Simulated DFE Error Propagation Results for Intel Channels

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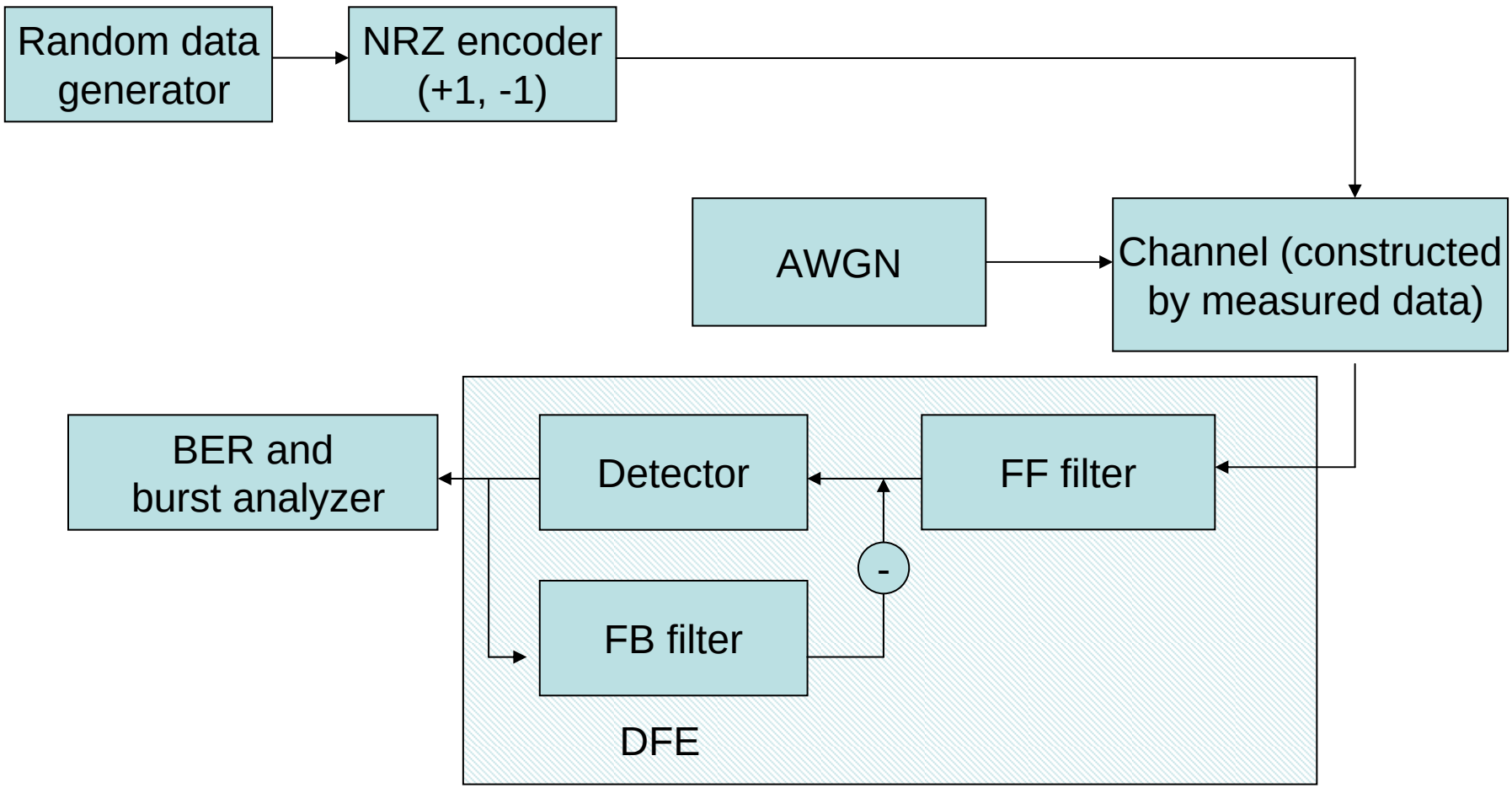
Purpose

- Simulate DFE Error propagation of Peters channels
  - Look at real channels from 802.3ap set
    - peters_01_0305
  - Independent validation of Hamstra spreadsheet results

Simulation pipeline



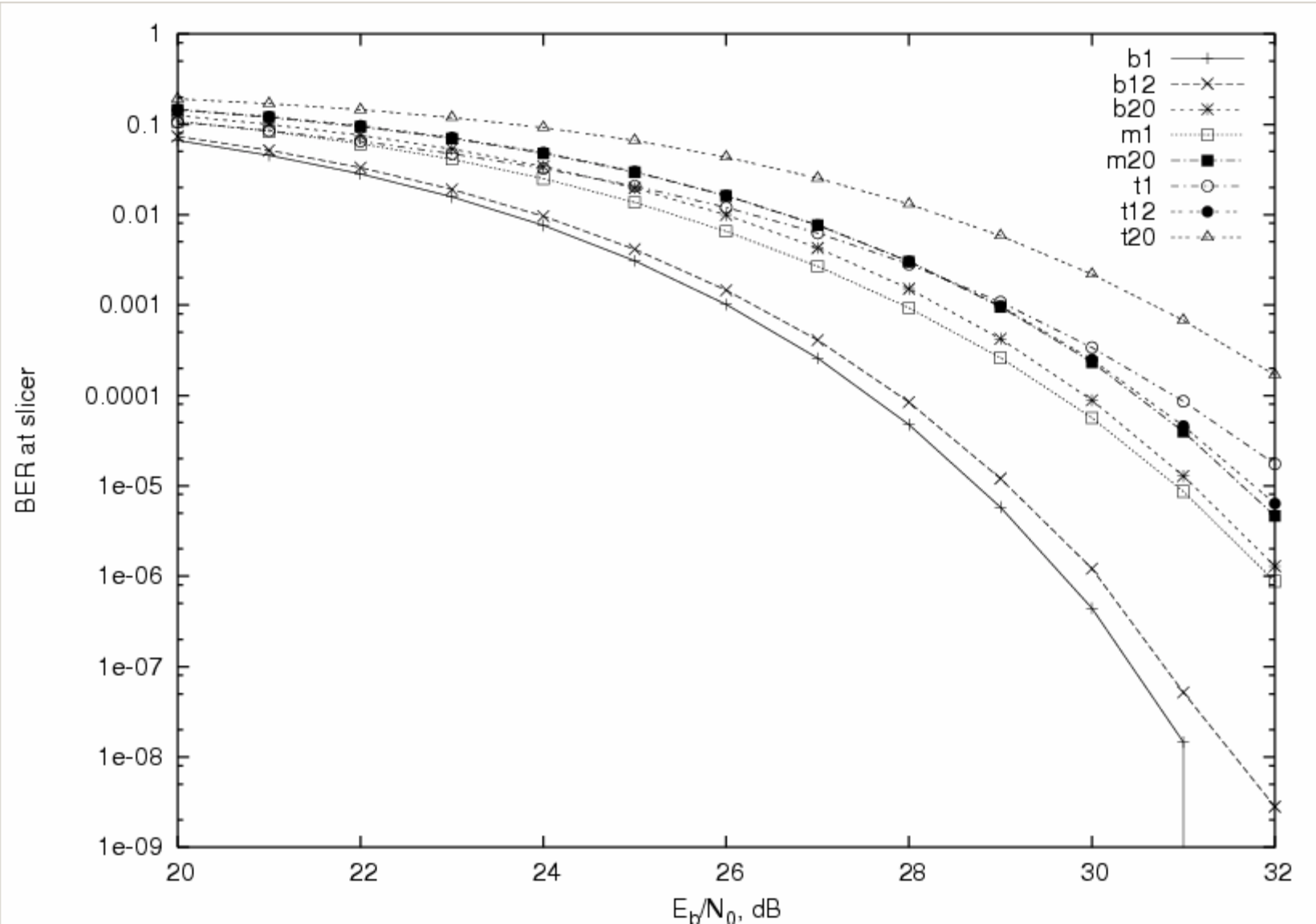
Simulator Details

- C++ simulator developed by Intel for 10GbaseT simulations
  - Simulations correlate with other 10GbaseT simulators
- SNR level set to create a $1E^{-5}$ BER
  - 10GbaseT experience shows that this level can be corrected by FEC
  - This BER reduces simulation run time.
    - Correlated with others
- All simulation results are for 5 FFE & 5 DFE taps
- In the following results bursts are defined as runs of errored bits
  - Burst ends at first correct bit

Channels processed

- Intel channel models
  - B1
  - B12
  - B20
  - M1
  - M20
  - T1
  - T12
  - T20 (seems to be the worst channel)

BER of optimal (5, 5) DFE



Error structure

- All channels showed burst distributions much higher than that expected by individual events at BER=E^{-5}.

Channel B1

Length	Error run length distribution
1	**0.60365**
2	**0.36453**
3	**0.0266729**
4	**0.0051474**
5	**0**

Channel B12

Length	Error run length distribution
1	**0.574142**
2	**0.415632**
3	**0.00657414**
4	**0.00219138**
5	**0.00146092**
6	**0**

Error structure, cont'd

Channel B20

Length	Error run length distribution
1	**0.333007**
2	**0.644499**
3	**0.0122249**
4	**0.00782396**
5	**0.00244499**
6	**0**

Channel M1

Length	Error run length distribution
1	**0.188026**
2	**0.581852**
3	**0.113658**
4	**0.0823199**
5	**0.02058**
6	**0.00795136**
7	**0.00374181**
8	**0.000935454**
9	**0.000467727**
10	**0.000467727**
11	**0**

Error structure, cont'd (2)

Channel M20

Length	Error run length distribution
1	0.251787
2	0.702145
3	0.0142971
4	0.0214456
5	0.00714853
6	0.00158856
7	0
8	0.000794281
9	0
10	0.000794281
11	0

Channel T1

Length	Error run length distribution
1	0.198856
2	0.0629471
3	0.479256
4	0.101574
5	0.0808298
6	0.0443491
7	0.0178827
8	0.00858369
9	0.00429185
10	0.000715308
11	0
12	0
13	0
14	0
15	0
16	0
17	0.000715308
18	0

Error structure, cont'd (3)

Channel T12

Length	Error run length distribution
1	0.302741
2	0.362336
3	0.0893921
4	0.0977354
5	0.0858164
6	0.0262217
7	0.011919
8	0.0107271
9	0.00595948
10	0.00595948
11	0.0011919
12	0

Channel T20

Length	Error run length distribution
1	0.24575
2	0.454405
3	0.0942813
4	0.057187
5	0.0757342
6	0.0309119
7	0.0185471
8	0.0123648
9	0.00309119
10	0.00463679
11	0.0015456
12	0
13	0
14	0.0015456
15	0

Conclusions

- At these BERs significant DFE error multiplication occurs on the Peters channels
- FEC can recover such channels to E^{-12}
- DFE error propagation is an important consideration for 802.3ap channels