Improving Manufacturing Intelligence Through Digitally Connected Operations

SAP Leonardo Conference
Chicago, IL | November 2-3, 2017

KENNAMETAL

NTT DATA

Introductions

Stefano Pandini (Sr. Manager, Business and System Integration, Kennametal)

Description: During the past 29 years, Stefano Pandini has been focused on delivering ERP solutions, with an emphasis on SAP implementation throughout the past 17 years. During this time Stefano has served in multiple roles from project manager and process lead to subject matter expert across different business areas, including marketing to supply chain. His current role is business and system integration with a focus on end to end processes.

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Barry Weaverling (Sr. IT Business Solutions Analyst, Kennametal)

Description: During the past 23 years, Barry Weaverling has been focused on delivery ERP solutions, with an emphasis on the SAP Production Planning and Quality Management modules along with supporting the North American shop floor system. During this time Barry has served in multiple roles from support to SAP implementations. His current role is business solutions analyst with a focus on the application processes.

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Jay Monahan (Senior Director – ERP Manufacturing Portfolio – SAP)

Description: or over 20 years, Jay Monahan has focused on designing, delivering and managing software solutions from the ERP to the Shop Floor. During this time, Jay has served as a practice lead, project manager and subject matter expert across both process and discrete industries. Current role is to support the NTT SAP ERP manufacturing portfolio through strategic alignment with our customers and SAP, to maintain and expand our existing offerings.

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About Kennametal

Global leader in tooling & wear resistant solutions

Kennametal delivers **productivity to customers** seeking peak performance, by providing **innovation wear-resistant solutions,** enabled through our **advanced materials science, application knowledge,** and commitment to a **sustainable environment.**

Video

At a glance

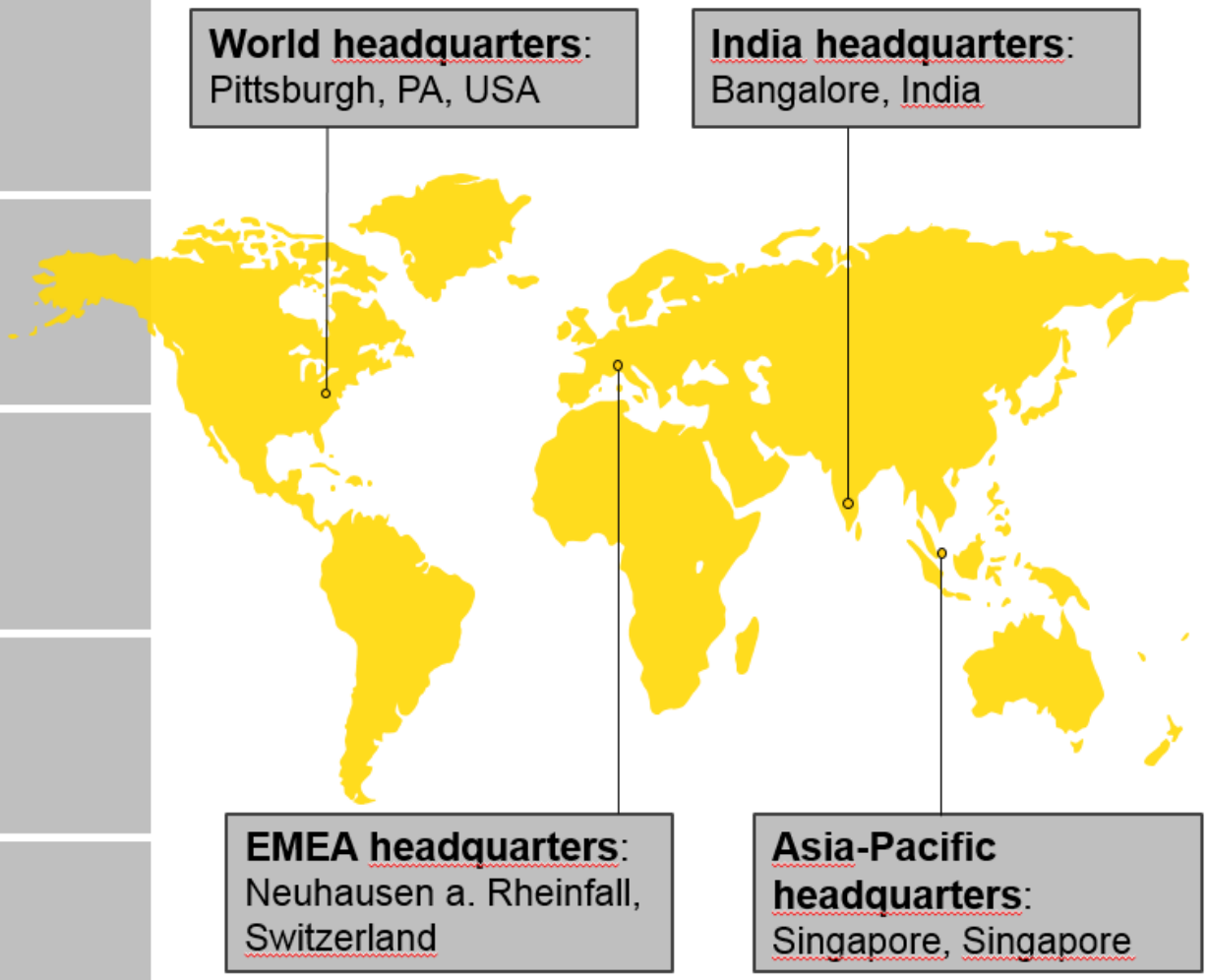
11,000
EMPLOYEES

$2.1 BILLION
IN REVENUES

80,000
CUSTOMERS

>60
COUNTRIES

1,500
ACTIVE PATENTS



Three newly-defined Business Segments

INDUSTRIAL

Kennametal Tooling and Metalworking Services

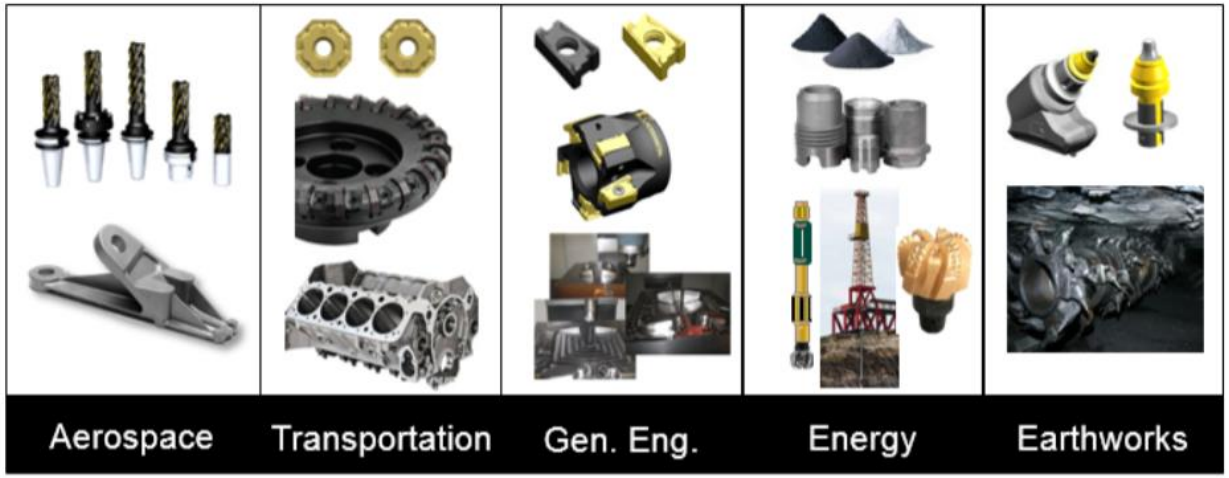
INFRASTRUCTURE

Engineered Products, Precision Surface Management and Life Extension Solutions

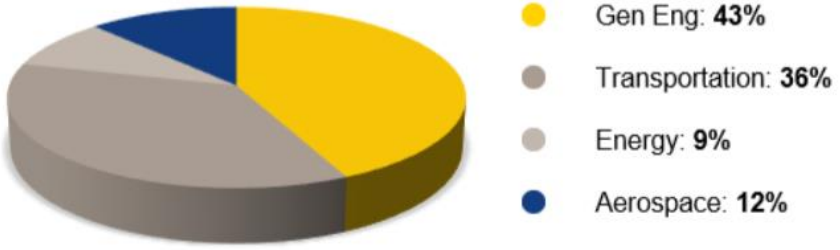
WIDIA

WIDIA Products Group

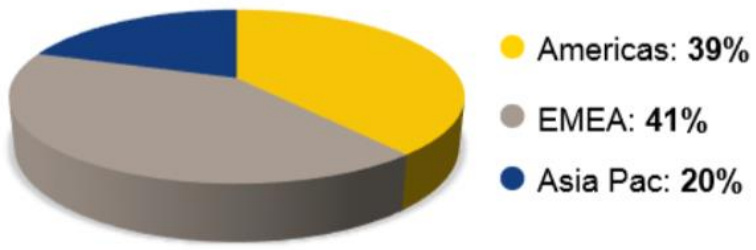
Focusing on core end markets to grow organically around the globe



Sales by End Markets

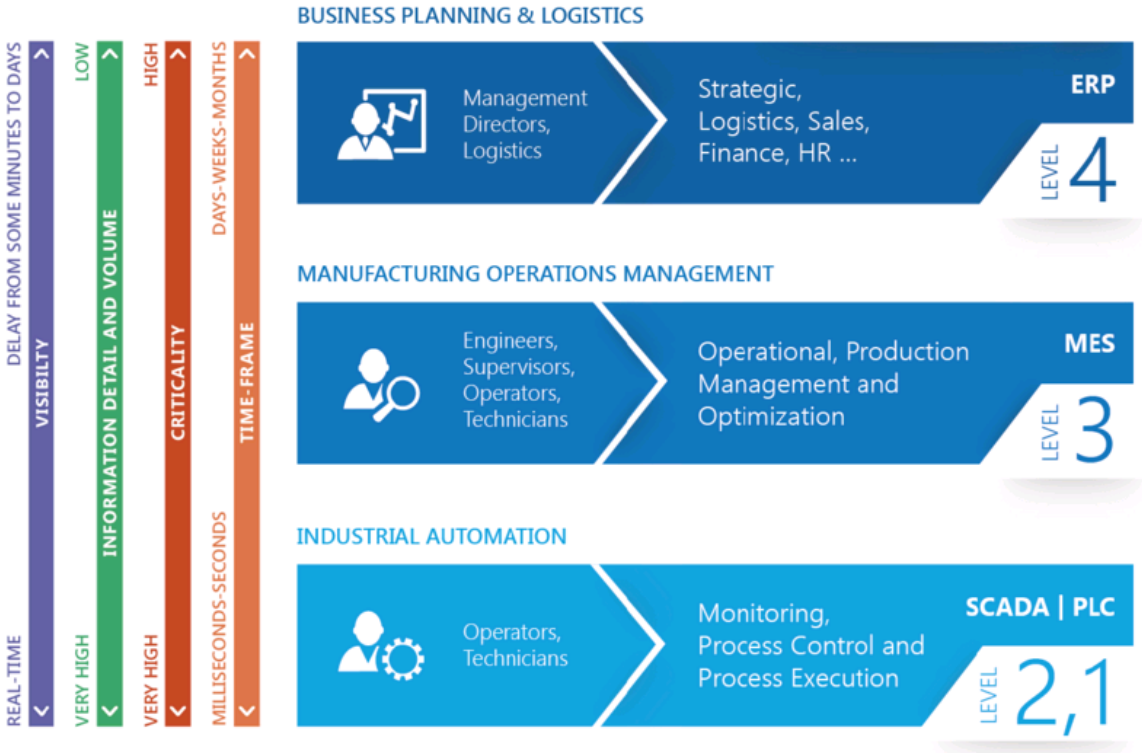


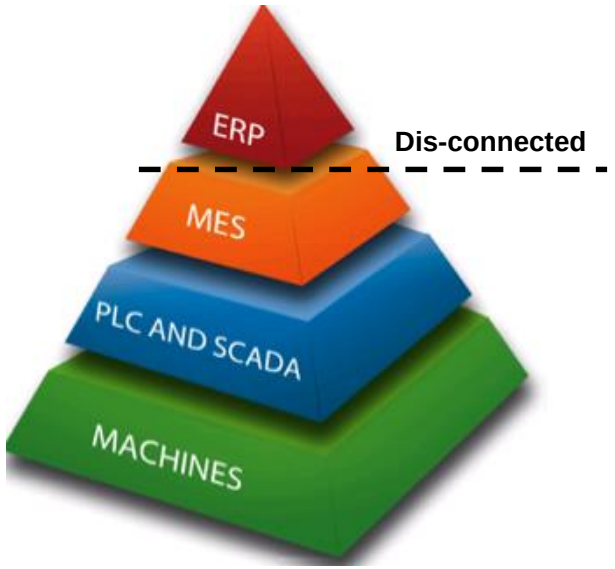
Sales by Geography



Why did we look at SAP MII?

There has been an increasing demand for closing the loop on disconnected shop floor processes and we searched the marked for Manufacturing Operations Management applications. We found that the strongest synergy was within SAP MII as we are running a global SAP ERP platform. To compete in next generation of manufacturing, we need to empower our shop-floor.





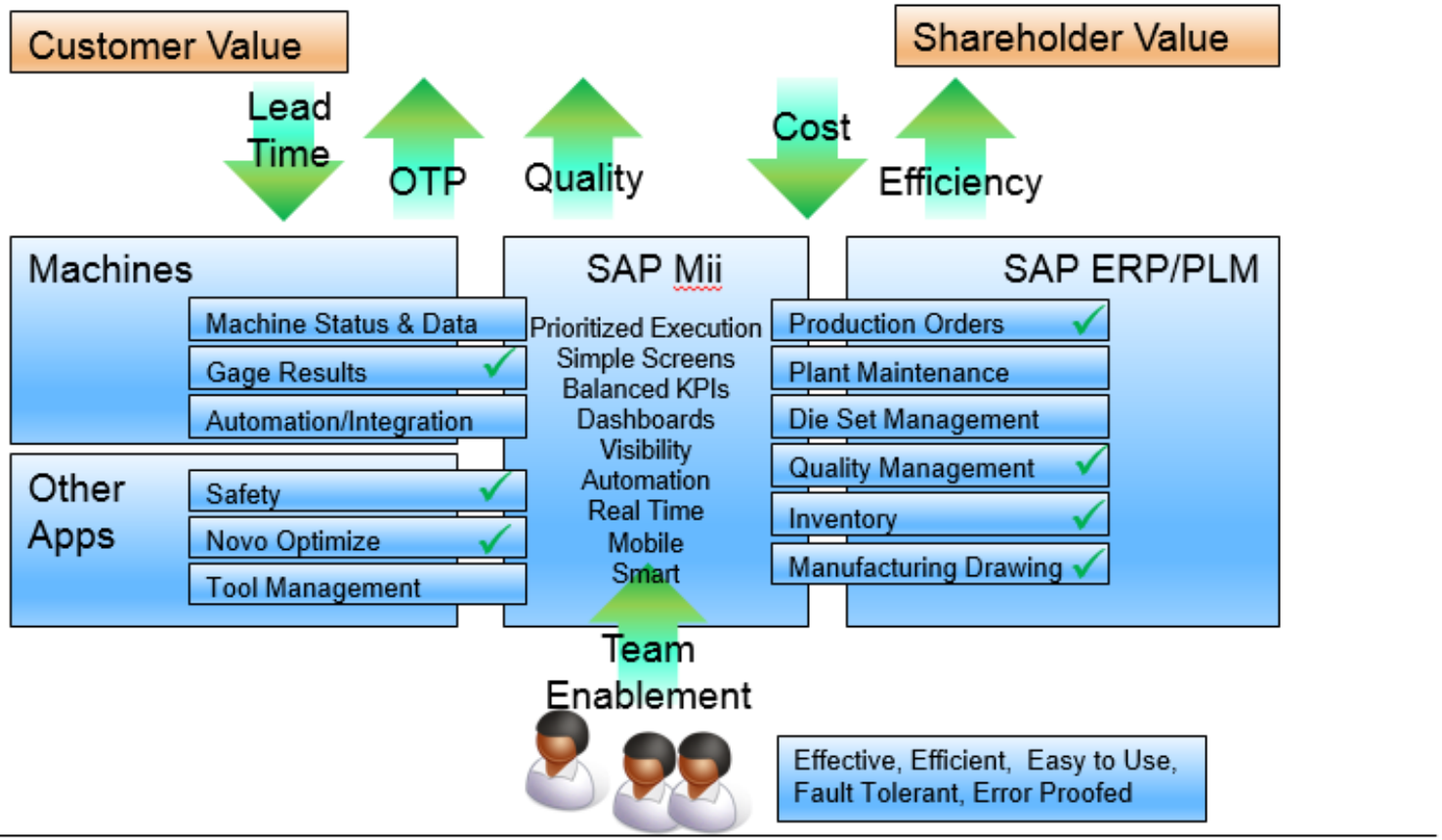
Business Challenges

- The plant has various shop floor data collection systems that are outdated.
- Real Time visibility of people, material, and machines.
- Supervisors have to spend more time on computers than on the floor.
- Prioritizing orders at machine level based on changing requirements.
- PLM data is not easily accessible from shop-floor.
- Performance feedback doesn’t exist.
- Multiple digital solutions but disconnected.
- Cell Dashboards either not present or manually updated.
- Data Quality reported to ECC is not the best.
- Operators don’t have all information and tools before setup.
- Machine integration/automations

Project Life

Project Background	Phase 1: Scope	Phase 2 :Scope	Phase 3 : Scope - Current
• NTT first introduced into Kennametal in 2014. • Initial project began in 2015 for shop floor strategy. • Implemented at first plant in December 2015. • Rolled out the solution to 2 more plants in 2016. • Phase 2, approved in May 2016, focused on further enhancements and deployments.	• Leverage SAP MII as primary operator interface for shop floor data registration and interface to SAP ECC system. • Deploy SAP MII at Pilot plant in Solon, Ohio. • Original Estimated Timeframe: 16 weeks. • Rolled out SAP MII solution to two more plants.	• Deploy SAP MII solution to additional 5 locations • Enhance SAP MII solution with few additional enhancements to improve data quality and optimize some screens help the operator	• Continue to deploy the solution to additional 17 sites • Develop additional functionality to manage and schedule the load of our batch processes • Manage Confirmation in SAP MII • Machine integration & OEE • Preparing phase 4 to complete the deployment to all sites and continue Machine integration

Kennametal Vision

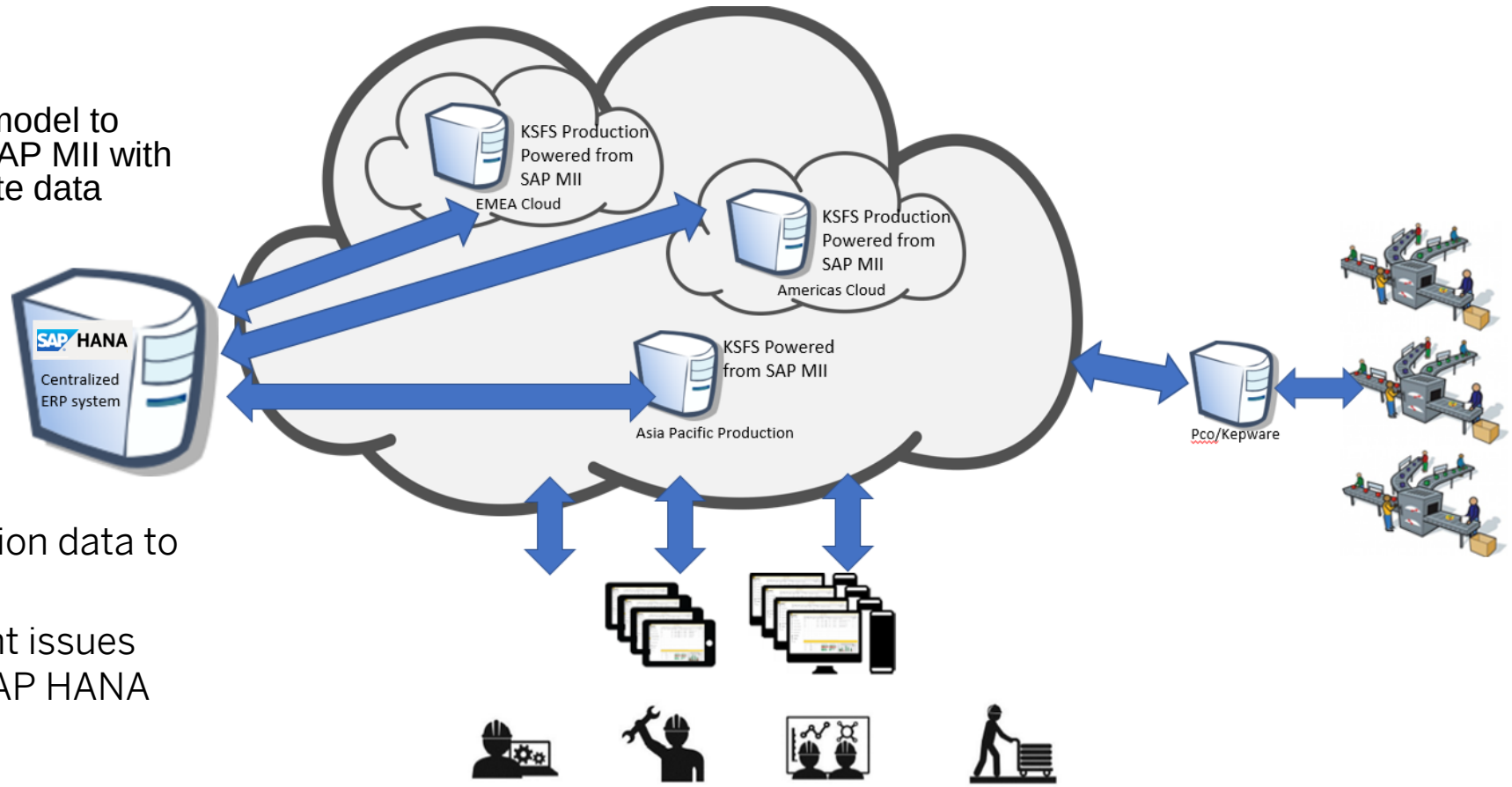


We've Covered the Basics, Let's Move the Needle

System Architecture

SAP HANA:

Big data model to support SAP MII with appropriate data



SAP MII:

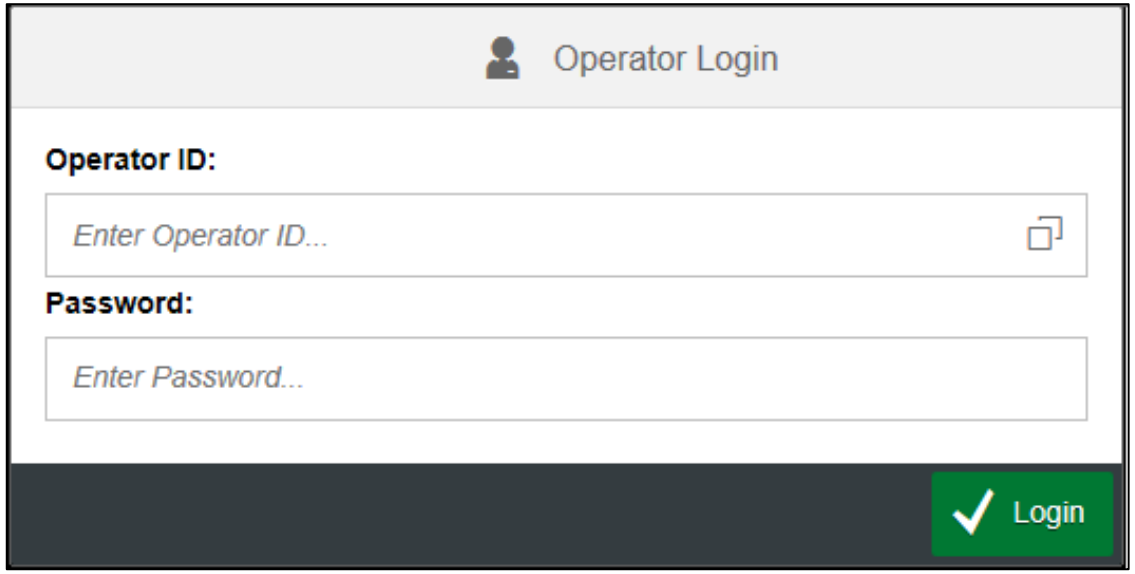
- Send Confirmation data to SAP HANA
- Send component issues movement to SAP HANA
- OEE

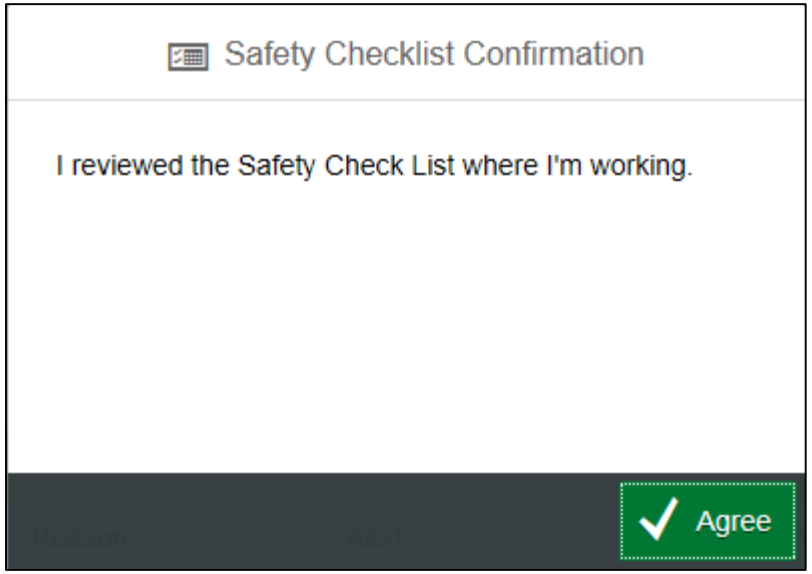
Key Strategy: Invest in the Network , Palo Alto security , re-cabling our plants

Current Functionality

- Operator Dashboard
  - Operator Login
  - Order Confirmations (Time Event Start/Stop, Normal, Collective)
  - Order Overview (Header, Operations, Documents, Inspection Lots)
  - Component Issue
  - Indirect Labor
  - Request Help
  - Drawing access
  - Quality management
  - Mark pack machine integration
- Supervisor Dashboard
  - Work Center level alerts
  - Resolve help
  - Manage Confirmations
- Cell Dashboard
  - Daily OEE
  - Actual vs Target
  - Schedule Adherence
  - Work In Progress

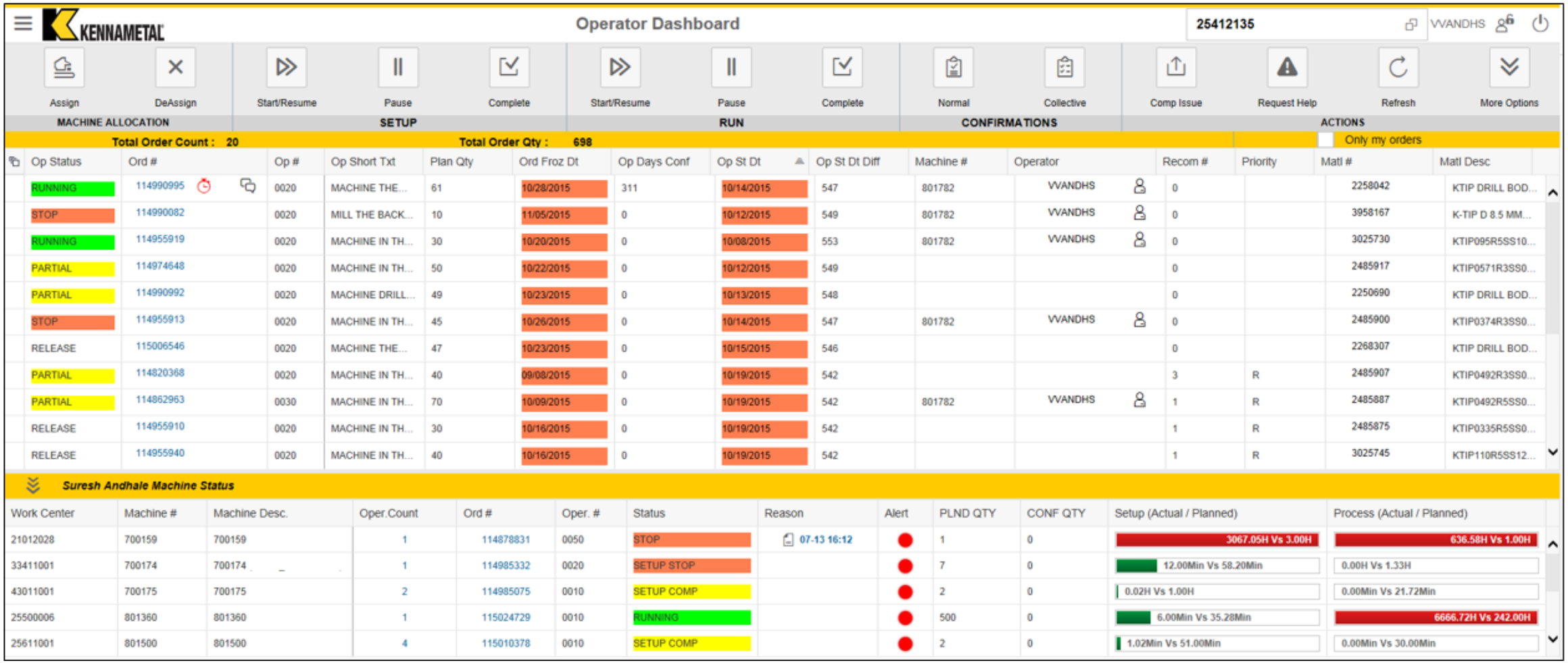
Operator Login





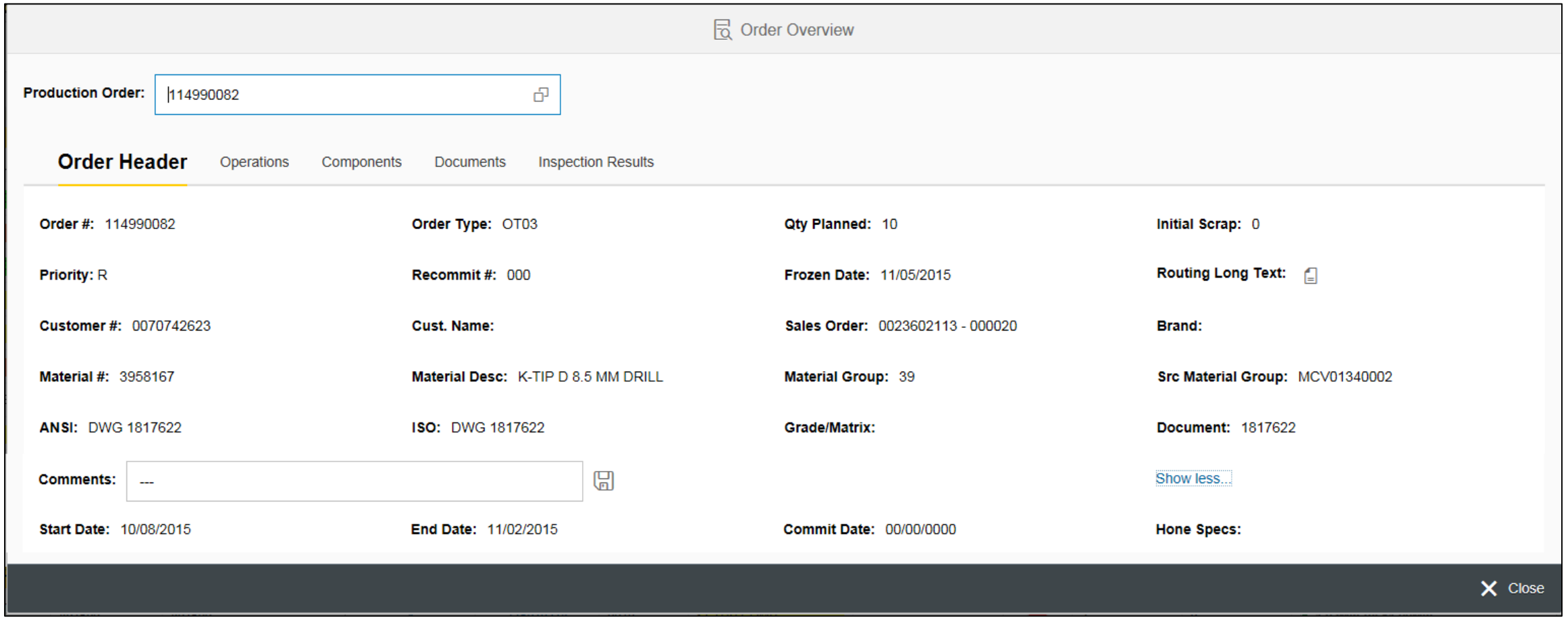
- Standard NetWeaver Login.
- Crew Primary User Logs then subsequent users are logged in to allow multiple user working for one PC.
- Safety check list check is performed every 20 hours by plant/employee.

Operator Dashboard



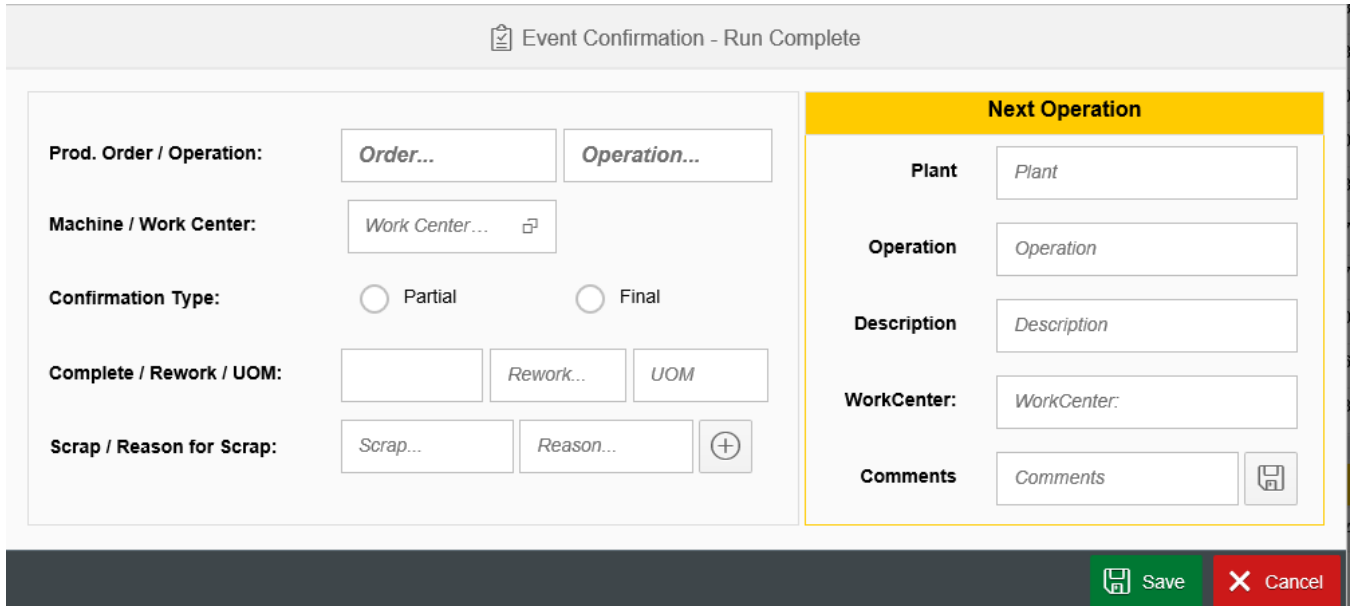
- Order Load List which is pre-sorted based on configurations possible at Plant/ WorkCentre level.
- Machine Summary: Show orders users is working on; Actual vs Planned time graphs.
- Start/Pause/Complete Order, Additional Functionality: Component Issue, Order Overview, Add Comments.

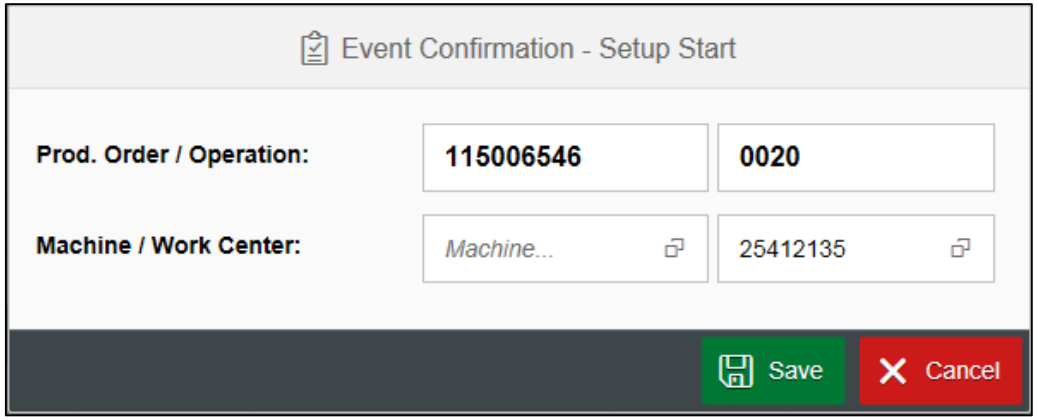
Order Overview

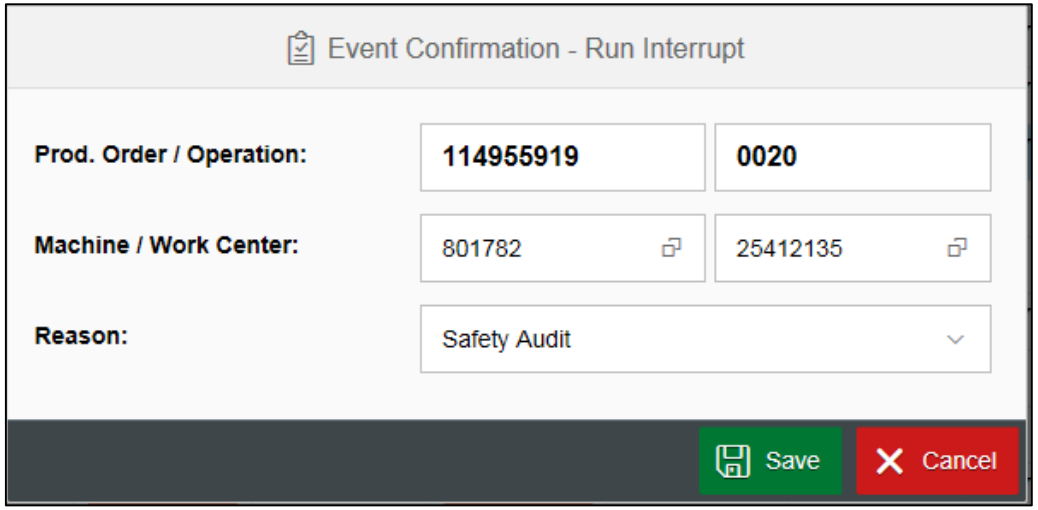


- Order header level details; add/update order level comments which will be visible on dashboard.
- Check all the operation status details.
- View associated documents & perform inspection result related tasks.

Time Event Confirmation

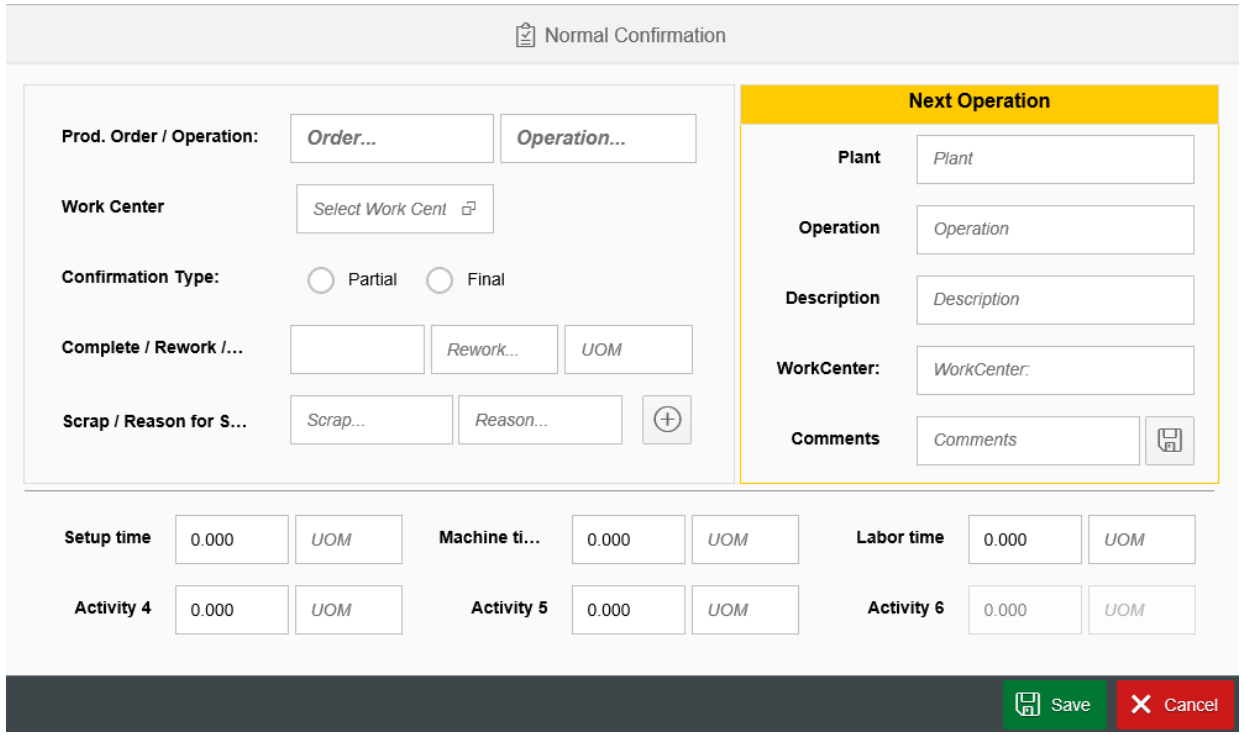






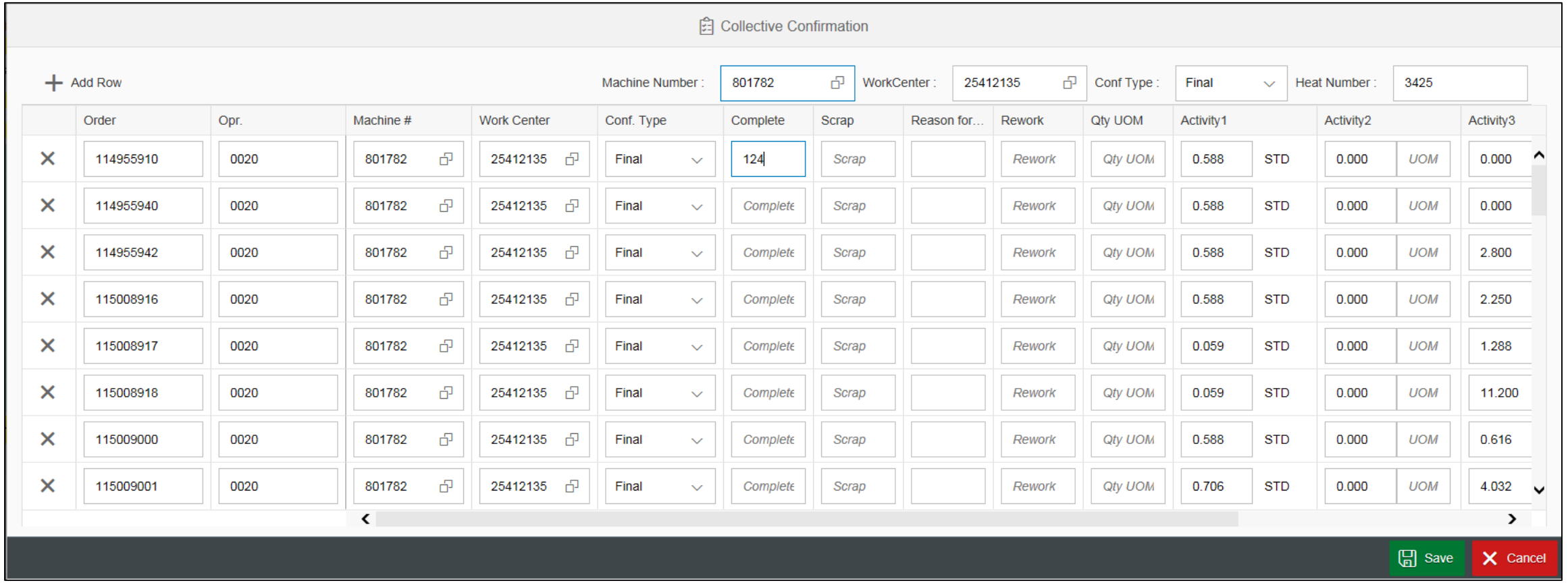
- Possible Time Events:
  - Setup: Start, Pause, Partial Complete or Complete.
  - Run/Process: Start, Pause, Partial Complete or Complete.
- Report completed quantities with rework or any scrap with reason codes.

Normal Confirmation



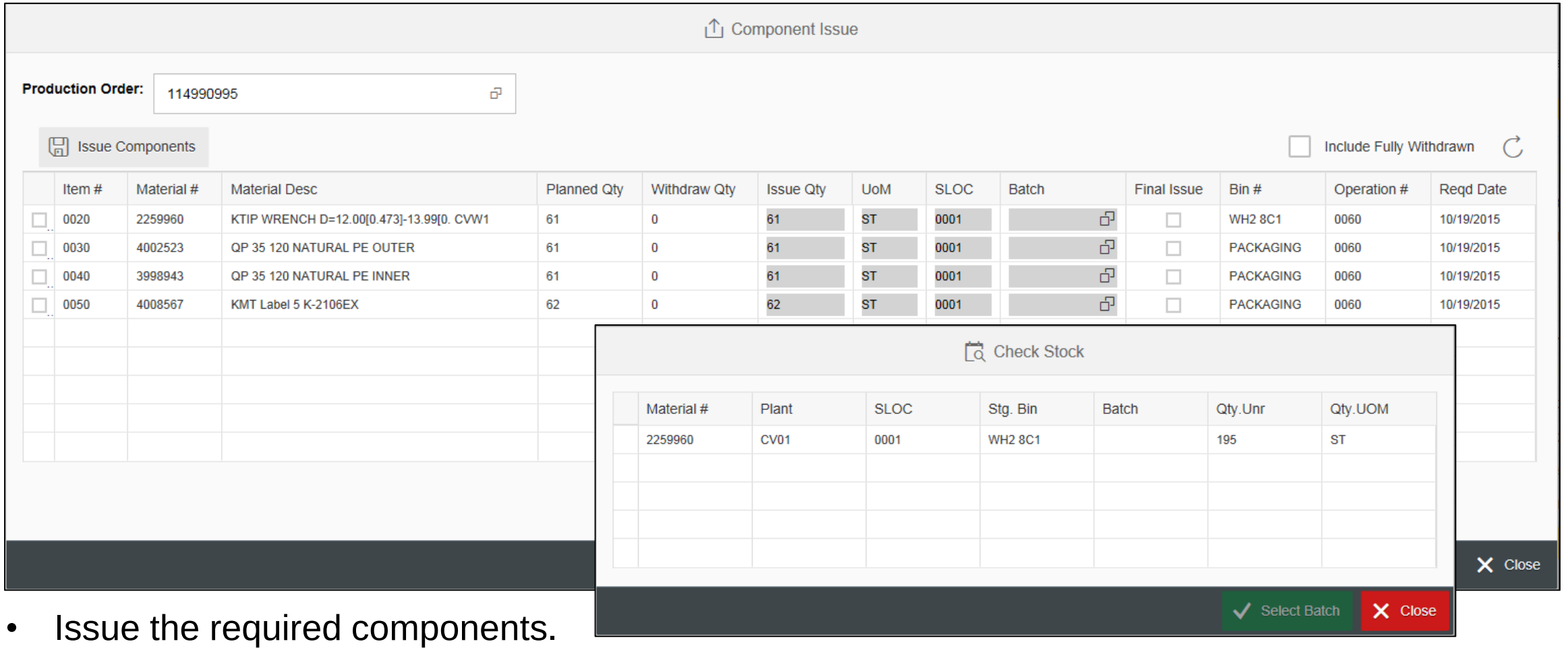
- User can select order from list or can directly click [Normal confirmation] button to start the normal confirmation.
- Report completed quantities with rework or any scrap with reason codes.
- Report data for required activity types (e.g. Setup, machine, labor etc.).
- User can see what is the next operation and work center

Collective Confirmation



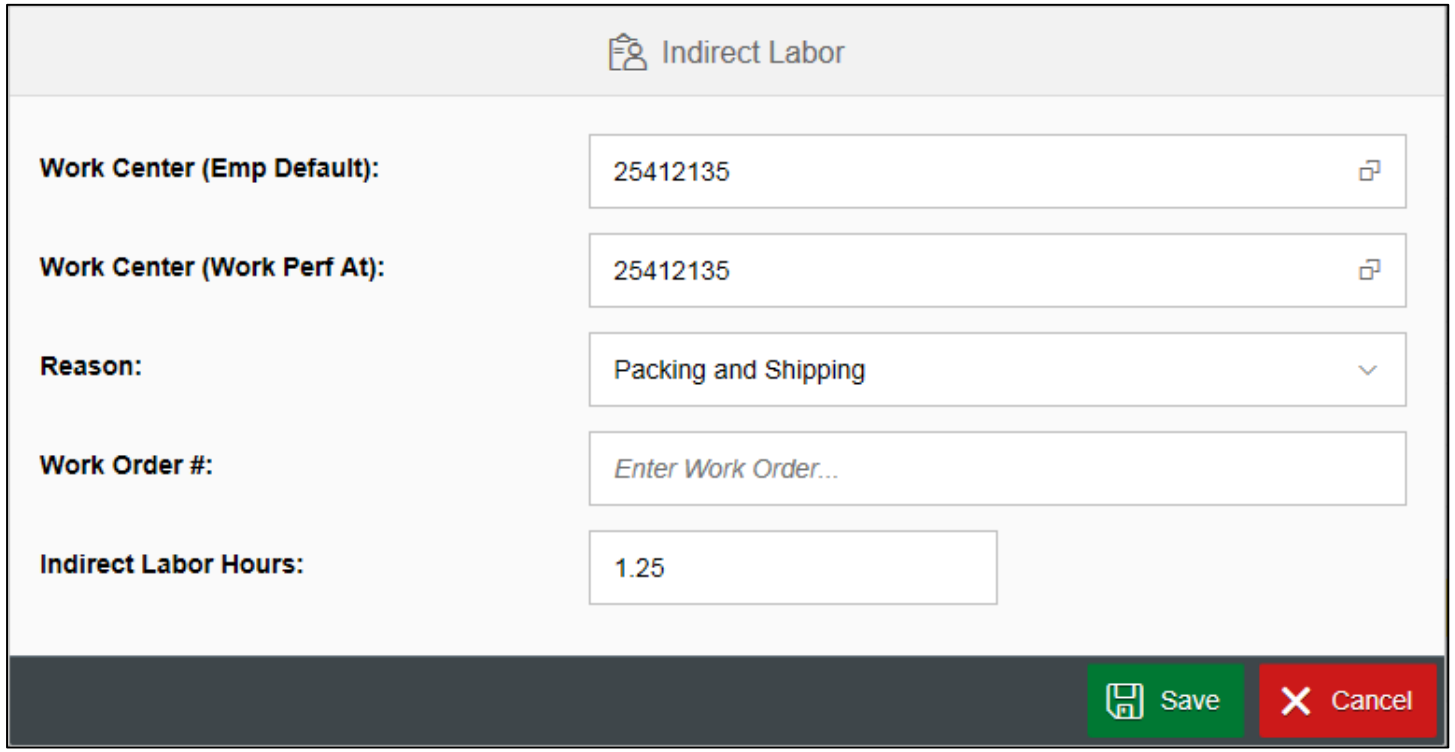
- Mainly used by Work Centers who run multiple orders at a same time e.g. Heat Treatment.
- Select multiple Production Orders from the list (press and hold the Shift key while selecting orders) alternatively scan order operation which will pull the default order details.
- Fill out details (partial, scrap, rework, reason for variation etc.), Machine/Furnace number, Conf. type : Final or Partial

Component Issue



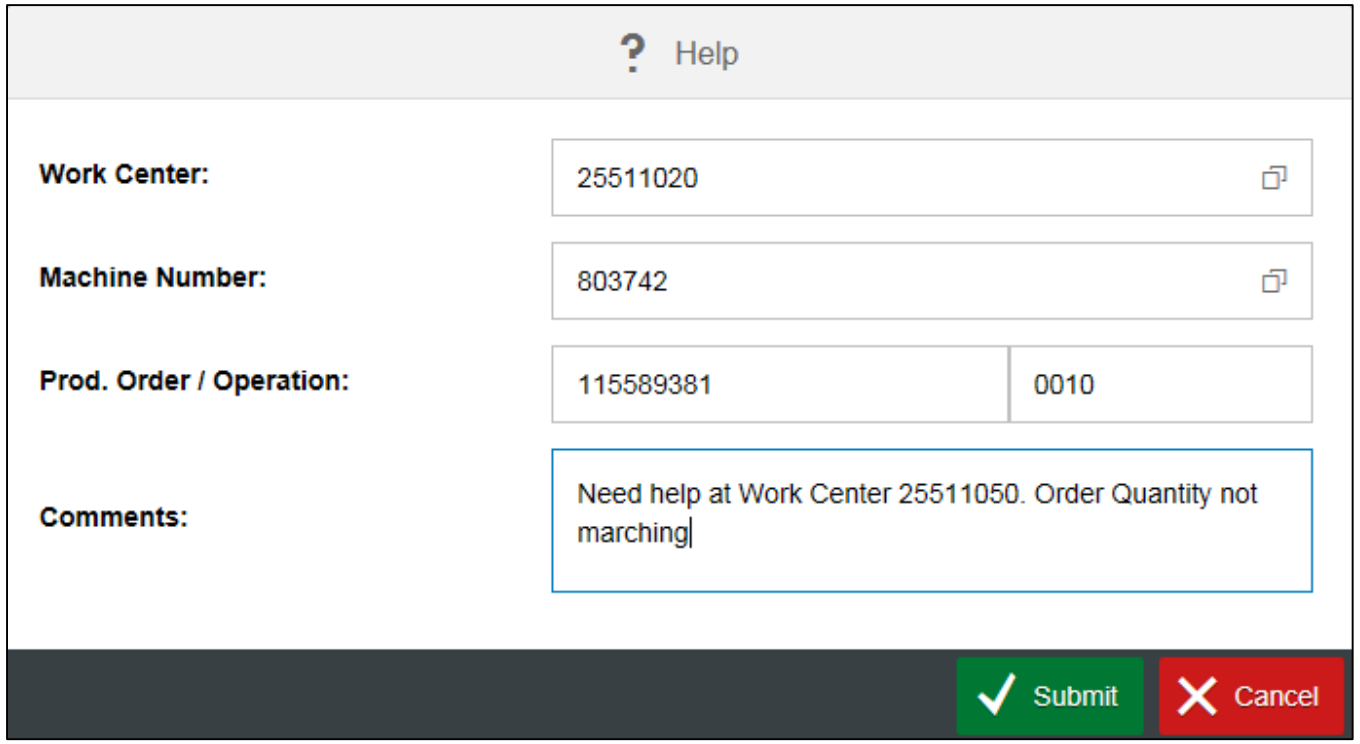
- Issue the required components.
- Enter Issue Quantity, Storage Location and Batch.
- Check the Stock.

Indirect Labor



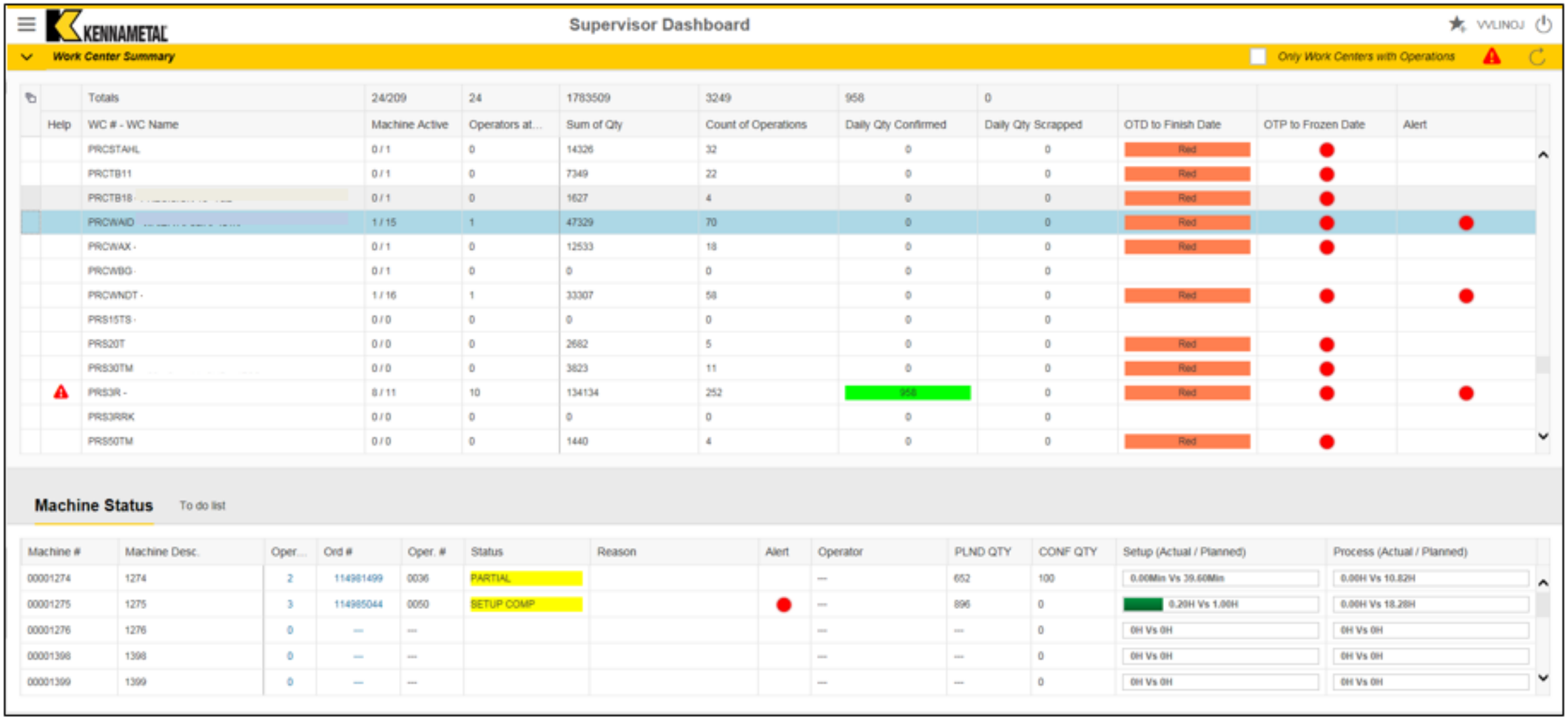
- Select Indirect Labor and fill out details (Reason, Work Order #, Hours).

Request Help



- To request HELP, click on “Request Help” icon.
- User can enter Machine number and Production Order number - both are optional.
- Supervisor will see the help notification on his or her dashboard.

Supervisor Dashboard



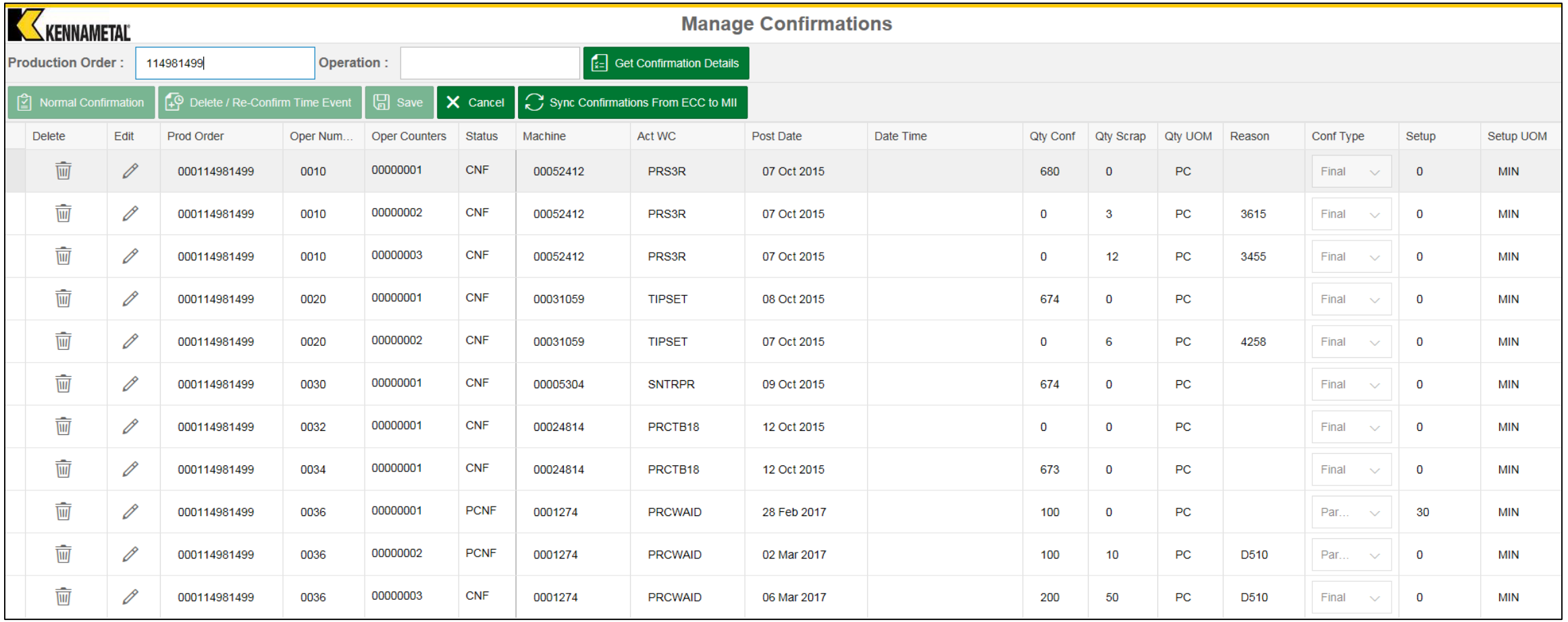
		Totals	24/209	24	1783509	3249	958	0			
	Help	WC # - WC Name	Machine Active	Operators at...	Sum of Qty	Count of Operations	Daily Qty Confirmed	Daily Qty Scrapped	OTD to Finish Date	OTP to Frozen Date	Alert
		PRCSTAHL	0 / 1	0	14326	32	0	0	Red		
		PRCTB11	0 / 1	0	7349	22	0	0	Red		
		PRCTB18	0 / 1	0	1627	4	0	0	Red		
		PRCWAID	1 / 15	1	47329	70	0	0	Red		
		PRCWAX	0 / 1	0	12533	18	0	0	Red		
		PRCWBG	0 / 1	0	0	0	0	0			
		PRCWNDT	1 / 16	1	33307	58	0	0	Red		
		PRS15TS	0 / 0	0	0	0	0	0			
		PRS20T	0 / 0	0	2682	5	0	0	Red		
		PRS30TM	0 / 0	0	3823	11	0	0	Red		
	⚠	PRS3R	8 / 11	10	134134	252	958	0	Red		
		PRS3RRK	0 / 0	0	0	0	0	0			
		PRS50TM	0 / 0	0	1440	4	0	0	Red		

Machine #	Machine Desc.	Oper...	Ord #	Oper. #	Status	Reason	Alert	Operator	PLND QTY	CONF QTY	Setup (Actual / Planned)	Process (Actual / Planned)
00001274	1274	2	114981499	0030	PARTIAL			---	652	100	0.00Min Vs 39.60Min	0.00H Vs 10.82H
00001275	1275	3	114985044	0050	SETUP COMP		●	---	896	0	0.20H Vs 1.00H	0.00H Vs 18.28H
00001276	1276	0	---	---				---	---	0	0H Vs 0H	0H Vs 0H
00001398	1398	0	---	---				---	---	0	0H Vs 0H	0H Vs 0H
00001399	1399	0	---	---				---	---	0	0H Vs 0H	0H Vs 0H

Supervisor Dashboard

- Summary view of all WorkCentre (or list of favorite work centers).
- If help icon is present in first column that means someone requested help.
- Once the issue is resolved, please click resolve and enter resolution text. This will also close the requested help.
- Alert based on current status of the order.
  - If setup for any production order in that work center takes 120%+ of routing time.
  - If run for any production order in that work center takes 120%+ of routing time.
  - If the setup or run is in pause state for more than 30 minutes.
  - If there is a delay of more than 30 minutes between Setup complete and Run Start.
- To know more details about the work center alert, please select the work center and review information in Machine Status and To-Do List to see the reason of alert.

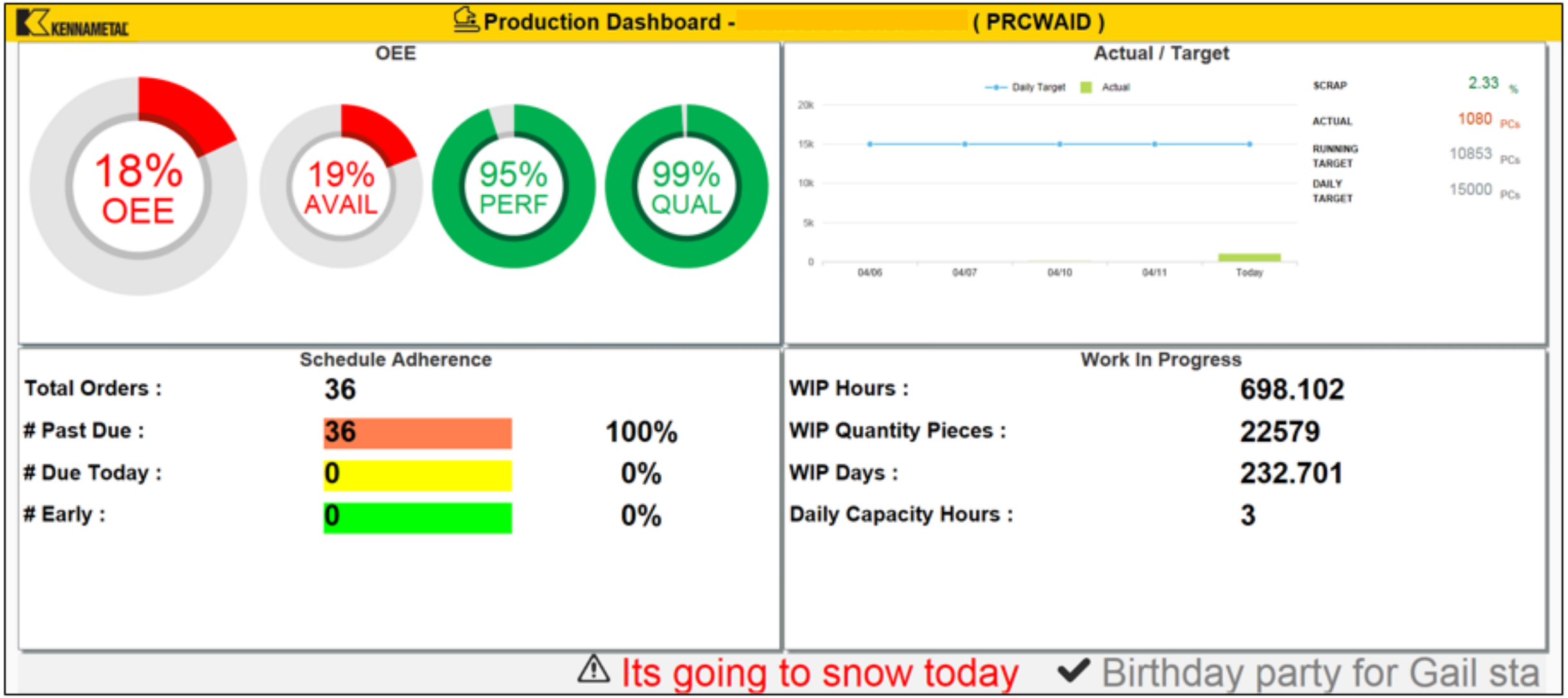
Manage Confirmations



Delete	Edit	Prod Order	Oper Num...	Oper Counters	Status	Machine	Act WC	Post Date	Date Time	Qty Conf	Qty Scrap	Qty UOM	Reason	Conf Type	Setup	Setup UOM
		000114981499	0010	00000001	CNF	00052412	PRS3R	07 Oct 2015		680	0	PC		Final	0	MIN
		000114981499	0010	00000002	CNF	00052412	PRS3R	07 Oct 2015		0	3	PC	3615	Final	0	MIN
		000114981499	0010	00000003	CNF	00052412	PRS3R	07 Oct 2015		0	12	PC	3455	Final	0	MIN
		000114981499	0020	00000001	CNF	00031059	TIPSET	08 Oct 2015		674	0	PC		Final	0	MIN
		000114981499	0020	00000002	CNF	00031059	TIPSET	07 Oct 2015		0	6	PC	4258	Final	0	MIN
		000114981499	0030	00000001	CNF	00005304	SNTRPR	09 Oct 2015		674	0	PC		Final	0	MIN
		000114981499	0032	00000001	CNF	00024814	PRCTB18	12 Oct 2015		0	0	PC		Final	0	MIN
		000114981499	0034	00000001	CNF	00024814	PRCTB18	12 Oct 2015		673	0	PC		Final	0	MIN
		000114981499	0036	00000001	PCNF	0001274	PRCWAID	28 Feb 2017		100	0	PC		Par...	30	MIN
		000114981499	0036	00000002	PCNF	0001274	PRCWAID	02 Mar 2017		100	10	PC	D510	Par...	0	MIN
		000114981499	0036	00000003	CNF	0001274	PRCWAID	06 Mar 2017		200	50	PC	D510	Final	0	MIN

- Manager (Delete, Add) confirmation directly in SAP
- Used by Supervisors to correct the bad data entered by Operator or to correct the confirmation entered by mistake

Work Center Dashboard



Work Center Dashboard

- Displayed on the overhead monitor in a cell or work center
- OEE Dashboard
  - Availability : Based on data using PCo Interface when machine is connected. If machine not connected based on the confirmations done by the operators.
  - Quality : Based on Good Quantity vs Scrap Quantity produced. It is not based on time lost due to scrap quantity.
  - Performance : The standard time is in the operation level in the routing. The standard machine activity (ACTIVITY02) time will be used.
- Actual vs Target
  - Last 5 day actual quantity vs target quantity for the work center
- Schedule Adherence
- Work in Progress
- Notification Banner

Future Plans (Short Term)

- Operator Dashboard
  - Collective Confirmation for Sintering , PVD work center - Put the results directly in SAP QM - Inspection Plans.
  - Collective Confirmation Bus (list of order/operation).
- OEE Dashboard
  - Plant, Work Center and Machine level OEE based on the date range.
  - Scrap quantity by Work Center, machine and operator.
  - Top scrap reasons by work center, machine and operator.
  - Integration with machine using MTConnect, OPC and PCo 15.1 for availability calculations.
- Work Center Group/ Tree Structure
  - Work Center Tree - Group, Sub group, work center's in tree with summarize data.

- Machine integration
  - Deploy more machine integration to reduce unnecessary time spent from the operator
  - Leverage more automation and machine optimization
  - Mark/Pack machine Integration
    - Integrate Automatic mark pack machine with SAP using SAP MII.
    - Sent the production order details to Mark/Pack machine
    - Interface the data read from the machines to SAP QA for specific tags.
- Rollout of current solution to the plants in Europe and replace the legacy system

Future Plans (Long Term)

- Top 2 Bottom integration
  - End to End optimization of product flow, automation and machine Integration.
- Scheduling/Sequences
  - In ERP (front end scheduling) to automatically schedule 80% of the orders.
  - Capacity, scheduling
  - Sequencing at machine level
    - Better tool management.
    - SPC control using SAP or another tool.

Benefits & Lessons Learned

- **Benefits:**
  - Real time performance and goal achievement visibility
  - Improved Actual time recording enabled optimized product costing processes
  - User friendly / easy to learn for shop floor operators.
  - Eliminated Interface errors through Real time integration with ERP.
  - Component Consumptions and Quantity confirmations as they happen.
  - Improved financial overview of production operation.
  - Improved data enabled detailed reporting and metrics of factory performance
  - Supervisor more on the floor (mobile devices).

- **Lessons Learned:**
  - SAP MII is just a system. To move any needle power users have to work by work center with operators, supervisors and lean methods
  - Initial priority on “User Adoption” is ok but shift focus to “Move the Needle” on business outcome.
  - Installation/configuration of local hardware setup to support existing shop floor footprint.
  - Scope discussions exploded once the real potential was understood by stakeholders and group governance.
  - We can actually run agile project mode faster then anticipated, we did from zero to go-live in 4 months.
  - Good Key User framework (SAP MII and SUITE on HANA) critical for success.