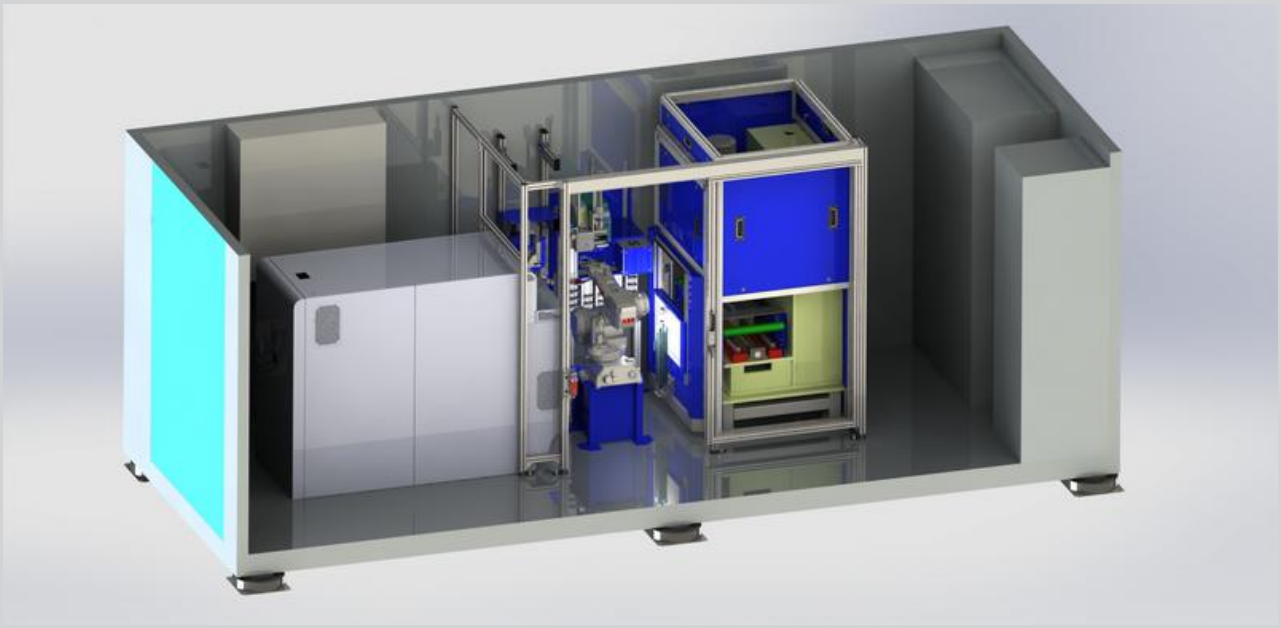
Metal Analysis



AUTOMATED METAL ANALYSIS

AUTOMATED METAL ANALYSIS

FASTEST METAL ANALYSIS FOR PROCESS CONTROL AND RESEARCH OF PRIMARY AND SECONDARY METAL MAKERS

BRIEF INTRO

Sample handling, sample preparation by milling and highly accurate elemental results in under 4 minutes for low-alloy steels) and analysis of main alloying elements like iron, aluminum and copper materials)

With our automation you get the fastest possible measurements; greatest throughput; lowest limits of detection; longest uptime; and most future-proof flexibility. It's the instrument of choice for primary and secondary metal producers, automotive and aerospace manufacturers and makers of finished and semifinished goods.

WHY AUTOMATE ILUSTRATED BY THE EXAMPLE OF VOESTALPINE

Minimal cycle times and minimal errors in sample preparation are essential for the efficiency of metal analysis in the process laboratory and thus for the process in steel plants. At Voestalpine yearly 400,000 samples are evaluated in plant's process laboratory primarly via automated spectrometric analysis of:

- incoming, in-production and outgoing materials
- New-material research

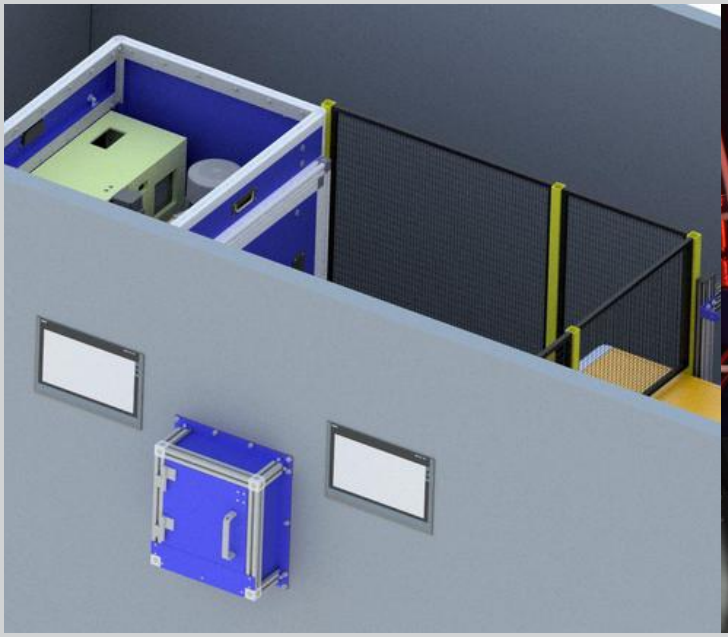
"One melt costs 50,000 euros. We make 100 melts per day. If we can improve our laboratory results, we can improve the process in the steel plant. That can quickly save millions of euros."

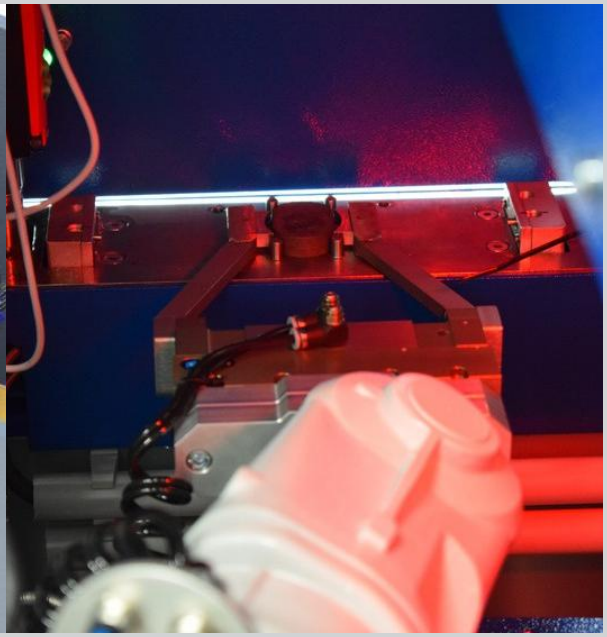
Thus every second that is shortened in metal analysis by our automation saves thousands of euros and, not least, enables more output.

YOUR BENEFITS:

- Software integration of any leading manufacturer of high-end arc/spark OES analyzer as well as XRF and XRD analyzer for primary & secondary metals & more
  - **SPECTRO AMETEK**
  - **THERMOFISHER SCIENTIFIC**
  - **MALVERN PANALYTICAL**
  - **BRUKER**
- Fastest possible and highly accurate sample preparation by our automated milling machine.
- High configurability (integration of sample temperature measurement, radioactivity measurement, argon cleaning, sample cooling etc. possible)

Quality Control Systems



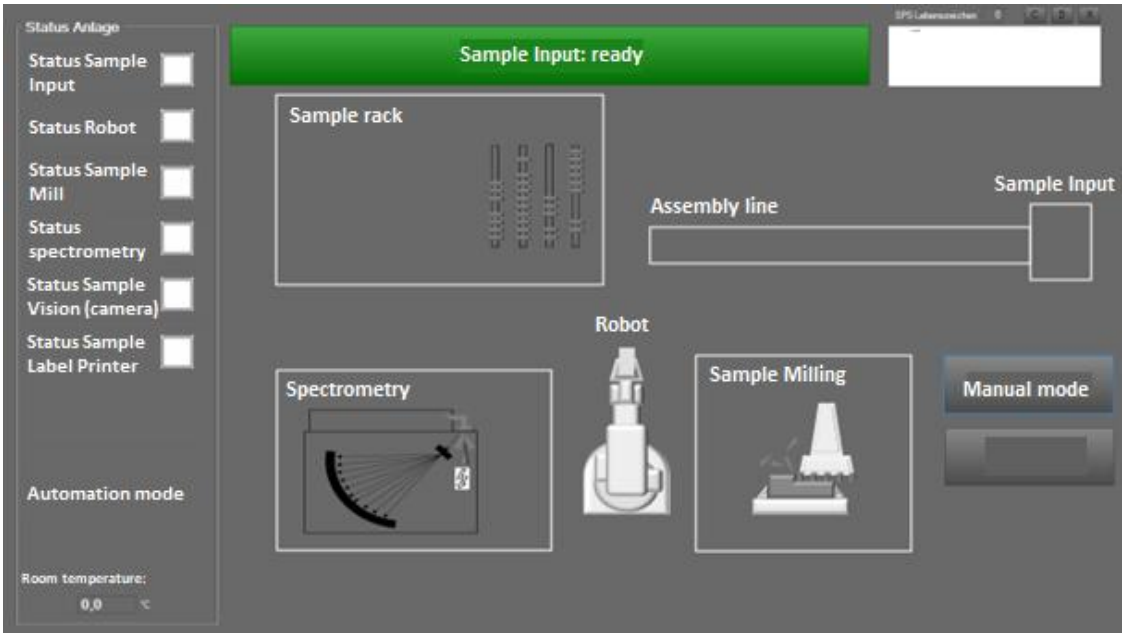


STEP 1: SAMPLING AND SAMPLE REGISTRATION

HOW IT WORKS

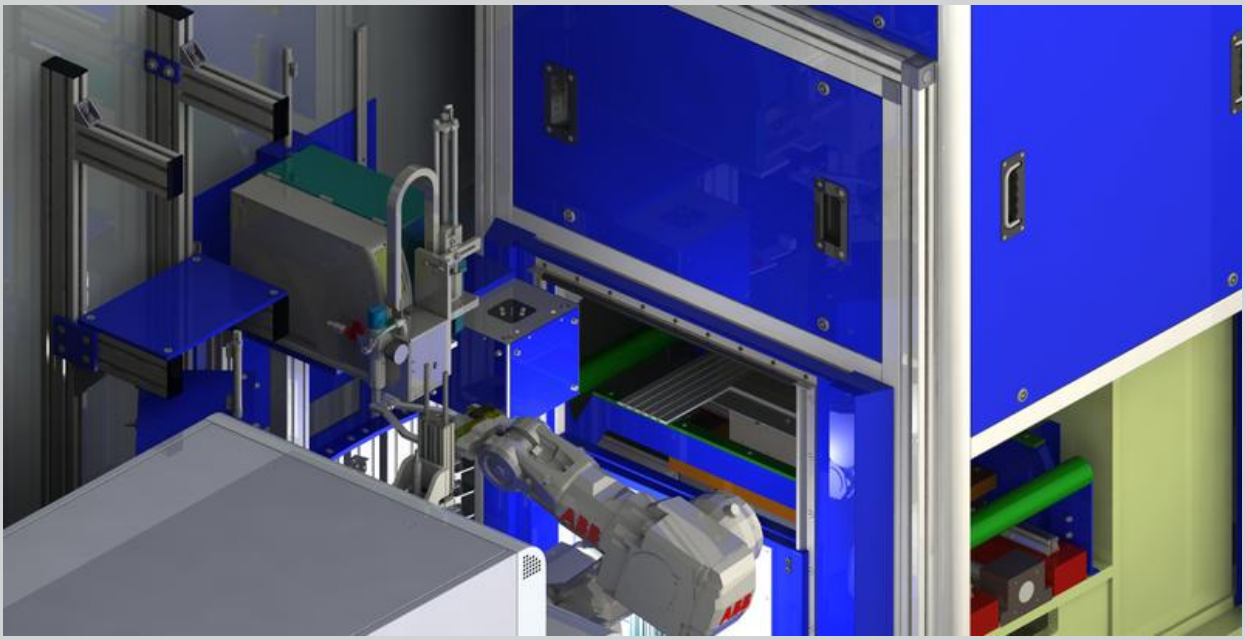
The operator takes a sample from the melt, cuts off the inlet pin, opens the input door and places the sample in the holder provided. A light barrier checks that it is present.
After the door is closed, the sample ID is selected on a touchscreen mounted above the input and thus logged into the system with all the associated sample data. A safety switch locks the input door until another sample can be introduced into the system. This is signaled by green and red indicator lights. A pneumatically operated linear cylinder transports the sample for transfer to the robot. On arrival, the sample is removed by the robot and sent for temperature measurement (step 2)

HMI (SAMPLE CONTROL SYSTEM)



Displays the system status, communication with higher-level systems, parameters and settings. Indicates the system status with "not ready", "ready", "in operation" or "fault".

Metal Analysis



SAMPLE PREPARATION TIME

STEP 2: SAMPLE PREPARATION BY MILLING

HOW IT WORKS

TIn the milling machine, the sample is placed in the clamping device and the sample data is transmitted, which contains the appropriate milling program for the respective material. The robot leaves the input area of the milling machine, the sample is clamped and the scale layer is removed from the surface. The robot removes the sample from the milling machine and holds it under our sample vision system (step 3).

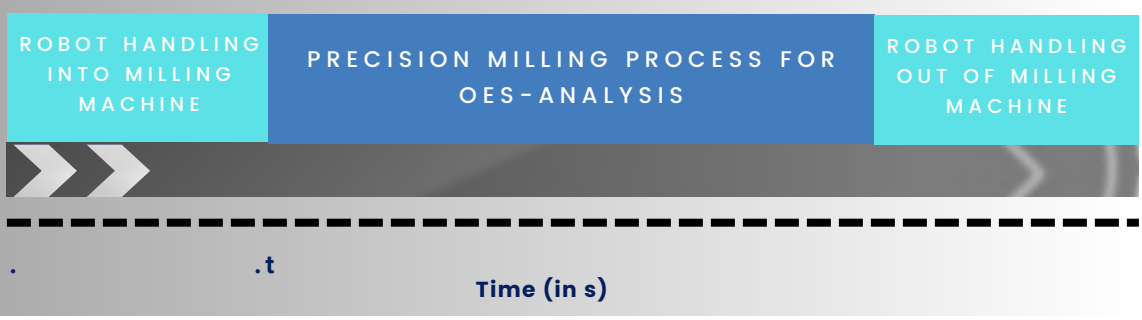
HOW IT LOOKS LIKE

WITHOUT PREPARATION

AFTER PREPARATION

TYPICAL CYCLE TIME FOR AUTOMATED MILLING

These are our standard times. The times can be set via our PLC as required



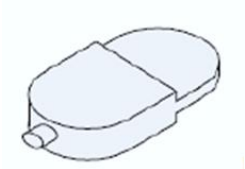
Quality Control Systems

SAMPLE SHAPES

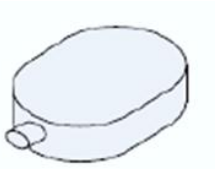
STEP 2: SAMPLE PREPARATION BY MILLING

SEVERAL SAMPLES SHAPES ARE POSSIBLE

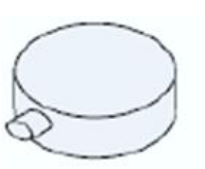
Thanks to our many years of expertise and our specially developed clamping unit, we can mill several sample shapes:



Double Thickness Lollypop

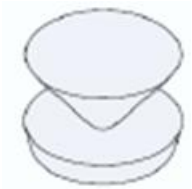


Oval Lollypop

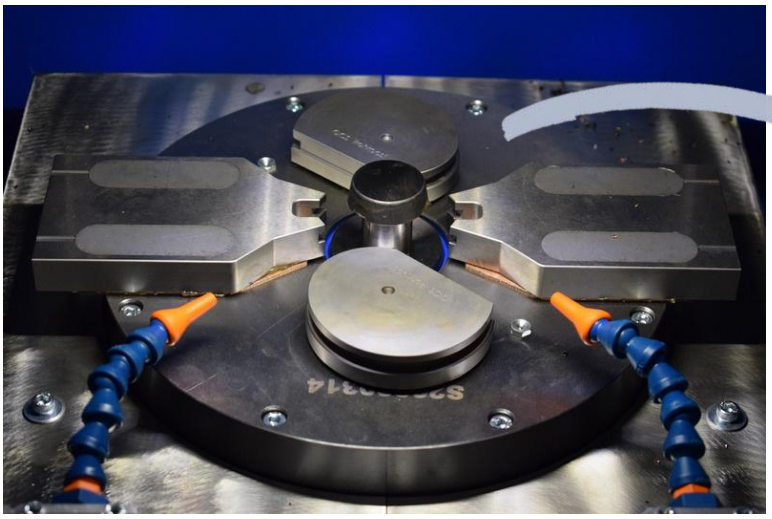


Cylindrical

Conical

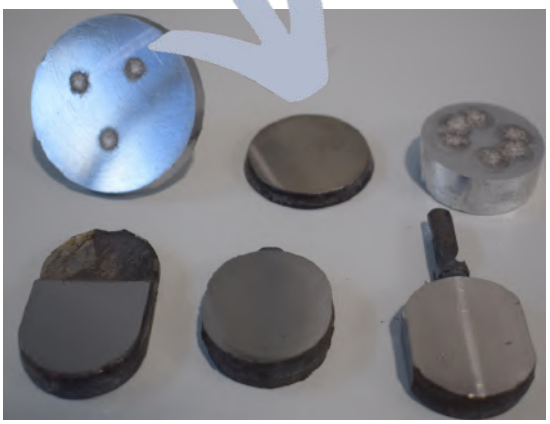


Aluminium Mushroom

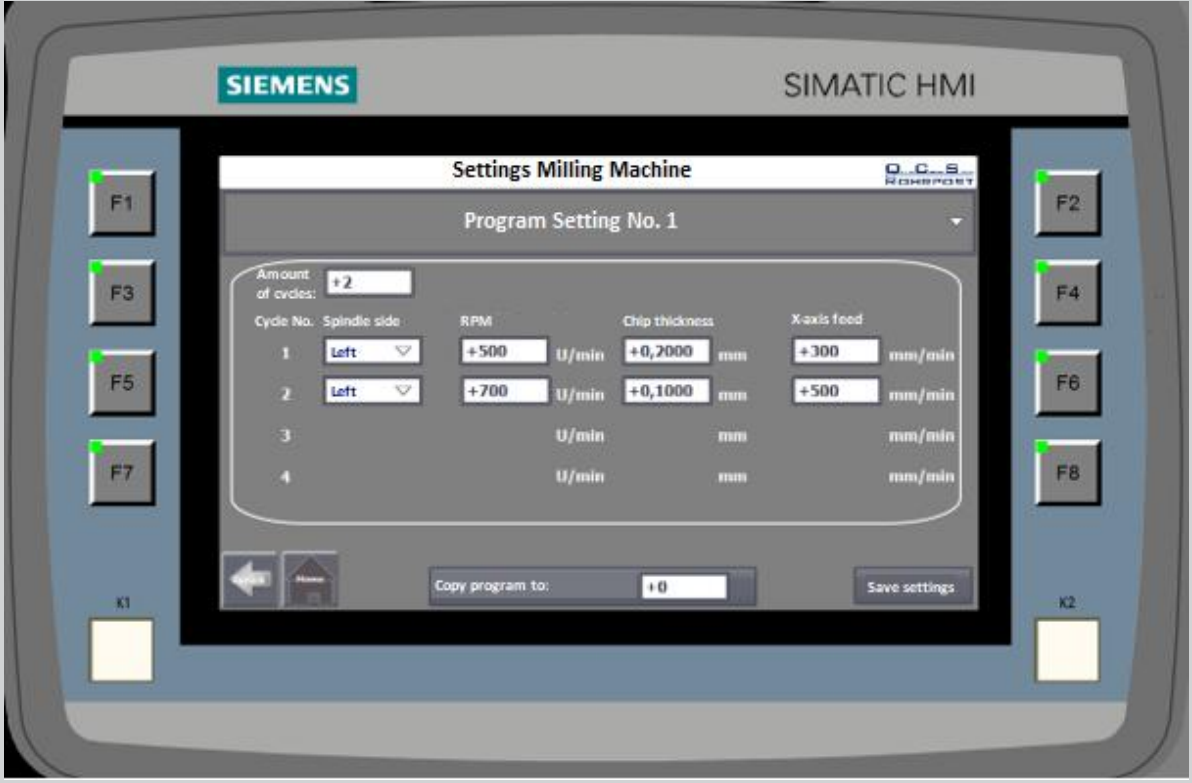


OUR CLAMPING UNIT FOR SAMPLES SHAPES

Several sample shapes after milling



Metal Analysis



MILLING PARATMETERS

STEP 2: SAMPLE PREPARATION BY MILLING

MILLING DEGREES OF HARDNESS UP TO 64 HRC

We do not manufacture conventional CNC milling machines. Our milling machines are specially designed for sample preparation of hardness grades up to 64 HRC. To achieve this, we use spindles developed in-house, which are easy to operate thanks to our software. In addition, we combine our software perspective with our decades of experience in the selection of suitable cutterheads and their inserts. This is essential to ensure representative sample surfaces even at hardness levels of 64 HRC and to keep wear as low as possible. This also means that the speed of the spindles can be individually parameterized. The chip thickness and X-axis feed can also be set individually. Our machine has 2 spindles and 2 cutter heads as standard to cover different sample shapes and sample hardnesses. The number of milling cycles can also be adjusted (see picture above).

CYCLES

Up to four milling cycles can be selected which are run one after the other with different parameters and milling heads.

SPINDLE SPEED (RPM)

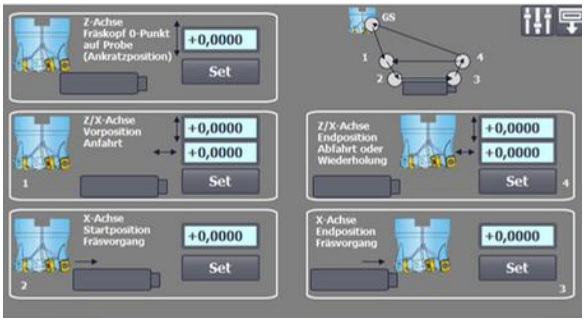
The right spindle speed plays a decisive role in achieving a perfectly flat sample surface, especially for very hard samples.

CHIP THICKNESS

Infeed of the height which specifies the amount of material removal per cycle. The sum of the chip thicknesses of all cycles must not exceed the maximum dimension. This setting is particularly helpful for expensive recal samples in order to mill off only as much as necessary.

X-AXIS FEED

Speed of the X-axis during the milling process. This parameter, in conjunction with the spindle speed, decisively influences the result of the finished sample surface.

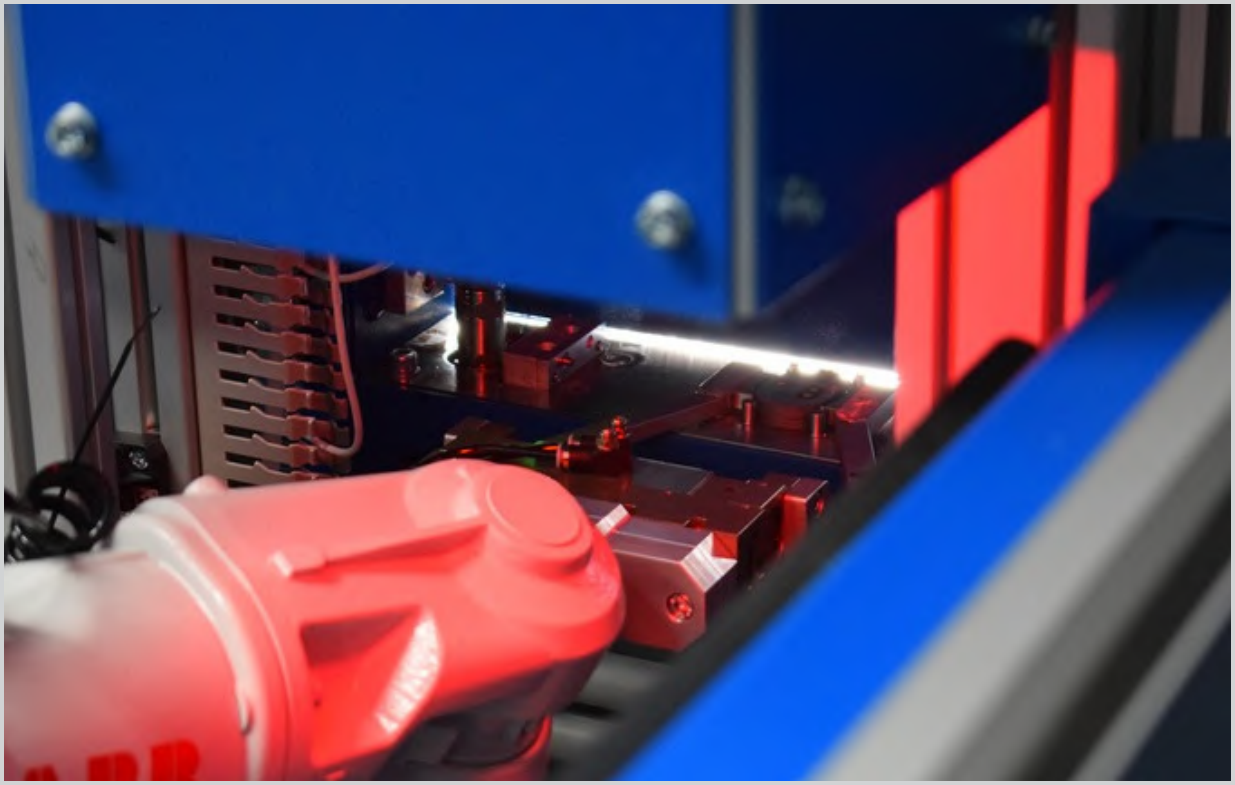


Various X- and Z-axis settings are possible to adjust the cutter heads and cutting plates to the sample shape and thickness. This includes, among other things:

- Z-axis positioning of the sample in the clamping device at the correct height using a hold-down device and our integrated height compensation
- X-axis positioning for the milling process at the speeds set in the programs
- Z combined X-axis positioning for the basic setting of several cycles

Quality Control Systems

Metal Analysis

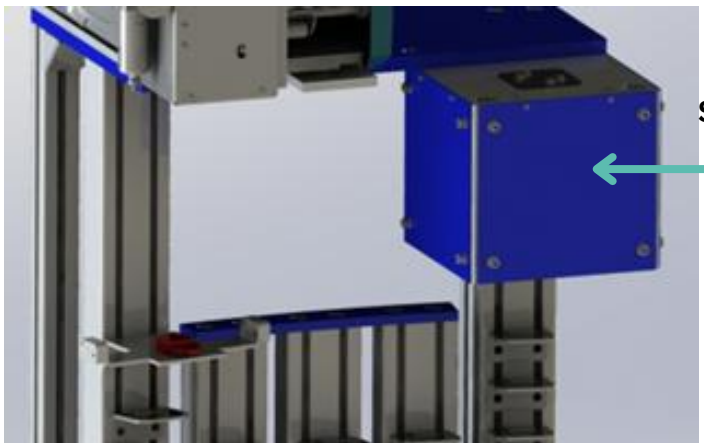


SAMPLE SURFACE CONTROL

STEP 3: SAMPLE SURFACE CONTROL (CAMERA)

OPTICAL DETECTION OF VISIBLE INCLUSIONS AND DEFECTS

After the milling process, the surface is checked for opical defections and any inclusions (blowholes). If there is sufficient free, clean and perfectly flat measuring surface, further processing toward spectrometry (step 4) is carried out, otherwise the sample is rotated and subjected to a further milling process. If sample surface is still insufficient for analysis the sample is discarded and the sample control system is notified by our software SamCoS.



FOR REPRESENTATIVE STABILITY THE SAMPLE SURFACE MUST BE PERFECTLY FLAT

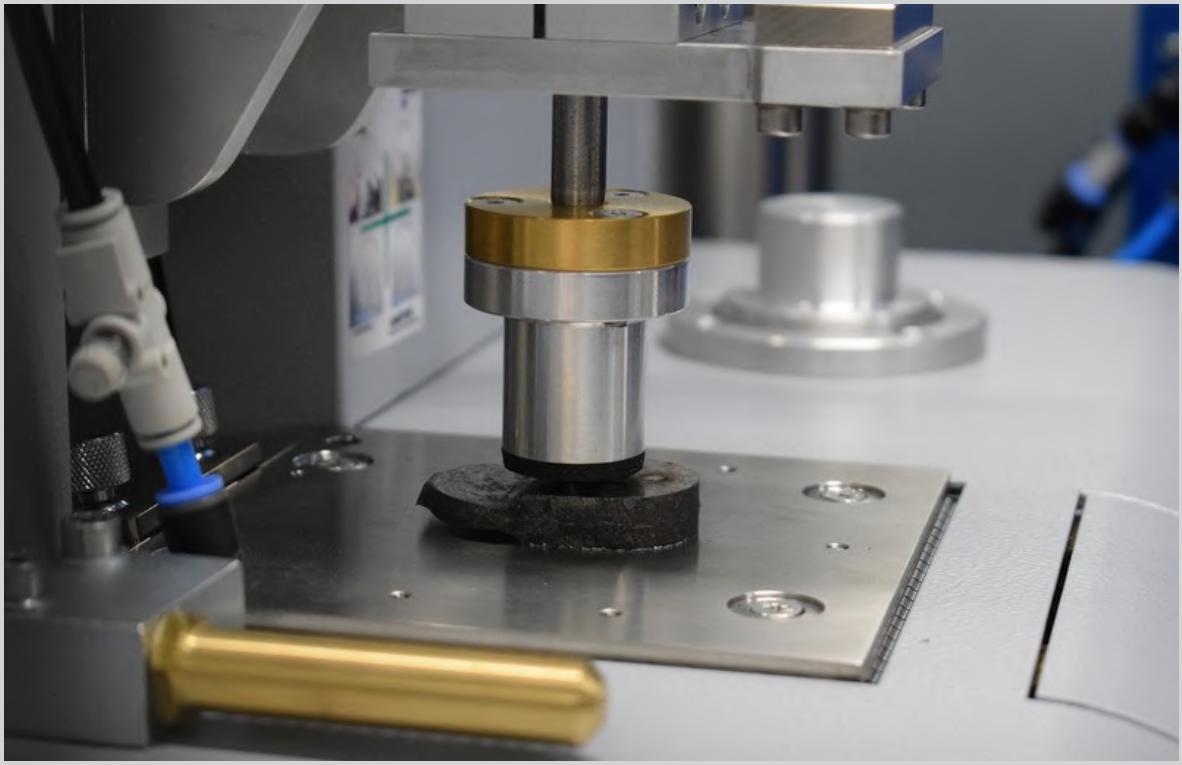
For representative analytical results the sample surface:

- must not have holes or bruns

- must not be humid or hot

- must not be non-perspendicular

Quality Control Systems

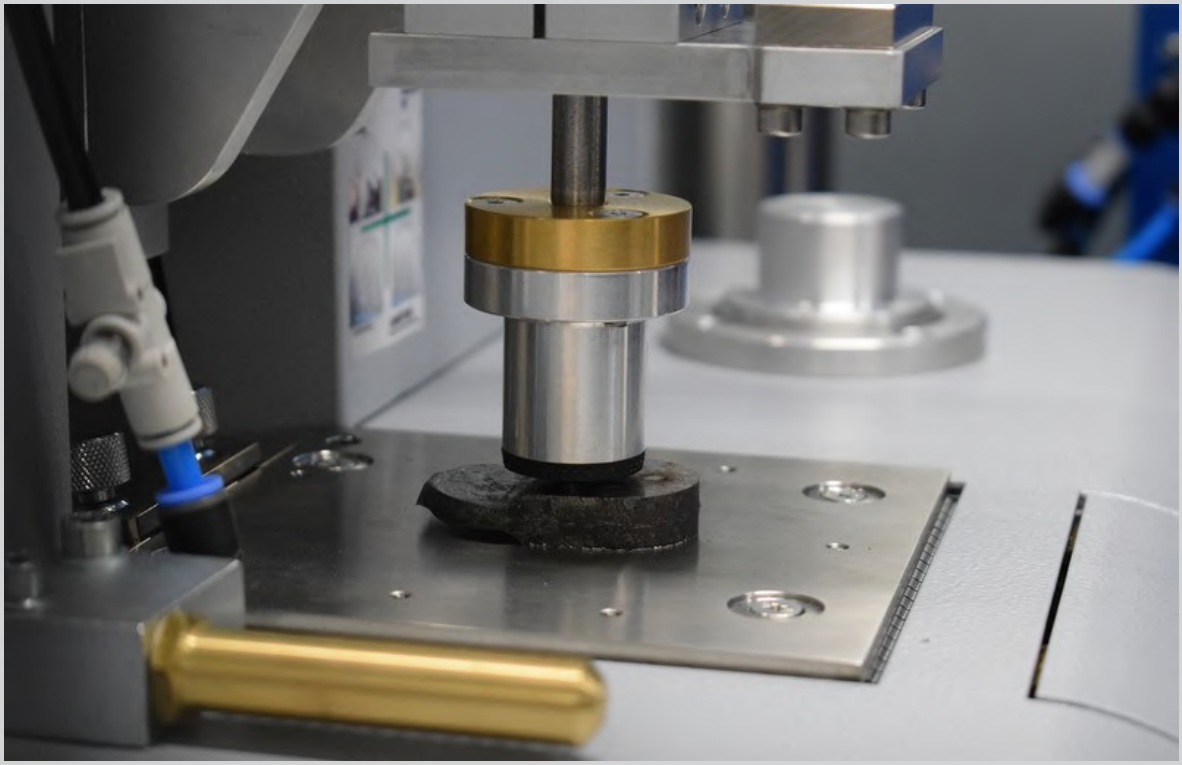


STEP 4: AUTOMATED SPECTROMETRY

AUTOMATED METAL ANALYSIS AND SPARKING STAND CLEANING

If the sample has the flat surface, it is fed into the spectrometry. The spectrometer generates an electric arc through electrical voltage which strikes the sample in a similar way to welding. The arc is generated in a protective atmosphere by means of argon flushing. The light emitted by the arc is guided to the inside of the device via a special fiber optic cable, where it is broken down into its spectrum. Several channels with different wavelengths determine the light intensity. From this, the device then calculates the chemical composition of the sample material in a complicated process. The measurement is carried out at several positions on the sample and the robot takes over the conversion to the new position. If enough valid measured values are available for averaging, the sample is completed and the analysis is read out by our software SamCos, converted into a valid protocol and forwarded to the steelworks control system.
Our automation includes fixation of samples with max. height 70mm by operated hold-down device, integrated cleaning of the electrode (after fixed interval) as well as blow-out device for sparking stand cleaning.

Metal Analysis



LABORATORY DATA MANAGEMENT

STEP 4: AUTOMATED SPECTROMETRY

ANALYSIS MANAGEMENT

All operational samples are stored in an internal sample database with the associated data and analysis results. The number is limited to 1000 entries, the oldest entry is automatically removed in case of overflow. The displayed selection can be limited by a time filter to find certain entries faster. By clicking on the line of the entry, all details are displayed in the right half of the screen.
If you additionally want to use the advantages of LIMS it offers you everything from analysis viewing, processing and evaluation, to automation of various processes, as well as documentation and data export, to monitoring of processes, archiving and tracking. We integrate the analysis management from our partner company Fink & Partner so that you get a full overview of your laboratory data with central master data management and fast, central access to all your laboratory data. Manage your measurement data centrally in a laboratory database and completely replace decentralized storage locations such as laboratory books or Excel lists. It offers you all the possibilities for creating technically flawless reports with added value and uniform layout according to accreditation specifications. There are no limits to the design of your reports – you decide what data appears. Simply choose from the wide range of layout templates or create your own personal layout if you wish. The reports can also be output in many other conceivable formats.

Date	Time	Charge	Quality	Program	C [%]	Si [%]	Mn [%]	P [%]	S [%]	Ni [%]	Mo [%]	Cu [%]	Sn [%]	Cr [%]	N [%]	Ti [%]
11.06.2021	13:15:38			FE_1	0,740	0,460	1,130	1,480	15,970	0,400	0,800	1,810	1,010	0,690	2,0200	0,1100
11.06.2021	13:15:38			FE_1	0,006	0,005	0,017	0,002	0,013	0,013	0,007	0,009	0,001	0,021	0,0008	0,0001
11.06.2021	13:15:38			FE_1	0,758	1,030	1,500	0,132	0,082	3,120	0,920	0,501	0,110	3,090	0,0398	0,1350
11.06.2021	13:15:37			FE_100	0,754	1,040	1,510	0,130	0,073	3,110	0,910	0,507	0,110	3,100	0,0392	0,1350
11.06.2021	13:15:37			FE_100	0,762	1,030	1,490	0,133	0,091	3,130	0,920	0,495	0,111	3,070	0,0404	0,1350
21.04.2021	09:25:21		1.4541	FE_100	0,001	0,750	2,000	0,030	0,031	8,990	0,000	3,000	4,500	19,050	0,5000	0,7000
07.04.2021	14:23:19		Lqd 135	LQD												
07.04.2021	14:06:15		Lqd 135	LQD												
07.04.2021	14:06:15		Lqd 135	LQD												
18.12.2020	14:19:35		1.4541	FE_100												
17.12.2020	16:39:07	2532	1.4541	FE_100	14,000											
17.12.2020	16:37:31	2532	1.4541	FE_100												
10.12.2020	15:52:25	7086	GGG nach DIN ...	HT												
10.12.2020	15:52:24	7081	GGG nach DIN ...	HT												
10.12.2020	15:52:24	7066	GGG nach DIN ...	HT												
10.12.2020	13:38:51	7086	1.4541	FE_100	0,740	0,460	1,130	1,480	15,970	13,000	0,800	1,810	1,010	0,690	2,0200	0,1100
10.12.2020	13:38:51		1.4541	FE_100	0,758	1,030	1,500	0,132	0,082	3,120	0,920	0,501	0,110	3,090	0,0398	0,1350
10.12.2020	13:38:50		1.4541	FE_100	0,754	1,040	1,510	0,130	0,073	3,110	0,910	0,507	0,110	3,100	0,0392	0,1350
10.12.2020	13:38:50		1.4541	FE_100	0,762	1,030	1,490	0,133	0,091	3,130	0,920	0,495	0,111	3,070	0,0404	0,1350
10.12.2020	13:38:44		1.4541	FE_100	0,106	0,101	0,085	0,139	0,179	0,183	0,151	0,081	0,142	0,121	<0,0...	0,0305
10.12.2020	13:38:44		1.4541	FE_100	0,106	0,101	0,085	0,139	0,179	0,183	0,151	0,081	0,142	0,121	<0,0...	0,0305
10.12.2020	13:38:38		RN19	FE_100	1,460	0,540	0,770	0,750	7,130	0,510	0,520	1,860	1,030	0,650	7,8600	0,9600

STEP 5: SAMPLE LABELING AND SAMPLE STORAGE

AUTOMATED LABELING AND RECALIBRATION

The robot removes the sample, has it labeled by the printer or laser and throws it into a waiting output box. Samples with specific identifiers are temporarily stored in the system according to the FIFO principle for later use (30-50 positions).
The system also contains control and recalibration samples which are fed to the spectrometer at parameterizable intervals for self-control or recalibration.

DIAMETER RECAL SAMPLE 1/10mm

The specification of the diameter is communicated to the robot when used, which then calculates the necessary positions of the circular path around the milling head for the deburring process

RADIUS OF SPARK 1/10mm

The measuring points (sparking points of the spectrometer) are placed in a circle around the center of the sample with this radius. The blue points are used to check that the measuring points are within the valid range.

ACTUAL AND MAXIMUM VALUE OF SPARKS

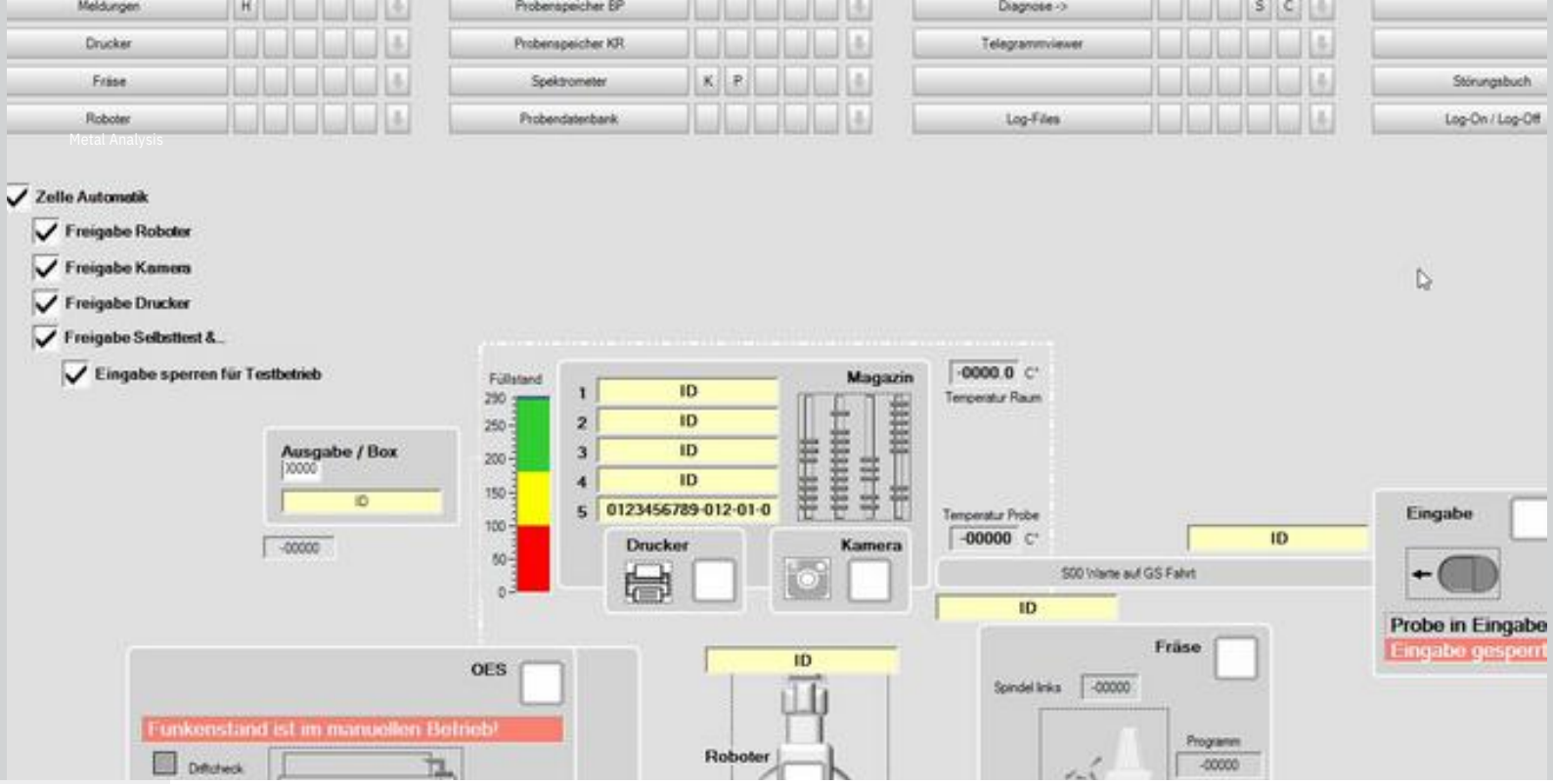
Number of possible measuring points (spark points on spectrometer). If all measuring points have been used, the sample is fed to the milling machine for surface preparation.

APPRIOPIATE MILLING PROGRAM

The correct milling program (spindle speed, axis positioning) is based on the sample height, sample diameter and other defined criteria.

AUTOMATED LABELING

We can integrate both label printers and laser printers for the identification of samples. Data to be printed can be set, e.g. sample ID, date of sample analysis etc.



LABORATORY MANAGEMENT SOFTWARE

LABORATORY MANAGEMENT SOFTWARE

SELECTABLE SUBMENUS FOR EFFICIENT LABORATORY MANAGEMENT

- Messages (display of all pending fault messages)
- Label/Laser Printer (status and reset)
- Milling machine (status and mode selection)
- Robot (status)
- Operations sample storage (overview and discharge of operational reserve samples)
- Recal sample storage (setting of control and recal samples)
- Spectrometer (status and reset)
- Sample database (overview of current and historical operational samples)
- Telegram viewer (historical overview of communication with higher-level control system)
- Log files (selection and viewing of log files)
- Malfunction book (online error documentation for maintenance and malfunctions)
- Log On / Log Off (user management)

SIMPLE DIAGNOSIS AND TROUBLESHOOTING

As our team has more than 40 years of experience, we can state from experience that our system runs trouble-free 24/7 with one service a year. However, in the rare event that faults do occur, they are stored in our **malfunction book** and can be retrieved at any time using specific filters. Maintenance work or replaced spare parts also appear in this book. In addition, all communication and errors that occur are saved in a **log file** that is generated daily to facilitate diagnosis in the event of a fault. With your consent, our technicians can connect to the systems remotely from anywhere in the world.

Quality Control Systems

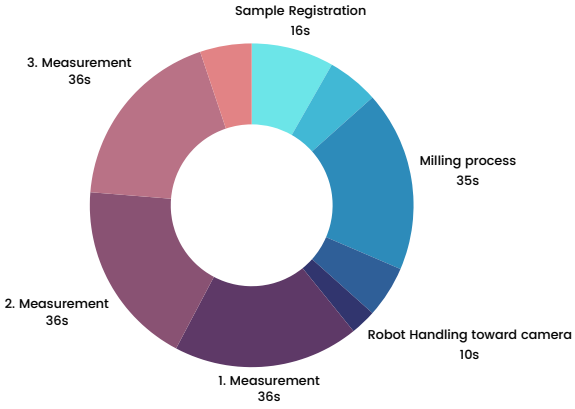
Metal Analysis

LABORATORY MANAGEMENT SOFTWARE

FASTEST METAL ANALYSIS

DECREASE YOUR TIME AND INCREASE YOUR SAMPLE THROUGHPUT

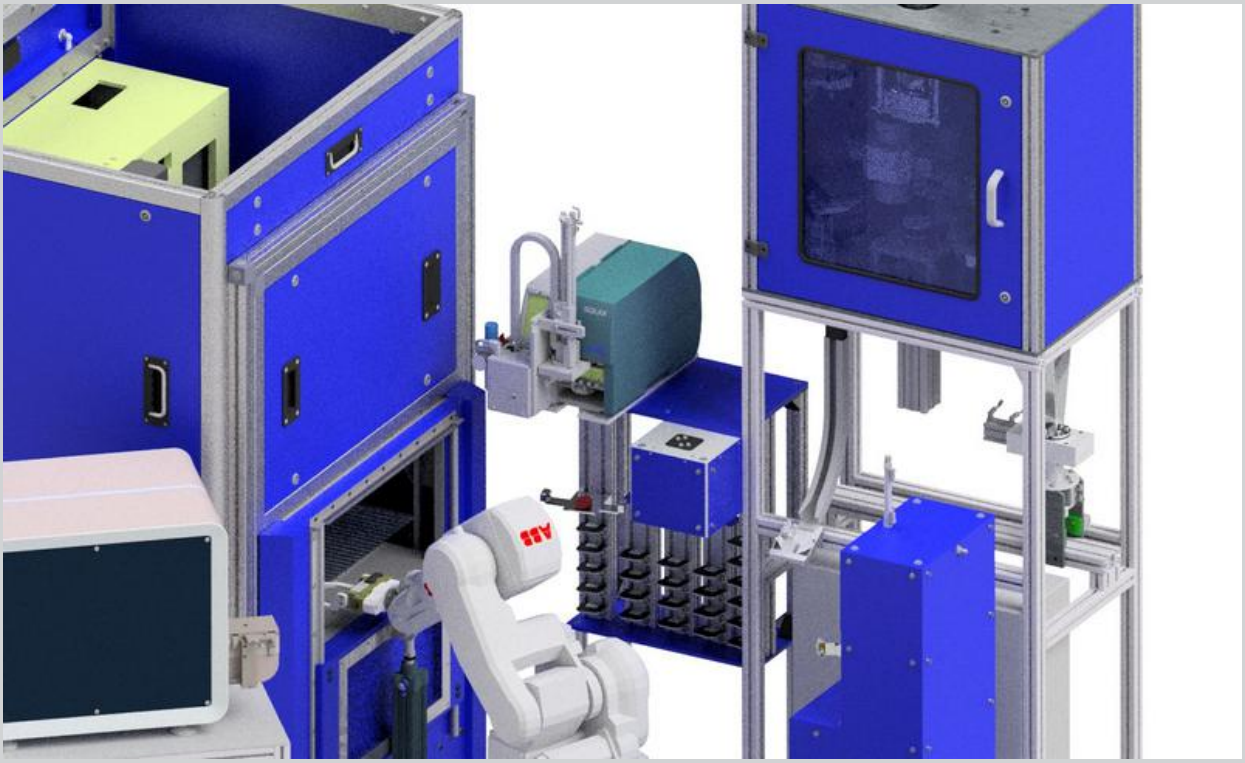
Cycle time varies in particular depending on the required number of milling cycles, which depends on the sample shape and sample hardness, as well as the number of measurement cycles on the spectrometer (2 measurements vs. 3 measurements). Based on the automation implemented at primary and secondary metal makers, we achieve approx. cycle times between 3,5 to 4 minutes.



SEE WHOLE PROCESS ON YOUTUBE:

Quality Control Systems

Metal Analysis



AUTOMATED PROCESS LAB WITH RECEIVING STATION

PROCESS LABORATORY WITH AUTOMATED TRANSPORT TUBE RECEIVING STATION

AUTOMATED METAL ANALYSIS, CLEANING AND RECALIBRATION

In addition to the automation by the container laboratory directly at the melting store, we offer planning, development as well as control of individual central laboratory concepts. The technical process is mainly comparable with the container laboratory (see slide 25), but with the following essential differences:

- Intersection to pneumatic transport tube system via several sending and receiving station
- Multiple analytical methods (e.g. OES, XRF, XRD, LIBS analyzers or C/S/N and O/N analysis) can be integrated in one sample handling system
- Several sample preparation machines e.g. combination of sample milling machine and sample punching machine for combustion analysis
- Multiple laboratory stations served by either sample conveyor belt or robot system

PROCESS OF SENDING AND RECEIVING STATION

Quality Control Systems