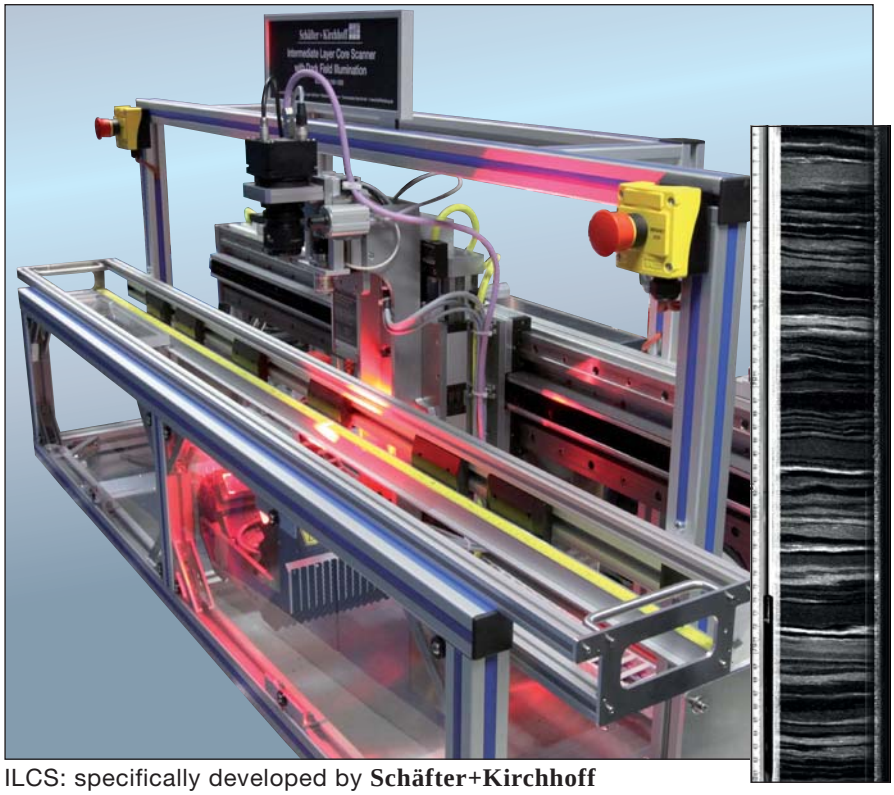
Application

ILCS – Intermediate Layer Core Scanner

Stratigraphy scanner using dark-field illumination

Innovative development in glaciology for the visualization of the laminar structure of polar ice cores

The ILCS Scanner was developed by **Schäfter+Kirchhoff** for expeditions into the polar regions and all of the mechanical, electronic and optical components were designed for use at temperatures down to -40°C.
The ILCS Scanner is used to image the laminar structure of up to 1.7 m long ice core sections.



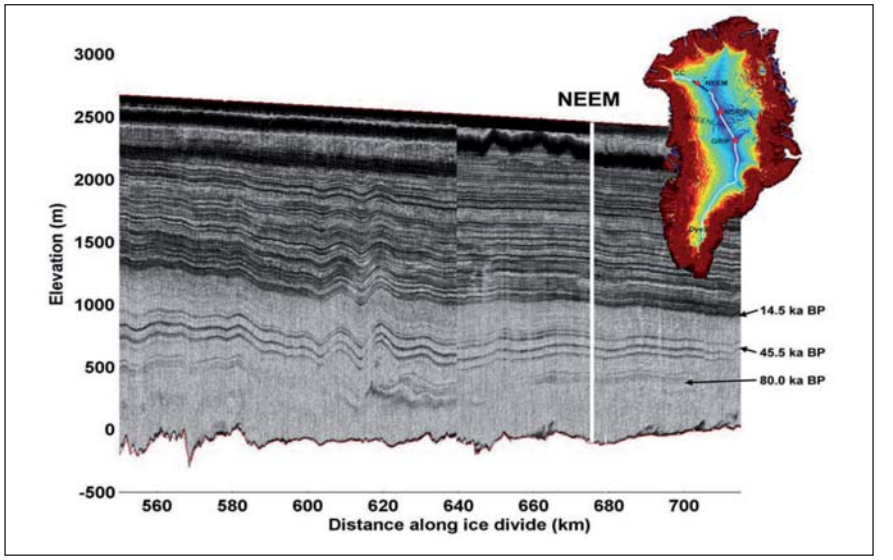
ILCS: specifically developed by **Schäfter+Kirchhoff** for -40°C operating temperatures

Right: a 40 cm portion of a typical scan

The annual variations in precipitation and deposition of dust and other particles on the icey surface of a glacier result in a characteristic laminar structure that is very informative, revealing climatic variations useful in dating the trapped ice core particles and air bubbles.

Also revealed in the ice are distant global changes, such as the deposited ash from volcanic eruptions from the other side of the world, which serve as a temporal reference when comparing ice core patterns from ice collected at various global locations. This allows the absolute dating of major and minor geologically important events.

For stratigraphic visualization, the optical inspection of the laminar variations proceeds by contiguously scanning manageable chunks of ice core until the many kilometers of a typical ice core have all been documented. The ice cores are sectioned according to a predefined strategy in order to reveal their laminar structure (see below) and are planed flat before scanning. The dark-field illumination depicts the particles and gas bubbles as lighter areas and the clearer ice appears dark.



NEEM – The North Greenland Eemian Ice Drilling Project

The collection of ice cores from the Greenland ice sheet, under the auspices of the (NEEM) North Greenland Eemian Ice Drilling project, was successfully completed in July 2010, after 3 years, when the drill-head hit the underlying bedrock. The ice cores from depths of up to 2.5 km provide a record of the past climate covering more than 120 000 years - back to the Eem warm period when the earth was 3–5°C warmer than today. The sea level was also higher than nowadays, lying about 5 m above current levels.
The large area scan macroscope (see page 52) was also developed by **Schäfter+Kirchhoff** for ice core analysis directly in the polar regions, where the ice is collected and stored.

ILCS – Intermediate Layer Core Scanner

Documentation of the visual stratigraphy of polar ice cores using a line scan camera sensor with dark-field illumination

Operating temperature:	-40°C
Resolution:	0.05 µm
Imaging width:	105 mm
Imaging length:	1250 mm single pass, 1700 mm double pass
Max scan speed:	22.7 mm/s
Scan rate:	48.5 s for a core of 1100 mm
Illumination:	2 x line LEDs (dark-field)

Ice core sectioning strategy as defined by the NEEM Project:

A: Microstructural investigations
B-D: Various visual stratigraphic analyses
E: Gas analysis
F: Archive