LDPC Adjustments from Motion #6, Chicago

Mark Laubach, Yang Han, Shaohua Yang, Ryan Hirth, Glen Kramer

14 May 2018 IEEE 802.3 Interim, Pittsburgh, PA, USA

Introduction

- Motion #6 from the March 2018 Rosemont, IL (Chicago) Task Force meeting, adopted slide 6 of kramer_3ca_1_0318.pdf as part of the improved alignment motion.
  - The adopted updated parity matrix, puncturing, information word and parity word sizes however were sized for the "New Code" option on slide 9, which is slightly different information word size than slide 6.
    - 10 bit alignment marker on slide 6 preferred over the 64 bit FEC CW Delimiter on slide 9 resulting in +64 bits for information word.
  - These changes adjust the information word size and puncturing to match slide 6.
- The actual parity code matrix is the same, no changes.
- In this presentation “new” refers to the changes made to match Slide 6 of kramer_3ca_1_0318.pdf

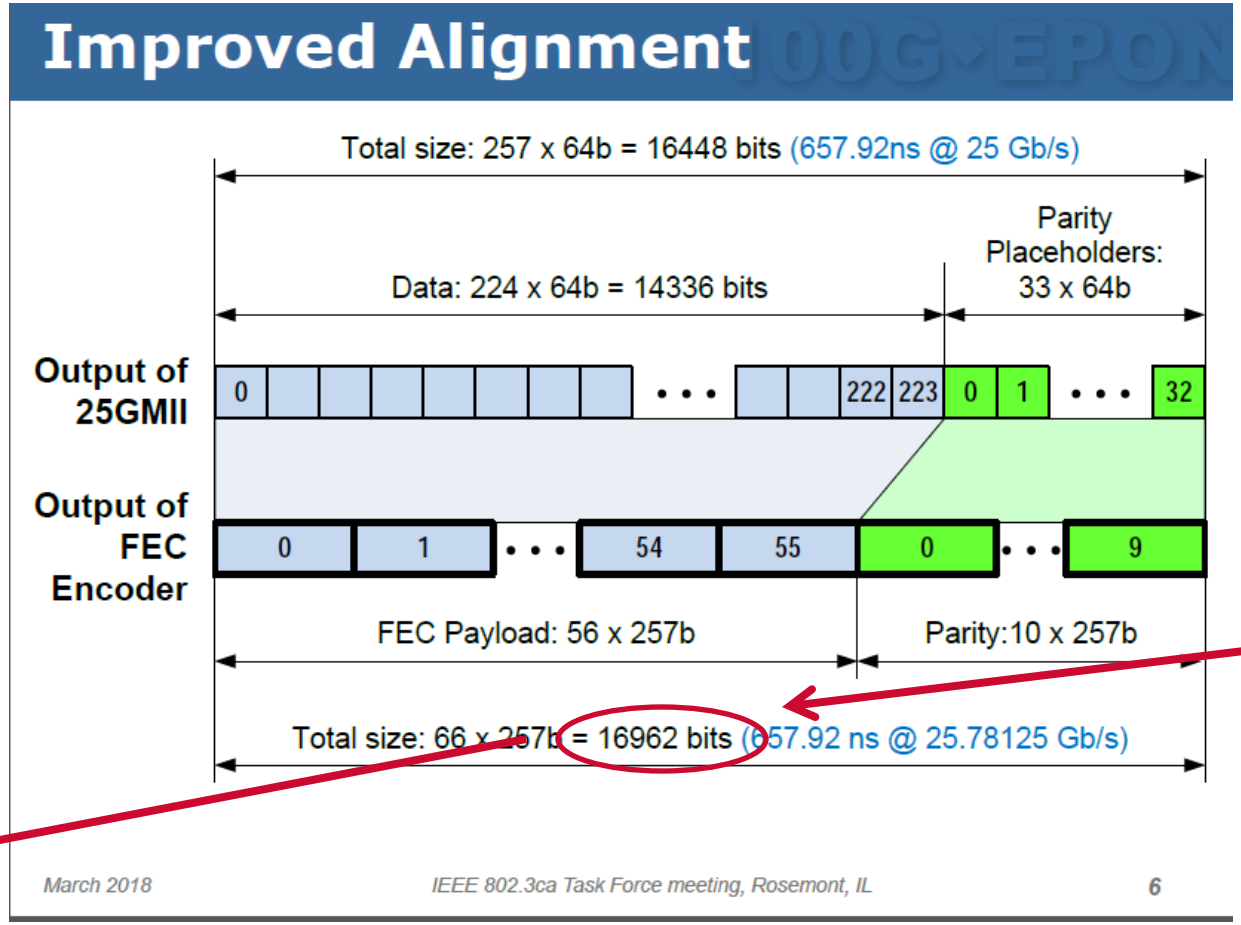
Review: kramer_3ca_1_0318.pdf, Slide 6 & 9

Motion adopted sizes for 16,888 bit codeword size from Page 9

- LDPC (16888,14328)
- 64bit “FEC CW Delimiter” method

Slide 6 uses a 10-bit alignment marker method:

- 56 * 257b information
- 10 * 256b parity
- 10 bits of alignment marker
- LDPC (16952, 14392) + 10bits



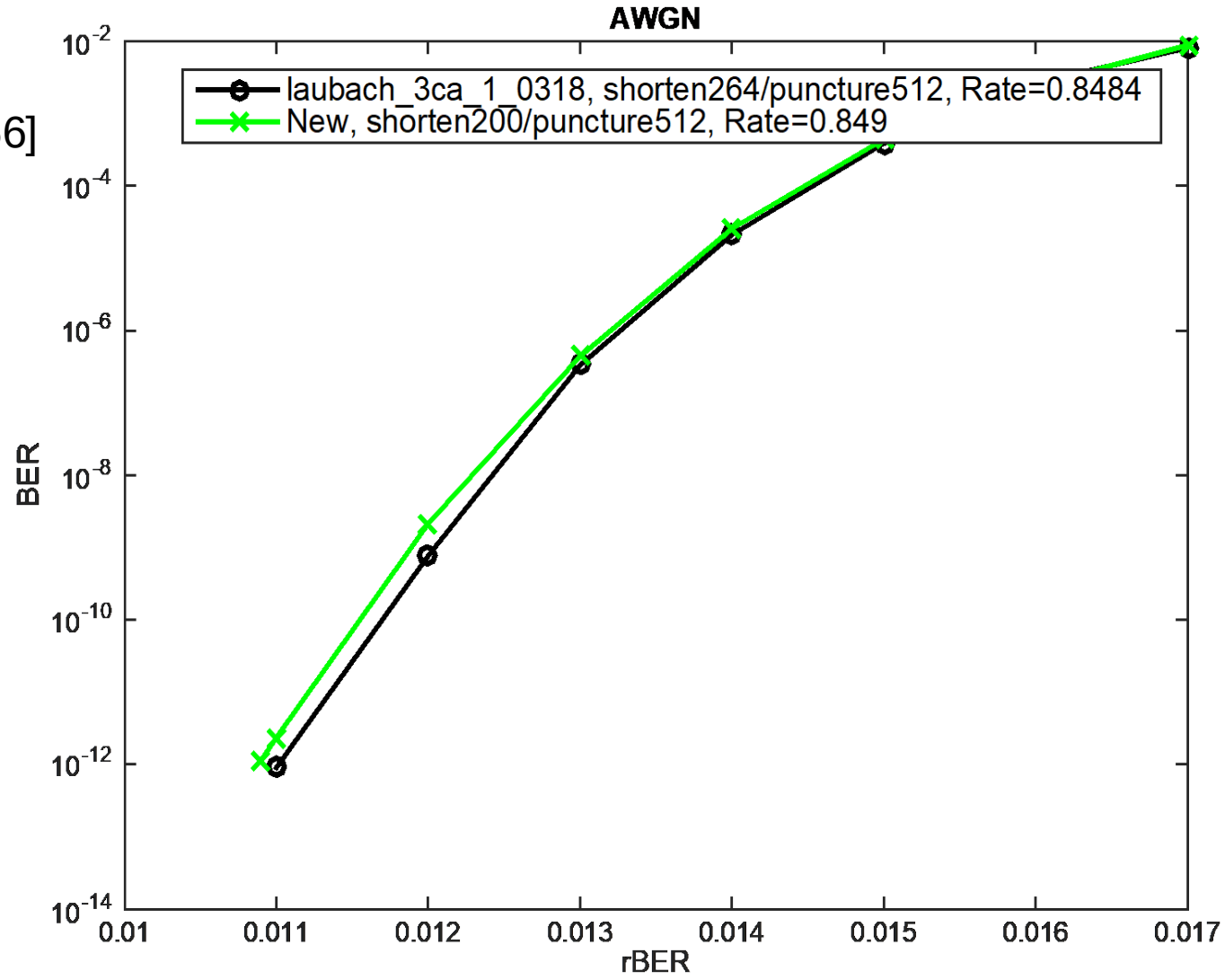
New Code LDPC(16888,14328)
12×69×256
57×256 = 14,592 14,328 264
12×256 = 3,072 2,560 512
17,664
16,888
0.8484
-0.03 dB

9

BROADCOM

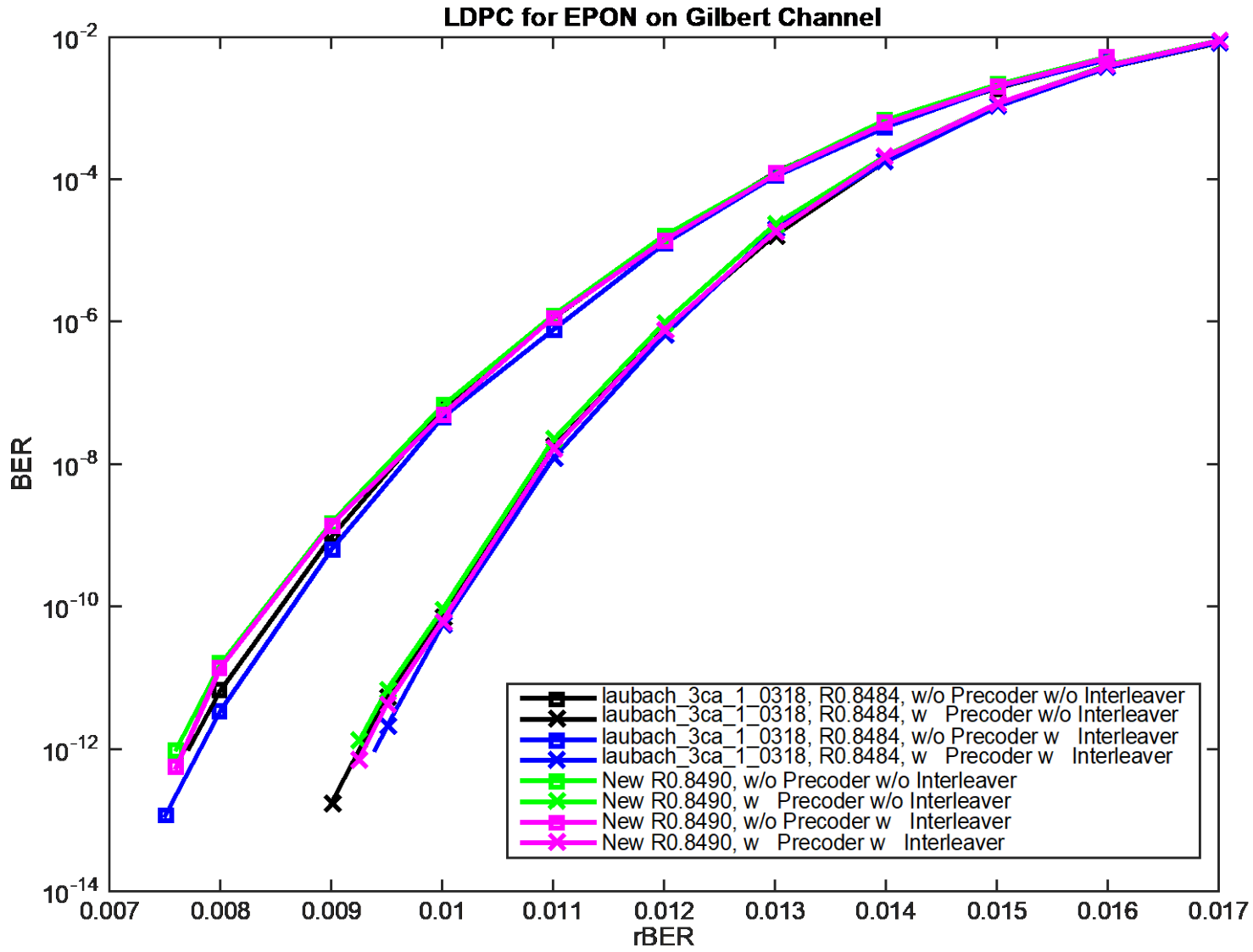
AWGN Performance

- laubach_3ca_1_0318 matrix [12x69ex256]
  - (16888,14328)
  - Parity: 2560
  - Punctured parity: 512 bits
  - Shortened information: 264 bits
  - Rate 0.8484
- “New” (Page 6) [12x69ex256]
  - (16952, 14392)
    - Note: information bit change: 14328 -> 14392
  - Parity: 2560
  - Punctured parity: 512 bits
  - Shorten information: 200 bits
  - Rate 0.8484 -> 0.849



BROADCOM

Gilbert Burst Model Performance



BROADCOM

Latency comparison

- Small change in buffer size.

LDPC	New Code	Updated Page 6 Code
	µsec @ 15 iterations	µsec @ 15 iterations
Encoder	1.331	1.331
Buffer	0.655	0.658 [a]
Decoder	2.0625	2.0625
Buffer	0.655	0.658 [a]
Total one-way	4.7035	4.7095

[a] Based on: (56 * 257 bits info) + (10 * 256 bits parity) + (10 * 1 bit alignment marker) = 16962 bits @ 25.78125 Gb/s line rate

LDPC Performance Review

	Length	Rate	Non-Zero Blocks	NECG [1] (dB²) (optical gain)					Reference
				AWGN	Gilbert Burst				
					Precoder Off	Precoder On	Precoder Off	Precoder On	
					With interleaver		Without interleaver		
LDPC	(18493,15677) [13x75x256]	0.848	290	2.6 (1.82-2.34)	1.76 (1.23 - 1.58)	2.03 (1.41 – 1.82)			laubach_3ca_1a_1117
			286	2.63 (1.84 - 2.37)	1.87 (1.31 – 1.68)	2.12 (1.48 – 1.91)	1.85 (1.3 – 1.67)	2.11 (1.48 – 1.9)	laubach_3ca_1_0118
	Option 2		275	2.618→2.602 ~~(1.83 - 2.36)~~ (1.82 – 2.34)	1.82→1.83 ~~(1.27 – 1.64)~~ (1.28 – 1.65)	2.09→2.08 ~~(1.46 – 1.88)~~ (1.46 – 1.87)	1.8→1.817 ~~(1.26 – 1.62)~~ (1.27 – 1.64)	2.06 (1.44 – 1.85)	laubach_3ca_1_0318
	"New" (Updated Page 6)		275	2.589 (1.81 - 2.33)	1.81 (1.27 – 1.63)	2.066 (1.45 – 1.86)	1.797 (1.26 – 1.62)	2.05 (1.44 – 1.85)	Draft 1.0 proposed comments (laubach_3ca_1_0518)

[1] Electrical gain over RS(255,223) of 7.1 dB. Optical gain is 0.7 to 0.9 * NECG.

[2] Capped at 15 iterations.

Note: the *red numbers* are updated gains obtained from longer simulations for Option 2 as promised from the last meeting.

Summary

- Updated LDPC to match Motion #6 from Chicago meeting introduced small changes in performance as documented.
- Changes to LDPC draft text are being processed through submitted comments against Draft 1.0.

Thank you


BROADCOM®
connecting everything®