

MILO VERMEULEN — 2-10-2017

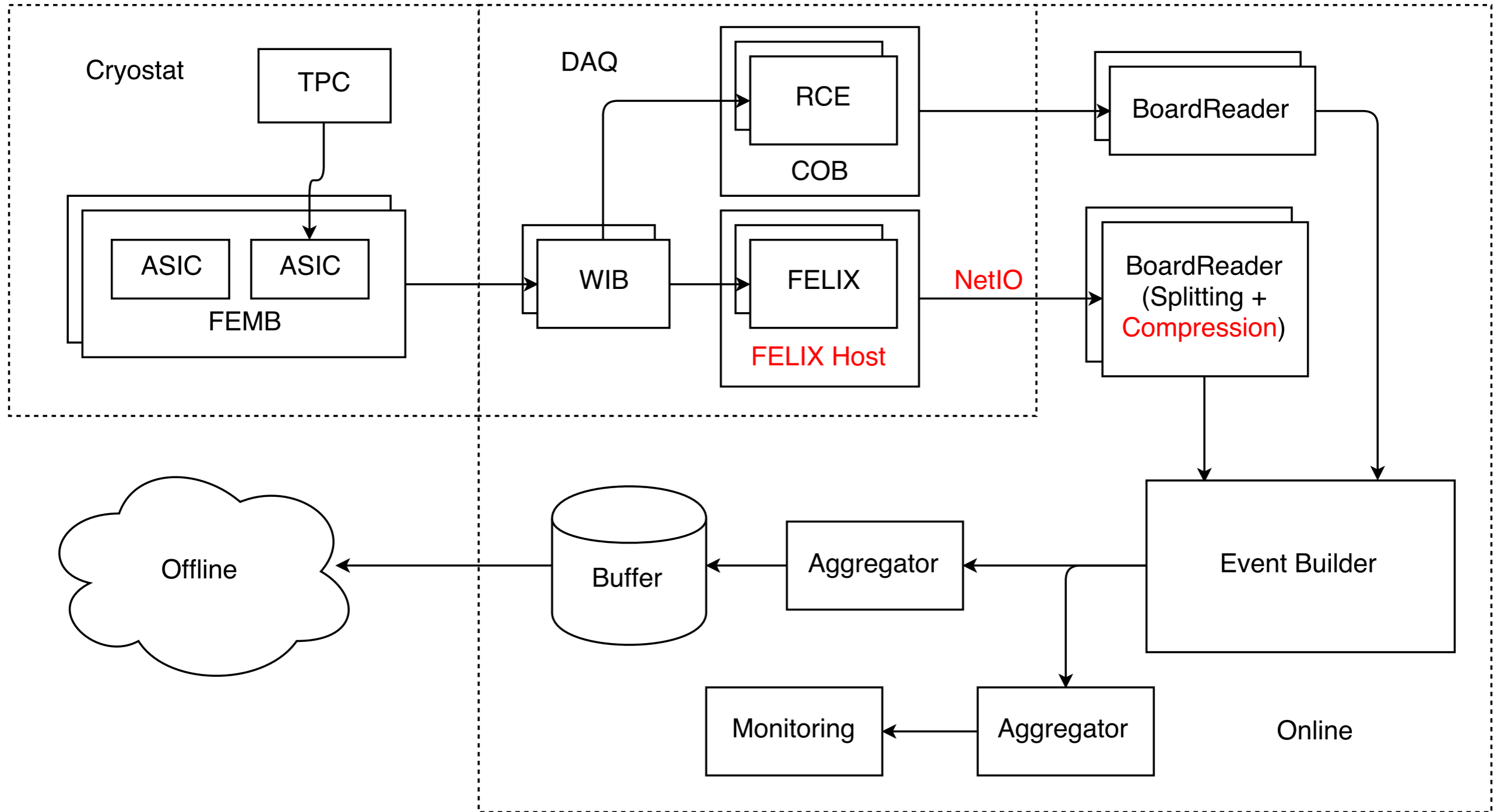
---

# COMPRESSION STUDIES SUMMARY

# GOALS

- ▶ Compress FELIX frames
  - ▶ Achieve a compression factor of 4
  - ▶ Be fast enough in (de)compression

# ProtoDUNE DAQ-chain



## Data format 1.0-rc1 as 32-bit words

Word	X	Y	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0		
1	1	0	Reserved (8)								SlotNo				CrateNo				FiberNo				Version = 1 [2]				K28.5 [1]									
2	1	1	WIB Errors (details <i>t.b.d.</i> )																Reserved (16)																WIB Header	
3	1	1	Timestamp [31:0]																																	
4	1	1	Z	Timestamp [62:48] or WIB counter [3]																Timestamp [47:32]																
5	1	1	Checksum_B[7:0]								Checksum_A[7:0]								Reserved								S2_Err <sup>C</sup>				S1_Err <sup>C</sup>					
	1	1																																	COLDATA 1 (28 Words)	
	1	1	...																																	
33	1	1	Checksum_B[7:0]								Checksum_A[7:0]								Reserved								S2_Err <sup>C</sup>				S1_Err <sup>C</sup>					
	1	1																																	COLDATA 2 (28 Words)	
	1	1	...																																	
61	1	1	Checksum_B[7:0]								Checksum_A[7:0]								Reserved								S2_Err <sup>C</sup>				S1_Err <sup>C</sup>					
	1	1																																	COLDATA 3 (28 Words) [4]	
	1	1	...																																	
89	1	1	Checksum_B[7:0]								Checksum_A[7:0]								Reserved								S2_Err <sup>C</sup>				S1_Err <sup>C</sup>					
	1	1																																	COLDATA 4 (28 Words) [4]	
	1	1	...																																	
117	0	1	CRC-32																																WIB Trailer	
118	0	0	IDLE (filled by FELIX firmware)																																Idle	
119	0	0	IDLE (filled by FELIX firmware)																																	
120	0	0	IDLE (filled by FELIX firmware)																																	

## NOTES:

1. First byte in stream is K28.5 for RCE, undefined for FELIX
2. Format version currently = 1. This specifies a header size of 4 words and a fragment size of 117
3. Bits [30:16] of word 3 may be either the upper 8 bits of the timestamp or a WIB debug counter  
Bit 31 ('Z') of word 3 = '0' for full timestamp mode (63 bit timestamp) or '1' for WIB counter mode
4. Second two COLDATA blocks omitted in RCE format when running at 5 Gbps

---

## FRAME GENERATOR

- ▶ ProtoDUNE doesn't exist yet
- ▶ Put reasonable but random numbers into frame format
  - ▶ Compression highly dependent on noise level
  - ▶ Simulated data more desirable
- ▶ Upside: familiarity with frame format

---

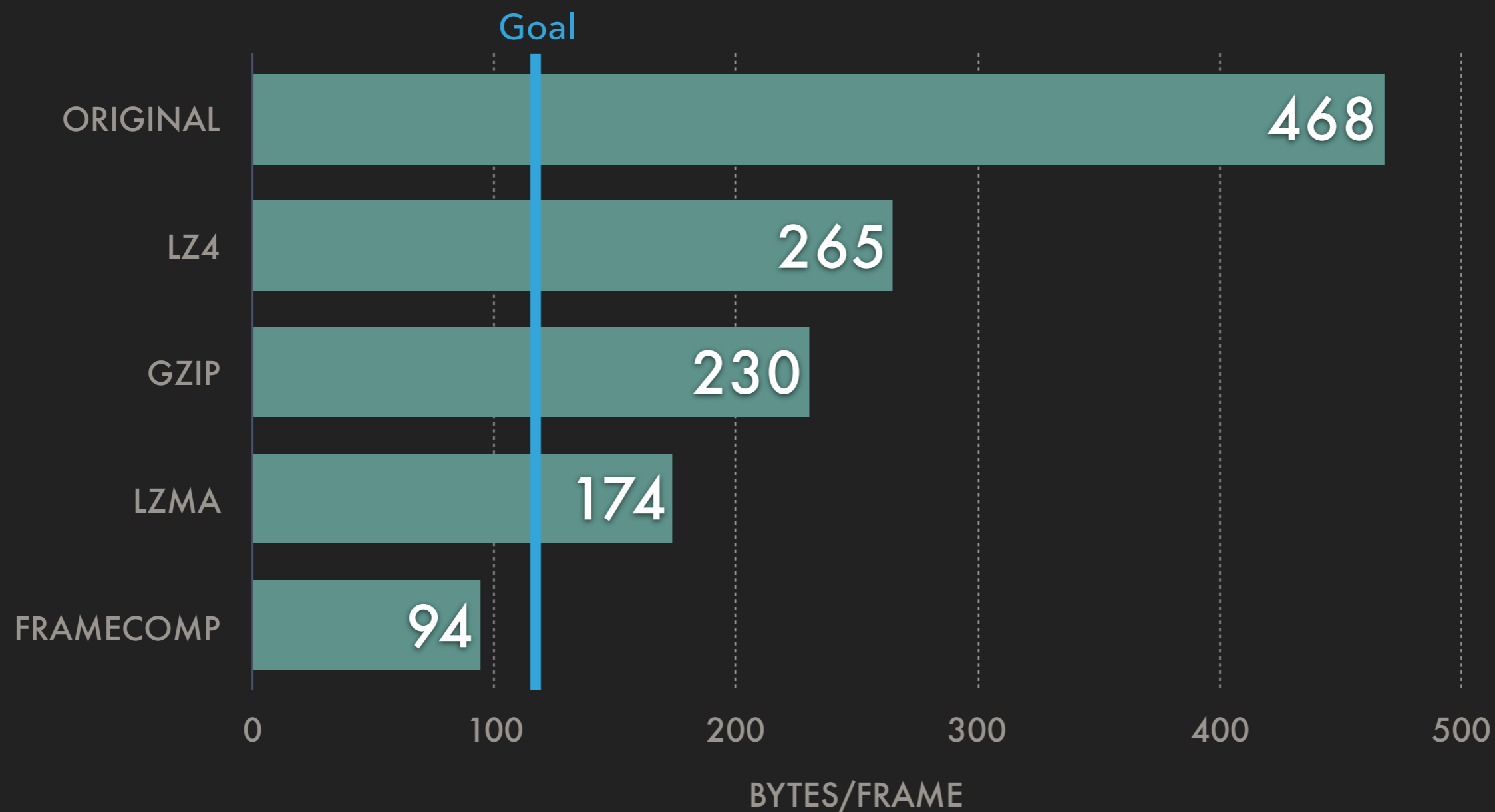
## FRAME COMPRESSOR PLAN

- ▶ Convert raw ADC values to differences between frames
  - ▶ Exploit waveform continuity
- ▶ Use Huffman compression
  - ▶ Denote more frequent values with shorter bit-strings

## RESULTS SO FAR

- ▶ Compression factor ~ 5
  - ▶ Heavily dependent on noise
  - ▶ Error fields and checksums guessed to best of ability
  - ▶ First WIB frames are just coming in
- ▶ Compression is much too slow
  - ▶ Not optimised at all

# COMPARISON BETWEEN COMPRESSION ALGORITHMS





---

## FUTURE PLANS

- ▶ Make it faster
  - ▶ Develop standardised benchmarks
- ▶ Integrate with test runs
- ▶ Do it fast
- ▶ Repo at <https://github.com/MiVermeu/FrameComp>