

RAMMS: Physics-Based Simulation of Natural Hazards

Rockfall Modelling and Engineering Applications

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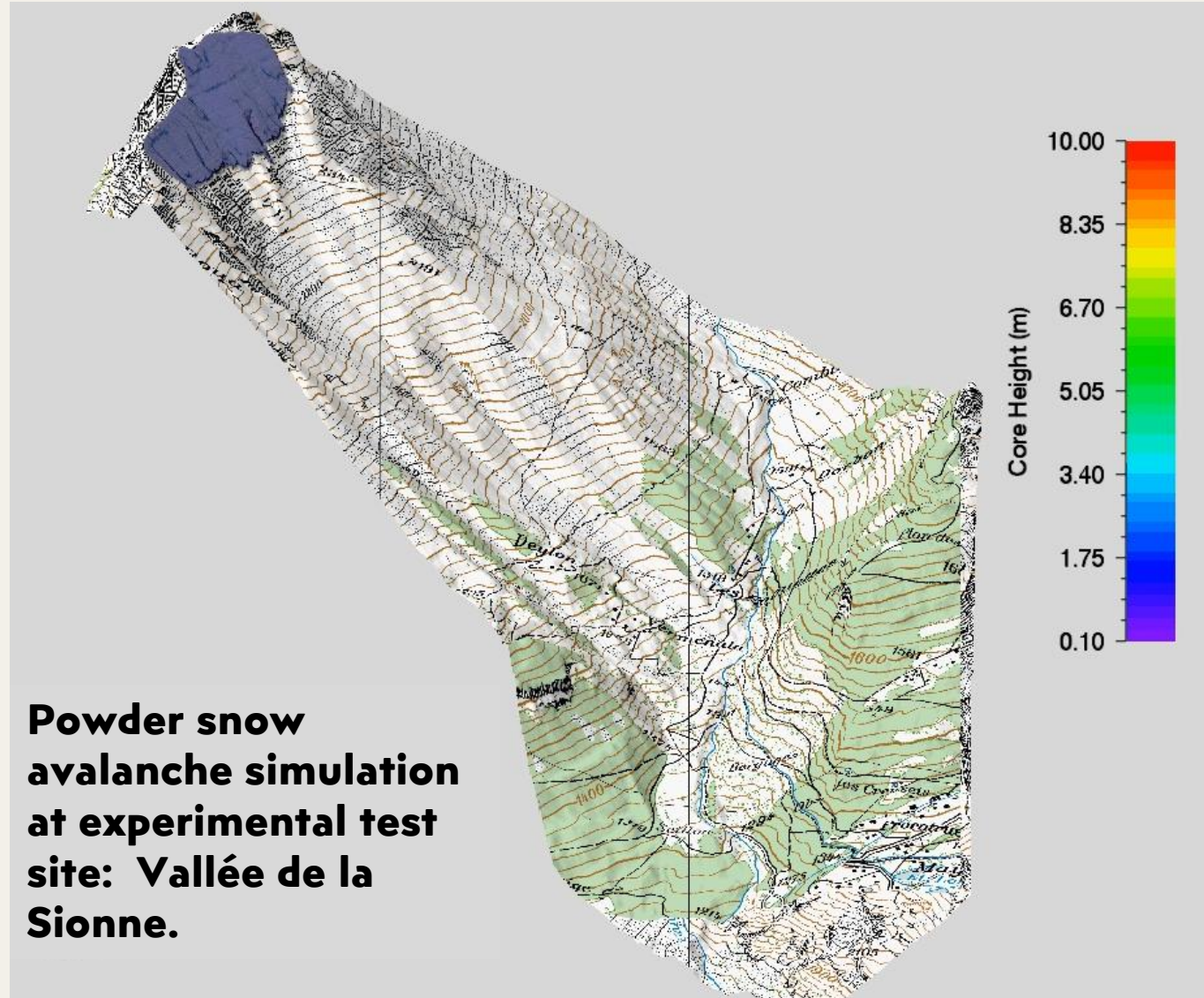
What is RAMMS?

Rapid **M**ass **M**ovement **S**imulation



RAMMS is a **physics-based modelling framework** for simulating rapid mass movements.

- Developed from **large-scale experiments and field observations**
- Used worldwide for **engineering design and hazard assessment**
- Simulates **avalanches, debris flows, and rockfall**
- Supports **risk analysis and protective structure design**



RAMMS Hazard Modules

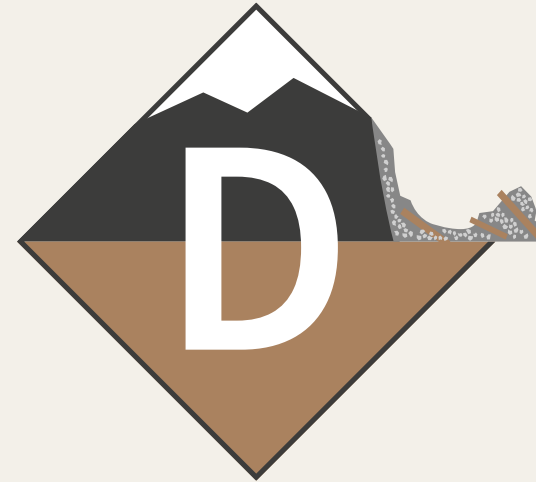


RAMMS::Avalanche
Dense flow avalanches

RAMMS::Extended
Powder snow avalanches

RAMMS::Debrisflow
Flowing debris

RAMMS::Rockfall
Rockfall simulation tool

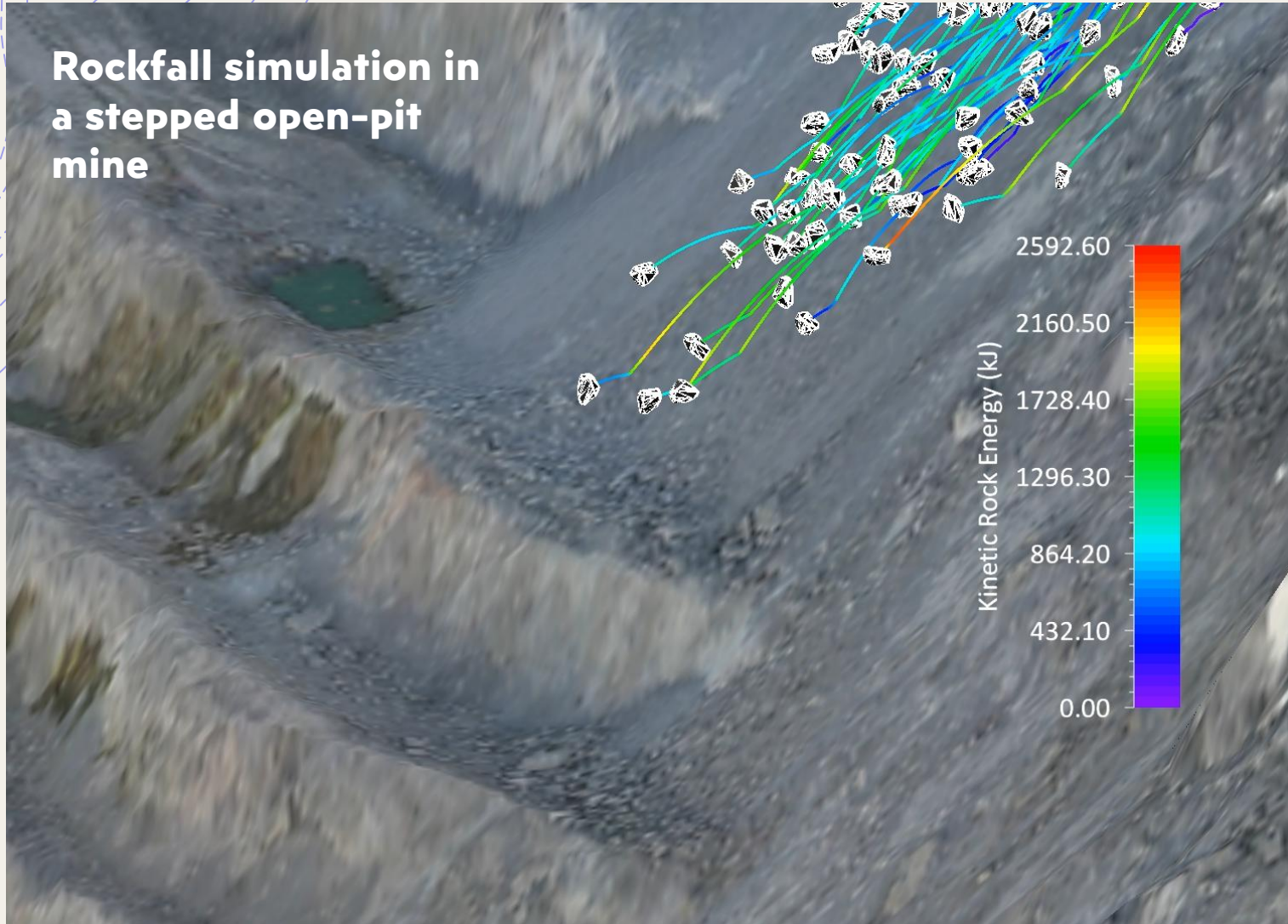


Here we focus on: RAMMS::Rockfall

Why Engineers Use RAMMS::Rockfall



Rockfall simulation in a stepped open-pit mine



Physics-Based

- Governing equations of motion
- Terrain interaction
- Material rheology

Calibrated

- Full-scale experiments
- Real events
- Field measurements

Engineering Tool

- Design of protection structures
- Hazard mapping
- Scenario simulation
- User friendly input/output



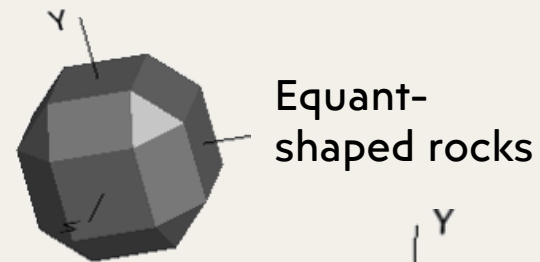
Full-Scale Experiments and Model Calibration



RAMMS parameters are not guessed — they are calibrated.

Controlled release of large blocks

- Used to **calibrate energy loss and terrain interaction**
- High-speed measurements
- Impact forces and trajectories recorded



Equant-shaped rocks

Wheel-shaped rocks



Walenstadt rockfall tests

RAMMS AG:

Scientific Background and Development



RAMMS AG

- Spin-off company originating from **WSL Institute for Snow and Avalanche Research (SLF)**
- Development of the **RAMMS modelling framework for natural hazards**
- Combines **scientific research, software development, and engineering applications**



Scientific Foundations

- **30+ years of research in rapid mass movements**
- Development of **numerical models for avalanches, debris flows, and rockfall**
- Extensive **field experiments and model calibration**

RAMMS is used by

- Engineering consultancies
- **Mining and infrastructure companies**
- **Government hazard mapping agencies**
- Research institutions

Additional Materials



Additional support available:

- **Online support** (email: support@ramms.ch)
- Scientific papers/references
- **ROCKY** – Online Chat-bot on our website <https://ramms.ch> (ask in your own language 24/7 about RAMMS)
- Advanced modelling **consulting**

