Fels

January 5, 1988

JADE Computer Note No. 98

W. BARTEL

Minutes of the JADE Software Meeting of Dec. 14, 1987 at DESY

This note is a collection of transparencies which have been shown during the software meeting at Dec. 14, 1987.

- **D. Pitzl** : New Routines for the Reconstruction of Photon Energies
- **J. E. Olsson** : Tokyo Shower Program for γ's
- **E. Elsen** : Chamber Resolutions in Monte Carlo
- **E. Elsen** : dE/dx Monte Carlo
- **R. Ramcke** : Inclusion of VTXC-Software
- **G. Eckerlin** : TP-ed MH-Events at DESY
- **C. Bowdery** : Which FORTRAN Compiler?

The following decisions were taken at the meeting:

1. The Pitzl leadglass programs should be implemented on the JADE library.
2. A separate library for vertex chamber routines should be created.
3. The vertex chamber calibration constants should be cast into a form which is compatible with the JADE calibration system.
4. Information on tapes containing data and tracked Monte Carlo events should be transferred to the library **JADEPR.TEXT.**
5. Before a decision can be taken on the FORTRAN 77 compiler to be used in JADE further investigations are necessary.

JADE Software meeting D. Pitzl 14.12.87

New Routines for the reconstruction of Photon Energies

- Corrections calculated by EGS4

  (Electron-Gamma Shower Monte Carlo, Version of 1985)

- valid for the Barrel-LG for 1979-86

- Effects considered are:

  1.) Leakage of Bhabha-Electron-Showers in the LG-Calibration : BBLEAK

  2.) Energy deposited by Photons in the material in front of the LG: ENLOSG

  3.) Leakage of Photon-Showers : LKCORR

  4.) Correction for the LG-readout-threshold:

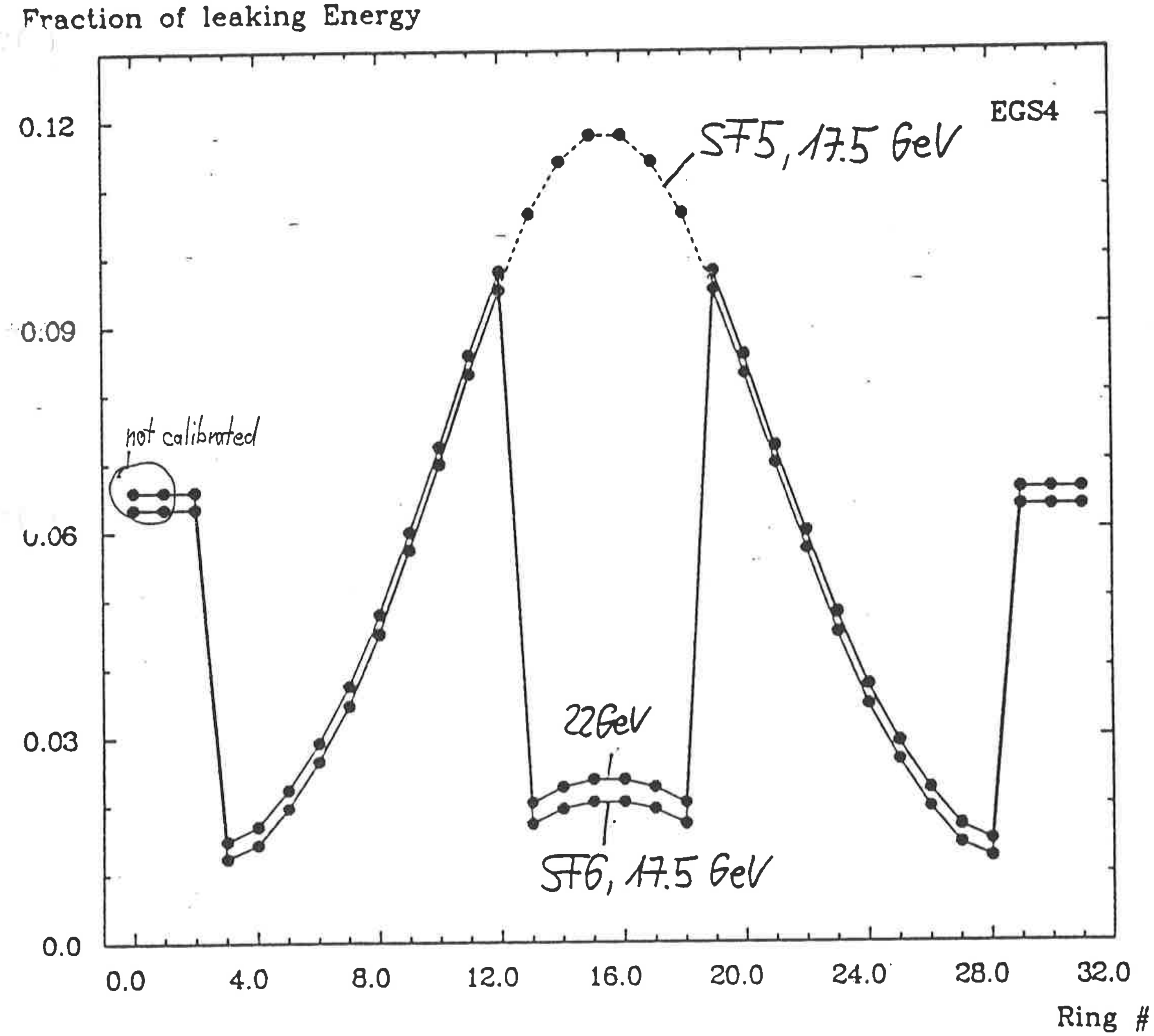
  THCORR

Leakage of Bhabha - Showers

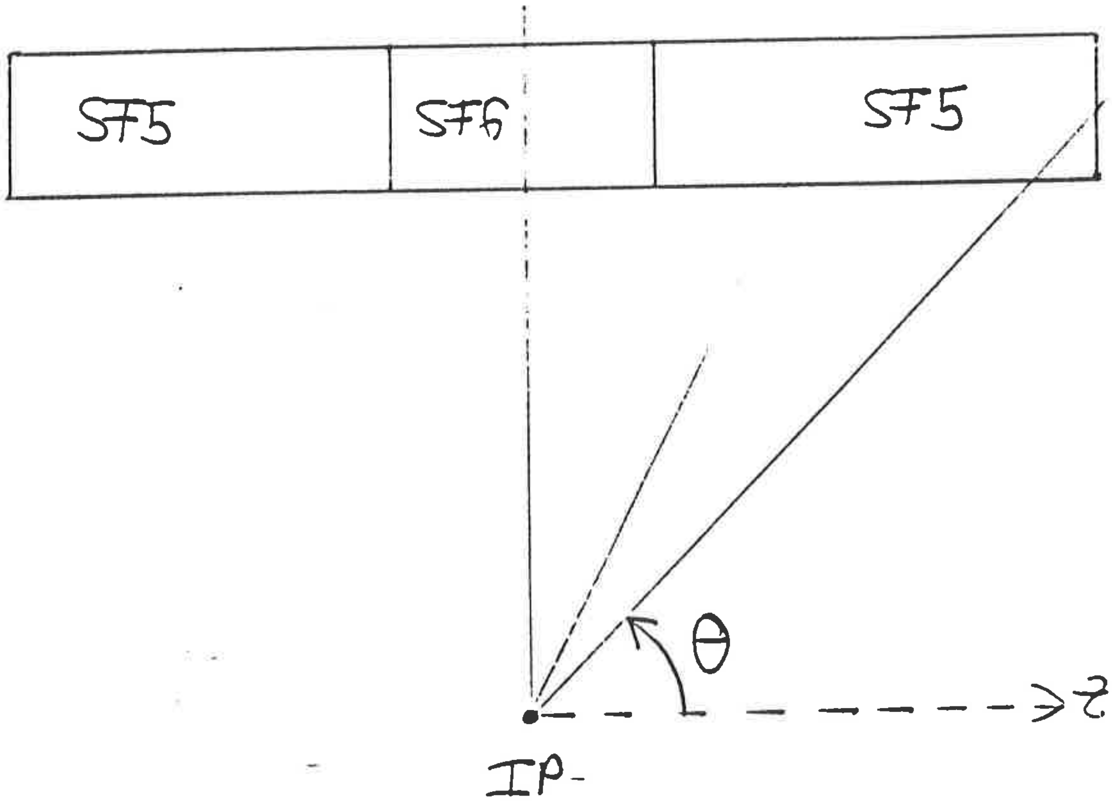
17.5 GeV with and without SF6 in the 6 central rings

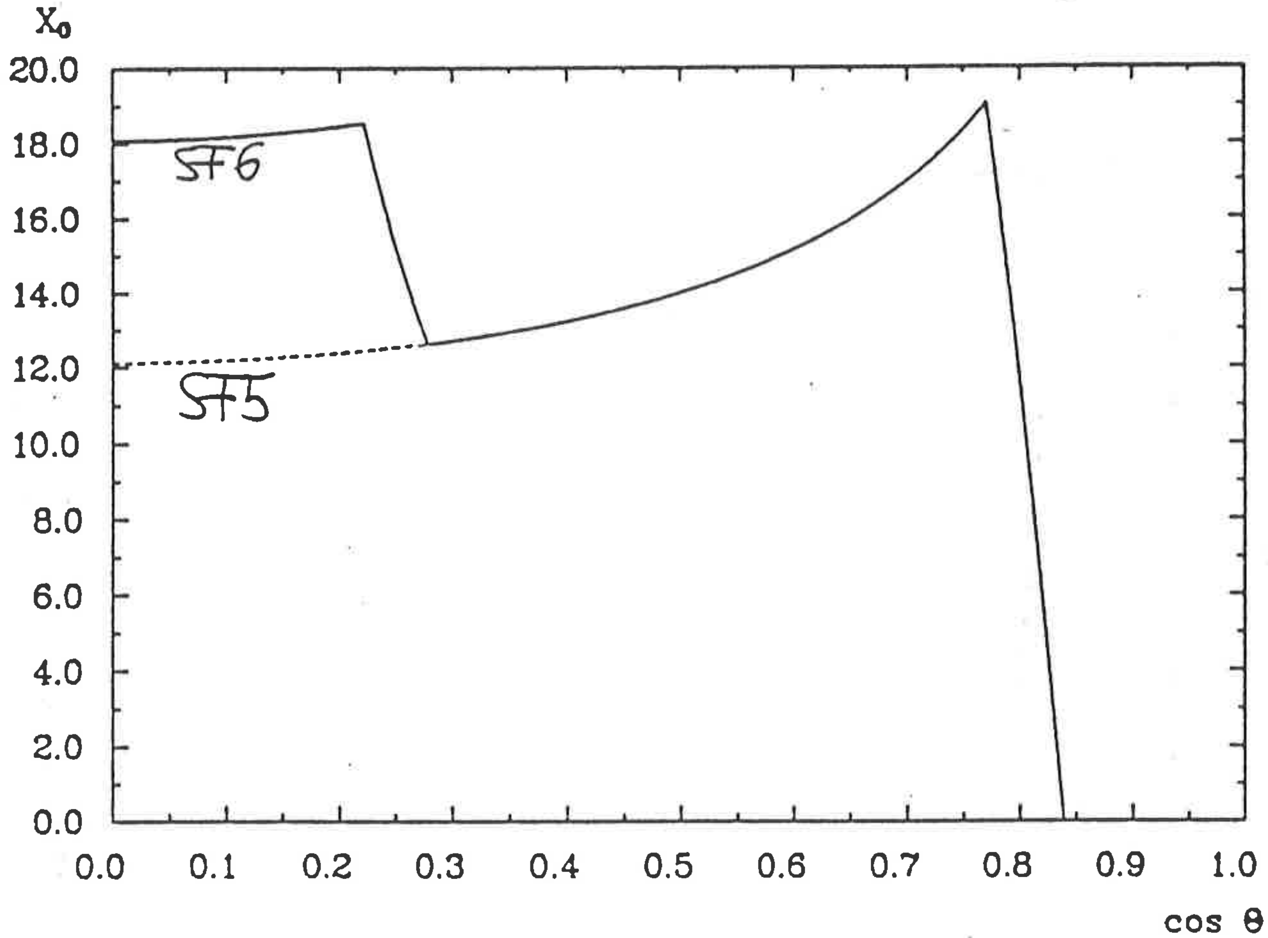
22.0 GeV with SF6.

Material infront of LG: 1.22 X_0 Al



Leakage of Bhabha-Showers at 17.5 and 22. GeV





effective Depth of Barrel-LG

Radiation Length

$$\frac{dE^e_{rad}}{dx} = -\frac{E^e}{X_0}$$

1.) Messel, Crawford

$$\frac{1}{X_0^{MC}} = 4\alpha r_e^2 N_A \frac{\varrho}{A} Z(Z+1) \ln\left(183/Z^{1/3}\right)$$

2.) Rossi : Coulomb-correction for high Z

$$\frac{1}{X_0^R} = 4\alpha r_e^2 N_A \frac{\varrho}{A} Z(Z+1) \frac{1}{1+0.12\left(Z/82\right)^2} \ln\left(183/Z^{1/3}\right)$$

3.) EGS :

$$\frac{1}{X_0^{EGS}} = 4\alpha r_e^2 N_A \frac{\varrho}{A} Z(Z+a(Z)) \cdot \left[\ln\left(183/Z^{1/3}\right) - b(Z)\right]$$

$$a(Z) = \ln\left(1440/Z^{2/3}\right) / \left[\ln\left(183/Z^{1/3}\right) - b(Z)\right]$$

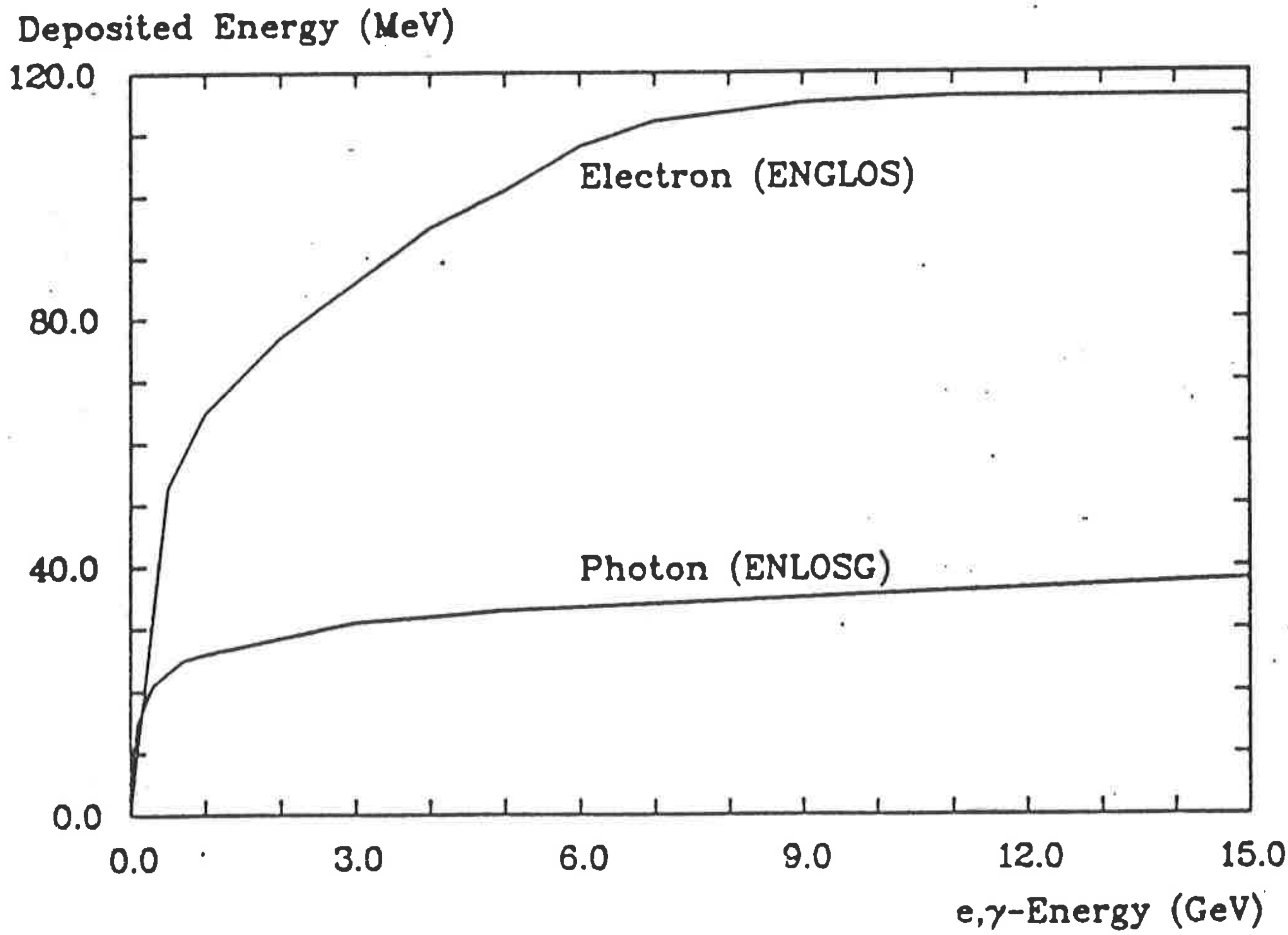
$$b(Z) = (\alpha Z)^2 \left[\frac{1}{1+(\alpha Z)^2} + 0.202 - 0.037(\alpha Z)^2 + 0.008(\alpha Z)^4 - 0.002(\alpha Z)^6\right]$$

cm	X_0^{MC}	X_0^R	X_0^{EGS}
SF5	2.23	2.54	2.475
SF6	1.53	1.70	1.66

mixture:

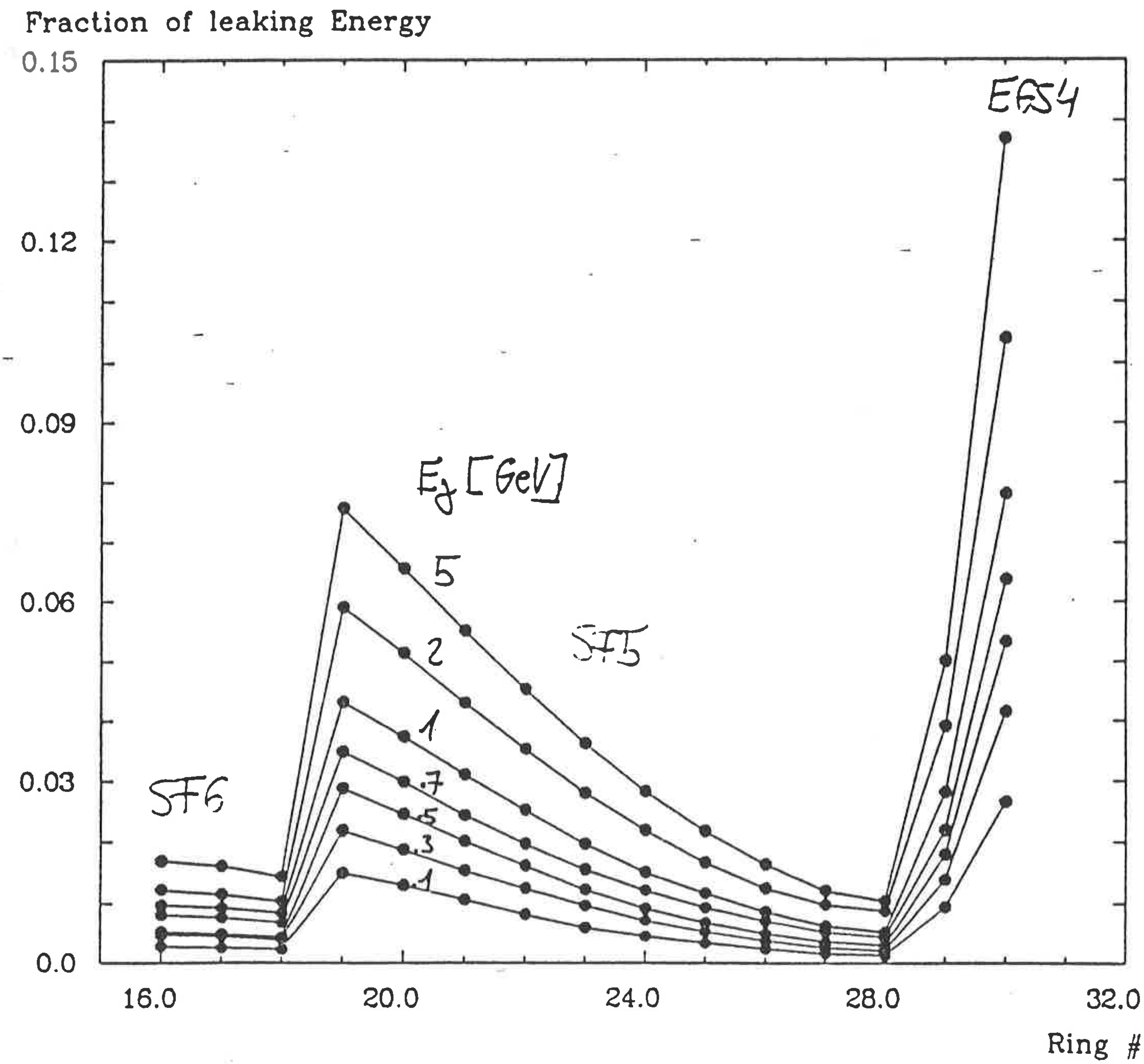
$$\frac{1}{\varrho X_0} = \sum_i \frac{w_i}{\varrho_i X_{0i}}$$

w_i = mass fraction



Energy deposited in 1 X_0 Alu by Electrons and Photons

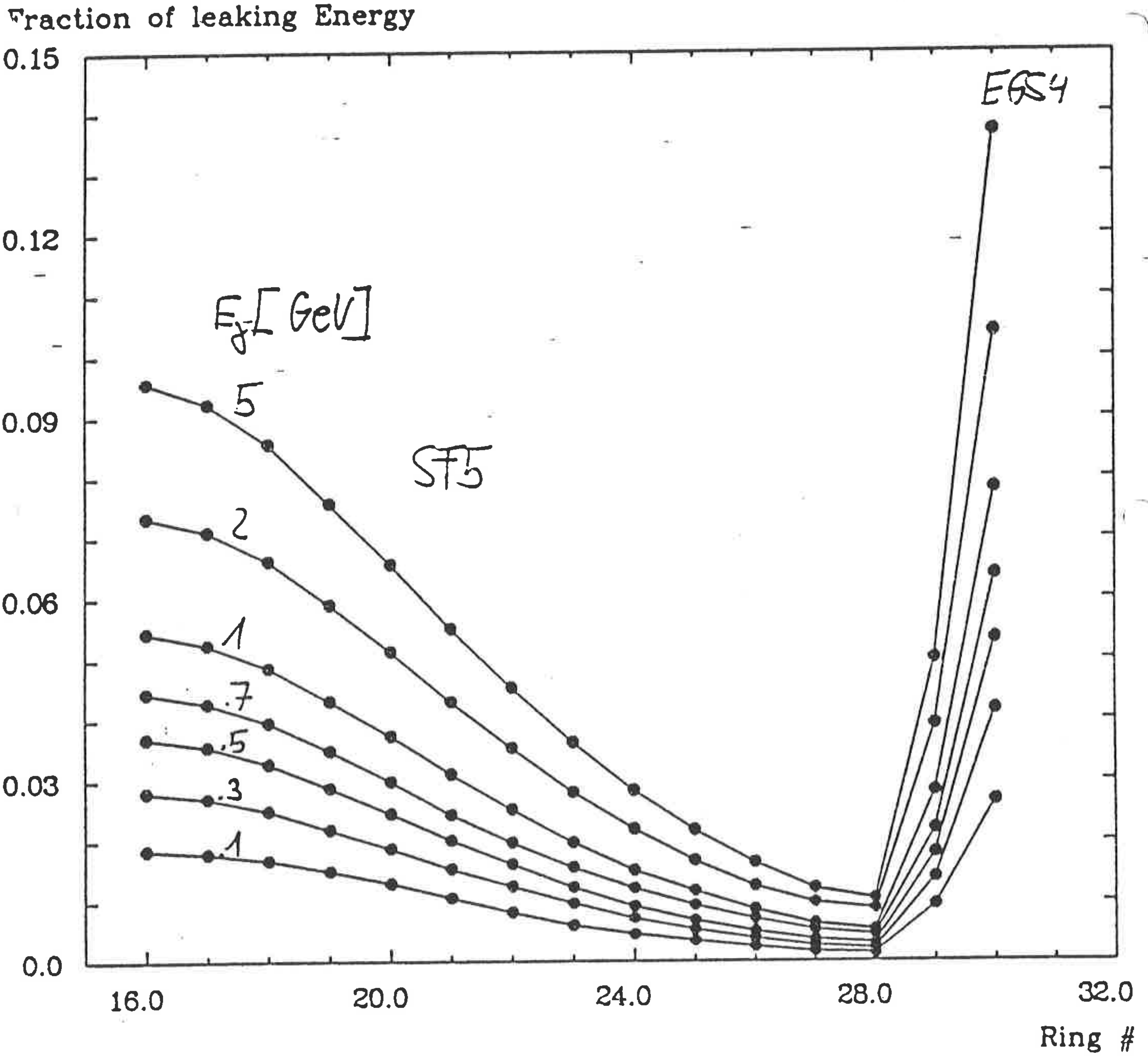
Leakage of Photon-Showers
with SF6 in the 6 central rings
material between ID and L6: $1.04 X_0$



Leakage of Photon Showers with SF5 and SF6

Leakage of Photon showers

only SF5

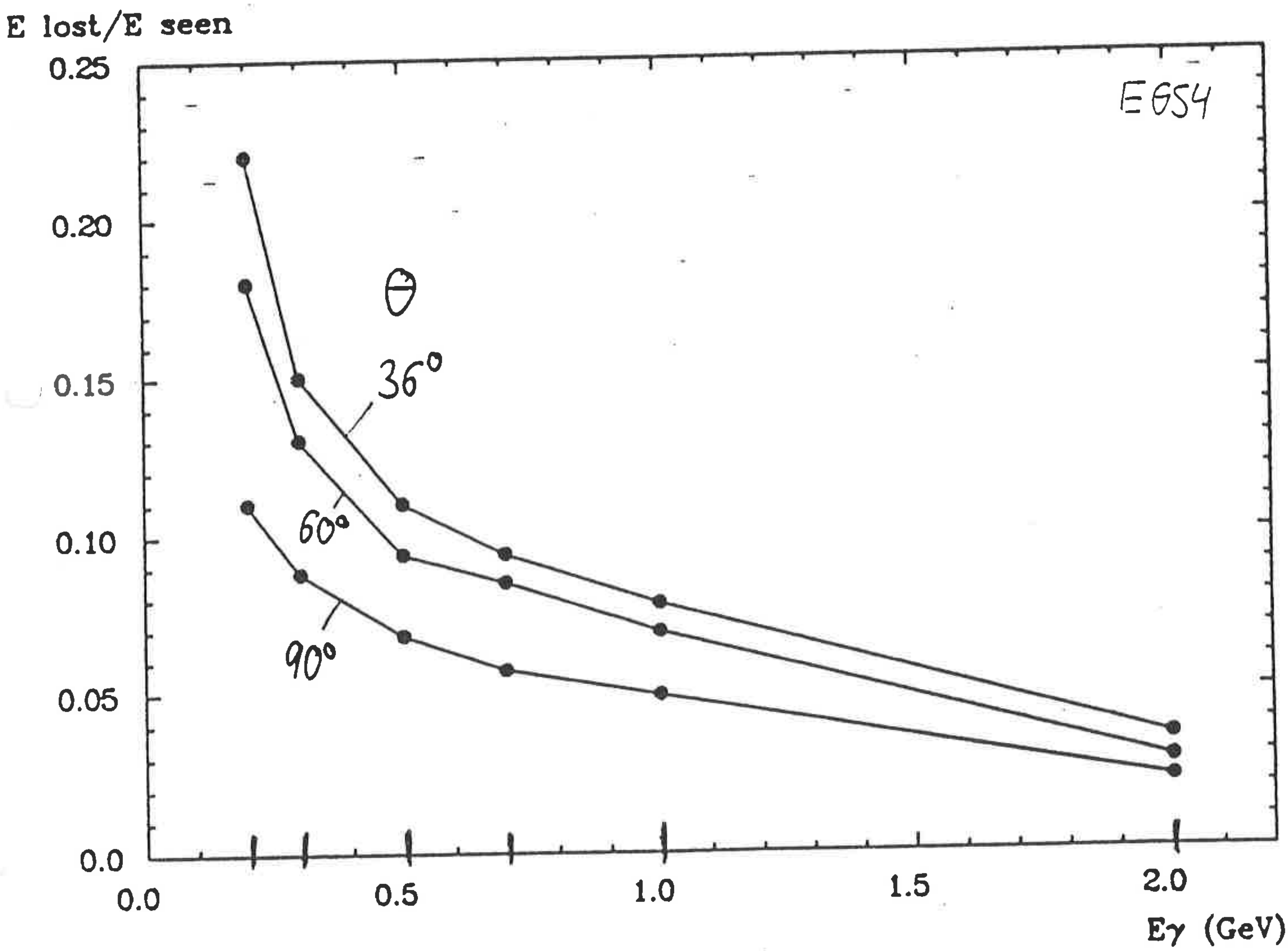


Leakage of Photon Showers with SF5 only

LG-Signal lost due to readout-threshold

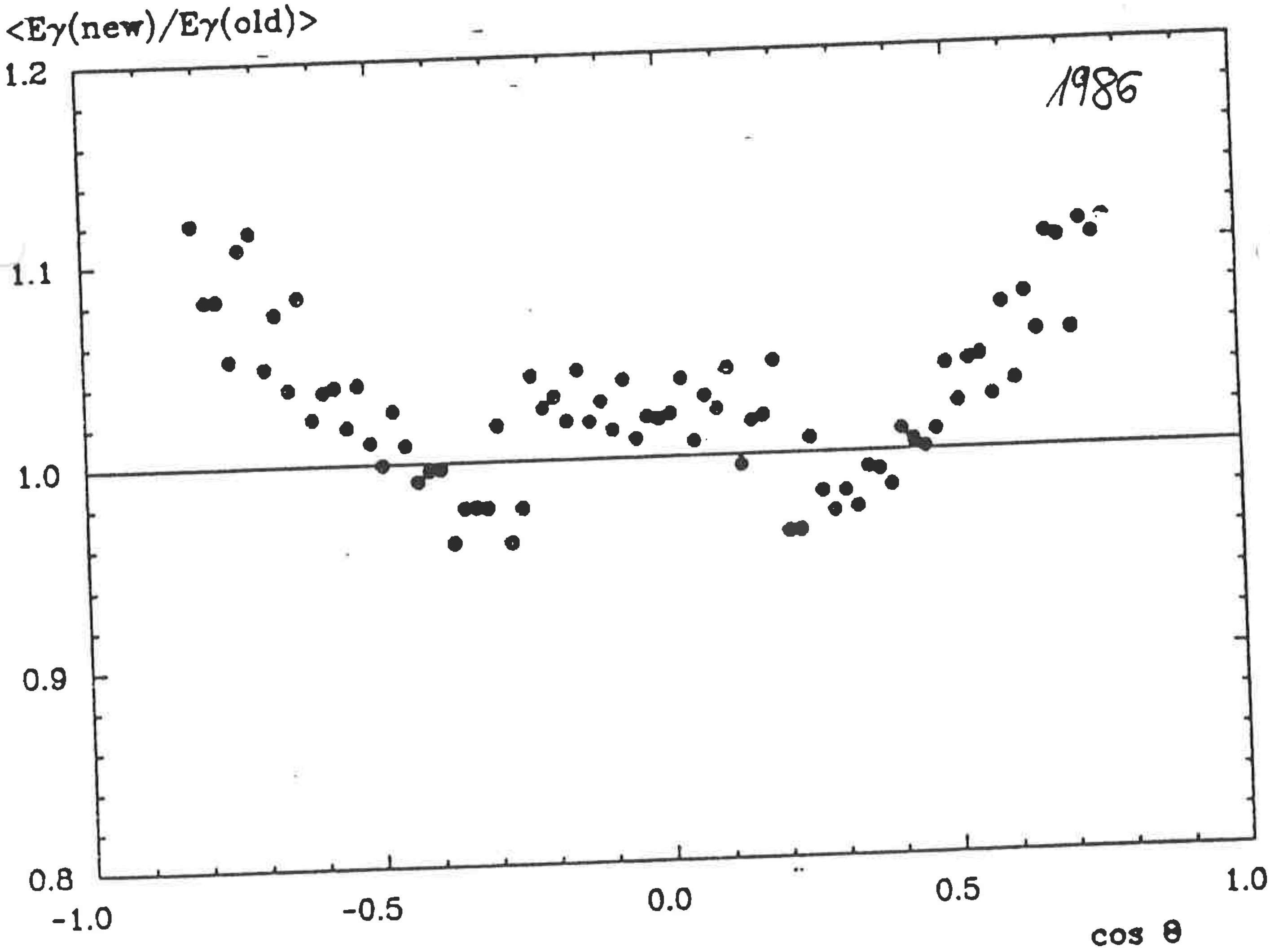
1979-82 : threshold of 5 ADC-counts ≙ 25 MeV

1983-86 " " 6 ADC-counts ≙ 36 MeV

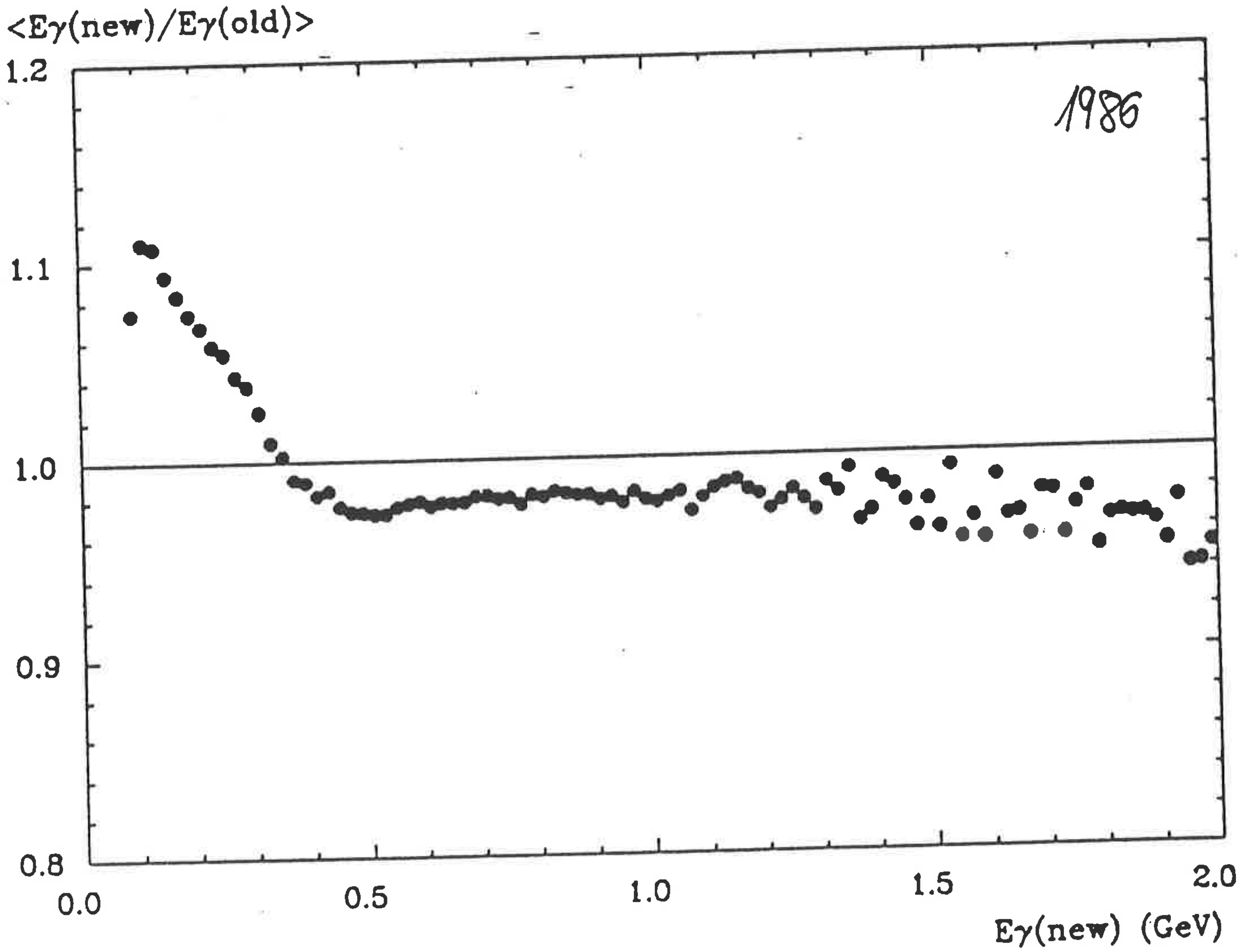


Threshold loss for θ = 36°, 60°, 90°

Comparison of 'new' and 'old' Photon Energies
cos θ-distribution, integrated over Energies



Integrated over Barrel-Part



Implementation

Two routines from the official JADE Lead Glass library 'JADELG.SOURCE/LOAD' have been changed:

- LGCLPB (called by LGANAL) calls BBLEAK and reduces the energy of every block in a cluster to correct the calibration. The result is stored in the ALGN-Bank. BBLEAK is not called for Monte Carlo Data (run number < 100).

- LGECOR (called by LGCDIR) calls ENLOSG, LKCORR and THCORR in an iteration loop which reconstructs the photon energy. All three routines increase the measured cluster energy.
  LKCORR is not called for MC-data which used Meier-Magnussen LG-Shower routines (Word 17 in HEAD-Bank =1) since here the leakage of photon showers is not simulated.

The new routines were installed on 'JADELG.SOURCE/LOAD' on 22.12.1987

J. Olsson 14/12-87

TOKYO Shower program for Simulation of photons/electrons in the JADE Lead Glass Detector

(1) Originally developed by A. Sato
(Master Thesis, Tokyo 1979)

General el. magn. shower program, based on
Messel & Crawford "Electron-Photon Shower Distribution Function"

(2) JADE specific details included by S. Yamada
Subr. NPECER, J.N. 20
"Nr of Photoelectrons from Čerenkov radiation"

Takes account of:
- Transparency of Leadglass to Č-radiation
- " – " Lightguide material
- Directional Dependence (total reflection)
- Photo Cathode Sensitivity of PM (Hamamatsu R594)

(3) Inclusion in private version of JADE standard tracking.
Used in $\gamma\gamma$ physics analysis for simulation of low energy γ.

Shortcomings:

* Original program 1-material program only
(i.e. SF5 only)

Sato's code is perfectly general, but the surrounding framework did not switch between different materials.

In the JADE tracking program inclusion, it was necessary to introduce equivalent thicknesses of radiation as inactive (black) leadglass in front of the barrel and end cap detectors.

* From 1983, with both SF5 and SF6 leadglass in the barrel, it did not give a useful simulation, since NPECER is only valid for SF5, and SF6 is much different.

* No possibilities for TOKYO to improve these shortcomings (time, manpower.)

Improvements: Autumn 85 – Summer 87.

Update Yamada's programs to derive NPECR6
(J.N. 2.0, supplem. 1)
⇒ describe Čerenkov radiation in SF6 blocks

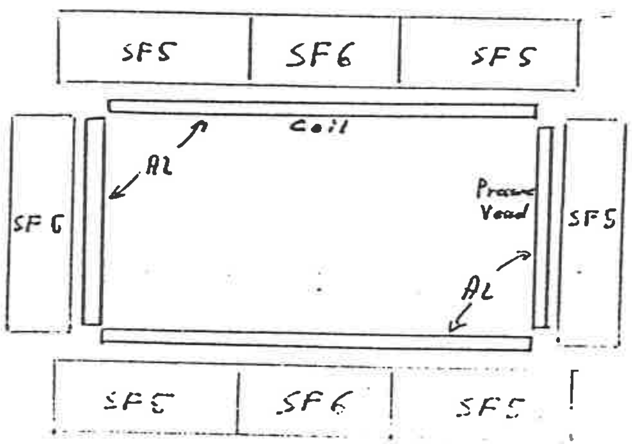
Use the structure of Yamada's simulation program for OPAL Lead glass system, to make the JADE program multi material.

Integrate with JADE standard Tracking program.

⇓

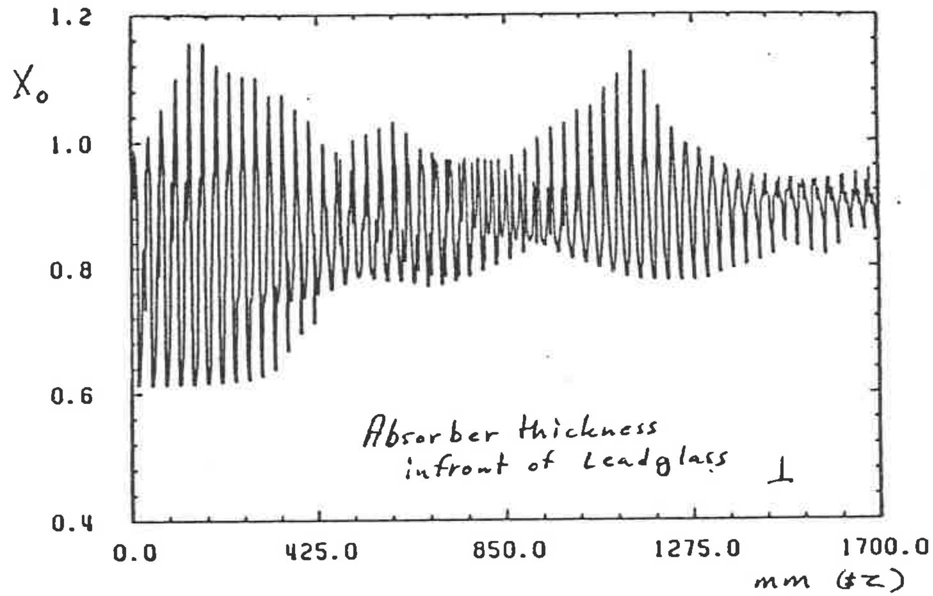
F11OLS. JADE66. S/L

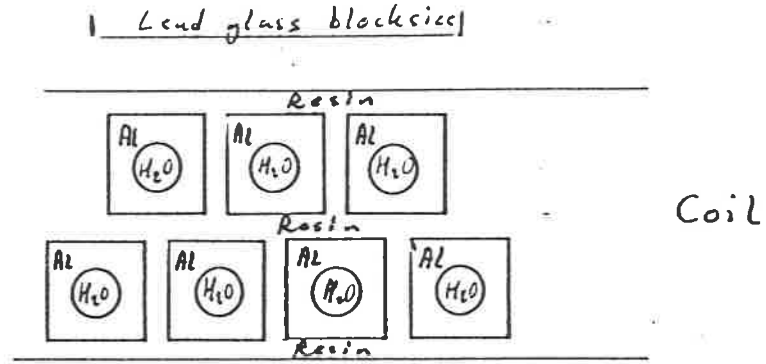
Now 3 materials: Al, SF5, SF6



(3)

subr. TJOCK





Average radiation slightly less than assumed in Block Data. (0.97 X_0)

(4)

IMPLEMENTATION

Several Subroutines changed (on JADE56.S):

MCJADE, STHEAD, WRTMCB, TRKGAM, TRKGMV

MCJADE:

a) New logical flag, LFLAG(6)

```
      COMMON/CFLAG/LFLAG(10)
      LOGICAL * 1 LFLAG
C
C          LFLAG(1) = SMEAR GAMMA AND ELECTRON ENERGIES
C          LFLAG(2) = GAMMA CONVERSION IN OUTER TANK AND COIL (TRKGAM)
C          LFLAG(3) = ABSORPTION LOSSES
C          LFLAG(4) = 3 DIM SHOWER PROFILE FIT TO EGS CODE
C          LFLAG(5) = .TRUE.   -->  WITH VERTEX CHAMBER TRACKING
C                   = .FALSE.  -->  WITHOUT VERTEX CHAMBER TRACKING
C                                   BUT OLD BEAM PIPE GEOMETRY AND
C                                 BEAM PIPE COUNTERS (BEFORE MAI 84)
C          LFLAG(6) = 3 DIM TOKYO SHOWER PROGRAM
```

b) Electrons (e.g. from γ conversion in beampipe) do not get standard lead glass tracking (i.e. in subr. TRLGL), but are passed into the TOKYO shower program, by MCJADE calling the interface routine LGMC56

STHEAD:

Word 17 in 'HEAD' is set = 2, for LFLAG(6)=.TRUE.
(set to = 1 for M-M Lg tracking)

Word 14 in 'HEAD' set to Version nr. of LGMC56

WRTMCB:

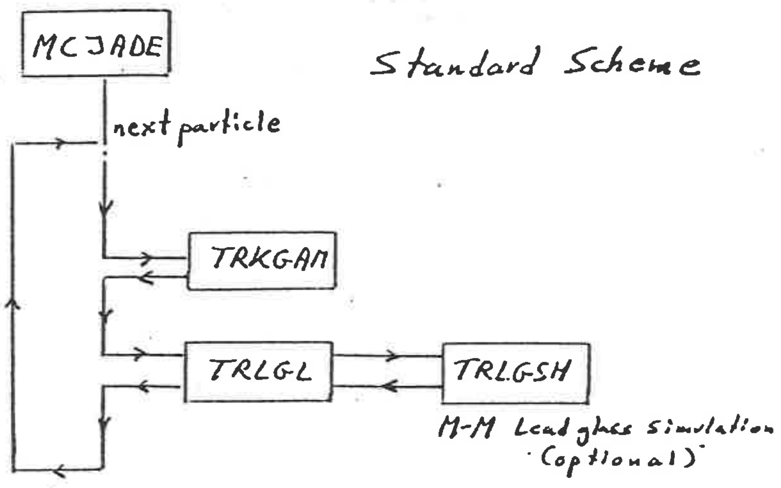
Writes a short bank 'SF56' containing some information on conversion of photons in material before leadglass. Useful in resolution studies.

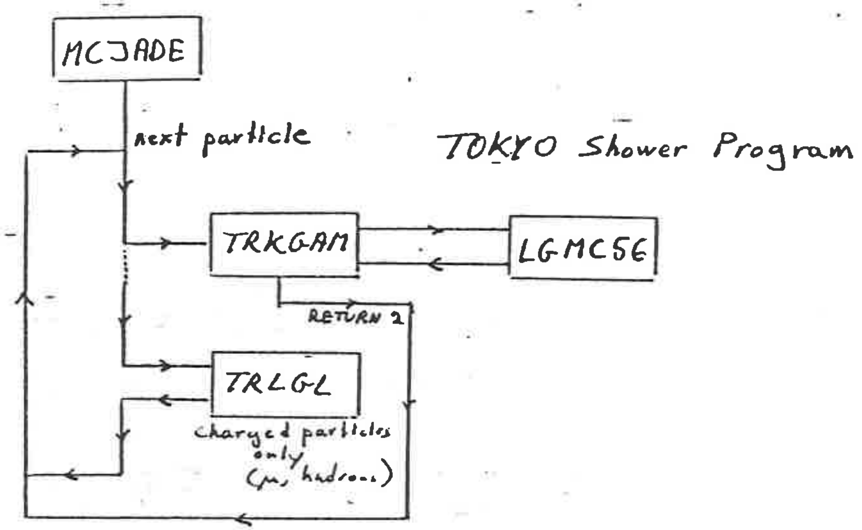
TRKGAM, TRKGMV:

Tracking of photon from interaction point to outer pressure vessel wall of Inner Detector, identical to standard TRKGAM/TRKGMV

Difference: The normal RETURN to MCJADE and subsequent call to TRLGL is replaced by call in TRKGAM to LGMC56 and a RETURN 2 (finish this particle).

γ tracking, simplified





Bedienungsanleitung

* Link with F11OLS.JADE56.L

in front of

F22RJB.RLMC.L (optional)

F22ELS.JMC.L

* Main program should contain

LFLAG(6) =.TRUE.

other LFLAG's are set correctly by program, if not correct already

(LFLAG(1)=LFLAG(2)=LFLAG(3)=.TRUE.)

* JADE Computer Note in preparation.

If you want to use the program before this note appears, please speak to J.Olsson concerning possible temporary INCLUDE's.

Performance

Speed: For low E_γ (≤ 500 MeV) somewhat faster than standard M-M Lg simulation.

For high E_γ much slower, rising $\sim$ linearly with $\gamma/e^\pm$ energy.

Simulation: So far almost exclusive usage in $\gamma\gamma$ physics.

Direct comparison with data and other MC simulations somewhat unclear, due to ongoing development of γ reconstruction routines, systematic effects in calibration and lack of pure, high statistics sources of low E_γ.

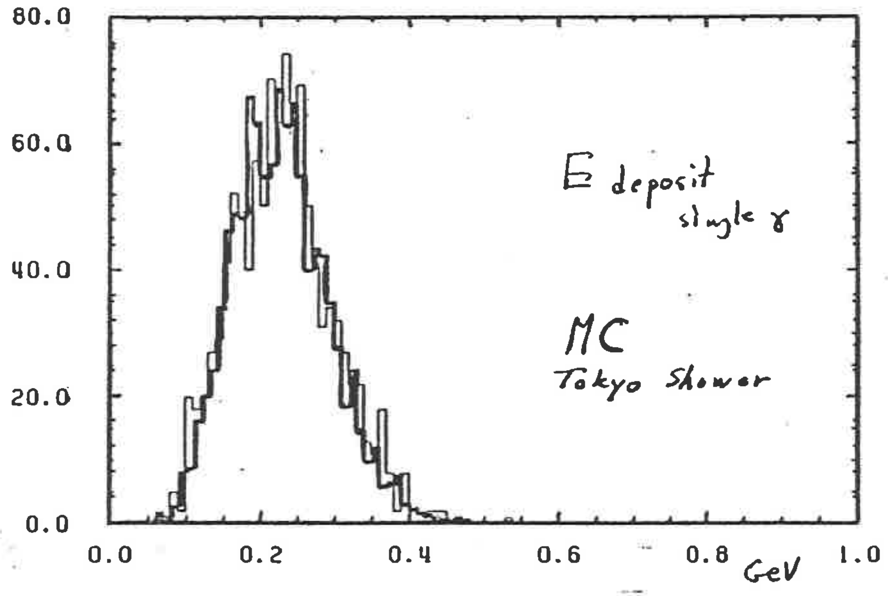
But: $\eta' \to \eta\pi^+\pi^-$, $\eta \to \gamma\gamma$
$f \to 2\pi^0$, $\pi^0 \to \gamma\gamma$

Kuhlen: γ-pair simulation

Low energy γ ~ OK, e.g. block multiplicities.

High energy γ: Too low block multiplicity, i.e. too narrow showers

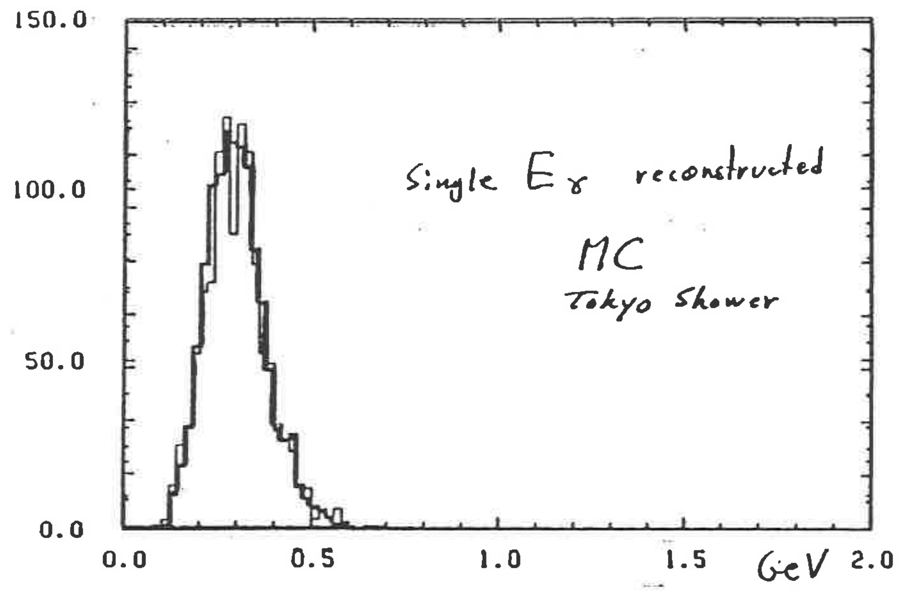
Yamada: At higher energies, photo- and electroproduction may be important, giving hadronic contributions to shower. This is not simulated.

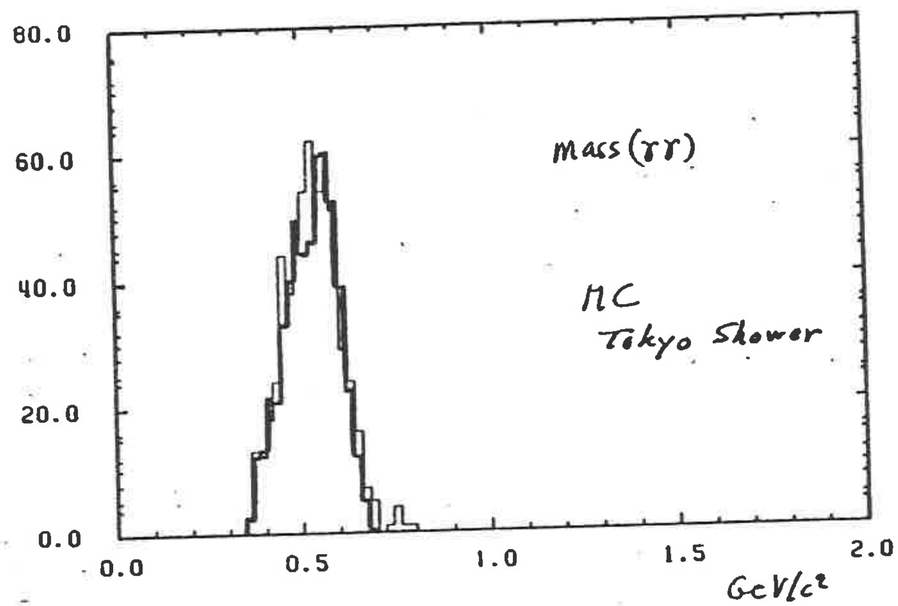


$e^+e^- \to e^+e^- \eta'$
$\hookrightarrow \eta\pi^+\pi^-$
$\hookrightarrow \gamma\gamma$

$E_{deposit}$: Calibrated pulse heights in Leadglass but no corrections for γ reconstruction

Here: Calibration systematics corrected.





E_γ : Cluster energy, corrected for energy loss, readout threshold, directional dependence etc.

(Pitzl, status 7/87)

Chamber Resolutions in Monte Carlo

With the improved understanding of both Jet- and vertex chamber an update of the Monte Carlo smearing procedure is neccessary.

The tail of $r\varphi$ resolution (asymmetric for DL8 data) may now be simulated both chambers using double gaussians.

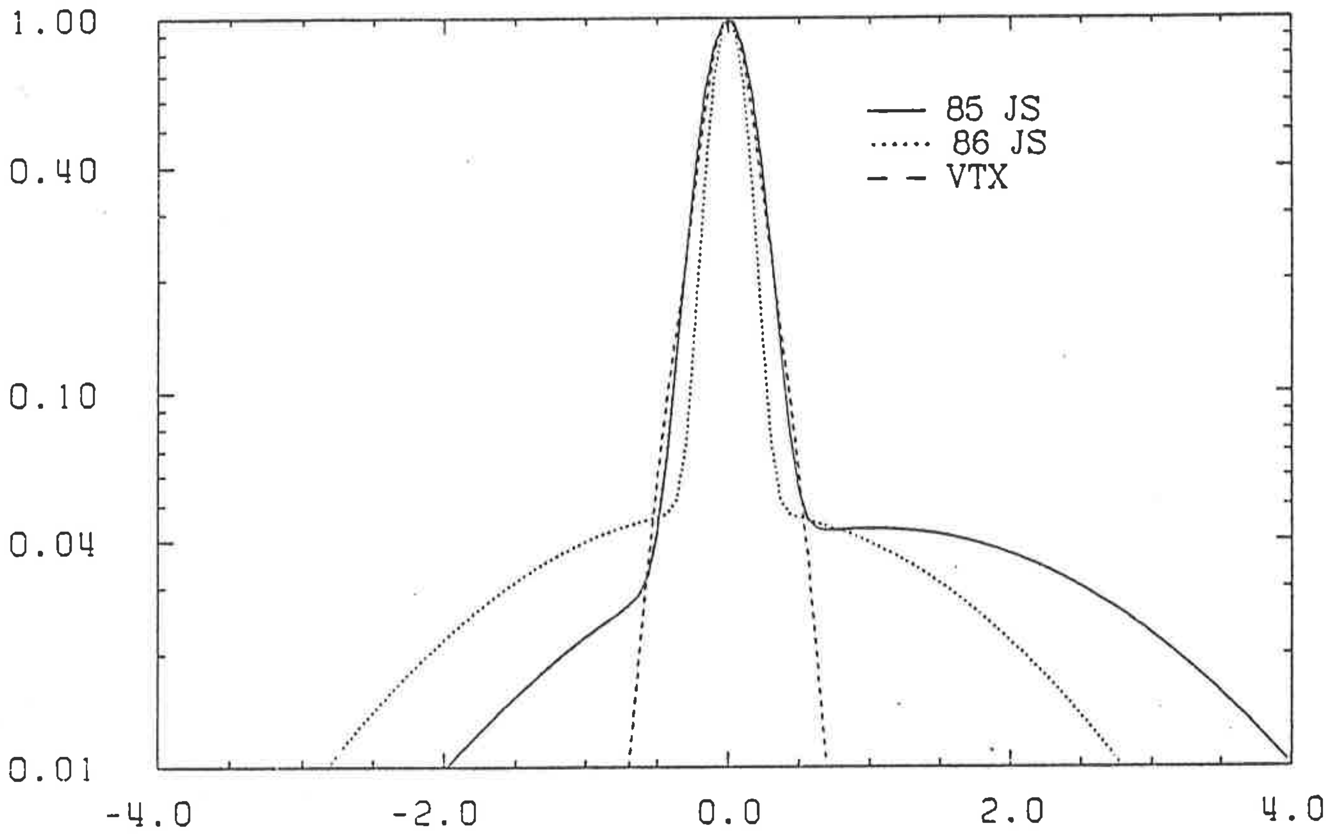
Other properties differ for DL8 and DL300 data:

	DL8	DL300
$r\varphi$ resolution	170 μm	112 μm
$r\varphi$ 2 track	7.5 mm	2 mm
z resolution	20 mm	40 mm

Routines are now available to simulate these properties correctly.

9/12/87   17.28.39   DSN=F22ELS.GP.RES

ST:	85	0	0	1
	86	0	100	2
	87	0	100	3



The new parameters are stored at the end of bank 'MTCO' which has been extended to 156 words.

Suggest to install in standard libraries after this meeting.

There will be drastic effects in some analyses!

E.E.

dE/dx Monte Carlo

New dE/dx Monte Carlo generator (see JADE Computer Note 97). K.Ambrus' hit research and full simulation of the hit composition of a track:

- Simulated energy loss spectrum matched to JADE data.
- Additional systematic error for agreement with exptl. resolution.(39 periods are distinguished)
- Expected mean truncated energy loss derived from JADE data.

Thesis K. Ambrus

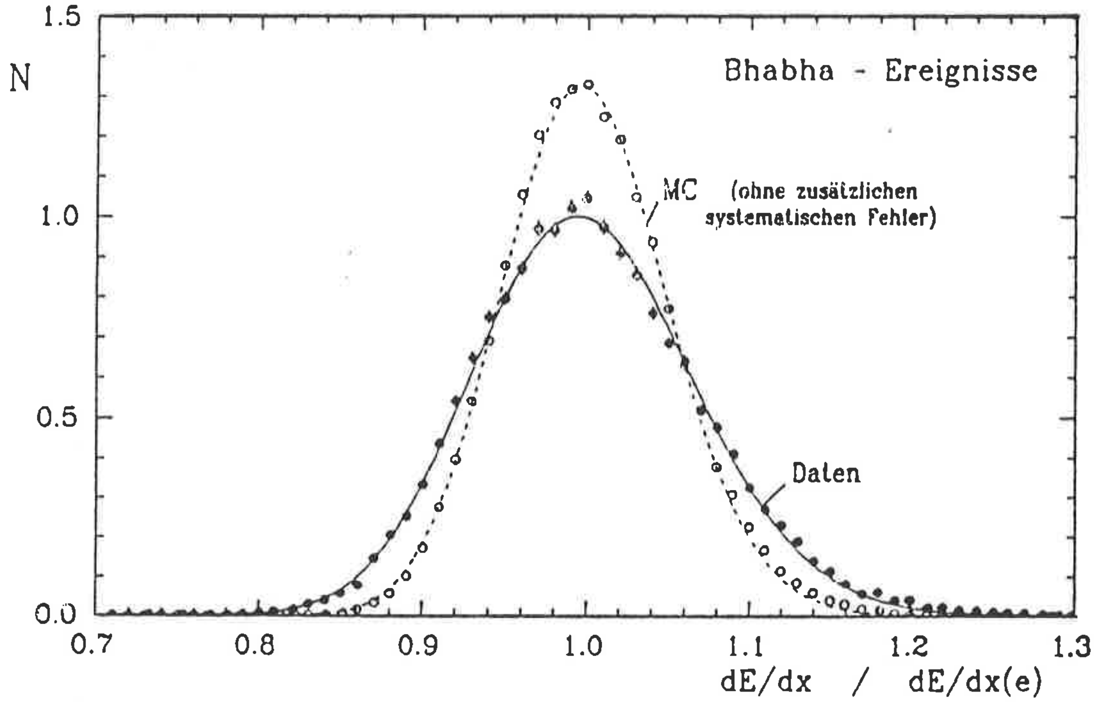


Abb. 3.10:
Die gemessenen truncated mean - Verteilung ist breiter als das mit derselben Landau-Verteilung rein statistisch erzeugten dE/dx-Spektrum. Dies deutet auf zusätzliche systematische Effekte bei der Energieverlustbestimmung hin.

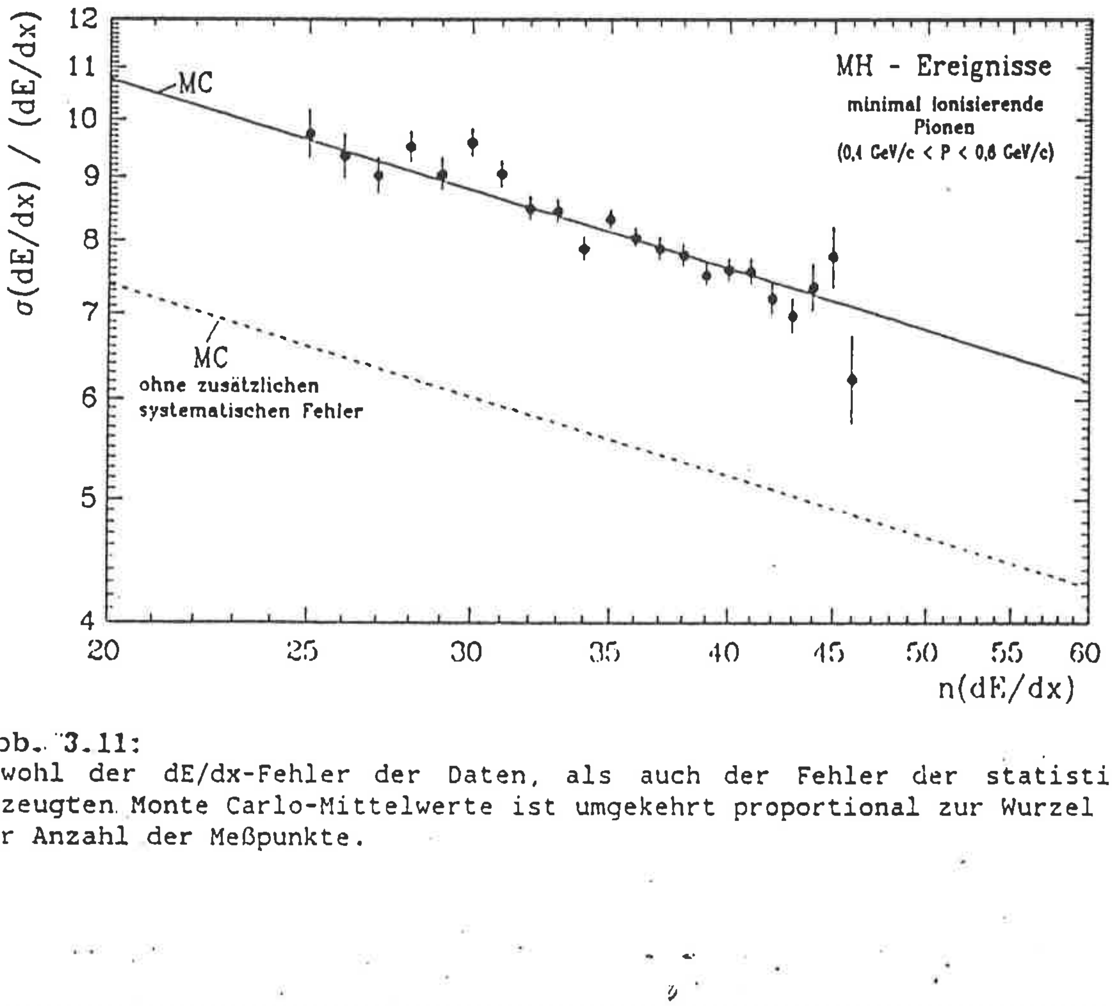


Abb. 3.11:
Sowohl der dE/dx-Fehler der Daten, als auch der Fehler der statistisch erzeugten Monte Carlo-Mittelwerte ist umgekehrt proportional zur Wurzel aus der Anzahl der Meßpunkte.

- Detailed hit simulation even for 'mixed tracks', i.e. tracks composed of hits from more than one particle.

- Hit Cleaning as in real data.

- Analyis of energy loss with routines used for real data.

Main difference to other existing generators is the simulation of the hit selection using the same analysis programs as for the real data (Modification of ZSFIT, which did not work for Monte Carlo at all.)

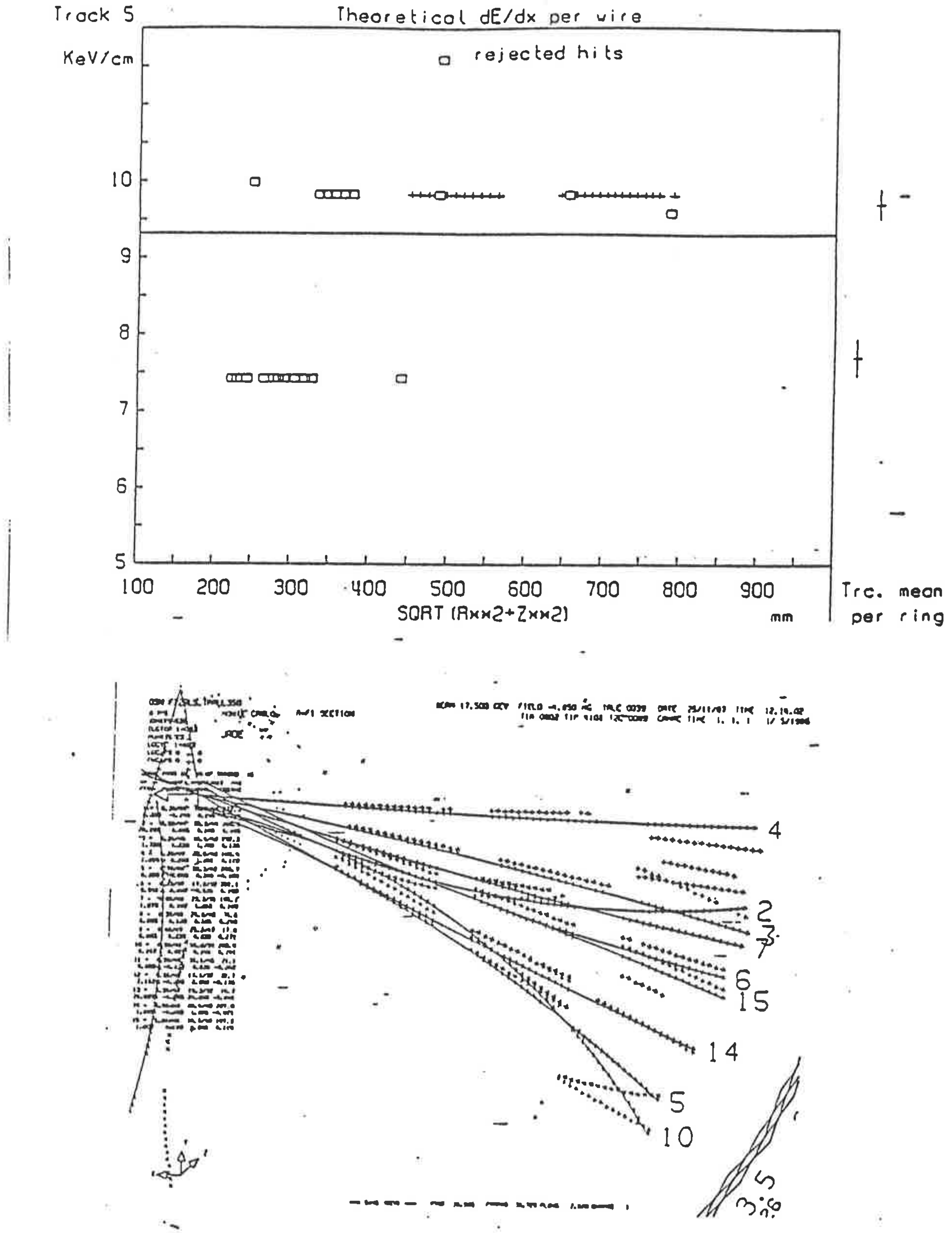


Figure 2: Theoretical mean dE/dx values for the hits associated with a single track (5). The boxes indicate the hits that have been rejected by the 'hit cleaning' procedure. The hit cleaning is based mainly on the proximity of adjacent tracks. The hits of the track have been created by different particles explaining the scattering of the theoretical values. The solid line indicates the value of the truncated mean after full simulation including the extra contribution $\sigma_{r,y,}$.

Usage

DEDXBN simulates the energy loss and performs the analysis as for real data. May be called in SUPERVISOR environment. Systematic error chosen according to selected simulation date in bank HEAD.

DEDXAN calls DEDXBN and fills dE/dx into TP banks.

Inclusion of VTXC- Software

Overview of Main Parts of VTXC- Software

1. Online Pulsefinding

The results of the online pulsefinding algorithm are stored in the "raw data bank" **'BPCH'**. All FADC values belonging to a pulse are kept. Therefore it is possible to calculate the timing offline

2. Reform Job

Only data checking is performed.

3. Creating VTXC-Bank

This JETC-like bank contains the timing information which is used in the combined fit. There are two methods whereby the VTXC-banks are created:

1. Using the online pulsefinding algorithm. A one dimensional timing correction (SK1) depending on the ratio ofthe heights of the first two bins in the pulse $< A_2 > / < A_1 >$ is performed. The results are stored in **'VTXC' 10**.
2. In order to get a better double pulse resolution an offline pulsefinding algorithm is used (ADN-SK2). That means: Add signals from left and right side of wires. Calculate the Differences of all pairs of adjacent bins in the sum signal and look for New pulses. A two dimensional timing correction (SK2) depending on the contents of the two first bins is then performed. The results are stored in **'VTXC' 9**. The VTXC 9 bank is *not* JETC compatible anymore. The amplitude of the pulse is replaced by the contents of the first two added bins. This information is needed

by the timing correction routines.
'VTXC' 9 format:
HDATA(i+1) = # of wire
HDATA(i+2) = added left and right 1st bins minus pedestal
HDATA(i+2) = added left and right 2nd bins minus pedestal
HDATA(i+4) = "raw" timing from added bins

4. VTXC-Pattern recognition

There exists a two-step pattern recognition for VTXC data:

1. ID tracks are extrapolated into the VTXC in order to find clear tracks in the VTXC. This procedure allocates about 75 % of possible links. The results are stored in a special VTXC pattern bank: **'VPAT' 19 or 20** (the number depends on the used VTXC generation 9 or 10)
2. The remaining VTXC hits are transformed into a parameter-space (ρ, θ) according to the following formula:

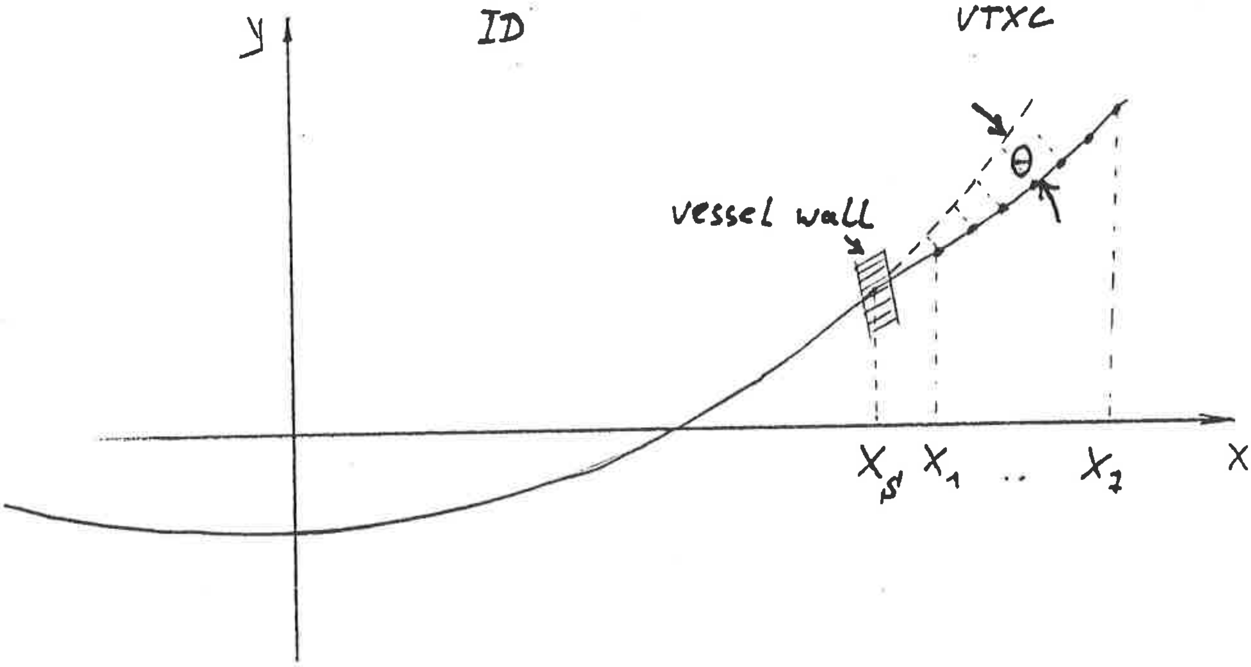
$$\rho = x \cdot \cos\theta + y \cdot \sin\theta$$

In that space, tracks ($\approx$ straight lines) are represented by clusters. Found clusters (tracks) are stored in a hit label bank: **'VTHT' 9 or 10**. These tracks are linked with ID tracks. All succesfully linked tracks - including those from 'VPAT' 19 or 20 - are collected in **'VPAT' 9 or 10**

5. Combined VTXC- and ID Fit: "COMFIT"

This fit includes multiple scattering in the inner vessel wall. The input of the combined fit is the work common filled by *P.Steffen's REFIT without vertex contraint.* In a system, in which the X-axis is determined by the first and last measured hit, the situation is shown in the

following picture:



The deviation due to the multiple scattering can be approximated by the following equation:

$$\delta_i = (x_i - x_s) \cdot \tan\Theta \qquad i = 1..7$$

As θ is small: $\tan\Theta \approx \Theta$. A track is represented by two parabolae:

$$F_{ID} = cx^2 + bx + a$$

$$F_{VT} = cx^2 + bx + a + (x - x_s)\Theta$$

That leads to the following χ^2 ansatz:

$$\chi^2 = \sum_{i=1}^{N1} \frac{(Y(x_i) - F_{ID}(x_i))^2}{\sigma_{ID}^2} + \sum_{i=1}^{N2} \frac{(Y(x_i) - F_{VT}(x_i))^2}{\sigma_{VT}^2} + \frac{\Theta^2}{\sigma_\Theta^2}$$

with:

$$\sigma_\Theta = \frac{0.014}{p}\sqrt{\frac{X}{X_0}} \cdot \left(1 + \frac{1}{9}\log(\frac{X}{X_0})\right) \qquad (p\ in\ GeV/c)$$

The scatterpoint x_s is fixed by the position of the vessel wall. There are four parameters (c, b, a, θ) which must be determined. This leads to system of linear equations whose matrix is four dimensional and symmetric. The inverse matrix (covariance matrix) is used for error propagation.

The approximation of parabolae is not valid for low momentum tracks. For such tracks an iterative circle fit is made. The curvature error due to using parabolae is:

$$\Delta crv = crv^3 \cdot (\frac{L_{Trk}}{2})^2$$

If Δcrv is bigger then a certain fraction of the reconstruction error $\epsilon \cdot err(crv)$ of the curvature then a circle fit is used. In the iteration loop the deviations of the hits from the reconstructed "circle" $(r = 0.5/c)$ are used to correct the parabola $(c, b, a, \Theta) \rightarrow (\bar{c}, \bar{b}, \bar{a}, \bar{\Theta})$. This leads to a new "circle" $(\bar{r} = 0.5/\bar{c})$. The iteration stops if the relative change in the curvature is small compared with the reconstruction error (taken from the covariance matrix). It also stops in the case of no convergence after a fixed number of iterations.

Discription of 'PATR' Bank from combined Fit

Head	1	header lenght	8
I*4	2	# of tracks	
	3	track data length	64
	4	PATERC history word	
	5	# of hits in ID	
	6	# of uncorr. hits	
	7	# of uncorr. linel.	
	8	COMFIT marker	0,1,2
TRACK 1	9		
R*4	..	see JADE-comp. note 12	
	48		
	49	X0 or (d0-r)	
	50	Y0 or phi	
	51	weight from covarianz matrix	
	52	error from cov. matrix x^4	
	53	error from cov. matrix x^3	
	54	error from cov. matrix x^2	
	55	error from cov. matrix x^1	
	56	error from cov. matrix x^0	
	57	error from cov. matrix angular	
	58	σ of VTXC-pre fit	
	59	# of VTXC hits used in COMFIT	
	60	extended VTXC-hitmask	
	61	extended VTXC-hitmask	
	62	COMFIT return code	
	63	bank generation number	9,10
	64	track number in VPAT-bank	
TRACK 2	..	...	

Remarks:

Position	
8:	0: no COMFIT-bank.
	1: COMFIT without VTXC. 2:COMFIT with VTXC
49,50:	save ID coord. systems. Used for extrapolation
:	into lead glass and muon filter
51:	weight: $w = N\sigma^2_{COMFIT}/(N1/\sigma^2_{ID} + N2/\sigma^2_{VT})$
63,64	used for backtracing into VPAT-bank

Status of Inclusion of VTXC- Software

At the moment (Dec. 87) there exsits a fine working "stand alone solution". First efforts have been made, to incorporate the VTXC-software into the JADE standard package. In this new version all internal commons have been overlayed on the standard CWORK common. So no additional common space is requried. The inclusion of all VTXC-calibration files into BUPDATE is under discussion. At the moment one can use our stand alone solution to run all VTXC software. In the near future, there will be a version which performs the whole VTXC analysis by a simple subroutine call.

Short discription of VTXC stand alone solution

All programs can be found on: **F22KLE.JVTXC.S**. The main program is **VTXMAIN**. Following steps are done:

- Load externals BDVTXC,JADEBD,T9CORR
- Set up constants for VTXC-analysis
- Load runvertices: CALL VTXCRJ
- Start event iteration loop
  - Fill event info common: CKOPP
  - Select calibration for current period: CALL VTXCAL
  - Build VTXC bank: CALL VTXCBK
  - Set up Spitzer's ID calibration
  - Run first part of VTXC pattern recognation: CALL YPREFT
  - Run second part of VTXC pattern recognation: CALL XFILT
  - Link VTXC and ID tracks together: CALL XTRLNK
  - Perform combined fit: CALL EVFITV. In EVFITV P.Steffen's REFIT will be called in order fill common CWORK.
- Print final statistics

The JCL-member is @VTXMAIN:

```
//FLTCFT JOB CLASS=A,NOTIFY=F22XXX,MSGLEVEL=(0,0),TIME=(1,00)
//*MAIN RELPRI=MED
%MACRO 'F22KLE.JVTXC.S(MORTGEP)'
// EXEC MORTGEP,MPGM=MORT3,CPGM=HXE,
//      GOREGN=2500K,DN=NULLFILE
%MACRO VTXMAIN
//LKED.SYSLIB DD
//            DD
//            DD
//            DD
//            DD
//            DD DISP=SHR,DSN=F22KLE.JVTXC.L
//            DD DISP=SHR,DSN=F11LHO.JADEGL
//            DD DISP=SHR,DSN=F11GOD.PATRECLD
//            DD DISP=SHR,DSN=JADELG.LOAD
//            DD DSN=R02SCH.TSOIPS.LOAD,DISP=SHR
//            DD DISP=SHR,DSN=F22ALL.JADEMUL
//            DD DISP=SHR,DSN=R01UTL.HBOOK321.L
//            DD DISP=SHR,DSN=R01UTL.CERN.KERNLIB4
//            DD DISP=SHR,DSN=F1EBLO.BOSLIB.L
//            DD DISP=SHR,DSN=SYS1.FT77LIB
//*--------------------------------------------------------------------
//*                    I N P U T
//*--------------------------------------------------------------------
//*                                                             FROM
MSS, DISK
//GO.FT02F001  DD DISP=SHR,DSN=F22XXX.INPUT.DISK
//*                                                             FROM
TAPE
//*O.FT02F001 DD UNIT=TAPE,DISP=SHR,
//*   DSN=F22XXX.INPUT.TAPE1
```

```
//*DD UNIT=AFF=FT02F001,DISP=SHR,
//*   DSN=F22XXX.INPUT.TAPE2
//*
//*
//*-------------------------------------------------------------
//*                    O U T P U T
//*-------------------------------------------------------------
//*O.FT03F001 DD DUMMY,DCB=R01DCB.VBS
//*
//*O.FT03F001 DD DSN=F22XXX.OUTPUT.MSS,
//*              DISP=SHR,DCB=R01DCB.VBS
//*
//*O.FT03F001 DD UNIT=FAST,DISP=(NEW,CATLG,CATLG),
//*        DCB=R01DCB.VBS,SPACE=(TRK,(240,60),RLSE),
//*        DSN=F22XXX.OUTPUT.DISK
//*
//*
//GO.FT03F001 DD UNIT=TAPE,DISP=(NEW,CATLG,CATLG),VOL=(,RETAIN),
//    DCB=(RECFM=VBS,LRECL=6236,BLKSIZE=24948),
//    DSN=F22XXX.OUTPUT.TAPE
//*---------------------------------------------------------------
//*               C  A  L  I  B  R  A  T  I  O  N
//*---------------------------------------------------------------
//GO.FT21F001 DD DISP=SHR,DSN=F11LHO.BUPDAT0
//GO.FT22F001 DD DISP=SHR,DSN=F11LHO.BUPDAT1
//*                                        FADC-Calibration
//GO.FT11F001 DD DSN=F22KLE.VCALB.S(CALB03),DISP=SHR,UNIT=FAST
//*                                        VTXC-Calibration
//GO.FT12F001 DD DSN=F22KLE.JVTXC.DATA(CALIBALL),DISP=SHR,UNIT=FAST
//*                                        RUNVERTEX
//GO.FT13F001 DD DSN=F22KLE.JVTXC.DATA(RUNVERTV),DISP=SHR,UNIT=FAST
```

ZEUS Meeting   Dec 14 – 16, 1987 at DESY

Monday Dec 14   Plenary Session   Seminarroom 4

9:00 – 9:30	Satus of HERA	D. Trines
9:30 – 9:45	Aim of the meeting G. Wolf	
9:45 – 10:30	Report from the Technical Coordinator	B. Loehr
10:30– 10:40	On safety	G. Poelz
11:00– 13:00	Test results	
	FCAL prototype	E. Ros
	VXD – IDC	A. Walenta
	VXD – TEC	C. Del Papa
14:00– 15:00	Report from electronics/DAQ meeting	K. Gather / L. Wiggers
15:00– 15:20	Report from the meeting of the Reconstruction Group	H. Kowalski
15:20– 15:35	Report from HEDA	E. Lohrmann
16:00–18:30	Parallel Sessions : CAL tracking DAQ SOS MUON	
18:40–19:15	Executive Meeting 1. Financing of FCAL, BCAL, RCAL 2. Finances of experiment 3. Financing of DAQ and of SASD tools 4. Deputy coordinator for DAQ 5. ZEUS members for HEDA 6. schedule 7. custom formalities 8. next ZEUS meetings	
19:30	Dinner in DESY Cafeteria	

Tuesday, Dec 15

9:00 – 11:00	Parallel Sessions	
9:30 – 10:30	Magnetic field measurements chaired by D. Saxon	
11:00– 15:00	Plenary Meeting Seminarroom 4 Status reports on	
11:00– 11:10	Solenoid, compensator	
11:10– 11:20	Iron yoke	
11:20– 11:30	yoke coils	
11:30– 11.50	FCAL prototype, design, construction	D. Hasell
11:50– 12:10	BCAL prototype, design, construction	D.Reeder
12:10– 12:30	Hadron-Electron separator	
12:30– 12:50	BAC	
12:50– 13:05	CTD	
	– – – – B R E A K – – – –	
14:00– 14:15	FDT,RTD,TRD	
14:15– 14:25	FMUON	
14:25– 14:35	BMUON	
14:35– 14:45	LPS	
14:45– 14:55	LUMI	
15:00– infinitum	Parallel Sessions	
17:00	W. Smith Dimuons DESY – seminar	

Wednesday Dec 16

9:00 – 12:00	Parallel Sessions	
9:00 – 10:00	Installation of tracking detectors chaired by D. Saxon	
10:30– 12:00	Spokeswheels chaired by B. Loehr	
12:00– 13:00	Executive meeting with P. Soeding and V. Soergel	
14:00–	Plenary Session Seminarroom 4	
14:00– 16:00	Data acquisition , software, Monte Carlo Trigger and DAQ for LUMI	A. Dwurazny
16:00– 16:30	Summary of the meeting	G. Wolf
17:00	A. Wroblewski Fits and Misfits DESY – seminar	

The modified vertex package

on F22KLE.VERTEX.S/L

Main modifications:

1. **Implementation of the Vertex chamber hardware**

   The multiple scattering is calculated in the (new or old) beampipe and the inner vessel wall.

   (VTXEE,VTXPRE,VTXPNT)

2. **Implementation of the common fit with Vertex- and Jetchamber ('COMFIT')**

   For proper calculation of the extrapolation errors in $R\varphi$ the full covariance matrix is used. The covariances are taken from COMFIT or from Gluckstern's formula. To store these covariances the T-array contains now 40 instead of 30 words for each track.

   Problems:
   COMFIT performs no ZS-fit, but copies the results of the ZS-fit from the input 'PATR'-bank. If this bank has more than 48 words per track, these words will be overwritten and any covariances lost. There is no guarantee that the (Gluckstern-) covariances used for ZS are correct. In addition one now has different multiple scattering, first measured points and track lengths for the $R\varphi$- and ZS-fits.

   All the Gluckstern covariances are calculated *without* any vertex constraint taken into account.

   (VTXPRE,VTXPNT)

3. **New vertex fitting procedure based on the Davidon variance algorithm**

   In contrast to the old procedure VERTEX this new procedure VTXDAV gives correct covariance matrices for the vertices, but wasn't designed to *find* vertices. To store these covariances in the V-array each vertex occupies now 13 instead of 10 words.

   Vertex-fits are now possible with up to 20 instead of 7 tracks. Several special- and debug-features are steered by the bits in the word MODE. It's possible to fit the vertex only in $R\varphi$ or in three dimensions.

   (VTXDAV,VERTEX)

Minor modifications:

1. All calculations of errors and of points on tracks are done in VTXPNT. For all circle calculations double precision is used.

2. To allow further changes the number of words for each track in the T-array (ITDLEN) and for each vertex in the V-array (IVDLEN) are kept in variables. They are initiated by VTXINI.

3. All common definitions are available in three macros:

Macro	Common	Contents
MVERTEX0	CVTXC	parameters set by VTXINI
MVERTEX1	CWORK1	T- and V-array
MVERTEX2	CVTX2	MODE and debug-information

4. A short description of the T- and V-arrays is available in VTXDEF.

5. For type 2 tracks in the PATR-bank a correction of the curvature and a recalculation of the first measured point is done by VTXPRE during the construction of the circles describing the tracks in the T-array.

   Two fudge-factors (SIGFAC,SFMUSC) are now used to adjust the extrapolation error in $R\varphi$. The new one scales the momentum dependence of the extraploation error.

   (defaults: 1.0)

6. To save the vertex fit results with all the covariances a new routine VTXBNC produces a bank named 'CVTX'.

7. In the calculation of the multiple scattering it is possible to set $\beta < 1$ by using one mass (DFMASS) for all charged particles.

   (default: 0.0)

8. The procedure VTXPNT has an extra parameter (DPHIT) returning the error of φ (without multiple scattering, used by VTXEE). A new entry (VTXIMP) allows the calculation of impact parameters.

Description of T-array (JT = track number · 40 − 40)

IT(JT+1)	=	flag	0 = track is incomplete or bad. not used 1 = track is good, but do not use in vertex fit 2 = tracl is good, use in vertex fit 3 = track was used in vertex fit (set by fit procedure)
T(JT+2)	=	$\pm R$	radius (+ means anticlockwise looking to -Z)
3	=	φ	azimuth at point (x_t, y_t, z_t), φ_0 at first measured point
4	=	θ	polar angle to xy-plane (0 = vertical to beam)
5	=	x_t	
6	=	y_t	point on track
7	=	z_t	
8	=	$\Delta\varphi$	error of φ
9	=	$\Delta\theta$	error of θ
10	=	Δx	error of x_t
11	=	Δy	error of y_t
12	=	Δz	error of z_t
IT(JT+13)	=	N_{point}	number of points on track
IT(JT+14)	=	N_V	number of vertex to which track belongs
15	=	S	extrapolated arc length (= 0 at first measured point)
16	=	$\Delta\phi_{MS}$	multiple scattering angular error (inner vessel wall)
17	=	$\Delta\phi_{MS}$	multiple scattering angular error (beampipe)
18	=	S	extrapolated arc length to inner vessel wall (near)
19	=	S	extrapolated arc length to beampipe (near)
20	=	L	projected track length in $R\varphi$
21	=	$\sin\varphi_0$	
22	=	$\cos\varphi_0$	
23	=	$\sin\theta$	
24	=	$\cos\theta$	
25	=	S	extrapolated arc length to origin (VTXDAV only)
26	=	S	extrapolated arc length to inner vessel wall (far)
27	=	S	extrapolated arc length to inner vessel wall (near)
28	=	SDX	number of standard deviations in x
29	=	SDY	number of standard deviations in y (used by VTXSRC)
30	=	SDZ	number of standard deviations in z
IT(JT+31)	=	flag	1 for COMFITted tracks, 0 else
32	=	cov_4	$R\varphi$ covariance (180 σ^2/N_{point} / L^4 (from Gluckstern))
33	=	cov_3	$R\varphi$ covariance (0.0)
34	=	cov_2	$R\varphi$ covariance ($-18\,\sigma^2/N_{point}$ / L^2)
35	=	cov_1	$R\varphi$ covariance (0.0)
36	=	cov_0	$R\varphi$ covariance (9/4 σ^2/N_{point})
37	=		σ^2/N_{point} in ZS
38	=	L_{ZS}	projected track length in ZS
39	=	ΔS	difference in arc length between $R\varphi$ and ZS
40	=		$R\varphi$ covariance for angular error (0.0)

Square of extrapolation error in $R\varphi$ without multiple scattering:

$$\delta^2_{xy} = \sum_{i=1}^{4} \mathrm{cov}_i \cdot X^i, \; X = S - {}^1/_2\, L$$

The words 1–15 are stored by VTXBNK or VTXBNC in the GVTX or CVTX-bank. To get the values for the point nearest to the vertex. VTXAFT has to be called first.

Description of V-array (JV = vertex number · 13 − 13)

IV(JV+1)	=	flag	0 = no vertex fit 1 = bad vertex fit 2 = vertex of one- or collinear two-prong 3 = good vertex 4 = e^+e^--pair vertex 5 = isolated single track vertex
V(JV+2)	=	x_V	
3	=	y_V	vertex coordinates
4	=	z_V	
5	=	Δx	error of x_V
6	=	Δy	error of y_V
7	=	Δz	error of z_V
IV(JV+8)	=	N_{fit}	number of tracks used in vertex fit
9	=	χ^2	χ^2 of vertex fit
IV(JV+10)	=	N_{all}	number of tracks belonging to vertex
11	=	cov_{XY}	XY-covariance
10	=	cov_{XZ}	XZ-covariance
13	=	cov_{YZ}	YZ-covariance

Special features steered by MODE

Bit 31 on : startpoint for vertex fit is the origin (VERTEX only)
Bit 30 on : vertex fit with runvertex constraint (VERTEX only)
Bit 29 on : vertex fit with constraint to a given axis (VERTEX only)
Bit 28 on : vertex fit only in $R\varphi$ (VERTEX,VTXDAV)
Bit 27 on : print some local statistics (VERTEX only)
Bit 26 on : overwrite PATR-bank with circle-parameters for type 2 tracks (VTXPRE)
Bit 25 on : message from VTXEE if failed (reason for failure)
Bit 24 on : use penalty function to constrain the vertex (VTXDAV only)

Usage of the fillwise runvertex determined with the vertex chamber

The subroutines needed are located on F22KLE.JVTXC.S/L. The runvertices are read from a sequential dataset. For this a FORTRAN unit 'nn' must be supplied:

```
//* In your JCL member :
//GO.FTnnF001 DD DSN=F22KLE.JVTXC.DATA(RUNVERTV),DISP=SHR,UNIT=FAST

C In your FORTRAN member :
C before the event loop, to initialize
      CALL VTXCRJ(nn)

C for each event, run or fill
      CALL VTXCRW( NRUN, RVX, RVY, RVDX2, RVDY2 )
```

The input to VTXCRW is the run number NRUN. RVX and RVY are the coordinates of the runvertex. RVDX2 and RVDY2 are the squares of the beam sizes.

G Eckerlin 14/12/87

TPed MH-Events at DESY

1) ALL MH-Datasets reanalysed with TP-Program from 12/86 are available under:

F11ECK.URZ.xxx

with xxx = TPM... for 1979-1984 Data

and xxx = G_____G____ for 1985 and 1986

- PATR/8 is created with Steffens r-φ and z-s Fits
- TP-Banks are taken from PATR/8
- Details see JCN83

List of Datasets see:

JADEPR.TEXT($MHTPLOG)

GE 14/12/87

2) 1986 Data were reanalysed with TP-version from 7/87 using J. Spitzers r-φ and z-s-Fit to create PATR/8 (replacing Steffens Fits) see JCN 94 & JCN 95 for details.

Name of datasets:

F11ECK.URZ.TP787.xxx

xxx = (see 1))

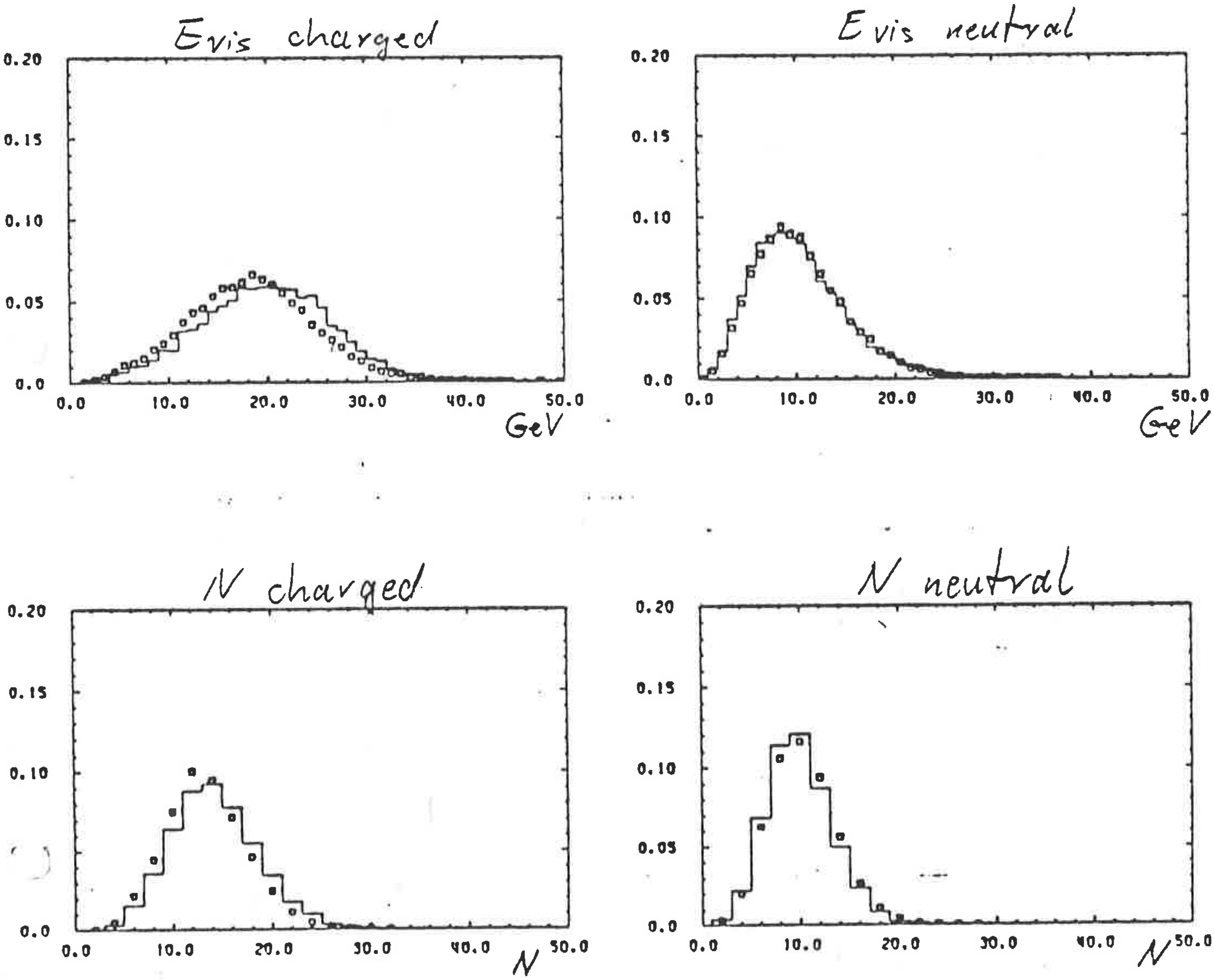
3) 1984 & 1985 MH-Events were TPed with a Version from 9/87 using z-chamber hits in addition in the z-s Fit (see JCN 95/1)

Datasetname: F11ECK.URZ.TP787.xxx

4) 1986 MH-Datasets with PATR/7 created with the Vertexchamber Software are stored in F22HAG.TAPE.URZNEU.xxx

GE 14/12/87

Compare of : — MH '86
and ○ MH '82



↳ 1986 data has ~2 charged tracks more

GE 14/12157

MC-Events at DESY

1) LUND 5.2 and WEBBER-MC with different parameter settings done in Heidelberg are stored under
F11BET.MHTPxx....   xx = CM-Energy
Details see F11BET.MCINFO(FILEINFO)
Generator source lib : F11BET.LUND.S

2) LUND 5.2 created at RAL are available under F22CHR.MHECMxx.
INFO in F22CHR.INFO(MCMHRAL)

| All events are tracked with the bugs reported in JCN87 |

ALL INFO-Files are now copied to JADEPR.TEXT. Member MCTPOIR gives more information

GE 14/12/...

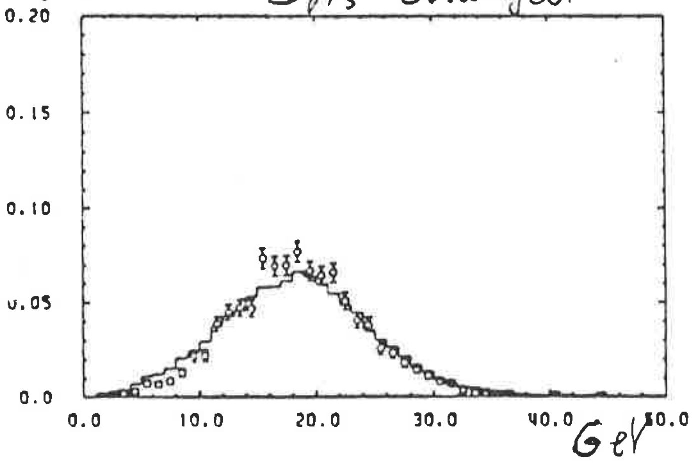
Compare of — MH '82

and ∘ LUND5.2

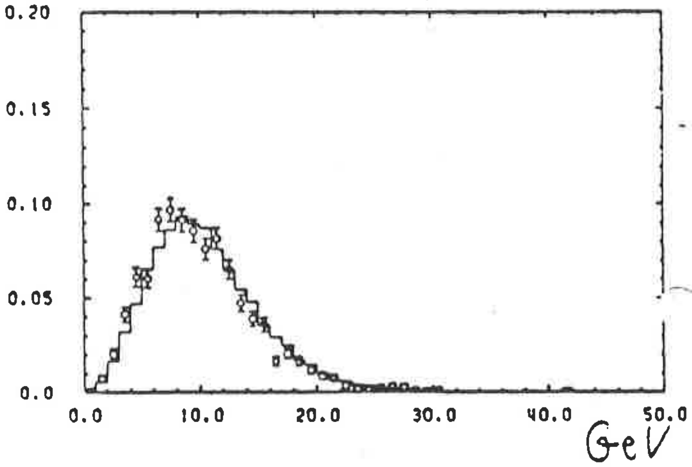
1982 tracking

generated at HD 1984

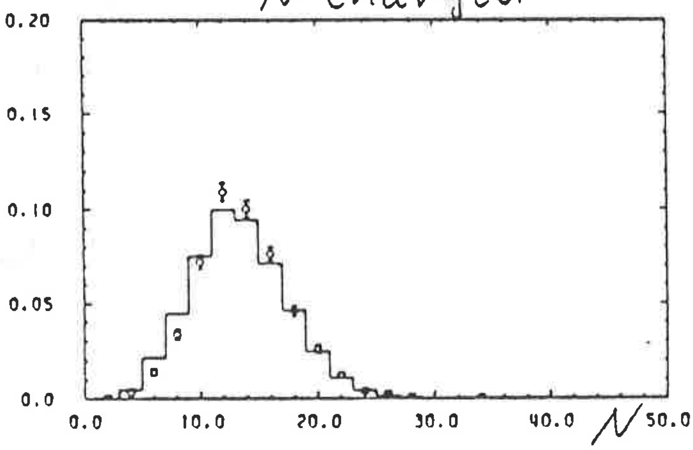
E_{vis} charged



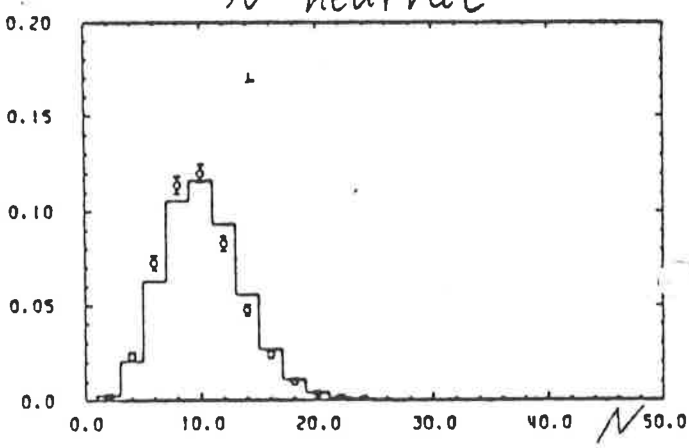
E_{vis} neutral



N charged



N neutral



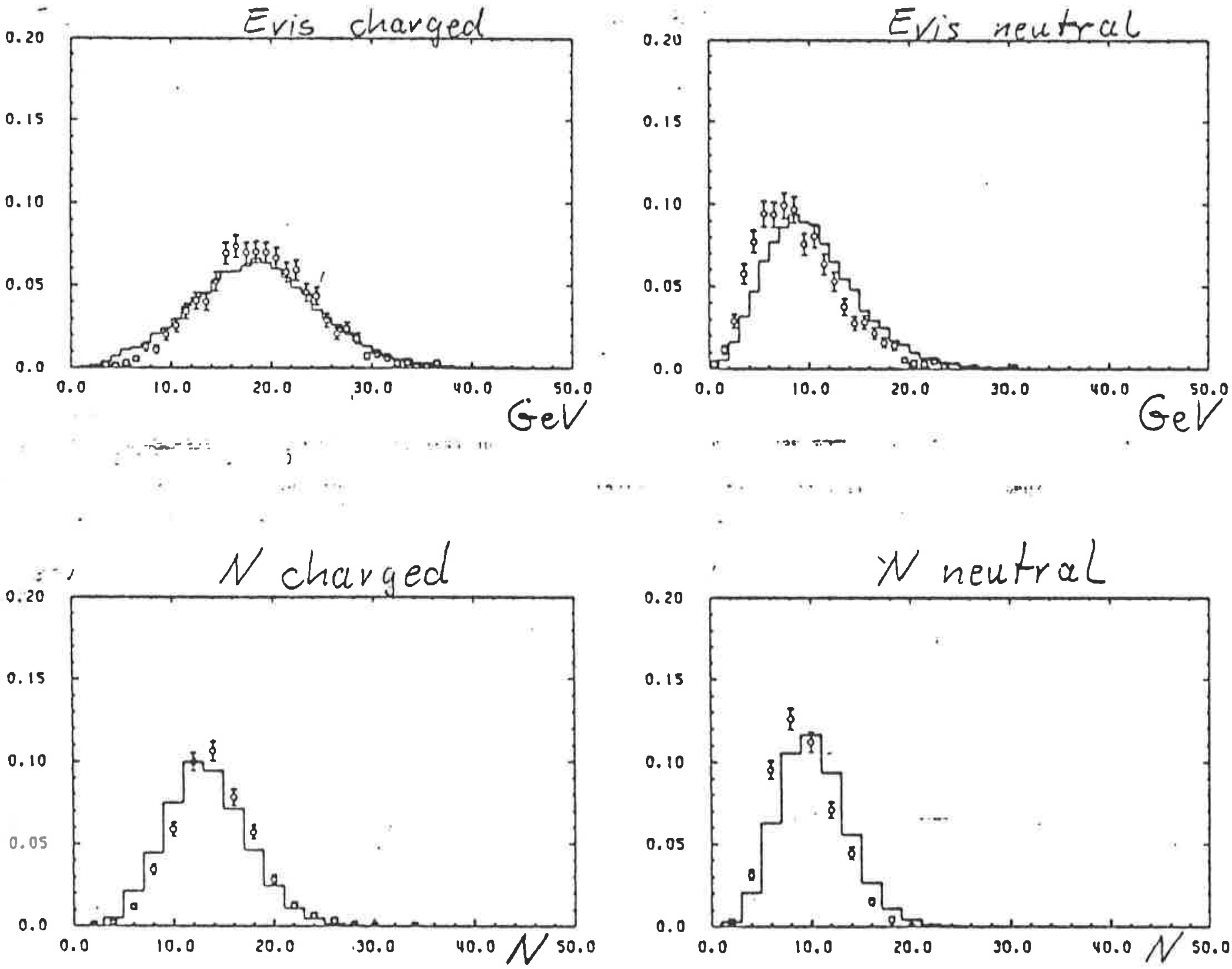
→ LUND 5.2 tracked 1984 (with the bugs reported in JCN 87) describes the data well.

GE

Compare of :   – MH '82

and   o LUND5.2

1982 tracking (Version /57,
generated at Heidelberg



→ LUND5.2, but tracked with the corrected routines

is a little bit worse, especially the

neutral Energy and Multiplicity changes.

3) LUND6.3

Generator source library with the JADE-Interface to the Tracking is

F11ECK.LUND63.S

original library: F11BET.LUND63.S

Tracked and TPed events will be at DESY around Jan 88.

The datasets will be named

F11ECK.URZMC.xxx

The datasetlist will be placed in

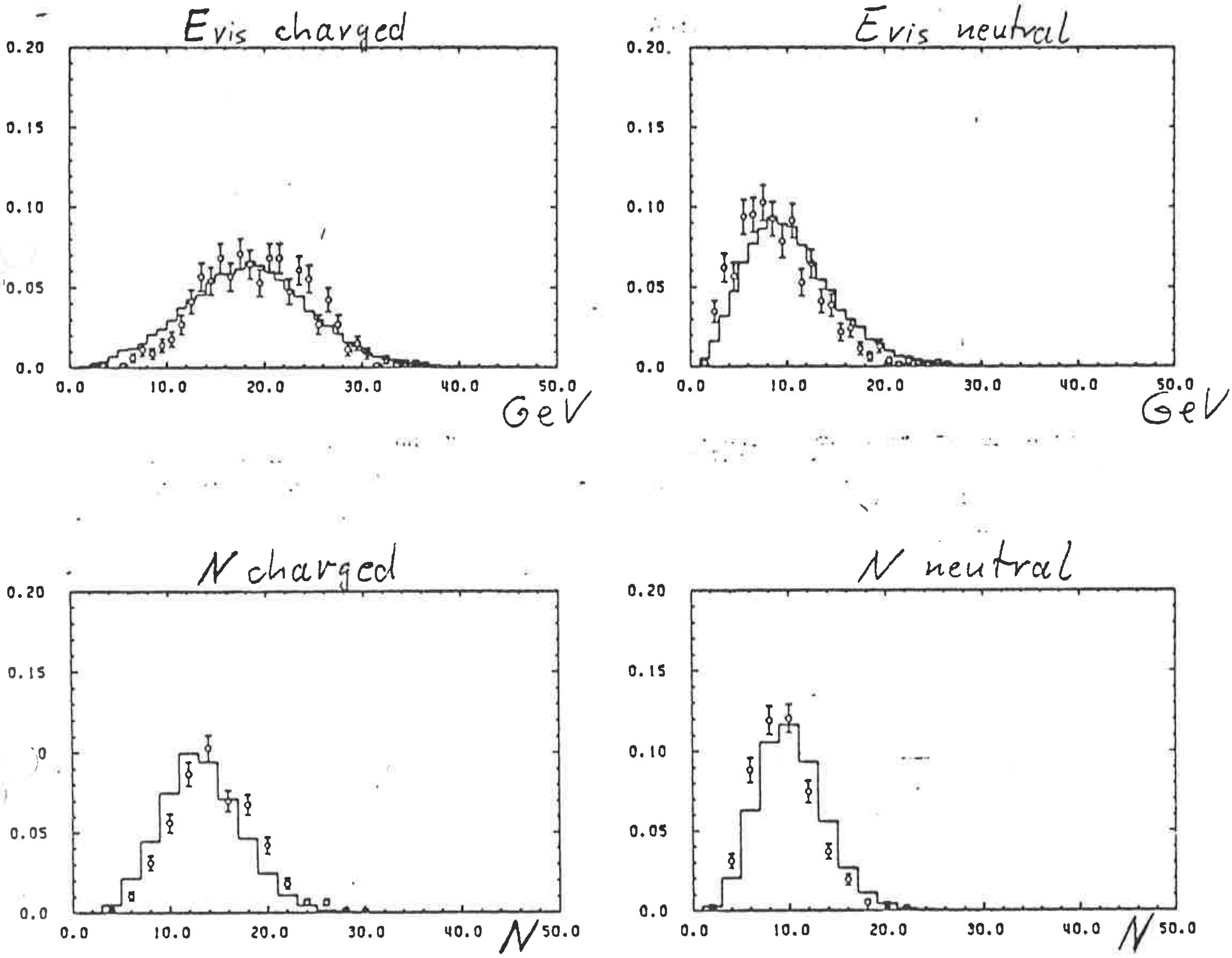
JADEPR.TEXT(MCTPLOG).

The DIRECTORY-file MCTPDIR gives a list of all MC-Infofiles in JADEPR.TEXT.

GE 14/1218

Compare of — MH '82

and o LUND6.3 shower
1982 tracking
generated at RAL



The agreement of the distributions from ~2000 MC-Event generated at RAL with the data gives no evidence for a bug in the Tracking or in the LUND6.3-Generator.

Status LUND6.3

At Heidelberg MC-Events will be generated for:

- 35 GeV 1986 detector ~ 50000 events
- 35 GeV 1982 detector ~ 50000 events
- 44 GeV 1985 detector ~ 25000 events

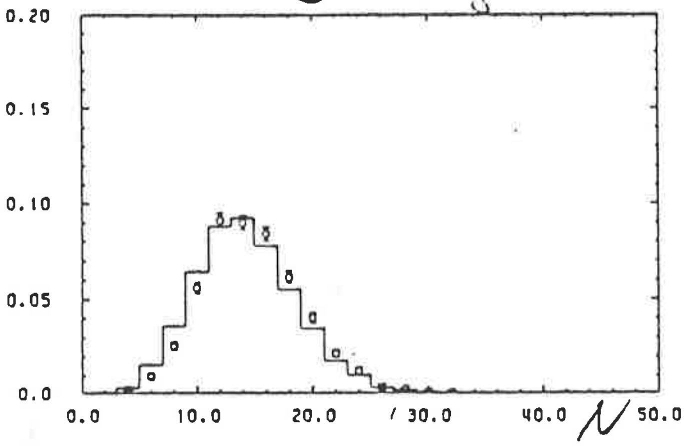
all generated with standard settings for LUND6.3
(except minor switches, see infofile for details)

A short comparison of ~ 5000 MC events
with 35 GeV 1986 detector and ~ 10000 real MH-events
from 1986 is shown in the appended figures

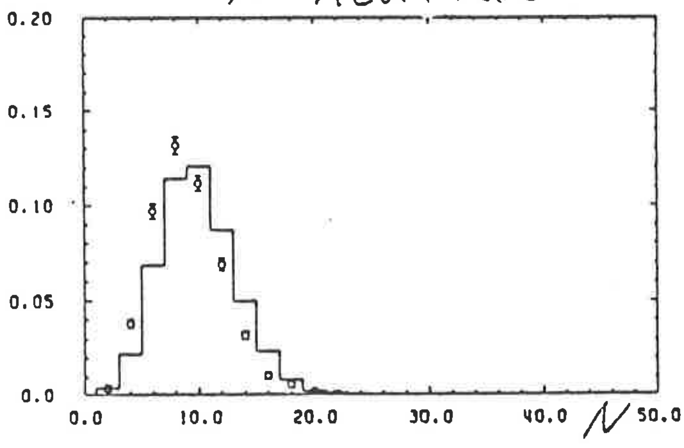
GE 14/12/87

comparing of — MH'86
and o LUND6.3, 1986 tracking

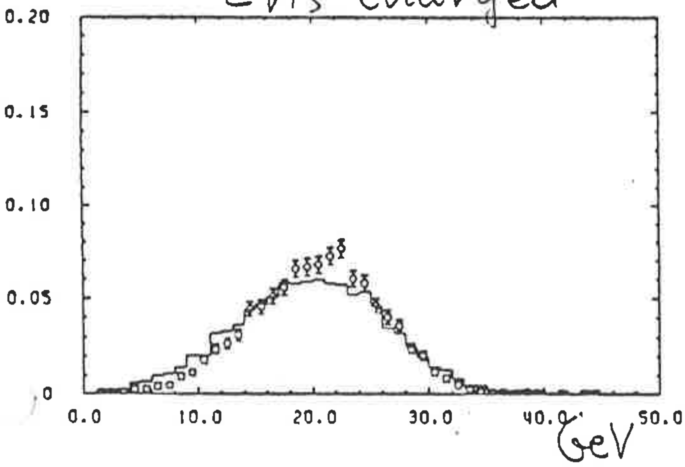
N charged



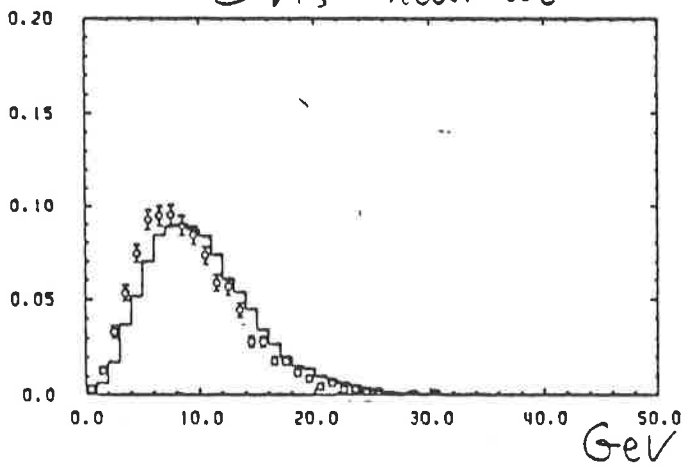
N neutral



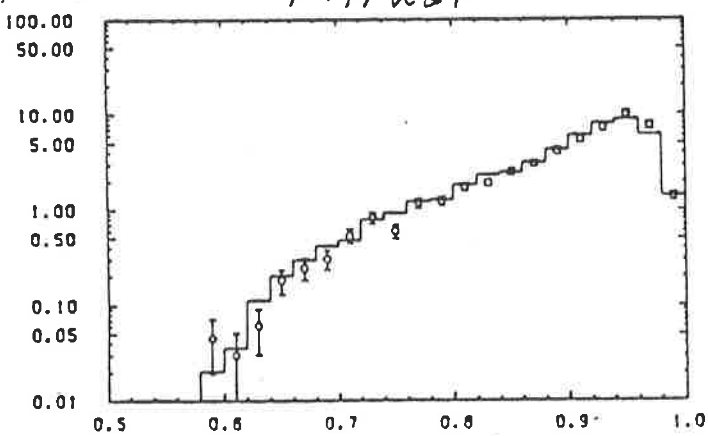
Evis charged



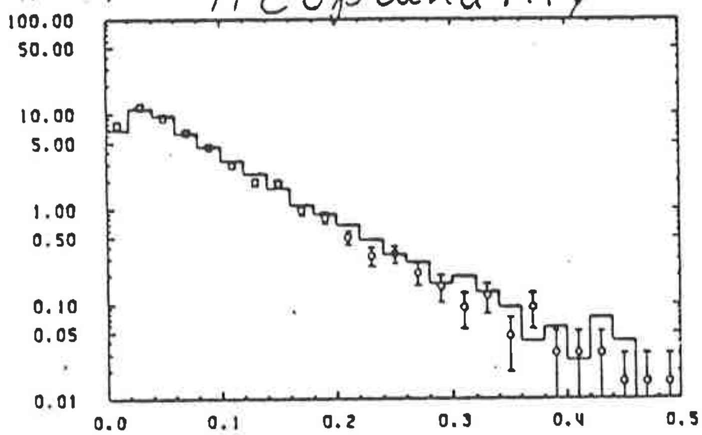
Evis neutral



Thrust



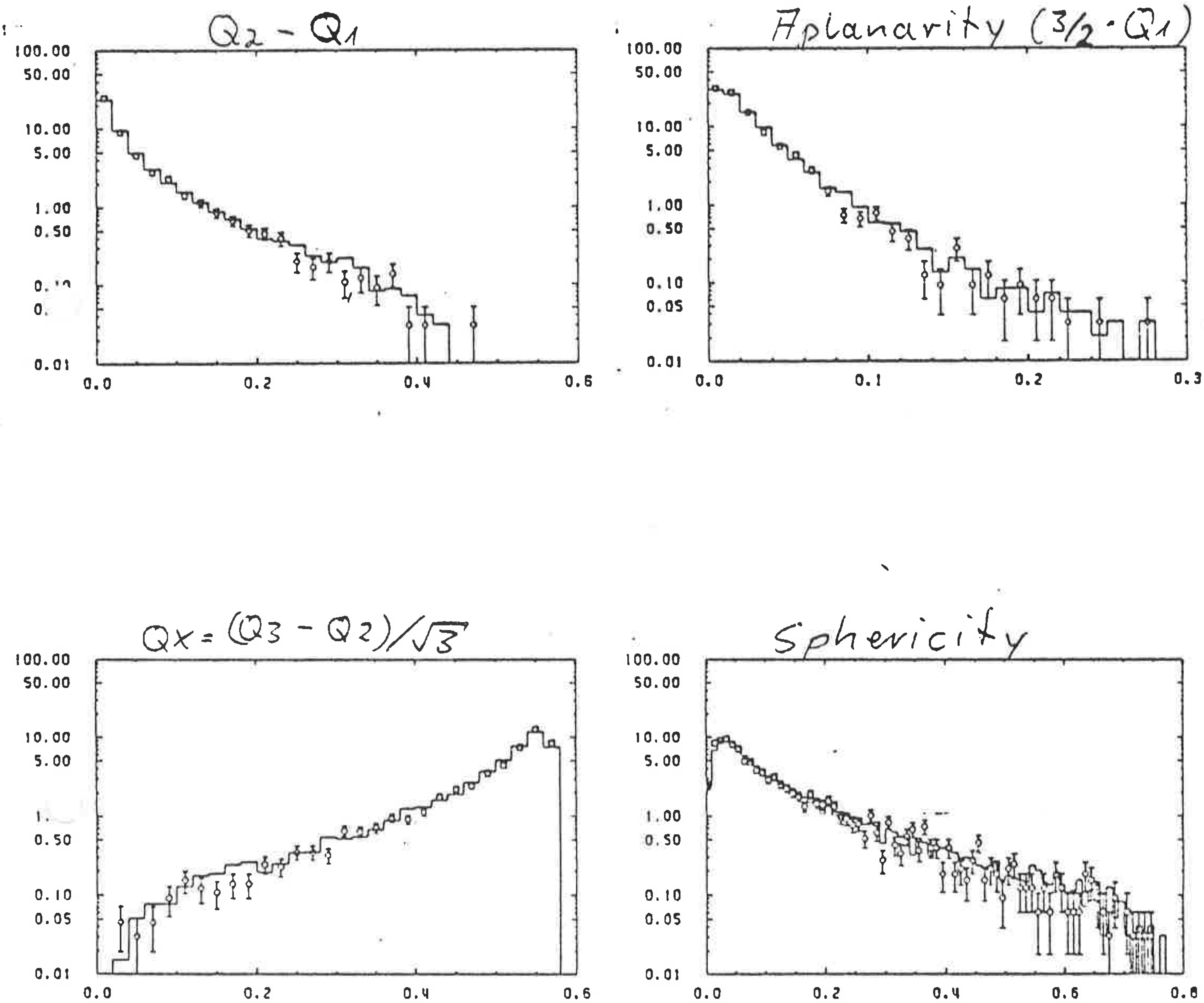
Acoplanarity



GE 14/12/87

— MH'86

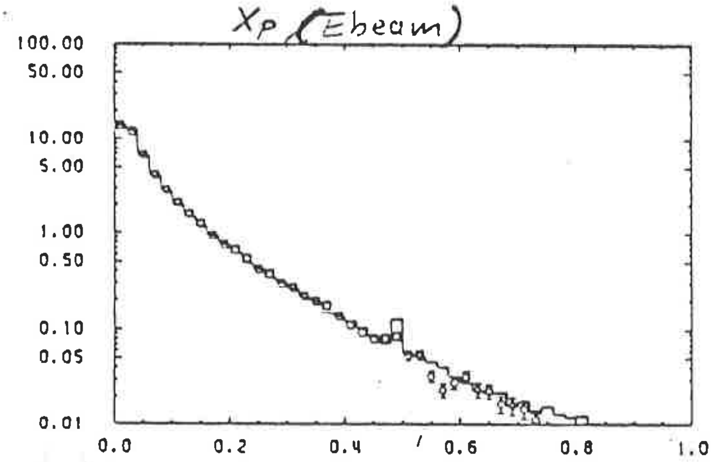
o LUND6.3 , 1986 tracking

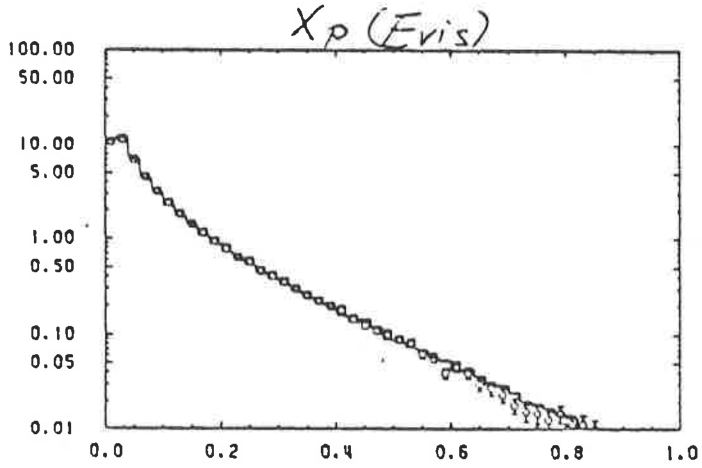


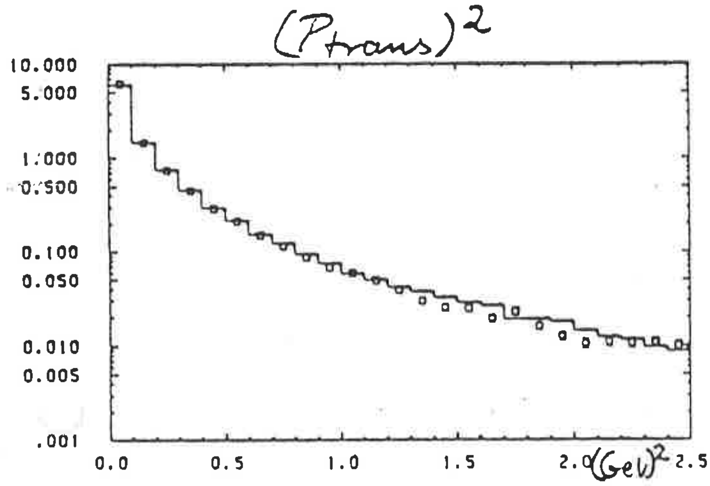
GE 14/12/87

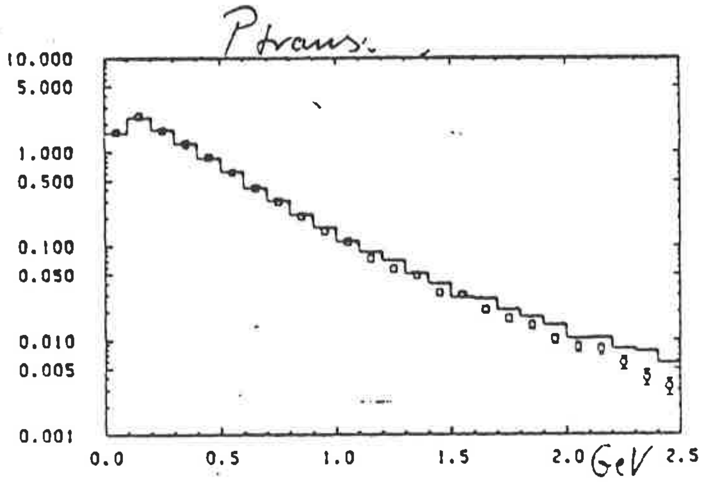
— MH '86

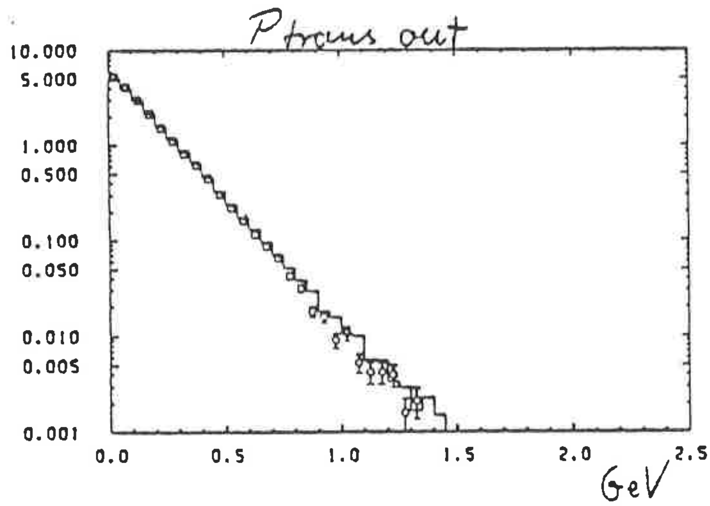
o LUND6.3, 1986 tradeing

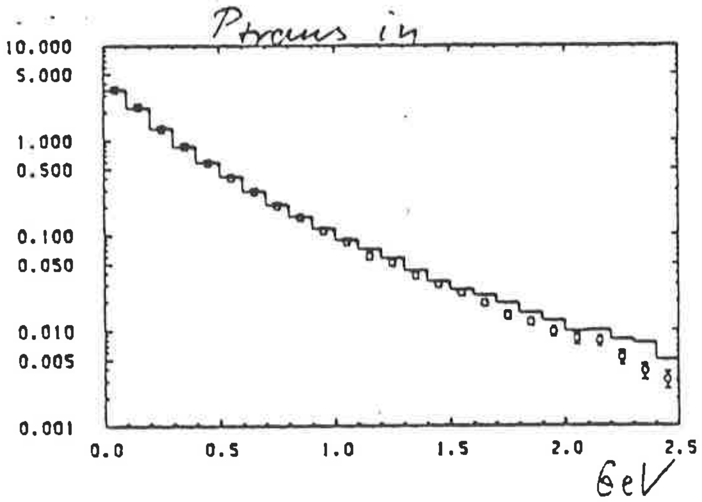










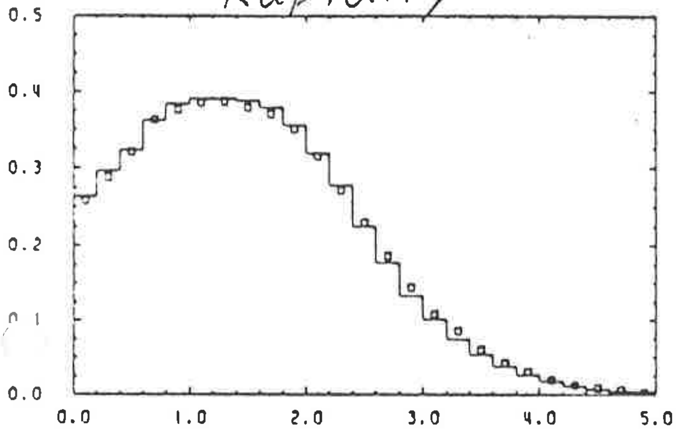


GE 14/12/87

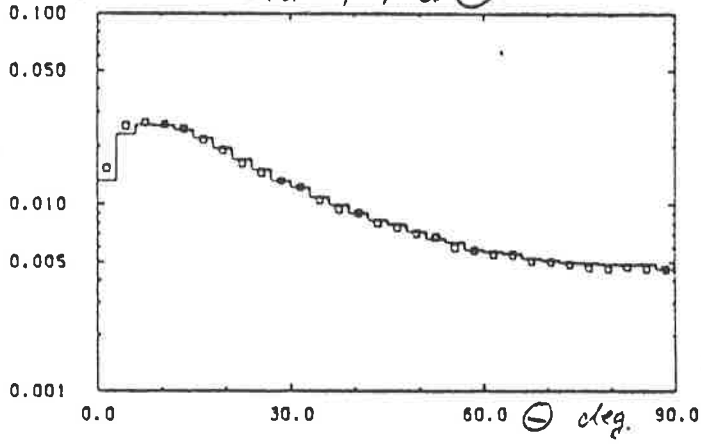
\- MH '86

○ LUND6.3, 1986 tracking

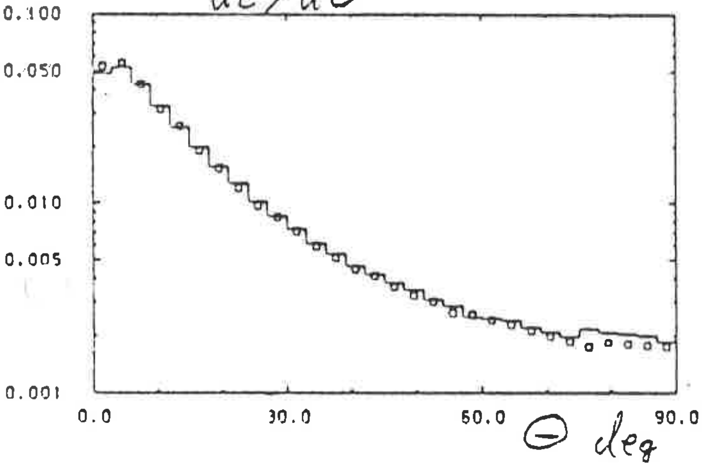
Rapidity



dN/dΘ



dE/dΘ



TP9 Status

14/12/87

- All the important routines are written and integrated.
- Most have been tested
- Bugs in TP8 have been corrected in TP9
  eg missing momentum had wrong direction
- Structure Chart drawn (best way of understanding the program)

To be done this week

- input options processor and options 'server'
- diagnostics code
- print out to be finalised
- testing and TP bank checking

Further work

- vertex chamber
- errors on direction cosines (charged tracks)

C. Bowdery
13/12/87

Which FORTRAN Compiler?

DESY

Language:	JADE uses:	DESY recommends:
FORTRAN 66	(IBM) HXE	(IBM) VS FORTRAN2 option LANGVL(66) or (IBM) HXE
FORTRAN 77	(Siemens) FORTRAN77	(IBM) VS FORTRAN2 LANGVL(77) → default

RAL

	JADE must use:
FORTRAN 66	(IBM) VS FORTRAN2 LANGVL (66)
FORTRAN 77	(IBM) VS FORTRAN2 LANGVL (77) → default

What is the problem?

LOAD modules are routinely copied from DESY to RAL (not source)

HXE load modules are compatible with RAL-compiled FORTRAN (from VS(2) compiler)

Siemens load modules are incompatible in principle. By maintaining a library of Siemens FORTRAN 77 functions, we can get programs to run. **THIS IS NOT IDEAL!** There could be problems in the future.

Proposal

Change from Siemens FORTRAN 77 to IBM VS FORTRAN(2) at DESY. Re-compile existing FORTRAN 77 members.

Consequences?

- Heidelberg will be affected (if Siemens load modules are copied from DESY) until VS FORTRAN (2) is available there.
- FORTRAN4 (HXE compiled) version of CERNLIB must be used until VS version available. (NAGLIB too.)

How much effort to change?

Since Siemens and VS FORTRAN load modules should not be mixed, changeover should occur all at once.

1) Members need changing:

Line 0 : from FORTRAN77
to FORTVS or FVS

Use JADE CLIST called REPLAC on a PS
eg define target line with string MEMBER & NAME
'change' string FORTRAN77
'replacement' string FORTVS

2) Re-compile members

Several options
a) COLOAD line commands on the LE screen.
b) COMP.PS JADE CLIST (prompts for userid for

c) Use Batch NEWLIB (when modified)

Link with: // EXEC NEWLIB PS= ...., PL= ...., FORTLIB='SYS1.FORT.LFVS'

d) Use COLOAD line commands on DIR screen

e) Other methods?

3) For new members in FORTRAN 77?

Use LANGUAGE FORTVS command (if necessary) before creating new members

or

Use I Ø FORTVS on a member already created

4) JCL changes (and NEWLIB LINK page)

Change: JFORT → VFORT or FORT : check parameters with HELP PROCS

When should the change be made?

after full consultations with affected DESY + HD users (UK-based personnel and Maryland personnel probably not directly affected.)

- sooner rather than later
- during a 'quiet' period (batch jobs could be affected)

Who will do the change?

- dE/dx routines on JADEGS ?
- new TP 9 library (every member) Chris Bowdery
- old TP 8 library (a few members) Chris Bowdery
- JADE private code owners

Safety? Make back-ups!

JADE CLIST (SEARCH) can be used to check all standard libraries contain no remaining FORTRAN77 (ie Siemens) members.

Could also check that all FORTVS members have been compiled. (?)

Too much bother?

- necessary for RAL
- Siemens FORTRAN 77 will disappear one day.
  Easier to make change now before more FORTRAN 77 language programs are written.