Channel-to-Channel Analysis of Aragats Multidirectional Muon Monitor's Data

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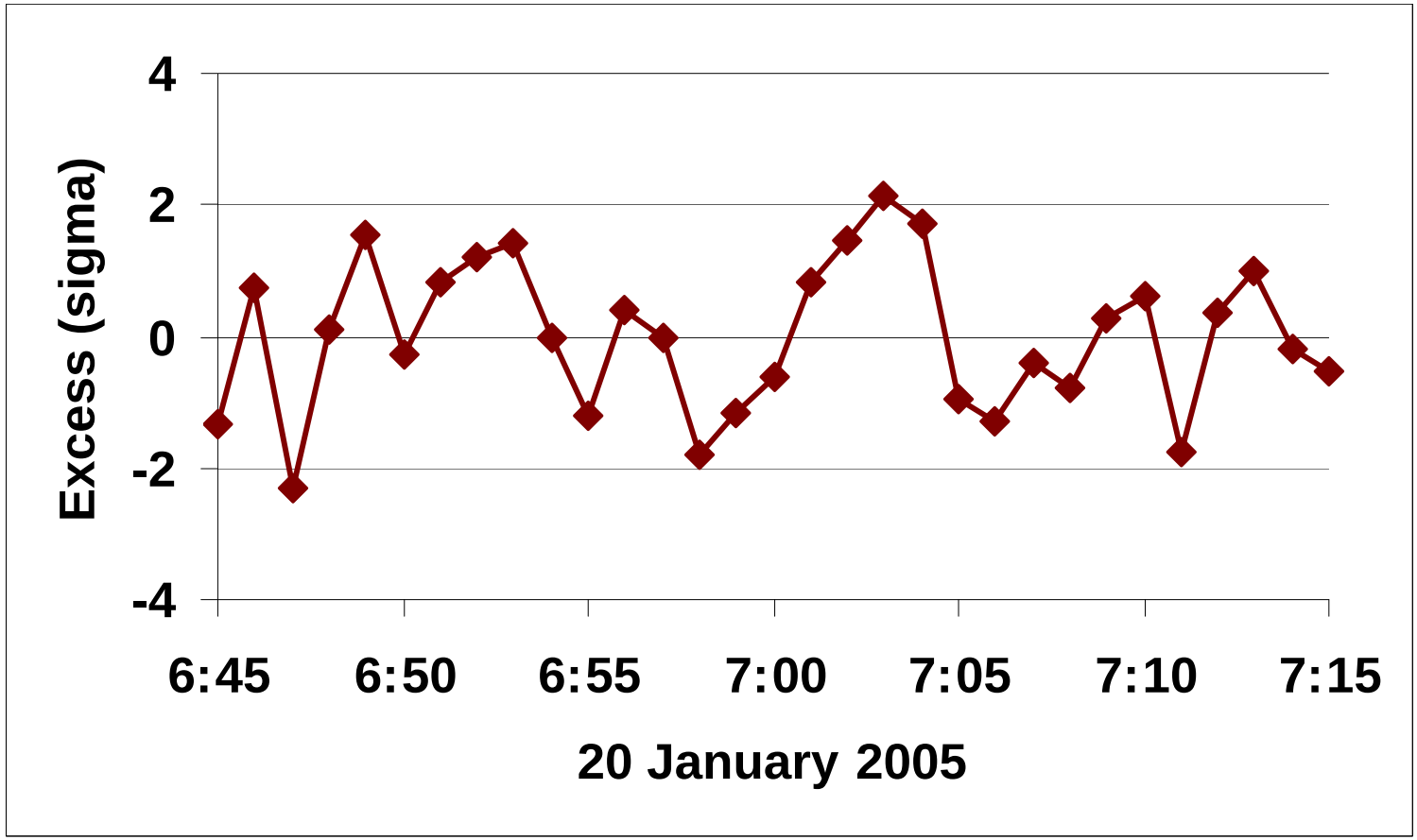
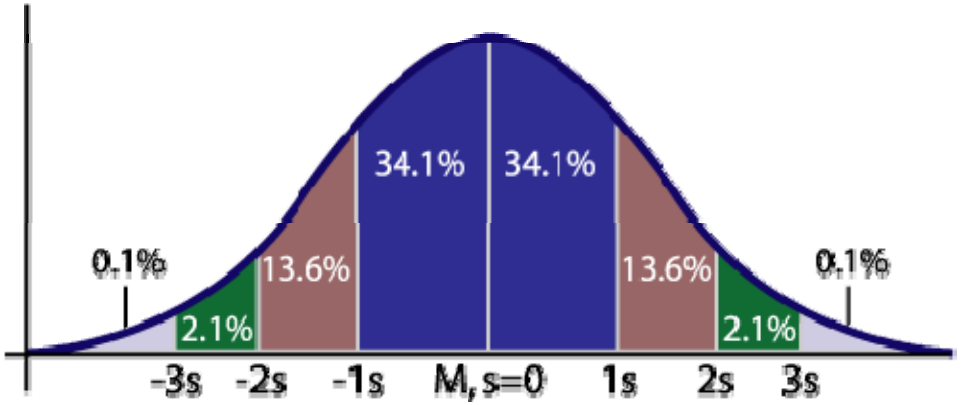
Data processing in multi channel detector:

- Traditional Gaussian approach uses single quantity – the sum of channel's counts
- Proposed approach uses all channel's counts, investigating their distribution

AMMM 1min count (sum of 42 channel's counts)



Probability of false alarm

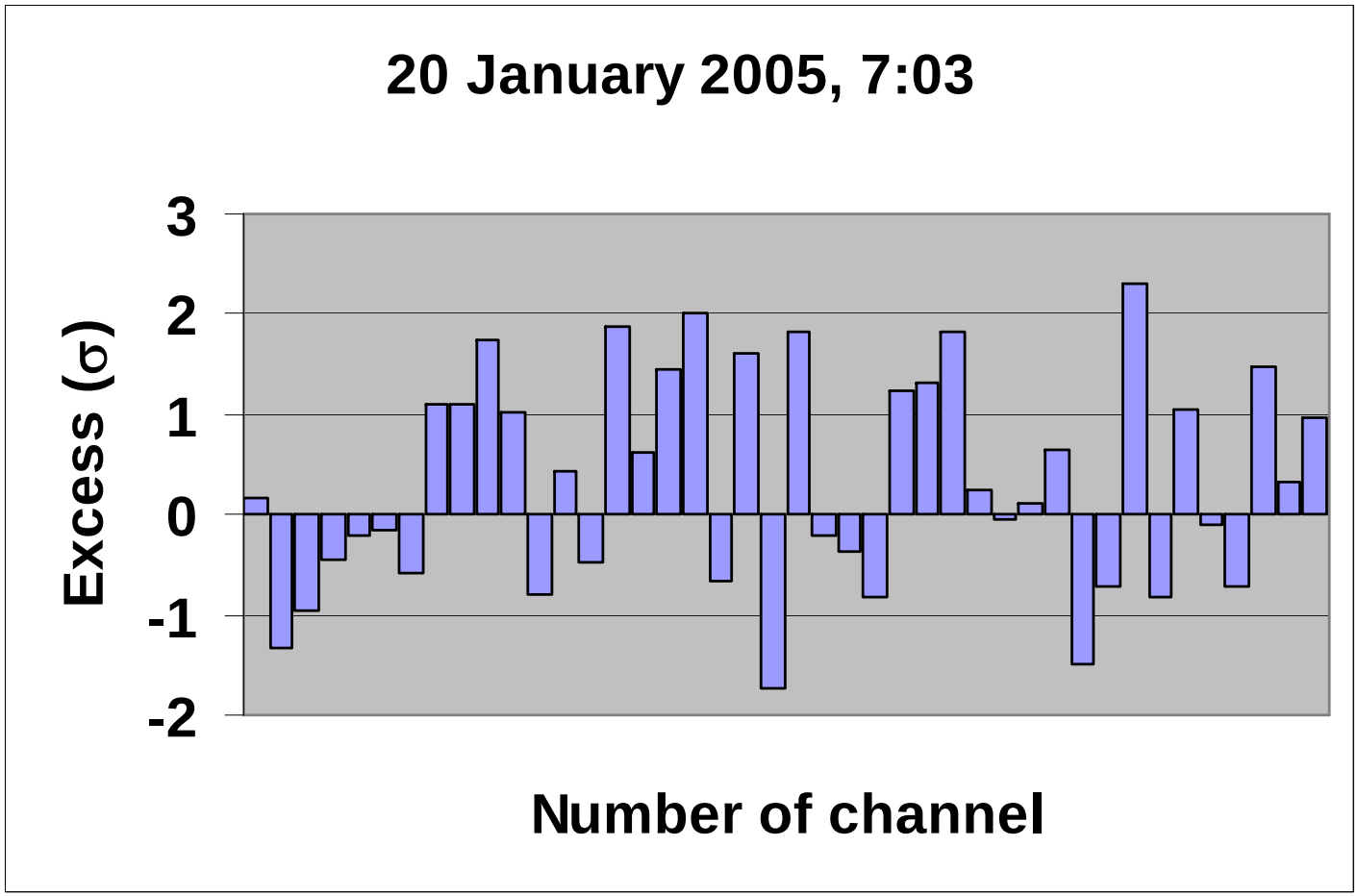


$$p(a\sigma) = \int_a^{\infty} G(x)dx$$

$$a = 1,\ p(\sigma) = 0.16$$

$$a = 2,\ p(2\sigma) = 0.023$$

Channel’s counts



Probability

$$P_{N,n}(p) = \frac{N!}{n!(N-n)!} p^n (1-p)^{N-n}$$

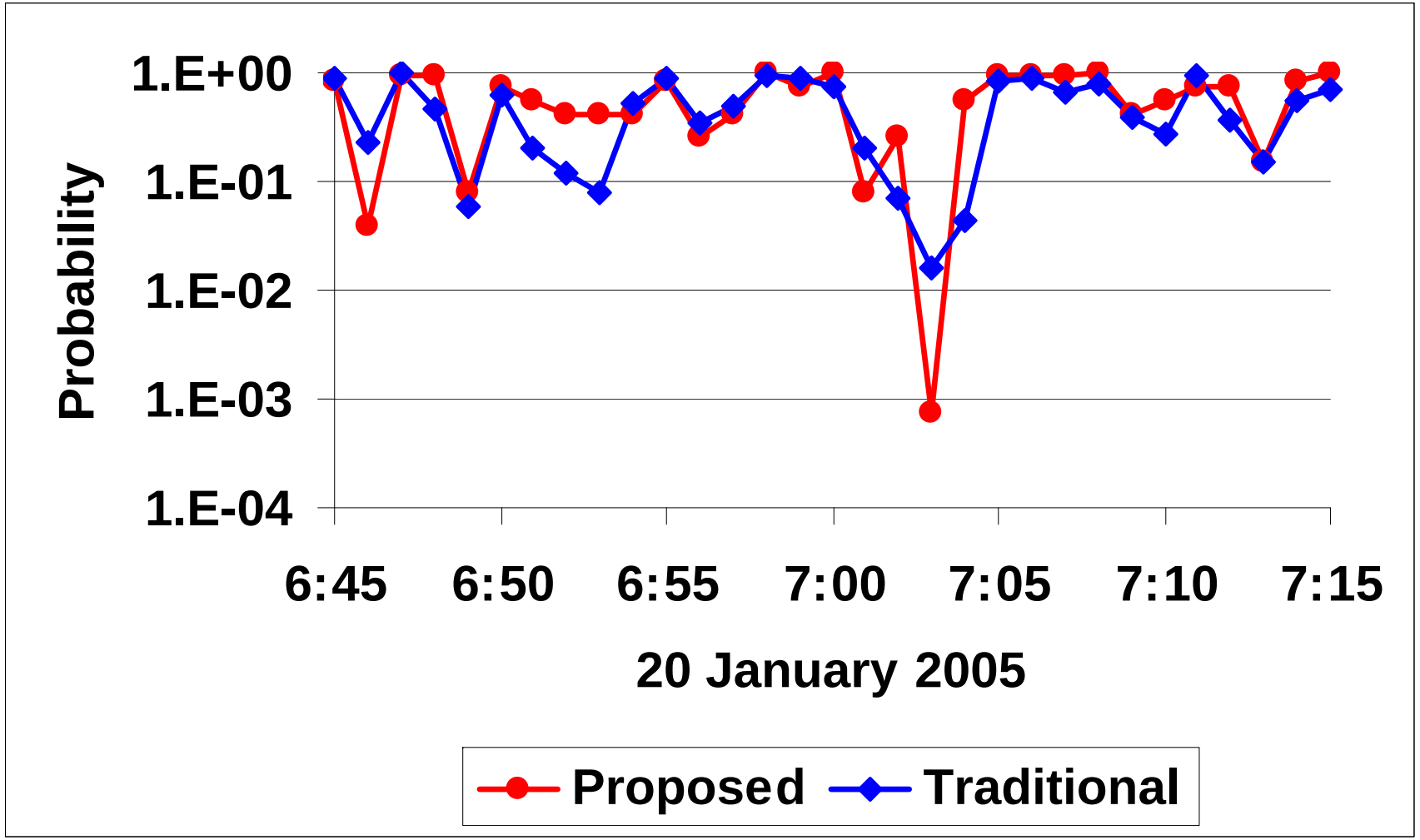
$$P_{42,15}(0.16) = 9.45 * 10^{-4}$$

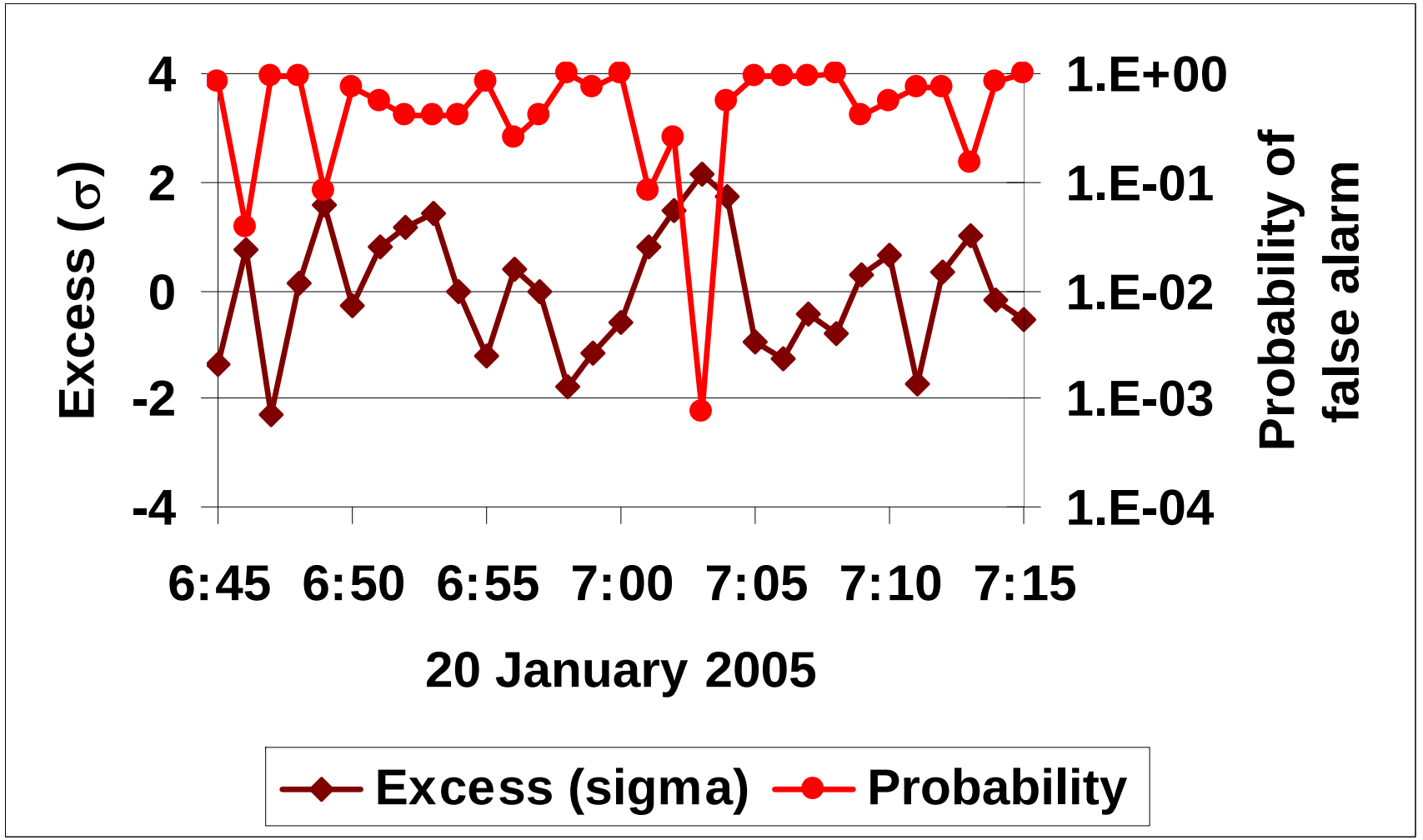
$$P = \sum_{m=15}^{42} P_{42,m}(0.16) = 1.36 * 10^{-3}$$

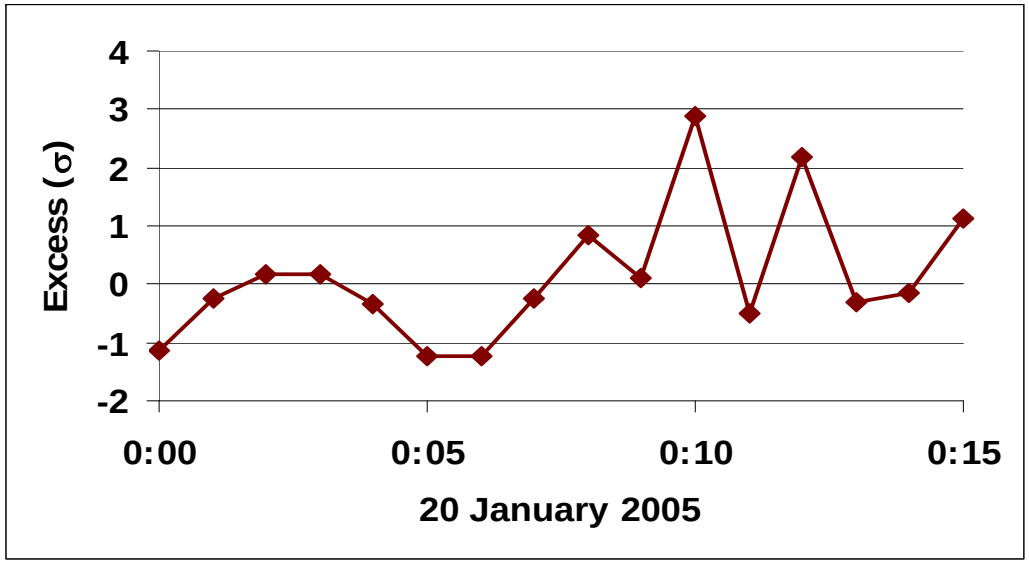
$$P_{42,16}(0.17) = 5.81 * 10^{-4}$$

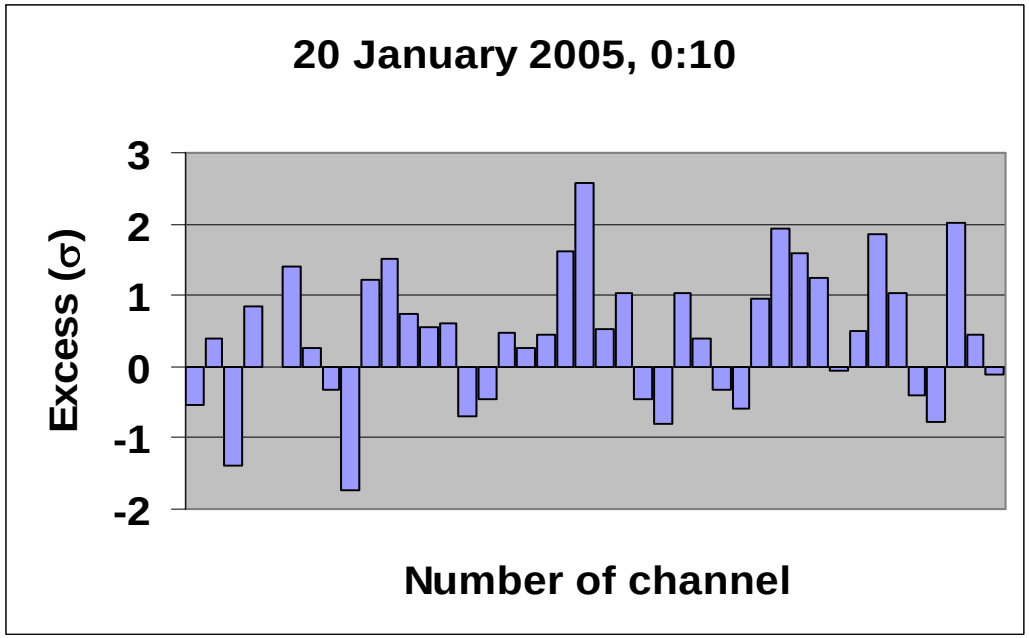
$$P = \sum_{m=15}^{42} P_{42,m}(0.17) = 8.29 * 10^{-4}$$

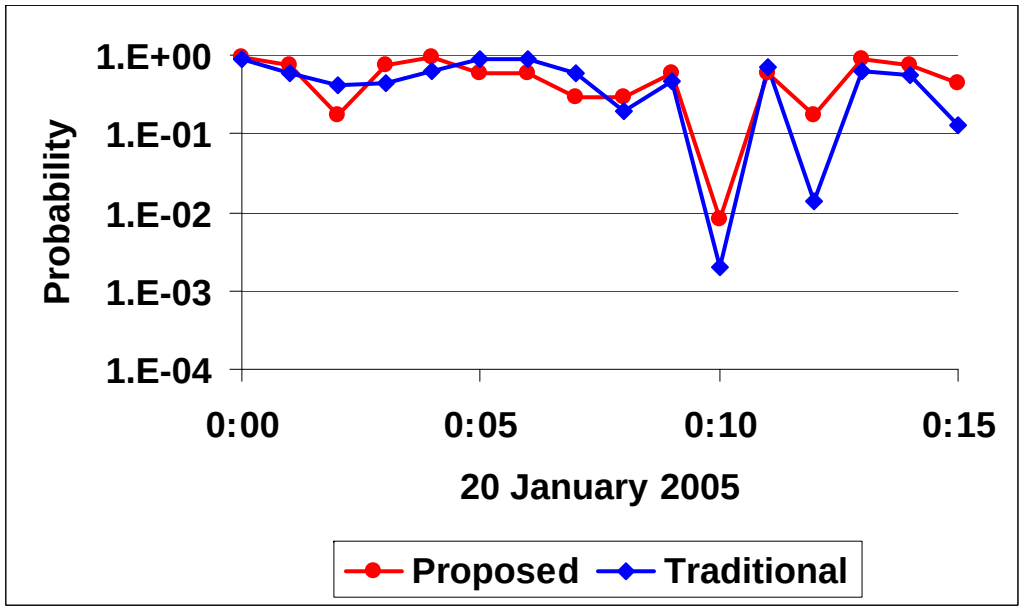
$$\frac{0.023}{P} \sim 28$$

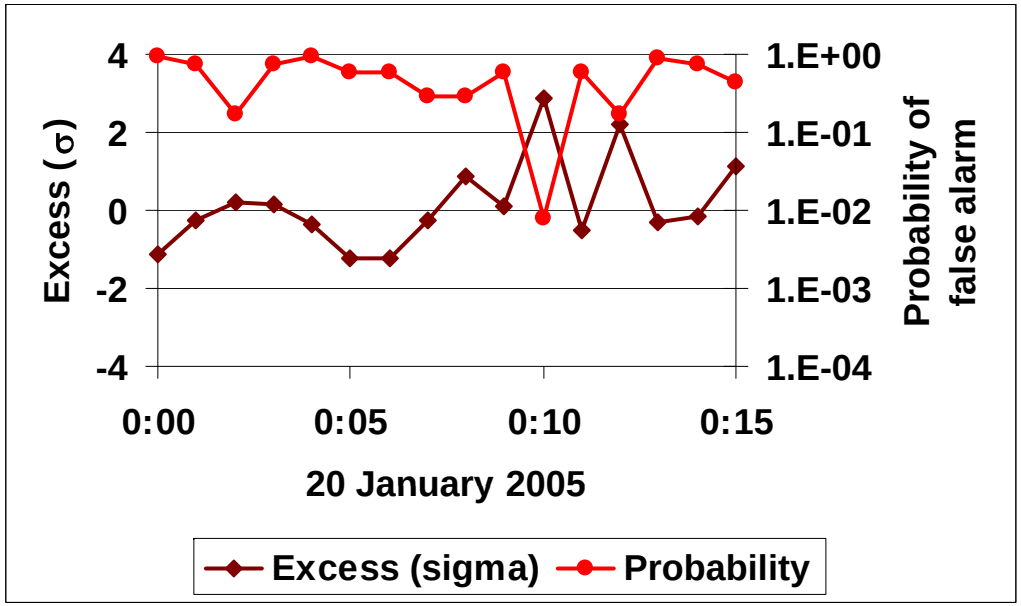

Probability
1.E+00
1.E-01
1.E-02
1.E-03
1.E-04
6:45
6:50
6:55
7:00
7:05
7:10
7:15
20 January 2005
Proposed
Traditional


4
2
0
-2
-4
Excess (σ)
1.E+00
1.E-01
1.E-02
1.E-03
1.E-04
Probability of false alarm
6:45
6:50
6:55
7:00
7:05
7:10
7:15
20 January 2005
Excess (sigma)
Probability

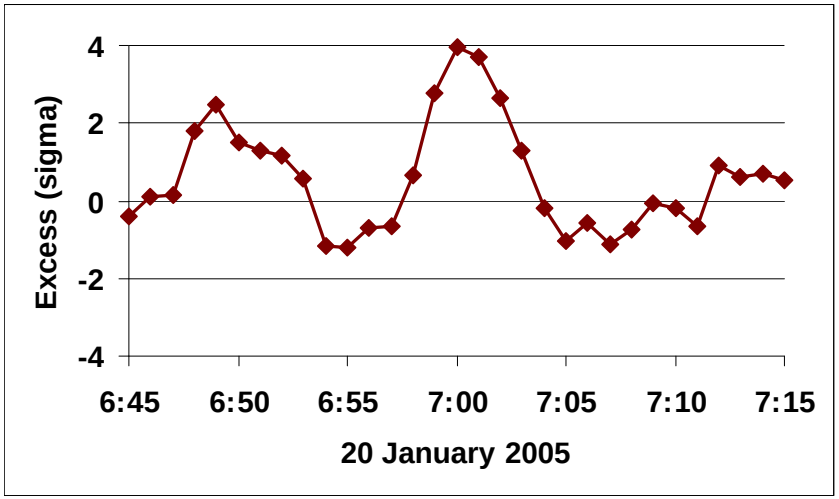

4
3
2
1
0
-1
-2
Excess (σ)
0:00
0:05
0:10
0:15
20 January 2005

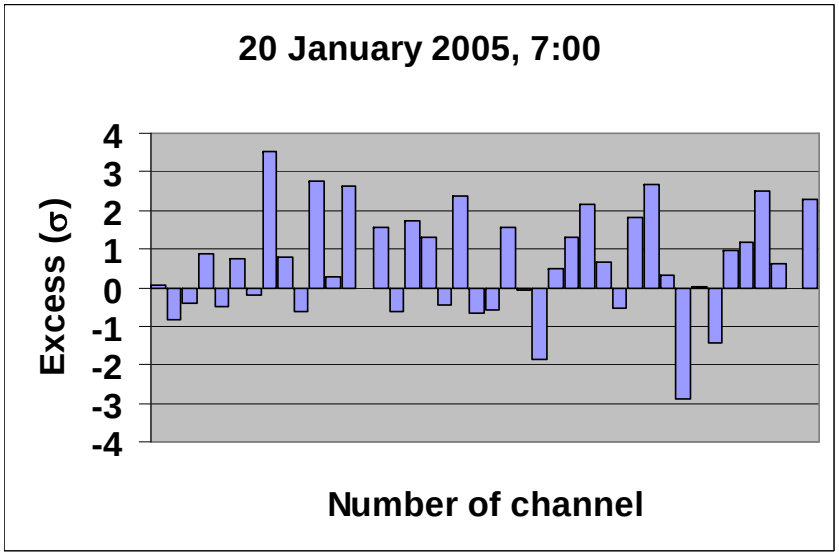

20 January 2005, 0:10
3
2
1
0
-1
-2
Excess (σ)
Number of channel


1.E+00
1.E-01
1.E-02
1.E-03
1.E-04
Probability
0:00
0:05
0:10
0:15
20 January 2005
Proposed
Traditional


4
2
0
-2
-4
Excess (σ)
1.E+00
1.E-01
1.E-02
1.E-03
1.E-04
Probability of false alarm
0:00
0:05
0:10
0:15
20 January 2005
Excess (sigma)
Probability

Removing 1 bad channel and using 5min data with the step 1min (moving average)





$$p(2.16\sigma) = 0.015$$

$$P = \sum_{i=11}^{41} P_{41,i}(0.015) = 1.9*10^{-7}$$

$$p(3.9\sigma) = 4.1*10^{-5} \sim 215P$$