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# Vector Boson Fusion Higgs in

Atlas-LHC





### Varouchas Dimitris



# **VBF** Topology & Characteristics

- V.B.F. or W.B.F. refers to the one of the 4 different production modes of Higgs boson in LHC
- □ 2<sup>nd</sup> biggest cross section after g-g fusion





# **VBF** Topology & Characteristics

General detection characteristics

- **2** forward jets (VBF jets) in high  $|\eta|$  values
- Central detector region: low gluon radiation activity due to colorless W/Z exchange
  - No «central» jets expected : jet veto can be applied. Special attention to

#### pile up





BF jet 1

VBF jet 2

H

W.Z

W, Z

 $q_2'$ 

 $q_2$ 



Background:		Cuts Description	
- Z + jets	Tau decay	- Number, $p_T$ of leptons/hadronic taus	
- t tbar - W + jets	Collinear Approx.	- Tau decays products, Not back to back, Missing $p_{\tau}$	
	VBF jets	- Constraints in VBF jets ( $p_{\tau}$ , $\eta$ , inv. mass)	
$m_{\tau\tau}$ reconstructed	topology	- jet veto	
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## Conclusions

- VBF Higgs topology characteristics with 2 forward jets and low central jet activity :
  - Background suppression

- Optimise signal significance
- One of the promising Higgs channels in ATLAS with its decay to  $\tau^+ \tau^-$ 
  - Detailed study using a full simulation of the detector has given results regarding the Higgs discovery



Jet Veto signal efficiency cut is improved 10 %

### **Back up Slides**







### **Collinear Approximation**



### Cuts

CUTS	II - case	lh - case	hh - case
Trigger	«e25i» or «mu20i» $e_{pT}$ >25GeV $\mu_{pT}$ > 20 GeV		«tau35i+MET40» tau <sub>pT</sub> > 35 GeV
Dilepton	#e + #µ = 2	#e + #µ = 1	
Tight jet	#jets > 1 (leading jet p <sub>T</sub> > 40GeV)		
Tight tau		#hadro.tau = 1	#hadro.tau = 2
Missing $p_T$	MET > 40 GeV	MET > 30 GeV	MET > 40 GeV
Collinear Approximation	0 <x<sub>I&lt;0.75 , cos(Δφ)&gt;-0.9</x<sub>	0 <x<sub>l&lt;0.75 , 0<x<sub>h&lt;1 cos(Δφ)&gt;-0.9</x<sub></x<sub>	0 <x<sub>h&lt;1 cos(Δφ)&gt;-0.9</x<sub>
Forward Jet	$\eta_{jet1} \bullet \eta_{jet2} < 0$		
Centrality	H decay products lie between two VBF forward jets in eta		
Jet Separation	Δη <sub>jj</sub> >4.4		
Di-Jet mass	M <sub>jj</sub> > 700 GeV		
Central Jet Veto	If 3th jet with $p_T$ >20 GeV, in $ \eta $ <3.2		







