

# Time & Frequency Domain Beamforming (1A)

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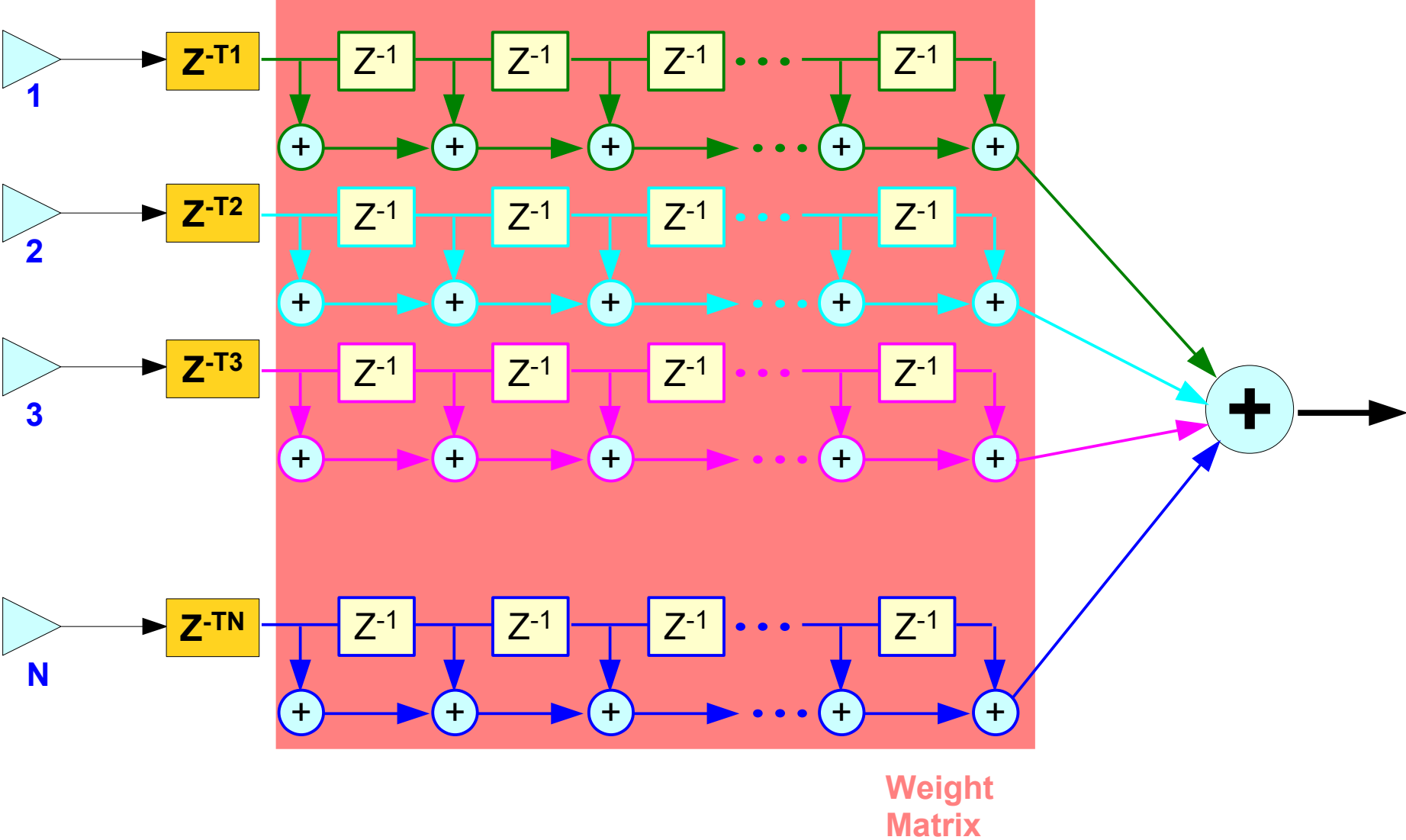
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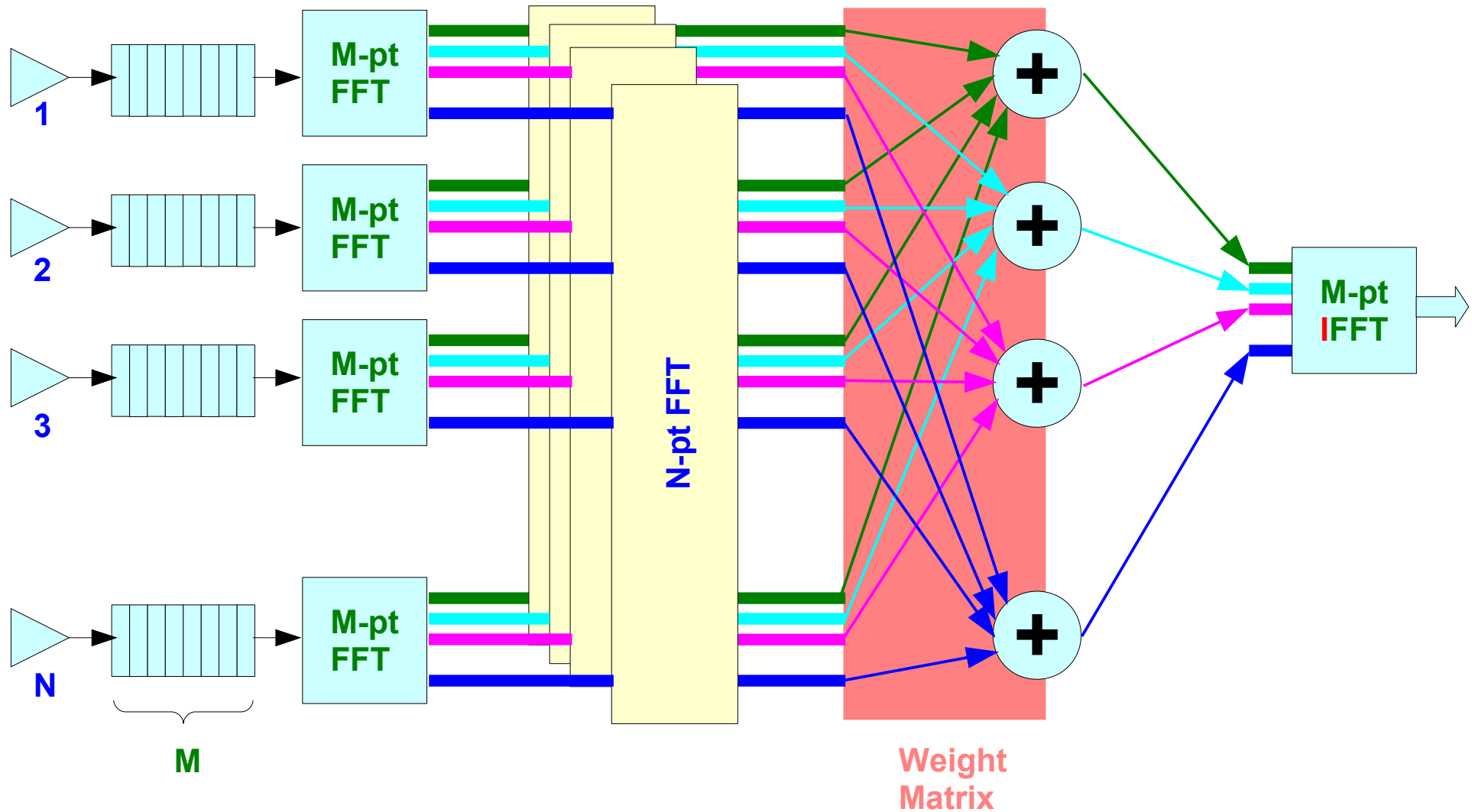
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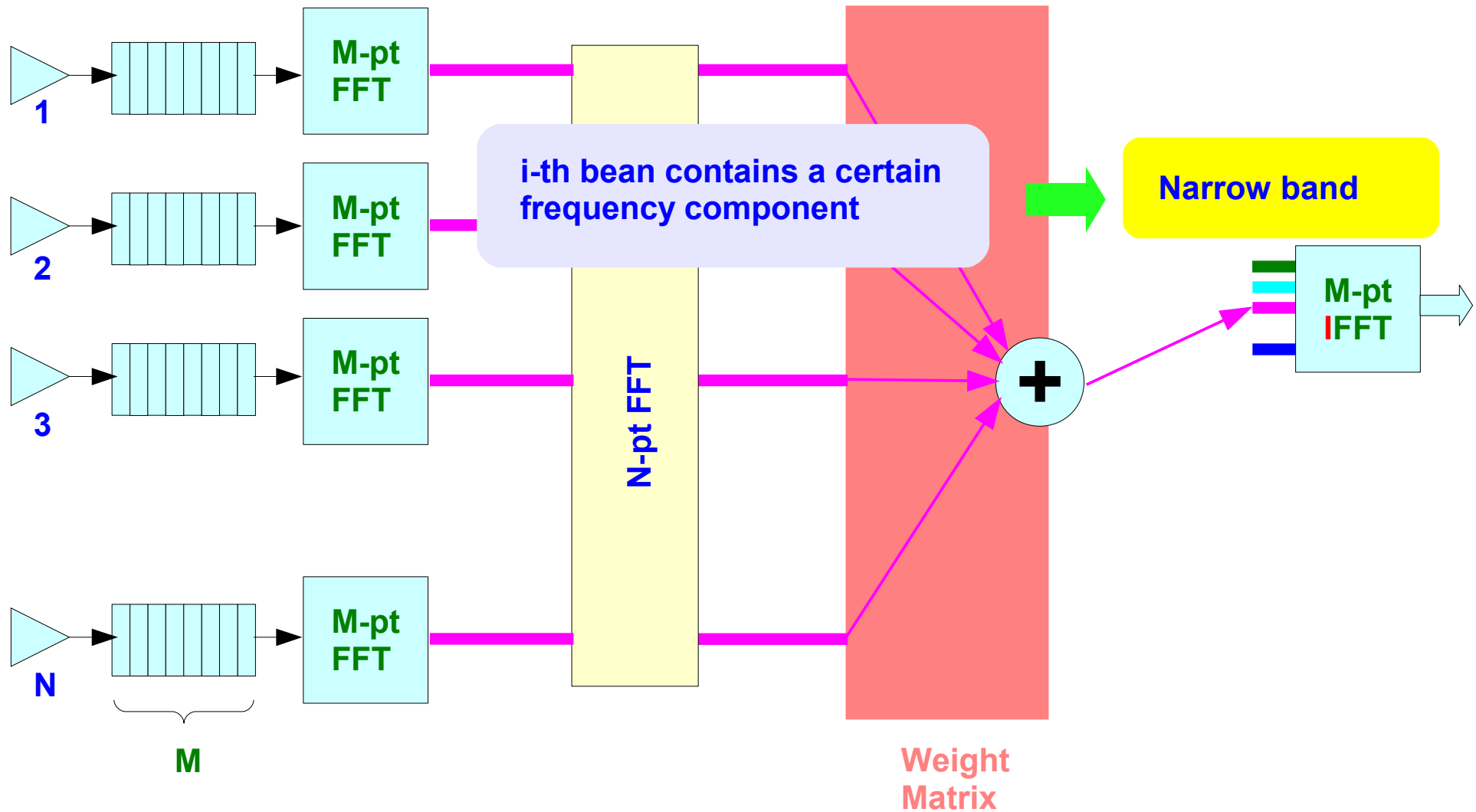
# Time-Domain Broadband Beamforming (1)



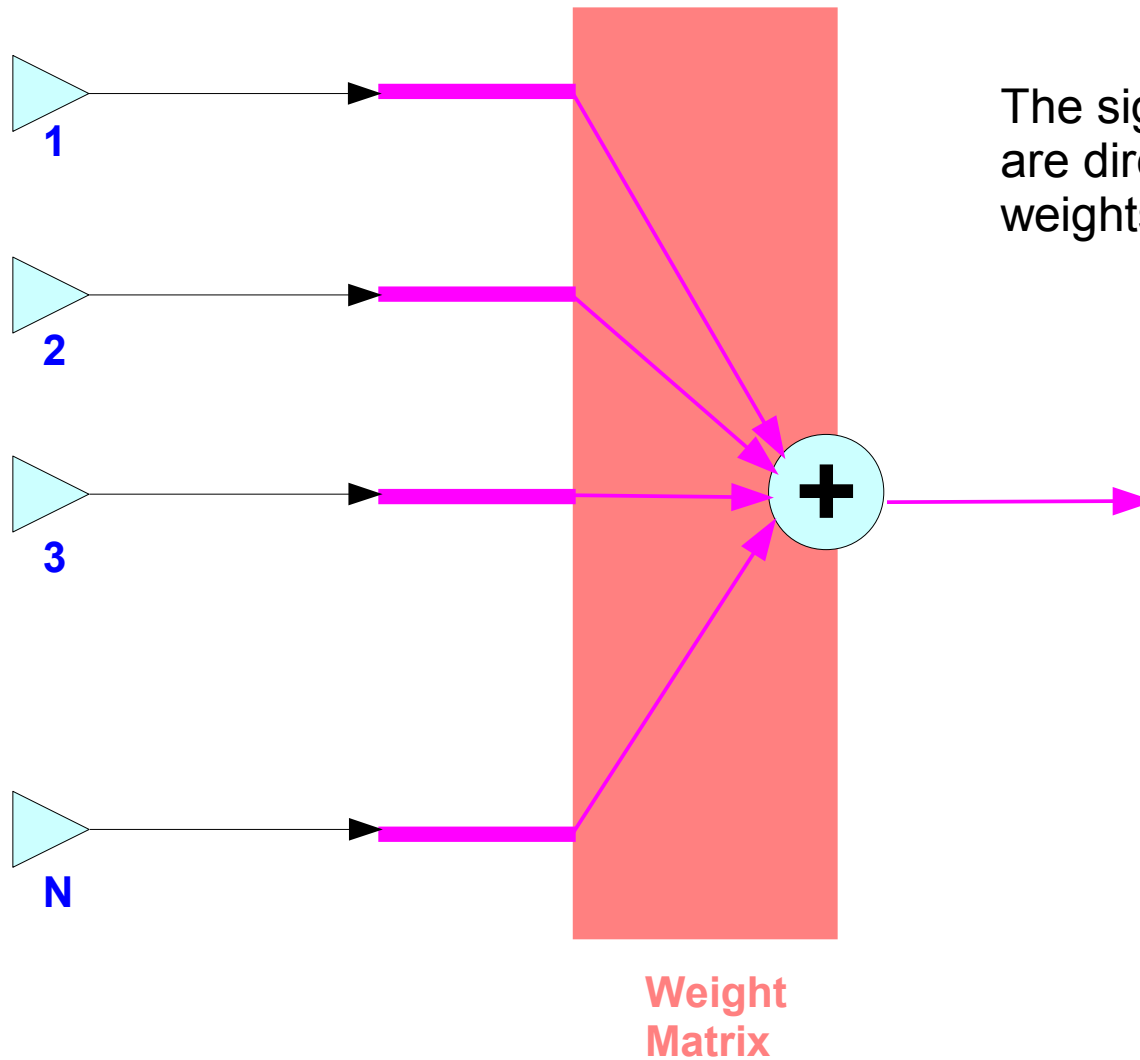
# Frequency-Domain Broadband Beamforming (1)



# Frequency-Domain Broadband Beamforming (2)

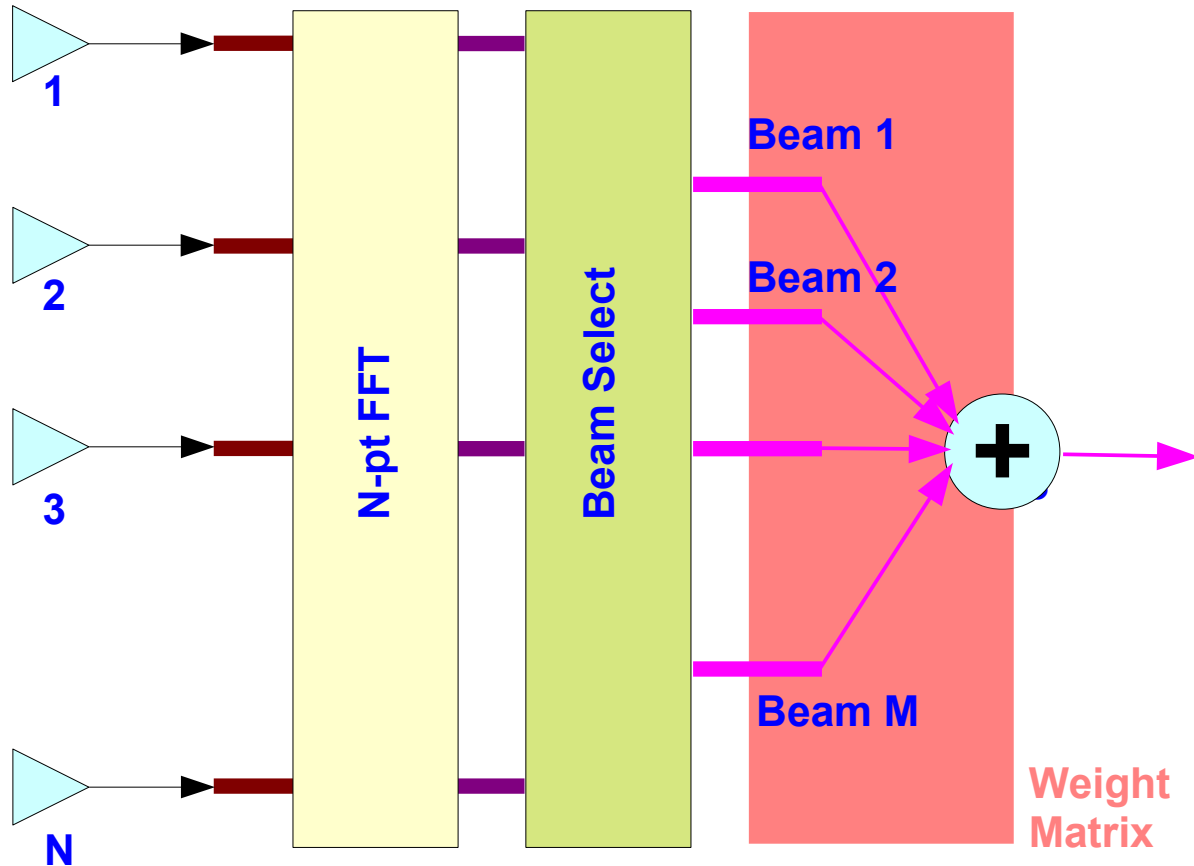


# Element-Space Beamforming (1)



The signals from the array elements are directly multiplied by a set of weights to form the desired beam

# Beam-Space Beamforming



The signals from the array elements are first processed by a multiple-beam beamformer to form a suite of orthogonal beams. The output of each beam can then be weighted and the result combined to produce a desired output

# Beam-Space Beamforming

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## 2-stage scheme

- Produce a set of multiple outputs  
(multiple beams steered in different directions)
- Weighted and combined to produce the array output



## References

- [1] <http://en.wikipedia.org/>
- [2] J.H. McClellan, et al., Signal Processing First, Pearson Prentice Hall, 2003
- [3] D. J. Allred, "Evaluation and comparison of beamforming algorithms for microphone speech processing", 2006
- [4] "Time domain Sonar Beamforming", [www.curtistech.co.uk/papers/beamform.pdf](http://www.curtistech.co.uk/papers/beamform.pdf)
- [5] "Beamforming Primer", [www.spectrumsignal.com/publications/beamform\\_primer.pdf](http://www.spectrumsignal.com/publications/beamform_primer.pdf)