Automatic grading and scaling of saw logs

Timber Measurements Society

Coeur D'alene, Idaho, April 2014

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The National Council for Timber Measurement Development (VMU)

Grading and sorting simultaneously

- **Every sawmill sorts for highest possible product value.**
- **Grading and sorting by timber measurement associations.**
- **Grading for payment: Must be identical where the instruction is used.**

Manual grading

- Grade
- Crook
- Species
- Rot
- Knot
- Bark
- Log type

Check scaling

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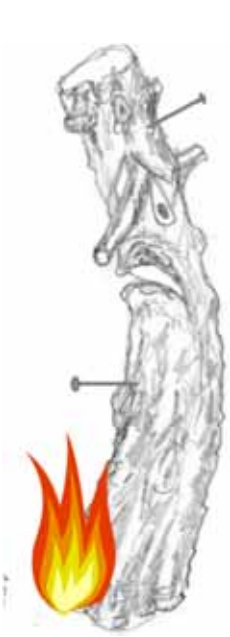
Pine grades from 1 january 2008

Grade 1	Grade 2	Grade 3	Grade 4	Cull log/no grade
				
• Butt log • Only small knots • Narrow ring width	• Top log • Sound knot	• Top- and butt log • Some knot	• Crooked logs • Some rot • Some blue stain • Big knot allowed	• Metal • Big crook • Burned/coal

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Automatic grading in three steps

- Manual evaluation
  - Rot
  - Species
  - Blue stain
- Automatic downgrading,
  - Metal
  - Crook
  - Max/min diameter
- Grading according to x ray,
  - Log type
  - Knot

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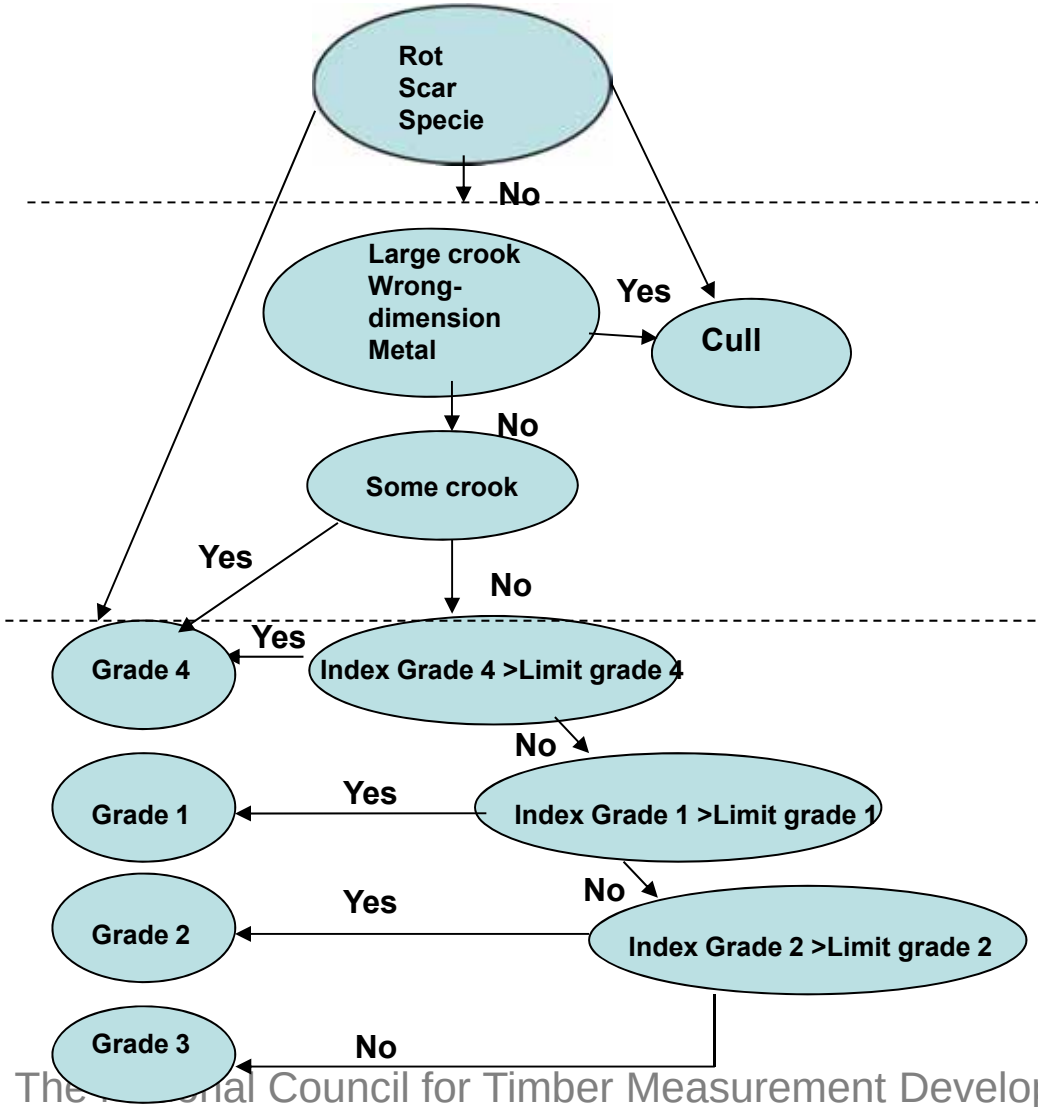
Automatic grading



Step 1
Manual evaluation of rot, scar, blue stain etc

Step 2
Automatic grading
-X-ray or coil for metall
-3D for ubf/crook and dimension

Step 3
Automatic grading with x-ray for grade 1-4,

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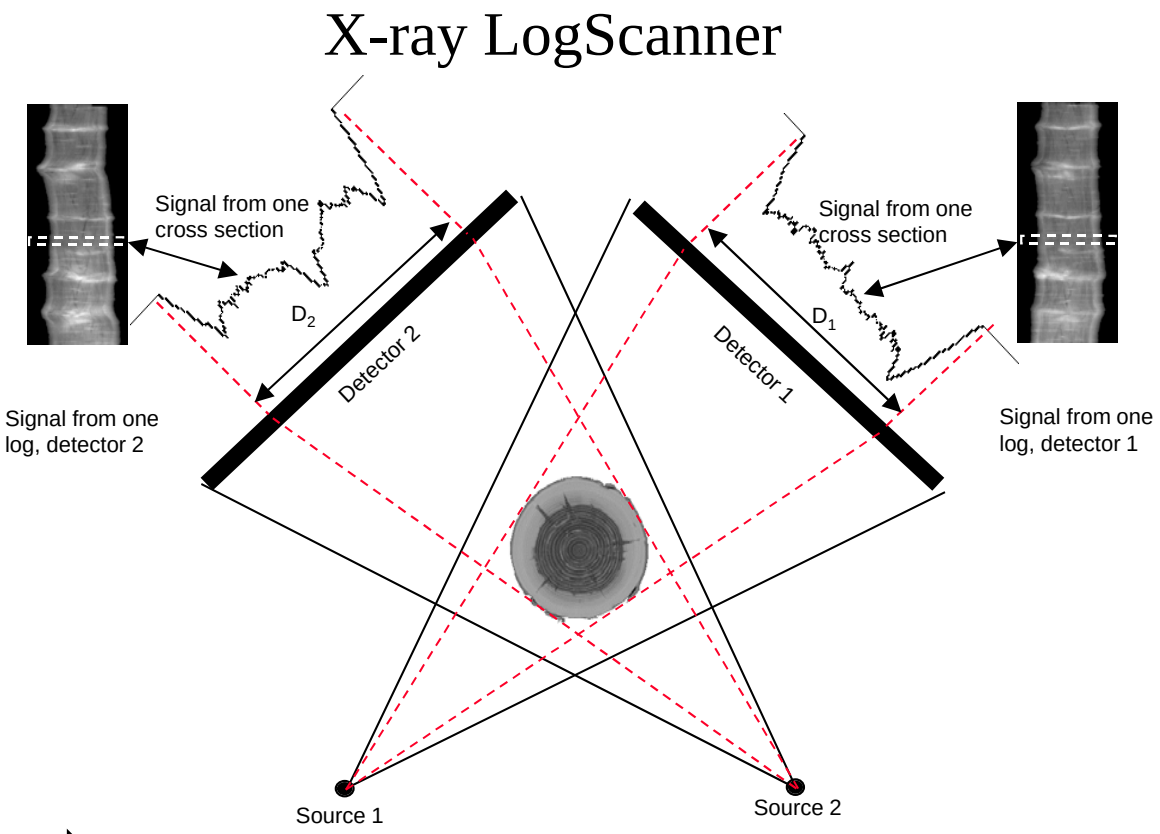
X-ray



knot volume, density, knot size, heartwood diameter etc

Index grade 1, grade 2, grade 4.

Example

High grade 1 index > limit grade 1
Low grade 2 index < limit grade 2

Grade 1

High grade 2 index > limit grade 1
Low grade 1 index < limit grade 2

Grade 2

The limits decides the distribution of grades

Adjust grading on control logs

		Nya gräns-värden	Befintliga gräns-värden	Justera
	Klass1	0,46	0,46	
	Klass2	0,42	0,42	
	Klass4	0,22	0,22	

		Automatisk klassning					
		Klass 1	Klass 2	Klass 3	Klass 4	Andel kontroll	Klassträff
Kontroll	Klass1	15,5	0,0	4,8	0,0	20,2	76%
	Klass2	0,1	15,9	4,1	2,8	22,9	69%
	Klass3	6,5	4,9	37,5	0,6	49,5	76%
	Klass4	0,3	1,9	2,7	2,4	7,4	33%
	Andel auto	22,4	22,7	49,0	5,8	100,0	

Antal röntgenklassade kontrollstockar	997
Träffprocent automatklassning	71%
Värdekvot	1,01

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Results so far

- Better degree of correct classified logs than full manual grading
- Easier to adjust with less manual assessments
- Better ways to evaluate each cause of downgrade

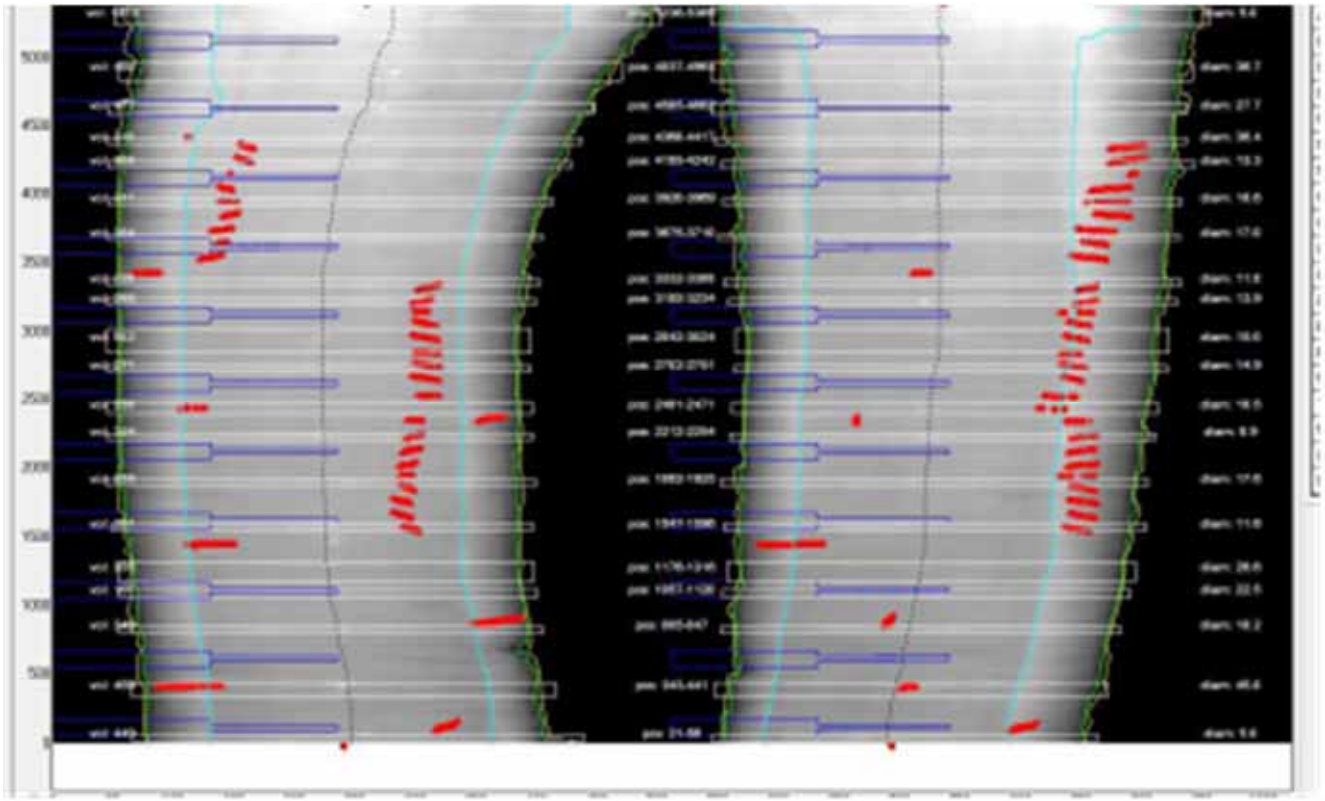
- Manual grading can be seen as more trustworthy,

Straightness – loss off yield

Loss of yield cm

≤ 20 cm = ok
21 – 120 cm = poor grade
> 120 cm = cull

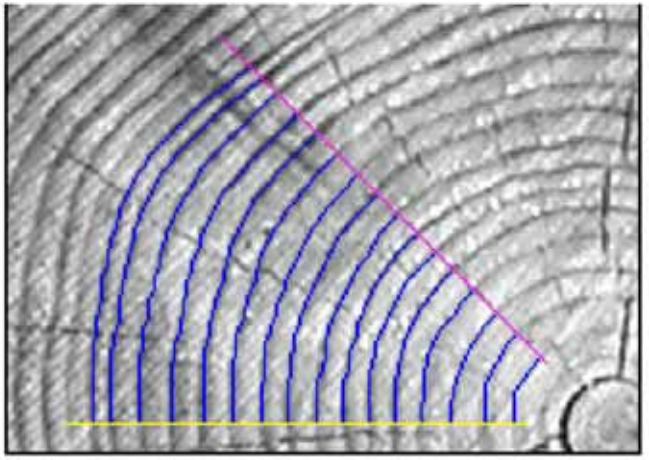
X-ray metal



Growth ring detection

Installation of camera and light

Grey Weighted Polar Distance Transform for Outlining Circular and Approximately Circular Objects



(c) The shortest path to each of the 16 end pixels in the object.

The research approach seems justified

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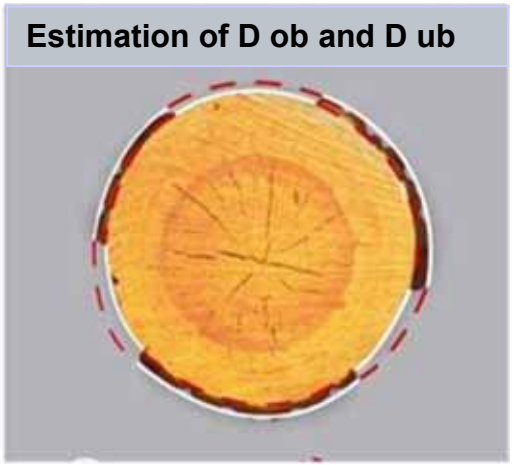
Diameter under bark –tracheid method

Applied since 2008



Problems with snow and sprinkled logs

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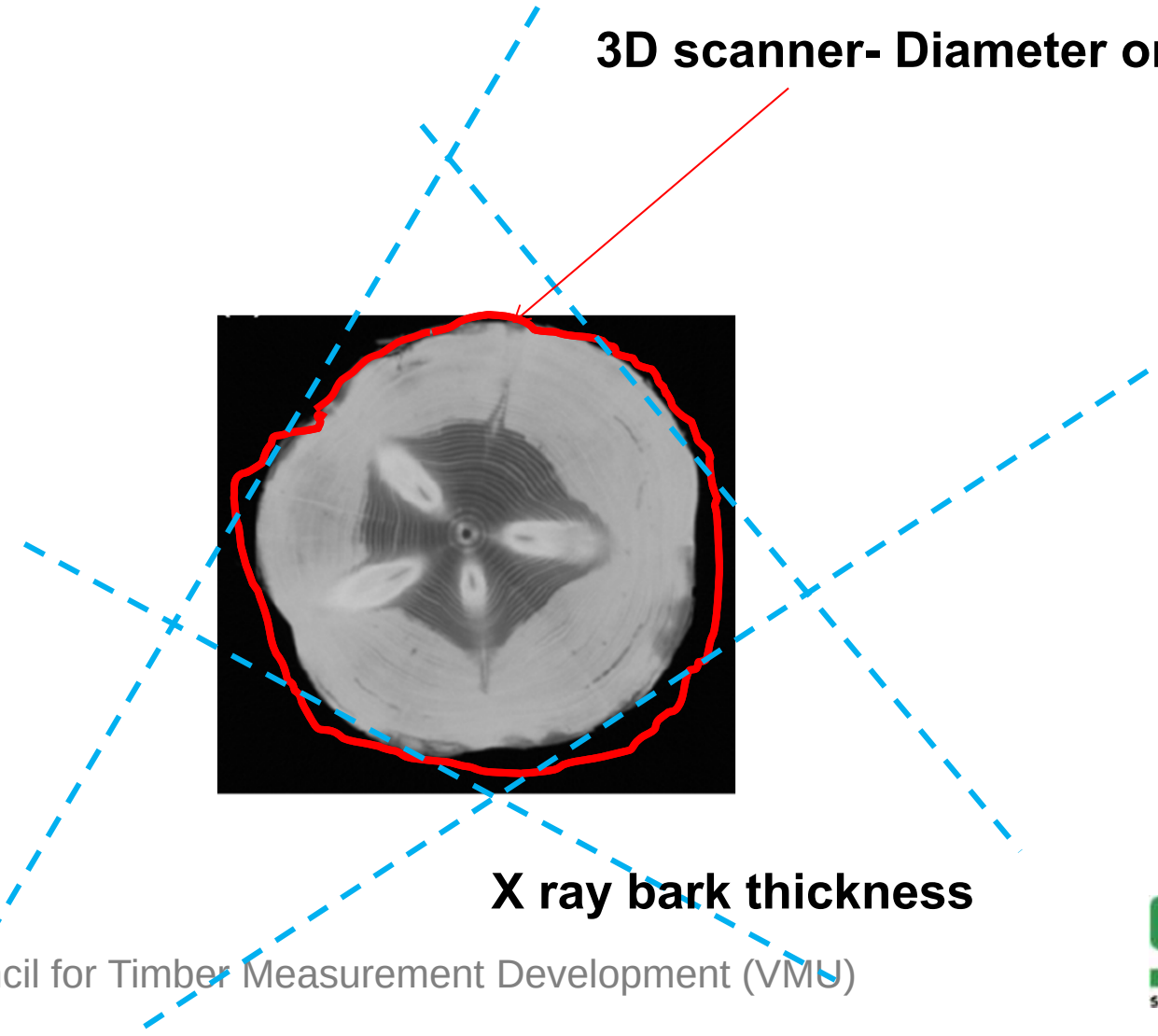
Diameter under bark X-ray



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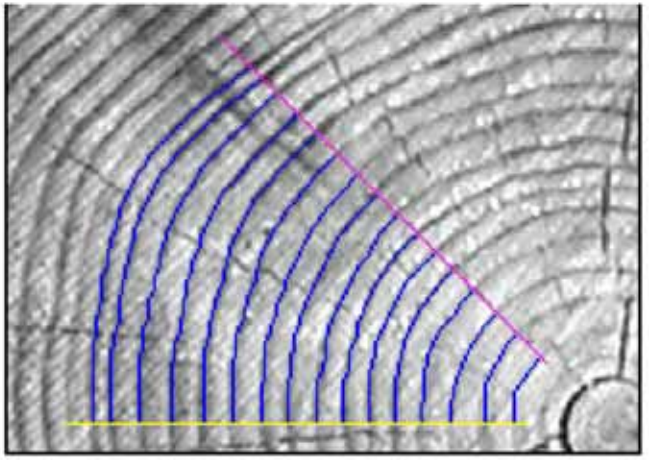
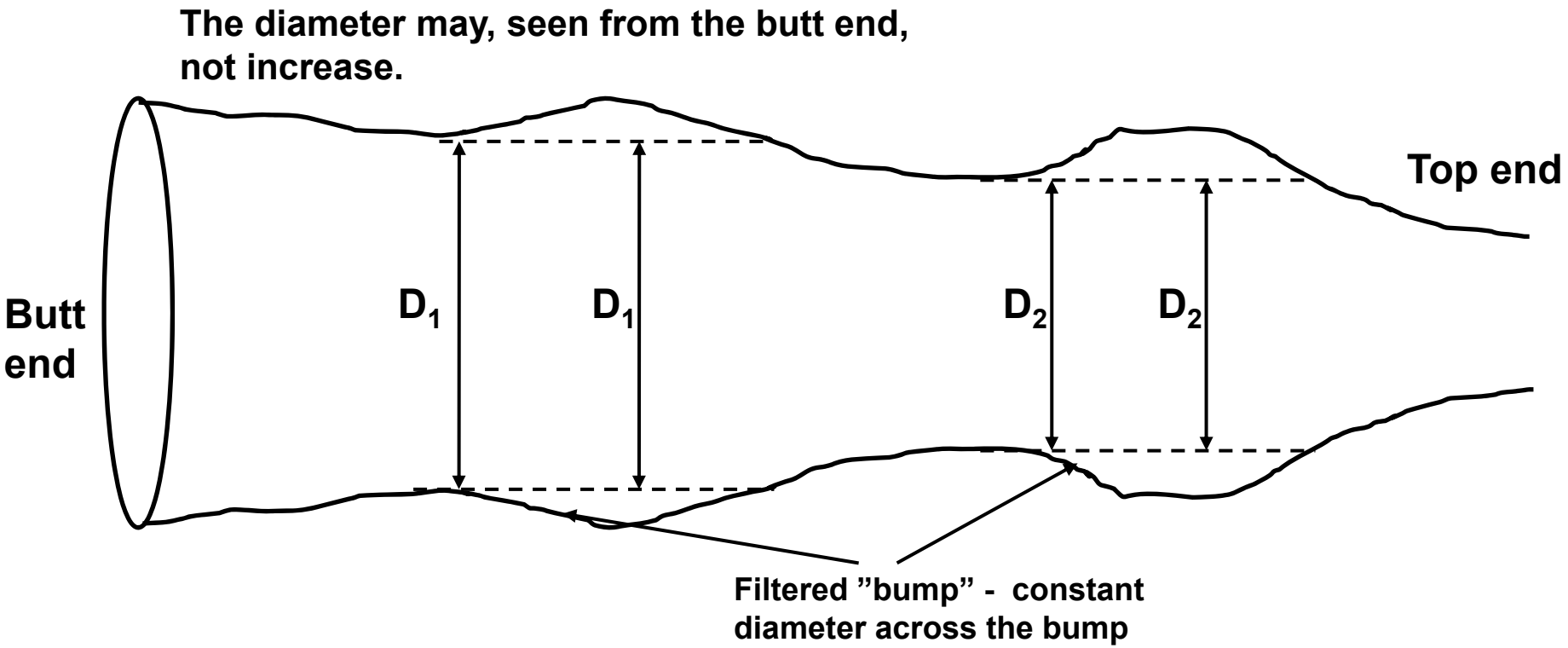


(c) The shortest path to each of the 16 end pixels in the object.

Measuring solid volume- principles

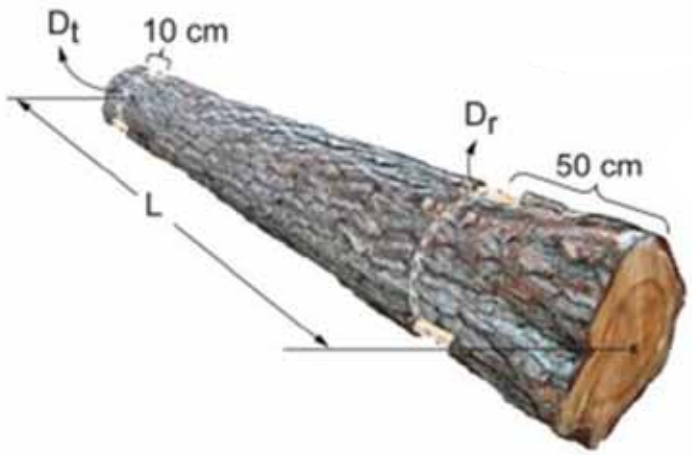
Filtering of ”bumps”



Measuring solid volume- application

Control

Measuring



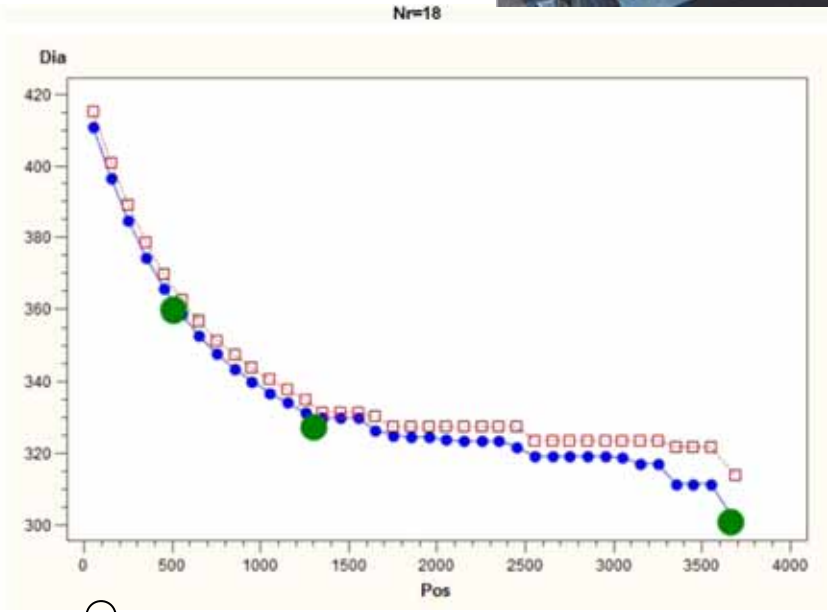


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Image analysis using stereo camera

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The End

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