# Validation of early pre–fall 2022 MC samples (*)

Jan Eysermans (MIT), Michele Selvaggi (CERN)

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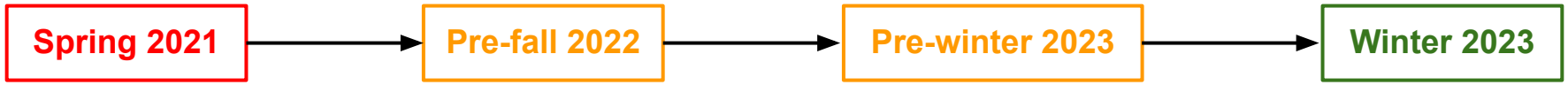
(*) Follow-up on what has been presented on Oct. 31 during the Higgs performance meeting (link)

# MC Campaigns overview




**Default Spring 2021 campaign – list of samples**

- Several issues found after using the samples by different analysis groups
- E.g. lepton isolation, electron collection broken, low track $p_T$ efficiency degradation , …

**Identify and fix the issues:**

- Several intermediate “pre” campaigns (pre-fall and pre-winter)
- Short overview in this presentation

**Aim for new Winter 2023 campaign by the end of the year**

- Will contain Delphes Particle Flow objects, isolation/overlap will be done in analysis on the fly
- Before launching the entire production, feedback required from analyzers to help final validation

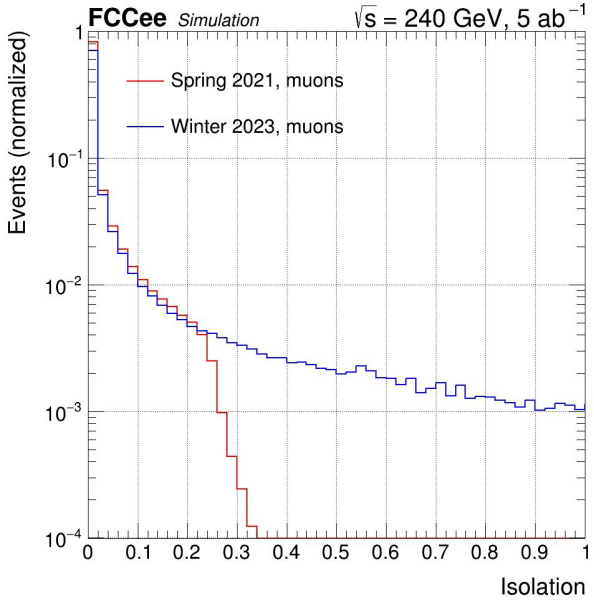
# Muon isolation

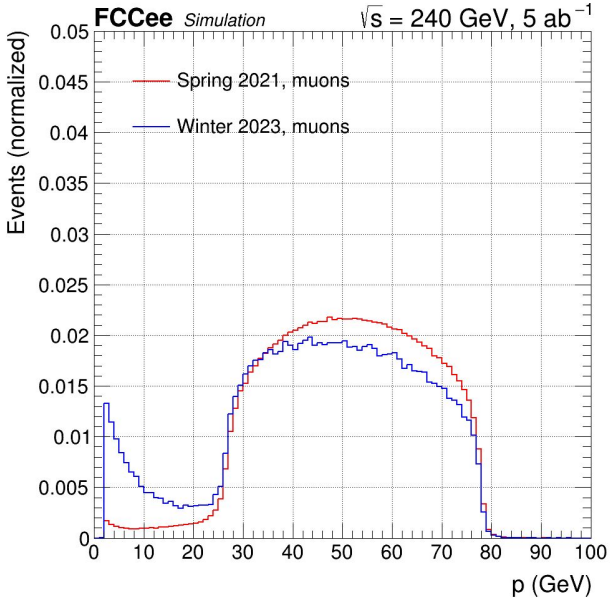
**In the Spring 2021 campaign, leptons are isolated, according to the standard isolation routine in Delphes**

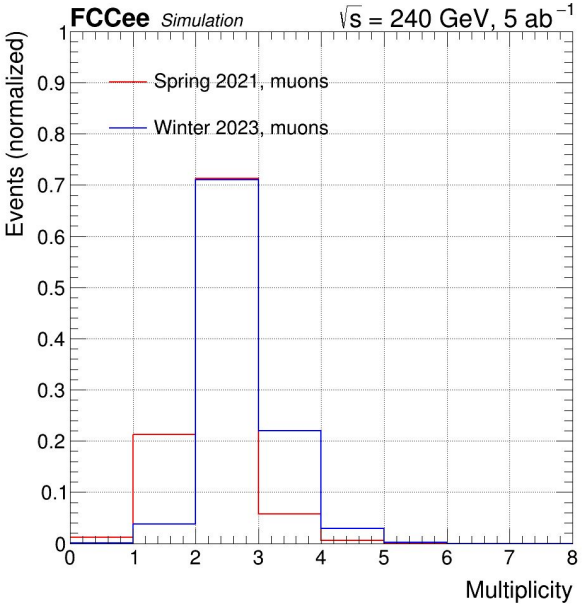
- Affects the lepton efficiency, as shown during last presentation

**In the new Delphes campaign, the objects by default will not be isolated**

- An isolation routine is written to compute the isolation on the fly
- Currently simple isolation based on momentum in user-defined cone size from RecoParticles



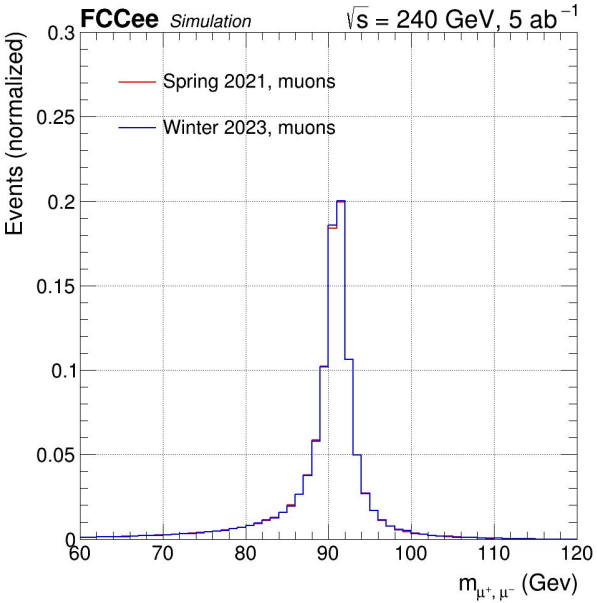



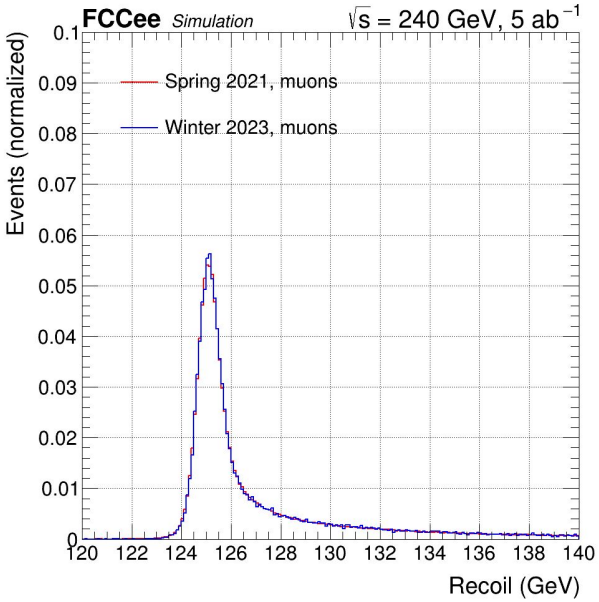



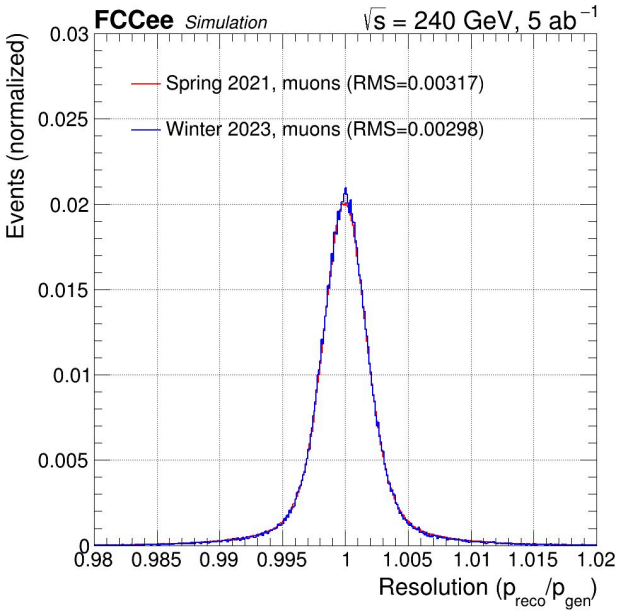
# Muon resolution

## Checked muon resolution

- Bug in initial pre–fall campaign, fixed (#122) in Winter 2023 campaign
- Resolutions are very similar



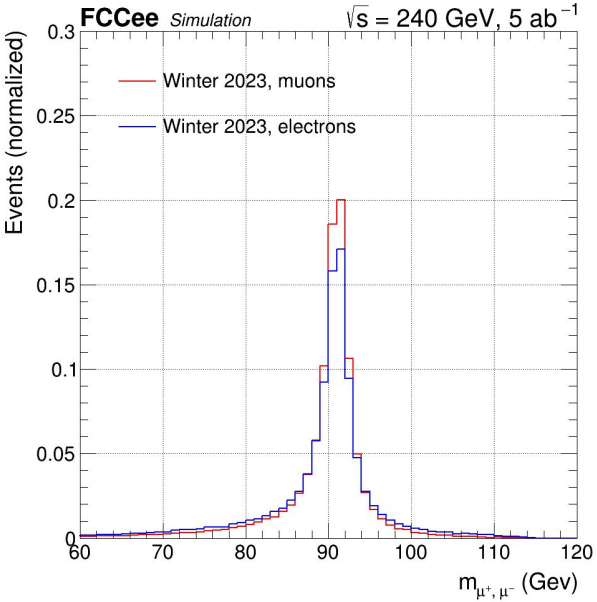
# Electrons

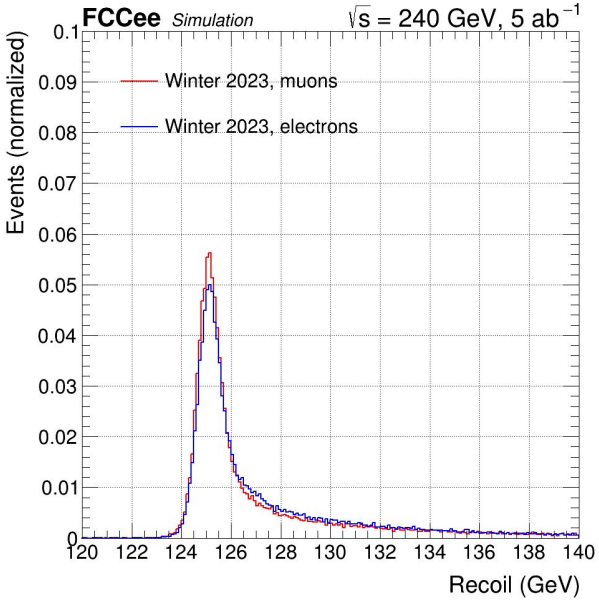
**Issues with electron collection found and fixed. Currently, in Delphes, electrons are treated identical to muons**

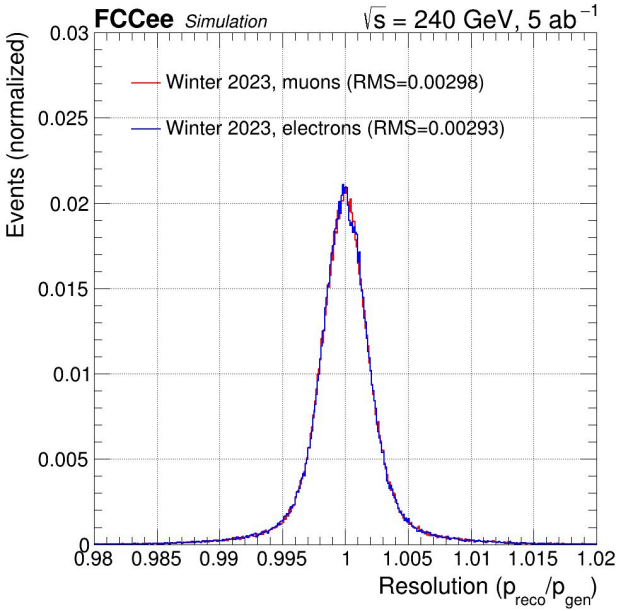
- No routines for the simulation of Bremsstrahlung in Delphes
- Momentum resolution identical to muons (taken from track covariance matrix)

## Comparison with muons

- The resolution $p_{reco}/p_{gen}$ is identical between muons and electrons, as expected
- Broader intrinsic resolution due to VBF production mode, which is enabled in Whizard



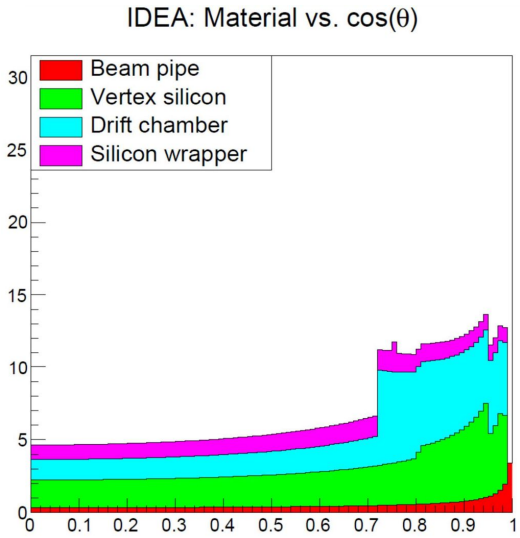
# Electron momentum smearing

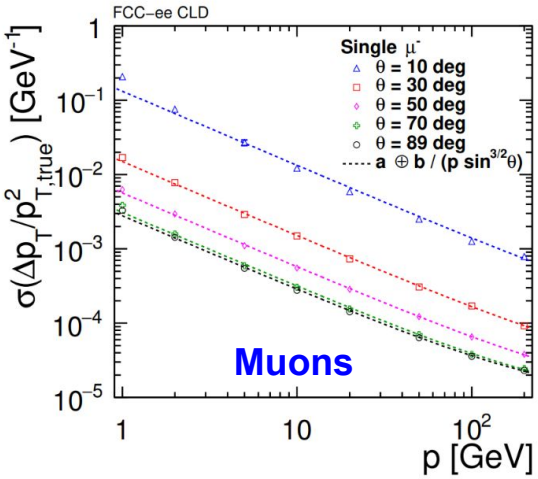
**Question arises how much the Bremsstrahlung impacts the electron resolution**

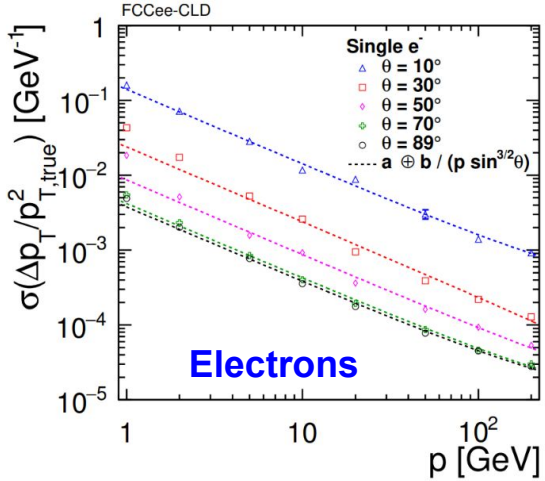
- Scales ~ linearly with material $X_0$
- Impact suppressed by measuring curvature at beginning and end of track in drift chamber

**A good estimation requires a full simulation of IDEA, which is not available yet**

- CLD did this study (see ref), comparing muon and electron resolutions
- Roughly factor of 2 worse resolution ( with $X/X_0$ (CLD) ~ 2 $X/X_0$ (IDEA) )



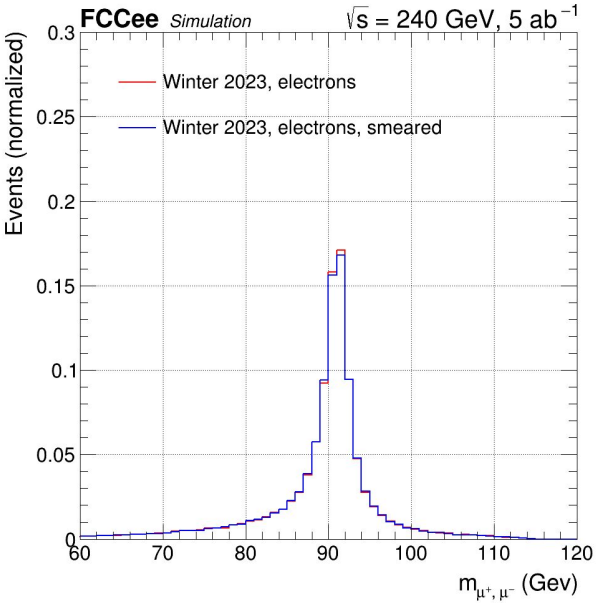
# Electrons

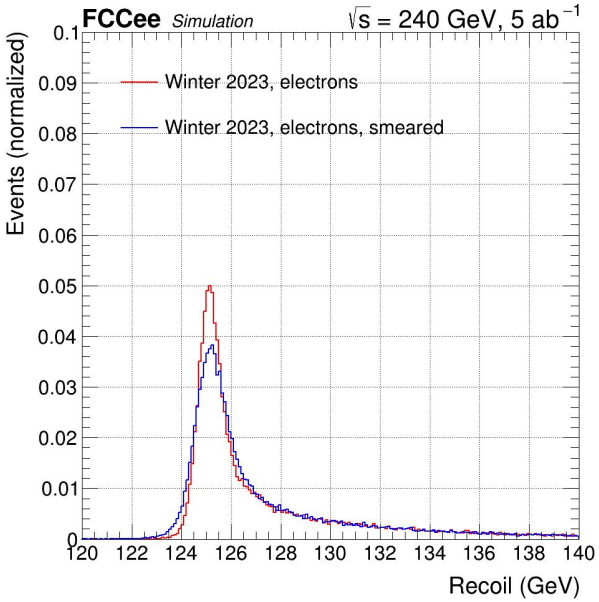
## Implemented smearing scaling in Delphes

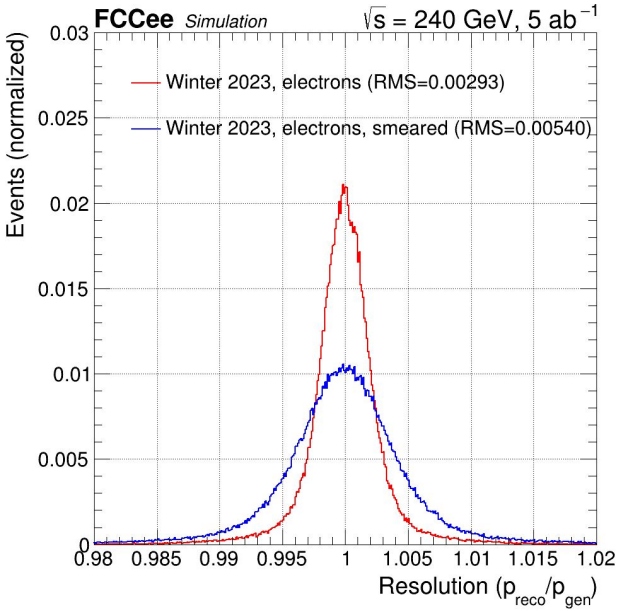
- Linear scaling of track covariance matrix
  - Electrons factor 2 (conservative)
  - Charged hadrons to be defined (currently set to 1.0)
- Exact scalings to be defined/optimized
  - Comparison with IDEA Full Sim?

```
module TrackCovariance TrackSmearing {

    set InputArray TrackMergerPre/tracks
    set OutputArray tracks

    ## minimum number of hits to accept a track
    set NMinHits 6

    ## magnetic field
    set Bz $B

    ## scale factors
    set ElectronScaleFactor 2.0
```

**Work in progress**



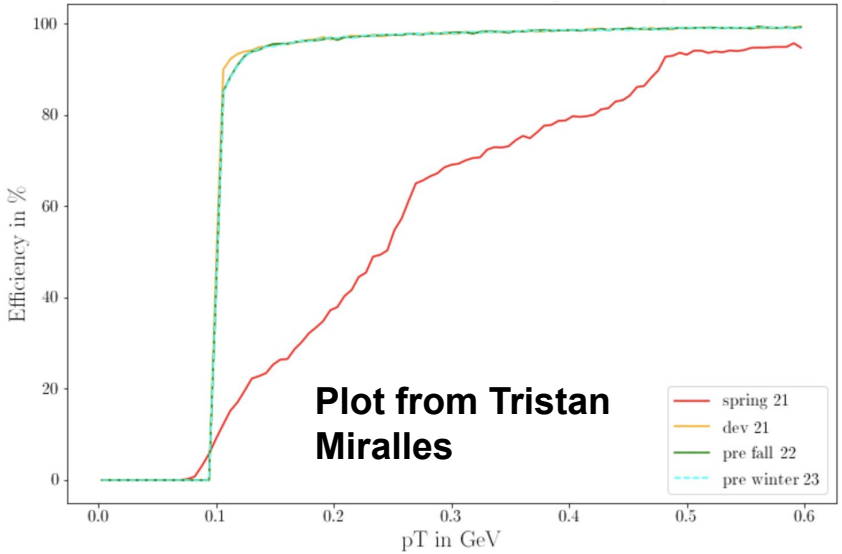



# Low track $p_T$ efficiency

**In the Spring 2021 samples, a degradation of low track $p_T$ efficiency was observed (range 0.1 – 1 GeV)**

- Efficiency = # charged RECO particles / # MC particles ()
- Based on B→KstTauTau samples

**Issue was related to a wrong track removal in the calorimeter**



# Conclusion

- Fixing and checking final issues in Delphes
- Electron smearing implemented, additional smearing factor to be optimized
- **Pre-winter 2023 campaign could be tested by other analyzers by reloading the analysis**