SUBATECH

ireS Institut de Recherches Subatomiques STRASBOURG

WYDZIAŁ FIZYKI POLITECHNIKA WARSZAWSKA

SSD Safety Review

STAR Silicon Strip Detector

SSD documentation web page

http://star.in2p3.fr/STAR_technique/Summer2002/Summer2002.html

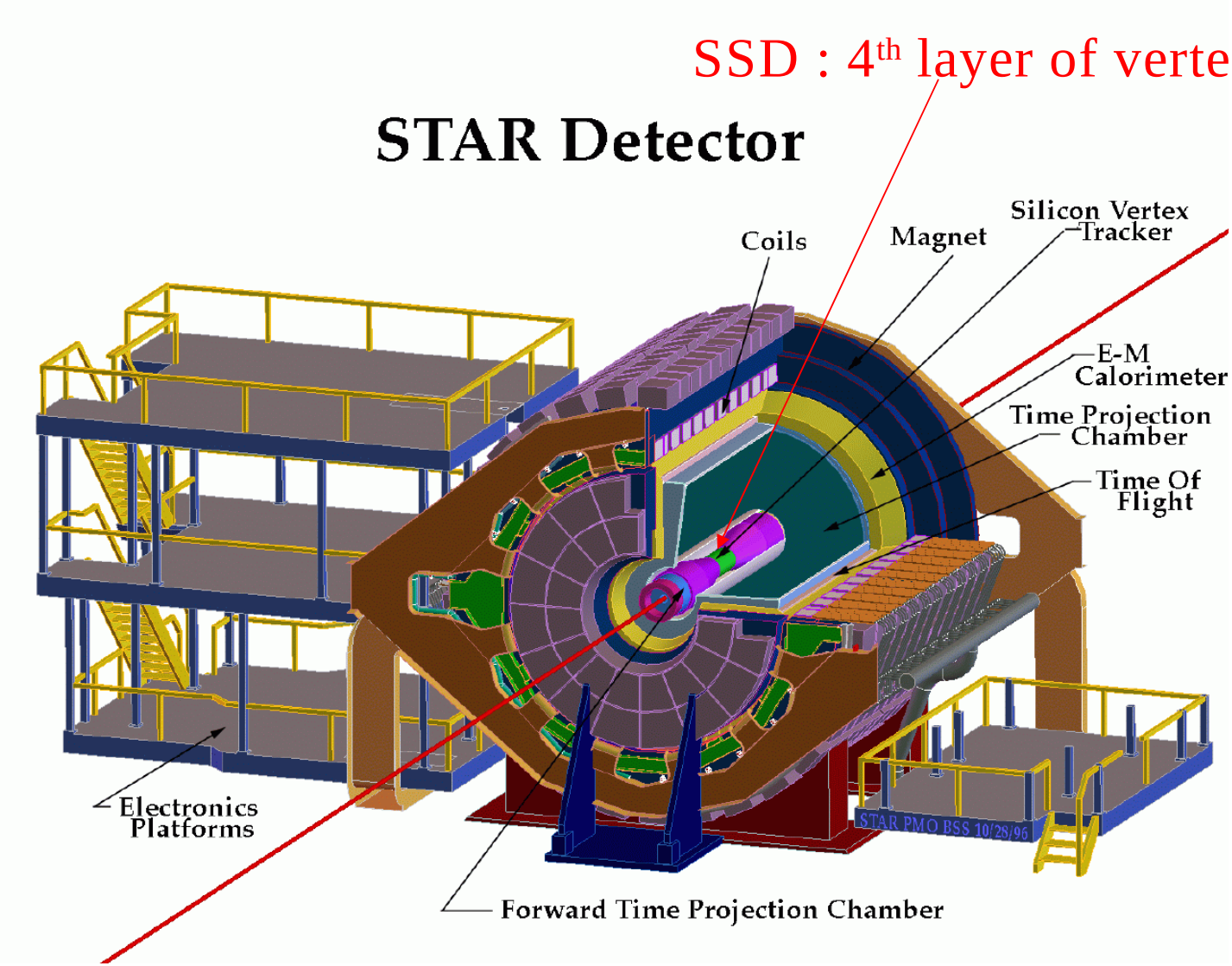
SSD Installation during the Summer 2002

Documents :

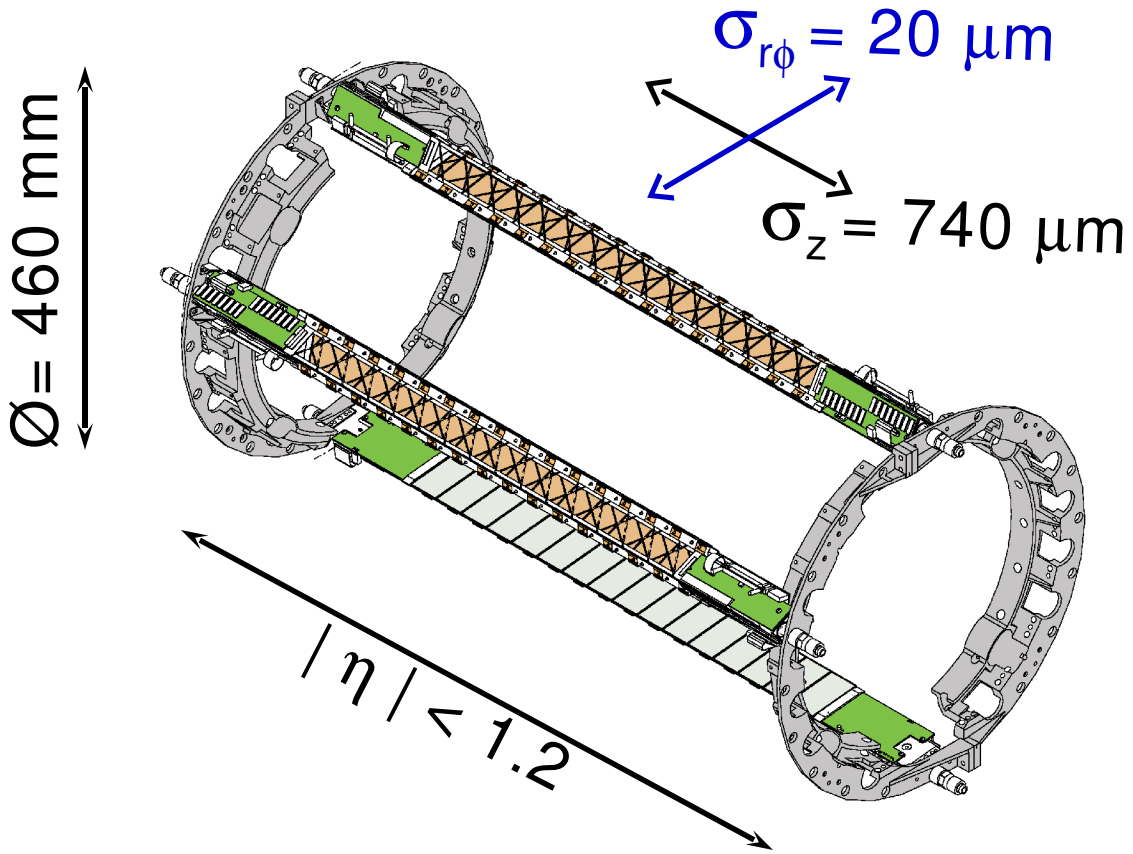
- A list of material shipped to the US and a tentative planning of the installation : installation_2002.doc, installation_2002.html
- General overview of the SSD : ssd_general_overview_doc_6.doc
- The SSD module : ssd_module_doc_3.doc
- The SSD ladder : ssd_ladder_doc_4.doc
- The SSD clamshells and mechanical structure : ssd_clam_meca_2.doc
- The SSD readout chain : ssd_readout_chain_3.doc
- The DAQ and Trigger requierements : ssd_daq&trigger_doc_2.doc
- The SSD air cooling system : ssd_cooling_system_doc_2.doc
- The SSD Slow Control Hardware : ssd_slowcontrol_hardware_doc_2.doc
- Specs of one low voltage power supply : pdf
- Specifications of the SSD cables and connectors : ssd_cables_connectors_doc_3.doc
- The SSD Online monitoring : ssd_online_doc_1.doc
- The SSD Interlocks : ssd_interlocks_doc_1.doc

SSD overview

SSD : 4th layer of vertex detecto



SSD Barrel : Overview

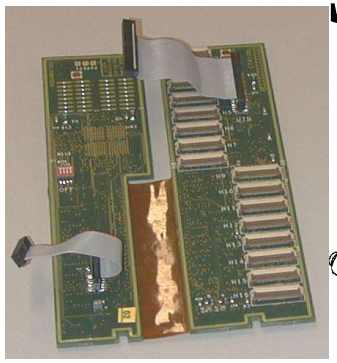


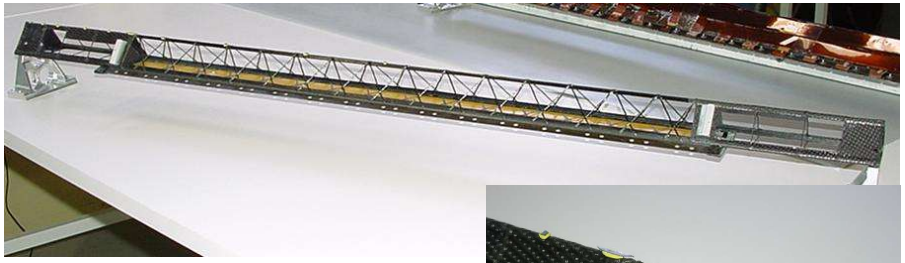
20 ladders
↳320 2D Si strips

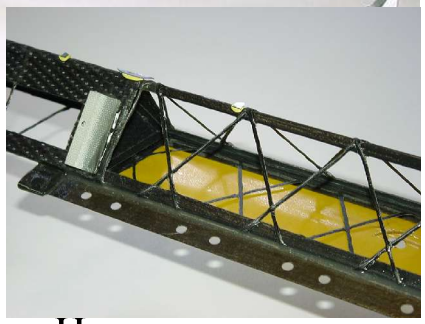
491520 channels

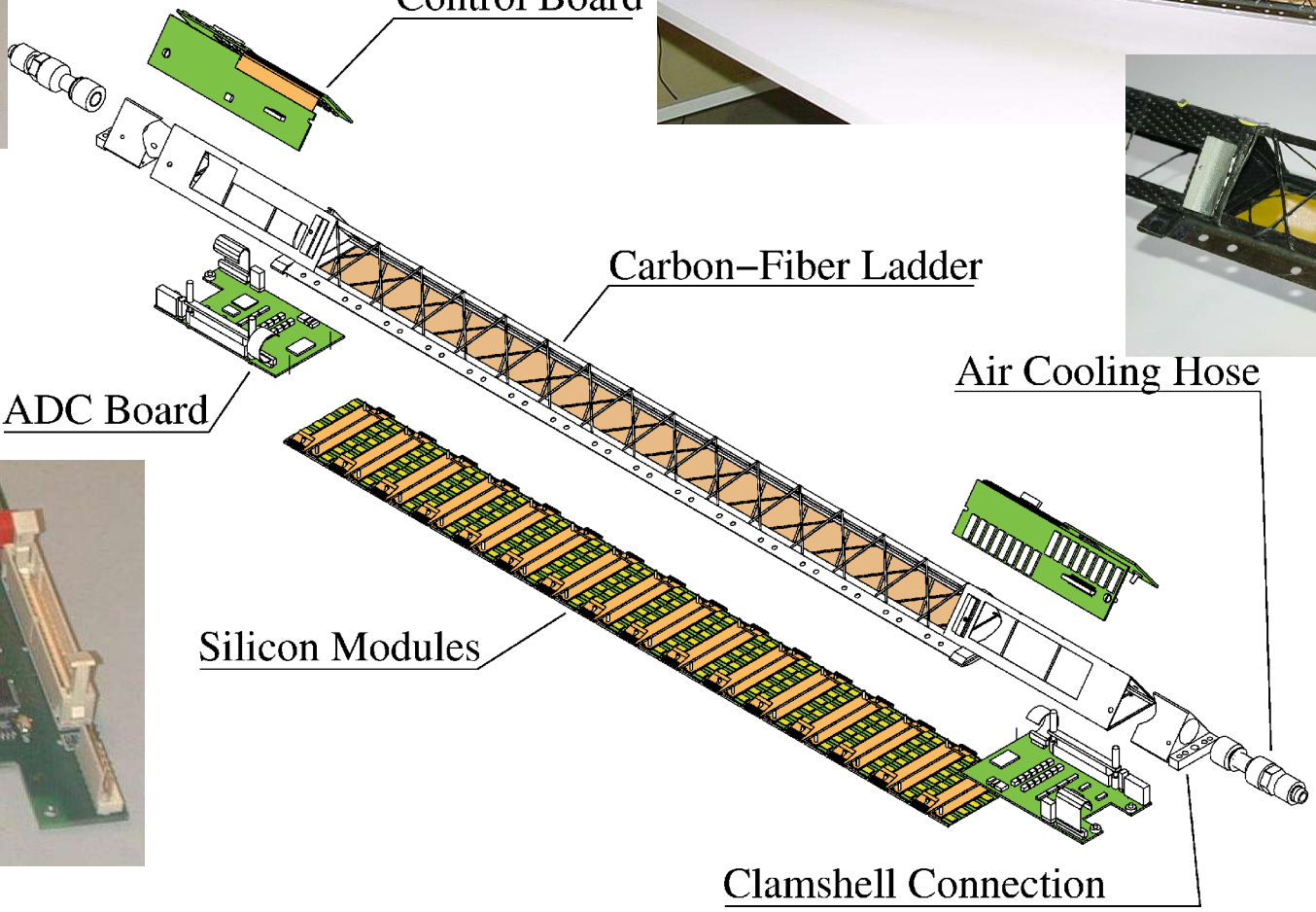
Readout = 7.8ms

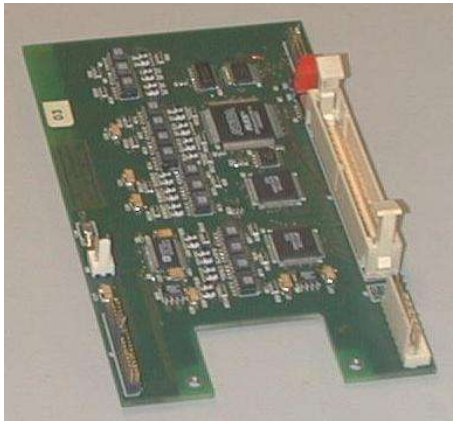
SSD Ladder : Overview









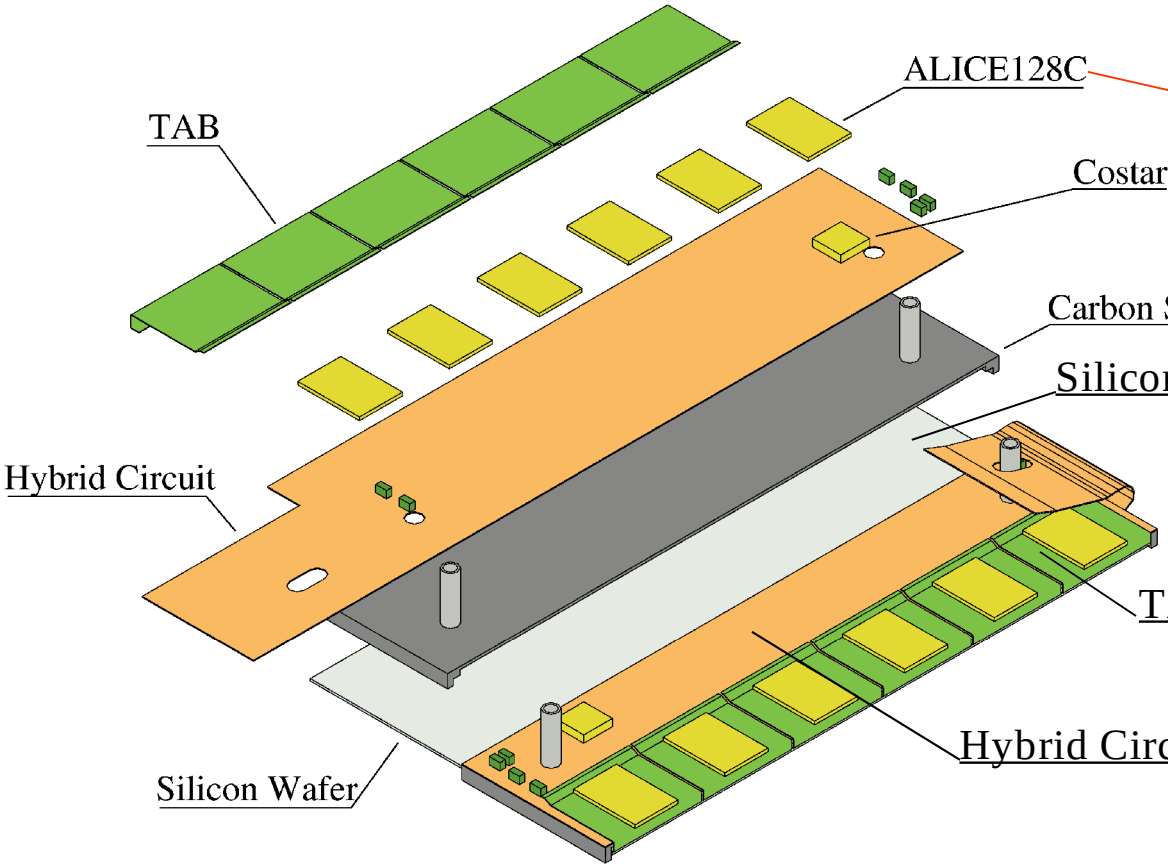


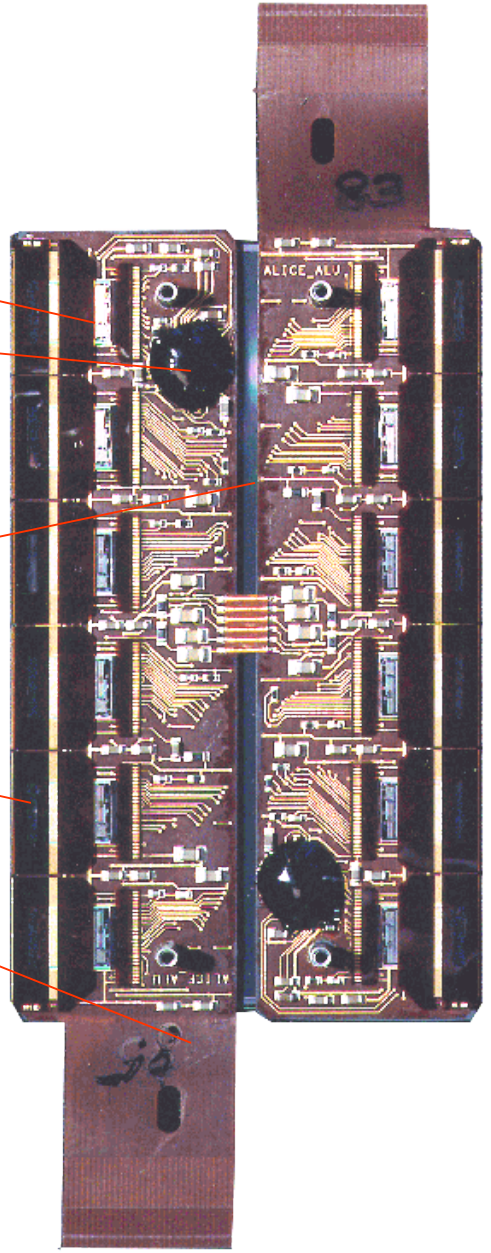
STAR Silicon Strip Detector

Ladder material

Module				*
Ladder	Upper part	Upper part		Carbon epoxy fiber
		Inside Deflector	Deflector	Carbon epoxy fiber
			Glue	Araldite 2013
		Inside stiffener	Stiffener	Carbon epoxy fiber
				Araldite 2013
		C2D2 board support		Glass epoxy fiber
	Base	Wings		Carbon epoxy fiber
		Central part		Kapton
		ADC board support		Carbon epoxy fiber/ Glass epoxy fiber
	Glue			Araldite 2013
Glue				Araldite 2013
Boards	ADC board			Glass epoxy fiber/Copper/ Standard electronic components and connectors
	C2D2 board			Glass epoxy fiber /Copper / Kapton / Standard electronic components and connectors
	Bottom Insulation foam			PVC
Cables	Module to C2D2 cable			Kapton/Aluminum
	ADC to ADC cable			PVC/Copper
	ADC to C2D2 cables			PVC/Copper
Cooling	Connectors			Polyacetal
	Shielding			Mylar

SSD Module

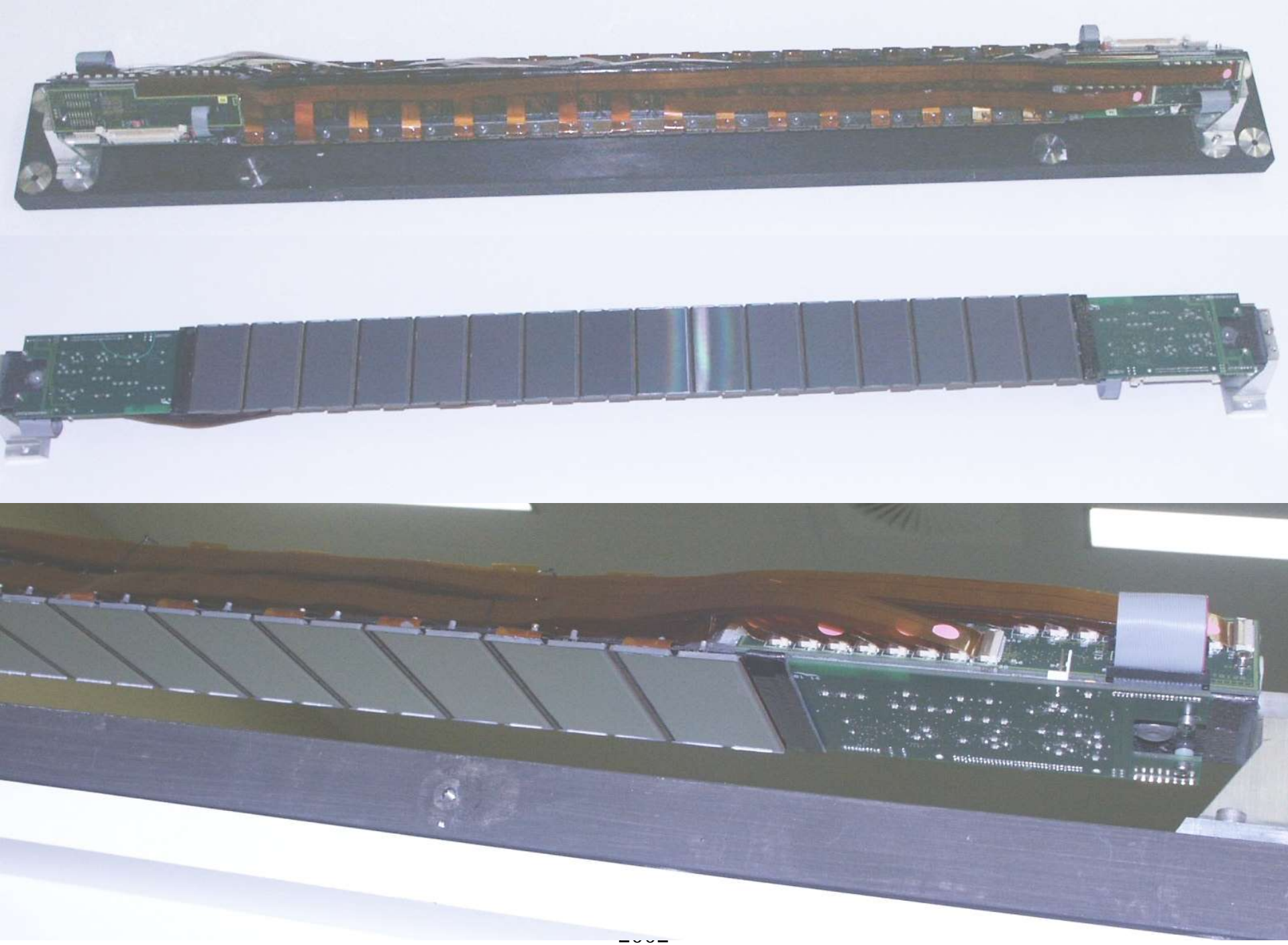


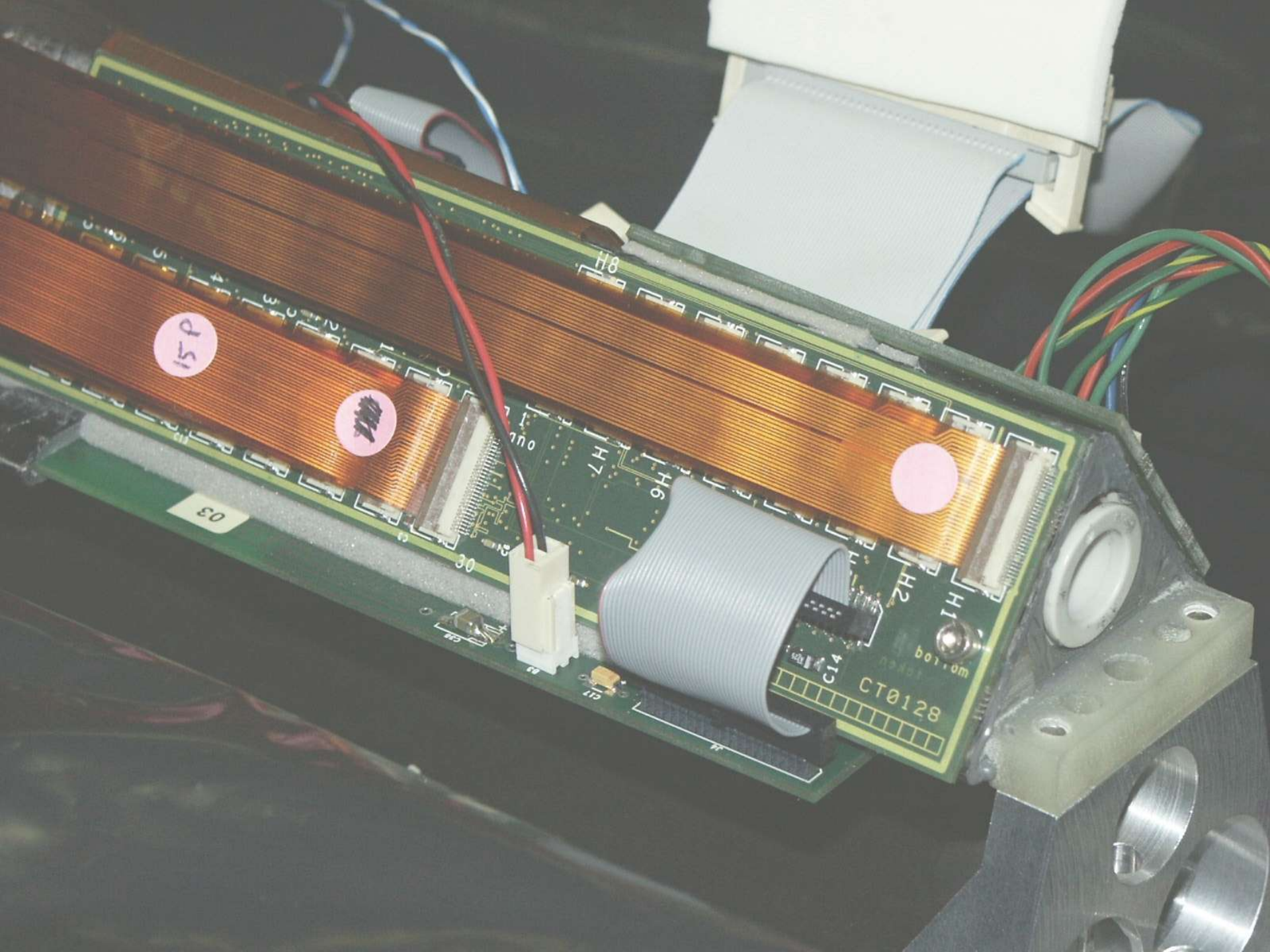


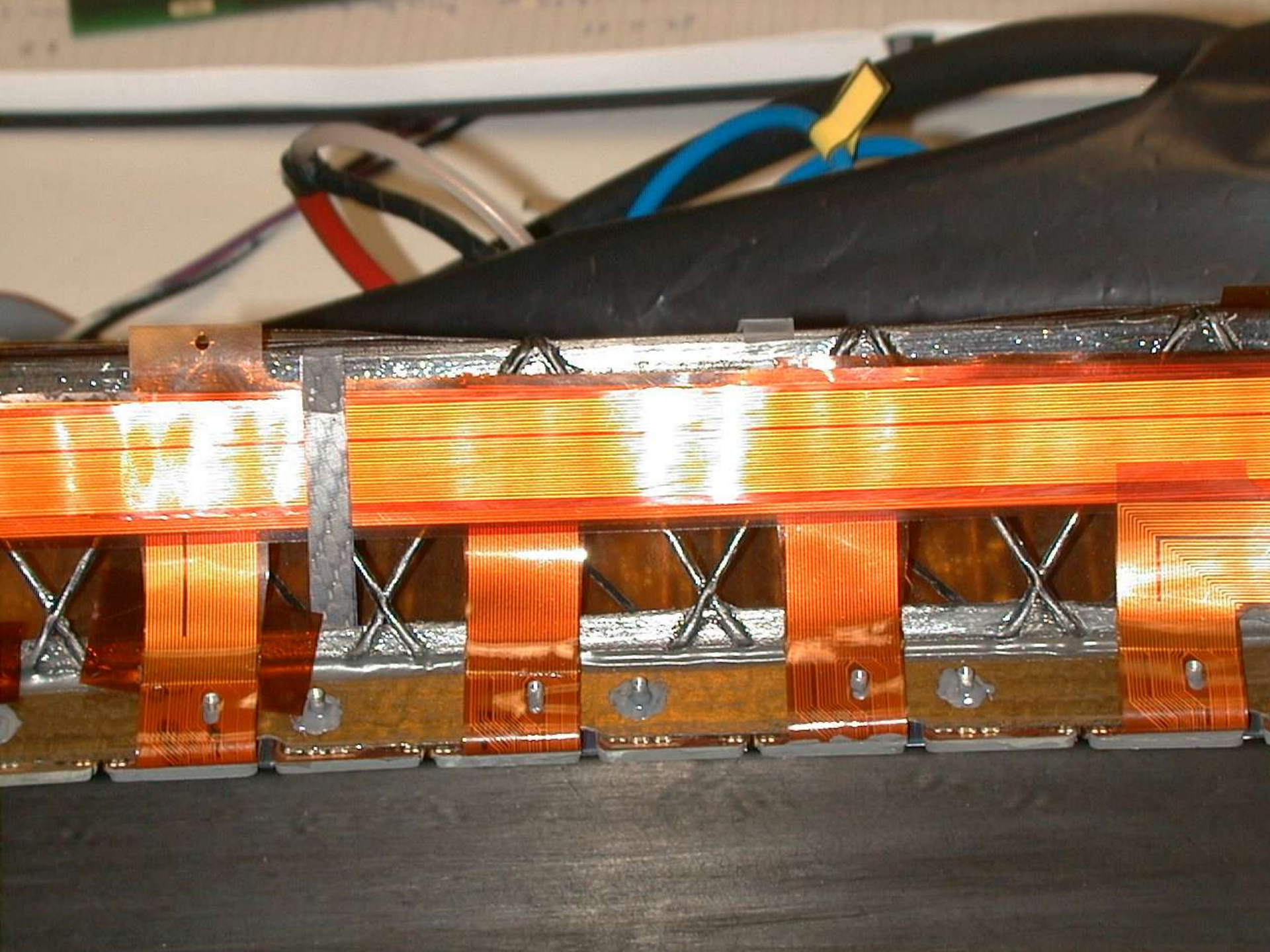
STAR Silicon Strip Detector

Module material

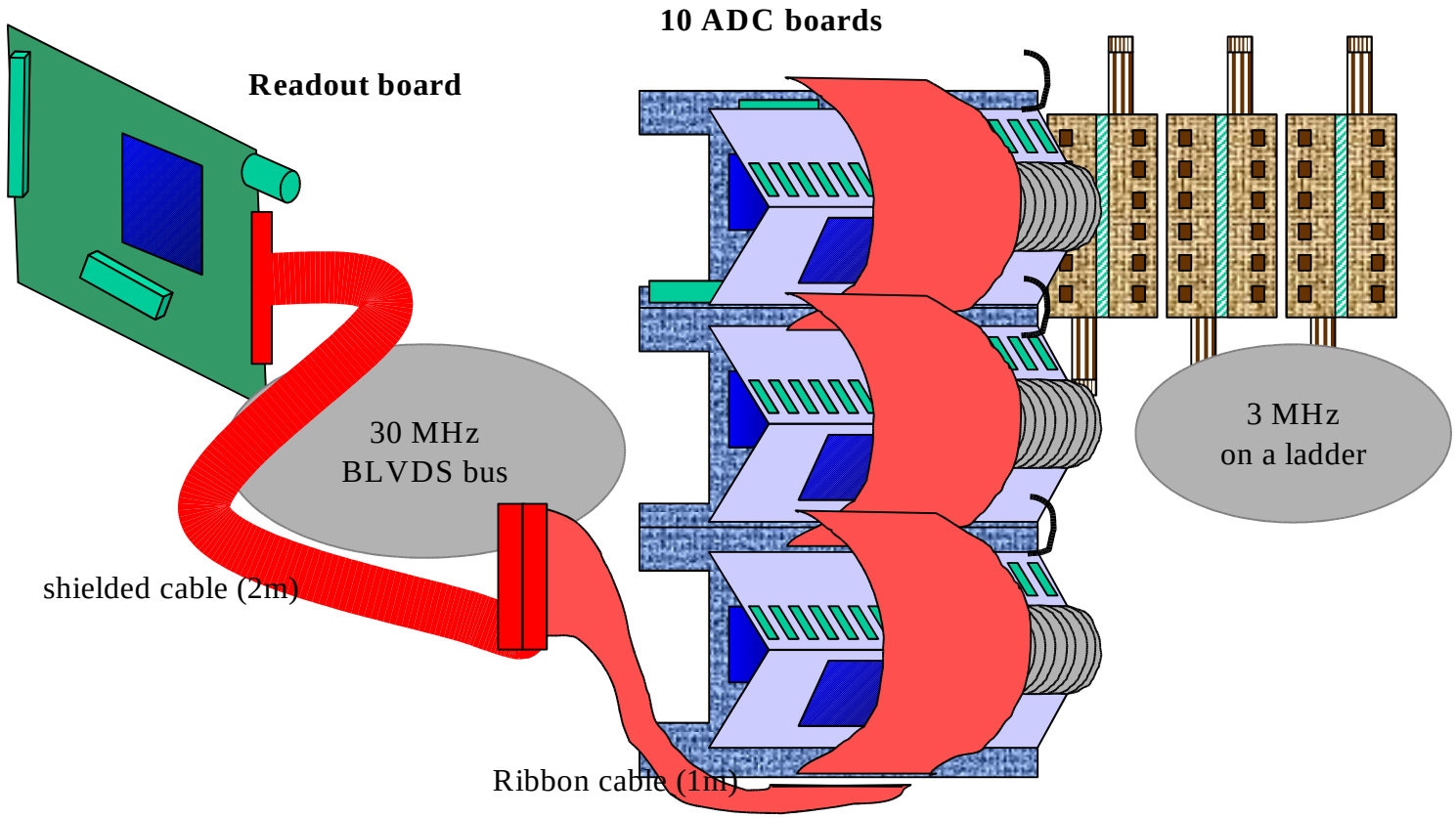
Wafer				Silicon
Hybrid	Printed circuit	Flexible circuit		Kapton/Copper
		A128C chip	chip	Silicon
			A128C glue	Silver silled epoxy paste H20E
		Costar chip	chip	Silicon
			Chip coat	Namics G8345 (epoxy based)
			wire bonding	Aluminum
		Passive components	SMD components	
			Glue	Silver silled epoxy paste H20E
	Stiffener	Stiffener		Carbon fiber/Epoxy
		Pins		Aluminum
		Glue		Epoxy Araldite 2014
	Glue (flex on stiffener)			Epoxy Araldite 2014
TAB	TAB			Kapton/Copper
	Chip coat			Namics G8345 (epoxy based)
Glue (wafer on hybrid)				Silicon RTV 162



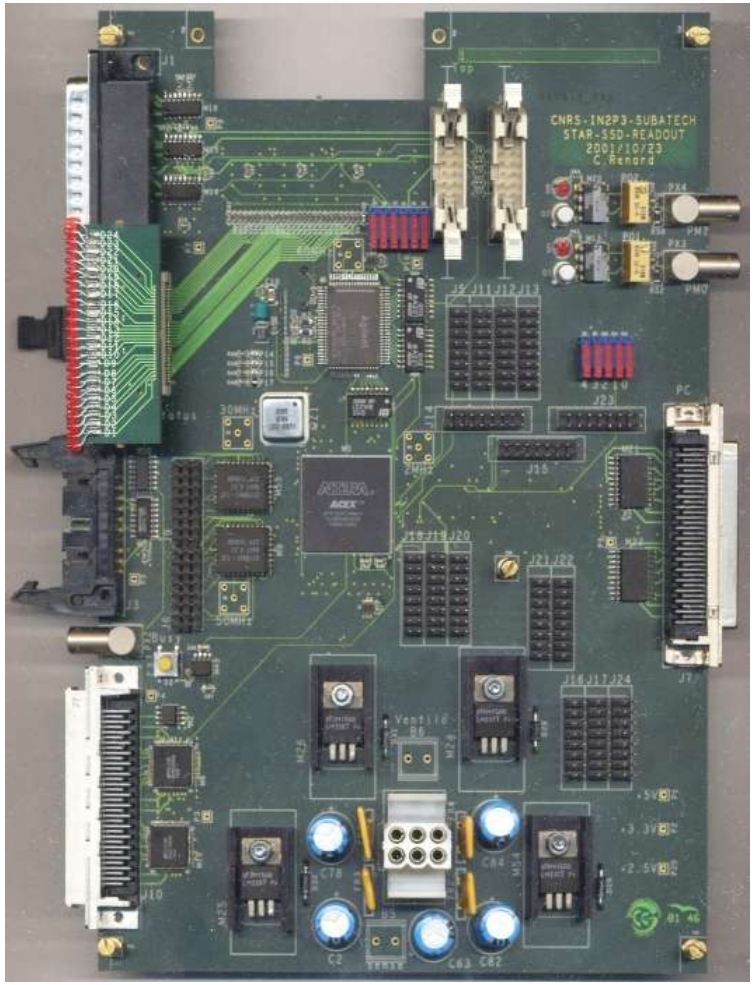

H8
H7
H6
H2
H1
C14
CT0128
bottom



Readout chain



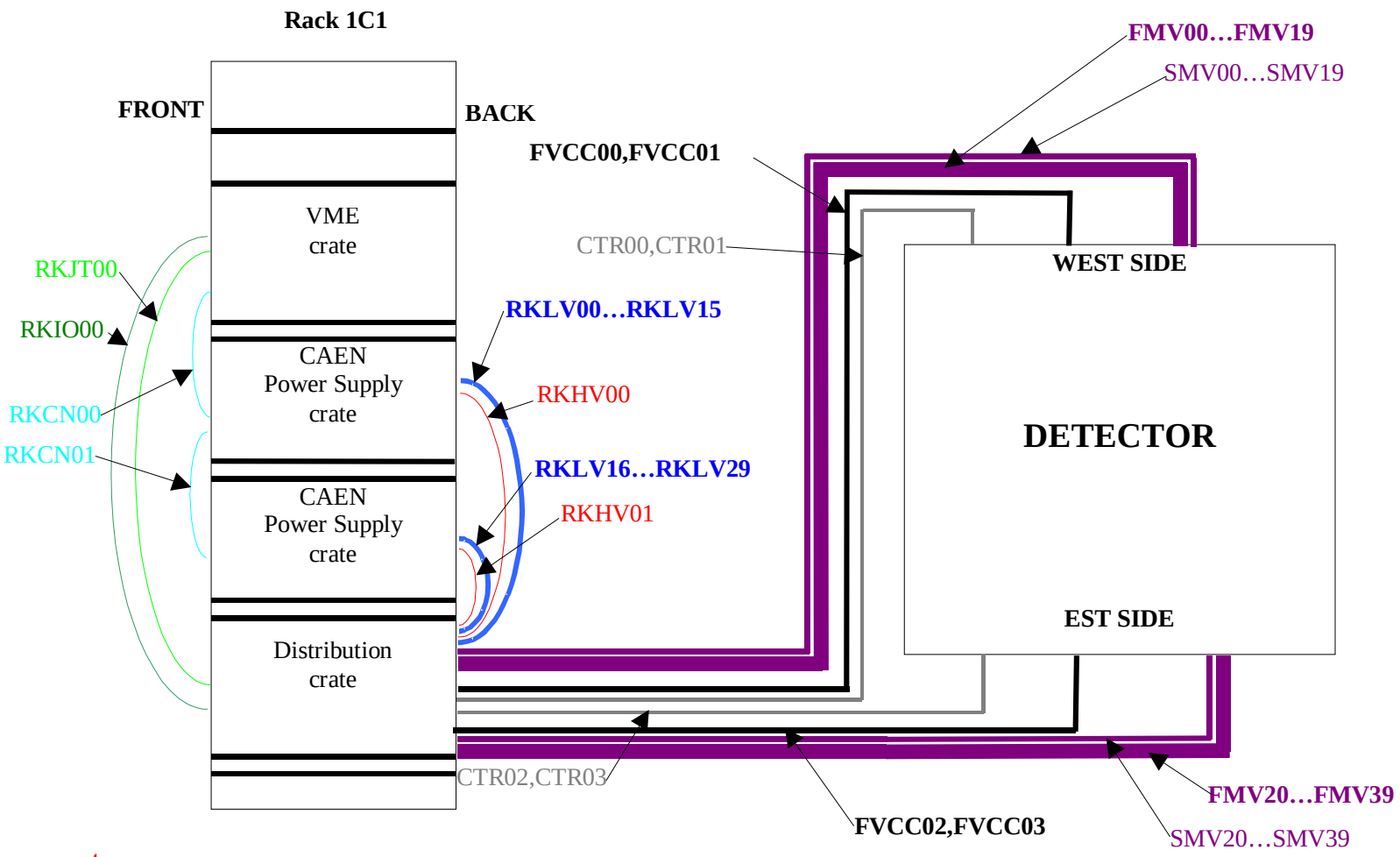
Readout board



- Interface of the barrel to :
  - Slow control
  - Trigger
  - Daq
- Located on the TPC wheel
- Power dissipation : < 20W
- Air cooled

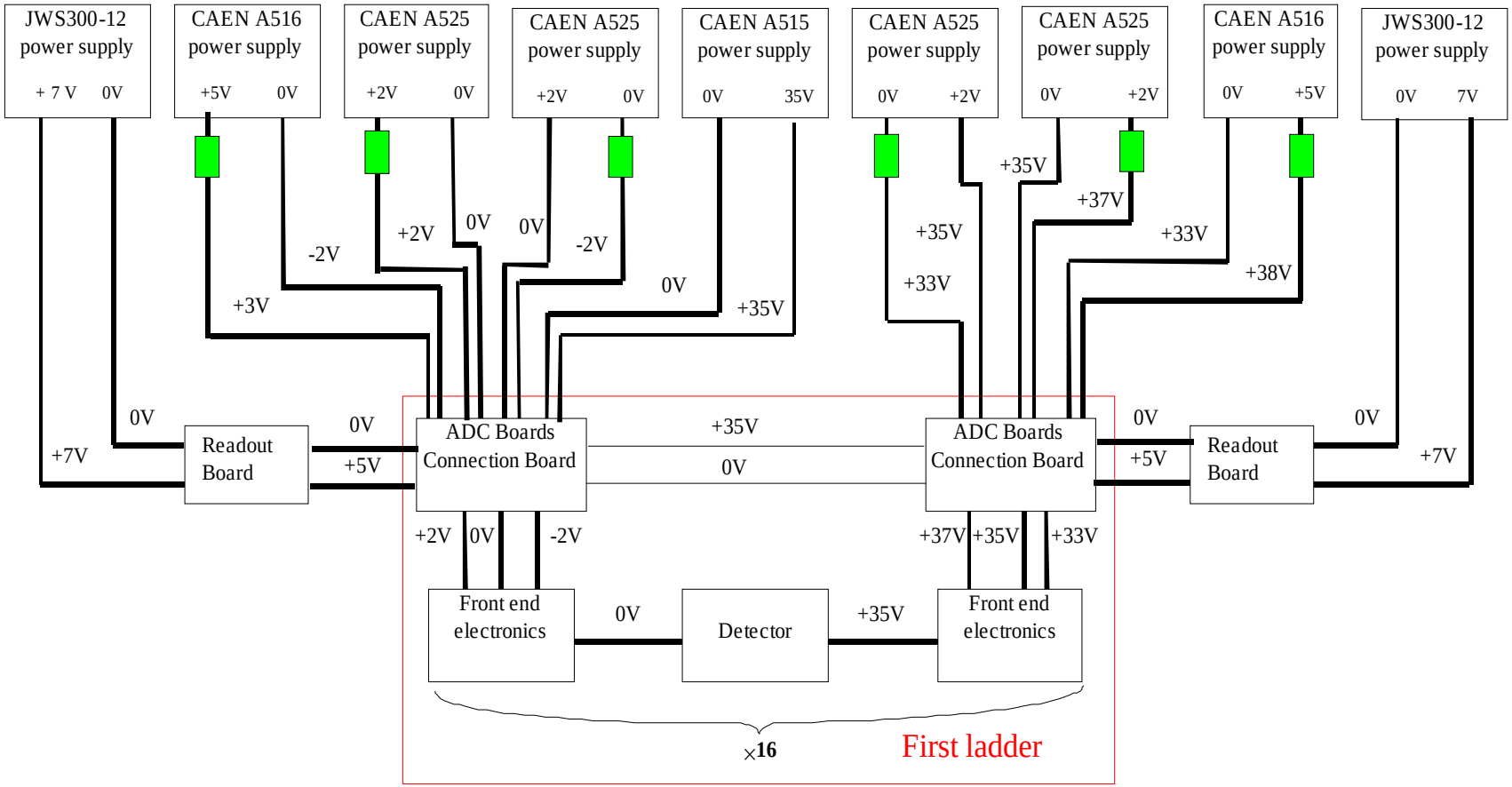
Location of the readout board

Overview of SSD slow control and power supply system



STAR Silicon Strip Detector

First ladder : power supply



4 amperes fuse

STAR Silicon Strip Detector

Caen power supply

- SY527 :
  - Universal Multichannel Power Supply System (CAEN | Nuclear Physics | SY527)
- A515 :
  - 16 Channel Floating 100 V/200 µA Board (CAEN | Nuclear Physics | A515)
- A516 :
  - 8 Channel Floating 12 V/1.5 A Board (CAEN | Nuclear Physics | A516)
- A525 :
  - 8 Channel Floating 4 V/3 A Board (CAEN | Nuclear Physics | A525)

Lambda Power Supply characteristics

- JWS300-12 : V_{max}= 12V, I_{max}= 27A
- Safety approval UL1950
- http://www.lambdapower.com/ftp/Specs/jws.

Cables characteristics on the cones

Cable name	AWG	Operating current	Operating Voltage	Manufacturer & part numb.	material	Voltage rating	Operating Temperature	Flammability rating
Power cables lowvolt. side	20	2 A	5 V	Alcatel Lyflex	PVC Copper	500 V	-10 C to +60 C	NF C 32-070 C2 CEI 332-1
Power cables high volt. side	20	2 A	35 V	Alcatel Lyflex	PVC Copper	500 V	-10 C to +60 C	NF C 32-070 C2 CEI 332-1
Sense cables lowvolt. side	24	0 A	5 V	Alpha wire 5599/5	PVC Copper Aluminium	300 V	-20 C to +80 C	UL VW1
Sense cables high volt. side	24	0 A	35 V	Alpha wire 5599/5	PVC Copper Aluminium	300 V	-20 C to +80 C	UL VW1
Signal & power cable	28	300 mA	0-5V	3M KU-KM PVV-SB	PVC Copper	300 V	-20 C to +60 C	UL VW1
High voltage cable	24	1m A	0-50V	Alpha wire 5092	PVC Copper	300 V	-20 C to +80 C	UL VW1

STAR Silicon Strip Detector

Characteristics of the connectors on the cone

Taitek : power cable and HV cable

- number of pins 8
- housing material : Nylon
- temperature rating : -40 C to +105C
- flammability rating : UL 94V-2
- Voltage rating AC 250 V rms
- current rating 5 A

FCI : sense cable

- number of pins : 6, double row
- temperature rating -55C to +125 C
- flammability rating UL 94V-0
- voltage rating AC 1000 V rms
- current rating 3 A

AMP : M series 14 position

- housings material : phenolic
- temperature rating : -55C to +150C
- flammability rating : UL94V-0
- voltage rating : AC 900 V,rms
- current rating : 13 A

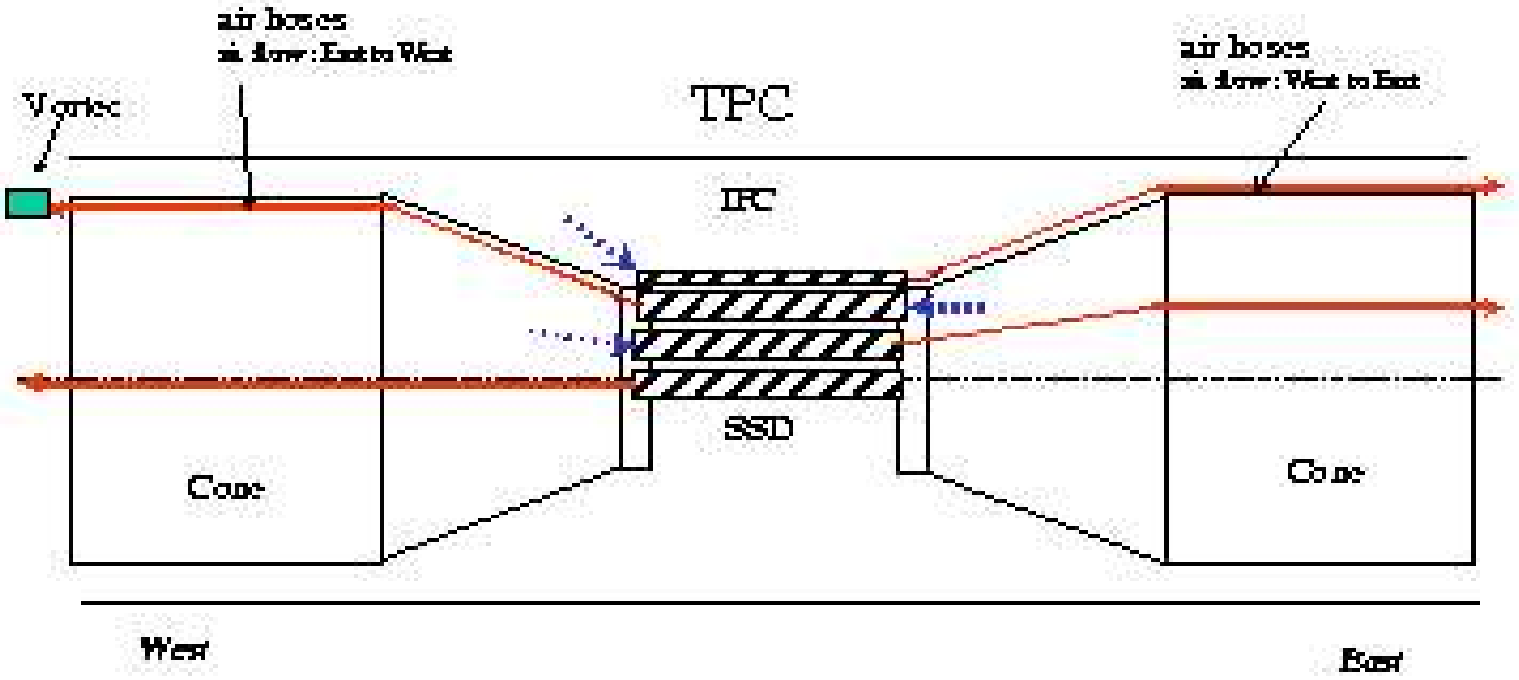
Characteristics of the cables from the platform to the TPC wheel

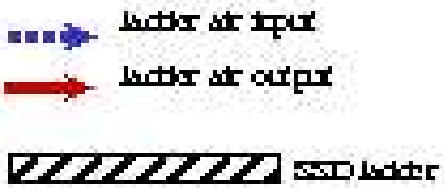
Cables	Nb cond	AWG	Manufacturer Part Number	Material	Operating Current	Operating Voltage	Voltage/ current Rating	Temperature Rating	Flammability Rating
Inside Rack Low & High Voltage	27	22	HELUKABEL LiY-CY 20070	Copper PVC	LV : 1A HV : 1mA	LV: 5V HV : 35V	300V / ?	-30°C 105°C	IEC 332-1
Readout board power supply	12	16	Hi-Flex-CY	Copper PVC	2A	5V	300V / ?	-30°C 70°C	IEC 332-1
Ladder power supply	12	16	Belden 8622	Copper PVC	LV : 2A HV : 1mA	LV : 5V HV : 35V	600V / 2A	80°C	UL 1581 VW1
Ladder power Sense	8	22	Belden 9421	Copper PVC	-	35V	300V / 2A	80°C	CSA FT4
Control	27	22	HELUKABEL LiY-CY 20070	Copper PVC	-	5V	300V/ ?	-30°C 80°C	IEC 332-1
Trigger	20	24	Belden 8170	Copper PVC	-	5V	300V / 1A	60°C	UL 1581

Characteristics of the connectors

Connectors	Cable / Location	Manufacturer Part Number	Material	Operating Current	Operating Voltage	Voltage Rating	Temperature Rating	Flammability Rating
Inside Rack Cable Low Voltage	RKLVxx PS, Distr Crate	Amphenol 777-RR-B25P	glass-filled thermoplastic	2A	5V	500V	-55°C 105°C	ULV94V-0
Inside Rack Panel Low Voltage	RKLVxx PS, Distr Crate	Amphenol 177-RR-B25S	glass-filled thermoplastic	2A	5V	500V	-55°C 105°C	ULV94V-0
Inside Rack Cable High Voltage	RKHVxx PS, Distr Crate	Amphenol 777-RR-C37P	glass-filled thermoplastic	1mA	35V	500V	-55°C 105°C	ULV94V-0
Inside Rack Panel High Voltage	RKHVxx PS, Distr Crate	Amphenol 177-RR-C37S	glass-filled thermoplastic	1mA	35V	500V	-55°C 105°C	ULV94V-0
Inside Rack Panel Mixed Voltage	FMVxx,SMVxx Rack	AMP CPC 206838-1	glass-filled thermoplastic	2A	35V	1500V	-55°C 105°C	ULV94V-0
Cable Mixed Voltage	FMVxx,SMVxx TPC Wheel	AMP CPC 206837-1	glass-filled thermoplastic	2A	35V	1500V	-55°C 105°C	ULV94V-0

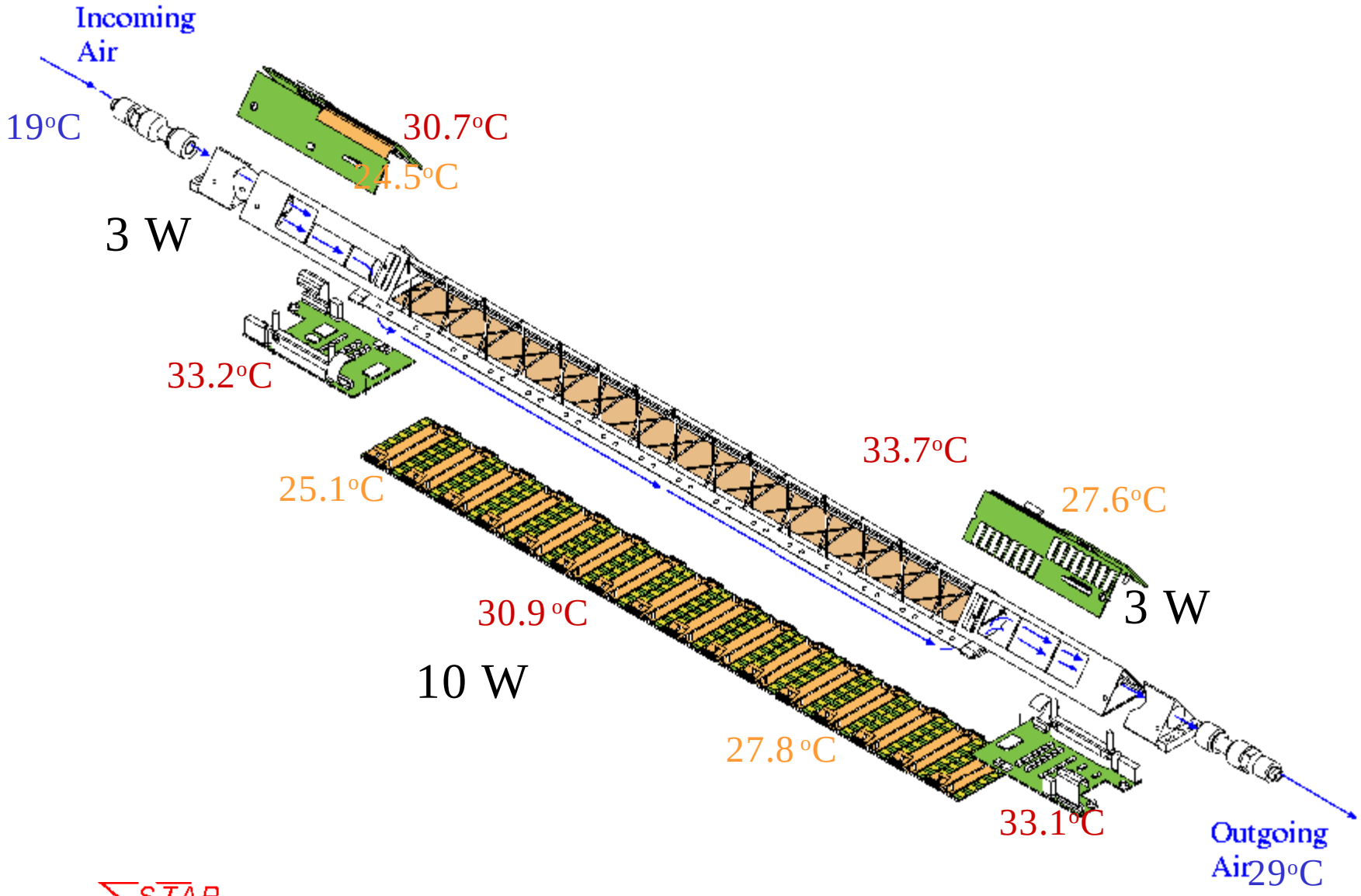
SSD cooling system : principle



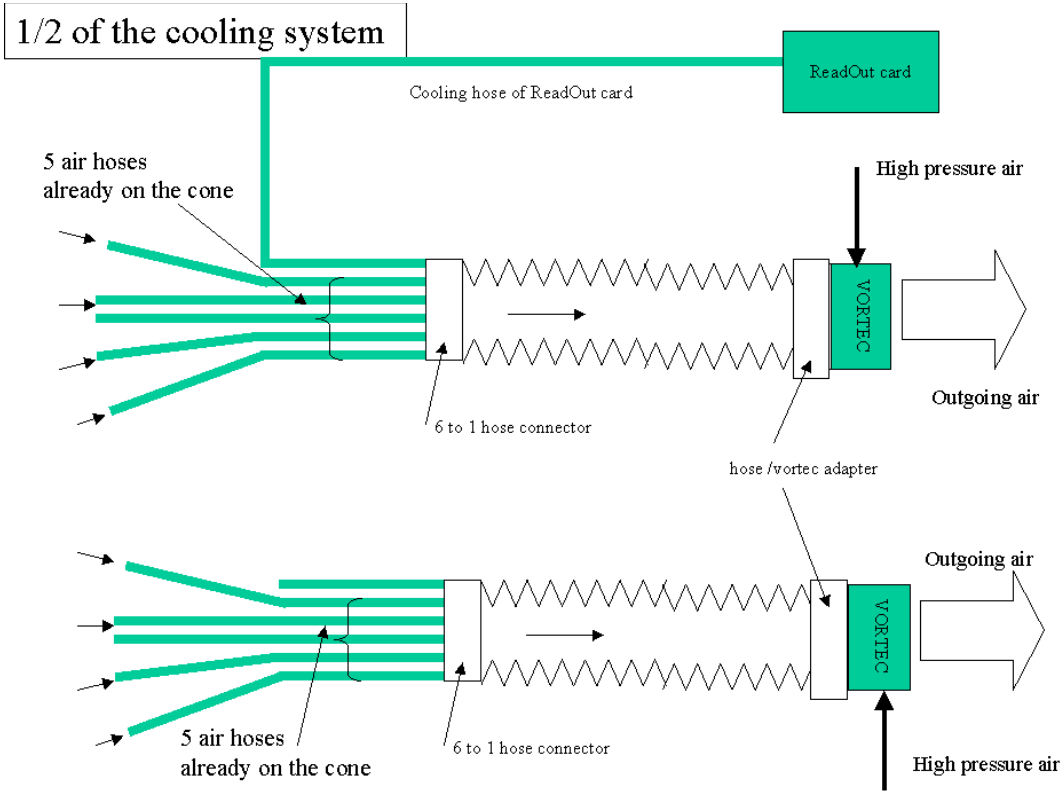


For the 1st year, the incoming air will be taken at the end of the cone using an air hose dedicated the an other ladder to simplify the shielding

SSD Cooling system : First Ladder



SSD cooling system : inside STAR

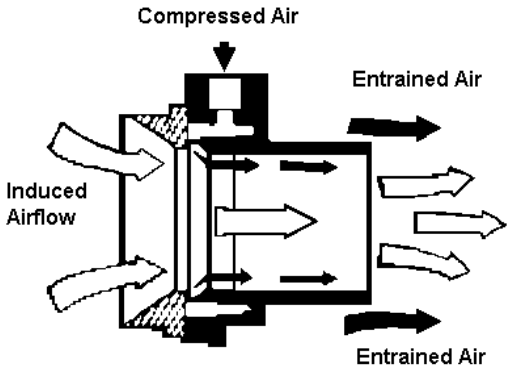


Temperature of the Readout board

- With cooling : 60 °C
- Without cooling : 70°C

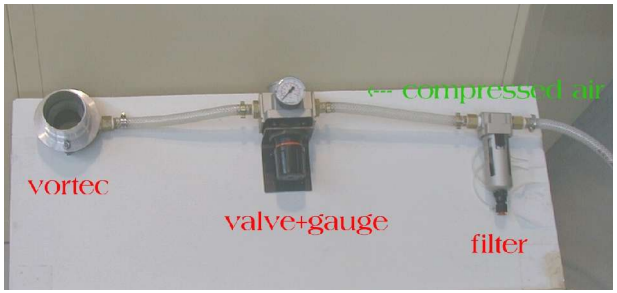
Noise level of transvector

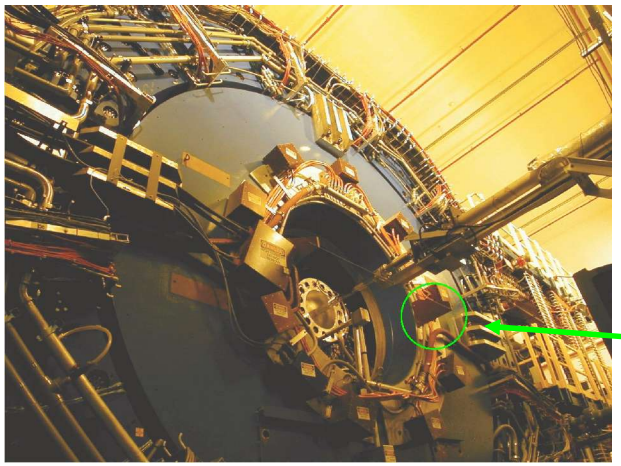
- 85dB at 0.5m
- 75 dB at 3m



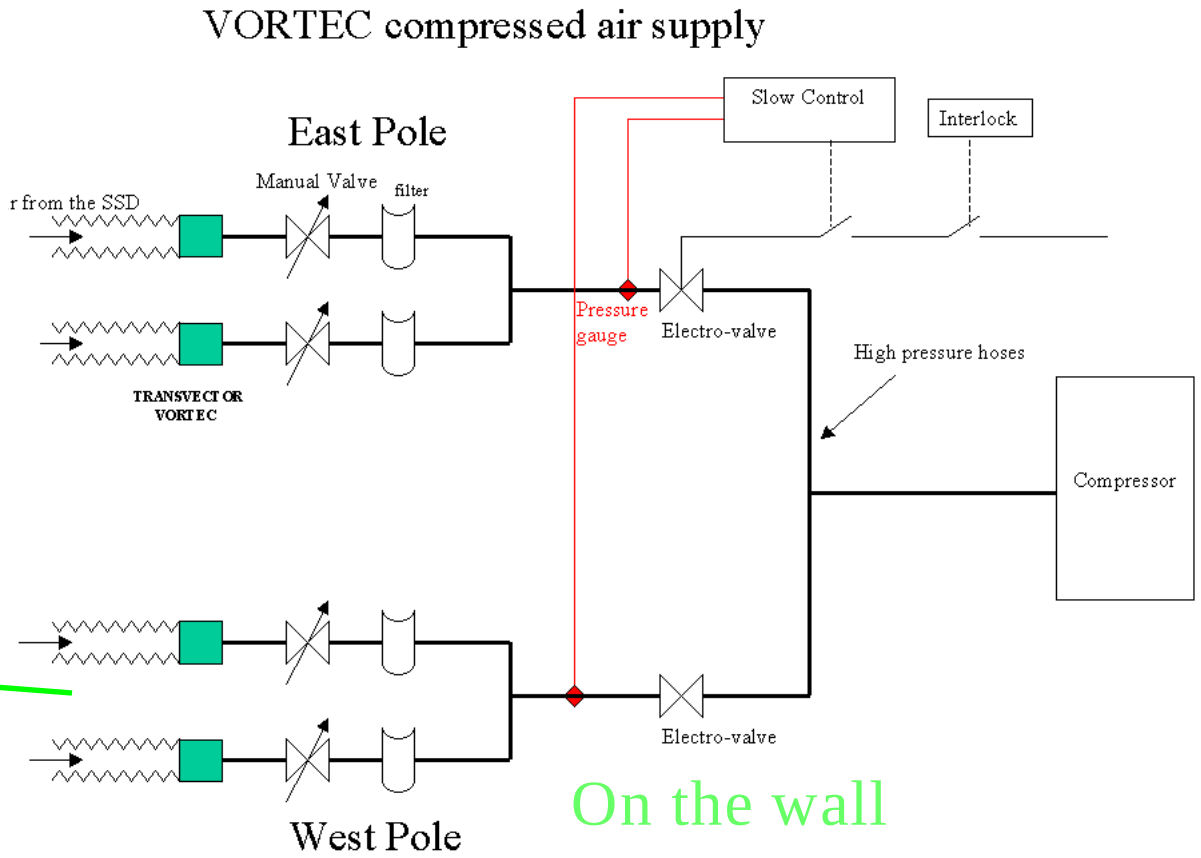
STAR Silicon Strip Detector

SSD Cooling system :outside STAR



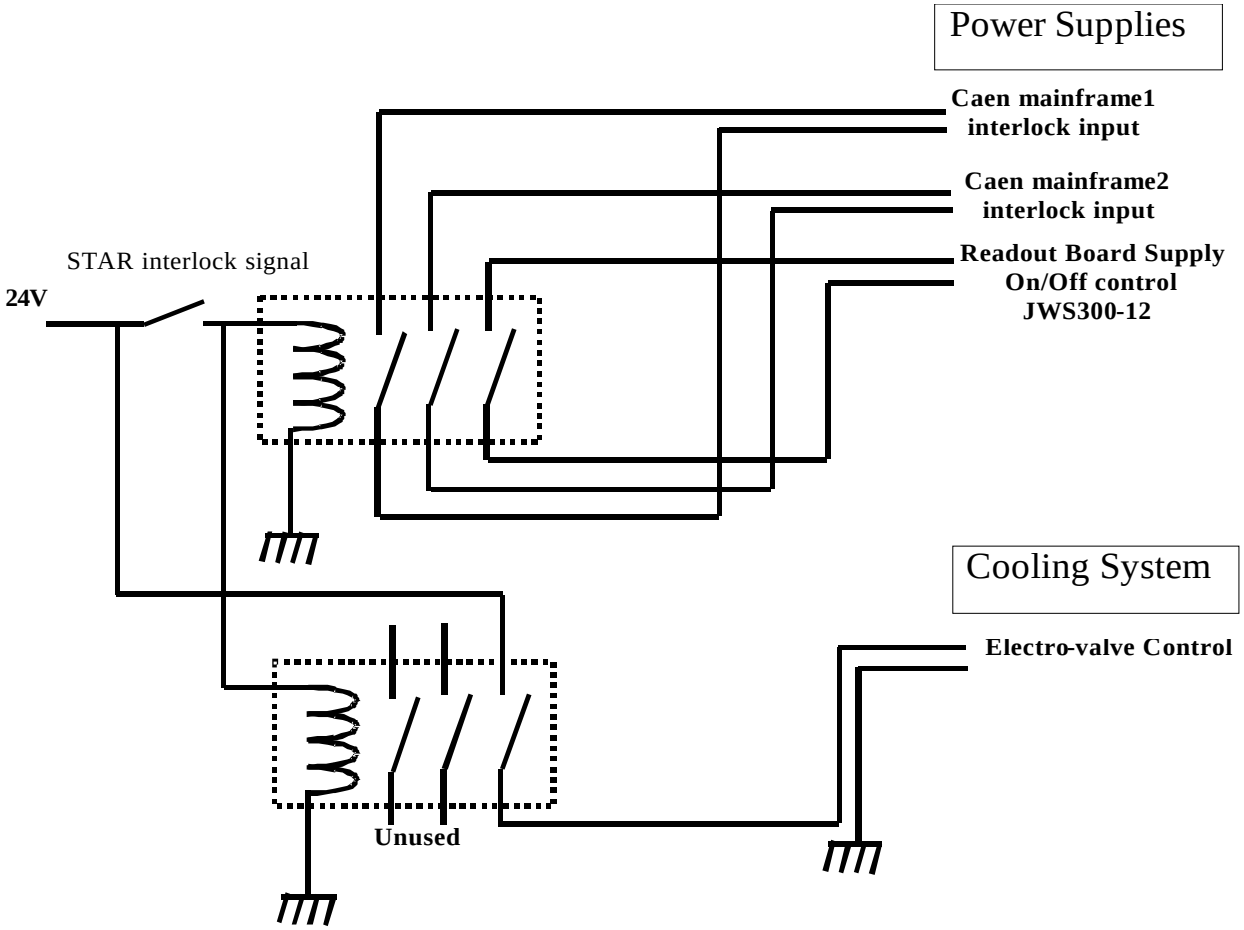


On the pole tips



On the wall

Interlocks



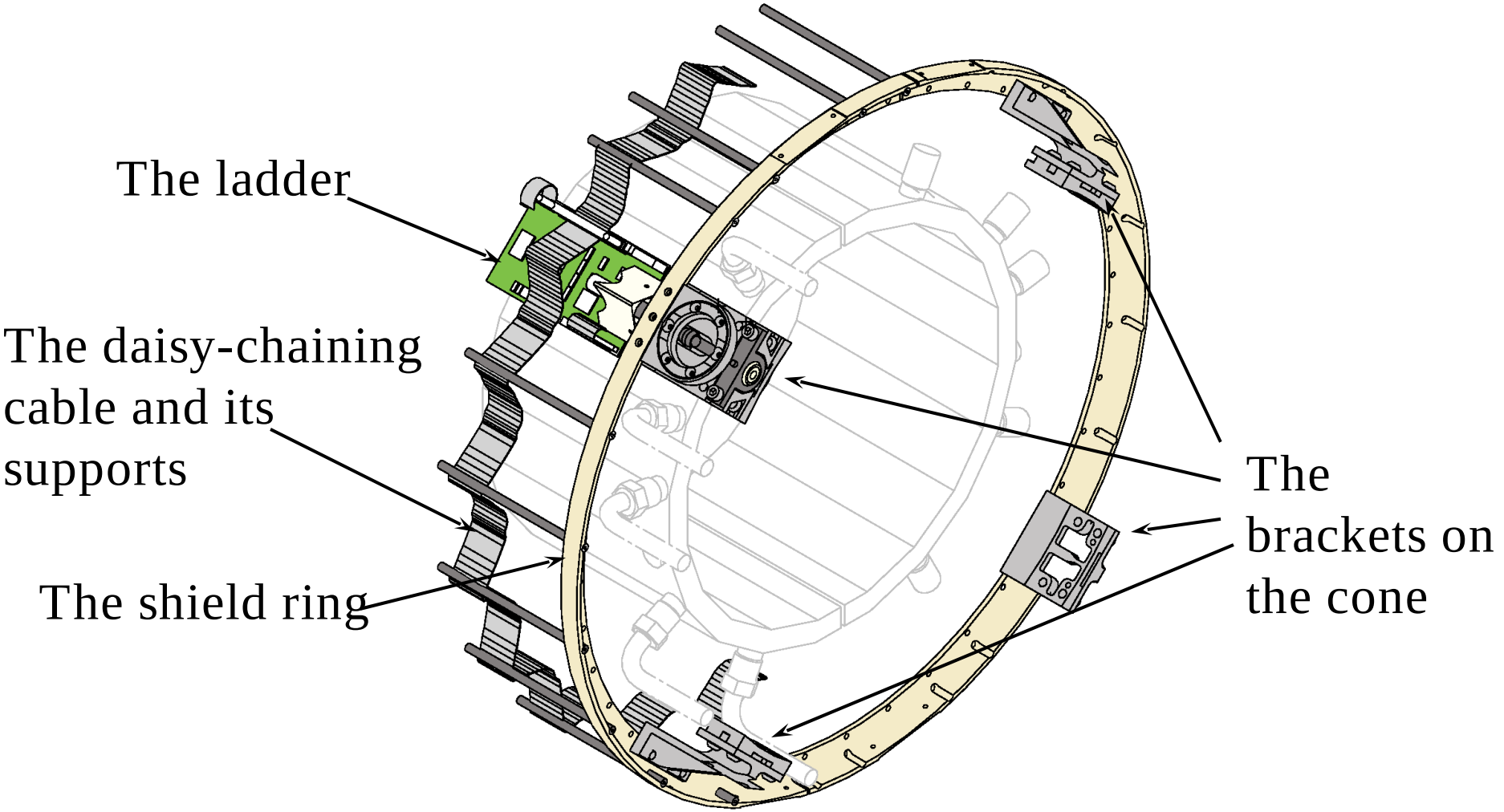
24V generated by OMRON 24 V 100 W, UL508 (listing)/1950

http://www.omron-ap.com/index_productpage/s82k.htm

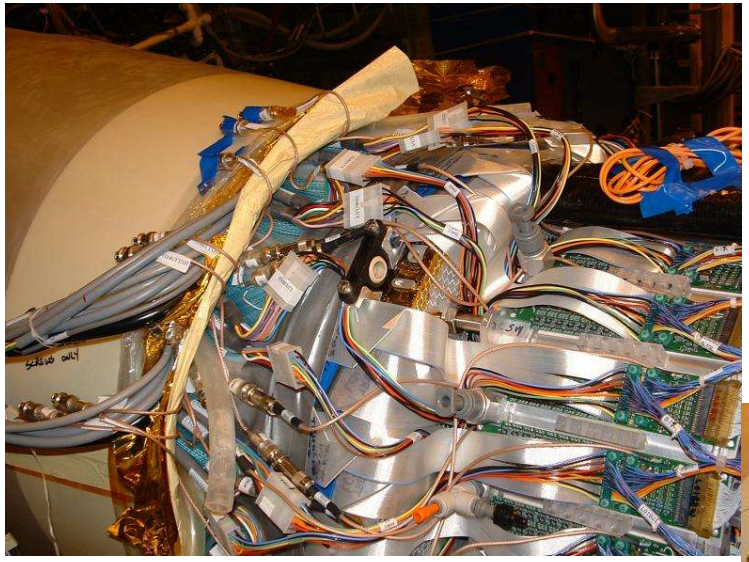
Ladder installation

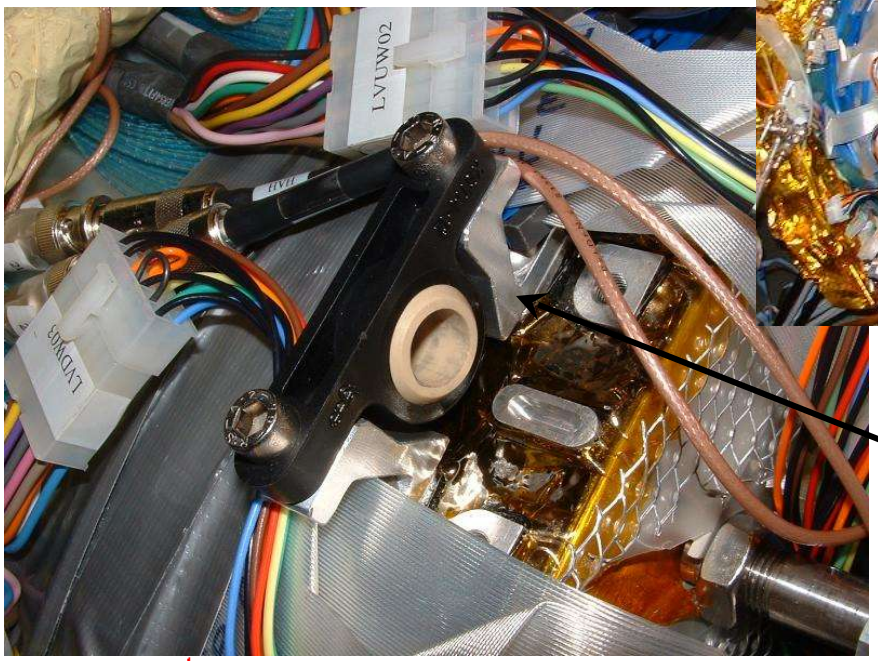
- The ladder and the SSD shield installation
  - At φ = -45° when looking East to West
  - Dedicated brackets to install/hold the ladder on the cone and to hold the shield rings
  - Simple brackets at φ = 45°, 135° and -135° to hold the shield rings

Ladder installation



Ladder installation





SSD brackets

Material of ladder support and daisy chain cable

Ensemble	Element	Manufacturer	Product Id	Material	Standards
Ladder support	Sigma pieces			Aluminum	
	Intermediate brackets			Aluminum	
	Bearings	Igus	KSTM	Polymer (iglide L280 / igulen G2)	UL 94 HB
Shield rings	Brackets			Glass fiber	
	Rings			Glass fiber	
Daisy-chaining cable	Supporting rods			Carbon fiber	
	SCSI Cable	3M	3749/68	Copper / Thermoplastic Elastomer	UL E42769/20297
	Connectors	3M	82068-6006	Copper / Glass Filled Polyester	UL 94 V-0
		3M	81068-600203	Copper / Liquid Crystal Polyester	UL 94 V-0
		Harting	60060685440	Copper / Glass Filled Polyester	UL 94 V-0

Installation Schedule

- Power supply : August 2002
- Slow control : August 2002
- DAQ : MiniDAQ installed August 2002
- Trigger : with MiniDAQ August 2002
- Ladder on the cone : September 2002
- Readout board : September 2002

  A test will be performed
- Cooling system : October 2002

Final Test October/November 2002