



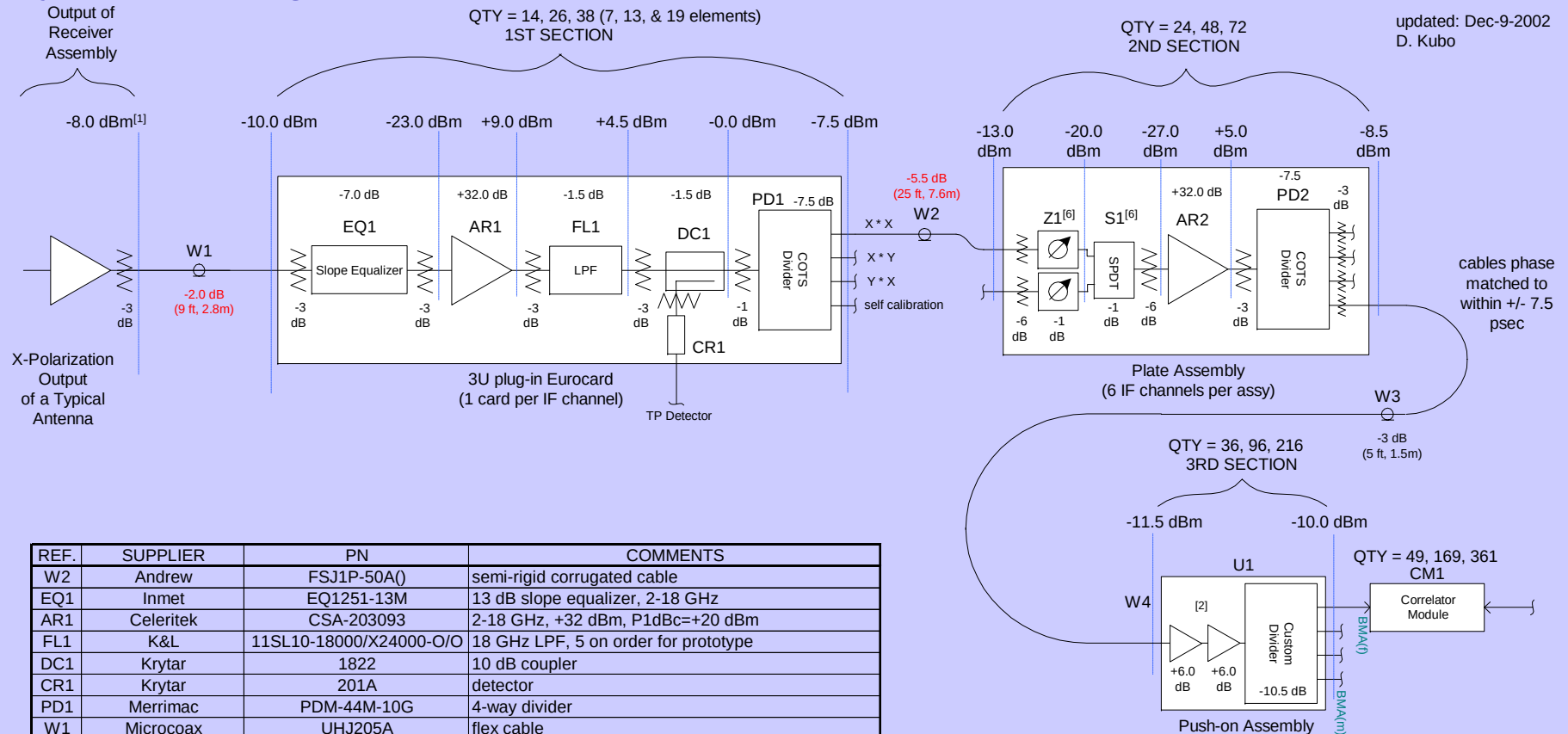
ASIAA

Correlator System Design

NTU PHYS

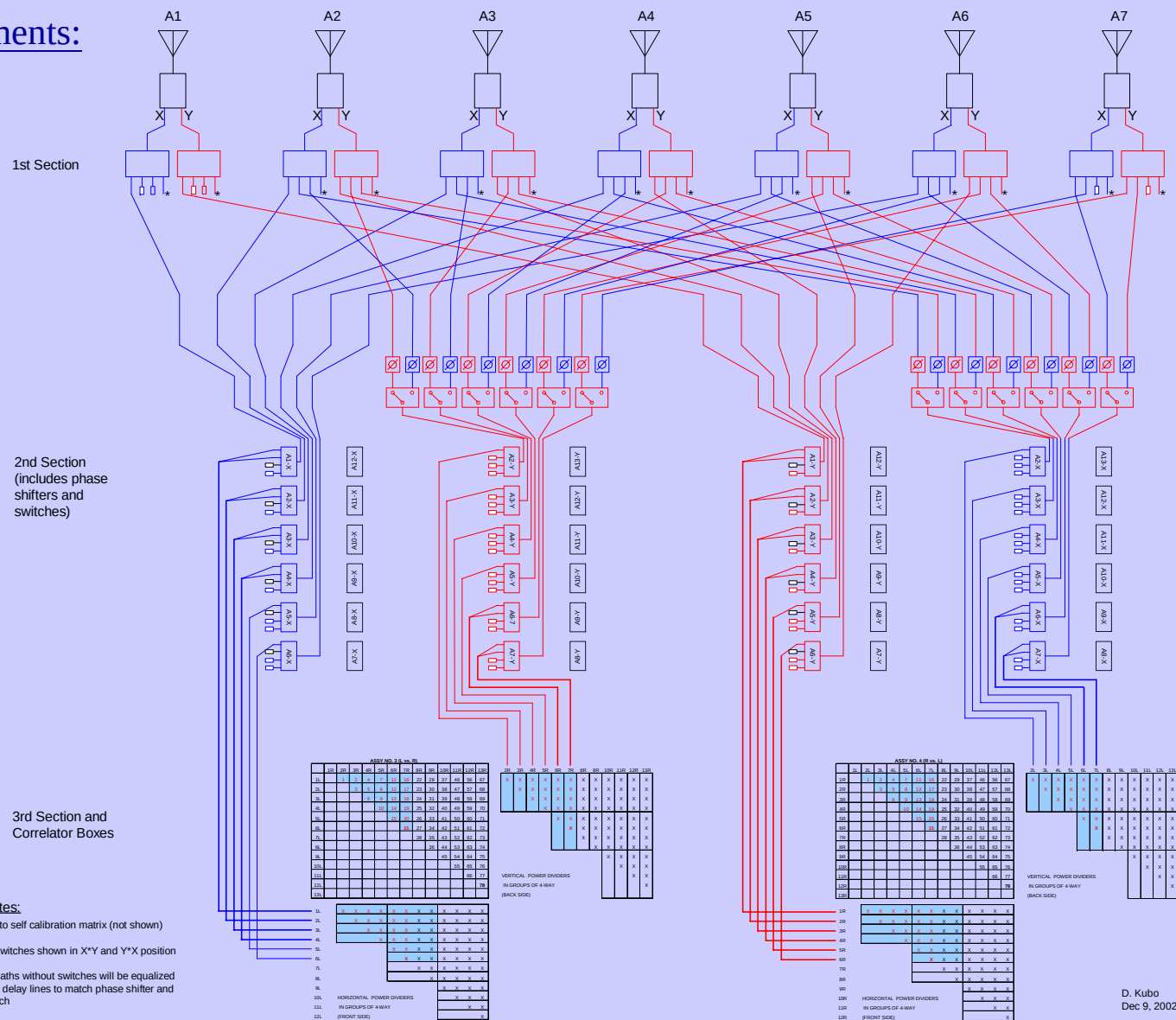


System Block Diagram:



REF.	SUPPLIER	PN	COMMENTS
W2	Andrew	FSJ1P-50A()	semi-rigid corrugated cable
EQ1	Inmet	EQ1251-13M	13 dB slope equalizer, 2-18 GHz
AR1	Celeritek	CSA-203093	2-18 GHz, +32 dBm, P1dBc=+20 dBm
FL1	K&L	11SL10-18000/X24000-O/O	18 GHz LPF, 5 on order for prototype
DC1	Krytar	1822	10 dB coupler
CR1	Krytar	201A	detector
PD1	Merrimac	PDM-44M-10G	4-way divider
W1	Microcoax	UHJ205A	flex cable
S1	Dow-Key	521-420803A	SPDT, terminated, DC-18 GHz
AR2	Celeritek	CSA-203093	same as AR1
PD2	Merrimac	PDM-44M-10G	same as PD1
W3	RF Coax	S141LLMM-60S	60 inch UT141-LL semi-rigid cable, phase matched
U1	ASIAA	custom in-house assy	will utilize 2 TGA8300 + custom 4-way
CM1	Meridian Microwave	TBD	Custom design, 2 on order
Z1	Weinschel	981	phase shifter, 2-18 GHz, +/-96 psec

- IF Interconnect, 7-elements:





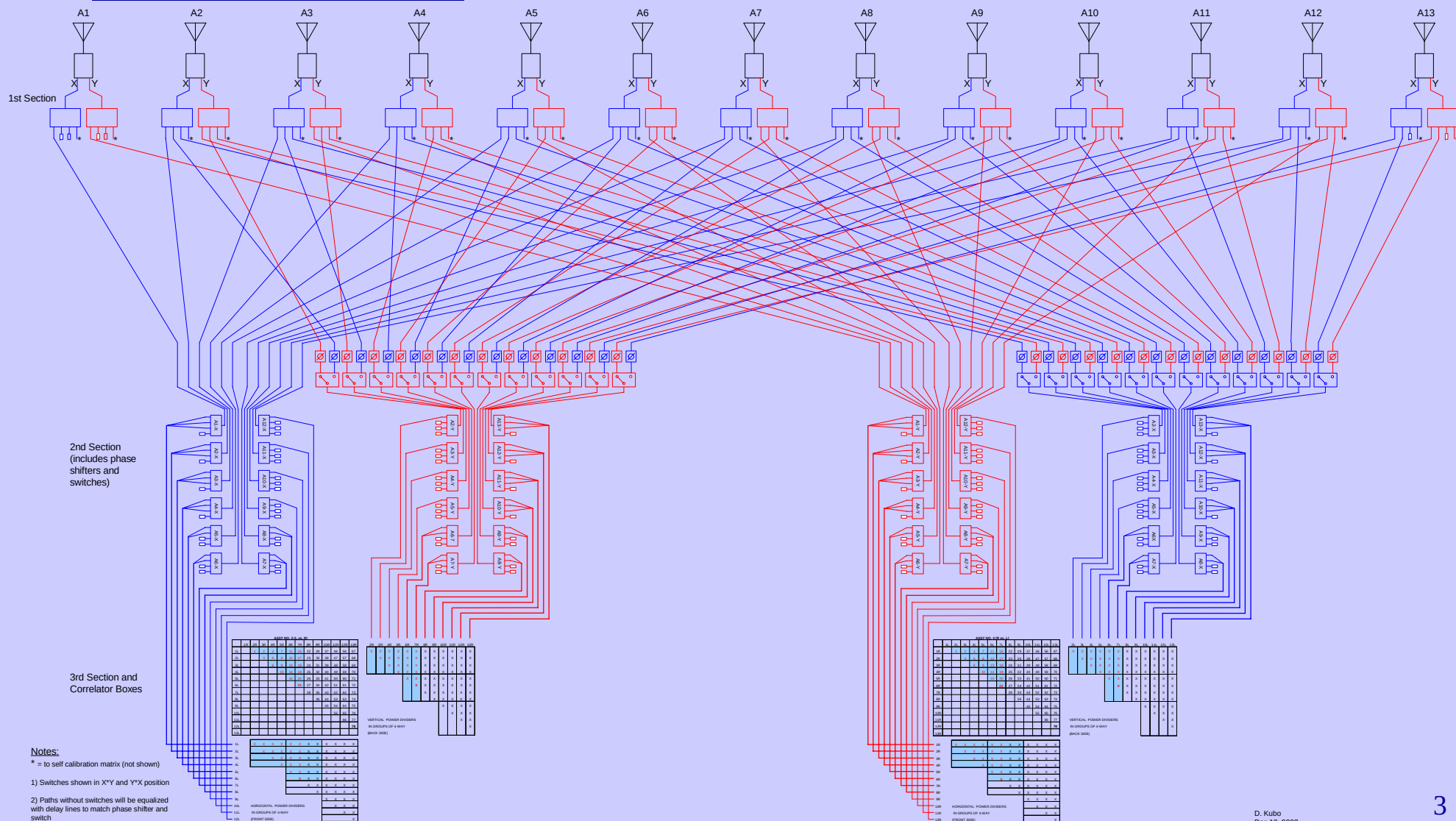
ASIAA

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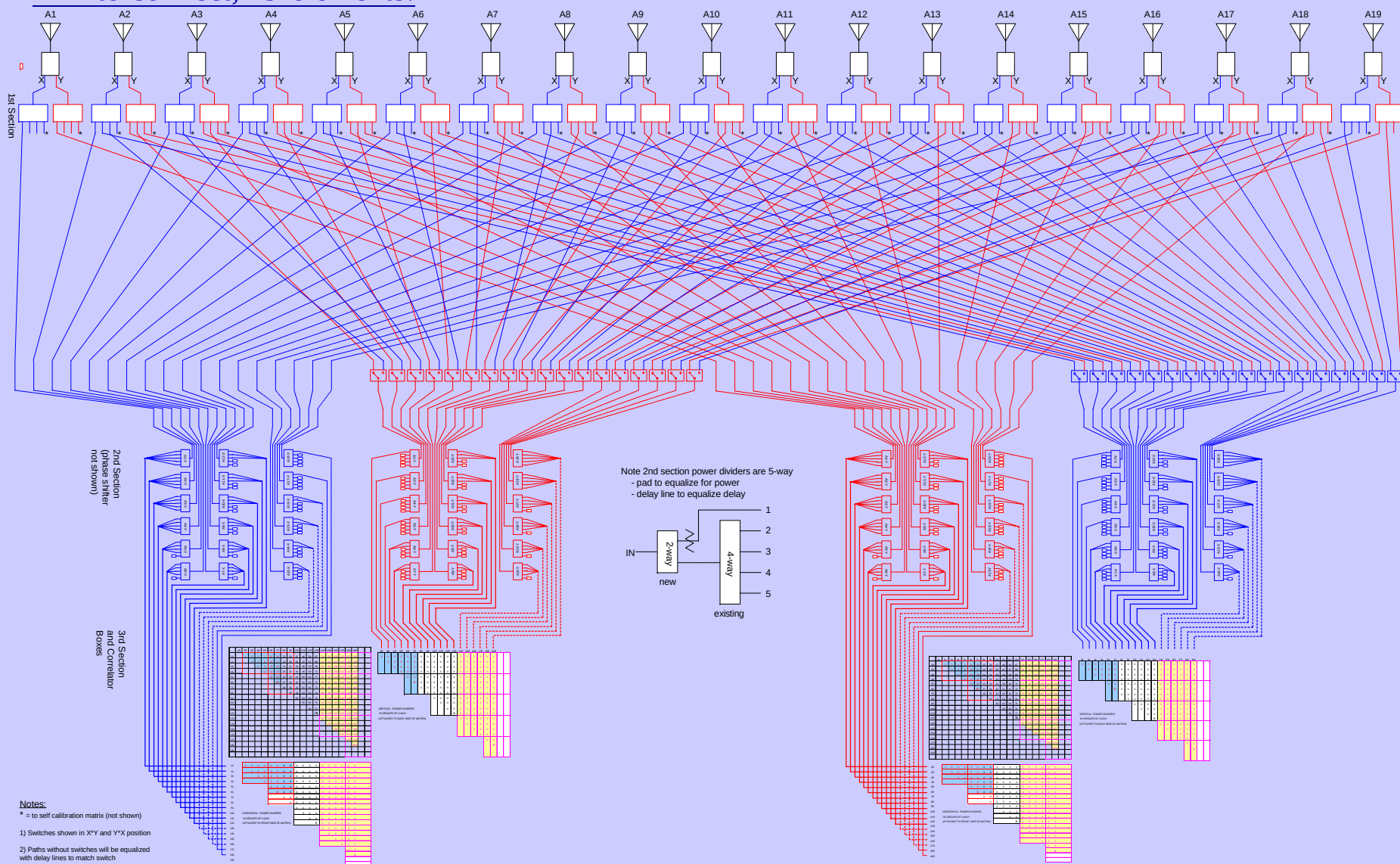
NTU PHYS



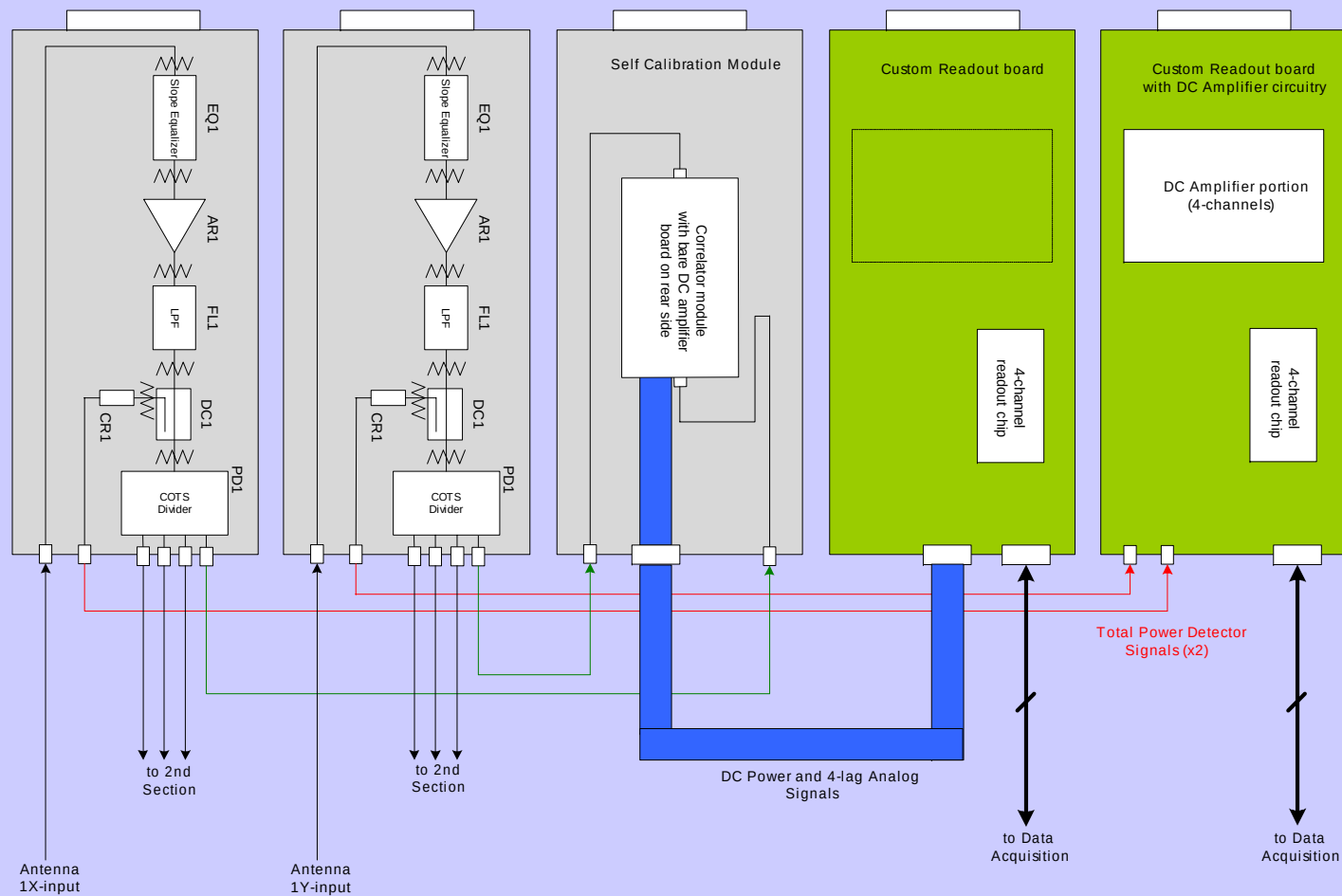
IF Interconnect, 13-elements:



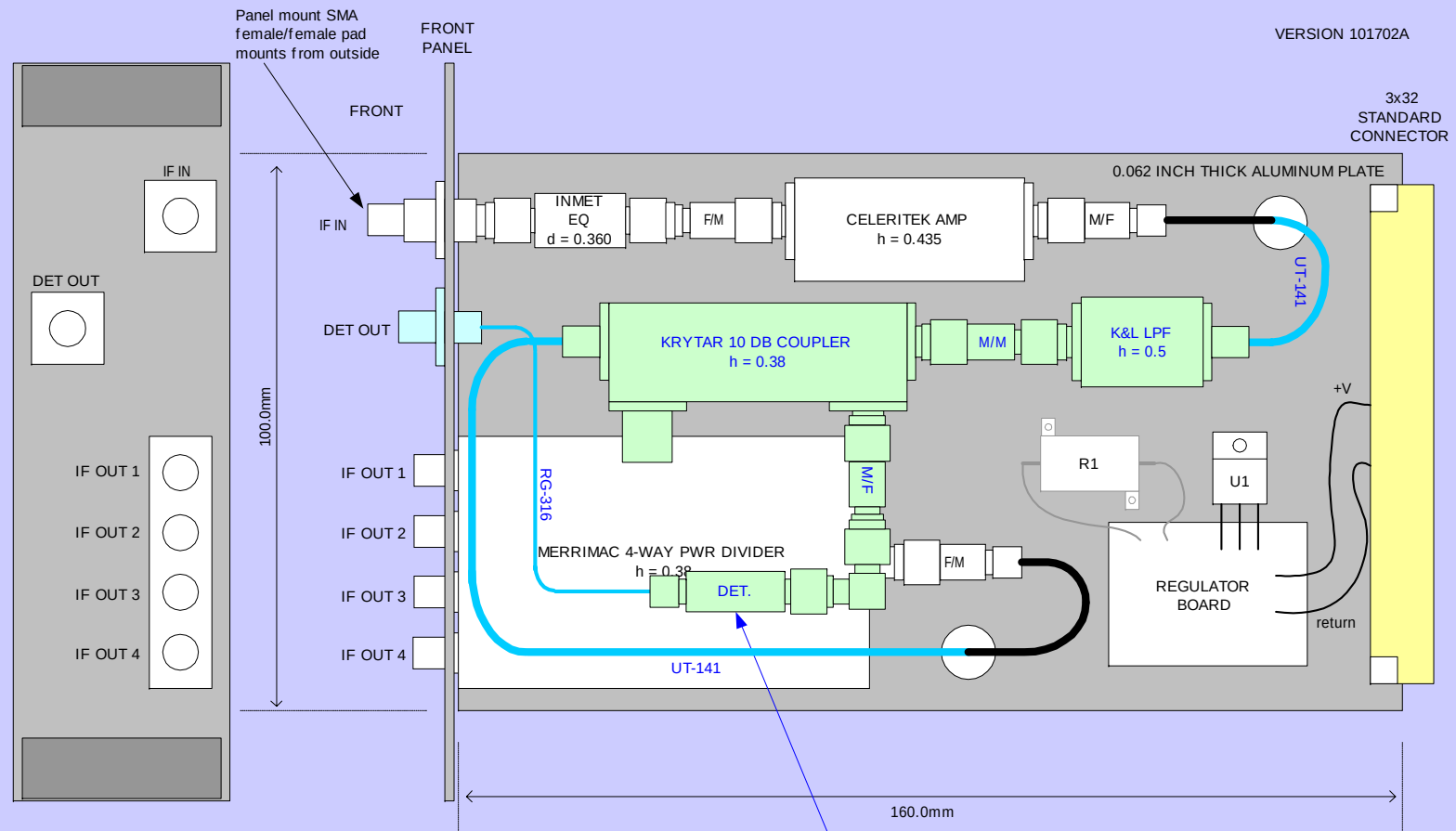
• IF Interconnect, 19-elements:



- First Section Assembly:
 - 3U Chassis Consisting of 5 Plug-in Modules:

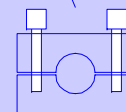


- First Section Assembly (cont'd):
 - IF Distribution Module (2/chassis):



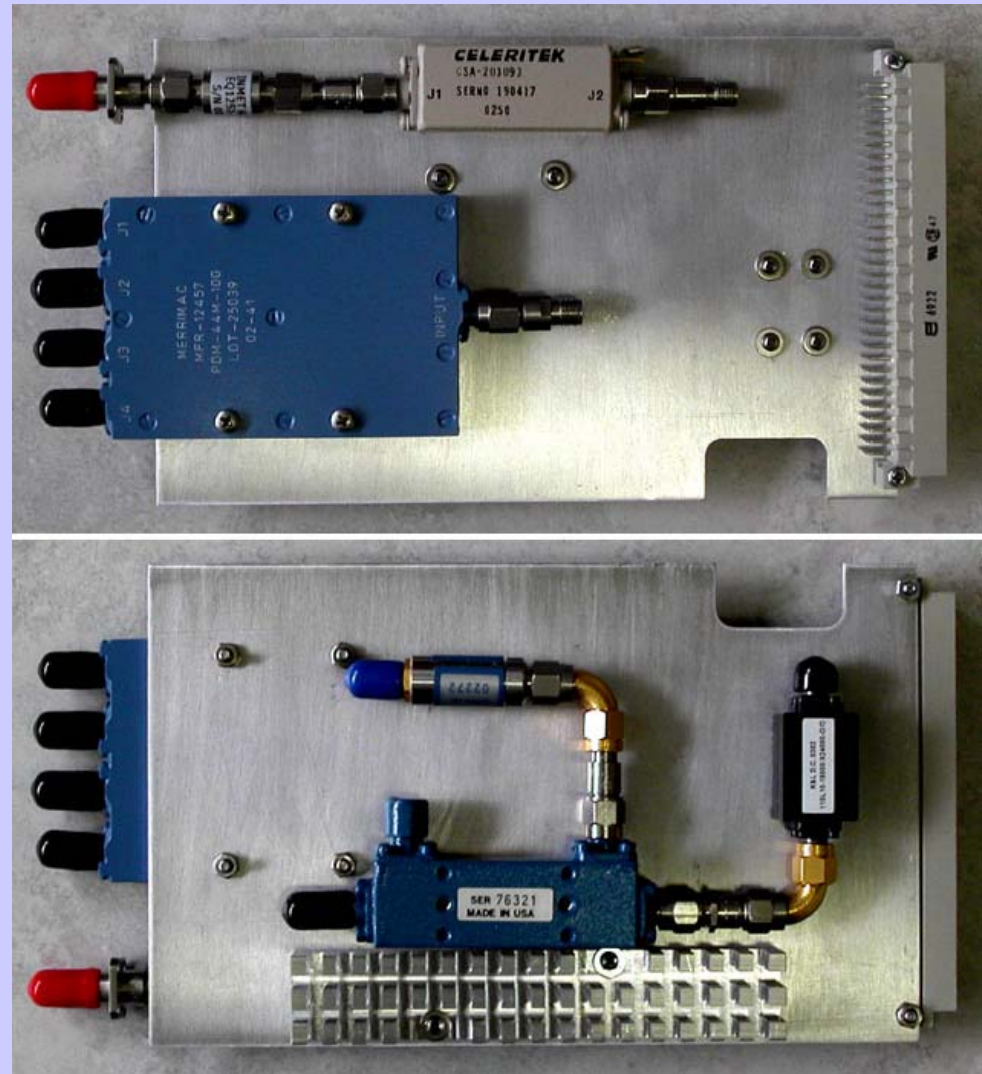
Notes:

- Blue items are located on the far side.
- UT-141 is 0.141 inch diameter semi-rigid coaxial cable.
- RG-316 is flexible coaxial cable.
- U1 is +12 VDC regulator, mounted directly to plate for heatsinking.
- R1 is 5W power resistor, mounted directly to plate for heatsinking.



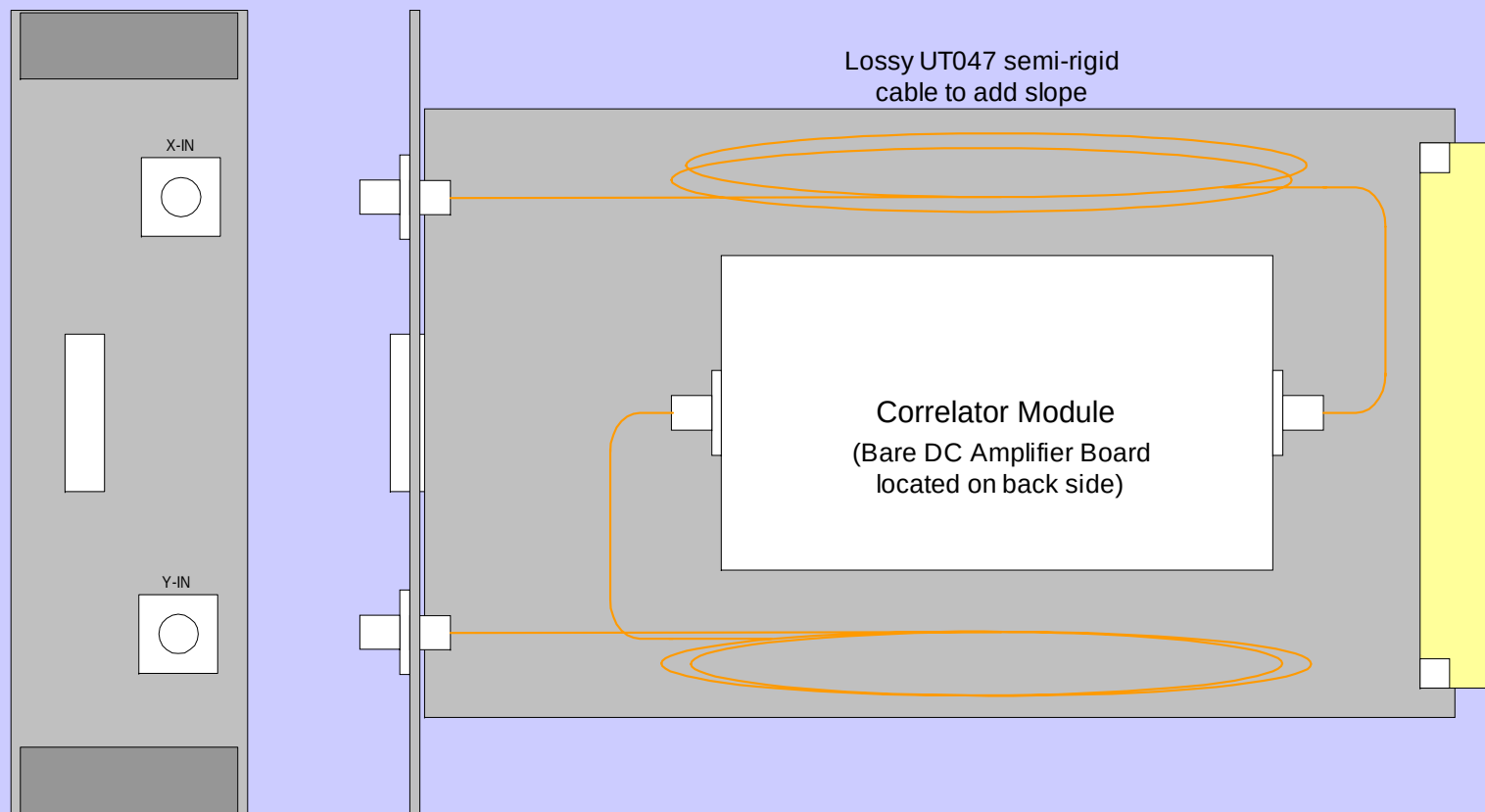
Detector held in place by clamp

- First Section Assembly (cont'd):
 - Photo (face plate missing):



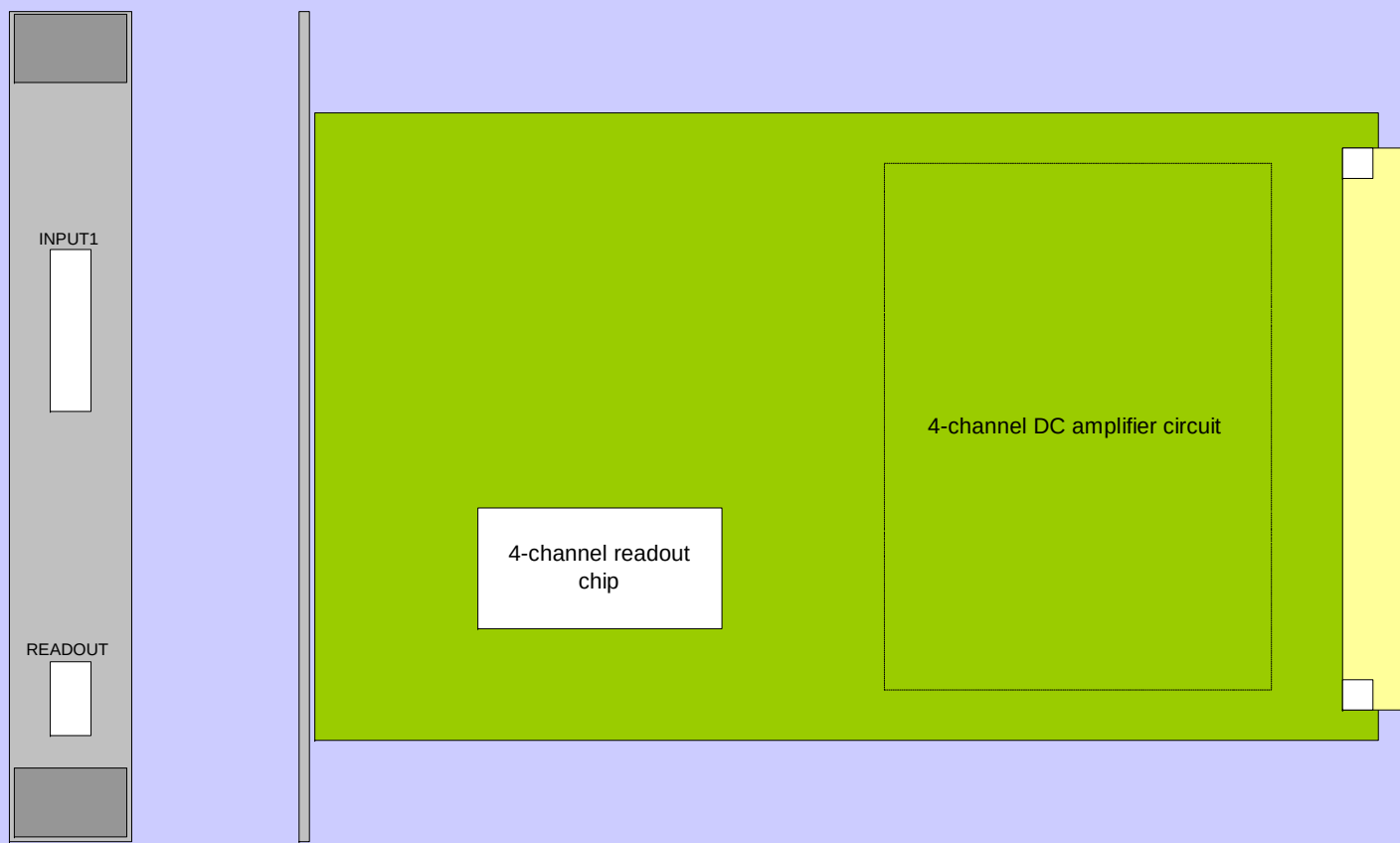


- First Section Assembly (cont'd):
 - X-Y Calibration Module (2/chassis):



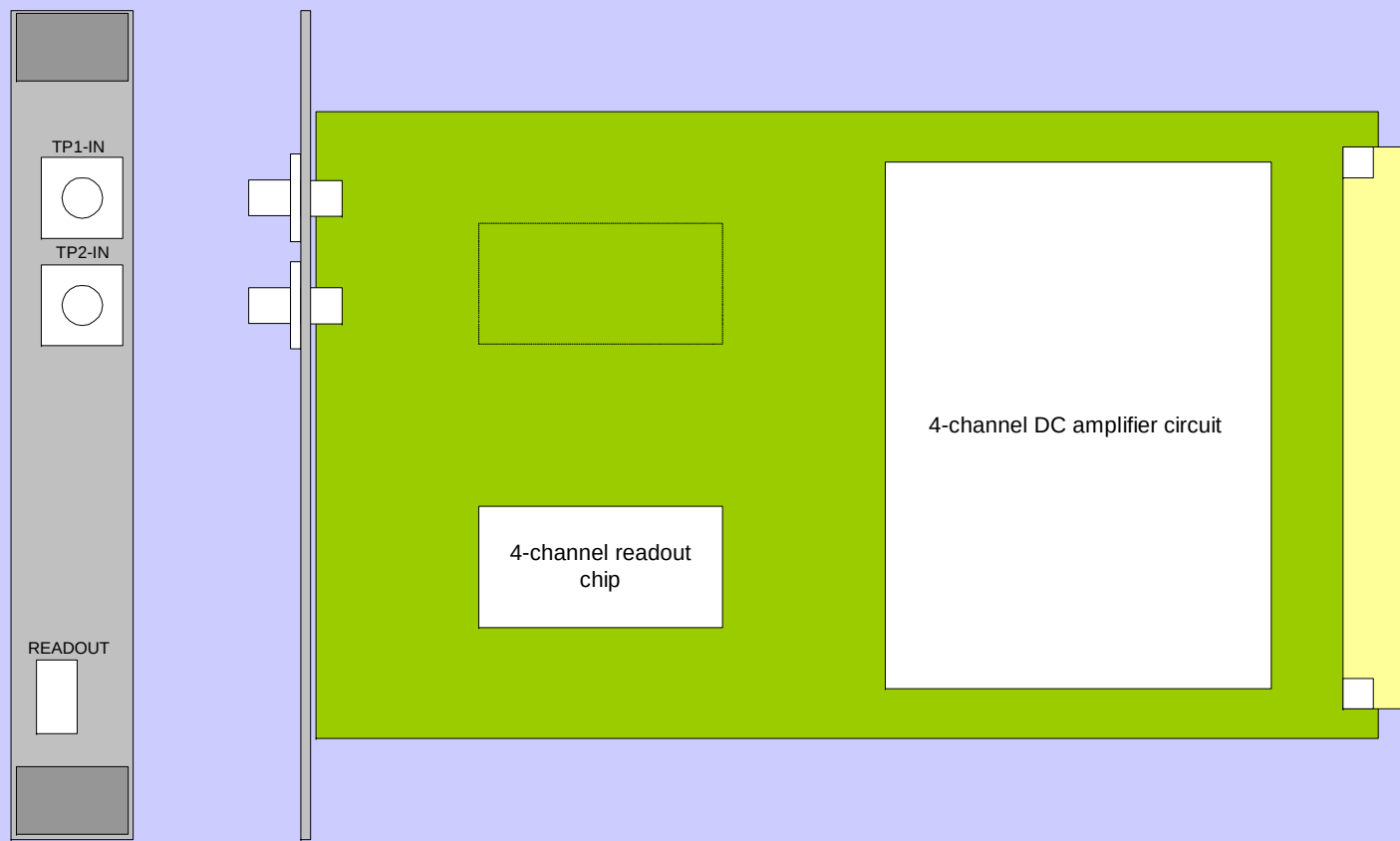


- First Section Assembly (cont'd):
 - Calibration Readout Module (1/chassis):



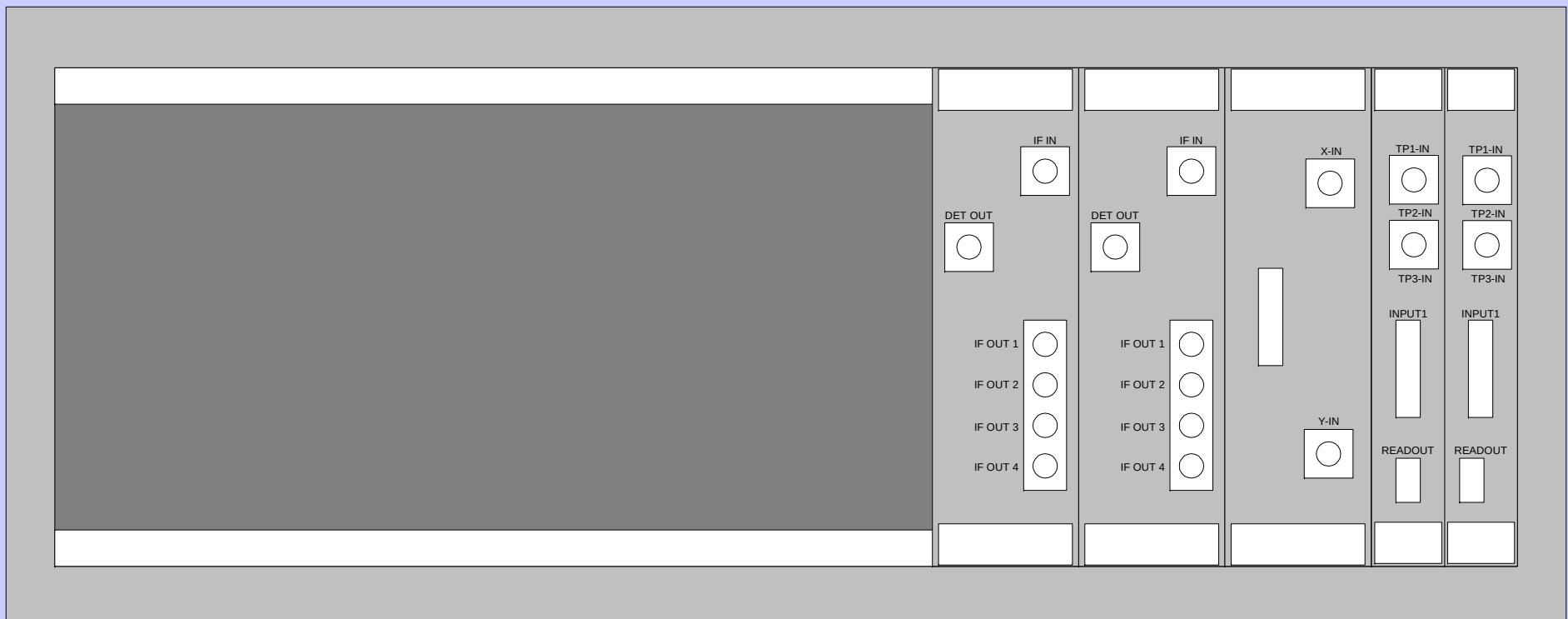


- First Section Assembly (cont'd):
 - Total Power DC Amplifier & Readout Module (1/chassis):

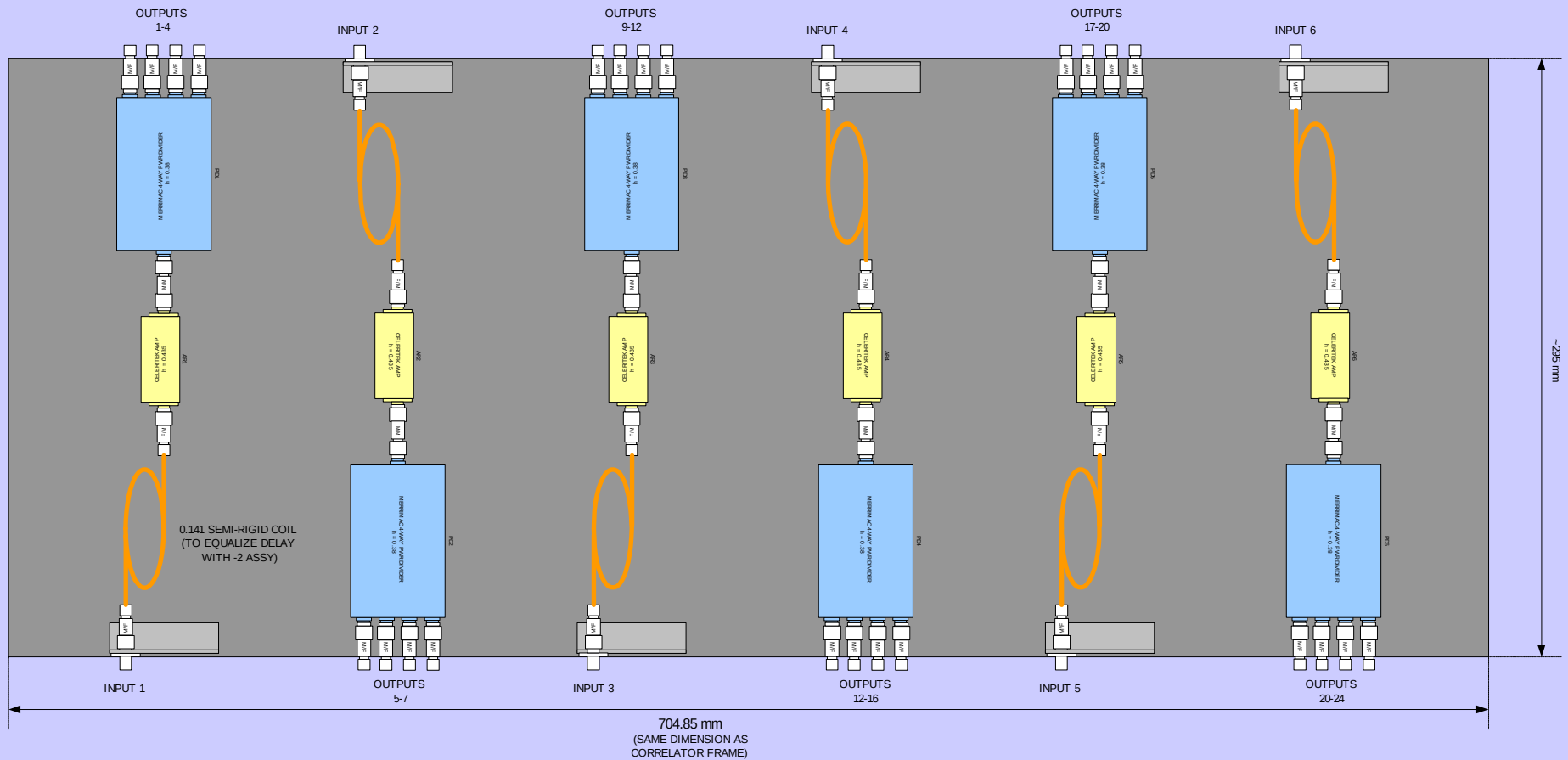




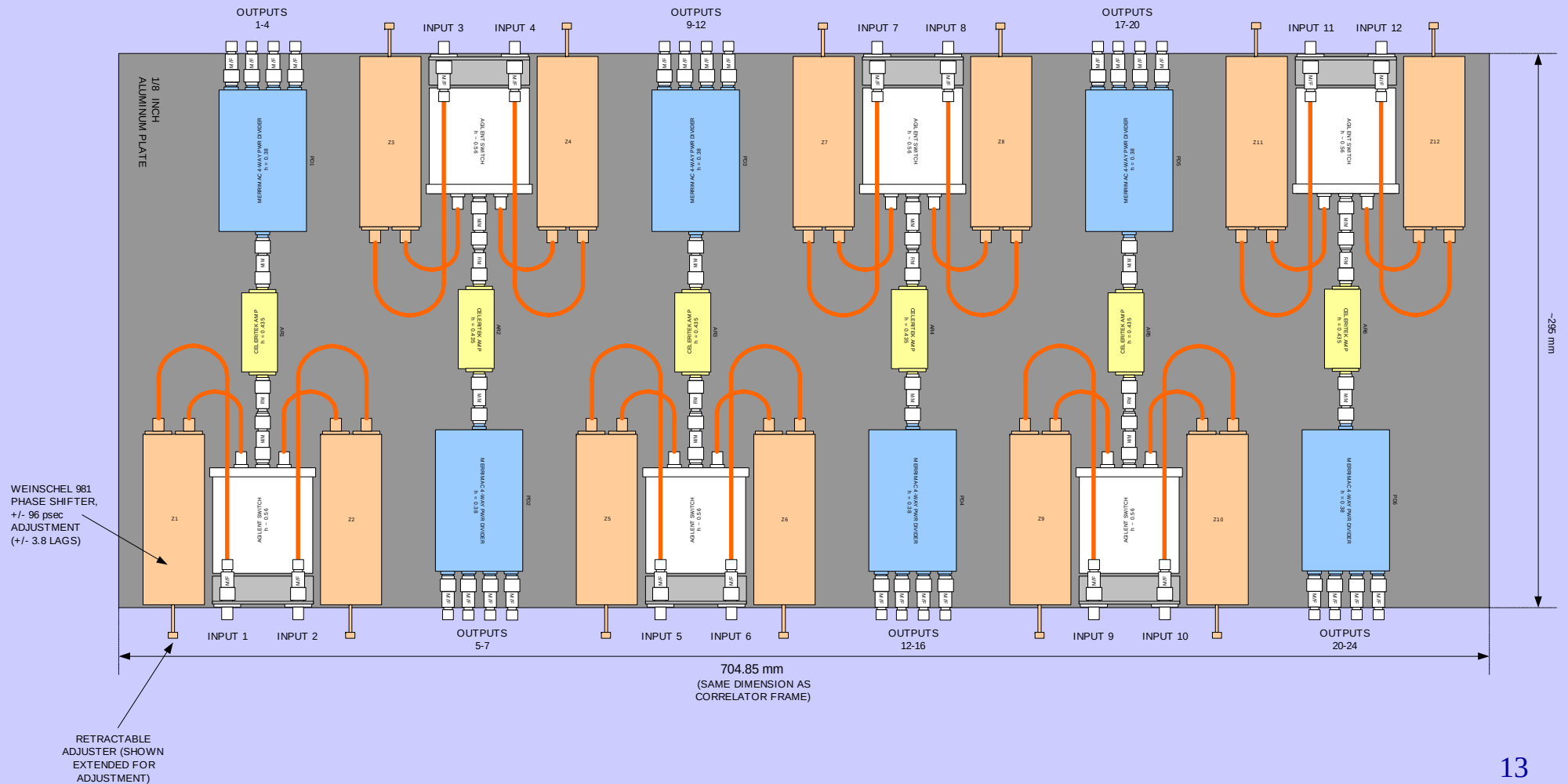
- First Section Assembly (cont'd):
 - 3U Chassis:
 - 1 chassis supports 1 antennas (2 IF channels)



- Second Section Plate Assembly:
 - 1 Plate Assembly:

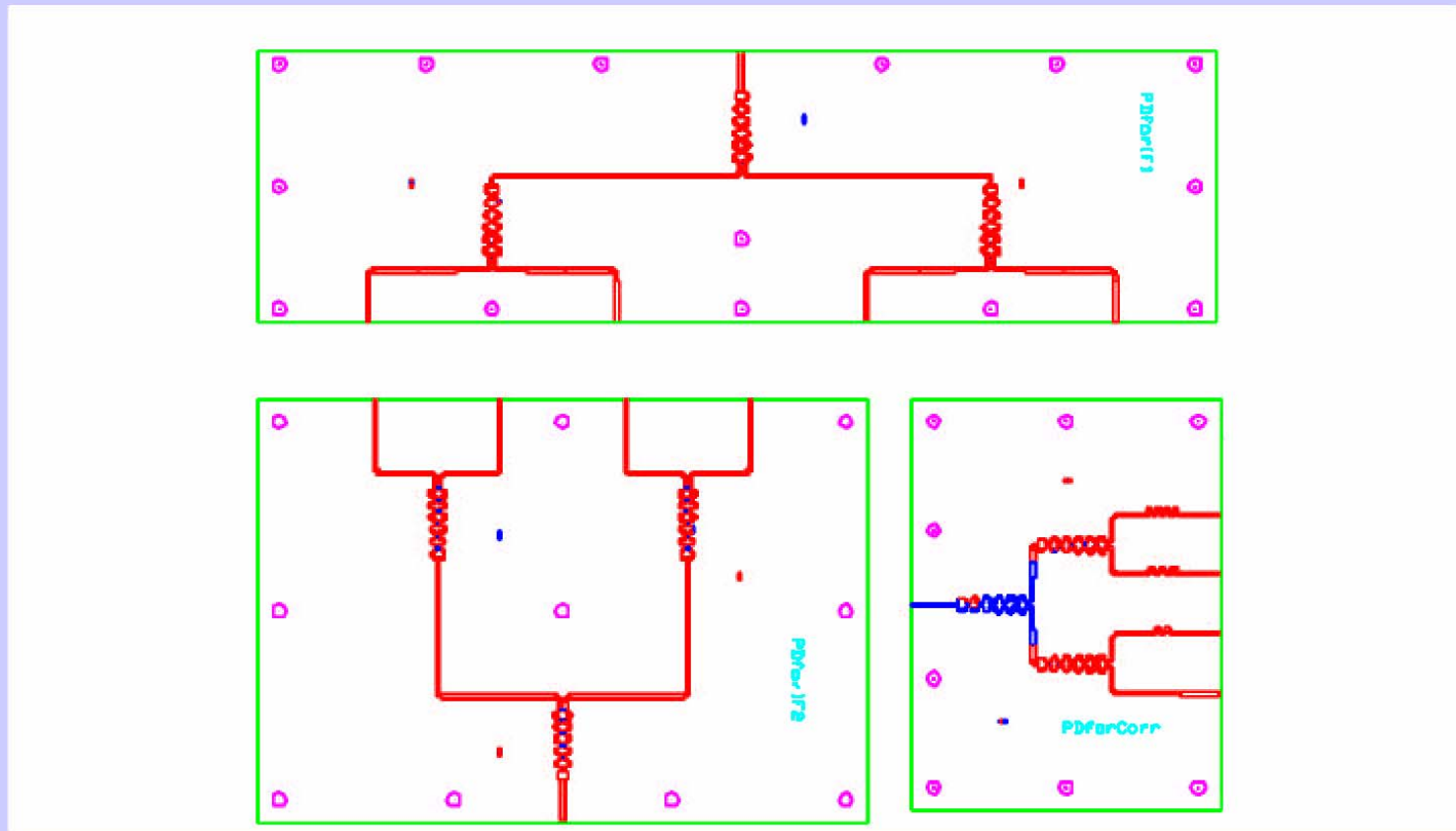


- Second Section Plate Assembly (cont'd):
 - 2 Plate Assembly:

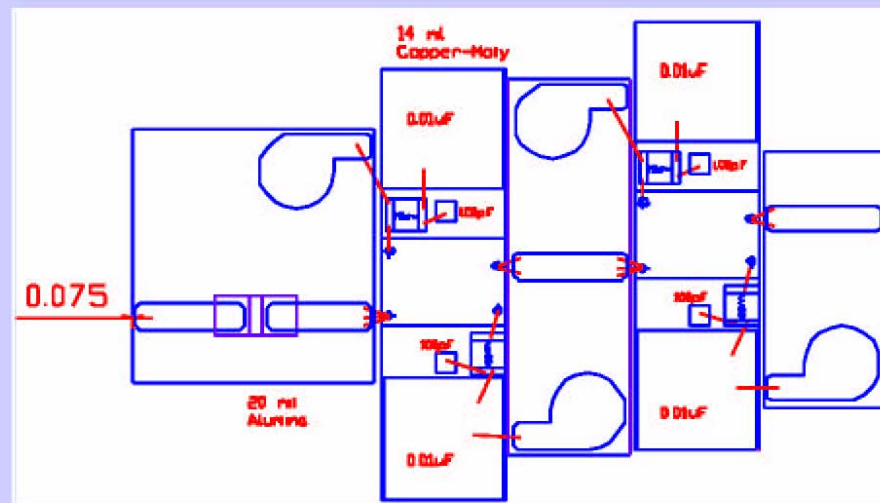
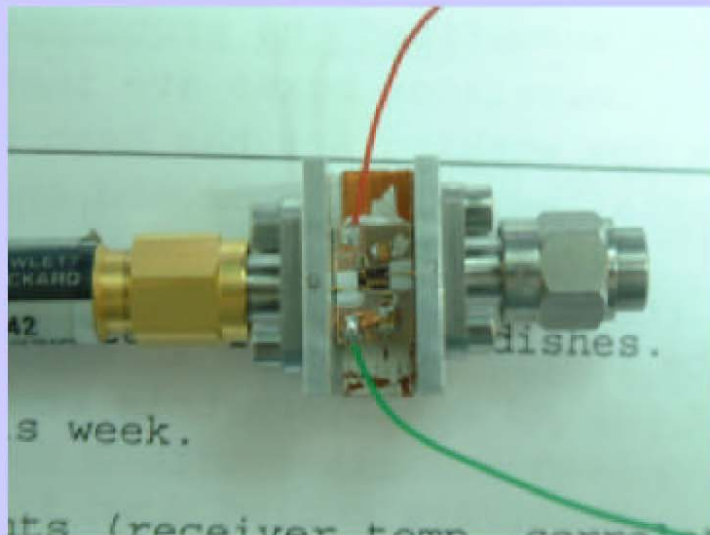




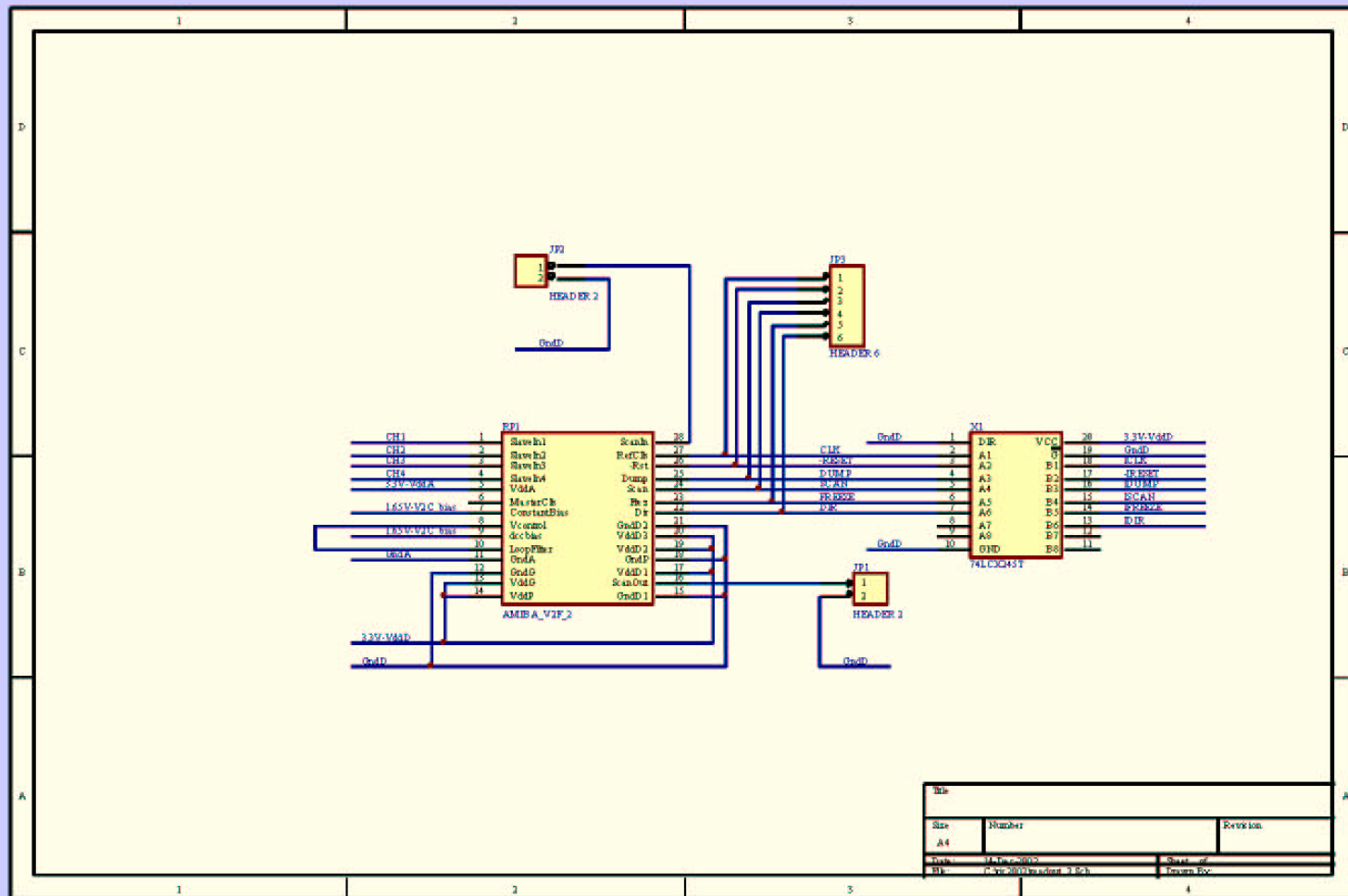
- 3rd Section Assembly:
 - Custom 4-Way Power Divider:



- 3rd Section Assembly:
 - Custom 4-Way Power Divider – 2 Stage MMIC Amplifier:



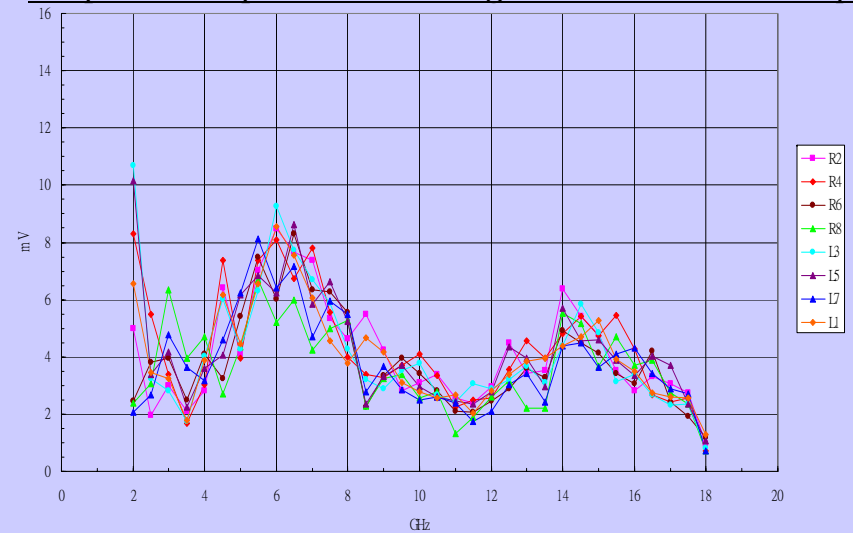
- 3rd Section Assembly (cont'd):
 - Readout Board Schematic:



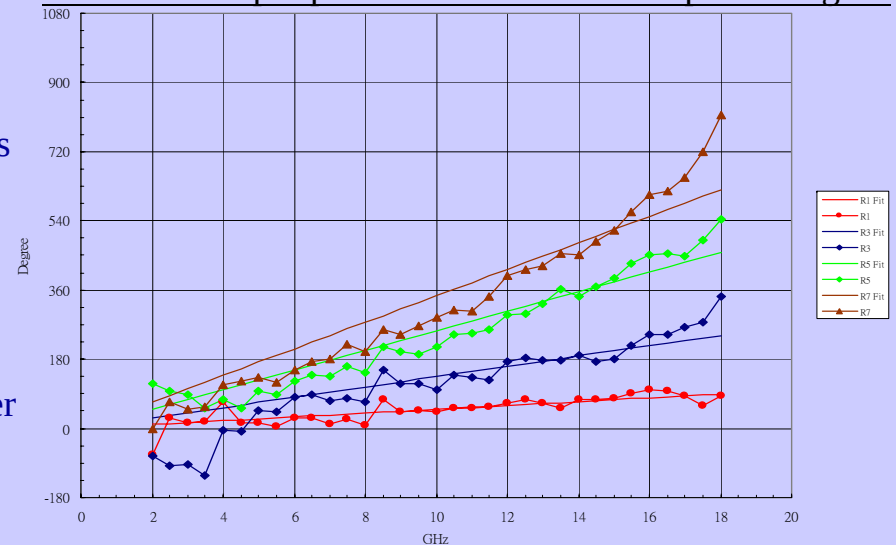


- Correlator Module:
 - Lessons learned from 16-lag prototype:
 - Responsivity of $>1500 \text{ Vrms/W}$ is acceptable
 - Large amplitude and phase variations prevent us from performing transformation for spectrum recovery
 - Lag spacing of 12.5 psec is too small by a factor of 2
 - New 4-lag Correlator module:
 - Spec (version 080102A) captures desired performance goals:
 - amplitude $\leq 3.0 \text{ dBpp}$ (2-18 GHz)
 - phase $\leq 30 \text{ deg pp}$ (2-18 GHz)
 - Responsivity $\geq 80 \text{ Vrms/W}$ for module, corresponds to $\geq 2000 \text{ Vrms/W}$ at mixers
 - Utilizes same double-balanced mixers
 - 6 dB pad added to mixer input ports to absorb reflections
 - Lag spacing has been corrected to 25 psec
 - Shorter delay lines allow more space for meander lines (less inter-coupling)

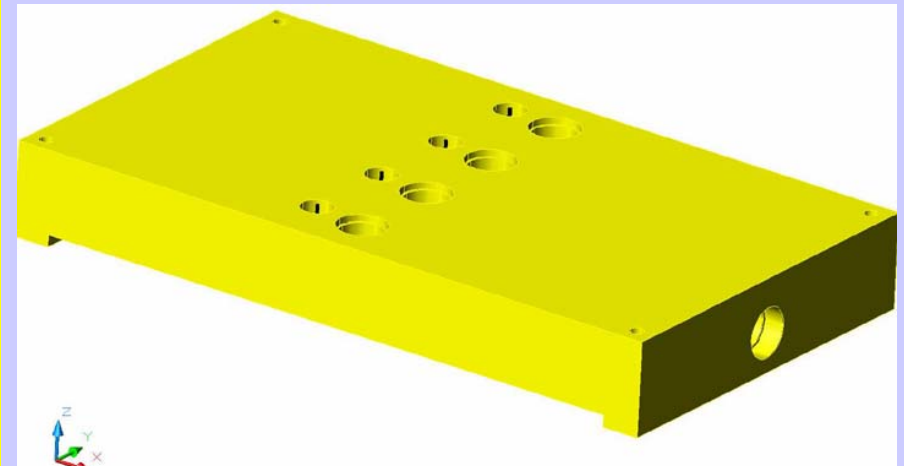
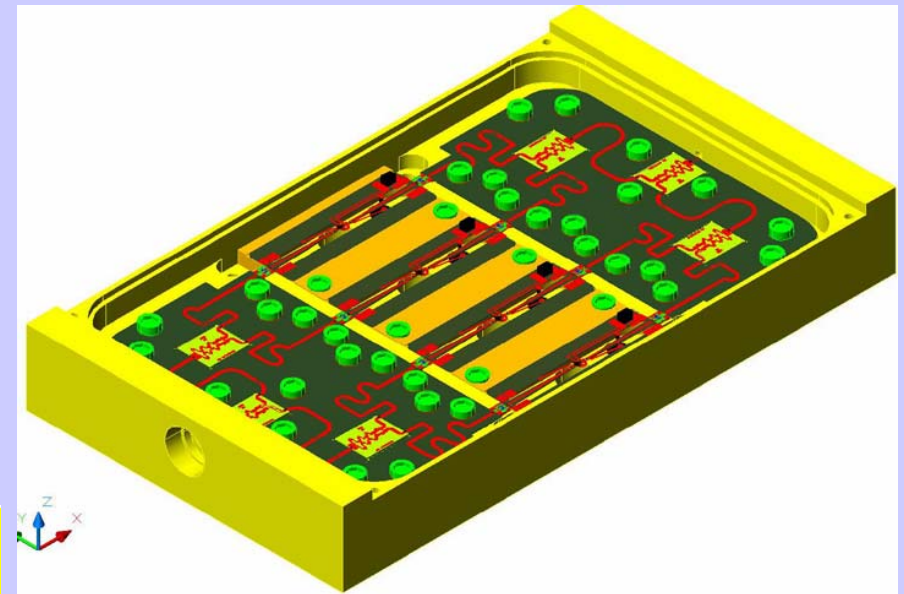
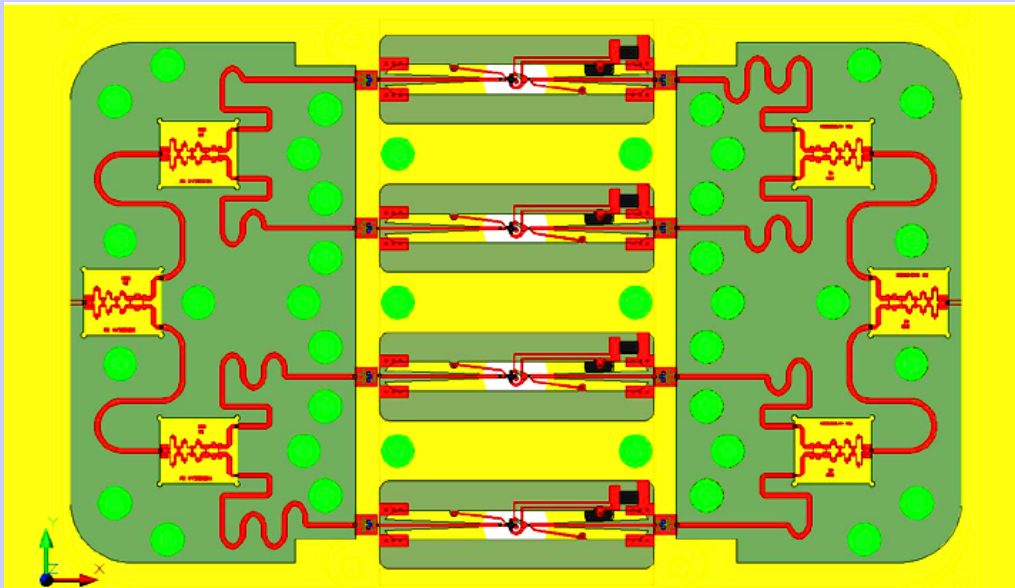
Amplitude responses to CW signals of 1KHz beat frequency



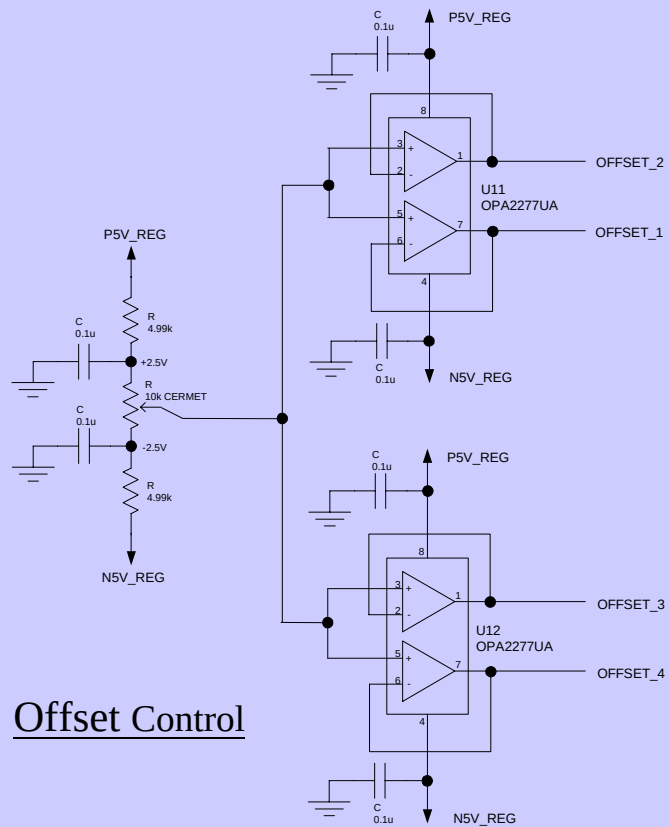
Correlator output phase difference with respect to lag L1



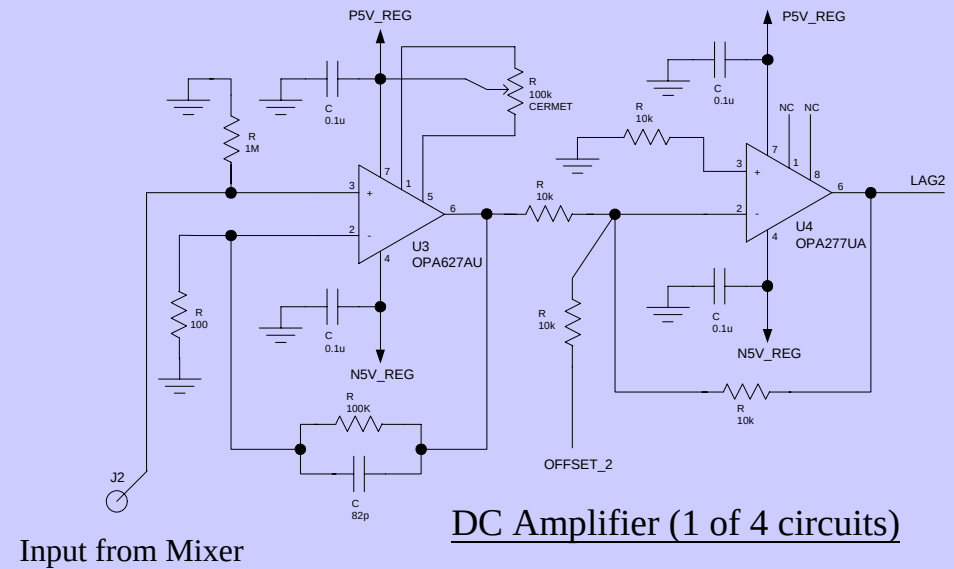
- Correlator Module (cont'd):
 - Meridian Microwave 4-lag Correlator module:
 - Dimensions of upper half module:
 - length = 88.90 mm (3.500 inches)
 - width = 50.80 mm (2.000 inches)
 - height = 12.065 mm (0.475 inches), with cover



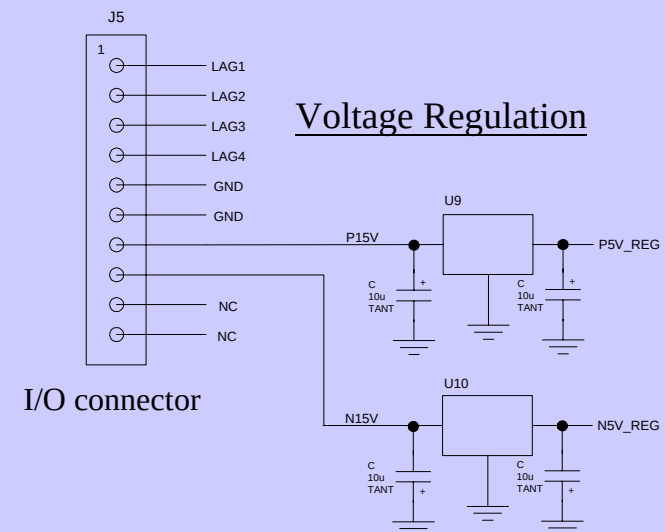
- Correlator Module (cont'd):
 - DC Amplifier Board Schematic:



Offset Control



DC Amplifier (1 of 4 circuits)

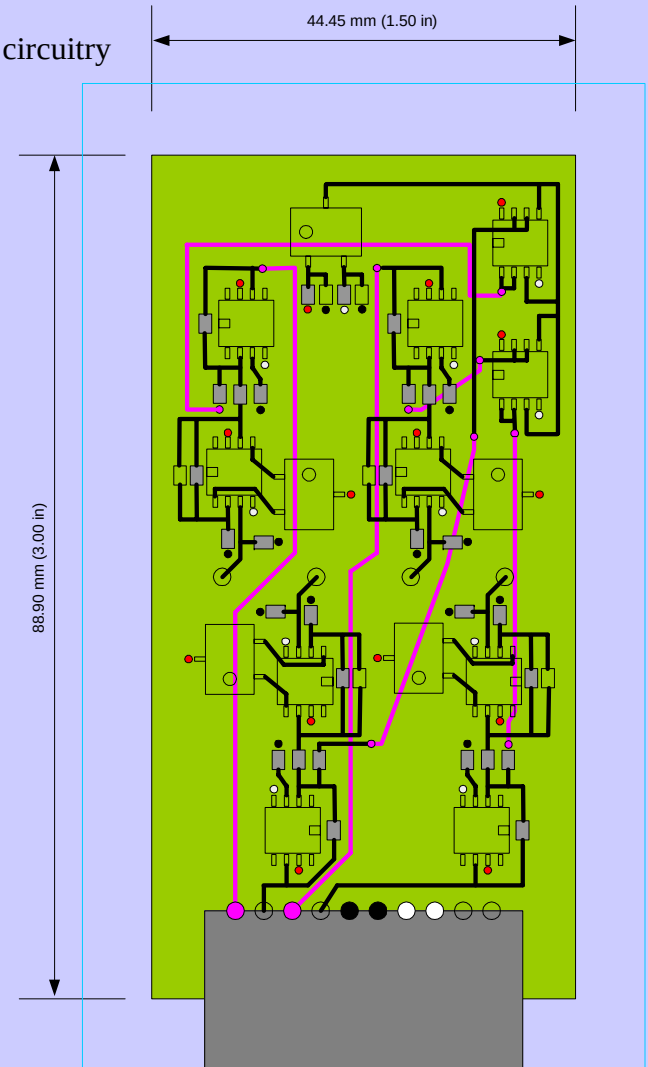
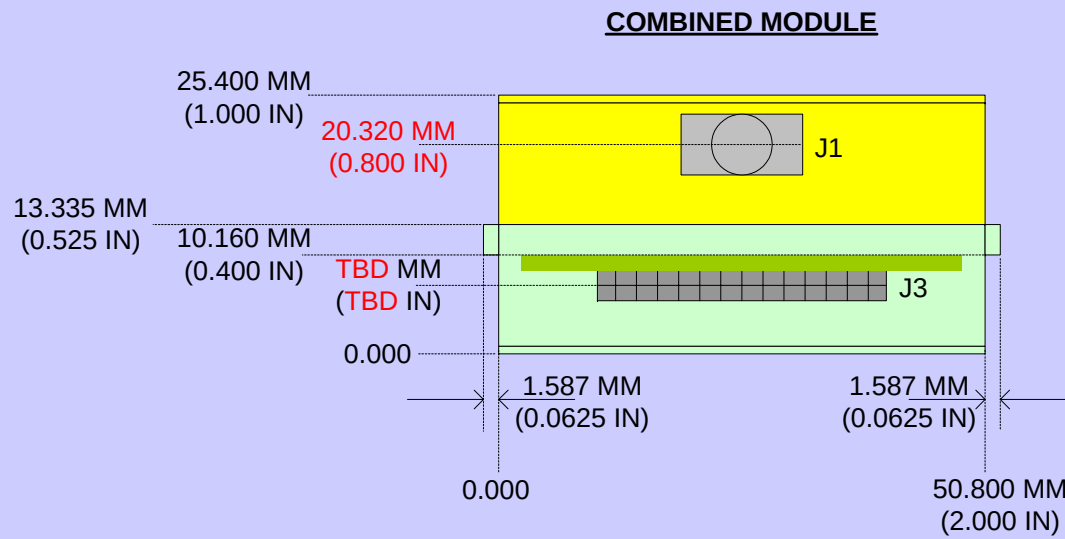


I/O connector

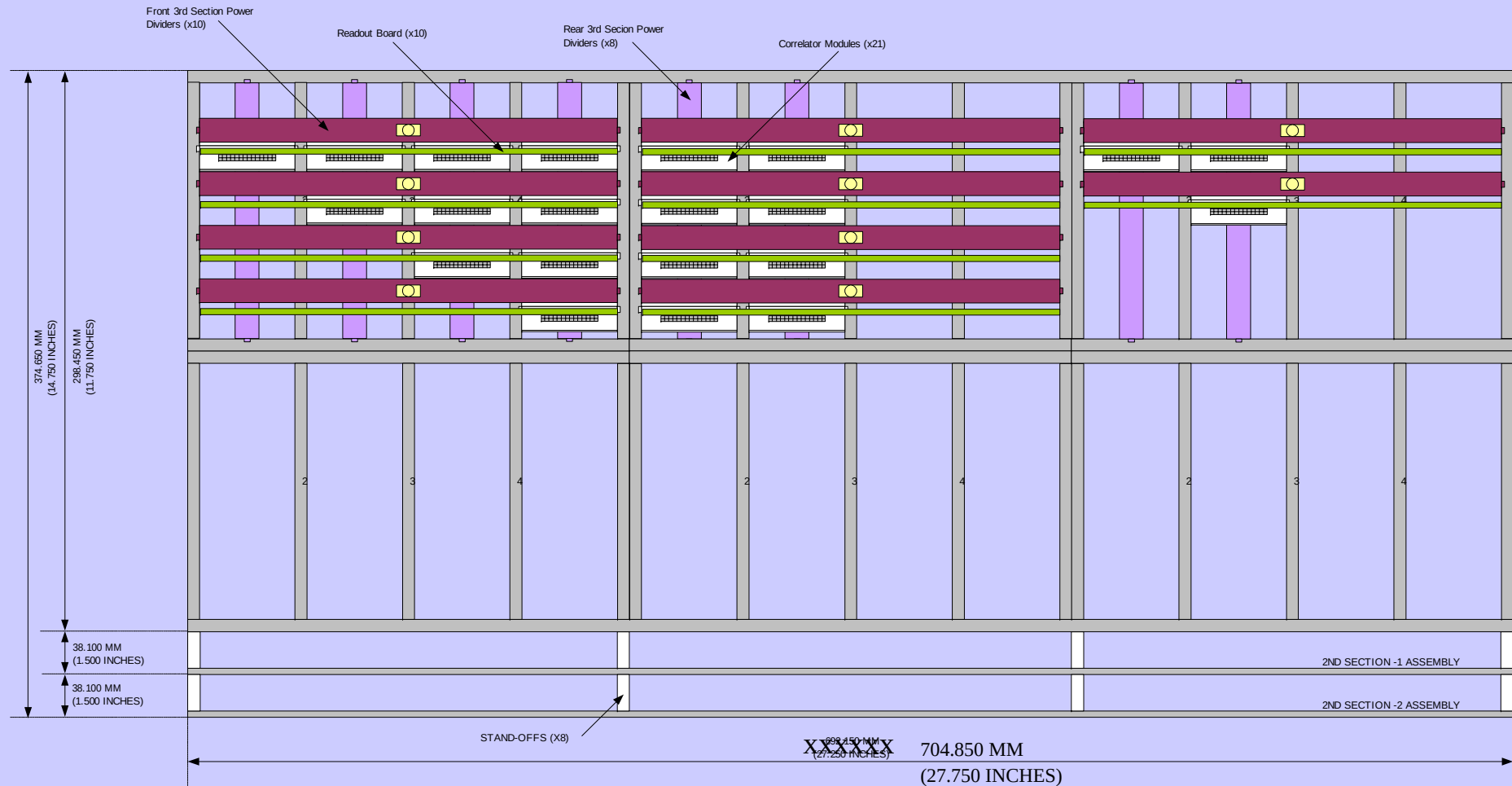
Voltage Regulation

- Correlator Module (cont'd):
 - DC Amplifier Board Packaging:

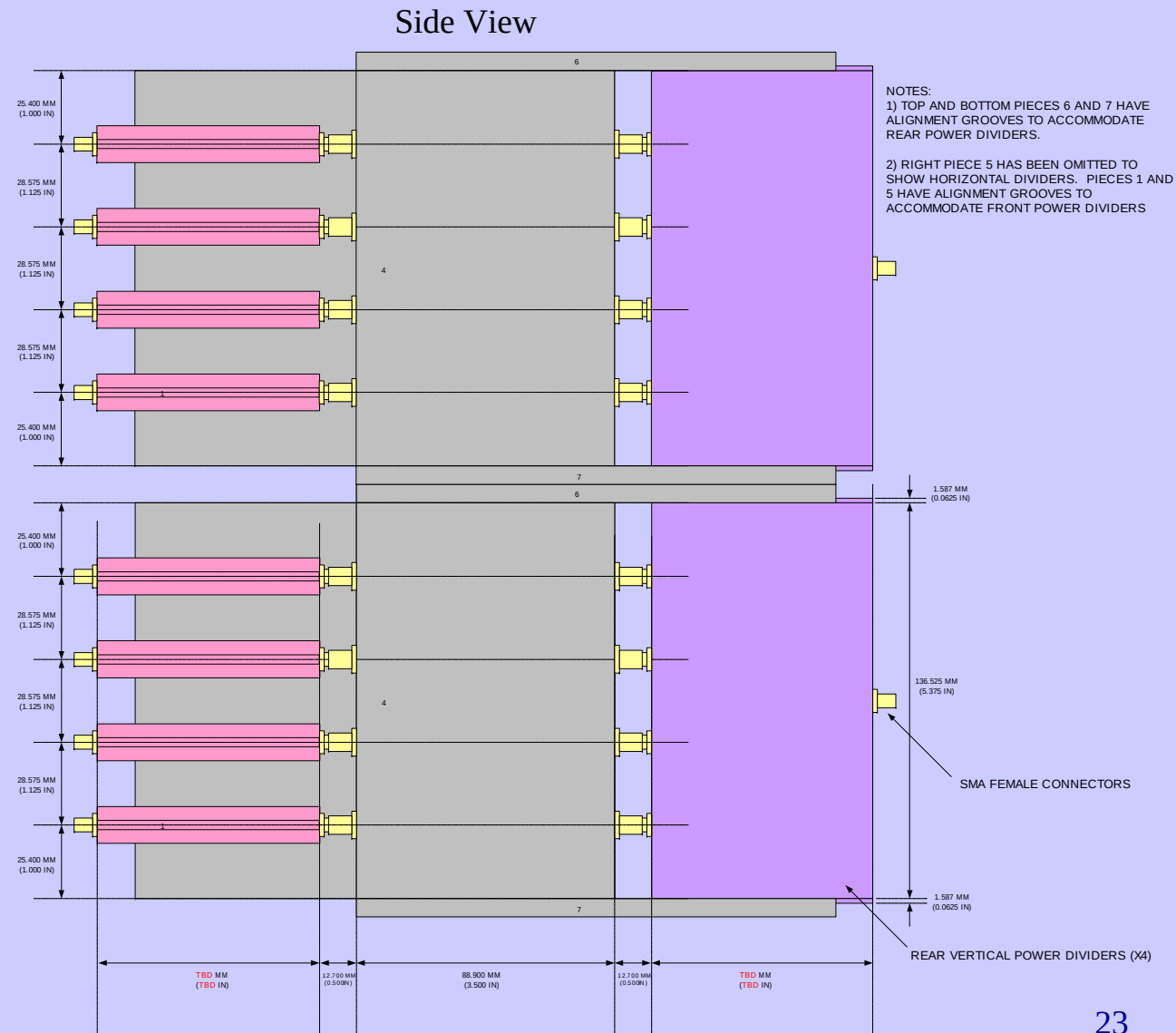
Regulator and offset circuitry
not shown on board



- Correlator Frame:
 - Populated for 7-elements (1 of 2 frames):



- Correlator Frame (cont'd):
 - Interconnect from 2nd Section plates to 3rd Section power dividers will be via 60 inch (152.4 cm) semi-rigid UT141-LL MicroCoax cable (low phase vs Temperature coefficient)
 - Cables phase matched to within ± 7.5 psec ($< 1/3$ lag spacing)
 - Expansion to 19-elements requires:
 - Addition of 2 more 3 row frames
 - Modification of 2nd Section plate assemblies
 - Addition of a total of 4 more 2nd Section plates





- Data Acquisition:

