



UNIVERZA V LJUBLJANI

RICH STATUS REPORT

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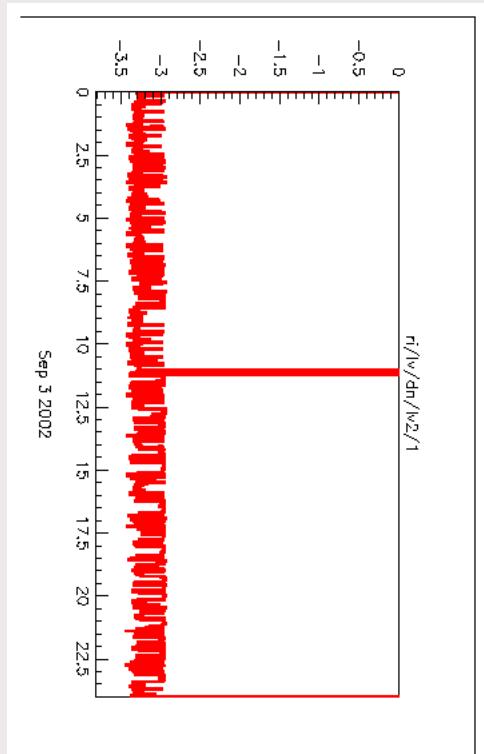
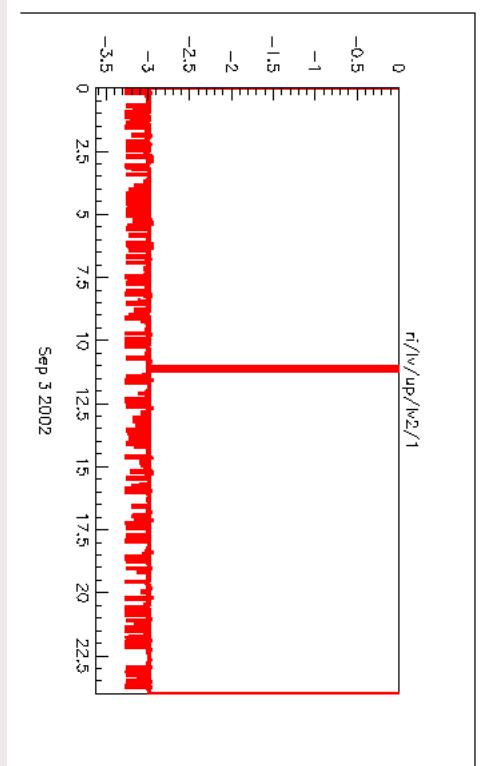
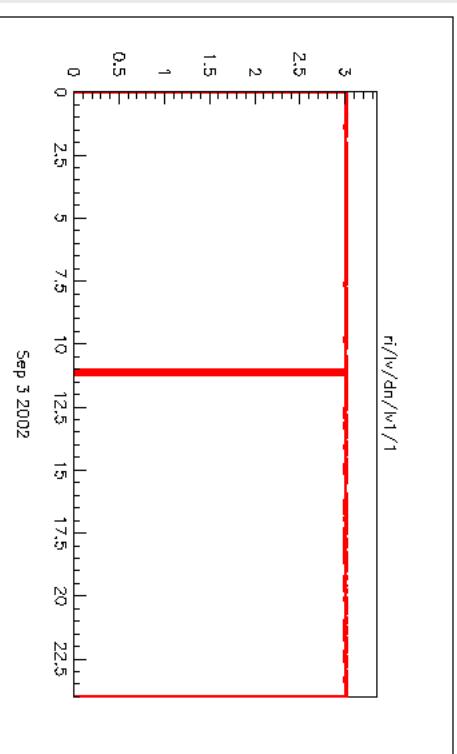
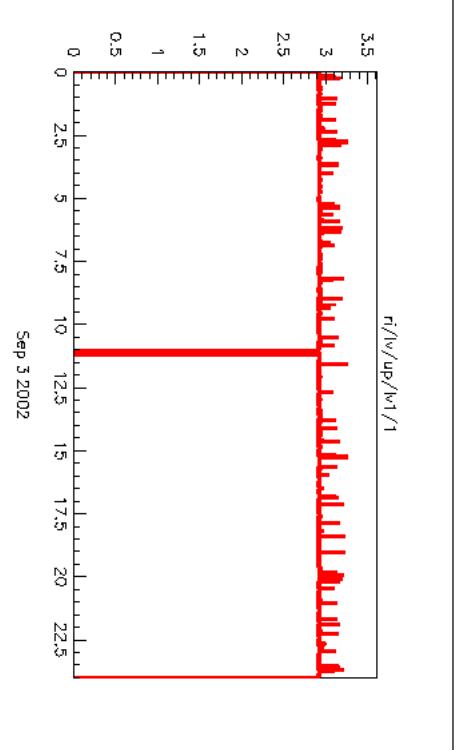
September 18, 2002
HERA-B Week, Sept. 2002

- ❖ Status of hardware
- ❖ Analysis news: multielectron likelihood on 2002 data
- ❖ Likelihoods once again
- ❖ Summary

Status of hardware

- ❖ All in all the system behaves OK
- ❖ Some problems in the LV power supplies (KEPCO) - switching from voltage to current limit mode
- ❖ The problem is under study, but the counter operation is not endangered

LV voltage variation vs time



Multielectron hypothesis likelihood

- ❖ If the EM shower starts in the PC1-PC4 region, each shower electron contributes its own ring → several rings get overlayed
- ❖ Multielectron hypothesis likelihood: tests the hypothesis that there is more than 1 ring at max Čerenkov radius (i.e. that the ring has at least twice the number of photons (> 60 instead of ≈ 30)).

- ❖ Existed already for 2000 data analysis, but should be more useful now (no MC chambers)

Indeed →

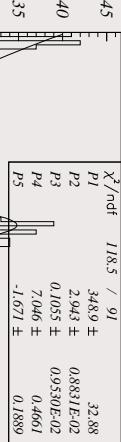
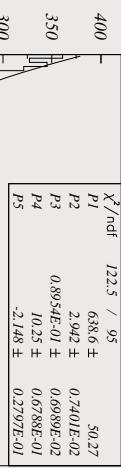
Multielectron hypothesis testing

2002 data

runs 19312 + 19393 + 19597

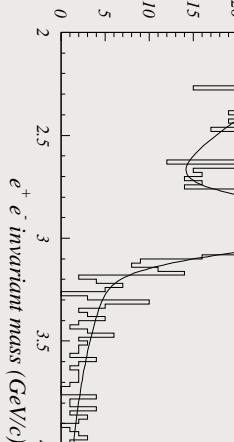
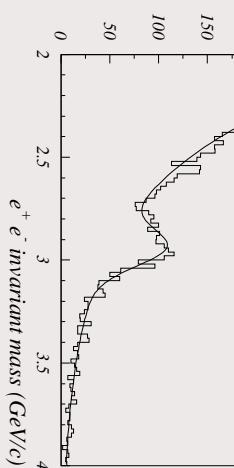
$leel > 0.9 \text{ and } lee2 > 0.9 \text{ and } prob(\chi_{e^+e^-}^2, I) > 0.05$

.and. $Ibrem.s.$



all e^+e^- pairs

1 Brem.
photon



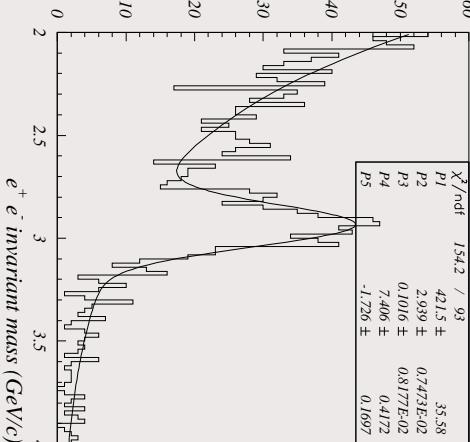
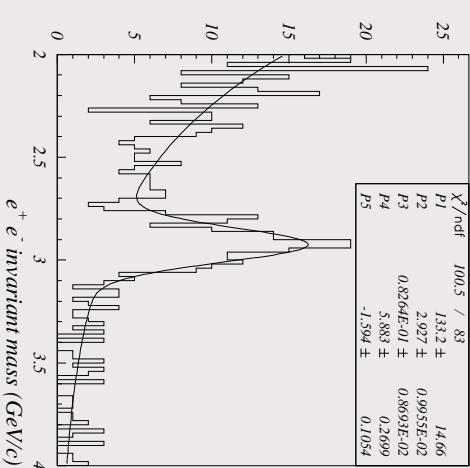
.and.($l_{\text{me1}} > l$.or. $l_{\text{me2}} > l$.or. $l_{\text{brem.s.}}$)

	χ^2/ndf	I
$P1$	100.5 / 83	14.66
$P2$	331.2 ±	2.927 ±
$P3$	0.8264E-01 ±	0.8693E-02
$P4$	5.883 ±	0.2699
$P5$	-1.594 ±	0.1054

.and.($l_{\text{me1}} > l$.or. $l_{\text{me2}} > l$.or. $l_{\text{brem.s.}}$)

	χ^2/ndf	I
$P1$	154.2 / 93	421.5 ±
$P2$	2.939 ±	0.7473E-02
$P3$	0.1016 ±	0.8177E-02
$P4$	7.406 ±	0.4172
$P5$	-1.726 ±	0.1697

multielectron
hypothesis cut
both cuts
or-ed

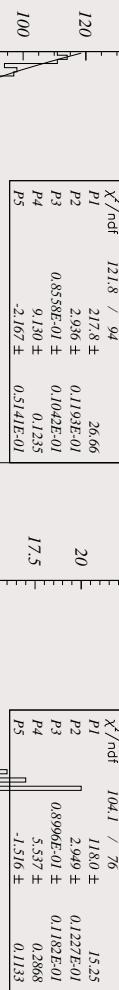


Multielectron hyp. - individual runs

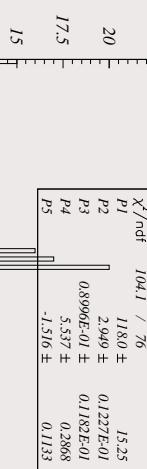
run 19597

Run 19597 (rp0000)

$leel > 0.9 \text{ and } lee2 > 0.9 \text{ and } prob(\chi^2_{\nu}, I) > 0.05$



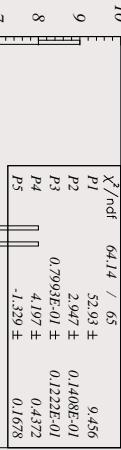
all e^+e^- pairs



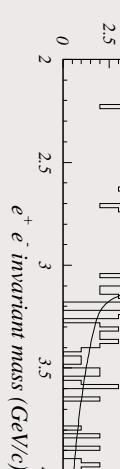
.and. $IbremS.$

1 Brem.
photon
both cuts
or-ed

$.and.(Ibme1 > I \text{ or } Ibme2 > I)$

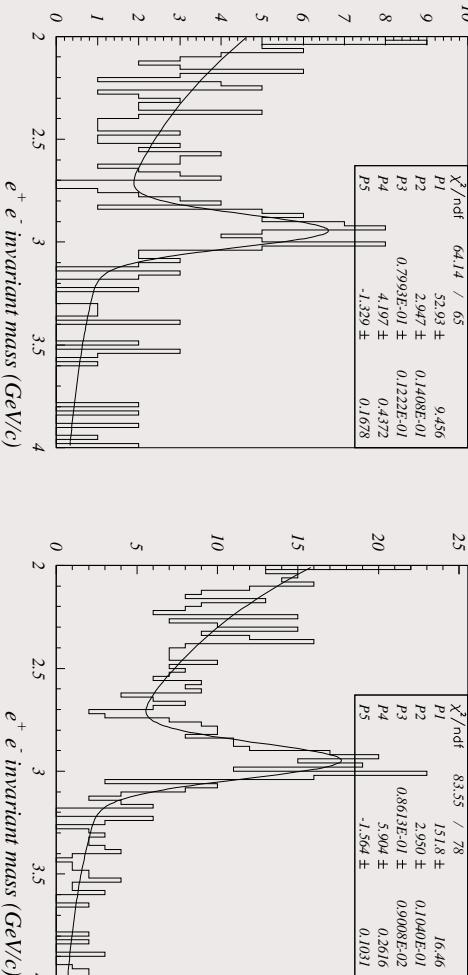


$.and.(Ibme1 > I \text{ or } Ibme2 > I \text{ or } IbremS.)$



multielectron
hypothesis cut

both cuts
or-ed

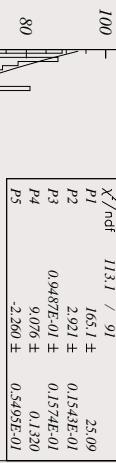


Multielectron hyp. - individual runs

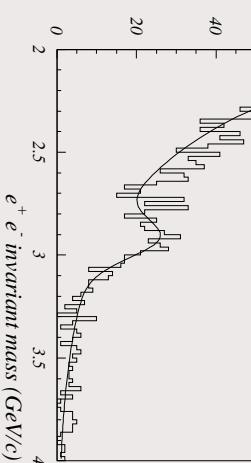
run 19312

Run 19312 (rp0000)

$leel > 0.9 \text{ and } lee2 > 0.9 \text{ and } prob(\chi^2_{\nu}, I) > 0.05$



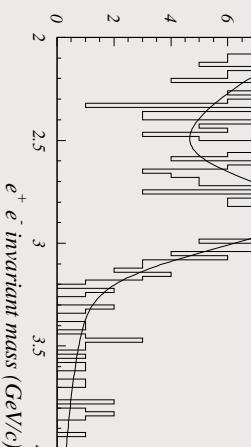
all e^+e^- pairs



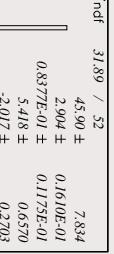
.and. $IbremS.$



1 Brem.
photon

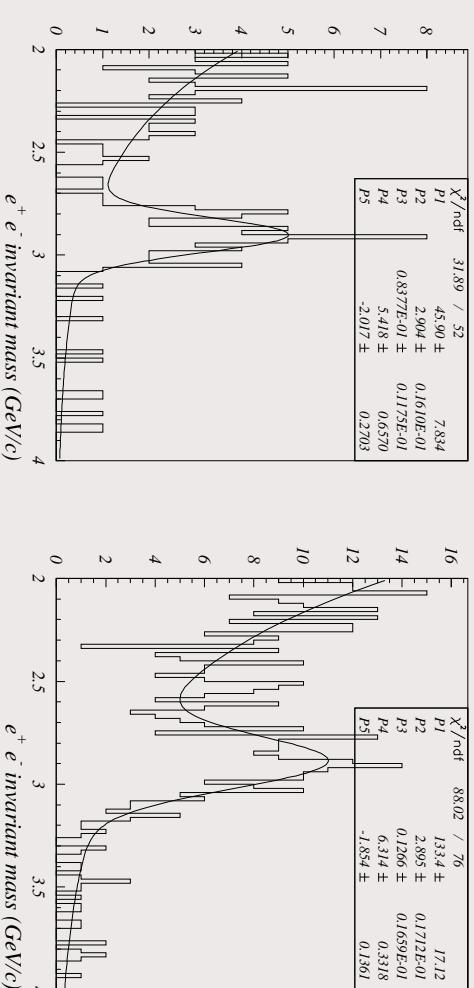


.and.($l_{me1} > l$.or. $l_{me2} > l$.or. $IbremS.$)

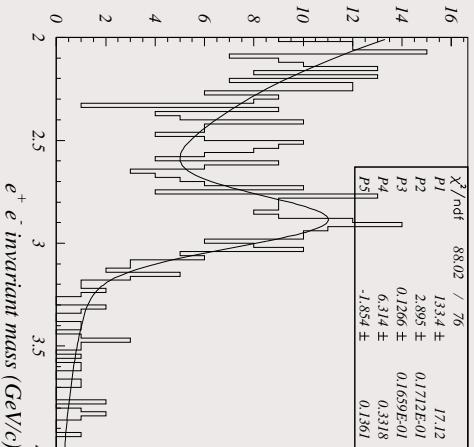


multielectron
hypothesis cut

both cuts
or-ed



.and.($l_{me1} > l$.or. $l_{me2} > l$.or. $IbremS.$)



Multielectron hyp. - individual runs

run 19385

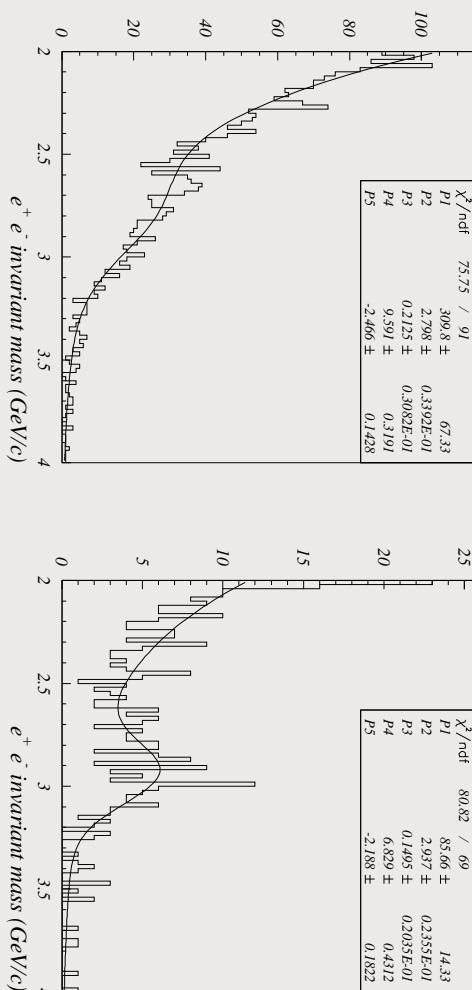
Run 19385 (rp0000)

$leel > 0.9 \text{ and } lee2 > 0.9 \text{ and } prob(\chi^2_{\nu}, I) > 0.05$



all e^+e^- pairs

.and. $IbremS.$



1 Brem.
photon

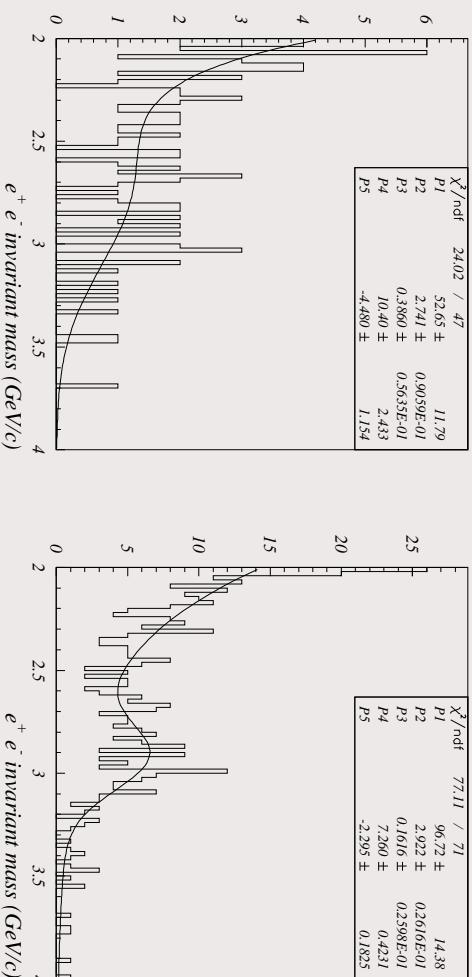
.and.($l_{me1} > l$.or. $l_{me2} > l$)

	χ^2/ndf	ν	I
p_1	24.02	47	11.79
p_2	52.65	100	2.741
p_3	0.9005E-01	100	0.5635E-01
p_4	10.40	100	2.433
p_5	-4.480	100	1.154

.and.($l_{me1} > l$.or. $l_{me2} > l$.or. $IbremS.$)

	χ^2/ndf	ν	I
p_1	77.11	71	14.38
p_2	96.72	100	2.922
p_3	2.922	100	0.2616E-01
p_4	0.1616	100	0.2598E-01
p_5	7.260	100	0.4231

both cuts
or-ed



Likelihood selection: efficiency/fake matrix

RICH particle ID with RITER:

use cuts on likelihoods for each individual hypothesis (p , K , $e + \mu + \pi$)

three selections: soft, medium, hard

determine from real data the probability that for given selection criteria a real π is identified as a π etc

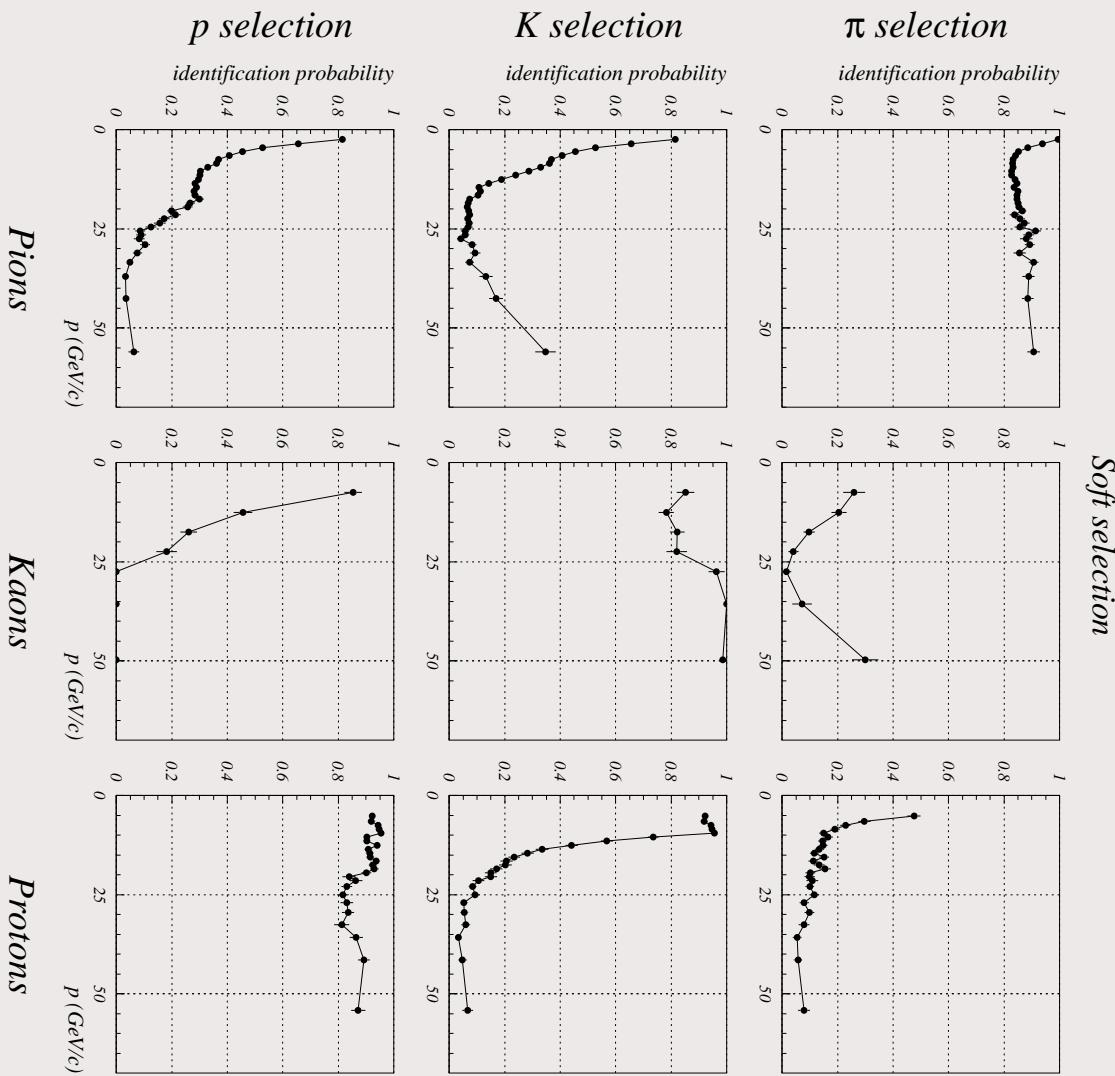
→ efficiency/fake matrix

$$\begin{pmatrix} \epsilon(\pi \rightarrow \pi) & \epsilon(\pi \rightarrow K) & \epsilon(\pi \rightarrow p) \\ \epsilon(K \rightarrow \pi) & \epsilon(K \rightarrow K) & \epsilon(K \rightarrow p) \\ \epsilon(p \rightarrow \pi) & \epsilon(p \rightarrow K) & \epsilon(p \rightarrow p) \end{pmatrix}$$

determine this matrix for each momentum interval →

N.B. You can of course use your own cut on likelihoods, but for the above three you can use efficiencies/fake probabilities which the RICH group provides!

Likelihood selection soft

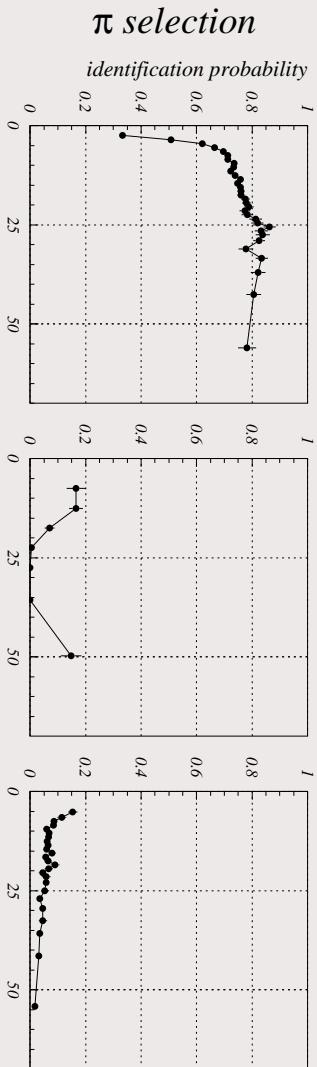


- ❖ very high efficiency
- ❖ purity depends on momentum

Likelihood selection medium

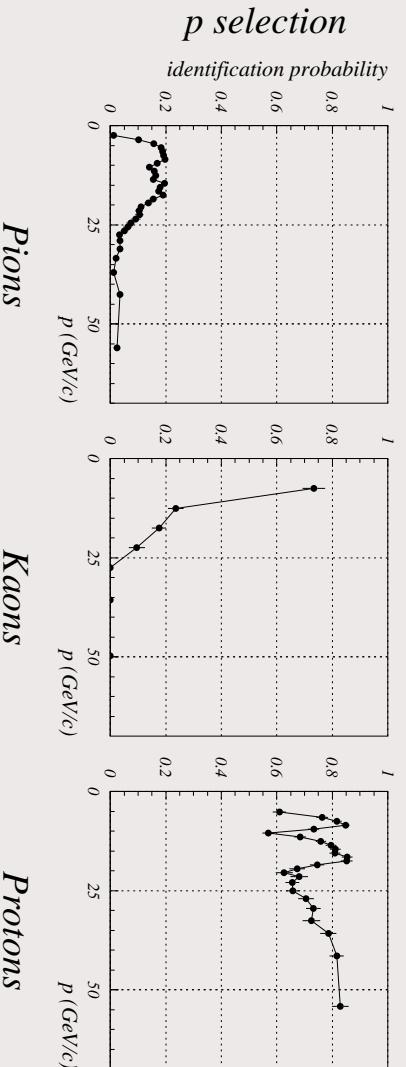


Medium selection



❖ rather high efficiency

❖ rather good purity



Pions

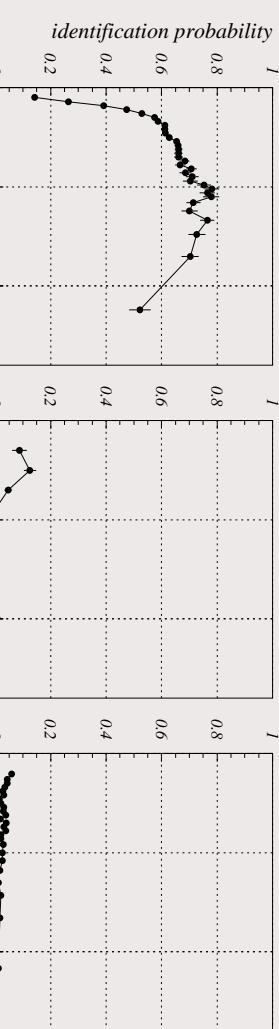
Kaons

Protons

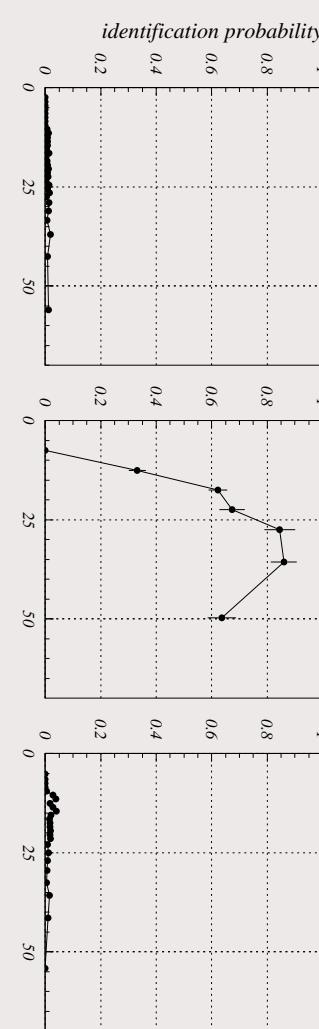
Likelihood selection - hard



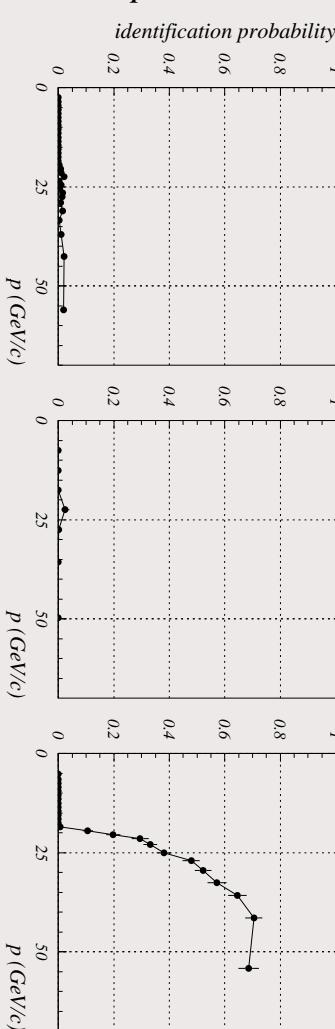
π selection



K selection



p selection



Hard selection

❖ excellent purity

❖ reasonable efficiency

Pions

Kaons

Protons

Summary

- ◆ Hardware is stable, small problems are under study
- ◆ Users are encouraged to try the multielectron hypothesis test
- ◆ ... and to use the RITER likelihoods for PID