FEDERAL UTILITY PARTNERSHIP WORKING GROUP SEMINAR

May 18-19, 2016
Cincinnati, OH

Commissioning

Otto Van Geet, PE
NREL

Hosted by:

Why Commission?

- Commissioning (Cx) of systems has its roots in ship building
  - first used to ensure a ship was seaworthy and ready for service.
- Cx is a specialized application of quality assurance.
- Good cx involves extensive testing and:
  - early planning,
  - continuous coordination,
  - comprehensive documentation, and
  - thorough O&M training.

An analogy to a ship's sea trials or "shake-down" cruise

FEMP Federal Energy Management Program

DUKE ENERGY®

Commissioning Background

- The **goals of commissioning** are to:
  - Improve energy performance and minimize energy consumption.
  - Reduce operating costs.
  - Ensure adequate O&M staff orientation and training.
  - Improve systems documentation.
- Specific to UESC:
  - "Performance assurance" rather than "savings guarantee" assists keeping costs reasonable and appropriate to the project size/ ECM
  - Use a consistent set of procedures/activities to monitor, adjust, and report on ECM performance.
  - utility/agency monitoring, comparison to baseline, makes improvement recommendations, and agency makes adjustments

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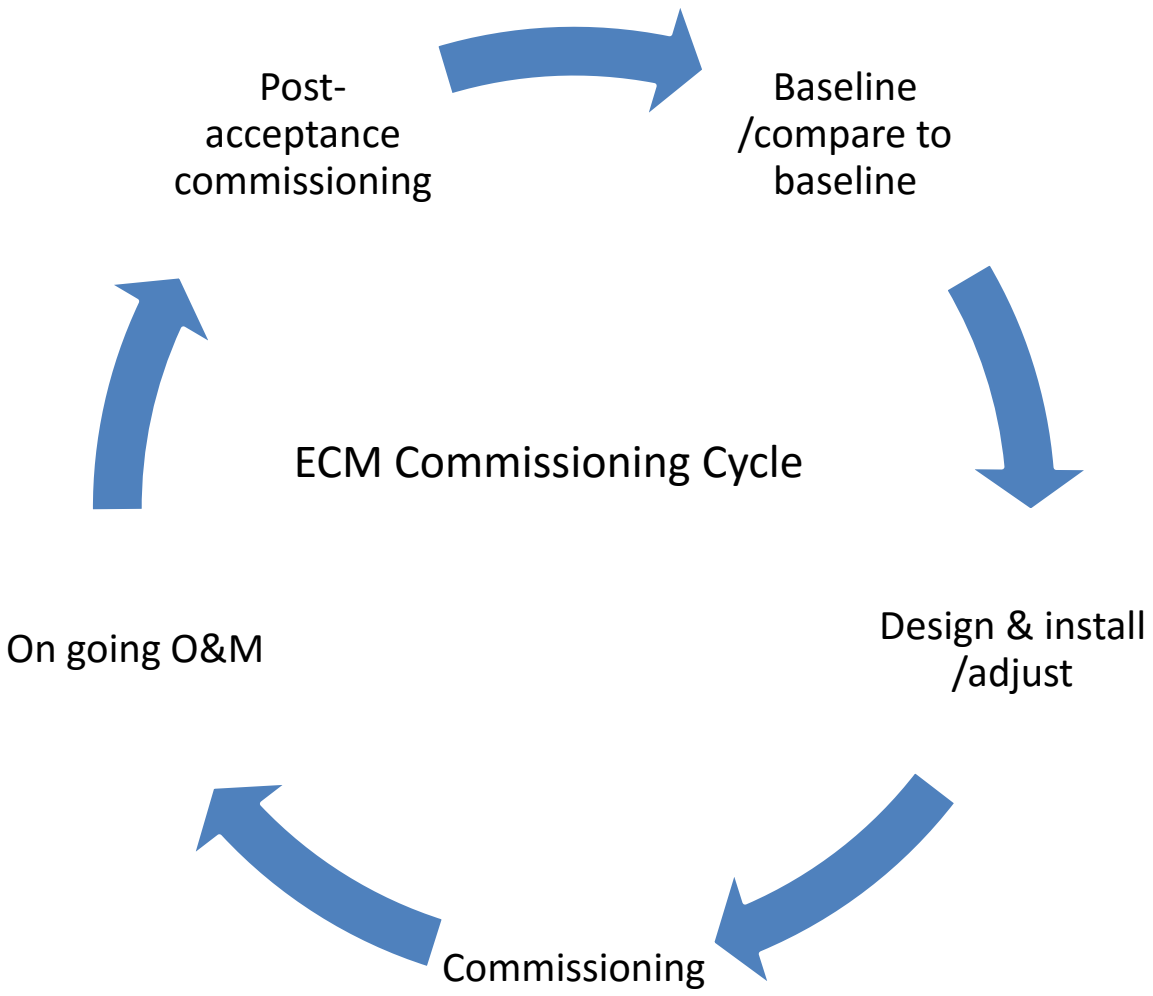
Role of Commissioning within a long-term Performance Assurance Plan



1. Cycle of ECM performance assurance

2. Baseline /compare:
   Existing equipment/system performance and O&M procedures and logs

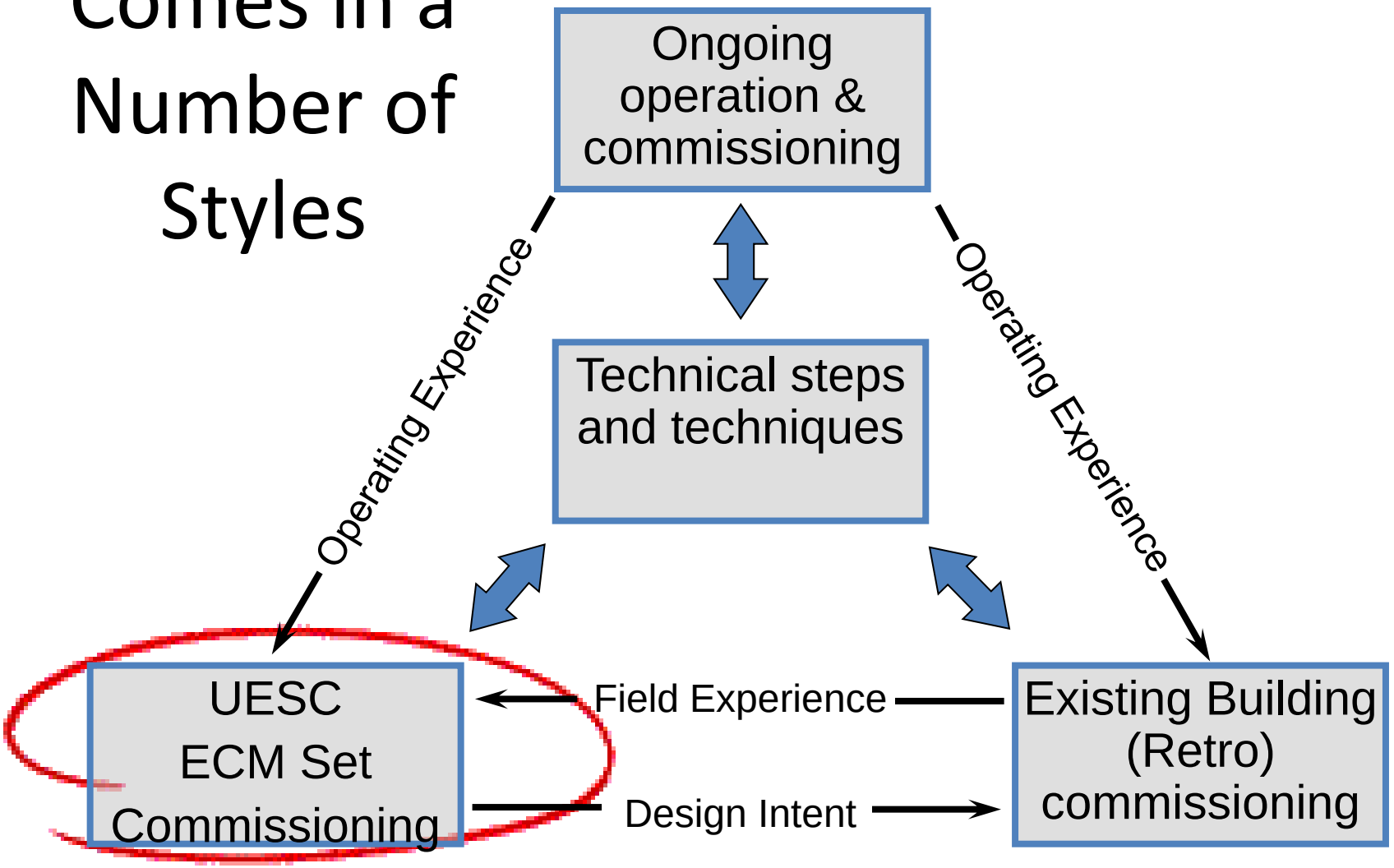
3. Design & install /adjust:
   improve equipment/system performance and update O&M procedures and logs

4. Pre-acceptance commissioning:
   prove performance meets design

5. On going O&M:
   updated O&M procedures and logs

6. Post-acceptance commissioning:
   monitor, adjust, assure long-term optimal performance

Commissioning Comes in a Number of Styles



Cx Activities for UESC

- Re-commissioning
  - Performed 5 to 10 years after previously commissioned
  - Used to help identify deferred maintenance
- Retro-commissioning (RCx)
  - Performed to existing buildings not previously commissioned
  - Usually instigated due to high energy bills or poor occupant comfort
- Monitoring-Based Commissioning (MBCx)
- Continuous-commissioning (CCx)
  - Ongoing process to resolve operating problems, optimize energy use and identify retrofits

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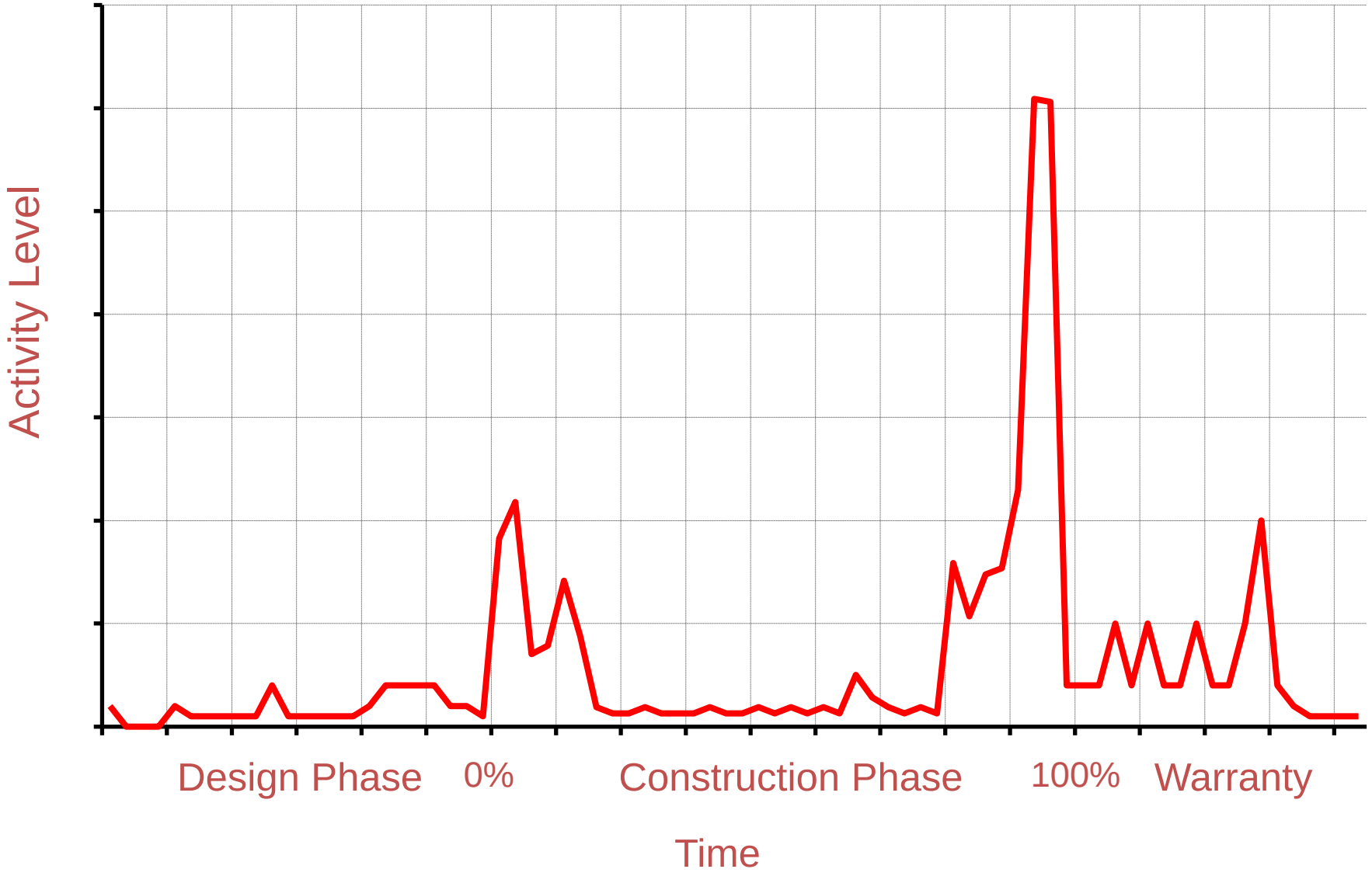
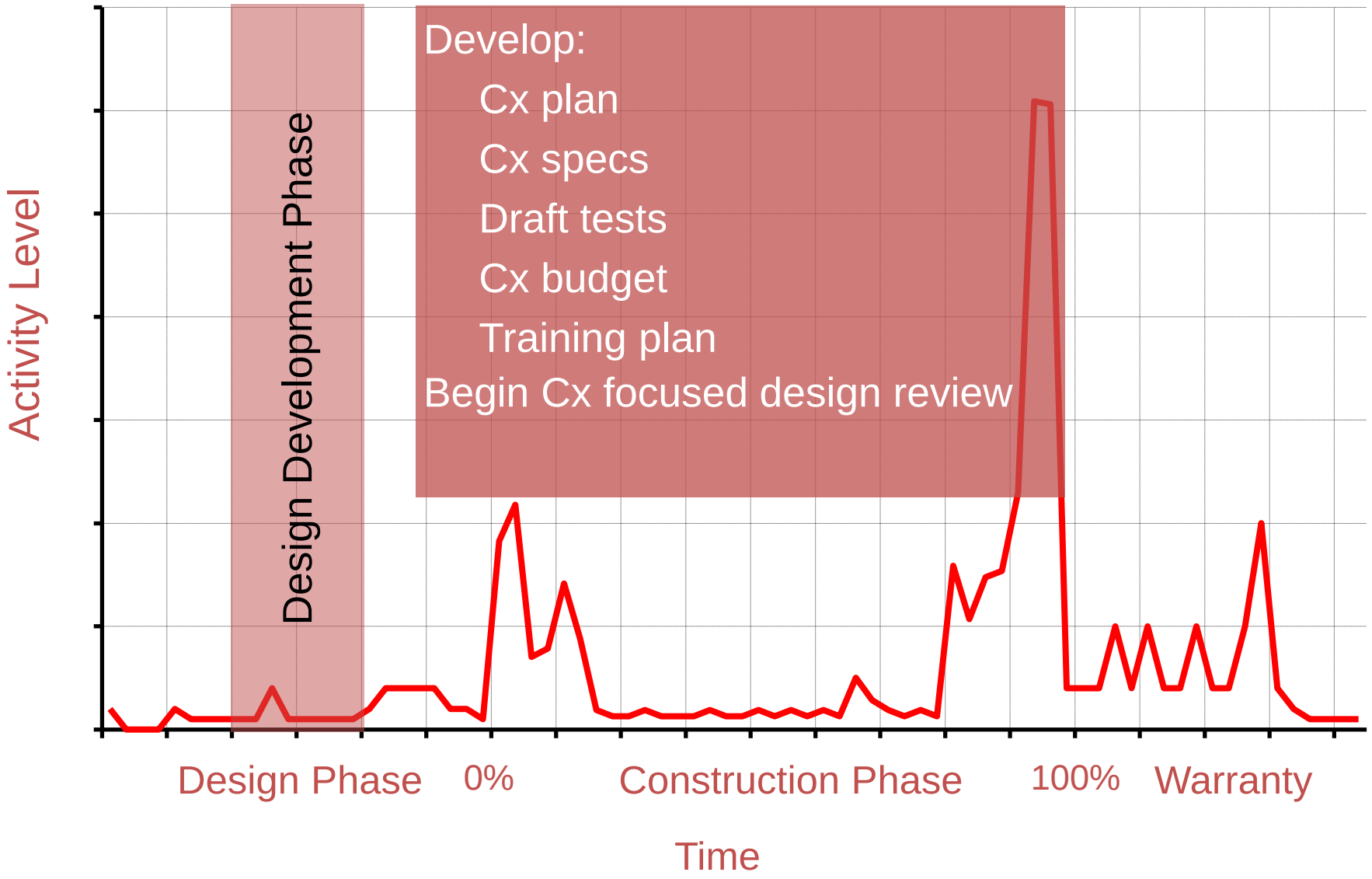
Development phase Commissioning Activity



Data for the graph courtesy Karl Stum; Summit Engineering

Construction Commissioning Activity



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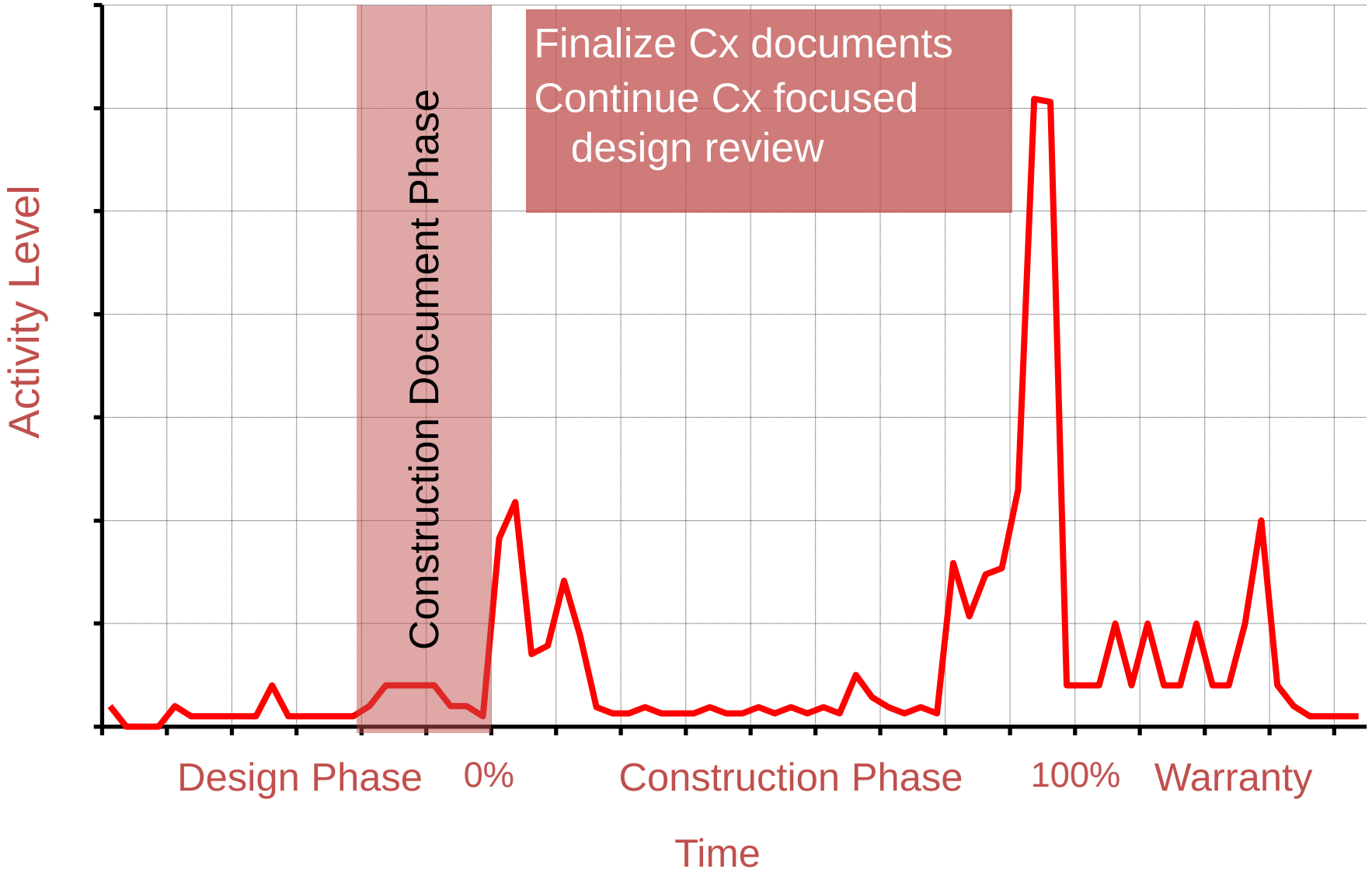
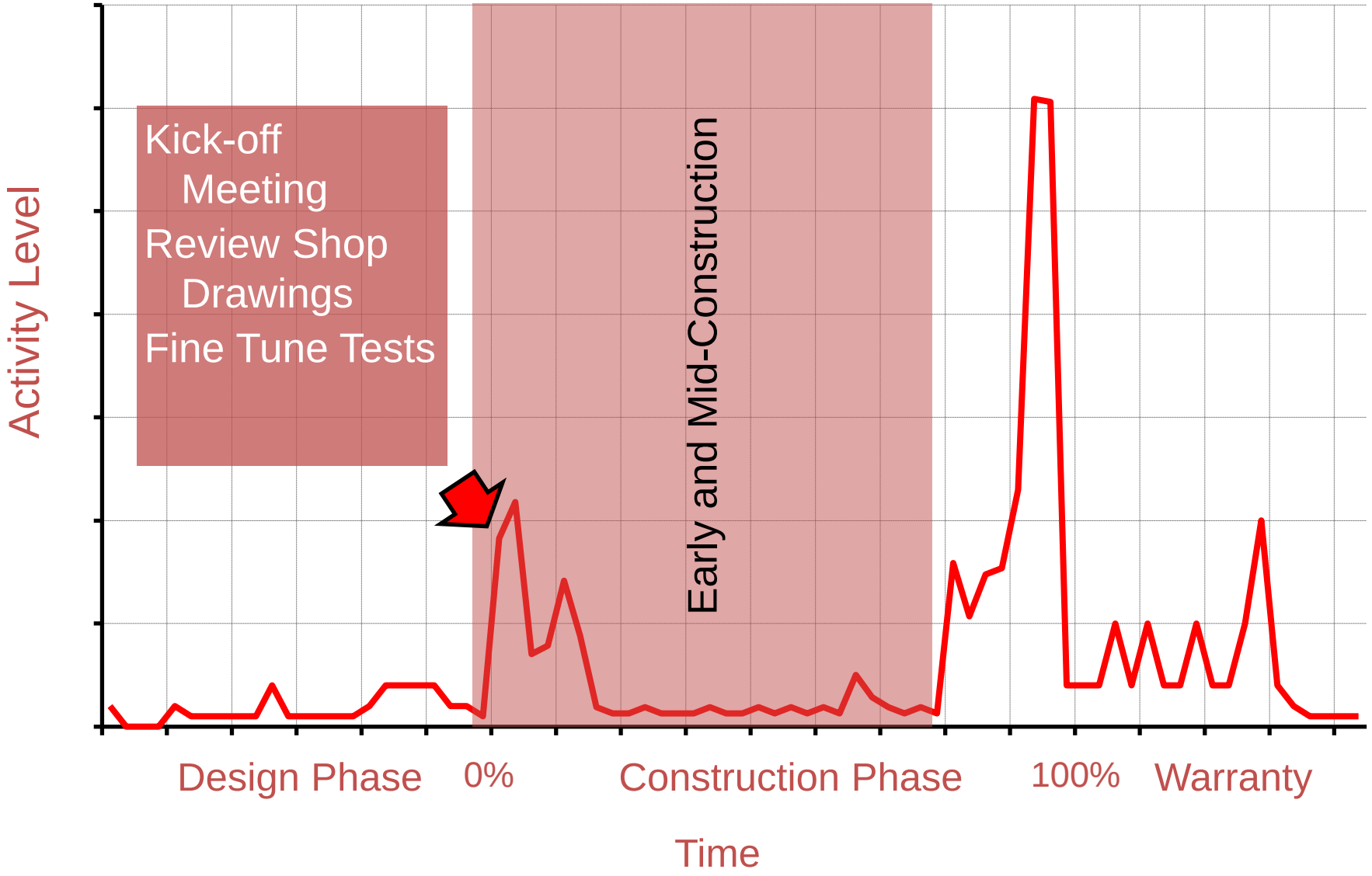
Construction Commissioning Activity



Data for the graph courtesy Karl Stum; Summit Engineering

Construction Phase Commissioning Activity



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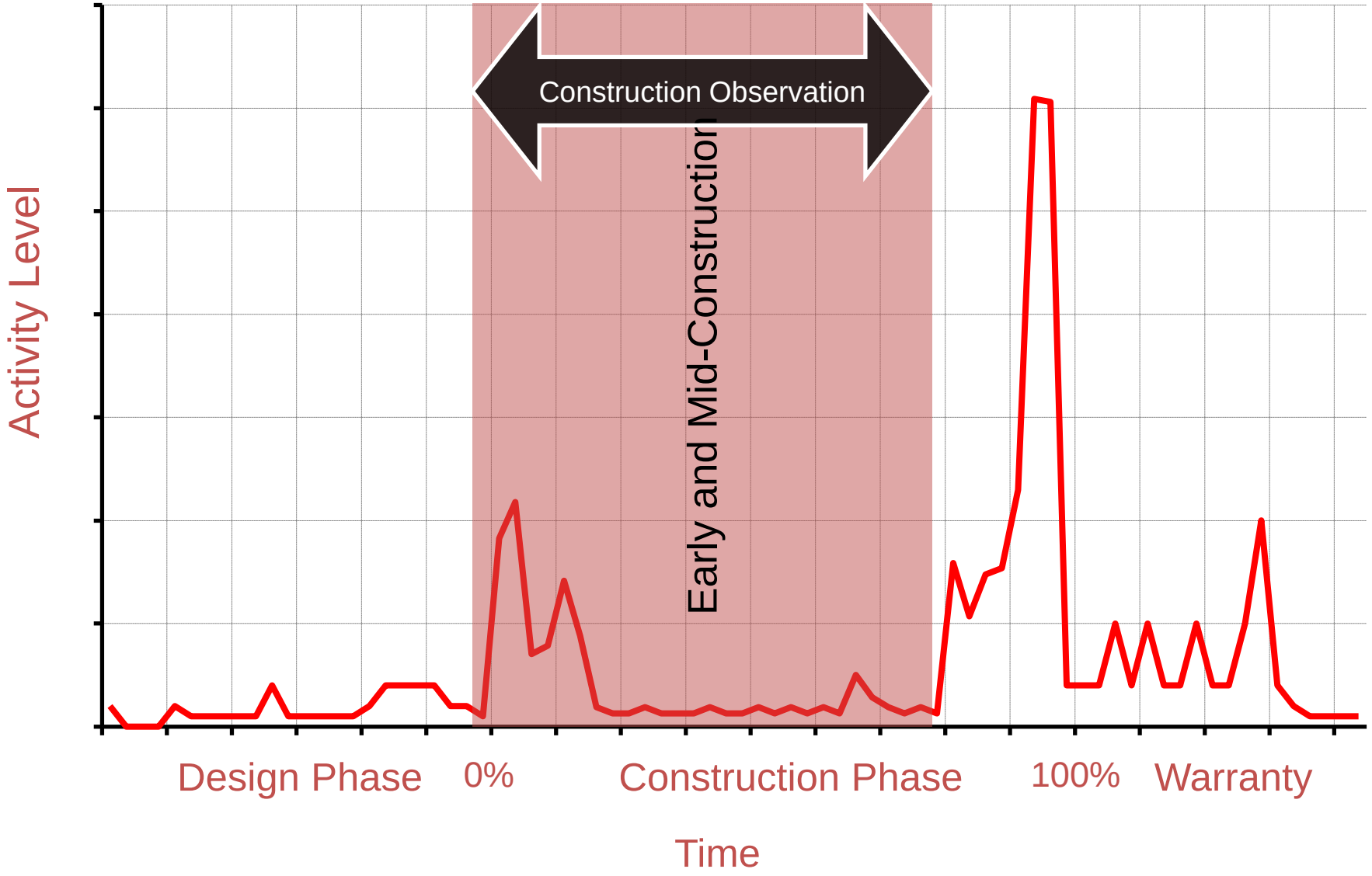
Construction Commissioning Activity



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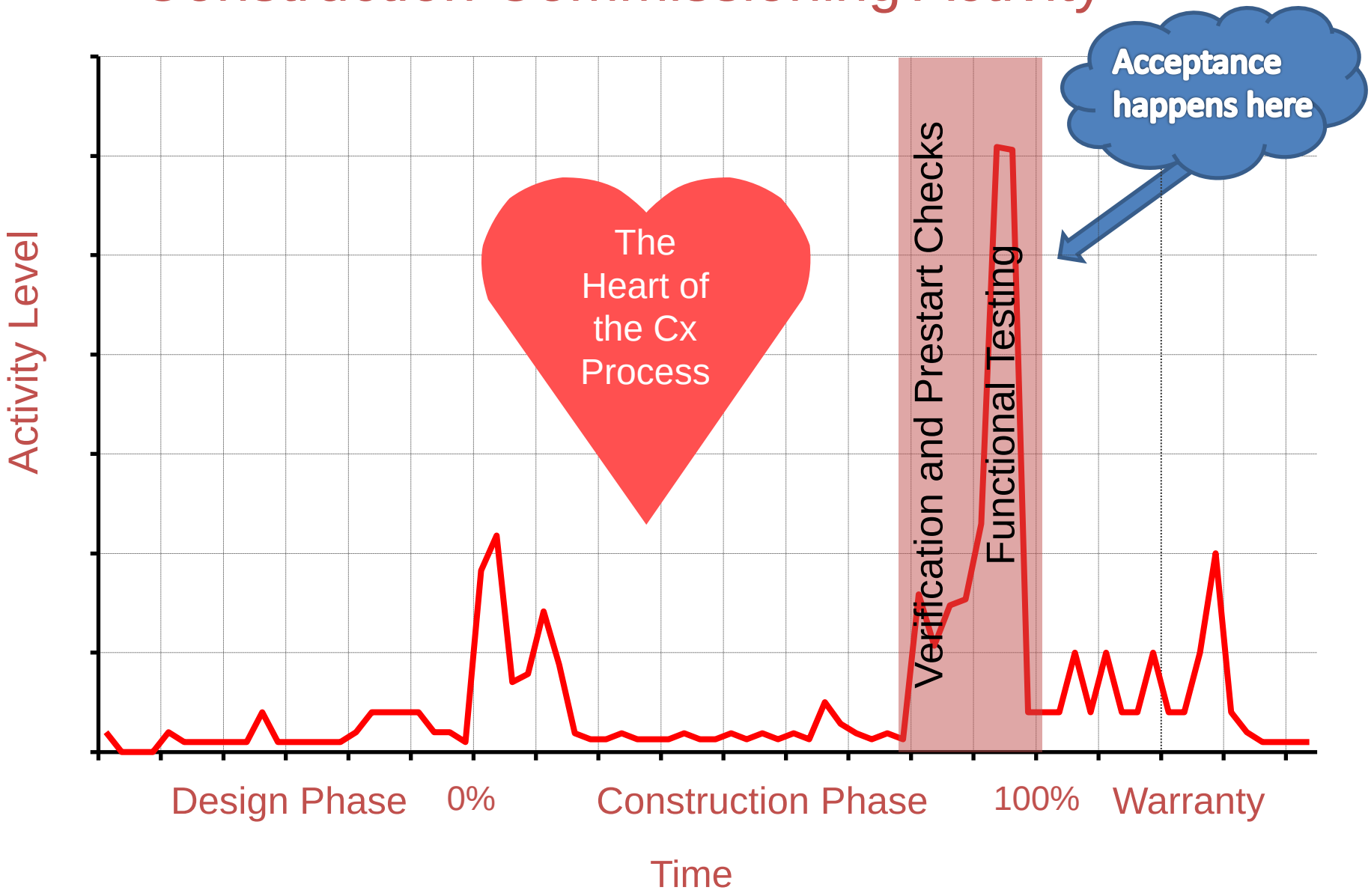

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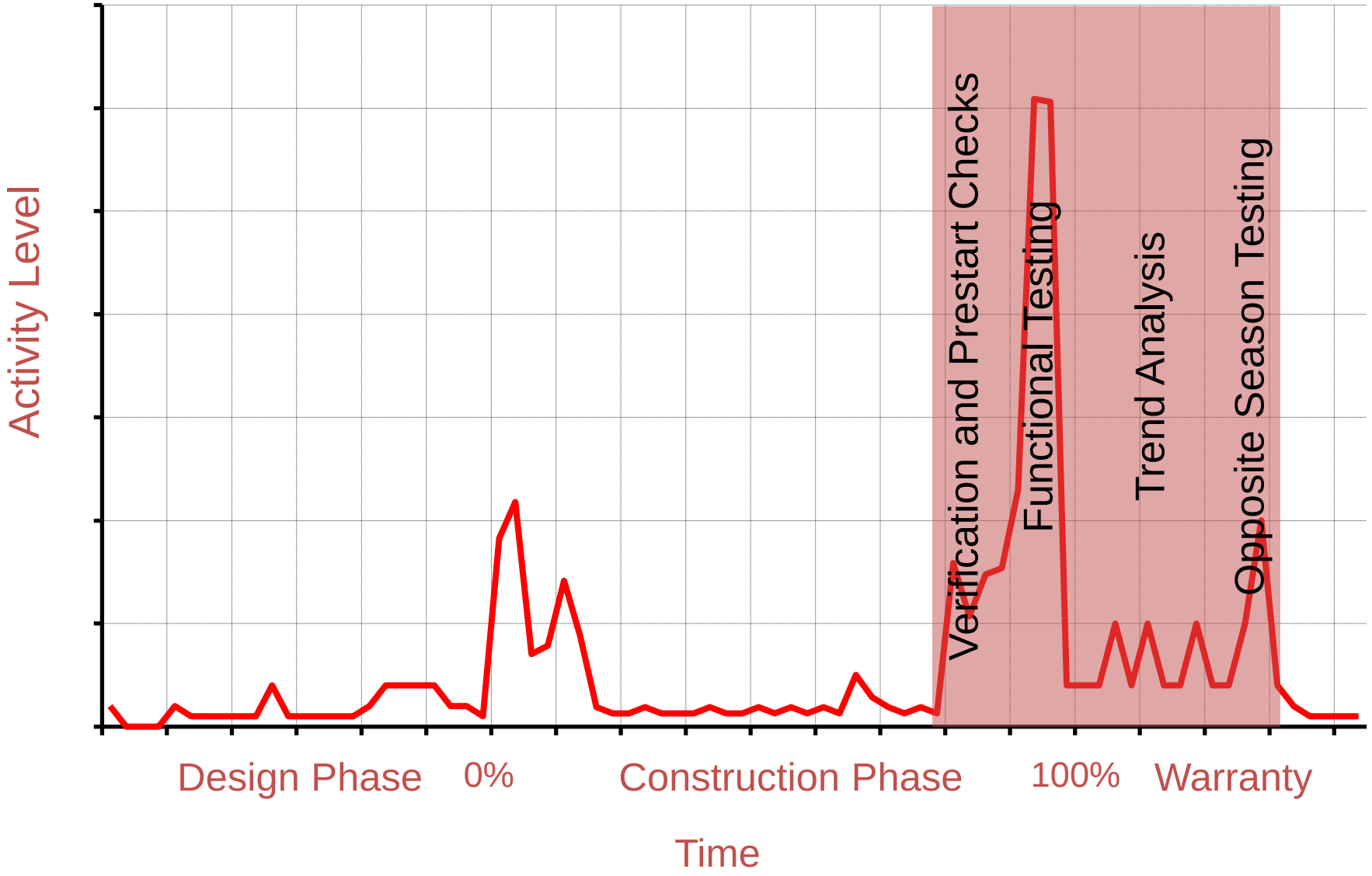
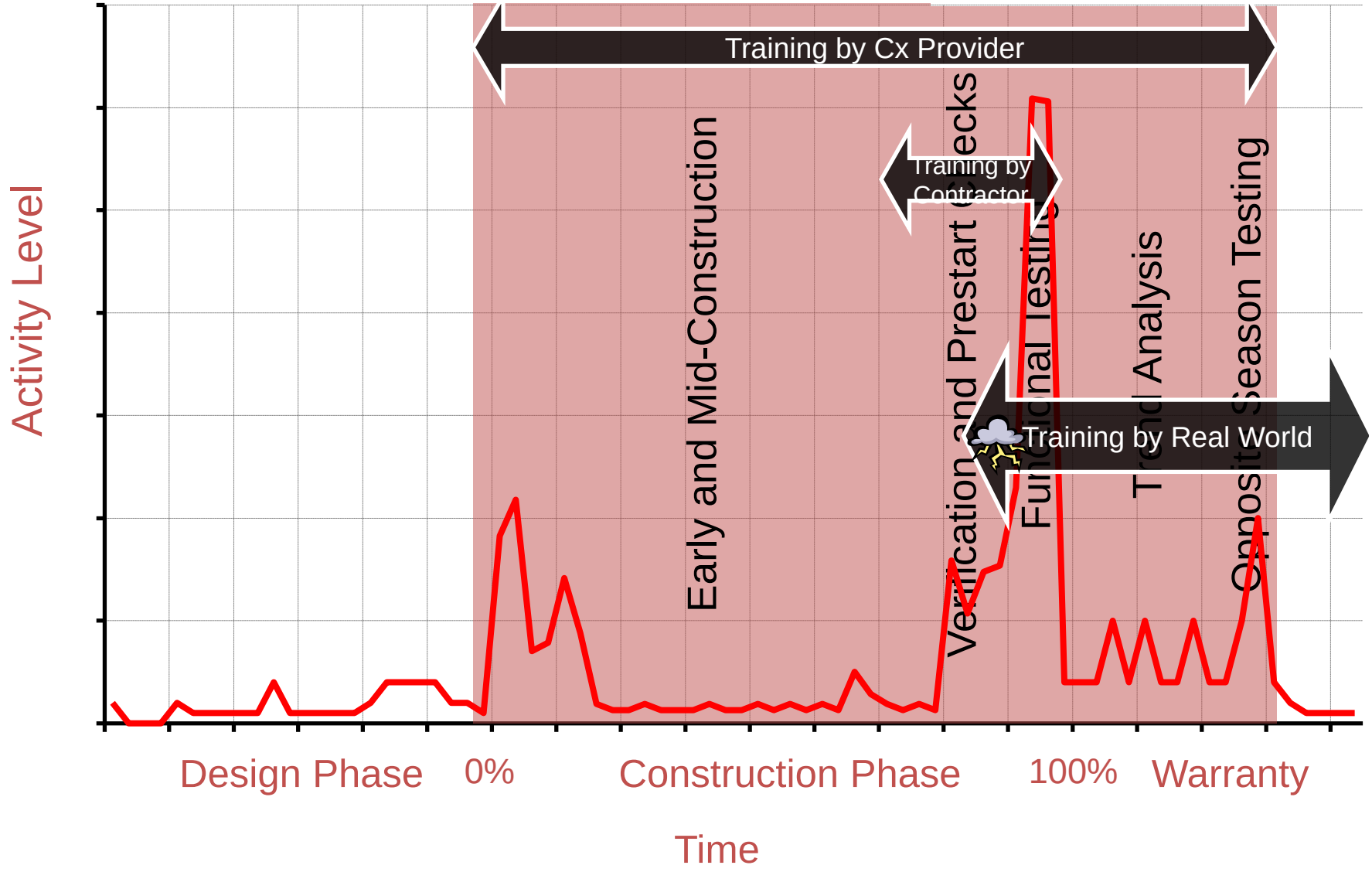


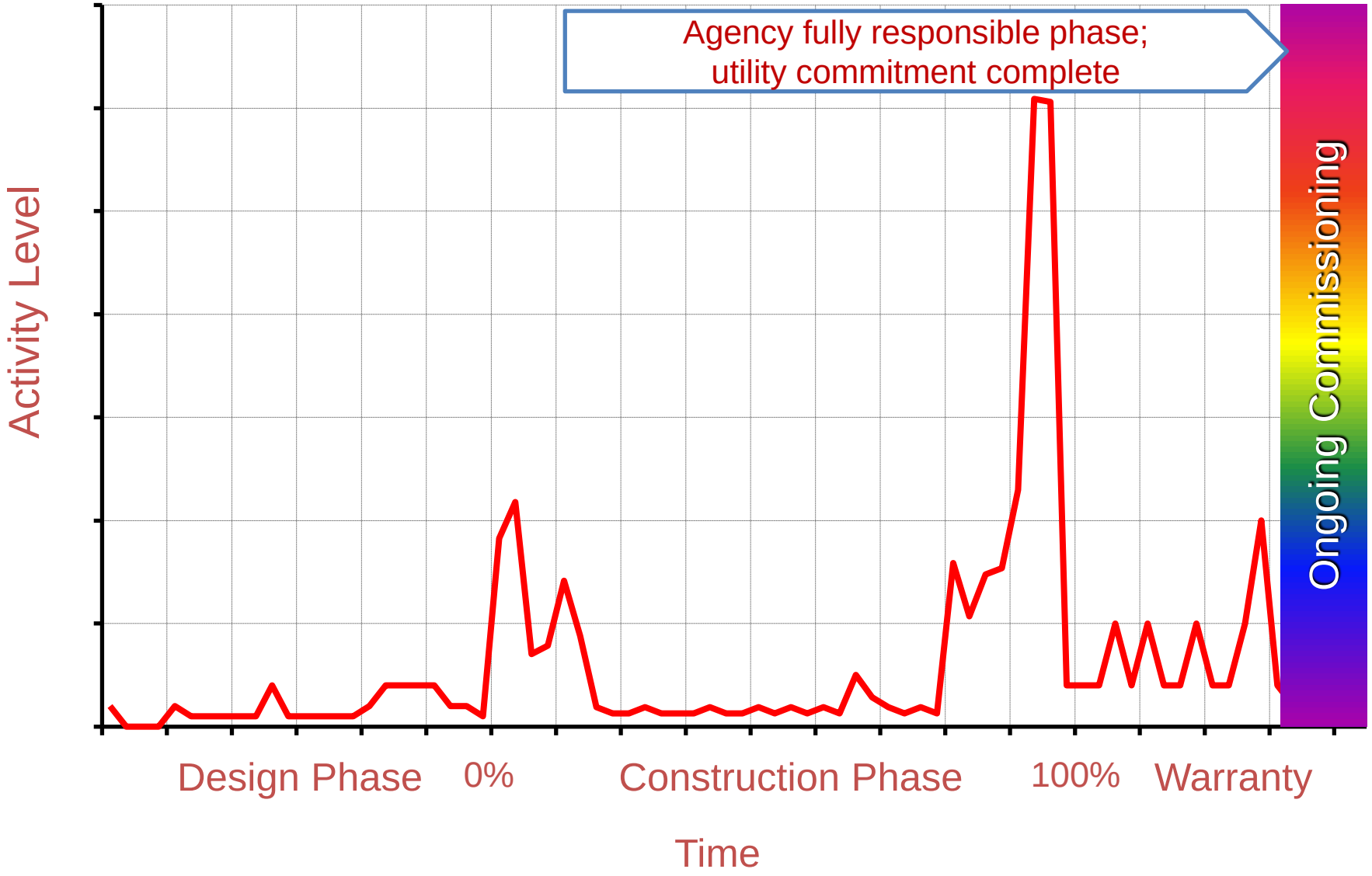
Data for the graph courtesy Karl Stum; Summit Engineering

Responsibility Shifting from Utility to Agency - Commissioning



Data for the graph courtesy Karl Stum; Summit Engineering

Agency fully responsible phase - Commissioning



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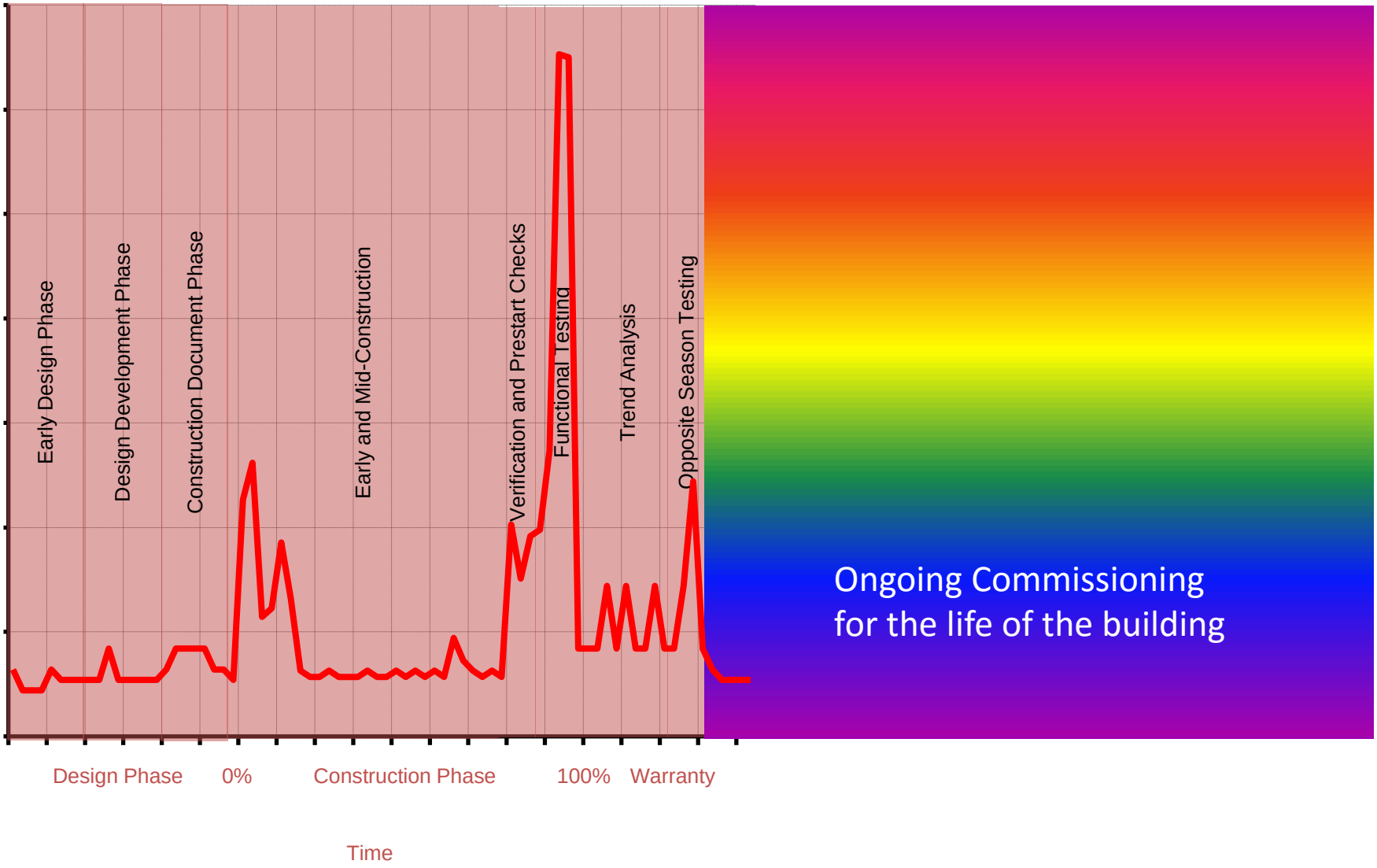
Commissioning Activity



Data for the graph courtesy Karl Stum; Summit Engineering

MBCx & AFDD Definitions

- **Monitoring-Based Commissioning (MBCx):** Use monitored data to assess equipment operation (new or existing buildings), typically ongoing

- **Automated Fault Detection and Diagnostics (AFDD):** Analytical software that detects specific issues in operation, enabling MBCx.

Benefits

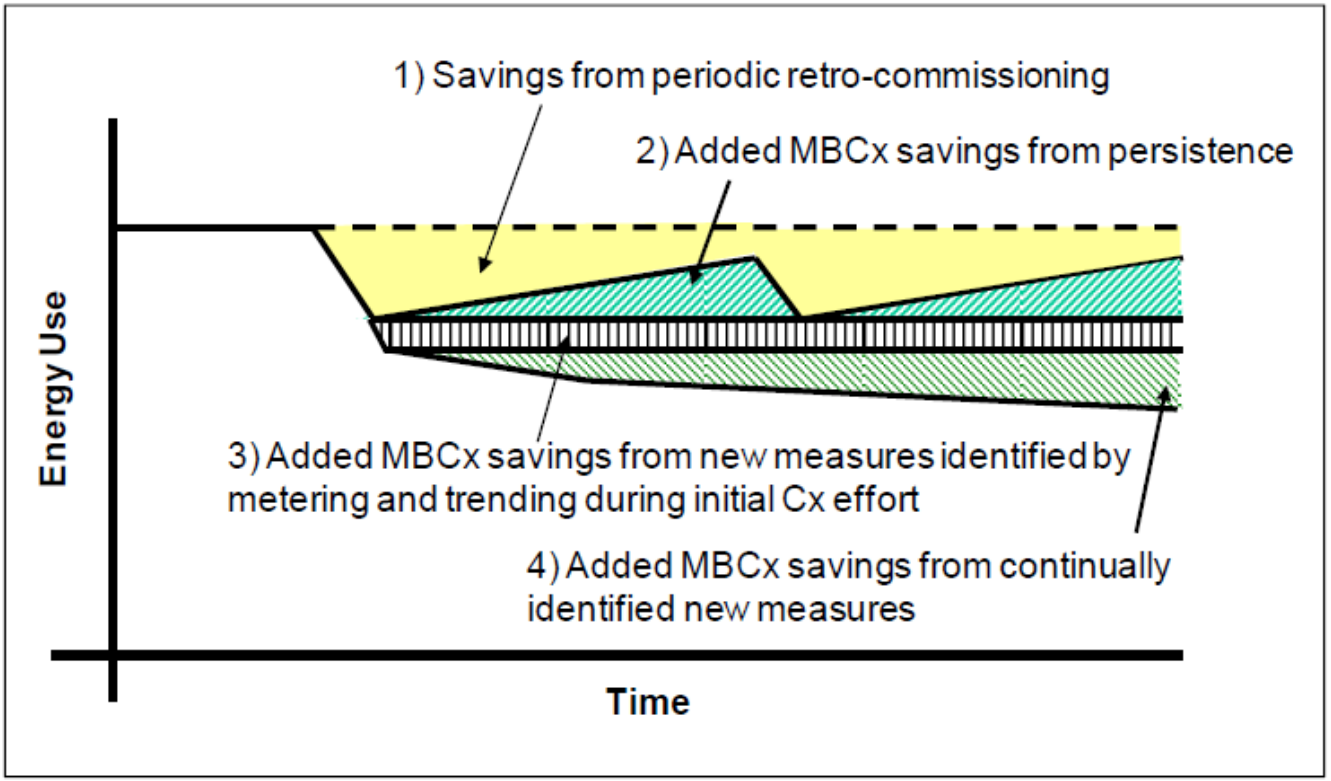


Figure 1. MBCx provides three streams of additional energy savings relative to RCx.

**Lawrence Berkeley National Laboratory, June 2009 report - Monitoring-Based Commissioning: Benchmarking Analysis of 24 UC/CSU/IOU Projects*

Studies show that 25% of RCx savings on average can be lost over 4 years without ongoing attention.

RCx Issues Identified

Issues/opportunities that can be detected:

- Air-Side Opportunities

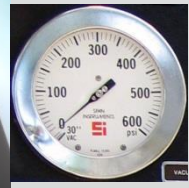
Equipment scheduling, ventilation/economizer control optimization, pressurization and temperature optimization

- Ideal VAV System Operation

Duct static pressure and discharge air temperature optimization, morning warm-up control, minimum VAV box flow reduction

- Water Side Opportunities

Temperature optimization (chilled water, condenser water, heating water), water-side economizer control, pump and pressure control, equipment staging



Fault Detection & Diagnostics (FDD)

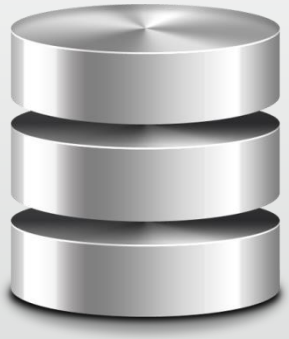
Detailed analytics down to the equipment level

Meter Data

Weather Data

BAS Data

Any device with a "pulse"



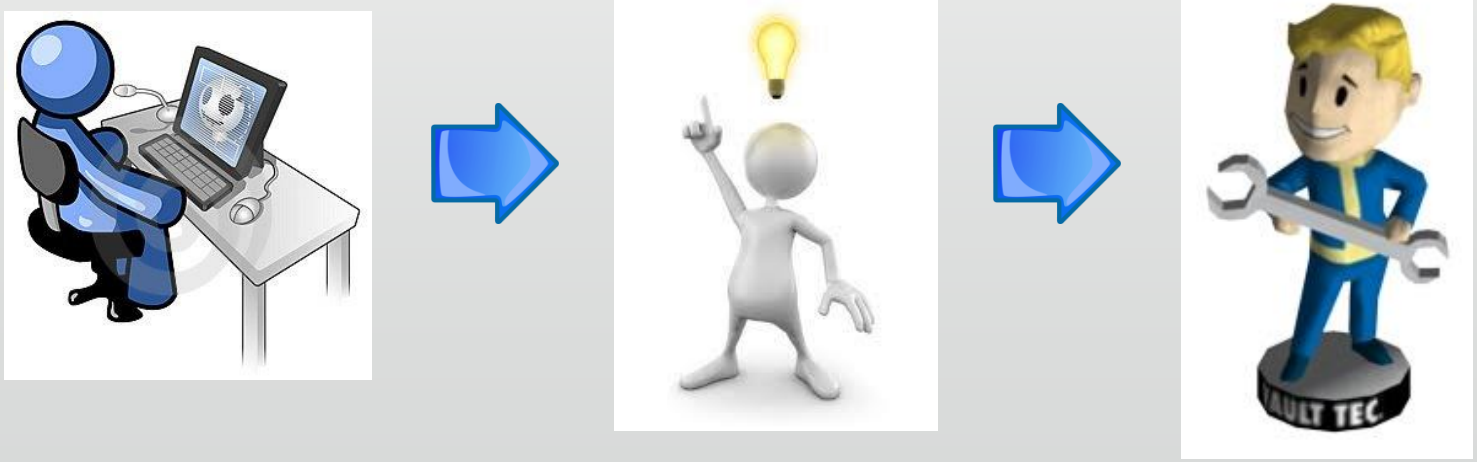
Database

Analytics provide information for action

Cloud based or local software

Fault Detection & Diagnostics (FDD)

- Data points constantly monitored and stored
- Programmed “rules” automatically detect “faults” or issues over all time
- One way communication – *provides information that requires human action*



Fault Detection & Diagnostics (FDD)

- Growing number of tools, not as many as EIS

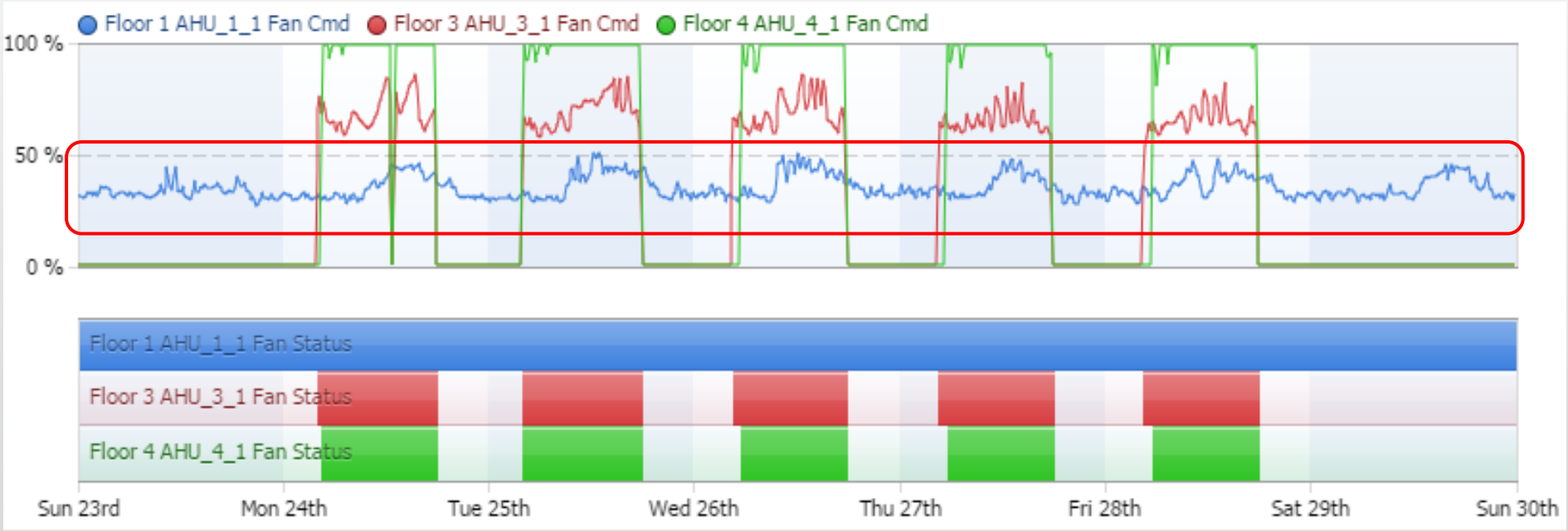
Examples:

- Purchased as a license: Sky Foundry SkySpark
- SAAS cloud hosted: Climetrics Analytika, Ezenics, KGS Buildings Clockworks, SciEnergy EnergyScape and more…
- Built in to BAS: Growing number of options

Example Fault - Scheduling

Example rule: “AHU ON During Scheduled Unocc”
(Equipment ON when it should be OFF)

Group	Rules	dur	Timelines	Targets
Floor 1 7 sparks	AHU On During Scheduled Unocc	97hr	Sun 30th Tue 1st Thu 3rd Sat 5t	AHU_1_1



AHU-1-1 operating 24/7 from 30%-50% fan speed

Questions?

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