

IAEA Workshop Wire Saw Technology

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Technology and Management for the Decommissioning of Nuclear Facilities – Prof. Dr.-Ing. Sascha Gentes



Content:

1. History
2. Function and arrangement
3. Areas of application
4. Classification
5. Tool

History

- First diamond wire saw was used in Carrara 1968
 - Experiments with a galvanic bonded diamond wire on a stationary system
- Commercialization in the 80's
- Use of diamond wire saws in almost all marble quarries in 1984
- Economic processing of the blocks instead of uncontrolled extraction by blowing



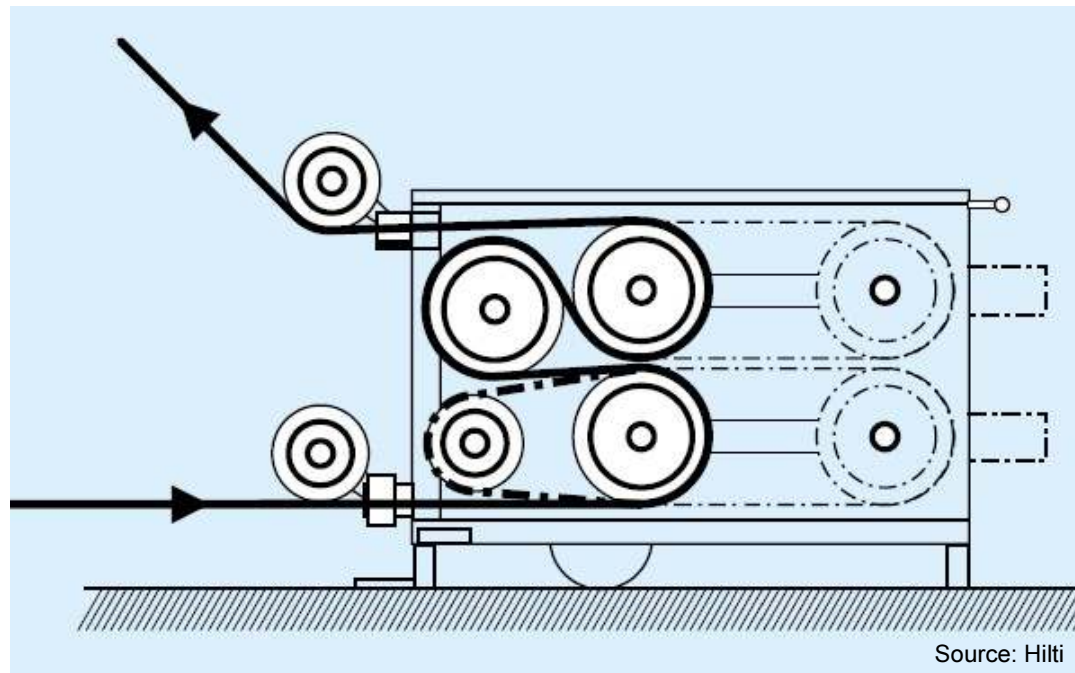
Carrara, Italy



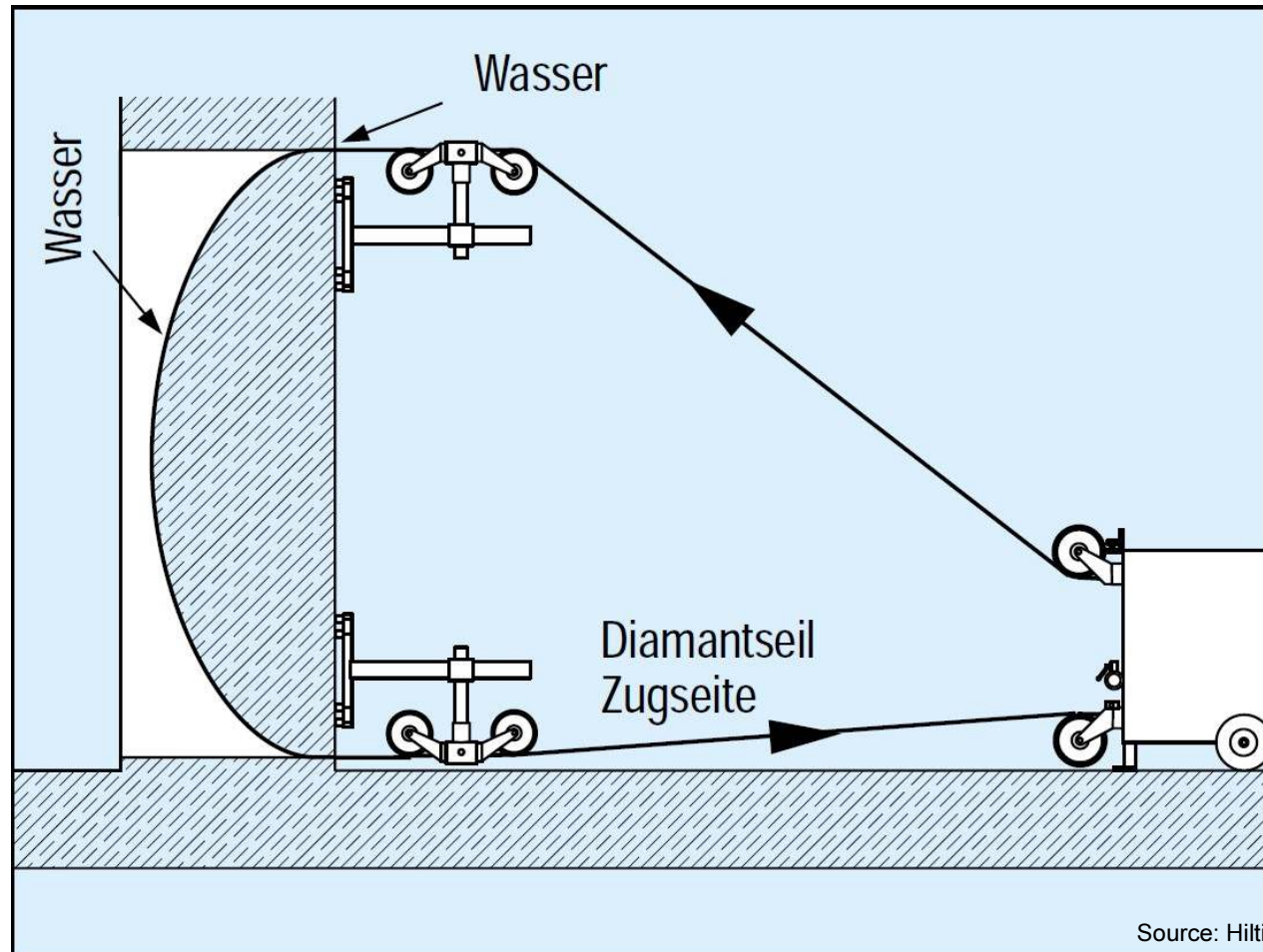
David by Michelangelo

Function impulse

- Impulse occurs through hydraulic engine or electric motor
- Pneumatic cylinder holds the wire on tension

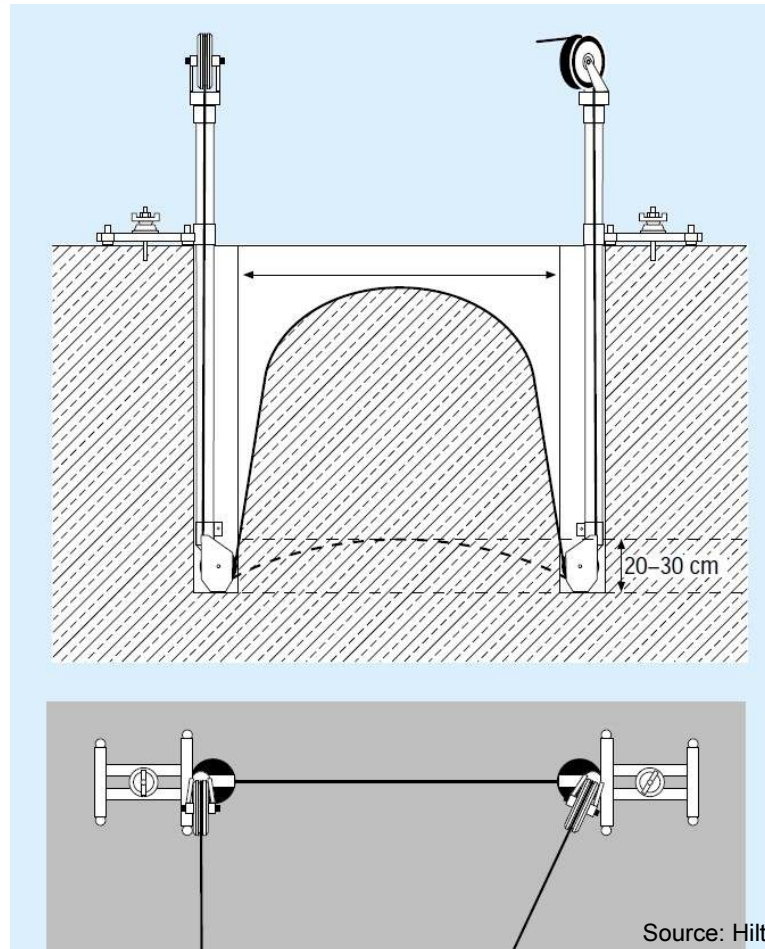


Procedure arrangement



Embracing procedure

Procedure arrangement



Source: Hilti

Depth cut with blind bores

Areas of application



Stone quarry



circle wire saw



CNC Contour cut



Disc cutting

Areas of application

- Building industry
 - Dismantling of steel and reinforced concrete structures
 - Decommissioning of nuclear facilities
 - Underwater workings
 - Dry cut is possible → advantage in areas poor in water
- Decommissioning of offshore platforms, ship wrecks and submarines



Classification

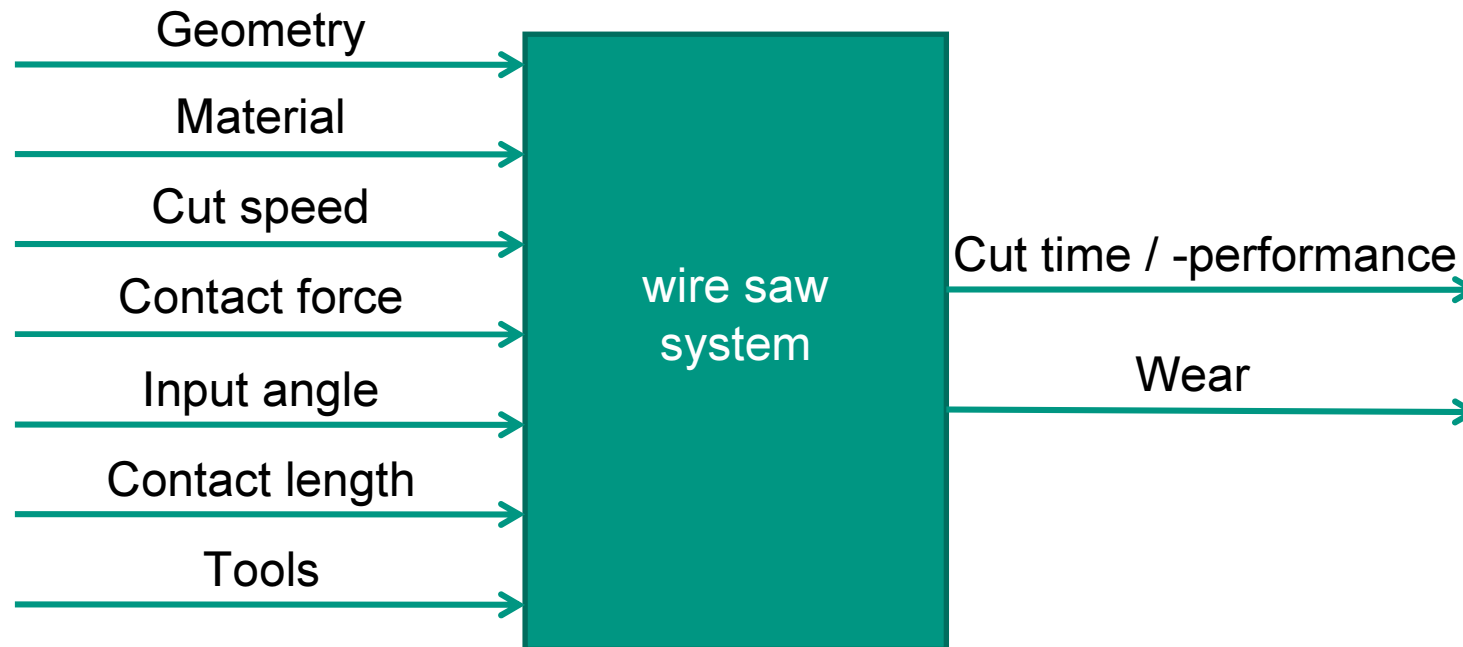
Pro

- High flexibility in application
- High cut performance
- Remote Handling
- Under water usable
- Low demand for drive power
- No restrictions in the cutting depth and the shape of the work piece
- Low setup- time and costs
- Low noise emission

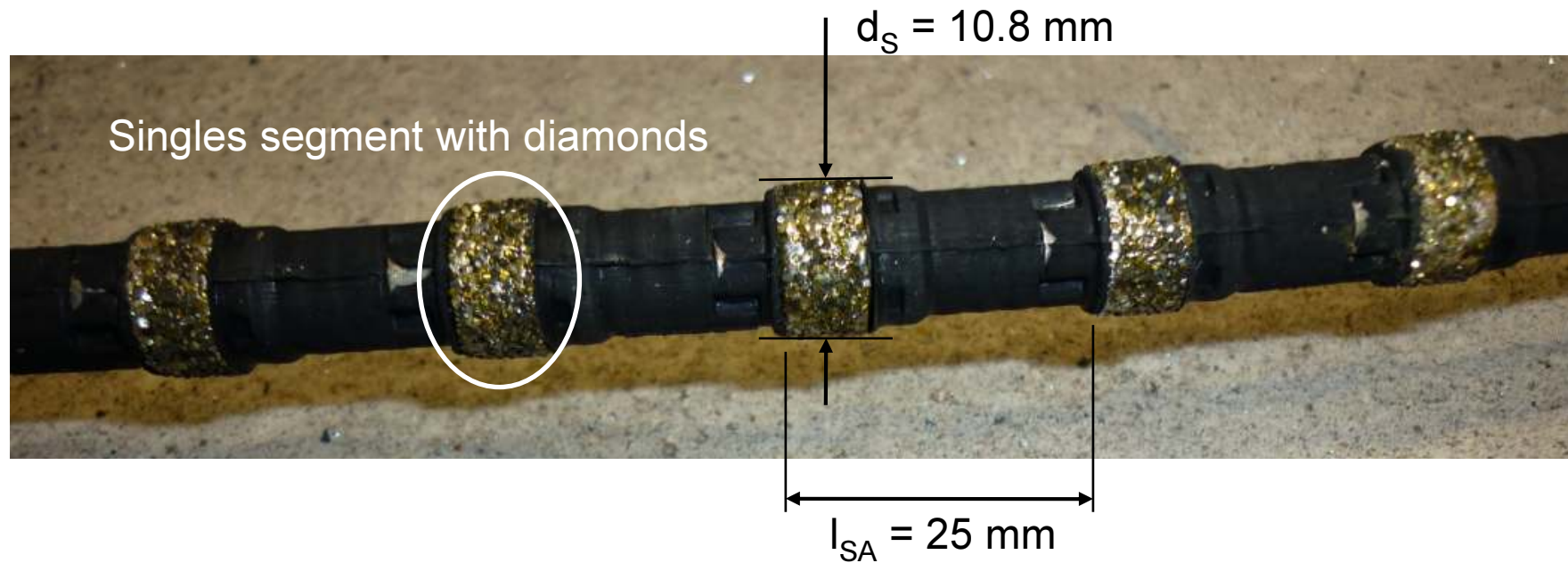
Contra

- Large cut width (11 mm)
- Sometimes rough cut surface
- High Risk of tool cracks and so a risk of injury for people
- Preparation Drillings for fixing are necessary
- High tool costs

System dimensions



Construction diamond wire



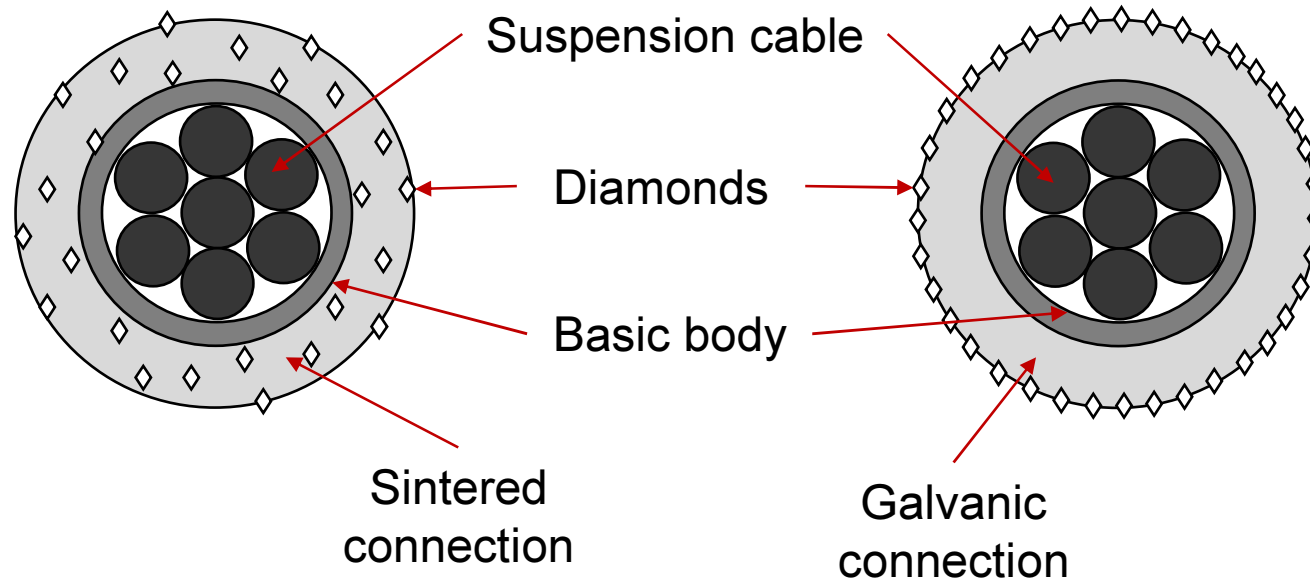
1 m = 40 segments = 100 € +

Cut through a diamond segment

- There are two kinds of production procedures

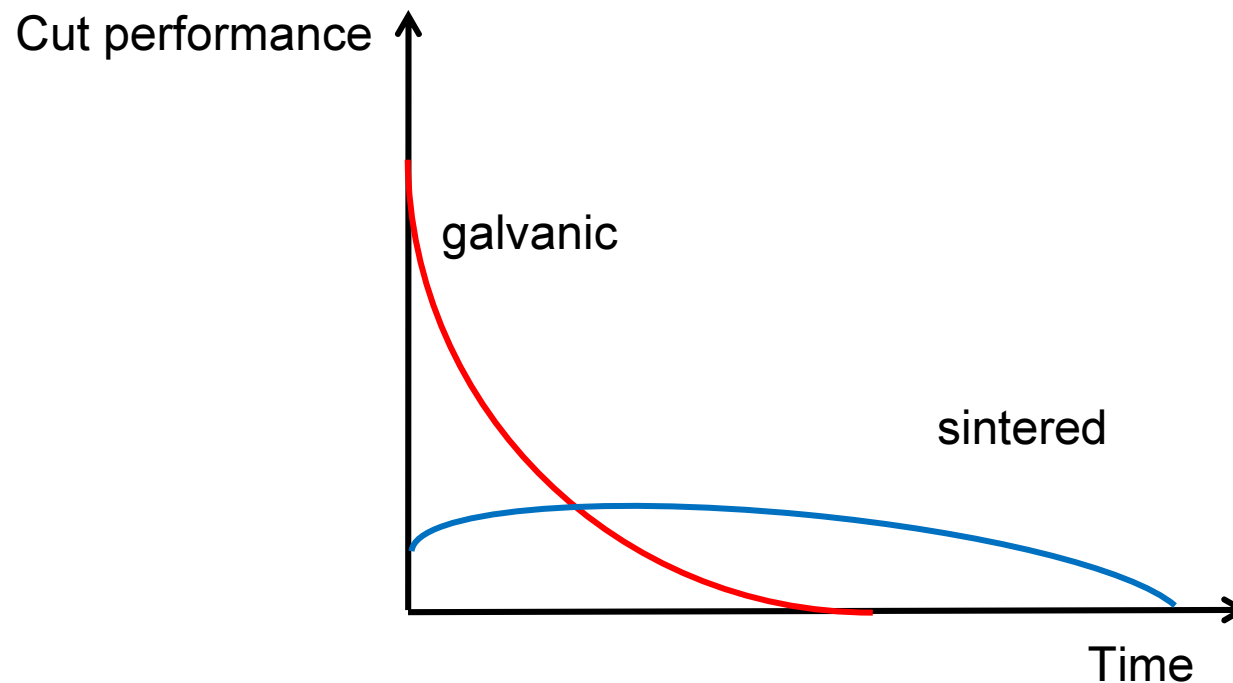
Sintered segment

Galvanic segment



Comparison diamond rope

- Comparison diamond rope with galvanic or sintered segments



Automated wire saw technology for underwater disassembly (ASTU)

Promoted by the Federal Ministry of Education and Research

Technology and Management for the Decommissioning of Nuclear Facilities – Prof. Dr.-Ing. Sascha Gentes



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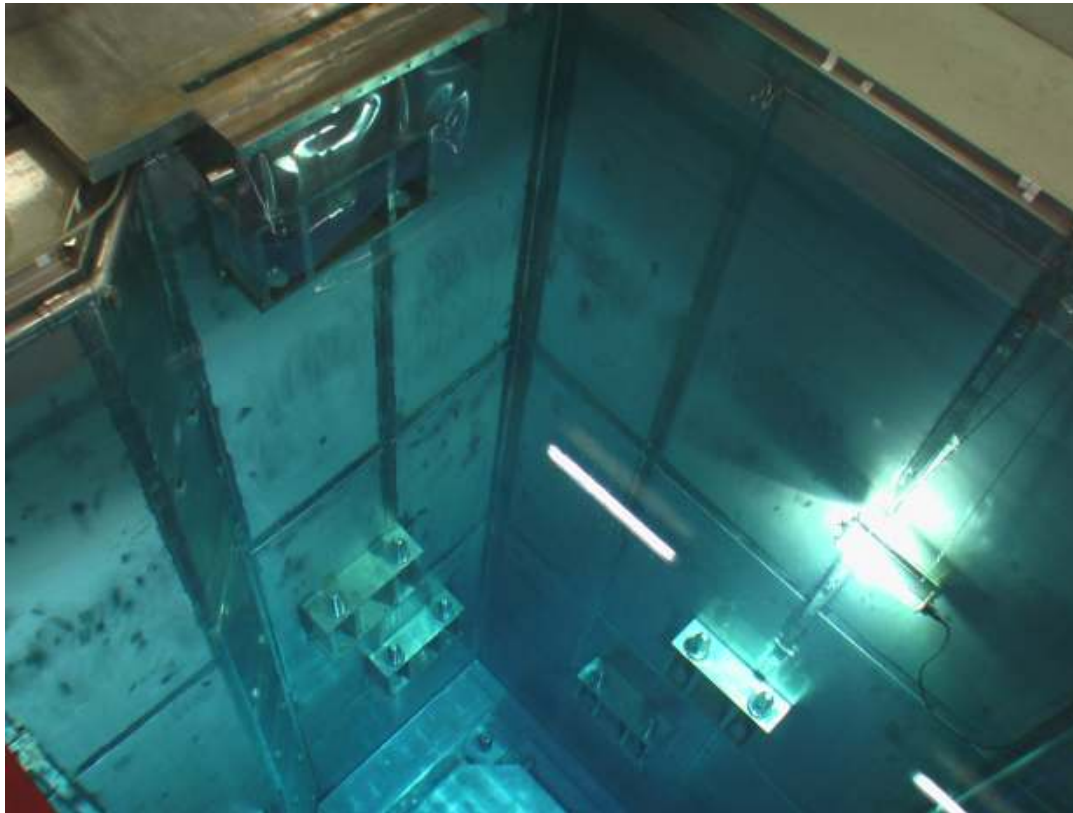
1. Initial position and problem
2. Objectives of the research project
3. Test stand
4. First results
5. Outlook

1. Initial position and problems

- The company Siempelkamp GmbH & Co.KG got the job of separating consoles in the nuclear fuel element basin in the nuclear power plant Obrigheim.



1. Initial position and problems



Demands

- Separation of austenitic material
- Applicable up to 8 m of water depth
- smooth cut surfaces
- Remote handling

1. Initial position and problems



Selected procedure:

Wire saw

Preattempts and cold test were carried out in the test hall of the TMB.




It has be shown that the calculated cut time was crossed in practice around the 10-fold.

To make the process more predictable this project was initiated.



2. Objectives of the research project

Test plan:

Material S235JR	Row 1 	Row 2 	Row 3 
Attempt			
1	t_1	t_1	t_1
2	t_2	t_2	t_2
3	...	...	...
4	...	...	...
...
10	...	...	...
11	...	...	...

Afterwards the same program for stainless steel (1.4301)

2. Objectives of the research project

The following parameters are recorded :

- Wire speed
- Wire contact pressure
- Driving power
- Wire kind and construction
- Test sample (material and geometry)
- Water temperature
- Contact force in the entry and escape of the cut sample
- Size distribution of the filings

2. Objectives of the research project

From the ascertained data a model should be developed, that enables making predictions to the optimum cut parameters for different geometry and materials.

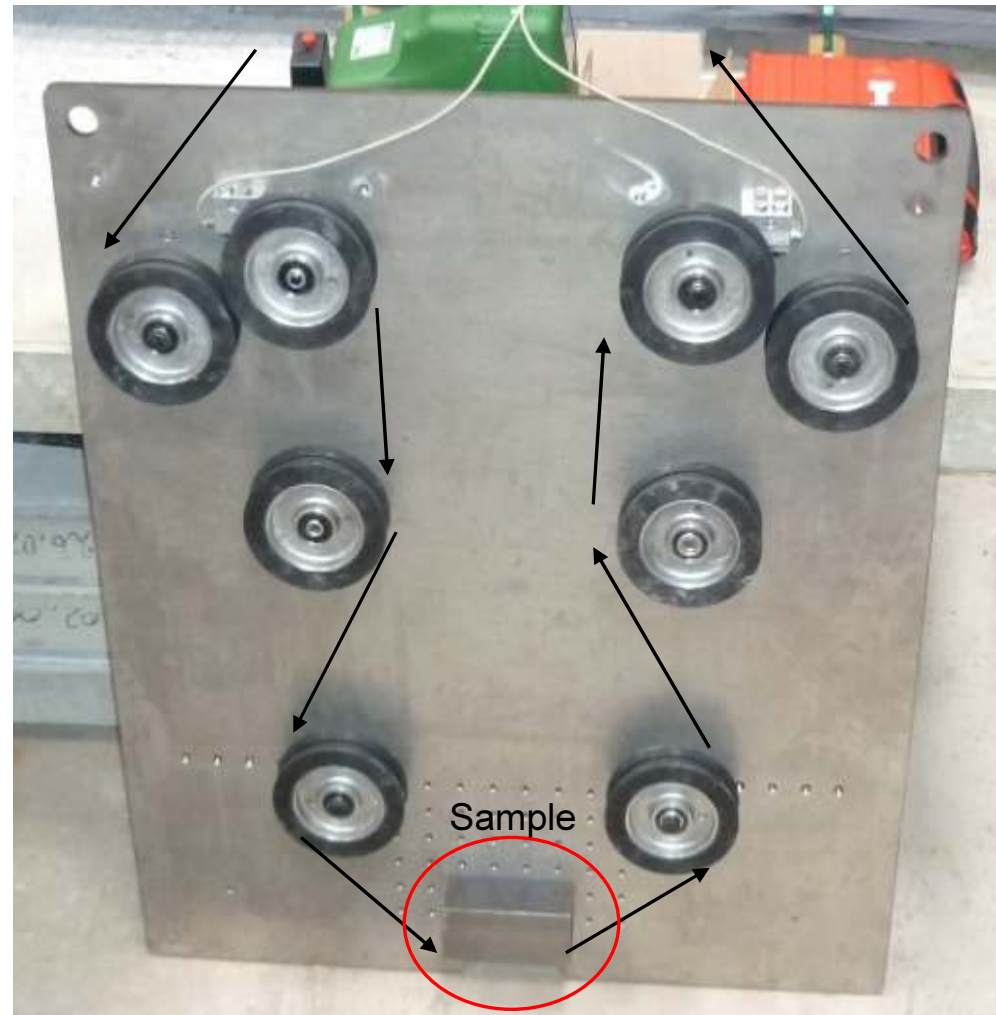
$$\text{Cut time } t_s = f(v_c, F_s, P, S, G, k, \dots)$$



3. Test stand



3. Test stand



3. Test stand

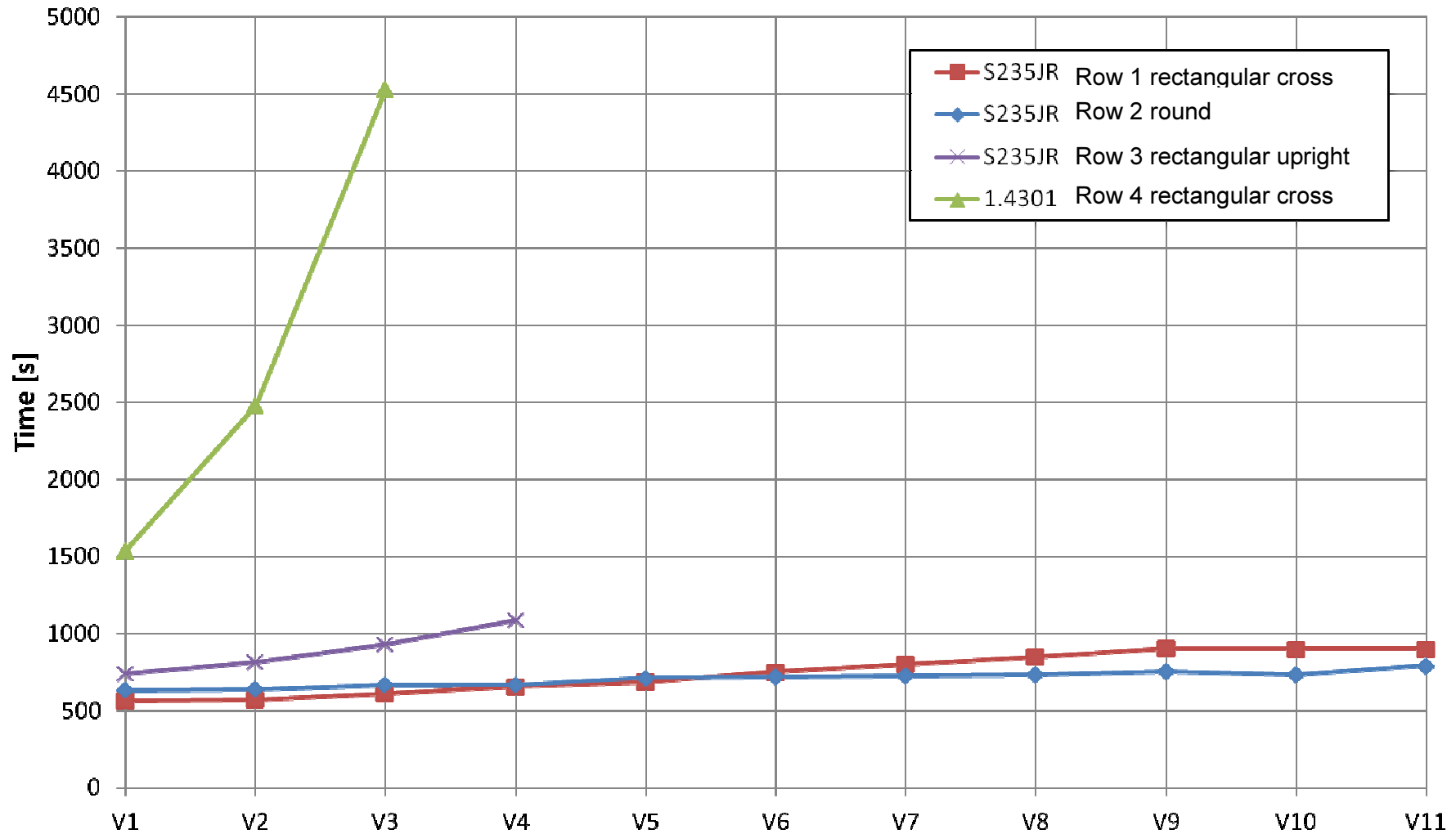


Control panel

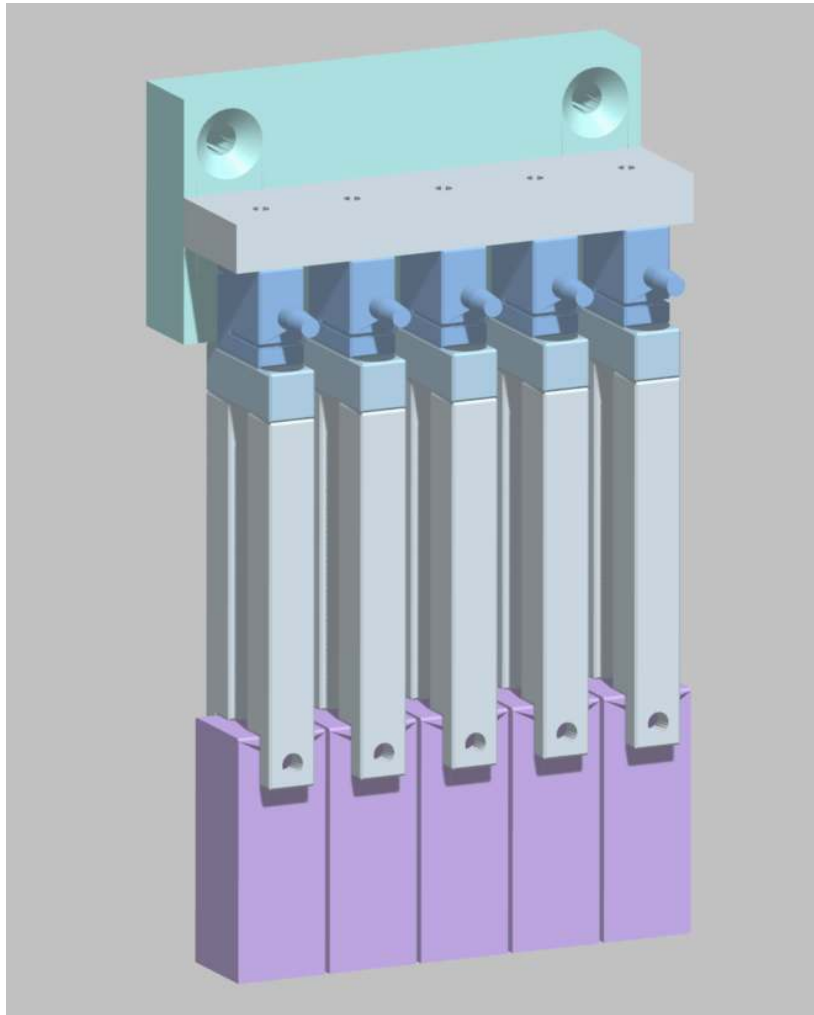


4. First results

Comparison Testrows



5. Outlook



- Completion stainless steel rows
- Cuts with partial samples
- Developing model
- Edge influence
- Composite geometries
- Create a method to classify wear of diamond wires



Thank you for your attention