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**** J A D E C O M P U T E R N O T E 43 ****
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**** A GENERAL SECOND REDUCTION PROGRAM ****
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J.OLSSON 25.08 1980

THE OUTPUT OF THE JADE FIRST DATA REDUCTION STEP CONTAINS C:A 10 % OF THE ORIGINAL TRIGGERS. ALTHOUGH THIS IS A SIZEABLE REDUCTION FACTOR, THE SAMPLE HAS STILL A VERY LOW DENSITY OF GOOD EVENTS. THIS MUST BE SO, SINCE THE REDUC1 STEP IS A VERY TIME-CONSUMING ONE AND THEREFORE MUST WORK WITH SAFE AND WIDE CUTS.

HOWEVER, EVERY RESEARCHER STUDYING A PARTICULAR KIND OF DATA IS FACED WITH THE PROBLEM OF READING > 100 TAPES, TO SELECT HIS GOOD EVENTS.

A SECOND REDUCTION STEP WOULD PARTLY SOLVE THIS PROBLEM. SUCH A PROGRAM MUST AGAIN COMBINE A SIZEABLE REDUCTION FACTOR WITH SAFE CUTS. ON THE OTHER HAND, THE REDUCTION MUST STILL RETAIN ENOUGH BACKGROUND EVENTS TO PROVIDE SAFE ESTIMATES OF BACKGROUNDS IN THE SAMPLES OF GOOD EVENTS THAT EVENTUALLY MAY RESULT. THIS MEANS A COMPROMISE BETWEEN WIDE CUTS AND GOOD REDUCTION FACTOR.

A REDUC2 PROGRAM MUST ALSO BE REASONABLY FAST. TO CREATE A REDUC1 TAPE IN THE GENERATION GROUP JADEPR.REDUC1.G00XXV00, SOME 150-200 CPU-MINUTES ARE SPENT. A REDUC2 PROGRAM SHOULD ONLY SPEND A FEW % OF THIS TIME, TO GIVE THE POSSIBILITY OF RERUNNING IT WITH DIFFERENT CUTS, SHOULD THE NEED ARISE.

A NUMBER OF SECOND REDUCTION PROGRAMS ALREADY EXIST. HOWEVER, THEY ARE MOSTLY SPECIALIZED FOR SELECTING EVENTS OF A CERTAIN KIND, LIKE MULTIHADRONS, BHABHAS, MUPAIRS ETC. IN THE FOLLOWING A PROGRAM IS DESCRIBED, THAT IS DESIGNED TO RETAIN ALL KINDS OF GOOD EVENTS.
THE REDUCTION FACTOR OF THIS PROGRAM, C:A 30 %, IS QUITE MODEST. THIS IS MAINLY DUE TO THE RELAXATION OF ORIGINALLY MUCH HARDER CUTS, IN ORDER TO RETAIN BACKGROUND EVENTS. STILL, THE ORIGINAL NR OF REDUC1 TAPES IS BROUGHT DOWN BY A FACTOR THREE.

THE PROGRAM IS BUILT UP IN A WAY SIMILAR TO THE STANDARD REDUC1 PROGRAM. THUS IS SETS WRITE FLAGS, SEPARATES EVENTS INTO CLASSES ACCORDING TO TRACK LENGTH AND TRANSVERSE MOMENTUM,ETC.. IN ADDITION, SELECTION CUTS ARE ALSO BASED ON TIME OF FLIGHT CHECKS AND LEAD GLASS CLUSTER ANALYSIS. FURTHERMORE, HIGH ENERGY NEUTRAL EVENTS (WHICH ARE ALWAYS KEPT IN REDUC1) ARE ONLY ACCEPTED IF THEY FULFIL A MINIMAL MOMENTUM BALANCE.

THE FLOW CHART OF THE PROGRAM IN SHOWN IN FIG.1. THE POINTS WHICH ARE MARKED W INDICATE SUCCESSFUL EVENT SELECTION, THE POINTS MARKED REJ. INDICATE REJECTION POINTS. THE VARIOUS STEPS OF THE PROGRAM ARE COMMENTED IN THE FOLLOWING.

1. DATA CHECK. RUNS WHICH CONTAIN "NONBEAM" DATA, E.G. COSMIC RUNS OR CALIBRATION RUNS (SUCH RUNS SOMETIMES GET MIXED IN WITH NORMAL DATA IN THE REDUC1 STEP) ARE REJECTED, USING THE SUBROUTINE RDATA.

2. TRIGGER CHECK. THIS STEP IS OPTIONAL, LIKE THE REDUC1 STEP LATER ON. IT PROVIDES THE POSSIBILITY OF REPEATING THE REDUC1 STEP ON DATA WHICH HAS NOT PASSED THE LATEST VERSION OF THE REDUC1 PROGRAM. FOR TIME REASONS, THE SUBROUTINE TRGCHK IS CALLED AT AN EARLY POINT, WHILE THE REST OF THE REDUC1 PROGRAM (WHICH REQUIRES PATTERN RECOGNITION) IS CALLED LATER.

3. PURE LUMITRIGGERS ARE REJECTED IF ETOT (TOTAL LEAD GLASS ENERGY) IS < 100 MEV.

4. OVERFLOW EVENTS ARE REJECTED IF THEY CONTAIN > 1200 HITS IN THE INNER DETECTOR AND < 500 MEV LEAD GLASS ENERGY. MOREOVER, OVERFLOW EVENTS WHICH FLOW OVER BECAUSE OF MANY FIRED LEAD GLASS BLOCKS IN THE BANK ALGL, WHICH ARE THEN KILLED IN THE "BAD LEAD GLASS" STEP, ARE NOT CONSIDERED AS OVERFLOW EVENTS IN THE FOLLOWING SETTING OF THE WRITE FLAG.

5. THE WRITE FLAG IWRT IS COMPUTED WITH THE STATEMENTS:

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IWRT=1
IF(IAC.EQ.0.AND.IFLW.EQ.0.AND.(IFTG.LT.11.OR ETOT.LT.100)) IWRT=0
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WITH

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IFLW = 1     IF OVERFLOW EVENT, OTHERWISE  IFLW = 0
IFTG > 10    IF TAGGED EVENT, OTHERWISE IFTG < 11
IAC = 1      IF  ETOT > 7000 MEV
        OR   IF  ECYL > 3500 MEV   ECYL=ENERGY IN BARREL
        OR   IF  ECAP1 > 4000 MEV AND ECAP2 > 500 MEV
        OR   IF  ECAP2 > 4000 MEV AND ECAP1 > 500 MEV
IAC = 0 IF ALL ENERGY IN ONLY ONE ENDCAP BLOCK  (>5000 MEV)
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THE WRITE FLAG IS USED TO WRITE THE EVENT EVEN IF IT FAILS LATER CHECKS. EXCEPTIONS ARE NEUTRAL EVENTS AND SOME CASES OF COSMIC SHOWERS, SEE BELOW AT POINTS 10 & 20.

6. EVENTS WITH Z-VERTEX OUTSIDE 350 MM AND Z-VERTEX QUALITY FLAG > 1 ARE REJECTED IF IWRT = 0. THIS IS THE SAME CUT AS THE PRESENT REDUC1 CUT. EARLY DATA HAD A REDUC1 CUT FOR Z-VERTEX OUTSIDE 450 MM.

7. THE REDUC1 STEP, SEE UNDER POINT 2. THE STEP IS PERFORMED WITH HELP OF THE SUBROUTINE REDONE, WHICH IS DESCRIBED IN A SEPARATE JADE COMPUTER NOTE (NR 42).

8. A DIVISION IS MADE FOR EVENTS WITH AND WITHOUT CHARGED TRACKS. WHILE NEUTRAL EVENTS ARE PASSED ON TO CLUSTER ANALYSIS, EVENTS WITH CHARGED TRACKS ARE PASSED THROUGH A SERIES OF TRACK CHECKS. NEUTRAL TAGGED EVENTS ARE WRITTEN HERE WITHOUT FURTHER CHECKS.

C H A R G E D T R A C K C H E C K S:

9. TAGGED EVENTS WITH ONLY ONE TRACK ARE WRITTEN DIRECTLY.

10. EVENTS WITH THE WRITE FLAG IWRT=1 ARE NOW WRITTEN, WITH EXCEPTION OF EVENTS WITH A GOOD Z-VERTEX OUTSIDE 200 MM, AND WITH > 95 % OF THE LEAD GLASS ENERGY IN THE BARREL. SUCH EVENTS ARE PASSED THROUGH THE FOLLOWING TRACK CHECKS.

11. EVENTS ARE NOW SPLIT INTO TWO CLASSES, ISTAR = 0 AND ISTAR = 1. FOR ISTAR = 1 EVENTS, AT LEAST ONE GOOD TRACK MUST EXIST. A GOOD TRACK HAS > 16 HITS IN EITHER R-FI OR R-Z FITS, AND HAS A CURVATURE WHICH IS < 0.00135 (CORRESPONDS TO 100 MEV TRANSVERSE MOMENTUM)

12. ONLY ISTAR = 1 EVENTS ARE CONSIDERED FOR FURTHER TRACK CHECKS. EVENTS WITHOUT GOOD TRACKS ARE PASSED ON TO THE CLUSTER ANALYSIS. FOR ISTAR = 1 EVENTS NOW TWO RATIOS ARE COMPUTED:
RATIO1 = ICNTR / IGODTR RATIO2 = ICNTS / IGODTR
WITH IGODTR = NR. OF GOOD TRACKS
ICNTR = NR OF GOOD TRACKS WHICH ORIGINATE INSIDE THE FIDUCIAL CYLINDER WITH Z < +-200 MM, R < 30 MM.
ICNTS = NR OF GOOD TRACKS WHICH ORIGINATE INSIDE THE FIDUCIAL CYLINDER WITH Z < +-200 MM, R < 10 MM.

13. THE ISTAR=1 EVENTS ARE NOW SPLIT INTO TWO CLASSES, THOSE WITH RATIO1 > .2 AND THOSE WITH RATIO1 < .2; EVENTS WITH 2 OR 3 TRACKS ARE PASSED ON TO THE FOLLOWING COLLINEARITY CHECK REGARDLESS OF THIS SEPARATION.

14. EVENTS WITH RATIO < .2 ARE SUBJECTED TO TWO CHECKS, DESIGNED TO REJECT COSMIC SHOWERS, AND IF NOT REJECTED ARE THEN PASSED ON TO THE CLUSTER ANALYSIS.

15. EVENTS WITH RATIO > .2 AND NR OF TRACKS < 1 OR > 3 ARE WRITTEN.

16. EVENTS WITH NR. OF TRACKS = 2 OR 3 ARE TESTED FOR COLLINEARITY IN THE THETA ANGLE. IF TRACKS ARE COLLINEAR WITHIN 14 DEG. (.25 RAD) THE EVENT IS CONSIDERED FOR TIME OF FLIGHT CHECK. IF NOT, EVENTS WITH RATIO1 > .2 ARE WRITTEN, OTHERWISE PASSED ON TO THE CLUSTER ANALYSIS.

17. COLLINEAR EVENTS WITH ETOT < 800 MEV ARE SUBJECTED TO A TIME OF FLIGHT ANALYSIS, USING THE SUBROUTINES CORLAR,TOFSMP AND TOFCHK. THE RESULTING QUANTITIES, TOFDIF AND TOFSUM ARE CUT WITH:
TOFDIF > 5.5 AND (TOFSUM.GT.30. OR TOFSUM.LT.-20) --> COSMIC
(SEE FIGUR 2.)
COSMICS ARE REJECTED.
TO BE WRITTEN, REMAINING EVENTS ARE REQUIRED TO HAVE RATIO2 > 0.
IF NOT, THEY ARE REJECTED.

C L U S T E R C H E C K, FOR NEUTRALS AND FAILING TRACK CHECK EVENTS

18. THE BANK 'LGCL' IS REQUIRED TO EXIST AND HAVE ERROR FLAG = 0.

19. IF ONLY ONE CLUSTER EXISTS, THE EVENTS ARE REJECTED IF THE ENERGY IN THE ENDCAPS IS < 50 MEV. THESE ARE EVENTS WITH A COSMIC IN THE LEAD GLASS BARREL (AND POSSIBLY ALSO EVENTS OF TYPE EE --> GAMMA + 2 NEUTRINOS).
OTHERWISE 1-CLUSTER EVENTS ARE WRITTEN.

20. NEUTRAL EVENTS ARE SUBJECTED TO SPECIAL TESTS:
A. IF THE INNER DETECTOR HAS > 1000 HITS (SUCH EVENTS EXIST), THE EVENT IS REJECTED.
B. A MINIMUM ENERGY BALANCE IS REQUIRED USING THE SUBROUTINE HWORLD 12 DIFFERENT HALF-WORLDS IN THE LEADGLASS SYSTEM ARE CONSIDERED. A HALF-WORLD CONSISTS OF ALL BLOCKS BETWEEN FI1 AND FI1 + PI, INCLUDING ENDCAPS. A HALFWORLD IS EMPTY IF ITS ENERGY IS < 50 MEV.
EVENTS ARE REJECTED IF THEY HAVE > 1 EMPTY HALF-WORLD OR IF THE RATIO BETWEEN OPPOSITE HALF-WORLDS IS < .05.

21. NEUTRAL EVENTS WITH < 10 CLUSTERS AND ETOT < 3*EBEAM ARE WRITTEN.

22. ALL REMAINING EVENTS ARE CHECKED FOR COLLINEAR CLUSTERS. THIS IS MAINLY TO INSURE THAT GOOD COLLINEAR TWOPRONGS ARE NOT LOST BECAUSE OF FAILING INNER DETECTOR OR FAULTY PATTERN RECOGNITION.
COLLINEARITY IS DEFINED BY
DELTA(FI) < .20 RAD, DELTA(Z) < 500 MM IN THE BARREL.
DELTA(X),DELTA(Y) < 350 MM IN THE ENDCAPS.
FOR NEUTRAL EVENTS, THE TWO COLLINEAR CLUSTERS ARE REQUIRED TO CONTAIN > 7 % OF THE TOTAL ENERGY.
EVENTS WITH NO COLLINEARS FOUND ARE REJECTED.

23. IF THE COLLINEAR EVENT CONTAINS 3-7 TRACKS, HAS ETOT < 800 MEV AND IS CLASSIFIED AS ISTAR = 1, THE EVENT IS PASSED ON TO TIME-OF-FLIGHT ANALYSIS, SEE ABOVE. THIS IS TO AVOID FEWPRONG COSMICS NOT CONSIDERED PREVIOUSLY, OR EVENTS WHERE PATTERN RECOGNITION HAS SPLIT TRACKS INTO SEVERAL NEW TRACKS.
REMAINING EVENTS ARE WRITTEN.

THE REDUC2 STEP IS STANDARDLY PERFORMED WITH THE REDUC1 TAPES AS INPUT. THE OUTPUT TAPES ARE FOUND IN THE DATA GENERATION GROUP

F11OLS.REDUCTWO.G00XXV00

A CATALOGUE OF THIS TAPES AND CORRESPONDING RUN NUMBERS AND BEAM ENERGIES CAN BE FOUND IN THE TEXT MEMBER

JADEPR.JADESR(REDUCTWO)

THE REDUC2 STEP CAN ALSO BE PERFORMED WITH A SIMPLE SUBROUTINE CALL.
THIS IS DESCRIBED IN JADE COMPUTER NOTE 42.

JADE COMPUTER NOTE 43
REDUC 2 FLOW CHART

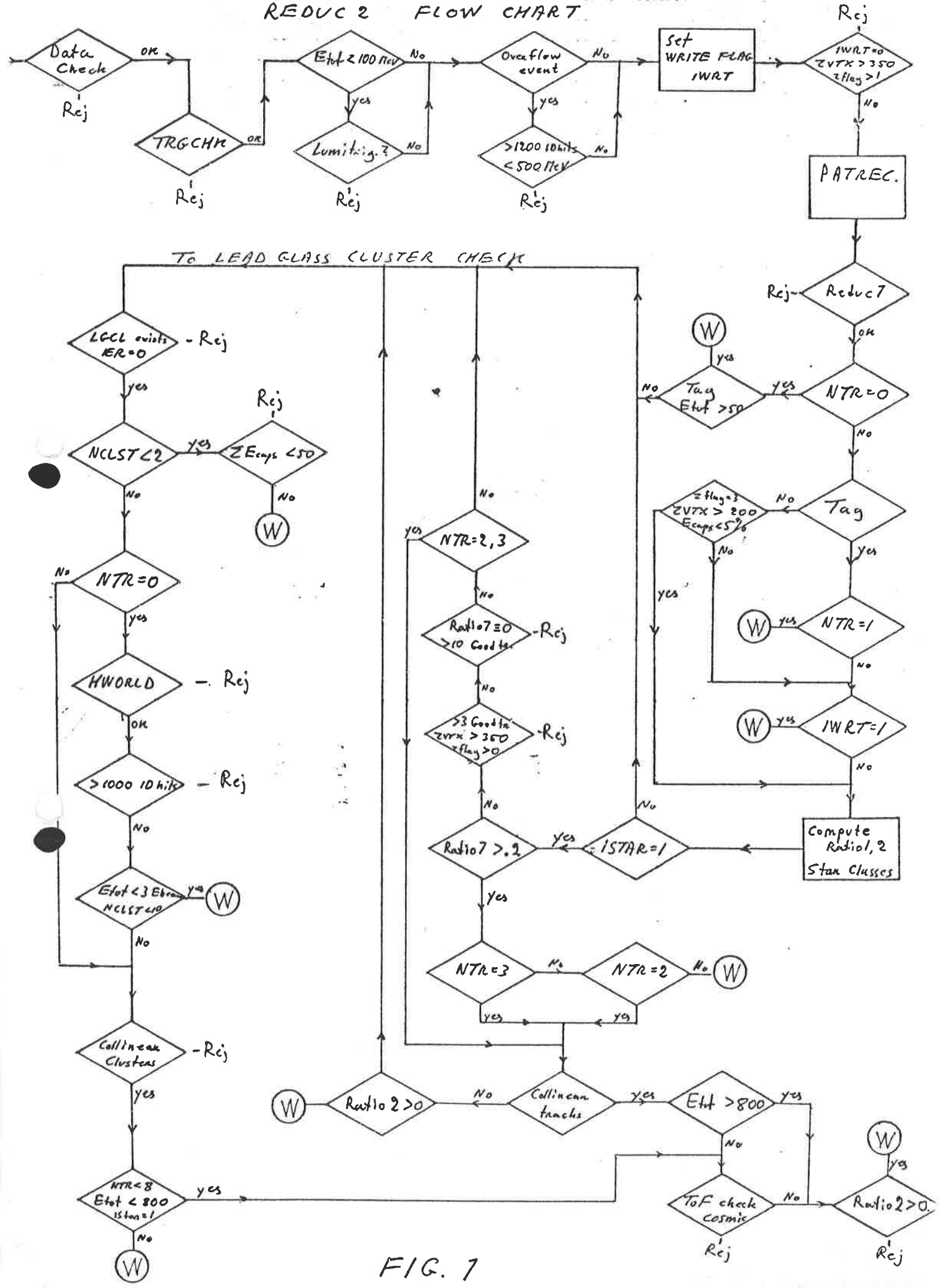

FIG. 1