Laboratory for Atmospheric and Space Physics
University of Colorado **Boulder**

LASP Electrical Engineer Group Capabilities

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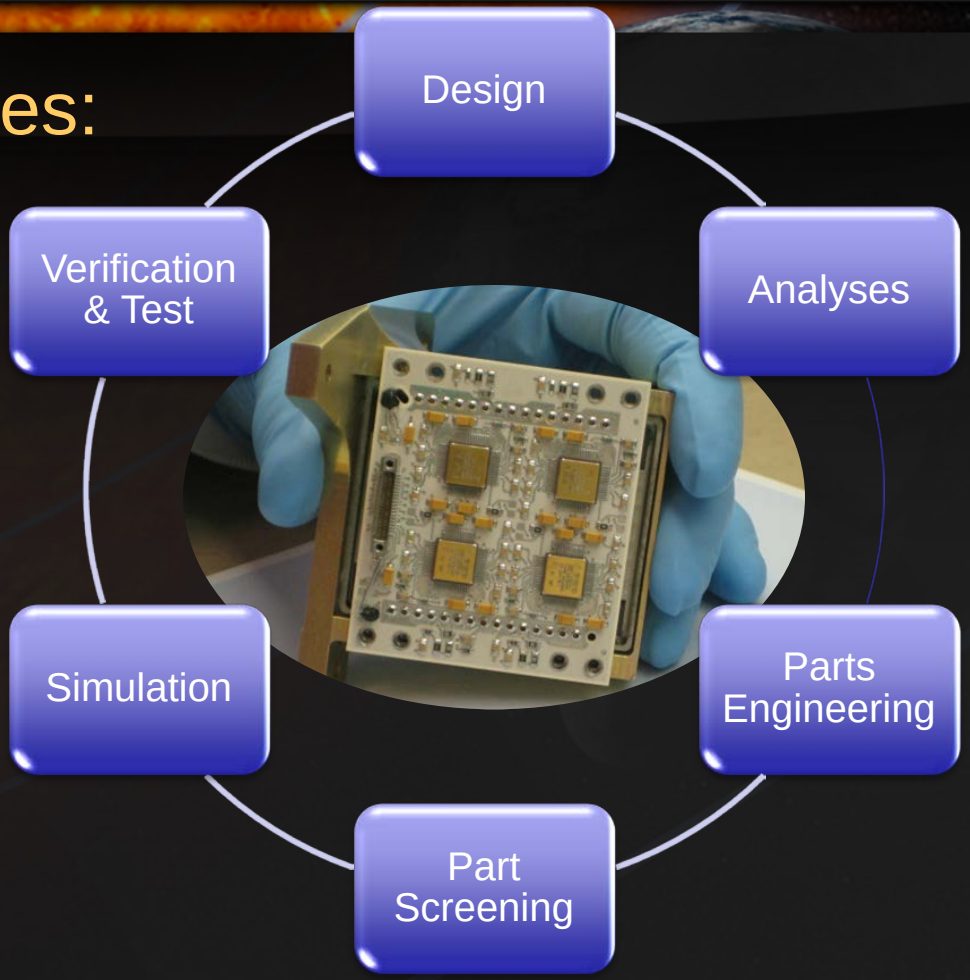
The 29th annual National Space Symposium
April 8-12

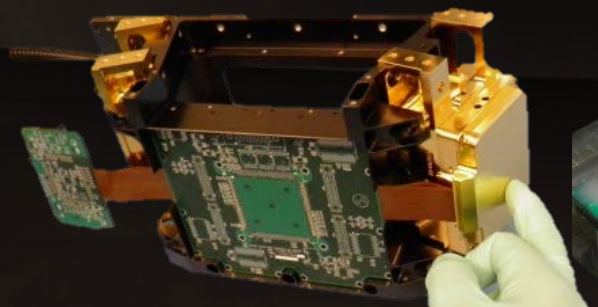
Electrical Engineering @ LASP

Broad range of capabilities:

- Analog Design
- FGPA Design & Simulation
- Digital Design
- Power Systems
- Control Systems
- RF Systems
- Parts Engineering
- Parts Screening
- PWB Design



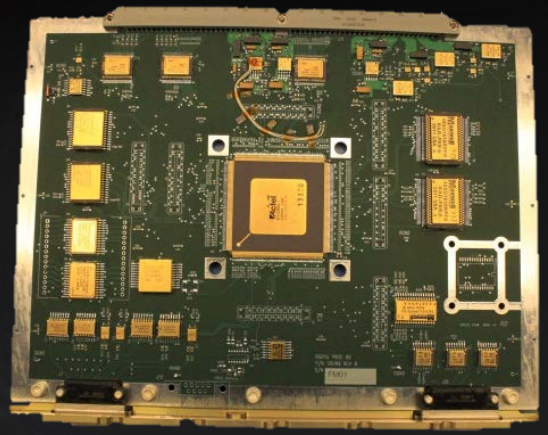
Detector-to-Downlink Full System Capability



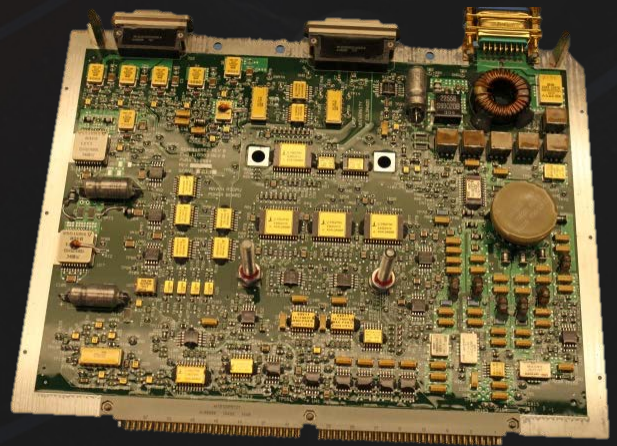
Detecting Physical Phenomena – Photons, Protons, Fields, Dust, …

Mechanisms – Open and precision closed-loop control

Flight Computers, FPGAs, and diverse S/C Interfaces



MAVEN IUVS

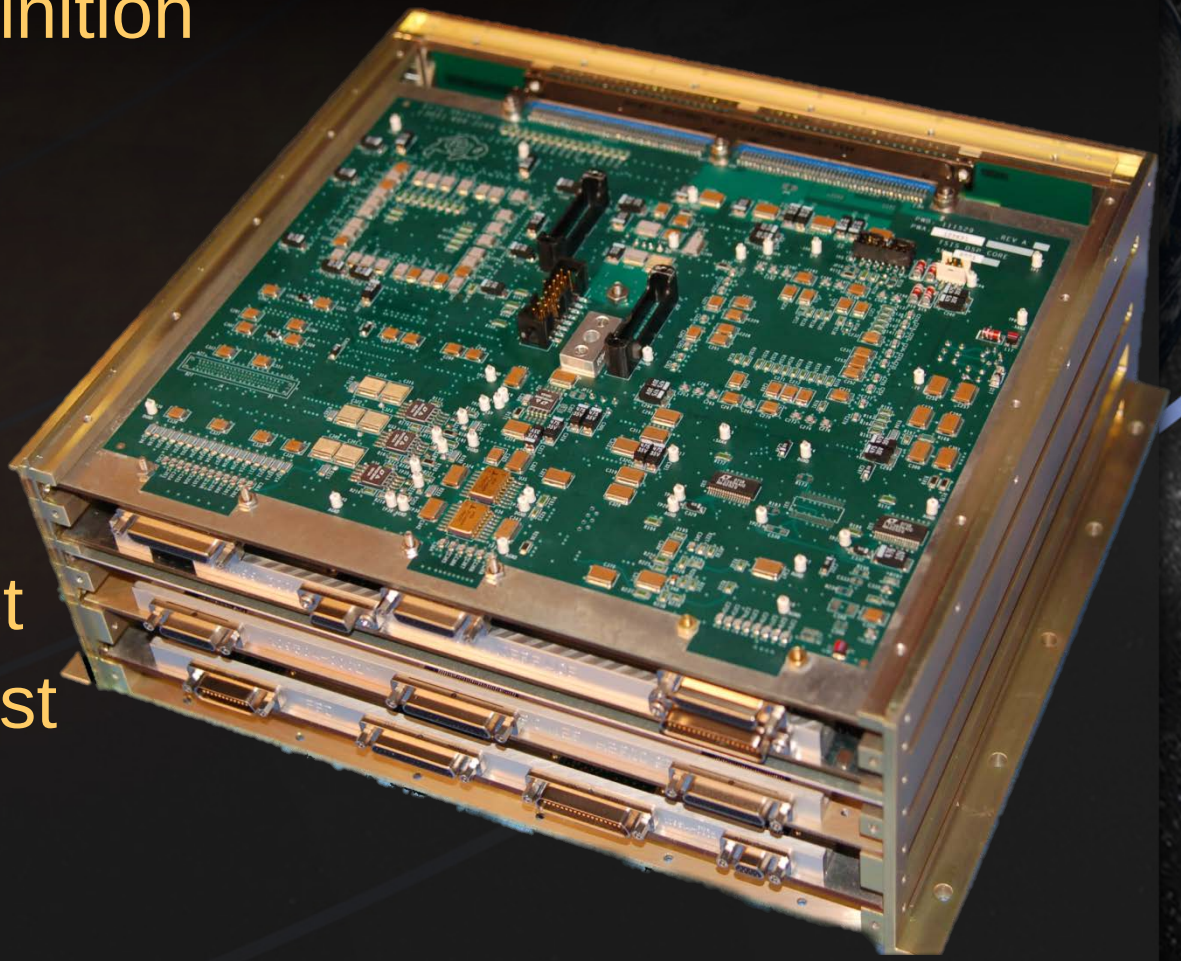


Low and High Voltage Power Supplies

All images are from the MAVEN Imaging UltraViolet Spectrometer Electronics

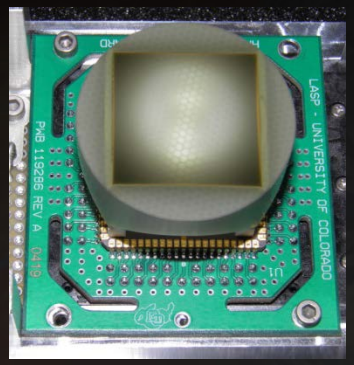
Engineering Through the Full Lifecycle

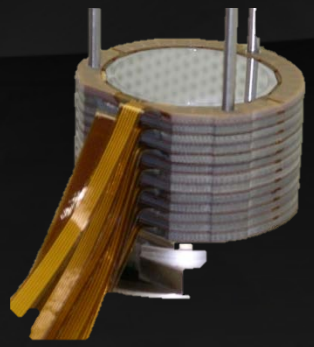
- Proposal concept generation and writing
- Requirements definition
- Schematics
- Simulation
- Prototype
- Parts selection and qualification
- ETU build and test
- Flight build and test
- I&T support
- Mission support



Detector Electronics Pushing Boundaries

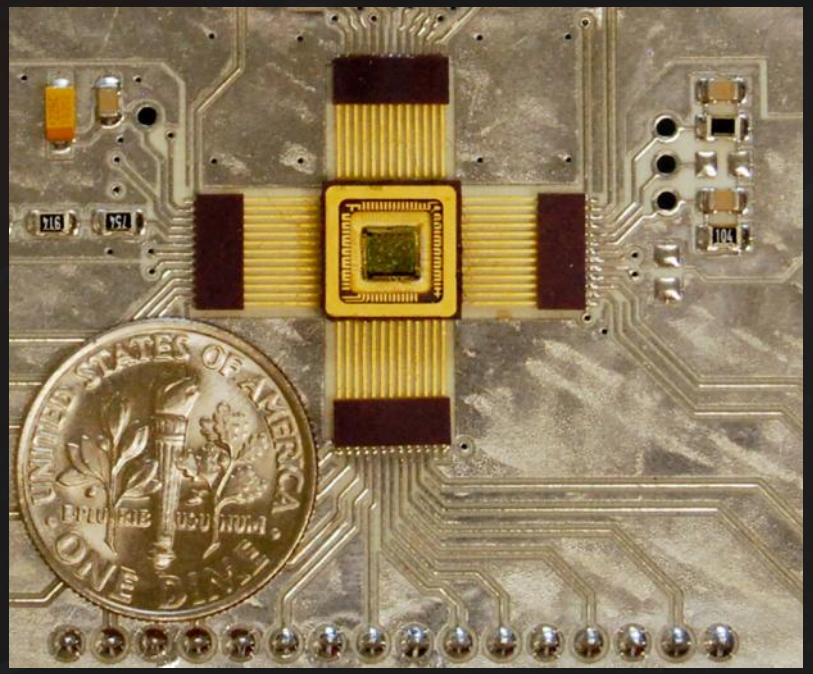
- Multiple detection disciplines
  - Photodiodes
  - Photoarrays
    - CCDs
    - CMOS
  - PMTs
  - MCPs
  - Bolometers
  - EM field detectors
  - Radiation detectors
  - Dust Detectors





Compact, Low Power, 6-channel ASIC

- Six Channels of charge sensitive electrometers
  - 20-bit analog-to-digital converters (10^6 Dynamic Range) per channel
  - Absolute error less than 0.7% from 50 fA to 2.5 nA, Noise < 12.5 fA
- Sensitivity is resistor selectable; 10 fC / Count nominal
- Low Power: ASIC uses 5 mW;
  external bias circuit uses 120 mW
- On chip self calibration circuitry for
  in flight gain measurement
- RAD Hard to 425 KRAD
- XRS Engineering Unit flown on two
  SDO/EVE Rocket Verification flights
- Custom 6-layer, 52-pin Ceramic Quad Flatpack



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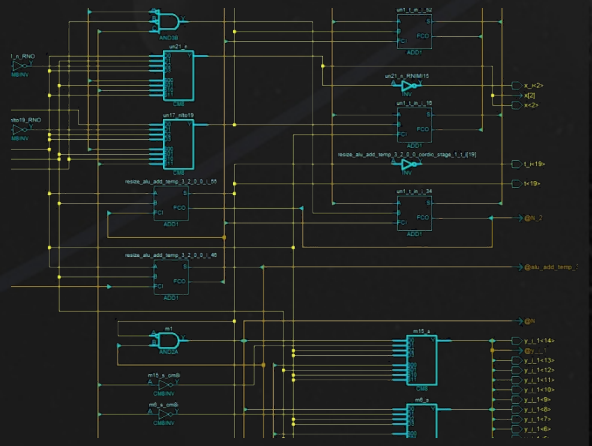
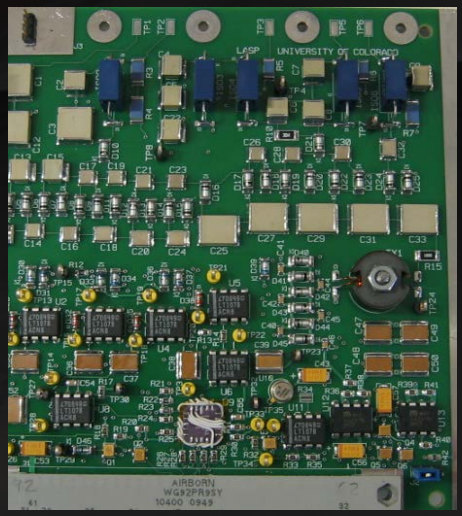
FPGA Design Group

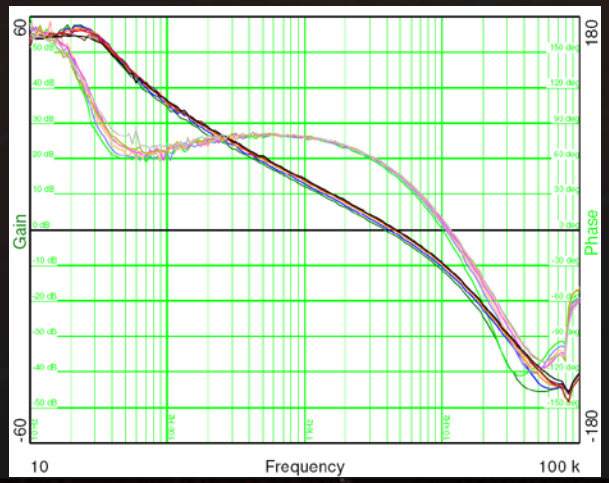
- Digital Signal Processing
  - Filters, FFT, Pulse Detection, Data Compression
- Digital Control Systems
  - Motor Control, Precision Optics, Power Systems, Control. Closed Loop Temperature Control
- System on a Chip Designs for Space
  - Embedded Processors, Fault Tolerance
- Memory Interfaces
  - SDRAM, Flash, Serial EEPROM, EDAC
- Spacecraft Communications Interfaces
  - CCSDS, Spacewire, PCI, 1553
- FPGA Test and Verification
- Proven FPGA design process

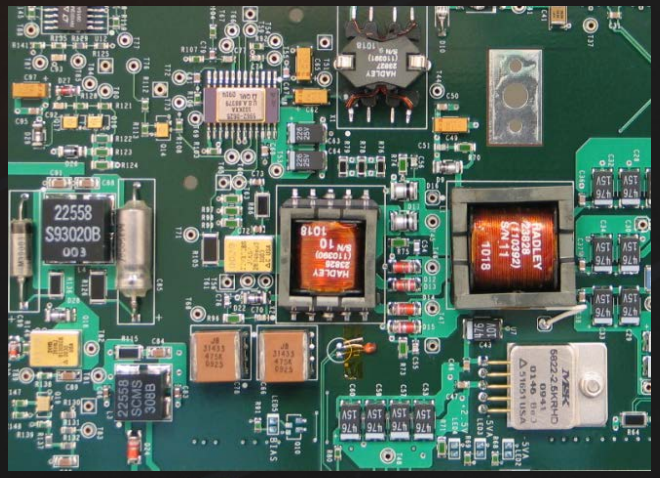


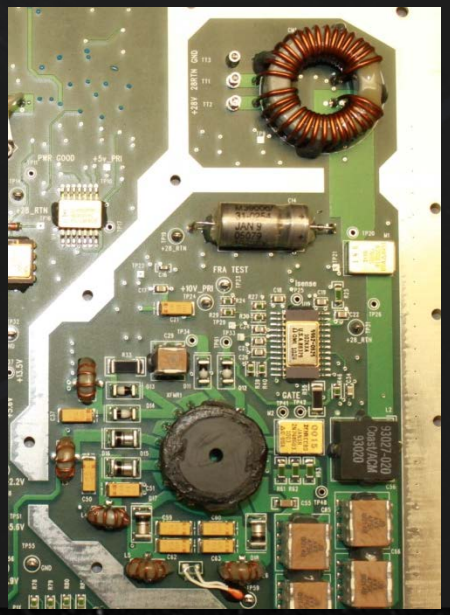
Broad Range of Power Systems

- LVPS: custom multi-output, flyback & forward, custom magnetics, linear post-regulation, HiRel bricks
- HVPS: low-noise, multi-output designs for PMTs, image intensifiers, energetic particle and dust detectors
- Thorough analysis and test: static, dynamic, stability, noise, thermal, part stress, worst case, etc.



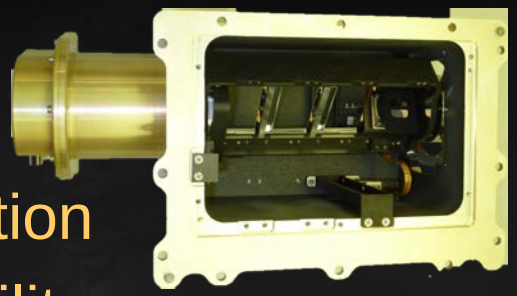


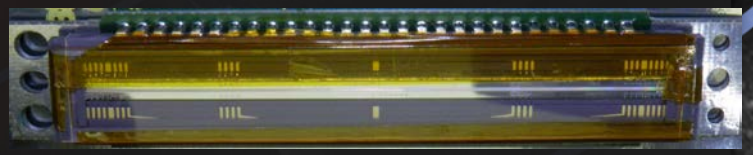


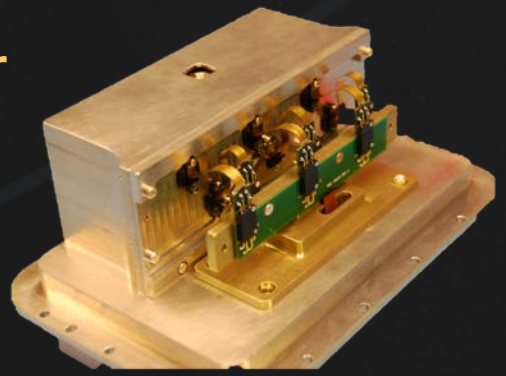


Precision Control System Design

- Over 40 Unique Spaceflight Mechanism Controllers since 1998
- Fery Prism Drive (FPD)
  - Precise closed-loop wavelength selection
  - Sub arc-second stability and repeatability
  - 80 Hz stabilization bandwidth
  - CCD position sensor for FPD uses subpixel interpolation
- Electronic Substitution Radiometer
  - Precision thermal balance controller
  - Calibrated uncertainty to less than 100ppm

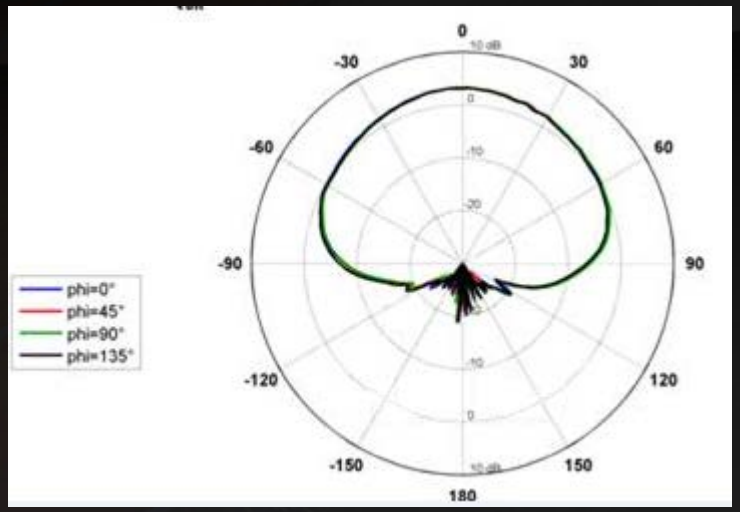




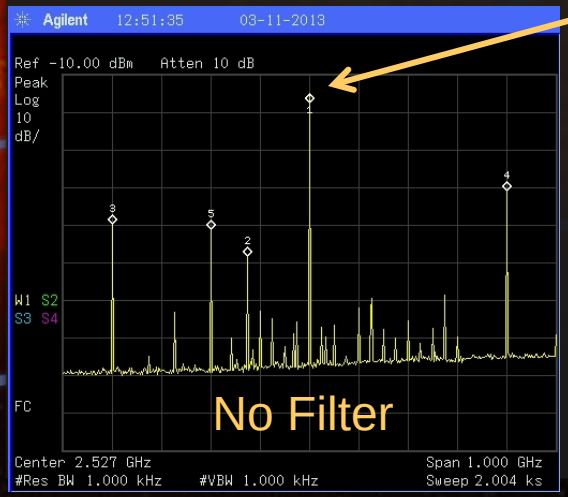


RF Systems

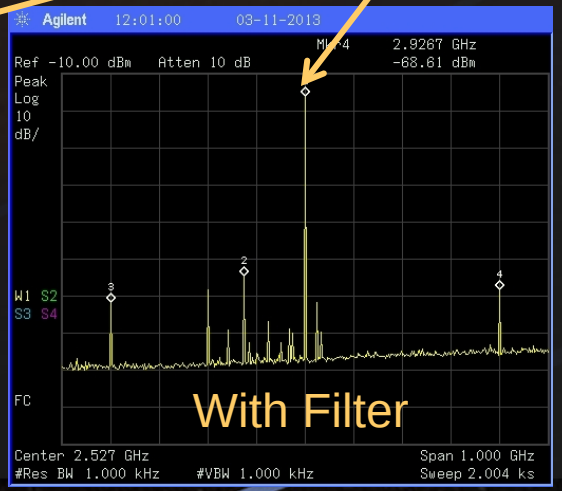
- 0 dB Gain Patch Antenna Design Out To 60 Degrees
- EM Simulation Tools For Coupled Microstrip Filter Designs
- RF Mixers and Filters Applied To X-Band CubeSat Design



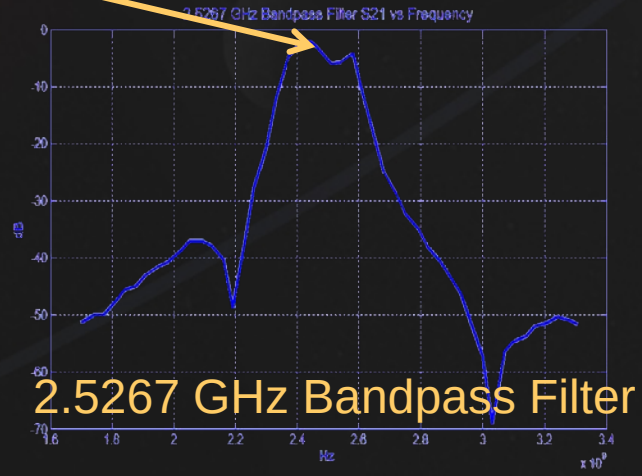
2.5267 GHz



No Filter



With Filter

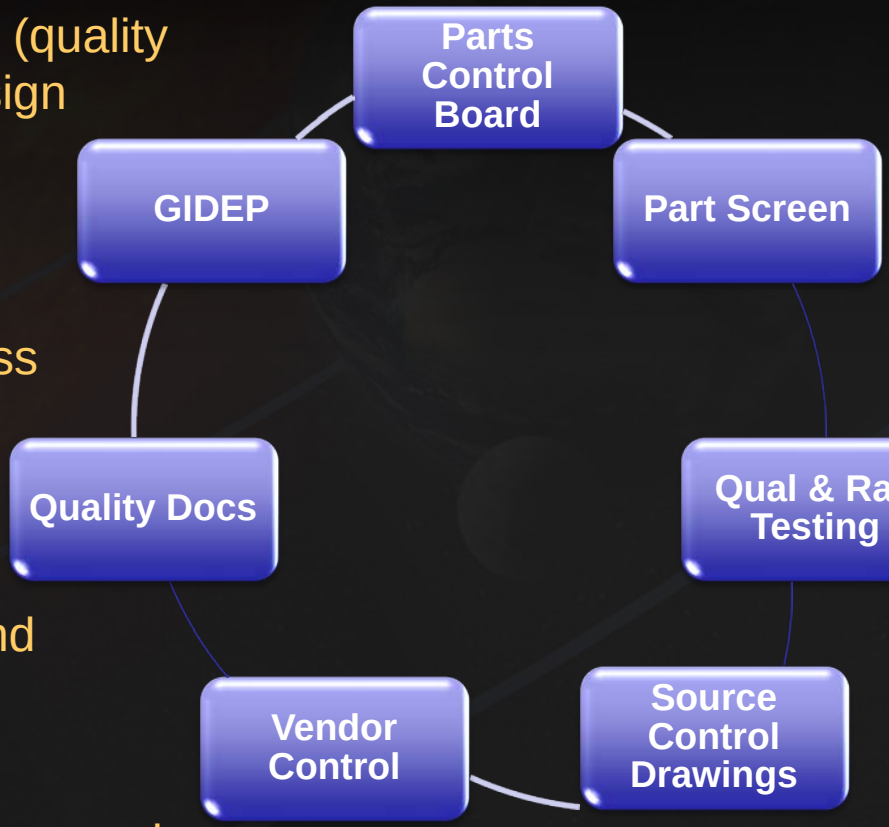


2.5267 GHz Bandpass Filter

Parts Engineering and Qualification

Proven success:

- Working with multi-organizational Parts Control Boards
- Working with multi-disciplined personnel (quality engineering, reliability engineering, design engineering, program management, suppliers, customers)
- Organized, timely, and comprehensive documentation of parts approval process
- Evaluating EEE parts against screening and qualification requirements
- Processing Non-Standard Part Approval Requests, program waiver requests, and negotiated quality documentation
- Certified pre-cap inspections
- Supporting EEE part costing efforts for proposals
- Managing GIDEP Advisories and Alerts



Innovative Electro-Mechanical Designs