QPE Pilot Acoustic (TL) results
QPE '09 Acoustic Adaptive Sampling Plans

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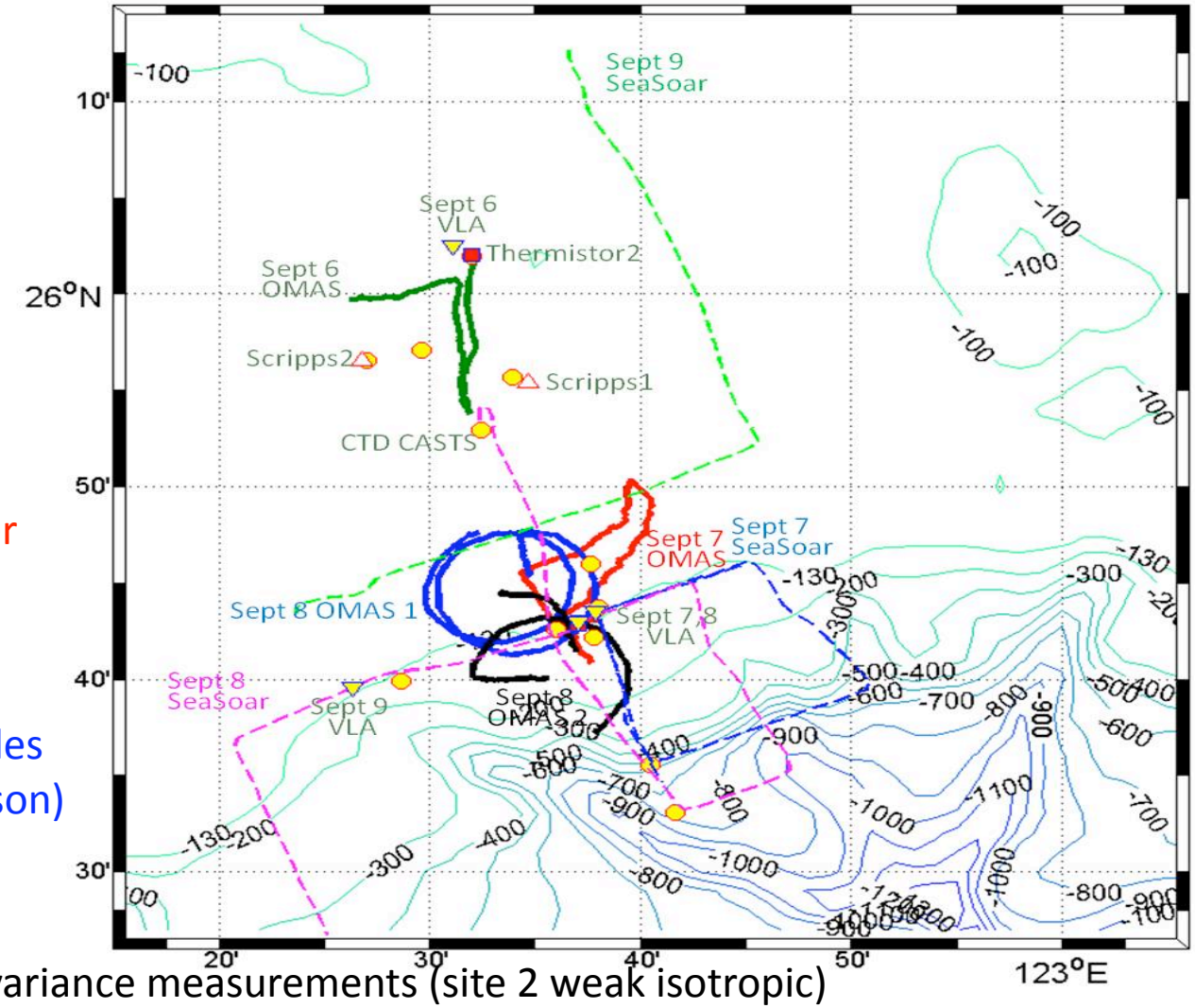
OASIS, Inc.
QPE Kauai Meeting
January 12, 2009

Acoustic Runs
3 days (of 5 planned)

Sept. 6
Shallow water (110m)
Single OMAS - Linear

Sept. 8
Shallow water (120m)
Single OMAS – L pattern
Lost signal in deeper water

Sept. 9
Two circular OMAS
TL measured for both circles
Coherence Studies (Emerson)
Loss of signal off of shelf



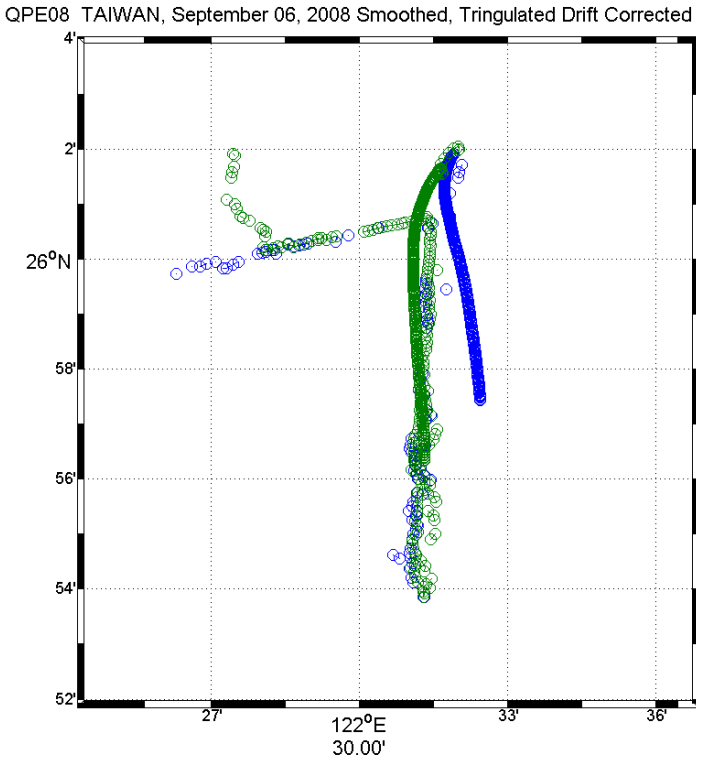
Acoustic Pilot Results:

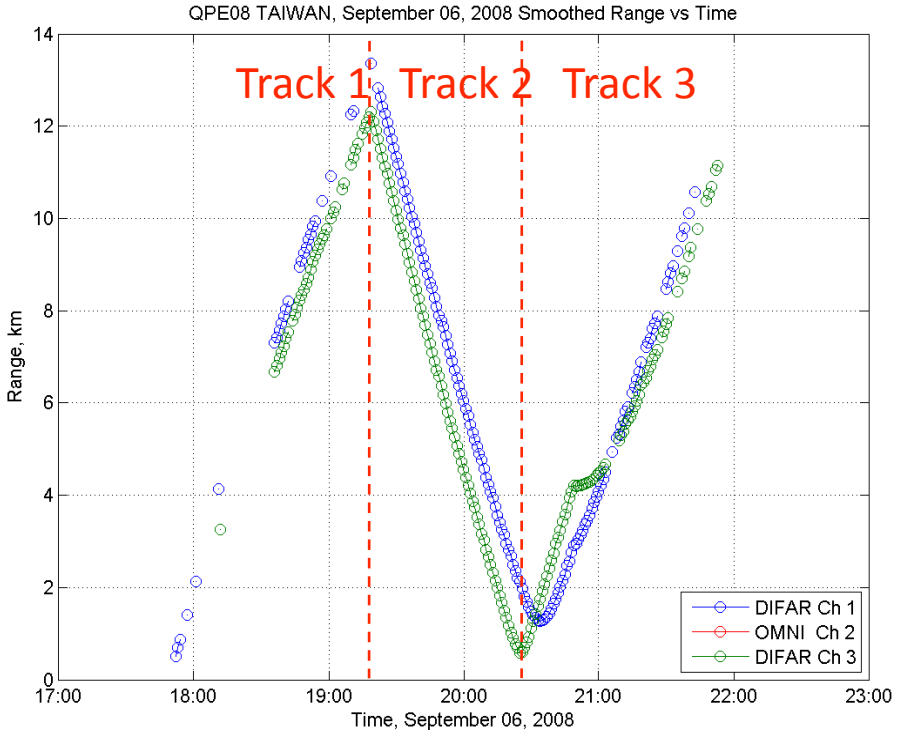
Isotropy/horizontal invariance measurements (site 2 weak isotropic)
Established baseline model from data (site 1/2)
Significant bathymetric effects on TL

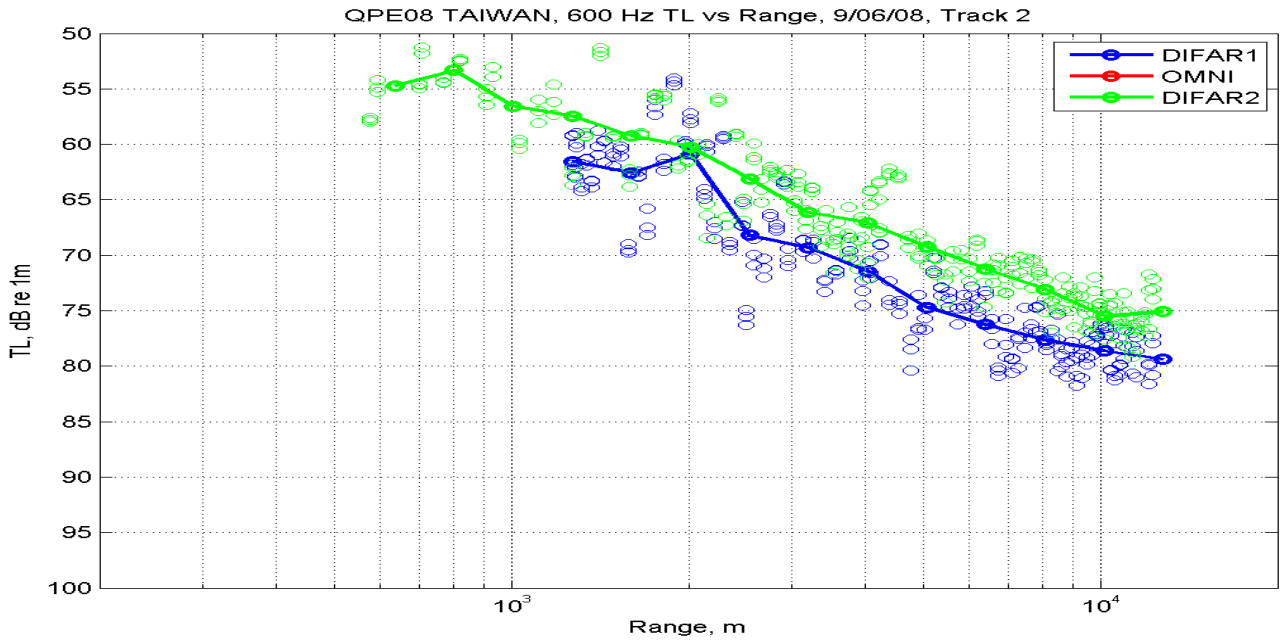
Successfully Demonstrated:

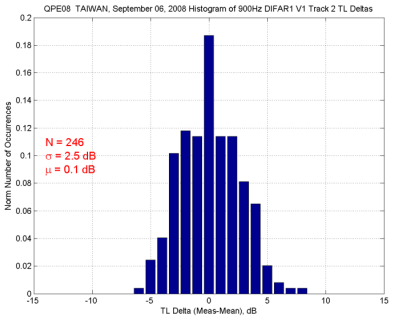
Night Ops/Deployment from NTU-Vessel

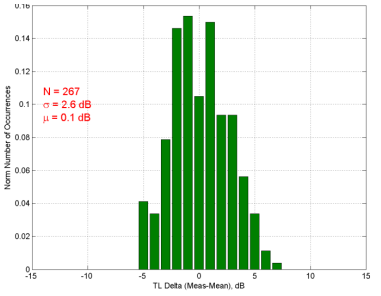
~ Range Independent TL Run
QPE08 TAIWAN, September 6,
OMAS # 15304 , ds=90ft, dr = 90ft

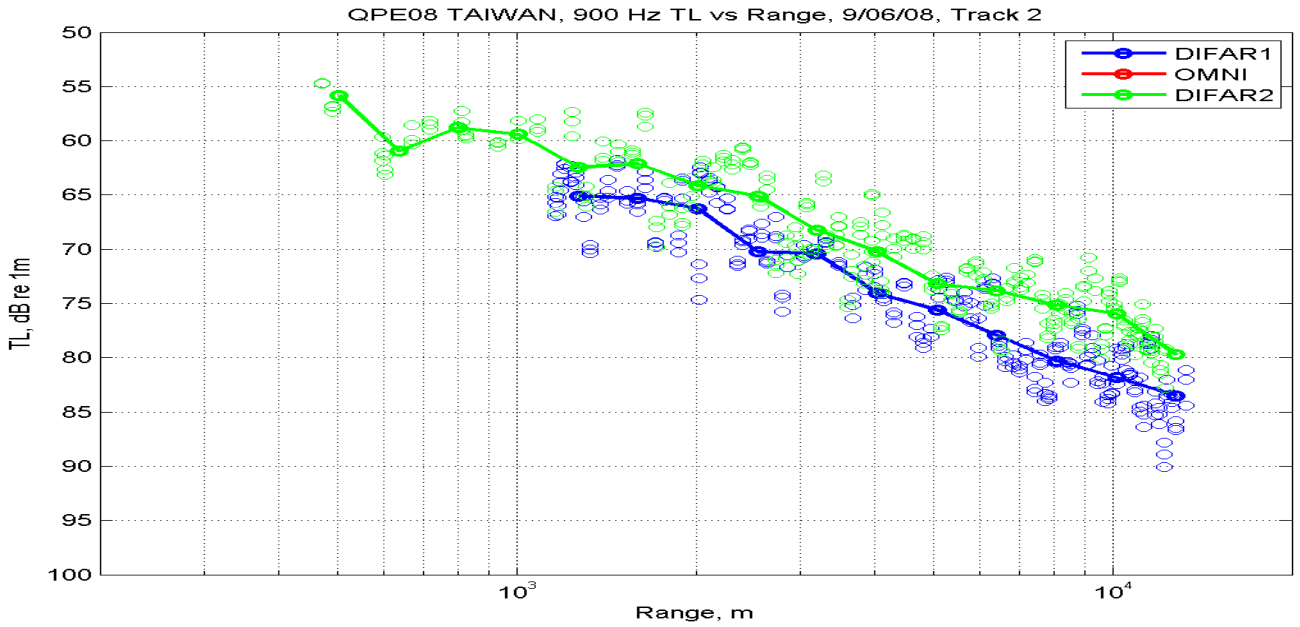





QPE08 TAIWAN, 600 Hz TL vs Range, 9/06/08, Track 2
DIFAR1
OMNI
DIFAR2
TL, dB re 1m
Range, m
50
55
60
65
70
75
80
85
90
95
100
10^3
10^4


QPE08 TAIWAN, September 06, 2008 Histogram of 900Hz DIFAR1 V1 Track 2 TL Deltas
N = 246
σ = 2.5 dB
μ = 0.1 dB
Norm Number of Occurrences
TL Delta (Meas-Mean), dB


N = 267
σ = 2.6 dB
μ = 0.1 dB
Norm Number of Occurrences
TL Delta (Meas-Mean), dB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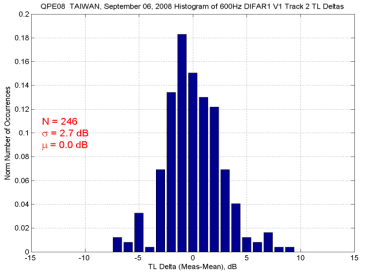
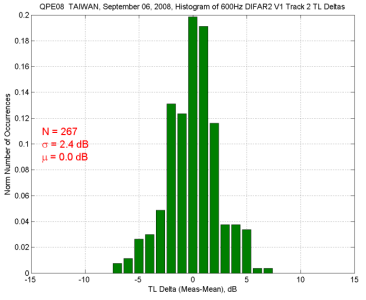
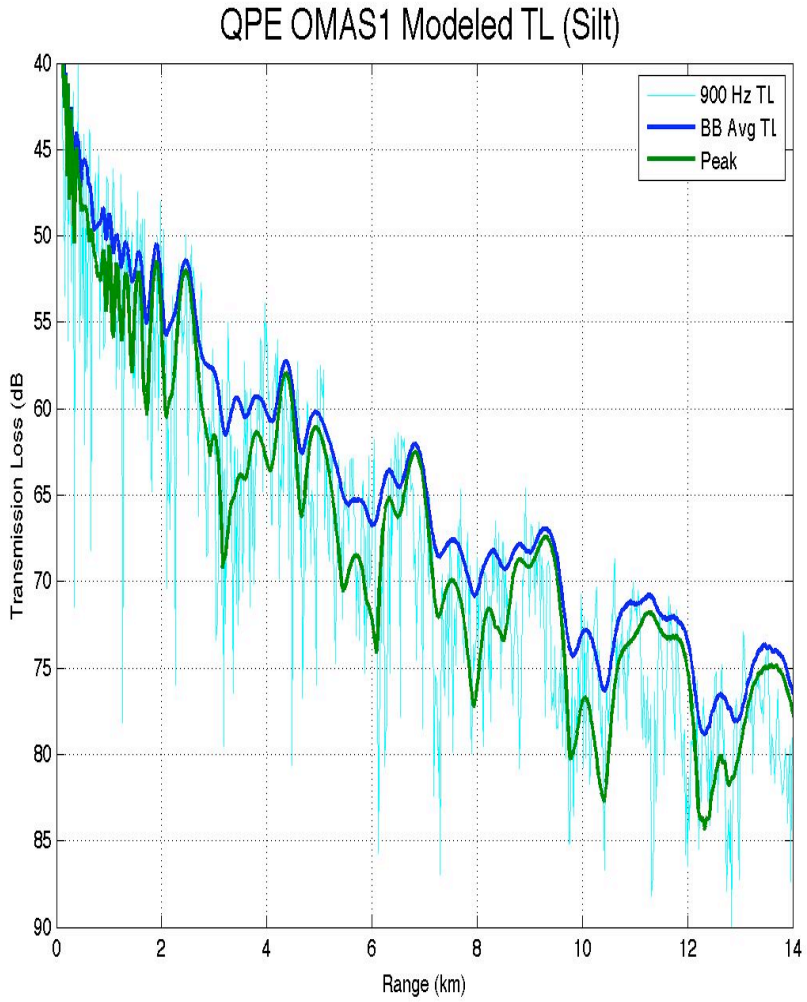

QPE08 TAIWAN, September 06, 2008 Histogram of 600Hz DIFAR1 V1 Track 2 TL Deltas
N = 246
σ = 2.7 dB
μ = 0.0 dB
Norm Number of Occurrences
TL Delta (Meas-Mean), dB

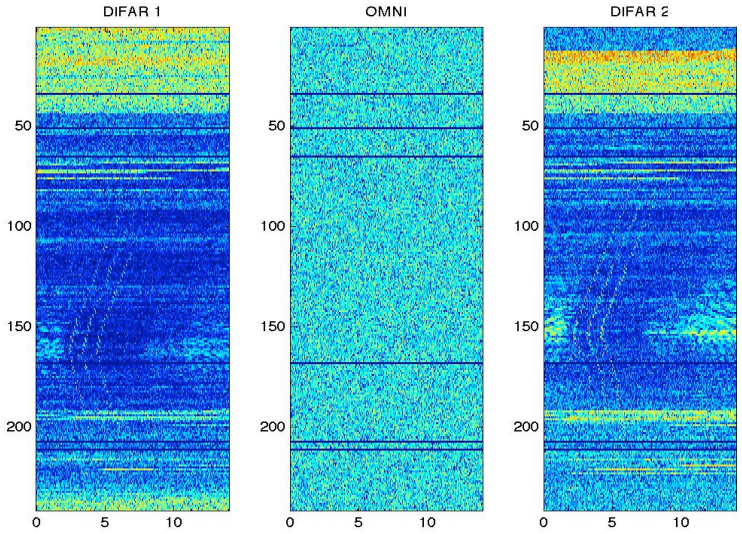

QPE08 TAIWAN, September 06, 2008, Histogram of 600Hz DIFAR2 V1 Track 2 TL Deltas
N = 267
σ = 2.4 dB
μ = 0.0 dB
Norm Number of Occurrences
TL Delta (Meas-Mean), dB

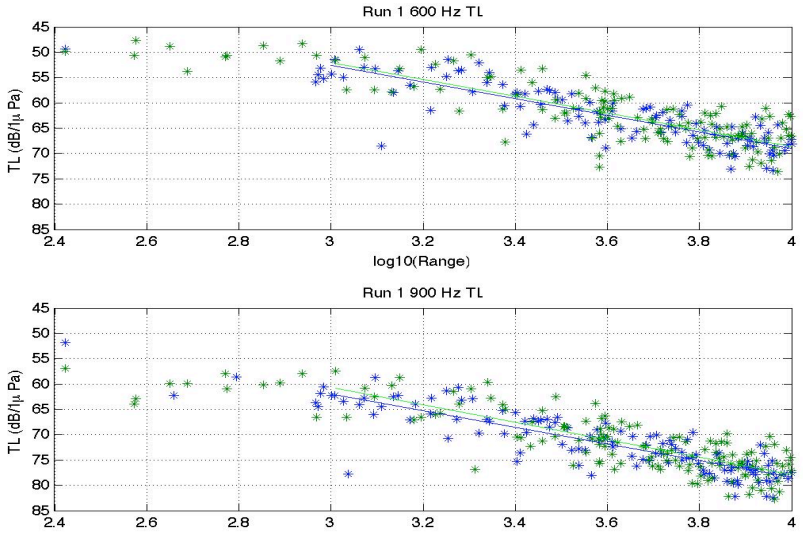
Model-Data Comparisons

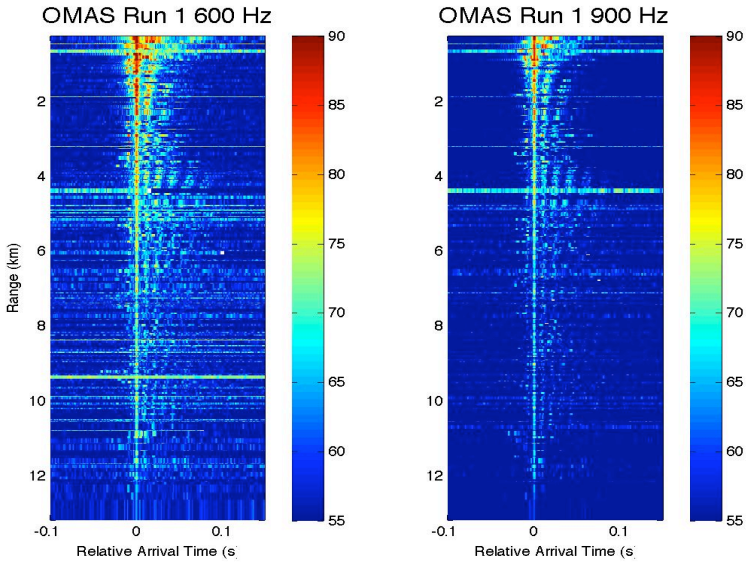
- Need to compare apples-to-apples
  - In order to increase SNR OMAS system transmits LFM and uses peak of the matched filter output as a proxy for TL
- In order to compare, we compute the BB PE field, FFT and pick the take the peak.

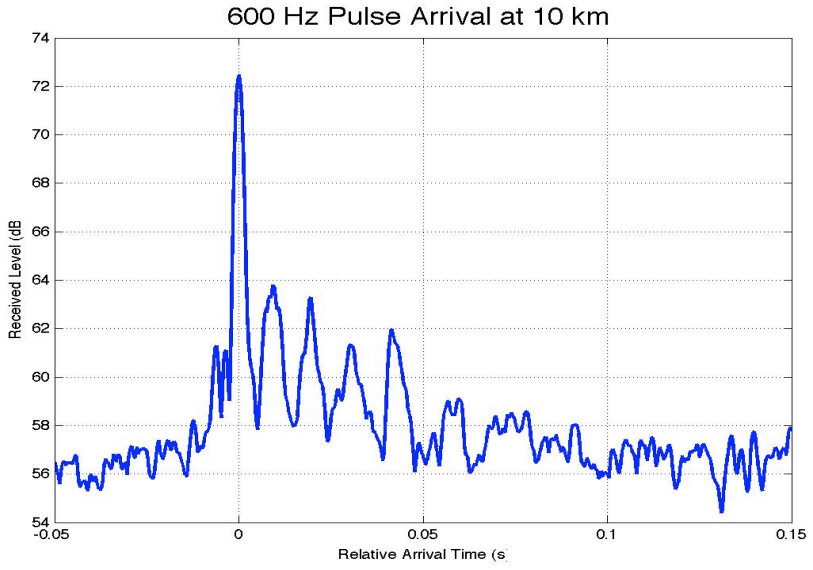


OMAS Broadband Measurements

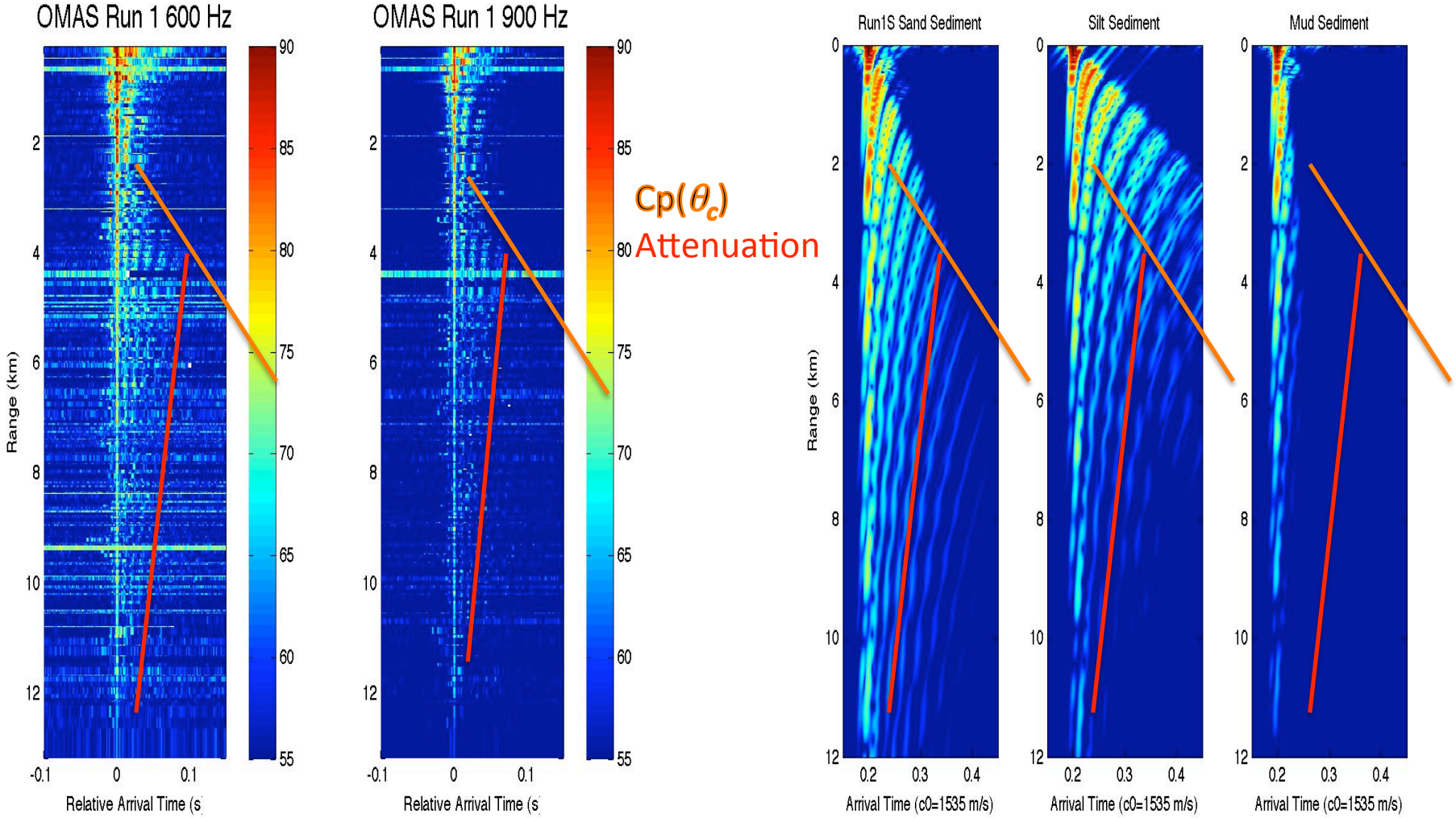






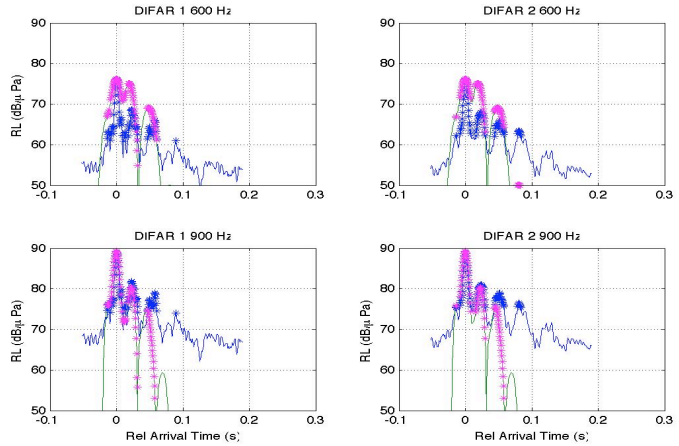


BB Signal vs. Range

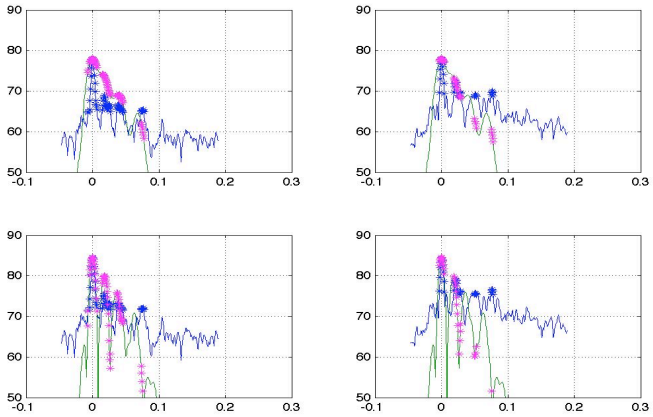


Pilot Data-Model Arrival Pattern Comparisons (*Normalized to peak*)
Using 1562 m/s 0.25 dB/λ 1.8 g/cc

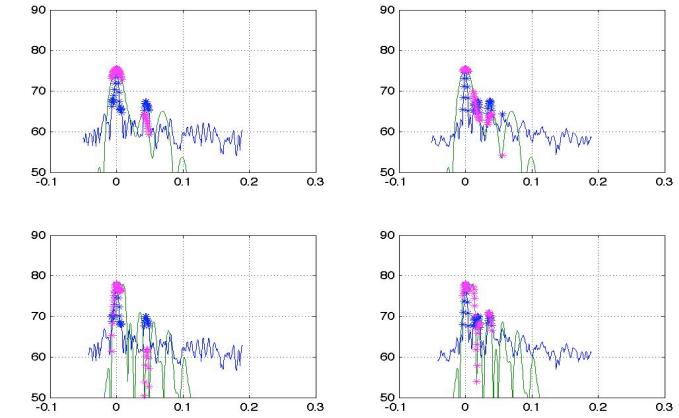
R = 4 km



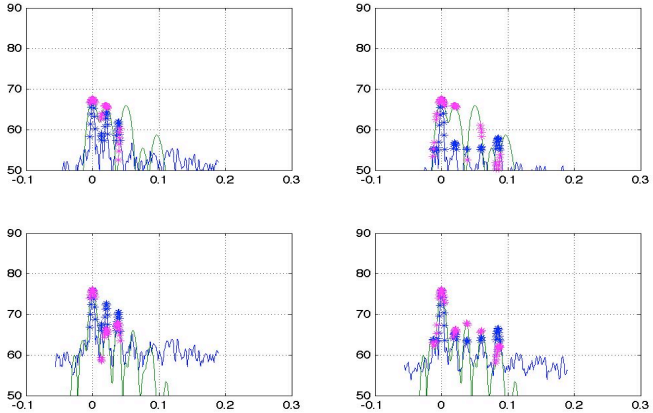
R = 5 km



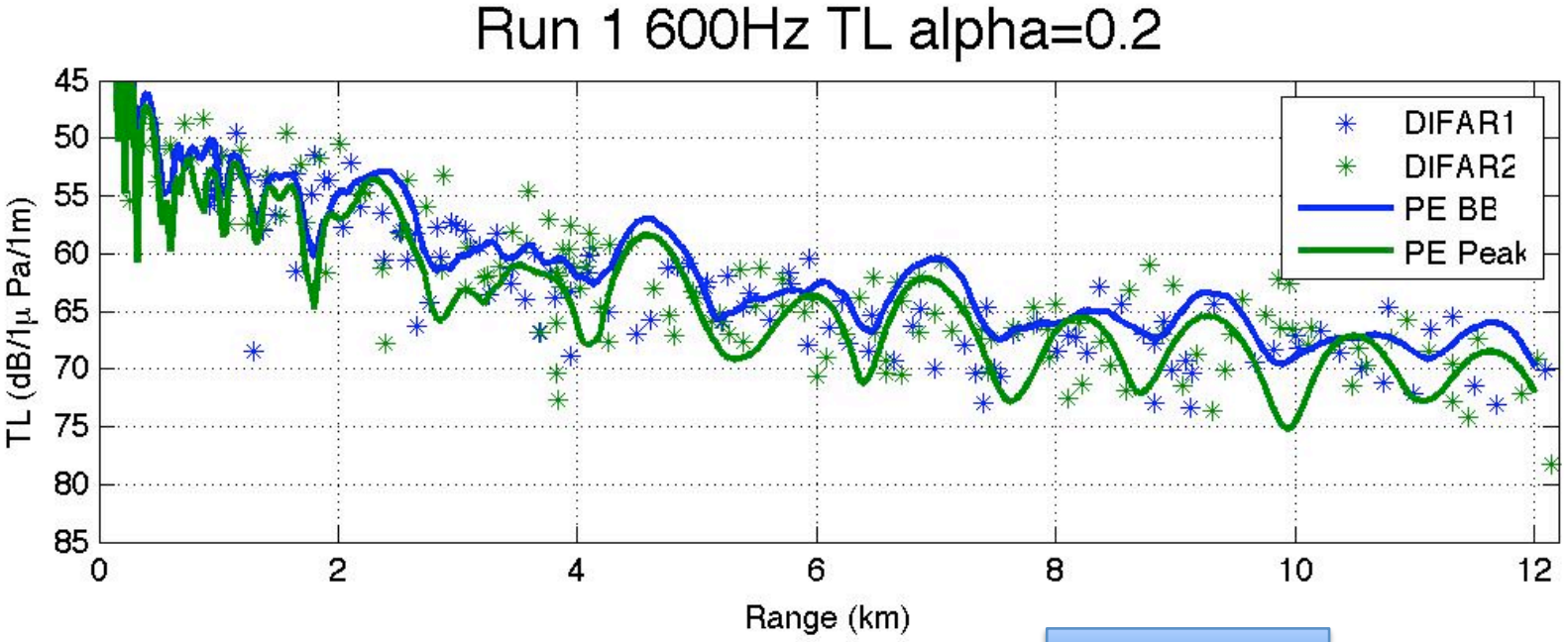
R = 8 km

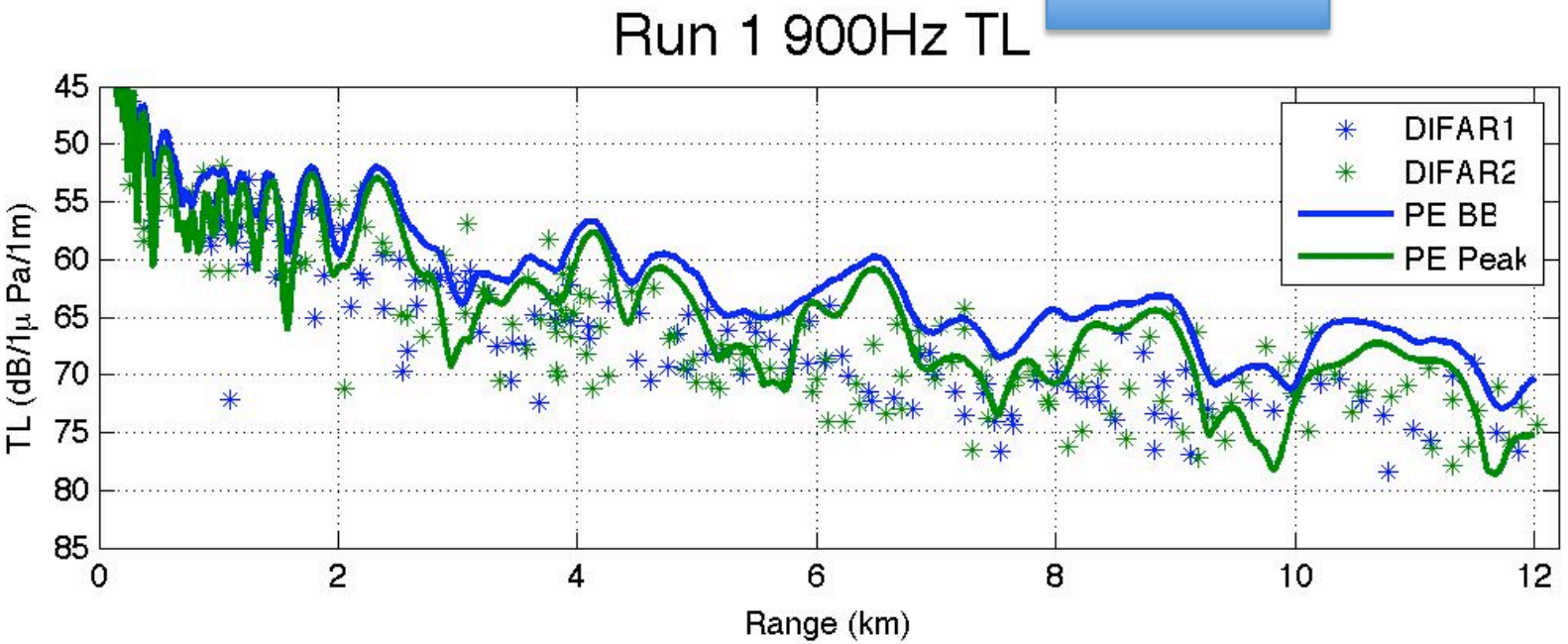


R = 10 km



Model-Data TL Comparison





QPE Pilot Acoustic Conclusions

- OMAS was successfully deployed (5 times) during night ops from RV-2
- Vessel noise does impact short range recordings
- Bathymetry (near shelf-break) strongly affects TL and must be accounted for in geometry planning
- OMAS MF-output can be used to determine signal evolution vs. range
- Signal waveform can be used to rapidly estimate a geo-acoustic Inversion
- DIFAR calibration issue needs to be resolved with local source

Objectives for 09 Test

- Primary Goal: Develop an integrated package for collecting and assimilating acoustic/ambient noise/ oceanographic data to reduce acoustic uncertainty
- Apply near-real time (NRT) MF geo-acoustic inversion to signals
- Using updated geo-acoustics perform acoustic sensitivity computation
- Analyze ambient noise to improve SNR prediction and exploitation
- Generate NRT acoustic adaptive sampling runs for reducing oceanographic variability

Acoustic Adaptive Sampling

- Integrate acoustic signal processing (signal and noise) with dynamic ocean forecast (MIT/SIO)
- Integrate updated geo-acoustics (from pilot/in-situ measurements)
- Assimilate ambient noise measurements (compare with predictions)
- Generate real-time acoustic sensitivity (uncertainty) and coverage maps
- Generate optimal adaptive sampling runs to both reduce uncertainty and optimize SNR

Acoustic AS Priorities for QPE'09

- At most 2 sites (personal preference: 1 and 4)
- Prefer Linear Tracks (in addition to circular)
- Return to previous sites after sufficient collection and assimilation of data (+3 days?)
- Transmit subset of acoustic data to shore
  - TL vs. range
  - MF evolution vs. range
  - Ambient noise omni statistics (Directionality?)
- Perform a set of "adaptive sampling" runs for reduction and exploitation of uncertainty.