

GPU Accelerated optical light propagation in CORSIKA8

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Dominik Baack¹ for the CORSIKA 8 collaboration²

SFB 876 Providing Information by Resource-Constrained Data Analysis

Introduction

Optical photons, created from fluorescence or Cerenkov emission in atmospheric cascades induced through high energetic cosmic rays are of major interest for several experiments. Since individual photons don't interact they can be simulated without any order as in the traditional sequential approach and on the contrary leads to reduced utilization of modern hardware infrastructure.

The new CORSIKA 8 framework enables the implementation and verification of these methods. With the use of dedicated high parallel acceleration hardware like GPUs the possible benefits with this data-parallel approach are even higher. First results and comparisons based on different algorithms and precision levels are shown.

Corsika 8 [1]

- New simulation framework for particle cascades
- Complex interactions are modeled on CPU
- Several parallel instances necessary to support a single GPU
- Trace data is unconditionally moved to GPU

Track Handling

- Restructure data to fit GPU
- Preliminary cuts in charge and energy

Filtering

- Currently, all traces are processed, but only a fraction produces measurable results
- Remove particle by simple inefficient or more complex efficient cuts depending

Output

Photon impact positions, time and angle is limited to a circular region of interest to reduce memory transfer and storage

Photon Propagation

- Fast interpolation enables efficient calculation of impact point compared to numeric integration

Photon Generation

- Generate photon vertically and rotate in particle frame

Cherenkov
Fluorescence

- Calculate preferred direction from experiment
- Emit in this direction

References

[1] M. Baringhaus and R. Ulrich, CORSIKA 8 - Towards a modern framework for the simulation of extensive air showers, In: EPJ Web of Conferences, Vol. 210, EDP Sciences, 2019, p. 02011.

Institutes & Acknowledgement

¹TU Dortmund, Deutschland
²<https://ciab.lip.kit.edu/AirShowerPhysics/corsika/> -/bibtex/master_authorslist_circ2021.tex

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Proceeding

PoS (ICRC2019) 181

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Track Handling

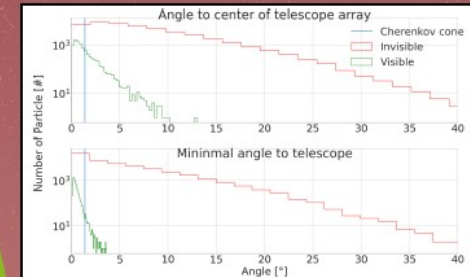


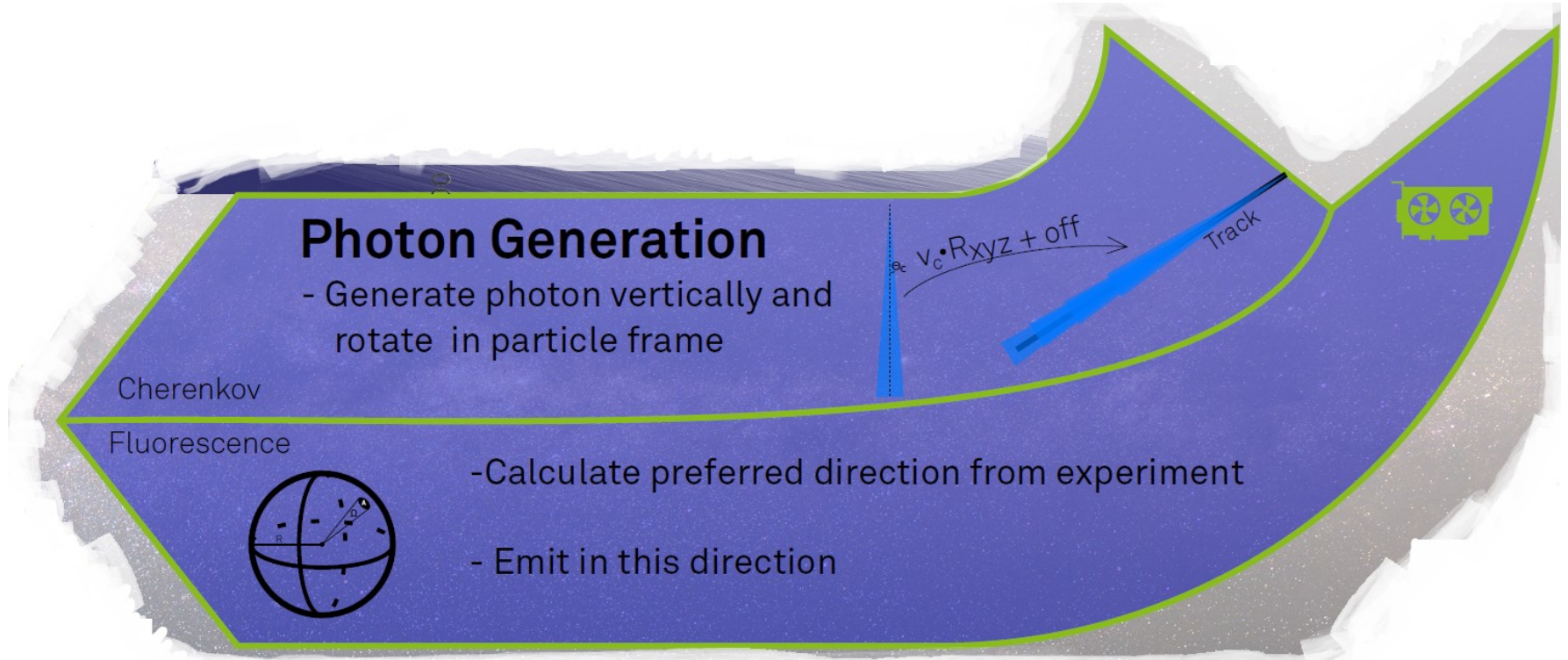
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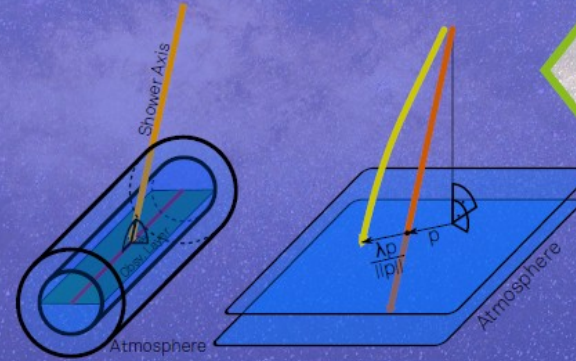
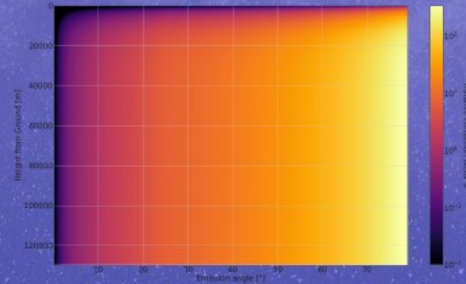
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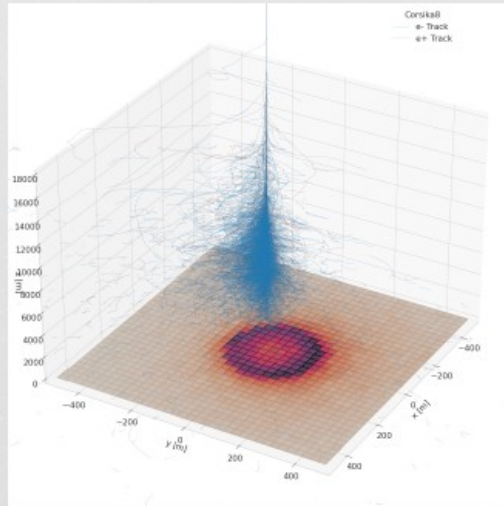


Photon Propagation

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