H->bb Weekly Meeting

Ricardo Gonçalo (RHUL)

HSG5 H->bb Weekly Meeting, 5 April 2011

News! News! News!

Forthcoming meetings:

- Simulation workshop tomorrow aimed at the physics needs for 2011-2012 data analysis: https://indico.cern.ch/conferenceDisplay.py?confId=133590
- New meeting on procedures for statistical interpretation of ATLAS results on April 15: https://indico.cern.ch/conferenceDisplay.py?confId=132499
- Workshop on combined performance for 2011, on 14 April: https://indico.cern.ch/conferenceDisplay.py?confId=132123

News! News! News!

- Two very interesting combined performance talks in last Higgs WG meeting
- May points I took: we'll need segment-tagged muons and we'll need to pay close attention to jets group activities:

Two main jet calibration schemes will be available for 2011/2012 data analysis:

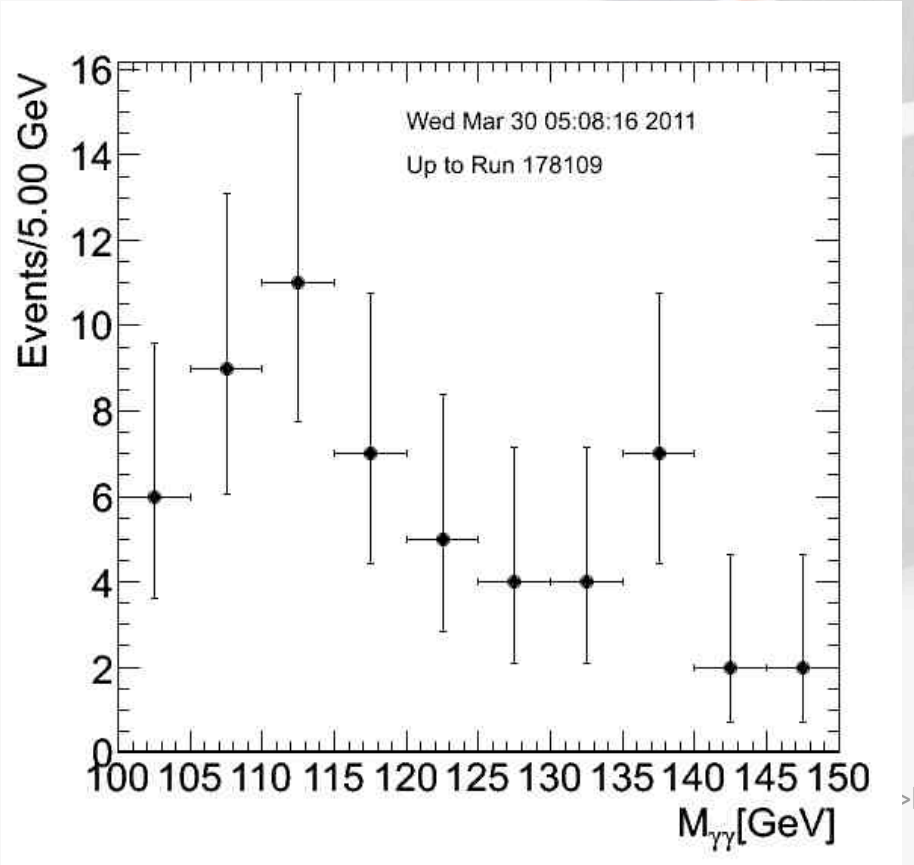
1) A simple-robust scheme based on EM+JES that is presently recommended for physics analysis supplemented with the GSC schemes (exploiting jet properties to improve the resolution without changing the mean energy). Here, cluster and tower jet will be supported.
2) The LC calibration scheme using LC-calibrated clusters as jet inputs using numerical inversion to set the final JES.I would like to point out that we seek help to work-out pile-upcorrections and uncertainties for the LC-scheme for the early analysis the new data.Regards,
3) The slides of the discussion int he last jet/etmiss meeting can be found here. https://indico.cern.ch/getFile.py/access?contribId=6&resId=0&materialId=slides&confId=131195

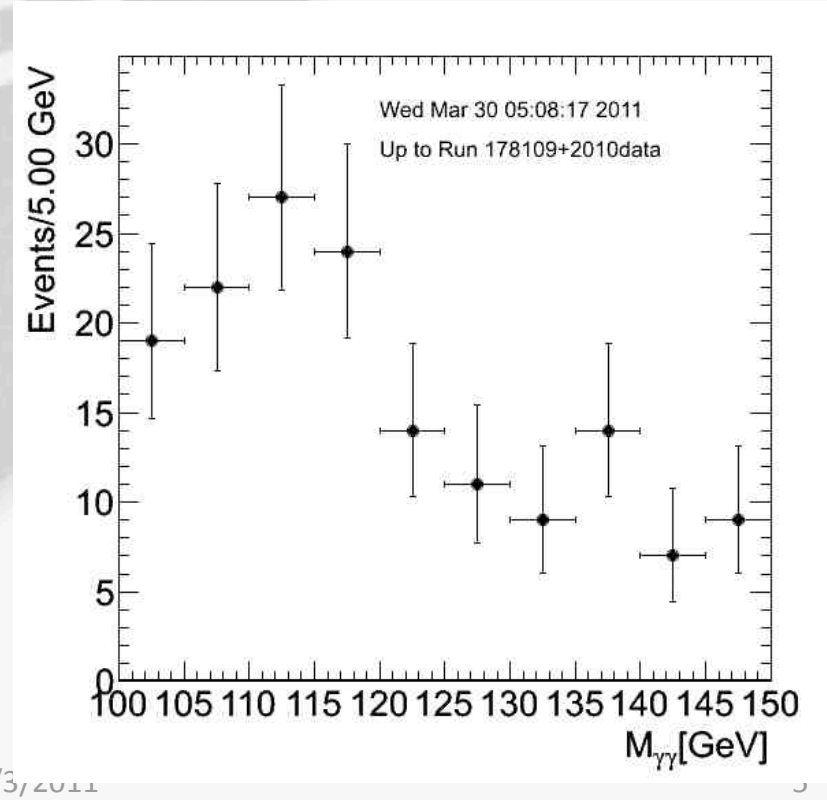
Monte Carlo Samples

- Need to review what we have and what we need for the coming year:
- Several ongoing strands:
  - Giacinto looking into Wbb in Powheg
  - Michiel looking into MC@NLO for VH signal
  - Michiel/Chris C-T, Aurelio: discussion of ttbb ME production in Alpgen
  - Mass points:
  - ZH(Zll), WH(Wlnu), ttH, VBF(Hbb) analyses have mass points: 115, 120, 125, 130 GeV/c2
- Any more WH/ZH (boosted/non-boosted) samples needed?
- Additional backgrounds?

Fast Monitoring

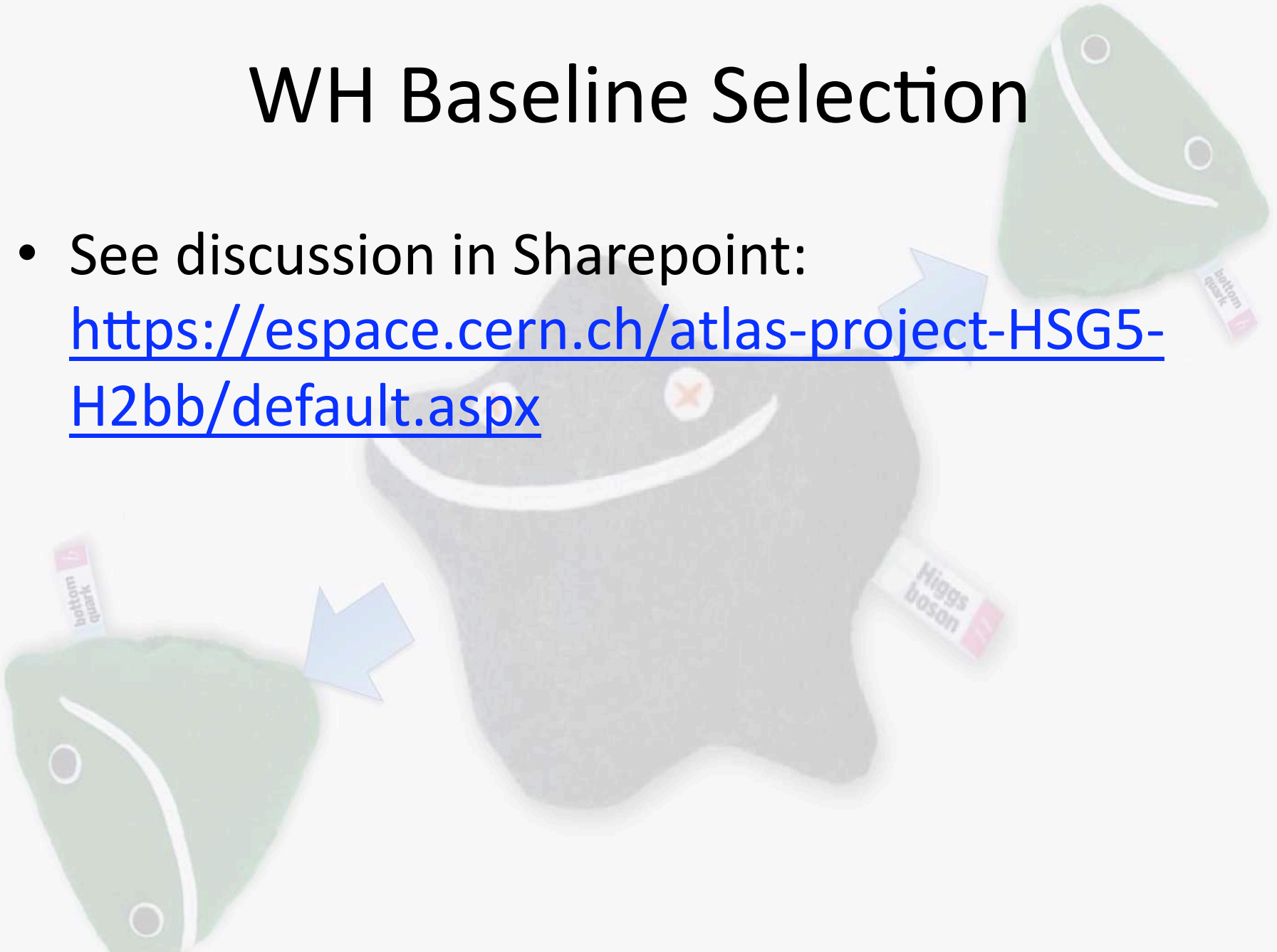
- H->gamma gamma: http://www-wisconsin.cern.ch/~fang/MonitoringHtoGamGam_d3pd/





WH Baseline Selection

- See discussion in Sharepoint: https://espace.cern.ch/atlas-project-HSG5-H2bb/default.aspx



Baseline analysis for WH, H->bb

Recommendations for WH baseline
Differences wrt WH cut flow
Expected CP recommendations for 2011

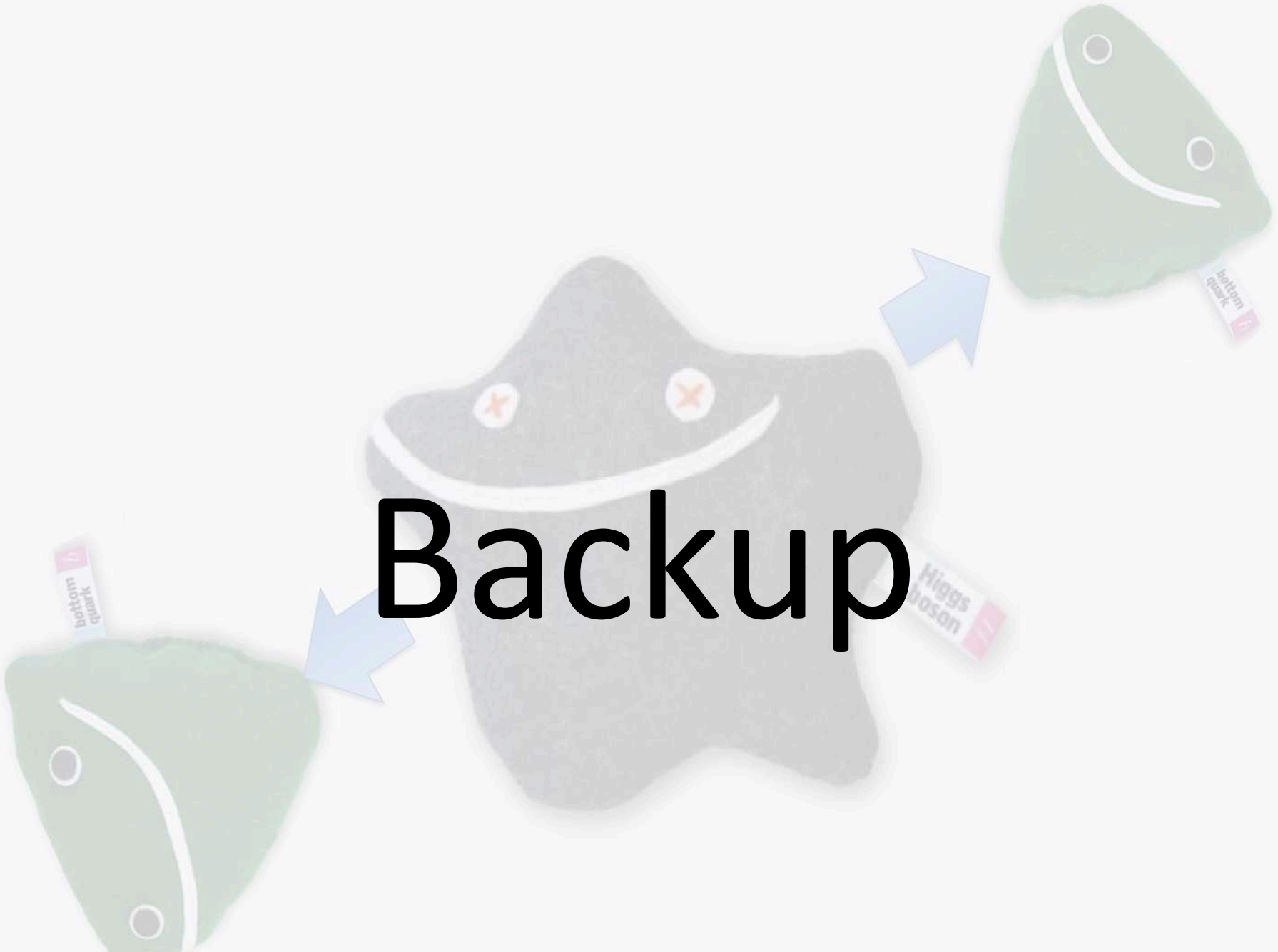
Sources:

lvqq: (winter note)	https://twiki.cern.ch/twiki/bin/view/AtlasProtected/HiggsWWsemilepConfNote2011Winter
llqq: (winter note)	https://twiki.cern.ch/twiki/bin/view/AtlasProtected/HiggsZZllqq
W/Z common:(2010 data)	https://espace.cern.ch/atlas-sm-wz-physics/Lists/Common%20Selection/AllItems.aspx
WH selection for cut flow:	https://twiki.cern.ch/twiki/bin/view/AtlasProtected/WHNoteSummer2011

Muon Selection	**lvqq**	**llqq**	**W/Z common**	**WH->lvbb (cut flow)**	**Proposal for WH**	**Obs**
finder	Staco combined or MuTag	Staco combined or MuTag	Staco	Muid	Staco	Investigate MuTag and Muid later
pT	> 20 GeV	> 20GeV	> 20 GeV	> 20 GeV	> 20 GeV	
|eta|	< 2.4	< 2.5	< 2.4	< 2.5	< 2.4	
MCP quality cuts	yes	yes	yes	yes	yes	
|Z0 wrt PV|	< 10mm	< 10mm	< 10mm	< 10mm	< 10mm	
|d0 wrt PV|	< 1mm	< 1mm	< 0.1mm	< 1mm	< 1mm	
isolation	pT(calo)20<1.8GeV	pT(trk)20<1.8GeV	pTtrk20/pT<0.1	pT(trk)20<1.8GeV	pTtrk20/pT<0.1	But study effect of different approaches
Electron selection						
author	1 or 3	1 or 3	1 or 3	1 or 3	1 or 3	
PID	RobusterTight	RobustMedium	Med/Tight_withTrackMatch	Tight_withTrackMatch	RobusterTight	Investigate alternatives later
pTcluster	> 20 GeV	> 20 GeV	> 20 GeV	> 20 GeV	> 20 GeV	
|eta|	< 2.47 excl. crack	< 2.5 incl. cracks	< 2.47 excl. crack	< 2.5 excl. crack	< 2.47 excl. crack	But try later to include the crack after studies
isolation	etcone30<6GeV	NA	caloIso98 (what's this???)	NA	etcone30<6GeV	This should be studied
b-layer hit	NA	NA	yes	NA	NA	Do we need b-layer hit cut?
|z0 wrt PV|	< 10mm	NA	NA	NA	< 10mm	
|d0 wrt PV|	d0signif < 10	NA	< 0.1mm	NA	d0signif < 10	But study effect of different approaches
vertex						
primary vertex	Nvtx>=1 & Ntrks>3	Nvtx>=1 & Ntrks>3	Nvtx>=1 & Ntrks>3	Nvtx>=1 & Ntrks>3	Nvtx>=1 & Ntrks>3	
MET						
algorithm	MET_LocHadTopo(|eta|<4.5) + MET_MuonBoy-MET_RefMuonTrac	MET_LocHadTopo - Sum(pTmu - ETlossInCalo)	METRefFinal	MET_LocHadTopo - Sum(pTmu - ETlossInCalo)	METRefFinal	Investigate alternatives later
Jet selection						
finder	AntiKt4H1Topo	AntiKt4H1Topo	AntiKtTopo (0.4 priority)	AntiKt4Topo	AntiKt4Topo	Should check other options
pT	> 30GeV	> 25GeV	> 30GeV	> 25GeV	> 25GeV	Investigate alternatives later
scale	EM+JES	EM+JES	EM+JES	EM+JES	EM+JES	
calibration	H1	H1	?	?	?	Should check other options
|eta|	< 4.5	< 3.2	< 4.5	< 2.5	< 2.5	
jet vertex fraction	NA	< 0.75 wrt PV	NA	< 0.75 wrt PV	NA	Investigate pileup
jet cleaning	Loose	Loose	Medium	Loose	Loose	Investigate alternatives later
Overlap removal						
jet-e	remove jet for dR<0.3	remove jet for dR<0.4	remove jet: dR<0.2(0.5 if pT>20)	remove jet for dR<0.4	remove jet for dR<0.4	Investigate alternatives later
mu-jet	NA	remove muon for dR<0.4	remove jet: dR<0.2(0.5 if pT>20)	remove muon for dR<0.4	remove muon for dR<0.4	Investigate alternatives later
mu-e	remove electron for dR<0.1	NA	NA	remove muon for dR<0.4	NA	Not needed (2nd lepton veto)
Event selection			(for 2011 data recluster jets)			
trigger						Need to investigate trigger
event cleaning	jet/ETmiss recommendation	jet/ETmiss recommendation	jet/ETmiss recommendation	jet/ETmiss recommendation	jet/ETmiss recommendation	
lepton	exactly 1 lepton	exactly 2 leptons same flavour	exactly 1 lepton	exactly 1 lepton	exactly 1 lepton as defined	
extra lepton veto e channel	veto robustMed. Electrons	opposite charge, veto otherwise	veto additional med.electrons	veto additional tight electrons	veto add. signal electrons	Investigate alternatives later
extra lepton veto mu channel	NA		veto add. combined muons	veto add. combined muons	veto add. signal muons	Investigate alternatives later
lepton pT additional cut	> 30GeV	NA	NA	NA	NA	
MET	> 30GeV	< 50GeV	> 25GeV	> 25GeV	> 25GeV	Investigate alternatives later
b tag	b-tag veto (SV0>5.72)	NA	SV0>5.85, |eta|<2.1, pT>30	IP3D+SV1 > 1.55	Investigate 1 and 2-tags	Start with SV0>5.85, but check all possibilities
Njets	exactly 2 or 3	>=2	NA	>= 2	>=2	
Additional cuts	m(jj) near mW & |eta(j)|<2.8	70<m(jj)<105, 76<m(ll)<106, et	NA	MT > 40 GeV	MT > 40 GeV	Investigate alternatives later

Next...

- Need to assign tasks:
- Triggers for 2011 data
- Choice of muon algorithms
- Choice of electron PID and fiducial cuts
- Jet calibration and JES systematic uncertainties
- B-tagging
- …
- Comments?



Backup

Proposed Roadmap for WH Analysis

- After the effort on cut flows, we're ready to start producing results!
  - Concentrating on un-boosted results here only because it's still unclear what would be feasible in boosted analysis until Dubna – commissioning work ongoing
  - BUT: work on boosted VH is starting in parallel – see e.g. Wahid's talk today
- Intended results:
  - Cut-based analysis focusing on WH -> e/μ ν b b
    - I think there should be at least 2 analyses, for cross checking results
    - Ideally using 2 different data formats (AOD vs D3PD)
  - Multivariate analysis in parallel, to improve on cut-based analysis
- Timeline:
  - Analyses should be semi-frozen by Dubna (17 – 19 May)
  - This leaves around 7 weeks
- Results in the form of:
  - Histogram with # events vs m_H
  - Table of # events expected for each value of m_H and background type – including statistical and systematic uncertainties
  - Exclusion plot vs m_H (95% C.L. limit on σ/σ_{SM})
  - …plus control plots etc

Questions to be answered

- Cut-based analysis focusing on WH -> e/μ ν b b
  - Establish analysis selection: why is each cut applied and why at each particular value? Are we convinced this is the right thing to do?
  - Establish set of systematic uncertainties: start from combined performance group recommendations. What are the most important? Are there any hidden pitfalls for us?
  - What b-taggers and why? What calibrations do we expect to be ready in time? What is the corresponding systematic uncertainty?
  - What sort of exclusion limits can we expect for 0.5, 1, 2 fb^{-1} ?

- Multivariate analysis in parallel, to improve on cut-based analysis
  - What event preselection should be used and why?
  - Use for signal-background separation only or target particular backgrounds?
  - What are the possible bias? Where can it go wrong?
  - What improvement can be expected wrt cut-based analysis for 0.5, 1, 2 fb^{-1} ?

- Exclusion plot vs m_H (95% C.L. limit on σ/σ_{SM})
  - Need someone to implement RooStats workspace

Date	Milestones wish list
17 May	Dubna workshop – analysis frozen After this: add data to un-boosted analysis and prepare for result approval Concentrate more effort on boosted VH with a view to obtaining results quickly
10 May	Review results with 2011 data from cut-based and multivariate analyses
3 May	Margin for dealing with unforeseen problems
26 April	Start looking at 2011 data if enough is available. Any surprises? How does the MC describe the new data? By now we should have a reasonable idea of results from the multivariate analysis
19 April	End of 2 weeks of beam scrubbing. (I'm away for Easter)
12 April	By now we should have a reasonable idea of the exclusion of the cut-based analysis First report on MVA preliminary results – establish plan for getting results by Dubna
5 April	Identify the worst systematics and discuss any possible improvements: •Any changes needed in analysis cuts? •Any study necessary for corrections to some systematic effect? Multivariate analysis: iterate on preselection cuts, methods, questions Assign tasks – divide the work to achieve better results!
29 March	Establish analysis cuts: •If possible as result of optimization •Use 2010 data to develop cuts and show that data is well described by background MC Start evaluating systematics
22 March	Iterate on analysis cuts – why is each cut applied at each particular value? Start iteration on multivariate methods to improve analysis

Reconstruction issues

- **Muon** CP group recommendations for release 16:
  - Reconstruction efficiency and isolation efficiency scale factors, momentum smearing functions
  - https://twiki.cern.ch/twiki/bin/view/AtlasProtected/MCPAnalysisGuidelinesRel16
- Jet/Etmiss recommendations for **jet cleaning** in release 16:
  - Medium jet cleaning should give similar rejection to rel 15 cleaning but with better efficiency
  - Tight jet cleaning should not be used – still under discussion
  - https://twiki.cern.ch/twiki/bin/view/AtlasProtected/HowToCleanJets#Bad_jets_rel16_data
- New!: Final **b-tagging calibrations** for release 16 based on full 2010 data:
  - https://twiki.cern.ch/twiki/bin/view/AtlasProtected/Analysis16
- e/gamma recommendations for **energy scale and resolution** in release 16:
  - https://twiki.cern.ch/twiki/bin/view/AtlasProtected/EnergyScaleResolutionRecommendations
  - And rescaler tool: https://twiki.cern.ch/twiki/bin/view/AtlasProtected/EnergyRescaler
- Standard Model **W/Z** group **baseline selection** for release 16 (next 4 slides):
  - See discussion in W/Z group Sharepoint
  - Also, finer points (and perhaps the not so fine) still being discussed