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## 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



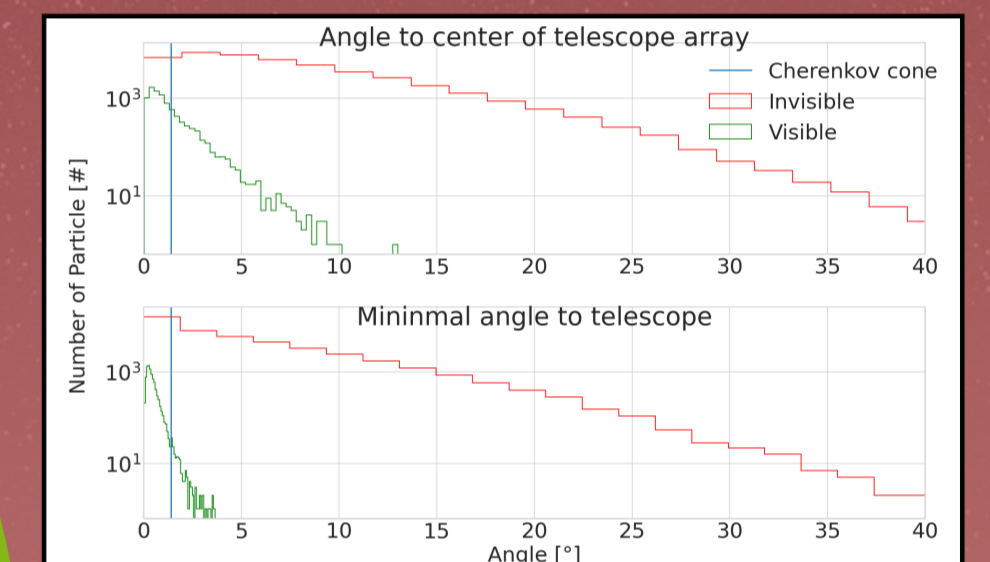
## Track Handling

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



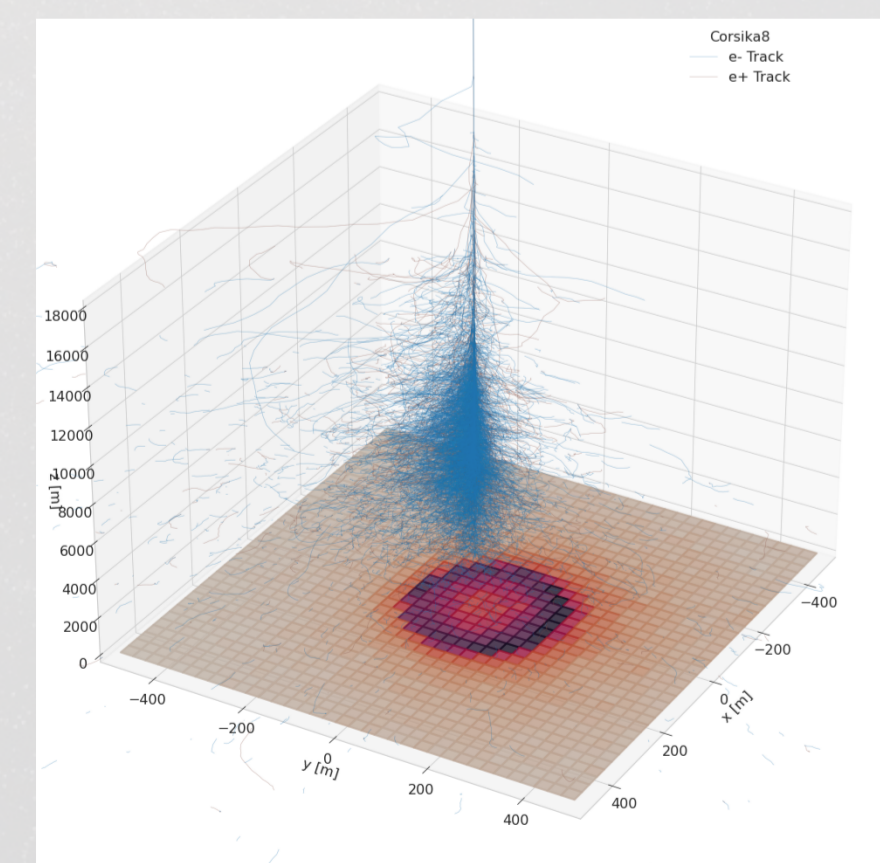
## Filtering

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



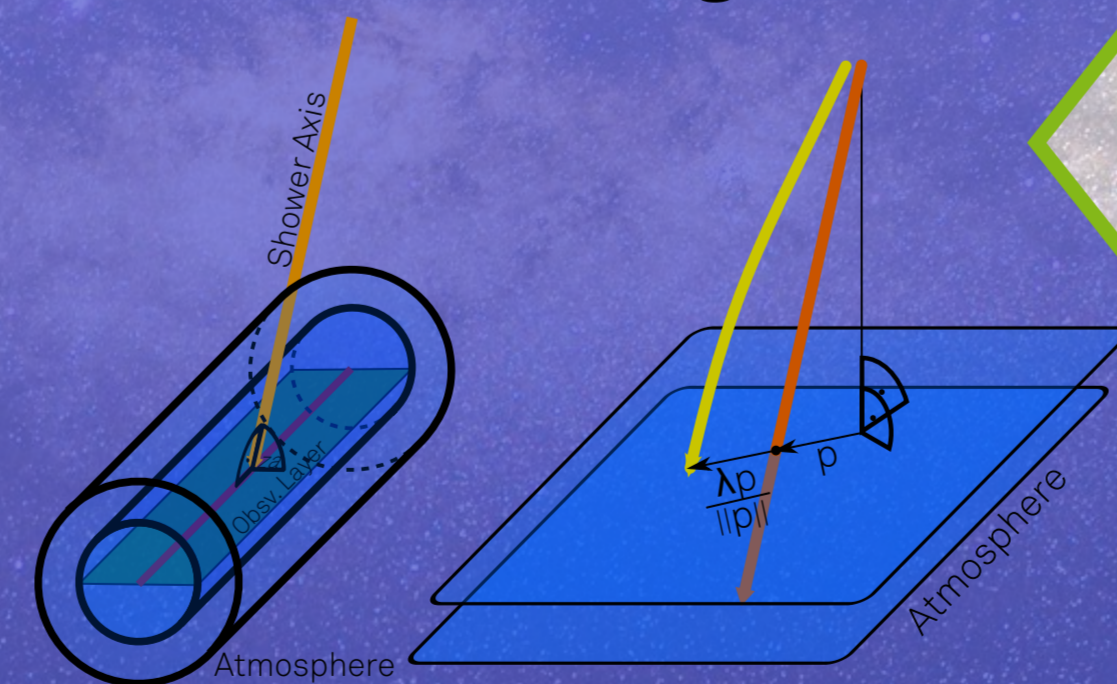
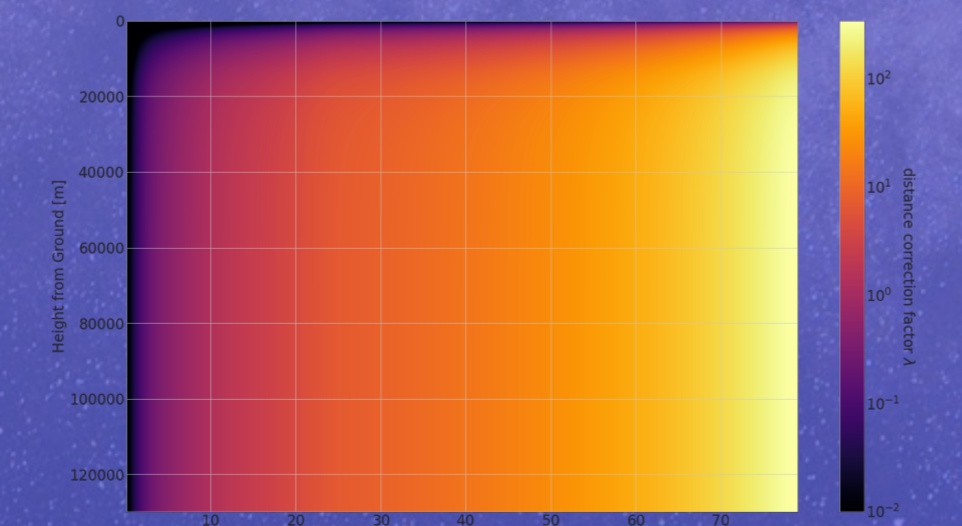
## Output

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



## Photon Propagation

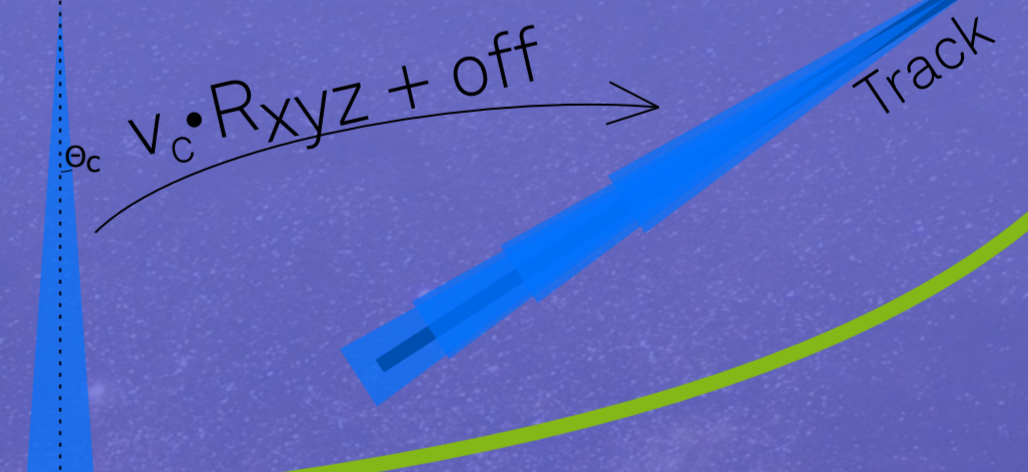
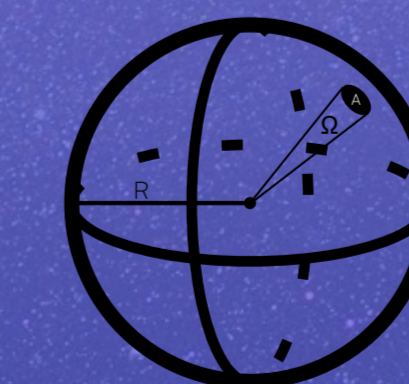
- Fast interpolation enables efficient calculation of impact point compared to numeric integration



## Photon Generation

- Generate photon vertically and rotate in particle frame
- Calculate preferred direction from experiment
- Emit in this direction

Cherenkov  
Fluorescence



## References

[1] M. Reininghaus 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.

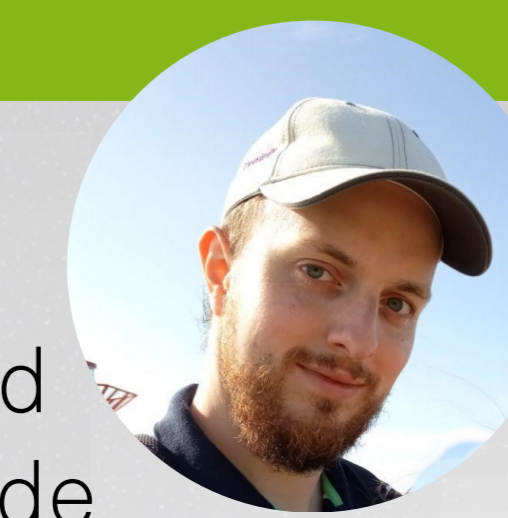
## Institutes & Acknowledgement

<sup>1</sup> TU Dortmund, Deutschland  
<sup>2</sup> [https://gitlab.iikp.kit.edu/AirShowerPhysics/corsika/-/blob/master/authorslist\\_icrc2021.tex](https://gitlab.iikp.kit.edu/AirShowerPhysics/corsika/-/blob/master/authorslist_icrc2021.tex)

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## Proceeding

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