

HAWC CDR

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Electronics Overview

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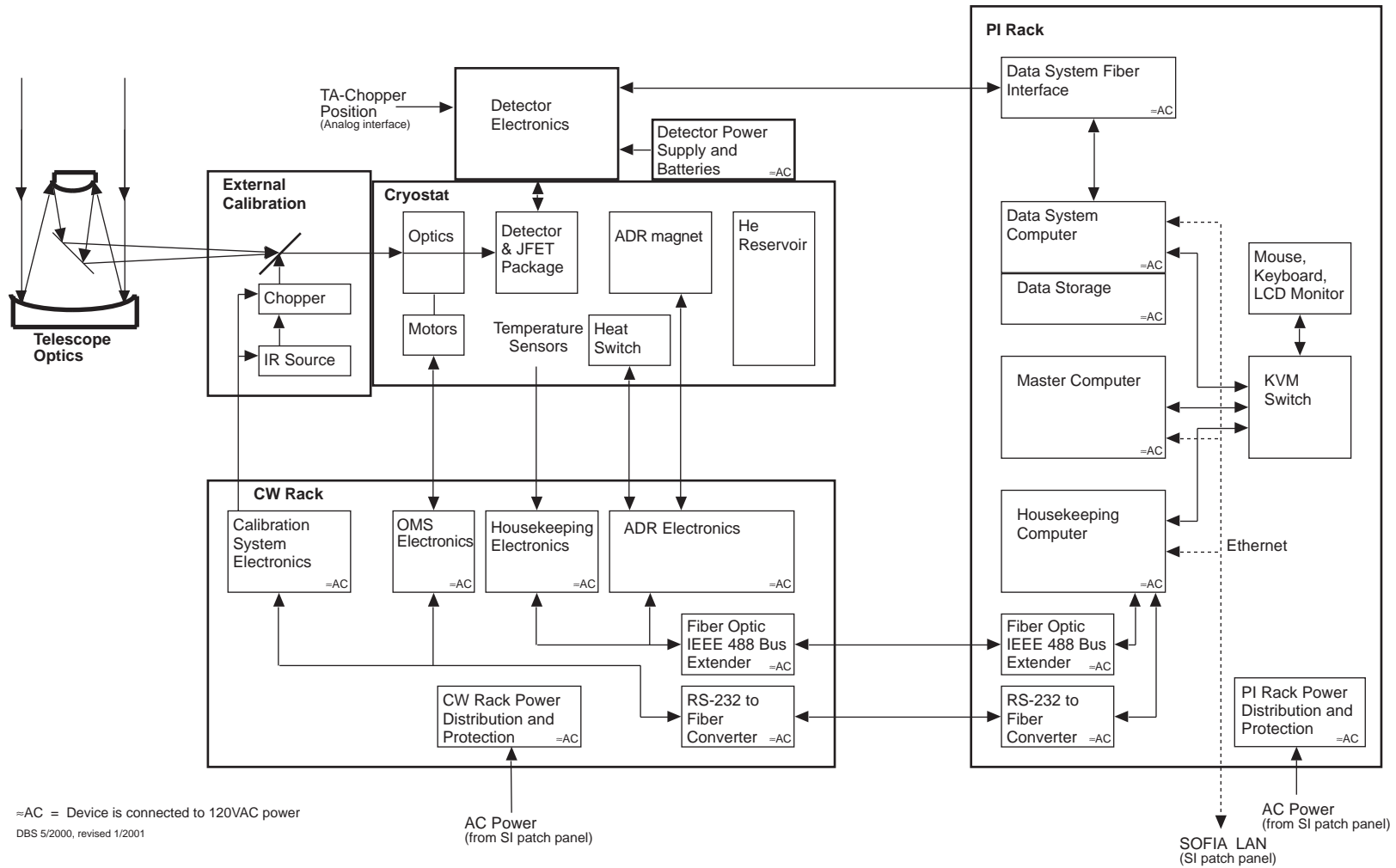


Electronic Subsystems

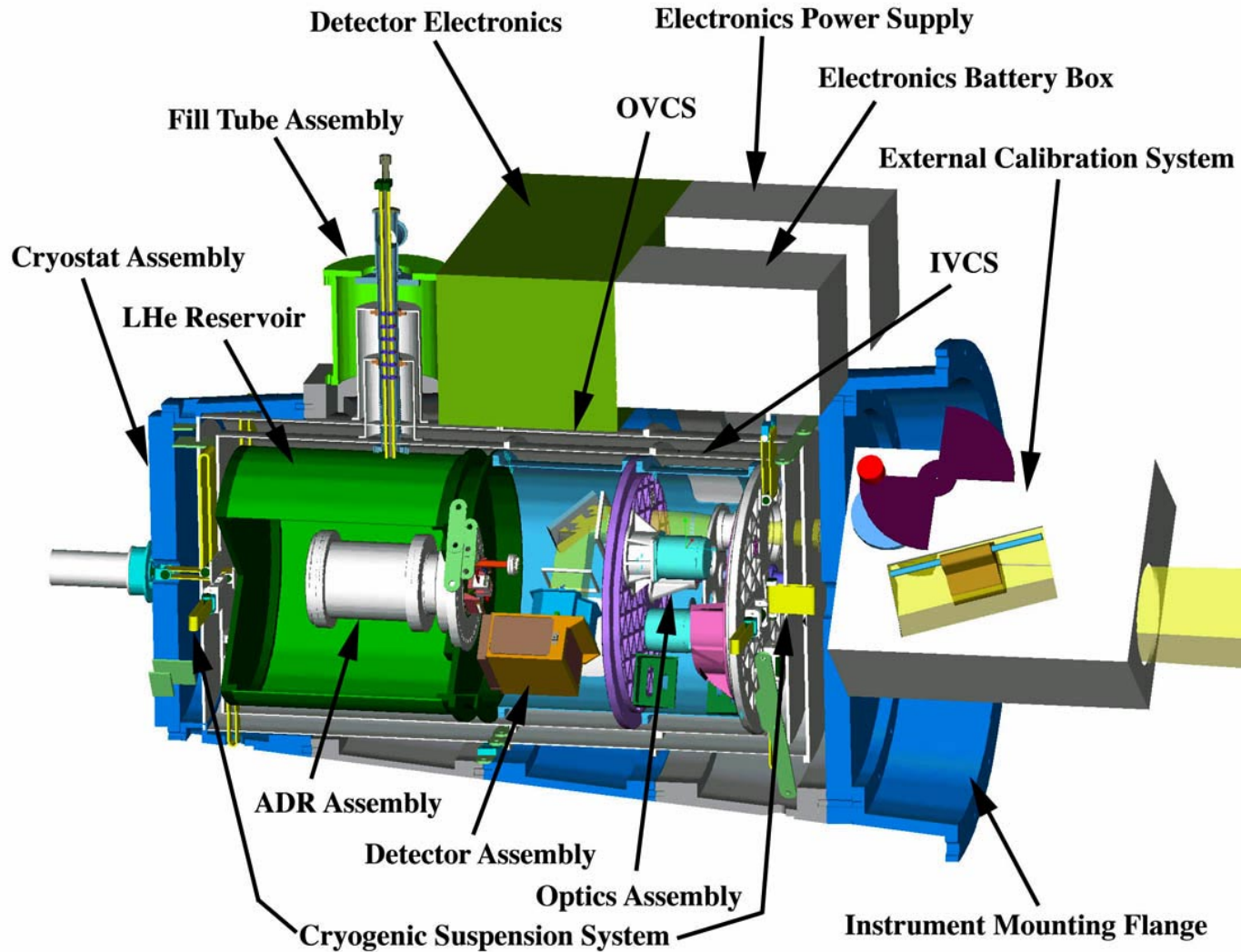


- **HAWC electronics divided into six subsystems**
 - Housekeeping
 - ADR
 - Opto-Mechanical control
 - Detector Electronics
 - Calibration
 - User Interface
- **Electronics mounted in three locations**
 - PI rack
 - Counterweight rack
 - Cryostat (SI flange)

HAWC Electronics Overview



Cryostat

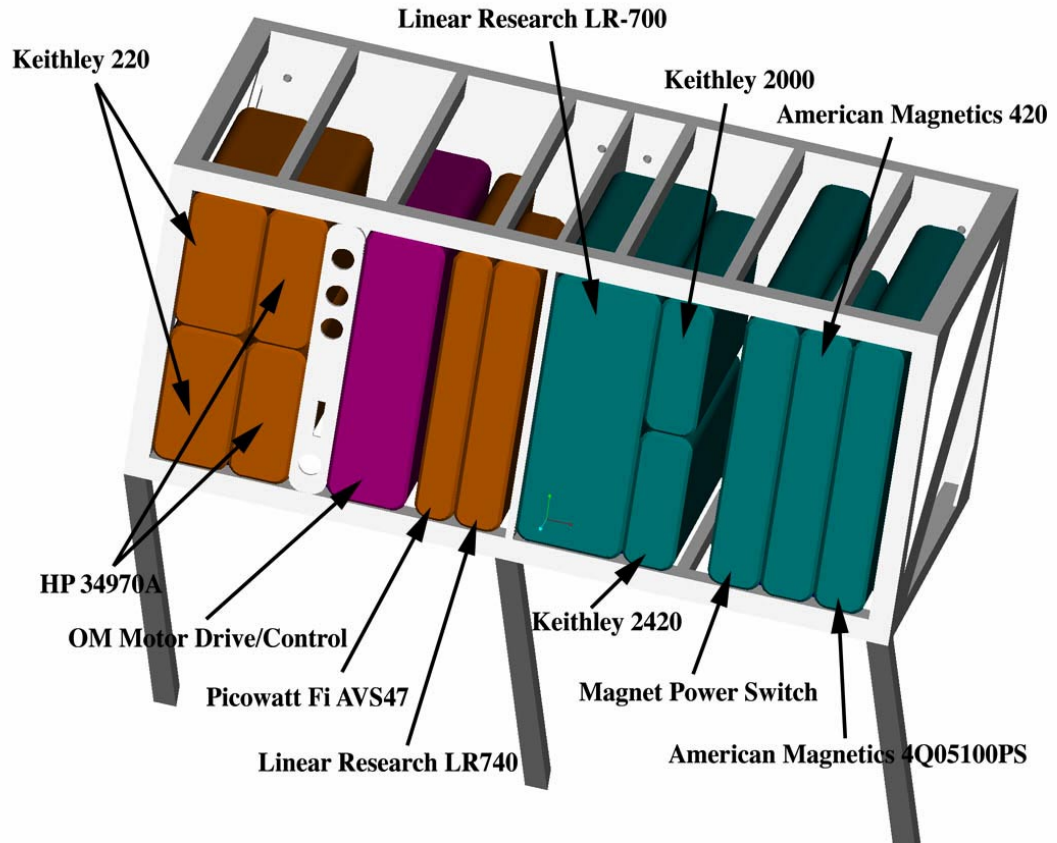


Counterweight Rack

Housekeeping Electronics

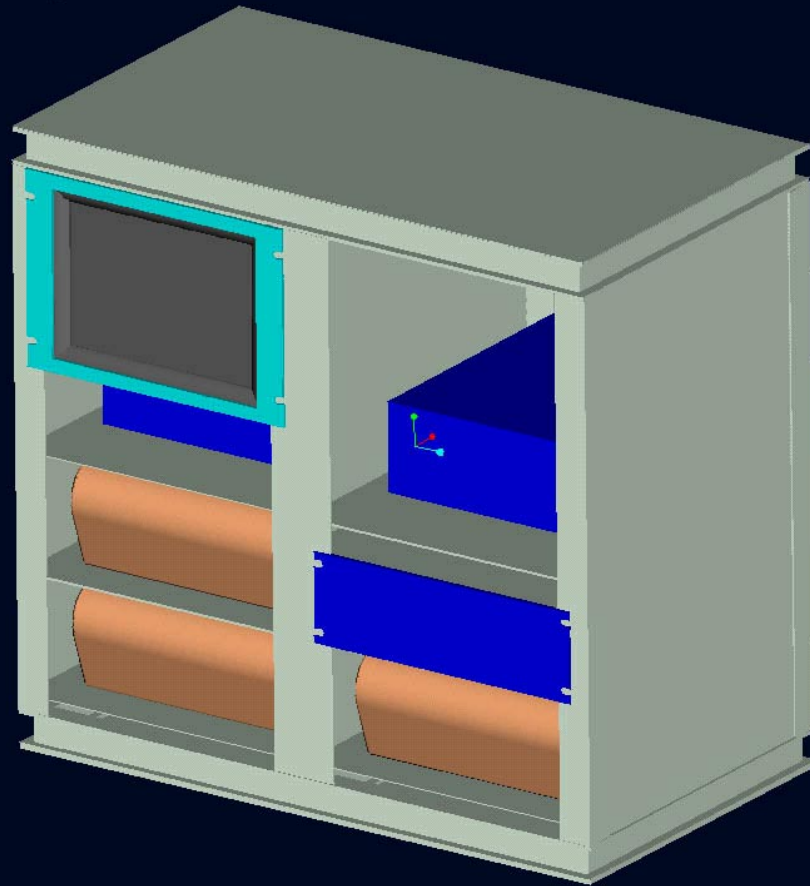
OM Control Electronics

ADR Control Electronics



PI Rack

PI (Floor) Rack





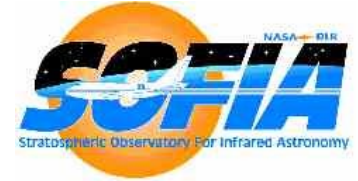
Design Philosophy



- **Use knowledge base from KAO**
- **Use COTS equipment where available**
- **Isolate all signals between telescope and PI rack using fiber optics**
- **Keep instrument installation simple**



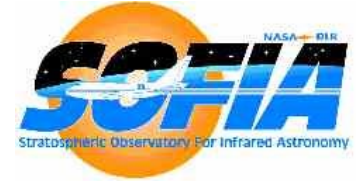
Interface to SOFIA



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- **Patch panel connections at PI rack**
 - AC power - UPS
 - AC power - non UPS
 - Ethernet switch (aircraft LAN)
 - Housekeeping computer
 - Data electronics computer
 - Master computer
 - (6) optical fibers to instrument
 - (2) RS-232 port, (2) GPIB bus extender, (2) custom data link
 - **Patch panel connections at telescope**
 - AC power - UPS
 - AC power - non UPS
 - Chopper
 - (6) optical fibers to PI rack
 - (2) RS-232 port, (2) GPIB bus extender, (2) custom data link



System Power



-
- **Maximum power usage**
 - Total for all components currently estimated at < 3850 VA
 - Actual power consumption of components will be less than maximum
 - Not all components used at same time
 - 600W (approx. 750VA) magnet supply only used during ADR cycle (pre-flight)

 - **AC power distribution**
 - Separate power distribution for UPS supplied components
 - Current limiting in power distribution strips
 - Each component contains fuse or breaker



Power Budget



Location	Component	Manufacturer	Model	Maximum Power	UPS (y/n)	UPS power	non-UPS	
Overhead rack	4 Quadrant High Current Magnet Power Supply	American Magnetics	4Q05100PS	600	n	0	600	
	Power Supply Programmer	American Magnetics	420	50	y	50	0	
	High Resolution Voltage Source	Keithley	2420	220	y	220	0	
	Detector Stage Thermometer Resistance Digitizer	Keithley	2000	22	y	22	0	
	Picoamp Excitation Unit	Linear Research Inc	LR-740	0	††	0	0	
	AC Resistance Bridge	Linear Research Inc	LR-700	100	y	100	0	
	8 Channel AC Resistance Bridge	Picowatt Fi	AVS47	12	y	12	0	
	Preamp for AVS47††	Picowatt Fi	Preamp	0	y	0	0	
	GPIB Interface for AVS47††	Picowatt Fi	AVS471B	0	y	0	0	
	HPIB to Fiber Extender GPIB140/2	National Instruments	777998-01	29	y	29	0	
	RS-232 Fiber Extender††	TBD (COTS)	TBD	0	††	0	0	
	RS-232 Fiber Extender††	TBD (COTS)	TBD	0	††	0	0	
	Magnet Power Switch	GSFC custom	-	30	n	0	30	
	Data Logger	HP	HP34970A	12	n	0	12	
	Data Logger	HP	HP34970A	12	n	0	12	
	Thermometry Current Source	Keithley	Model 220	60	n	0	60	
	Thermometry Current Source	Keithley	Model 220	60	n	0	60	
	Optics Mechanism Motor Controller	GSFC custom/COTS	-	100	y	100	0	
	Overhead counterweight rack total						1307	
	Cryostat	ADR magnet††	American Magnetics	-	0	††	0	0
		JFET/detector package††	GSFC custom	-	0	††	0	0
		Detector Electronics††	U.C. custom	-	0	††	0	0
		Detector Electronics Power Supplies	U.C. custom/COTS	-	270	n	0	270
Detector Electronics Battery Charger		U.C. custom/COTS	-	100	n	0	100	
Cryostat total						370		
PI rack	Detector electronics fiber interface	U.C. custom	-	25	n	0	25	
	Detector electronics (data) computer	TBD (COTS)	TBD	240	y	240	0	
	Data system mass storage	TBD (COTS)	TBD	90	y	90	0	
	Housekeeping computer	TBD (COTS)	TBD	240	y	240	0	
	HPIB to Fiber Extender GPIB140/2	National Instruments	777998-01	29	y	29	0	
	master computer	TBD (COTS)	TBD	240	y	240	0	
	RS-232 Fiber Extender††	TBD (COTS)	TBD	0	††	0	0	
	RS-232 Fiber Extender††	TBD (COTS)	TBD	0	††	0	0	
	LCD video display 1	TBD (COTS)	TBD	50	y	50	0	
	LCD video display 2	TBD (COTS)	TBD	50	y	50	0	
	KVM switch	TBD (COTS)	TBD	25	y	25	0	
	PI (floor) rack total						989	
	Calibration	Calibration sources	U.C. custom	-	250	n	0	250
Calibration system controller		TBD (COTS)	-	150	n	0	150	
Calibration total						400		
Total (Watts)						3066	1497	1569
Total (VA)	Estimated power factor conversion (Watts to VA)	0.8						
	Total non-UPS power (VA)						1961.25	
	Total UPS power (VA)						1871.25	
	Total system power (VA)						3832.5	

notes †† components listed with zero power are powered from other components in the system



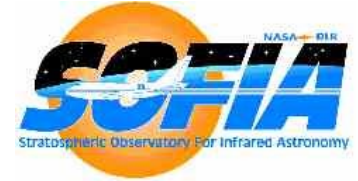
Electrical Safety



- **ADR magnet and supplies**
 - High current, but low voltage
 - Magnet and power supplies have internal voltage protection if coil current is interrupted
 - Magnetic field strength may require access restrictions during ADR cycle (preflight preparations)
- **Gases or liquids controlled by electronics**
 - None
- **High voltage**
 - 120 VAC power is only high voltage used in system
 - Most signals less than 12V
 - All enclosures grounded
 - All components have current limiting (fuse or breaker)



Open Issues



- **Need specification from SOFIA of allowable peak power during power up. May require sequencing turn on of components. (TA_SI_04)**