Cut-based TauID and Systematic Studies

Björn Gosdzik
ATLAS workshop on Tau Lepton Physics
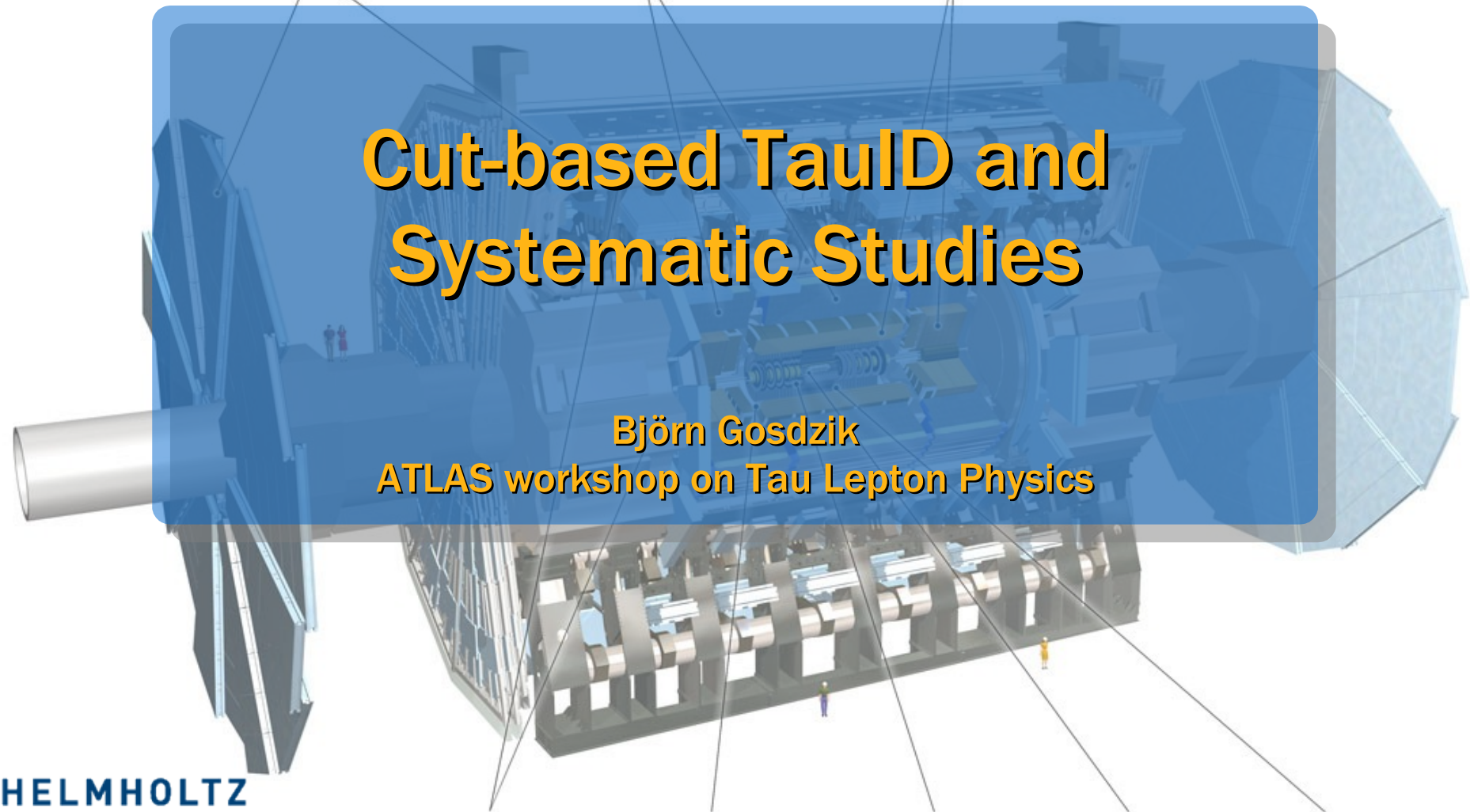
Muon Detectors
Tile Calorimeter
Liquid Argon Calorimeter
Toroid Magnets
Solenoid Magnet
SCT Tracker
Pixel Detector
TRT Tracker

Overview

I. Update on Safe Variables

II. Study on cell systematics

– Motivation and plans

– First results

III. Summary

# News from Safe Variables

- Safe Variables are now implemented in rel. 15 (see TWiki:

  https://twiki.cern.ch/twiki/bin/view/AtlasProtected/TauIdentification#Identification_for_Safe_Variable)

- Do we understand our variables (how safe are they?)

  - How powerful are the individual variables? (see next 6 slides)

  - Are the variables influenced (strong) by systematics? (next part)

- Better understanding of cuts, helps us to detect variables which are probably useless

- Outlook: Summer student project

  - New optimization with new release and samples
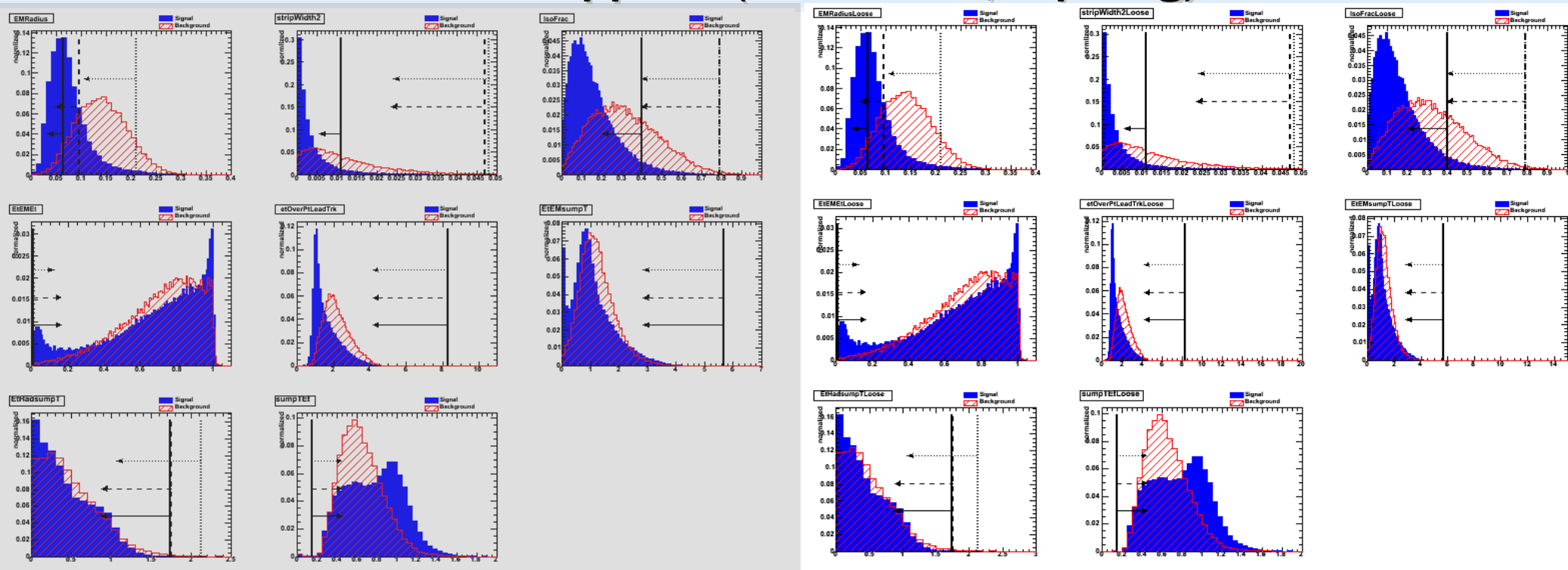
  - Will look on new variables (HadRadius, dRTrkAvg, ...)
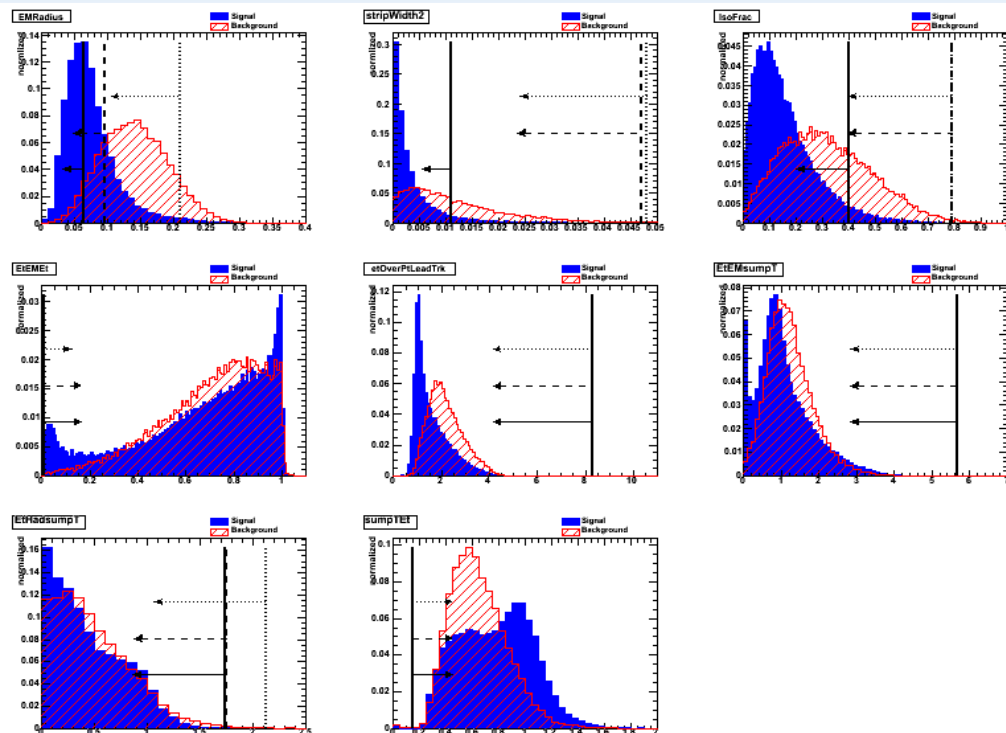
Cut based TauID and Systematic Studies

Distributions no cuts applied (25-45 GeV, 1-prong)

Cut based TauID and Systematic Studies

Distributions loose cuts applied (25-45 GeV, 1-prong)

Cut based TauID and Systematic Studies

Distributions medium cuts applied (25-45 GeV, 1-prong)

Cut based TauID and Systematic Studies
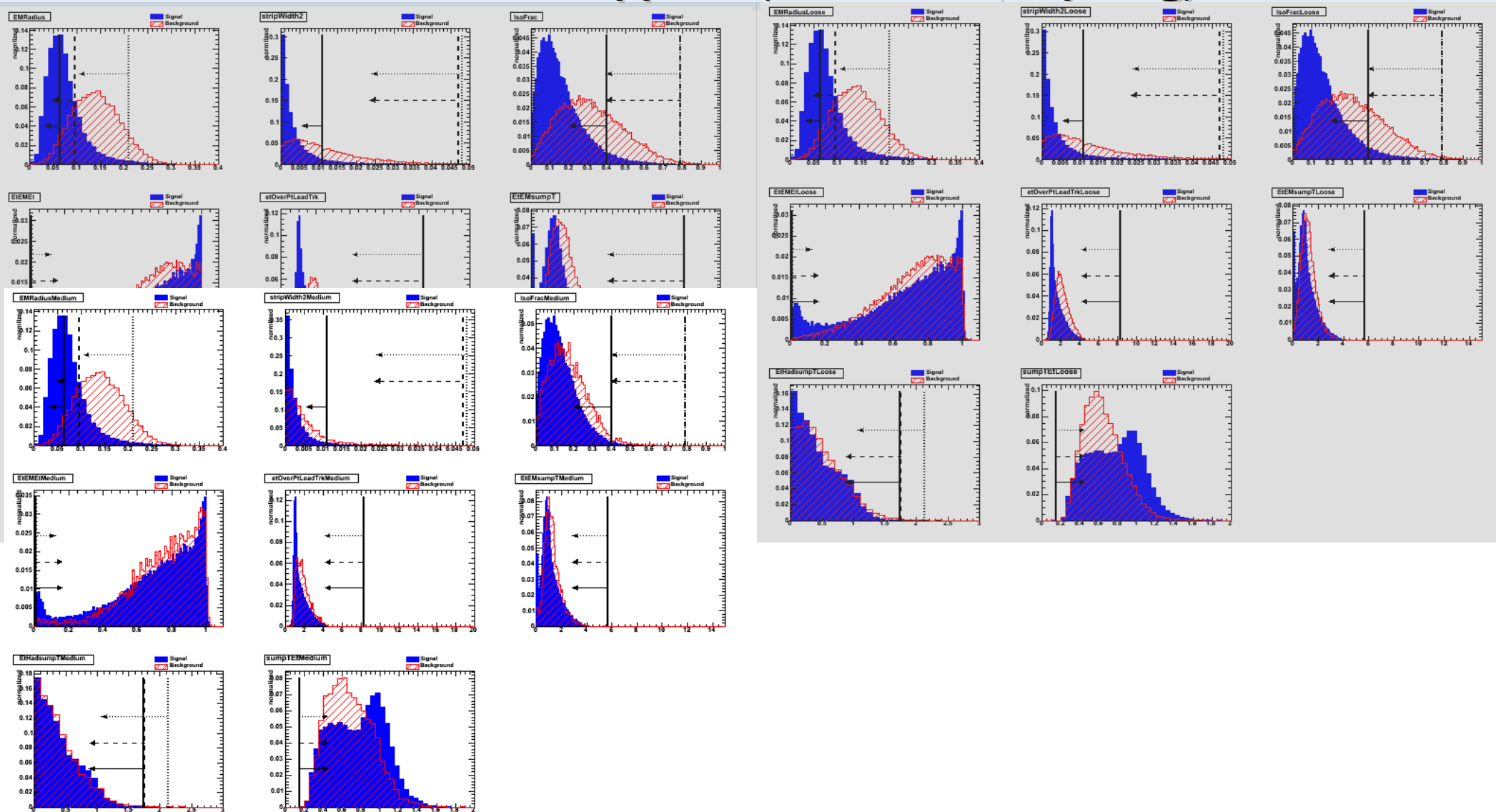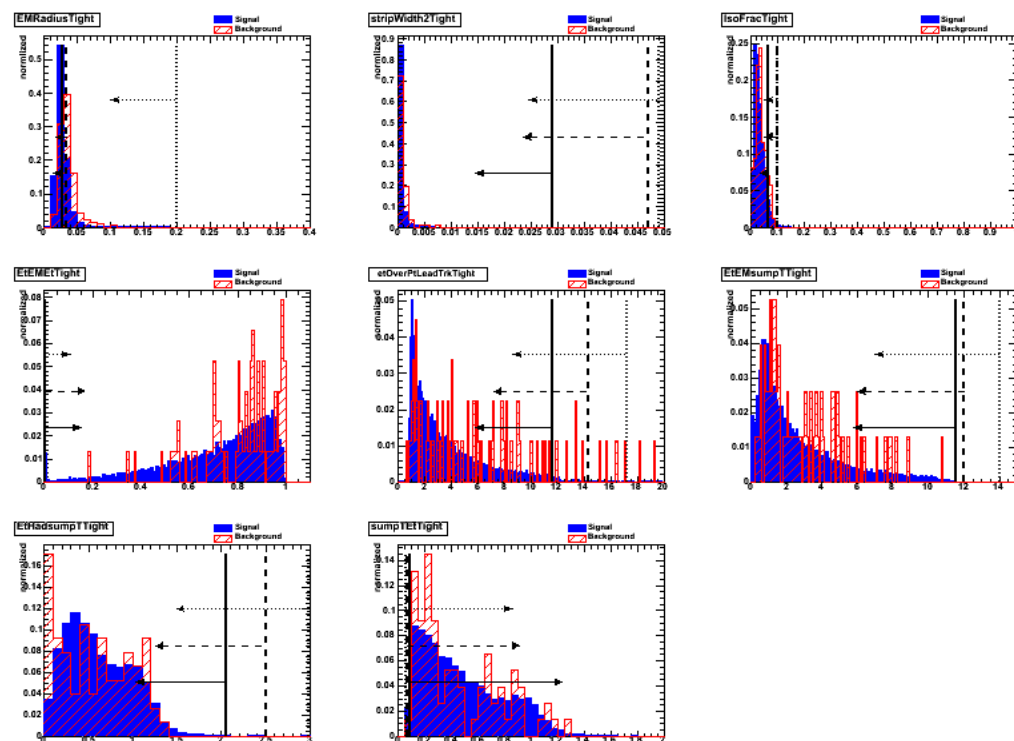
Distributions tight cuts applied (25-45 GeV, 1-prong)
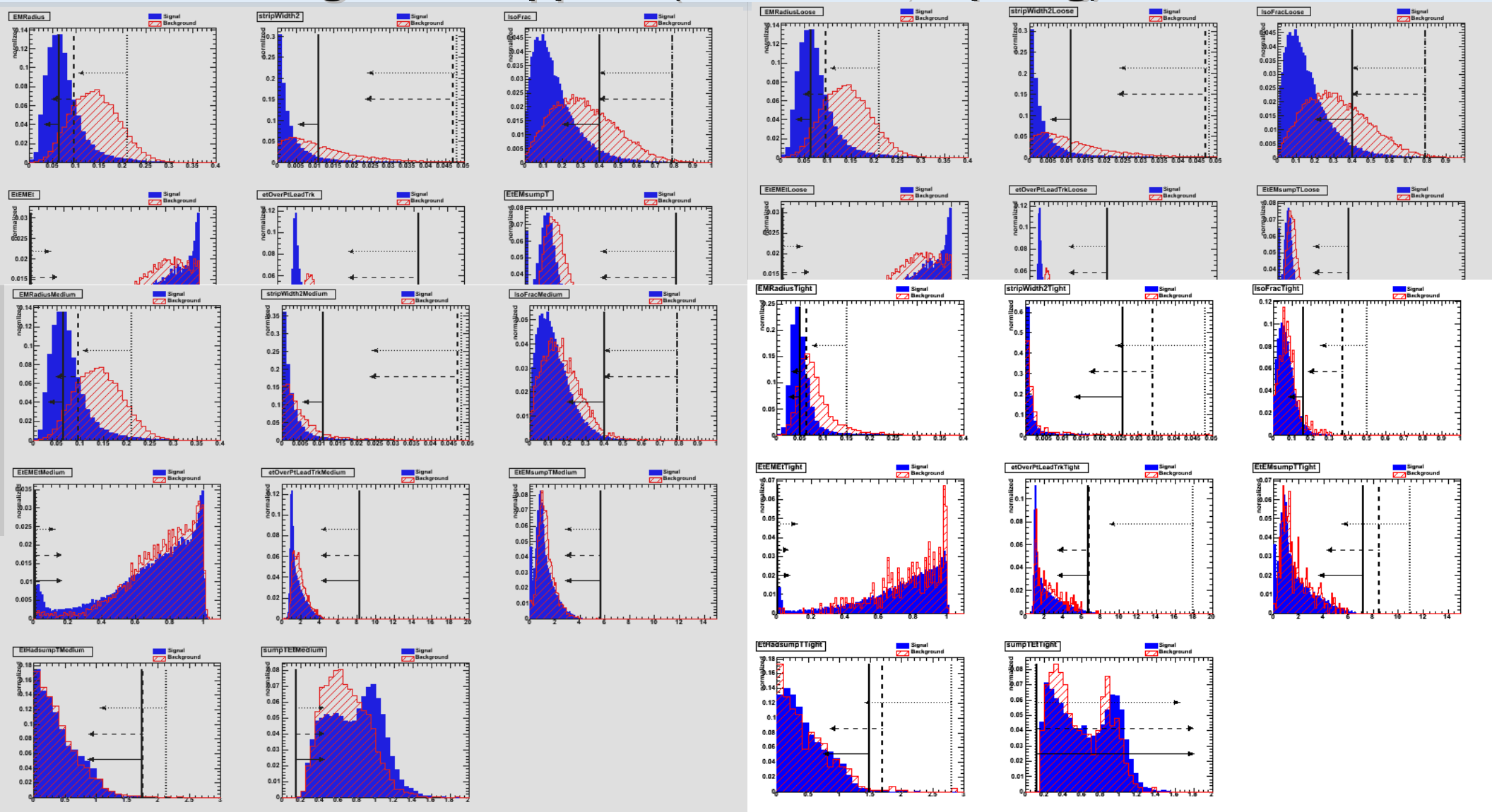
Cut based TauID and Systematic Studies
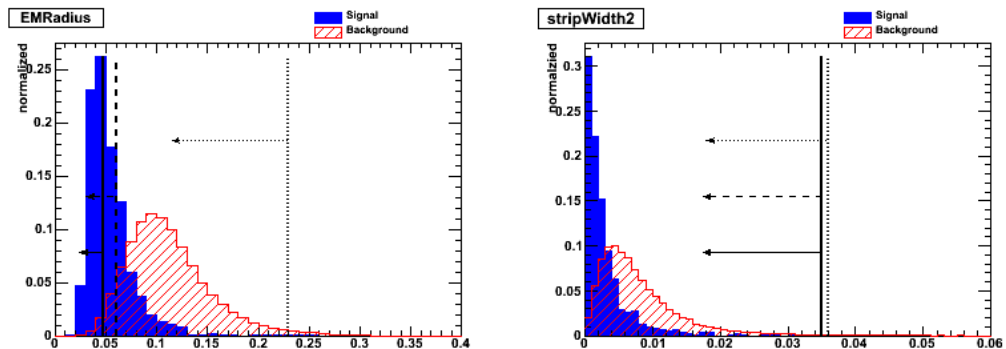
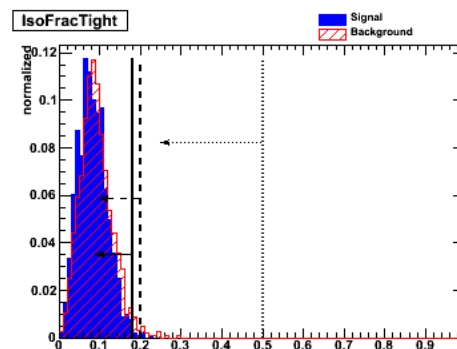# No cuts vs. tight cuts (>100 GeV, 1-prong)
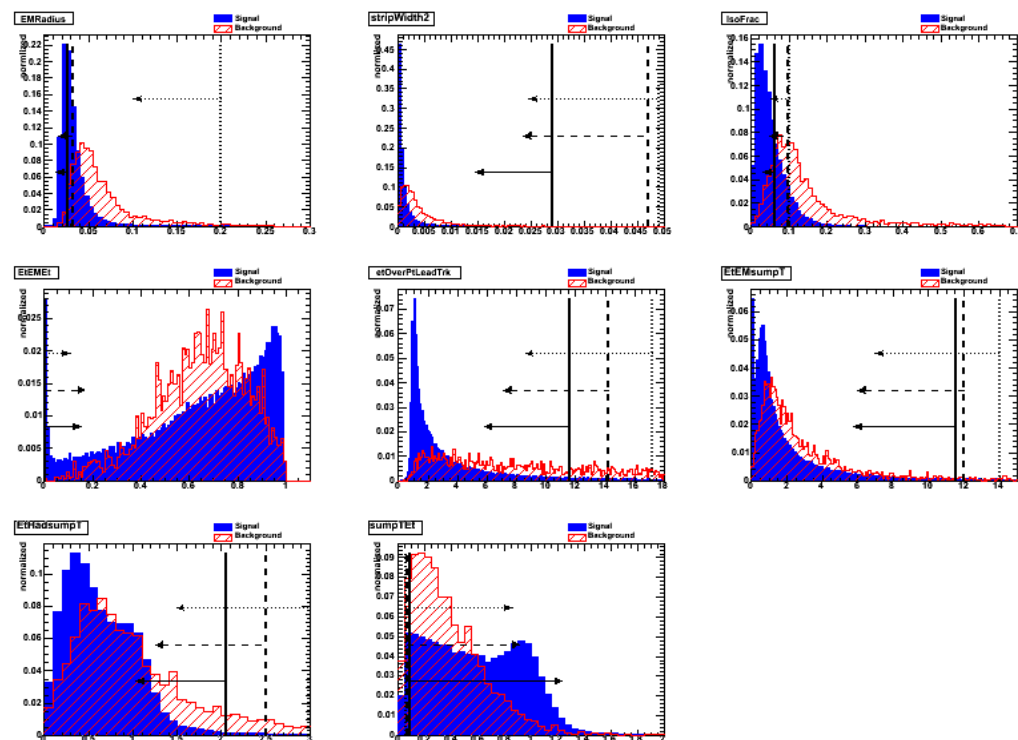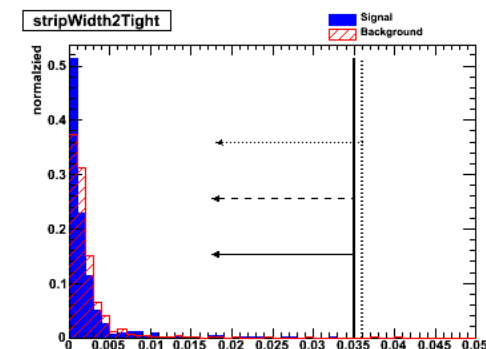
No cuts

Tight cuts

Cut based TauID and Systematic Studies

No cuts vs. tight cuts (70-100 GeV, 3-prong)

No cuts

Tight cuts
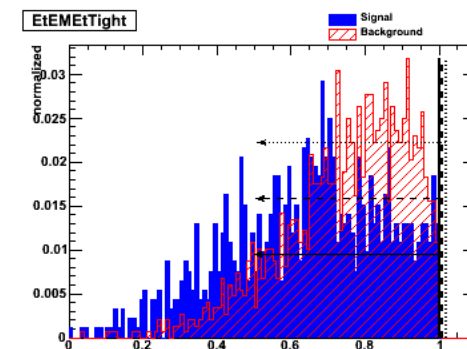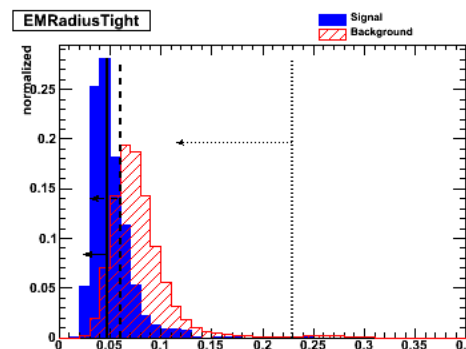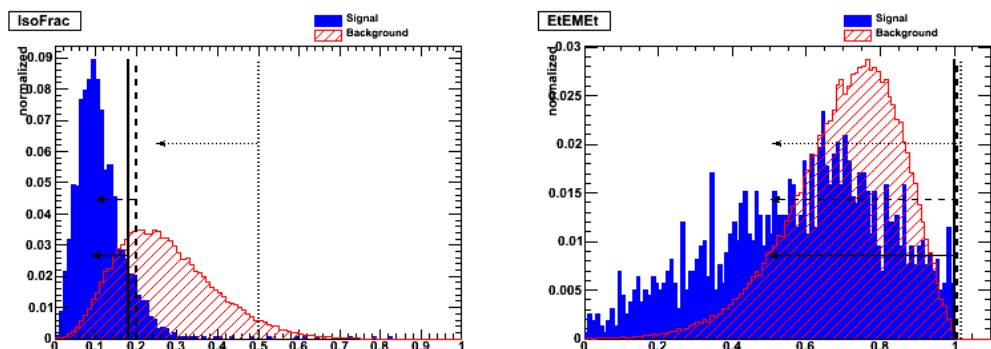
**Cut based TauID and
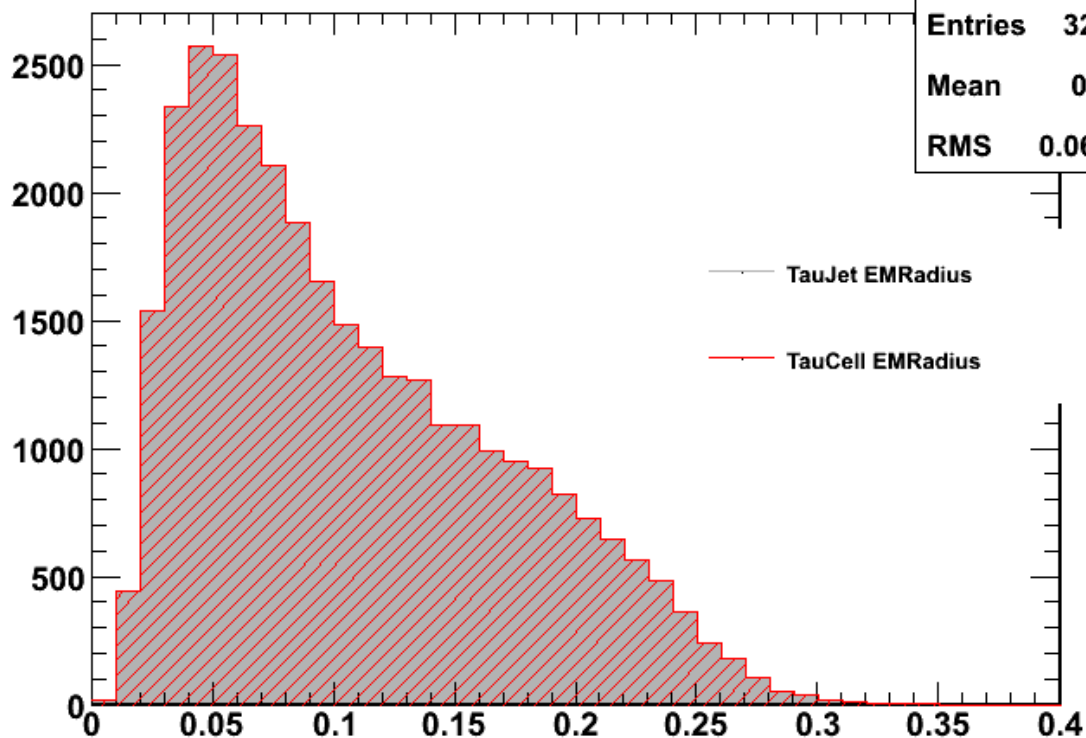Systematic Studies**

Motivation for systematics

- **Study uncertainties on cell energy:**

    - Smearing of EM scale/had scale

    - Smearing of individual cells

    - Add noise on individual cells

- **Should help us to understand**

    - Calorimetric uncertainties

    - Discriminating variables

- **Topological cell cluster are associated to TauJets, uncalibrated cells are used to calculate discriminant variables**

- **Uses all cells of the associated TopoCluster within a certain dR (e.g. dr<0.4 for EMRadius)**

- **So far no such kind of study has been accomplished (e.g. in Jet-etmiss-wg)**

Cut based TauID and Systematic Studies

Recalculate discriminants: EMRadius

- New EventViewUserData class to extract cell information of cells associated to TauJet

- No uncalibrated TopoCluster Container in ESD! (CaloTopoCluster), i.e. link TauJet->Cells is broken, will be fixed soon

- Short term solution: run tauRec, JetRec and CaloRec on top of your analysis (e.g. TauDPDMaker to produce D3PD)

- Calculation of discriminants based on tauCellBuilder.cxx

Disclaimer: All plots are just for demonstrative purpose, please don't analyse them
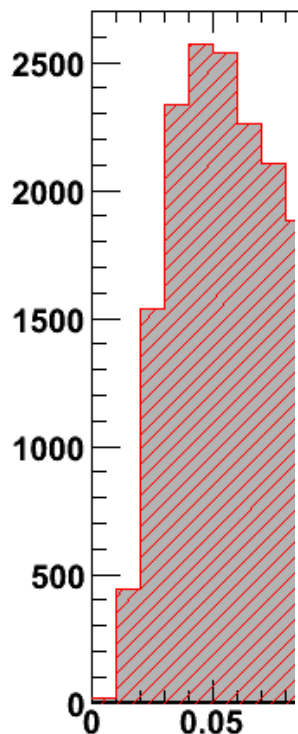
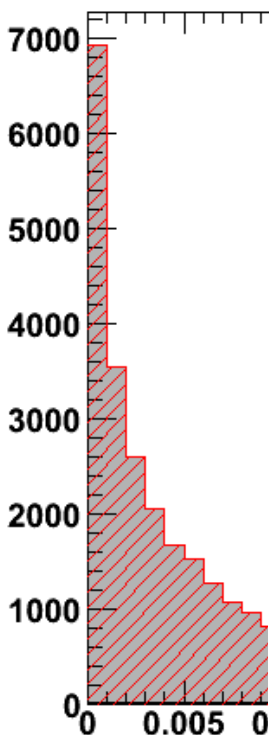# Cut based TauID and Systematic Studies

Recalculate discriminants: stripWidth2

Comparison TauJet_EMRadius/TauCell_EMRadius

TauRec_EMRadius

Entries   32098

Comparison stripWidth2

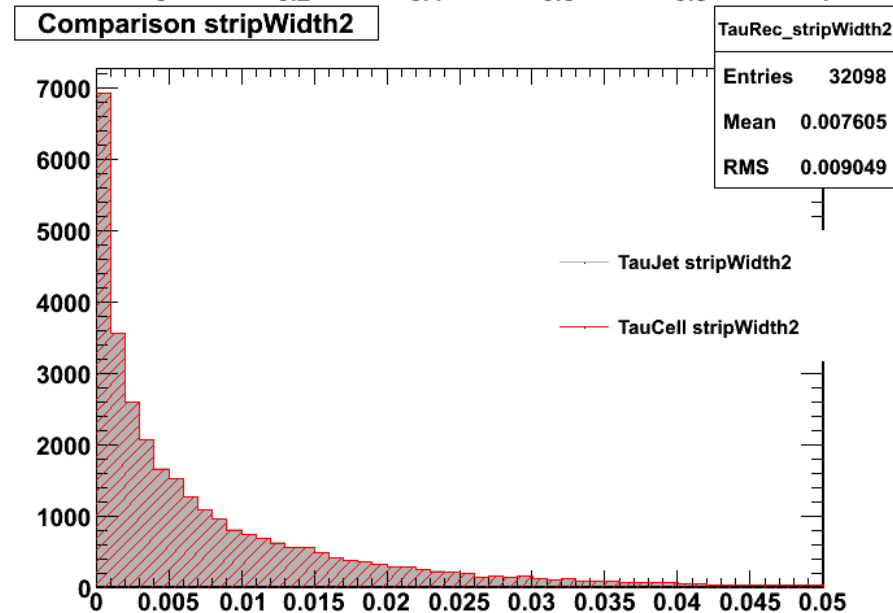| TauRec_stripWidth2	
Entries	32098
Mean	0.007605
RMS	0.009049

TauJet stripWidth2

TauCell stripWidth2

Cut based TauID and Systematic Studies

Recalculate discriminants: IsoFrac
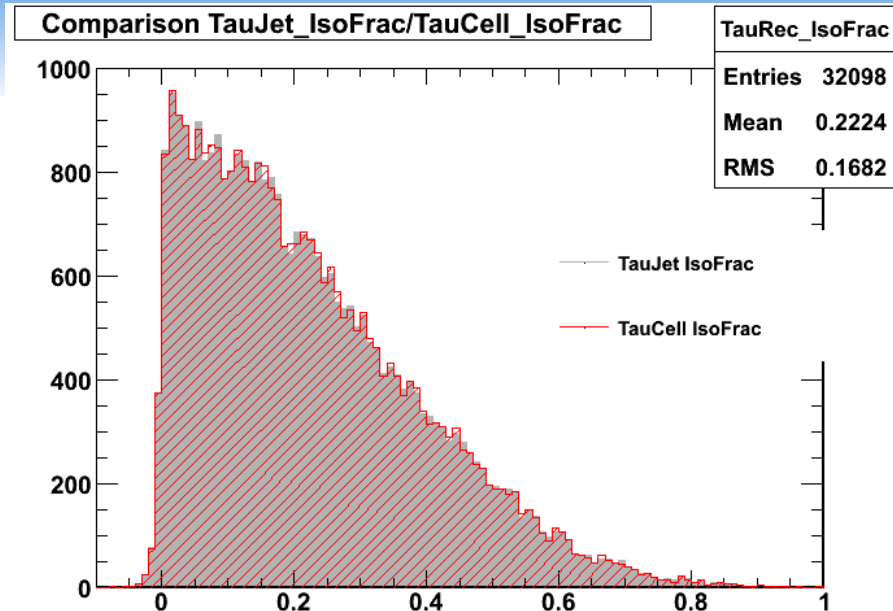
Cut based TauID and Systematic Studies

Energy smearing gaussian

5 % →

Comparison TauJet_EMRadius/TauCell_EMRadius

TauRec_EMRadius	
Entries	32098
Mean	0.107
RMS	0.06356

TauJet EMRadius
TauCell EMRadius

Comparison TauJet_EMRadius/TauCell_EMRadius

TauJet E
TauCell E

← **50 %**

Cut based TauID and Systematic Studies
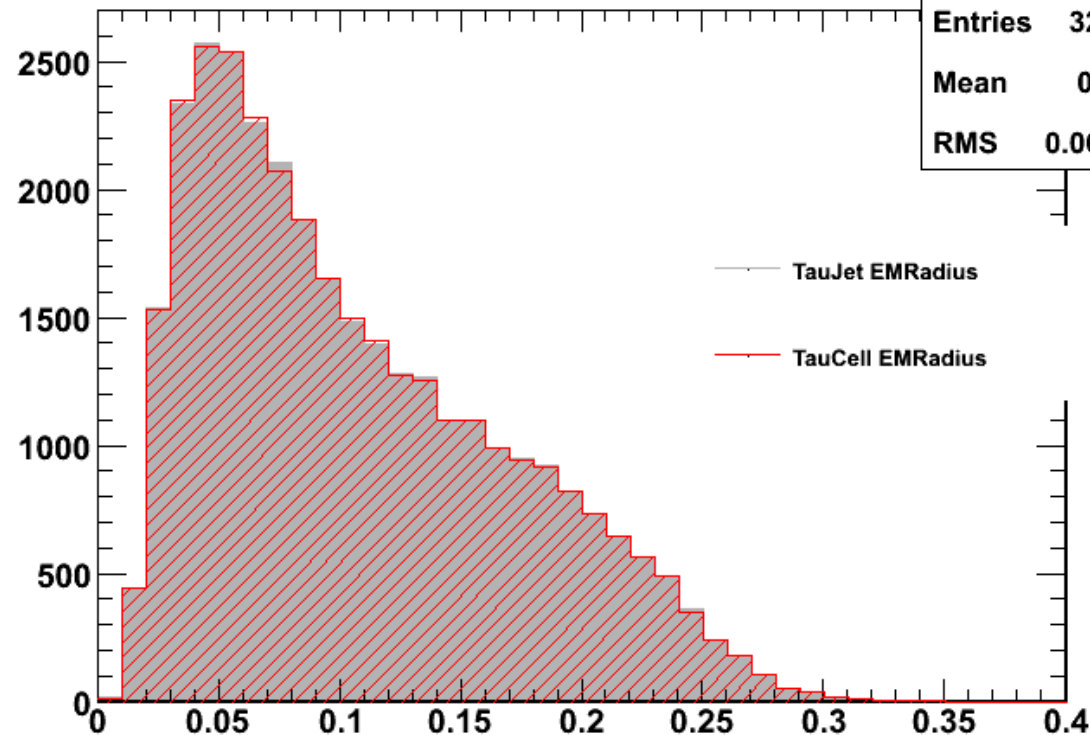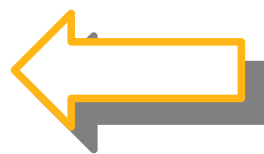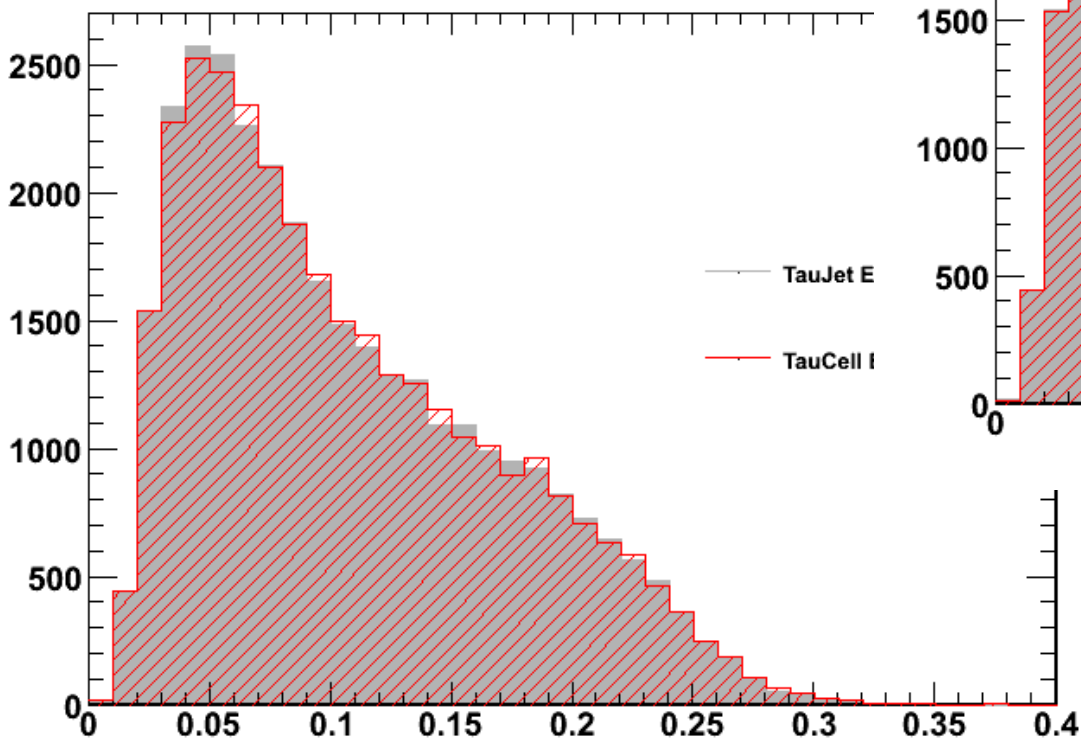
Energy smearing uniform

Cut based TauID and Systematic Studies

Noise

Cut based TauID and Systematic Studies
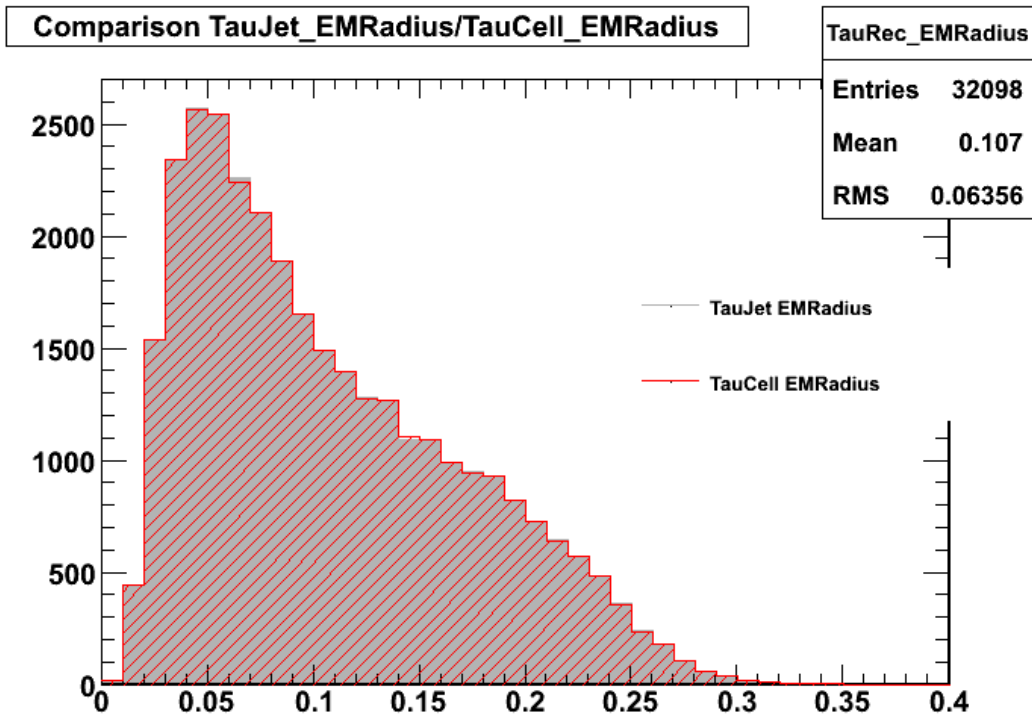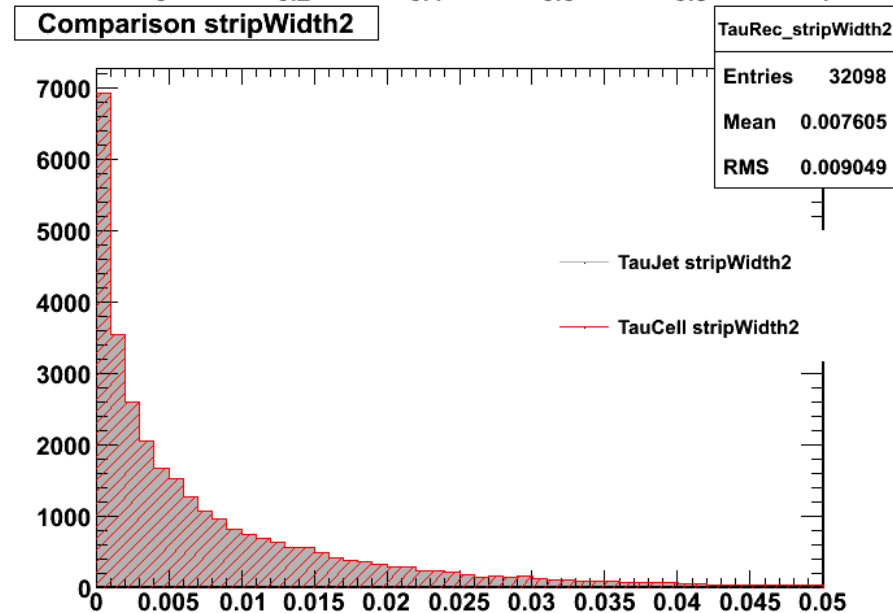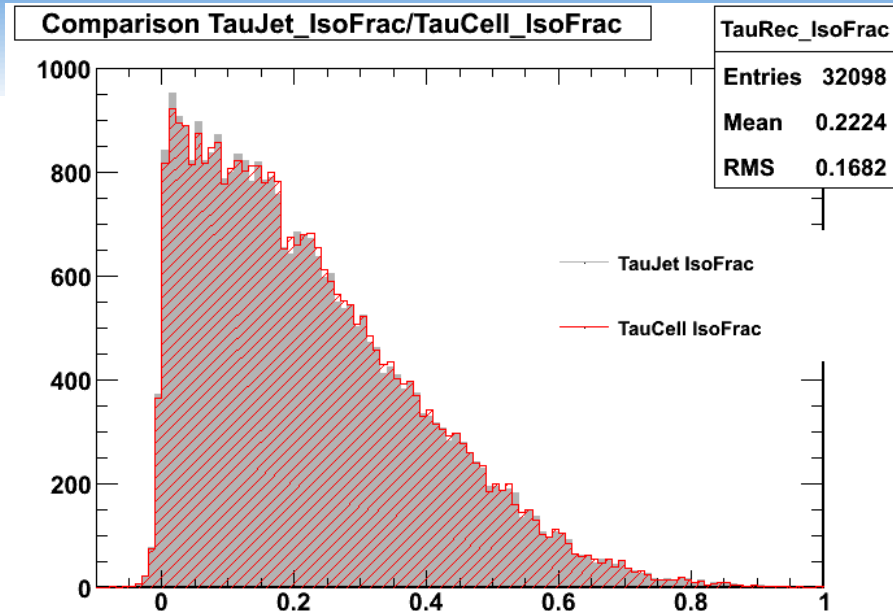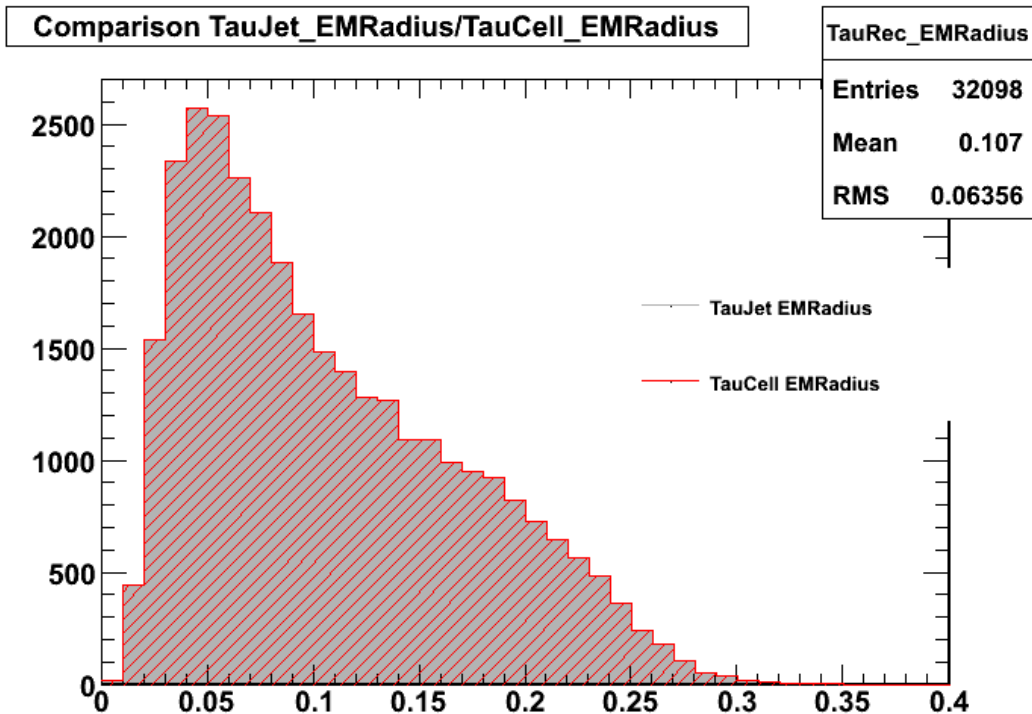
Summary

- **Update on Safe Variables:**
  - Implemented! (Thanks to C. Gwilliam for being our guinea pig ;))
  - Understanding of variables ongoing
  - Summer student project on new optimization

- **Study on cell systematics:**
  - No similar study before
  - Method available to extract information of individual cells associated to TauJets -> re-calculate discriminants
  - We can now apply any kind of smearing, mis-calibrating our noise before calculating the discriminant variables
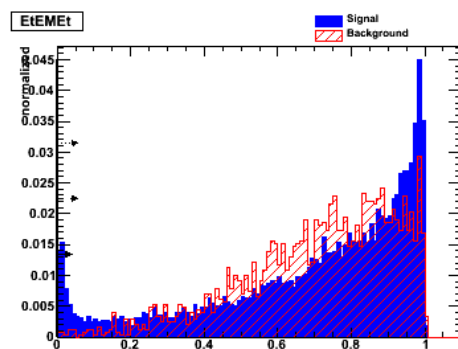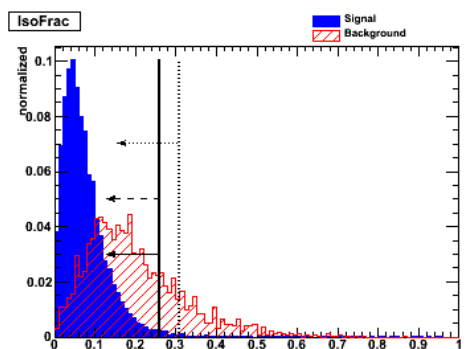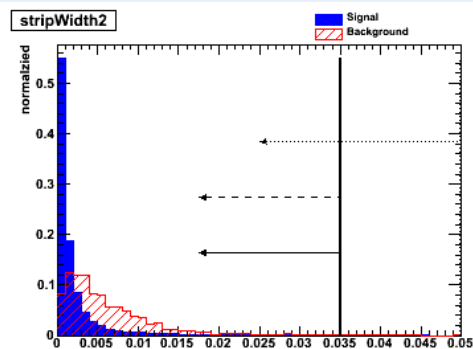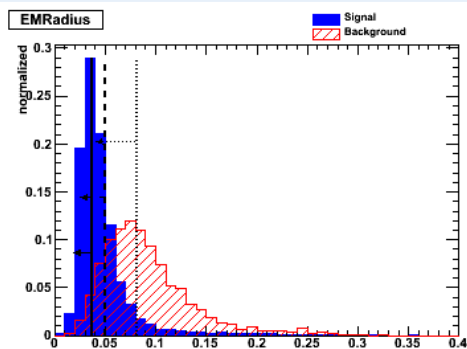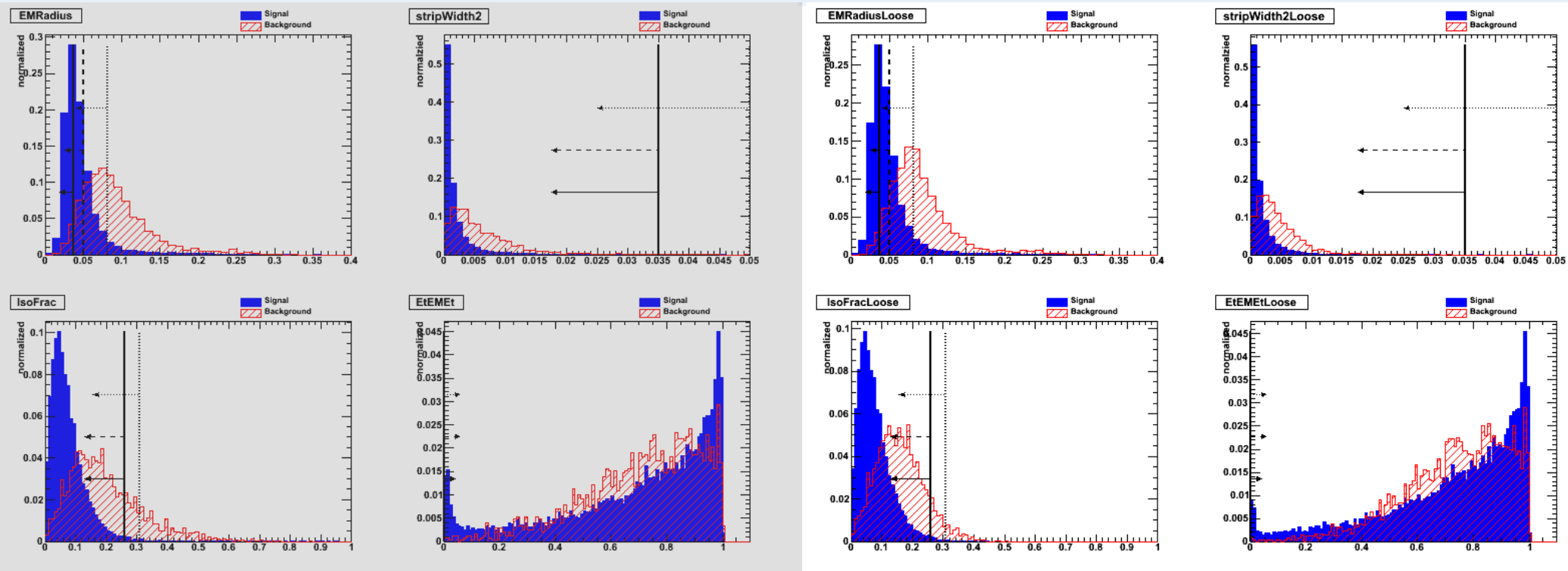
Backup

**Update on Safe Variables
Study on cell systematics**

Distributions no cuts applied (45-70 GeV, 1-prong)

Update on Safe Variables
Study on cell systematics

Distributions loose cuts applied (45-70 GeV, 1-prong)

Update on Safe Variables
Study on cell systematics

Distributions medium cuts applied (45-70 GeV, 1-prong)

Update on Safe Variables
Study on cell systematics

Distributions tight cuts applied (45-70 GeV, 1-prong)

Cut based TauID and Systematic Studies

Energy smearing gaussian

5 %
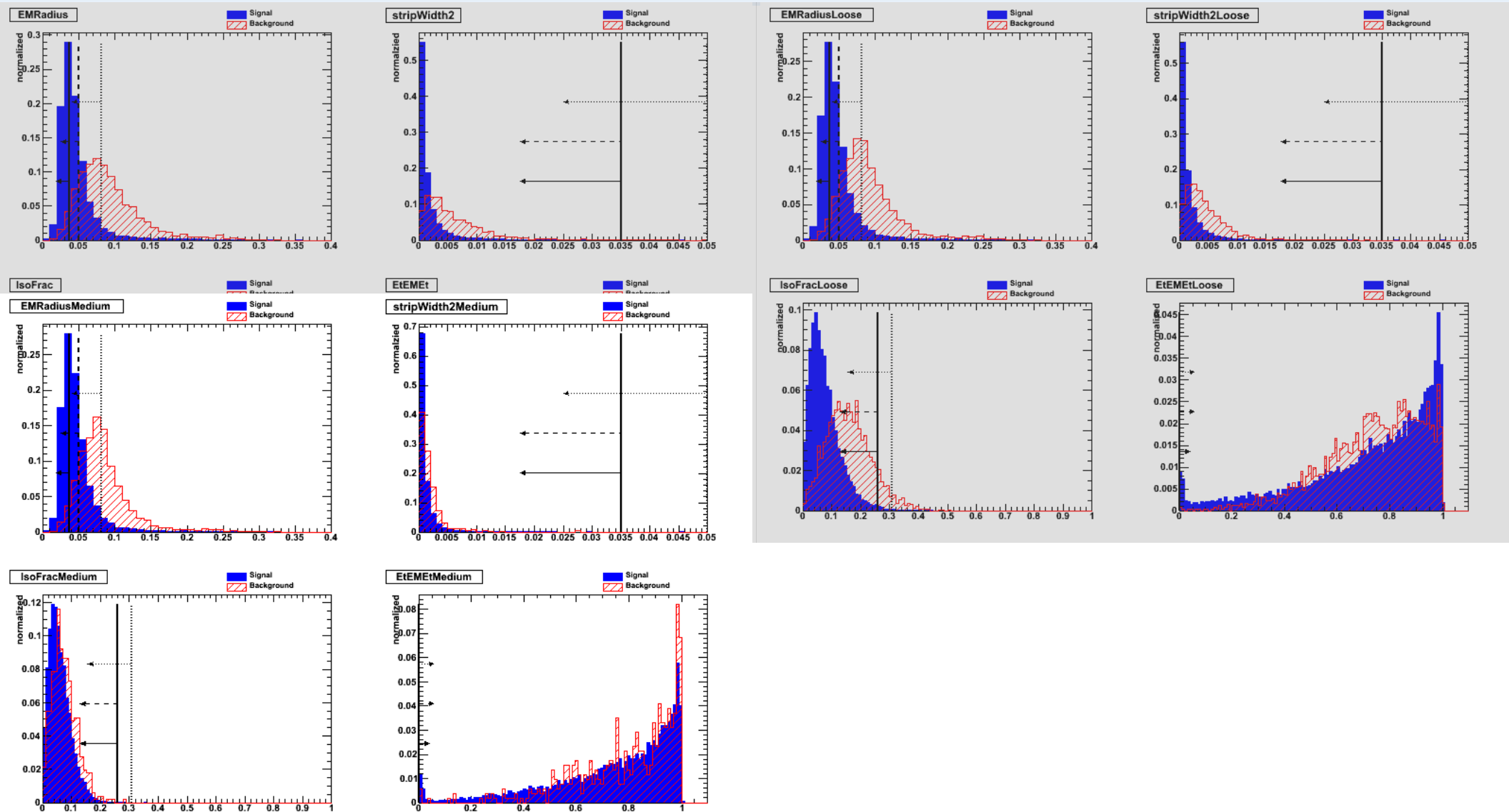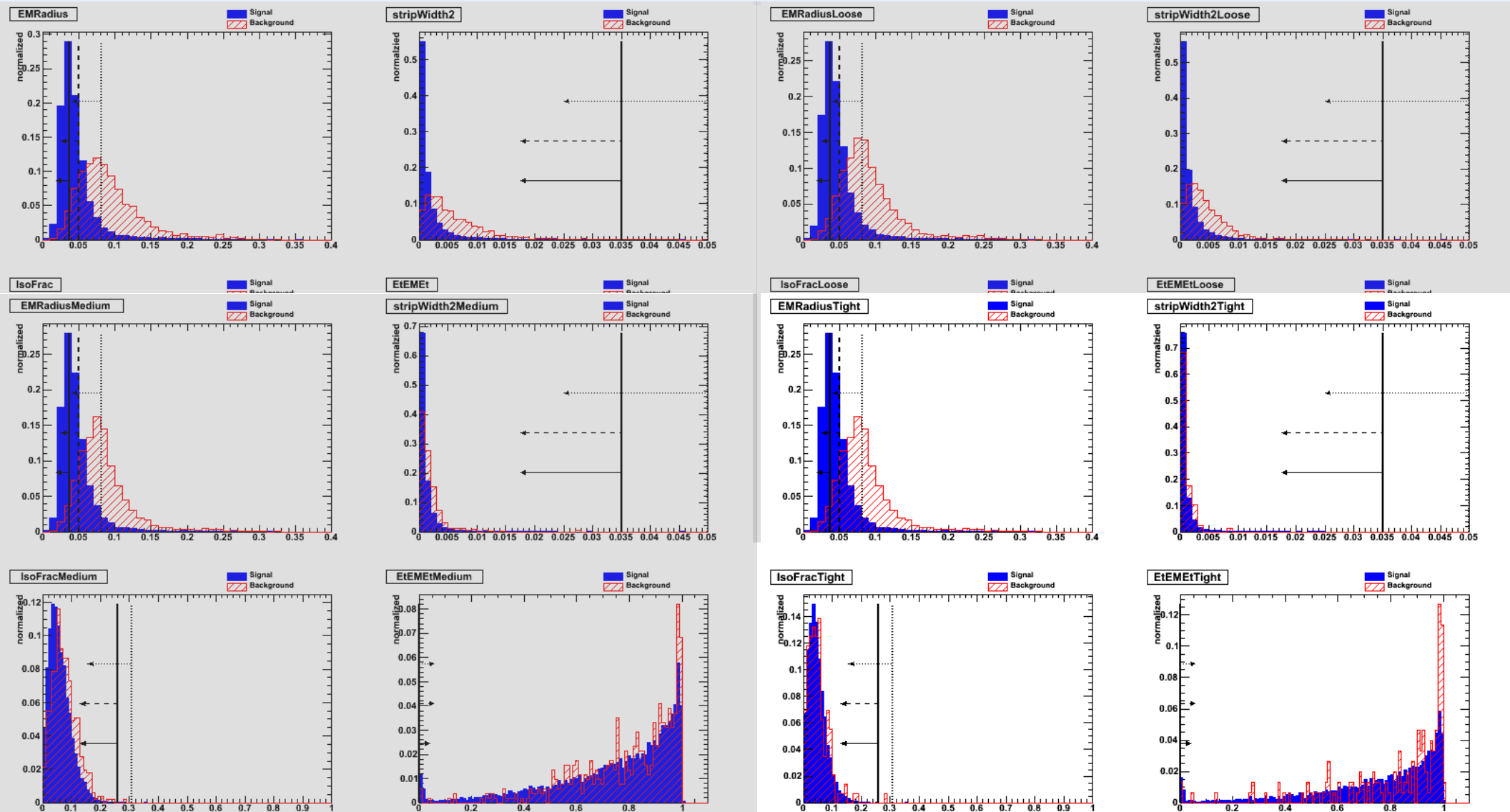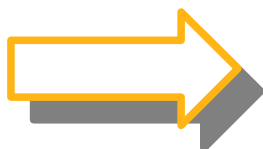
Comparison TauJet_IsoFrac/TauCell_IsoFrac

TauRec_IsoFrac	
Entries	32098
Mean	0.2224
RMS	0.1682

TauJet IsoFrac

TauCell IsoFrac

Comparison TauJet_IsoFrac/TauCell_IsoFrac

TauJet

TauCell

50 %

Energy smearing gaussian

5 %

50 %