OFDM and Turbo coding:

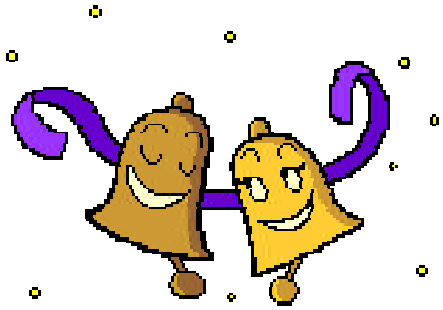
the perfect marriage

Liesbet Van der Perre, on behalf of the T@MPO team

OFDM and turbo codes are complementary

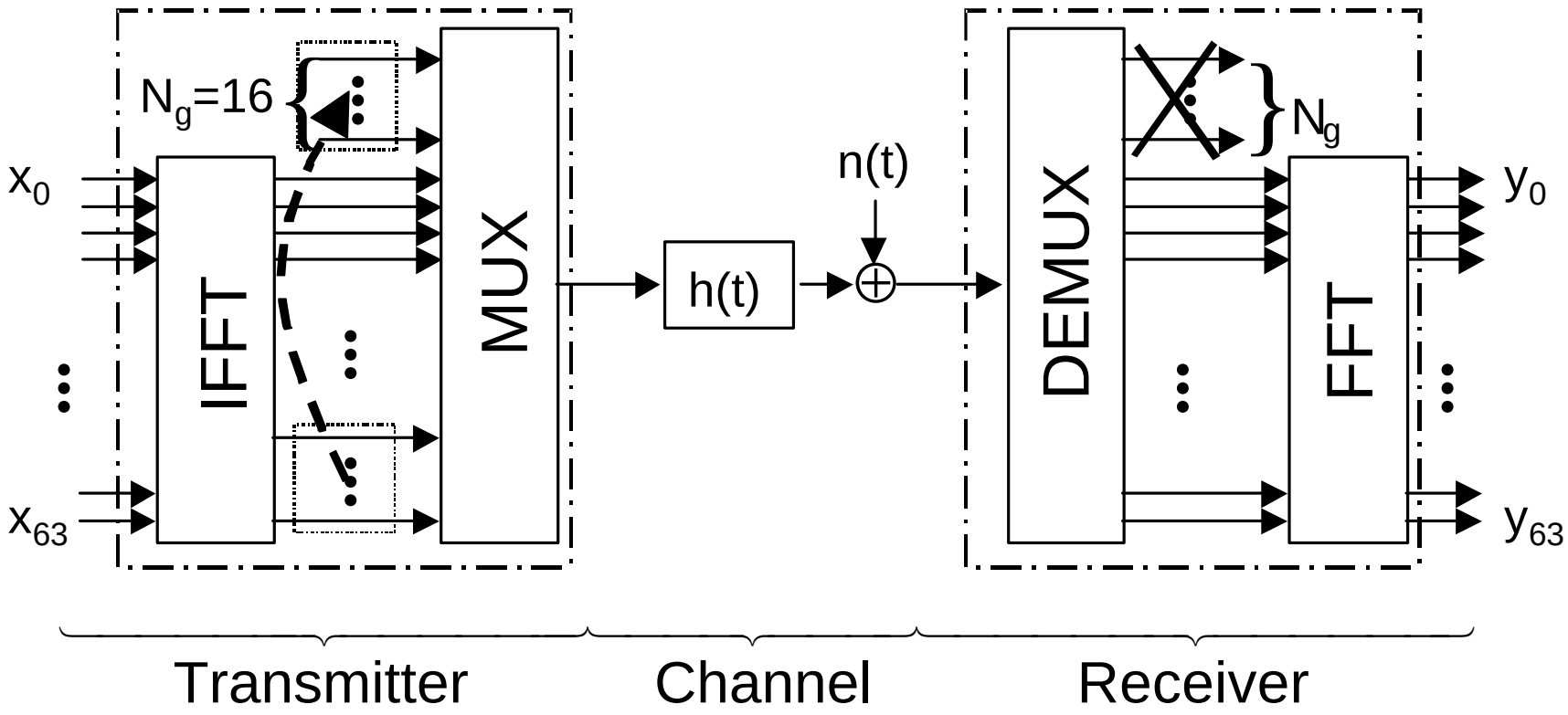
OFDM mitigates multipath

Turbo codes approach capacity limit

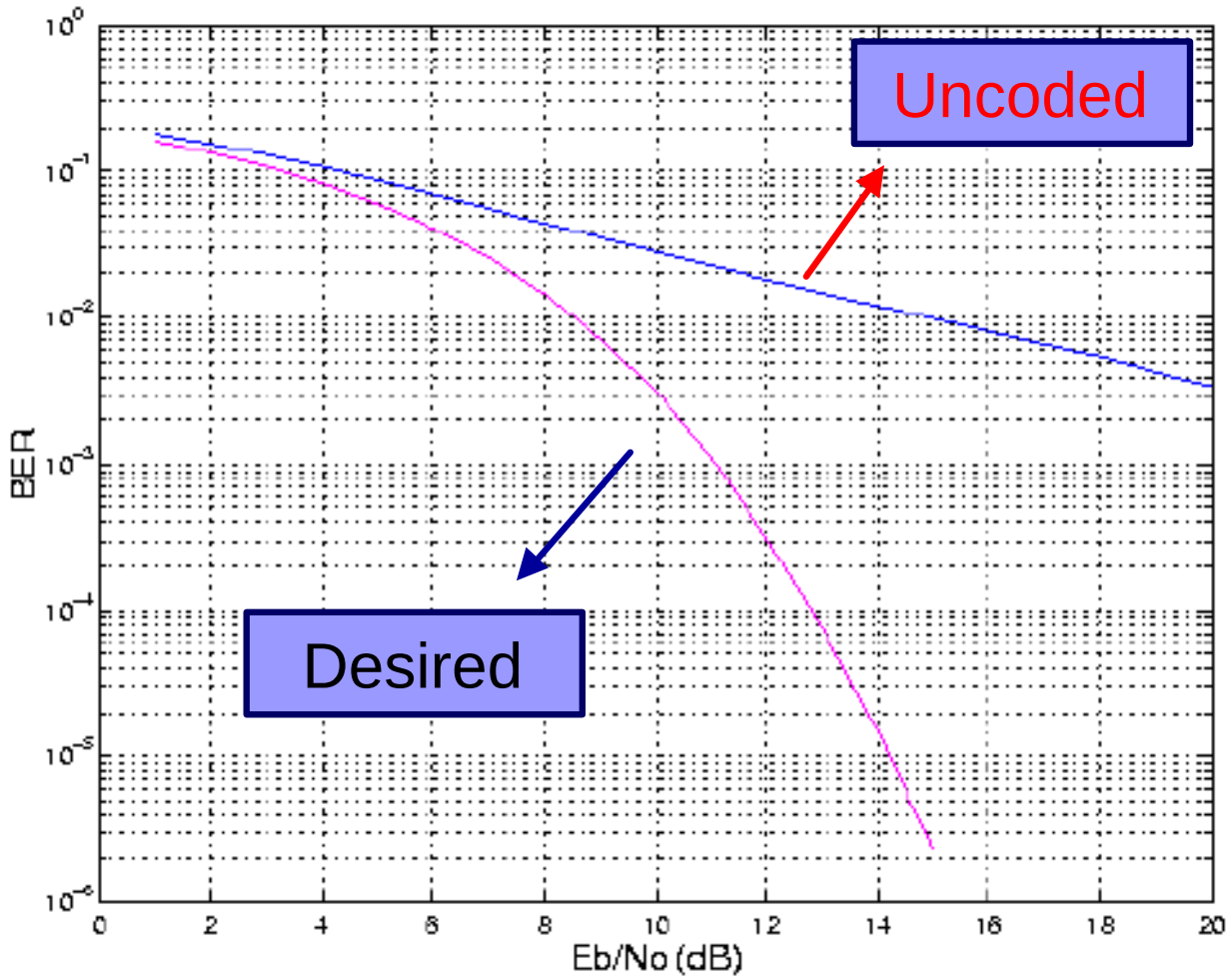


But: a good effort is needed to make it work!

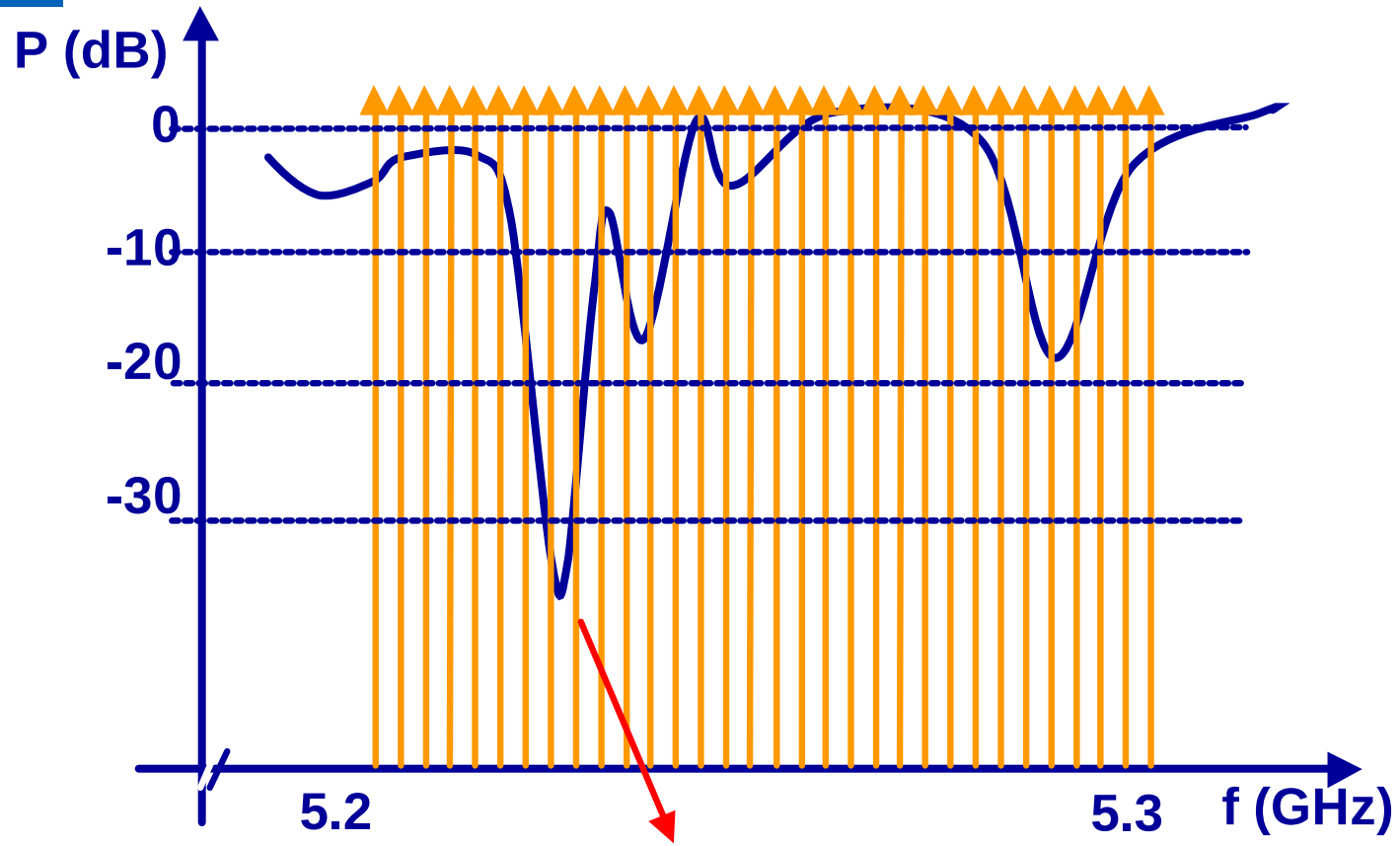
OFDM modulates on parallel carriers by (I)FFT operations



But: Uncoded performance is bad in frequency selective fading

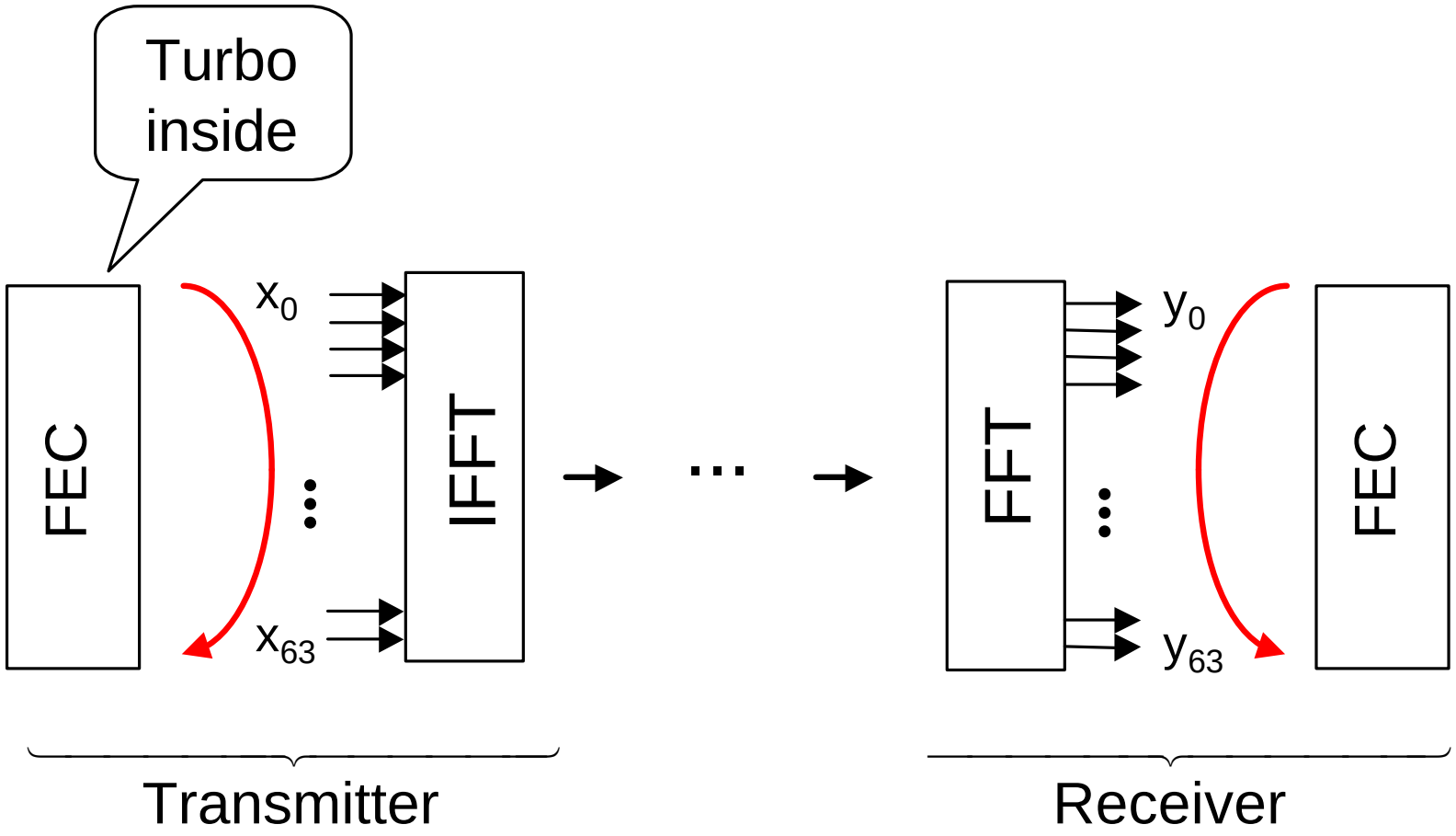


OFDM needs good error correction

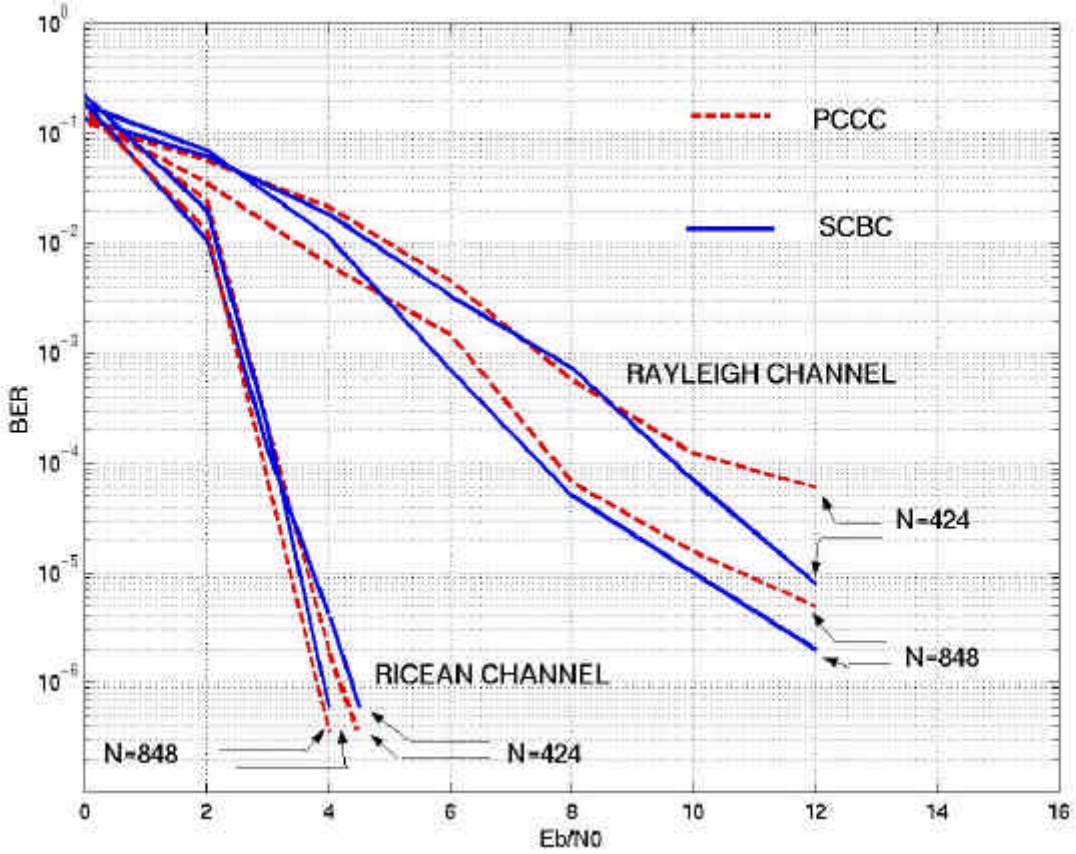


bad carriers dominate the performance

Forward error correction is performed over the carriers

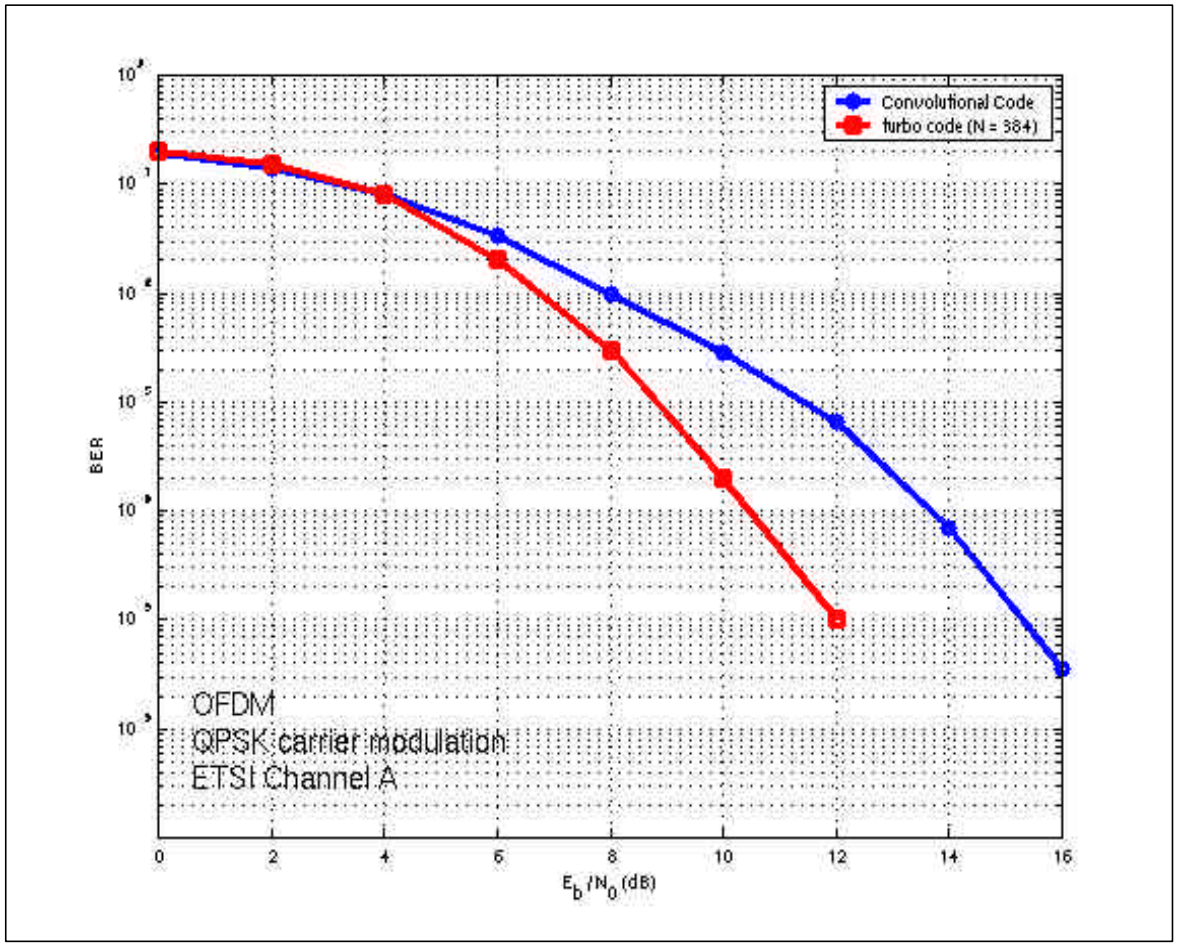


The performances on AWGN and flat fast fading channels are excellent



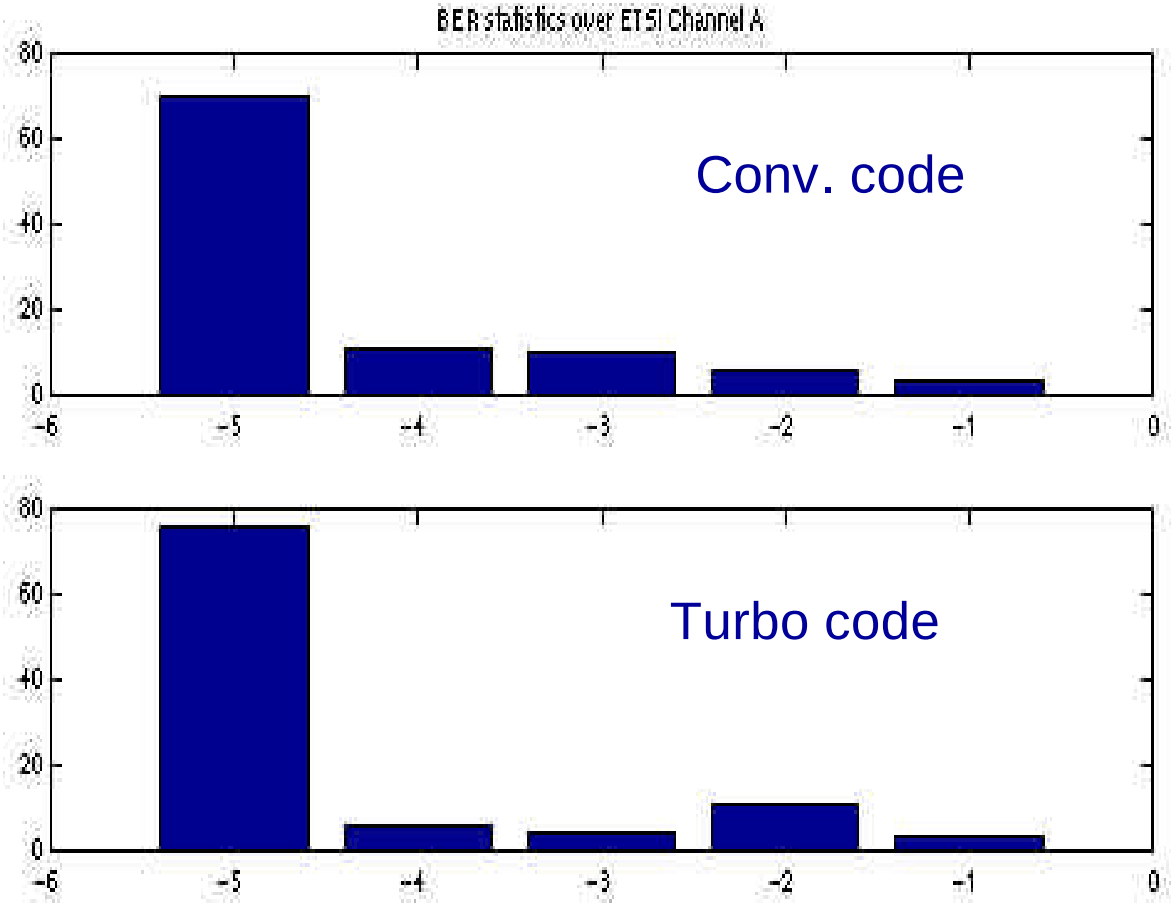
LOS (Ricean)
or
non-LOS (Rayleigh)

Never trust a wireless channel: What in frequency selective fading?

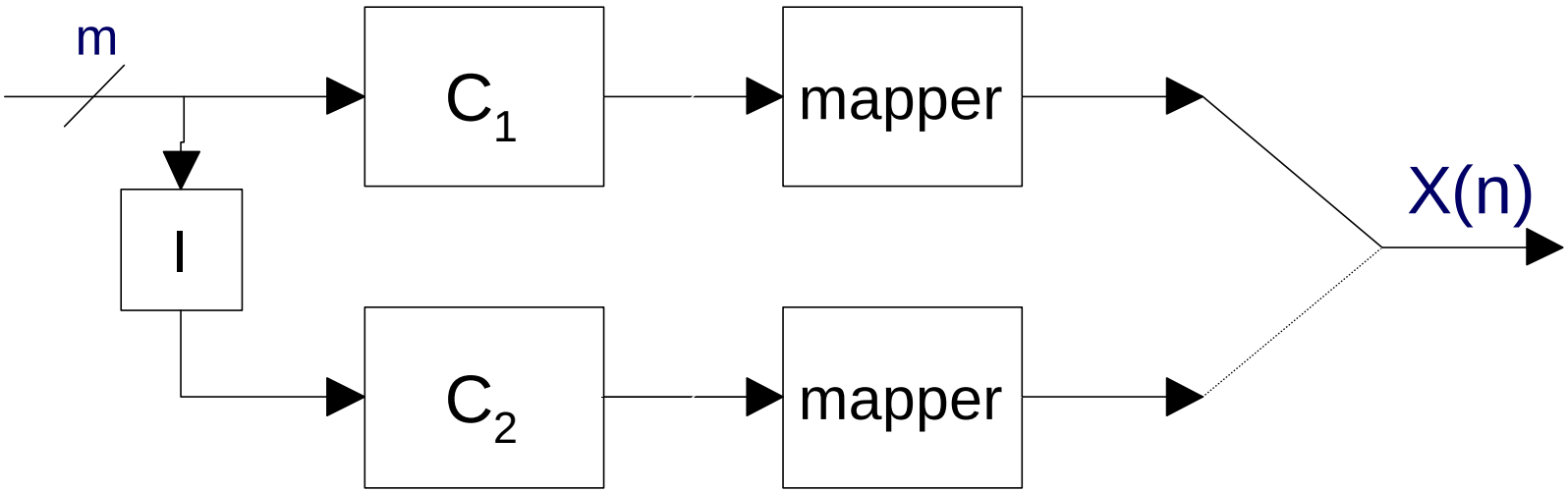


The bad carriers are still show breakers

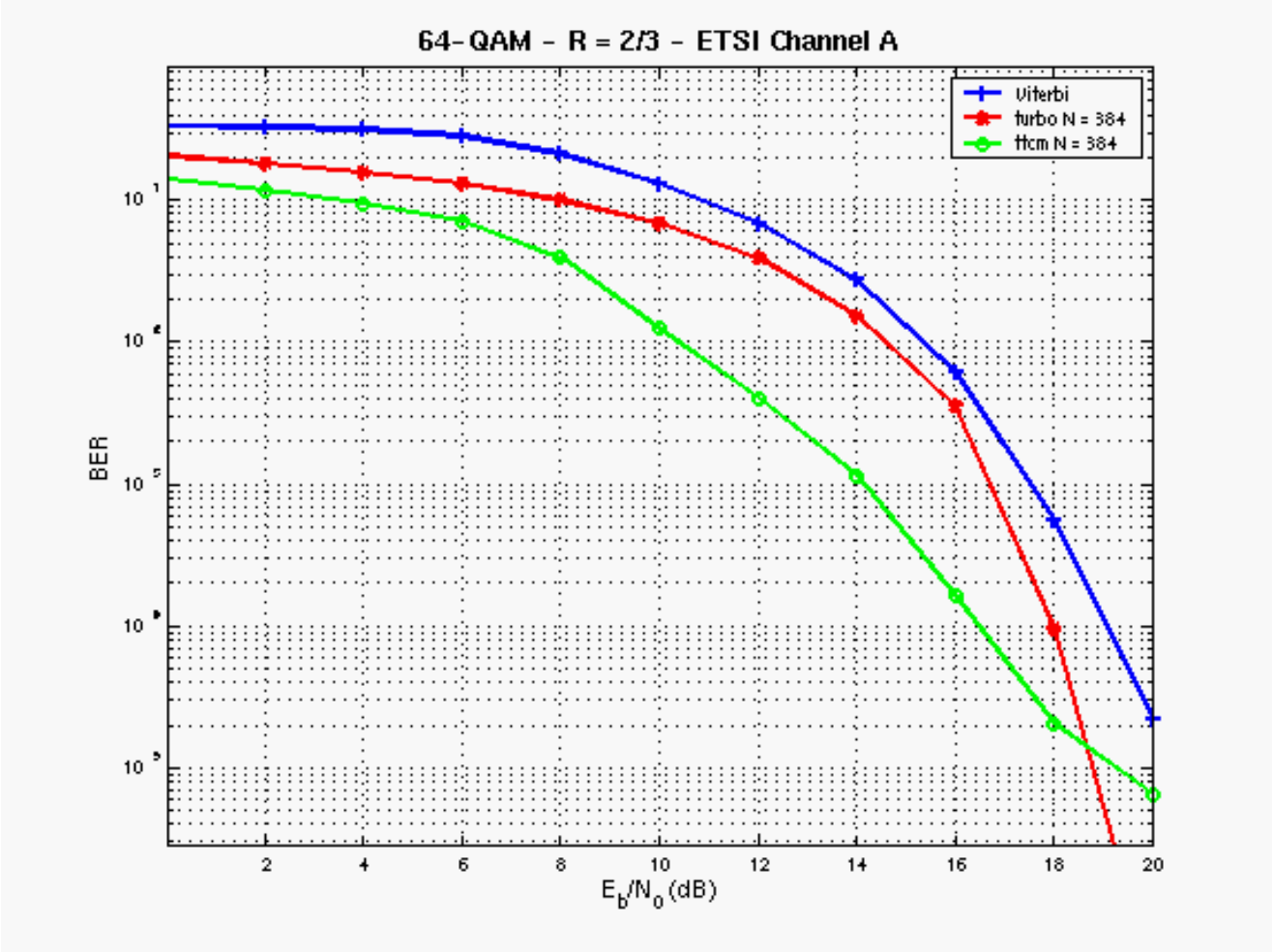
BER statistic on ETSI Ch. A



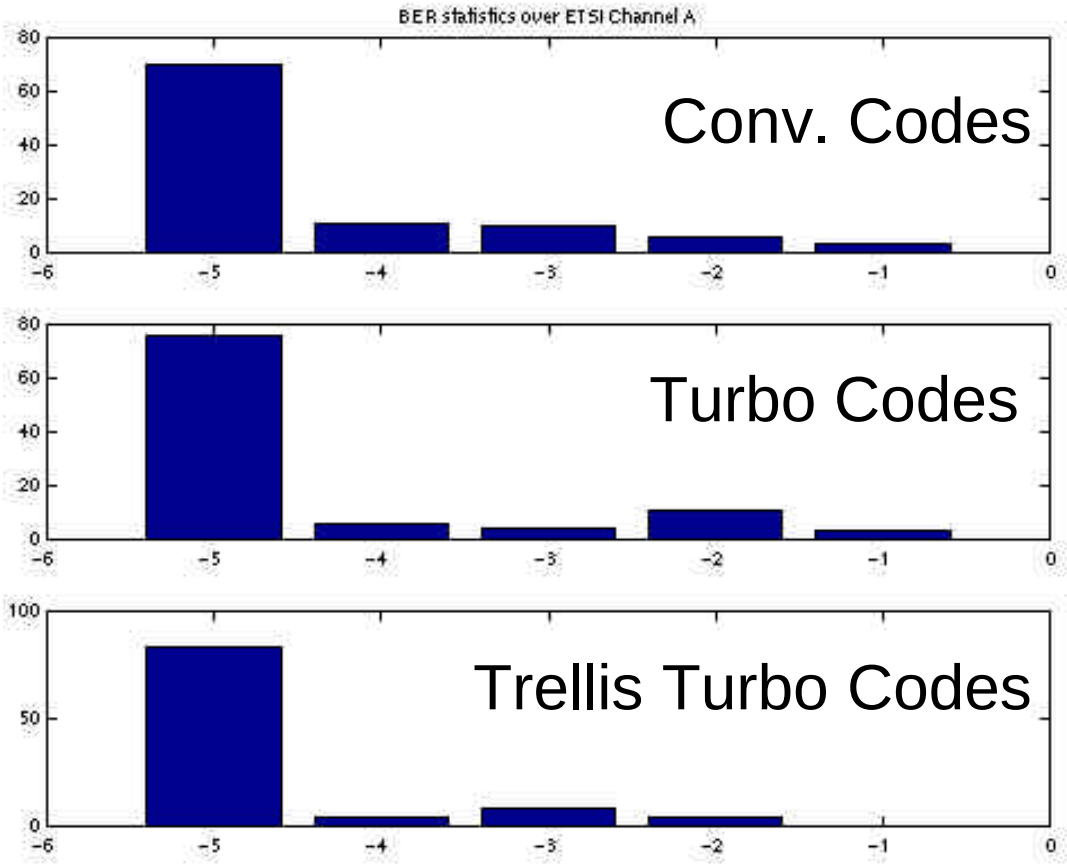
Turbo trellis modulation may solve the problem



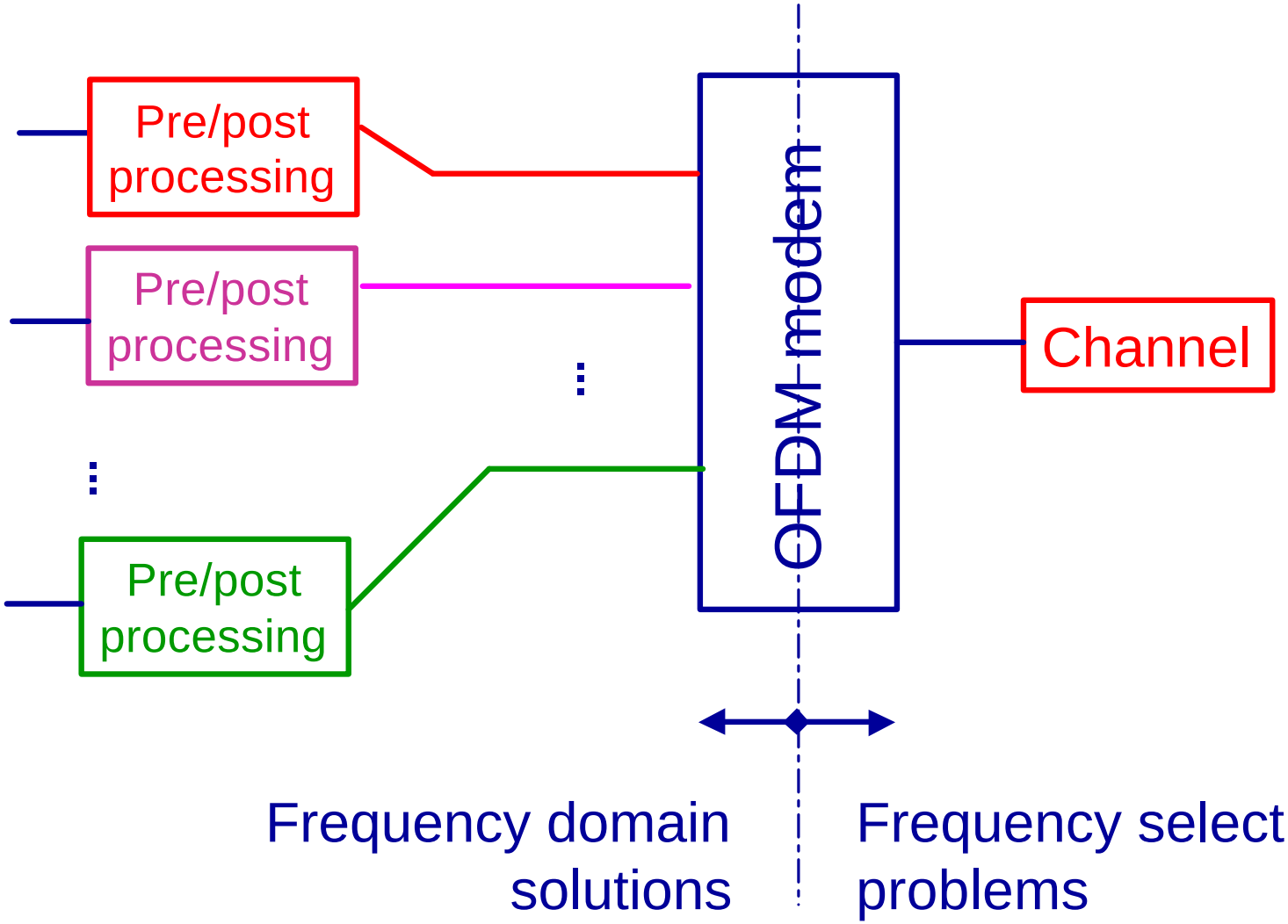
Turbo trellis modulation performs better indeed



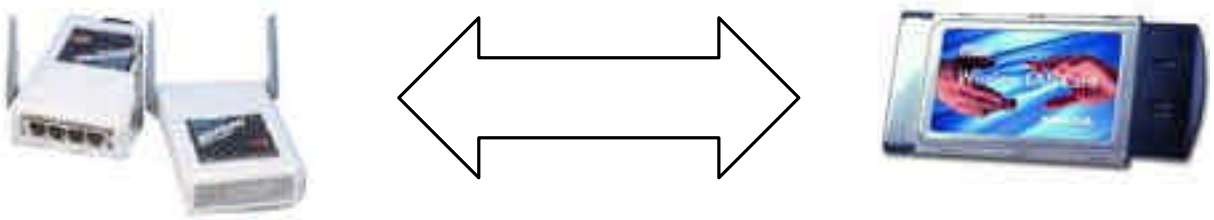
Trellis solution has nice statistics, but is less flexible



OFDM naturally enables solutions to frequency selective problems



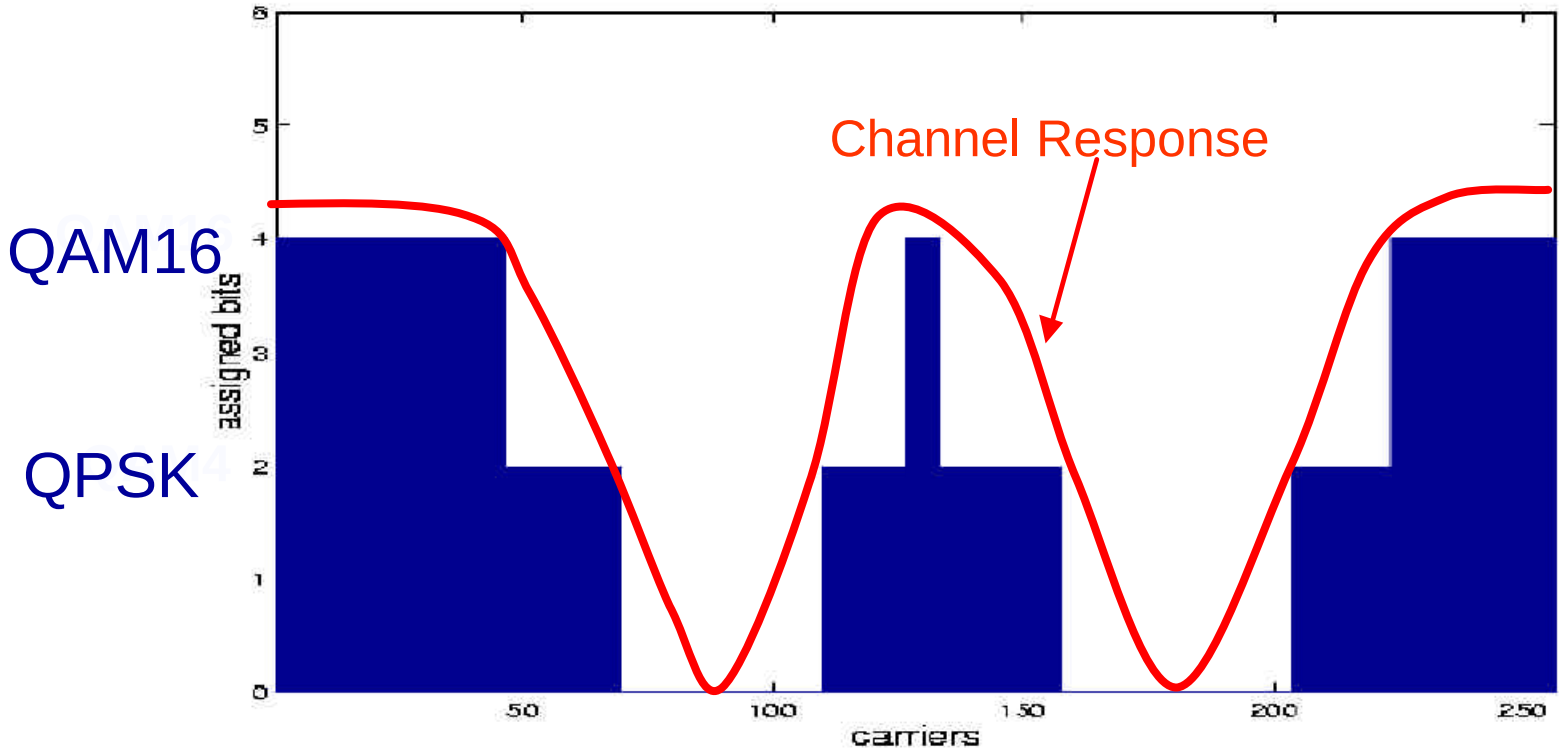
Let the turbo decoder profit from OFDM



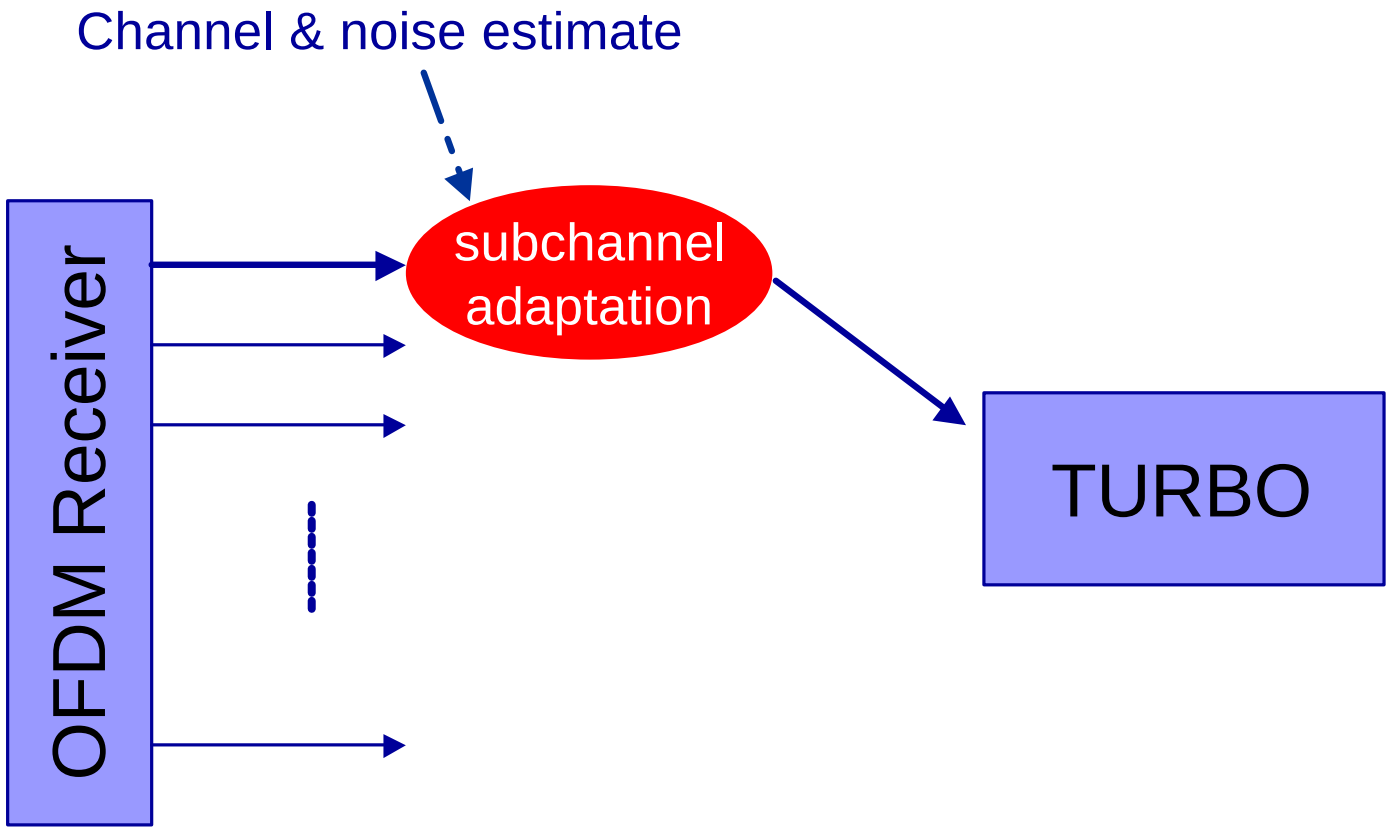
At transmitter:
adaptive loading

At receiver:
adaptive decoding

Adaptive loading avoids bad carriers

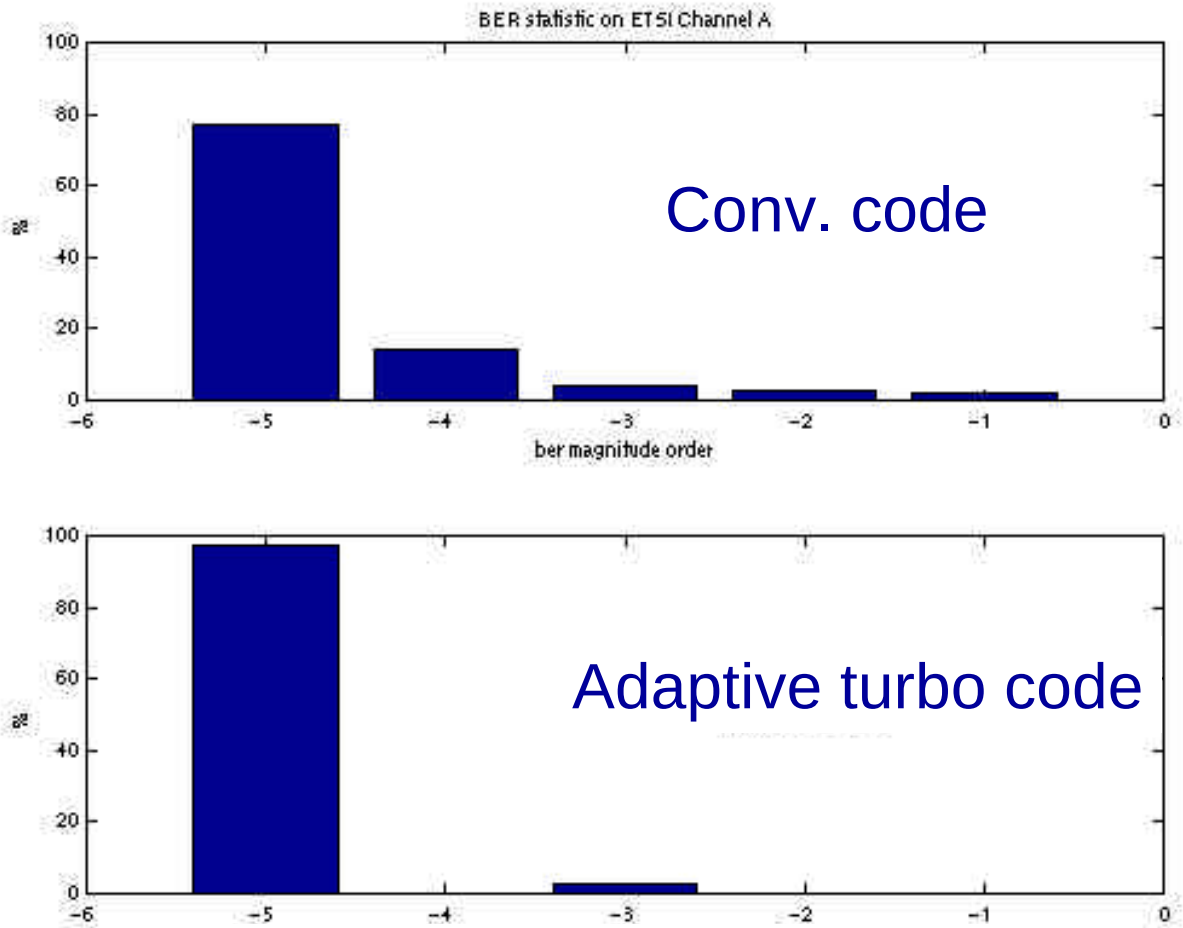


Adaptive decoding is (almost) for free



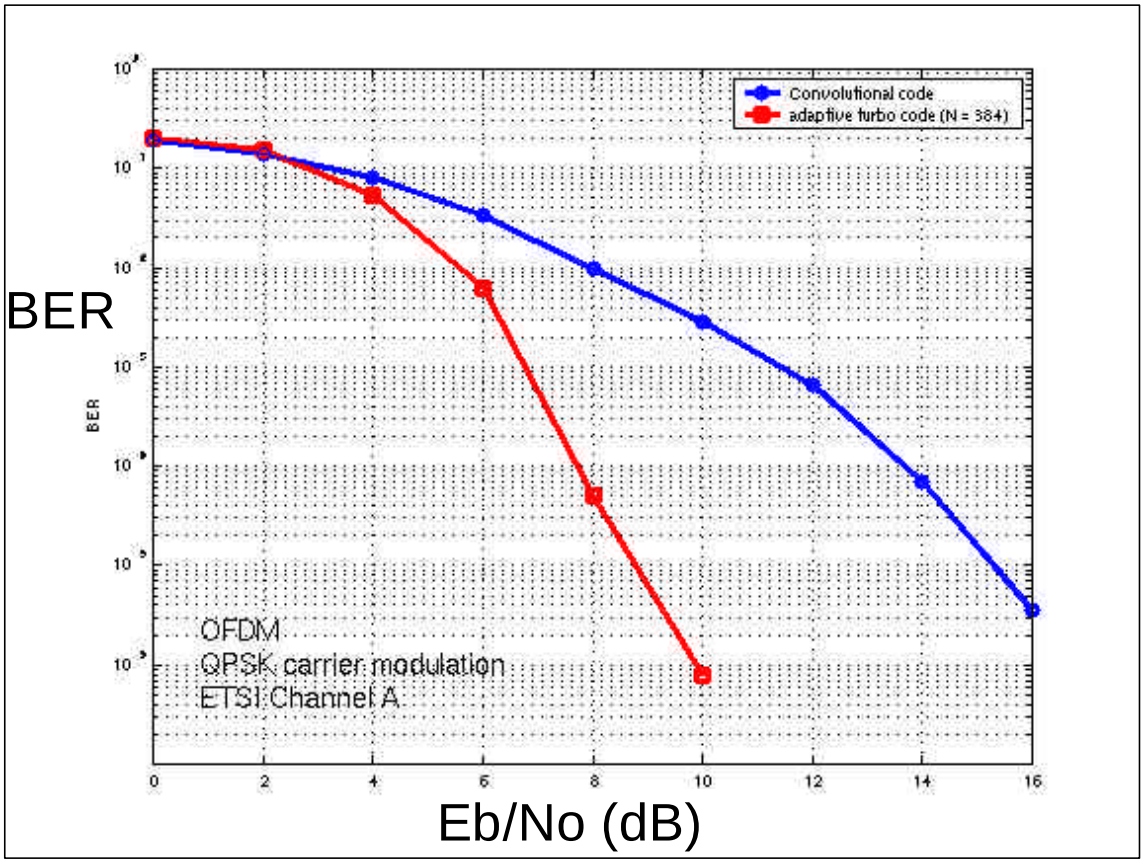
only DSP effort in receiver is needed

Also the ‘bad’ carriers have to surrender



BER statistic on ETSI Ch. A

Performance is increased significantly



We put the emphasis on ‘real’ bit-based turbo codes at the moment

? Why not product codes?

! Turbo codes achieve on the average better performance for different code rates

? Why not Trellis coded modulation?

! Turbo codes allow a flexible implementation towards different rates and modulation schemes

-> A good combination of performance and flexibility

We further investigate product codes and trellis coded modulation

- On a reconfigurable platform, the balance may tumble over
  - improved flexibility through **code** programmability
  - improved performances through **code** adaptation
- Implementation study was rather limited till now
- What about serial concatenating convolutional codes?

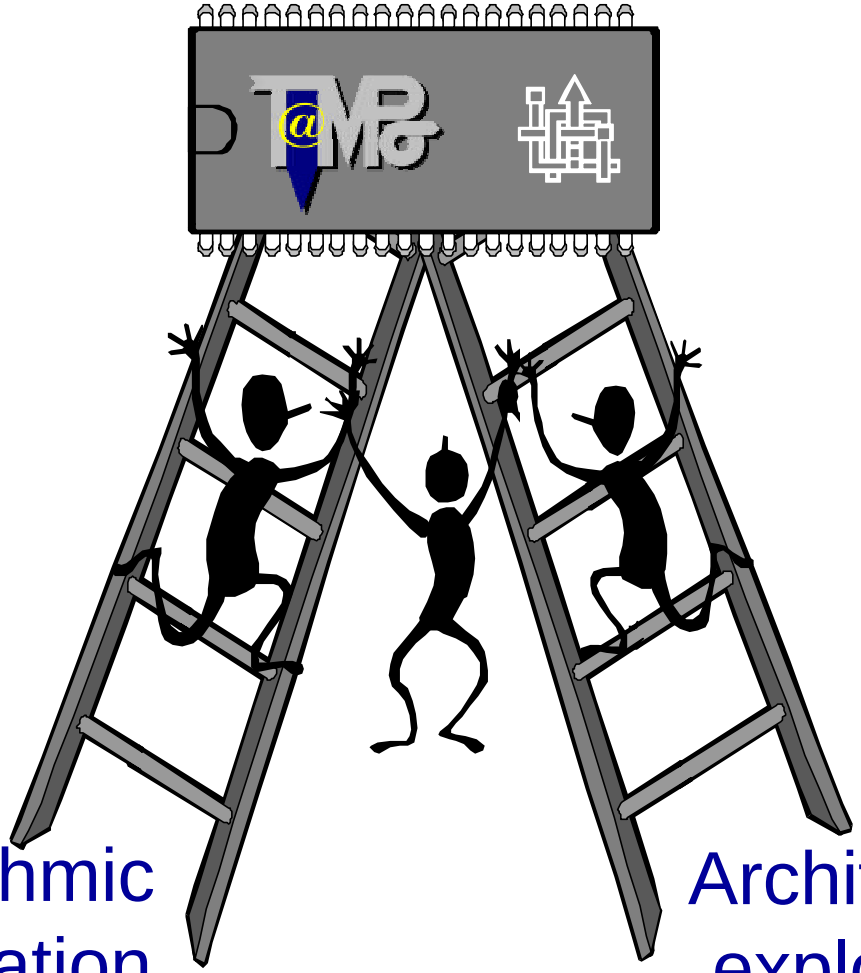
What are we waiting for?

- ! Appropriate turbo coding solution

Practical impediments need to be tackled

- Speed: 50-100 Mbps will be required
- Power consumption: a clear bottleneck due to memory accesses
- Latency: real-time communications
- Flexibility: adapt coding scheme to service and channel

IMEC's effort should lead to T@MPO
(Turbo @ Minimum POwer)



Algorithmic exploration

Architectural exploration

Please spread the good news ...