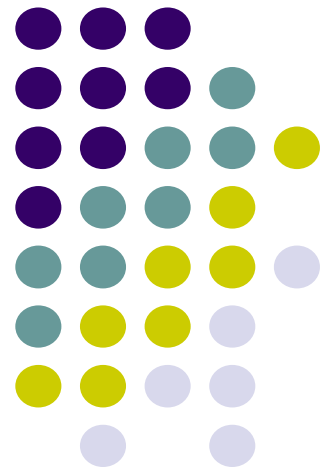


# A Comparative Study the Proposed LDPC Codes

IEEE P802.3an Task Force  
Ottawa, ON, Sept' 04

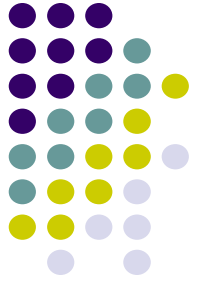
D. Dabiri, N. Barot, J. Tellado  
Teranetics Inc.



# Overview



- Proposed LDPC Codes
  - LDPC (2048, 1723)
  - LDPC (1024, 833)
- Simulation Results for LDPC (2048, 1723)
- Simulation Results for LDPC (1024, 833)
- Comparison Table
- Conclusion



# LDPC (2048, 1723)

- First proposed in rao\_1\_1103.pdf
- Floating Point Simulation Results down to  $7e-11$  in rao\_1\_1103.pdf.
- It was realized that codes with lower latency are highly desirable (muller\_1\_0304.pdf).
  - A low latency code (992, 829) (rao\_1\_0504.pdf) was proposed but simulation results stopped above  $1e-8$ .
- In rao\_1\_0704.pdf the LDPC (2048, 1723) was proposed for the second time to the task force.

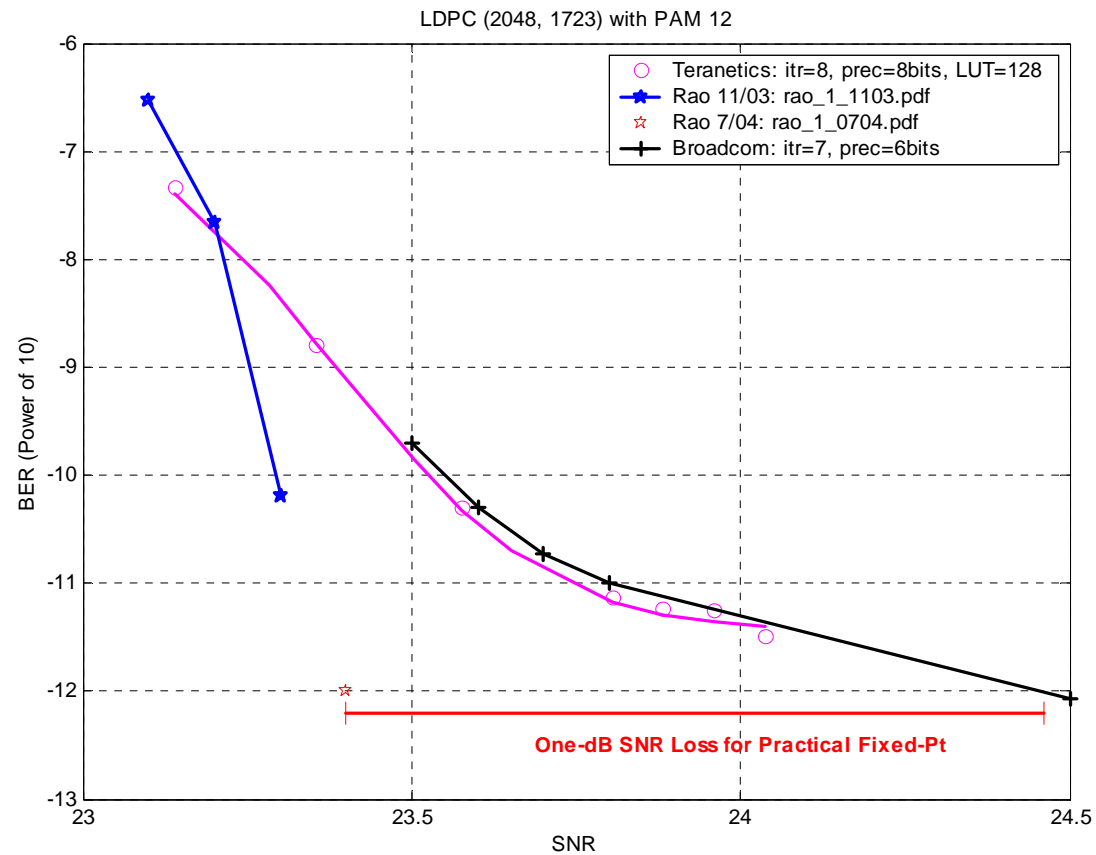


# LDPC (1024, 833)

- Motivated by the search for lower latency codes.
- First proposed by Seki (seki\_1\_0704.pdf) improving on the low latency LDPC (1024, 781) presented in dabiri\_1\_0304.pdf.
- Floating point simulation results down to  $1e-12$  with 80% confidence was presented in seki\_1\_0704.pdf.
- Until recently lower latency was considered to be its main advantage over (2048, 1723) ...

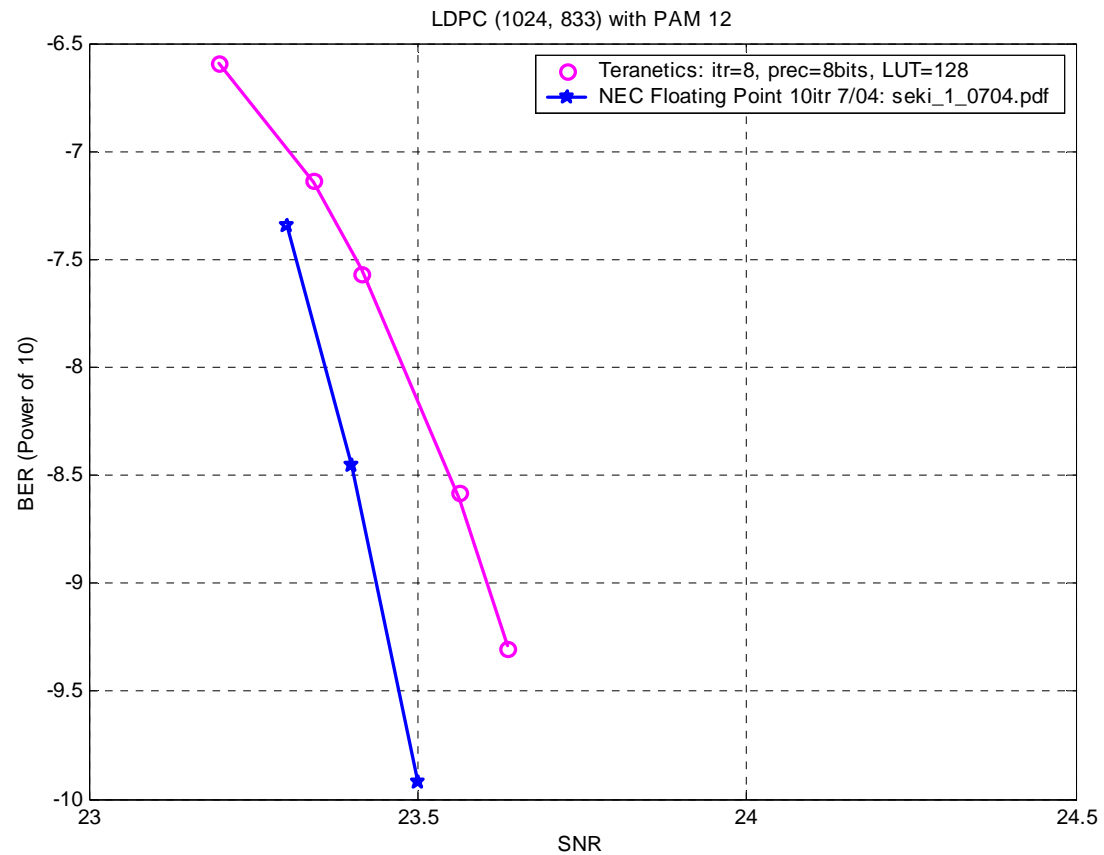


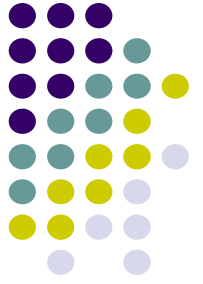
# (2048, 1723) Fixed Point Simulations





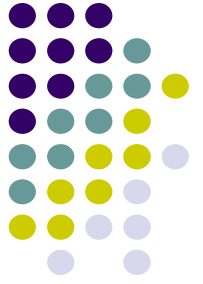
# (1024, 833) Fixed Point Simulations





# Comparison

|                              |                              |                             |                             |
|------------------------------|------------------------------|-----------------------------|-----------------------------|
|                              | (1024,833)<br>5bits/32W(NEC) | (2048,1723)<br>8bits/128W   | (2048,1723)<br>12bits/4096W |
| Gap to Cap                   | 4.8 dB                       | 4.9 dB<br>(Error Floor)     | 3.9 dB                      |
| No Itr                       | 7                            | 8                           | 12                          |
| Arithmetic                   | 5bits                        | 8bits                       | 12bits                      |
| Tables                       | 32 W                         | 128 W                       | 4096W                       |
| Total Tables<br>(minLatency) | 1.6 Mbits                    | 12.5 Mbits<br>(~6.25MGates) | 600 Mbits<br>(~300MGates)   |
| Latency                      | 189 nsec                     | 370 nsec                    | 370 nsec                    |



# Conclusions

- Multiple vendors have confirmed that there is a very significant risk associated with the LDPC (2048, 1723) code.
- There is no indication of existence of a practical decoder for the LDPC (2048, 1723) code.
- NEC has shown excellent performance of the (1024, 833) code down to  $1e-13$ .
- We have shown a very close match to Seki's results down to  $5e-10$ .
- More results will be available to the Task Force.