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8mm Video Tape Test

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I. Usage of 8mm Video Tape Media at Fermilab

In the past 2 years, Fermilab has added the 8mm magnetic tape media/technology to numerous computer systems for many reasons. The amount of storage space on an 8mm tape is equivalent to approximately fifteen 9 track tapes; each 8mm tape is 1/2 the cost of a 9 track tape. Therefore, the cost per byte on the 8mm tape is 1/30 of the 9 track media cost. By using 8mm tapes, operator assisted tape mountings are reduced, physical storage space is reduced, and transportation/shipping is simplified. In addition, the 8mm tape hardware is relatively inexpensive.

For the 1988/1989 collider run, CDF used approximately 2400 8mm tapes for RAW and analyzed data and distributed more than 5000 copies of these tapes. Since CDF plans to use 8mm tapes almost exclusively for the 1991 collider run, it is important to have some idea of the long term readability and reliability of these media. This memo describes the testing of 10 **SONY** and 10 **FUJI** 8mm Video tapes.

II. 8mm Video Tape Format and Test Procedures

CDF data tapes are **ANSI** standard file structured, labeled format. For this test, 10 **SONY P6-120MP** video tapes and 10 **FUJI P6-120** video tapes were created in this format and subjected to multiple reads. In addition, a few tapes were subjected to a simple accelerated aging test.

The tapes were created with 9 files on each tape, containing 840,000 records for a total of 1.7 GBytes. These files occupied 75% of the tape's capacity. See table "C" for detailed information on the creation of the test tapes. The Fermilab 8mm tape copy facility was used to create the test tapes.

The tapes were read on the CDF LAVC using **VAX 3100's** and **3200's** equipped with **EXABYTE EXB-8200** cartridge tape drives. A VMS copy was used to read each tape 100 to 150 times on each of two different tape drives to verify that results were not drive related. Each tape was mounted, copied to a null device, dismounted, remounted and then copied again. This was performed via a batch job and continued 24 hours a day until completion. There was also a log file created that showed the status of each record copied. This process typically took 10 to 15 days per tape per drive.

Table "A" shows the successful number of copies and number of failures of each test tape. A **SUCCESSFUL** copy means that there were **NO** errors detected during the complete copy of all nine files on each tape to a null device. A **FAILURE** means that there was at least one error detected during the copy process. The usual process for a tape failure was an intermittent parity error on a single file. With repeated readings, the intermittent failures often turned into hard failures. Hard failures continued even when the tape was switched to another drive. See Table "B" for a shortened view of this process.

Five tapes that completed the testing with zero errors were then put into the trunk of a car for two months (7-30-90 through 9-30-90) to subject them to temperature changes from 50 degrees F. to 120+ degrees F. in hopes of accelerating the aging process. These tapes were then re-tested.

III. Tape Drive Information

During the course of this project, seven different 8mm tape drives were used for the read test. None of the tape drives were cleaned before or during the test. Tape drive CDF25\$MKB500 failed about half way through the project and had to be replaced. All other tape drives caused no significant problems.

Occasional soft tape drive errors did show up during the testing. One was **SYSTEM-F-TAPEPOSLOST**, magnetic tape position lost, and the other was **SYSTEM-F-ILLIOFUNC**, illegal I/O function code. CDF experience shows that these two specific errors do not correlate with problems on the tape media. Although these errors are reported as failures in the results, they have been annotated as soft errors.

IV. Results

During the entire testing procedure the **FUJI** tapes were consistently readable. See tables "A" and "B". There was one read parity error on one file on **FUJI08**. This error did not reproduce. **FUJI09** had one read failure in approximately 150 successful copies and then had one file fail intermittently with a parity error for the rest of the test. The retesting of three tapes subjected to the temperature swing produced no tape media related errors.

The **SONY** tapes were a completely different story. Only four **SONY** tapes copied successfully. All the rest had tape errors ranging from one single "file read parity error" all the way to total failure. The retesting of two tapes subjected to the temperature swing failed with parity errors. If the **SONY** tapes are marginal, then this temperature variation may have pushed them over the edge from success to failure.

Table A

Tape Copy Success and Failure

<u>Tape</u>	<u>Success</u> <u>1st Drive</u>	<u>Failure</u> <u>1st Drive</u>	<u>Success</u> <u>2nd Drive</u>	<u>Failure</u> <u>2nd Drive</u>
Sony01	160	0	130	0
Sony02	62	49	2	32
Sony03	0	23	0	10
Sony04	100	0	111	0
Sony05	67	13	28	45
Sony06	24	21	0	16
Sony07	111	0	108	1
Sony08	110	0	73	64
Sony09	118	0	116	2*
Sony10	112	8*	110	1*
Fuji01	136	0	127	0
Fuji02	127	0	144	0
Fuji03	130	0	133	0
Fuji04	158	0	118	0
Fuji05	150	0	117	1*
Fuji06	129	0	110	0
Fuji07	103	2*	110	0
Fuji08	113	0	104	1
Fuji09	100	2	91	28
Fuji10	117	0	116	0

ReTest Portion - (Tapes Stored in Trunk)

Sony01	74	33
Sony04	1	25
Fuji01	107	0
Fuji02	101	4*
Fuji03	104	0

* Soft Drive Related Errors

Table B

Below is a brief description of each test tape on each tape drive.

<u>Test Tape</u>	<u>Tape Drive</u>	<u>Actual Drive</u>	<u>Comments</u>
Sony01	1st. Drive	CDF23\$MKB500:	Successful copy - No errors
Sony01	2nd. Drive	CDF25\$MKB500:	Successful copy - No errors
Sony02	1st. Drive	CDF25\$MKB500:	Copied successfully, then failed intermittently, then failed totally
Sony02	2nd. Drive	CDF23\$MKB500:	Two successful copies, then total failure
Sony03	1st. Drive	CDF25\$MKB500:	Total failure
Sony03	2nd. Drive	CDF23\$MKB500:	Total failure
Sony04	1st. Drive	CDF23\$MKB500:	Successful copy - No errors
Sony04	2nd. Drive	CDF25\$MKB500:	Successful copy - No errors
Sony05	1st. Drive	CDF25\$MKB500:	Copied successfully, then failed intermittently
Sony05	2nd. Drive	CDF23\$MKB500:	Failed intermittently, then failed totally
Sony06	1st. Drive	CDF23\$MKB500:	Copied successfully, then failed intermittently, then failed totally
Sony06	2nd. Drive	CDF25\$KMB500:	Total failure
Sony07	1st. Drive	CDF23\$MKB500:	Successful copy - No errors
Sony07	2nd. Drive	CDF25\$MKB500:	Copied successfully except for one failure
Sony08	1st. Drive	CDF25\$MKB500:	Successful copy - No errors
Sony08	2nd. Drive	CDF23\$MKB500:	Copied successfully, then failed intermittently, then failed totally
Sony09	1st. Drive	CDF01\$MUB0:	Successful copy - No errors
Sony09	2nd. Drive	CDF01\$MUB1:	Two failures, but the log file implies both were drive related

Table B (Continuation)

<u>Test Tape</u>	<u>Tape Drive</u>	<u>Actual Drive</u>	<u>Comments</u>
Sony10	1st. Drive	CDF01\$MUB1:	Copied successfully, then failed intermittently, but the log file implies failures were system related
Sony10	2nd. Drive	CDF23\$MKB500:	One failure, but the log file implies a drive related error
Fuji01	1st. Drive	CDF23\$MKB500:	Successful copy - No errors
Fuji01	2nd. Drive	CDF25\$MKB500:	Successful copy - No errors
Fuji02	1st. Drive	CDF23\$MKB500:	Successful copy - No errors
Fuji02	2nd. Drive	CDF25\$MKB500:	Successful copy - No errors
Fuji03	1st. Drive	CDF23\$MKB500:	Successful copy - No errors
Fuji03	2nd. Drive	CDF25\$MKB500:	Successful copy - No errors
Fuji04	1st. Drive	CDF23\$MKB500:	Successful copy - No errors
Fuji04	2nd. Drive	CDF01\$MUB0:	Successful copy - No errors
Fuji05	1st. Drive	CDF27\$MKB500:	Successful copy - No errors
Fuji05	2nd. Drive	CDF01\$MUB1:	One failure, but the log file implies a tape drive error
Fuji06	1st. Drive	CDF01\$MUB0:	Successful copy - No errors
Fuji06	2nd. Drive	CDF01\$MUB0:	Successful copy - No errors
Fuji07	1st. Drive	CDF01\$MUB1:	Two failures, but the log file implies both were drive related
Fuji07	2nd. Drive	CDF01\$MUB1:	Successful copy - No errors
Fuji08	1st. Drive	CDF23\$MKB500:	Successful copy - No errors
Fuji08	2nd. Drive	CDF25\$MKB500:	Copied successfully except for one failure
Fuji09	1st. Drive	CDF01\$MUB0:	Two failures, but the log file implies one was drive related and the other tape related
Fuji09	2nd. Drive	CDF01\$MUB1:	28 intermittent failures
Fuji10	1st. Drive	CDF01\$MUB1:	Successful copy - No errors
Fuji10	2nd. Drive	CDF01\$MUB0:	Successful copy - No errors

Table B - Retest Portion - (Tapes Stored in Trunk)

<u>Test Tape</u>	<u>Tape Drive</u>	<u>Actual Drive</u>	<u>Comments</u>
Sony01	1st. Drive	CDF01\$MUB0:	Copied successfully, then failed intermittently
Sony04	1st. Drive	CDF25\$MKB500:	One successful copy, then 24 failures
Fuji01	1st. Drive	CDF25\$MKB500:	Successful copy - No errors
Fuji02	1st. Drive	CDF01\$MUB1:	Four failures, but the log file implies they were drive related
Fuji03	1st. Drive	CDF01\$MUB1:	Successful copy - No errors

Table C

8mm Test Tape Creation Information

<u>Tape</u>	<u>Creation Date</u>	<u>Copy System</u>	(Test Tapes) <u>Write Drives</u>	(Original tape) <u>Read Drives</u>
SONY01	4-16-90	FNTAPE	MUA2:	MUA0:
SONY02	4-16-90	FNTAPE	MUB0:	MUA0:
SONY03	4-16-90	FNTAPE	MUB1:	MUA0:
SONY04	4-16-90	FNTAPE	MUB2:	MUA0:
SONY05	6-29-90	FNTAPA	MUA2:	MUA1:
SONY06	6-29-90	FNTAPA	MUB0:	MUA1:
SONY07	6-29-90	FNTAPA	MUB1:	MUA1:
SONY08	6-29-90	FNTAPA	MUA2:	MUA1:
SONY09	6-29-90	FNTAPA	MUB0:	MUA1:
SONY10	6-29-90	FNTAPA	MUB1:	MUA1:
FUJI01	4-14-90	FNTAPA	MUA1:	MUA0:
FUJI02	4-14-90	FNTAPA	MUA2:	MUA0:
FUJI03	4-14-90	FNTAPA	MUB0:	MUA0:
FUJI04	4-14-90	FNTAPA	MUB2:	MUA0:
FUJI05	6-27-90	FNTAPE	MUA2:	MUA1:
FUJI06	6-27-90	FNTAPE	MUB0:	MUA1:
FUJI07	6-27-90	FNTAPE	MUB1:	MUA1:
FUJI08	6-29-90	FNTAPA	MUA2:	MUA1:
FUJI09	6-29-90	FNTAPA	MUB0:	MUA1:
FUJI10	6-29-90	FNTAPA	MUB1:	MUA1: