SPACE PHYSICS RESEARCH LABORATORY

TIDI

System overview

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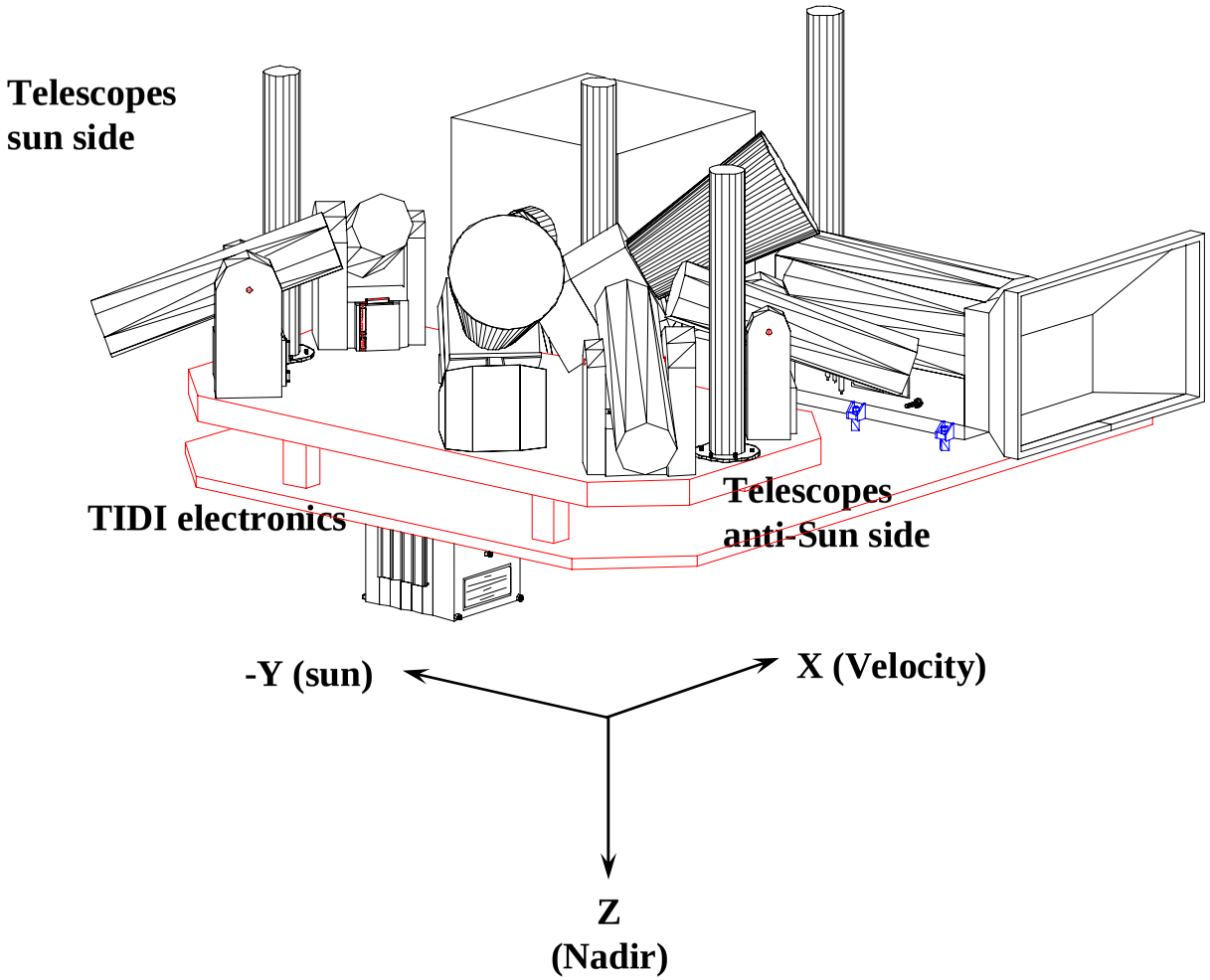
System

- Instrument consists of a Fabry-Perot interferometer (profiler) fed by four limb scanning telescopes
- Measure line of sight winds to 3 m/s accuracy
- Altitude coverage 60-300 km
- Altitude resolution 2 km
- Horizontal resolution 100 km
- Design lifetime 2 years
- APL is building the telescopes
  - CDR May 7

TIDI/Spacecraft configuration



Configuration

- **Limb scanning telescopes**
  - **Fixed Azimuth ±45° and ±135° to S/C velocity vector**
    providing simultaneous sun/anti-sun ground tracks
  - **Zenith scan over the altitude range of 60 - 300 km**
    10° operational scan range, 20° scan range for bearing lube
  - **Off axis Gregorian design using low scatter primary and 11.5° sun shade**
  - **0.05° x 2.5° fov (2 km x 100 km at earth limb)**
  - **Voice coil drive and Linear Variable Differential Transformer (LVDT) readout**
  - **Pyro actuated aperture cover**
  - **Focal plane shutter for sun avoidance**

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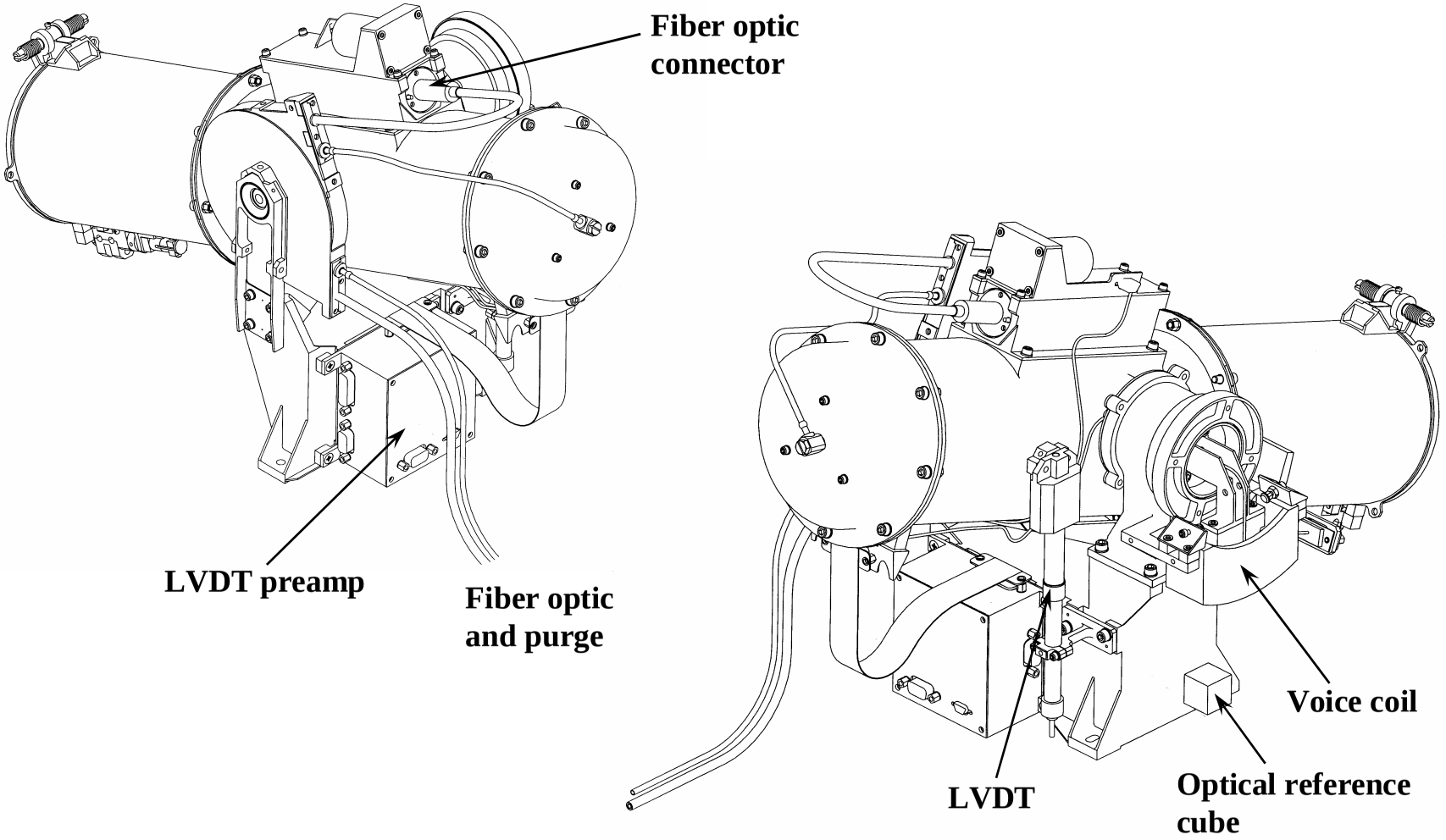
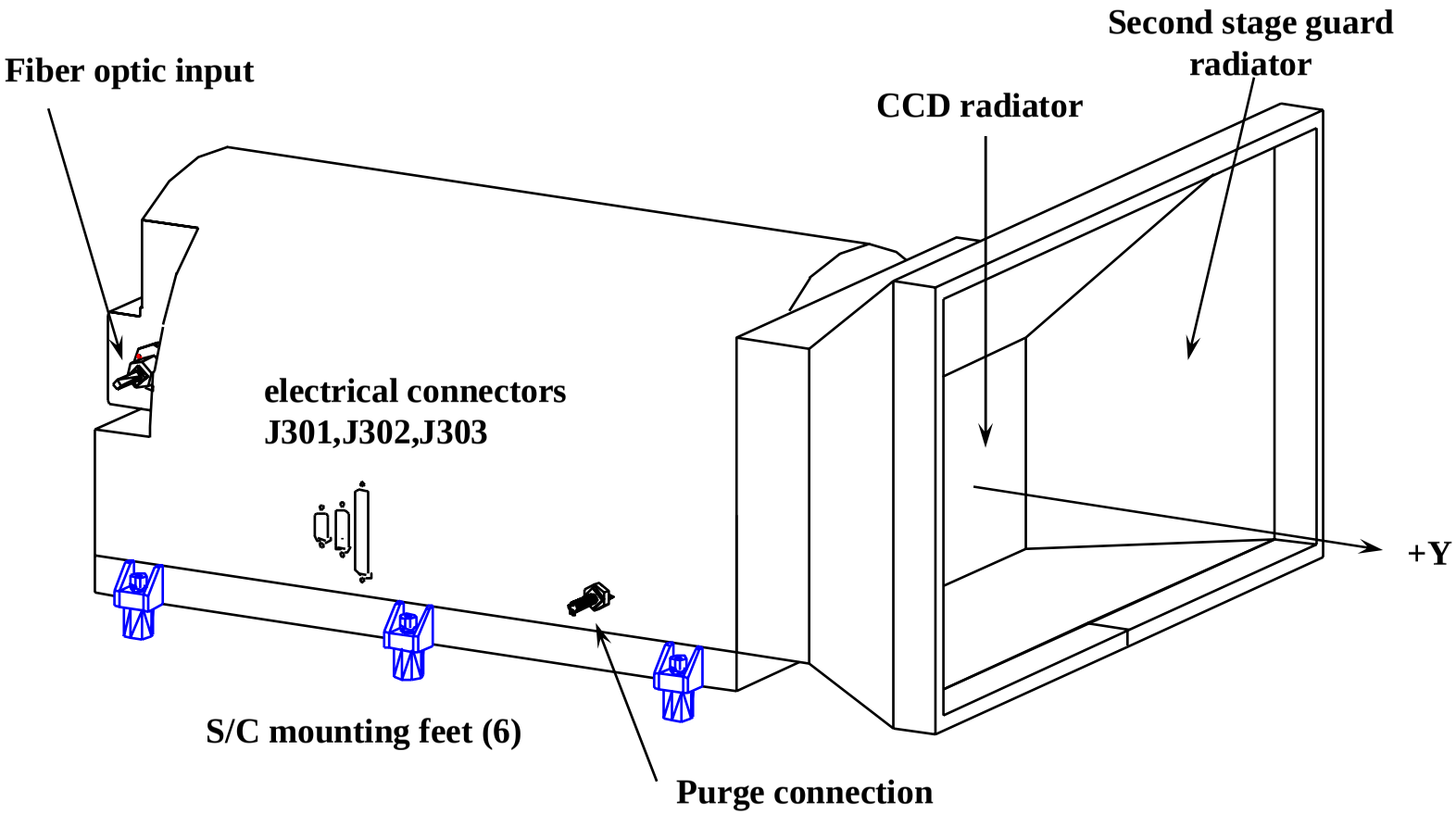
Telescope



Configuration

- **Profiler**
  - **Fabry-Perot interferometer optimized for wind measurement**
  - **2 filter wheels to allow for wind, temperature, and density measurements**
  - **5 shaped input fields imaged onto the CCD detector**
  - **Conical optic for image transformation to a rectangular array**
  - **Site 2000 x 800 back thinned CCD**
  - **passive cooling of the CCD to -80° C**
  - **Etalon temperature maintained at 20 ± 5° C over a beta cycle (120 days)**
  - **3 point kinematic mount**
  - **3 zone PWM heater control**

Profiler


Second stage guard radiator
Fiber optic input
CCD radiator
electrical connectors
J301,J302,J303
+Y
S/C mounting feet (6)
Purge connection

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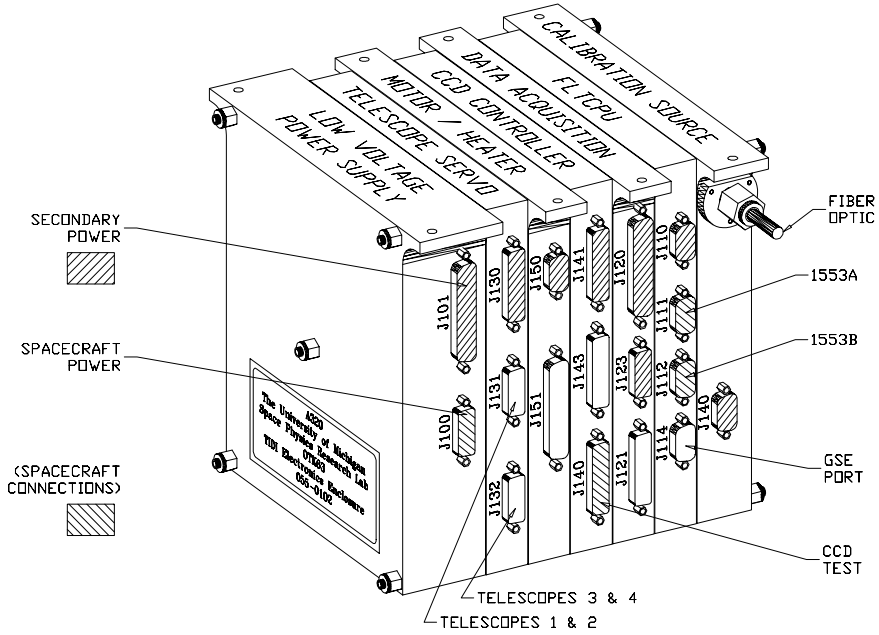
Configuration

- **Electronics, 7 stackable decks**
  - **Power supplies**
  - **Flight computer, 80C51 processor**
  - **Data acquisition**
  - **CCD controller**
  - **Filter wheels, telescope shutters, and PWM heaters**
  - **telescope servos**
  - **Calibration lamps**

Electronics



Configuration

TIDI

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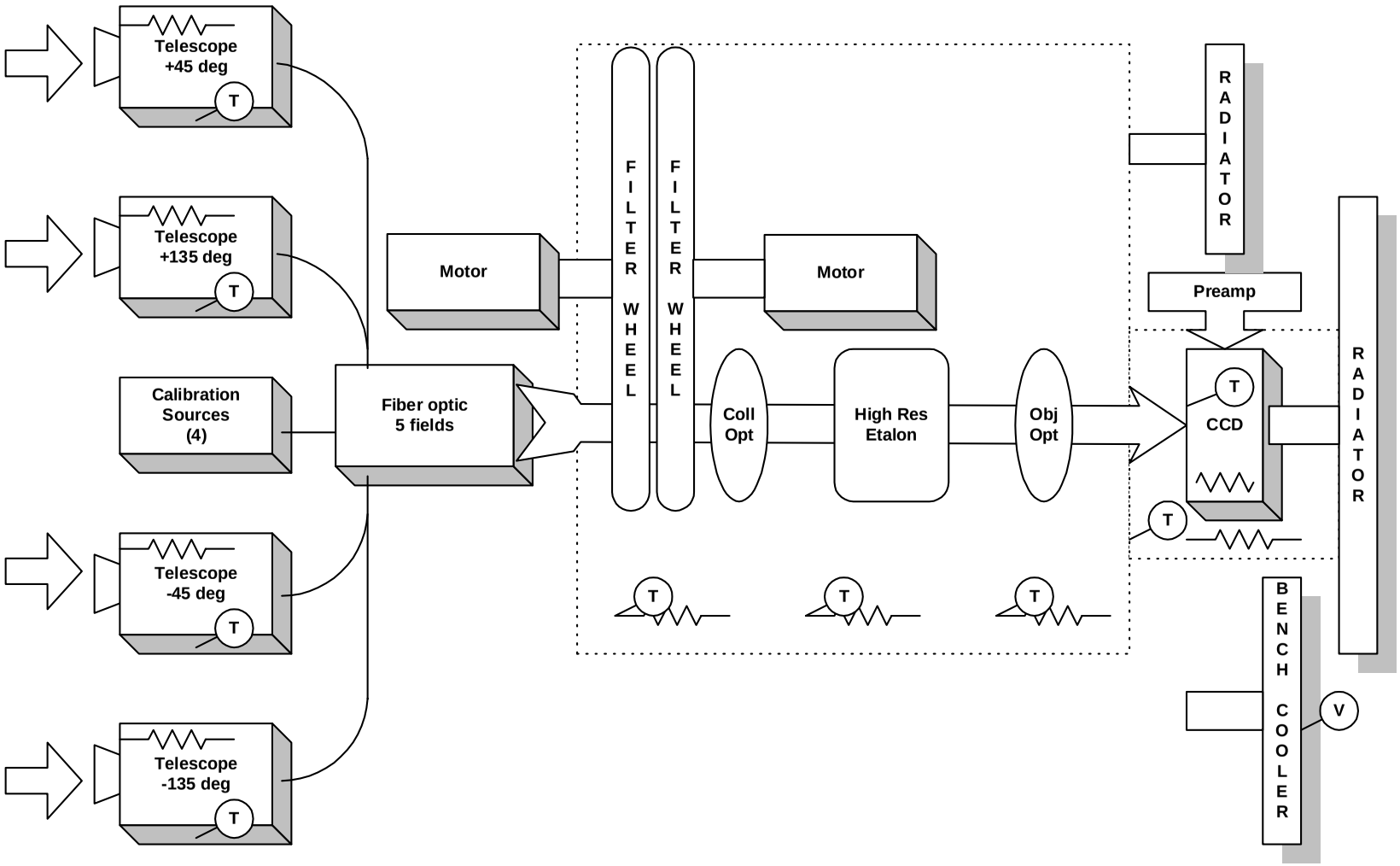
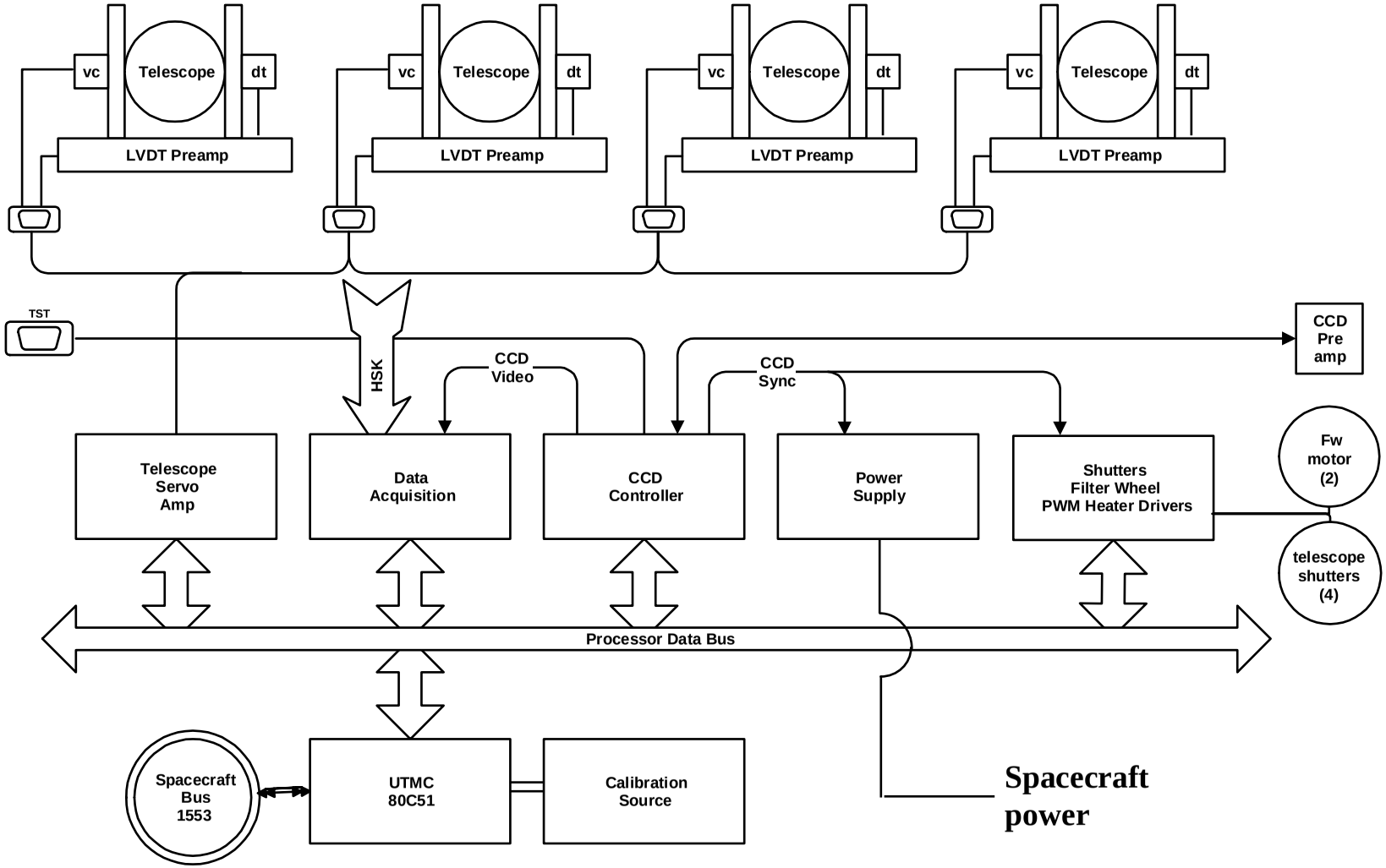


configuration



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TIDI

Instrument Parameter Summary

Component	Qty.	Envelope in (cm)	Weight lb (Kg)	Power hot/cold W
Telescope	4	19.2 x 12.5 x 9.5 (49 x 32 x 24)	33.9 (15.4)	6.3 / 7.4
Profiler	1	28.5 x 20 x 13.5 (72 x 51 x 34)	34.5 (15.7)	3.5 / 7.1
Electronics& Harness	1	9 x 8.5 x 8 (23 x 22 x 20)	17.6 (8.0)	7.4 / 7.5
Totals	6		86.0 (39.1)	17.2 / 22.0

Spacecraft Resources

Parameter		Comment
Mass	39 kg	Cap
Pointing	45,135,225,315 deg off Ram	FOV 35 deg cone
Atmosperic Region	60 to 300 km	
Scan Range	16 to 23 deg nominal	Below local horizonal
Full Scan Range	+/-11 deg	Centered 20 deg below local horizontal
S/C Inclination	74 degrees	
S/C Alititude	625 +/- 25 km	Numbers in package for 600 km
Thermal Interface		
Radiators	Profiler, Telescope	
Optical Bench	-55 to +25 C	
Profiler	-20 to + 40 C	-34 to + 60 C survive
E-box	-20 to + 40 C	-29 to +50 C survive
Profiler Stability	10 deg C per orbit	10 deg C per meter
ACDS/Nav Req		
S/C Pointing	+/-1 deg	3 sigma
Knowledge	.03 deg	
Jitter/Stability	.03 deg	10 sec
Position	1 km	
Velocity	.25 m/s	
Upset Torques	5 & 3 oz-in	Filter Wheel / Telescope
Special	Messages	Ter Xing, Sun Ang, Yaw Manuver

Spacecraft Resources

Parameter		Comment
CDMS		
Commands	2k byte / day	
Modes	Programmable	
Data Rate	2494 b/s	
Duty cycle	100%	
Interface	1553	
Power		
Average	0,8,11,11	Includes margin for Servo
Nominal Peak	0,8,30,30	Peak includes Motors, Servo and Cal
Peak	0,8,50,50	Servos into Stop
Peak Durations	200,1000 ms	Servos into stop may trig shutdown
Cleanliness		
Integration Area	Class 100,000	
S/C Surface	1000	
Hydocarbon	15 ppm	
Purge	N_2	Profiler, Focal Plane, Telescopes
Special		
I & T	Bench Cooler	
TV	Radiator Cold plate	
Mission	Yaw Man, Cover release	
Radiation	1 uC cal lamp starter	

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Changes since PDR

- Added a second filter wheel to increase temperature and density coverage
- Revised optical design for better chromatic performance
- Revised optical design due to glass availability
- Higher radiation dose level announced

Vendor status for major components

TIDI

IN

- LVDT's
- Input optics

DUE

- EM fiber optic, May
- Etalons, mid May
- CCD's, June-July
- Conical mirrors, July
- Imaging optics, July-Aug
- Voice coils, first week Aug
- Filter wheel motors, first week Aug
- Flight fiber optic, Sept
- Filters, Aug
- Telescopes, Dec

CDR updates

- **CCD vendor production problem**
  - **TIDI CCD's part of a contaminated batch (many hot spots)**
  - **Problem found late in production run**
  - **Leak in new vacuum installation found to be source of problem**
  - **Problem corrected**
- **New delivery no earlier than Oct 1 (mid Nov likely)**
- **Course of action**
  - **Proceed with I&T with engineering or grade 2 devices**
  - **May be able to absorb Oct 1 delivery with small schedule impact**
  - **Grade 2 devices may be usable as fallback**
- **If swap is necessary late in program**
  - **1-2 mo recalibration effort**