Towards robust pre-processing of kHz-rate laser observations

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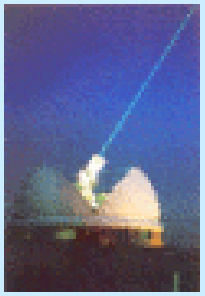


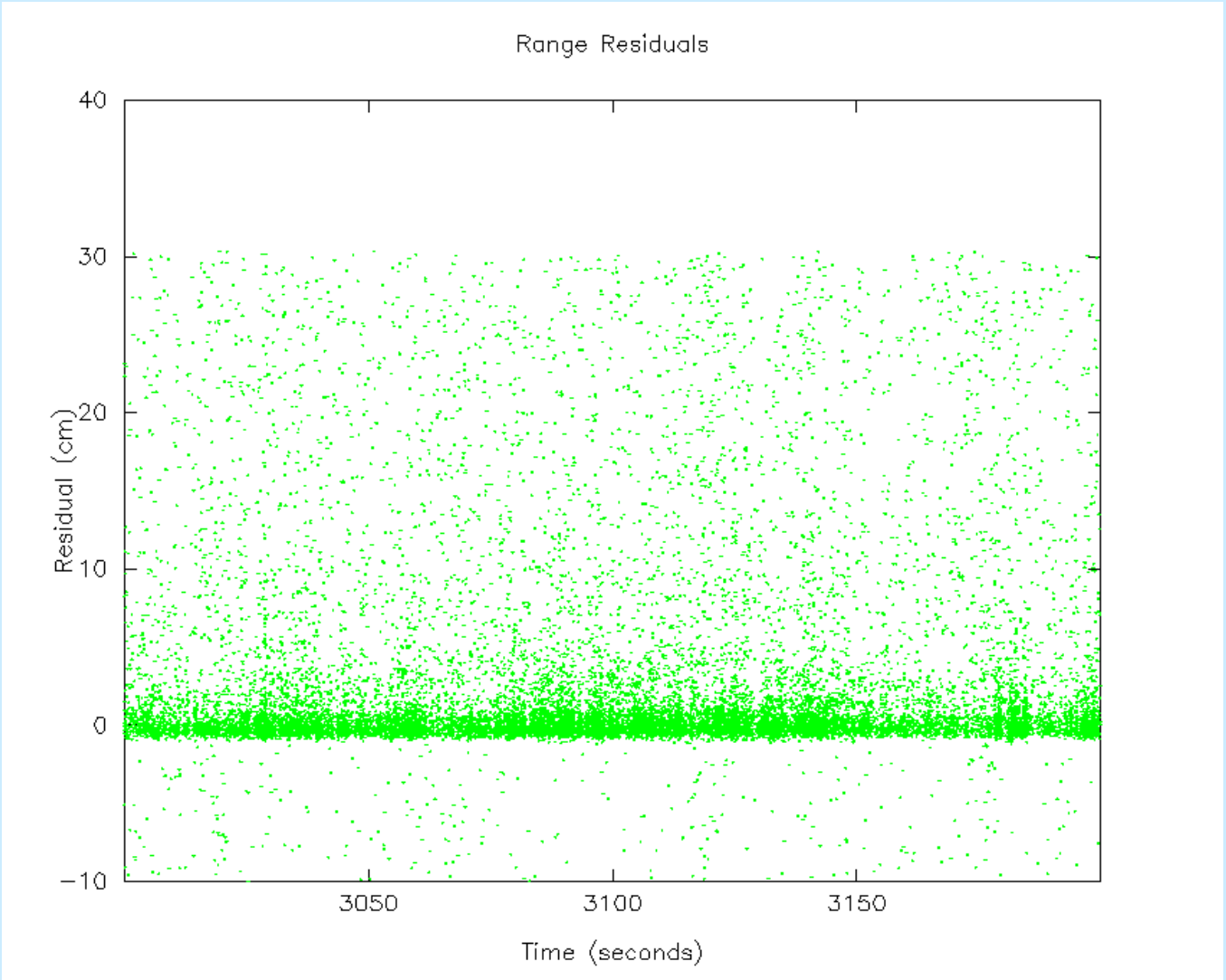
Advantages

- Very short pulse length of the laser (10ps cf ~100ps for 10Hz laser);
- + the SGF single-photon policy;
- + hi-resolution of event timer:
  - the measurements probe in fine detail the targets' geometries and lead to complex structure in de-trended O-C plots

Caution

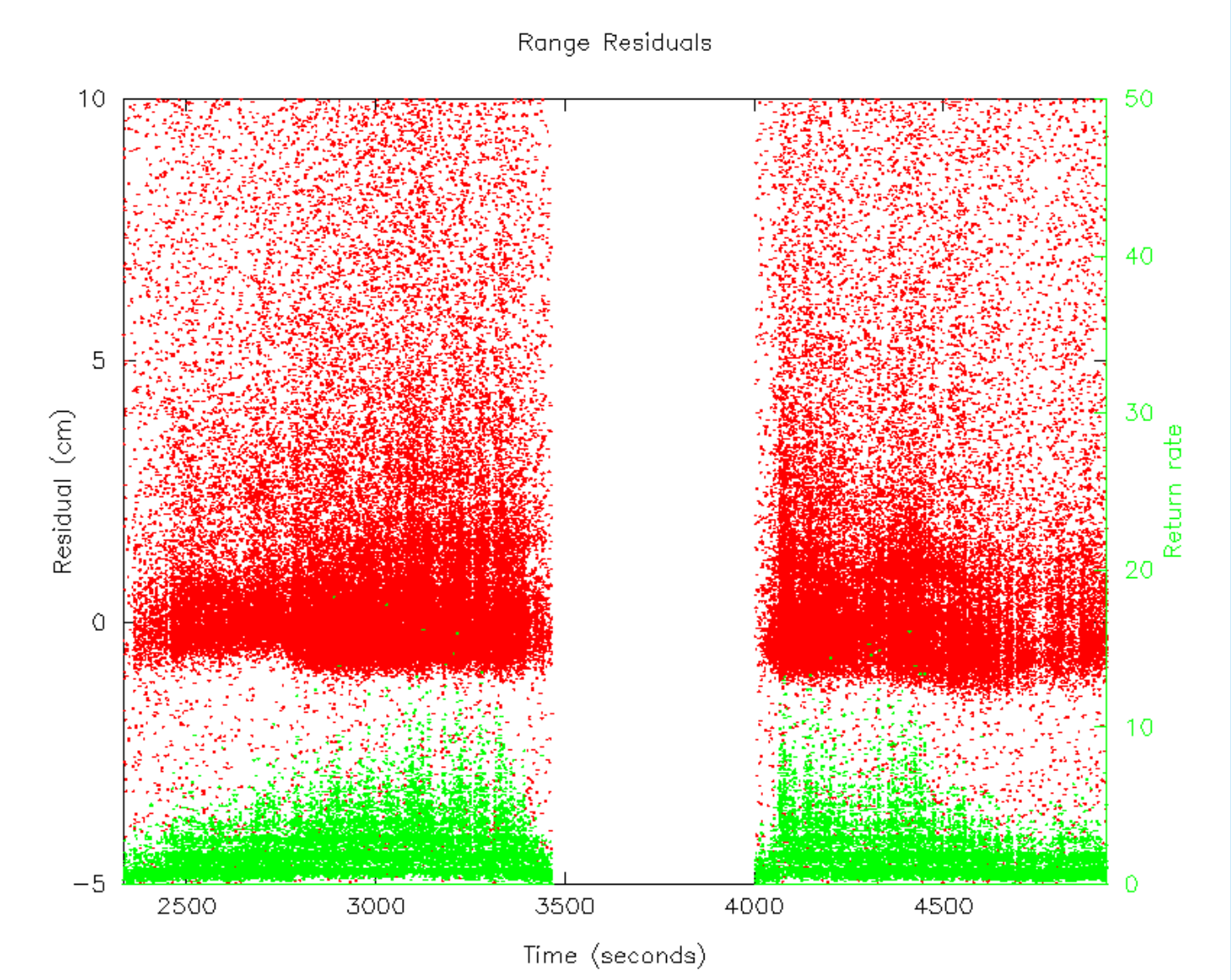
- Particular emphasis on processing LAGEOS:
- Very important to provide continuity with existing long series of 10Hz data from the site;
- Must not introduce apparent system jump:
  - Different CoM for kHz than for 10Hz (245mm)?
- Especially important if sometimes revert to 10Hz
  - (but Georg says ‘once you use kHz, never want to go back’!)
- Work in progress – model of LAGEOS response compared with Herstmonceux kHz data.
- Develop noise rejection strategy and CoM value.

kHz data – few minutes of LAGEOS

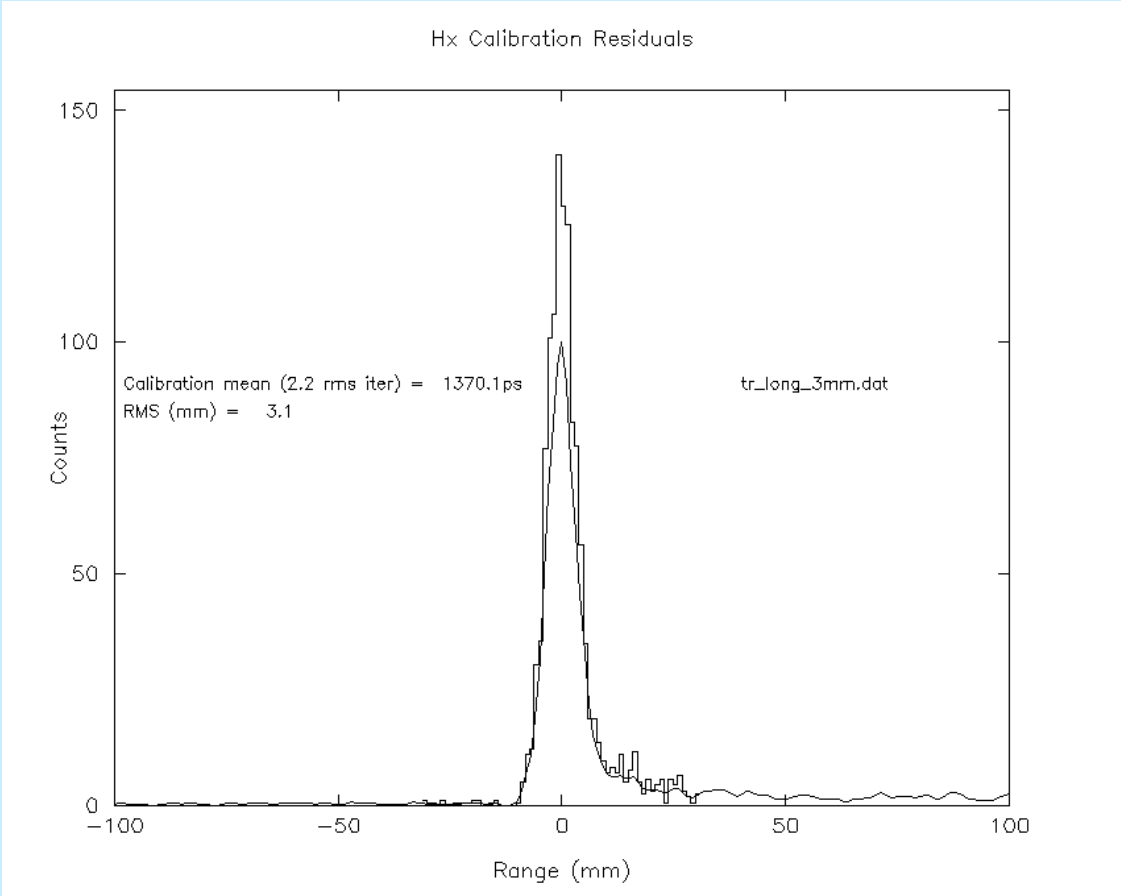


De-trended by tight O-C selection, orbit fit, then applied to wide selection

Return-rate statistics – mean ~ 3%, max 10%

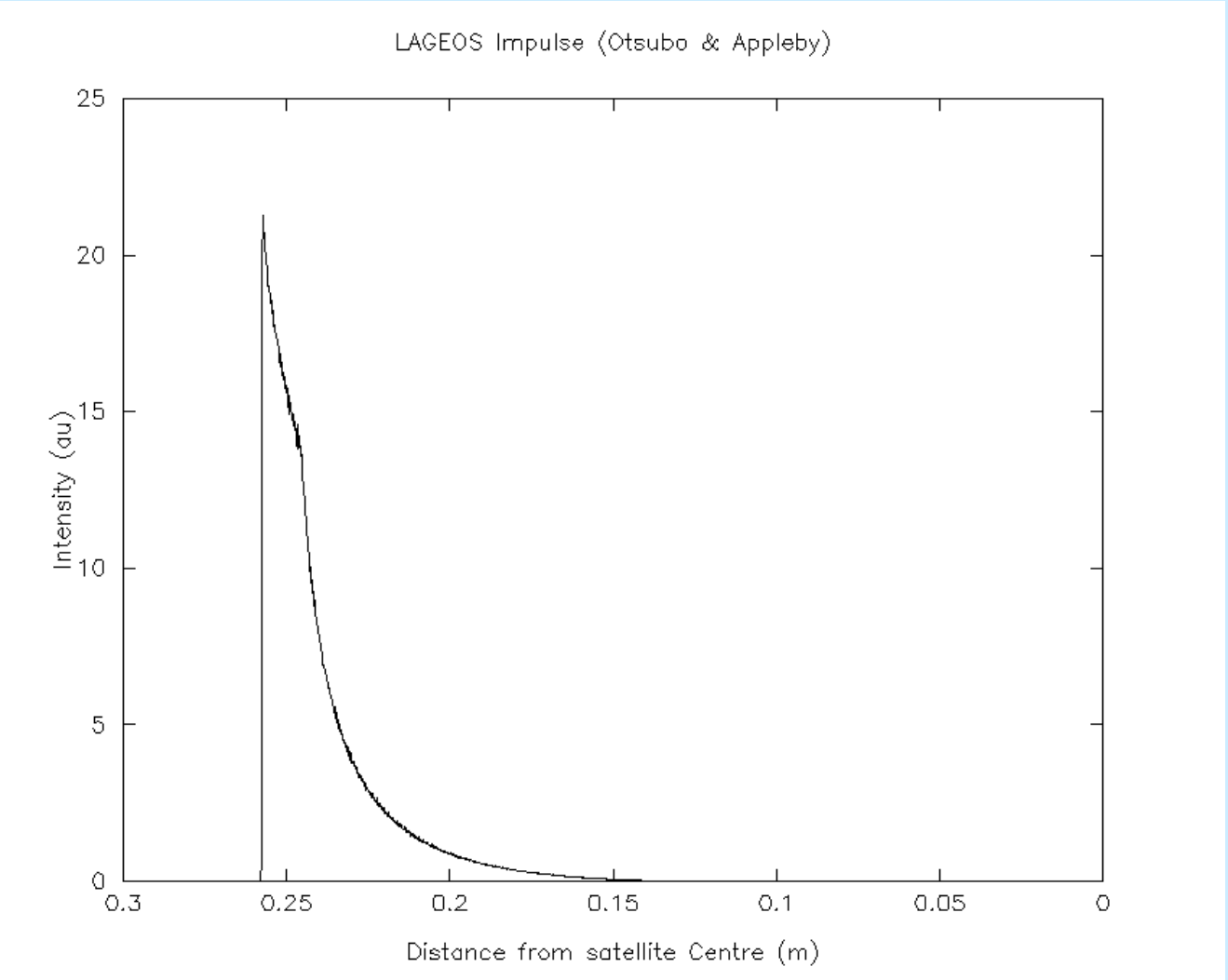


At single-photon, expect distribution of de-trended residuals to be convolution of whole-system response with LAGEOS impulse

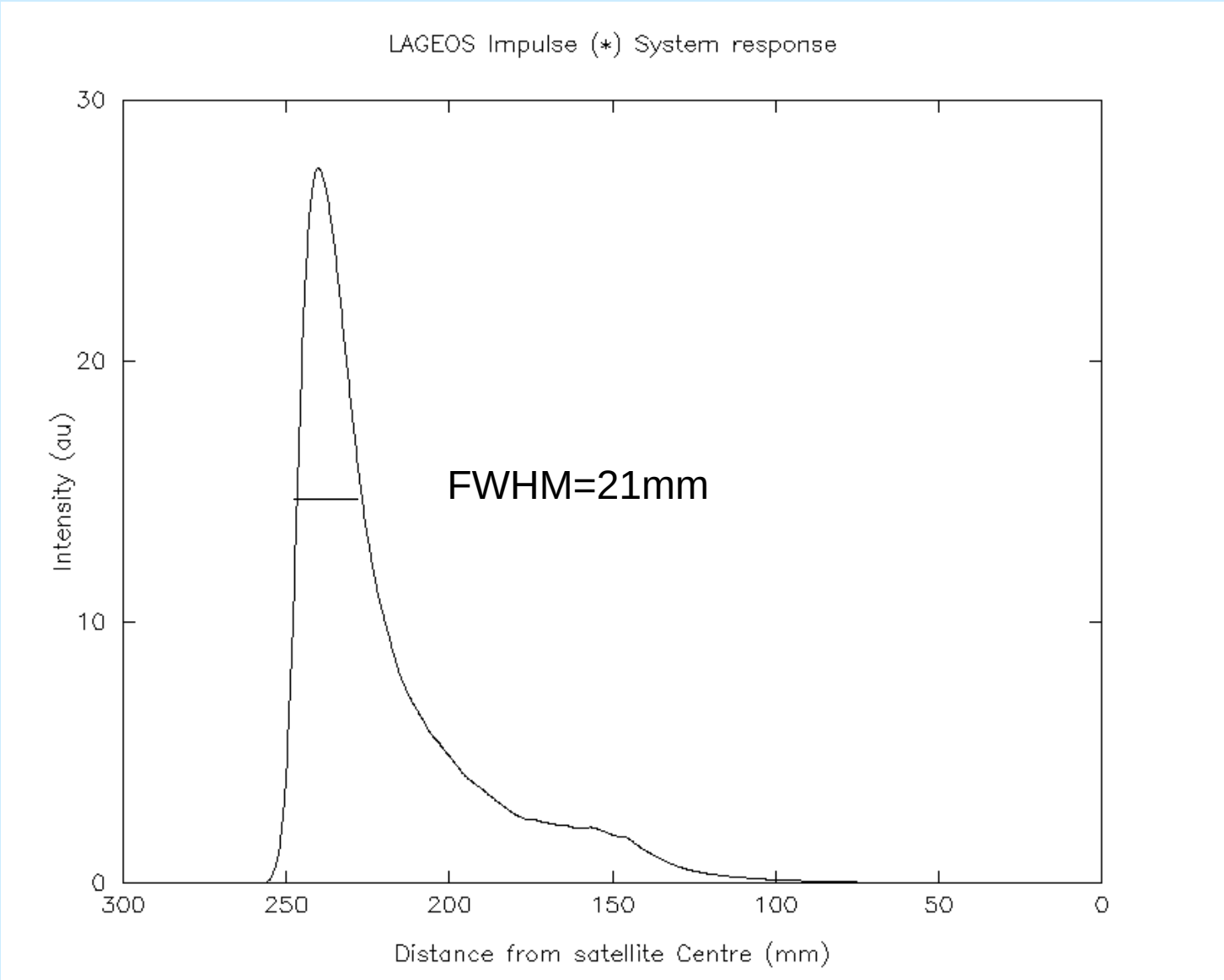


System response obtained from target-board ranging at << single photons

LAGEOS impulse (Otsubo & Appleby, 2003)



System (∗) LAGEOS



Comments

- Distribution is ‘very’ non-Gaussian
- Simple (3σ) iteration for noise removal not recommended:
  - Tends to include ‘short’ noise
- Looking at scheme to estimate σ from well-defined FWHM:
  - Then reject at -1.5σ, +3σ
- Model suggests FWHM=21mm, σ=9mm
  - In practice, getting σ of 8.5 to 9mm
- Plus CoM ~245±1mm (prelim) for mean value processing.

Real data from a pass processed using this scheme.
σ = 8.5mm: data will be rejected at -12 and +25mm