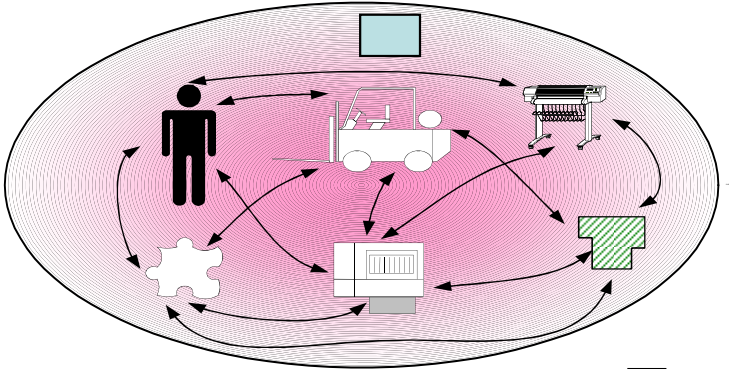


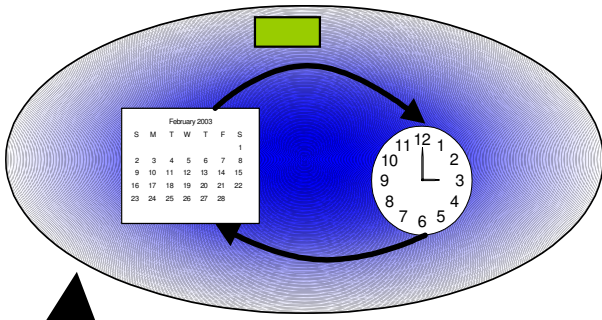
Simulation Elements

Lecture4
Jan8,2005

Objects and Relations

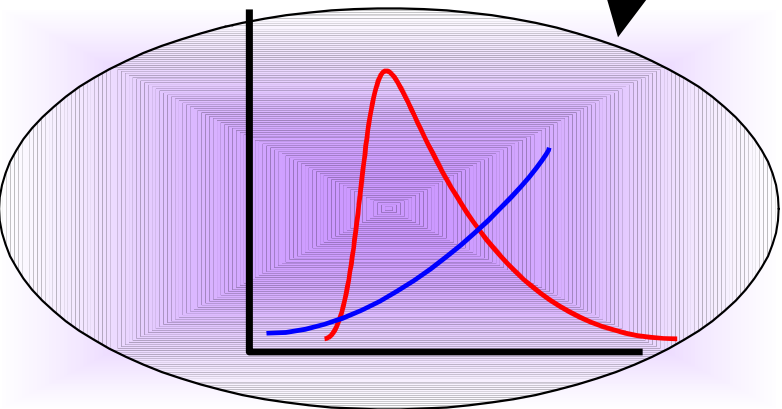


Timer

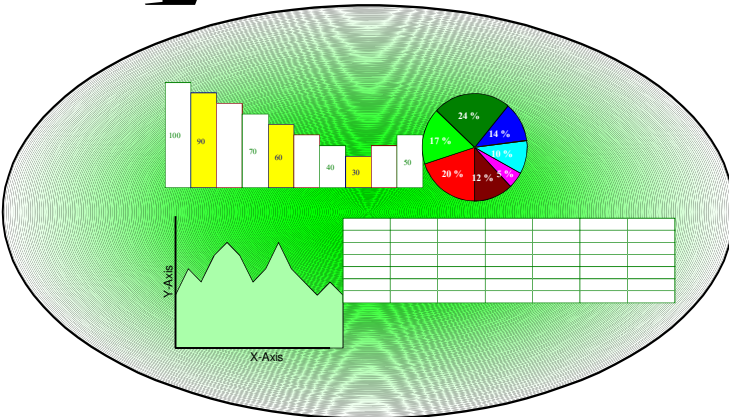


Execute

Random number and Events generation



Output & Animation



Discrete Event Simulation

Meaning : Simulating for discrete system.

Discrete system : System that have changing event at discrete time.

Such as :

Assembly line

Restaurant

Retail shop

Service activity

Airport

Call service

Example of **Continuous system**

Process manufacturing

Racing game

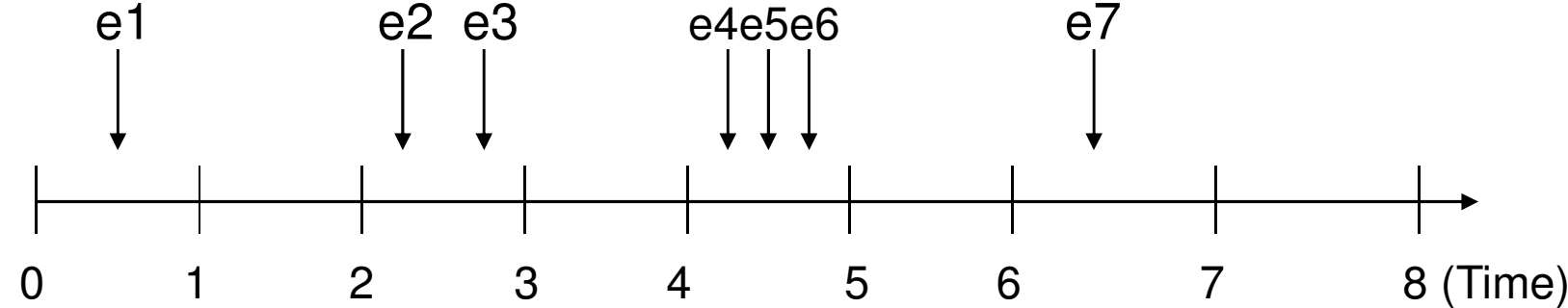
Heat transfer

Liquid flow

Electrical system

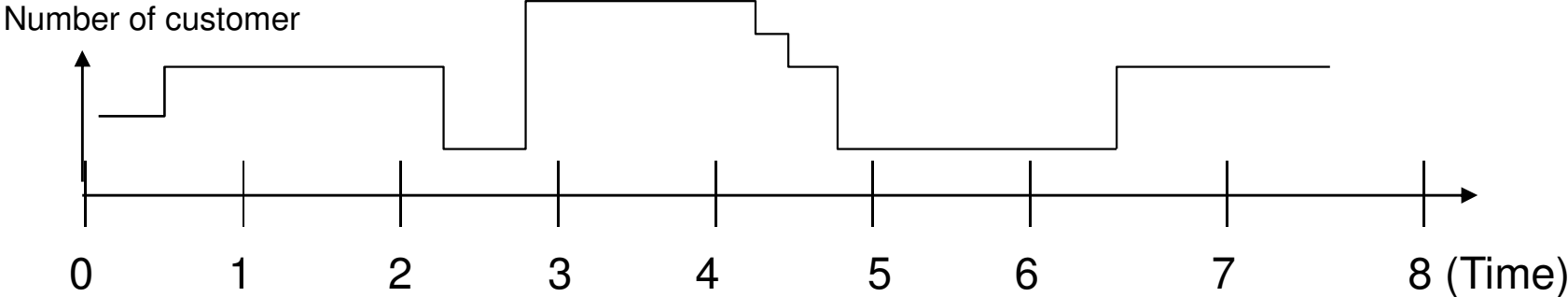
Discrete events

(number of customer)



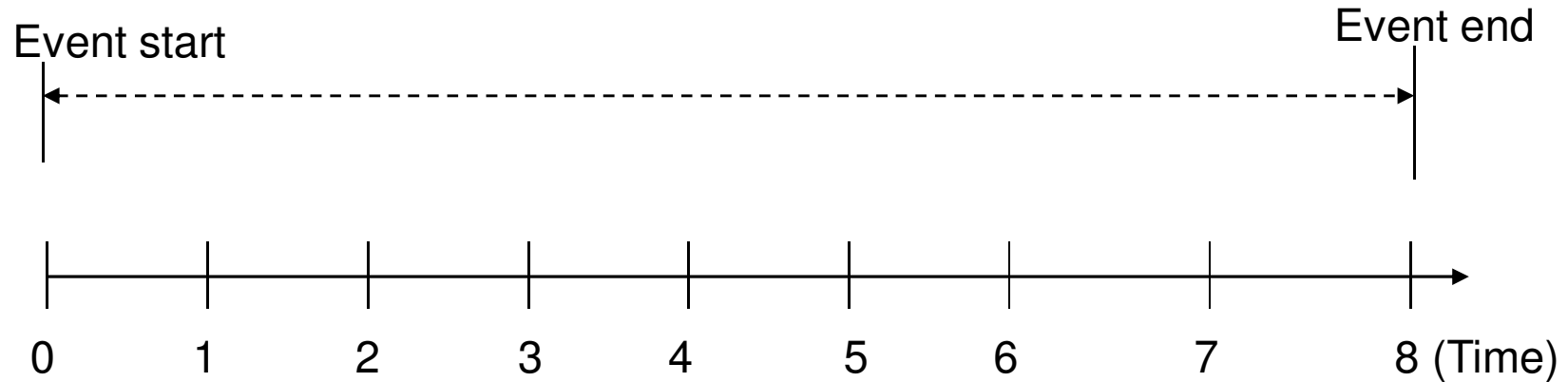
Events that change stage of system arise discretely.

Stage change

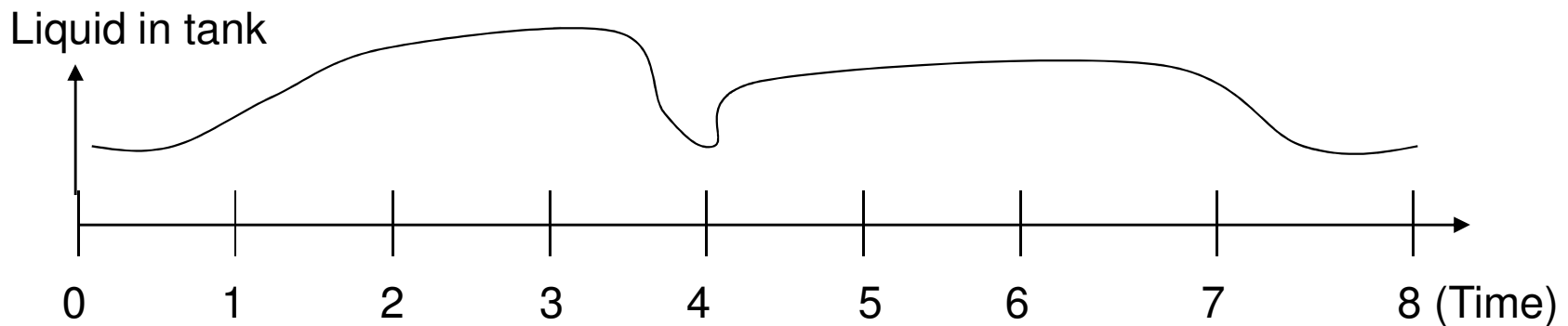


Continuous Event

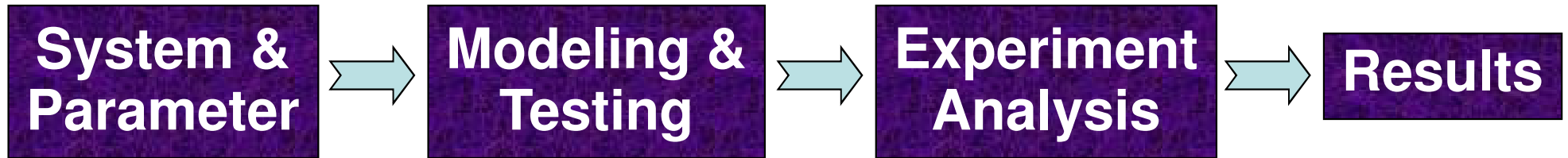
(Liquid in tank)



Stage change



Model Testing



Verification : Transforming the collected information into a model is done accurately,
building the model right.

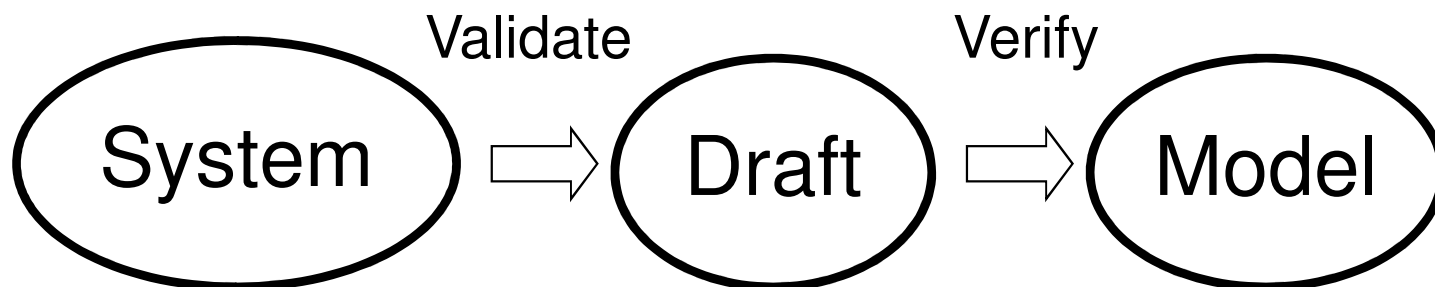
Is “Code” = Model?

Validation : Model behaves consistent with the study objectives,
building the right model

Is Model = System?

Verification & Validation

- Monitor error messages (obviously)
- Single entity release, Step through logic
 - Set Max Batches = 1 in Arrive
 - Replace part-type distribution with a constant
- Stress model under extreme conditions
- Parameter stepping ---- Result monitoring



Terminating Simulation

- Random input leads to random output
- Run a simulation (once) - what does it mean?
 - Was this run “typical” or not?
 - Variability from run to run (of the same model)?
- Need statistical analysis of output data
- Time frame of simulations
 - Terminating: Specific starting, stopping conditions
 - Steady-state: Long-run

Terminating Conditions

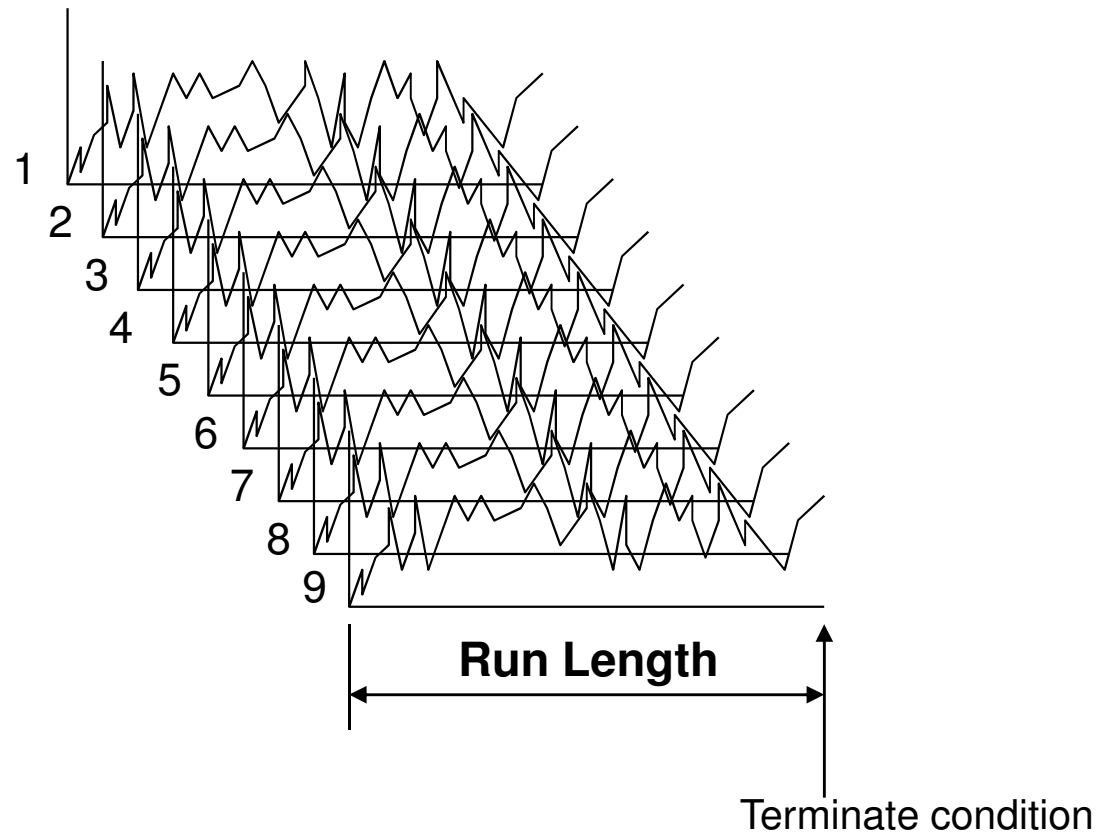
Terminate by Time

Terminate by Entered Entity

Terminate by Departed Entity

Terminate by Conditions

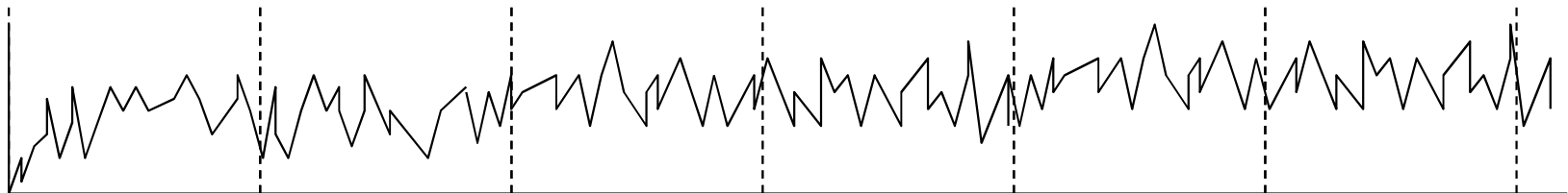
**Many
Replications**



Non-terminating simulation



How to replicate



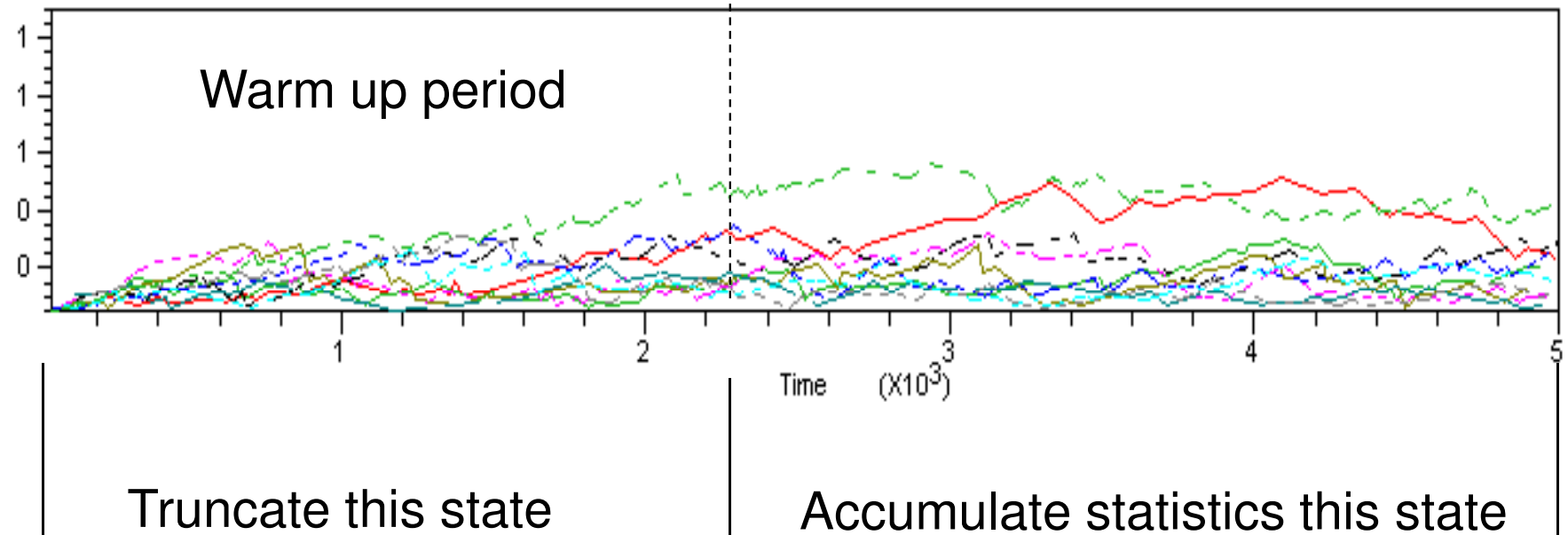
←→
Run Length

Transient state or Warm up period

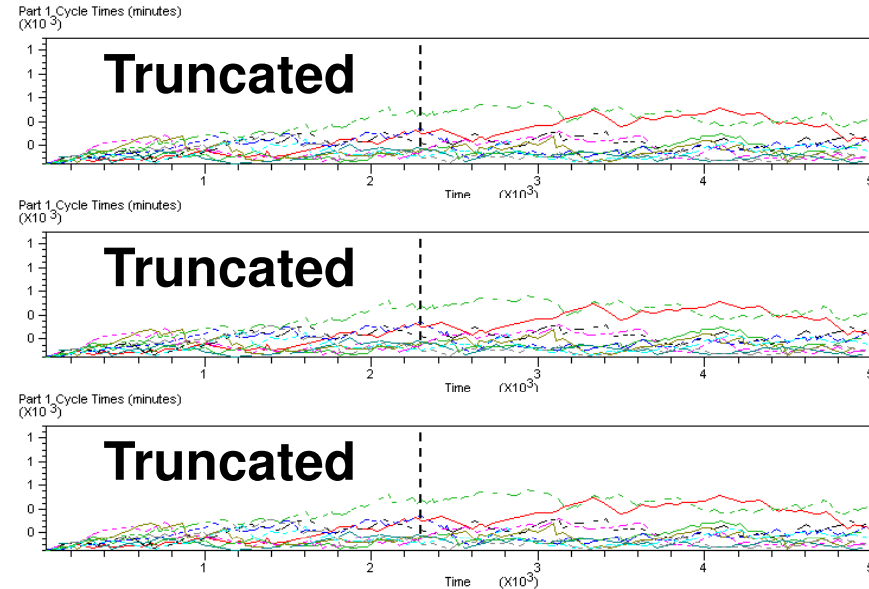
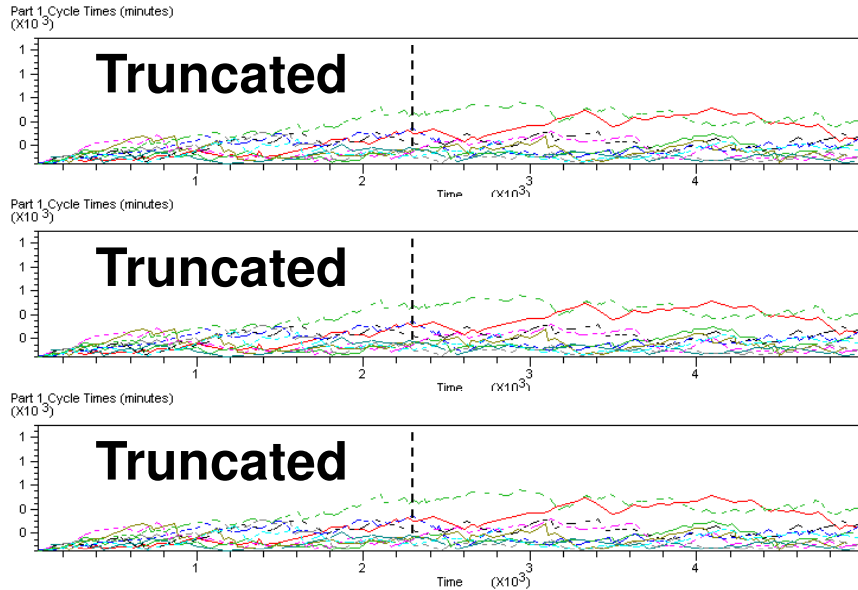
- Most models start *empty and idle*
 - *Empty*: No entities present at time 0
 - *Idle*: All resources idle at time 0
 - In a terminating simulation this is OK if realistic
 - In a non-terminating simulation, though, this can *bias* the output for a while after startup
 - Bias can go either way (up and down)
 - Depending on model, parameters, and run length, the bias can be very severe

Truncated Replication

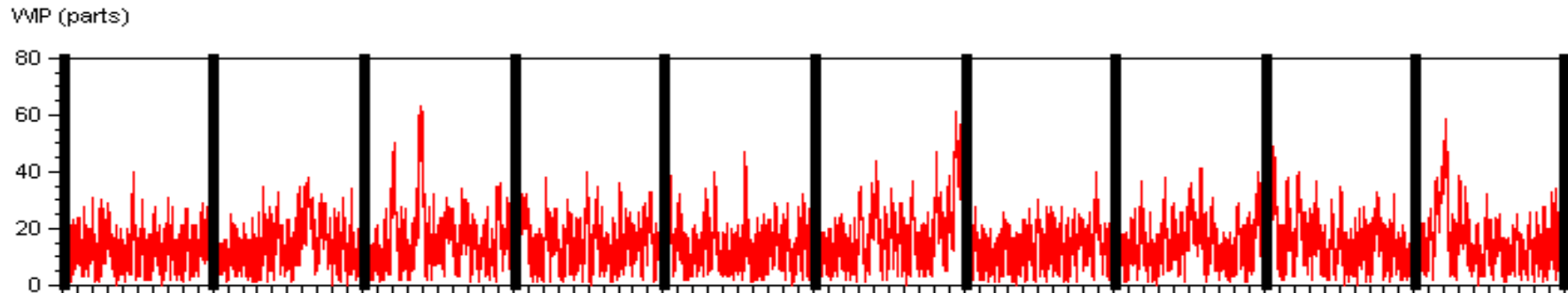
Part 1_Cycle Times (minutes)
($\times 10^3$)



How to run by batches



Terminating simulation is costly lost of truncated time



Non-terminating simulation is economically time

Only 1 truncate

Wirot Puttavitee: one@water-pacific.com