



CEOS/WGCV/IVOS MTF comparison

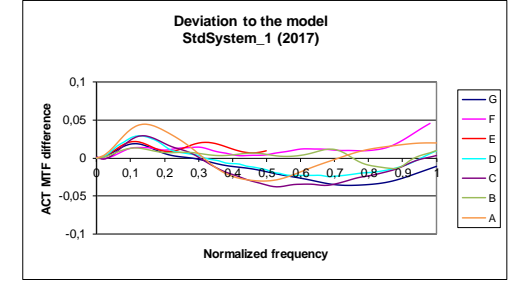
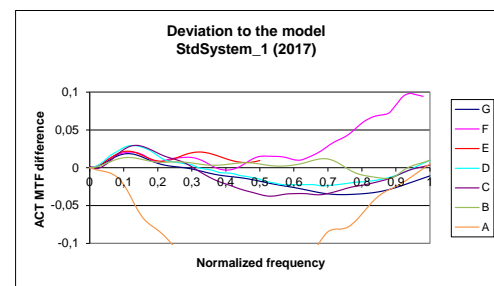
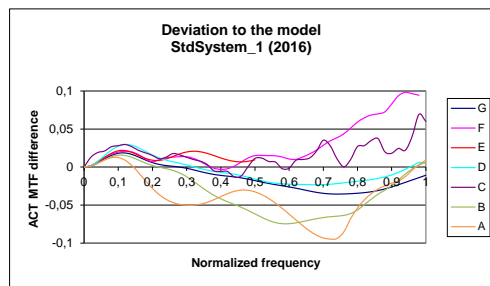
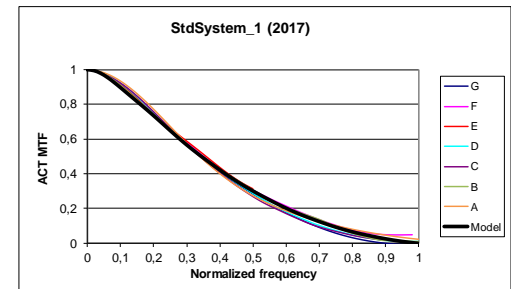
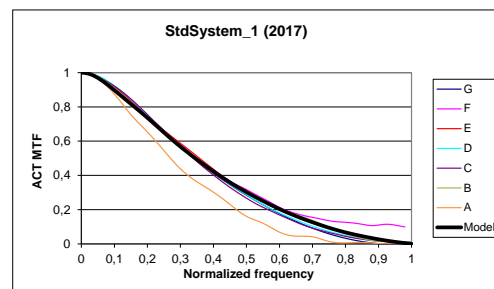
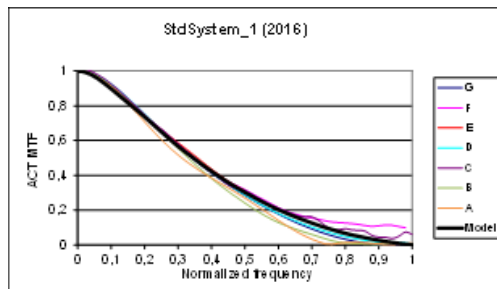
F. Viallefont-Robinet and the MTF project team



[retour sur innovation](#)

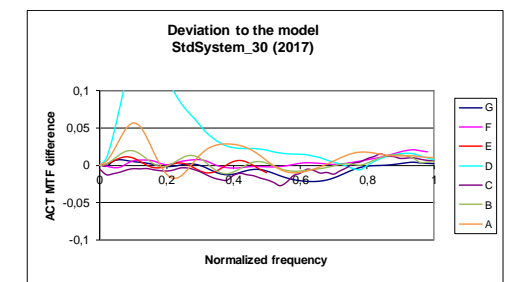
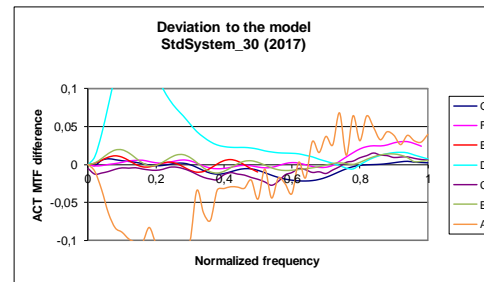
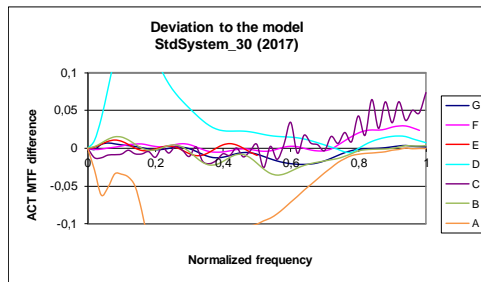
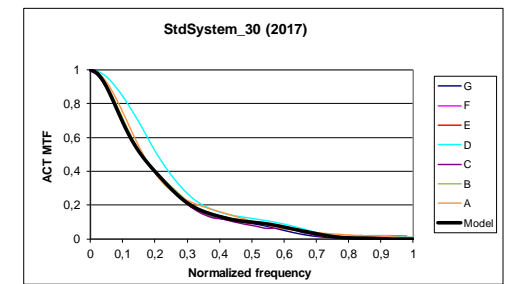
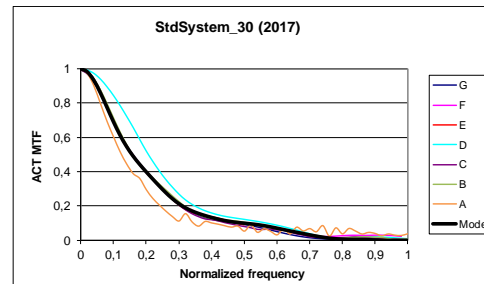
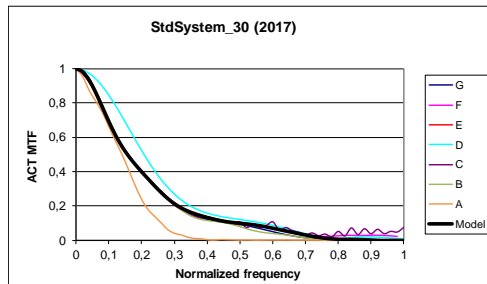
MTF comparison: last results

- Integration of the last results of participant A: A results for the standard system cases are now close to the other participants ones



MTF comparison: last results

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MTF comparison: conclusions recall

- Necessity of covering various MTF shapes for an accurate comparison
- Interest of comparing the whole curve and not only the MTF value at Nyquist frequency
- Fairly good agreement between the results
- Singular results:
 - Truncation ?
 - Inadequate (implicit?) model ?

MTF comparison: benefits

- Minor or major bugs correction for some participants
- Validation or verification of the implementation of the method for each participant
- Assessment of the performance of the implementation for each participant
- Opportunity to improve each implementation through the information brought by the presentations of the various implementations given last IVOS
- A paper in preparation to capitalize and valorize this work

Coffe Break !

MTF comparison: status/objectives

- First objective: a common paper including all participants
 - Journal suggestions: Optics Express
 - Writing organization: F. Viallefont-Robinet initiates the paper, each participant write the section describing his/her method
 - Link to ISO 122233 method: not done, won't be done with a short delay

MTF comparison: status/objectives

- First objective: a common paper including all participants
 - Have a look to the changes suggested after Dennis' review

MTF comparison: status/objectives

- Second objective: creation of a first reference dataset
 - Create a directory with free access to selected data: to ask to ESA (CaVal portal)
 - Define the corresponding reference results: to discuss/valid
 - Ask users to give their « blind test results » before access to the reference results in order to improve the reference dataset: data policy, data management to define

MTF comparison: status/objectives

- Starting point for data policy:

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MTF comparison: status/objectives

- **Starting point for data policy:**

Data Access & Policy

The geo spatial quality reference dataset (GSQRD) is composed of small edges images and corresponding geo spatial quality metrics. The edge images of the geo spatial quality reference dataset, as made available via the CEOS/WGCV calval portal, may be freely used and copied for **research, educational** and other **non-commercial purposes**, provided that any use of the data are accompanied by an acknowledgement of the MTF project of CEOS/WGCV/IVOS (see below).

For commercial use , an approval of the MTF project team is mandatory.

When accessing the geo spatial quality reference dataset for the first time, a simple registration to the CalVal portal is required. This information will only help keeping track of the dataset users and will be kept confidential.

In order to promote blind test, the user of the geo spatial quality reference dataset is asked to send the metrics computed with the reference edge images to get the spatial quality metric(s) part of the geo spatial quality reference dataset.

Don't mention the metrics values but the difference to this values.

MTF comparison: status/objectives

- **Starting point for data policy:**

Acknowledgments

If you intend to use geo spatial quality reference dataset in a publication or a report, please:

- Acknowledge the MTF project in the following way: "The geo spatial quality reference dataset have been established by the MTF project team of CEOS/WGCV/IVOS : calvalportal address.
- Refer to the associated publication(s) : "Comparison of MTF measurements using the edge method", Optics Express (to confirm), Françoise Viallefont-Robinet, Dennis Helder, Renaud Fraisse, Amy Newbury, Frans van den Bergh, DongHan Lee, Sébastien Saunier.

Roadmap

- Other future potential objectives:
 - Process other data (medium priority to begin with)
 - Sensitivity and accuracy analysis
 - **Study other metrics (RER, FWHM, ER slope, Edge overshoot, ...) and think about their aims**
 - **Extend the edge method comparison to natural edges**
 - **Compare methods (edge, linear target, point sources, NN) for a unique (virtual) sensor**
 - MTF or PSF models
 - Impact of the PSF/MTF shape
 - Focus assessment
 - Other kind of targets (bridges for instance)

Other metrics

Recall of DongHan's presentation given in 2015 as a starting point for the discussion

Other metrics

List:

Definitions:

Aims: intuitive metric ? robust metric ? Easy/ier to assess ? Metric of requirements ? Useful for GIQE ? Useful for sharpening ?

Computations:

Highpriority dataset:

What:

Who:

When:

Other metrics

Extract of paper written by R. R. Auelmann entitled Image Quality Metrics concerning GIQE and the associated metrics:

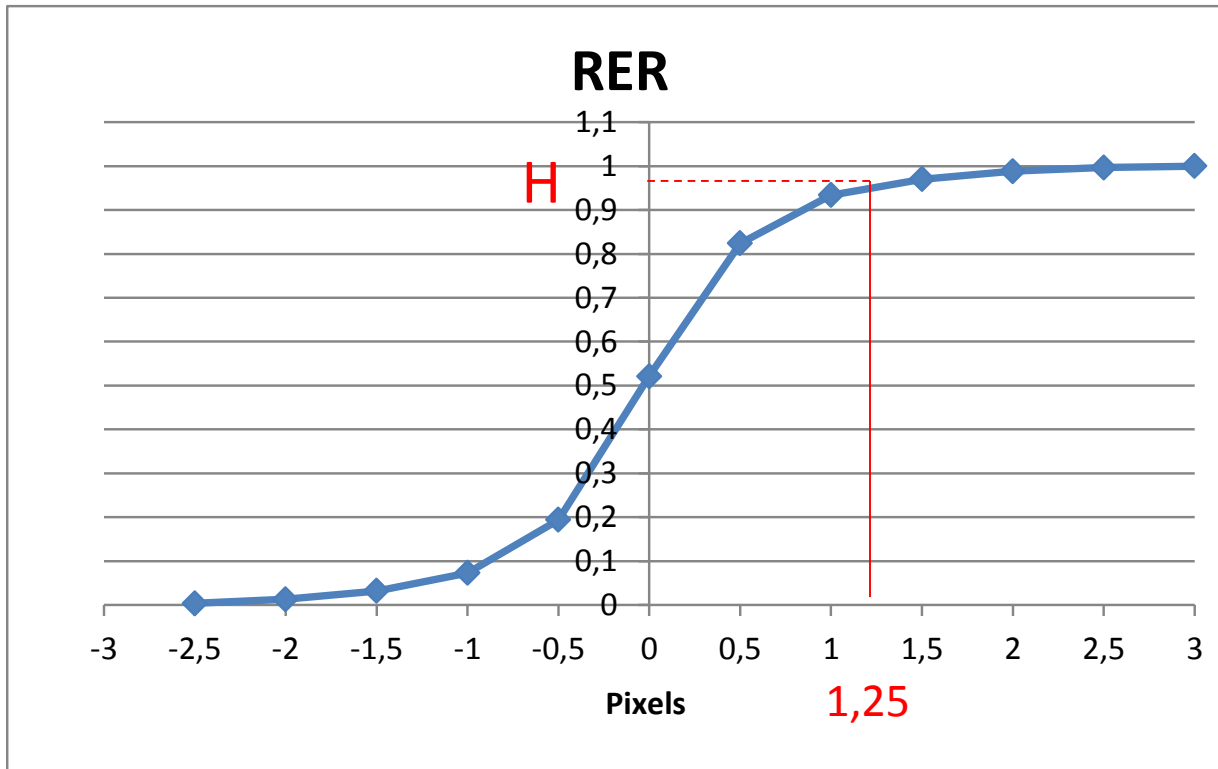
As early as the 1950s photo interpreters used an empirical equation to compare image quality between sensor designs. That equation included not only resolution but also a metric related to the point spread function. The 1980s saw the development of a more sophisticated approach in which image quality was expressed in NIIRS, which image analysts compare to a rating scale concerning interpretability. The General Image Quality Equation (GIQE) has been developed, which makes it possible to compute the NIIRS as a function of three main factors: (1) resolution (expressed in terms of the ground sample distance (GSD), (2) the **relative edge response (RER)**, which is indirectly related to the point spread function, and (3) the signal to noise ratio (SNR). The form of the GIQE is

$$\text{NIIRS} = c_0 + c_1 \cdot \log_{10} \text{GSD} + c_2 \cdot \log_{10} \text{RER} + c_3 \cdot H + c_4 \cdot G / \text{SNR}$$

H is an overshoot value derived from the edge response function, and G is a noise gain associated with image post processing. The c_i are constants. So for example, a change of \pm one NIIRS corresponds to halving or doubling the distance between the sensor and the scene.

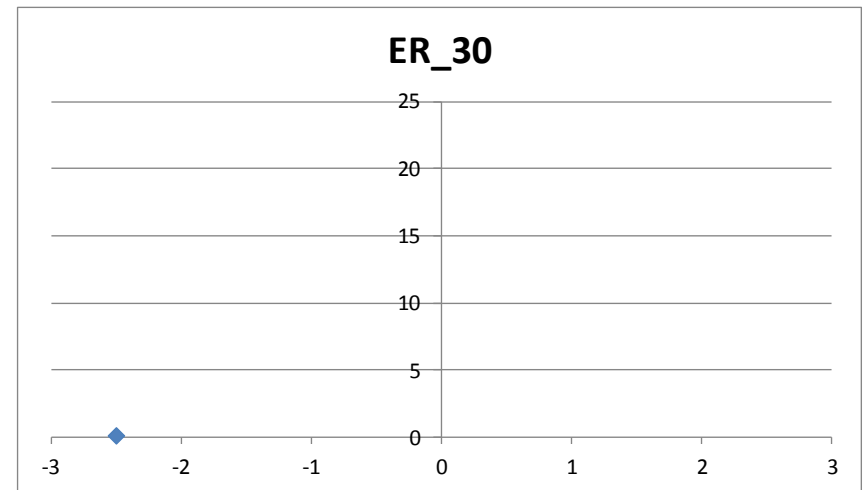
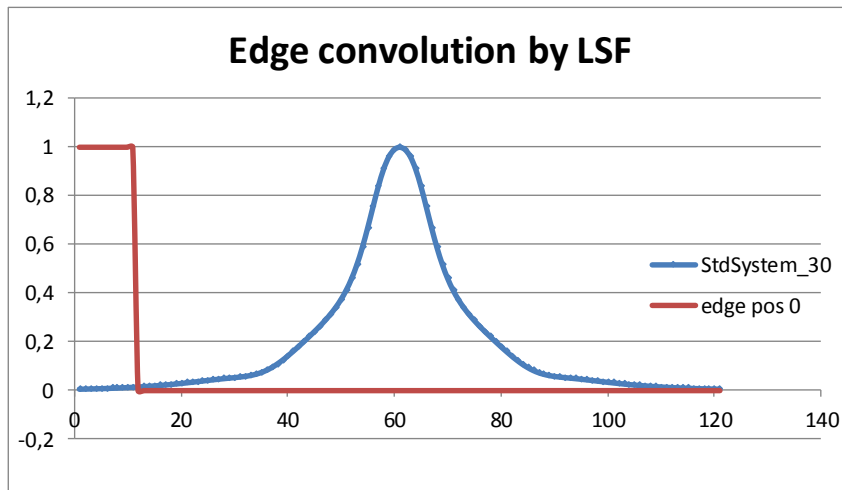
Other metrics

Definition: overshoot H



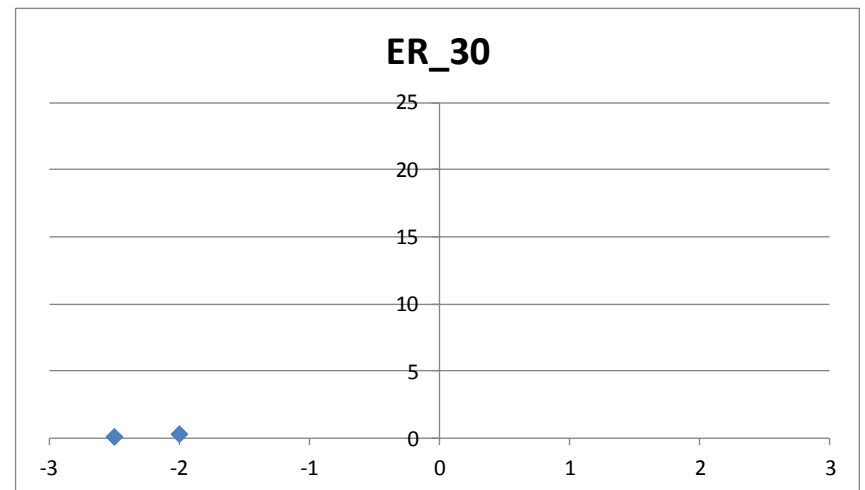
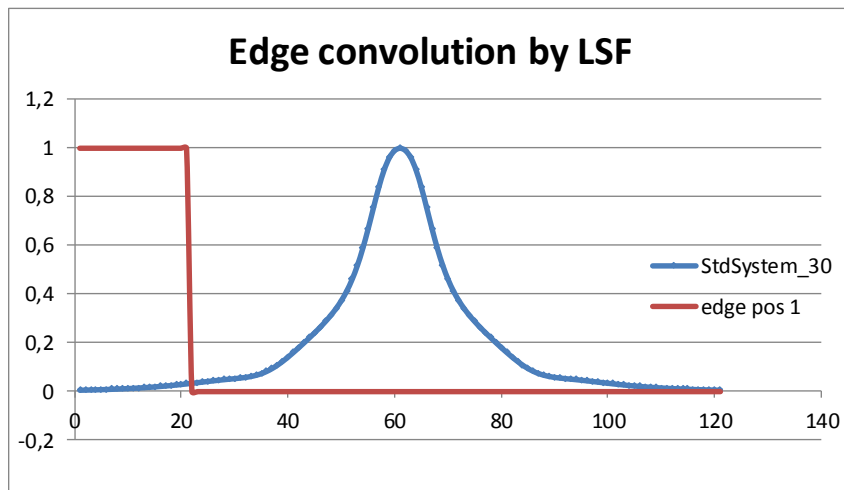
Other metrics

Sensitivity



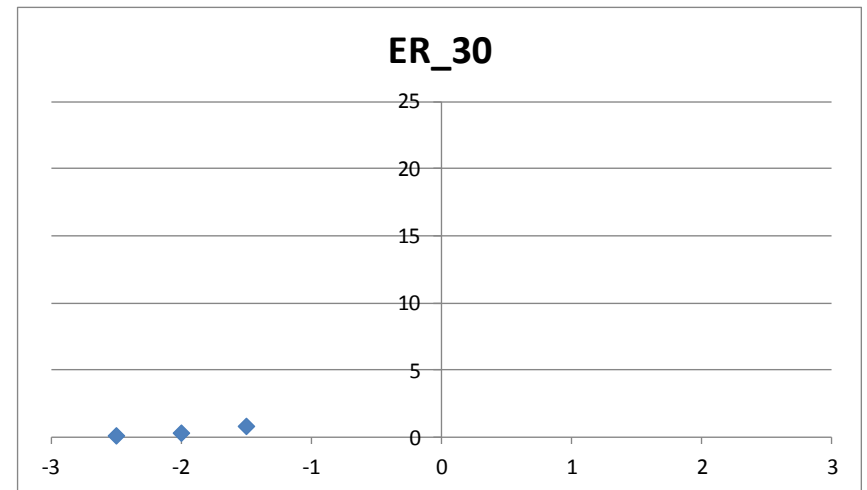
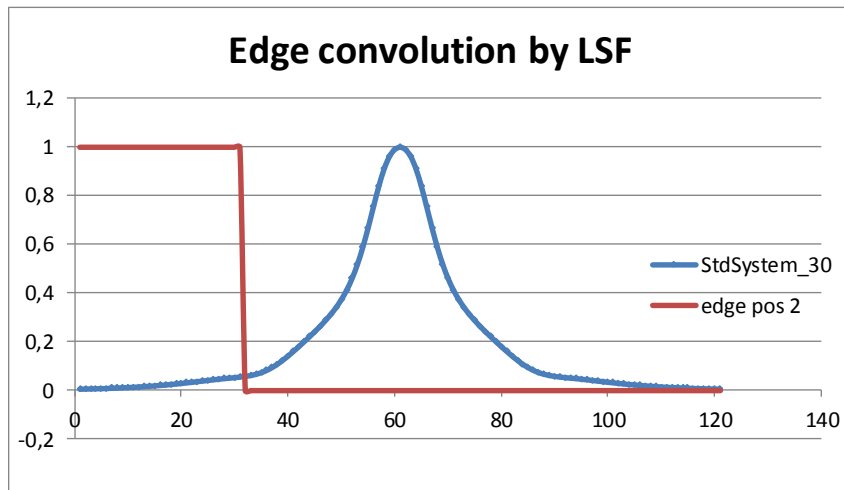
Other metrics

Sensitivity



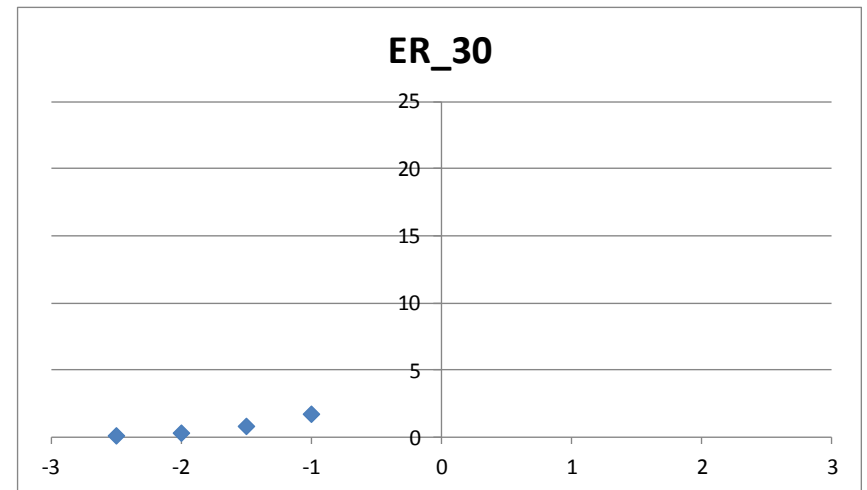
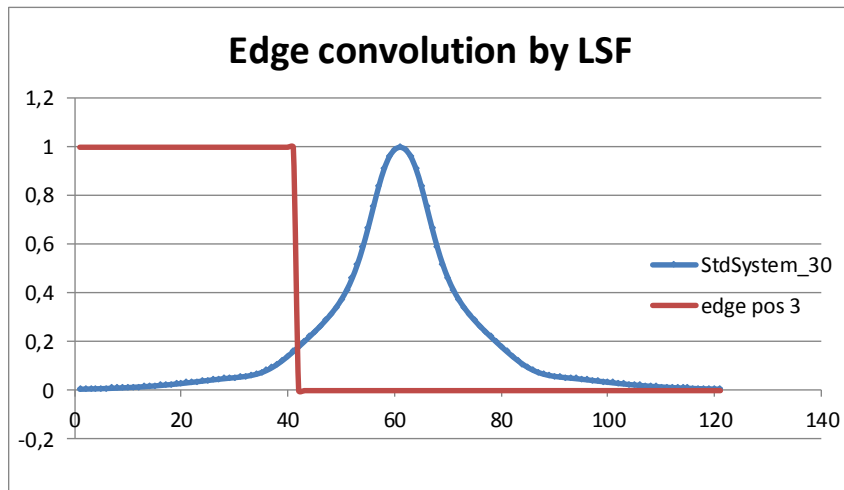
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Sensitivity



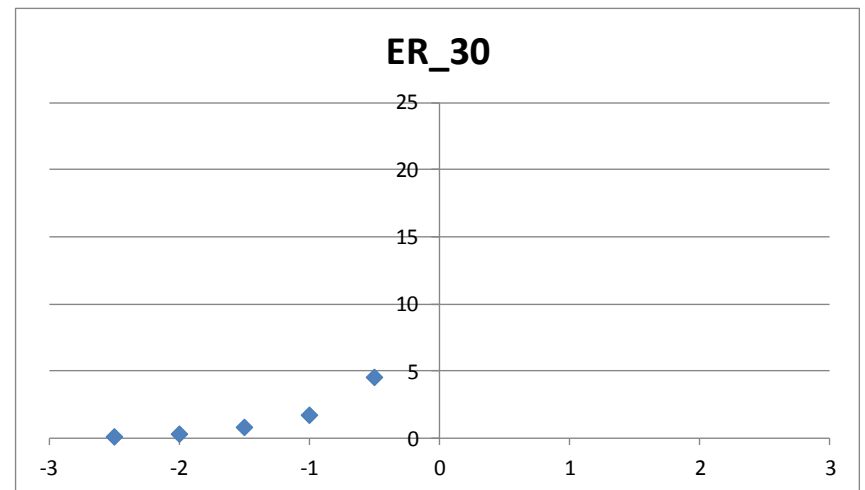
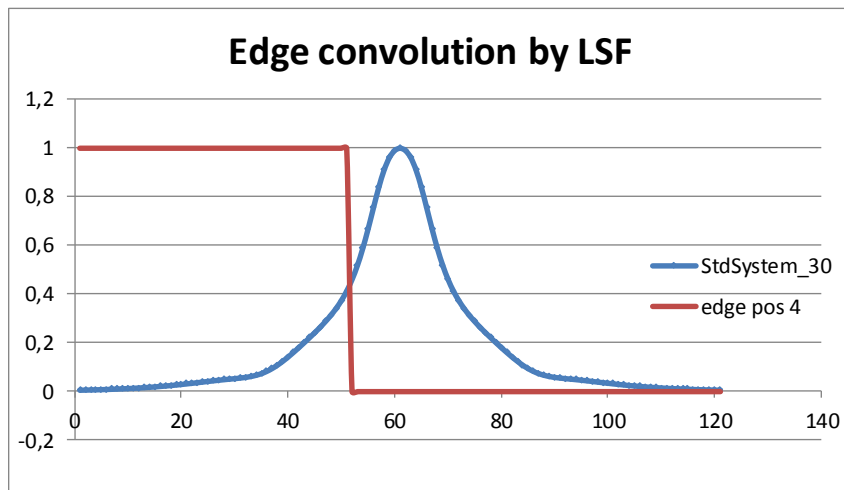
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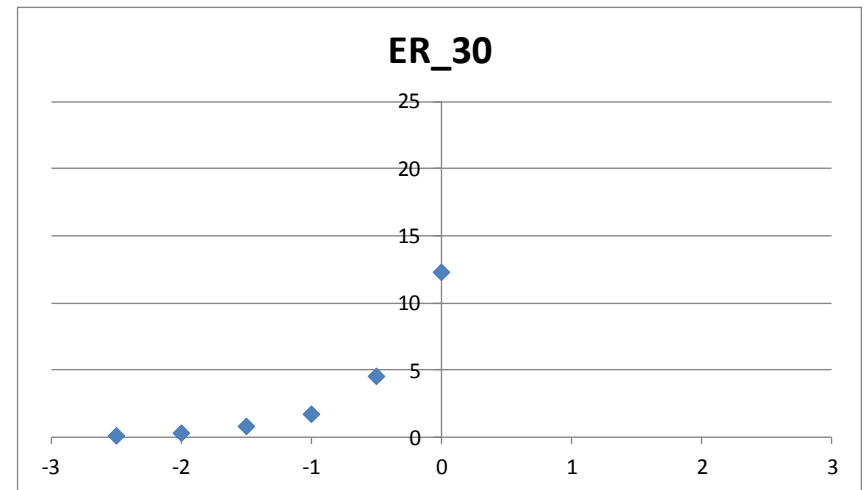
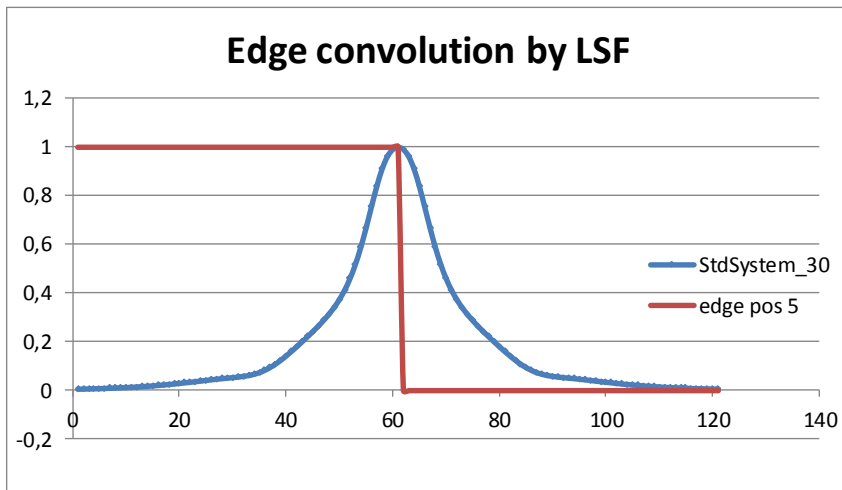
Other metrics

Sensitivity



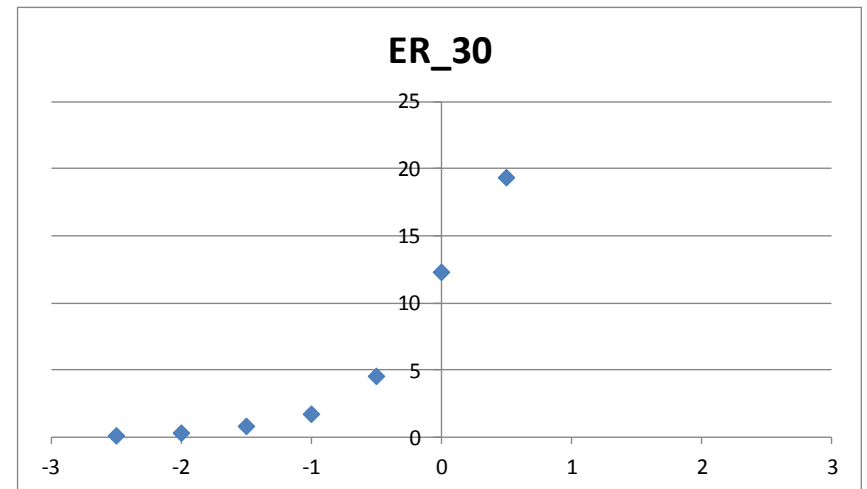
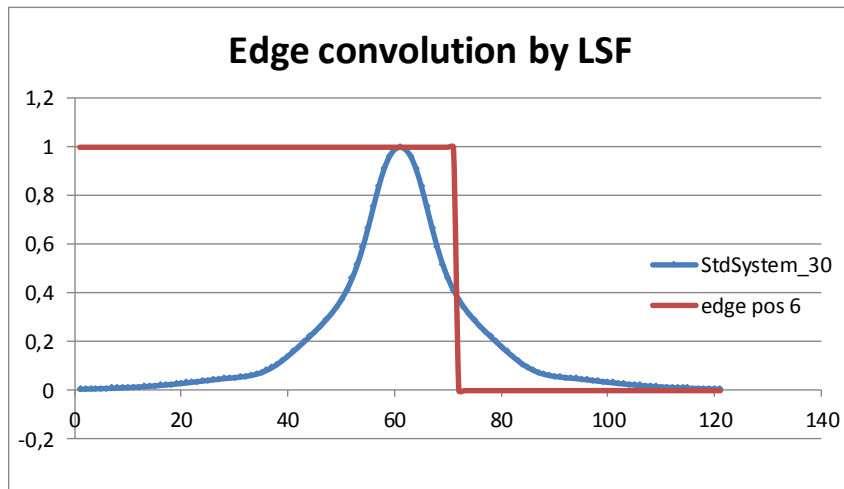
Other metrics

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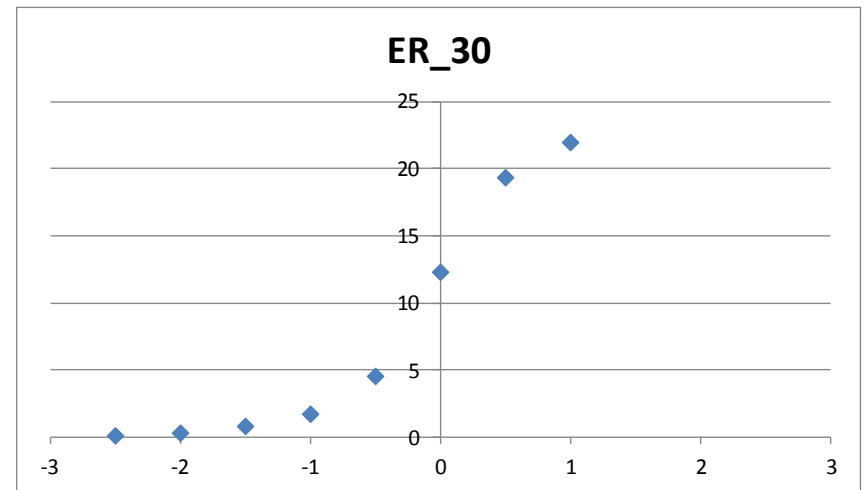
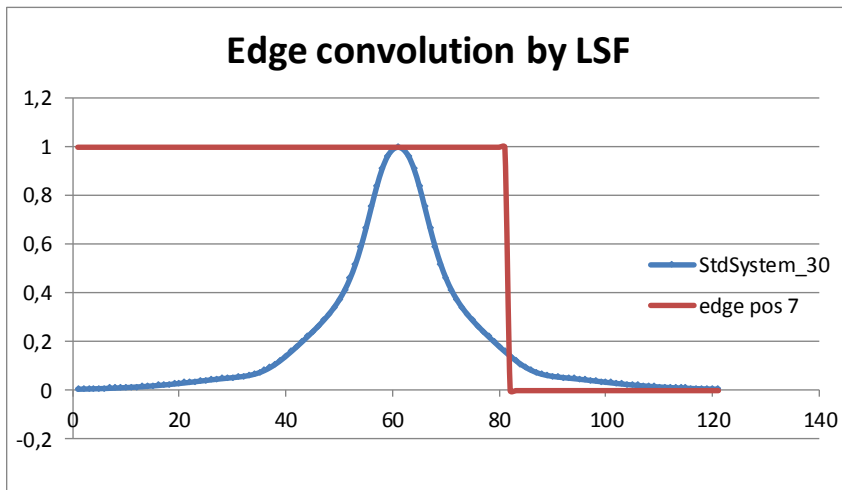
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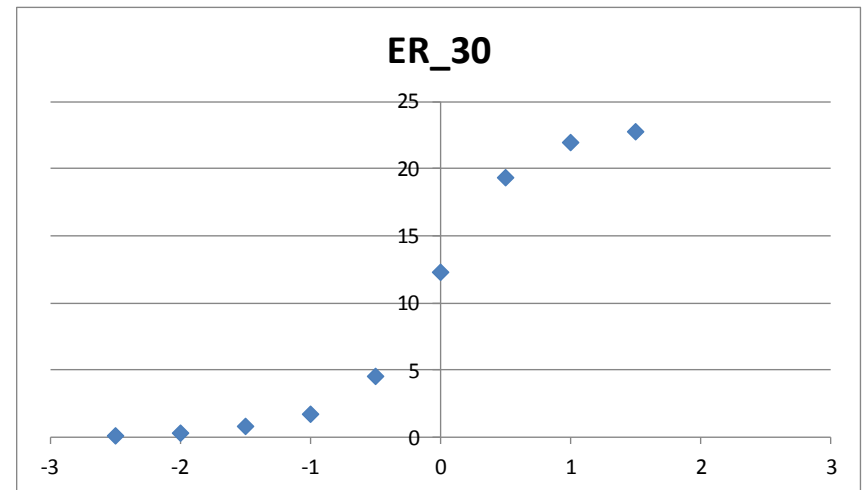
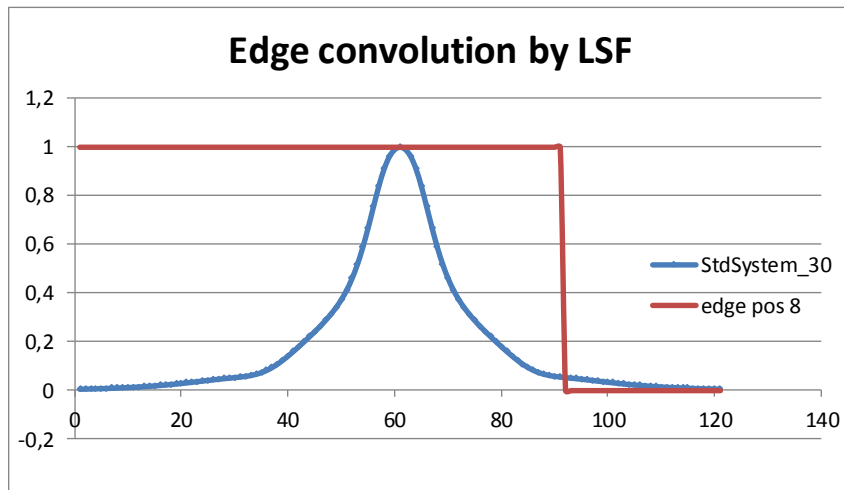
Other metrics

Sensitivity



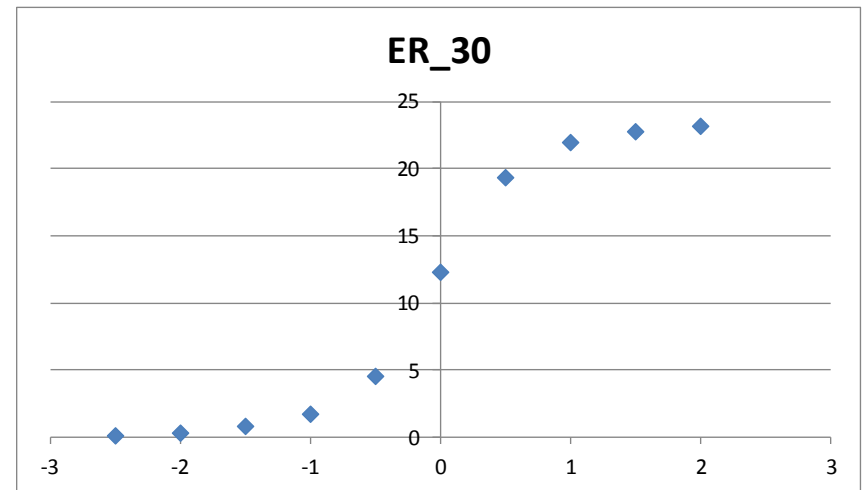
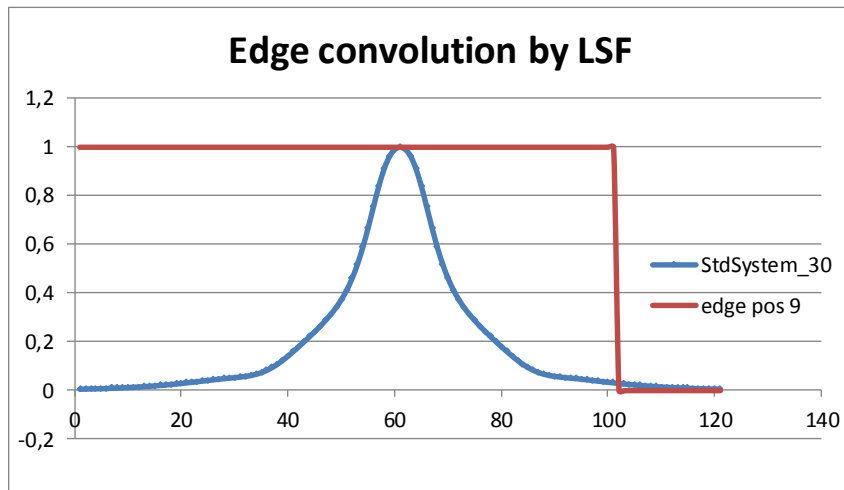
Other metrics

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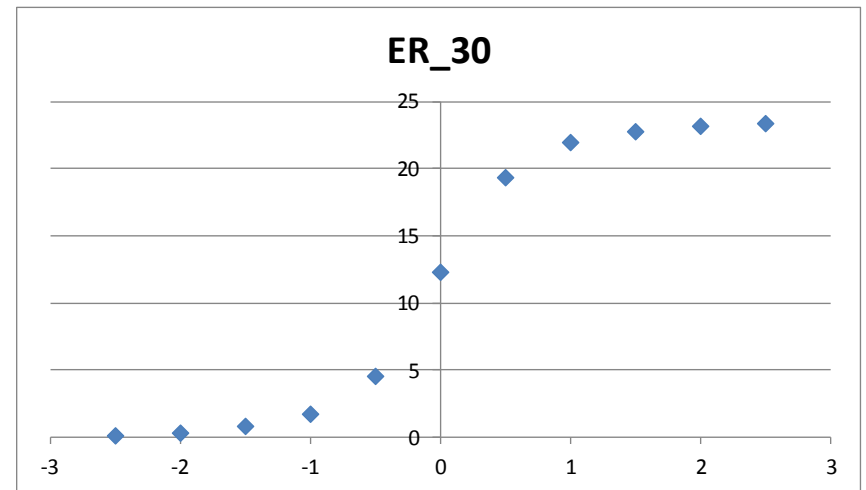
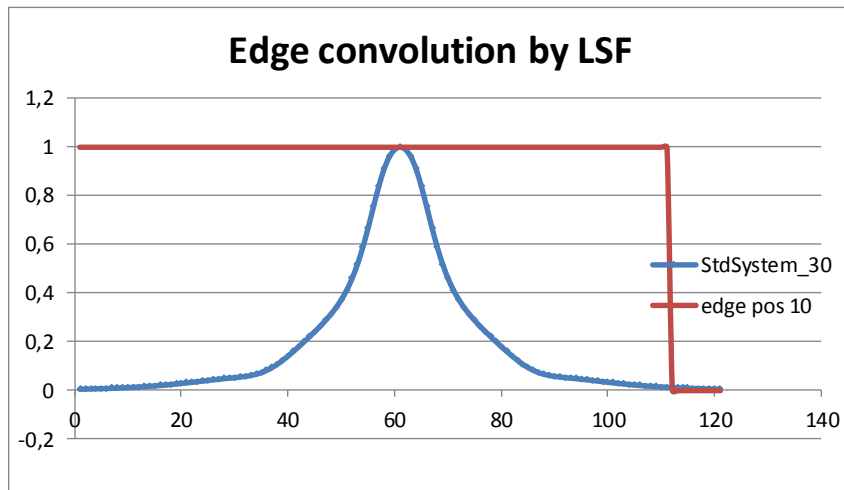
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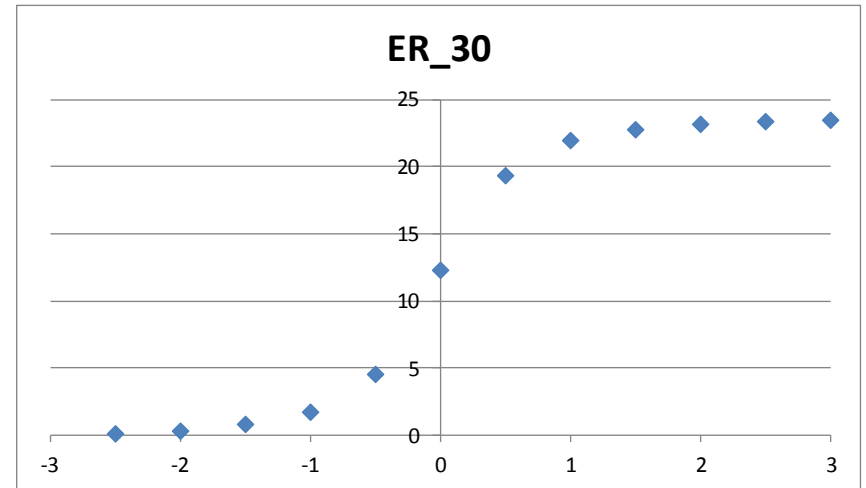
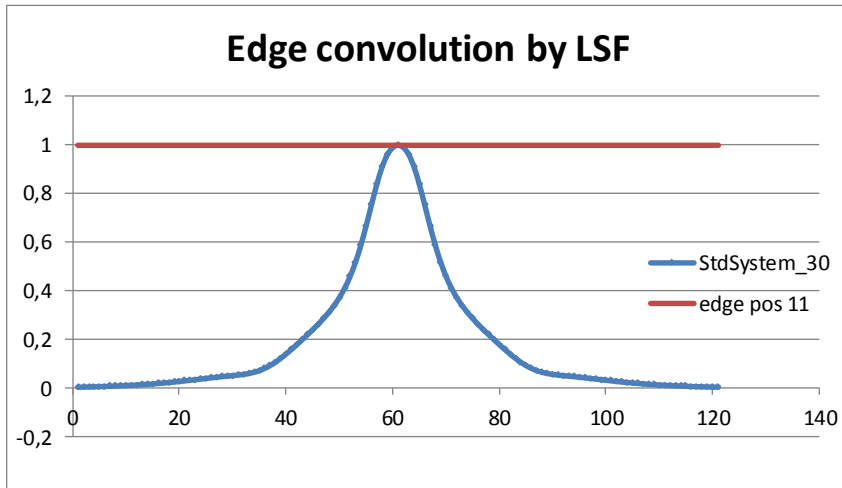
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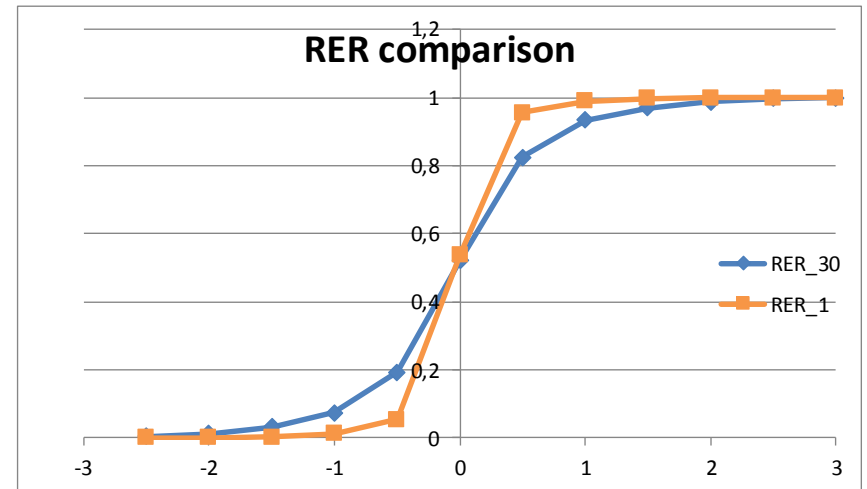
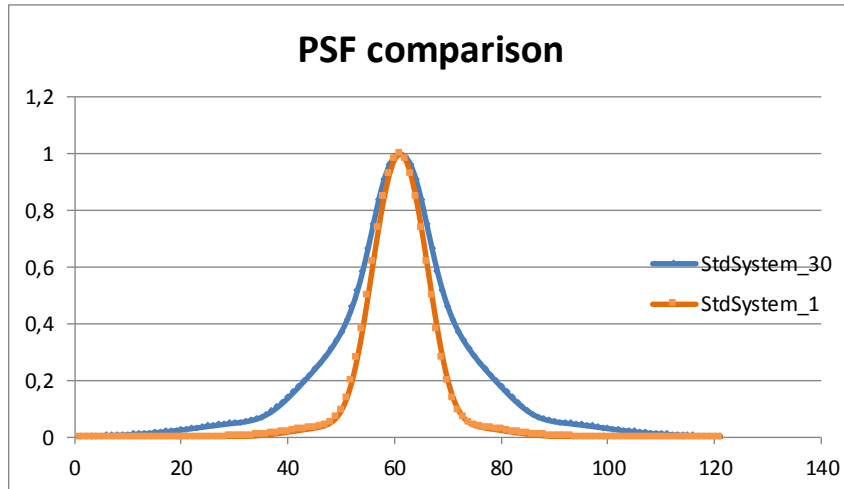
Other metrics

Sensitivity



Other metrics

Sensitivity



Other metrics

	Aims	Interest/Drawback	Sensitivity
RER			
RER slope			
FWHM			
H			

Other metrics

HighPriority DataSet	RER	RER slope	FWHM	FW25 %M	FW80%M	SNR (definition to check)
KARI	X	X	X	X	X	X
SDSU	X	X				X
TZ	X		X			X
CSIR						
ONERA	X	X				
Airbus DS						
Digital Globe						