Factory Upload Programs, Straw Relaxation, & Straw Width

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Mu2e Factory Upload Programs

- Workers will record measurements at each step of straw/panel construction
  - Create barcode, measure length, thickness, epoxy record
- Files saved uniquely as:

  [measurement type] + [date & time] + [workstation ID] .csv
- Eventually, save factory files in central location (on server?)
- All programs/example files now on github

Initially Create Straw

```
sam@sam-Q502LAB:~/Mu2e-Factory/make_straw$ python2.7 make_straw.py
scan worker ID
spenders01
scan workstation ID
wsb0001
enter batch number
15

scan straw barcode (scan end code to stop or type "end")
demo1
scan parent barcode (if applicable)
straw1

scan straw barcode (scan end code to stop) or type "end"
demo2
scan parent barcode (if applicable)


scan straw barcode (scan end code to stop) or type "end"
demo3
scan parent barcode (if applicable)
straw2

scan straw barcode (scan end code to stop) or type "end"
end
```

Enter Epoxying Informaion

```
sam@sam-Q502LAB:~/Mu2e-Factory/glueups$ python2.7 glueups.py
scan worker ID
spenders01
scan workstation ID
wsb0001
enter glue batch number:
5

scan straw barcode (scan end code to stop or type "end")
demo1
scan glueup type
first end
comments (if any):
endpiece is loose

scan straw barcode (scan end code to stop) or type "end"
demo2
scan glueup type
first end
comments (if any):


scan straw barcode (scan end code to stop) or type "end"
demo1
scan glueup type
second end
comments (if any):


scan straw barcode (scan end code to stop) or type "end"
end
```

Enter Straw Thickness

```
sam@sam-Q502LAB:~/Mu2e-Factory/straw_thicknesses$ python2.7 straw_thicknesses.py
scan worker ID
spenders01
scan workstation ID
wsb0001

scan straw barcode
demo1
thickness:
5

scan straw barcode (scan end code to stop or type "end")
demo2
thickness:
6

scan straw barcode (scan end code to stop or type "end")
demo3
thickness:
6

scan straw barcode (scan end code to stop or type "end")
end
```

Enter Straw Lengths

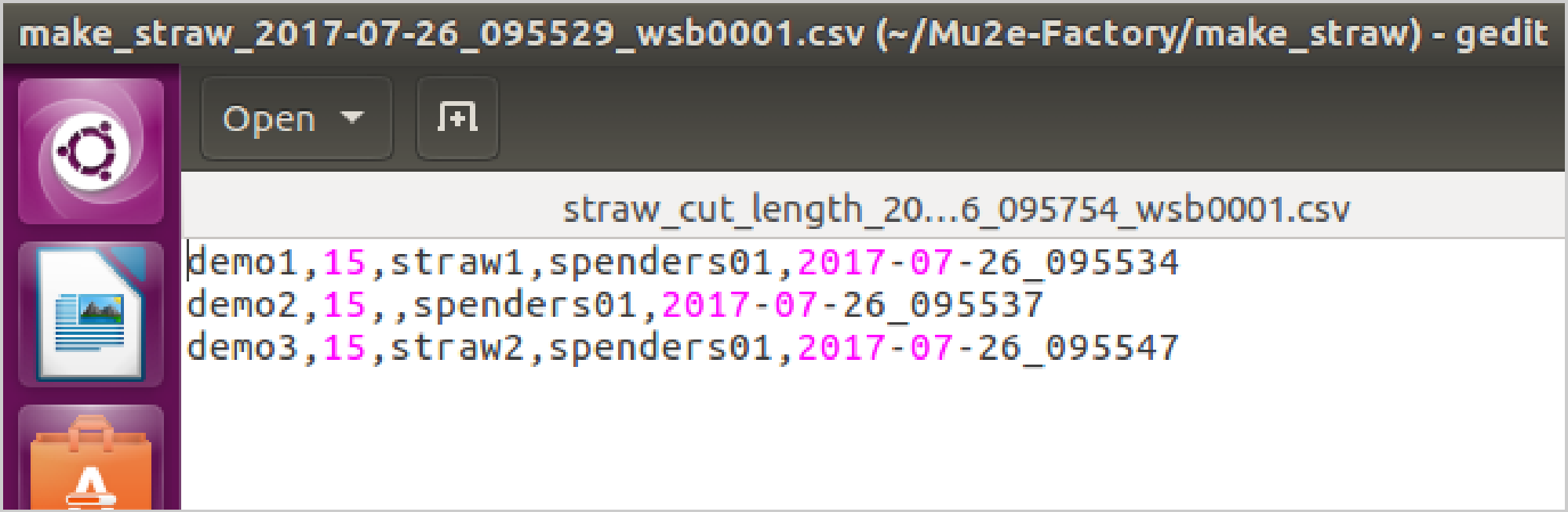
```
sam@sam-Q502LAB:~/Mu2e-Factory/straw_cut_lengths$ python2.7 straw_cut_lengths.py
scan worker ID
spenders01
scan workstation ID
wsb0001

scan straw barcode (scan end code to stop or type "end")
demo1
enter nominal length
55
enter measured length
54
enter temperature (C)
22
enter humidity
50
comments
the cut is bad

scan straw barcode (scan end code to stop) or type "end"
demo1
enter nominal length
65
enter measured length
65
enter temperature (C)
22
enter humidity
50
comments


scan straw barcode (scan end code to stop) or type "end"
end
```

Information Saved as CSV



Manager Uploads Everything

- All files saved in one location, named by type, date
  - Probably make folder for each day
- One program finds all of these files and uploads to database
- Data not uploaded as it is taken in case mistake is made

Manager Uploads Everything

```
sam@sam-Q502LAB:~/Mu2e-Factory/master_upload$ python2.7 master_upload.py
succesfuly made straw demo1
succesfuly made straw demo2
succesfuly made straw demo3
thickness upload success!

1 records inserted or updated
thickness upload success!

1 records inserted or updated
thickness upload success!

1 records inserted or updated
upload straw length success!

1 records inserted or updated
upload straw length success!

1 records inserted or updated
glueup upload success!

1 records inserted or updated
glueup upload success!

1 records inserted or updated
glueup upload success!

1 records inserted or updated
```

Data Appears in Database

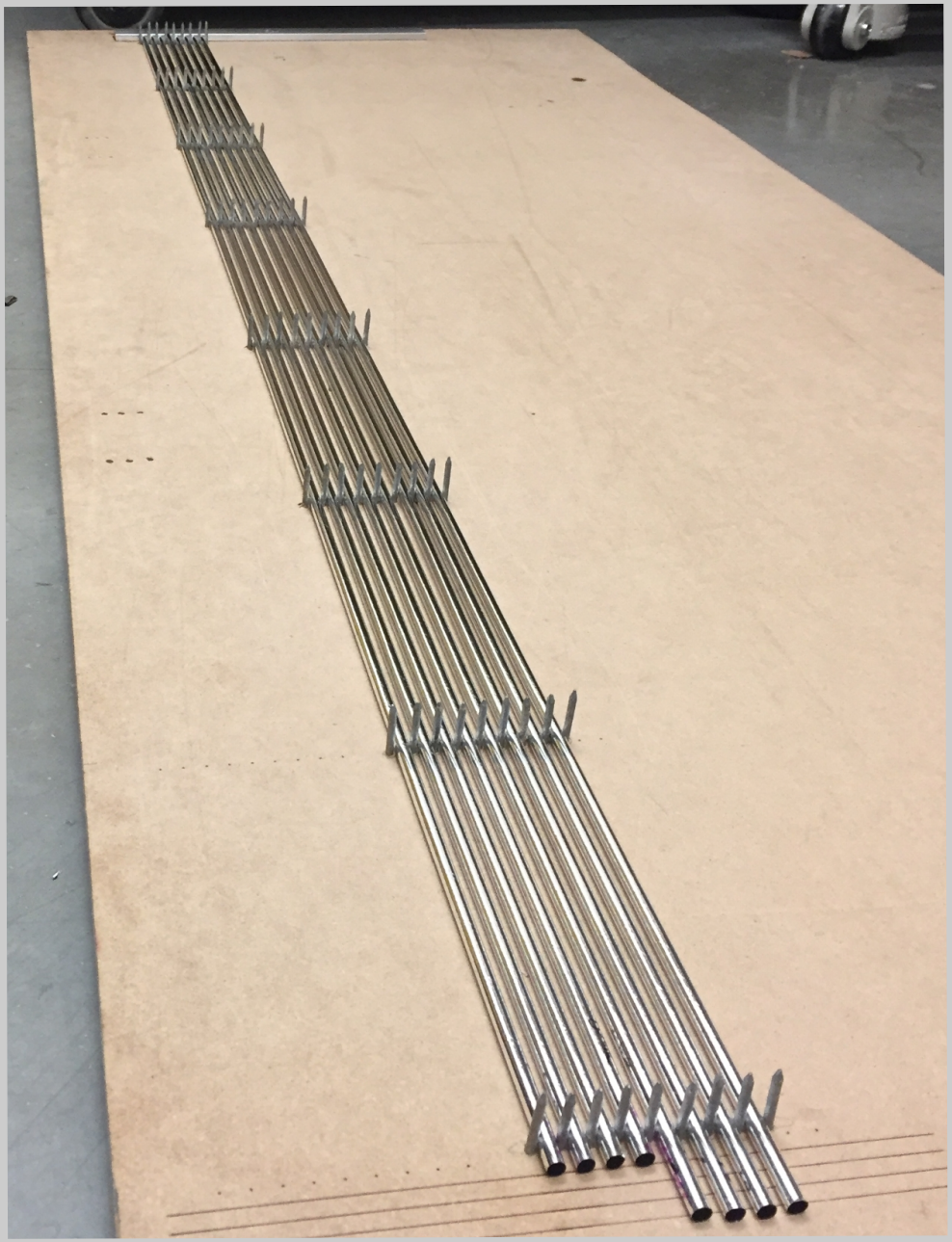
view/edit	straw1	06/23/2017 14:52:29-0500	wk-spenders01	wsb0001	1500.0	1200.0	12.0	55.0		mu2e_writer
view/edit	straw1	06/23/2017 14:53:04-0500	wk-spenders01	wsb0001	1500.0	1200.0	12.0	55.0		mu2e_writer
view/edit	st123456	06/15/2017 13:24:15-0500	wb0001	wsb0001	1200.0	1199.5	23.1	45.3	This is a test	mu2e_writer
view/edit	st123456	06/22/2017 16:09:14-0500	wb0001	wsb0001	1200.0	1199.5	23.1	45.3	This is a test	mu2e_writer
view/edit	st00045	06/30/2016 13:15:33-0500	wb0001	wsb0001	1.0	0.00065	2.0	2.1	This is a test	mu2e_writer
view/edit	st00045	06/30/2016 12:45:54-0500	wb0001	wsb0001	1.0	0.00065	2.0	2.1	This is a test	mu2e_writer
view/edit	st00045	06/30/2016 12:40:36-0500	wb0001	wsb0001	1.0	0.00065	2.0	2.1	This is a test	mu2e_writer
view/edit	st00045	06/30/2016 12:38:16-0500	wb0001	wsb0001	1.0	0.00065	2.0	2.1	This is a test	mu2e_writer
view/edit	st00045	06/30/2016 12:15:20-0500	wb0001	wsb0001	1.0	0.00065	2.0	2.1	This is a test	mu2e_writer
view/edit	st00045	06/30/2016 13:41:53-0500	wb0001	wsb0001	1191.0142633	1191.0	23.0	41.0	This might be the first test to work	mu2e_writer
view/edit	st00045	06/30/2016 13:20:49-0500	wb0001	wsb0001	1.0	0.00065	2.0	2.1	This is a test	mu2e_writer
view/edit	st00045	06/30/2016 13:22:39-0500	wb0001	wsb0001	1198.4738224	24.0	9.0	18.0	This is a test	mu2e_writer
view/edit	st00045	06/30/2016 13:59:24-0500	wb0001	wsb0001	1182.57232845	1182.57	7.0	48.0	Will this one work?	mu2e_writer
view/edit	st00045	06/30/2016 13:49:49-0500	wb0001	wsb0001	1109.3500086	1109.35	8.0	4.0	Maybe this will work	mu2e_writer
view/edit	st00044	06/27/2016 11:42:15-0500	wb0001	wsb0001	1200.0	1199.5	23.1	45.3	This is a test	mu2e_writer
view/edit	st000001	02/27/2015 13:10:20-0600	wb0001	wsb0001	5.0	4.98	72.0	57.0		swhite
view/edit	demo2	07/26/2017 10:48:09-0500	wk-spenders01	wsb0001	65.0	65.0	22.0	50.0		mu2e_writer
view/edit	demo1	07/26/2017 10:48:09-0500	wk-spenders01	wsb0001	55.0	54.0	22.0	50.0	the cut is bad	mu2e_writer

dump to CSV plot search data config data <prev next>

Second Generation Relaxation Test

- Purpose: To determine how long we must wait to cut straws after tensioning
- Procedure
  - Tension 4 pairs of straws at 800gf
    - Control pair, 30 seconds, 16 hrs, 24 hrs
  - Immediately cut with laser to same length (cut off minimal material)
  - Track distance from straw end to engraved line with 1/100” ruler and microscope

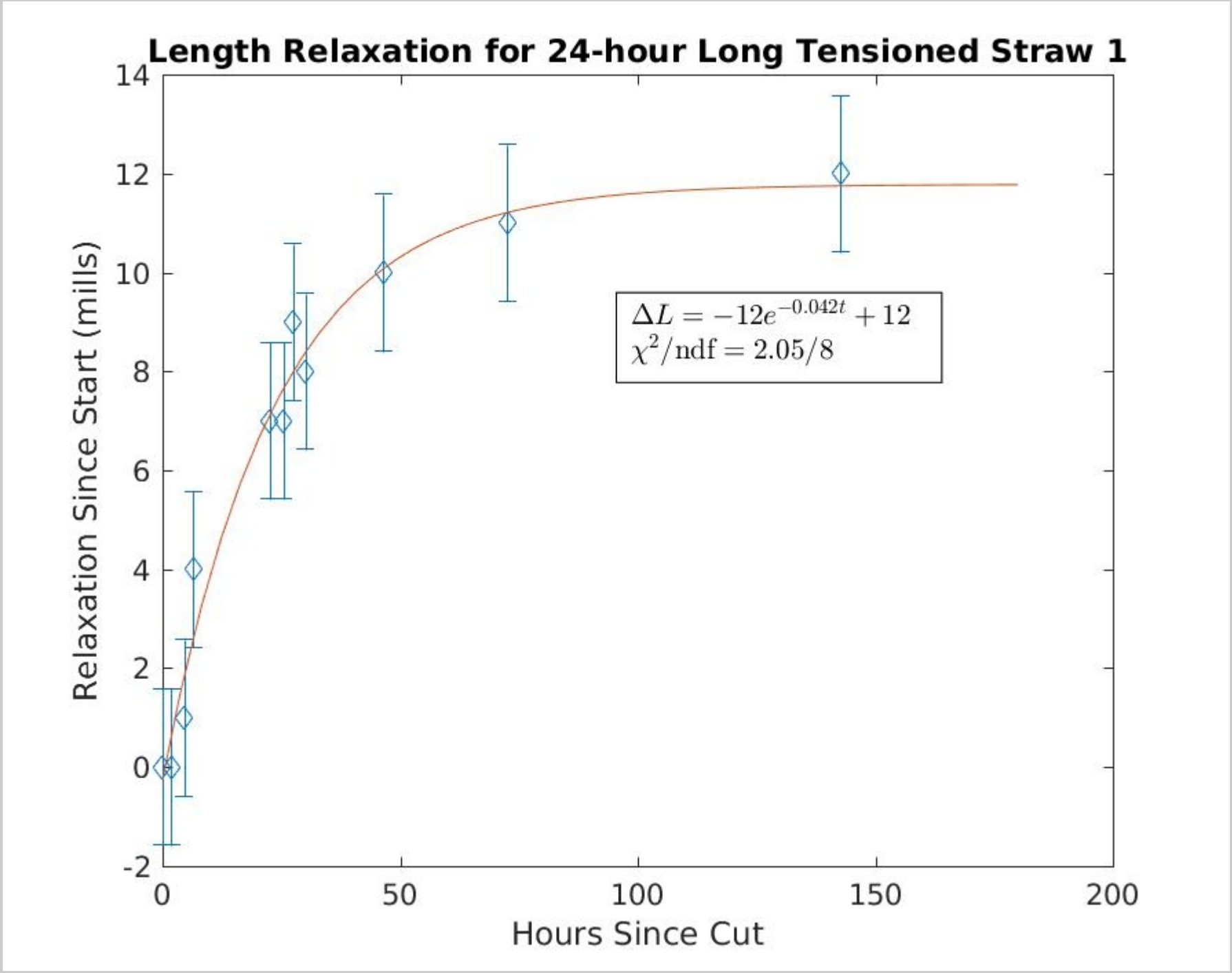
Apparatus

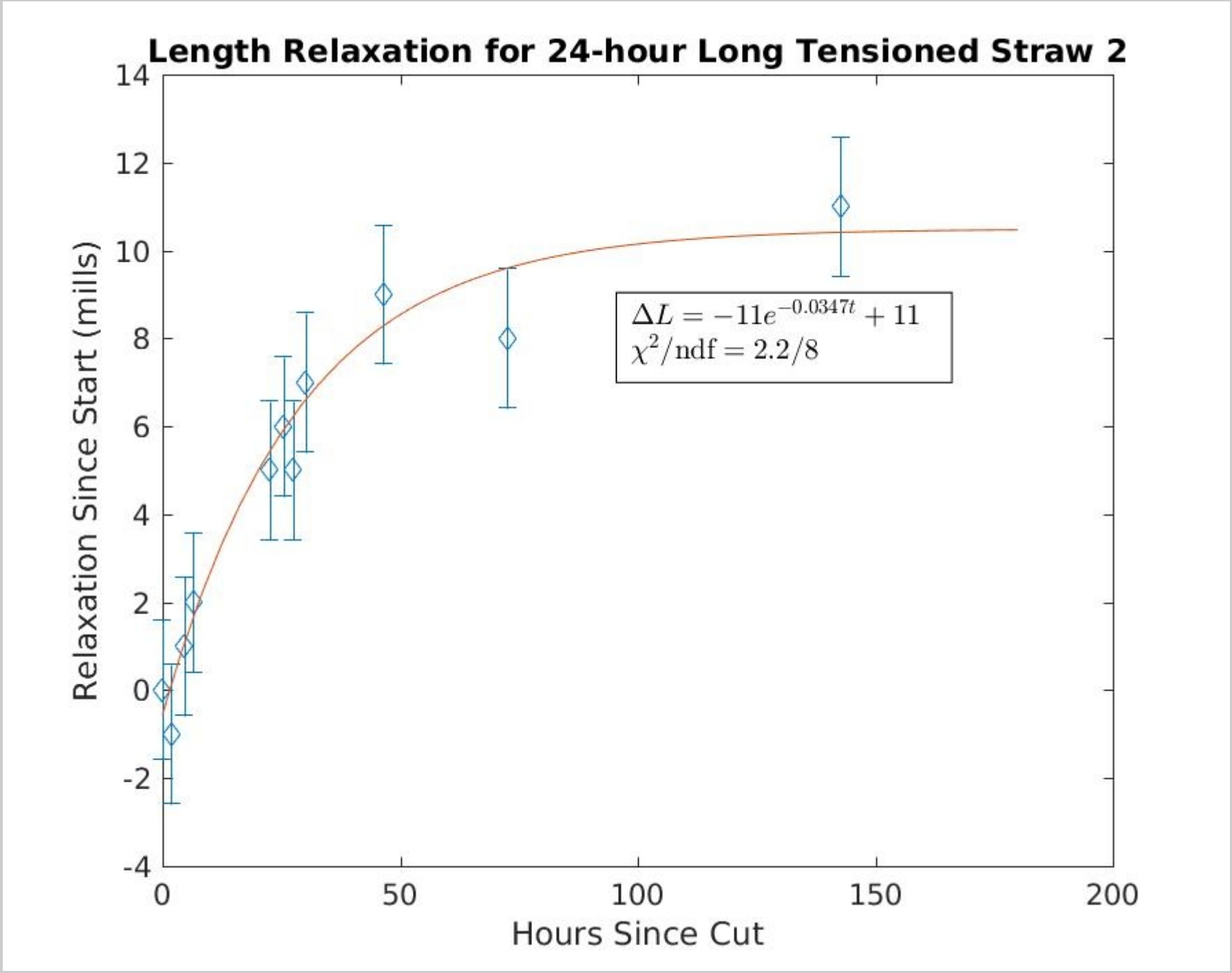


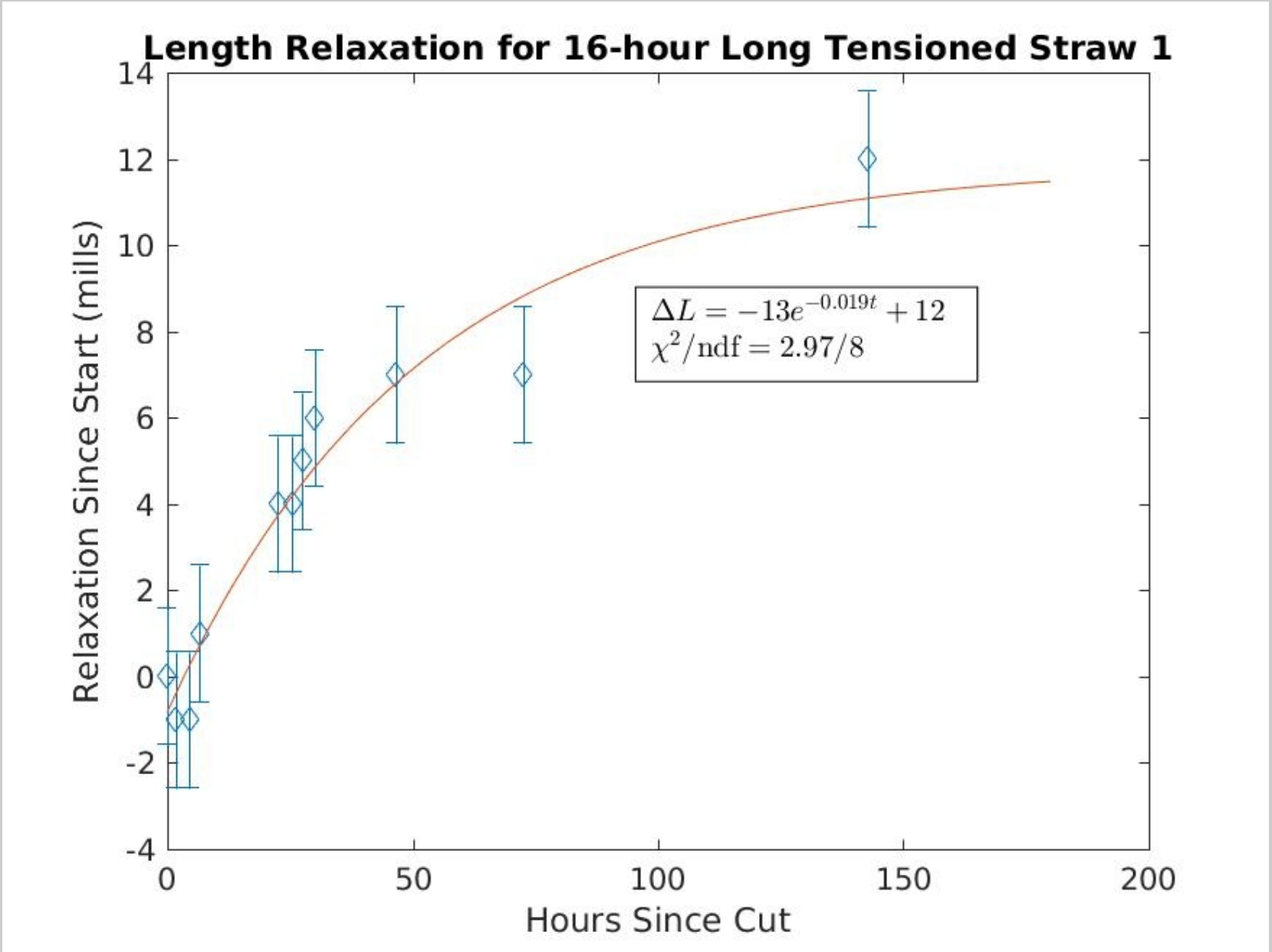
Analysis

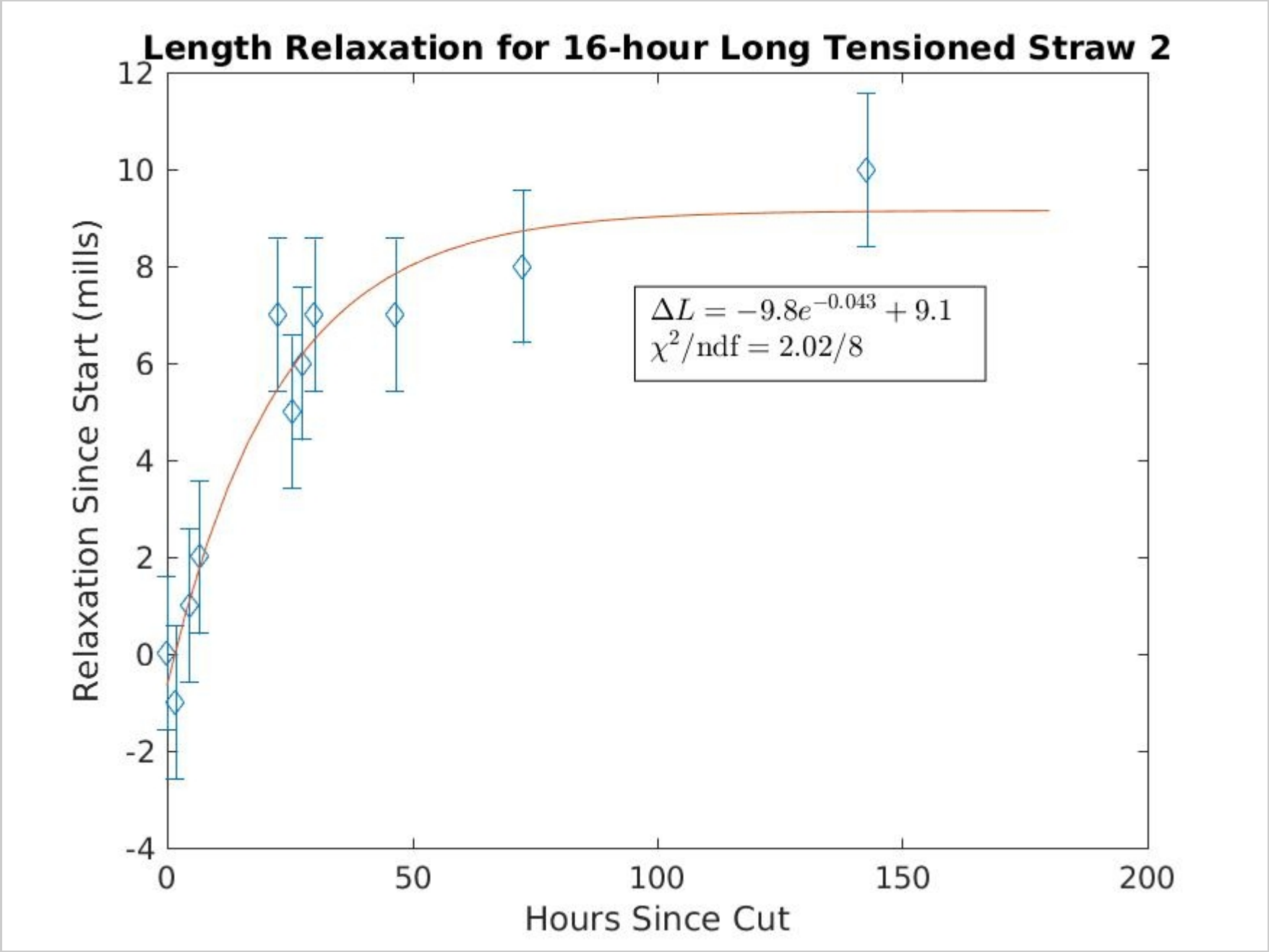
- Straw length dependent on environment
  - Length change corrected by relative change in control straws
- Expected length to decay exponentially
  - Length change fit to

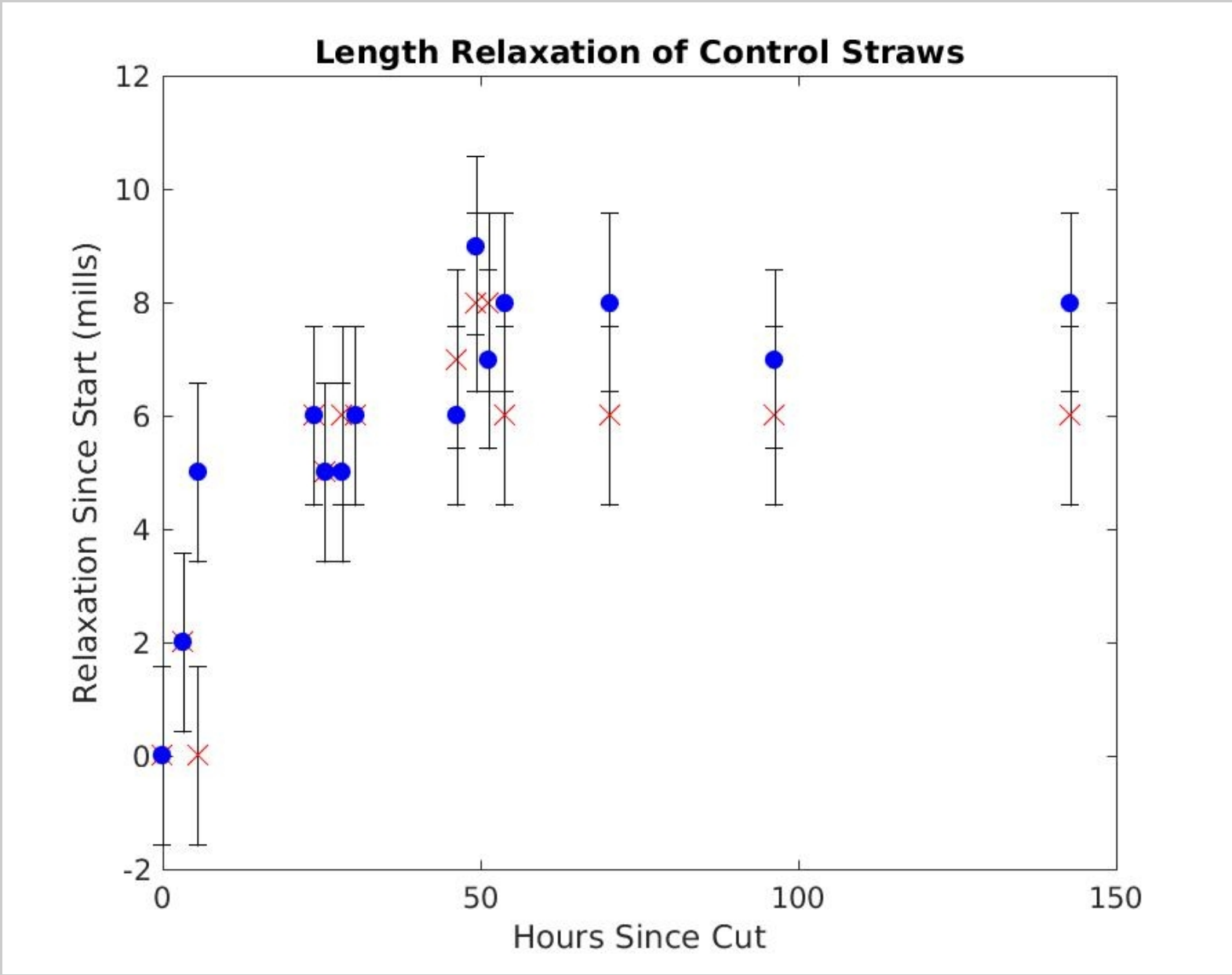
$$y = A*\exp(-b*t) + C$$

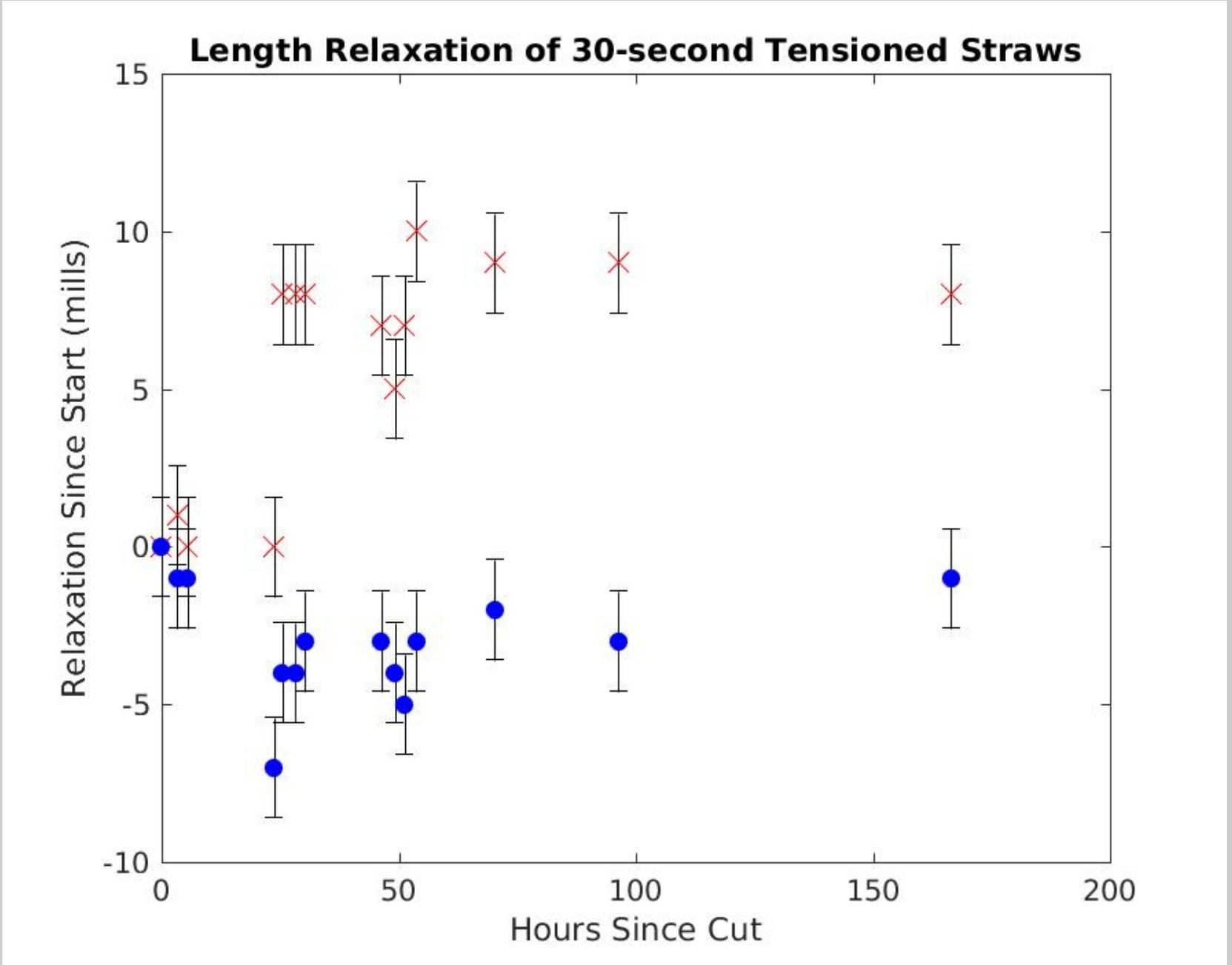

Length Relaxation for 24-hour Long Tensioned Straw 1
Relaxation Since Start (mills)
Hours Since Cut
14
12
10
8
6
4
2
0
-2
0
50
100
150
200
$\Delta L = -12e^{-0.042t} + 12$
$\chi^2/\mathrm{ndf} = 2.05/8$


Length Relaxation for 24-hour Long Tensioned Straw 2
Relaxation Since Start (mills)
Hours Since Cut
$\Delta L = -11e^{-0.0347t} + 11$
$\chi^2/\mathrm{ndf} = 2.2/8$
14
12
10
8
6
4
2
0
-2
-4
0
50
100
150
200


Length Relaxation for 16-hour Long Tensioned Straw 1
Relaxation Since Start (mills)
Hours Since Cut
$\Delta L = -13e^{-0.019t} + 12$
$\chi^2/\mathrm{ndf} = 2.97/8$
14
12
10
8
6
4
2
0
-2
-4
0
50
100
150
200


Length Relaxation for 16-hour Long Tensioned Straw 2
Relaxation Since Start (mills)
Hours Since Cut
$\Delta L = -9.8e^{-0.043} + 9.1$
$\chi^2/\mathrm{ndf} = 2.02/8$
12
10
8
6
4
2
0
-2
-4
0
50
100
150
200


Length Relaxation of Control Straws
Relaxation Since Start (mills)
Hours Since Cut
12
10
8
6
4
2
0
-2
0
50
100
150

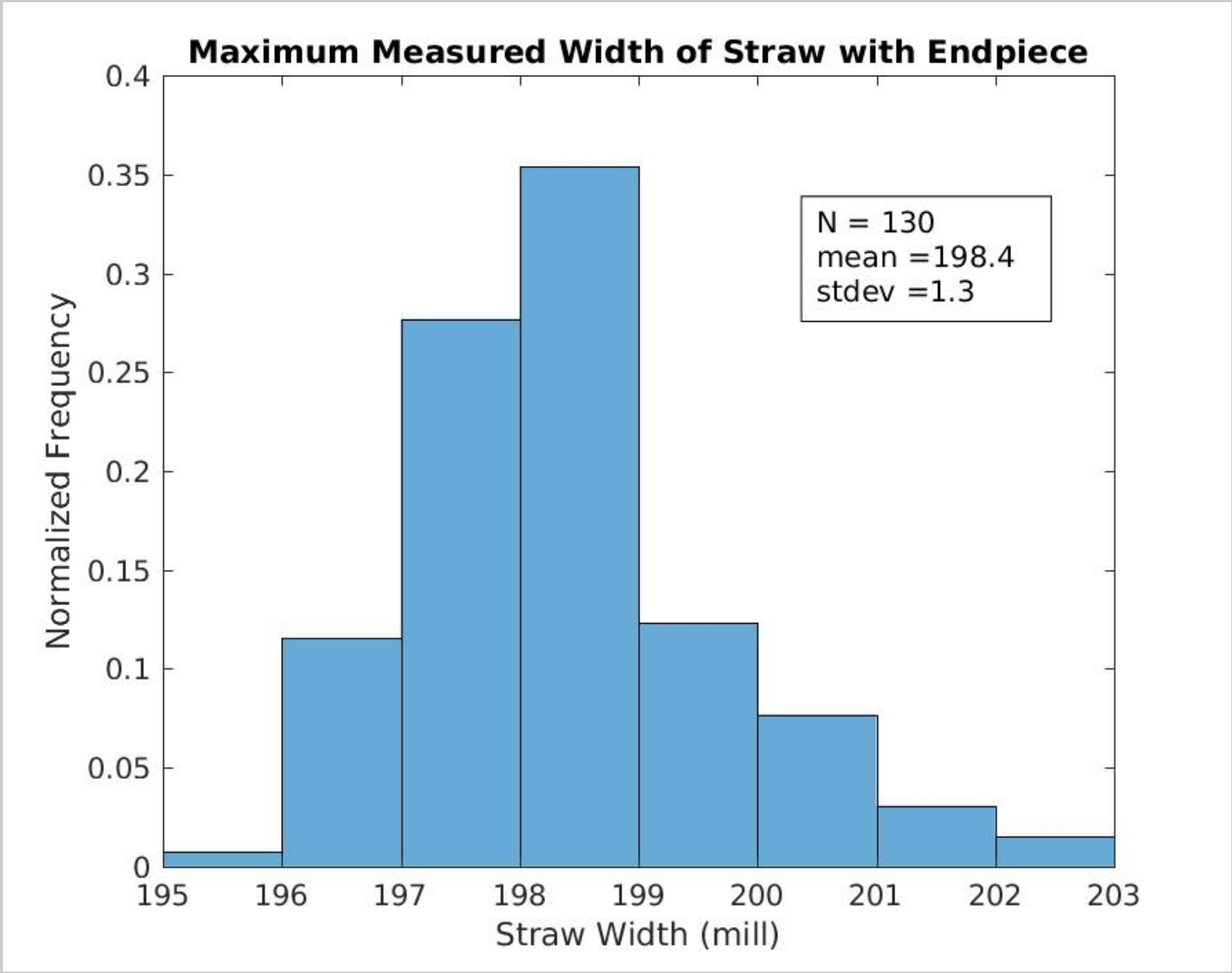

Length Relaxation of 30-second Tensioned Straws
Relaxation Since Start (mills)
Hours Since Cut
15
10
5
0
-5
-10
0
50
100
150
200

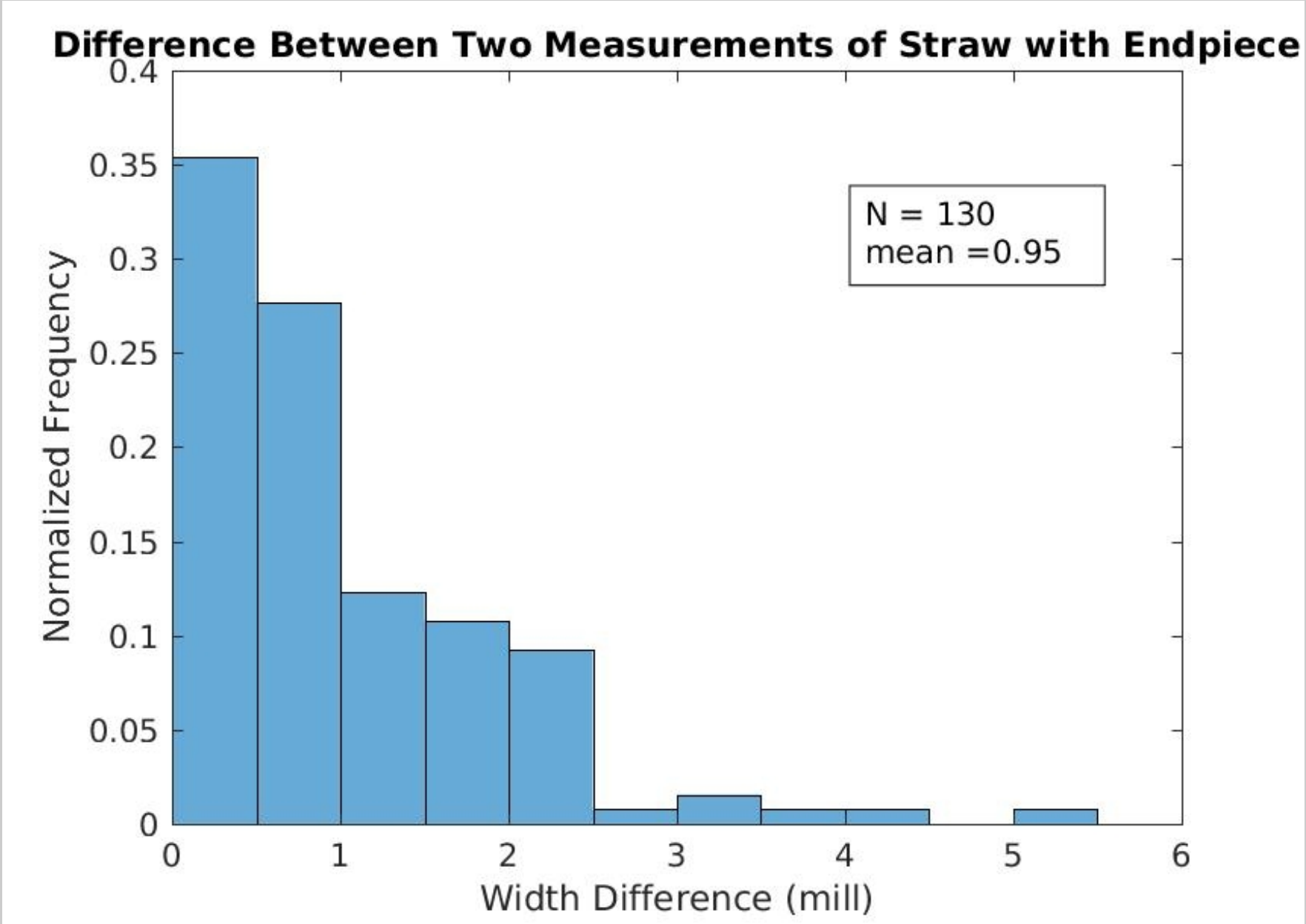
Conclusion

- Straw length converges in 4 days
  - Time constant ~0.04/hr
- Straws tensioned for 24hrs and 16hrs show similar behavior
- Straws Tensioned for 30 sec. show no notable length change

Straw Width Measurement

- Purpose
  - Possibly center sense wire by relation to straw, not endpiece
  - Determine what diameter to make tracker components
- Procedure
  - 130 straws with epoxied endpiece measured vertically and horizontally with micrometer
  - Measured at cleanest point (no epoxy)

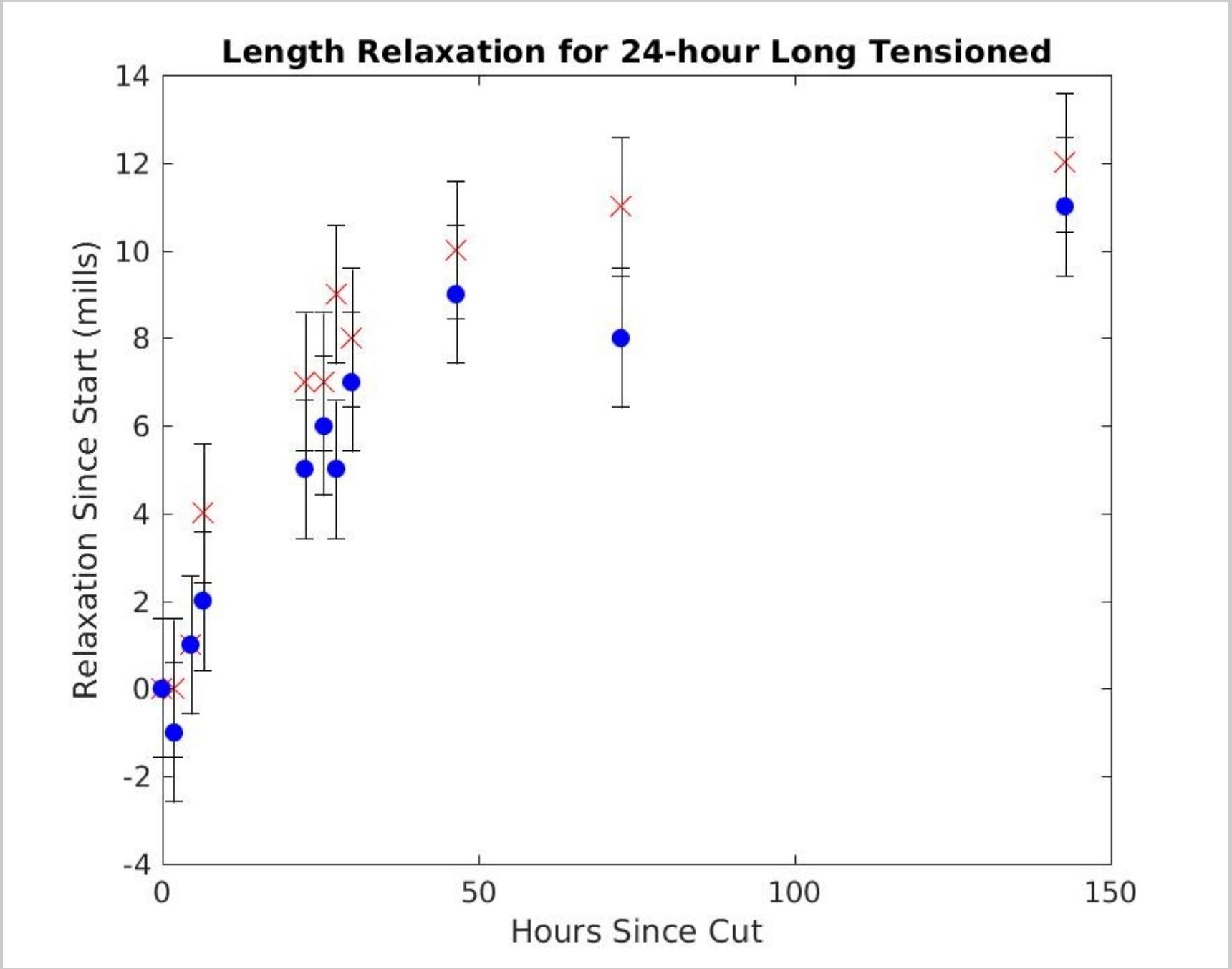

Maximum Measured Width of Straw with Endpiece
Normalized Frequency
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
195
196
197
198
199
200
201
202
203
Straw Width (mill)
N = 130
mean =198.4
stdev =1.3

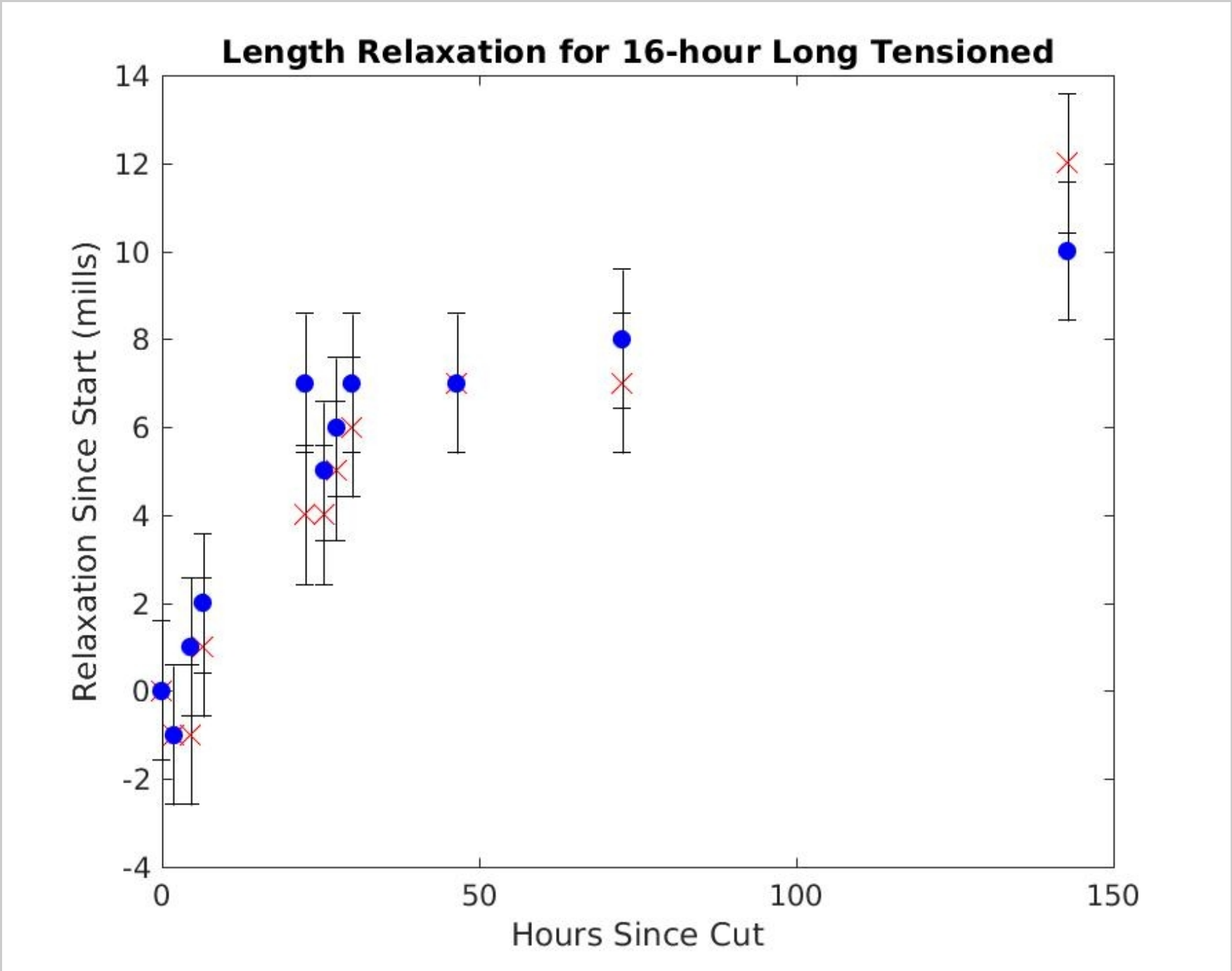

Difference Between Two Measurements of Straw with Endpiece
Normalized Frequency
Width Difference (mill)
N = 130
mean =0.95
0
0.05
0.1
0.15
0.2
0.25
0.3
0.35
0.4
0
1
2
3
4
5
6

Conclusion

- Mean width = (198±1) mill
  - About 25% of straws larger than mean
- Must get all epoxy off – will add mills to width
- Avg. width difference ~ 1 mill
  - 40% have width difference > 1 mill

Backup


Length Relaxation for 24-hour Long Tensioned
Relaxation Since Start (mills)
Hours Since Cut
14
12
10
8
6
4
2
0
-2
-4
0
50
100
150


Length Relaxation for 16-hour Long Tensioned
Relaxation Since Start (mills)
Hours Since Cut
14
12
10
8
6
4
2
0
-2
-4
0
50
100
150