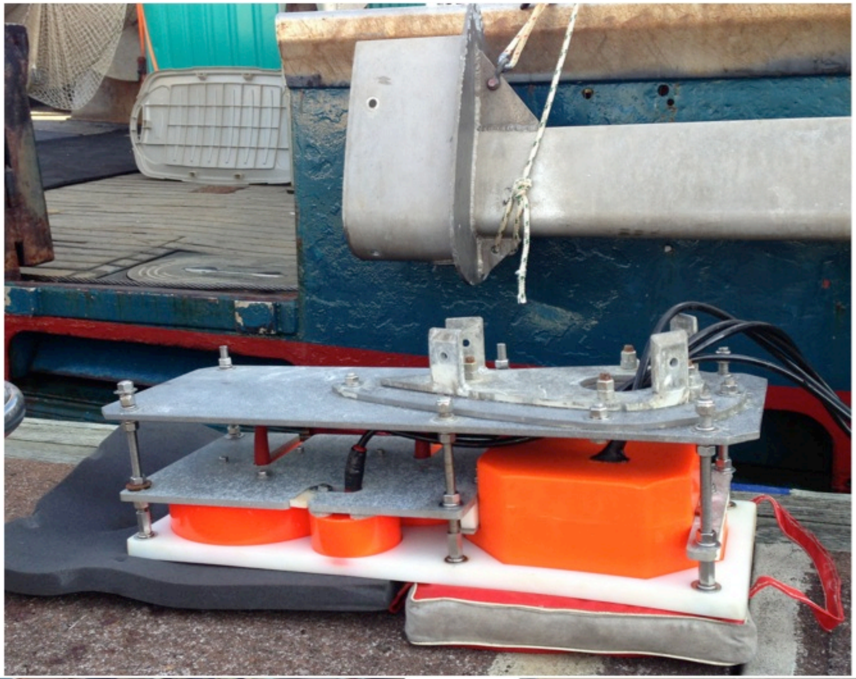
Calibration Analysis

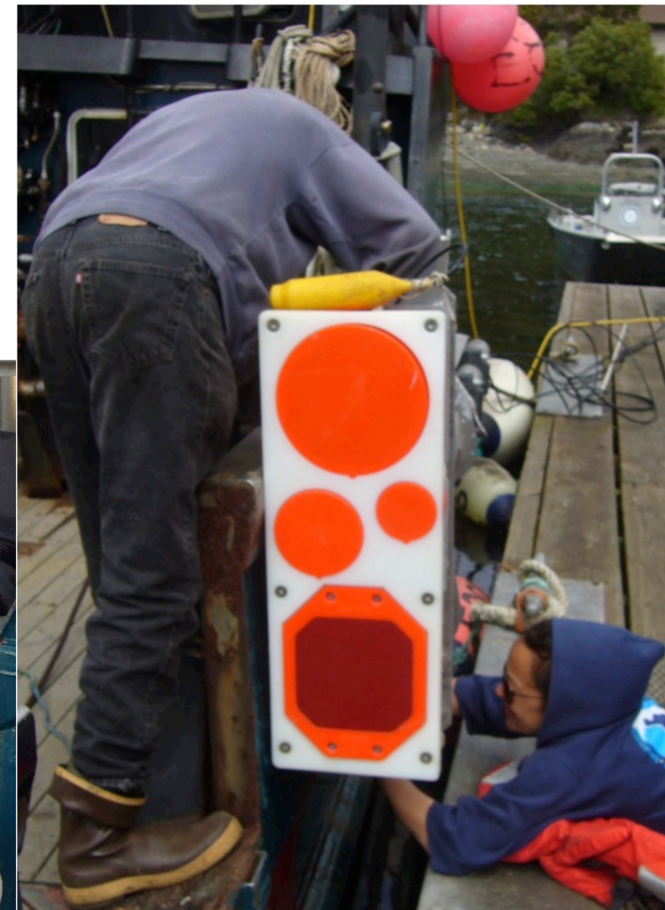
Mei Sato and John Horne

Data collection

- CTD profile
- For each frequency-pulse length combination: on axis, beam pattern swing

ER60 Setup

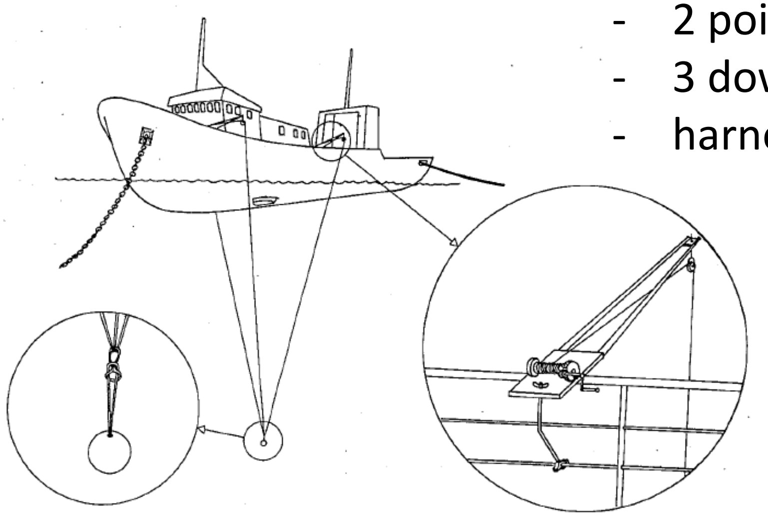


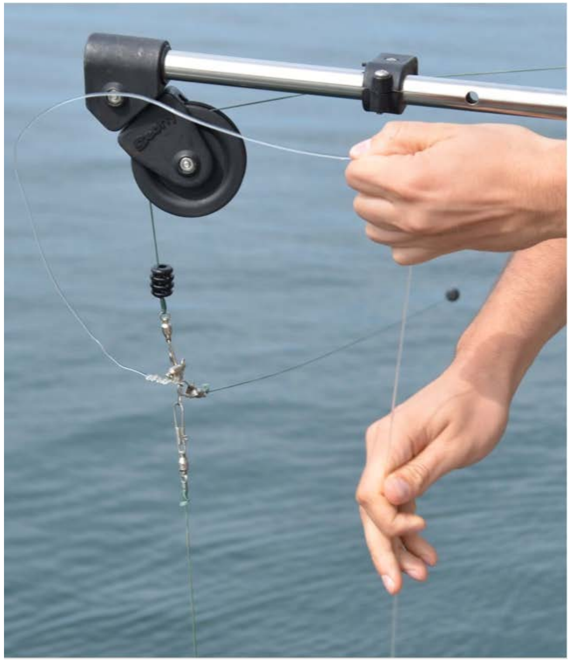


Under the kitchen counter

Calibration setup

- 2 point anchor
- 3 down riggers
- harness and calibration sphere





Goal

- Determine G_0 and S_a correction values

$$S_V(R,P_r) = P_r + 20\log R + 2\alpha R - 10\log\left(\frac{P_t G_0^2 \lambda^2 c\,\tau\psi}{32\pi^2}\right) - 2\times S_a \text{ correction}$$

$$TS(R,P_r) = P_r + 40\log R + 2\alpha R - 10\log\left(\frac{P_t G_0^2 \lambda^2}{16\pi^2}\right)$$

http://support.echoview.com/WebHelp/Reference/Algorithms/Echosounder/Simrad/EK60_Power_to_Sv_and_TS.htm

Goal

- Determine G_0 and S_a correction values

$$S_V(R,P_r) = P_r + 20\log R + 2\alpha R - 10\log\left(\frac{P_t G_0^2 \lambda^2 c \tau \psi}{32\pi^2}\right) - 2 \times S_a \text{ correction}$$

$$TS(R,P_r) = P_r + 40\log R + 2\alpha R - 10\log\left(\frac{P_t G_0^2 \lambda^2}{16\pi^2}\right)$$

$\Rightarrow$ Update .ecs file with new G_0 and S_a correction values

$\Rightarrow$ Update S_v gain and S_a correction values in ER or ES software

http://support.echoview.com/WebHelp/Reference/Algorithms/Echosounder/Simrad/EK60_Power_to_Sv_and_TS.htm

How to determine G_0 and S_a correction values?

$$\text{calc. TS gain} = \frac{TS_{measured} - TS_{theory}}{2} + G_{old}$$

$$\text{calc. Sv gain} = \frac{10\log(Sa_{measured} / Sa_{theory})}{2} + G_{old} + Sa_{old}$$

calc. Sa correction = calc. Sv gain – calc. TS gain

new G_0 = calc. Sv gain
new Sa correction = calc. Sa correction

Data analysis

1. Parameter settings for ER60
2. Characterize sampling environment
3. Theoretical TS/ S_a correction values
4. Measured TS/ S_a correction values (Echoview)
5. Calculate new G_0 and S_a correction (Excel sheet)

=> Update .ecs file and acquisition software

1. Parameter settings for ER60

<u>Can change if needed …</u>

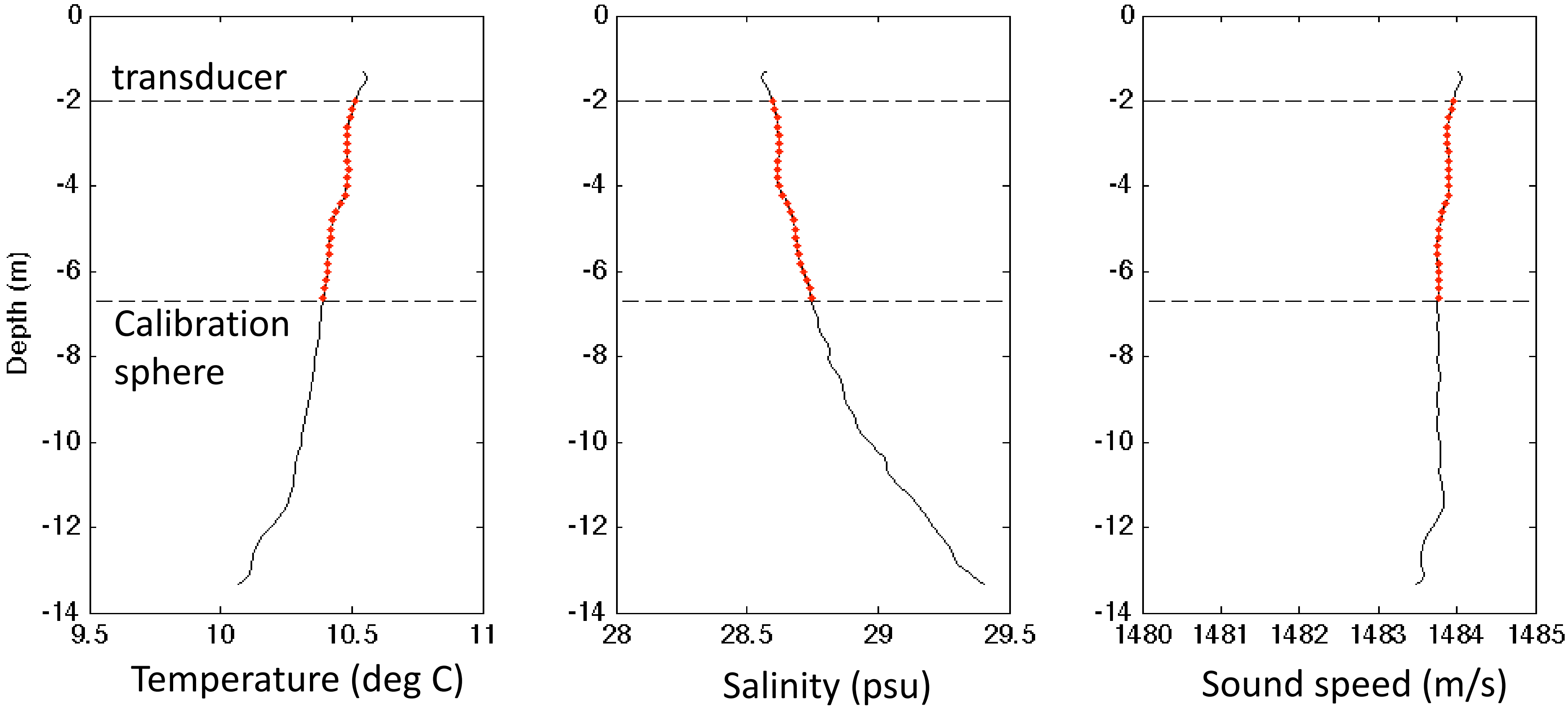
- S_a correction
- transducer gain
- 3 dB beam angle
- angle offset/sensitivity
- 2-way beam angle

<u>Cannot change …</u>

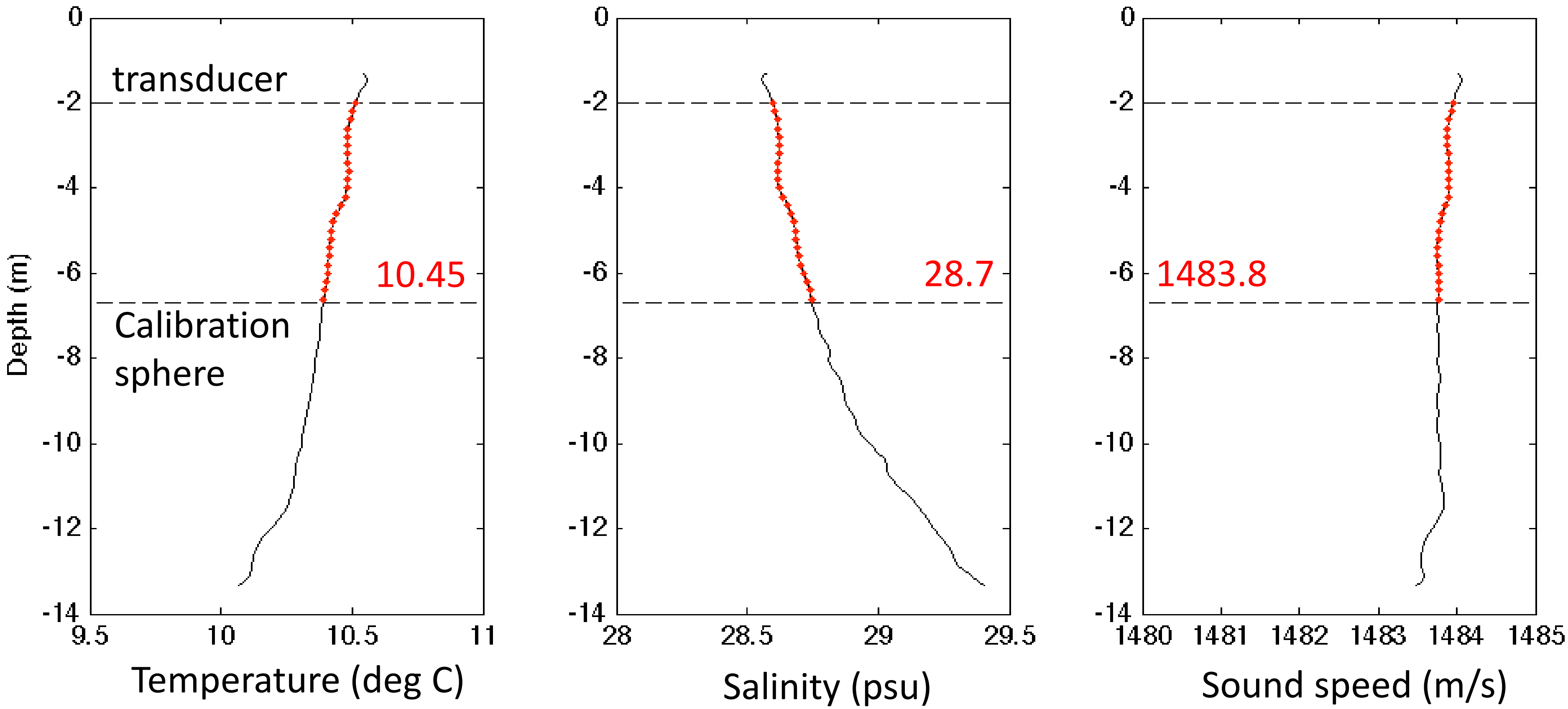
- frequency
- transmitted pulse length
- transmitted power

```
#==========================================================================================
#            ECHOVIEW CALIBRATION SUPPLEMENT (.ECS) FILE (SimradEK60Raw)
#                              7/12/2011 12:40:38
#==========================================================================================
#
#     +----------+   +-----------+   +----------+   +----------+   +----------+
#     | Default  |-->| Data File |-->| Fileset  |-->| SourceCal|-->| LocalCal |
#     | Settings |   | Settings  |   | Settings |   | Settings |   | Settings |
#     +----------+   +-----------+   +----------+   +----------+   +----------+
#
# - Settings to the right override those to their left.
# - See the Help file page "About calibration".
#==========================================================================================

Version 1.00


#==========================================================================================
#                                FILESET SETTINGS
#==========================================================================================

# SoundSpeed = # (meters per second) [1400.00..1700.00]
# TvgRangeCorrection = # [None, BySamples, SimradEx500, SimradEx60, BioSonics, Kaij
PulseLength, Ex500Forced]
# TvgRangeCorrectionOffset = # (samples) [-10000.00..10000.00]


#==========================================================================================
#                                SOURCECAL SETTINGS
#==========================================================================================

SourceCal T1
    # AbsorptionCoefficient = 0.0097472 # (decibels per meter) [0.0000000..100.00000
    # EK60SaCorrection = 0.0000 # (decibels) [-99.9900..99.9900]
    # Ek60TransducerGain = 26.5000 # (decibels) [1.0000..99.0000]
    # Frequency = 38.00 # (kilohertz) [0.01..10000.00]
    # MajorAxis3dbBeamAngle = 7.10 # (degrees) [0.00..359.99]
    # MajorAxisAngleOffset = 0.00 # (degrees) [-9.99..9.99]
    # MajorAxisAngleSensitivity = 21.90 # [0.10..100.00]
    # MinorAxis3dbBeamAngle = 7.10 # (degrees) [0.00..359.99]
    # MinorAxisAngleOffset = 0.00 # (degrees) [-9.99..9.99]
    # MinorAxisAngleSensitivity = 21.90 # [0.10..100.00]
    # SoundSpeed = 1500.00 # (meters per second) [1400.00..1700.00]
    # TransmittedPower = 200.00000 # (watts) [1.00000..30000.00000]
    # TransmittedPulseLength = 1.024 # (milliseconds) [0.001..50.000]
    # TvgRangeCorrection = SimradEx60 # [None, BySamples, SimradEx500, SimradEx60, B
Kaijo, PulseLength, Ex500Forced]
    # TwoWayBeamAngle = -20.600000 # (decibels re 1 steradian) [-99.000000..-1.00000

SourceCal T2
    # AbsorptionCoefficient = 0.0373058 # (decibels per meter) [0.0000000..100.00000
    # EK60SaCorrection = 0.0000 # (decibels) [-99.9900..99.9900]
    # Ek60TransducerGain = 27.0000 # (decibels) [1.0000..99.0000]
    # Frequency = 120.00 # (kilohertz) [0.01..10000.00]
    # MajorAxis3dbBeamAngle = 7.00 # (degrees) [0.00..359.99]
    # MajorAxisAngleOffset = 0.00 # (degrees) [-9.99..9.99]
    # MajorAxisAngleSensitivity = 23.00 # [0.10..100.00]
    # MinorAxis3dbBeamAngle = 7.00 # (degrees) [0.00..359.99]
    # MinorAxisAngleOffset = 0.00 # (degrees) [-9.99..9.99]
    # MinorAxisAngleSensitivity = 23.00 # [0.10..100.00]
    # SoundSpeed = 1500.00 # (meters per second) [1400.00..1700.00]
    # TransmittedPower = 1000.00000 # (watts) [1.00000..30000.00000]
    # TransmittedPulseLength = 1.024 # (milliseconds) [0.001..50.000]
    # TvgRangeCorrection = SimradEx60 # [None, BySamples, SimradEx500, SimradEx60, B
Kaijo, PulseLength, Ex500Forced]
    # TwoWayBeamAngle = -21.000000 # (decibels re 1 steradian) [-99.000000..-1.00000

#==========================================================================================
#                                LOCALCAL SETTINGS
#==========================================================================================
```

2. Sampling Environment



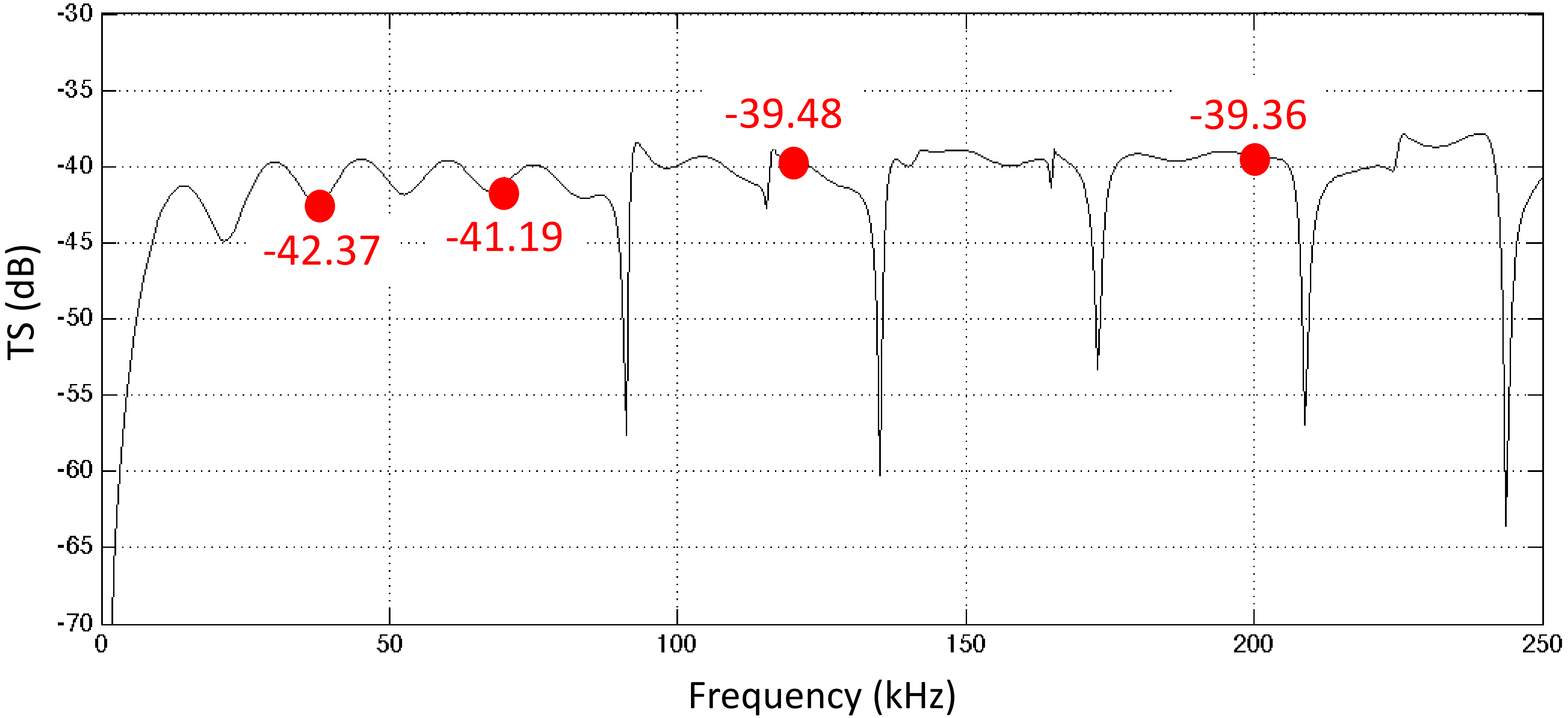
2. Sampling Environment



Use average value between transducer and calibration sphere depths

=> Put calculated sound speed (c) and absorption (α) values in .ecs file

3. Theoretical TS/ S_a values



$$S_a = 4\pi(1852)^2 \frac{10^{TS/10}}{10^{\Psi/10}\, r^2} \quad [m^2/\ n.\ mi.^2]$$

(Ψ = Two-way beam angle)

Data Analysis

1. Parameter settings for ER60
2. Physical environment
3. Theoretical TS/ S_a correction values
4. Measured TS/ S_a correction values (Echoview)
5. Calculate new G_0 and S_a correction (Excel sheet)

=> Update .ecs file and data acquisition software

$$\text{calc. TS gain} = \frac{TS_{measured} - TS_{theory}}{2} + G_{old}$$

$$\text{calc. Sv gain} = \frac{10\log(Sa_{measured} / Sa_{theory})}{2} + G_{old} + Sa_{old}$$

calc. Sa correction = calc. Sv gain – calc. TS gain