Mechanical model

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Mechanical model (I)

- Tilt of a string is defined by direction cosines at top of T-bar
  - $T_x \equiv \frac{dx}{dz}$
  - $T_y \equiv \frac{dy}{dz}$

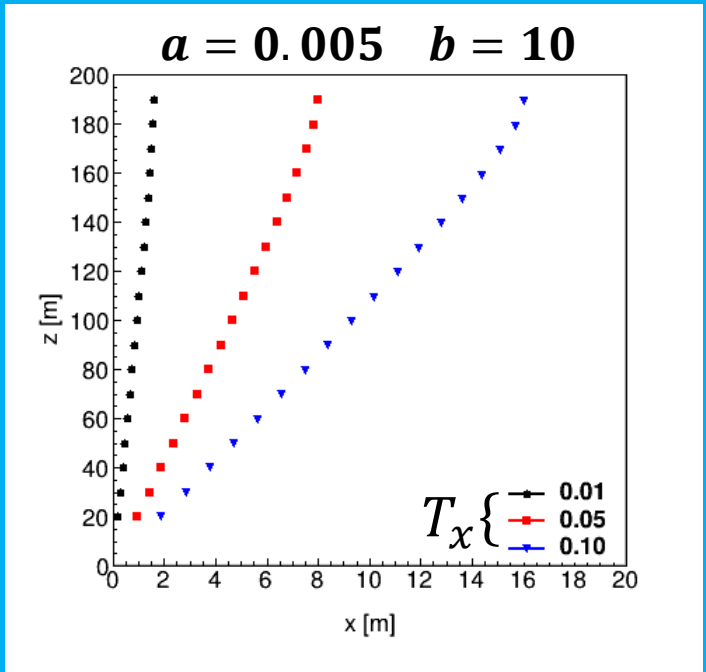
- For a straight line, position of module at floor i is then given by
  - $\Delta x_i = T_x \times h_i$
  - $\Delta y_i = T_y \times h_i$
    - where $h_i \equiv$ height (with respect to top of T-bar)

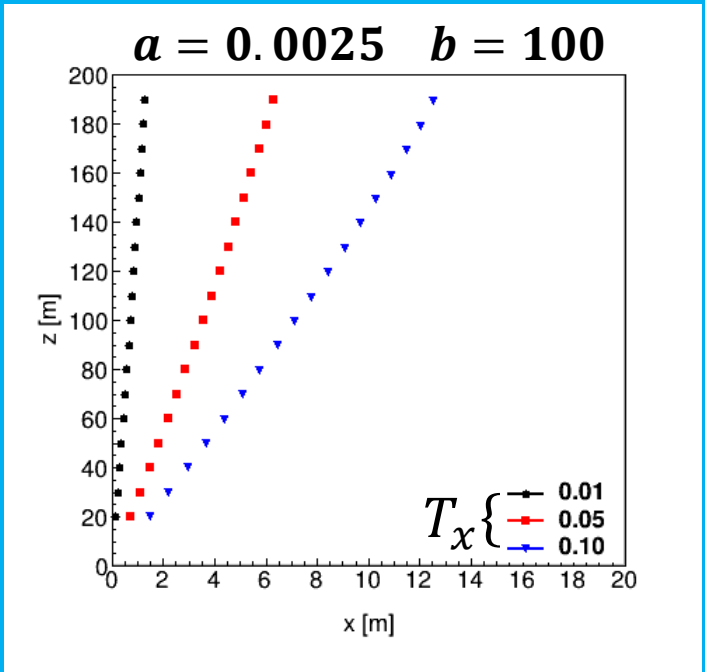
Mechanical model (II)

- Curvature of string is described by effective height of module
  - $h' = h + b\log(1 - ah)$
    - $0 \leq a \leq H^{-1}$
    - $0 \leq b$

$H \equiv$ total height of string

curved towards vertical ($\log(1 - ah) \leq 0$)





Procedure (I)

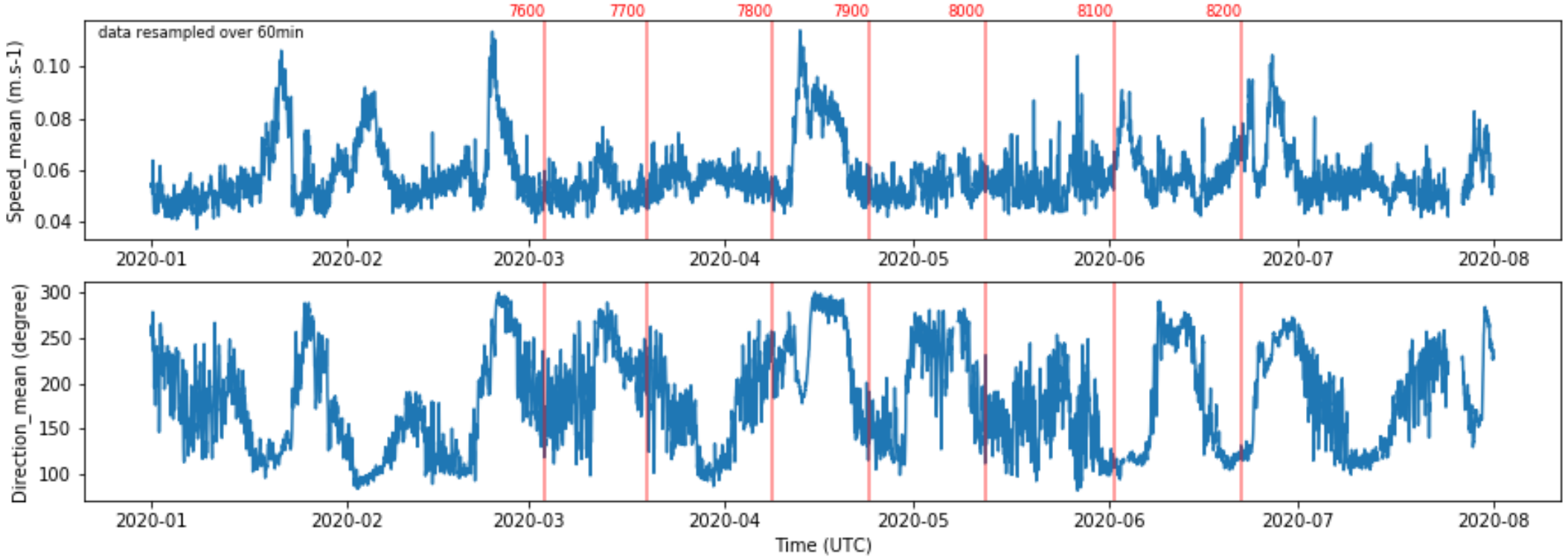
- Run acoustic event builder
  - JAcousticsEventBuilder.sh <detector file> <run number>
    - creates¶
      <toashort file> KM3NeT_DDDDDDDD_RRRRRRRR_toashort.root
      <event file> KM3NeT_DDDDDDDD_RRRRRRRR_event.root

- <Jpp>/examples/JAcoustics/mechanics:(run|plot).sh
  1. 2D-scan of a and b
  2. repeated fits of model to data covering an extended data taking period
  3. plotting of average χ^2 / NDF of fits

¶ DDDDDDDD and RRRRRRRR correspond to detector serial number and run number, respectively.

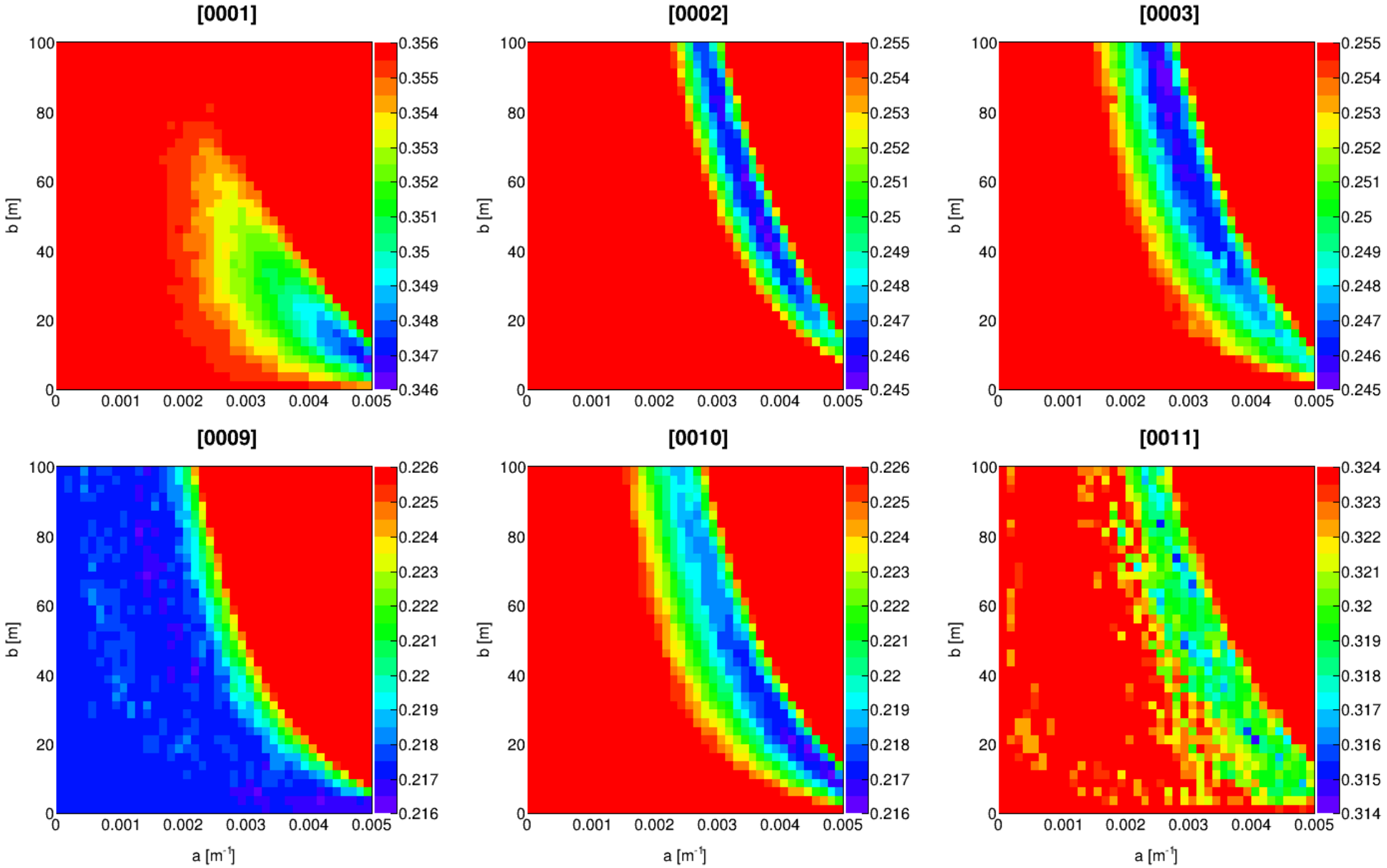
Procedure (II)

picture by Lilian



Procedure (III)

- Input data
  - (relative) hydrophone positions from Vincent B.
  - detector file and tripod positions as obtained from scans
    - see presentation at Calibration meeting d.d. 30 July 2020
  - ORCA detector 49, runs 7830—7860

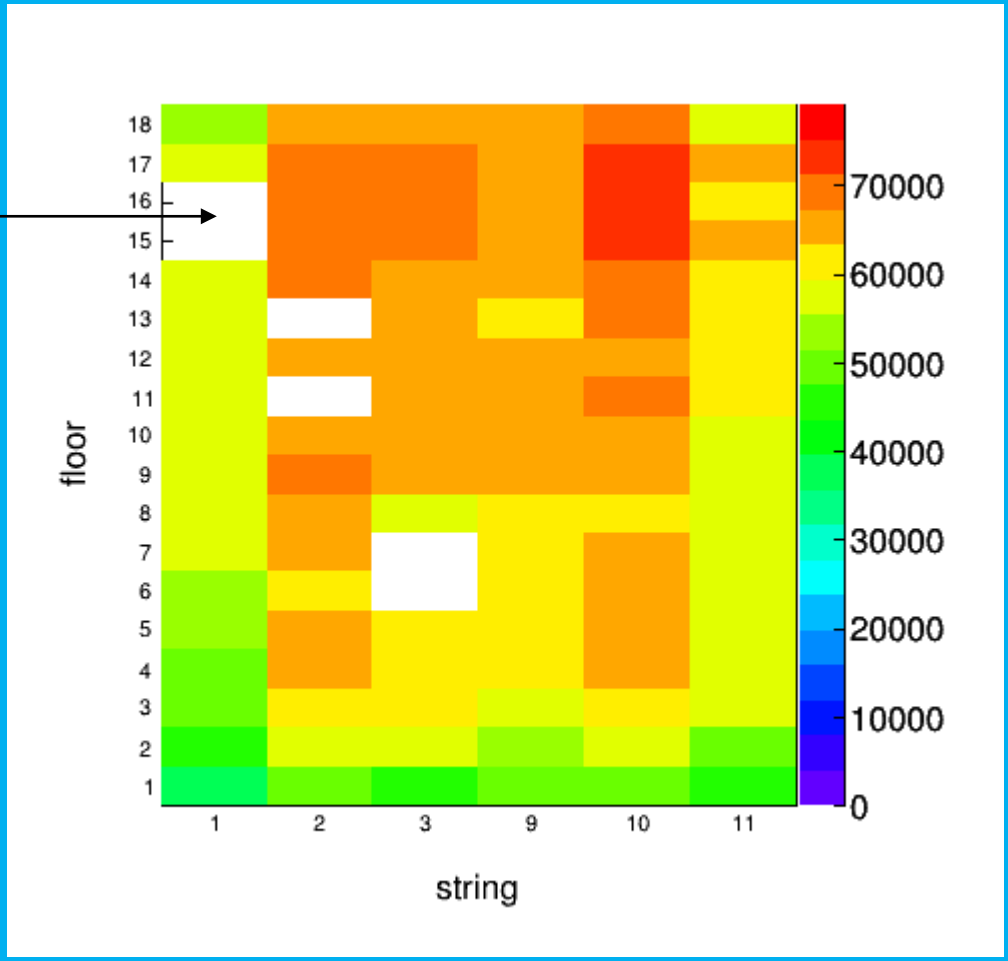

[0001]
[0002]
[0003]
[0009]
[0010]
[0011]
b [m]
a [m⁻¹]
0
20
40
60
80
100
0.001
0.002
0.003
0.004
0.005
0.356
0.355
0.354
0.353
0.352
0.351
0.35
0.349
0.348
0.347
0.346
0.255
0.254
0.253
0.252
0.251
0.25
0.249
0.248
0.247
0.246
0.245
0.226
0.225
0.224
0.223
0.222
0.221
0.22
0.219
0.218
0.217
0.216
0.324
0.323
0.322
0.321
0.32
0.319
0.318
0.317
0.316
0.315
0.314

Results

string	$a\ [m^{-1}]$	$b\ [m]$	$\Delta\frac{\chi^2}{\mathrm{NDF}}$
1	0.00490	10.000	0.010
2	0.00300	82.500	0.029
3	0.00250	100.000	0.014
9	0.00130	80.000	0.001
10	0.00410	22.500	0.014
11	0.00290	50.000	0.012

Detector

flooded?



Conclusions

- Expected curvatures of strings are observed
  - strings 2, 3, 10 and 11 exhibit similar patters
    - pattern of string 11 is less pronounced, possibly due to alignment with AB2 and AB3
  - string 9 remains straight
    - this string has (supposedly) no buoy
  - string 1 prefers sharpest curvature at the very top
    - flooded optical module?