ALEPH 89-180
PHYSIC 89-70
Ron Settles
12. Nov. 1989

Minutes of the QCD Meeting on 28. Sept. 1989

Present: Günter Hauser, Eberhard Lange, Thomas Lohse, Wolfgang Mãnner, Scott Menary, Andreas Roth, Gerald Rudolph, Richard St. Denis, Heinz Sander, Michael Schmelling, Hans-Jõrg Schmidt, Ron Settles, Terry Sloan, Makoto Takashima, Werner Wiedenmann, Weimin Wu, Dezhi Xu.

1. The distributions for the first QCD paper were discussed.

2. Brian Webber gave us a talk on his model, "HERWIG".

3. – Contribution by Gerald Rudolph: Several investigations of the parameter fitting method have been done.

I. Fit 4 parameters of LUND 2^{nd} order to LUND shower at 92 GeV:

A comparison of my fit results (2^{nd} iteration) with Hans-Joerg Schmidt's shows

- Agreement in σ and B;
- Some discrepancy in y_{min} and Λ;
- H.J.'s errors are 5 - 10 times bigger than mine;
- Overall, the χ^2 of my fit is slightly better, but H.J's set fits thrust better.

Since the χ^2 is anyway bad for most of the distributions, the result depends on the set of distributions chosen (matching the 2 models is not possible).

The deviations in Λ and y_{min} reported earlier when fitting test samples generated at a point on the hypersphere have bneen studied once more. Fitting only 1 parameter at a time (get rid of correlation) shows slight systematic deviations in each of the parameters, probably due to the parabolic parametrisation.

II. Fit 5 parameters of LUND shower to LUND shower at 92 GeV:

Since this model fits lower energy data best, it should be studied in more detail.

Fitting the 5 parameters Λ, M_{min} (or Q_0), σ, A and B to several test event samples generated at the center of the sphere (where the method should be most reliable) and using the distributions x, S, A gives the correct result on average but large fluctuations occur sometimes.

The χ^2 of the fit is excellent, as expected. Correlations between parameters are very high (around 0.9). They don't go away if 1 or 2 parameters are held fixed. Results are more stable if only 1 parameter is fitted at a time, but still same fluctuations are larger than the 1–σ errors from MINUIT.

III. A fit of LUND shower to 35 GeV TASSO data gives an overall good fit and

$$\begin{aligned} \Lambda &= 0.380 \pm .008 \text{ GeV} \\ M_{min} &= 1.640 \pm .080 \text{ GeV} \\ \sigma &= 0.375 \pm .004 \text{ GeV} \\ A &= 0.628 \pm .030 \text{ GeV} \\ B &= 0.939 \pm .040 \text{ GeV}^{-2}, \end{aligned}$$

quite close to the defaults, except perhaps M_{min}. Therefore, I don't confirm the rather strange values for Λ, A and B obtained by Phil Burrows and published in the TASSO paper. Phil's set gives a worse overall χ^2.

Correlations are not as strong as in the case above.

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1. Fit Lund $O(\alpha_s^2)$ to Lund parton shower, 92 GeV

parameter	default (PETRA/PEP)	compare fit results: GERALD	HANS-JÖRG
Λ [GeV]	.50	$.815 \pm .055$	$1.04 \pm .60$
y_{min}	.02	$.0174 \pm .0005$	$.029 \pm .006$
σ [GeV]	.40	$.497 \pm .005$	$.490 \pm .030$
B [GeV^{-2}]	.70	$.291 \pm .008$	$.287 \pm .030$

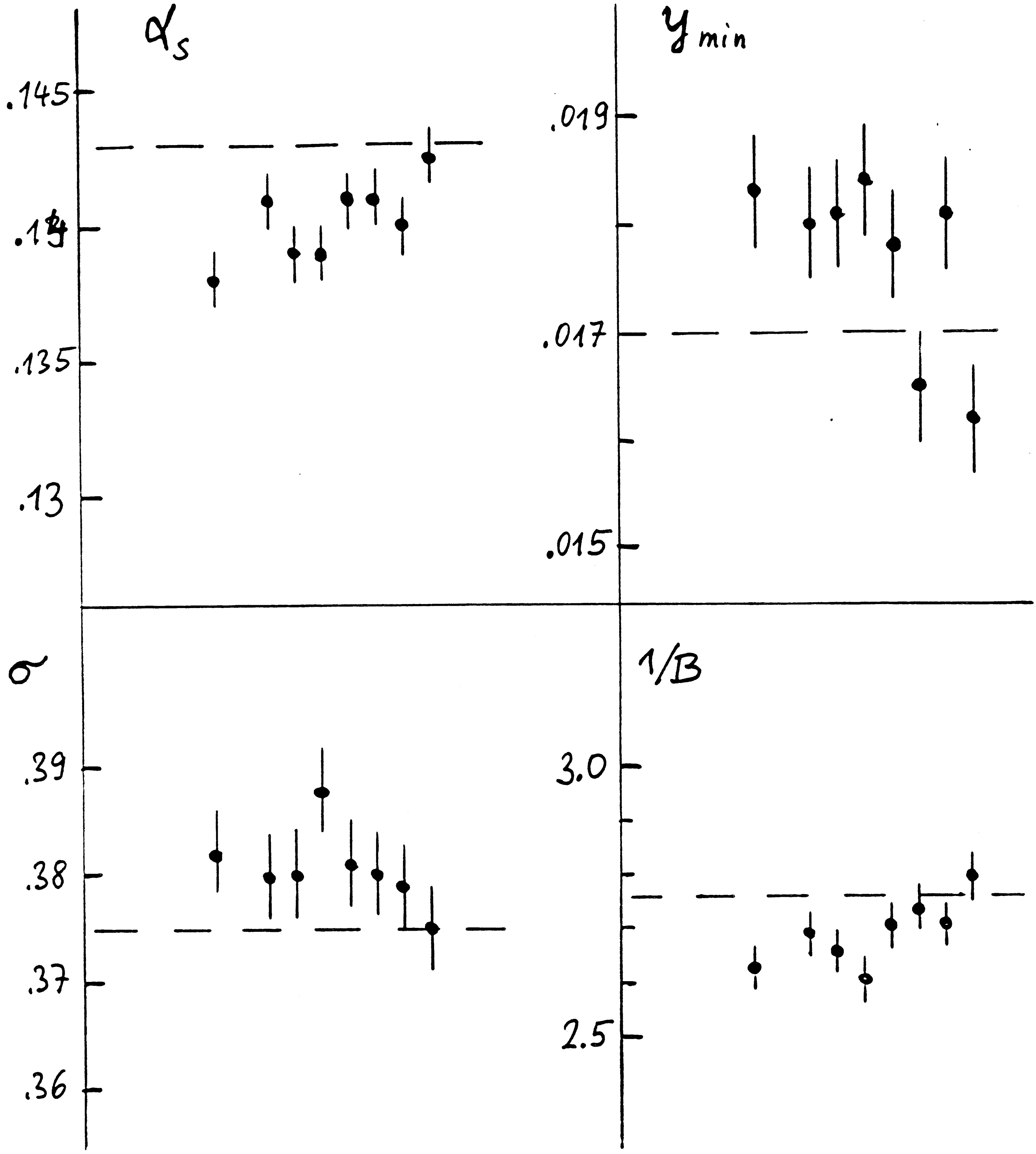
Comments: good agreement in B and σ.
agreement in Λ within error.
discrepancy in cut-off parameter y_{min}.

Observable	# intervals	χ^2 – value (15000 ev. Lund $O(\alpha_s^2)$ – 3000 ev. Lund p.s.)		
N_{ch}	13	69	64	
x_p	26	89	188	← too many high-x, too few soft
$p_{T out}$	9	85	138	
$p_{T in}$	9	30	63	
Q_1	6	155	159	
Q_2	7	13	118	← too much peaked
T	9	260 ← miserable!	43	← much better!
Min	7	285	198	
Obl	8	4	95	
sum χ^2 =		990	1066	

My fit used N_{ch} x p_{To} p_{Ti} Q_1 Q_2 Min Obl as observables

Correlation coefficients (global):

α_s	y_{min}	σ	$\frac{1}{B}$
.45	.66	.66	.84



Fit of Lund $O(\alpha_s^2)$ to Lund $O(\alpha_s^2)$ test events (8 samples, 3000 ev. each) at 92 GeV.

Testpoint lies on boundary of parameter region (sphere).

Fit each parameter at a time. (avoid correlations)

2. Fit Lund p.s. to Lund p.s., at 92 GeV
(as a test of the method)

Paramter ranges:

Λ_{LLA} :	.20 – .40 – .60	GeV
Q_0 :	1.0 – 2.0 – 3.0	GeV
σ :	.25 – .35 – .45	GeV
A :	.20 – .50 – .80	
B :	.50 – .90 – 1.3	GeV^{-2}

↑ center of sphere (= default values)

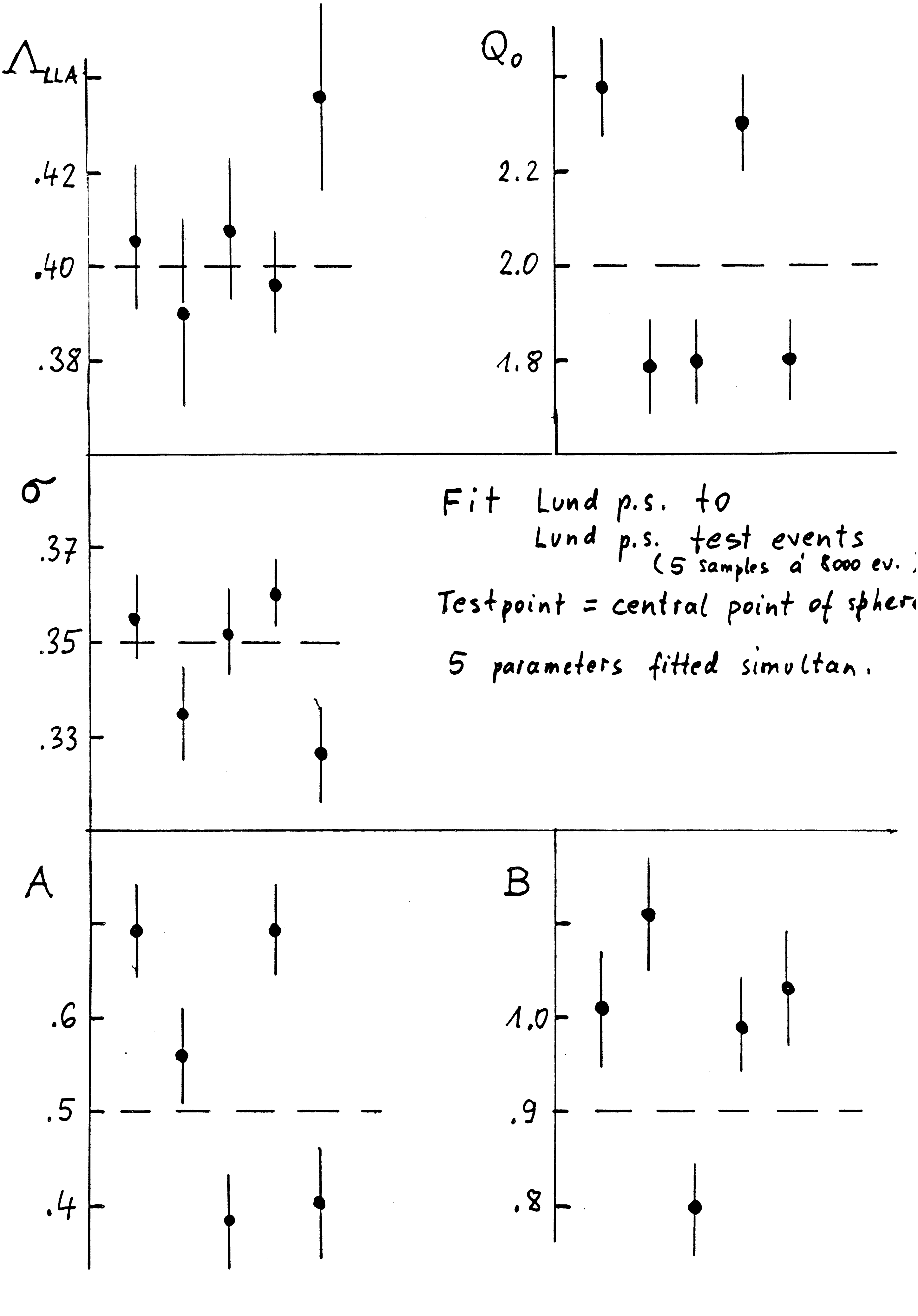
MC statistics generated : $1/2 \; 10^6$

Fit observables X, S_c, A_c

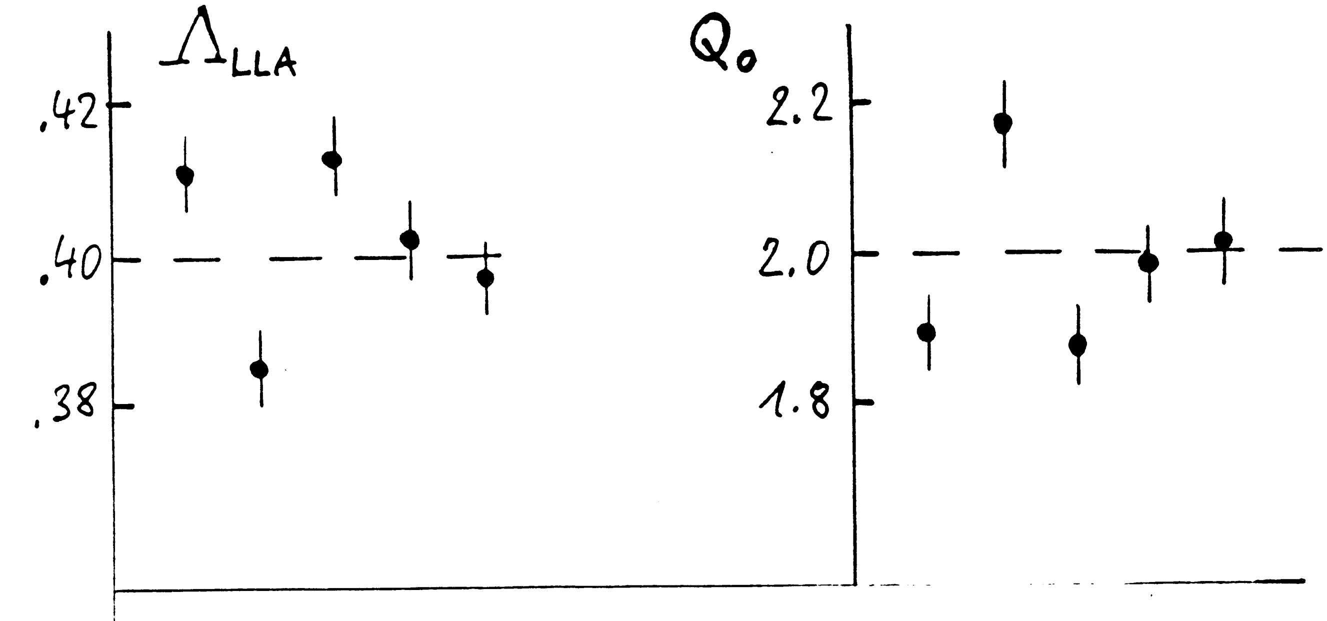
Adjust 5 parameters simultaneously:
large fluctuations in some cases
prob. due to large degree of correlation:

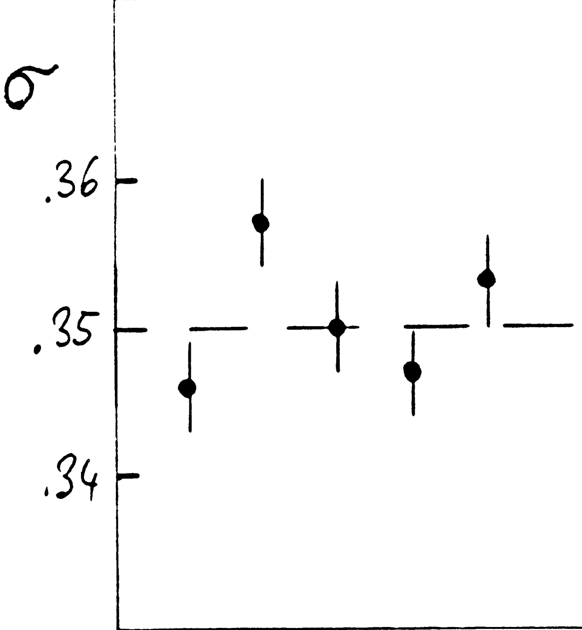
Λ	Q_0	σ	A	B	
.90	.70	.90	.92	.95	"global" correlat coefficients given by MINUIT

Adjust one parameter at a time (fixing the other 4 at the values they should have):
good resutts no systematic shifts,
errors given by MINUIT seem too small, however



Λ_{LLA}
.42
.40
.38
Q_0
2.2
2.0
1.8
σ
.37
.35
.33
Fit Lund p.s. to
Lund p.s. test events
(5 samples á 8000 ev.)
Testpoint = central point of sphere
5 parameters fitted simultan.
A
.6
.5
.4
B
1.0
.9
.8

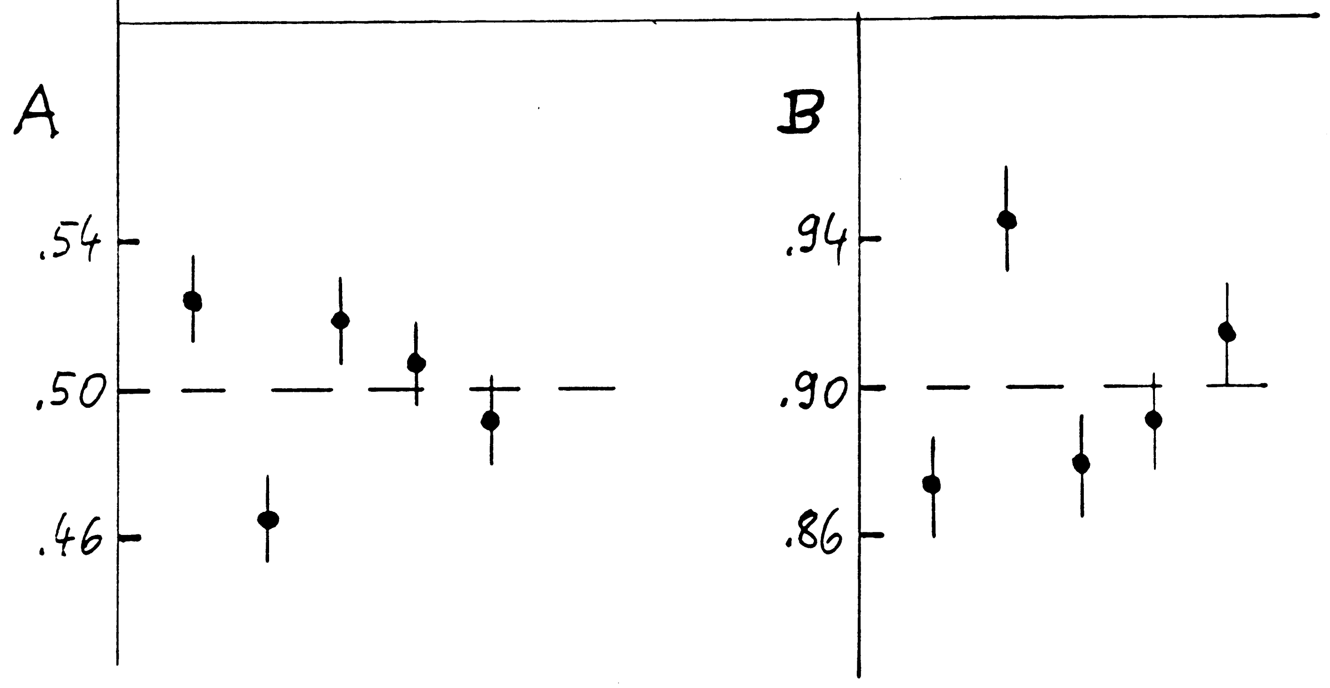




Fit Lund p.s. to
Lund p.s. test events

Testpoint = central point of sphere

fitted each parameter
at a time



3. Fit Lund p.s. to TASSO Data, 35 GeV

Used same parameter region than at 92 GeV
Statistics generated 1/2 10^6 events
global fit to observables X P_{To} P_{Ti} $\langle P_{To}^2\rangle$ $\langle P_{Ti}^2\rangle$ S A T

Parameter	def.	MARK II FIT 29 GeV	My fit to MARK II data	TASSO FIT 35 GeV	My fit to TASSO data
Λ	.40	.40	.43 ± .004	.26	.38 ± .008
Q_0	1.0	1.0	1.1 ± .05	[1.0]	1.64 ± .08
σ	.35	.354	.34 ± .003	.39	.375 ± .004
A	.50	.50	.45 ± .01	.18	.628 ± .03
B	.90	.90	.77 ± .02	.34	.939 ± .04

$$\frac{\chi^2}{ndf} = \frac{209}{132} = 1.6$$

Result close to defaults.
correlation coeff. (global):

Λ	Q_0	σ	A	B
.60	.65	.70	.70	.80

TASSO published parameter set
gives somewhat worse description

$$\frac{\chi^2}{ndf} = \frac{252}{132} = 1.9$$

for above set of distrib's.
(p_T tails worse,
but Aplanarity better)