JADE Computer Note No. 76
11.6.84
Karlheinz Meier

A Collection of Programs Used in the Analysis of Inclusive Photon Production

Introduction

This note describes a few routines which have been used for the analysis of LG-energy depositions and might be of some interest for other users as well. It should, however, be stressed that the special purpose of the analysis was the study of -mass spectra in multihadronic events. The programs are not general tools for any kind of photon analysis in JADE.

The aim here is to describe only the technical properties of the programs. Information about the (physical) background can be obtained from the DESY Internal Report F11/01 which will be available in July.

Any questions, suggestions or complaints should be directed to IBM-userid F11MEI or to Karlheinz Meier, CERN, EP-Division.

Source Files and compiled versions of the described routines can be found on

Source : F11MEI. SHOWS
Load : F11MEI. SHOWL

The Program JBPROD

JBPROD is a complete job ready for submission. It creates an output file containing a new bank named 'GAMR' with all photons used in the inclusive $\gamma(\gamma\gamma)$ - analysis. The following steps are being performed :

- recalibrate LG
- rerun modified cluster-analysis
- connect charged tracks with clusters
- analyse shape of neutral showers
- create output file with 'GAMR' - bank

The 'GAMR'-bank shows a similar structure as the 'PATR'-bank. It starts with a header containing general event information, followed by the properties of the single photons.
The double-shower information is only available on special request in the subroutine SHWFIT (see description below).
All given energies are in MeV units.
Cluster coordinates are (x,y) in case of the barrel and (φ,z) in case of the endcaps.

Location of words in 'GAMR'

Header :

word	content
1	# words in header
2	# photons in 'GAMR'
3	# words/photon without double shower fit
4	# words/photon for the double-shower fit only
5	# blocks for all photons
6	γ-Energy of all photons (ΣE_γ)
7	used vertex : 1 → event vertex 0 → (0.0.0)

Single particle information :

word	content
1	photon number
2	detector part (-1.0.1)
3	# blocks
4	analysis flag : 0 : no fit 1 : single-shower fit 2 : double-shower fit
5	date of cluster analysis
6	Energy
7	Impact point (1. coordinate)
8	Impact point (2. coordinate)
9	dx
10	dy
11	dz

12	X^2 from comparison with single shower
13	pointer to corresponding LGLC-cluster
14	not used
15	single shower fit
16	fitted impact point (1. coordinate)
17	fitted impact point (2. coordinate)
18	σ (1. coord.)
19	σ (2. coord.)
20	dx)
21	dy) from fit
22	dz)
23	X^2 from fit to single shower
24	not used
25	double shower fit
26	fitted impact point (1. coord., 1. photon)
27	fitted impact point (2. coord., 1. photon)
28	fitted impact point (1. coord., 2. photon)
29	fitted impact point (2. coord., 2. photon)
30	σ(1. coord., 1. photon
31	σ(2. coord., 1. photon)
32	σ(1. coord., 2. photon)
33	σ(2. coord., 2. photon)
40	Energy-ratio between the two photons from fit
41	(Energy-ratio)
42	Mass of double strucutre
43	X^2 from double shower fit
44	not used
45	not used

The Subroutine GEGAMM

Unpacking the information from the 'GAMR'-bank can (for example) be done with a routine like

GEGAMM (NGAM, N1, N2)

NGAM is the number of photons found in 'GAMR' (output variable). N1 and N2 are parameters used in a special analysis and without interest here.

The photon 4-vectors are stored in the array

COMMON /CPARTC/ GANMAT (40,10).

GANMAT contains the following information :

GANMAT(N.1) = E_γ
(N.2) = $E_{\gamma,x}$
(N.3) = $E_{\gamma,y}$
(N.4) = $E_{\gamma,z}$
(N.5) = detector part
(N.6) = # blocks
(N.7) = X^2/D.O.F.
(N.8) = not used
(N.9) = not used
(N.10) = Pointer to LGCL

All three following routines are used in the main analysis program but might also be of interest for special applications.

The Subroutine SHWCPR

The subroutine

SHWCPR (VERT,CHI22)

compares a single electromagentic shower profile with a measured block topology and calculates a X^2-value. The properties of the measured clusters have to be loaded into the

COMMON /CLOAD/

which can be done for the LGCL-Cluster IC by calling

CLUSIN(IC,IFIND)

(IFIND=0 → Cluster not existing,
IFIND=1 → everything o.k.)

The 3-dim array VERT(β) has to be filled with the vertex of the photon. this can e.g. be (0.0.0) or the run-vertex. The output variable CHI22 contains the X^2 for the agreement between the measured block topology and the single-photon hypothesis.

The Subroutine SHWFIT

The subroutine

SHWFIT(ICHOIC,VERT,PSSF,CHI22,PDSF,CHI24,ERATIO)

applies a single and/or double shower fit to a measured block topology.

Input variables :

ICHOIC	:	1: single shower fit only 2: double shower fit only 3: single and double shower fit
VERT(3)	:	Vertex (see description SHWCPR)

Output variables :

PSSF (2)	:	Optimized impact coordinates for single photon
DSSF (4)	:	Optimized impact coordinates for both photons in a double shower
CHI22	:	Optimized X^2 for single photon hypothesis
CHI24	:	Optimized X^2 for double photon hypothesis
ERATIO	:	Optimized energy ratio between the two photons in case of a double-shower fit.

As in the case of SHWCPR the measured cluster properties are being transferred via the

COMMON /CLDAT/ .

The fitting is done with the MINUIT algorithm SIMPLEX. Since a slightly modified version is used, the private MINUIT library

F11MEI.MINUIT.LOAD

has to be linked.

A warning : The double shower fit optimizes 5 parameters for a very complicated (z and E-dependent) shower function. It is therefore extremely slow. Only single clusters should be analysed !

The Subroutine EXPECT

The subroutine

EXPECT(IPART,E,VAR,VERT,NBLOCK,IBLIST,BLCFRC,AVGSUM)

is used by the routines SHWCPR and SHWFIT and might also be interesting for other purposes. It calculates the expected energy fraction in any LG-block

of the JADE-detector from an electromagnetic shower with a given impact point, a vertex and an energy. This is done by integrating the theoretical shower function SF (contained in the member EXPECT) with the use of the VEGAS integration method.

Input variables :

IPART	:	detector part
E	:	Energy of showering particle
VAR(2)	:	Impact coordinates
VERT(3)	:	vertex coordinates
NBLOCK	:	number blocks, for which the energy fraction is calculated
N(BLOCK) IBLIST	:	list of block addresses, for which the energy fraction is calculated.

Output variables :

(NBLOCK) BLCFRC	:	list of energy fractions for all required blocks
AVGSUM	:	sum of all calculated energy fractions.