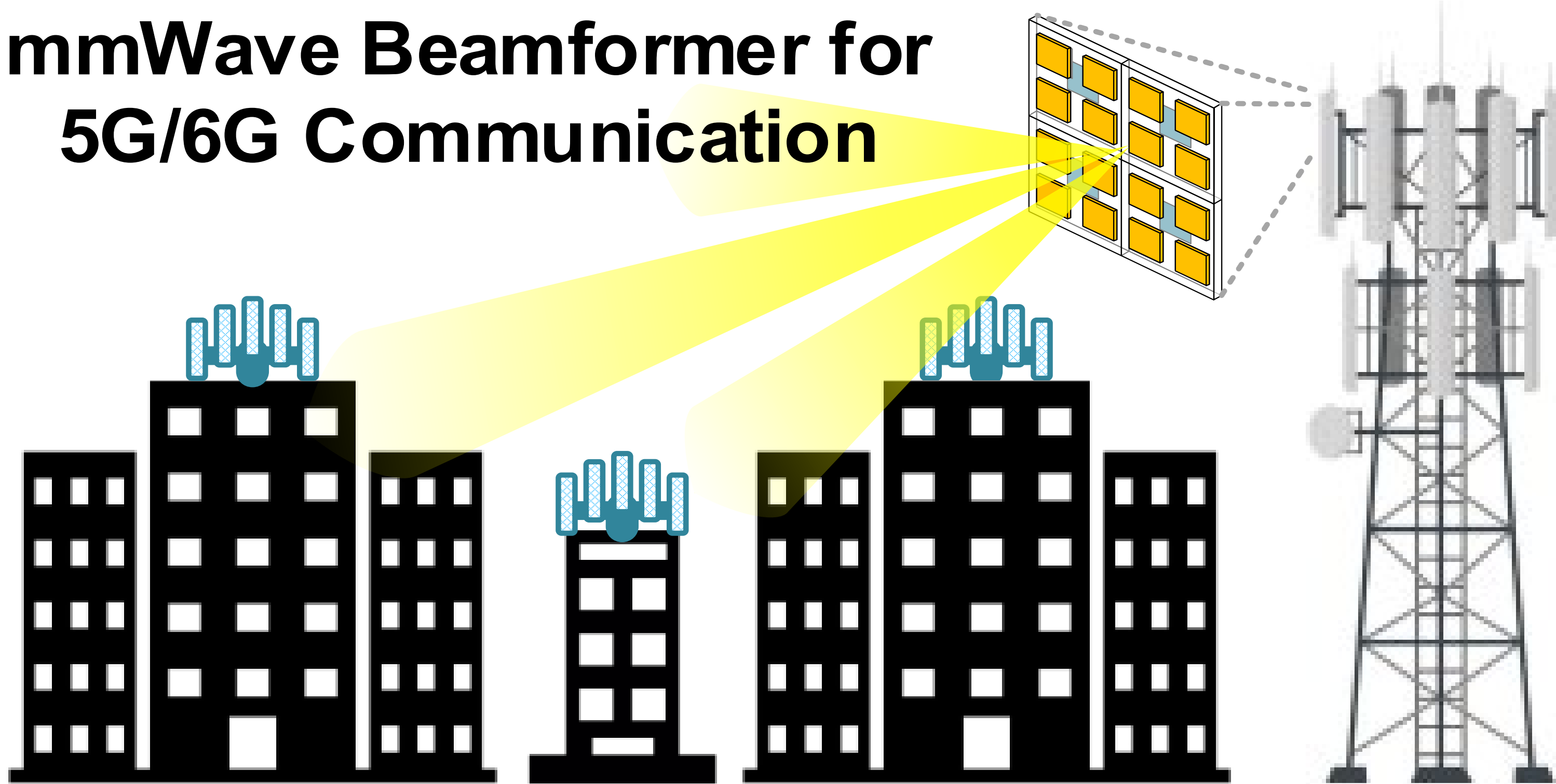


Integrated Circuit Design Center, ECE Department, HKUST

A 28-GHz Sliding-IF Phased-Array Transmitter with 24% Peak Efficiency and 0.26-mm²/Element Area Efficiency

Li Wang, Zilu Liu, Ruitao Ma and C. Patrick Yue

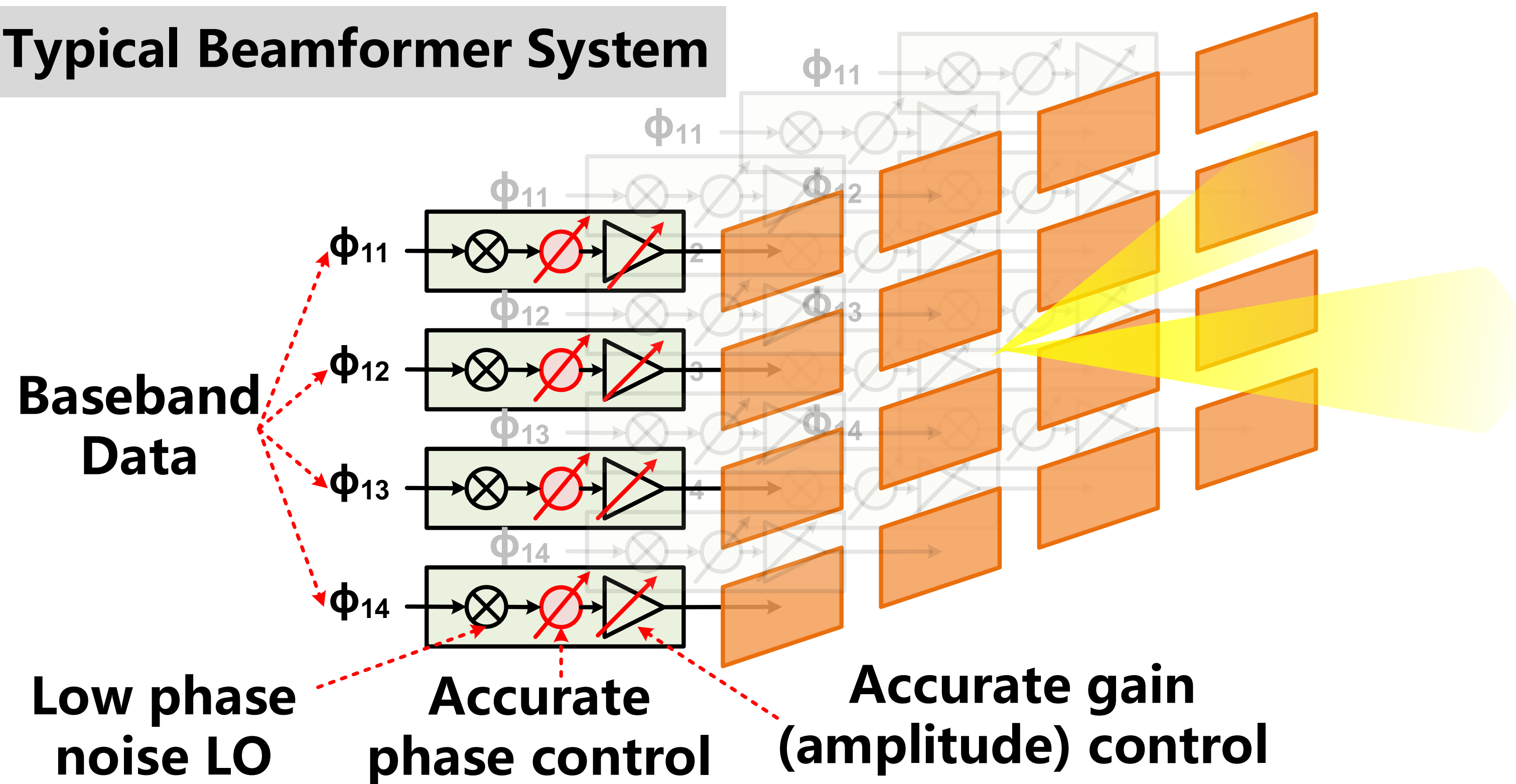
mmWave Beamformer for 5G/6G Communication



mmWave Beamformer for Satellite Communication



Typical Beamformer System



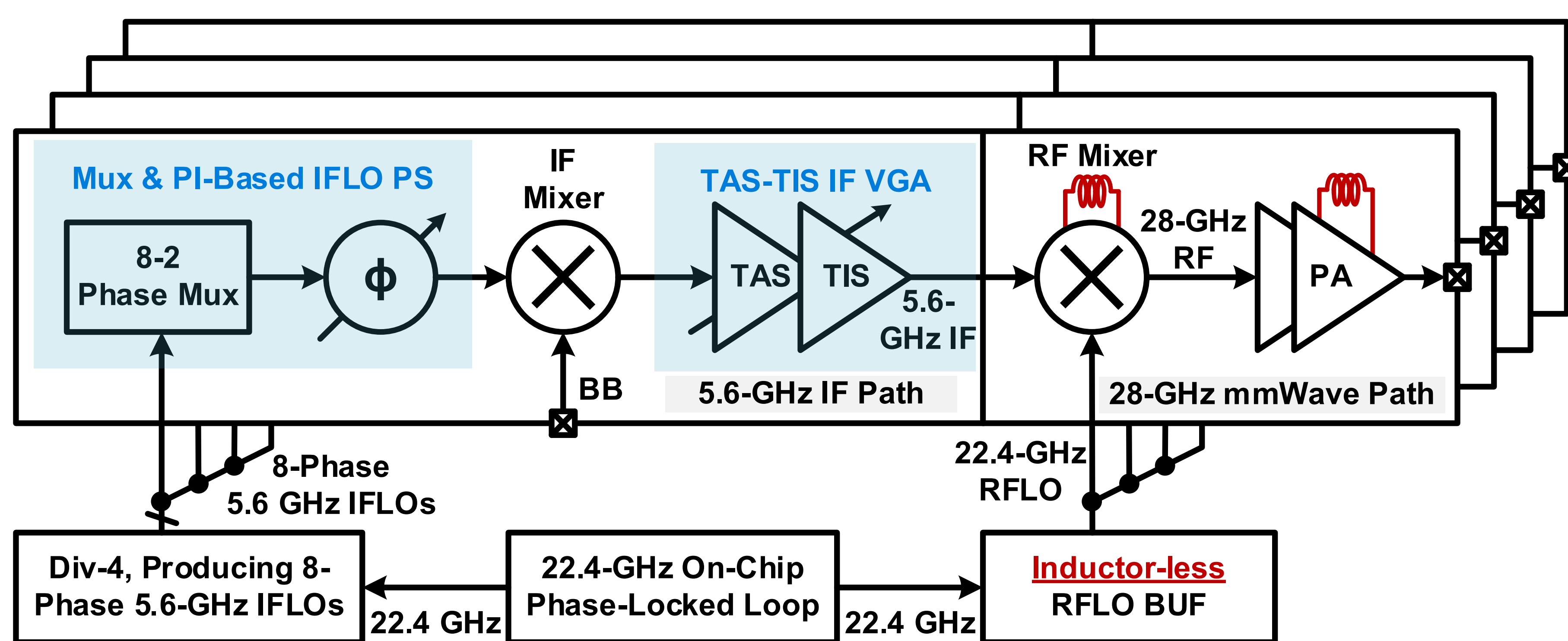
❖ Challenges for current mmWave beamformer IC:

- Huge power consumption but low efficiency
- Large chip area due to multiple inductive devices
- Lack of compact on-chip frequency synthesizer
- Inaccurate phase and gain control

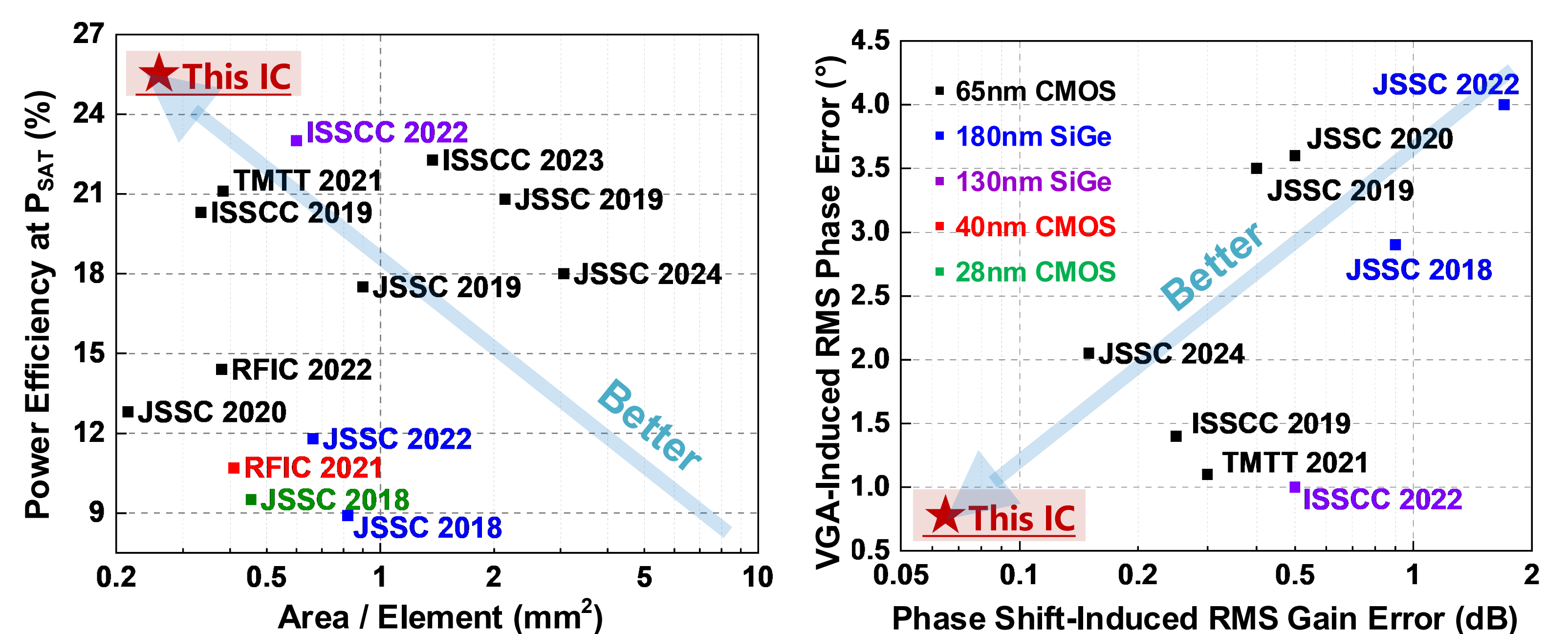
❖ Novel architecture and implementation are needed to provide better efficiency and control accuracy

Proposed architecture:

A sliding-IF phased-array transmitter system with intermediate-frequency local oscillator phase shifting scheme

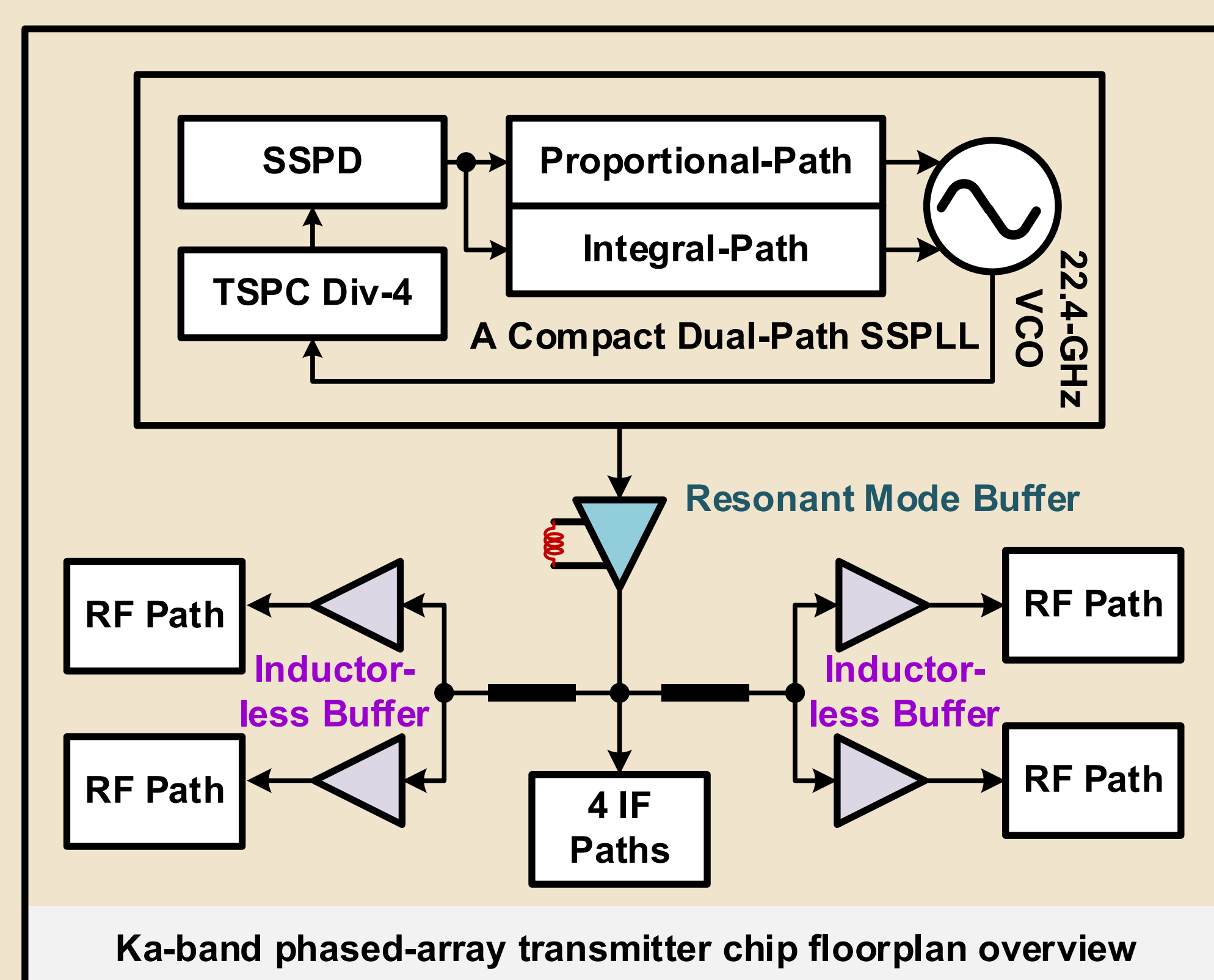


Comparison with the state-of-the-art

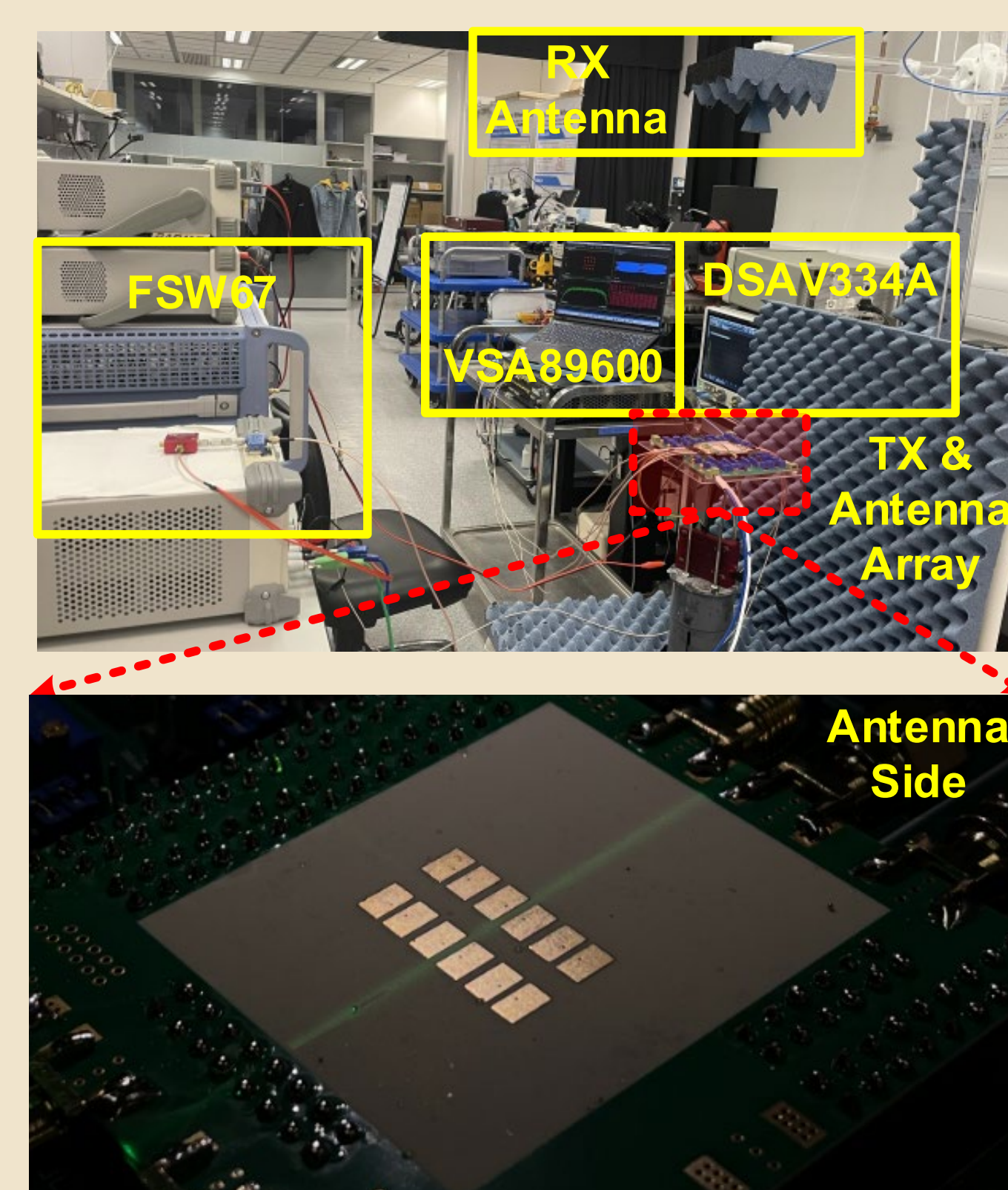


Architecture overview:

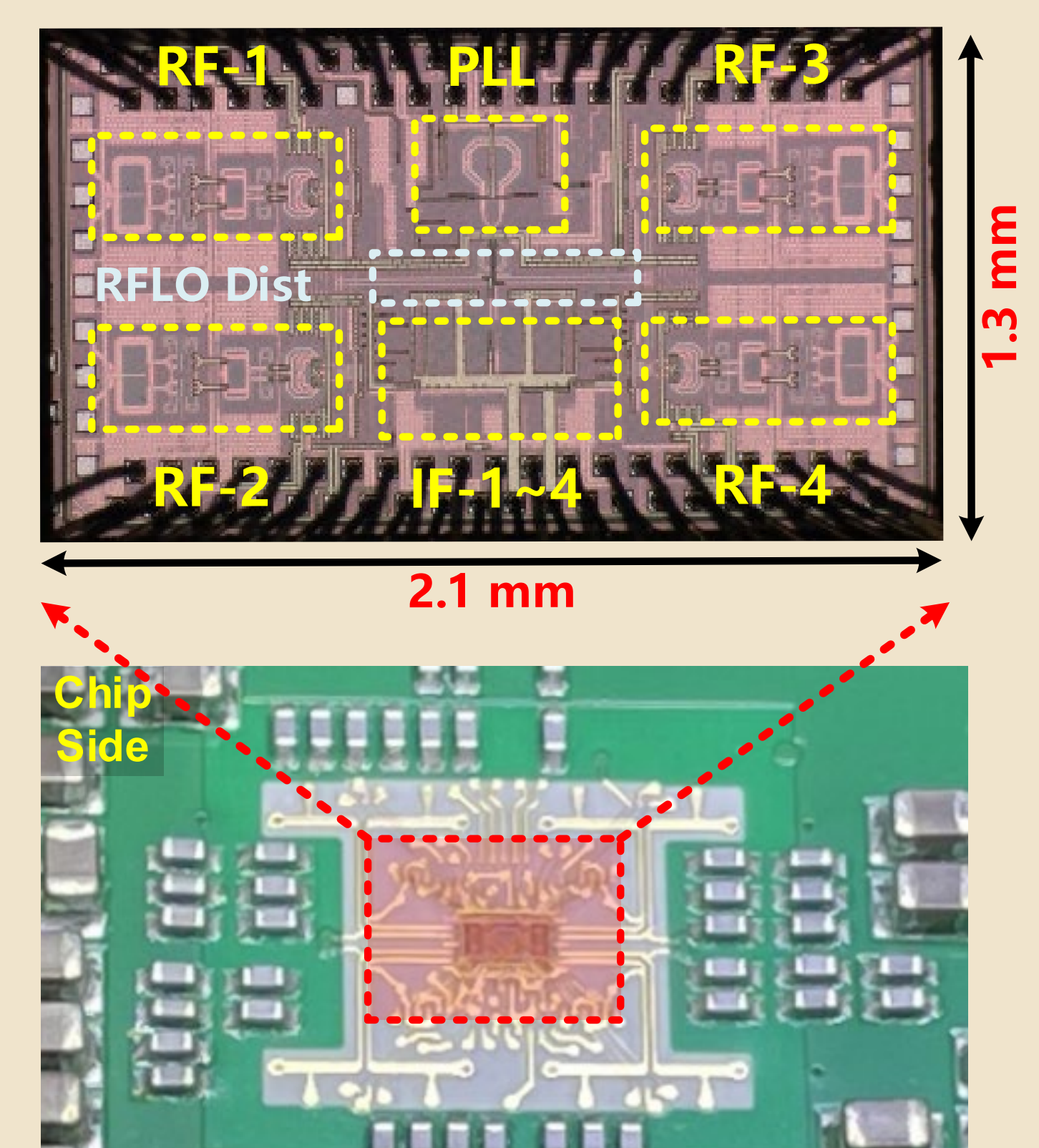
1. Sliding-IF architecture: 22.4-GHz RFLO and 5.6-GHz IFLO
2. Phase shift at IFLO: high accuracy, small area
3. Gain control in IF: phase-invariant gain control
4. On-chip PLL: smallest area with 61.23-fs integrated jitter
5. Overall: highest efficiency for area and power, highest accuracy for phase and gain control



Chip floorplan overview



Over-the-air measurement setup



Chip photo and packaging

Acknowledgment

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