Attachment A
TGN-94
Version 2.1
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Specification of Input Cable Assemblies for the CDF Level 1 Calorimeter Trigger Upgrade

Revision for 2.1: both ends of cable have ground shield connected to connector shell. (Section 3.2)

1 Introduction

This note specifies the cable assemblies which will be used to send data from the calorimeter front-end boards to the Level 1 Calorimeter trigger in Run II. These cables are hereafter referred to as **Level 1 Cables**.

The Level 1 cables consist of a 10 twisted pair cable with an overall ground shield with a 20 pin SCSI-II style connector at each end. The overall length of each cable is 215 feet. A total of 1450 cables are needed: 1200 cables used + 120 spares installed + 130 spares stored.

Section 2 describes the mechanical and electrical properties of the cable. Section 3 describes the termination of the cables. Section 4 describes the electrical testing to be performed on each cable.

2 Cable Electrical and Mechanical Specification

Consists of 10 twisted pairs; 28 AWG, cellular polyolefin insulated, 88 Ohm Single End Mode Impedance, 134 Ohm differential impedance; overall core wrap, overall dual shield and overall jacket. Includes shield drain wire. For example, Berk-Tek part number 270233.

2.1 Construction Details

TWISTED PAIR (10) Two insulated conductors twisted with a left-hand lay. One twist per inch.

CONDUCTOR 28 AWG stranded, 7/36, tinned copper; 0.015" nominal diameter.

INSULATION Cellular Polyolefin, $0.034 \pm 0.001''$ diameter.

OVERALL CABLE CONSTRUCTION Ten (10) twisted pairs cabled together with a left-hand lay.

CORE FILLER Cable core filler, minimum applied to achieve a circular cross section.

Table 1: Color Code, base-color/band mark. Concentric groups of cable pairs with layer 1 closest to center.

Pair	1st Cond	2nd Cond	Layer
1	White/Tan	Tan/White	1
2	White/Brown	Brown/White	1
3	White/Pink	Pink/White	2
4	White/Orange	Orange/White	2
5	White/Yellow	Yellow/White	2
6	White/Green	Green/White	2
7	White/Blue	Blue/White	2
8	White/Violet	Violet/White	2
9	White/Gray	Gray/White	2
10	Tan/Brown	Brown/Tan	2

CORE WRAP Cellular polypropylene, 0.005" nominal thickness.

TAPE SHIELD Laminated aluminum/polyester, 0.0015" nominal thickness, helical wrap, aluminum side facing out, in contact with a 28 AWG stranded copper drain wire.

BRAID SHIELD 38 AWG, tinned copper, 85% minimum coverage.

JACKET PVC, color black, nominal thickness: 0.020" minimum (preferred), 0.040" maximum.

OVERALL DIAMETER not to exceed 0.325" nominal.

PAIR COLOR CODE See table 1.

PRINT LEGEND "VENDOR" 28 AWG SHIELDED TYPE CL2 75C (UL).

2.2 Performance

IMPEDANCE $134 \pm 10\%$ Ohms differential impedance at 5 MHz.

TIME DELAY 1.35 nsec/ft nominal (speed 76%).

TIME SKEW maximum 0.035 nsec/ft pair to pair for any 2 pairs.

DC RESISTANCE 68.2 Ohms/kft maximum.

DIELECTRIC STRENGTH 1.0 KVAC for 1 minute.

ATTENUATION 0.023 db/ft maximum at 5 MHz.

TEMP/VOLT Power Limited Circuit Cable Type CL2, 75°C.

FLAMMABILITY UL 1581 Flame test.

3 Cable Assembly

Cables are to be assembled as per University of Chicago drawing UCCDF-2-21 Revision E. The cables shall be cut to lengths of $215'0'' \pm 12''$. Fujitsu or Harting SCSI-II type connectors are used on both ends with pin-out as specified in Table 2.

3.1 Connectors

The 20 pin connectors are similar to SCSI-II connectors: Fujitsu FCN-237R020-G/F with metal cover FCN-230C020-C/E or Harting #60030205210 with metal cover #60030200255. The cable assembler must use tooling supplied by the connector manufacturer for assembly.

3.2 Treatment of ground shield

On the both ends of the cable the ground braid and drain wire shall make electrical contact with the connector shell.
Treatment of the ground sheild:

1. Trim back PVC jacket to position shown in drawing.
2. Trim ground braid and drain wire to be 5/16" longer than PVC jacket.
3. Fold ground braid and drain wire back over PVC jacket.
4. Trim tape shield at end of PVC jacket.
5. Wrap the ground braid with 1 layer of 1/4" wide x 1-3/8" long copper tape with conductive adhesive.
6. Apply clamp of metal cover over copper tape.

Table 2: Connector to cable connections. Conductor colors given by base-color/band mark.

Pair	1st Cond		2nd Cond	
	Pin	Color/Band	Pin	Color/Band
1	1	White/Tan	2	Tan/White
2	3	White/Brown	4	Brown/White
3	5	White/Pink	6	Pink/White
4	7	White/Orange	8	Orange/White
5	9	White/Yellow	10	Yellow/White
6	11	White/Green	12	Green/White
7	13	White/Blue	14	Blue/White
8	15	White/Violet	16	Violet/White
9	17	White/Gray	18	Gray/White
10	19	Tan/Brown	20	Brown/Tan

3.3 Cable Strain Relief

Strain relief is provided by the metal connector shell clamping on the cable outer jacket. This strain relief shall be sufficient to support a load of 20lbs without slipping.

4 Testing of Assembled Cables

Each cable is to be tested for continuity and shorts by the vendor. An automatic cable tester will be provided by the University of Chicago to perform these tests:

1. Test continuity of each of the 20 conductors (the resistance must be less than 20 Ohms for each).

2. Test for shorts between each conductor and the 19 other conductors. Each conductor shall support 25VDC relative to all other conductors (grounded) with a current not to exceed $10\mu A$.

3. Test for shorts between each conductor and the ground shield. Each conductor shall support 25VDC relative to ground shield with a current not to exceed $10\mu A$.

4. Test to make sure shell of End 2 is NOT shorted to shield or End 1. Ends must support 25VDC relative to each other with a current not to exceed $10\mu A$.