



A Pretty Fast Simulation of the Particle Flow for TLEP

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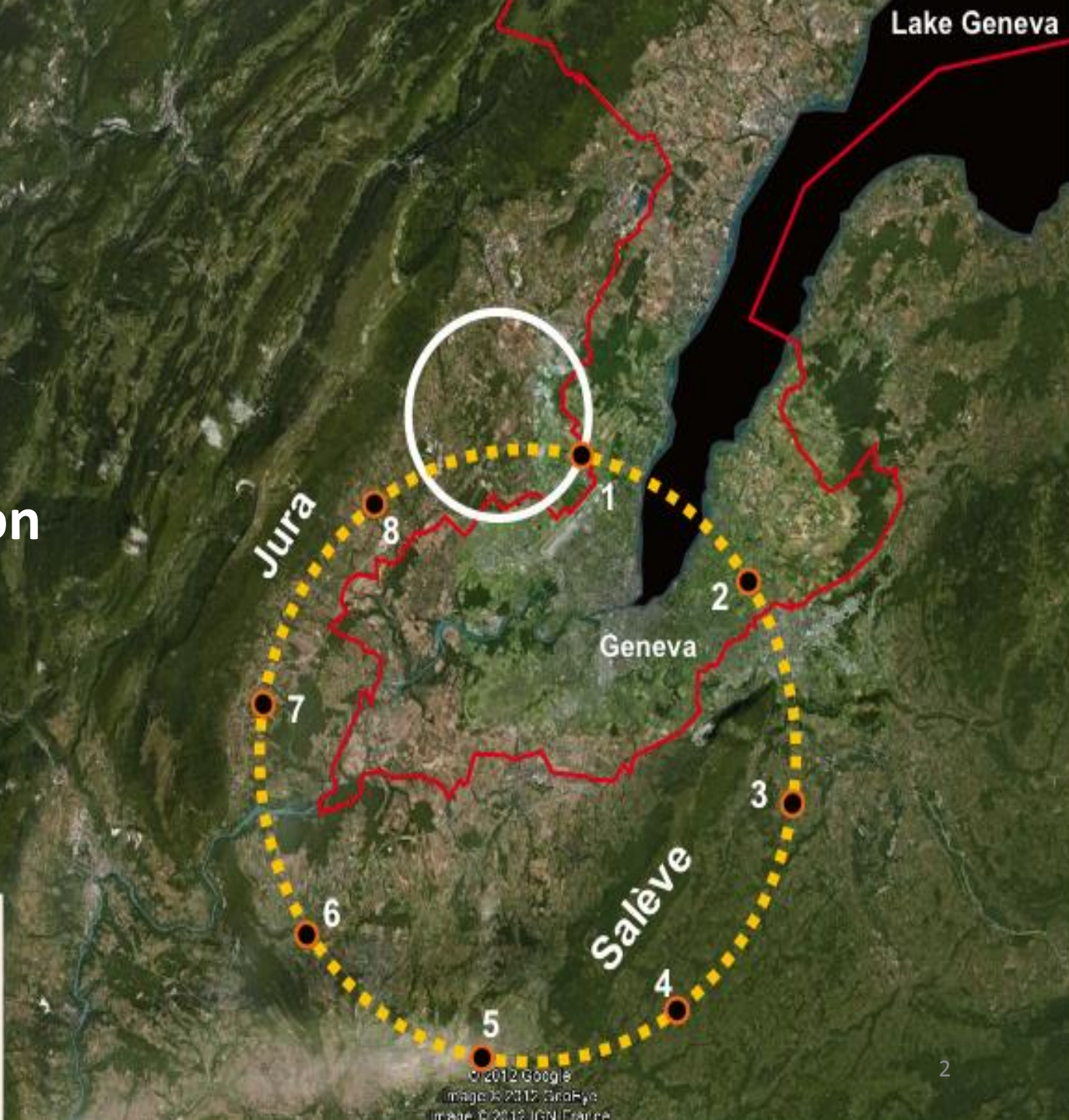
Supervisors: Colin Bernet, Luca Malgeri, Patrizia Azzi



Possible location

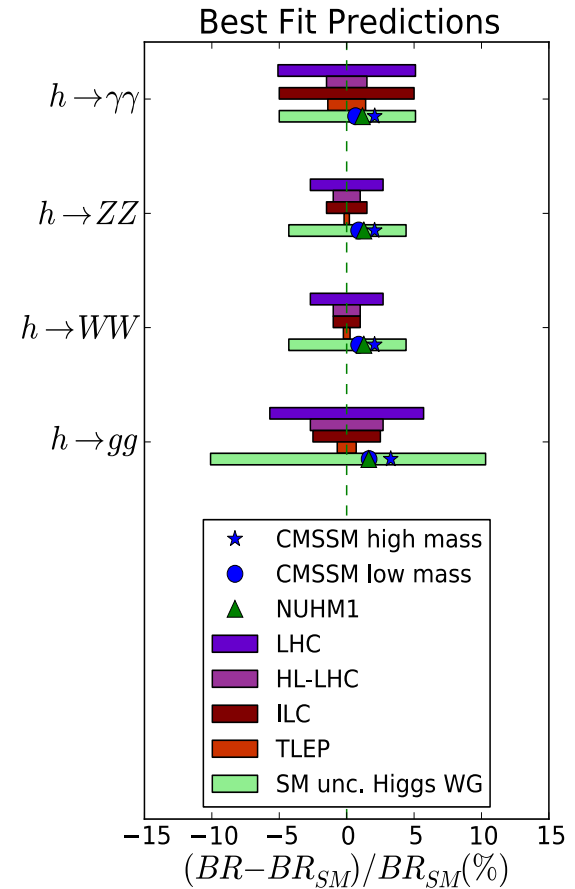
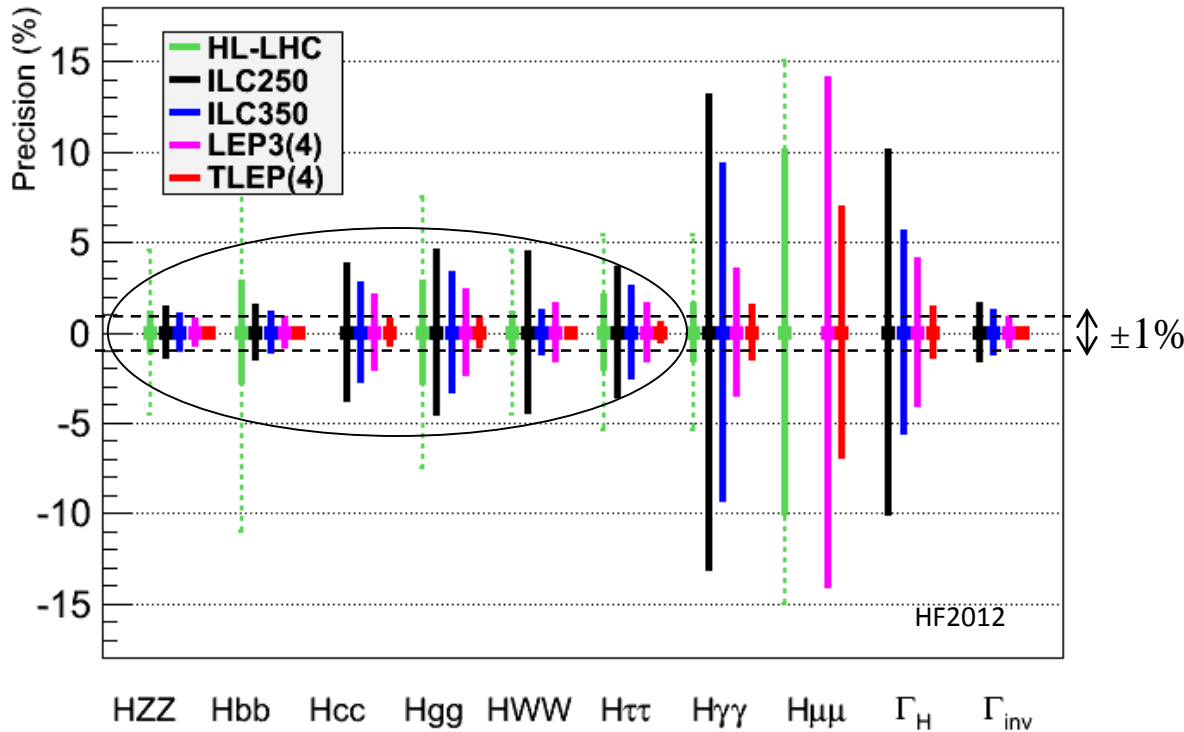
LEGEND

- LHC tunnel
- HE_LHC 80km option
- potential shaft location



TLEP as a Higgs factory

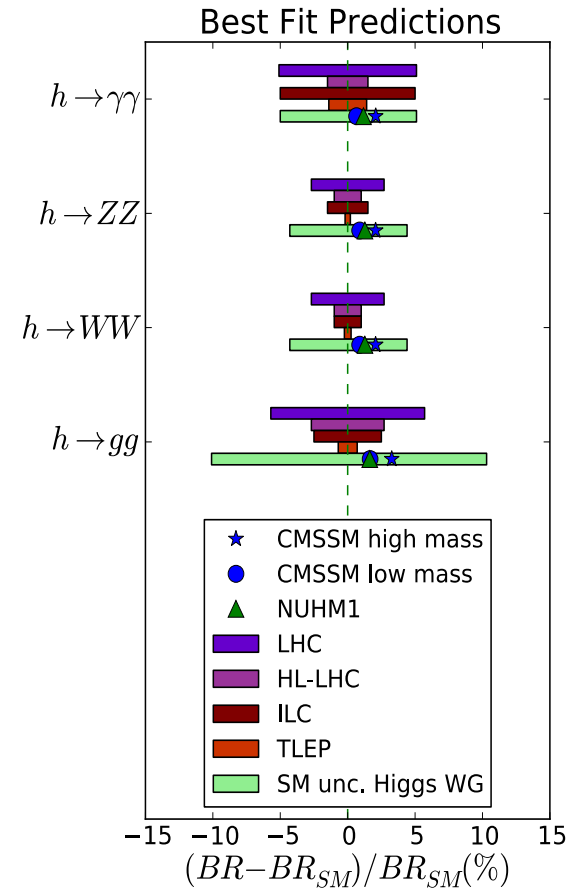
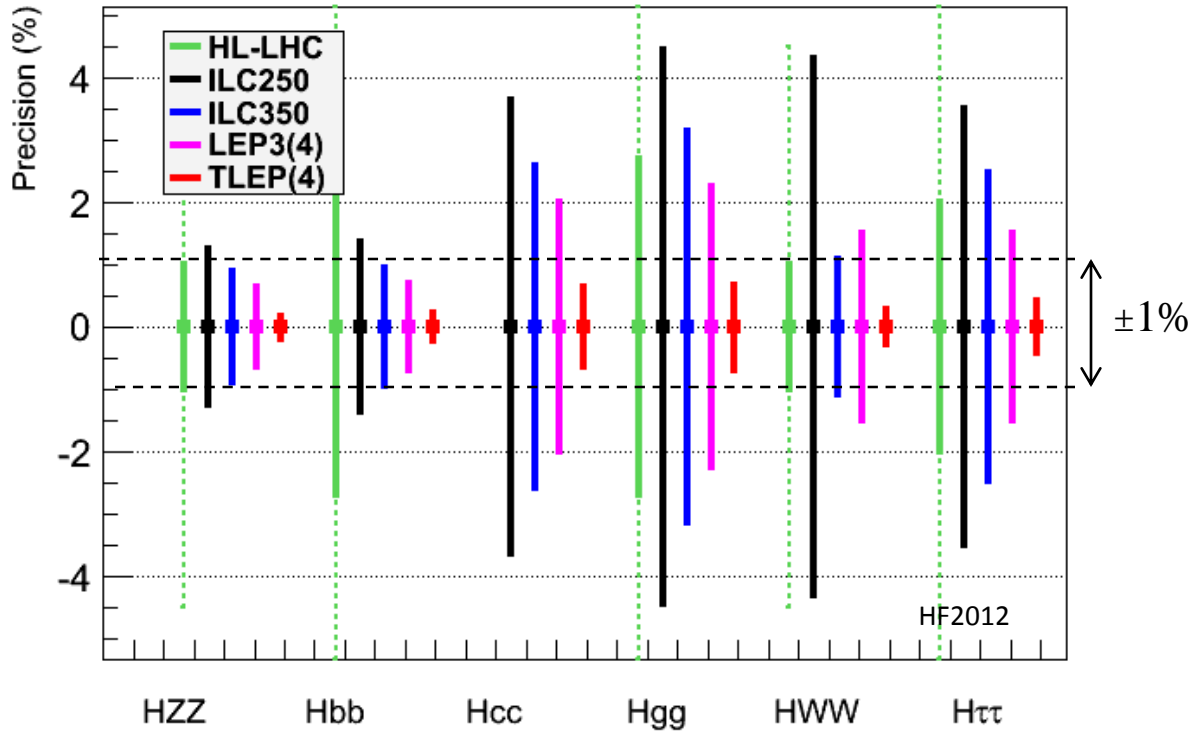
- Need sub-percent precision for a sensitivity to multi-TEV New Physics
 - Compare HL-LHC, ILC, LEP3, TLEP



- Summary : TLEP reaches the needed accuracy
 - ILC prospects similar to HL-LHC's
- Much theoretical work also needed

TLEP as a Higgs factory

- Need sub-percent precision for a sensitivity to multi-TEV New Physics
 - Compare HL-LHC, ILC, LEP3, TLEP



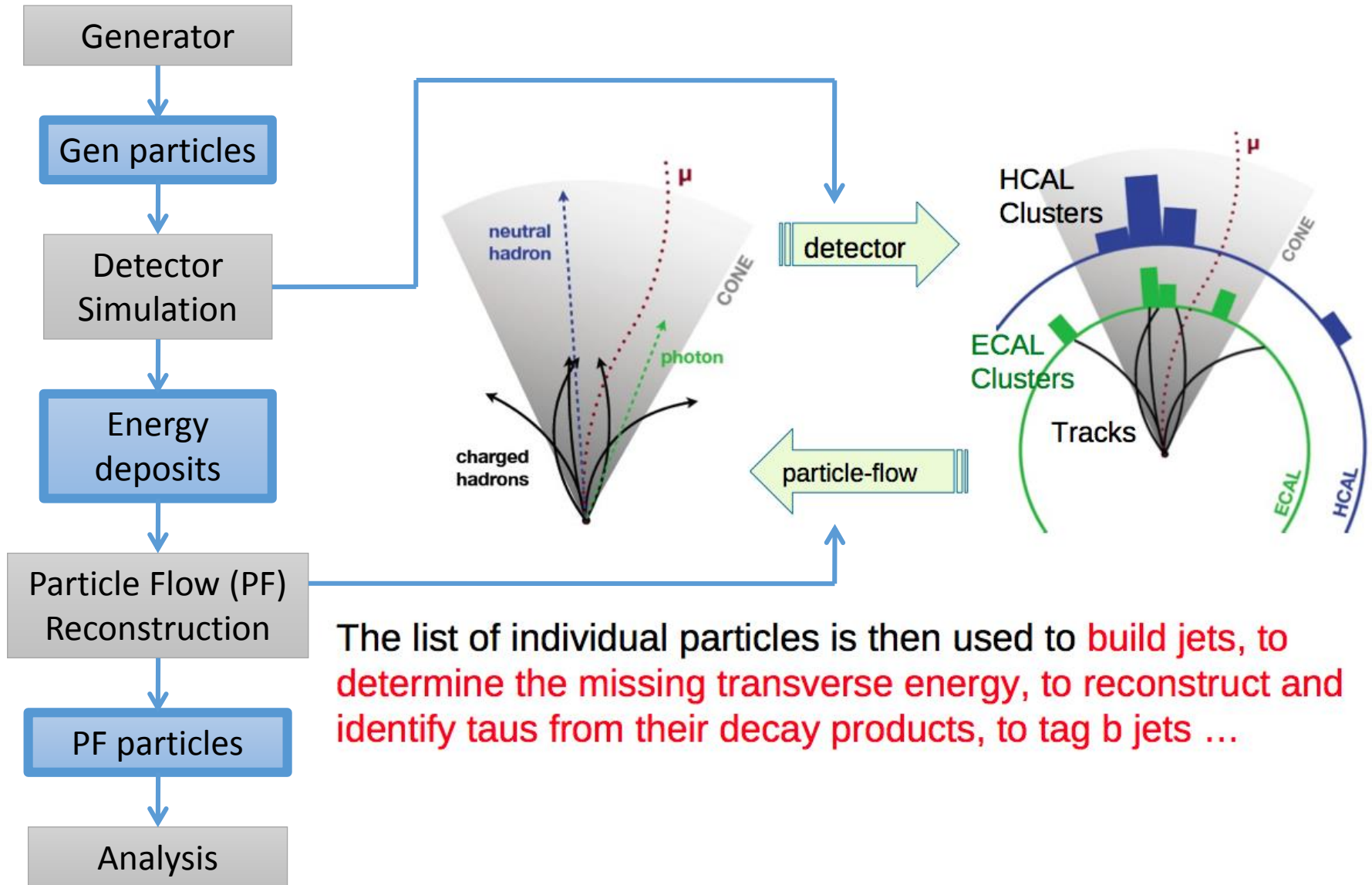
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Outline of the project

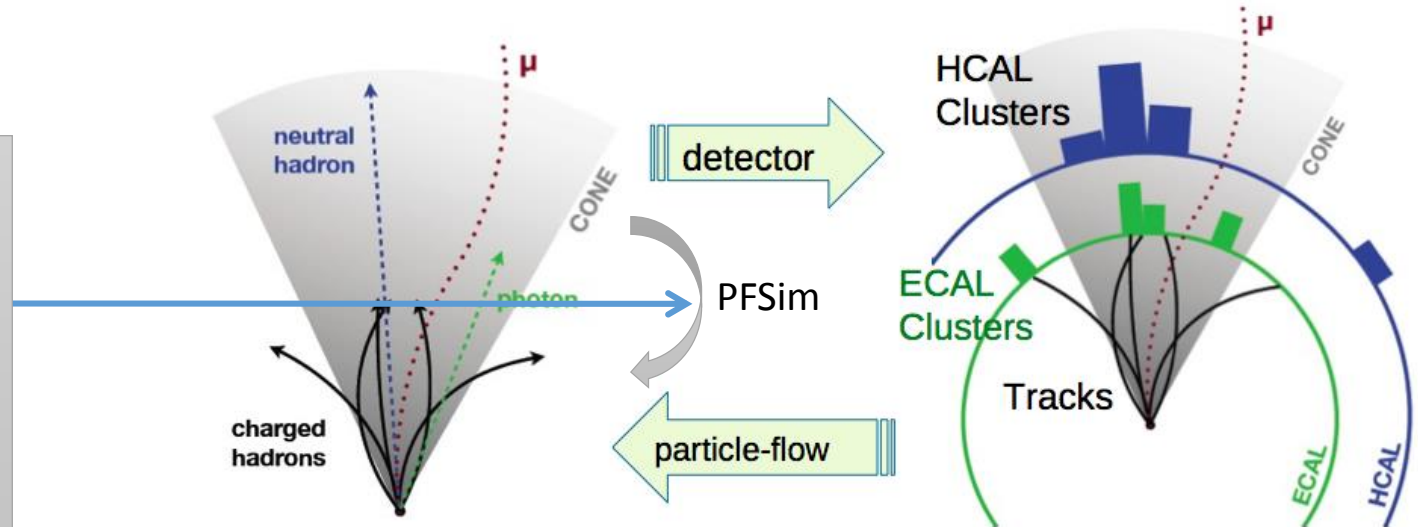
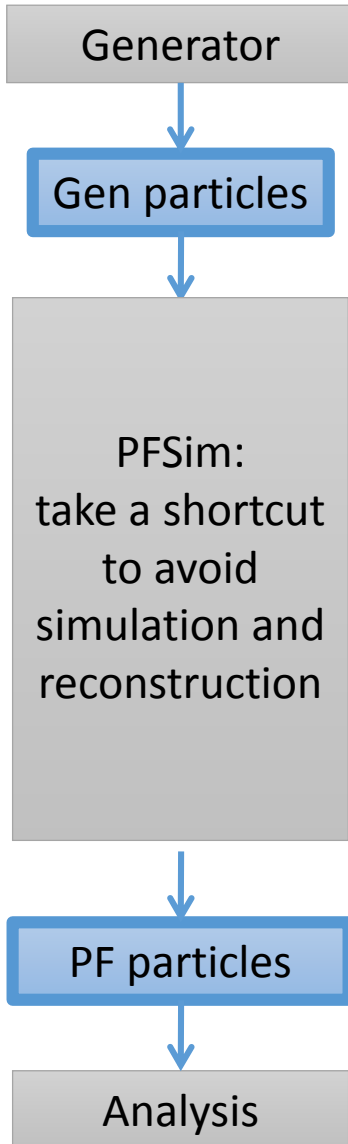
- **Goal:**
 - Allow people to get started with TLEP physics analyses
 - Use these analyses to guide detector design
- **What do we need?**
 - A simple and fast simulation
 - with a few tunable parameters (detector resolution and acceptance)

And we can do this by using the...

Particle Flow



Particle Flow

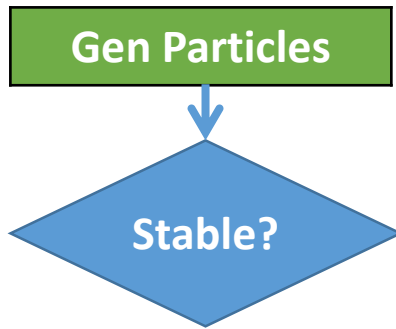


The list of individual particles is then used to **build jets**, to **determine the missing transverse energy**, to **reconstruct and identify taus from their decay products**, to **tag b jets** ...

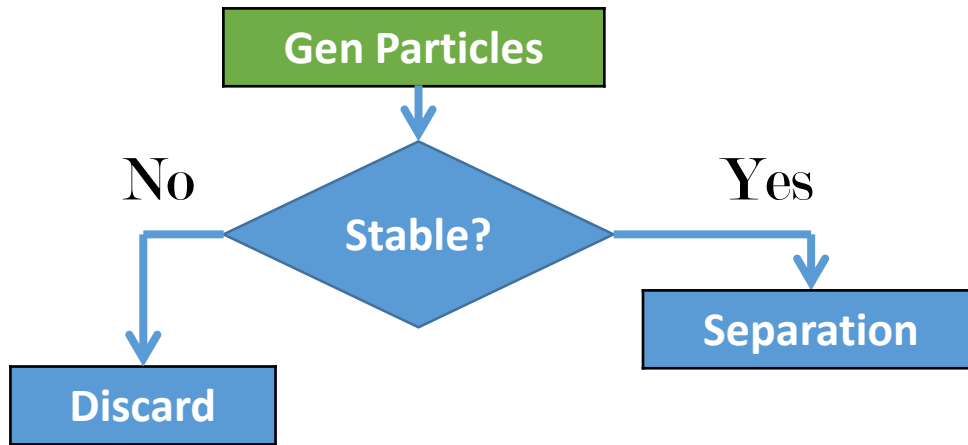
What Particle Flow is?

Gen Particles

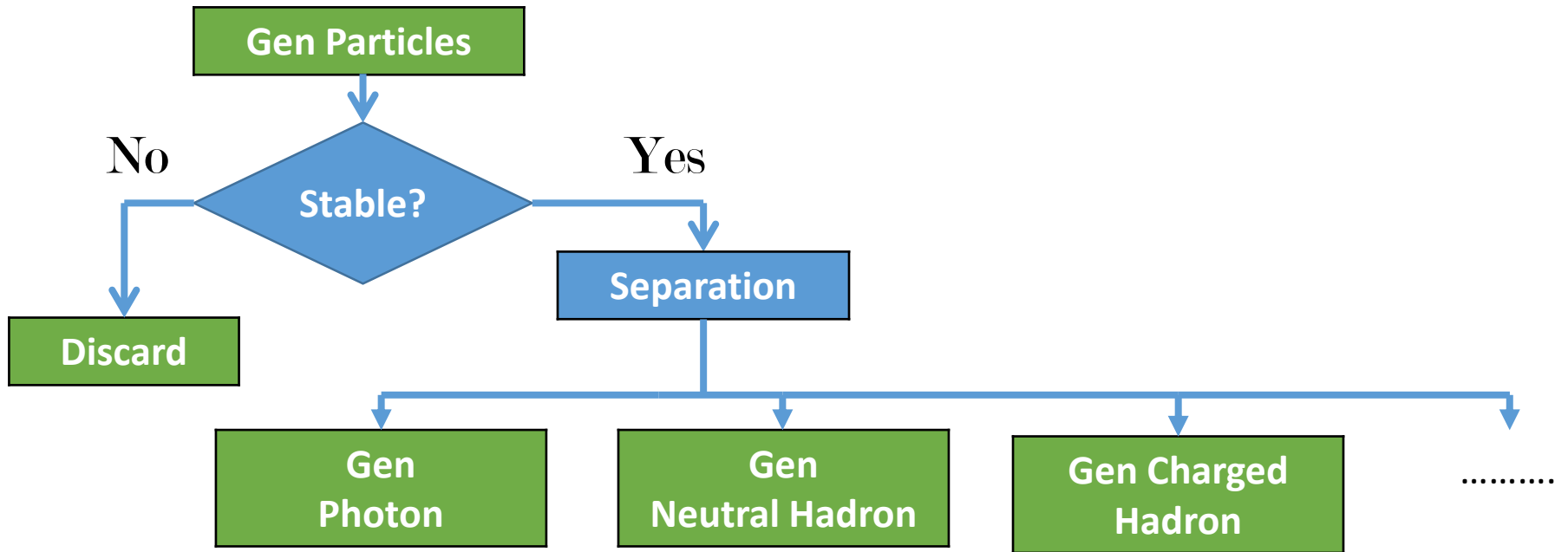
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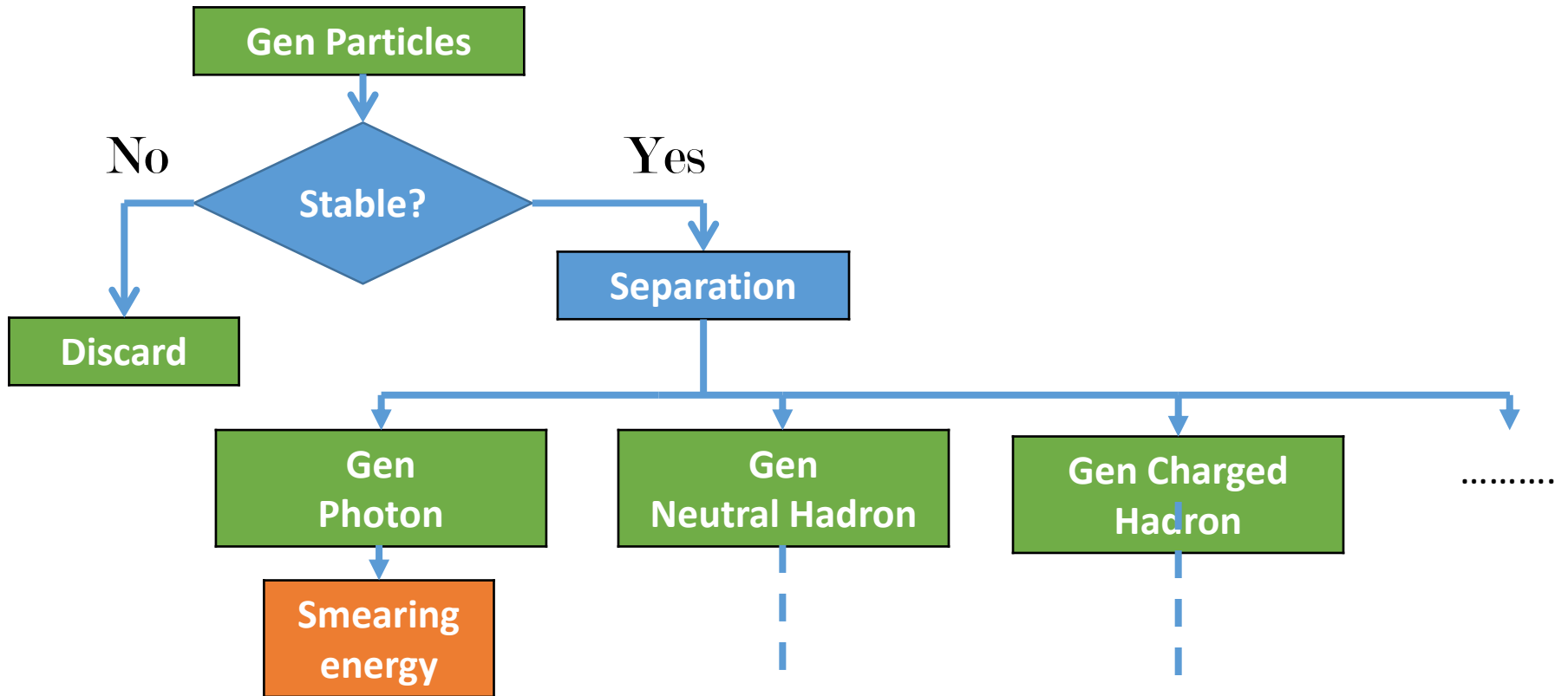
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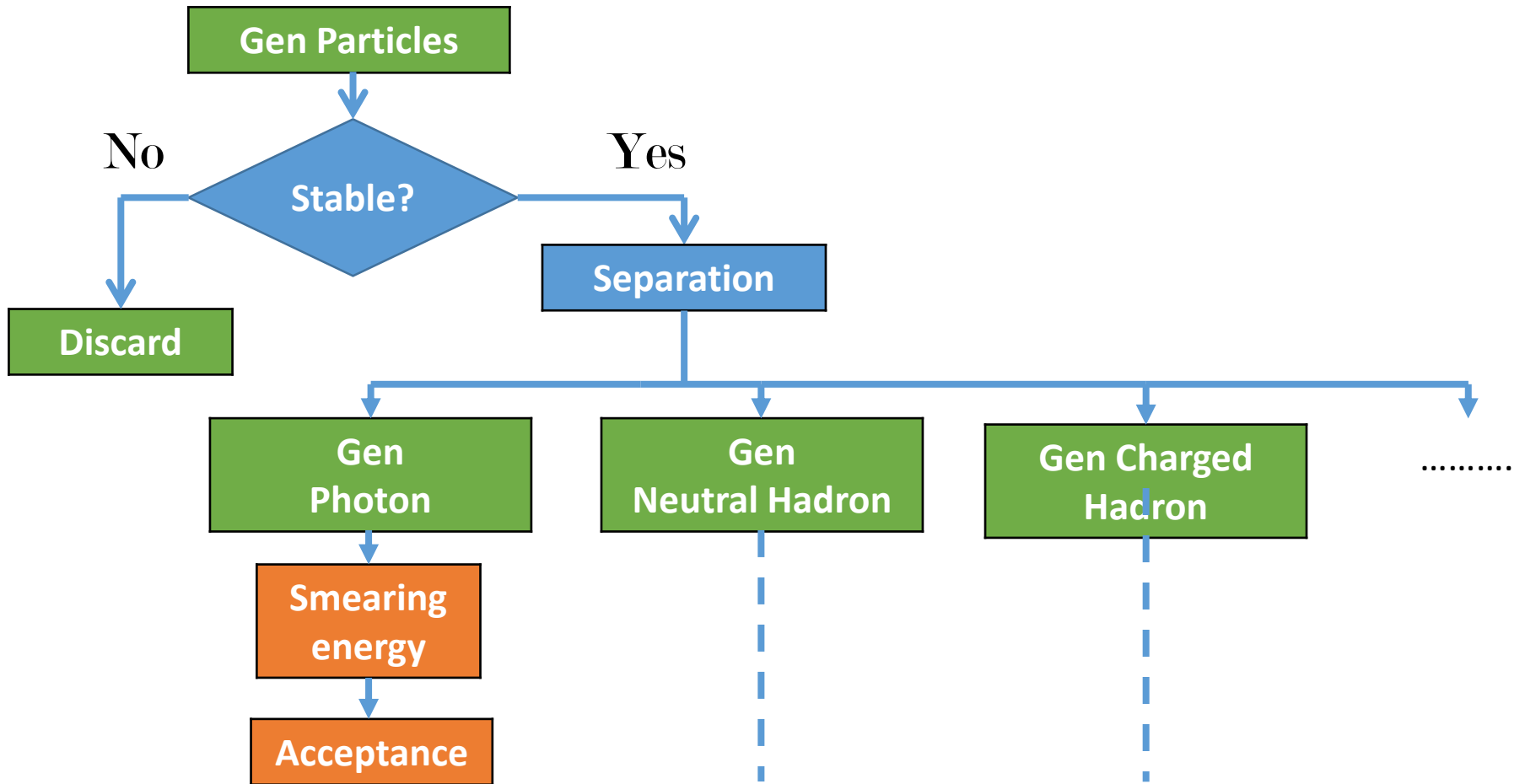
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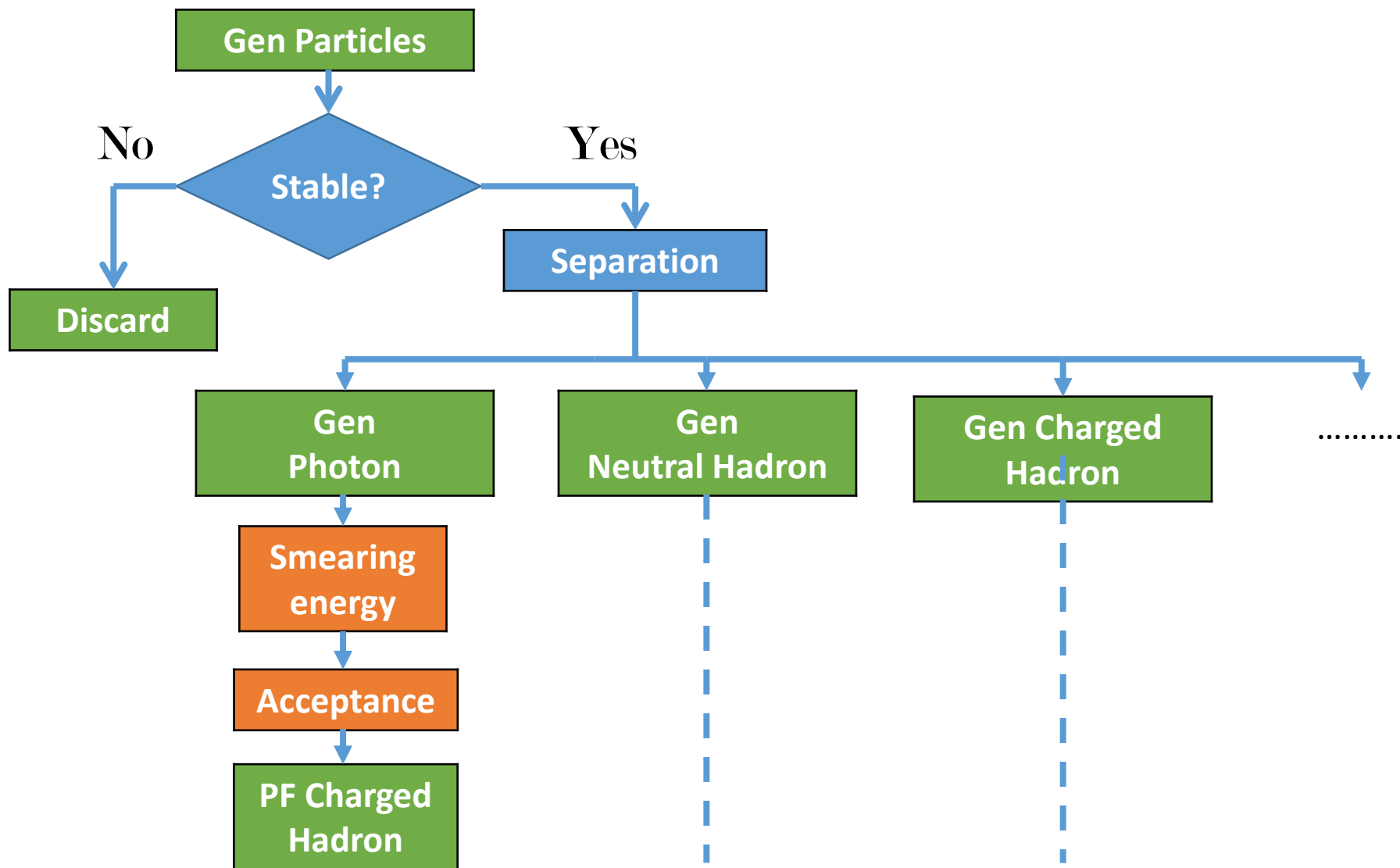
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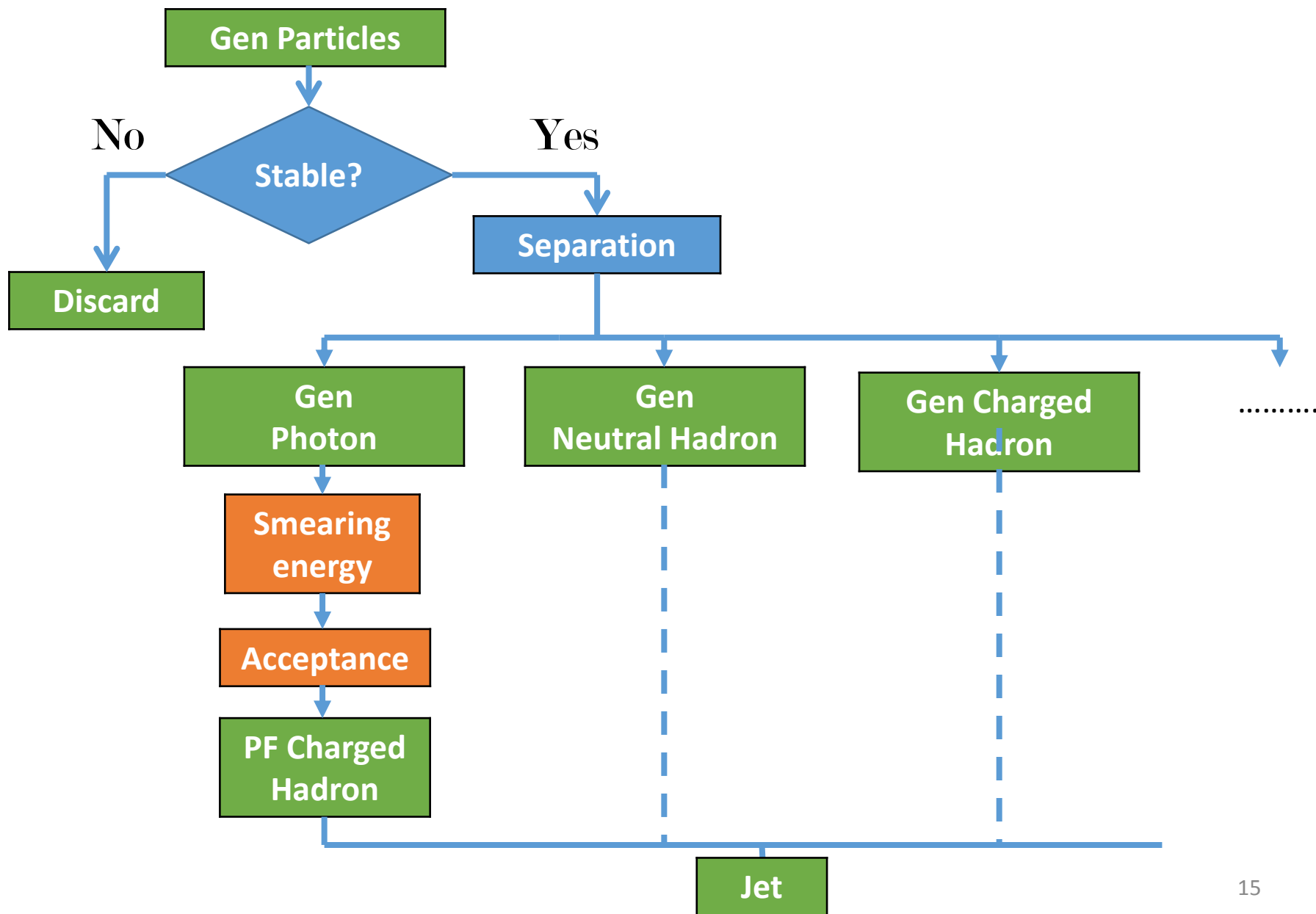
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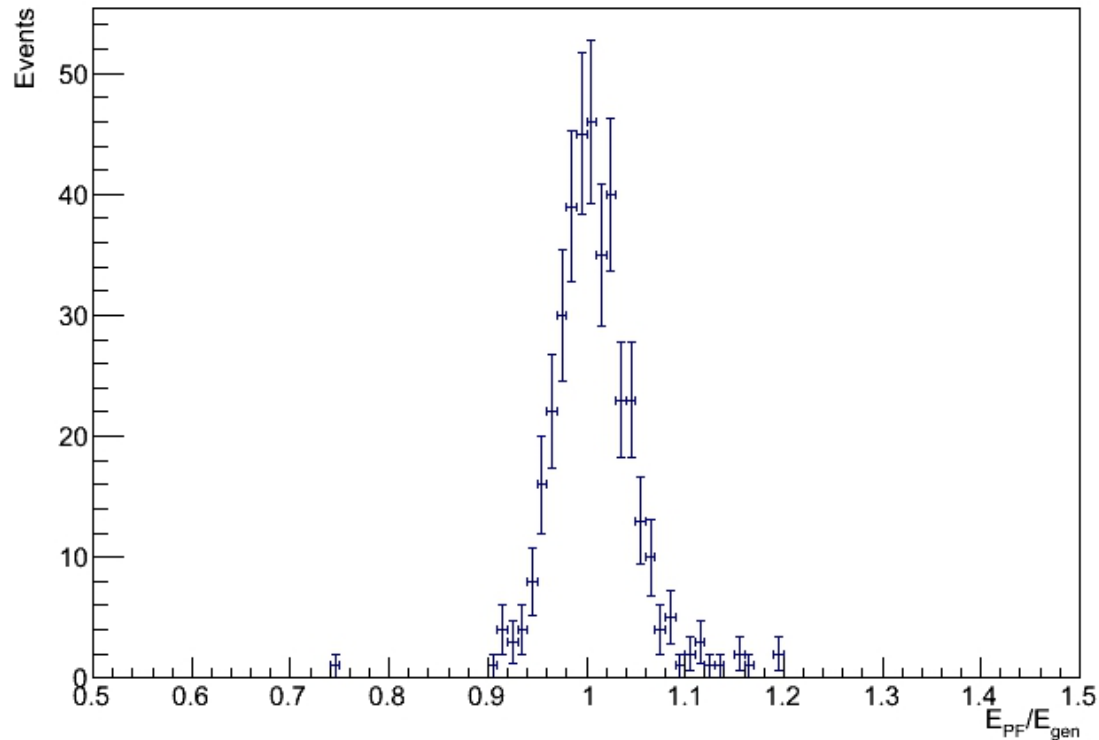
What Particle Flow is?



Measurement of the photon energy resolution

To obtain results the following technique was used:

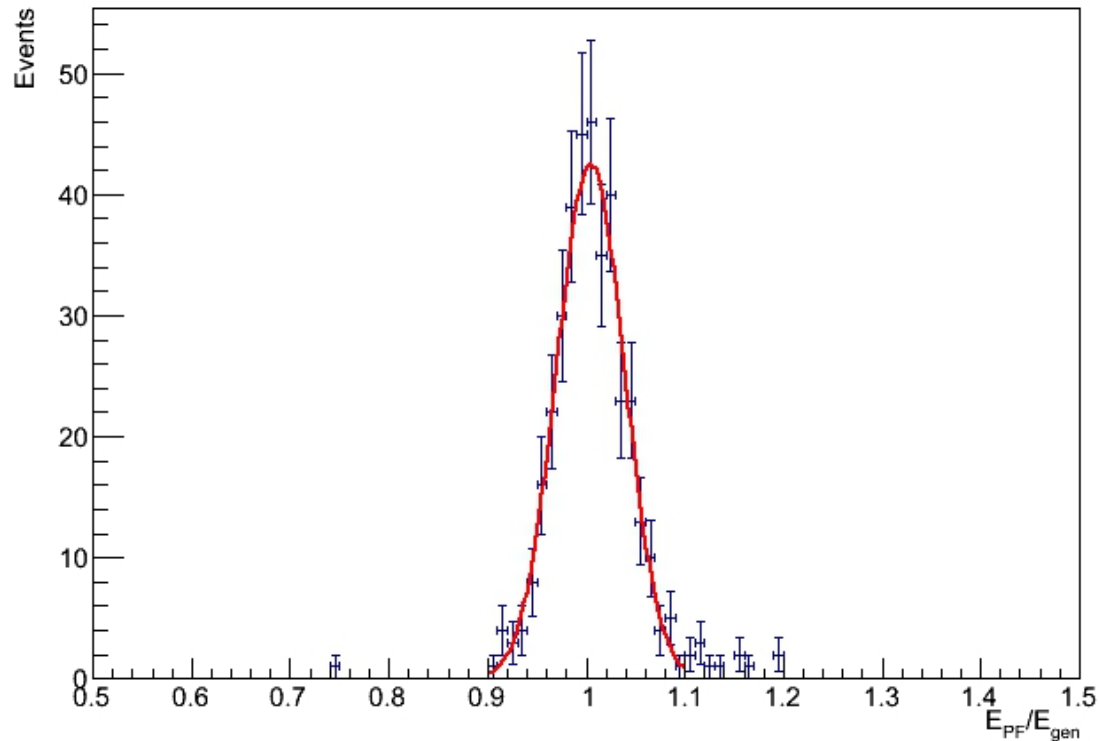
- Produce the distributions of E_{PF}/E_{gen}



Measurement of the photon energy resolution

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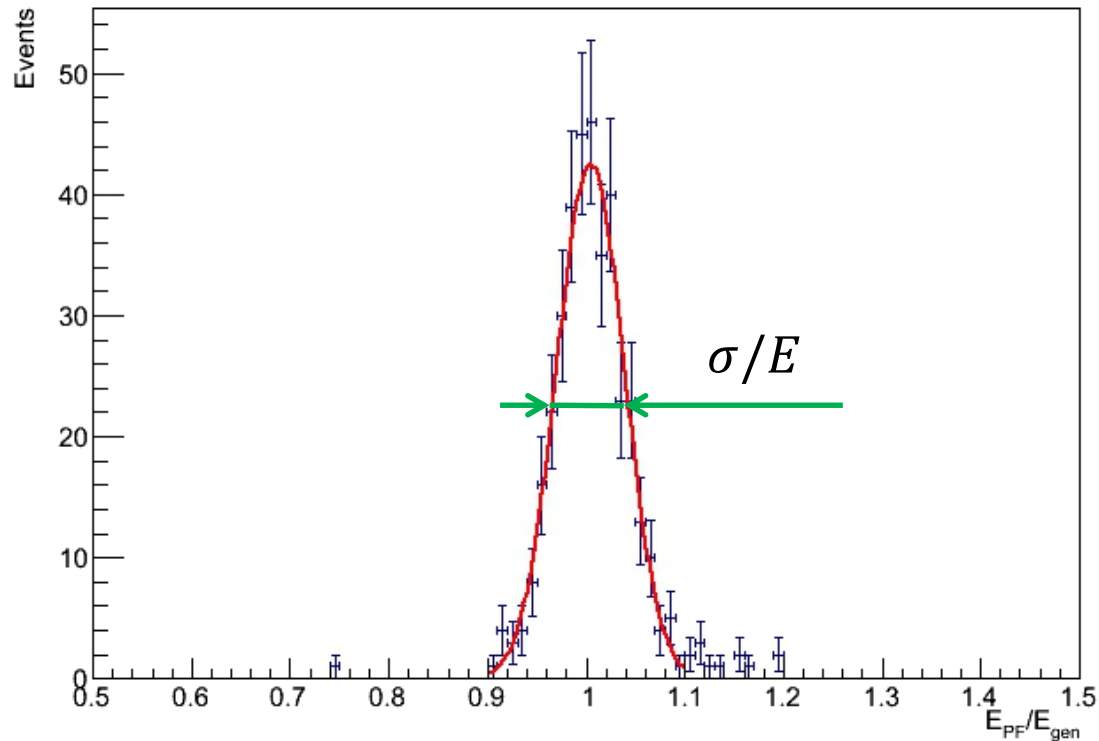
- Produce the distributions of E_{PF}/E_{gen}
- Fit it by the Gaussian



Measurement of the photon energy resolution

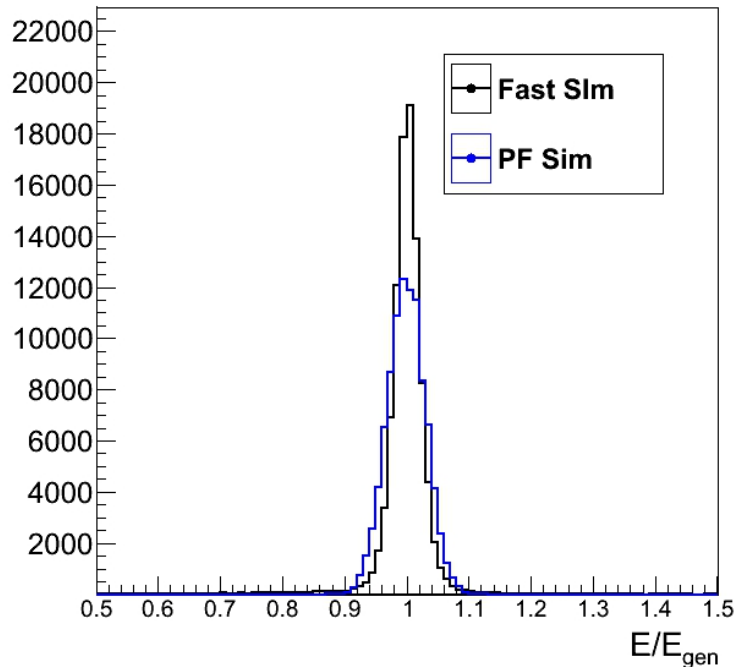
To obtain results the following technique was used:

- Produce the distributions of E_{PF}/E_{gen}
- Fit it by the Gaussian
- Obtain the relative resolution of the ECAL



From the resolution to parameters

- If we do the segmentation over energy and pseudorapidity we will get the resolution map.



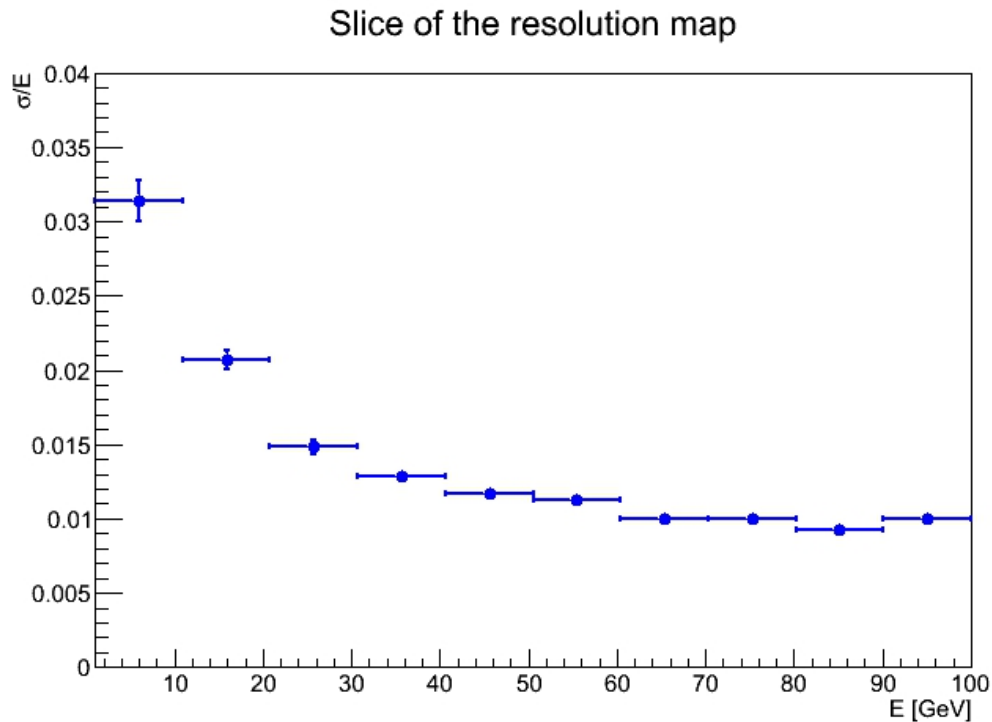
Particle gun was used to produce events

The official simulation and reconstruction of CMS was used to measure detector properties related to individual properties

A huge amount of segments requires a large statistics.
During this project 100k events samples were used.

From the resolution to parameters

- Then we can obtain a slice of the resolution map

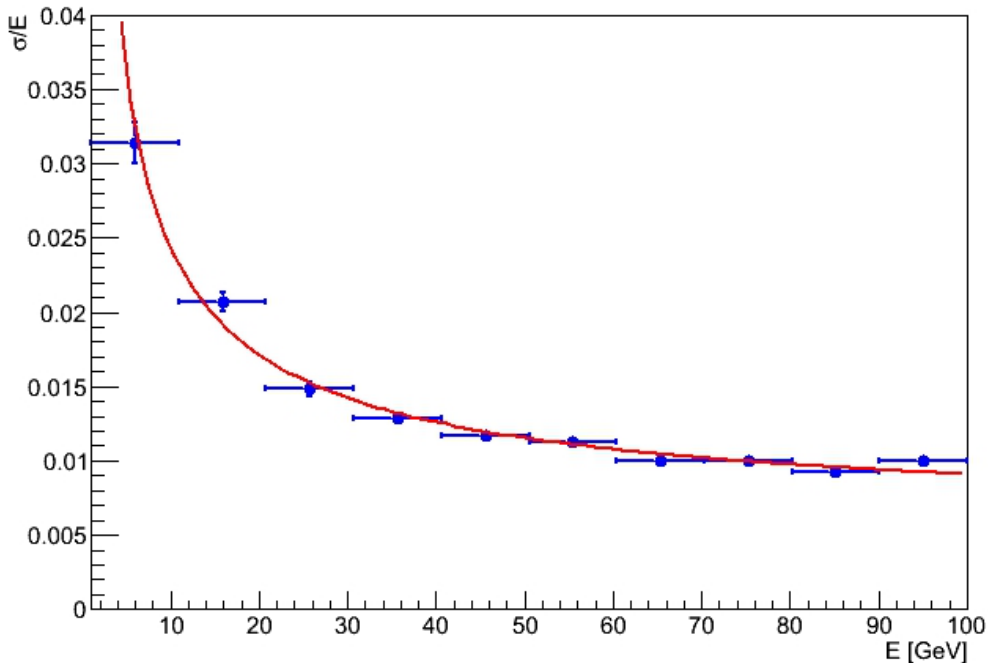


From the resolution to parameters

- Then we can obtain a slice of the resolution map
- Fit it using parameterized function of ECAL's relative resolution:

$$\frac{\sigma}{E} = \sqrt{\left(\frac{A}{\sqrt{E}}\right)^2 + \left(\frac{B}{E}\right)^2 + C^2}$$

Slice of the resolution map




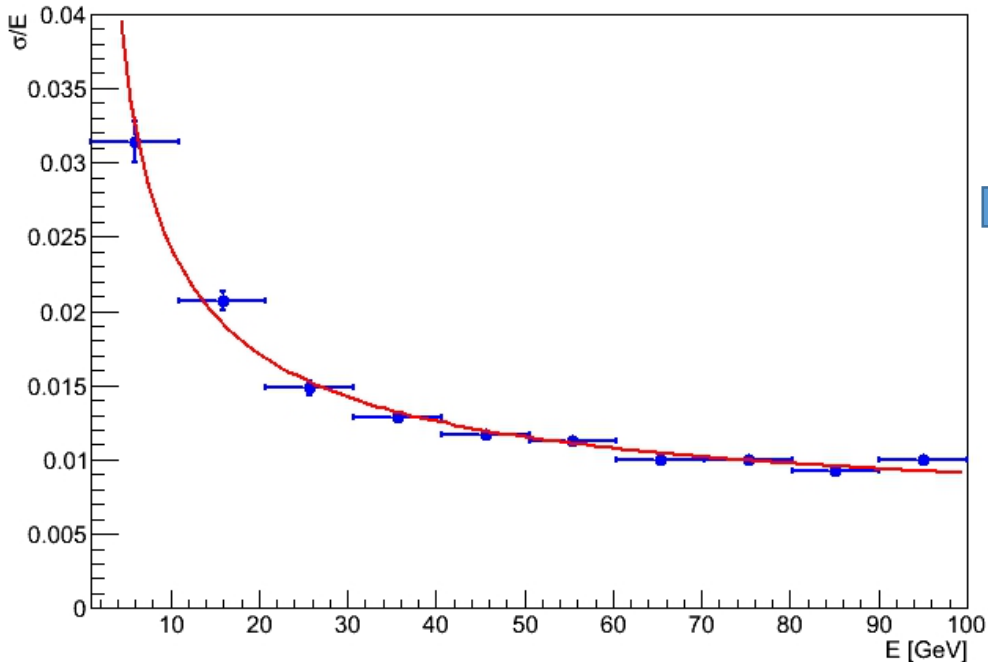
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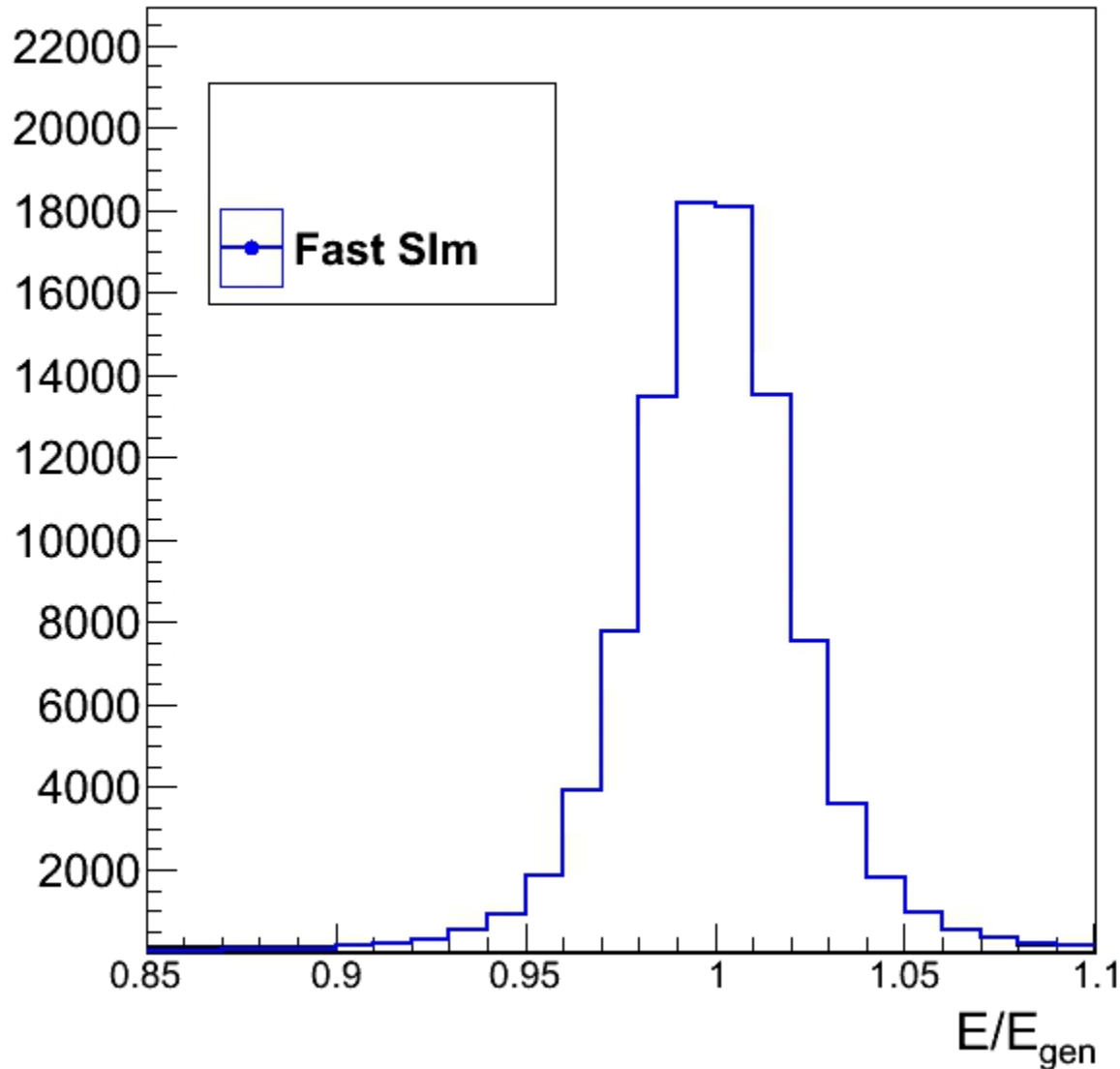
- Obtain the ECAL's parameters

Slice of the resolution map



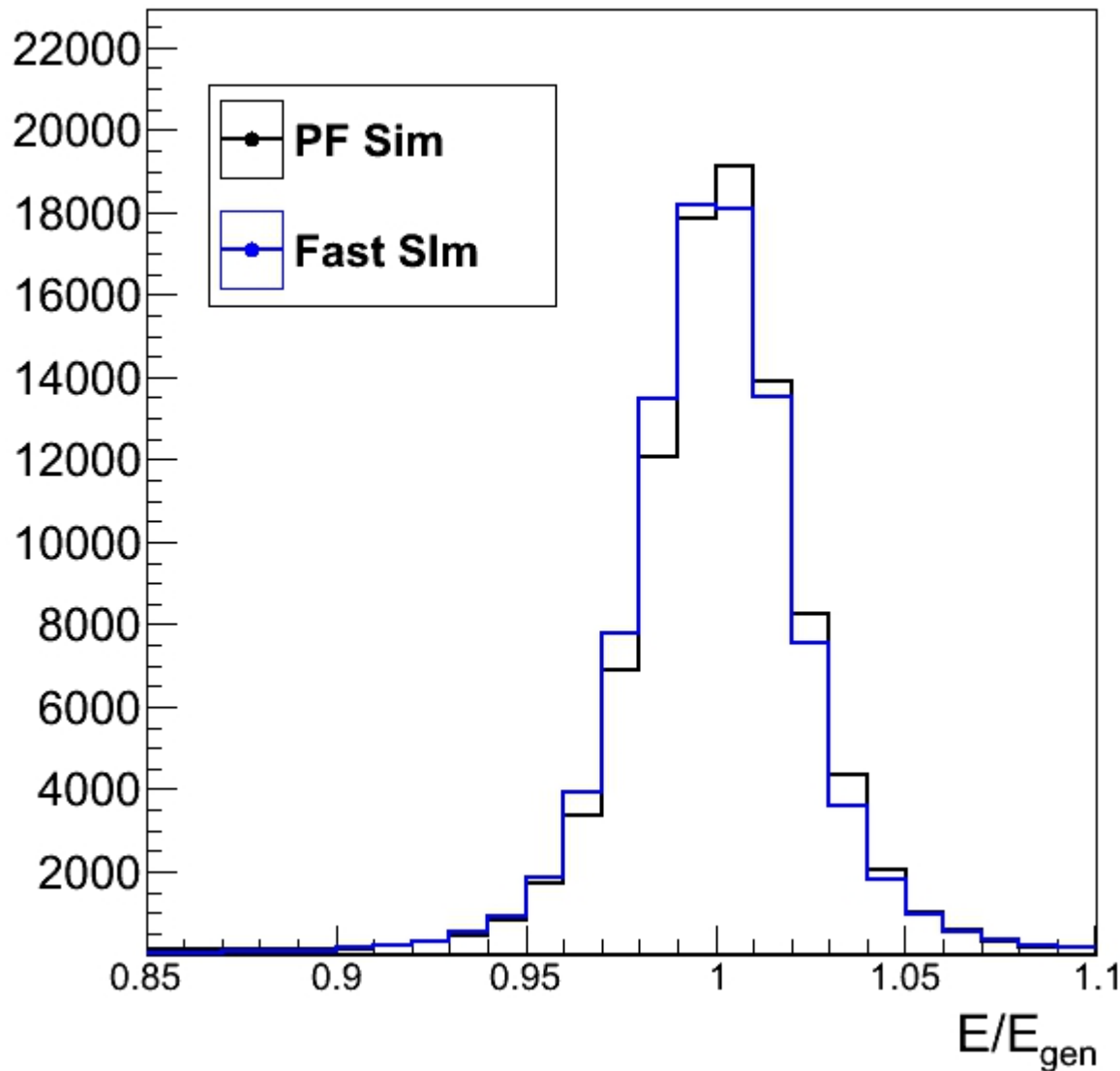
EXT NO.	PARAMETER NAME	VALUE	ERROR
1	A	1.61660e-01	5.78466e-03
2	B	1.72414e-01	5.07922e-02
3	C	1.05081e-02	1.25194e-03

Comparison of the Fast Sim and PF Sim



And what we could expect after our measurements?

Comparison of the Fast Sim and PF Sim



And what we could expect after our measurements?

Nice match!

Thanks for your attention!

Any questions?