SMR3562 “Project” Presentation

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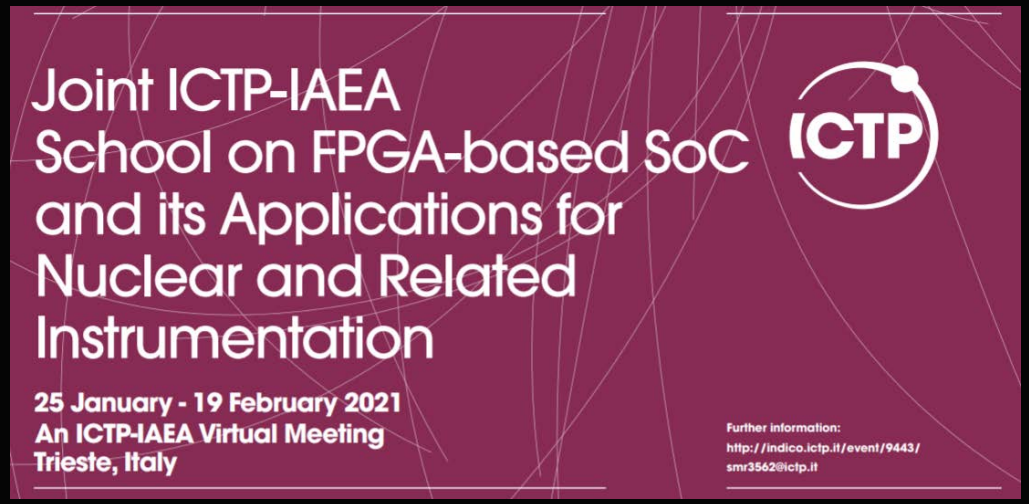


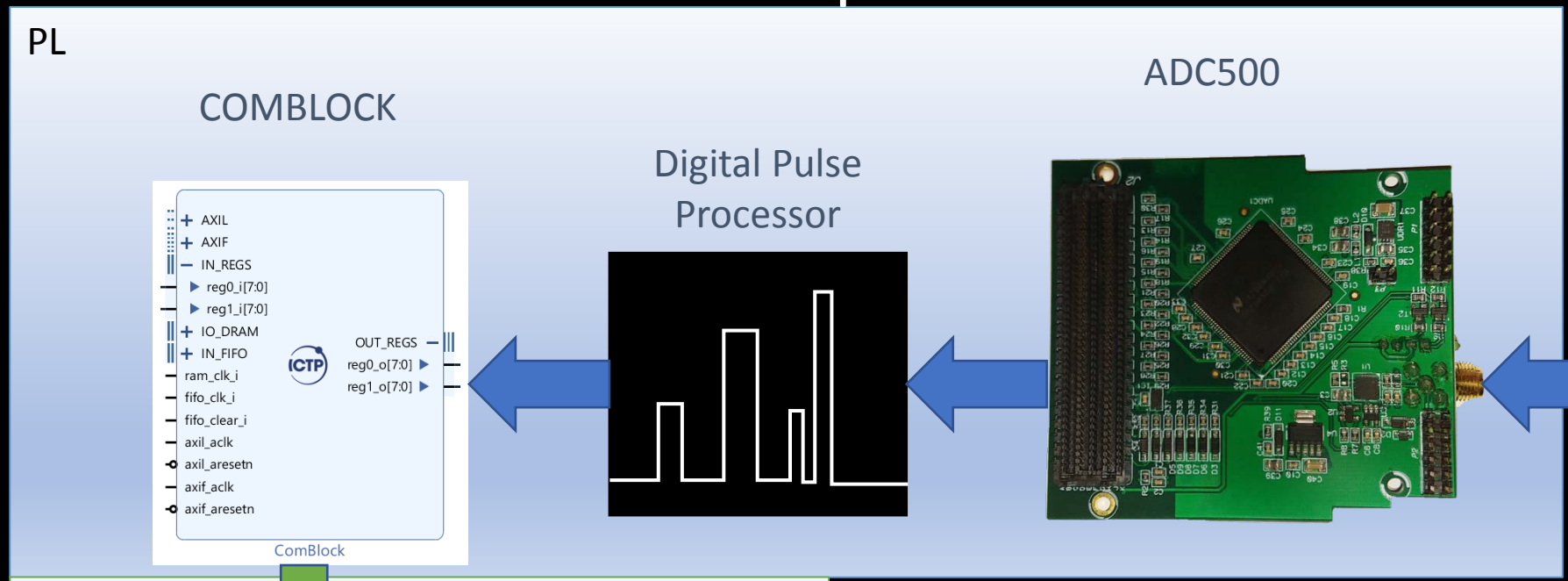
Outline

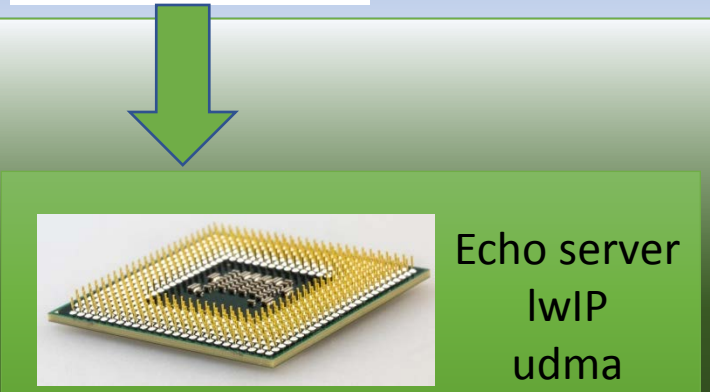
- Project Overview
- What I attempted Differently
- Project Challenges
- Challenges and Suggestions
- What REALLY worked in this workshop for me
- Experience gained
- Conclusion

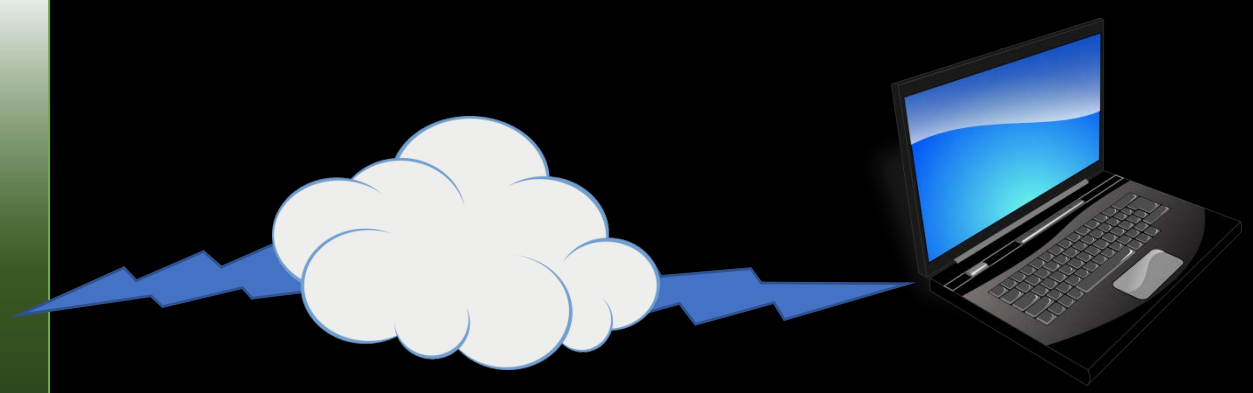
Remote Virtual Instrumentation

- Task: set up a data acquisition system that
  - receives signals from an “experiment setup”, and
  - processes this signal to determine
    - the number of the pulses that exist at the output of the system under test, and
    - magnitude of the pulses that exist at the output of the system under test.
  - The DAS will be remotely controlled (over a network – the Internet)

Overview of the setup

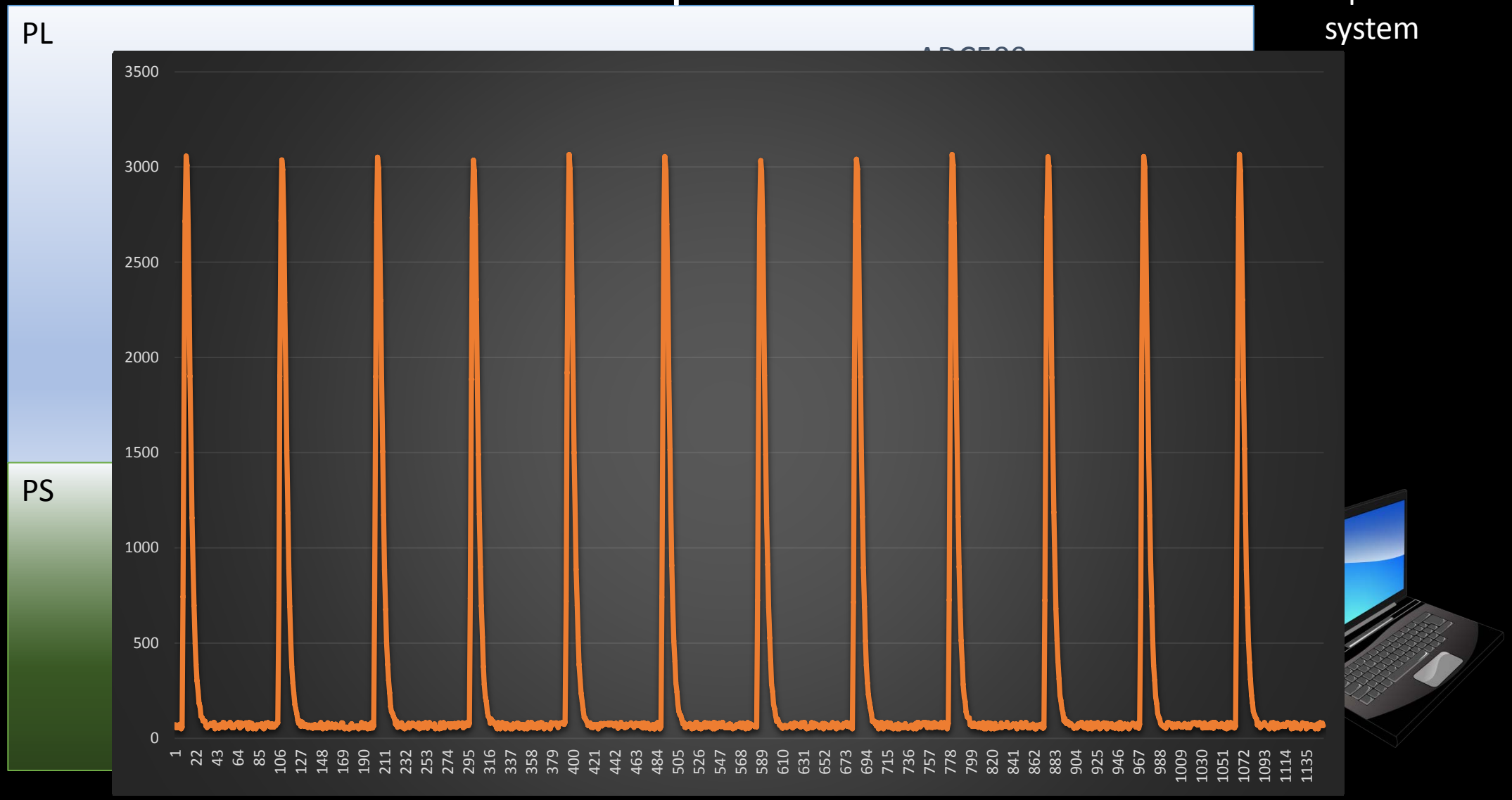






Overview of the setup

- Pulse train was generated on the computer to simulate a photon discharge system



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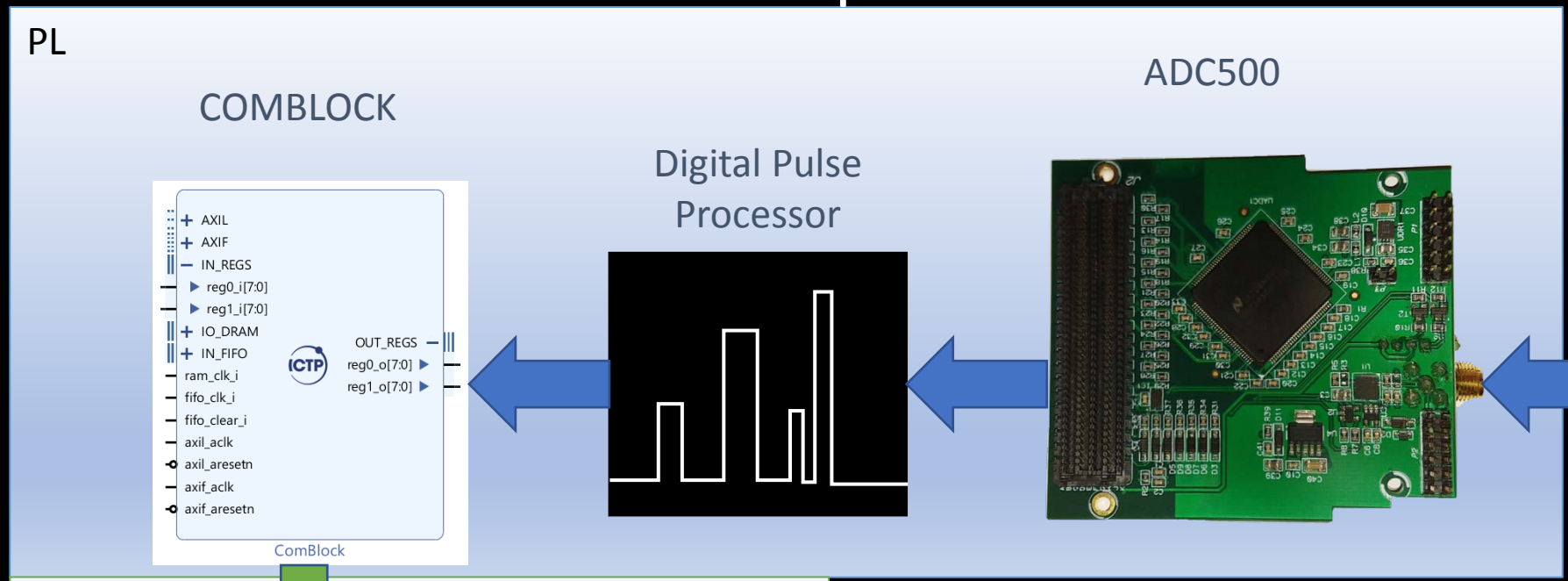
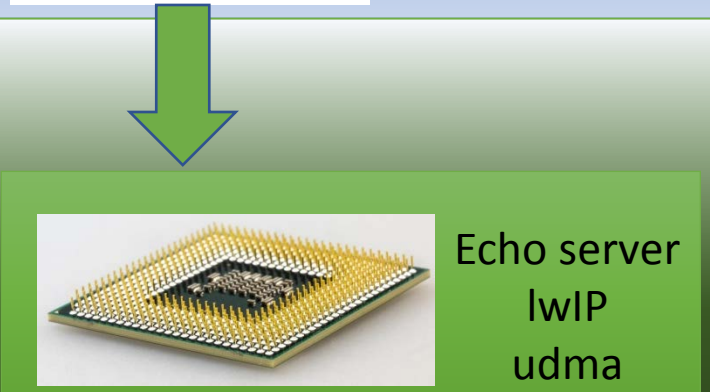
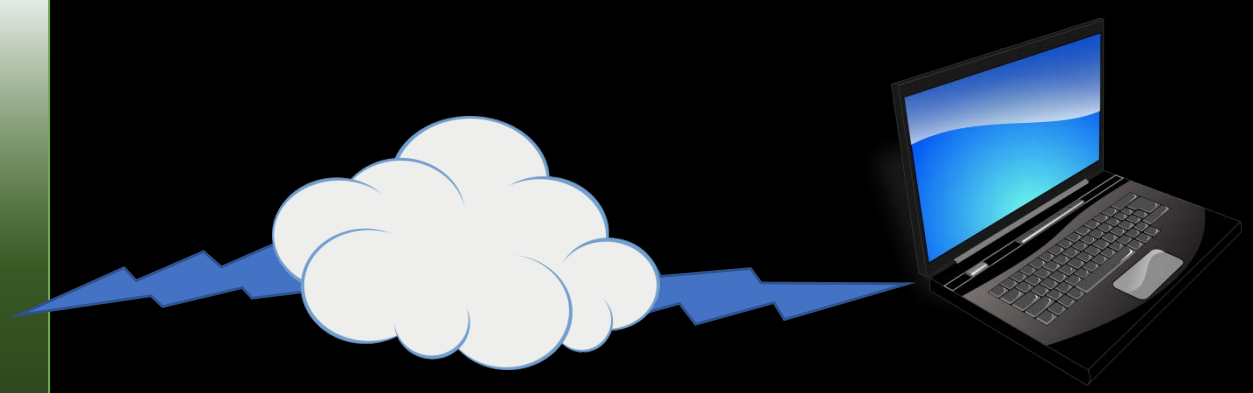
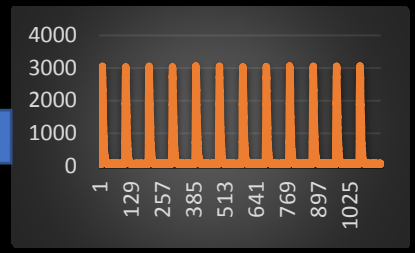






Overview of the setup

- A 500 MHz analogue to digital converter
- Coupled with a decimator to make oversampling possible (oversampling was not used in this project.



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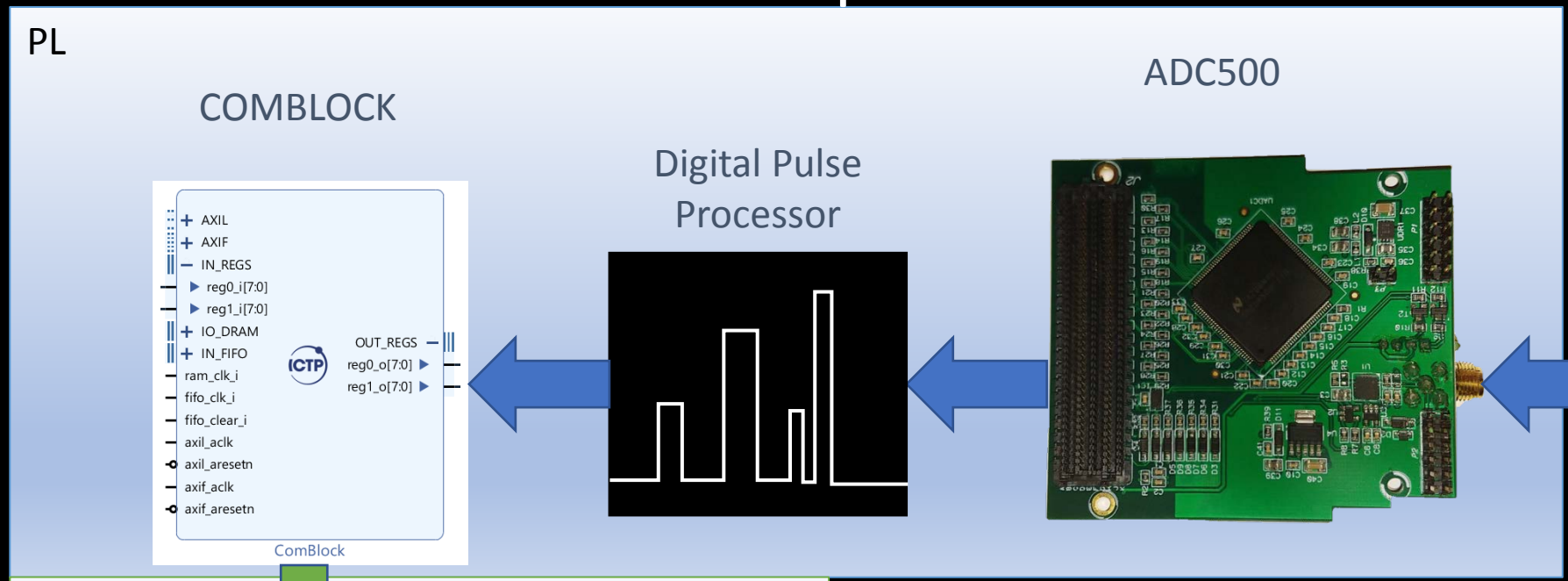

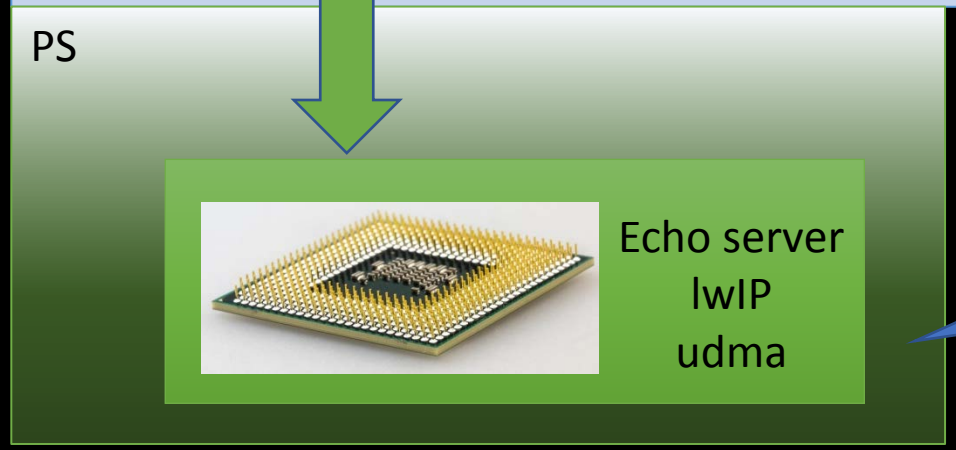

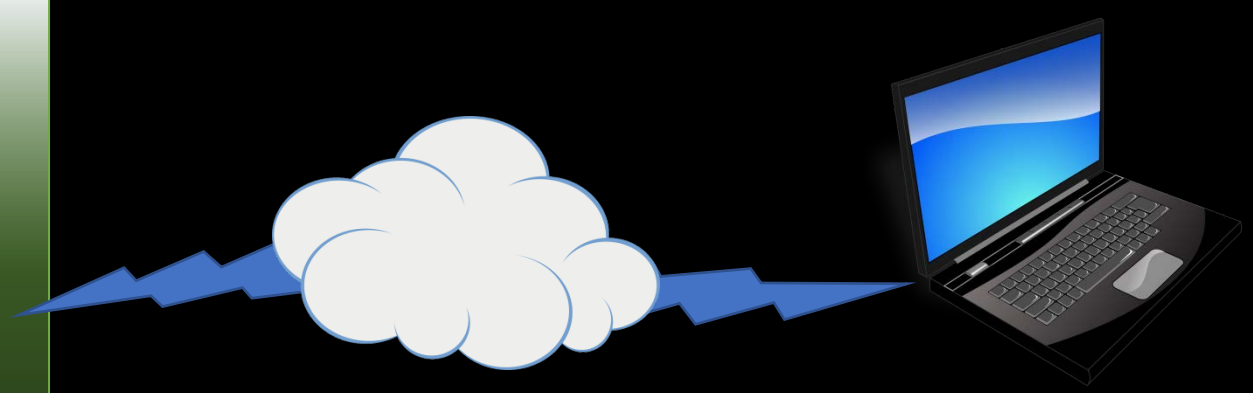

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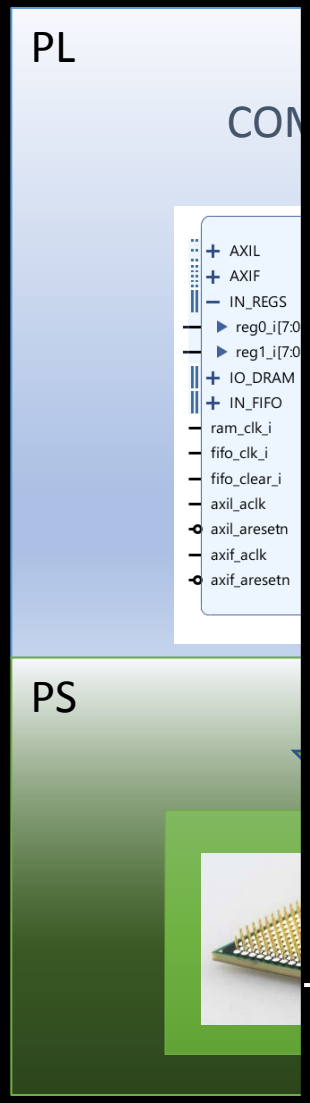
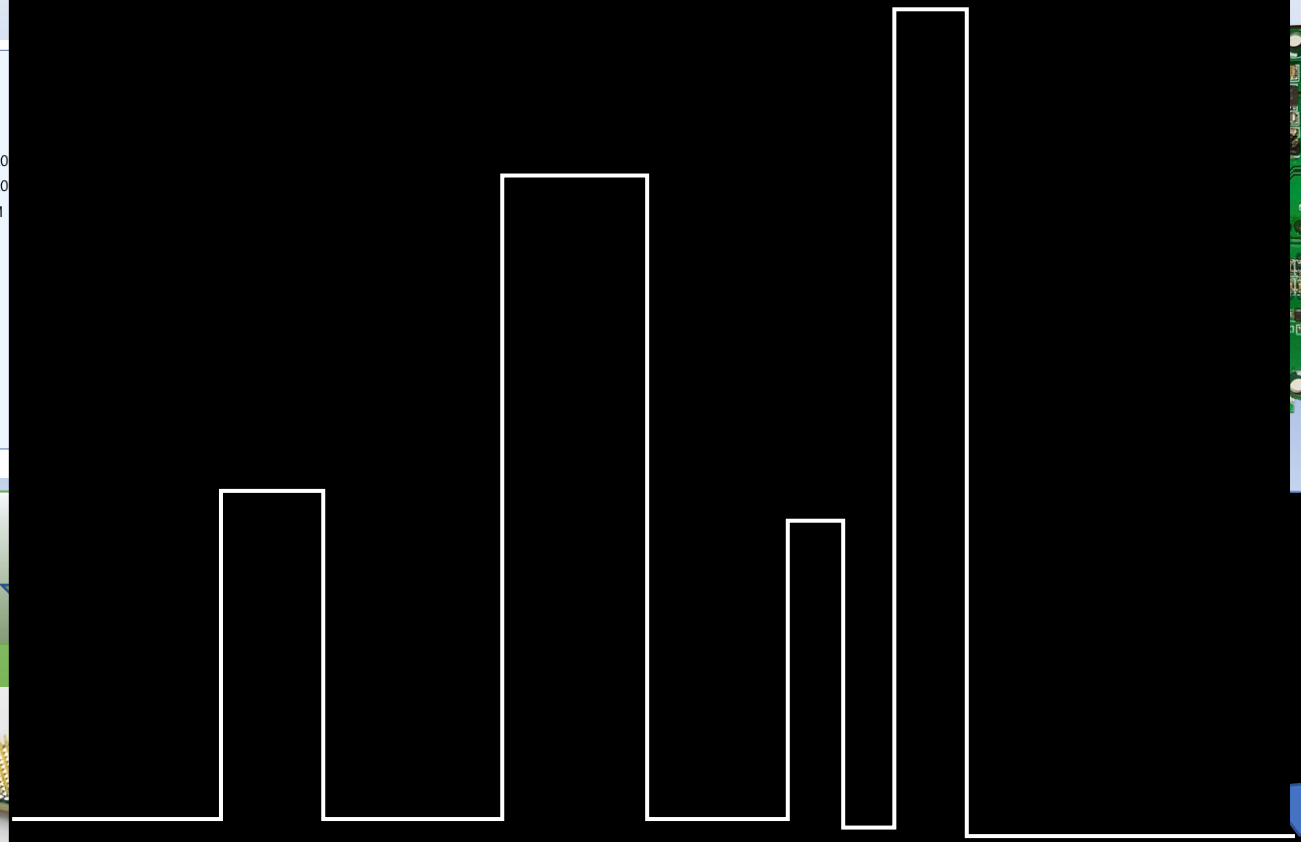
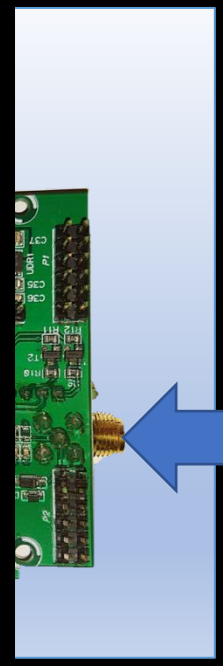
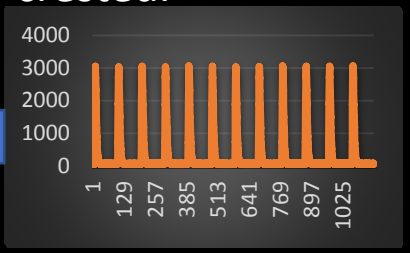




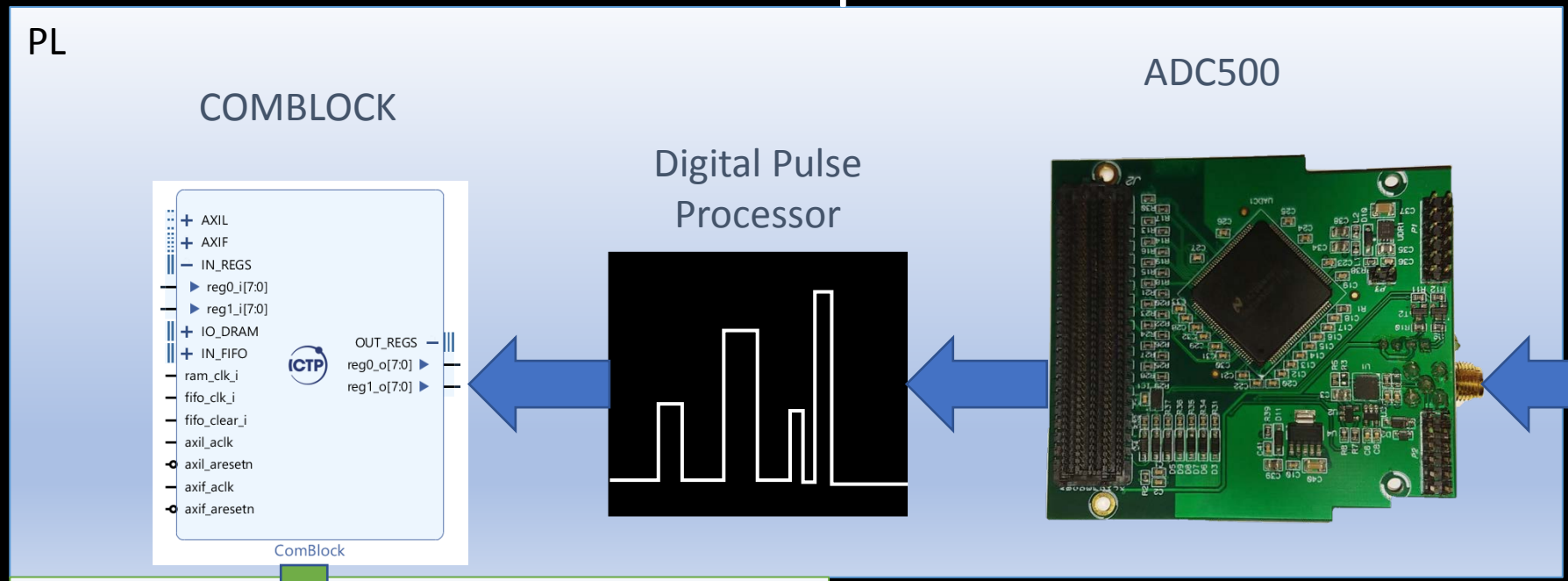


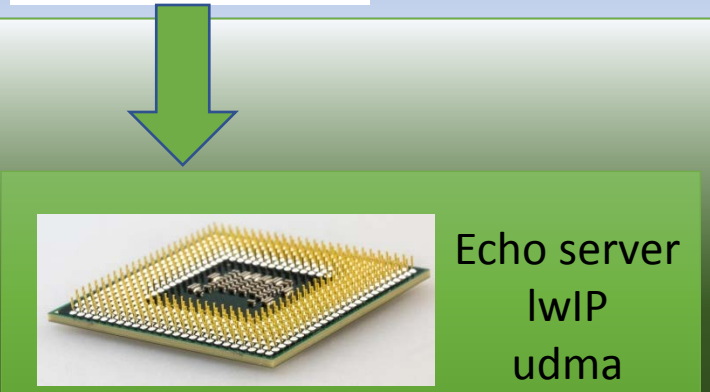


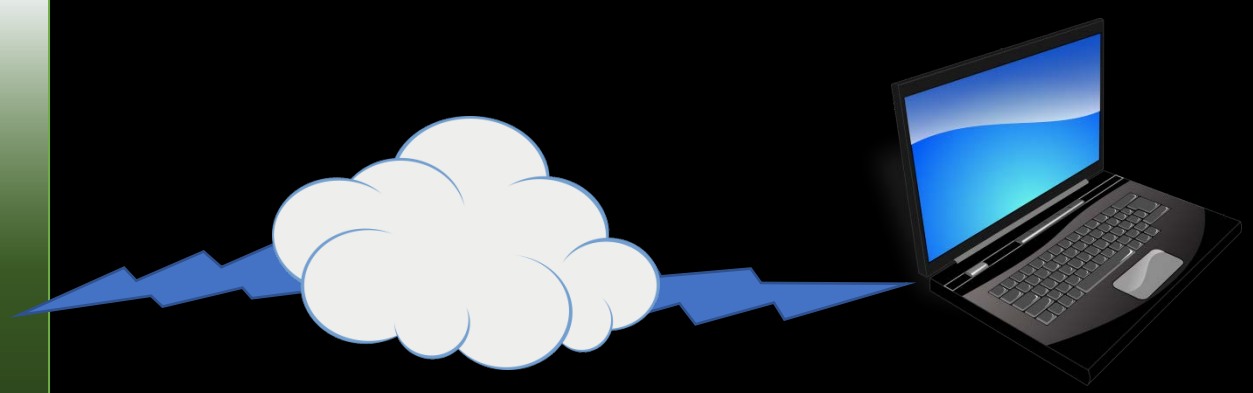
Digital pulse processor:

- Differentiate signal to obtain rising edge
- Store max value of pulse
- Output the maximum value of the pulse once the signal has crested.

Overview of the setup

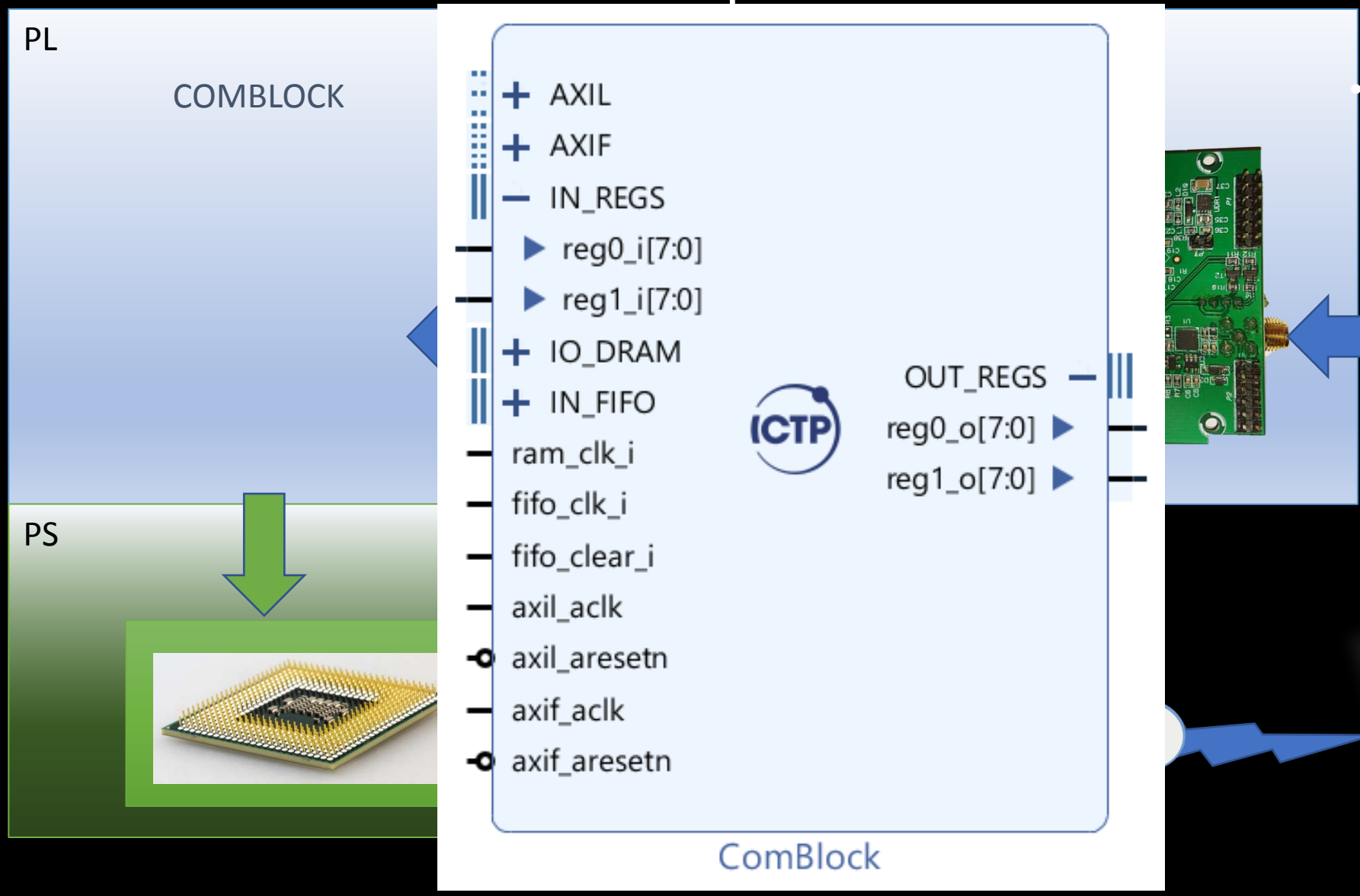


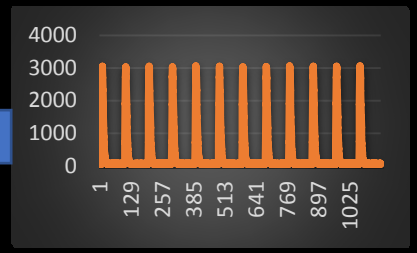




Overview of the setup

- Handle communications with the FIFO
- RAM not used because we want data sequentially
- Provide a suite of registers for holding data during processing.





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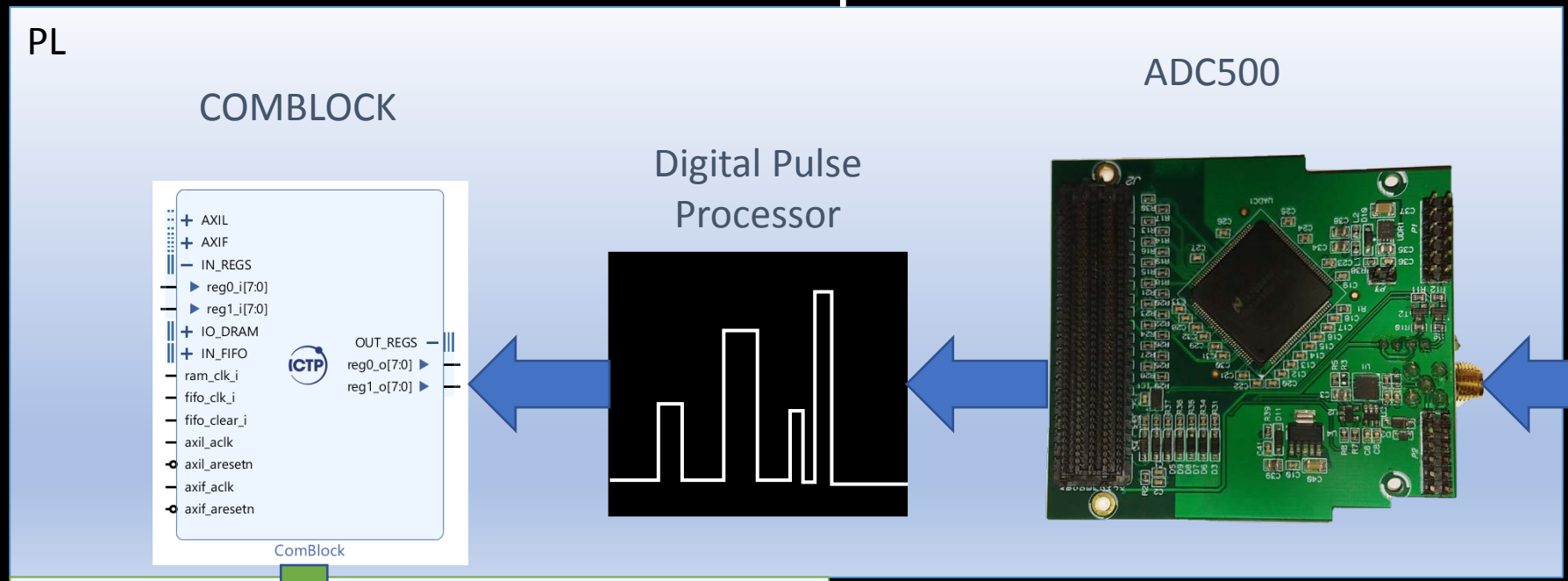
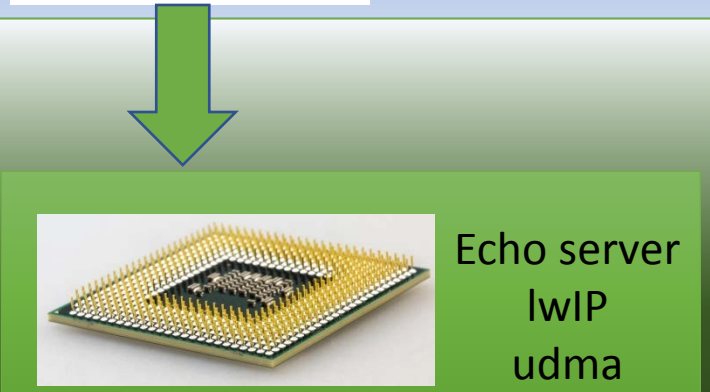
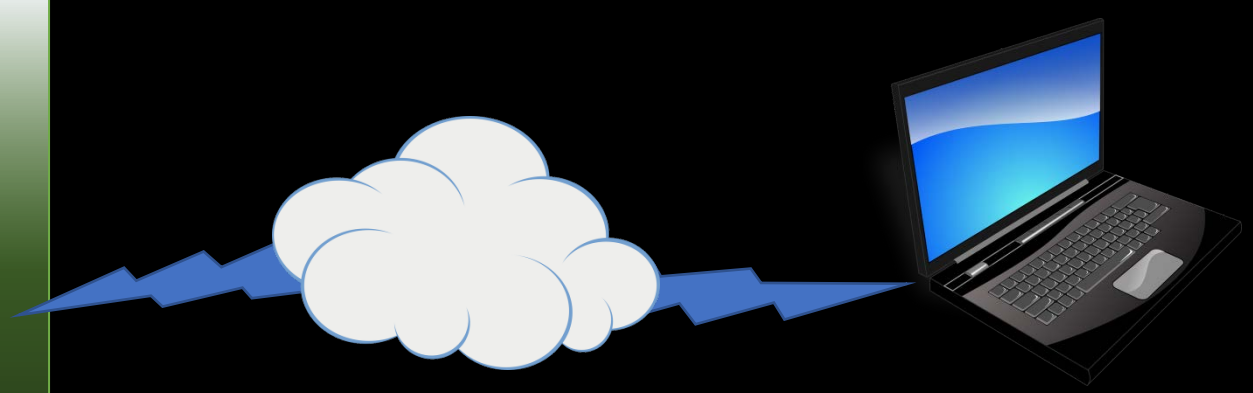






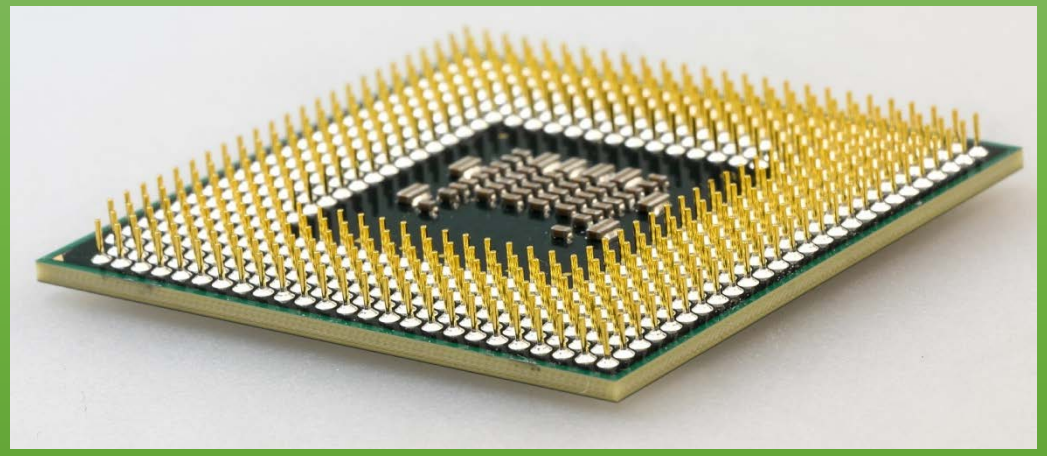
Overview of the setup

- Use freertos to ensure that multiple threads can run concurrently.
- lwIP handles TCP and IP issues
- Echo server receives and interprets data received into commands.

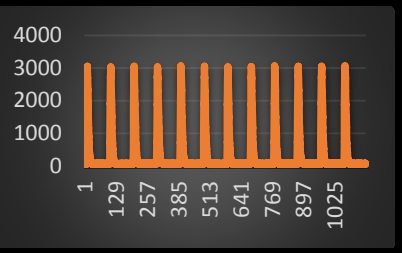
PL

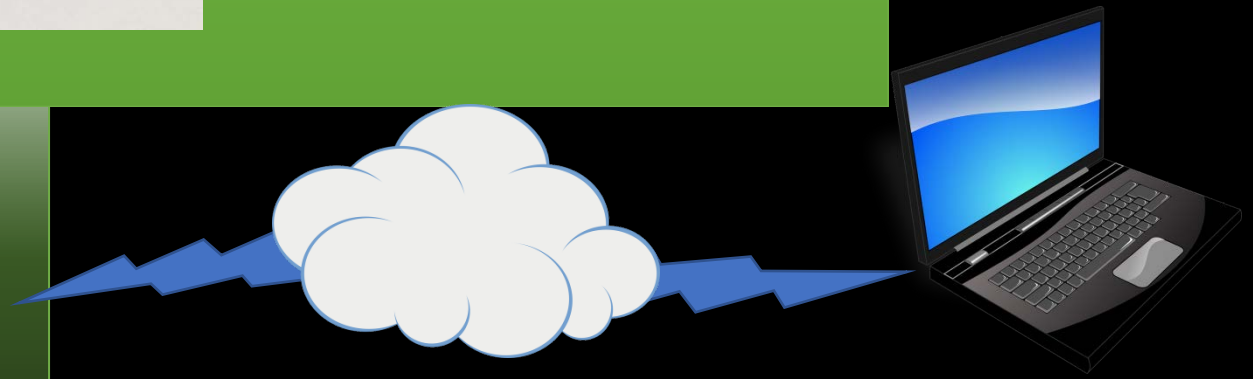
COMBLOCK

ADC500



Echo server
lwIP
udma





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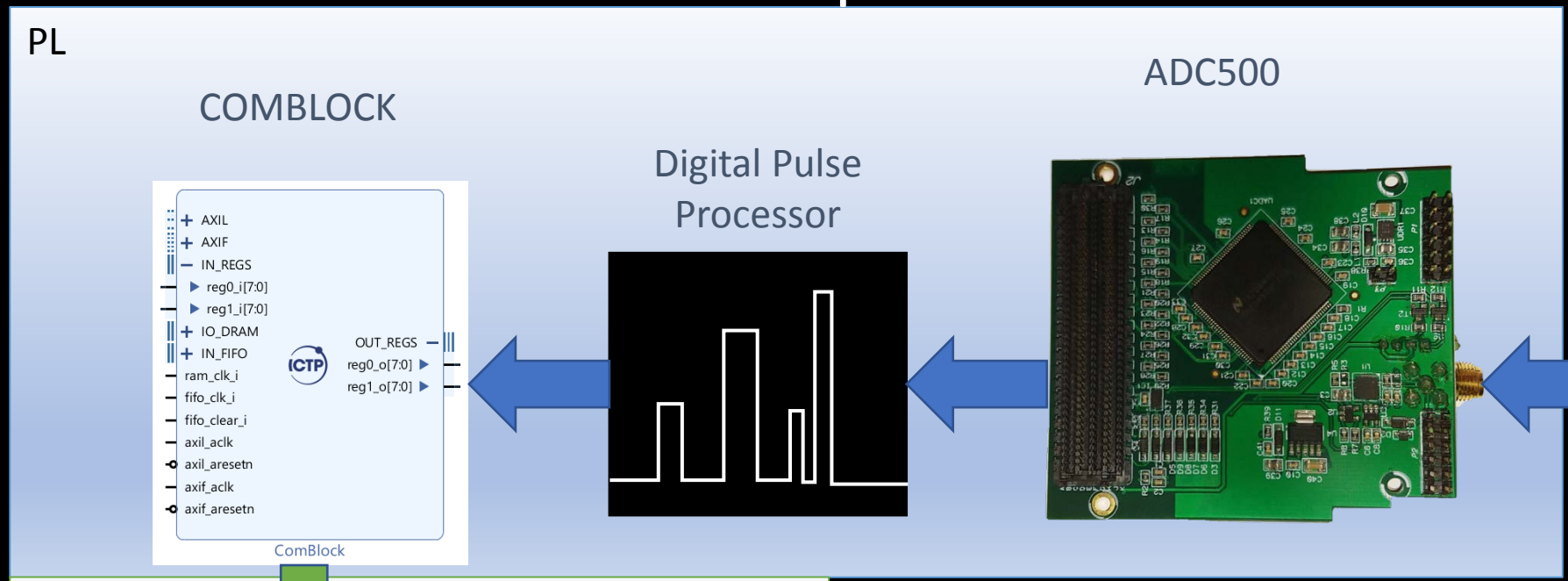
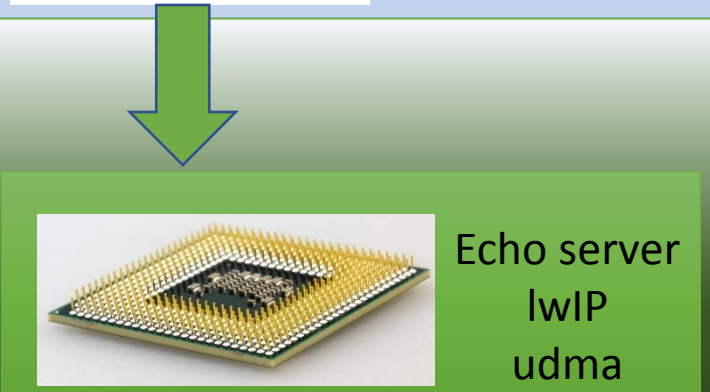
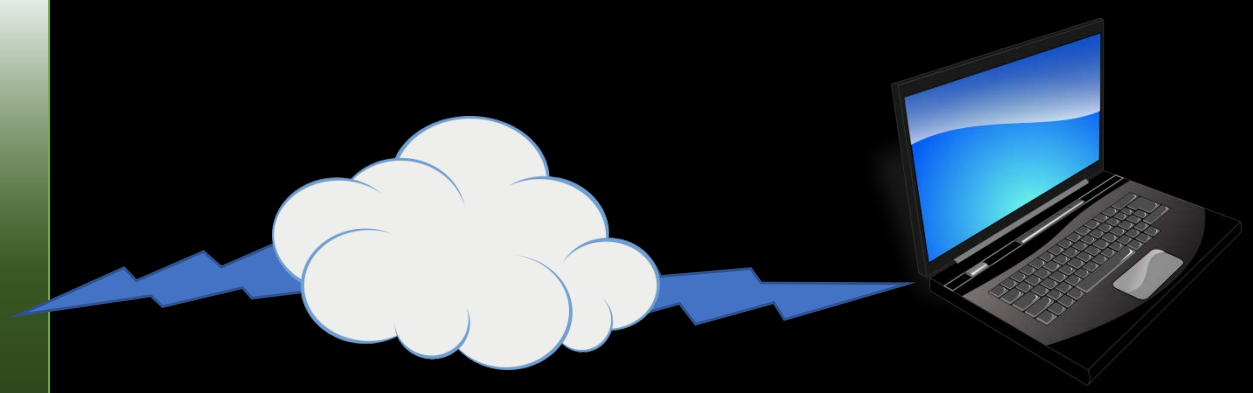
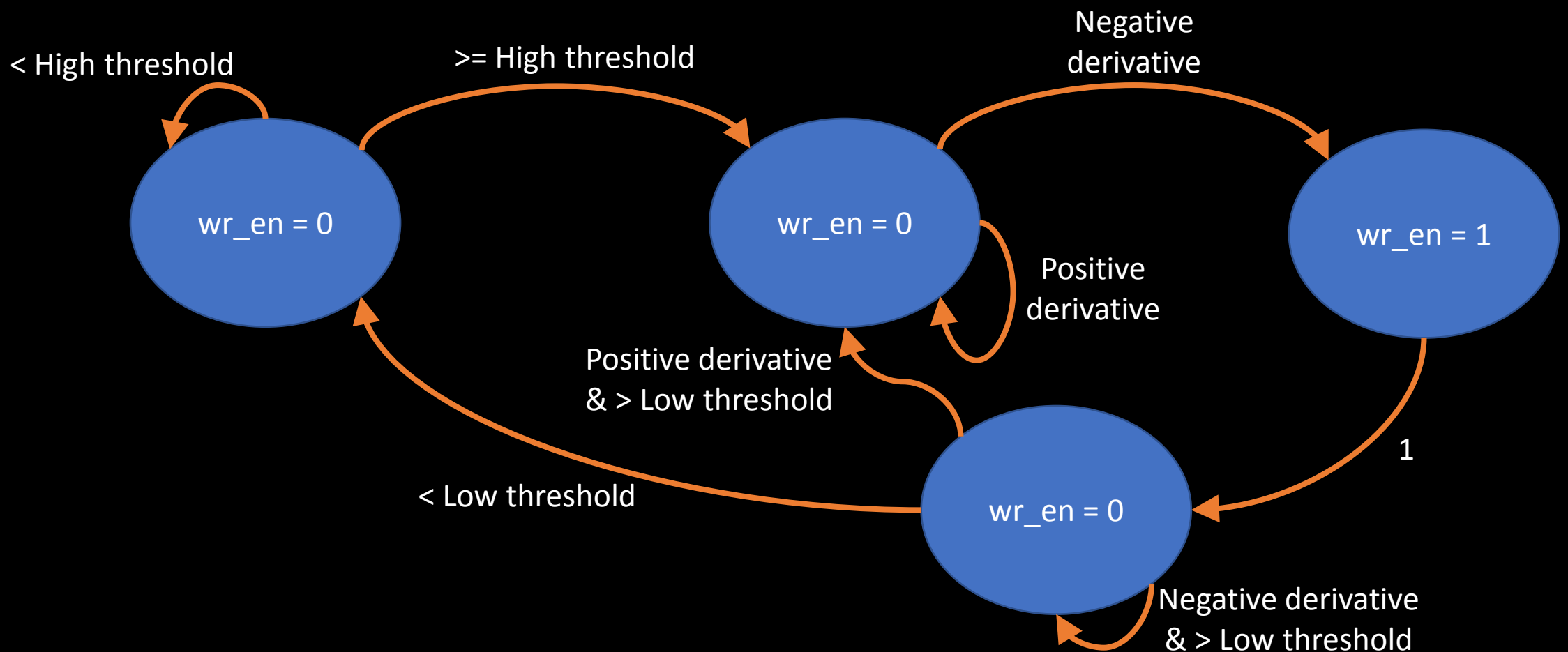






What I tried differently:

- In the Digital Pulse Processor, I used the HIGH and LOW thresholds to create a state machine to count overlapping pulses.



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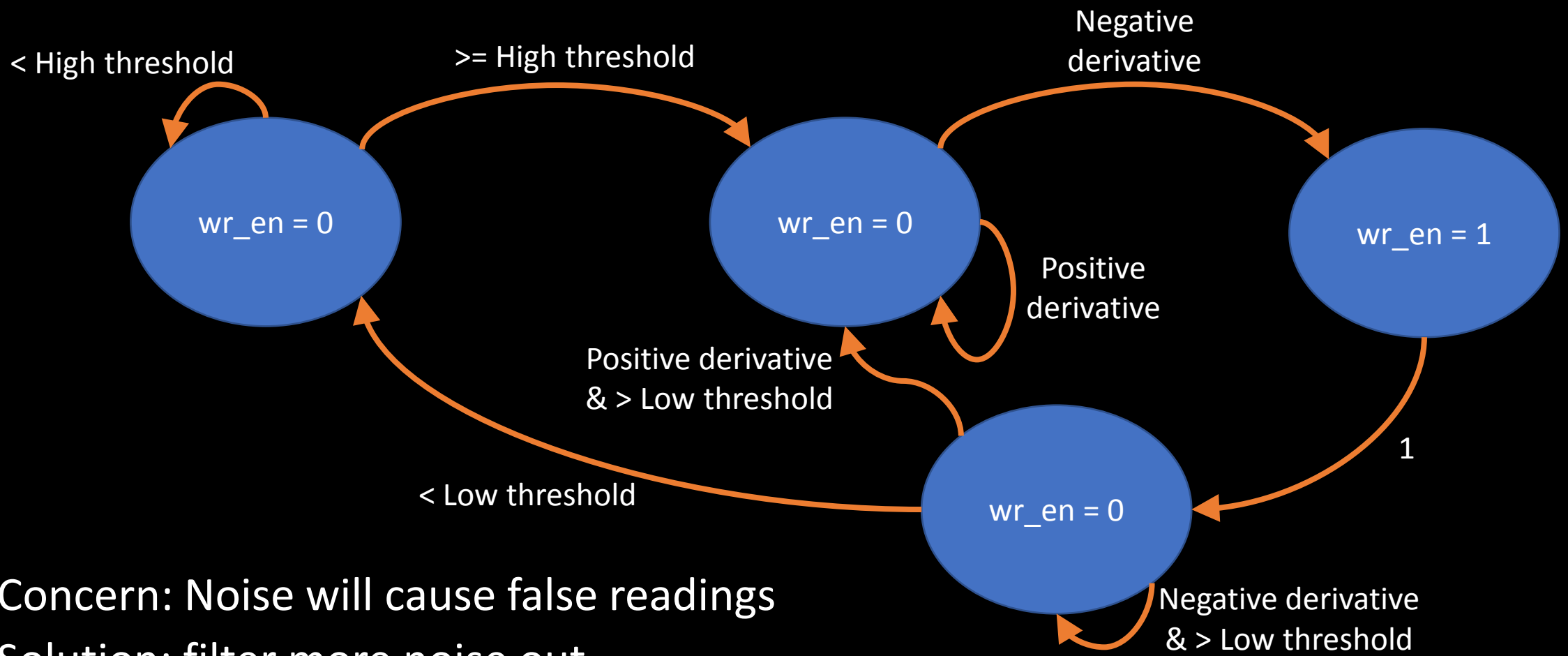
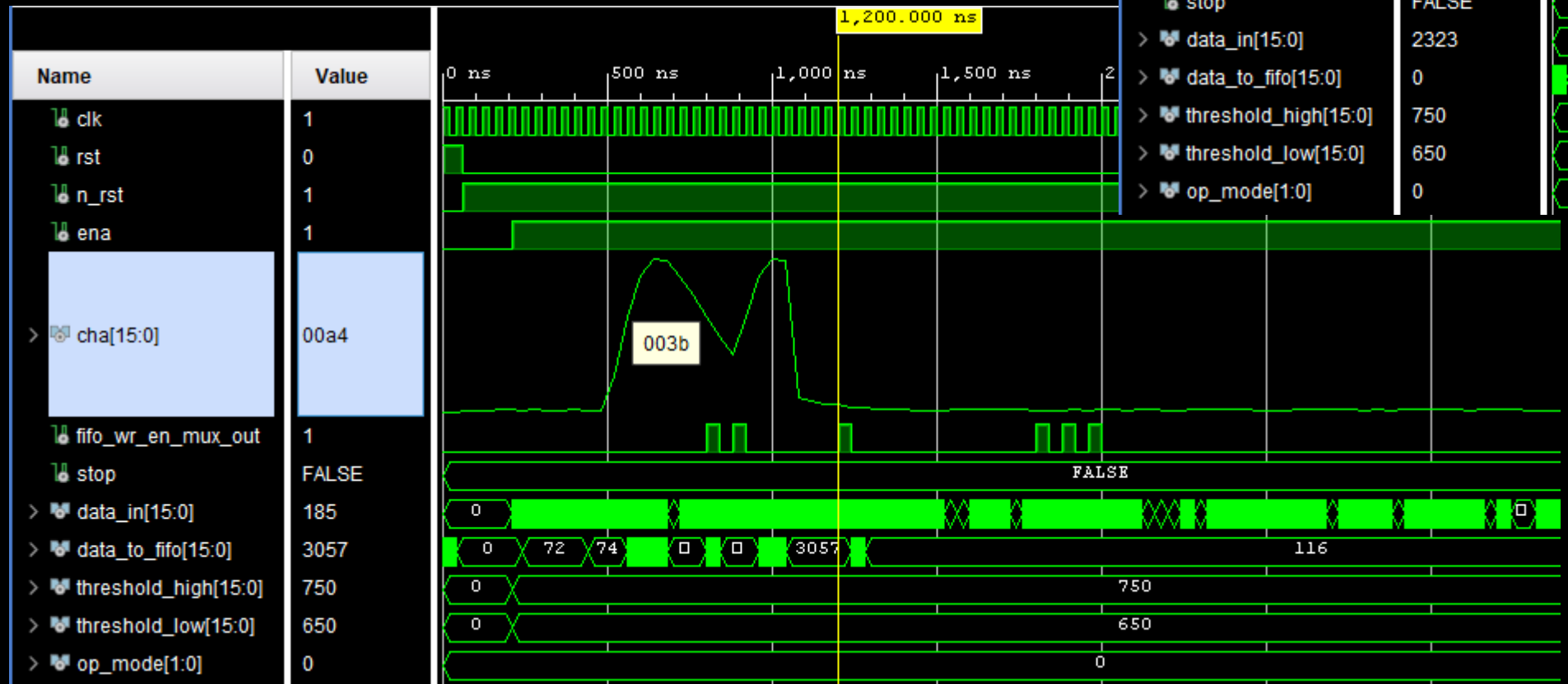


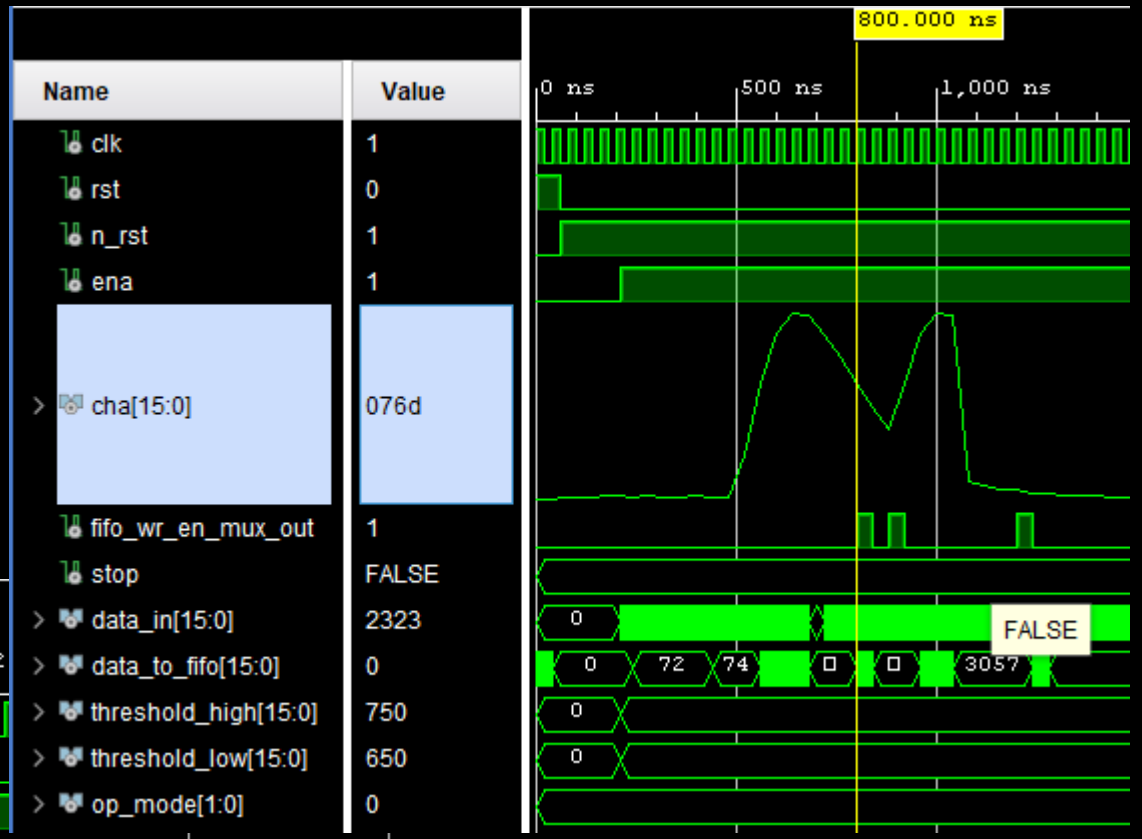
Concern: Noise will cause false readings

Solution: filter more noise out

Project Challenges

- I didn’t finish the project
  - The DPP I worked on is buggy so I didn’t use it





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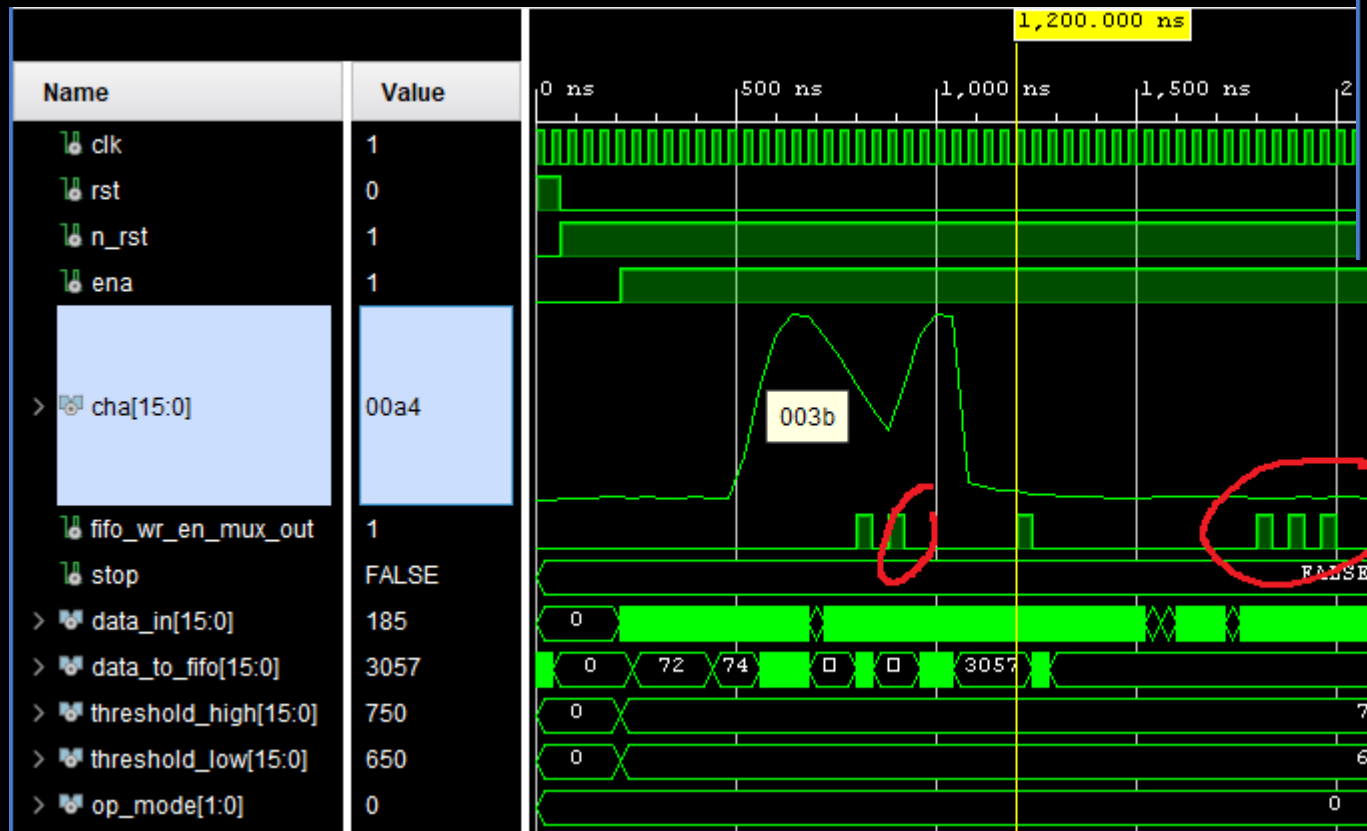

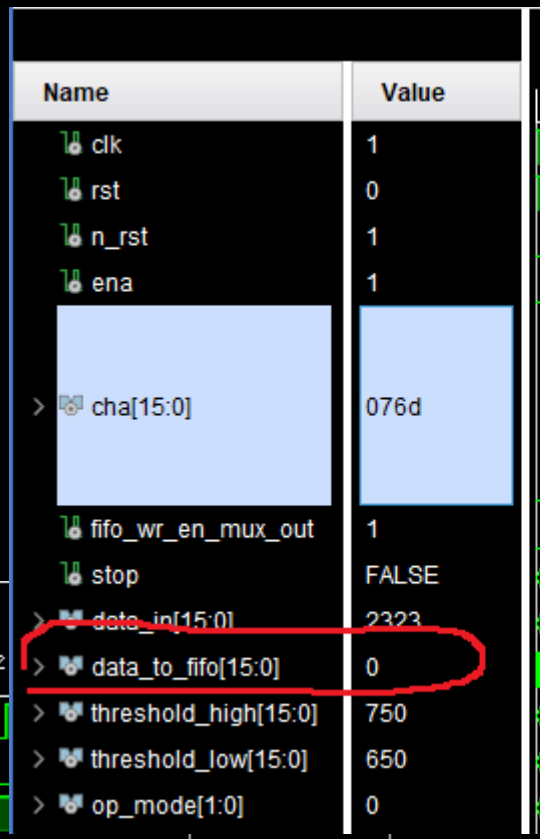

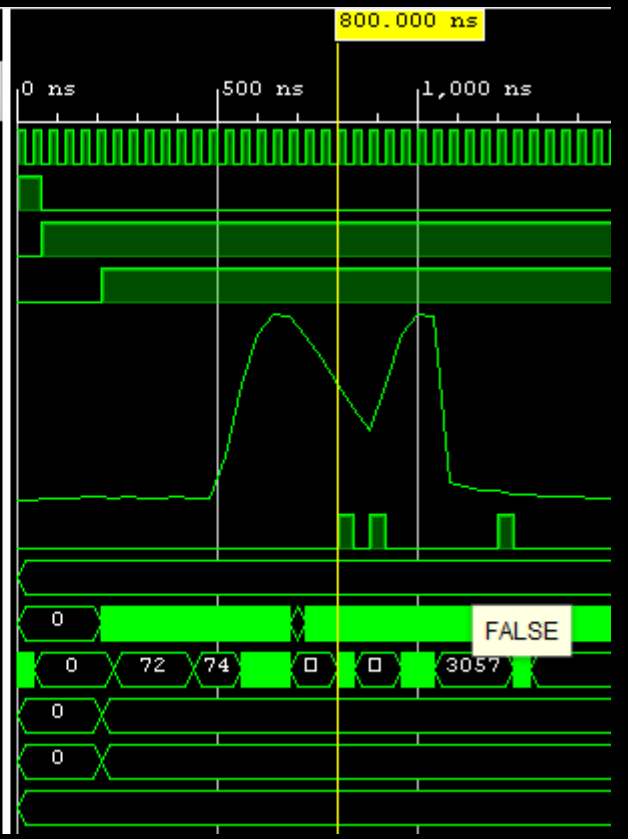

Project Challenges

- I didn’t finish the project
  - I just figured out (I think) the multiple thread things in FreeRTOS this morning.

Challenges / Suggestion

- Nothing beats having the equipment physically on hand to play / practice with
  - Let participants know ahead of time what hardware would be used.
  - Ask for existing equipment – maybe alternatives may exist.
- Better inter-participant communication would need to be worked on
  - Many of us were using slack for the first time and it was kinda unnatural

Commendations (What I loved about the workshop)

- It was great to have a computer to work with remotely.
  - Next best thing after sliced bread
  - The machines were really well-speced (significantly better than mine ☺)
- Very good presentations
- Good availability of staff for interaction

- I enjoyed the labs because they were practical.
- I enjoyed the lectures because they went beyond just information to give the “why” behind things.

Experience Gained

- Developed my first SoC application
- Started learning to use an OS on an embedded system
- IP-demystified
  - IPs are not written only by Martians
  - Built my first IP
- Got better understanding of GIT

Conclusion

I applied for this workshop in order to learn and gain experience in SoCs for instrumentation.

- I have gotten more experience than I desired
  - One more tool in my arsenal for remote instrumentation and experimentation
  - I am already planning exercises that I will use with my students next semester
- I intend to start doing some work on medical instrumentation
  - Processing of EEG signals

Thank You!

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Appreciation

- My lab / project partners
- Werner Florian
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- Cristian Sisterna
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- Maria Liz Crespo
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