LHC Beam Loss Monitor Threshold Comparator

Design Considerations

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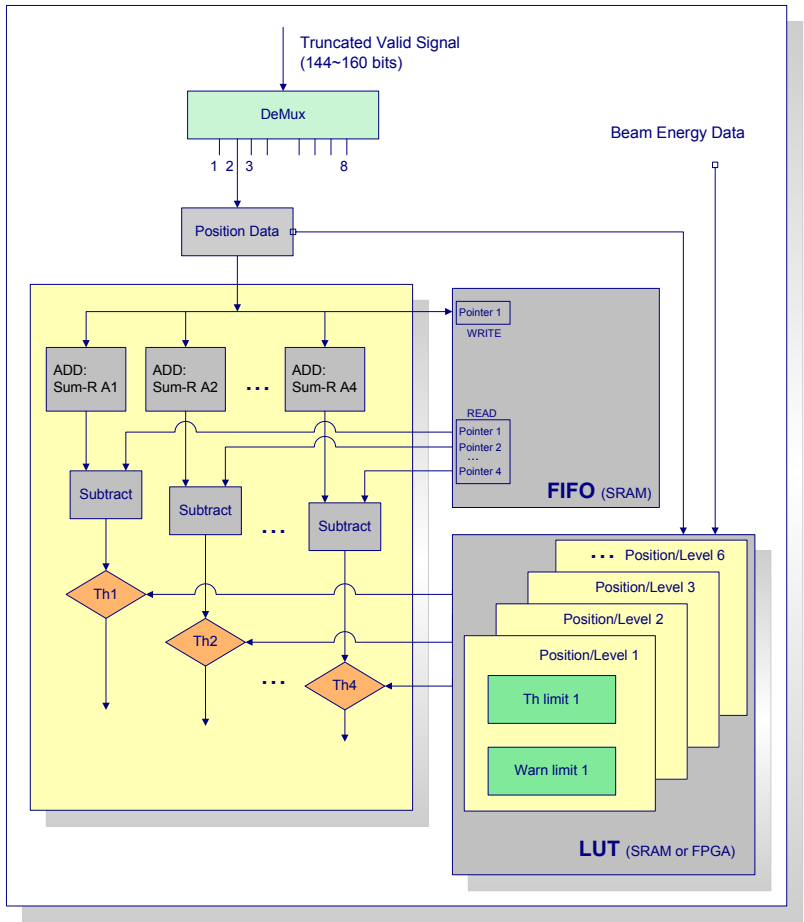
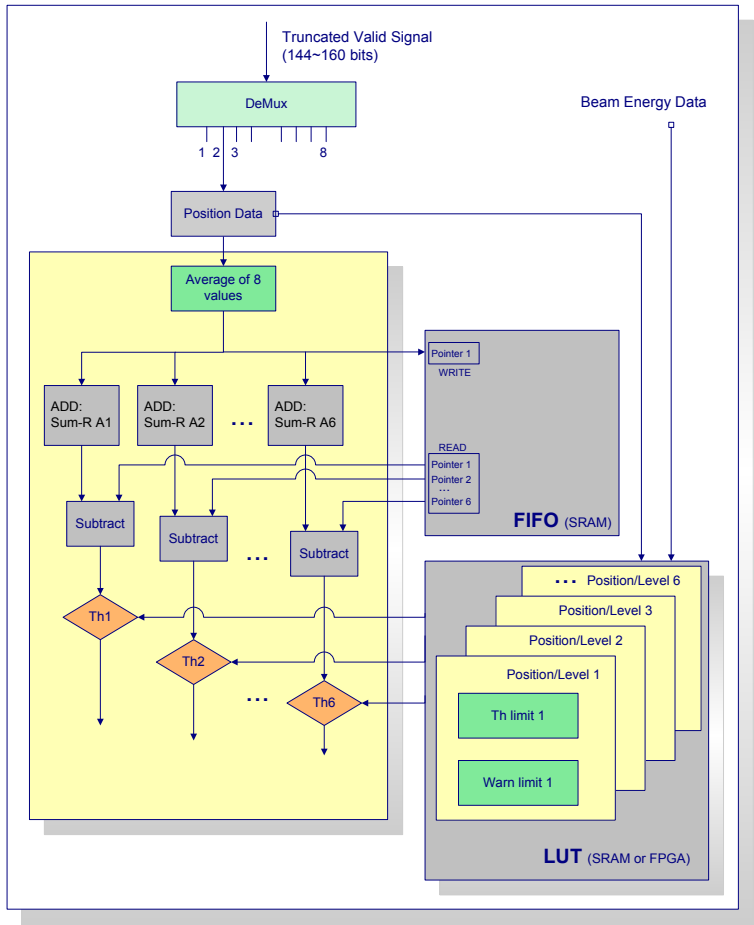
Two Parallel TC Systems



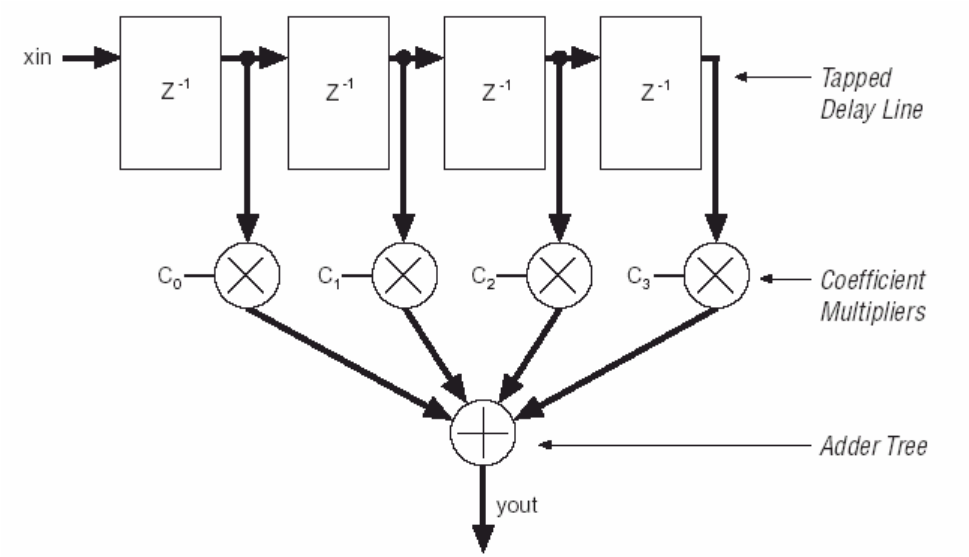
- 40µs – 10ms (step of 40µs)
- 250 values (total 4,000 values)
- 4 time windows



- 10ms – 100s (step of 320µs)
- 312,500 values (total 5,000,000 values)
- 6 time windows

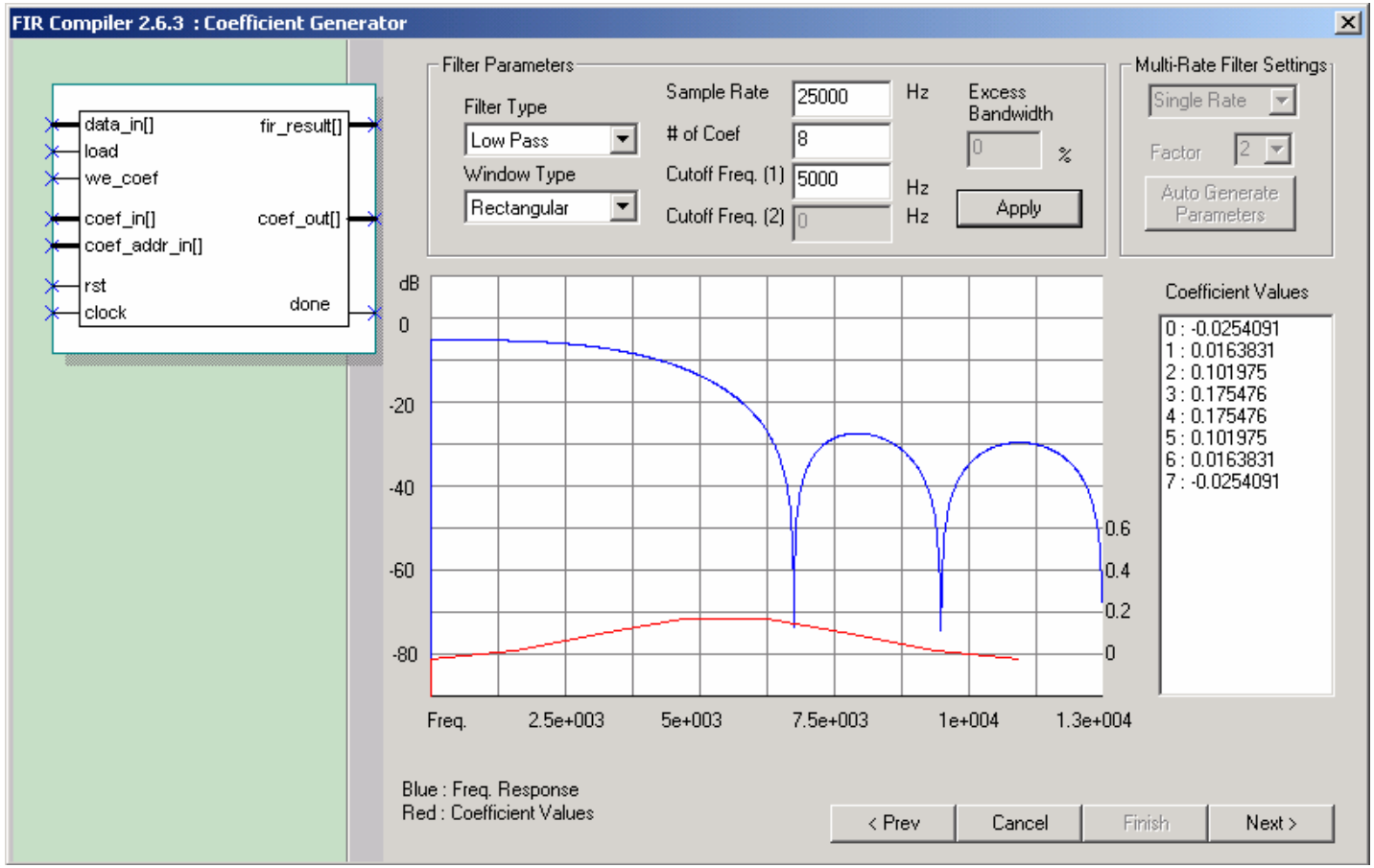
Averaging Over 8 Values

- **The 8 value average can be easily done by using a digital Low-Pass filter**
- **In a single DSP block a 9-bit 8-tap FIR filter is possible**
- **The EP1S20 has 10 DSP blocks available.**
- **The coefficient values can be created and analysed either by MATLAB or by QUARTUS II**



Basic FIR Filter

FIR Compiler



- If $c_n = 0.125$ then the output value will be an average of the 8 values
- By changing the coefficient values other types of averages can be made

Memory Requirements

Time	Memory for 16 Ionisation Chambers	
	Complete	Averaged*
100 s	39062 KB	4768.37 KB
1 ms	400 Bytes	50 Bytes
40 μs	16 Bytes	2 Bytes
*Every 8 incoming values an averaged one is kept		

SRAM* usage for 100s Data	Memory for 16 Ionisation Chambers	
	Complete	Averaged
(%)	*476.84*	*58.21*
*Using one of the **2048Kbx36b memory chip**		

	Time	Memory per Ionisation Chamber	Memory for 16 Ionisation Chambers
Complete	(up to) 10 ms	250 Bytes	4000 Bytes
Averaged	(up to) 100 s	312500 Bytes	5000000 Bytes
Total		**312750 Bytes**	**5004000 Bytes (=4.77 MB)**

Universal Table (LUT for *Th* & *W*)

The values needed to approximate both 3D LUTs that hold the *Th* & W levels are:

2(*Th* & *W*) x 6(Position Levels) x 8(Energy Levels) x 10(TimeWindows) = 960 values

Advantages of a universal table:

- **One table for all monitors**
- **Can thoroughly be prepared and checked before it is uploaded.**
- **Quick and easy upgraded on all systems when it is needed.**
- **Less computation in each system. Read vs. Calculated (Note that 10*16*2 = 320 comparisons on each card)**
- **Small enough to be kept internally on an M-RAM block (4Kx144bits).**