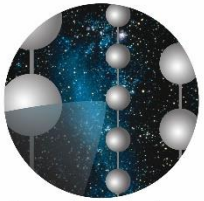
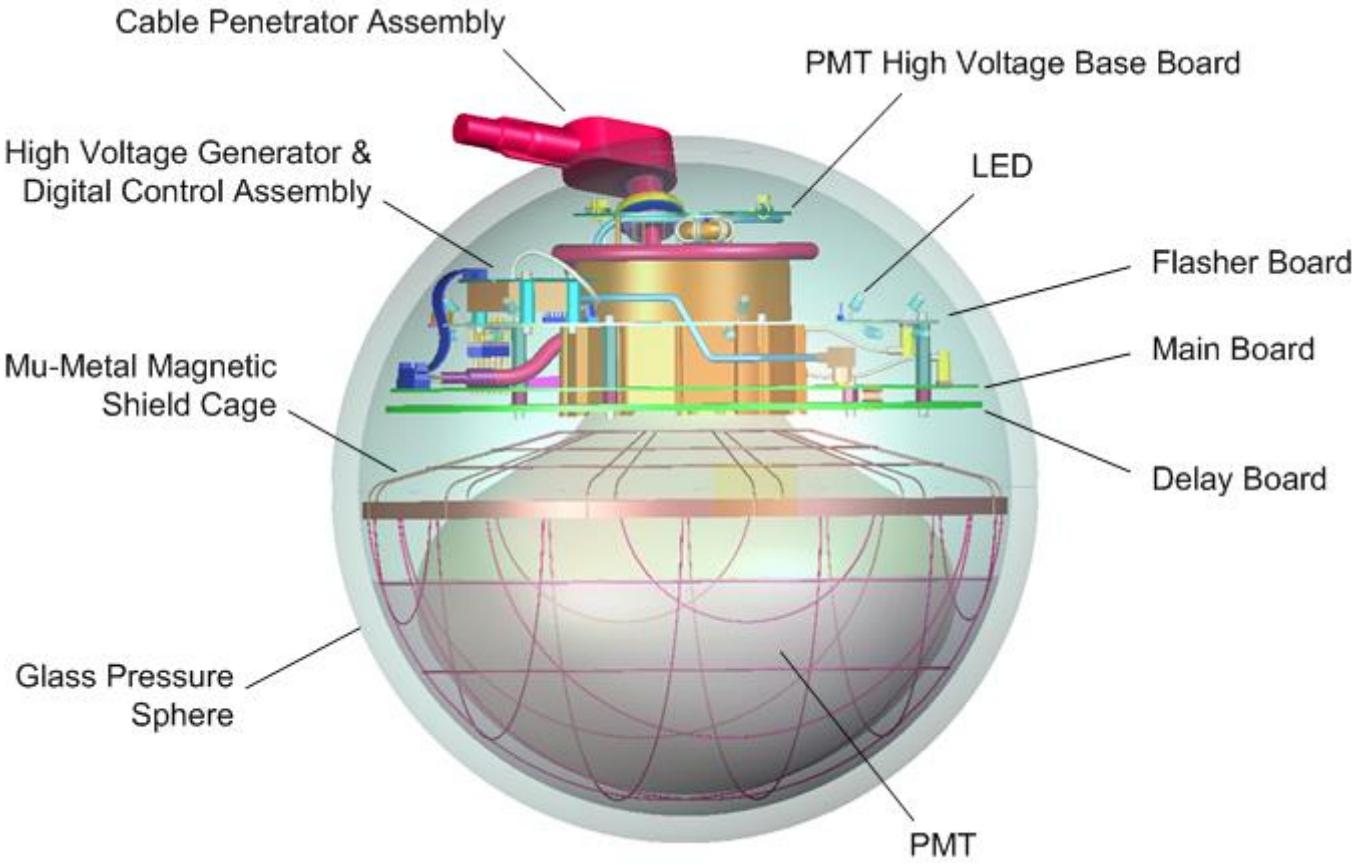


Low Brightness Flashers Analysis

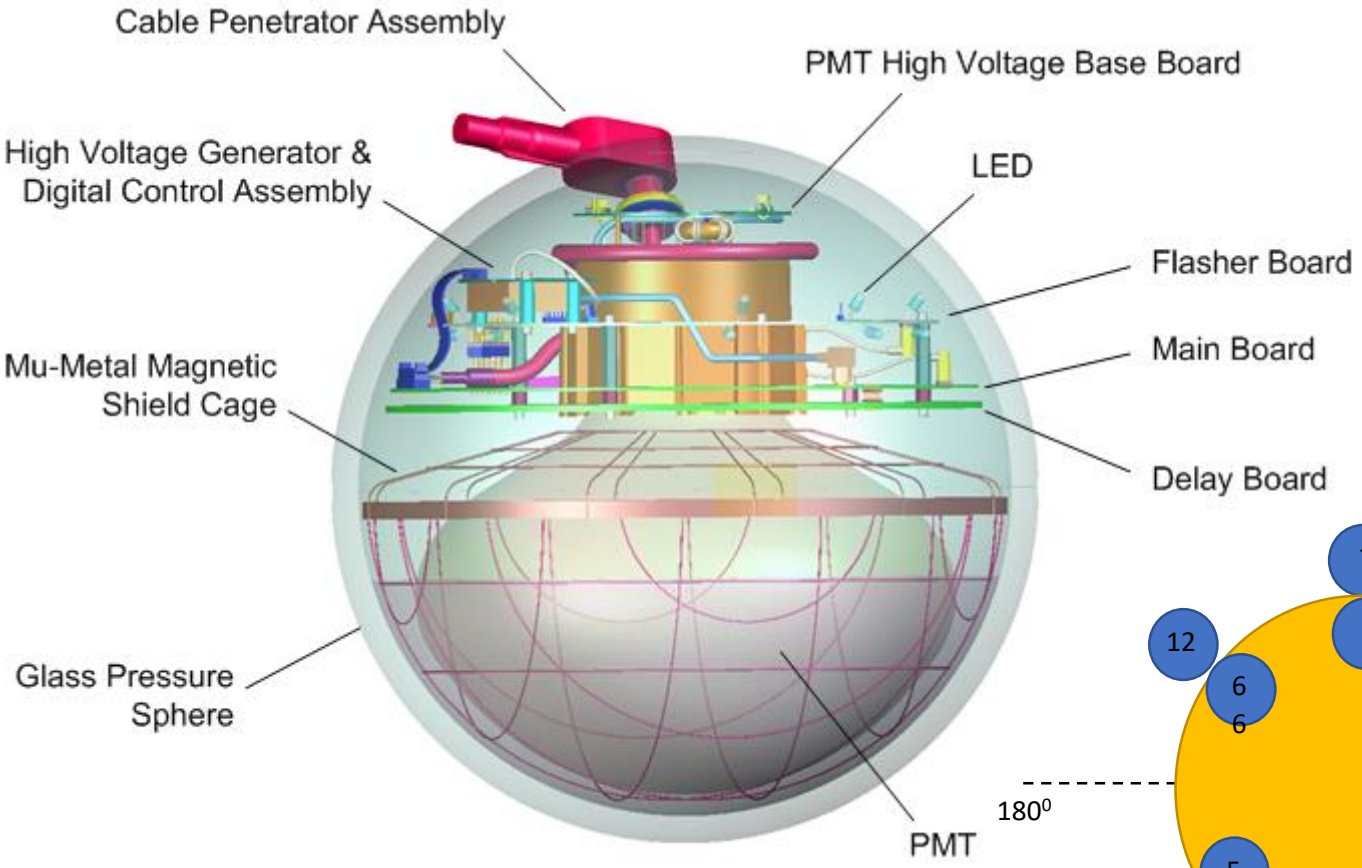
Prabandha Nakarmi

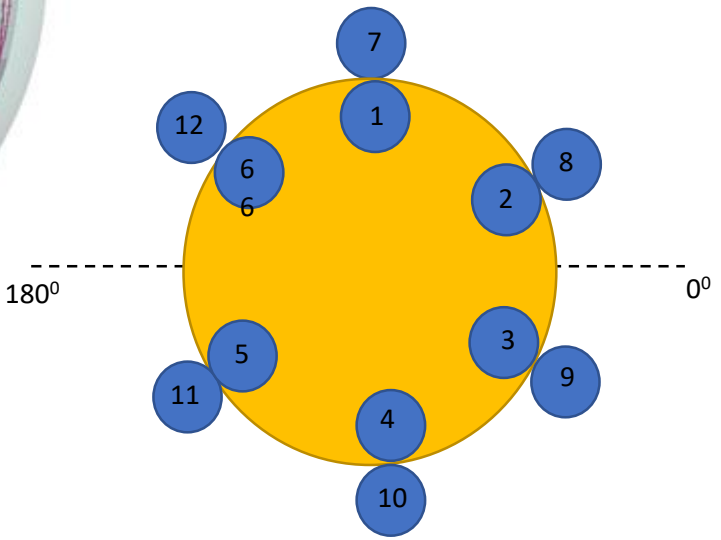
The University of Alabama

DOM and flasher board



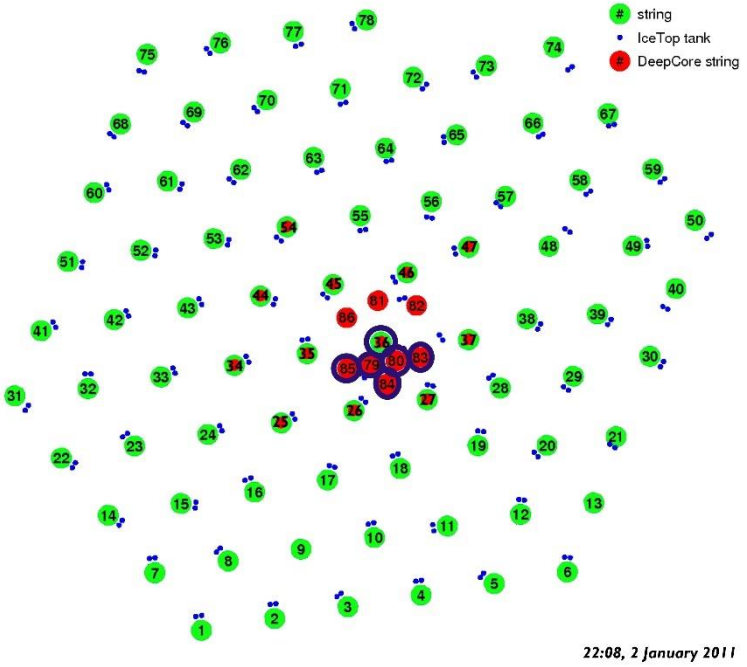
DOM and flasher board





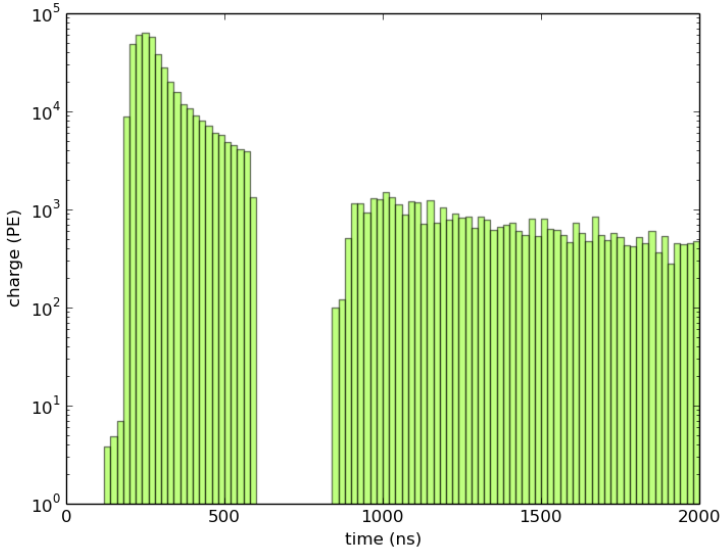
Studies ongoing for Gen2: low brightness flashers

- In 2017 Dawn commissioned a set of flasher data in the densest area of strings in DeepCore, with low brightness and width
- Includes single LED data for all horizontal LEDs
- The idea is to do ice model studies in this dense area of the detector with a more modest light output than in our default flasher setting for ice model studies

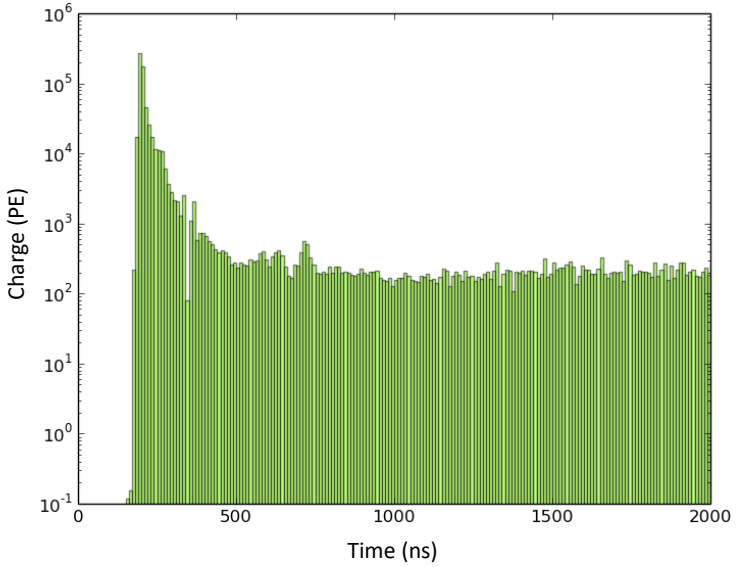


For more details: https://wiki.icecube.wisc.edu/index.php/All_Purpose_Flasher_Set_2017

Low brightness flashers

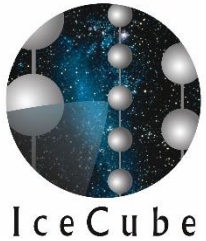


Charge vs. time on a neighboring string in DeepCore, typical ice model run settings

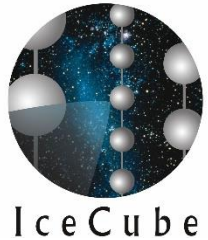


Charge vs. time on a neighboring string in DeepCore, low brightness flasher run settings

Factors Used in our study

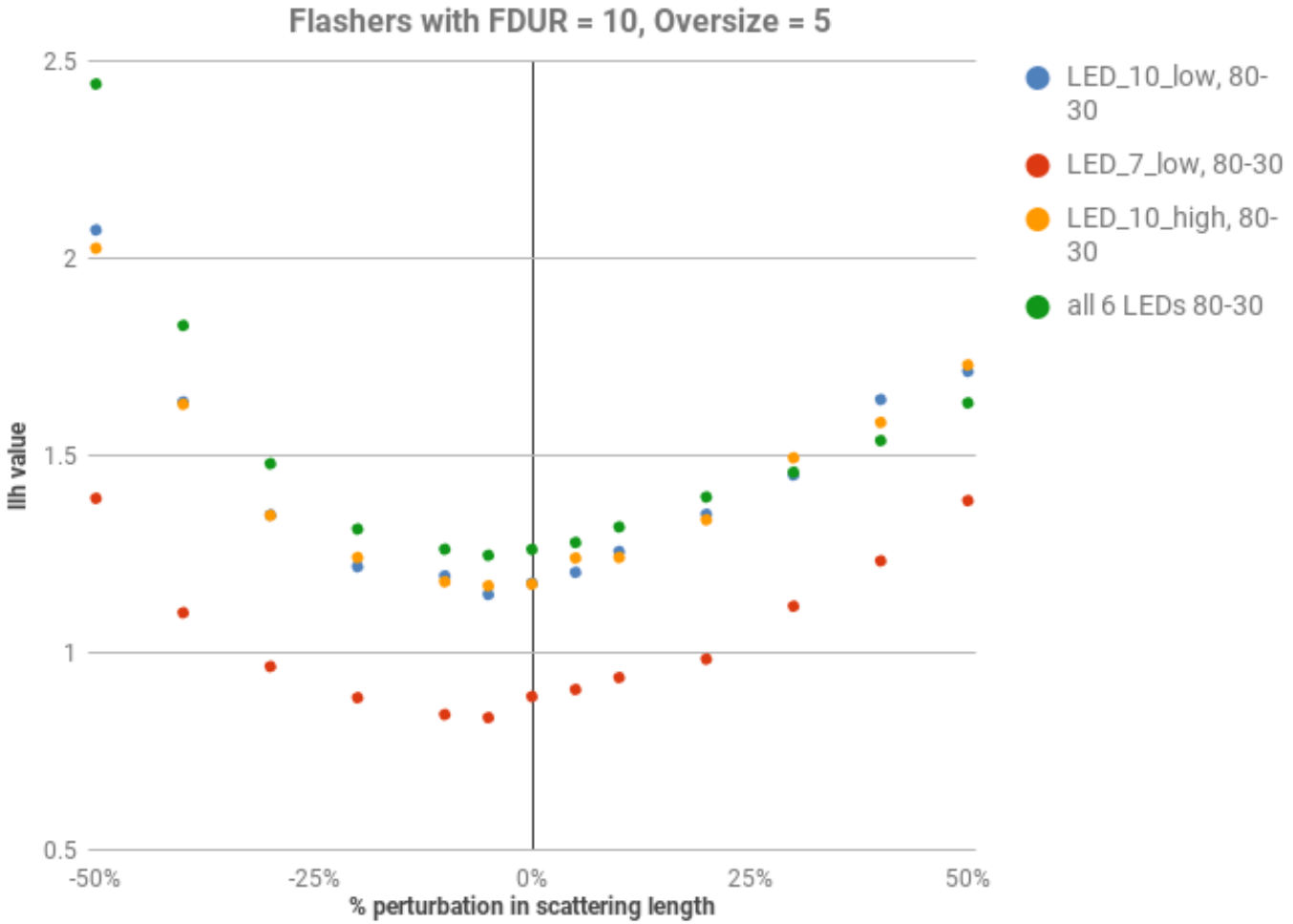


- Default ice model – llh implementation of Spice3 from the trunk of ppc
- FLDR – Azimuthal angle of flashing LED (0 to 360)
- FDUR – Flasher duration (0 to 70 ns)
- Oversize – Size factor of receiver DOM
- Brightness and Width – brightness of LED (0 to 127), default for low brightness (B=40, W=20)
- Scattering length
- Anisotropy angle (default 130)
- Magnitude of anisotropy(k1 & k2): default -0.106, 0.053 ; k2 = -k1/2
- Different angular sensitivity (default – as.flasher)
  - For more details: https://arxiv.org/pdf/1301.5361.pdf

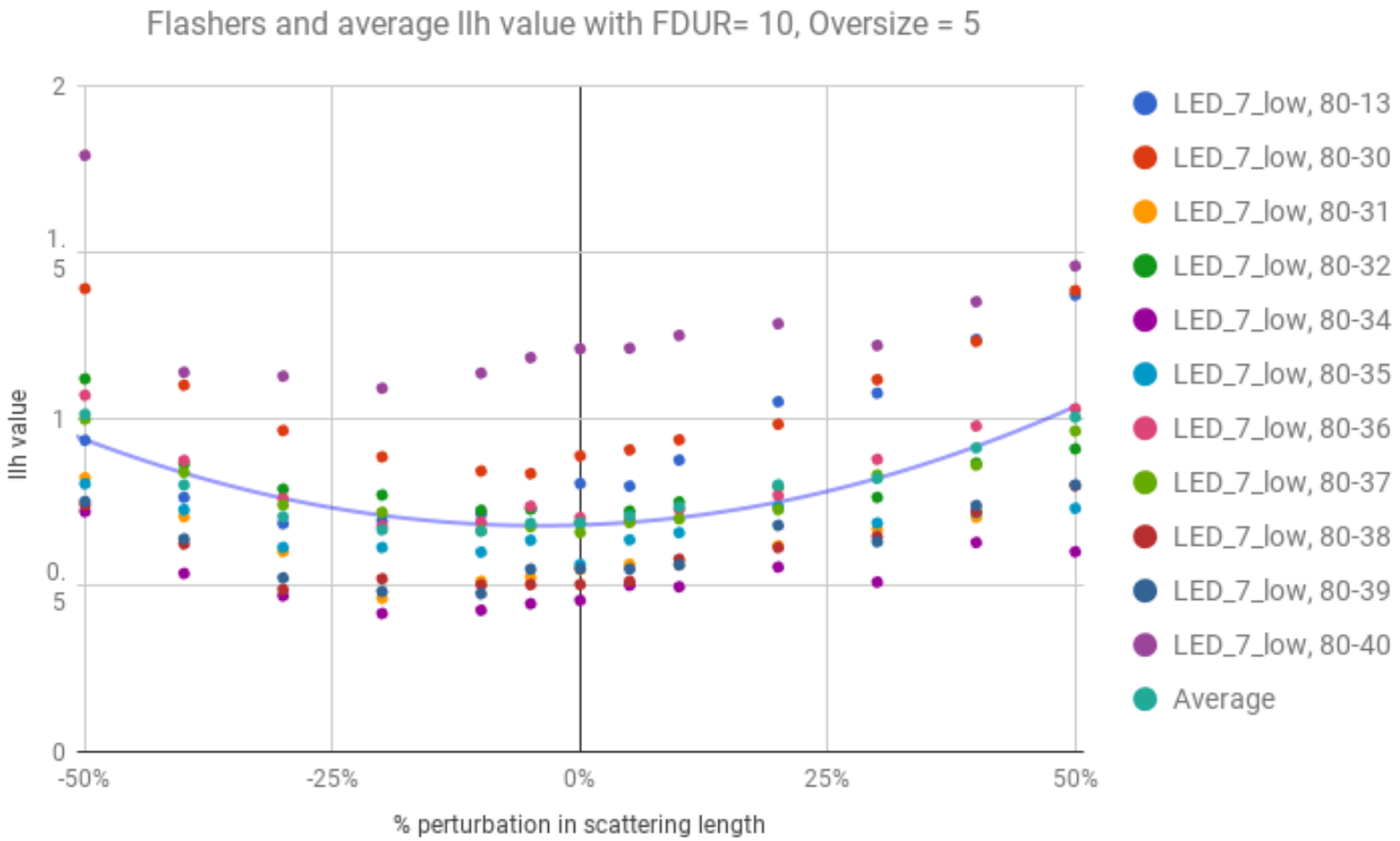


Results

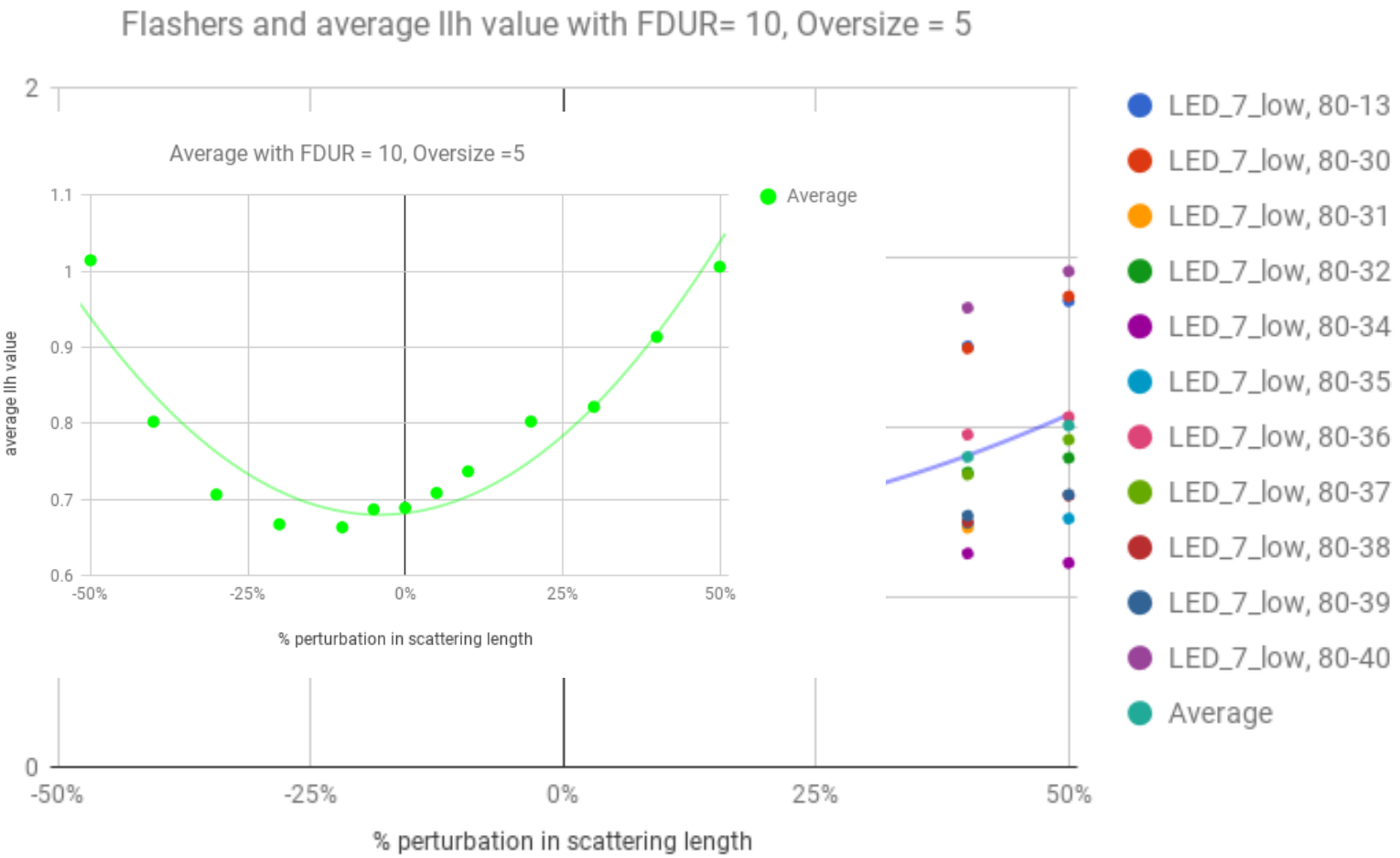
LED 10 with low and high brightness, LED 7 with low brightness, all 6 LEDs for DOM 80-30



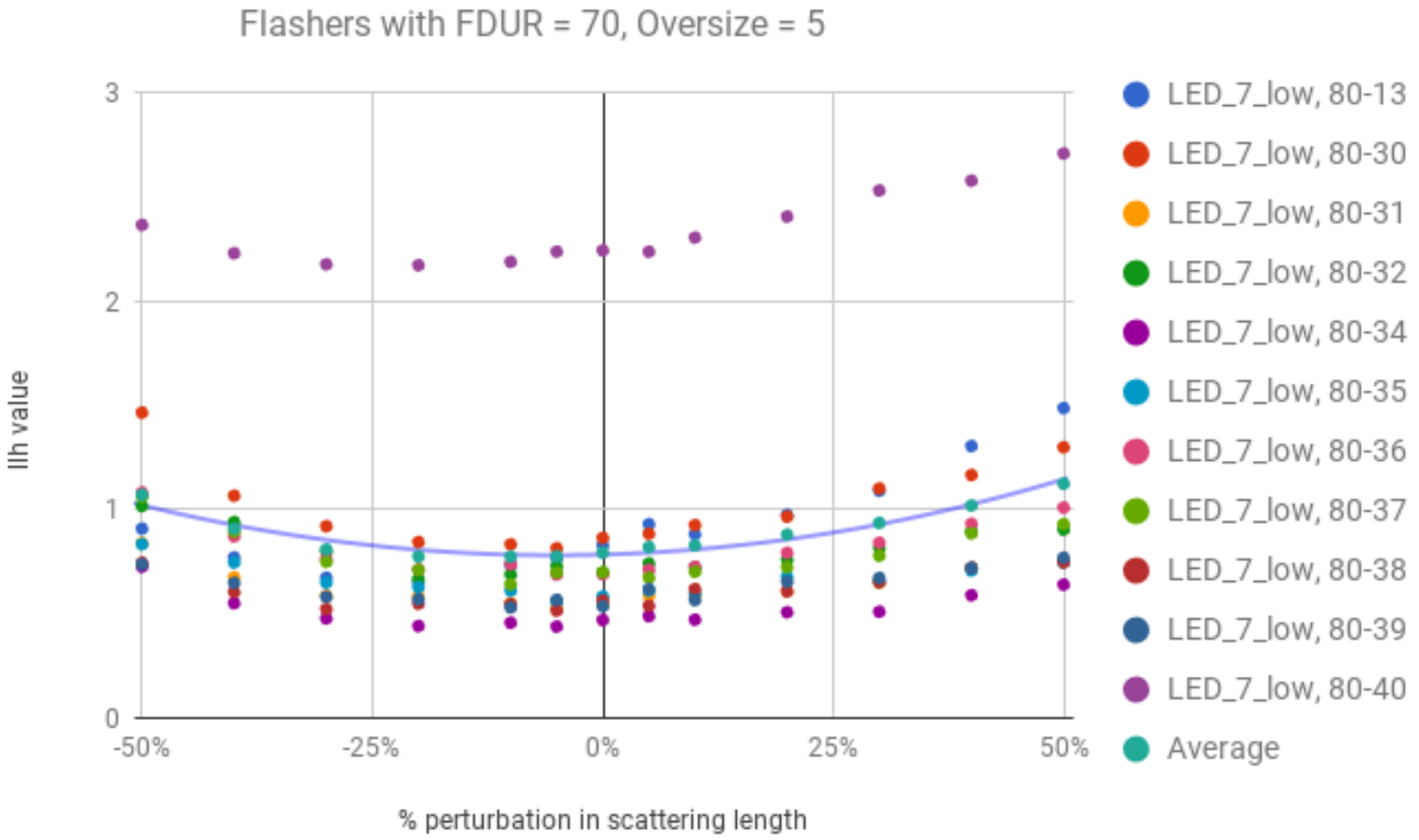
LED 7 of different DOMs of string 80



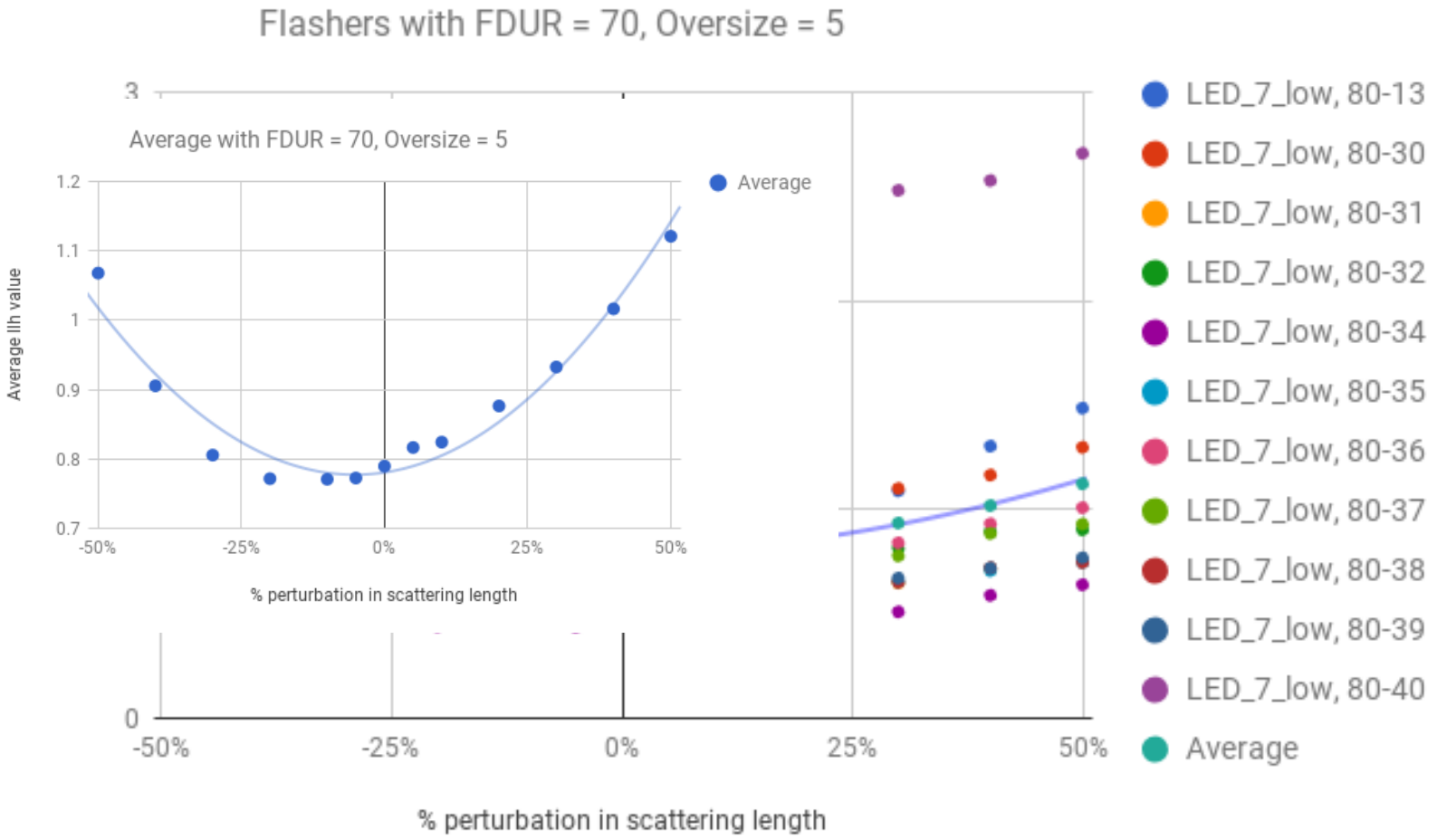
LED 7 of different DOMs of string 80



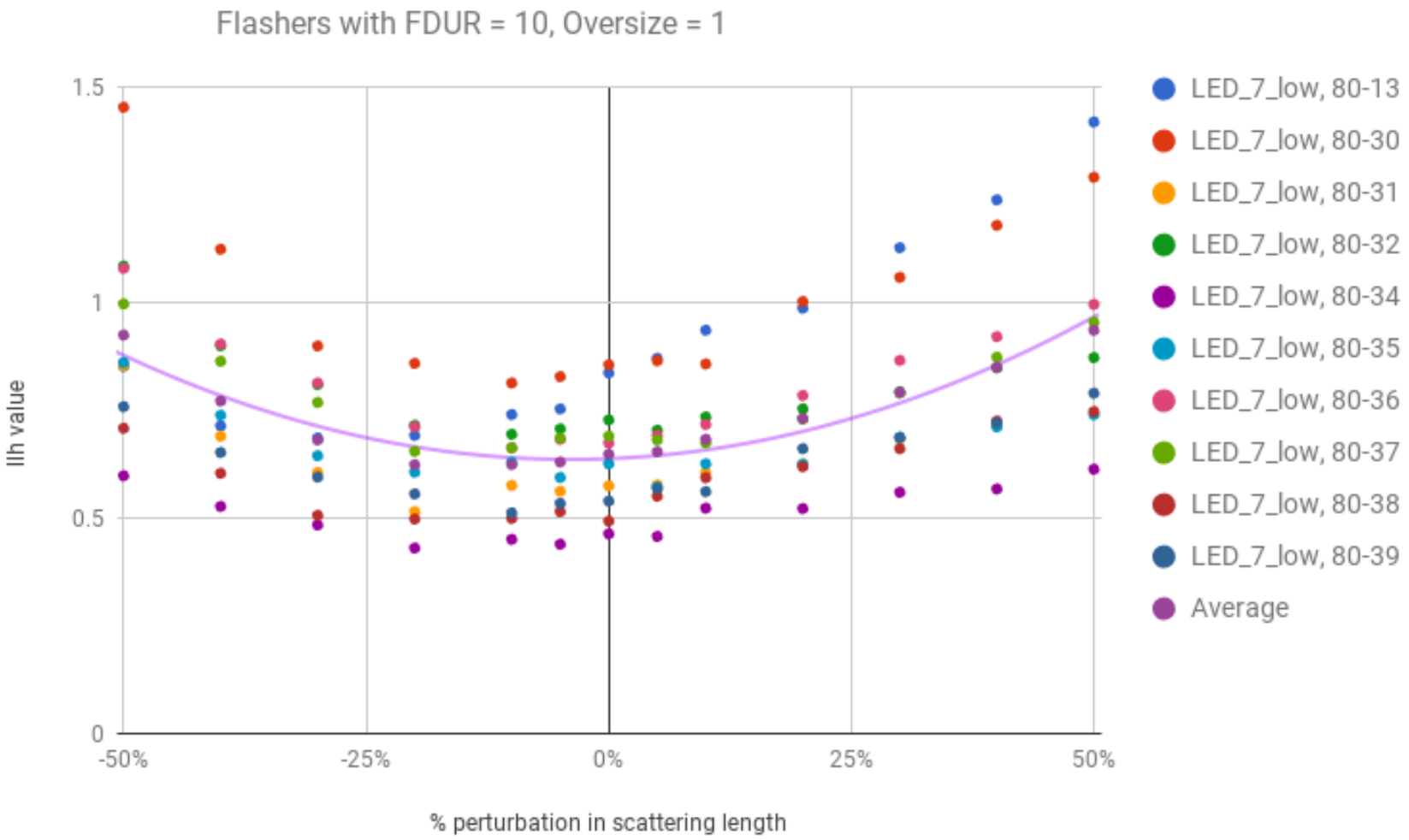
FDUR 10 → 70


Flashers with FDUR = 70, Oversize = 5
llh value
3
2
1
0
-50%
-25%
0%
25%
50%
% perturbation in scattering length
LED_7_low, 80-13
LED_7_low, 80-30
LED_7_low, 80-31
LED_7_low, 80-32
LED_7_low, 80-34
LED_7_low, 80-35
LED_7_low, 80-36
LED_7_low, 80-37
LED_7_low, 80-38
LED_7_low, 80-39
LED_7_low, 80-40
Average

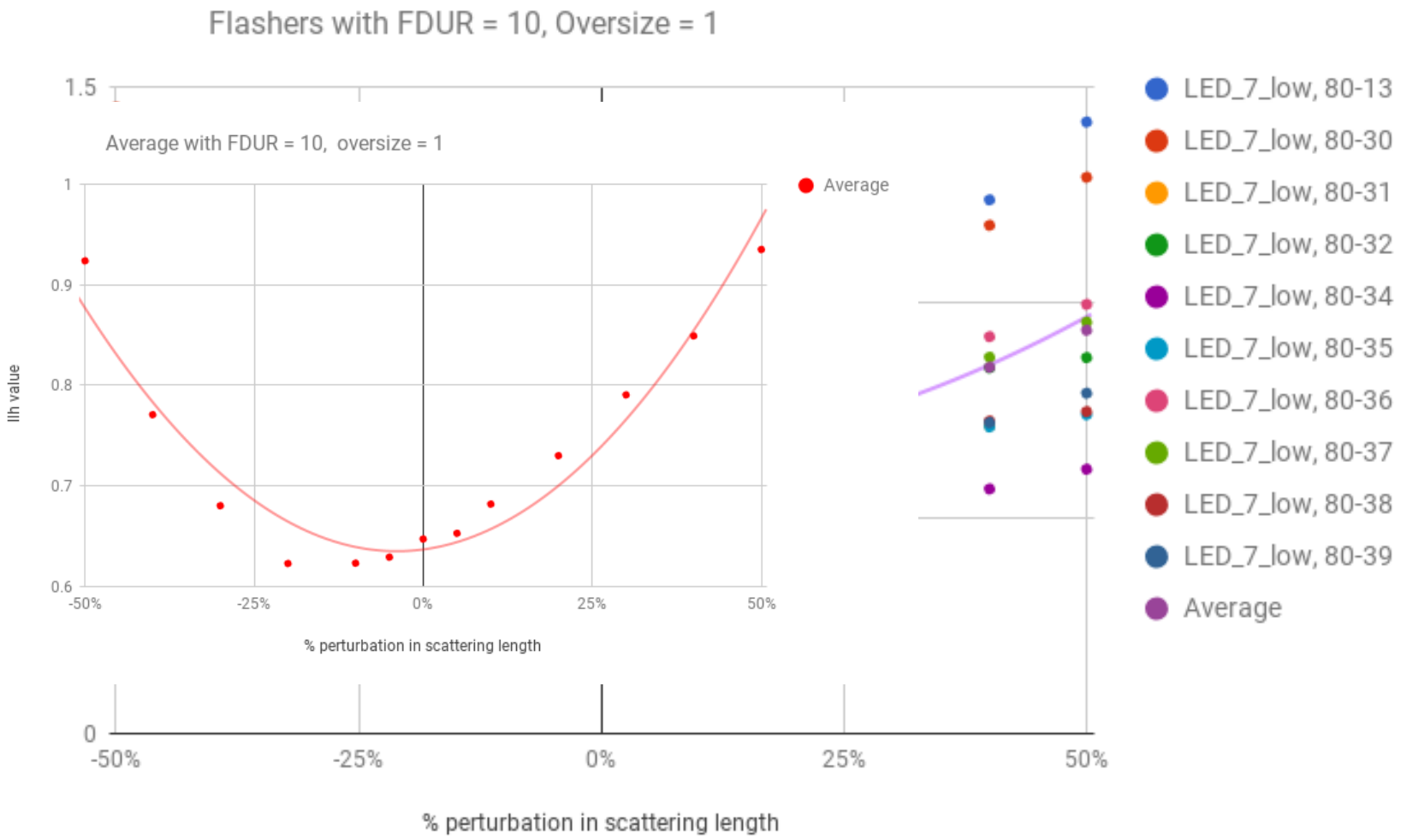
FDUR 10 → 70


Flashers with FDUR = 70, Oversize = 5
Average with FDUR = 70, Oversize = 5
Average
Average llh value
% perturbation in scattering length
LED_7_low, 80-13
LED_7_low, 80-30
LED_7_low, 80-31
LED_7_low, 80-32
LED_7_low, 80-34
LED_7_low, 80-35
LED_7_low, 80-36
LED_7_low, 80-37
LED_7_low, 80-38
LED_7_low, 80-39
LED_7_low, 80-40
Average
% perturbation in scattering length

FDUR 10, Oversize 1

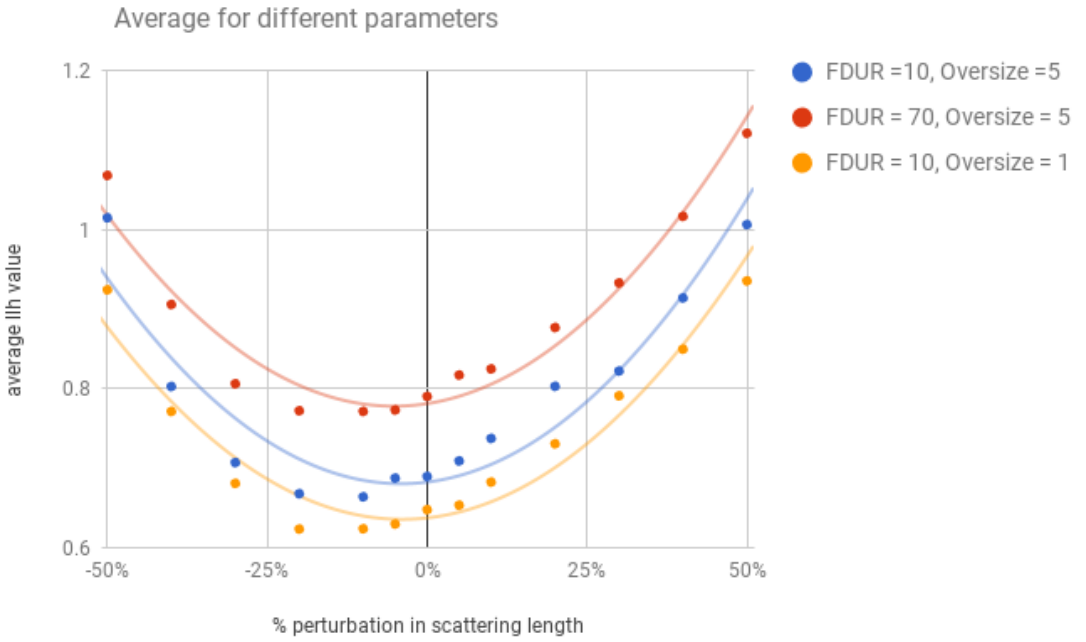


FDUR 10, Oversize 1



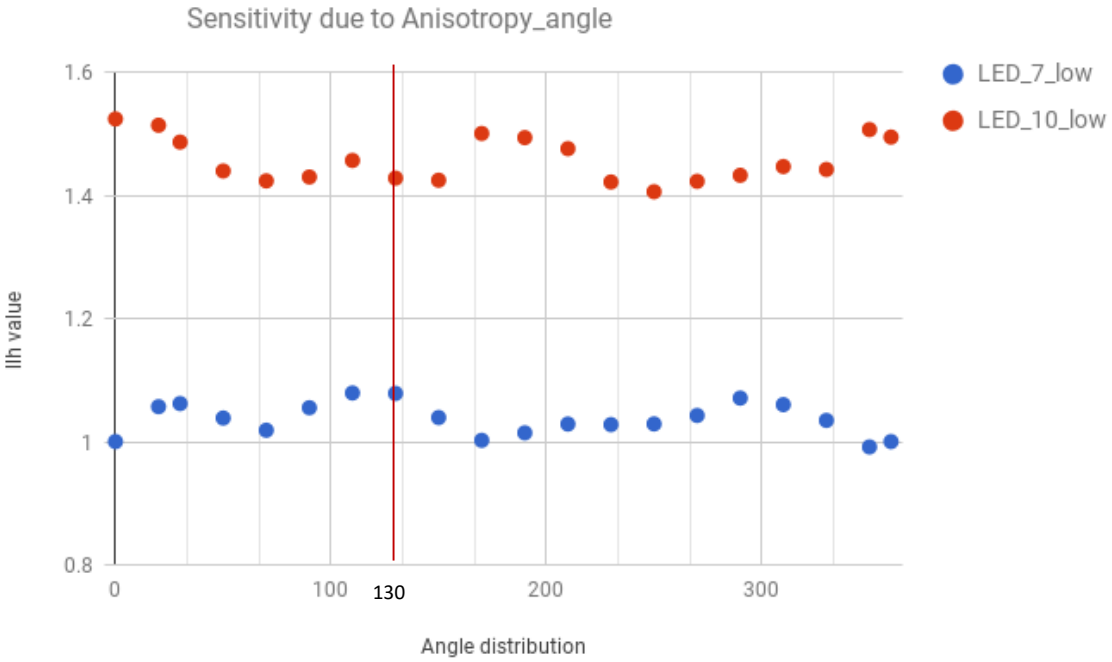
Average_comparison

The polynomial fit for averages for different settings looks same, and we can clearly see the shifting of llh values when we change FDUR and Oversize factor.



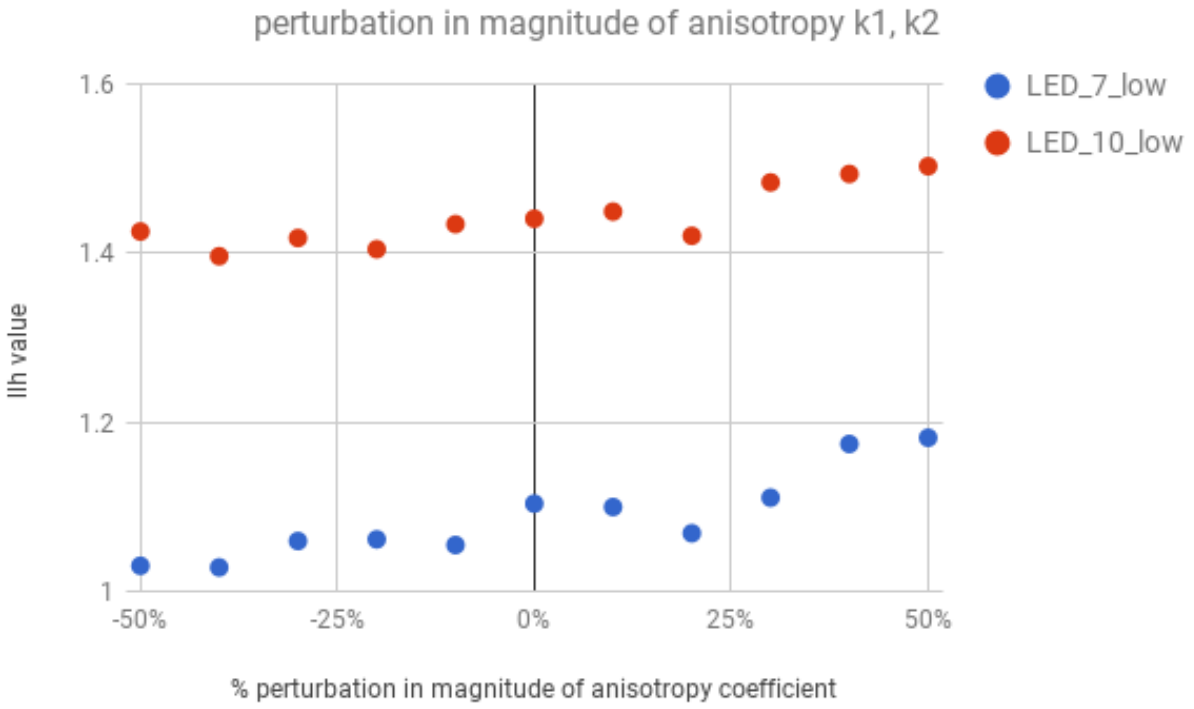
Anisotropy angle

- Default value for Anisotropy angle = 130
- Two flasher LED of same Dom 180 degrees apart



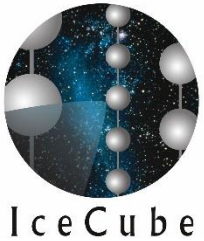
Anisotropy magnitudes k_1 & k_2

% pert	k1	k2
-50%	-0.053	0.0265
-40%	-0.0636	0.0318
-30%	-0.0742	0.0371
-20%	-0.0848	0.0424
-10%	-0.0954	0.0477
0%	-0.106	0.053
10%	-0.1166	0.0583
20%	-0.1272	0.0636
30%	-0.1378	0.0689
40%	-0.1484	0.0742
50%	-0.159	0.0795



$$k_2 = -k_1 / 2$$

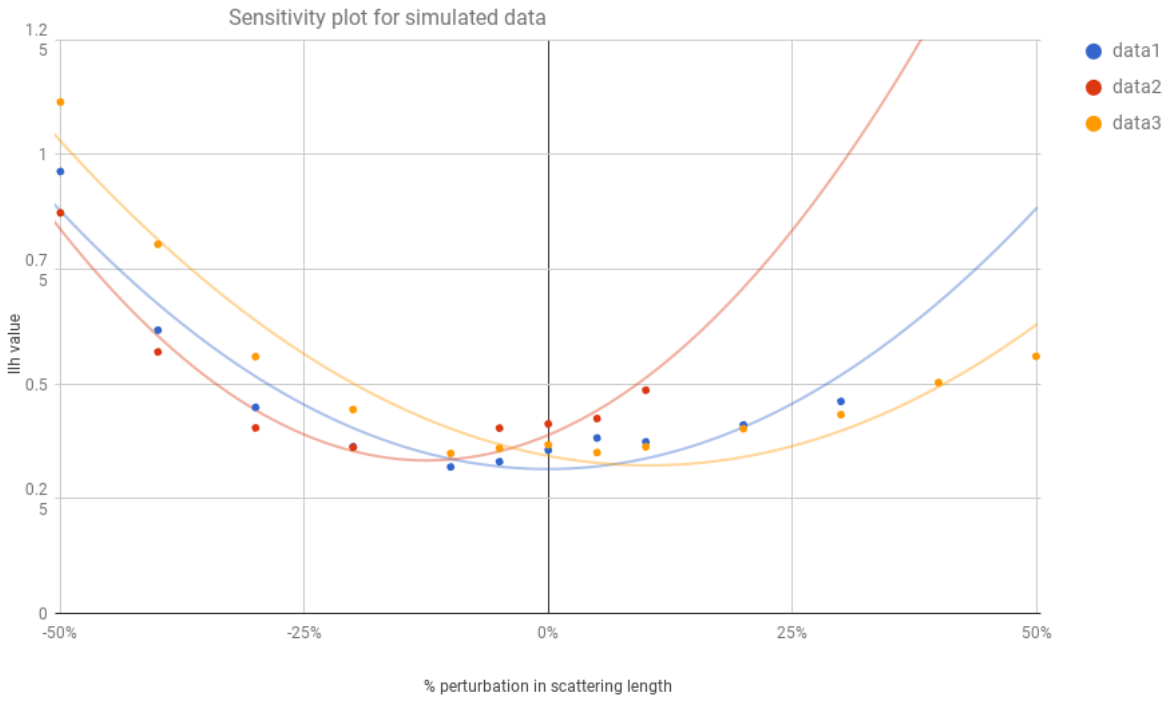
Angular sensitivity for different settings



Angular sensitivity	LED_7	LED_10
as.flasher	1.07478	1.42056
as.h1-100cm	1.0726	1.43477
as.h2-50cm	1.04531	1.42255
as.h3-30cm	1.0844	1.46661
as.holeice	1.03477	1.41036
as.nominal	1.13239	1.41737

Simulated data

- This was to check the sensitivity of our analysis
- Data1 was default data, unperturbed
- Data2 was -10% perturbed in scattering length
- Data3 was +10% perturbed in scattering length




Thanks !

Backup slide for perturbation of absorption length

Change due to absorption length