$e^+e^- \rightarrow ZH \rightarrow q\bar{q}b\bar{b}$

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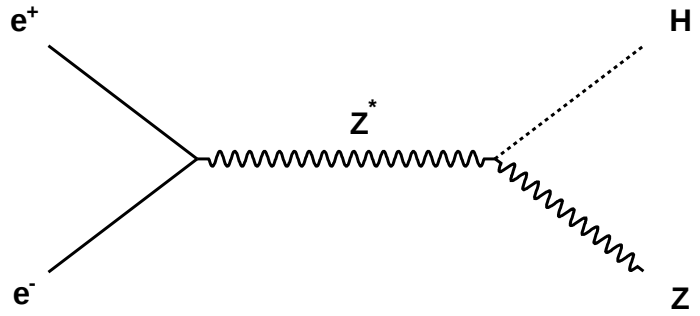
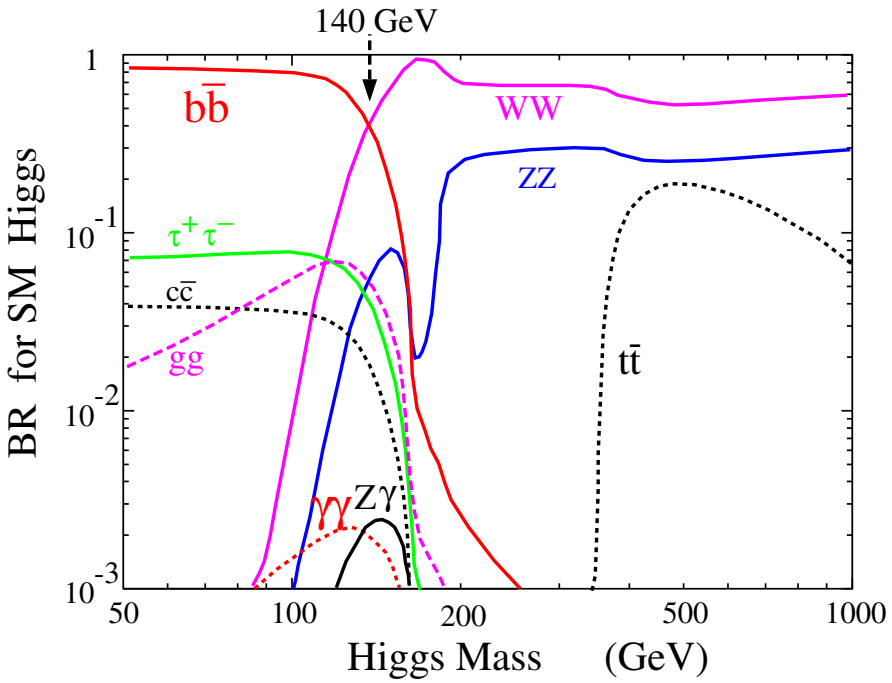
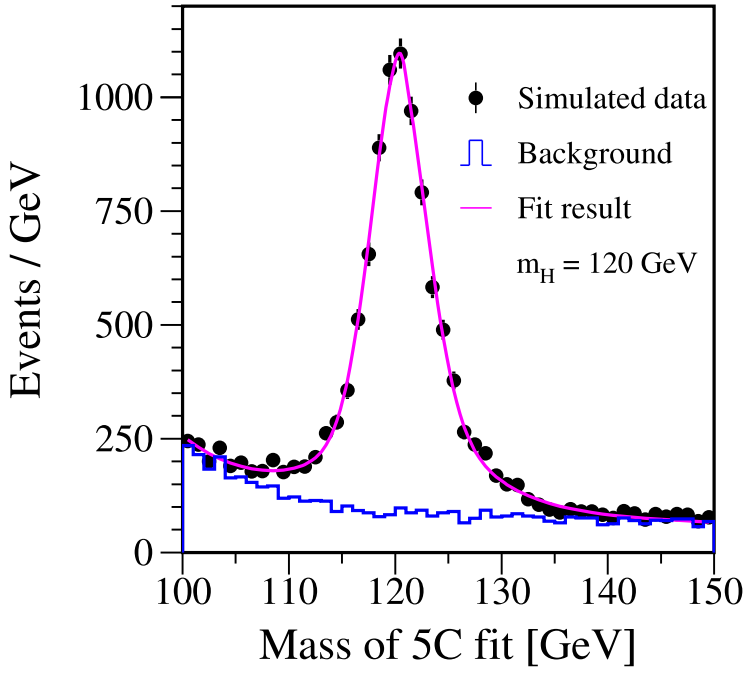


- **Higgs mass reconstruction via $M_{b\bar{b}}$**

Higgs decay



- Br($h \to b\bar{b}$) $\sim$ 68% @ $M_h = 120$ GeV
- Pandora-pythia v3.3 Monte Carlo
- $e^+e^- \to ZH \to q\bar{q}b\bar{b}$ @ 350 GeV
- integrated luminosity of 500fb^{-1}



- TESLA fast simulation: EPJ C44(2005) 481 by P. García-Abia, W. Lohmann, A. Raspereza
- $ZH \to q\bar{q}q'\bar{q}'$ @ 350 GeV $\Longrightarrow \Delta(m_H) =$ 45 MeV
- goal: full detector simulation and reconstruction
- goal: compare different PFAs

Event reconstruction

- **Detector simulation: LDC00Sc detector model @ Mokka v6.2;**
- **Marlin v00-09-09; MarlinReco v00-05; MarlinUtil v00-05**
- **Flavour tagging: LCFIVertex package v00-02-02**
  - **use training sample in b-tag package**
  - **is it OK for LDC00SC at Mokka 6.2 ??? calibration constant and PFA**
  - **we do not show results by b-tag in this talk**
- **Jet finder: KtJet package v1.08 (C++)**
- **Kinematic fitting: KinFit package @ CMS (C++)**

$e^+e^- \rightarrow ZH \rightarrow q\bar{q}b\bar{b}$ event selection

- **We follow the paper EPJ C44(2005) 481 to select four jets event**
  - **total visible energy:** $E_{visible} >= 0.8 * 350$ **GeV**
  - **particle plow object number:** $N_{PFOs} >= 40$
  - **event shape parameter T (thrust):** $T < 0.85$ **and** $|\cos(\theta_T)| < 0.80$
  - **force events to have 4 jets, and parameter** $\log_{10}(1/y_{34}) < 5.0$
    - **jet energy:** $E_{jet} > 10.0$ **GeV**
    - **jet theta:** $|\cos(\theta)| < 0.99$

- **Kinematic fitting: 5C fitting**
  - χ^2 **probability:** $P(\chi^2) > 0.05$
  - **use smallest** χ^2 **of kinematic fitting to choose jet pairing**

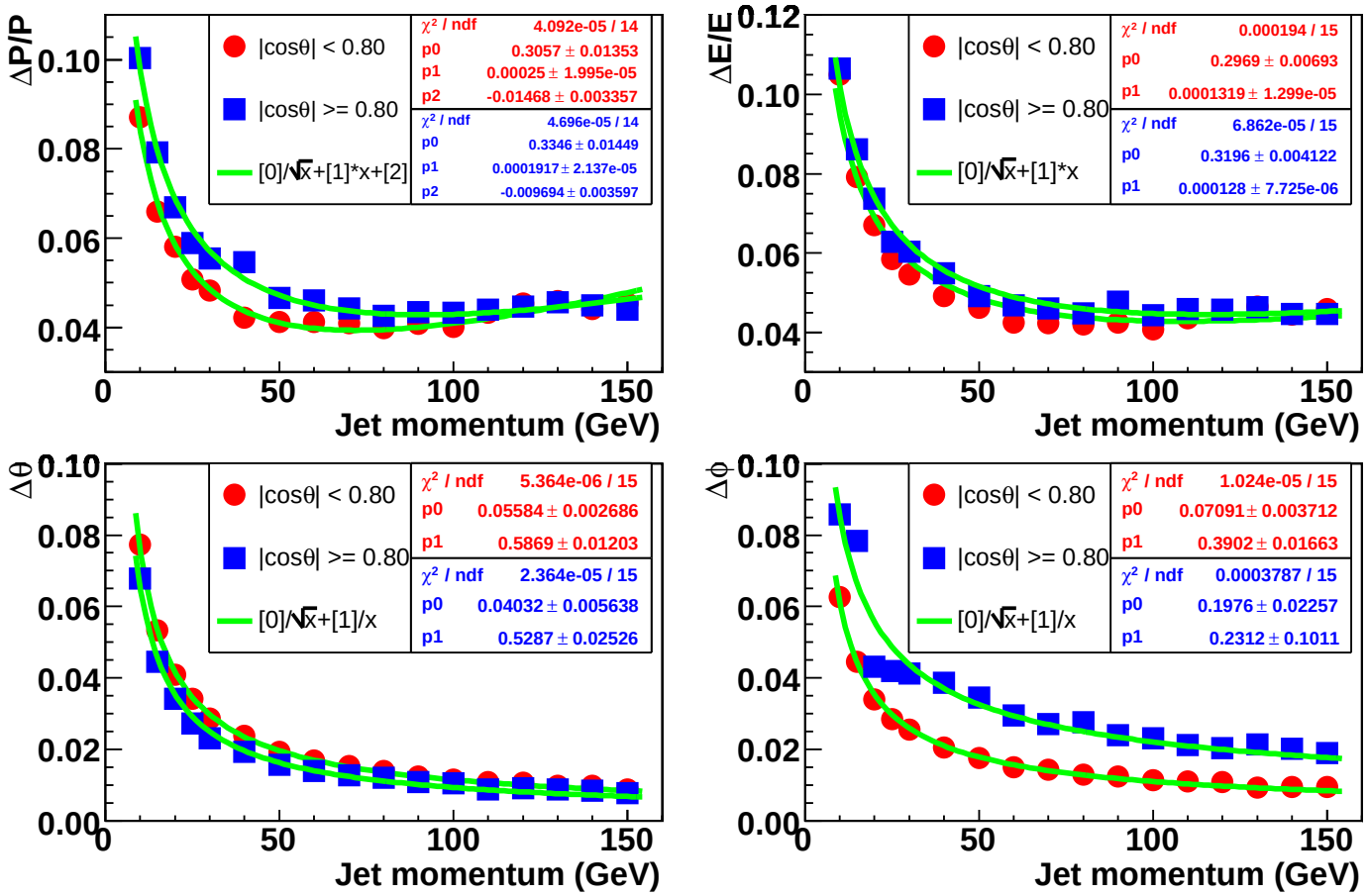
- **b-tag for jets**
  - **Results I: without b-tag**
  - **Results II: at least two b jets with b-tag**

Kinematic fitting

- **12 measured variable: Momentum, Theta and Phi for four jets**
- **5 Constraints**
  - $\sum p_x = 0.0$
  - $\sum p_y = 0.0$
  - $\sum p_z = 0.0$
  - $\sum E - E_{cm} = 0.0$
  - $M_{j1j2} = M_Z$
  - **jet mass is fixed (OPAL method)** $E_{fit} = \sqrt{p_{fit}^2 + (E_{meas}^2 - p_{meas}^2)}$
- **check kinematic fitting**
  - **Pull variable** $\frac{y_{meas} - y_{fit}}{\sqrt{\sigma_{meas}^2 - \sigma_{fit}^2}}$
  - **Pull distribution: a normal Gaussian**

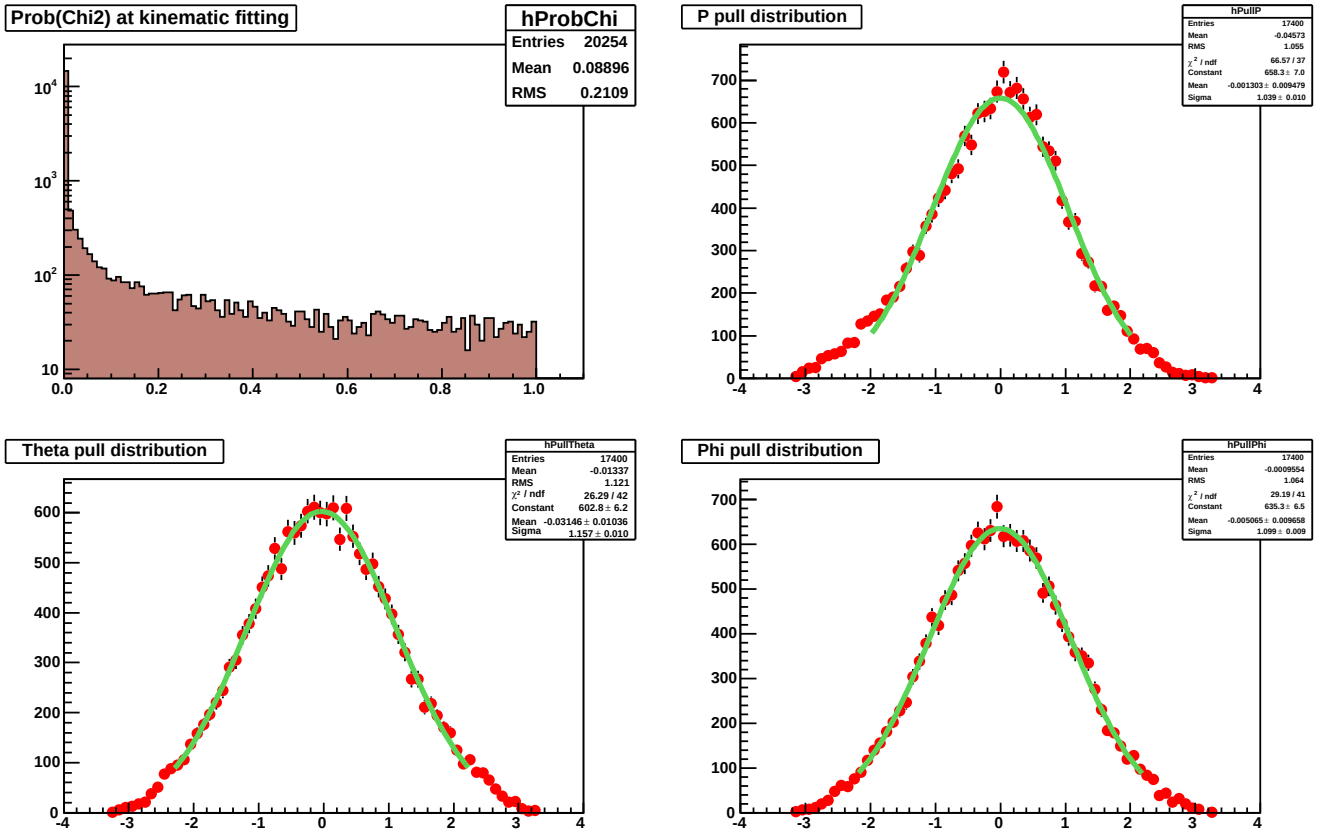
Jet resolution: $e^+e^- \rightarrow q\bar{q}$

- **Jet resolution: $e^+e^- \rightarrow q\bar{q}, q = u, d, s, c$ and without ISR**



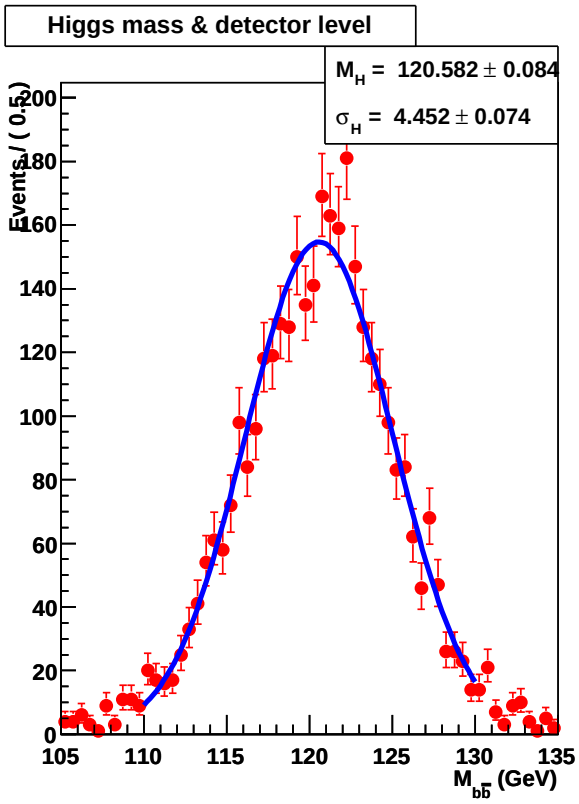
Pull distribution

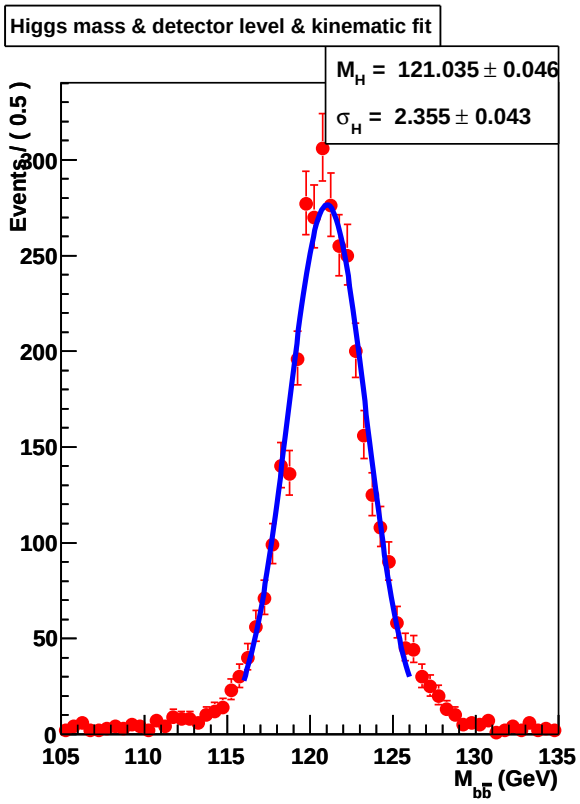
- **χ^2 probability $P(\chi^2)$ is reasonably flat for $P(\chi^2) > 0.05$, and pull distributions are close to a Gaussian with mean of zero and sigma of one for events with $P(\chi^2) > 0.05$**



Higgs mass fitting

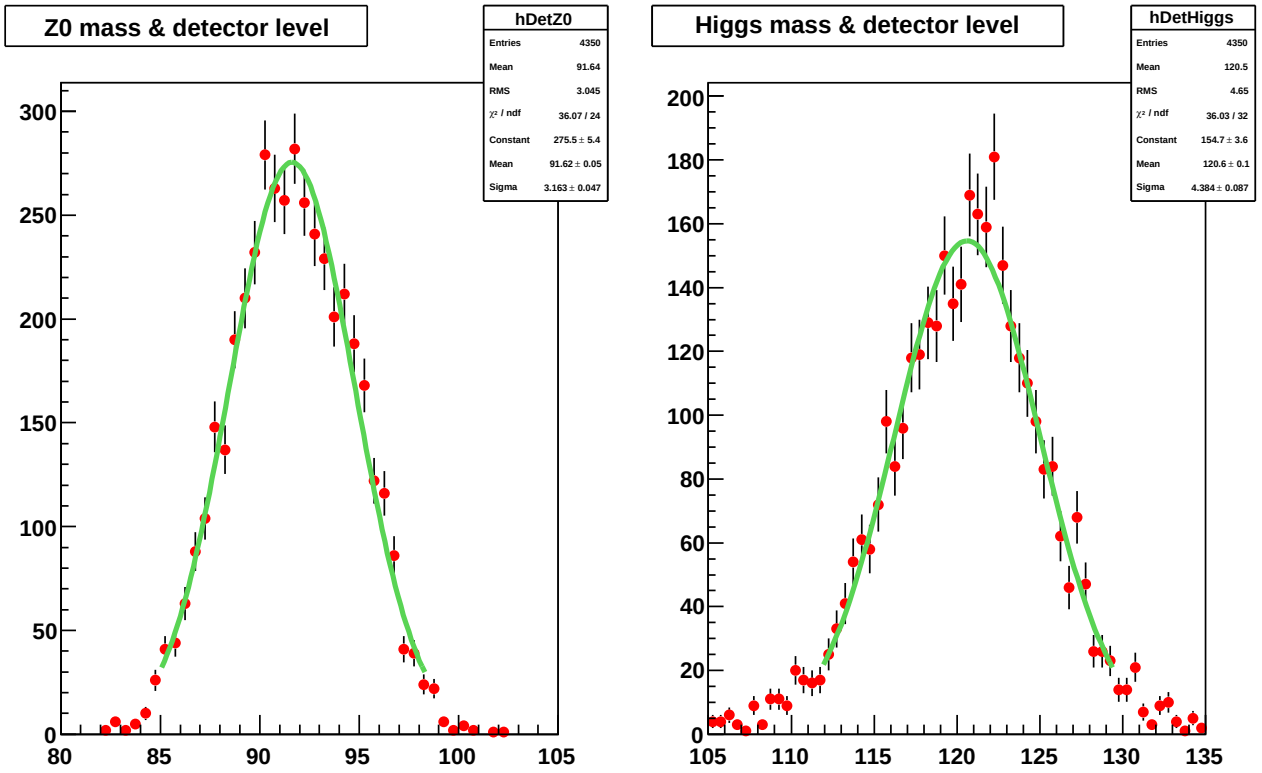
- **Kinematic fitting improves mass resolution: $\Delta(m_H) = 46$ MeV**
- **TESLA fast simulation with background events: $\Delta(m_H) = 45$ MeV**





Higgs mass fitting

- **MC uses $M_{Z^0} = 91.2$ GeV & $M_H = 120.0$ GeV**
- **fitted $M_{Z^0} = 91.6$ GeV & $M_H = 120.6$ GeV ← calibration constants ?**



Summary

- **A analysis code is ready for $e^+e^- \rightarrow ZH \rightarrow q\bar{q}b\bar{b}$ study**
  - **Kinematic fitting could improve Higgs mass resolution**
  - **b-tag effect: we do not show results**
    - **use training sample in b-tag package**
    - **is it OK for LDC00SC at Mokka 6.2 ???**

- **To do list**
  - **jet resolution for b jets**
  - **take into account the background events**
  - **wait for simulated samples for detector model @ LOI**