

EM Technical Note

Filters and Gains for EM 2040, EM 710, EM 302 and EM 122



KONGSBERG

EM Feature Explanation

The what, the why, the how of EM Filters and Gains

There is always a small risk of false detections in a multibeam echo sounder. This is due to external factors such as fish shoals, acoustical interference from other systems, passing over vessel wakes, etc. According to bottom conditions, you can apply the included filters to assist the system in discriminating against erroneous measurements.

It is recommended to use different filter settings than those recommended only if the occurrence of false detections is higher than expected.

Where are the EM Filtering options in SIS?

The **Filtering** function is located in *Filter and Gains* tab of the *Runtime Parameters* window in the *Kongsberg SIS* software.

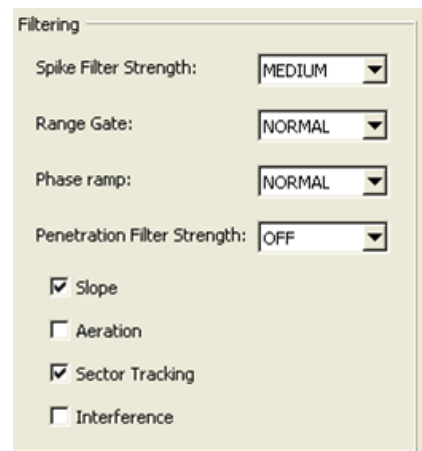
These are the settings recommended for 'basic filters':

- **Spike Filter Strength:** Medium
- **Range gate:** Normal
- **Phase ramp:** Normal
- **Penetration Filter Strength:** Off

The recommended 'advanced filters' settings are:

- **Slope:** On
- **Aeration:** Off
- **Sector Tracking:** On
- **Interference:** Off

Runtime Parameters > Filters and Gains



How it is done during multibeam data acquisition?

The bottom detection is performed in two passes in each ping. Filtering is performed after every pass.

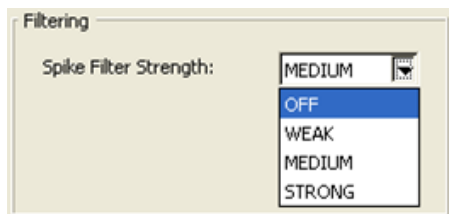
- The first pass is done on all beams individually.
- The second pass is done only on beams which lack valid detection. However, the system then uses relaxed acceptance criteria within range windows derived from neighbouring beams with accepted detection.

It is always beneficial to eliminate erroneous measurements before post processing. In addition, if a false detection in a beam is eliminated in the first pass, a valid detection may be acquired in the second pass.

Some of the basic filters (not all) are explained below.

Spike Filter Strength:

Choose between **OFF**, **WEAK**, **MEDIUM** and **STRONG**.

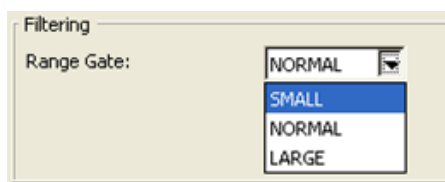


This is used to define to what degree a non-smooth bottom is to be accepted. The filter remove beams with depths that deviate too much from a smoothed bottom profile as derived from the detected beams. The stronger filtering, the less deviation is accepted.

If you select OFF, no filtering will take place.

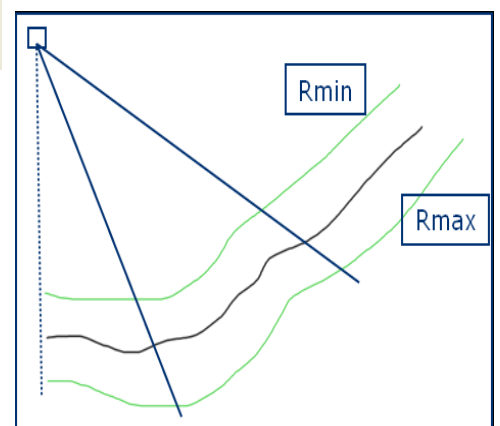
Range Gate:

Choose between **SMALL**, **NORMAL** and **LARGE**.



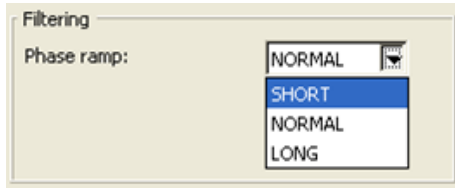
The range gate setting is used to determine the size of the bottom detection window; the depth limits are based on the information from the previous pings. If the depth varies considerably (more than 10%) it may be useful to select a large range gate, but this may also increase the chance for false echoes from side lobes, interference or other noise source. A large range gate may reduce the ping rate slightly.

Drawing for Range Gate



Phase Ramp:

Choose between **SHORT**, **NORMAL** and **LONG**.



The 'Phase Ramp' is basically the bottom detection resolution. A better phase detection is added to improve depth resolution in outer beams.

It sets how many samples to be used for phase detection of each depth. The shorter phase ramp, the higher resolution, but also more noise in the data.

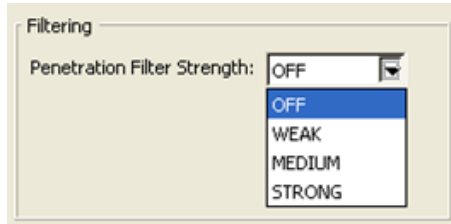
Normal: Our advice.

Short: To detect small sand waves. Example: sand waves of 15 cm at 30m depth.

Long: Data is filtered to reduce noise

Penetration Filter Strength:

Choose between **OFF**, **WEAK**, **MEDIUM** and **STRONG**.



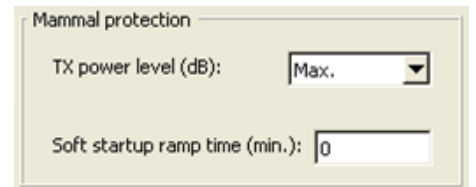
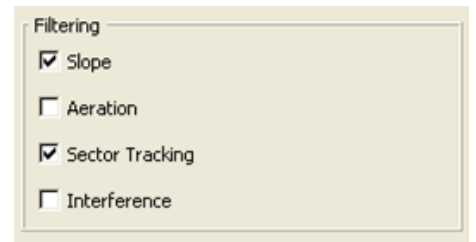
The 'Penetration Filter Strength' has been made to reduce a tendency to track on sediment layers below the sea floor on central beams in areas with soft seafloor and distinct sediment layers.

Main features:

- Uses same frequency for port and starboard sector (in order to minimize frequency difference between center and edge sectors).
- Priorities the first instead of the strongest bottom echo for central beams.

Advanced filter options:

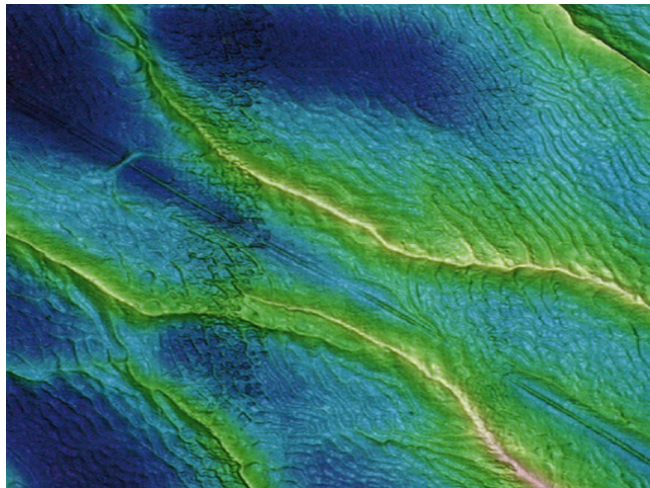
Find explanations on these advanced filters in a different EM Technical Note.



Results after bottom detection

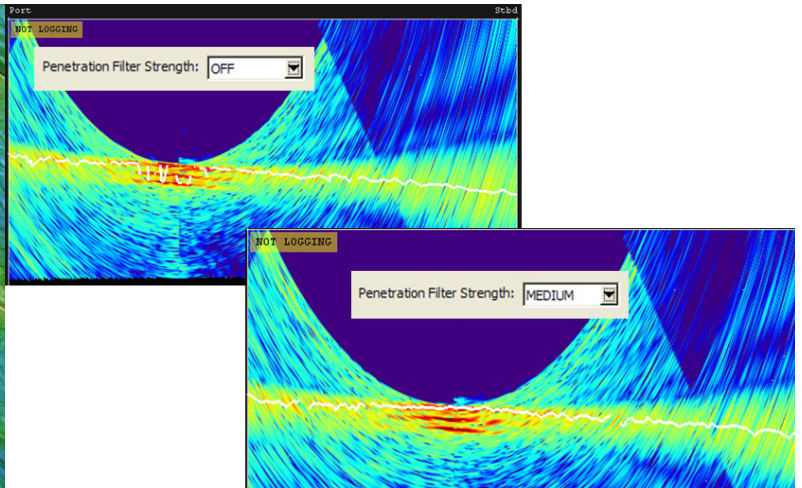
Phase Ramp > 'Short'

15cm sand waves at 30m depth



Penetration Filter Strength: 'OFF and MEDIUM'

Bottom detection through three sediment layers



Facts and tips

EM Filter and Gains module is the result of many years of development of EM multibeam products and provide the customers with unique software features that will guarantee the best bottom detection results in real time in the survey market.

With our EM series of multibeam echosounders customers save a lot of time performing data cleaning during post-processing due to the amazing capabilities of our filters and gains applied in real time.

Together with our RTDC (Real Time Data Cleaning) module that uses set of rules (parameters) that control the algorithms used to process the EM multibeam echo sounder data, we are proud to provide the most efficient and robust multibeam data acquisition and processing in real time in the hydrographic market.

December 2013

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