MASS FINISHING – Medical Industry

Rösler Oberflächentechnik GmbH – GS Machine Sales

Speaker: Michael Striebe Global Process & Sales Expert

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1.SURFACE FINISH OF MEDICAL COMPONENTS / APPLICATIONS

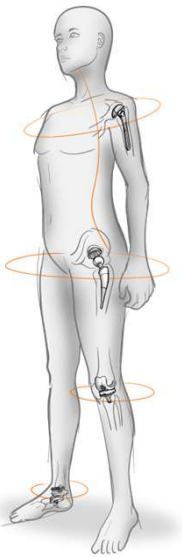
1.SURFACE FINISH OF MEDICAL COMPONENTS/APPLICATIONS

For more than **30 years** Rösler surface finishing has been an essential part of the orthopedic implant manufacturing technology….

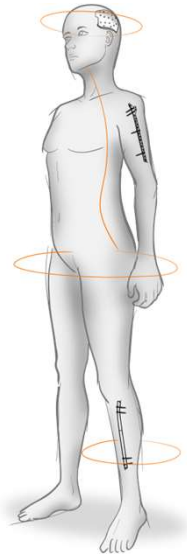
Typical applications

- Endoprosthesis implants
- Trauma implants
- Spinal implants
- Dental implants
- Medical instruments

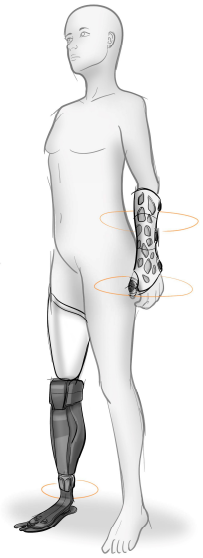
1.SURFACE FINISH OF MEDICAL COMPONENTS/APPLICATIONS



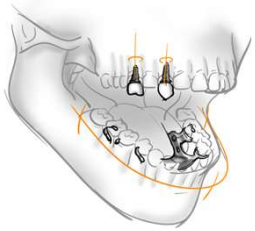
Endoprosthesis implants



Trauma implants

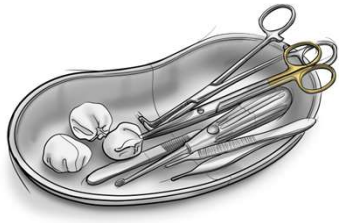


Prosthesis/ Orthosis

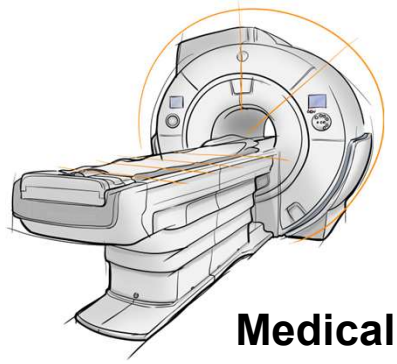


Dental implants

Spinal implants

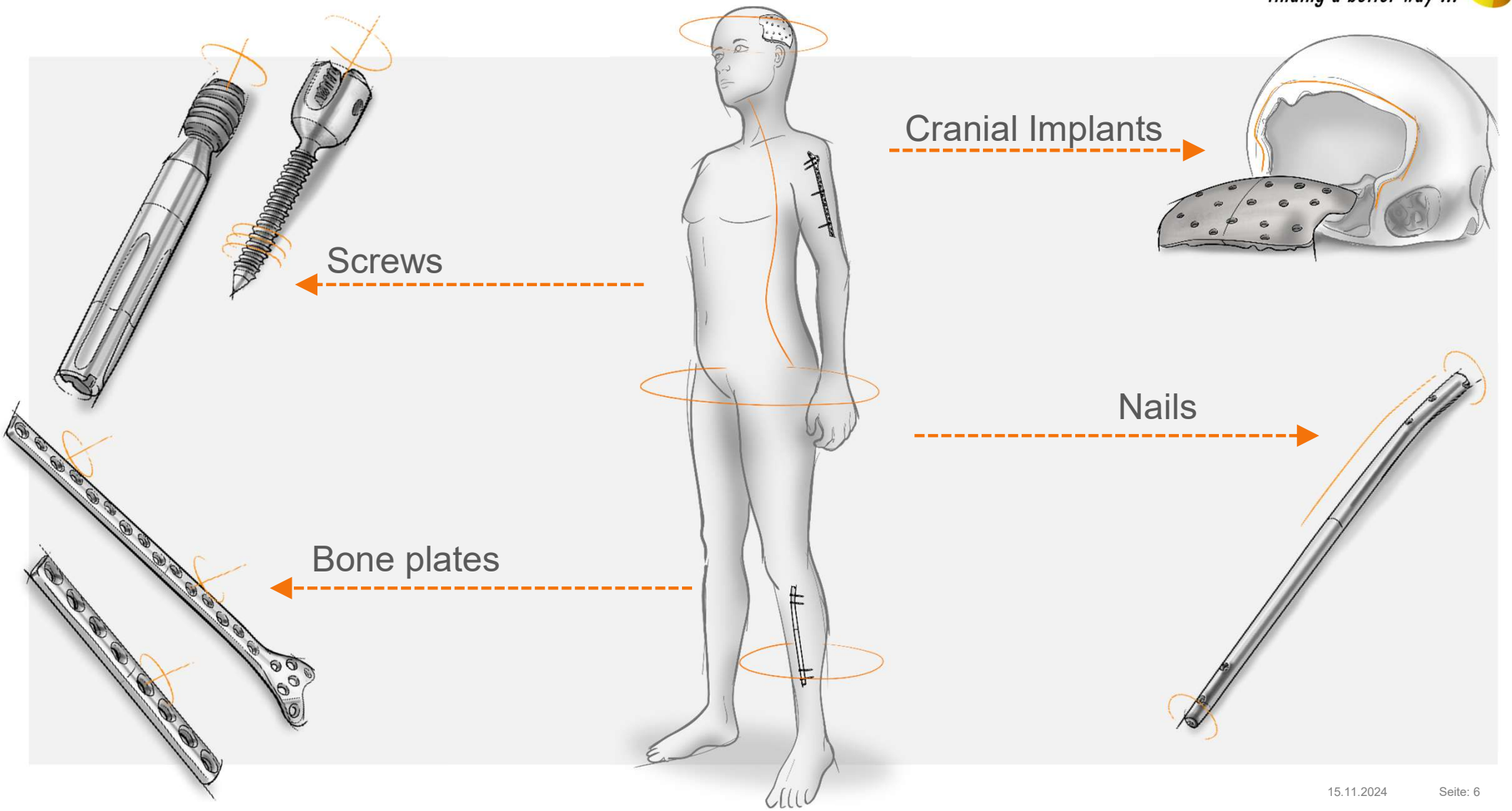


Medical instruments

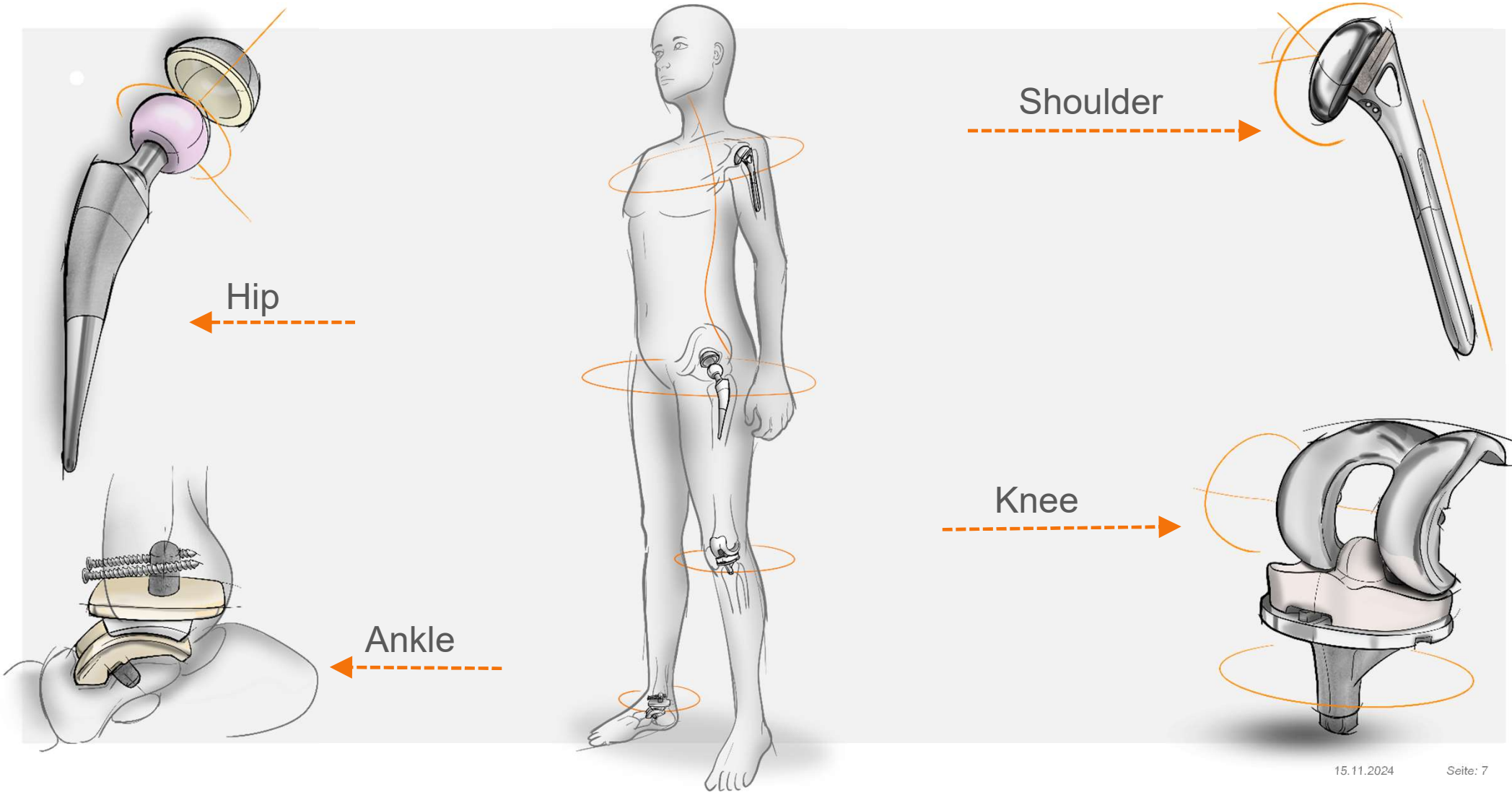


Medical devices

1.SURFACE FINISH OF MEDICAL COMPONENTS/APPLICATIONS



1.SURFACE FINISH OF MEDICAL COMPONENTS/APPLICATIONS



2.COMMON FINIHSING SYSTEMS & METHODS

2. COMMON FINISHING SYSTEMS & METHODS

INFLUENCING FACTORS

- Material
- Material hardness
- Machining quality of raw part
- Process water
- Compound
- Media – abrasivness
- Media - size
- Machine & parameters

2. Common Finishing Systems & Methods - Drag Finishing Systems

Drag Finishing System

- single part treatment / no damages
- 2-3 step process available
- technical surface < 0.02 Ra
- high gloss mirror finish

Typical Applications

- Femur
- tibia
- hip-stem &-ball
- ankle
- ...

2. Common Finishing Systems & Methods - Drag Finishing Systems

PROCESSING OF HIP STEMS

raw part

Required quantity / week : 1000 pcs. / 3 shifts

finished part

2. Common Finishing Systems & Methods - Drag Finishing Systems

PROCESSING OF HIP STEMS

- R 4/700 SF
- 2 steps pre grinidng
- Ceramik pre grinding
- Fine grinding RKH plastic media
- Polishing : dry polish

PROCESSING OF HIP STEMS

Drag Finishing machine R 4/700 SF process describtion

Type of workpieces: Hip stem
Material: Titanium (TiA/6V4)
Batch quantity: 3 parts/spindle
12 pcs

Treatment step: Fine grinding

Media: RKE 6 K

Compound: LF113
Processing time: 135 min

Type of workpieces: Hip stem
Material: Titanium (TiA/6V4)
batch quantity: 3 parts / spindle
12 / batch

Treatment step: Fine grinding
Media:
RKH/4 10 P,15P, 10K, 15K

Compound: LF113
Processing time: 45 min

Type of workpieces: Hip stem
Material: Titanium (TiA/6V4)
batch quantity: 3 parts / spindle
12 / batch

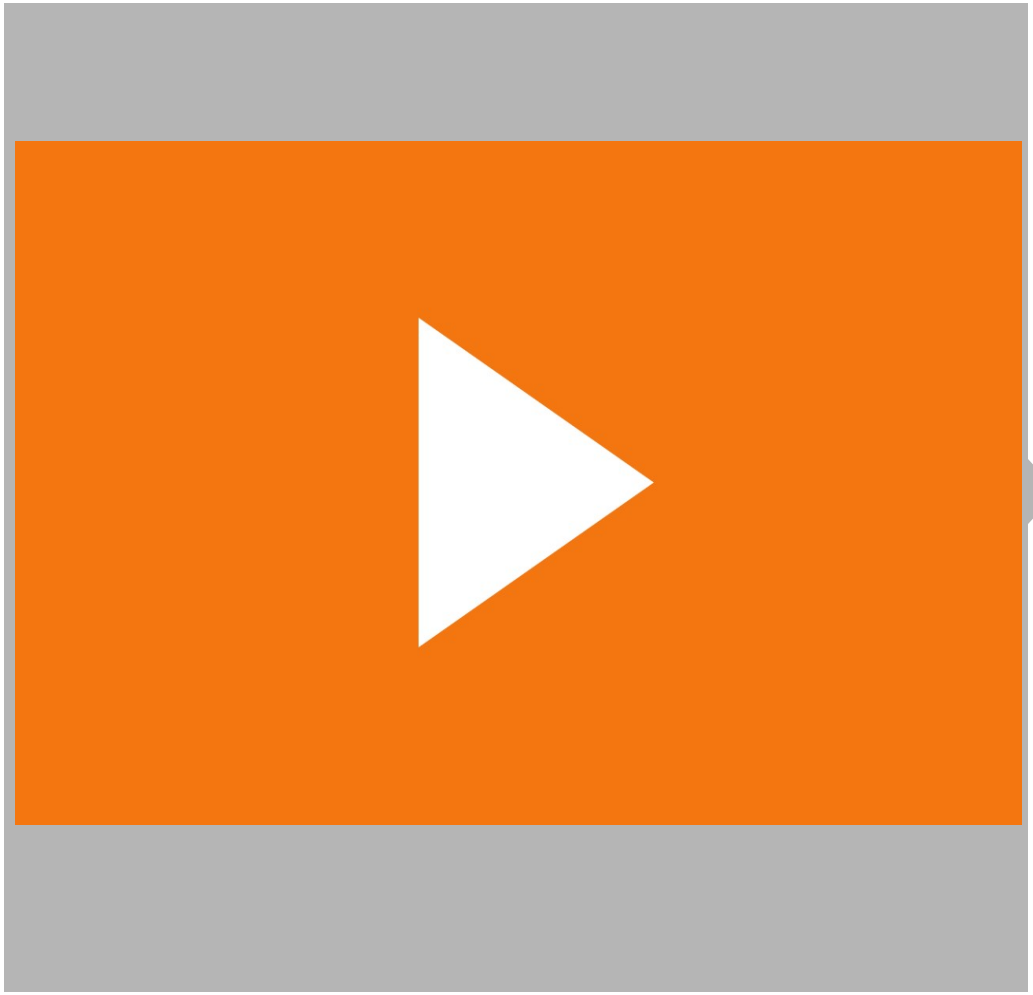
Treatment Level: Polishing

Media : SV16 77303

Compound: dry process
Processing time: 60 min

2. COMMON FINISHING SYSTEMS & METHODS

DRAGFINIHSING KNEE JOINT / FEMUR



2. Common Finishing Systems & Methods - Drag Finishing Systems

PROCESSING KNEE JOINT / FEMUR

Material:	CoCr (casted)
Quantity:	24-28 pcs/batch (6-7x4)
Machine:	R 4/1300 SF (3 step process)
Starting condition: machined surface	
Process:	pre-grinding, fine-grinding polishing
Process time:	approx. 80+90+30min

2. Common Finishing Systems & Methods - Drag Finishing Systems

EXAMPLE: TIBIA

Material:	CoCr (casted)
Quantity:	24 pcs/batch (4x6)
Machine:	R 4/1300 SF (2 step process)
Starting condition:	machined surface
Process:	grinding, polishing
Process time:	approx. 30 + 60 min

2. Common Finishing Systems & Methods - Drag Finishing Systems

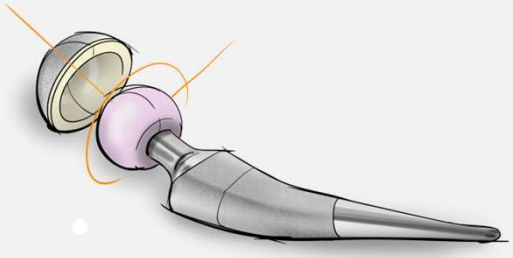
EXAMPLE: HIP STEM

Material:	titanium, CoCr (forged)
Quantity:	32 pcs /batch (4x8)
Machine:	R 4/1300 SF (2 step process)
Starting condition:	machined surface
Process:	grinding, polishing
Process time:	approx. 90 + 60 min

2. Common Finishing Systems & Methods - Drag Finishing Systems

EXAMPLE: FEMORAL HEAD

Material:	stainless steel, CoCr
Quantity:	24 pcs/batch (MSH6)
Machine:	R 4/700 SF (2 step process)
Starting condition:	machined surface
Process:	grinding, polishing
Process time:	approx. 30 + 20 min

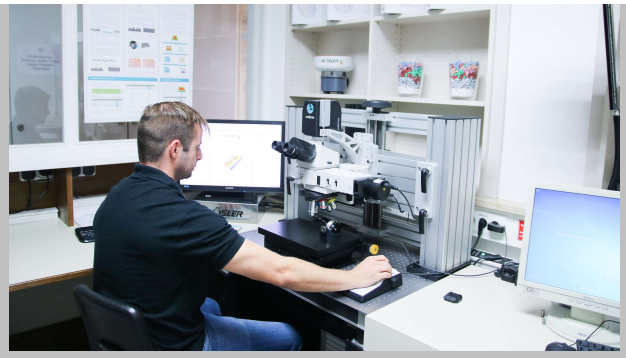


SURFACE – ROUGHNESS / RAW PART QUALITY

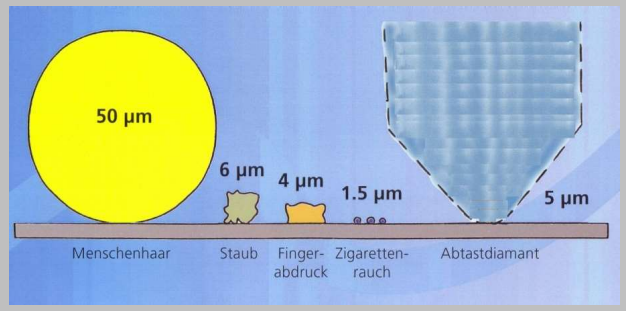
Starting surface (after CBN-grinding):
Ra 0.6 – 1.0 µm | Rz 3.5 – 5.0 µm

2 step process (fine-grinding and polishing)
optional – process to be preferred
by higher starting roughness
or femur with „box”

Starting surface (after CBN-grinding):
Ra 1.0 – 2.0 µm | Rz 5.0 – 7.0 µm



For comparison…

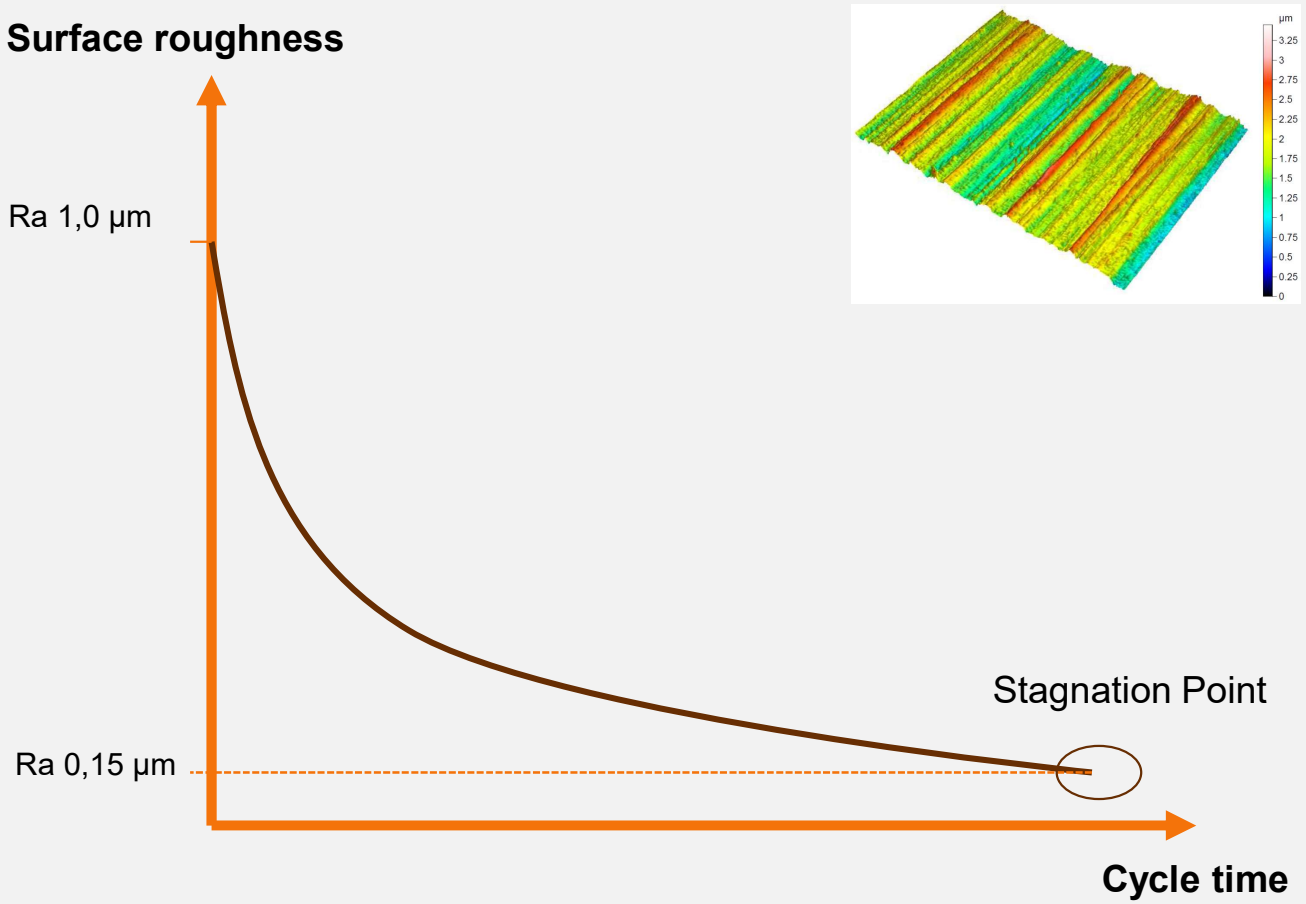


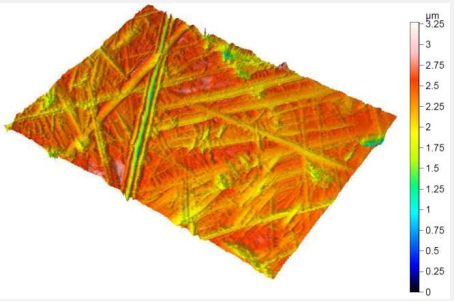
3 step process

pre-grinding step 1:	Ra* 0.2 – 0.3 µm | Rz* 1.5 – 2.5 µm
fine-grinding step 2:	Ra* 0.03 – 0.04 µm | Rz* 0.3 – 0.4 µm
polishing step 3:	Ra* 0.03 – 0.04 µm | Rz* 0.2 – 0.3 µm

2. COMMON FINISHING SYSTEMS & METHODS

STEP 1 – CERAMIC CUT DOWN

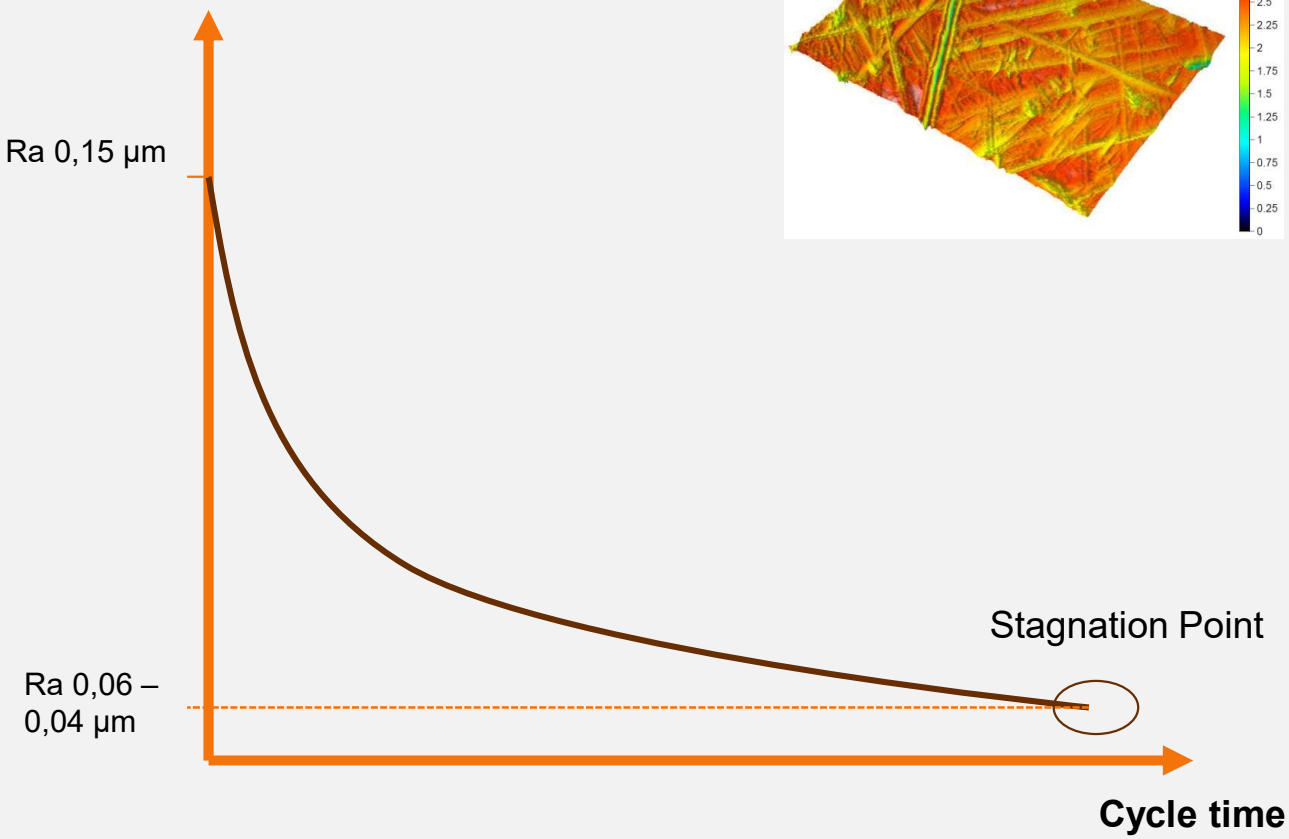


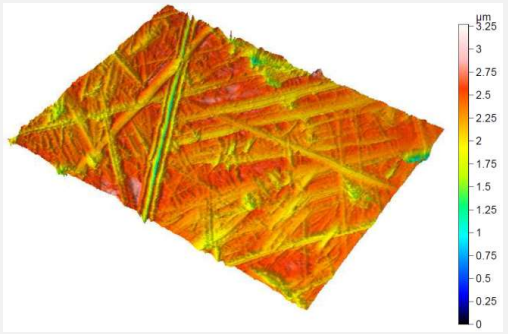


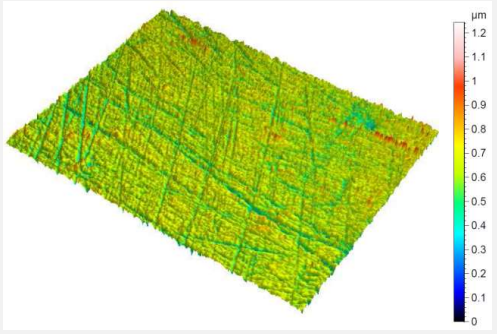
ISO 4287			
Amplituden-Parameter - Rauheitsprofil			
Ra	0.146	µm	*Gauss-Filter, 0.8 mm*
Rz	1.58	µm	*Gauss-Filter, 0.8 mm*
Rp	0.423	µm	*Gauss-Filter, 0.8 mm*
Rv	1.16	µm	*Gauss-Filter, 0.8 mm*
Rsk	-1.35		*Gauss-Filter, 0.8 mm*
Rku	7.45		*Gauss-Filter, 0.8 mm*
Materialanteilsparameter - Rauheitsprofil			
Rmr	0.279	%	*c = 0.1 µm unter dem höchsten Punkt, Gauss-Filter, 0.8 mm*
Rmr	3.26	%	*c = 0.2 µm unter dem höchsten Punkt, Gauss-Filter, 0.8 mm*
Rmr	55.8	%	*c = 0.5 µm unter dem höchsten Punkt, Gauss-Filter, 0.8 mm*
Rmr	98.1	%	*c = 1 µm unter dem höchsten Punkt, Gauss-Filter, 0.8 mm*
Rmr	98.9	%	*c = 1.2 µm unter dem höchsten Punkt, Gauss-Filter, 0.8 mm*
Rmr	100	%	*c = 2 µm unter dem höchsten Punkt, Gauss-Filter, 0.8 mm*
Andere 2D-Parameter			
Rauheitsprofil-Parameter			
Rmax	1.68	µm	*Gauss-Filter, 0.8 mm*

2. COMMON FINISHING SYSTEMS & METHODS

STEP 2 – PLASTIC MEDIA FINE GRINDING



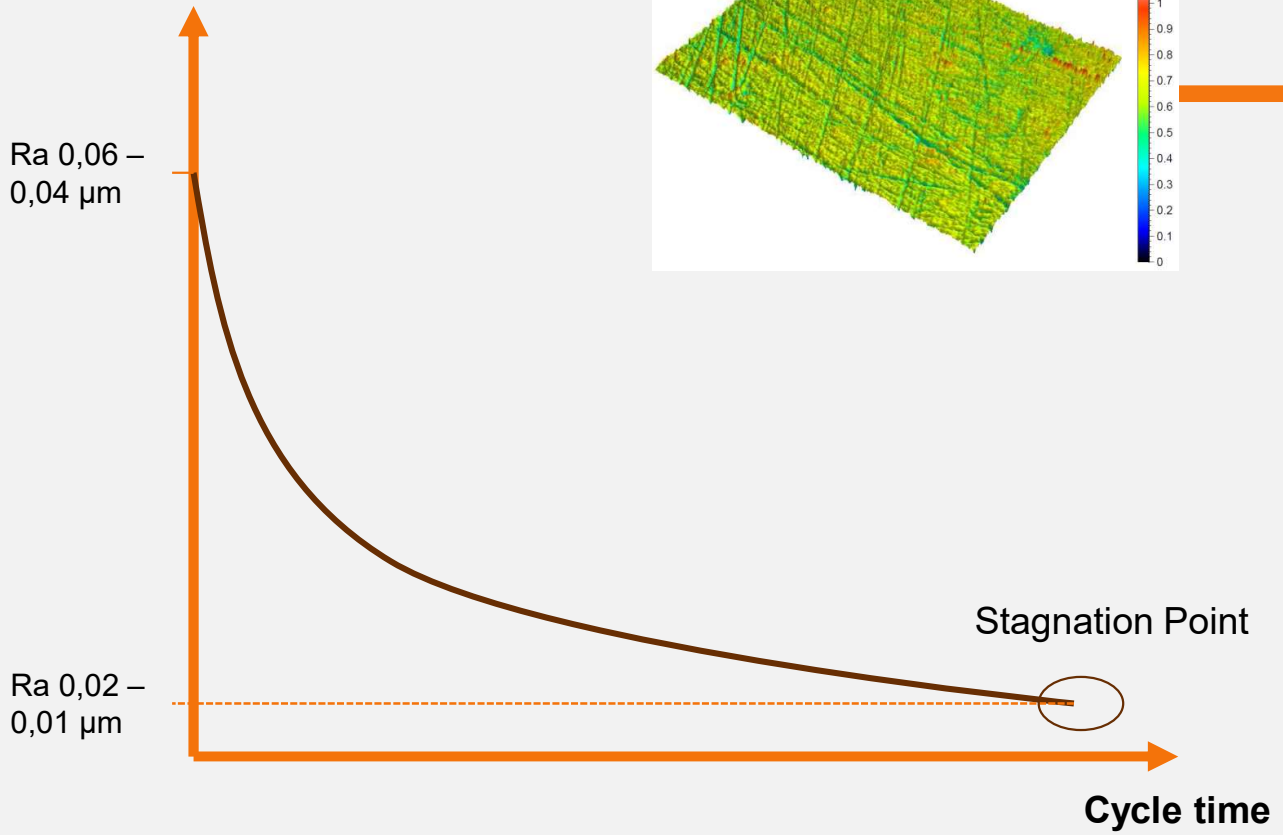


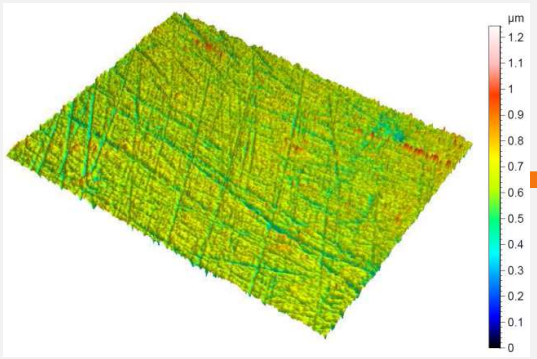


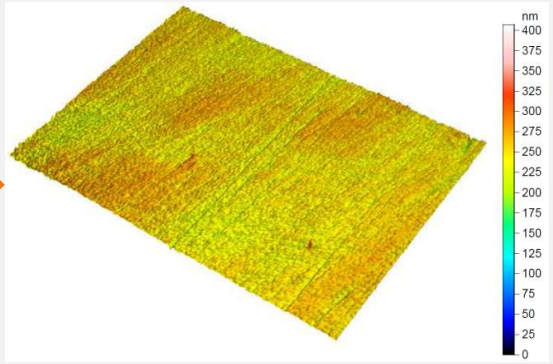
ISO 4287			
Amplituden-Parameter - Rauheitsprofil			
Ra	0.0638	µm	*Gauss-Filter, 0.8 mm*
Rz	0.683	µm	*Gauss-Filter, 0.8 mm*
Rp	0.252	µm	*Gauss-Filter, 0.8 mm*
Rv	0.431	µm	*Gauss-Filter, 0.8 mm*
Rsk	-0.915		*Gauss-Filter, 0.8 mm*
Rku	4.78		*Gauss-Filter, 0.8 mm*
Materialanteilsparameter - Rauheitsprofil			
Rmr	0.564	%	*c = 0.1 µm unter dem höchsten Punkt, Gauss-Filter, 0.8 mm*
Rmr	15.7	%	*c = 0.2 µm unter dem höchsten Punkt, Gauss-Filter, 0.8 mm*
Rmr	98.0	%	*c = 0.5 µm unter dem höchsten Punkt, Gauss-Filter, 0.8 mm*
Rmr	100	%	*c = 1 µm unter dem höchsten Punkt, Gauss-Filter, 0.8 mm*
Rmr	100	%	*c = 1.2 µm unter dem höchsten Punkt, Gauss-Filter, 0.8 mm*
Rmr	100	%	*c = 2 µm unter dem höchsten Punkt, Gauss-Filter, 0.8 mm*
Andere 2D-Parameter			
Rauheitsprofil-Parameter			
Rmax	0.841	µm	*Gauss-Filter, 0.8 mm*

2. COMMON FINISHING SYSTEMS & METHODS

STEP 3 – DRY POLISHING

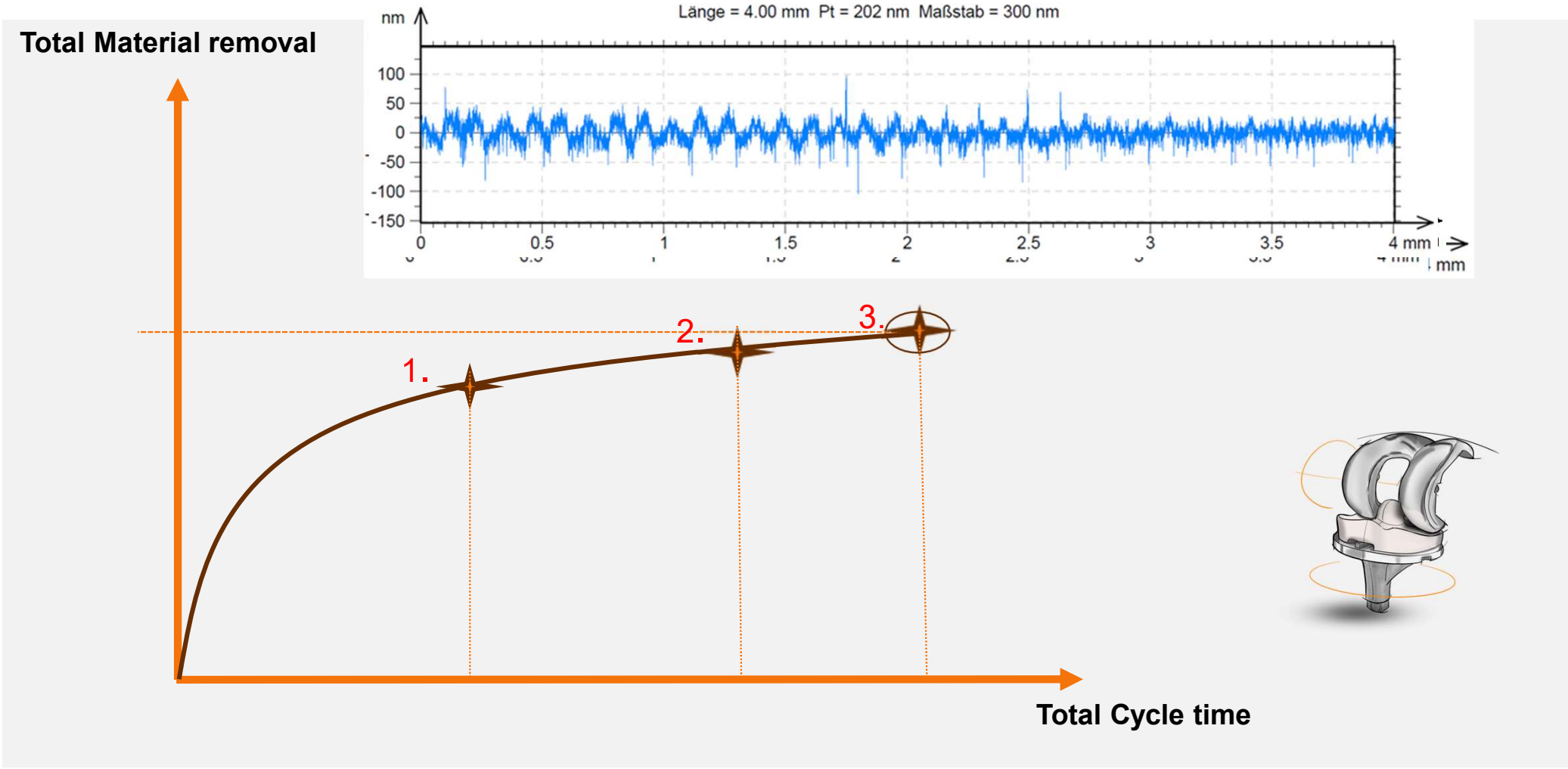






ISO 4287			
Amplituden-Parameter - Rauheitsprofil			
Ra	10.8	nm	*Gauss-Filter, 0.8 mm*
Rz	136	nm	*Gauss-Filter, 0.8 mm*
Rp	61.8	nm	*Gauss-Filter, 0.8 mm*
Rv	74.2	nm	*Gauss-Filter, 0.8 mm*
Rsk	0.011		*Gauss-Filter, 0.8 mm*
Rku	4.03		*Gauss-Filter, 0.8 mm*
Materialanteilsparameter - Rauheitsprofil			
Rmr	73.6	%	*c = 100 nm unter dem höchsten Punkt, Gauss-Filter, 0.8 mm*
Rmr	100	%	*c = 200 nm unter dem höchsten Punkt, Gauss-Filter, 0.8 mm*
Rmr	100	%	*c = 500 nm unter dem höchsten Punkt, Gauss-Filter, 0.8 mm*
Rmr	100	%	*c = 1000 nm unter dem höchsten Punkt, Gauss-Filter, 0.8 mm*
Rmr	100	%	*c = 1200 nm unter dem höchsten Punkt, Gauss-Filter, 0.8 mm*
Rmr	100	%	*c = 2000 nm unter dem höchsten Punkt, Gauss-Filter, 0.8 mm*
Andere 2D-Parameter			
Rauheitsprofil-Parameter			
Rmax	189	nm	*Gauss-Filter, 0.8 mm*

2. COMMON FINISHING SYSTEMS & METHODS



PROCESSING OF KNEE JOINT / FEMUR

Processing Goal: Polishing the entire femur surface

raw part

Milled CNC process and fine grinding

finished part

DRAG FINISHING – MACHINE TYPES

R4/700 SF

R6/1000 SF

R4/1300 SF

3. SURF FINISHING – NEXT LEVEL FINISHING

3. SURF FINISHING - NEXT LEVEL FINISHING

THE PROCESS AT A GLANCE

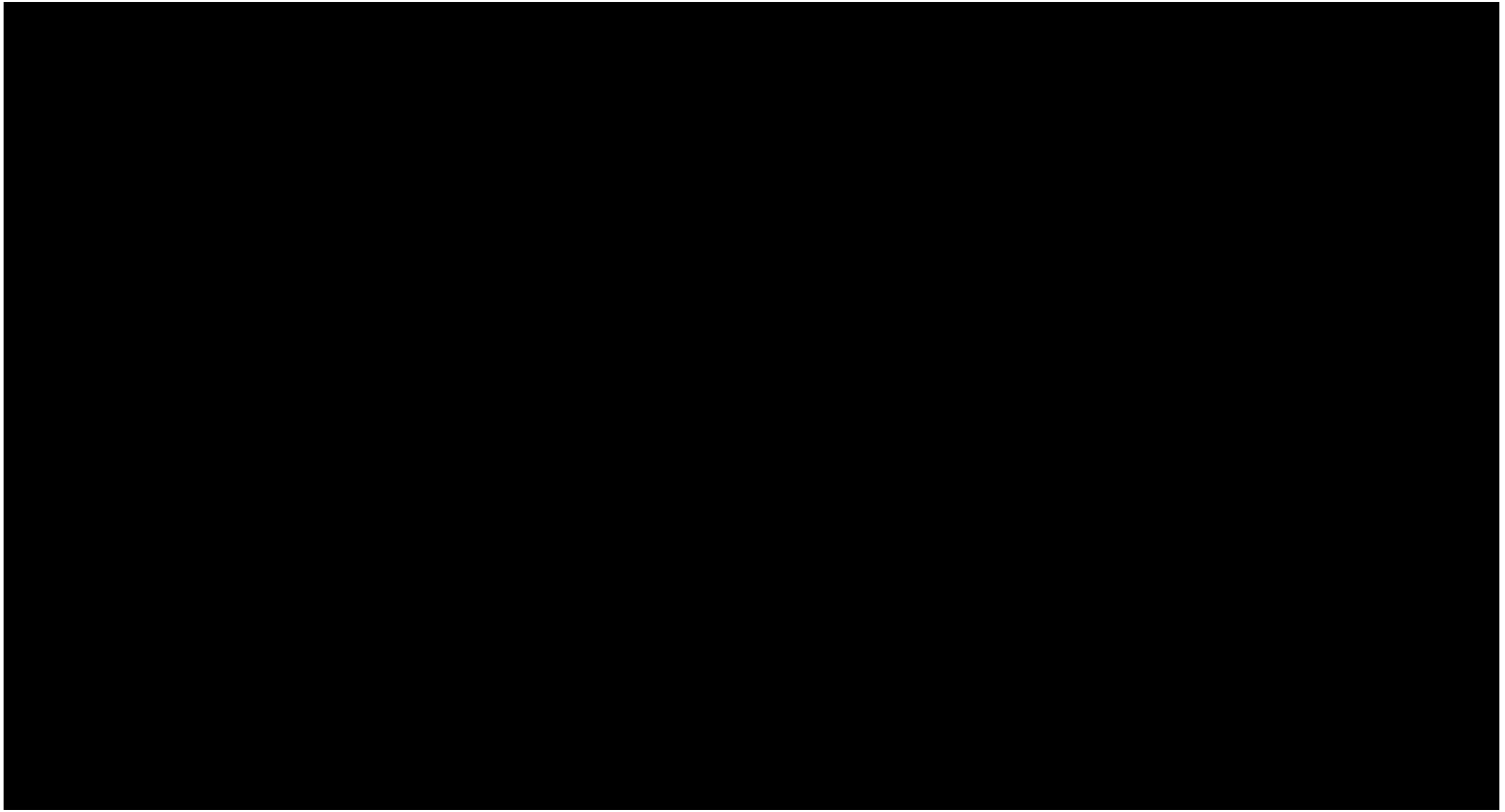
- Selective and defined machining of clampable workpieces with complex geometry trough spinning working bowl
- Damage-free single part machining "One Piece Flow“
- High machining intensity due to adjustable parameters :

  Speed of the working bowl

  Variable immersion depth in the media

  Variable Inclination Angle of the work spindle
- High reproducibility in connection with a high degree of automation
- Possibility of linking with existing prefabrication (e.g. CNC machining)
- Short cycle times in combination with the various possible applications
- Shorter machining times than drag grinding, combined with high removal rate
- Both wet and dry processes can be mapped

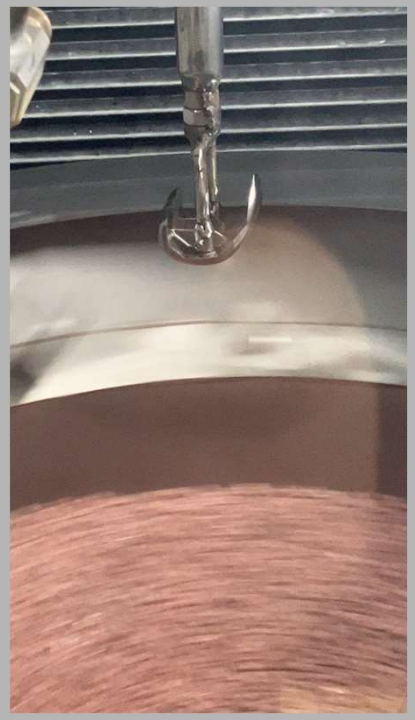
3. SURF FINISHING - NEXT LEVEL FINISHING

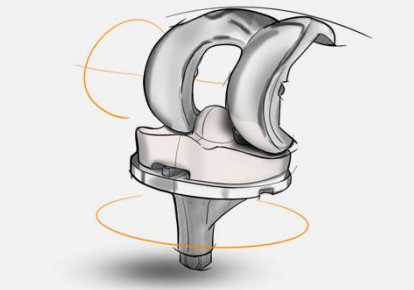


3. SURF FINISHING - NEXT LEVEL FINISHING

SURF FINISHING SYSTEM – MULTI SPINDLE

RMSF 4/800 or RMSF 6/1000
Oscilation Movement





3. SURF FINISHING - NEXT LEVEL FINISHING

2 STEP PROCESS - INSTEAD OF THREE STEPS - FEMORAL HEAD

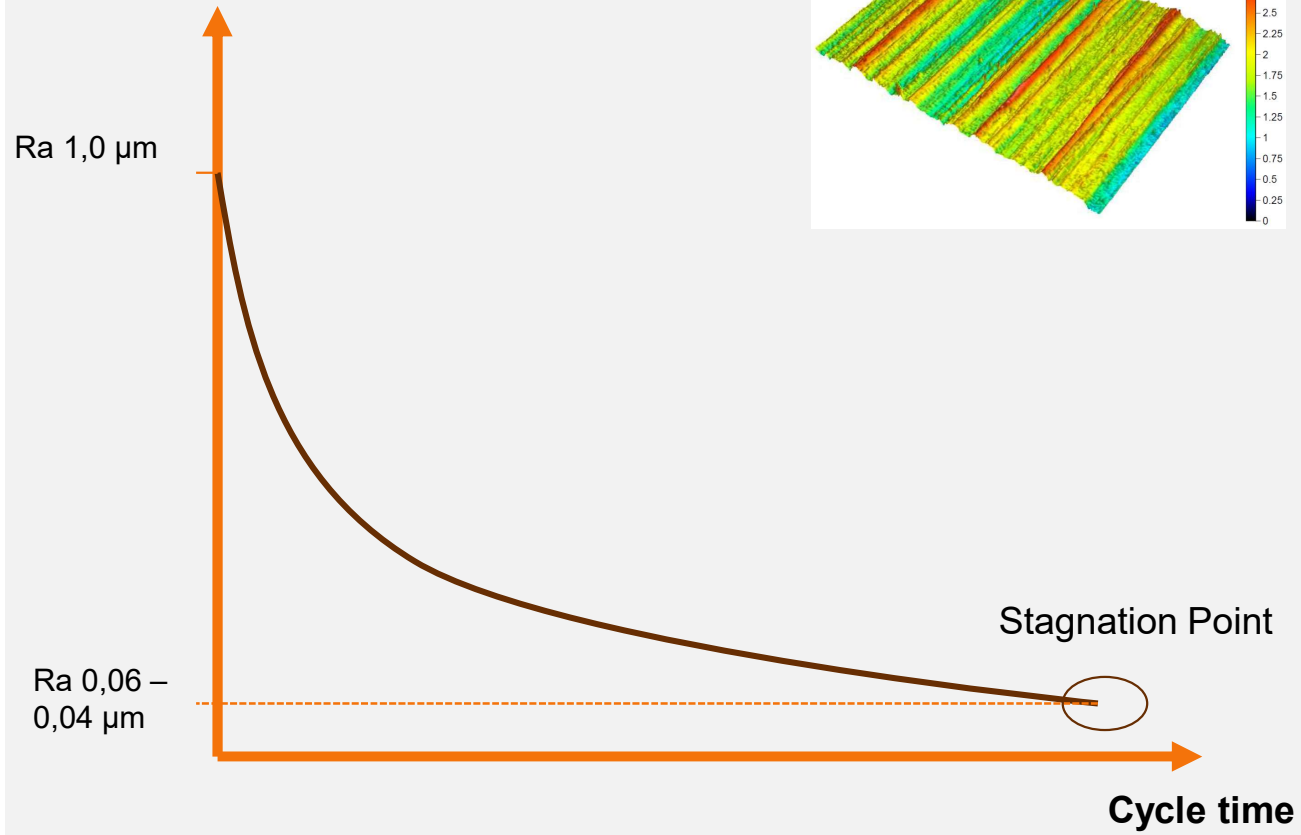
Step 1: Fine grinding
Start Ra 0,8 - 0,6 µm
Finish Ra 0,04µm
Plastic Media only
RKH/4-Mix
Compound
30 – 40 min

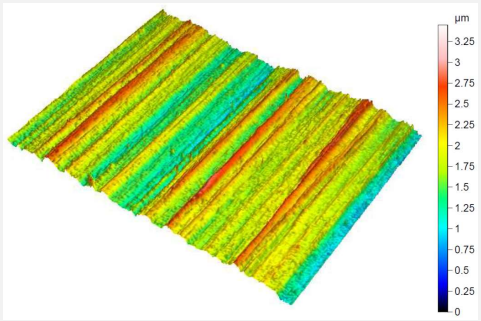
Step 2: Dry polishing
Start Ra 0,04
Finish Ra 0,01
- 0,02µm

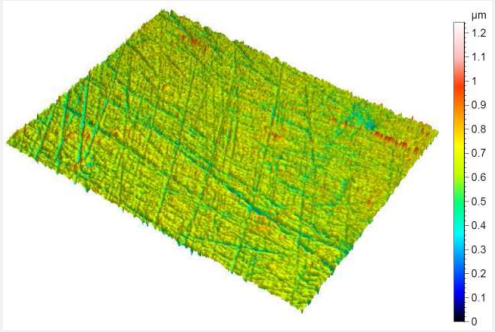
SVK 16 – 77303
15 min

3. SURF FINISHING - NEXT LEVEL FINISHING

STEP 1 – PLASTIC MEDIA FINE GRINDING



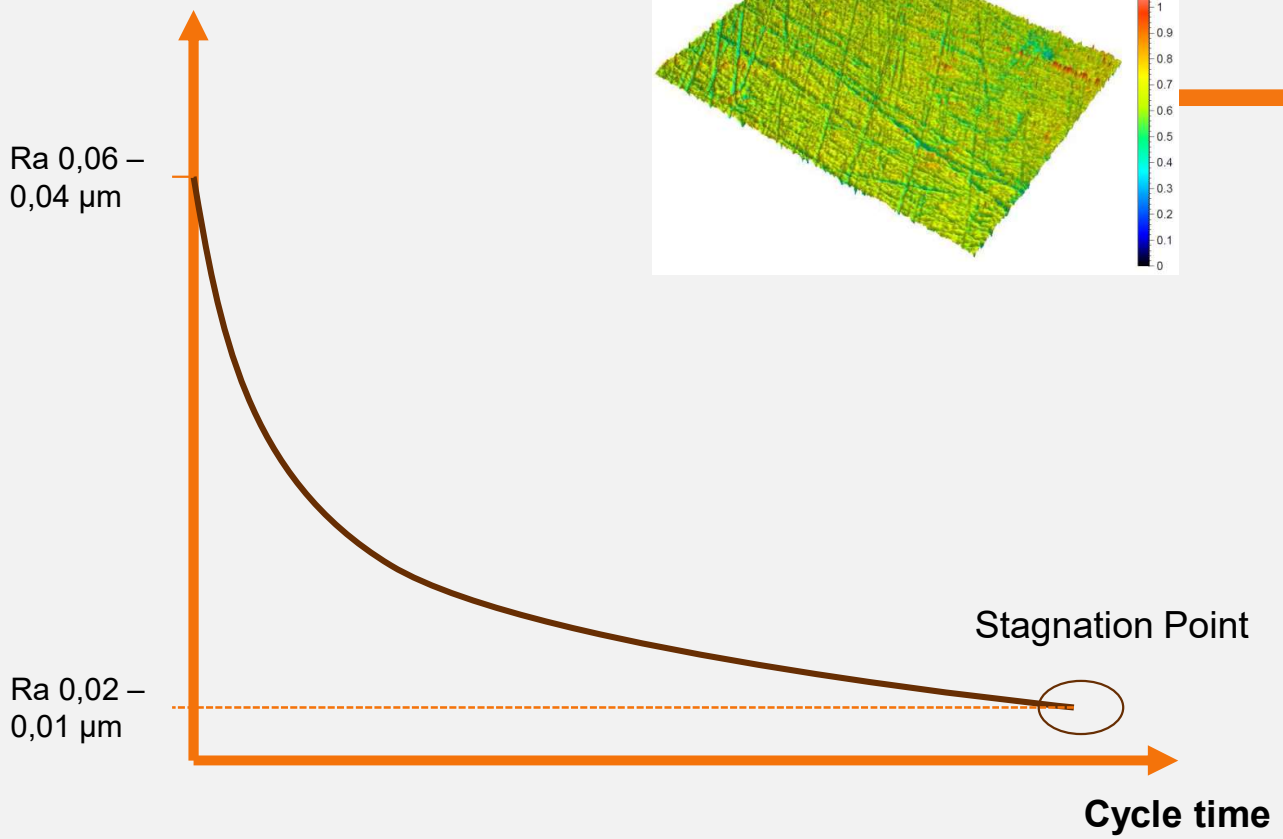


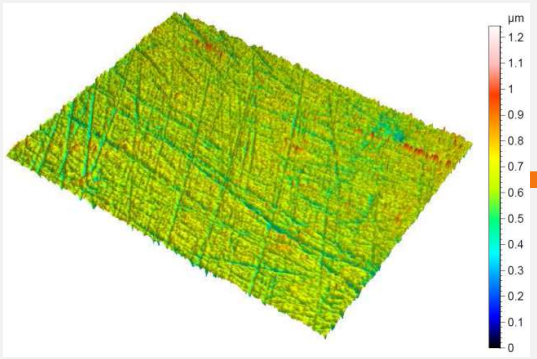


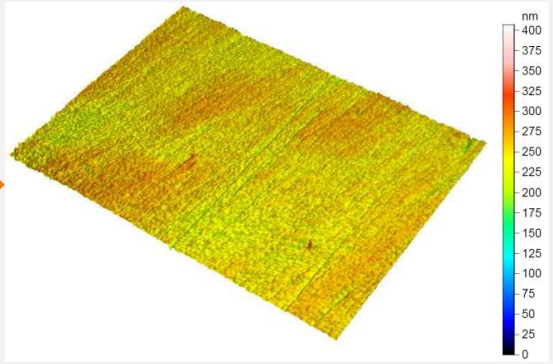
ISO 4287			
Amplituden-Parameter - Rauheitsprofil			
Ra	0.0638	µm	*Gauss-Filter, 0.8 mm*
Rz	0.683	µm	*Gauss-Filter, 0.8 mm*
Rp	0.252	µm	*Gauss-Filter, 0.8 mm*
Rv	0.431	µm	*Gauss-Filter, 0.8 mm*
Rsk	-0.915		*Gauss-Filter, 0.8 mm*
Rku	4.78		*Gauss-Filter, 0.8 mm*
Materialanteilsparameter - Rauheitsprofil			
Rmr	0.564	%	*c = 0.1 µm unter dem höchsten Punkt, Gauss-Filter, 0.8 mm*
Rmr	15.7	%	*c = 0.2 µm unter dem höchsten Punkt, Gauss-Filter, 0.8 mm*
Rmr	98.0	%	*c = 0.5 µm unter dem höchsten Punkt, Gauss-Filter, 0.8 mm*
Rmr	100	%	*c = 1 µm unter dem höchsten Punkt, Gauss-Filter, 0.8 mm*
Rmr	100	%	*c = 1.2 µm unter dem höchsten Punkt, Gauss-Filter, 0.8 mm*
Rmr	100	%	*c = 2 µm unter dem höchsten Punkt, Gauss-Filter, 0.8 mm*
Andere 2D-Parameter			
Rauheitsprofil-Parameter			
Rmax	0.841	µm	*Gauss-Filter, 0.8 mm*

3. SURF FINISHING - NEXT LEVEL FINISHING

STEP 2 – DRY POLISHING







ISO 4287			
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Rp	61.8	nm	*Gauss-Filter, 0.8 mm*
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Rsk	0.011		*Gauss-Filter, 0.8 mm*
Rku	4.03		*Gauss-Filter, 0.8 mm*
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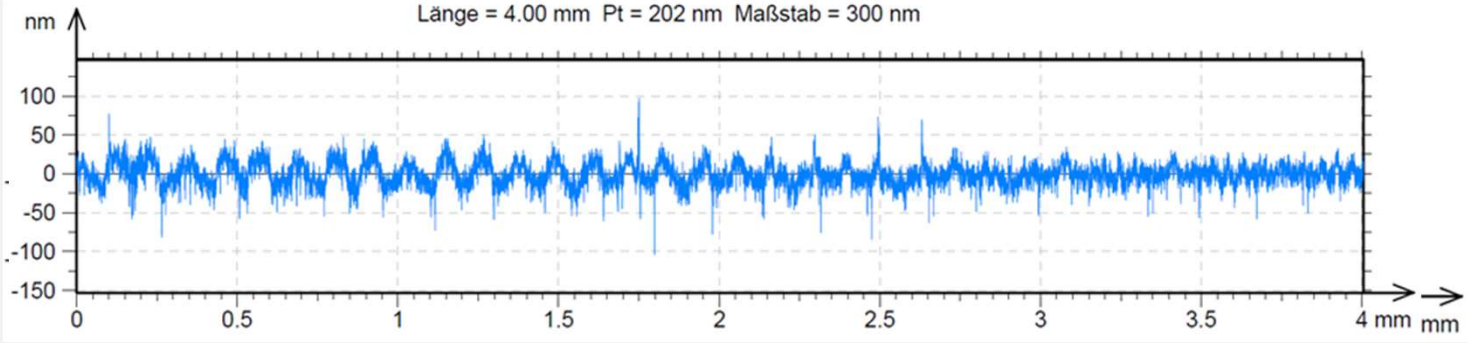
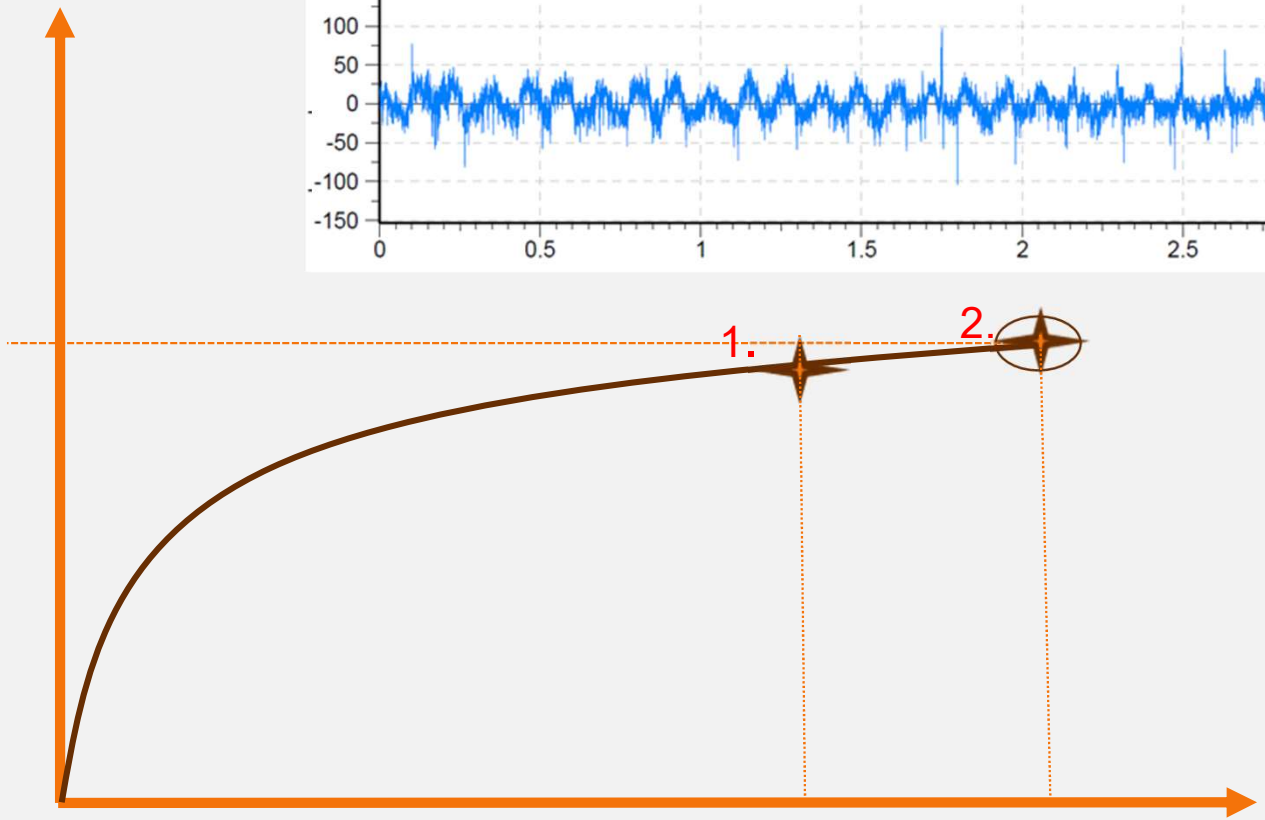
Rmr	100	%	*c = 200 nm unter dem höchsten Punkt, Gauss-Filter, 0.8 mm*
Rmr	100	%	*c = 500 nm unter dem höchsten Punkt, Gauss-Filter, 0.8 mm*
Rmr	100	%	*c = 1000 nm unter dem höchsten Punkt, Gauss-Filter, 0.8 mm*
Rmr	100	%	*c = 1200 nm unter dem höchsten Punkt, Gauss-Filter, 0.8 mm*
Rmr	100	%	*c = 2000 nm unter dem höchsten Punkt, Gauss-Filter, 0.8 mm*
Andere 2D-Parameter			
Rauheitsprofil-Parameter			
Rmax	189	nm	*Gauss-Filter, 0.8 mm*

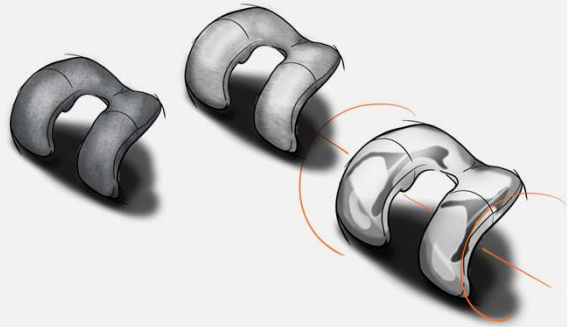
3. SURF FINISHING - NEXT LEVEL FINISHING

RÖSLER finding a better way ...

Total Material removal



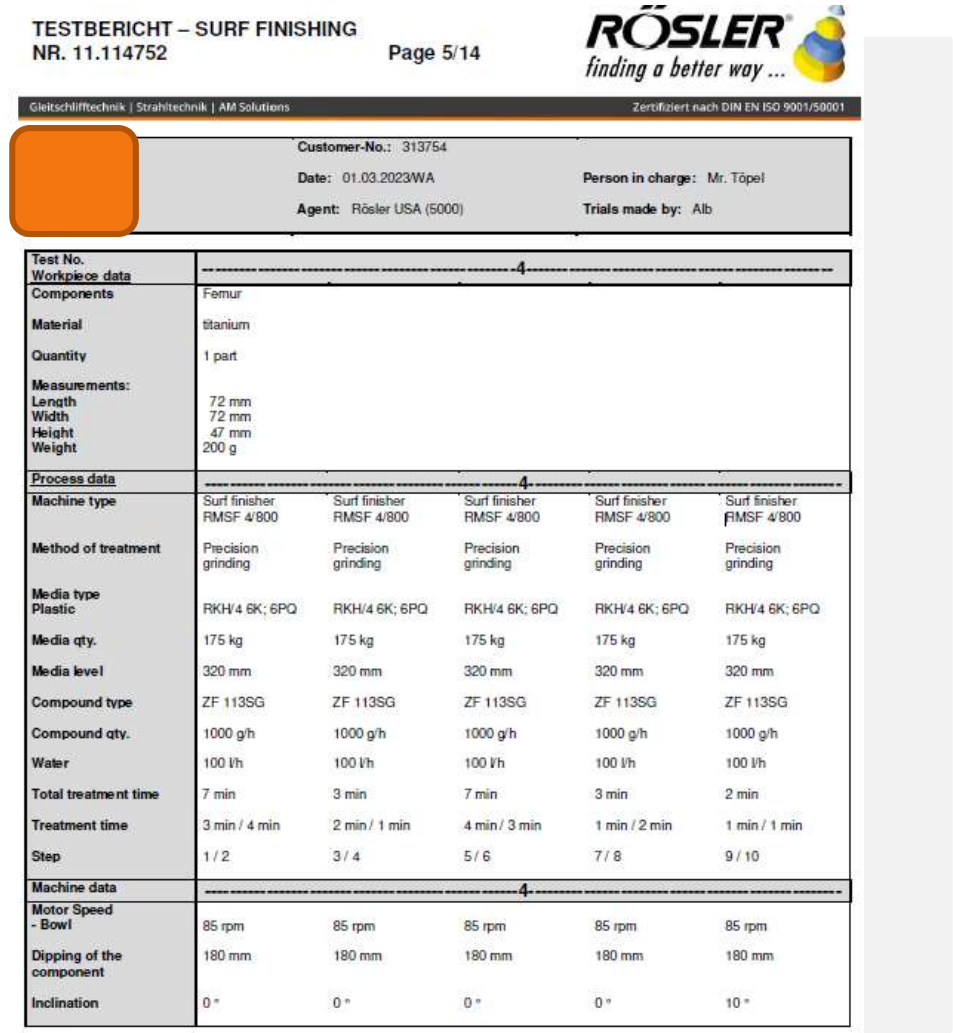




Total Cycle time

3. SURF FINISHING - NEXT LEVEL FINISHING

- Trials at Rosler Germany RMSF 4/800
- Titanium and Co Cr femural knee
- Roughness raw part box Ra 0,35 – 0,36µm
- Result box Ra 0,045 - 0,063 µm
- All over finish Ra 0,02 – 0,03 µm
- Only two step process right from CNC machining
- Incl. box finishing



TESTBERICHT – SURF FINISHING
NR. 11.114752 Page 5/14

Gleitschlifftechnik | Strahltechnik | AM Solutions — Zertifiziert nach DIN EN ISO 9001/50001

Customer-No.: 313754
Date: 01.03.2023/WA — Person in charge: Mr. Töpel
Agent: Rösler USA (5000) — Trials made by: Alb

Test No. / Workpiece data	4				
Components	Femur				
Material	titanium				
Quantity	1 part				
Measurements:					
Length	72 mm				
Width	72 mm				
Height	47 mm				
Weight	200 g				
Process data	4				
Machine type	Surf finisher RMSF 4/800	Surf finisher RMSF 4/800	Surf finisher RMSF 4/800	Surf finisher RMSF 4/800	Surf finisher RMSF 4/800
Method of treatment	Precision grinding	Precision grinding	Precision grinding	Precision grinding	Precision grinding
Media type Plastic	RKH/4 6K; 6PQ	RKH/4 6K; 6PQ	RKH/4 6K; 6PQ	RKH/4 6K; 6PQ	RKH/4 6K; 6PQ
Media qty.	175 kg	175 kg	175 kg	175 kg	175 kg
Media level	320 mm	320 mm	320 mm	320 mm	320 mm
Compound type	ZF 113SG	ZF 113SG	ZF 113SG	ZF 113SG	ZF 113SG
Compound qty.	1000 g/h	1000 g/h	1000 g/h	1000 g/h	1000 g/h
Water	100 l/h	100 l/h	100 l/h	100 l/h	100 l/h
Total treatment time	7 min	3 min	7 min	3 min	2 min
Treatment time	3 min / 4 min	2 min / 1 min	4 min / 3 min	1 min / 2 min	1 min / 1 min
Step	1 / 2	3 / 4	5 / 6	7 / 8	9 / 10
Machine data	4				
Motor Speed - Bowl	85 rpm	85 rpm	85 rpm	85 rpm	85 rpm
Dipping of the component	180 mm	180 mm	180 mm	180 mm	180 mm
Inclination	0 °	0 °	0 °	0 °	10 °

AUTOMATIC SURF FINISHING SYSTEM – MULTI SPINDLE

- Trials at Rosler Germany RMSF 4/800
- Cobald - Chrome femural knee special & revision
- Three parts finished:
  - pre grinding
  - box polished partial finish
  - completly finished
- Roughness raw part special box Ra 0,407µm
- Result box special Ra 0,049 µm
- Roughness revision raw box
  - Ra 2,59-2,97 µm

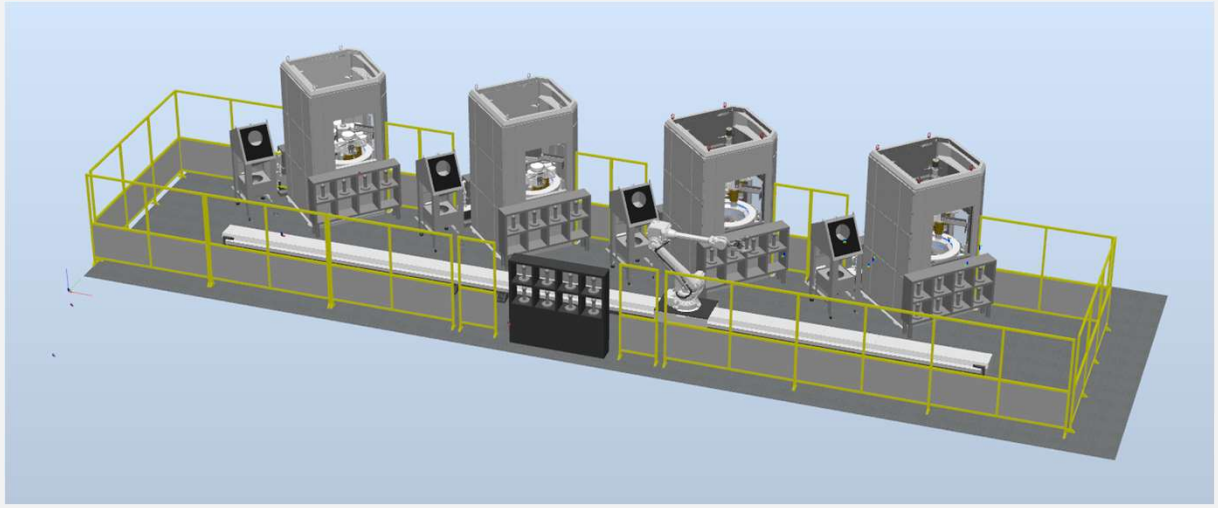
Result revision box Ra 0,63 - 0,63µm

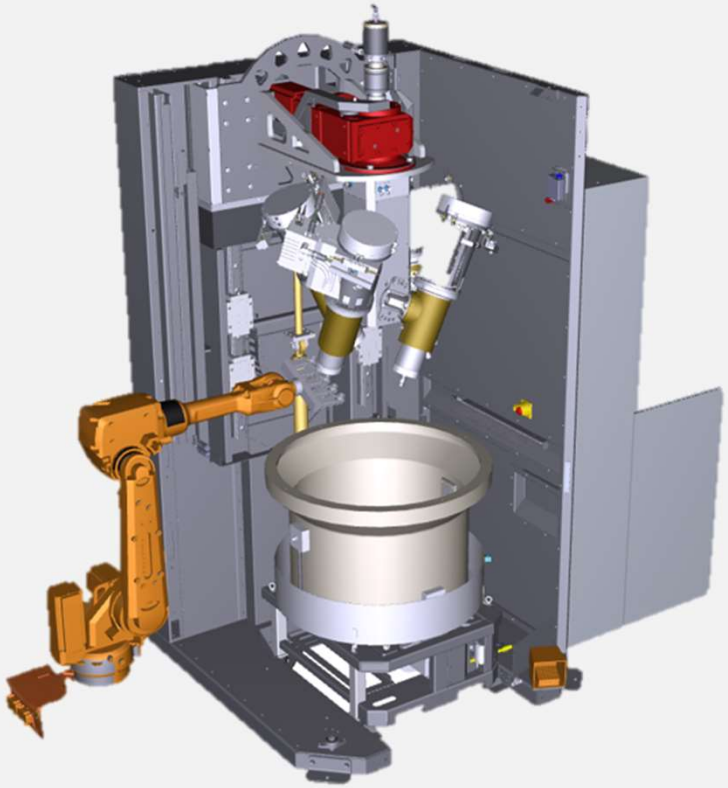
Results raw parts vs. finished CoCr material

Results raw parts vs. finished Ti material

3. SURF FINISHING - NEXT LEVEL FINISHING

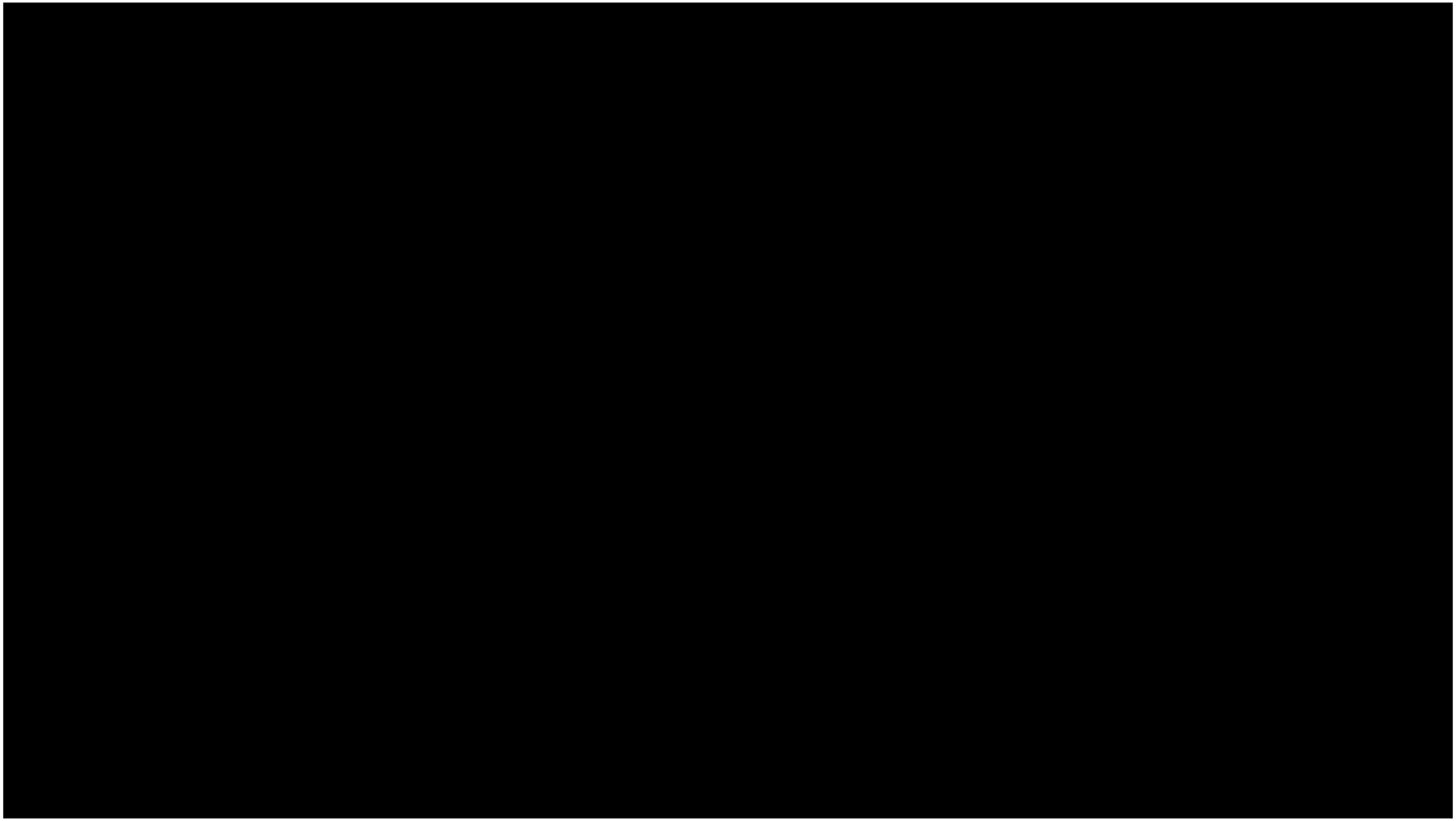
How to automate a RMSF 4/800 Multi Surf Finsher ?



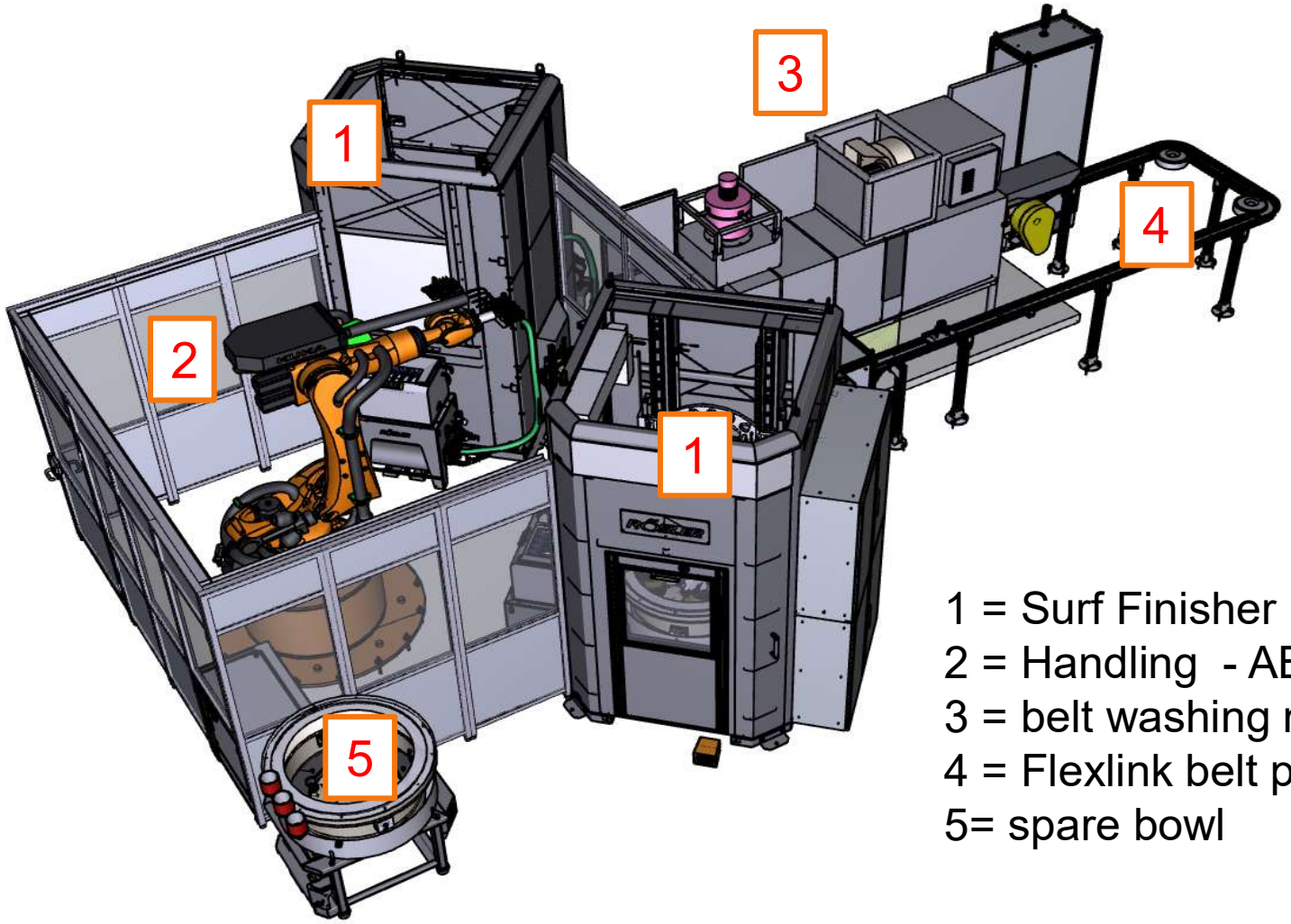


3. SURF FINISHING - NEXT LEVEL FINISHING

How to automate a RMSF 4/800 Multi Surf Finsher ?



How to automate a RMSF 4/800 Multi Surf Finsher ?

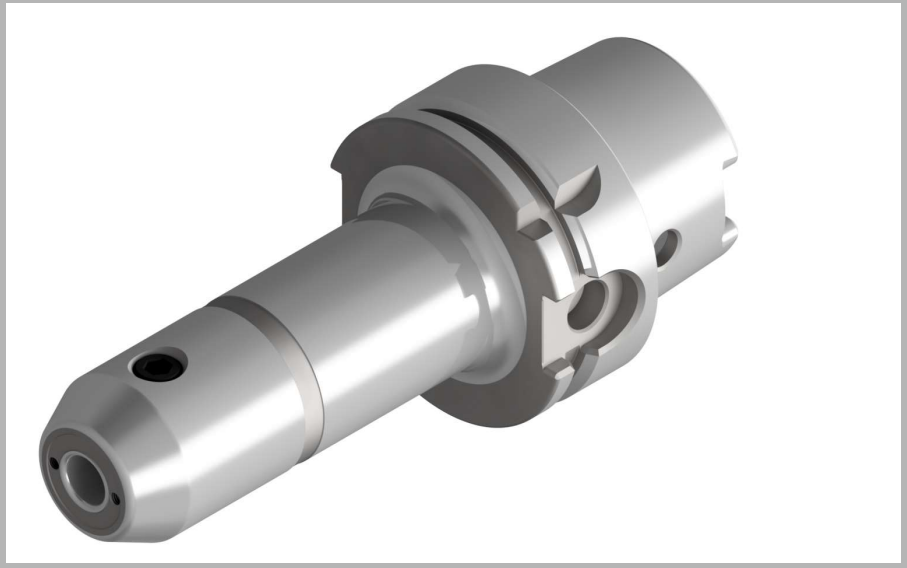


1 = Surf Finisher RMSF 4/800
2 = Handling - ABB Robot
3 = belt washing machine
4 = Flexlink belt parts transfer
5= spare bowl

3. SURF FINISHING - NEXT LEVEL FINISHING

AUTOMATIC SURF FINISHING SYSTEM – MULTI SPINDLE

- RMSF 4/800 or RMSF 6/800
- Fixturing main pneumatic fixtur with HSK 100



4.NEW MATERIALS FOR ORTHOPEDIC IMPLANTS

4.New Materials for Orthopedic Implants

FACTS – OVERVIEW - CONCLUSION

As the mediacl markets grow the number of sugeries per year is rising, it is a noticable fact – the rising pressure for more effiency through rising quantities, manufacturing costs and the need for high skilled workforce.

The development in the market goes on as surgens, scientists and patients require use of new materials for special demands.

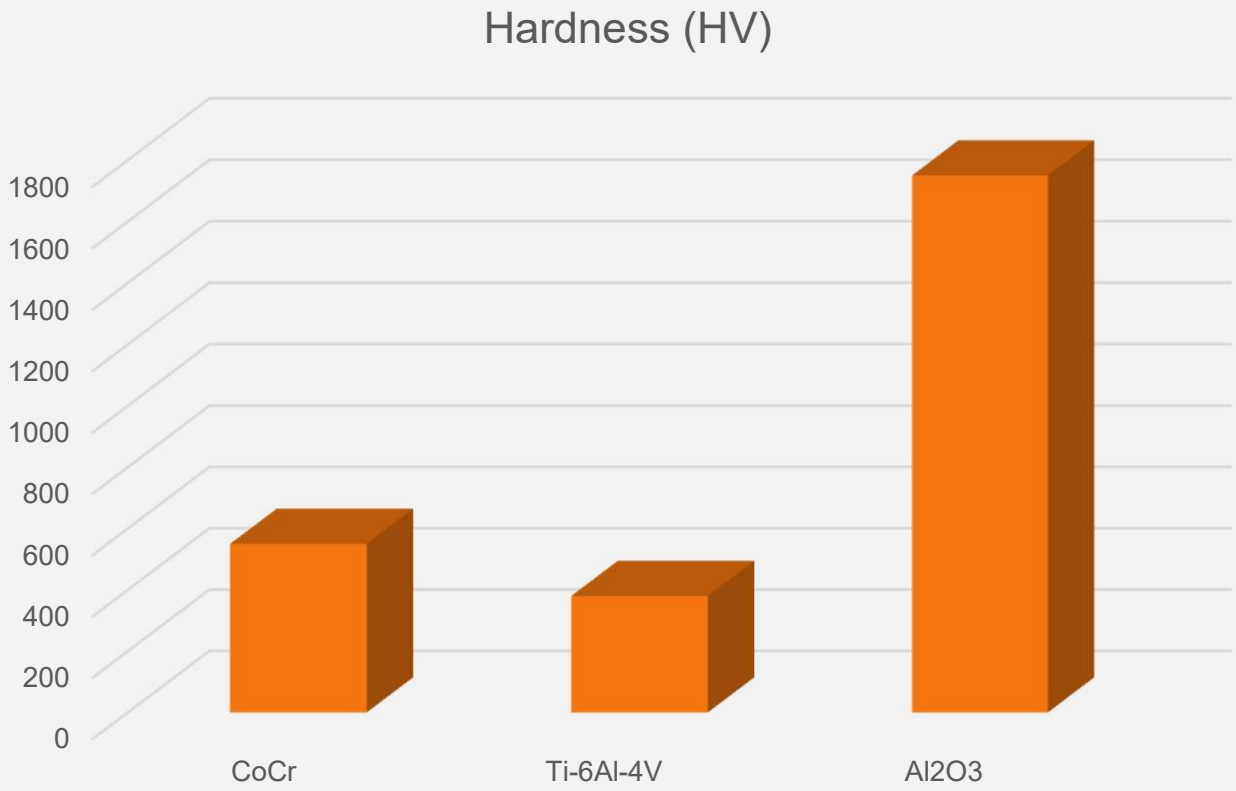
- Cobalt Chrom
- Titanium - Ti 6
- Titanium and PVD coated parts
- Titanium and heat treated materials
- Ceramic materials made from Aluminum Oxides or Zirkonia Oxides or combinations

New materials require new finihsing methods, consumables and machine requirements

4.New Materials for Orthopedic Implants

Material hardnes an its effects

The material hardness is also an indicator for the wear resistance of a specific material.



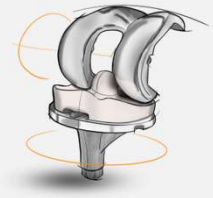
4. New Materials for Orthopedic Implants

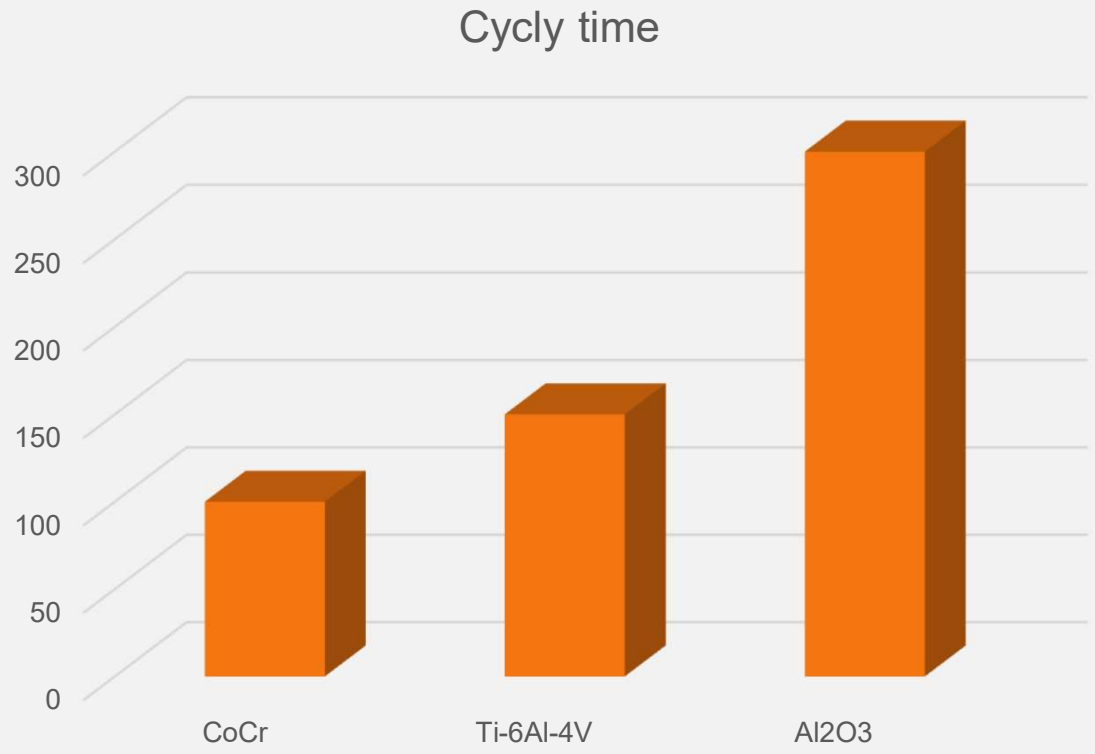
Benchmark Surf Finishing:

CoCr = 45 min

Ti 6 = 70 min

Ceramic = 240 min

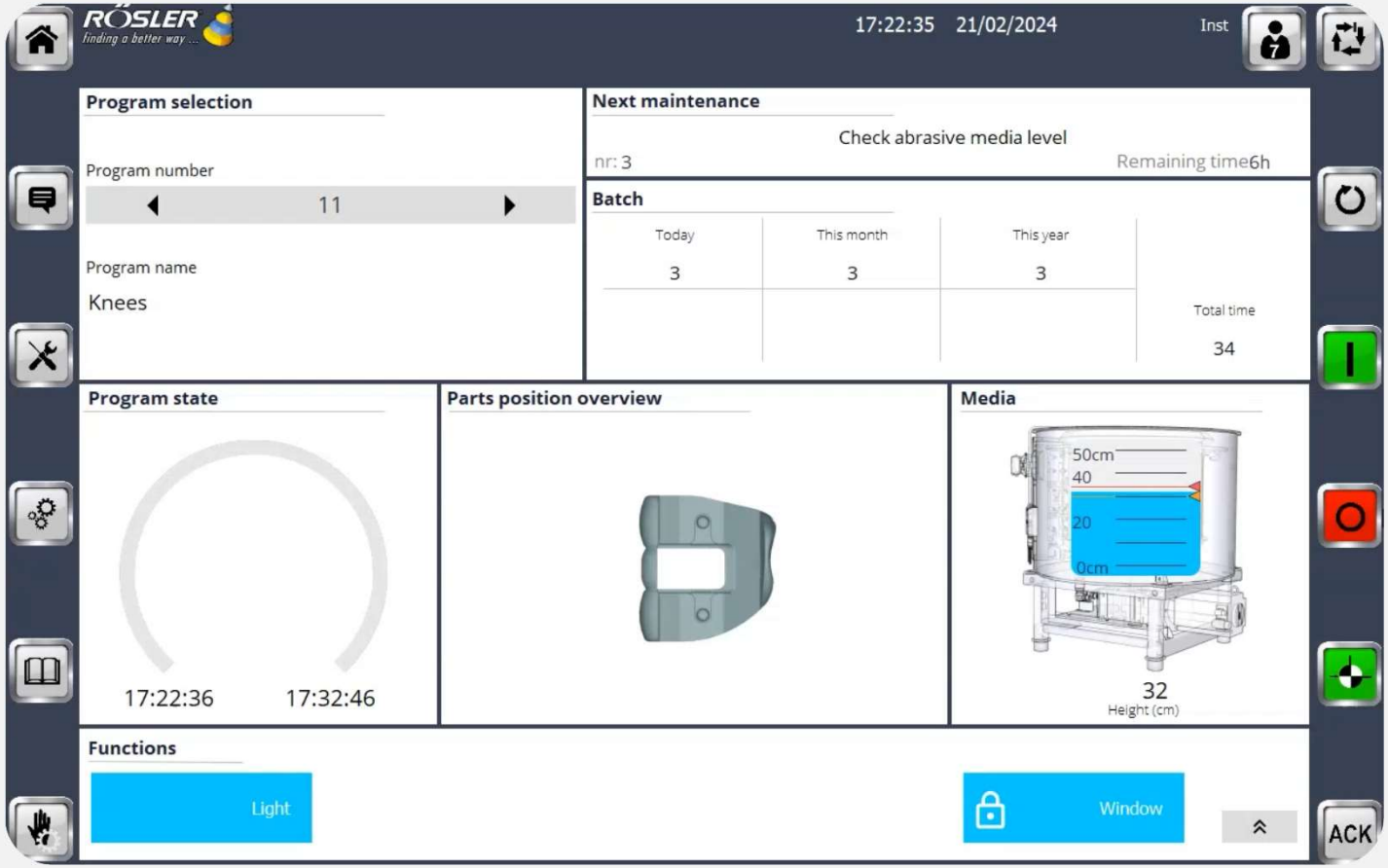




5.PROCESS MONITORING

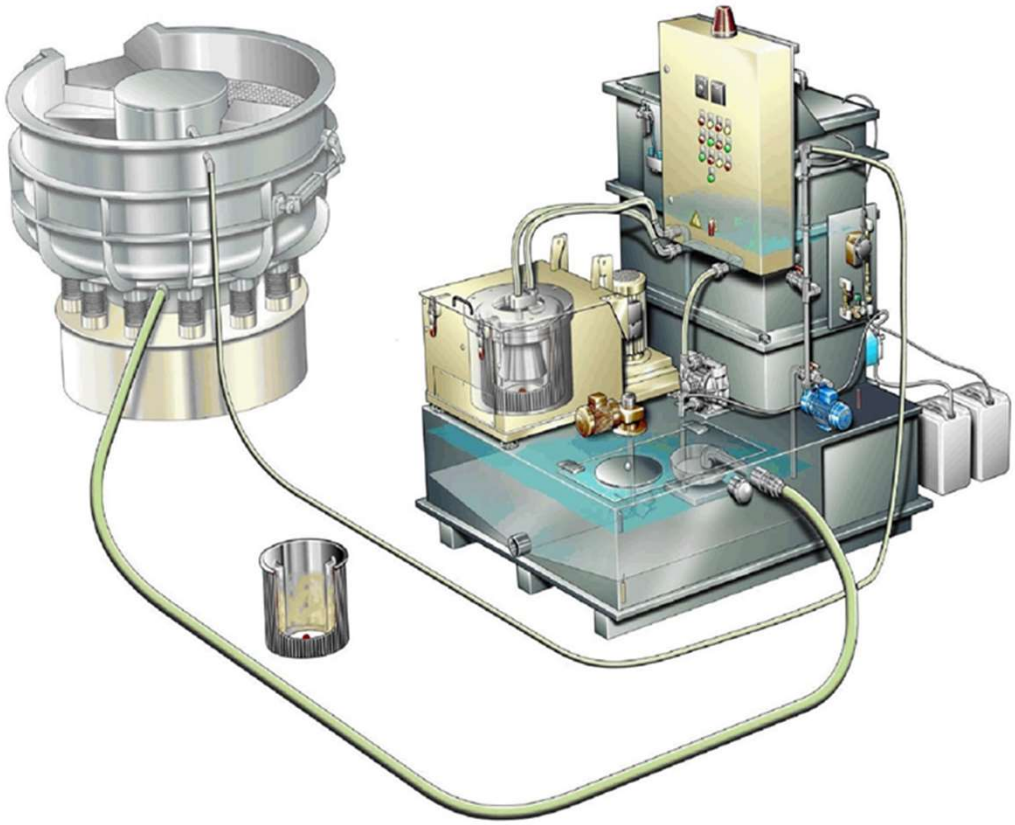
5. Process Monitoring

HMI Surf Finisher RMSF 4/800



- Specific material removal in dedicated areas
- Visulaizing all process & processing parameters

5. PROCESS MONITORING



Process water circulation system

Over 99% of the finishing systems do have a process water circulation system.

So far it was quite difficult and connected to a high effort to monitor and regulate the water quality.

5. PROCESS MONITORING

Process water circulation system

- Quality of process water is essential for a stable finihsing process.
- Water quality, parameters and tolerance levels must be set and monitored.

SMART SOLUTIONS

5. PROCESS MONITORING

Rösler Smart Solutions

Digitization at Rösler

PATENT APPLICATION FILED
20210121135416O1DE

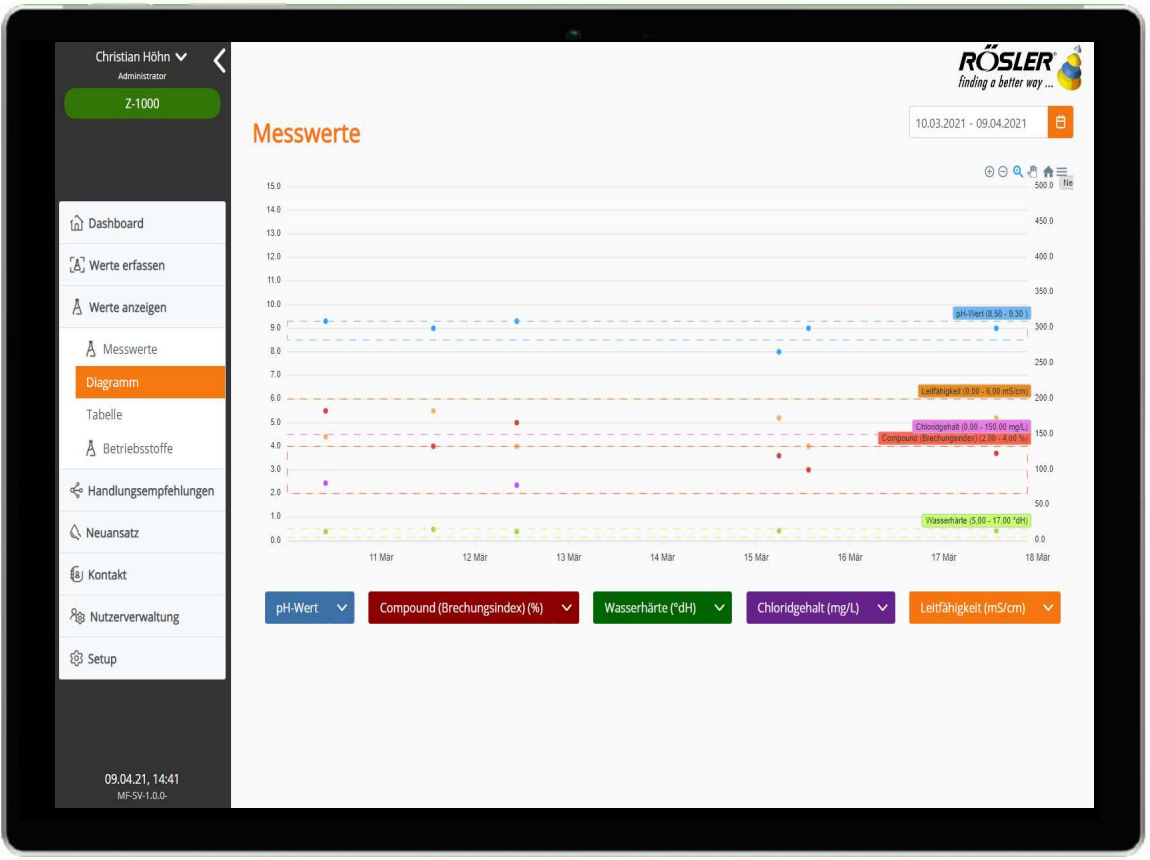
Process and cost transparency	Active monitoring with recommend-dations for action	Fast reaction in case of differences or disturbances due to data archiving	Intelligent process and system control with service life forecasts	Optimized use of resources and cost reductions

Reducing the complexity of process water management by digital support

5. PROCESS MONITORING

SMART SOLUTIONS

RÖSLER finding a better way ...



Smart Solutions Software

Parameters to be monitored:

- Compound concentration
- Water hardness
- pH value
- Conductivity
- Turbidity
- Bacterial content
- Up to 13 different parameters in total

6.GENERAL APPLICATIONS

EXAMPLE: DENTAL DRILL

Material:	titanium
Quantity:	24 pcs/batch (MSH6)
Machine:	R 4/700 SF
Starting condition:	oxide layer
Goal:	grinding, remove oxide layer
Process:	grinding
Process time:	approx. 15 min

SURFACE FINISHING OF MEDICAL COMPONENTS

Tube vibrators

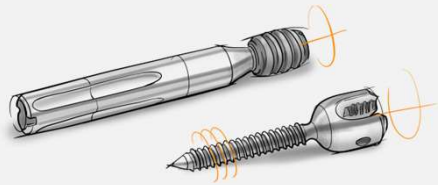
Rotary vibrators

Typical applications

- bone plates
- bone screws
- prosthetic components
- instruments

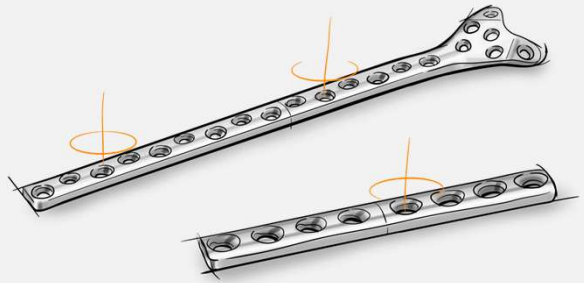
Your benefit

- cost-effective finishing
- highly flexible



EXAMPLE: BONE PLATES

Material:	titanium / stainless steel
Dimensions:	up to 310 mm
Machine:	R 620-2E-KF
Process:	Keramo-Finish
Process time:	approx. 12 h (grinding) approx. 6 h (smoothing) approx. 3.5 h (polishing)
Goal:	polishing remove scratches



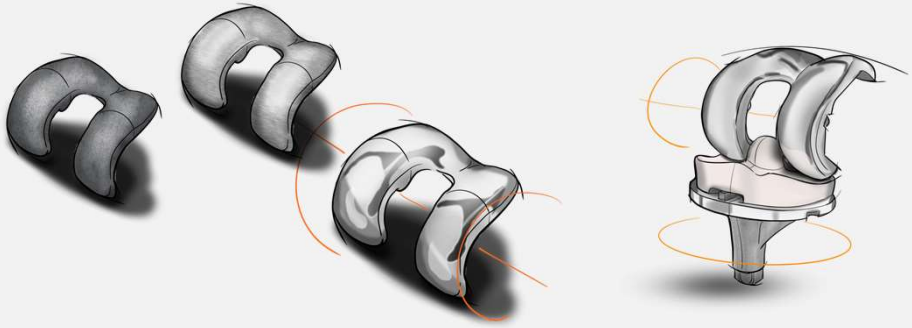
SURFACE FINISHING OF MEDICAL COMPONENTS

Rösler High-Performance - 3000 rpm Rotary Vibrator R150DL-2

- Finishing of complex and delicate work pieces
- Suitable for low volume production
- Fixture system for work pieces / connected to the bowl
- Highly intensive finishing for deburring, grinding, high-gloss polishing
- Even and absolutely repeatable finishing result
- 2 special high speed motors (3000rpm) / tiltable
- Pneumatic lifting device available

EXAMPLE: KNEE JOINT / FEMUR

Material:	CoCr
Quantity:	20 - 30 pcs
Machine:	R 150 DL-2
Starting condition:	machined surface Ra 0.6 µm
Process:	grinding / polishing
Process time:	approx. 6 h (grinding) approx. 2 h (polishing)
Goal:	polishing Ra <0.05µm mirror finish



SURFACE FINISHING OF MEDICAL COMPONENTS

Rösler centrifugal disc finishing

Typical applications

- screws
- dental implants
- stents
- bone screws

Your benefit

- effective finishing of small parts
- high speed finishing

EXAMPLE: BONE NAIL, BONE PLATE

Material:	CoCr, titanium
Dimensions:	bone nail: 480 mm bone plate: 40 - 150 mm
Quantity:	30 bone nails / batch 150 - 300 plates / batch
Machine:	FKS 55.1 E-SA-SO
Starting condition:	machined surface
Process:	grinding / polishing
Process time:	60 - 90 min

EXAMPLE: CANNULA

Material:	stainless steel
Dimensions:	1.6 – 2 mm (diameter) 41 mm (length)
Machine:	FKS 04.1 E-SA-KF
Process:	Keramo-Finish
Process time:	approx. 4 h (grinding) approx. 15 min (polishing)
Goal:	surface smoothing

RÖSLER
finding a better way ...

AUTOMATIC
FINISHING SYSTEMS

AUTOMATIC DRAG FINISHING SYSTEM

R6/1000 SF-A with robotic work piece handling

MASS FINISHING

SHOT BLASTING

AM SOLUTIONS

www.rosler.com

Rösler Oberflächentechnik GmbH
Vorstadt 1
D-96190 Untermerzbach

Tel.: +49 9533 / 924-0
Fax.: +49 9533 / 924-300
E-Mail: info@rosler.com