

Thermal Properties of Loblolly Pine from Naturally Regenerated Stands



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Project Overview

- Thermochemical Characterization
 - Proximate
 - Ultimate
 - Gasification
- Silvicultural Regimes
 - Growth Rate
 - Feedstock Type
- Linkage to LTSP



Overview of Feedstocks

Origin	Sample	Type
Crossett Experimental Forest	CEFSW01	Slab wood
	CEFSW02	Slab wood
	CEFSW03	Slab wood
	CEFBW01	Bole wood
	CEFBW02	Bole wood
	CEFBW03	Bole wood
	CEFWT01	Whole Tree
Hope Experimental Station	HESBW01	Bole wood
	HESTL01	Tops and Limbs
	HESSW01	Slab wood

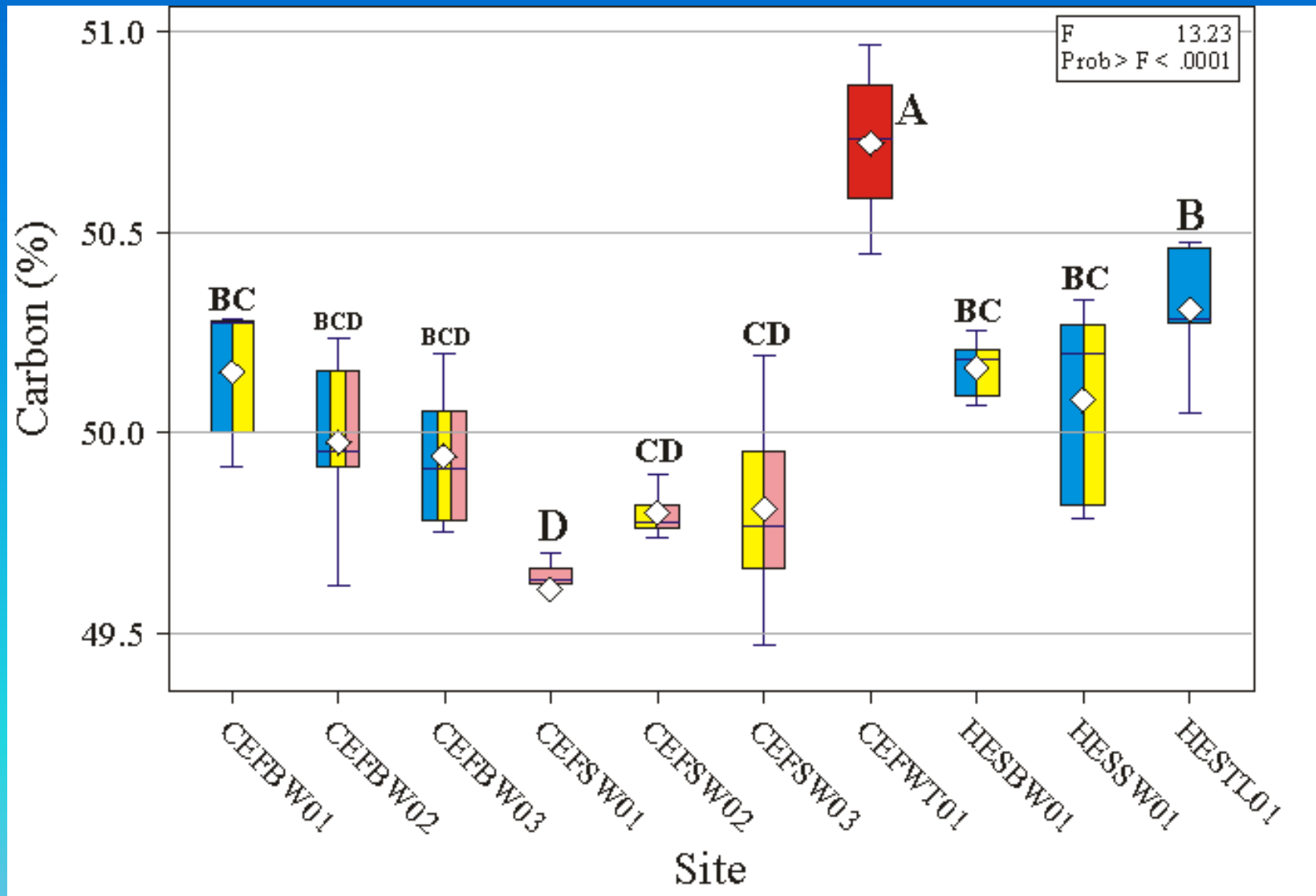
Elemental Analyses

Sample	Elemental Analysis							
	Carbon (%)		Hydrogen (%)		Nitrogen (%)		Oxygen (%)	
	Avg C (%)	St.Error (%)	Avg H (%)	St.Error (%)	Avg N (%)	St.Error (%)	Avg O (%)	St.Error (%)
CEFSW01	49.6	0.05	6.3	0.02	0.04	0.01	44.1	0.06
CEFSW02	49.8	0.03	6.2	0.04	0.02	0.01	44.0	0.03
CEFSW03	49.8	0.12	6.1	0.03	0.01	0.01	44.1	0.12
CEFBW01	50.1	0.08	6.4	0.05	0.06	0.01	43.4	0.12
CEFBW02	50.0	0.11	6.3	0.03	0.00	0.00	43.7	0.24
CEFBW03	49.9	0.08	6.2	0.04	0.02	0.01	43.8	0.07
CEFWT01	50.7	0.09	6.2	0.04	0.23	0.02	42.8	0.09
HESBW01	50.2	0.04	6.3	0.01	0.10	0.01	43.4	0.03
HESTL01	50.3	0.08	6.2	0.04	0.06	0.02	43.4	0.12
HESSW01	50.1	0.12	6.1	0.07	0.06	0.03	43.8	0.16

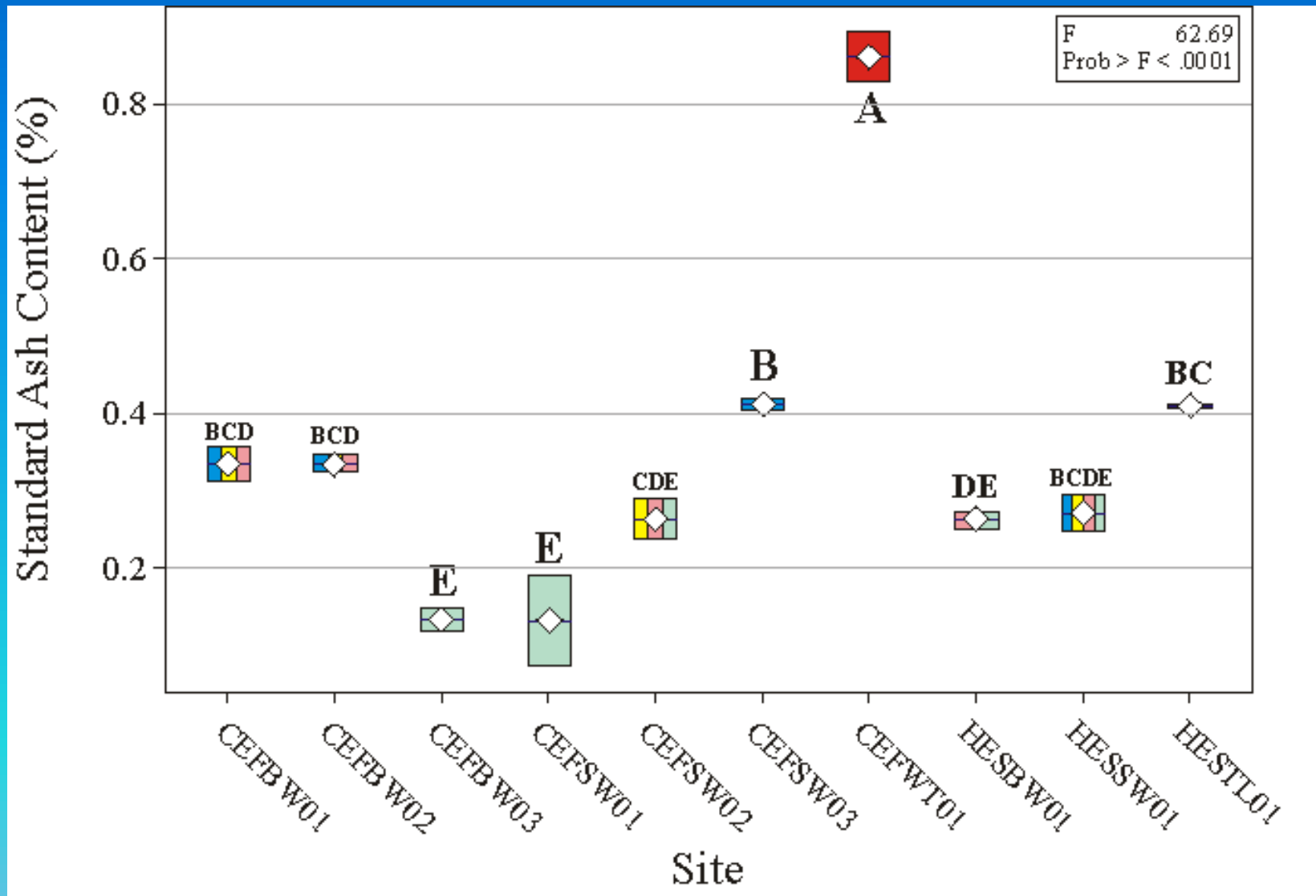
Proximate Analyses

Feedstock	Moisture Content (wt%)	Volatile Matter (wt%)	Fixed Carbon (wt%)	Ash Content (wt%)
CEFSW01	9.91 ± 0.5	82.88 ± 0.38	16.95 ± 0.35	0.16 ± 0.03
CEFSW02	12.5 ± 0.47	82.49 ± 0.29	17.28 ± 0.27	0.23 ± 0.02
CEFSW03	10.14 ± 0.26	82.02 ± 0.54	17.71 ± 0.51	0.27 ± 0.03
CEFBW01	9.3 ± 0.08	83.83 ± 0.22	15.92 ± 0.21	0.25 ± 0.01
CEFBW02	9.29 ± 0.22	84.25 ± 1.12	15.49 ± 1.09	0.26 ± 0.04
CEFBW03	9.37 ± 0.22	83.11 ± 0.04	16.68 ± 0.09	0.21 ± 0.04
CEFWT01	8.61 ± 0.19	79.33 ± 0.12	19.82 ± 0.09	0.85 ± 0.04
HESBW01	8.63 ± 0.24	83.85 ± 0.25	15.87 ± 0.26	0.28 ± 0.02
HESTL01	7.97 ± 0.34	81.48 ± 0.1	18.13 ± 0.08	0.39 ± 0.02
HESSW01	9.58 ± 0.08	81.17 ± 0.42	18.55 ± 0.4	0.28 ± 0.03

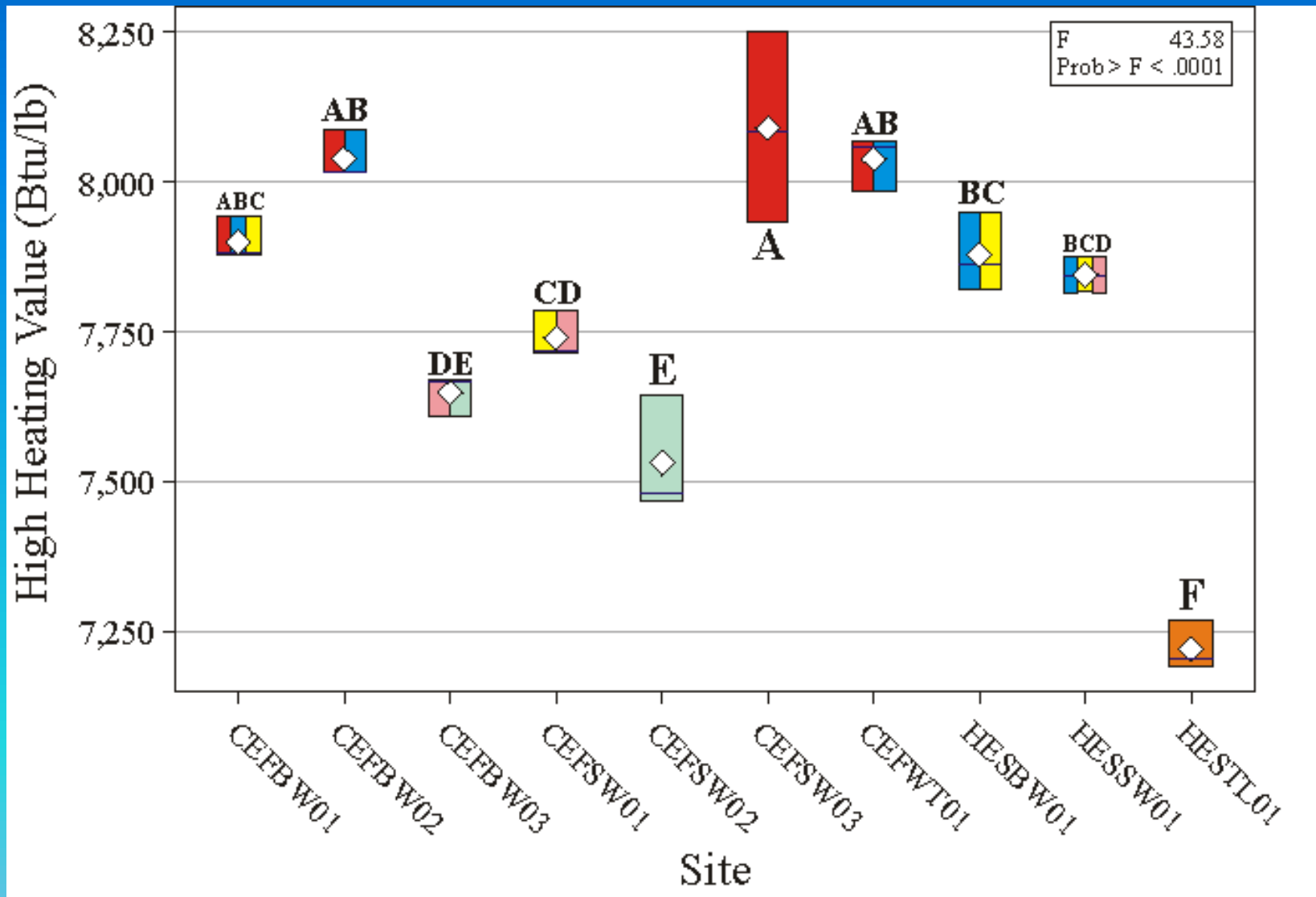
Carbon Content



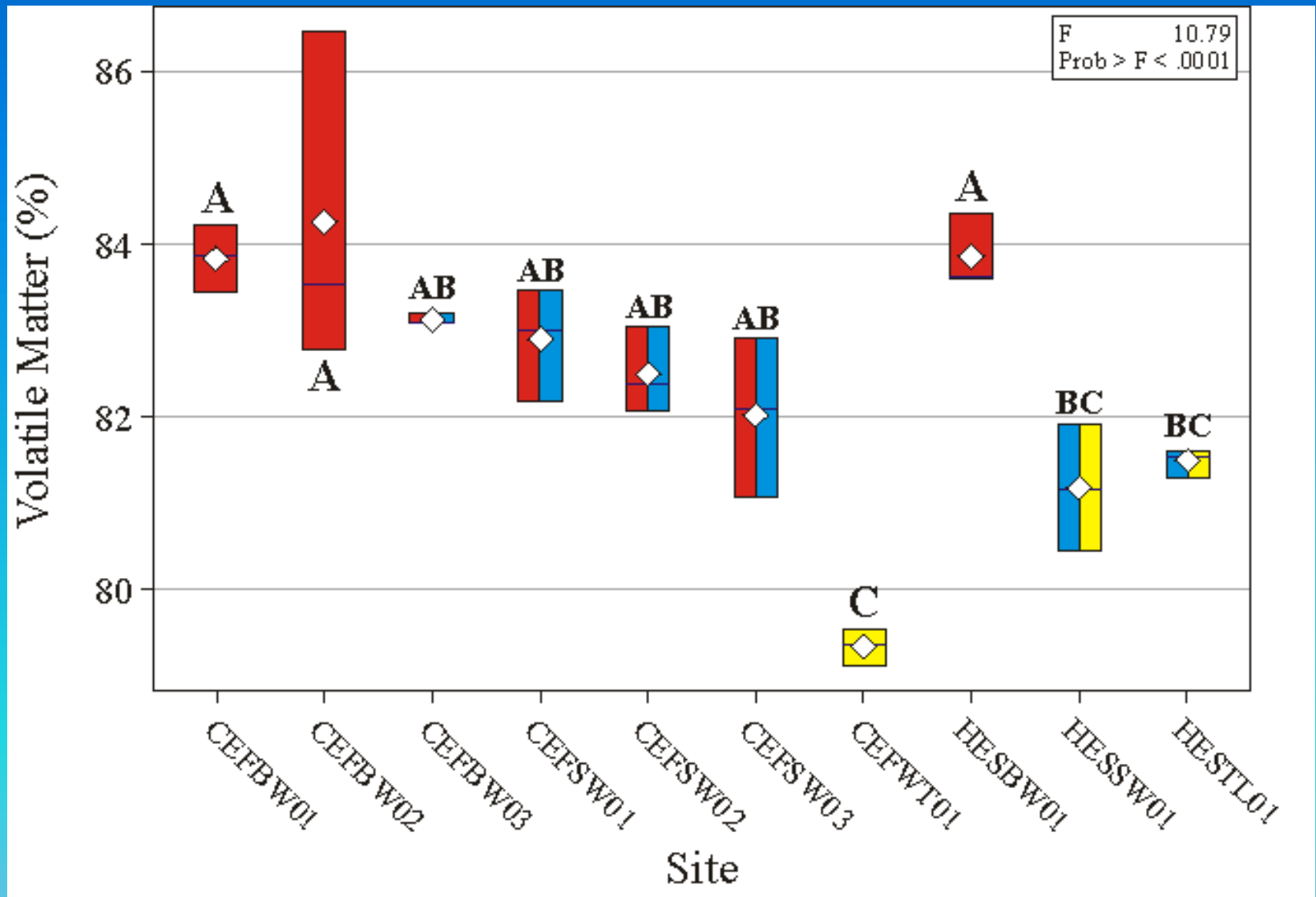
Standard Ash Content



High Heating Value



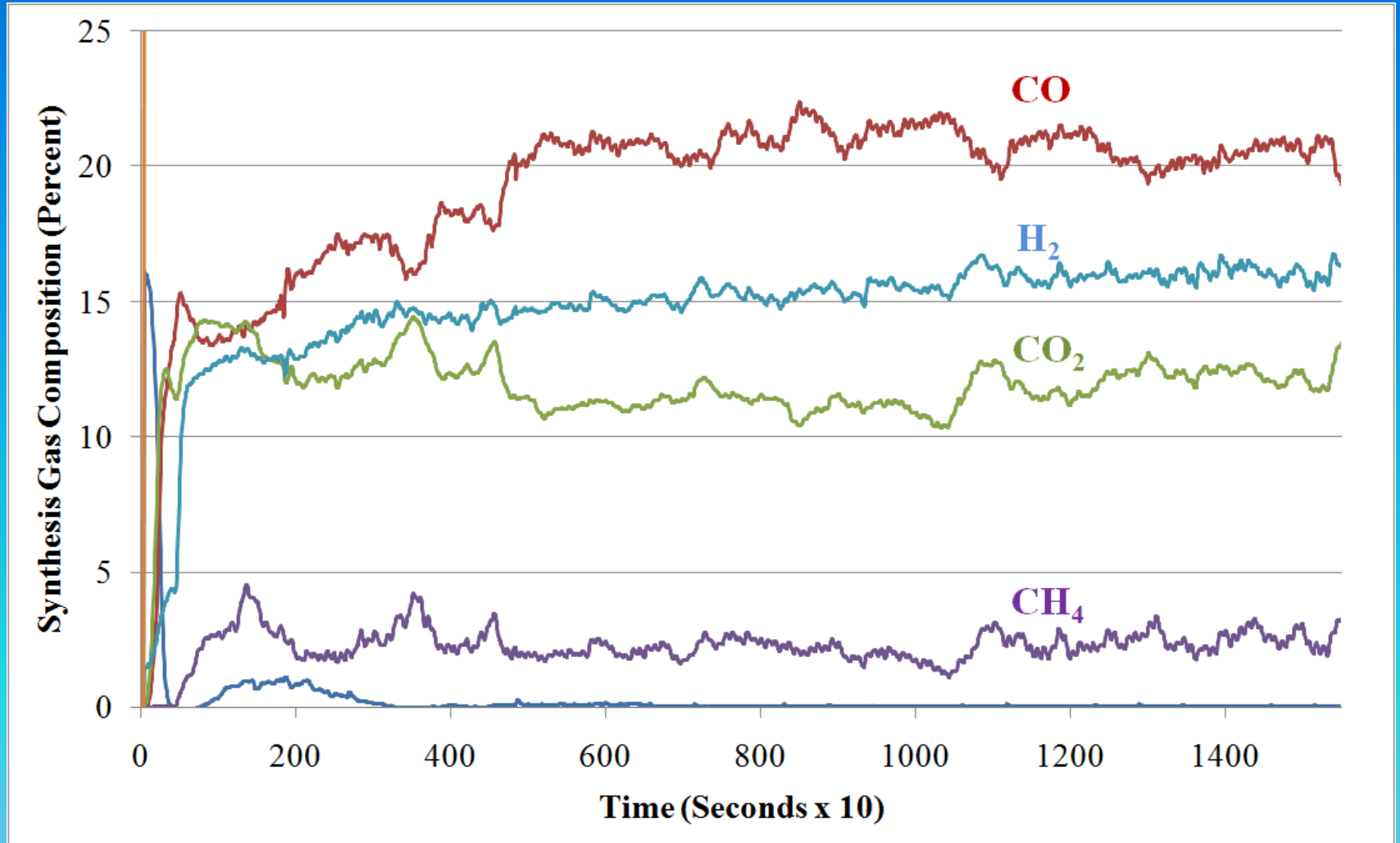
Volatile Matter



Gasification: Downdraft

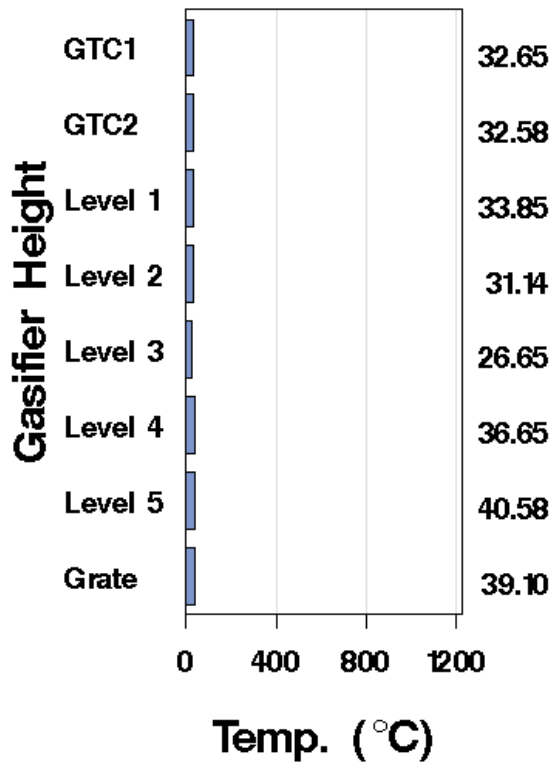


Gas Analysis – Mixed SYP

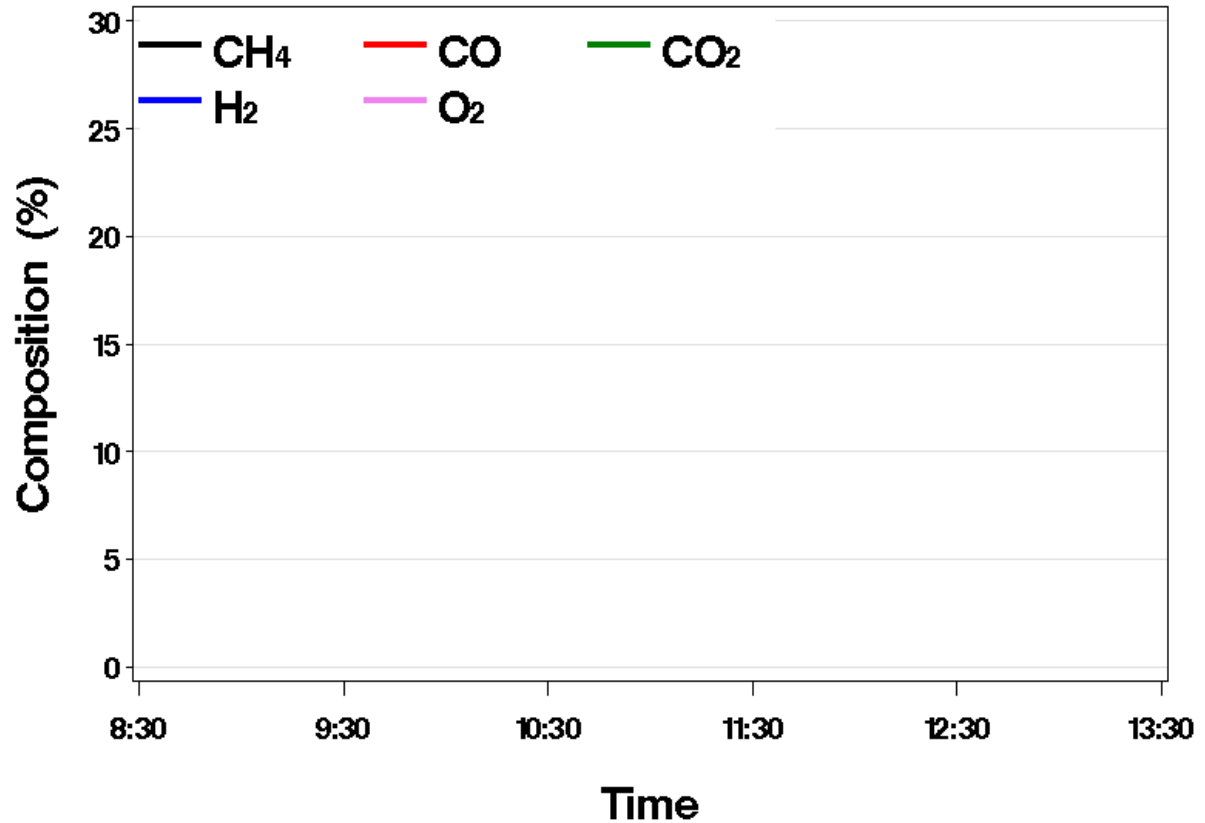


Mixed SYP (Flowrate = 70 scmh)

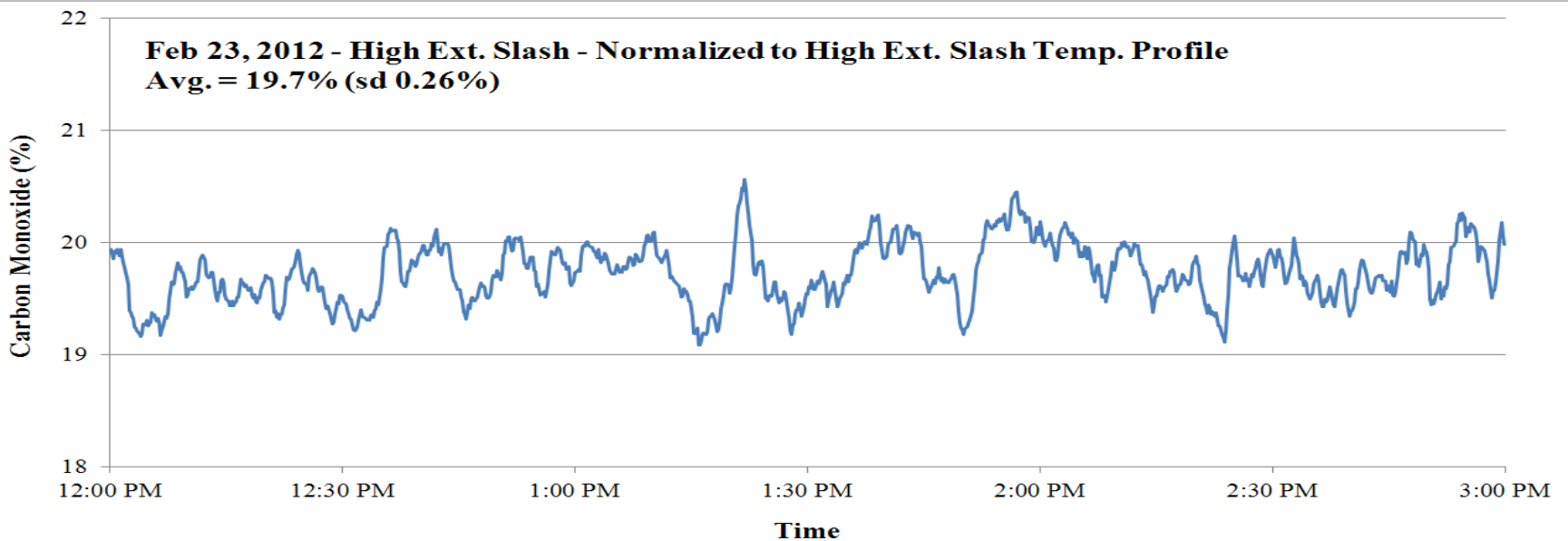
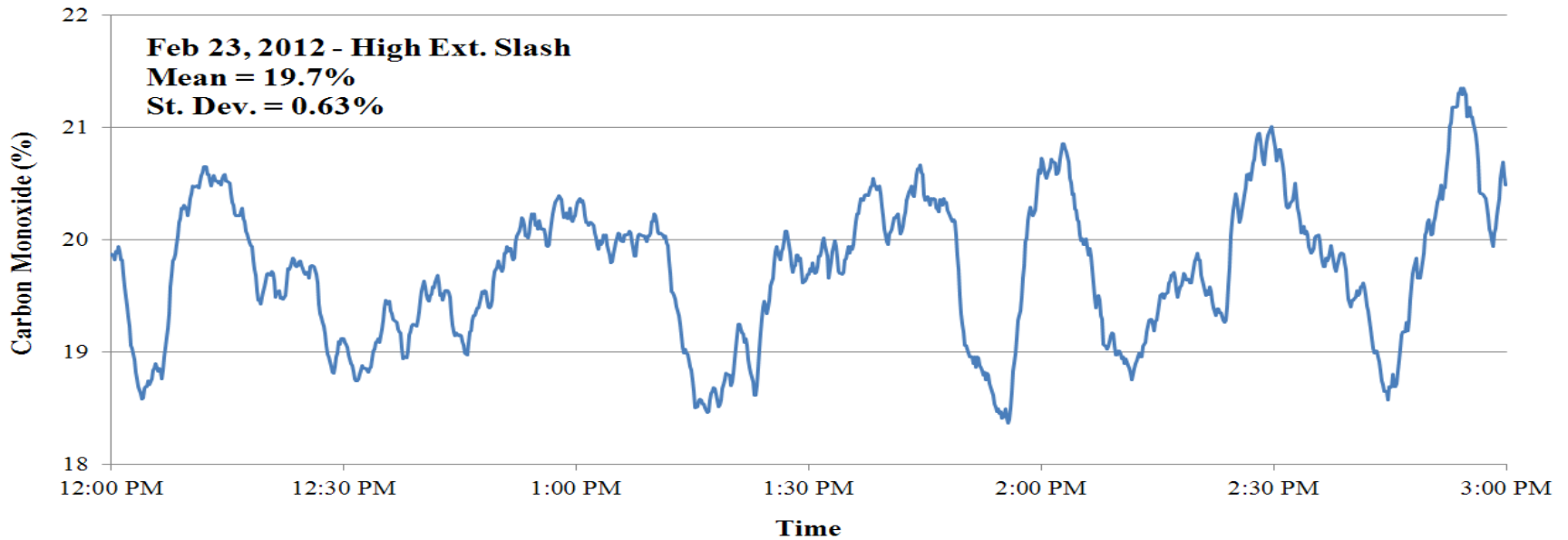
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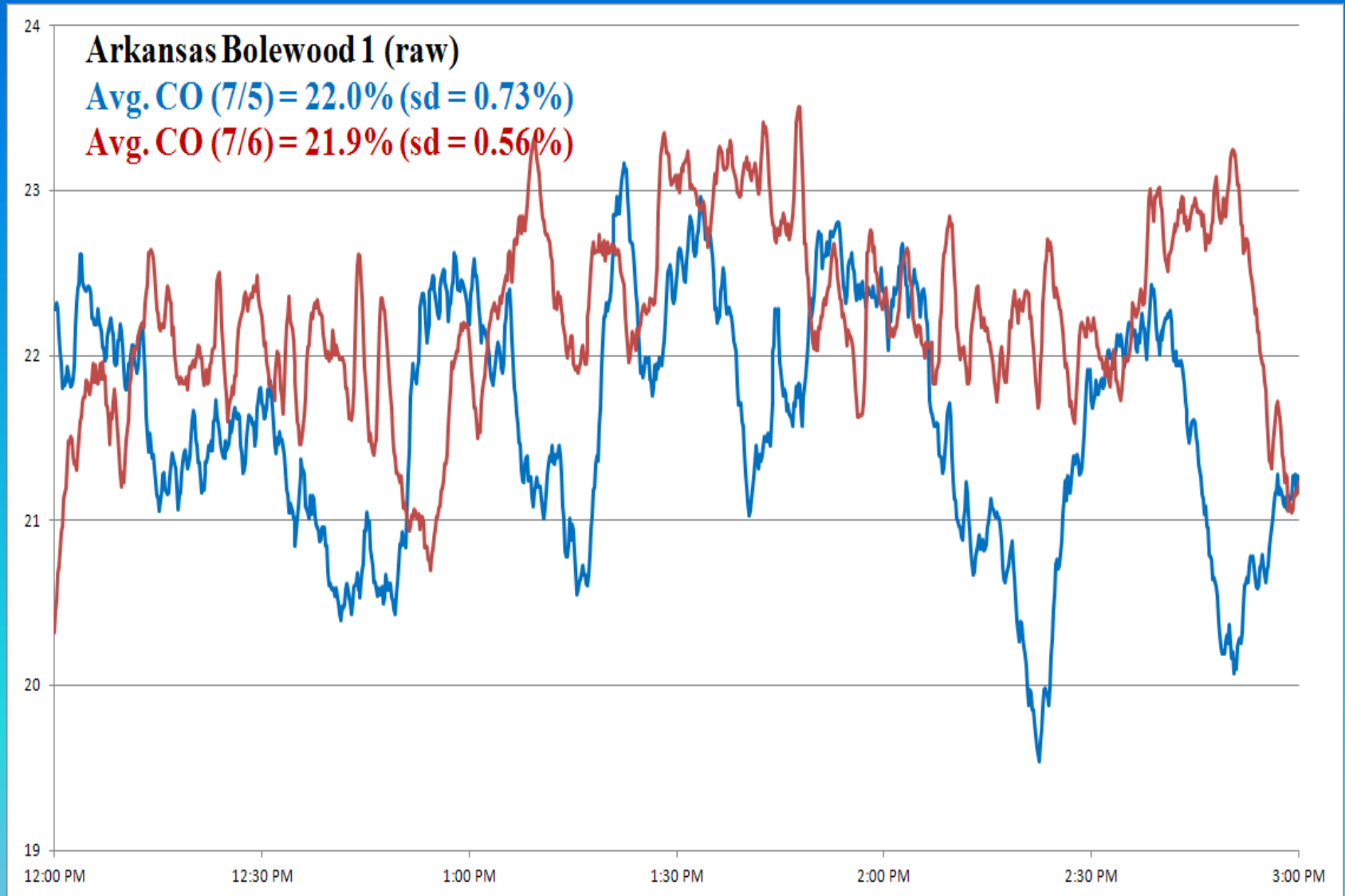
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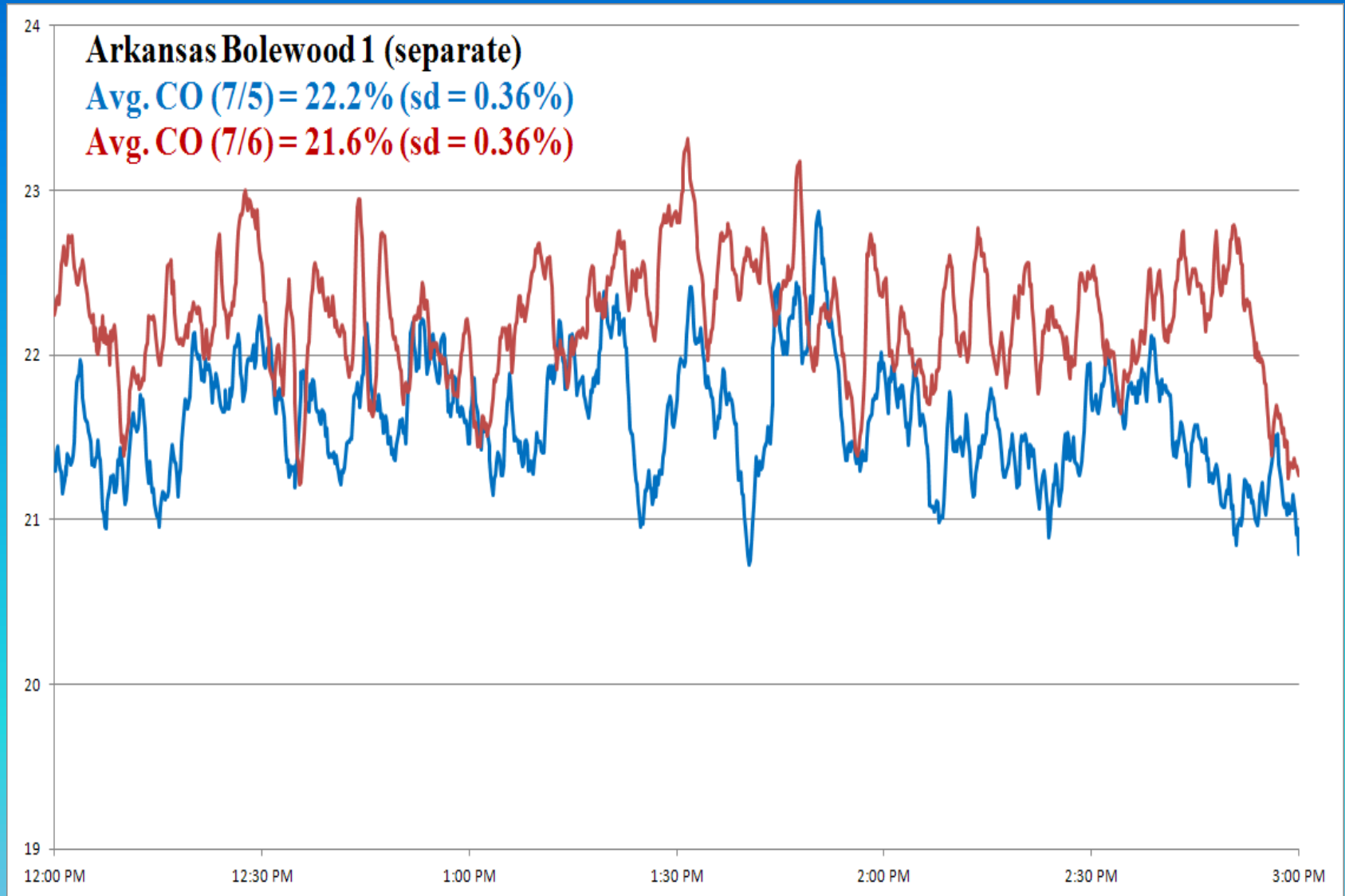
Temperature/Syngas Fluctuations



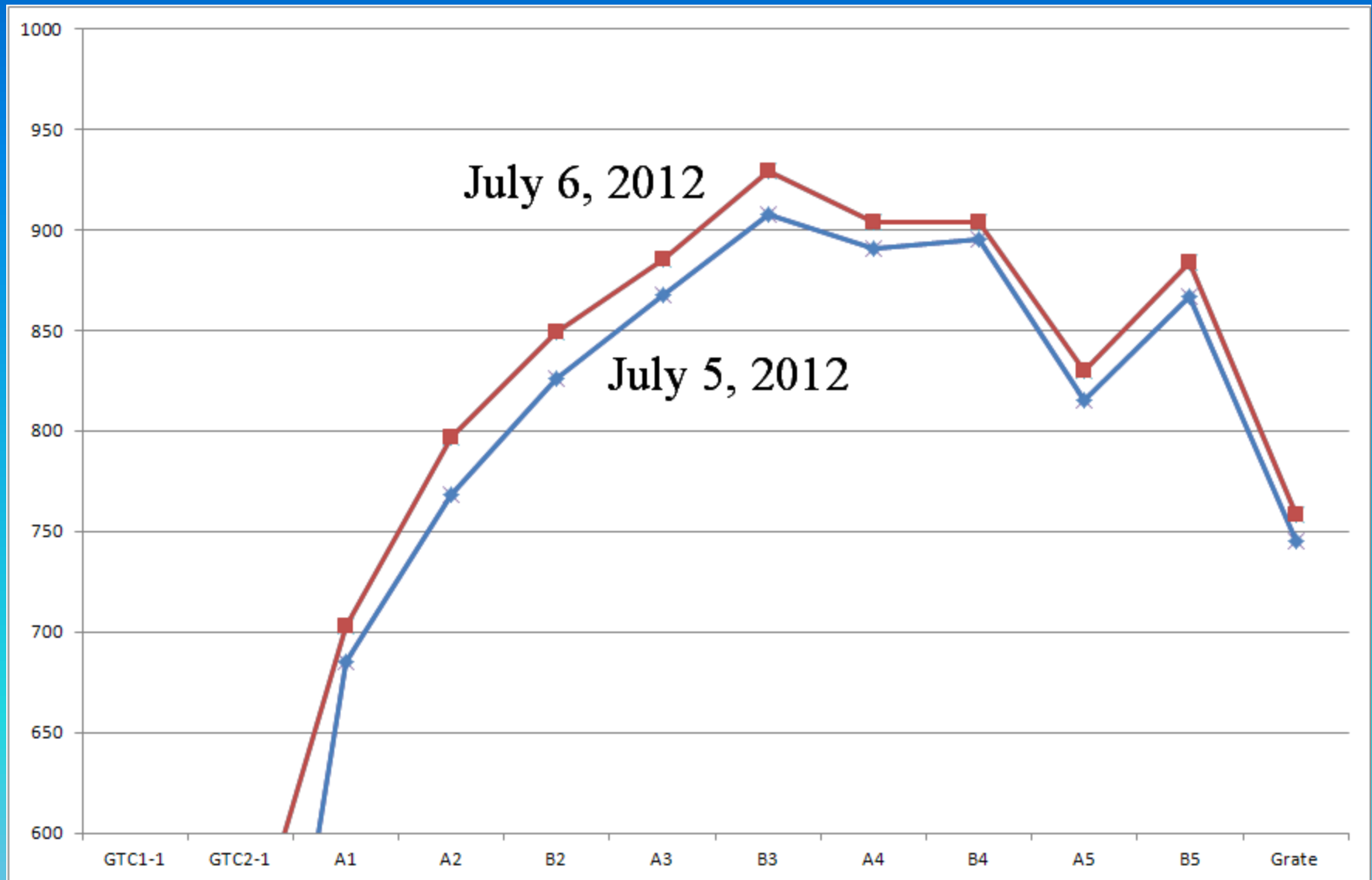
Loblolly Bole – CO% (raw)



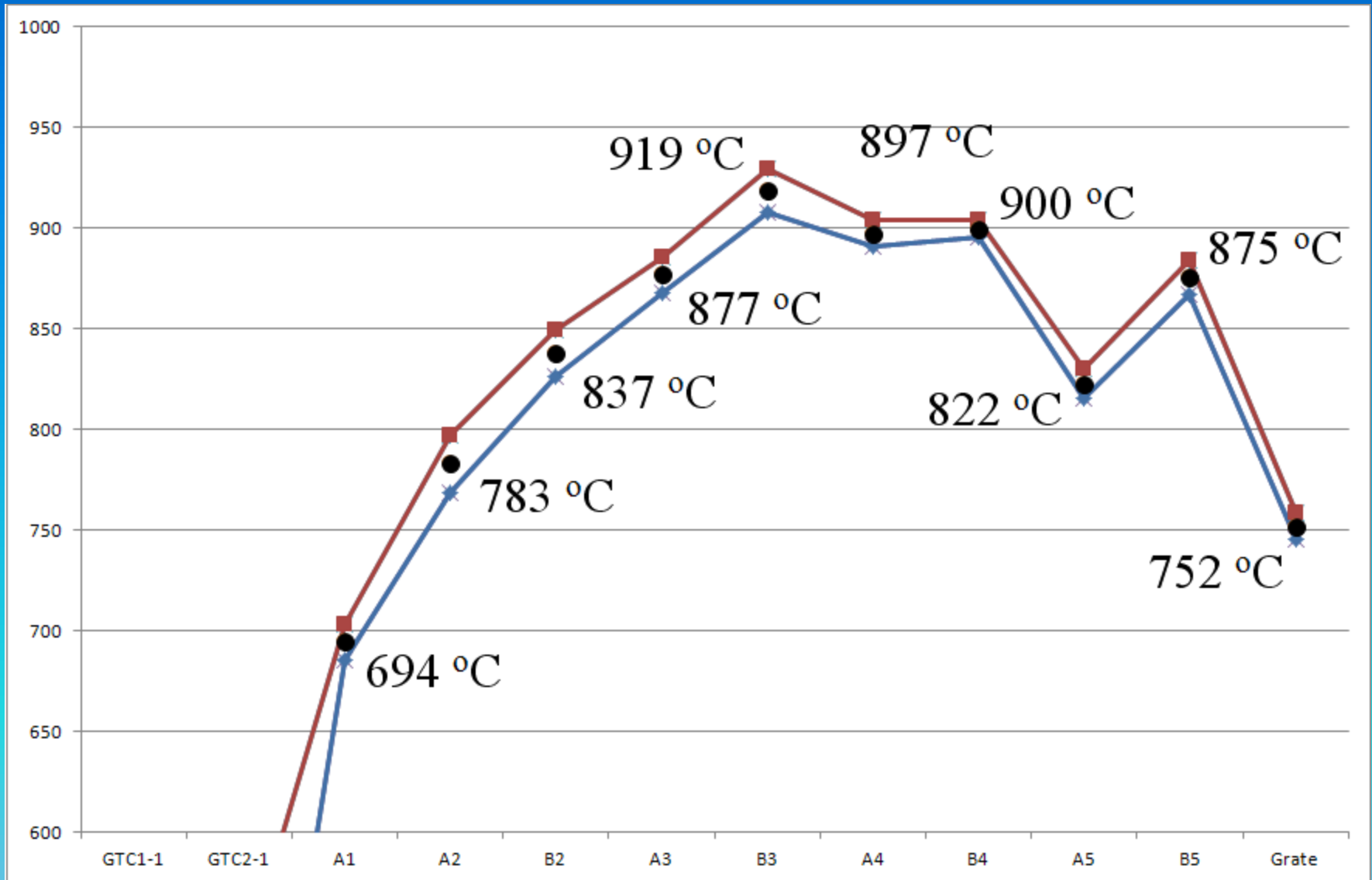
Loblolly Bole – CO% (normalized[1])



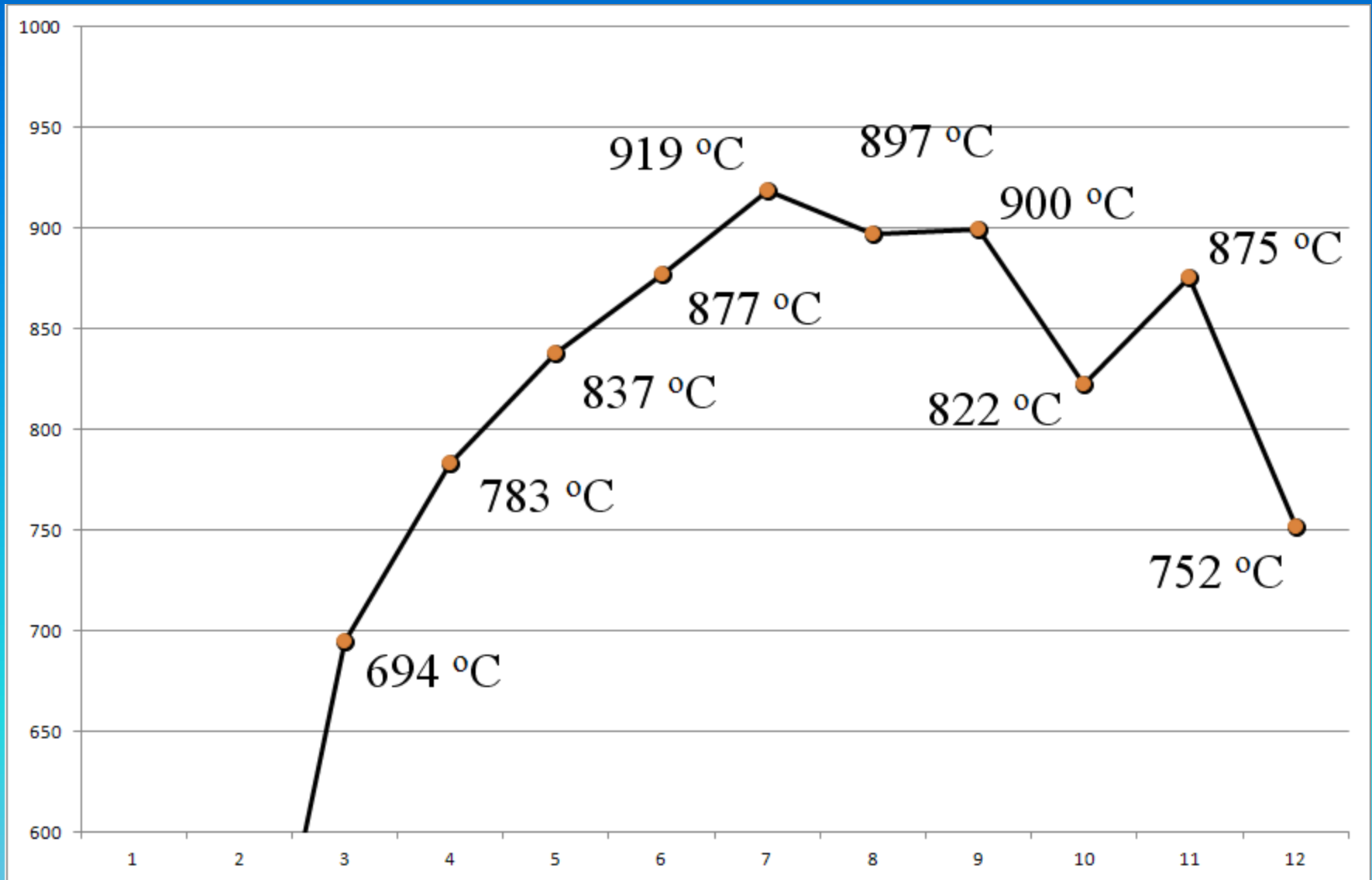
Gasifier Temperature Fluctuations



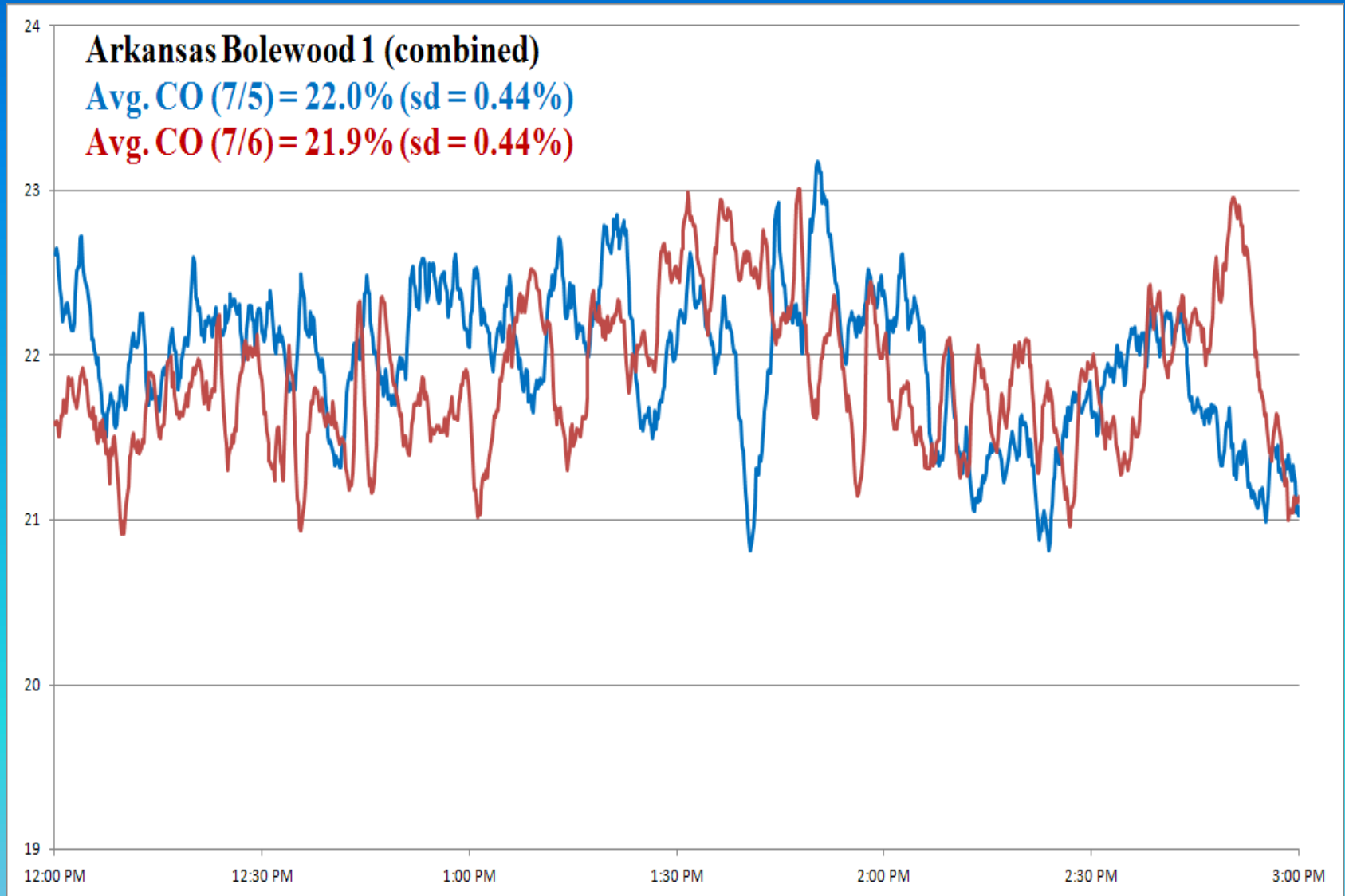
Gasifier Temperature Fluctuations



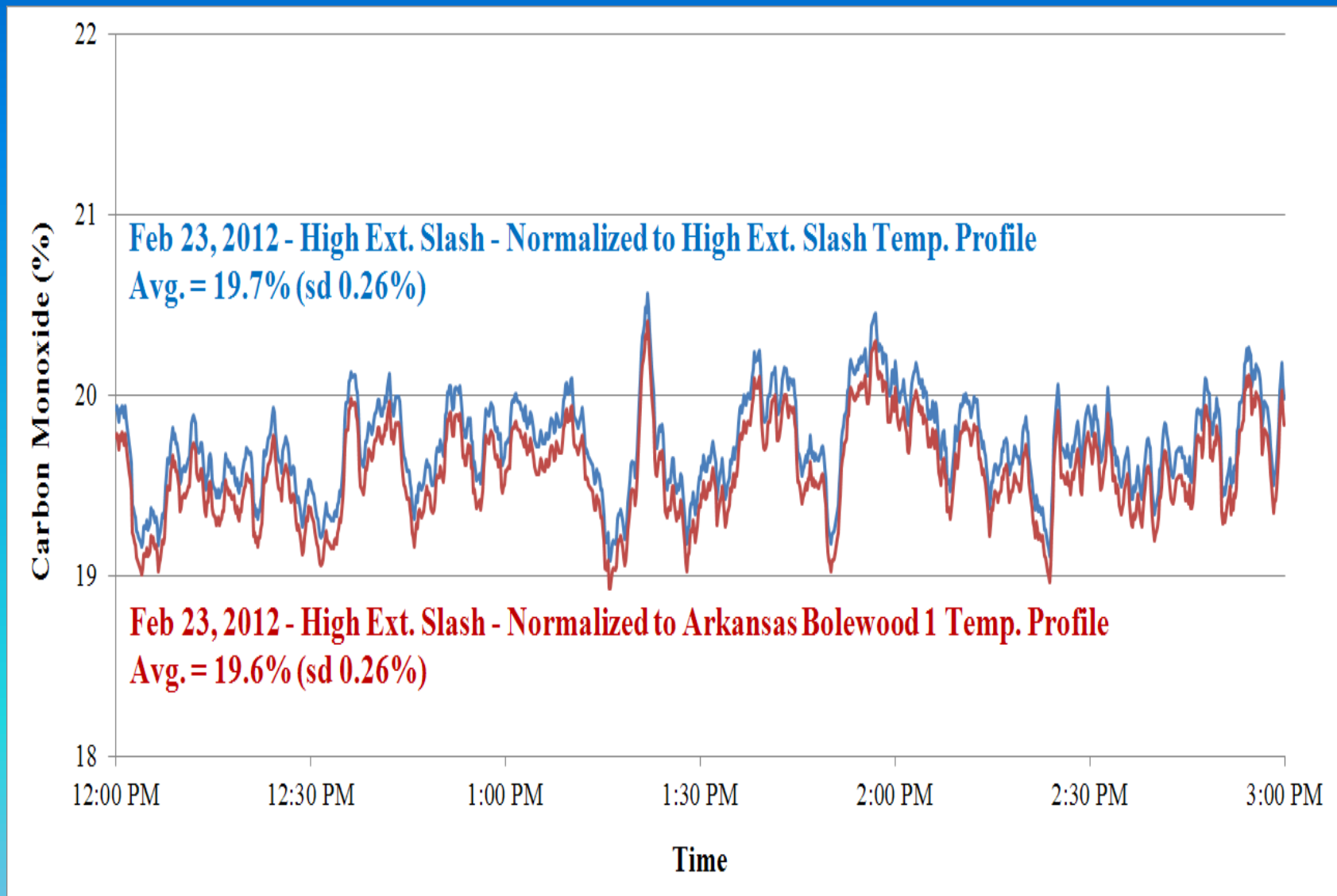
Gasifier Temperature Fluctuations



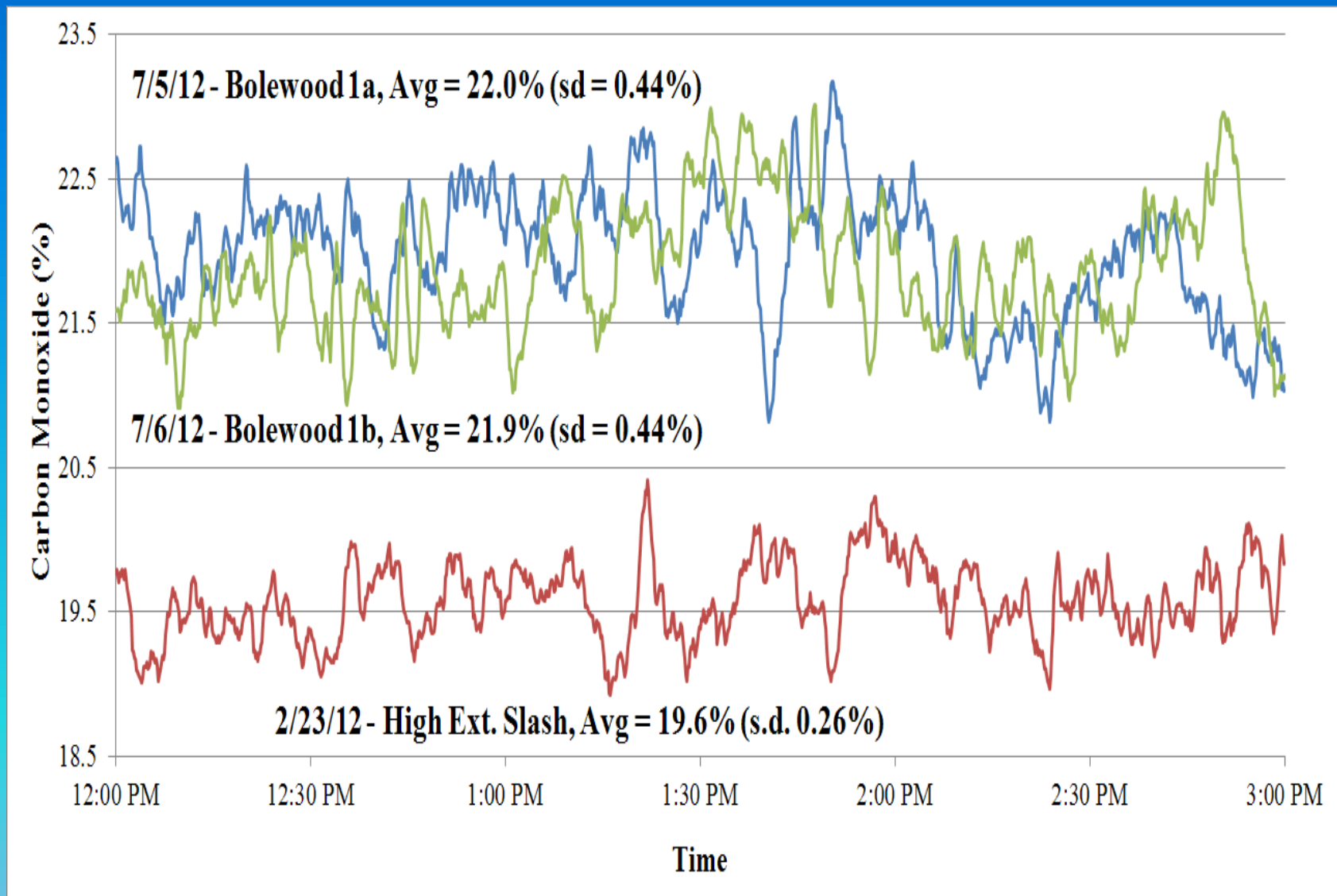
Loblolly Bole – CO% (normalized[2])



High-Ext. Slash Temp. Profile Normalization



Arkansas Lob BW vs. High Ext. Slash



Conclusions

- Proximate/Ultime Analyses
 - Silviculture and Feedstocks are Significantly Different
- Gasification
 - Variability of Test Conditions Affect Results
 - Does Appear That Syngas Composition is a Function of Feedstock
- Very Early Stages in Syngas Analysis