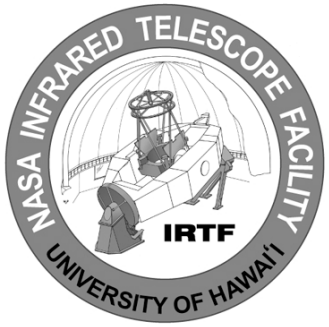


TCS3 Project

Replacement of the Telescope Control System for the IRTF

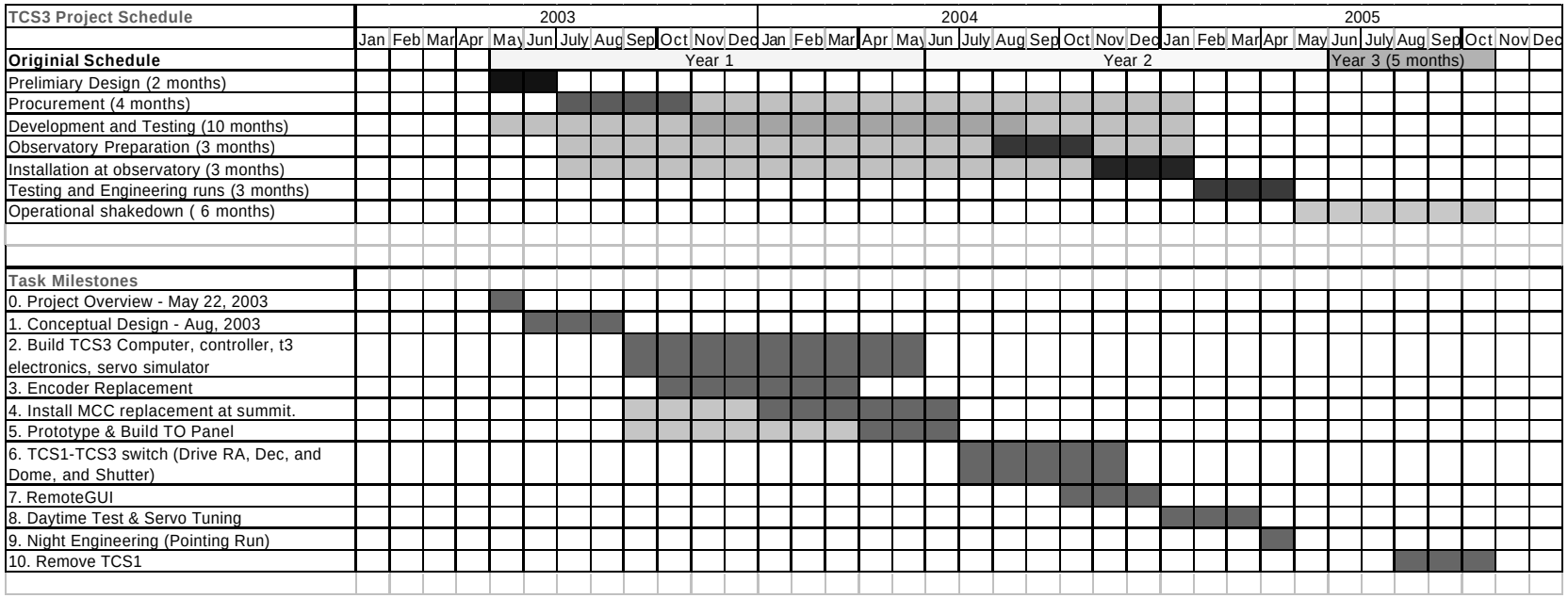
Conceptual Design Review

Aug 2003

Review Topics

- 1. Schedule, Tasks, and Budget
- 2. System Overview
- 3. Computers, Servo Controller, and Servo Simulator
- 4. T3 Electronics
- 5. Encoder
- 6. MCC Replacement
- 7. Facility IO
- 8. Software
- 9. TCS1-TCS3 Switching
- 10. RemoteGUI
- 11. TCS1 Removal

Schedule



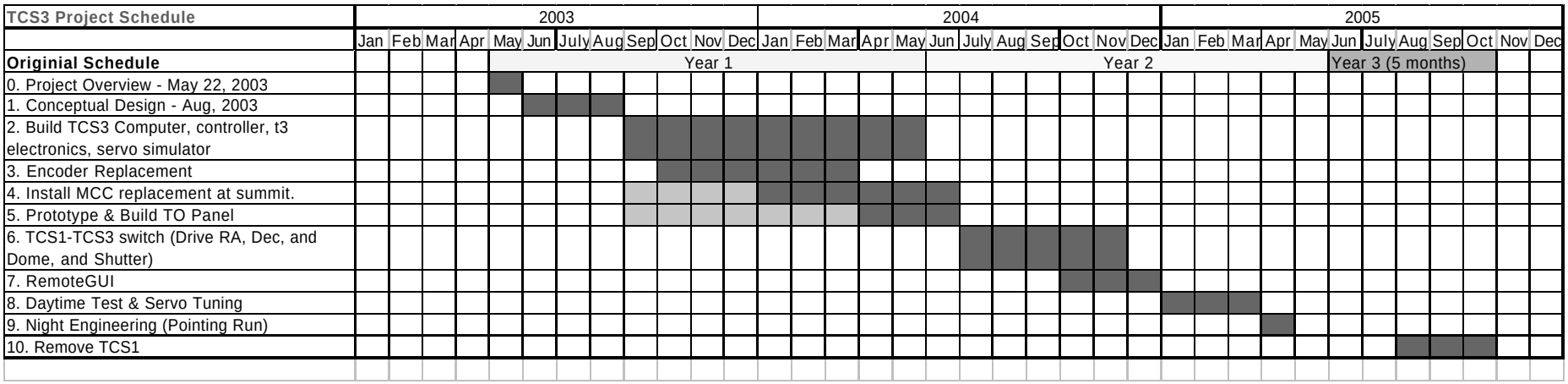
The original TCS3 Schedule given in the NASA proposal

The New Task oriented T3 Schedule.

Tasks

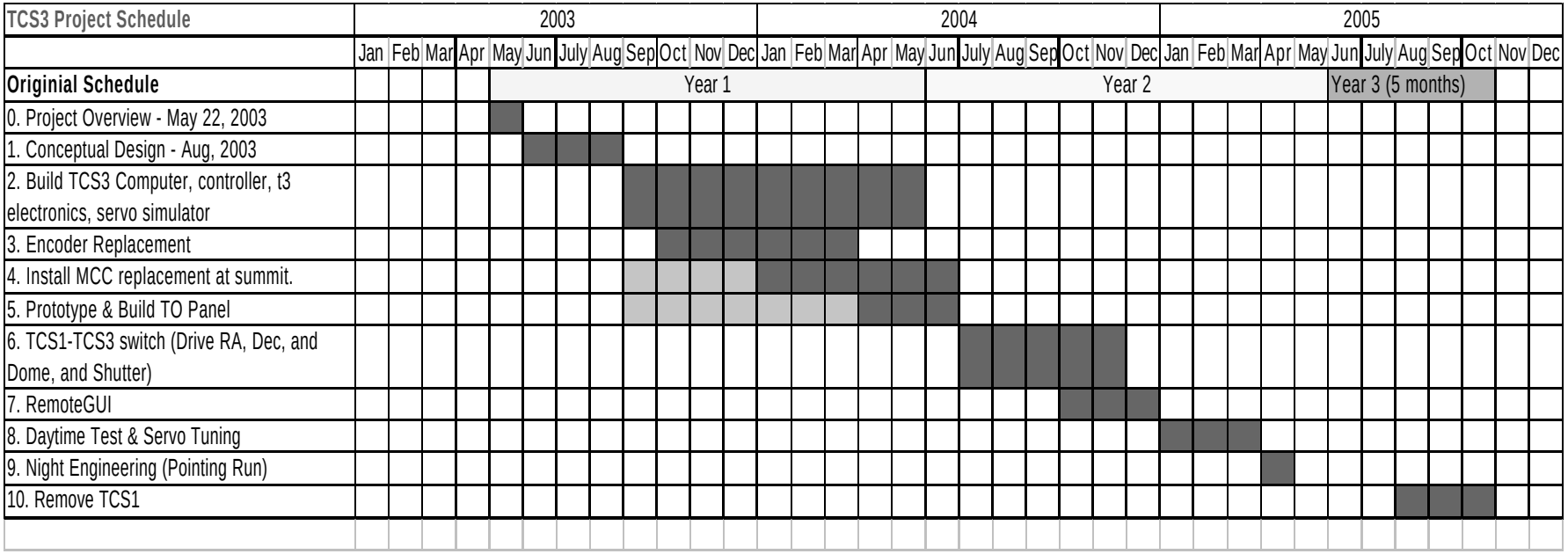
- 2. Build TCS3 Computer, Servo Controller, and T3 Electronics, Servo Simulator
- 3. Encoder Replacement
- 4. Install MCC Replacement at Summit
- 5. Prototype and Build TO Panel
- 6. TCS1-TCS3 Switch (or Drive the RA, Dec, Dome and Shutter)
- 7. RemoteGUI
- 8. Daytime Test & Servo Tuning
- 9. Night Engineering (Pointing Run)
- 10. Remove TCS1

Task 2 – Build T3 Computer, Servo Controller, and Servo Simulator



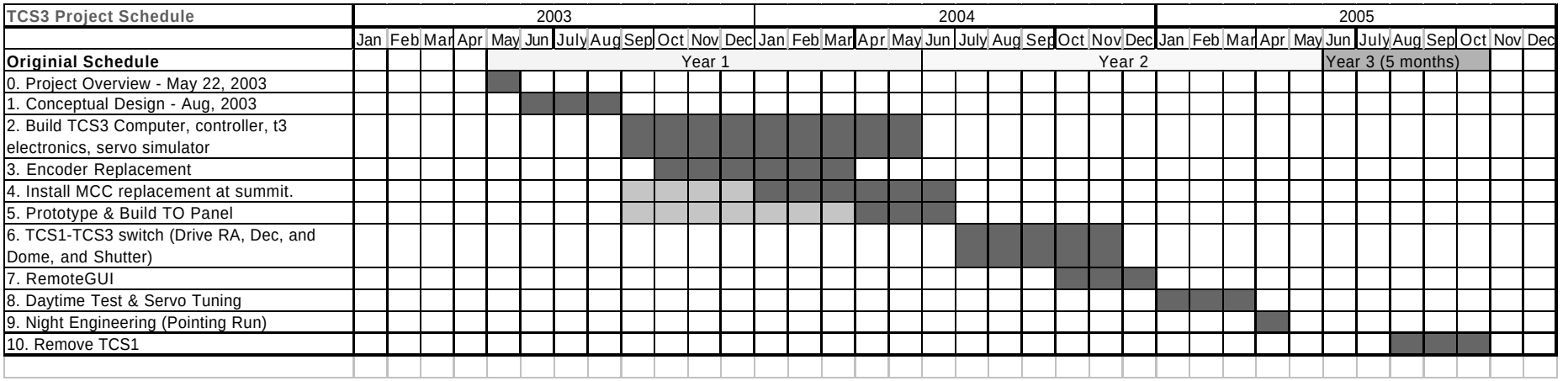
- Purchase computer, servo controller.
- Purchase T3 Equipment Rack
- Design and Build T3 Electronics
- Build servo simulator
- Develop TO Panel Prototype
- Control HA, Dec simulator using the computer, controller, and T3 Electronics.

Task3 – Encoder Replacement



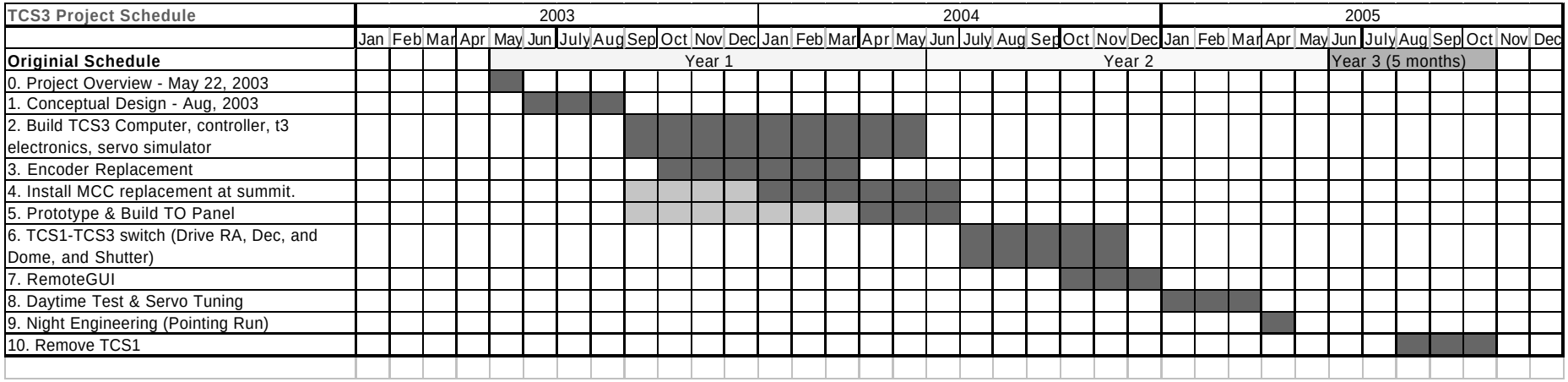
- Install new absolute Encoders
- Install new incremental Encoders
- Read current Dome Scanner
- Install T3 computer at the summit.
- Acquire encoder data into T3 computer.

Task 4 – Install MCC Replacement at Summit



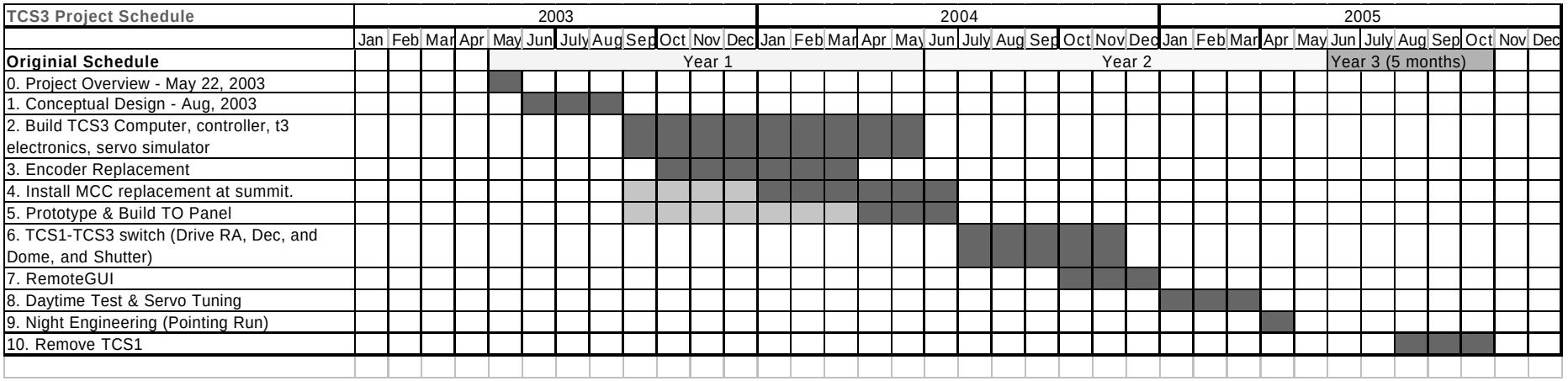
- Prep TO area for new T3 Display and TO Panel
- Purchase Facility IO hardware
- Write Facility IO software.
- Install Facility IO at the summit.
- Develop MCC replacement GUI.
- Switch non-critical MCC function to TCS3

Task 5 – Prototype and Build TO Panel



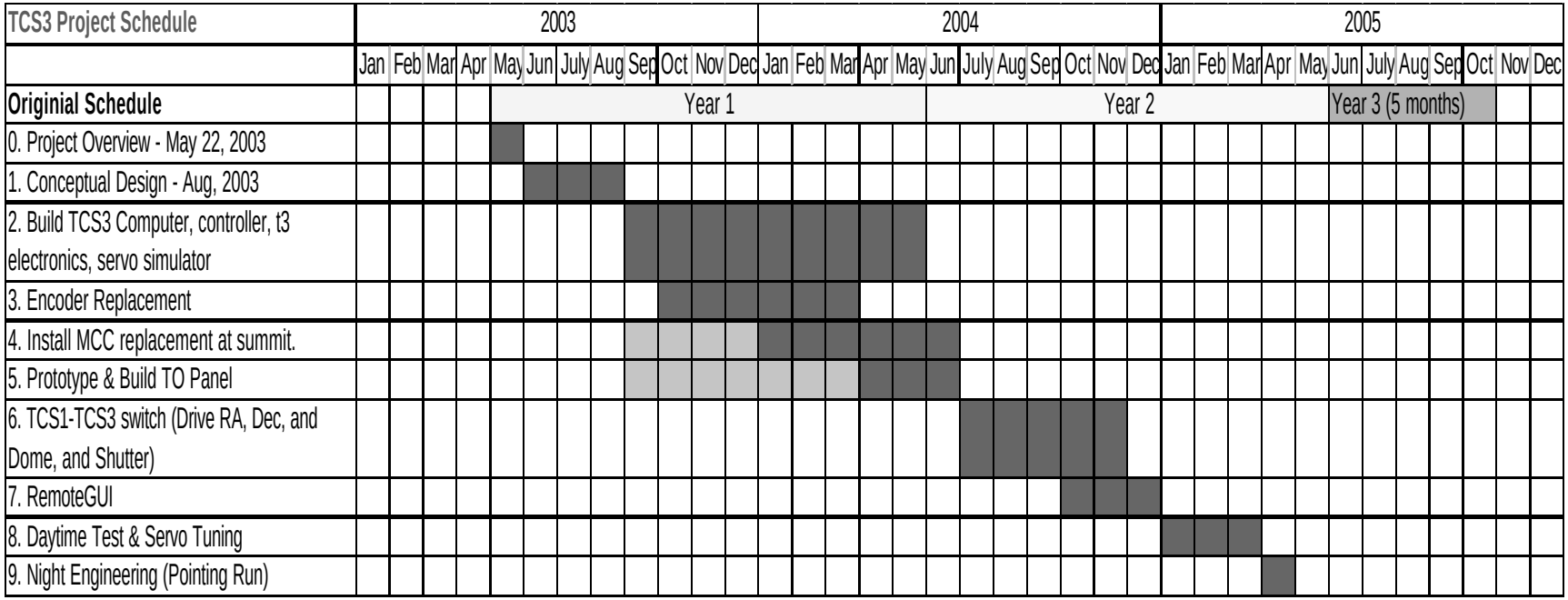
- Development of the TO Panel prototype is preliminary task.
- Construct 2 each TO Panels.
- Install TO Panel in lab and summit system.

Task 6 – TCS1/TCS3 switching



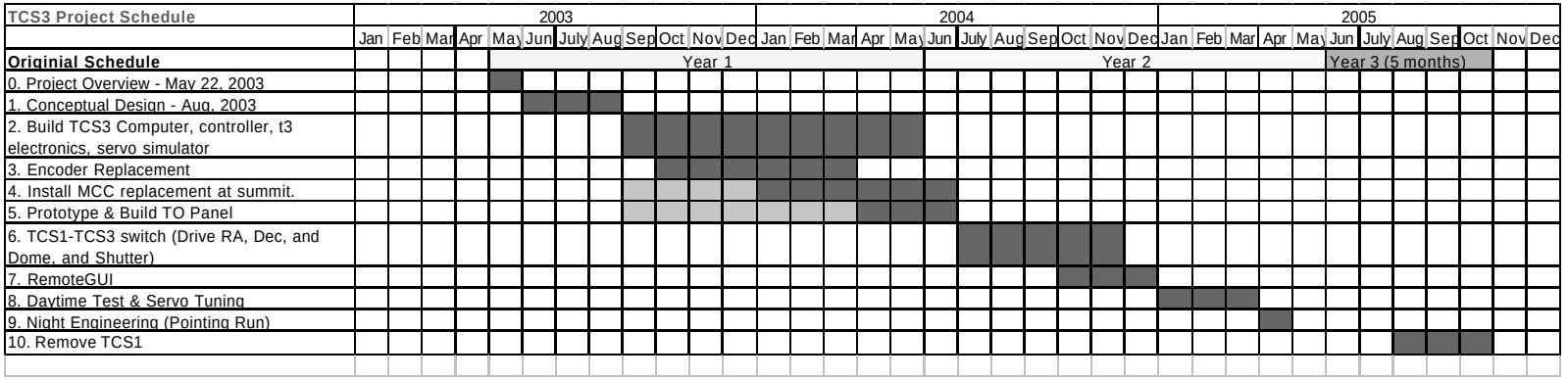
- Install tcs1/tcs3 switch over hardware.
- Develop switch over procedure
- Switch & Test Dome Control
- Switch & Test HA, Dec axis control.
- Install new Shutter JBOX and control using MCC replacements.

Task 7 – RemoteGUI



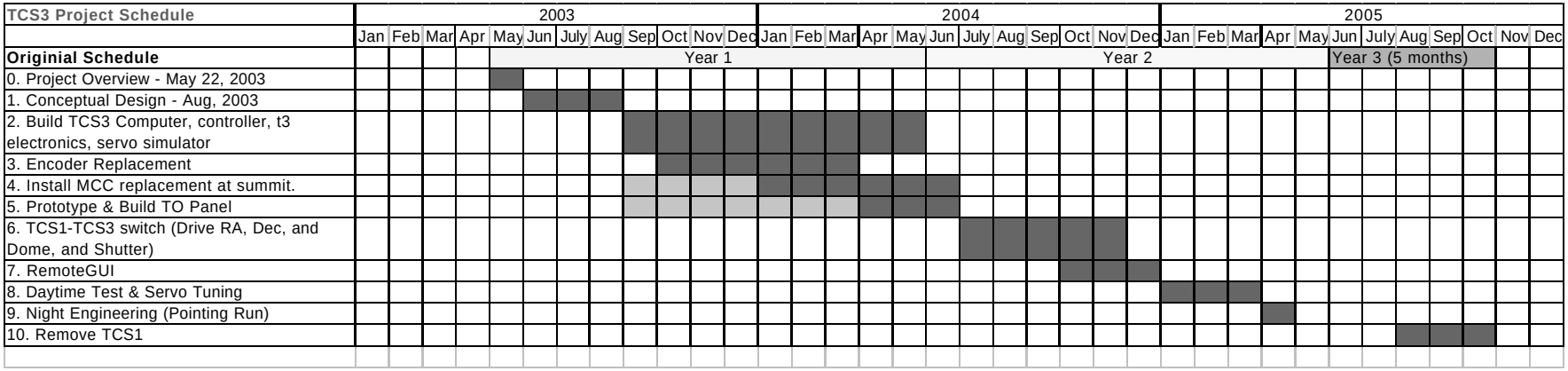
- Purchase computers to run remoteGUI software
- Implement RemoteGUI software.

Task 8 – Daytime Tests



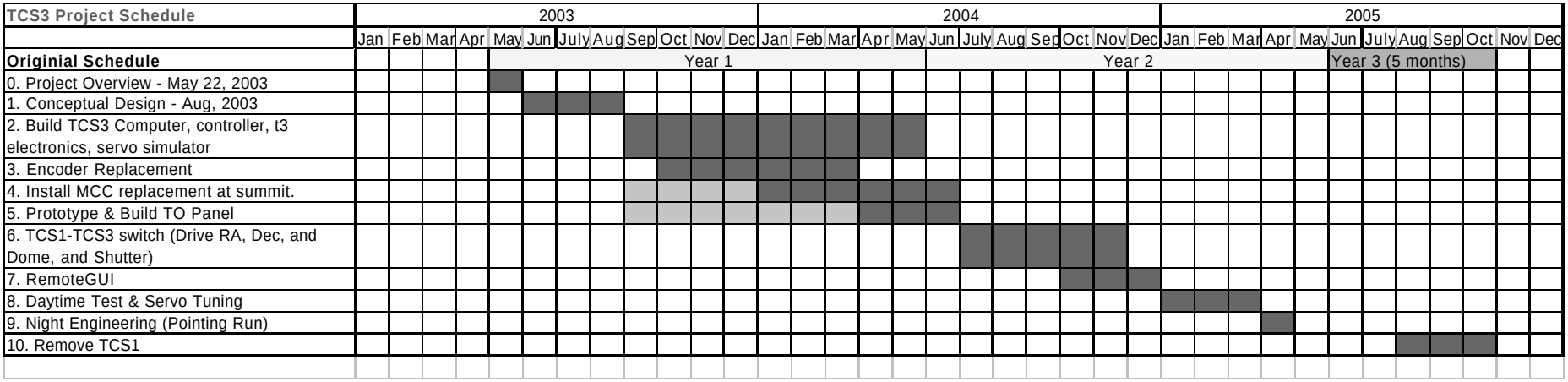
- Schedule Daytime Engineering Test.
- Switch from TCS1 to TCS3.
- Tune servo for HA, Dec, and Dome control.
- RA, Dec, and Dome performance is acceptable.

Task 9 – Night Engineering



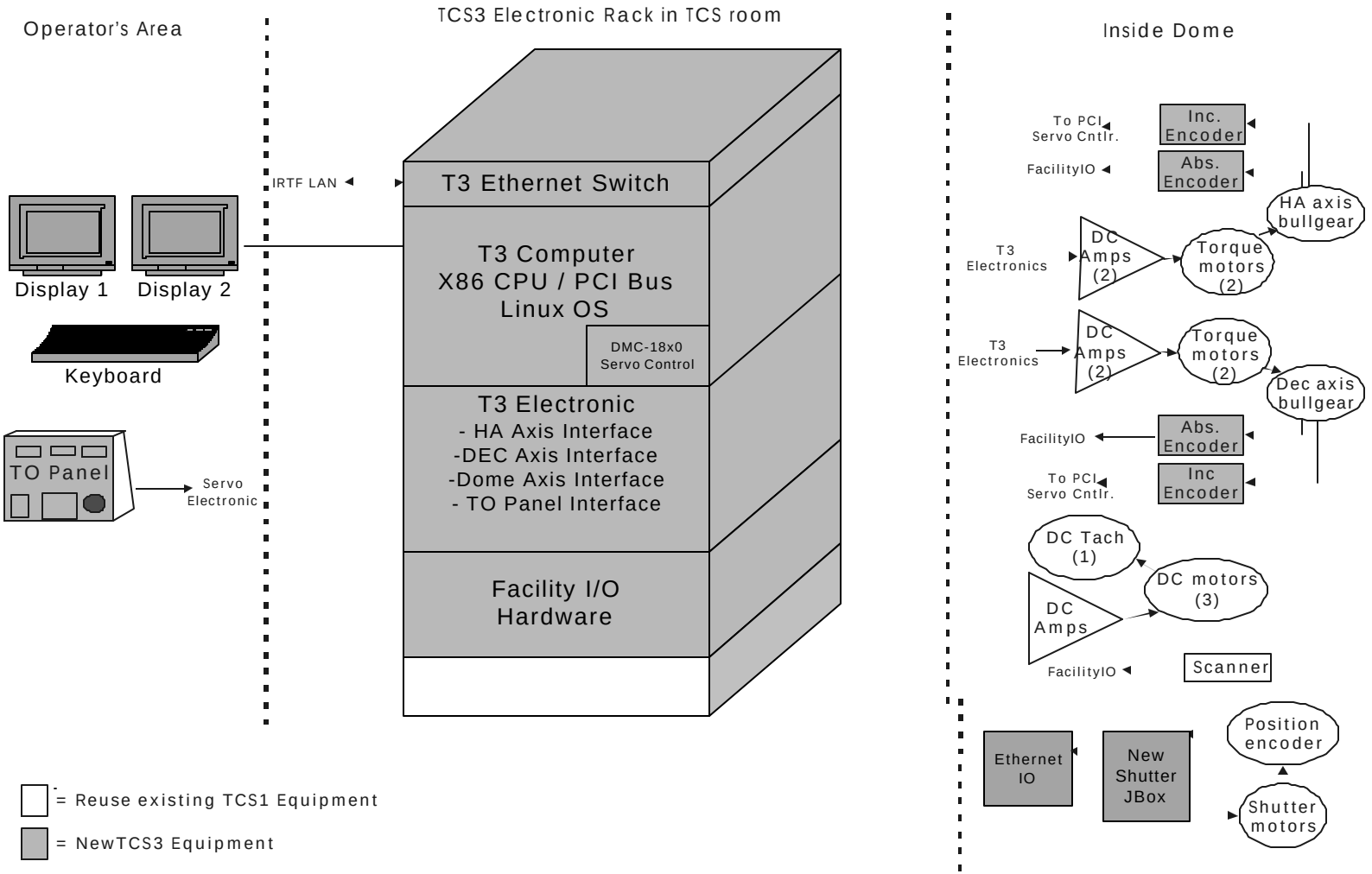
- Take pointing calibration data.
- Reduce and input correction to T3.
- Benchmark pointing performance.

Task 10 - Remove TCS1



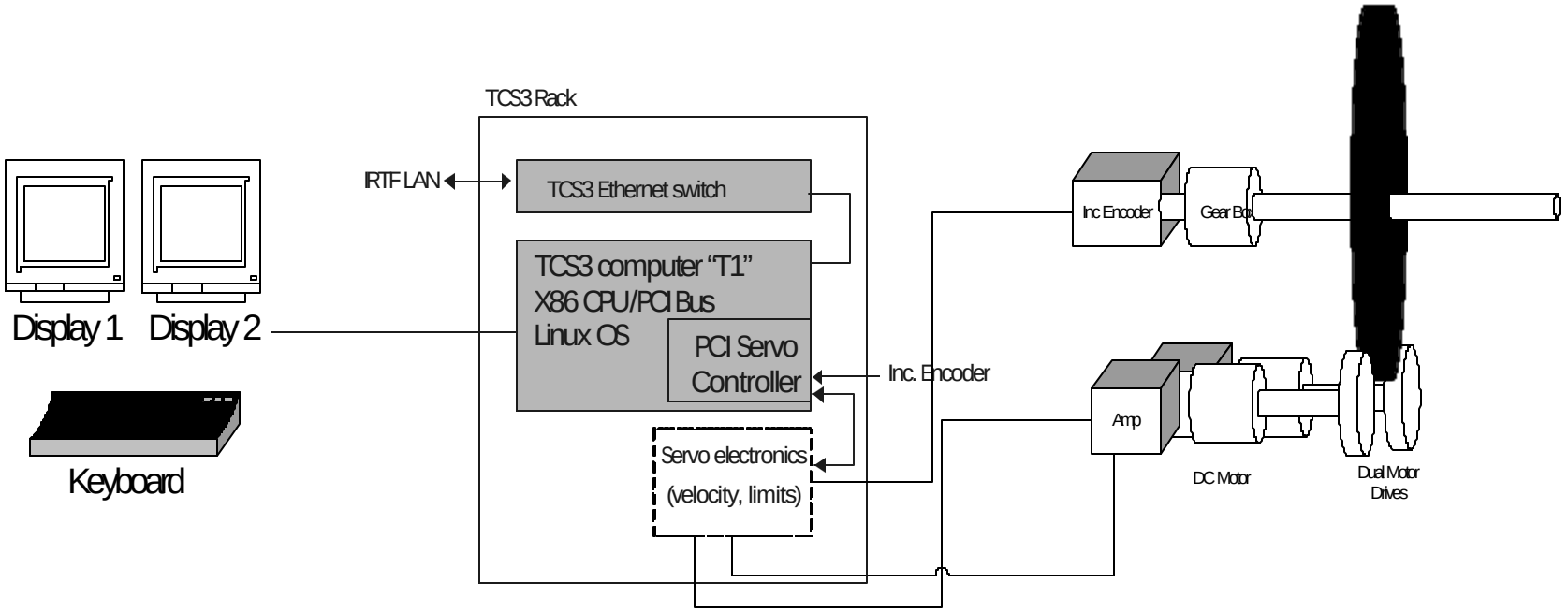
- Decommission TCS1
- Remove TCS1 Equipment
- Remove TCS1-TCS3 switching equipment
- Remove TCS1 APE and Install T3 APE.
- Remove TCS1 Inc. Encoder and relocate T3 Inc. Encoders.

2. Overview



- Identify Major TCS3 components

3. Computer System and Servo Controller, and Servo Simulator



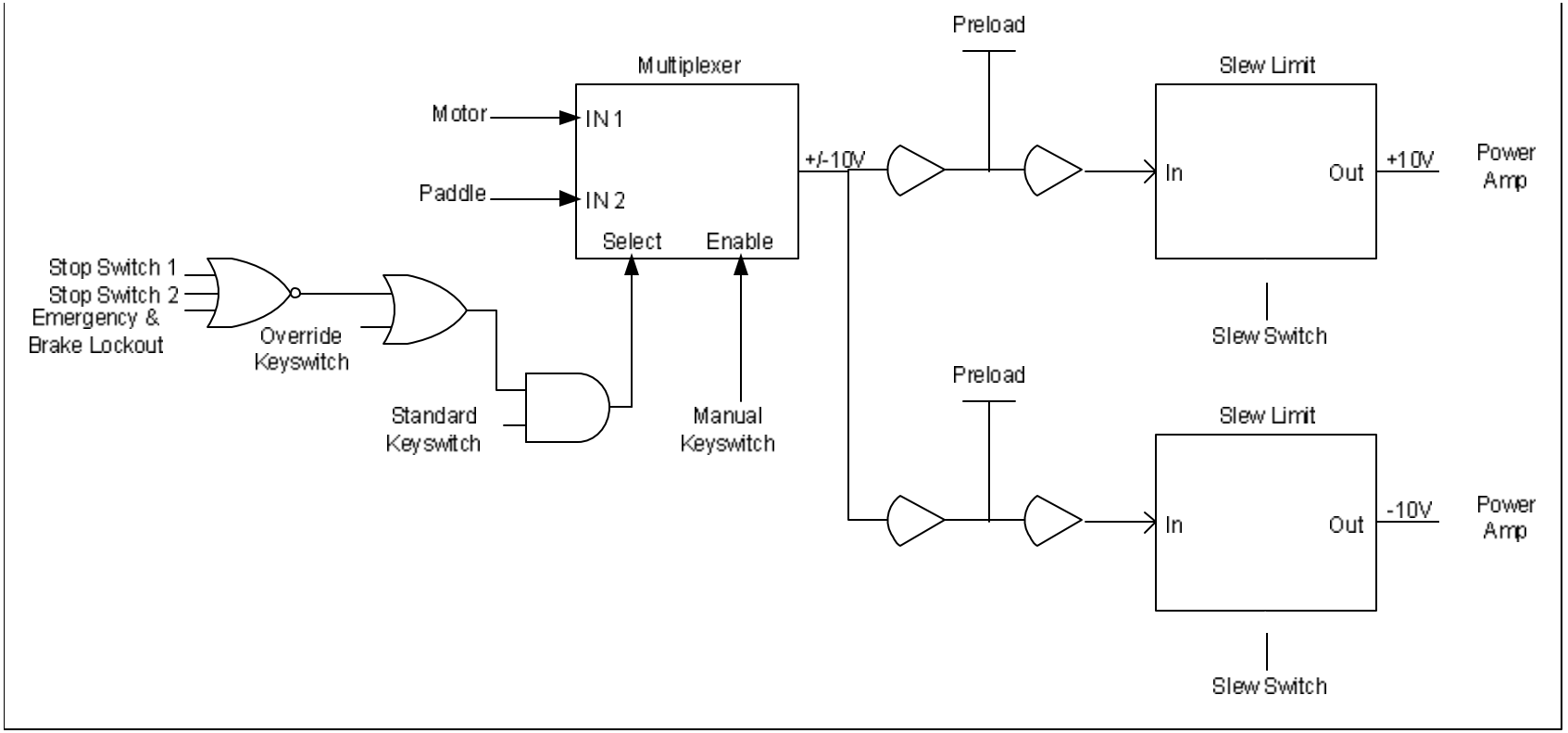
- Computer, with DMC-18x0 PCI Controller
- Servo Simulator

4. T3 Electronics (1)

T3 Electronic are in-house designed and build electronics providing these functions:

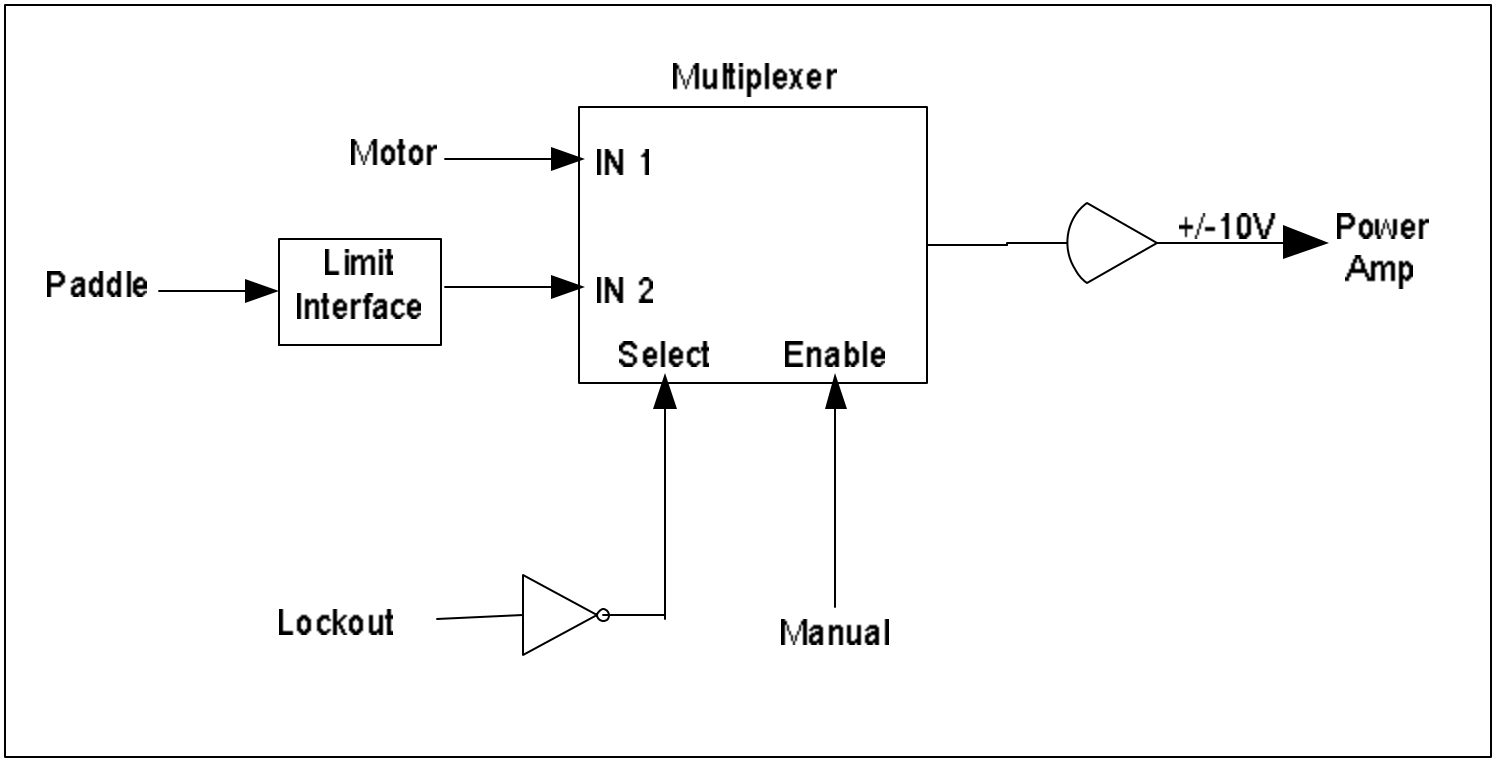
- - HA and Dec Axis Interface
- - Dome Interface
- - Safety Circuit
- - TO Panel Interface

4. T3 Electronics (2)



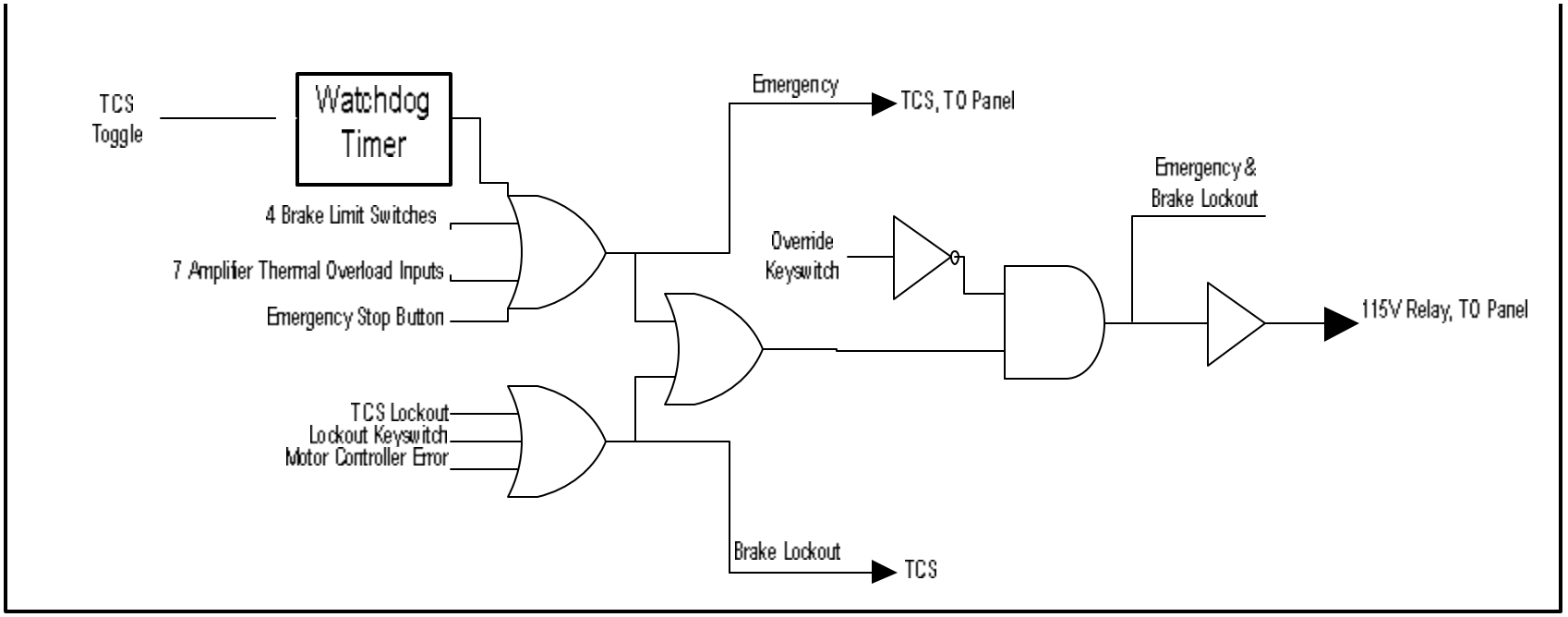
- HA and Dec Axis Interface

4. T3 Electronics (3)



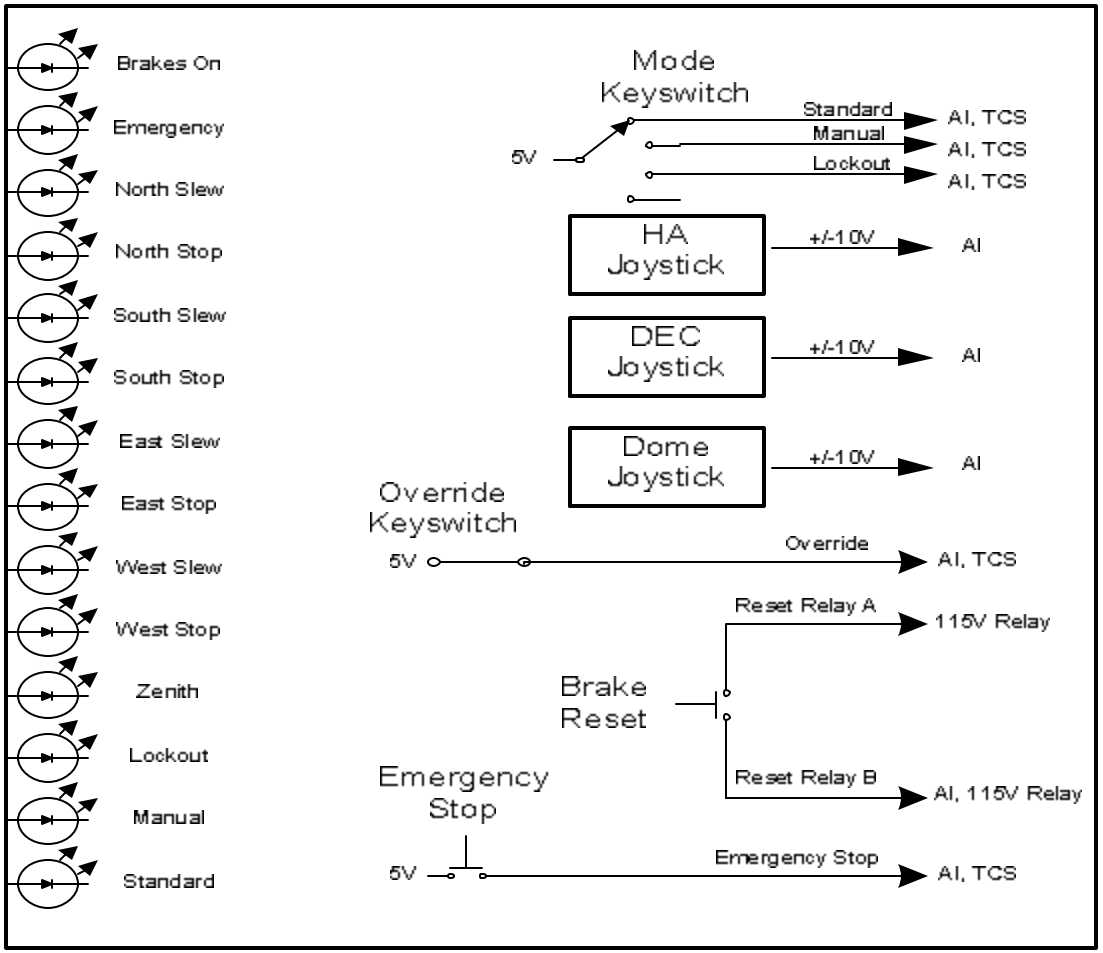
- Dome Interface

4. T3 Electronics (4)



- Safety Circuit

4. T3 Electronics (5)



- TO Panel Electronics

5. Encoders

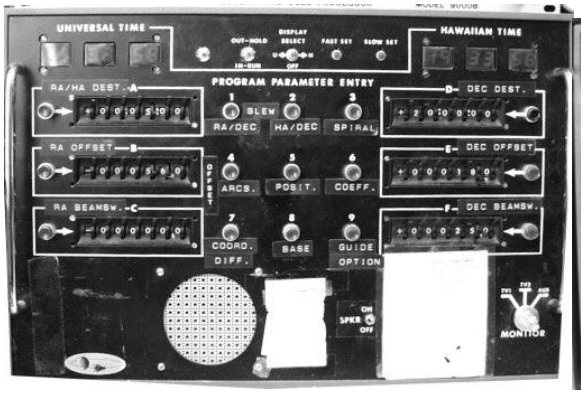
- Keep tcs1 encoders in place until tcs1 is decommissioned.
- Install new absolute encoders at bullgear. “Decrease” resolution to 1 arcsecond.
- Install new increment encoders at bullgear. Increase resolution to 0.01 arcseconds.
- After tcs1 is decommission, remove Inc. & Abs Encoders.
- Relocated T3 Incremental Encoder at bullgear.
- Install new APE encoders at old APE location.
- Redirect dome serial data from scanner to T3 computer.

5. Encoders – Our plan is still evolving

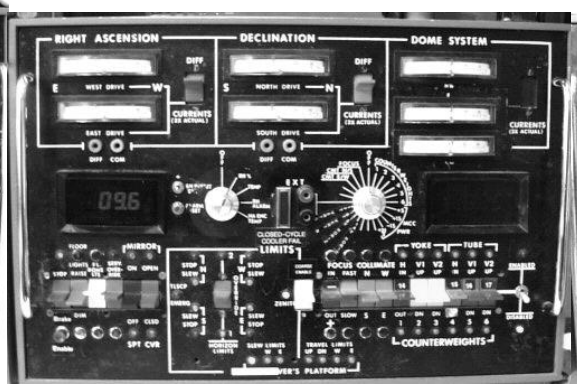
- Recently we discovered it may be possible to continue using the current APE in the new system. So APE plan may be modified to:
- Purchase a spare APE encoder (Mechanical hardware).
- Purchase new APE electronics.
- Switch encoder output at yoke from TCS1 to TCS3.
- TCS1 inductive and resolver data to MCC
- TCS3 APE Electronic interface to T3 computer.

6. MCC replacement

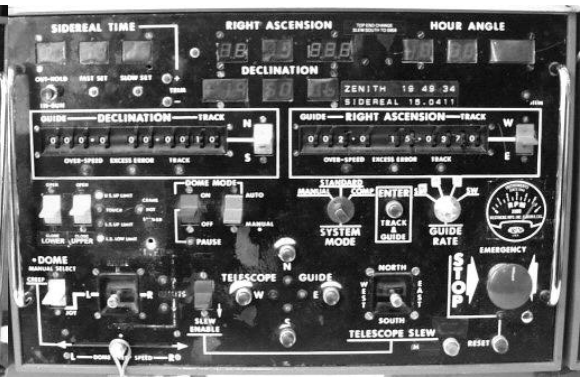
MCC1



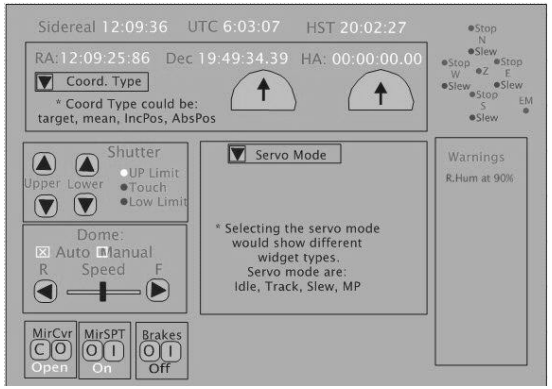
MCC2



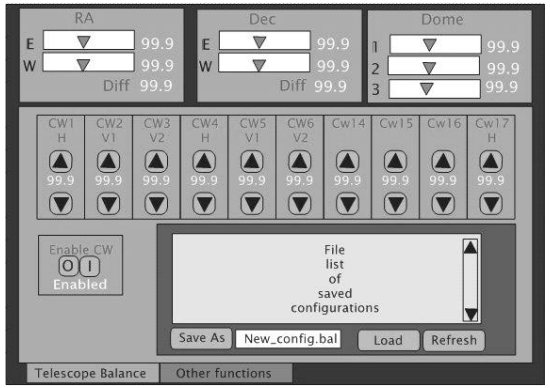
MCC3



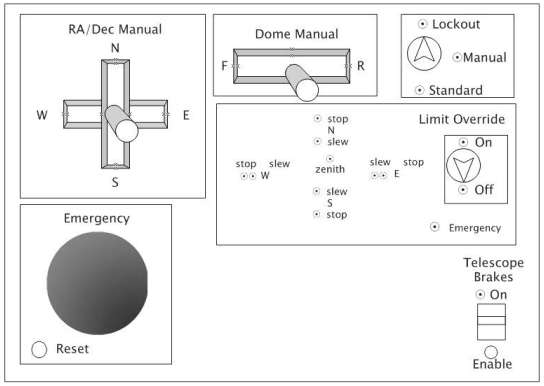
T3 Display1



T3 Display2



TO Panel



- Old MCC vs. New T3 Displays

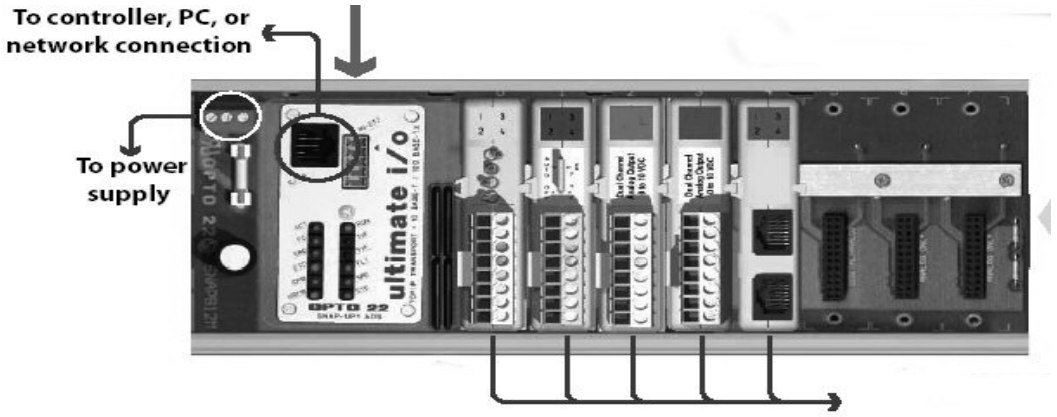
7. Facility IO

Requirements

- 10 Hz update
- Can be easily expanded.
- Good support – widely used.
- Wide variety of IO options.
- Ethernet based interface.

IO Estimate (as of 8/20/03):

Digital In	34
Digital Out	40
Analog In	22
Analog Out	0
Others	serial(1)



We have selected the Opto22 SNAP line of devices.

8. Software

- Software Guideline:

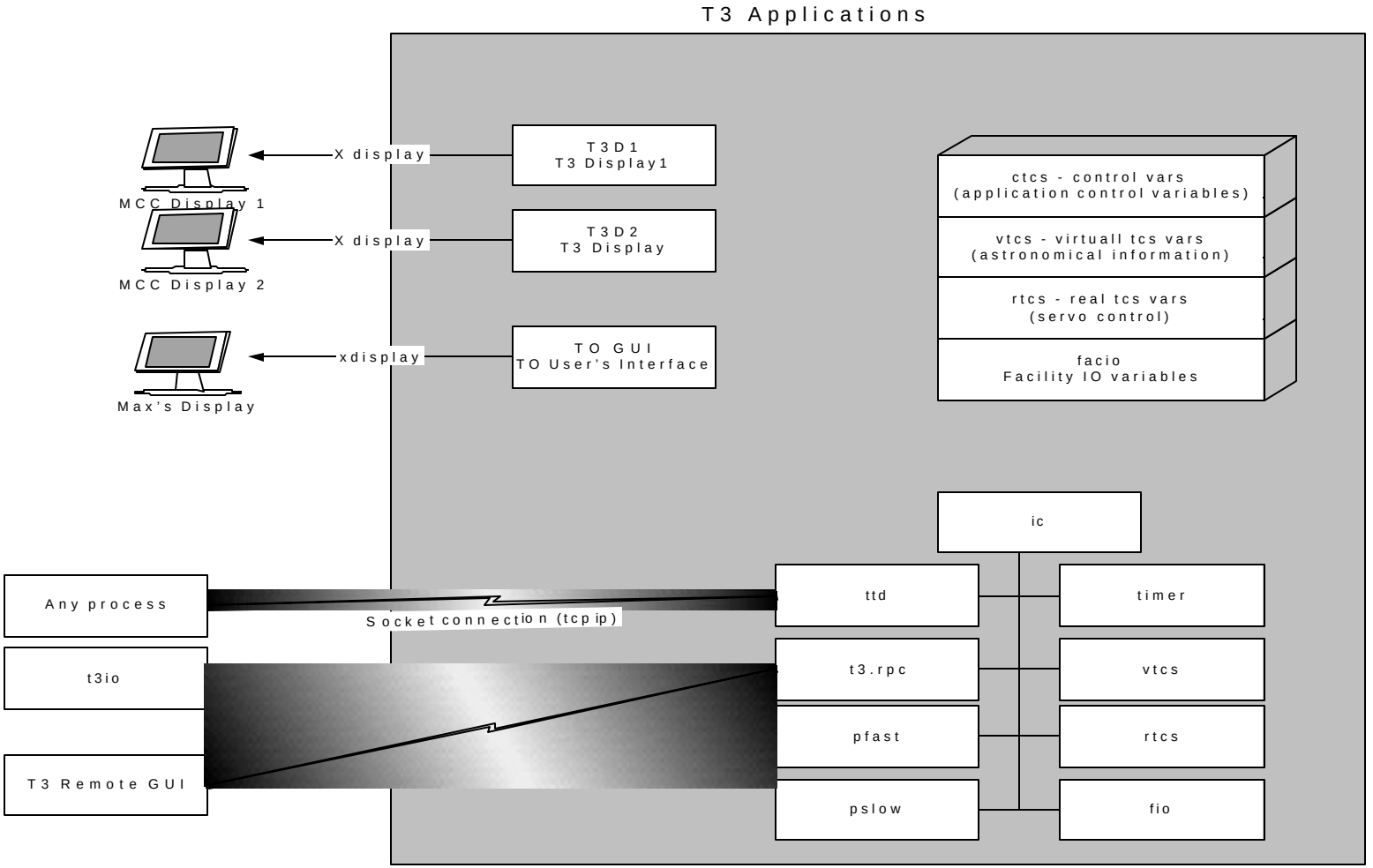
- Development and deployment on a Linux OS/x86 system.
- All application written in C – minimize the use of other computer languages.
- Astronomy calculations algorithms are done using slalib or TCSpk.
- Pointing correction to be based on the TPOINT software application.
- GUI is written using GTK+
- Use the POSIX API for system and clib calls, shared memory, message queues, scheduling and processing control.
- Berkeley Socket API and remote procedures call (RPC) are used for network libraries.

8. Software (2)

	CS	FK5		equinox	2000.000		Epoch	(current epoch)
		Base			Base Rates (as/s)			
		19:49:34.39	20:28:19.20		0.00	0.00		
Name	OS.enable	OffSets (as)						
User	off	0.00	0.00					
Beam	off	0.00	0.00		Scan Rates (as/s)			
Scan	off	0.00	0.00		0.00	0.00		
	Target	19:49:34.39	20:28:19.20					

- Position Table
- Mean-To-Mount Calculations
- Pointing Correction based on TPOINT
- Software Modes
- Idle, Track, Slew, MP, and MV.
- Dome: Manual or Automatic
- Shutter: Same as current system
- Facility Communication: telnet interface (TCP/IP) or t3io (UDP)

8. Software (3)



- Block diagram of T3 applications

9. TCS1-TCS3 Switching

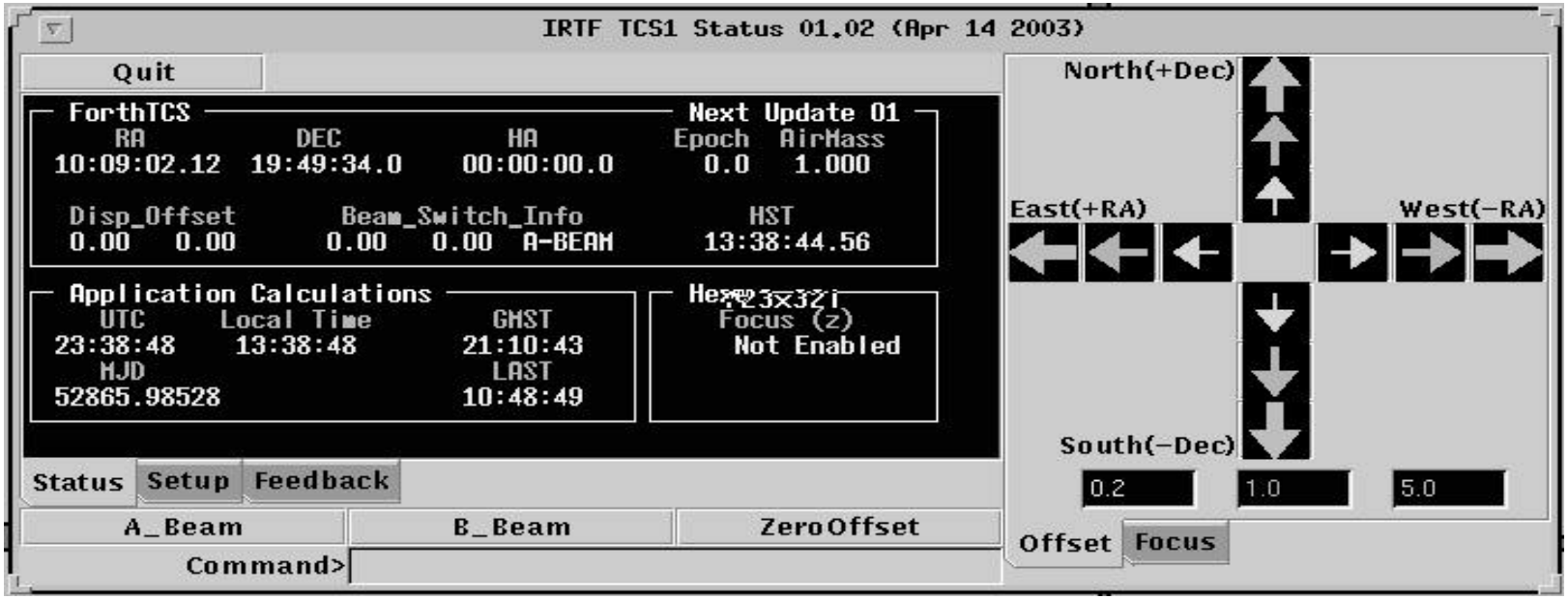
- Develop hardware and procedure to switch between TCS1 and TCS3.
- No detail information at this time – should a straight forward job.

- Shutter Control:
- New JBox connecting to Ethernet IO device.
- Communications over slip ring using existing X10 devices installed by the IQUP project.

10. RemoteGUI

- Remote GUI is a scaled down T3 GUI used by
- Summit Observers, Remote Observer, Day Crew.

- Replaces current hardware hand paddle and tcs1_status program. But should be similar in concept to the tcs1_status program.



11. Remove TCS1

- Decommission TCS1
- Remove TCS1 Equipment
- Remove TCS1-TCS3 switching equipment
- Remove TCS1 APE and Install T3 APE.
- Remove TCS1 Inc. Encoder and relocate T3 Inc. Encoders.

The End