Using Scanners to Determine Usage and Log Yard Inventory

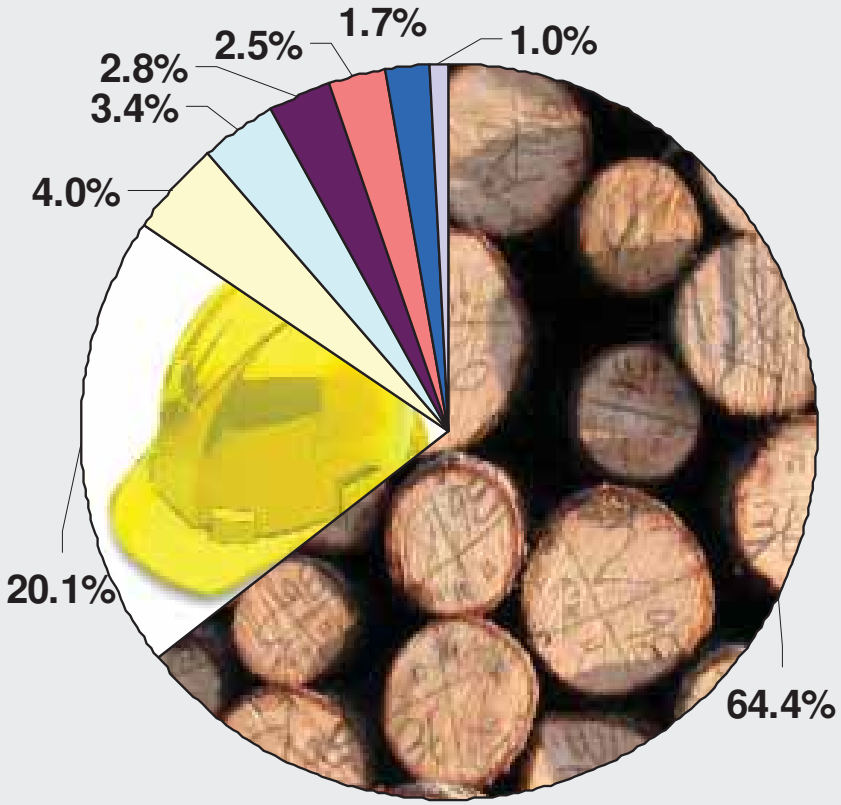
Log Yard Inventory

Why are they needed?

- Necessary for monthly financial statement
- Generally used to calculate usage (thus cost):
  beginning inventory + *deliveries* - *ending inventory* = *usage*
- Used to maintain and plan for availability of raw material for mill
- Does not <u>really</u> impact financial performance; "cutout to cutout, the usage is what it is"

Lumber: cost and value drivers

Typical components of cost in manufacturing lumber (depreciation not included)



Log Yard Inventory

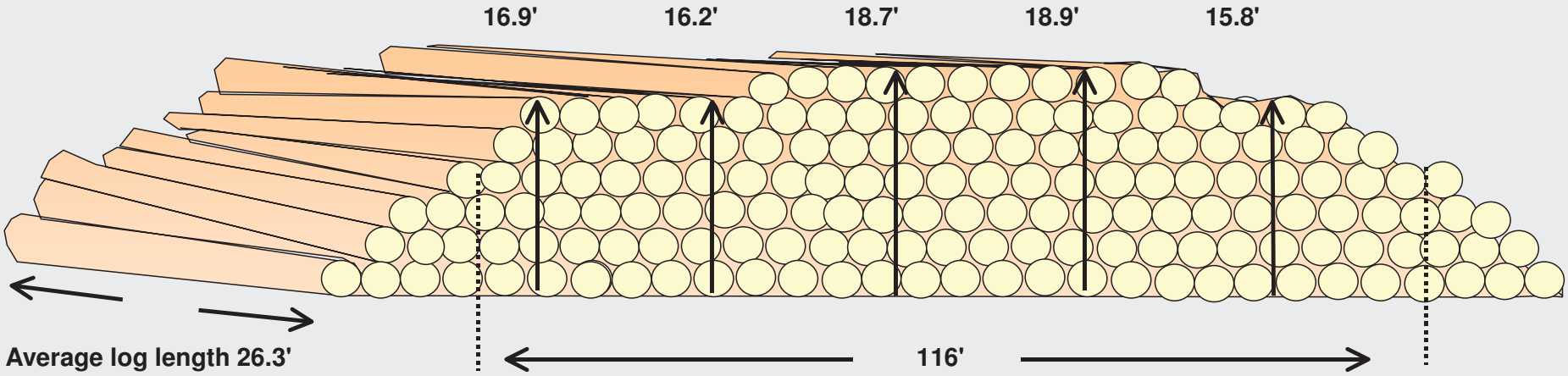
Main methods of accounting:

- Stacked measure
- Scaled into inventory
- Sample scaled
  - Weight expanded
  - Count based
- Book estimated inventory

Stacked measure

- In general, a wood stack (log deck) contains roughly 67% wood, 10% bark, and 23% void
- Solid wood ratio variable due to quality of stacking, straitness and smoothness of wood, bark thickness and diameter (bigger logs = higher factor)
- Defect and nominal measure need to be factored to convert to cubic log scale
- Can be converted to Scribner, but ratios are quite variable

Stacked Measure

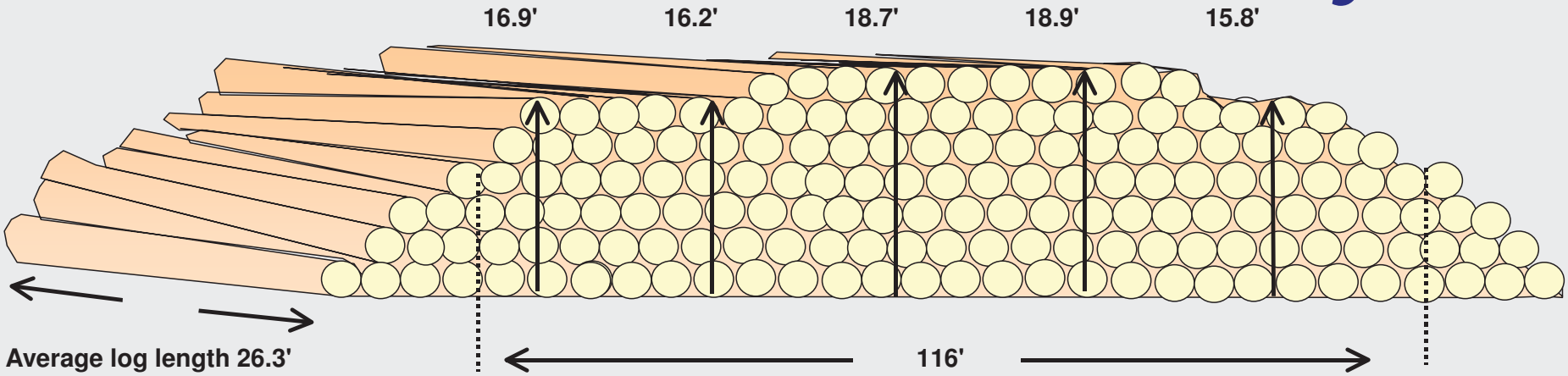


Cubic area of log deck: 116 x 26.3 x ((16.9 + 16.2 + 18.7 + 18.9 + 15.8) ÷ 5) = **52,778.8** ft^3 (1,494.52 m^3)

Gross volume solid wood factor: 0.67 x 52,778.8 = 35,361.8 ft^3 (1,091.0 m^3);

Net volume assuming an average 4.7% defect; 35,361.8 ft^3 x (1-.047) = **33,699.8 ft^3** or 337 ccf (954.26 m^3)

Scaled into inventory



All of the logs in this deck were scaled and the total was 193.3 MBF.

The ratio of log volume to cubic foot; square foot; or lineal foot is generally taken for use when only partially depleted (or for use on decks inventoried via stacked measure).

Example: 193.3 mbf ÷ 116′ = 1.67 mbf/ft.

Sample scaled

Using delivery/payment scale

- Stacker operator or weigh-master enter load destination (mill deck, deck#) into load data
- Volume is expanded into deck, same as for mill, timber sale, etc.
- Works best when loads go straight from truck to deck

Sample scaled

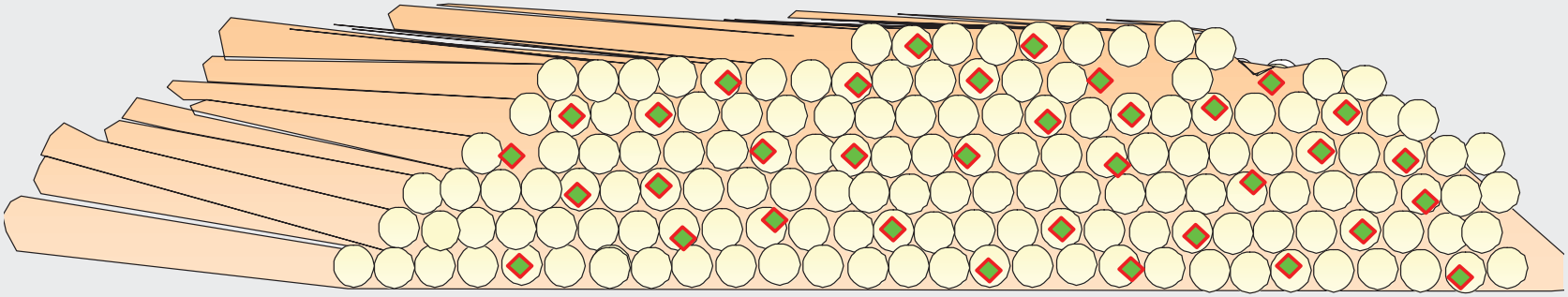
Using dedicated inventory system

- Works well when truck loads are delivered in a non-sorted state (thus losing the integrity of the truck-load weight), e.g., after sorted in the log yard
- Stacker operator accounts for bundle destination (mill deck, deck#) using weight or count
- If weight is used, generally weighed by loadrite ®, or load-cell on cable dead-head (on non-hydraulic machines)
- If count is used, log bundles generally have a flash card placed on end of each bundle (can be used in conjunction with weight for inventorying partially depleted decks).

Sample scaled example

Using dedicated inventory system

- Stacker operator accounts for bundle destination (mill deck, deck#) using weight or count



- Deck has 36 bundles and a total of 1,194.4 tons; volume converted via 6.19 tons/mbf ratio (obtained from sample scaling); 1194.4 ÷ 6.19 = 193 mbf; 193 ÷ 36 = 5.361 mbf/bundle

Book estimated inventory (perpetual inventory)

(Beginning inventory + deliveries) – usage = ending inventory

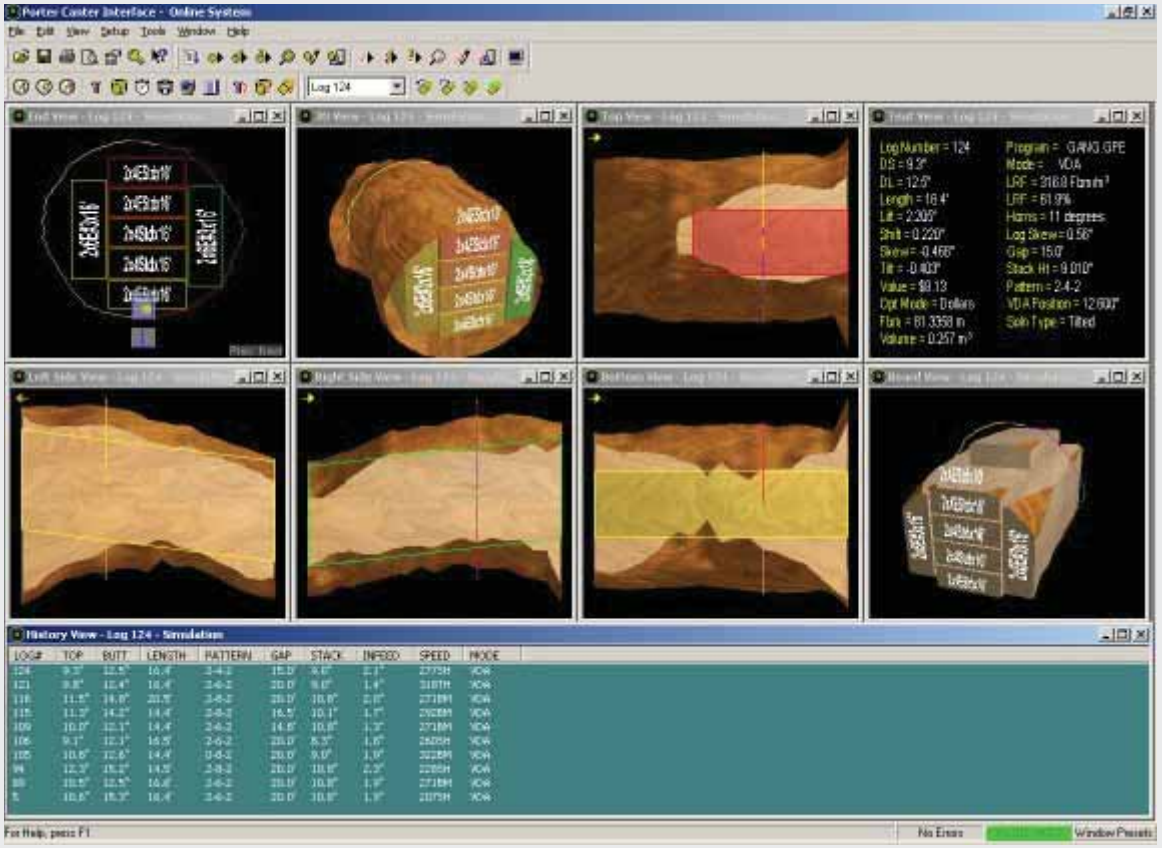
Month	Begin Inv (MBF log)	Deliveries (MBF log)	Production (MBF lum)	Pegged recovery	Calc. usage (MBF log)
January	8,134.24	5,126.12	7,421.62	1.92	3865.43
February	9,394.93	6,016.02	7,712.39	1.92	4016.87
March	11,394.08	3,192.10	7,599.84	1.92	3958.25
April	10,627.93	452.81	7,911.44	1.92	4120.54
May	6,960.20				

Scanner log scale

- Most mills using scanners and optimizers to obtain optimal recovery given the shape of a log and the value of the products that can be manufactured
- Given that the above process involves measuring and mapping log shape (dimensions); log volume is easily determined and reported
- Many mills don't use scanner volumes

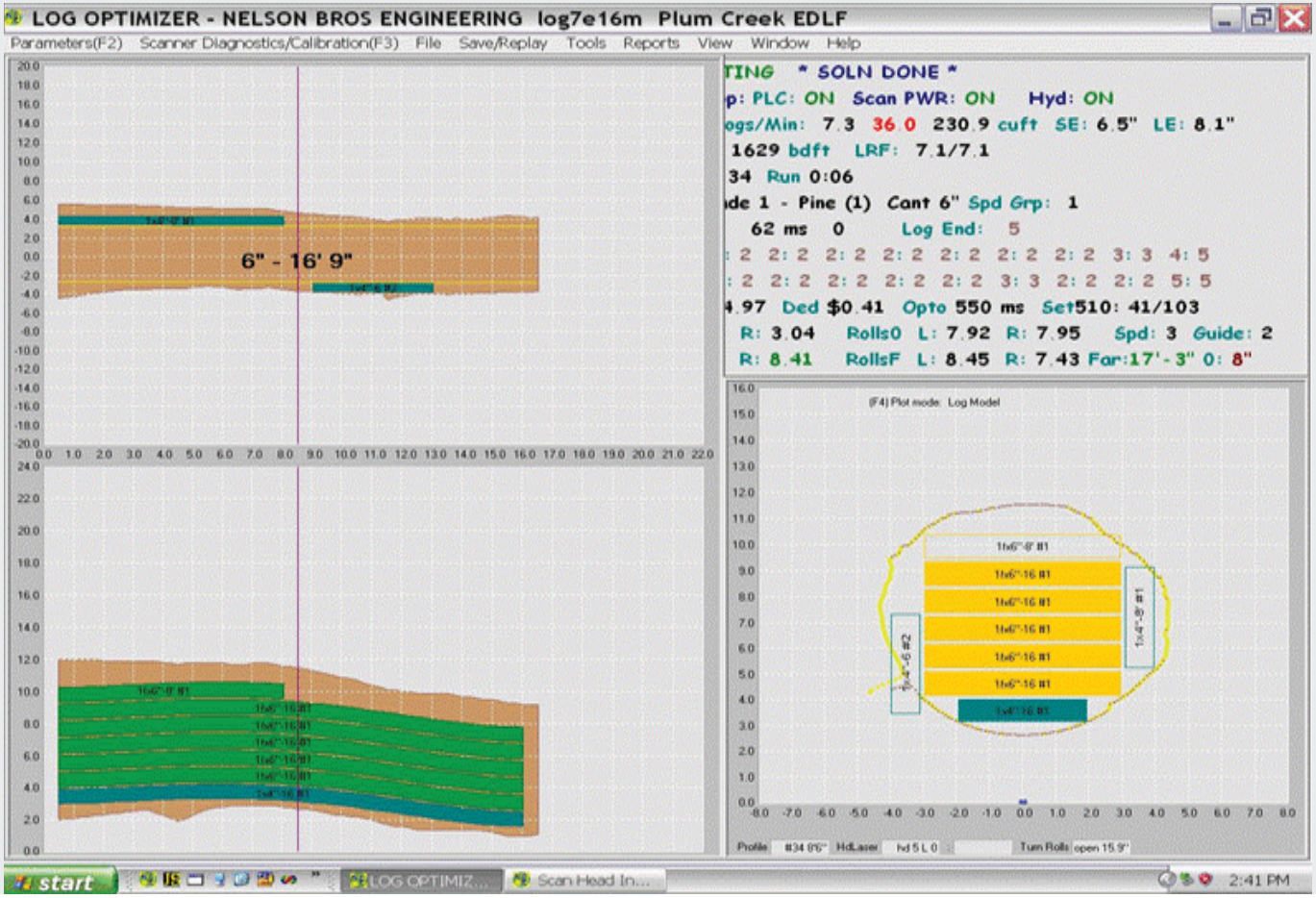
Scanner log scale

Scans; measures in 3-D; measures volume



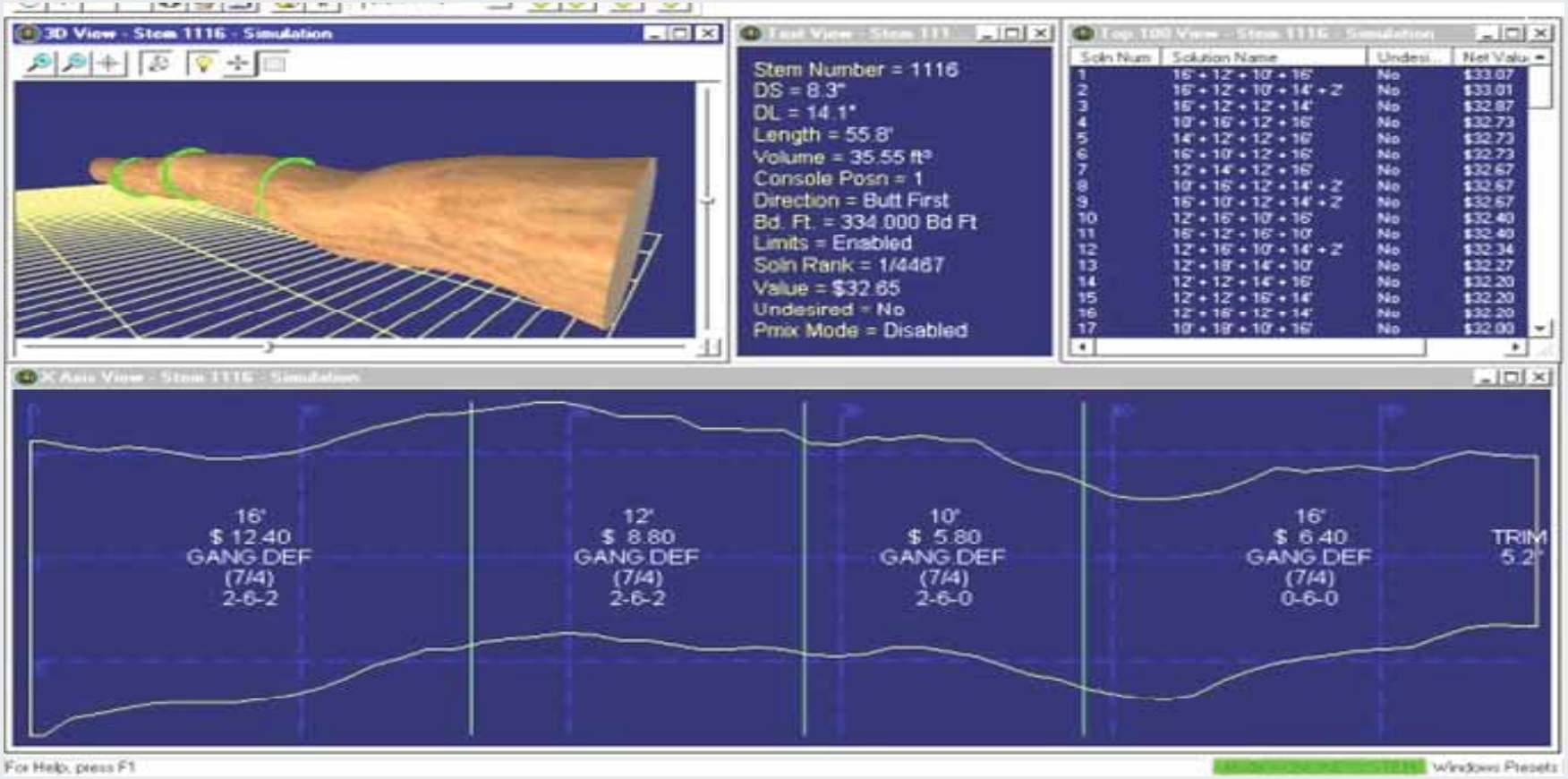
Scanner log scale

Primary Breakdown system – curve sawing optimization projection



Scanner log scale

Bucking optimization



Scanner log scale

- Accurately maps and measures a logs shape and thus volume
- Measures volume differently from stick scaled
- Does not measure defect volume*
- Generally about 8-15% more volume than stick scaled USFS cubic (but consistent by species).

Total logs processed	351				
Total PP_LPP logs	351	=	100%		
Average log length	13.0'	=	3.96 m		
Average log top diameter	10.6"	=	26.9 cm		
Average Smalian volume/log	9.53 ft^3	=	0.270 m^3		
Total Smalian log volume	3346.3 ft^3	=	94.756 m^3		
Total board volume	1938.89 ft^3	=	54.903 :	=	57.90%
Total Chip volume	1064.5 ft^3	=	30.143 :	=	31.80%
Total sawdust volume	342.94 ft^3	=	9.711 m	=	10.20%
Total mbf lumber	25.125 mbf				
Average bf lumber/log	71.581 bf/log				
Projected LRF	7.508				
Projected sawmill recovery	57.90%				
Total number of boards	3849				
Total center cant boards	3227	=	83.80%		
Total center cant edger boards	861	=	22.40%		
Total side board flitches	621	=	16.10%		
Total side boards	622	=	1 board(s)/flitch		
Total edger split side boards	1	=	0.16%		
Pieces routed to edger	1482	=	38.50%		
Total lumber value	$11,934.29	=	$34.00/log		
Total chip value	$958.05				
Total sawdust value	$102.88				
Total manufacturing costs	$3,571.84				
Net total product value	$9,423.38				
Material under 4.0" diameter	0	=	0.0 lin	=	0.000 ft^3
Material over 14.0" diameter	47	=	74.0 li	=	82.34 ft^3
Total downtime	0:33:23		(HH:MM:SS)		
Manual overrides in auto	24				
Logs processed in manual	0				
EDLF productivity based on target of 2800 log		=	12.50%		

Scanner log scale

- To determine ratio of scaled volume to scanned volume, logs are scaled and run through the scanner
- Tests are conducted monthly and accumulated to obtain a good average

Scanner log scale

DF test January 16, 2007

DF with 6.53 avg SED. 1/16/07

	log yard scale		Scanner		
	Gross	Net	Cubic		
1	624.8	578			
2	712.6	629.2			
3	668.1	605.7			
4	661.3	565.2			
5	697	631			
6	767.3	684.1			
7	607.1	545.5			
8	996.3	916.9			
9					
10			Scanner		
11			Data		
12					
	5734.5	5155.6	6500.51	Gross	0.882161553
				Net	0.793107002

		@ 10.5% trim	LRF
Stacker BF	54751	49002.15	9.504644

Scanner log scale

Test data compilation

Scanner Correction/Mill RecoveryTests

									Gross CorrectionFactor		
		Avg Block	Scaler Volume		Scanner	Gross	Sorter	Test	**DF**	**LPP**	**WF**
Date	Sort	Diameter	Gross	Net	Volume	Cor.Fac.	Tally	LRF	**0.903**	**0.874**	**0.845**
10/18/2006	WF	7.68	8317.9	7763.8	9700.7	0.857	88201	10.17			0.857
10/5/2006	WF	7.93	5277.7	4956.3	6333.4	0.833	58977	10.65			0.833
1/17/2006	DF	6.53	5734.5	5155.6	6500.5	0.882	54751	9.50	0.882		
9/20/2006	DF	6.6	5868	5551.7	6393.6	0.918	55971	9.02	0.918		
10/10/2006	DF	6.69	9260.9	8379.2	10150.6	0.912	88675	9.47	0.912		
11/28/2006	LPP	6.76	4529	3994.7	5184.6	0.874	44968	10.07		0.874	
1/16/2007	DF	6.53	5734.5	5155.6	6500.5	0.882	54751	9.50	0.882		
2/20/2007	DF	6.91	5736.8	5108	6326.0	0.907	54752	9.59	0.907		
3/7/2007	DF	6.86	6007.5	5493.2	6540.0	0.919	57639	9.39	0.919		

Scanner log scale reporting

February Production Report

Date	Shift	Specie	Product	Scheduled Hours	Down Time Min.	Avg. S.E.D.	Block Count	Scanner Cubic Feet	Factored Usage Log Vol. CF	Green Lumber Production	Est. Finished Lum Prod.	LRF	Percent Up-time
1-Feb	A	DF	Studs	10	66	6.62	9,256	22,027	17,900	182,405	164,621	9.20	89%
1-Feb	B	DF	Studs	10	33	6.82	9,625	24,337	19,777	205,173	185,169	9.36	95%
5-Feb	A	DF	Studs	10	23	6.65	9,626	23,065	18,744	197,771	178,488	9.52	96%
5-Feb	B	DF	Studs	10	15	6.64	10,601	25,282	20,545	215,062	194,093	9.45	98%
6-Feb	A	DF	Studs	10	22	6.73	10,239	25,179	20,462	209,399	188,983	9.24	96%
6-Feb	B	DF	Studs	10	25	6.64	10,716	25,539	20,754	215,747	194,712	9.38	96%
7-Feb	A	DF	Studs	10	26	6.64	10,391	24,754	20,116	206,143	186,044	9.25	96%
7-Feb	B	DF	Studs	10	12	6.82	10,800	27,256	22,149	232,821	210,121	9.49	98%
8-Feb	A	WF	Studs	10	45	7.94	8,513	29,669	22,381	260,258	234,883	10.49	93%
8-Feb	B	WF	Studs	10	25	7.83	9,060	30,607	23,089	277,740	250,660	10.86	96%
12-Feb	A	DF	Studs	10	42	6.94	7,908	20,353	16,540	167,251	150,944	9.13	93%
12-Feb	B	DF	Studs	10	22	6.76	9,069	22,598	18,364	191,536	172,861	9.41	96%
13-Feb	A	DF	Studs	10	31	6.74	10,132	24,948	20,274	202,909	183,125	9.03	95%
13-Feb	B	DF	Studs	10	18	6.79	10,640	26,528	21,558	223,872	202,044	9.37	97%
14-Feb	A	DF	Studs	10	29	6.64	10,126	24,265	19,719	196,512	177,352	8.99	95%
14-Feb	B	DF	Studs	10	25	6.83	10,118	25,710	20,893	214,101	193,226	9.25	96%
15-Feb	A	WF	Studs	10	28	7.89	8,741	30,153	22,746	253,644	228,914	10.06	95%
15-Feb	B	WF	Studs	10	35	7.97	8,847	30,956	23,352	273,314	246,666	10.56	94%
19-Feb	A	DF	Studs	10	33	6.89	9,517	24,391	19,821	195,417	176,364	8.90	95%
19-Feb	B	DF	Studs	10	23	7.00	9,992	26,820	21,795	225,909	203,883	9.35	96%
20-Feb	A	DF	Studs	10	19	6.93	10,155	26,309	21,380	215,177	194,197	9.08	97%
20-Feb	B	DF	Studs	10	16	6.81	10,607	26,606	21,621	221,690	200,075	9.25	97%
21-Feb	A	LP	Studs	10	20	7.22	10,150	28,481	22,161	239,493	216,142	9.75	97%
21-Feb	B	LP	Studs	10	45	7.31	9,666	27,824	21,649	240,571	217,115	10.03	93%
22-Feb	A	WF	Studs	10	29	8.03	8,264	29,579	22,313	247,309	223,196	10.00	95%
22-Feb	B	WF	Studs	10	20	8.31	8,923	34,228	25,820	301,708	272,291	10.55	97%
26-Feb	A	DF	Studs	10	46	6.85	9,515	24,330	19,772	194,362	175,412	8.87	92%
26-Feb	B	DF	Studs	10	10	6.77	10,669	26,362	21,423	212,835	192,084	8.97	98%
27-Feb	A	DF	Studs	10	28	6.90	9,909	25,456	20,687	204,760	184,796	8.93	95%
27-Feb	B	DF	Studs	10	22	6.84	10,142	26,324	21,392	211,100	190,518	8.91	96%
28-Feb	A	DF	Studs	10	46	6.85	9,350	24,387	19,818	192,575	173,799	8.77	92%
28-Feb	B	DF	Studs	10	16	6.81	10,527	26,351	21,414	215,816	194,774	9.10	97%
				320.0	**895.0**		**311,794**	**840,674**	**670,429**	**7,044,380**	**6,357,553**	**9.48**	**95%**
										Trim Gain			

	Avg. S.E.D.	CF/Block	Usage CCF	MBF Lumber*	MBF Prod./Hr.*	LRF	% Up-time
"A" Shift	7.01	2.14	3,248.32	3,037.26	18.98	9.35	94%
"B" Shift	7.03	2.16	3,455.97	3,320.29	20.75	9.61	96%
Total	**7.02**	**2.15**	**6,704.29**	**6,357.55**	**19.87**	**9.48**	**95%**
DF	6.79	2.03	4,869.17	4,467.68	18.62	9.18	96%
WF	7.99	2.67	1,397.02	1,456.61	24.28	10.43	95%
LP	7.26	2.21	438.10	433.26	21.66	9.89	95%
Total	**7.02**	**2.15**	**6,704.29**	**6,357.55**	**19.87**	**9.48**	**95%**

Conclusions

- Stacked measure is inherently inaccurate given the expectations of accounting for mill profitability, however, it is a relatively inexpensive and simple method of accounting for log yard inventory.
- Stacked measure is much more accurate when used with cubic as opposed to Scribner
- There are fairly accurate methods of accounting for log yard inventory volume, e.g., scaled, sample scaled, etc., however, these are more expensive to administer and may require an initial investment in equipment

Conclusions (cont.)

- Many of the shortcomings of current log yard inventory systems can be overcome if one uses scanner data to determine usage and thus ending inventory
- Scanner derived usage data is more accurate (especially when used with cubic) than is usage as derived from log yard inventory *(beginning inventory+ deliveries – ending inventory = usage)*
- Tracking usage/recovery via scanners has other value in that it can identify problems in the mill

Conclusions (cont.)

- Finally, regardless of log yard inventory methods, scanner data is an excellent corroborative source of usage information which can be used in conjunction with the physical inventory for very little cost or effort