International MUON Collider Collaboration

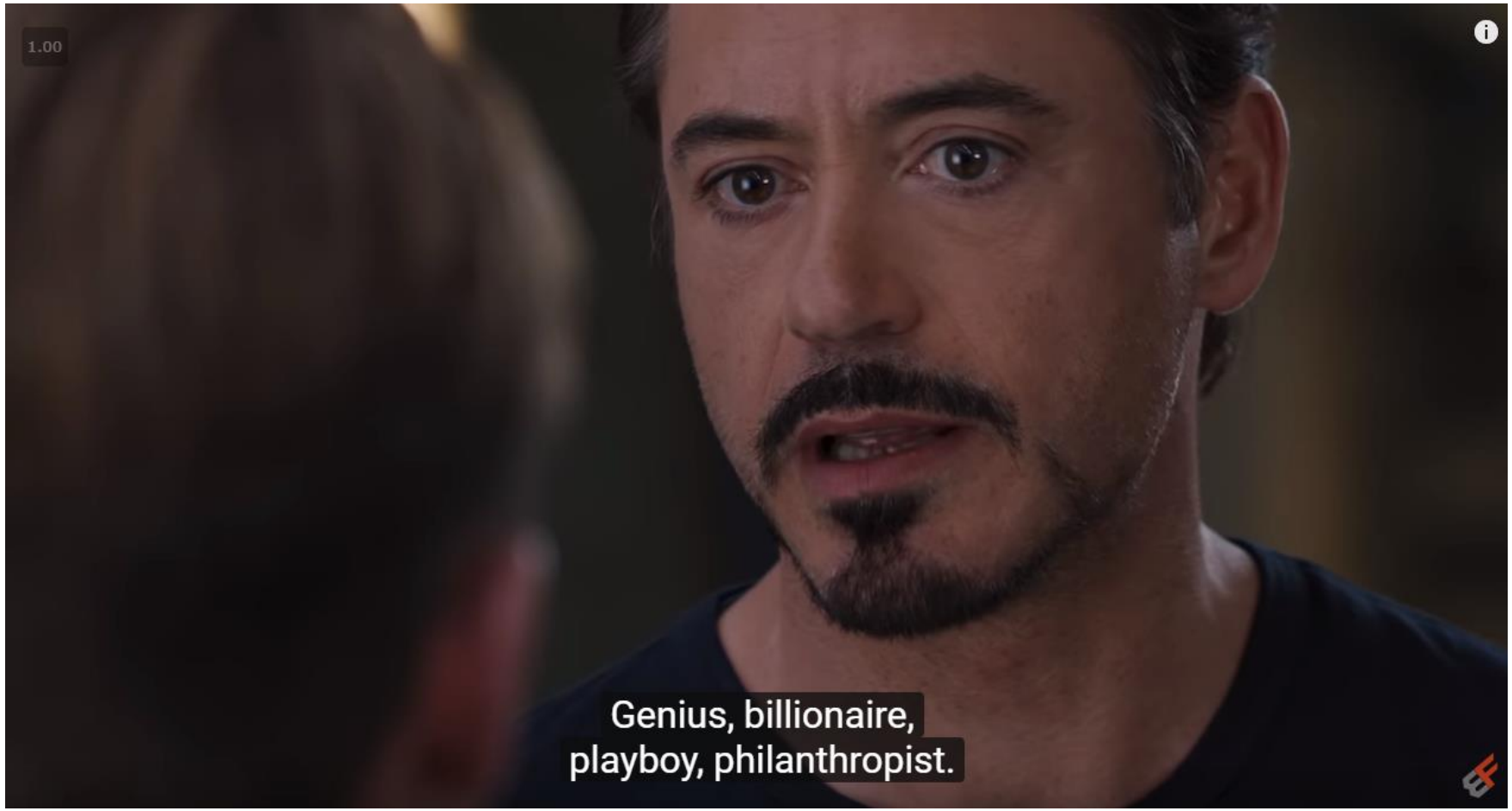
SAPIENZA UNIVERSITÀ DI ROMA

Working for The future Collider

L. Castelli

Who am I?

- Not Iron Man



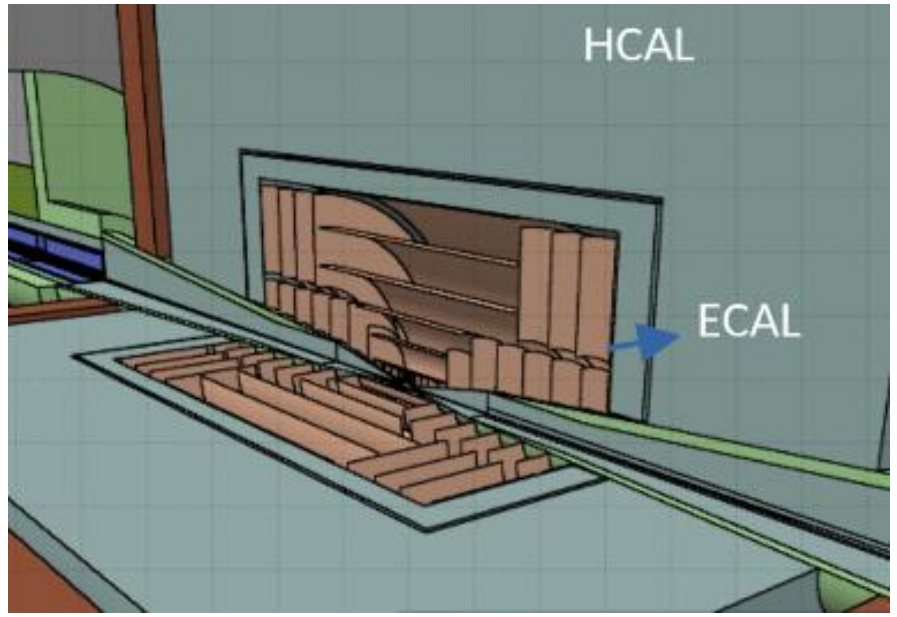
Who am I?

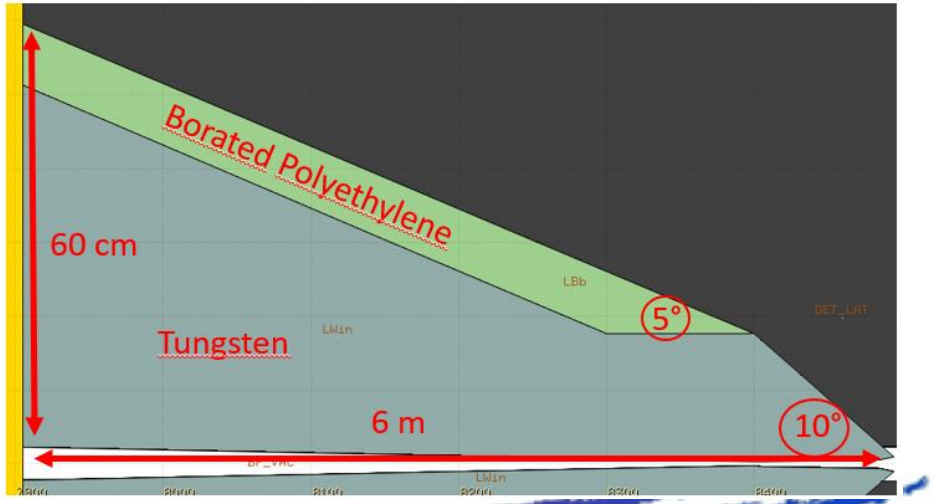
- Bachelor and master degree Physics at Università degli Studi di Padova
  - Experimental physics
  - Machine Learning
  - High energy particle physics
- High school math and physics teacher
- Briefly data analyst for an insurance company
- PhD student in Accelerator Physics at Sapienza – Università di Roma

What do I do?

What do I do?

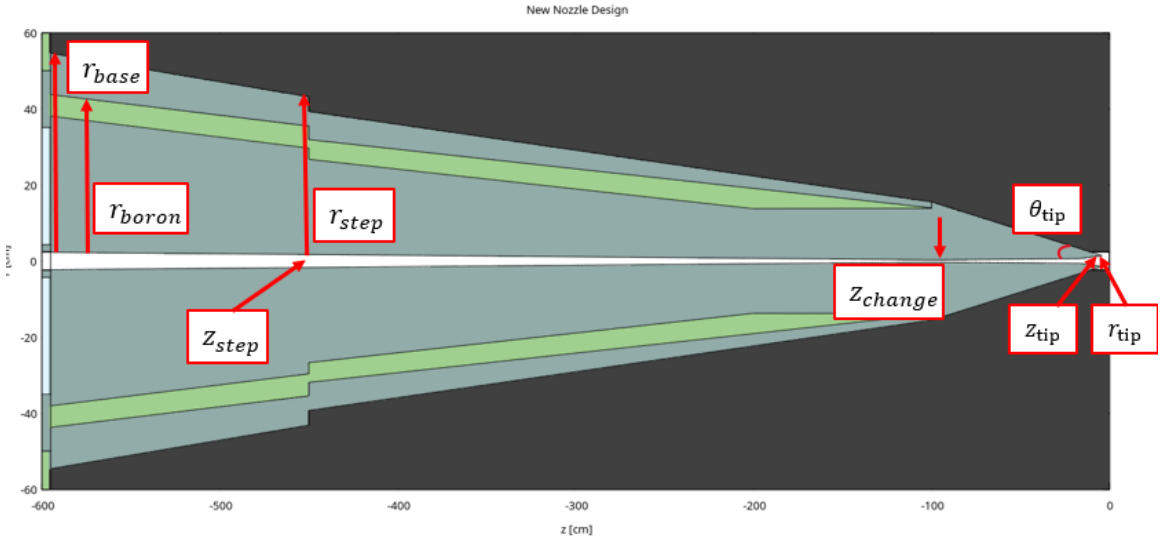
- Machine-Detector Interface optimization for $\sqrt{s} = 3\ TeV$ Muon Collider
- Muons decay ⇒ Decay products interact with machine elements ⇒ Beam-Induced Background arrives in the Detector
- Nozzles reduce the flux and allow to do physics, but they reduce the acceptance

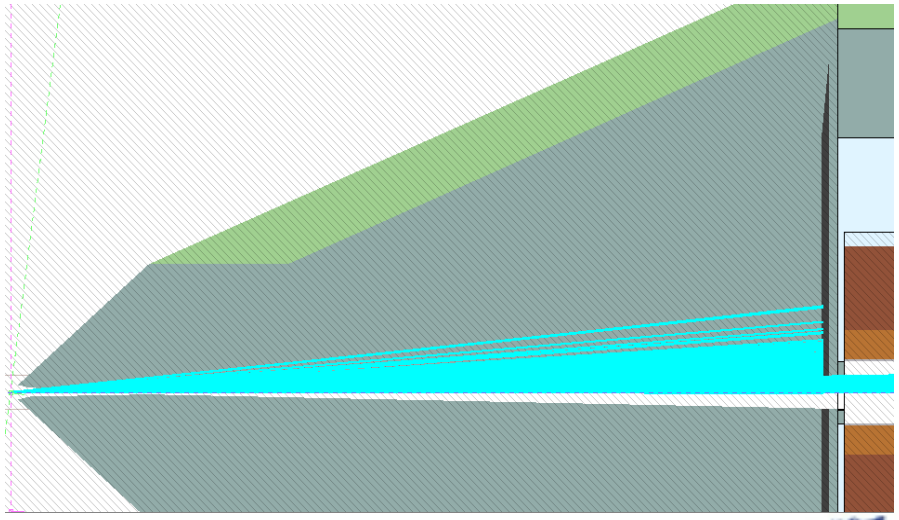




What do I do?

- Search for the optimal geometry considering BIB flux, BIB effects in the detector and Nozzle volume
- Three approaches:
  - By hand simulation with FLUKA
  - XGBoost regressor to parametrize the BIB flux as function of the geometry
  - Bayesian optimization loop with FLUKA simulations
- Study of possible solution to tag forward muons





What do I do?

- Another day in the office

```
[lcastell@muonc-monster ~]$ rfluka -e executable/fluka.x -M 1 mc_simplified_nozzl
e_01.inp

                                F L U K A

Dir:    /users/muoncollider/lcastell/fluka4-4.0
Data:   /users/muoncollider/lcastell/fluka4-4.0/data
/users/muoncollider/lcastell/fluka4-4.0/bin/rfluka: line 20: cd: executable: No s
uch file or directory
Exec:   /users/muoncollider/lcastell/fluka.x
```

```
[lucastel@lxplus934 ~]$ condor_submit --spool job.sub
Submitting job(s).....................................................
.................................
100 job(s) submitted to cluster 12924.
[lucastel@lxplus934 ~]$
```

```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
```

ChatGPT Auto

how do I survive the day?

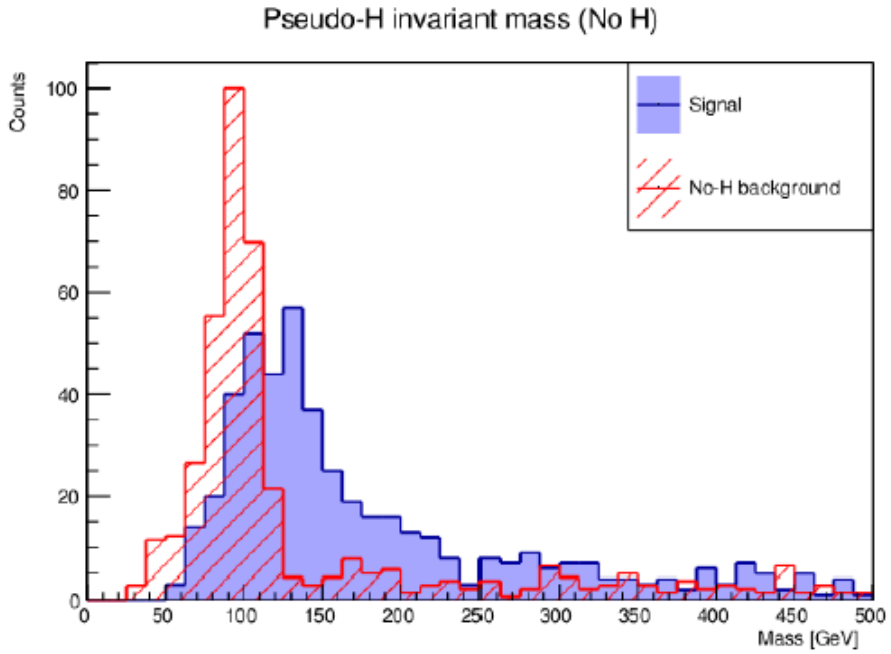
Is there something specific weighing on you today?

Why did I choose this activity?

- I was interested in Muon Collider since 2^{nd} year of the bachelor
- I find fascinating the idea of something completely new with possibility to study deeply the Higgs physics
- I am inclined to look far ahead in future rather than the near one
- I want to be a professor

Are you happy?

- I miss doing Higgs invariant mass plots
- My work is stimulating and challenging
- FLUKA gives, FLUKA takes…
- Overall, I don't think about the salary I had back in the insurance company




```
Geomtr: Particle in region     6 (cell #   22)
 in position   3.390766935E-01  3.580316788E-01 -1.482781036E+02
 is now causing trouble, requesting a step of  6.636063598E-06 cm
 to direction  2.144915783E-01 -9.177258270E-01  3.343241978E-01
 end position  3.390781168E-01  3.580255887E-01 -1.482781014E+02
 R2:  4.931122459E-01 R3:  1.482789236E+02 cm  error count:  5
 X*U   (2D): -2.558458234E-01 X*U   (3D): -4.982880387E+01 cm
 X*UOLD(2D): -2.262093097E-01 X*UOLD(3D): -4.943368166E+01 cm
 Kloop:   90484521, error code:  -3 Nfrom:  4999 Ntrack:     2
 old direction  2.830372188E-01 -8.998662772E-01  3.318593315E-01, lagain, lstnew, lsense  F  F  T
 Particle index    3 total energy   1.535607015E-03 GeV
Try again to establish the current region  moving the particle of a  1.000000000E-06 long step
We succeeded in saving the particle:  current region is n.     5 (cell #   22)
```

What do I expect from my future?

- I expect to be there when the first stone of the Muon Collider will be settled (hopefully with a permanent position)
- I hope to do more Higgs invariant masses

What do I do? - Extra

- Sometimes I make cool T-Shirt

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Thank you for the attention

Reference

- [1] First ref

Backup

Backup