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WAREHOUSE SIMULATOR

Ankit Kumar

AnyLogic Conference 2025

Agenda

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2 **Opportunity**
Objective | In scope

3 **Simulator - Overview**
Simulation Video | Modeling stages | Metrics | Model validation

4 **Scenario Analysis**
Slotting use case | Scenario analysis

5 **Application: Scenario building**
Features | Usage

About us

DHL Group

Five Operating Divisions

DHL Express

International time-definite shipments

DHL Global Forwarding, Freight

Air, ocean and overland freight forwarding services

DHL Supply Chain

Tailor-made logistics services and supply chain solutions

DHL eCommerce

Domestic parcel transport; deferred cross-border services

Post & Parcel Germany

Nationwide post and parcel network in Germany

Opportunity

Objective

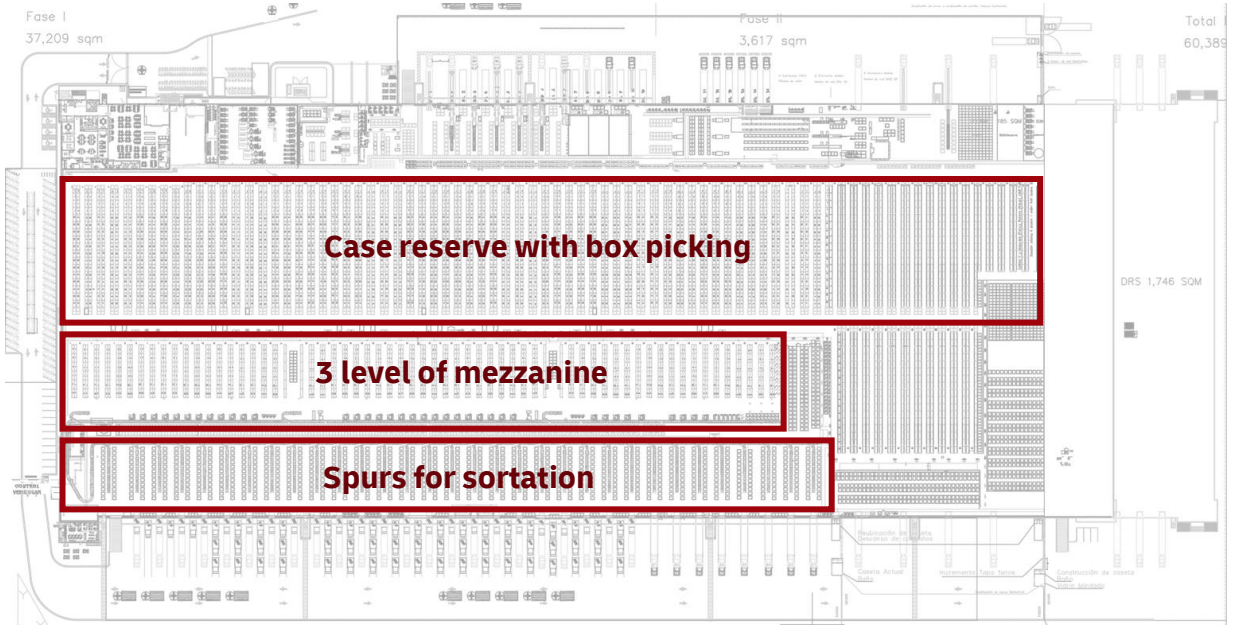
- Customer with more than **3m€ AGP** opportunity in warehousing
- This development is for Site team for better Operation management backed by Simulation.
- **Cloud based Simulator**

Site Profile

- Opportunity type : Warehousing
- Sector : Retail
- Site Area : ~ 50k sq. m
- Storage profile : Mezzanine and Racks
- Product profile : Footwear, Apparel and Equipment
- Pick Profile : Units (Mezzanine), Cases(Racks)
- Slotting : Fixed (re-slotting)

Operational profile

Orders/Day:	**~9000**	Avg. FTEs:	**~1,000**
Lines/Day:	**~30000**	Active SKUs:	**~70k**
Picking distribution**:**	**70% lines from mezzanine**		



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SIMULATOR OVERVIEW

Simulator - Model overview (Video)

Simulation Modelling Activities

Execution Edge

Complex opportunity required GSDC to work with multiple stakeholders, write codes and spend time in understanding operations

Scope definition and data gathering → Data analysis and transformation → Process Modelling → KPI creation and Results validation → Training and handover

5

STAKHOLDER ENGAGEMENT

1000+

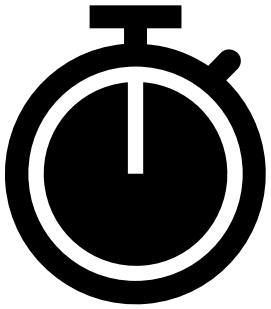
LINES OF CODING REQUIRED

1200+

HOURS IN MODELLING & VALIDATION

Simulator – Metrics

KPIs and metrics enable users to read and correctly interpret the models to drive decision making.

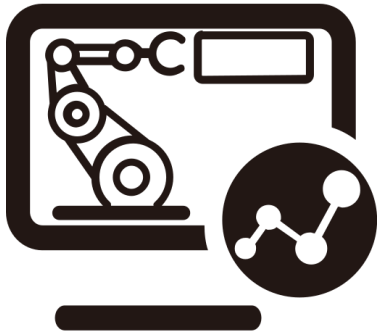


Turn Around Time

Represents the time it takes to perform an activity/tasks. For example: Time it takes to complete Wave, Tasks, Order, Shipment etc.

Congestion

Measures congestion/bottlenecks in the operations leading to higher wait time. For example: Congestion in Conveyor, Queuing to pick items etc.



Resource Utilization

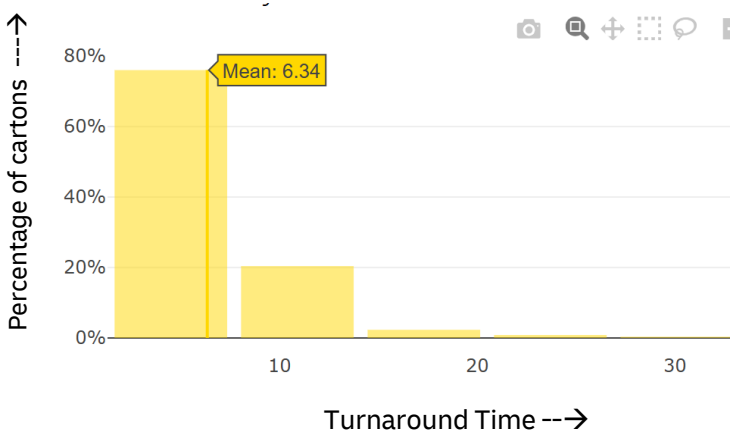
Represents the utilization of the resources currently occupied in performing activities. For example: How well are we utilizing resources for picking, packing, VAS and sorting activity etc.

Metrics details as in the model

KPIs and metrics enable users to read and correctly interpret the models to drive decision making

Turn Around Time

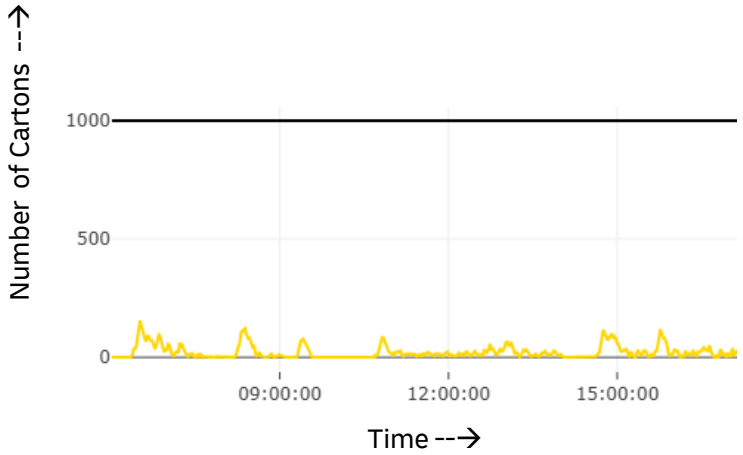
- **Turn Around time of cartons on the conveyor**



- Distribution of turnaround time calculated for each carton.
- The data shows that:
  - The mean turnaround time is approximately 6.3 minutes for about 80% of the cartons.

Congestion

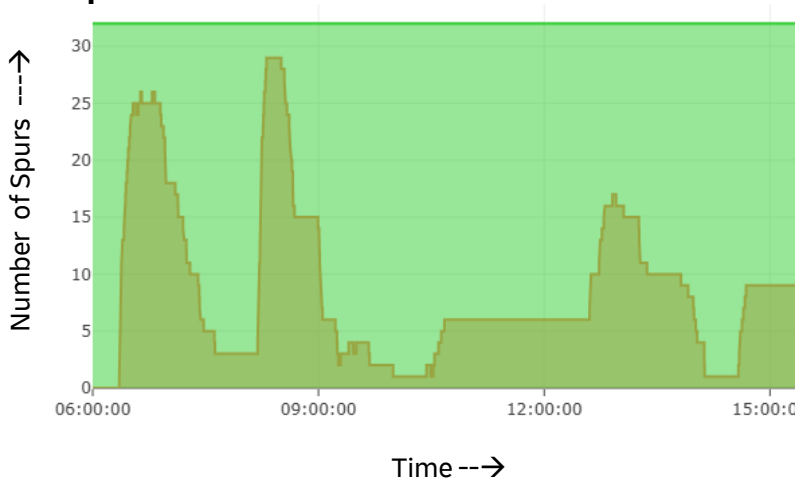
- **Number of cartons on the conveyor**



- Shows real-time carton count on the conveyor over time.
- A black line indicates the maximum allowable cartons to prevent blockage.
- Increases in carton numbers reflect conveyor congestion over time.

Resource Utilization

- **Spur Utilization**



- The graph indicates the number of spurs needed over a specific time interval.
- A dark green line represents the maximum number of spurs available, currently set at 32.
- This graph can be used to understand spur utilization over time.

Simulator - Model validation

Simulation Model was able to represent outbound process which enables operations to test scenarios before rolling out strategies/initiatives

Info details

Date : 29-05-2025

Operational Model		Simulation Model
Average **298 minutes**	**Wave TAT**	Average **286 minutes**
Average **118 minutes**	**OLPN TAT**	Average **67 minutes**
Average **122 minutes**	**Palletization TAT**	Average **146 minutes**
Average **13 minutes**	**Task TAT**	Average **15 minutes**
Average **4 minutes**	**Convey TAT**	Average **6 minutes**

Some factors may not be captured in the model as they represent exceptions or situations in Daily ops

TAT = Turn around time

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SCENARIO ANALYSIS

Slotting challenge and Improvement opportunity

Enhancing Picking Efficiency and reducing pick and pass orders: The Power of Slotting

Baseline Scenario

High SKU Dispersion: Significant dispersion of SKUs (e.g.sportswear) across multiple aisles,
it is Present in 58 aisles at Level 1 and 47 aisles at Level 2, despite needing SKUs for only 47 total aisles.
Increased Distance for Picking.

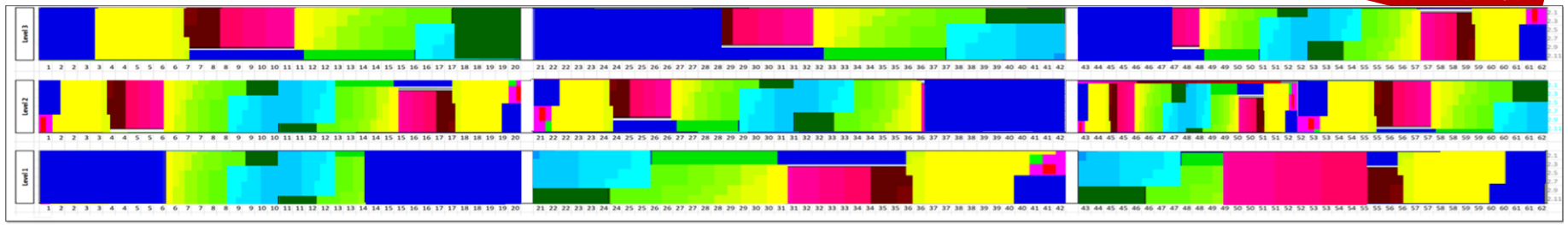
Slotting Scenario

Reduce SKU Dispersion: Consolidate SKUs into fewer aisles (align with 47 total aisles needed on the same level).
Decrease Picking Distance: Shorten travel time for pickers by optimizing SKU placement.
Efficient task creation : less pick and pass orders

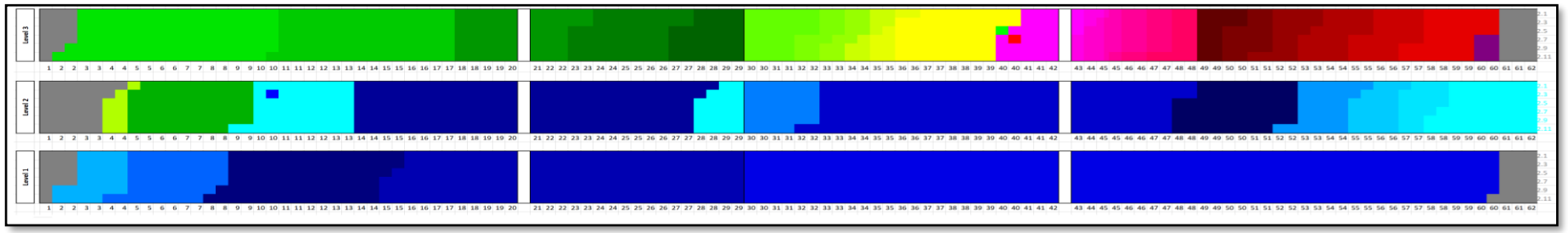
As-Is Scenario	To-Be Scenario
#Distinct Aisles Visited/Order	#Distinct Aisles Visited/Order
2.08	1.78
Avg. Distance Travelled to Start Picking Process (in #Aisles)	Avg. Distance Travelled to Start Picking Process (in #Aisles)
13.31	10.04
Avg. Distance Travelled During Picking Process (in #Aisles)	Avg. Distance Travelled During Picking Process (in #Aisles)
8.16	5.11
%Pick & Pass	%Pick & Pass
29.15%	24.82%
%Multilevel	%Multilevel
23.00%	20.99%

Slotting example 12-month data

Baseline Scenario



Slotting Scenario

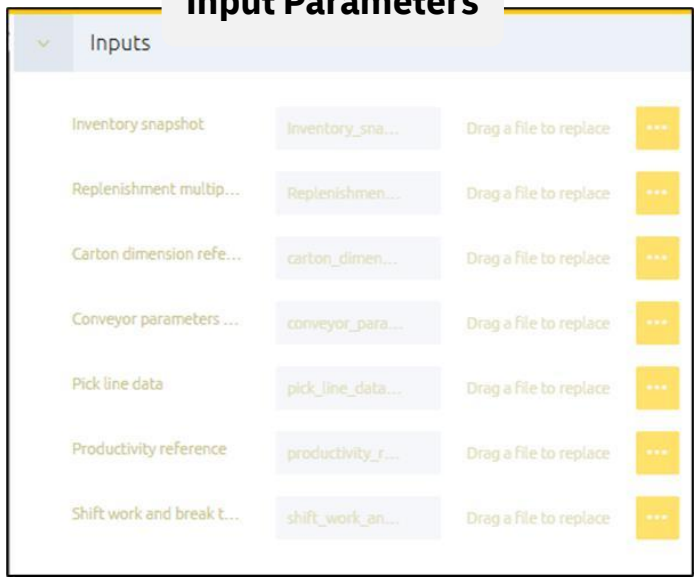


Overview of the slotting strategy being tested and how to interpret the metrics

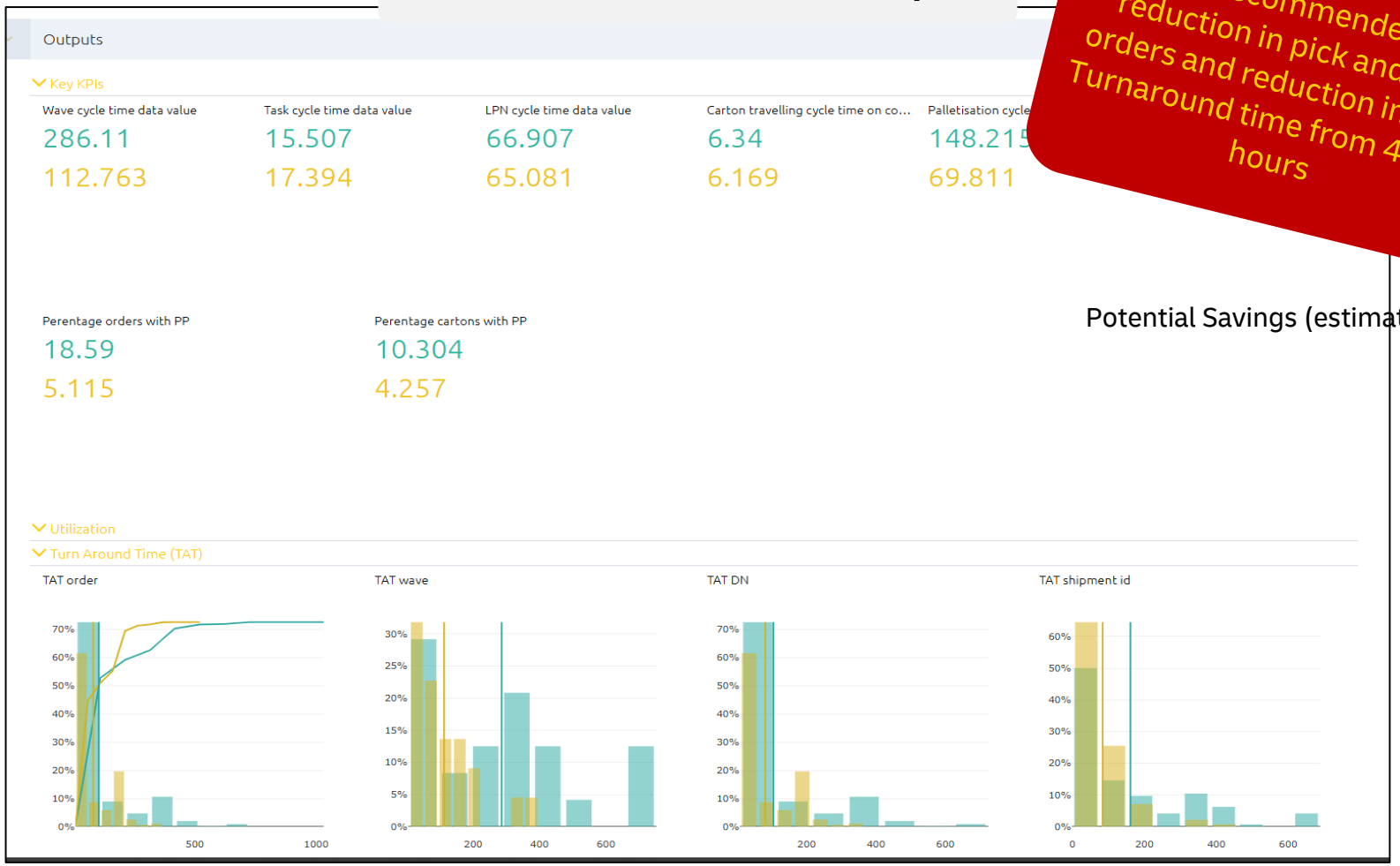
Scenario Analysis: Baseline vs Slotting scenario

Easy to use and customize the Input parameters and associated results by Leverage Anylogic cloud to perform scenario analysis, test strategies and initiatives.

Input Parameters



Baseline Results + Scenario Analysis



Model recommended **72%** reduction in pick and pass orders and reduction in Wave Turnaround time from 4.8 to 2 hours

Potential Savings (estimation)

Simulation Data = 29-05-2025

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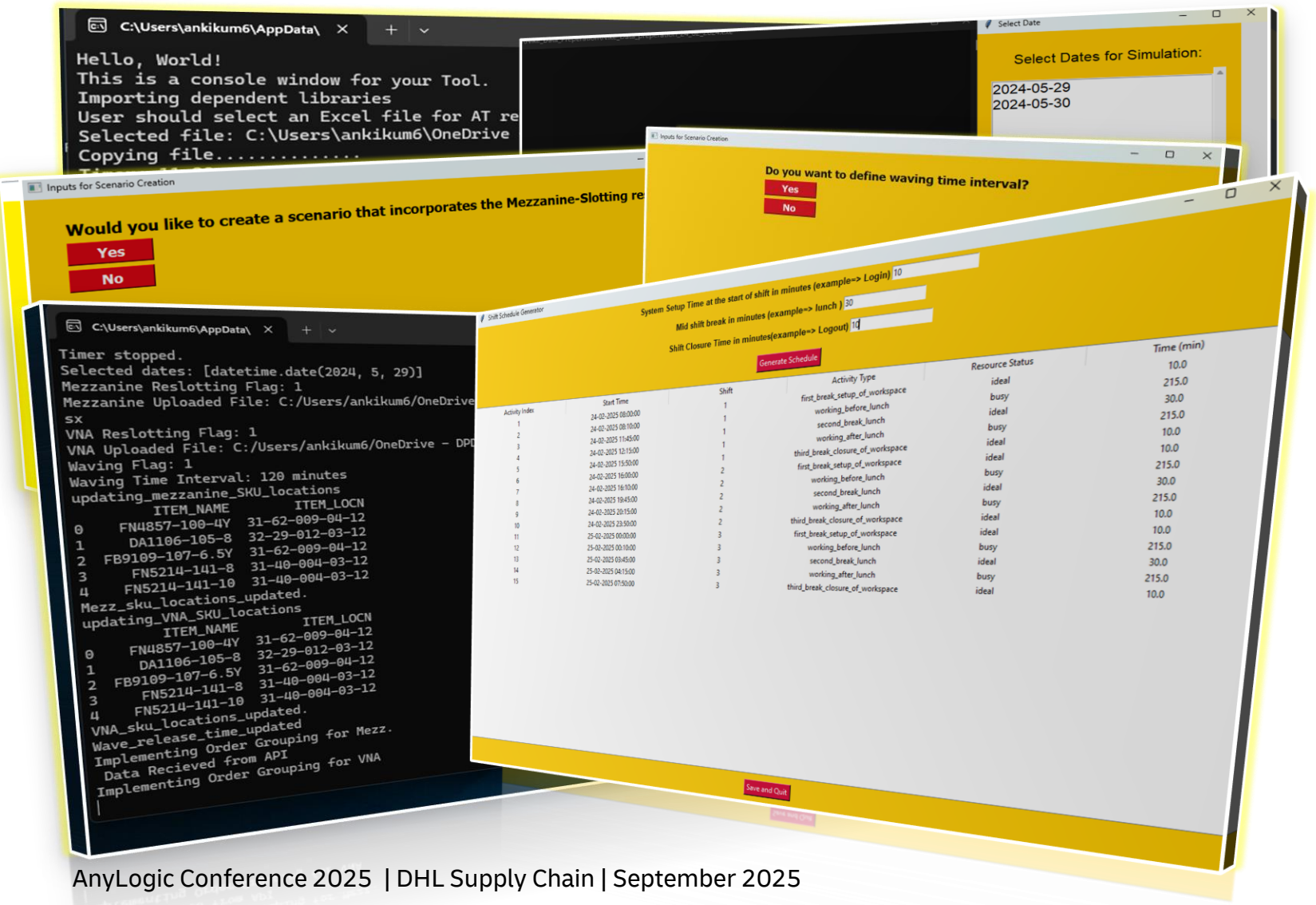
APPLICATION: SCENARIO BUILDING

Application: Data preparation and Scenario building

Application helps in cleaning and transforming data required for Scenario analysis



- **Key Features of application:**
  - Desktop Application (one time installation)
  - Time-Saving and User friendly
  - Flexibility in creating Scenarios
  - API Based task creation – Optimization algorithm to represent order grouping logic

- **Types of Scenario**
  - Slotting (Case reserve/Mezzanine)
  - Waving (time interval based)
  - Shift timings (user input)

- **Using The Application:**
  1. Launch the Application
  2. Selecting the AT-Report File
  3. Updating Slotting Results
  4. Defining Waving Time Interval
  5. Finalizing Shift Timings

THANK YOU

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