

Institute of High Energy Physics Chinese Academy of Sciences



Weekly Report

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Introduction

- # HHML non-res analysis:
 - CDS reply has been posted last Friday.
 - Plan to prepare the INT for review in this week.

2LSS

- Combined fit regions
 - QED (internal conversion)
 - Material conversion
 - HT_lep in em+mm for HF-mu
 - HT_lep in me+ee for HF-e
 - Drll01 in me+ee for HF-e
 - WZ control region in 31
 - VVjj with mjj cut



Table 5.6 Definition of control regions.	Orthogonality requirements	with respect to signal reigo	n are highlighted in blue.
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Channel	Region	$N_{ m lep}^{\sum Q_i^{\ell}}$	$N_{ au_{ ext{had}}}^{\sum Q_i^{\ell}}$	N _{jet}	N_{b-jet}	BDT cut	$m_{\ell\ell\ell}$ [GeV]	$m_{\ell^+\ell^-}$ [GeV]	$m_{\ell^{\pm}\ell^{\pm}}$ [GeV]	$E_T^{\rm miss}$ [GeV]	m _{jj} [GeV]						
2ℓSS	WZCR	3±1	0	> 2	0	$BDT_{All} < -0.4$	$ m_{aba} - m_{-} > 10$	$ m_{aa} - m_{-} < 10$		> 30							
	W Z CK	5	0	22	0	$BDT_{Vjets} > -0.8$	$ m_{\ell\ell\ell} - m_Z > 10$	$m_{\ell\ell\ell} = m_Z > 10 m_{\ell\ell} = m_Z < 10 \qquad > 3$		2 50							
	W±W±;;CP	$2^{\pm 2}$	0	0	0	0	≥ 2	> 2	≥ 2	0	$BDT_{All} < -0.4$					mm. >10	> 300
	W = W = JJ CK	2- 0	22	0	$BDT_{Vjets} > -0.8$			$ m_{\ell\ell} - m_Z > 10$		> 500							
	OmisID	$e^{\pm}e^{\pm}$	0	~ 2	0				[76 5 101 3]								
	QIIIISID	$e^{\pm}e^{\mp}$	0 < 2	< 2	0			[78.5, 102.3]	[70.5, 101.5]								
	Conv CR	$2^{\pm 2}$	0	≥ 2	≥ 1												
	QED CR	$2^{\pm 2}$	0	≥ 2	≥ 1												
		let at	0	2.2	1												
nF-e CK		<i>ι</i> − <i>e</i> −	0	2,3	2												
	HF- μ CR	$\ell^{\pm}\mu^{\pm}$	0	2,3	≥ 1												

Template fit control region plots



Additional two regions for WZ and WZjj:

- One binned fit for WZ (Njets distribution just for visualization)
- We don't observe Njets dependent shape. While 3I channel is different => Hard to have a 2I & 3I combined fit







Fit validation

- It is preformed in CR + SR, using hybrid datasets. Sideband data in CR and Asimov data in SR.
- Incertainty included: Full detector systematic + main theory uncertainty with flat numbers in cross section.
- Good agreement with VV alone fit.





Combined

Pull plots

Constraint in QmisID is due to its contribution to CRs.



ATLAS Internal

\prod						Norm VV
			•			QmisID
						ATLAS TAUS TRUEHADTAU SME TES MODEL C
						ATLAS MUON SCALE
			ī			ATLAS MUON SAGITTA BESBIAS
			T			ATLAS MUON CB
						ATLAS MET SoftTrk Scale
			I			ATLAS MET SoftTrk ResoPorp
						ATLAS_MET_SoftTrk_DecoDero
			1			ATLAS_WET_SUILIK_RESUFAIA
			1			
						ATLAS_JET_Pileup_RnoTopology
			1			ATLAS_JET_Pileup_OffsetNev
			•			ATLAS_JET_JER_EffectiveNP_9
			•	-		AILAS_JEI_JER_EffectiveNP_8
			•			ATLAS_JET_JER_EffectiveNP_7
						ATLAS_JET_JER_EffectiveNP_6
						ATLAS_JET_JER_EffectiveNP_5
			•			ATLAS_JET_JER_EffectiveNP_4
			•			ATLAS_JET_JER_EffectiveNP_3
						ATLAS_JET_JER_EffectiveNP_2
			•	-		ATLAS_JET_JER_EffectiveNP_12restTerm
		(•			ATLAS_JET_JER_EffectiveNP_11
						ATLAS_JET_JER_EffectiveNP_10
						ATLAS_JET_JER_EffectiveNP_1
			•			ATLAS_JET_JER_DataVsMC_MC16
			•			ATLAS JET Flavor Response
			• •			ATLAS JET Flavor Composition
						ATLAS JET EtaIntercalibration TotalStat
						ATLAS JET EtaIntercalibration NonClosure posEta
			T			ATLAS JET EtaIntercalibration NonClosure negEta
						ATLAS JET EtaIntercalibration NonClosure 2018data
						ATLAS JET EtaIntercalibration Modelling
			1			ATLAS JES EffectiveNP Statistical6
						ATLAS JES EffectiveNP Statistical5
			1			ATLAS IES EffectiveNP Statistical
						ATLAS IES EffectiveNE Statistical?
						ATLAS_JES_EffectiveNIP_Statistical2
			1			ATLAS_JES_EffectiveNP_Statistical1
			T			ATLAS_JES_EffectiveND_ModellingS
		•	1			ATLAS_JES_EffectiveNP_Modelling1
			T			
			•			ATLAS_JES_EffectiveNP_Mixed2
						AILAS_JES_EffectiveNP_Mixed1
			•			AILAS_JES_EffectiveNP_Detector1
						ATLAS_JET_BJES_Response
						ATLAS_EG_SCALE_ALL
ليبينا						ATLAS_EG_RESOLUTION_ALL
-	-2 -	-1 () .	1 2	2	
		(ð- Ð)/Δθ			
		10 00	$\gamma - \gamma$			



Large correlations between QmisID and mu-fake, mu-hf-e, could due to large statistics and overconservative uncertainty

- Try to decorrelate it between two regions to see which region is responsible.
- Try to decorrelate QmisID into three terms: Closure, statistical, Z-peak window ? Then constraint could be reduced.
- Largest correlation: muVVjj and VVjj x-section PDF, which is understandable.

Selection cut	2ℓSS	3ℓ	$3\ell W^{\pm}Z \ CR \ for \ 2\ell SS$
Trigger	SL OR DL	SL OR DL	SL OR DL
TrigMatch	Tight <i>e</i> or μ	\checkmark	\checkmark
N_ℓ	==2	==3	==3 (2ℓ SS +1 type Loose)
Total charge	+ 1	±1	±1
Lepton selection	Т	ℓ_1 : L, $\ell_{2,3}$: T	$\ell_0: L, \ell_{1,2}: T$
low di-lepton mass veto	$m(\ell^{\pm}\ell^{\pm}) > 12 \text{ GeV}$	$m(\ell^+\ell^-) > 12 \text{ GeV}$	$m(\ell_i \ell_j) > 12 \text{ GeV} (i, j \in \{0, 1, 2\})$
p_T^ℓ	> 20 GeV	$\ell_1 :> 10 \text{ GeV}, \ell_{2,3} :> 15 \text{ GeV}$	$\ell_0 :> 10 \text{ GeV}, \ell_{1,2} :> 20 \text{ GeV}$
au-veto	\checkmark	\checkmark	\checkmark
<i>b</i> -veto	\checkmark	\checkmark	\checkmark
N _{jets}	≥ 2	≥ 2	≥ 2
Z-veto	-	$ m_{SFOS} - 91.2 > 10 \text{ GeV}$	-
$Z - \gamma$ -veto	-	$ m_{lll} - 91.2 > 10 \text{ GeV}$	$ m_{lll} - 91.2 > 10 \text{ GeV}$
<i>ℓℓ-</i> pair	-	-	\geq 1 OSSF pair
Z+jets selection	-	-	$ m_{SFOS} - 91.2 < 10 \text{ GeV}$
E_T^{miss}	-	-	> 30 GeV

Table 17: $3\ell W^{\pm}Z$ CR for the 2ℓ SS analysis, compared to the 3ℓ and 2ℓ SS pre-selection.