Content

Data recording

Online data recording is done by L-AFIS systems. Using different interfaces (network, serial ports, digital 24V I/O inputs) they collect all data from production and inspection equipment and transmit these results once per minute to the database. Parallel once per minute all PCs displaying collected data read those from database.
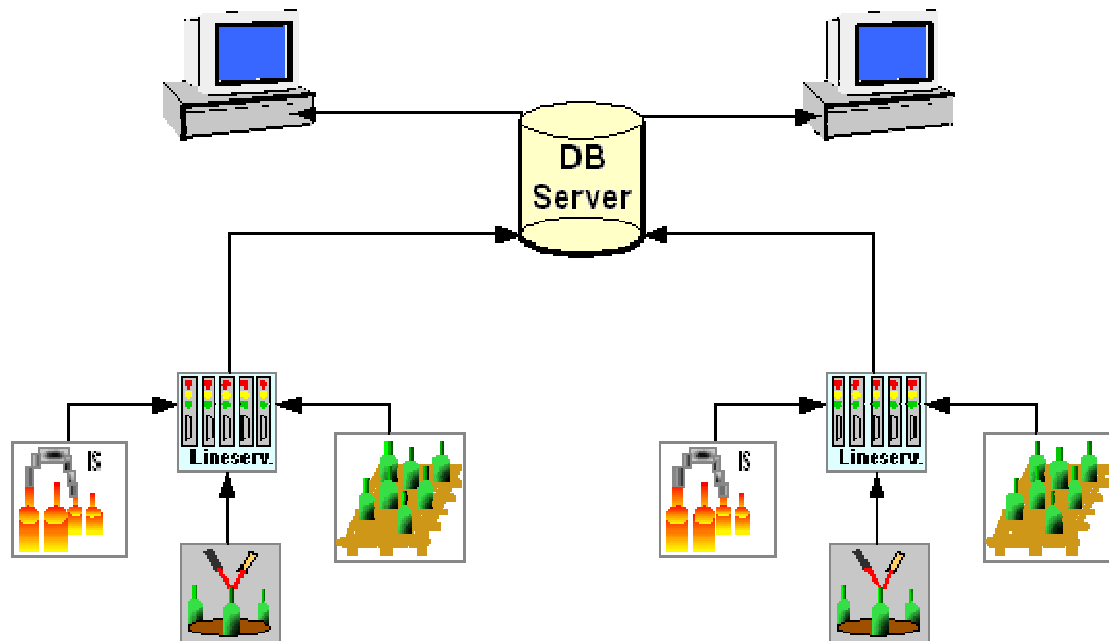
All counting results are accumulated and stored in 5-minute slots.

This means, the most recent 5-minute slot is updated once per minute, until 5 minutes have been passed, and the next 5-minute slot starts. This allows stepping through results in 5 minutes slots for the most recent hour. For long time storage counting results are compressed to 1-hour slots. Of course all events (Alarms, Telegram messages, Sampling results etc.) are stored without accumulation.

The lehr delay time can be recorded / calculated also by iAfis. All you have to do is to provide a suitable encoder sensor at lehr drive.

Display of results

iAfis has different solutions to display results. Also the customer has the facility to modify displayed pages or to create new ones along his requirements later. Theoretically each PC or user could get his own individual set of screens. Colour changes or different LED states may also be defined to pull attraction of operators to upcoming problems, or to honour good production with green background colour.

The first screen is normally used to display an overview about the complete plant. A separate box can represent each production line. Values may be displayed either as numeric values, or as bars, or as histogram lines (one pixel for each of the most recent 40 minutes).
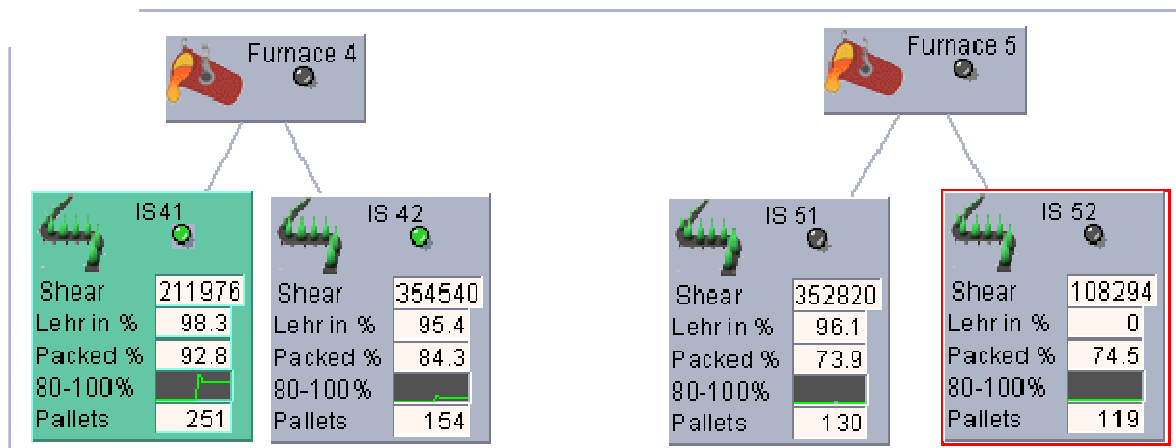
Of course as an alternative it is possible to show more than one box per production line, to see additional details of inspection equipment for each shop.

Another way to get a quick overview is the PTM table, showing the efficiency percentages of all shops, with breakdowns for shifts and each hour.

Shift / Line	L41	L42	L51	L52
21.10.06 Afternoon shift	92.7%	89.3%	54.1%	74.8%
14:00 - 14:59	76.2%	75.1%	67.3%	79.1%
15:00 - 15:59	104.6%	81.8%	79.5%	83.0%
16:00 - 16:59	97.2%	96.6%	87.0%	71.3%
17:00 - 17:59	94.6%	93.9%	32.2%	71.3%
18:00 - 18:59	95.2%	93.3%	22.1%	72.1%
19:00 - 19:59	94.5%	98.9%	0.5%	84.8%
20:00 - 20:59	87.8%	90.2%	37.1%	53.7%
21:00 - 21:59	91.6%	85.0%	107.2%	83.5%
21.10.06 Night shift	93.9%	85.5%	86.3%	68.3%
22:00 - 22:59	89.9%	81.7%	79.5%	76.5%
23:00 - 23:59	85.9%	88.0%	92.7%	79.1%
00:00 - 00:59	109.7%	82.2%	79.8%	80.2%
01:00 - 01:59	97.7%	81.7%	87.5%	78.9%
02:00 - 02:59	89.2%	81.7%	86.9%	76.1%
03:00 - 03:59	90.9%	92.1%	80.5%	47.0%
04:00 - 04:59	98.6%	93.4%	101.4%	29.2%
05:00 - 05:59	89.4%	83.1%	82.3%	79.5%

Detailed view for one production line

To get a realistic impression, it is possible to show the production line as it physically exists, using one separate box for each inspection machine:

IS41

ICAM-L

Input	110725
Rejects	1345
Rej. %	1.2
Sidewall	1329
Sidewall. %	1.2
Stress	16
Stress %	0

DELTA-L

Input	109592
Rejects	2526
Base	395
Base %	0.4
Stress	246
Stress %	0.2
Finish	2153
Finish %	2

M-L

Inspected	107124
Defects %	1.1
CIS %	1.5
Output	104391

IS-M

Avg. Bpm	147.2
Shear	211976
Gobs loaded %	98.8
IS-Rejects %	1

Lehr

Delay	60
Input	208297
Input %	98.3
Output	210526
Output %	99.3

Palettizer

LHS	103569
RHS	93080
Total	196649
Pallets	251
Eff.%	92.8

ICAM-R

Input	99839
Rejects	1351
Rej. %	1.4
Sidewall	1334
Sidewall %	1.3
Stress	17
Stress %	0

DELTA-R

Input	98257
Rejects	2505
Base	649
Base %	0.7
Stress	835
Stress %	0.8
Finish	1076
Finish %	1.1

M-R

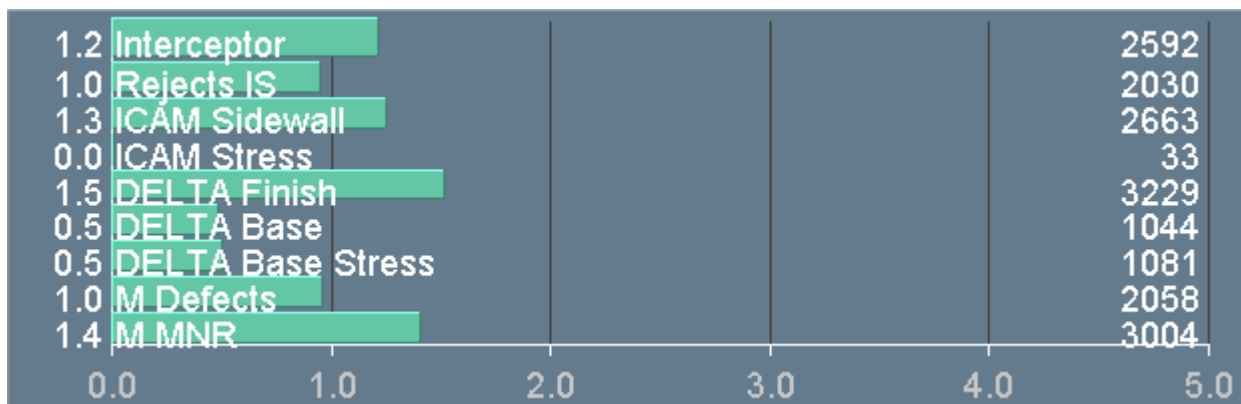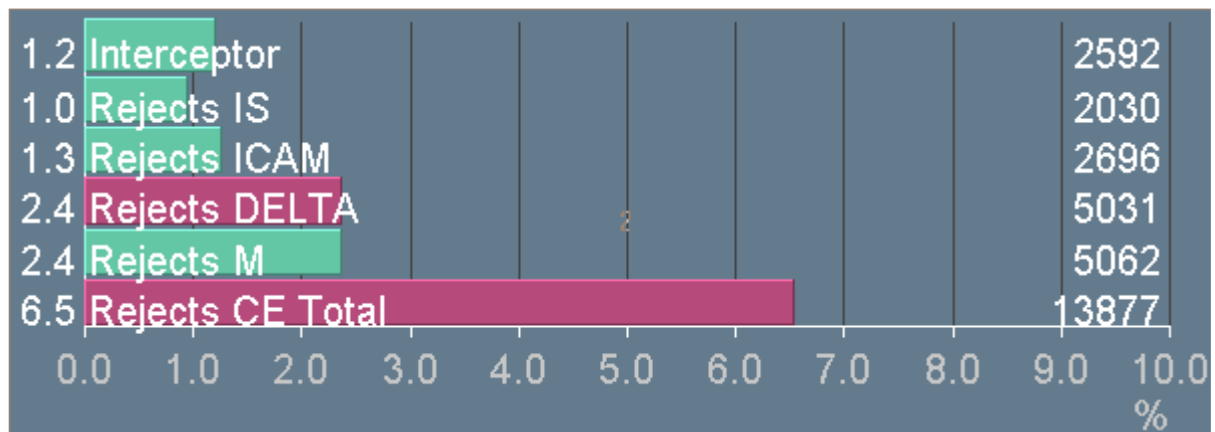|	
Input	95787
Defects %	0.9
CIS %	1.5
Output	93458

Each box can keep up to 8 different values. Customer decides how much rows per box should be used and what they should display.

Counter diagrams

Another way to display results is the usage of counter diagrams. Up to 16 different pages can be configured. At left margin the percentage values are displayed, at right margin the absolute values. This helps to interpret high percentage values for rejects. Have 20% rejects being caused by 2 bad bottles out of 10 sample bottles, or was this caused by 2000 of 10000 bottles rejected?

Each bar also can have his individual threshold defined for colour change from green to red.

%		Abs.
1.2	Interceptor	2592
1.0	Rejects IS	2030
1.3	Rejects ICAM	2696
2.4	Rejects DELTA	5031
2.4	Rejects M	5062
6.5	Rejects CE Total	13877

Scale: 0.0 1.0 2.0 3.0 4.0 5.0 6.0 7.0 8.0 9.0 10.0 %

| %		Abs.
1.2	Interceptor	2592
1.0	Rejects IS	2030
1.3	ICAM Sidewall	2663
0.0	ICAM Stress	33
1.5	DELTA Finish	3229
0.5	DELTA Base	1044
0.5	DELTA Base Stress	1081
1.0	M Defects	2058
1.4	M MNR	3004

Scale: 0.0 1.0 2.0 3.0 4.0 5.0

Histograms

Histograms show the evolution of rejects over the time axis and clarify, whether the reject had been on same level over complete period of time, or had been lower most of time, however with one peak during a certain period:
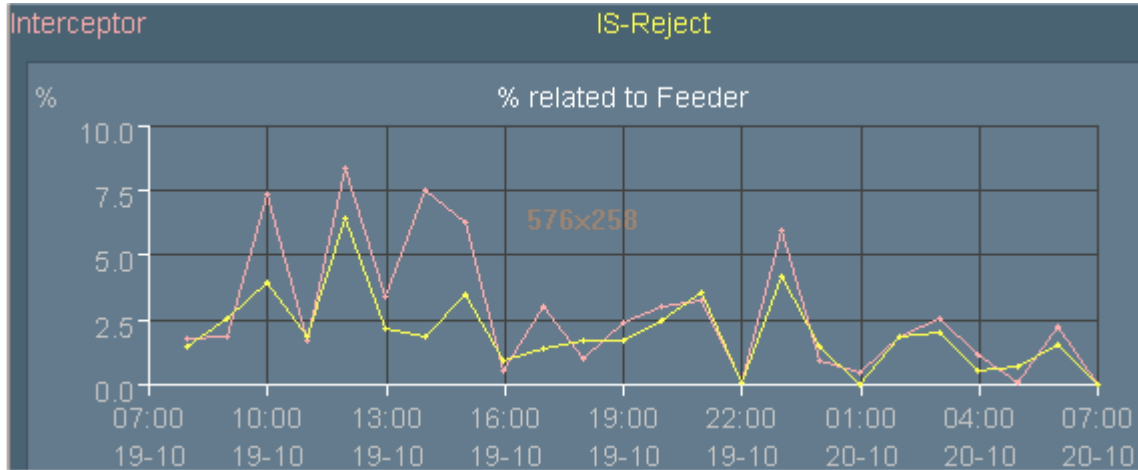

Up to 16 pages can be used; each page can display up to 8 different values. In case of more than one leg used at inspection area it is helpful to add pictures for left / right comparison to increase the quality of set-up. In this picture you can see, that different adjustments between finish inspection on left and right hand side had been corrected after 13:00:
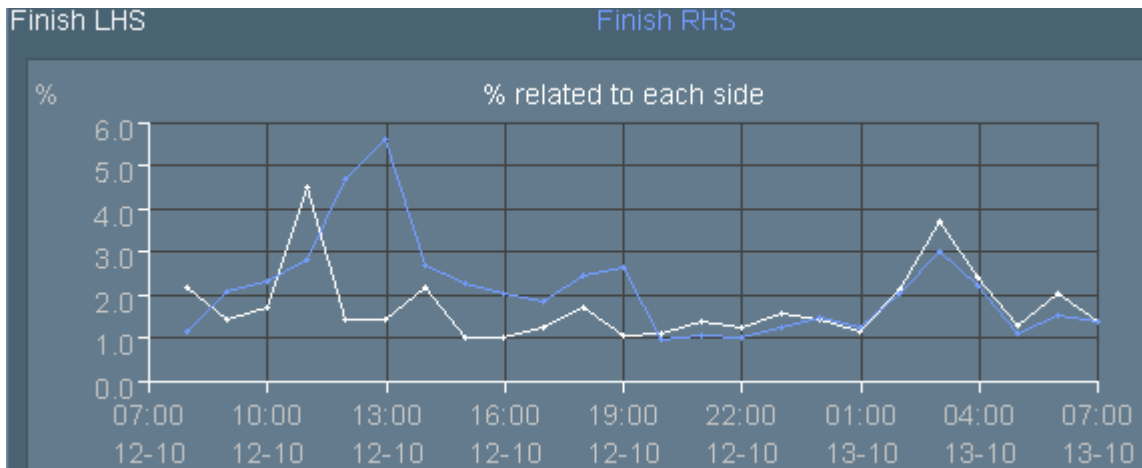
Mould dependent defect results

The most detailed information about production process can be won by inspection equipment with mould number reading. Because then defects information is available separate for each mould number. What iAfis does is to combine this information also with the section of production machine. The Hot End operator feeds this in on iAfis mould table. Therefore iAfis can display defects with mould number <u>plus</u> section of production machine. Defects are shown in descending order. By selecting one defect at upper part of screen the distribution for this defect over all sections and moulds is updated at lower part of screen. In this example defect *Split Top* was selected. As you can see in lower part, mainly section 12 front with mould number 3 had been involved. The total reject of this defect was 1.1% (1954 containers), mainly caused by section 12 front / mould 3. More than 8% of mould 3 was found with this defect.
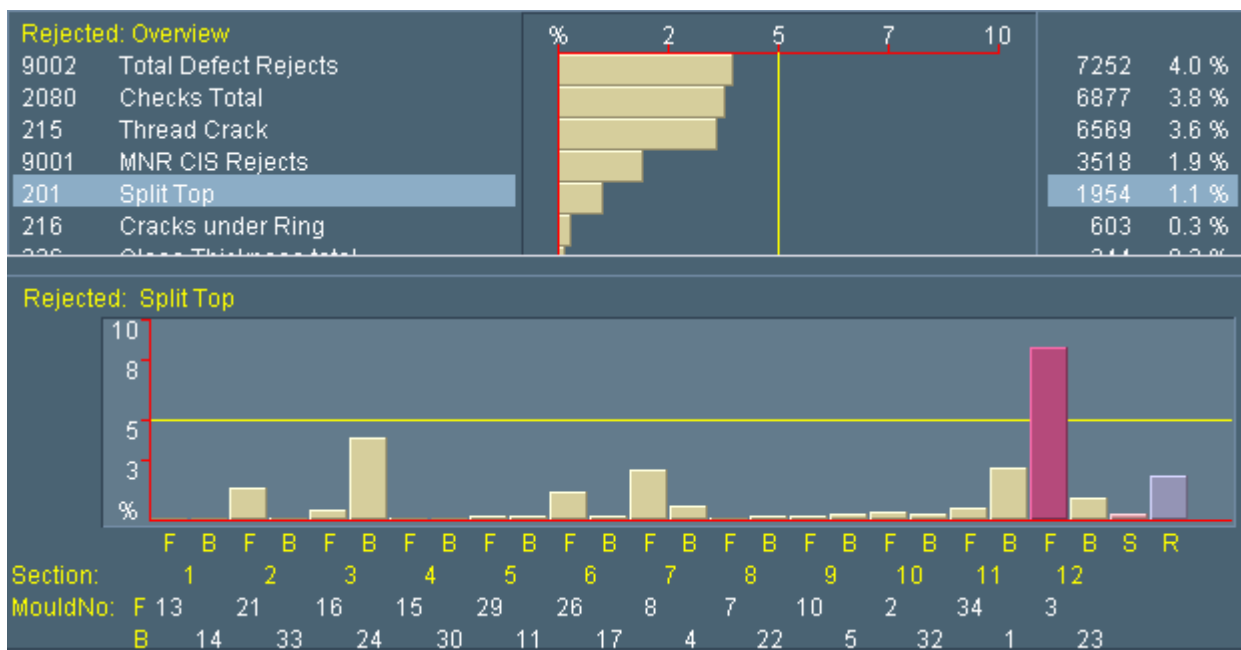
With one mouse click you can see a histogram for this combination of defect and mould number / section. All changed parts during selected period of time (here 2 x neck ring changed) are shown also.
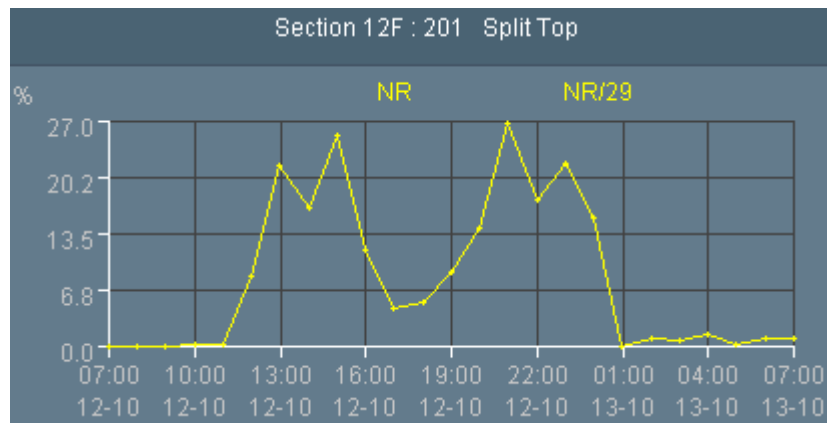
Section Efficiency

Picture section efficiency shows at lower screen part all sections. By selecting one section, those defects are show at upper part of screen. This is the most important picture for the operator at Hot End, helping to work section by section to increase the pack using his knowledge to eliminate the founded defects. At this example section 3 front (mould number 30) was selected. Main problem on this had been wall thickness (357 containers or 8.4% rejects by wall thickness for this section / mould).
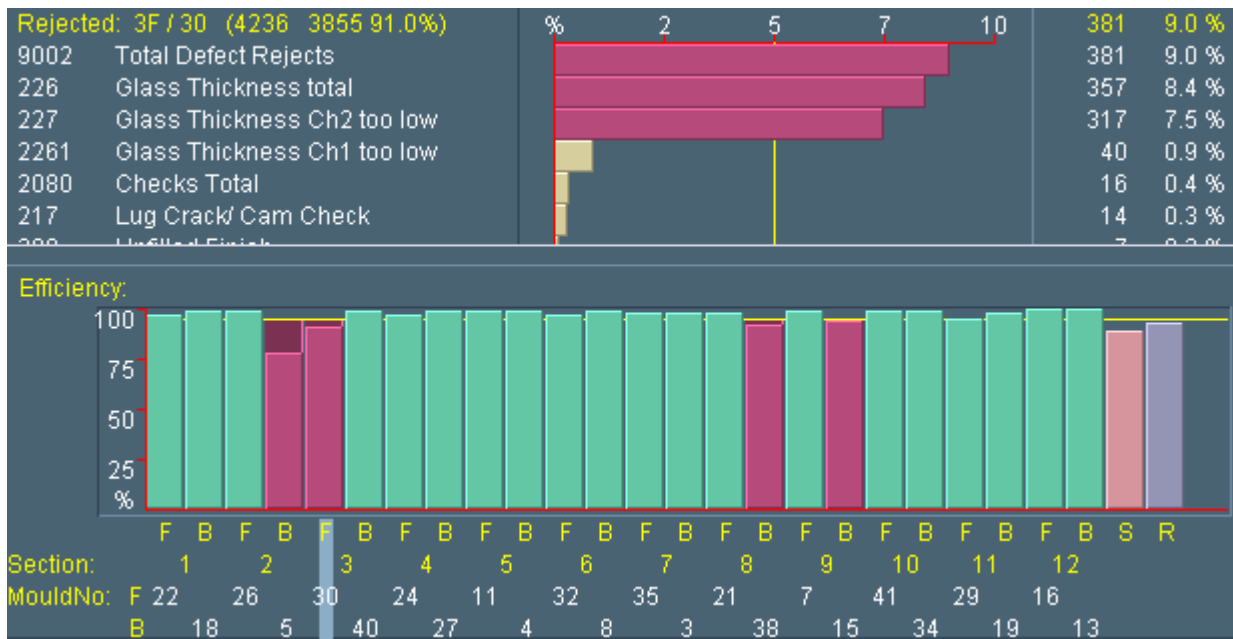
Also here with one mouse click the histogram for one defect and one section or mould can be displayed. As you can see, defect thickness decreased after replacement of Blow mould, Baffle arm, Plunger and Thimble.
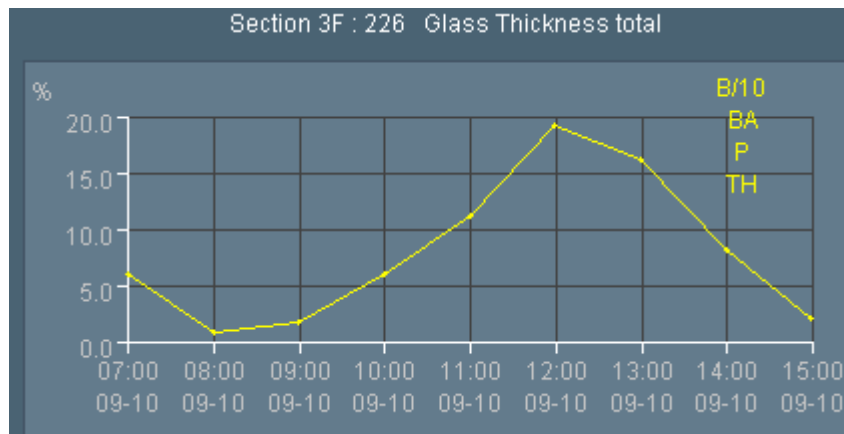
Mould reading rates

With this picture it is possible to find out those moulds having reading problems. Below bar marked with letter S at right margin all those containers are collected, for which a valid mould number had been read, but no valid section could be found. Reasons might be:

- Resorting of bottles with mould numbers not actually produced
- HE operator did not update mould table after change. If this happens, the bar of the removed mould would decrease to 0%.
- Phantom reading. Mould reader found not existing mould numbers.

Below bar R all bottles with mould number 0 are collected (not readable).
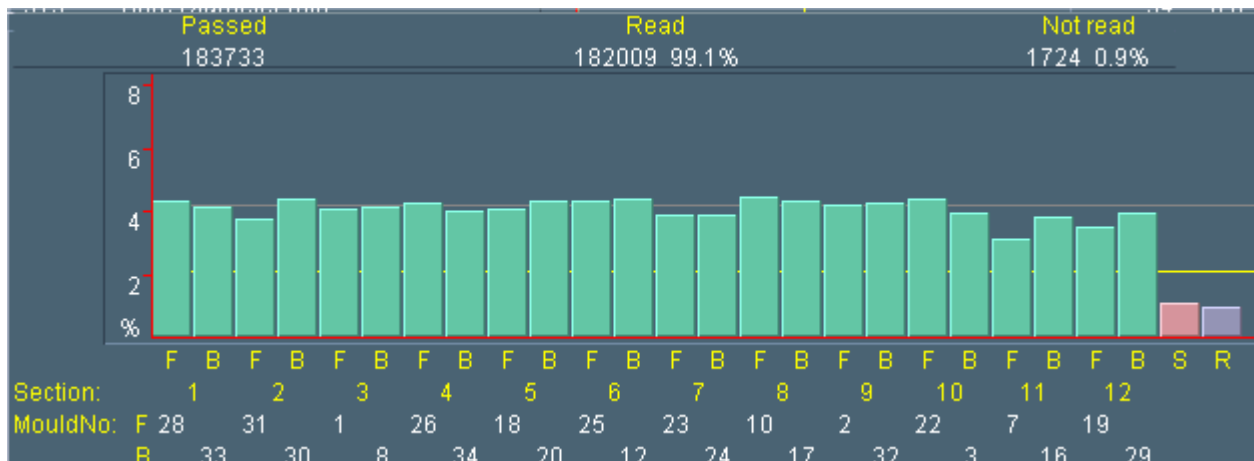
Also here with one mouse click the history can be selected. While the upper picture shows rate of no reads R at 0,9%, this was not a constant rate all the time. Instead during day shift rate of no reads was around 2% and decreased after 16:00.
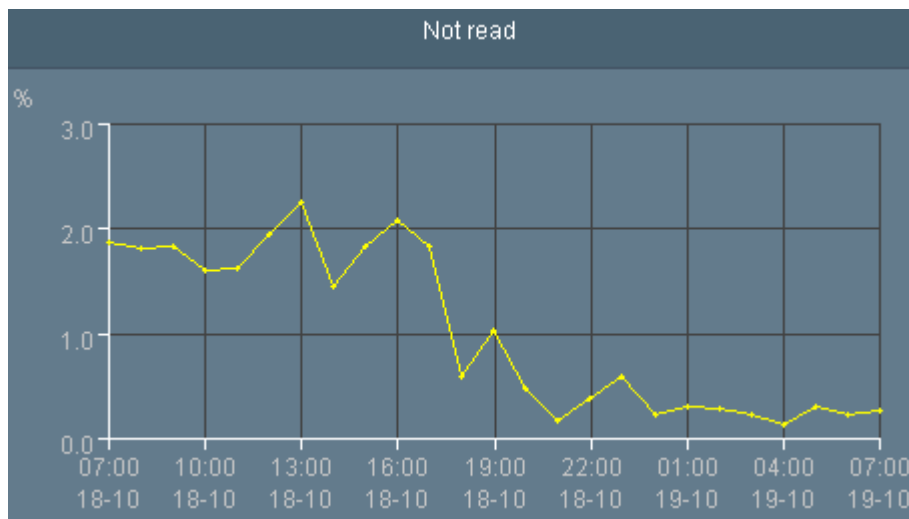
History of mould rejects

Important to trace your quality is the history of mould rejects. To be sure, which mould number had been in reject during which period of time, have a look here:

RefDate	Mould	Message	Error	Sta.	Pos.
19.10.06 13:04	14	off plumb	Off Plumb/ Body Leaner	5	2
19.10.06 13:22	14	off plumb	Off Plumb/ Body Leaner	5	2
19.10.06 17:09	34	DANNY CRACK	Danny Crack	11	2
19.10.06 19:09	34		Danny Crack	0	0
19.10.06 20:39	5	BENT NECK	Defect not defined	11	2

At 13:04 reject for mould number 14 was started (red marked); at 13:22 this reject was stopped. Reason and section of IS machine are stored. If you look at stop of reject for mould 34 at 19:09, section and position of IS machine are missing. This means, at that time mould 34 had already been replaced by another mould in IS machine. It had been replaced by mould 5 on section 11 position 2 (back). But as you can see, this mould change did not solve the problem, because later also reject for mould 5 was started.

Here is another way how mould reject history can be seen:

Mould	Sta.	SRError	FROM	UNTIL	MINUTES	SysRej	Qty.%	Tot.%
5	11 B	----	19.10.06 20:40	19.10.06 20:59	20	125	24.4	0.12
34	0 S	207	19.10.06 17:09	19.10.06 19:10	121	128	100.0	0.12
34	11 B	207	19.10.06 17:09	19.10.06 19:10	121	457	85.3	0.44

Let us have a look at mould 34. While this was on IS machine, 457 bottles (85.3% of this mould) were rejected by mould reject. After mould change of course this was running for a while still on Cold End and during this time 128 bottles (100% of this mould) were rejected. Calculated against complete production however this had been only 0.44% plus 0.12%.

Message exchange (Telegrams)

Message topics can be created to filter messages by topic later. Here are some examples for message topics:

- Critical defects
- Main defects
- Tiny defects
- Breakdown / Problems at Hot End
- Breakdown / Problems at Cold End
- Generic message

It can be defined for each topic, who may send this message or not (Hot End Operator, Cold End Operator, Laboratory Operator, Shift Supervisor, System Administrator etc.). Different filter buttons help to find messages later by sender, by receiver, by topic etc. Two timestamps are stored with each message: when it had been sent, and when the receiver confirmed receipt. Additionally each message can contain one defect code from defect code list, and also one mould number, to sort messages later also by these criteria's. And least not last a free text can be added to each message.

Example for messages:

Name	RefDate	Mould	Message	Error
Main Defect	18.10.06 05:23	0	lap marks #15	Lap Marks
Main Defect	18.10.06 05:23	0	lap marks #15	Lap Marks
Main Defect	18.10.06 05:39	0	cur #11,17	Defect not defined
Main Defect	18.10.06 05:48	34	cur	Defect not defined
Main Defect	18.10.06 08:07	12	cur	Defect not defined
Small Defect	18.10.06 08:44	7	washboards	Defect not defined
Small Defect	18.10.06 08:44	7	washboards	Defect not defined
Small Defect	18.10.06 09:06	0	washboards +# 30 lof , #3 lof	Defect not defined
Small Defect	18.10.06 09:06	0	washboards +# 30 lof , #3 lof	Defect not defined
Notice	18.10.06 09:40	1	wash boards	Wash Boards
Notice	18.10.06 09:41	7	wash boards	Wash Boards
Small Defect	18.10.06 11:29	0	15 minutes stop	Defect not defined
Small Defect	18.10.06 11:29	0	15 minutes stop	Defect not defined
Small Defect	18.10.06 11:47	0	again another 30minutes stop	Defect not defined
Small Defect	18.10.06 11:47	0	again another 30minutes stop	Defect not defined

Specific information from Hot End

Part exchange

All part changes at production machine can be recorded by AFIS. For each type of part a maximum standby time can be defined, after which this part should be exchanged. Different colours show, how many % of this lifetime has been passed. This helps machine operator to find out quickly, whether problems with quality at one section might be caused by parts or tools, which have exceeded their optimal lifetime.

Section # 0 is used for all parts common for the complete machine (like shear, gob distributor etc.).

MOULDPART	0F	0B	1F	1B	2F	2B	3F	3B	4F	4B	5F	5B
Blow mould			02	12	2?	20	11	21	10	0?	1	22
Bottom plate			05	05	05	09	05	05	05	05	05	05
Blow head			05	5	05	05	05	05	05	14	5	05
Take out tonge			05	05	05	05	05	05	15	15	05	17
Through			15	15	15	15	15	15	15	15	15	15
Deflector	*	18					24	24		28		
Counterblow valve					24							
Vacuum valve			30	30	30	30	30	30	30	30	30	30
Plunger mechan…	*	08	02	02	02	02	02	02	02	02	02	02
Baffle arm											03	
Neckring holder	*	14	10	29	10	10	10	10	10	10	10	10
Blow head arm			13	13	13	13	13	13	13	13	13	13
Take out arm									30	30		

Legend: 0 | 0%- 80% | 80%-100% | 100%-120% | 120%-….

Different views help to analyse changed parts and can be sorted by column header (i.e. by date, by section, by part name or by reason):

Date	Section	MouldNo.	Part	Reason
19.10.06 07:01	4 B	15	M - Blow mould	Dirty
19.10.06 07:06	4 B	72	B - Blank mould	Dirty
19.10.06 09:43	7 F	85	NR - Neckring	Seam
19.10.06 10:02	7 F	64	B - Blank mould	Seam
19.10.06 10:33	7 F	47	B - Blank mould	Dirty
19.10.06 11:14	7 B	95	TH - Thimble	Crack
19.10.06 12:50	3 F	58	NR - Neckring	Seam
19.10.06 12:54	12 F	68	B - Blank mould	damaged
19.10.06 13:01	2 F	80	NR - Neckring	Dirty
19.10.06 13:01	2 B	45	NR - Neckring	Dirty

This view shows how often each part type had been changed:

Part	Number
B - Blank mould	13
BA - Baffle	1
P - Plunger	4
TH - Thimble	7
NR - Neckring	16
M - Blow mould	12
BP - Bottom plate	1
TOT - Take out tonge	1
TOA - Take out arm	2

Another view shows changes per section, helping to find quickly see the section with most parts changed (4B):

1F	1B	2F	2B	3F	3B	4F	4B	5F	5B
	NR/39	NR/80	NR/45	NR/58	B/55	B/76	M/15	M/19	M/11
		M/27	M/29	B/52	P	P	B/72		
				P	TH	TH	M/31		
				TH	TH	NR	M/34		
				TH	NR	NR	B/69		
				NR	NR		P		
				NR	M/4		TH		
				B/74	B/64		NR		
				NR/37	B/73		NR		
					NR/49		M/23		
							B/78		
							M/30		
							BP		
							BA		
							B/57		

Next picture shows how many minutes each part was used and how many bottles have been produced with that (based on speed of production machine – bottles per minute).

Date	Sect...	Mould...	Part	Reason	Until	Min...	Bottl...	Qty.%
19.10.06 07:01	4 B	15	M - Blow mould	Dirty	19.10.06 17:40	639	3834	1.8
19.10.06 07:06	4 B	72	B - Blank mould	Dirty	19.10.06 21:10	844	5064	2.4
19.10.06 09:43	7 F	85	NR - Neckring	Seam	20.10.06 06:59	1277	7662	3.6
19.10.06 10:02	7 F	64	B - Blank mould	Seam	19.10.06 10:33	30	180	0.1
19.10.06 10:33	7 F	47	B - Blank mould	Dirty	20.10.06 06:59	1227	7362	3.5
19.10.06 11:14	7 B	95	TH - Thimble	Crack	20.10.06 06:59	1185	7110	3.4
19.10.06 12:50	3 F	58	NR - Neckring	Seam	19.10.06 20:48	478	2868	1.4
19.10.06 12:54	12 F	68	B - Blank mould	damaged	20.10.06 06:59	1086	6516	3.1

Section breakdowns

Reasons and duration of breakdowns can be typed in manually or recorded automatically. Based on the number of used sections the total breakdown time over complete machine is calculated. Here they had 10 machine minutes breakdown during 24 hours (0,7%):
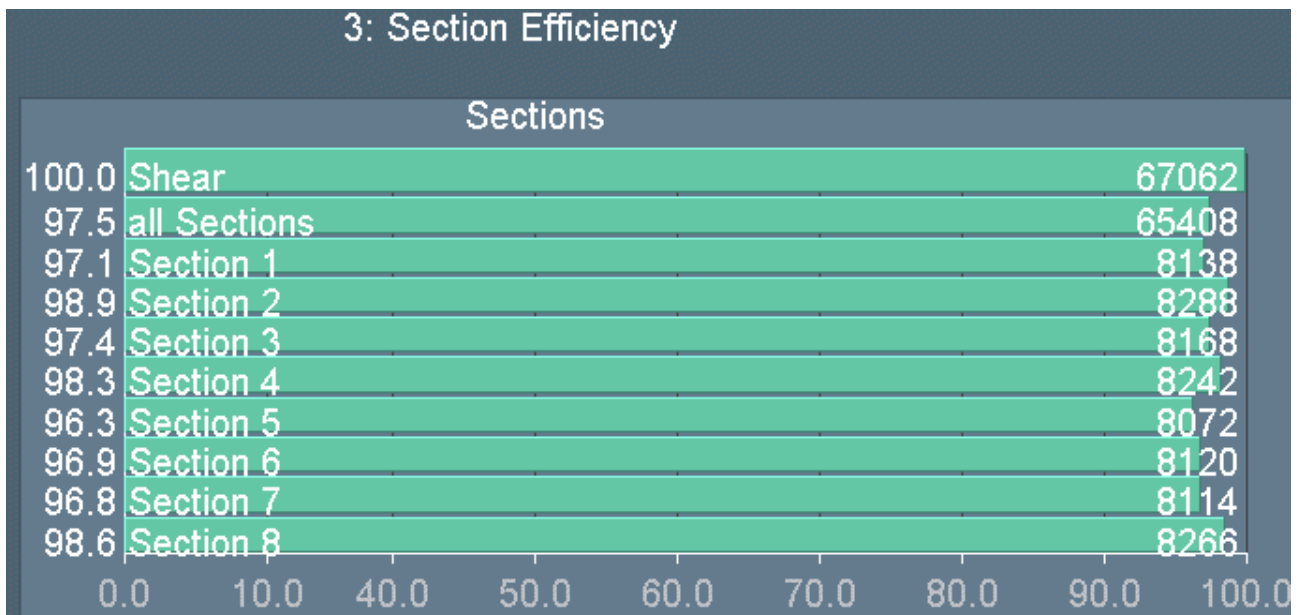
RefDate	Sta.	NSectio...	Down...	MACHM...	BDREASON	Comment
19.10.06 11:10	4	12	10	1	Section/IS-Machine	chanched baffle cooling pip da...
19.10.06 14:36	3	12	35	3	Section/IS-Machine	fitters working on wipper head
19.10.06 14:51	12	12	15	1	Section/IS-Machine	change blow head arm
19.10.06 15:16	7	12	10	1	warehandling equip...	change wipper finger
19.10.06 17:25	12	12	15	1	warehandling equip...	change wipper finger
19.10.06 19:38	12	12	10	1	warehandling equip...	change take out head damage
19.10.06 22:30	4	12	10	1	warehandling equip...	Changing worn out wiper finger
19.10.06 22:31	1	12	10	1	warehandling equip...	Changing worn out wiper finger

Machine minutes

10.0 / 1440 = 0.7% L41 Delete

In case each section of IS machine delivers one pulse per "Gobs delivered", iAfis will record section efficiency automatically and also section stops automatically (in case section pulse pauses for >= 1 minute). See pictures how this data / events are shown:

3: Section Efficiency

Sections

100.0	Shear	67062
97.5	all Sections	65408
97.1	Section 1	8138
98.9	Section 2	8288
97.4	Section 3	8168
98.3	Section 4	8242
96.3	Section 5	8072
96.9	Section 6	8120
96.8	Section 7	8114
98.6	Section 8	8266

0.0   10.0   40.0   50.0   60.0   70.0   80.0   90.0   100.0

Values on left hand side are showing % of gobs delivered per section, values on right hand side # of gobs delivered per section.

SECTION	RefDate	Info	INFO1	INFO2
2	10/04/11 08:17			
2	10/04/11 08:19			
2	10/04/11 08:30			
2	10/04/11 08:31			
2	10/04/11 08:37			
2	10/04/11 08:45			
2	10/04/11 09:41			
2	10/04/11 09:42			
6	10/04/11 08:01			
6	10/04/11 08:04			
6	10/04/11 08:06			
6	10/04/11 08:09			
6	10/04/11 08:10			
6	10/04/11 08:11			

Picture above is showing section stops, section 2 was stopped from 8:17 until 8:19, again from 8:30 until 8:31 etc.

Picture above is showing one row for each section and one column for each hour. Section 7 was stopped for 7 minutes between 2:00 and 3:00

In case customer is using Emhart FlexIS Database Interface, iAfis can communicate direct with Emhart server to record and deliver more information. See picture below showing a TopTen list of losses combined from Hot Enad and Cold End:

Samples

Samples inspected for quality at Hot End can be added to same screen mask used at Cold End (see description in next chapter).

Gob weight

If the weight scale at Hot End is equipped with a serial COM-Port, the gob weight can be recorded automatically and displayed separated by front and back gob:

EKF Elektronik GmbH * Philipp-Reis-Str. 4 * 59065 HAMM (Germany)
Tel. +49 (0)2381/6890-0 * Fax. +49 (0)2381/6890-90 * E-Mail info@ekf.de * Internet http://www.iafis.com
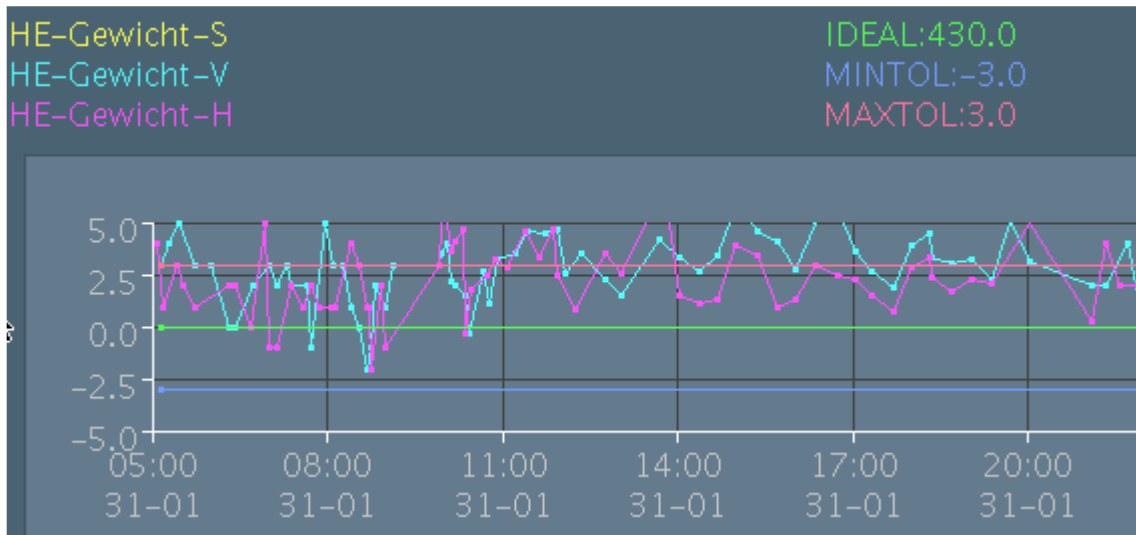
Specific information from Cold End

Mould set inspection

Results of mould set control / lehr output control can be typed into the page shown below. Additionally part changes from Hot End are displayed to show reactions at Hot End in accordance to detected defects at Cold End. And also mould rejects are displayed on same page to show reactions to critical defects. One comment field is available per shift to add observations etc.

Time	Place	1F	1B	2F	2B	3F	3B
22:00		----	33	18	30	27	8
	MI			501	403		
23:00				501			
00:00				501			
01:00				21			
02:00							
03:00							
04:00							
05:00							
3 / A	MI	3 Pallets had to be blocked (Mould 18)					

What does this picture show? At 22:00, when mould 18 was running on section 2F (blue background), a heel crack (defect code 501, yellow background) was found at Cold End. Reject for this mould was started with reason code 501 and active within the next 2 hours (23:00, 00:00, red background). At least the mould on section 2F was changed from 18 to 21 (mould 21 arrived at Cold End between 01:00 and 02:00, blue background).

Control of packed ware

For each article and even for each article/customer combination a set of defect codes for control of packed ware can be defined. Each defect can be grouped as critical, main, small or tiny. Additionally a set of rules can be defined, how many defects from each group force pallets to be marked as blocked. Example

- 1 Critical defect or
- 2 Main defects
- 1 Main defect **and** 2 small defects
- 4 small defects **and** 2 tiny defects

After each added result the software will proof along the given rules whether the tested lot of pallets should be blocked or not. Colour change to red background alarms if pallets have to be blocked, or colour change to yellow if defects were found, but no pallets need to be blocked. As long no defect at all was found, background colour will stay green. When the test for one lot of pallets is closed, automatically blocked pallets will be inserted into database.

Name	Info	05:18	07:06	09:03
	Los-Nr.	7	7	7
	von Paletten-Nr.	8	18	22
	bis Paletten-Nr.	17	21	29
	Kommentar	2	2	2
9991	Los akzeptiert	Ja	Ja	Ja
9990	Kein Fehler von AQL	Ja	Ja	Ja
9992	Gesperrt von AQL	Nein	Nein	Nein
	Operator	Franz	Zauer	Zauer
1010	Affenschaukel Hals			
1020	Affenschaukel Körper			
1125	Blasen offen innen			
1570	Glassplitter innen angeklebt			
1800	Innenverschmutzung			
1980	Loses Glas im Behälter			
2060	Mündung überpresst, überzogen			
2070	Mündungsgrat aussen			
2080	Mündungsgrat innen			
2150	Pegelkleber			
1030	Angeschlagene Mündung			
1040	Artikel aussen verschmutzt			
1050	Ausgebauchte Fläche			

Control of inspection equipment

Results from control of inspection equipment can be typed in here (0=not ok, 1=o.k, 2=adjusted). Additionally short comments can be added. Different groups of persons can add their test results (normally Cold End operator and Maintenance people). Here for instance DELTA finish test was not good, and later Maintenance people adjusted again camera 1 on left Delta and camera 2 on right Delta.

Time	PGroup	ICAM-L	ICAM-R	DELTA-L-B	DELTA-R-B	DELTA-L-F	DELTA-R-F
09:00	CE-Operator	1	1	1	1	1	1
10:00	CE-Operator	1	1	1	1	0	0
11:00	Maintenance	1	1	1	1	2 / Camera 1	2 / Camera 2
12:00	CE-Operator	1	1	1	1	1	1
13:00	Maintenance	1	1	1	1	1	1
14:00	CE-Operator	1	1	1	1	1	1

Worksheet for inspection equipment

Another screen is used to require maintenance people. On one page all production lines are visible. On each PC running iAfis software people from maintenance can either have a look at not closed problems reported, or they can close problems after repair and add a short comment what they did.

Arbeitsblatt Sortiermaschinenelektriker L01 : NoArticle						
Angefordert am	Linie	durch	Gerät	Problem	Erledigt	Abhilfemaßnahmen
2003-01-06 15:07	L01	HE	WST-L	Problem 1	2003-01-07 16:02	Lösung 1
2003-01-06 16:01	L01	CE	MCAL-R	Problem 2	2002-01-07 16:04	Lösung 2
2003-01-07 14:07	L01	CE	WST-R	Problem 3	2003-01-07 16:05	Lösung 3
2003-01-07 16:08	L02	CE	Tassenklebung	Problem 4	2003-01-07 16:48	Lösung 4
2003-01-07 16:48	L02	CE	WST-L	Problem 5	2003-01-07 16:55	Lösung 5
2003-01-07 16:55	L01	SUP	WST-L	Problem 6	2003-01-08 10:49	Lösung 6
2003-01-07 17:29	L01	SUP	WST-L	Problem 7	2003-01-08 10:49	Lösung 7
2003-01-08 13:31	L01	SUP	CO-R	Problem 8		

Alle Anforderungen ▽ ▽ ▽ Sichern

L01 ▽ <<< << < [06 . 01 . 03 14 : 00 08 . 01 . 03 13 : 59

Pallet Labelling

Iafis also can print pallet labels with barcode. With this option for each pallet the timestamp is stored when a pallet leaves the palletizer. In case a pallet is blocked, this is shown also within same table:

Ref-Datum	Verpackung	Los	Nummer	Gesperrt	Gespr.Datum	LABELED
01.02.05 05:11	7237	7	16	Nein		01.02.05 08:00
01.02.05 05:27	7237	7	17	Ja	01.02.05 06:34	01.02.05 06:34
01.02.05 05:44	7237	7	18	Ja	01.02.05 06:26	01.02.05 06:25
01.02.05 06:01	7237	7	19	Ja	01.02.05 06:26	01.02.05 06:25
01.02.05 06:18	7237	7	20	Nein		01.02.05 08:01
01.02.05 06:36	7237	7	21	Nein		01.02.05 08:33
01.02.05 06:54	7237	7	22	Nein		01.02.05 08:34

Blocking pallets

Of course it is possible to add blocked pallets. If a pallet is resorted later, this can be stored also by iAfis.

Ref-Datum	Los	Nummer	Fehler	Formen	Gesperrt	Name	PACKDATE	Nachsortiert
01.02.05 06:26	7	18	BB	8	true	Oere	01.02.05 05:44	?
01.02.05 06:26	7	19	BB	8	true	Oere	01.02.05 06:01	?
01.02.05 06:34	7	17	BB	8	true	Oere	01.02.05 05:27	?

Laboratory

Although all needed test items will be defined during installation phase of iAfis, customer can add later new ones at any time also. They can be defined as variable test (1 or 2 values measured per container), or as attributive test (thermal shock for instance). Master data definition per container type includes test items, definition of height (where to measure), tolerances and schedule of tests. See this picture how new test are defined:

NAME	NUMERO	INFO	SECTIONS	MOULDS	ATTRIB	VALPERBOT
Weight	1000	Weight	true	true	false	1
Brimfull	1200	Brimfull	true	true	false	1
Fillpoint	1300	Fillfull	true	true	false	1
Height	2000	Height	true	true	false	1
Pushup	2100	Pushup	true	true	false	1
Leaner	2200	Leaner	true	true	false	1
B-1 Dim	3010	B-1 Dimen...	true	true	false	2
B-2 Dim	3020	B-2 Dimen...	true	true	false	2

A test has a unique NAME (short expression) and a number (NUMERO). INFO is used for more explanation expression. In reports results are ordered by NUMERO, not in alphabetical order of NAME. This helps you to create an order by zones of the bottle or by type of test. You may define attributive tests (good / failed) as well as test where you get one or two measured values (VALPERBOT)

Definitions of specifications

For each bottle type an individual set of items to be measured can be defined with tolerances. For each item there are the following tolerances that may be defined:

IDEAL, MINTOL, MAXTOL defines the tolerances for each single measured bottle. MAXAV and MINAV (Max. and min. average) define the tolerance that the average of a complete batch may not exceed. Additionally this can be used also as warning level for a single bottle (not failed, but already outside average tolerance).

MAXDIFF can be used for ovality. Defines the maximum difference between maximum and minimum value measured at round bottles

All modifications to specifications are stored also to have a history of modified definitions for each bottle. Of course also comments and name of person who made modification can be stored.

LabChecks	Mean	MinTol	MaxTol	MinAv	MaxAv
Weight	349.0	0.0	0.0	0.0	0.0
Capacity	568.0	562.0	574.0	563.0	573.0
Brimfull	596.0	586.0	606.0	592.5	599.5
Lean	0.0	0.25	5.6	0.5	4.5
Height	248.5	246.9	250.1	247.7	249.3
Pressure	27.0	12.0	55.0	14.0	35.0
VerticalLoad	0.0	4000.0	0.0	8000.0	0.0
ImpactShoulder	1.0	0.0	0.0	1.0	0.0
ImpactHeel	1.0	0.0	0.0	1.0	0.0
Pushup	3.5	1.7	6.4	2.5	4.5
TopRing	26.55	26.3	26.8	26.4	26.7
BottomRing	28.6	27.8	29.4	28.2	29.0
BoreA	17.25	16.5	18.0	16.6	17.9
BoreB	17.5	15.5	21.0	16.5	20.0
TiltedFinish	0.0	0.0	0.6	0.0	0.4
CrimpDepth	3.85	3.7	4.0	3.8	3.9
B-DIM1	25.0	24.2	25.8	0.0	0.0
B-DIM2	29.0	26.0	31.0	27.0	30.0
B-DIM3	74.4	73.0	75.8	73.7	75.1

Recording data in laboratory

Of course all test results can be typed in manually. But if the equipment has a computer interface, results can be taken automatically by connecting this interface (normally COM-Port) to one computer in laboratory. Here is a short list of the most used equipment that can be connected to iAfis:

- Weight scales from Mettler / Toledo / Sartorius for Weight and Capacity tests
- AGR Volume Comparator
- AGR Volume Measurement
- Mitutoyo / IBR / Brecht-Multiplexer for DIGIMATIC calliper
- Magnamike Wallthickness
- AGR Ramp-Pressure and Vertical Load Tester, AGR SPT
- AGR Coatingmeter (HECM and FCMS)
- INEX Prolaser
- AGR ASG
- AGR Vision Bottle Gauge 7000
- INEX / ICS Minilab
- MSC AMD
- OTTO Camera Measurement System

Recording data can either be done in laboratory, at Cold End, at Hot End, wherever a PC is connected to network. Because iAfis knows the actual running moulds at Cold End, with one mouse click these are copied into the screen for tests. An advantage is, that also the section where this mould is running is copied and stored together with test results. Later then results can be analysed by mould numbers **and** by sections.

Sta	Pos	Mld	Weight	Fillpoint
3	F	1	465.00	661.00
9	F	2	466.00	660.00
3	B	3	468.00	651.20
6	F	4		
12	B	5		
11	F	7		
5	B	11		
6	B	12		
7	F	13		

Results out of tolerance are displayed with red background. Additionally a small yellow bar shows, how far the result is still away from tolerance limits (displayed with the small green vertical bars). As you can see here, the value 651.20 for Fillpoint is still nearby the lower limit. Average and standard deviation are recalculated after each incoming result and displayed on lower part of the screen (not shown here).

Another advantage is, that different tests can be combined. For instance Weight, Capacity and Fillpoint. Or wall thickness at upper contact zone, at lower contact zone, and on bottom. Thereby each container is handled only once. Only select with one click what you want to measure:

File	View	Job	Mould	News	Report	Service	Help

Print   Save   Delete   Terminate

Sta	Pos	Mld	Thickness 1	Thickness 2	Thickness 3
3	F	1	2.10	2.20	1.80
9	F	2	1.10	1.40	1.70
3	B	3	1.90	1.30	1.75
6	F	4			
12	B	5			
11	F	7			
5	B	11			
6	B	12			
7	F	13			
2	B	16			
8	B	17			
8	F	18			
5	F	20			
10	F	22			
12	F	23			
7	B	24			
11	B	25			
4	F	26			
2	F	27			
1	F	28			
4	B	30			

Name:

Comment:

Date: 20.07.07 15:33

Line: L41 ☐ReTest 20 °C

Job: JOB_1011_L41_1

Article: 1011

Customer: ----

Check: ○VBG7000 ●use Mouldtable

CombiChecks   Tickness 1-3 ▽

Thickness 1 ▽   ▽

Thickness 2 ▽   ▽

Thickness 3 ▽   ▽

In case the values are taking from COM-Port of PC, here is the work to be done for a measurement of thickness in 3 zones:

- Select the production line. This will automatically load the bottle from actual job. Or click to *Previous Job* in case you have still to do a test for the old job.
- Type in you name or initials to be stored with the test
- Select what you want to measure (here Thickness 1-3). This will automatically load the tolerances etc. for you.
- Either select automatic mould table copy to read current mould table from Cold End, or type in mould number manual. For this case you will be asked whether you want to use the set of mould numbers used with last test.
- Select Device if not already done (i.e. Magnamike on COM-2)

From that point you have your hands free to handle the bottles. Put metal ball into 1st bottle, measure thickness at upper contact zone and press footswitch. Result is copied and highlighted on screen. Now measure thickness at lower contact zone. Press footswitch if done and measure thickness of base. Take out metal ball, place it in next bottle and repeat in same way until all bottles have been done.

Of course you can place the cursor at any row meantime if you want to repeat measurement for a bottle.

If you want to get a printout, click to PRINT button.

When results have been done, click to SAVE button to store your result.

In case of tolerance problems then a telegram to be sent to Hot End and Cold End is offered. This makes sure that important information is forwarded immediately:

Reports for laboratory tests

There are different reports that come with laboratory. First report is a printout of a done batch. If you measured different items together, they can be printed out together. See this example from a Prolaser test. For reasons of space this has been reduced here to only 4 items measured:

Lab Sample Report

16.04.06 03:07

| _Line_ | L01 | _Job_
Name | Test1
asp | _Article_
Comment | Test | 16.04.06 03:07 .. 16.04.06 03:07 |

_	MinTol	Mean	MaxTol	n	MinAv	Av	MaxAv	dx
Height	266.60	268.40	270.20	20	267.50	268.54	269.30	0.10
Lean	0.00	0.00	6.00	20	0.00	1.65	5.00	1.33
B-DIM1	25.00	25.80	26.60	20	25.40	25.66	26.20	0.14
T-Dim	28.00	28.33	28.65	20	28.10	**28.14**	28.55	0.10

Sta	_Pos_	_Mld_	_Height_	_Lean_	_B-DIM1_	_T-Dim_
0 0		25	268.62 / 268.62	1.92	25.55 / 25.67	28.06 / 28.23
0 0		3	268.61 / 268.61	1.26	25.57 / 25.79	28.00 / 28.27
0 0		23	268.62 / 268.62	3.29	25.57 / 25.79	**27.97 / 28.15**
0 0		21	268.51 / 268.51	0.26	25.35 / 25.62	28.12 / 28.22
0 0		9	268.65 / 268.65	1.62	25.42 / 25.66	28.03 / 28.31
0 0		12	268.70 / 268.70	0.44	25.50 / 25.82	28.01 / 28.21
0 0		26	268.49 / 268.49	2.87	25.58 / 25.71	28.03 / 28.20
0 0		33	268.48 / 268.48	1.77	25.42 / 25.63	28.03 / 28.21
0 0		6	268.65 / 268.65	0.68	25.58 / 25.84	28.12 / 28.29
0 0		10	268.53 / 268.53	1.27	25.56 / 25.74	**27.98 / 28.17**
0 0		16	268.48 / 268.48	3.59	25.52 / 25.82	28.07 / 28.31
0 0		34	268.19 / 268.19	0.46	25.58 / 25.80	28.01 / 28.19
0 0		4	268.51 / 268.51	0.68	25.51 / 25.84	28.02 / 28.22
0 0		13	268.59 / 268.59	2.72	25.60 / 25.74	28.07 / 28.18
0 0		18	268.51 / 268.51	0.43	25.64 / 25.83	28.09 / 28.22
0 0		20	268.47 / 268.47	0.50	25.58 / 25.83	28.08 / 28.24
0 0		30	268.59 / 268.59	1.39	25.54 / 25.86	28.12 / 28.22
0 0		36	268.53 / 268.53	1.73	25.64 / 25.82	28.06 / 28.23
0 0		17	268.56 / 268.56	5.35	25.56 / 25.76	**27.97 / 28.16**
0 0		7	268.54 / 268.54	0.81	25.56 / 25.81	28.03 / 28.30

Results that exceed tolerance are marked with red colour; those ones that exceed the warning level (Average tolerance) with yellow colour).

Another report you can get is a daily report, which includes one row for each item measured with # of bottles, smalles and biggest value, average, standard deviation and qty. of bottles that failed the test (Tols):

Lab Batch Report

20.07.06 06:10

| Line | L01 | Job | Test1 | Article | Test | | 19.07.06 06:00 .. 20.07.06 05:59 |

LabChecks	MinTol	Mean	MaxTol	BatchSize	MinVal	Average	MaxVal	StdDevi	Tols
Weight	0.00	349.00	0.00	64	349.93	351.01	352.15	0.53	0
Capacity	562.00	568.00	574.00	64	566.76	568.48	570.32	0.83	0
Lean	0.25	0.00	5.60	31	0.57	2.35	5.22	1.17	0
Height	246.90	248.50	250.10	31	248.23	248.70	249.47	0.31	0
Pressure	12.00	27.00	55.00	776	12.80	29.70	35.00	5.40	0
Top Ring	26.30	26.55	26.80	31	26.22	26.42	26.57	0.07	2
Bottom Ring	27.80	28.60	29.40	31	28.15	28.40	28.56	0.09	0
Tilted Finish	0.00	0.00	0.60	31	0.03	0.10	0.38	0.07	0
B-DIM1	24.20	25.00	25.80	31	24.72	24.99	25.29	0.13	0
B-DIM3	73.00	74.40	75.80	31	73.38	74.26	75.23	0.40	0
B-DIM4	72.00	73.40	74.80	31	72.44	73.42	74.48	0.47	0
B-DIM5	72.00	73.40	74.80	31	72.12	73.25	74.46	0.62	0
B-DIM6	72.00	73.40	74.80	31	72.65	73.41	74.35	0.47	0
B-DIM7	73.00	74.40	75.80	31	73.81	74.42	74.98	0.31	0
HE-Weight	345.00	349.00	353.00	220	347.99	350.54	353.38	0.78	1

When a job is finished, the same report is generated automatically above the complete job runtime:

Lab Job Report

20.06.06 08:19

Line	L01			
Datum				07.06.06 10:22 .. 20.06.06 08:17
Job	test1			
Article	Test			

LabChecks	MinTol	Mean	MaxTol	BatchSize	MinVal	Average	MaxVal	StdDevi	Tols
Weight	0.00	436.97	0.00	726	425.27	438.49	453.97	5.05	0
Capacity	559.00	568.00	575.00	726	559.48	568.49	574.29	2.57	0
Lean	0.00	0.00	5.80	334	0.22	1.90	7.15	1.14	2
Height	250.30	252.00	253.70	334	251.46	252.22	253.82	0.35	1
Pressure	14.00	0.00	0.00	7953	8.00	29.66	35.00	5.37	71
Top Ring	26.30	26.60	26.90	334	26.14	26.48	26.70	0.09	15
Tilted Finish	0.00	0.00	0.60	334	0.03	0.11	0.41	0.05	0
B-DIM3	74.20	75.70	77.20	334	74.51	75.43	76.34	0.37	0
B-DIM4	73.20	74.70	76.20	334	73.49	74.47	75.51	0.44	0
B-DIM5	73.20	74.70	76.20	334	73.37	74.59	75.84	0.57	0
B-DIM6	73.20	74.70	76.20	334	73.40	74.71	75.89	0.53	0
B-DIM7	74.20	75.70	77.20	334	74.92	75.61	76.36	0.29	0
HE-Weight	429.12	437.12	445.12	3447	416.83	438.06	473.13	5.33	410

Of course you can also get a report where only failed tests are shown:

Mld.	MinVal	MaxVal	Tols	MinTol	Mean	MaxTol	ReT...	Status	LabChecks	RefDate
0	353.38	353.38	-	345.00	349.00	353.00	false	1	HE-Weight	2007-07-19 18:51:2
2	3776.85	3776.85	<-	4000.00	0.00	0.00	false	1	VerticalLoad	2007-07-19 08:53::
3	2501.55	2501.55	<-	4000.00	0.00	0.00	false	1	VerticalLoad	2007-07-19 08:53::
20	26.22	26.42	<-	26.30	26.55	26.80	false	1	TopRing	2007-07-19 09:56:5
20	26.26	26.43	<-	26.30	26.55	26.80	false	1	TopRing	2007-07-20 12:18::
31	26.29	26.39	<-	26.30	26.55	26.80	false	1	TopRing	2007-07-20 12:18::
35	26.28	26.46	<-	26.30	26.55	26.80	false	1	TopRing	2007-07-20 12:18::
40	26.26	26.43	<-	26.30	26.55	26.80	false	1	TopRing	2007-07-19 09:56:5

Another report shows the values ordered by mould numbers:

Article	LabChecks	Mld.	MinTol	Mean	MaxTol	Batc...	MinVal	Aver...	MaxVal	StdD...	Tols	N
147...	HE-Weight	0	345.00	349.00	353.00	124	348.93	350.25	351.91	0.60	0	
147...	Lean	1	0.25	0.00	5.60	1	1.36	1.36	1.36	0.00	0	
147...	Height	1	246.90	248.50	250.10	1	249.49	249.49	249.49	0.00	0	
147...	Pressure	1	12.00	27.00	55.00	5	17.30	21.12	24.50	3.10	0	
147...	TopRing	1	26.30	26.55	26.80	1	26.32	26.38	26.43	0.08	0	
147...	BottomRing	1	27.80	28.60	29.40	1	28.32	28.43	28.54	0.16	0	
147...	TiltedFinish	1	0.00	0.00	0.60	1	0.07	0.07	0.07	0.00	0	
147...	B-DIM1	1	24.20	25.00	25.80	1	24.75	24.90	25.06	0.22	0	
147...	B-DIM3	1	73.00	74.40	75.80	1	74.08	74.23	74.38	0.21	0	
147...	B-DIM4	1	72.00	73.40	74.80	1	73.29	73.53	73.77	0.34	0	
147...	B-DIM5	1	72.00	73.40	74.80	1	72.65	73.09	73.53	0.62	0	
147...	B-DIM6	1	72.00	73.40	74.80	1	72.81	73.16	73.52	0.50	0	
147...	B-DIM7	1	73.00	74.40	75.80	1	74.17	74.29	74.41	0.17	0	
147...	Lean	12	0.25	0.00	5.60	1	0.79	0.79	0.79	0.00	0	
147...	Height	12	246.90	248.50	250.10	1	248.52	248.52	248.52	0.00	0	
147...	Pressure	12	12.00	27.00	55.00	5	24.10	27.68	33.40	3.57	0	
147...	TopRing	12	26.30	26.55	26.80	1	26.43	26.49	26.55	0.08	0	
147...	BottomRing	12	27.80	28.60	29.40	1	28.45	28.54	28.62	0.12	0	
147...	TiltedFinish	12	0.00	0.00	0.60	1	0.06	0.06	0.06	0.00	0	
147...	B-DIM1	12	24.20	25.00	25.80	1	24.87	24.97	25.07	0.14	0	
147...	B-DIM3	12	73.00	74.40	75.80	1	73.98	74.42	74.87	0.63	0	
147...	B-DIM4	12	72.00	73.40	74.80	1	73.02	73.54	74.06	0.74	0	
147...	B-DIM5	12	72.00	73.40	74.80	1	72.80	73.40	74.01	0.86	0	
147...	B-DIM6	12	72.00	73.40	74.80	1	73.02	73.46	73.89	0.62	0	
147...	B-DIM7	12	73.00	74.40	75.80	1	74.20	74.56	74.92	0.51	0	
147...	Lean	13	0.25	0.00	5.60	1	3.63	3.63	3.63	0.00	0	
147...	Height	13	246.90	248.50	250.10	1	248.45	248.45	248.45	0.00	0	
147...	Pressure	13	12.00	27.00	55.00	5	19.40	23.16	29.40	4.15	0	
147...	TopRing	13	26.30	26.55	26.80	1	26.40	26.44	26.47	0.05	0	
147...	BottomRing	13	27.80	28.60	29.40	1	28.37	28.42	28.48	0.08	0	

Analysis of laboratory tests

As add on to tables with results iAfis offers different graphical analysis tools. One is to display all tests done within an html page. For each batch a picture like below is shown then:
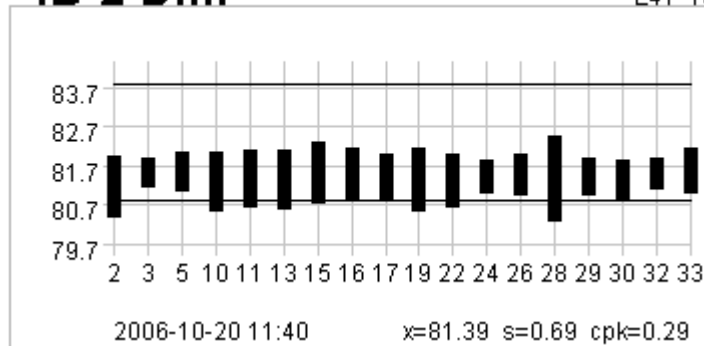
:Height
L41 1011

```
284.2 ─
283.2
282.2 ─  ─    ─ ─    ▪    ─ ─  ─ ─  ─ ─ ─ ─  ─ ─
281.2        ▪     ▪      ▪
280.2 ─
       2  3  5 10 11 13 15 16 17 19 22 24 26 28 29 30 32 33
```

2006-10-20 11:40   x=282.00 s=0.19 cpk=2.28
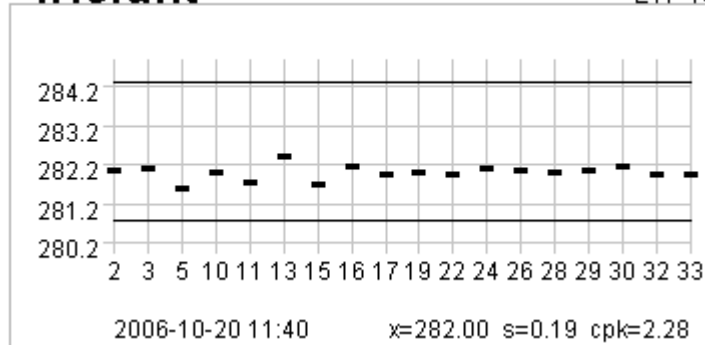
In case of round containers, where diameters are measured with 2 values (Minimum and Maximum per measuring point), results are displayed in this way:

:B-2 Dim
L41 1011

```
83.7
82.7
81.7  █▪█▪█▪█▪█▪█▪█▪█▪█▪█▪█ █▪█▪█▪█
80.7
79.7
       2  3  5 10 11 13 15 16 17 19 22 24 26 28 29 30 32 33
```

2006-10-20 11:40   x=81.39 s=0.69 cpk=0.29

If you have a look at mould 28, you can see that this is not only out of minimum tolerance. It also is more oval than round (height of the bar).

Other tools show results either sorted by reference date of the batch, or sorted by mould number, or sorted by sections of IS machine. At upper part of the picture average for each batch is displayed as horizontal bar, and average +- 3 * standard deviation as vertical bar. Within red background the qty. of bad containers is shown. If you click to one batch (here 20.10.2006 16:40) all values of that batch are displayed at lower part of the picture. As you can see mould number 13 and 16 had been out of tolerance.
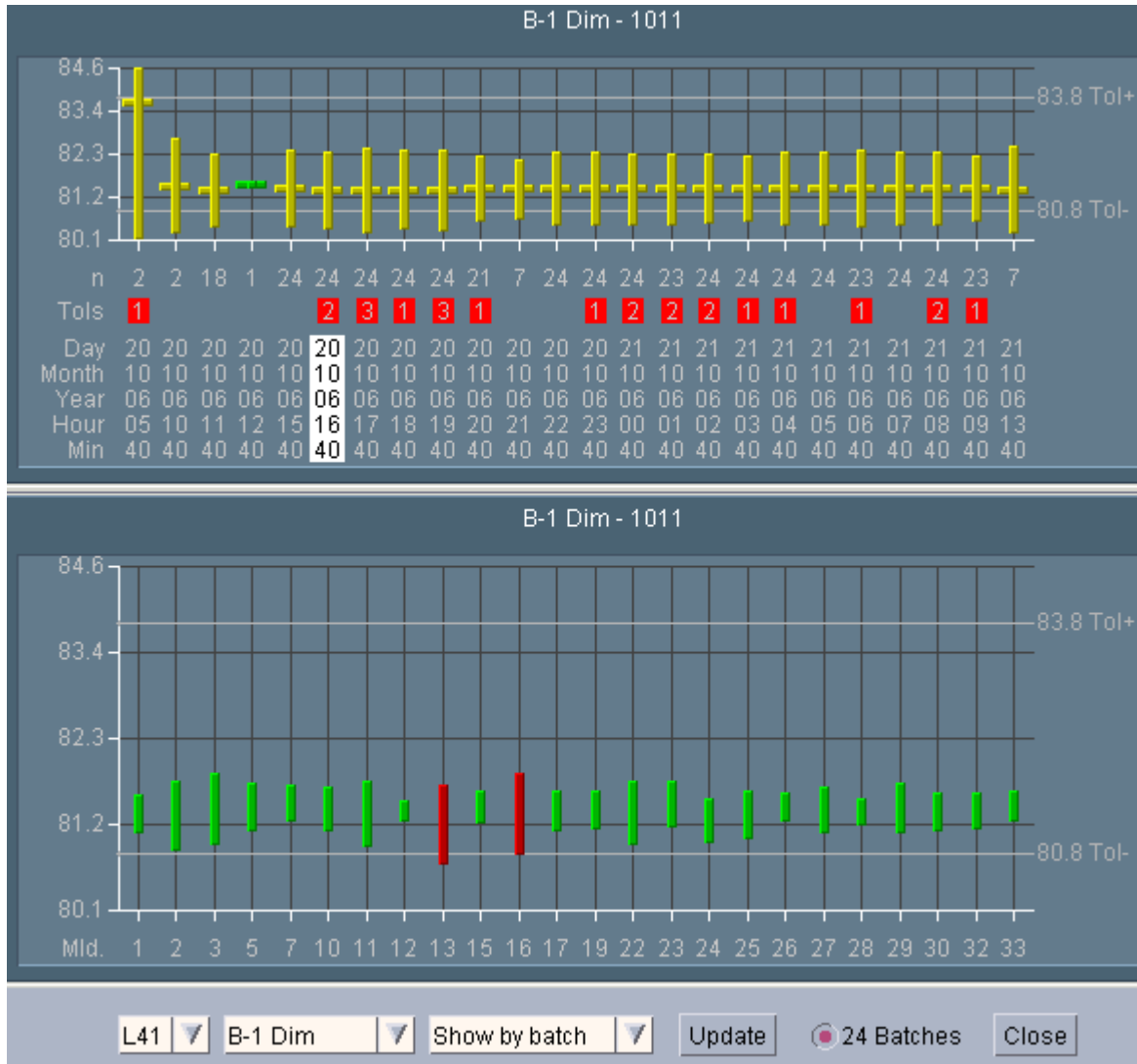
In next picture results are sorted by mould number. The upper horizontal bars show the average for each mould above all batches (+- 3 * standard deviation by vertical bar). Mould number 16 is selected; 6 times out of tolerance. All results of mould 16 are displayed at lower part:
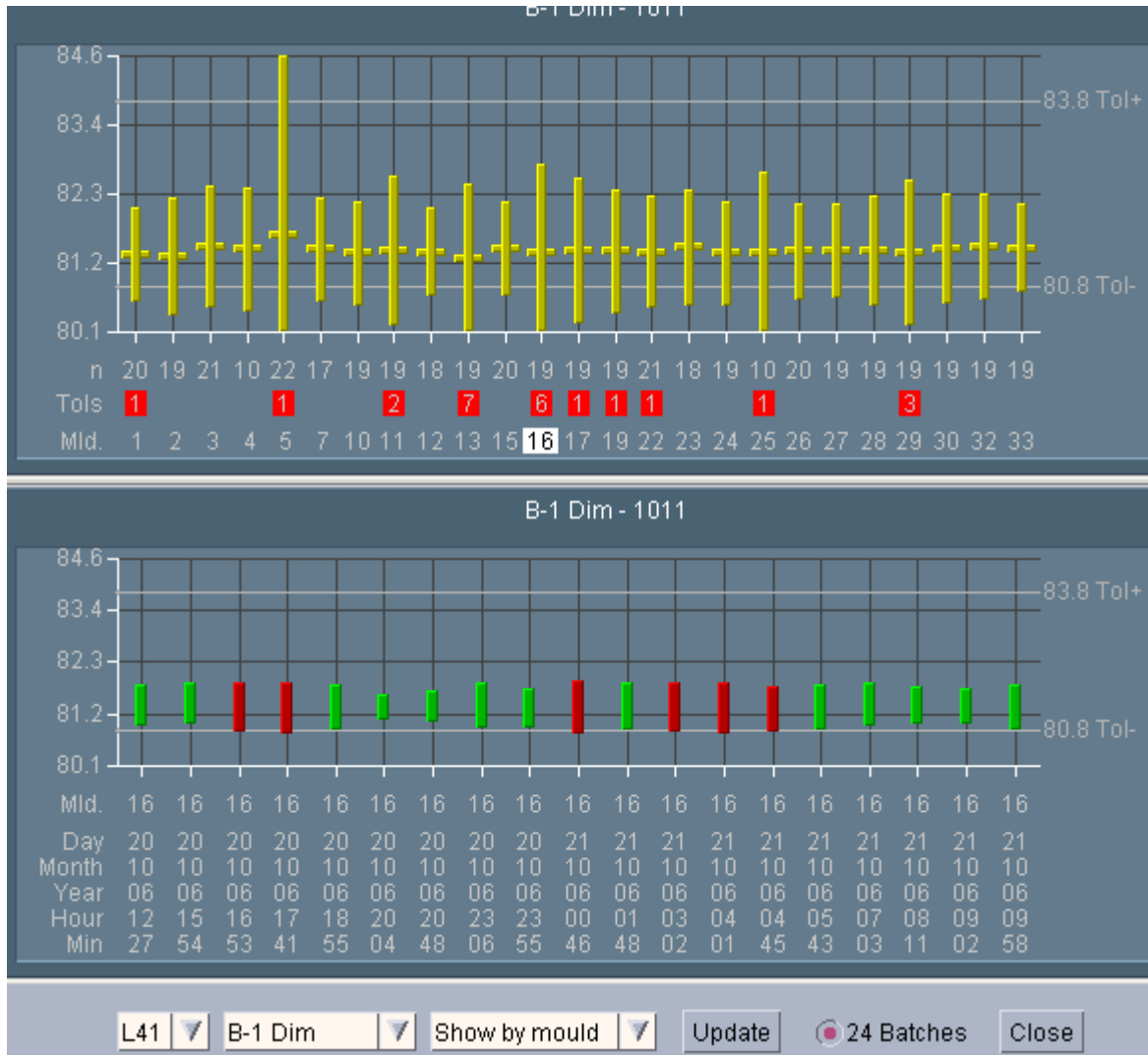
Last picture shows results sorted by section. Horizontal bar shows average per section. Section 7F is selected (white cursor frame); 7 containers had been bad. All results from selected section are displayed at lower part of picture. As you can see, no mould change took part (always mould number 13 displayed at lower part).
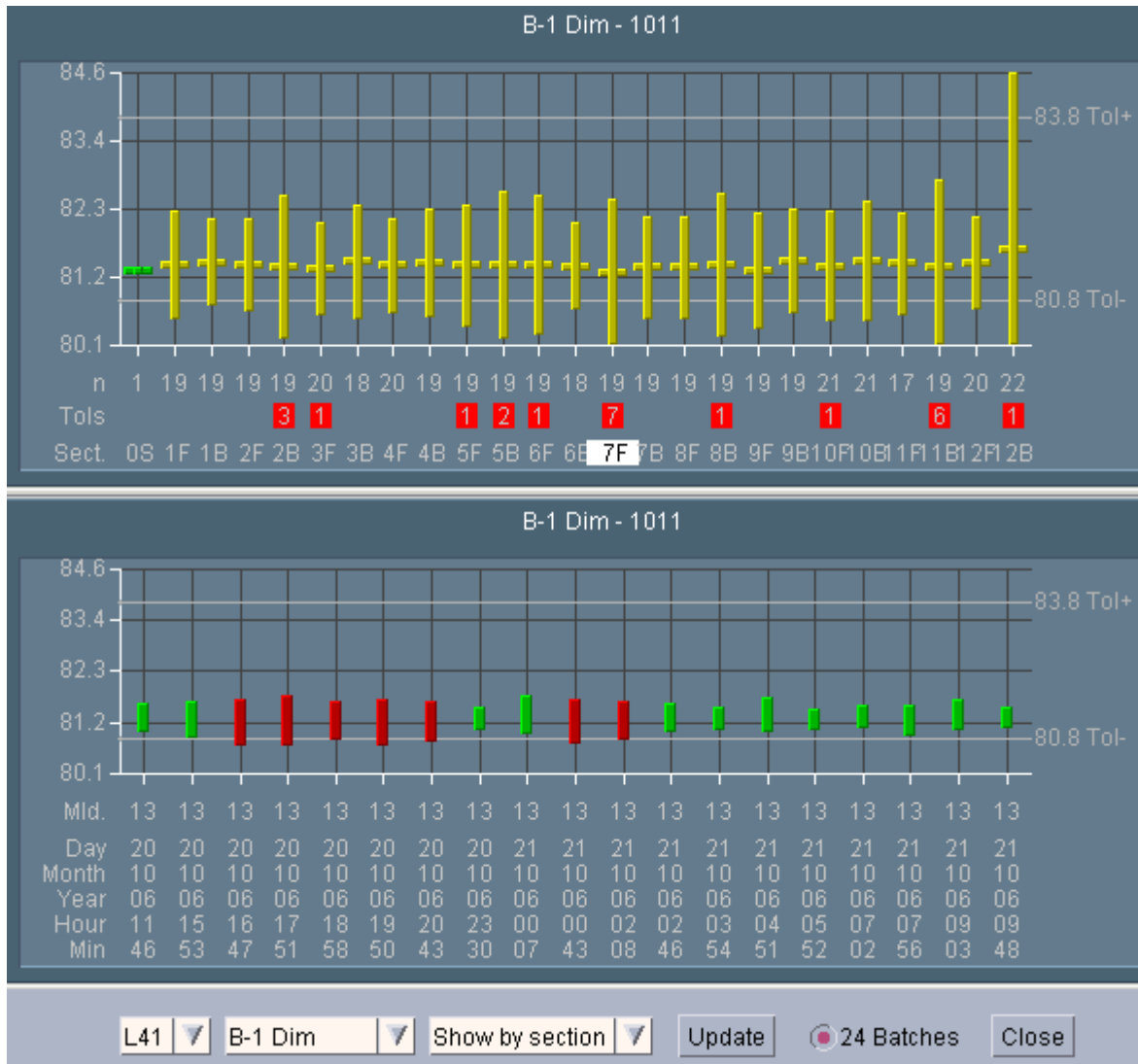
Alarms

There are different kinds of alarms configurable. Simple ones are formula for counter values. In case a counter values within wanted period of time is higher or lower as the defined threshold, automatically a message can be sent. Then this alarm will be suspended for the defined idle time before being enabled again. This kind of counter value alarm is normally used for high reject levels, different reject levels between left and right inspection lane, or for breakdown of mould reading rates. Can be used also for non-iAfis events. Only connect a 24V signal to AFIS, and define an alarm to be sent each time this signal creates an output pulse (iAfis counting result > 0 within one minute).

Another type of alarm is watching that weight measured at Hot End is inside tolerance.

You also can define alarms to send a message in case of mould rejects being active longer than wanted period of time.

Or define a mould reject to be stopped by iAfis automatically after mould has been changed plus additionally period (i.e. 8 hours) has been passed. Because sometimes people change a mould at Hot End, and Cold End people forget to stop the mould reject after this mould has disappeared from Cold End. Afterwards, when repaired mould is used 1 or 2 days later, they wonder, why this is rejected again. Of course because they forgot to delete it from inspection machines reject list. So this can be done automatically as well.

List of products that interface with iAfis

List below only contains such equipment that real have been running or is still running with iAfis. In case you are missing equipment you are using, do not hesitate to contact us.

Hot End equipment

All forming machine equipment from different supplier (Bottero, Emhart Glass, Futronic, GPM etc can be interfaced. Normally these signals are interfaced by 24V inputs on iAfis side:

- Shear on/off
- Shear cut pulse
- Interceptor or section pulse "Gobs loaded"
- IS Reject pulse
- Hot bottle counter / Lehr input counter

iAfis can take data from Emhart FlexIS Interface by Ethernet network – for such cases only Lehr input counters has to be connected

XPAR Vision system or Tiama I-CARE system can be interfaced by Ethernet network:
- Inspected per section / position from IS
- Defects per section / position found
- Missing bottles per section / position

Gob Weight results
- Weightscales from Mettler / Toledo / Kern / Sartorius etc. by RS232
- Gedevelop Gob weight by Ethernet network

Cold End equipment

Sidewall inspection
- Emhart-Powers Scanner 8000 by Qualitrac Arcnet network
- Emhart FlexBC by Ethernet network
- Emhart ViC by Ethernet Network
- INEX 5 x 512 by RS422
- INEX Superinspector-2 by RS422
- INEX Superinspector-3 by Ethernet network
- Krones / Symplex by Ethernet network
- IRIS Evolution-12 –16 by RS422 or by Ethernet network
- Tiama MCAL-1 by 24V-signals SDL
- Tiama MCAL-2 by 24V-signals SDL
- Tiama MCAL-3 by Ethernet network or by 24V-signals SDL
- Tiama MCAL-4 by Ethernet network
- Tiama Alphacam by RS232
- Tiama ICAM by RS232

Base / Finish inspection
- Emhart-Powers Scanner 8000 by Qualitrac Arcnet network
- Emhart FlexBC by Ethernet network
- Emhart ViB by Ethernet network
- ICS Base Inspector by Ethernet network
- INEX Superscan-2 by RS422
- INEX Superscan-3 by Ethernet network
- IRIS Evolution-1 –2 -5 by RS422 or by Ethernet network
- Krones / Symplex by Ethernet network
- Tiama Multistation 1 by 24V-signals SDL
- Tiama Multistation 2 by 24V-signals SDL or by RS422
- Tiama Multistation 3 by Ethernet network or by 24V-signals SDL
- Tiama Multistation 4 by Ethernet network
- Tiama Deltacam by RS232

Check Detectors
- AGR-PCC system by RS422
- Busch & Spreen ISM / GPM by RS422
- Emhart FlexT by Ethernet network
- Emhart-Powers TIM-LAN by Qualitrac Arcnet network
- Emhart ViM by Ethernet network
- Tiama Check+ by Ethernet network
- Tiama CO / M1 by RS422
- Tiama Mouldreader series 200 by RS422

Other ones
- AGR CIS by serial connection
- AGR OLT by 24V-signals
- AGR Highspeed OLT by RS422
- AGR Sample Pressure Tester by RS422
- Emhart Minilab by Ethernet network
- Emhart MLP Pressure Tester by Ethernet network
- Powers DHG by 24V-signals
- Powers Wall Thickness by 24V-signals

Palletizer counting, Photocell etc.
- Interfaced by 24V signals

Laboratory equipment

- AGR DSG by Ethernet connection
- AGR Hot End Coating Meter by RS232
- AGR Finish Coating Meter by RS232
- AGR Ramp Pressure Tester / Vertical Load tester by RS232
- AGR VGB 7000 Vision system by RS232
- INEX Prolaser by RS232
- Magnamike Wall Thickness probe by RS232
- Tiama Dimension control / Inside Finish by Ethernet network
- Weight scales (Mettler, Toledo, Sartorius etc.) by RS232
- Mitutoyo Digimatic equipment by RS232
- Brecht Digimatic Multiplexer by RS232