Optical Receiver Sensitivity

Rainer Schwemmer, LHCb Electronics Meeting Dec. 2014

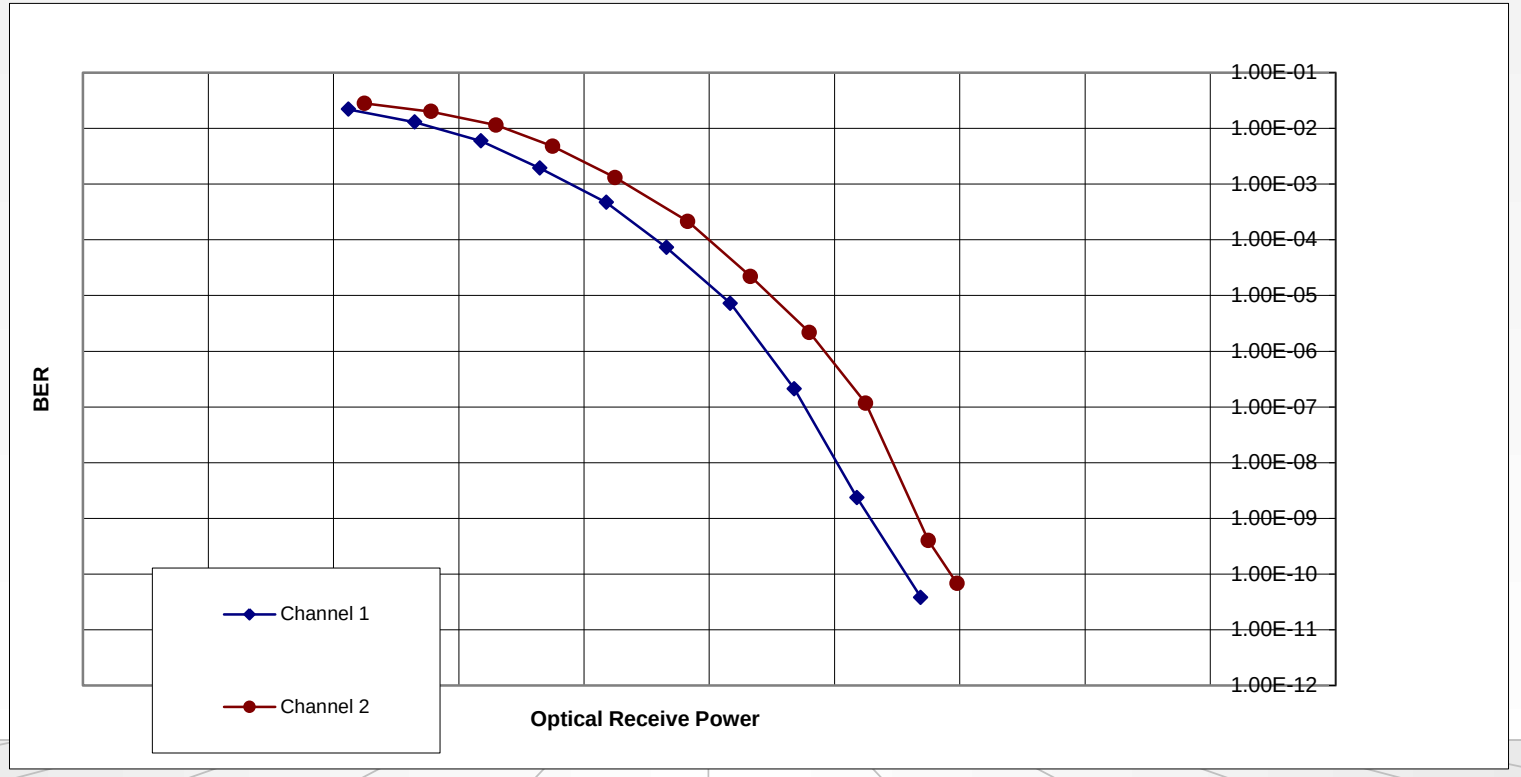
Goal

- Determine the spread of sensitivity of different MINIPod receivers
  - For the Detector → DAQ direction
- Sample of 20 x12 receivers from Marseille
  - 240 receivers in total
  - ~ 2-3% of planned installation

Methodology

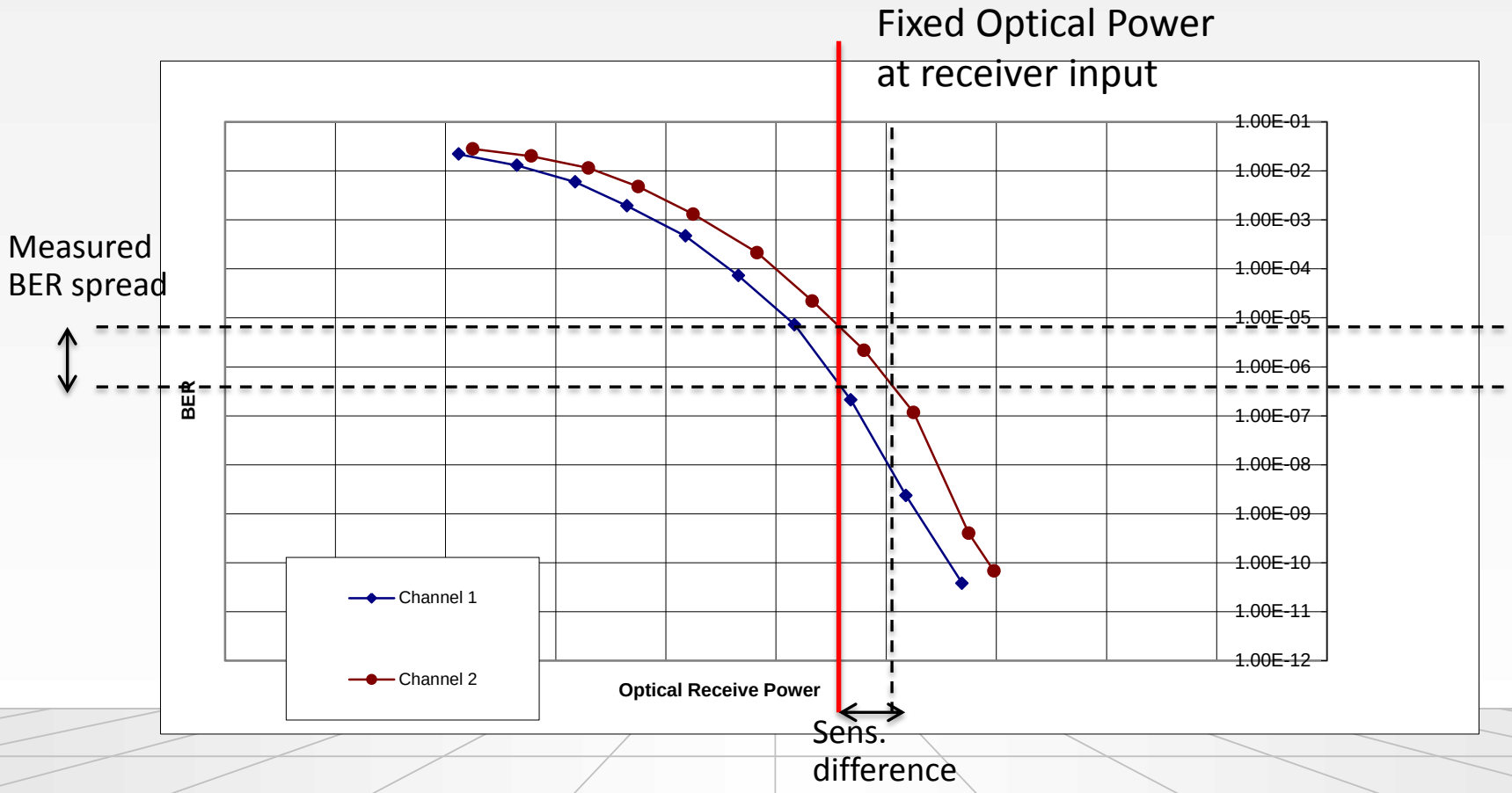
- Unfortunately no x12 tester for sensitivity measurements available
- The receivers need to go onto the new AMC40 prototypes → limited time frame
- Fixed transmitter with stable optical power output, change receivers and try to map resulting BER to sensitivity

Methodology



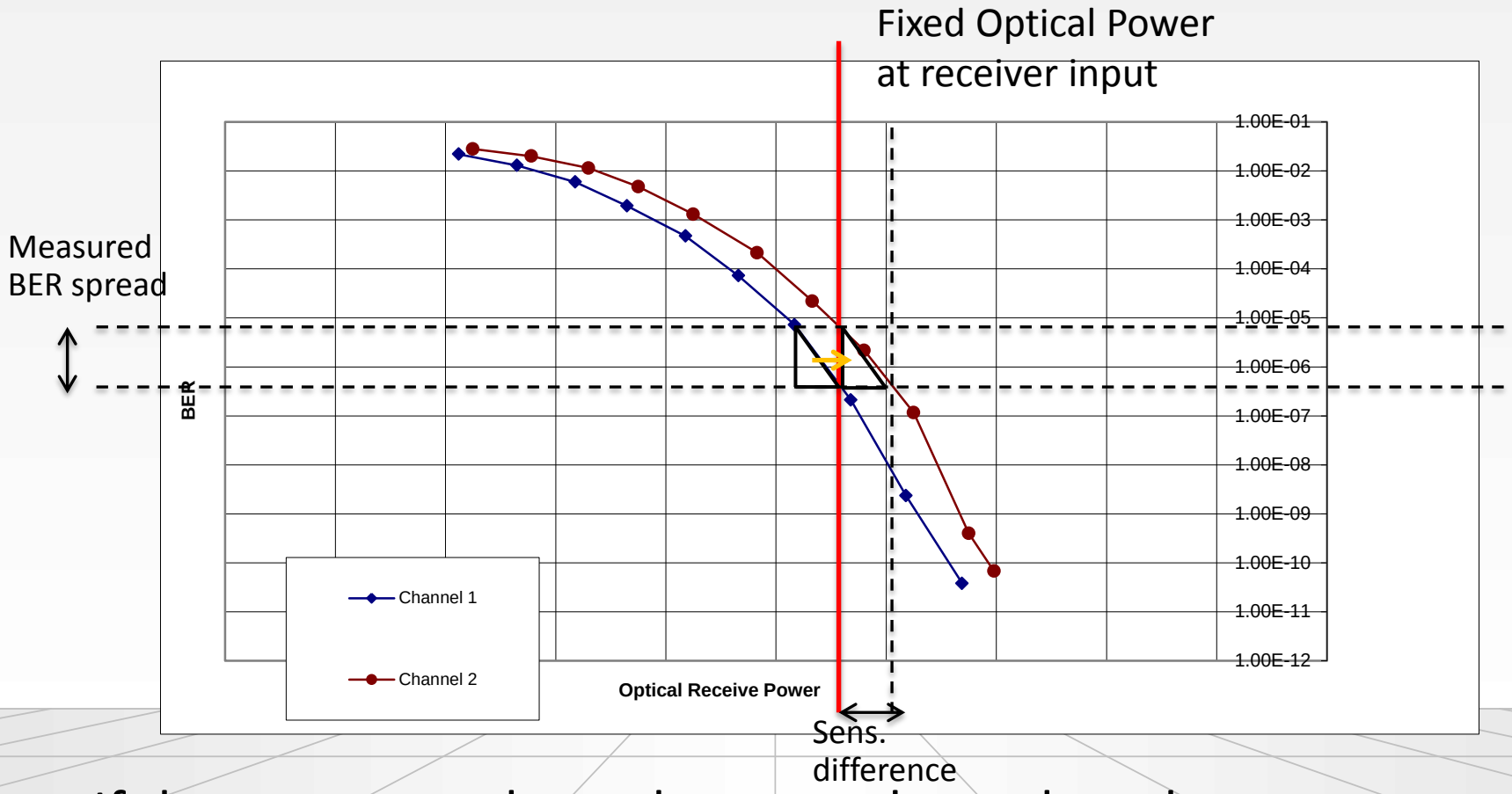
- Assumptions:
  - Curve for different receivers has same shape but is moved to the left or to the right depending on sensitivity
  - Transmitter output power is stable between on/off cycles

Methodology



- Inject optical signal at fixed power
- Measure BER of different receivers at this power

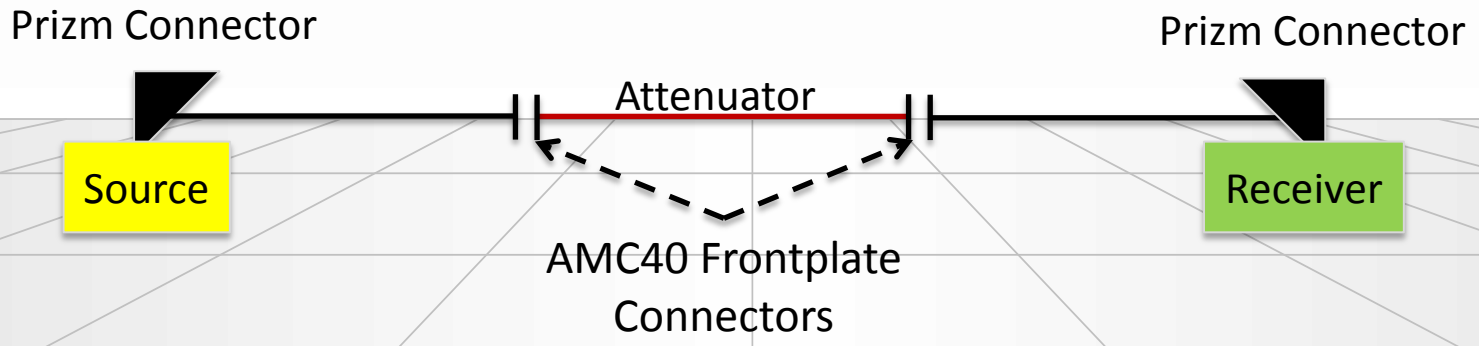
Methodology



- If the two curves have the same shape then the two triangles are identical
- Use the BER difference measured on a reference receiver to get the power/sensitivity value of the device under test

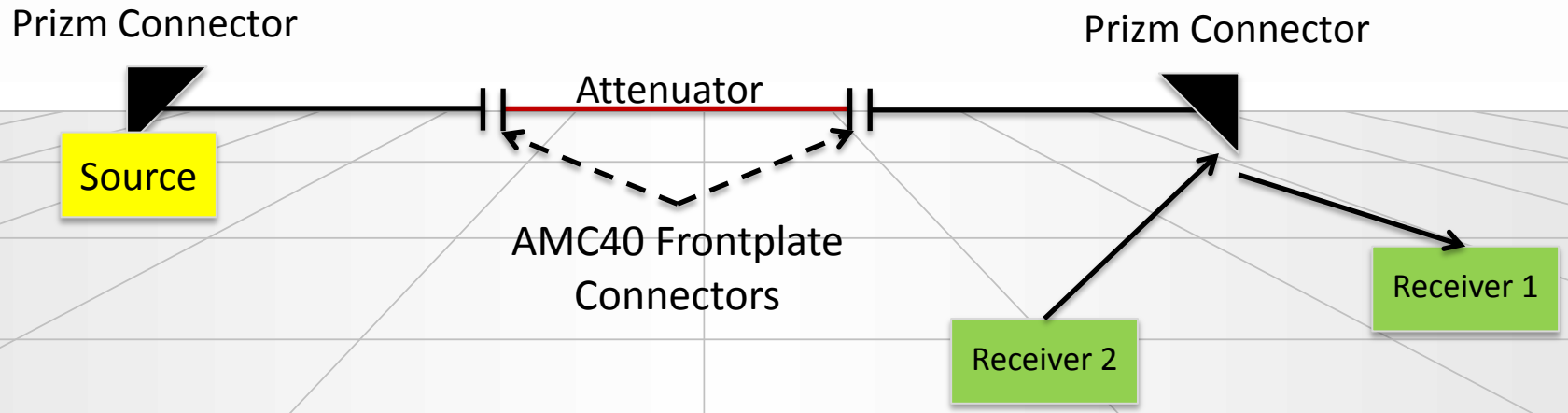
Setup

- One x12 Transmitter of one prototype AMC40 as source
  - Attenuated to intensity which actually produces errors
- Swap out receivers on the board and measure BER

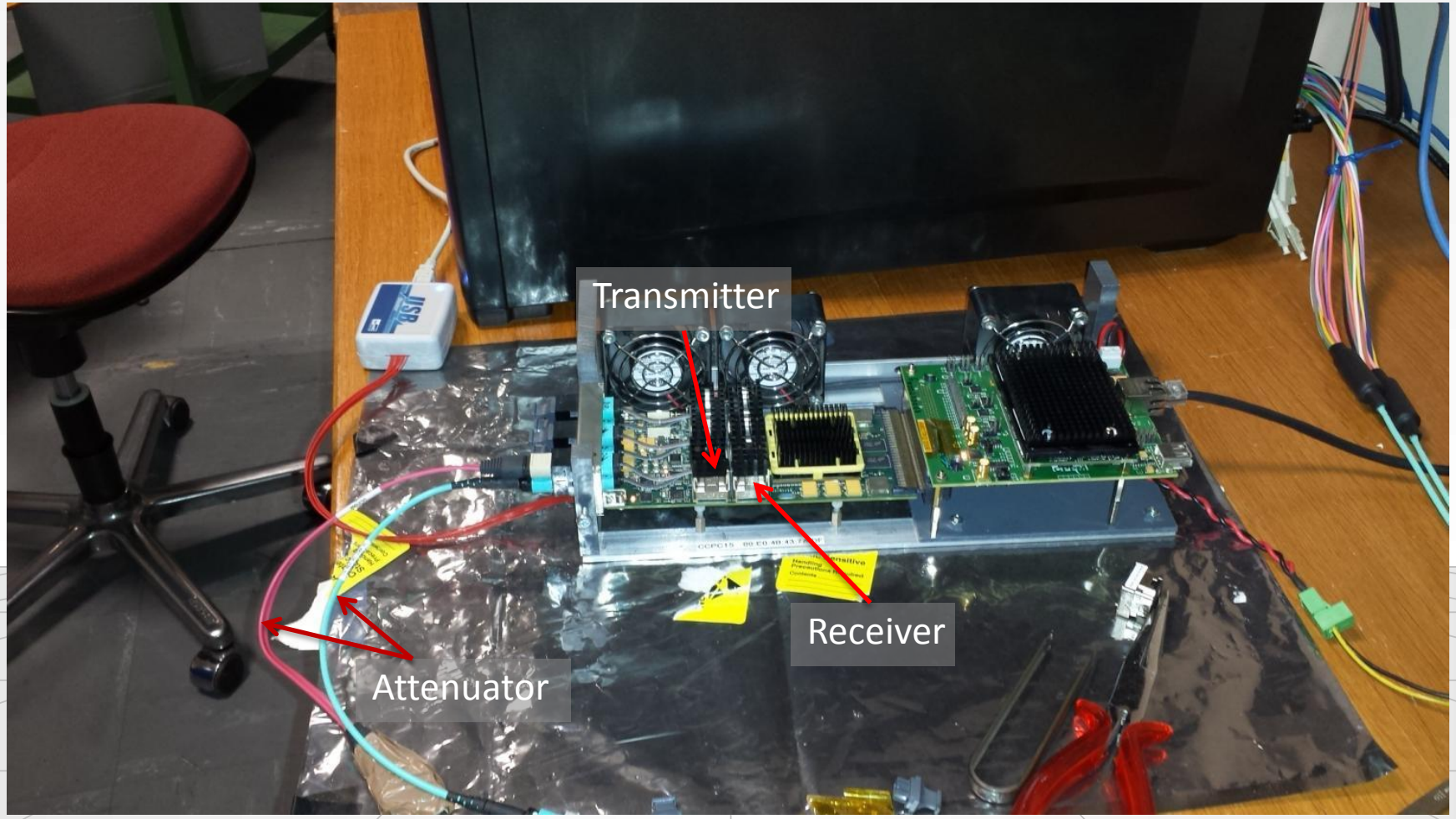


Setup

- One x12 Transmitter of one prototype AMC40 as source
  - Attenuated to intensity which actually produces errors
- Swap out receivers on the board and measure BER
- Have to power cycle the board for swapping out receivers though

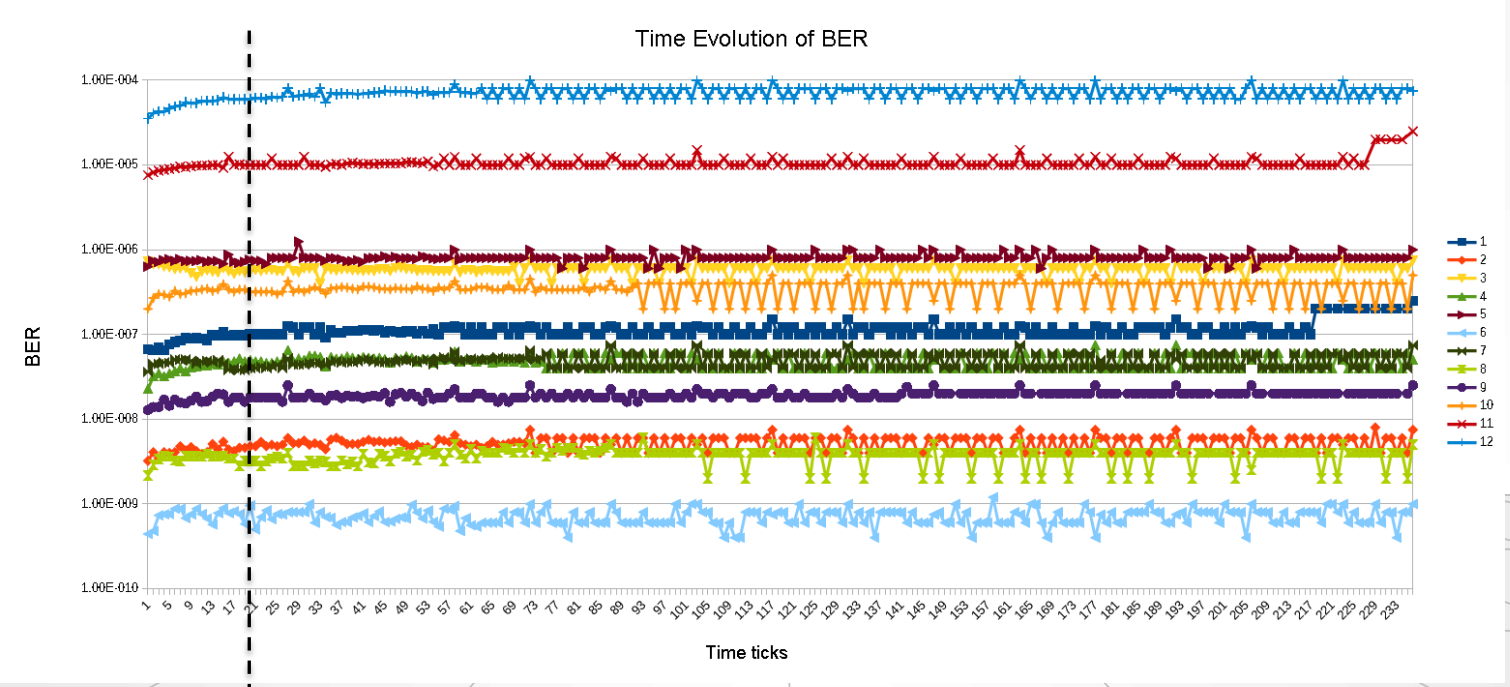


Setup



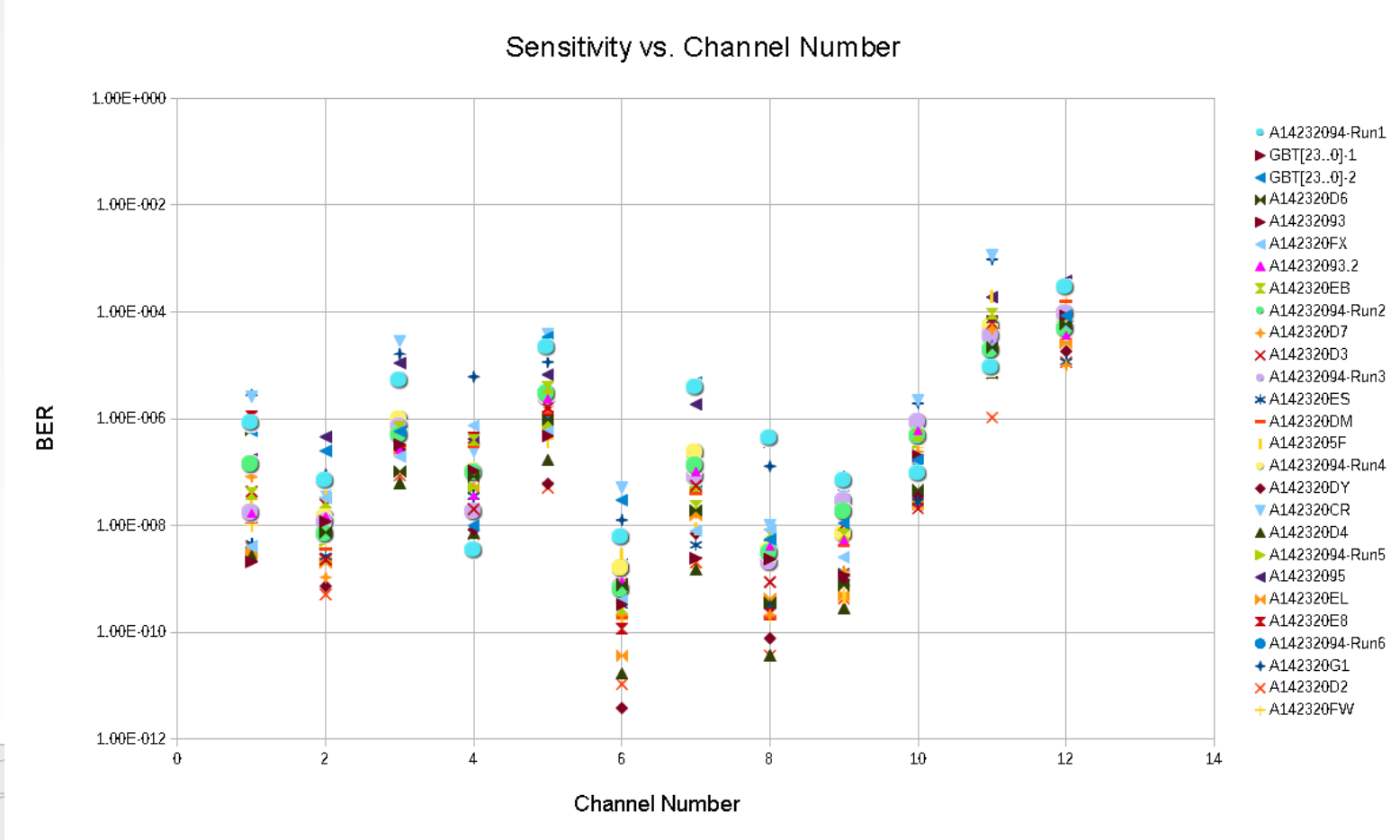
Results

- Temperature dependency



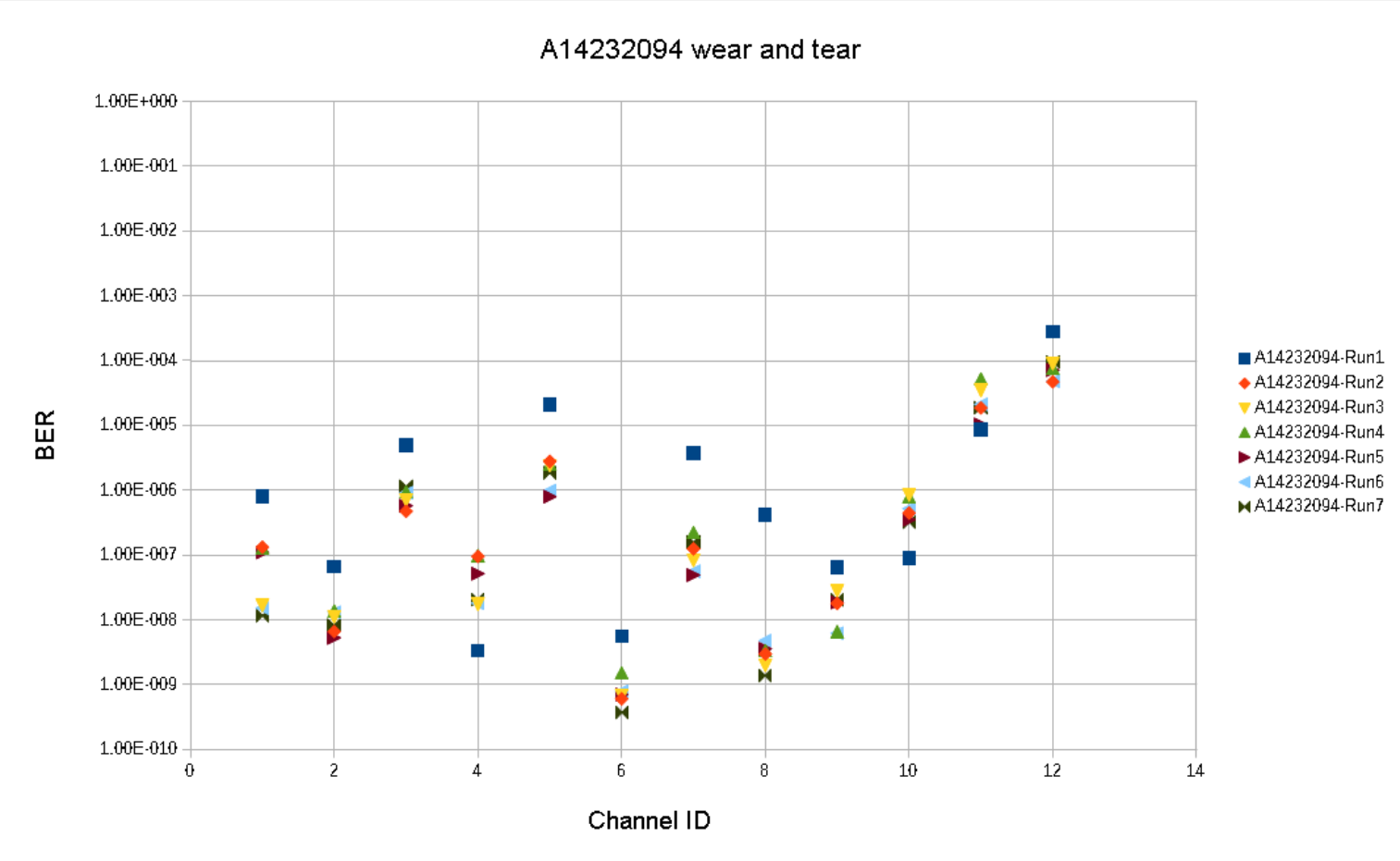
10 min

Results



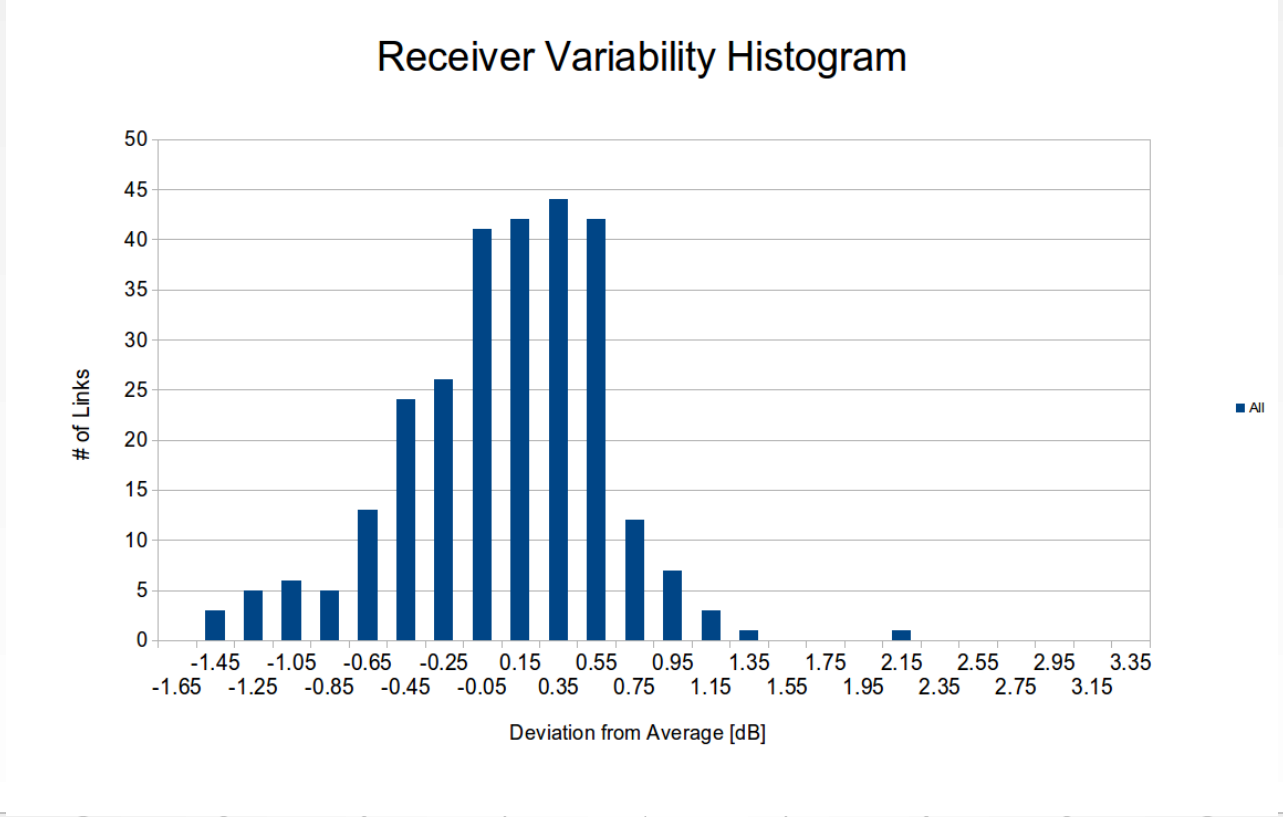
- Bit error rate vs Channel ID
- Individual channels form clusters
  - Injected optical power is different on different channels
  - Attenuator is not same on every channel

Results



- Every now and then: put the same receiver back into the socket
- Variation is quite large
- Prism connector seems to have quite a large spread on re-connects

Results



- After conversion of BER into optical power
- Distribution is centered around average
- No absolute values yet, because we have not measured absolute value of optical output power

Conclusions

- Spread of sensitivity is quite large (+- 1 dB)
- A large portion of it is probably due to losses in connector rather than receiver
- Need to do calibration of transmitter to get absolute sensitivity values (2-3 days of measurements in optics lab)