Clock
and
Monitor & Control

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Clock

- What does it do?
  - Synchronizes events across the array
  - Establishes stable sampling for A/Ds
- How precisely synchronized?
  - FFT frames from receiver must line up in correlator
  - A few microsec is adequate
  - Precise delays will drop out of interferometry calibration
- How stable for samplers?
  - Sample rate ~650 Msamp/sec
  - Stability ~10^{-11} in 1 sec adequate
  - Minimal coherence loss

Clock design

- Needed at each receiver node
  - Central clock distributed by fiber?
  - Local GPS-conditioned unit at each node?
  - Common clock for LFD and xNTD is likely
- Current state of development low
  - But little innovation required
- No major challenges/risks
  - Requirements modest
  - Multiple well-established solutions available
  - Must implement a solution within ~12 months
  - Skills needed – experience with similar systems

Monitor & Control

- M&C has many functions
  - Point antenna tiles
  - Select frequency bands in receiver
  - Basic correlator control (stop/go)
  - Array beam pointing
  - Binning – FOV pointing
  - Distribution/archiving of calibration data
  - Gathering of sensor data
    - Temperatures (chips, enclosures, environment)
    - Voltages
    - GPS for TEC calibration
  - Monitoring of calibration solutions
  - Thresholds and health assessments
  - Diagnostic functions
  - FPGA code upload
  - Remote user interface

M&C – what is needed for v1?

- Minimal initial system
  - Is feature needed for the key science goals?
  - Does feature accelerate overall development?

Two approaches:

- Custom system
  - Minimal targeted code to start (can be very quick)
  - Grow later (but how much would have to be discarded?)

- Adopt existing system (ATOMS?)
  - Is it a good match to our problem (overkill?)
  - Constraints, learning curve and overhead?

M&C

- State of the design?
  - There is no design as yet
- Innovation required?
  - Not much, these things are routinely done
- Challenges/problems
  - This is a substantial job
  - Remote access/control must be well designed
  - Needed on relatively short timescale
- Skills needed
  - Software expertise, relevant experience

M&C

- Interdependencies
  - Many items under M&C
  - Some dependencies can be cleanly handled via interfaces
    - Receiver control
    - Antenna pointing, etc.
  - Some items are internal
    - User interface
    - Health assessment algorithms

- R-T computer may need close coordination
  - Calibration data needed lots of places in timely fashion
  - M&C team needs to interact closely with RT computer teams