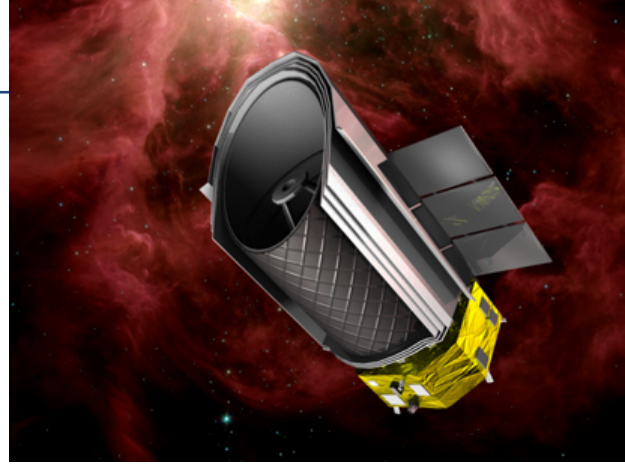


The Italian participation to SAFARI-SPICA is coordinated by IAPS - INAF

1. Instrument Control Unit:
   - DPU & OBS (IAPS)
   - ICU Box and backplane (national industry + IAPS)
   - Power Supply Unit (national industry + IAPS)
   - tests and Integration of the ICU
     - MCU (Mechanisms Control Unit, NL+B), CCU (Cooler Control Unit, F) e DPU (national industry + IAPS)

1. LNA (Low Noise Amplifiers) (national industry + IAPS)

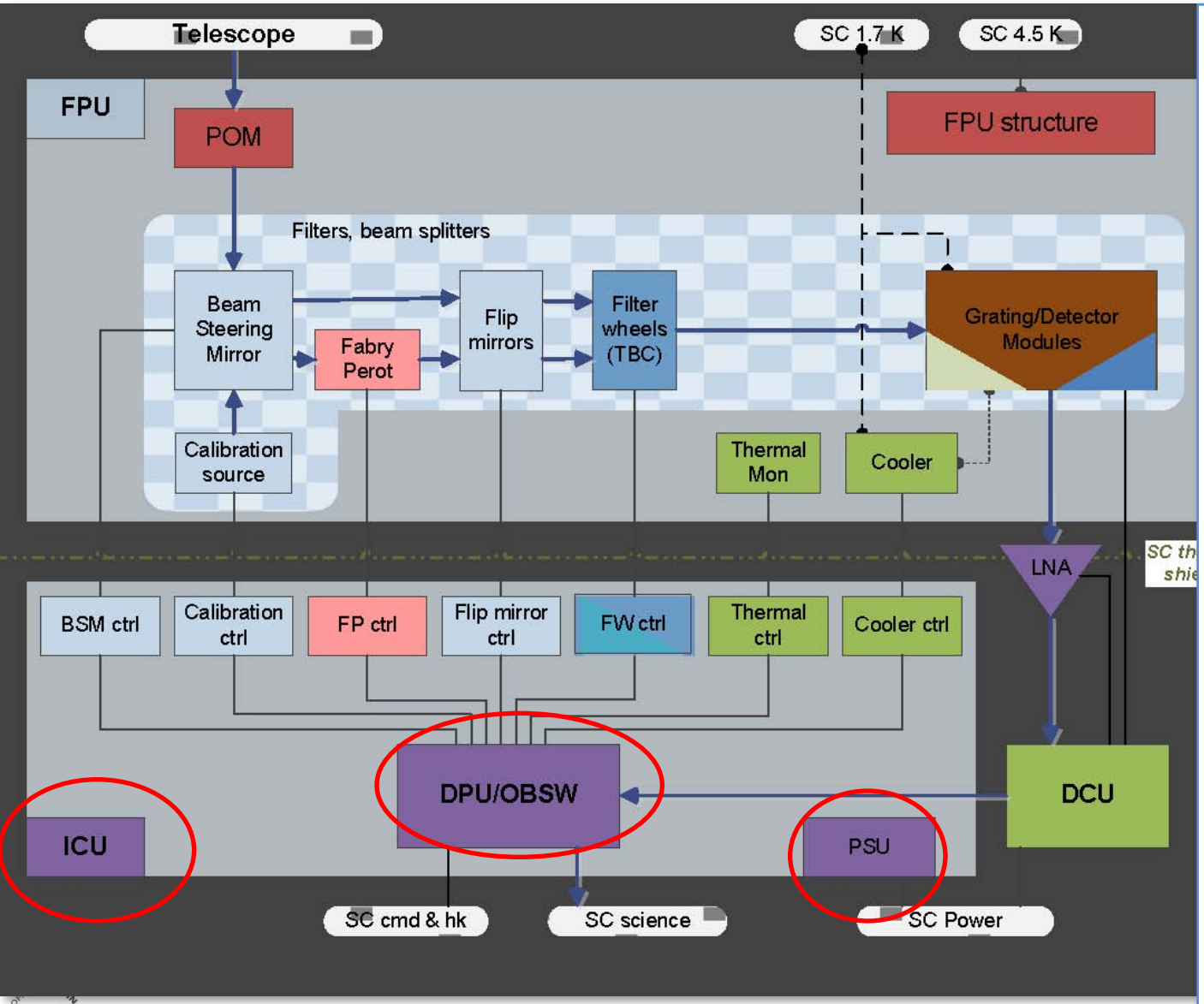
2. Participation to the ICC (Instrument Control Center) IAPS-OABO-UniPD

3. Participation to the steering committee of the SAFARI Consortium

4. Responsibility of the coordination of the Galaxy evolution Working Group in the SAFARI science Team

5. Participation to the Science Team IAPS-OABO-UniPD-UniBO
   - Two italian CoIs: L. Spinoglio & C. Gruppioni
   - Science associates: A. Franceschini, F. Pozzi, plus many others involved in the M5 proposalpreparation

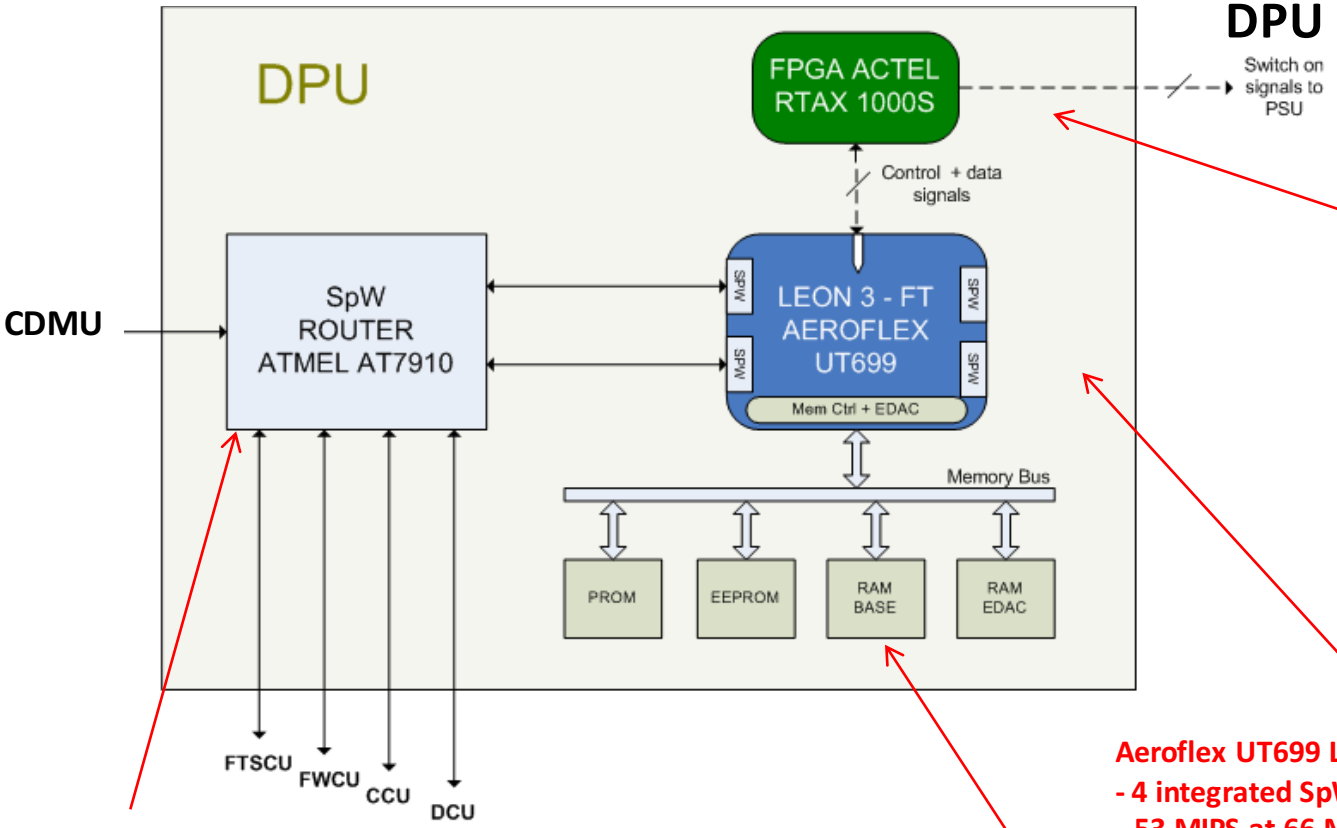
SAFARI ICU DPU OBS



ICU will include:
-DPU to implement the Instrument control and data handling functionalities
- PSU power supply unit to provide secondary power to the other warm electronic units
- MCU mechanisms control unit (mirrors and wheels control)
- CCU cooler control unit (instrument thermal monitor and control)

-Only DPU and PSU will be supplied by Italy
+ SAFARI On Board Software (OBS)

DPU High level architecture



Small capacity Actel FPGA to implement additional logic:
- control signals for subsystems switch ON/OFF
- DPU board HW monitoring functions
- DPU board reset (TBC)

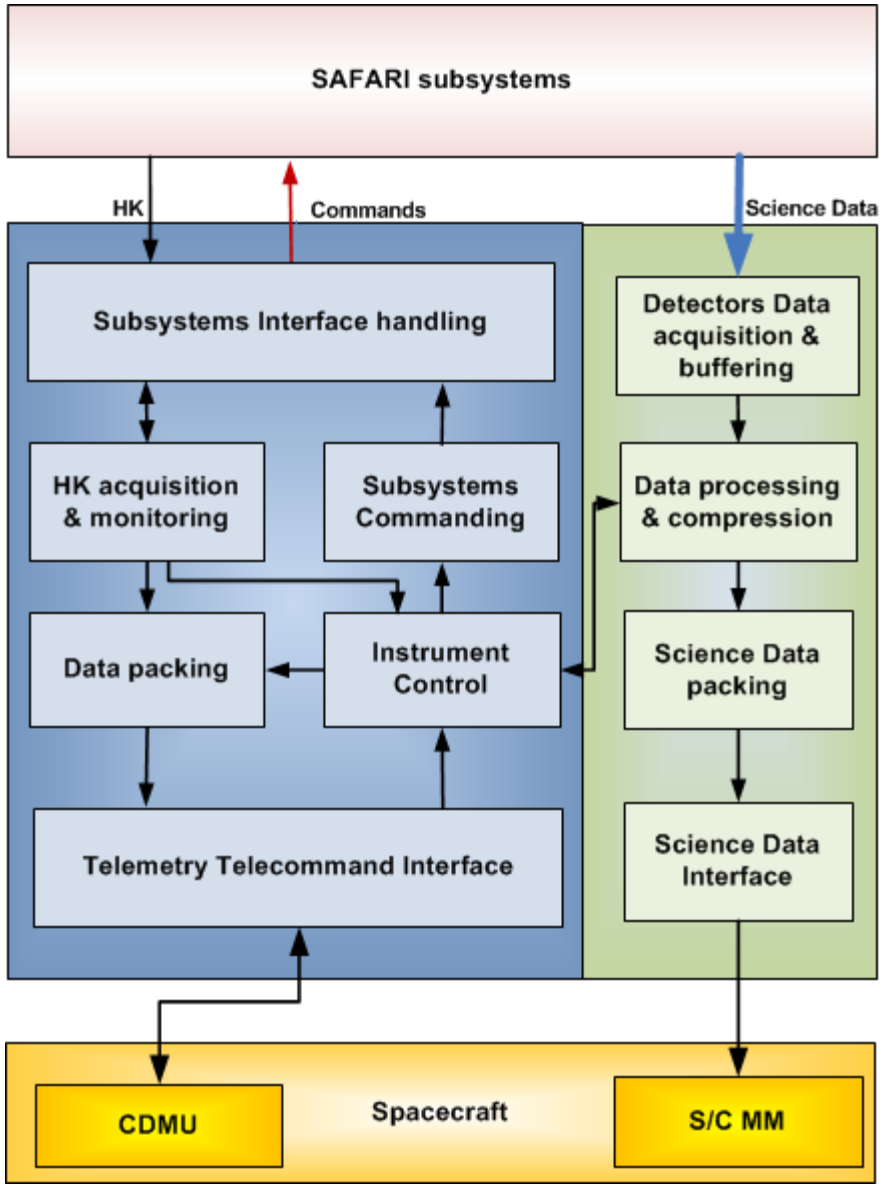
Aeroflex UT699 Leon3-FT processor:
- 4 integrated SpW ports, two of which supporting RMAP
- 53 MIPS at 66 MHz clock frequency:
WARNING: can be insufficient if science data rates from DCU highly exceed 4 Mbits/s (=> compression algorithm with a CPU load greater than 20-30 MIPS)

Atmel AT7910 SpW Router connected to the external SpW links and to Leon processor
-Time Codes from SPICA network automatically propagated to all the Safari units, as required by the internal synchronization scheme
- non-blocking crossbar switch connecting any input port to any output port
- the 8th SpW port of the Router can provide a second connection to CDMU (if crossed strapping required) or a third connection to the Leon (to improve bandwidth)

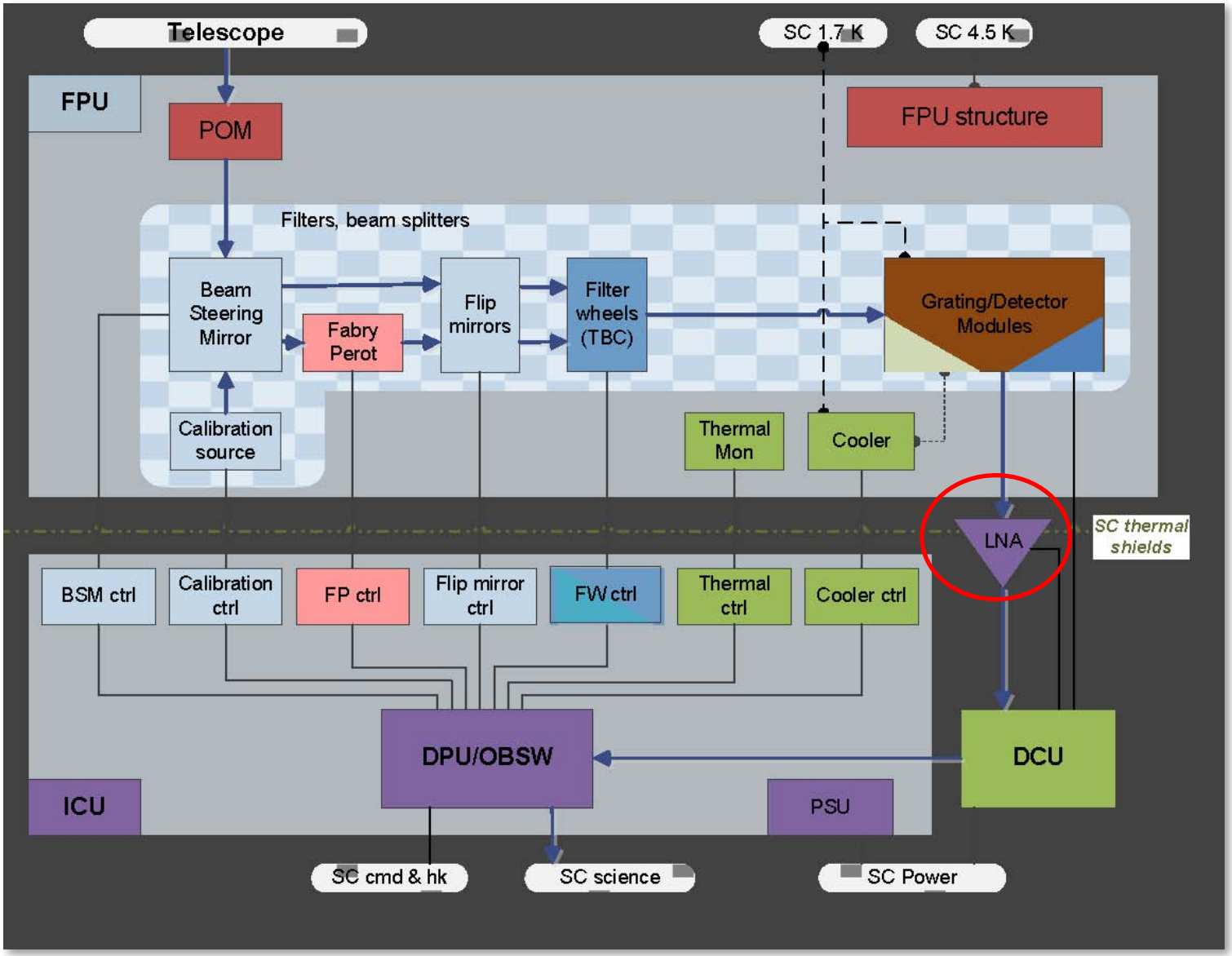
Estimated memory requirements:
- PROM: 256 kB
- EEPROM: 3 MB
- SRAM: 40 MB (32 + 8 for EDAC redundancy)

DPU On Board Software

- Telemetry and Telecommand exchange with the S/C
- Instrument Commanding, based on the received and interpreted TCs, in agreement with the current instrument operating mode
- Instrument monitoring and control, based on the Housekeeping data (HK) acquired from the other instrument units
- Detectors readout data acquisition, pre-processing and formatting according to the selected Telemetry protocol
- On board time management and synchronization of all the instrument activities
- On board Memories management

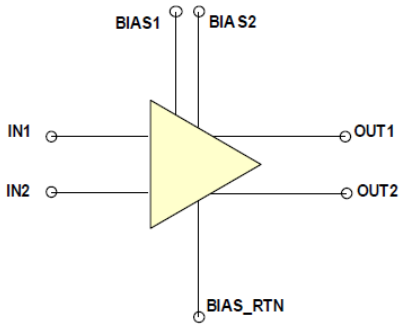


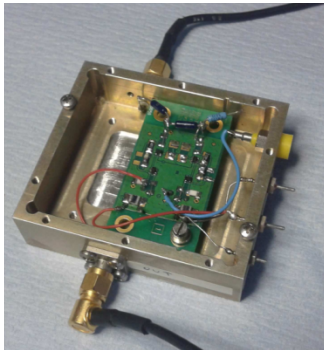
SAFARI LNA


Telescope
SC 1.7 K
SC 4.5 K
FPU
POM
FPU structure
Filters, beam splitters
Beam Steering Mirror
Fabry Perot
Flip mirrors
Filter wheels (TBC)
Grating/Detector Modules
Calibration source
Thermal Mon
Cooler
LNA
SC thermal shields
BSM ctrl
Calibration ctrl
FP ctrl
Flip mirror ctrl
FW ctrl
Thermal ctrl
Cooler ctrl
DPU/OBSW
DCU
ICU
PSU
SC cmd & hk
SC science
SC Power

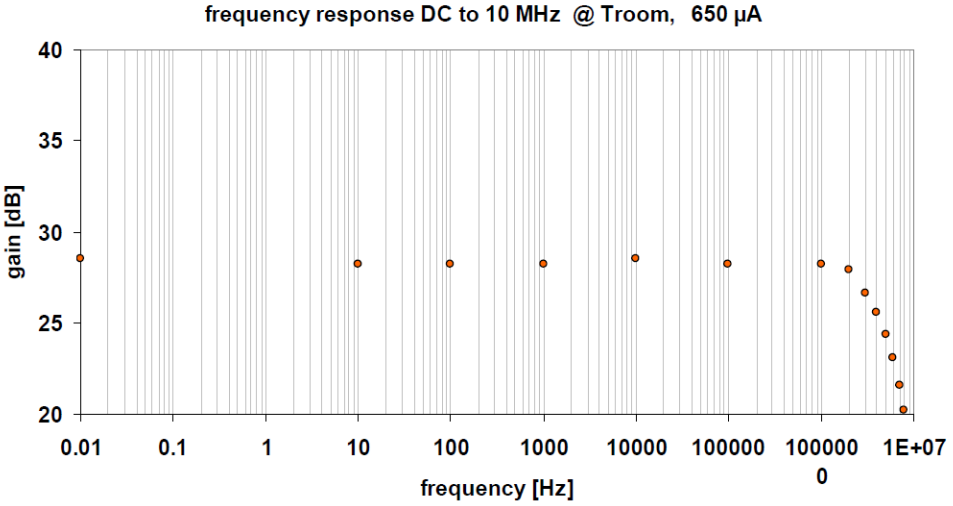
First prototype and preliminary test (TAS-I, Milano, INAF/IAPS, CNR/IFN)

Single channel LNA interfaces, whose core is the INFINEON BFP650 HeteroJunction Si:Ge.

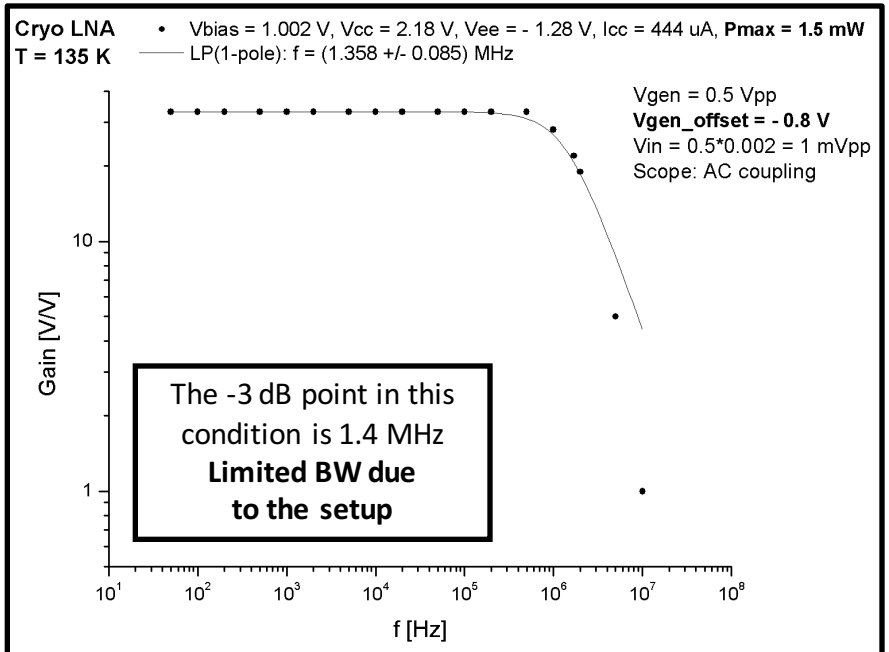




Main requirements to be satisfied at 135 K are:
BW: DC to 3 MHz
GAIN: 20 V/V
NOISE: < 3nV/sqrt(Hz) (< 1nV/sqrt(Hz) as goal)
POWER: < 2 mW/channel (goal), 5 mW/channel MAX

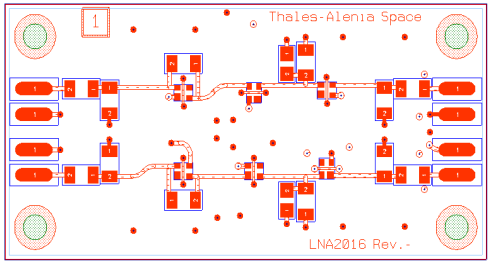


Frequency response from DC to 10 MHz at Troom and at low power (~1mW). The -3 dB point in this condition is around 4 MHz. G ~ 25 V/V

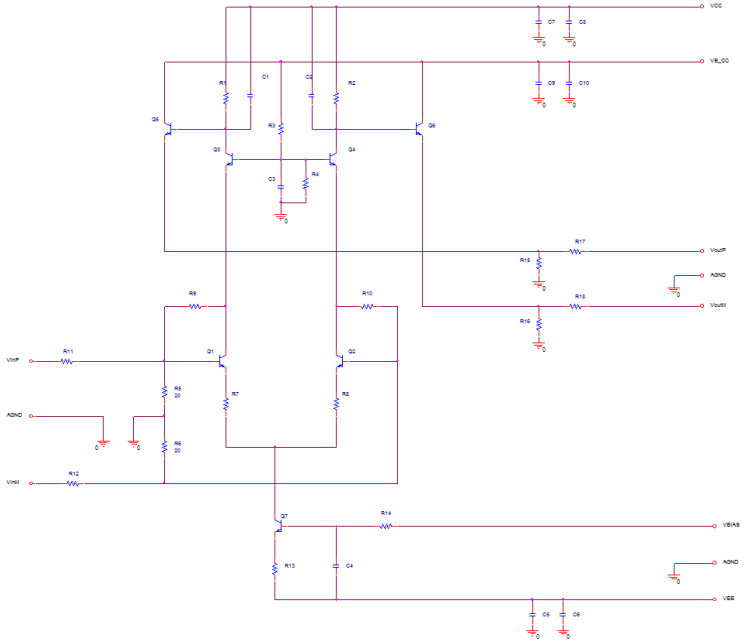


New prototype: LNA2016

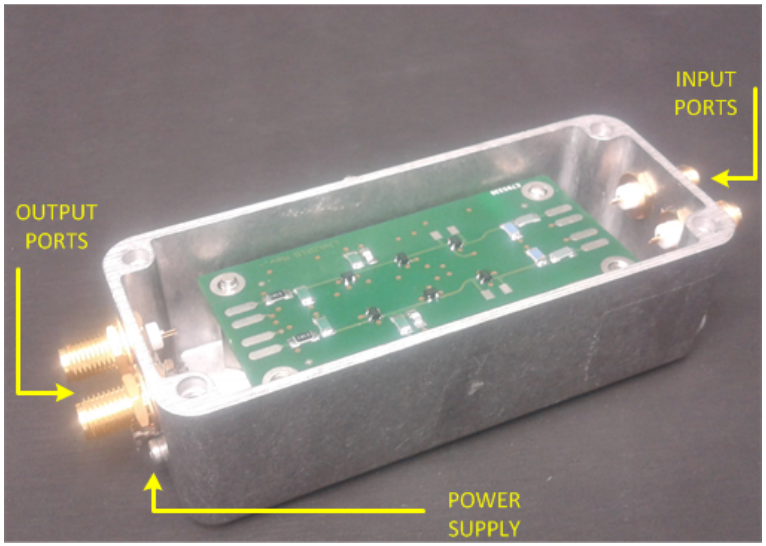
- Reconfigurable PCB allowing test of alternative configurations
- Improved 4-layer layout with guarding of sensitive nodes
- Full differential Input-Output
- Cascode input stage to allow larger bandwidth
- Assembled with proven cryo-compatible EEE parts



Prototype layout



overall schematics



Test box during assembly (March 2016)