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Calibration for 1986 REDUC1 and Status of Rutherford Tapes

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The 1986 data taken have been routinely sent to Rutherford and analysed as in previous years, despite of expected changes due to the FADC installation for the Jet Chamber. Some precaution had been taken to adapt the calibration files to the best known constants known at the time. However, after analysing the data in detail some problems showed up which will be presented in this note.

Jet Chamber Constants

Four sets of constants for the Inner Detector calibration can be distinguished:

a) Global T0 (for each ring)	Subroutine JETCAL
b) Individual T0 (for each wire)	/CALIBR/ constants JTPL
c) z parameters (for each wire):	/CALIBR/ constants ZCAL, JTPL
2 Pedestals	
Relative Gain	
Effective Wire Length	
d) Cell parameters (for each cell)	/CALIBR/ constants JTAB

Whereas the global T0 is kept in Data statement and applied in subroutine JETCAL the other constants are split over several locations in COMMON /CALIBR/. Depending on the run the COMMON /CALIBR/ is loaded from the calibration file F11LH0.BUPDAT0 or for the later runs from F11LH0.BUPDAT1. The files F11LH0.AUPDAT1 or F11LH0.KALWRK0 hold subsets of the data of the BUPDATx files as summarized below.

F11LH0.BUPDAT0/1 Complete set of calibration constants including the extensive list of "spinning" lead glass blocks, which changes from run to run. The file is long and time consuming to read. The noisy block list is needed whenever the leadglass data is calibrated, i.e. ALGN is created from ALGL. If one is not doing leadglass calibration, one usually prefers the shorter AUPDAT1 file.

F11LH0.AUPDAT1 Contains all calibration constants from BUPDAT0/1 except for the list of noisy lead glass blocks. Considerably shorter and faster to read.

F11LH0.KALWRK0 This file is a copy of the last run period of the BUPDAT1 file and used as a work file for the REFORM job, that continuously adds the information for the "spinning" lead glass blocks. Since during datataking only this file is up-to-date concerning the noisy leadglass blocks, it is the only file that can be used for the REDUC1 at Rutherford Lab. The current version of KALWRK0 is copied to every REFORM tape sent to Rutherford.

Clearly, since leadglass "spinning" block list is the only difference between these files, all other constants, in particular other leadglass constants and Jet Chamber constants should be the same on all files. This has not been the case during 1986.

Leadglass Constants

The leadglass constants consist of pedestals and gains for individual blocks as well as the run dependent list of noisy blocks. The latter is continuously being updated during the REFORM step. The data are initially kept in the calibration file F11LH0.KALWRK0, which has to be copied to F11LH0.BUPDAT1 occasionally. Gains and pedestals for the leadglass system are kept in the calibration in a similar way as for the Jet chamber. They are loaded into /CALIBR/ constants LGMA.

Jet Chamber Constants 1986

Before starting the 1986 REDUC1 the calibration constants for the Jet chamber were estimated. The biggest change was expected for the z-calibration, namely the ADC pedestals, which used to be around 50 for the DL8s and are 0 for the FADCs. Also, the relative gains in the system had no relation to the previous values (the corresponding electronics had been replaced), so that the relative gains were set to 1 and the pedestals to 0. These constants were implemented on the F11LH0.BUPDAT1 calibration file in the beginning of 1986. However, they were not copied to F11LH0.AUPDAT1 and F11LH0.KALWRK0, where they should have been in effect for the REDUC1 job in Rutherford. Instead, up to end of May 86 (run number is indicated in the table), the constants of the last update, namely the 1983 calibration were used. With the update of KALWRK0 end of May 86 the estimates of the Jet chamber parameters finally came into effect. At the same time the relative T0s changed from the values of 1983 to the values of 1984.
The global T0 was changed to the new values for the FADCs at about the same time, a shift of two DL8 clock counts. However, it showed up only now, that, due to a program bug, none of the global T0 applied since 1980, had any effect on the data. Instead of the correct value an undefined variable was used in subroutine JETCAL, the standard JETC calibration routine called by the supervisor routine. The subroutine JRECAL, which performs REcalibration of an existing Jet chamber bank, always used the correct code. This routine may optionally be called by the user, e.g. in the TP step. As a result, probably no global T0 correction was applied for REDUC1 or any recalibration using the standard SUPERY routine, since, most likely, unitialised variables are set to zero. In fact if the variable had been largely different from zero complete failure of pattern recognition would be expected.
The table below summarizes the parameters used for the two 1986 periods together with best values as they are known now after a more careful calibration. The additional change not yet mentioned is an increase in the parameter for the effective wire length by 4%. The numbers in parentheses indicate the year for which the constants were determined.

Jet Chamber Calibration Constants used for REDUC1 in Rutherford Lab

Parameter	< run 26372	≥ run 26372	Best Values	Units
Global T0	? probably 0	? probably 0	4	DL8 clock cnts.
Gain	1 (1983)	1 (1986)	1	rel. units
Pedestal	50 (1983)	0 (1986)	0	DL8 ADC cnts.
rel. T0	0 (1983)	0 (1984)	0	DL8 clock cnts.
Eff. Wire length	1 (1983)	1 (1983)	1.04	rel. units

Leadglass Constants 1986

Together with the Jet chamber constants the leadglass gains and pedestals were left at the 1983 values for the first period and at the 1984 values for the second period in 1986. Since in 1984 the gains of the leadglass system were changed to account for the higher beam energy, the 1983 numbers still might be a better approximation of the 1986 values than the values from 1984. The final numbers for 1986 will not be known before an expert from Tokyo deals with the task of determining them.

Determination of Jet Chamber Constants 1986

For historical reasons, the JADE calibration scheme allows two versions of the z-constants to appear in the calibration blocks. Effective wire length, relative gain and two pedestals were originally regularly determined for each wire from a pulser calibration run and stored in the calibration block JTPL (together with a relative T0). The pulser calibration has been carried out for the last time in 1983 and since then all expert knowledge has disappeared. Still, these parameters will always be used when the standard pattern recognition is performed, especially in REDUC1.

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In 1981, Peter Dittmann introduced the dedicated calibration block ZCAL in /CALIBR/ and also left us with a procedure to determine the constants, which again are effective wire length, relative gain and two pedestals. These constants are applied, whenever the subroutine ZSFIT is

called.
The best values for the 1986 z-calibration have now been derived by using Dittmanns procedure adapted to the modifications required for the flash ADC system. For pragmatic reasons and also, since they give the better resolution, these numbers were converted to equivalent numbers for the JTPL calibration block. Therefore, the JTPL and ZCAL numbers are truly equivalent for 1986 and do not only carry the same name. Note, however, that this procedure has been tried for the first time. Effective wire length and pedestals are somewhat correlated and it was observed that the JTPL numbers for pedestal were systematically higher than the ZCAL numbers. This effect is compensated by a correspondingly smaller effective wire length.

Bias for the 1986 REDUC1 at Rutherford Lab

The losses encountered due to inadvertent use of incorrect or not yet final calibration files, and a program bug are determined by reprocessing a few REFORM tapes with the correct calibration, as it is known today, and by comparing the output with the output obtained from the REDUC1 tapes from Rutherford. The physics channel which is probably most affected is the two prong class, which is not backed up by a leadglass energy selection (μ-pairs, low energy 2-photon 2-prongs). We normalize the losses to the number of accepted 2-prong events after a second, more stringent reduction REDUC2 and a visual scan of the events. The numbers are given in the table below. Note, however, that also 3- and 4-prongs were found among the lost events.

Losses of good two prong events from one calibration to the other

Fraction of two prong Events lost	Run <26372	Run ≥26372
for Rutherford REDUC1	14.8%	0.5%
REDUC1 with new calibration	0.5%	0.5%

The loss of good events in the period before end of May 1986 is severe. The loss for the second period of 1986 seems to be at the level that will be encountered with any new set of Jet chamber calibration constants, since the z-cut is not placed far away from the tail of the good events. Note, that for all previous years, the final calibration was only made available after REDUC1 had been performed. Inspection of the events shows, that in all cases the loss is due to the z-calibration, which affects the z-vertex calculation (cuts at ±300 mm) as well as the rz-fits of individual tracks (cut on z-intercept at ±300 mm). The loss in spring 1986 is due to the nonzero z-pedestal (from 1983). The T0 error affects resolution but is not essential for the track cuts in r-phi in REDUC1 (rmin<50mm). The error in the leadglass calibration causes some events with energy close to threshold (and cut values in REDUC1) to be treated as track rather than energy triggers.

Comment on Selection of Earlier Years

Due to the various problems mentioned above the data selections and analyses of earlier years may be affected. Here the points are summarized again:

Global T0 not applied in JETCAL	since 1980
z-calibration for PATREC not updated	since 1983
Leadglass gains and pedestals not updated	since 1983.