CLRC

9th December 2000

To: Anna Di Giorgio/Riccardo Cerulli-Irell, Christophe Cara, Lionel Duband, Peter Hargrave, Joe Taylor, Brian Stobie, James Bock, Jean-Paul Baluteau
From: John Delderfield
cc: Matt Griffin, Bruce Swinyard, Dave Smith, Colin Cunningham, Gerald Lilienthal, Berend Winter

SPIRE HARNESSING, etc.

It's important that all the recipients respond in detail to this note.

Please find a block diagram of SPIRE. This has been updated to reflect information from the recent reviews. It's best printed in at least A3 colour. This note primarily concerns the non-bolometer systems, but you will note some information missing in the block diagram for photometer bias, JFET supply, JFET heater and JFET temperature areas. I was part-way through generating a comprehensive note on the bolometer systems' design details when I decided it would be best to break off and sort out these more straightforward areas.

We are moving rapidly to a reasonably detailed definition of instrument harnesses :

i. as part of ensuring that we have a complete instrument electronics definition that fits together
ii. due to the lead-times for cryostat harness procurement, both flight and test.
iii. the proper mechanical detailing and assembly sequences so that the harness' accommodation is OK

The intention is to set in place a sufficient framework that when Doug Griffin starts in January, he can put together the more detailed SPIRE harness document, assigning large numbers of FSFTP connector IDs, etc..

Let me run through the harness provision.

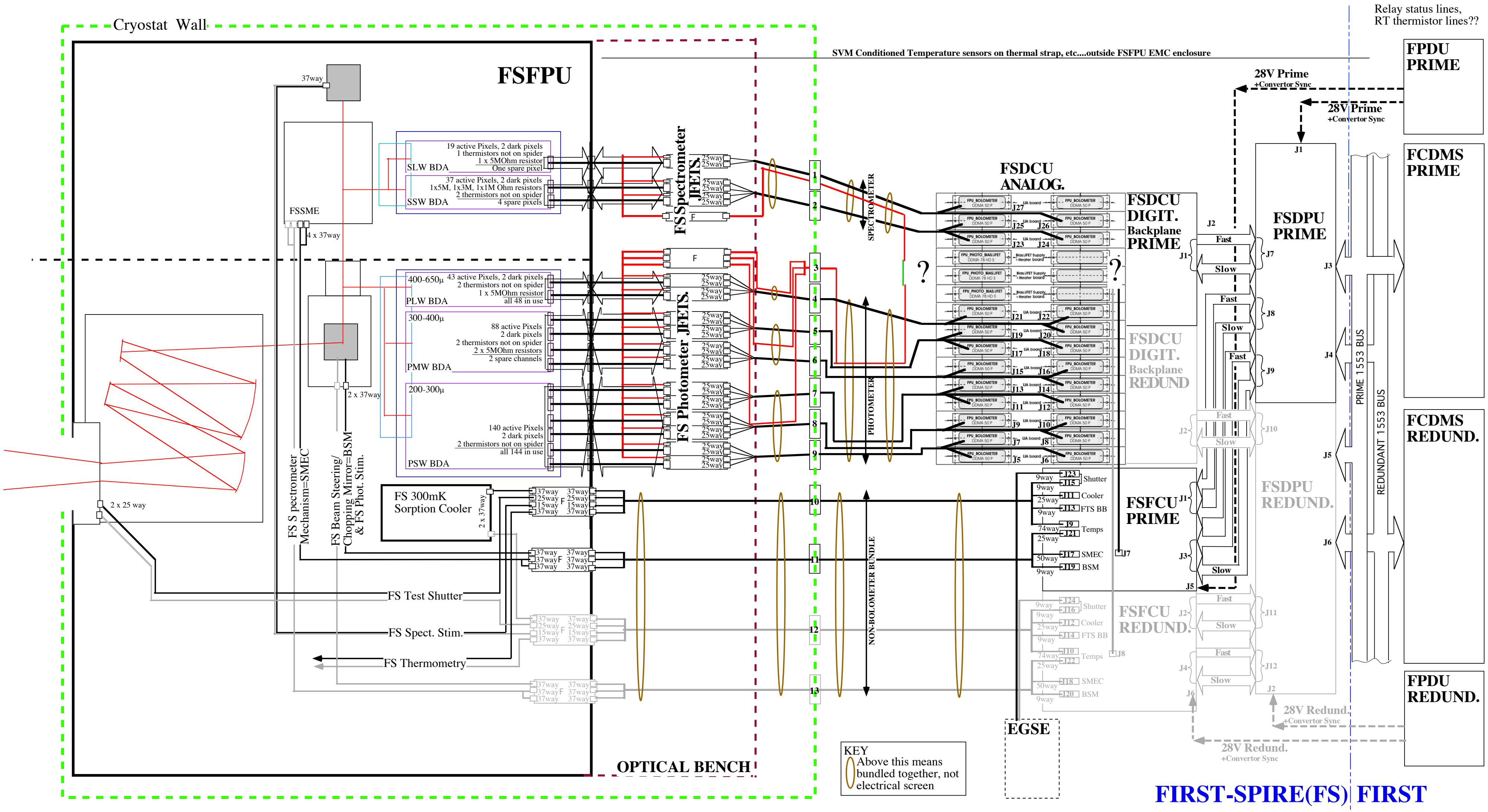
Each subsystem provides its own cold harnesses with each mechanism delivery, and for the STM if that does not involve a real sub-system. These are essentially isothermal harnesses that travel around the FSFTP with appropriate shielding,, probably in 30AWG copper, terminating in MDMs as shown in the block diagram. My intention would be to install them in the structure and, unless they fail, to leave them there. Quite apart from any sensor/drive screening for their own subsystem purposes, these harnesses must not introduce EM noise into the FSFTP…nor should EM leak from the subsystems themselves! Please supply harness conductor sizes (electrical and physical) to both myself and Berend ASAP. All grounds are referenced to a secondary star ground in the FCU, and the harnesses should not join any of the conductors on connector pins to chassis.

Subsystem suppliers might find it useful to build short non-flight EGSE cables to join these harnesses directly to the DCU (or a breadboard of it) without the cryoharness or filters being present. Such harnesses should include (boxed?) inline impedance equivalent components. Making these components switchable to simulate both hot and cold cryoharness would be very useful.

Even if drive outputs are fully filtered in the FCU, they and other leads could pick-up noise in the cryoharness before reaching the FSFTP. Therefore all these harnesses pass through the FSFTP wall in an R.F. tight seal via Filter Units supplied by JPL. Having threatened to make these units in which wires could be rearranged input-output, I've relented and the block diagram is meant to mean that they have all wired 1:1 in:out between connectors if not contact numbers. Some details still mean tidying up. As the harnesses have internal screens along the rest of their length, will there be unwanted wire:wire crosstalk in the Filter Units if wiring is open track? More importantly can subsystem designers please confirm that their signals being transmitted work properly with 2.2nF to chassis hung on each if the conductors…as mentioned in my last information pack {note that this is ±~30% with tolerance and temperature, and there is no matching}.

The harnesses that run from the Filter Units to the DCU are defined in the attached table. These are ESA provided for flight and I will very shortly edit these details into the IIDB. Please provide updated current and resistance details using the conditions defined therein ASAP, *even if the last input is unchanged.* I would suppose that any reasonable cable capacitance is swamped out by the R.F. filters, but comment if you have other opinions. Note that these listings may have a slightly alternative form to that which you saw at the reviews because I have arranged matters explicitly to show the presense of some reliability improving "robustness" lines.

Merry Christmas


Cryostat Wall
FSFPU
37way
FSSME
4 x 37way
19 active Pixels, 2 dark pixels
1 thermistors not on spider
1 x 5MOhm resistor
One spare pixel
SLW BDA
37 active Pixels, 2 dark pixels
1x5M, 1x3M, 1x1M Ohm resistors
2 thermistors not on spider
4 spare pixels
SSW BDA
400-650μ
43 active Pixels, 2 dark pixels
2 thermistors not on spider
1 x 5MOhm resistor
all 48 in use
PLW BDA
300-400μ
88 active Pixels
2 dark pixels
2 thermistors not on spider
2 x 5MOhm resistors
2 spare channels
PMW BDA
200-300μ
140 active Pixels
2 dark pixels
2 thermistors not on spider
all 144 in use
PSW BDA
2 x 37way
2 x 25 way
FS S pectrometer Mechanism=SMEC
FS Beam Steering/ Chopping Mirror=BSM & FS Phot. Stim.
FS 300mK Sorption Cooler
FS Test Shutter
FS Spect. Stim.
FS Thermometry
FS Spectrometer JFETS
FS Photometer JFETS
OPTICAL BENCH
SPECTROMETER
PHOTOMETER
NON-BOLOMETER BUNDLE
SVM Conditioned Temperature sensors on thermal strap, etc....outside FSFPU EMC enclosure
FSDCU ANALOG.
FSDCU DIGIT. Backplane PRIME
FSDCU DIGIT. Backplane REDUND
FSFCU PRIME
FSFCU REDUND.
FSDPU PRIME
FSDPU REDUND.
Shutter
Cooler
FTS BB
Temps
SMEC
BSM
Fast
Slow
28V Prime +Convertor Sync
28V Redund. +Convertor Sync
Relay status lines, RT thermistor lines??
FPDU PRIME
FCDMS PRIME
FCDMS REDUND.
FPDU REDUND.
PRIME 1553 BUS
REDUNDANT 1553 BUS
EGSE
KEY
Above this means bundled together, not electrical screen
FIRST-SPIRE(FS)
FIRST

	No. of Cond. Pins	No. of shield pins	Max.allowed Conductor Res.(Ohms)	Mean Current (A)/condt.	Peak Current (A)/condt.	Remarks	Cernox Type or Connect.ID
AUXILIARY PRIME 10	*Total Pins in use=*			*98*	*[69therm]*		
Spect JFET chassis therm.	4	0.25	1000	2.50E-09	2.50E-09	Scr. Tw. Quad	CX-1070
Phot JFET chassis therm.	4	0.25	1000	2.50E-09	2.50E-09	Scr. Tw. Quad	CX-1070
FSFPU chassis therm.	4	0.25	1000	2.50E-09	2.50E-09	Scr. Tw. Quad	CX-1070
Photometer 2K box	4	0.25	1000	2.50E-09	2.50E-09	Scr. Tw. Quad	CX-1050
Spectrometer 2K box	4	0.33	1000	2.50E-09	2.50E-09	Scr. Tw. Quad	CX-1050
M3,5,7 Optical Subench	4	0.33	1000	2.50E-09	2.50E-09	Scr. Tw. Quad	CX-1050
Input Baffle Therm	4	0.34	1000	2.50E-09	2.50E-09	Scr. Tw. Quad	CX-1050
30	28	2	37 way connector			All therm	*DCU J9*
FTS BB Flood Heater	2	0	30	3.00E-03	3.00E-03	Twisted Pair	
FTS BB Flood Heater(rob.)	2	0	30	3.00E-03	3.00E-03	Twisted Pair	
FTS BB Flood Therm.	4	0.5	1000	2.50E-09	2.50E-09	Scr. Tw. Quad	CX-1070
FTS BB case nr. SOB I/F therm	4	0.5	1000	2.50E-09	2.50E-09	Scr. Tw. Quad	CX-1070
FTS BB Point Stimulus	2	0	30			Twisted Pair	
15	14	1	37 way connector to two 15 ways			9therm+6	DCU J13+9
Pump heater	2	0	10	3.00E-02	3.00E-02	Twisted Pair	
Pump heater(rob.)	2	0	10	3.00E-02	3.00E-02	Twisted Pair	
Pump therm.	4	0.2	1000	2.50E-09	2.50E-09	Scr. Tw. Quad	CX-1050
Evap. diag. heater	2	0	10	0.00E+00	0.00E+00	Twisted Pair	
Evap. therm.	4	0.2	1000	2.50E-09	2.50E-09	Scr. Tw. Quad	CX-1030
Shunt therm.	4	0.2	1000	2.50E-09	2.50E-09	Scr. Tw. Quad	CX-1030
Pump heat SW heater	2	0	10	1.60E-03	1.60E-03	Twisted Pair	
Evap. heat SW heater	2	0	10	1.60E-03	1.60E-03	Twisted Pair	
Pump heat SW heater(rob.)	2	0	10	1.60E-03	1.60E-03	Twisted Pair	
Evap. heat SW heater(rob.)	2	0	10	1.60E-03	1.60E-03	Twisted Pair	
Pump heat SW therm.	4	0.2	1000	2.50E-09	2.50E-09	Scr. Tw. Quad	CX-1050
Evap. heat SW therm.	4	0.2	1000	2.50E-09	2.50E-09	Scr. Tw. Quad	CX-1050
35	34	1	37 way connector			21therm+14	DCU J11+9
Shutter Actuator	2	0	10			Twisted Pair	
Shutter Heater	2	0	10			Twisted Pair	
Shutter Actuator Therm	4	0.5	1000	2.50E-09	2.50E-09	Scr. Tw. Quad	CX-1070
Shutter Vane Position	4	1	1000	2.50E-09	2.50E-09	Scr. Tw. Quad	
Shutter Actuator Therm	4	0.5	1000	2.50E-09	2.50E-09	Scr. Tw. Quad	CX-1070
18	16	2	25 way connector			9therm+9	DCU J15+9
DRIVES PRIME 11	*Total Pins in use=*			*97*	*[19therm]*		
SMEC Mechanism Temp	4	1	1000	2.50E-09	2.50E-09	Scr. Tw. Quad	CX-1050
SMEC posn sensors	19	1	1000	1.00E-04	1.00E-04	TBD	
SMEC drive coil	2	1	10	8.00E-03	8.00E-03	Scr. Tw. Pair	
SMEC drive coil(rob.)	2	1	10	8.00E-03	8.00E-03	Scr. Tw. Pair	
SMEC drive coil volts	2	1	1000	2.50E-09	2.50E-09	Scr. Tw. Pair	
SMEC home/limit switches	18	1	1000	1.00E-03	1.00E-03	TBD	
SMEC Launch Latch	2	0	10			Scr. Tw. Pair	
SMEC/SOB I/F therm	4	1	1000	2.50E-09	2.50E-09	Scr. Tw. Quad	CX-1070
60	53	7	two 37 way connectors			10thm+20+19+11	DCU J17+21
BSM chop drive coil	2	0.5	10	2.50E-03	2.50E-03	Scr. Tw. Pair	
BSM jiggle drive coil	2	0.5	10	2.50E-03	2.50E-03	Scr. Tw. Pair	
BSM chop drive coil(rob.)	2	0.5	10	2.50E-03	2.50E-03	Scr. Tw. Pair	
BSM jiggle drive coil(rob.)	2	0.5	10	2.50E-03	2.50E-03	Scr. Tw. Pair	
BSM chop posn. sense coil	5	1	100	2.50E-03	2.50E-03	TBD	
BSM jiggle posn. sense coil	5	1	100	2.50E-03	2.50E-03	TBD	
BSM therm	4	0.5	1000	2.50E-09	2.50E-09	Scr. Tw. Quad	CX-1050
BSM Launch Latch	2	0	10			Twisted Pair	
BSM Launch Latch sensor	2	0	1000			Twisted Pair	
Phot. BB Point Stimulus	2	0	30			Twisted Pair	
BSM/SOB I/F therm	4	0.5	1000	2.50E-09	2.50E-09	Scr. Tw. Quad	CX-1070
37	32	5	37 way connector			9therm+28	DCU J19+21

	No. of Cond. Pins	No. of shield pins	Max.allowed Conductor Res.(Ohms)	Mean Current (A)/condt.	Peak Current (A)/condt.	Remarks	Cernox Type or Connect.ID
AUXILIARY REDUNDANT 12	*Total Pins in use=*			*98*	*[69therm]*		
Spect JFET chassis therm.	4	0.25	1000	2.50E-09	2.50E-09	Scr. Tw. Quad	CX-1070
Phot JFET chassis therm.	4	0.25	1000	2.50E-09	2.50E-09	Scr. Tw. Quad	CX-1070
FSFPU chassis therm.	4	0.25	1000	2.50E-09	2.50E-09	Scr. Tw. Quad	CX-1070
Photometer 2K box	4	0.25	1000	2.50E-09	2.50E-09	Scr. Tw. Quad	CX-1050
Spectrometer 2K box	4	0.33	1000	2.50E-09	2.50E-09	Scr. Tw. Quad	CX-1050
M3,5,7 Optical Sub-bench	4	0.33	1000	2.50E-09	2.50E-09	Scr. Tw. Quad	CX-1050
Input Baffle Therm	4	0.34	1000	2.50E-09	2.50E-09	Scr. Tw. Quad	CX-1050
30	28	2	37 way connector			All therm	DCU J10
FTS BB Flood Heater	2	0	30	3.00E-03	3.00E-03	Twisted Pair	
FTS BB Flood Heater (rob.)	2	0	30	3.00E-03	3.00E-03	Twisted Pair	
FTS BB Flood Therm.	4	0.5	1000	2.50E-09	2.50E-09	Scr. Tw. Quad	CX-1070
FTS BB case nr. SOB I/F therm	4	0.5	1000	2.50E-09	2.50E-09	Scr. Tw. Quad	CX-1070
FTS BB Point Stimulus	2	0	30			Twisted Pair	Unused?
15	14	1	See L.H.S.			9therm+6	DCU J14+10
Pump heater	2	0	10	3.00E-02	3.00E-02	Twisted Pair	
Pump heater (rob.)	2	0	10	3.00E-02	3.00E-02	Twisted Pair	
Pump therm.	4	0.2	1000	2.50E-09	2.50E-09	Scr. Tw. Quad	CX-1050
Evap. diag. heater	2	0	10	0.00E+00	0.00E+00	Twisted Pair	
Evap. therm.	4	0.2	1000	2.50E-09	2.50E-09	Scr. Tw. Quad	CX-1030
Shunt therm.	4	0.2	1000	2.50E-09	2.50E-09	Scr. Tw. Quad	CX-1030
Pump heat SW heater	2	0	10	1.60E-03	1.60E-03	Twisted Pair	
Evap. heat SW heater	2	0	10	1.60E-03	1.60E-03	Twisted Pair	
Pump heat SW heater(rob.)	2	0	10	1.60E-03	1.60E-03	Twisted Pair	
Evap. heat SW heater(rob.)	2	0	10	1.60E-03	1.60E-03	Twisted Pair	
Pump heat SW therm.	4	0.2	1000	2.50E-09	2.50E-09	Scr. Tw. Quad	CX-1050
Evap. heat SW therm.	4	0.2	1000	2.50E-09	2.50E-09	Scr. Tw. Quad	CX-1050
35	34	1	37way connector			21therm+14	DCU J12+10
Shutter Actuator	2	0	10			Twisted Pair	
Shutter Heater	2	0	10			Twisted Pair	
Shutter Actuator Therm	4	0.5	1000	2.50E-09	2.50E-09	Scr. Tw. Quad	CX-1070
[Shutter Vane Position]	4	1	1000	2.50E-09	2.50E-09	Scr. Tw. Quad	CX-1070
Shutter Actuator Therm	4	0.5	1000	2.50E-09	2.50E-09	Scr. Tw. Quad	CX-1070
18	16	2	25 way connector			9therm+9	DCU J16+10
DRIVES REDUNDANT 13	*Total Pins in use=*			*97*	*[19therm]*		
SMEC Mechanism Temp	4	1	1000	2.50E-09	2.50E-09	Scr. Tw. Quad	CX-1050
SMEC posn sensors	19	1	1000	1.00E-04	1.00E-04	TBD	
SMEC drive coil	2	1	10	0.00E+00	8.00E-03	Scr. Tw. Pair	
SMEC drive coil(rob.)	2	1	10	0.00E+00	8.00E-03	Scr. Tw. Pair	
SMEC drive coil volts	2	1	1000	2.50E-09	2.50E-09	Scr. Tw. Pair	
SMEC home/limit switches	18	1	1000	1.00E-03	1.00E-03	TBD	
SMEC Launch Latch	2	0	10			Scr. Tw. Pair	
SMEC/SOB I/F therm	4	1	1000	2.50E-09	2.50E-09	Scr. Tw. Quad	CX-1070
60	53	7	two 37 way connectors			10thm+20+19+11	DCU J18+22
BSM chop drive coil	2	0.5	10	0	2.50E-03	Scr. Tw. Pair	
BSM jiggle drive coil	2	0.5	10	0	2.50E-03	Scr. Tw. Pair	
BSM chop drive coil(rob.)	2	0.5	10	0	2.50E-03	Scr. Tw. Pair	
BSM jiggle drive coil(rob.)	2	0.5	10	0	2.50E-03	Scr. Tw. Pair	
BSM chop posn. sense coil	5	1	100	0	2.50E-03	TBD	
BSM jiggle posn. sense coil	5	1	100	0	2.50E-03	TBD	
BSM therm	4	0.5	1000	2.50E-09	2.50E-09	Scr. Tw. Quad	CX-1050
BSM Launch Latch	2	0	10			Twisted Pair	
BSM Launch Latch sensor	2	0	1000			Twisted Pair	
Phot. BB Point Stimulus	2	0	30			Twisted Pair	Unused?
BSM/SOB I/F therm	4	0.5	1000	2.50E-09	2.50E-09	Scr. Tw. Quad	CX-1070
37	32	5	37 way connector			9therm+28	DCU J20+22

Notes:

1. All screens insulated and no currents to be returned via above listed screens. The 100 CVV connectors are in the middle of this run. For end tails at FCU and FPU see Block diagram.
2. Outside of each of these cables to be separately r.f. screened and these screens joined to connector backshells
3. Mean current per conductor when that side (prime or redundant) is active...shall be zero in unpowered side. When 4 wires are used, 2 for current and 2 for voltage sense, mean current = half conditioning current (x fraction of time energised).
4. Peak current per conductor is for "derating" sizing and is the worst case for any one conductor in group over a timescale of 5 mseconds.
5. "(rob.)" means robustness and spells out that the harness includes duplicate wires for critical functions, permitting some wire breakages without forcing prime to redundant side switching
   ....such wires drive the same heater/coil as others, although might initially measure volts and amps rather than having identical function.
6. Fraction numbers of pins for shields means that sometimes more than one insulated signal ground shield terminates on a given pin.
7. If drive wires, which should be heavily filtered to remove unnecessary high frequencies anyway, are required by FIRST to be screened, these screens cannot pass through the number of pins available and should be chassis/backshell terminated.
8. The above listing applies from the FSFPU RF Filter outputs to the DCU warm electronics, excepting that the "tails" at the DCU end are partitioned to suit its connectors I.e. temperature sensors are regrouped.
   The choice of material and its gauge to keep below the required overall impedance end-to-end are to be specified by the harness supplier, the specification applying in the case of the cryostat running at working temperature.
   This suggests stainless steel for many of the conductors in the cryogenic element of the harness and brass for the remainder of them, plus brass for all the conductors in the other element outside the 100-way CVV connectors.