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Interprofessional Projects Program

Innovating Process Improvements in Manufacturing

Fall 2008

FINKL
A. FINKL & SONS CO.

IPRO 304
INTERPROFESSIONAL PROJECTS PROGRAM

Advisors and Members

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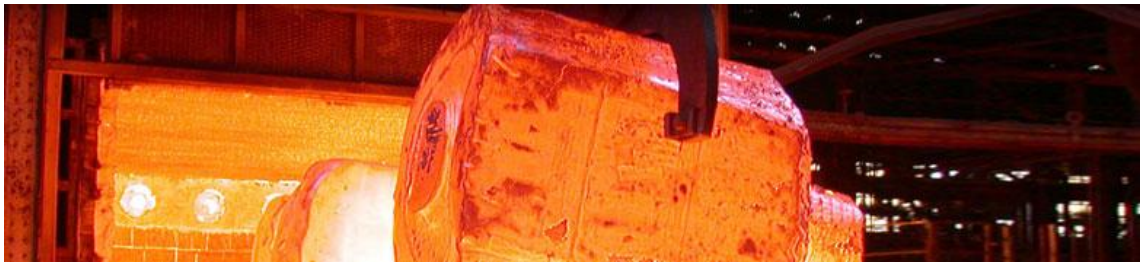
A. Finkl & Sons Co.

Melting

Forging



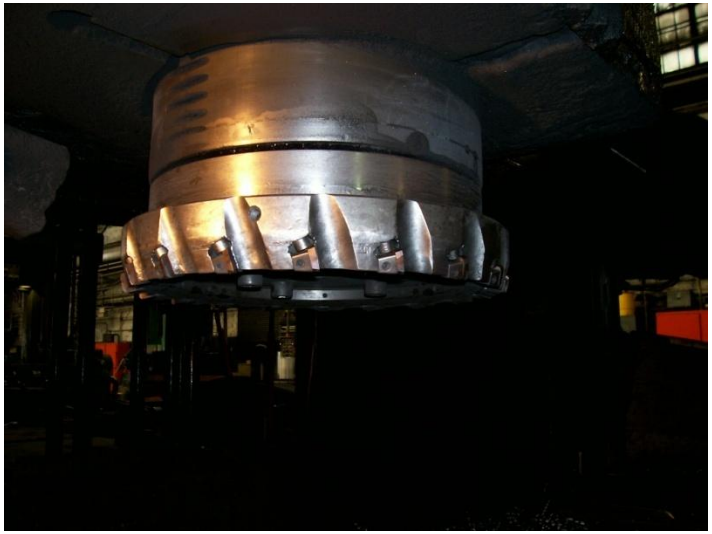
Heat Treating

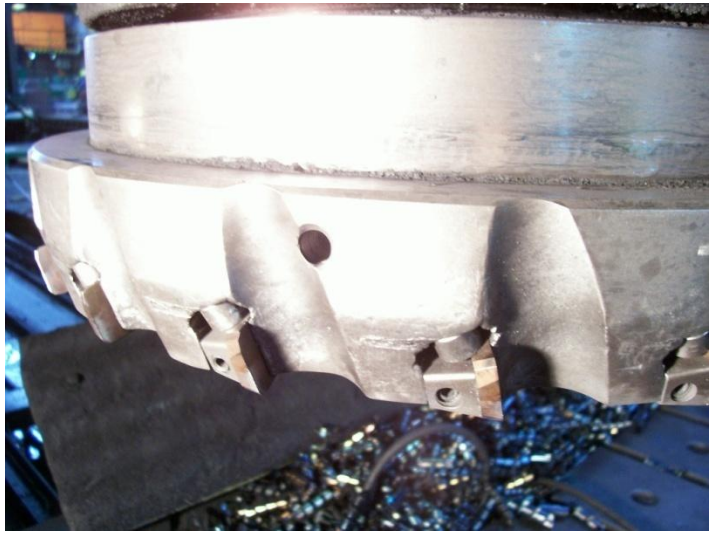
Milling Process

Finished Product

Advancement Opportunity

- Milling machine (below) contains inserts broken during milling process
- To develop a working prototype
- Automatically monitor & detect broken inserts
- Provide A. Finkl & Sons with the proper data & statistics of which solution to invest in





Business Perspective

According to A. Finkl & Sons

- A milling machine is billed at $120 per hour
- 20-25 inserts are broken per day per machine
- Takes 5 minutes to change inserts

Total Estimated Loss Per Machine

- 100-125 minutes per day
- $200-$250 per day
- $6000-$7500 per month

Objectives of Current IPRO

- Determine a way to detect broken inserts
- Alert the mechanic monitoring machine in order to replace inserts
- Use of accelerometer
- Laser detection
- Power meter
- Research, test and inform A. Finkl & Sons of the best solution to invest in

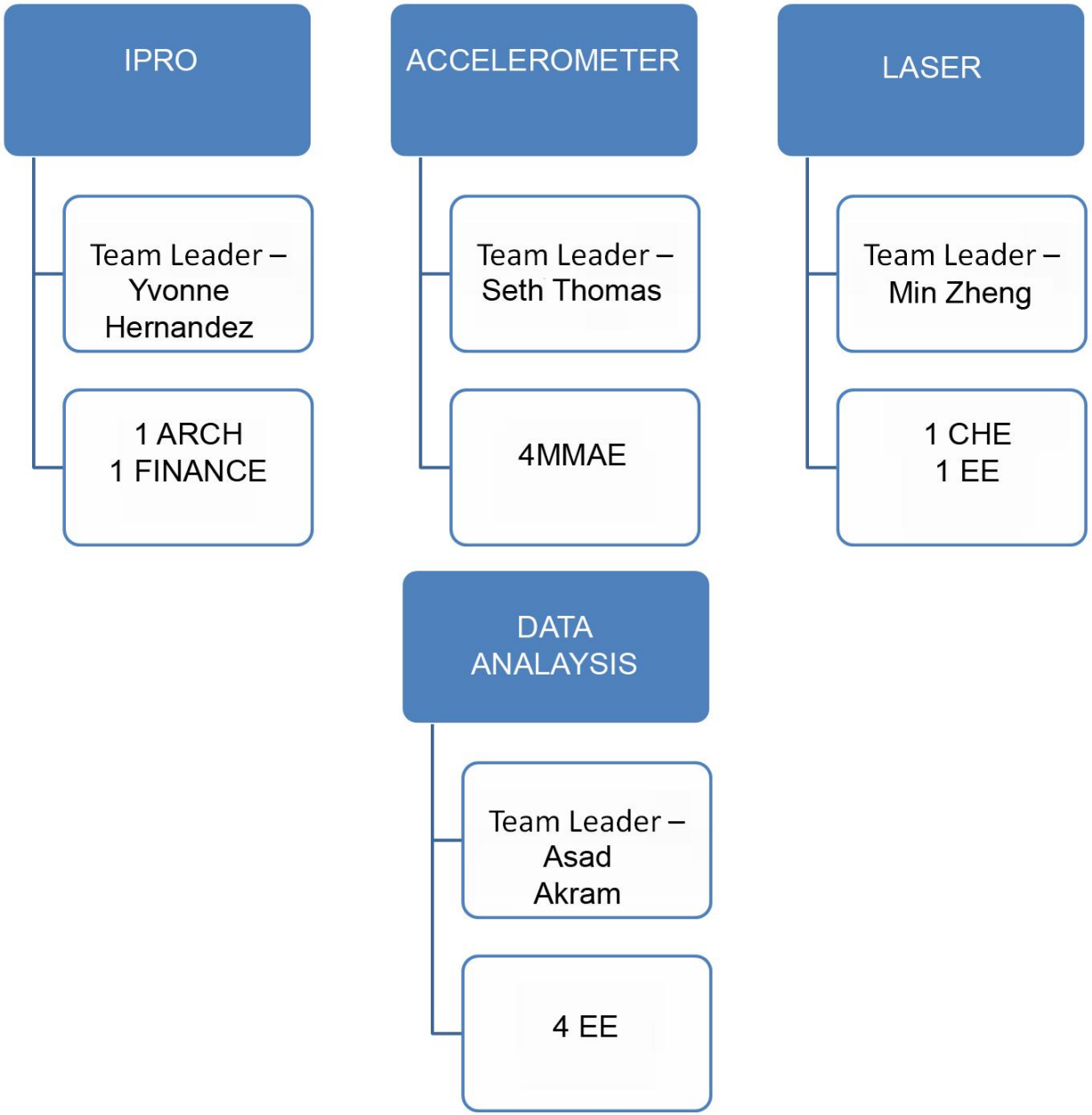
Previous IPRO

- Researched different solutions
  - Acoustics
  - Microphone
  - Camera
- Found accelerometer to be best option
- Wired accelerometer on bearing housing not as effective

Our Results

- Accelerometer used differently to measure vibrations
- Obtained more effective data
- Analyzed data to show results
- Accelerometer is best option for A. Finkl & Sons

Team Organization



Current Methods for Tool Monitoring

Laser Detecting System

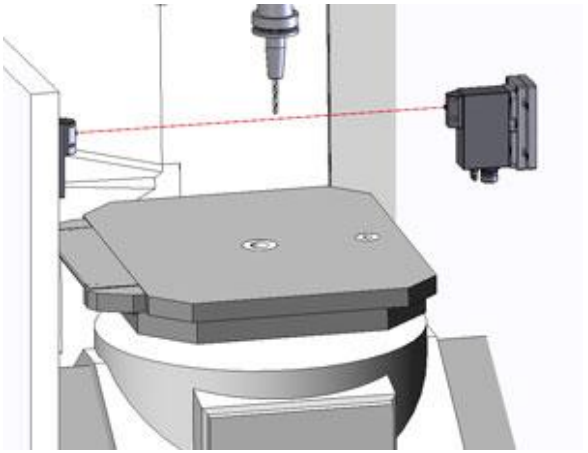
• 2008 International Manufacturing Technology Show (IMTS) in September

•A well-accepted tool breakage monitoring system

Drawbacks

•Requires Computer Numerical Control (CNC)

•A. Finkl & Sons milling machines also lack essential control software



Picture courtesy: BLUM

Current Methods for Tool Monitoring

Power Meter

- Recommended by BLUM

Power meter

- Technically feasible
- Requires considerable amount of research and effort

Accelerometer Features

Desired accelerometer characteristics:

High Resolution:

- High Frequency Response
- High Sampling Rate

Versatility:

- Wired vs. Wireless

High Measurement Accuracy:

- Acceleration range

Techkor Accelerometer

Chosen Accelerometer Package Because:

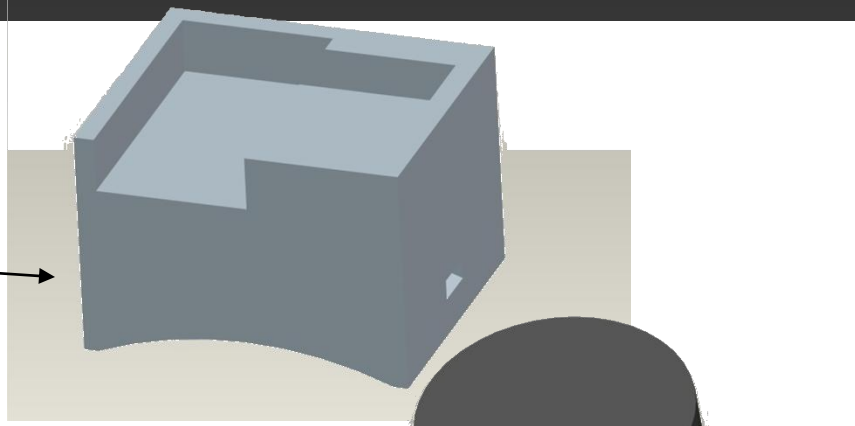
- 0-50G acceleration range
- Up to 40 kHz Sampling rate
- Wireless Transmission
- Automatically downloads data
- Hundreds of Accelerometers can be handled by 1 Access point.
- Maintenance Watchdog program can notify operator when a problem has occurred.

MAINTENANCE WATCHDOG™

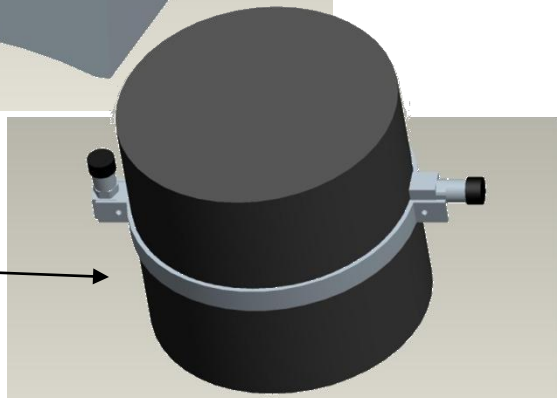
Experimental Setup

- Many techniques were explored to mount the accelerometers to the area of interest
- As the requirements of the problem changed, the method was changed

Spring 2008 mounting

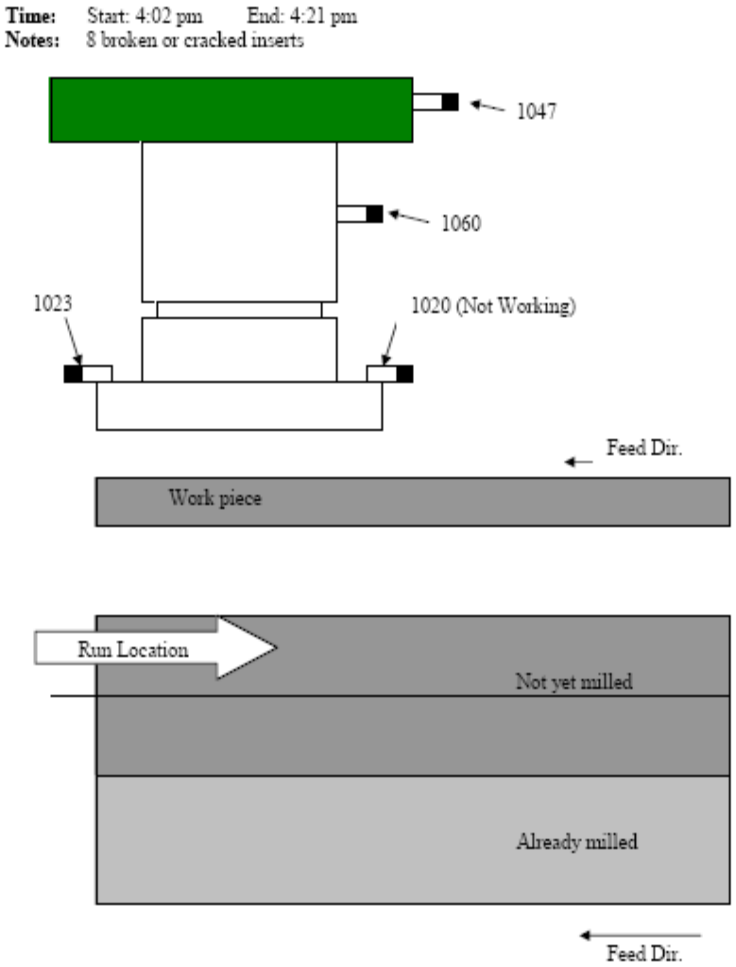


Fall 2008 initial method

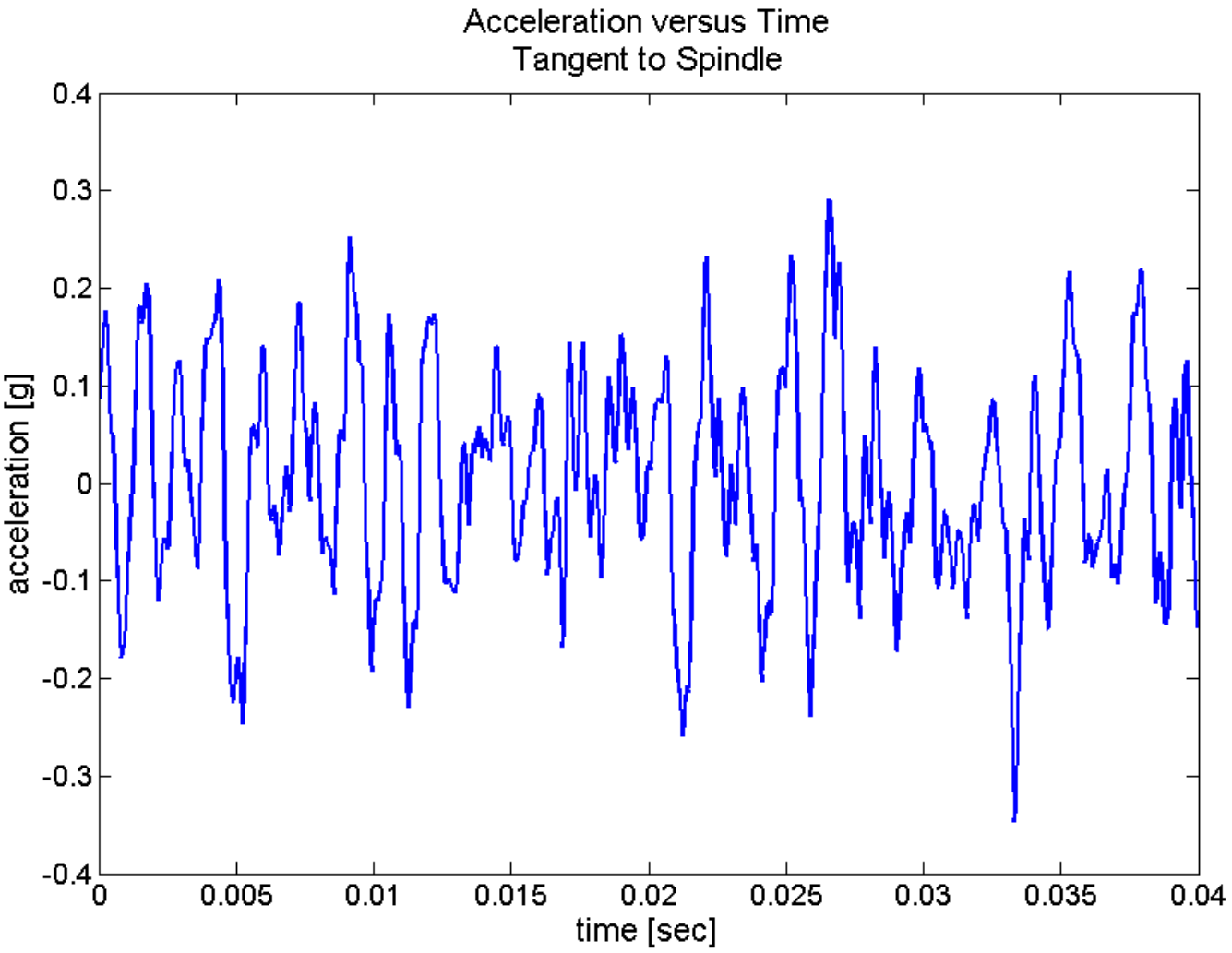


Current method

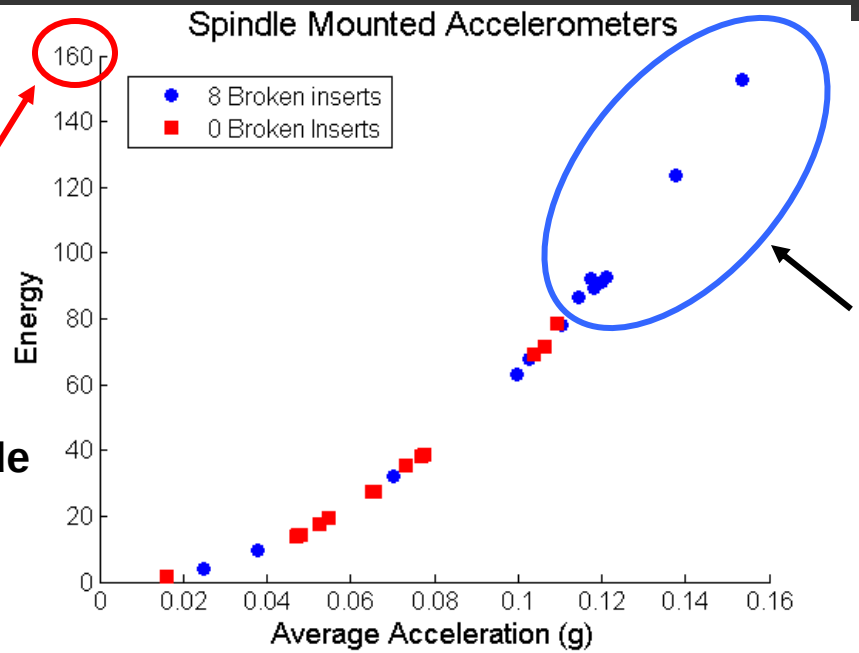
Experimentation and Testing



Data Graphs

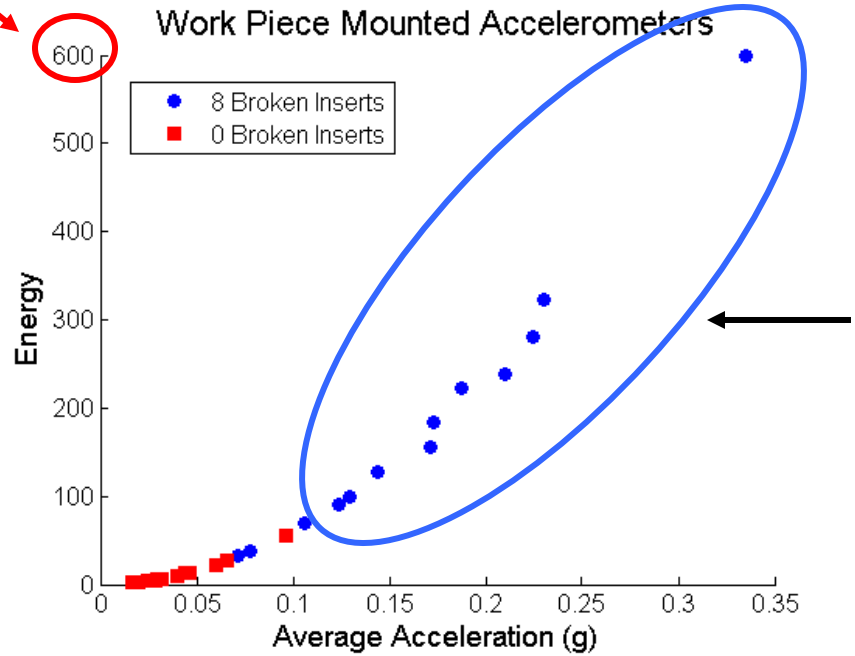


Signal Analysis



Large magnitude difference

Indicates multiple broken inserts



Indicates multiple broken inserts

Achievements

"Using accelerometer to detect real-time insert breakage is now possible"

-IPRO 304

Advantages to A. Finkl & Sons

- Cost reduction (Less Labor)
- More consistent surface finish
- Greater Efficiency

Achievements

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Future Suggestions

•Work with Techkor or software developing company

•Cost association

•Continued proof of concept – i.e. machines not mounted to floor

•Use a Design of Experiments method, such as Plackett-Burman, to examine how the variables in the experiment interact

•Develop a method of automatic notification for laborers at A. Finkl & Sons

Questions?

We would like to thank A. Finkl & Sons, Professors Maurer and Mostovoy and the IPRO office for all the support.

Thank You!

IPRO Team 304

Questions?