Developing two multiaxial testing machines to link strength and microstructure of weak snow layers

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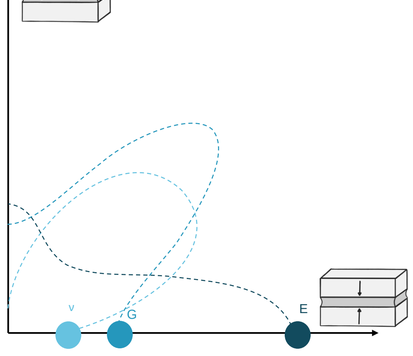
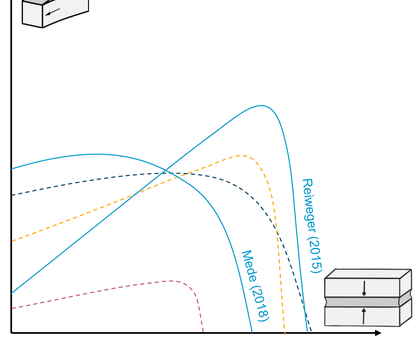
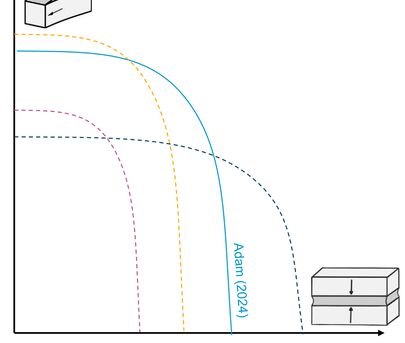
Introduction

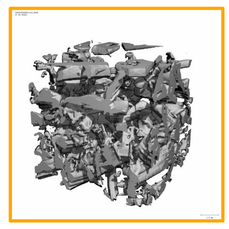
Further improving avalanche forecasting will likely involve mechanically informed models.
These models require material properties as input parameters.
Mechanical properties of snow strongly depend on the environmental and loading conditions.
The main research gaps are:

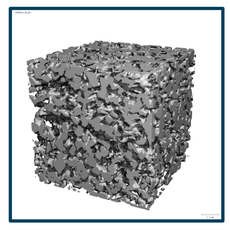
- Material behavior under multiaxial loading conditions
- Influence of snow microstructure



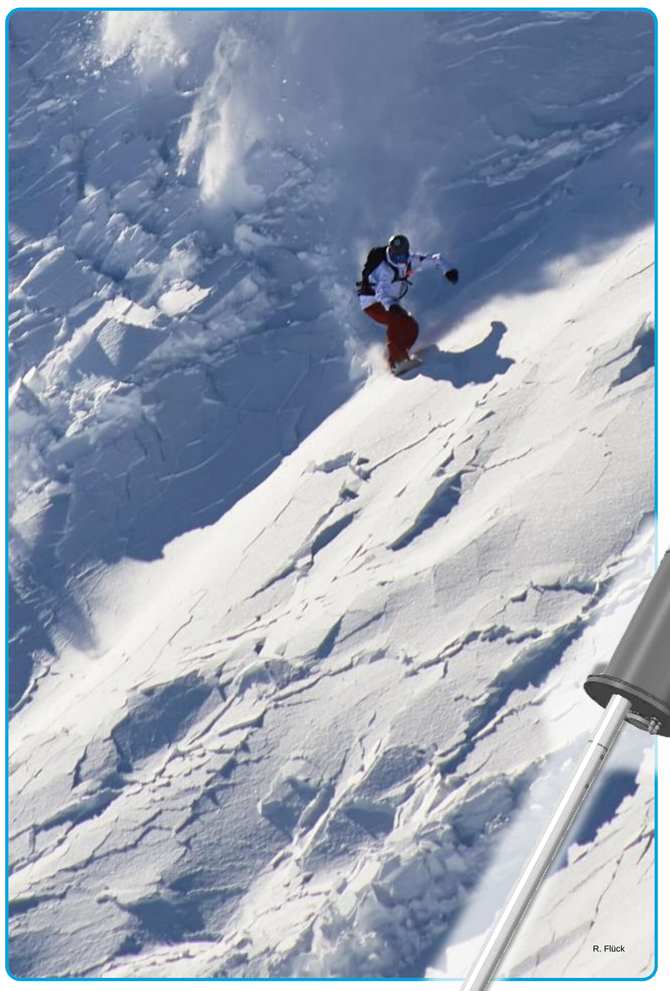




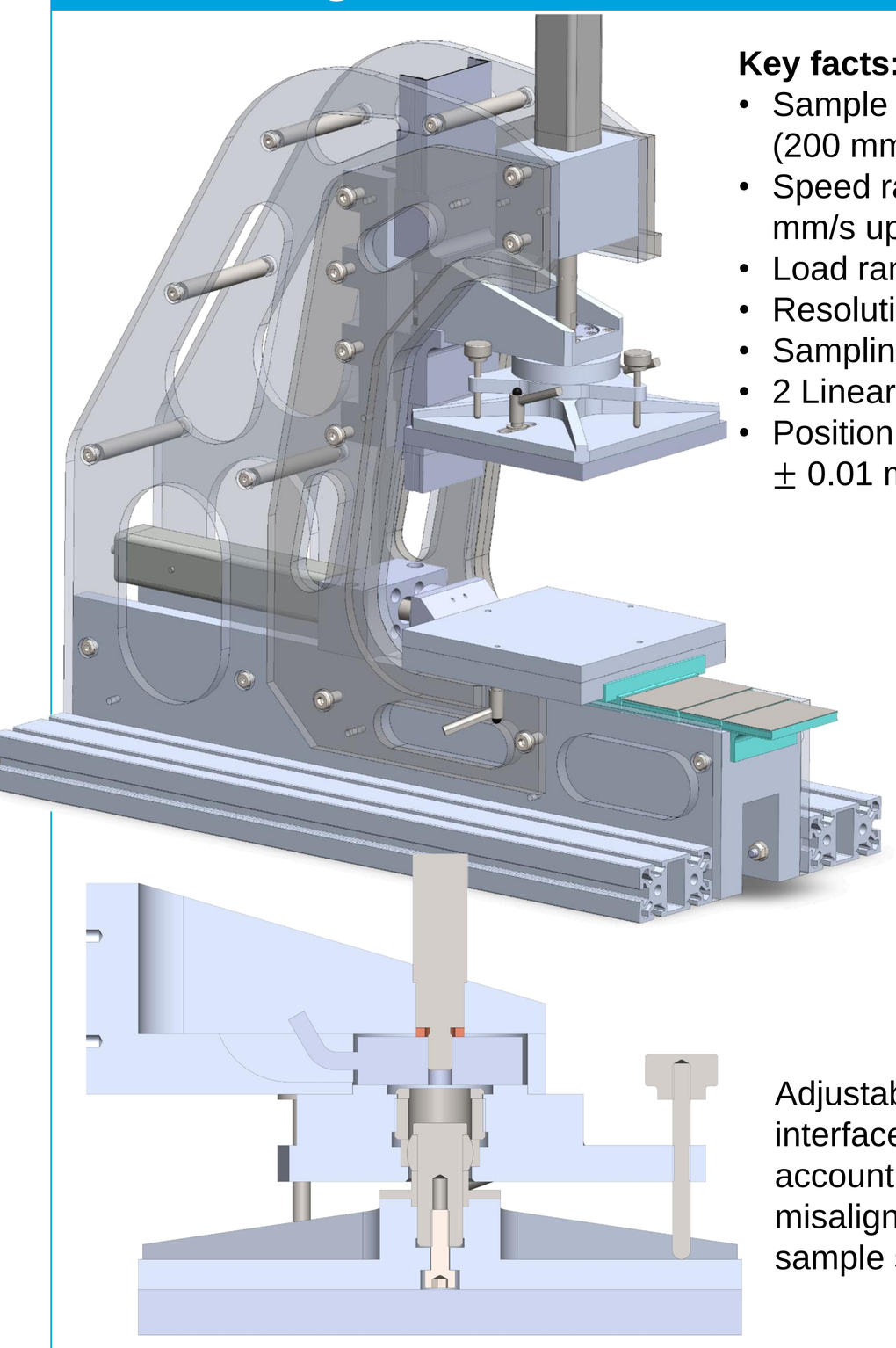




→ Experimentally determining these properties requires specialized testing equipment.

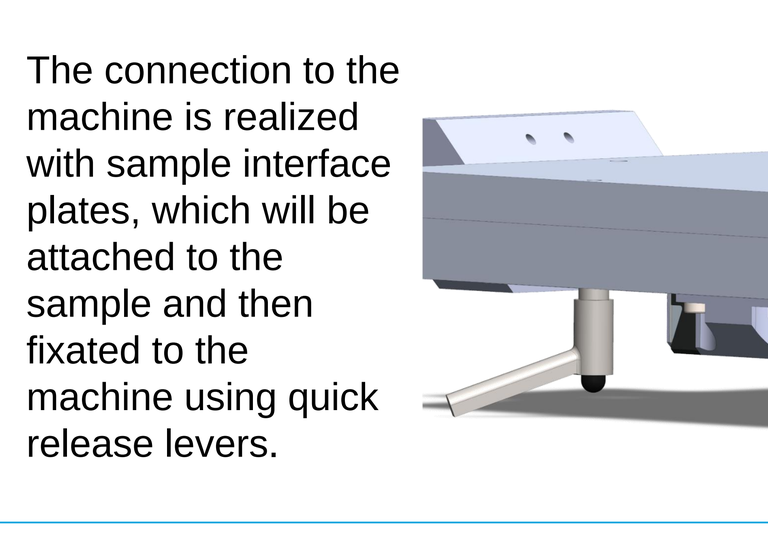


Testing machine for the cold lab



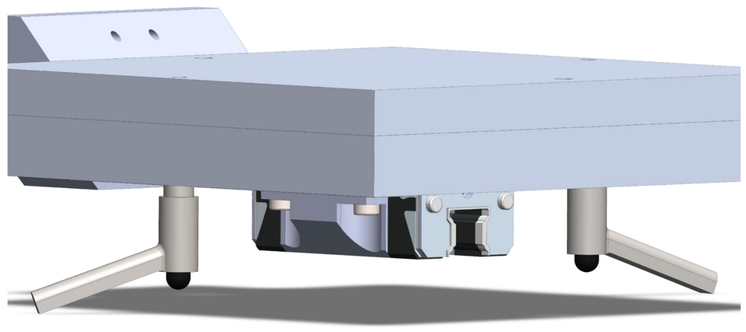
Key facts:

- Sample volume: $(200\ mm)^3$
- Speed range: 0.05 mm/s up to 0.3 m/s
- Load range: 0 to 1 kN
- Resolution: 0.1 N
- Sampling rate: 500 Hz
- 2 Linear encoders
- Position repeatability: ± 0.01 mm



Adjustable upper interface (± 5°) to account for misalignment of the sample surface.

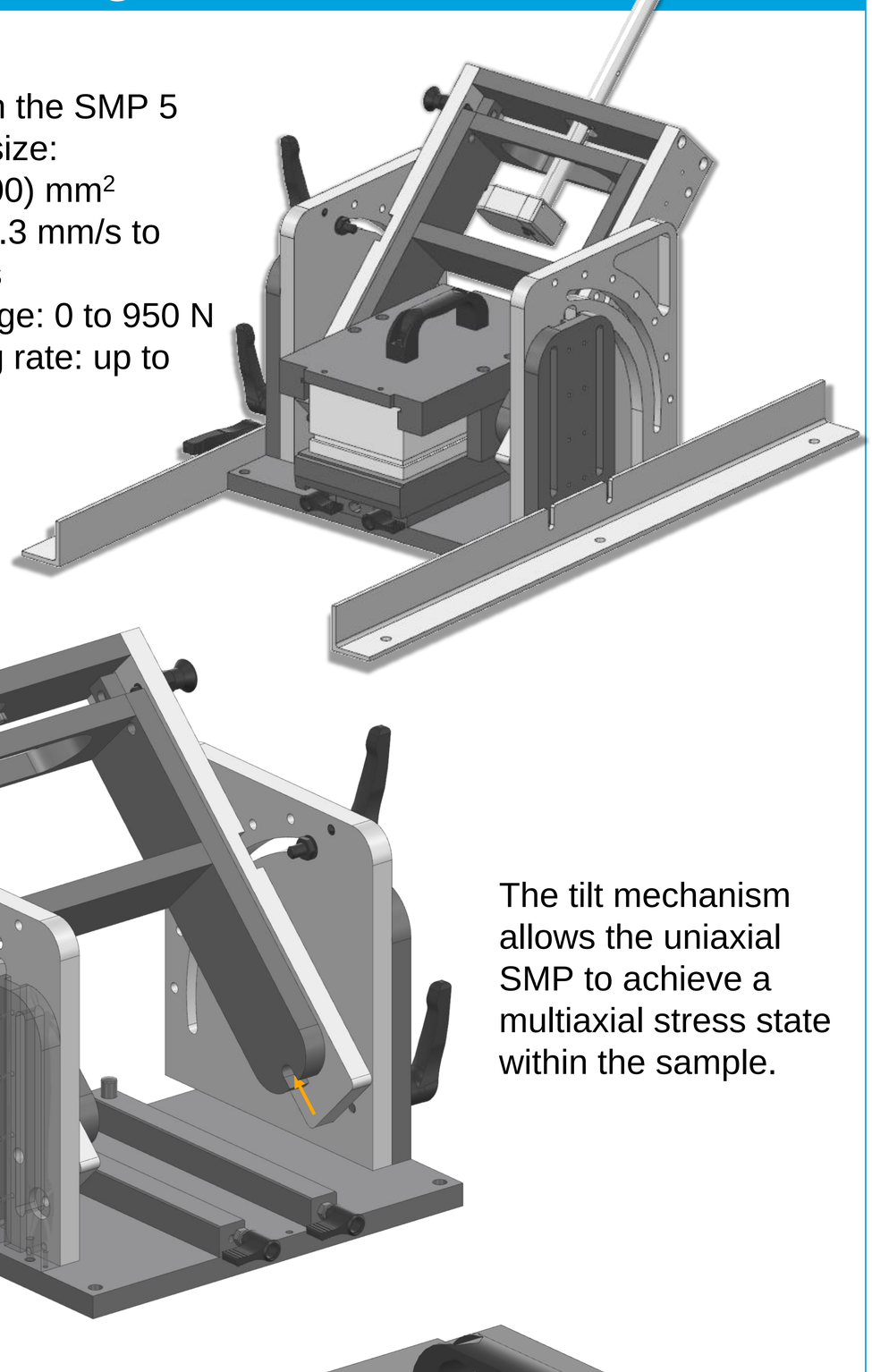
The connection to the machine is realized with sample interface plates, which will be attached to the sample and then fixated to the machine using quick release levers.



Testing machine for the field

Key facts:

- Based on the SMP 5
- Sample size: $(200 \times 100)\ mm^2$
- Speed: 0.3 mm/s to 1.5 mm/s
- Load range: 0 to 950 N
- Sampling rate: up to 5 kHz



The tilt mechanism allows the uniaxial SMP to achieve a multiaxial stress state within the sample.

The connection to the sample is realized with interface plates with pins and slats.
The load is applied through pins which are located at the level of the weak layer to avoid unwanted moments.