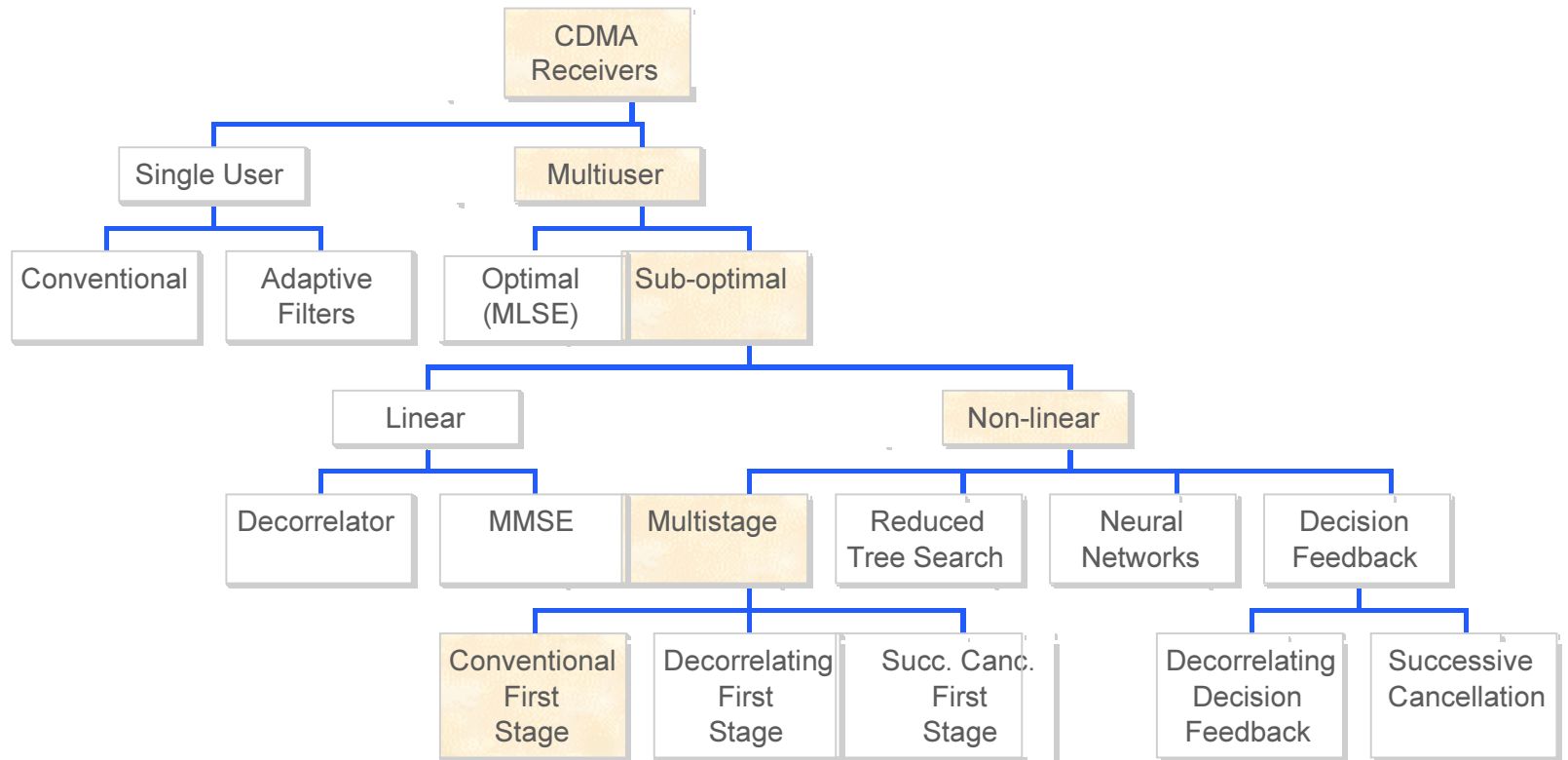




Example Application: Multiuser Detection

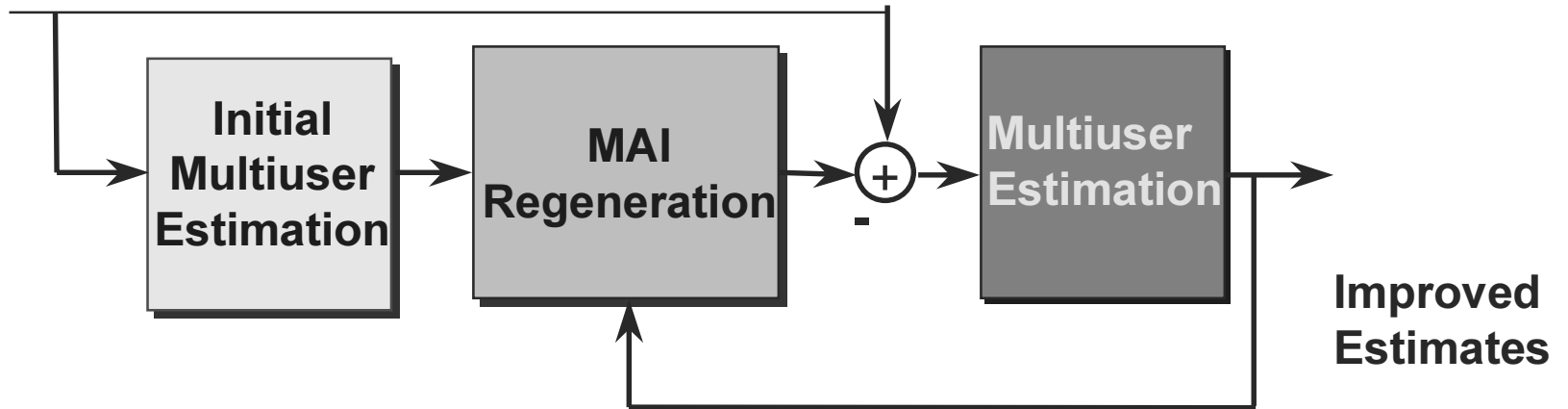


CDMA Receivers





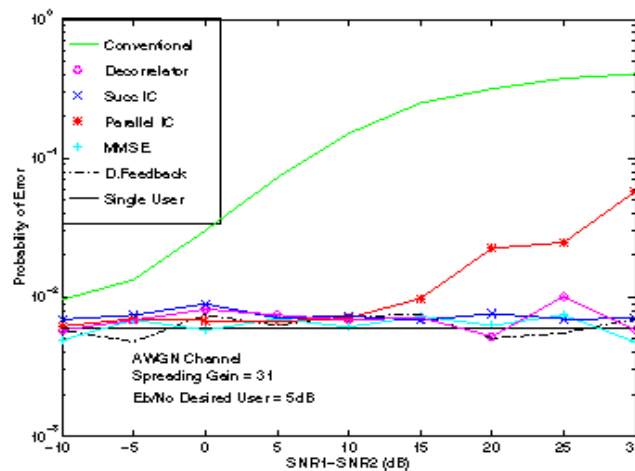
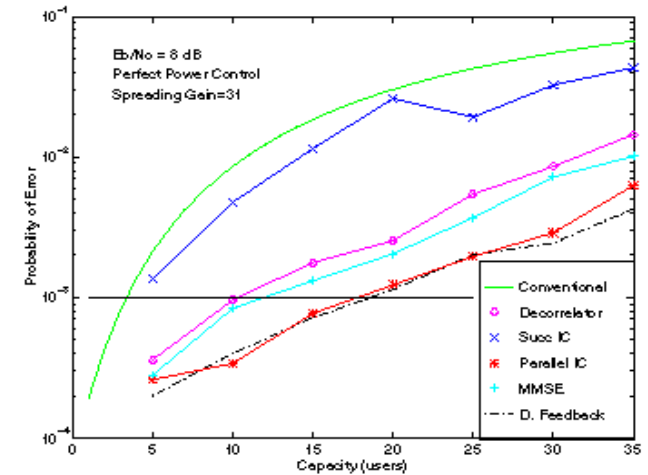
Approach to Multiuser Detection





Multiuser Receiver Performance

- Offer significant capacity gains over conventional receiver
- Provide robustness in near/far situations



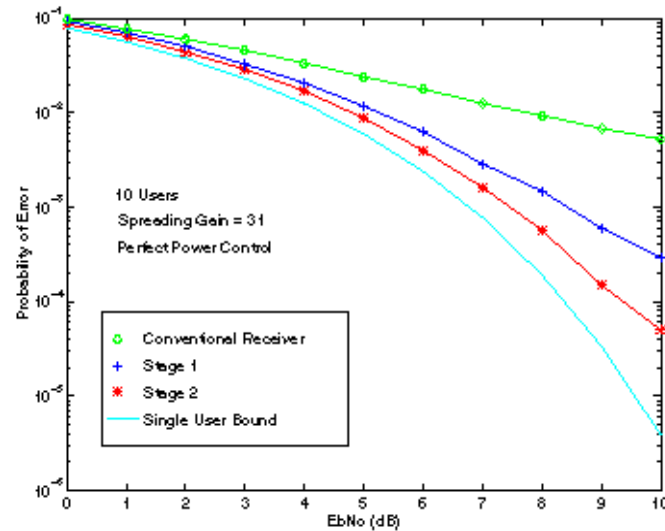
- Parallel cancellation provides excellent tradeoff between complexity and performance



WGN

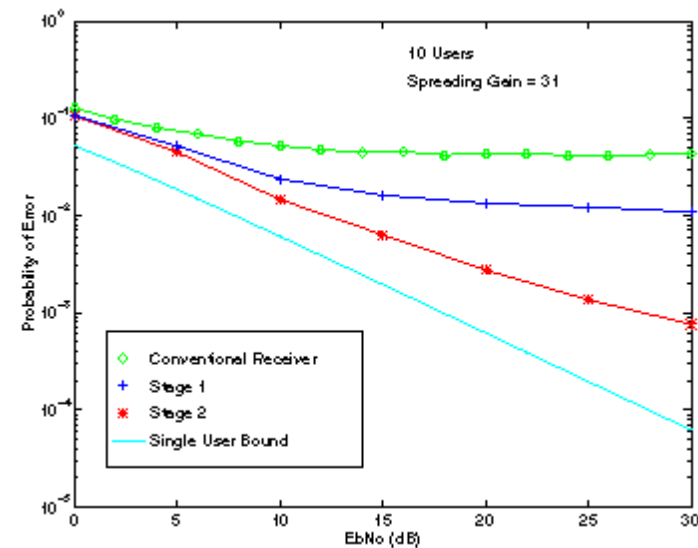


Performance



• Significant improvements are observed with few stages of interference cancellation for different channel conditions

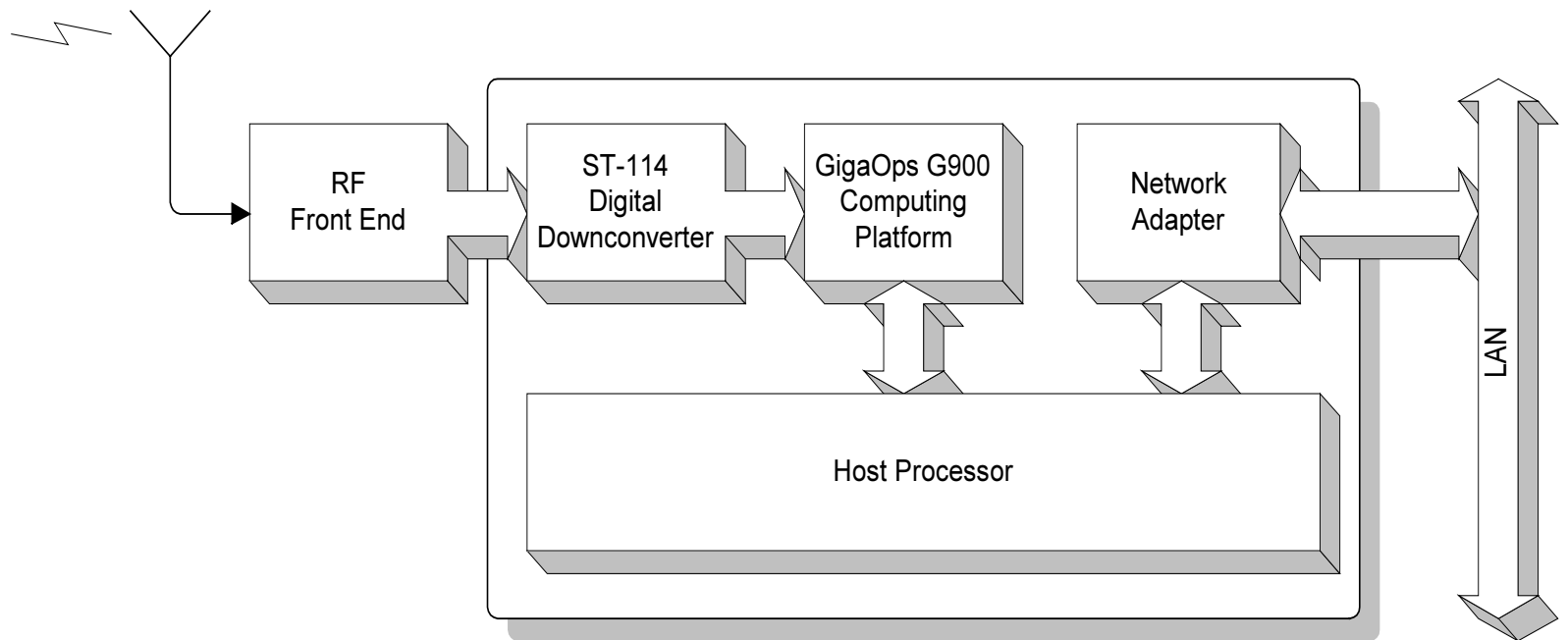
• Multistage cancellation approaches the single user bound as the number of stages increases



Rayleigh Fading



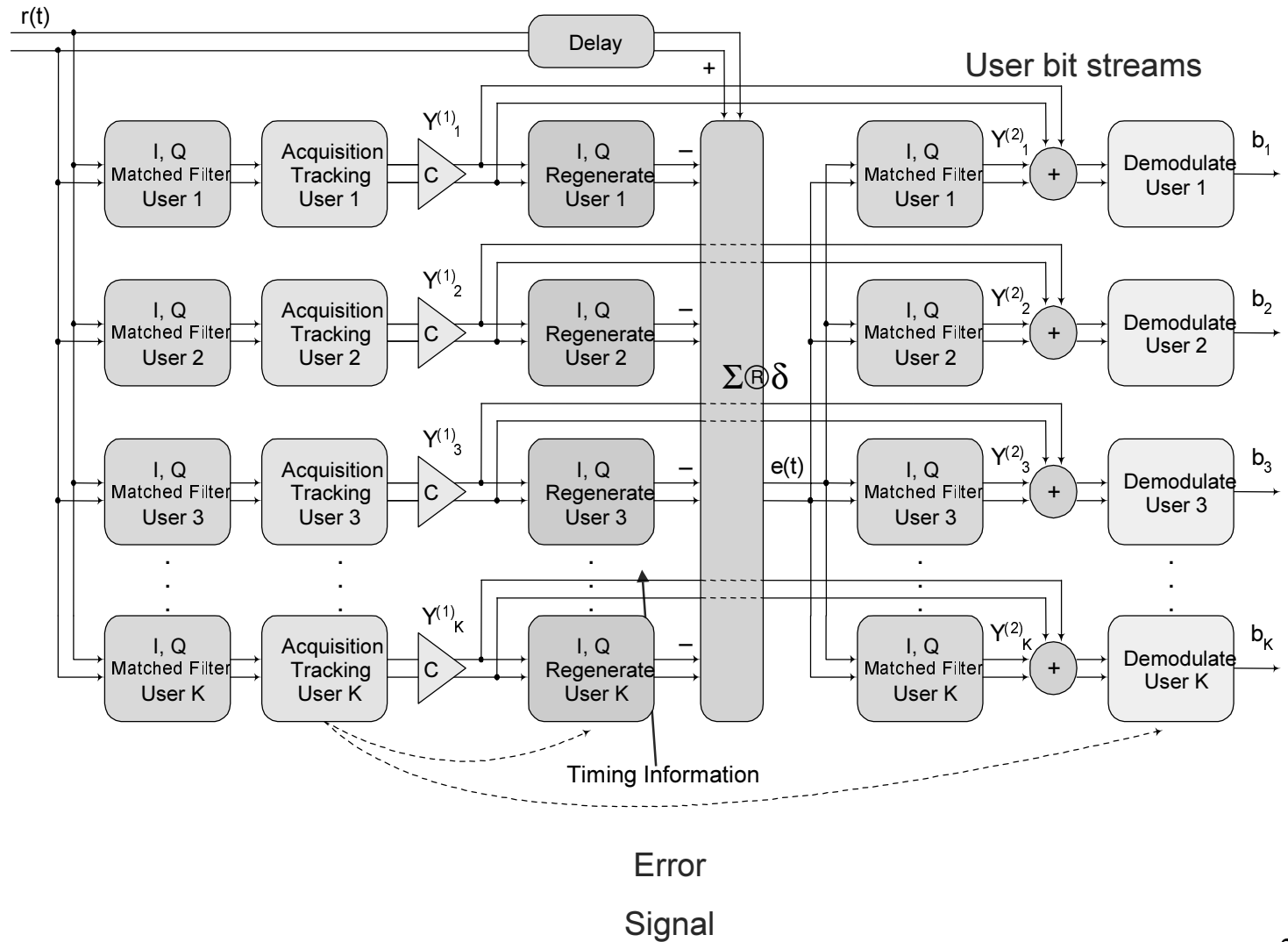
Receiver Block Diagram





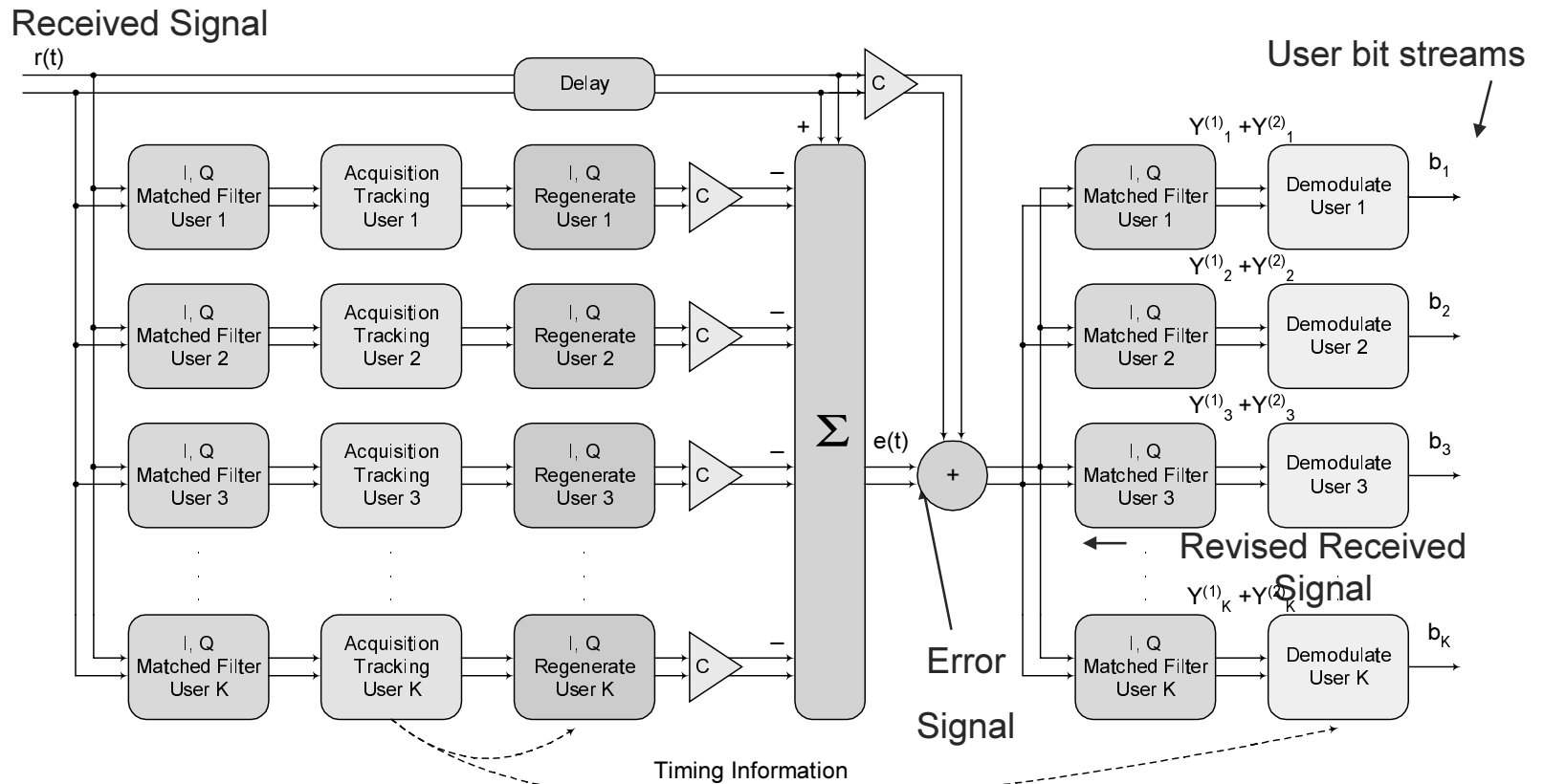
Parallel Interference Cancellation

Received Signal



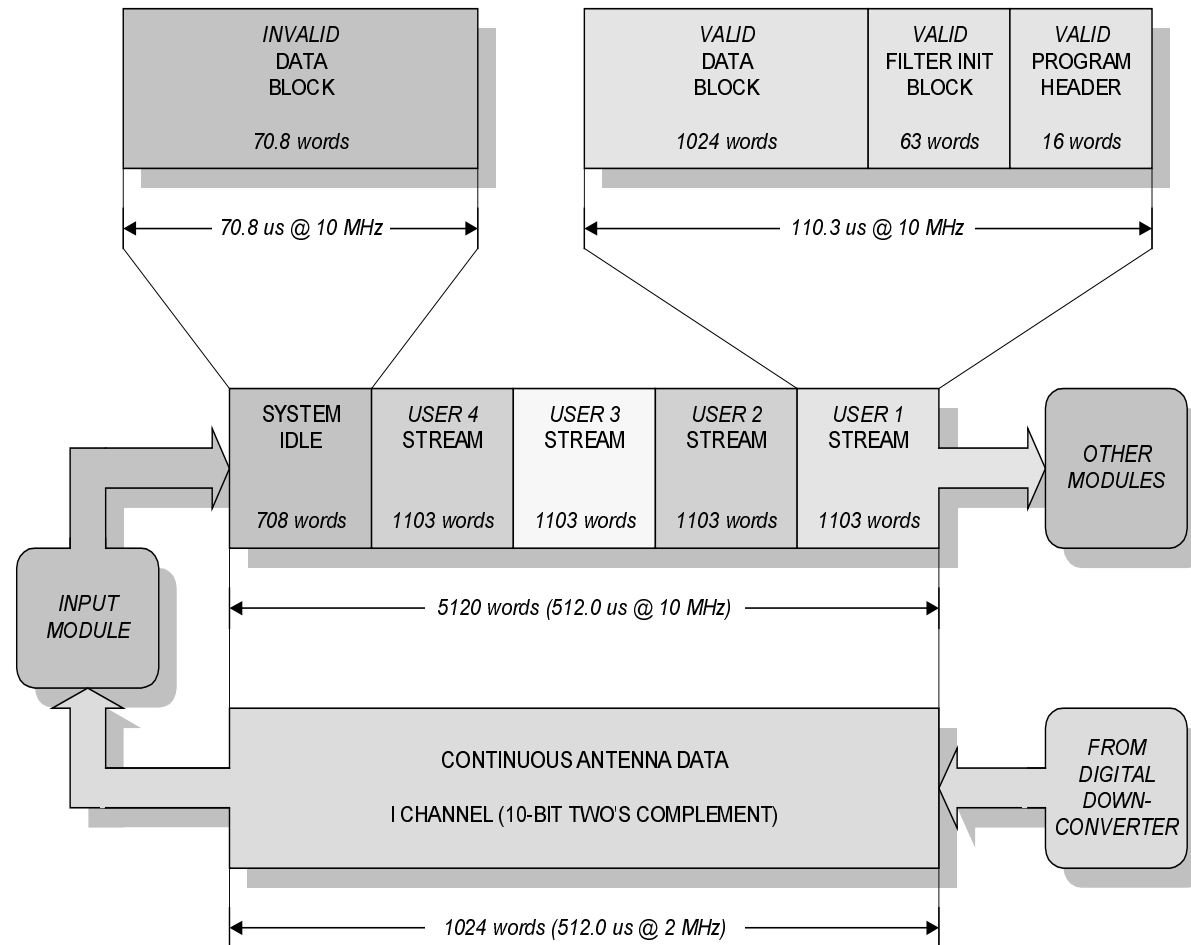


Data Flow Oriented PIC





Block Composition





System Specifications



- Transmitter

- Handle 4 users
- 31.25 kbps / user
- Processing gain 16
- Modified Gold codes
- Chip Rate = 500 kHz
- DBPSK with rectangular pulse shaping
- 1 MHz RF Bandwidth

- Multiuser Receiver

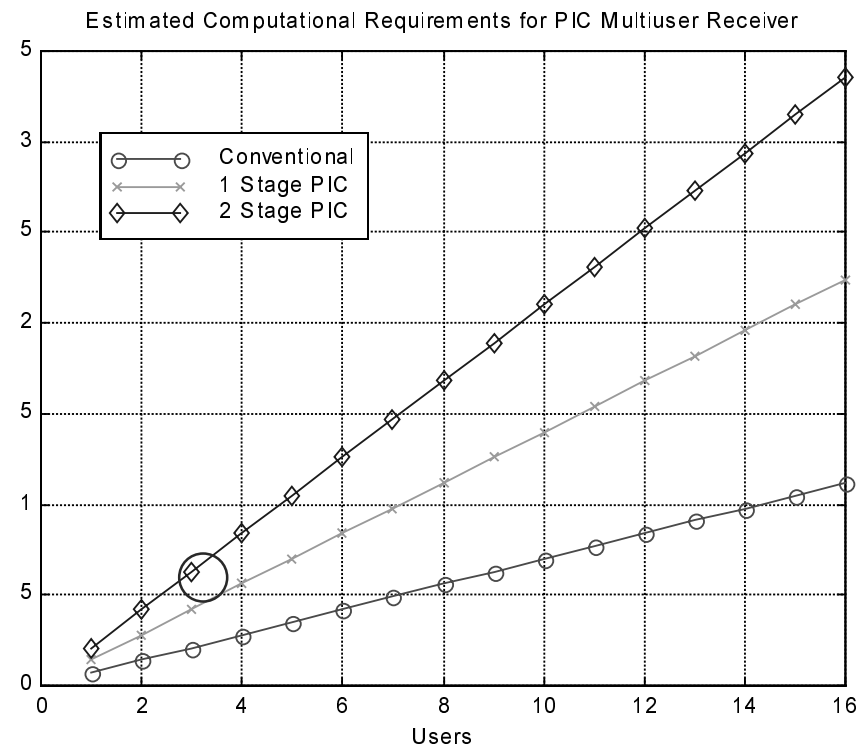
- Harris 50214 DDC yields 2 MHz complex envelope
- Stream-oriented modular processing pipeline
- Employ parallel interference cancellation
- 10 MHz processing clock
- Chips over sampled by 4



Computational Requirements

- Matched filter receiver
- N_c : PG = 16
- N_s : 4 samples per chip
- F_s : 2 MHz sample rate
- N : number of stages
- K : number of users

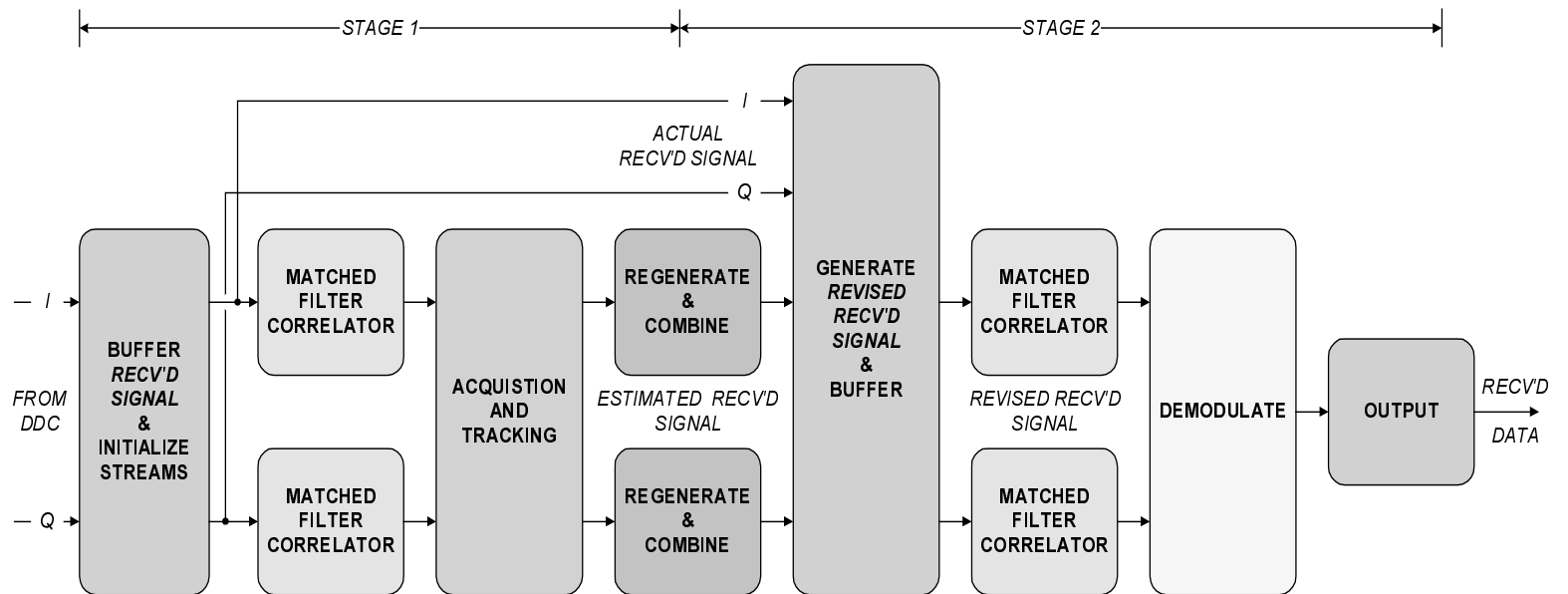
$$O = KN \times (2N_c + N_s - 1) \times F_s$$



* Excludes tracking and regeneration



Multuser Receiver Data Flow





GigaOps G900 Platform

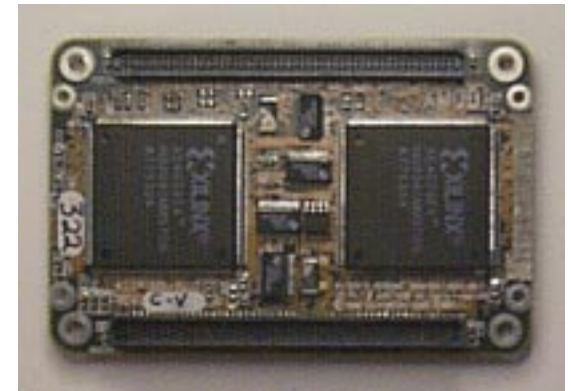
- G900 Platform

- Holds up to 16 XMODs
- PCI-based
- FPGA-Host data transfers
- 6 16-bit busses
- Programmable clock generation



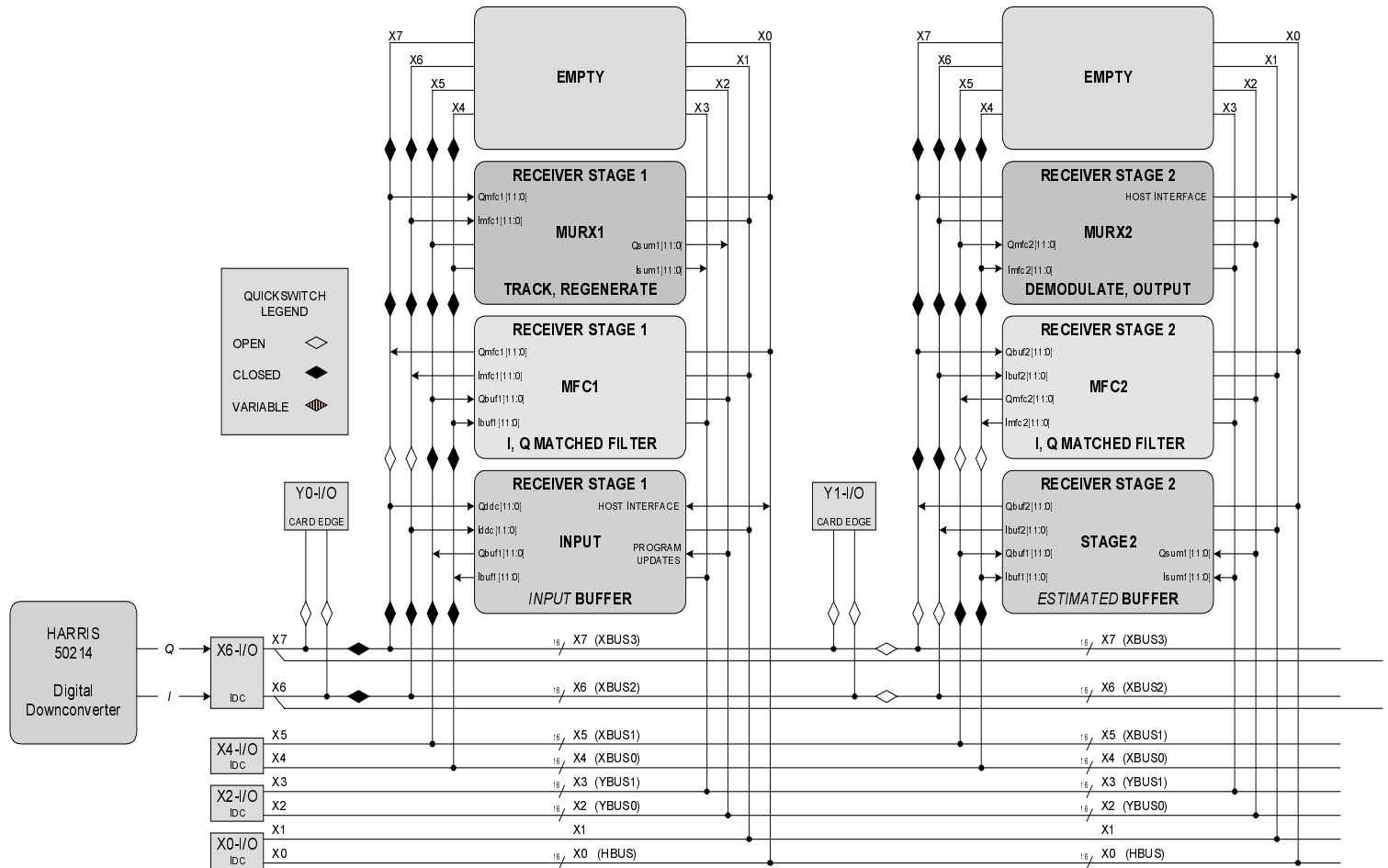
- X210 XMOD

- Holds 2 Xilinx XC4028 (~ 28k gates)
- 4 16-bit busses switchable in stack
- 8 MB DRAM, 256k SRAM



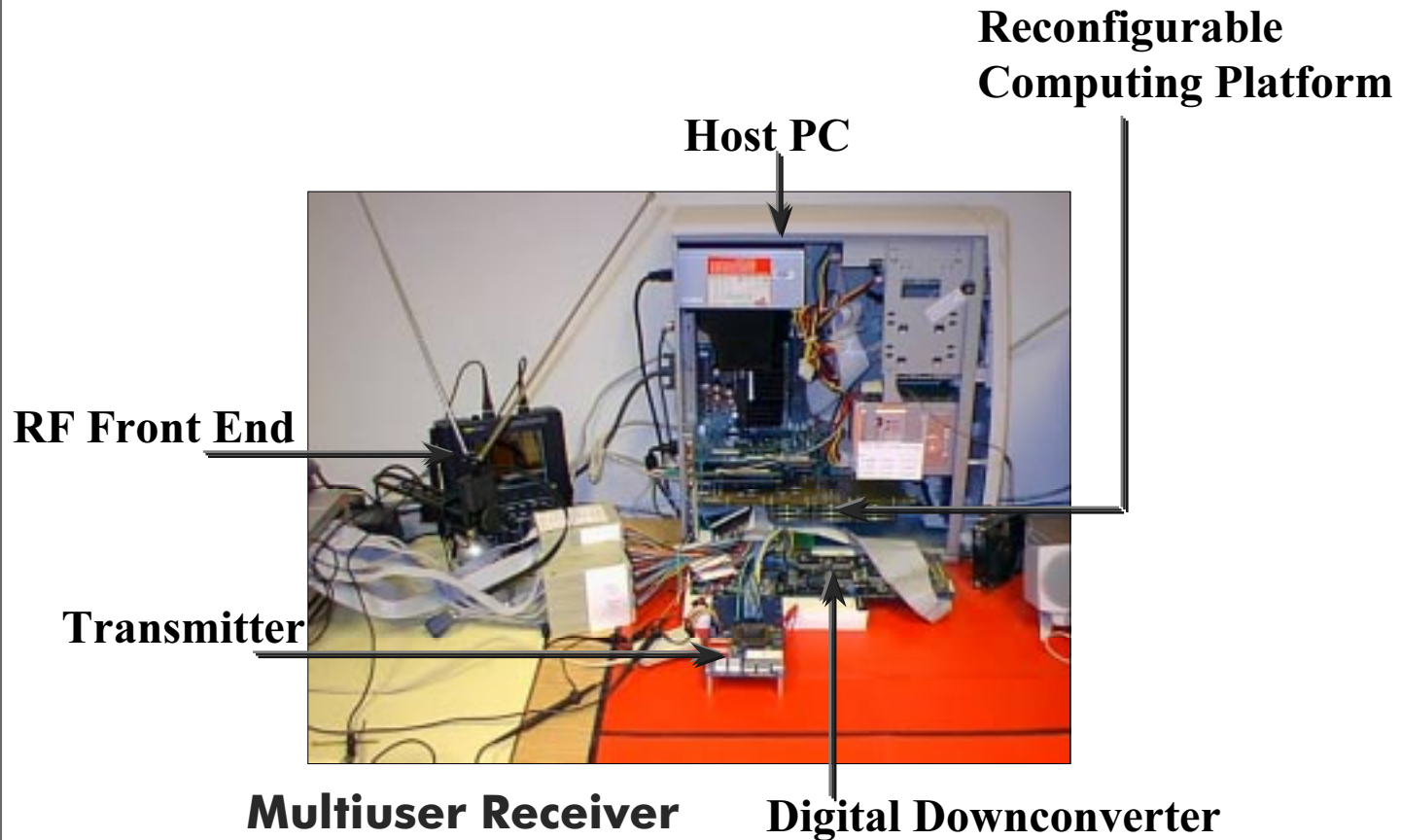


Multuser G900 Layout





Multiuser Receiver Hardware





Preliminary Hardware Results

- Non-coherent DBPSK
- 4 Users
- Modified Gold codes
- PG = 16
- Averaged BER over all 4 users
- Averaged MAI environment by “slipping” undesired users.
- Average BER improvement of 350 times over conventional!

