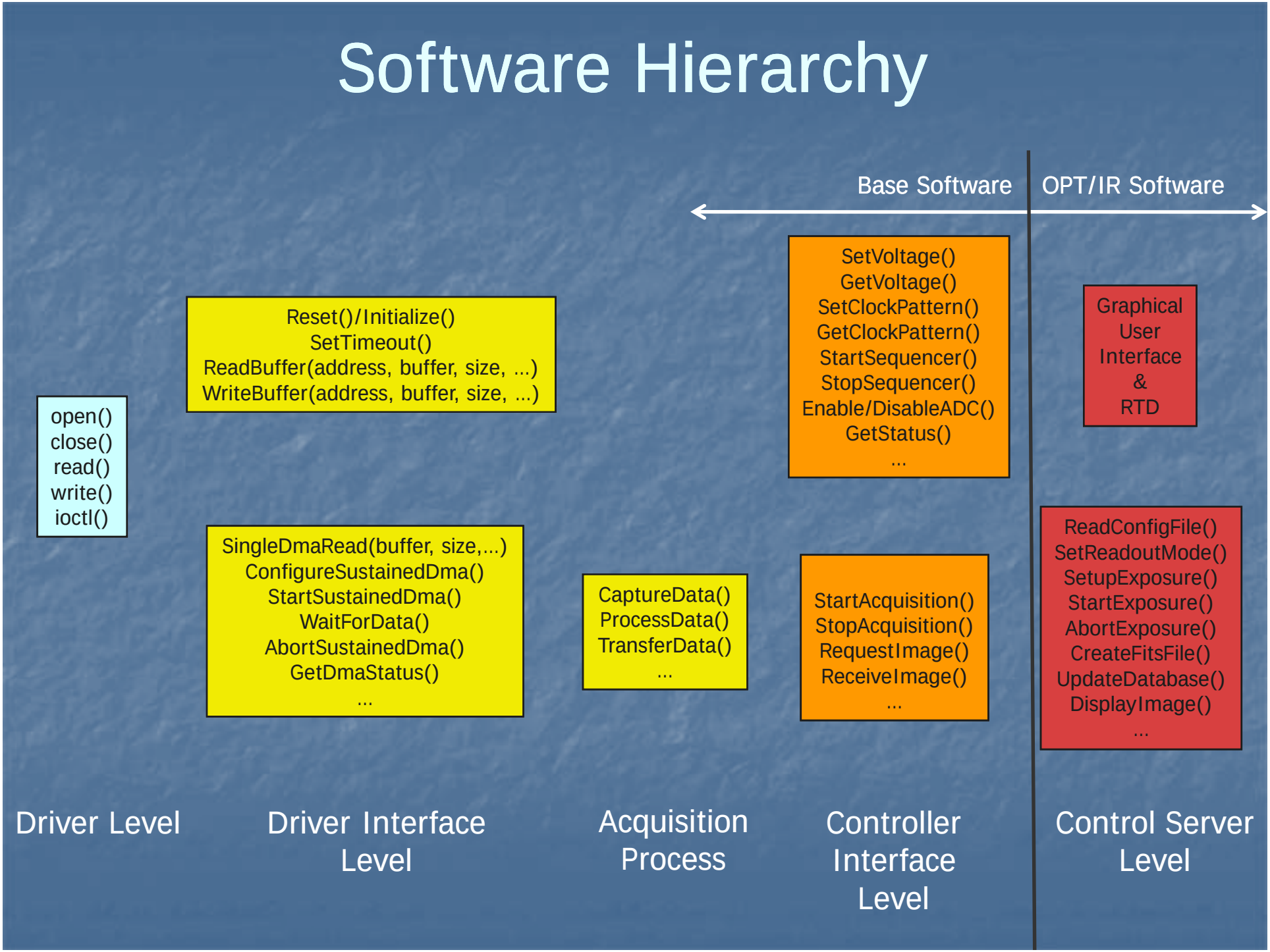


With the current Linux-PC model
we can achieve 200 Mbytes/s
sustained input data-rate with co-adding
(double correlated read-out)

The Processes



Software Hierarchy



Software Modules

- *dicNGC* - Dictionary (both OPT/IR)
- *ngcdrv* - Device Driver
- *ngcb* - Driver Interface and Basic Routines
- *ngcpp* - Pre-Processing
- *ngcdcs* - Control Software & Server

Base SW

- *ngcgui* - Engineering & IR GUI
- *ngcrtd* - Engineering & IR Real-Time Display

IR SW + Opt. SW (engineering)

- *ngciracq* - IR Acquisition Processes
- *ngcircon* - IR Control SW & Server
- *ngclcu* - NGC-LCU Interface SW (IR, for VLTI)

IR SW

205726 lines of code

- The modules will be part of the VLTSW Releases.
- All modules contain Test Procedures for TAT (automated testing).

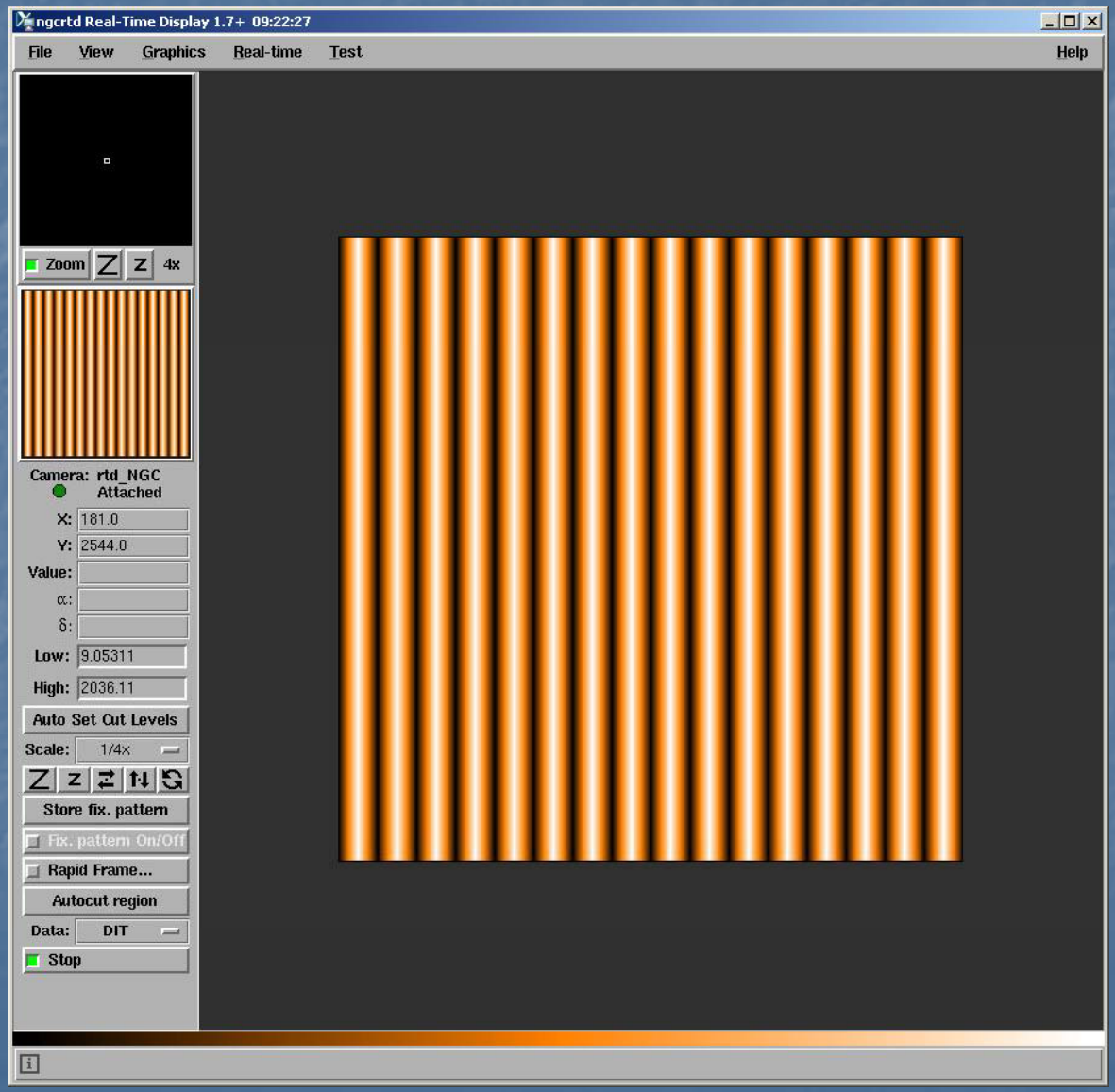
Driver and Interface

- Device Driver for Linux kernels 2.4 and 2.6 (software module "*ngcdrv*").
- One channel for System Control (COM) and one channel for sustained DMA data transfer.
- Driver Interface Libraries hide changes in the HW-communication protocol and changes in the operating system (LINUX kernel) and make the SW transparent to the next SW layer. They are part of the NGC Base Software, which also contains some other functionality (such as a transparent threads interface, priority control, etc.) and a Simulator for the NGC HW (software module "*ngcb*").

Acquisiton Processes

- The pre-processing framework for the multi-threaded Acquisition Process has been taken over from IRACE (software module "*ngcpp* ").
- Currently this is required mainly for the data pre-processing in IR applications.
- Template Processes have been developed, which are an easy-to-use and stand-alone tool to visualize NGC raw-data on the RTD.
- The acquisition processes for the ESO Standard IR Detectors (HAWAII 1Kx1K, HAWAII2-RG 2Kx2K, ...) are assembled in a separate software module ("*ngciracq* "). Special setups (e.g. mosaics) for specific instruments may require special software modules ("*xxacq* ").

NGC Real Time Display ("*ngcrtd*")



Controller Interface

- The controller interface provides Modular Objects for Sequencer-, CLDC- and ADC-Control, for interfacing to the Acquisition Process and for the Asynchronous Data Reception (software module "*ngcdcs*").
- These objects can be assembled in the Control Server in an arbitrary way to reflect all functionality of any NGC hardware configuration (i.e. Multiple Instances of Sequencer-, CLDC-, ADC-modules and any number of Acquisition Processes). The module configuration is done through a System Configuration File.
- The control server can be used as NGC-HW Control Sub-System of the NGCOSW. That is the maximum degree of communality as the same compiled and linked object is used by both applications to access the HW. It can be configured at Run-Time for the one or the other purpose.

Configuration Files

- The detector voltages are defined in a Voltage Configuration File in Short-FITS format (*xxx.v*).
- The voltage configuration files can be loaded to any CLDC instance in the system.
- The Clock-Patterns can be defined both in ASCII-Format (*xxx.clk*, *IRACE-style*) and in a new Binary Format (*xxx.bclk*, output of the Graphical Editing Tool BlueWave). The formats can be converted automatically.
- Synchronization with external events (e.g. trigger) can be done after any state in any clock-pattern.
- A new Sequencer Programming Language has been defined to make maximum use of the new HW capabilities (all code is executed at the same speed-level within the firmware). File extension is "*xxx.seq*".
- Multiple Sequencer Instances within one system are supported.

Sequencer Programs

- The sequencer programs are fully driven by Setup Parameters (e.g. DET.DIT, DET.NDIT, window parameters, ...).
- Support of Arithmetic Expression Evaluation (TCL-syntax) to derive any program-loop parameter from the setup parameters and to compute attributes like exposure time estimations and minimum DIT.
- Support of Sub-Routines and Include-Files to minimize the code length.
- The program complexity can be scaled:
  - Simply do not “USE” any setup parameter.
  - Simply omit the “SCRIPT” part for arithmetic expression evaluation.

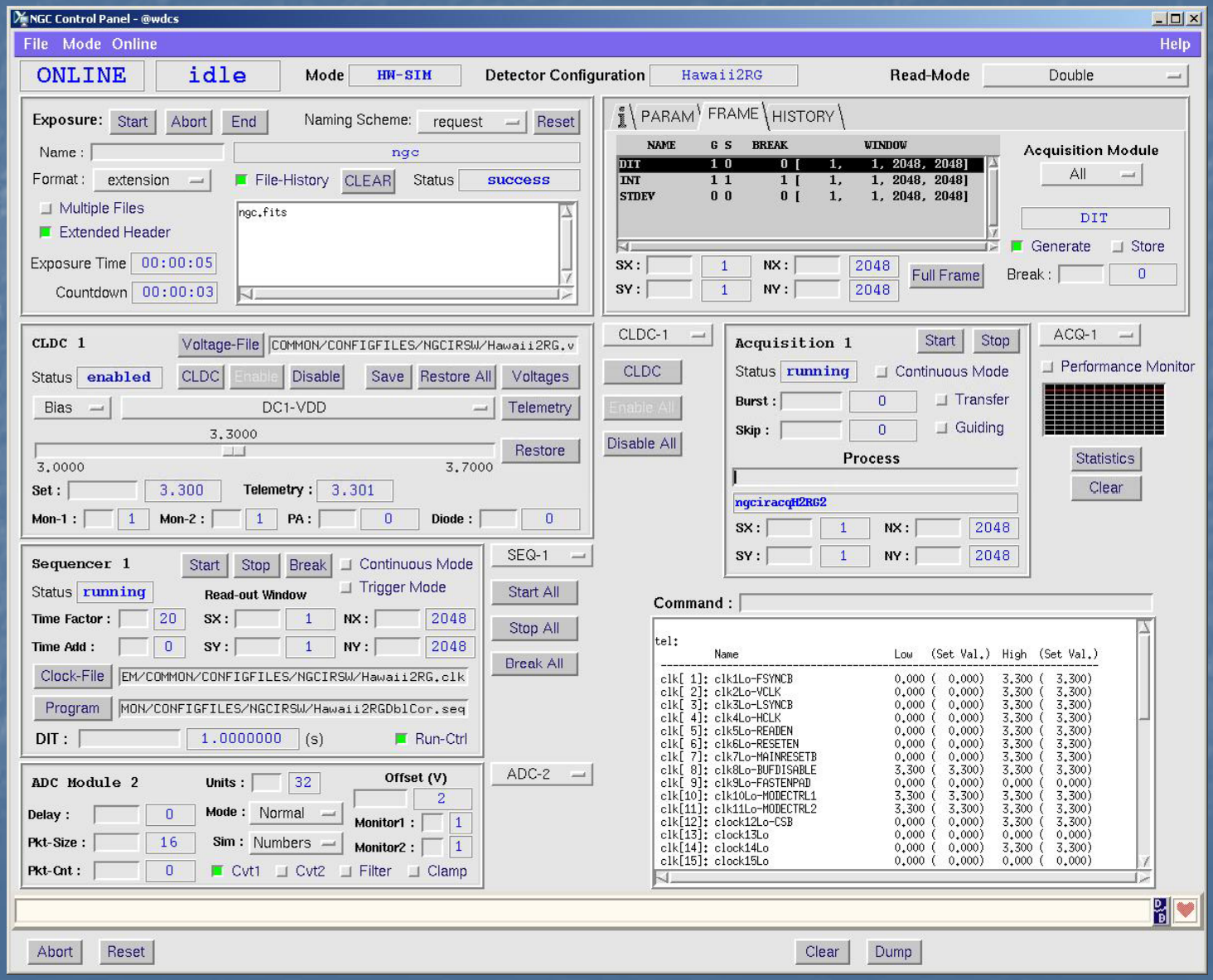
Infrared Setup

- The data-taking is defined through “Read-Out Modes”:
  - Read-out modes are defined by the Sequencer Program(s) running on the sequencer module(s) and by the corresponding Acquisiton Process(es) to be launched.
  - Read-out modes are selected by Name or a Unique ID (a Default Mode can be given).
- Window Read-Out is done by evaluating the window parameters within the sequencer program.
- The read-out modes and the voltage- and clock-pattern-configuration files to be loaded when going *ON-LINE* are defined in a Detector Configuration File. This also defines the detector parameters (size, type, name, mosaic arrangement, ...).

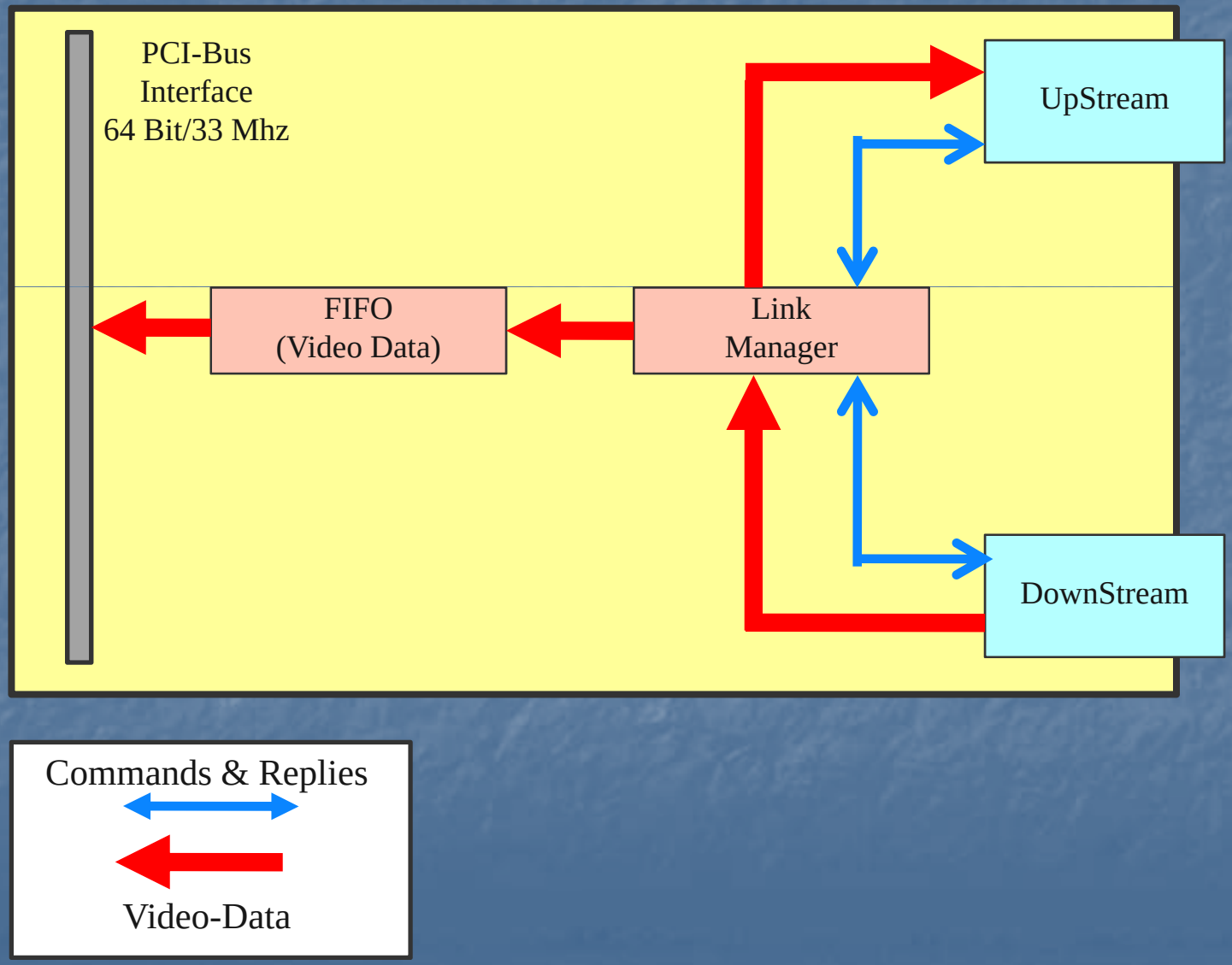
Infrared “Exposures”

- Sustained Detector Read-Out and Video Display on the RTD (display remains active during the “Exposure”).
- User-definable Frame-Types (DIT, STDEV, HCYCLE, intermediate results...). The types can be selected to be generated and/or stored during an “exposure”.
- Exposure Break-Conditions can be set per “per frame-type”.
- Individual SW-Windows per frame-type.
- Sustained Data-Transfer between NGC-LLCU and IWS for application specific Post-Processing (slow control loops, e.g. secondary auto-guiding).
- Burst-Mode for fast raw data acquisition.

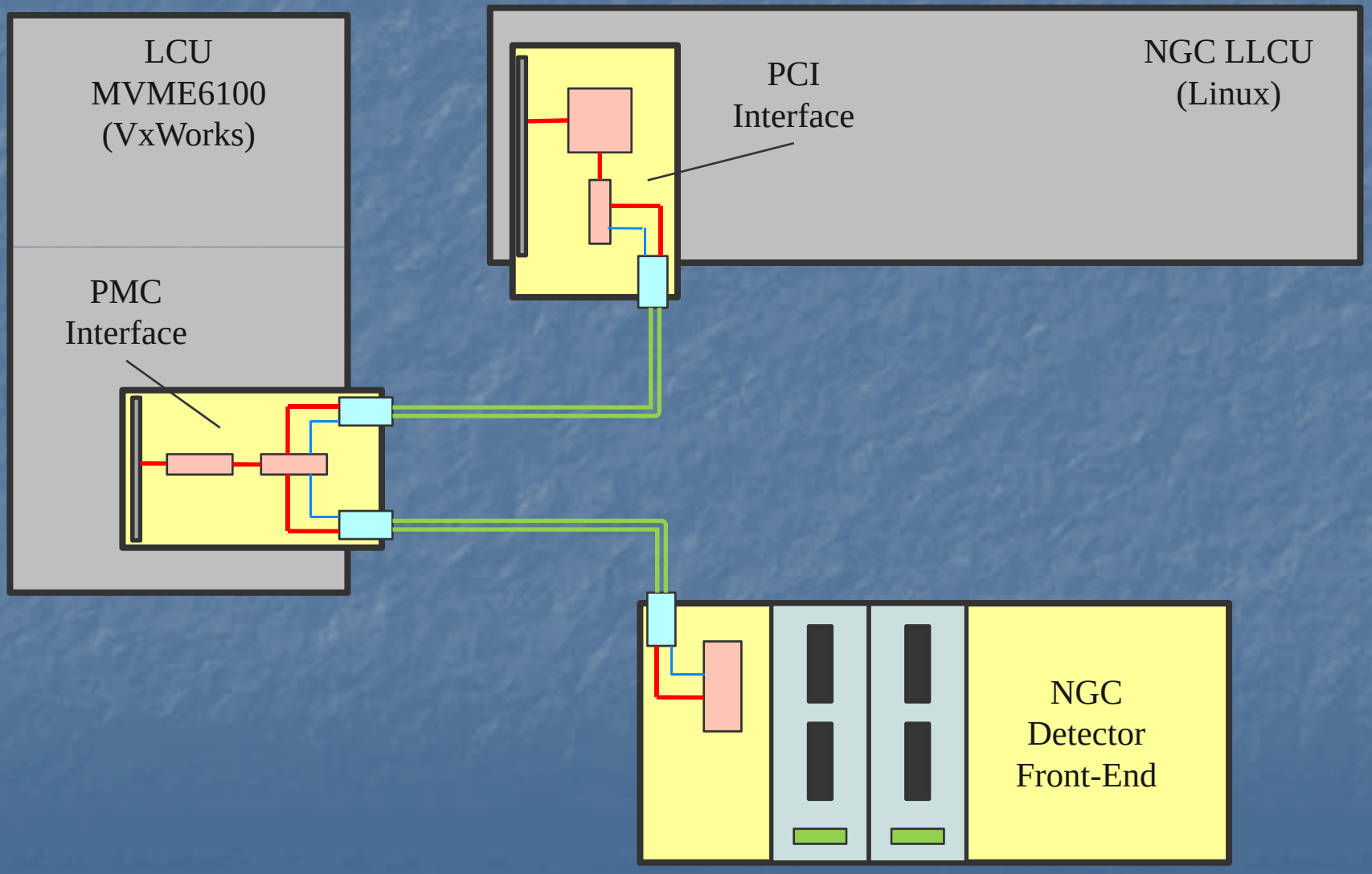
Graphical User Interface ("*ngcgui*")



PMC Interface (for VLTI)



VLTI-System


LCU
MVME6100
(VxWorks)
PMC
Interface
PCI
Interface
NGC LLCU
(Linux)
NGC
Detector
Front-End

NGC-LCU Interface Software

- Software module "*ngclcu*".
- VxWorks Device Driver for the NGC PMC Interface card.
- Sustained DMA (64 Bit / 33 MHz, 128 MPixels/s)
- Data Capture Library
- Possibility to install a User-Defined Interrupt Service Routine (to minimize the latency).
- Latency: min. 4 µs, max. 6 µs depending on the configurable DMA-Blocksize (32 – 512 Bytes).
- Maintenance & Test Tools
  - Remote access from NGC-LLCU to board registers
  - Visualize data on RTD
  - Check data integrity

Preview

- Integration into VLTSW-Release.
- New Detectors (Aquarius).
- Control SW for Sidecar ASIC.
- General procedure for Multiple Window Read-Out.
- Handling of the Guide-Window for the HAWAII2-RG array (parallel exposures).
- Acquisition processes for AO-Applications.

Documentation

- VLT-MAN-ESO-13660-4510 NGC - User Manual
- VLT-MAN-ESO-13660-4085 NGC Infrared DCS - User Manual
- VLT-MAN-ESO-13660-4086 NGC Optical DCS - User Manual
- VLT-MAN-ESO-13660-4560 NGC-LCU Interface SW – User Manual
- VLT-LIS-ESO-13660-3907 NGC Project Glossary
- VLT-LIS-ESO-13660-3908 NGC Project Acronyms