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VBTF plans with 0.1 to 1 pb^{-1} data

Goals

The VBTF goal for ICHEP is to submit for publication a paper describing measurements of:

- inclusive W, W+, and W- production cross sections, in electron, muon, and combined channels
- inclusive Z production cross section, in electron, muon and combined channels
- the inclusive cross section ratio W/Z in electron, muon and combined channels
- the inclusive cross section ratio W+/W- in electron, muon and combined channels

The target luminosity for these measurements is roughly 1 pb^{-1}. At this luminosity, the expected statistical precision for the Z cross section is 6% per channel. At lower luminosities, the Z samples are inadequate to estimate lepton efficiencies and MET modelling, and the measurement strategy must rely on simulations, W samples, and other control samples to interpret the observed W and Z signals as cross section measurements. As the luminosity of good CMS runs delivered in time for ICHEP cannot be predicted with certainty, the VBTF must plan to support both measurement scenarios. In the event that 1 pb^{-1} is quickly achieved, the lower luminosity techniques can serve as cross checks and early indicators of analysis performance.

The successful achievement of VBTF publication goals depends largely on successful commissioning of lepton, missing ET, and luminosity measurements. The task force will therefore share a number of tasks with the commissioning efforts of the corresponding DPGs and POGs.

Organization

The task force is led by Juan Alcaraz and Jeffrey Berryhill, with Georgios Daskalakis and Luca Lista serving as deputies. The VBTF is a subunit of the EWK PAG which reports to the EWK conveners.

Detailed task lists for performing the measurement will be specified in advance. Related tasks are grouped together, and are to be conducted by teams in close contact with one another.

Teams

Muon ID and muon reconstruction efficiencies in Wmunu and Zmumu

Team membership:MUON POG + Nicola Amapane, Alexey Svyatkovskiy, Adam Everett, Hwidong Yoo, Javier Santaolalla, Begona De La Cruz, Andy Kubik (task coordinator), Stoyan Stonyev, Alexey Drozdestskiy, Clara Jorda, Jordi Duarte, Ivan Vila, Rocio Vilar, Lara Lloret, Alicia Calderon, ...

Objectives
Study and evaluate the validity of the baseline muon ID criteria for Wmunu and Zmumu. Propose modifications or alternatives if necessary.
Study, correct/determine muon reconstruction inefficiencies in the context of Wmunu and Zmumu MC-biased cross section measurements

Muon isolation efficiencies in Wmunu and Zmumu

Team membership:MUON POG + Nicola Amapane, Alexey Svyatkovskiy, Adam Everett, Hwidong Yoo, Javier Santaolalla, Begona De La Cruz, Andy Kubik, Stoyan Stonyev, Alexey Drozdestskiy (task coordinator), Clara Jorda, Jordi Duarte, Ivan Vila, Rocio Vilar, Lara Lloret, Alicia Calderon, ...

Objectives
Study and evaluate the validity of the baseline muon isolation criteria for Wmunu and Zmumu. Propose modifications or alternatives if necessary.
Study, correct/determine muon isolation inefficiencies in the context of Wmunu and Zmumu using random cones (+phase space template

Electron ID and electron reconstruction efficiencies in Wenu and Zee

Team membership: Francesca Cavallari, Josh Bendavid, Nikolaos Rompotis,Giovanni Franzoni,Jason Haupt ,Kevin Klaploetke , Jeremiah Mans ,Claude Charlot , David Sabès , Roko Plestina, Roberto Salerno , Roko Plestina , Damir Lelas , Ivica Puljak , Christos Lazaridis

Objectives
Study and evaluate the validity of the baseline electronID criteria for Wenu and Zee. Propose modifications or alternatives if necessary.
Study, correct/determine electron reconstruction inefficiencies in the context of Wenu and Zee MC-biased cross section measurements

Electron isolation efficiencies in Wenu and Zee

Team membership: Francesca Cavallari, Josh Bendavid, Nikolaos Rompotis,Giovanni Franzoni,Jason Haupt ,Kevin Klaploetke , Jeremiah Mans ,Claude Charlot , David Sabès , Roko Plestina, Roberto Salerno , Roko Plestina , Damir Lelas , Ivica Puljak , Christos Lazaridis

Objectives
Study and evaluate the validity of the baseline electron isolation criteria for Wenu and Zee. Propose modifications or alternatives if necessary.
Study, correct/determine electron isolation inefficiencies in the context of Wenu and Zee using random cones (+phase space template)

MET Commissioning (EWK/JETMET)

Team membership: Michail Bachtis, Kira Grogg, Chiara Rovelli, Emanuele Di Marco, Mara Senghi Soares, Carmen Diez, Massimo Nespolo, Stefano Lacaprara, Matthieu Marionneau, David Wardrope, Robin Nandi, Phil Dudero, Chris Rogan, Artur Apresyan, Maria Spiropulu, Florent Lacroix, Meenakshi Narain, Gena Kukartsev, Michael Segala

Task	Team members	Status
W Events - after a tight selection but loose cut on MET		not started yet

- how well does the shape of the MET distribution in the MC match real data?
  - ♦ demands control of the background as well
  - ♦ critical: position and shape of the peak (maybe better to look at MT)
  - ♦ check the tail to the high end
  - ♦ check events with a jet veto - probes the lepton contribution
  - ♦ check events with an energetic jet - probes the jet contribution
- what is the composition (thinking of PF) ?
- Compare CaloMET, tcMET and PFMET on an event-by-event basis
  - ♦ examine events in which differences are large - is there any sign of an error?
  - ♦ are there events in which one method gives an unusually high value?
  - ♦ if so, what is the reason?

Task	Team members	Status

Z Events - should already be very clean		not started yet

- how well does the shape of the MET distribution in the MC match real data?
  - ♦ check events with a jet veto - probes the lepton contribution
  - ♦ check events with an energetic jet - probes the jet contribution
- what is the composition (thinking of PF) ?
- are the parallel and perpendicular components of the hadronic part (Uperp and Uparallel) well simulated?
- which MET is best (has the best resolution)?
  - ♦ Since there is no intrinsic large MET component for Z events, we can use them to make a data-driven comaprison.
  - ♦ Drop one of the leptons and recalculate the MET. Compare to the value before dropping the lepton.
  - ♦ Which method has the narrowest distribution of the difference?
  - ♦ Is the distribution of the difference well simulated?

Task	Team members	Status
Min-Bias and/or di-Jet Events - should have little intrinsic MET		not started yet

- are there tails to the MET?
- is the MET mean and rms stable as a function of time and instantaneous luminosity?
- is the MET distribution, and the components to the MET, reproduced by the MC?

Online Muon Selection (EWK/Muon POG/TSG)

Team membership:Muon POG HLT + L1 Trigger DPGs + Cristina Botta, Begona De La Cruz, Monika Jindal, Ivan Furic, Hwidong Yoo, Gian Piero Di Giovanni, Joe Gartner, ...

Task	Team members	Status
Trigger performance studies		
Use events triggered by non-muon triggers (min-bias, jets, ...) for early data to check muon trigger performances on off-line reconstructed muon		
Cross check trigger response by different muon detectors (DT vs RPC, CSC vs RPC)		
Consider the extrapolation at higher pt of trigger performance studies done for quarkonia events		
Cross check trigger efficiency estimates with early estimates from the Z, even with low statistics		
Trigger efficiency for early W analysis		

Online Electron Selection (EWK/Electron POG/TSG)

Team membership: Monika Grothe, Jessica Leonard , Vladimir Rekovic, Bryan Dahmes , Clémentine Broutin , Alexandre Zabi

Task	Team members	Status
L1 efficiency in Barrel and Endcaps, from unbiased SC in minbias/jet triggered samples, as a function of ET, eta, phi, charge (if applicable) and time		
L1 efficiency from Jpsi/Upsilon electron candidates		
With sizable unbiased W candidates, L1 efficiency of W electrons		
With sizable Z samples, L1 efficiency with tag&probe methods		
For the steps above, evaluate efficiency of HLT ECAL clustering		
For the steps above, evaluate efficiency of HLT pixel matching for electron candidates		
For the steps above, evaluate efficiency of HLT KF tracking for electron candidates		
For the steps above, evaluate efficiency of HLT isolation and ID cuts for electron candidates, with or without pixel matching		

Offline Muon Selection, efficiencies and acceptance (EWK/Muon POG)

Team membership: Maria Cepeda, Michele De Grutola, Alexey Drozdestskiy, Mingshui Chen, Isabel Josa, Carmen Diez, Clara Jorda, Jordi Duarte, Lorenzo Uplegger, Ronald Remington, ...

Task	Team members	Status
For commissioned criteria, devise reconstruction, id, and isolation selection for W's and Z's		
Study the possibility to lower the pt > 25 GeV cut on W analysis for early data		
Study the possibility to extend the Z μμ analysis at abs( )<2.4; evaluate the cases with one single-muon trigger with abs( )<2.1, and another muon within abs( )<2.4		
Evaluate the sample with one global muon + one tracker muon in order to increase the statistics for the early Z measurement		
Revise the isolation selection, trying to adopt the same cut for Z and W (relative isolation?)		
Study the effect of lowering the pt cut for Z analysis		
Efficiency efficiencies and acceptances for W and Z muon analyses. Experimental uncertainties on efficiencies aand acceptance.		
Estimate single muon trigger efficiencies and uncertainties from dedicated trigger studies. Correct MC preditions taking into account inefficiencies when necessary		
Estimate single muon reconstruction efficiencies and uncertainties from dedicated studies. Correct MC preditions taking into account inefficiencies when necessary		
Estimate single muon isolation efficiencies and uncertainties from dedicated studies (random cones probably). Correct MC preditions taking into account inefficiencies when necessary		
Determine acceptance for reference cuts using MC corrected for inefficiencies and momentum scale/resolution distortions (see below). Assign (experimental) systematics due to uncertainties in the studies. Both for W and Z		

Offline Electron Selection and Efficiencies (EWK/Electron POG)

Team membership: Mikhail Makouski, Francesca Cavallari, Chiara Rovelli, Emanuele Di Marco, Riccardo Paramatti, Kalanand Mishra, Nikolaos Rompotis, David Futyan, Chris Seez, Dave Evans, Yanjun Tu, Puneeth Kalavase, Sanjay Padhi,Giovanni Franzoni,Jason Haupt , Jeremy Werner , Nadia Adam , Valerie Halyo, Matthew Lebourgeois

Task	Team members	Status
For commissioned criteria, devise reconstruction, id, and isolation selection for W's and Z's		
apply tight electron cuts (MC based) to reveal the W MT peak		
apply tight electron cuts + MET (MC based) to reveal the W MT peak		

apply looser symmetric cuts (MC based) to reveal the Z Mee peak
apply looser asymmetric cuts (MC based) to reveal the Z Mee peak
check the SC,SC distributions then the SC,electron distributions
check the relative efficiency and background rejection of the W selection by looking at the MT,MET plot for the various selections
check the relative efficiency and background rejection of the Z selection by looking the Mee plot for the various selections
test the data-driven optimization cuts if available
test different selections (cut based,categorized,likelihood,...) starting from the simpler ones
estimate reconstruction, selection, trigger efficiencies using W samples
estimate reconstruction, selection, trigger efficiency biases using W samples
estimate charge mis-ID from same-sign Z events

Muon momentum scale and resolution (EWK/Muon POG)

Team membership: MUON POG + Daniele Trocino, Javier Santaolalla, Pablo Martinez, Ivan Furic, Jonatan Piedra, Marco De Mattia, Roberto Castello...

Task	Team members	Status
Study distortions in the resolution and scale shifts affecting W and Z signals in the muon channel; correct MC if necessary; provide feedback to Muon POG and alignment teams, correct data distributions if shifts are too big.		
Follow tracker resolution studies at very low luminosities <= 100 /nb from low mass resonances, J/Psi, Upsilons, ... and estimate the expected scenario for W/Z.		
Study ans interpret variations with azimuthal angle for muons in QCD events and Ws. Evaluate possible strategies in the absence of Z signals if discrepancies between data and MC are too big in W events.		
Study Z shape and try to identify average shifts and resolutions in barrel and endcap with 1 /pb		
Create distorted muon collections in MC for final measurement according to the latest available input		

Electron energy scale and resolution (EWK/Electron POG)

Team membership: Irakli Svintradze, Yurii Maravin, Riccardo Paramatti, Stéphanie Baffioni , Damir Lelas , Ivica Puljak

Task	Team members	Status
Compare ET, fBrem, and E/p distributions from W candidate electrons with MC, for EE and EB, for supercluster and tight electron selections		
Estimate/tune necessary material (or estimate an empirical resolution function) to account for width of E/p or fBrem, in as many bins of eta as possible, for SC and tight electron selections		
Estimate energy scale necessary to match observed W candidate ET distribution, in as many bins of eta as possible, for SC and tight electron selections		
Compare with analogous results from J/psi and Upsilon studies		
Once sizable Z samples are available, tune energy scale and resolution (or a multi-parameter resolution function) to make observed and simulated lineshapes agree		
Estimate material or other simulation tunings which could account for differences between observed and expected Z lineshapes		

W Signal Extraction

Team membership (electrons): Andrew Ivanov, Sadia Khalil, Stilianos Kesisoglou, Kristian Hahn, Phil Harris, Pieter Everaerts, Josh Bendavid, Jon Hays, David Futyan, David Wardrope, Maria Cepeda, Isabel Josa, Ping Tan, Anirban Saha, Fan Yang, ...

Task	Team members	Status
For both electron and muon channels, W+/-, W+, W-, and Calo/tc/PFMET reconstructions, and for different detector regions (endcap/barrel) as needed, commit code to support main QCD background subtraction methods, and test in 35X:		
ABCD analytic background estimation, for several pairs of discriminants (individual and combined lepton isolations, muon d0, electron id or id variables, MET/MT/deltaPhi), and devise bin boundaries suitable for 0.1 and 1 pb-1		
1D template background estimation, with binnings suitable for 0.1 and 1 pb-1, for several formulations of background control samples and template variables		
1D shape extrapolation fit, for several choices of variables		
With early and later data, estimate correlation of discriminant pairs for a background control sample		
Construct ad-hoc shapes to describe observed MET/MT for first W signal; either float shape parameters to estimate MET/MT resolution and scale or isolate a high purity sample for templating		
With sizable Z samples, conduct Z-driven W MET/MT modelling (boson PT sampling, ersatz MET sampling)		
EWK background modelling: initially from MC and then later accumulating data-driven ingredients (normalizing Z background for W to observed Z yields and lepton efficiencies, e.g.)		
QCD modelling systematics estimation: what 2d correlated efficiencies/shapes are allowed by the data, and what is the corresponding bias from template/ABCD assumptions		
MET modelling systematics estimation: differences between observed and expected W signal efficiencies/shapes		
All the steps above informed by MET commissioning conclusions		

Z Signal Extraction

Team membership (electrons): Mikhail Makouski, Kalanand Mishra, Kevin Sung, Si Xie, Andre Schorlemmer, Ilya Kravchenko, Clémentine Broutin, Alexandre Zabi,Jeremy Werner, Dmitry Bandurin, Valerie Halyo, Christos Lazaridis, Luca Lista, FRancesco Fabozzi, Davide Piccolo, Michele De Gruttola, Annapaola De Cosa, Youn Roh, Renata Rodrigues, Jiyeon Han, Yeonsei Chung, Manuel Zeise, Danilo Piparo, Joram Berger, Natalie Heracleous, Otto Hindrichs, ...

Task	Team members	Status
Z background subtraction methods for high-purity categories (tag-tag). Low lumi: MC methods, jet fake rate methods; High lumi: same-sign and hyper-ABCD methods		
Z background subtraction methods for low-purity categories (tag-supercluster, tag-track): line shape fitting or extrapolation		
Tag-and-probe efficiency estimation incorporating background subtraction methods		
cross section estimation: simple analytic/iterative calculation and simultaneous LH fit to lineshapes, starting with two and expanding to multiple categories as needed		
Systematics estimation: signal and background lineshape uncertainties in low purity categories		

Theoretical uncertainties on the acceptance

Team membership:Pieter Everaerts, Phil Harris, Kristian Hahn, Kevin Sung , Stéphanie Baffioni, David Sabès, Nikola Godinovic Valerie Halyo, Scott Yost, Nadia Adam, Juan Alcaraz, Efe Yazgan, Renata Rodrigues, Anirban Saha, Ping Tan

Task	Team members	Status
Theoretical uncertainties on the acceptance estimation with (possibly NNLO/EWK/resummation reweighted) NLO generator: W,W+,W-,Z,W/Z,W+/W- for electrons and muons		
PDF uncertainties (eigenvectors + alpha_S)		
ISR radiation effects: perturbative effects, non-perturbative effects, gluon resummation		
EWK uncertainties: FSR, weak effects, interferences (only relevant off-peak)		
UE, parton shower, and other production model uncertainties		
NNLO/NLO, factorization/renormalization scale dependence uncertainties		

Dataset/trigger path selection and luminosity estimation

Team membership:Monika Grothe, Jessica Leonard, Marco Zanetti, Bryan Dahmes, Stephanie Beauceron

Task	Team members	Status
Periodically compile good run list as endorsed by PVT. What are the criteria by which PVT is estimating good runs, and is it in alignment with our interests?		
Recommend a trigger path selection for each menu with sizable good run luminosity		
Update ElectroweakAnalysis code to define trigger selection		
Catalog datasets containing good runs with selected triggers, maintain python files		
Estimate luminosity for good runs of each trigger (or logical combination of triggers) selected, and its uncertainty, as prescribed by lumi group		

Results integration

Team membership: Jeffrey Berryhill, Georgios Daskalakis, Steve Nahn, Markous Klute, Luca Lista, Juan Alcaraz

Task	Team members	Status
Assemble all ingredients and uncertainties to estimate cross section (ratios) and total statistical and systematic uncertainties		
Compare electron and muon measurements and check compatibility		
Possibly produce combined electron + muon results treating the common systematic uncertainties		

-- JuanAlcaraz - 15-Apr-2010

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