S2/S3 Calibration

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For the Calibration Team (cast of thousands!)

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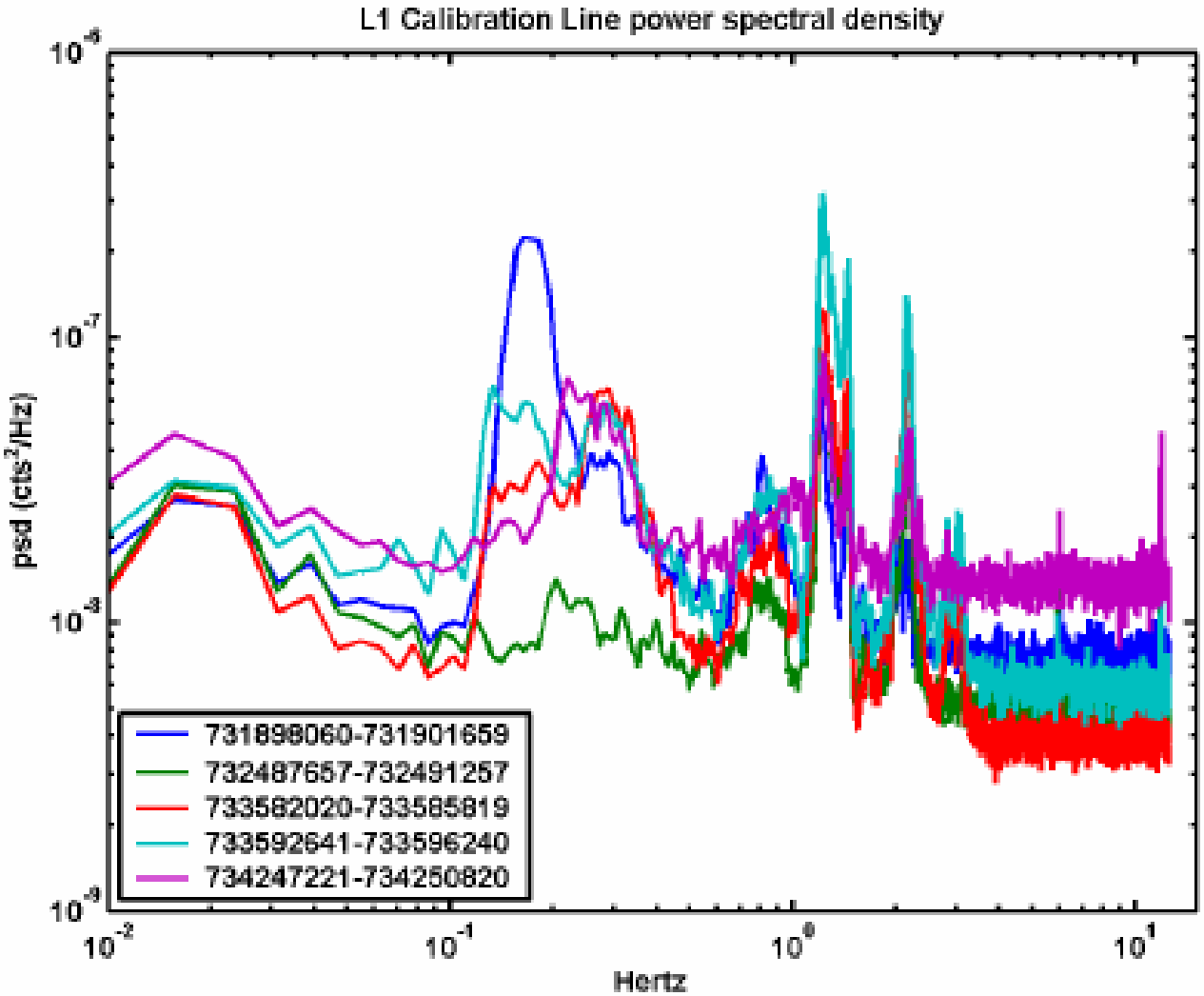
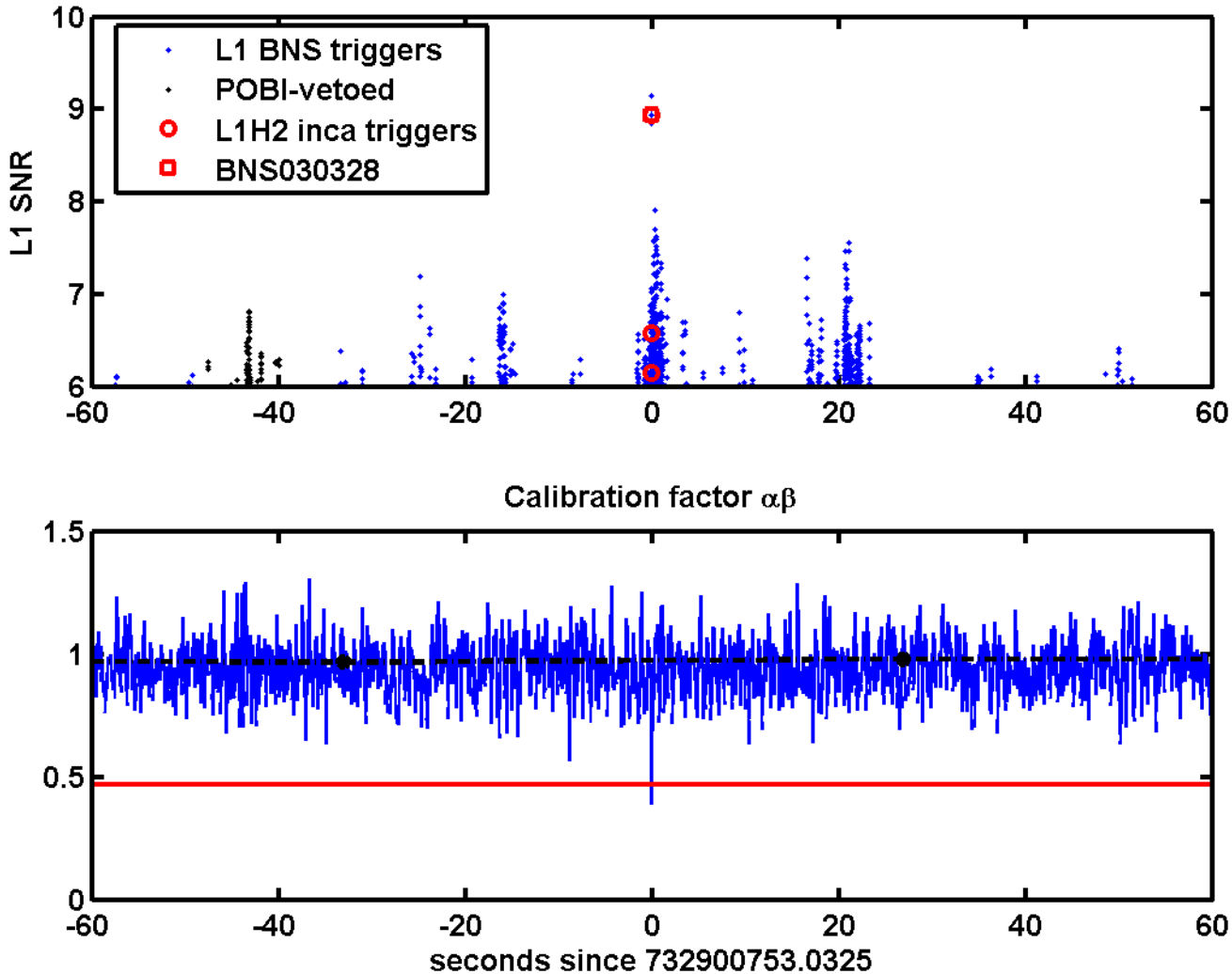
S2 calibration

- Final calibration done a long time ago
- Comprehensive S2 error document T040060 (to use as reference in papers) with error estimates.
  - Random errors in α:
    - L1: 2% before 731714478, and 0.5% afterwards.
    - H1: 6% before 730793022, and 2% afterwards.
    - H2: 3%.
  - Fast fluctuations estimates: 10% in L1

“Fast” fluctuations



Fast fluctuations: new DQ flag?



S3 calibration

- V2 (presented at June meeting)
- V3 (Final!) coming soon. To do list:
  - Alphas, betas from demodulated lines
  - Update models for alpha, beta consistency
  - Incorporate hardware measurements in LHO models
  - Validation (autocal, review!)

Review Committee

- **Albert Lazzarini (chair), David Shoemaker, Rai Weiss** (Thanks!)
- Charge:

The primary goal of the Calibration Review Committee is to **ensure the validity of the procedures used in calibration, and also to validate the results of those procedures**, starting with the S3 calibration. (With reference to S2 where it is helpful.) Issues include:

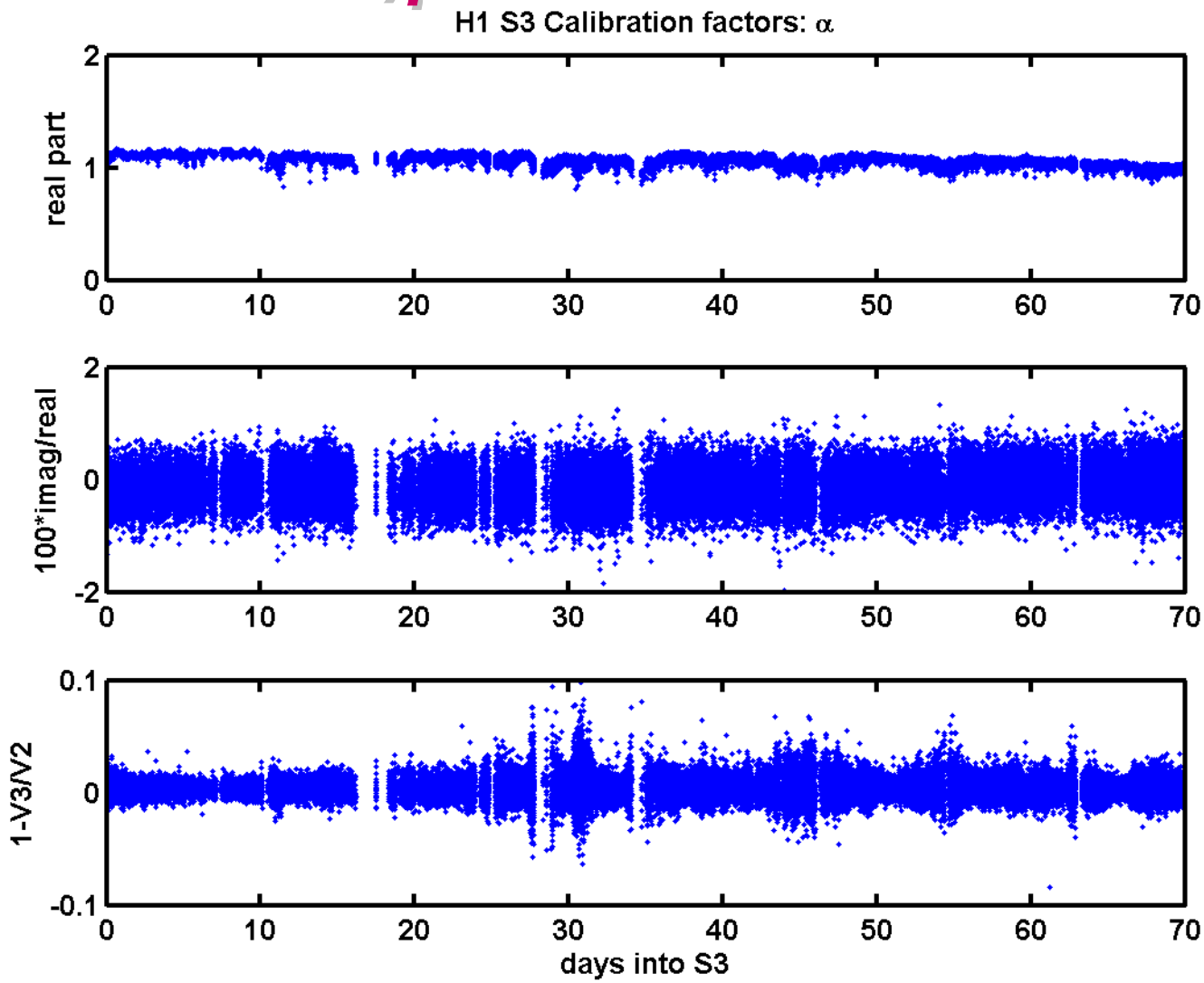
- DC calibration of test masses
- Matlab models used
- Data quality of measurements taken (reference functions, line amplitude, hardware measurements)
- comparisons with autocal results
- requirements for sampling time from analysis groups

It would also be valuable to assess present calibration techniques and results in a wider context, in particular in terms of whether achievable calibration accuracy meets the scientific needs of the various analyses, and also what new methods might give good progress in the future. The Calibration Review Committee should also consider these issues if possible, or make recommendations about how the LSC should assess these larger questions.

S3 V3 α,β coefficients

- V2 (from P. Sutton's SenseMon)
  - β from SenseMon averaging input matrix
  - α from SenseMon's line amp, β, and $G_0(f_0)$
- V3 (from Xavier Siemens's h(t) code)
  - Complex β from demod
    $(1/D_0)*(DARM-EXC)/ASQ$
  - Complex α from demod
    $(-D_0/G_0)*ASQ/DARM$
  - Non-zero mean of imaginary part indicates errors in reference functions D0,G0 (at cal freq), or in model.
  - Standard deviations of imaginary parts are error estimates in real part (and depend on sampling frequency).

S3 V3 α,β coefficients: H1



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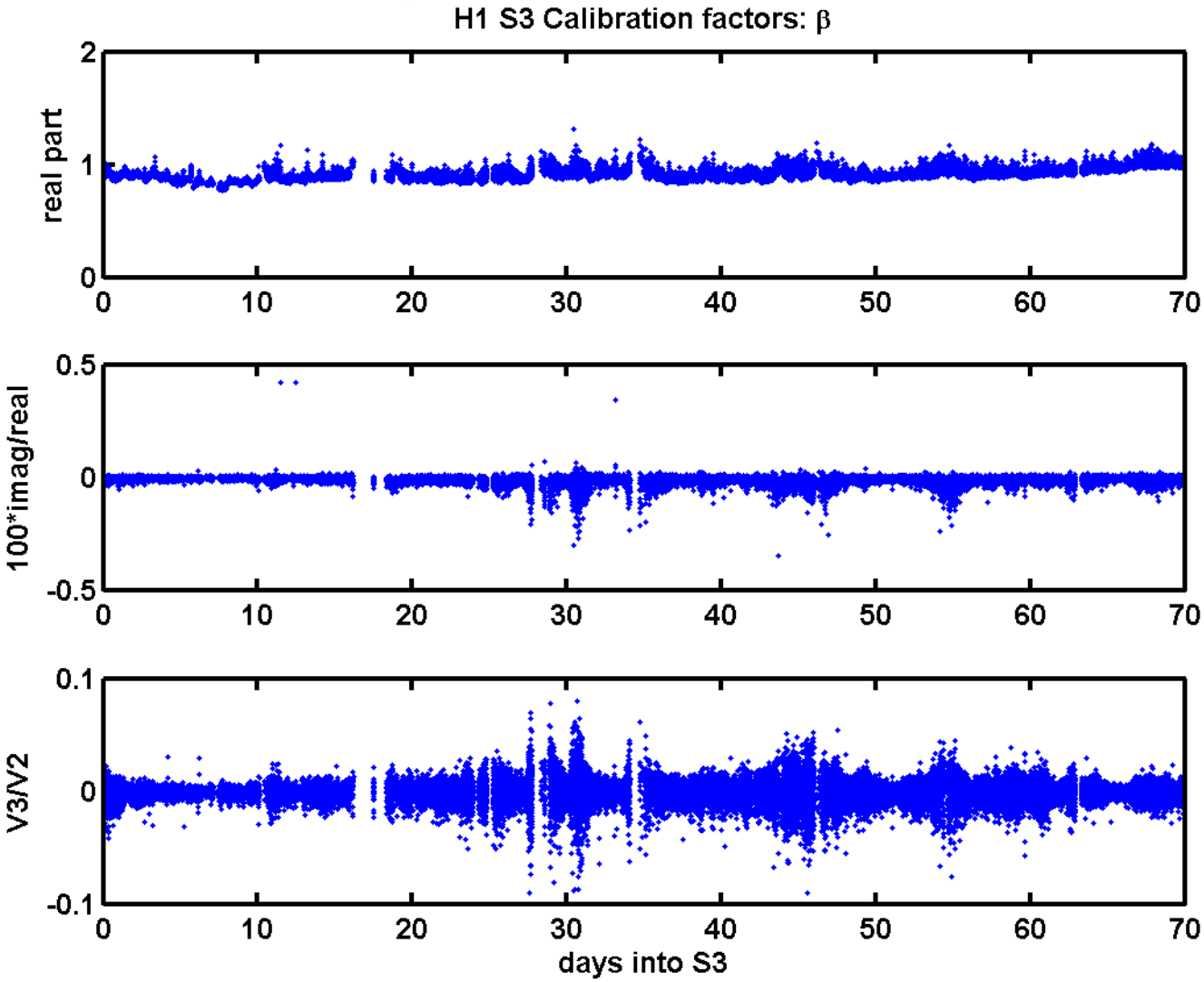
S3 V3 α,β coefficients: H1



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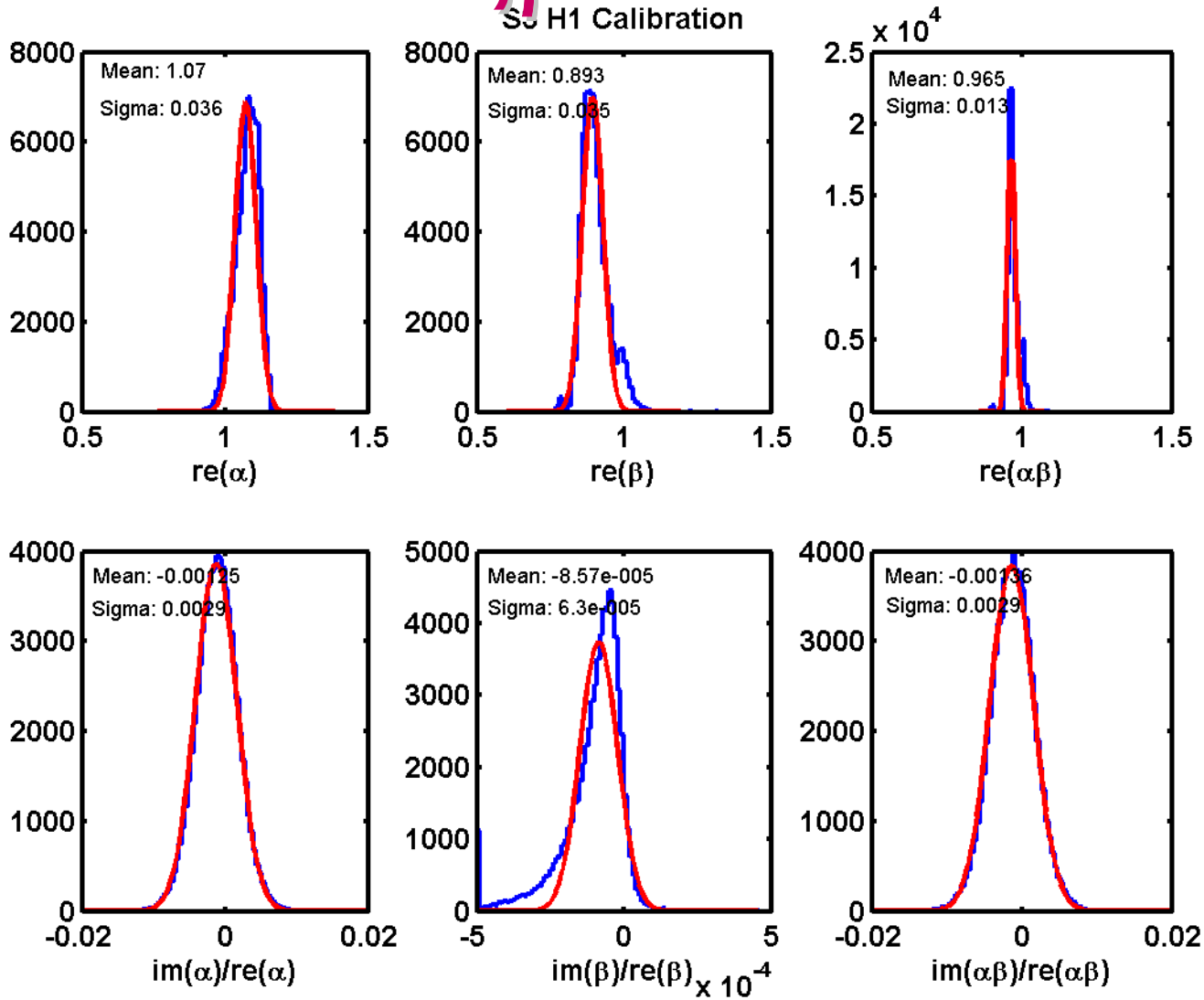
S3 V3 α,β coefficients: H1



Over all of S2:

α variation: 4%
αβ variation: 1%

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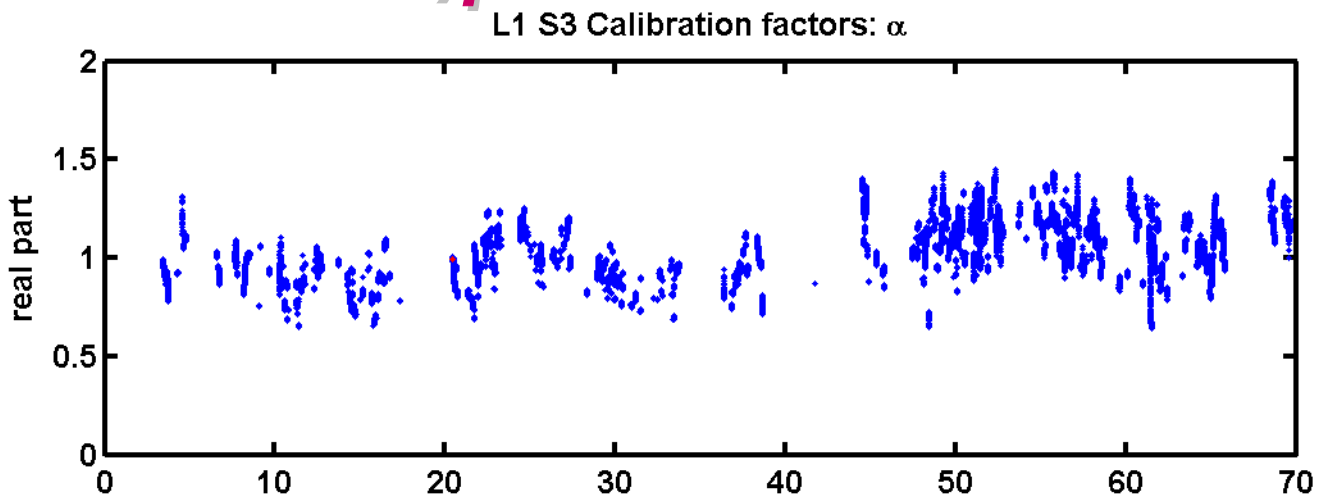
Error:
0.3%

S3 V3 α,β coefficients: L1



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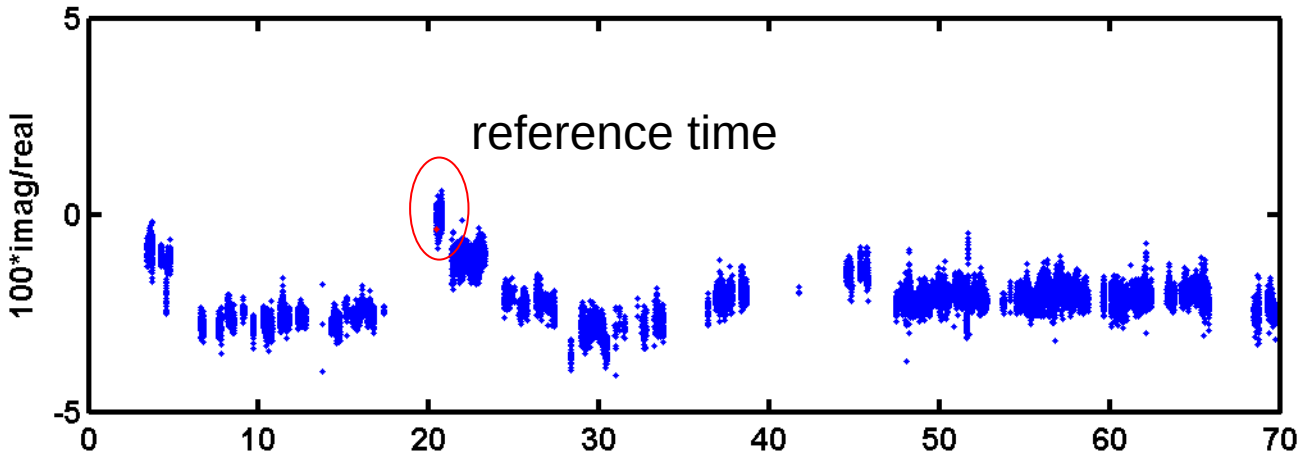
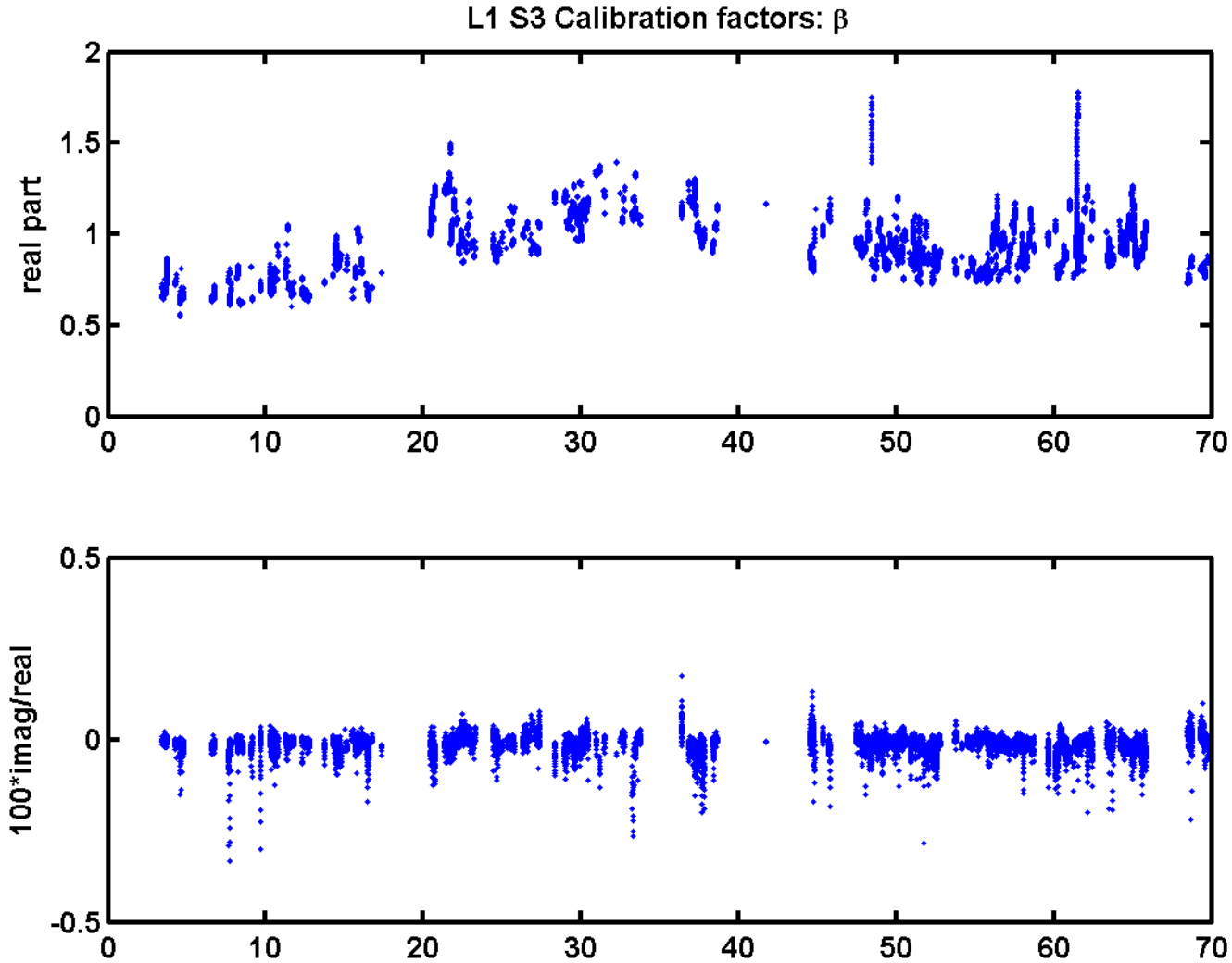
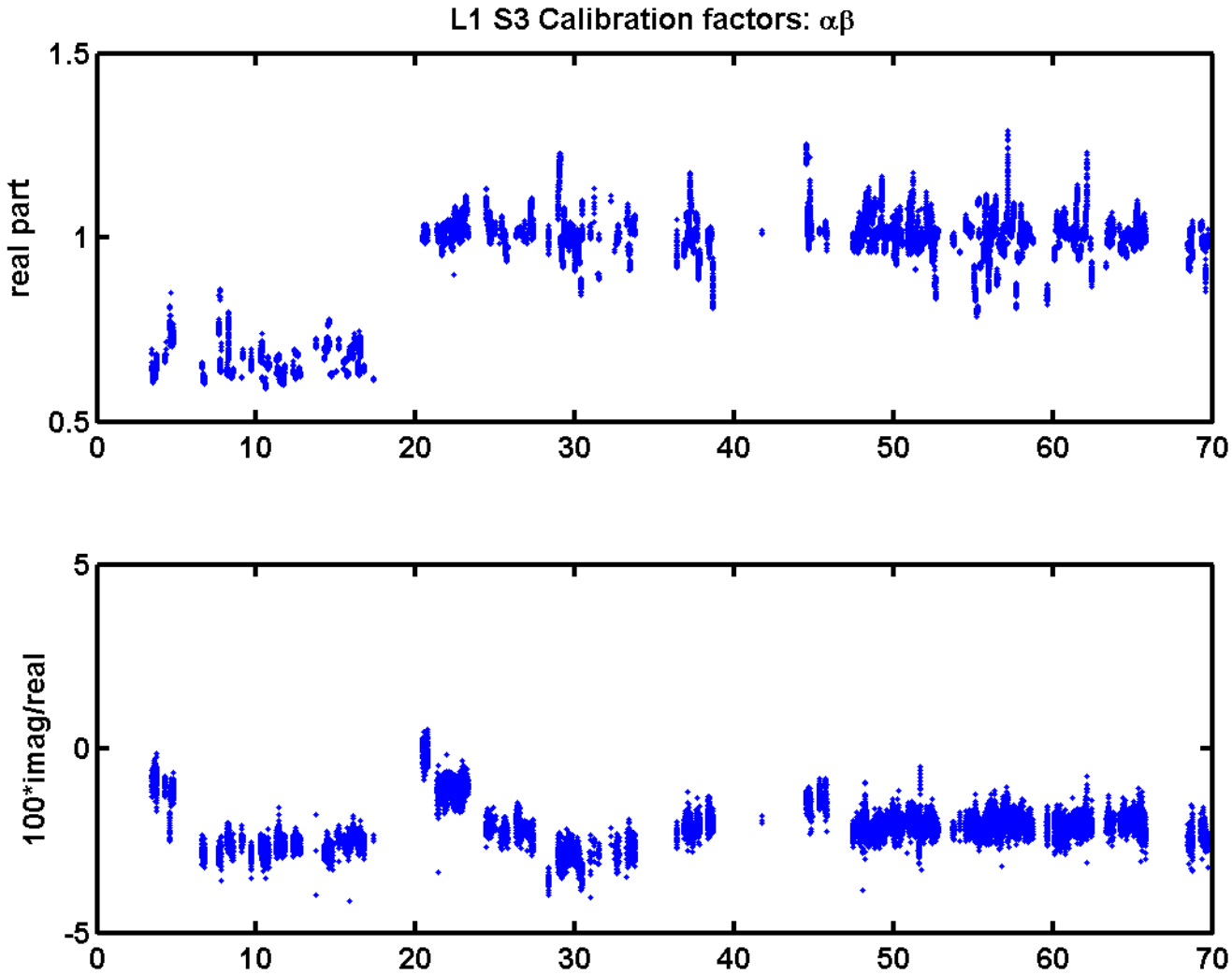


~2°

S3 V3 α,β coefficients: L1



S3 V3 α,β coefficients: L1



Preliminary S3 errors

- Errors from reference models in S3 ~ errors in S2 (5-10%)
- Random variations, errors in alpha, beta (60 sec integration time):

	α error	α S2 variation	$\alpha\beta$ S2 variation
L1	0.5%	15%	5%
H1	0.3%	4%	1%
H2	0.7%	6%	2%

Future (S4)

- Photon calibrator: good progress!
- DC/AC calibration: LLO/LHO consistent measurements (HEPI!)
- Loop parameters, data quality indicators from calibration
- Pre-run estimates of calibration reliability
- Faster estimates of (smaller?) calibration fluctuations