

## UPDATE ON THE IMAGE ANALYSIS OF COTTON FIBERS CROSS-SECTIONS

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### Abstract

The Image analysis of the cross section of cotton fibers constitutes an excellent reference method for maturity and fineness measurements. However, this technique is too slow to be of practical use in commercial operations. Therefore, in collaboration with Cotton Incorporated, it was decided to create asset of cotton standards. Such standards should have a low level of variability and be prepared in quantities large enough to be used during at least a decade. The primary goal is to have cottons of known values to calibrate high-speed instruments (e.g., dual compression testers, AFIS, etc.).

### Materials and Methods

- One hundred four cotton bales were selected and analyzed.
- For each bale:
  - 10 samples were tested on HVI (4 micronaire, 4 color, 10 length/strength)
  - 10 samples were tested on AFIS (60,000 fibers)
  - A minimum of 4,000 cotton fiber cross-section images was processed (for seven of the 104 bales 40,000 cross sections were analyzed). This totaled around 850,000 thousand cross-sections.

The range of HVI fiber properties represented by the 104 bales is shown Figure 1.

The procedures followed to sample the bales for cross-sections analysis was as follows (Figure 2):

- Seventy pounds of lint from each bale were mixed using the International Cotton Calibration Standard Committee procedure for producing reference cottons.
- From the card web produced, 20 samples per bale were collected.
- The samples 1 through 5 were sub-sampled (8 pinches per sample) and the lint collected hand blended. From this sample, 2 fibrograph combs were taken.
- This procedure was repeated for samples 6-10, 11-15 and 16-20.
- From each of the 8 combs produced, one sample was taken for embedding.

The method developed at the SRRC New-Orleans by Devron Thibodeaux was then used to prepare the sub-samples and the software developed by Bugao Xu (UT Austin) was used to analyze the cross sections.

The image analysis measurements performed on each cross section were:

- perimeter,
- area,
- theta.

The results are presented table 1.

A complete analysis of the results will be published in the near future.

Table 1. Fiber cross section analysis on 104 bales.

Bale	Area			Perimeter			Theta		
	Mean	Stdev	CV%	Mean	Stdev	CV%	Mean	Stdev	CV%
2684	84.6	4.1	4.8	45.8	0.8	1.7	0.520	0.023	4.4
2792	95.8	4.7	4.9	46.0	0.9	2.0	0.581	0.010	1.7
2888	101.5	3.6	3.6	47.2	0.7	1.5	0.579	0.007	1.2
2952	95.0	2.9	3.1	47.7	0.7	1.5	0.536	0.012	2.3
2996	104.8	5.8	5.5	51.1	1.2	2.3	0.519	0.016	3.0
2999	89.7	4.1	4.6	51.1	0.9	1.9	0.451	0.015	3.4
3004	99.3	3.0	3.1	48.4	0.8	1.6	0.545	0.014	2.5
3008	82.1	4.1	5.1	48.0	1.1	2.3	0.467	0.019	4.1
3009	85.3	4.5	5.3	46.0	1.1	2.3	0.520	0.015	3.0
3016	100.6	5.0	5.0	51.4	1.2	2.2	0.495	0.014	2.7
3022	113.6	5.4	4.8	54.4	0.8	1.5	0.500	0.012	2.3
3029	102.5	1.9	1.8	51.6	0.9	1.7	0.500	0.013	2.6
3030	97.6	2.9	2.9	53.0	0.9	1.7	0.456	0.011	2.5
3033	101.1	4.8	4.8	51.8	1.3	2.5	0.497	0.010	2.1
3035	96.4	2.9	3.0	54.2	0.8	1.5	0.433	0.006	1.3
3038	101.9	4.6	4.5	52.2	1.0	2.0	0.489	0.006	1.2
3039	112.5	5.3	4.7	54.6	1.3	2.4	0.494	0.010	2.1
3042	102.3	2.9	2.8	50.6	0.8	1.6	0.517	0.007	1.3
3043	93.3	3.4	3.7	50.9	1.0	1.9	0.470	0.014	3.0
3044	93.9	2.4	2.5	50.5	0.9	1.9	0.480	0.011	2.3
3045	116.8	5.8	4.9	51.5	0.9	1.7	0.566	0.013	2.3
3046	105.7	2.3	2.2	50.4	0.9	1.8	0.539	0.014	2.7
3051	101.0	5.1	5.1	54.9	1.7	3.1	0.442	0.019	4.3
3054	96.1	1.9	1.9	49.8	0.6	1.3	0.505	0.008	1.6
3055	114.9	6.0	5.3	55.0	1.3	2.4	0.493	0.011	2.3
3056	102.9	2.6	2.6	54.3	0.7	1.4	0.460	0.014	3.0
3057	99.1	3.8	3.8	55.3	1.0	1.8	0.429	0.017	4.0
3068	99.6	5.7	5.7	51.7	1.2	2.3	0.486	0.018	3.6
3074	134.4	6.5	4.9	54.7	1.2	2.2	0.574	0.013	2.3
3075	101.3	6.3	6.2	56.3	2.0	3.5	0.423	0.016	3.7
3081	105.2	3.8	3.7	51.6	1.0	2.0	0.513	0.008	1.5
3089	91.5	3.1	3.3	61.3	1.4	2.2	0.329	0.015	4.6
3096	100.4	3.3	3.3	57.6	0.7	1.3	0.400	0.009	2.2
3097	106.7	8.0	7.5	54.5	2.1	3.9	0.471	0.009	1.9
3104	106.5	4.7	4.4	56.9	1.4	2.4	0.432	0.010	2.4
3106	118.7	5.9	5.0	55.0	1.6	2.8	0.509	0.011	2.1
3107	117.1	2.5	2.2	52.6	0.8	1.5	0.547	0.009	1.6
3112	121.7	5.9	4.9	54.3	1.6	3.0	0.535	0.020	3.7
3115	97.2	4.5	4.7	59.0	1.5	2.6	0.370	0.013	3.4
3116	94.9	3.3	3.5	61.5	0.9	1.5	0.333	0.015	4.4
3117	105.8	3.5	3.3	57.5	1.1	2.0	0.425	0.018	4.2
3119	108.2	4.3	4.0	54.8	1.0	1.7	0.474	0.015	3.2
3122	102.5	6.2	6.0	49.4	1.7	3.4	0.542	0.011	2.1
3123	103.4	1.6	1.5	52.3	0.6	1.1	0.490	0.009	1.8
3129	90.7	6.4	7.0	57.6	2.0	3.5	0.365	0.020	5.5
3132	103.0	3.1	3.0	52.6	0.7	1.3	0.482	0.013	2.7
3138	114.6	2.3	2.0	57.7	1.0	1.7	0.451	0.009	1.9
3140	99.5	3.4	3.4	44.8	0.6	1.2	0.627	0.010	1.6
3141	95.7	2.4	2.5	47.0	0.8	1.7	0.557	0.008	1.5
3142	97.4	3.6	3.7	46.2	0.8	1.7	0.583	0.012	2.1
3143	116.3	7.2	6.2	50.0	1.3	2.6	0.594	0.018	3.0
3144	91.6	2.4	2.6	49.8	0.7	1.4	0.483	0.013	2.6
3145	104.0	1.8	1.8	52.3	0.6	1.1	0.493	0.012	2.4
3146	101.8	3.5	3.4	48.5	1.1	2.3	0.557	0.013	2.3
3147	100.1	2.6	2.6	47.4	0.8	1.7	0.572	0.013	2.3
3150	103.2	2.3	2.2	49.9	0.5	1.0	0.535	0.009	1.7

Table 1. Fiber cross section analysis on 104 bales (continued).

Bale	Area			Perimeter				Theta	
	Mean	Stdev	CV%	Bale	Mean	Stdev	CV%	Bale	Mean
3151	109.8	8.3	7.6	51.4	1.3	2.5	0.536	0.017	3.1
3152	112.3	3.9	3.4	53.3	1.1	2.0	0.513	0.011	2.2
3153	108.9	5.6	5.2	52.9	1.4	2.6	0.503	0.008	1.6
3154	110.6	3.9	3.5	49.4	0.9	1.8	0.579	0.008	1.4
3155	109.2	6.7	6.1	48.6	1.4	2.9	0.591	0.011	1.9
3156	115.3	3.9	3.4	50.0	0.7	1.4	0.589	0.017	2.9
3157	124.0	4.4	3.5	58.7	0.7	1.1	0.474	0.011	2.3
3158	119.7	5.3	4.5	55.8	0.8	1.5	0.500	0.011	2.2
3159	125.5	4.6	3.6	58.1	1.4	2.3	0.490	0.011	2.3
3160	117.2	3.4	2.9	56.3	0.9	1.6	0.484	0.011	2.3
3161	113.8	6.0	5.3	54.9	1.2	2.1	0.492	0.010	2.1
3162	114.7	6.2	5.4	54.0	1.3	2.5	0.510	0.011	2.1
3165	115.2	4.3	3.7	53.1	1.0	1.9	0.530	0.011	2.1
3166	98.0	2.0	2.0	53.9	0.7	1.4	0.444	0.008	1.8
3167	124.3	2.9	2.4	53.4	1.1	2.0	0.563	0.014	2.4
3168	112.7	3.9	3.5	52.2	1.1	2.2	0.537	0.008	1.5
3169	117.1	5.9	5.0	54.1	2.0	3.7	0.520	0.017	3.2
3170	101.1	4.3	4.3	55.7	1.4	2.4	0.432	0.009	2.0
3171	103.4	5.4	5.3	51.5	1.3	2.5	0.510	0.013	2.6
3172	114.2	3.5	3.1	53.8	1.0	1.8	0.514	0.009	1.7
3173	113.6	4.3	3.8	53.0	1.3	2.4	0.527	0.017	3.3
3174	124.0	5.7	4.6	54.5	1.4	2.6	0.538	0.019	3.5
3175	122.9	7.4	6.1	54.1	1.4	2.5	0.540	0.013	2.5
3176	122.9	5.6	4.5	54.1	1.1	2.0	0.542	0.008	1.4
3177	112.5	6.3	5.6	51.2	1.7	3.4	0.552	0.012	2.2
3178	122.7	4.3	3.5	56.0	0.7	1.3	0.505	0.006	1.1
3179	118.9	7.5	6.3	55.8	1.5	2.7	0.498	0.014	2.8
3180	117.7	7.9	6.7	56.0	2.4	4.4	0.491	0.014	2.9
3181	121.0	3.3	2.7	53.1	0.9	1.6	0.550	0.005	1.0
3182	116.9	6.2	5.3	53.3	1.5	2.8	0.530	0.010	2.0
3183	121.0	4.2	3.4	55.4	0.9	1.6	0.512	0.009	1.7
3184	107.2	5.3	5.0	51.9	1.0	2.0	0.514	0.011	2.0
3185	110.6	5.7	5.1	52.0	1.3	2.4	0.526	0.013	2.6
3186	110.5	7.1	6.4	51.8	1.7	3.4	0.531	0.007	1.4
3187	94.5	4.2	4.4	52.1	1.1	2.1	0.453	0.019	4.2
3188	113.2	3.0	2.6	54.6	0.5	0.9	0.492	0.011	2.2
3189	117.7	4.8	4.1	56.4	1.2	2.0	0.481	0.016	3.3
3190	114.0	3.1	2.7	52.4	0.3	0.6	0.532	0.008	1.5
3191	104.9	5.1	4.8	51.5	1.5	2.8	0.512	0.018	3.5
3192	110.3	3.0	2.8	52.7	0.9	1.6	0.512	0.010	1.9
3193	125.8	6.0	4.7	55.6	1.4	2.5	0.526	0.010	1.9
3194	111.7	5.7	5.1	55.5	1.8	3.3	0.472	0.010	2.1
3195	114.9	3.9	3.4	55.4	0.7	1.2	0.486	0.011	2.4
3196	125.1	6.5	5.2	52.7	1.3	2.5	0.578	0.011	1.8
3212	108.6	4.1	3.8	47.7	0.8	1.7	0.606	0.008	1.2
3214	94.4	3.5	3.7	48.4	0.7	1.5	0.521	0.011	2.1
3215	103.2	3.0	2.9	47.1	0.6	1.2	0.595	0.016	2.7
4409	124.8	4.7	3.7	54.3	0.9	1.7	0.545	0.011	2.0

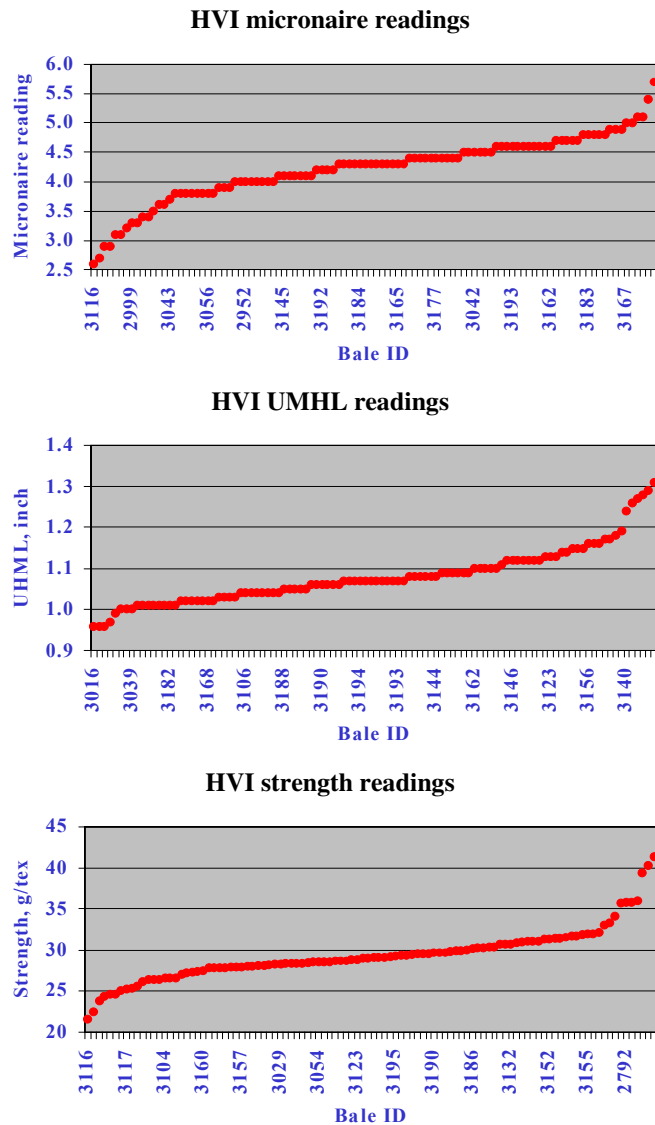


Figure 1. HVI readings obtained on the 104 selected bales.

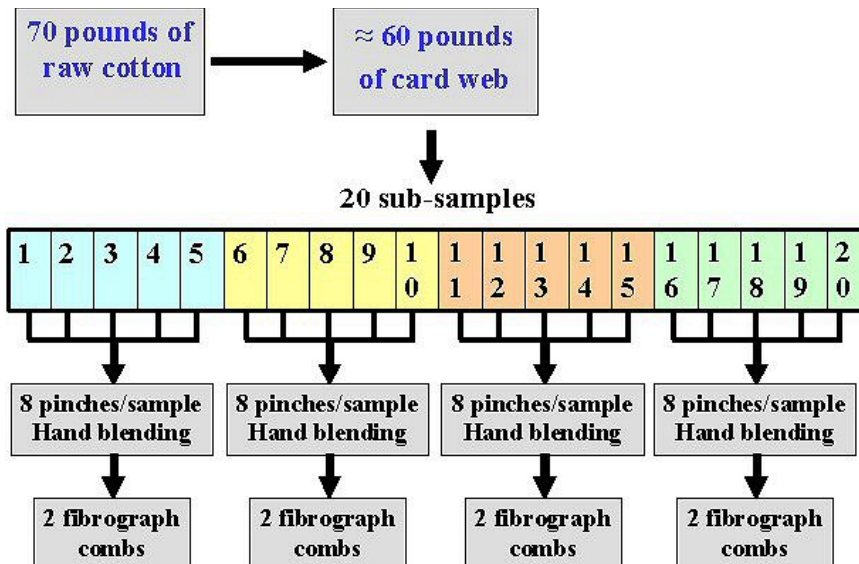


Figure 2. Procedure followed to sample the bales for fiber cross-sections analysis.