# DEPENDENCE OF KINEMATIC VARIABLES OF $Z$ BOSON CREATED IN $pp$ INTERACTIONS IN ATLAS ON KINEMATIC CUTS APPLIED ON ITS SECONDARIES*

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We will study the $Z$ boson production and its decay to an electron–positron pair. This work is devoted to the dependence of the invariant mass, rapidity and $p_{\mathrm{T}}$ of the $Z$ boson created in $pp$ interactions on kinematic cuts applied on its secondaries.

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On a generator level, two objects were studied — generated $Z$ boson and the $Z$ boson reconstructed from decay products. Chosen cuts are summarized in Table I with the appropriate cross section.

TABLE I

First set.

| Event class | $\sigma$ [$\times 10^6$ fb] | $\sigma$ with eff. 70% [$\times 10^6$ fb] | Number of events | Number of events in % |
|---|---|---|---|---|
| all events | 1.520 | 0.745 | 978157 | 97.8 |
| $\lvert\eta\rvert < 2.5$ both | 0.746 | 0.366 | 479773 | 47.9 |
| $\lvert\eta\rvert \in <2.5;3.2>$ one | 0.212 | 0.104 | 136235 | 13.6 |
| $\lvert\eta\rvert \in <2.5;3.2>$ both | 0.052 | 0.025 | 33511 | 3.3 |
| $\lvert\eta\rvert \in <2.5;5.0>$ one | 0.282 | 0.138 | 181245 | 18.1 |
| $\lvert\eta\rvert \in <2.5;5.0>$ both | 0.112 | 0.055 | 71909 | 7.2 |
| $\lvert\eta\rvert \in <2.5;7.5>$ one | 0.287 | 0.141 | 184640 | 18.4 |
| $\lvert\eta\rvert \in <2.5;7.5>$ both | 0.121 | 0.059 | 77638 | 7.7 |

For the analysis of the invariant mass, three formulas were used for the fitting. It is Gauss formula, Breit–Wigner formula and a relativistic variant

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of Breit–Wigner. The solid bar indicates currently accepted value of the $Z$ boson mass. Although a relativistic Breit–Wigner gives more accurate prediction for $M_Z$ and $\Gamma$ than the non-relativistic variant, it is not the best fit as seen from $\chi^2/ndf$. Next variables used for the analysis is the $p_{\mathrm{T}}$ distribution and the rapidity distribution. The mean for secondary $Z$ boson is shifted slightly to higher values than the generated $Z$ boson means.

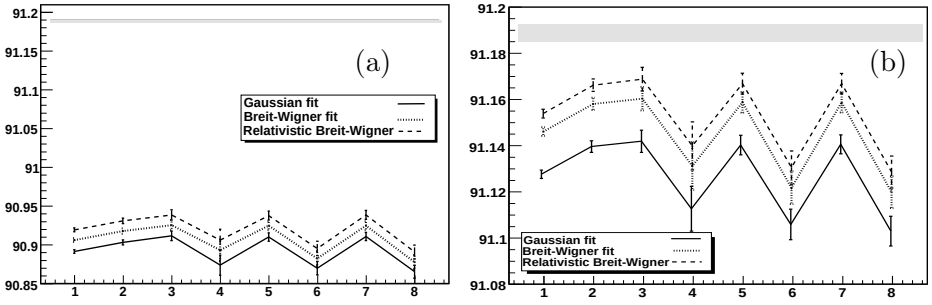



Fig. 1. Fitted mean of $Z0$ mass distribution (a) secondary, (b) generated.

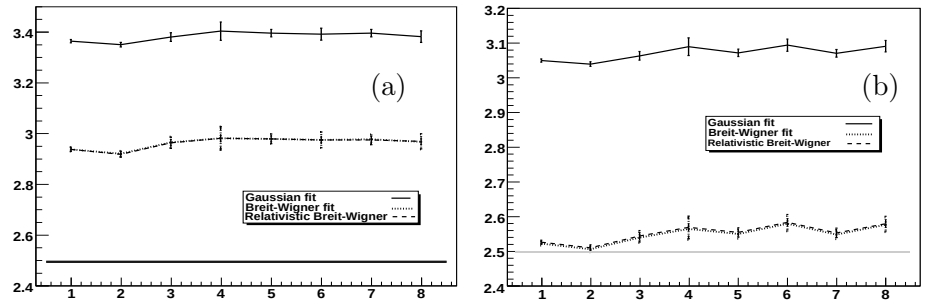



Fig. 2. Fitted gamma of $Z0$ mass distribution (a) secondary, (b) generated.

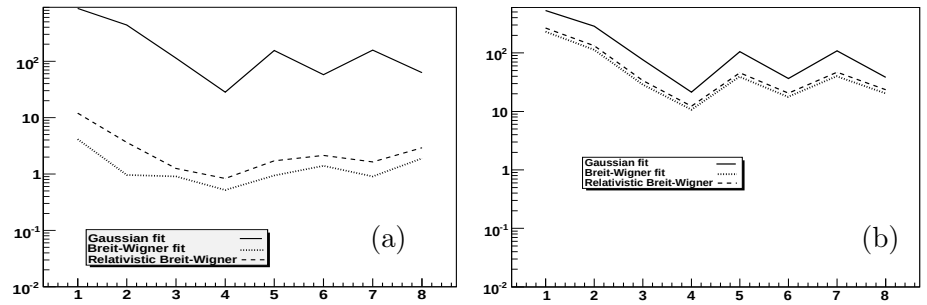



Fig. 3. Fitted chi squared over *ndf* of the $Z0$ mass distribution (a) generated, (b) secondary.

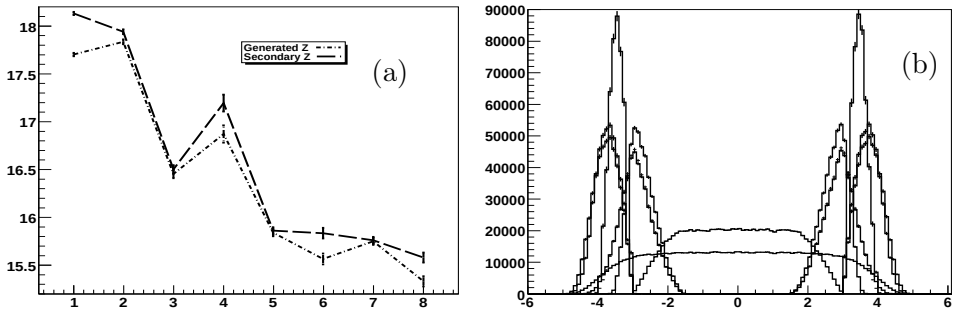



Fig. 4. (a) Fitted mean of $Z0p_{\mathrm{T}}$ distribution generated *versus* secondary. (b) $Z0$ rapidyty distribution.

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## REFERENCES

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