TOF DAQ, slow control and temperature read-out

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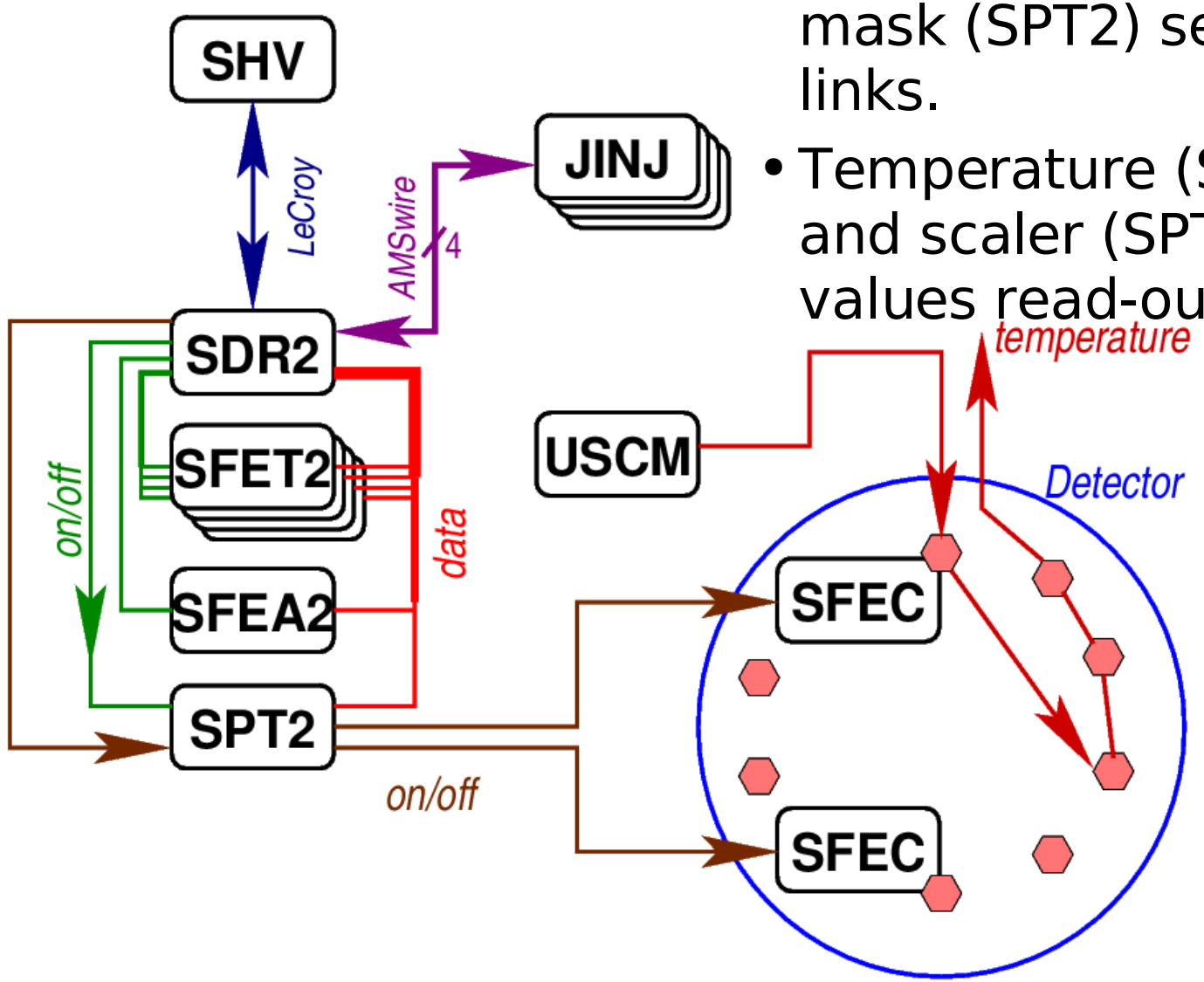
AMS TIM @ CERN, 11-15 April 2005

Topology



- Threshold (SFET2, SFEA2) and mask (SPT2) settings via data links.
- Temperature (SFET2, SFEA2) and scaler (SPT2) requests and values read-out via data links.
- Status monitor and control with p2p lines.
- HV settings via LeCroy connection.

Power-up procedure (1)

- Default status is on for everything, when receiving 28 V.
- DC/DC converters:
  - when a 28 V line is powered, the corresponding halves of S9052 and S9074 start working (no on/off control; no settings).
- SHV:
  - when a 28 V line is powered, the corresponding half start working: HVE ramp-up; default output settings.
  - Then it is ready to receive commands from SDR2.

Power-up procedure (2)

- S-crate:
  - when a 28 V line is powered, the corresponding halves of the S-crate boards start working;
  - the powered SDR2 half can switch off all corresponding modules.

- At power-up, each electronics module perform a boot sequence ending in a known state. Then it is ready to receive/send data/commands.

- If problems exist, explicit commands need to be sent.

PDS OUTLET #8 : LOWER TOF

PDS bus	PDS line	Patch Heater power @ at 113Vdc, W	Patch Heater resistance, Ω	Number of patches	Patch dimensions, mm	Power density @ 126.5Vdc, W/cm2	Total power consumption @ 113Vdc, W
A	8	1.875	6810	4 (2 each Plane +/-Y)	190x80	0,015	1,875x4+ 3,75*2+ 7,5*2= 30
	8	3.75	3405	2 (1 each Plane +/-Y)	870x95	0,005	
	8	7.5	1703	2 (1 each Plane +/-X)	600x50	0,03	

- THERMOSTAT SET POINT: -27°C/-22°C (when enabled)
- MAX TEMP LESS THAN SAFETY LIMITS BY ANALYSIS (SEE LTA THERMAL ANALYSIS REPORT IN LOWER TOF SECTION)
- NO USE OF HEATERS ON-ORBIT ISS IS FORESEEN , BUT DURING ACTIVATION SEQUENCE IF OCCURING IN THE COLDEST CASES TO BRING TEMPERATURE TO THE MIN SWITCH ON

YES

Mission longer than 3 years. Can we make them available on ISS too?

Warnings, alarms, actions

- Define the key-temperatures:
  - T_- = min{SFEC, PMT, scint. temperatures}
  - T_+ = max{SFEC, PMT, scint. temperatures}
- Automatic countermeasures should be taken when:
  - $T_- < -25°C$
    or
  - $T_+ > +40°C$

Mission duration > 3 years

Condition	Alert	Automatic action
$T < -35°C$	*Alarm*	Turn on heater until $T > -30°C$
$T < -25°C$	*Warning*	None
$T > +40°C$	*Warning*	None
$T > +50°C$	*Alarm*	Turn off TOF until $T < +45°C$

SDR2 functionalities

- SDR2 performs 3 sets of operations:
  - DAQ,
  - trigger and
  - slow-control operations.

	Get	Set	Via	Target
Trigger	Mask	Mask	A.FE	SPT2
	Scaler	Scaler (reset)	A.FE	SPT2
Slow Control	Status (monitor)	Status (on/off)	A.FE	SPT2, SFE*
	HV (status)	HV	DSP/LeCroy	SHV
	Imon		DSP?	backplane
	Temperature		A.FE	SFET2, SFEA2
		Threshold	A.FE	SFET2, SFEA2
DAQ	(DAQ mode)	DAQ mode	—	A.CDP
	Event data		A.FE	SPT2, SFE*

Front-end data formats (1)

- SFET2 output words are (19+2)-bits long.

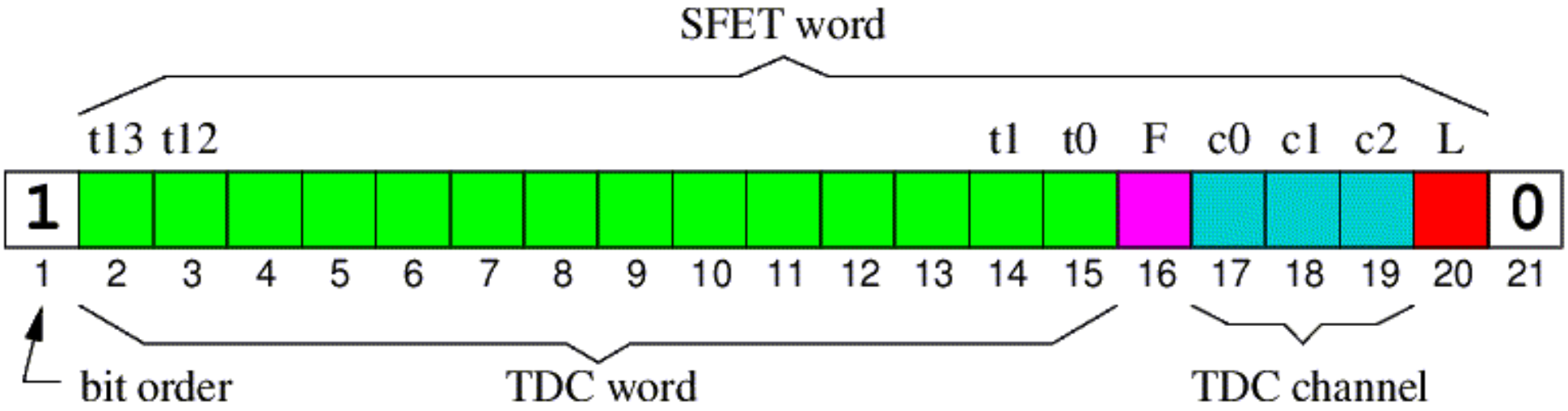


Figure 5. Input SFET time data format. The TDC word bits are "t0"…"t13" (least to most significant); F = 0 (1) means that the analog signal crossed downward (upward) the fixed threshold; the following three bits ("c0"…"c2") encode the channel number; L = 1 indicates that this is the last SFET word.

- See http://ams.cern.ch/AMS/Electronics/SubD/Scint/

Front-end data formats (2)

- Charge data are streams of 12-bits words (G1 then G5).

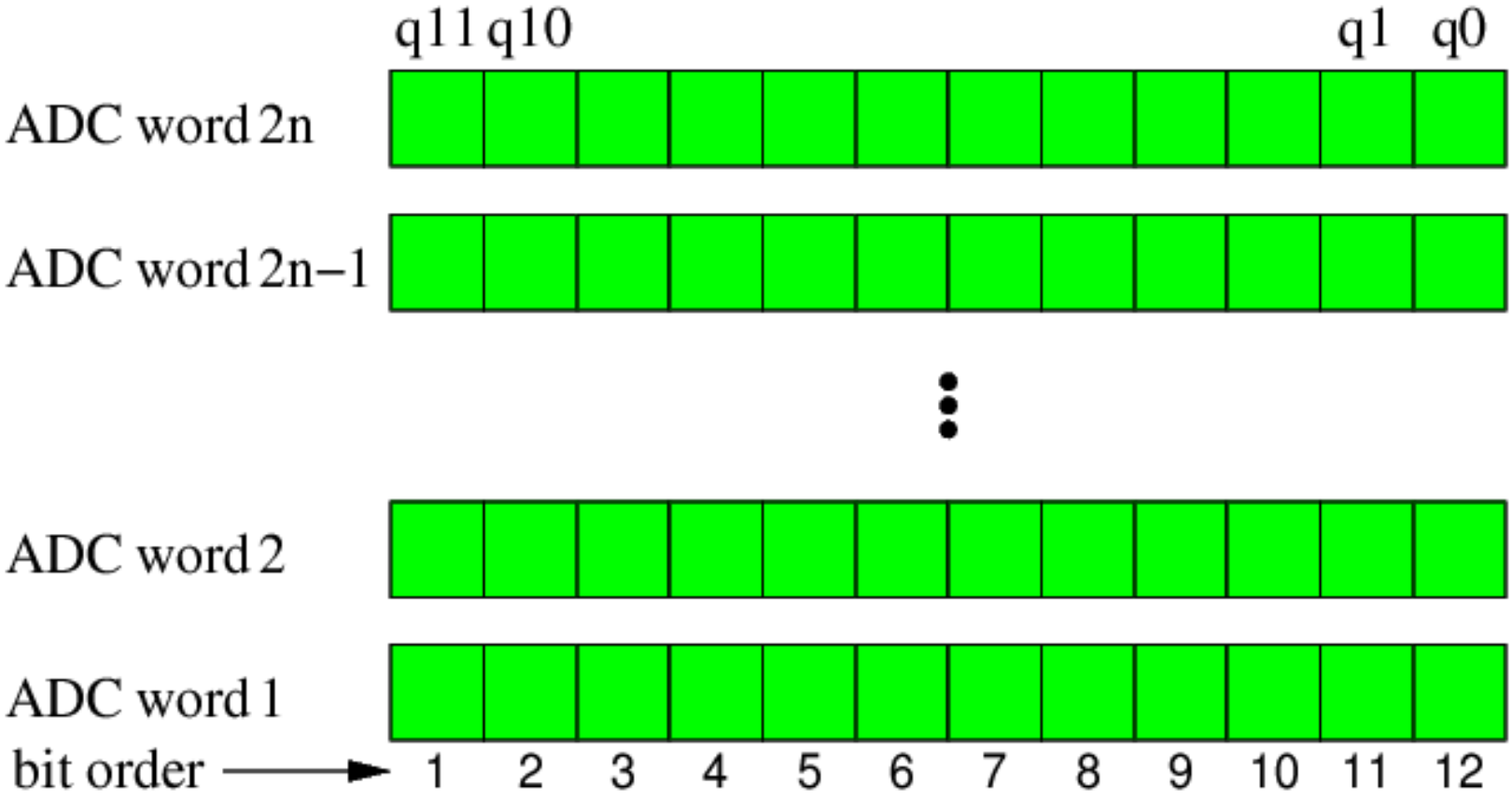


Figure 6. Input SFE*x* charge data format. The ADC 12-bits words are continuously transmitted following the reception of the charge strobes. Becouse the number of channels to be read is 10, $n = 20$ ADC word are transmitted.

Current and status monitor

- Each S-crate board keeps a status line updated with the logical OR of the status of its input LV protection circuits.
- SDR2 receives all status lines.
- The status word has for each board:
  - one status bit (on/off);
  - 2 bits for the drained current.

Status control

- SDR2 has two (1+1) SDR modules. Each SDR module controls the status of the corresponding half crate.

- Status control lines for:
  - SFET2 a;
  - SFET2 b;
  - SPT2;
  - SFET2 c;
  - SFET2 d;
  - SFEA2;
  - one line for the two SFEC boards.

- Both the two SFEC boards are off if at least one SDR module sends the command “turn off”.

Temperature read-out

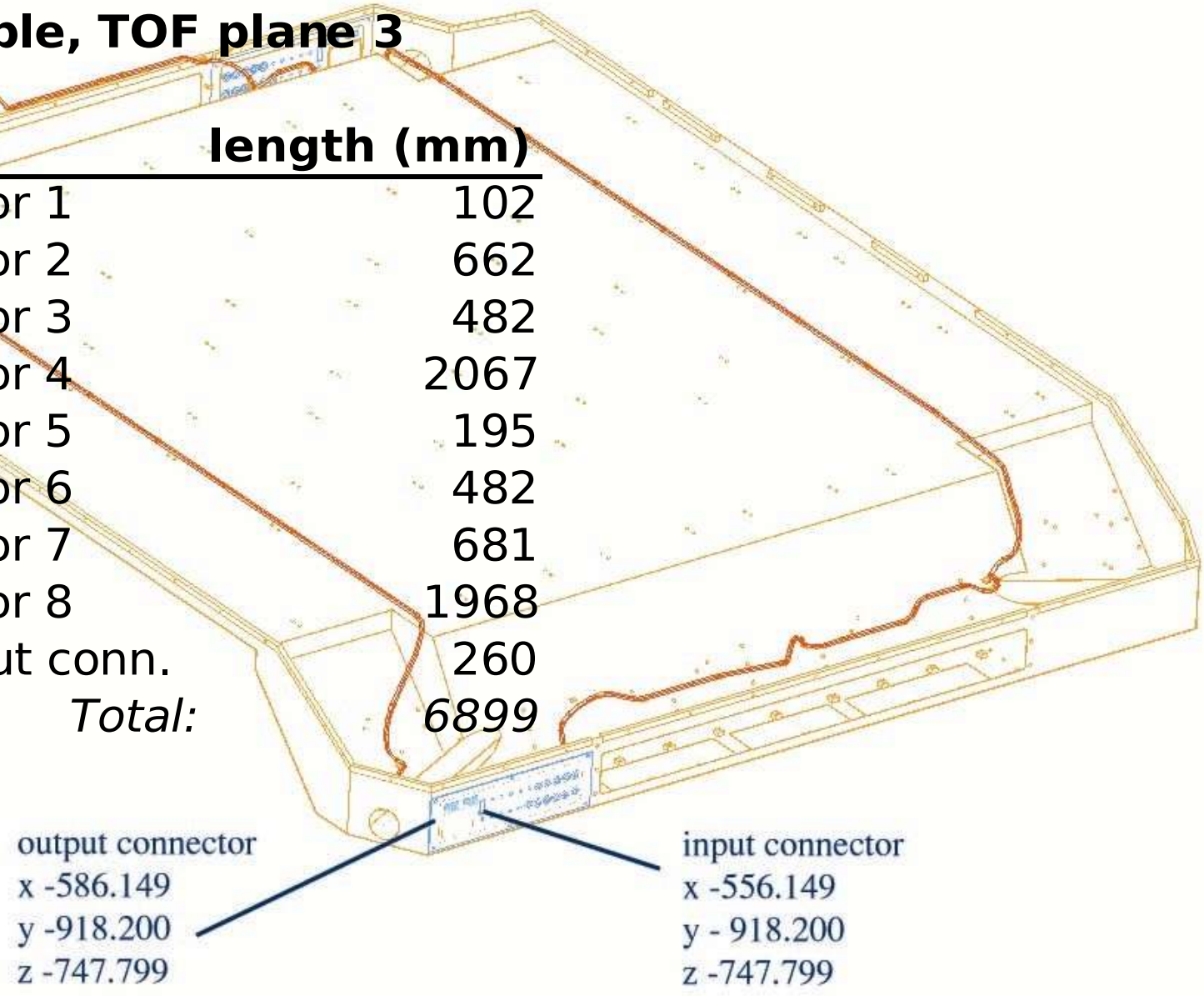
- SFET2 and SFEA2 have on-board temperature sensors: values are sent to SDR2 via the data link (TOFwire).
- Slow-control commands are used to get temperatures.
- “GetTemperature” sent on each event and values stored in SDR2.

- Temperature sensors on S-crate, SHV and xPD walls, together with temperature sensors inside the TOF detector, are read system-wise (GTN).
- The temperature cables inside TOF have the following properties:
  - input and output connector on the same patch-panel;
  - 8 temperature points per TOF plane;
  - 1 bus per TOF plane.

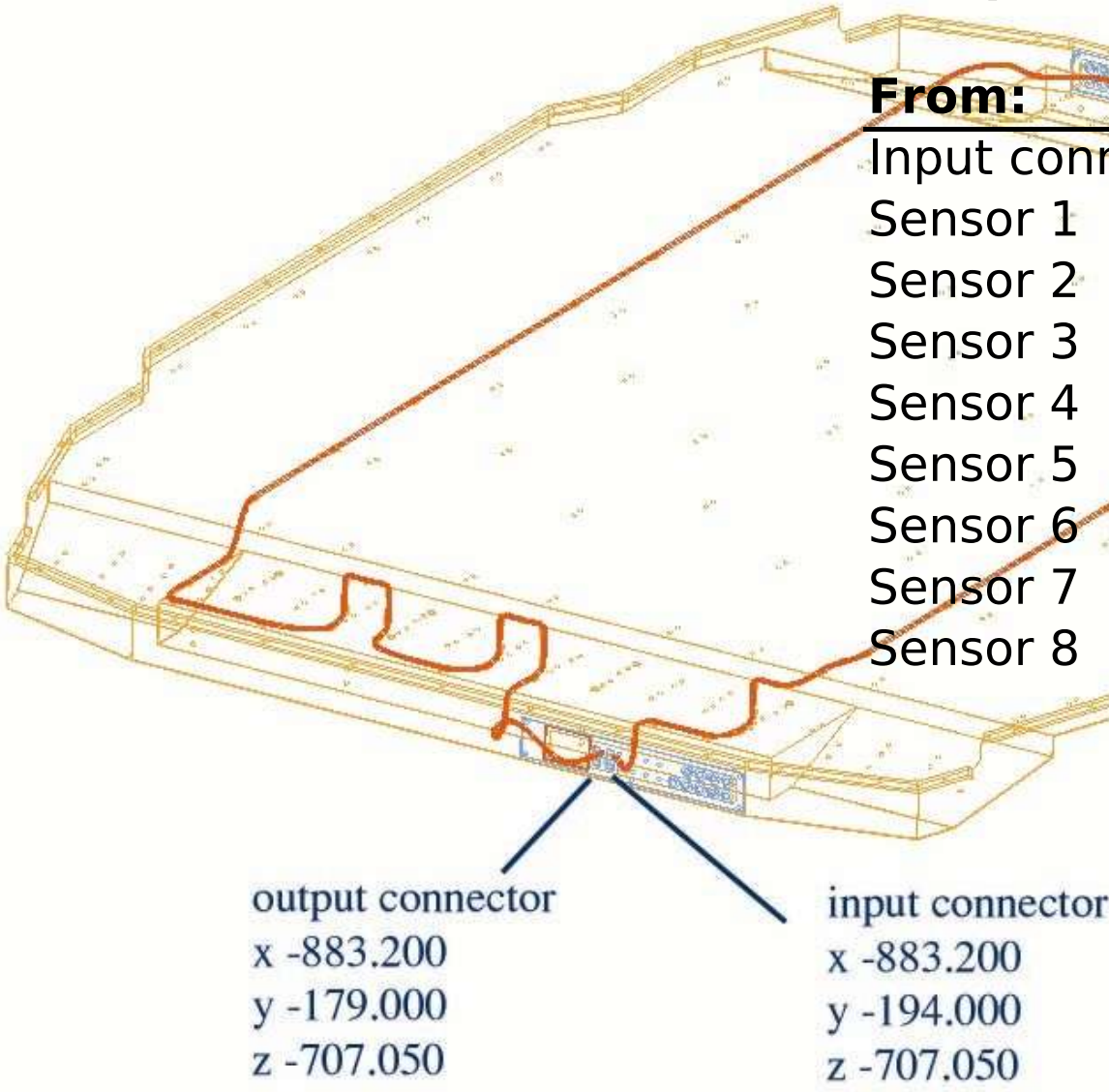
Plane 3 temperature

Temperature cable, TOF plane 3

From:	To:	length (mm)
Input conn.	Sensor 1	102
Sensor 1	Sensor 2	662
Sensor 2	Sensor 3	482
Sensor 3	Sensor 4	2067
Sensor 4	Sensor 5	195
Sensor 5	Sensor 6	482
Sensor 6	Sensor 7	681
Sensor 7	Sensor 8	1968
Sensor 8	Output conn.	260
	Total:	*6899*



Plane 4 temperature



Temperature cable, TOF plane 4

From:	To:	length (mm)
Input conn.	Sensor 1	284
Sensor 1	Sensor 2	1794
Sensor 2	Sensor 3	544
Sensor 3	Sensor 4	257
Sensor 4	Sensor 5	312
Sensor 5	Sensor 6	2108
Sensor 6	Sensor 7	323
Sensor 7	Sensor 8	452
Sensor 8	Output conn.	122
	Total:	*6196*