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ENGINEERING NOTE
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SUBJECT
LAZI - IBM PROGRAM

NAME R. HARVEY
DATE 1/26/59

PURPOSE:

THIS PROGRAM MAKES A FIRST ORDER CORRECTION TO THE AZIMUTHAL ANGLE AS GIVEN FROM HYDROS' PARABOLIC FIT. A NEW ENDPOINT (AVERAGED) FOR TRACK ONE IS CALCULATED AND FOR TYPE 71-79 EVENTS, A NEW LENGTH FOR THE DECAYING Σ_1^- (AND K^+ IF IT DECAYS IN THE CHAMBER.)

INPUT - OUTPUT:

THE INPUT IS DEDX — EVENT TYPES 5x, 6x, OR 7x. THE OUTPUT IS "ADJUSTED DEDX" WHICH CAN BE IDENTIFIED BY NON-ZERO WORD SIX ON THE MASTER CARD. IF WORD SIX IS 9999999999, THE DEDX MOMENTUM FOR THE "Λ INTERPRETATION" WAS USED IN THE CALCULATIONS, IF WORD SIX IS 8888888888 - THE DEDX MOMENTUM FOR THE "K INTERPRETATION" WAS USED. "ADJUSTED DEDX" MEANS THAT CORRECTED QUANTITIES REPLACE OLD QUANTITIES AND FOR TRACK ONE, THE LEAST SQUARES INITIAL COORDINATES ARE LOST. EXCEPT FOR THIS, THE OUTPUT IS IDENTICLE TO DEDX.

AZIMUTHAL CORRECTION:

LET $\delta\phi$ DENOTE THE CORRECTION TO THE AZIMUTH, DUE TO THE FACT THAT HYDRO USES A PARABOLIC FIT.

$$\delta\phi = -0.705 \frac{a\,|p^m|}{(p^m)^3} \left(\ell/2\right)^{1.28}$$

WHERE $a = 35.7(\pi)$, $88.2(K)$, $140(p)$, $166(\Sigma')$

LAZI

AND ℓ, p^m ARE LENGTH AND MOMENTUM READ OFF THE DEDX CARDS.

THE CORRECTED DIRECTION COSINES ARE:

$$n_x' = n_x^m \cos\delta\phi - n_y^m \sin\delta\phi$$

$$n_y' = n_y^m \cos\delta\phi + n_x^m \sin\delta\phi$$

WHERE n_x^m, n_y^m ARE READ FROM DEDX.

FOR TRACK 1, THIS CORRECTION IS MADE TO THE FINAL DIRECTION COSINES. ALSO $\delta\phi_{TRK1} = -\delta\phi_{USUAL}$.

FOR ALL REMAINING TRACKS, CORRECTIONS ARE MADE ON INITIAL DIRECTION COSINES.

THE AZIMUTHAL CORRECTIONS ARE INDEPENDENT OF EVENT TYPE AND NOT MADE TO 2 PT. TRACKS.

VERTEX CORRECTIONS:

THE METHOD OF CORRECTING A VERTEX IS A FUNCTION OF THE EVENT TYPE, HENCE THIS OUTLINE IS SPLIT INTO THREE CASES.

(1) ANY TYPE 6X EVENT:

THE INITIAL x, y COORDINATES OF TRACK TWO REPLACE THE FINAL x, y COORDINATES OF TRACK ONE.

IF TRACK ONE IS A 2 POINT TRACK THEN:

$$\frac{z_2^i + z_1^f}{2} \longrightarrow z_1^f$$

IF TRACK ONE > 2 POINT THEN:

z_1^f NOT CHANGED.

(WHERE $i \equiv$ INITIAL, $f \equiv$ FINAL).

(2) ANY TYPE 5X EVENT:

$$\frac{x_2^i + x_3^i}{2} \longrightarrow x_1^f \quad ; \quad \frac{y_2^i + y_3^i}{2} \longrightarrow y_1^f$$

TRACK 1 IS 2 PT:

$$\frac{z_3^i + z_2^i + z_1^f}{3} \longrightarrow z_1^f$$

TRACK 1 > 2PT:

z_1^f NOT ALTERED.

(3) ANY TYPE 7X EVENT:

HERE WE CORRECT A 3 TRACK VERTEX (1, 2, 4) AND ONE (POSSIBLY TWO IF TRACK 4 DECAYS) 2 TRACK VERTEX. THE 3TRACK VERTEX IS DONE AS AN AVERAGE OF 3 - 2TRACK VERTICIES, NAMELY (1,2), (1,4), (2,4). HENCE WE DISCUSS THE 2 TRACK VERTEX FIRST.

Two TRACK VERTEX:

$$x_{c_{ij}} = \frac{(m_i'' x_i'' - m_j'' x_j'') - (y_i'' - y_j'')}{m_i - m_j}$$

$$y_{c_{ij}} = y_j'' + m_j''(x_{c_{ij}} - x_j'')$$

WHERE $m_i = n_{yi}''/n_{xi}''$ AND SUPERSCRIPT "H" DENOTES VALUES READ IN FROM DEDX CARDS. THE TRACK COORDINATES ARE EITHER THE INITIAL OR FINAL TRACK COORDINATES DEPENDING ON THE INDICIES i, j.

THE Z COMPONENT IS A LITTLE MORE COMPLICATED:

$$Z_{C_{ij}} = \frac{\bar{Z}_i \ell_i'' \cos\lambda_i'' + \bar{Z}_j \ell_j'' \cos\lambda_j''}{\ell_i'' \cos\lambda_i'' + \ell_j'' \cos\lambda_j''}$$

WHERE $\bar{Z}_k = Z_k^H + \sqrt{\Delta X_k^2 + \Delta y_k^2}\ \tan\lambda_k^H \cdot Sign(k)$

AND $\Delta X_k = (X_{C_{ik}} - X_i^H)$; $\Delta y_k = (y_{C_{ik}} - y_i^H)$

$$\tan\lambda_k^H = \frac{\sin\lambda_k''}{\sqrt{1-\sin^2\lambda_k''}} \quad ; \quad \sin\lambda_k'' = n_{Z_k}^H$$

$$Sign(k) = \left(\frac{|\Delta X_k|}{\Delta X_k}\right)\left(\frac{|n_{X_k}^H|}{n_{X_k}^H}\right)$$

A TEST IS MADE ON $X_{C_{ij}}$ AND $y_{C_{ij}}$, (ie)

$|y_{C_{ij}} - y_k| \leq .5$ (SIMILARLY FOR X)

WITH $k = i, j$

IF THIS TEST FAILS, AN ERROR CARD IS PUNCHED AND THIS EVENT REJECTED.

THREE TRACK VERTEX:

A THREE TRACK VERTEX IS CONCIDERED AS THREE TWO TRACK INTERSECTIONS. LET THE THREE TRACKS BE LABELED i, j AND k. WE PROCEED BY FIRST CALCULATING:

$(X^c, y^c, Z^c)_{ij}$, $(X^c, y^c, Z^c)_{ik}$, $(X^c, y^c, Z^c)_{jk}$

USING THE 2 TRACK PROCESS.

THEN $\bar{X}_{ijk} = \dfrac{\sum_{(pq)} X^c_{(pq)} \ell_{(pq)}}{\sum_{(pq)} \ell_{(pq)}}$ $\left\{\begin{array}{l}(pq) \text{ CONCIDERED AS} \\ \text{SINGLE INDEX, ie} \\ (pq) = (ij), (ik), \text{ OR } (jk)\end{array}\right\}$

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WITH $\ell_{(pq)} = \frac{1}{2}\left(\ell_p'' \cos\lambda_p'' + \ell_q'' \cos\lambda_q''\right)$

FROM THE NEW (124) VERTEX AND NEW (23) VERTEX, THE LENGTH OF TRACK TWO IS COMPUTED BY THE USUAL DISTANCE FORMULA.

FOR EVENT TYPES 71 AND 72 A NEW (45) VERTEX AND HENCE NEW LENGTH FOR TRACK 4 IS CALCULATED. WITH THE EXCEPTION OF x_1^t, y_1^t, z_1^t, NONE OF THE "AVERAGED" COORDINATES ARE INCLUDED IN THE OUTPUT BECAUSE THIS PROGRAM WAS DESIGNED TO PRECEED SKAP I WHERE ONLY THE LENGTHS OF TRACKS 2 AND 4 ARE USED.

PROGRAM RUNNING INFO:

WITH SWITCHES SET AS USUAL 70 1951 1951 +
FOLLOW THE PROGRAM WITH DATA CARDS.
TO RESTART — TRANSFER TO 0801.
USE 80-80 BOARD IN 533 UNIT.

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LAZI ERROR CARDS

WORD 1 5000000050

" 2 $\Delta y^c = |y_i^H - y_{c_{ij}}| - .5$; OR Δx^c

" 3 $y_{c_{ij}}$ OR $x_{c_{ij}}$

" ~~4~~ y_i^H OR x_i^H

" 5 ID
" 6 A
" 7 B
" 8 SERIAL NO. OF EVENT

} SEE BELOW.

ID = 01 xxxx 8000

xxxx		COORDINATE THAT FAILED TEST
0946	→	y_I
0547	→	y_{II}
0597	→	x_I
0647	→	x_{II}

WHERE "I" & "II" HAVE FOLLOWING RELATIONSHIP TO "A" & "B"

(B, A)	I	II
(0, 50)	TRACK 1	TRACK 2
(14, 50)	TRACK 1	TRACK 4
(14, 7)	TRACK 2	TRACK 4
(7, 57)	TRACK 2	TRACK 3
(21, 71)	TRACK 4	TRACK 5

IF THE DEDX CARDS ARE OUT OF ORDER, A CARD CONTAINING THE EVENT SERIAL NO. 8 TIMES IS PUNCHED OUT.