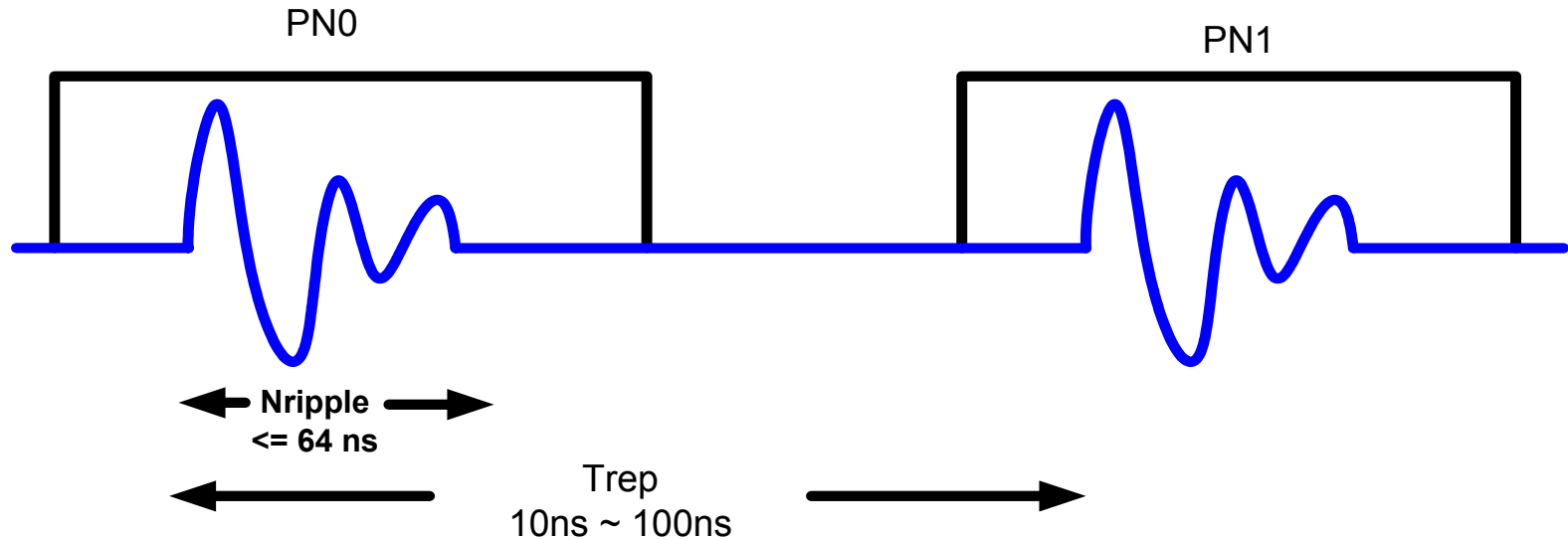
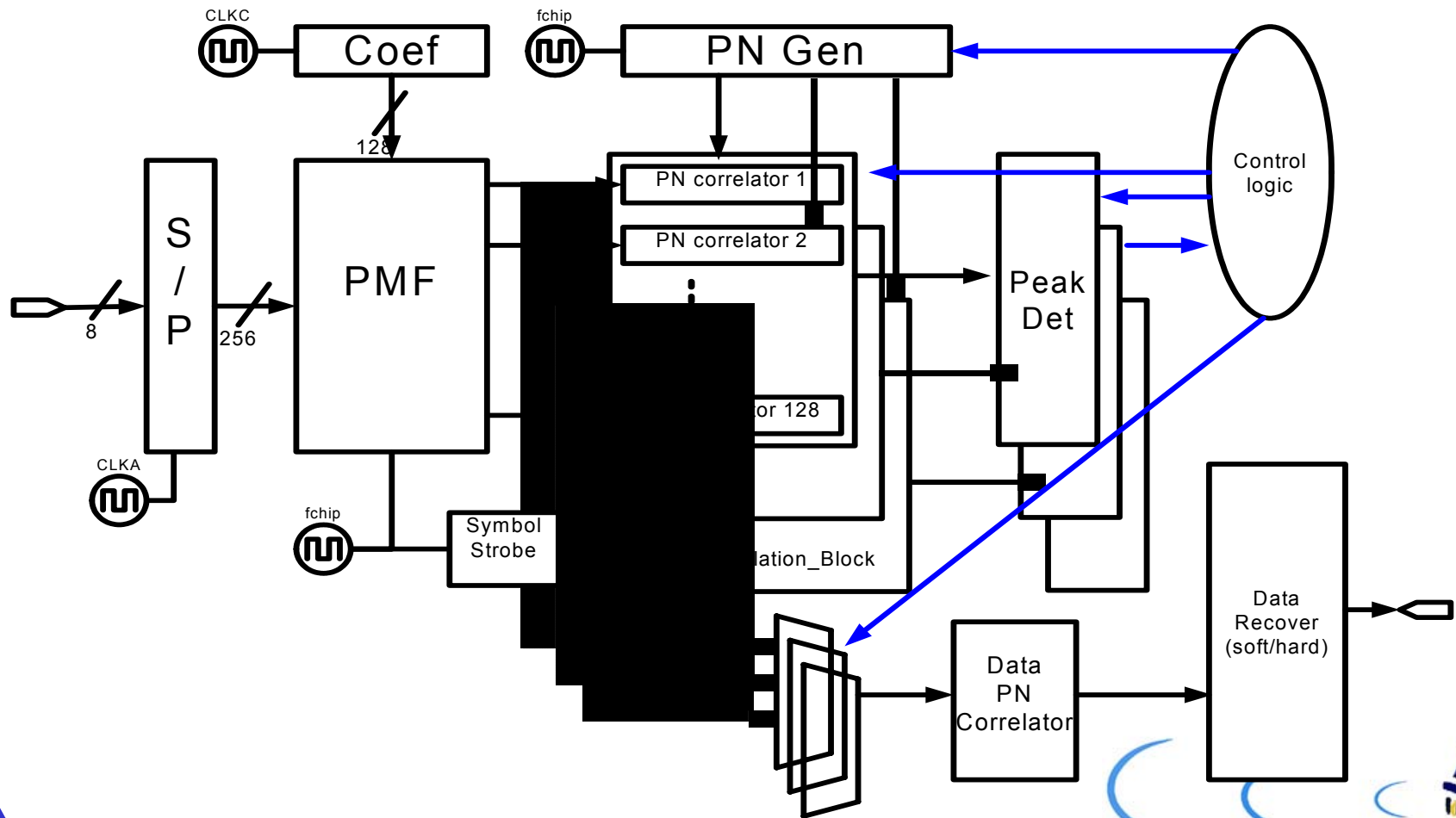


Specs for Baseband



- Pulse Repetition Rate: 100MHz to 1 MHz
- Maximum receivable Pulse ripple length (Nripple=Npulse+Nspread): $< 64\text{ns}$ (128 samples)
- Sampling rate: 2 GHz
- PN spreading is ranging from 1 to 1024 chips

Baseband Overview



Operation Modes

- *Acquisition mode:*

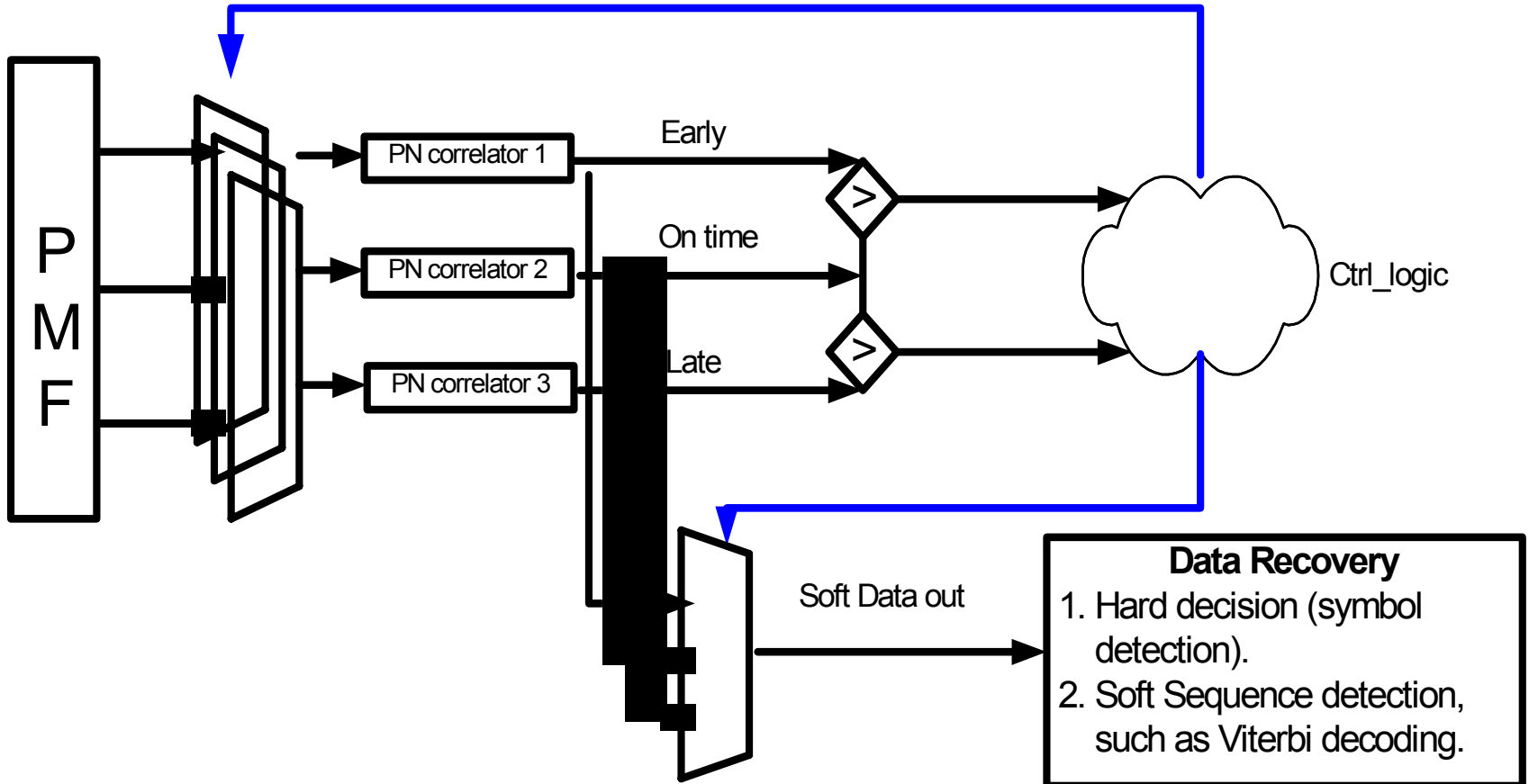
Receiver tries to lock the signal with a certain PN phase. The implementation uses a mixed mode of parallel and serial search, depends on the tradeoffs between hardware and acquisition time.

- *Tracking mode:*

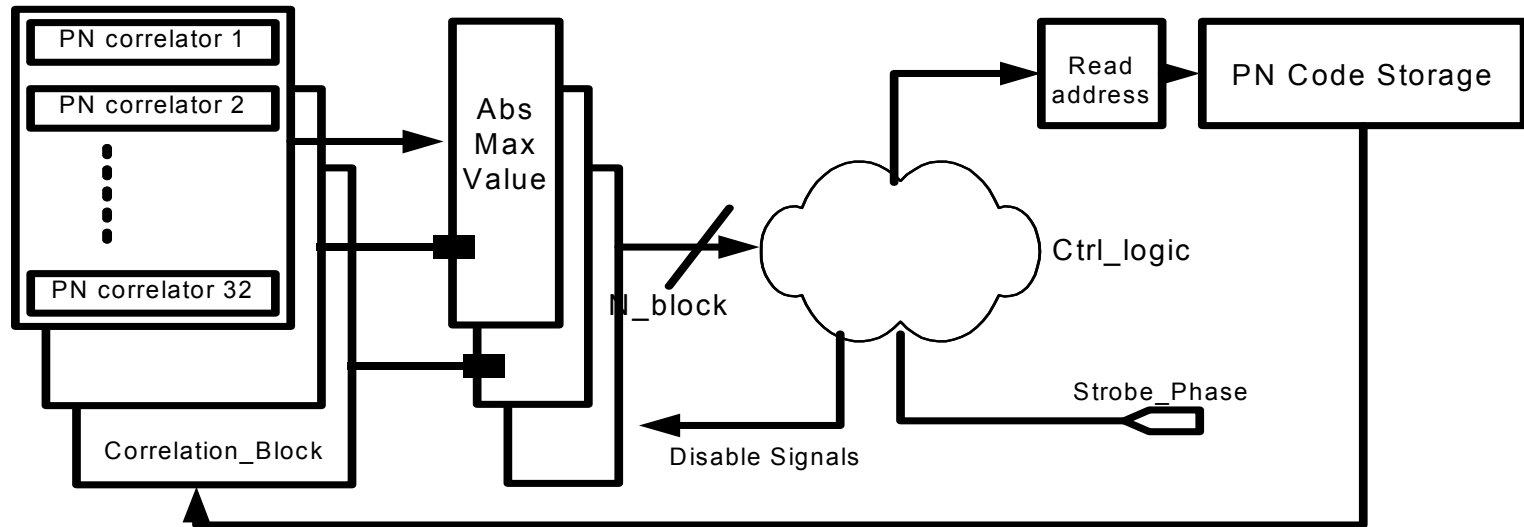
Track the sampling time error caused by the changing channel, sampling clock offset between transmitter and receiver. If the signal is moving toward the boundary of sampling window, it will feedback a control signal to front end to shift the sampling window. And we take the maximum signal to do data recovery.



Data Recovery

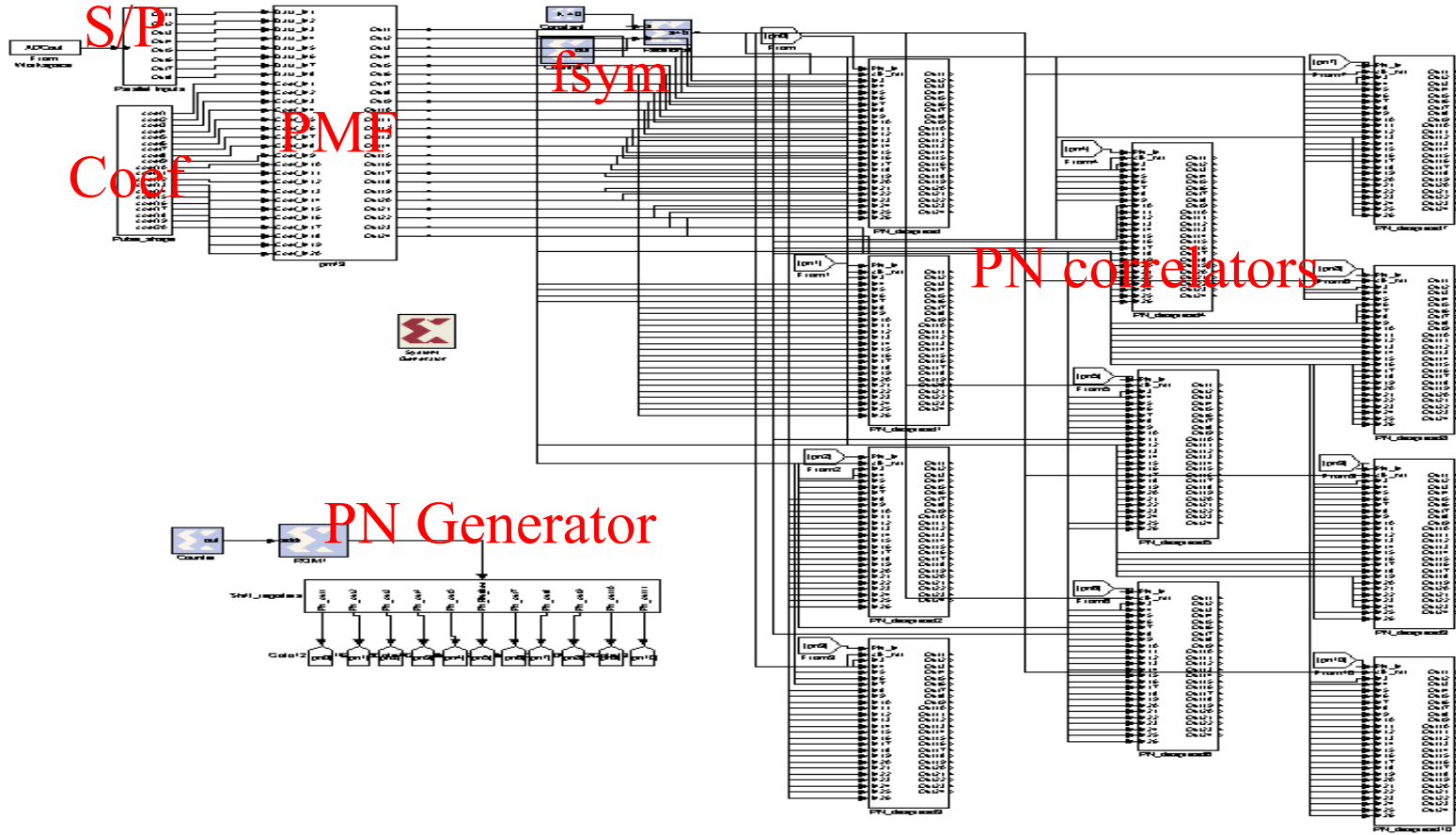


Control logic



- A reading clock to fetch the PN phase and a programmable PN length is needed.
- Strobe_phase signal is used to define the symbol boundary after entering tracking mode.
- An enable/disable control bus is needed for gated clock in PN correlators for power saving purpose.

Implementation in Xilinx



Processing Gain

- Input EbNo is -11dB. Results show 1024 chips is enough.
- (1) Acquisition mode, ~400 chips is enough for suppressing the acquisition error below $1e-3$.

Chips	Prob. of Miss lock	Prob. of False alarm	EbNo @ output
300	0.0037	0.0041	14.4245 dB
400	0.86e-3	1.3e-3	15.6643 dB

- (2) Data recovery mode, ~100 chips could achieve an uncoded bit error rate of $1e-3$.

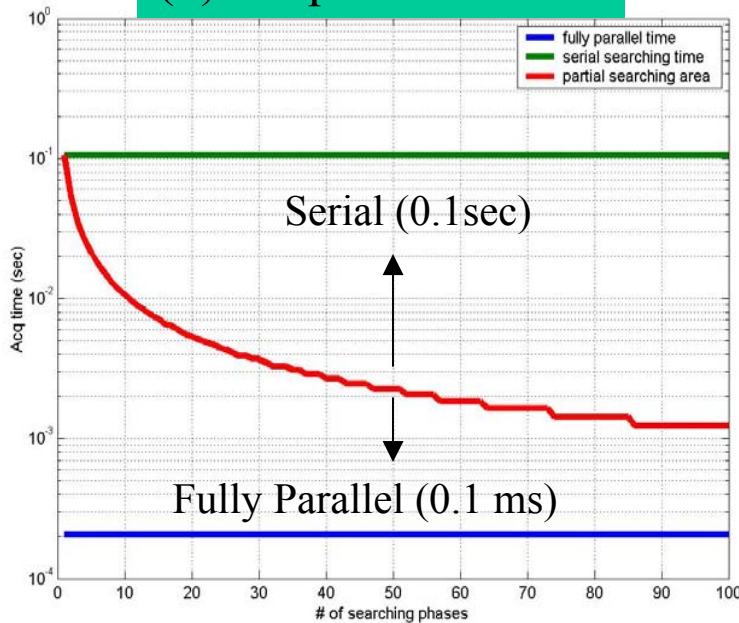
Chips	10	100	200
BER	0.1663	1.1e-3	2e-5



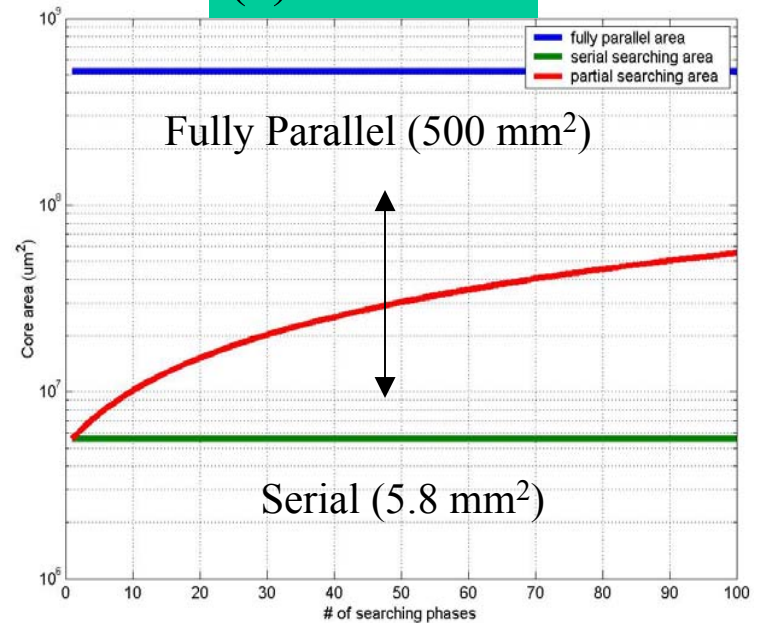
Parallel v.s. Serial Acquisition

- Assume the worst case using 1024 PN chips, while pulse rate is equal to 100 ns. We need to choose somewhere in between.

(1) Acquisition Time



(2) Area Cost



Area and power estimation

Block	Area (mm ²)
Pulse Matched Filter (256 inputs, 128 outputs)	4.951512
PN Generator (max 1024 chips)	0.232100
Peak detector Block (128 inputs)	2.880800
Data Recovery (Track 3 samples)	0.068600
Control Logic (state flow)	<0.001
PN correlators (contain 128 correlators)	2.469600
Total	10.614000

