JES using Z($\rightarrow e^+e^-$) + jet events

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Fermilab

JEC meeting

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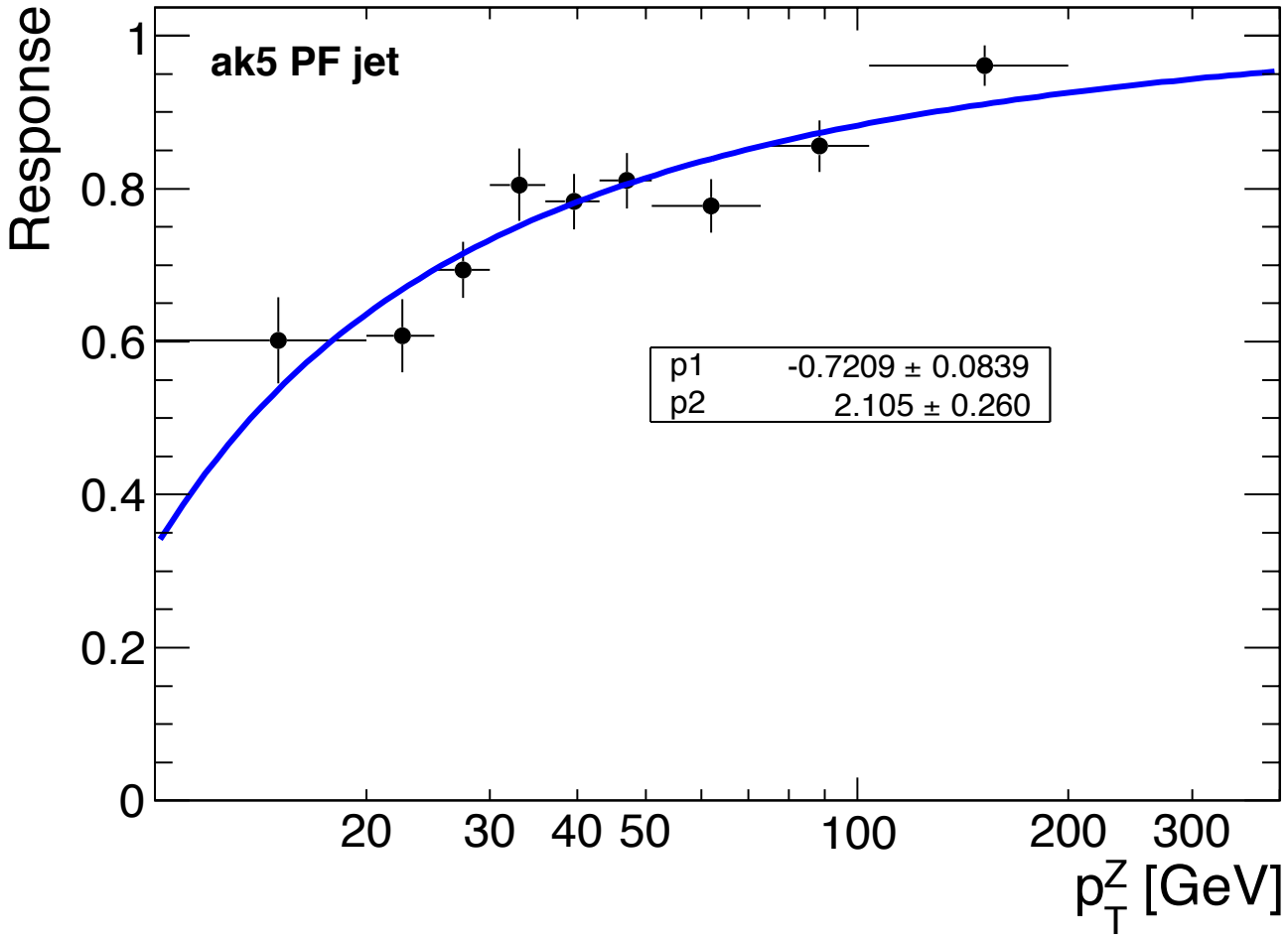
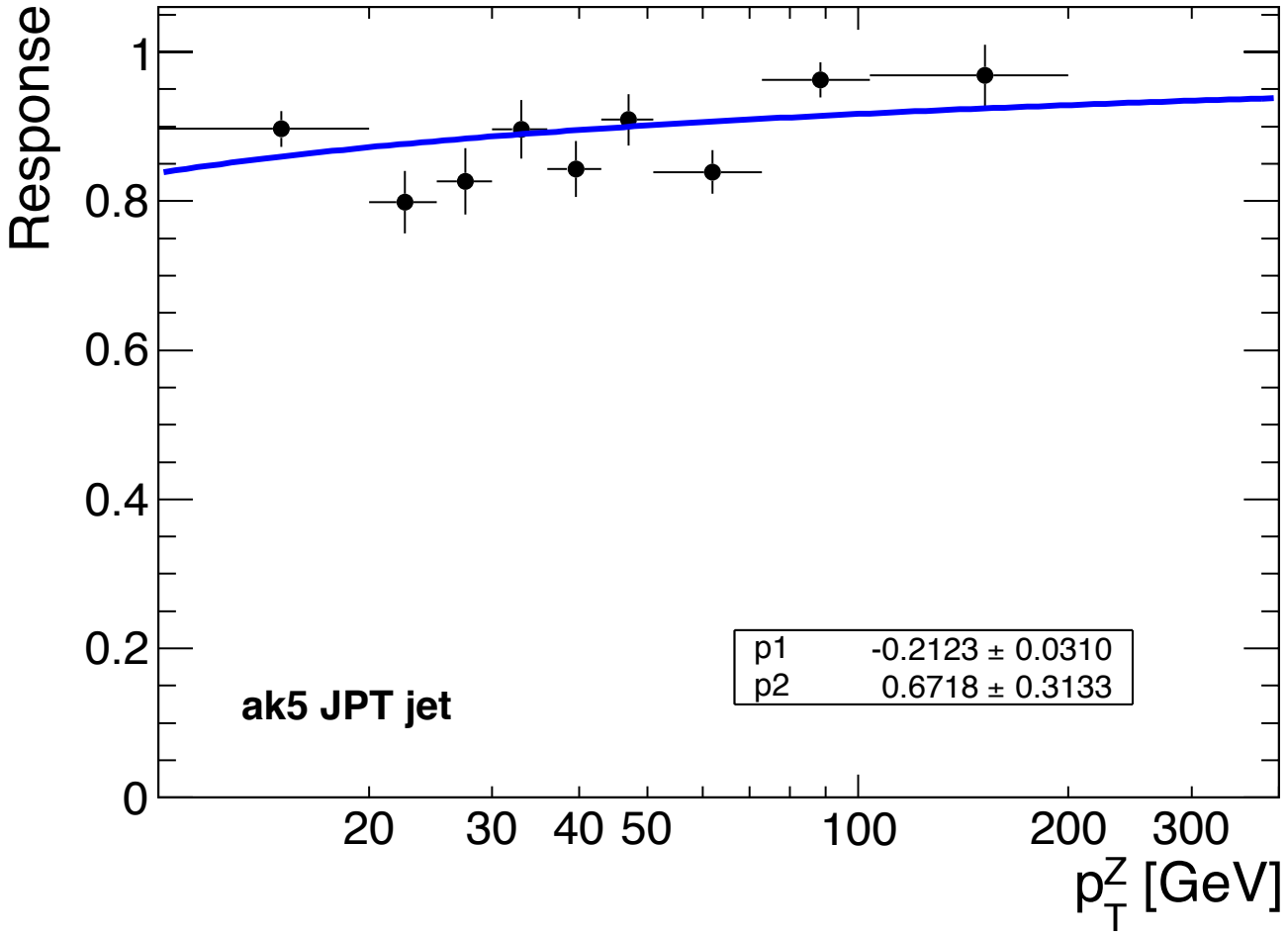
PF jet response (=p_T^{jet}/p_T^Z) as function of Z p_T

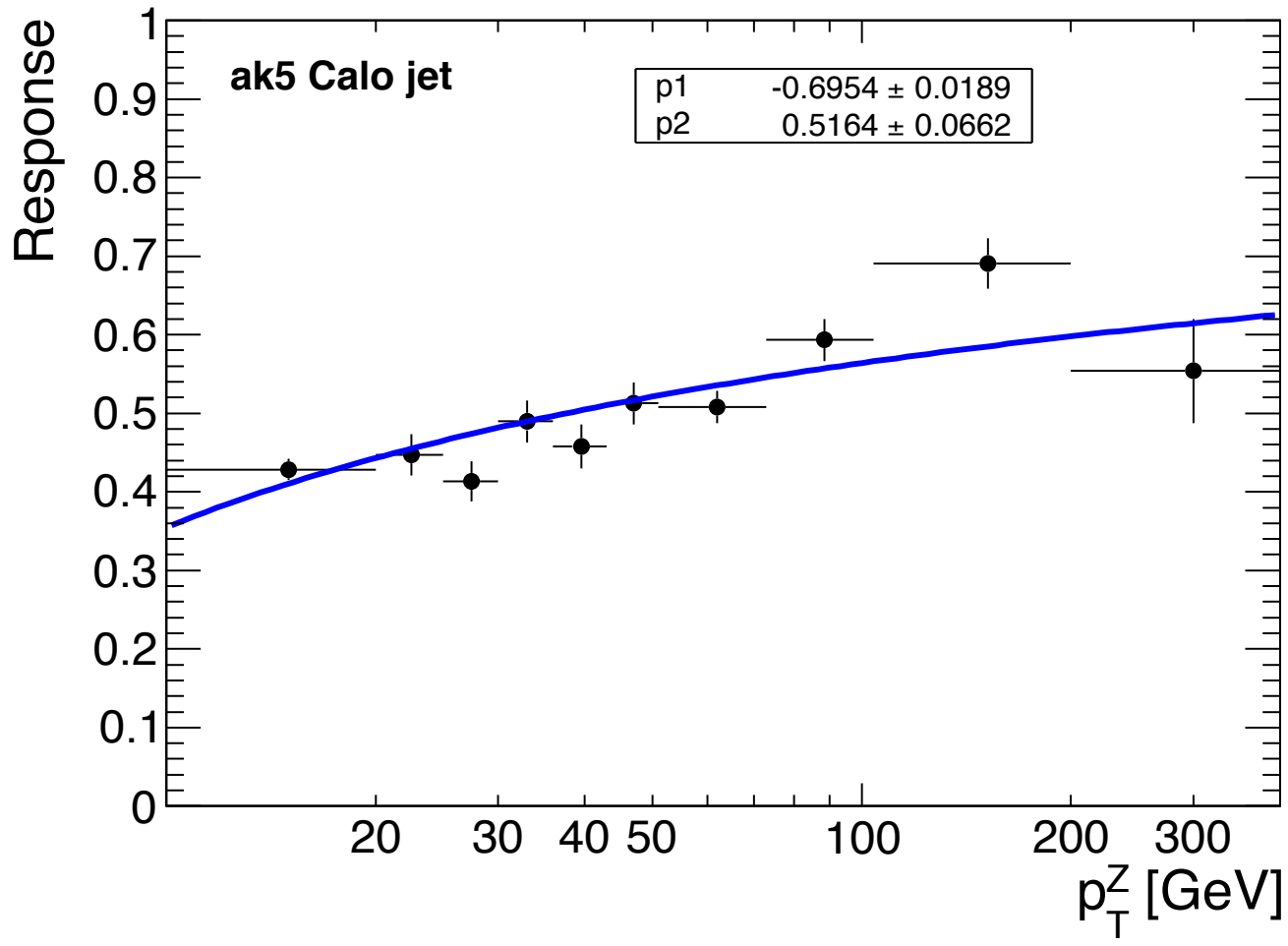


response parametrization: $\mathrm{Response} = 1 + \dfrac{p_1}{[\log(p_T^{\gamma/Z})]^{p_2}}$

JPT jet response as function of Z p_T



Calo jet response as function of Z p_T



systematic uncertainty

Systematic uncertainty from p_T balance

- Estimated somewhat conservatively

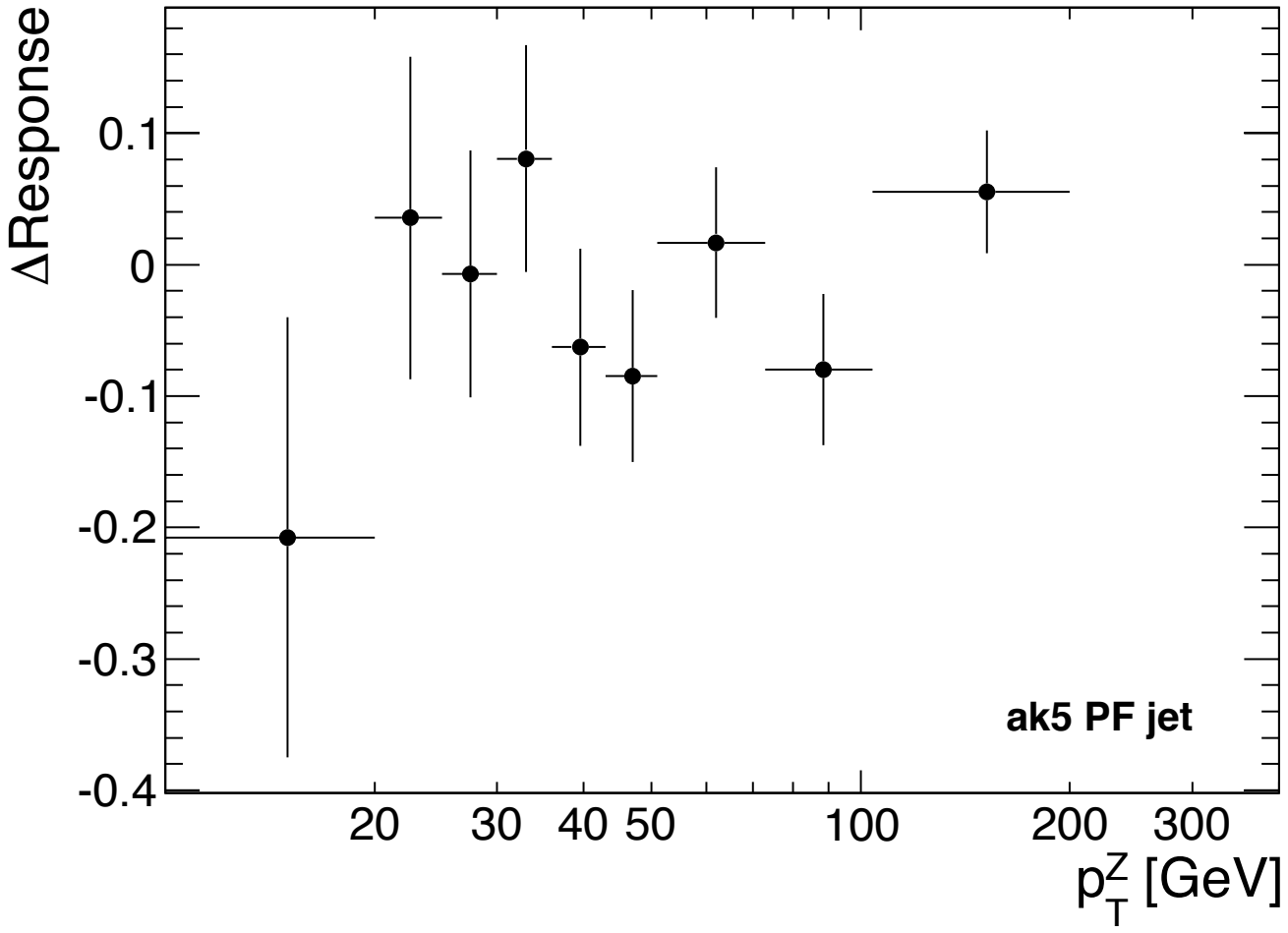
- Vary Z+jet p_T balance condition in two orthogonal ways
  - Fix $|\Delta\phi - \pi| < 0.2$.
    - then vary 2nd jet p_T cut
    - in the range 0.05−0.3 in steps of 0.05.

  - Fix 2nd jet p_T cut <0.2.
    - then vary $|\Delta\phi - \pi|$ cut
    - in the range 0.1−0.4 in steps of 0.1.

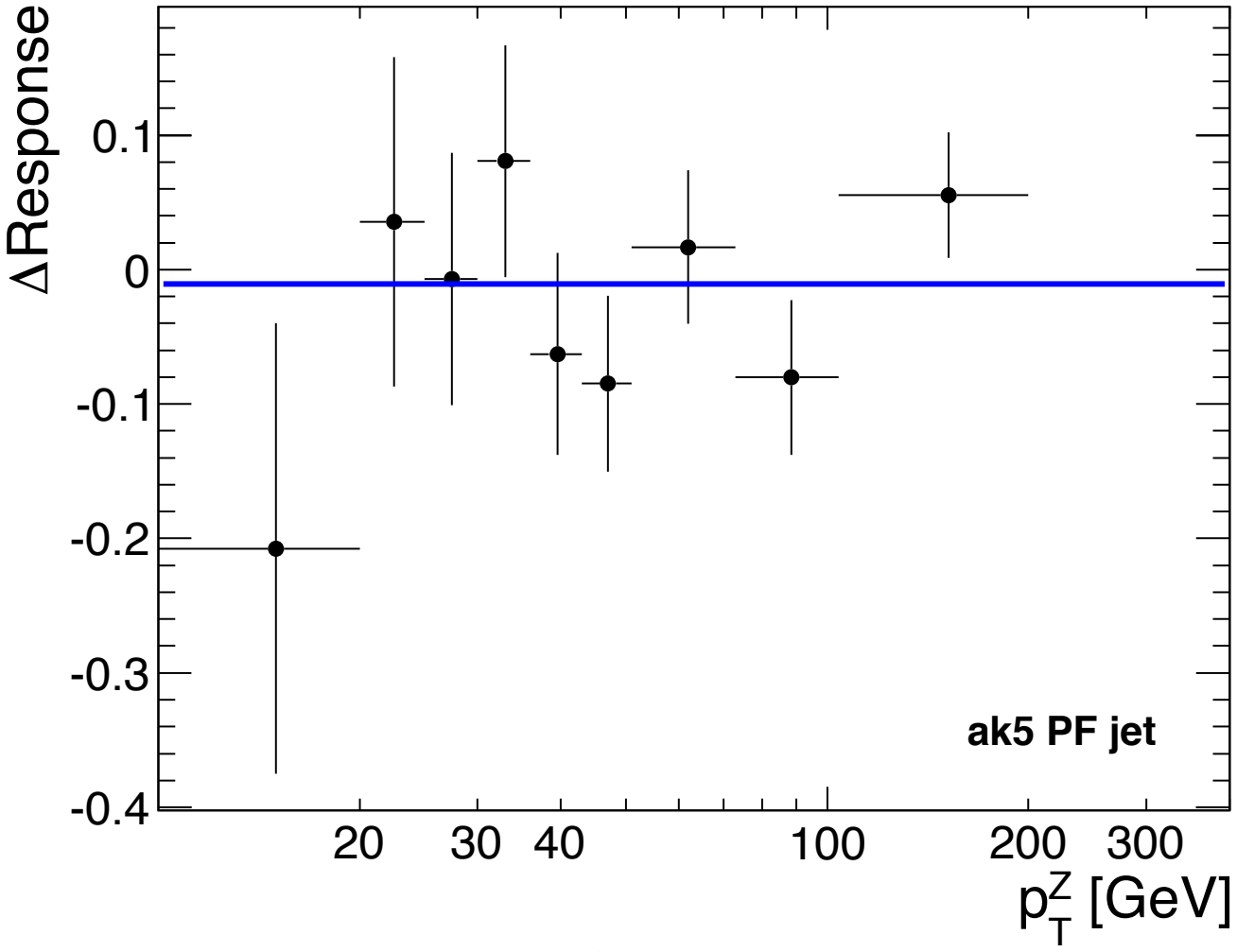
- Take the largest deviation as systematic uncertainty

See my last presentation from two weeks ago for more details.
In addition to these, there will be systematic uncertainty from Z p_T measurement, flavor-mapping, and extrapolation.

Systematic uncertainty in PF jet response



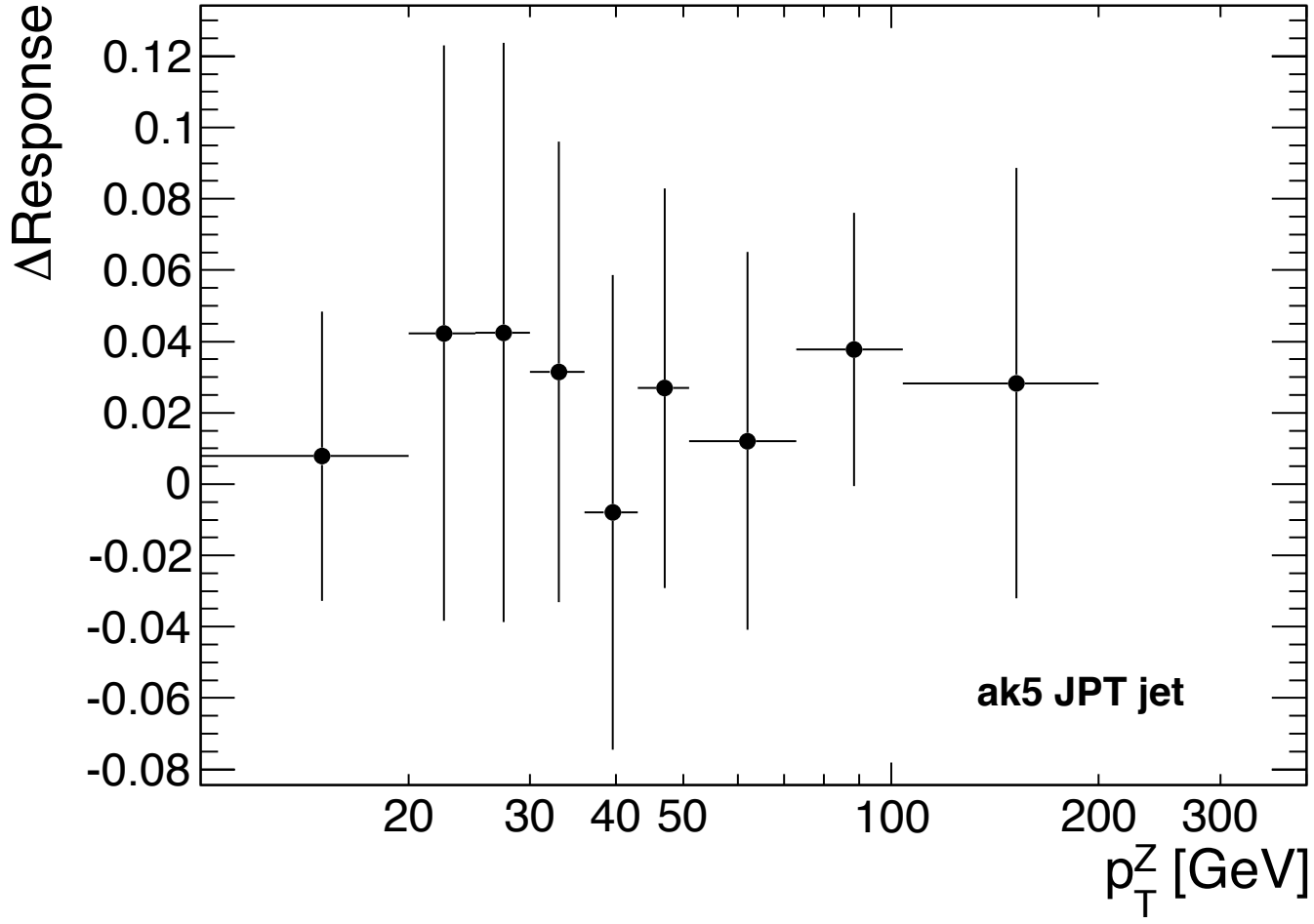
Systematic uncertainty in PF jet response



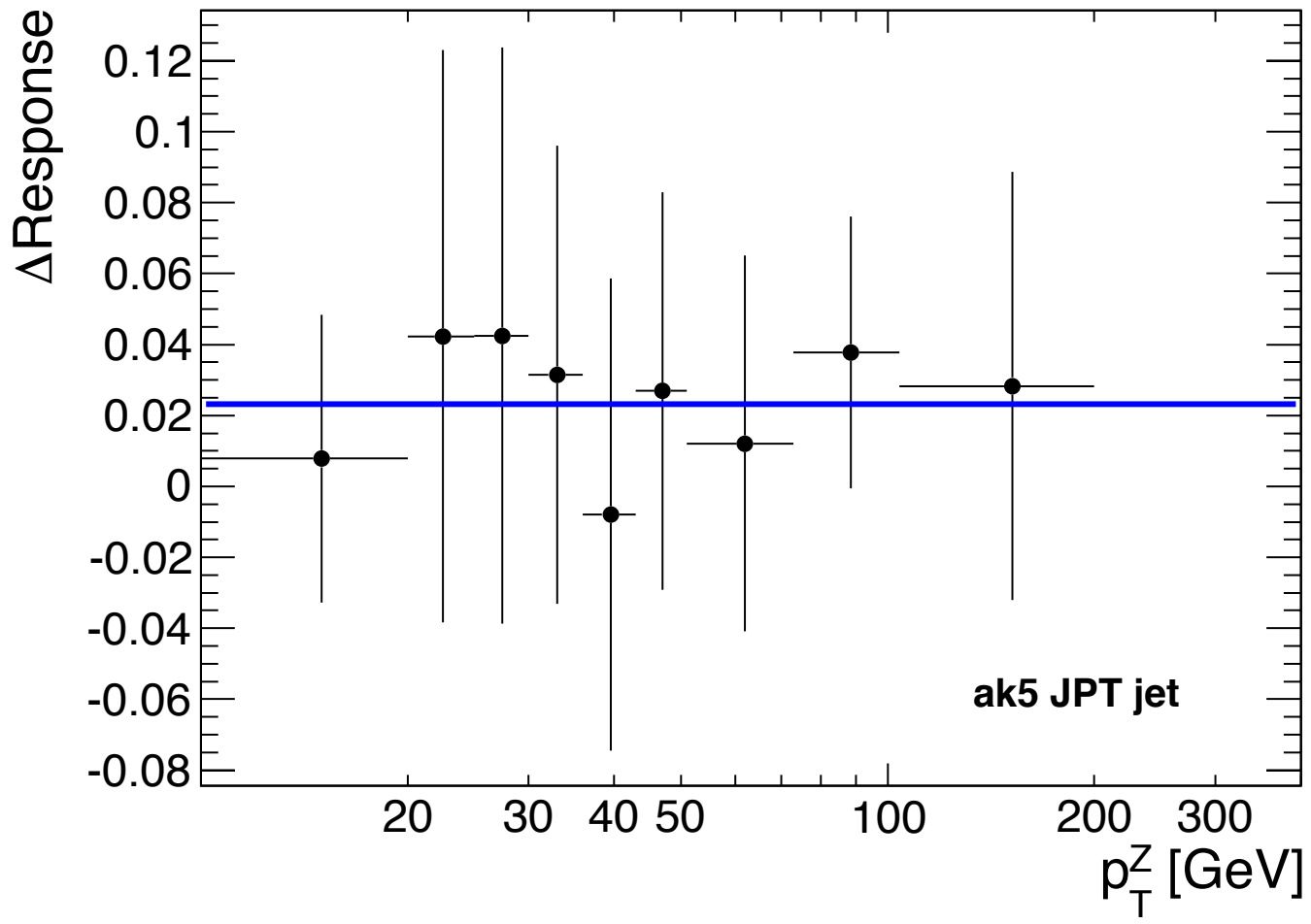
Fit all the data points to a constant using χ^2 minimization

average systematics due to p_T−balance procedure = 0.011 ± 0.023

Systematic uncertainty in JPT jet response

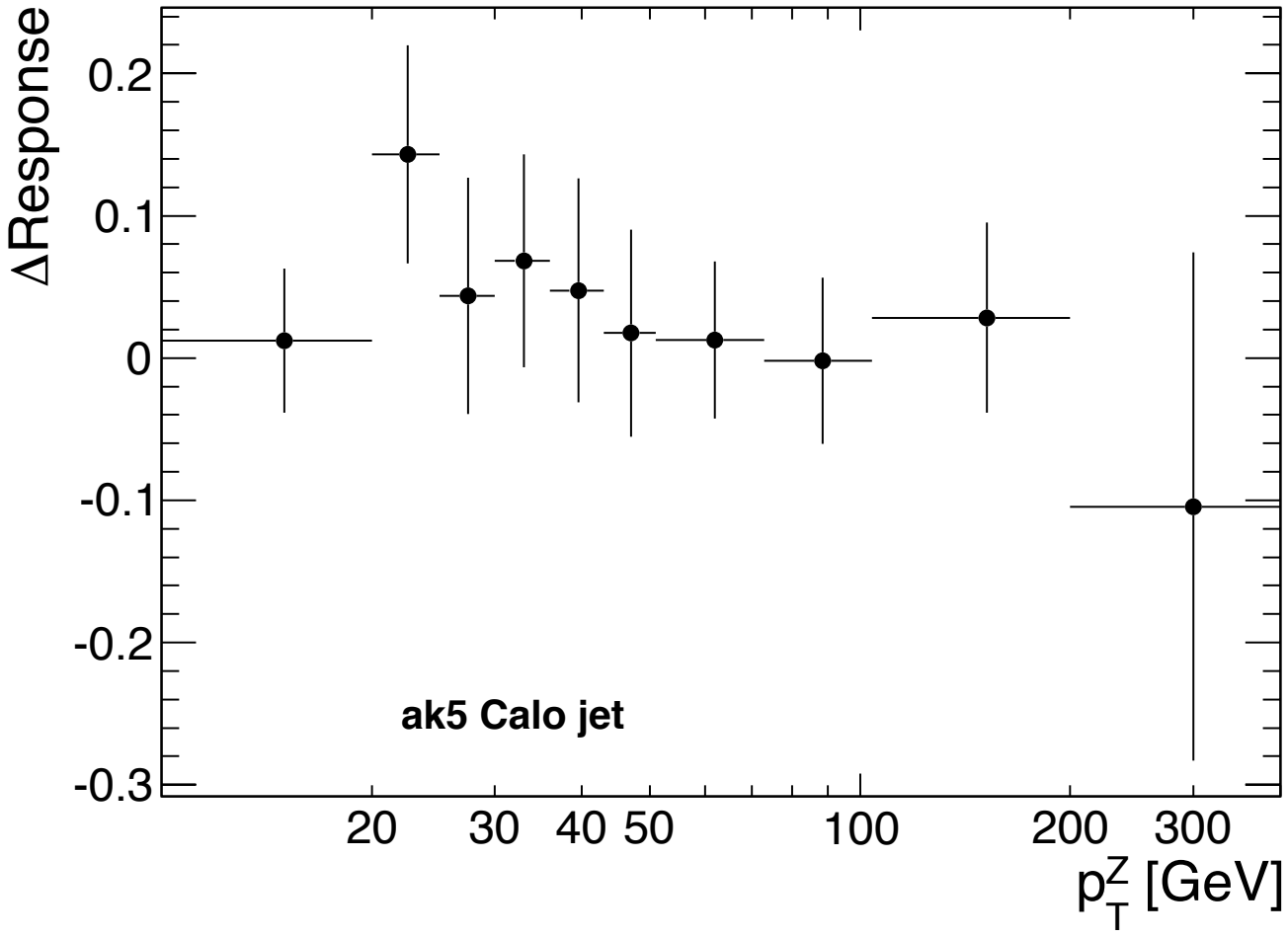


Systematic uncertainty in JPT jet response

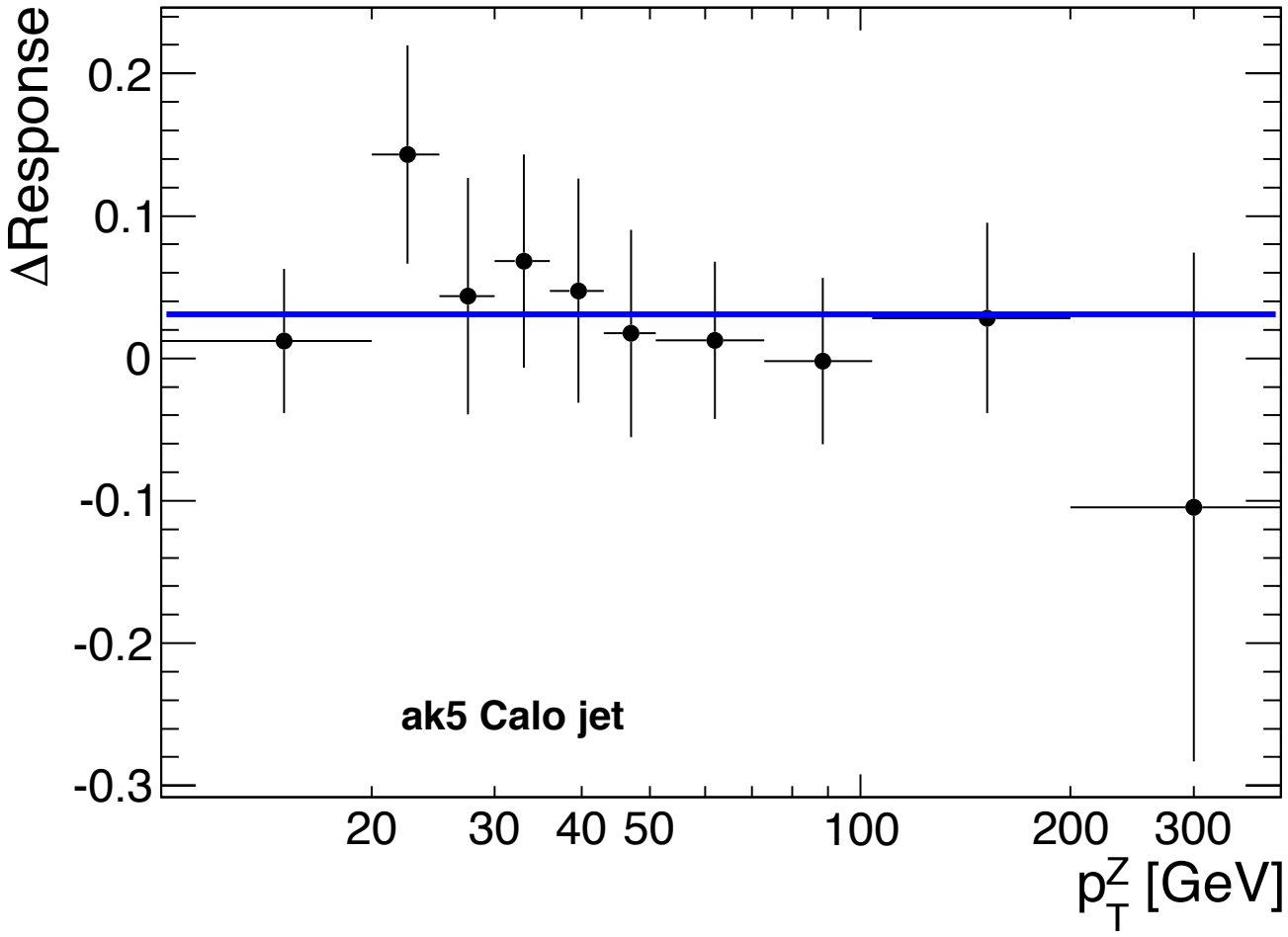


average systematics due to p_T−balance procedure = 0.023 ± 0.018

Systematic uncertainty in Calo jet response



Systematic uncertainty in Calo jet response



average systematics due to p_T−balance procedure = 0.031 ± 0.022

To-do list

✦Derive the response in latest Monte Carlo
- so that we can compute data/MC scale factors

✦Can calibrate Calo and JPT jets by normalizing their response to PF jet

✦Compute flavor-mapping function between Z+jet and dijet
- so that we can combine absolute correction from three channels

✦Compute remaining systematics
- Z p_T measurement
- in flavor mapping

✦Also, try MPF method
- so that we can compare with the results derived from p_T balance
- or improve on the systematic uncertainty.

Backup

Data sample and trigger

	Run-range	Data sample	Trigger path
Run 2010 A	132440−137028	/EG/Run2010A-Sep17ReReco_v2/RECO	HLT_Photon10_L1R
	138564−140401	„	HLT_Photon15_Cleaned_L1R
	141956−144114	„	HLT_Ele15_SW_CaloEleId_L1R
Run 2010 B	146428−147116	/Electron/Run2010B-PromptReco-v2/RECO	HLT_Ele17_SW_CaloEleId_L1R
	147196−148058	„	HLT_Ele17_SW_TightEleId_L1R
	148819−149064	„	HLT_Ele17_SW_TighterEleIdIsol_L1R_v2
	149181−149442	„	HLT_Ele17_SW_TighterEleIdIsol_L1R_v3

- These are the lowest p_T unprescaled single electron triggers
- Used release for analysis:
  CMSSW_3_8_7
- JSON file:
  Cert_132440-149442_7TeV_StreamExpress_Collisions10_JSON_v2.txt

Z+jet p_T–balance

Event selection:

- ✦Jet in the control region: $|\eta| < 1.3$
- ✦Use standard Z ($\rightarrow e^+e^-$) reconstruction
- ✦Select clean Z+1 jet event events
  - require $(\Delta\phi - \pi) < 0.2$,
  - extrapolate $p_T^{2nd} / p_T^{Z} \rightarrow 0$

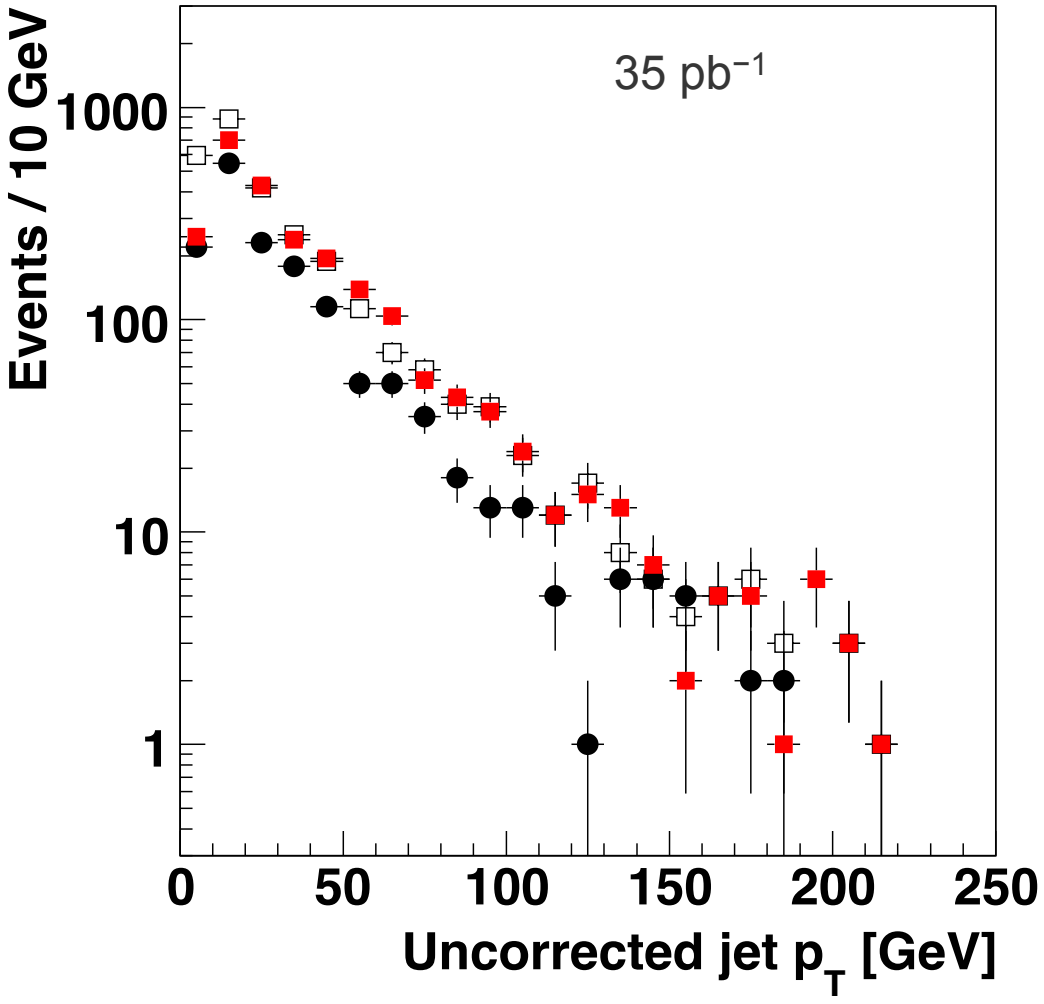
Jet:

- ✦ak5 Calo, PF, JPT jets
- ✦require loose/minimal jet Id

Z:

- ✦ $60 < M_{ee} < 120$ GeV
- ✦Signal purity about 98%
- ✦Electrons
  - $E_T > 20$ GeV, within ECAL fiducial acceptance
  - "Loose" electron Id (VBTF - WP95)

Uncorrected jet p_T spectrum



✦At least one identified Z boson in the event
✦Leading jet in $|\eta| < 1.3$
✦ak5 algorithm

solid circles: Calo jets
Open boxes: PF jets
Solid boxes: JPT jets

About 1500 events have good Z+jet p_T balance ➜ only these events are useful for our purpose