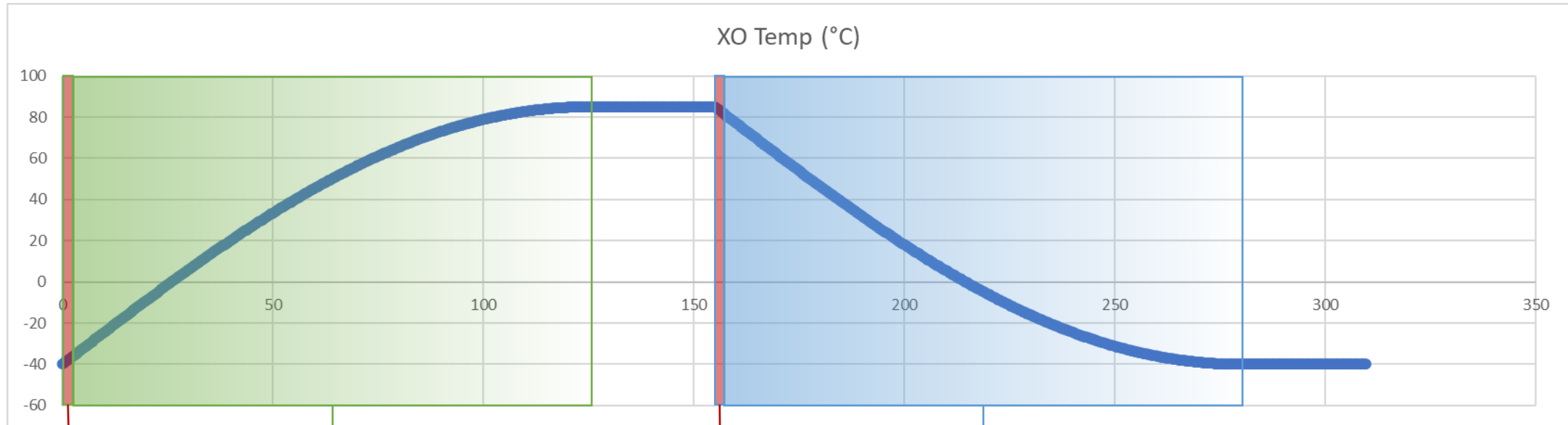


# 60802 Time Sync – NRR Drift Tracking & Error Compensation in Multi-hop Simulations

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Version 1

# Temperature Ramp Phases



**Within 2 s of discontinuity**

**Ramping Temp Up**

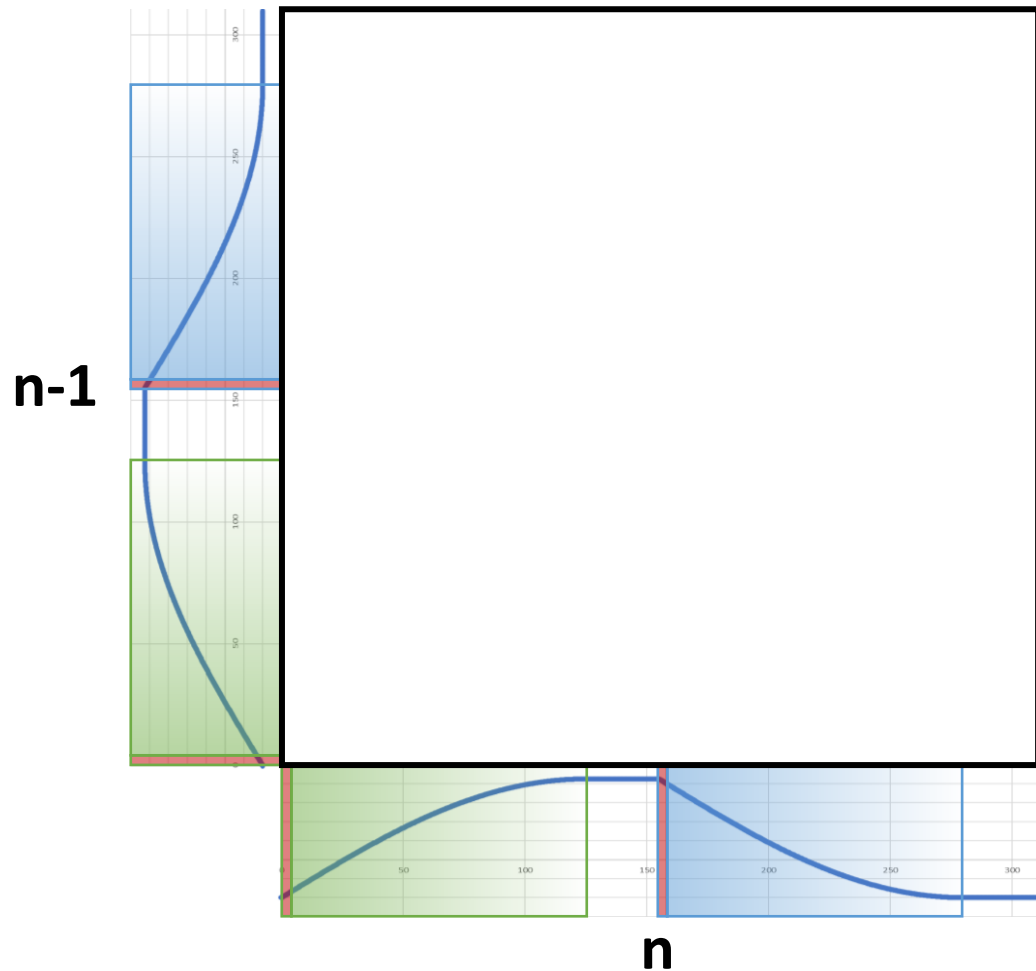
**Within 2 s of discontinuity**

**Ramping Temp Down**

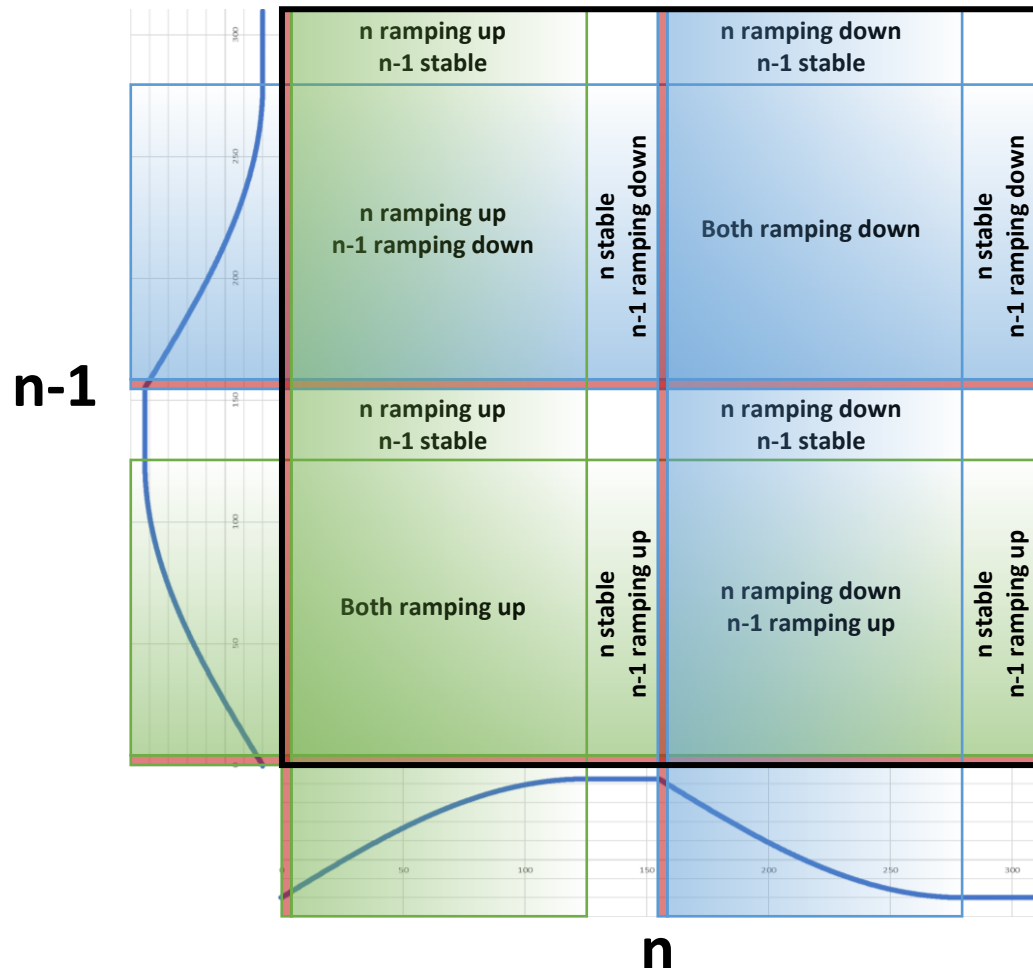
# Summary of Approach

- NRR depends on drift and current node (n) and previous node (n-1)...which is determined by temperature (and rate of temperature change) of the nodes.
- If there was no timestamp error, it would be deterministic: Node (n) is at position X on the temp curve...and Node (n-1) is at position X...then mNRRca (or mNRRcb) is Z.
- But there is timestamp error, so Z is actually a distribution with mean and standard deviation.
- So...you can create a lookup table for the mean and standard deviation.

# Temperature Ramp Phases – 2 Nodes



# Temperature Ramp Phases – 2 Nodes



- Relatively stable rate of change for most of the possible combinations.
  - 1 s resolution
- Small areas where there is no temperature change (hence drift)
  - 1 s resolution to keep things simple
- Areas immediately after discontinuities require greater resolution
  - 62.5 ms resolution

# For Multi-hop Simulations

- First run many, many 2-hop simulations to build a lookup table for NRR error due to clock drift.
  - Uses piecewise-linear model for clock drift.
  - For given parameters, including Timestamp Error.
- Then use the lookup table as an input to the multi-hop simulator.
  - Rather than calculating NRR error from clock drift by looking into the past and modelling clock drift errors (assuming linearity) and timestamp errors.
  - Note: this removes the ability to see the breakdown of NRR error from timestamp error vs. clock drift.
- Runs faster than previous simulator
  - Avoids massive slowdown from using piecewise-linear model for clock drift.

# Thank you!

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