

Designing for Insight:

The Persona-Centric Dashboard Workshop

FEATURING



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AGENDA

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Introductions

Welcome! Get Settled

02

Core Concepts

Foundations for Good Dashboards

03

Customer Show & Tell

Live walk through from Tulip Customers

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Data Management

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Dashboard Demo

From Common Data Model to Building a Dashboards

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Analytics - Tips & Tricks

Focus on App-Based best practices for Analytic Building

07

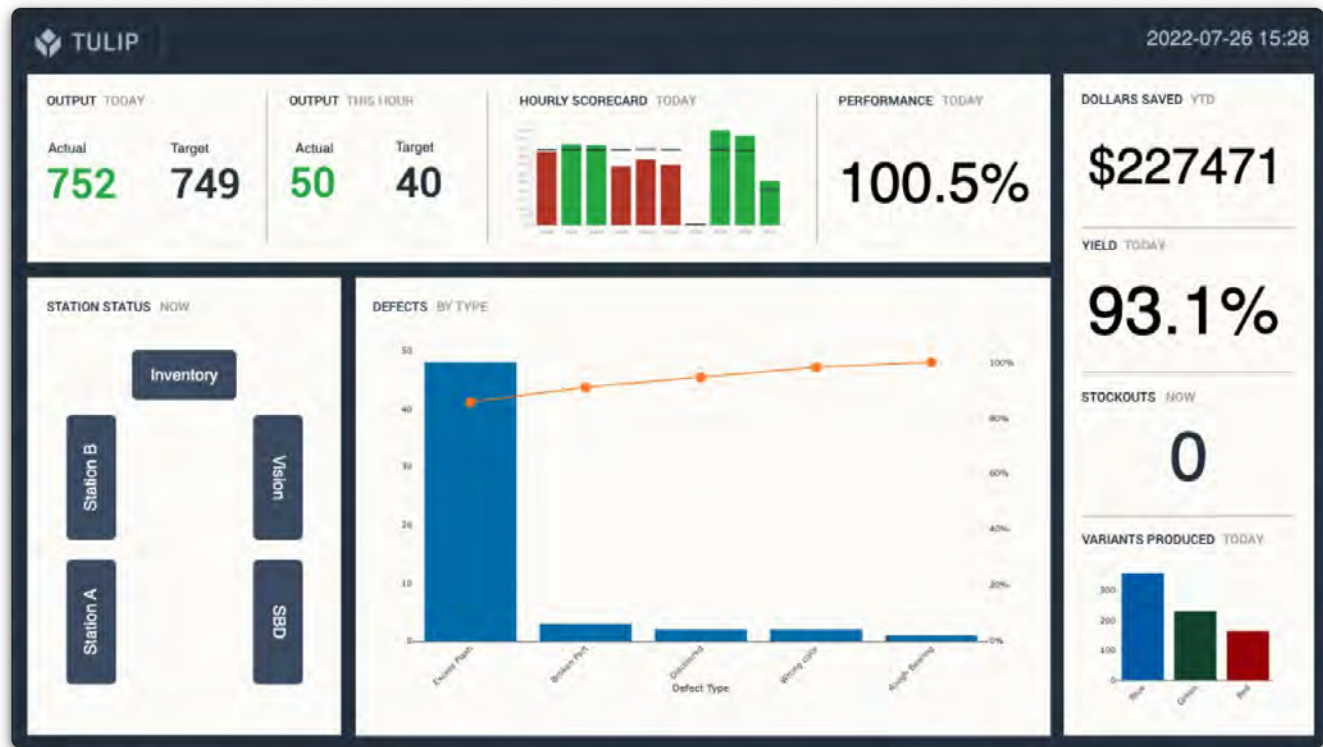
Enterprise Visualization

Architecture considerations and best practices

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Wrap-Up

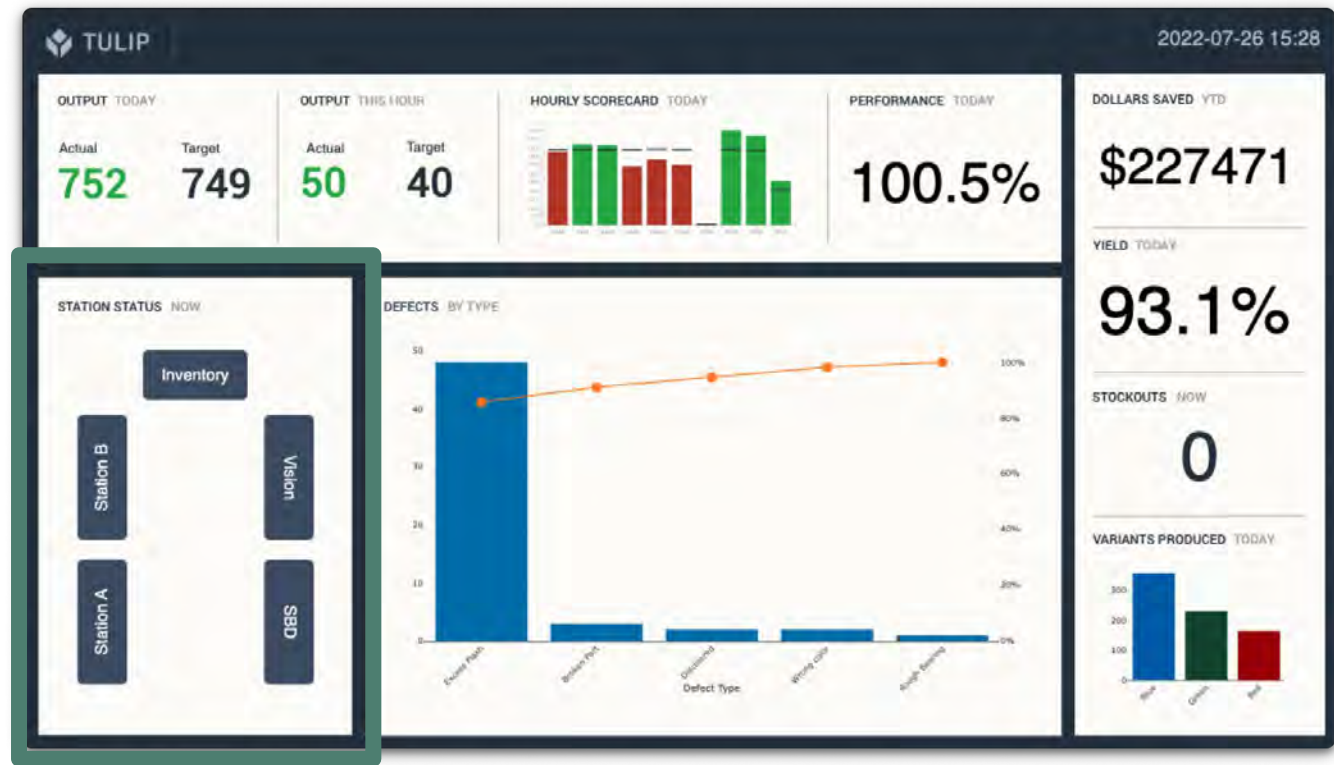
Key Takeaways



Who is this dashboard most likely designed for?

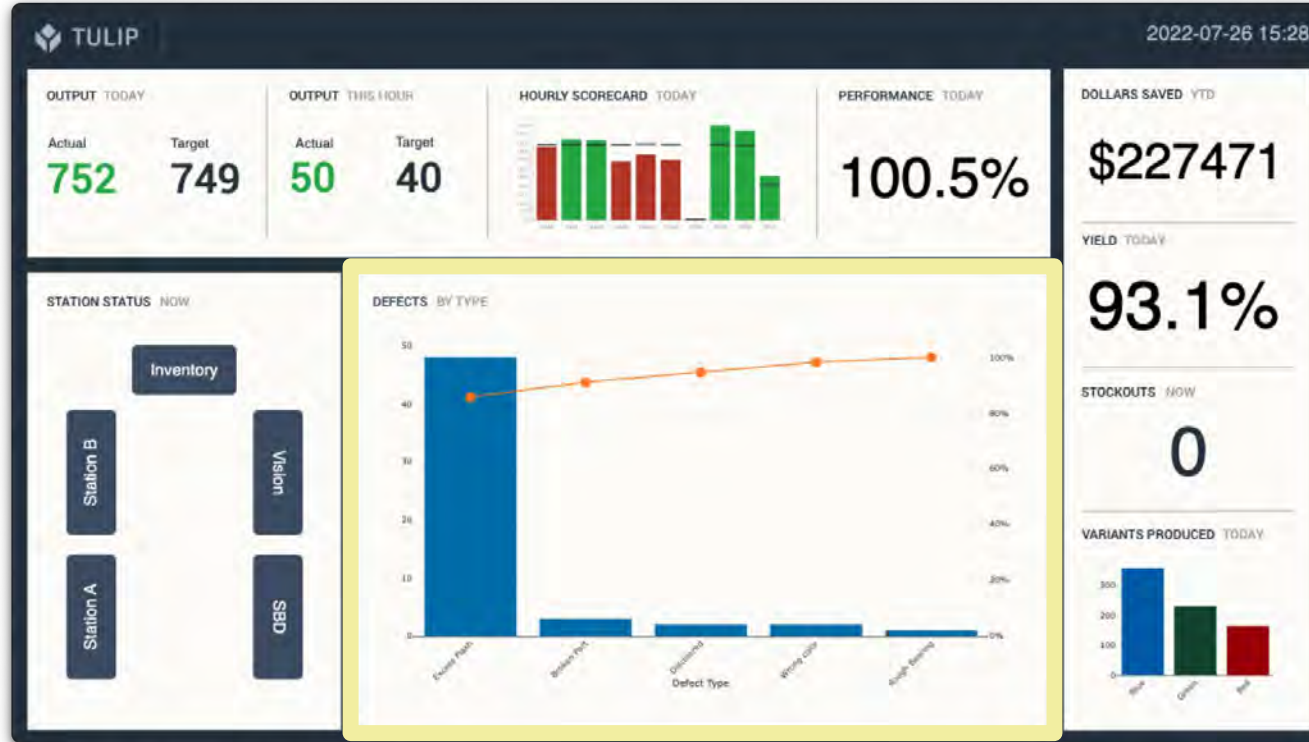
Where did your eyes go first?

Is there anything confusing? Is there context missing to make it useful?



Good Use of Dynamic

Context: Clear location-based layout for easy filtering

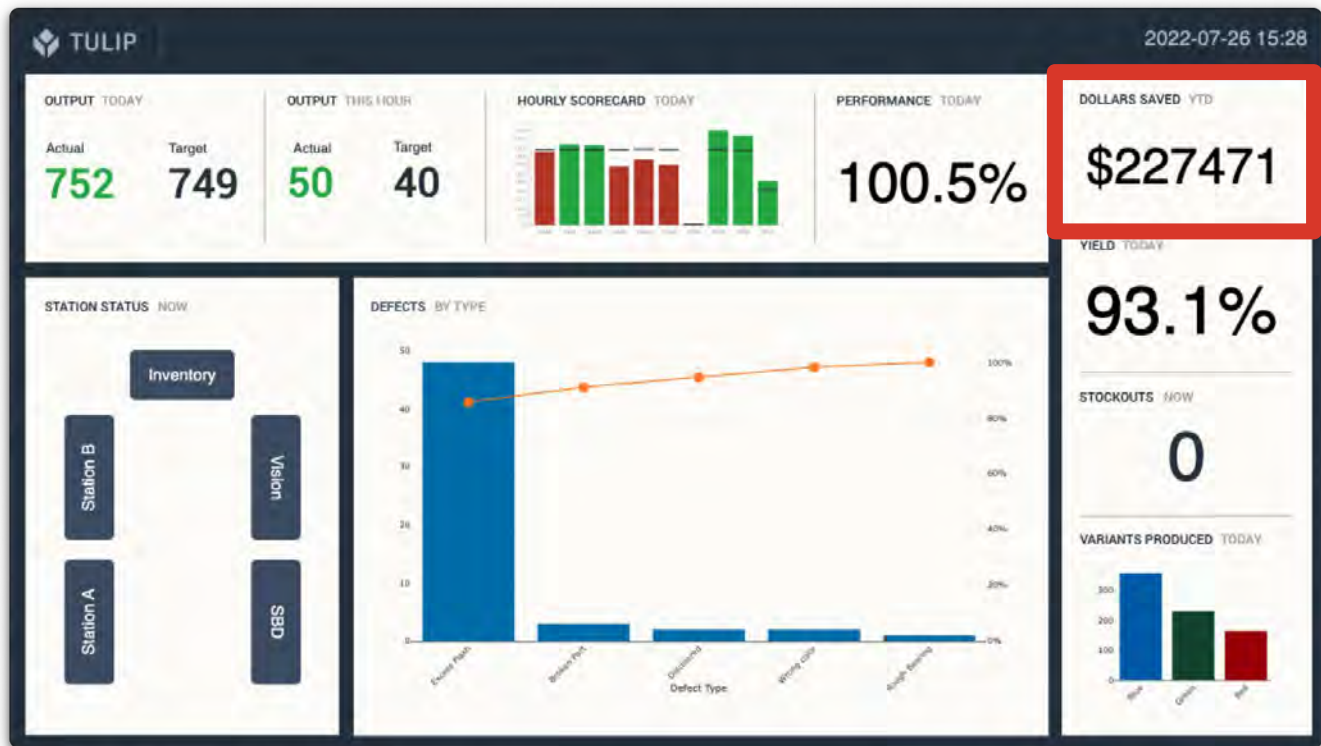


Good Use of Dynamic

Context: Clear location-based layout for easy filtering

Not Actionable Enough:

The analytic is massive, but is anything actionable? What's the Root Cause or Action an Operator should take?



Good Use of Dynamic

Context: Clear

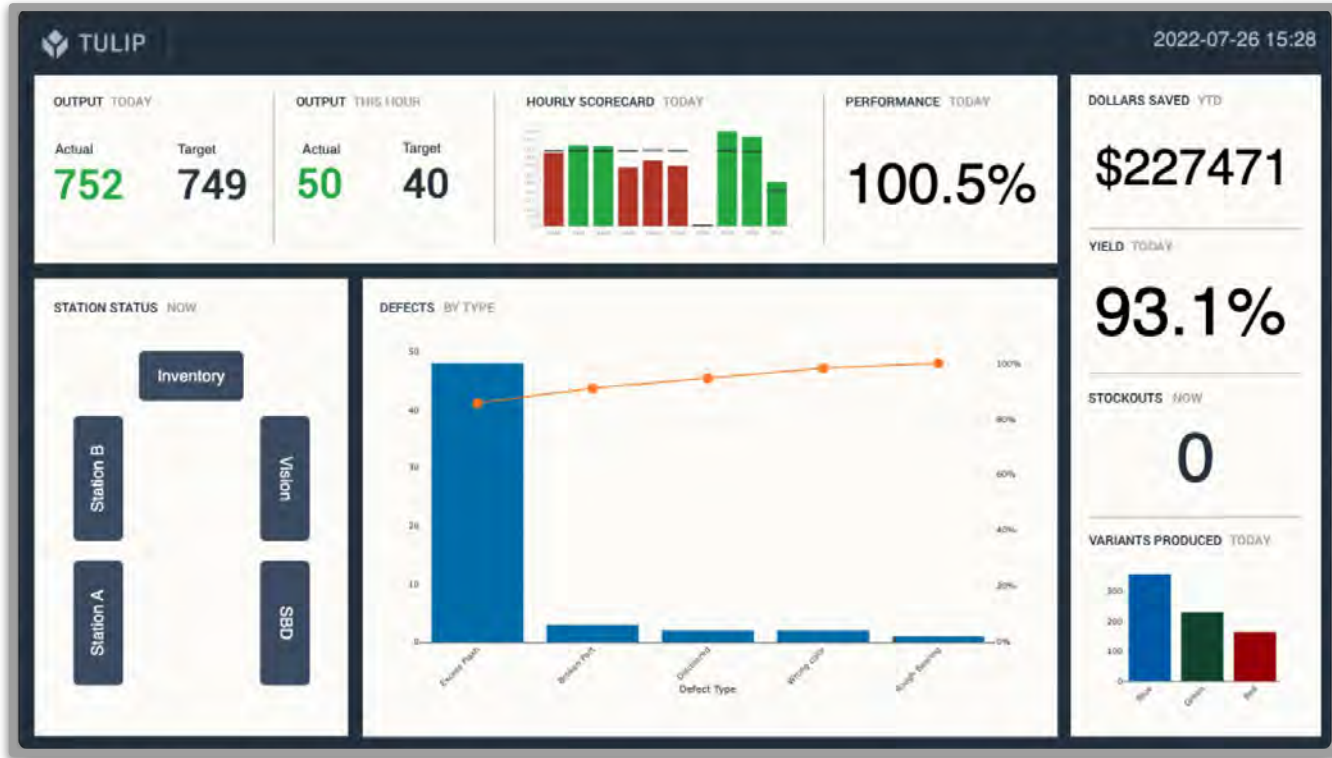
location-based layout for
easy filtering

Not Actionable Enough:

The analytic is massive,
but is anything actionable?
What's the Root Cause or
Action an Operator should
take?

Measure Impact, Not

Activity: Is there a tactical
metric to drive immediate
behavior? (e.g. Scrap this
Shift)



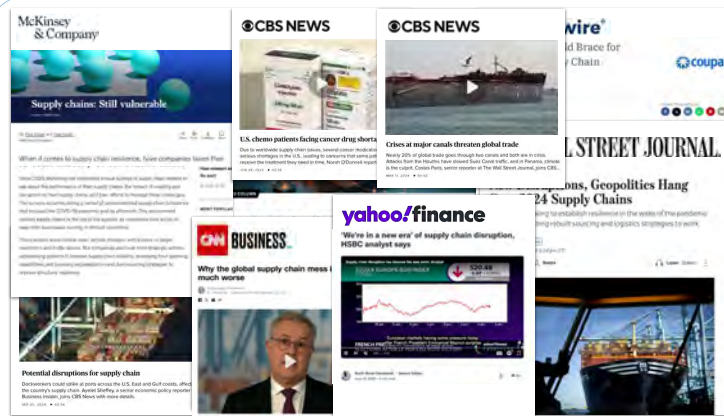
Still unclear on *who* this dashboard is for ...



Demand and expectations are increasingly unpredictable

Operations leaders need to **solve problems quicker** to prevent delays.

Manufacturers must **be able to be agile** to remain competitive.



Real-time communication and data access are now non-negotiable expectations.



Dashboards are not reports. They are the **Real-Time Communication Interface** that drives rapid, agile **problem-solving**.

Data is Everywhere.
Insight is Not.



The Bad News...

You're drowning in data

Data is Everywhere. Insight is Not.



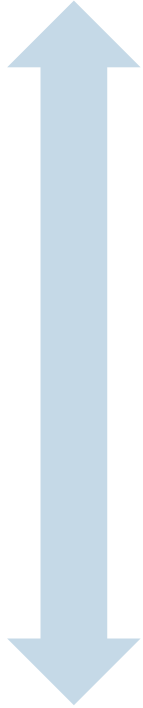
The Bad News...

You're drowning in data

The Good News...

You're drowning in data

Different Personas have different needs



Executive Dashboards

Real time health score and key metric reporting by plant to drive standard process across sites



Operational Dashboards

See the status of connected cells, lines and assets in real time, and monitor andon and escalations for downtime



Station Context

Embed analytics in apps that empower workers at their stations. Provide asset or assembly performance data and history, and enable them to execute their work and escalate issues if needed

Core Concepts

Foundation and Framework for Building Dashboards



Three Pillars of Insightful Design

Context Driven

The What

Cognitive Load Reduction

The How

Actionable Insights

The Why



Three Pillars of Insightful Design

Context Driven

The What

Cognitive Load Reduction

The How

Actionable Insights

The Why

Show Delta, Not Just Absolute:

Highlight the difference (Δ) from the target, last shift, or last hour. A user cares more about being -5% below target than the absolute number (1,900 units).



Interactivity for Exploration:

Allow the user to click on a high-level metric (e.g., Low OEE) to instantly open the root-cause analysis (e.g., Downtime Pareto Chart).

Three Pillars of Insightful Design

Context Driven

The What

Cognitive Load Reduction

The How

Actionable Insights

The Why

Limit Data Density:

Avoid cramming too much information. If a chart requires more than 10 seconds of interpretation, it should be moved to a drill-down view.

Filter First, View Second:

The dashboard must load only the data relevant to the user's current context (e.g., their line, their shift, their role). Utilize dynamic filtering based on user login, location, or associated machine.



Visual Hierarchy:

Use size, position (Top-Left), and color to immediately draw the eye to the single most critical piece of information for that persona.

Three Pillars of Insightful Design

Context Driven

The What

Cognitive Load Reduction

The How

Actionable Insights

The Why

Decision-Driven Design:

Every metric displayed must align with a tangible decision or action the user can take (e.g., "Schedule Maintenance," "Reroute Materials," "Notify Quality Team").



Measure Impact, Not Just Activity:

Focus on key performance indicators (KPIs) that show the result of an action, not just the activity itself (e.g., show "Downtime Cost" not just "Downtime Duration").

Matching the Dashboard to the Persona

A dashboard is only effective if it answers the right questions for the right person. The design, data, and density must be tailored to the user's specific role and their immediate goals.

Operator

Embedded / Operational

"Am I ahead or behind my takt time goal for the current unit/batch?"

Engineer

Analytical / Historical

"What is the largest, repeatable defect pattern, and how can I improve the process to eliminate it?"

Supervisor

Tactical / Real-Time

"Where is the bottleneck right now, and what do I need to fix in the next 30 minutes?"

Plant Manager

Strategic / Aggregated

"Are we on track for the week, and which area requires my highest-level attention or resource allocation?"

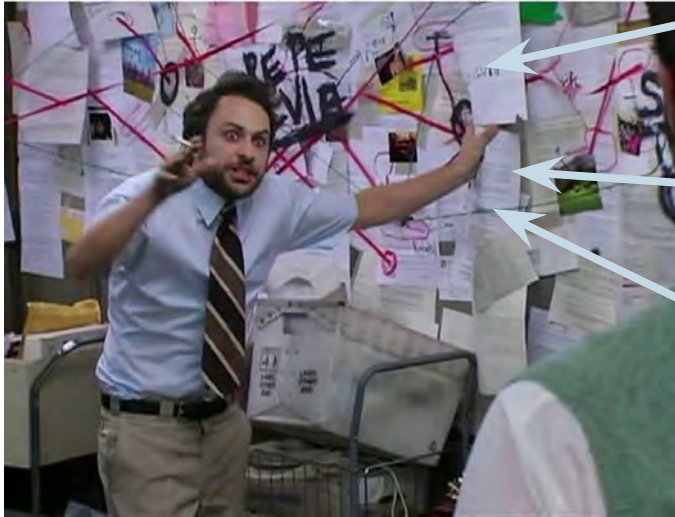
Best Practices

Foundation and Framework for Building Dashboards



A strong data structure within Tulip is
the foundation for actionable insights.

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the foundation for actionable insights.



A Poorly **Standardized**
Data Structure

Data That is Hard to
Understand

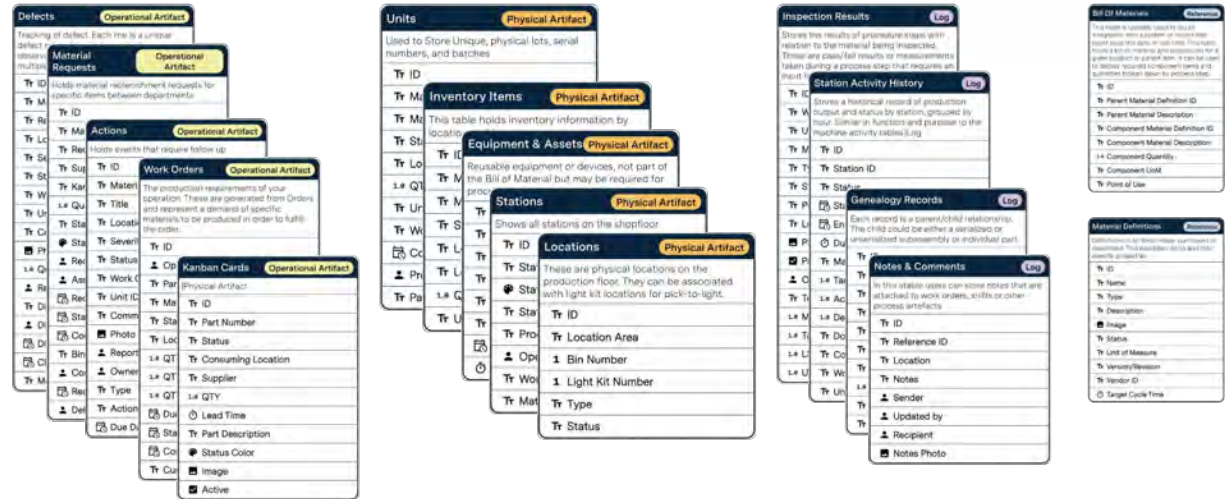
Data Missing **Context**

What is the Common Data Model (Tulip Library)?

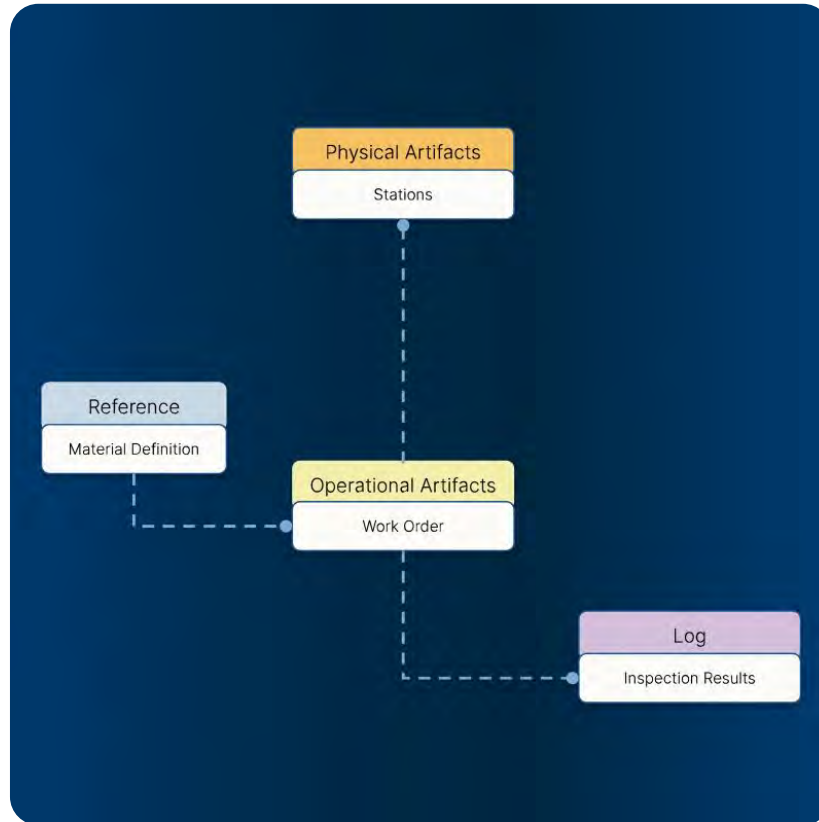
The Tulip Library Common Data Model is a schema that unifies data from apps into a standard structure that makes building and deploying easier and faster.

A **Composable** architecture allows for additions as the use case grows

Scalable Add to further products, use cases and lines over time



What are the parts in the data model and how does it work?



Physical Artifacts are physical objects that operators interact with: *Stations, Equipment, Inventory, etc.*



Operational Artifacts are manufacturing process objects: *Work orders, defects, material requests, etc.*



Logs are manufacturing records: *Notes, Station Records, Inspection Results,*

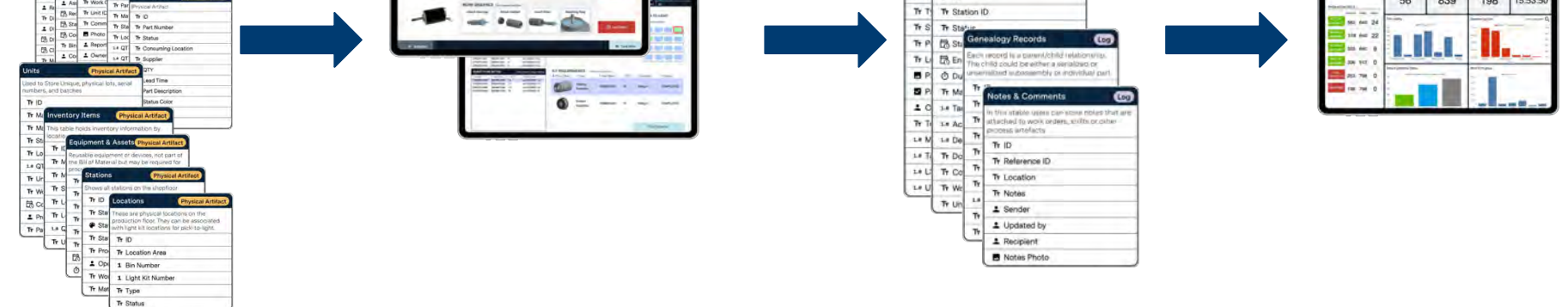


References are any definitions or records that provide more context to a process: *Bill of Materials and Material Definitions*

100

Tracking of defect: Each line is a unique defect	
Material Requests	Operation defect
1. To get ready material requirement requests for the day's work before production	

The screenshot displays the 'Station Activity History' interface. At the top, there's a header with 'Station Activity History' and a 'Refresh' button. Below this is a table with columns: 'Time', 'Activity', and 'Work Orders'. The table contains several rows of data, including 'Tr 10', 'Tr 11', 'Tr 12', 'Tr 13', 'Tr 14', 'Tr 15', 'Tr 16', 'Tr 17', 'Tr 18', 'Tr 19', 'Tr 20', 'Tr 21', 'Tr 22', 'Tr 23', 'Tr 24', 'Tr 25', 'Tr 26', 'Tr 27', 'Tr 28', 'Tr 29', 'Tr 30', 'Tr 31', 'Tr 32', 'Tr 33', 'Tr 34', 'Tr 35', 'Tr 36', 'Tr 37', 'Tr 38', 'Tr 39', 'Tr 40', 'Tr 41', 'Tr 42', 'Tr 43', 'Tr 44', 'Tr 45', 'Tr 46', 'Tr 47', 'Tr 48', 'Tr 49', 'Tr 50', 'Tr 51', 'Tr 52', 'Tr 53', 'Tr 54', 'Tr 55', 'Tr 56', 'Tr 57', 'Tr 58', 'Tr 59', 'Tr 60', 'Tr 61', 'Tr 62', 'Tr 63', 'Tr 64', 'Tr 65', 'Tr 66', 'Tr 67', 'Tr 68', 'Tr 69', 'Tr 70', 'Tr 71', 'Tr 72', 'Tr 73', 'Tr 74', 'Tr 75', 'Tr 76', 'Tr 77', 'Tr 78', 'Tr 79', 'Tr 80', 'Tr 81', 'Tr 82', 'Tr 83', 'Tr 84', 'Tr 85', 'Tr 86', 'Tr 87', 'Tr 88', 'Tr 89', 'Tr 90', 'Tr 91', 'Tr 92', 'Tr 93', 'Tr 94', 'Tr 95', 'Tr 96', 'Tr 97', 'Tr 98', 'Tr 99', 'Tr 100'. Below the table, there's a section for 'Work Orders' with a 'Refresh' button and a 'Station Activity History' button.



Data in Tulip

When working with data, it's crucial to maintain organization to avoid clutter and centralize information. With Tulip, storing and managing your data is made easy with multiple options based on your needs. Because Tulip is a self-serve platform, you can determine which of your data is transmitted and stored.

Tables

Tables are a cross between spreadsheets and relational databases that are customizable to however you need to present your data. They are sharable data sources that multiple apps can use.

Tr ID	Tr Material ID	Tr Status	Tr Consumin...
1	HSY-TO-TK	HSY-00024	FULL
2	ROT-TO-TK	ROT-00012	EMPTY
3	EBY-TO-TK	EBY-00014	EMPTY

Completions

App Completions are ideal for storing and organizing production data. Metadata fields are automatically generated and stored once a user completes or Cancels the app. Completions can not be edited

Start Time	End Time	Duration	Logged in User
2024-09-13 15:20:13	2024-09-13 15:26:27	00:06:14	john.smith@tulip.com
2024-09-12 16:19:37	2024-09-13 15:19:53	22:50:56	john.smith@tulip.com
2024-09-12 15:05:29	2024-09-12 15:06:56	00:01:27	john.smith@tulip.com

Connectors

Connectors allow you to connect to external data sources with Tulip (HTTP APIs, SQL databases, MQTT Brokers and OPC UA servers) to read and write data in ERP, Databases...



Demo



Quality Technician, Material Review Board Dashboard

Context Driven Visualization

This Week's Non Conformance Details

Cognitive Load Reduction

Clear Metrics and Insight

Actionable Insights

Leads the Quality Technician towards conclusions faster



Instance-Based View

Context Driven Visualization

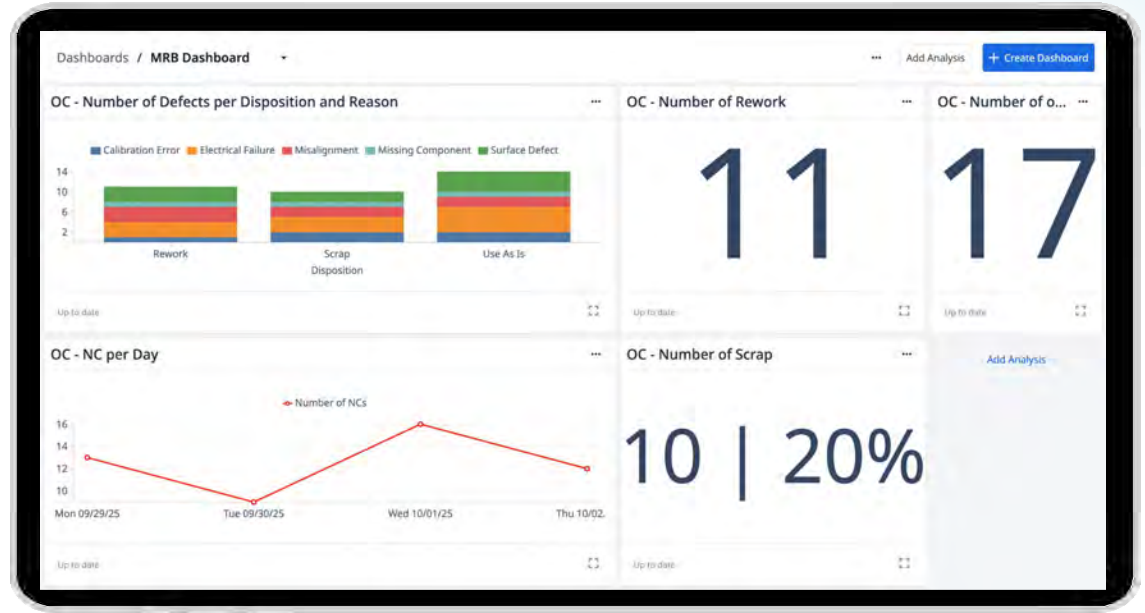
*This **Week's** Non Conformance Details*

Cognitive Load Reduction

Clear Metrics and Insight

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Analytic Building, Tips and Tricks



Single Values

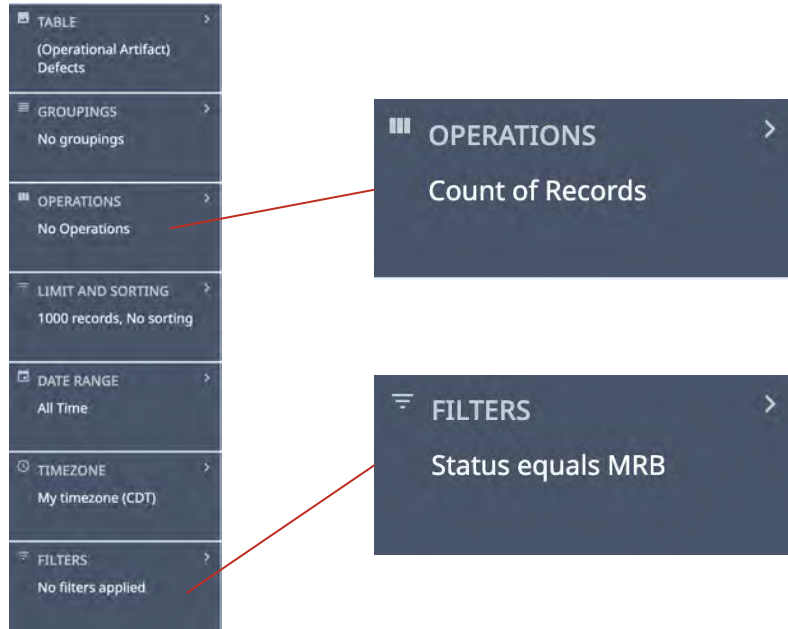
Single Values can be utilized for standalone metrics in order to make quick decisions. From a development standpoint, they are simplistic and great for learning analytics

TABLE	>
(Operational Artifact) Defects	
GROUPINGS	>
No groupings	
OPERATIONS	>
No Operations	
LIMIT AND SORTING	>
1000 records, No sorting	
DATE RANGE	>
All Time	
TIMEZONE	>
My timezone (CDT)	
FILTERS	>
No filters applied	



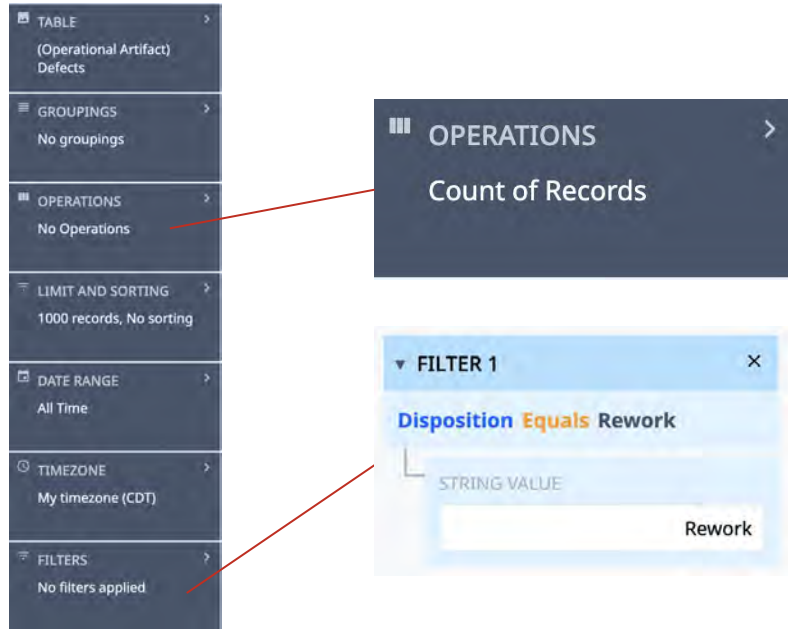
Single Values

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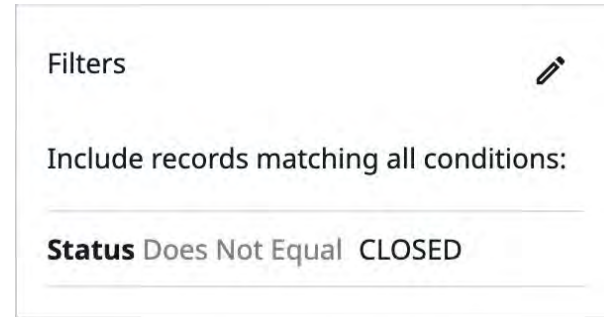


Single Values

Single Values can be utilized for standalone metrics in order to make quick decisions. From a development standpoint, they are simplistic and great for learning analytics



App Based Filtering



Single Values

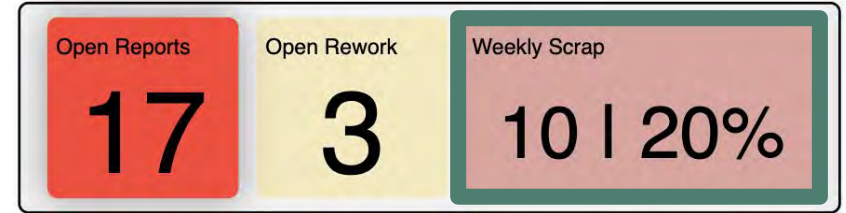
Single Values can be utilized for standalone metrics in order to make quick decisions. From a development standpoint, they are simplistic and great for learning analytics

- TABLE
(Operational Artifact) Defects
- GROUPINGS
No groupings
- OPERATIONS
No Operations
- LIMIT AND SORTING
1000 records, No sorting
- DATE RANGE
All Time
- TIMEZONE
My timezone (CDT)
- FILTERS
No filters applied

▼ OPERATION 1 ×

Expression

```
COUNT((Operational Artifact) Defects  
Disposition = 'Scrap') + ' | ' +  
ROUND((100 * COUNT((Operational  
Artifact) Defects Disposition =  
'Scrap')) / COUNT()) + '%'
```



Line Graphs

Line Graphs can be used to observe trends and aggregated data based on common groupings

TABLE
(Operational Artifact)
Defects

GROUPINGS
Date Submitted

OPERATIONS
Count of Records

LIMIT AND SORTING
1000 records, No sorting

DATE RANGE
All Time

TIMEZONE
My timezone (CDT)

FILTERS
No filters applied

GROUPING 1

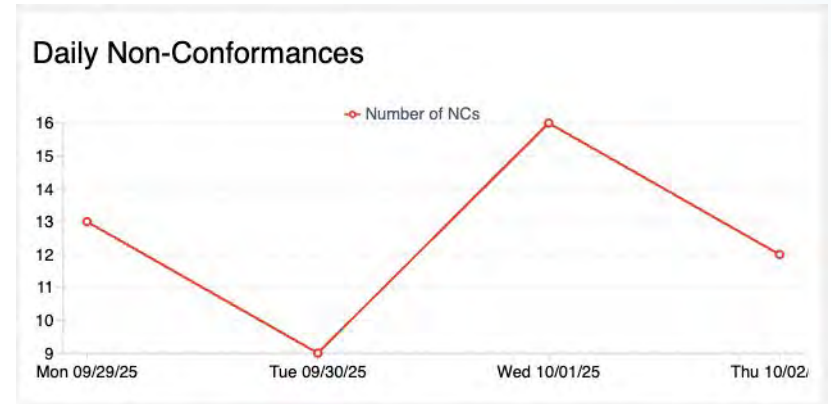
Date Submitted

GROUP VALUE

☒ Yes
☐ No

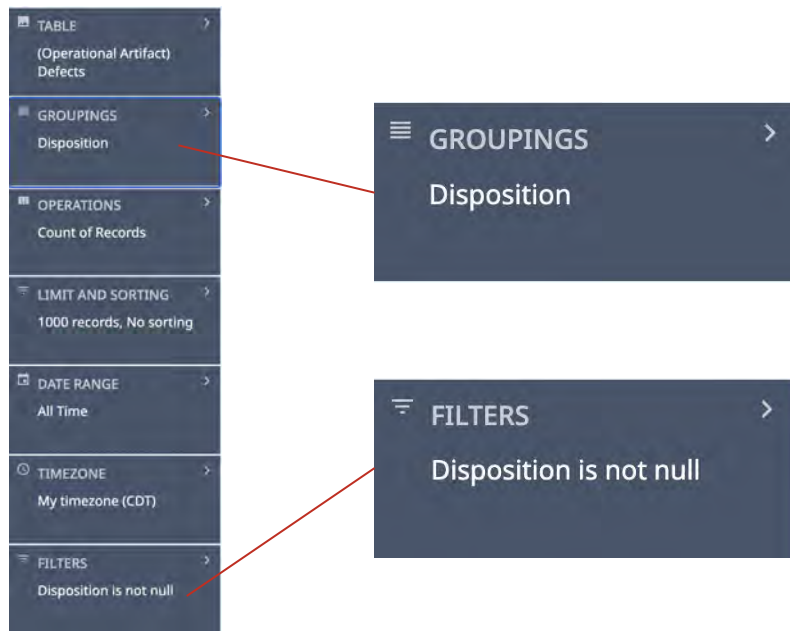
GROUP BY

Day

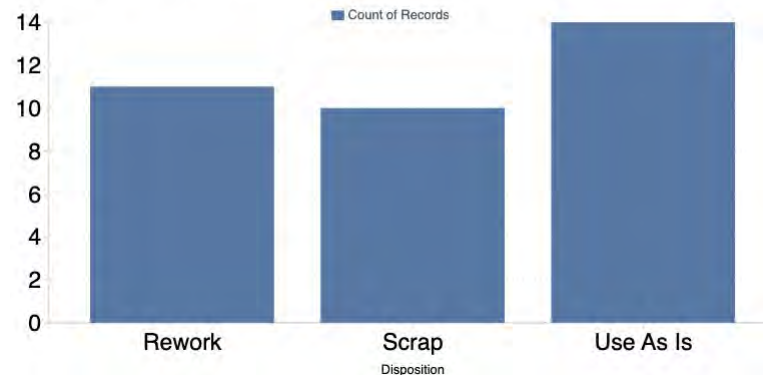


Bar Graphs

Bar Graphs can be used to observe trends and aggregated data based on common groupings



Defects per Disposition



Let's enhance this graph



Bar Graphs

Line Graphs can be used to observe trends and aggregated data based on common groupings

TABLE
(Operational Artifact)
Defects

GROUPINGS
Disposition & Reason

OPERATIONS
Count of Records

LIMIT AND SORTING
1000 records, No sorting

DATE RANGE
All Time

TIMEZONE
My timezone (CDT)

FILTERS
Disposition is not null

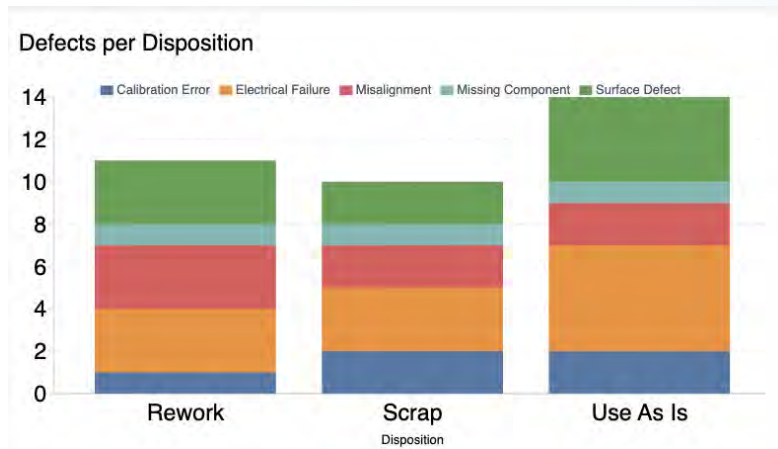
GROUPINGS
Disposition & Reason

Visualization

X Axis
Disposition

Y Axis
Count of Records

Compare By
Reason



More Analytics Tips and Tricks

Other Facets of the Analytics Builder

The screenshot displays the Analytics Builder interface. On the left, a sidebar lists facets: TABLE (Operational Artifact) Defects, GROUPINGS (No groupings), OPERATIONS (No Operations), LIMIT AND SORTING (1000 records, No sorting), DATE RANGE (All Time), TIMEZONE (My timezone (CDT)), and FILTERS (No filters applied). The main area shows the configuration for the 'LIMIT AND SORTING' facet, with a blue 'Add sorting' button. Below it, the 'LIMIT' is set to 1000. The 'SORTING 1' section shows 'Count of Records' in descending order. A red arrow points from the 'LIMIT AND SORTING' facet in the sidebar to the 'LIMIT' and 'SORTING 1' configuration area. Another red arrow points from the 'DATE RANGE' facet in the sidebar to the 'REFERENCE FIELD' dropdown menu, which is open and shows a list of date range options: Today (checked), Yesterday, Current Hour, Current Week, Current Month, Last 60 Minutes, Last 7 Days, Last 30 Days, Fixed: Date Range, Fixed: All Dates Before, Fixed: All Dates After, Relative: Date Range, Relative: All Dates Before, Relative: All Dates After, and All Time.

TABLE
(Operational Artifact)
Defects

GROUPINGS
No groupings

OPERATIONS
No Operations

LIMIT AND SORTING
1000 records, No sorting

DATE RANGE
All Time

TIMEZONE
My timezone (CDT)

FILTERS
No filters applied

Add sorting

LIMIT
1000

SORTING 1
Count of Records Descending

REFERENCE FIELD
☒ Created At
☐ Updated At

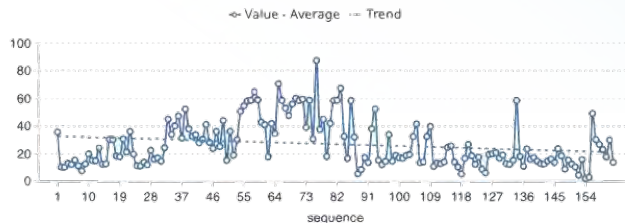
- ✓ Today
- Yesterday
- Current Hour
- Current Week
- Current Month
- Last 60 Minutes
- Last 7 Days
- Last 30 Days
- Fixed: Date Range
- Fixed: All Dates Before
- Fixed: All Dates After
- Relative: Date Range
- Relative: All Dates Before
- Relative: All Dates After
- All Time

More Analytics Tips and Tricks: Visualizations

Extend Tulip chart visualizations with configurable layers to help gain insights from time-series data.

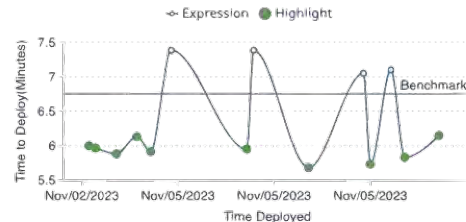
Trend Lines

Follow your data with linear or moving average type trend lines to understand your production over time.

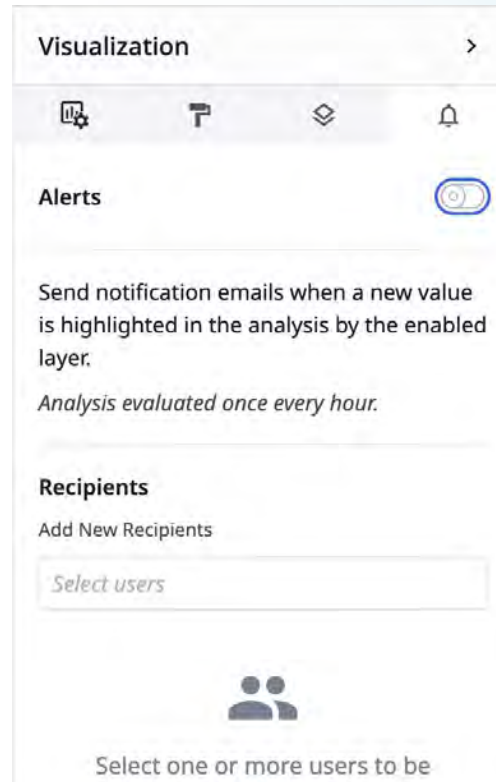
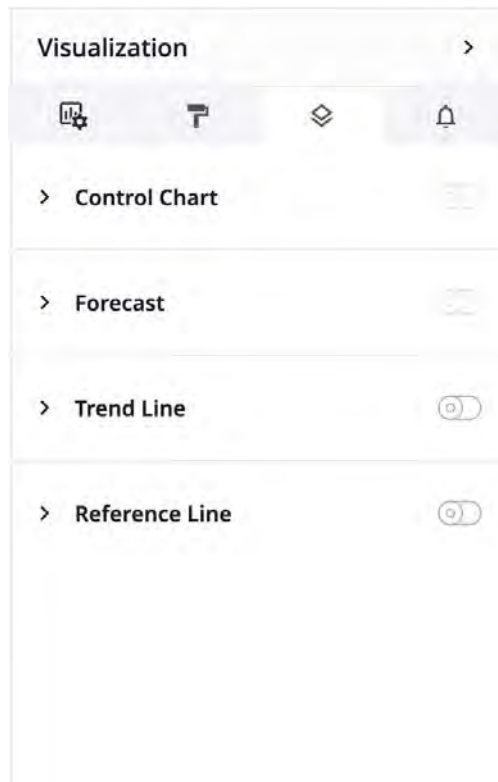
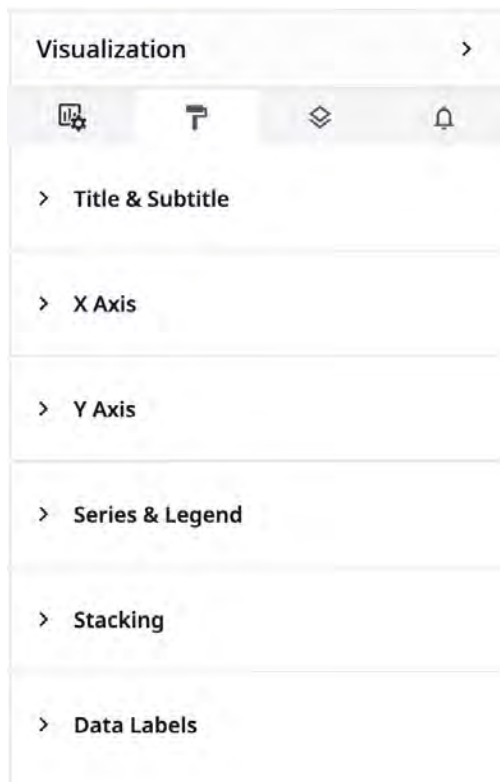


Reference Lines

Configure your own references and benchmarks and highlight key values that above or below the goal.



More Analytics Tips and Tricks: Visualizations



Interactive Table Widget

Leveraging Table data to provide direct insight to a specific process - Using Filters

Tr Location	Tr Material Defini...	Tr Reason	Tr Comments
Station B	Product-2	Surface Defect	oContamination on surface ...
Station A	Product-1	Calibration Error	Scale zero offset incorrect.
Station B	Product-2	Surface Defect	PAINT CHIPPED OFF CO...
Station D	Product-2	Missing Component	BRACKET MISSING FRO...
Station C	Product-1	Misalignment	PART DIDNT SIT IN RIGH...
Station D	Product-1	Misalignment	Slight shift detected in fixt...
Station B	Product-1	Missing Component	No bolt, noT sure wHy
Station C	Product-1	Surface Defect	Paint chipped off corner.
Station A	Product-1	Surface Defect	Scratch observed on housi...
Station B	Product-2	Missing Component	no bolt, not sure why
Station C	Product-1	Misalignment	Conveyor beLt pushed pa...
Station C	Product-1	Electrical Failure	BOARD FAILED INITIAL P...
Station A	Product-1	Misalignment	SLIGHT SHIFT DETECET...
Station D	Product-1	Missing Component	Clip not mounted in correc...
Station B	Product-1	Surface Defect	Paint chipped fof corner. o...
Station B	Product-2	Misalignment	Alignment pin sworn down...
Station C	Product-2	Misalignment	PART DIDNT SIT IN RIGH

Widget

Step

App

Filters

Include records matching all conditions:

Status equals MRB

Default sort by

First by Date Submitted

Enable operators to sort all fields

Conditional formatting

Abc Date Submitted

On or before

Current Day St...

1 fields formatted

Abc Tr Location

Is equal to Tr Mode - Location

1 fields formatted

Filters

Include records matching all conditions:

Status equals MRB

Interactive Table Widget

Leveraging Table data to provide direct insight to a specific process - Using Conditional Formatting

Tr Location	Tr Material Defini...	Tr Reason	Tr Comments
Station B	Product-2	Surface Defect	oContamination on surface ...
Station A	Product-1	Calibration Error	Scale zero offset incorrect.
Station B	Product-2	Surface Defect	PAINT CHIPPED OFF CO...
Station D	Product-2	Missing Component	BRACKET MISSING FRO...
Station C	Product-1	Misalignment	PART DIDNT SIT IN RIGH...
Station D	Product-1	Misalignment	Slight shift detected in fix...
Station B	Product-1	Missing Component	No bolt, noT sure wHy
Station C	Product-1	Surface Defect	Paint chipped off corner.
Station A	Product-1	Surface Defect	Scratch observed on housi...
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Widget

Step

App

Filters

Include records matching all conditions:

Status equals MRB

Default sort by

First by Date Submitted

Enable operators to sort all fields

Conditional formatting

+

Abc

Date Submitted

On or before

Current Day St...

1 fields formatted

Abc

Tr Location

Is equal to Tr Mode - Location

1 fields formatted

Conditional formatting

Abc Date Submitted

On or before

Current Day St...

1 fields formatted

Abc Tr Location

Is equal to Tr Mode - Location

1 fields formatted

AI Insights (and soon... Tulip Agents)

Leveraging Table data to provide direct insight to a specific process - Using Conditional Formatting

Comments

Contamination on surface ...
Scale zero offset incorrect.
PAINT CHIPPED OFF CO...
BRACKET MISSING FRO...
PART DIDNT SIT IN RIGH...
Slight shift detected in fixt...
No bolt, noT sure wHy
Paint chipped off corner.
Scratch observed on housi...
no bolt, not sure why
Conveyor beLt pushed pa...
BOARD FAILED INITIAL P...
SLIGHT SHIFT DETECET...
Clip not mounted in correc...
Paint chipped fof corner. o...
Alignment pin sworn down...
PART DIDNT SIT IN RIGH



Summarizing Comments on
an hourly basis:

 **Frontline Copilot™**

Product-2

Contamination, alignment
issues, missing parts, and
electrical failures.

Station C

Parts misalignment, sensor
issues, contamination, and
electrical problems.

Enterprise Visualization



**Shop floor data is one of the most
valuable assets in a manufacturing
enterprise.**

That value multiplies when shop floor
data is integrated across broader
business systems.

Enterprise Visualization Options

Manual

Daily / Weekly

Ad-hoc Reporting

Point to Point

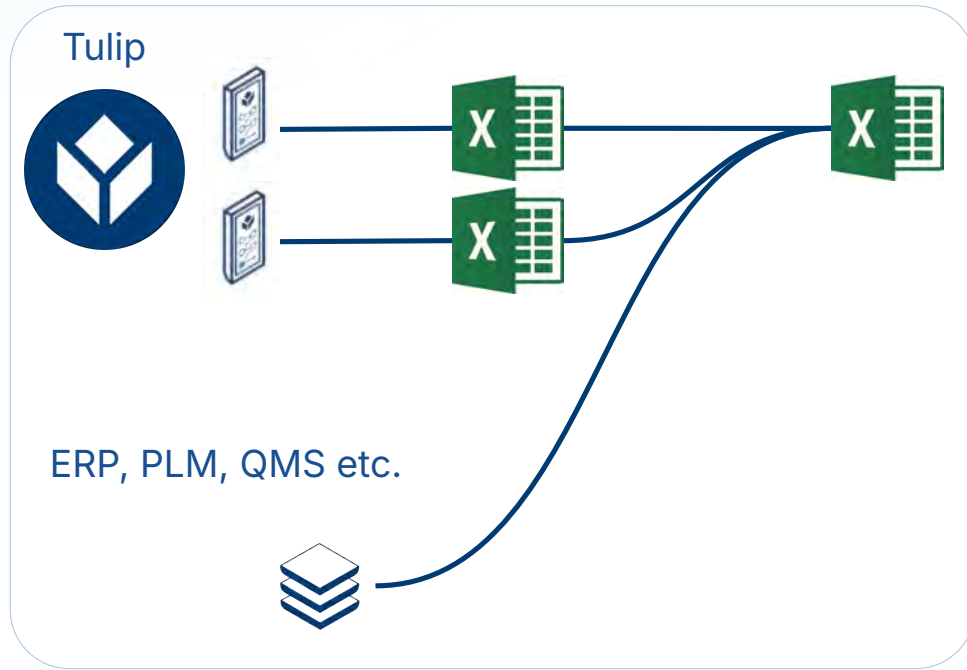
Near Real-Time

BI Tool Visualization

Hub & Spoke

True Real-Time

DataOps Strategy



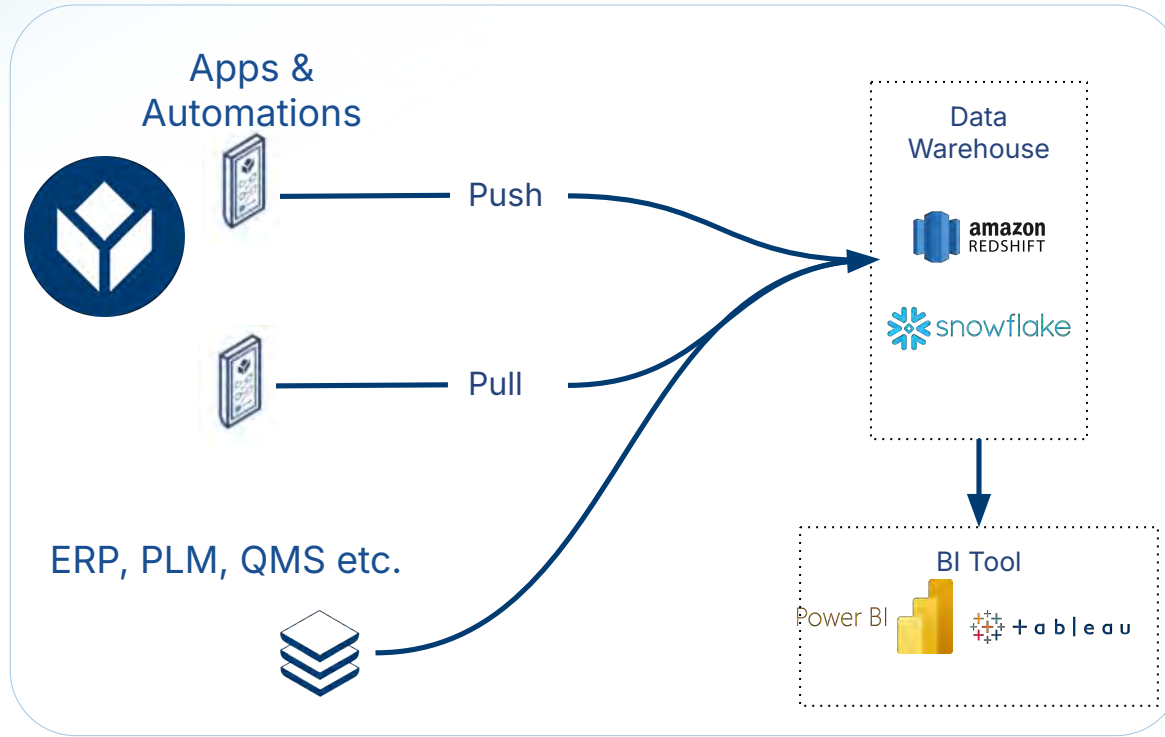
Method:

- Manually export CSVs

Pros/Cons:

- Static, Manual Analytics
- Best for Ad-Hoc Reporting
- Lots of hoops, downloads, and pivot tables

Enterprise Visualization | Point to Point



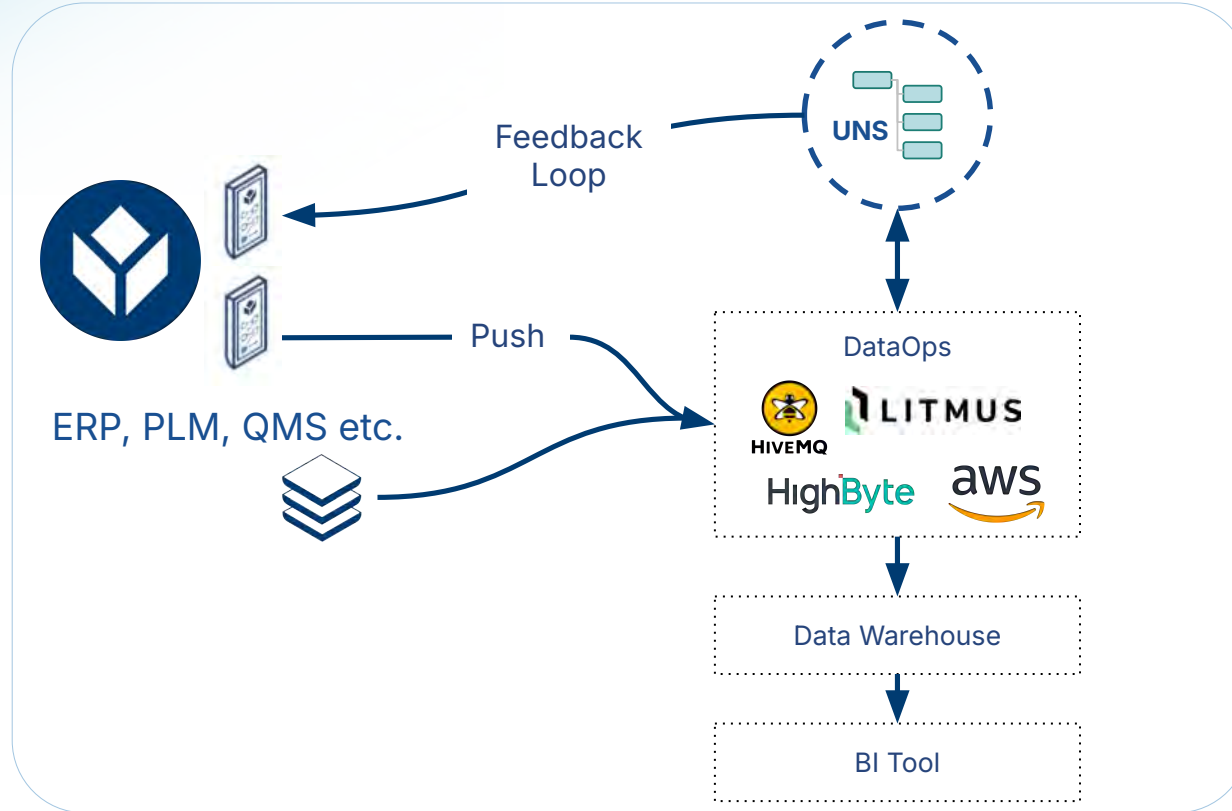
Methods:

1. **Tulip-Driven Extraction** – Push data via Apps or Automations through Connectors (API/SQL)
2. **External Service-Driven Extraction** – leveraging Tulip's API

Pros/Cons:

- Enterprise-Level Dashboard
- Harder to send Aggregated insights back to Tulip

Enterprise Visualization | Hub & Spoke



Methods:

Tulip-Driven Extraction – Push data via Apps or Automations to Message Broker via MQTT Connector

And

UNS-Driven Insights – Push data back into Tulip via Message Broker

Pros/Cons:

- Streamlined access to BI tools
- Alerting and notifications back to Tulip

Wrap-Up



Tulip Applications (Data Collection)



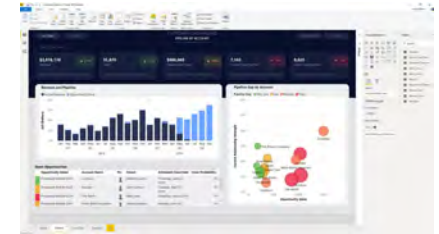
Real Time Dashboards



Shop Floor Process



Enterprise Level Visualization



Process Optimization

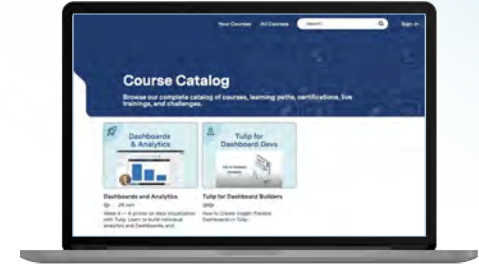
Key Takeaways

1. A strong data structure is the **foundation**
2. Dashboards are not reports - they are a real-time **communication interface**
3. Design with the **persona in mind**
4. Insights should drive **action**

Resources

Library

- [Dashboard Layout UI Template](#)



University

- [Tulip for Dashboard Builders](#)
- [Dashboards and Analytics Course](#)



QUESTIONS?



TULIP

THANK YOU