

Aquarius Cal/Val Meeting at REMSS  
27 March 2012

# **Radio Frequency Interference (RFI) Assessment**

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# Summary of Radiometer RFI Algorithm

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- 4 Parameters:
  - WM ( $W_s$ ): Local mean running average window: **20**
  - TM ( $T_m$ ): Local mean running average glitch threshold: **1.5**
  - TD ( $T_{det}$ ): RFI detection glitch threshold: **4**
  - WD ( $W_r$ ): RFI detection neighborhood window: **5**
- Step 1: The WM samples surrounding the SUT are identified. If any of these samples have been flagged in a previous iteration of the algorithm, that sample is eliminated.
- Step 2: The surviving samples from Step 1 are averaged and this mean is known as the "dirty mean". Samples greater than the dirty mean by TM multiples of the standard deviation are eliminated.
- Step 3: If there are surviving samples from Step 2, they are averaged to arrive at the "clean mean".
- Step 4: If the SUT is greater than the "clean mean" by TD multiples of the standard deviation, it is flagged as RFI.
- Step 5: If the SUT is flagged as RFI, WD samples surrounding the SUT are flagged as RFI.
- Currently about 10%-30% of Sacc are being flagged (see slides after NEDT estimates).

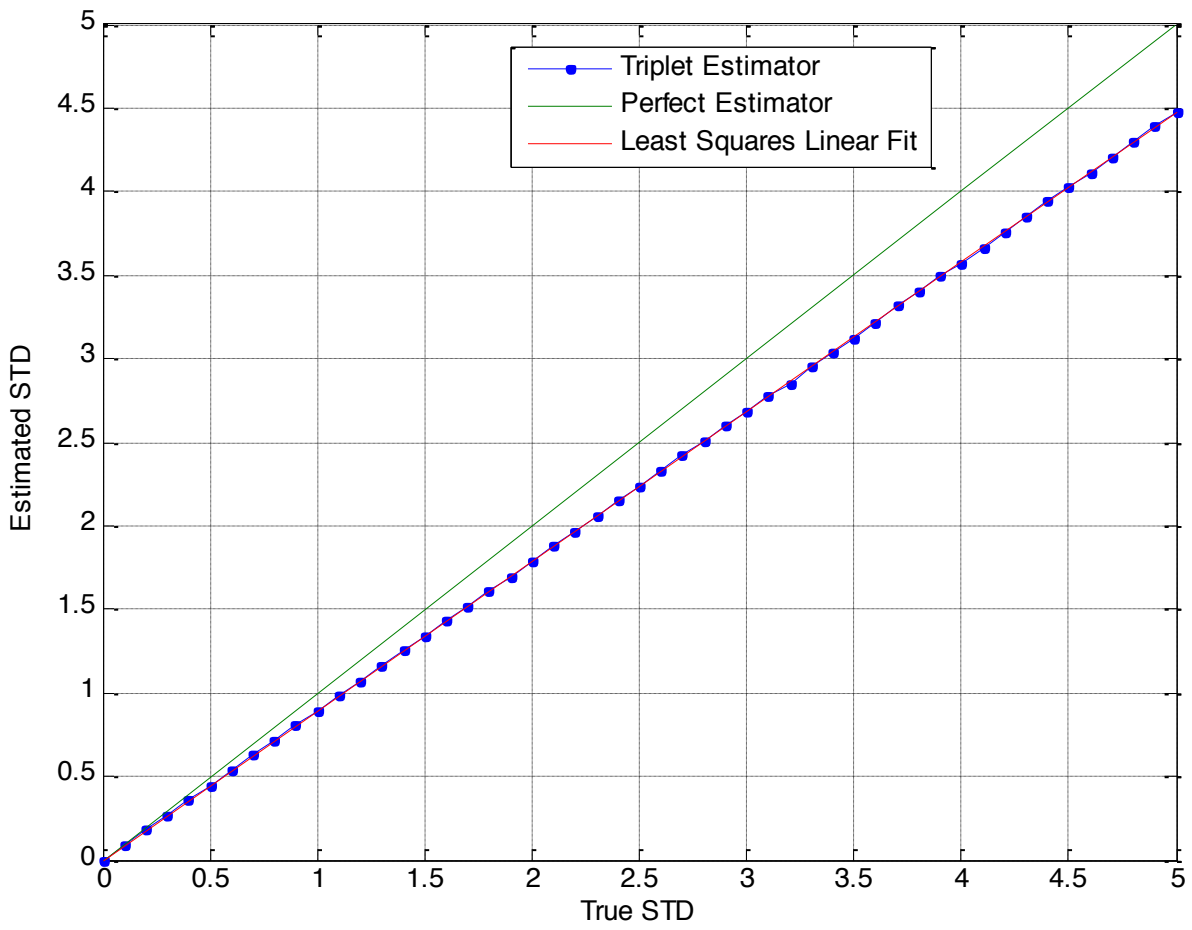
# Estimation of NEDC (Noise Equivalent Delta Counts) and NEDT

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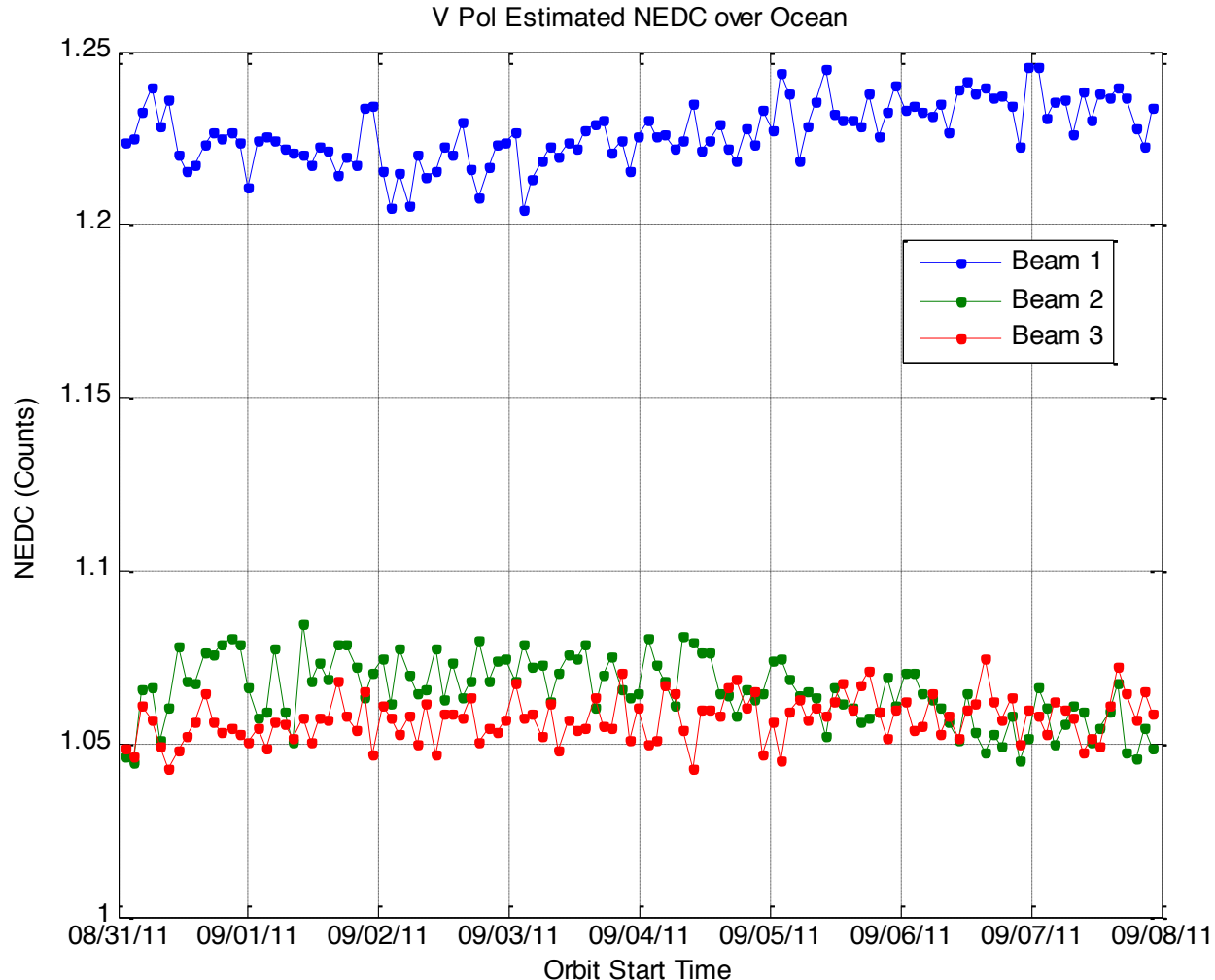
1. Input: short accumulations (Sacc) of antenna looks (5 per subcycle).
2. Filter out Sacc contaminated by land, ice (all analysis in this presentation are for ocean only). Also filter out any Sacc with RFI flag set.
3. For any consecutive triplet of Sacc with RFI flag=0, compute the variance and average over one orbit.
4. Multiply by correction factor to compensate for effect of the two 20ms and three 10ms short accumulations to arrive at the NEDC.
5. Multiply by average gain over the orbit to find NEDT for that orbit.

# Correction Factor

Found by a Monte Carlo simulation using Gaussian RVs.

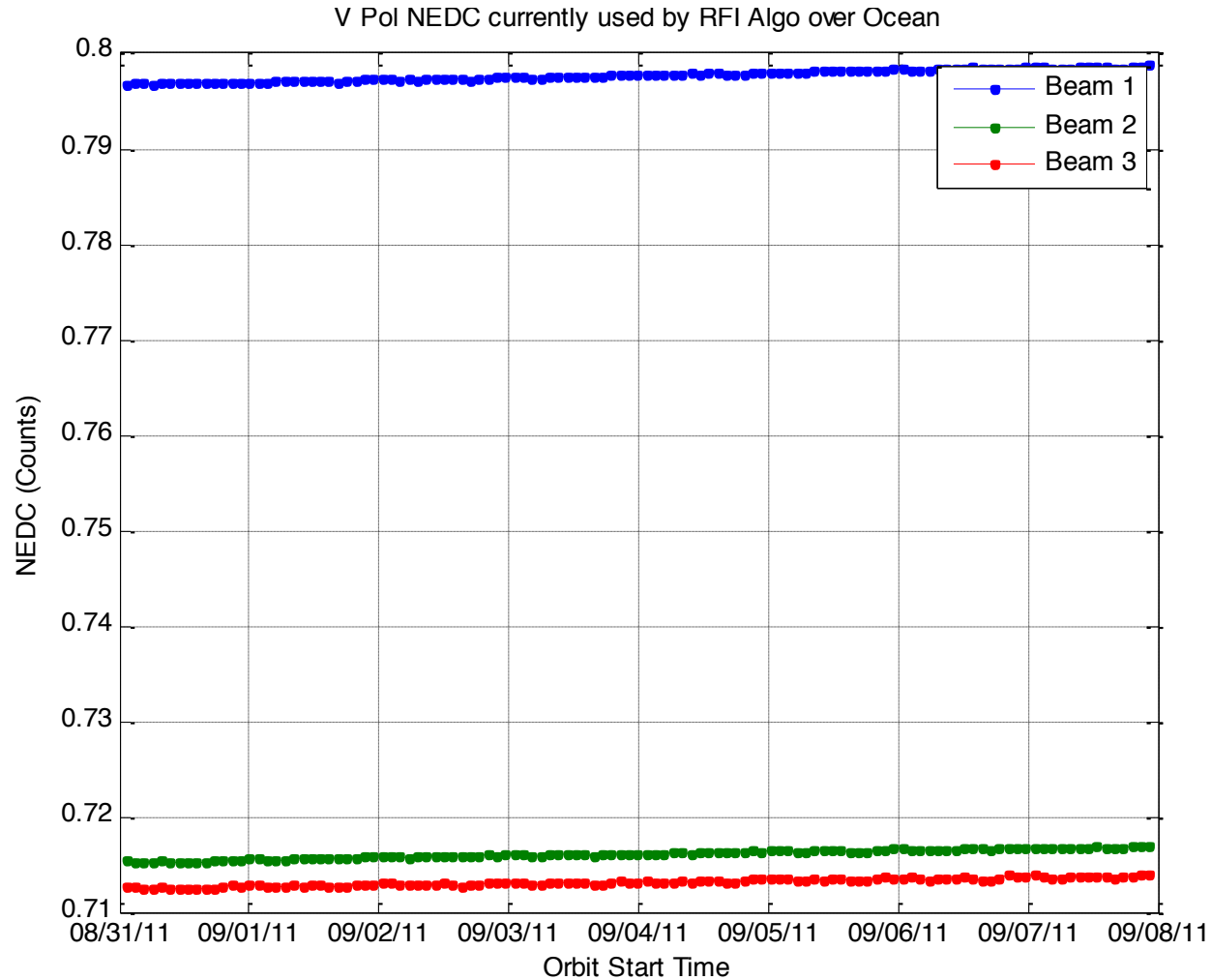


# NEDC Estimate, V Pol

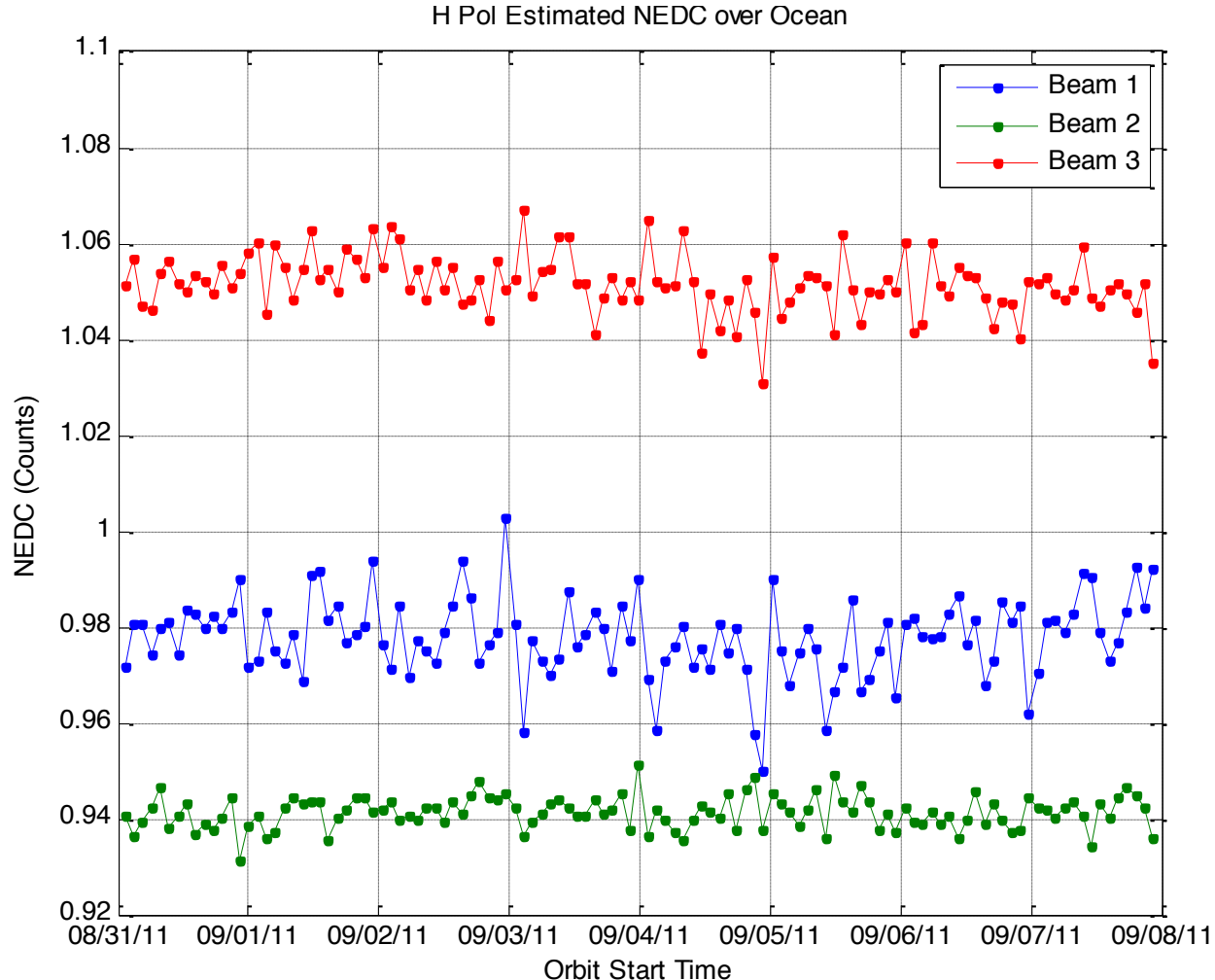


# NEDC Currently In-Use, V Pol

Uses average gain result (to follow)

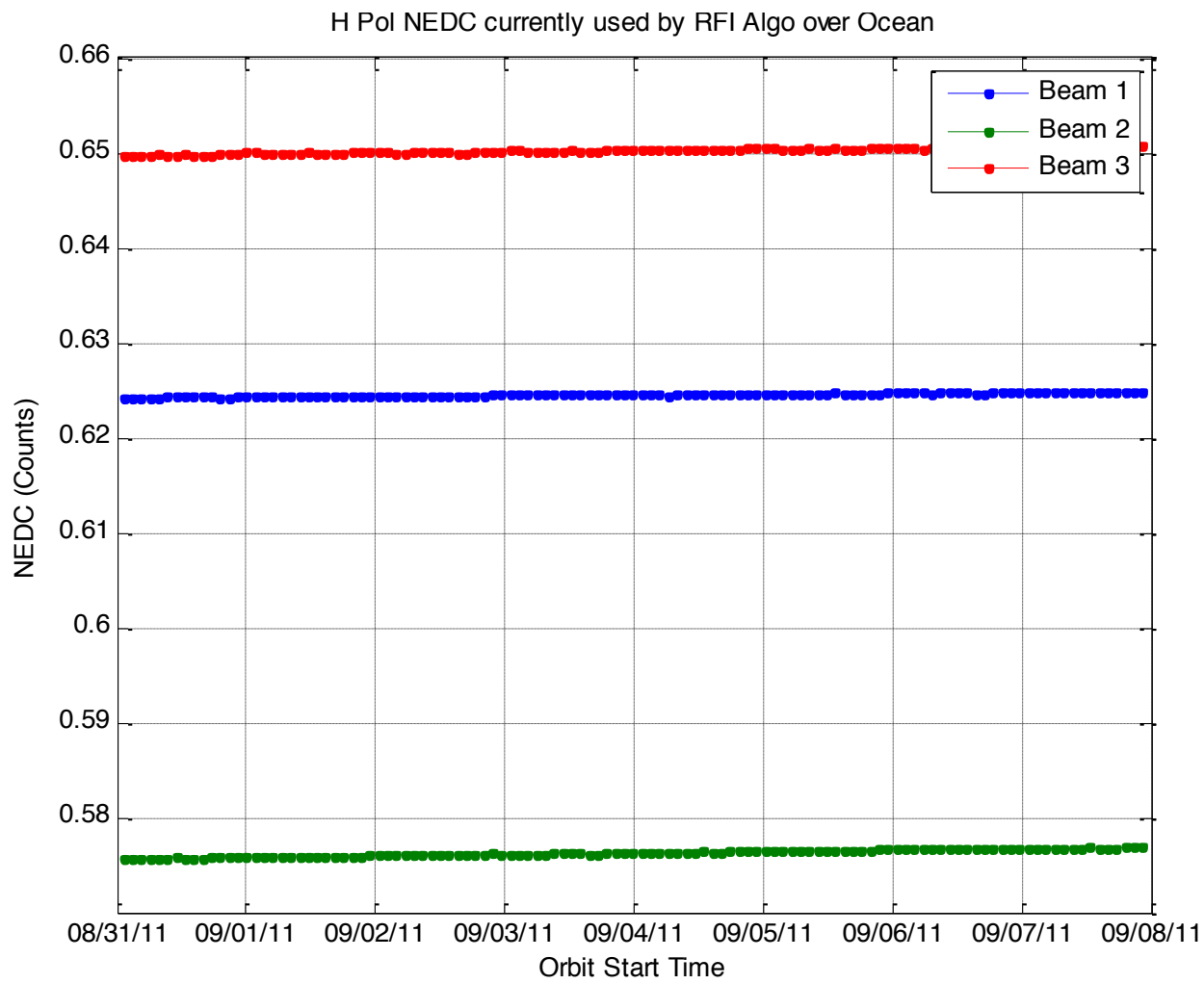


# NEDC Estimate, H Pol



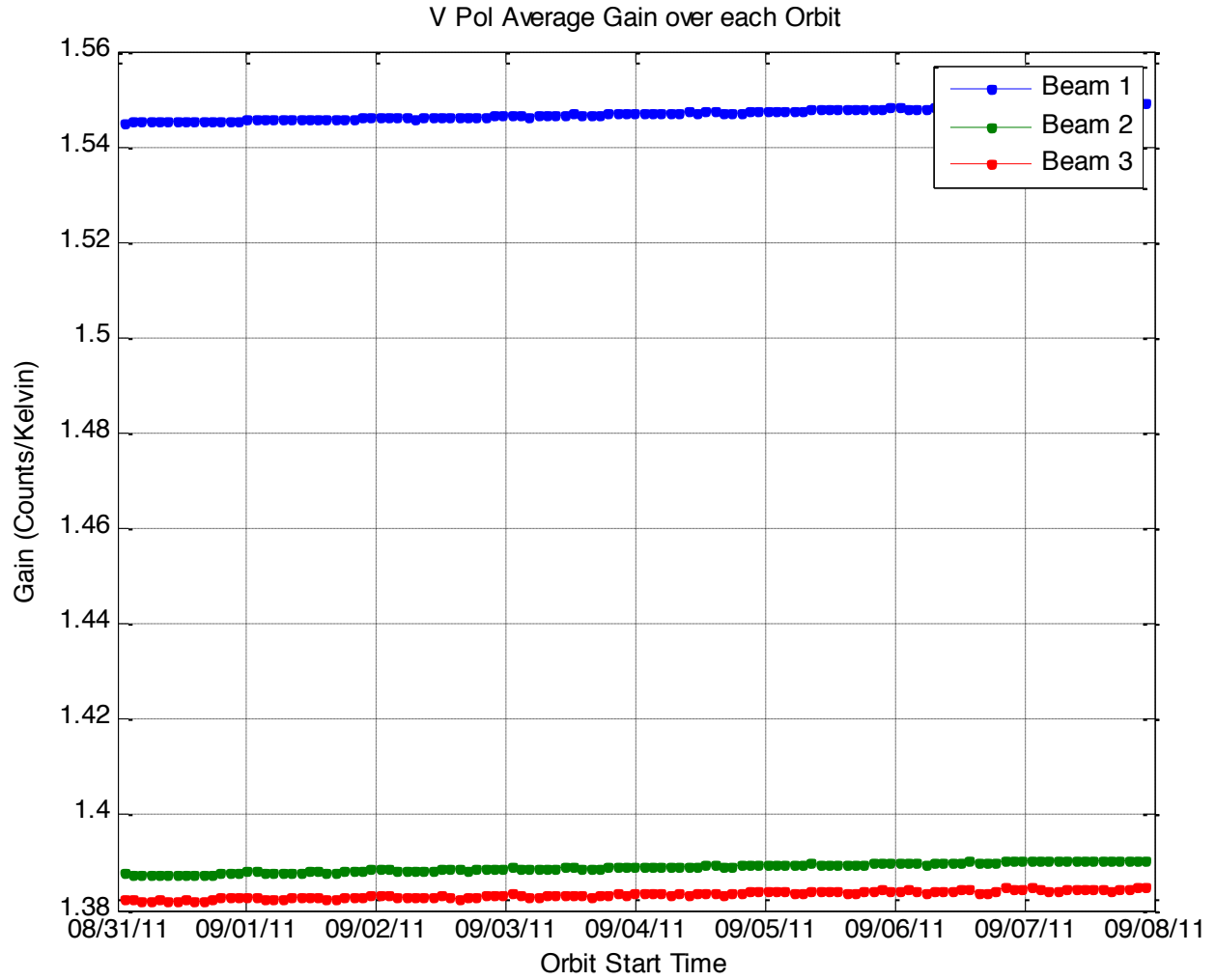
# NEDC Currently In-Use, H Pol

Uses average gain result (to follow)

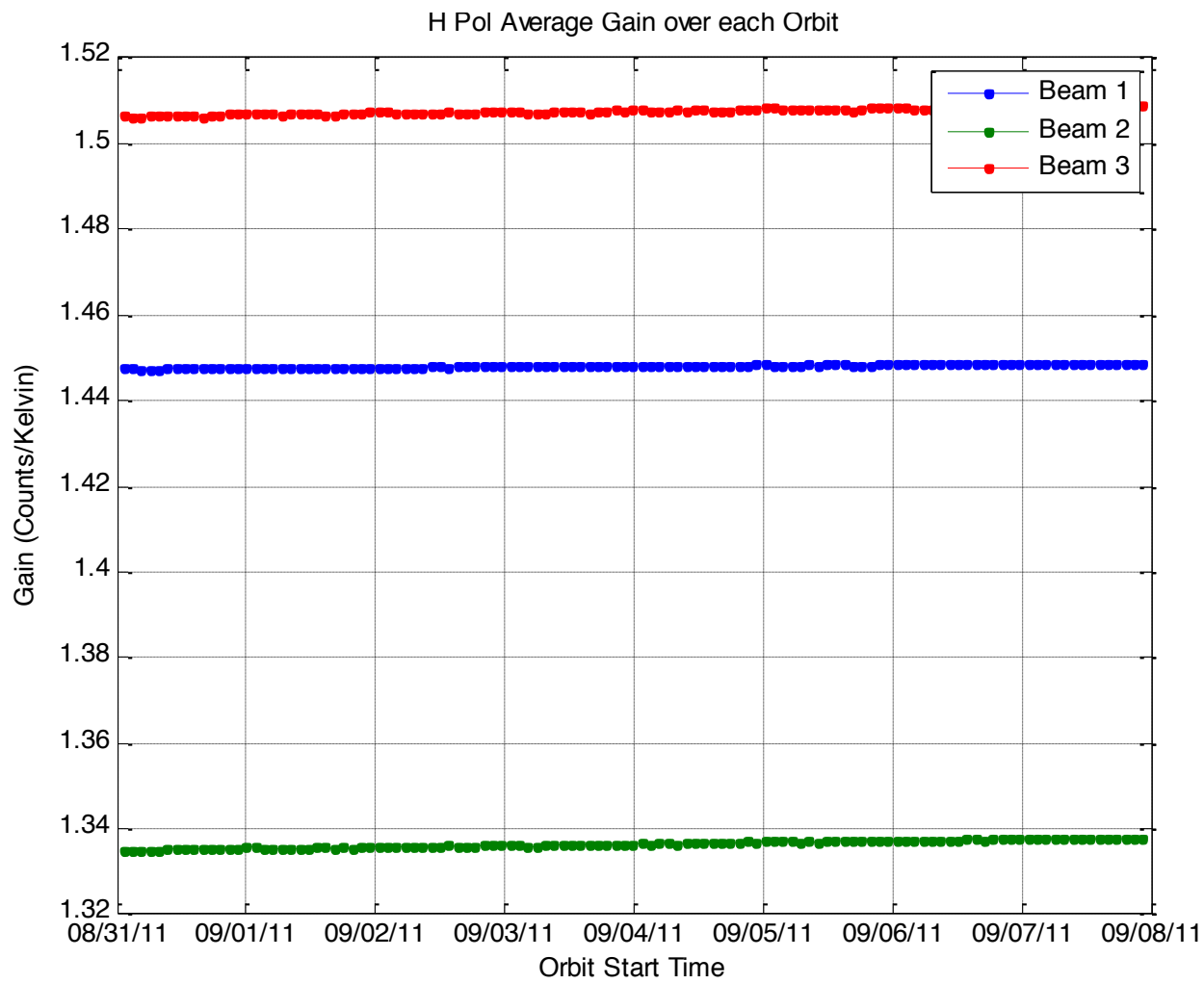




# Average Gain, V Pol

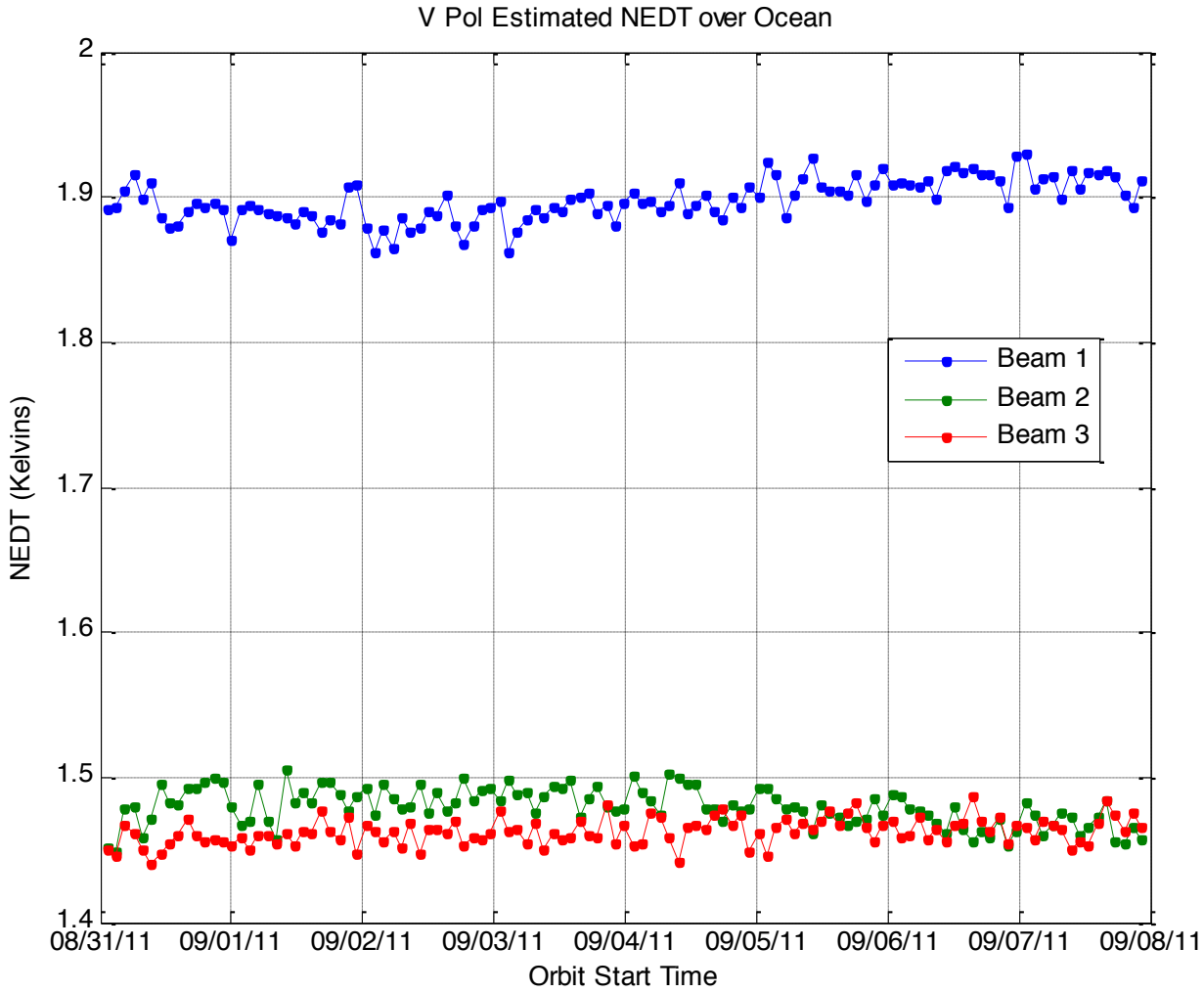


# Average Gain, H Pol



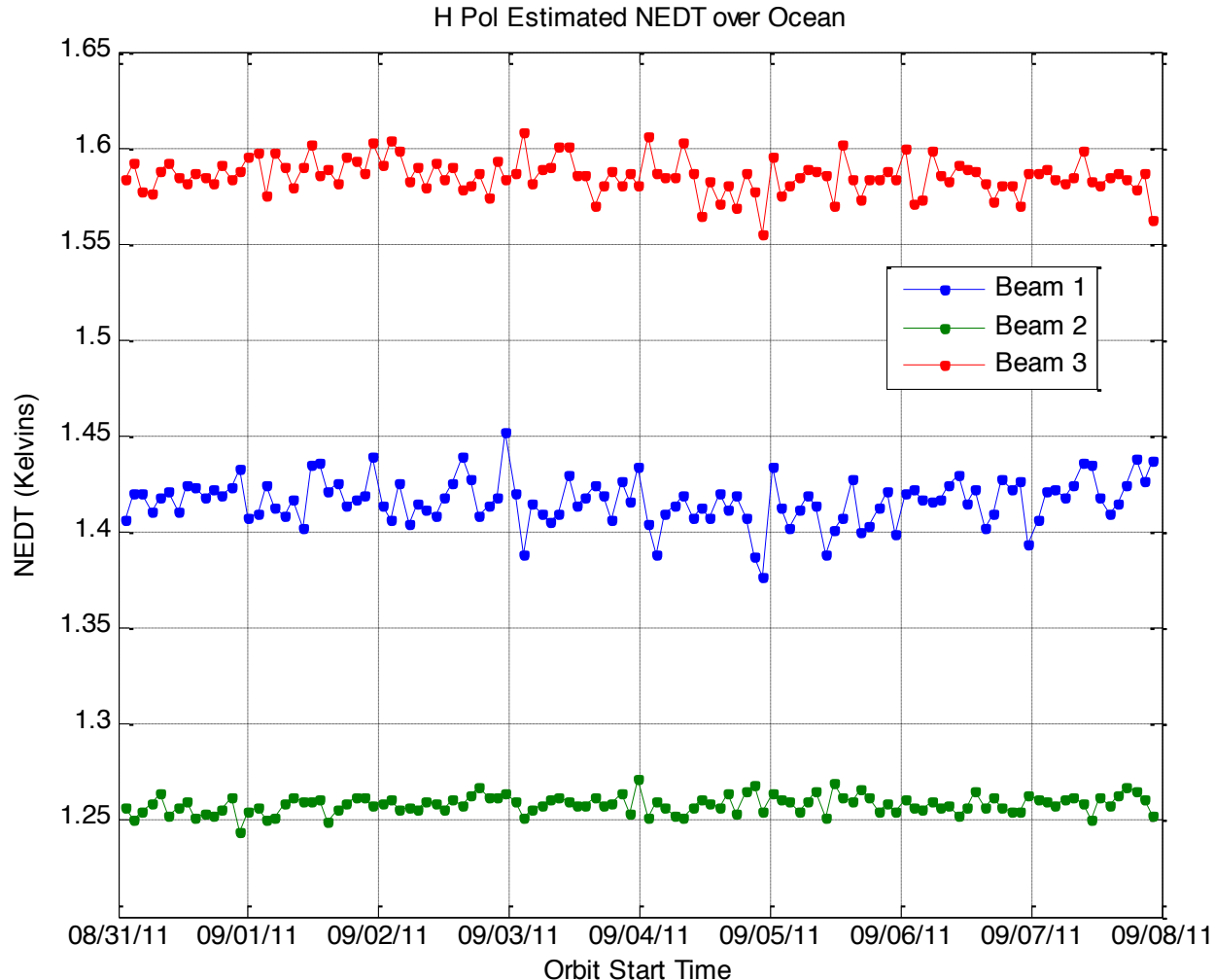
# NEDT Estimate, V Pol

Current Value: 0.51566387



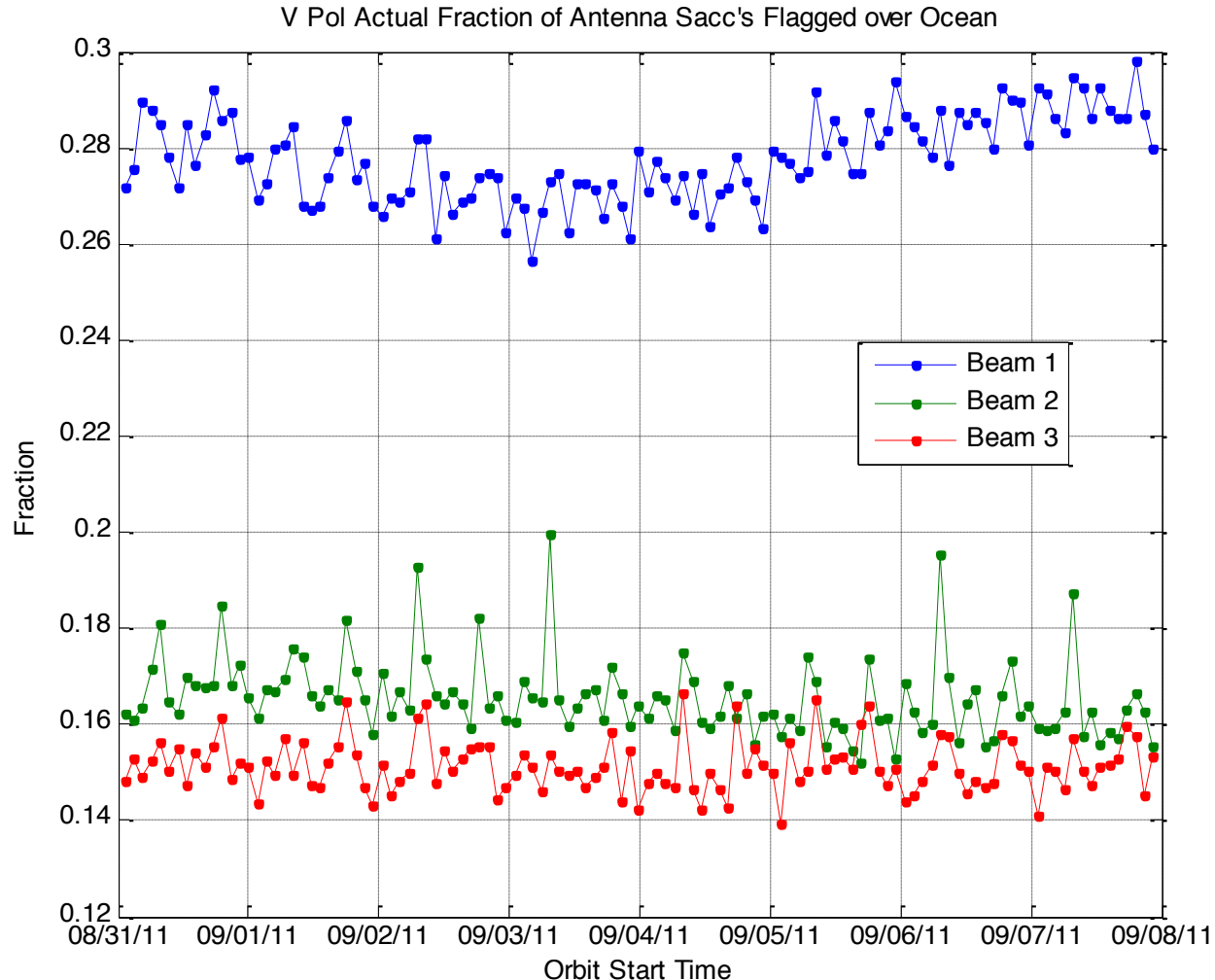
# NEDT Estimate, H Pol

Current Value: 0.431336172

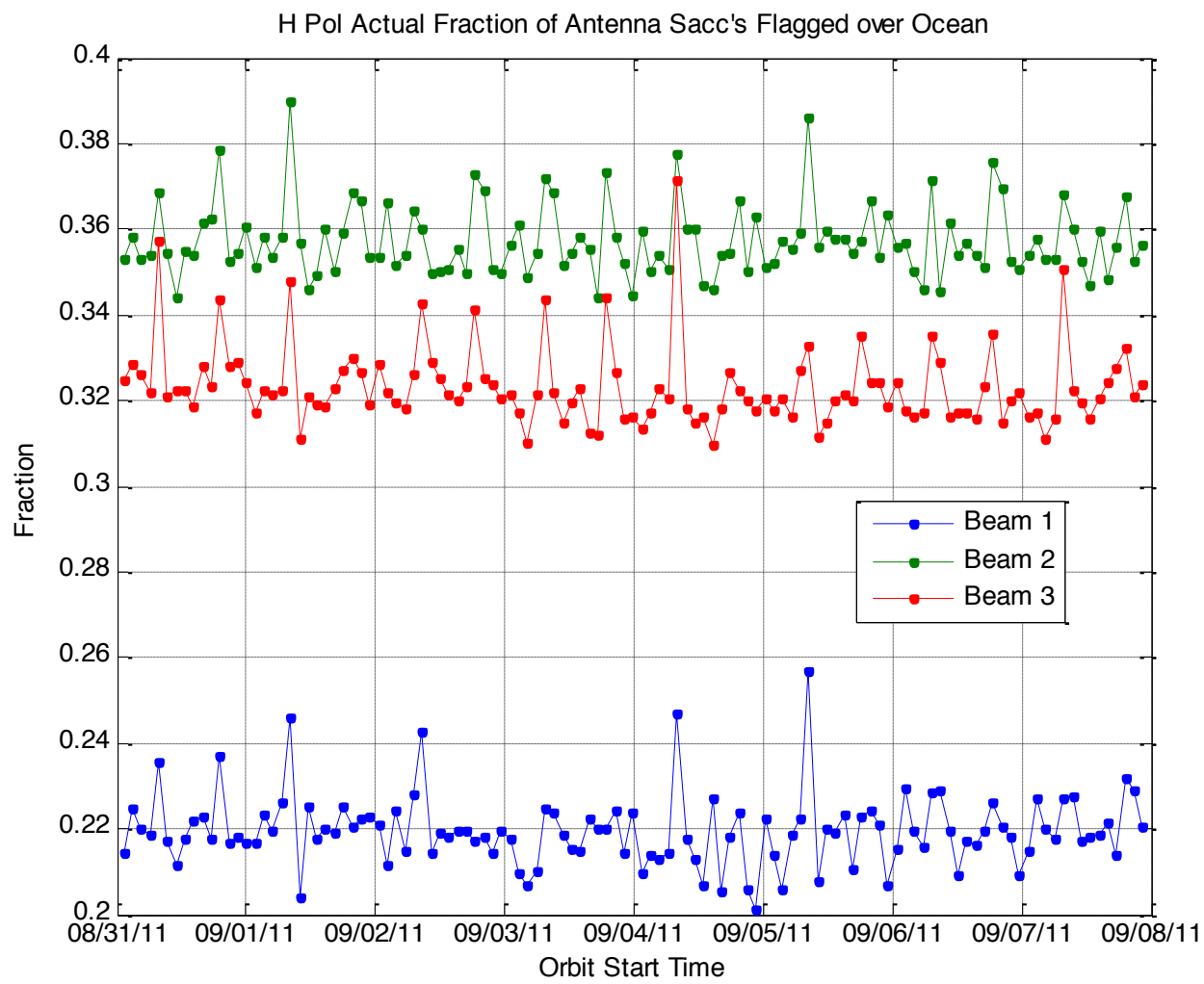


# Fractions of Sacc Flagged, V Pol

Differences between 3 beams are a result of NEDC currently in use not matched to true/estimated/empirical NEDC.



# Fractions of Sacc Flagged, H Pol



# NEDC for Dicke Load (Lacc1) for 1 Orbit (Q2011243011100)

100ms NEDC	V Pol	H Pol
Beam 1	4.8023	4.618
Beam 2	4.2446	4.2989
Beam 3	4.4384	5.0638

100ms NEDC*sqrt( 10)	V Pol	H Pol
Beam 1	15.1863	14.6034
Beam 2	13.4226	13.5945
Beam 3	14.0355	16.0132

10ms NEDC from Sacc	V Pol	H Pol
Beam 1	1.4114	1.107
Beam 2	1.155	1.1281
Beam 3	1.1433	1.254



# Fraction of Sacc with RFI Flag Set

- Monte Carlo simulations were carried out with artificial Gaussian-distributed Saccs with estimated/empirical NEDC, for two orbits.
- This is a measure of the false alarm rate.
- For V Pol, values for Beams 2 and 3 are reversed comparing simulations and actual results.

Q2011243011100.L2_EVSCI_V1.2			
<b>Simulated</b>	V	H	
Beam1		0.0721	0.0764
Beam2		0.0515	0.1018
Beam3		0.0523	0.1008
<b>Actual</b>			
Beam1		0.2726	0.2145
Beam2		0.1619	0.353
Beam3		0.1483	0.3248
Q2011243024900.L2_EVSCI_V1.2			
<b>Simulated</b>	V	H	
Beam1		0.0726	0.0763
Beam2		0.0502	0.1034
Beam3		0.0539	0.0977
<b>Actual</b>			
Beam1		0.2753	0.2248
Beam2		0.161	0.3583
Beam3		0.153	0.3287



# Other Issues

- Some orbits exhibit a shift between L1 and L2 timestamps in V1.2DR and V1.2.3 (Ex. Q2012005225200)
- Some orbits do not exhibit this shift (Ex. Q2012068225100)
- This analysis is done with V1.2 RFI flag code – further updates?

