

Treatment of NOFIT events in the 10 GeV/c K^- -experiment

About 60 o/o of the K^- - interactions give no kinematic fit because more than one neutral particle is associated with the event (called NOFIT events in the following discussion). Although NOFIT events are more difficult than in the 8 GeV/c π - experiment it is hoped that some useful physics can be done with these events.

NOFIT events are treated by SLICE in the following manner :

- a) information from the GLOMC record is stored,
- b) mass assignments and type/hypothesis numbers for various tracks are taken from the SLICE card and the NOFIT channel matrix,
- c) a missing neutral "particle" is inserted,
- d) c.m.s. quantities and resonances are calculated as for good fits.

1) The NOFIT channel matrix

Title block CHAN is used to indicate mass assignments - or type/hypothesis numbers for decays - for various non-pion tracks. Each row of the channel matrix corresponds to one channel. It consists of the following items : a channel number (between 1 and 999), mass assignments of up to 4 non decaying tracks, the target particle and type/hypothesis numbers of up to 4 decaying tracks. Items that are not used must be zero. Within these 2 classes (non-decaying, decaying) the masses are arranged in decreasing order, positive before negative charge.

For Σ^+ and K^+ or K^- decays there exist usually 4 fits due to different decay modes and ambiguity in the cm system in the case of zero-degree fits. Thus event type $\Sigma^+ K^-$ consists of 16 different channels. It is therefore important to choose the correct secondary fits.

2) SLICE card information

The correct mass assignments and/or decays for a particular event are indicated on the SLICE card by the negative channel number which is punched in cols. 41-44. This is yet not sufficient since the measurement order of tracks is not fixed. Therefore one has to indicate the second labels of all non-pion tracks in the same order as the masses are given in the channel matrix. These labels are punched between cols. 45-50. Tracks not indicated on the SLICE card are automatically assumed to be pions. Therefore the same channel number can be used for 2-, 4-, ... prongs.

3) Examples

We will consider the following reactions :

- A) $p (AF) + K^- (A3) + Z^0$ (K^- from ionization)
- B) $p (AZ) + \pi^+ (A3) + K^- (A4) + \pi^- (A5) + Z^0$ "
- C) $\pi^+ (AZ) + p (A3) + \pi^- (A4) + K^- (A5) + Z^0$ "
- D) $p (AW) + \pi^+ (A3) + \pi^- (A4) + \pi^- (A5) + K^0 (AM) + Z^0$ (K^0 -decay, type/hyp. = 5101000001)
- E) $\pi^+ (AZ) + \pi^- (A3) + Z^0$
- F) $\pi^+ (AZ) + \pi^- (A3) + \Lambda^0 (AN) + Z^0$ (Λ^0 -decay, type/hyp. = 5101000002)
- G) $K^+ (AZ) + \pi^+ (A3) + K^- (AQ) + \pi^- (A5) + \Lambda^0 (AM) + Z^0$ (K^+ from ionization, Λ^0 -decay, K^- -decay, type/hyp.= 5001030103).
- H) $K^+ (AR) + \pi^+ (A3) + K^- (AQ) + \pi^- (A5) + \Lambda^0 (AM) + Z^0$ (Λ^0 -decays, K^+ -decay, type/hyp. = 5100000104, K^- -decay, type/hyp. = 5001000102)

The corresponding rows in the channel matrix are :

- A) 60 P K 0 0 P 0 0 0 0
- B) 60 P K 0 0 P 0 0 0 0
- C) 60 P K 0 0 P 0 0 0 0
- D) 65 P 0 0 0 P 5101000001 0 0 0
- E) 1 0 0 0 0 P 0 0 0 0
- F) 13 0 0 0 0 P 5101000002 0 0 0
- G) 146 K 0 0 0 P 5101000002 5001030103 0 0
- H) 159 0 0 0 0 P 5101000002 5100000104 5001000102 0

The SLICE card information for these events will be the following (cols. 41-50 only, other information is the same as for good fits) :

- 44 |
- A) -60 F3
- B) -60 24
- C) -60 35
- D) -65 WM
- E) -1
- F) -13 N
- G) -146 2QM
- H) -159 RQM

4) Ambiguous track identification

The momentum of a track is sometimes so high that one can not decide the mass assignment from ionization, we call such a track ambiguous. The maximum number of FITS or NOFITS accepted by SLICE is 3 hypotheses. Therefore special action has to be taken in the case of ambiguous tracks where many hypotheses are possible. For a 4-prong event for example one gets 4 combinations for 2 ambiguous tracks with different charge, but only 3 combinations with the same charge. Therefore the following solution should be accepted : for all events with more than 2 ambiguous tracks (also with 2 amb. tracks of the same charge) the number -999 should be punched into the SLICE card for the channel (cols 41-44). The information about second track labels is not necessary in this case since it will not be used. No calculations will be done in SLICE for these events but merely the GEOMC record will be copied onto a separate tape. The cards for this channel should be kept separately.

5) Program AUTO for automatic decisions

A set of routines has been written which can be incorporated in GRIND and will do a selection of hypotheses which fulfill certain criteria - like probability limits, missing mass limits, proton momentum, interaction volume and others - criteria that are used by the physicist to decide an event from GRIND output. The only criterium that can not be applied is ionization since Iep's do not provide this information (otherwise the program could work fully automatic without paper output). These routines are guided by information from title blocks. Also amount and nature of printout can be governed from titles.

Program AUTO allows to read in a GRIND library tape, create a complete GRIND BCD-output and perform the selection of hypotheses as mentioned above. A condensed output is provided which produces lists of acceptable FITS, acceptable NOFITS (AUTO actually uses the NOFIT channel matrix to find the channel number and takes also care of ambiguous tracks), a list of tracks which could be identified from ionization and a list of SLICE cards that have been punched for this event. Since SLICE cards are punched for accepted FITS/NOFITS only, the amount of cards is actually less than with the present subroutine SLICAR which produces one card for every fit.

AUTO has been used for about 50 o/o of the CERN events on the CDC 3400 (32 K memory). The computer time used was about 40 minutes for a tape of about 900 events, including printout of geometry and decisions on the on-line printer (it should take about 15 minutes for a tape if one punches SLICE cards only). A description of AUTO and the additional title blocks can be found in TC/PROG/66-3.

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