New Penelope raytracing capabilities

A SPIS-Services development

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Purpose and objectives

General purpose 3D ray-tracer proving/supporting:

- Generic meshed shapes for emitting and collecting objects
- Geometries being imported from B-Rep representations
- A generic support of ray/particles (not only the visible light)
- Various types of interactions rules, in volumes as well in surface.
- Following an OOA and a Java based implementation.

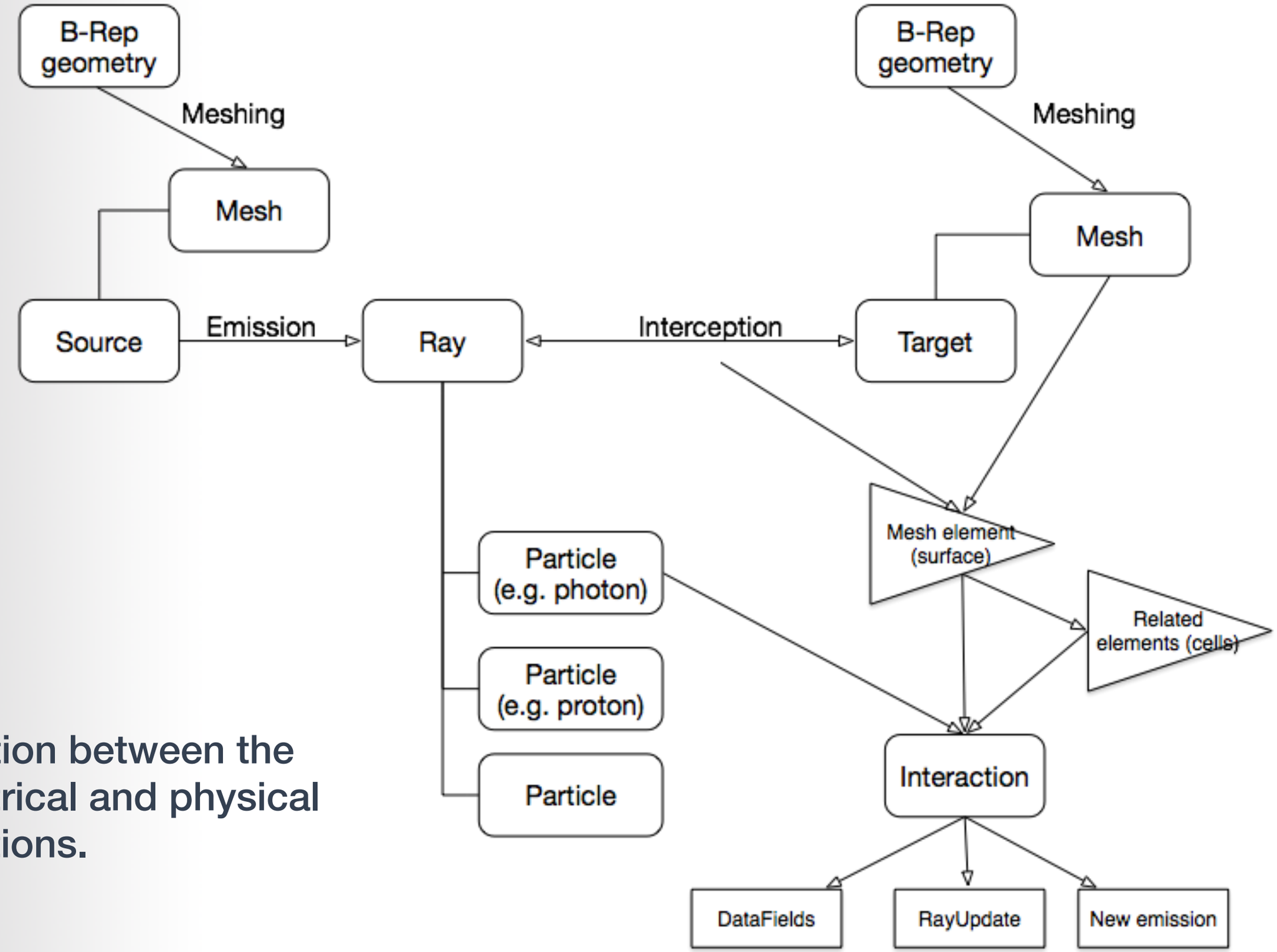
Various potential applications

- Lighting and shadowing
- Radiative eat transfert (i.e. view factors…)
- Simple radiations analysis and sector shielding analysis
- Comtamination, optics…

New implementation in Penelope for low level elements

Dedicated applications expected in the frame of the Artenum/ ONERA SPIS-SERVICES offer.

Global design and key concepts



Distinction between the geometrical and physical interactions.

First tests

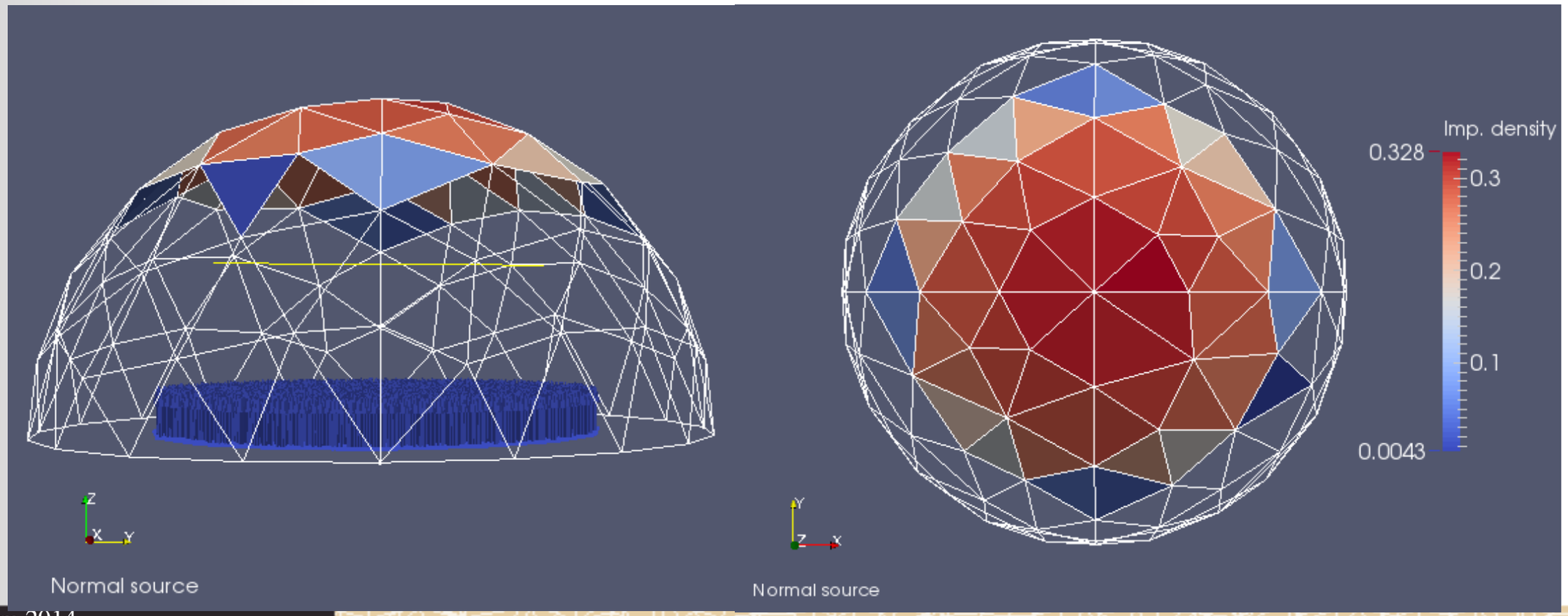
Preliminary results

Check the global functionalities and physical models
Check the relevance of the approach and the performances level

Sources and emissions
- Surface sources: normal, omnidirectional, Lambertian, metallic…
- Under development: punctual and volume sources.

Interception
- Validation of intercepted surface mesh elements and related cells, edges, nodes; ordering (first/last element)
- Energy conservation (i.e. no ray lost)
- View factors

Interactions
- interception, shadowing
- Volume absorption



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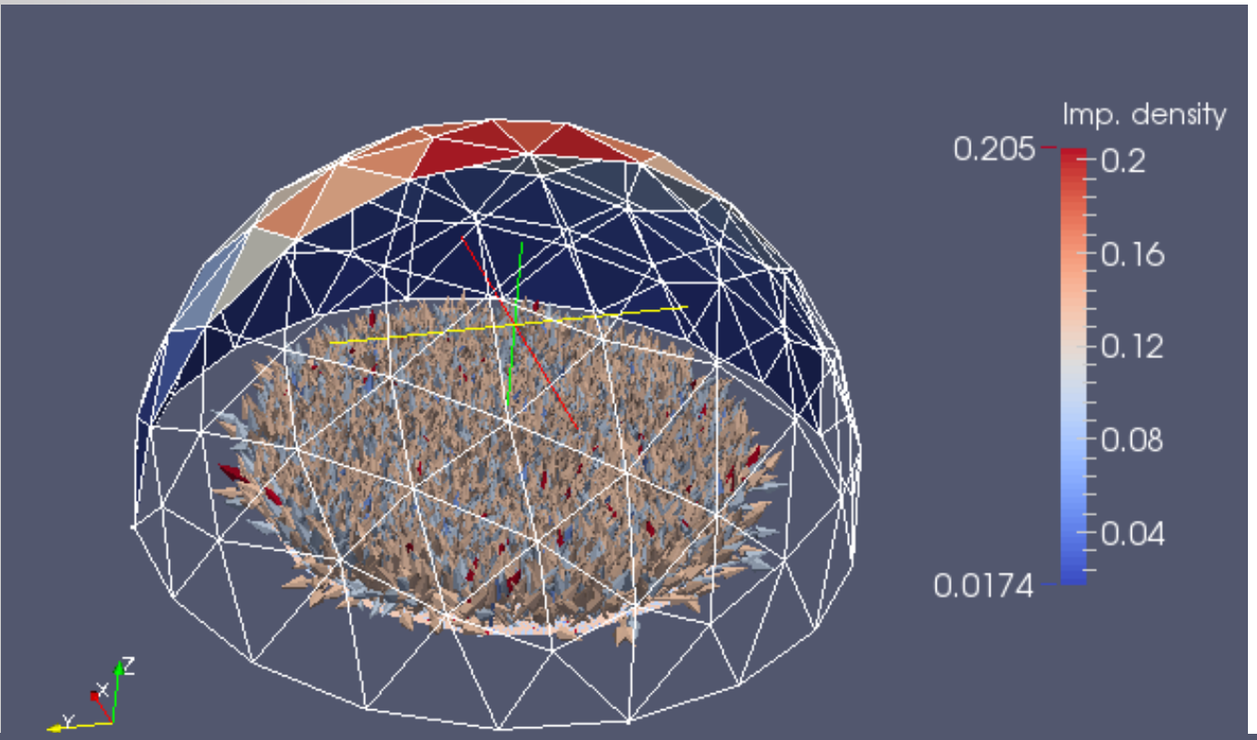
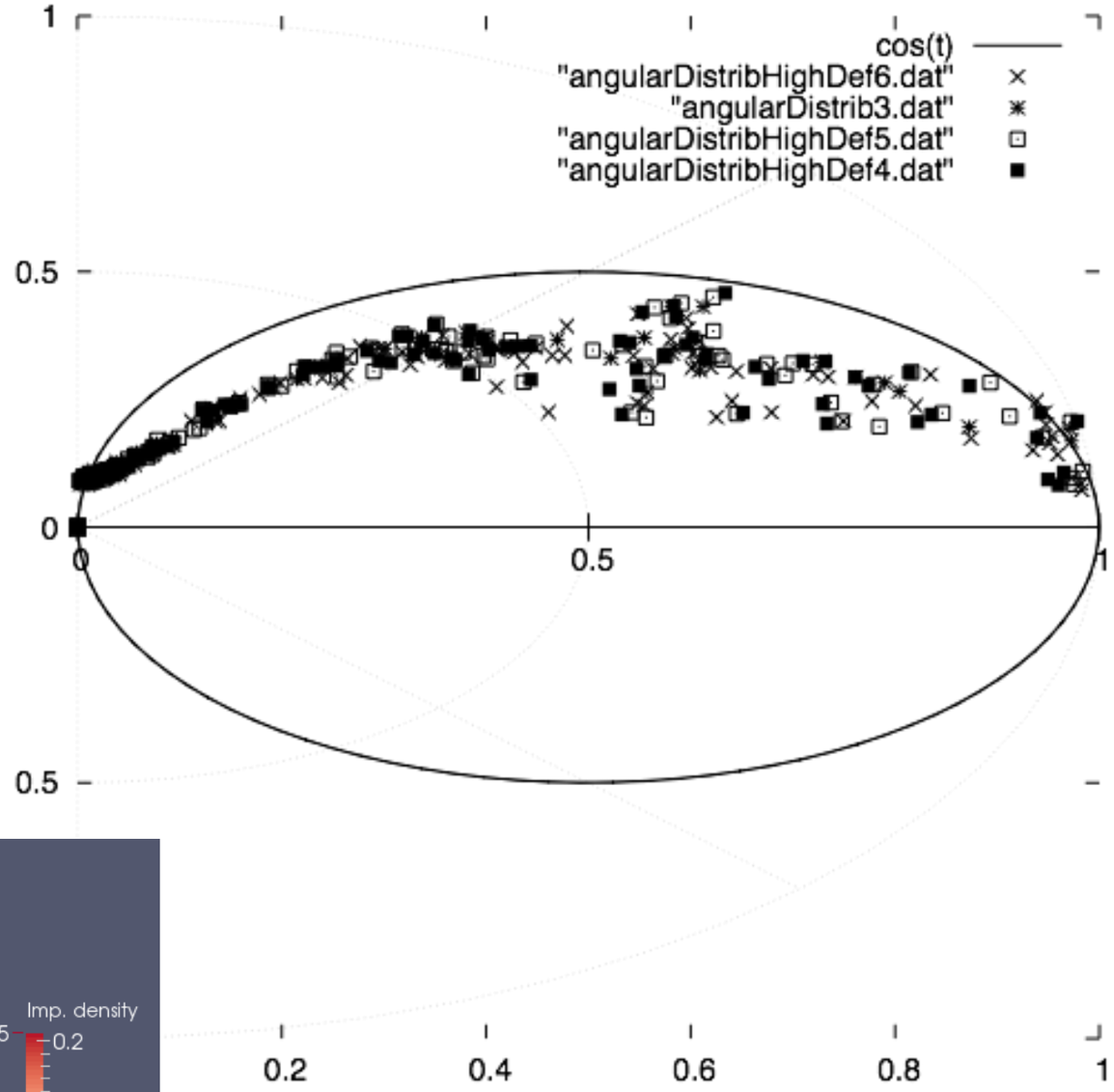
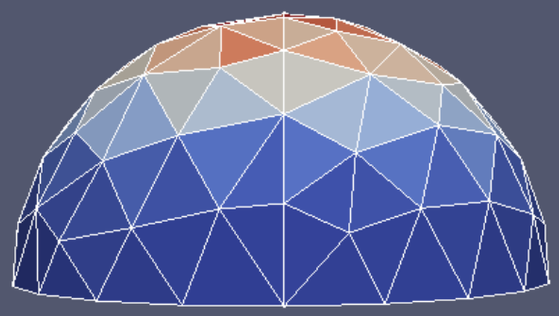
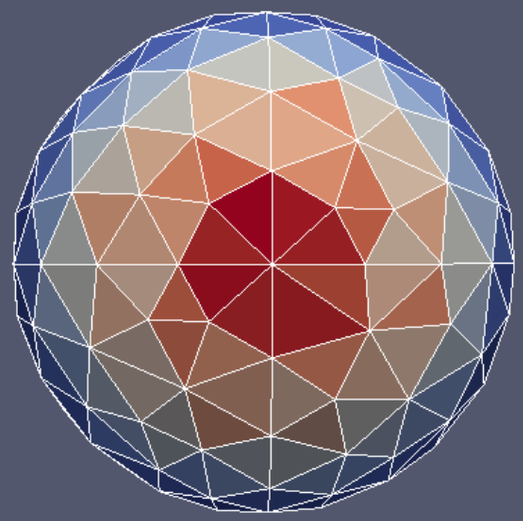
Lambertian emission







Lambertian source 1



Lambertian source 1

Preliminary results

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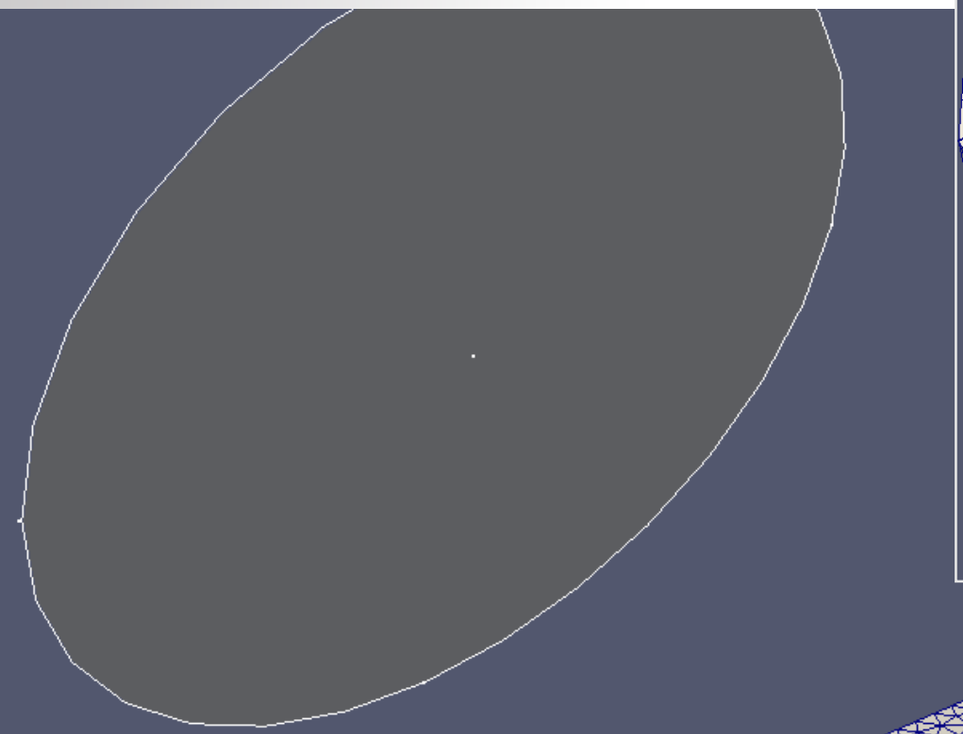
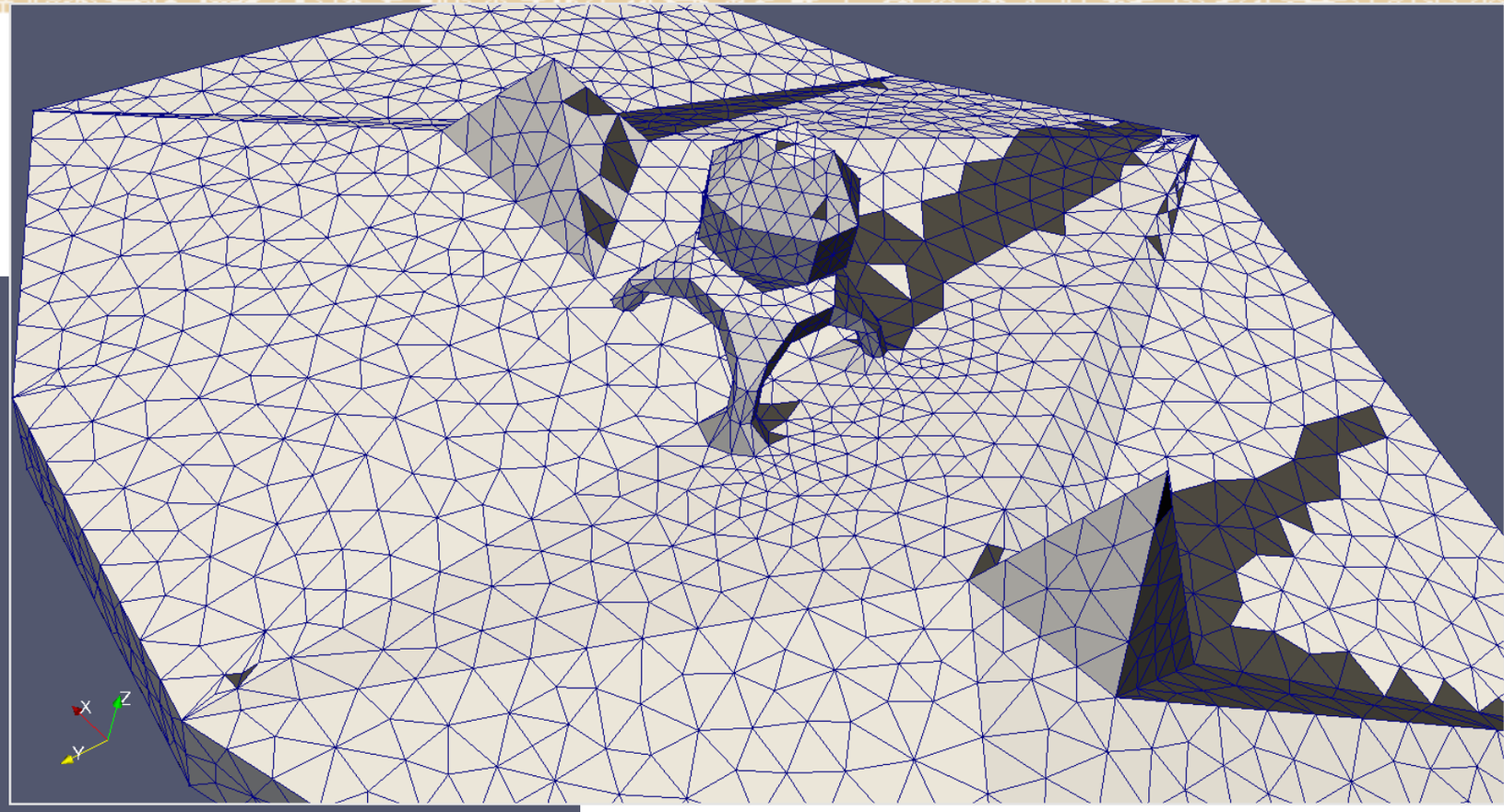
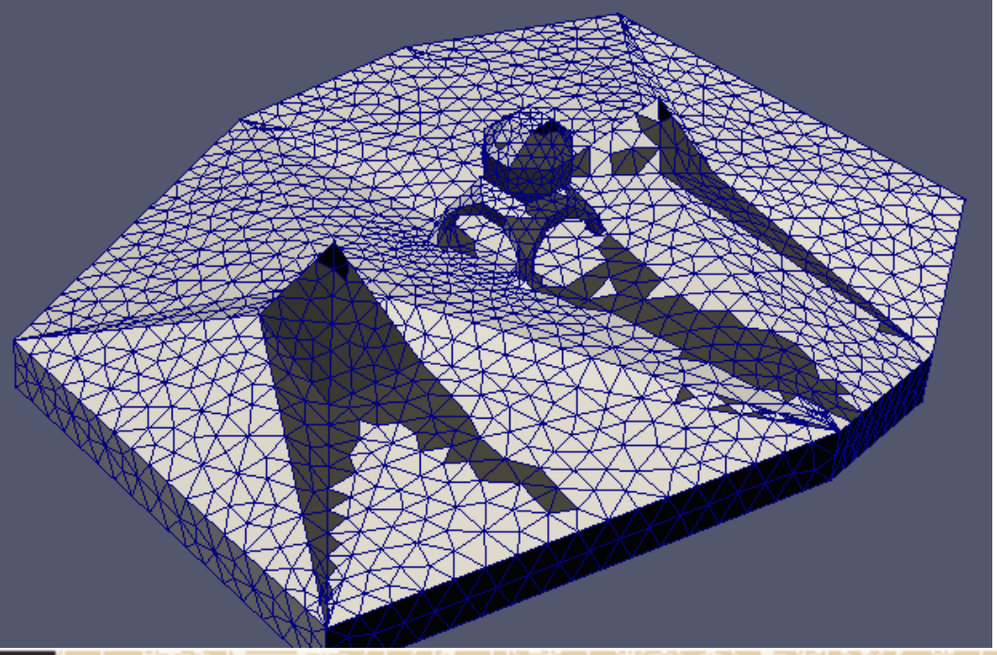
Shadowing







Preliminary results

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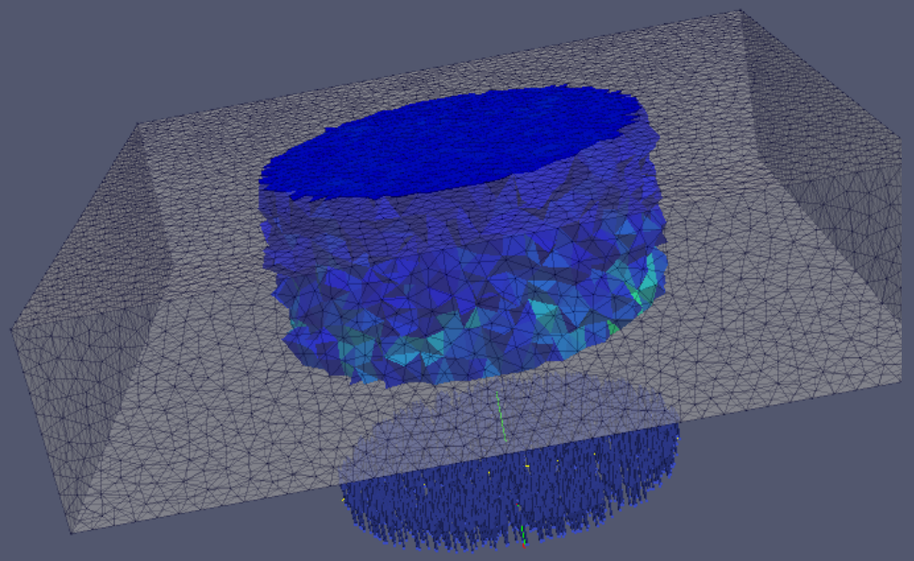
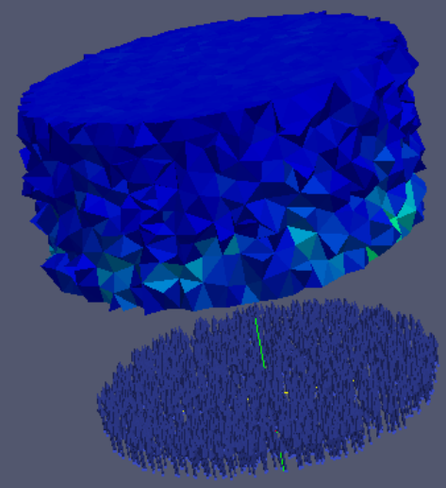
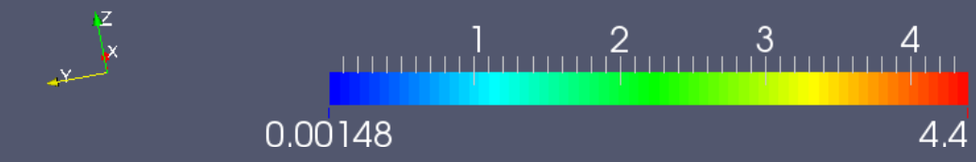
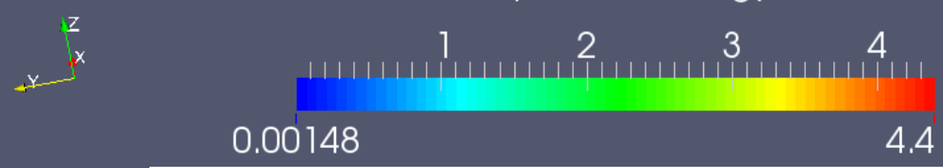
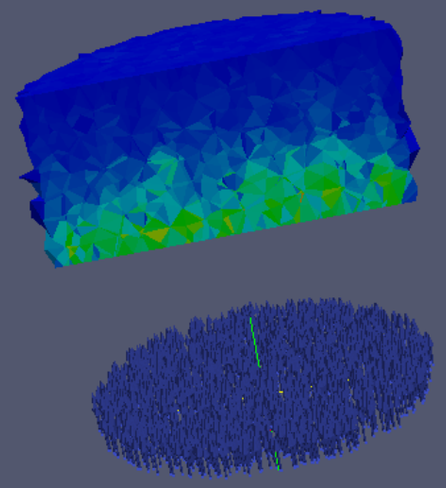
Volume interaction

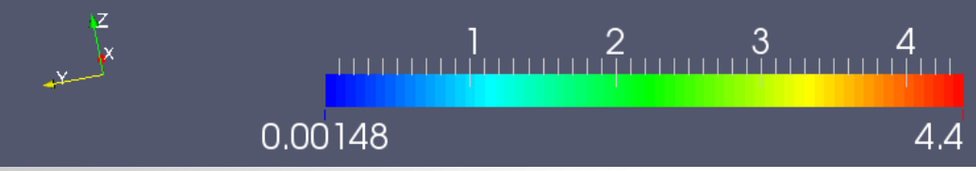


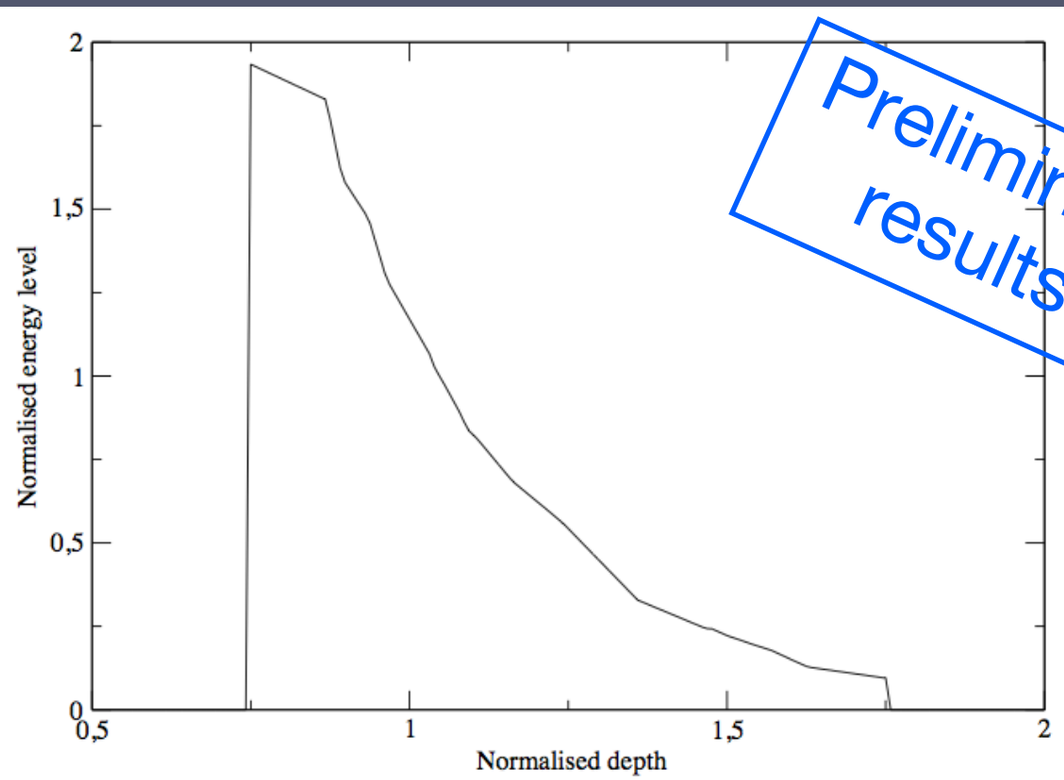












Preliminary results

Conclusion

- A new general purpose ray-tracer available in Penelope
- Thanks to the Penelope/Keridwen context, rich and very versatile geometrical support (B-Rep and mesh)
- Potential support of various physical interaction process
    - Optical
    - Matter-particle

➡ Middle range objective: Simple 3D sector shielding analysis module in SPIS-PRO (see SPIS-Services)

However:

- Currently till experimental
- Optimisations still open (e.g. parallelization)
- Numerical and physical validation should be pushed further before concrete applications and further developments