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Features for a station design
Cramer Rao Bound (CRB) is an index of accuracy
Loss of coherence (LOC)

Features for a station design
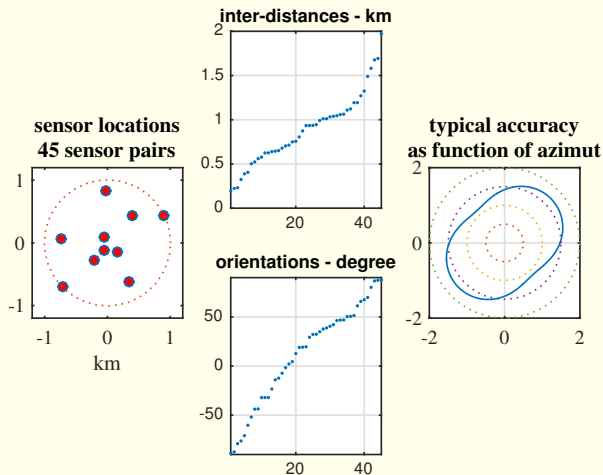
IS37: 10 sensors, hence 45 pairs.

inter-distances - km

**sensor locations
45 sensor pairs**

km

orientations - degree

**typical accuracy
as function of azimut**

Elements of interest:

- the scale factor (aperture)
- the relative locations of the sensors

$\rightarrow$ uniformity of ...

$\rightarrow$ accuracy isotropy

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Features for a station design
Cramer Rao Bound (CRB) is an index of accuracy
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By moving the 2 most distant sensors

sensor locations
45 sensor pairs

inter-distances - km

moving the
2 extreme sensors

orientations - degree

typical accuracy
as function of azimut

km

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Features for a station design
Cramer Rao Bound (CRB) is an index of accuracy
Loss of coherence (LOC)
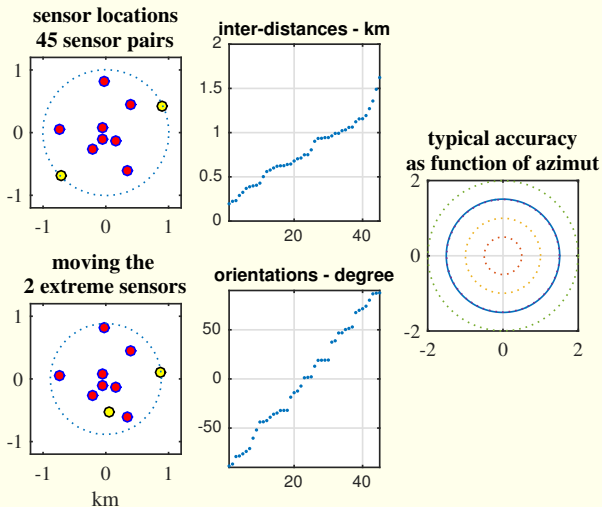
CRB as an index of accuracy
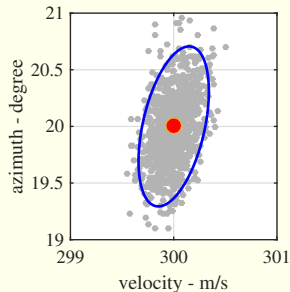
- Depending on the noise we observe different couples of values (grey points).
- A good estimator has to provide a set of values located around the true value with a dispersion as low as possible.
- The CRB provides a lower bound for the dispersion.
- A good estimator converges asymptotically to the CRB.

- the CRB is used to determine the confidence region (ellipse)
- it is worth to notice that the CRB does depend on the true values of the parameters that are unknown. Usually we replace by the estimated value.

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Features for a station design
Cramer Rao Bound (CRB) is an index of accuracy
Loss of coherence (LOC)

Loss of coherence

- usually the sensors of the same station are very far from the source of interest, several hundreds of km compared to 1 km.
- however the signals arriving on the two sensors are not fully coherent. But in the absence of clear explanations a "black box" model is considered:

$$\log \mathsf{MSC}(f) \approx -\beta f^2 \times d^2$$

where d is the distance between deux points of observation, f the frequency and β a LOC decay factor.
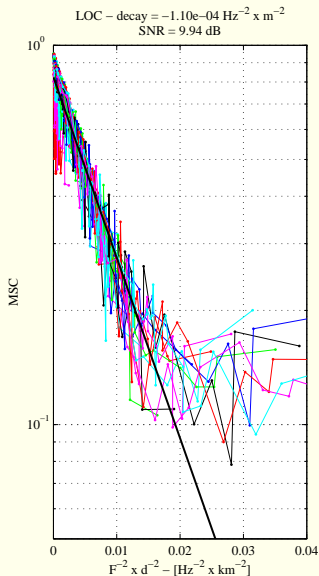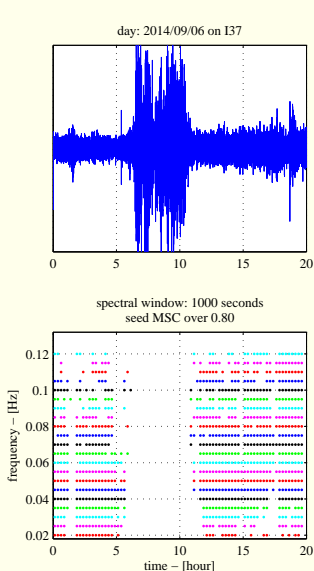This simple model does not take into account the orientation of the sensor axis w.r.t. the direction of arrivals.

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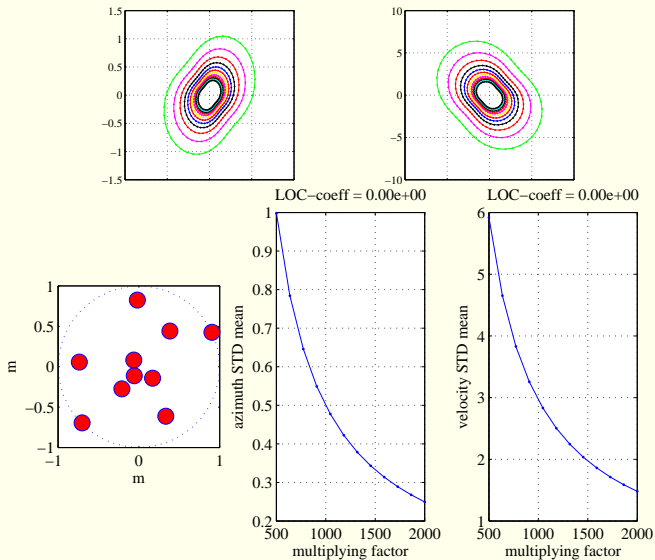A few conclusions

LOC
CRB

Protocol

- For a given frequency in the selected bandwidth of interest B and for a given time window T, we perform the MSCs for each pairs of sensors. If the two closest sensors have an MSC over 0.8 in a certain T/F cell, we keep this T/F cell for all combinations of interdistances.
- We average on the duration of the file.

- Bandwidth $\begin{bmatrix} 0.05 & 0.11 \end{bmatrix}$ Hz,
- Time window duration $T = 500$ seconds,
- Time duration about 20 hours, i.e. about 144 windows.
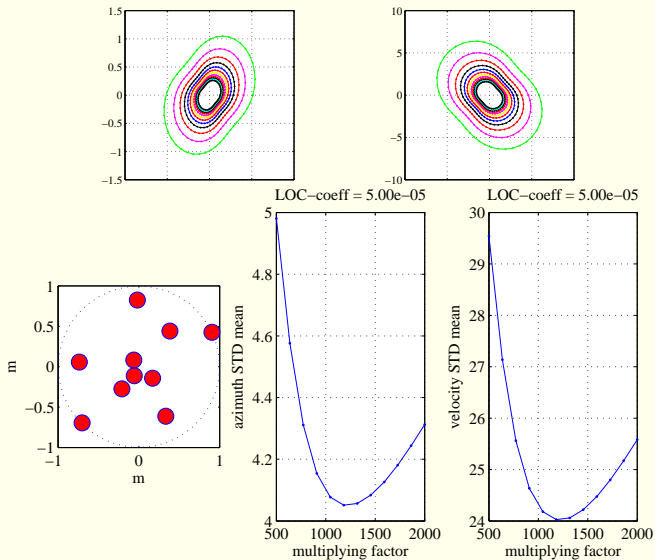- In the selected bandwidth the acceptance rate is ..

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L O C
C R B

IS37, with 10 sensors then 45 interdistances

day: 2014/09/06 on I37

spectral window: 1000 seconds
seed MSC over 0.80

LOC − decay = −1.10e−04 Hz^{-2} x m^{-2}
SNR = 9.94 dB

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LOC
CRB

No LOC

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LOC
CRB

LOC with $\beta = 5e^{-5}$

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LOC
CRB

LOC with $\beta = 9e^{-5}$

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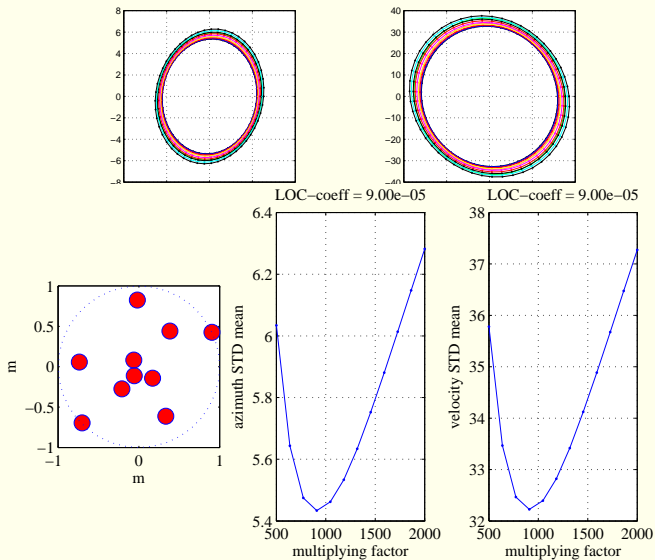
Conclusion

- re-visite the LOC model
- study the effect of the sensor relative locations on the CRB in presenc of LOC. Is the uniformity of distance/orientation useful?