Karlsruhe Institute of Technology

Freestyle Assginment: Snow Scene

For Graphikprogrammierung und Anwendung WS 2018

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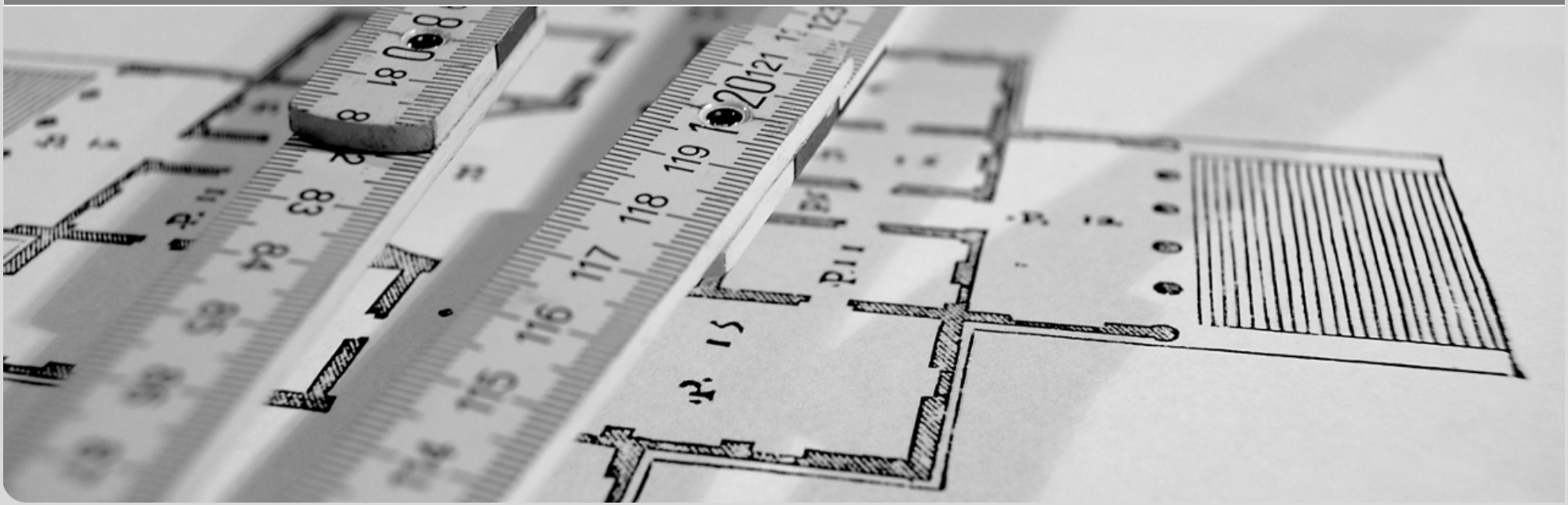
COMPUTER GRAPHICS GROUP



The Concept

A snowy scenery that includes:

- A snowfall particle system
- Volumetric snow on top of the terrain
- A system that tracks footprints
- Snowfall that increases the amount of volumetric snow and refills footprints
- Snow height and refill rates depending on terrain(slope, height)
- Snowy trees

Particle System

- Use instanced drawing to draw quads with snowflake texture
- Create a new buffer for the random particle data (position, rotation)
- Randomize wind on startup
- Add a time uniform using QTime
- In the shader:
  - Use modulo operation to wrap particles around camera
  - Animate falling and wind with time uniform

Volumetric Snow

- Use QImage to store heightmaps
- Load current snowheight into texture arrays
- In tessellation evaluation shader:
  - Access texture array
  - Move vertex on y-axis
  - Calculate new normal
- Evaluate lighting equation with new snow texture

Filling the heightmaps

- At startup:
  - Split terrain into patches
  - Generate white QImage for each patch
  - Calculate slope for each pixel of the image
  - Write slope into alpha channel of the pixel
- Use these images to draw over the current heightmap using a QPainter
- Load new heightmap into memory

Footprints & snowy trees

Footprints:

- Use predefined image for a footprint
- Determine patch and pixel and draw into heightmap

Snowy trees:

- Interpolate material with white depending on the normal
- Remember alpha testing!
- Also use the current height for interpolation

Performance review

Main Bottlenecks:

- Pixel operations on heightmaps
- Slopemap creation

The other changes had no severe performance impact!