ANALOG DEVICES

AHEAD OF WHAT'S POSSIBLE™

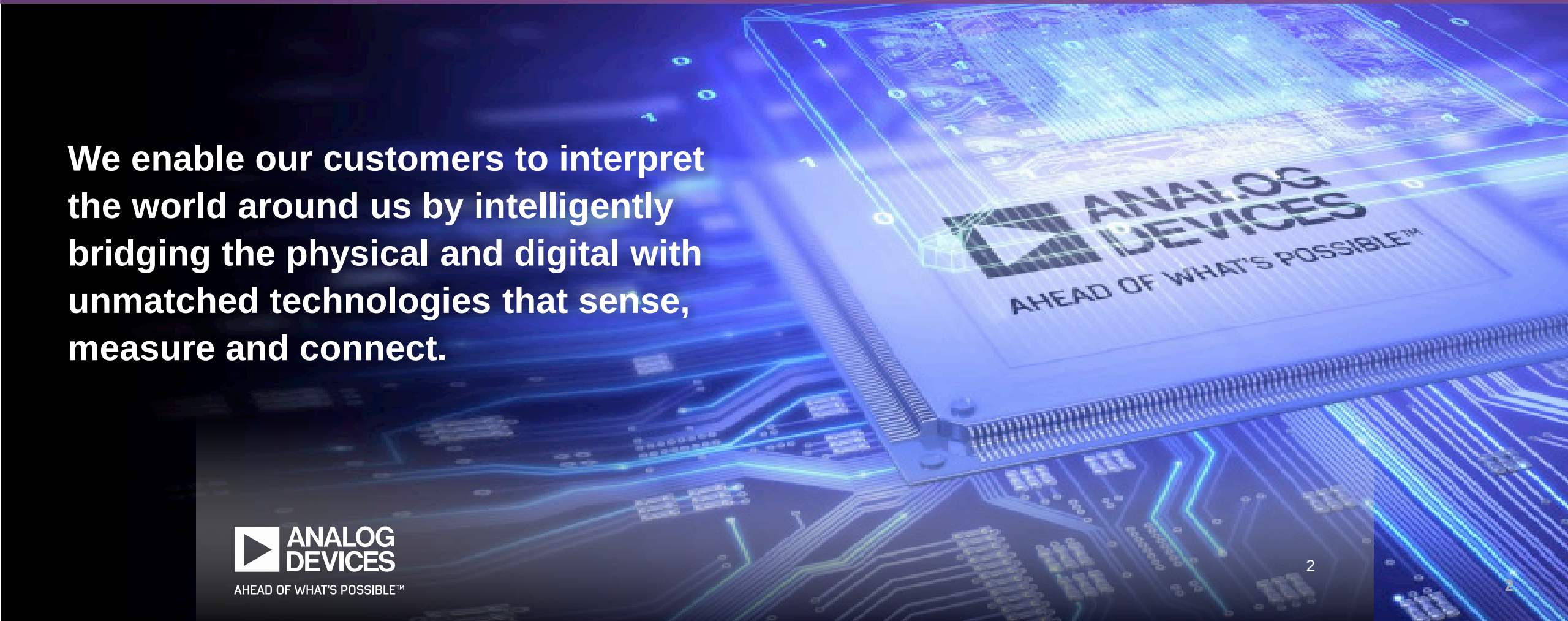
RF Technology for 5G mmwave Systems

THOMAS CAMERON, PHD

THE SILICON VALLEY 5G SUMMIT

ADI 50 1965 2015

WHAT WE DO



We enable our customers to interpret the world around us by intelligently bridging the physical and digital with unmatched technologies that sense, measure and connect.

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Agenda

- Hybrid Beamforming
- mmwave Radio technologies
- Optimizing the Antenna Design
  - Example – antenna with 60dBm EIRP
- RF Technology Pipeline

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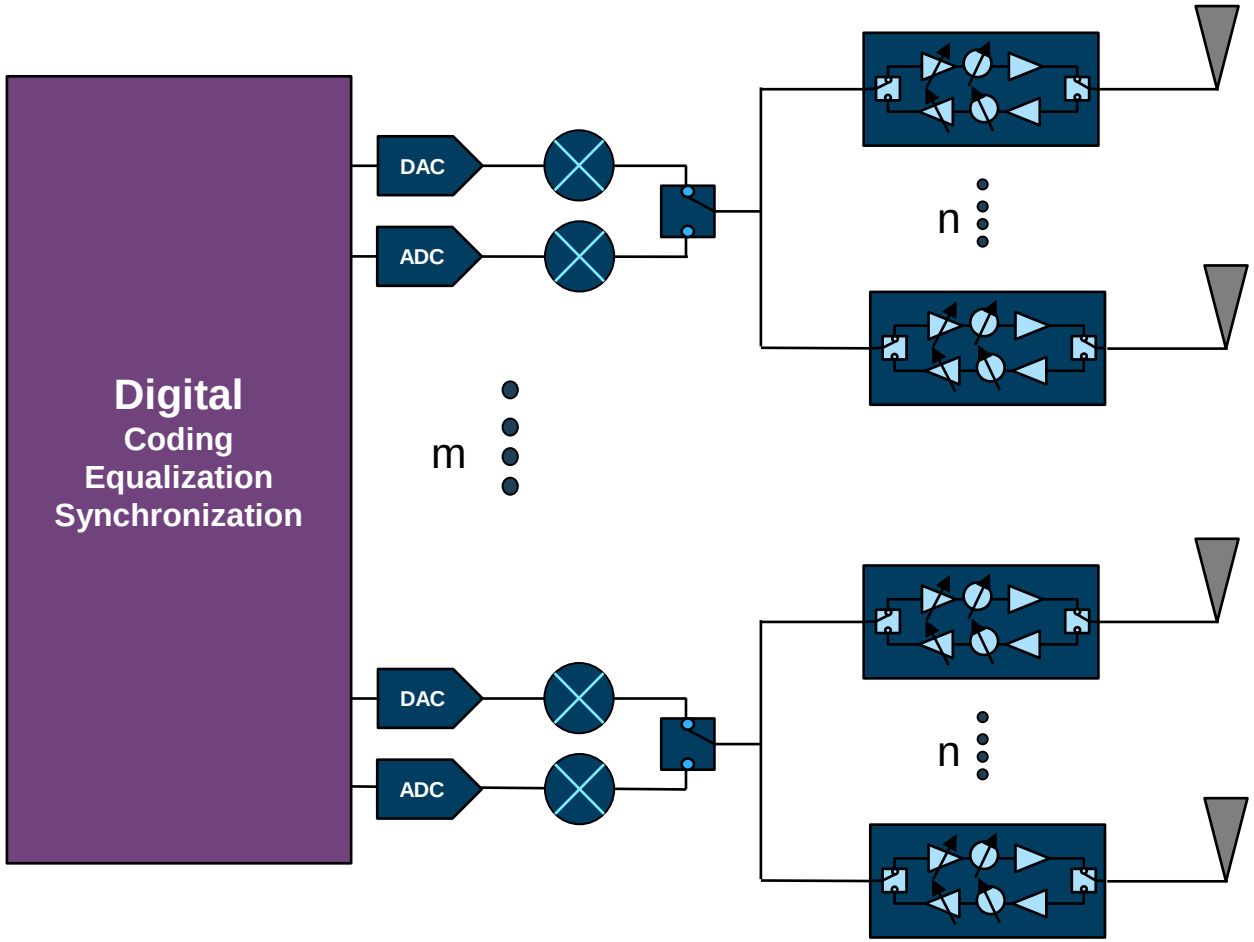
mmwave Hybrid Beam Forming



- RF beamforming channel for single stream (n antennae per data stream)
- m up/down converters and m sets of ADCs and DACs
- Total antennae = mXn
- Enables spatial multiplexing and multi-user MIMO

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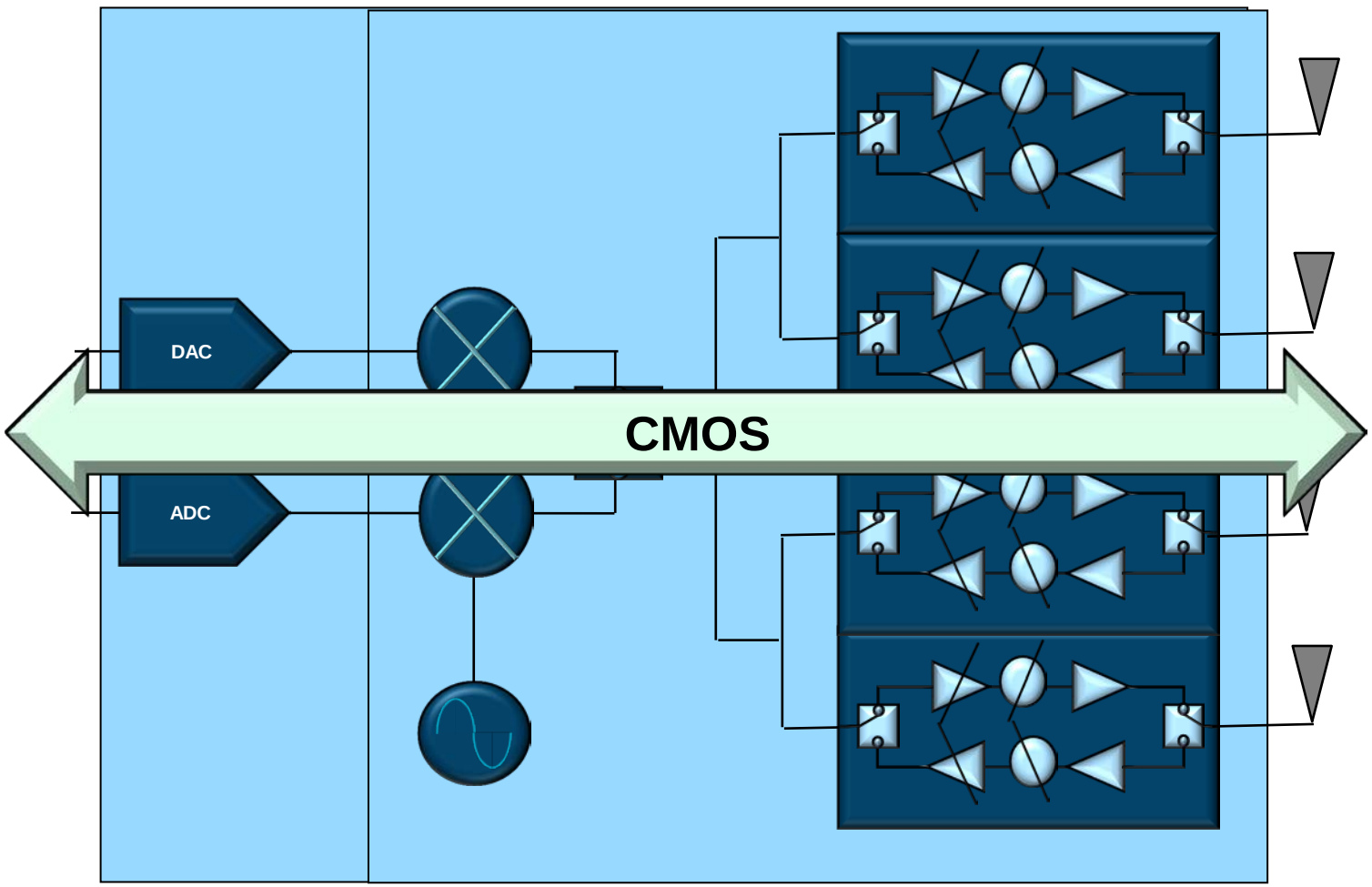
mmwave Radio Technology



Application

Architecture

Partition

Technology fit

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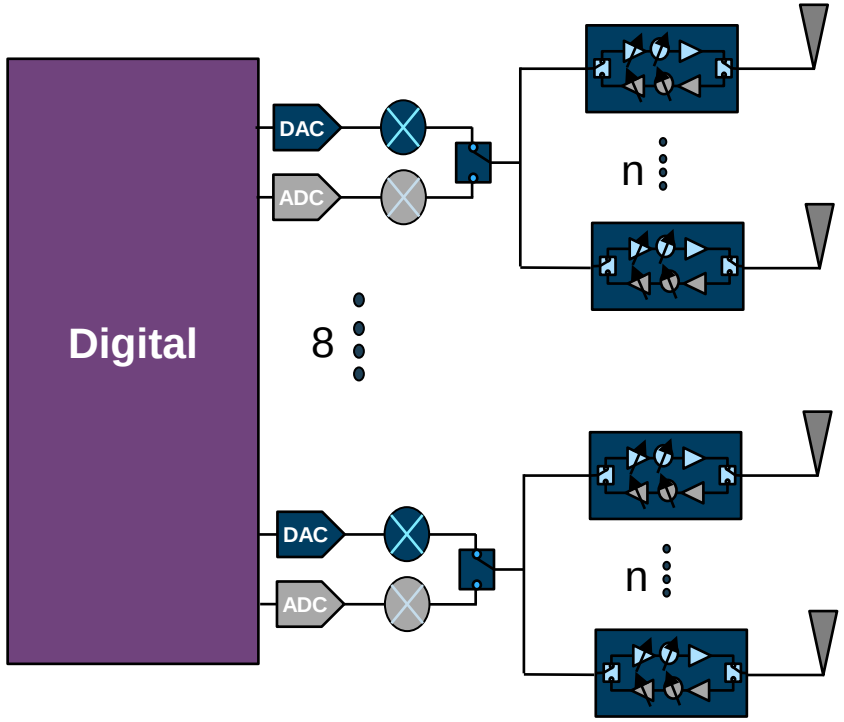
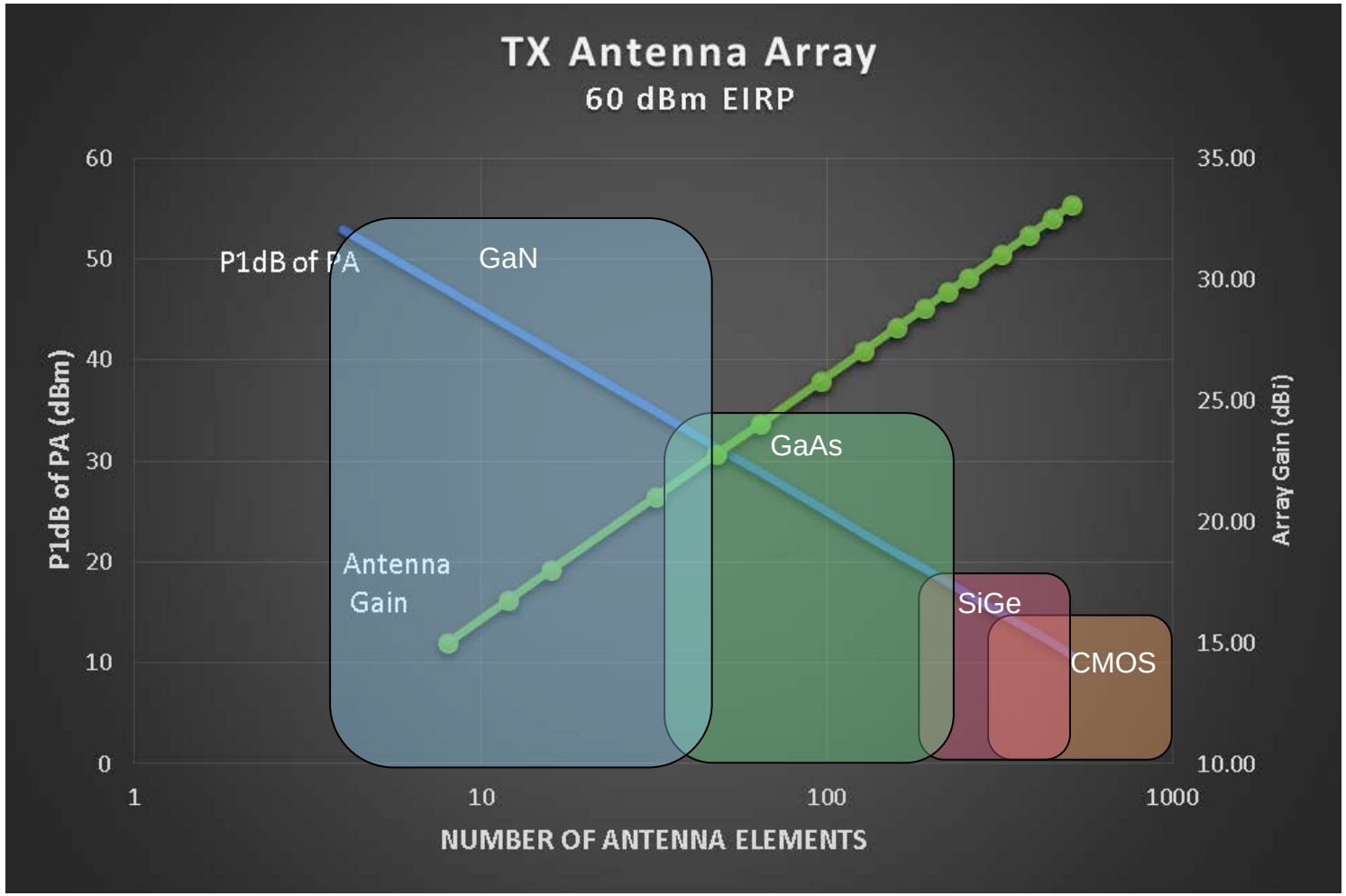
Optimizing the Antenna Array Design





- Assumptions:
  - 60dBm EIRP
  - 3-4 GHz IF, 800MHz BW
  - PAPR =9 dB

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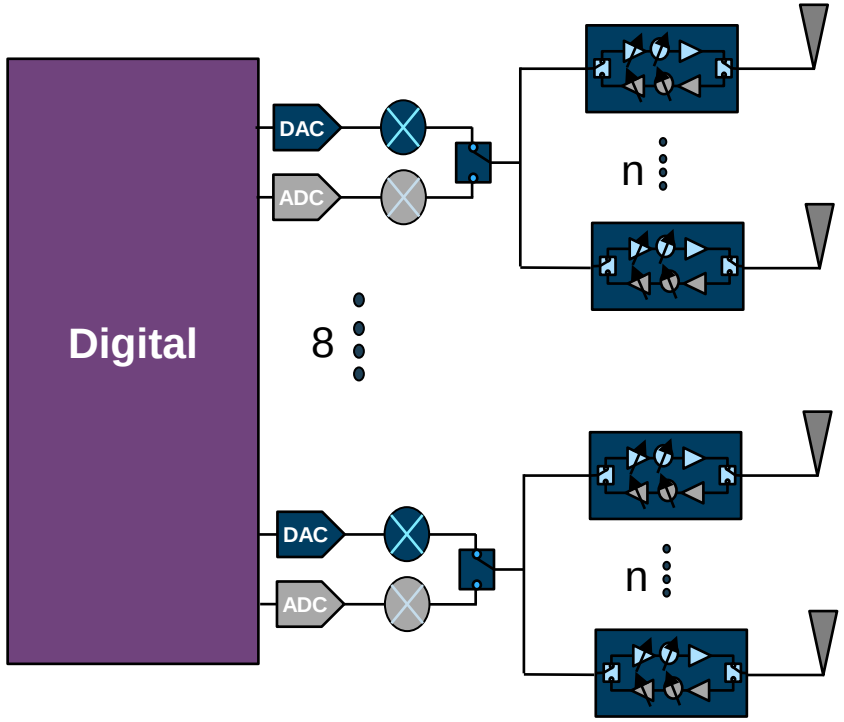
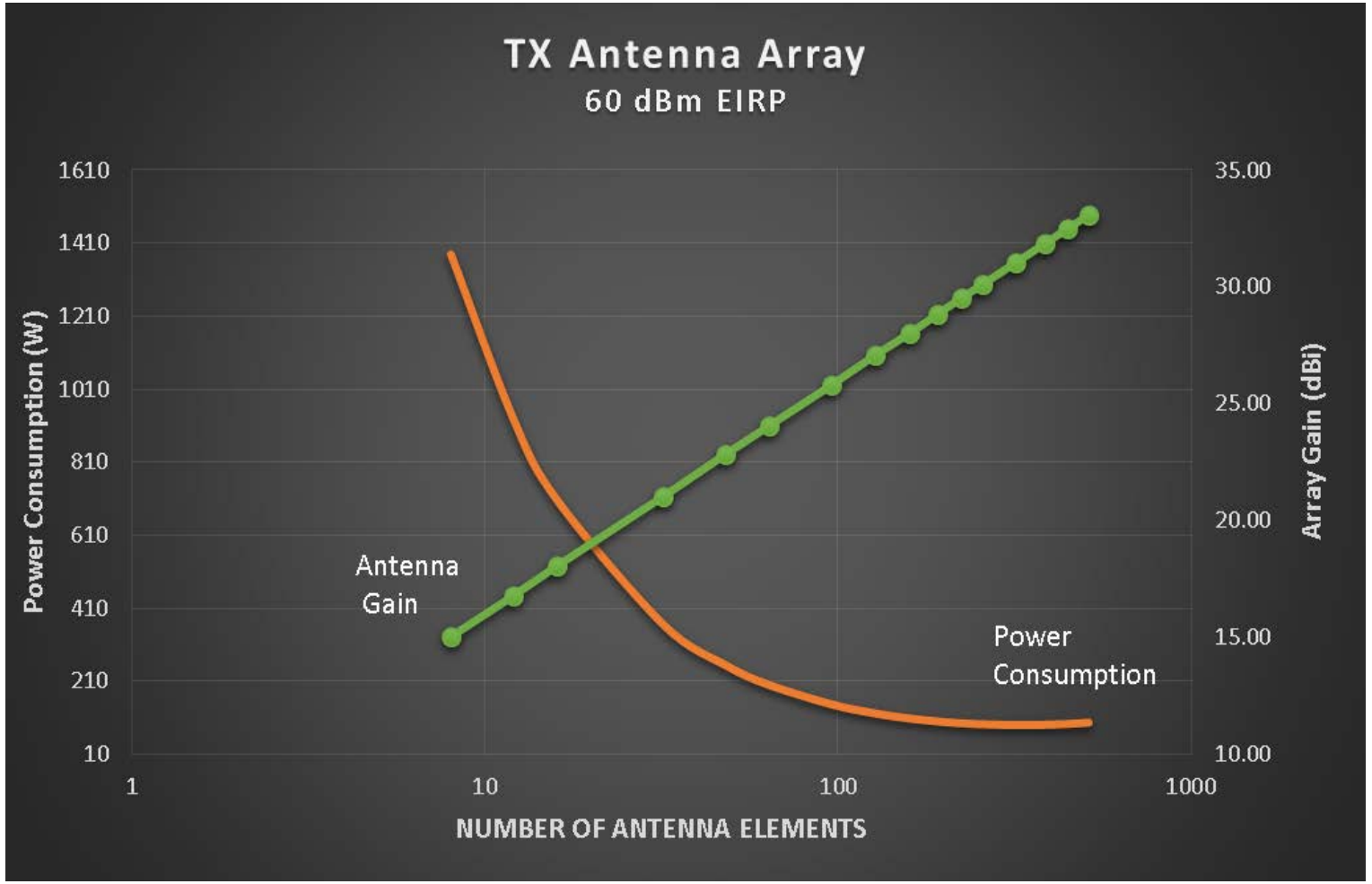
Optimizing the Antenna Array Design





- DC power consumption scales inversely with antenna size
- Beyond 500 elements diminishing returns

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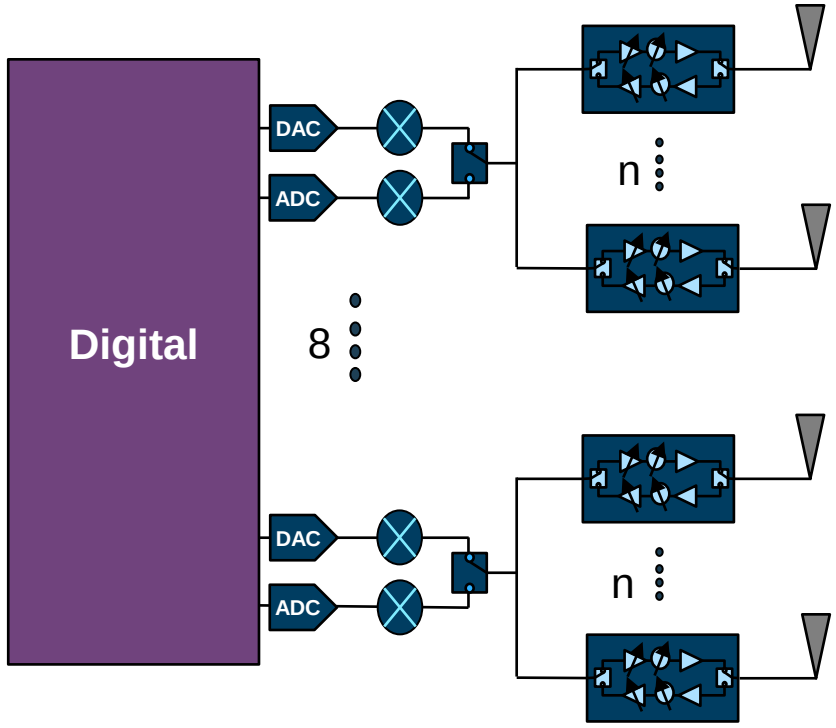
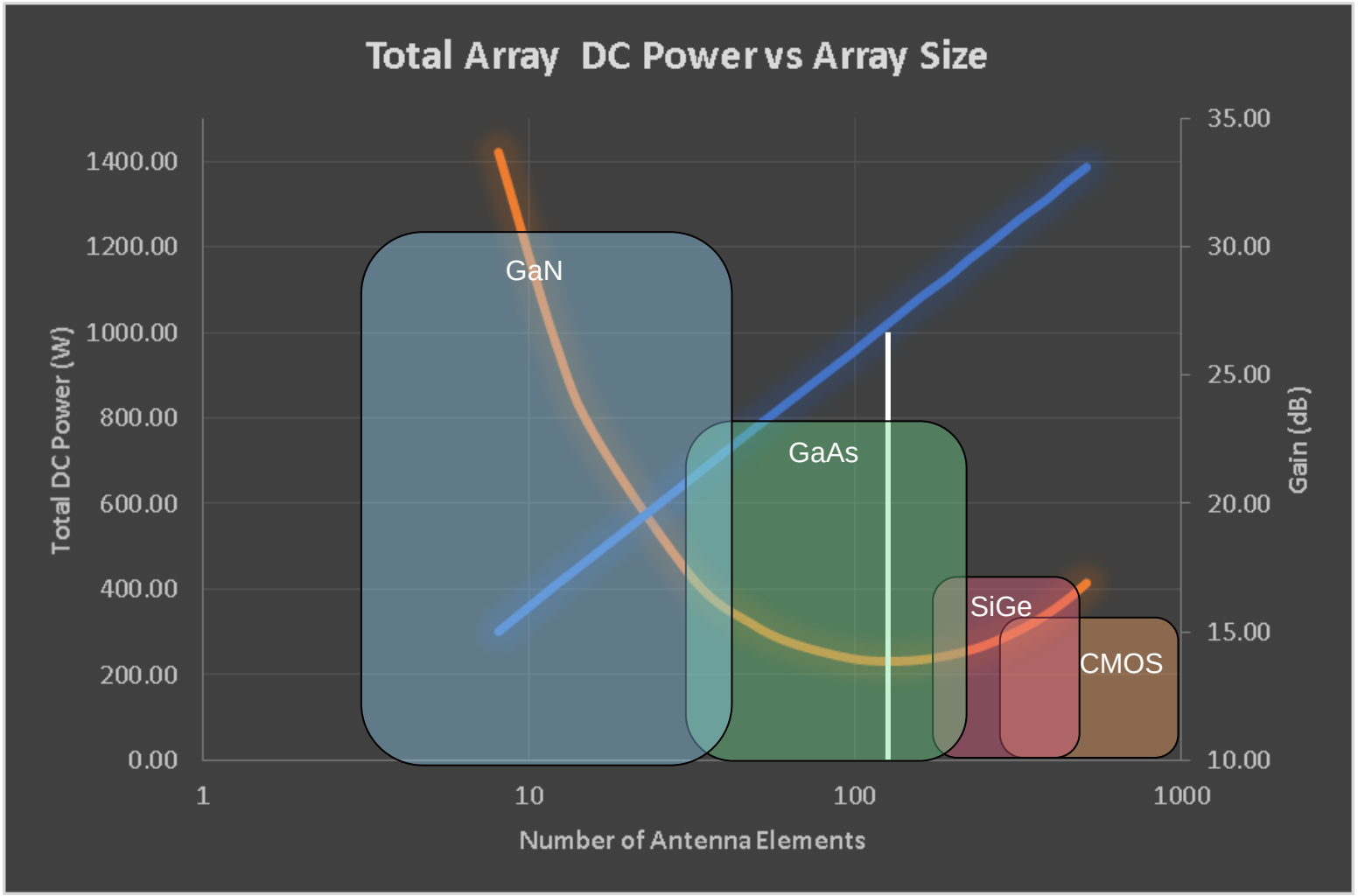
Optimizing the Antenna Array





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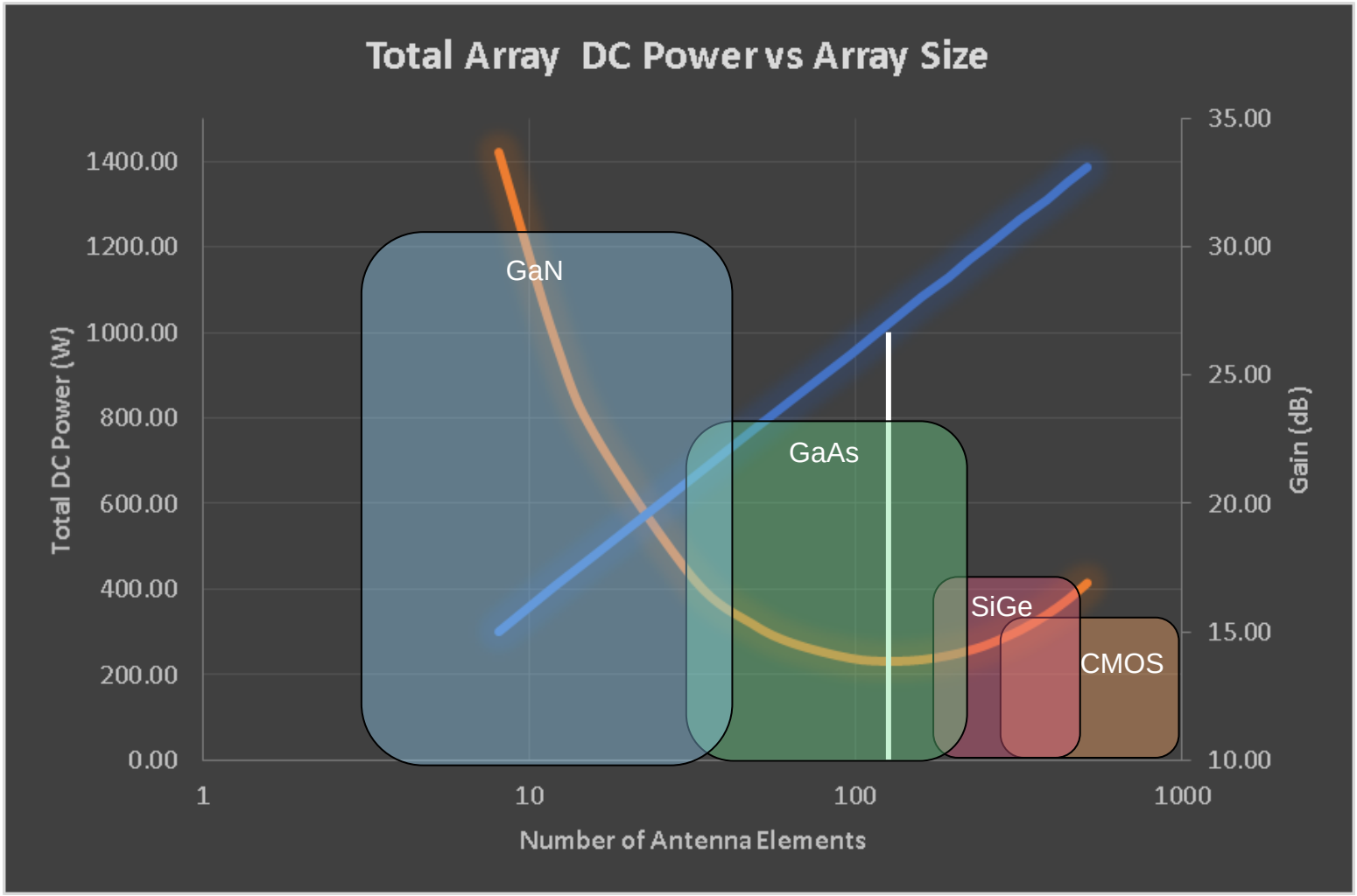
Optimizing the Antenna Array

- DC power is optimized with array sizes of ~128 element
- Larger arrays allow for the use of silicon PAs and allow RFICs to fit λ/2 spacing
- Smaller arrays would be optimal for lower EIRP requirements



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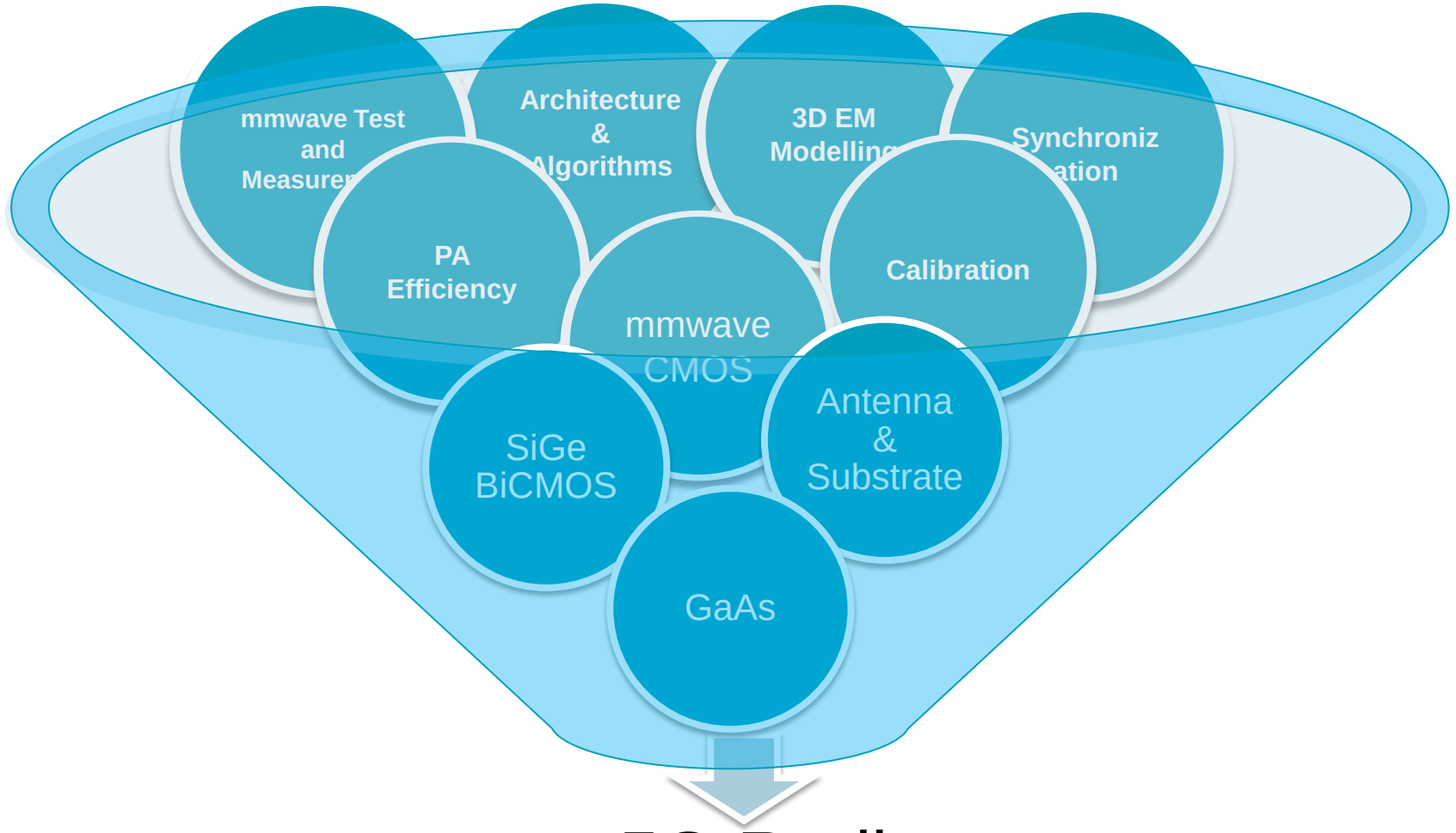
5G RF Technology Pipeline



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