EPIC))) Enabling Practical Wireless Tb/s Communications with Next Generation Channel Coding
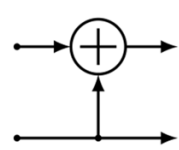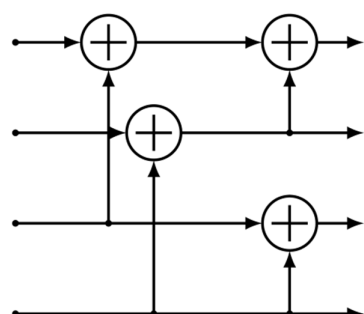
Polar Codes: A New Era in Forward-Error-Correction

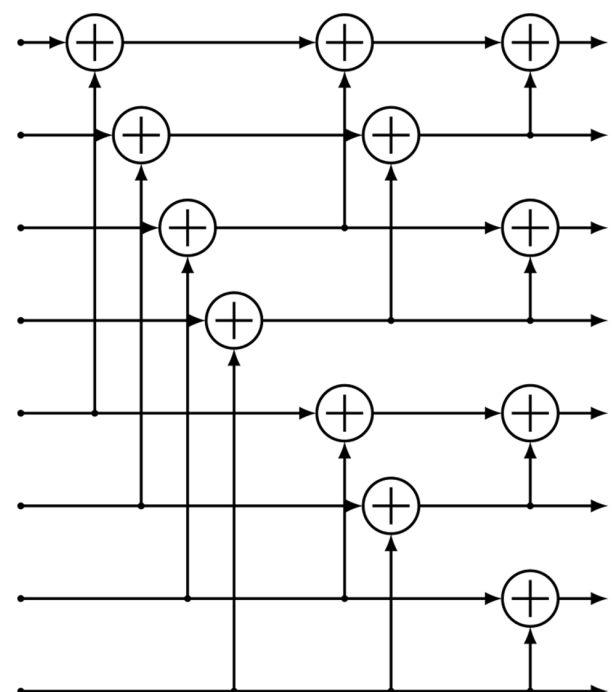- A capacity-achieving code with a recursive encoder and decoder structure

Length-2 Polar Encoder

Length-8 Polar Encoder

Length-4 Polar Encoder

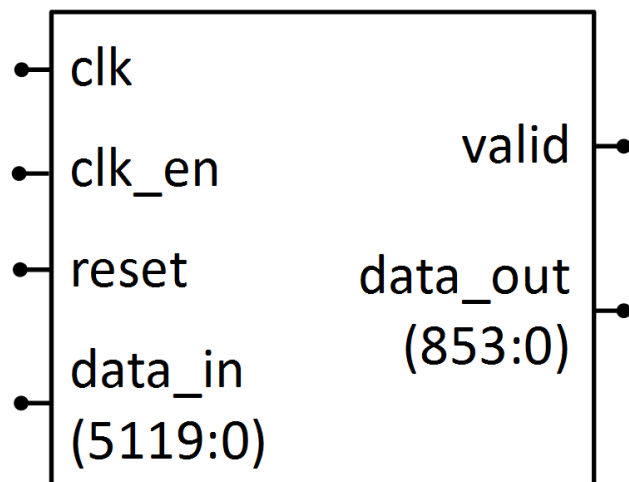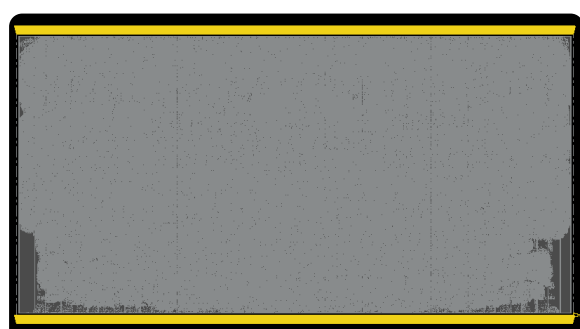- Used in 3GPP 5G NR standard for protecting control channels
- Delivers high-throughput at low energy per bit due to low implementation complexity

EPIC Polar Code ASIC Implementation
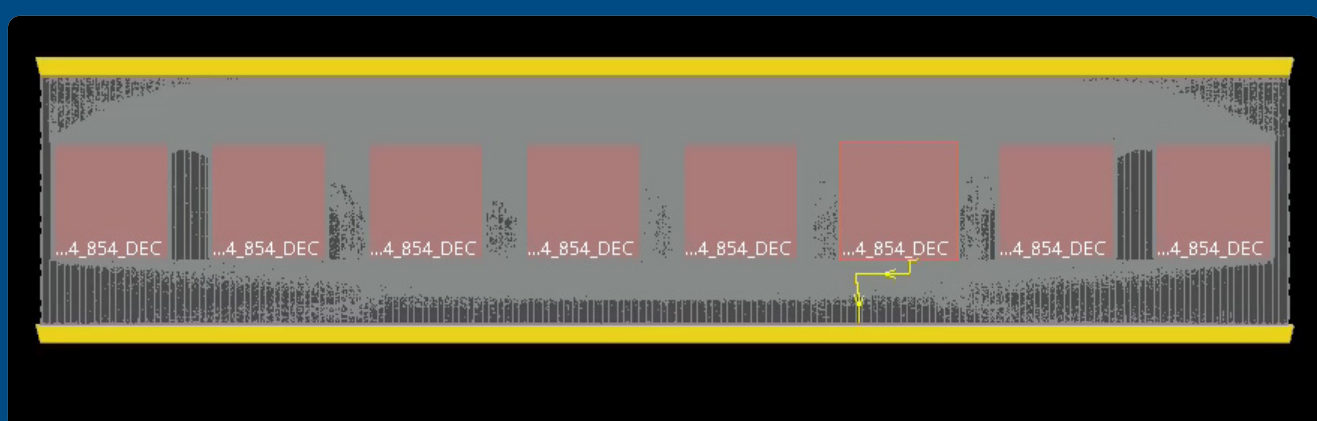
- ASIC virtual silicon tape-out available

Floorplan : 1255 x 630 μm
Utilization : 67%

clk
clk_en
reset
data_in (5119:0)
valid
data_out (853:0)

- Optimized for 16nm FinFET technology

Parameter	Target	Achieved
Throughput (Tb/s)	1	1.025
Area (mm^2)	10	0.791
Power (W)	1	1.167
Energy-per-bit (pJ/bit)	1	1.14
Latency (ns)	100	50

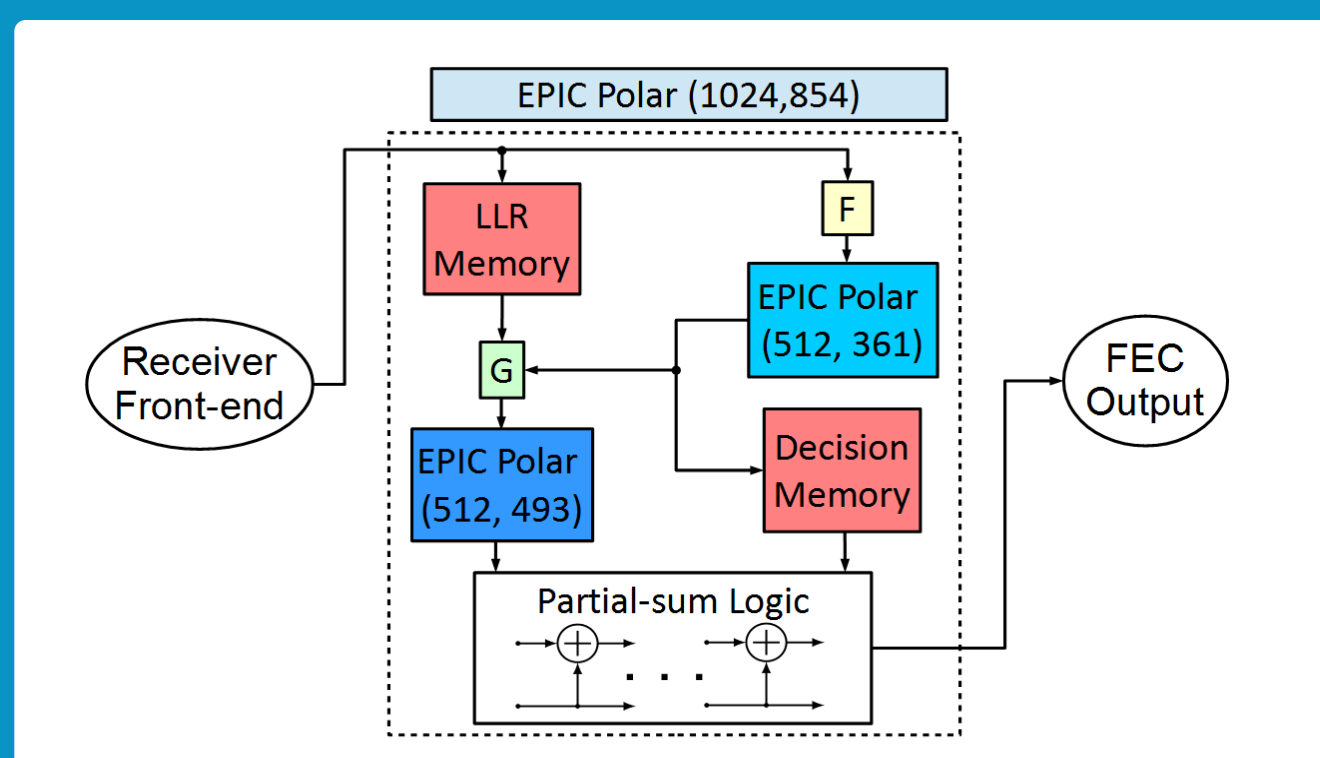- Multicore solution for better power density

Floorplan: 5000 x 850 μm   Utilization: 52%

Polar Code MWC2020

EPIC Polar Code Architecture

- Block length (N): 1024 bits, Payload (K): 854 bits. Coding overhead: 20%
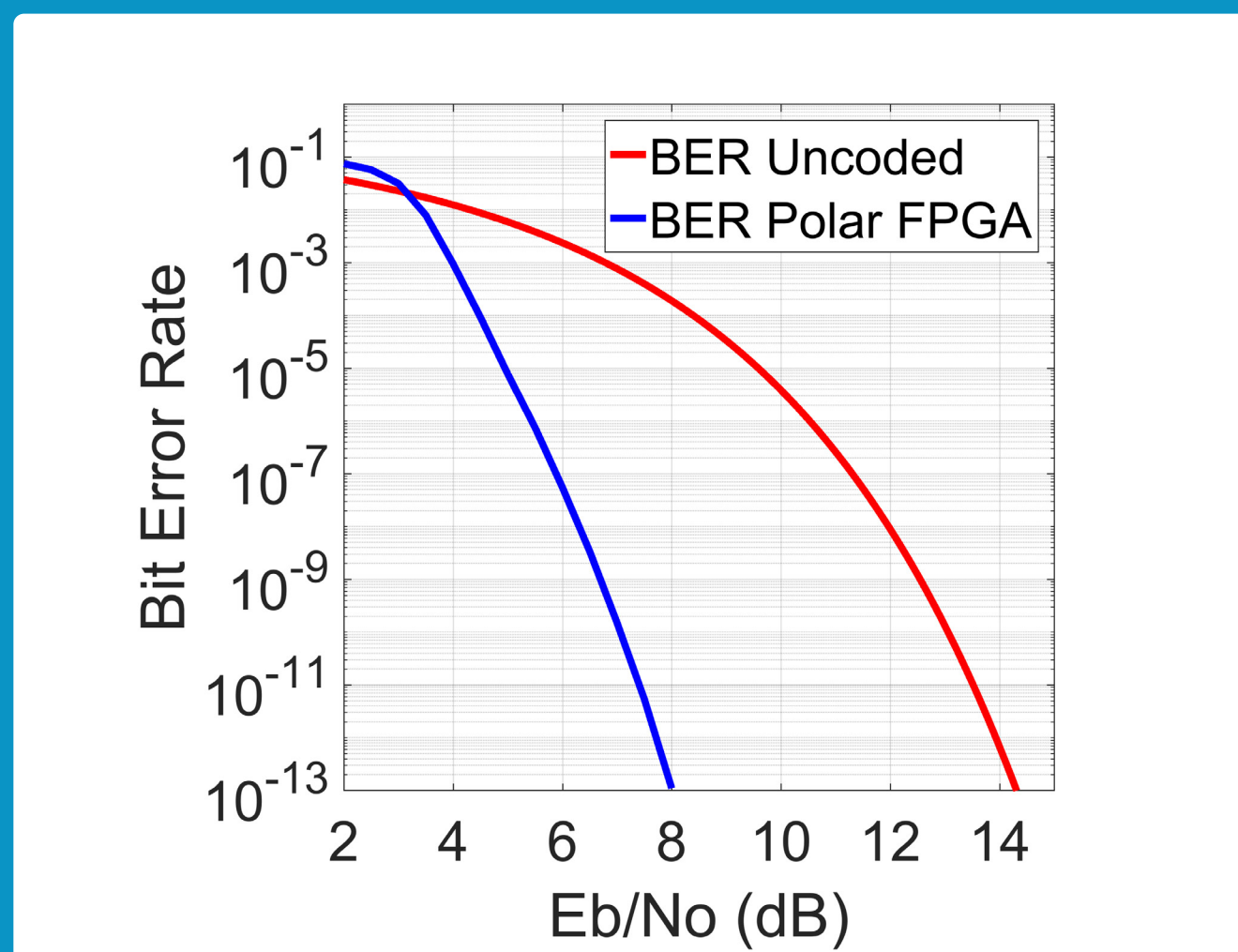- Unrolled pipelined architecture optimized for throughput and energy efficiency

- Decoder properties
  - Successive cancellation algorithm
  - Multi-bit decisions
  - Adaptive quantization of channel outputs

EPIC B5G Polar Code Performance

EPIC Polar Code
EPIC Targets
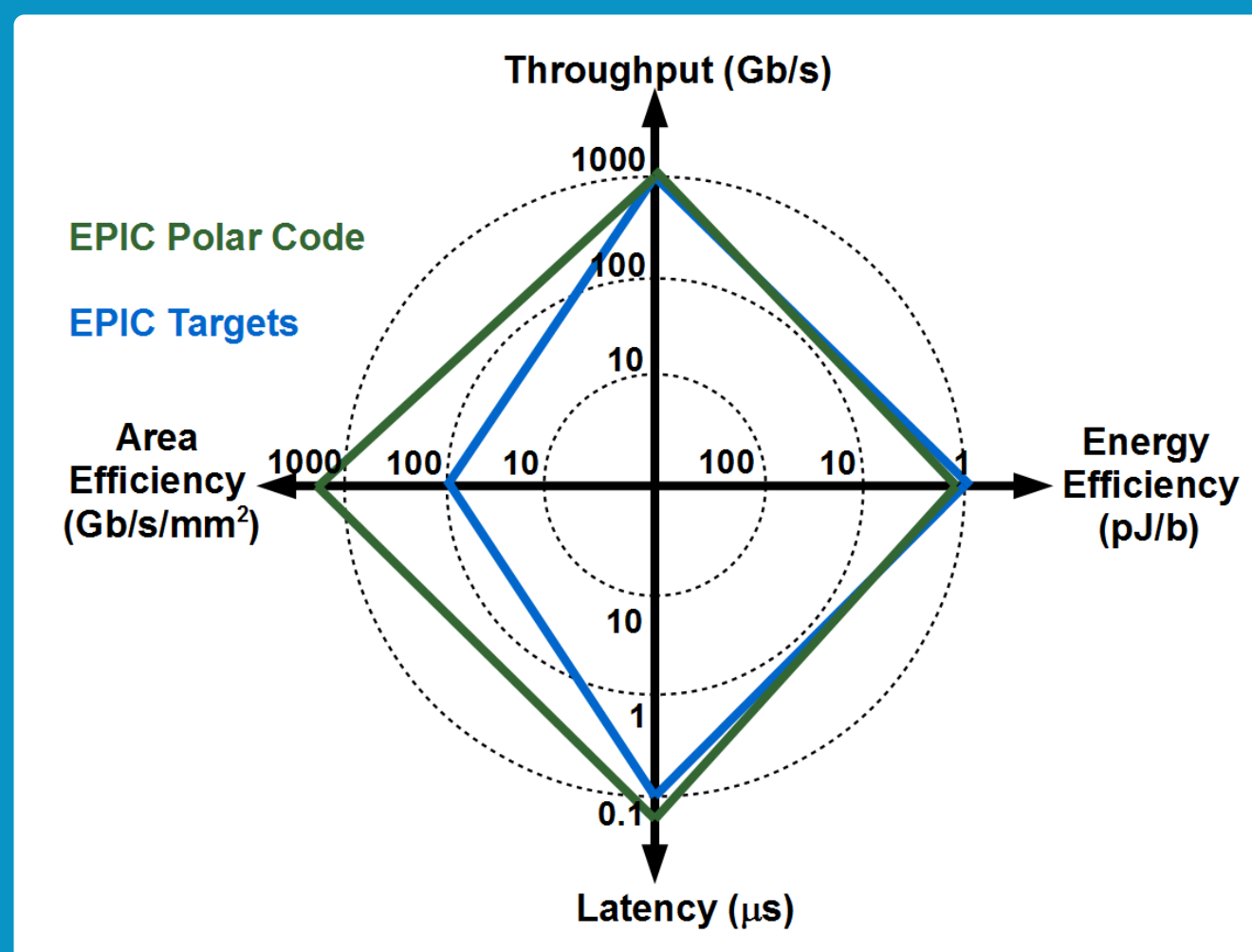
Error Correction Performance

BER Uncoded
BER Polar FPGA

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