The STAR-IST system

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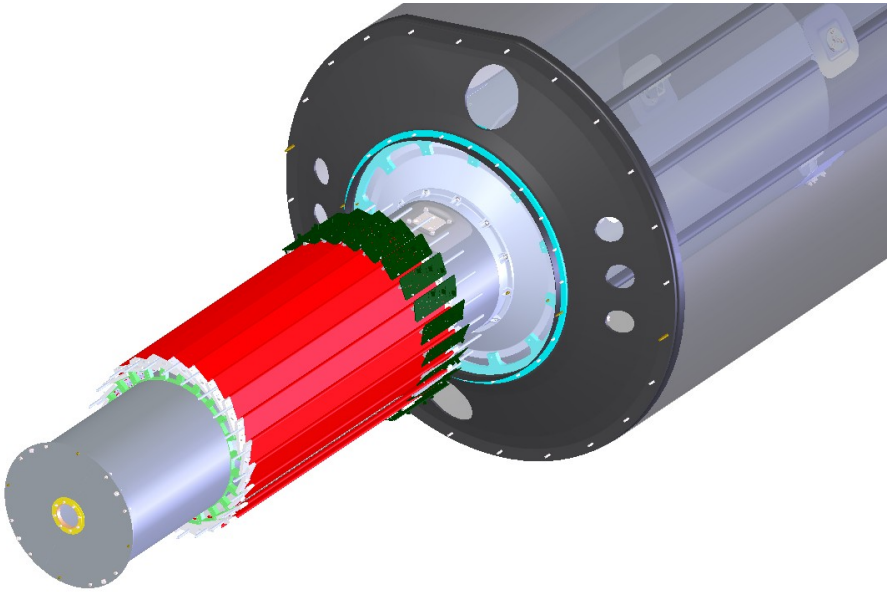


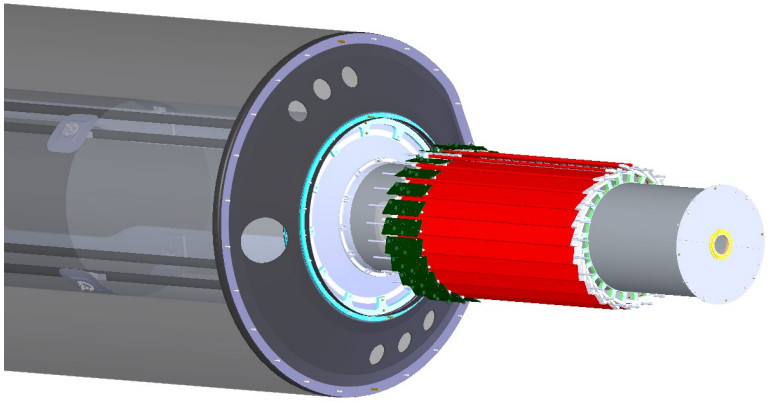
IST talk outline

STAR HFT

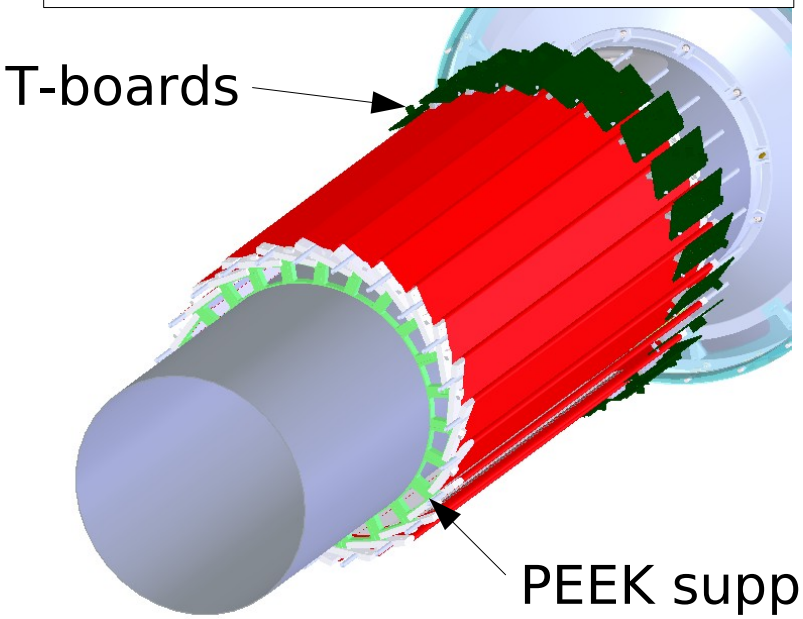
- overview Intermediate Silicon Tracker
- staves, sensors and readout chips
- flex hybrids
- cooling system
- cables and interface boards
- readout system and bias supplies
- grounding scheme

IST overview

- Mechanically supported by carbon fiber tube
- All services hooked up at West side



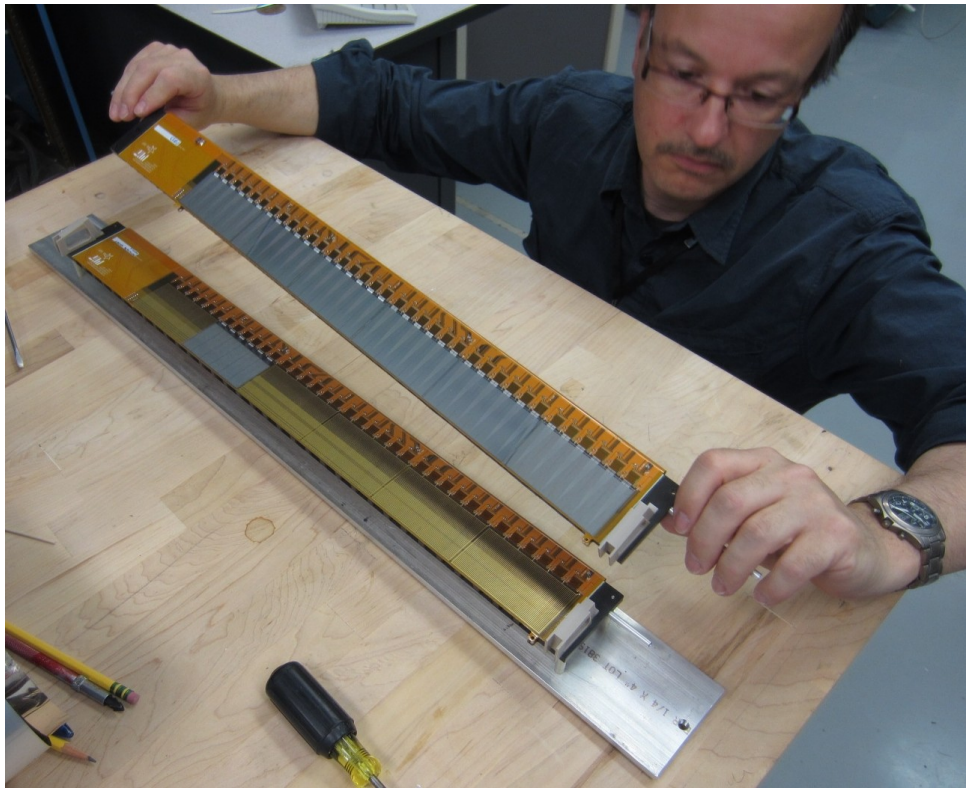
- carbon fiber staves
- room T fluid cooling



- 1 layer of active silicon
- 24 tiled ladders
- 3 electrical segments / ladder

- radius = 14cm
- stave length = ~60cm

IST stave overview



- stave length = ~60cm
- active length = ~50cm
- 6 sensors per ladder
- 36 APV chips per ladder

- nominal sensor bias voltage = 60V
- < 1uA per sensor
- +1.25V/-1.25V per APV
- < 0.5W per APV
- nominal 11W per ladder

- core material is CF honeycomb with CF facesheets
- flex hybrid co-cured with core
- integrated Al cooling tube
- PEEK support pieces and fasteners

IST flex hybrid

Material = DuPont Pyralux
- AP 8515: Copperclad laminate
- LF 0100: Sheet adhesive
- LF 0110: Coverlay

STAR IST HYBRID Stackup

*Dimensions in inches. No tolerance.

IST cooling system

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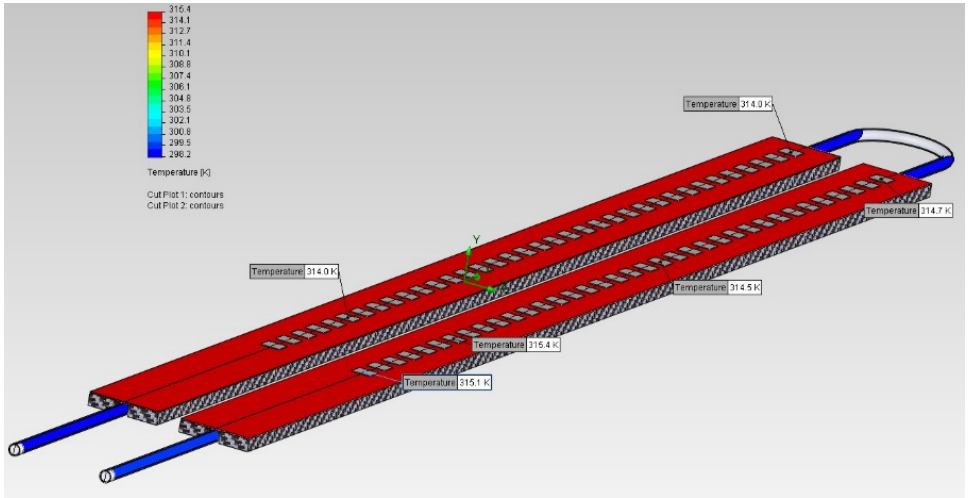


ADVANTAGE® MAKING WATER WORK™ since 1977

PROPOSAL

June 3, 2010

Proposal # 86358 KSTP

Mr. Robert Pisani
Brookhaven National Labs
Fiscal Division
Upton, NY 11973-5000

Telephone: 631-344-4572
Fax:
pisani@bnl.gov

Dear Mr. Pisani:

At your request, we are pleased to offer the following ADVANTAGE proposal.

Maximum Portable Chiller, Model M1-5W-SP .....$ 12,665

3M™ Novec™ 7200 Engineered Fluid

Introduction

3M™ Novec™ 7200 Engineered Fluid, ethoxy-nonafluorobutane ($C_4F_9OC_2H_5$), is a clear, colorless and low-odor fluid intended to replace ozone-depleting substances (ODSs), compounds with high global warming potential (GWP) and chlorinated materials in many applications. Its physical properties are compared with several other ODS replacement fluid candidates in Tables 1 and 2.

This proprietary fluid has zero ozone depletion potential and other favorable environmental properties (see Table 2). It is low in toxicity, with a time-weighted average exposure guideline of 200 ppm (eight hour average).

Novec 7200 fluid has a higher boiling point than most CFCs, HCFCs and HFCs, reducing evaporative losses. The low surface tension and low viscosity of Novec 7200 fluid make it ideal for use in vapor degreasing and cold cleaning applications. In addition, its chemical and thermal stability, nonflammability and low toxicity make it useful for other industrial applications such as specialty solvent and heat transfer applications (see below).

Applications

- Cold cleaner (flex circuits, wipe solvent)
- Cleaning and rinsing agent for vapor degreasing
- Light-duty cleaning (neat)–particulates, fluorolubes, light oils, fluoropolymers
- Lubricant carrier
  Fluorocarbons
  Hydrocarbons
  Silicones
- Specialty solvents, dispersion medium, reaction medium, extraction solvent
- Spray contact cleaner
- CFC, HCFC, HFC and PFC replacement agent
- Heat Transfer Fluid (See 3M Electronic Materials "Thermal Management Fluids and Services" brochure.)

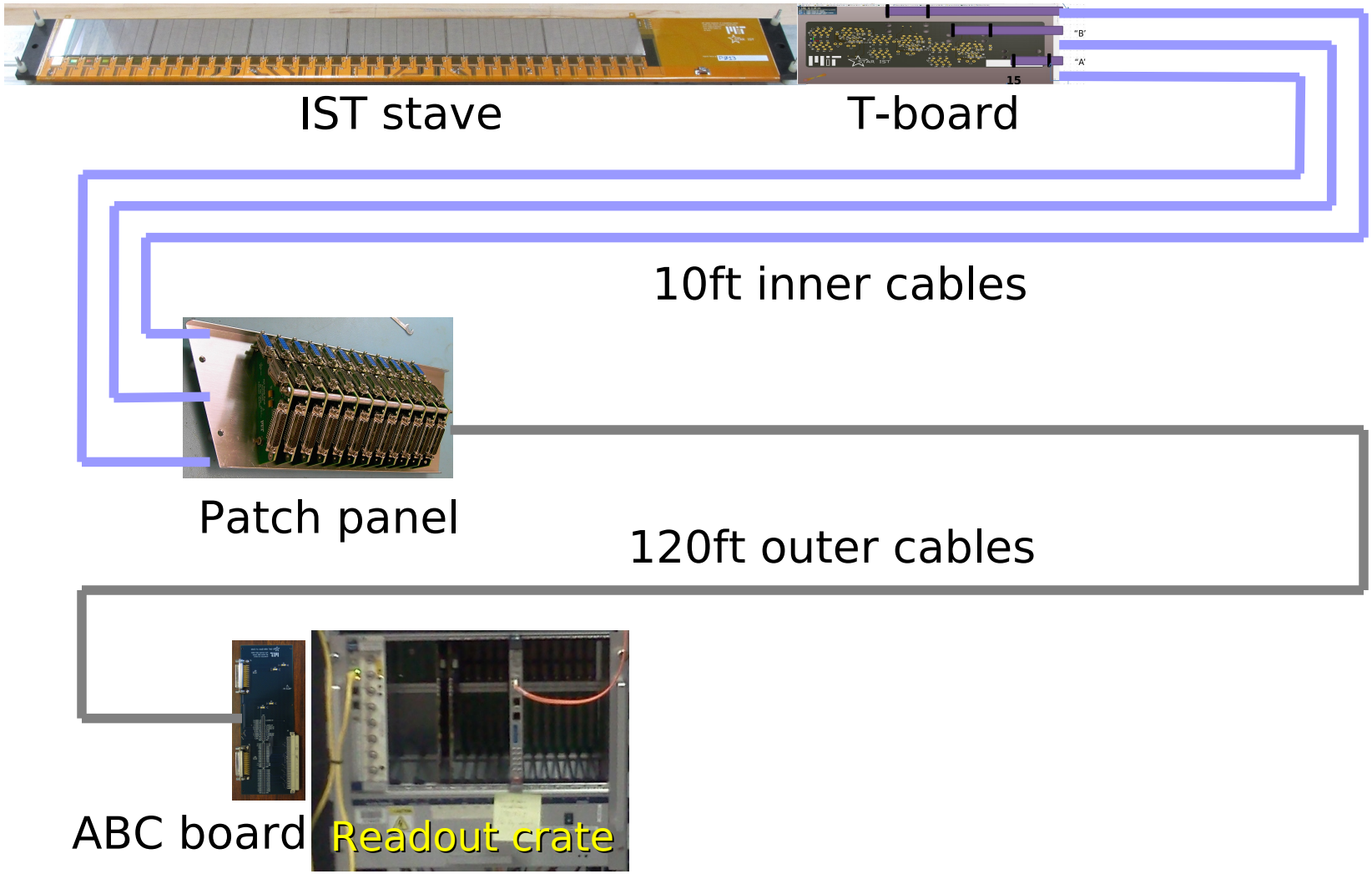
Material Description

Ingredients	3M™ Novec™ 7200 Engineered Fluid
Ethoxy-nonafluorobutane[1]	99.0% minimum
Appearance	Clear, colorless
Non-volatile residue (NVR)	1.0 ppm maximum

[1] Novec 7200 fluid ($C_4F_9OC_2H_5$) consists of two inseparable isomers with essentially identical properties. These are $(CF_3)_2CFCF_2OC_2H_5$ (CAS No. 163702-06-5) and $CF_3CF_2CF_2CF_2OC_2H_5$ (CAS No. 163702-05-4).

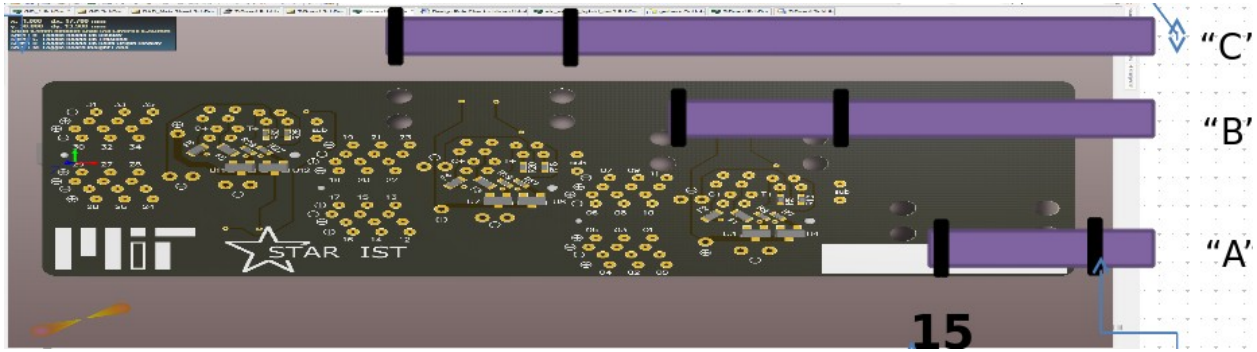
Cooling 2 staves in series with Novec 7200 at 25 degC
System interlocked with IST power supplies
Currently working out the details

IST readout chain



IST T-board

Prototype T-boards



T-board with 3 IST inner cables attached

- only active (discrete) components are for I2C
- 0.25A polyfuses on sense lines
- FR4

The T-board is secured with screws to the stave
The cables are strain relieved on PEEK support brackets

IST inner cables

STAR HFT

ALPHA WIRE
CUSTOMER PRODUCT SPECIFICATION

Part Number: 518222		**Issue:**	**1**
Page 1 of 2 Pages		**Issue Date:**	**8/2/2012**
		Effective Date:	**9/27/2012**

A. Construction — **Diameters (in)**

1) Component 1 — 19 X 1 PAIR
   a) Conductor — 28 (SOLID) AWG TC — 0.013
   b) Insulation — 0.006" Wall, Nom. FEP — 0.025
      (1) Color Code — Alpha Wire Color Code A

Pair	Color	Pair	Color	Pair	Color
1	BLACK-RED	8	RED-GREEN	15	GREEN-WHITE
2	BLACK-WHITE	9	RED-WHITE	16	GREEN-BROWN
3	BLACK-GREEN	10	RED-BLUE	17	GREEN-ORANGE
4	BLACK-BLUE	11	RED-YELLOW	18	GREEN-YELLOW
5	BLACK-BROWN	12	RED-BROWN	19	WHITE-BLUE
6	BLACK-YELLOW	13	RED-ORANGE		
7	BLACK-ORANGE	14	GREEN-BLUE		

   c) Pair — 2/Cond Cabled Together
      (1) Twists: — 16.0 Twists/foot (min)
2) Component 2 — 4 X 1 COND
   a) Conductor — 22 (7/30) AWG TC — 0.030
   b) Insulation — 0.010" Wall, Nom. FEP — 0.050
      (1) Color Code — Alpha Wire Color Code E

Cond	Color	Cond	Color	Cond	Color
1	BLACK	3	RED		
2	BROWN	4	ORANGE		

3) Cable Assembly — 23 Components Cabled
   a) Twists: — 3.0 Twists/foot (min)
4) Shield: — Alum/Mylar Tape, 25% Overlap, Min.
   a) Foil Direction — Foil Facing In
   b) Drain Wire — 22 (7/30) AWG TC
5) Jacket — 0.010" Wall, Nom.,FEP — 0.298 (0.320 Max.)
   a) Color(s) — VIOLET
   b) Print — ALPHA WIRE-* P/N 518222 19PR 28 AWG 4C 22 AWG
      * = Factory Code

B. Applicable Specifications

C. Environmental Compliance

1) EU Directive 2002/95/EC(RoHS):
   All materials used in the manufacture of this part are in compliance with EU Directive 2002/95/EU regarding the restriction of use of certain hazardous substances in electrical and electronic equipment.
2) REACH Regulation (EC 1907/2006):
   This product does not contain Substances of Very High Concern (SVHC) listed on the European Union's REACH candidate list in excess of 0.1% mass of the item. For up-to-date information, please see Alpha's REACH SVHC Declaration.

D. Physical & Mechanical Properties

1) Temperature Range — -80 to 150°C
2) Bend Radius — 10X Cable Diameter
3) Pull Tension — 75 Lbs, Maximum

E. Electrical Properties — (For Engineering purposes only)

1) Voltage Rating — 300 V_{RMS}
2) Component 1
   a) Mutual Capacitance — 13.7 pf/ft @1 kHz, Nominal
   b) Ground Capacitance — 24.7 pf/ft @1 kHz, Nominal
   c) Characteristic Impedance — 106 Ω
   d) Inductance — 0.19 µH/ft, Nominal
   e) Conductor DCR — 71 Ω/1000ft @20°C, Nominal

Part Number: 518222		**Issue:**	**1**
Page 2 of 2 Pages		**Issue Date:**	**8/2/2012**
		Effective Date:	**9/27/2012**

3) Component 2
   a) Capacitance — 20.8 pf/ft @1 kHz, Nominal Conductor to Conductor
   b) Ground Capacitance — 37 pf/ft @1 kHz, Nominal
   c) Inductance — 0.18 µH/ft, Nominal
   d) Conductor DCR — 16.4 Ω/1000ft @20°C, Nominal
4) Overall
   a) OA Shield DCR — 10.4 Ω/1000ft @20°C, Nominal

F. Other

1) Packaging — Flange x Traverse x Barrel (Inches)
   a) Bulk(Made-to-order)

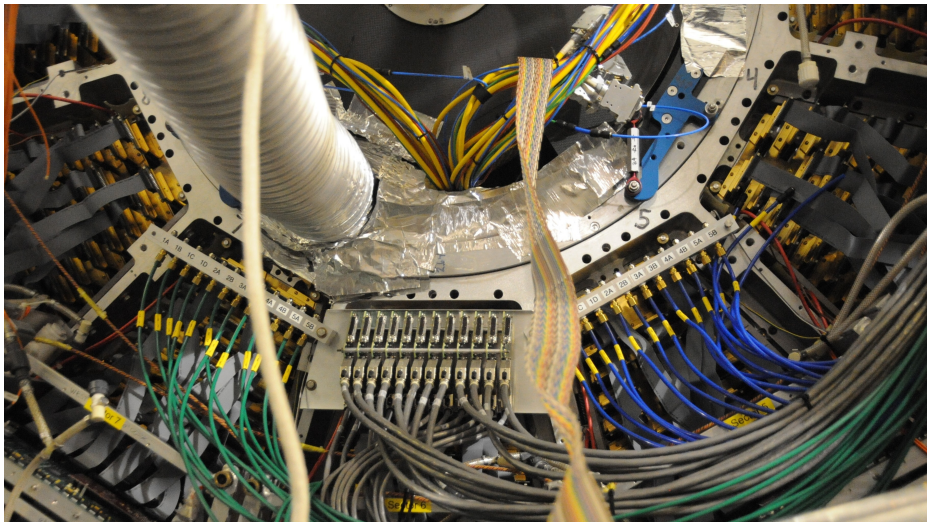
This Design is custom, Made-To-Order & once accepted, the order is NON-CANCELLABLE & NON-RETURNABLE.

Accepted By: Benjamin R. Buck	Date:
Company:	Title:

All stock received

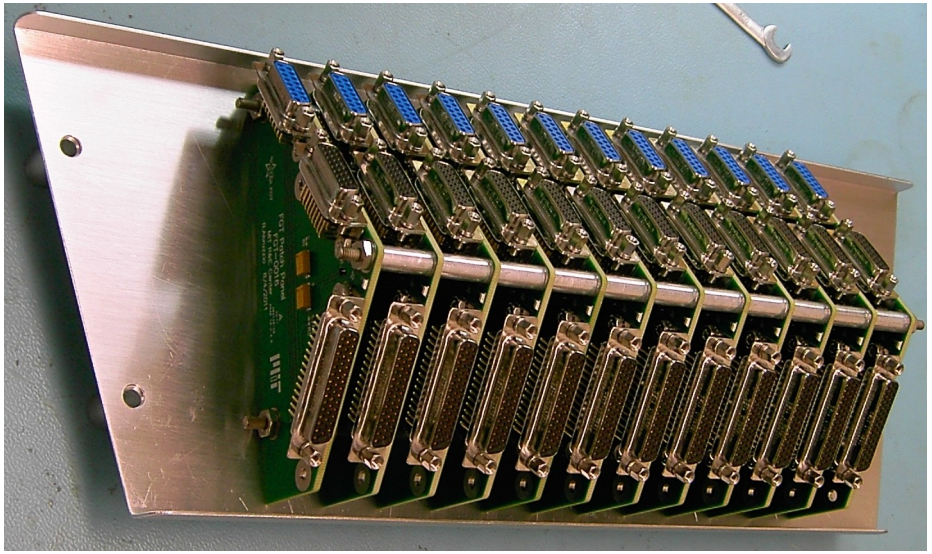
We will submit a sample for burn test

IST patch panel board



FGT patch panels

IST patch panels will be very similar, but more spread out around and on other side of STAR



IST patch panels
- connect inner to outer cables
- provides power regulation (~4W per board)
- distributes bias voltage
- 0.25A polyfuses on sense lines
- FR4

IST outer cable

STAR HFT

ALPHA WIRE COMPANY
CDC PRODUCT SPECIFICATION

Part Number: CDC9691 — **Issue:** 1
Page 1 of 1 Pages — **Issue Date:** 8/20/2012

		Diameters
A. Construction		
1) Component 1	19 X 1 PAIR	
a) Conductor	24 (7/32) AWG TC	
b) Insulation	0.016" Wall, Nom. Foam Polyethylene	
(1) Color Code	9 SOLID COLORS/ 19 STRIPED/ 0 NUMBER CODED	
c) Pair	2/Cond Cabled Together	
2) Component 2	4 X 1 COND	
a) Conductor	18 (7/26) AWG TC	
b) Insulation	0.016" Wall, Nom. PVC	
(1) Color Code	4 SOLID COLORS/ 0 STRIPED/ 0 NUMBER CODED	
3) Cable Assembly	2 Components	
a) Core Wrap	CM Tape, 25% Overlap, Min.	
4) Shield:	AM Foil Tape, 25% Overlap, Min.	
a) Drain Wire	24 (7/32) AWG TC	
5) Jacket	0.032" Wall, Nom., PVC	0.577"
a) Color	SLATE	
6) Packaging	1000FT PUTUP	
B. Industry Approvals		
1) UL	CM VW-1	
2) CSA	NONE	
3) MIL	NONE	
4) CE Compliant	NO	
5) ROHS Compliant	YES	
C. Physical & Mechanical Properties		
1) Temperature	80 C	
D. Electrical Properties		
1) Voltage Rating	300 V_{RMS}	
2) Impedance	100 Ohms +/-10%	
3) Mutual Capacitance	13 pF/ft Nom.	
4) Ground Capacitance	22 pF/ft Nom.	
5) Velocity of Propagation	78% Nom.	
6) DC Resistance	24 Ohm/1000ft @20C	
7) Skew	< 5 ns/100ft	
E. Other		
1) Requested Quantity	5000Ft., 8000Ft., 10000Ft.	

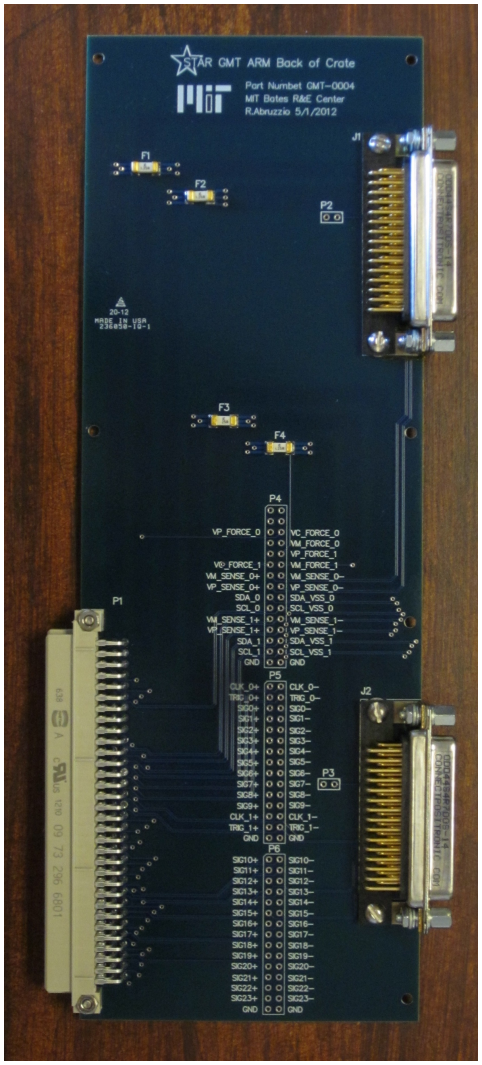
Application Notes
Note:
The 19 twisted pairs have the design as the pairs from the Belden 1424A cable, therefore we expect similar electrical performance in terms of impedance, attenuation, cross-talk and skew. As with the Belden cable, there are no specification limits on these parameters.

Order in early FY13Q1

We will submit a sample for burn test

Is similar construction to Belden type 1425A which carries NEC type CM rating

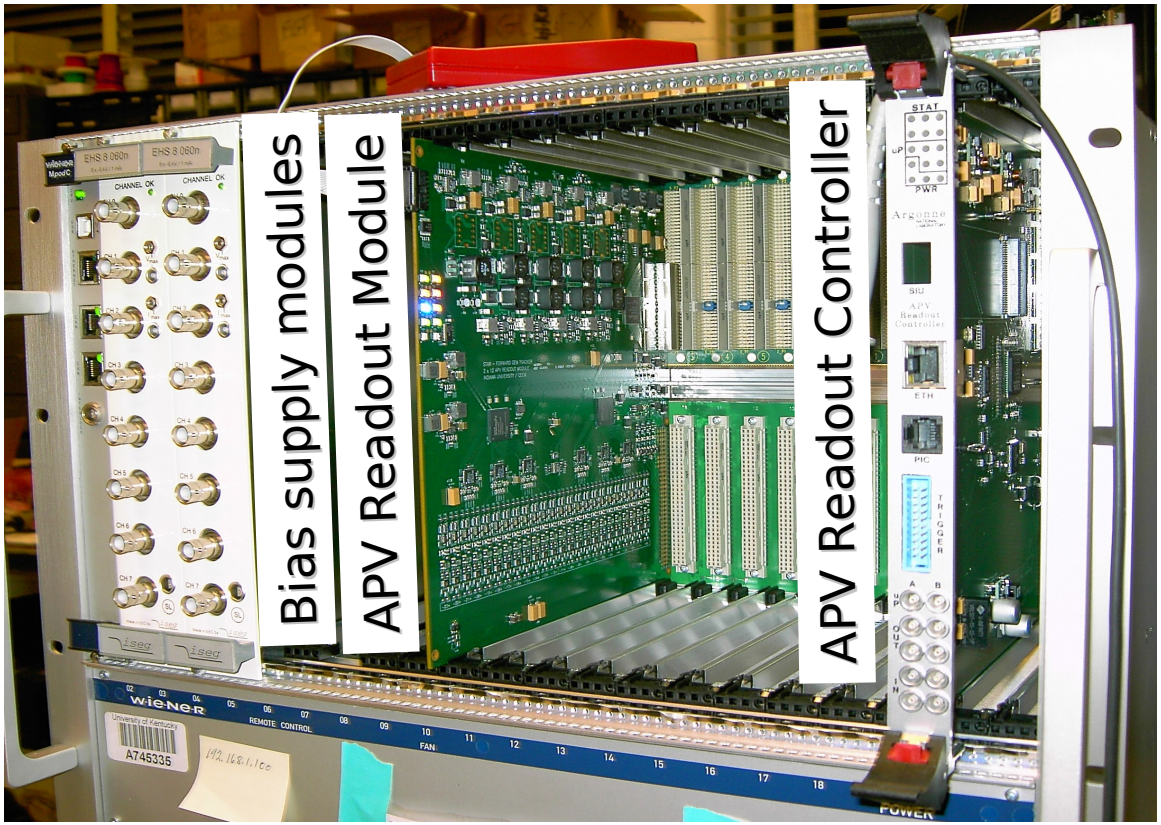
IST back of crate board



FGT ABC board
aka IST prototype ABC board

IST ARM Back of Crate board
- connects the 120ft long outer cables to the back of the readout module in the readout crate
- provides 4A power line fusing
- connects the bias voltage with a cable from the bias supply at the front of the readout crate

IST readout crate



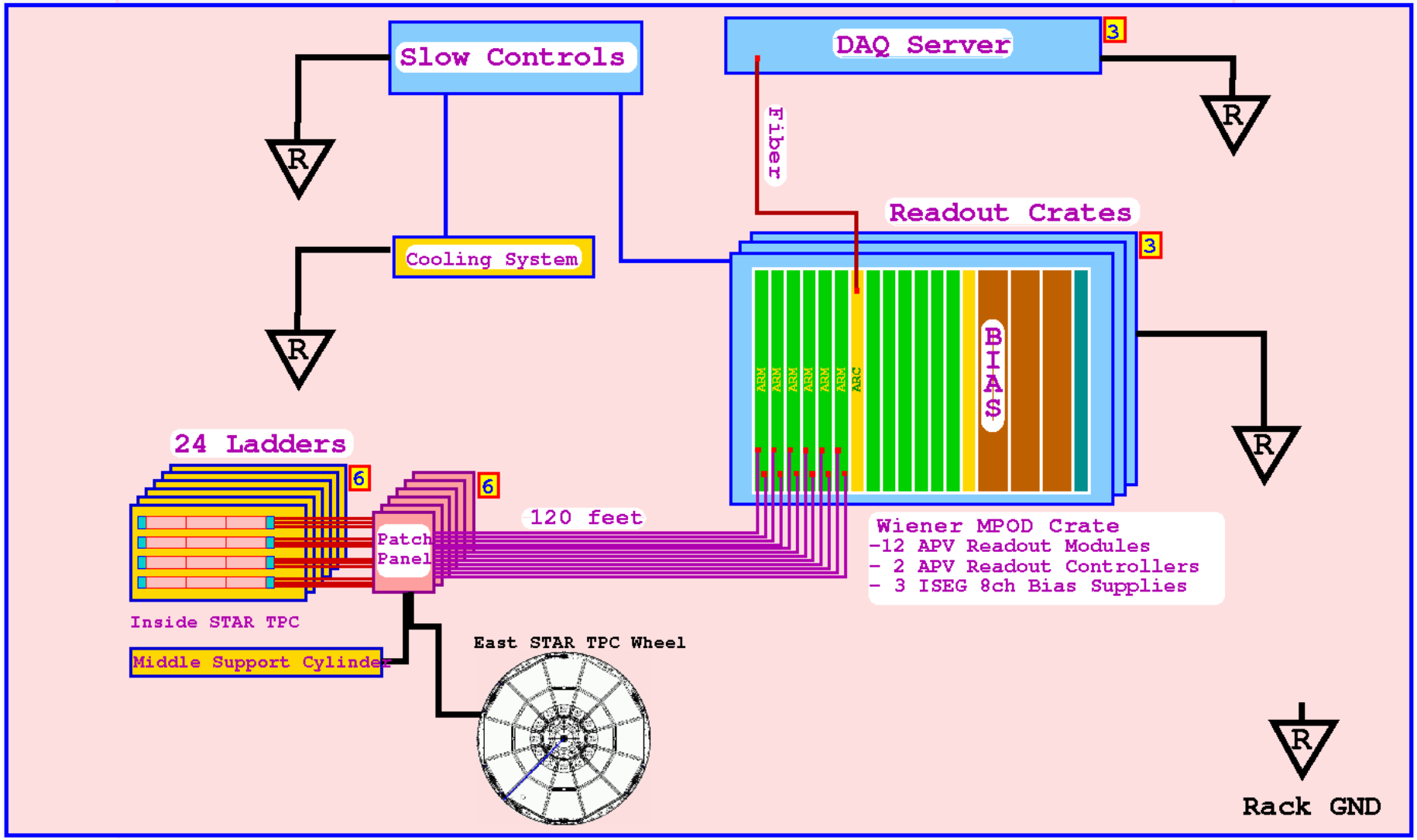
3 readout crates

3 bias supplies / crate

2 ARC's / crate

12 ARM's / crate

Readout crates are connected to the STAR interlock system

The bias supplies are ISEG EHS 8205 8-channel 500V/10mA
The connectors are BNC and the supplies will have hardware voltage and current limits (< 200V and < 1mA)

IST grounding scheme