Robust Mobile Multimedia Conferencing

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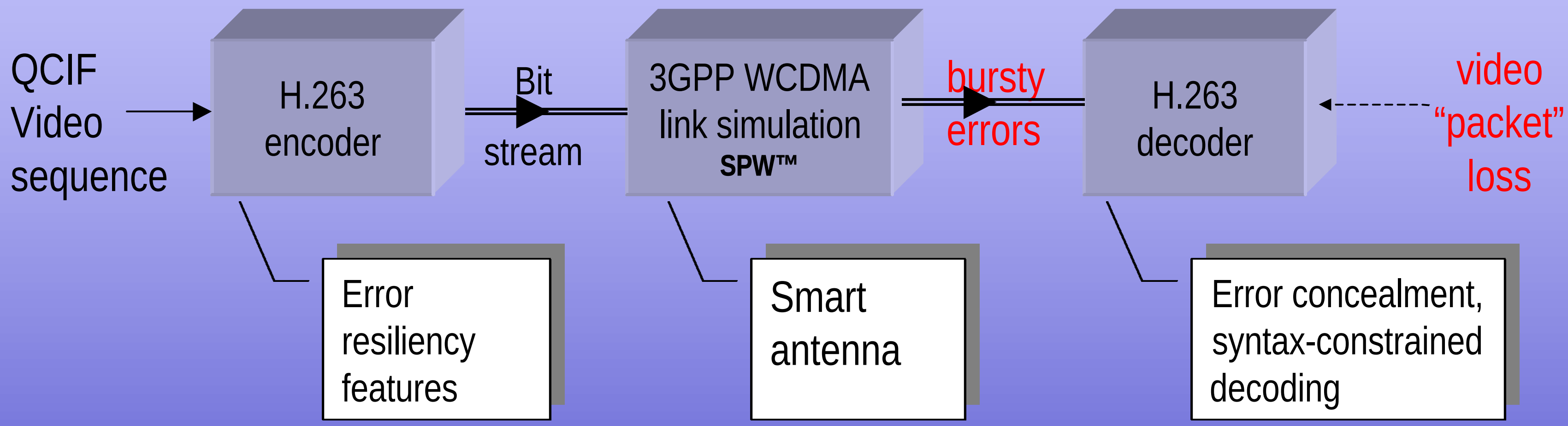
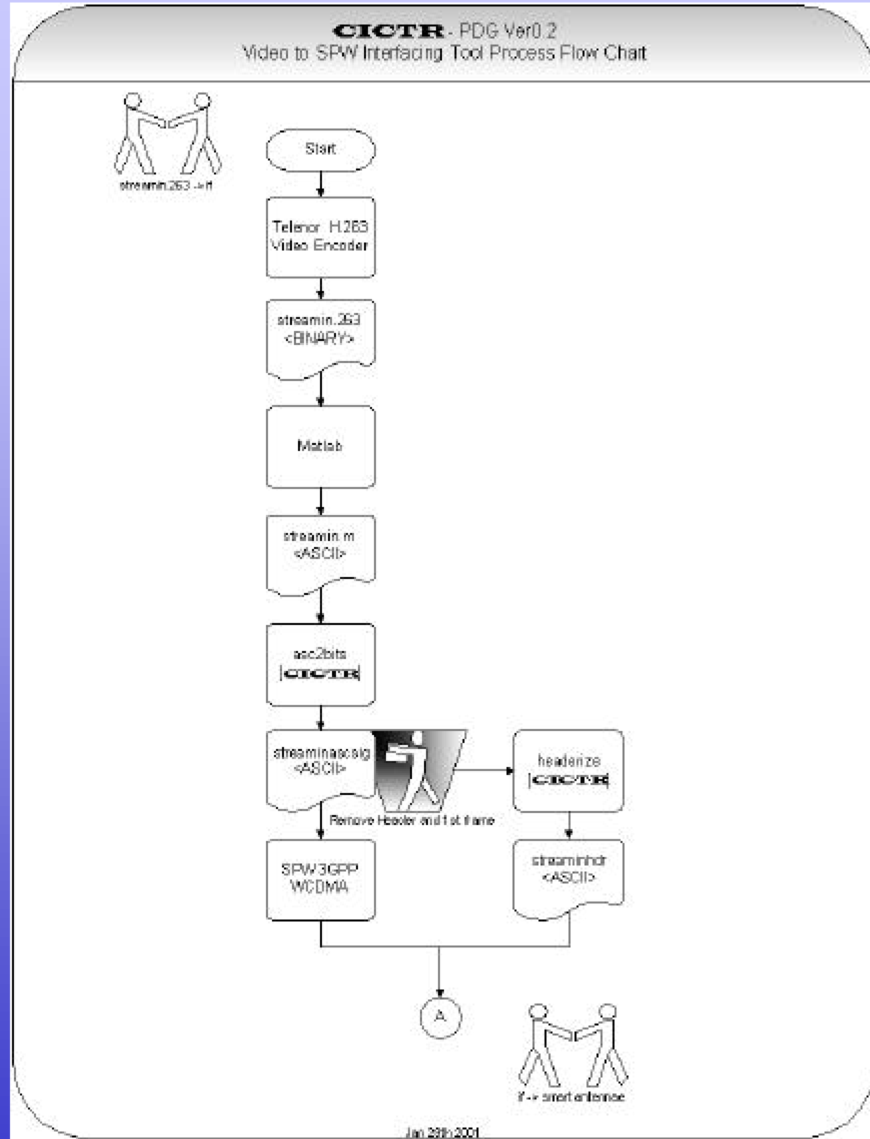
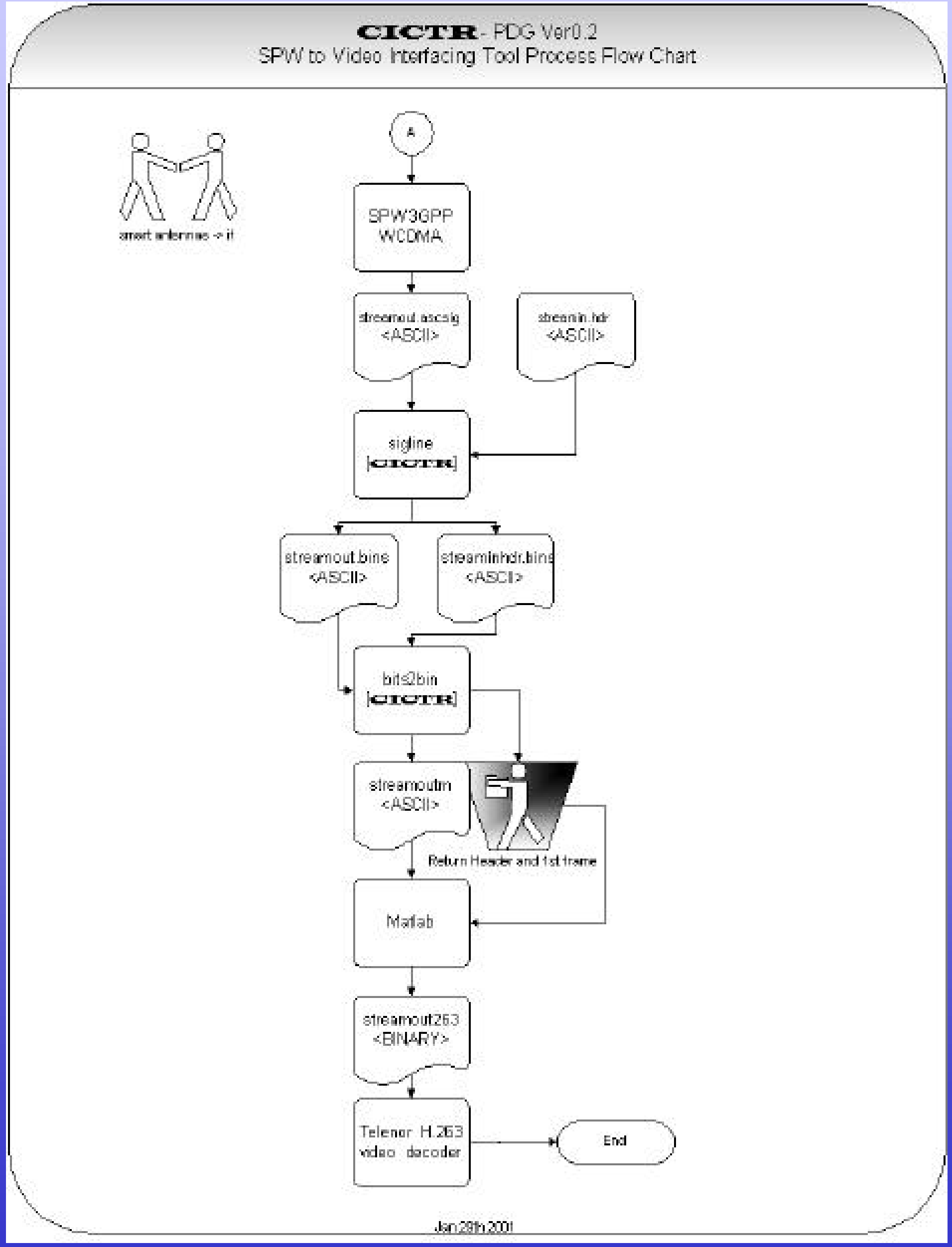


Main Goals

- Integrated system development
- Performance evaluation and engineering guidelines
- Development and evaluation of new error-resiliency methods


CICTR - PDG Ver0.2
Video to SPW Interfacing Tool Process Flow Chart
Start
Telenor H.263
Video Encoder
streamin.263
<BINARY>
Matlab
streamin.m
<ASCII>
asc2bits
CICTR
streaminascsig
<ASCII>
Remove Header and 1st frame
headerize
CICTR
SPW 3GPP
WCDMA
streaminhdr
<ASCII>
A
Jan 29th 2001


CICTR - PDG Ver0.2
SPW to Video Interfacing Tool Process Flow Chart
A
SPW3GPP WCDMA
streamout.ascsig <ASCII>
streamin.hdr <ASCII>
sigline [CICTR]
streamout.bins <ASCII>
streaminhdr.bins <ASCII>
bits2bin [CICTR]
streamoutm <ASCII>
Return Header and 1st frame
Matlab
streamout263 <BINARY>
Telenor H.263 video decoder
End
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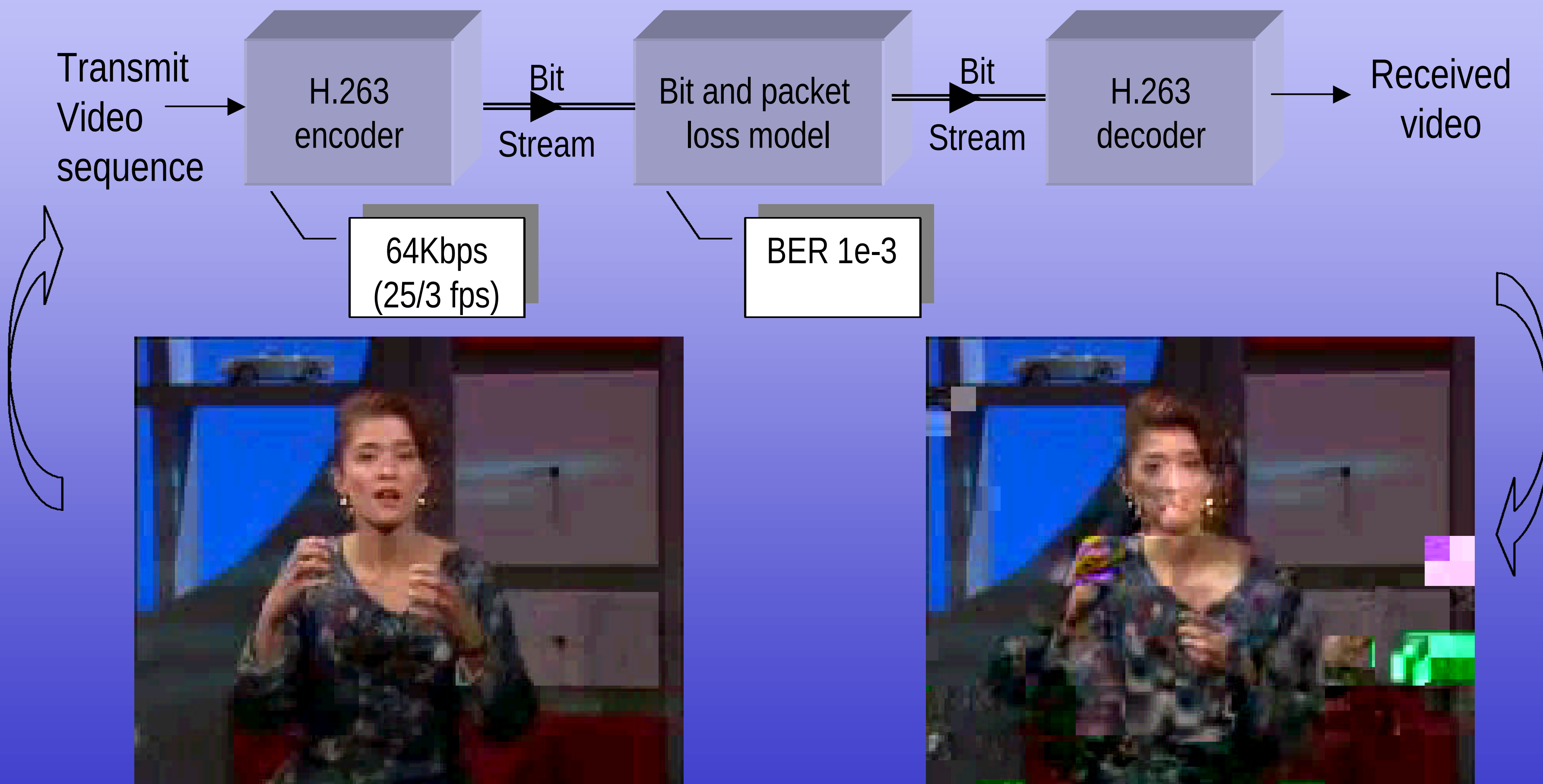

Transmit sequence
PSNR = 35.5dB

Received sequence
PSNR = 18.7dB

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- Error Resilient H.263 Codec
  - Objective
    - Devise and incorporate effective error resiliency techniques into the existing low bit rate video coding standard, H.263. These techniques will protect against both packet (group of blocks (GOB)) loss and losses due to individual bit errors. Error-resiliency requires augmentations of both the source encoder and the decoder.
  - General Work Strategy
    - Work from existing (C) source code for H.263 (from Telenor)
    - Identifying insertion points and "least invasive" methodology for implementation of error-resiliency features
    - Debugging and Performance Evaluation

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- Error Resilient H.263 Codec Techniques
  - Error Recovery at the Decoder
    - Alternative motion vector selection for lost Intermode blocks
    - Block refresh for Intramode blocks
  - Rate-distortion Optimized Inter/Intra MB Mode Selection At the Encoder, Consistent With Decoder Error Recovery
    - Full pel accuracy
    - Half pel accuracy
  - Rate-distortion Optimized Synchronization Marker Insertion, Consistent With Decoder Error Recovery
  - Sequence Decoding of Motion Vectors, Based on Residual Source Redundancy

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- Error Resilient H.263 Codec Techniques
  - Rate-distortion Optimized Mode Selection
    - Inter-coding of MBs requires far fewer bits (~ 1/3) than those required for Intra-coding.
    - However, under random packet loss, intermode coding incurs much greater expected distortion, with errors propagated through time.
    - These facts motivate rate-distortion optimized MB mode selection.
    - Expected distortion measured consistent with decoder's error recovery.
    - Estimation takes into account error propagation (recursively estimate for current frame based on estimate for past frame).
    - Expected distortion evaluated at pixel-level precision.
    - Mode selection for each MB to minimize the Lagrangian cost D(mode) + Lambda R(mode)

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- Smart Antenna
  - Objective
    - Devise and incorporate smart antenna strategies which utilize multi-path diversity of uplink and downlink wireless channels. The smart antenna will reduce co-channel interference at base station and increase signal power at mobile station, which will result in lower bit error rate and higher video quality.
  - General Work Strategy
    - Use Signal Processing Worksystem (SPW™), a block-oriented, physical layer end-to-end simulation tool, which conforms to current standards for 3G WCDMA. Design and build blocks that implement smart antenna features. Incorporate H.263 codec to evaluate overall system performance.

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- **Smart Antenna Details**
  - Spatially-dependent uplink channel model built
  - Constant-modulus (blind) algorithm smart antenna applied to uplink transmission
  - Started training-based adaptive smart antenna
  - Formatted H.263 bit stream for use in SPW
  - Complete training-based adaptive smart antenna
  - Start spatially-dependent downlink channel model
  - Increase simulation speed and resolve SPW installation issues
  - Application of smart antenna to downlink

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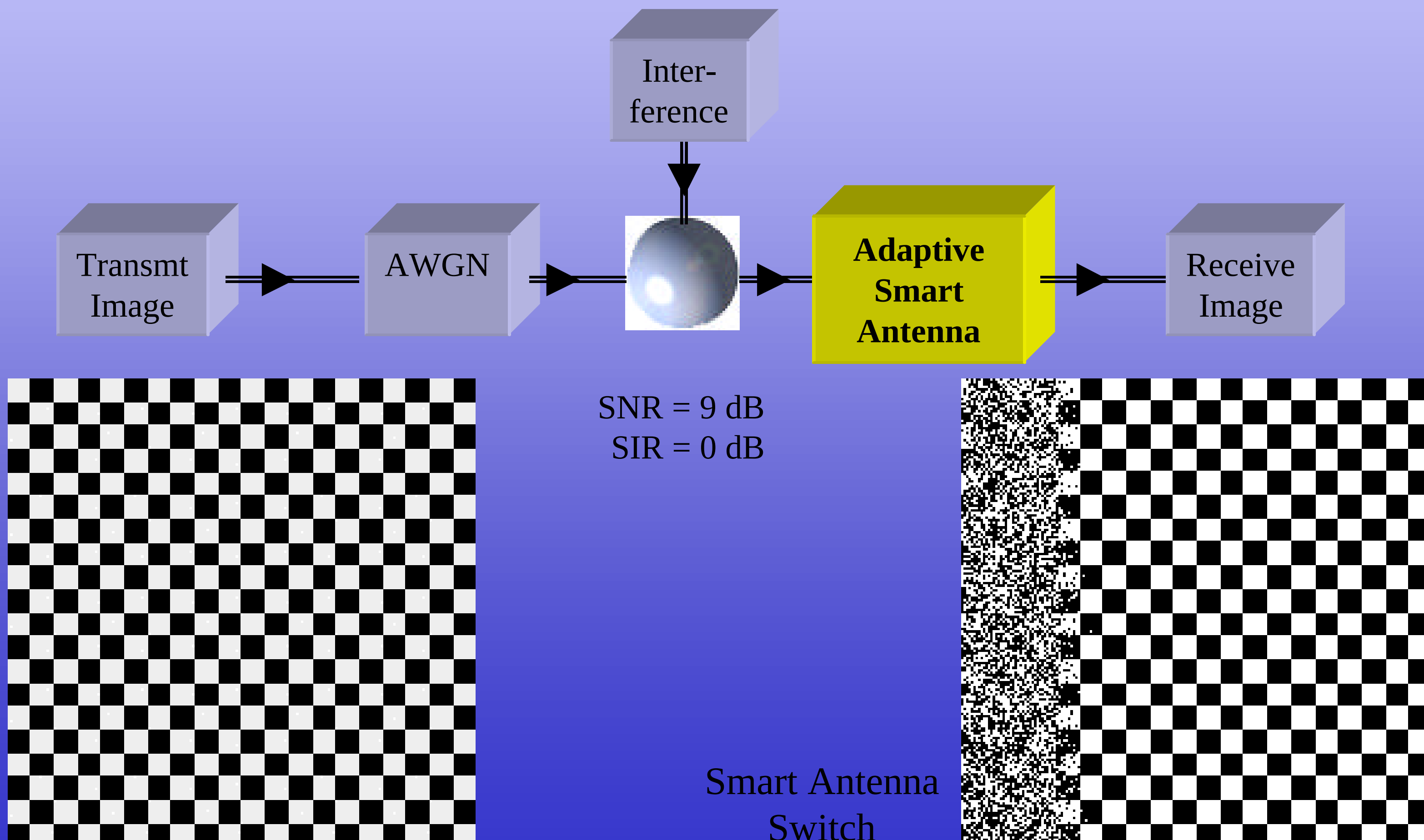
- **Smart Antenna Demonstration**



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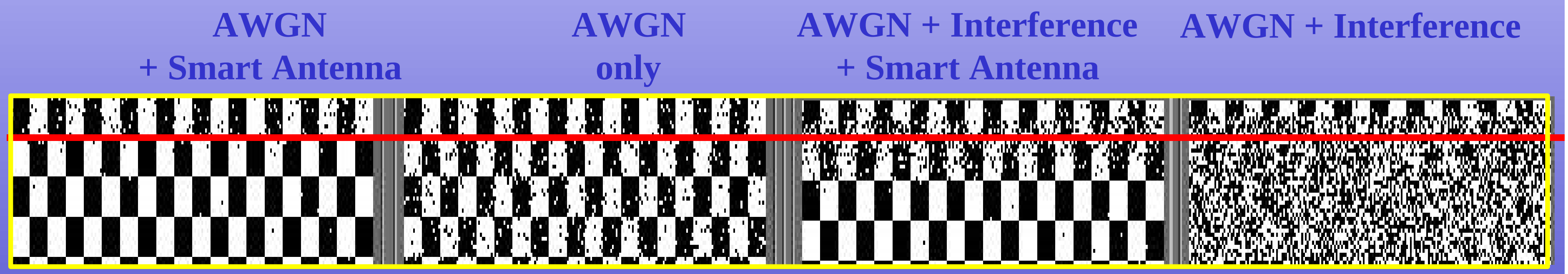
- **Smart Antenna Demonstration**



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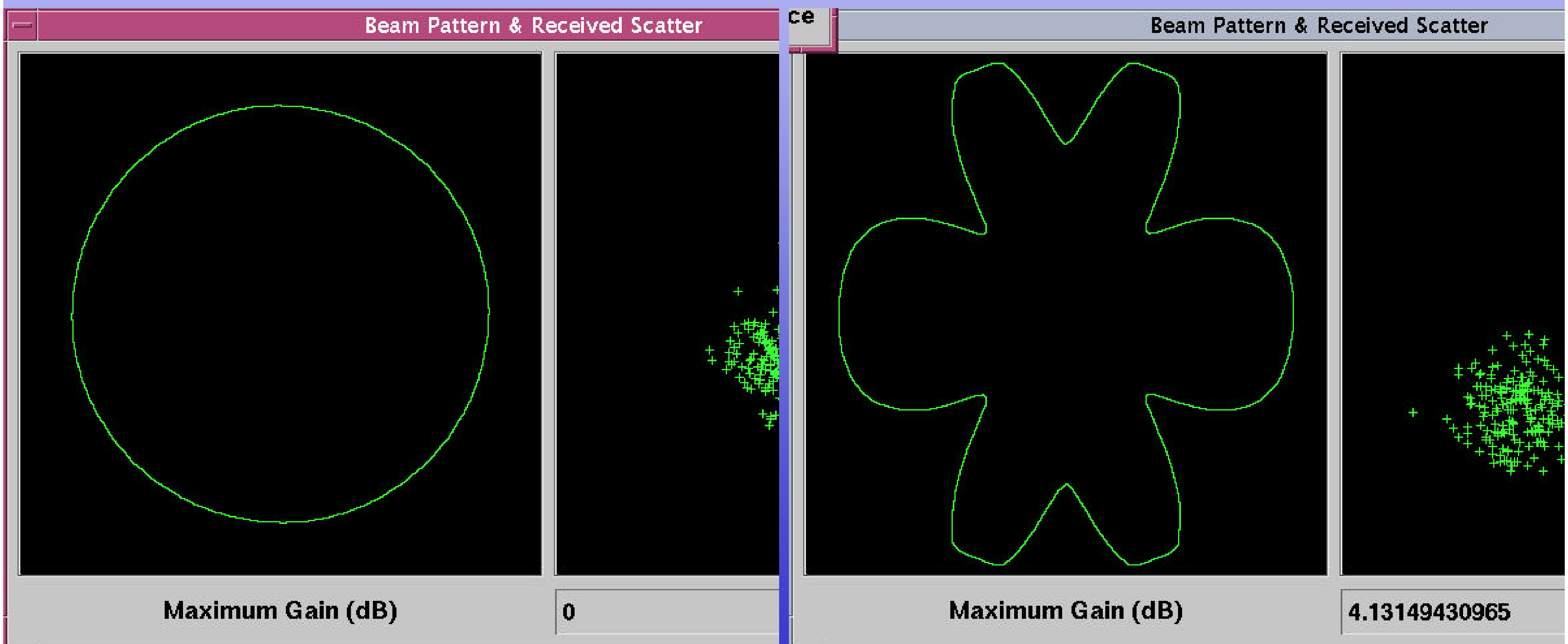
- **Smart Antenna Adaptation in SPW**



Transient

Steady State

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- **Summary**
  - Development and evaluation of error-resilient video coding/decoding methods
  - Development and evaluation of smart antenna methods for uplink and downlink spatial diversity gains
  - Integration of methods into SPW end-to-end 3G CDMA system

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