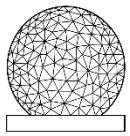
RDBE-G / R2DBE–G Setup and Operations

Chet Ruszczyk

IVS Virtual TOW 2021



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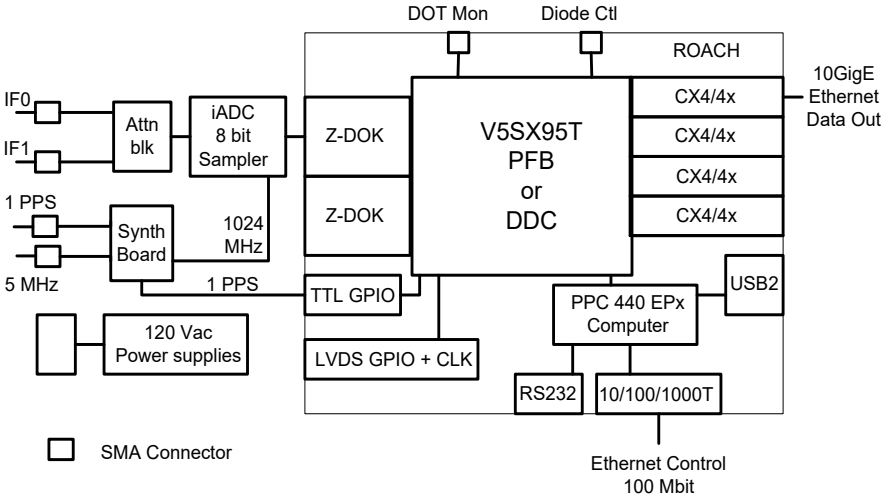
Overview

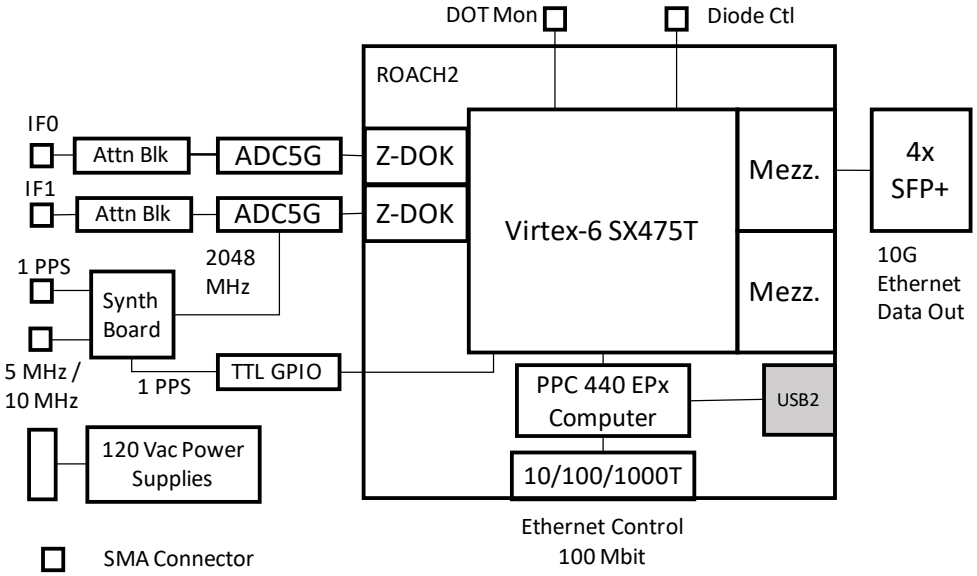
- Overview
- Capabilities
- State of operations
- Next steps
- General operational questions

Block Diagram(s)

RDBE-G Block Diagram



R2DBE-G Block Diagram



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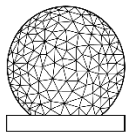
Overview

- RDBE-G was the 2nd Generation DBE system (Roach1 based unobtainium)
  - Emerged from a joint NRAO / MHO collaboration
  - Case, LCD display, attenuation, synthesizer board
  - CX4 - 10G Ethernet
- R2DBE-G is a 3rd generation DBE (Roach2 based still available)
  - Leveraged from SAO's EHT system
    - ADC card initialization routine
  - Mezzanine board allows specification of 10G interface (SFP+)

System	Input IF BW	Output Channels[1]	Data Rates	Boot Options	VGOS Compliant
RDBE-G	512 MHz	16 | 32	2 | 4 Gbps (complex)	NFS, USB, SDRAM	No
R2DBE-G	2 GHz	16 | 32| 64	2 | 4 | 8 Gbps (complex)	NFS	Yes

Note 1: Configuration of ½ the output channels per polarization for the total number of output channels



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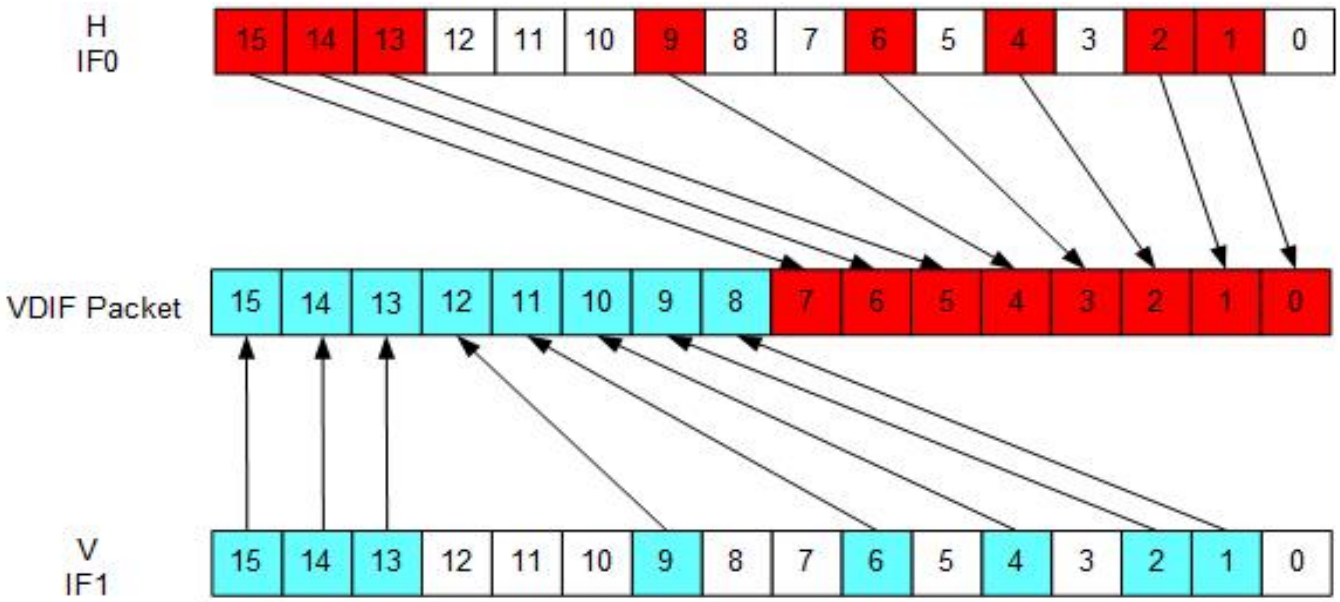
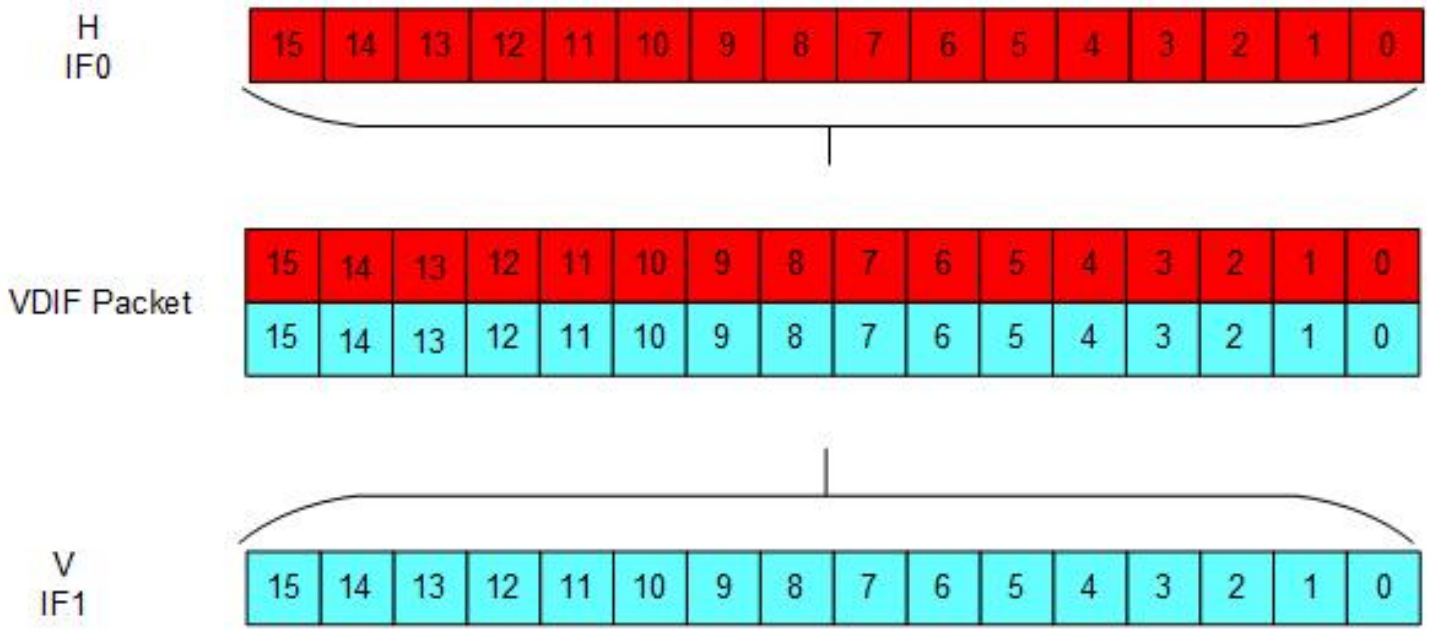
Legacy or RDBE-G Channel Output Configuration

- 16 channels total / IF
- 2 Gbps data rate / DBE resulting in 8 Gbps aggregate per scan (4 DBE's)

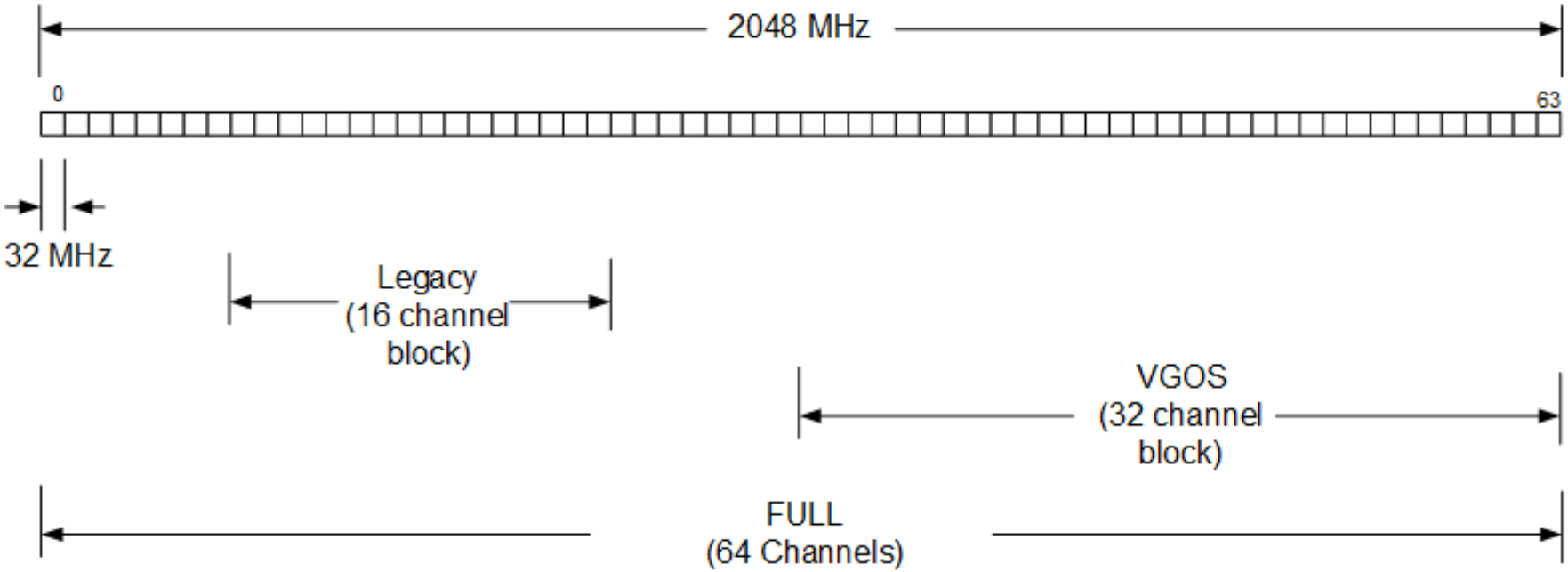


Legacy 32 RDBE-G Channel Configuration

- Disabling channel select results in all channels selected
  - 16 channels total / IF
  - 4 Gbps data / RDBE-G resulting in 16 Gbps per scan



R2DBE-G Channel Configuration



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Operational Features

- RDBE-G is a standalone system that boots into a known operation configuration
  - Communication to the outside world is enabled
  - NTP daemon started
  - FPGA loaded
  - Persistent configuration for:
    - Interfaces (10G, network stack)
    - VDIF headers are configured
  - DOT time is synchronized
  - Data is enabled
- PCFS configures
    - Channels and other observation dependent parameters
    - Enables multicast

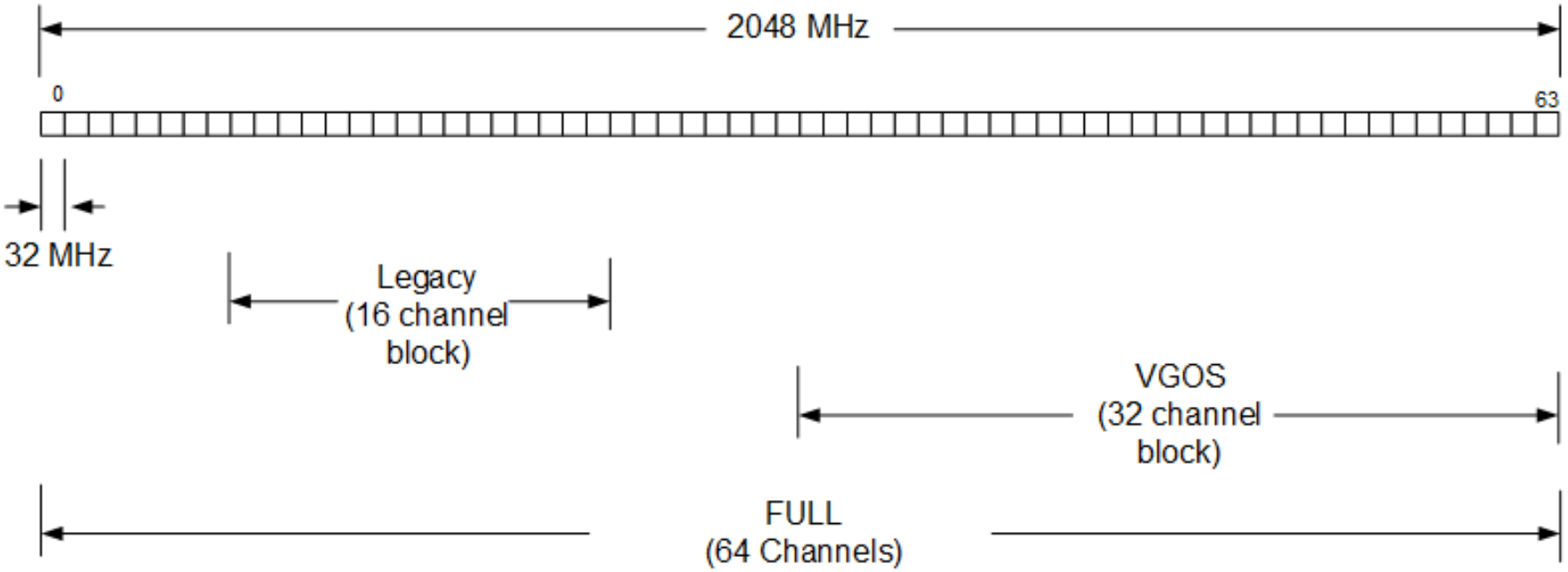
Operational Features

- R2DBE-G
  - Communication to the outside world is enabled
  - NTP daemon started
  - Requires user interaction (a script executed)
    - Loading personality
    - Synchronization of the ADC's
    - Persistent configuration 10G interface and VDIF headers
  - PCFS configures
    - Channels and other observation dependent parameters
    - Defines the channel mode (Legacy, VGOS, FULL)
    - Enables multicast
  - All commands related to channel information return full 64 channels for IF
- VSI-S software interface to system
  - RDBE-G Command set -> 3.0
  - R2DBE-G Command set -> 1.1.0

R2DBE-G Software Updates

- Originally the R2DBE-G was not backward compatible
  - 64 channel information / IF
  - Limited resources resulted in support not available for:
    - Pointing (Tsys)
    - Multicast processing
- New command introduced that provides backward compatibility
  - dbe_num_chan (next page)
    - Legacy - 16 channels / pol
    - VGOS – 32 channels / pol
    - Full – 64 channels / pol
- Commands impacted:
  - dbe_tsys, bstate, quantization, pcal, multicast

R2DBE-G Channel Configuration



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dbe_num_chan – Get / set the number of channels to interface with, legacy, VGOS, and Full channel selection mode

Command: → dbe_num_chan = < chan_type > : < chan_start > : < chan_end> ;

← !dbe_num_chan = <return code>;

Query: → dbe_num_chan?:

← !dbe_num_chan ? <return code>: < chan_type > : < chan_start > : < chan_end> ;

Purpose: To set the number of channels to output for chsel, tsys, pcal, quantize, and multicast commands to make the output both backwards compatible with RDBE, support VGOS (1024 MHz), and provide the full information.

Settable Parameters:

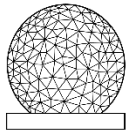
Parameter	Type	Allowed Values	Defaults	Comments
chan_type	char	legacy | vgos | full	vgos	legacy – output only 16 channels for 512 MHz support vgos – output only 32 channels for 1024 MHz support full – output 64 channels for 2048 MHz support
chan_start	int	0-63	0	Channel start. See Note 1, 2.
chan_end	int	0-63	31	Channel end. See Note 1, 2.

Monitor Only Parameters:

Parameter	Type	Values	Comments
chan_type	char	legacy | vgos | full	legacy – output only 16 channels for 512 MHz support vgos – output only 32 channels for 1024 MHz support full – output 64 channels for 2048 MHz support
chan_start	int	0-63	Channel start.
chan_end	int	0-63	Channel end.

Notes:

1) The channel type will define the delta between the start and end channels specified. If legacy, then 16 channel delta must exist between start and end. If0 and IF1 should be the same channel settings.
2) The channel start and end will be applied both to IF0 and IF1, different channel selection is not allowed at this time.



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dbe_num_chan status

- Presently, dbe_num_chan is partially implemented
  - dbe_chsel implemented
  - Supports tsys query for pointing checks during pre-ops.
    - Previously Wf was pointing blind.
- Full integration of the command is under development - Priority
  - Legacy multicast support
    - No changes to the PCFS processing of multicast
    - SEFD's during start and stop message
    - Multicast logging
  - quantization
  - pcal
  - bstate

R2DBE Firmware

- 1 Personality type (FPGA code)
  - Polyphase filter bank
    - Input is two 2048MHz BW IFs
    - Output selects 16/32/64 of 128 possible 32-MHz channels (2Gbps/4Gbps/8Gbps)
    - Output is a 8224 byte VDIF data format
    - **Complex Data**
      - Standard 32 byte header
    - eVLBI VTP protocol available

Boot Up

- RDBE
  - Boots from NFS, USB, SDRAM, bootp
  - rdbe_server loads and configures the FPGA personality
- R2DBE
  - ***Must*** boot from NFS
  - katcp used to load personality and calibrate FPGA
    - Performed manually at present
    - Automated configuration is being developed

R2DBE IO Channel Selection

- Capability to set the input output channel assignment for the VLBI Payload
  - Input is two 2048MHz IFs
  - Output is 8/16/32 out of 64 per IF possible 32-MHz channels
  - The command
    - dbe_chsel = <input>:<channel(s)>;
    - input
      - 0 or 1 for IF0 or IF1
    - channel(s)
      - individual channels (0-63)

Monitoring Capabilities

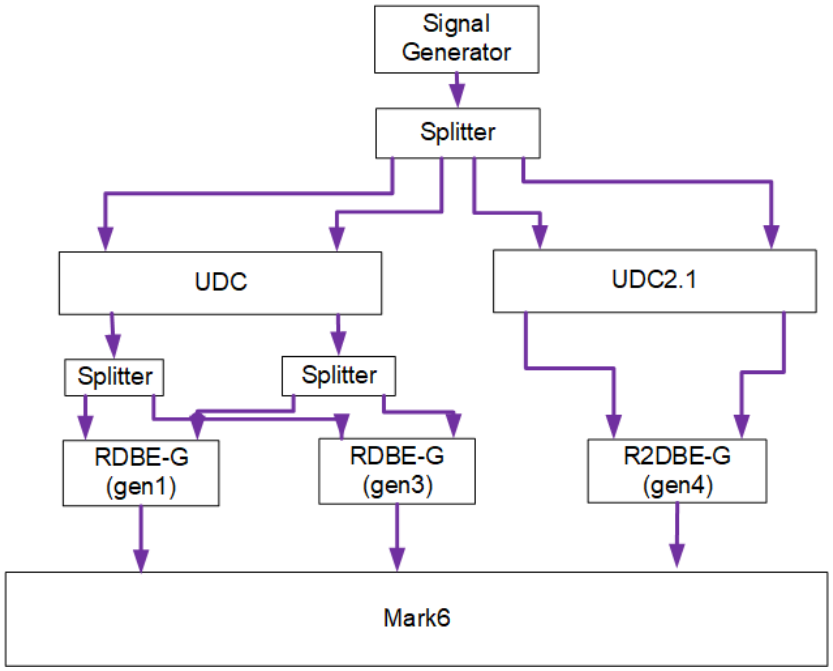
- 1pps monitoring
  - Multcast monitoring data broadcast 1 per second (1pps)
  - dbe_1pps_mon = <enable> : <multicast IP address> : <port>;
  - Use r2dbe_mon.py on a system attached to same network to receive multicast data
    - Working with PCFS for processing information
  - Tsys monitoring
    - System temperature measurement all 64 channels / pol
    - On power / off power of the receive chain
    - tsys data is summed every second
  - ***Raw Capture Mode – Removed from R2DBE***

State of Operations

- Westford meets the VGOS requirements
  - 1GHz processing
  - Pointing capability just added
- Documentation and integration to be released in two stages
  - First release:
    - System checkout
      - miss-wiring of the LCD display has been found on a few systems
    - Software for NFS mount point
    - Configuration documents for setting up NFS server
    - User's manual
    - Command Set
  - Second release:
    - Software for full version 1.1 command set support

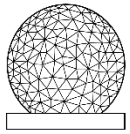
Next Steps

- RDBE vs. R2DBE personality complex data comparison
  - USB versus LSB
  - Summary – comparing RDBE real data with RDBE and R2DBE complex data
    - There are 8 tests defined for the zero baseline
      - RDBE real data is the control
      - RDBE-G and R2DBE
        - Inversion and conjugation switches for the personality
    - After resolution with DiFX trunk
      - Execute VLBI fringe test
        - RDBE/R2DBE/DBBCv2 or v3



Questions on presentation or operational problems?

Thank you



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