



Higgs to 4 leptons in Athena with eventView

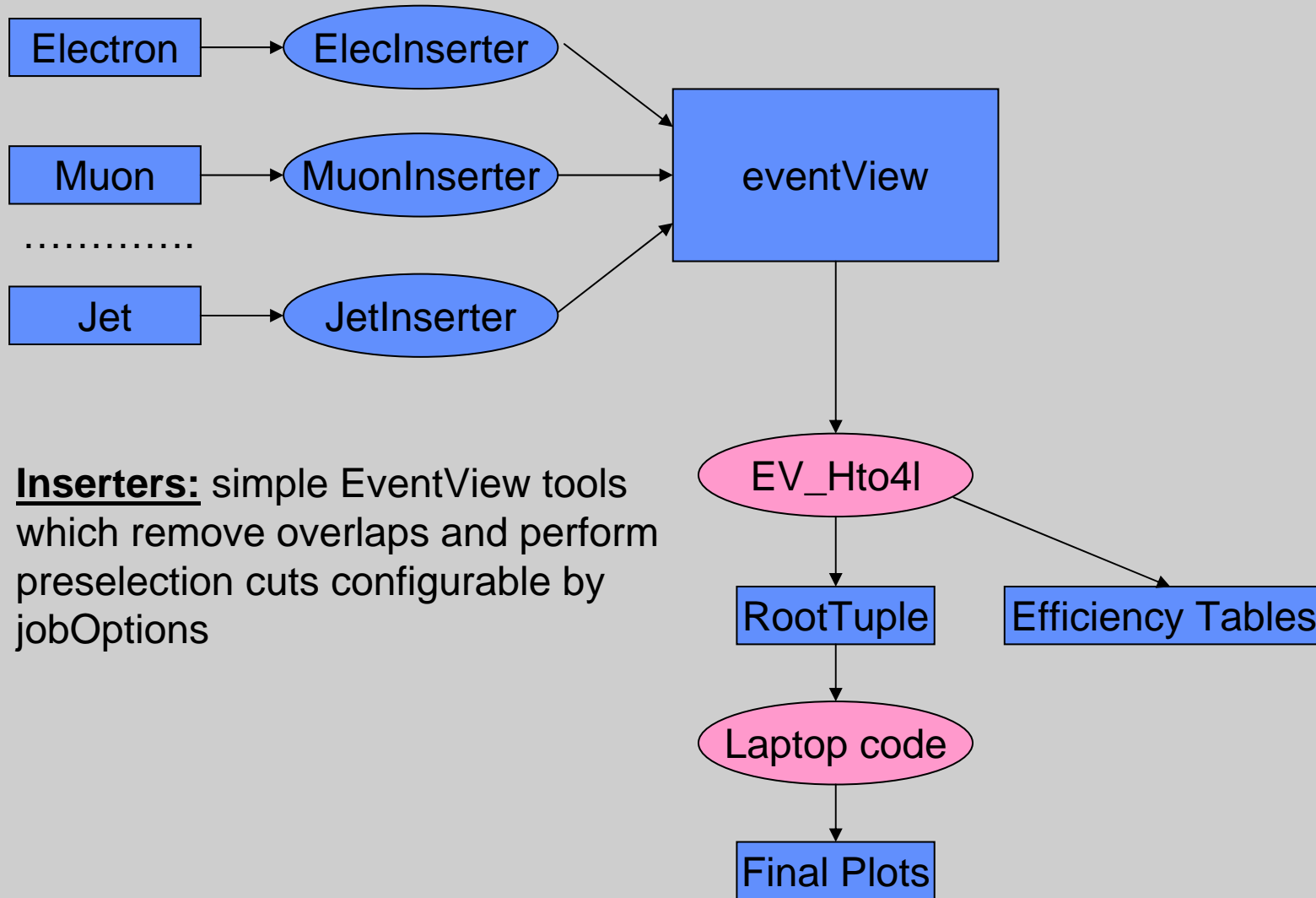
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Higgs WG meeting CERN, 28-Oct-05

Outline

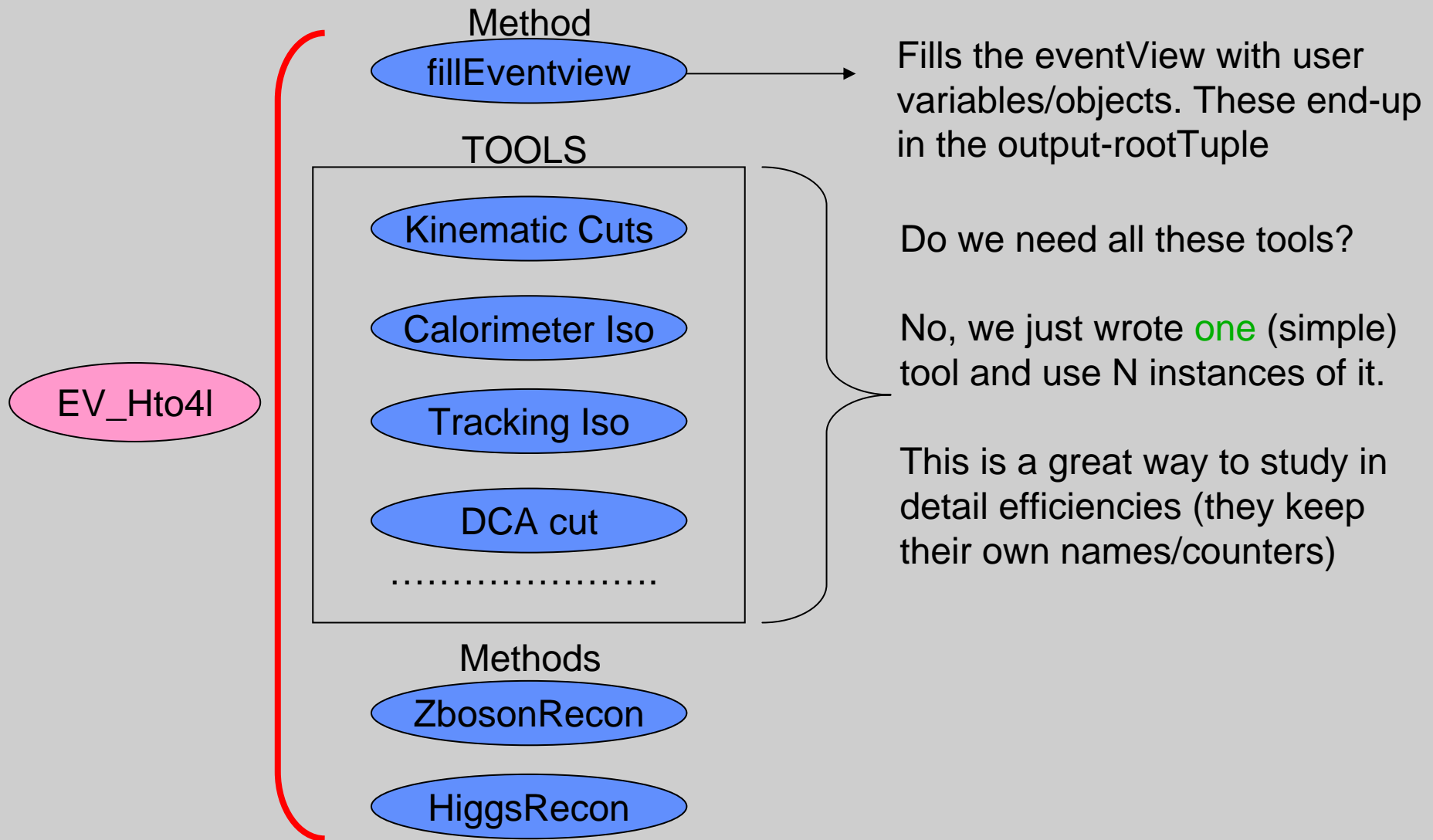
- ◆ H->4l in Athena using eventView
 - Simpler/Cleaner way to do the analysis.
 - Straightforward for efficiency studies and cut optimization.
 - Eases studies of how Linearity/Uniformity, Resolution, tails, shower shapes etc, affect the analysis.
 - Straightforward sharing of resources with other analyses.
- ◆ Why eventView: new algo EV_Hto4l
 - EV_Hto4l structure.
 - EV_Hto4l tools.
 - First Results (examples).
 - Proposal to check Algo+Tool in CVS (HiggsToFourLeptons).
- ◆ See SP talk at the PAT Event Data Model meeting next Tuesday (technical details):
<http://www.lapp.in2p3.fr:/elog/LARGH8Analysis/>
- ◆ EventView (Sep/05 Software Week) K.Cranmer, A. Farbin:
<http://agenda.cern.ch/fullAgenda.php?ida=a045109>

Structure (simplified+what I have tried)



Inserter: simple EventView tools which remove overlaps and perform preselection cuts configurable by jobOptions

EV_Hto4l algorithm and its tools



EV_Hto4l : jobOptions(1)

```
#
# Setup Dlls for analysis and set algorithm options
#
theApp.Dlls += ["AnalysisTools" , "TruthParticleAlgs"]
theApp.Dlls += ["UserAnalysis"]
theApp.TopAlg += ["EV_Hto4l/higgs"]
higgs=Algorithm("higgs")
#
# Top Algorithm (I call it "higgs")
#
higgs.OutputLevel=ERROR

#
# The higgs analysis factory tools (order matters)
#
higgs.Hto4lTools=[
    "EV_Hto4lPreselectionTool/fourEMLArClusters",
    "EV_Hto4lPreselectionTool/fourTrkMatchClusters",
    "EV_Hto4lPreselectionTool/fourTrkQualClusters",
    "EV_Hto4lPreselectionTool/threeIsoEMLArClusters",
    "EV_Hto4lPreselectionTool/fourIsoEMLArClusters",
    "EV_Hto4lPreselectionTool/fourIsolatedTracks",
    "EV_Hto4lPreselectionTool/fourLowImpParamTrks"
]
```

Notice: there are 7 tools defined however all 7 are re-incarnations of the same "Preselection Tool" (in this case the tool is actually an eventViewBaseTool)

EV_Hto4l : jobOptions(2)

Hto4l.fourEMLArClusters.cutName	= "fourEMLArClusters"	}	Kinematic cuts only (TDR std cuts)
Hto4l.fourEMLArClusters.doHto4e	= True		
Hto4l.fourEMLArClusters.etaMax	= 2.5		
Hto4l.fourEMLArClusters.ptLow	= 7.0*GeV		
Hto4l.fourEMLArClusters.ptHigh	= 20.0*GeV		
Hto4l.fourTrkMatchClusters.cutName	= "fourTrkMatchClusters"	}	Kinematic cuts + 4 egclusters/tracks
Hto4l.fourTrkMatchClusters.doHto4e	= True		
Hto4l.fourTrkMatchClusters.useTrackMatch	= True		
Hto4l.fourTrkQualClusters.cutName	= "fourTrkQualClusters"	}	Kinematic cuts + 4 egclusters/tracks + 4 isEM tracks (no TRT)
Hto4l.fourTrkQualClusters.doHto4e	= True		
Hto4l.fourTrkQualClusters.useTrackMatch	= True		
Hto4l.fourTrkQualClusters.useTrkQualIsEM	= True		
Hto4l.fourTrkQualClusters.useTRT	= False		
Hto4l.threelsoEMLArClusters.cutName	= "threelsoEMLArClusters"	}	Kinematic cuts + 4 egclusters/tracks + 4 isEM tracks (no TRT) + 3/4 isEM clusters
Hto4l.threelsoEMLArClusters.doHto4e	= True		
Hto4l.threelsoEMLArClusters.useTrackMatch	= True		
Hto4l.threelsoEMLArClusters.useTrkQualIsEM	= True		
Hto4l.threelsoEMLArClusters.useTRT	= False		
Hto4l.threelsoEMLArClusters.useCaloIsEM	= True		
Hto4l.threelsoEMLArClusters.nCaloNonIsoEle	= 1 #num of Non-Iso elec (3+1)		

EV_Hto4l : jobOptions(3)

Hto4l.fourIsolatedTracks.cutName	= "fourIsolatedTracks"	}	Kinematic cuts + 4 egclusters/tracks + 4 isEM tracks (no TRT) + 4 isEM clusters + 4 isolated tracks
Hto4l.fourIsolatedTracks.doHto4e	= True		
Hto4l.fourIsolatedTracks.useTrackMatch	= True		
Hto4l.fourIsolatedTracks.useTrkQuallsEM	= True		
Hto4l.fourIsolatedTracks.useTRT	= False		
Hto4l.fourIsolatedTracks.useCaloIsEM	= True		
Hto4l.fourIsolatedTracks.nCaloNonIsoEle	= 0		
Hto4l.fourIsolatedTracks.useIsolation	= True		
Hto4l.fourIsolatedTracks.isolationCone	= 0.2 # in deltaR		
Hto4l.fourIsolatedTracks.absoluteIsolationCut	= 10.0*GeV		
Hto4l.fourLowImpParamTrks.cutName	= "fourLowImpParamTrks"	}	Kinematic cuts + 4 egclusters/tracks + 4 isEM tracks (no TRT) + 4 isEM clusters + 4 isolated tracks + 4 small perigee tracks
Hto4l.fourLowImpParamTrks.doHto4e	= True		
Hto4l.fourLowImpParamTrks.useTrackMatch	= True		
Hto4l.fourLowImpParamTrks.useTrkQuallsEM	= True		
Hto4l.fourLowImpParamTrks.useTRT	= False		
Hto4l.fourLowImpParamTrks.useCaloIsEM	= True		
Hto4l.fourLowImpParamTrks.nCaloNonIsoEle	= 0		
Hto4l.fourLowImpParamTrks.useIsolation	= True		
Hto4l.fourLowImpParamTrks.isolationCone	= 0.2 # in deltaR		
Hto4l.fourLowImpParamTrks.absoluteIsolationCut	= 10.0*GeV		
Hto4l.fourLowImpParamTrks.useImpactParamCut	= True		
Hto4l.fourLowImpParamTrks.impactParamSigmaCut	= 5.0		

Efficiency table S/B for default cuts

<u>Higgs->4e</u>				
	Total	Passed	Efficiency	TotalEff
fourEMLArClusters	8076	734	0.0909	0.0909
fourTrkMatchClusters	734	734	1.0000	0.0909
fourTrkQualClusters	734	531	0.7234	0.0658
threeIsoEMLArClusters	531	435	0.8192	0.0539
fourIsoEMLArClusters	435	266	0.6115	0.0329
fourIsolatedTracks	266	250	0.9398	0.0310
fourLowImpParamTrks	250	223	0.8920	0.0276
ZeeReconstruction	223	223	1.0000	0.0276
HtoZZ4eReconstruction	223	165	0.7399	0.0204

Total				0.0204

Default Analysis
(TDR-like)

<u>Zbb->4l</u>				
	Total	Passed	Efficiency	TotalEff
fourEMLArClusters	94513	10745	0.1137	0.1137
fourTrkMatchClusters	10745	10745	1.0000	0.1137
fourTrkQualClusters	10745	4274	0.3978	0.0452
threeIsoEMLArClusters	4274	408	0.0955	0.0043
fourIsoEMLArClusters	408	53	0.1299	0.0006
fourIsolatedTracks	53	24	0.4528	0.0003
fourLowImpParamTrks	24	14	0.5833	0.0001
ZeeReconstruction	14	14	1.0000	0.0001
HtoZZ4eReconstruction	14	7	0.5000	0.0001

Total				0.0001

7/94500 Zbb events pass

3iso + 1non-iso example

Higgs->4e

	Total	Passed	Efficiency	TotalEff
fourEMLArClusters	8076	734	0.0909	0.0909
fourTrkMatchClusters	734	734	1.0000	0.0909
fourTrkQualClusters	734	531	0.7234	0.0658
threeIsoEMLArClusters	531	435	0.8192	0.0539
fourIsolatedTracks	435	435	1.0000	0.0539
fourLowImpParamTrks	435	384	0.8828	0.0475
ZeeReconstruction	384	381	0.9922	0.0472
HtoZZ4eReconstruction	381	281	0.7375	0.0348

Total				0.0348

Example that can be refined:
3iso+1non-iso-Clusters
 -Must be checked against Zij background

Zbb->4l

	Total	Passed	Efficiency	TotalEff
fourEMLArClusters	94513	10745	0.1137	0.1137
fourTrkMatchClusters	10745	10745	1.0000	0.1137
fourTrkQualClusters	10745	4274	0.3978	0.0452
threeIsoEMLArClusters	4274	408	0.0955	0.0043
fourIsolatedTracks	408	408	1.0000	0.0043
fourLowImpParamTrks	408	236	0.5784	0.0025
ZeeReconstruction	236	230	0.9746	0.0024
HtoZZ4eReconstruction	230	88	0.3826	0.0009

Total				0.0009

88/94500 Zbb events pass
 (before Higgs mass cut)

The point of the example is:
 It is now very easy to study
 any cut flow without writing a
 single line of src code.

Summary

- ◆ A new modular `EV_Hto4l` algorithm is being developed (within the `eventView`)
 - Cut flow implemented in terms of a single preselection tool, fully configurable from `jobOptions`.
 - New Structure eases analysis, performance studies, cut optimization and collaboration with other developers.
 - Many other benefits not yet explored by the authors (experience comes after trying the various possibilities)
- ◆ We have already received very positive feedback:
 - Would like to CVS commit the code in `HiggsToFourLeptons`
 - This will allow interaction/feedback from software experts
 - It will allow parallel development by the collaborating parties
 - It will serve as an example to other Higgs analyses (we had requests for the presently private source code)