12-Pulse Module Overview

OEE: Overall Equipment Effectiveness

OEE – Description

Overall Equipment Effectiveness

- Is an industry standard
- Is a Key Performance Indicator (KPI) for production and areas close to production
- Describes the effectiveness of a machine

Goal: Identification of the efficiency of machines and their optimization

OEE consists of 3 single key figures:

1. Availability
2. Performance
3. Quality

OEE – Workflow

OEE-Workflow

- **Scope**
  - Strategy of maintenance
  - Optimization of equipment
  - Appliance for time-and production planning
  - Facts about cycle time, availability,
  - Efficiency, capacity
  - Appliance for decisions of investments

Pulse OEE

Key facts

- Fulfill the Continental automotive procedure for OEE (cam0600429)
- Reduce network traffic due to using a caching mechanism
- Allows to categorizes recorded downtime with an web based user front end
- Includes OEE reporting
- Offers configurable dashboards
- Configurable analyze and reporting hierarchies
- Configurable failure catalogs
  - Creation of catalogs based on CAM0600429
  - Flexible assignment to machines or nodes

OEE Procedure CAM0600429

OEE = EquipmentAvailability x Performance x QualityRate

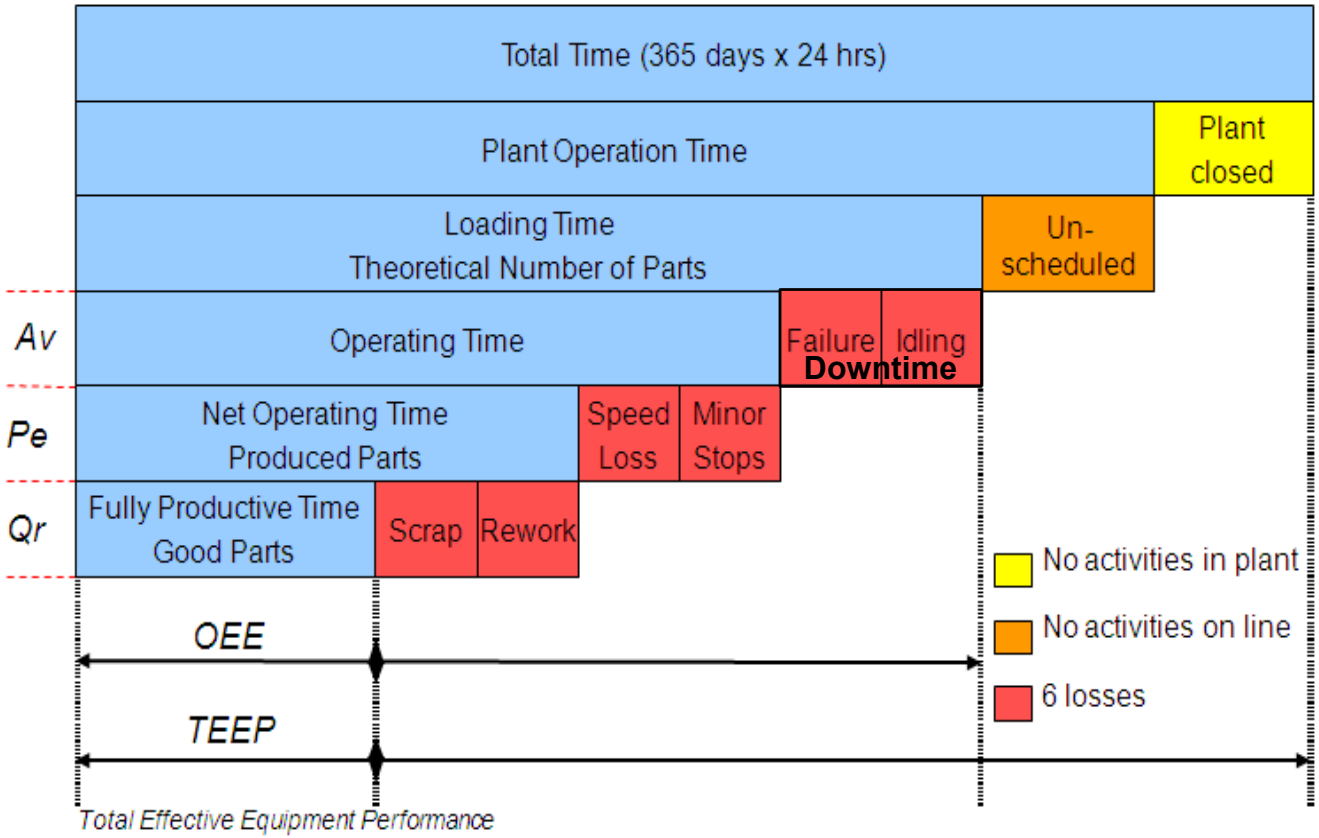
$$EquipmentAvailability = \frac{\sum OperatingTime}{\sum LoadingTime}$$

$$Performance = \frac{\sum (IdealCycleTime * PartsProduced)}{\sum OperatingTime}$$

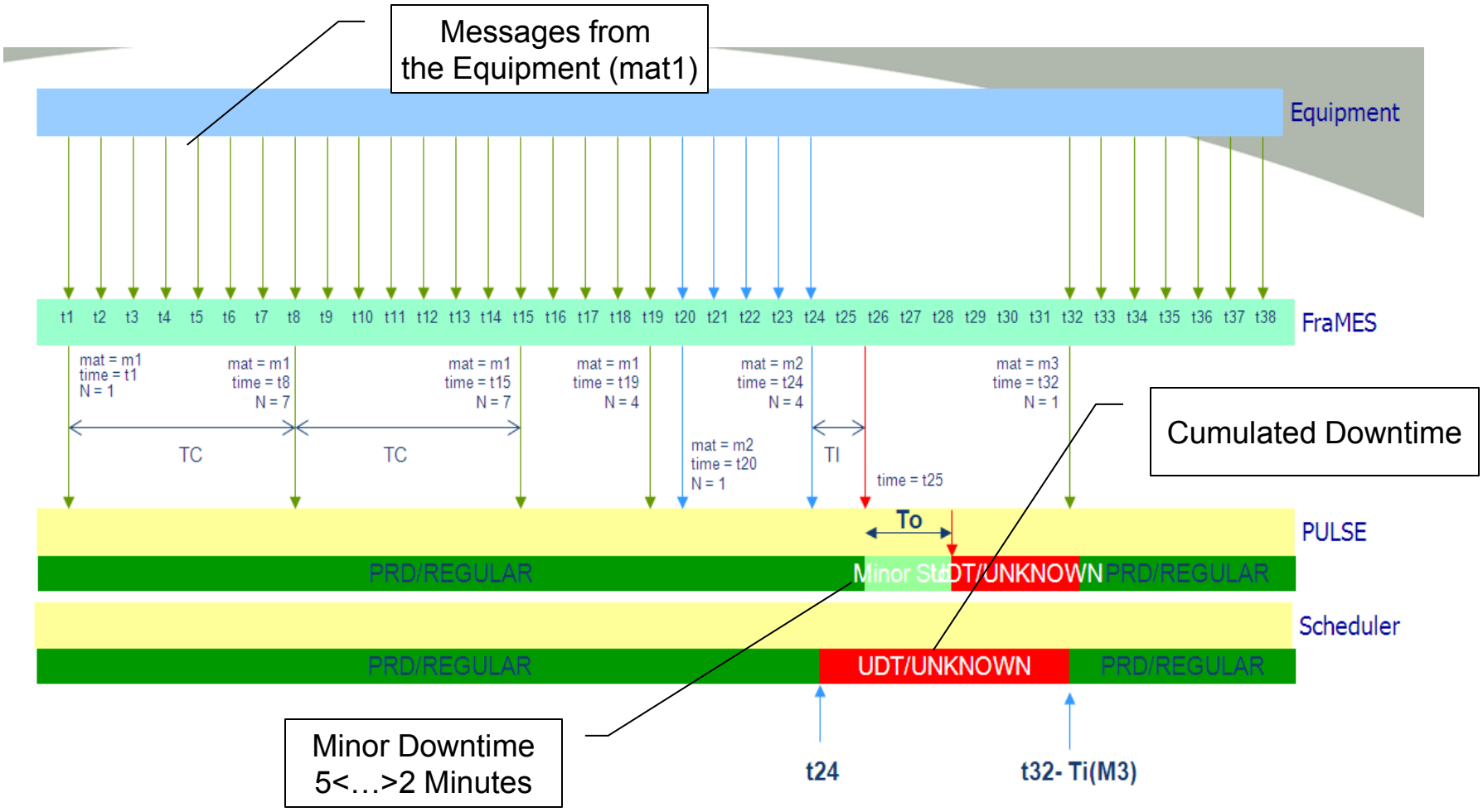
$$QualityRate = \frac{\sum TotalPartsProduced - \sum FailureParts}{\sum TotalPartsProduced}$$

Introduction to Time model

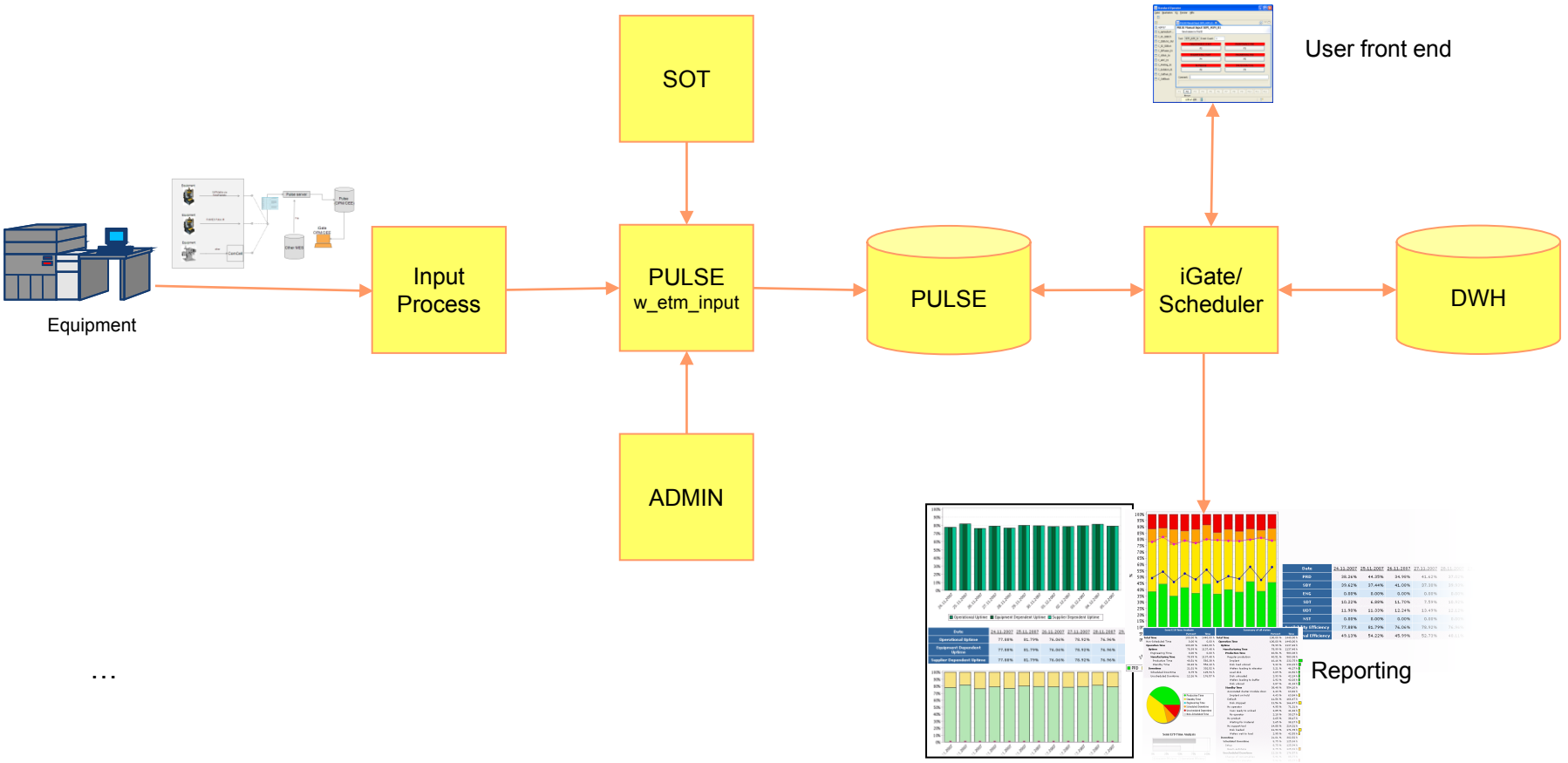
Definition: methodical acquire of the Six Big Losses (red)



Caching mechanism

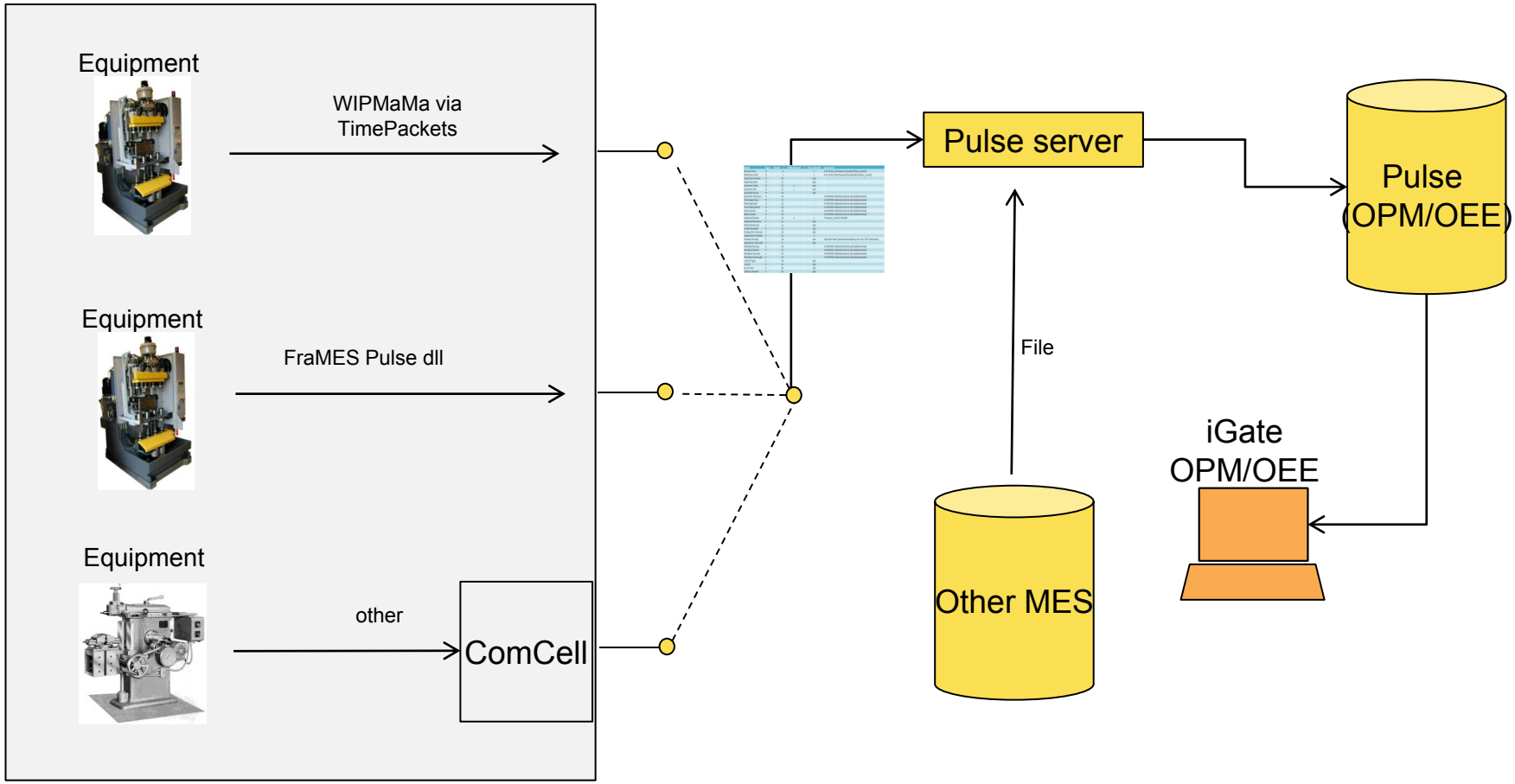


PULSE – Architecture



OPM/OEE connection overview

The connection from production client vary from location and depends on specific requirements



Example of FraMES data flow

FraMES Pulse
dll

OEE Header

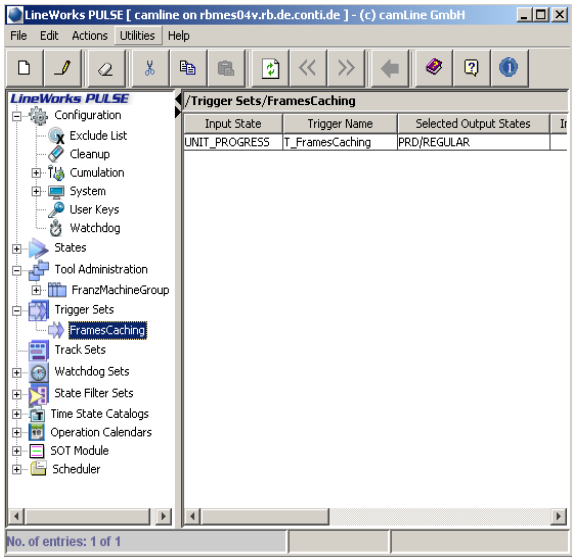
State: UNIT_PROGRESS
State comment: Event for regular production

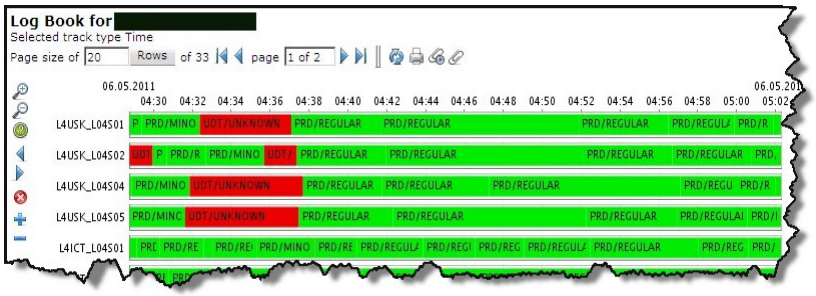
Userdata

Actual units: 10
Effective units: 10
Product: A2C123456
Process group: MILLING

"business logics"

Trigger running in business logics





iGate Front end

Pulse
(OPM/OEE)

Example of data structure

Array definition

Name	Type	Index	OPM rel.	OEE rel.	Comment
Actual Units	D	0		x	# of Units a Process is started (Test_Count)
Effective Units	D	1		x	# of Units that Passed the Machine (Pass_Count)
Quantity Checkin	D	10		opt	
Quantity Start	D	11		opt	
Quantity Yield	D	12	x	opt	
Quantity Fail	D	13	x	opt	
Quantity Scrap	D	14		opt	
Quantity Testruns	D	20		-	
Teststeps Pass	D	21		-	
Teststeps Fail	D	22		-	
Teststeps Saved	D	23		-	
Texts Saved	D	24		-	
Blobs Saved	D	25		-	

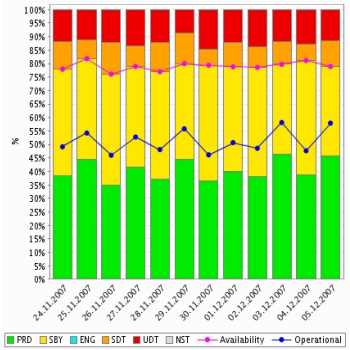
Name	Type	Index	OPM rel.	OEE rel.	Comment
Material Name	S	10	x	x	Product_ID A2C123456
Material Revision	S	11		opt	
Material Group	S	12		opt	
Order Number	S	13		opt	
Production Version	S	14		opt	
Operation Number	S	15		x	
Process Group	S	16		opt	SAP shorttext (can be mandatory for non WIP)
Operation Descript	S	17		opt	
Testplan Group	S	20		-	
Testplan Name	S	21		-	
Testplan Version	S	22		-	
Testplan Datatype	S	23		-	
Unit Id Type	S	30		opt	
UnitId	S	31		opt	
Error Text	S	33		opt	
Library Version	S	34		opt	

Example of code

```
void DoSendProdChange ()
{
        short i, sRetVal = 0;
        char szState[40] = {0};
        char szComment[160] = {0};
        short sUsrDataCnt = 2;
        pul_USERDATA UserData[20] = {0};
        short sUsrFldCnt = 2;
        pul_USERFIELD UserFields[20] = {0};

        strcpy(szState, "UNIT_PROGRESS");
        strcpy(szComment, "Event for production regular");

        // setting of user data
        // two elements for index 0,1,
        UserData[0].sIndex =  0; // Actual units (test_count)
        UserData[1].sIndex =  1; // Effective units (pass_count)

        UserData[0].dUserData = 10; // Value for achal units
        UserData[1].dUserData = 10; // Value for effective units


        // setting of user field data (depending on the design)
        // two elements for index 10,16
        UserFields[0].sIndex = 10; // Product
        UserFields[1].sIndex = 16; // Process group

        strcpy(UserFields[0].szUserField, "A2C1234556"); // Value for product
        strcpy(UserFields[1].szUserField, "MILLING"); // Value for process group

        // send data to Pulse
        sRetVal = pul_SendMessageData (szState, szComment,
                                       sUsrDataCnt,  UserData,  sUsrFldCnt,  UserFields);

        if (!sRetVal) {
                pul_ShowError();
        }
}
```

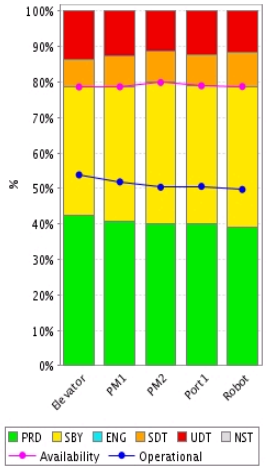

OEE Reporting

Tool / tool group OEE trend



Date	24.11.2007	25.11.2007	26.11.2007	27.11.2007	28.11.2007
PRD	38.26%	44.35%	34.98%	41.62%	37.02%
SBY	39.62%	37.44%	41.08%	37.30%	39.93%
ENG	0.00%	0.00%	0.00%	0.00%	0.00%
SDT	10.22%	6.88%	11.70%	7.59%	10.92%
UDT	11.90%	11.33%	12.24%	13.49%	12.12%
NST	0.00%	0.00%	0.00%	0.00%	0.00%
Availability Efficiency	77.88%	81.79%	76.06%	78.92%	76.96%
Operational Efficiency	49.13%	54.22%	45.99%	52.73%	48.11%

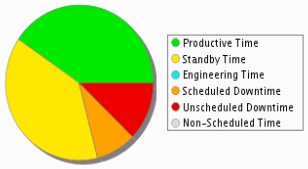
Cluster module compare

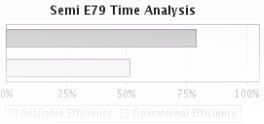


	Elevator	PM1	PM2	Port1	Robot
PRD	42.36%	40.83%	40.25%	39.95%	39.17%
SBY	36.29%	37.86%	39.65%	39.00%	39.60%
ENG	0.00%	0.00%	0.00%	0.00%	0.00%
SDT	7.83%	8.68%	8.93%	8.70%	9.59%
UDT	13.53%	12.63%	11.17%	12.35%	11.64%
NST	0.00%	0.00%	0.00%	0.00%	0.00%
Availability Efficiency	78.65%	78.69%	79.90%	78.96%	78.77%
Operational Efficiency	53.86%	51.89%	50.38%	50.60%	49.72%

Tool detail analysis

Semi E10 Time Analysis	Percent	Time
Total Time	100,00 %	1440,00 h
Non-Scheduled Time	0,00 %	0,00 h
Operation Time	100,00 %	1440,00 h
Uptime	78,99 %	1137,48 h
Engineering Time	0,00 %	0,00 h
Manufacturing Time	78,99 %	1137,48 h
Productive Time	40,51 %	583,38 h
Standby Time	38,48 %	554,10 h
Downtime	21,01 %	302,52 h
Scheduled Downtime	8,75 %	125,94 h
Unscheduled Downtime	12,26 %	176,57 h

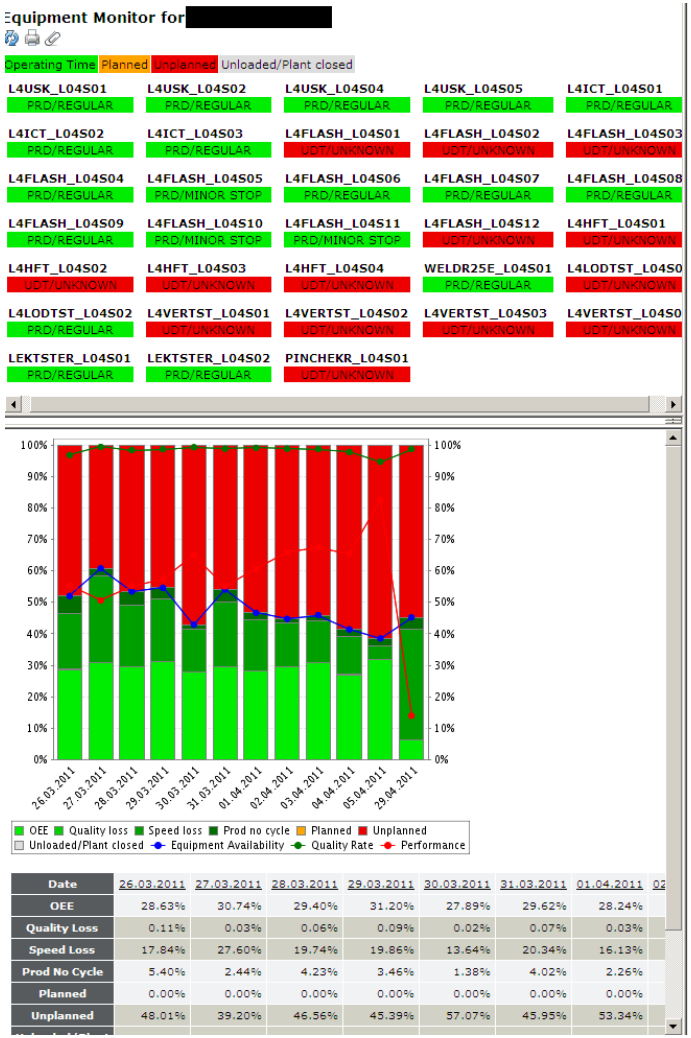




Summary of all states	Percent	Time
Total Time	100,00 %	1440,00 h
Operation Time	100,00 %	1440,00 h
Uptime	78,99 %	1137,48 h
Manufacturing Time	78,99 %	1137,48 h
Productive Time	40,51 %	583,38 h
Regular production	40,51 %	583,38 h
Implant	16,16 %	232,75 h
Disk load unload	9,32 %	134,23 h
Wafers loading to elevator	3,21 %	46,27 h
Load disk	3,09 %	44,52 h
Disk unloaded	2,93 %	42,24 h
Wafers loading to buffer	2,92 %	42,03 h
Disk unload	2,87 %	41,34 h
Standby Time	38,48 %	554,10 h
Associated cluster module down	4,43 %	63,84 h
Implant on hold	4,43 %	63,84 h
Default	11,56 %	166,47 h
Disk stopped	11,56 %	166,47 h
No operator	4,95 %	71,31 h
Cass ready to unload	2,85 %	41,04 h
No operator	2,10 %	30,27 h
No product	2,65 %	38,17 h
Waiting for material	2,65 %	38,17 h
No support tool	14,88 %	214,31 h
Disk loaded	11,93 %	171,78 h
Wafers wait to load	2,95 %	42,53 h
Downtime	21,01 %	302,52 h
Scheduled Downtime	8,75 %	125,94 h
Setup	8,75 %	125,94 h
Beam autotune	8,75 %	125,94 h
Unscheduled Downtime	12,26 %	176,57 h
Change of consumables	5,96 %	85,77 h
Waiting for elevator	5,96 %	85,77 h

- tools
- tool groups
- cluster tools
- cluster modules

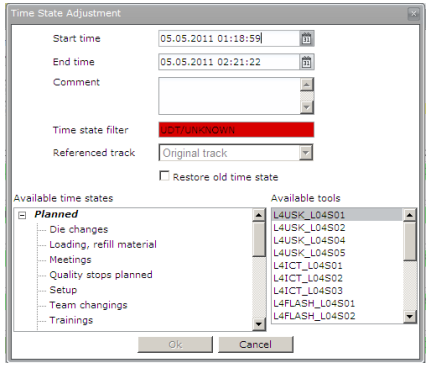
OEE Dashboard



Date	26.03.2011	27.03.2011	28.03.2011	29.03.2011	30.03.2011	31.03.2011	01.04.2011	02
OEE	28.63%	30.74%	29.40%	31.20%	27.89%	29.62%	28.24%	
Quality Loss	0.11%	0.03%	0.06%	0.09%	0.02%	0.07%	0.03%	
Speed Loss	17.84%	27.60%	19.74%	19.86%	13.64%	20.34%	16.13%	
Prod No Cycle	5.40%	2.44%	4.23%	3.46%	1.38%	4.02%	2.26%	
Planned	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	
Unplanned	48.01%	39.20%	46.56%	45.39%	57.07%	45.95%	53.34%	

- Easy creation of dashboards
- Dashboard can be defined per user
- Global dashboard can be defined

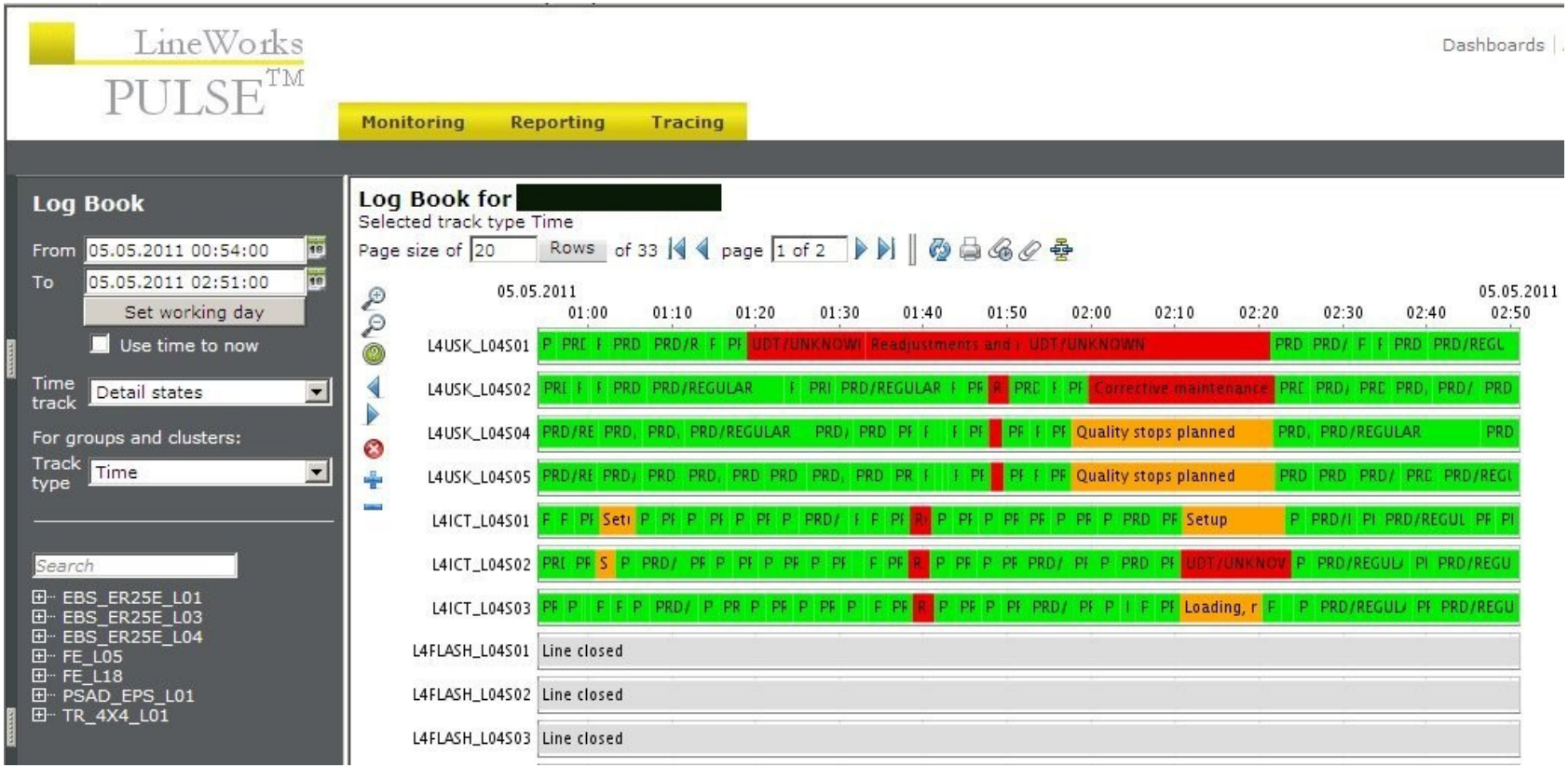
OEE Downtime categorization client



- Machine Downtime Catalog

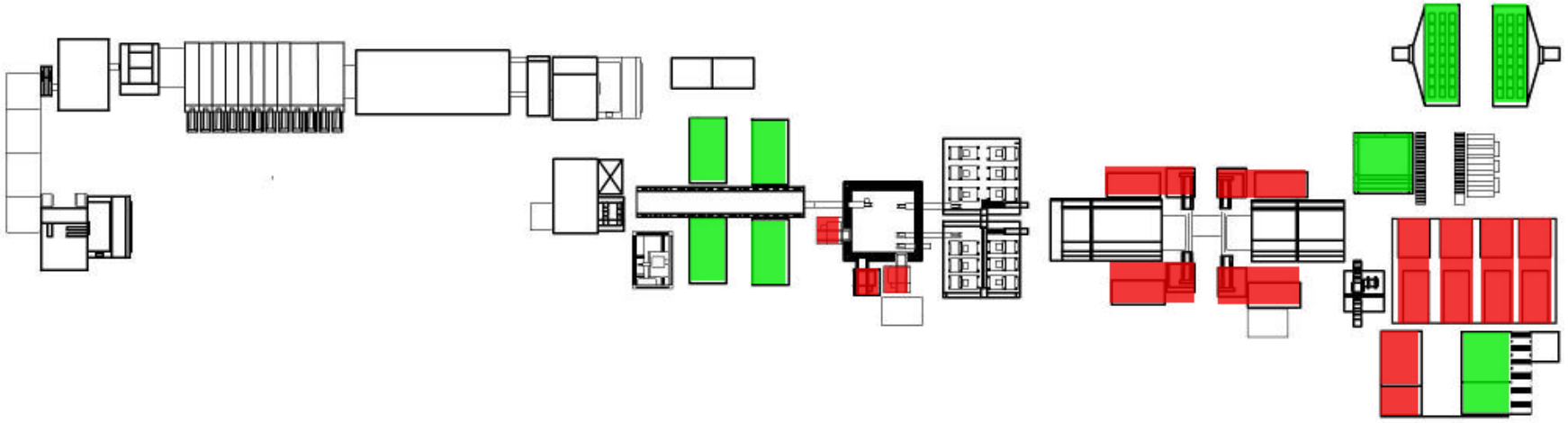
- Categorized machine downtimes will be displayed as additional track

OEE Log Book



- Log Book is the result track of original track plus assigned machine downtime states

OEE FAB Layout



- Shows the actual status of line/production area

Benefits of Pulse OEE

- Efficiency improvement of equipment
  - Real-time evaluation of equipment
  - Presents the potential of production
  - Time and failure analysis (recipe execution time, material tracking etc.)
  - Calculation of productivity index ref. to Conti OEE
  - Effective online monitoring, reporting and tracking with up-to-date WEB technology
  - Flexible administration of equipment models

Semi E10 Time Analysis

	Percent	Time (h)
Total Time	100%	104,00
Non Scheduled Time	15,58%	16,20
Operation Time	84,42%	87,80
Uptime	30,5%	31,73
Engineering Time	9,1%	9,45
Manufacturing Time	21,43%	22,28
Productive Time	11,1%	11,53
Standby Time	10,3%	10,75
Downtime	53,9%	56,07
Scheduled Down	40,6%	42,26
Unscheduled Down	13,3%	13,80