CRC for Premium Quality Wool

Evenness (of Fibre Assemblies)

Produced for the CRC for Premium Quality Wool undergraduate program by;
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Definition of Evenness

- Evenness of Fibre Assemblies
  - e.g. colour, twist, hairiness
- commonly linear density changes
  - mass per unit length (e.g. g/km or tex)
- Assessed by
  - CV of linear density (CV%)
  - deviation from mean linear density (U%)
  - Mass Diagrams
  - Spectrograms

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Significance

- slivers and rovings
  - less even products
  - material wastage
- yarns
  - strength variation (thin places)
  - production efficiency
    - more ends down (spinning, winding)
  - number of fibres in yarn cross-section is critical
- fabric
  - production efficiency
    - more yarn breaks in weaving & knitting
  - uneven appearance
    - barre (woven)
    - weft knitted

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Standards for Evenness

- IWTO-18-67(E)
  - Uster Evenness Tester
  - Capacitance Principle

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Describing Evenness

- Single Value methods
  - CV%
  - U% (proprietary method)
  - limiting irregularity CV(lim.)
  - index of irregularity (I)
- Other methods
  - diagram
    - charted deviations
  - spectrogram
    - frequency of deviations

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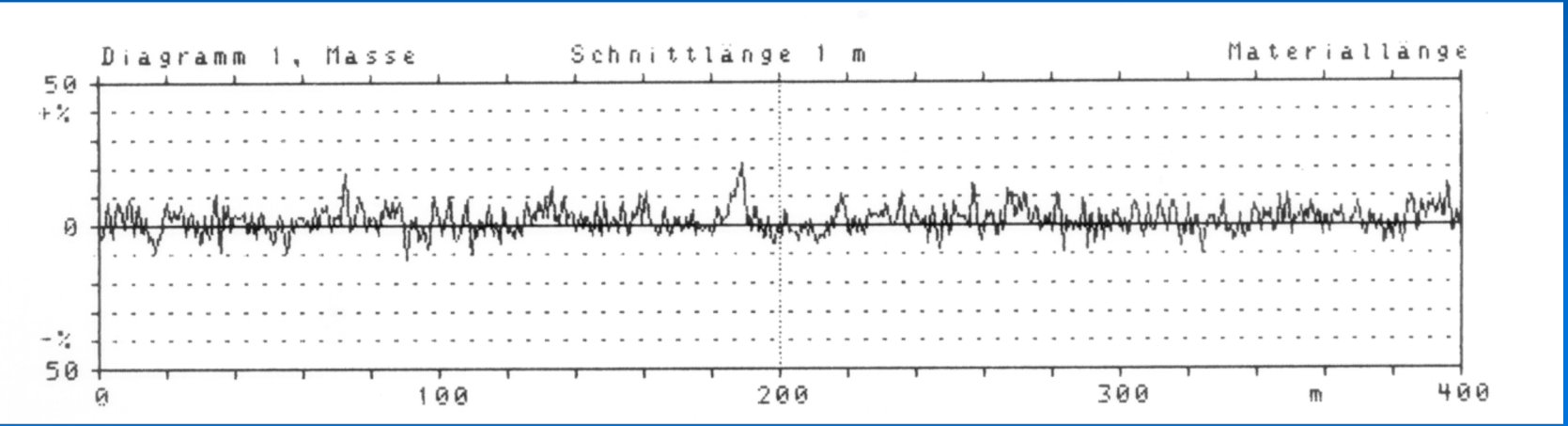
U% and CV%

- **Mass Diagram**



$$CV\% = \frac{s.d.}{mean} \times 100\%$$

$$U\% = \frac{\text{mean deviation}}{mean} \times 100\%$$

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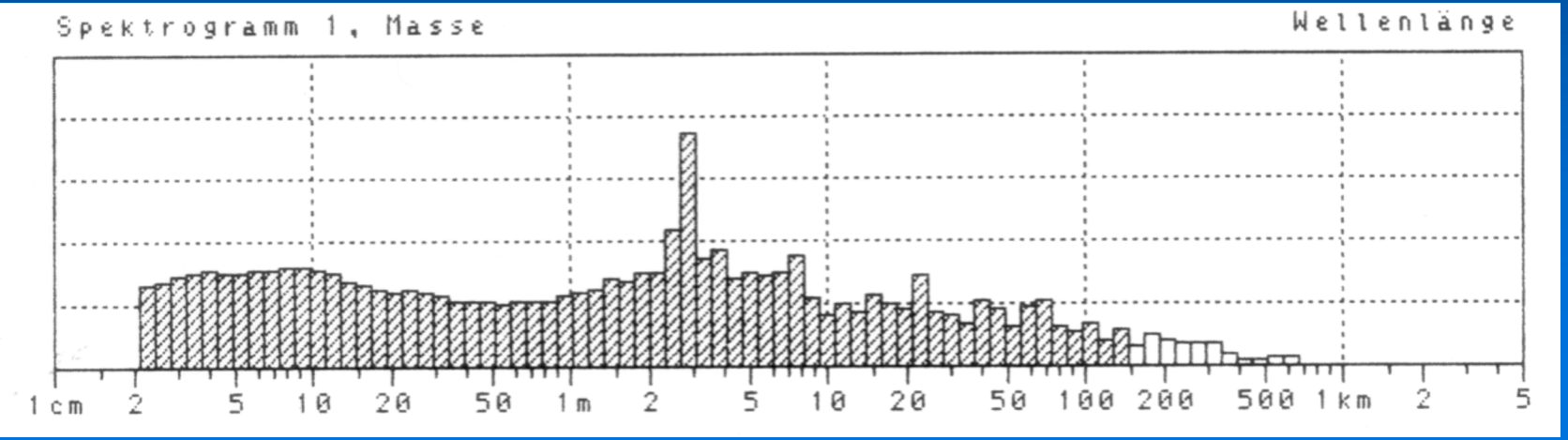
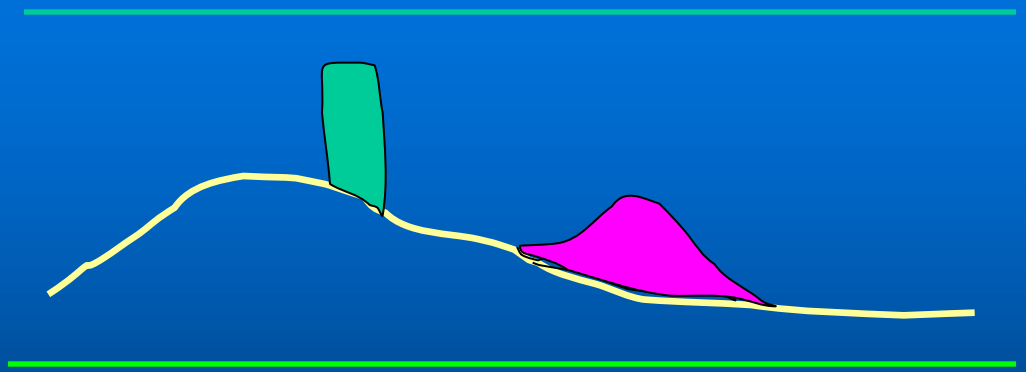
Spectrogram

– typical read-out



– Chimney

– Hump



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Limiting Irregularity

- a completely random fibre array will be this even

$$CV_y(\text{lim.}) = \frac{100\sqrt{(1 + 0.0004\,CV_d^2)}}{\sqrt{n}}$$

- this converts to

$$CV_y(\text{lim.}) = \frac{3.58\,d_f}{\sqrt{\text{tex}}}$$

- finer fibres are better

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Index of Irregularity (I)

$$I = \frac{CV\ (eff)}{CV\ (lim.)} \qquad (always > 1)$$

where CV (eff.) = measured (effective) irregularity

CV (lim.) = calculated limiting irregularity

- how close is machinery to achieving the ideal randomness?
- I gradually reduces through the sliver-roving-yarn processing

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