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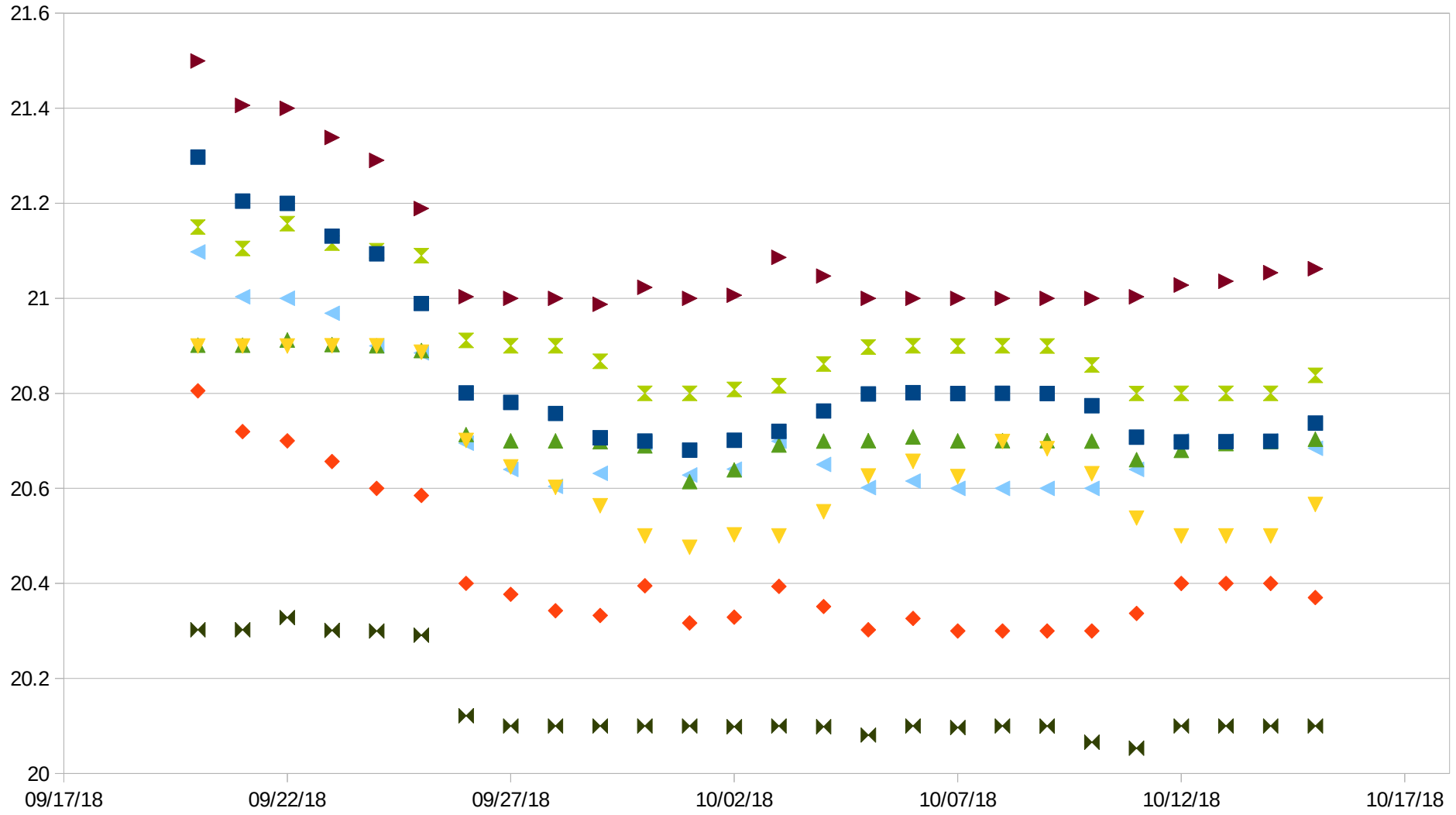
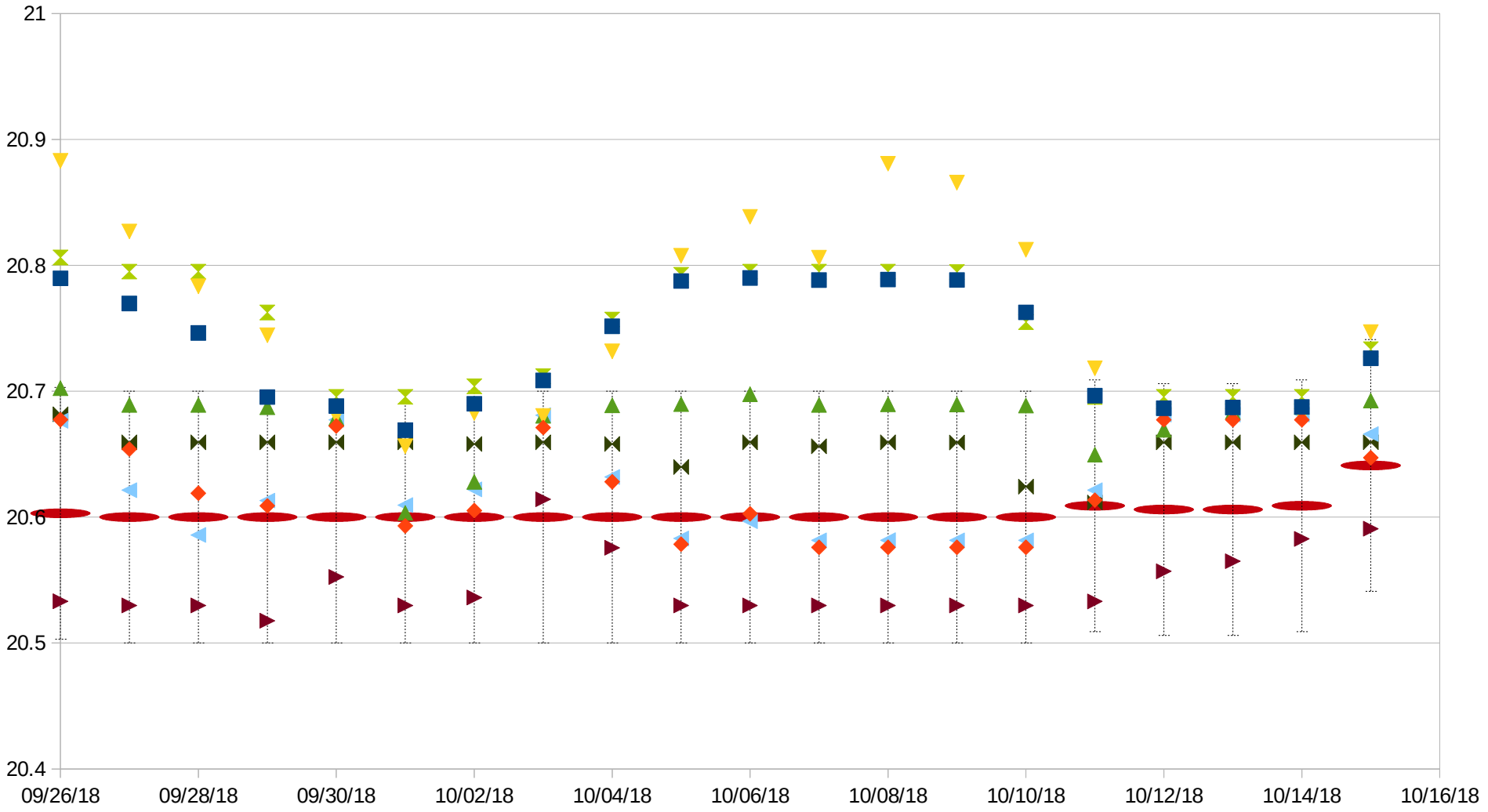
Quick Update on lH2

- Updated plot for systems Performance paper to Root Style
- Use ‘averaging’ as suggested previously
- Trying to find balance between overcrowding plot and simplicity

Problem: Sensors Uncalibrated



Calibrate without magnetic field effects



Calibration Procedure

- Manage the data into equal sized intervals

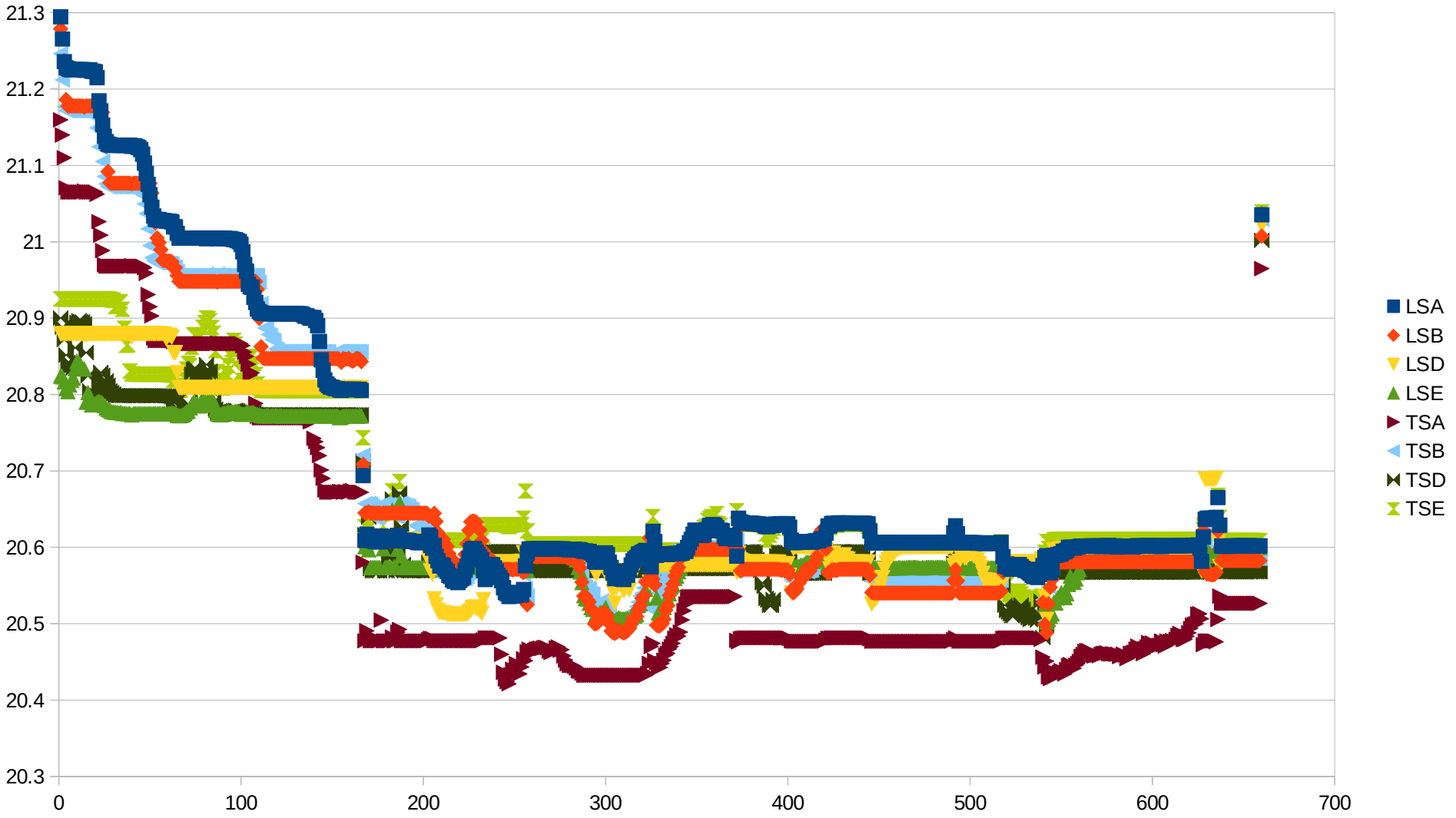
$$T_{average} = \frac{T_{previous}\Delta t_{first} + \sum_i T_i \Delta t_i + T_{last}\Delta t_{last}}{t_{interval}}$$

$$t_{interval} = \Delta t_{first} + \sum_i \Delta t_i + \Delta t_{last}$$

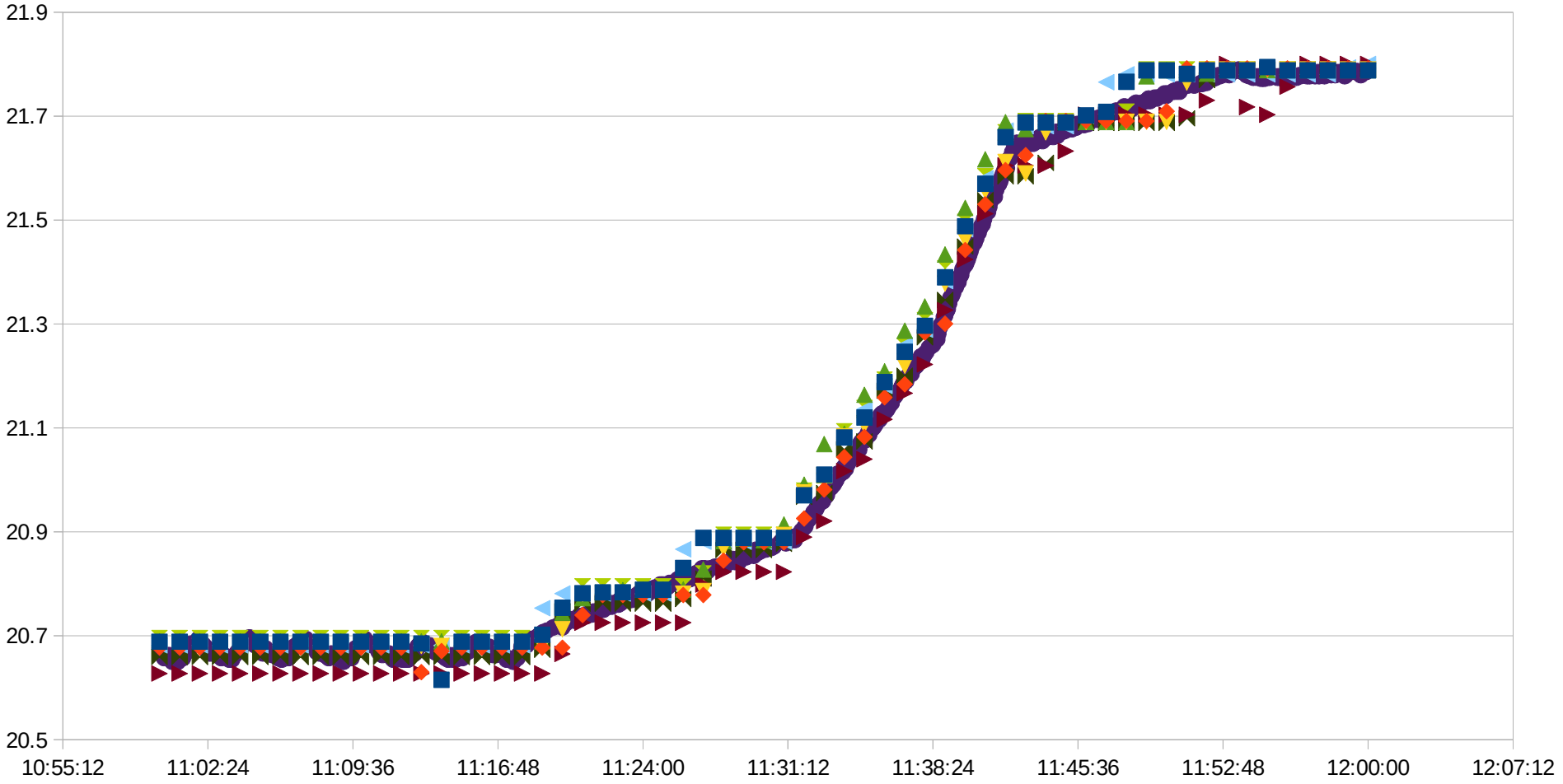
- Apply Calibration

$$T_{corrected} = \frac{T_{reading} + c_{cut-off} - c_{magnet} I}{c_{Temperature}}$$

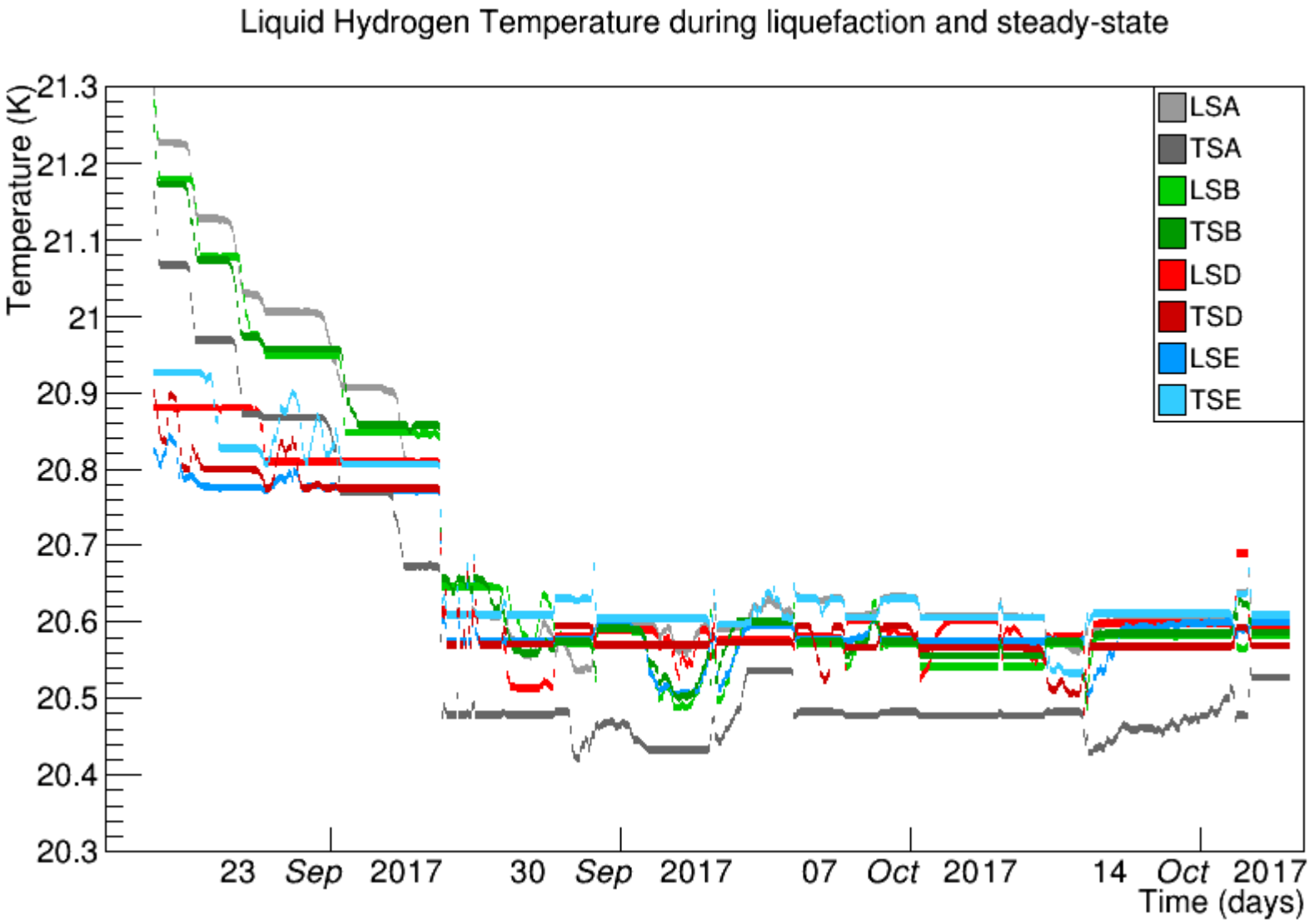
After Calibration



Temperature sensors vs boiling temperature during heating

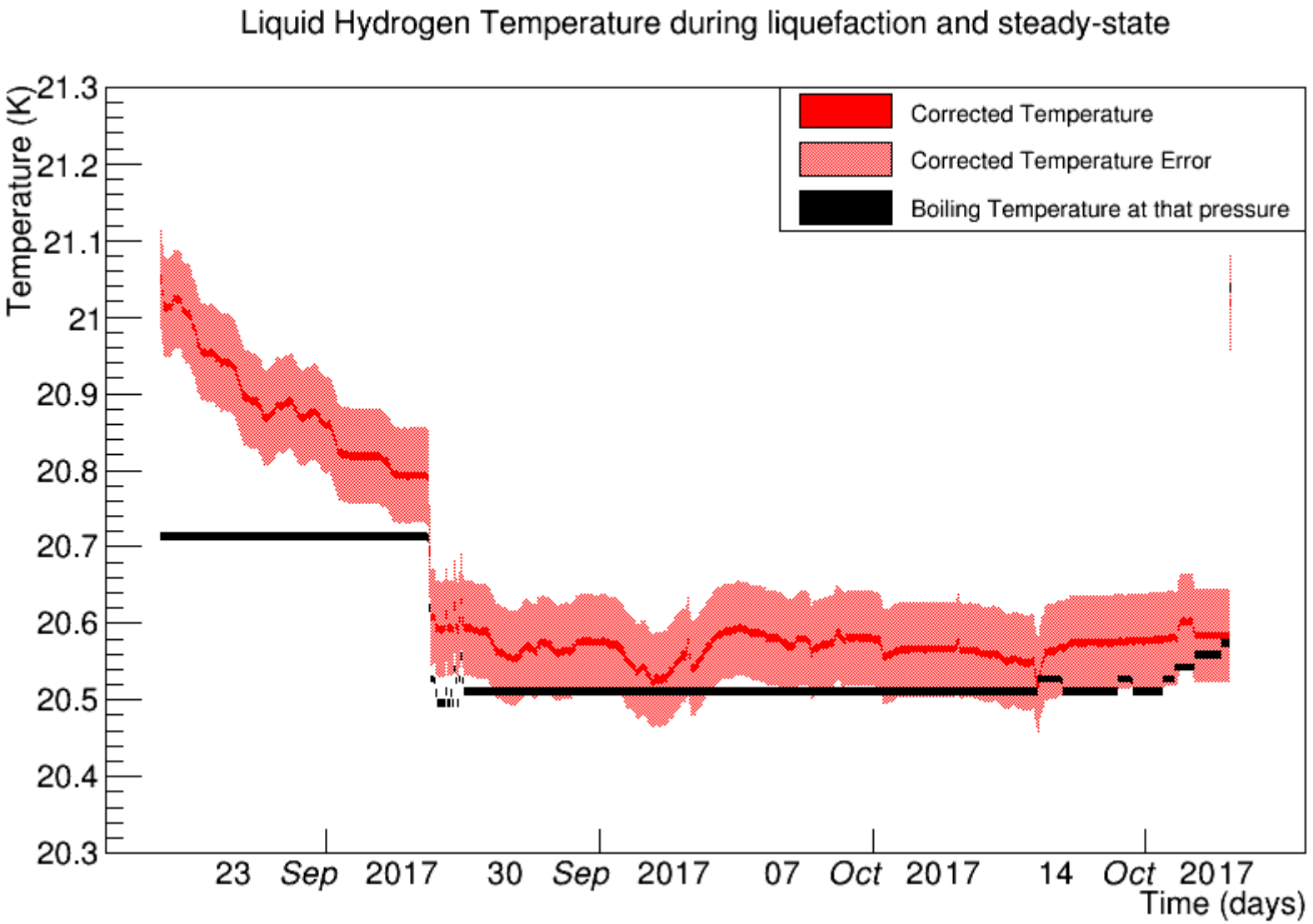


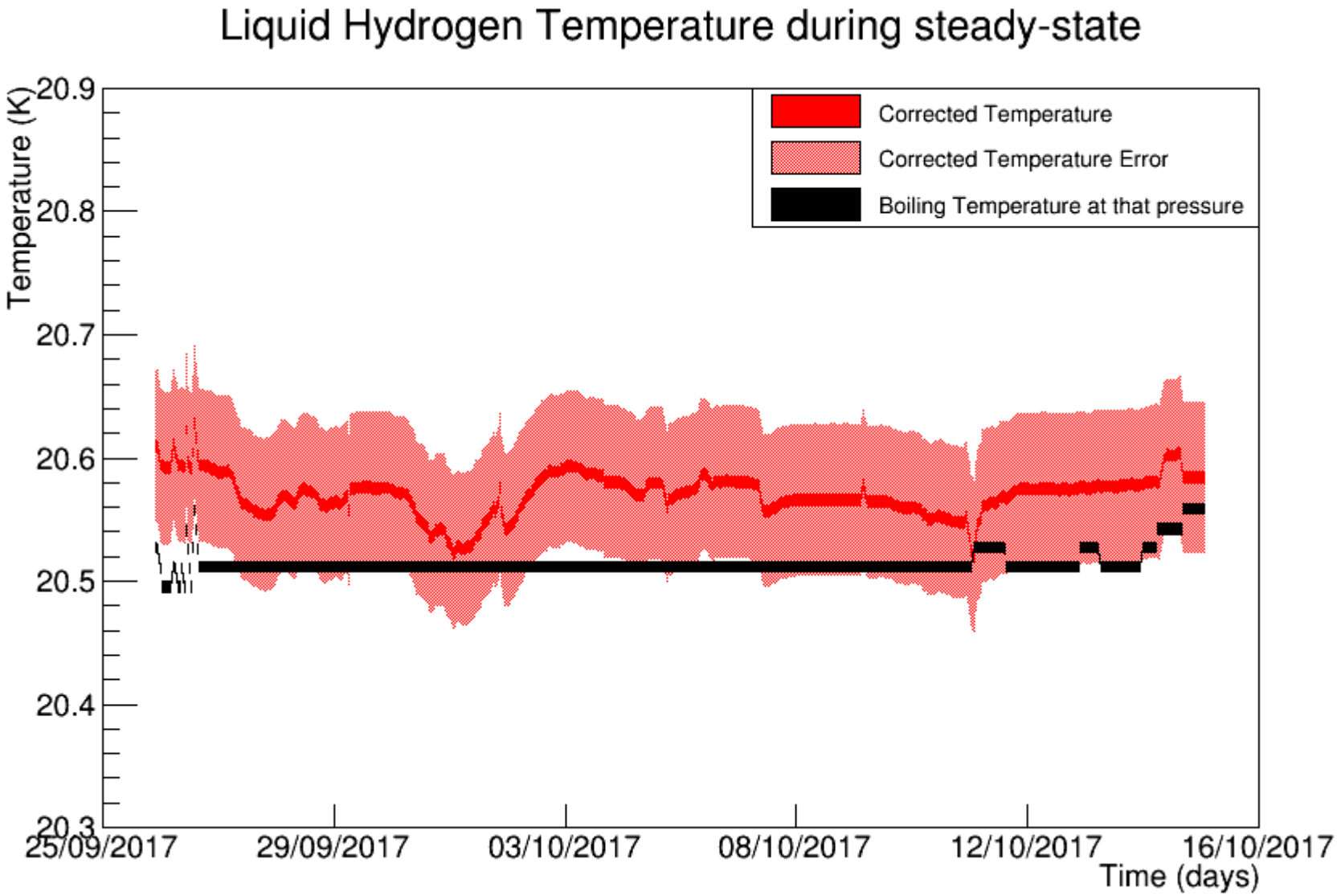
Root Style


Liquid Hydrogen Temperature during liquefaction and steady-state
Temperature (K)
21.3
21.2
21.1
21
20.9
20.8
20.7
20.6
20.5
20.4
20.3
LSA
TSA
LSB
TSB
LSD
TSD
LSE
TSE
23 Sep 2017
30 Sep 2017
07 Oct 2017
14 Oct 2017
Time (days)

Alterations

- Change to Root Style, add Time
- Add Error Bars
- Too crowded for individual sensors
- => Take Average
- Lose Filling and Emptying detail
- => Only use during steady-state, but miss out on sensitivity we do see, also emphasises limitation of calibration procedure


Liquid Hydrogen Temperature during liquefaction and steady-state
Temperature (K)
21.3
21.2
21.1
21
20.9
20.8
20.7
20.6
20.5
20.4
20.3
Corrected Temperature
Corrected Temperature Error
Boiling Temperature at that pressure
23 Sep 2017
30 Sep 2017
07 Oct 2017
14 Oct 2017
Time (days)


Liquid Hydrogen Temperature during steady-state
Temperature (K)
20.9
20.8
20.7
20.6
20.5
20.4
20.3
Corrected Temperature
Corrected Temperature Error
Boiling Temperature at that pressure
25/09/2017
29/09/2017
03/10/2017
08/10/2017
12/10/2017
16/10/2017
Time (days)

Errors included

- Error calculation from code

```
resolution = 0.1
Pressure_sensor = 0.014
Sensor_accuracy = 0.009
Sensor_stability = 0.012
Sensor_magnetic = 0.008
Cal_Temp = 20.0
Boil_Temp = 21.692
No_sensors = 8.0
```

```
other_error = ((No_sensors * (((((resolution/Cal_Temp) ** 2.0 + (Pressure_sensor/Boil_Temp) ** 2.0 +
(((2 * (resolution ** 2.0)) ** 0.5)/Cal_Temp) ** 2.0) ** 0.5) * Cal_Temp) **2.0 + (Sensor_magnetic) **
2.0 + (Sensor_stability) ** 2.0 + (Sensor_accuracy) ** 2.0)) ** 0.5)/No_sensors
```

```
    phase_error.append((((np.std([phase_vector[0], phase_vector[1], phase_vector[2], phase_vector[3],
phase_vector[4], phase_vector[5], phase_vector[6], phase_vector[7]]))/No_sensors) ** 2.0 + other_error
** 2.0) ** 0.5)
```

Issues

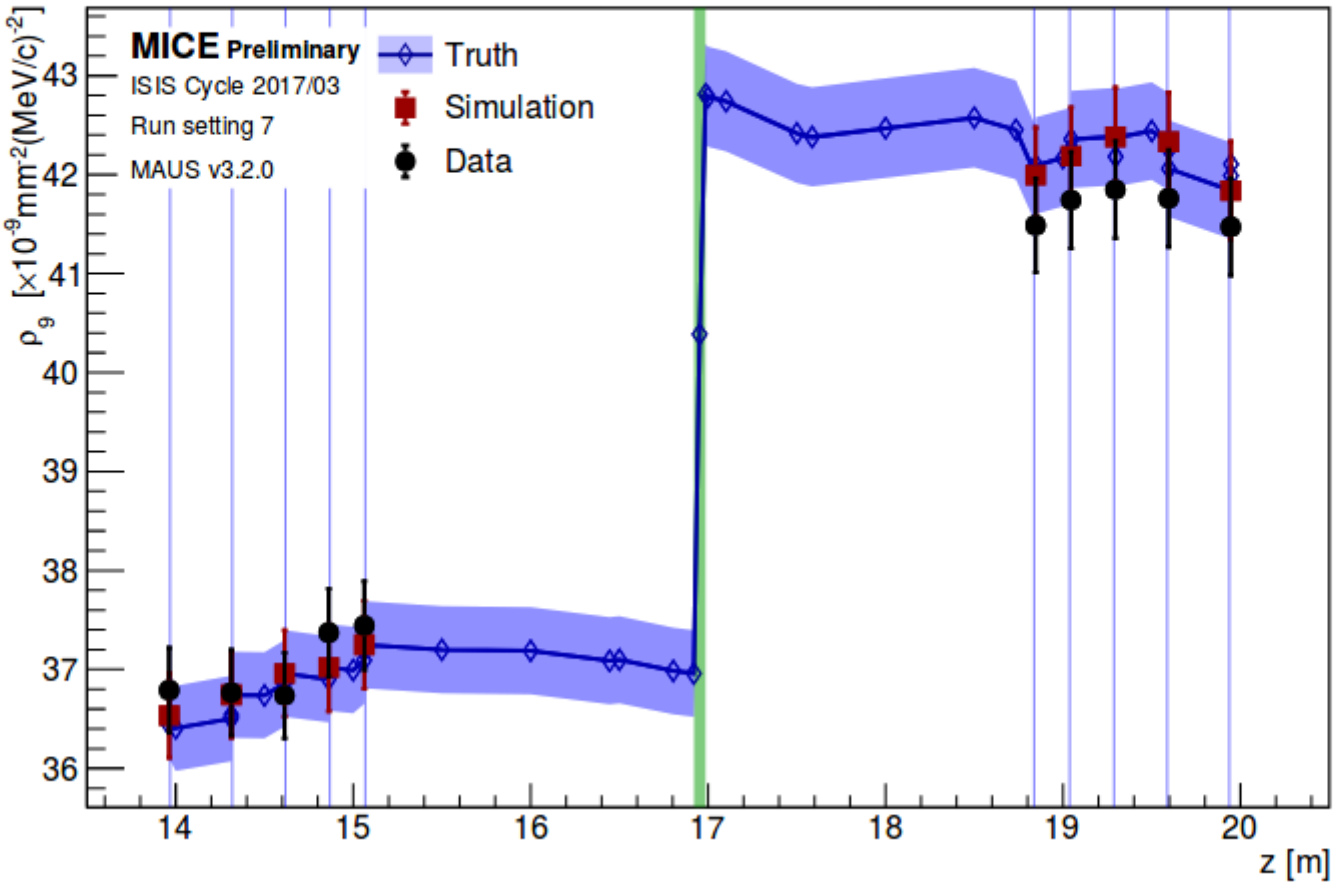
- Can average be taken during steady-state or are sensors independent
- Pressure accuracy may be overestimated, need to check difference in pressure above and below vessel again
- Estimate magnetic error (different from manufacturer)

Wedge Update

- Little Progress since CM
- Looked at difference between my results and Tanaz’s
- Looked at Francois’ KNN as similar
- Order agrees with Francois LiH analysis, but not Tanaz’s
- Perhaps Tanaz’s uses further processing, trying to understand discrepancy

The END

(9%) Contour density evolution (kNN)
6-mm 140-MeV/c beam – LiH – flip



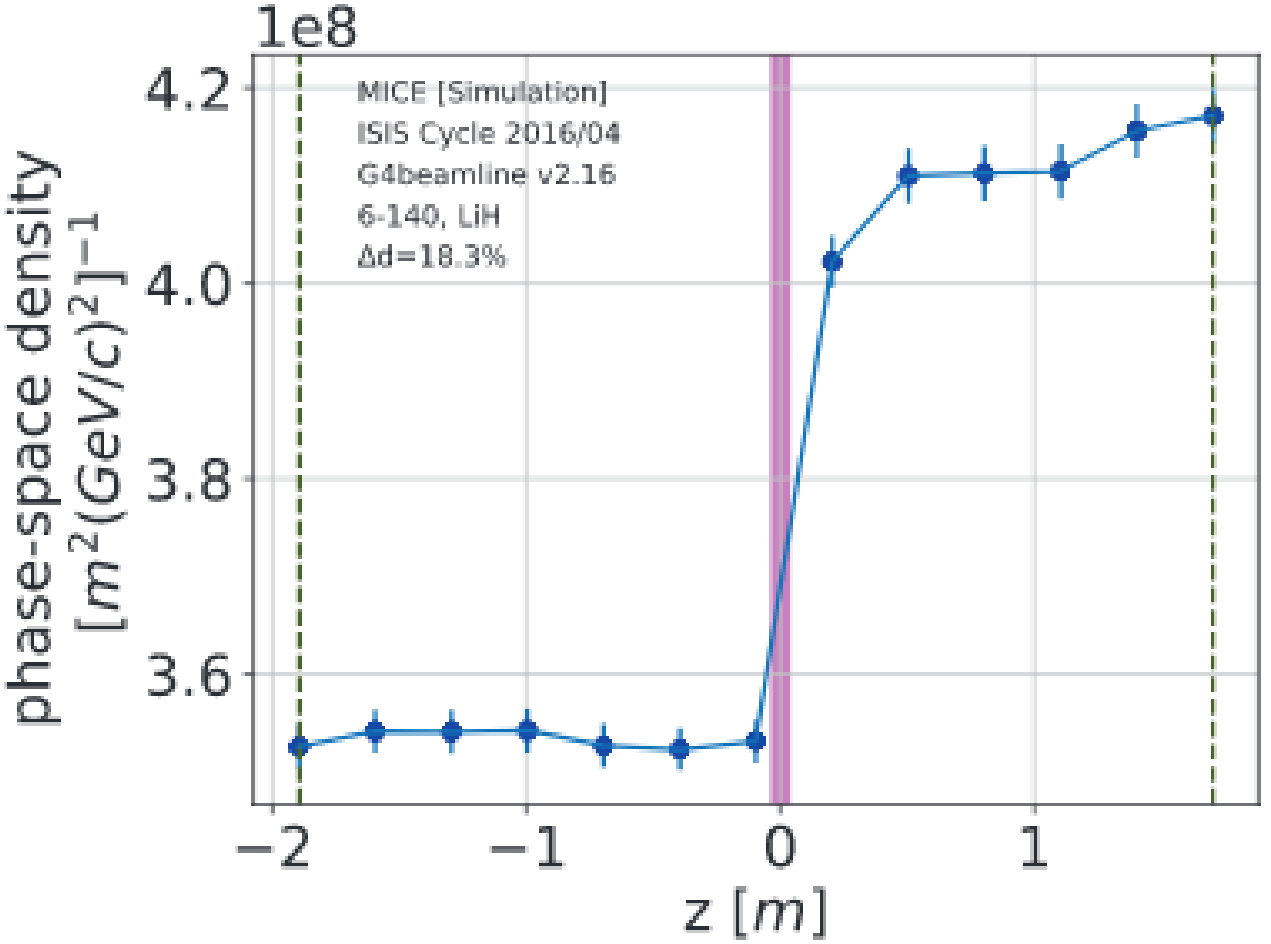
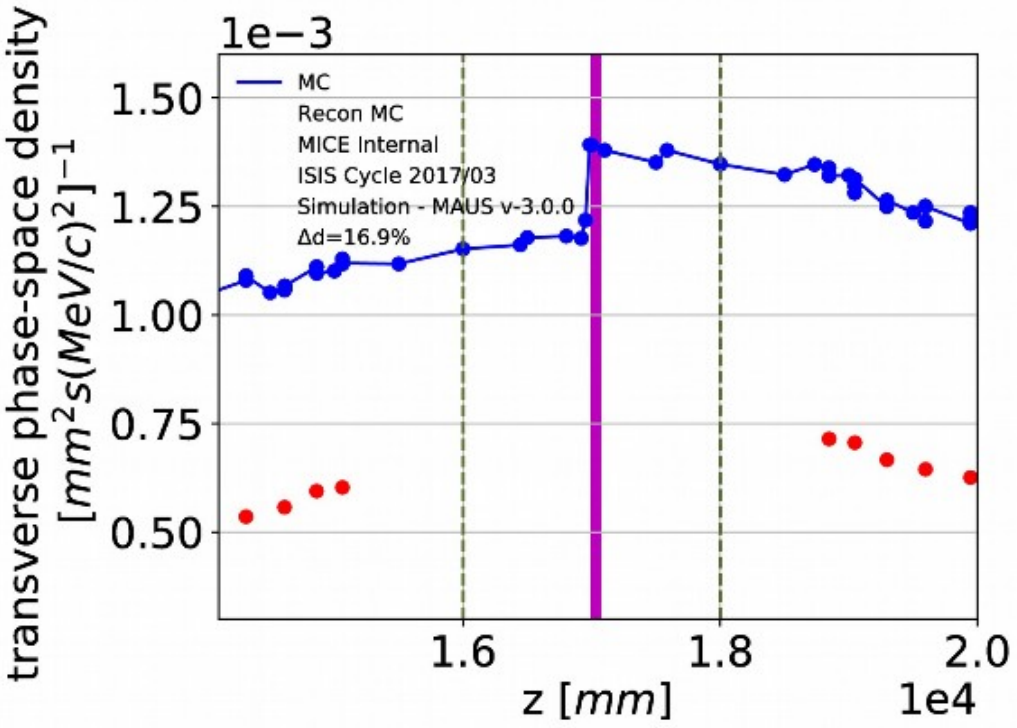
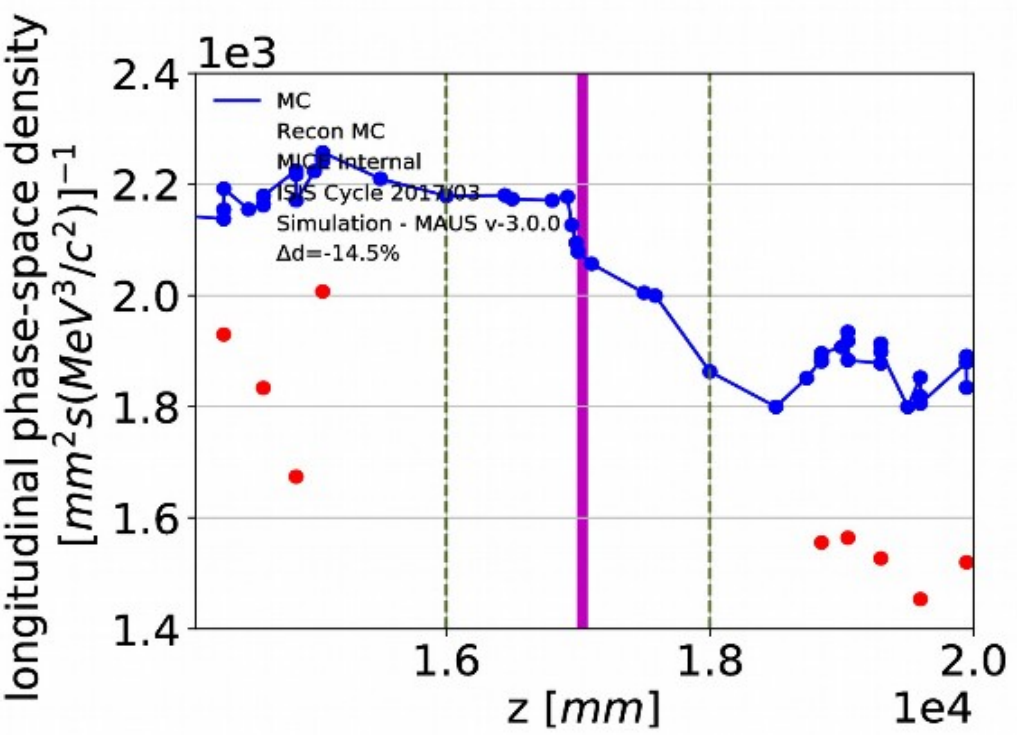


Figure 4: Evolution of the core phase-space density for the $6-140$ beam setting.

IPAC plot?


1e−3
MC
Recon MC
MICE Internal
ISIS Cycle 2017/03
Simulation - MAUS v-3.0.0
Δd=16.9%
transverse phase-space density
$[mm^2s(MeV/c)^2]^{-1}$
1.50
1.25
1.00
0.75
0.50
1.6
1.8
2.0
z [mm]
1e4


1e3
MC
Recon MC
MICE Internal
ISIS Cycle 2017/03
Simulation - MAUS v-3.0.0
Δd=-14.5%
longitudinal phase-space density
$[mm^2s(MeV^3/c^2)]^{-1}$
2.4
2.2
2.0
1.8
1.6
1.4
1.6
1.8
2.0
z [mm]
1e4