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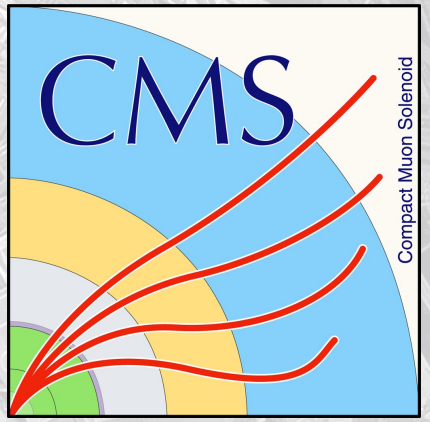

Tau Lifetime in NANO

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Tau POG

Overview

- Identified a set which can benefit analyses exploiting tau spin correlations and the tau POG can use central nanoAODs to deriving calibrations for them
- Previously proposed to add tau lifetime information to central NanoAOD but size increase is +10.7% (which was deemed unacceptable)
- Current solution is the production of custom private NanoAODs with this additional information which are also skimmed to reduce processing overhead. (Private resources → Inefficient)
- As an alternative, we had discussions in regards to custom tau-flavored Nano during a previous cross-POG meeting
  - Important to note here is that the production is only run on a subset of samples namely the tau-related MC samples and datasets.
  - In the last presentation, a thorough study of the expected storage requirements for a single Era were presented
- The feedback we got in general was not in favour of the custom nanoAOD but instead to try to reduce the event content size further to to allow from an inclusion into central Nano production
- Study into further data reductions is presented here

Further Data reductions for inclusion into central Nano

We have reduced the event content size as much as possible by removing some of the "less-useful" quantities

As a baseline, we keep all quantities needed to repeat Run-2 H→$\tau\tau$ CP analysis strategy

Note, we had hoped that the additional new information could improve the analysis strategy further, and also benefit other analyses, so there are some downsides to the reduction

Tests conducted on CMSSW_14_0_X using RelVal_TTBar sample with PU (~50k events)

- 1. Adding tau Lifetime (old PR deemed unacceptable): **10.7% Increase in kb/evt | 10.5% Increase in file size**
- 2. Removing Track parameters(+covariances): **4% Increase in kb/evt | 4.2% Increase in file size**
- 3. Same as 2 + Removal of IP length: **3.6% Increase in kb/evt | 3.9% Increase in file size**
- 4. Same as 3 + increasing the lepton cuts:
  - **Evt size is the same as (3) but, the file size is marginally smaller | 3.8% Increase in file size**
- 5. Same as 3 + Removing n_{dof} from refitted SV (Replaced with χ^2 with χ^2_{red}) + Removing n_{dof} from PV:
  - **3.57% Increase in kb/evt | 3.7% Increase in file size**

Summary

- We proposed to use option 5 from the previous slide
  - Refitted secondary vertex for 3-prong taus (with covariance matrix) + reduced χ^2 of the SV fit
  - Impact parameter vector (with significance) of the electron, muon, and tau tracks wrt PV fitted with beam-spot constraint
  - Primary vertex with beam-spot constraint (position and covariance matrix) + reduced χ^2
- This will bring a 3.6% increase in the event size and 3.7% increase in filesize
- While this is perhaps still a bit high it is a significant (~ 1/3) reduction compared to the previous PR (~11%)
- We don't think it is possible to reduce the event size further without compromising analyses
- We are preparing a PR for this which will be made later today, if we agree with the event size increase we would like this to be included in nano v14 before the 10th April deadline

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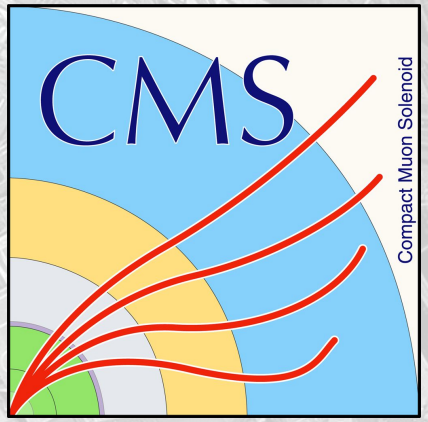
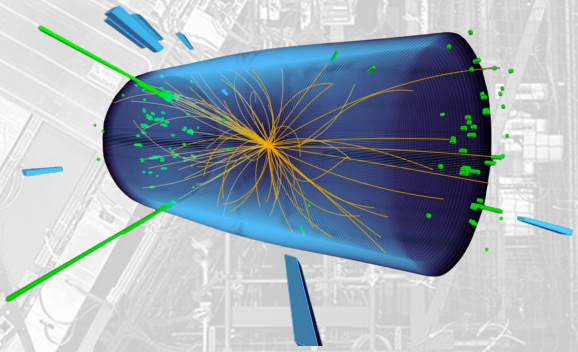
Thank you !