



LONGEVITY OF HIGH DENSITY MAGNETIC MEDIA

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PRESENTATION OUTLINE

WHY THE STUDY WAS CONDUCTED?

WHAT WERE THE TECHNICAL AREAS STUDIED?

HOW THE MEASUREMENTS WERE MADE?

WHAT WERE THE FINDINGS OF THE WORK?

PURPOSE OF THE STUDY

EVALUATE HIGH DENSITY MAGNETIC TAPES AND
DETERMINE RELIABLE **ARCHIVAL MEDIA** FOR USE BY NARA

COMPARE AND CONTRAST PHYSICAL AND CHEMICAL
CHARACTERISTICS OF IBM 3590, DLT, SDLT TAPES

EFFECT OF **TEMPERATURE AND HUMIDITY** ON HIGH
DENSITY MAGNETIC MEDIA

COMPUTE **LIFE EXPECTANCIES** FOR THE TAPE TYPES

EXAMINE ERROR CORRECTION CAPABILITIES
FOR THE **TAPE DRIVES**

TECHNICAL STUDY AREAS

MICROSTRUCTURE ANALYSIS OF RECORDING MEDIA

INTRINSIC MAGNETIC PROPERTIES - MAGNETIC REMANENCE

BINDER HYDROLYSIS AND LUBRICANT STUDY

PHYSICAL PROPERTIES - RESISTIVITY AND FRICTION

RECORDING PROPERTY - RF AMPLITUDE CHANGES

TAPE ERROR CHANGES - ECC

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METHODS OF INVESTIGATION

TRANSMISSION ELECTRON MICROSCOPY

VIBRATING SAMPLE MAGNETOMETER

GAS CHROMATOGRAPHY MASS SPECTROMETRY

RF-AMPLITUDE RESPONSE TESTING SYSTEM

SOFTWARE TESTING TOOL FOR DATA ERROR PROFILING

STUDY CONDITIONS

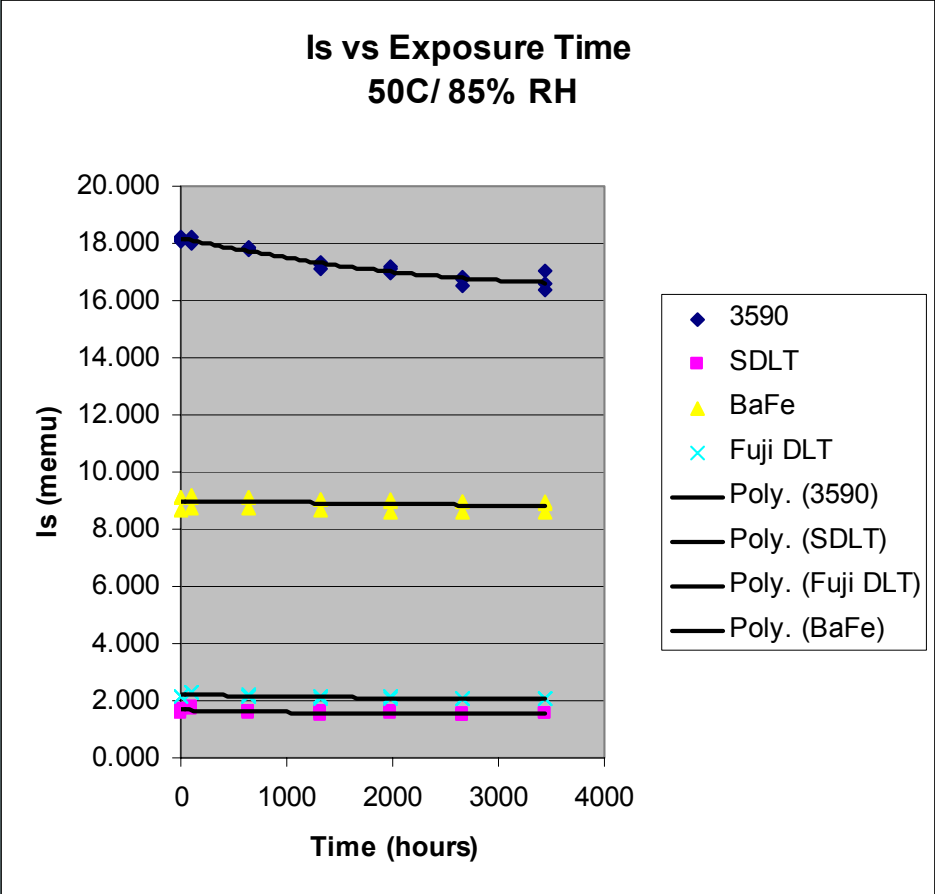
THREE DIFFERENT TEMPERATURE HUMIDITY CONDITIONS

40° C, 50% RH, 50° C, 75% RH, 50° C, 85% RH

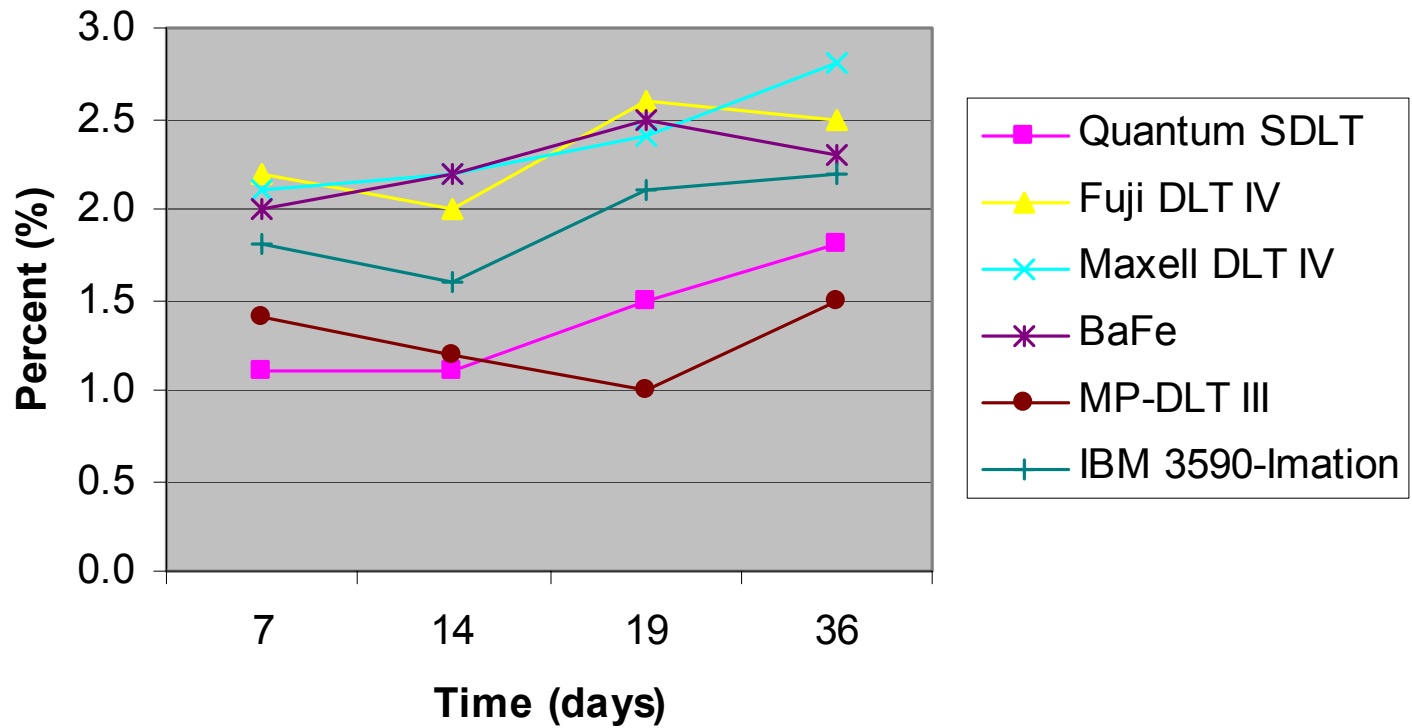
TOTAL TIME DURATION OF SAMPLING - **SIX MONTHS**

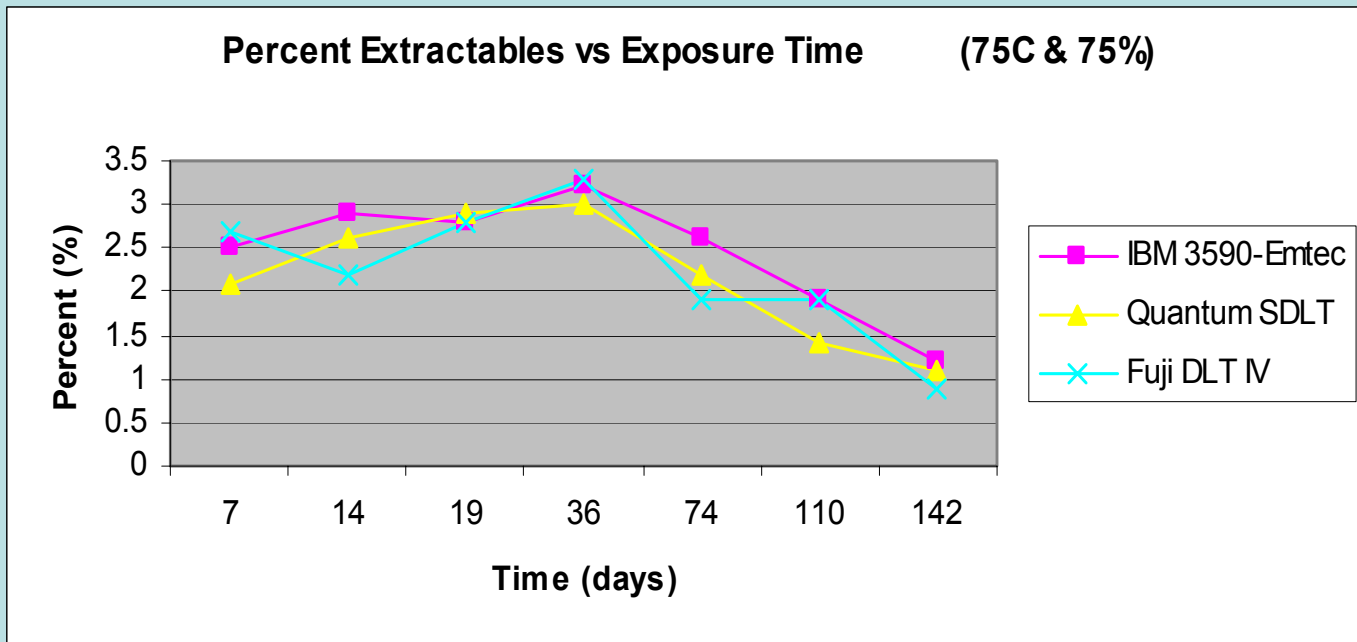
SAMPLING FREQUENCY VARIED BY EXPERIMENT

MAGNETIC STABILITY PREDICTIVE MODELING
(ARRHENIUS RELATIONSHIP)

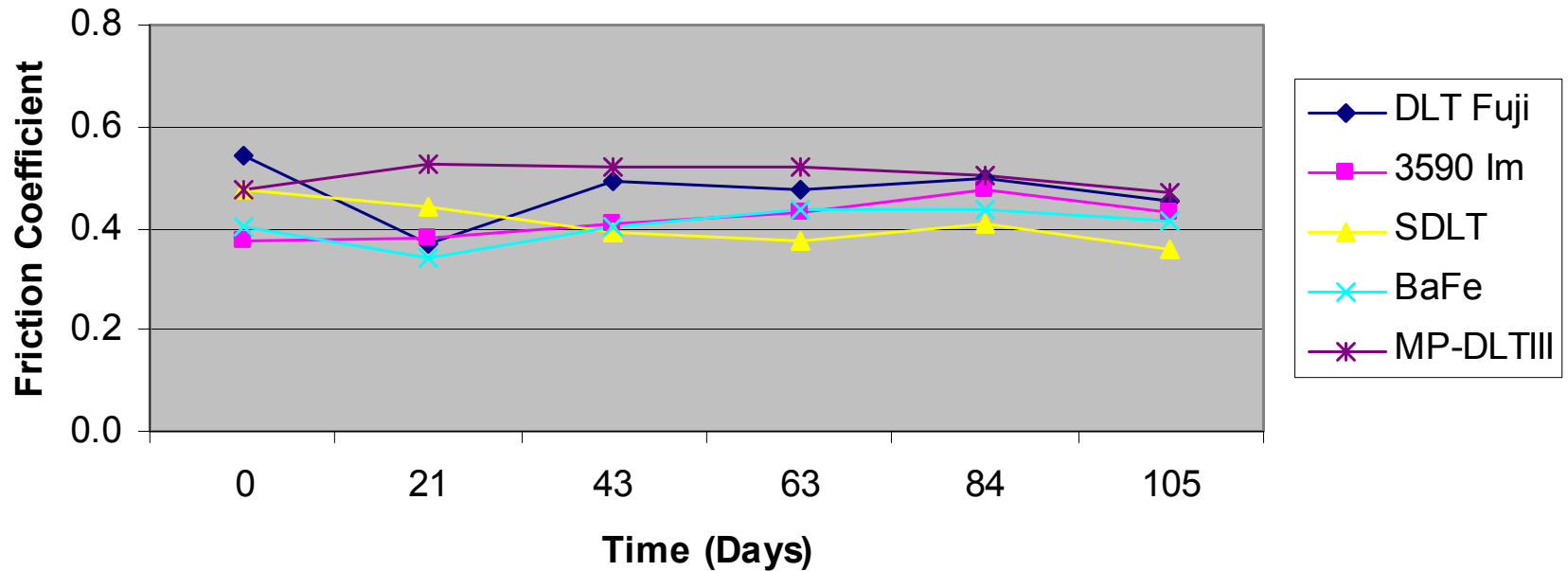


Percent Extractables vs Exposure Time 50 C & 54.5% RH

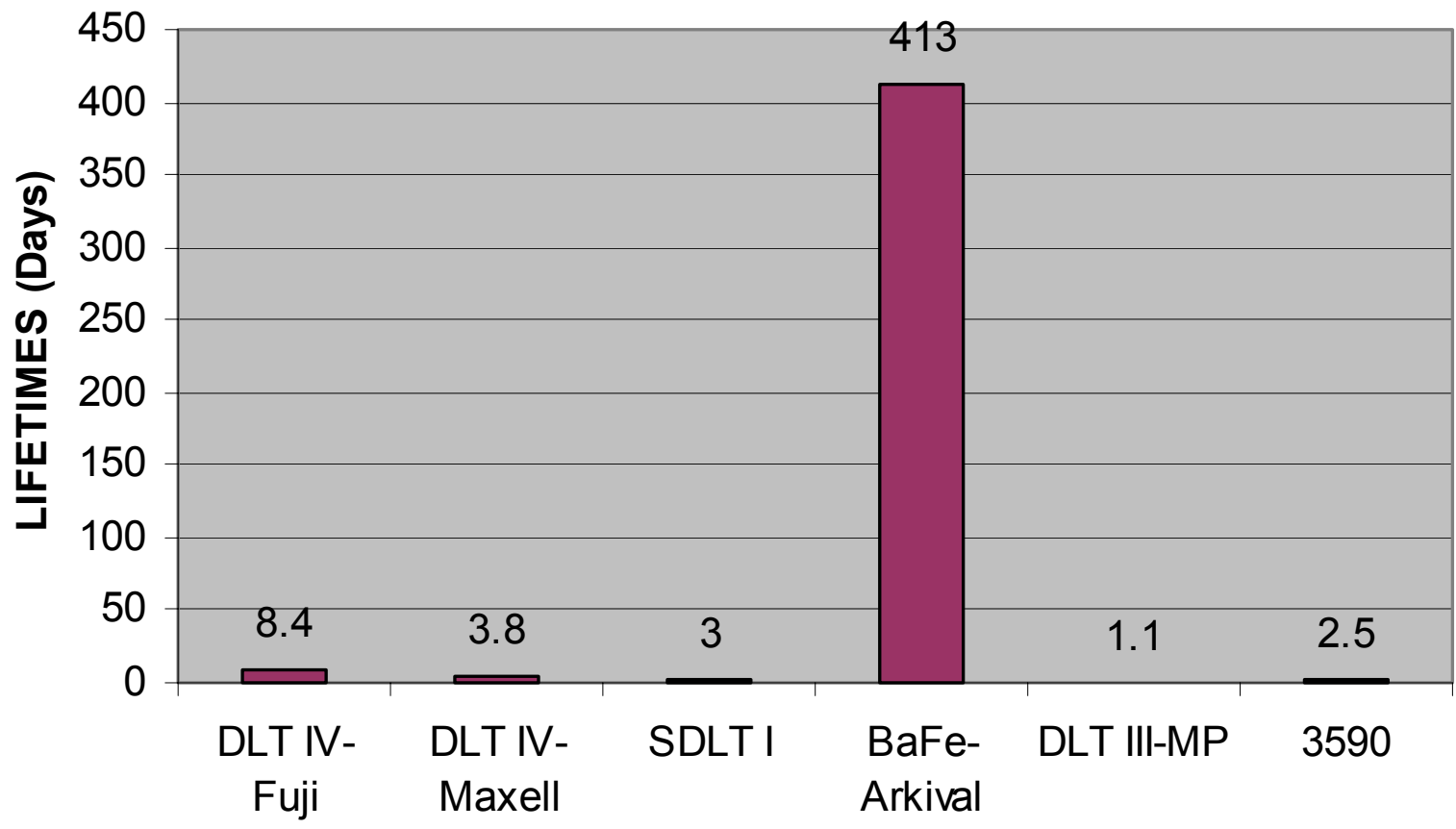




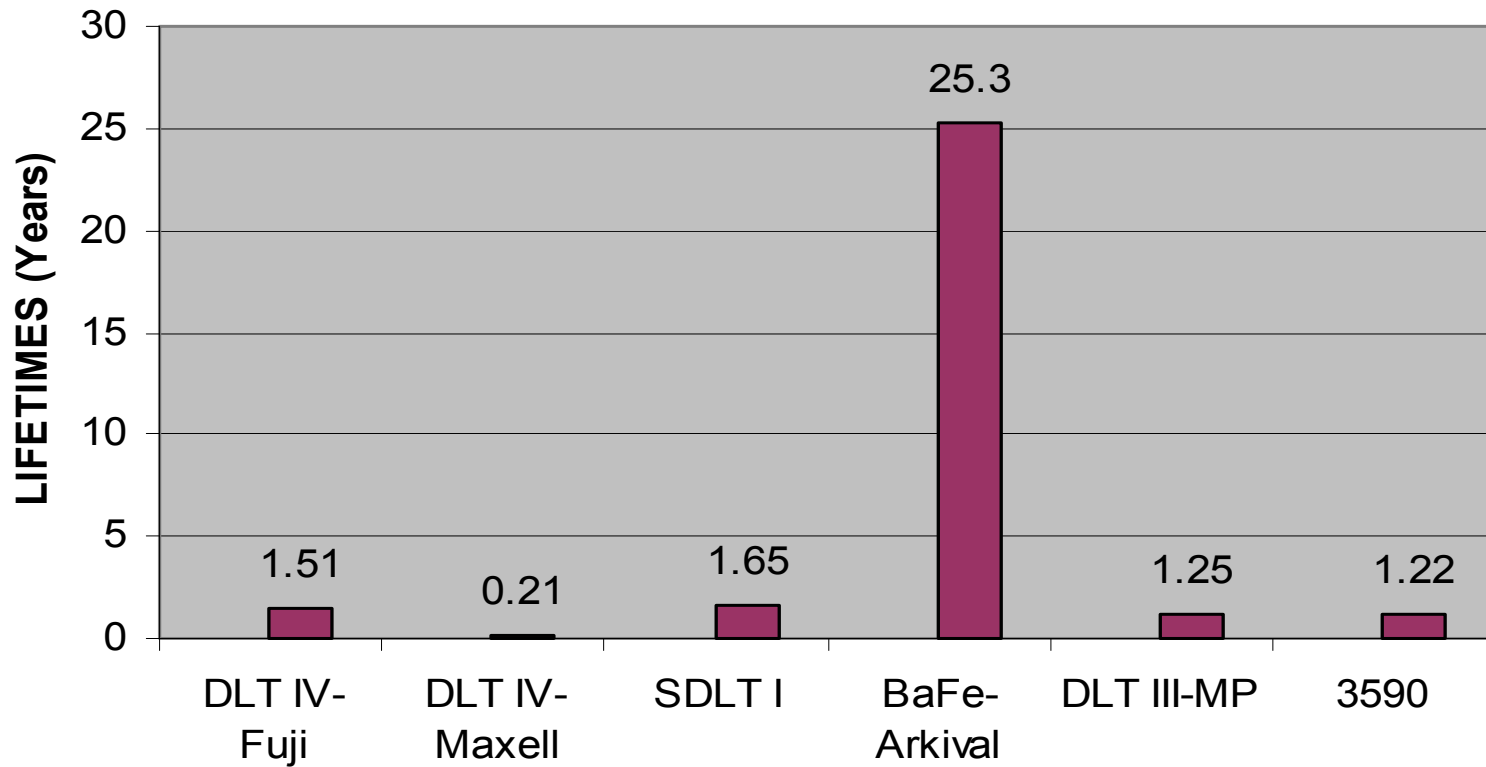
Comparative Friction Coefficient vs Time (50C/50% RH)



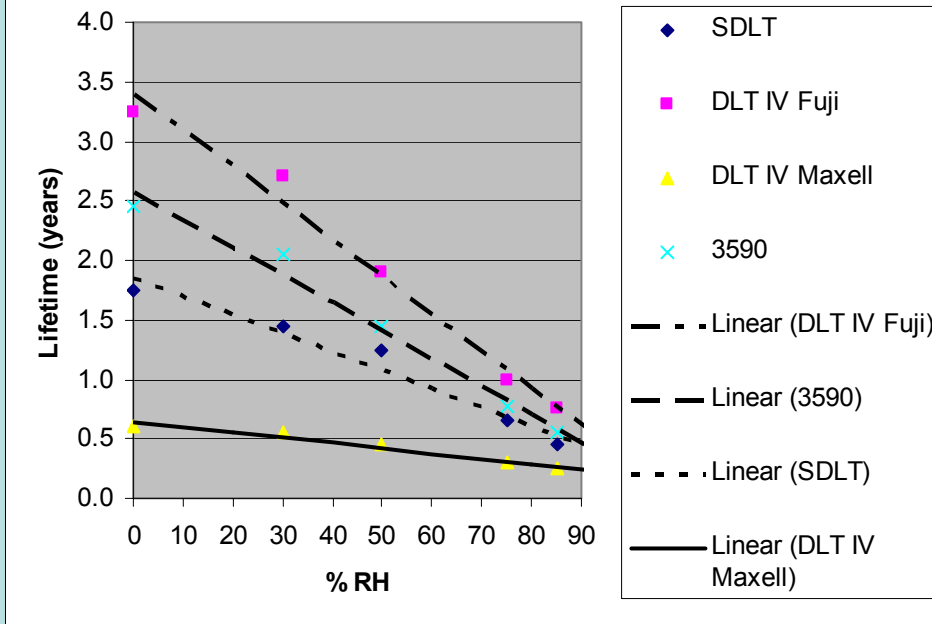
LIFE EXPECTANCIES 80C & 100% RH



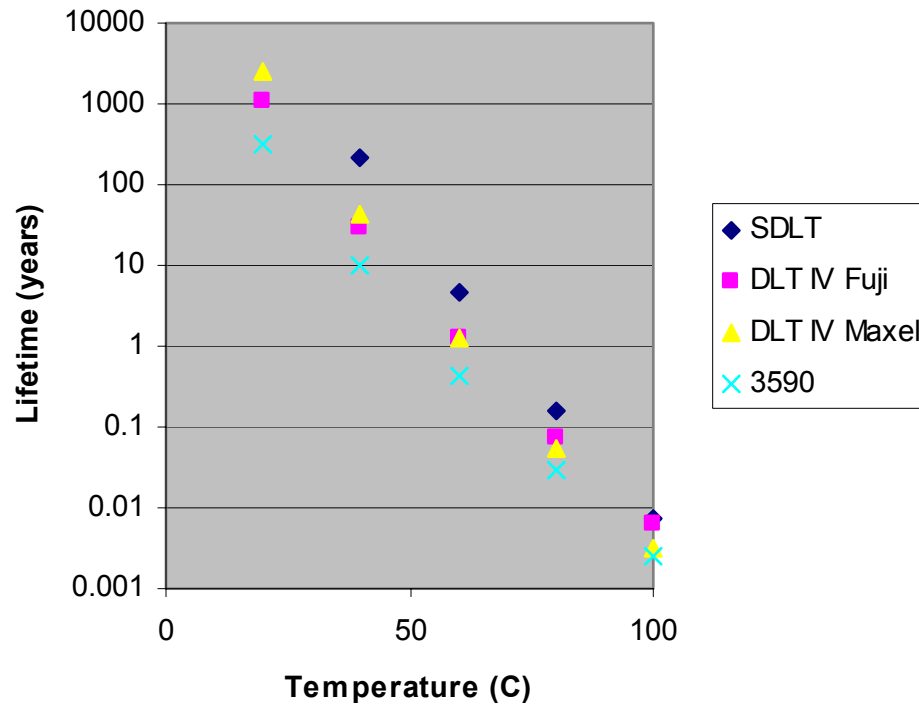
LIFE EXPECTANCIES 50C & 50% RH



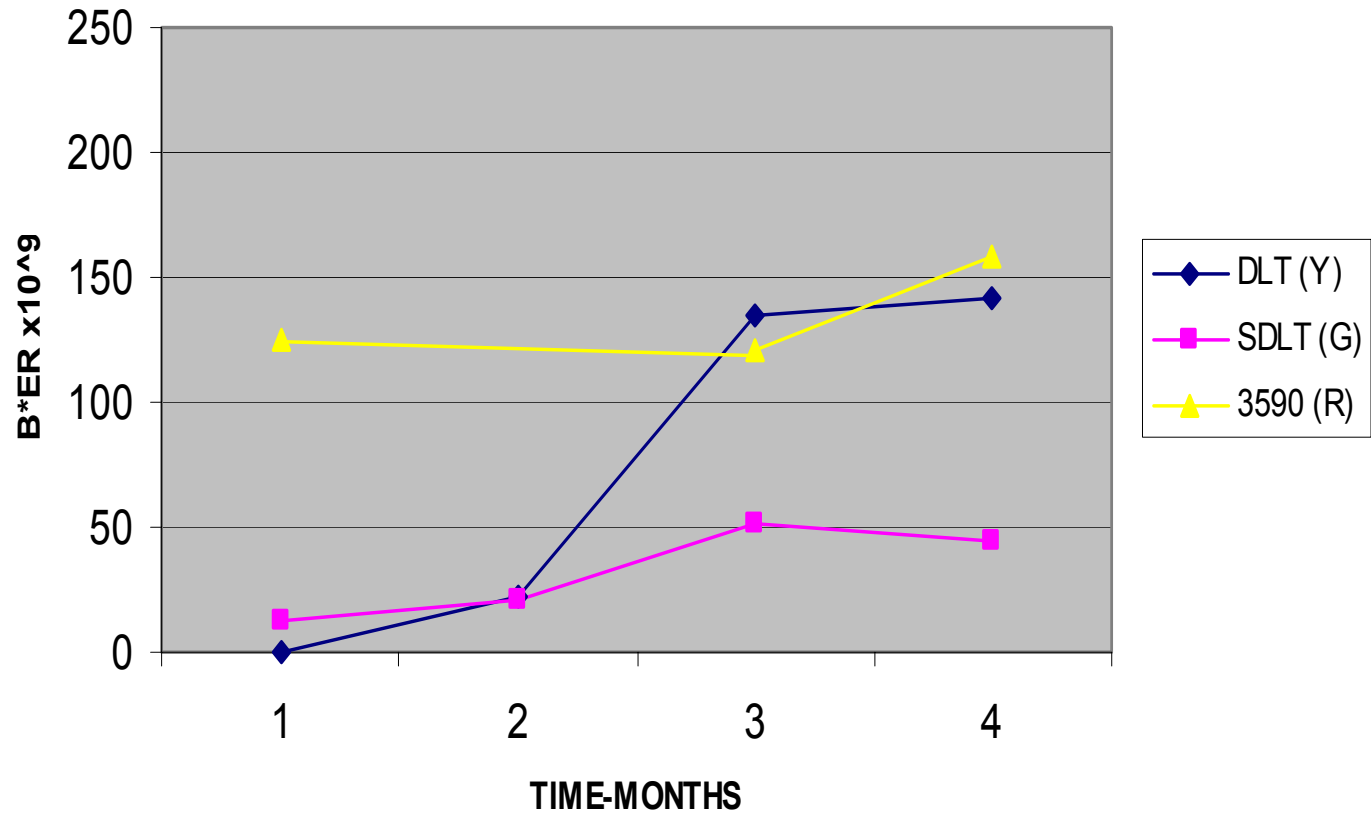
LIFE EXPECTANCIES 50C vs. RH



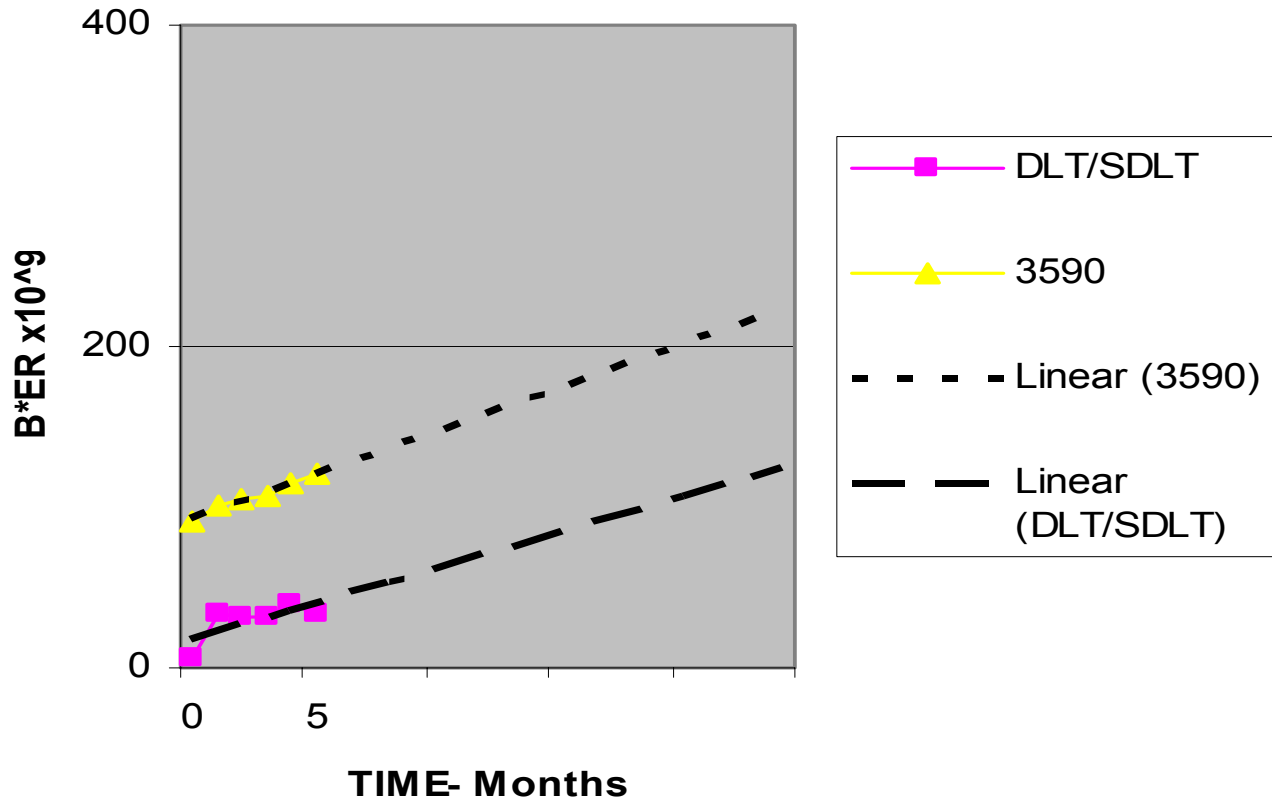
LE 30% RH vs TEMPERATURE
basis: Is-Saturation Magnetization



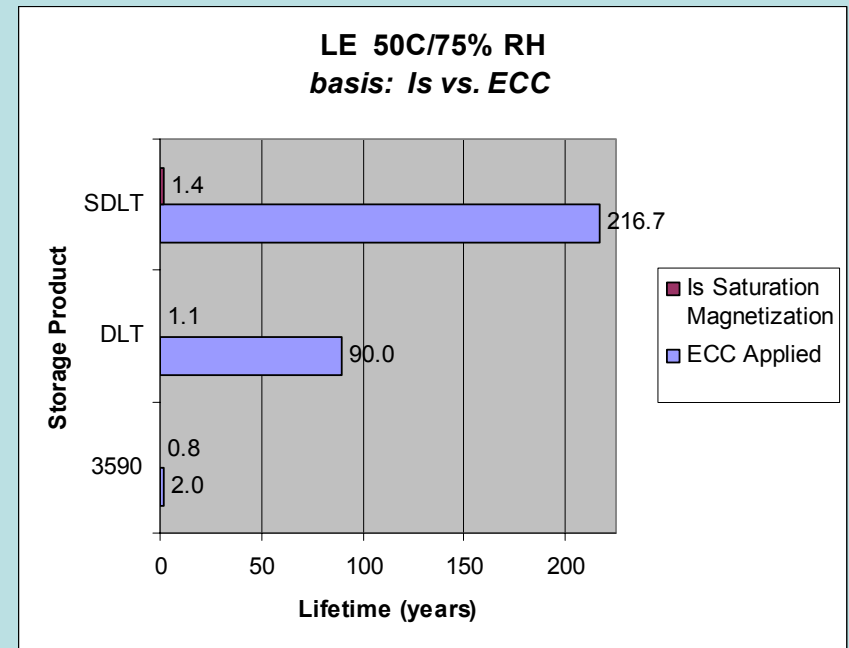
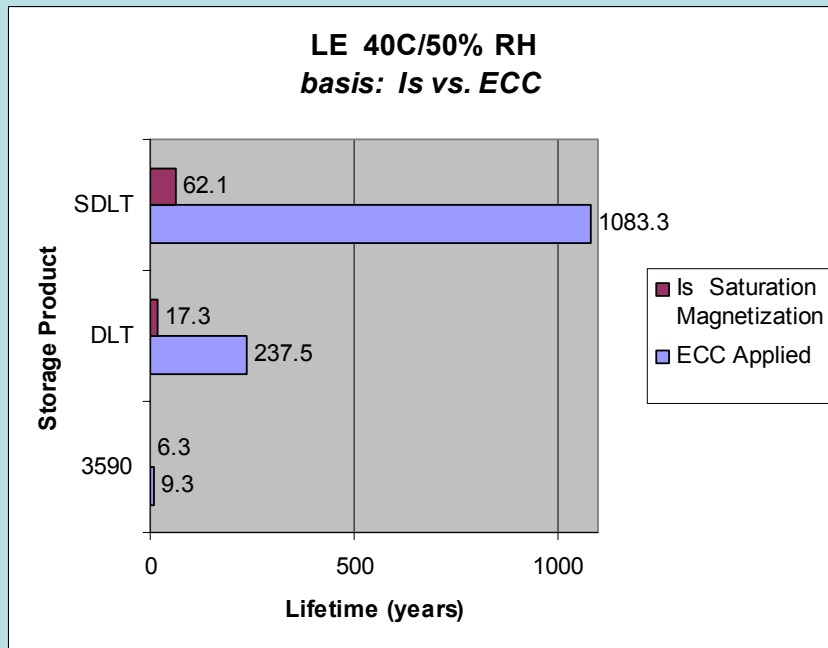
COMPARING MEDIA TYPES 50C/ 85% RH



LE PROJECTIONS 40C/ 50% RH



Two examples showing the LE projections using the Is projection and with ECC applied projection-
 note: all LE values decrease with higher temp and RH; The power of the ECC is obvious in all cases;
 the ECC efficiency is indicated by the difference in LE between products (best SDLT then DLT then
 3590)



SUMMARY

MAGNETIC REMANENCE CHANGES FOR HIGH DENSITY MEDIA DEPENDS ON IMPOSED ENVIRONMENTAL STRESS

MINIMUM BINDER HYDROLYSIS PRODUCTS OBSERVED FOR DLT(IV), SDLT, IBM 3590 TAPES

RESISTIVITY AND FRICTION COEFFICIENT CHANGES WERE WITHIN THE ISO/ECMA SPECIFICATIONS FOR THESE PRODUCTS

THREE ORDERS OF MAGNITUDE **DECREASE IN LIFE EXPECTANCY (LE)** FOR ALL TAPES WHEN TEMPERATURE INCREASED FROM **20 TO 40 CELSIUS** EVEN AT 30% RH

THREE ORDERS OF MAGNITUDE **DECREASE IN LE** WERE OBSERVED HUMIDITY INCREASED FROM **30 TO 75%** AT CONSTANT TEMPERATURE OF 20 CELSIUS

SUMMARY

LOWER READ AND WRITE ERROR RATES FOR DLT THAN IBM 3590 MEDIA DURING FIRST WRITE AND READ TESTING

CORRECTABLE ERRORS AND ERROR RATE INCREASED WITH INCREASING TEMPERATURE AND HUMIDITY

AT 50 C/75% RH, LE COMPUTED AFTER USING ECC, DLT(IV) - 16 YEARS, IBM 3590 - 10 YEARS

TAPE FAILURES AND DATA LOSSES OBSERVED IN ALL THREE STORAGE PRODUCT STUDIED

DLT(IV) AND SDLT TAPES SHOWED THE MOST STABLE PERFORMANCE UNDER THE CONDITIONS EXAMINED, MOST FAVORABLE ARCHIVAL STORAGE MEDIA

REFERENCES

Ron Weiss et.al., “Environmental Stability Study and Life Expectancies of Magnetic Media for Use with IBM 3590 and Quantum Digital Linear Tape Systems”. Final Report to the National Archives and Records Administration, Delivered by Arkival Technology Corporation, under contract requirement, NAMA-01-F-0061, 2002, PP 1-94,

John W.C. Van Bogart, “Media Stability Studies”. Final Report prepared by National Media Laboratory, PP 1-86, 1994.

Acknowledgement

National Archives and Records Administration

Contract - NAMA-01-F0061

And

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RESOURCES

Copies of the complete Report and Appendix for the study entitled, “Environmental Stability Study and Life Expectancies of Magnetic Media for Use with IBM 3590 and Quantum Digital Linear Tape Systems” are available in either a printed bound volume or CD.

Requests can be made to Arkival Technology at

NARAstudy@ARKIVAL.com