Preparation for Jet Analysis of Jupiter data using MarlinReco+PandoraPFA

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Satoru Uozumi (Kobe University)

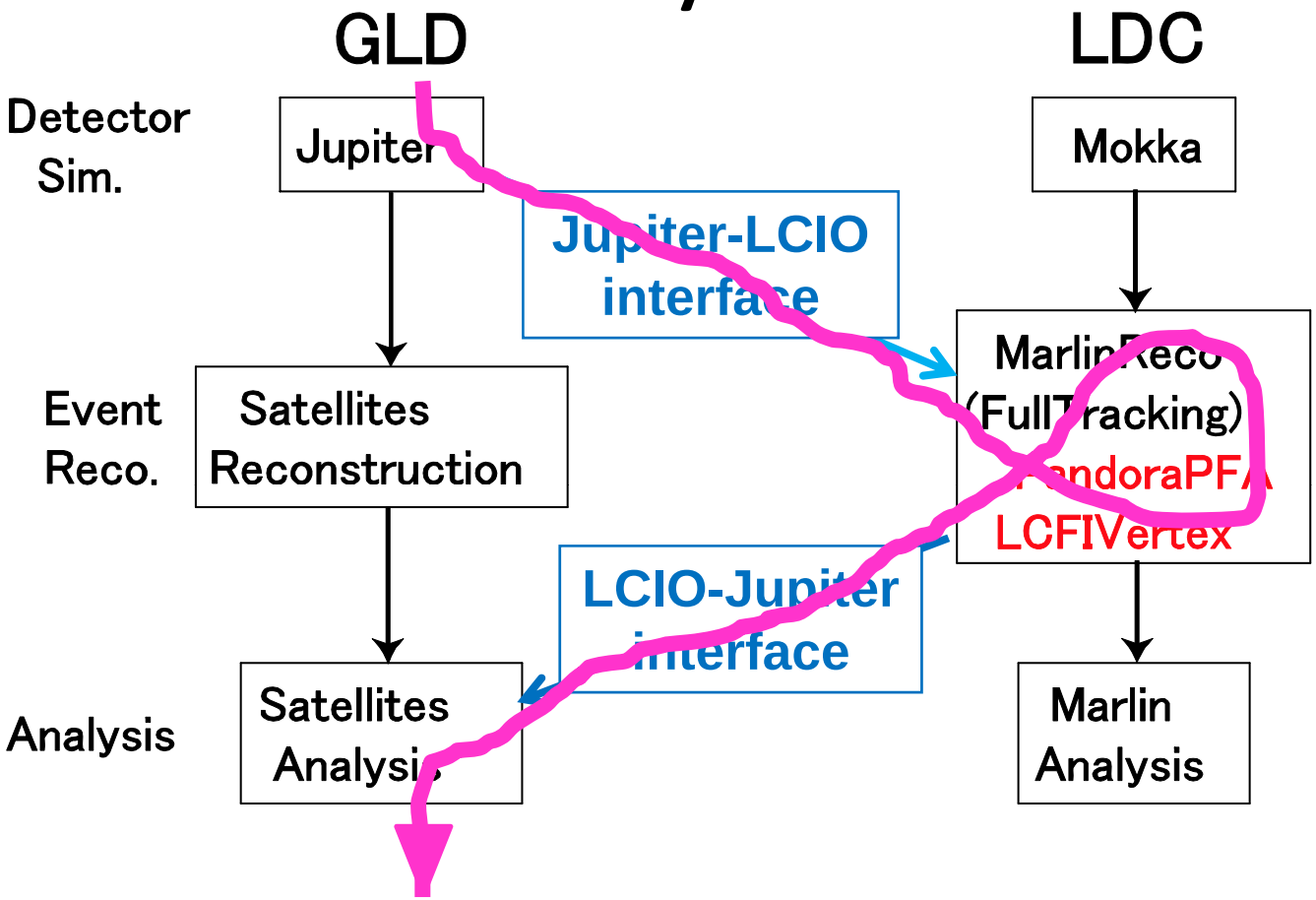
Goal of this work:
Detector optimization with benchmark process of Zh -> jets mode

Processes ($e^+e^-\rightarrow$)	$\sqrt{S}$ (GeV)	Observables	Comments
ZH, ZH→e^+e^-X,	250	σ, m_H	m_H=120GeV, test materials and γ_{ID}
→$\mu^-\mu^+$X	250	σ, m_H	m_H=120GeV, test $\Delta P/P$
ZH, H→cc, Z→νν	250	Br(H→cc)	Test heavy flavour tagging and anti-tagging of light quarks and gluon
, Z→qq	250	Br(H→qq)	Same as above in multi-jet env.
Z* → $\tau^+\tau^-$	500	σ, A_{FB}, Pol(τ)	Test π^0 reconstruction and τ rec. aspects of PFA
tt, t→bW, W→qq'	500	σ, A_{FB}, m_{top}	Test b-tagging and PFA in multi-jet events. m_{top}=175GeV
$\chi^+\chi^-$, $\chi_2^0\chi_2^0$	500	σ, mχ	Point 5 of Table 1 of BP report. W/Z separation by PFA

This benchmark process probes performance of :

- Vertexing and flavour-tagging.
- Di-jet mass reconstruction.

Analysis tools



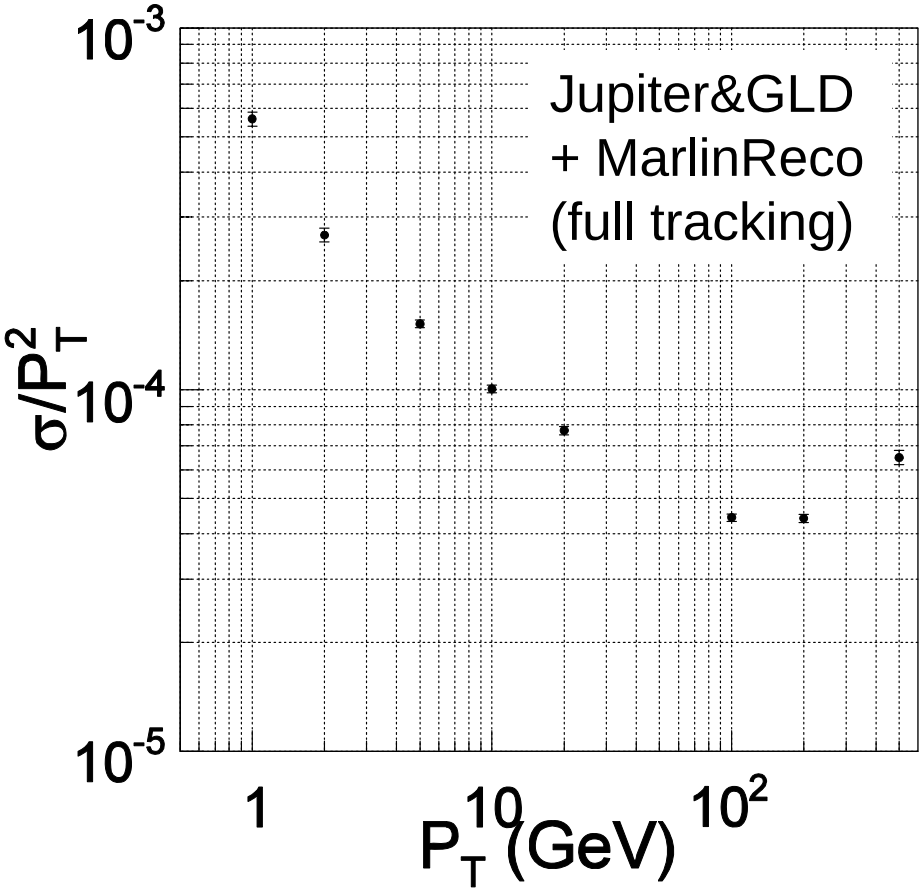
- Interfaces are being developed to reconstruct Jupiter data with Marlin modules.
- Before entering the actual analysis, need to solve many compatibility problems and to tune parameters using single particles / z-pole events.

This talk reports preliminary results of:

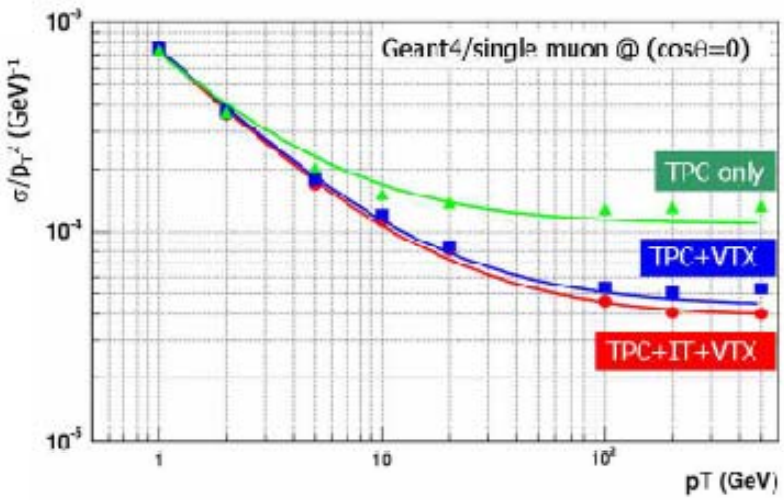
- Tracking performance (P_T, d_0 resolution) of MarlinReco,
- Vertexing and flavour tagging performance of LCFIVertex,
- Higgs-mass distribution reconstructed by PandoraPFA,

for the Jupiter & GLD data.

Momentum Resolution for single muon

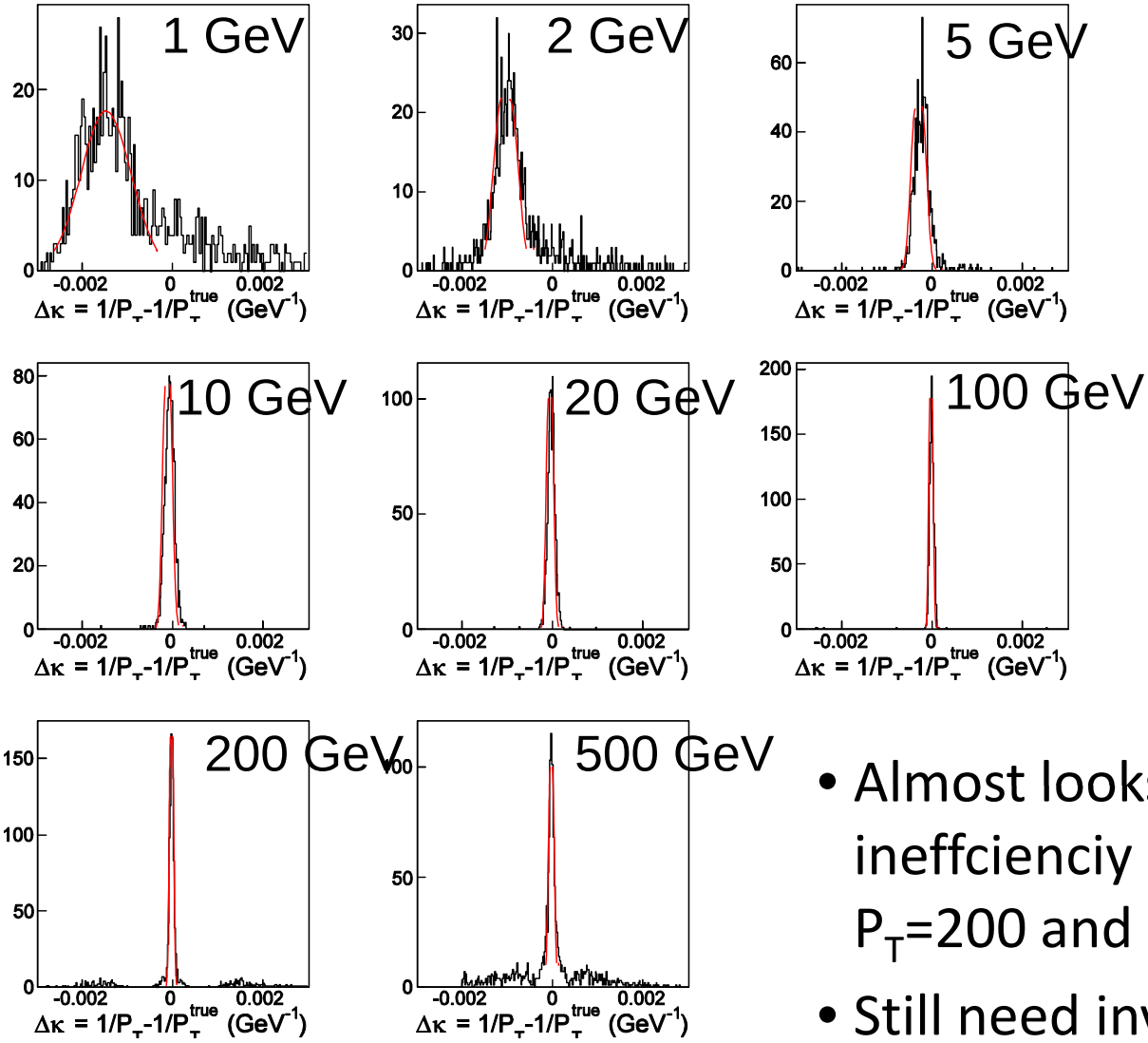


GLD DOD



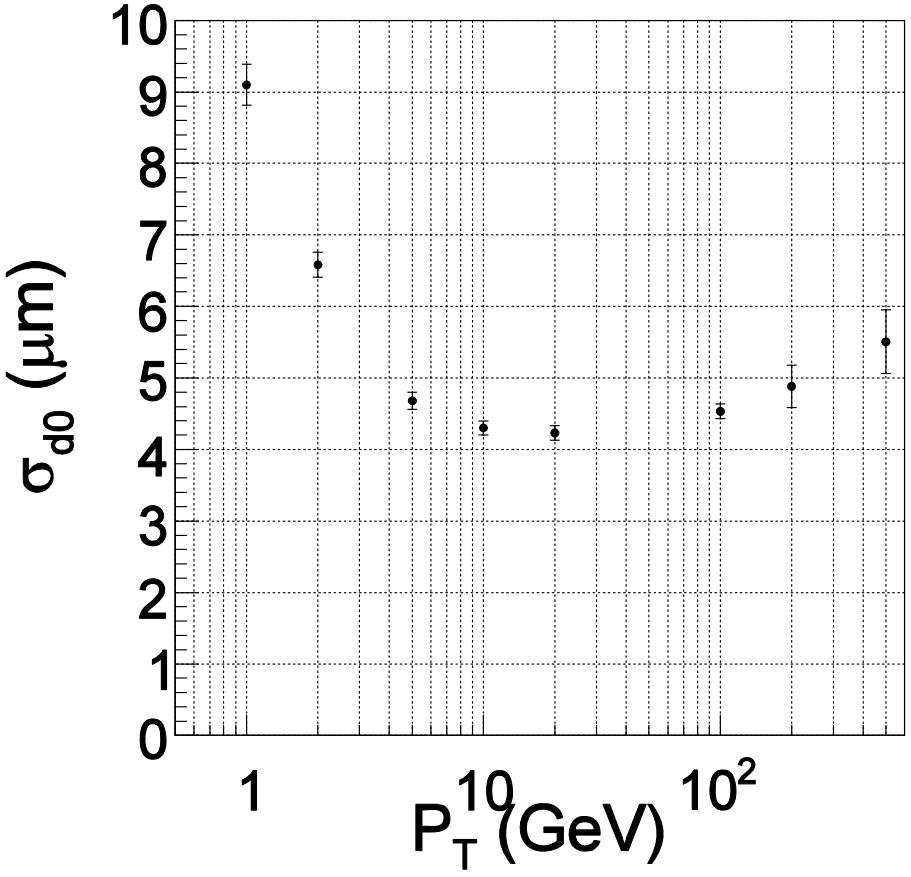
- Single muon data ($\cos\theta=0$, $\phi=90^o$, z_0=+1cm) generated by Jupiter and converted to lcio.
- The momentum resolution looks consistent with past result with Jupiter+Satellites (except p_T=500GeV).

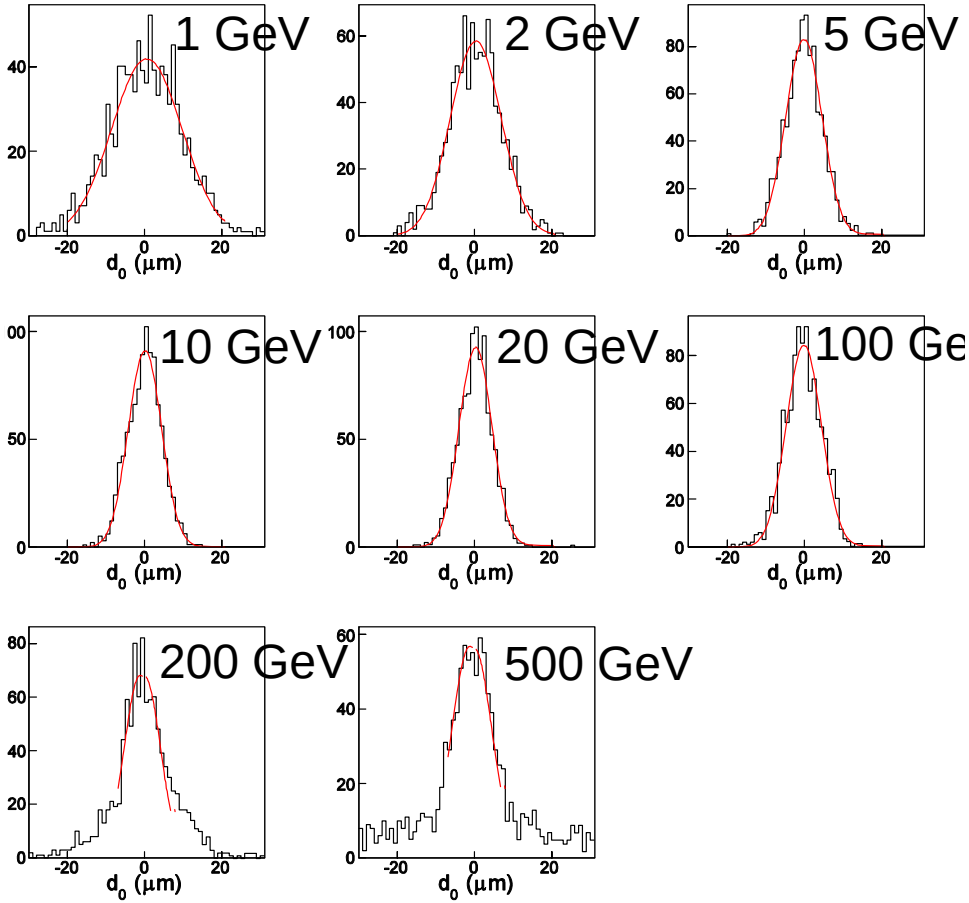
Momentum Resolution for single muon



- Almost looks fine, however ineffciencyiy has been seen at P_T=200 and 500 GeV.
- Still need investigation…

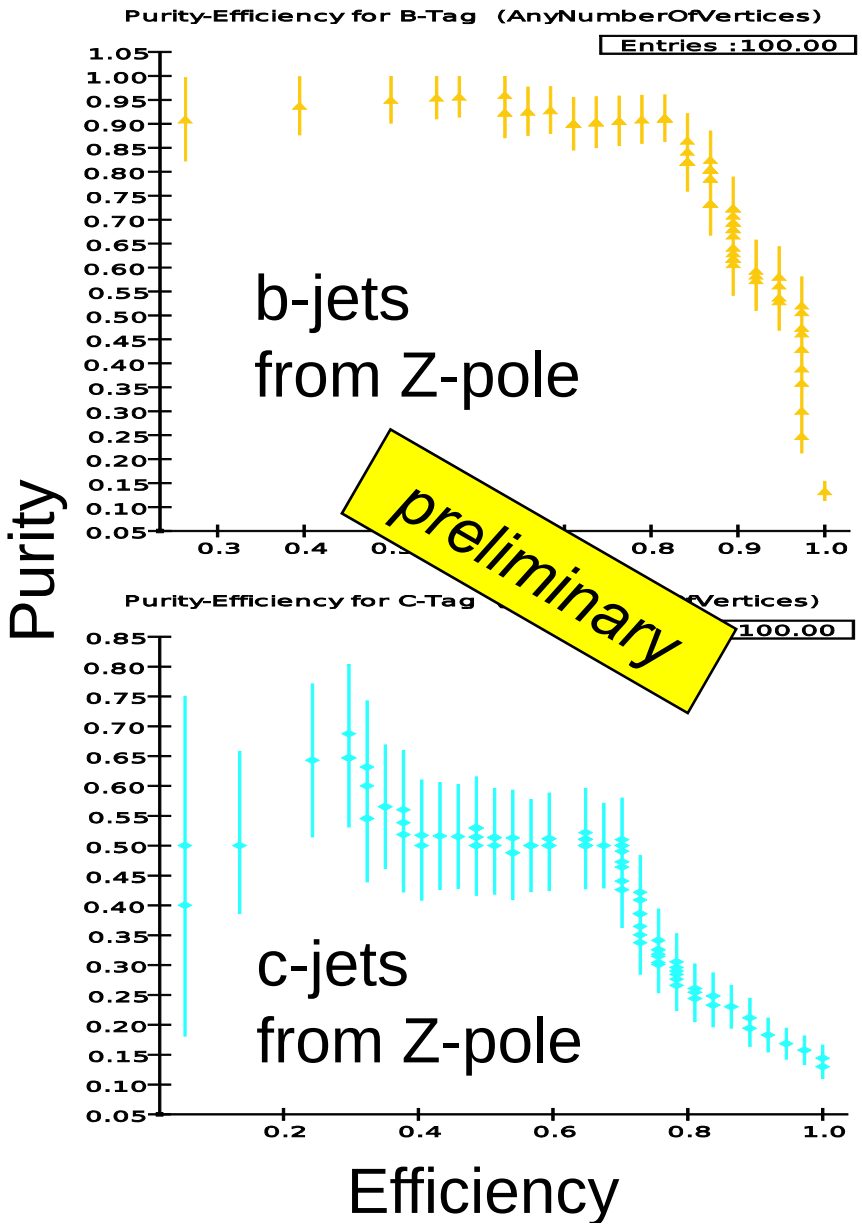
Impact-Parameter Resolution for single muon

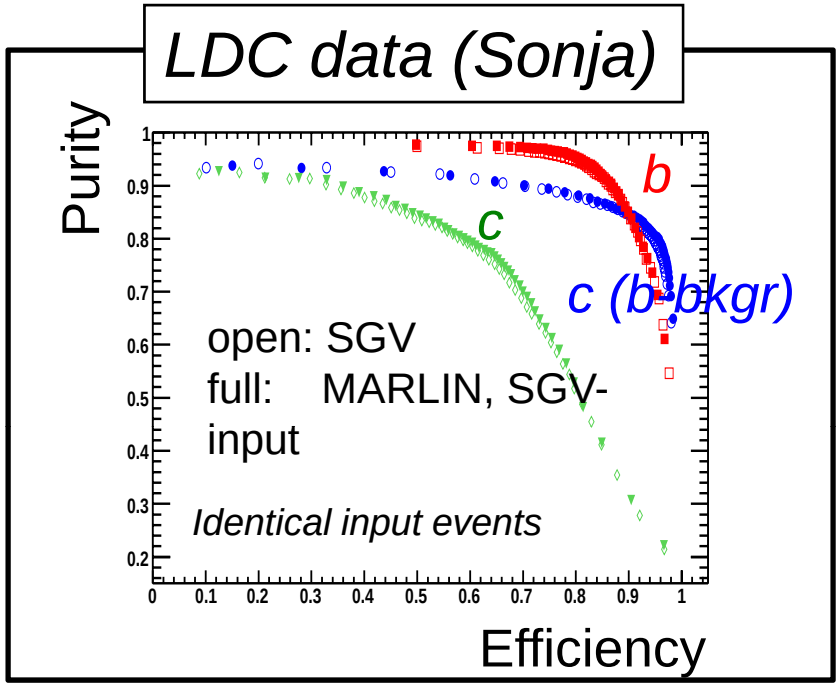




- Again Single muon data with generated d_0 = 0 μm.
- Going to be slightly worse in >100 GeV, but reasonably good for the vertex finding.

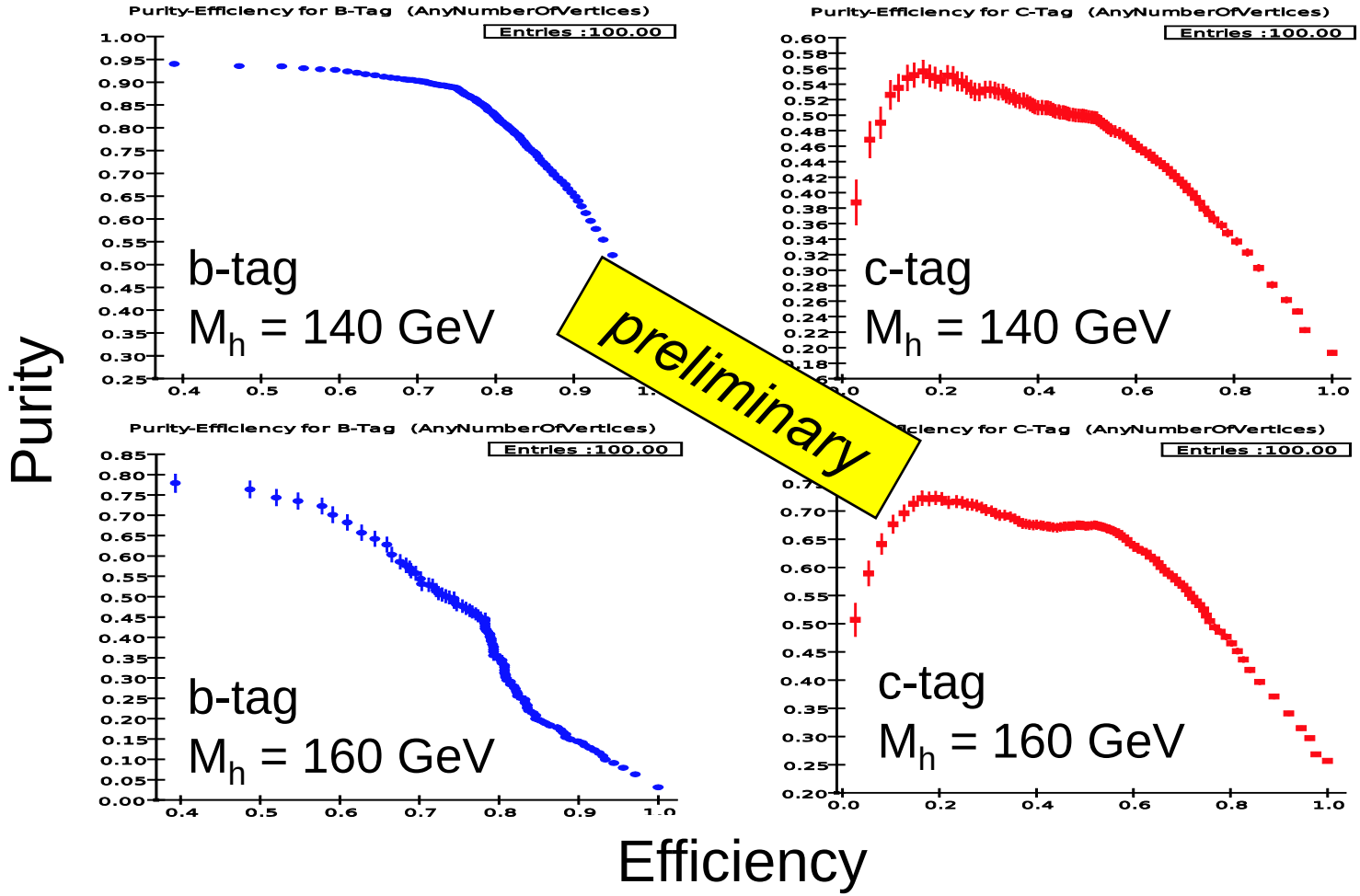
Flavour tagging with LCFIVertex (Z-pole data by Jupiter&GLD)





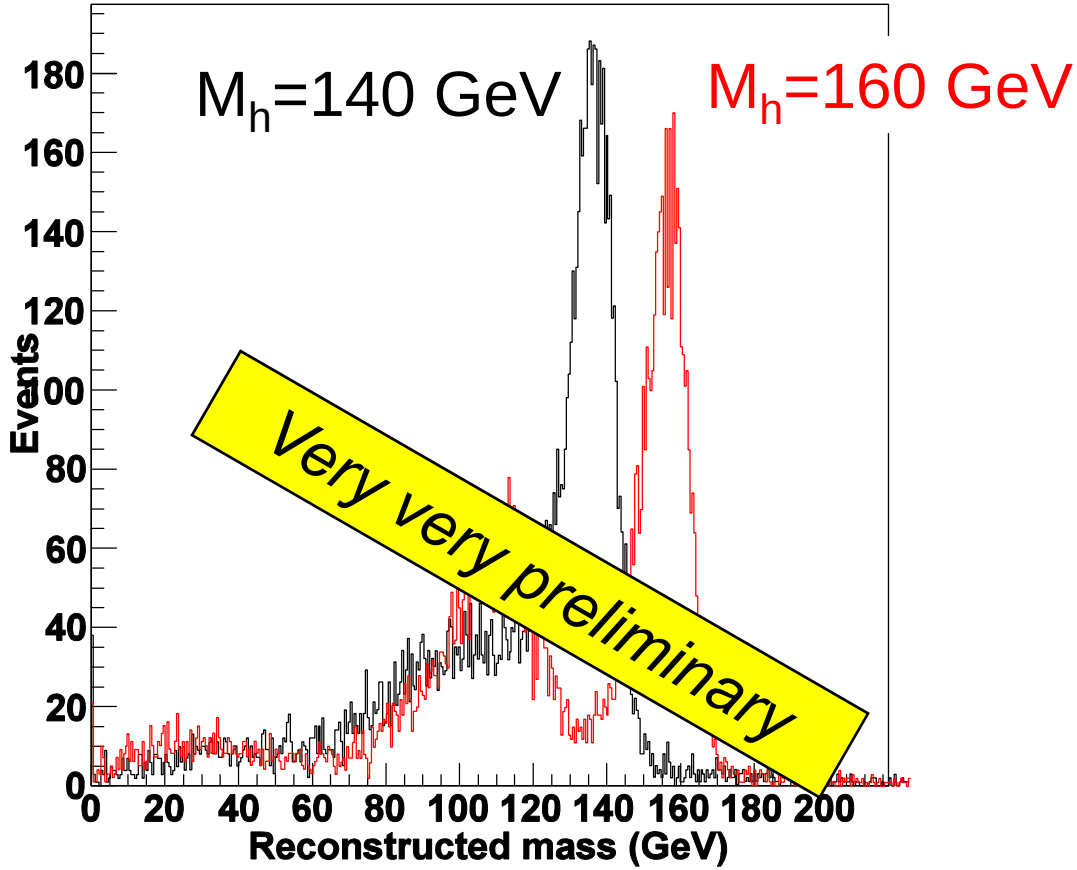
- Same neural-net with LDC simulation is used.
- The b-tagging performance is reasonably good.
- c-tagging for c-jets is not yet as good as LDC case, need investigation.

Flavour tagging with LCFIVertex (Zh, Z→νν, h→j j data by Jupiter)



- The b-tagging gets worse with boosted jets (Mh=160GeV).
- Overall performance is not well enough yet, need tuning of LCFIVertex parameters for the GLD/GLD'.

Reconstructed Higgs Mass by PandoraPFA (Zh, Z→νν, h→j j data by Jupiter)



- Very preliminary, just plot all the events, no cut is applied.
- Still peak position is shifted from the generated value? Need investigation and tuning…

Summary

- We are going to perform optimization study using
  Zh → jets mode using Jupiter+Marlin processors.
- After defeating many technical problem on Jupiter→Marlin compatibility, an analysis path is established!
- However performance of event reconstruction is not yet perfect, need investigation and precise tuning on many parameters (calibration, neural-net, cut values…)

(Near Future) Plans

- Detailed parameter tuning to have the best performance with GLD and GLD-prime geometry.
- Estimate sensitivity on Br(H→cc) and compare it between the GLD and GLD-prime.