Update simulazioni

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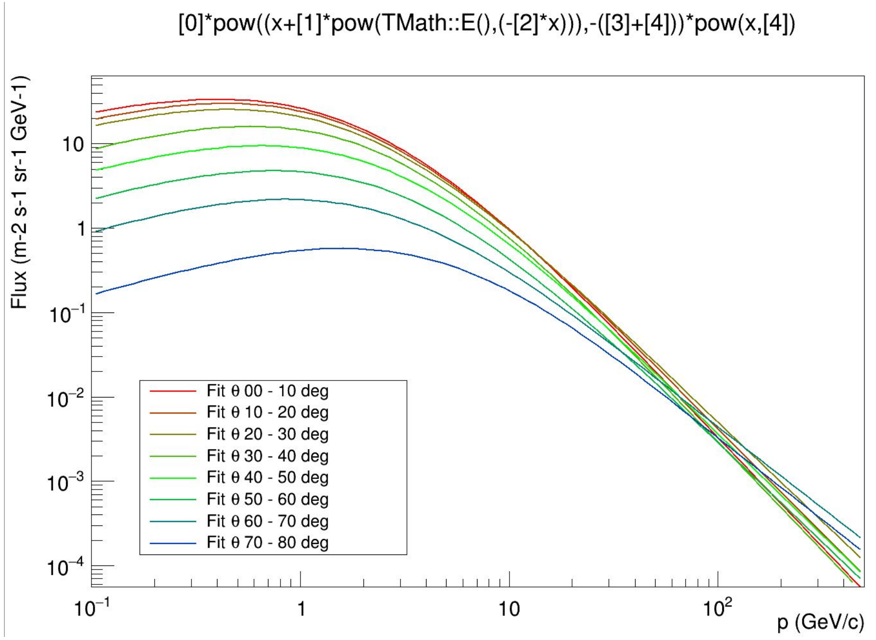
Update

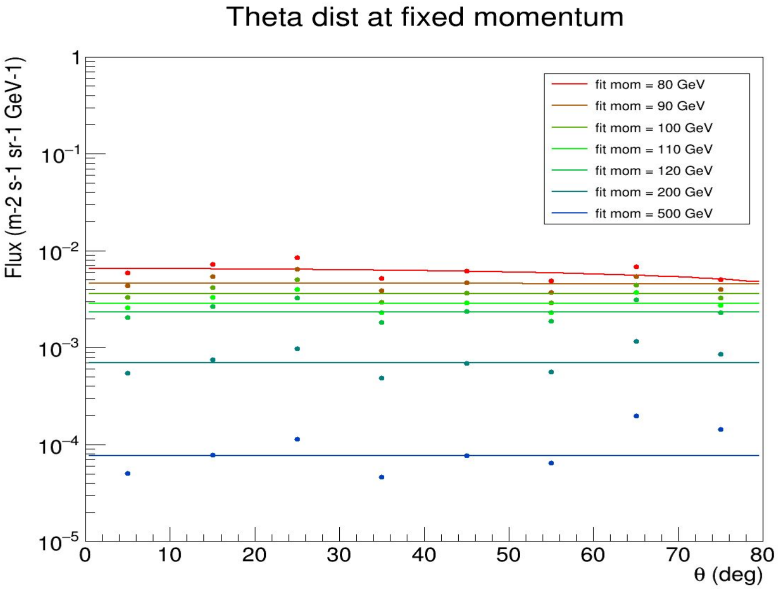
- Generatore di muoni
  - Aggiornato con i parametri dei fit di Lorenzo B
  - Controllo dei fit in θ ad impulso fissato
  - Primi test con range in impulso esteso a 500 GeV

- Simulazione della diga di Bilancino
  - Geometria di Olek implementata in GGS
  - Posizionamento rivelatore, superficie di generazione, ...
  - Simulazioni di controllo

Generatore di muoni

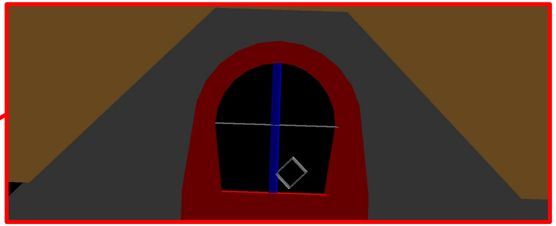
- Formule utilizzate
  - $Flux_{\theta}(p) = A_0\,[p + A_1\,e^{-A_2 p}]^{-(A_3+A_4)} * p^{A_4}$
  - $B_0\,(\cos(\theta))^{B_1}$

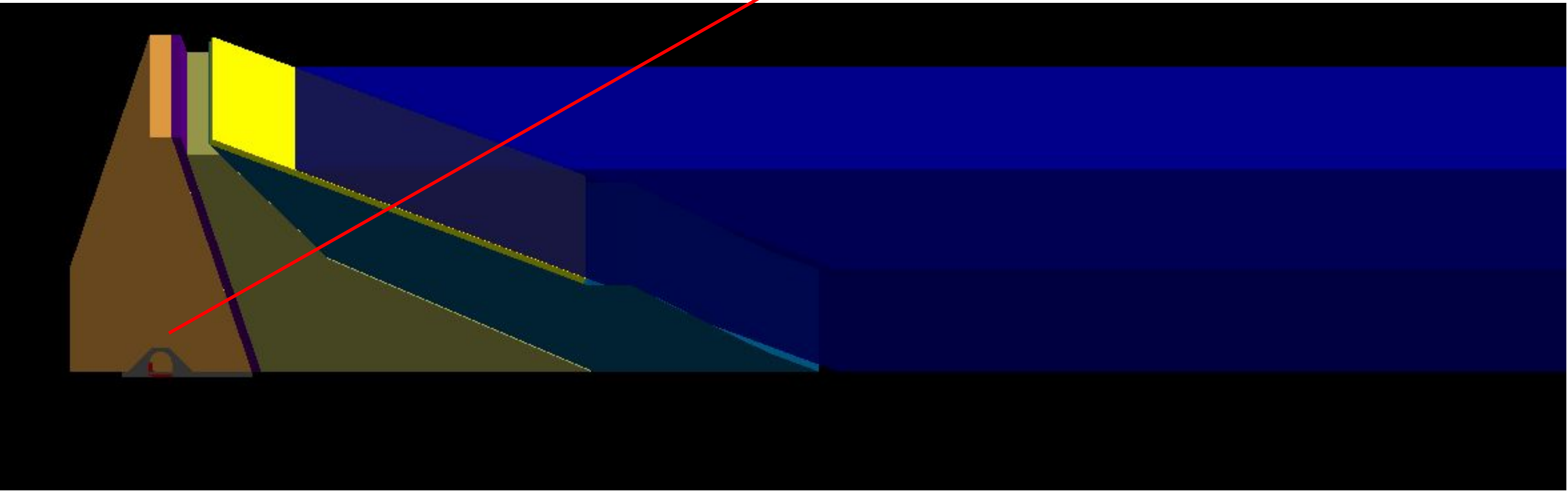




Simulazioni Bilancino

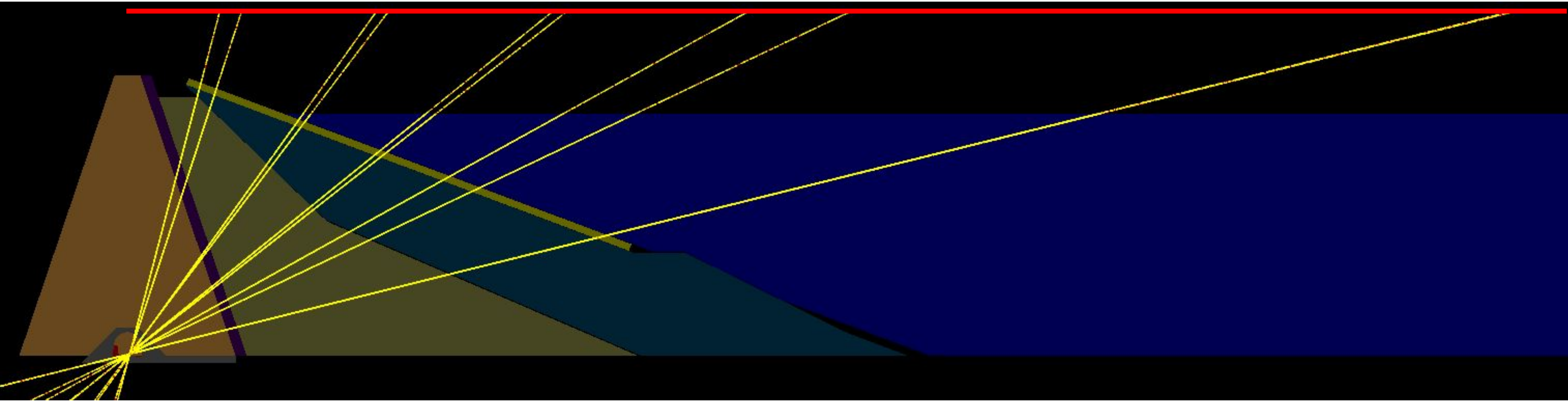
- Geometria della diga
    - Rivelatore posizionato all’interno del tunnel





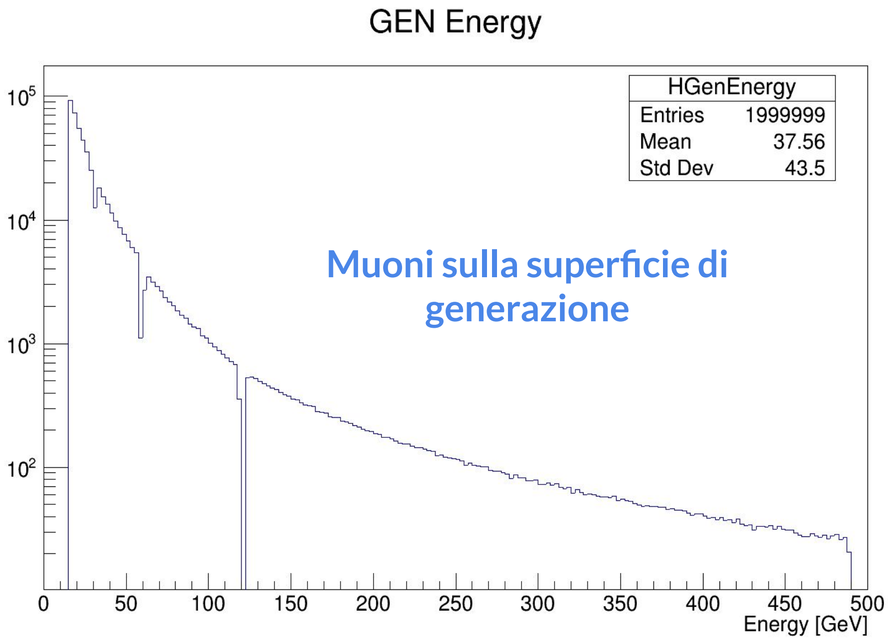
Simulazioni Bilancino

- Superficie di generazione (vista x-z)
  - Superficie orizzontale a quota z = 50 m
  - Dimensioni: 250 m lungo x e 300 m lungo y

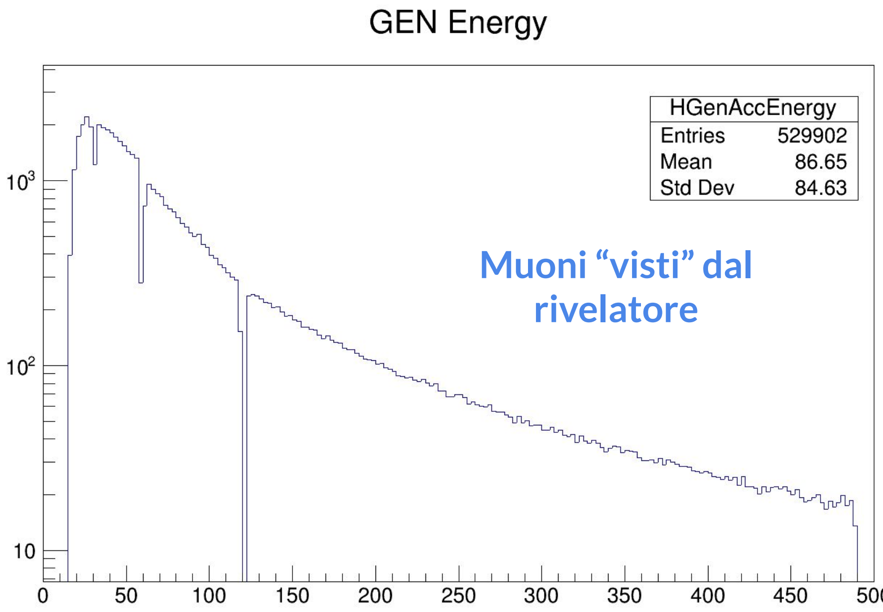


Simulazioni Bilancino

- Range di impulso dei muoni
  - Muoni con p<15 GeV non raggiungono il rivelatore
  - NB: vengono simulati solo i muoni che inizialmente "puntano" nelle vicinanze del rivelatore.
  - Simulazioni in range di impulso per aumentare la statistica nelle code ad alta energia



Muoni sulla superficie di generazione



Muoni "visti" dal rivelatore

Lorenzo Viliani

Simulazioni Bilancino

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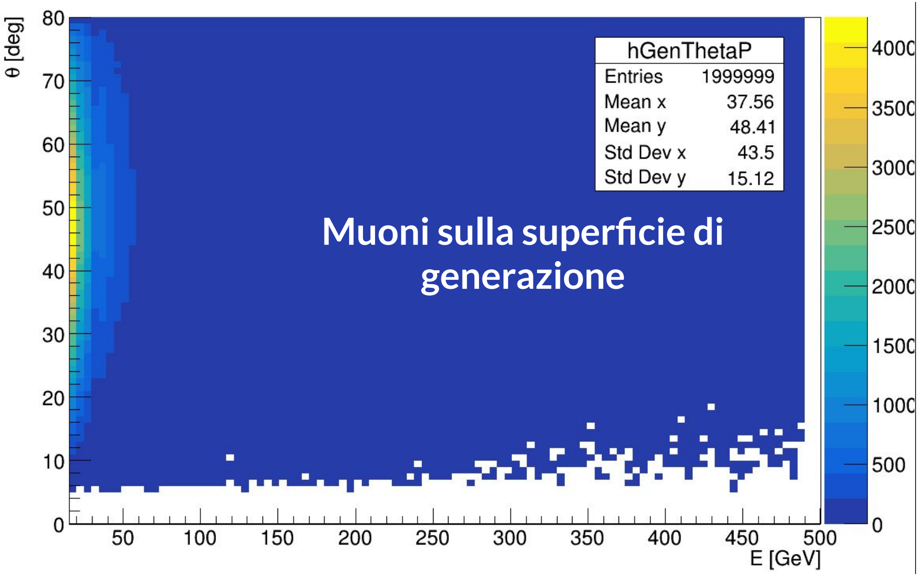
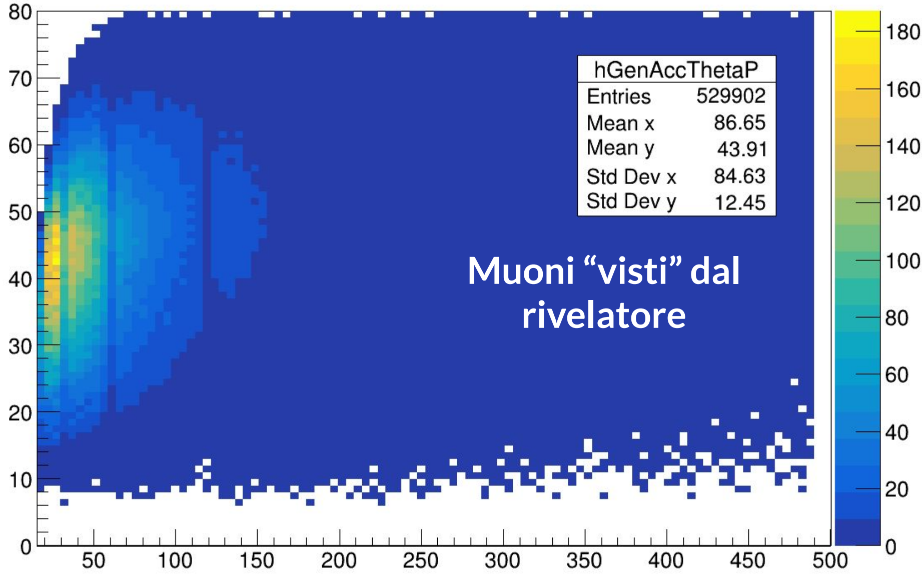
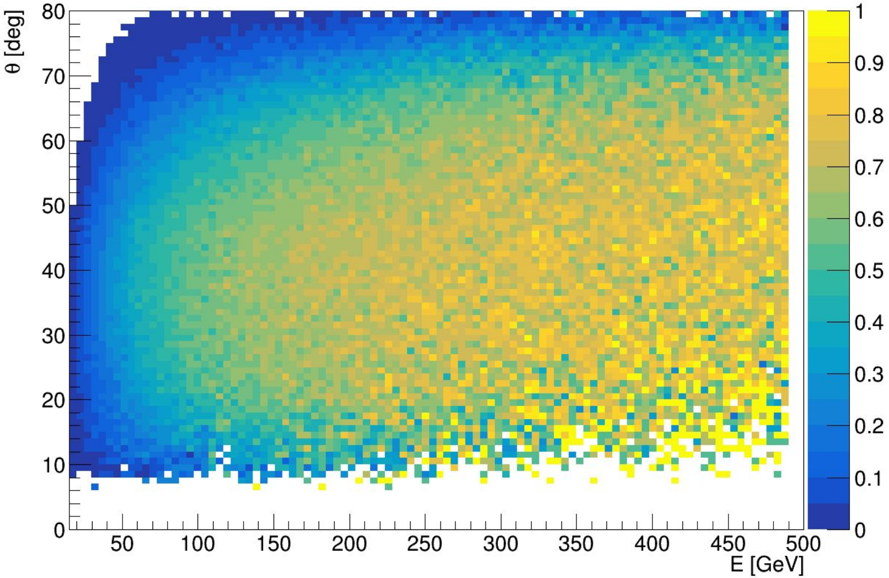
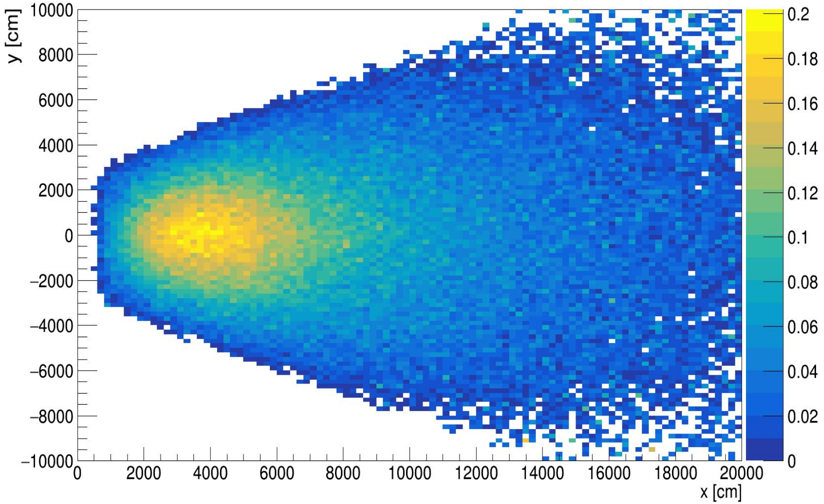




Simulazioni Bilancino

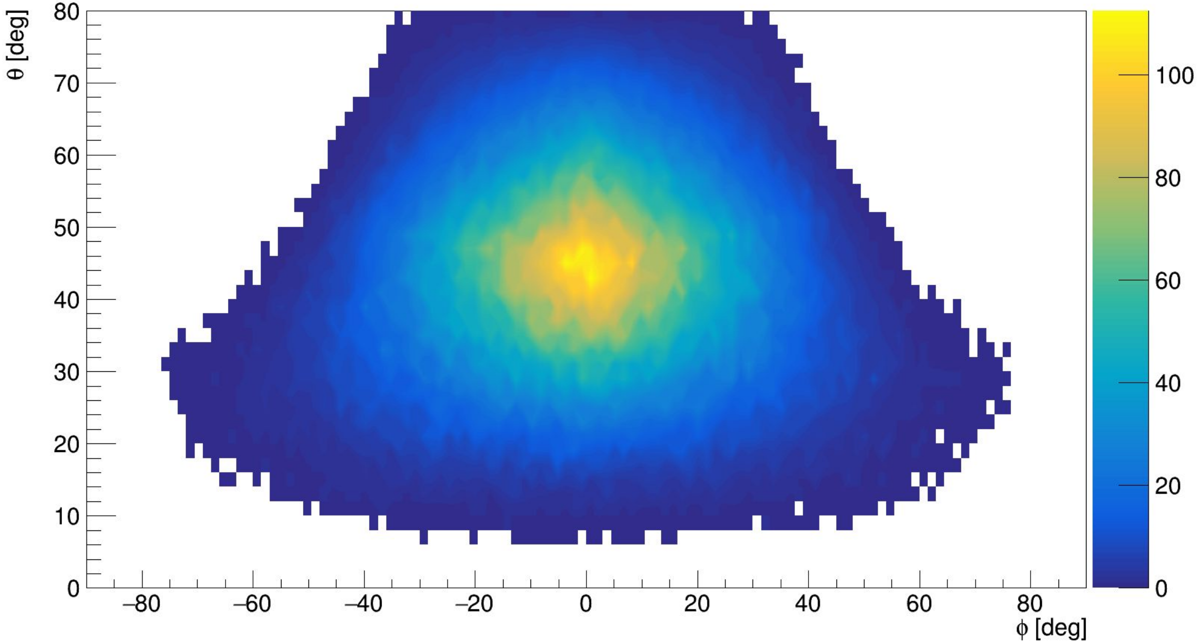
- Efficienze: rapporto fra numero di muoni in accettanza e numero di muoni generati





Simulazioni Bilancino

- Mappa angolare



BACKUP

Repository for MITO software

- Gitlab MITO group
  - https://baltig.infn.it/mito
  - If you want to contribute, sign in to baltig.infn.it and I will add you to the group
- Gitlab repository for Geant4 based MC simulations:
  - https://baltig.infn.it/mito/muraysimulation
  - Contains software for muon generators, detector simulation, predefined Geant4 useractions, etc. mainly developed by Nicola
- Gitlab repository for the simulation software developed by Massimo and Sandro:
  - https://baltig.infn.it/mito/mimasw

Geant4 muon generator - workflow

- Adamo flux (code):
  - Start from Adamo data and build analytic functions representing the differential flux vs p and θ.
  - Data are represented by 8 analytic functions of diff. flux vs p, one for each θ bin of 10° width (from 0° to 80°).
- Produce text tables (code):
  - Sampling the above functions we build text tables containing the differential flux at fixed p and θ values (more details in the next slides).
- MC generation (code):
  - Tables are converted to 2D histograms (x=p, y=θ, bin content=differential flux).
  - Histograms are sampled using standard ROOT methods.
- Interface to Geant4 (code)

Details on the first steps

- We start from 8 analytic functions of diff. flux vs p:
  - $Flux_\theta(p) = A_0\,[p + A_1\,e^{-A_2 p}]^{-(A_3+A_4)*}p^{A_4}$ for $\theta \in [\theta_i, \theta_j]$
  - NB: different function used by Sandro and Massimo
  - For each θ bin, a different set of parameters A_i (i=0,1,2,3,4) is defined (fixed and hardcoded!).
  - Momentum range: 0.1 - 130 GeV

- In order to get the flux at fixed p and θ:
  - For a given p, extract $Flux_\theta$ from the 8 functions above -> 8 fluxes at fixed p and different θ,
  - $Flux_p(\theta) = (Flux_{\theta 0}, Flux_{\theta 1}, ..., Flux_{\theta 7})$
  - Fit with $B_0\,(\cos(\theta))^{B1}$ and get the B_0 and B_1 parameters
  - Extract the flux at the desired θ value.