

Software Defined WWV Receiver

Shad Nygren

HFIA Conference

San Diego CA

February 12, 2009

Presentation Agenda

- Brief Review of Last Year's Presentation
- Discuss Research Goals
- Discuss of work done this year
- Discuss of future work

Last Year

- 5MHz & 10MHz WWV Receiver
 - Crystal Filter Bank
 - Direct Conversion Receiver
 - AM Envelope Detector / Demodulator
- Correlator for 5ms 1KHz tone burst
- Use difference from local CDMA 1PPS UTC to calculate path length from WWV to Datron
- Use path length and great circle distance to calculate Ionosphere Virtual Height

Research Goal

- Implement system at multiple sites capable of receiving WWV
- Gather long term data to support improved models of the ionosphere
- Investigate and develop statistical models for polarization distortion

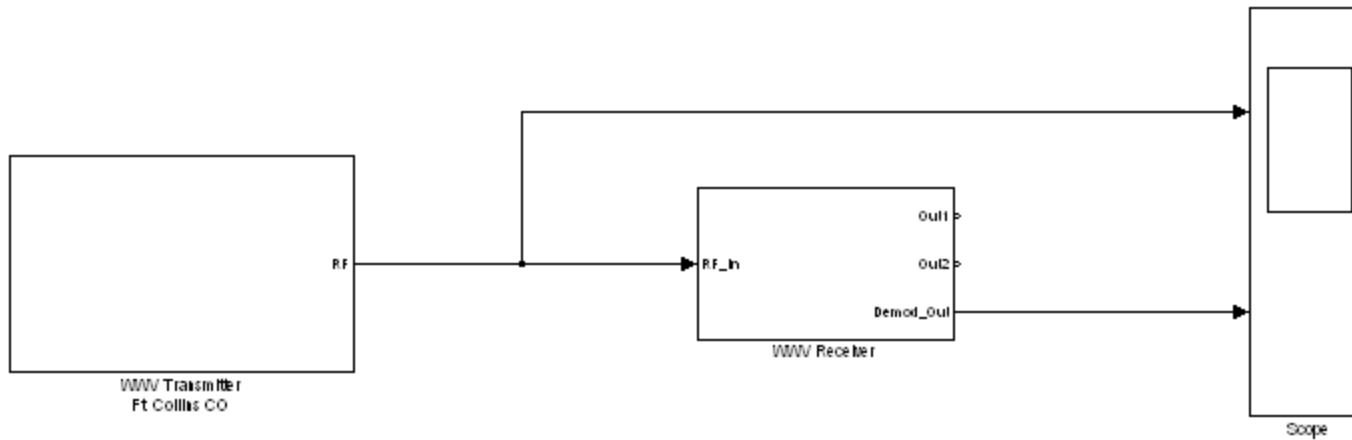
Chirp Sounders vs WWV

- Chirp Sounder
 - Frequency Sweep
 - Transmits at intervals of minutes
 - Unknown phase
- WWV
 - Selected frequencies across band
 - Transmits continuously
 - Sends 1PPS synched to UTC
 - Carrier frequency and phase is referenced

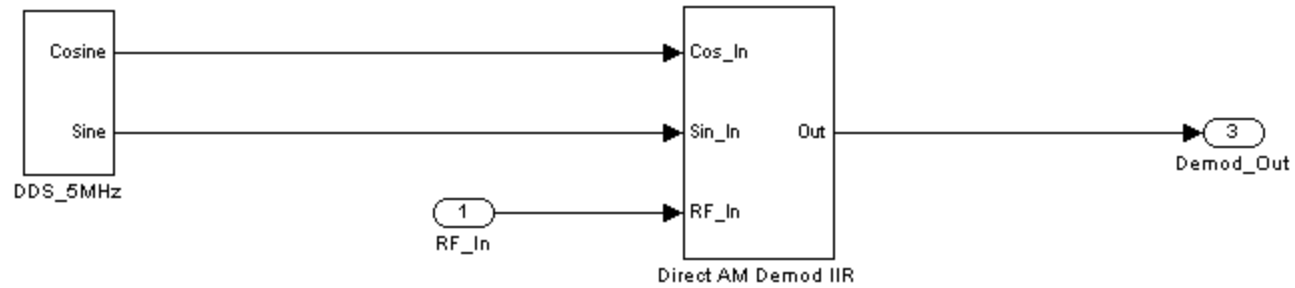
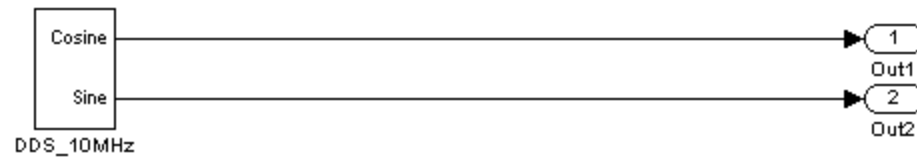
This Year

- Use Xilinx Virtex-4 SX35 FPGA to implement software defined versions of
 - Direct Conversion Receiver
 - AM Envelope Detector / Demodulator

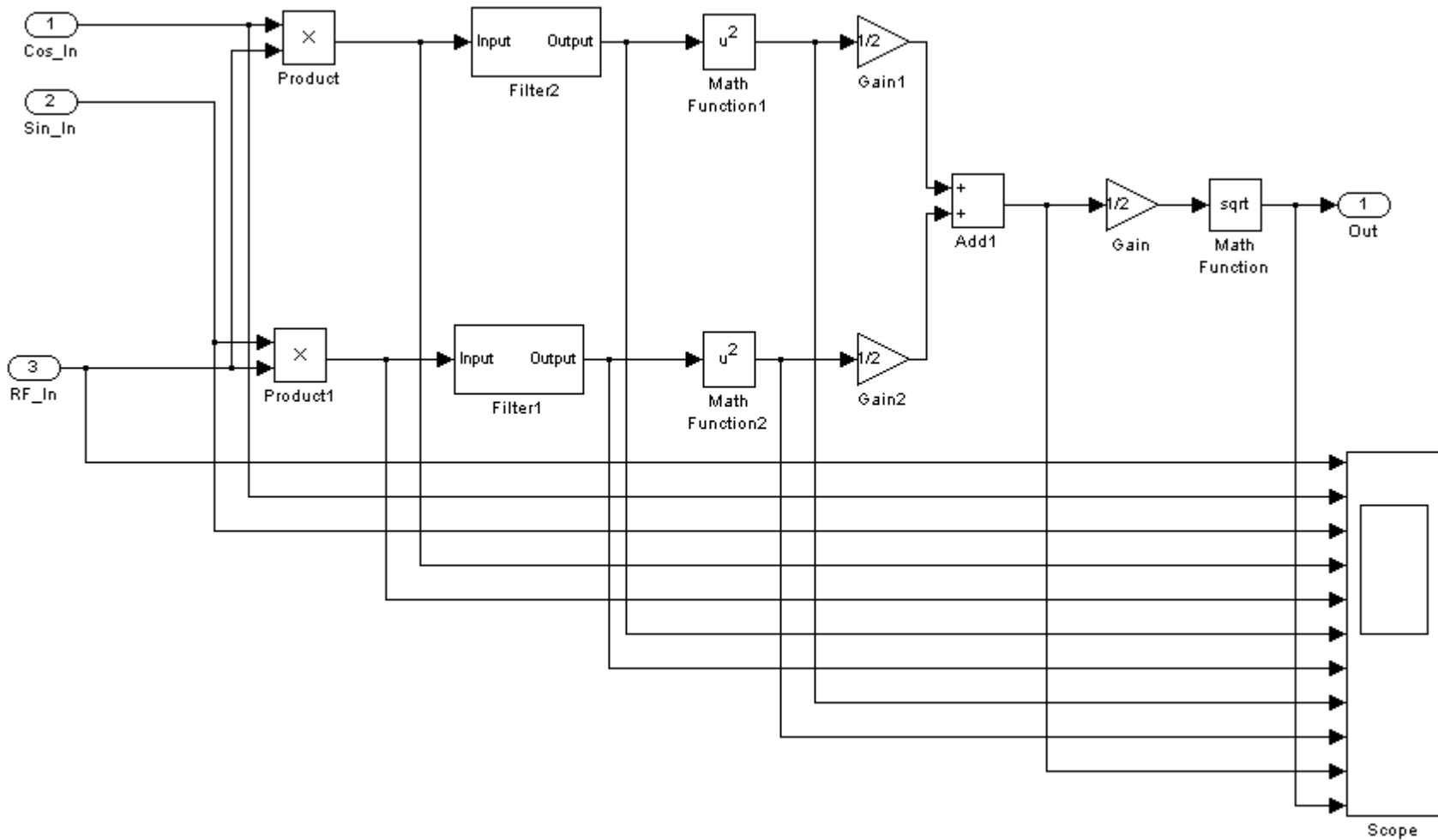
Top Level Model



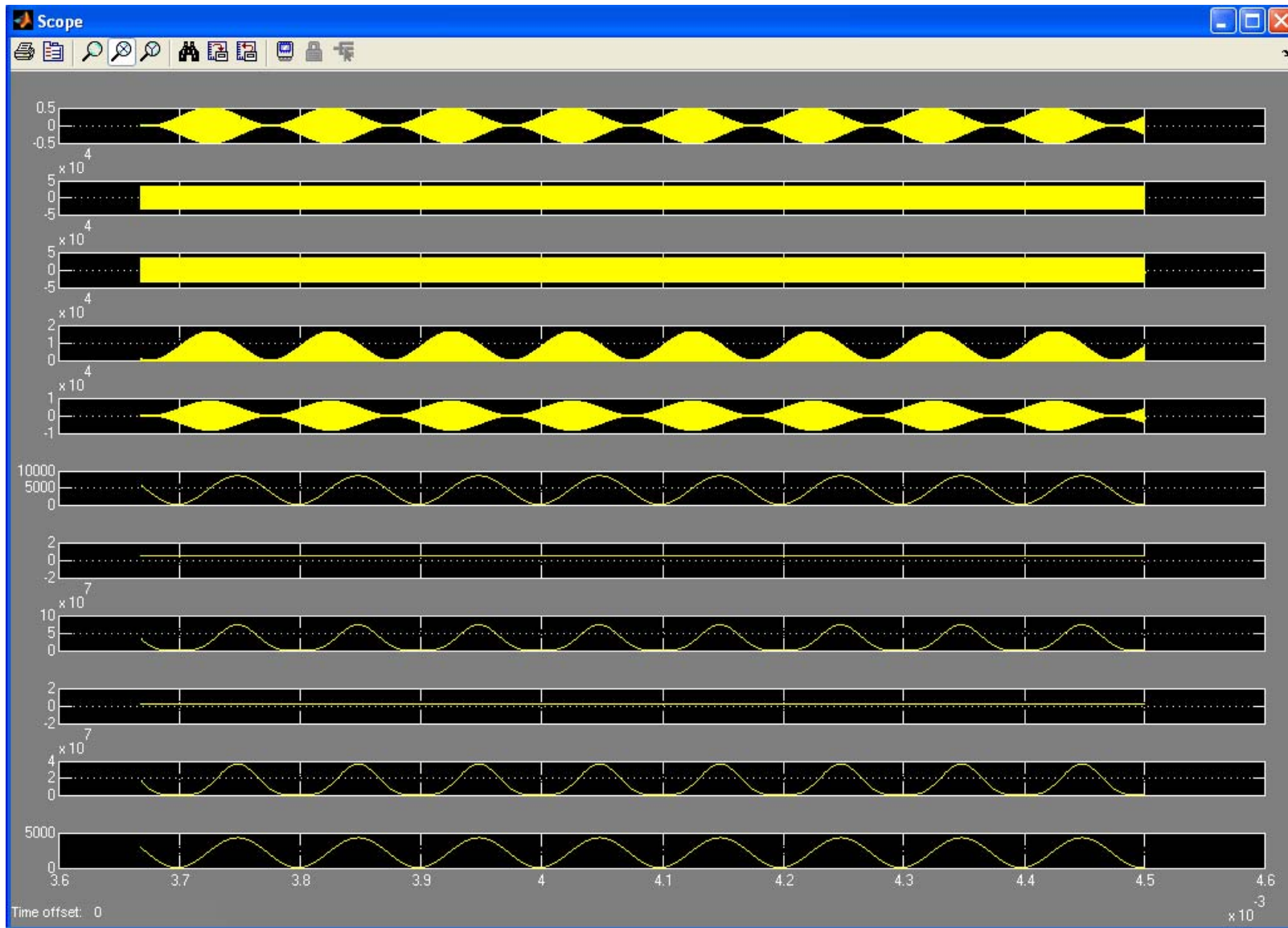
Receiver Block



Demodulator Block



Scope Block



VHDL Generation from Simulink

- VHDL is being generated from Simulink
- The VHDL is syntactically and functionally correct – very helpful
- Some minor VHDL hand edits are necessary to make all the modules match up
- Using Xilinx System Generator for DSP would help this situation

Future Goals

- Move to Virtex-5 FX with Power PC
- Run Linux
- Implement distributed network of receivers
- Collect and analyze data
- Develop and implement improved ionosphere channel models

Questions?