

OpenI40

OPEN SOURCE INDUSTRY 4.0

Concepts & Technology overview

What are OpenI40 project & software?

- Is an Open Source Industry 4.0 Advanced Production Planning Software.
 - The mission is to complete a common open source platform basis for I4.0 projects having an Advanced Production Scheduler (APS) easy to integrate to every Manufacturing Execution System (MES) software or Enterprise resource planning (ERP) software.
 - The APS is in alpha version, manages and displays floor equipment, machines, production resources, employees, materials detailed production tasks plans.
 - The platform is configurable, extensible and will be completely documented.

APS features – 1/4 internal MRP

- OpenI40 has an internal management resource planning (MRP)
 - Manages products/production cycles, phases, bill of materials
 - Manages production resources: complete companies/plants/departments/warehouses/work centers/machines and secondary resources (employees, other equipments) data model and management.
 - Manages purchase/sales/working/transfer orders
 - Can create work orders and working tasks from sales order lines and production cycles informations.
 - Manages tasks and work orders relations.
 - Manages material and missing material according to basic needs algorithms or with level of reorder algorithm.
 - Can create missing purchase orders and work orders.

APS features – 2/4 internal APS Engine

- The internal scheduling system supports:
 - Forward and backward scheduling (also mixed)
 - Infinite/finite capacity scheduling.
 - Various kind of supplier/consumer tasks time alignment due to material transfer strategies.
 - Complex per “ machine “ and per “secondary resource” calendar allocations.
 - Complex machines/secondary resources setup and work configurations with coherent timeline calculations.
 - Setup time calculations with optional changeover matrix configuration.
 - Work time calculation with various logics (also customizable).
 - Timeline and gantt calculation according to various optimizations options.

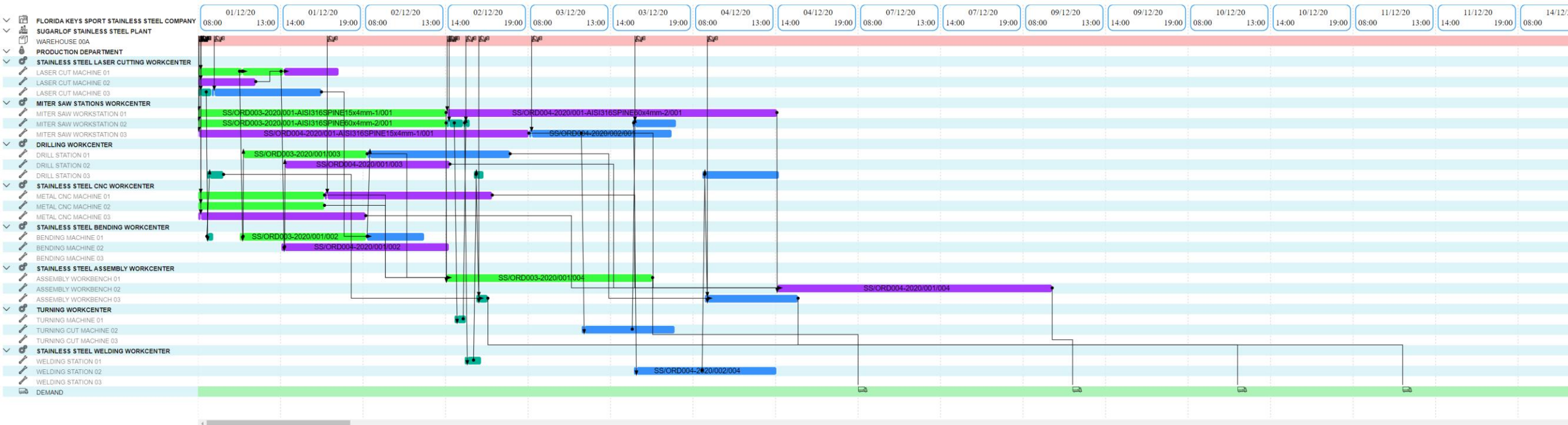
APS features – 3/4 integration layers

- The APS has multiple layers of integration:
 - A native database interface layer for standalone installations (compatible with all commercial and non commercial databases).
 - A REST interface layer to directly load and save to 3rd party systems.
 - A JSON format file loader layer.
 - Custom integration layers can be easily developed for custom purposes.

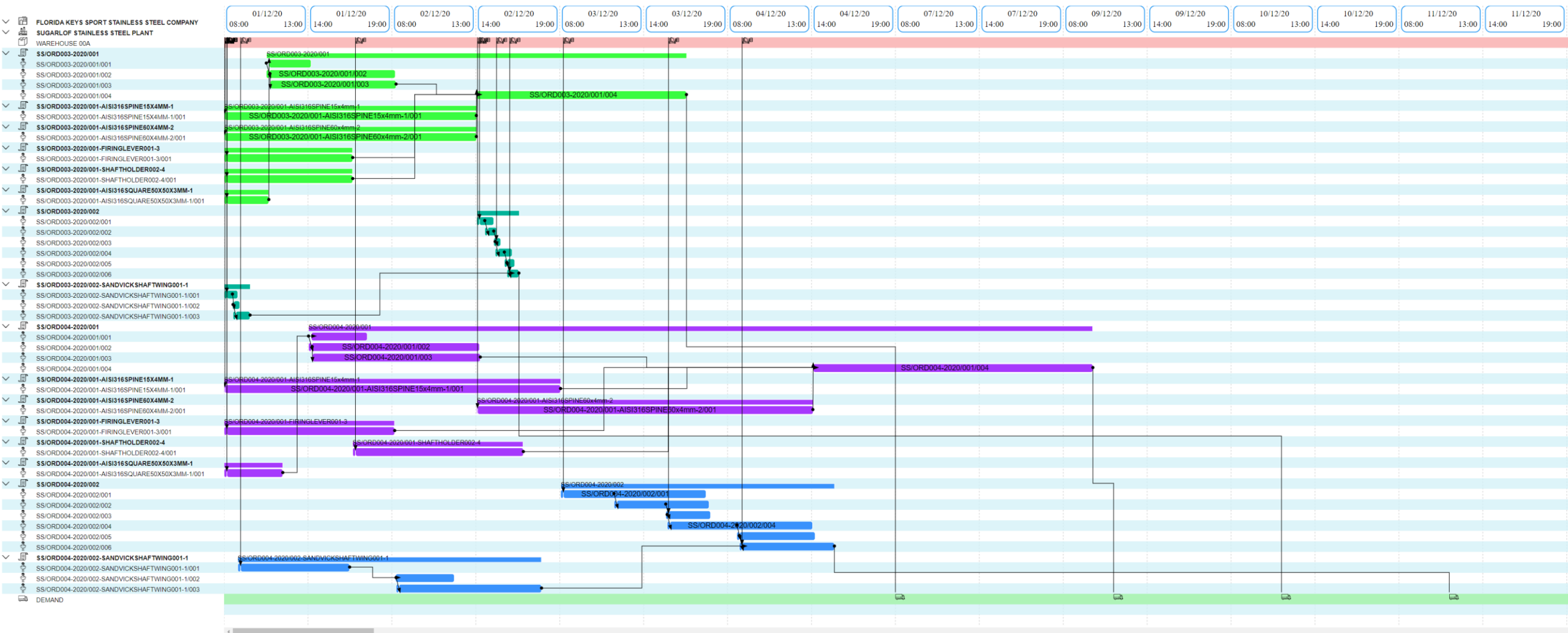
These layers options let OpenI4.0™ being suitable from standalone installations scaling up to a fully integrated tool inside a 3rd party software suite.

- The web gui of scheduling system supports:
 - Resources gantt
 - Work orders gantt
 - Resources loading/use graphics
 - In depth detail of each tasks with its material/cycle/phase/bill of material infos.
 - Scheduling problems overview.
 - Scheduling configuration settings to mix multiple algorithms and options for work orders sets.

APS GUI features – Resources Gantt



APS GUI features – Orders Gantt



APS GUI features – Tasks list

code ↑↓	description ↑↓	work order ↑↓	sequence ↑↓	work center ↑↓	machine ↑↓	setup start ↑↓	setup end ↑↓	work start ↑↓	work end ↑↓
SS/ORD003-2020/001-001	Cutting 15x30mm window in SQUARE50x50x3mm	SS/ORD003-2020/001	001	SS-LASER-CUTTING-WKC	SS-LASERCUTMACHINE-01	12/1/20, 10:40 AM	12/1/20, 10:41 AM	12/1/20, 10:41 AM	12/1/20, 2:11 PM
SS/ORD003-2020/001-002	Bending piece to be 17x15x17 mm	SS/ORD003-2020/001	002	SS-BENDING-WKC	SS-BENDING-01	12/1/20, 10:31 AM	12/1/20, 10:42 AM	12/1/20, 10:42 AM	12/2/20, 8:12 AM
SS/ORD003-2020/001-003	4 drills of 4mm for spine insertions	SS/ORD003-2020/001	003	SS-DRILLING-WKC	SS-DRILLING-01	12/1/20, 10:44 AM	12/1/20, 10:45 AM	12/1/20, 10:45 AM	12/2/20, 8:15 AM
SS/ORD003-2020/001-004	Trigger mechanism assembly	SS/ORD003-2020/001	004	SS-ASSEMBLY-WKC	SS-ASSEMBLY-01	12/2/20, 2:02 PM	12/2/20, 2:03 PM	12/2/20, 2:03 PM	12/3/20, 4:33 PM
SS/ORD003-2020/001-AISI316SPINE15x4mm-1-001	Cutting AISI316SPINE15x4mm	SS/ORD003-2020/001-AISI316SPINE15x4mm-1	001	SS-MITER-SAW-WKC	SS-MITER-SAW-WKC-01	12/1/20, 8:00 AM	12/1/20, 8:03 AM	12/1/20, 8:03 AM	12/2/20, 2:03 PM
SS/ORD003-2020/001-AISI316SPINE60x4mm-2-001	Cutting AISI316SPINE60x4mm	SS/ORD003-2020/001-AISI316SPINE60x4mm-2	001	SS-MITER-SAW-WKC	SS-MITER-SAW-WKC-02	12/1/20, 8:00 AM	12/1/20, 8:03 AM	12/1/20, 8:03 AM	12/2/20, 2:03 PM
SS/ORD003-2020/001-FIRINGLEVER001-3-001	Cutting firing lever	SS/ORD003-2020/001-FIRINGLEVER001-3	001	SS-CNC-WKC	SS-CNC-01	12/1/20, 8:00 AM	12/1/20, 8:10 AM	12/1/20, 8:10 AM	12/1/20, 4:40 PM
SS/ORD003-2020/001-SHAFTHOLDER002-4-001	Shaping shaft holder	SS/ORD003-2020/001-SHAFTHOLDER002-4	001	SS-CNC-WKC	SS-CNC-02	12/1/20, 8:00 AM	12/1/20, 8:10 AM	12/1/20, 8:10 AM	12/1/20, 4:40 PM
SS/ORD003-2020/001-AISI316SQUARE50x50x3mm-1-001	Cutting square aisi316 piece 50x50x3 mm	SS/ORD003-2020/001-AISI316SQUARE50x50x3mm-1	001	SS-LASER-CUTTING-WKC	SS-LASERCUTMACHINE-01	12/1/20, 8:00 AM	12/1/20, 8:10 AM	12/1/20, 8:10 AM	12/1/20, 10:40 AM
SS/ORD003-2020/002-001	Trunkating SANDVIKROUND BAR1500x7mm for 130 cm length	SS/ORD003-2020/002	001	SS-MITER-SAW-WKC	SS-MITER-SAW-WKC-02	12/2/20, 2:03 PM	12/2/20, 2:13 PM	12/2/20, 2:13 PM	12/2/20, 3:04 PM
SS/ORD003-2020/002-002	Making sharp point	SS/ORD003-2020/002	002	SS-TURNING-WKC	SS-TURNING-WKC-01	12/2/20, 2:32 PM	12/2/20, 2:42 PM	12/2/20, 2:42 PM	12/2/20, 3:15 PM
SS/ORD003-2020/002-003	Cutting fins	SS/ORD003-2020/002	003	SS-MITER-SAW-WKC	SS-MITER-SAW-WKC-02	12/2/20, 3:04 PM	12/2/20, 3:14 PM	12/2/20, 3:14 PM	12/2/20, 3:29 PM
SS/ORD003-2020/002-004	Welding fins to raw shaft	SS/ORD003-2020/002	004	SS-WELDING-WKC	SS-WELDING-01	12/2/20, 3:09 PM	12/2/20, 3:19 PM	12/2/20, 3:19 PM	12/2/20, 4:10 PM
SS/ORD003-2020/002-005	Drilling line and blade holes	SS/ORD003-2020/002	005	SS-DRILLING-WKC	SS-DRILLING-03	12/2/20, 3:42 PM	12/2/20, 3:52 PM	12/2/20, 3:52 PM	12/2/20, 4:19 PM
SS/ORD003-2020/002-006	Assembly shaft wing and shaft together	SS/ORD003-2020/002	006	SS-ASSEMBLY-WKC	SS-ASSEMBLY-03	12/2/20, 3:51 PM	12/2/20, 4:01 PM	12/2/20, 4:01 PM	12/2/20, 4:34 PM
SS/ORD003-2020/002-SANDVICKSHAFTWING001-1-001	Cutting sandvick sheet	SS/ORD003-2020/002-SANDVICKSHAFTWING001-1	001	SS-LASER-CUTTING-WKC	SS-LASERCUTMACHINE-03	12/1/20, 8:00 AM	12/1/20, 8:10 AM	12/1/20, 8:10 AM	12/1/20, 8:49 AM
SS/ORD003-2020/002-SANDVICKSHAFTWING001-1-002	Bending sandvick piece to obtain raw wing	SS/ORD003-2020/002-SANDVICKSHAFTWING001-1	002	SS-BENDING-WKC	SS-BENDING-01	12/1/20, 8:30 AM	12/1/20, 8:35 AM	12/1/20, 8:35 AM	12/1/20, 8:56 AM
SS/ORD003-2020/002-SANDVICKSHAFTWING001-1-003	Drilling raw wing for spine insertion	SS/ORD003-2020/002-SANDVICKSHAFTWING001-1	003	SS-DRILLING-WKC	SS-DRILLING-03	12/1/20, 8:32 AM	12/1/20, 8:42 AM	12/1/20, 8:42 AM	12/1/20, 9:33 AM
SS/ORD004-2020/001-001	Cutting 15x30mm window in SQUARE50x50x3mm	SS/ORD004-2020/001	001	SS-LASER-CUTTING-WKC	SS-LASERCUTMACHINE-01	12/1/20, 2:11 PM	12/1/20, 2:12 PM	12/1/20, 2:12 PM	12/1/20, 5:32 PM
SS/ORD004-2020/001-002	Bending piece to be 17x15x17 mm	SS/ORD004-2020/001	002	SS-BENDING-WKC	SS-BENDING-02	12/1/20, 2:02 PM	12/1/20, 2:13 PM	12/1/20, 2:13 PM	12/2/20, 2:13 PM

Scheduling set Nr. 1 ✕

⚙️ Open schedule settings wizard

Scheduling algorithm

→ Forward

Task ordering options

1. ⬆ sales order/production order priority
2. ⬆ sales order/production order asked delivery date

Optimization options

1. minimum work time
2. finished soon
3. minize setup

Material management options

- ☒ use work order peggings and relation between task
- ☒ use actual phisically stocked goods as production raw materials/semi-finished parts
- ☒ use existing purchase orders to supply raw material/semi-finished goods
- ☒ create work orders on missing goods
- ☒ create purchase orders on missing goods

Work orders to schedule

- SS/ORD003-2020/001
- SS/ORD003-2020/001-AISI316SPINE15x4mm-1
- SS/ORD003-2020/001-AISI316SPINE60x4mm-2
- SS/ORD003-2020/001-FIRINGLEVER001-3
- SS/ORD003-2020/001-SHAFTHOLDER002-4
- SS/ORD003-2020/001-AISI316SQUARE50x50x3mm-1
- SS/ORD003-2020/002
- SS/ORD003-2020/002-SANDVICKSHAFTWING001-1
- SS/ORD004-2020/001
- SS/ORD004-2020/001-AISI316SPINE15x4mm-1
- SS/ORD004-2020/001-AISI316SPINE60x4mm-2
- SS/ORD004-2020/001-FIRINGLEVER001-3
- SS/ORD004-2020/001-SHAFTHOLDER002-4
- SS/ORD004-2020/001-AISI316SQUARE50x50x3mm-1
- SS/ORD004-2020/002
- SS/ORD004-2020/002-SANDVICKSHAFTWING001-1

Resources use

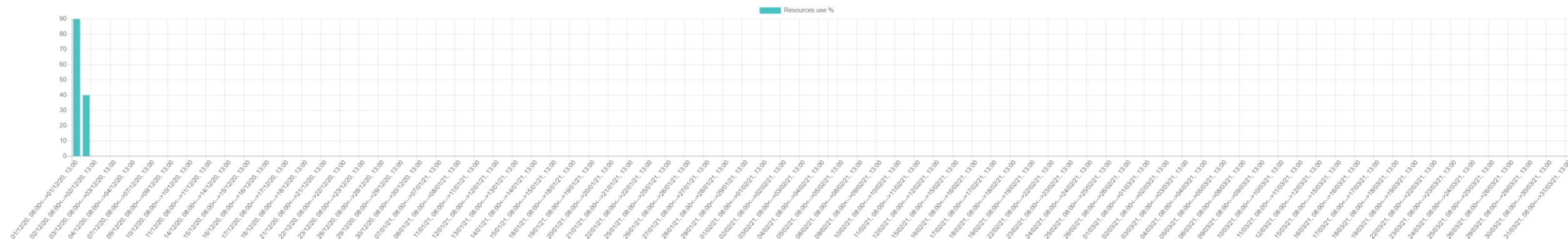
Florida keys sport stainless steel company

Sugarlof Stainless steel Plant

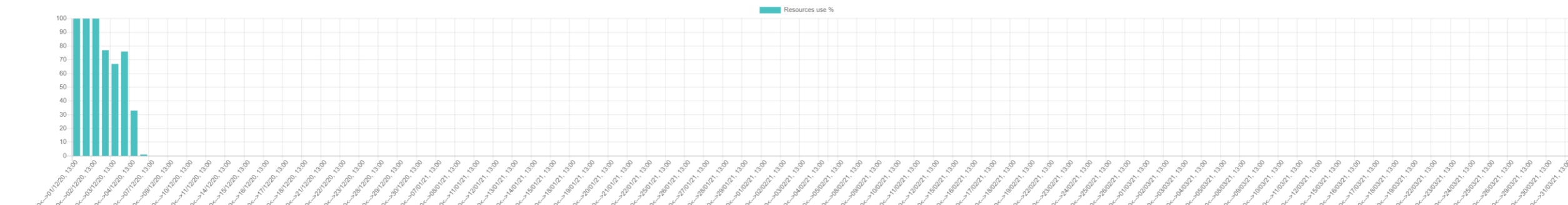
Production department

Workcenters

Stainless steel laser cutting workcenter



Miter saw stations workcenter



Task infos

Task overview

Task info

Material

Equipment info

Production cycle/operation

Task chain of dependencies

code	SS/ORD004-2020/001-AIS316SPINE60x4mm-2-001
description	Cutting AIS316SPINE60x4mm
work order	SS/ORD004-2020/001-AIS316SPINE60x4mm-2
sequence	001
assigned machine	SS-MITER-SAW-WWC-01
start setup	12/2/20, 2:03 PM
end setup	12/2/20, 2:06 PM
start work	12/2/20, 2:06 PM
end work	12/4/20, 2:06 PM

✓ OK

Task materials

Task overview

Task info

Material

Equipment info

Production cycle/operation

Task chain of dependencies

Code	Description	Required qty	Satisfied from
AIS316ROUND BAR200x4mm	Stainless steel ais316 round bar 200 x 4 mm	133.20	• 133.20 from warehouse WH002

✓ OK

Task equipment infos

Task overview

Task info

Material

Equipment info

Production cycle/operation

Task chain of dependencies

Setup equipment			
machine code	machine description	start at	end at
SS-MITER-SAW-WWC-01	Miter saw workstation 01	12/2/20, 2:03 PM	12/2/20, 2:06 PM
resource code	resource description	start at	end at
EMPLOYEE-SS-14		12/2/20, 2:03 PM	12/2/20, 2:06 PM
Work equipment			
machine code	machine description	start at	end at
SS-MITER-SAW-WWC-01	Miter saw workstation 01	12/2/20, 2:03 PM	12/2/20, 2:06 PM
resource code	resource description	start at	end at
EMPLOYEE-SS-14		12/2/20, 2:06 PM	12/4/20, 2:06 PM

✓ OK

APS GUI features – Task details (2/2)

Production cycle/operation

Task overview

Task info Material Equipment info **Production cycle/operation** Task chain of dependencies

Cycle info

code	CYCLE-AIS1316SPINE60x4mm	
description	Cutting AIS1316SPINE60x4mm piece	
product code	AIS1316SPINE60x4mm	
plant code	STB002	

001 Cutting AIS1316SPINE60x4mm

Anagraphic info

code	OP-CYCLE-AIS1316SPINE60x4mm-001	
description	Cutting AIS1316SPINE60x4mm	
sequence code	001	
plant code	STB002	

Bill of material

Product code	Use coefficient	Picking warehouse
AIS1316ROUNDBAR200x4mm	0.333	WH002

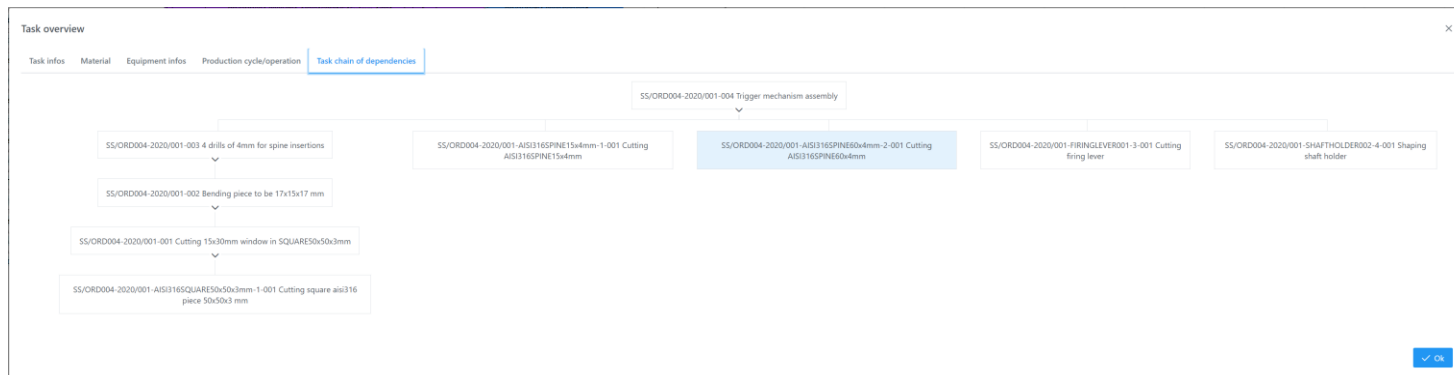
Equipment configuration

Work center	Setup time	Work time
SS-MITER-SAW-WKC	3 min.	3 minute/pz

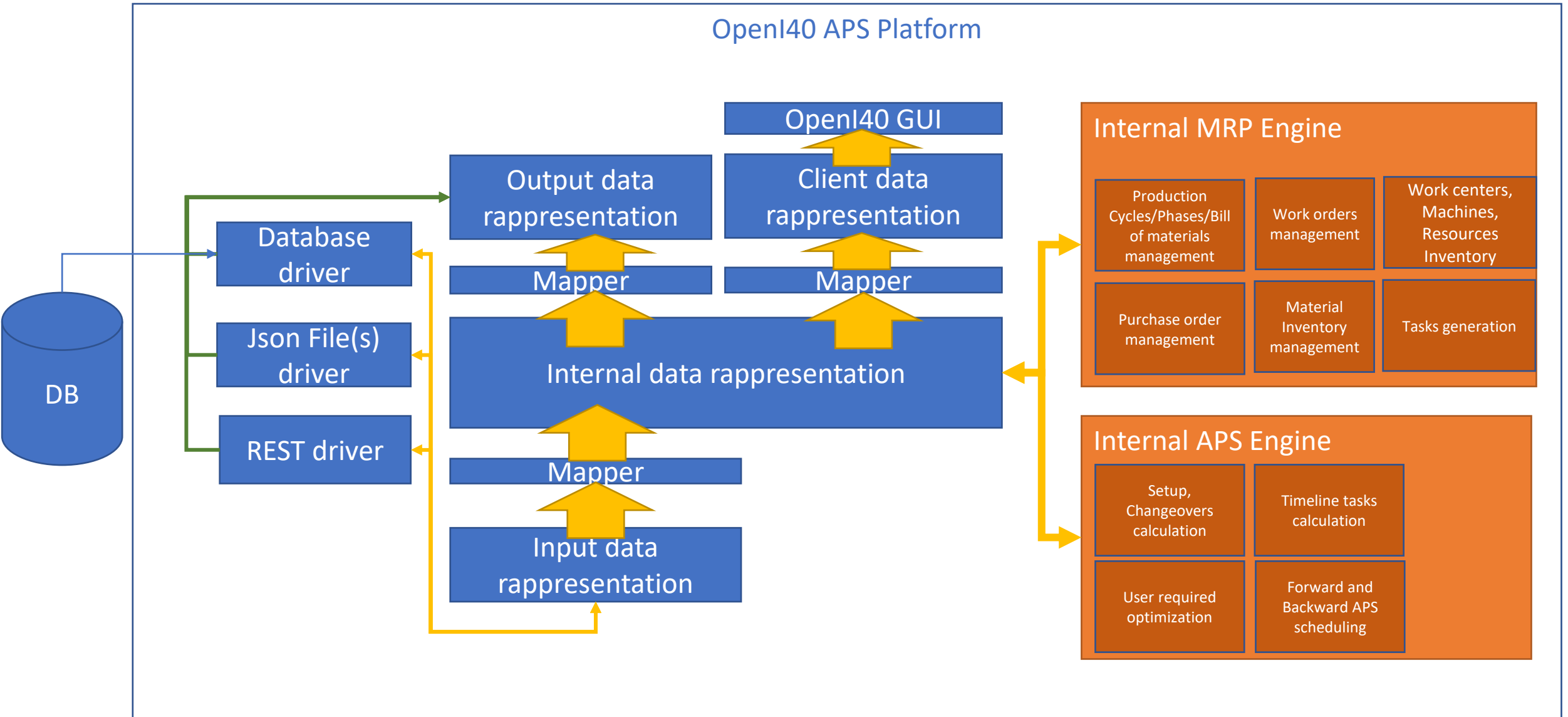
Operations

✓ OK

Task chain of dependencies



APS architecture



Based on solid industry standard technologies



Runs on:



Web browsers:



Database platforms:

