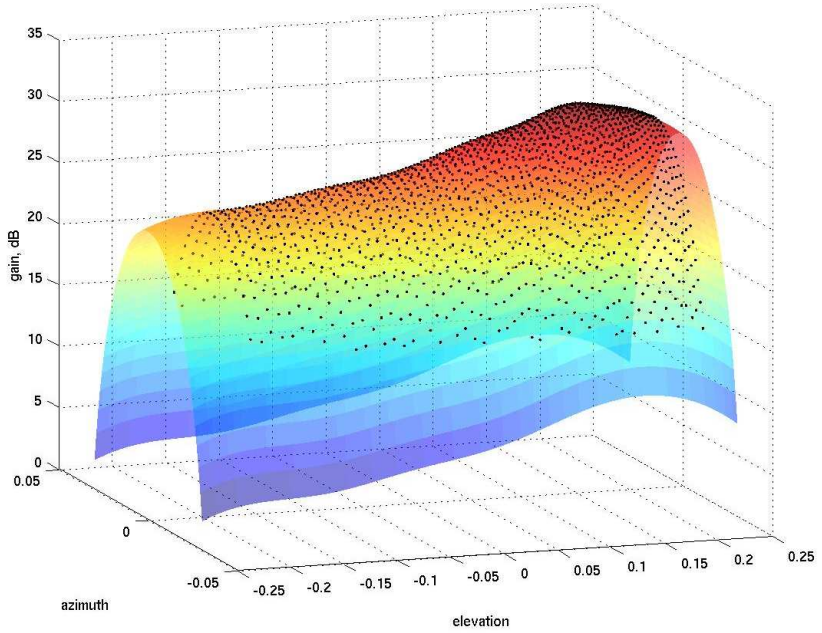
ASCAT RADIOMETRIC CALIBRATION

J. J. W. Wilson

ASCAT TRANSPONDERS

ASCAT TRANSPONDER TOWERS

ANTENNA GAIN PATTERN & GAIN SAMPLES



ASCAT CALIBRATION ALGORITHM

$$\Omega_1\left(\Delta\psi_{SKEW},\Delta\theta_{ELE},\Delta\phi_{AZI},S,K,R_{SL}\right) = \sum_{i=1}^{i=P} \tau(i).\left(\begin{array}{l} G_{MEASURED}(\theta_N(i),\phi_N(i)) - \\ G_{NOM}(\theta_N,\phi_N,\Delta\psi_{SKEW},\Delta\theta_{ELE},\Delta\phi_{AZI},S,K,R_{SL}) \end{array}\right)^2$$

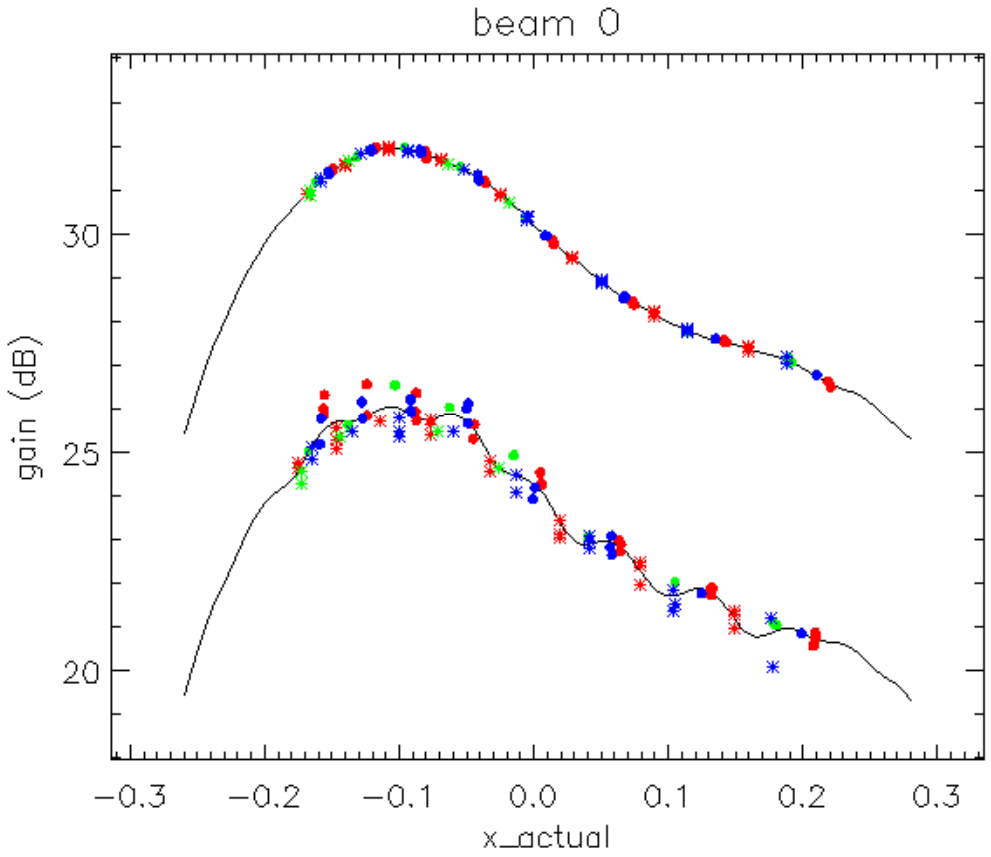
$$\Omega_2\left(d_{nm},\beta(b,t)\right) = \sum_{i=1}^{i=P} \tau(i)\left(\begin{array}{l} G_{MEASURED}(\theta_N(i),\phi_N(i)) \\ - \\ \beta(b,t)\, D_{FIT}(\theta_N,\phi_N,d_{nm})\, G_{NOM}(\theta_N,\phi_N) \end{array}\right)^2$$

$$\Omega_3\left(c_{nm}\right) = \sum_{i=1}^{i=P} \left(\begin{array}{l} G_{MEASURED}(\theta_N(i),\phi_N(i)) \\ - \\ B(t(i))\, C_{FIT}(\theta_N,\phi_N,c_{nm})\, G_{NOM}(\theta_N,\phi_N) \end{array}\right)^2$$

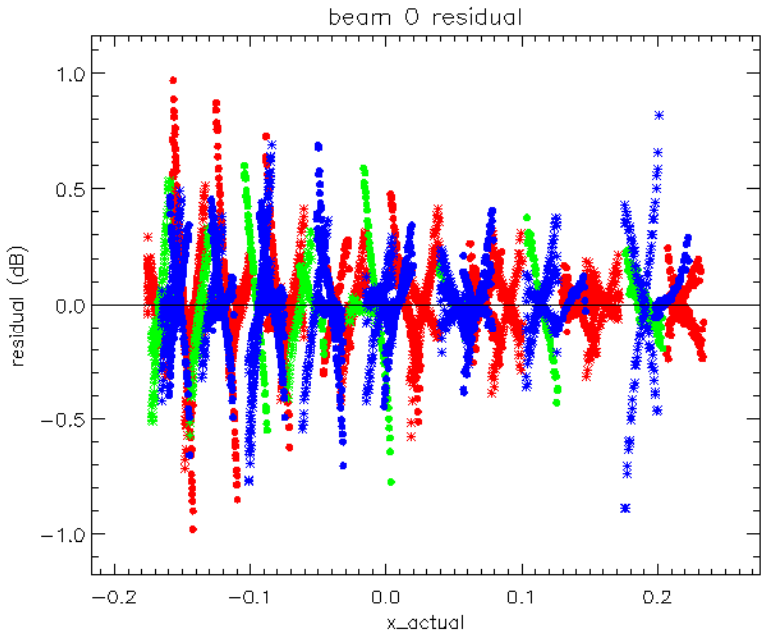
$$B(t) = \frac{1}{6}\sum_{b=1}^{b=6} \beta(b,t)$$

$$G_{EST}(\theta_N,\phi_N) = C_{EST}(\theta_N,\phi_N,c_{nm},\Delta\psi_{SKEW},\Delta\theta_{ELE},\Delta\phi_{AZI})\, G_{NOM}(\theta_N,\phi_N,\Delta\psi_{SKEW},\Delta\theta_{ELE},\Delta\phi_{AZI},S,K,R_{SL})$$

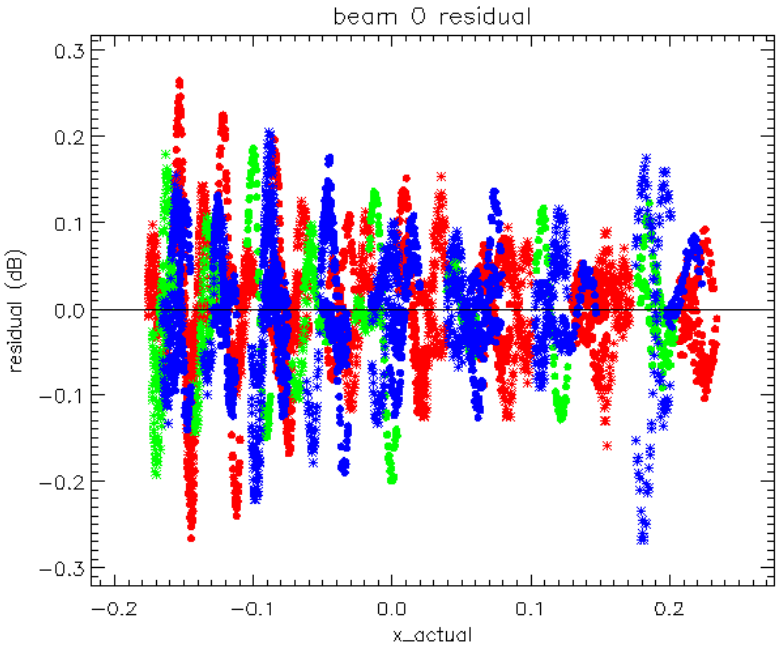
ANTLF ELEVATION GAIN CUTS



ANTLF ELEVATION GAIN RESIDUES

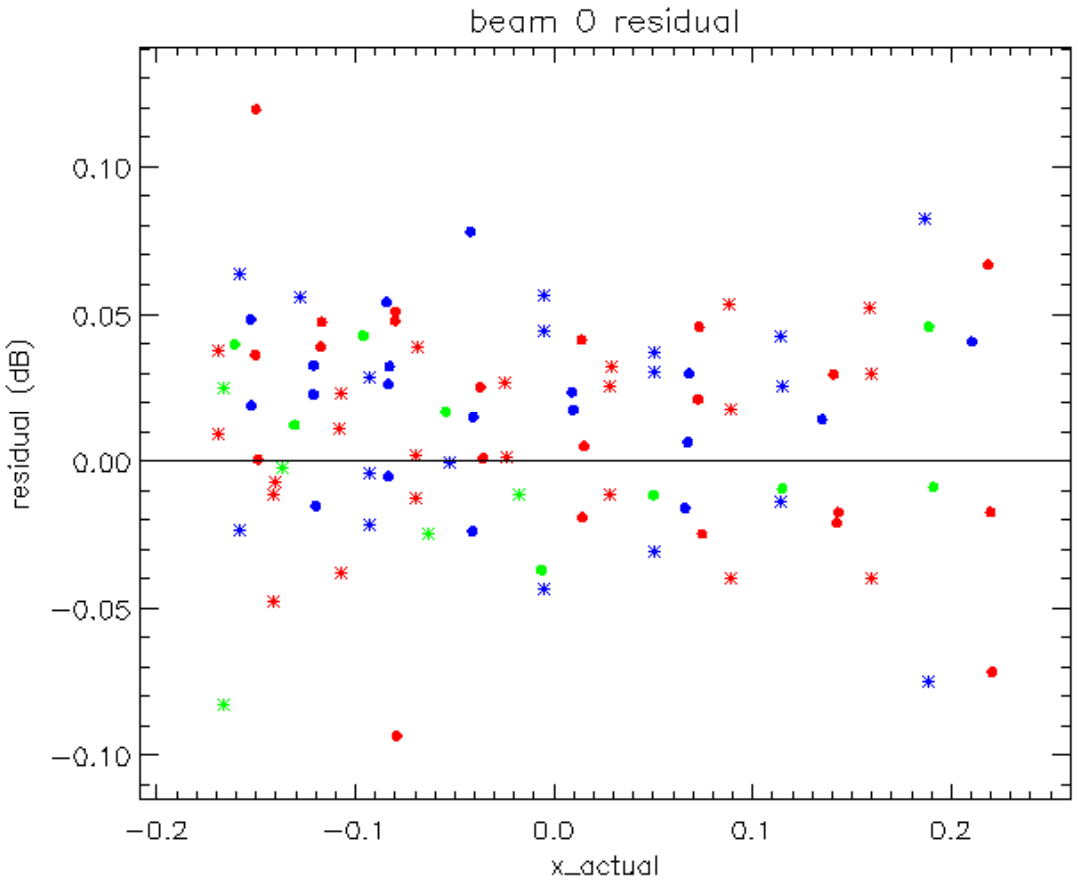


Un-weighted

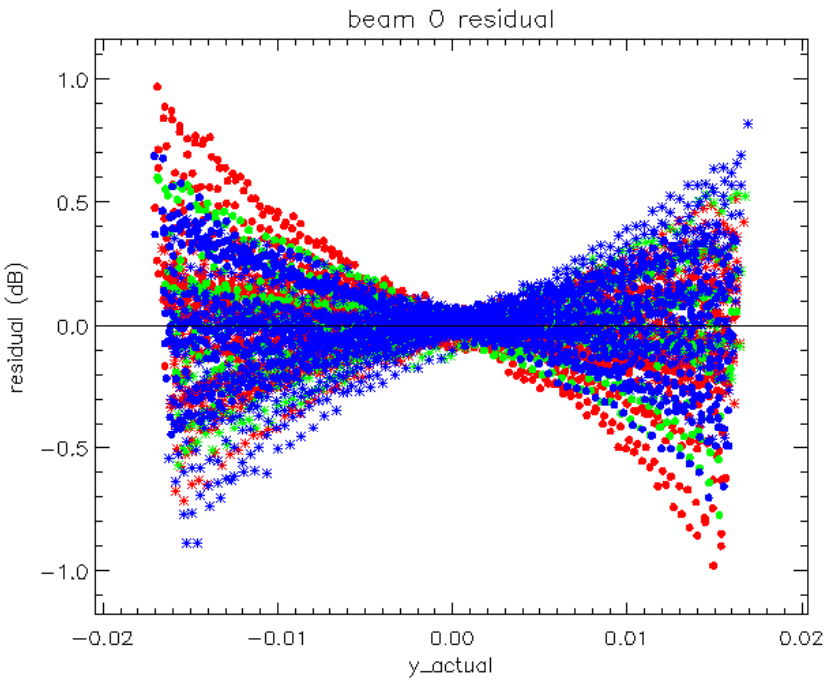


Weighted

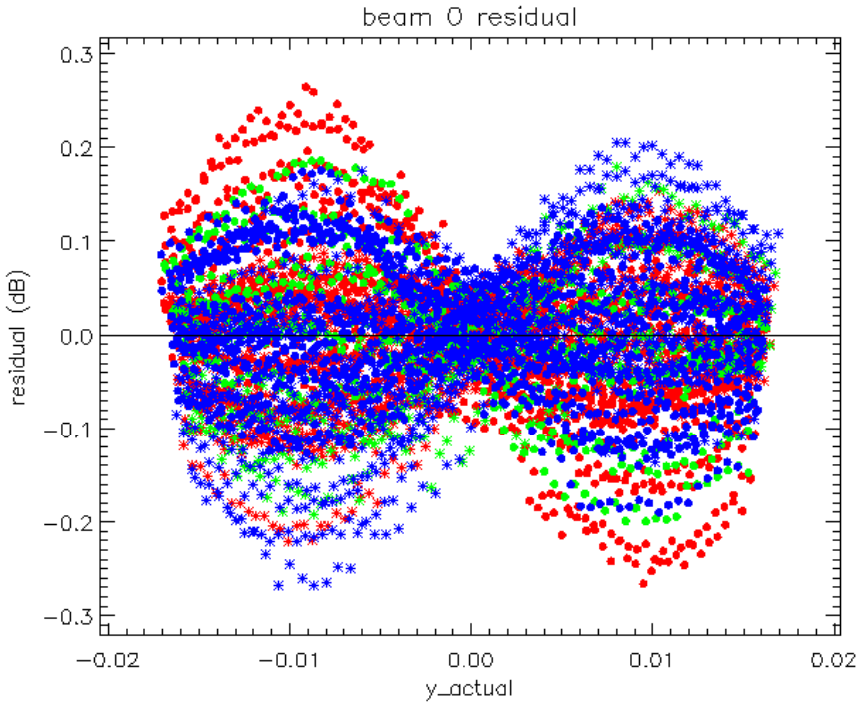
ANTLF PEAK ELEVATION GAIN RESIDUES



ANTLF AZIMUTH GAIN RESIDUES



Un-weighted



Weighted

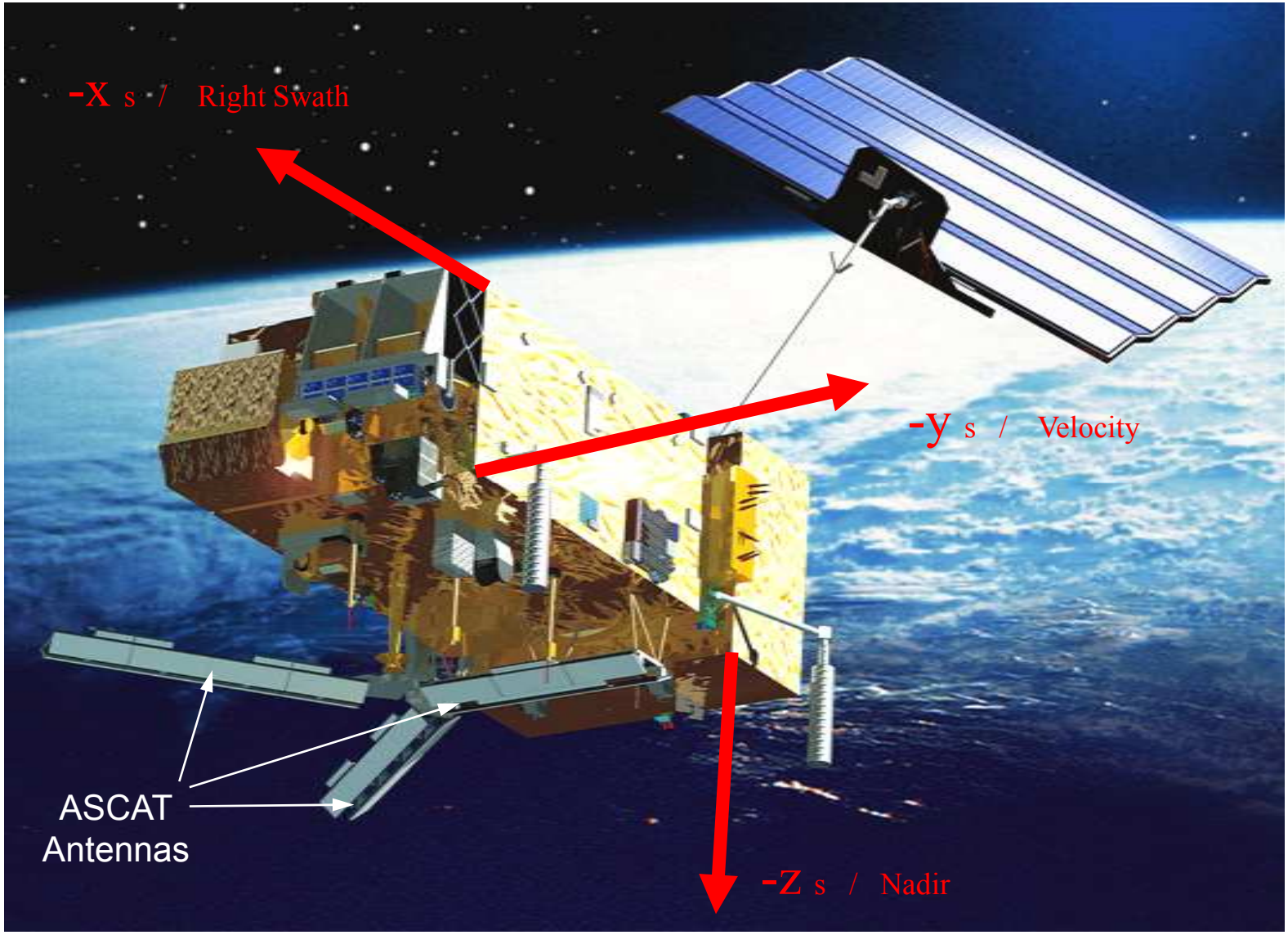
DETERMINISTIC RADIOMETRIC ACCURACY / STABILITY ERRORS

- Bias Error
- ε = + / - 0.017 dB

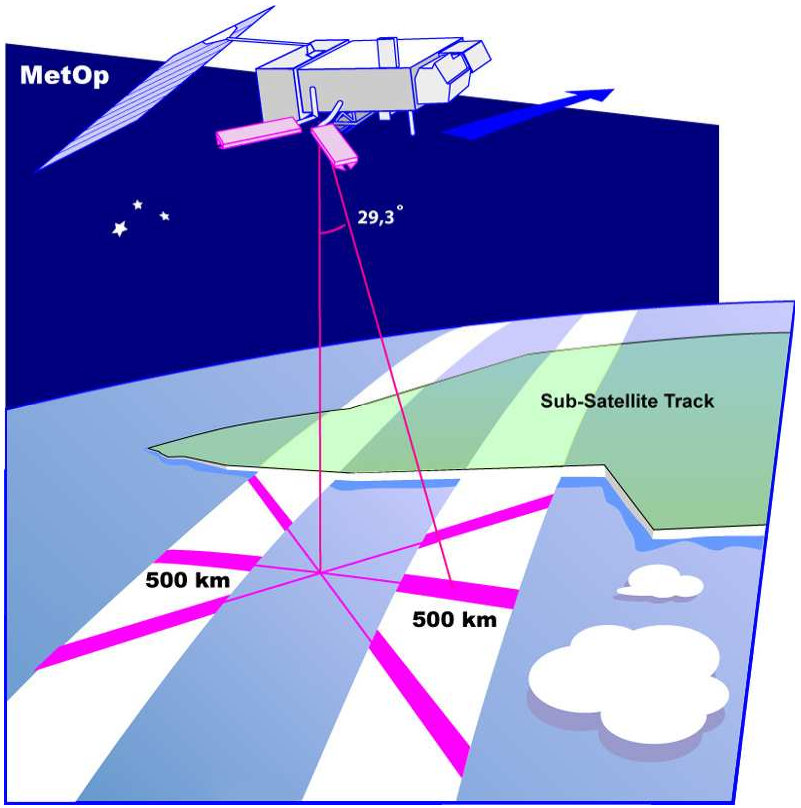
- Noise-Like Error
- Δ = + / - 0.054 dB (1σ value)

- Quasi-Static Error Associated With Thermal Variation Over Orbit
- δ = + 0.0029 dB $\rightarrow$ + 0.0525 dB

ASCAT



ASCAT



- Two 550 km swaths with incidence angle range of 25 - 65°
- 3 fan beam antennas looking towards each swath
- Real-aperture radar, C-band (5.255GHz) & VV polarisation

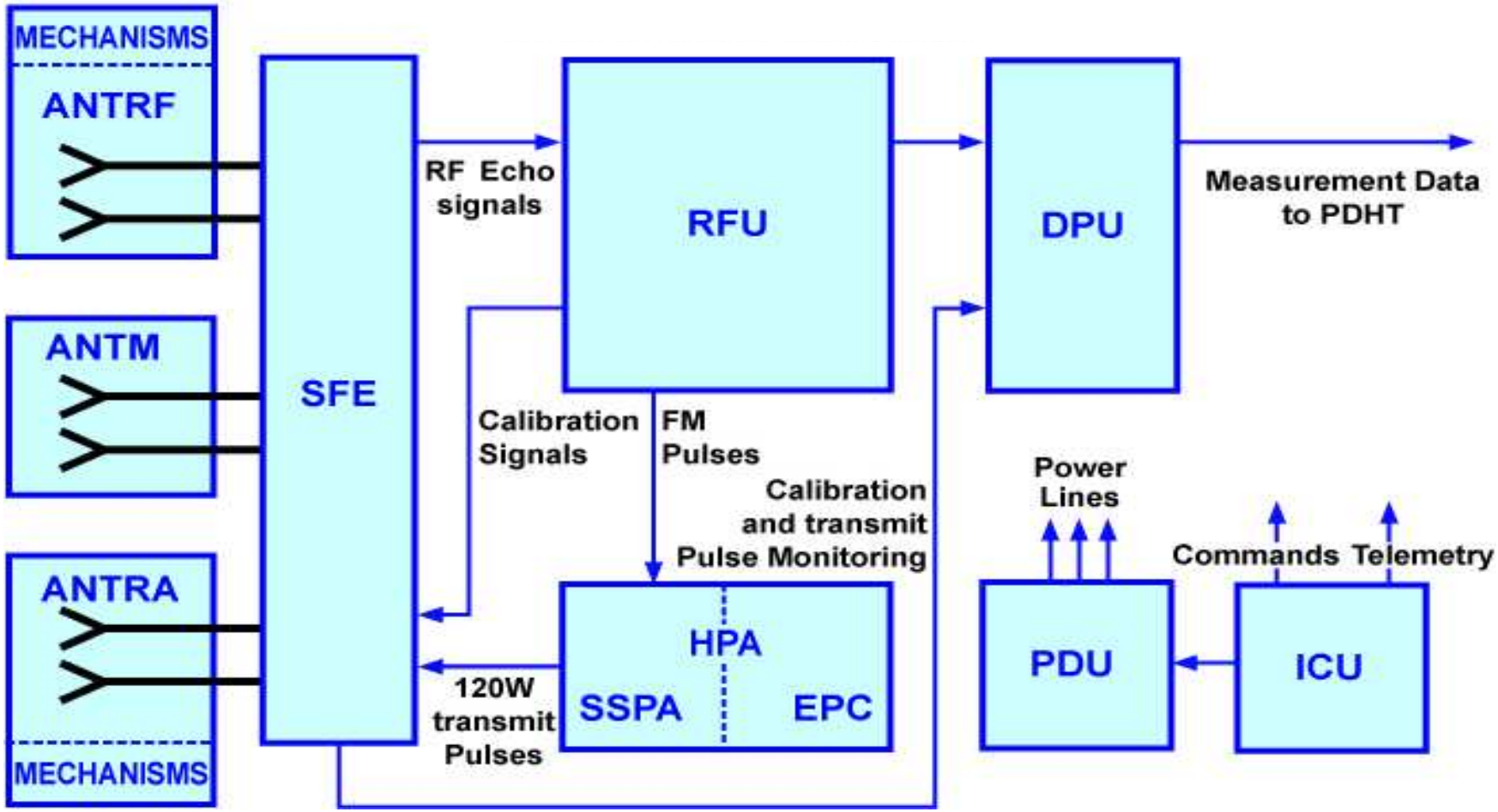
ASCAT Beam Timeline

MEASUREMENT TECHNIQUE

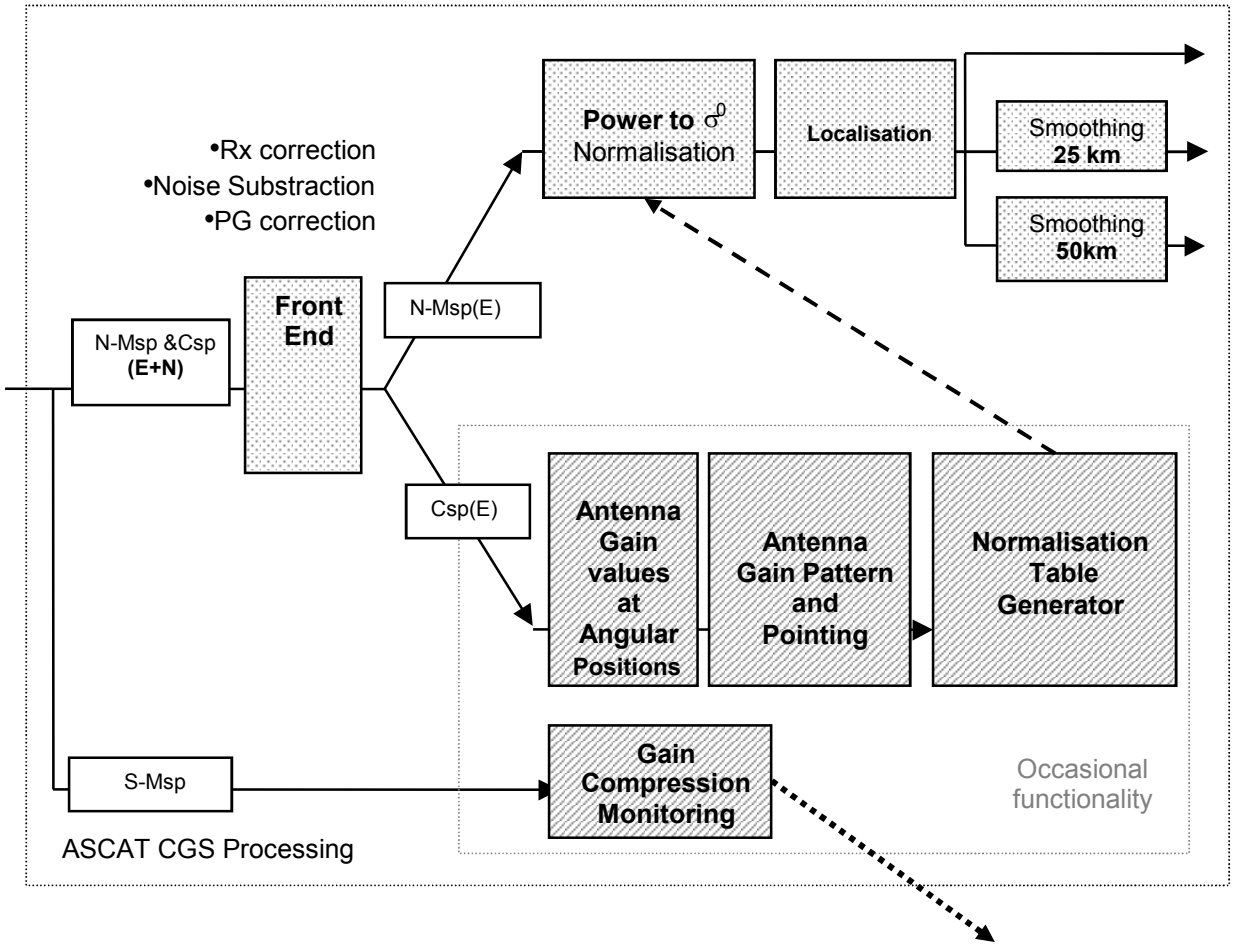
- Transmit Linear FM Pulse
- Receive Echo
- Mix with Regenerated Linear FM Pulse
- Fourier Transform
- Detect

- Frequency corresponds to slant range
- Signal Power Related to Sigma Zero

INSTRUMENT ARCHITECTURE BLOCK DIAGRAM



GROUND PROCESSOR ARCHITECTURE



INSTRUMENT CHARACTERISTICS

- Mass: 260 kg
- Data Rate: 42 kbits/s
- DC Power: 215 W
  - RF Peak Power: 156 W
  - Duty Cycle: 28 %

INDUSTRIAL TEAM

- Astrium GmbH (Instrument)
  - SES (Antennas Electrical)
  - CASA (Antennas Structure)
  - Kongsberg (Deployment Mechanism)
  - Sener (HD&R Mechanism)
  - Crisa (DPU)
  - ComDev (SFE)
  - Alcatel (HPA & RFU)
  - Fiar (PDU)
  - CIR (ICU)

EUMETSAT ASCAT WORK

- ASCAT Fully Automatic Operational Processor Design including Development of Special Calibration Algorithm
- ASCAT Transponder Site Selection
- ASCAT Transponder Tower Design & Construction