

# State Predicted Interference Cancellation and Equalization (SPICE)

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 MSR

 MITRE  
Technology  
Program

# Problem

- In the presence of severe co-channel interference, a spread-spectrum signal's spreading gain is not enough
- New signal processing methods are needed to remove the co-channel interference *prior* to despreading

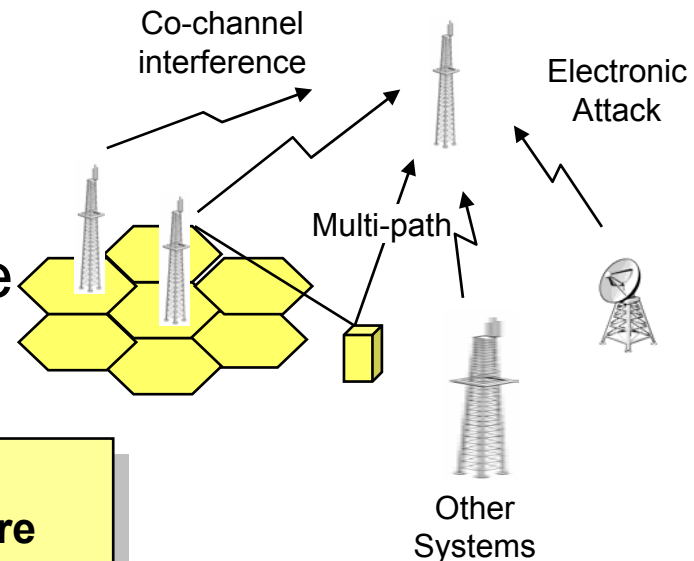
# Background

## ■ Increasingly crowded RF spectrum

- High frequency reuse (e.g. CDMA, sectoring)
- COTS solutions concentrate in specific bands

## ■ Interference types

- Multi-path components
- Co-channel interference
- Electronic attack



**Without additional interference cancellation performance of future communications systems will be limited**

# Objective

- **Develop next-generation interference cancellation and equalization (ICE) solution for CDMA systems by developing advanced non-linear multi-user detection algorithms.**

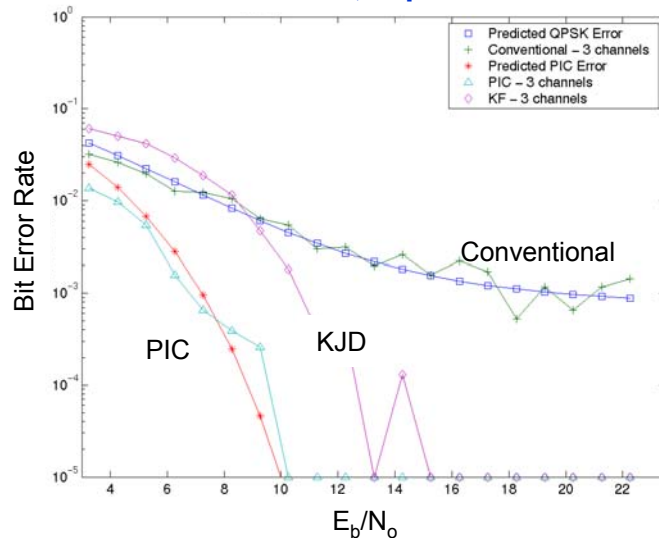
# Activities

- **Developing alternate MUD algorithms**
  - **Multi-stage parallel interference cancellation**
  - **Hybrid methods**
- **Improving computational efficiency**
- **Increasing robustness**
- **Determining performance bounds**

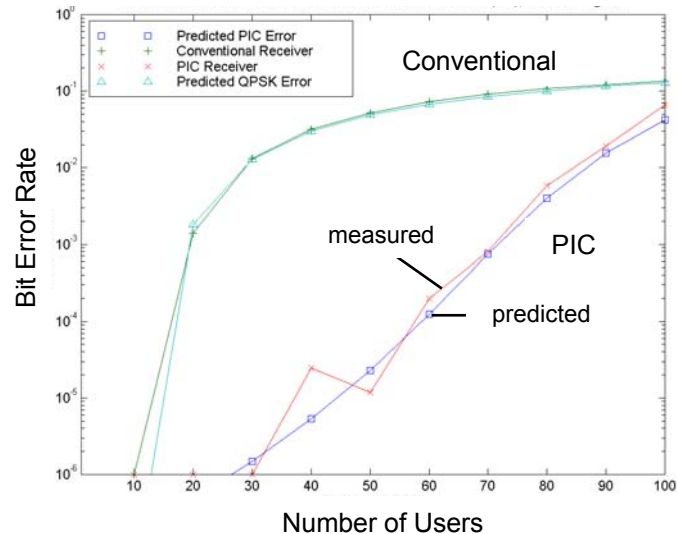
# Highlight

- Multi-User Detection Algorithms:
  - Improve detection performance
  - Increase network capacity

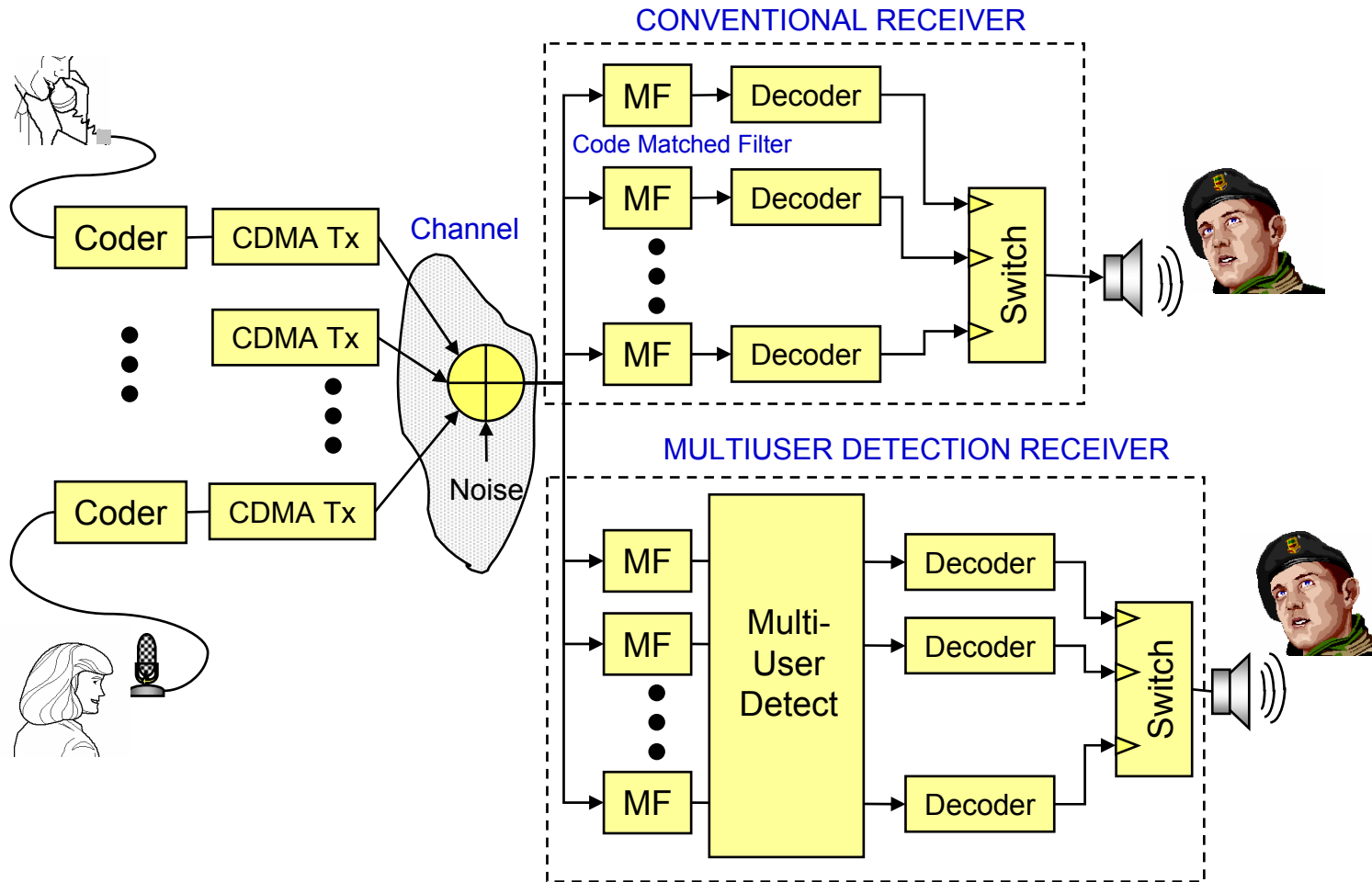
BER vs. SINR–PIC with Soft-Decision, Equal Powers



User Capacity, PIC with Soft-Decision



# Demonstration



# Impacts

- **Performance improvement of cellular systems**
  - **Increased capacity**
- **Insertion of PCS/Cellular technology into the battlefield**
  - **Interference cancellation**
  - **Ad hoc networks**

# Future Plans

- Integration of advanced equalization techniques
- Demonstrate and test against real-world signals
- Design high-level algorithm architecture for ASIC implementation

