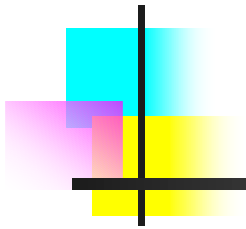


Jet/MET status

B.Andrieu (LPNHE, Paris)

Outline:

- Status
- Certification plans
- Projects
- Summary

Jet-ID: status of cuts

- Last version v5.0 for p14 (dec. 2003)
  - 0.05 < EMF < 0.95
  - CHF < 0.4
  - HotF < 10
  - n90 > 1
  - L1 confirmation: L1CONF = l1set/ (p_T * (1- CHF)) > 0.4 (CC,EC)
    > 0.2 (ICD)
- Recent studies (T. Golling) suggest to keep only
  - 0.05 < EMF < 0.95
  - CHF < 0.4
  - L1 confirmation
    - Same as before (w/o remapping) OR
    - L1CONF > 0.4 (CC,ICD,EC) (w/ remapping)
- Proposed classification
  - "good" = passes all above cuts
  - "bad" = not good and passes L1 confirmation
  - "noise" = does not pass L1 confirmation

Jet-ID: certification goals

Jet-ID certification

- will not include (too analysis dependent):
  - trigger efficiencies
  - systematic uncertainties

- should include:
  - statistical uncertainties
  - a tool and/or a prescription to redo the efficiencies, so analysers can estimate the systematic uncertainties in their analysis in a consistent manner.
  - documentation: how the tool should be used, why, D0-Note, etc.
  - efficiencies as a function of p_T and detector η
  - maybe also as a function of vertex (primary, Ariel's code?) z-coordinate.

Note: Tobi's code was written for top_analyze, but we aim for an automated process to produce these functions (jet_cert package in D0 Framework)

Jet-ID: certification open questions

- Use tracks and vertices to confirm jets (and conversely)
  - CPF (vtx) = sum (p_T tracks in jets within 1 cm from PV) / sum (p_T all tracks in jets)
  - Minimum Bias Probability
  - Help to identify two types of background:
    - superposition of min. bias with hard scattering outside the barrel region
      → can be re-vertexed
    - Energy contribution from additional min. bias interactions
      → important for jets with p_T < 20 GeV only
  - See Ariel Schwartzmann's talks at CALGO for more details
- Jets outside L1 coverage (old runs)
  - Use old jet quality cuts (f90, CHF,...)
  - Include track confirmation?
- Parametrize as a function of z_{vertex} for jets in ICR?
- Selection/trigger biases?
  - Jet-ID efficiency is measured using a probe jet back-to-back to a tag (γ, jet)
    → Additional activity (e.g. extra jet) can cause mismatch between tag and probe
  - Should we veto activity outside probe (and tag) window?
  - If N jets are reconstructed where you expect N –1 or N +1, is it inefficiency?
    → validity of efficiency as a single number to be applied on a per jet basis?
  - See also Project IV below.

Jet-ID projects (I)

L1 confirmation studies

- L1 remapping for ICR
  - L1 confirmation not more efficient w/ remapping

  → cross-check if it is done correctly
  - Correct and/or optimize L1 confirmation cut w/ remapping
- L1 towers performance and stability with time
  - use 0 bias - no lumi events within normal runs
  - improve L1 confirmation based on this information
- Calculation of L1 confirmation variables
  - treatment of very high energy towers (L1 readout saturates at 64 GeV)
  - treatment of low (or even negative) energy towers
    → alternatives to truncating the list to 100 hottest towers?
  - treatment of non-conical (merged and/or splitted) jets
  - distribution of L1 energy for L1 towers shared between two jets

Jet-ID projects (II)

Monte Carlo simulation tuning

- Compare jet-shape related variables in data to Monte Carlo
  - variables:
    - η-width, ϕ-width, f90
    - EMF, HADF, CHF
    - jet profiles: $dp_T/d\eta$, $dp_T/d\phi$
    - $<\psi(r/R)>$ = fraction of jet transverse energy inside a cone of radius r
  - data sets: γ+jets, dijets (beware of trigger bias), W/Z + jets, min. bias
  - Monte Carlo: detailed simulation, PMCS

- Try to improve jet simulation
  - Provide information to simulation experts
  - Follow up modifications and give feedback when implemented

→ Joint project with calibration (e/π tuning)?

Jet-ID projects (III)

Study of cone-jet algorithm

- Efficiency at low p_T
  - Cut at $p_T/2$ during proto-jet formation
    → gain of efficiency of 6 % for p_T ~ 15 GeV (E. Busato, CALGO, 26 Oct. 2004)
  - Values of preclustering parameters
    - p_T^{min} cut on towers used as seeds for precluster (500 MeV)
    - p_T^{min} cut at the end of preclustering (1 GeV)
  - Preclusters too close to an already found proto-jet not used as seeds
- Performances at high luminosity (= higher event multiplicity)
  - Timing, number of fake jets
  - No cut on proto-jets before merging/splitting
    note: there was a 8 GeV cut in RunI
- Differences with CDF
  - Lost jets problem not seen
  - Smaller Search Cone not used
- See D0-note 4457 for more items

Jet-ID projects (IV)

Jet-ID universality w.r.t. physics sample

- Jet-ID efficiency is
  - higher at low p_T in "soft" events (low p_T jets leading jets) than in "hard" events (low p_T jets radiated from the leading jets)
    (Run I D0-note 3324, figs. 5 and 8)
  - different for jets having undergone or not splitting and merging
    (Run II D0-note 3985, fig. 18)
- compare jet-ID efficiency between minimum bias, di-jet and gamma-jet events
- towards a jet-ID valid for all samples
  - study parameterization of jet-ID efficiency and purity as a function of jet transverse shape-related variables (e.g. transverse energy density, eta_width, phi_width, ...)

Note: no more necessary if jet simulation in Monte Carlo reproduces data, otherwise might be very useful

MET: status

- Propagation of EM scale and JES corrections to MET
  - This improves data/MC comparison (Z→ ee)
  - Lower QCD background in Wbb/WH analysis when using corrected vs uncorrected MET
- MET corrections for d0correct in p16.05.00
  - EM, mu, jets MC smearing propagated to corrected MET
  - No additional over-smearing of MET (analysis dependent)
- MET code in p17.00.00 checked
- JetMET LBN selection certification version 6.0
  - Includes all pass1/pass2 data
  - met_dq package in cvs

MET: certification goals

MET certification

- will not include (too analysis dependent):
  - missing ET fake rate
  - missing ET cut efficiency
- should include:
  - best MET definition to be used by analysers
  - official code to get the certified MET definition
  - official code to allow the users to perform MET corrections (e.g. possibility to apply MET corrections for private ID-definitions of good objects)
  - reference plots for certified MET definition on selected samples (W/Z+jets, QCD dijet)

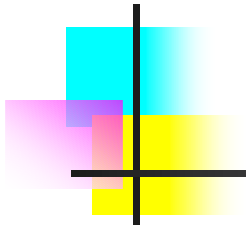
Note: code & procedure in development for an automated process (met_cert package in D0 Framework)

MET: studies (for certification or later)

- With t42 in killing mode, keep CH cells for uncorrected MET computation instead of adding the CH fraction of good jets?
- Uncorrected MET (METD) includes "noise" (not L1 confirmed) jets
  → should these noise jets be removed from MET calculation?
- What is a "bad" jet (L1 confirmed)? Should we correct it for JES?
- Overlap between Jet and EM definition?
  → should be solved when JES depends on EM fraction
- Fake muons using "medium" criteria in d0 correct cause large MET tail
- Old (RunI) MET correction for calorimeter energy deposit of the muon
- Main problem:
  - Most analyses applied huge over-smearing on EM/muon/jets in MC
  - Even after propagating this smearing to MET, large discrepancy still present
  - Problem with calibration of unclustered energy?
    - Large scalar ET differences between data and MC in Z→ ee observed
    - More studies and official calibration needed

MET: projects

- Uncorrected MET comparison : pass1 vs pass2 (~= without/with t42)
  manpower : 1 Ph.D/Professor
  timescale : 1 month
  contacts : Sophie Trincaz-Duvoid, Patrice Verdier
- Effect of p17 calorimeter calibration on uncorrected MET
  manpower : 1 Ph.D/Professor
  timescale : 1-3 month
  contacts : Ursula Bassler, Jan Stark, Sophie Trincaz-Duvoid, Patrice Verdier
- Detailed studies on missingET corrections in the d0correct framework
  manpower : 1 Ph.D/1 post-doc
  timescale : 3 months
  contacts : Frederic Deliot (d0correct), Emmanuel Busato (jet), Raimund Stroehmer (muon)
  Jan Stark (EM), Patrice Verdier (MET)
- Unclustered energy studies
  manpower : 2 Ph.D/postdoc
  timescale : 6-9 months
  contacts : Ashish Kumar, Robert Kehoe, Kirti Ranjan, Brajesh C. Choudhary (z->ee)
  Sophie Trincaz-Duvoid, Patrice Verdier
- Met certification package : met_cert → Samuel Calvet
  manpower : 1 Ph.D
  timescale : 6-9 months
  contacts : Sophie Trincaz-Duvoid, Patrice Verdier



Summary

- Jet/MET are essential ingredients for (almost) all analyses
- Lots of projects for short/mid/long term identified
- Manpower needed

→ please join!