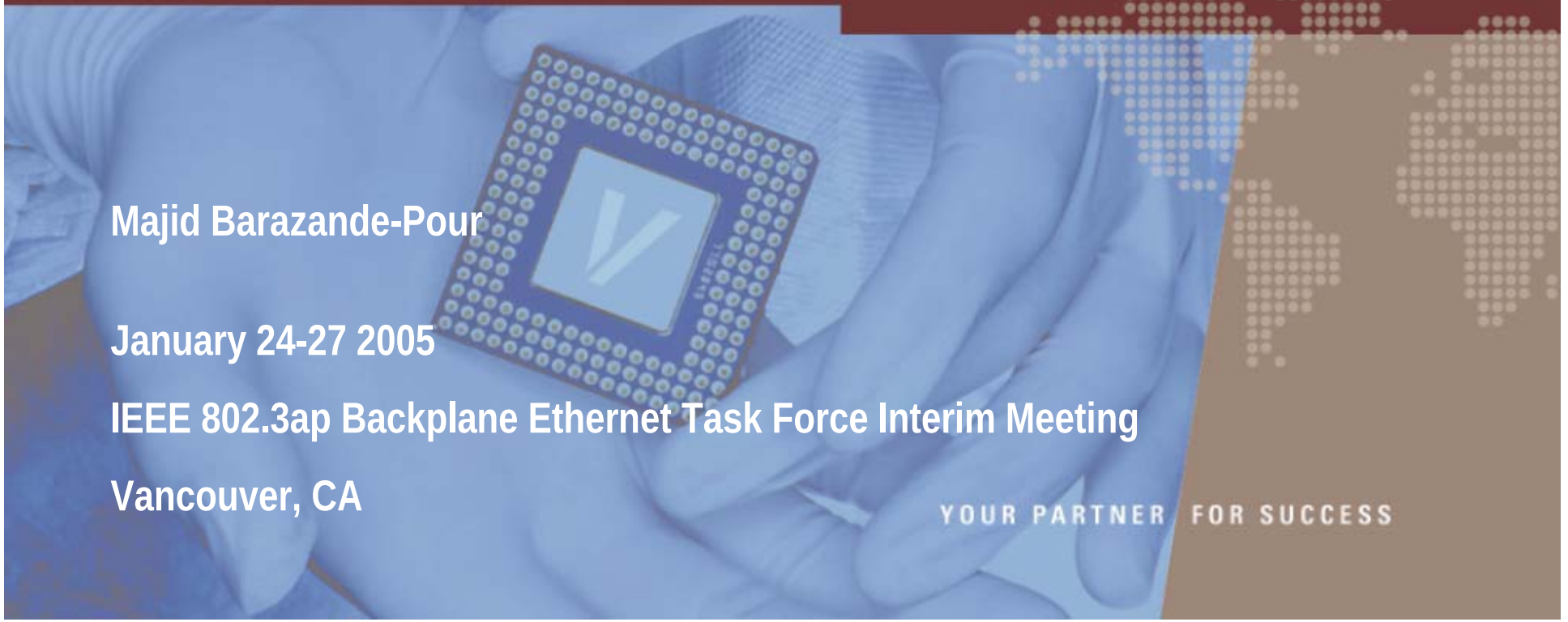
VITESSE

A Close Look at Statistical Eye and Issues



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January 24-27 2005

IEEE 802.3ap Backplane Ethernet Task Force Interim Meeting

Vancouver, CA

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Outline

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- Introduction
- High level block diagram and flowcharts
- User Parameters
- Channels (interpChannels function)
- Receiver (FFE+ DFE, ExtractCursosrs function)
- BER bound calculation and display (CalcStatEye and DispalyEye functions)
- Conclusion

Introduction

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- StatEye:
  - Contours of Constant CDF's for different amplitude and sampling times
  - Effects of jitter, xtalk and ISI (TX filter, channel and Rx filter)
- StatEye was initially developed by Anthony Sanders and now is supported by StatEye organization.
- The original application was for **channel compliancy** in OIF.
- Receiver Structure was first only DFE.
- FFE was later added to receiver.
- Continuous time equalizer was also added to it by Xilinx for OIF.
- Question: Can StatEye be used for selecting proper modulation scheme?

Backplane Simulation Model

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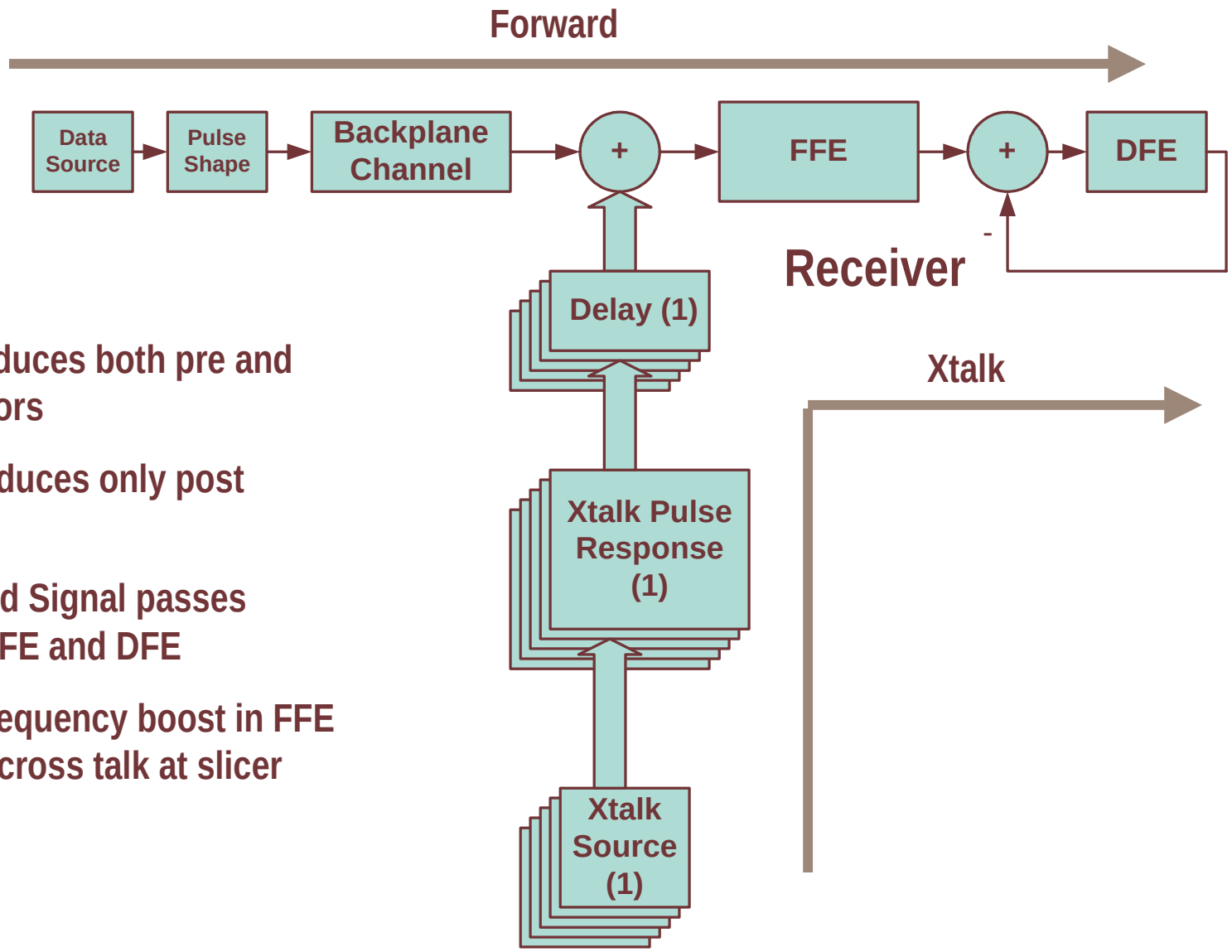

- FFE reduces both pre and post cursors
- DFE reduces only post cursor
- Forward Signal passes through FFE and DFE
- High frequency boost in FFE amplifies cross talk at slicer input.

Staeye Algorithm

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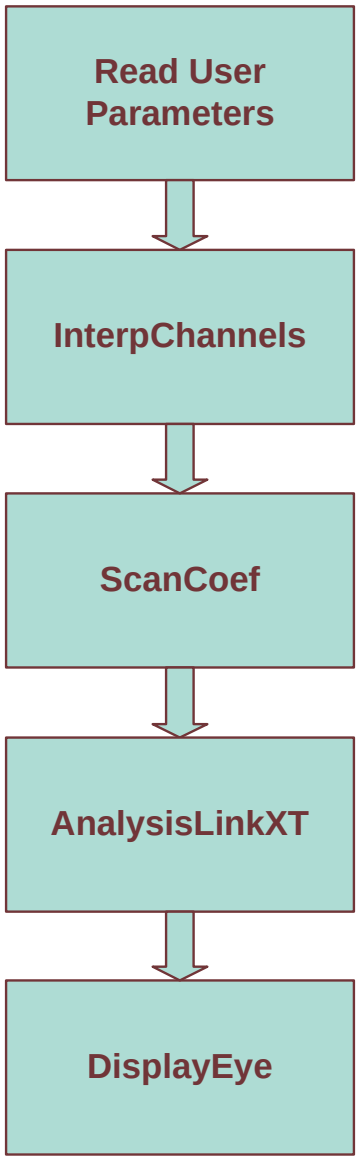

User Parameters

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- Bit Rate
- Transmitter
  - TX Jitter
    - peak-to-peak TX Jitter
    - random Gaussian Jitter
  - TX Pulse Shape (Rectangular, Gaussian)
  - Modulation (NRZ, PAM4)
  - TX Pre and Post Emphasis Range
  - TX Filter Type(RC, Bessel, Single pole, Two pole)
- Receiver
  - FFE and DFE (number of taps)
- Channel and Xtalk S parameters
- Plot and Display Options

InterpChannels

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- Channel types
  - ABCD
  - 4-port S parameter Measurements
  - 2-port S parameter Measurements
- Inputs
  - RX and TX signal Pulse types`
    - Raised cosine, single pole, two pole, bessel
- Outputs
  - Frequency response of channel and xtalk's
    - Idata.Channel_data,
    - Idata.Aggressors_data
  - Transmit pulse (idata.Tx_iSignal)

ScanCoeff

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- Finds the optimum values of sampling time, precursor and post cursors by maximizing the vertical eye opening
- timeSweep {-txdj/2-8*txrj:scanResolution:txdj/2+8*txrj]
- Centre = 0 (only eye center)
- Function Calls
  - mtfunScan (sets timesweep)
    - ExtraxtCursors
      - Quick mode (start =-4, finish=20, 25 bits)
      - FFE and DFE applied and calculated only for forward signal, NOT by Xtalk
    - CaslStatEye (calculates histograms)
    - Calculates eye opening at the center

ScanCoef

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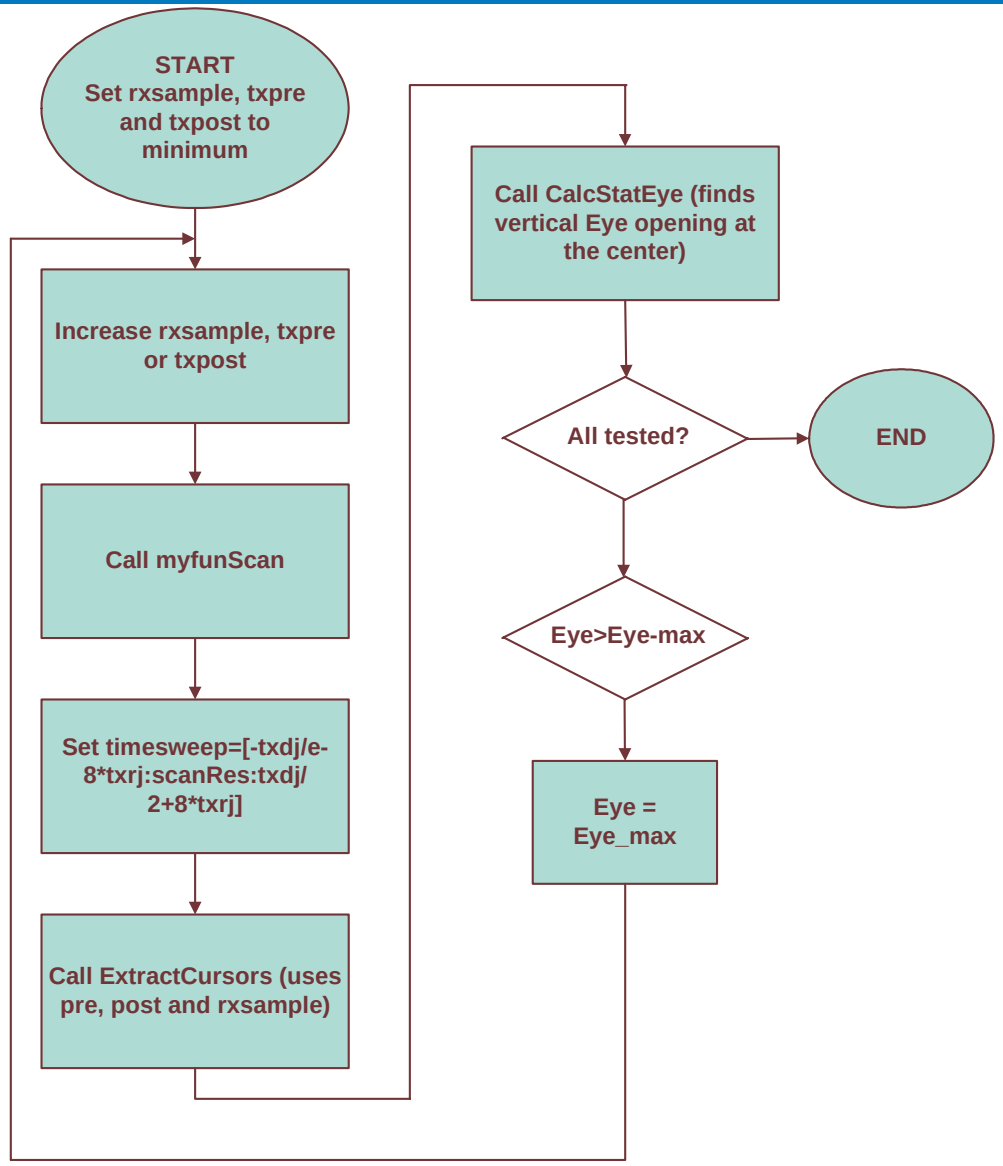

ExtractCursors

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- Calculates the cursor values for forward and xtalk signals
- FFE and DFE is done through calling functions
  - do_ffe and d0_dfe
- The cursor values are used in CalcStatEye to find the CDF's.
- FFE and DFE optimization is **done** and **applied** only for **forward** signal.
- FFE and DFE optimization is done **separately**.

- Sets timeSweep to
  - [-txdj/2-8*txrj-0.65:ScanResolution:txdj/2+8*txrj+0.65]
- Sets Centre=[-0.6:scanResolution:0.6] for scanning the eye
- Function Calls
  - ExtractCursors
    - accurate mode (start =-10, finish=60, 705 bits)
    - **FFE and DFE applied and calculated separately and only for forward signal, NOT Xtalk.**
  - CalcStatEye (calculates cursors' pdf's)

DisplayEye

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- Dispalys countours
- Displays Bathtub

Conclusion

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- In the current version of stateye (v 3.0e) :
  - Xtalk signals are not passed through FFE. High frequency boost in FFE increases the cross talk and reduces the eye opening.
  - FEE and DFE taps are not jointly optimized.
- Before modifying stateye for duobinary, receiver structure and optimization in stateye for NRZ should be verified and examined in details.