Process Simulation in manufacturing
Introduction to simulation and Flexsim

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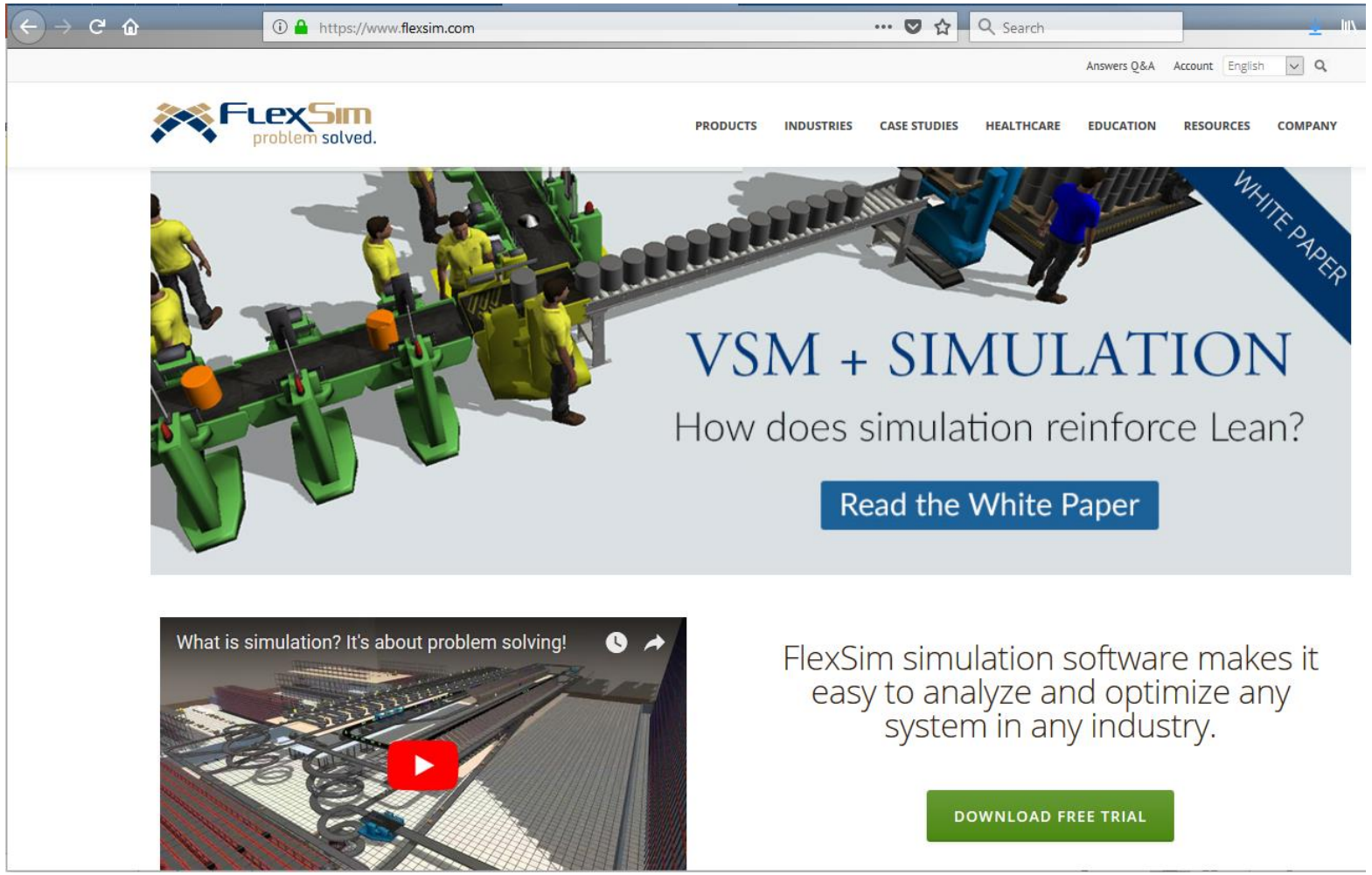
DIGIFOF

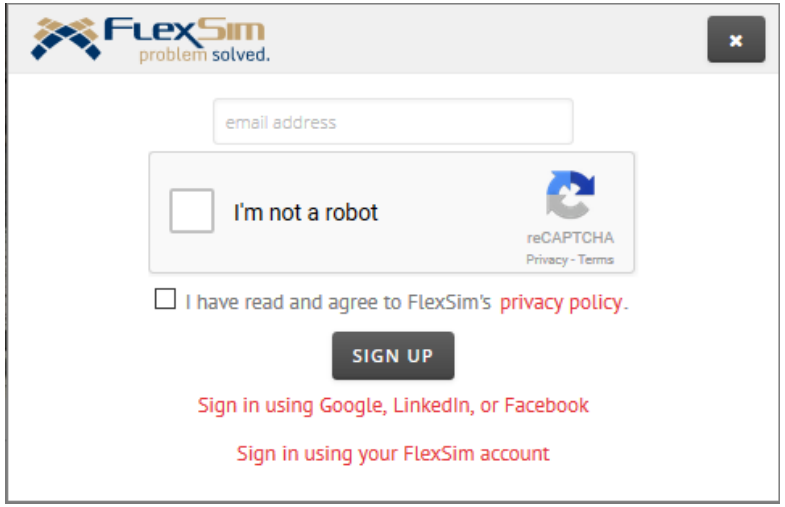
DIGITAL DESIGN SKILLS FOR FACTORIES OF THE FUTURE

Agenda

- What is Simulation?
- Why to Simulate?
- Which are the main phases of a simulation project?
- What is FlexSim?
- The FlexSim Simulation Logic
- Demo Case: Simple manufacturing process
- FlexSim Tutorials
- Advanced Topics

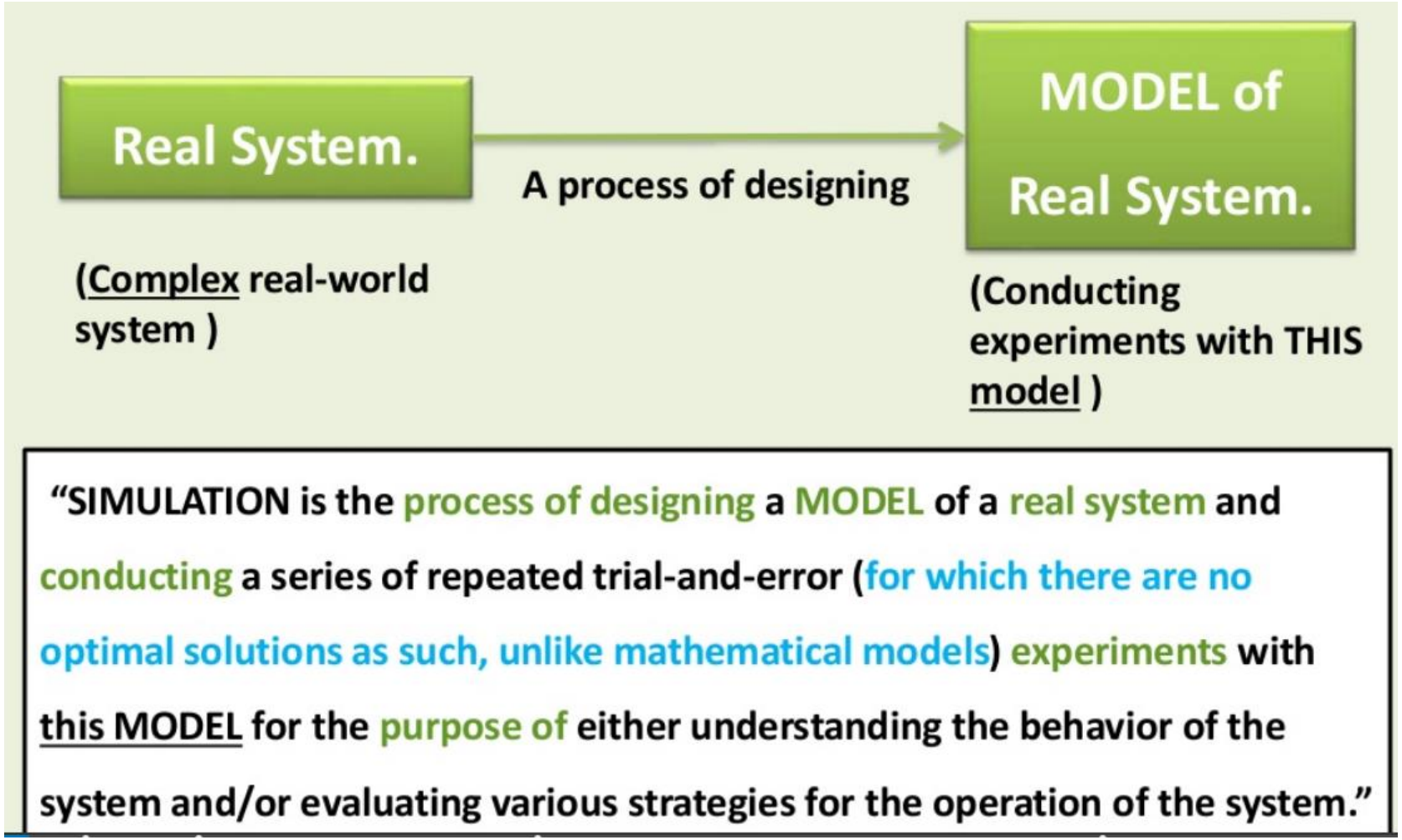
Downloading FlexSim



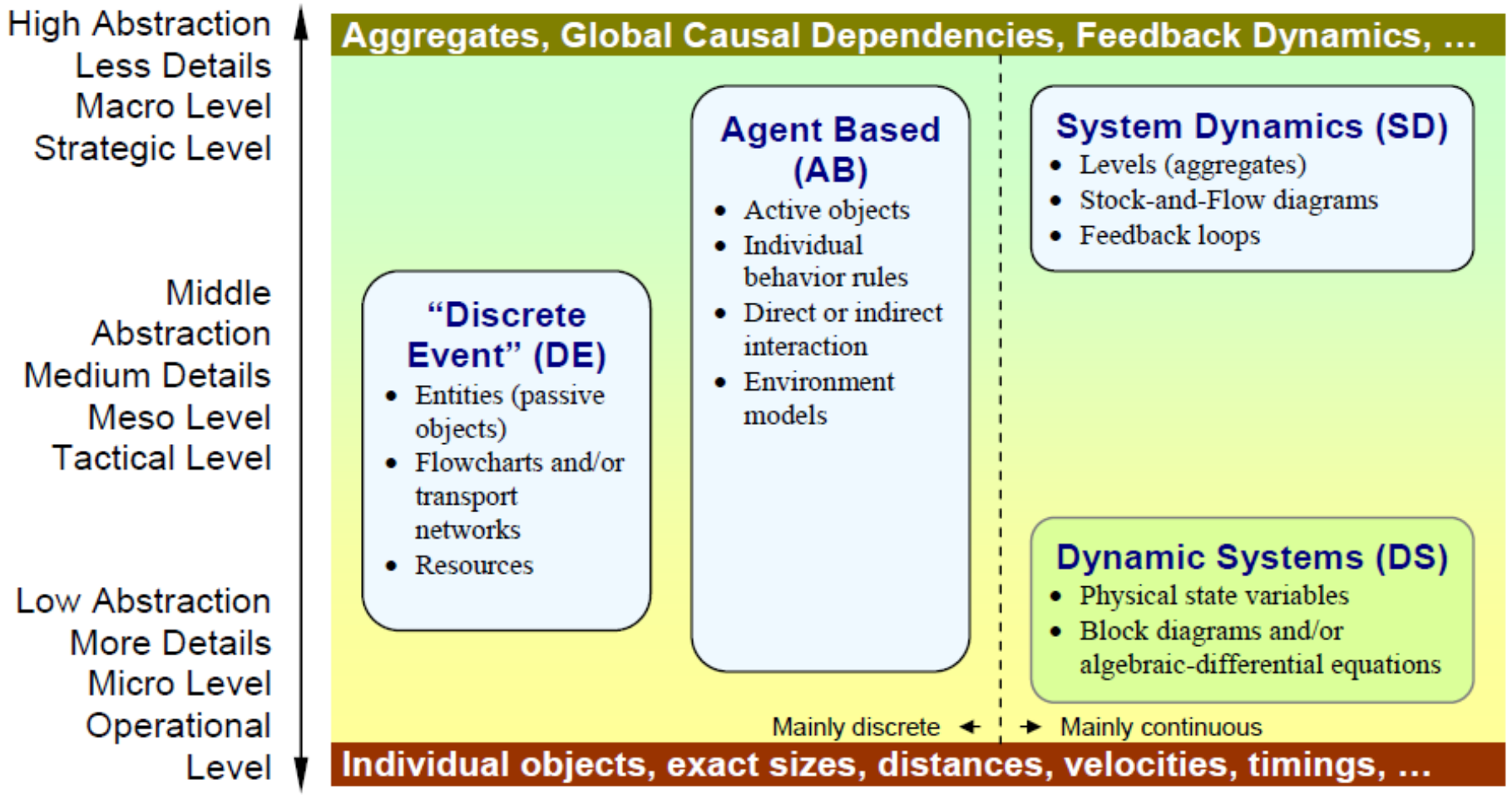


What is Simulation?

What is Simulation?



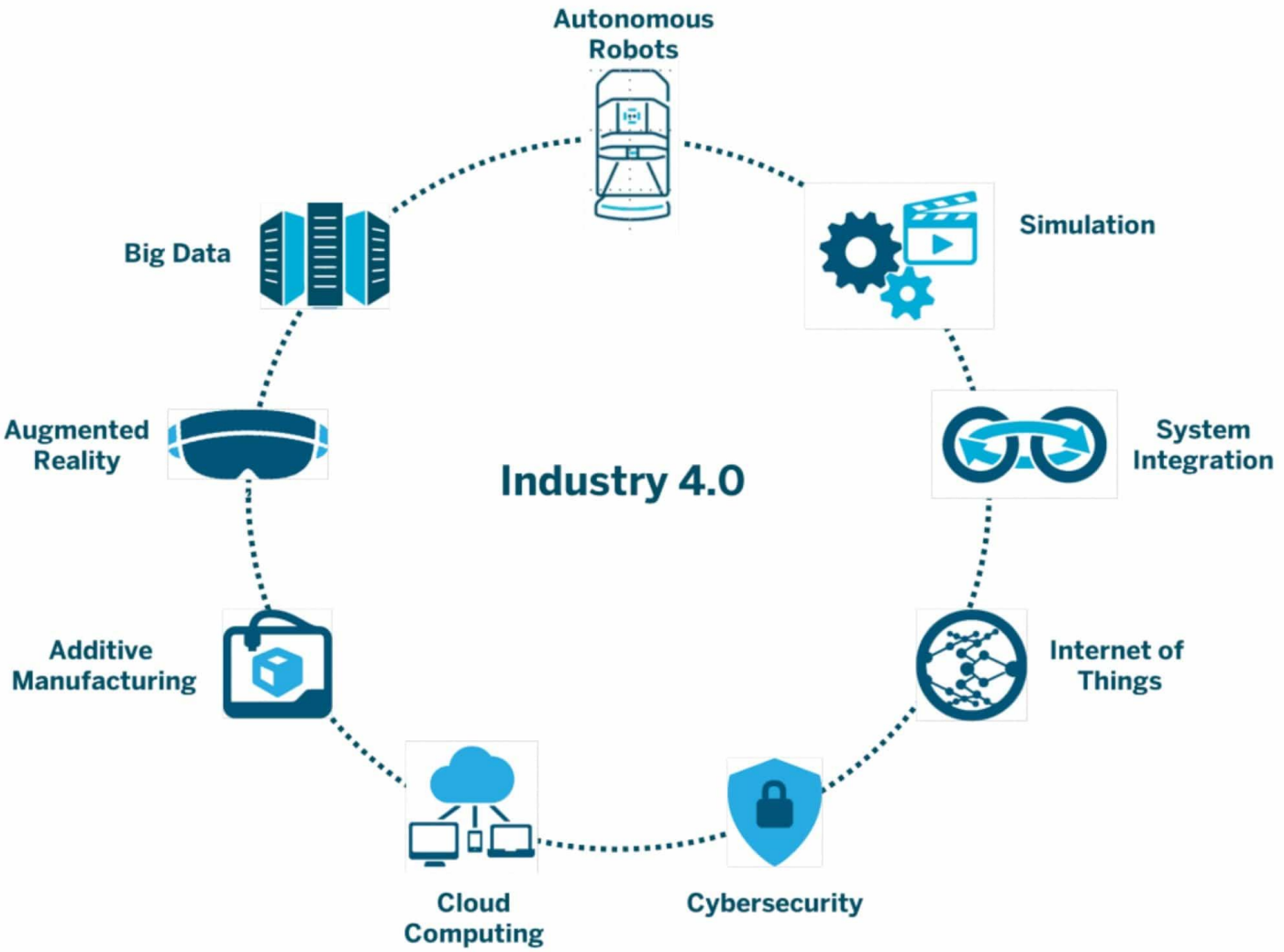
Simulation paradigms



Types of simulation

Discrete Event Simulation	Agent Based Simulation	System Dynamics
Process-oriented: focus is on modeling the system in detail	**Individual-oriented**: the focus is on modeling the entities and interaction between them	**System-oriented**: the focus is on modeling the system observable
Based on entity flows through blocks	Based on the single agents interacting with each others	Based on stocks and flows between stocks
Entities are passive	Agents are active	Continuous systems, no entities
Global system behavior	Global behavior results as the interaction of many agents	Global system behavior as a number of interacting feedback loops
Adopted in business process, manufacturing, logistics and service delivery processes	Mainly applied in social sciences including marketing, social processes, and healthcare/epidemic models	Adopted in urban, social, ecological types of systems.

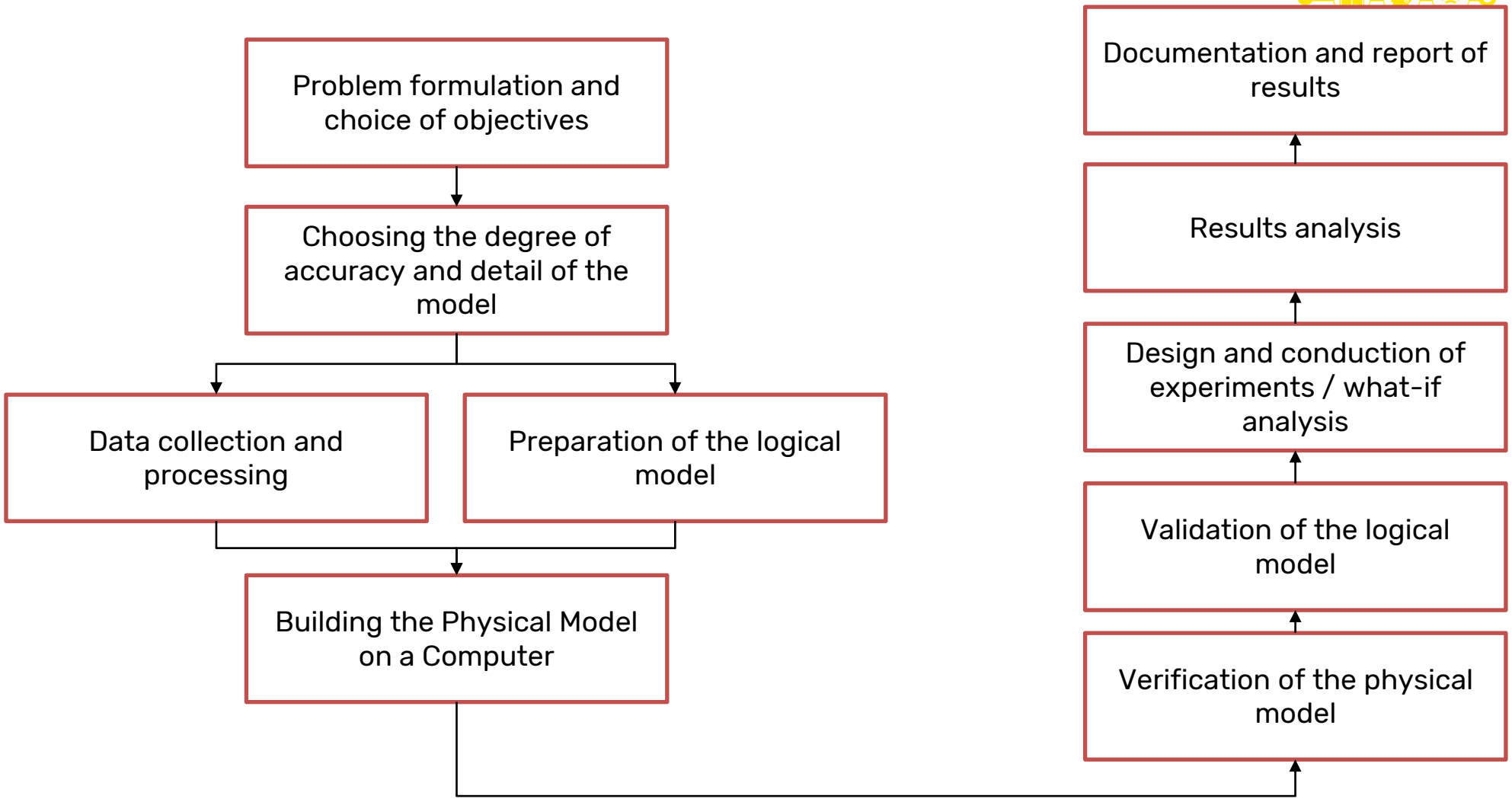
Why to Simulate?



We have far more data, evidence, and computer models to make decisions today, but that also means we have far more information overload and excessive choice proliferation. The number and complexity of choices seem to be growing beyond our abilities to analyze, synthesize, and make decisions. The acceleration of change reduces the time from recognition of the need to make a decision to completion of all the steps to make the right decision. ... **Many of the world's decision making processes are inefficient, slow, and ill informed.**[1]

[1] The Millennium Project, "15 Global Challenges. Facing Humanity," last modified 2009, http://www.millennium-project.org/millennium/challeng.html.

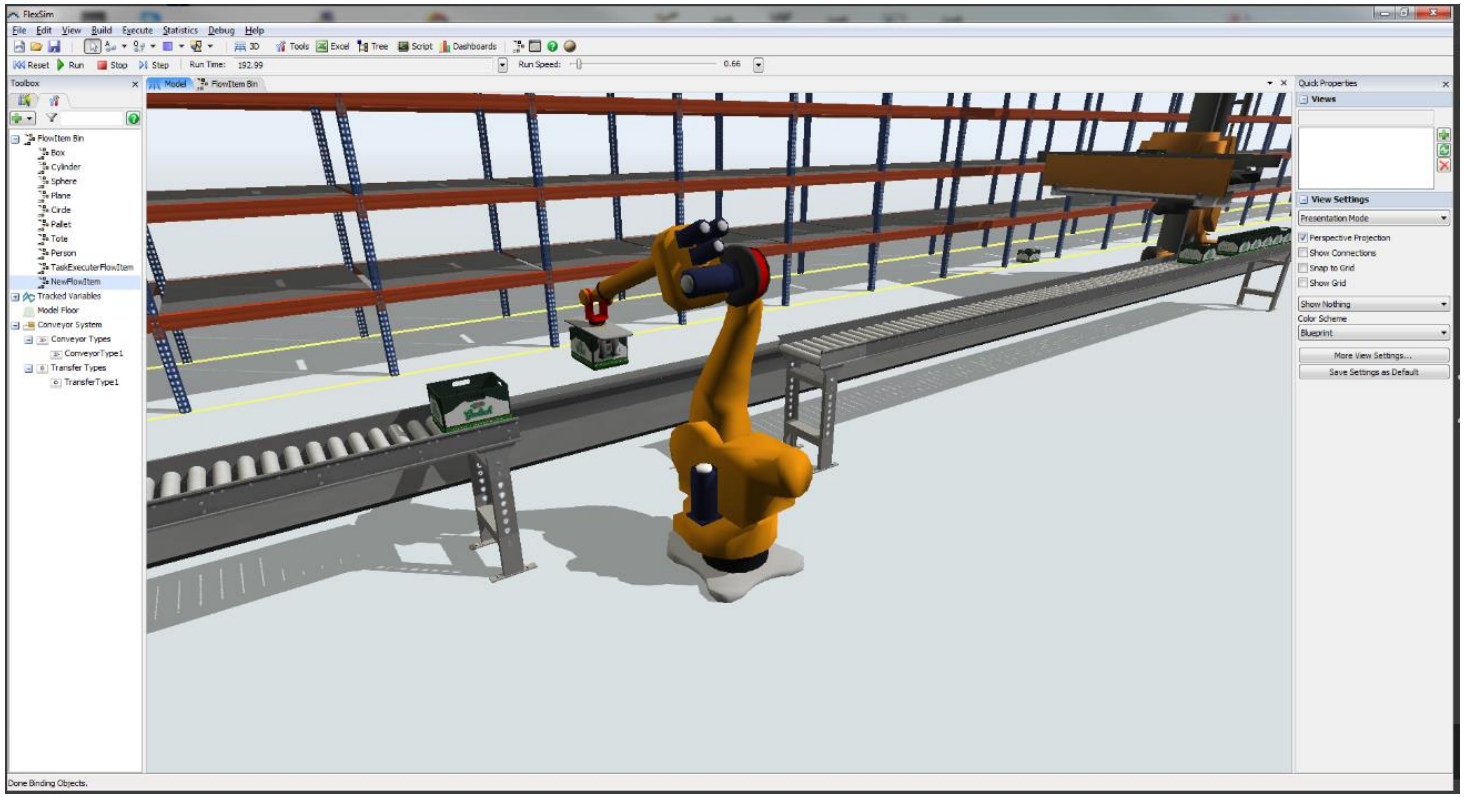
Which are the main phases of a simulation project?



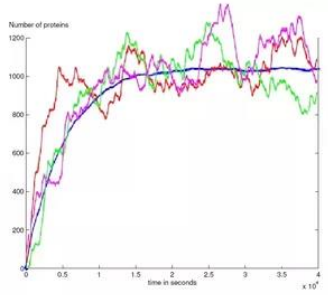
What is FlexSim?

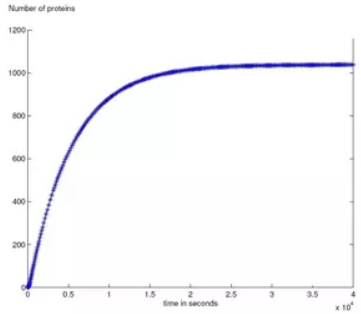
What is FlexSim?

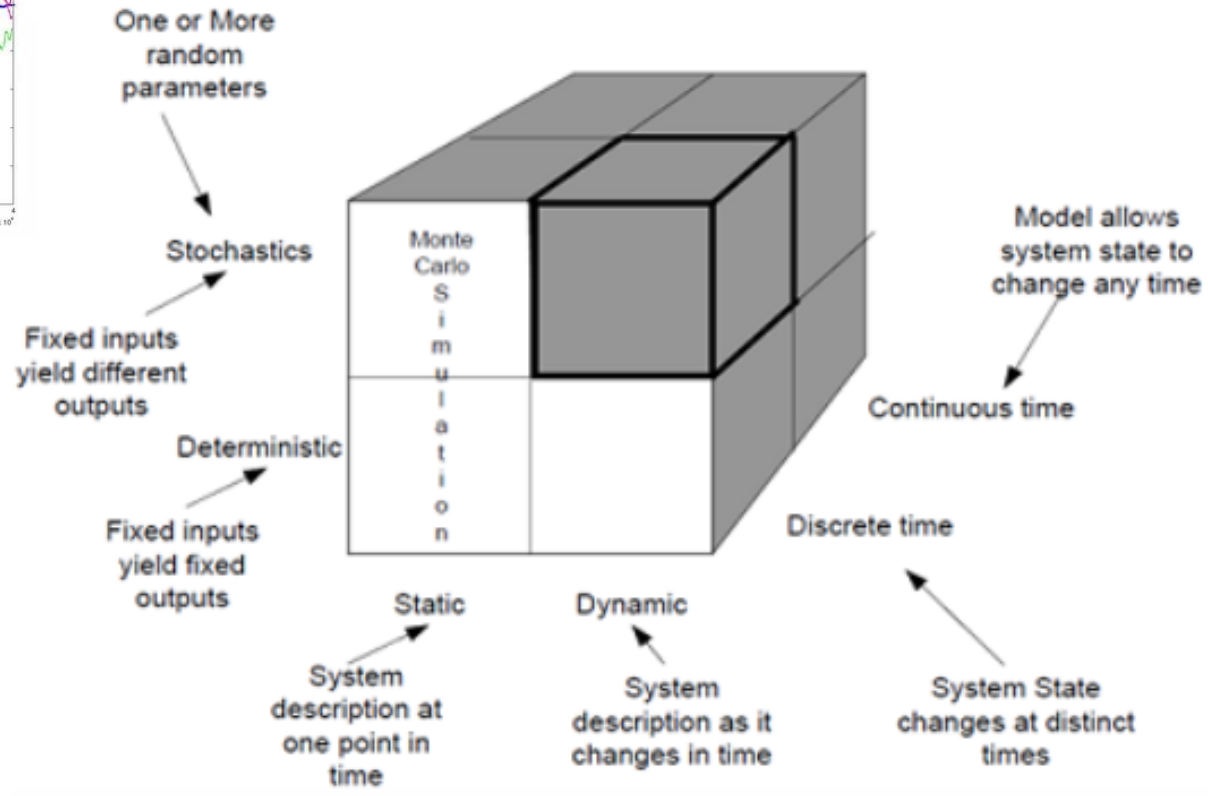
- FlexSim is a 3D object-oriented simulation software.
- FlexSim is a Stochastic, Dynamic, and Discrete Time simulation software.
- It models, simulates, predicts, and visualizes systems.

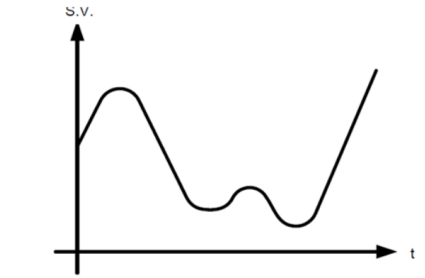


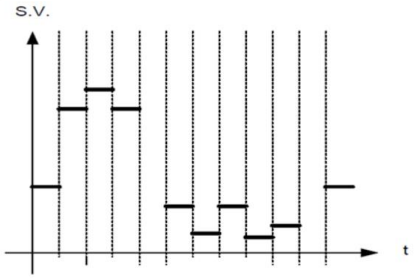
What is FlexSim?











Applications

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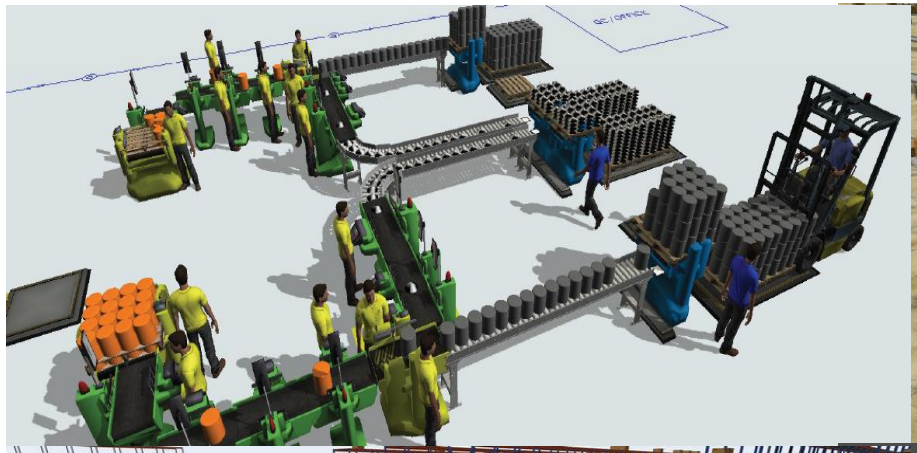
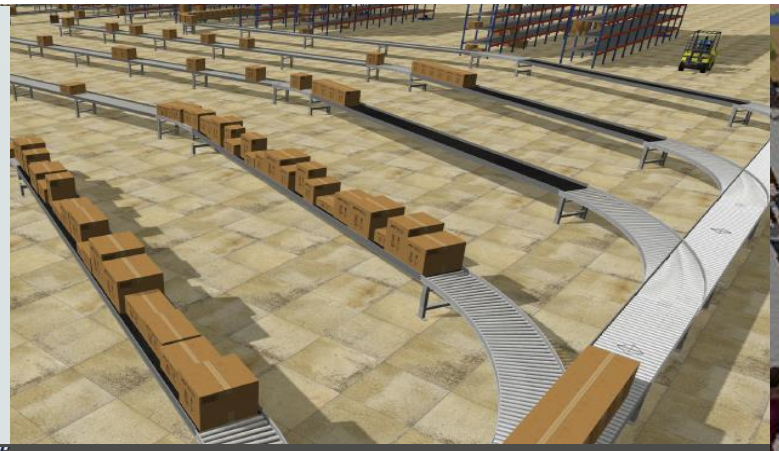
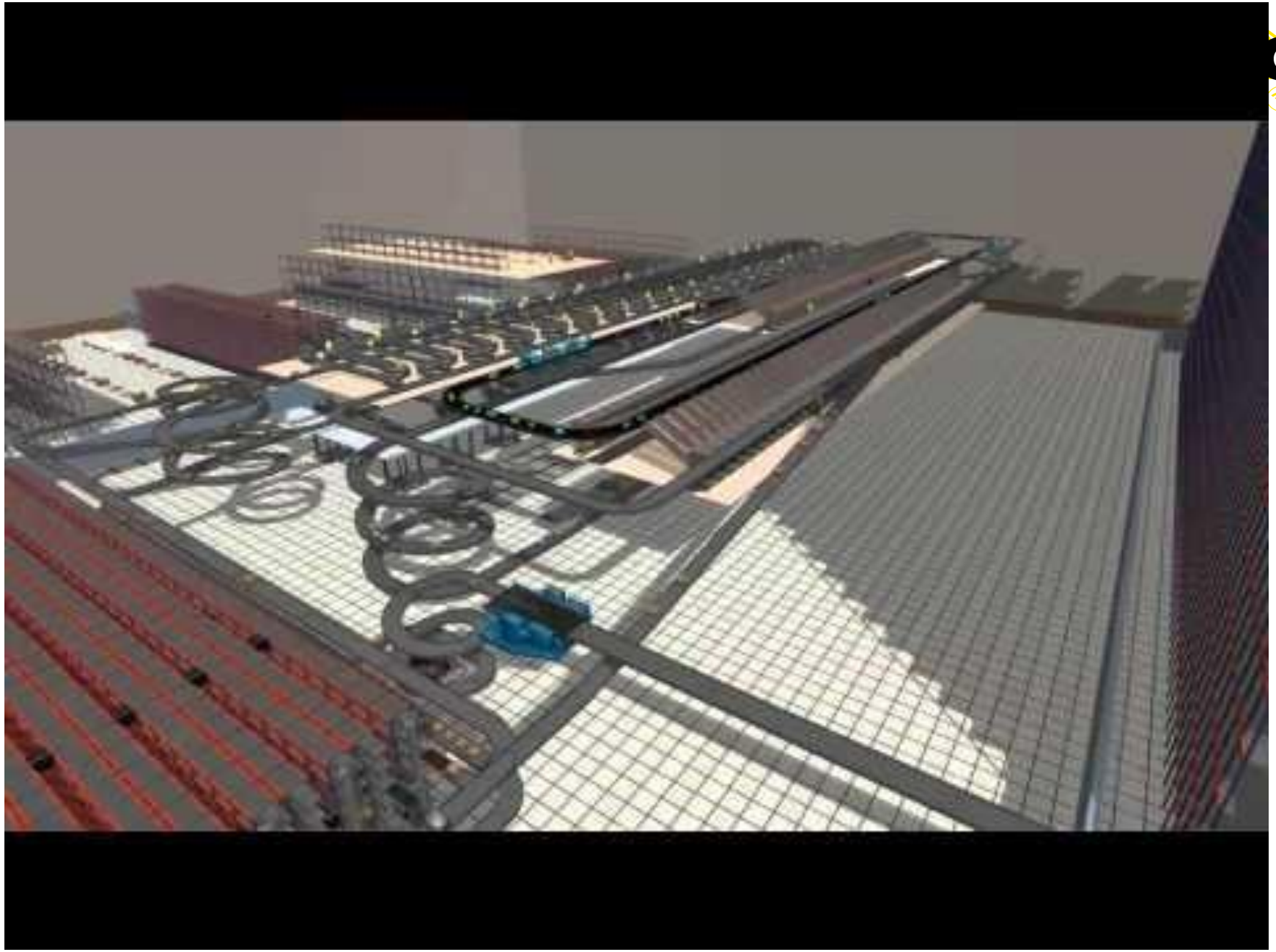
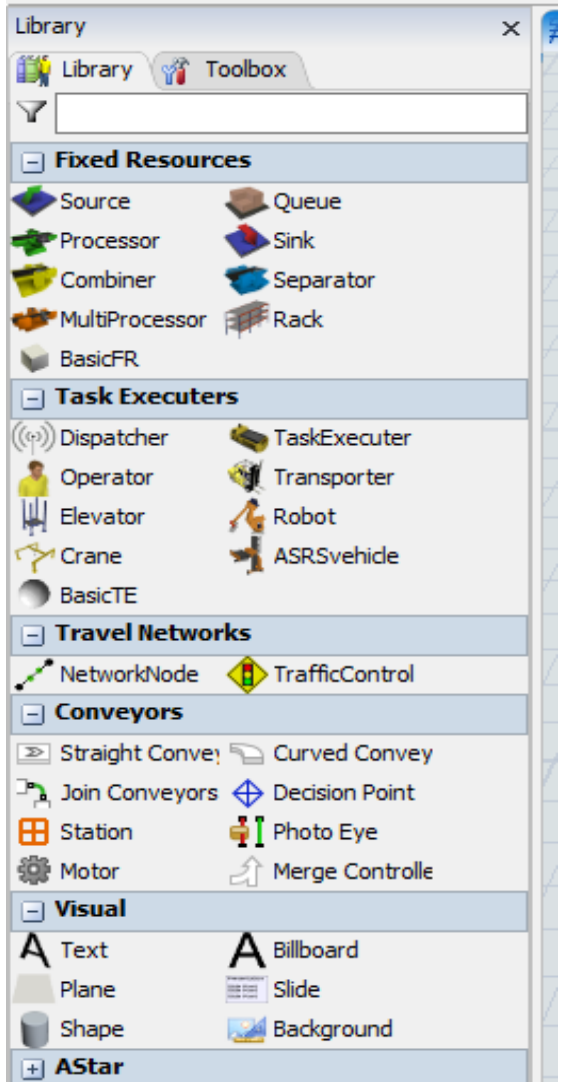
Manufacturing | Material Handling | Healthcare | Packaging | Logistics

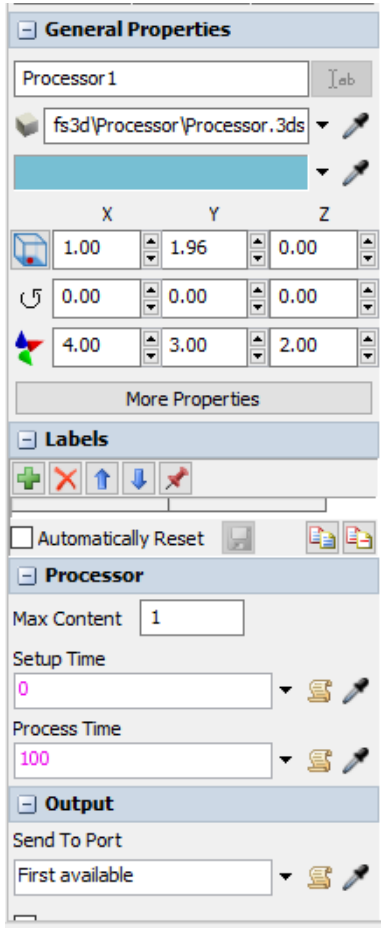





FlexSim Simulation Logic

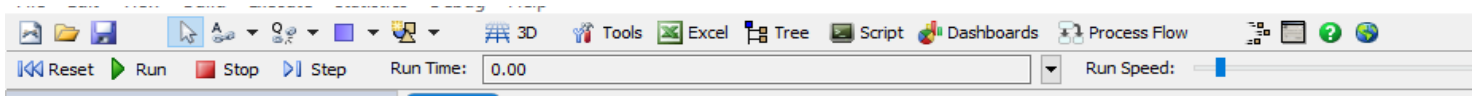


- Objects Library

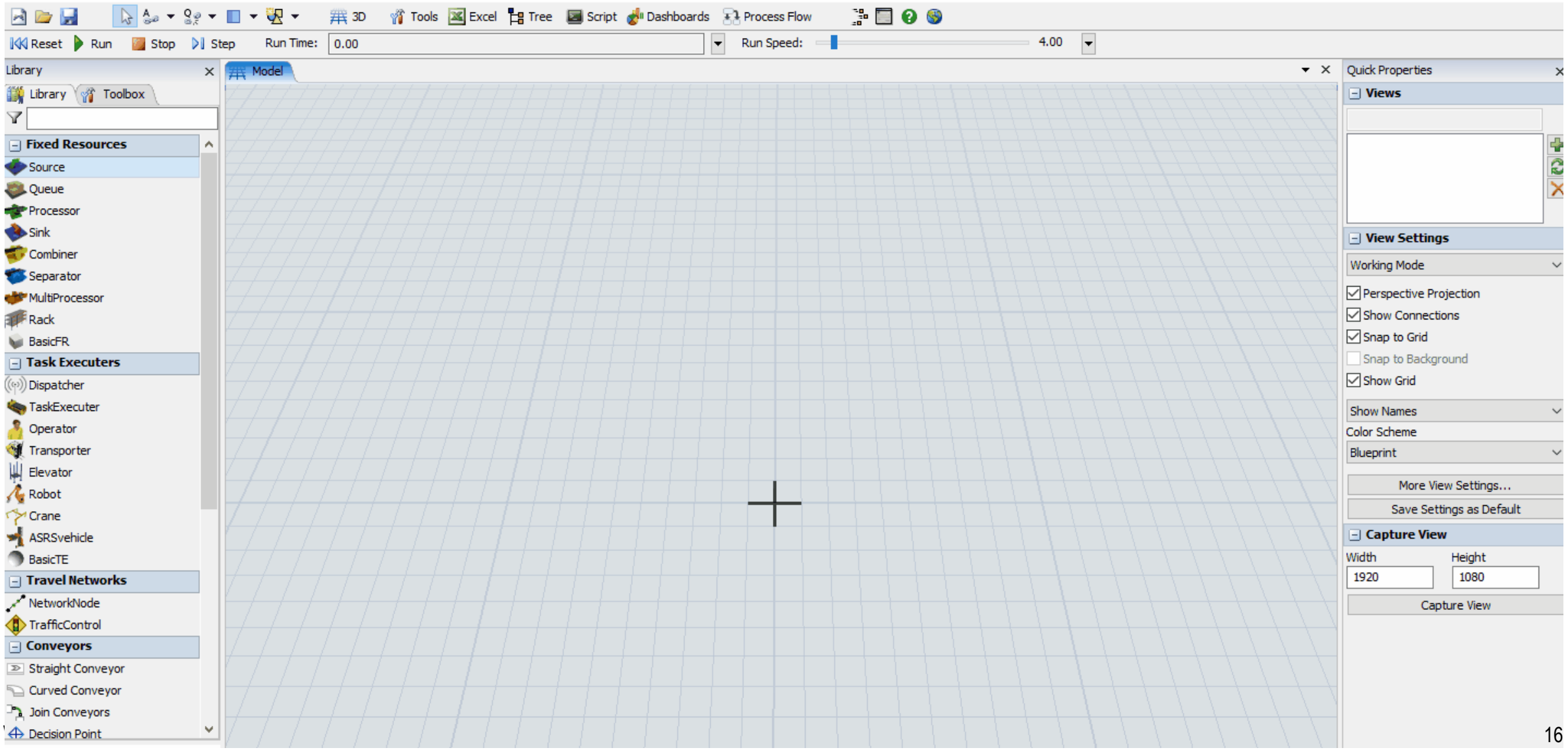


- Object properties and statistics

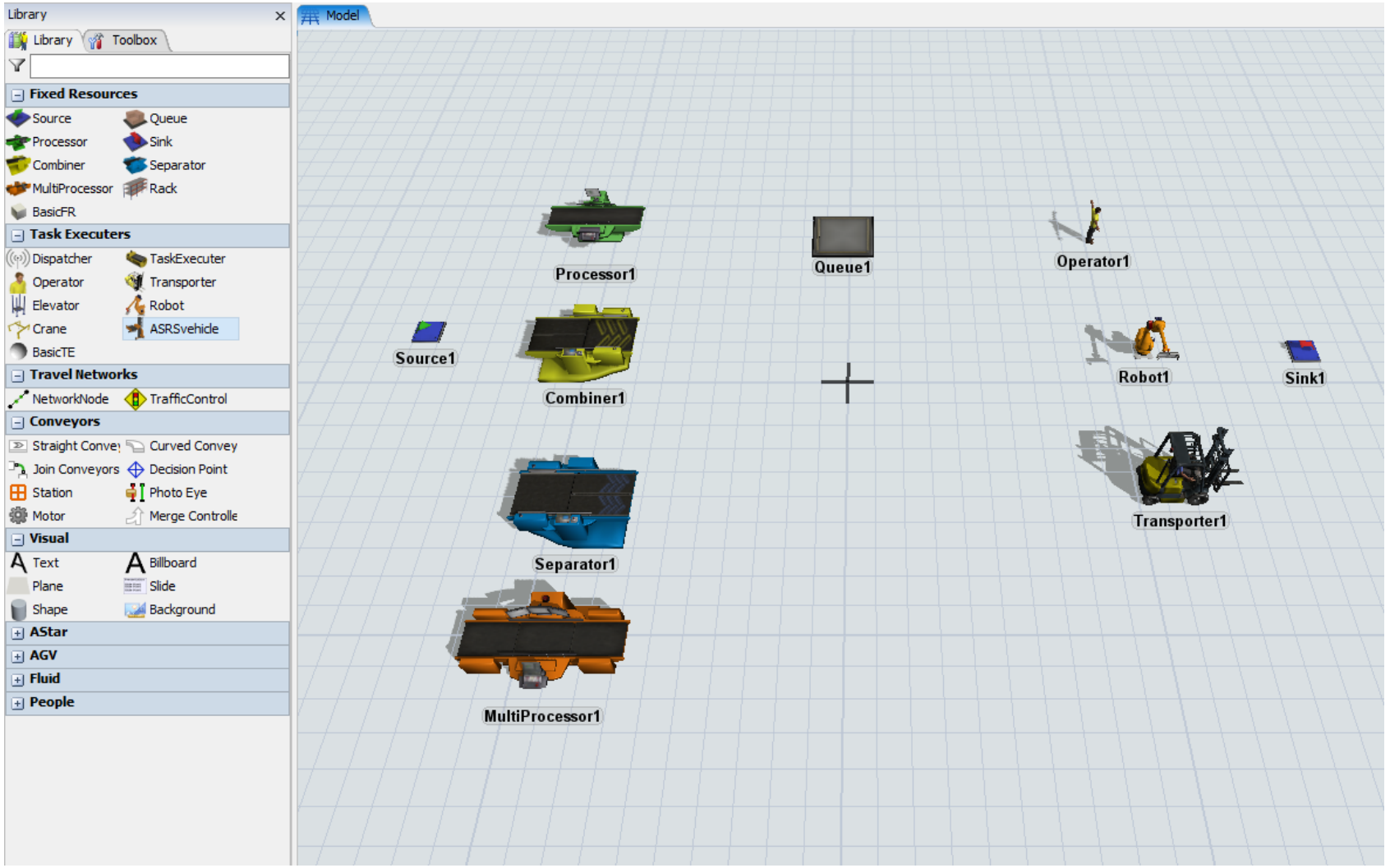
- Run settings



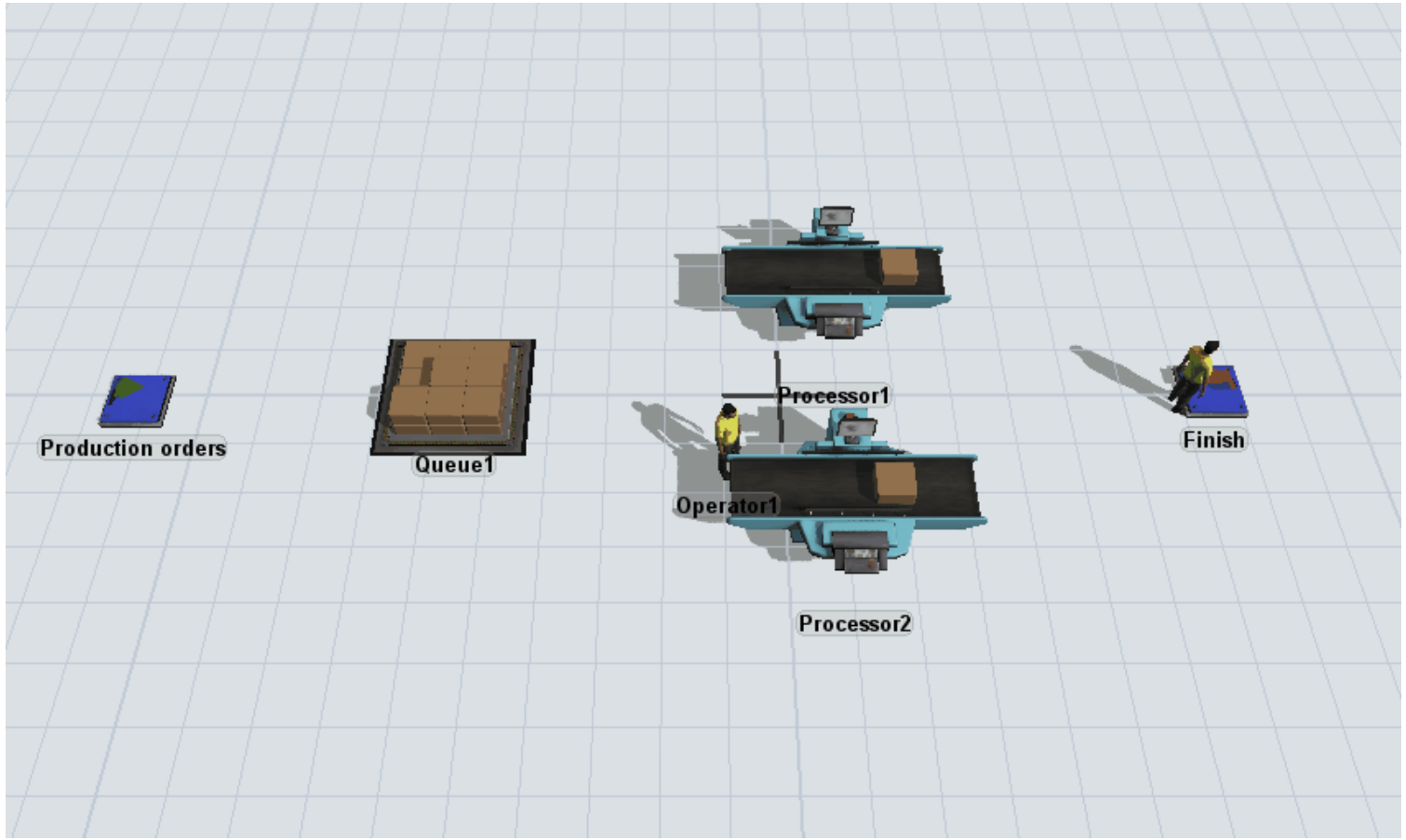
FlexSim Simulation Logic



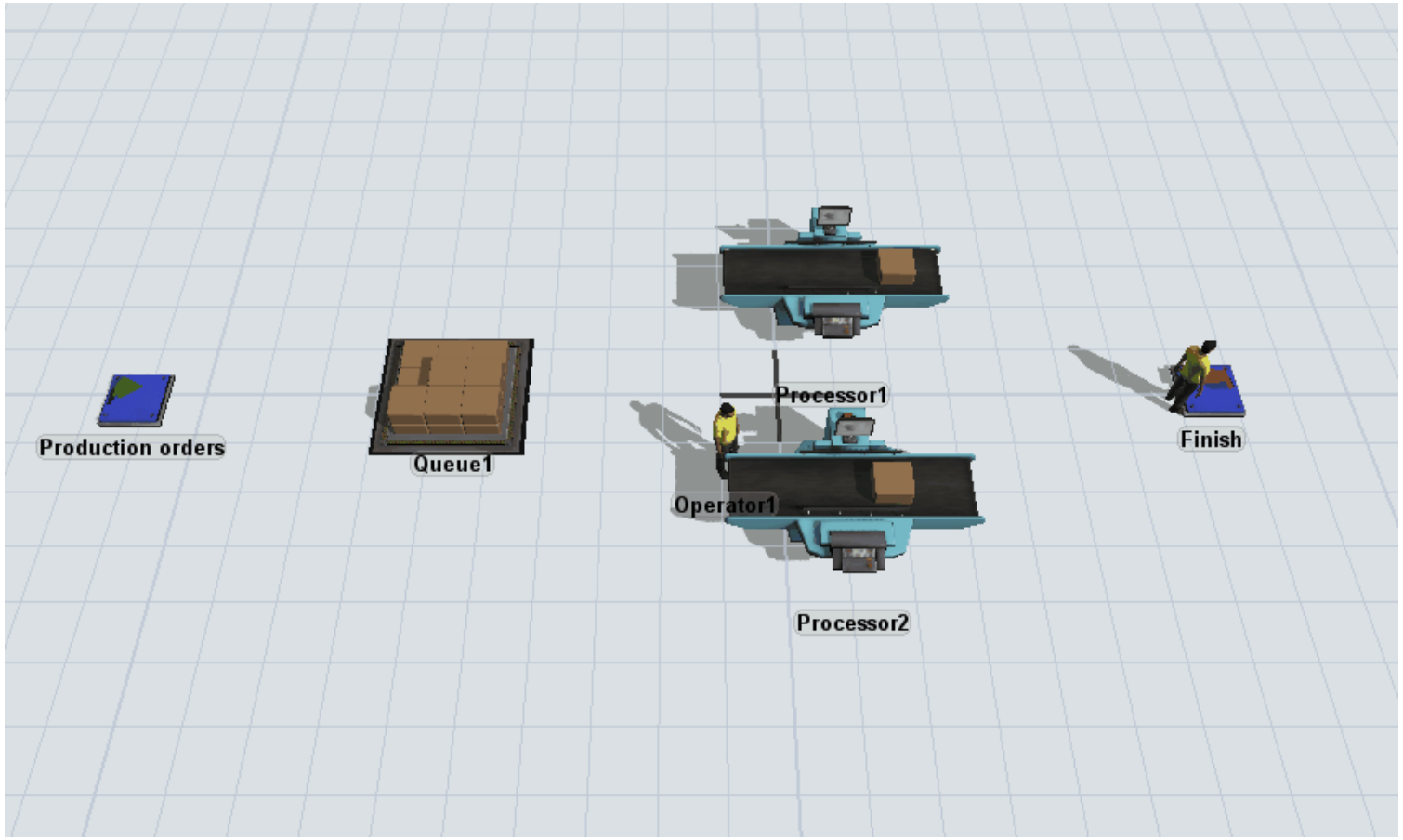
FlexSim objects



Simple Manufacturing Process: 3D Model



Simple Manufacturing Process: Process Flow



Shared Assets

- List: ItemsToTransport
- Resources: Operators

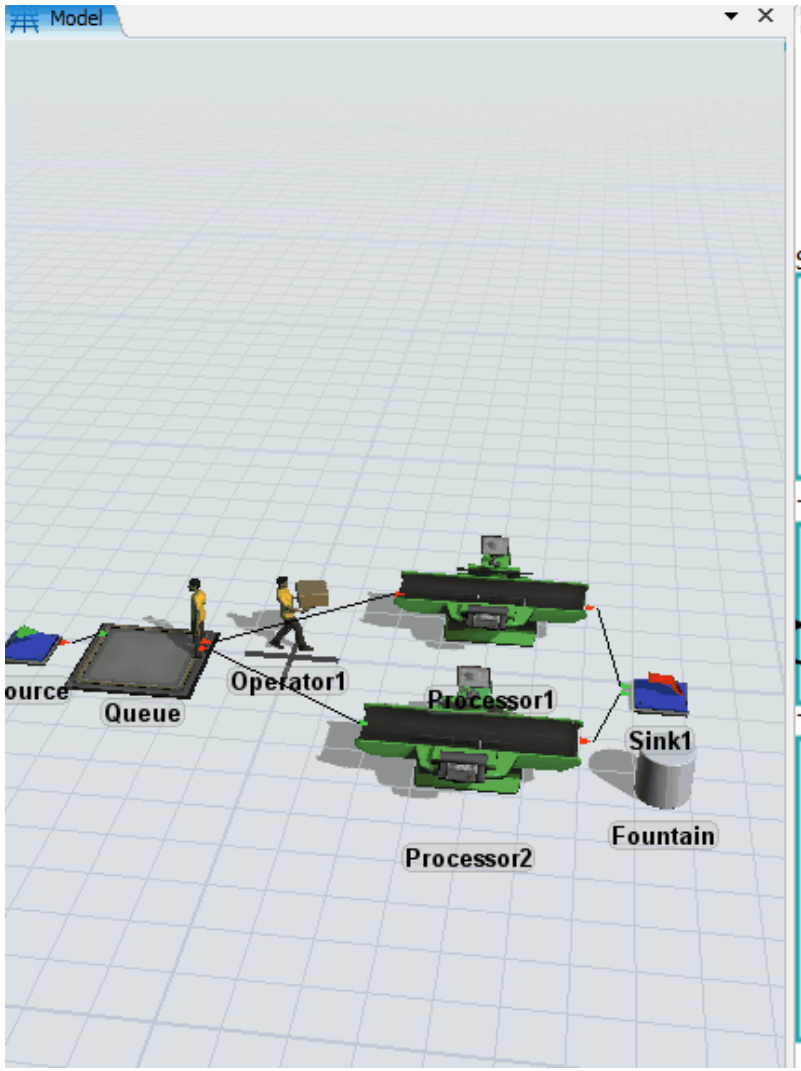
Task Creation

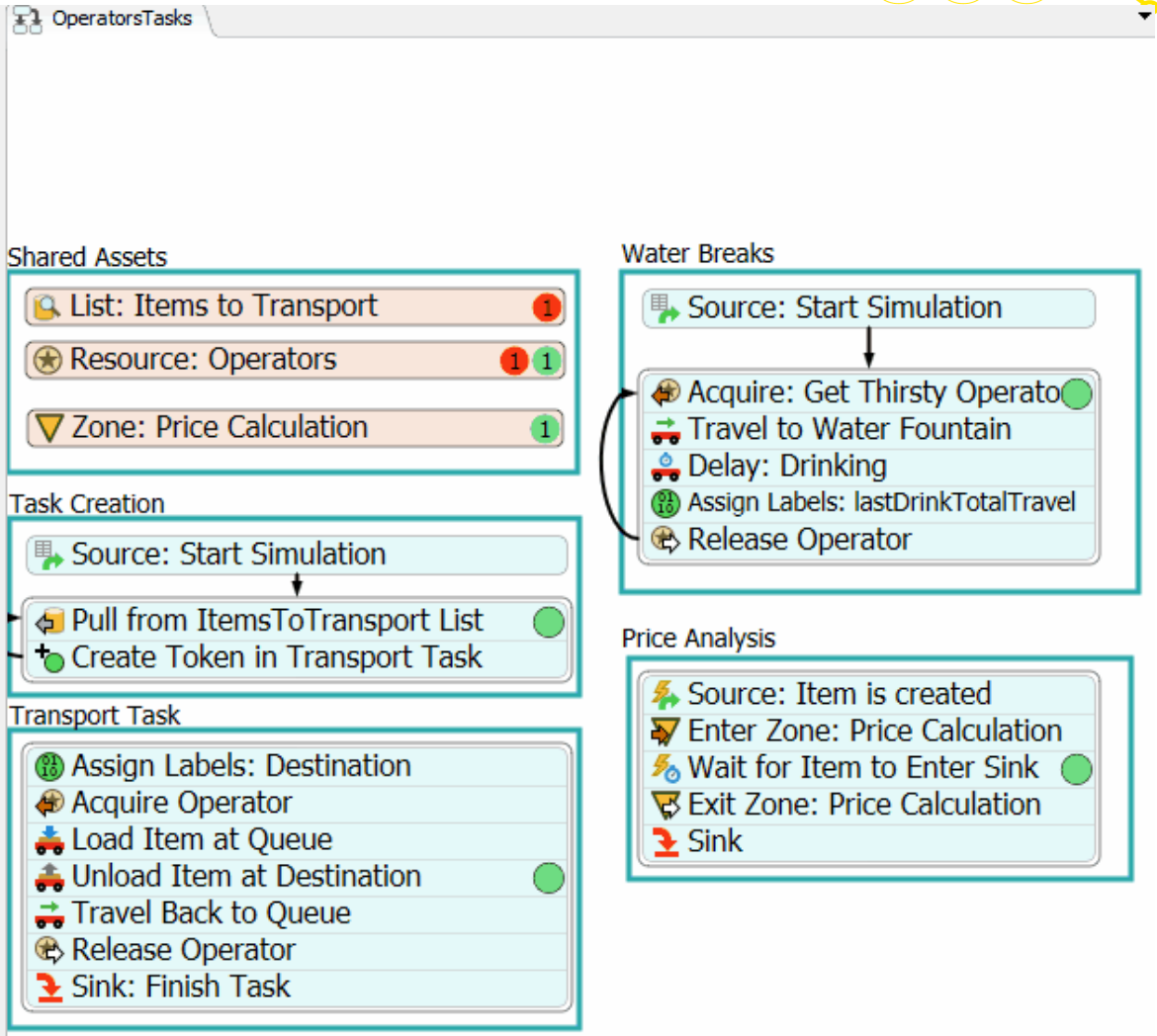
- Source: Start Simulation
- Pull from ItemsToTransport List
- Create Token in Transport Tasks

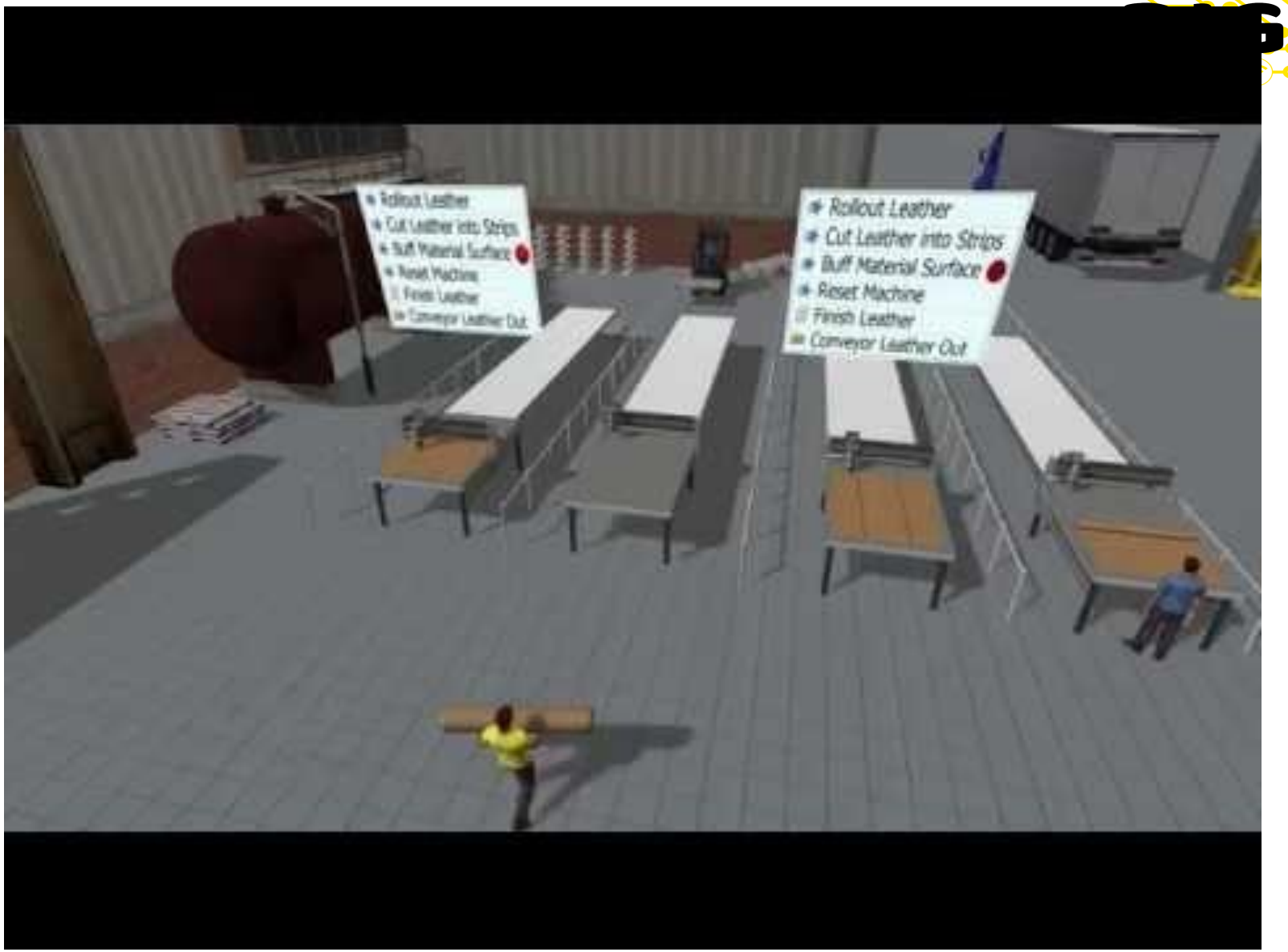
Transport Tasks

- Assign Labels: Destination
- Acquire Operator
- Load Item at Queue
- Unload Item at Destination
- Travel back to Queue
- Release Operator
- Sink: Finish Task

Simple Manufacturing Process: Adding detail





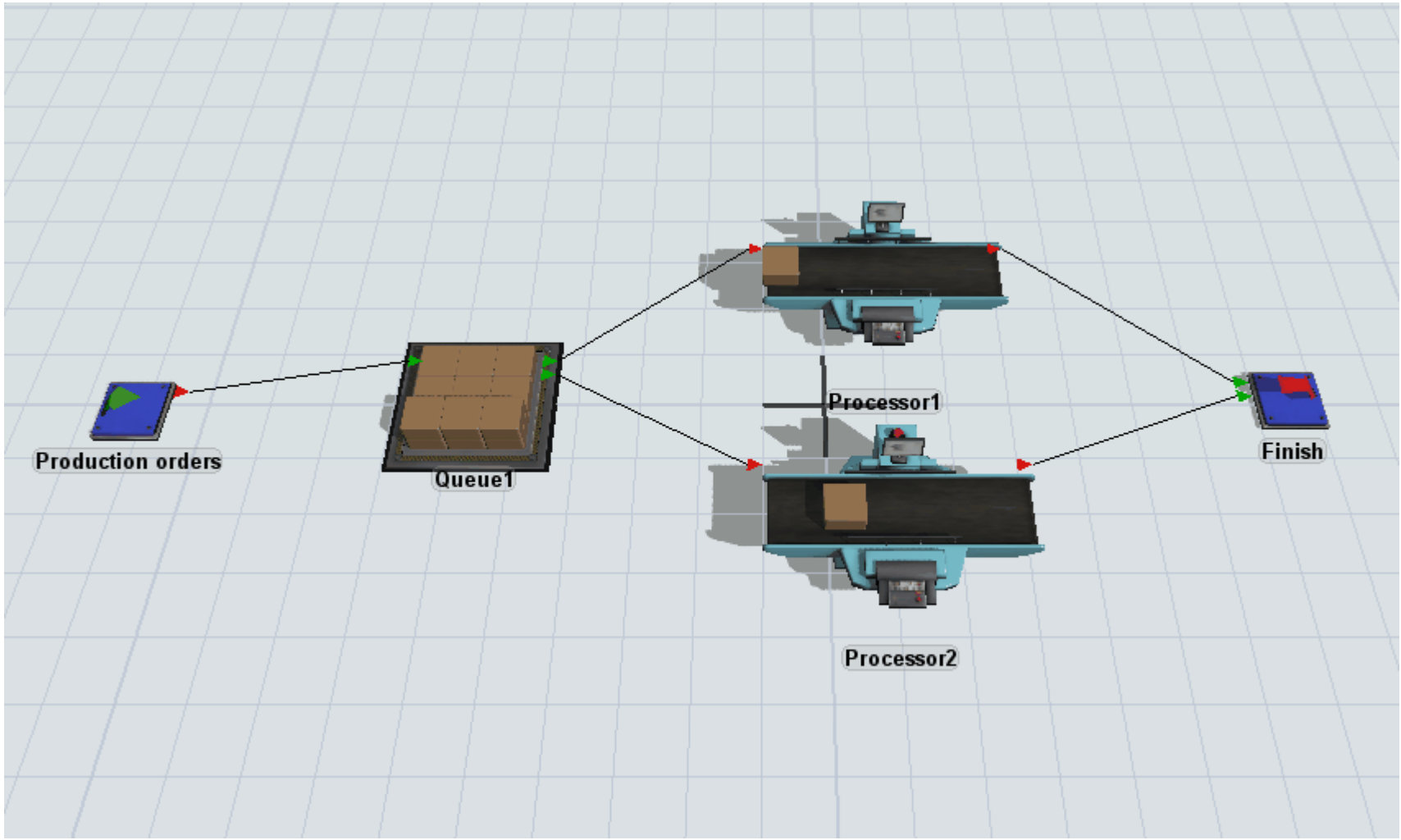

Rollout Leather
Cut Leather into Strips
Buff Material Surface
Reset Machine
Finish Leather
Conveyor Leather Out

Tutorials FlexSim

Learning FlexSim

Applied Simulation:
Modeling and Analysis using FlexSim

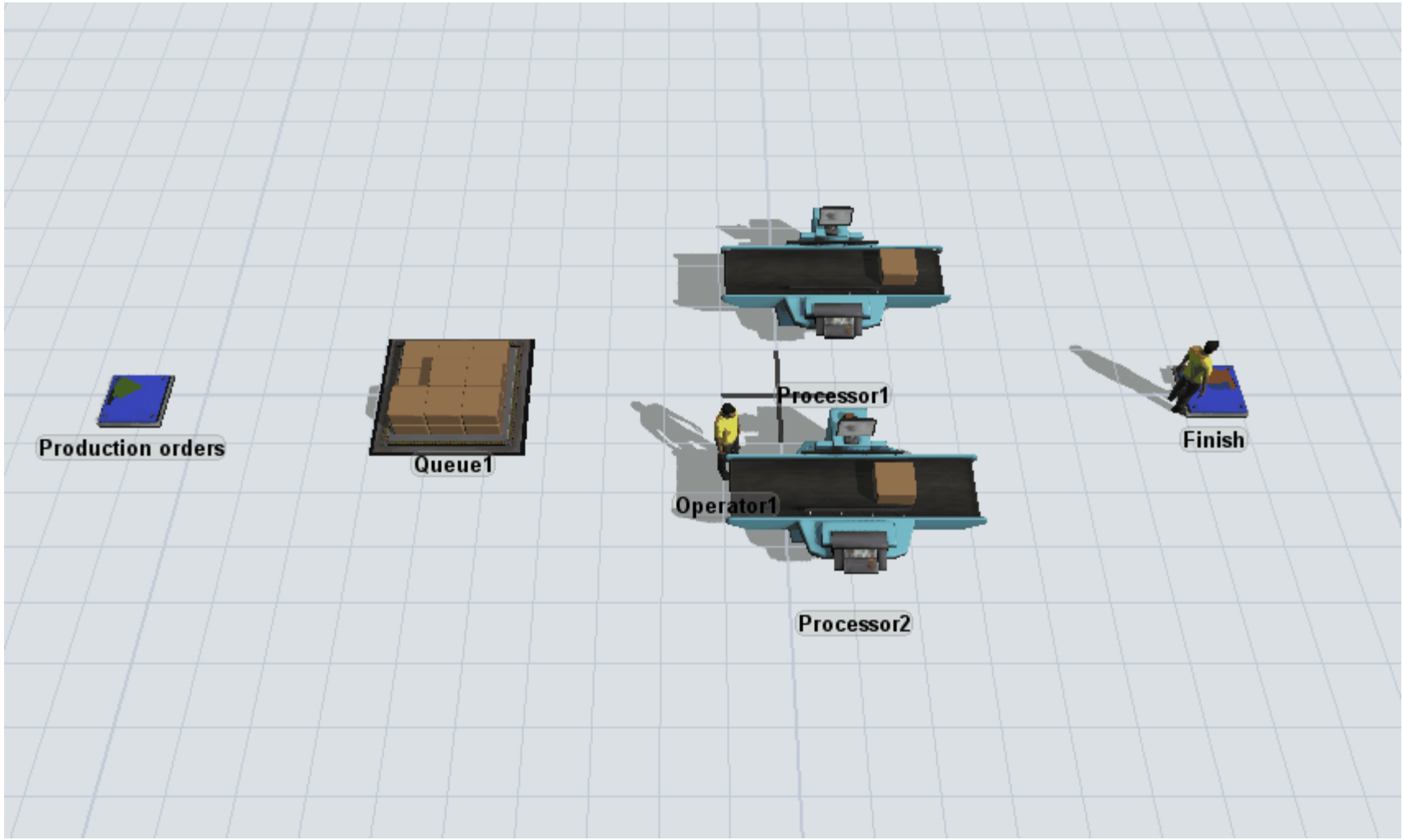
Tutorial 1



Important Concepts:

- Objects´ properties
- Objects´ Statistics
- Objects´interconnections
- Arrival Style (i.e. Interarrival time)
- Processing time

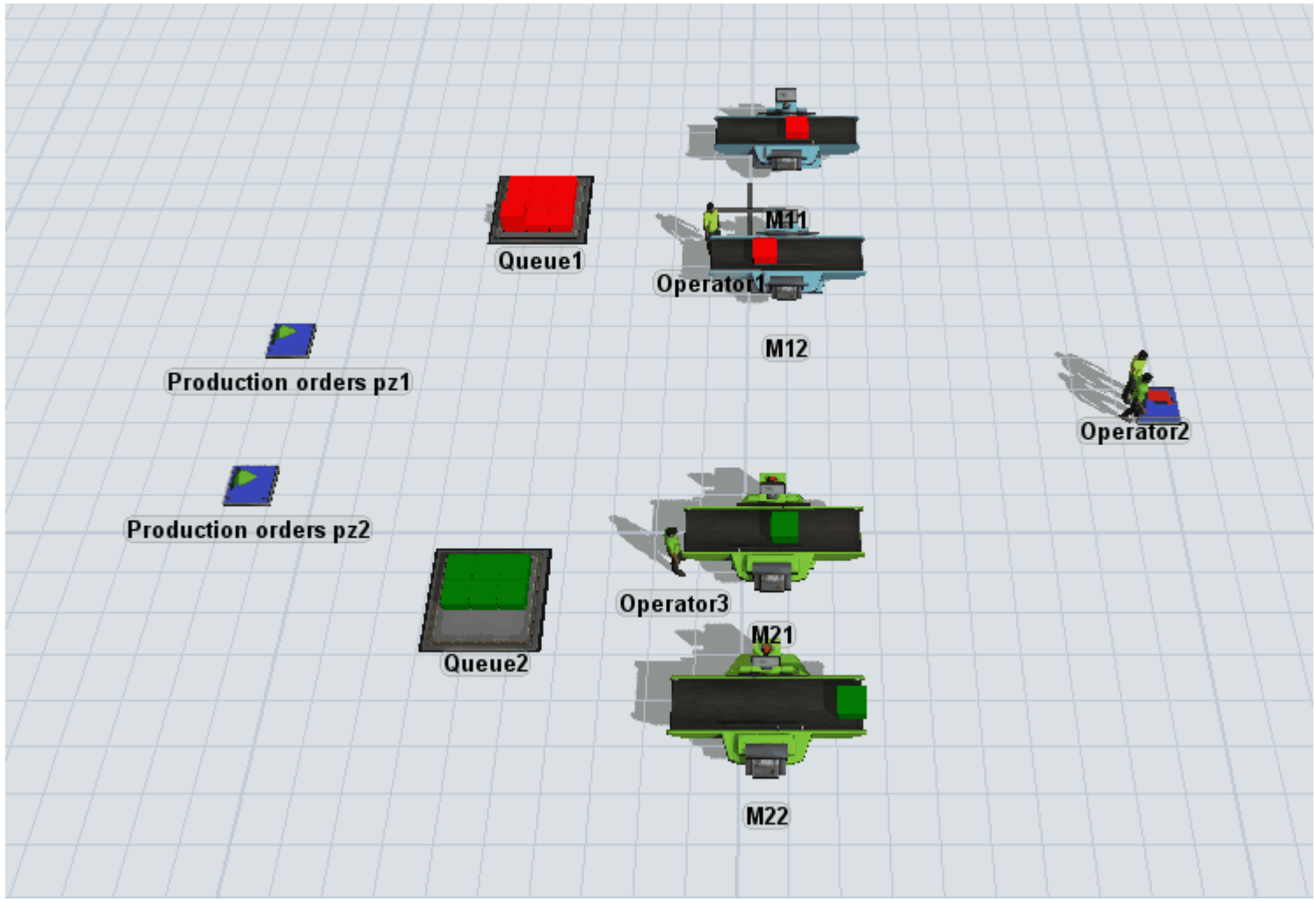
Tutorial 2



Important Concepts:

- Task executers (transportation)

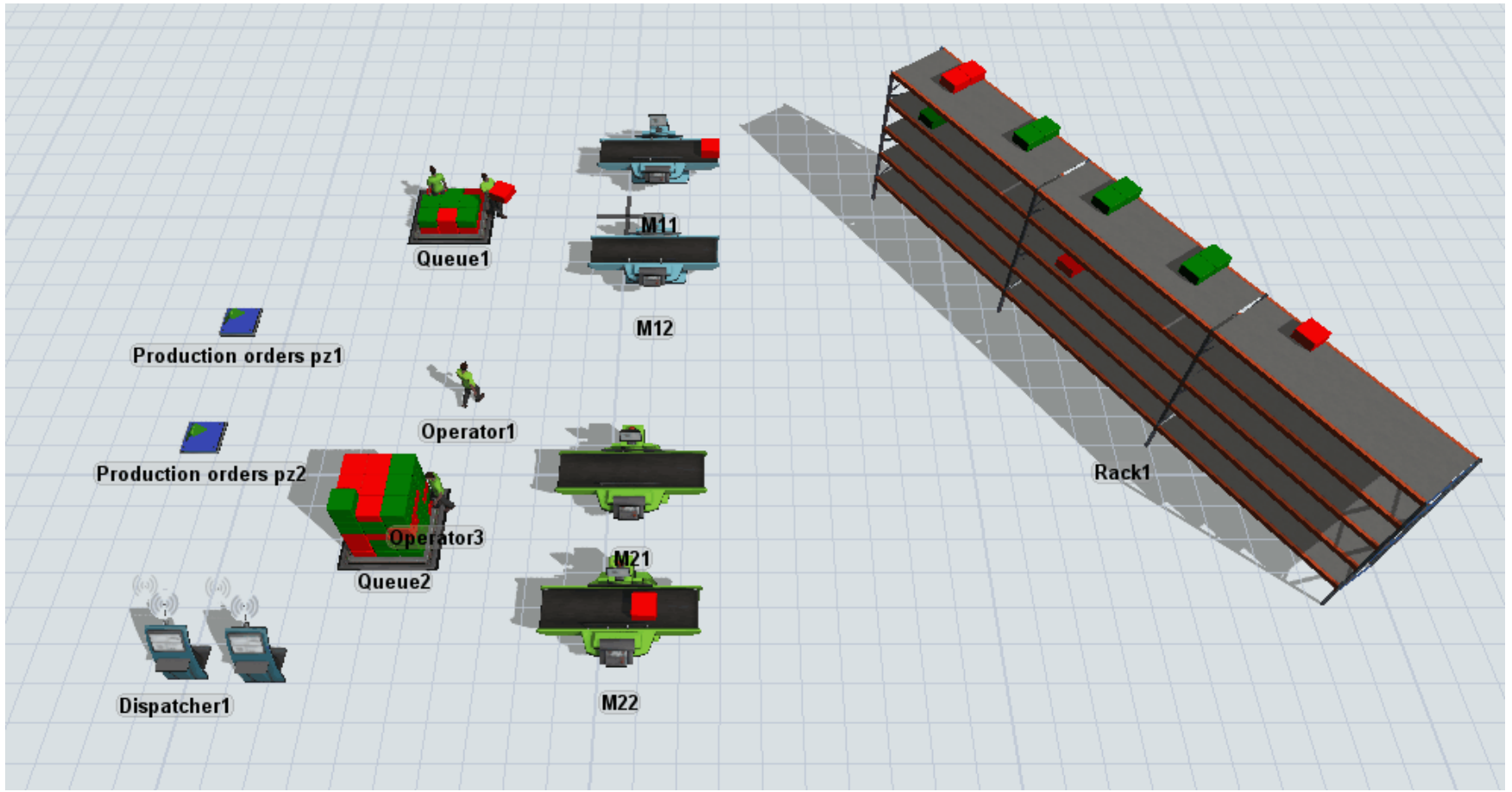
Tutorial 3



Important Concepts:

- Product properties (i.e., type, color)
- Scalation of production (i.e. Multiple processors´ types)

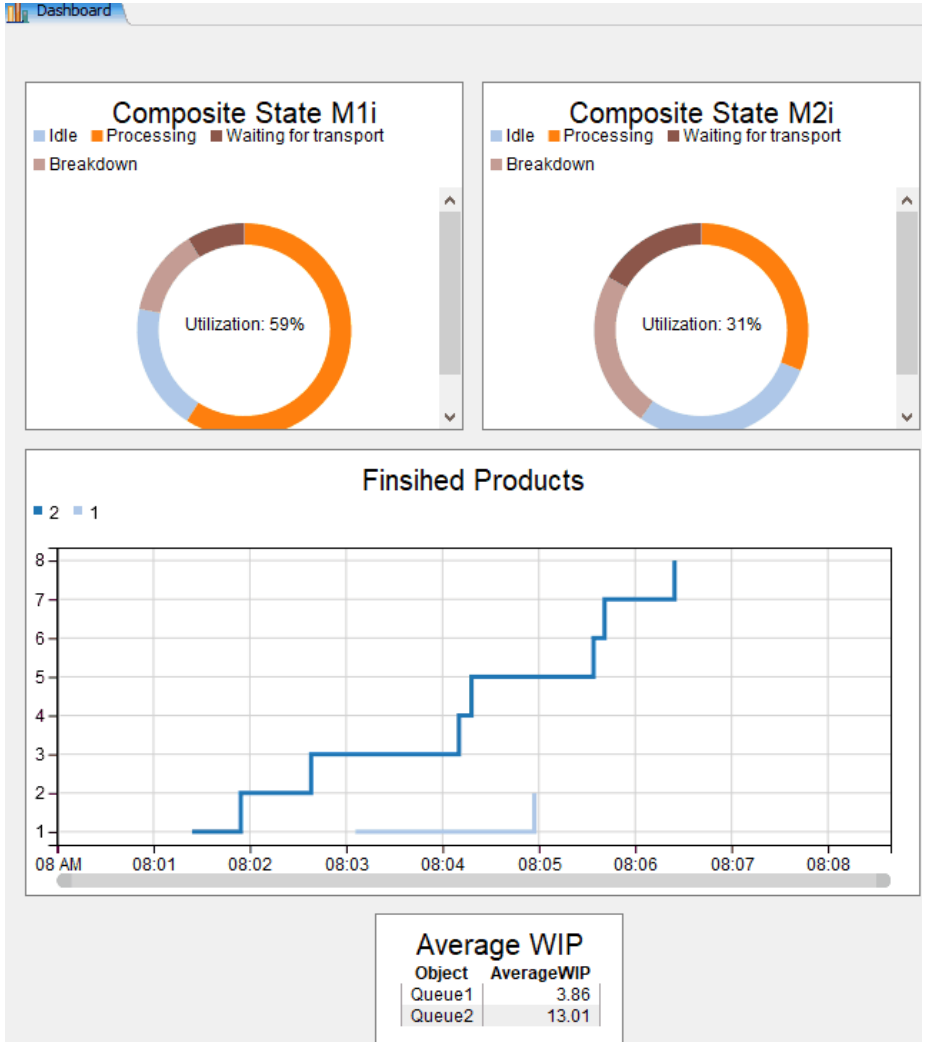
Tutorial 4



Important Concepts:

- Task executers coordination (i.e. Dispatcher)
- Item List
- Global Tables (i.e., Process time, Process steps)
- Job-shop production sequencing
- Warehousing (i.e. Rack)

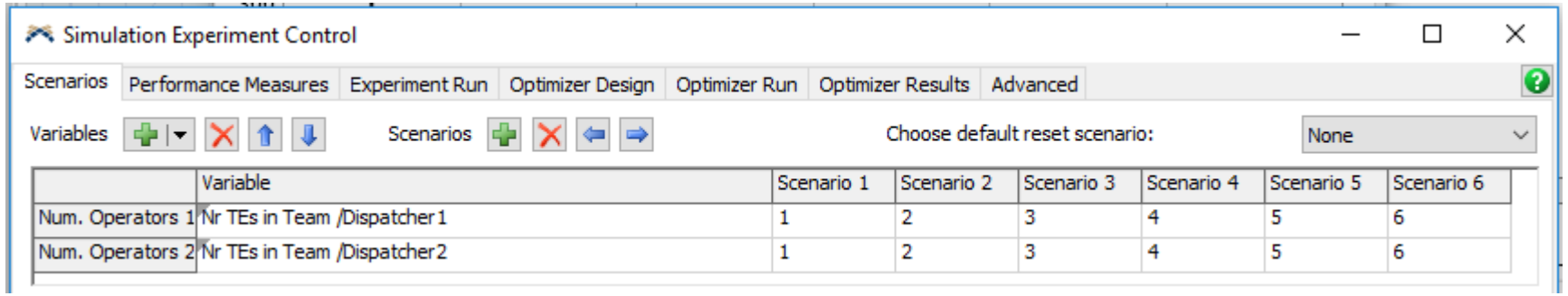
Tutorial 5

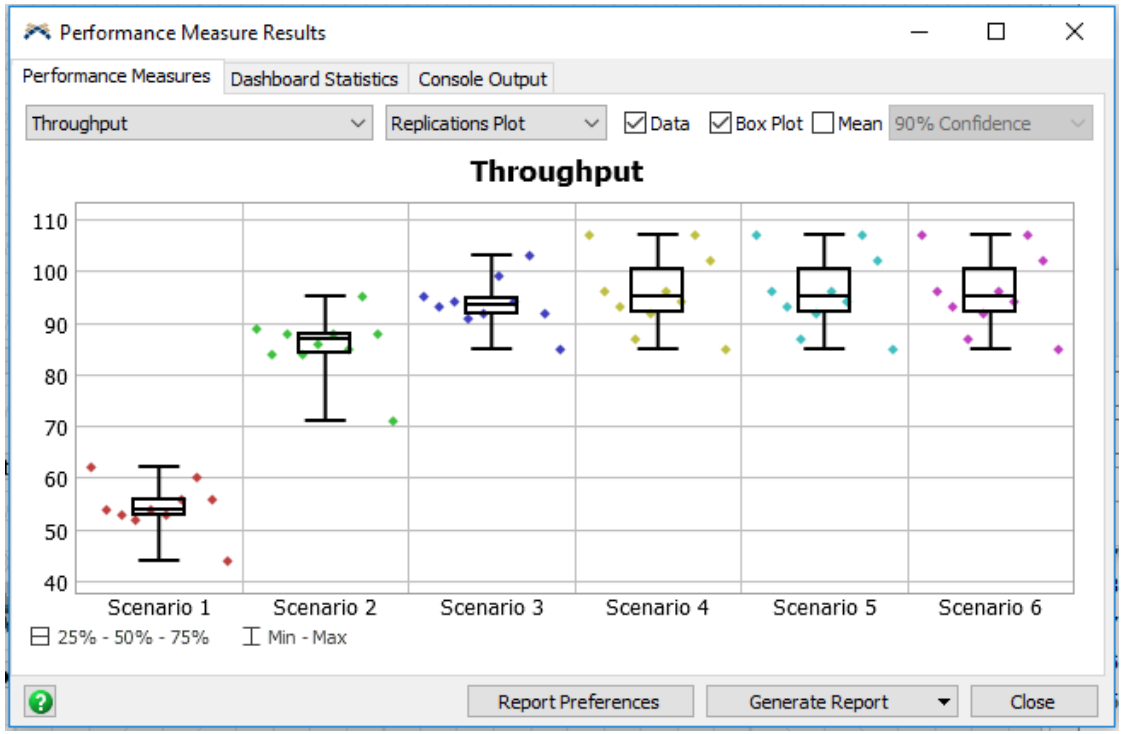


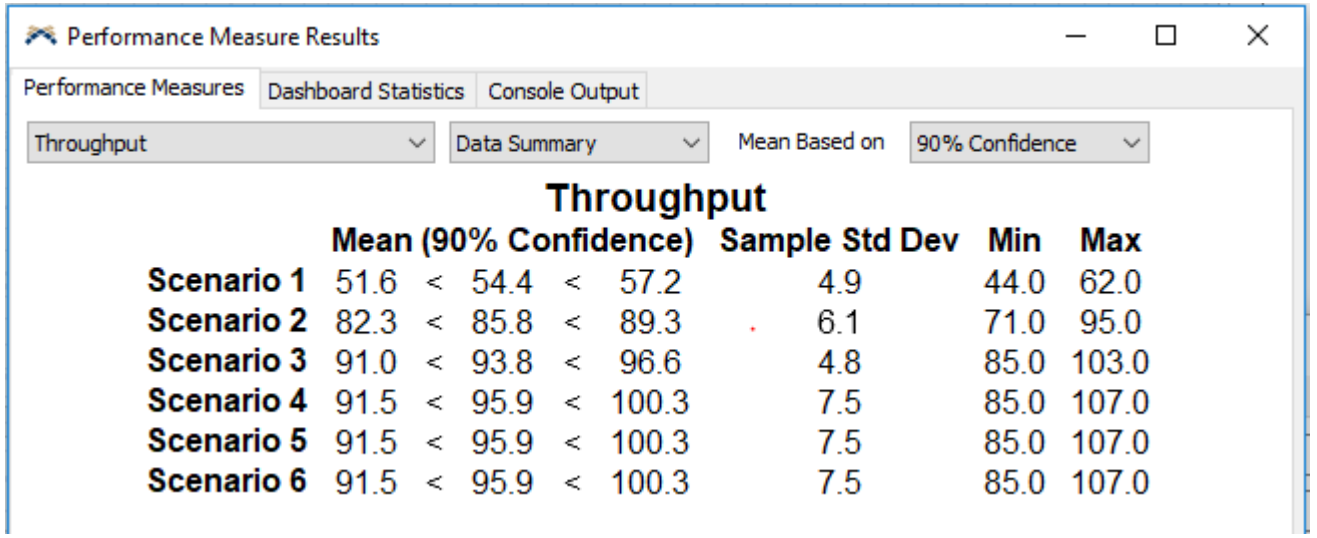
Important Concepts:

- Performance Measurement (i.e., Dashboard).
- Machine Failures (i.e., MTBF, MTTR).
- Group of Resources

Tutorial 6





Important Concepts:

- Statistics Collector
- Design of Experiments