IMPACT OF NON-GAUSSIAN NOISE ON LDPC PERFORMANCE

Pouria Saadatikhoshrou
Stefano Biccari
Kasra Alizadeh

POLITECNICO
MILANO 1863

NOKIA

Meet the Team

Pouria Saadatikhoshrou

pouria.saadatikhoshrou@mail.polimi.it

Stefano Biccari

Stefano.biccari@mail.polimi.it

Kasra Alizadeh

kasra.alizadeh@mail.polimi.it

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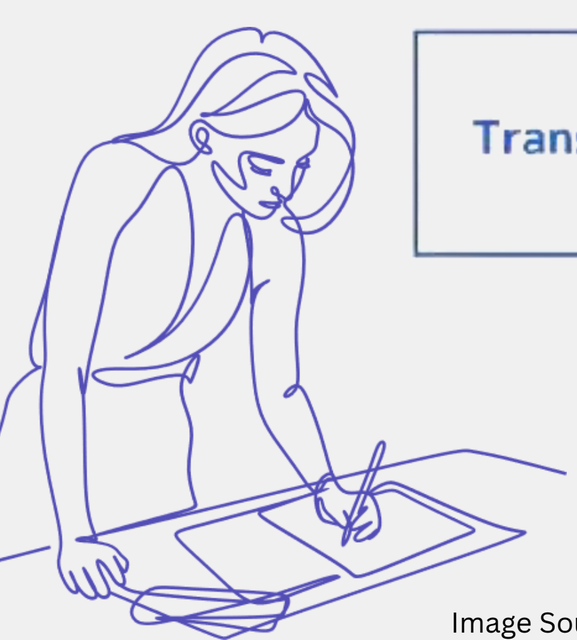
introduction

- Importance of reliable data transmission over noisy channels in digital communication
- Observe system performance shift from ideal AWGN conditions to non-Gaussian noise distributions



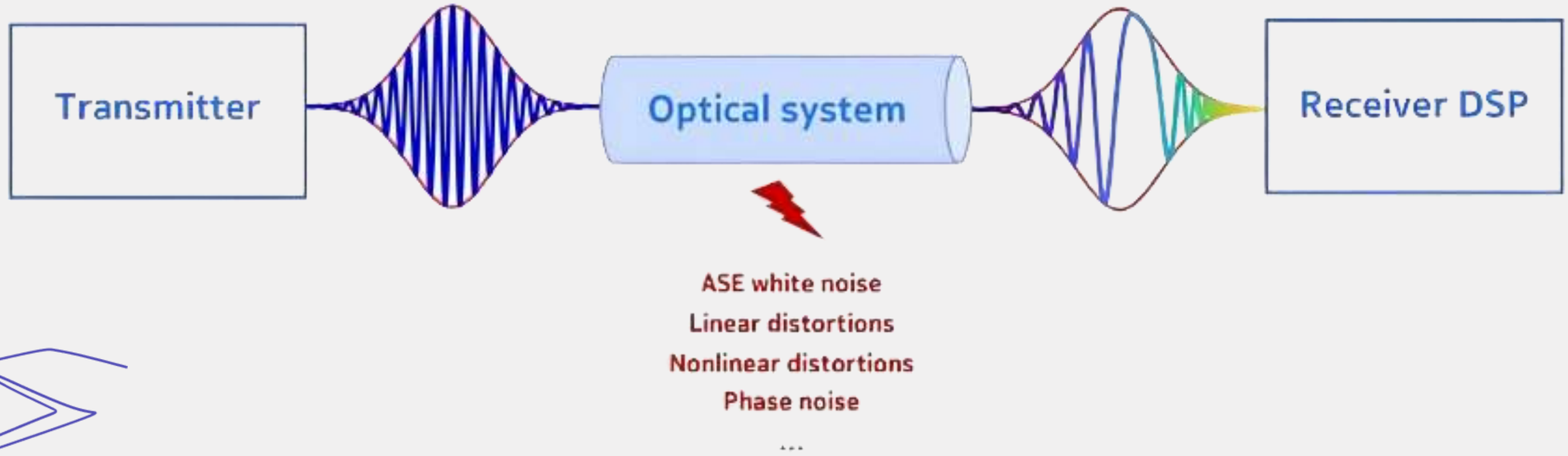


Image Source: Poli-Nokia Innovative Teaching by Andrea Carnio, Francesca Rosati, Giancarlo Gavioli, Gianluca Boiocchi. Nokia Vimercate, April 23, 2024.

Objectives

- Build a system using MATLAB
- Implement LDPC scheme and 64-QAM modulation
- Simulate performance with AWGN

- Start from the previously built system
- Consider non-Gaussian noise distribution (parameters provided)
- Discuss expected performance changes

LDPC Codes

- Error-correcting codes using sparse bipartite graph
- Represent parity-check matrix
- Enable near-capacity performance
- Efficient decoding

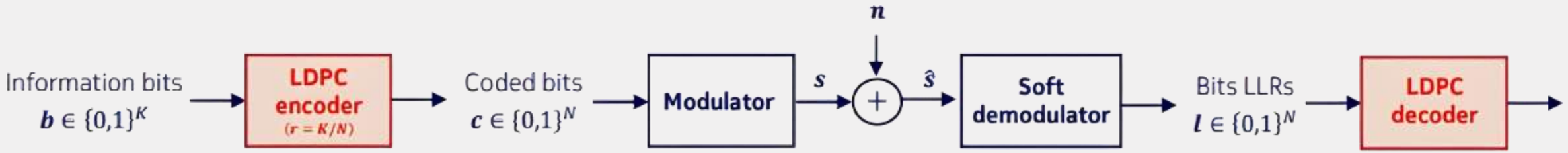
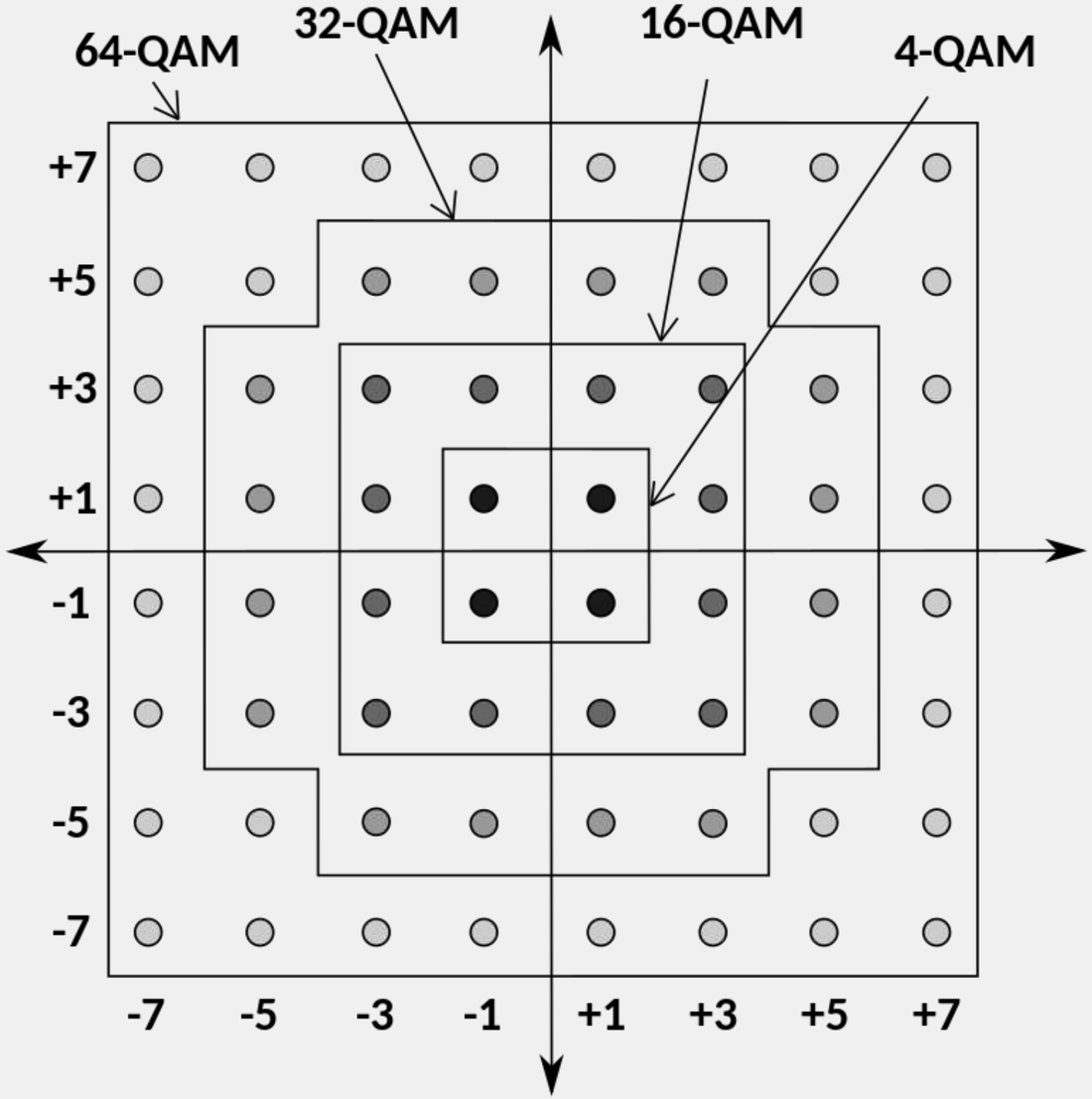


Image Source: Poli-Nokia Innovative Teaching by Andrea Carnio, Francesca Rosati, Giancarlo Gavioli, Gianluca Boiocchi. Nokia Vimercate, April 23, 2024.1

64-QAM

- Definition
- Data Efficiency
- Susceptibility to Noise



Noises

- Noise in Signal Transmission
- Additive White Gaussian Noise (AWGN)
- Non-Gaussian Noise
- Calculation of Non-Gaussian Noise
  - Generation
  - Variance

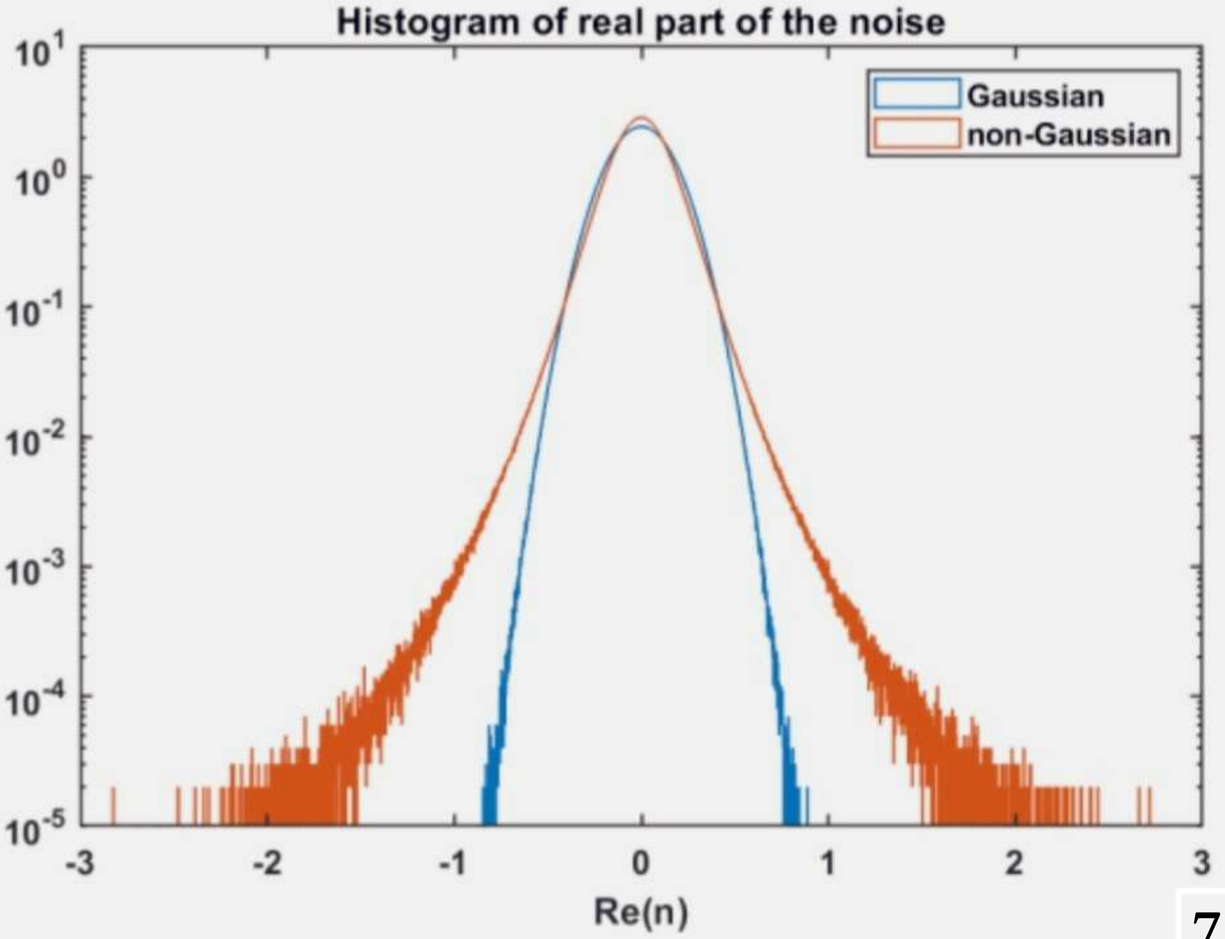
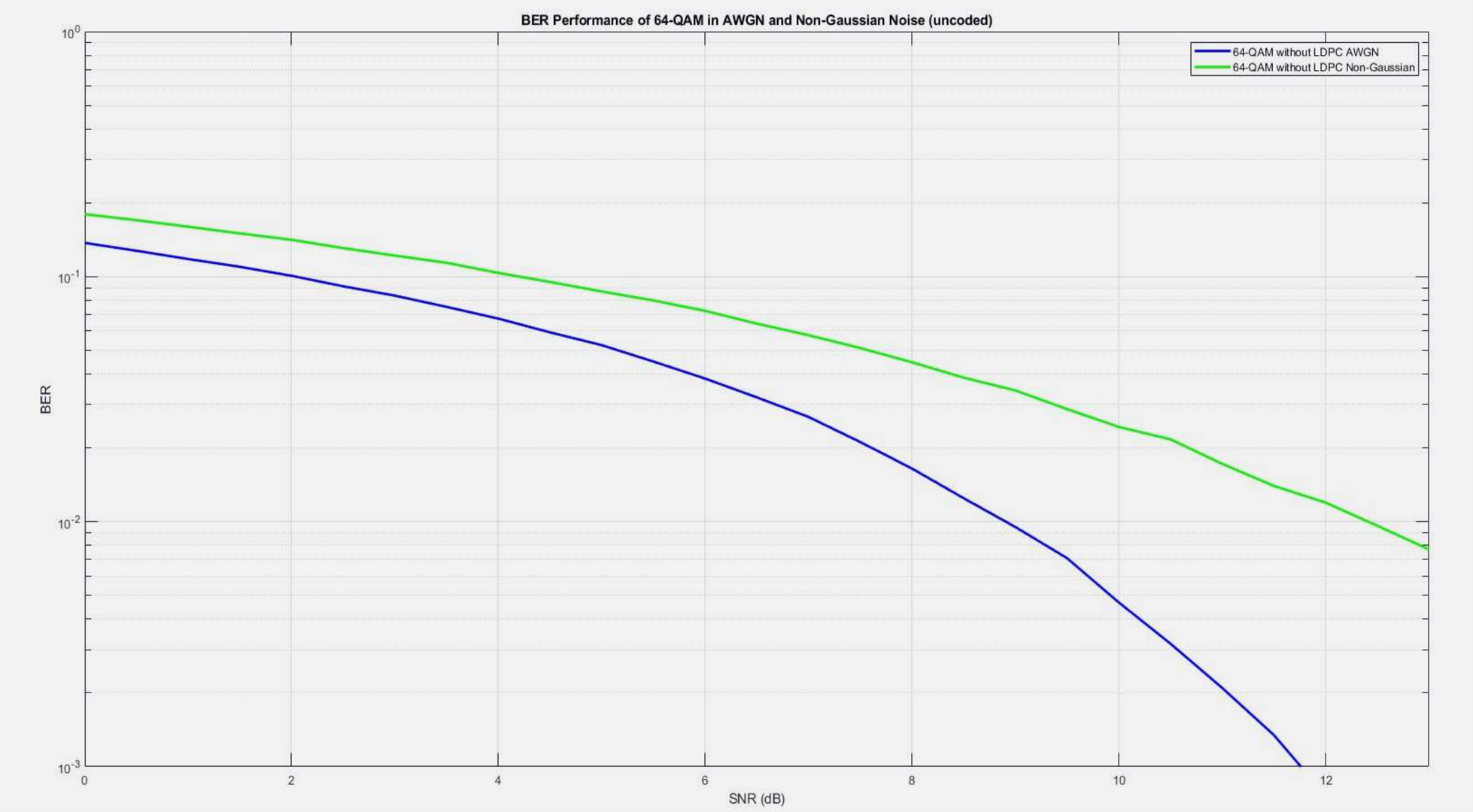


Image Source: Poli-Nokia Innovative Teaching by Andrea Carnio, Francesca Rosati, Giancarlo Gavioli, Gianluca Boiocchi. Nokia Vimercate, April 23, 2024.

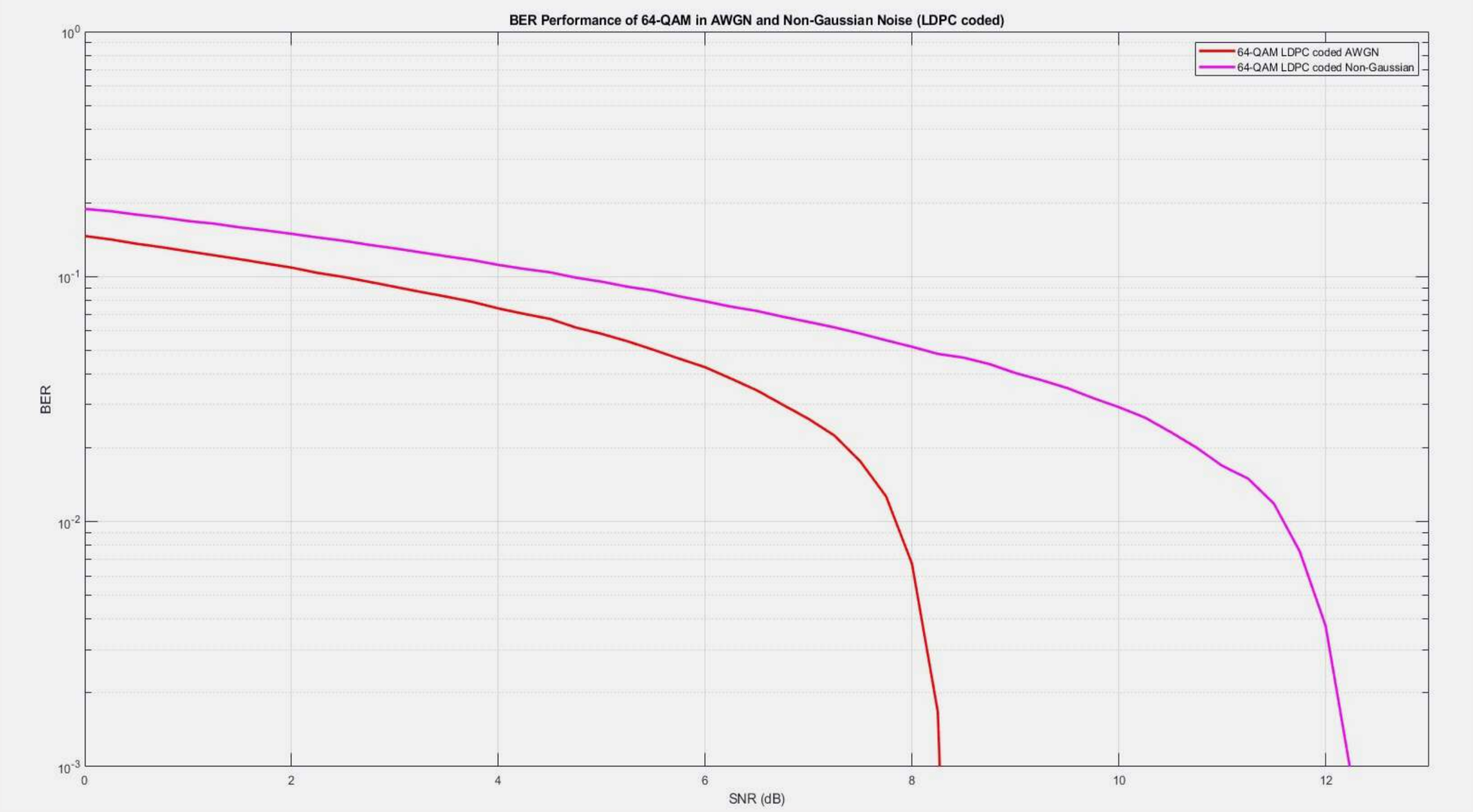
Parameters of the simulated LDPC code

- Parameters of the Simulated LDPC Code
  - Code Length: $N = \frac{k_{LDPC}}{R} = 64800$
  - Code Type: DVB-S2 LDPC code
  - Design Source: Derived from DVB-S2 standard
- Simulation Details
  - Information Bits (k): 58320
  - Maximum Number of Iterations: 100
  - Number of Frames: 100
  - Code Rate: 9/10

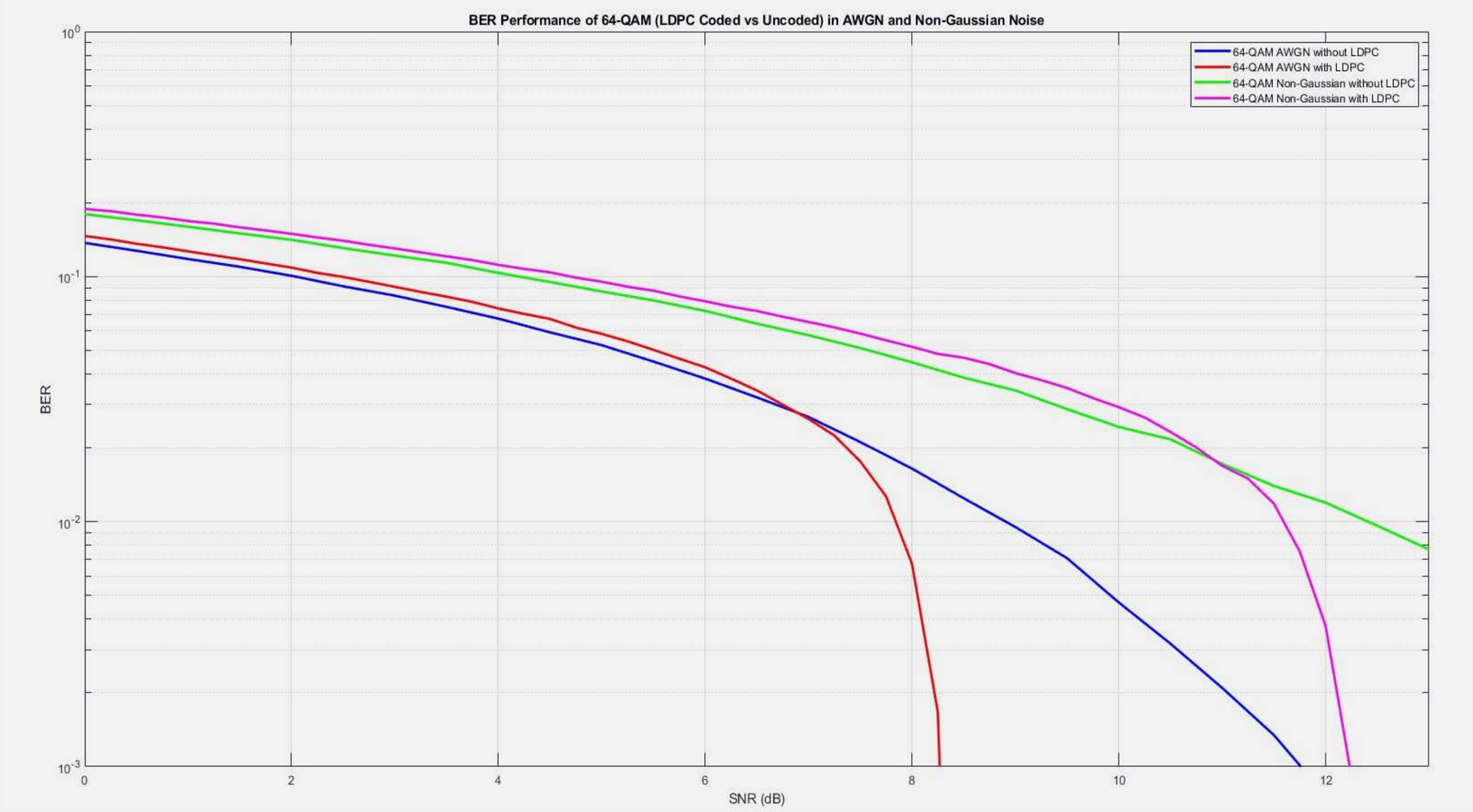
BER performance without LDPC



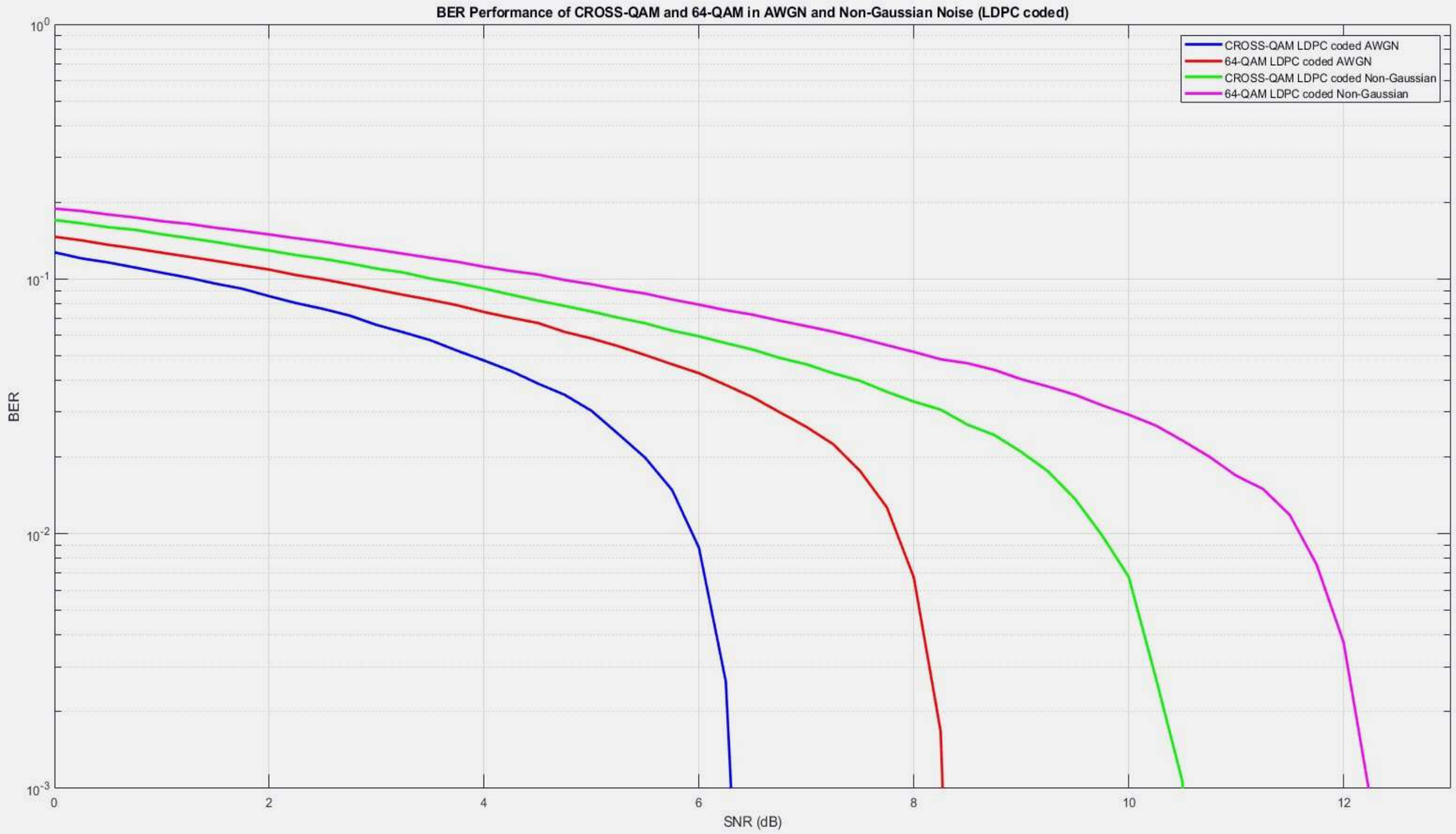
BER performance with LDPC



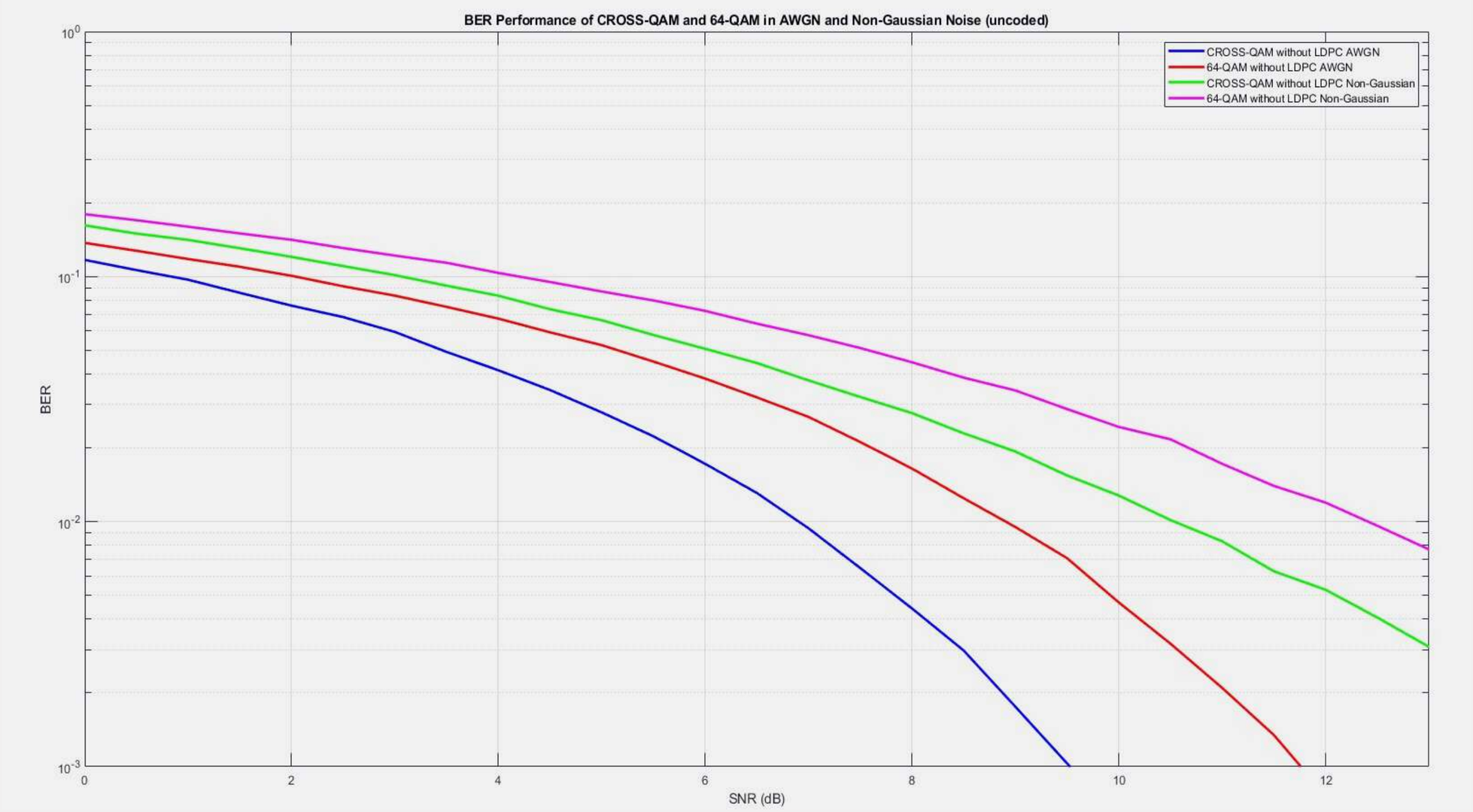
LDPC vs without LDPC



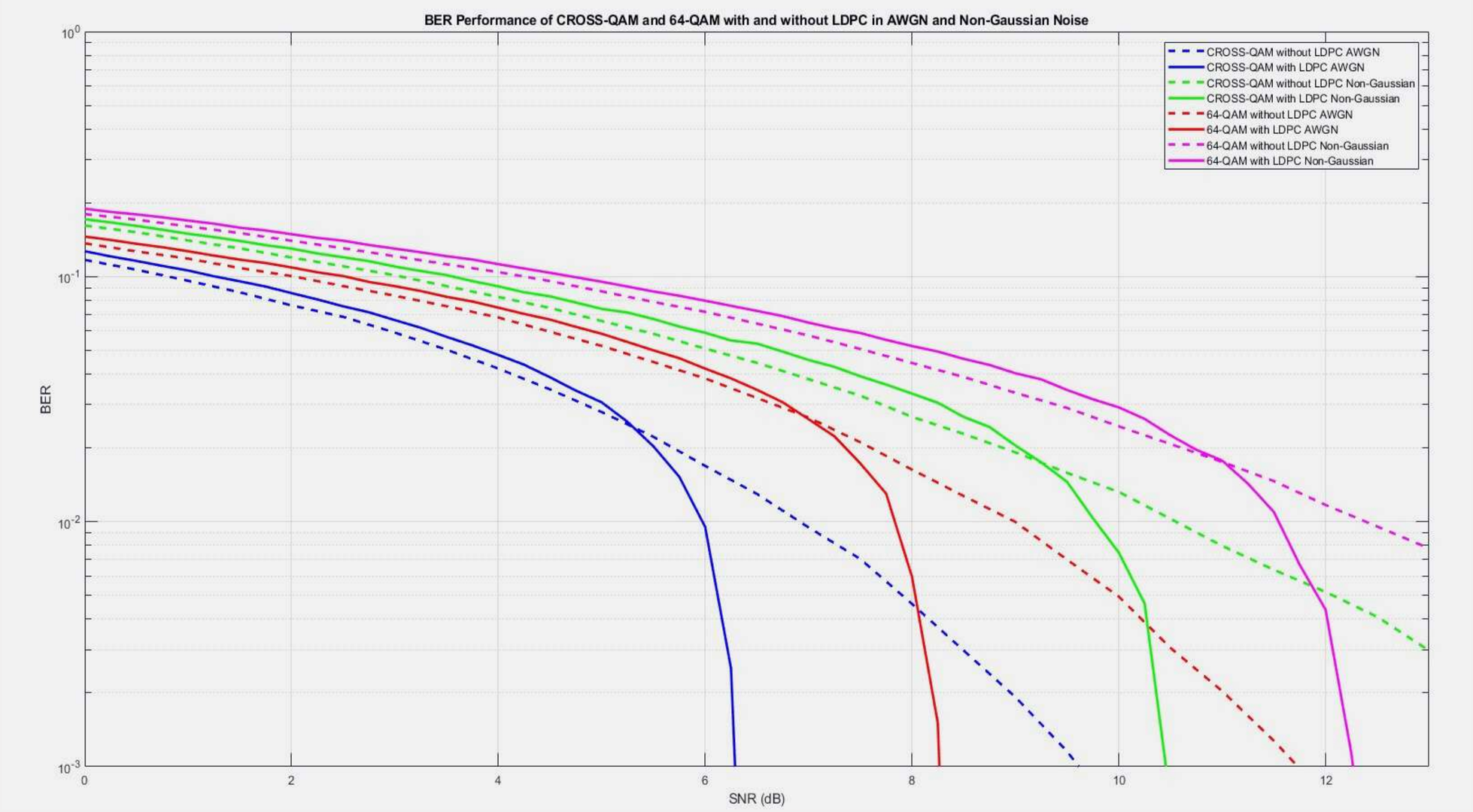
Cross-QAM vs 64-QAM with LDPC



Cross-QAM vs 64-QAM without LDPC



64-QAM and Cross-QAM with and without LDPC Codes

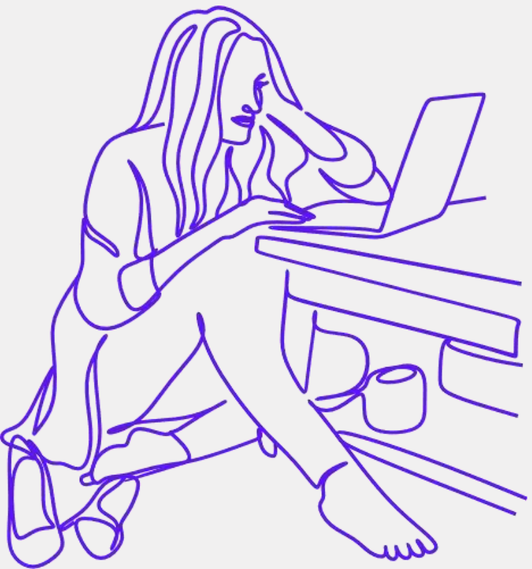


Conclusion

- LDPC Codes Performance: Reliable across various noise conditions
- Effect of Noise Types: System affected by non-Gaussian noise
- Reaching Desired BER: Higher SNR necessary for non-Gaussian environments

Further Information

SCAN ME



THANK YOU!

Pouria Saadatikhoshrou
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