3-D surface to 2-D barcode
Background to the approach

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"The validity of the fundamental assumptions of uniqueness and reproducibility of firearms-related tool marks has not yet been fully demonstrated"

National Research Council, Ballistic Imaging.(Cork, D. L., Rolph, J. E., Meieran, E. S. and Petrie, C. V., Eds.) 2008, Washington DC: The National Academies Press.

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The amount of correspondence does not provide a criterion for identification.

Biasotti demonstrated that the fundamental premise that one would intuitively expect to find a greater proportion of corresponding features on bullets fired from the same gun simply wasn't true in practice .

This is because of the variation in the total number of striae and sub class characteristics.

Banksy 2006

These interfere to a far lesser degree when consecutive line matching is invoked and so comparisons of the physical extent of the correspondence may well do the same thing for cartridge case identification.

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"A Statistical Study of the Individual Characteristics of Fired Bullets," Journal of Forensic Sciences, Vol. 4, no.1, pp. 34-50.
Alfred Biasotti (1959)

For Smith and Wesson revolvers he concluded

The average percentage of matching lines does not provide a criterion for identification.

but

*Consecutive line matching **is** a good criterion for identification*

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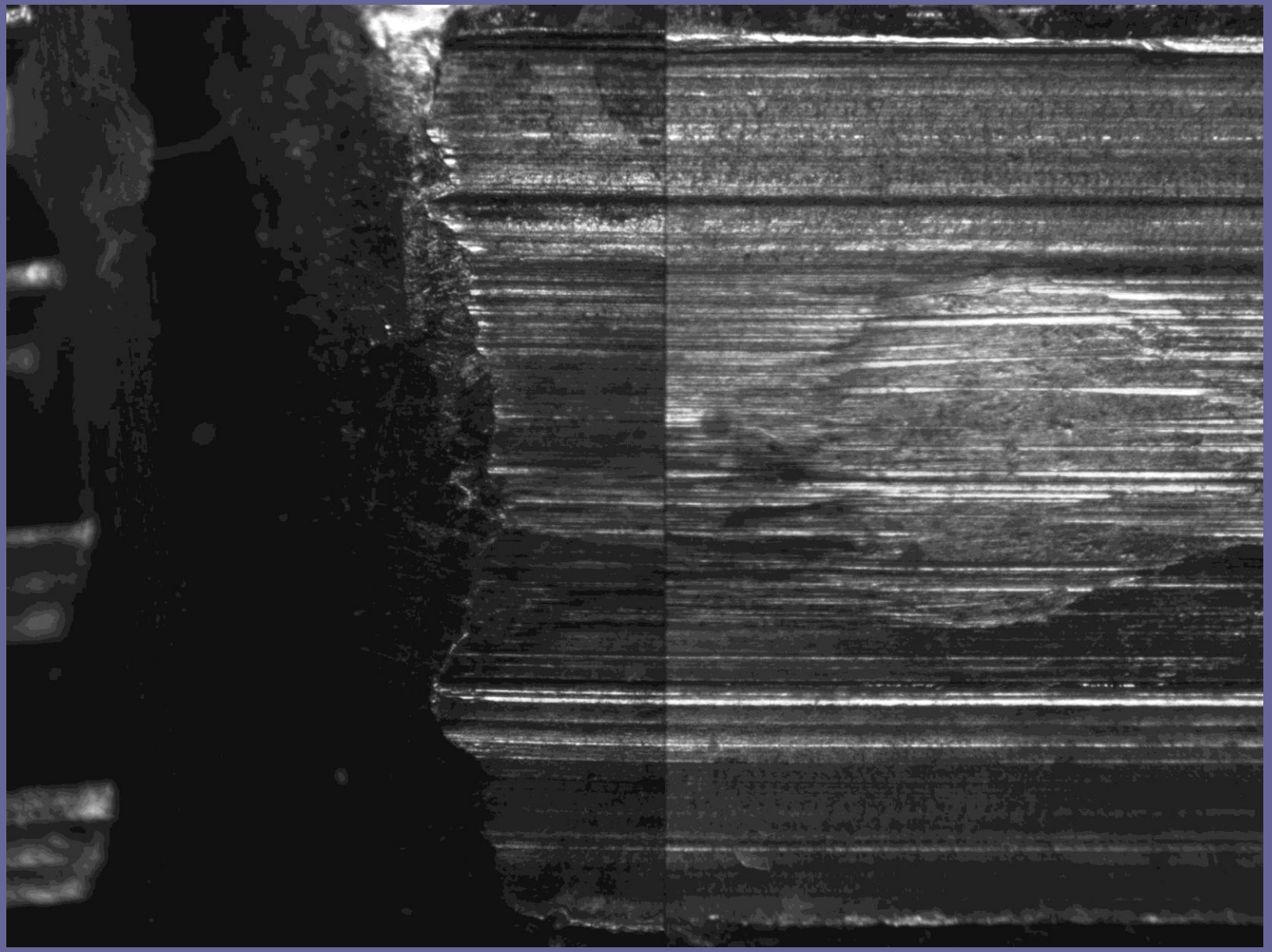

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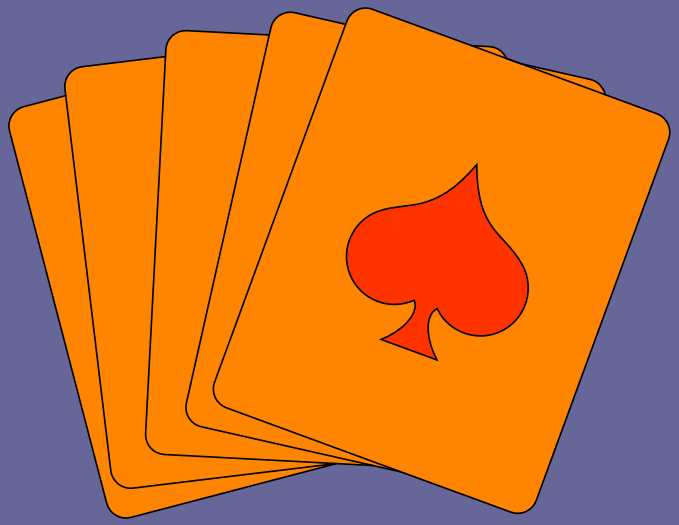

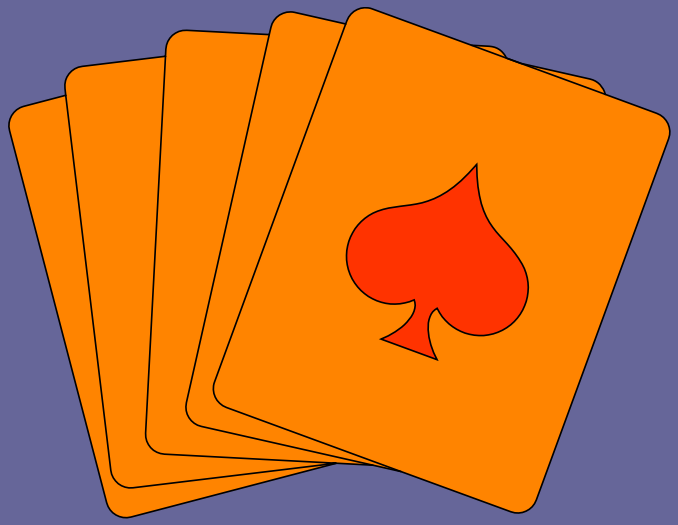

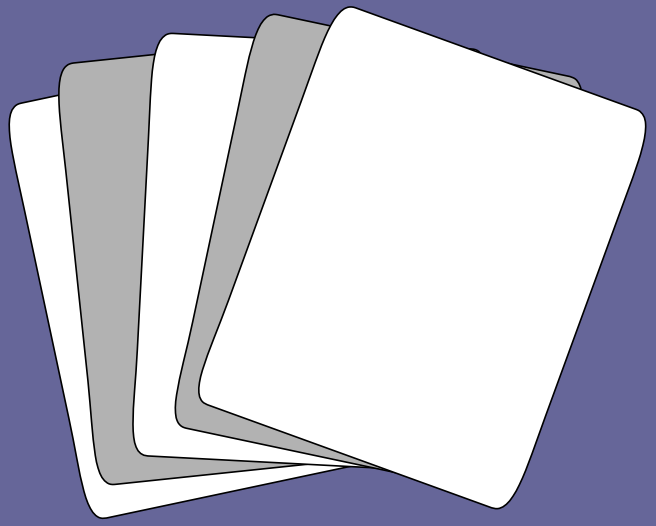

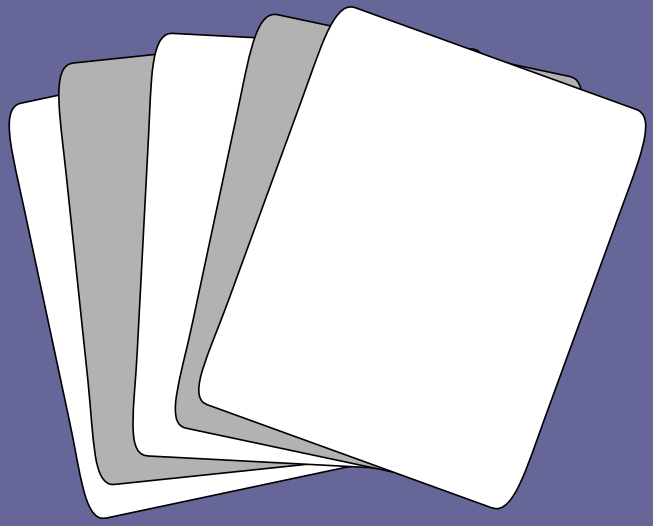

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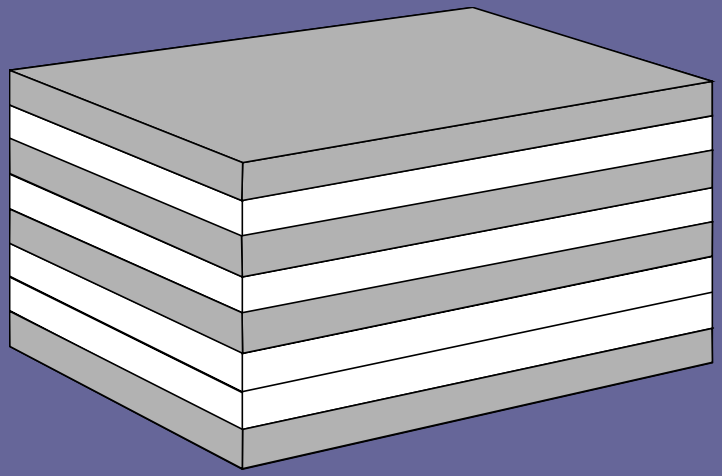

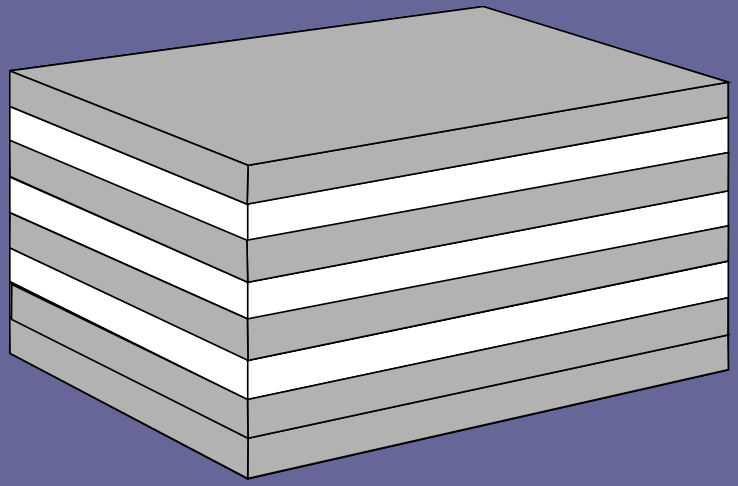

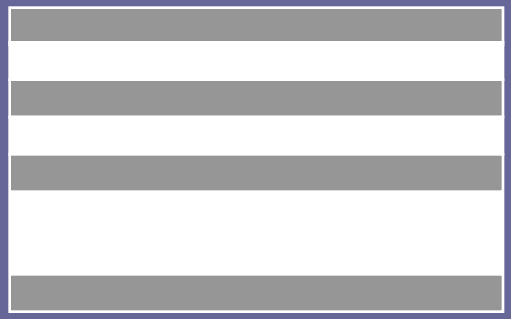

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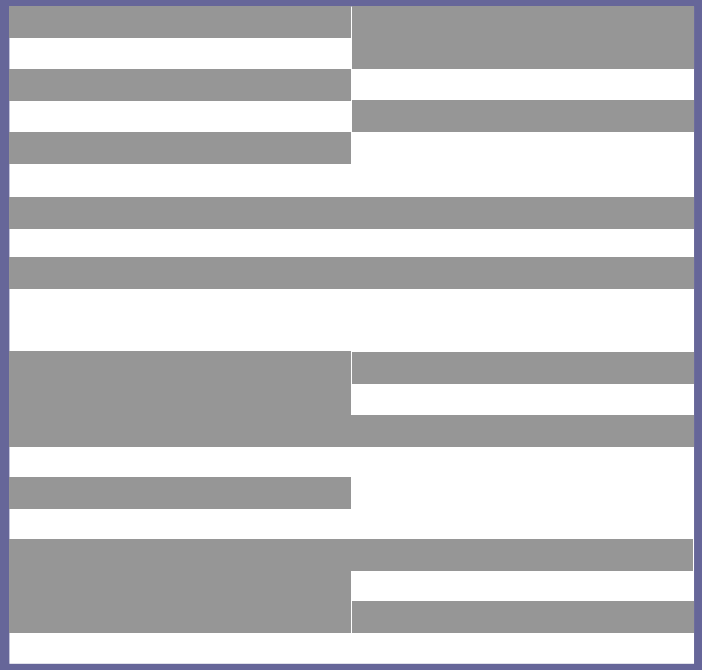
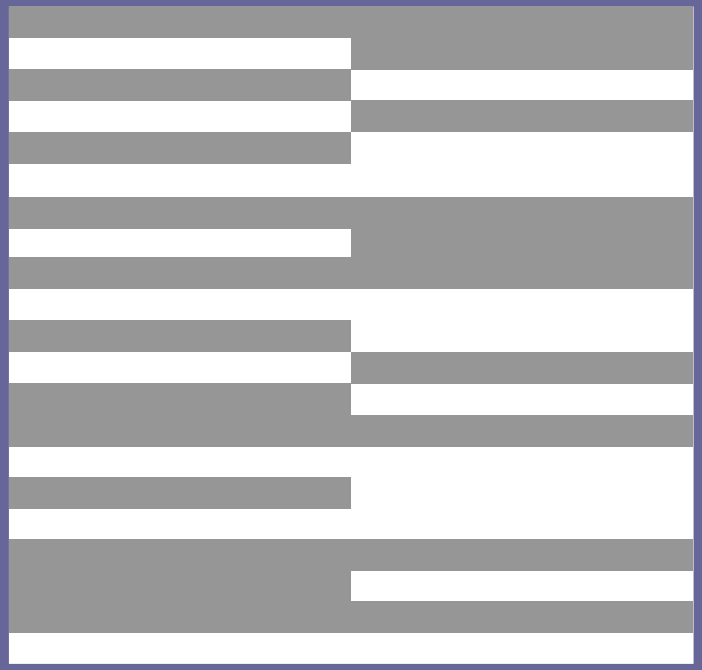
3 consecutive lines



Poor match with no consecutive lines



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The reason that CMS works is that number of individual sequences that you're matching on a land impression is

$$(N - n + 1)$$

As opposed to

$$N! \Big/ n!(N - n)!$$

Which for a sequence of 5 on a Smith and Wesson revolver is 59 rather than 5 million

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Assuming 60 striae we have 56 sequences of 5, in other words 1-2-3-4-5, 2-3-4-5-6, 3-4-5-6-7, ...,56-57-58-59-60 because for N striae we have (N-n+1) sequences of n

We can base these sequences on the distance of the striae from the leading edge or the separation distances between them or the ratio of the separation distances.

Treating these integer sequences as words our data base for each land impression is simply a paragraph of words subject to a word search

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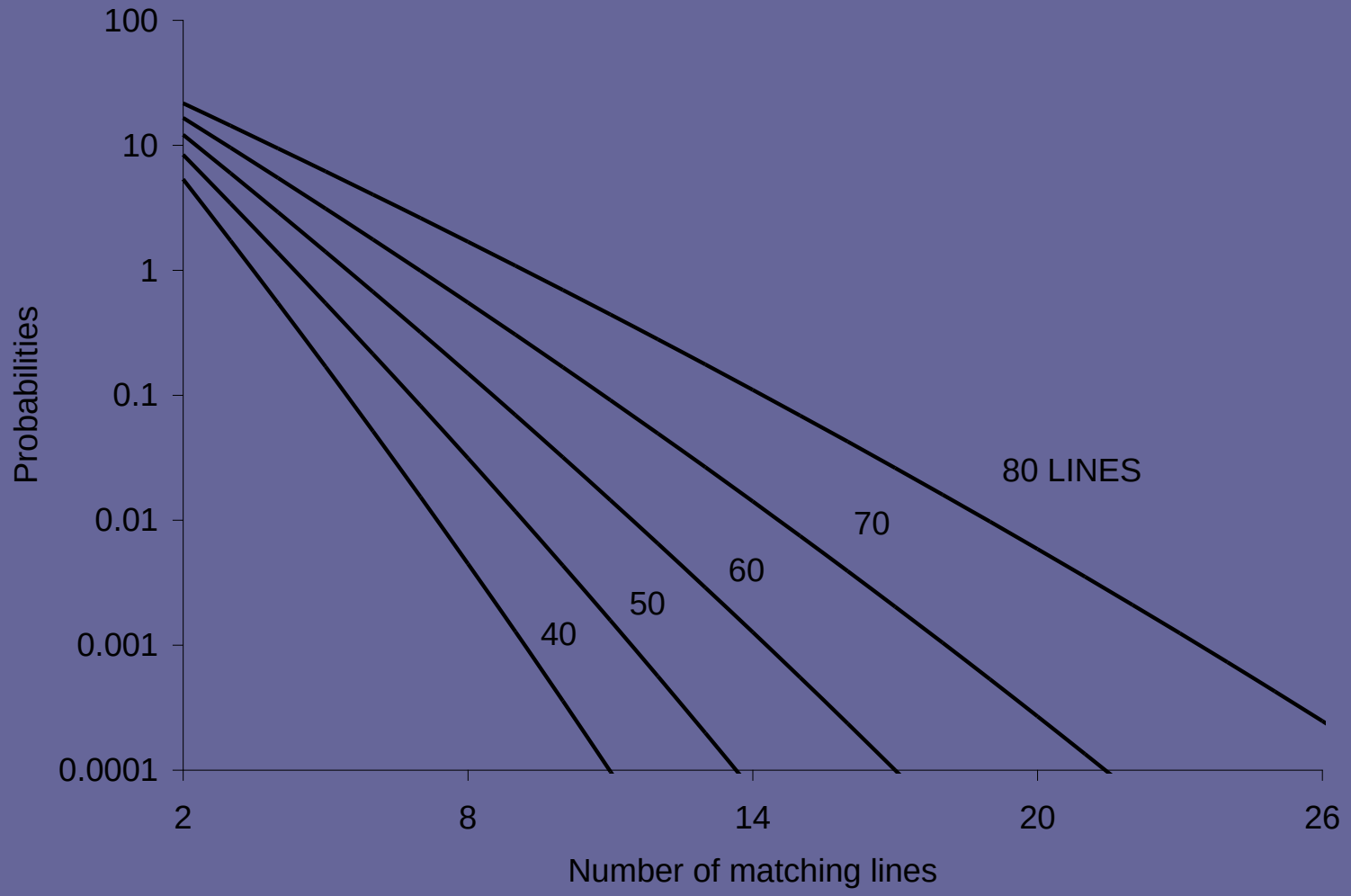

When there are 40 lines there are 4 million comparisons for 6 that simply match and when there are 80 there are 300 million

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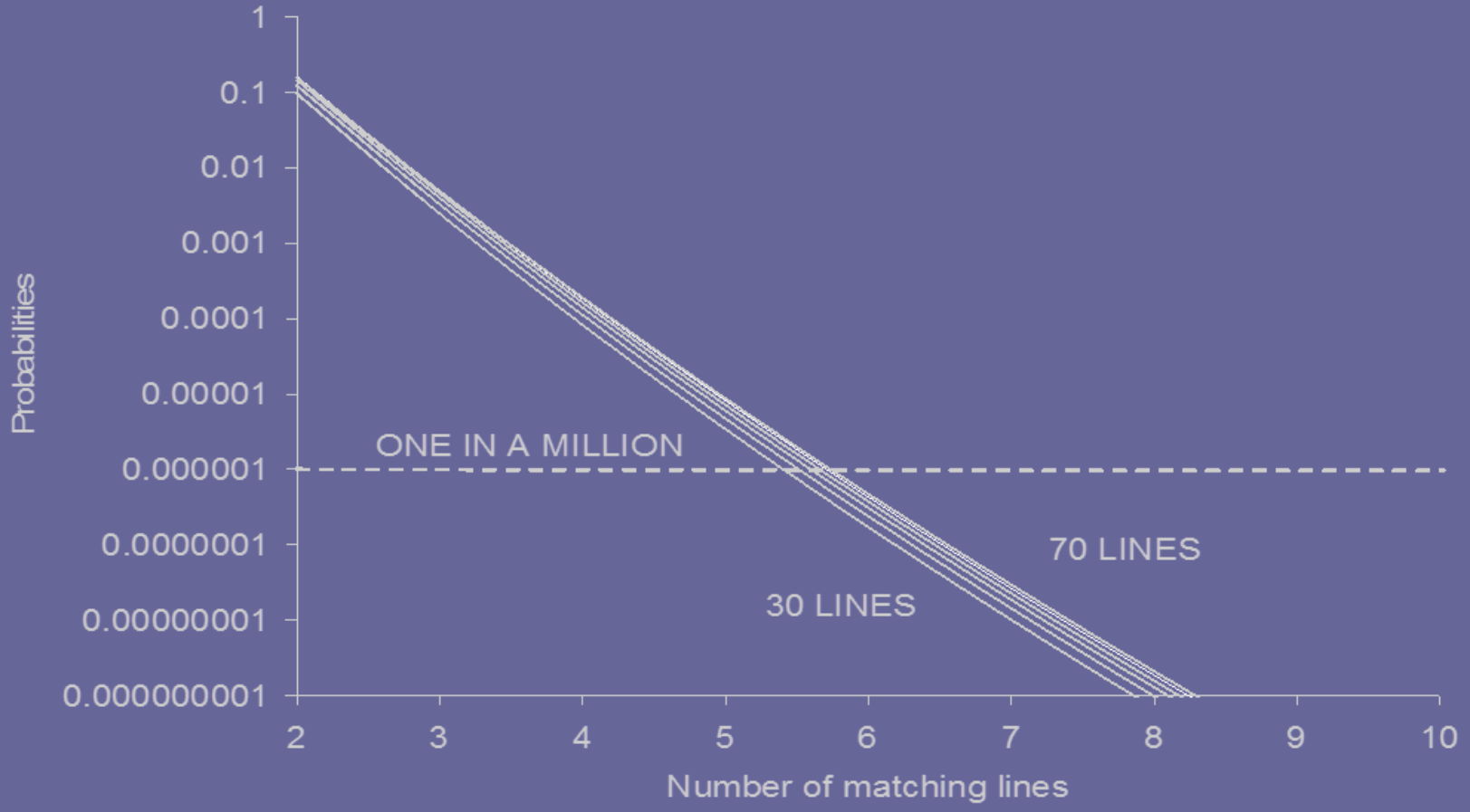
When there are 30 lines there are 25 comparisons for 6 that consecutively match and when there are 70 there are 65



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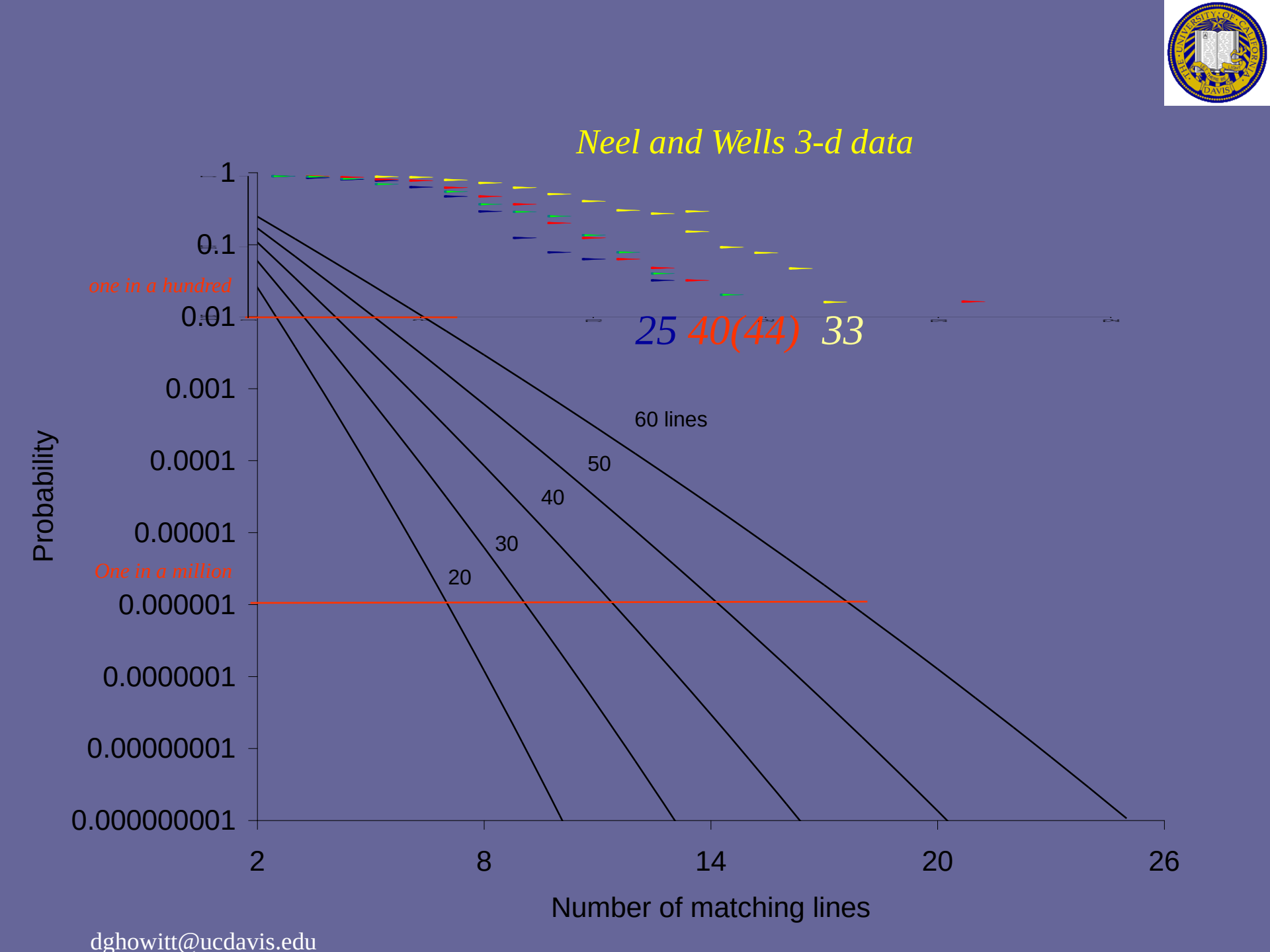

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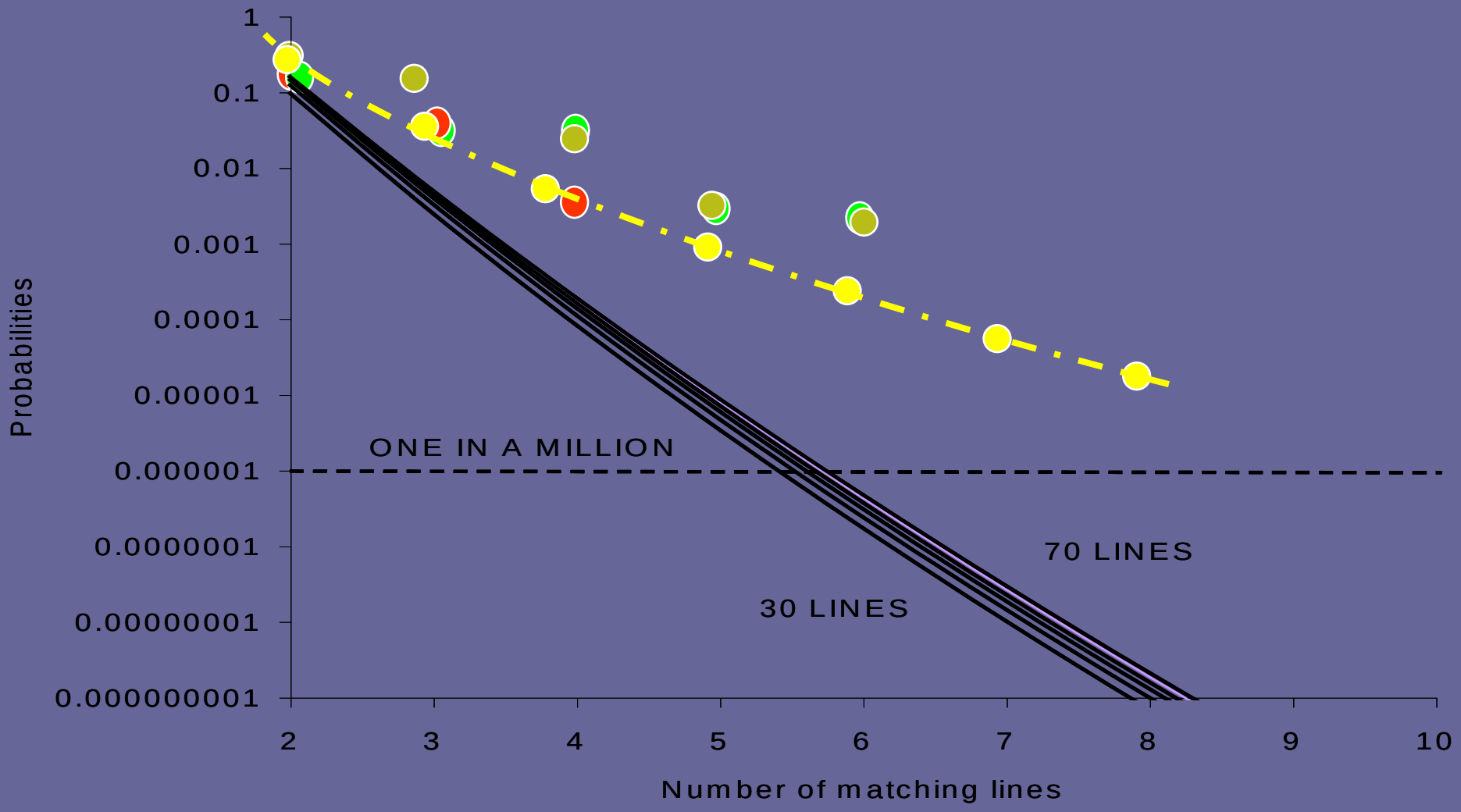
Neel and Wells data



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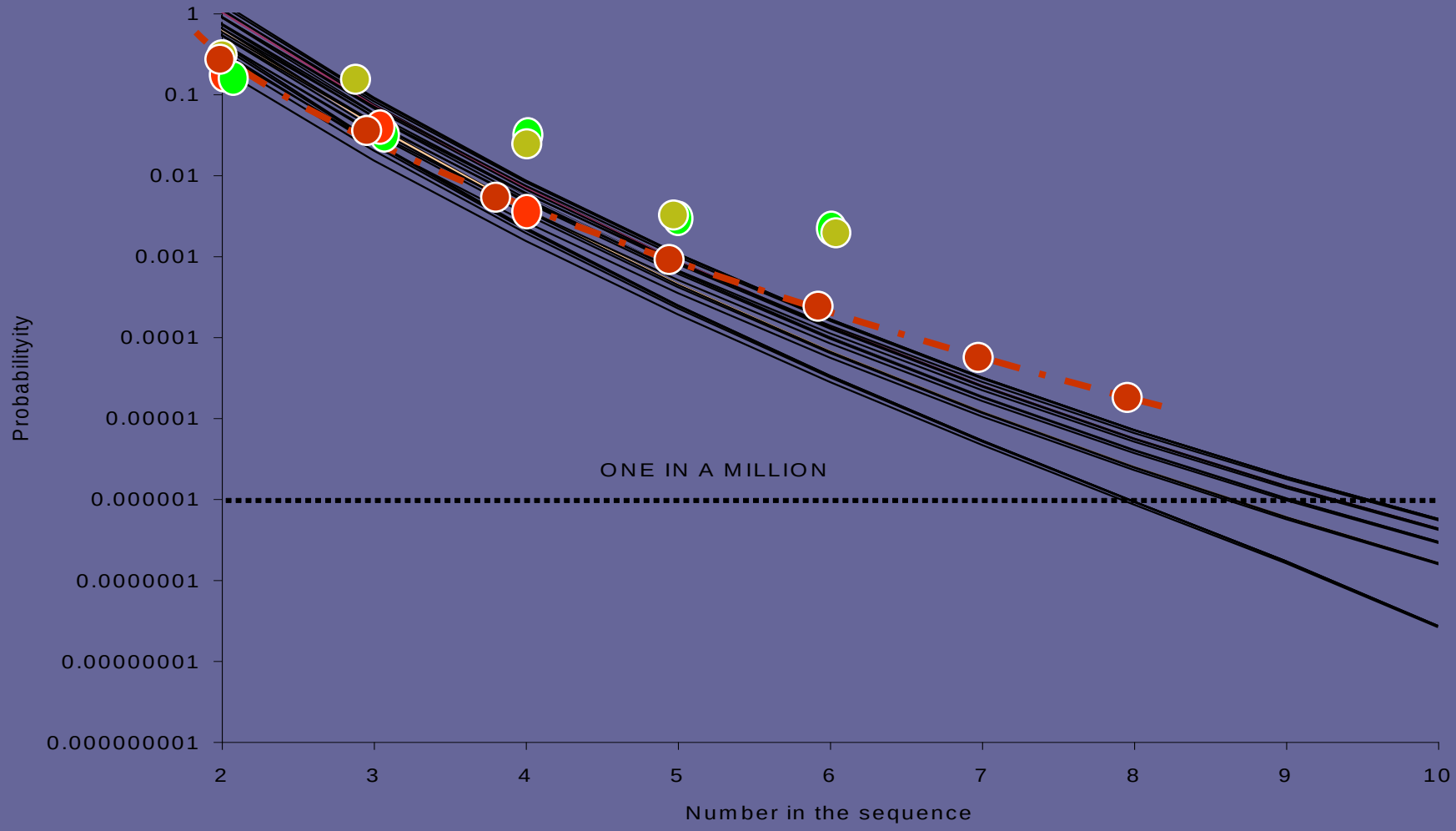
Neel and Wells data at 53 microns



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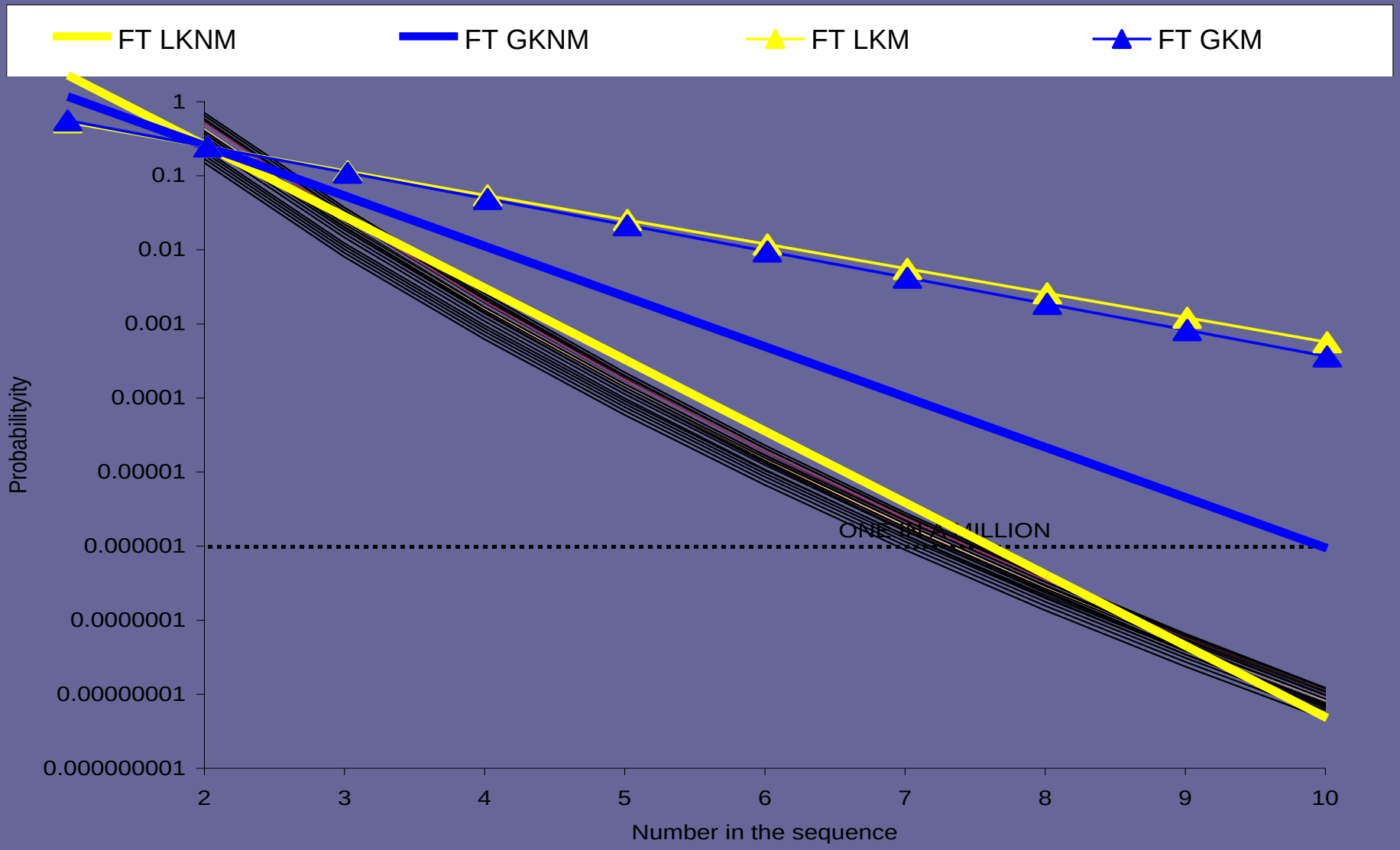
Tulleners Thompson Contender data assuming 35 micron resolution



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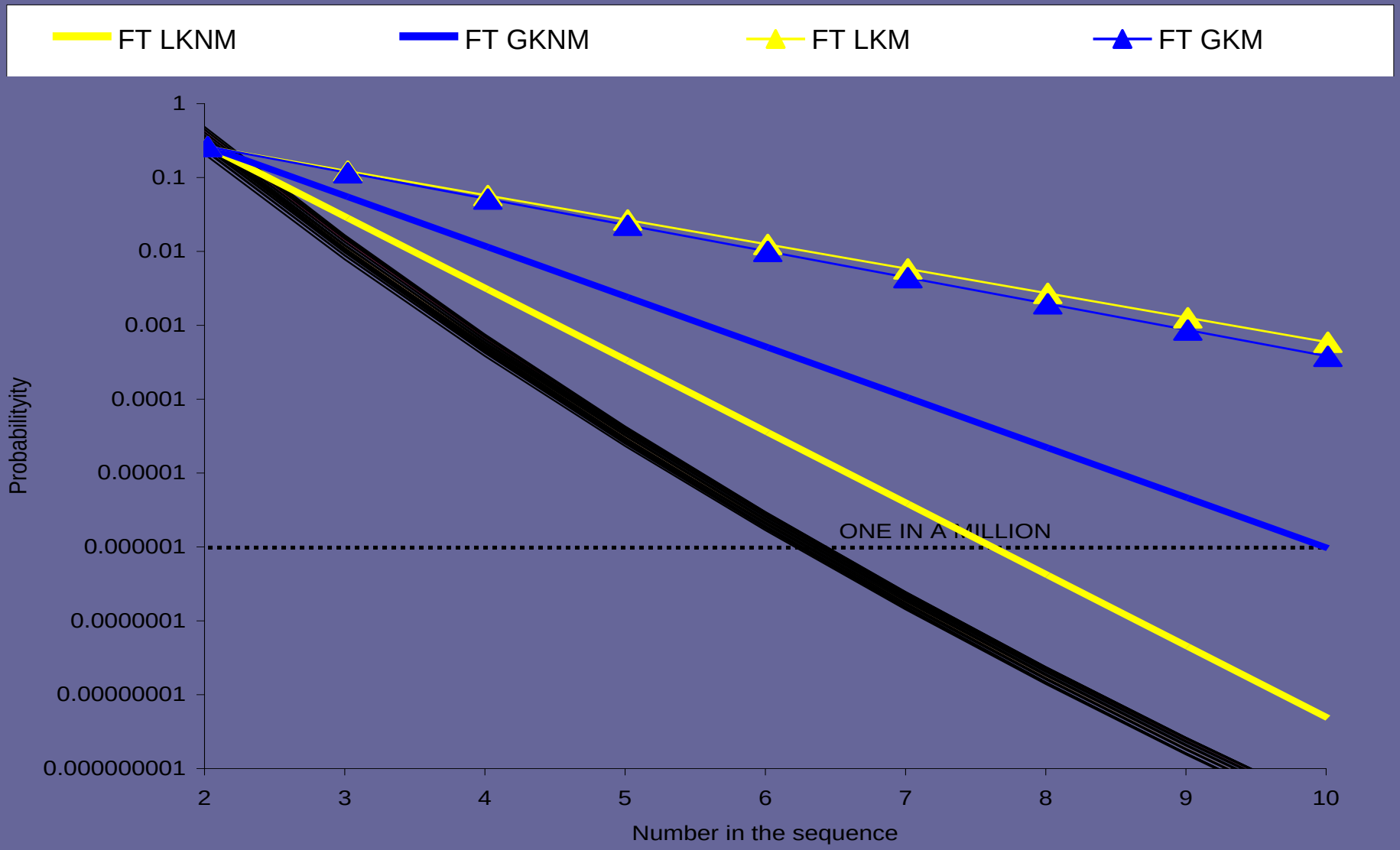
Tulleners Thompson Contender data assuming 20 micron resolution



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