Inclusive Charm Production in Two Photon Collisions at LEP with the L3 Detector

Alan L. Stone
Louisiana State University

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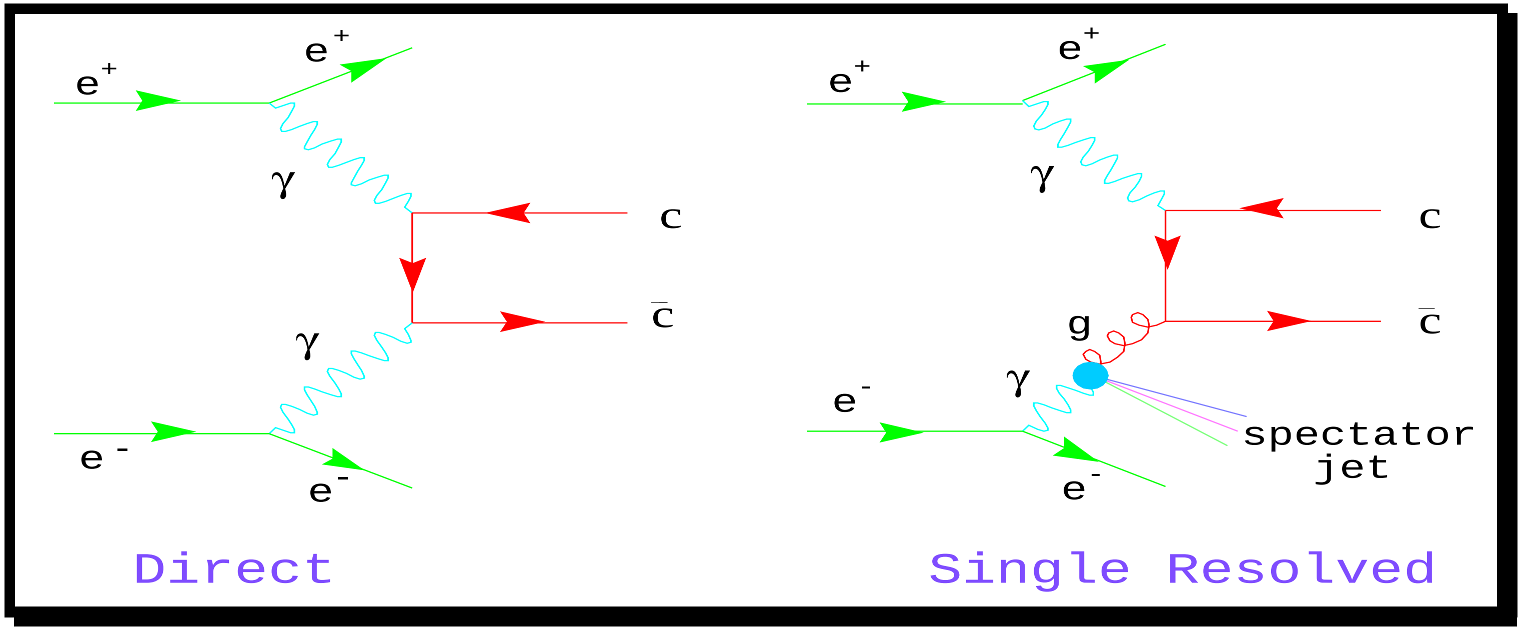
Rencontres De Moriond
Les Arcs, Savoie, France

- ☞ **Motivation**
- ☞ **Analysis**
- ☞ **Results (Preliminary)**

Motivation



- Test of QCD
- Gluon content of Photon (**resolved...**)
- Constrain Mass of Charm Quark
- First LEP2 measurement

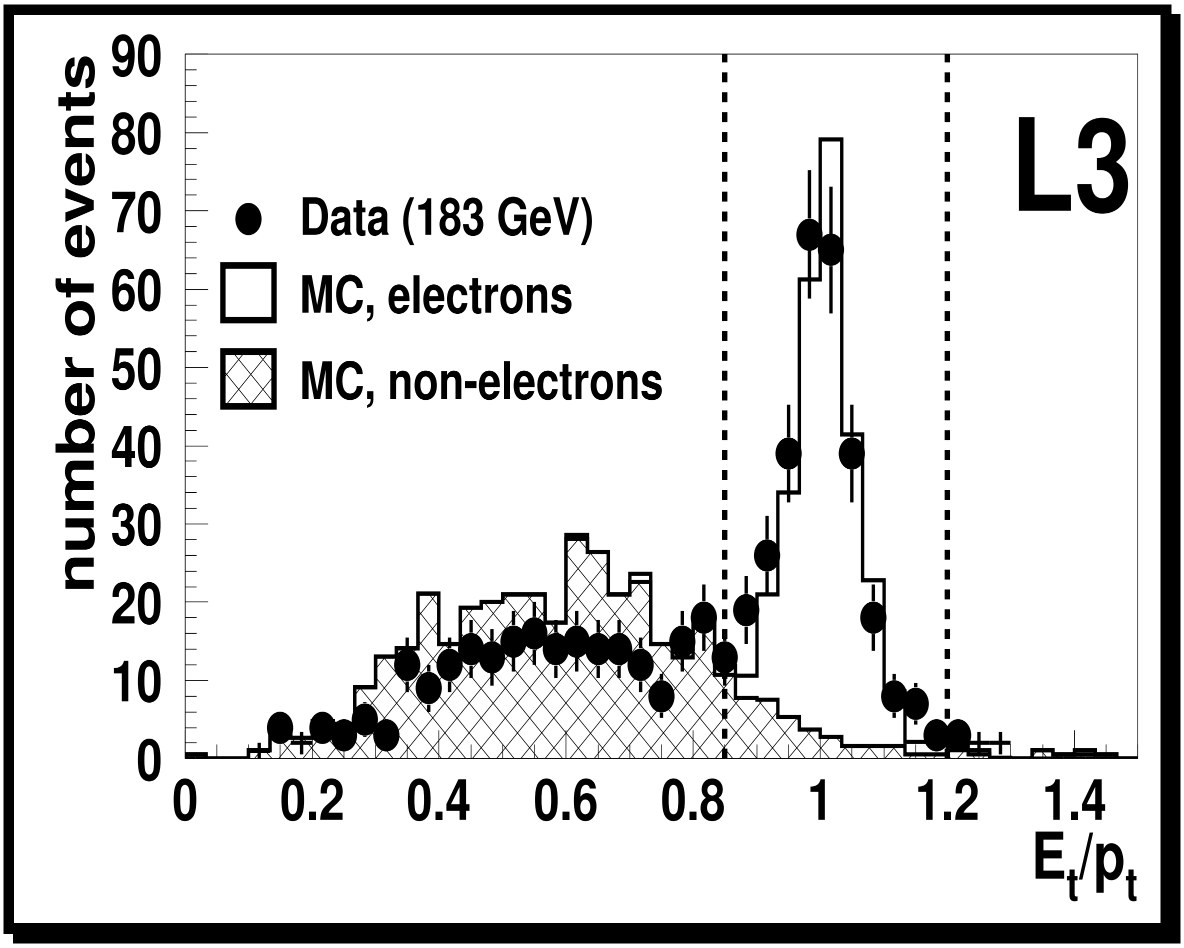
$$\boxed{\int \mathcal{L}\, \mathrm{dt} = 165\ pb^{-1} \text{ at } \sqrt{s} = 91 - 183\ GeV}$$

Event Selection

❒ **Hadron Selection**: $e^+e^- \rightarrow e^+e^- +$ **hadrons**

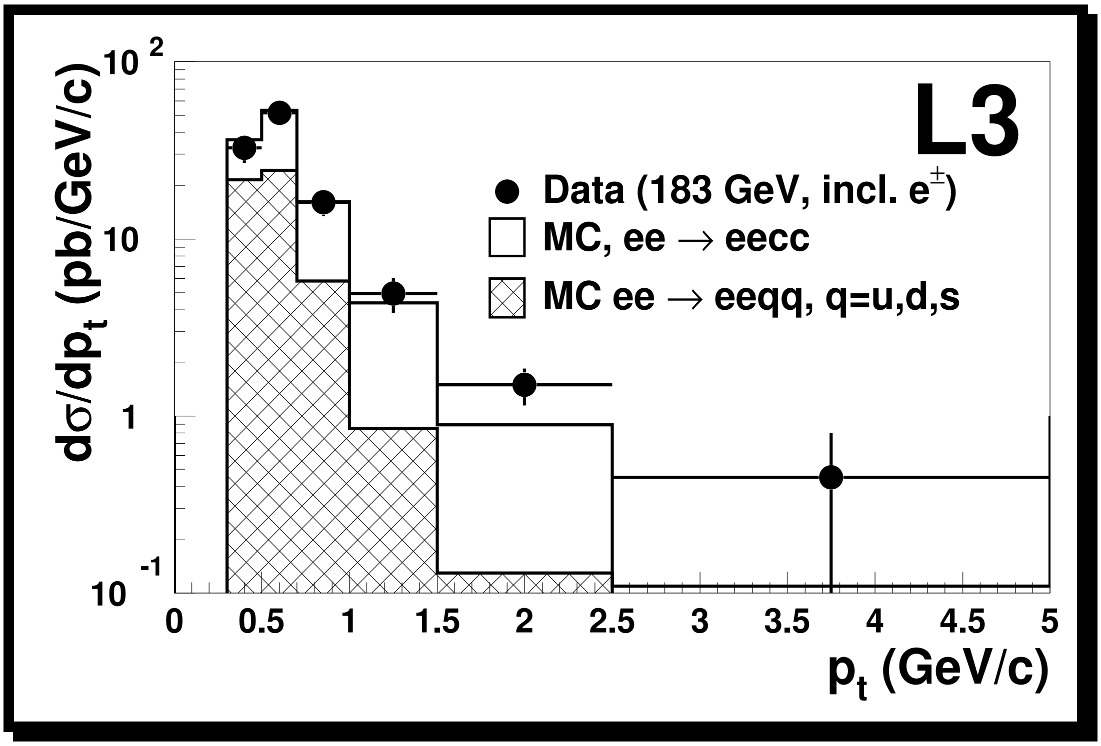
❒ **Lepton Selection**: $c \rightarrow$ **lepton(s)**

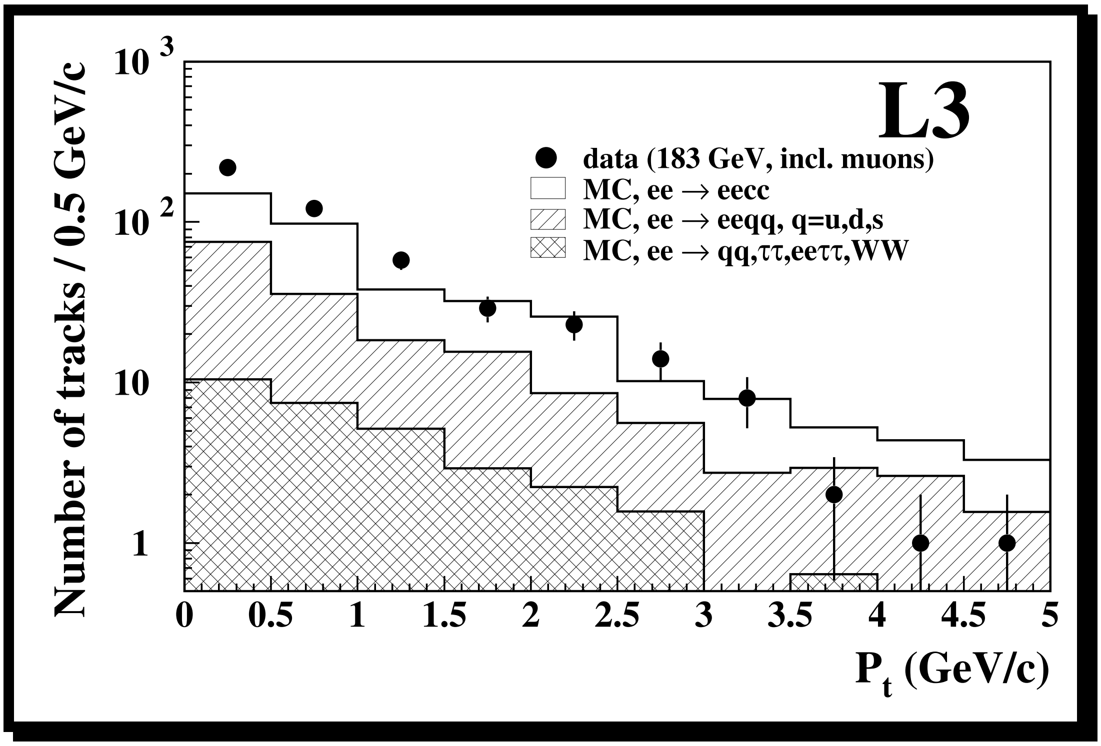
$\mu^{\pm}$ Selection	**$e^{\pm}$ Selection**
$\lvert\cos\theta\rvert < 0.90$	$\lvert\cos\theta\rvert < 0.72$
$P_{\mu} > 2$ GeV/c	$E_e > 0.5$ GeV
$P_{\mu} < 0.2E_{beam}$	$\Delta\phi < 20$mrad
	$0.85 < dE/dx < 1.15$
	$0.85 < E_T/p_T < 1.2$



MC: PYTHIA vers. 5.722

Analysis


L3
Data (183 GeV, incl. e±)
MC, ee → eecc
MC ee → eeqq, q=u,d,s
dσ/dp_t (pb/GeV/c)
p_t (GeV/c)
10^2
10
1
10^-1
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5


L3
data (183 GeV, incl. muons)
MC, ee → eecc
MC, ee → eeqq, q=u,d,s
MC, ee → qq,ττ,eeττ,WW
Number of tracks / 0.5 GeV/c
P_t (GeV/c)
10^3
10^2
10
1
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5

Results

$\sqrt{s}$ GeV	183	161-172	130-140	91
$\int \mathcal{L}$ dt pb^{-1}	52.22	21.15	12.05	79.74
ϵ_{trig} (%)	78.6 ± 1.1	82.6 ± 1.8	83.0 ± 2.4	87.2 ± 1.0

Electrons

N_{obs}	301	118	55	210
N_{exp}	294	117	46	144
N_{bkg}	127	54	22	98
Π_{elec} (%)	86.4 ± 1.5	80.1 ± 1.8	86.1 ± 1.5	86.1 ± 3.3
ϵ_{elec} (%)	23.4 ± 1.0	22.2 ± 1.0	18.7 ± 2.1	11.9 ± 1.2
Π_{charm} (%)	58.5 ± 2.1	54.8 ± 2.3	59.5 ± 5.5	55.6 ± 4.8
ϵ_{charm} (%)	0.56 ± 0.03	0.54 ± 0.03	0.49 ± 0.07	0.28 ± 0.04

Muons

N_{obs}	52	17	–	62
N_{exp}	42	16	–	48
N_{bkg}	18	8	–	26
Π_{μ} (%)	100.0	100.0	–	100.0
ϵ_{μ} (%)	33.4 ± 1.5	33.4 ± 1.5	–	33.4 ± 1.5
Π_{charm} (%)	59.7 ± 6.0	56.8 ± 5.8	–	66.7 ± 9.6
ϵ_{charm} (%)	0.07 ± 0.01	0.07 ± 0.01	–	0.07 ± 0.02

Results

Cross section of Charm Production in $\gamma\gamma$ Collisions

$$\sigma = \frac{N_{sel}}{\mathcal{L}} \frac{\Pi_{charm}}{\epsilon_{charm}}$$

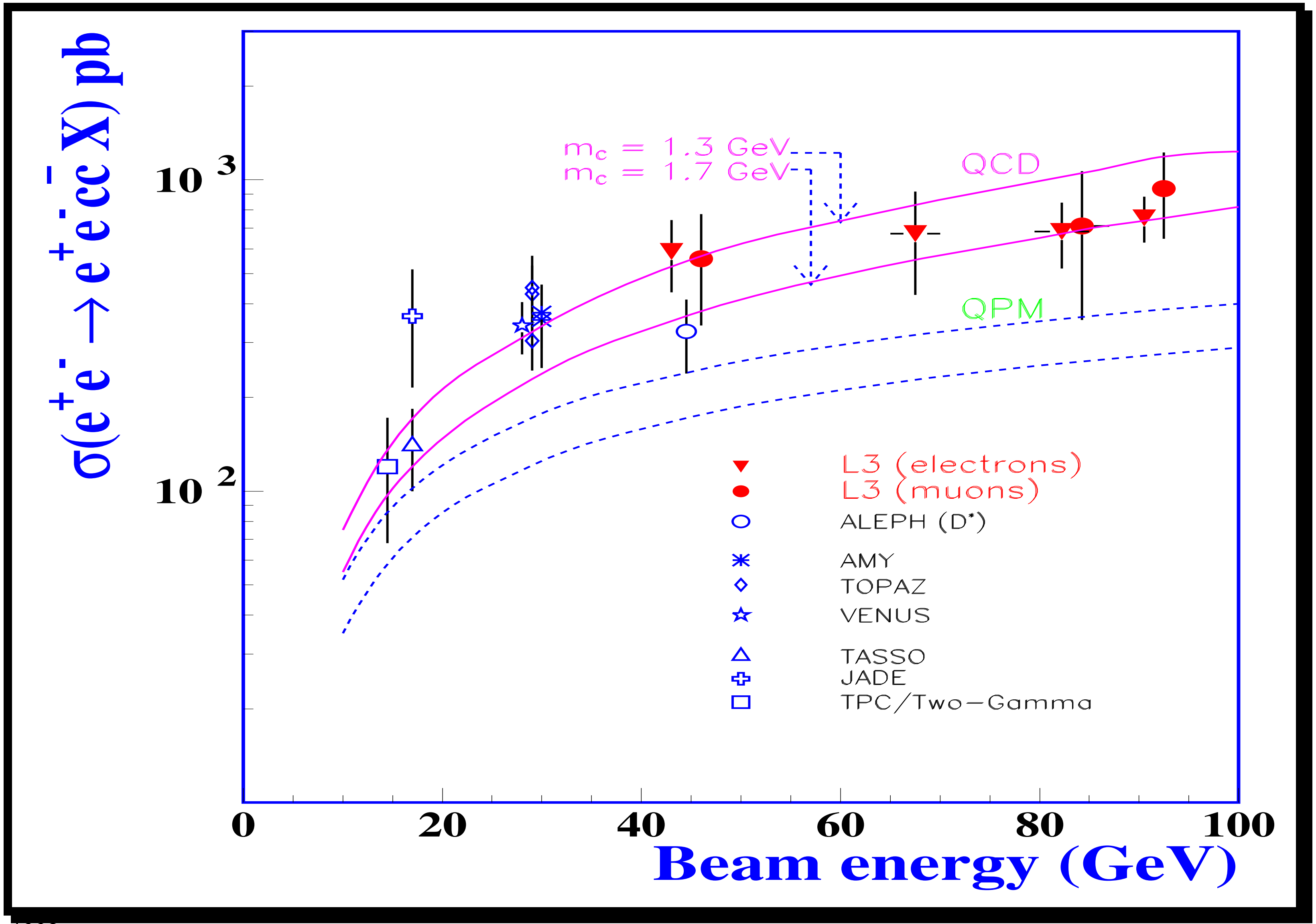
- $e^+e^- \rightarrow e^+e^- c\bar{c}$ (**Electron Tag**)

$$\sigma_{183\ GeV} = 755 \pm 75(\mathrm{stat}) \pm 102(\mathrm{syst})\ [\mathrm{pb}]$$
$$\sigma_{161-172\ GeV} = 682 \pm 116(\mathrm{stat}) \pm 114(\mathrm{syst})\ [\mathrm{pb}]$$
$$\sigma_{130-140\ GeV} = 672 \pm 153(\mathrm{stat}) \pm 191(\mathrm{syst})\ [\mathrm{pb}]$$
$$\sigma_{91\ GeV} = 589 \pm 76(\mathrm{stat}) \pm 134(\mathrm{syst})\ [\mathrm{pb}]$$

- $e^+e^- \rightarrow e^+e^- c\bar{c}$ (**Muon Tag**)

$$\sigma_{183\ GeV} = 936 \pm 228(\mathrm{stat.}) \pm 178(\mathrm{syst})\ [\mathrm{pb}]$$
$$\sigma_{161-172\ GeV} = 711 \pm 330(\mathrm{stat.}) \pm 134(\mathrm{syst})\ [\mathrm{pb}]$$
$$\sigma_{91\ GeV} = 558 \pm 139(\mathrm{stat.}) \pm 166(\mathrm{syst})\ [\mathrm{pb}]$$

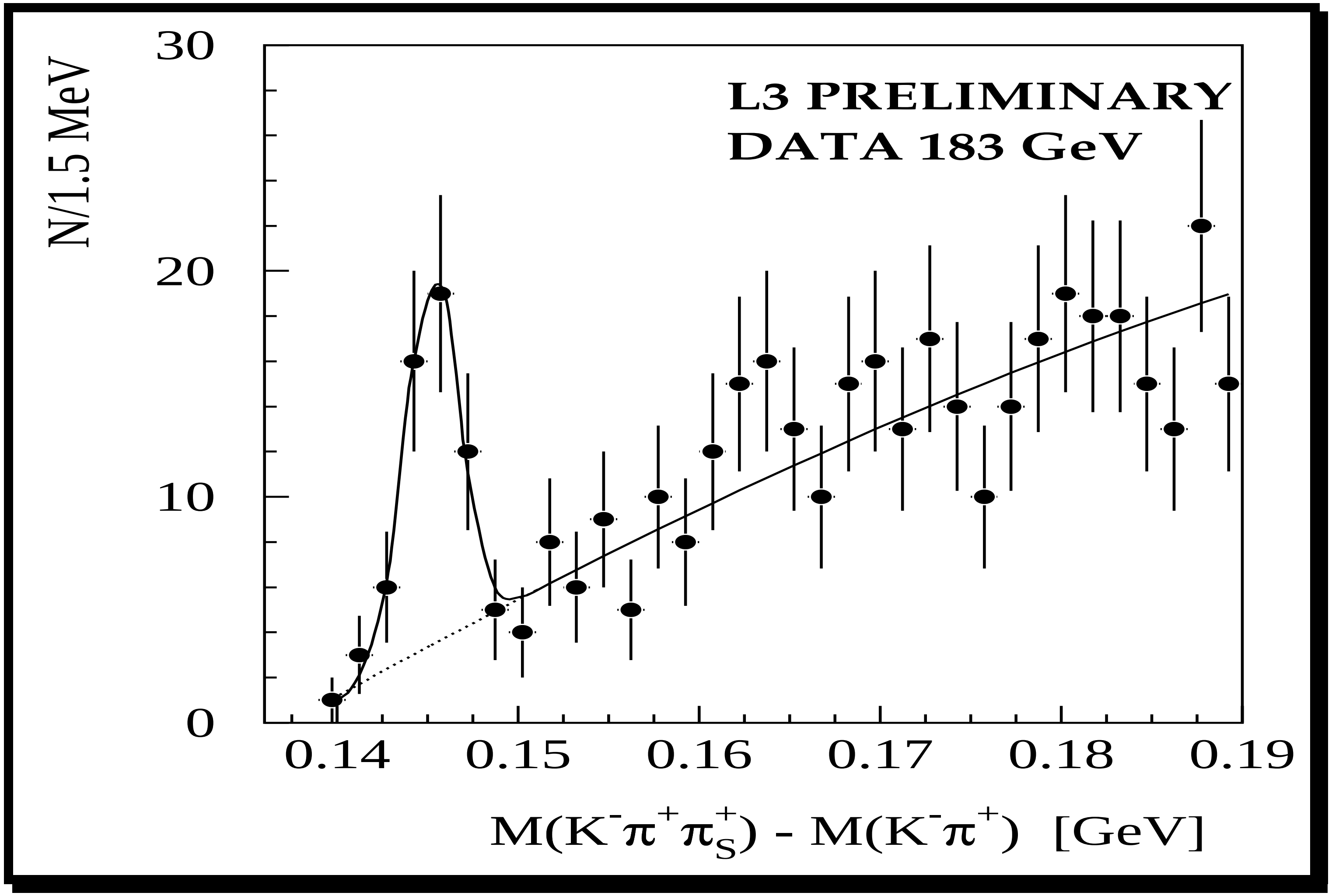
Results



$\sigma(e^+e^- \to e^+e^- c\bar{c} X)$ pb
10^3
10^2
m_c = 1.3 GeV
m_c = 1.7 GeV
QCD
QPM
L3 (electrons)
L3 (muons)
ALEPH (D*)
AMY
TOPAZ
VENUS
TASSO
JADE
TPC/Two−Gamma
0
20
40
60
80
100
Beam energy (GeV)

Analysis

$$D^{*\,\pm} \rightarrow D^o\,\pi_s^{\pm} \rightarrow K^{\mp}\,\pi^{\pm}\,\pi_s^{\pm}$$



Conclusion

- Cross Sections of inclusive charm production in $\gamma\gamma$ collisions have been measured with L3 detector at LEP1, LEP1.5 and LEP2 energies using lepton tag.
- Results are in agreement with QCD predictions.
- Additional Charm Tag analyses are in progress.
- Results are Preliminary.