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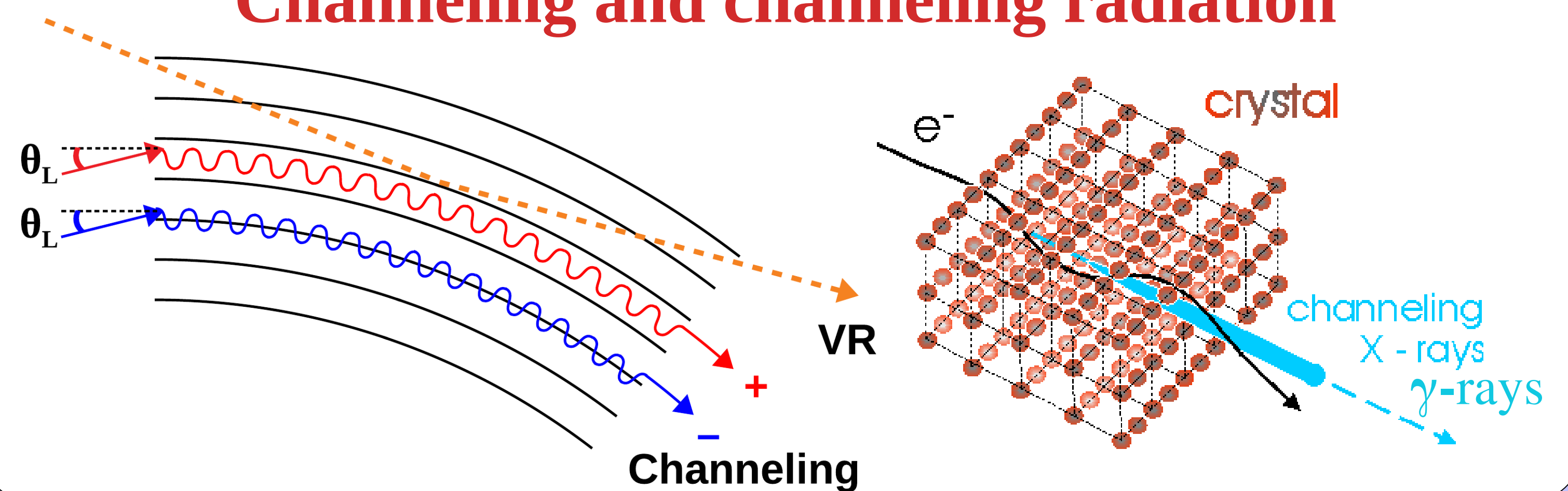
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Introduction to Trillion

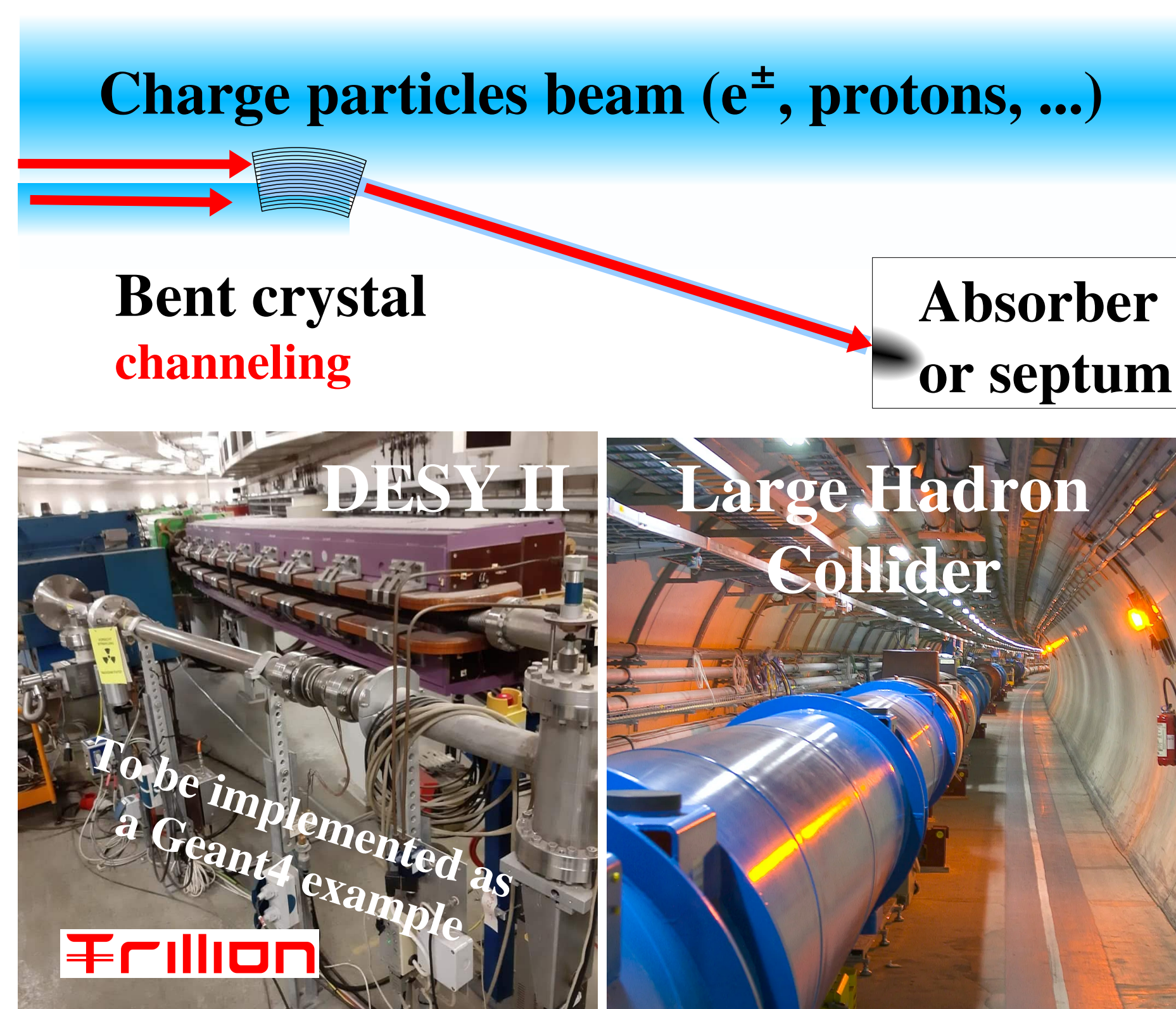
The Marie Skłodowska-Curie Actions Global Fellowships project **TRILLION** is dedicated to the implementation of both physics of **electromagnetic processes in oriented crystals** and the design of specific applications of crystalline effects into **Geant4 simulation toolkit**¹ as **Extended Examples** to bring them to a large scientific and industrial community and under a free Geant4 license. **Geant4** is a toolkit for the simulation of the passage of particles through matter.



Channeling and channeling radiation



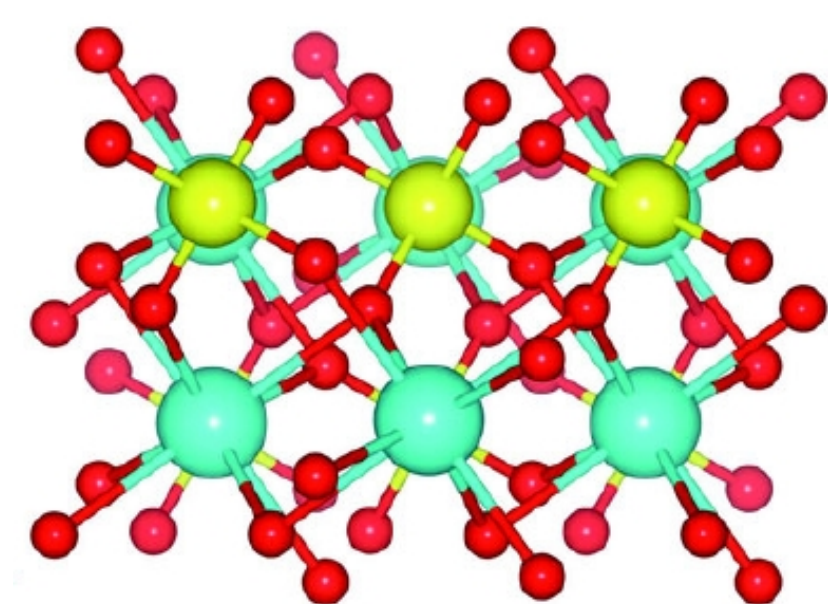
Crystal-based collimation and extraction³ of charged particles from an accelerator



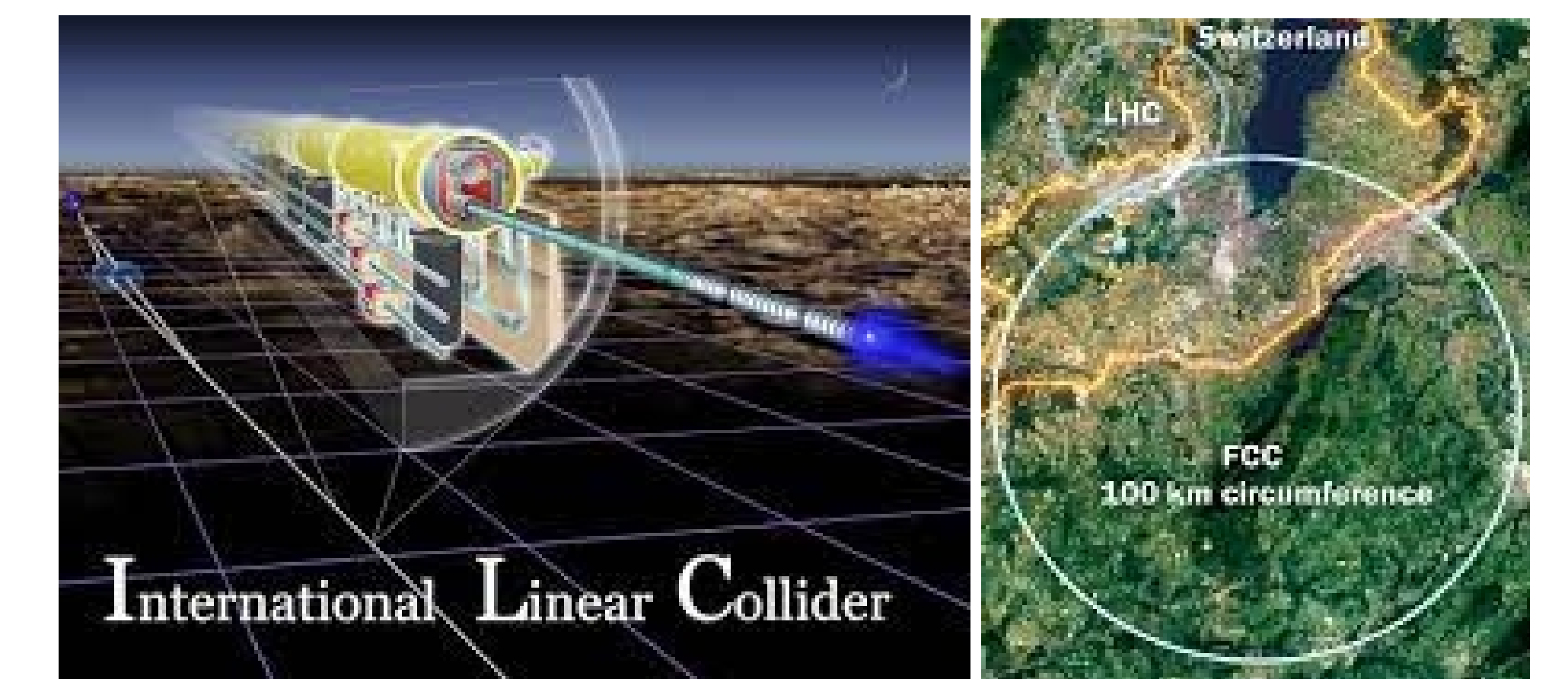
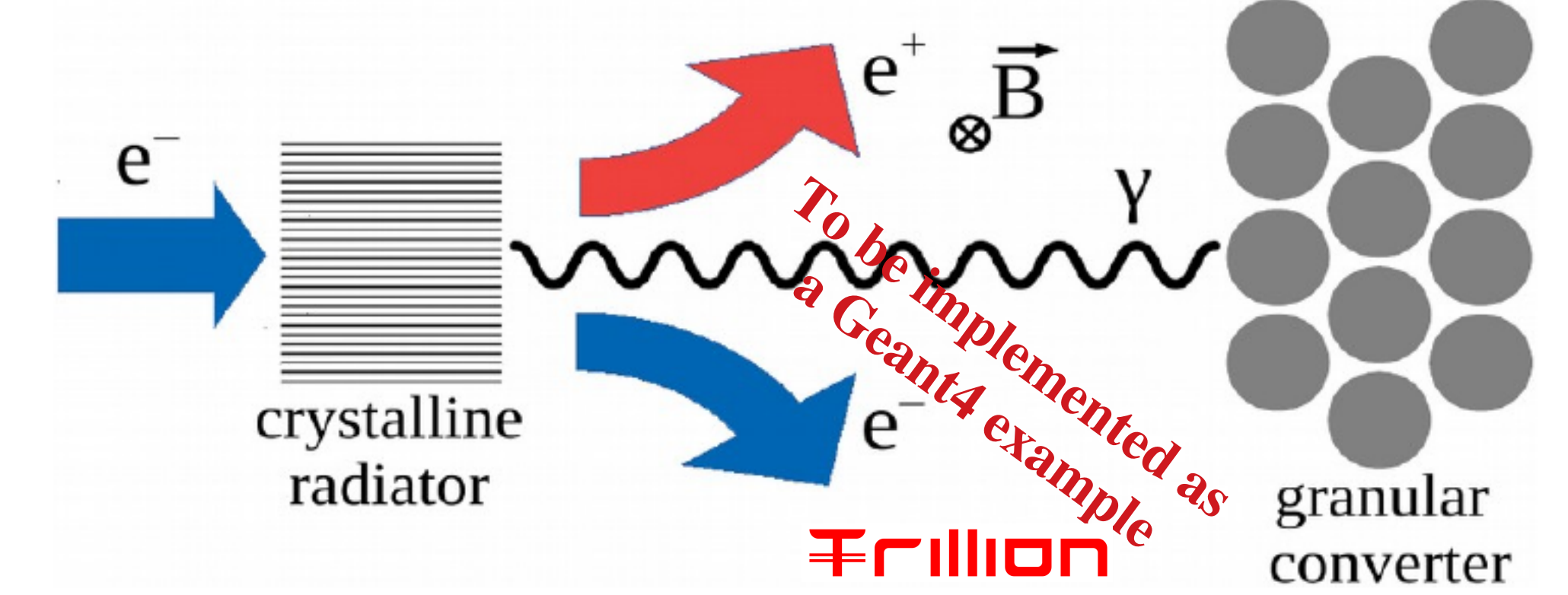
Applications of a crystal²

Gamma-ray Space Telescope⁴

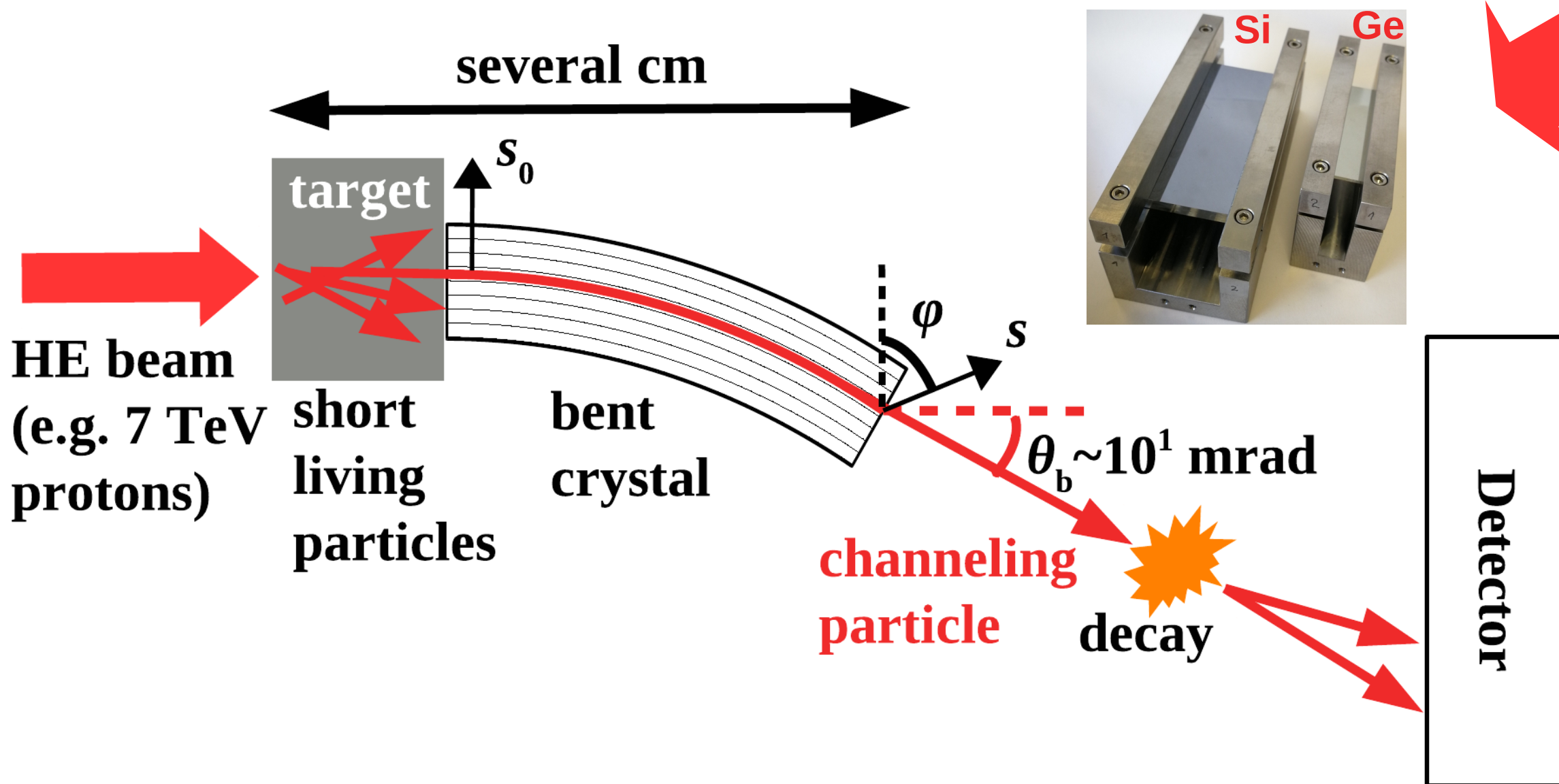
Compact EM calorimeter to detect γ -rays



Crystal-based hybrid positron source for future e^+e^- and muon colliders⁵

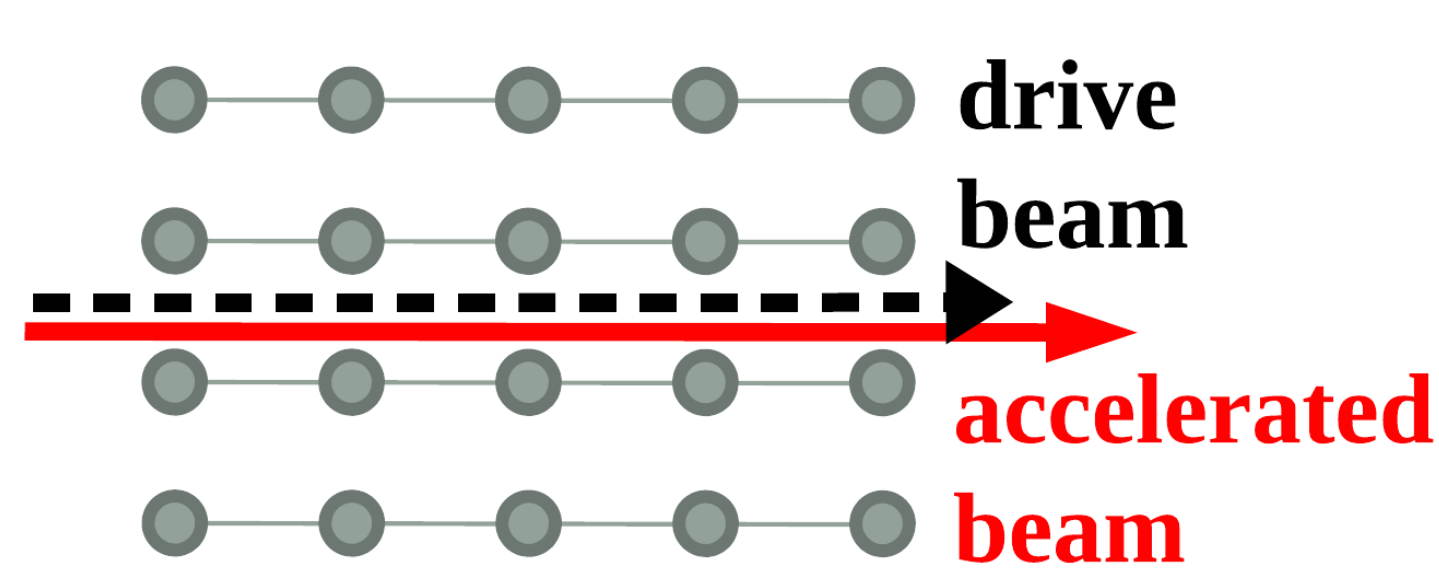


Measurement of magnetic and electric dipole moments of exotic particles⁷

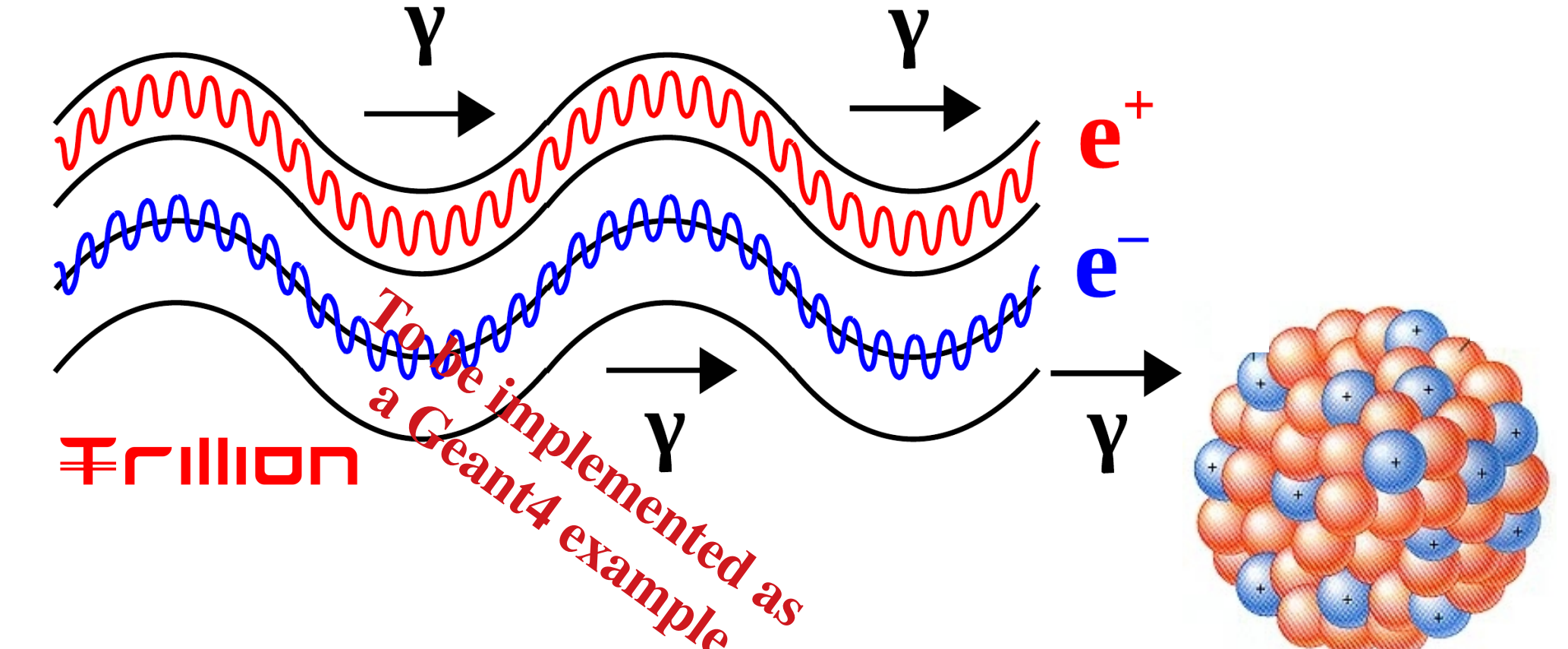


Crystal

Wakefield acceleration⁸



Crystalline source of intense coherent hard X-ray and gamma radiation, for nuclear and medical physics⁶



Implementation of channeling model into Geant4

CRYSTALRAD simulation code⁹ designed for tracking of charged particles in a crystal and for calculation of radiation spectra is a **baseline code** for channeling and channeling radiation model implementation into Geant4.

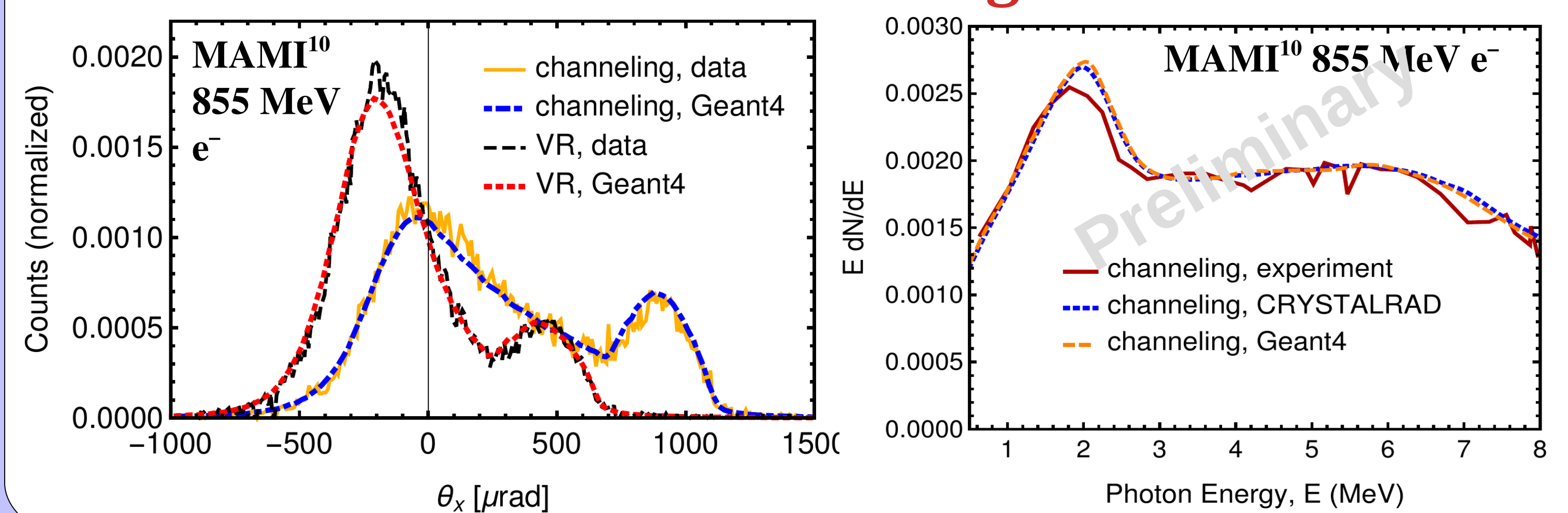
The implementation mechanism is **Geant4 FastSim interface**, which is a **PhysicsList independent** model and is activated only in a certain **G4Region**, at a certain **condition (ModelTrigger)** and for certain **particles (IsApplicable)**.

```
G4bool ChannelingModel::IsApplicable(const G4ParticleDefinition& particleType)
```

```
G4bool ChannelingModel::ModelTrigger(const G4FastTrack& fastTrack)
```

```
void ChannelingModel::DoIt(const G4FastTrack& fastTrack, G4FastStep& fastStep)
```

Validation of Geant4 channeling model with data²



Conclusions

Channeling model has been implemented into Geant4 using FastSim interface and validated with experimental data and CRYSTALRAD simulations.

Trillion examples can be applied in nuclear and medical physics (X- and γ -ray source), for e^+e^- synchrotrons and colliders (positron source; beam extraction).

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