APV25 for MaDPhoX

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APV25 Advantages

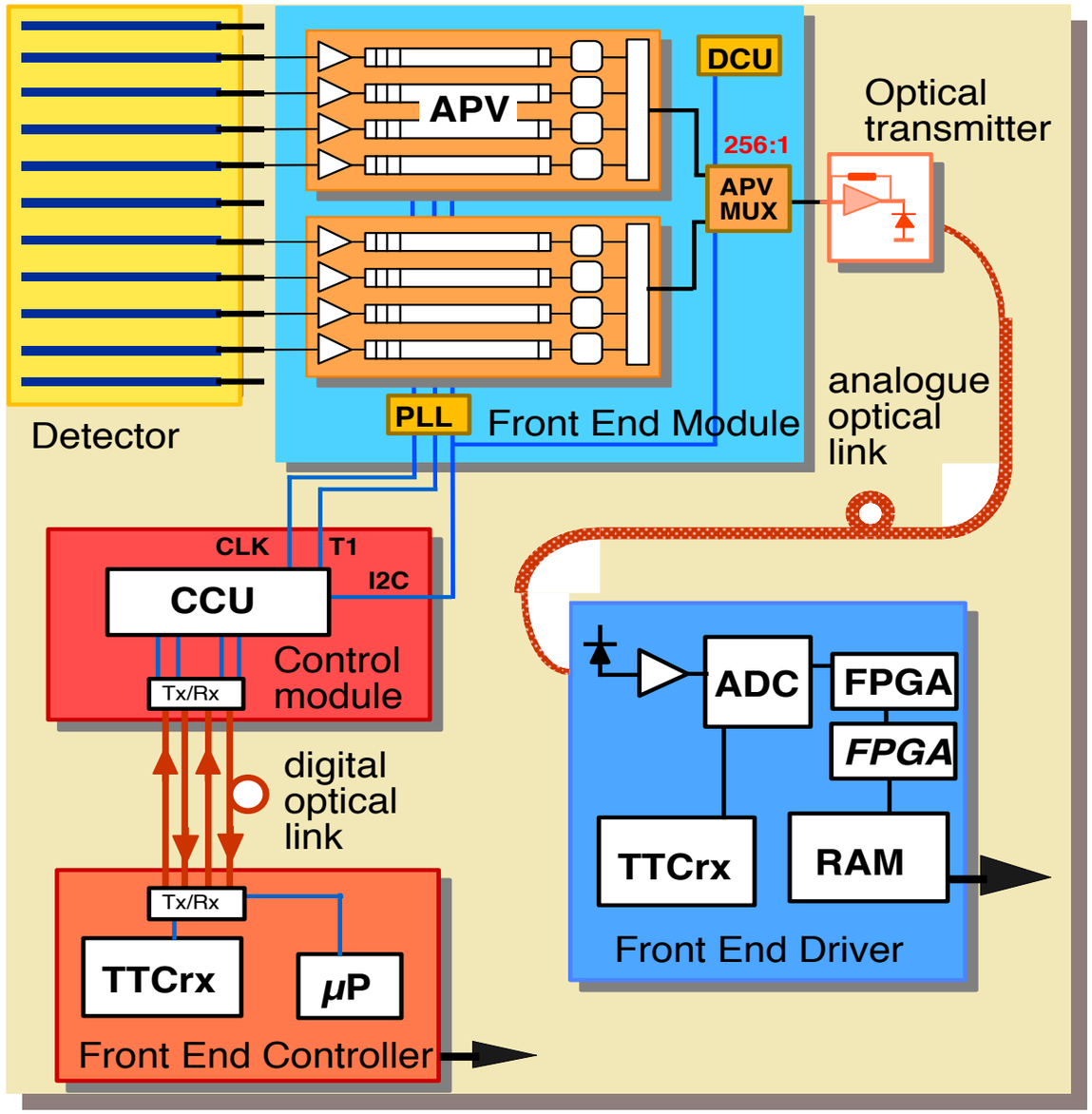
- 0.25μm CMOS
  - increased radiation tolerance
  - lower noise
- analog readout
  - greater design flexibility
  - improved resolution and efficiency with available sensors

➡ A safer choice with rapidly changing radiation dose

➡ The only choice for thinner sensors or operation while under-depleted (after extreme radiation dose)

Considerations

- APV25 availability
- Hybrid design requirements
- DAQ design requirements
- Costs
- Availability of working parts to bootstrap efforts



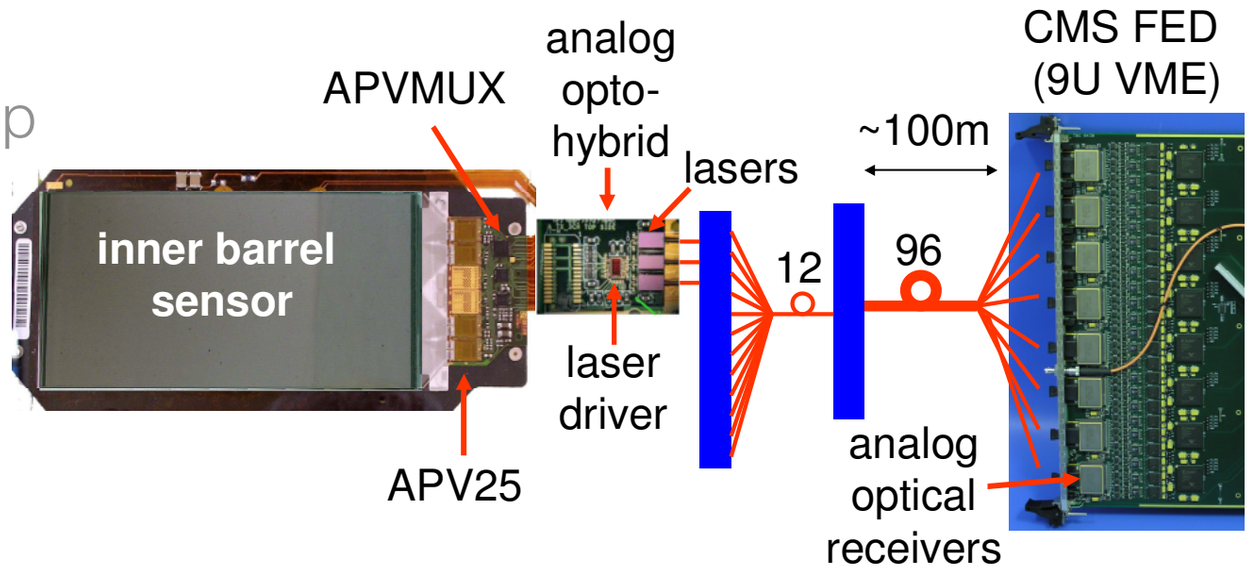
APV25 Availability

Geoff Hall at CERN procured all chips produced and held in reserve by vendors for CMS

- Availability of 100% good chips is not a problem
- Price is 28 CHF/chip diced in gelpack
- Payment from a CERN account is easiest but other terms are available
- We can get them whenever we are ready
- Checking to see whether we need to worry about them disappearing before we need them.

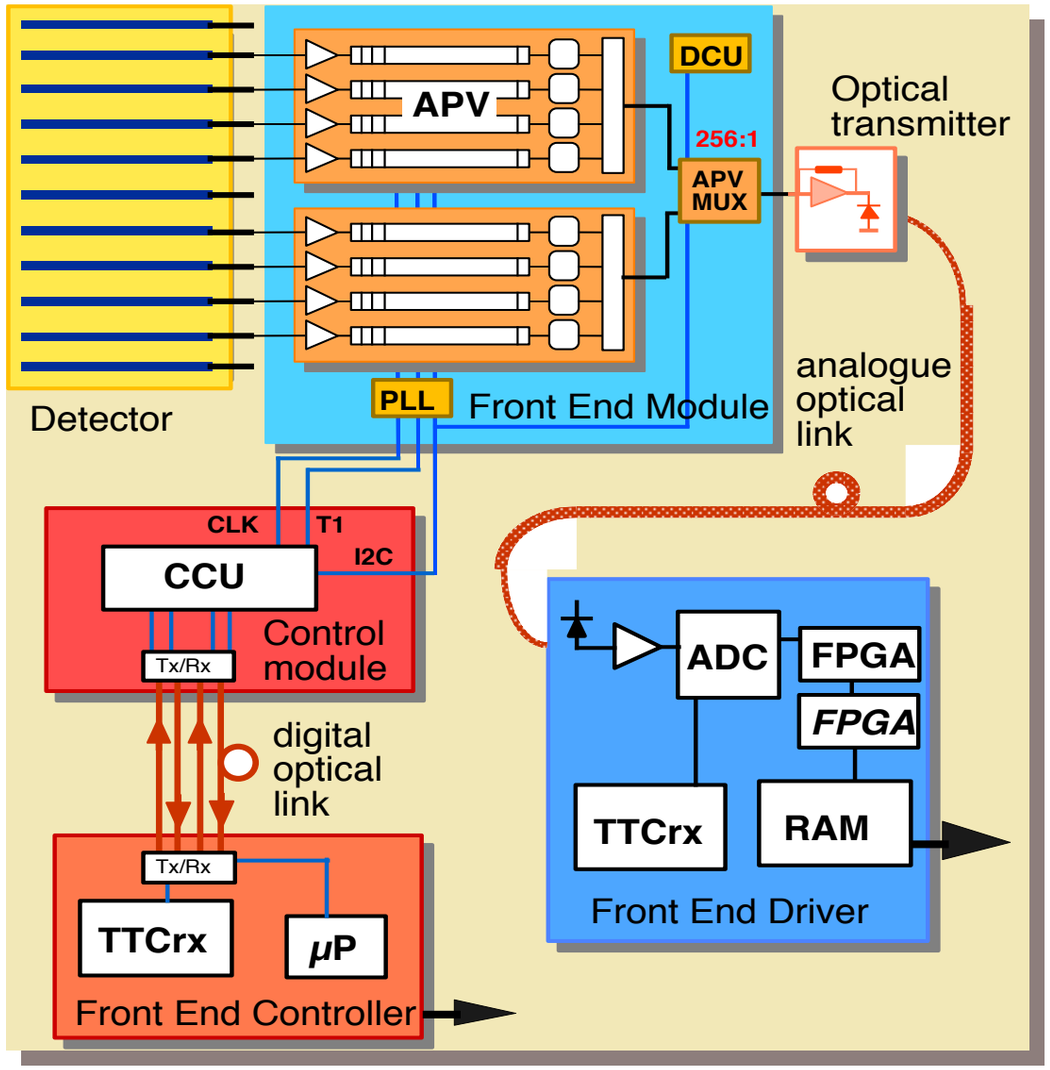
Hybrid Design Requirements

- CMS hybrids use an APV25 “chipset” of sorts: would be a turnkey solution
  - APVMUX/PLL multiplexes analog outputs from two APV25
  - DCU monitors supply voltages and temp
  - checking on availability
- Separate opto-hybrid turns output into analog optical
  - off-the shelf optoelectronics
  - Separation allows design flexibility, isolates and minimizes power and cooling requirements for main hybrid



DAQ Design Requirements

- The FEC/CCU is distributes global timing and trigger information
- The FED is the heart of the DAQ
  - digitization
  - Trigger selection / synchronization
  - zero suppression
  - channel ordering
  - event building
  - (etc., as programmed via FPGA)



Costs

- Aside from the chip, I don't know enough to do my own estimate
- However, D0 investigated using the APV25 for RunIIb, and came up with ~$2/channel including everything.
- For our detector, that would come to roughly $100K, all inclusive.
- D0 assumed maximal re-use of CMS DAQ architecture: for a smaller experiment such as ours, M&S might be saved by designing our own solutions, but at the cost of significant effort.
- Some major costs (e.g. optical components) will be reduced significantly from 10 years ago.

Currently Available Components?

- UCSB has a number of CMS hybrids we can work with to get started
- A spare DAQ from UCSB, now at Bristol is available (awaiting confirmation)
- A DAQ from UCSB may also be available for at least a year
  - ➡ This is more than enough to get us started.
- We may benefit from broad use of APV25 (Super Belle, STAR IST, Compass, EUDET/SiLC test beam, etc.) in finding freebies and support.

Summary

- APV25 readout is definitely attractive, clearly possible
- Not surprisingly, the chips are a small slice of overall cost
- Depending upon ABCD costs, a decision may be difficult. Some input from simulation would be helpful.
  - relative performance of ABCD and APV25
  - availability of thinned silicon for first plane-pair
  - additional acceptance possible with increased headroom in radiation tolerance of sensors