

FPGA coprocessors for acceleration of shape algorithms in hybrid VPX HPEC systems





- IC part of a R&D program with the EBO University in Brittany for shape recognition algos running in FPGAs
- First part of the program was about developing new innovative implementations in FPGA of Fast Fourier Transform (FFT) and Discrete Cosine Transform (DCT) leading to :
 - Reduction in execution time
 - Decrease of the FPGA resources

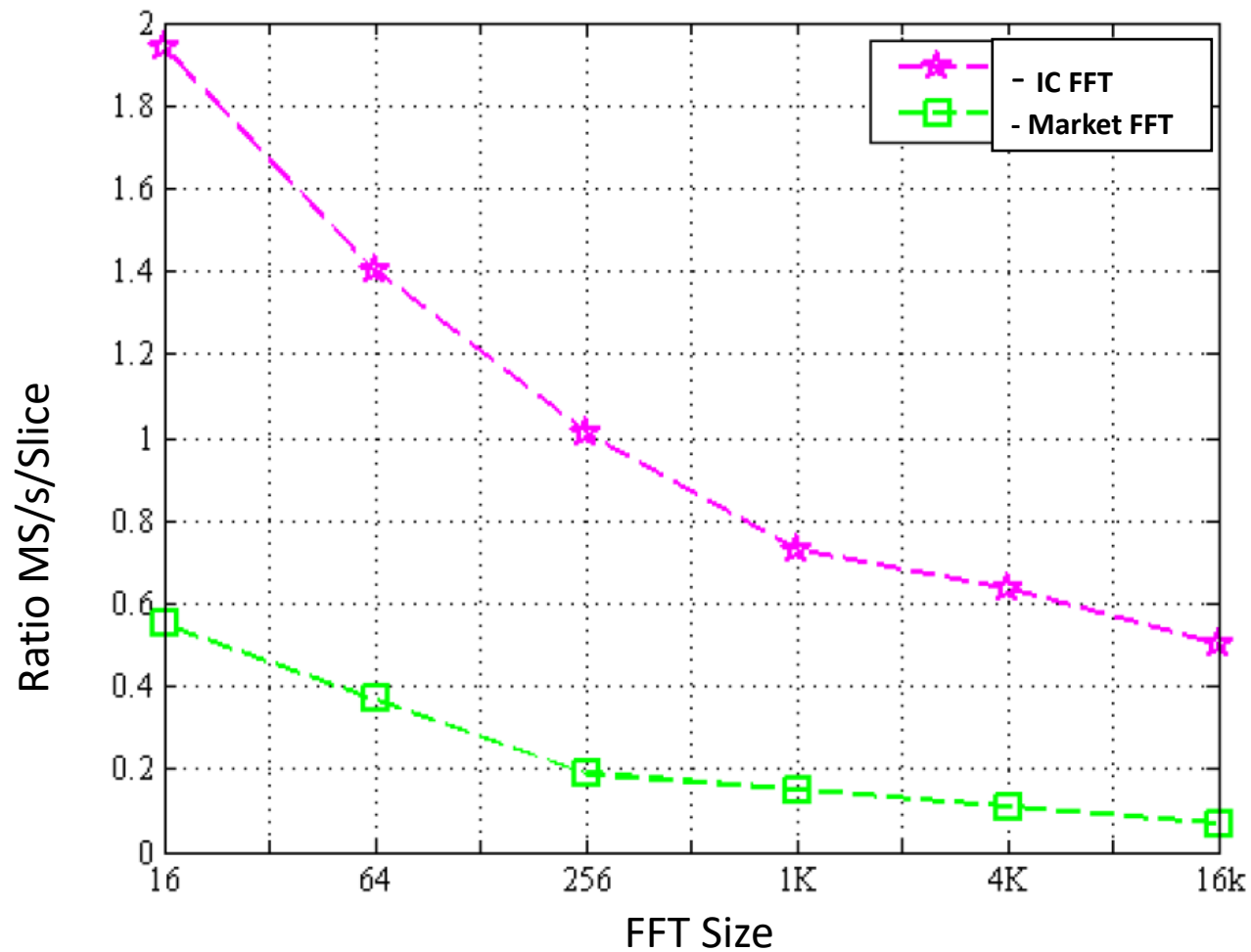


Shape Recognition FFT Performances

- Achievement in improving FFT performances compared to the IP on the market:
 - Improvement by a factor of 5 of the ratio throughput versus the number of slices for a 256 FFT
 - Improvement by a factor of 4 of the ratio throughput versus the number of slices for a 16K FFT
- Power for execution in a continuous mode of:
 - 1024 points FFT in a Virtex-6 FPGA: 100 mW
 - 4096 points FFT: 150 mW
 - 64 points FFT: 50 mW.



Shape Recognition FFT Performances





Shape Recognition Algorithm

- Second part of the program consisted in using the improved FFT and build a high speed shape recognition algorithm
- Base of the Shape Recognition Algorithm:
 - Processing of a digital correlation between a target image and a reference image.
 - This correlation is carried out:
 - By multiplying the spectrums of the target image and the reference image (using a 2D FFT to get the spectrums of the images),
 - Then taking the inverse 2D FFT of the result.
 - Energy of the correlation peak normalized to the total energy of the correlation plan



Shape Recognition Algorithm

- Achievements:
 - One XC7VX690T can simultaneously support around 30 correlation architectures described above, each correlation architecture being able to process around 4,000 images per second.
 - One XC7VX690T can process and decide on 120,000 images per second.
 - A VPX HPEC system with 5 dual Virtex-7 boards IC-FEP-VPX6b, each one connected to two 12 x 10GbE optical FMC IC-OPT-FMCA can process 1.2 Mega images per second





Last generation of FPGAs



Example with the VU13P UltraScale+:

- 3.5 Million of logic cells (Factor of 5 compared to XC7VX690T and up to 12 K DSP enhanced slices-factor of 4)
- 128 32.25 Gb/s transceivers and multi terabit per second throughput
- Integrated 100GE MAC blocks and PCIe Gen3 cores
- Advanced clock management, distributed clock buffers allowing the processing of massive parallel applications with high width buses (typically 2048 bits)
- IC is currently designing new Ultrascale+ COTS boards to take benefit from these outstanding performances (IC-FEP-VPX6d/e)



IC-OPT-FMCa in partnership with Reflex Photonics

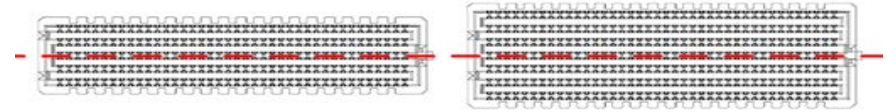
• IC-OPT-FMCa supports the 2 FMC connectors:

• VITA57.1 FMC HPC

10 full duplex optical link at up to 28Gbps each max

• VITA 57.4 FMC HSPC

12 full duplex optical link at 28Gbps each max



		Carrier	
		VITA 57.1	VITA 57.4
F M C	VITA 57.1	Compatible	Compatible
	VITA 57.4	N/A	Compatible

