

NIST Decision Tree for Consensus Building

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Outline

- Bettin *et al.* (2013) CCM.D-K2
— Liquid density
- NIST Decision Tree
- Trujillo *et al.* (2025) CCM.V-K4
— Capillary viscometry
- Sensitivity Analysis & Model Selection

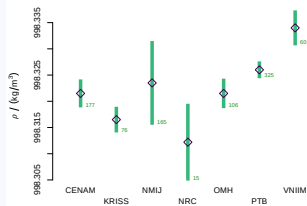
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References

- Koepke, Lafarge, Possolo, Toman (2017)
Consensus building for interlaboratory studies,
key comparisons, and meta-analysis
DOI [10.1088/1681-7575/aa6c0e](https://doi.org/10.1088/1681-7575/aa6c0e)
- Possolo, Koepke, Newton, Winchester (2021)
Decision Tree for Key Comparisons
DOI [10.6028/jres.126.007](https://doi.org/10.6028/jres.126.007)

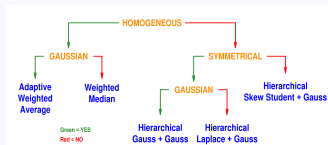
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CCM.D-K2: Deuterated Water (20 °C)



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NIST Decision Tree



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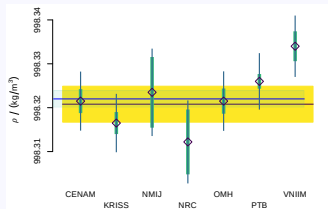
NIST Decision Tree

<https://decisiontree.nist.gov>

~ Live Demonstration ~

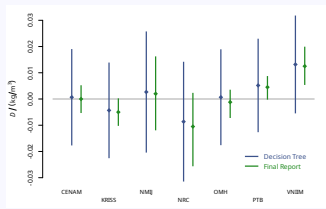
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CCM.D-K2: Deuterated Water (20 °C)



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CCM.D-K2: Deuterated Water (20 °C)



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Interpreting Data Reduction Choices

- Every data reduction is **loaded with assumptions** that often remain **unstated** and **untested**
 - **Relation** between measured values and measurand
 - Pattern and typical size of **dispersion of measured values**
 - Kinds and typical sizes of **lab-specific measurement errors**

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Overdispersion: Dark Uncertainty

Standard Deviation of Measured Values 0.0069 kg/m³Geometric Average of Reported Standard Uncertainties 0.0031 kg/m^3

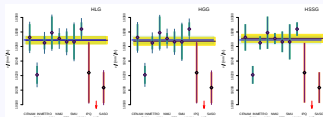
Excess Dispersion (Naive Evaluation)

| | |
|---|--------------------------|
| $\sqrt{0.0069^2 - 0.0031^2} \text{ kg/m}^3$ | 0.0062 kg/m ³ |
|---|--------------------------|

- **Dark Uncertainty** is the excess dispersion of the measured values above and beyond what the reported uncertainties suggest that the measured values should show
- NIST Decision Tree **propagates dark uncertainty** to KCRV and (optionally) to the DoEs

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CCM.V-K4-2018: Liquid B (10 °C)



| MODEL | LAB EFFECTS | KCRV | $U(KCRV)$ | τ |
|-------|--------------|---------|-----------|--------|
| HLG | Laplace | 10268.4 | 5.3 | 13.6 |
| HSSG | Skew Student | 10267.4 | 5.4 | 12.7 |
| HGG | Gaussian | 10267.5 | 4.6 | 11.7 |

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Listening to the Data — Respectfully

- Measurement results can tell us how they should be modeled and reduced
- Selecting a data reduction procedure before examining the measurement results is like buying a pair of shoes without first trying them on for fit

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Listening to the Data — Consequentially

- Computation of KCRV and DoEs should be **consistent with a statistical measurement model** that is **scientifically credible** and **adequate** for the actual measurement results
- Model selection should include analysis of **sensitivity** to modeling assumptions
- Formal **model selection criteria** (like AIC, BIC, or LOOIC) can also be of assistance