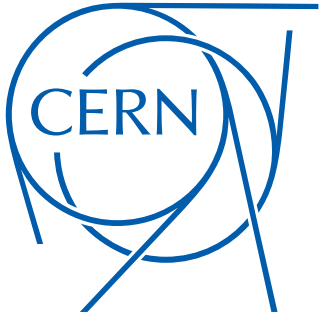
ATLAS Rx Pixels plugins



ATLAS EXPERIMENT

Geoffrey Mullier

CHIPP Winter school 2015

Albert Einstein Center / Laboratory for High Energy Physics

January 23, 2015

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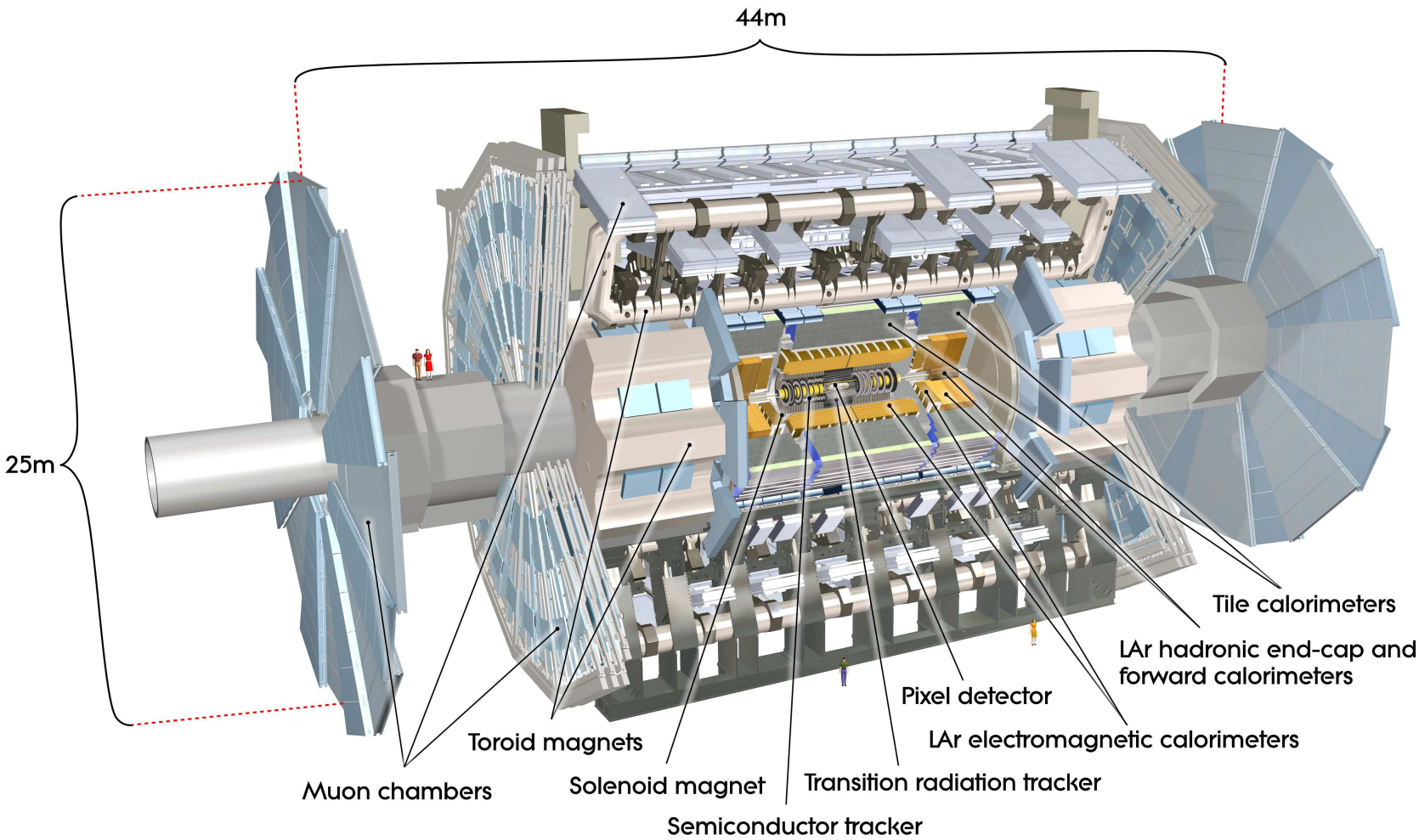
ATLAS structure



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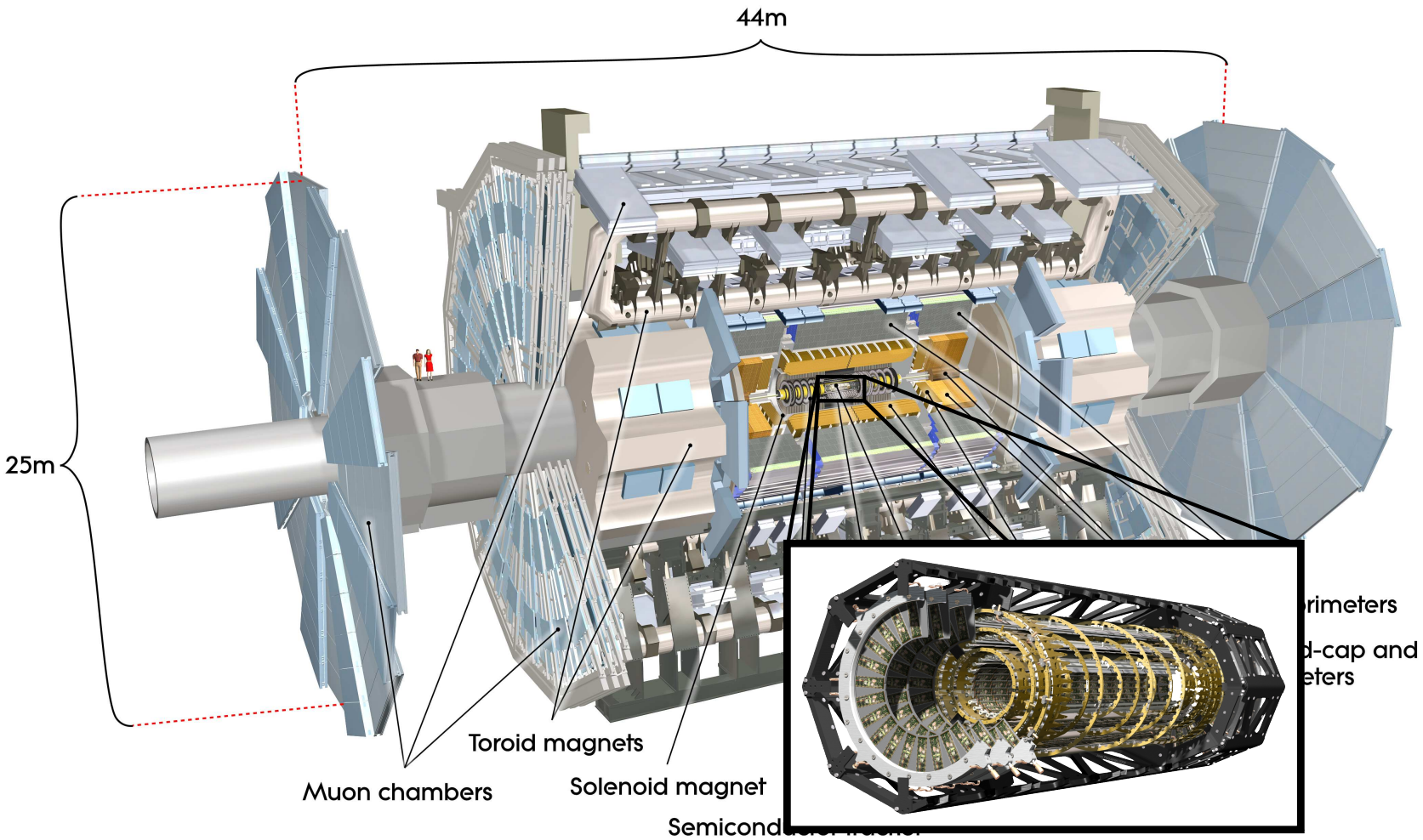
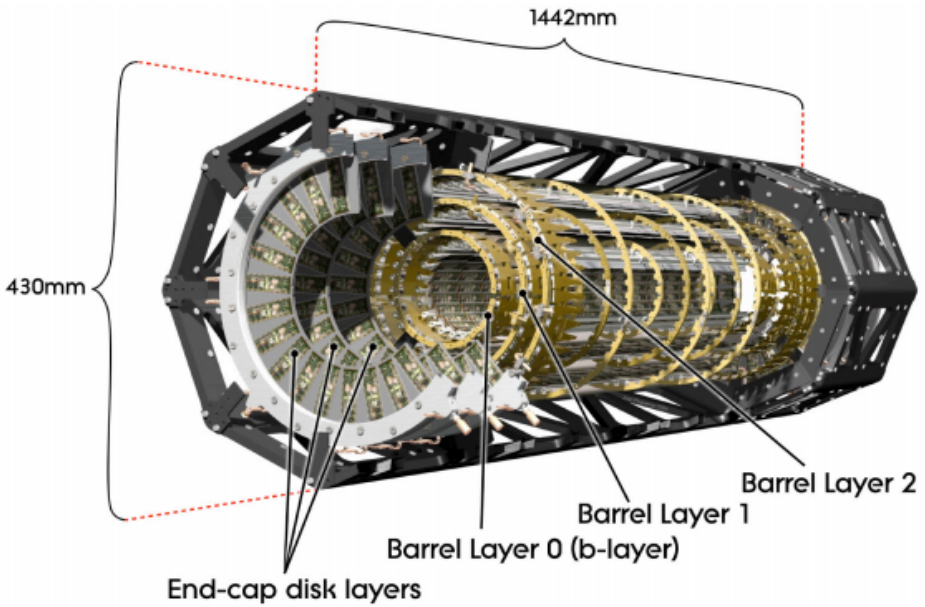
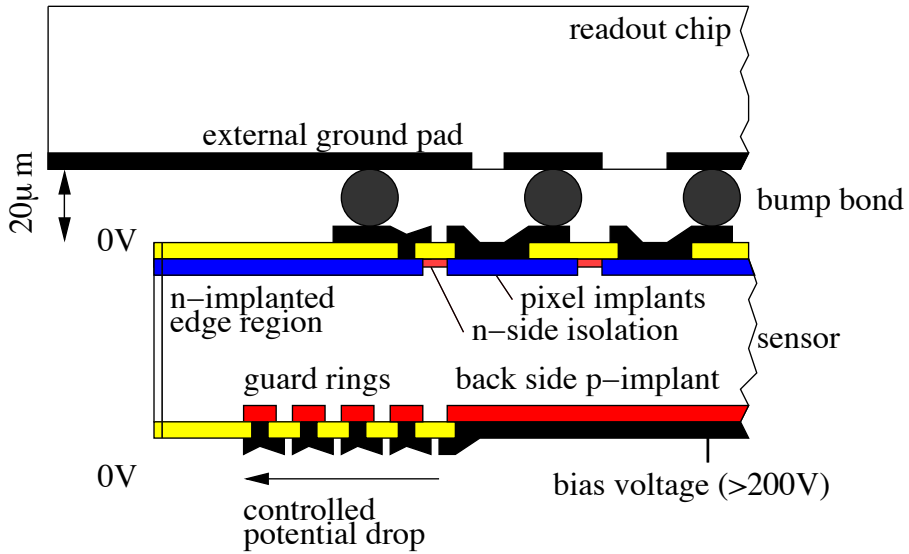


Pixel detectors

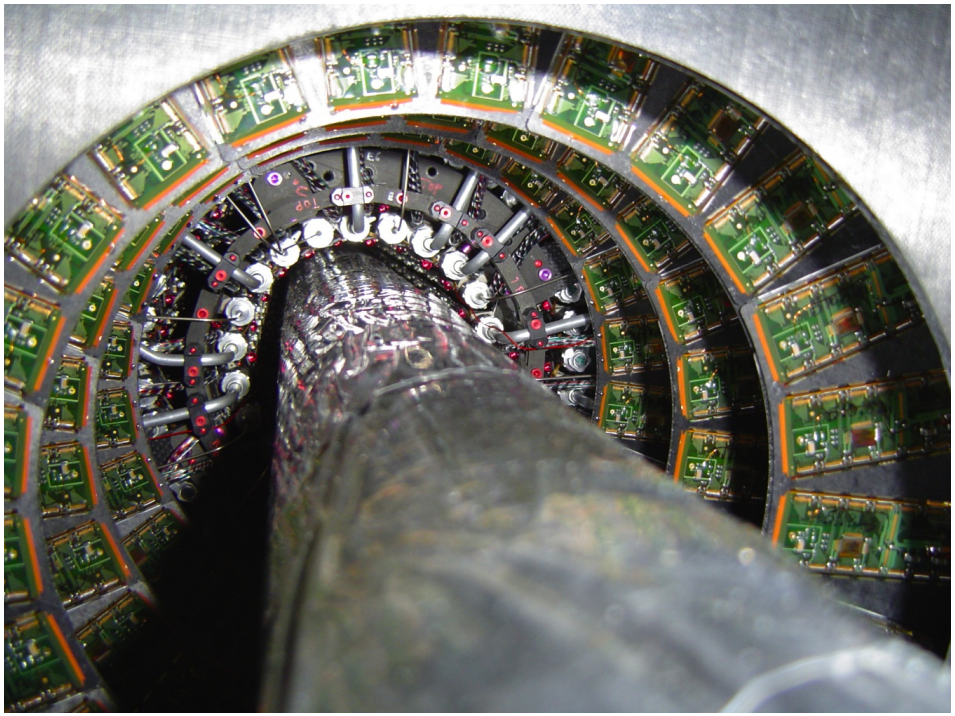




Characteristics & usage

- Semi conductor sensors
- Small sized pixels ($\approx$ 50 μm $\times$ 300 μm)
- 3 layers ($\approx$ 4, 10, 13 cm)
- High granularity $\rightarrow$ spatial resolution $\approx$ 10 μm
- Important for vertex identification and track reconstruction
- NEW : IBL

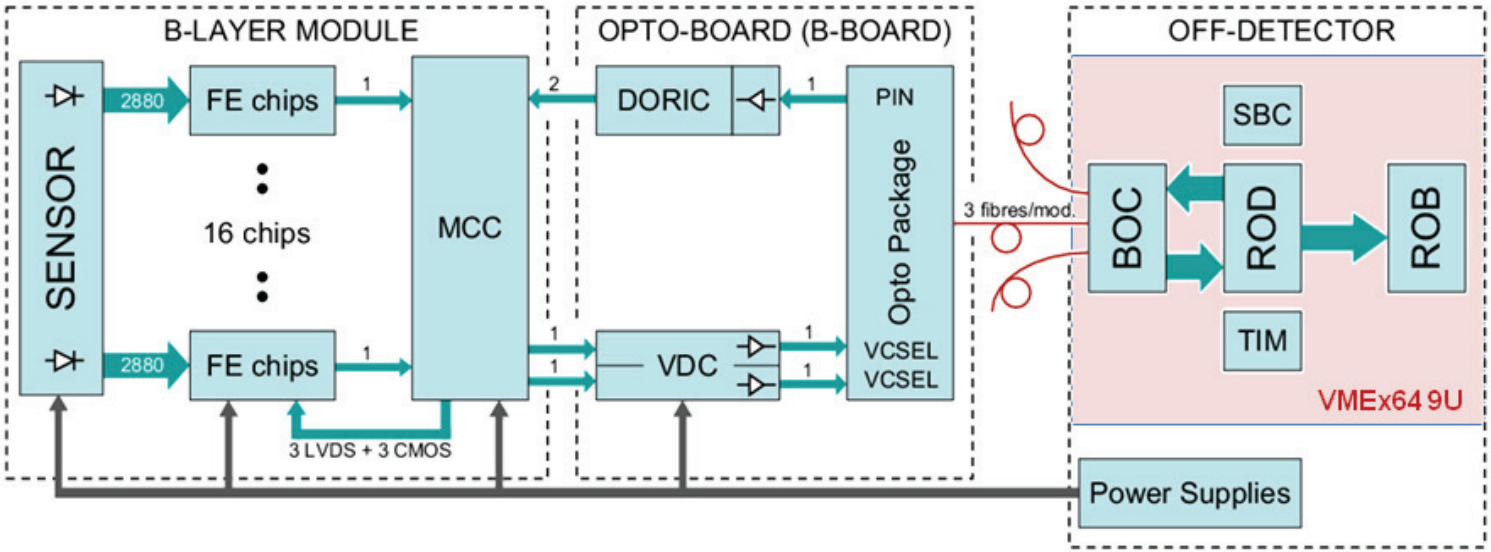
IBL



Insertable **B** **L**ayer

- New layer inside the existing pixel sensor (at $\approx$ 3 cm)
- Smaller sized pixels ($\approx$ 50 μm $\times$ 250 μm)
- Important for High luminosity phases
  - Vertex reconstruction
  - Balancing dead channels

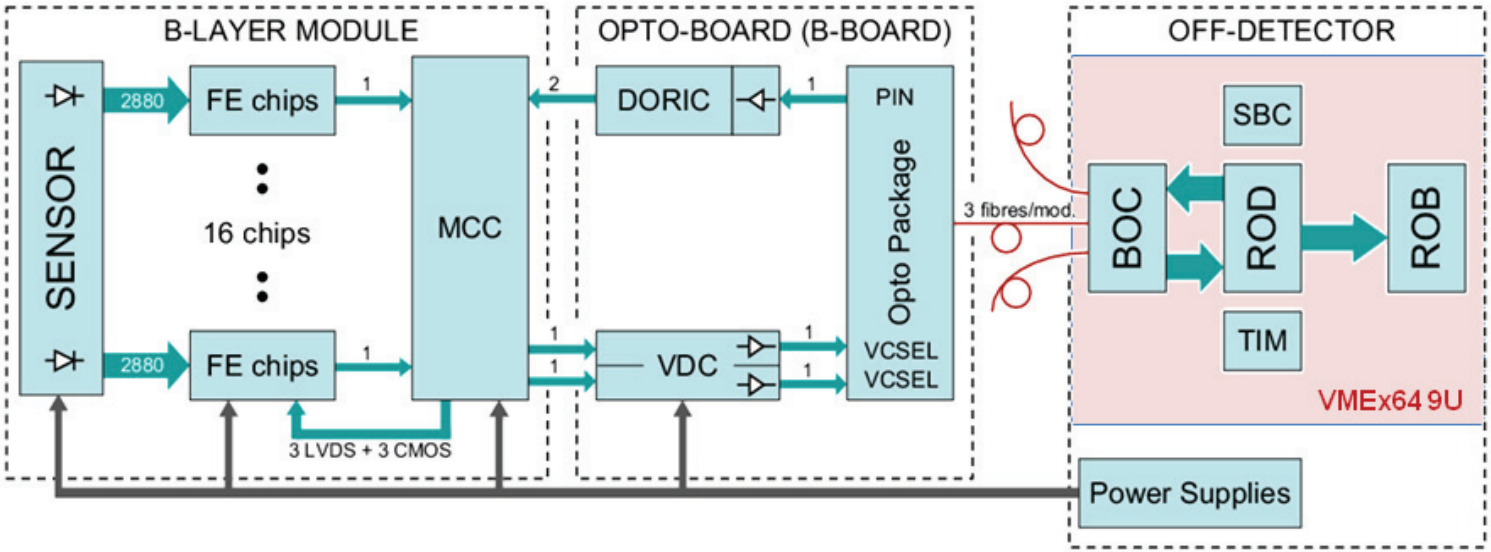
Readout Pixels/IBL



Path from Sensor to Off-Detector

Sensor → MCC → Optoboard → Rx Pugin on BOC → ROD → ROB

Readout Pixels/IBL



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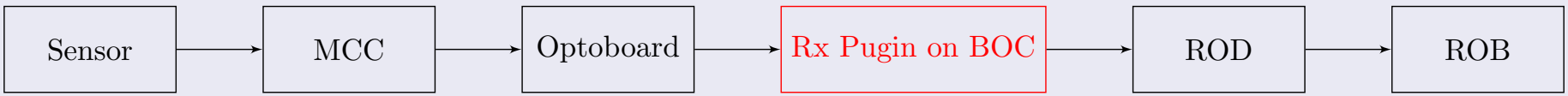
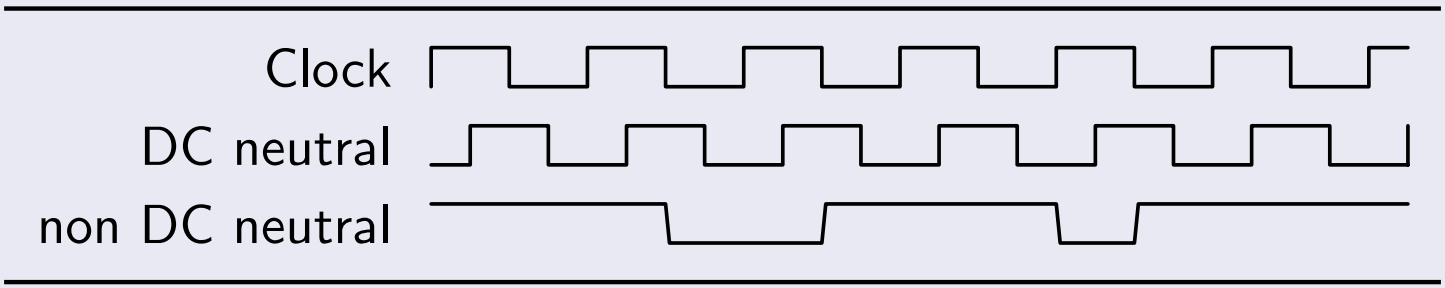


Readout IBL / Pixels

DC neutrality

- A signal is said DC neutral if there is no DC component to the signal in other terms $\lim_{T\to\infty} \frac{1}{T}\int_0^T V\mathrm{d}t = 0$
- The IBL use a DC neutral encoding of data (8b10b)
- The older hardware use a non DC neutral encoding and DC neutral but lower bandwidth (Manchester)



Problems?

Tx Plugins

- None

Rx Plugins

- New SNAP12 plugins don't like non DC neutral signals
- Old FE-I3/MCC, that cannot be replaced, send a non DC neutral signals
- We want to be able to use new BOC design which is all around better
- Cannot produce old ASIC anymore
- Need to design a new Plugin that doesn't mind non DC neutral input

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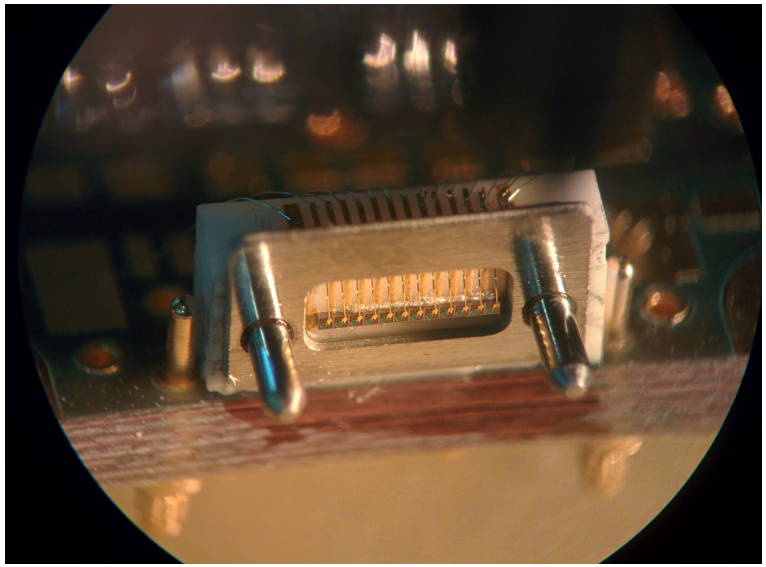
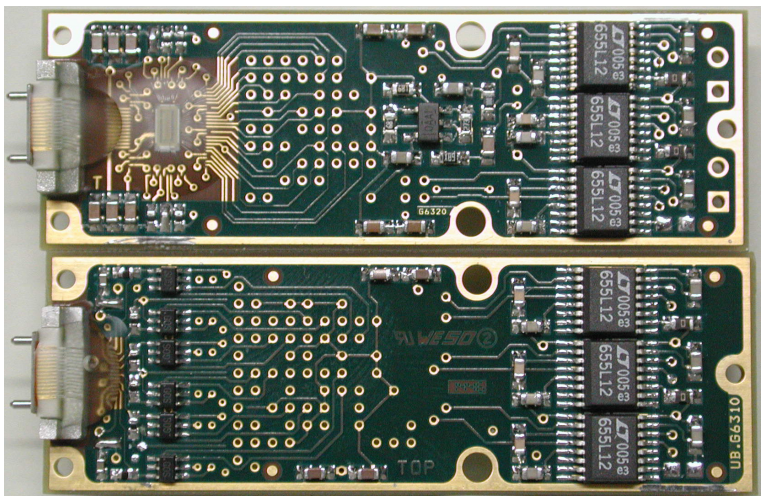
Rx Board philosophy

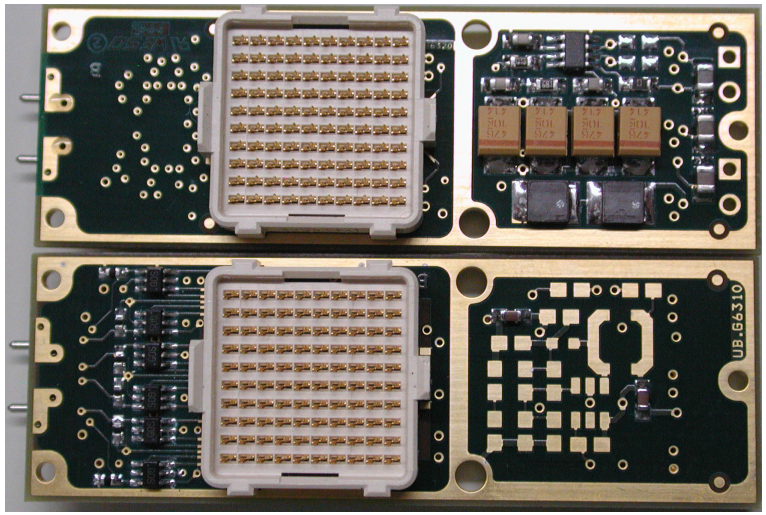


Rx Board philosophy

Pull up / Amplification ?

- Discrete Component
- ASIC





Rx Board philosophy

Pull up / Amplification ?

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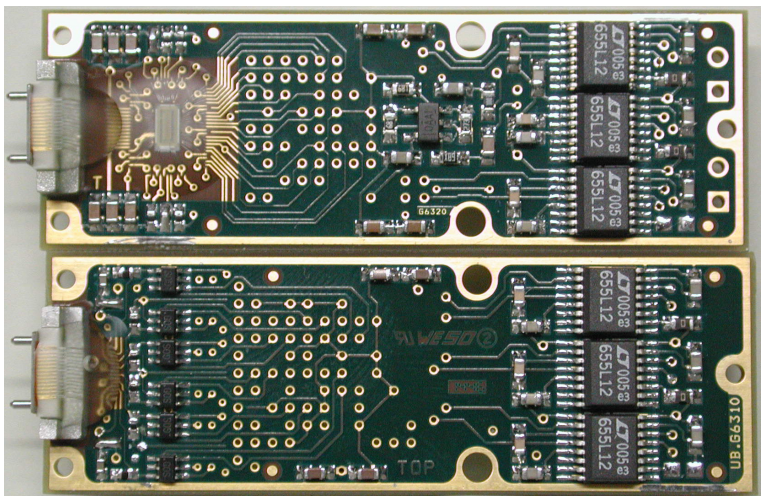
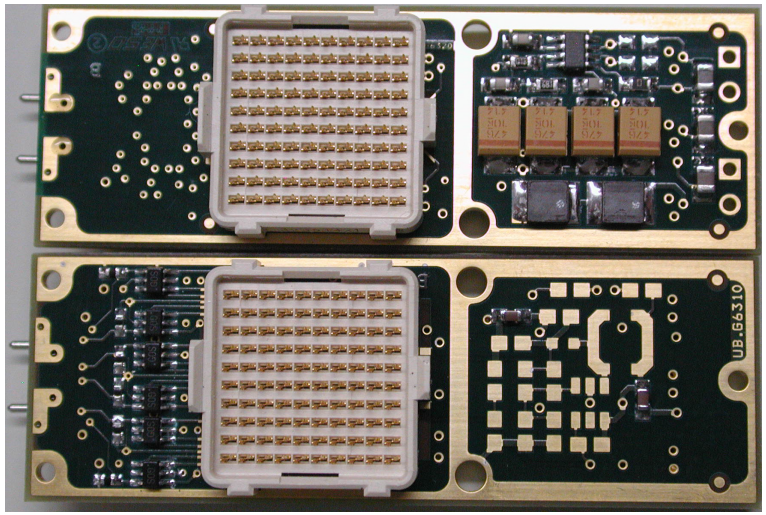
} Test them to find it out!





How to test them out?

Electrically

- Verify the characteristics on its own by signal injection onto the electronics
- Measure directly on BOC (Back Of Crate Card)

Do they actually transmit correctly?

- Loopback test using the BOC software
- Bit error rate testing (BERT) using the BOC

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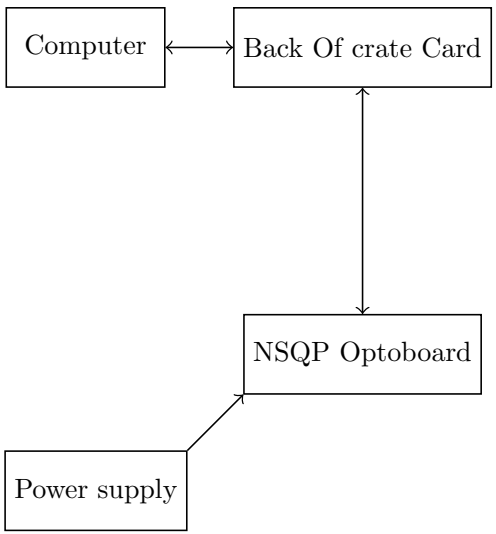
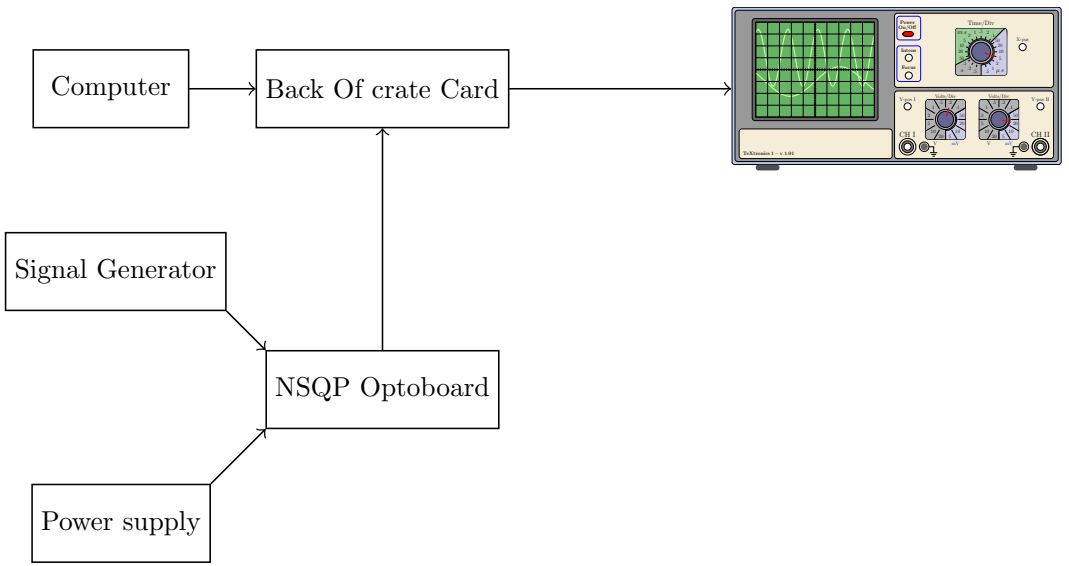
Measurements

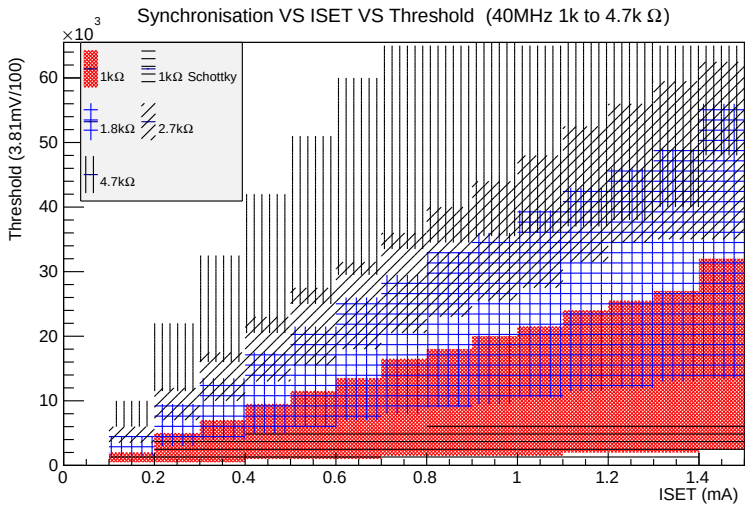
Principle

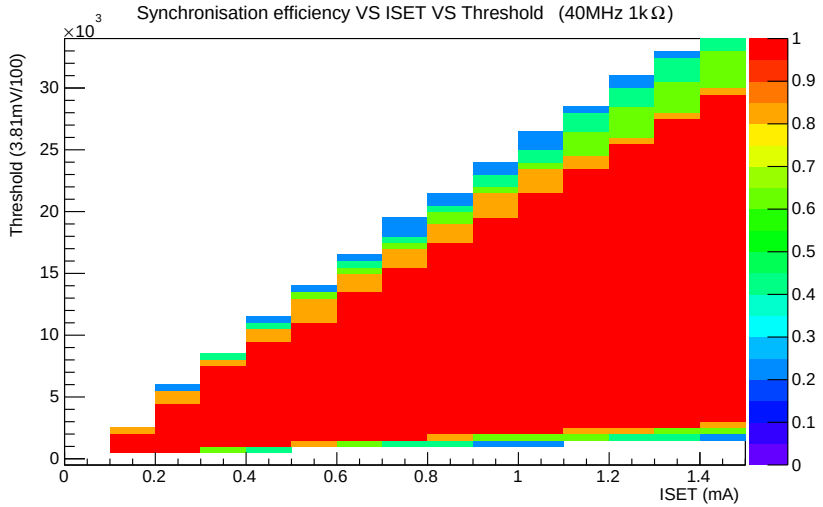
- Verify the range in which the BOC recognises the incoming signals
- Measure erros from memory of the BOC (FiFo)
- Measure signal on BOC from pattern signal generator

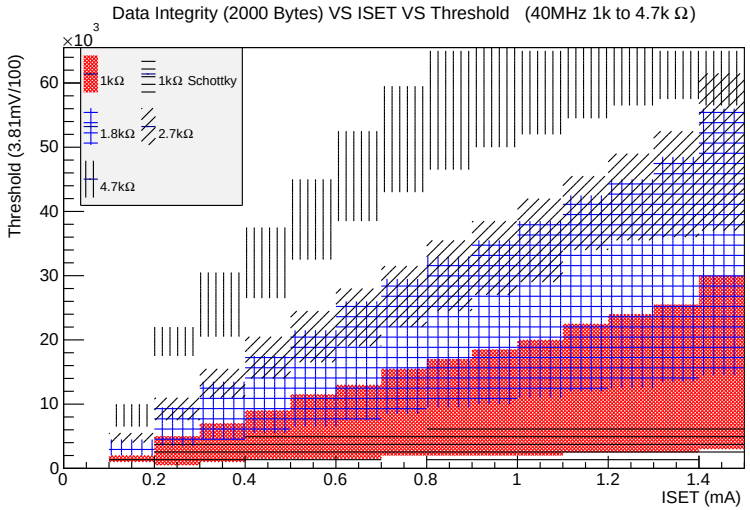


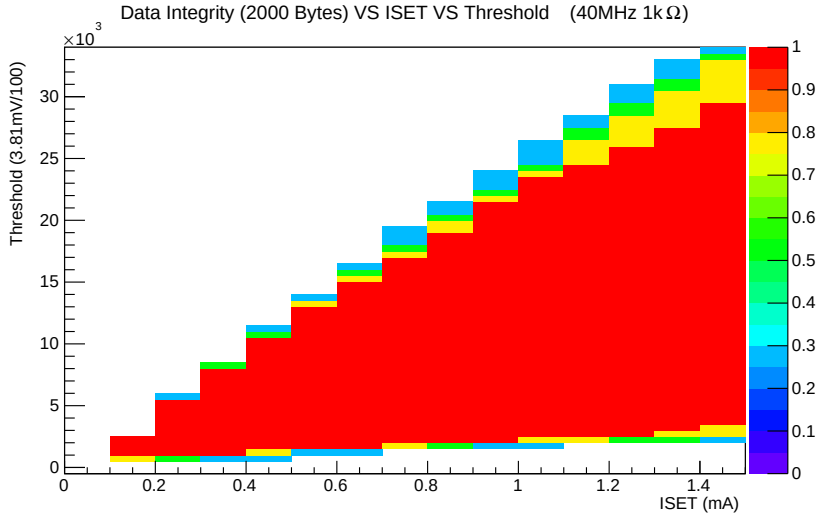


Preliminary testing of the discrete solution









And the ASIC?

Encouraging after first testing but...

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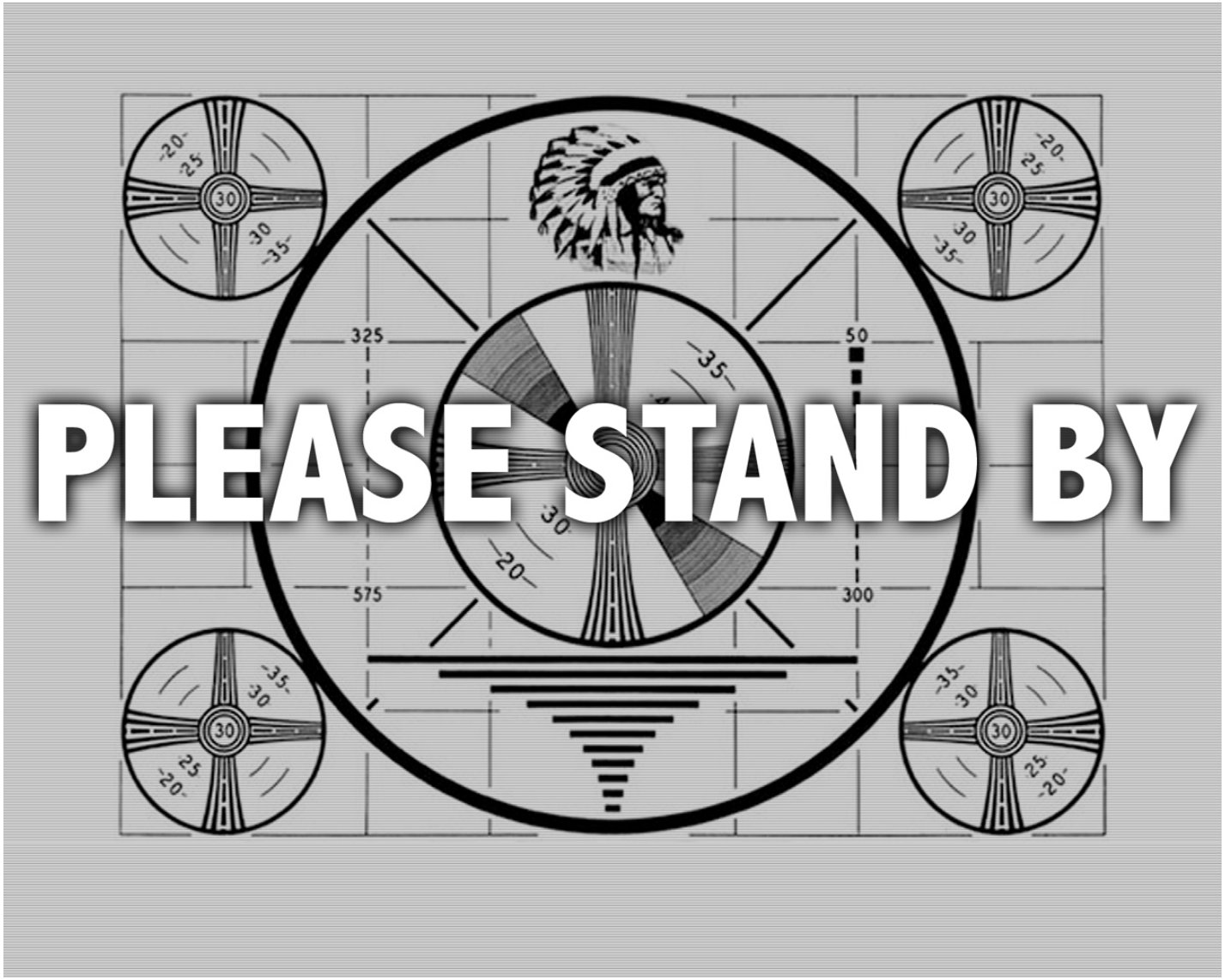

Project outlook

Not so far away in space time

- Full test of both "almost" final version of respective designs
- Aeging test of both designs

Further down the road

- Production and testing of 300 plugins
- Installation of said 300 plugins

Thanks for listening