

Accelerating Radio Correlation Algorithms Using Parallel Architectures

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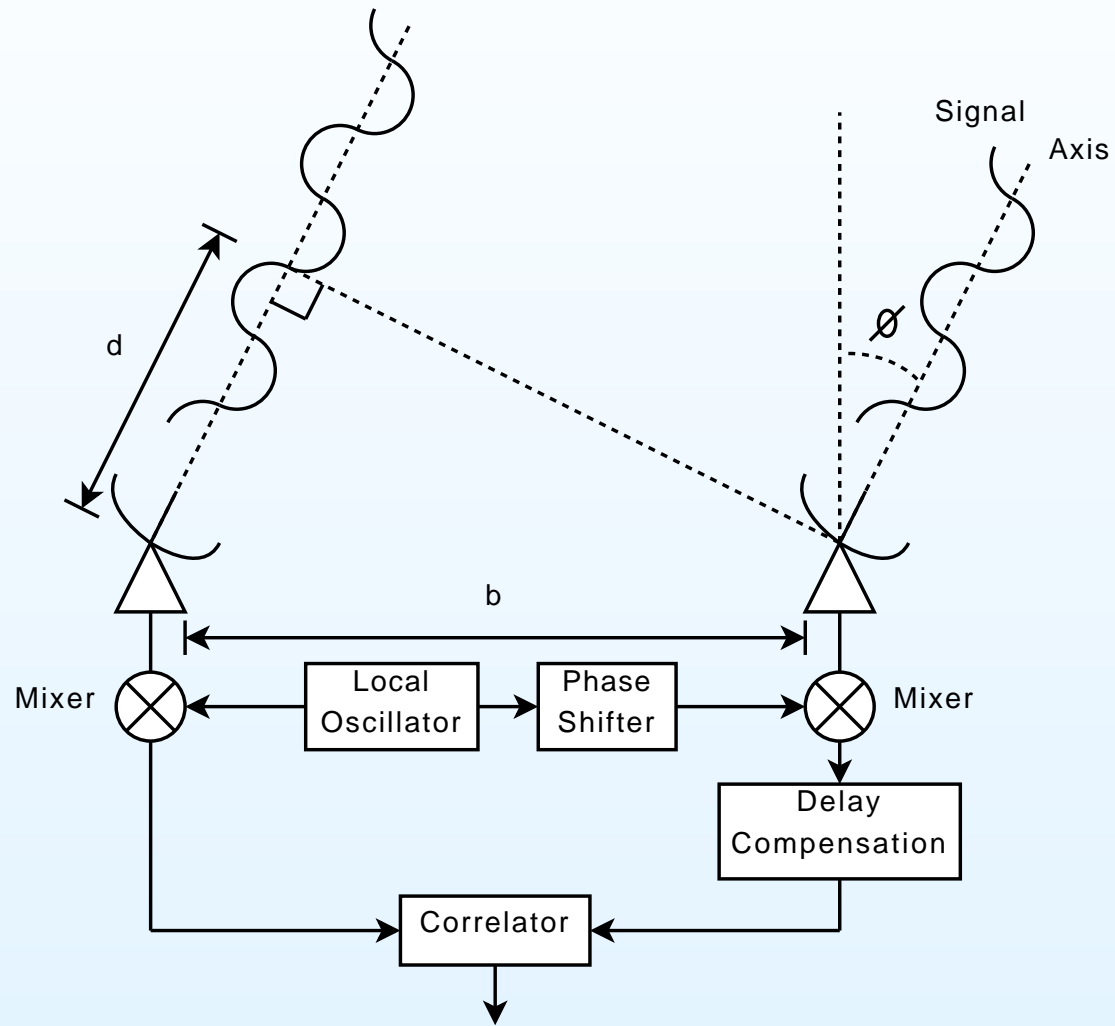
Western Australian Radio Astronomy Centre of Excellence

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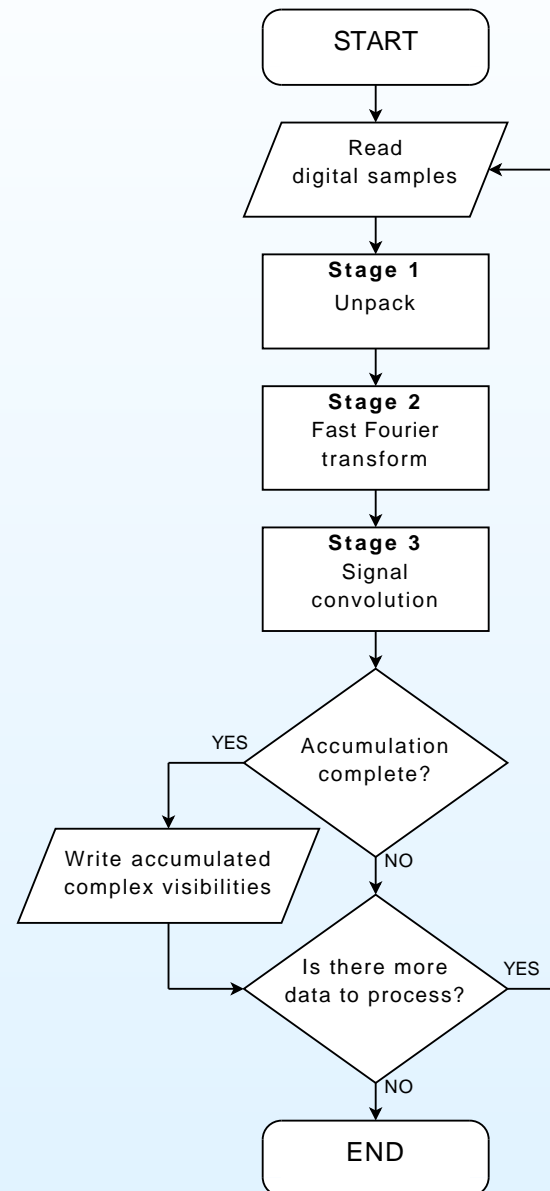
Radio astronomy

- Radio astronomy is a subfield of astronomy that studies celestial objects at radio frequencies
- Observable radio frequencies range from 15MHz to 1.5THz
- A unique view of the universe
- Radio waves are observed using radio telescopes

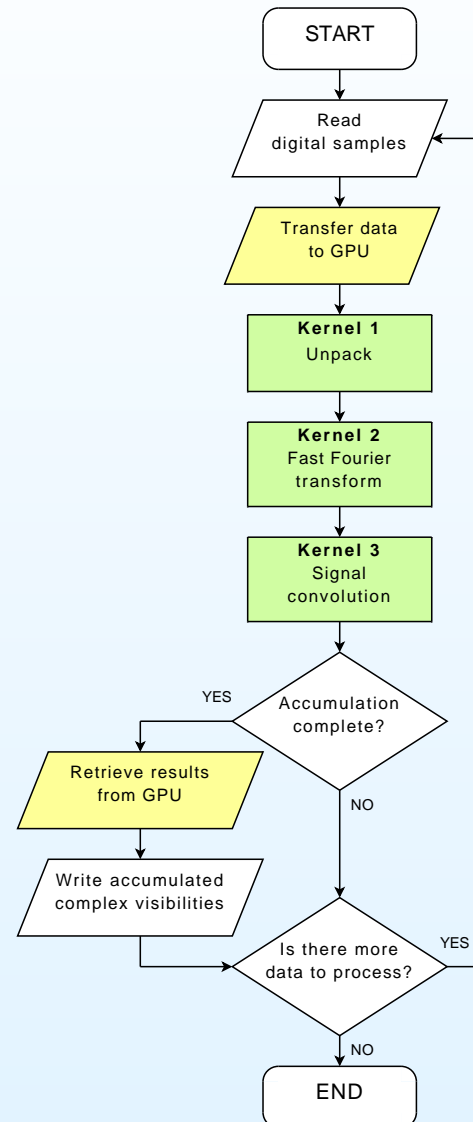
Radio interferometer



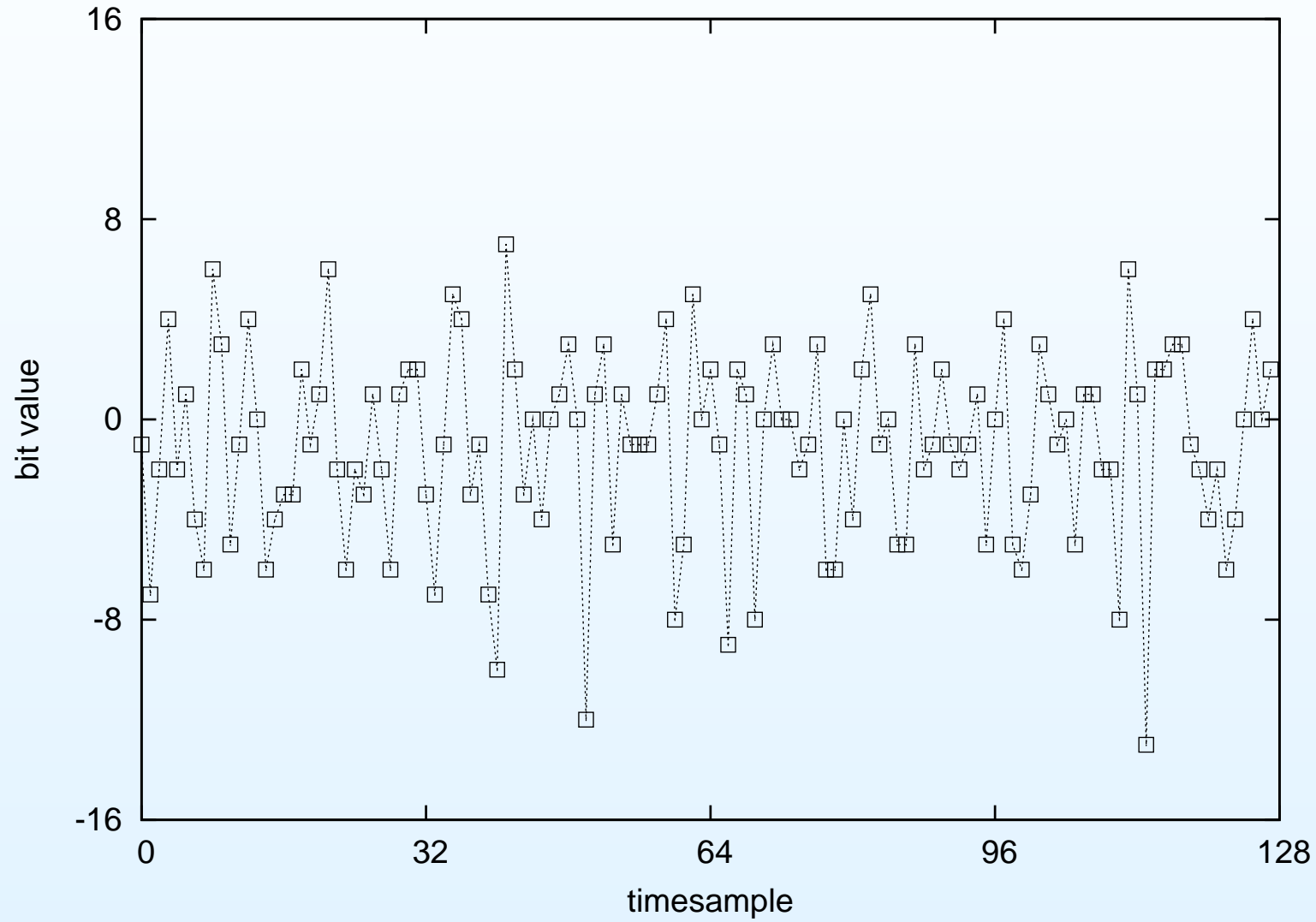
Correlation algorithm



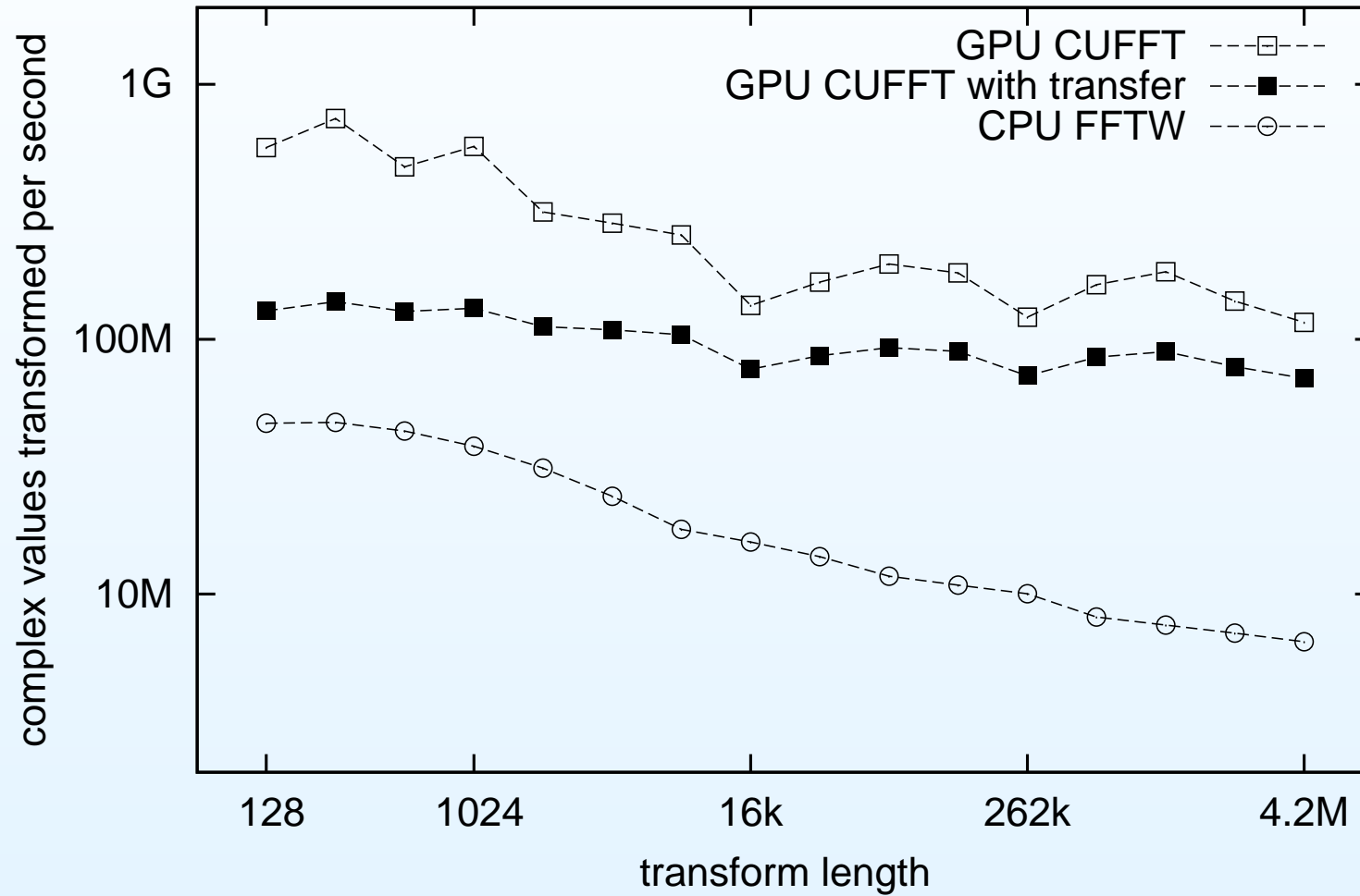
GPU correlation algorithm



Unpack kernel

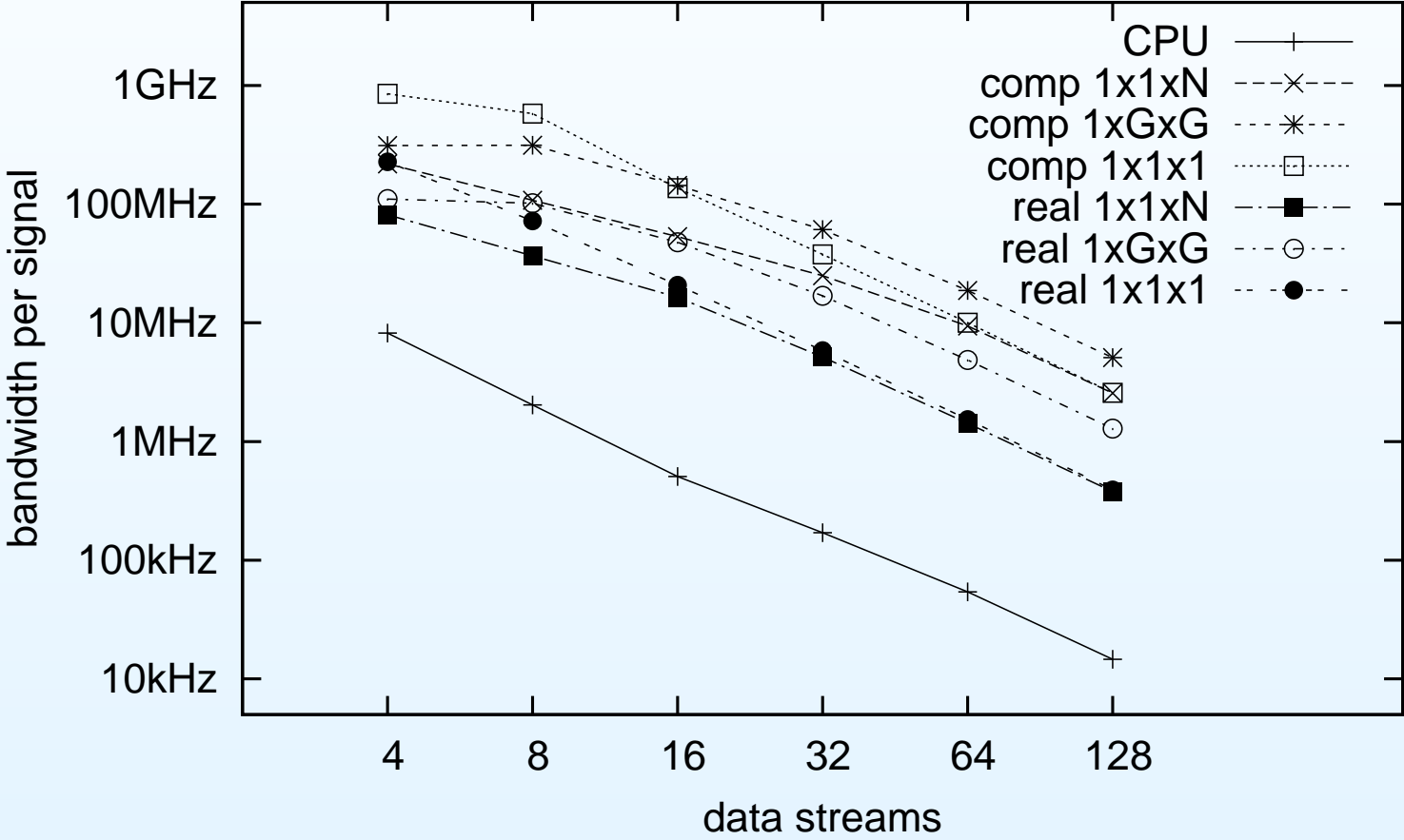


Fast Fourier transform kernel

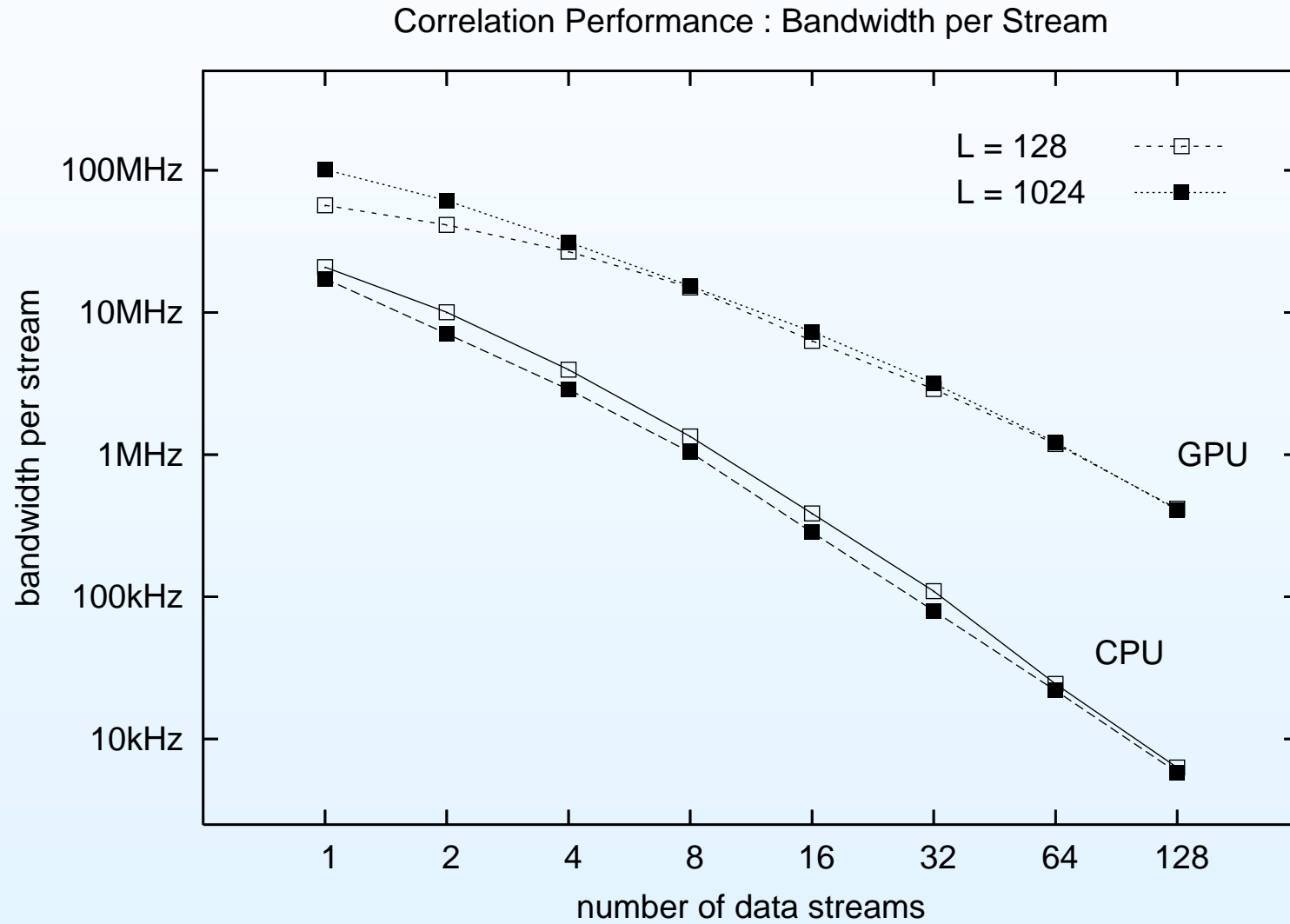


Convolution kernel

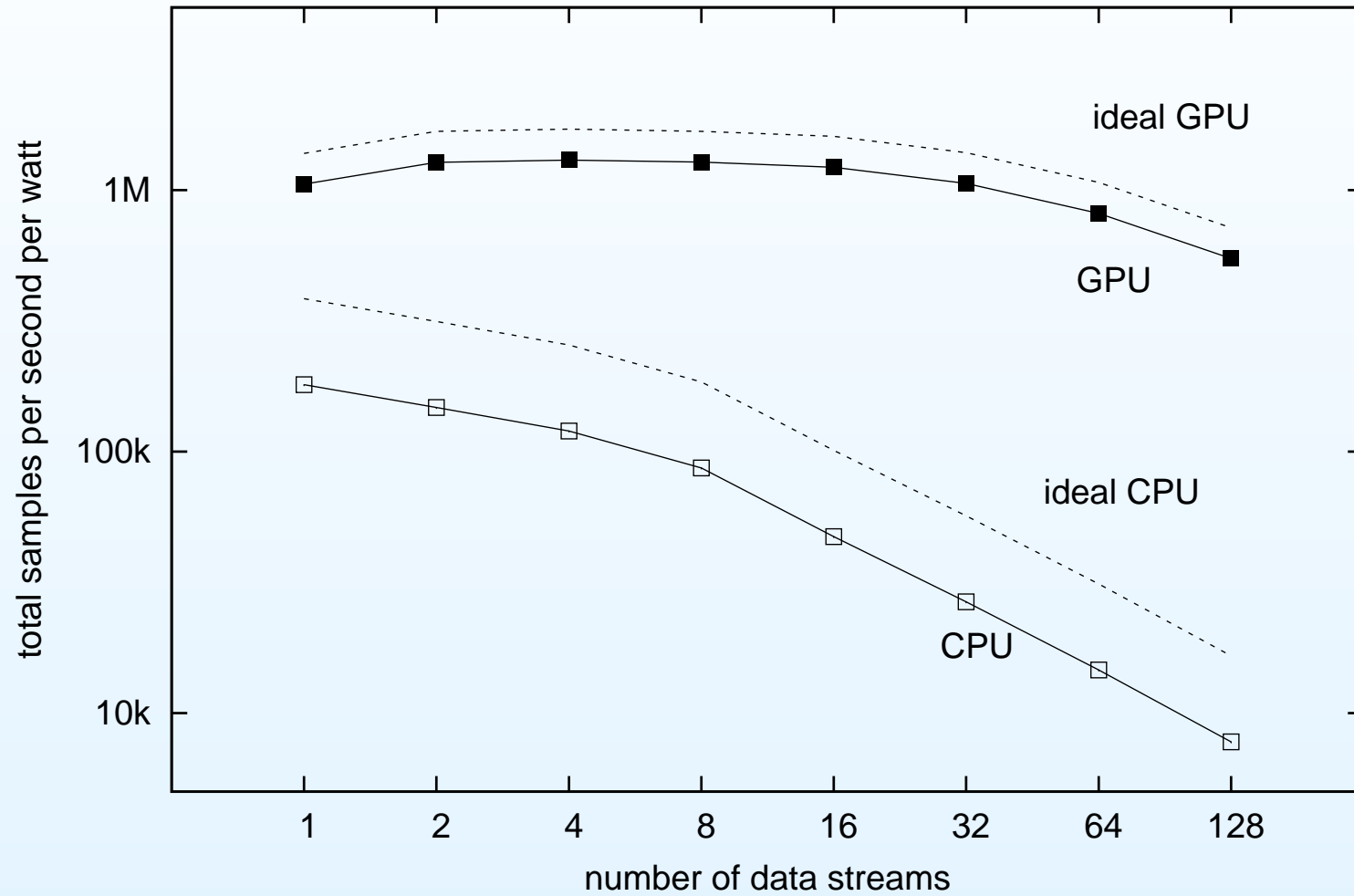
Performance of methods for L=128 input transforms



Real-time performance per stream

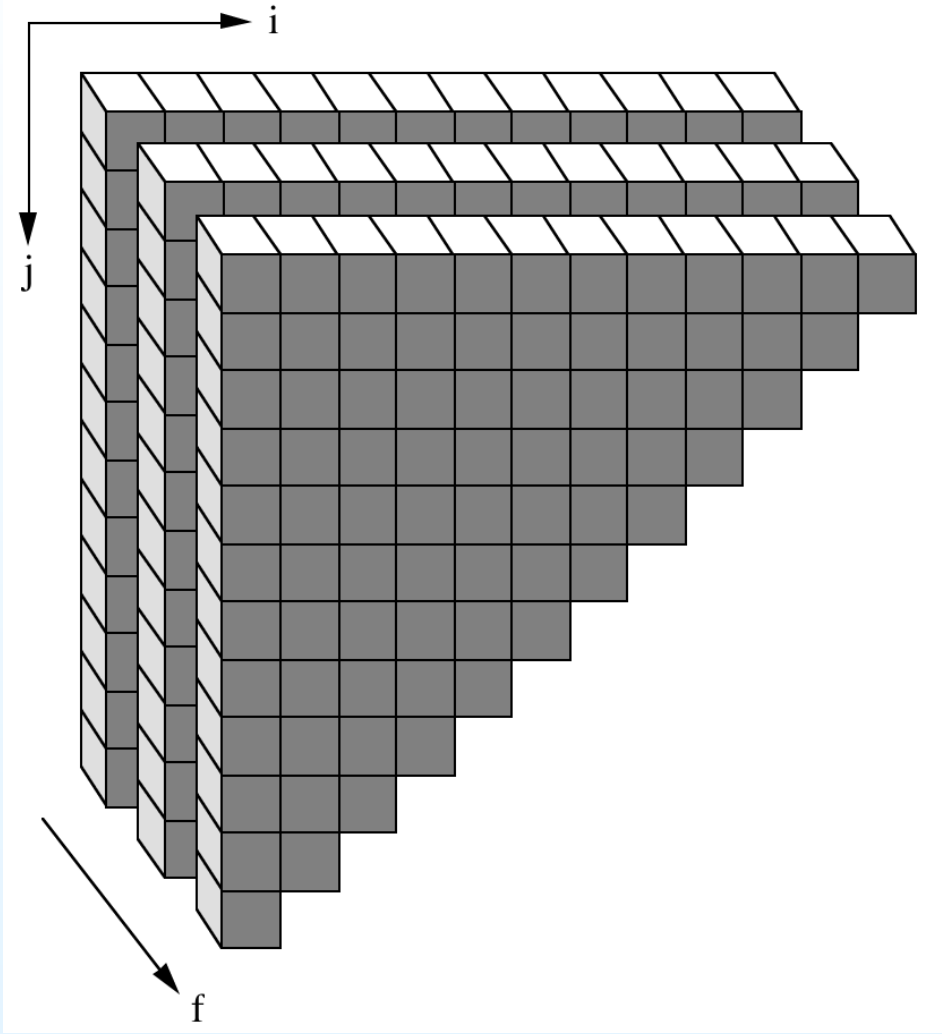


Power efficiency

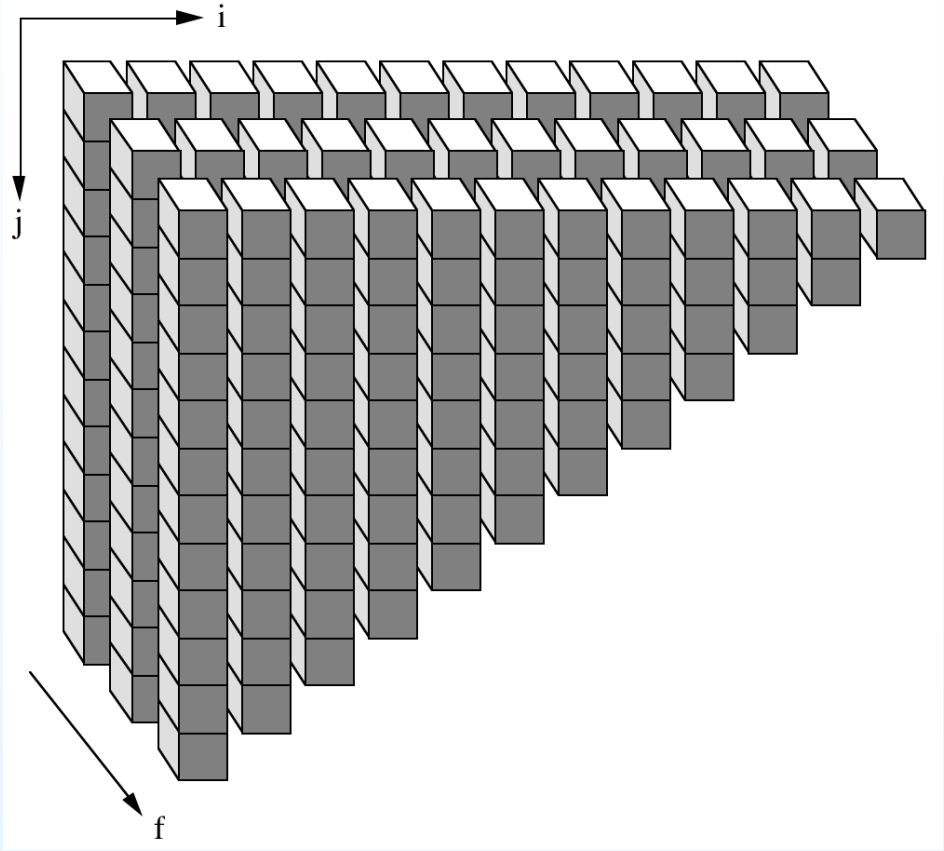




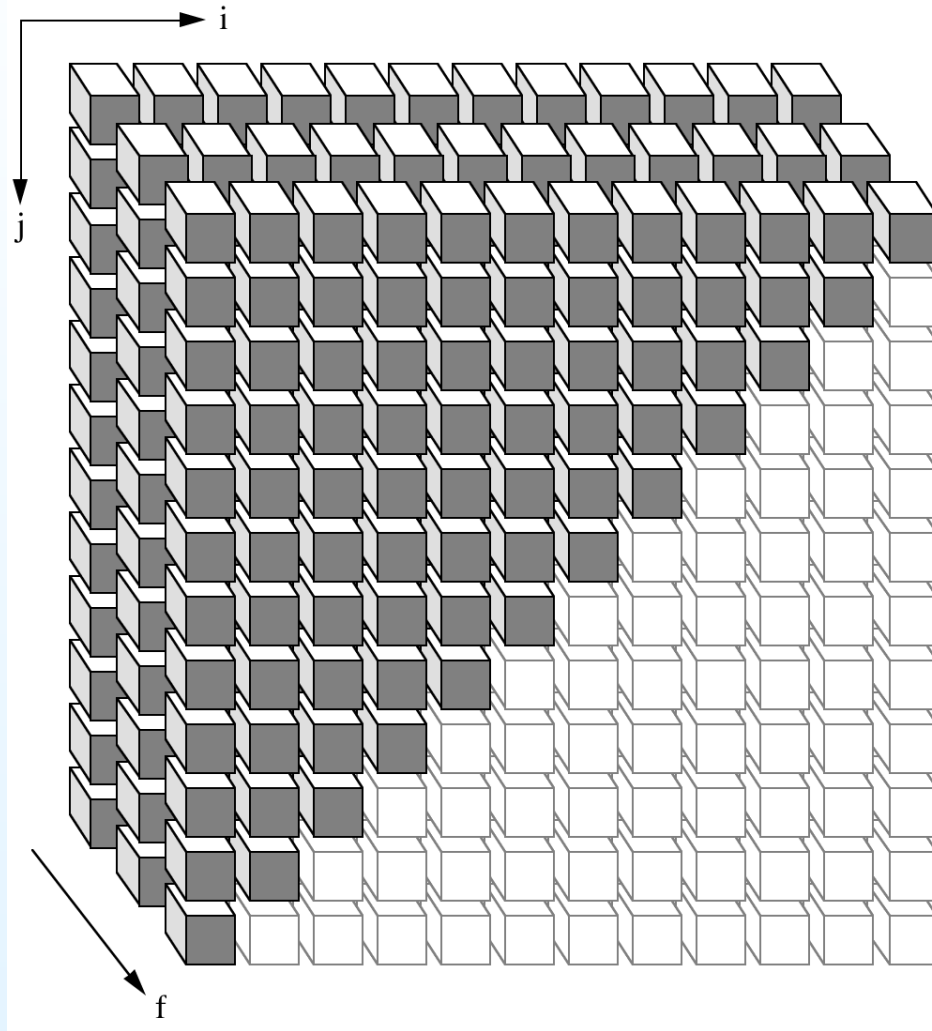
Convolution Stage Approach: parallel by frequency



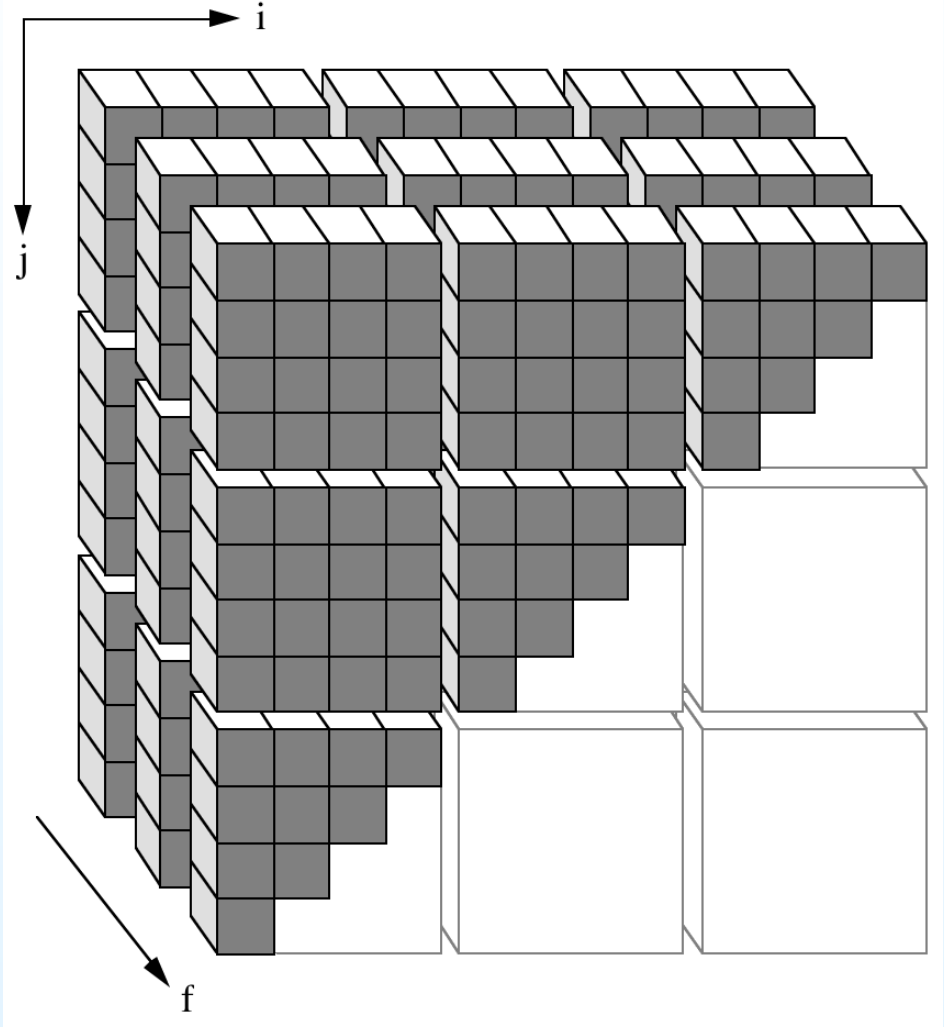
Convolution Stage Approach: parallel by stream



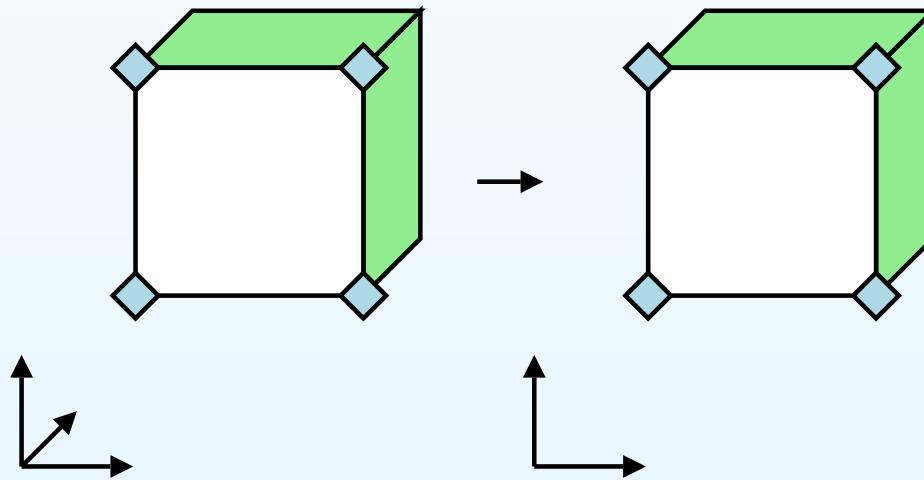
Convolution Stage Approach: parallel by pair



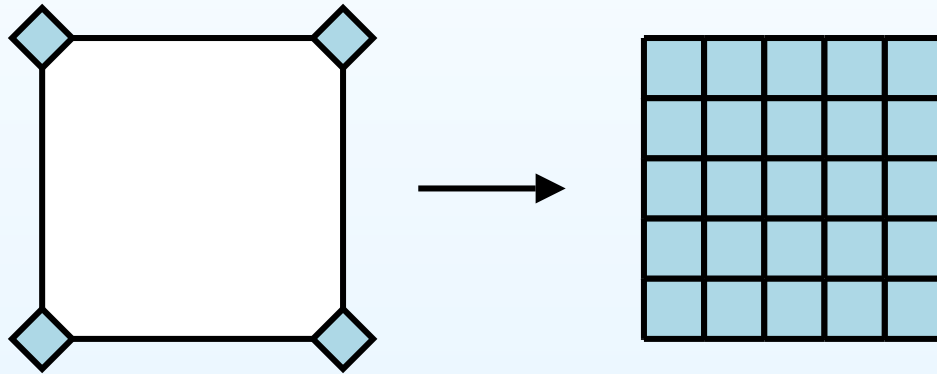
Convolution Stage Approach: parallel by groups



Graphics Pipeline: Vertex Processor



Graphics Pipeline: Rasterisation



Graphics Pipeline: Fragment Processor

