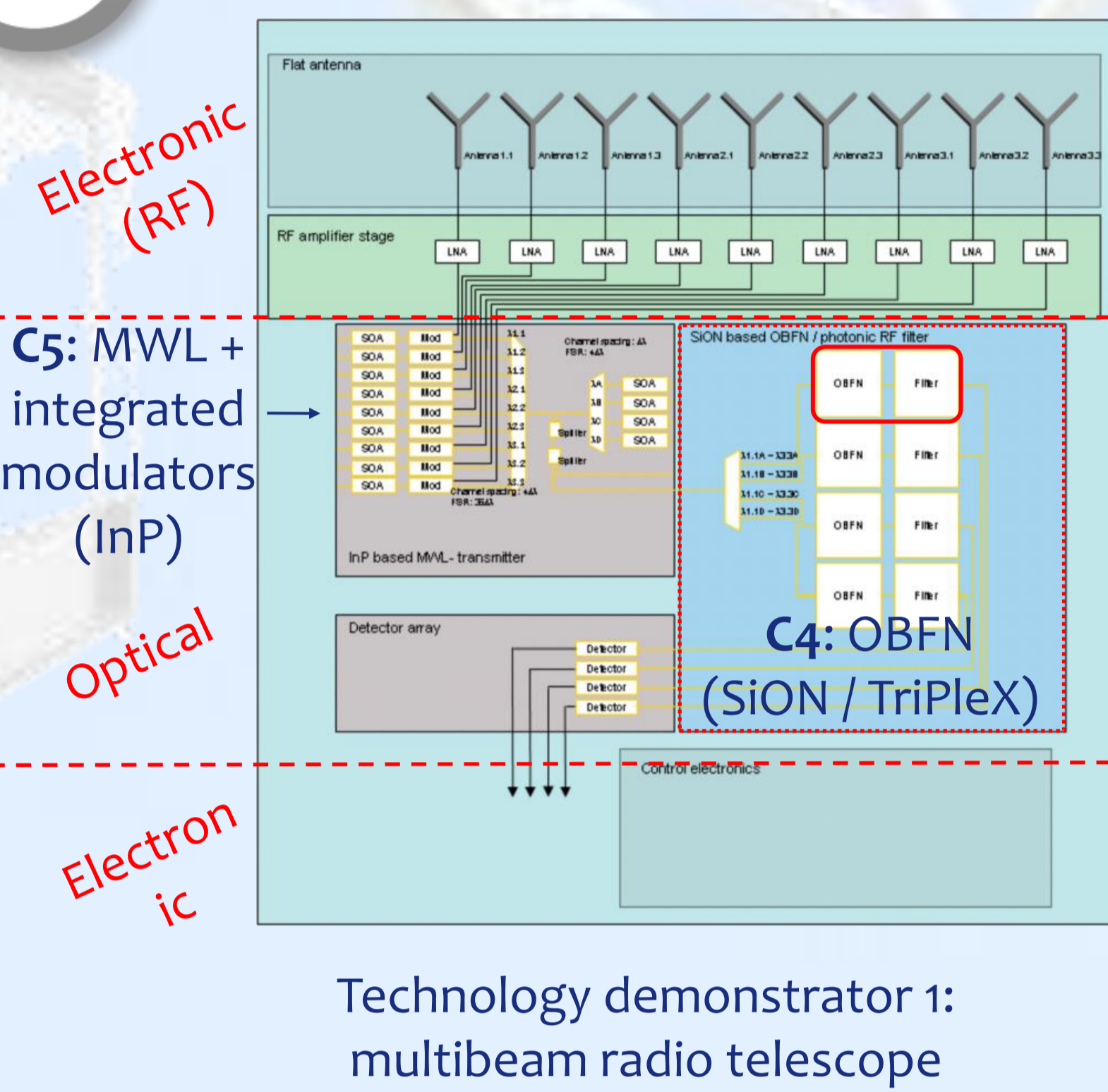


Advanced Optical Beam Forming Networks for Broadband Phased Array Antenna Systems

C4 - Broadband Optical Beamforming Networks

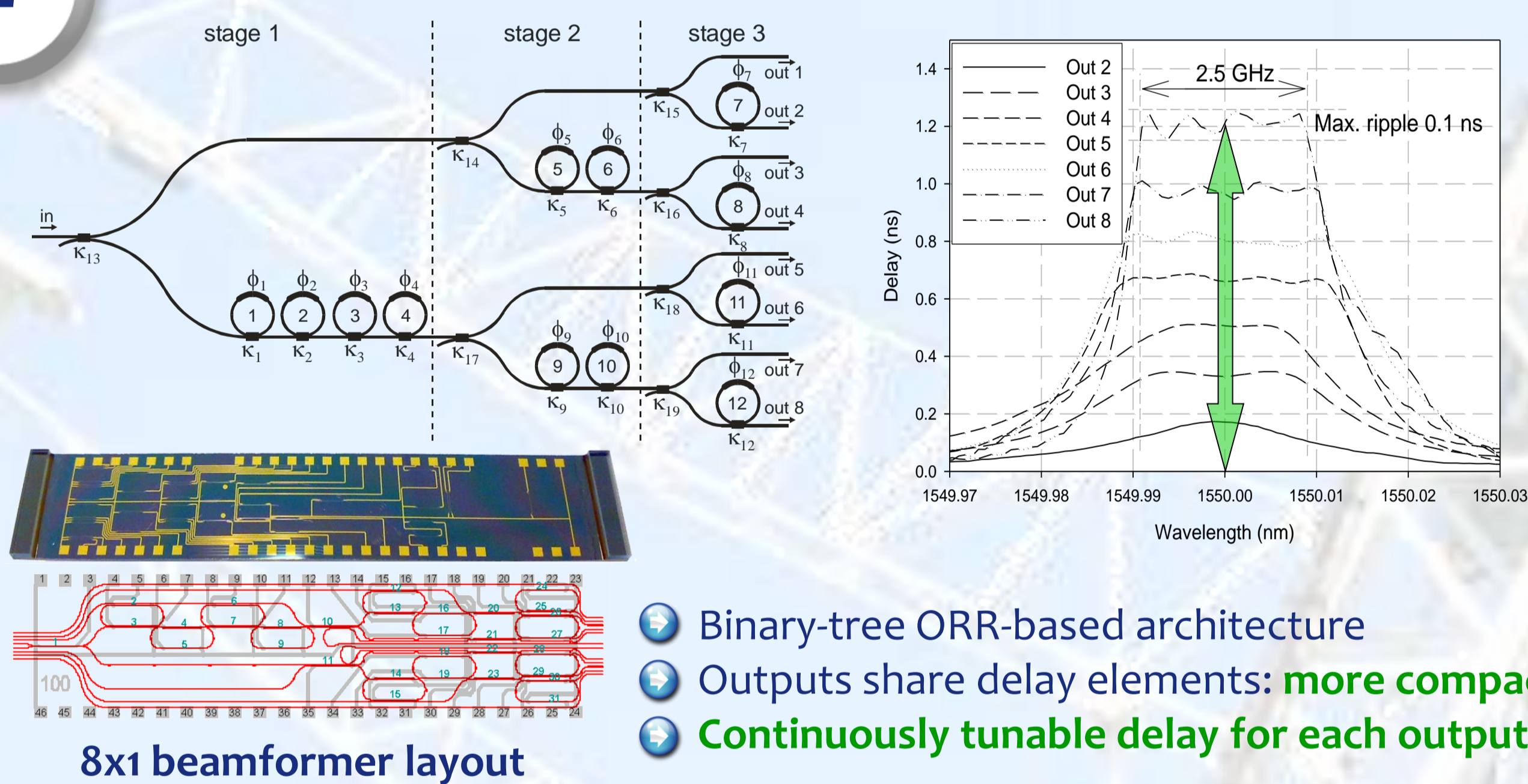
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1 Introduction

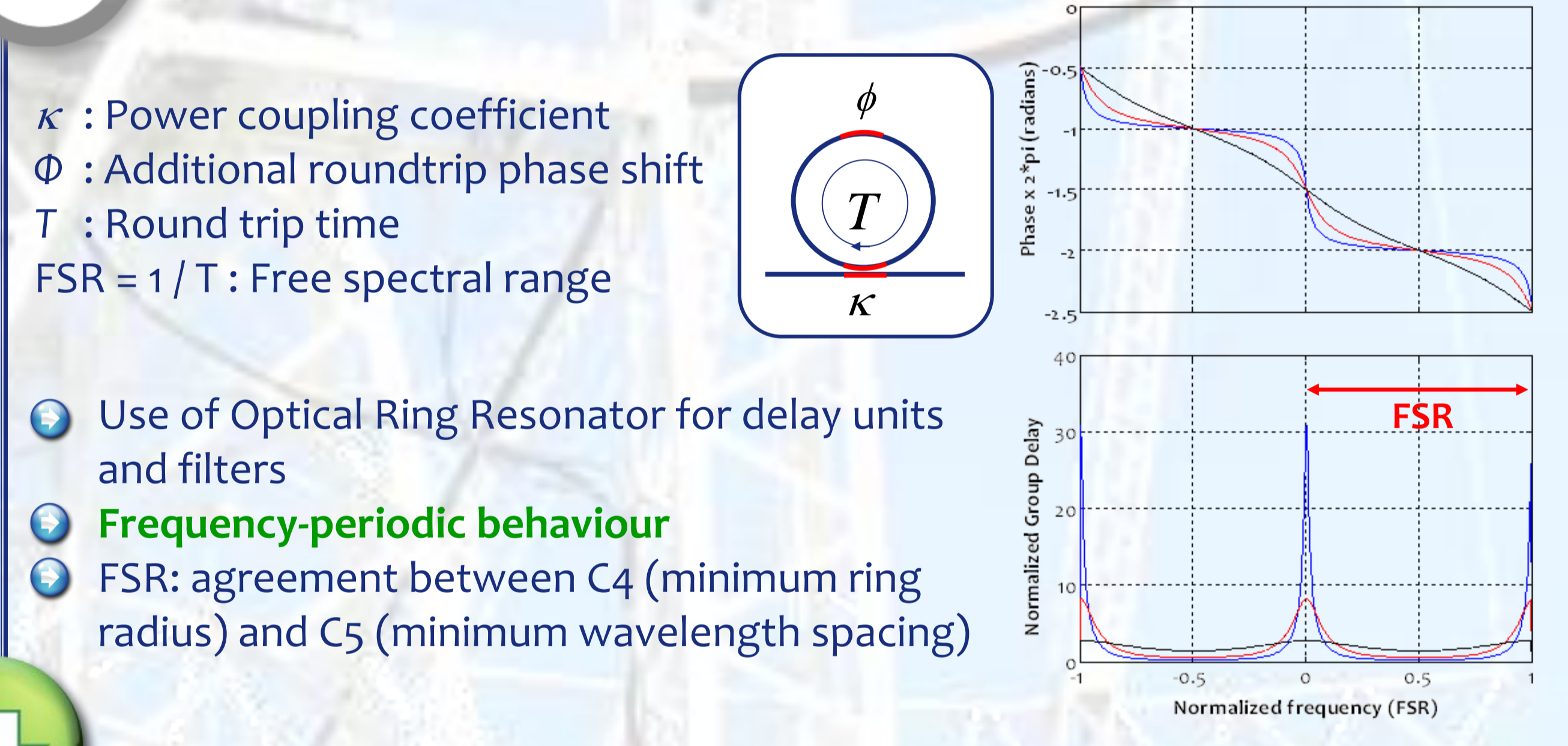


- Phased array antennas offer a number of advantages: beamforming, multibeaming, electronic beam scanning, interference nulling capability
- In practice, they are limited by the performance of the beam forming networks (BFNs)
 - Possible improvement: **Electronics & Photonics Integration**
- Optical BFNs (OBFNs) overcome the typical issues of all-electrical beamformers by providing
 - large bandwidths
 - RF frequency transparent
 - True Time Delay (squint-free) characteristic over the band of interest
 - EMI immunity
 - compactness and light weight
- Advanced OBFNs based on Optical Ring Resonators (ORRs) allow continuously tunable delay operation
- For large arrays, the OBFN may become **very complex**
- The challenge in workpackage C4 is to realize an **advanced single-chip OBFN** able to reduce system complexity and cost, and capable of **multibeaming**

2 OBFN architecture: binary tree



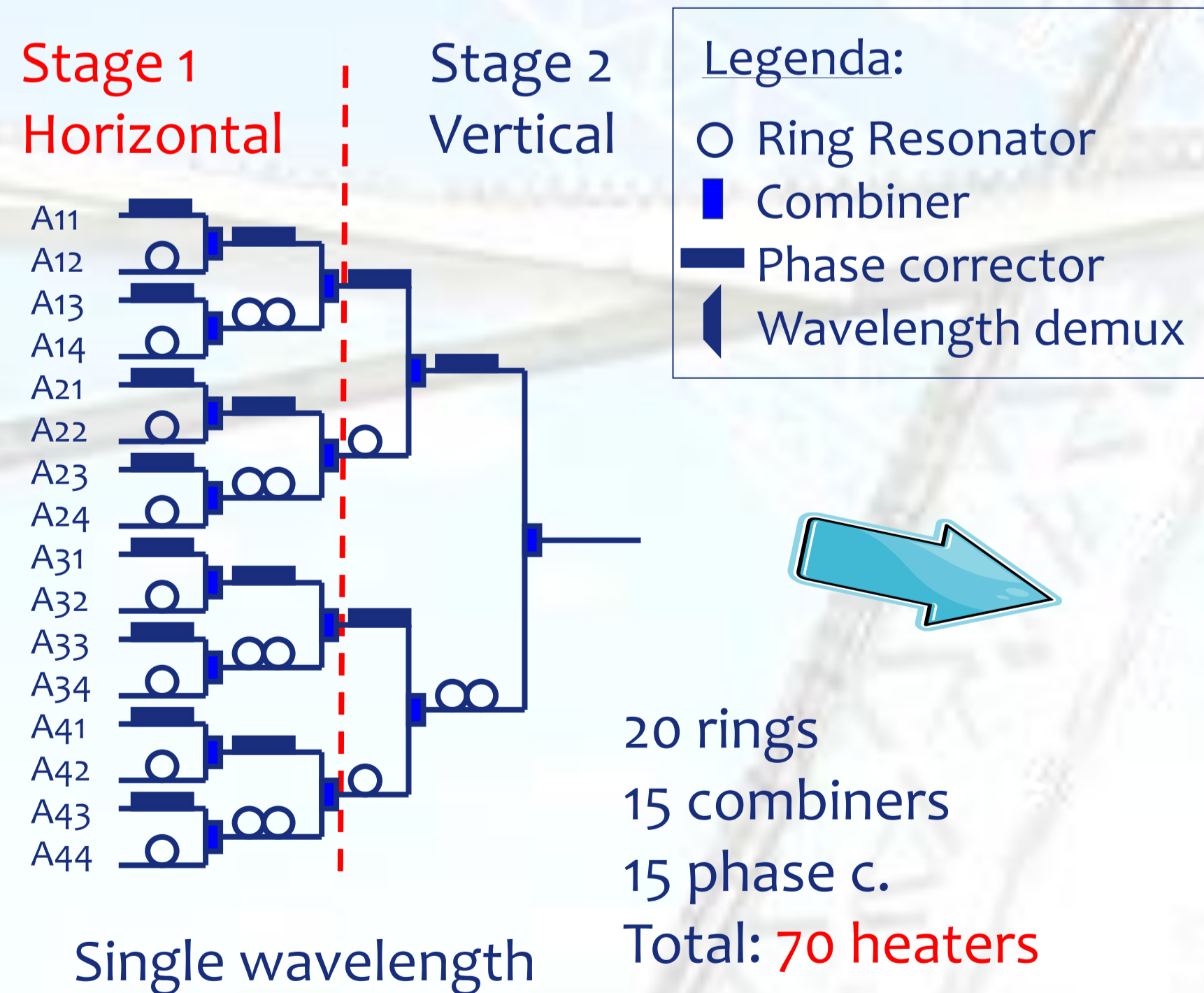
3 Optical Ring Resonator-based TTD units



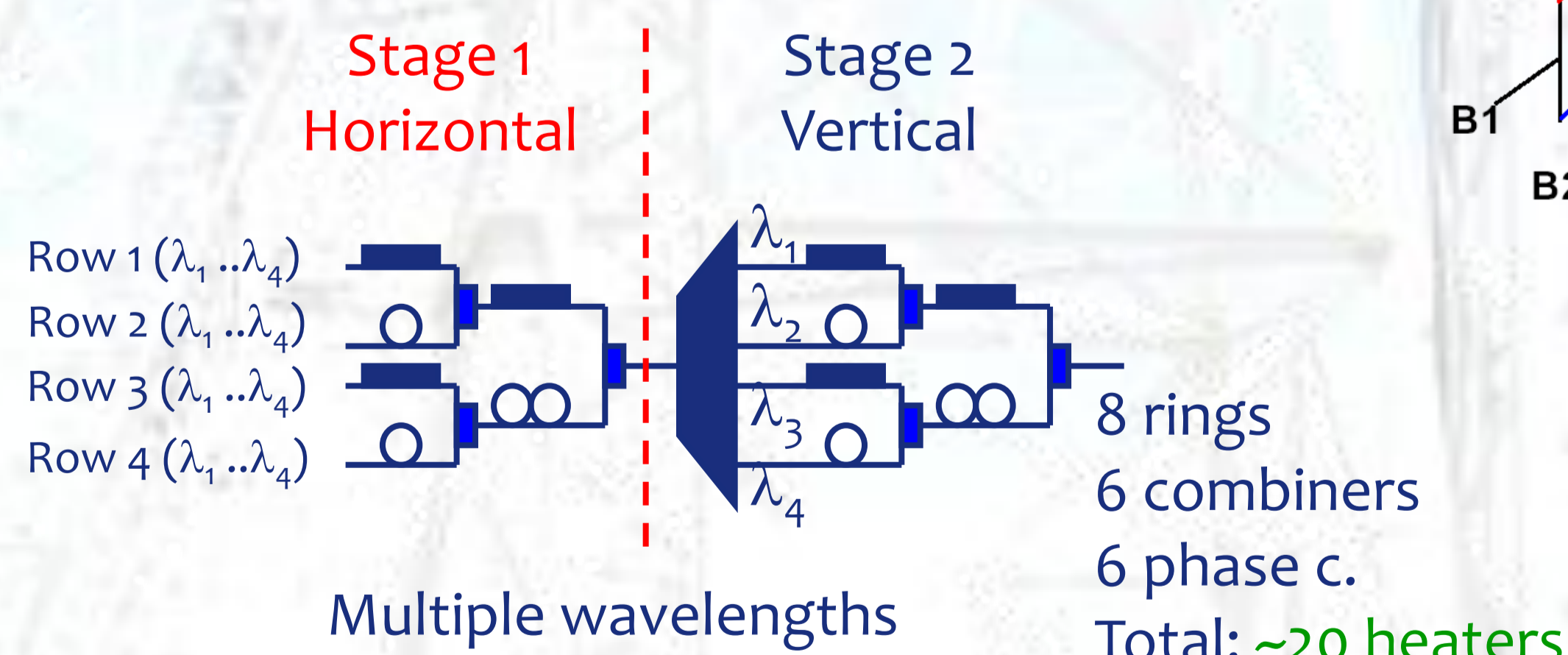
4 Multiwavelength OBFN

IDEA: Multiwavelength Optical Beam Forming Network with ORR-based Binary-tree Architecture

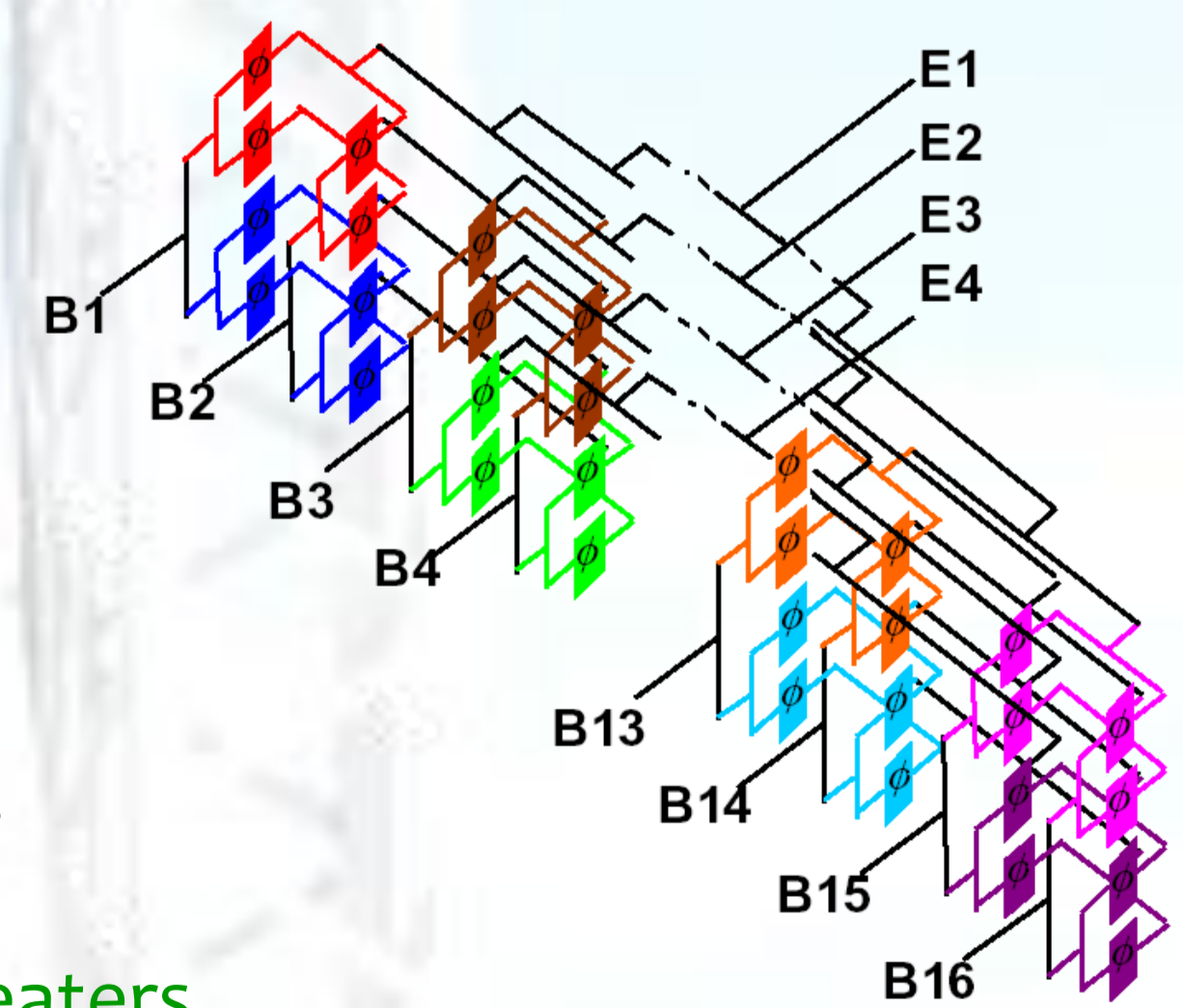
Example: 4x4 beamforming network



- Wavelength division multiplexing (WDM) to achieve multiple signal paths
- Choice of the optimum FSR (C4 and C5)



- Advantages:
- Compact & cheap WDM OBFN
 - Possibility to realize wideband parallel **multibeaming architectures**



5 Conclusions

The frequency-periodic behaviour of ORR-based delay units and filters allows the realization of a WDM-based multi-signal-path OBFN, thus reducing system complexity and cost and making possible an integrated realization of a multiple-beam OBFN.