Higgs activities

- Reminder of (Atlas wide) Higgs CSC topics
- Current activities
  - Mostly related to $H \rightarrow \gamma\gamma$

Topic/Note		Analysis Issues		Overlap			Performance Note Reference		
Number	Topic	Number	Topic	Detector	Physics	Performance	*Number*	Topic	N
HG-1	Higgs -> gamma gamma	HG-1-1	Mass reconstruction:Energy measurement,Vertex combining tracker and calo vs luminosity			Egamma	EG-3		
		HG-1-2	Photon identification, study of isolation			Egamma	EG-2		
		HG-1-3	Study of conversions			Egamma	EG-4		
		HG-1-4	Estimates of photon purity, measurement of background with data		SM		SM-4		
		HG-1-5	inclusive vs more exclusive (H+jet,VBF, associated production with Z, ttbar?) signatures						
HG-2	H->4 leptons	HG-2-1	Lepton performance issues			Egamma,Muon	EG-1,EG-3,CM-1		
		HG-2-2	Impact of low lumi pileup and muon cavern background			Egamma,Muon	EG-3,CM-1		
		HG-2-3	combination of tracker and calo			Egamma	EG-5		
		HG-2-4	b->lepton rejection with Isolation and anti-impact parameter cuts			b-tagging ?	??		
		HG-2-5	Methods for background evaluation (Zbb and ttbar)						
		HG-2-6	Improvements with neural network/multivariate techniques						
HG-3	VBF H->tau tau	HG-3-1	lepton-lepton and lepton-hadron						
		HG-3-2	had-had final state feasibility						
		HG-3-3	tau identification			JetEtmissTau	JET-16		
		HG-3-4	mass resolution			JetEtmissTau	JET-13,JET-14		
		HG-3-5	NLO studies for signal and backgrounds						
		HG-3-6	study of backgrounds control samples of W/Z+2j,W/Z+3j		SM		SM-6		
		HG-3-7	QCD (fake) background (fake e and/or fake hadronic tau)			JetEtmissTau,Egar	EG-1,JET-16		
		HG-3-8	estimation of backgrounds from data						
		HG-3-9	forward jet reconstruction efficiency, calibration			JetEtmissTau	JET-6,JET-10		
HG-4	H->WW	HG-4-1	Background studies from control samples		top (?)	b-taging (?)	T-5		
		HG-4-2	use of VBF for CP measurement						
HG-5	ttH, H->bb	HG-5-1	signal reconstruction, combinatorics		top (?)		T-5,T-3		
		HG-5-2	background shape and systematic uncertainties						
		HG-5-3	b-tagging, optimal performances, initial performances			b-tagging	BT-2		
HG-6	ttH, H->WW*	HG-6-1	2 same sign leptons, 3 leptons. Studies with full simulation						
HG-7	H/A -> tau tau	HG-7-1	tau trigger	trigger		JetEtmissTau			
		HG-7-2	tau identification			JetEtmissTau	JET-16		
		HG-7-3	mass reconstruction and Etmiss resolution			JetEtmissTau	JET-14		
		HG-7-4	use of (soft) b-tagging			b-tagging	BT-4		
		HG-7-5	study of SM W->tau nu Z->tau tau as control channels		SM ?	JetEtmissTau	JET-15		
HG-8	bbH/A -> mumu @ low mass / intermediate mass	HG-8-1	mass resolution			Muon	CM-1		
		HG-8-2	backgrounds						
HG-9	Invisible Higgs	HG-9-1	HZ studies with full sim.						
		HG-9-2	VBF production	trigger					
		HG-9-3	ttbaarH						
HG-10	Charged Higgs	HG-10-1	CPX, MSSM: tt--hWWbb-->bb l nu qq bb discovery potential (or together with ttH)						

Some key points of CSC studies:

- Strong overlap with detector performances,especially for benchmark channels
  - Investigate effects of realistic detector simulation
- How to understand backgrounds from data themselves ?
- Trigger related issues:
  - Channels without clear trigger strategy (invisible Higgs in VBF production, H→bb in VBF production, etc…)
  - Optimization of trigger for “very” low luminosity:
    - Extract as much information on background as possible
    - Understand trigger efficiencies for Higgs
    - (coupled to offline performances)

Higgs-CSC related activites in CERN team

- Start from aspects related to $H \rightarrow \gamma\gamma$ channel:
  - Conversions (Thomas)
  - Photon trigger efficiency (Valeria)
- Possible collaboration with Annecy / Orsay

Conversions (Thomas)

- Aim: use backtracking algorithm (starting from outside to inside) to find and study conversions
- Code from CTB has been ported to Atlas. Works on 60 GeV pt single photons from CSC (re-running reconstruction from digits).
- With release 12, TRT track segments should be available and allow to extend the reach of the algorithm
- To do:
  - Is the efficiency for Higgs events the same as for single photons ? (busier environment)
  - Apply to pi0/photon separation: Applying E/p cut for converted photon is expected to bring some improvement in the rejection

Photon Trigger (Valeria)

- Start from Rome analysis of E.Thomas
- Results from this analysis reproduced with the Rome samples (CBNT level analysis, plan to migrate to AOD)
- Now looking at CSC output
  - 20 and 60 GeV single photons
  - Higgs events
  - Filtered Jet (Pythia pt>17 GeV) sample for “fake” rate
  - 11.0.41 (or 11.0.3) simulation, “private” reconstruction with 11.0.5 to get trigger informations into CBNT
  - First results will be shown at the e/gamma meeting during the T&P week
- Next steps:
  - Rate vs Pt threshold, details L2 cuts, L1 isolation => Input for photon trigger in first run
  - L1 isolation vs offline
  - How to measure photon trigger & offline efficiencies from data ?

Other activities:

- Ashfaq Ahmad : looking at misaligned simulation, impact on Higgs mass resolution
  - Starting to work on AOD based analysis
- Andreas Wildauer: ttH, H$\rightarrow$bb
  - With full simulation
  - Vertexing and b-tagging
  - (presentation at Higgs meeting 20/04/2006: Comparison between full-fast simulations and between Rome-CSC samples)
- Iwona Grabowska-Bold: CP parity of H/A (MSSM Higgses) with $\tau\tau$ decays:
  - Atlfast studies
  - Topic which will require high luminosity