

## Preface:

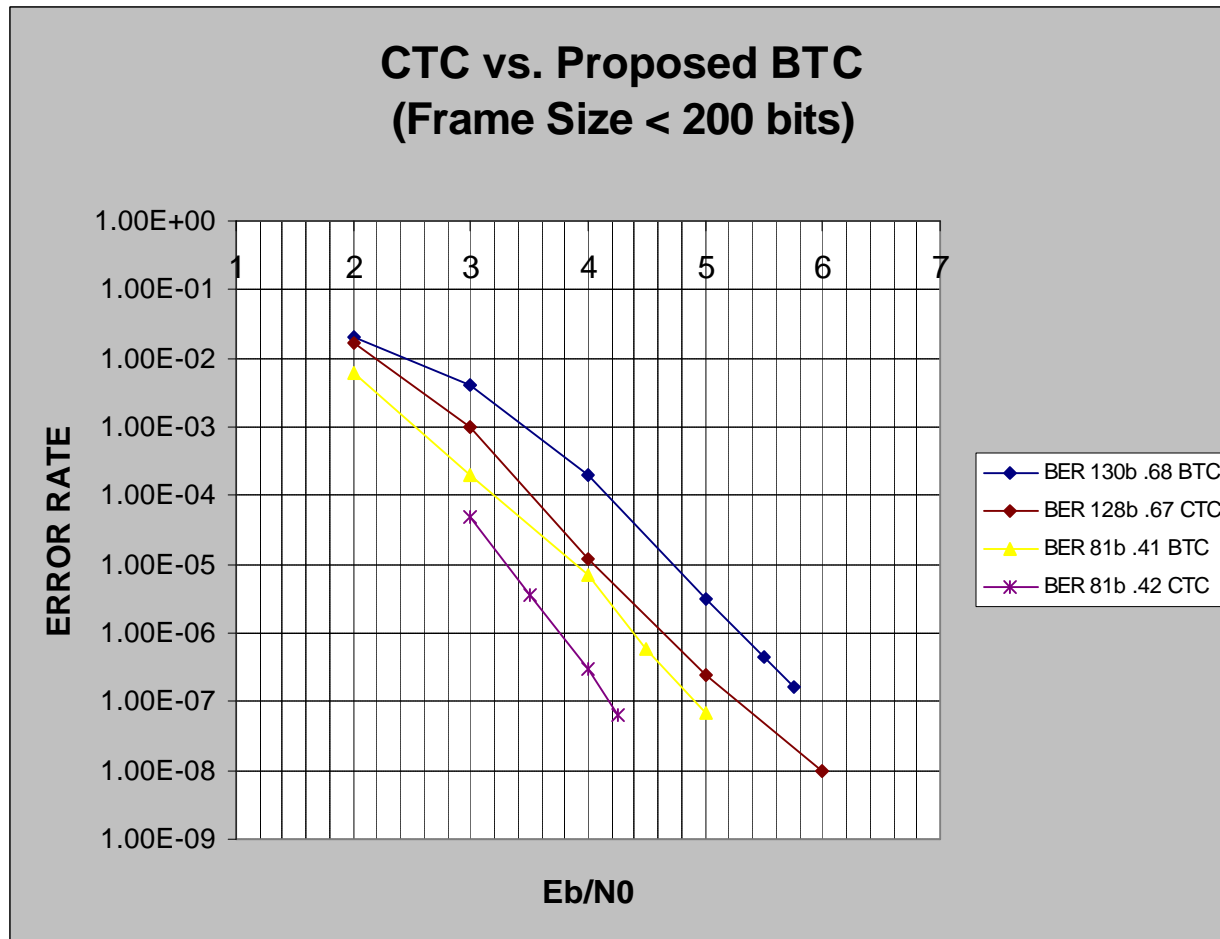
*These slides were presented on May 15<sup>th</sup> 2001, in Orlando Florida to the IEEE 802.16.4 standards body. The meaning of some slides may not be apparent without the oral portion of the presentation. However, the data within the presentation clearly illustrates that Convolutional Turbo Codes (CTC) outperform Block Turbo Codes (BTC) over a wide range of code rates and frame sizes.*

*Furthermore, in the course of compiling data, iCODING has yet to find any performance points at which BTC's exceed the performance of CTC's for any code rate or frame size.*

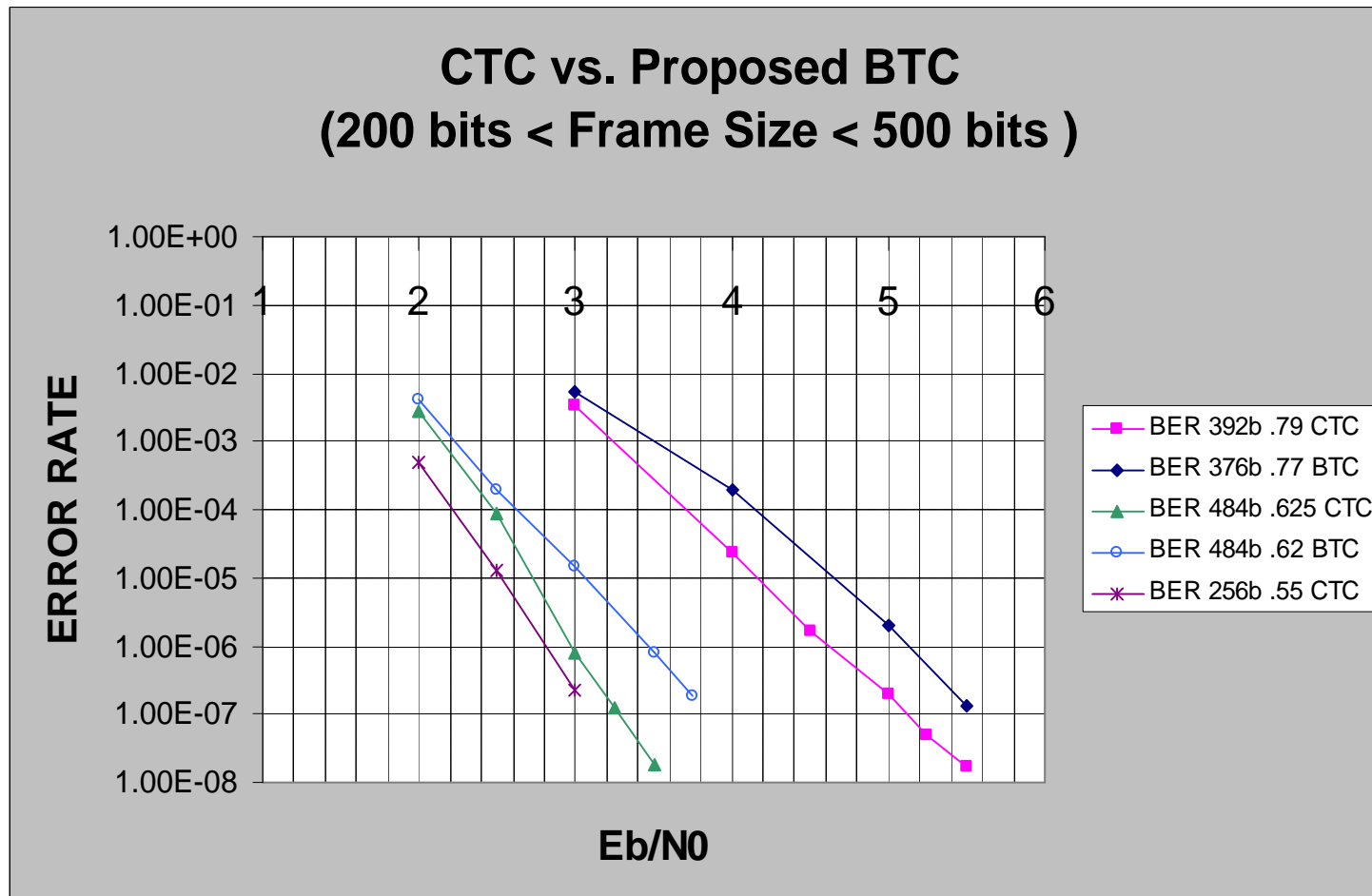
# Convolution Turbo Codes for 802.16.4

- Best Performance
- Low Implementation Complexity
- Highly Flexible
- Useful For Power Limited Unlicensed Band
- Wide acceptance in other standards bodies
- Excellent availability of cores and technical literature

# Small Frame Performance



# Medium Frame Performance

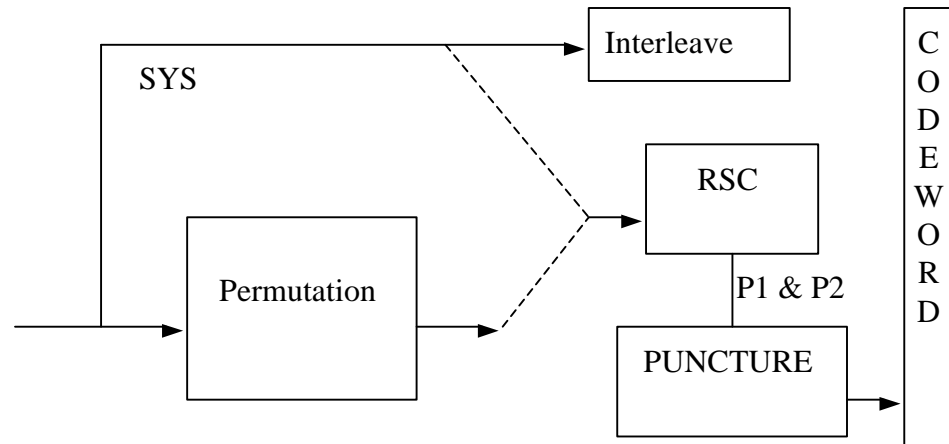




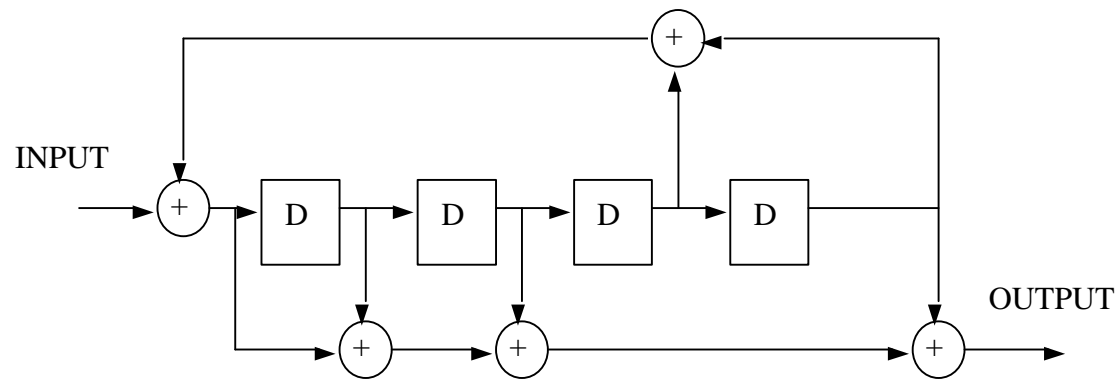
# CTC Lower Complexity

- Uses the same “Base” Code for all frame sizes and all code rates
- Codes are “2D”
- Less extrinsic memory required (much less when compared with 3D BTC)
- Fewer subiterations when compared with 3D code

# Simple Encoder Format For all Code Rates and Frame Sizes



# Same Simple Constituent Code For All Frame Sizes and Code Rates



# Simple Puncture Patterns for achieving difference code rates

<b>RATE 1/2</b>							
SYSTEMATIC	1	1					
PARITY 0	1	0					
PARITY 1	0	1					
<b>RATE 2/3</b>							
SYSTEMATIC	1	1	1	1			
PARITY 0	1	0	0	0			
PARITY 1	0	0	1	0			
<b>RATE 3/4</b>							
SYSTEMATIC	1	1	1	1	1	1	
PARITY 0	1	0	0	0	0	0	
PARITY 1	0	0	0	1	0	0	



## BTC require many constituent codes to implement different frame sizes

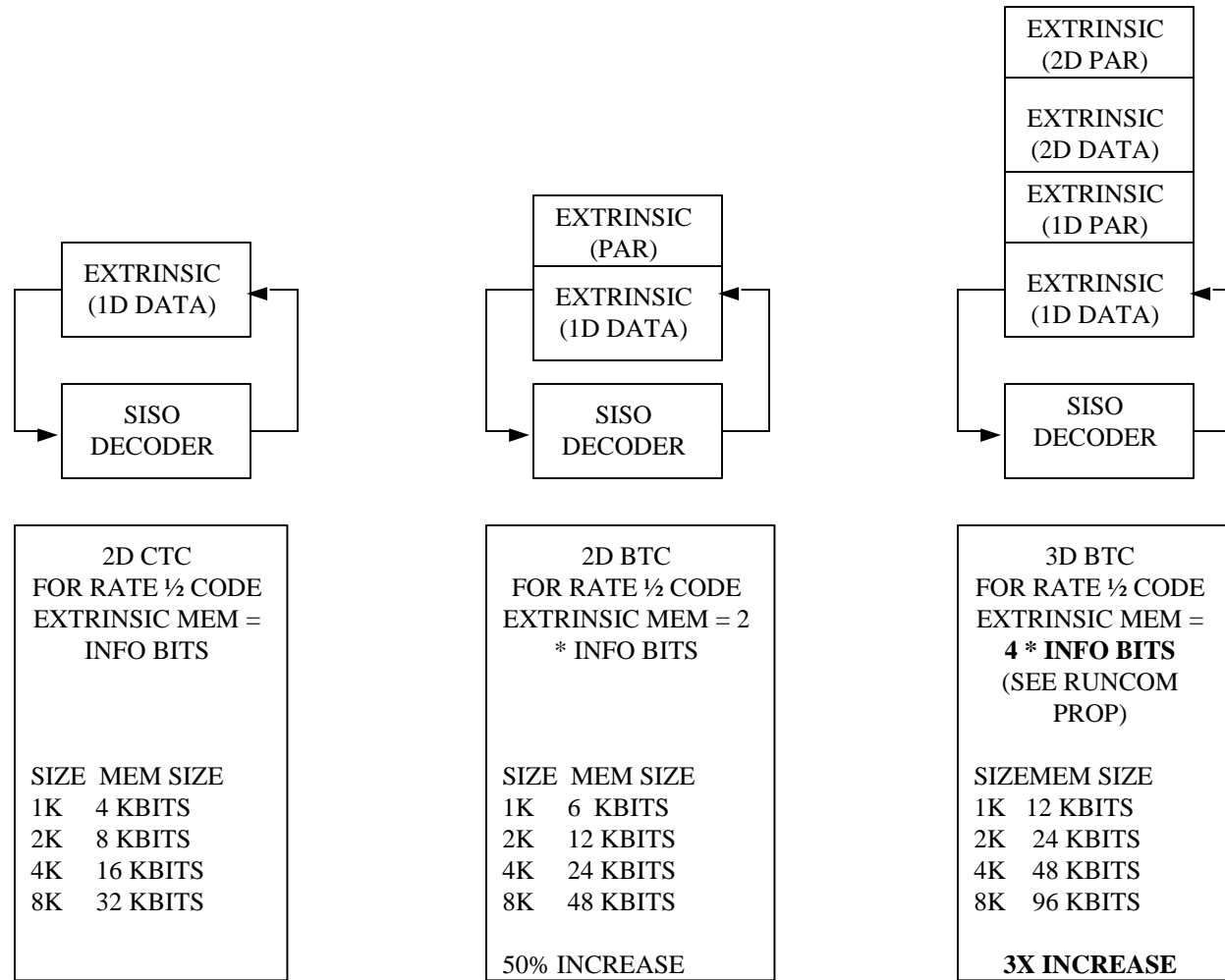
(64,57) Extended Hamming Code
(32,26) Extended Hamming Code
(16,11) Extended Hamming Code
(32,31) Parity Check Code
(16,15) Parity Check Code
(4,3) Parity Check Code



# Compatibility with 802.11a

Modulation	CC RATE	CTC RATE	CODED BIT/SYM	DATA BITS/SYM	SYM/TC FRAME	INFOBITS/TC FRAME
BPSK	1/2	1/2	48	24		192
BPSK	3/4	3/4	48	36		192
QPSK	1/2	1/2	96	48		
QPSK	3/4	3/4	96	72		
16QAM	1/2	1/2	192	96		
16QAM	3/4	3/4	192	144		
64QAM	2/3		288	192		
64QAM	3/4	3/4	288	216		
256QAM	2/3	2/3	384	256		
256QAM	3/4	2/3	384	288		

# 2D/3D TC Extrinsic Memory Reqs.



# 3D Codes Require More Subiterations

**SUBITERATIONS FOR 2D CTC**

4 ITERATIONS  
\*2 SUBS/ITR

8SUB ITS

**SUBITERATIONS FOR 2D BTC**

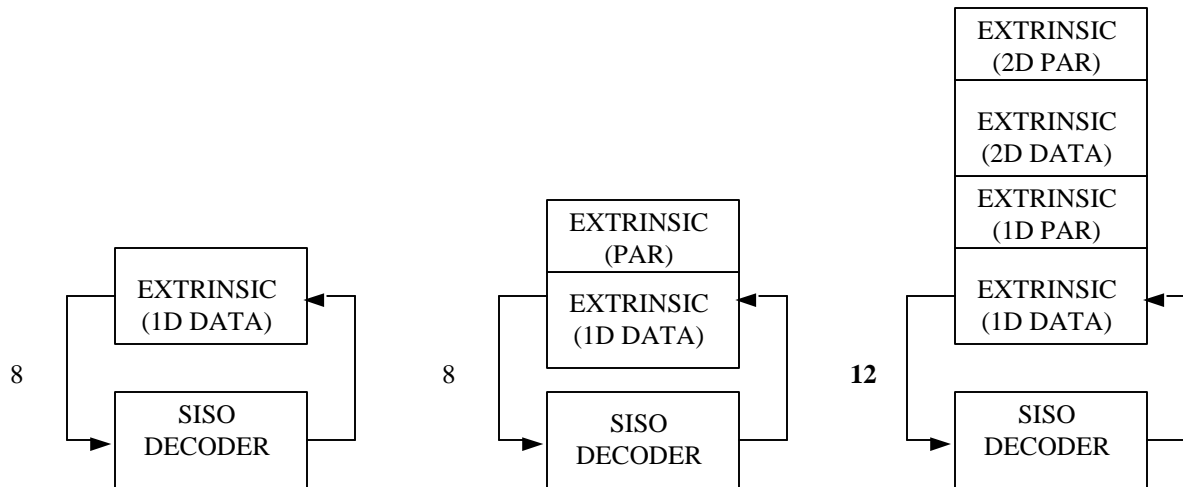
4 ITERATIONS  
\*2 SUBS/ITR

8SUB ITS

**SUBITERATIONS FOR 3D BTC**

4 ITERATIONS  
\*3 SUBS/ITR

12SUB ITS



# Wider Acceptance by other Standards

- CDMA 2000
- W-CDMA
- DVB-RCS
- DVB-RCT (Leading Candidate)
- ITU/DSL (Leading Candidate)
  
- Great acceptance means greater IP

# CTC – The best performance.

