/ Olsson

JADE Computer Note 45

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8.9.1980

New corrections for the space-time relation in the JET chamber.

New correction formulae are given in this note which should be used in the calculation of the space coordinate in the γ-ϕ plane from the observed drifttime.

The explanation of the new corrections will appear in another note in which the analysis of the data performed by using new corrections wil also be shown.

I) The overall corrections which does not vary cell by cell.

The space coordinate Y measured in the drift direction is calculated from the observed drifttime T in the following way.
Y is measured in mm unit and T is measured in clock unit.

I-1) Time pedestral correction before pattern recognition.

True time pedestral is given for each wire by the sum of TOFF(IWIRE,ICELL) and TO(IRING).
TOFF is the wire dependent pedestral which is calculated by pulser data.
TO(IRING) is calculated by using wire crossing tracks for each ring and gives the absolute pedestral:

TO(IRING) is corrected in two steps.
Before pattern recognition, the contribution, TOFIX(IRING) of average flight time and propagation time is also corrected.

T = T-(TO(IRING) + TOFIX(IRING) + TOFF(IWIRE,ICELL))

TOFIX(1) = 0.65 clock
TOFIX(2) = 0.71 clock
TOFIX(3) = 0.76 clock

The values of the TO(IRING) are given in the Table 1.

I-2) Time slewing correction.

$$AMPMX = MAX(AMPL,AMPR)$$

old formula

AMPMX < 300:

$$T = T + A1 + A2 \times AMPMX$$
$$A1 = -1.0356, \ A2 = 0.00345$$

new formula:

AMPMX < AMPLIM(1)

$$T = T + (A1 + A2 \times AMPMX + A3 \times AMPMX \ xx \ 2)$$

AMPLIM(1) < AMPMX < AMPLIM(2)

$$T = T + (A4 + A5 \times AMPMX + A6 \times AMPMX \ xx \ 2)$$

$$AMPLIM(1) = 250, \ AMPLIM(2) = 500$$

$$A1 = -1.494, \ A2 = 7.872 \times 10^{-3}, \ A3 = -1.157 \times 10^{-5}$$

$$A4 = -0.8207, \ A5 = 2.926 \times 10^{-3}, \ A6 = -2.561 \times 10^{-6}$$

I-3) The conversion from the drifttime to the space coordinate in the drift direction.

$$Y = C\ (IRING) \times T \ > 0$$
$$C(1) = 0.3769, \ C(2) = 0.3753, \ C(3) = 0.3826$$

I-4) The correction for the aberration due to the dispersion of the drift path.

$$Y = Y + TSHFT$$

$$Y > RADI; \quad TSHFT = (1/\cos(\alpha+\beta) - 1) \times RADI$$

$$Y < RADI; \quad TSHFT = (1/\cos(\alpha+\beta) - 1) \times Y$$

where

α = Lorentz angle > 0,
β = angle of the track with respect to the wire plane.

$\gamma = \alpha+\beta < 0$; RADI = RADTL

$\gamma = \alpha+\beta > 0$; RADI = RADIR old constants

RADIL = RADIR = 2.9 mm

new constants

RADIL = 6.8 mm, RADIR = 4.0 mm   for $B \neq 0$

RADIL = RADIR = 5.0 mm   for $B = 0$

<u>I-5) The correction for the aberration due to the variation of the drift velocity near the wire.</u>

$-\infty$ < Y < RVEL; Y = Y + VARVEL x (Y-RVEL) xx 2

Y might be negative very near the wire.

old constants

RVEL = 5 mm, VARVEL = 0.012 1/mm

new constants

RVEL = 2.5 mm VARVEL = 0.048 1/mm

Y = 0 ; ΔY = 0.30 mm

Y = -0.5mm; ΔY = 0.43 mm

<u>I-6) Change the sign of Y for the hit in the left hand side of the wire plane.</u>

<u>I-7) Correction for the wire staggering.</u>

IWIRE = odd Y = Y + WSTG

IWIRE = even Y = Y - WSTG

IWIRE = 1 —16

WSTG = 0.15 + 0.05 = 0.2 mm

0.15 mm = original wire staggering

0.05 mm = average contribution of the electrostatic force to the wire staggering

I-8) Correction for the flight-time of a particle.

$|Y| = |Y| - CFLTM \times R$

R = radial distance from the interaction point in mm

FLTM = 1.67×10^{-4}

I-9) Correction for the propagation of a signal along the wire.

$|Y| = |Y| - CPROP \times (ZPHYS - |ZFT|)$

ZFT = Z coordinate of a hit calculated by using a fitted line in
R-Z plane. Unit mm

ZPHYS = half of the physical wire length

= 1222.9 mm

CPROP = 2.17×10^{-4}

I-10) Time pedestral correction after pattern recognition.

The overcorrection of the time pedestral is now corrected.

$|Y| = |Y| + TOFIX(IRING) \times C(IRING)$

After these corrections, the new type of corrections is applied by using the calibration constants which are given by disk files.

II) The corrections which vary cell (half cell) by cell (half cell)

The calibration constants to be used in this stage can be obtained by reading disk files of the calibration constants.

Now we have two calibration files.

F11NOZ.DELTV3.SALL

F11NOZ.DELTV3.A7502.SALL

corresponding to the data which are taken in 1979 and 1980, respectively.

The file is read in such a way:

```
READ  (IUNIT)  (DLTAR(I),I=1,L)
L = 1536
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The content of DLTAR is

	symbol	correction
DELTAφ(96,2)	δ_0	distortion of the overall drift field
DELTA1(96,2)	δ_1	distortion of the drift field around edge wires
DELTA2(96,2)	δ_2	
DELTA3(96,2)	δ_3	dummy
DELTA4(96,2)	δ_4	
DELTA5(96,2)	δ_5	wire position
DELTA6(96,2)	δ_6	
DELTA9(96)	δ_9	Δ(Lorentz angle)
DELTA10(96)	δ_{10}	dummy

The corrected coordinate Ycor is given by subtracting the correction ΔY from the Y calculated so far.

Y is measured still in the drift direction.

ΔY is calculated by summing up the following corrections, namely:

$$\Delta Y = \Delta Y5,6 + \Delta Y9 + \Delta Y0 + \Delta Y1,2$$

$$Ycor = Y - \Delta Y$$

II-1) The correction for the wire positions, ΔY5,6.

$$\Delta Y5,6 = \Big[\big\{ \mathrm{DELTA6(ICELL,1)} + \mathrm{DELTA5(ICELL,2)} \times \mathrm{ZFT/ZMX} \big\} \times (\mathrm{WIRE}-8)$$
$$+ \big\{ \mathrm{DELTA6(ICELL,1)} + \mathrm{DELTA6(ICELL,2)} \times \mathrm{ZFT/ZMX} \big\} \Big] \times 10$$
$$/ \big\{ \cos(-\alpha) + \mathrm{SIN}(-\alpha) \times \mathrm{TAN}(\beta) \big\}$$

where

WIRE = 1 - 16

ZFT = Z coordinate calculated by a fitted line in R-Z plane.

ZMX = 1211.5 mm

TAN(β) = Slope of a track element in a cell with respect to the wire plane

II-2) The correction for the cell dependent Lorentz angle, $\Delta Y9$.

If the 96 Lorentz angle α's are used in the conversion of the Y coordinate from the drift direction to the direction perpendicular to the wire plane, no further correction is needed.

In this case, the Lorentz angle for each cell is calculated by

$$\alpha\,(\text{ICELL}) = \alpha_0 + \text{DELTA9(ICELL)}$$

δ9 in degrees!

and

$$\Delta Y9 = 0$$

If α_0 is used for the conversion, the following correction is needed:

$$\Delta Y9 = \text{DELTA9(ICELL)} \times \text{TAN}\,(\alpha + \beta) \times Y$$

II-3) The correction for the parabolic distortion of the drift field in the large drift space, ΔY_0.

$|Y| < \text{YS(IRING)}; \quad \Delta Y_0 = 0$

$Y < -\text{YS(IRING)};$

$$\Delta Y_0 = + \text{DELTA0(ICELL,1)} \times (\text{WIRE-WMID}) \times \text{TAN}(\alpha + \beta) \times (Y + \text{YS(IRING)})$$

$Y > \text{YS(IRING)}$

$$\Delta Y_0 = - \text{DELTA0(ICELL,2)} \times (\text{WIRE - WMID}) \times \text{TAN}(\alpha + \beta) \times (Y - \text{YS(IRING)})$$

where

$YS(1) = YS(2) = YS(3) = 15$ mm

$WMID = 8.5 + Y(WIRE = 8) \times SIN(-\alpha)/20$

II-4) The correction for the distortion of the drift field around edge wires, $\Delta Y_{1,2}$

For the wires 4 - 13, $\Delta Y_1 = 0$

For the wires 1,2,3

$Y < 0$: $\Delta Y_{1,2} = DELTA1(ICELL,1) \times (WIRE-4)\ xx2xY$

$Y > 0$: $\Delta Y_{1,2} = DELTA1(ICELL,2) \times (WIRE-4)xx2xY$

For the wires 14,15,16

$Y < 0$: $\Delta Y_{1,2} = DELTA2(ICELL,1) \times (WIRE-13)xx2xY$

$Y > 0$: $\Delta Y_{1,2} = DELTA2(ICELL,2) \times (WIRE-13)xx2xY$

III) The transformation to the standard Jade coordinate system

The coordinate in the standard Jade coordinate system (Xst, Yst) is calculated by using the corrected Y coordinate in the drift direction (Ycor), wire number (WIRE), cell number (ICELL) and Lorentz angle (α) .

$Xst = ((WIRE-1) \times 10 + FSENSW(IRING) + Y_{cor} \times SIN(\alpha))$
$\quad \times \cos(\phi) - Y_{cor} \times \cos(\alpha) \times SIN(\phi)$

$Yst = -((WIRE-1) \times 10 + FSENSW(IRING) + Y_{cor} \times SIN(\alpha))$
$\quad \times SIN(\phi) + Y_{cor} \times \cos(\alpha) \times \cos(\psi)$

where

WIRE = 1 - 16

$$\psi = ((ICELL-1) \times 4+2) \times 3.75^{o} \text{ for } IRING = 1$$
$$= ((ICELL-25) \times 4+2) \times 3.75^{o} \text{ for } IRING = 2$$
$$= ((ICELL-49) \times 2+1) \times 3.75^{o} \text{ for } IRING = 3$$

FSENSW = 211.0, 421.0, 632.33 mm

Table 1 Table of T_o and α_o

Data	RUN No.	Pedestral File	B	old			new			old	new	Calibration File
				To(1)	To(2)	To(3)	To(1)	To(2)	To(3)	α_o	α_o	
1979 summer	1-1486	F22PWA. PEDEST. R565V2	7000 A	-3.4	-3.0	-2.0	-3.9	-3.9	-3.0	18.5	18.5	F11NOZ. DELTV3. SALL
1979 autumn	1487-1485	F22PWA. PEDEST. R1687V4	7000 A	3.2	3.3	3.3	2.4	2.4	2.4	18.5	18.5	
1979 autumn	1846-2520	F22PWA. PEDEST. R1991V4	7000 A	0.59	0.59	0.59	0.2	0.2	0.2	18.5	18.5	
1980 before mid. of June	2521-3727	F22PWA. PEDEST. R1991V4	7000 A	0.59	0.59	0.59				18.5		
	2521-3727	F22PWA. PEDEST. R2683V4	7000 A				-2.5	-2.5	-2.5		19.5	
1980 after mid of June	3728-	F22PWA. PEDEST. R1991V4	7500 A	1.2	1.4	1.5				19.8^o		F11NOZ. DELTV3. A7502. SALL
	3728-	F22PWA. PEDEST. R4041V4	7500 A				-6.1	-6.1	-6.1		21.0	