Exercise GEANT4 course, NAFY002, 2018

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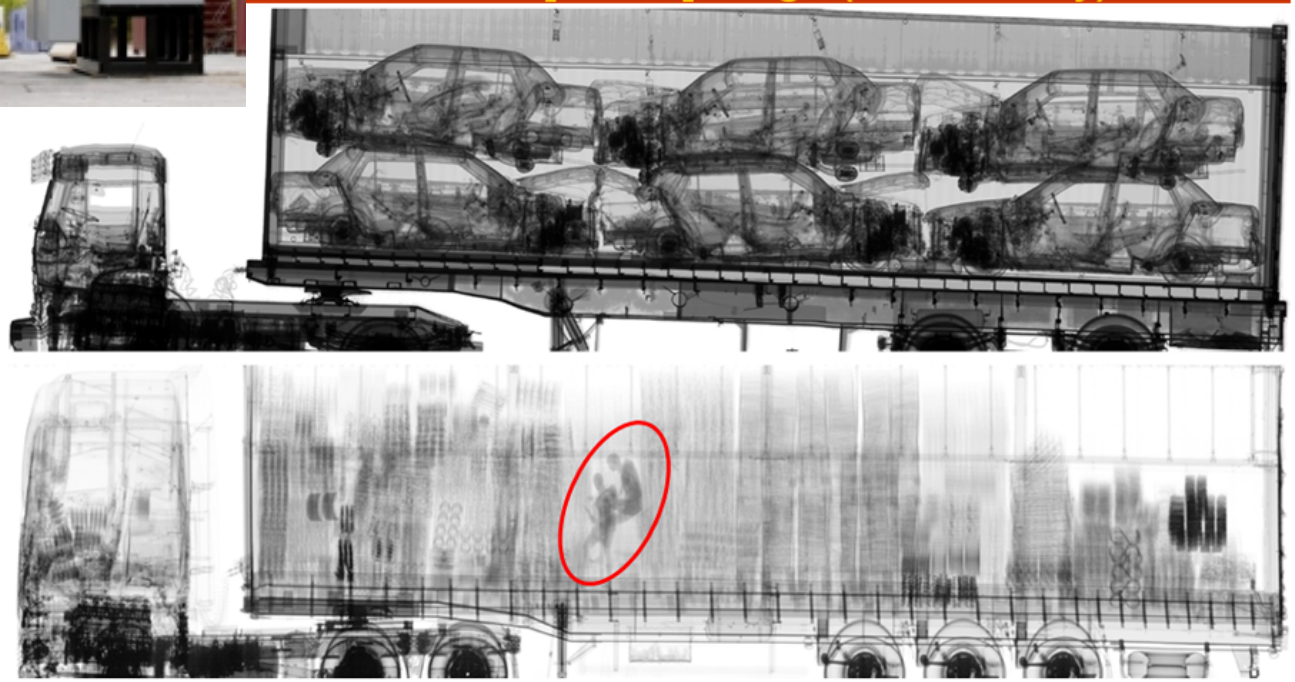
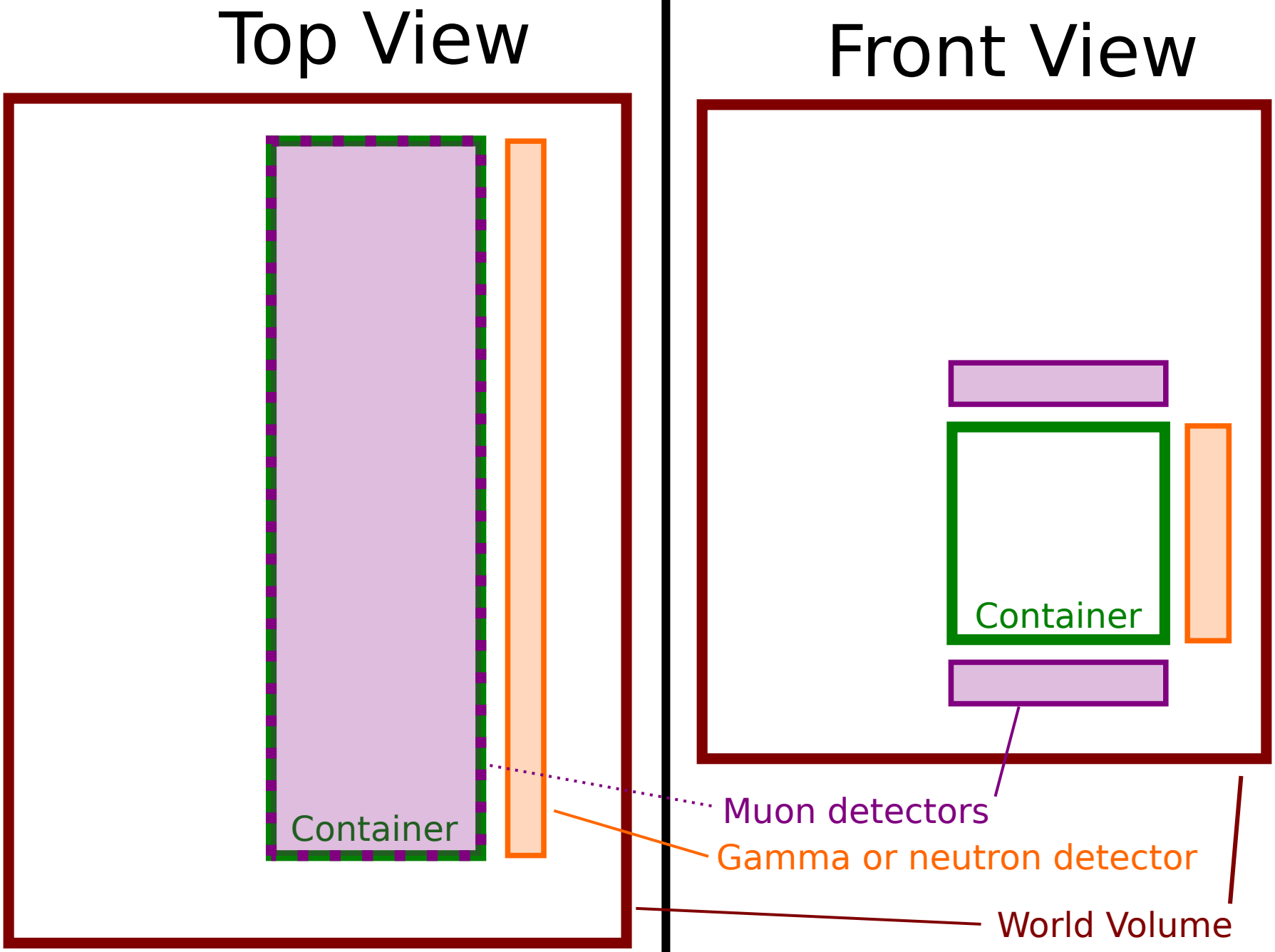
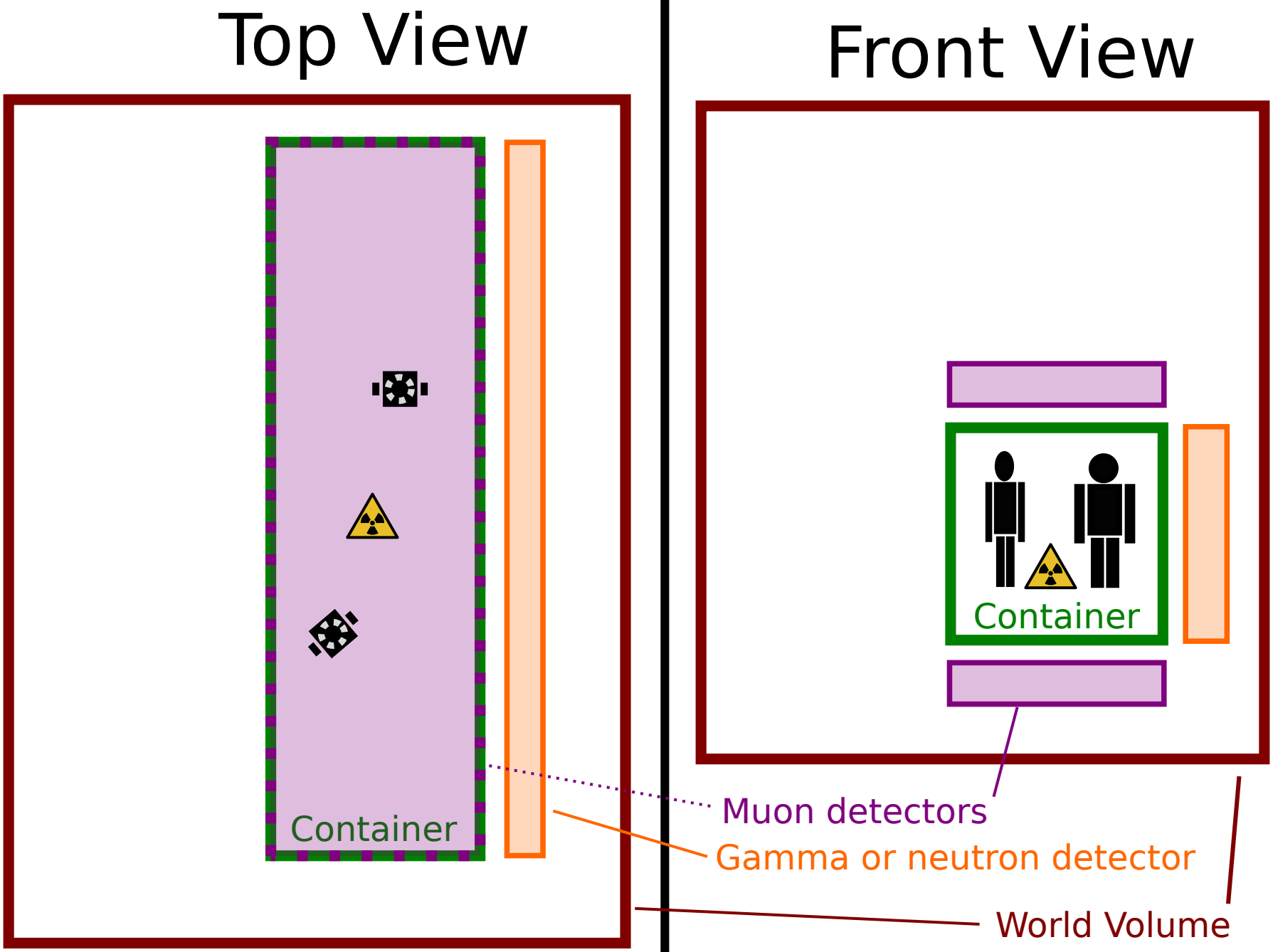
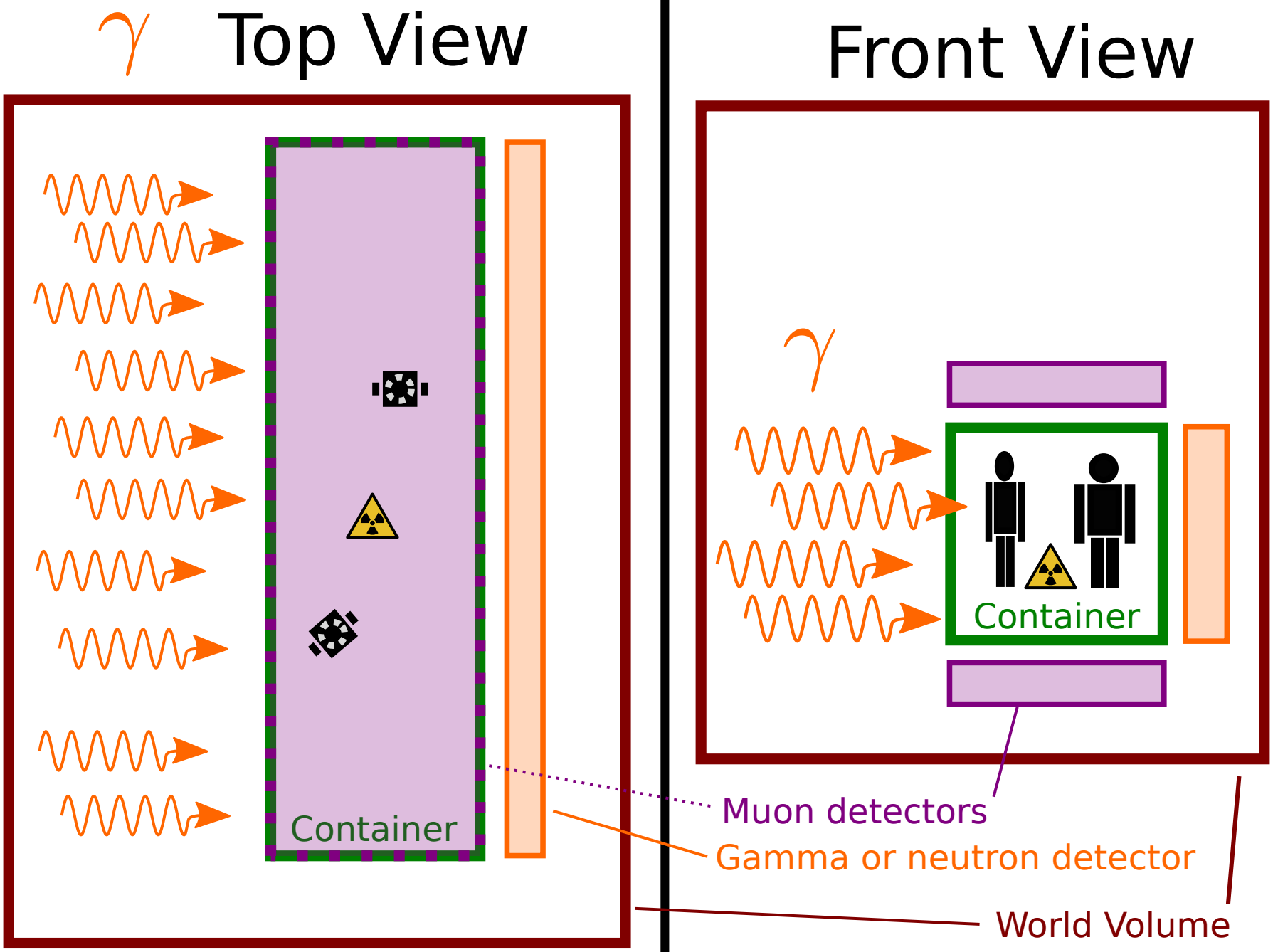
Transmission [Direct] Image (Linac X-Ray)

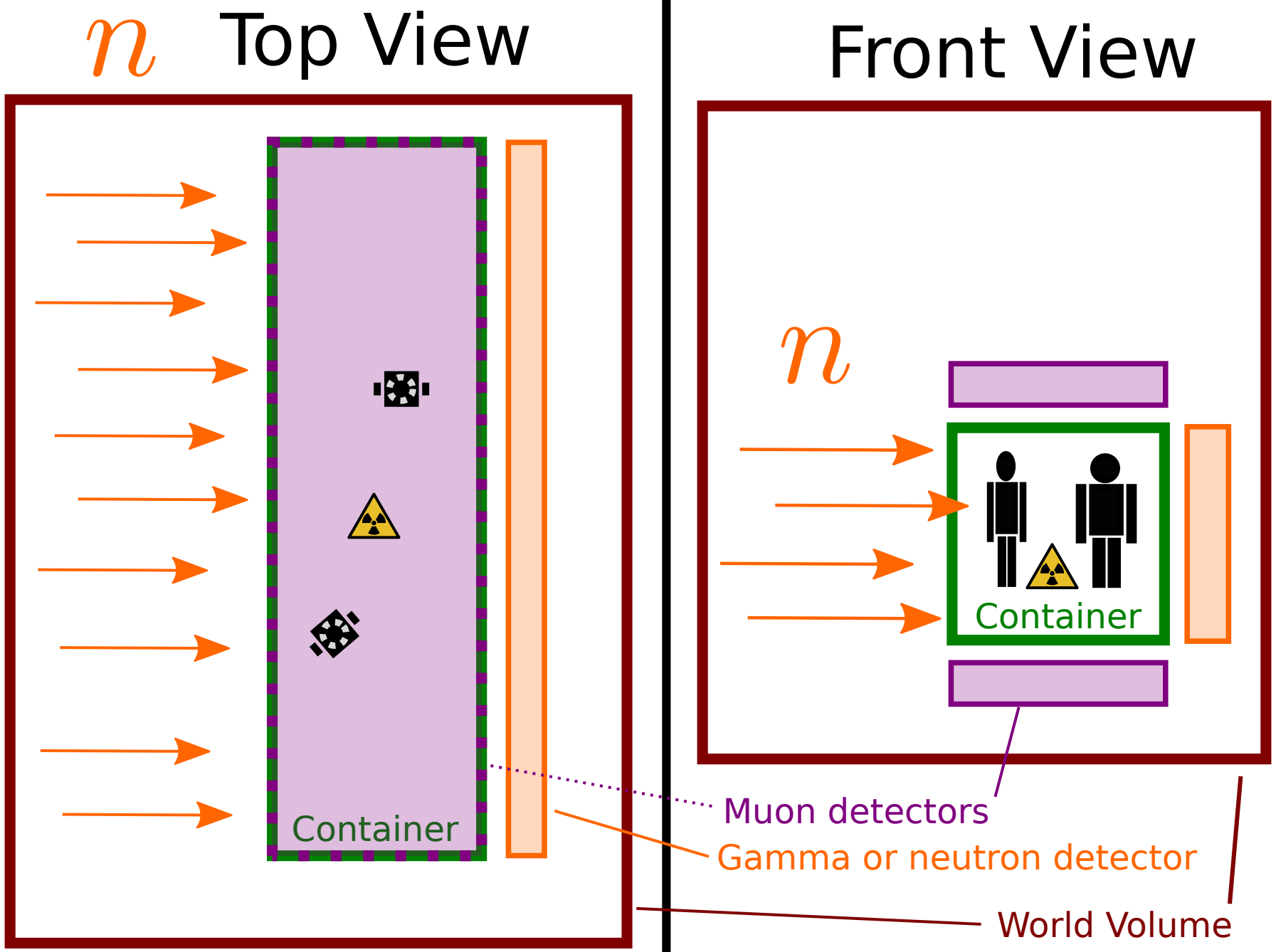


https://mpoverello.com


Top View
Front View
Container
Container
Muon detectors
Gamma or neutron detector
World Volume

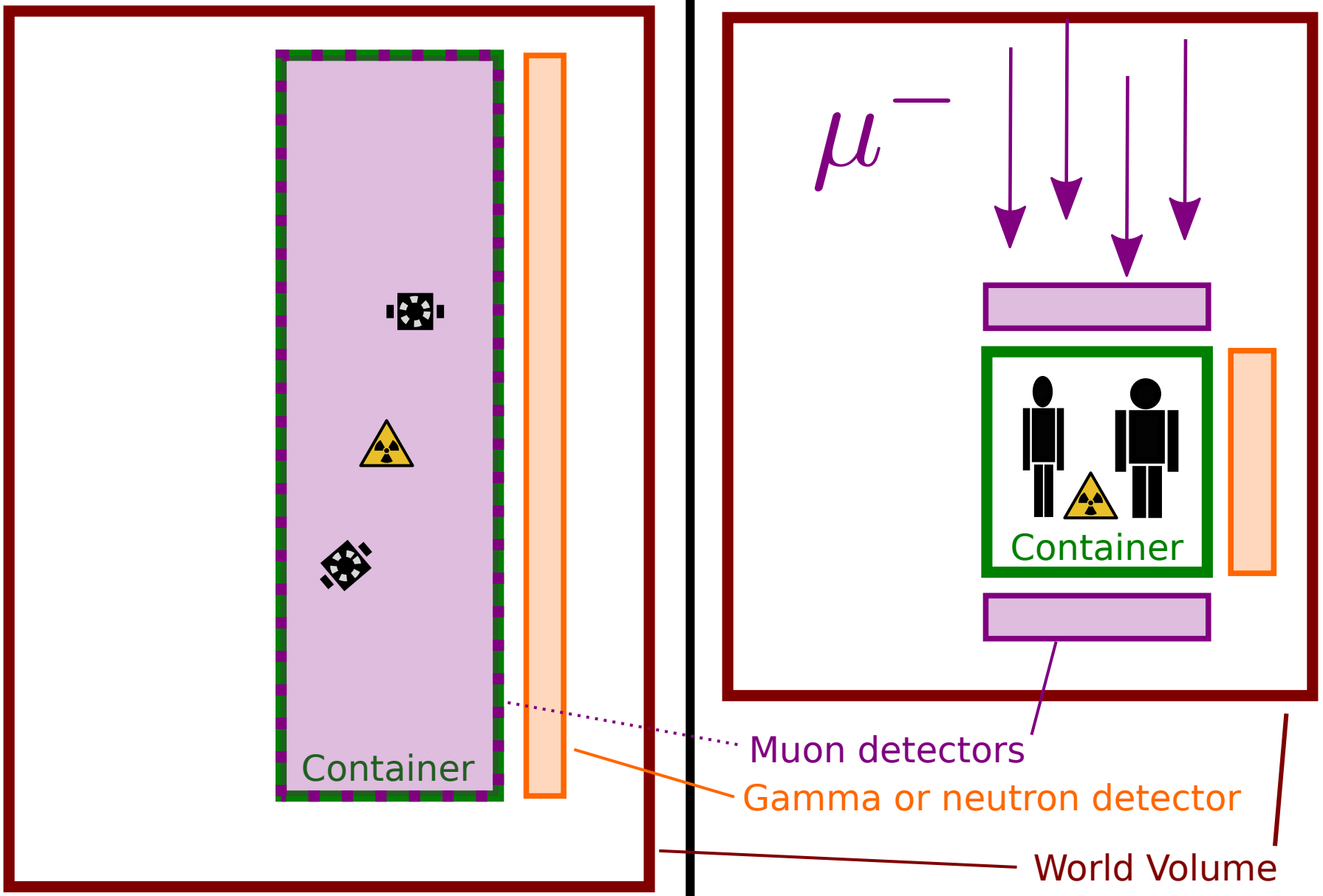

Top View
Front View
Container
Container
Muon detectors
Gamma or neutron detector
World Volume


γ
Top View
Front View
Container
γ
Container
Muon detectors
Gamma or neutron detector
World Volume


n
Top View
Container
Front View
n
Container
Muon detectors
Gamma or neutron detector
World Volume

Top View

Front View



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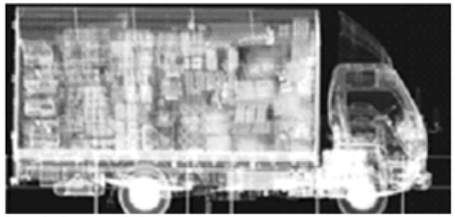
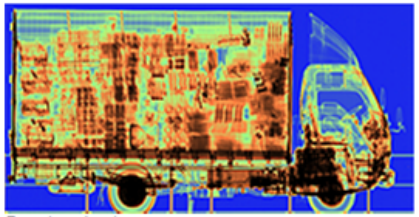
Imaging Software – Examples of *other imaging tools...*


Original Image

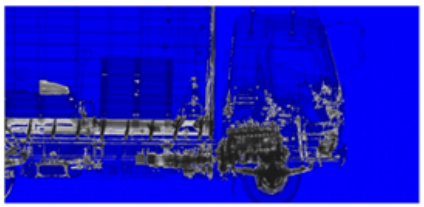

Inverted greyscale image

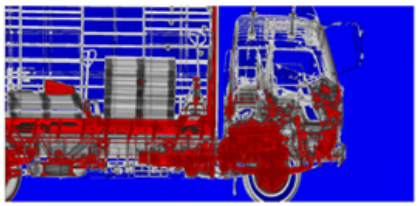

Psuedo colour image


Log Correction


Quick Optimize


Crystal Clear




Histogram Functionality


Original Image


Edge Enhance & Sharpen

Container scanner by gammas, neutrons and muons

- Container:
  - 10 m long, 3 m wide, and 3 m high
  - wall material 5 mm aluminum
  - Fill with air
- Objects inside the container:
  - Varios shapes, sizes, material and positions.
  - Be creative while still keeping it realistic
  - Have fun
- Detectors:
  - 10 m long, 3 m high, and 10 cm thick
  - Material is `CsI` (γ, μ^-) or `scintillator` (n)
  - γ, n: located with a gap of 10 cm next to the container
  - μ^-: same gap as (γ, μ^-) but located on top and bellow the container
- Scan beam:
  - 5 MeV gammas, 15 MeV neutrons, and 4 GeV muons
  - Parallel beam uniformly distributed in 10 m $\times$ 3 m.
  - Sideways direction for γ, and n and downward direction for μ^-.

Requirements

- Physics list:
  - Use `FTFP_BERT_HP`
- Primary Generator Action:
  - Don't use General Particle Source (GPS)
  - Use `ParticleGun` and randomize the vertex position
- Object inside the container:
  - Implement at least four objects of different materials
  - Use parameterized volumes for positions and materials
  - You may also use assembly and placement
- Detector plate γ, n:
  - Use command-based scorer and score energy deposition
- Detector plate μ^-:
  - Write to file the interaction positions of the muons in the top and bottom detector
  - Compute offline/online the scattering angle
  - Create 2D histogram $(x, y)_{\mu_\mathbf{o}}$ increment its content by the scattering angle

Report

- Deadline Friday October 5th, 2018
  - If need to extend the deadline, contact us.
- Create a report that includes the following:
  - Your name, instute/department name and email address
  - Source code of `main()` with reasonable amount of comment lines
  - Images of detector plane for gamma and neutron beams made by the scorer
  - Image of 2D histogram for muon scattering
  - A few snapshots of events
- Upload your report to Indico in PDF format

Notes

- `iridium` account:
  - It will live until the deadline including few extra weeks later
- Comunication with teachers:
  - Don't send us emails with large attachment files. If you have a question and need to show us some pictures, upload them to Indico and send us plain text email. Don't use anonymous email accounts, use your institutional email account.
  - Keep all header and source code you implemented as well all macro files. We may request you to send them to us.