Model independent measurement discussion points

Stable and unstable

- Are pions usually treated as stable or unstable?
- What are the advantages and disadvantages of treating b-hadrons as “stable” or “unstable” in a measurement?
  - Do b-hadrons ever interact with the detector?
- What are the advantages and disadvantages of treating tau leptons as “stable” or “unstable” in a measurement?

Well defined?

- Which of these are
  - physically distinguishable in principle
  - Experimentally distinguishable in practice

1. Electrons from a Z decay vs electrons from a virtual photon
2. Photons from QED FSR vs Photons from the hard matrix element
3. Photons from QED FSR vs Photons from pion decay
4. Muons from a tau vs muons from the hard matrix element
5. Jets from a top decay vs jets from gluon exchange
6. Neutrinos from a W decay vs neutrinos from charm decay
7. Neutrinos from a W decay vs a Dark Matter particle
8. Jets from a gluon vs jets from a quark

Questions:

1. In which ways does the electroweak part of the Standard Model differ from its QCD part?
2. What role does the input parameter scheme play?
3. What role does the renormalisation scheme play?
4. How are higher-order corrections defined?
5. What characterises IR safety in the EW sector? What are its consequences?
6. What are the consequences of the fact that the EW sector of the Standard Model is a broken symmetry? How does it impact NLO calculations?

Antonio Ortiz
Instituto de Ciencias Nucleares, UNAM
antonio.ortiz@nucleares.unam.mx

Instituto de Ciencias Nucleares UNAM

September 14, 2021

1. What is the energy density estimated for central heavy ion collisions at the LHC energies? Can we still describe partons as a collection of distinct individual hadrons?

2. What are some signatures which indicate the formation of QGP in heavy ion collisions?

3. The nuclear modification factor is significantly below unity at high pT in central AA collisions. How do we understand this effect?

MPI and HI-like effects

Instituto de Ciencias Nucleares UNAM

Can we infer N_{mpi} (target variable) from a given a set of input variables? → Regression problem

We use a multivariate regression technique based on Boosted Decision Trees (BDT) with gradient boosting training, which is implemented in TMVA (arXiv:physics/0703039)

We use the existing data on p_{T} spectra as a function of multiplicity [OK for MPI studies in minimum-bias pp collisions]

- **Input variables:** Event-by-event average p_{T} of charged particles / Multiplicity

For systematic uncertainties other set of input variables was considered: Charged particle multiplicity in the pseudorapidity region covered by VZERO detector / Transverse spherocity