FEC Proposal for NGEPON - update
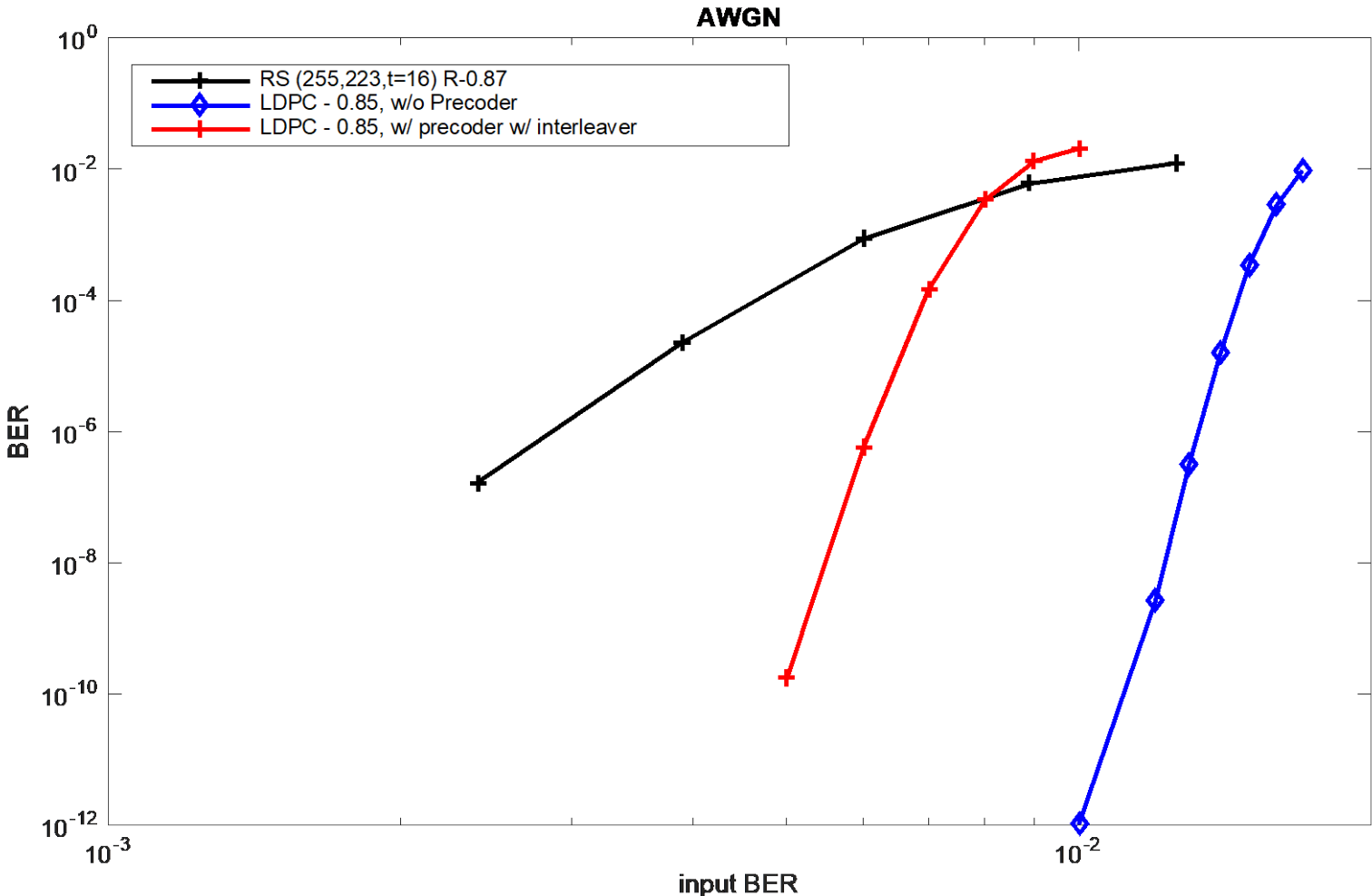
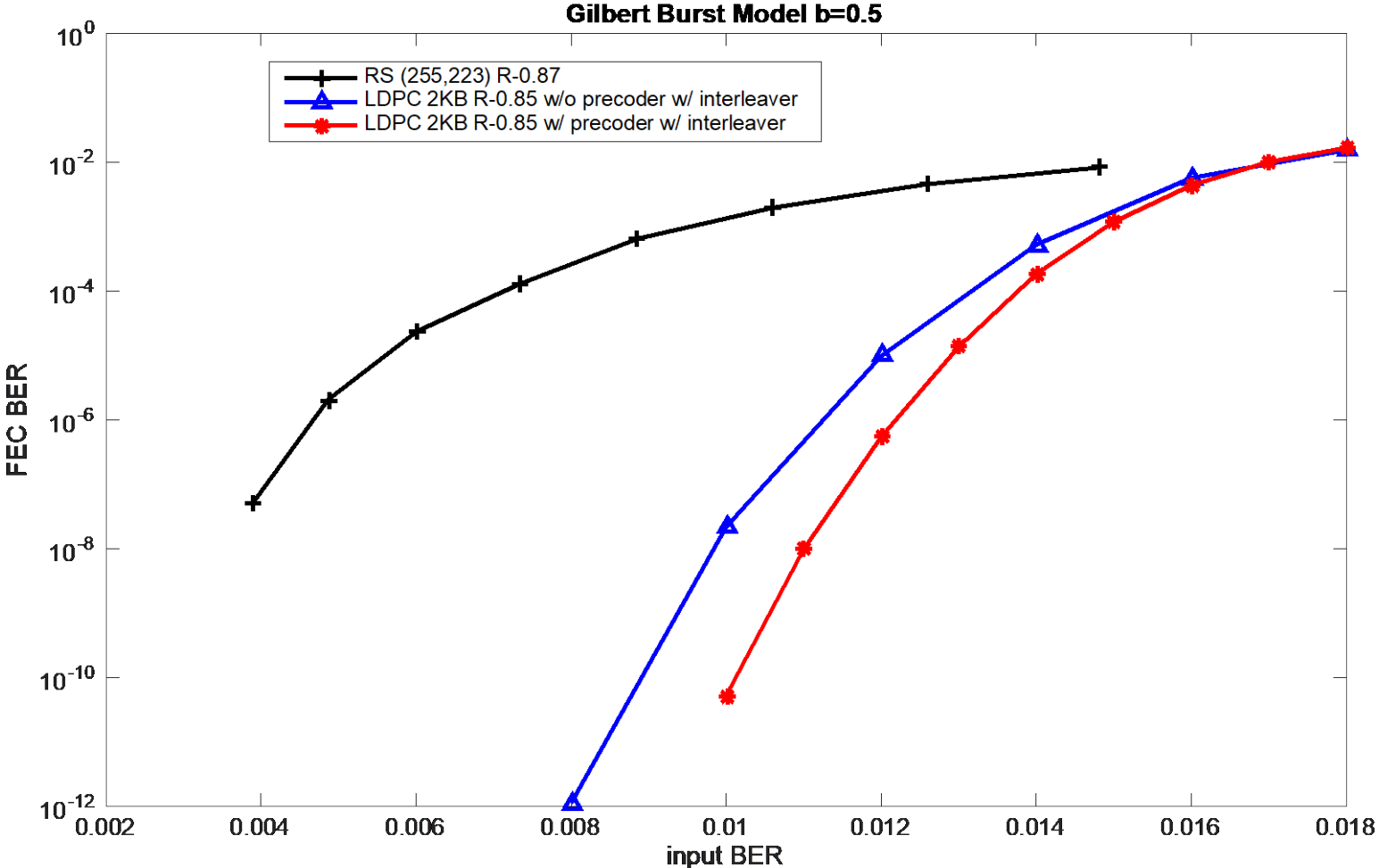**Mark Laubach, Shaohua Yang, Ryan Hirth, Glen Kramer**

03 July 2017

Introduction

- An LDPC(18493,15677) 0.848 rate FEC code, code matrix, and interleaver, along with pre-coding was proposed at the May 2017 meeting
  - laubach_3ca_1_0517 with update laubach_3ca_4_0517

- Two concerns were voiced:
  - Not all implementations will use a DFE in the receiver
    - Noted that pre-coding impairs AWGN-only noise model FEC performance
  - Desired optical gain ≥ 1.5 dB over 10G-EPON FEC

- Actions since last meeting
  - Additional simulation for AWGN-only with precoding
  - Added simulation for interleaver w/o precoding for Gilbert burst model
  - Referenced optical gain "0.7-0.9 × electrical gain" from vanveen_3ca_1b_0317.pdf

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AWGN Performance

Gilbert burst error performance

Gilbert Burst Model b=0.5

Legend:
- RS (255,223) R-0.87
- LDPC 2KB R-0.85 w/o precoder w/ interleaver
- LDPC 2KB R-0.85 w/ precoder w/ interleaver

Axes: input BER (x-axis), FEC BER (y-axis)

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FEC Code Gains

Review from 0517 presentation:

	Length	Rate	Parity	User	Encoded	NECG[1] (dB)		Normalized Die Size [2]	Notes
						AWGN	Gilbert Burst		
LDPC	2kB	0.848	2816	15677	18493	2.46	2.02[3]	7.7	bits (18493,15677)
RS	(255,223)	0.8745	256	1784	2040	0	0	1	S=8, T=16 (10G-EPON)

Additional study results:

	Noise Model + options	NECG[1] (dB)	Electrical -> Optical (dB)	
			x0.7	x0.9
LDPC	AWGN (w/wo interleaver)	2.46	1.7	2.2
	Gilbert Burst (w/interleaver, w/precoder)	2.02[3]	1.4	1.8
	Gilbert Burst (w/interleaver, wo/precoder)	1.85	1.3	1.7

[1] Electrical gain over RS(255,223)

[2] Relative to RS(255,223) size

[3] Corrected from 0517 presentation

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Summary

- AWGN-only noise model with pre-coding does impair LDPC performance
  - ~1 dB impact

- The LDPC(18493,15677) 0.848 rate as proposed and x0.7 – x0.9 electrical to optical conversion provides ≥ 1.5 dB optical gain for AWGN-only noise model w/o pre-coding

- The proposed interleaver used without precoding provides gain with Gilbert burst model without impacting AWGN-only performance

- Authors conclusion: the proposed LDPC(18493,15677) 0.848 FEC code with parity code matrix and interleaver stands as is.

- Assumption that use of pre-coding will remain in debate in the Task Force.
  - May be applicable for use over electrical sub-link as suggested in anslow_3bs_04_0715.pdf

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Thank you

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