# Compact and stable NIR spectrometers for woodworking

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Ibsen photonics

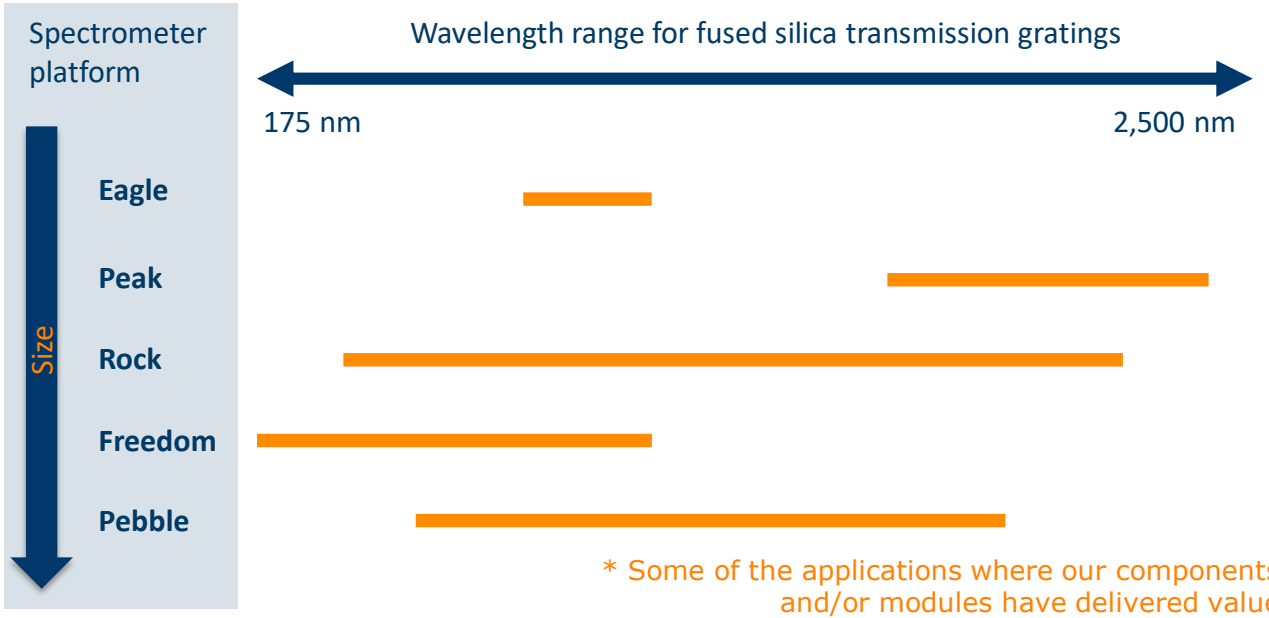
Spectrometer specialist

# Ibsen is a manufacturer of OEM spectrometers for integration into spectroscopic instruments

| Three main reasons to choose Ibsen | How it impacts consistency | Annual output |
|---|---|---|
| **Transmission gratings** | High **efficiency**<br>High **stability**<br>Enable **compact** design | **+40k** |
| **Spectrometer design** | **+200 years** combined tenure in design team<br>**Environmentally robust** design<br>**Thermally stable** opto-mechanics<br>Designed for **volume production** | **+6** |
| **Spectrometer production** | Low **unit-to-unit** variation by design<br>High transferability<br>**100% inspection** of all units | **+8.5k** |

# Our solutions cover the spectrum from 175 nm to 2.5 µm and add value to many applications

**We cover the entire spectrum supported by fused silica transmission gratings**
Wavelength coverage from all platforms in decreasing size




* Some of the applications where our components and/or modules have delivered value

**Final applications***

- Healthcare
- Agriculture
- Pharmaceuticals
- Security
- Oil & Gas
- Process Analysis
- Light & Display

# Outline

- Application example from woodworking
- Benefits of NIR spectroscopy
- Challenges
- Components of an NIR spectrometer system
- Compact PEBBLE NIR spectrometer
- Why PEBBLE NIR is ideal for woodworking

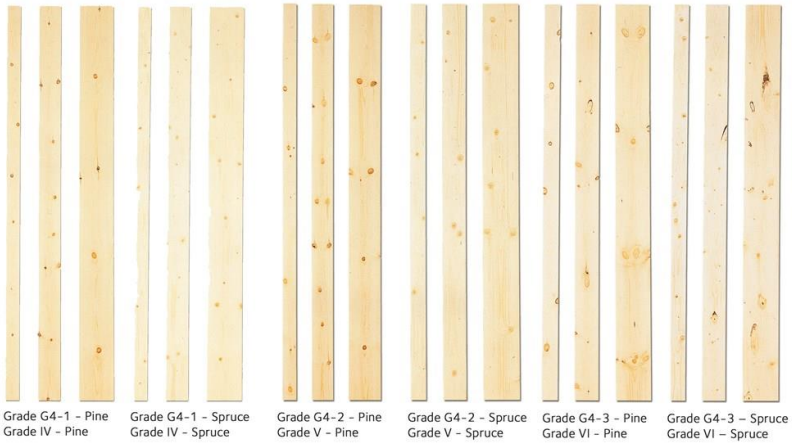
# Current method for grading of wood

**Visual inspection by trained expert**

Normal wood | Resin | Bark | Knots | other

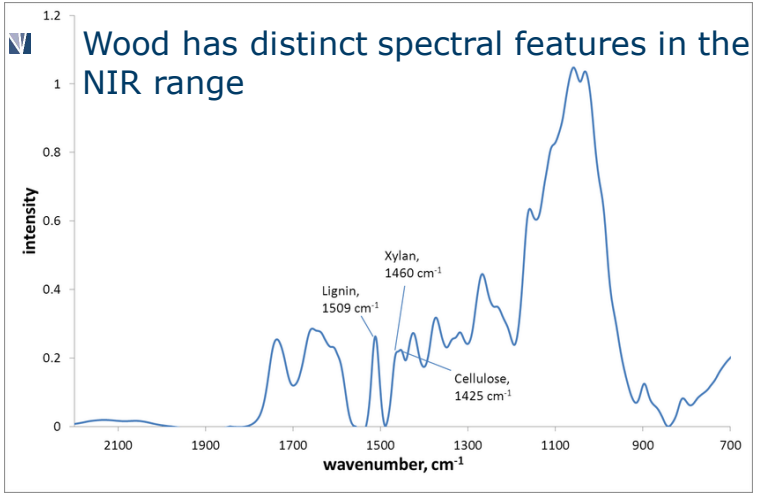
**Issues**

- Subjective
- Limited repeatability



# NIR spectroscopy is well suited for wood grading

- Objective
- Fast
- No sample preparation



# The key challenges are stability and transferability

**Stability:**

Performance should be maintained when the unit is exposed to temperature changes, vibrations and shock

For the spectrometer environmental variations often lead to mechanical displacements of optical components

**Transferability:**

The instrument should provide the same result for the same sample measured with different instruments

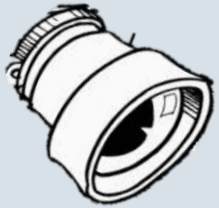
For the spectrometer this often translates to low unit-to-unit variation for resolution and peak shape

# Key components of an NIR system

Ibsen photonics

**Light source**

**Optics**



**Spectrometer**

**Software**

# PEBBLE NIR spectrometer

- **950 nm – 1700 nm**
- **Numerical aperture 0.22**
- **12 nm resolution**
- **Uncooled InGaAs detector array with 128 pixels**
- **Footprint of 23 x 21 x 8 mm³**
- **3 kHz frame rate**

# Benefits

- **Compact size**
- **High sensitivity**
- **High frame rate**
- **Environmental stability**
- **Low unit-to-unit variation**

# Why PEBBLE NIR is the best compact spectral sensor on the market

**Stability:**

- PEBBLE NIR uses **no moving parts**
- PEBBLE NIR uses **transmission optics** which guarantees better stability than reflective optics
- PEBBLE NIR is based on a **proven, rugged opto-mechanical design**

**Transferability**

- PEBBLE NIR provides **low unit-to-unit variation** by design
- **Low variation of resolution** due to tolerance tolerant design
- **100% inspection** against PASS/FAIL criteria for key parameters
- **Symmetrical and consistent peak shapes** due to lens-based design

# The EPIC questions?

- What can EPIC members do for Ibsen?
- Help us understand the specific requirements for woodworking

- What can Ibsen do for EPIC members?
- Be your partner for spectrometer modules for handheld field instruments

# Thank you very much for your attention!