Visualiner 3D

Snap-on Diagnostics

Machine Vision - Based Alignment for Vehicle Wheels: Space to Factory to Garage

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Snap-on Diagnostics
San Jose, California, USA

Presented at Automekanika XV - Frankfurt

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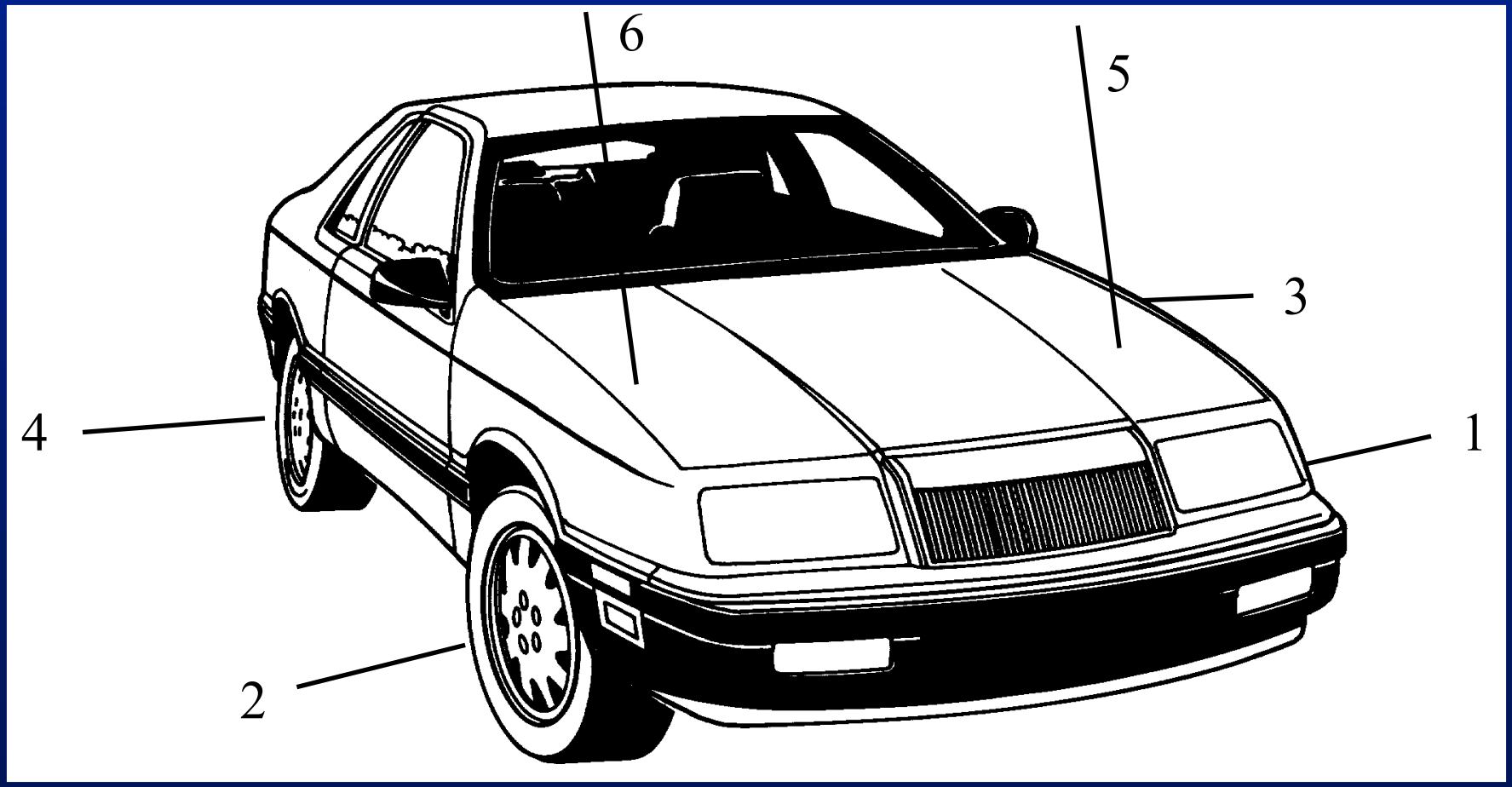
“wheel alignment” is really “axle geometry measurement”



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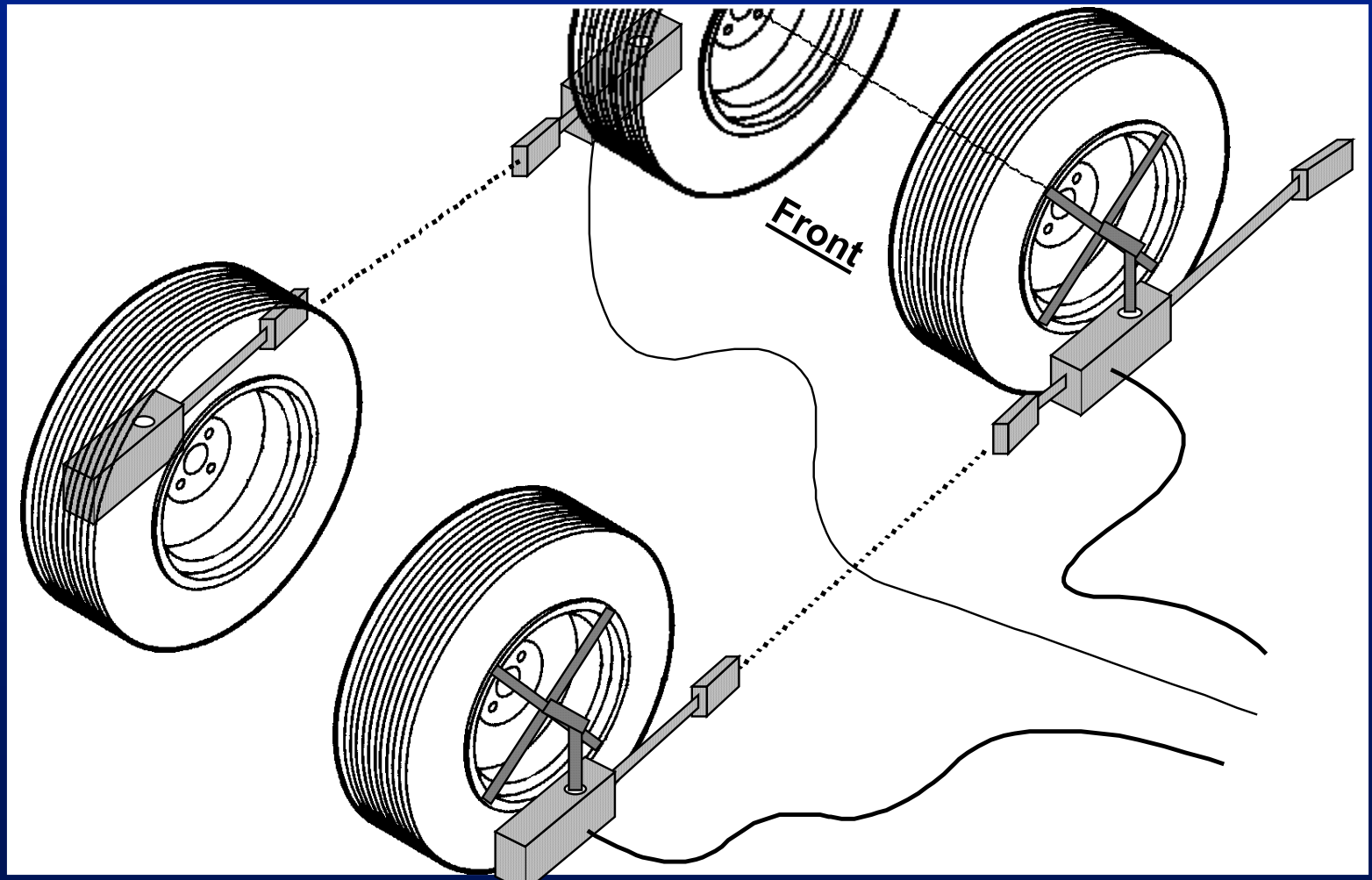
Conventional Wheel Aligner Instrumentation



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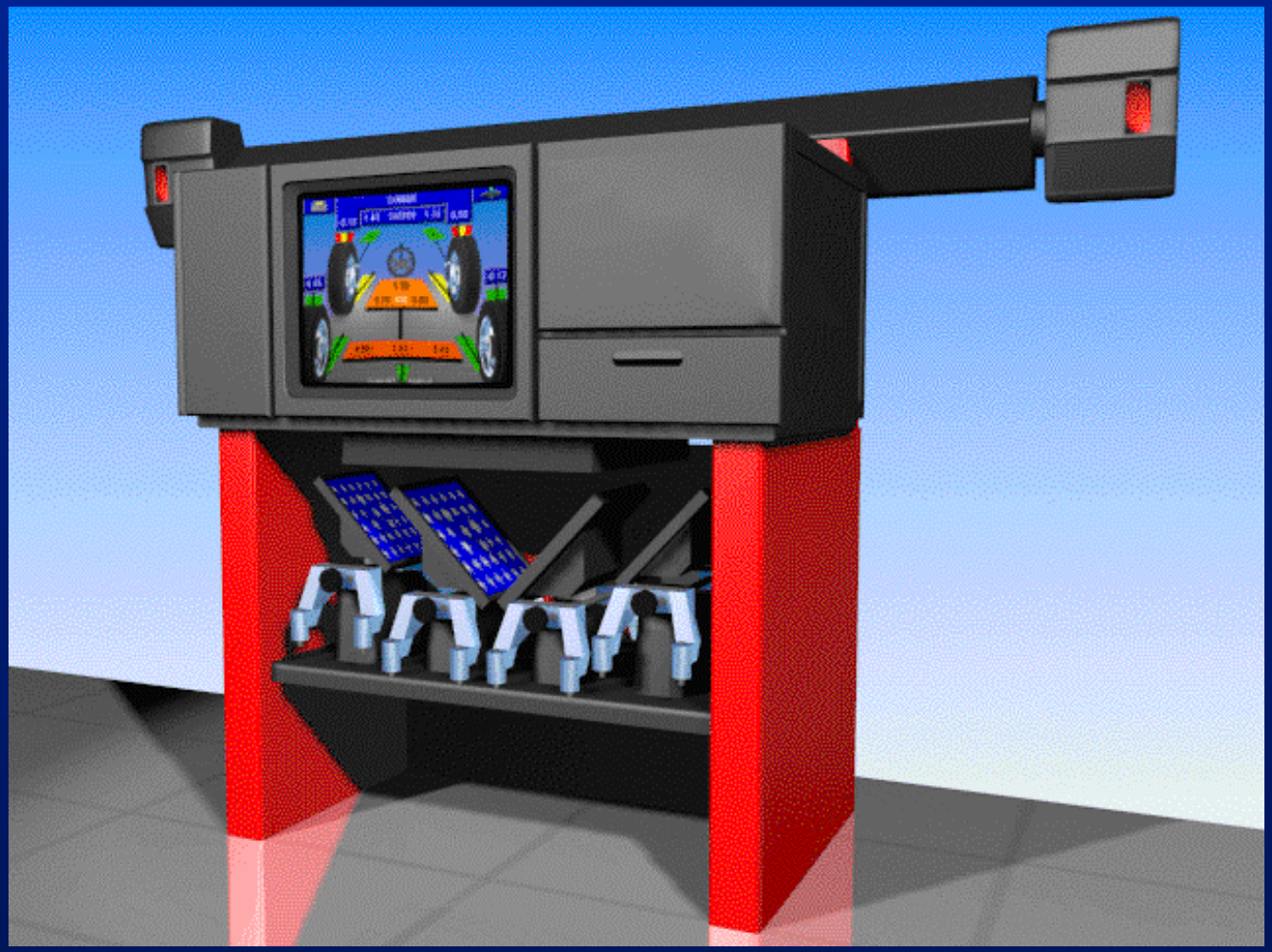

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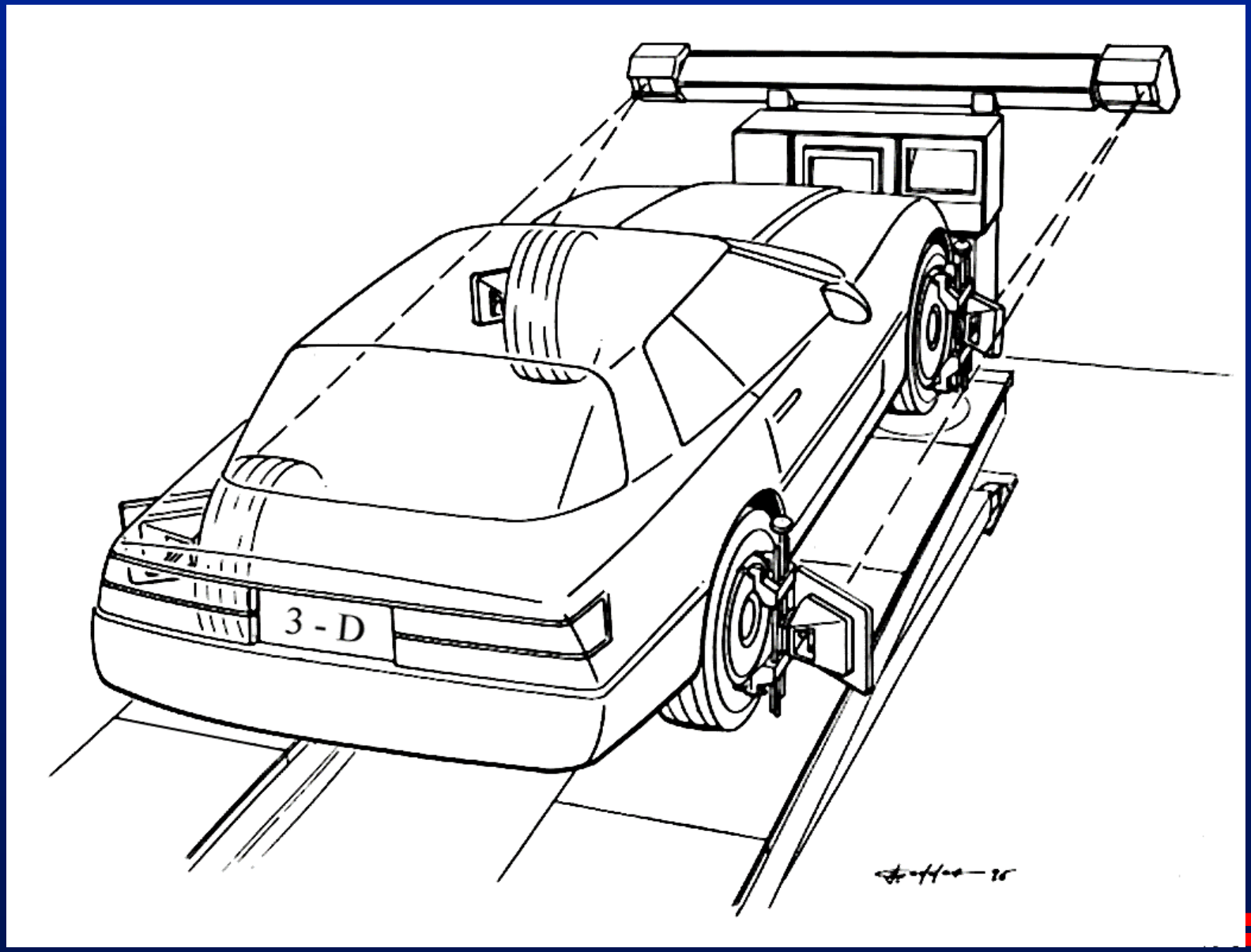

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What is the 3D Visualiner ?

- Solid-state cameras and wheel targets
- Modern machine vision software
- Array of high-power microprocessors
- 3-dimensional workstation software
- 3-D graphical user interface / presentation
- Database of adjustment illustrations

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Why machine vision? Benefits:

- The aligner is faster and more productive
- More reliable, cheaper to operate
- Easier to operate, physically and cognitively
- High precision
- Easier for technicians to learn
- More capable geometric instrumentation

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Benefits: It's faster.

- In field use it's almost twice as fast
  - 6 minutes on 3D-V, 11 minutes on conventional. *Measured from drive-in to print-out on 3000 cars*
  - Greater technician productivity
  - More alignments per bay per day
- No jacking. The vehicle stays on its wheels.
- Built-in expert help.
- Graphic illustrations and textual descriptions for all adjustments.

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Benefits: More reliable, cheaper to operate

- No calibration after it's installed
- No sensitive electronics in the heads
  - No downtime due to damaged heads
- No wires to get tangled, broken, or lost
- No radio-frequency interference
- No batteries to recharge or wear out
- No electronics under the wheels (turntables) to get dirty and rusty

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Benefits: Easier to operate.

- Light-weight heads. Easy to carry and easy to mount
  - Less physical effort, greater productivity
- No interference from under-car obstructions
  - Spoilers or air dams
  - Low exhaust pipes
  - Custom running boards
  - Low-rider vehicles

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Benefits: High Precision

- Wheels stay on the ground during measurement
  - real road conditions, not laboratory conditions
- Full lock-to-lock caster swings, T-O-O-T
- No caster distortion due to vehicle yaw during caster swing
- High resolution electronic cameras

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Benefits: It's easier for mechanics to learn

- Ergonomic, intuitive graphical interface
  - Alignment meters displayed in 3-D
- All vehicle adjustments shown graphically
  - Exclusive 3-D orientation indicator simplifies diagrams
- Expert, context-sensitive help is 1 or 2 keystrokes away at all times

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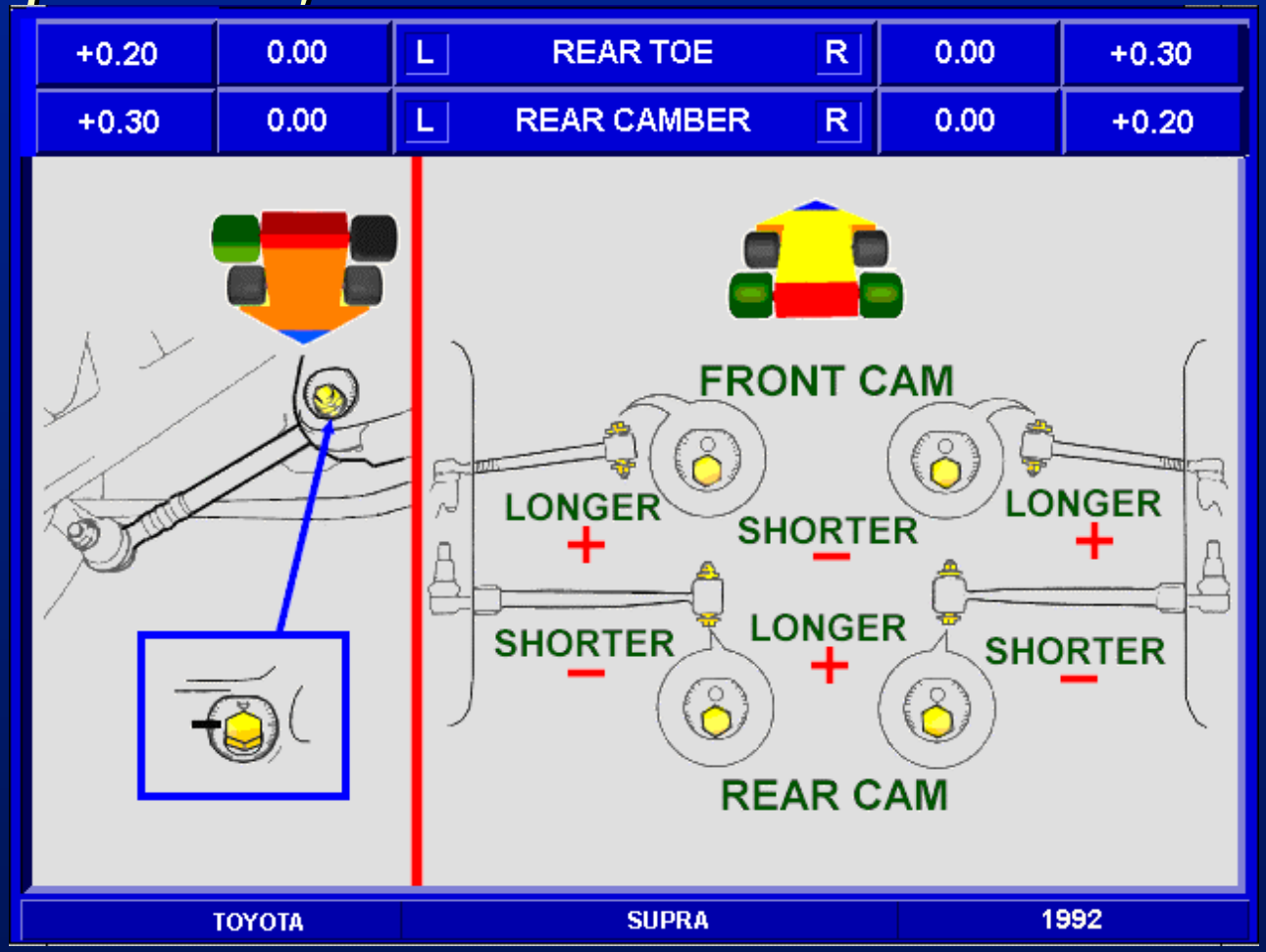
Graphic adjustment illustrations



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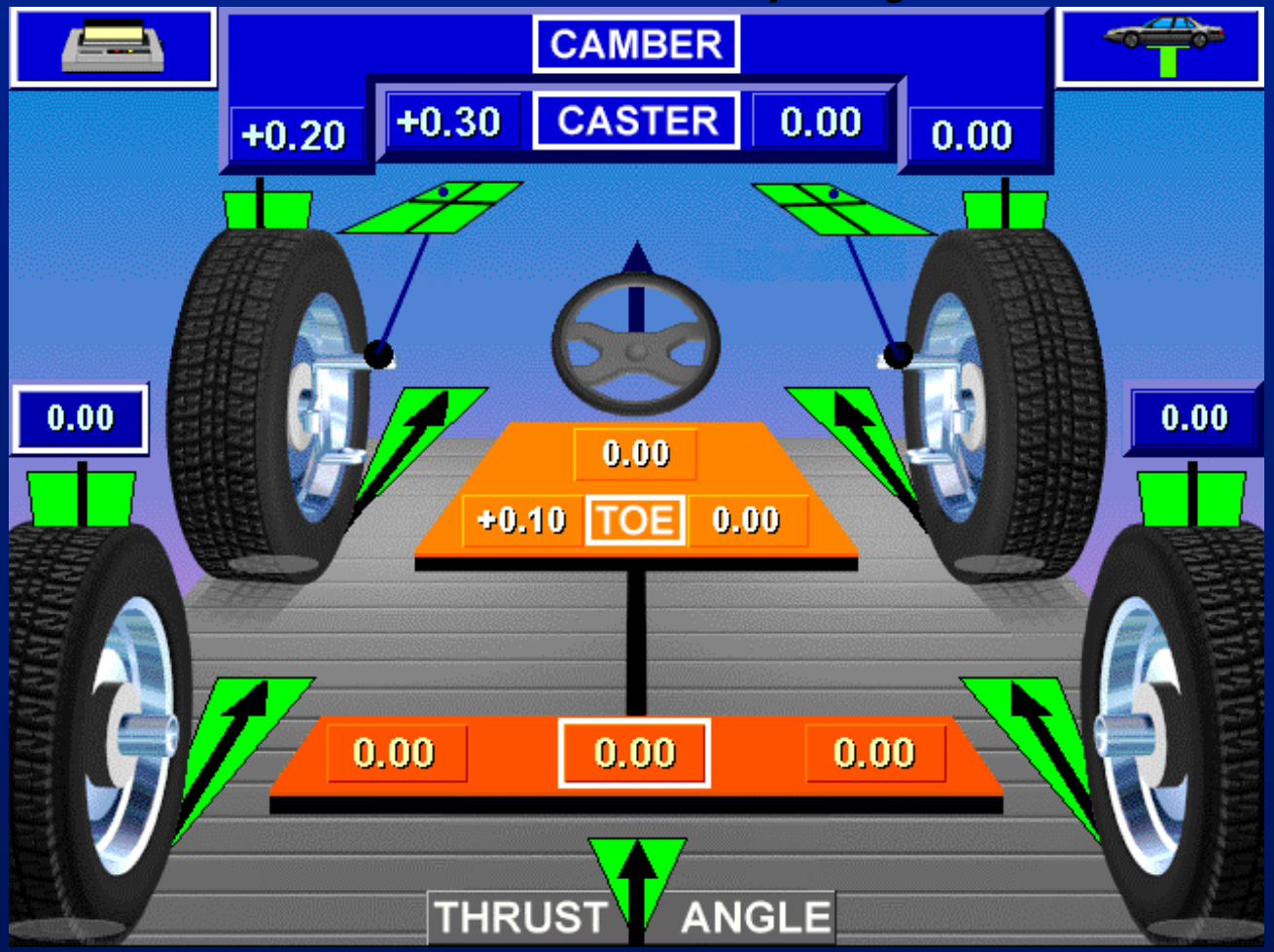
3-Dimensional meter display



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Benefits: ***New vehicle measurements***

- Absolute wheel base distances
- Absolute rim-to-rim track widths
- Individual wheel side-set
- Symmetry about vehicle center line
- other geometries previously impractical with conventional instruments . . .

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Why is 3D alignment now possible ?

- Availability of great computer power
  - Pentium processors, faster clock speeds
  - Parallel microprocessor arrays
- High resolution solid state cameras
- New machine vision technologies
  - Stochastic subpixel interpolation techniques
  - High-precision microelectronics manufacturing
  - Well-developed alignment techniques

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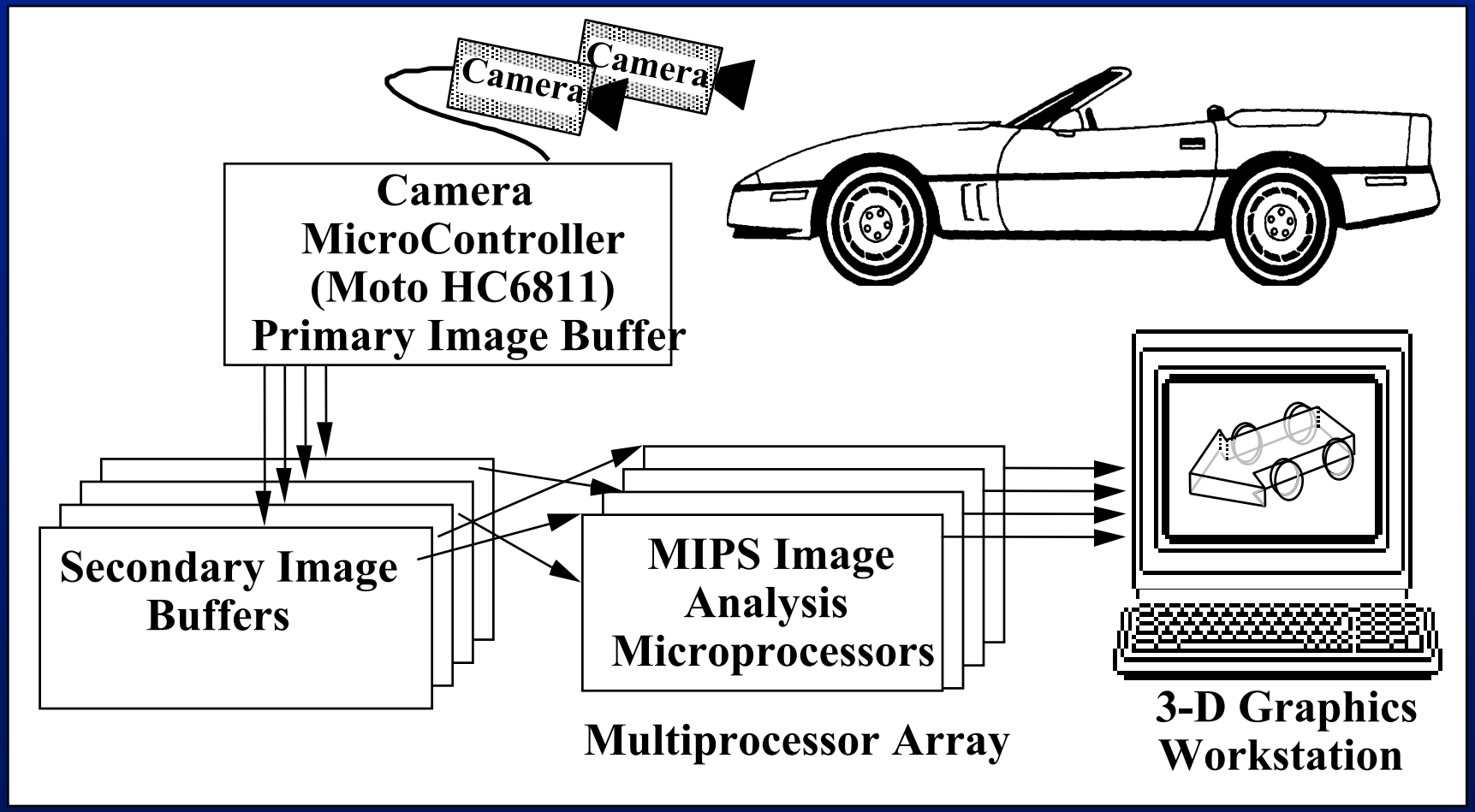
Machine Vision Architecture



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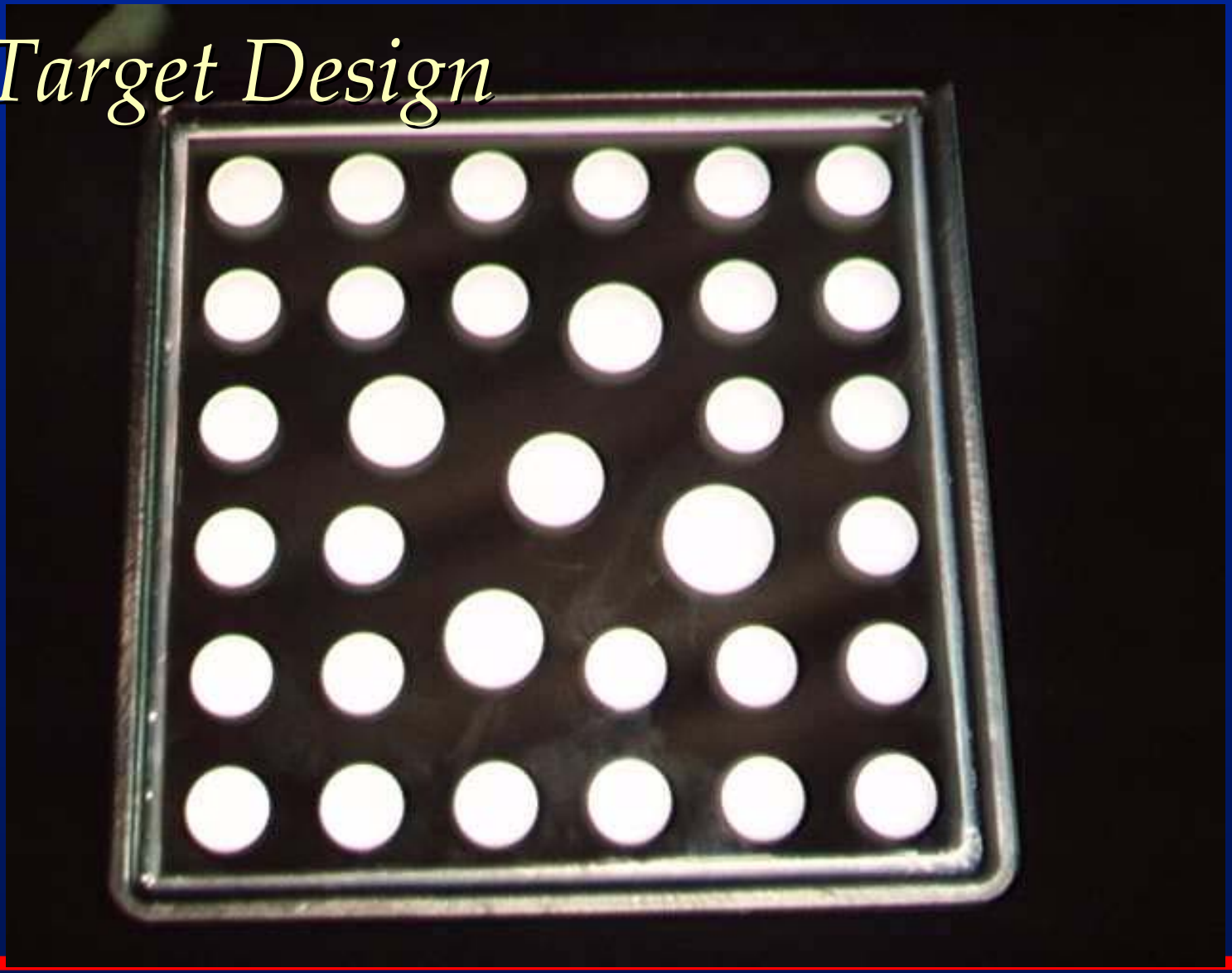
Target Design



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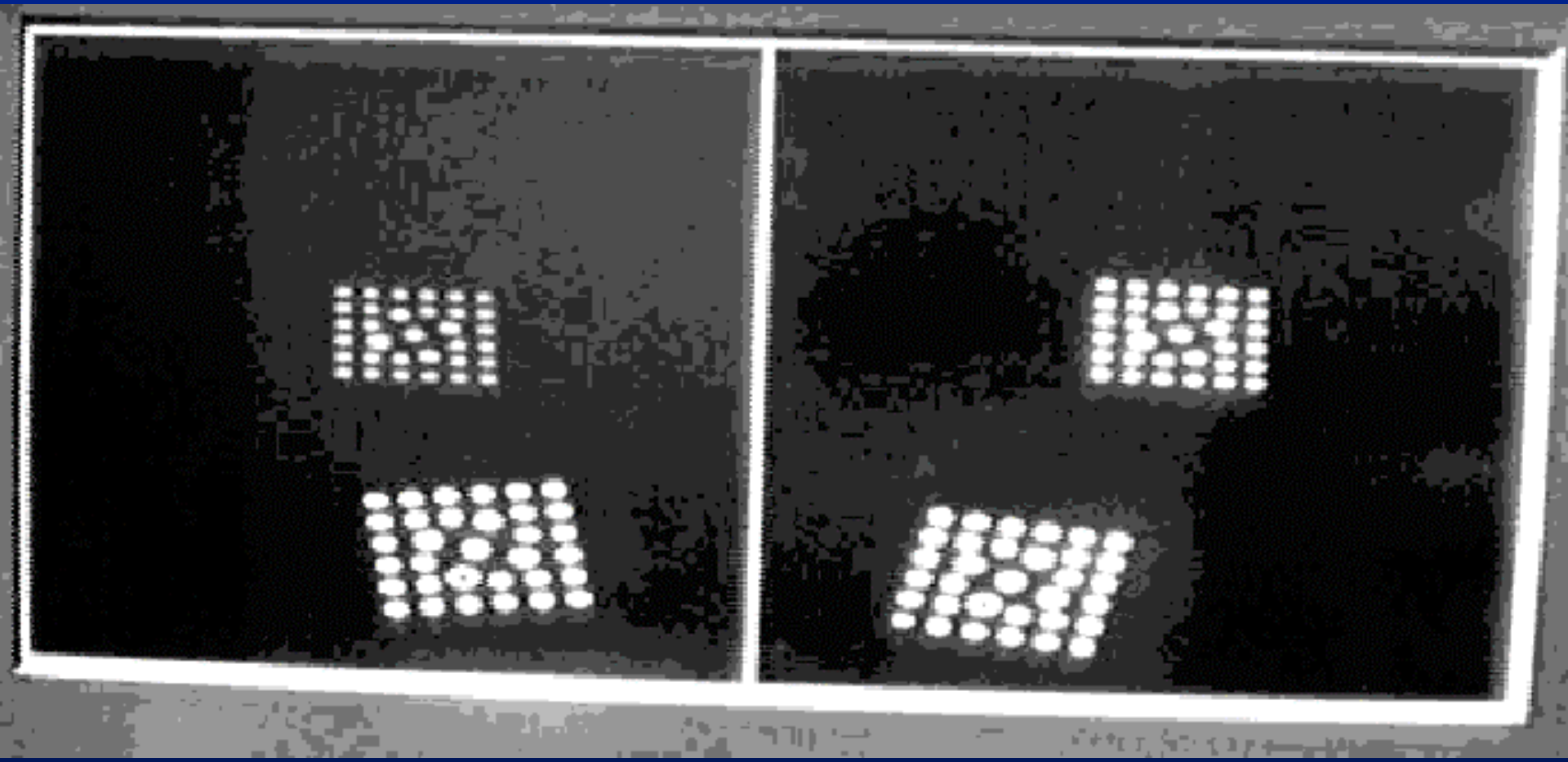
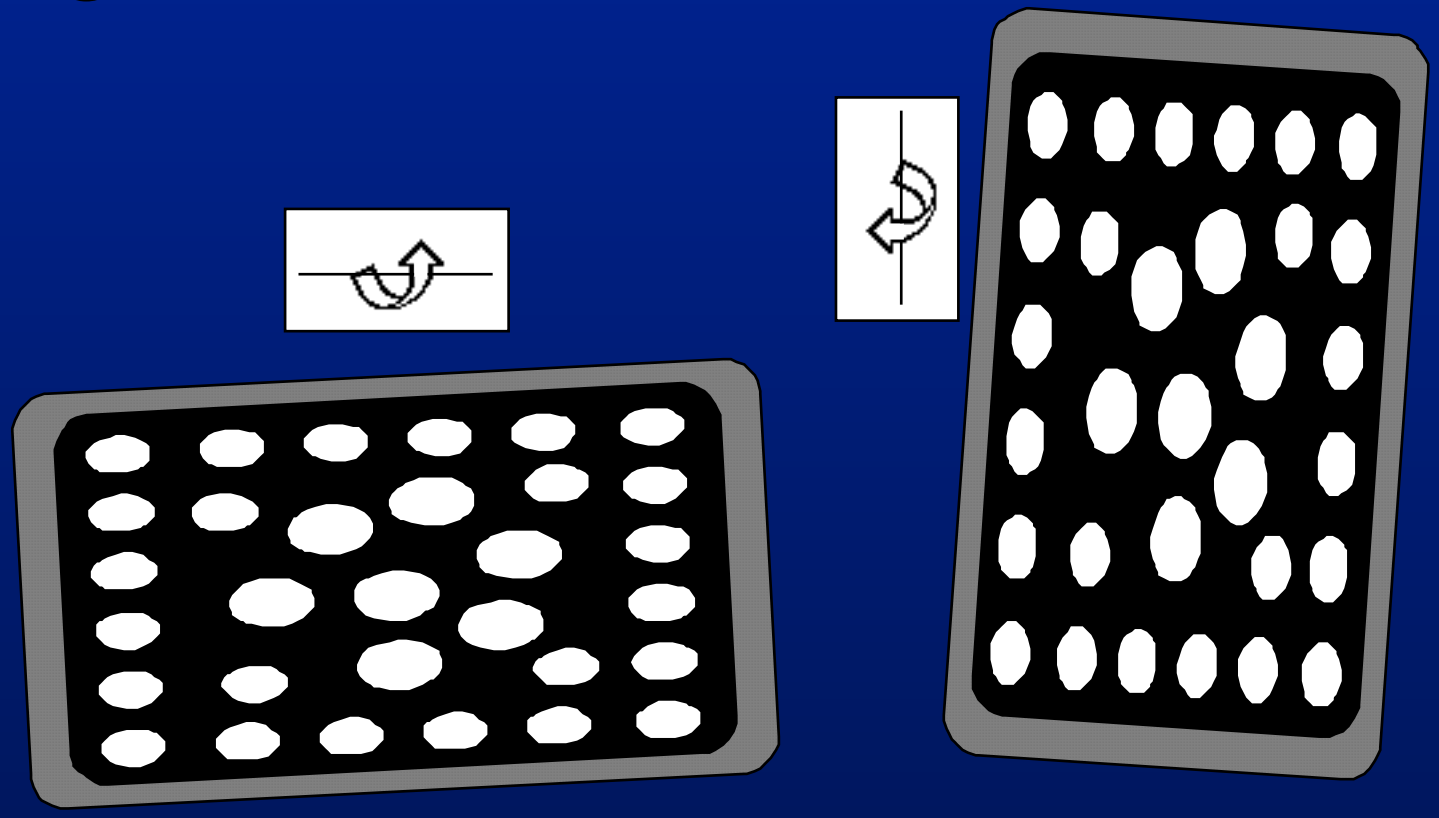
Camera Views



Target distortion: rotation



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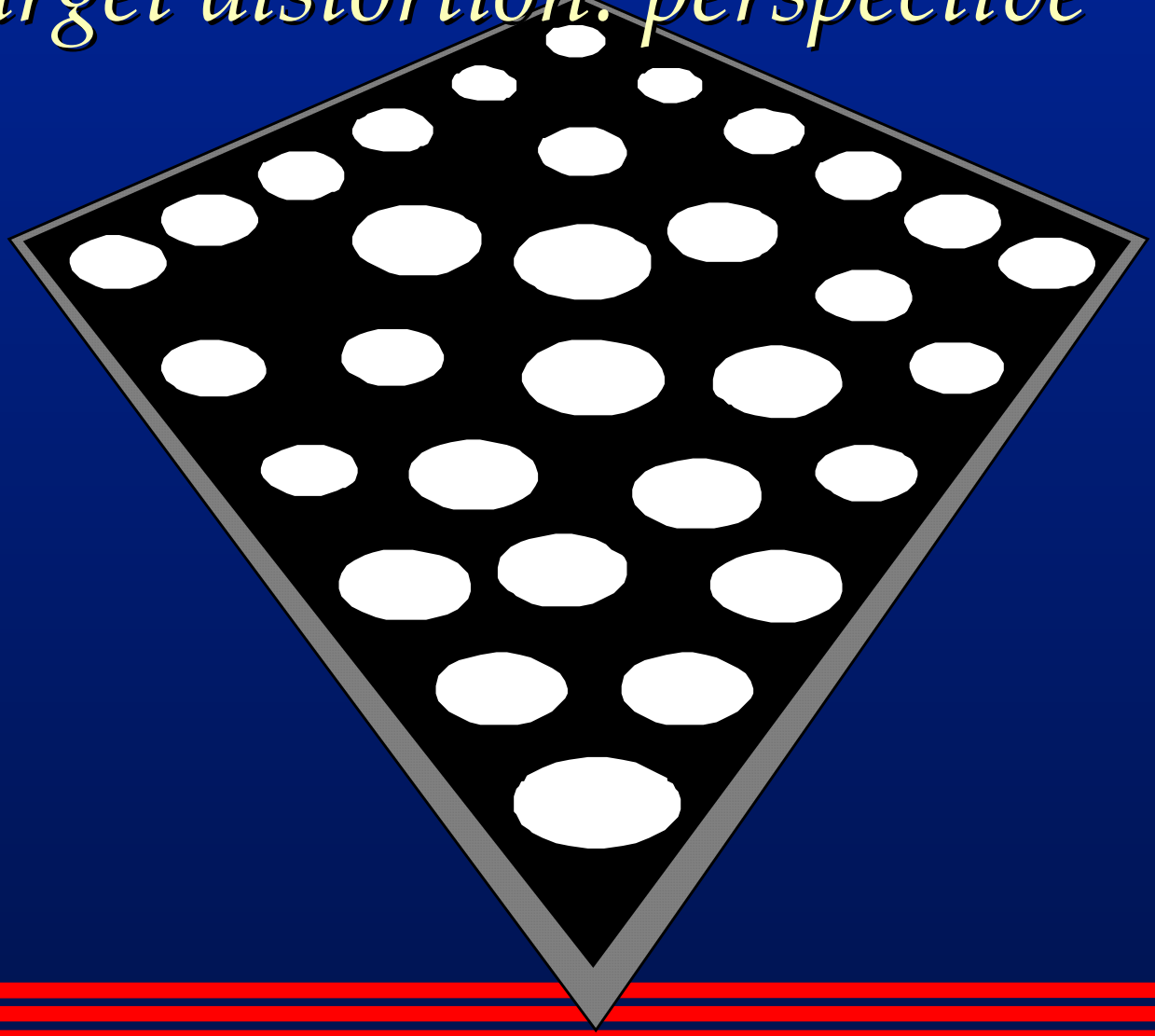
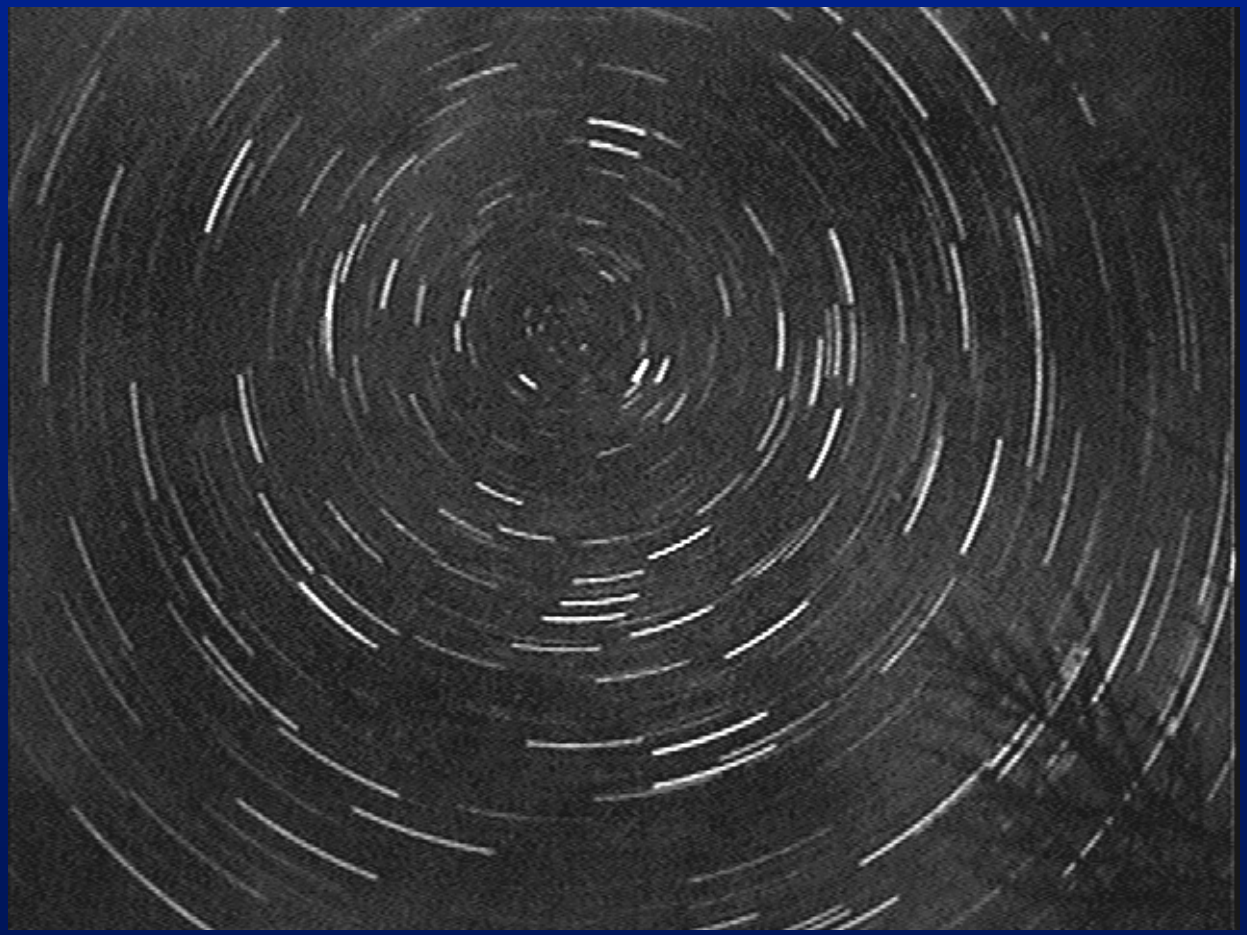
Target distortion: perspective



Target motion infers axis of rotation



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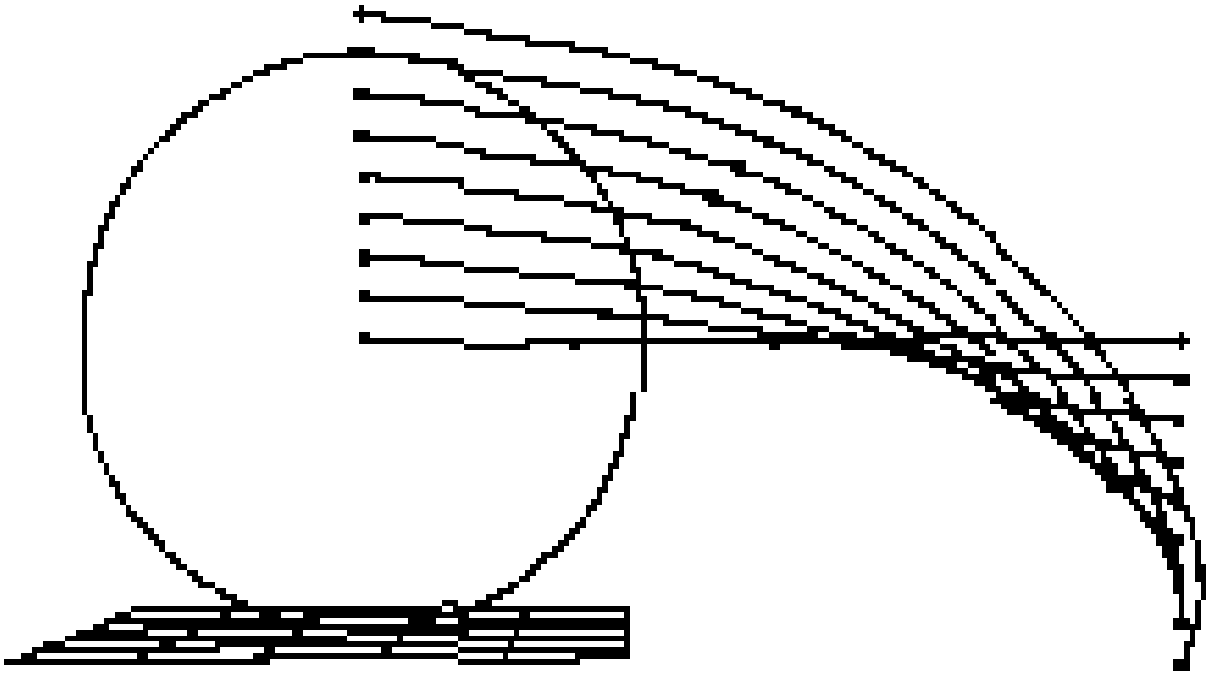
Cycloidal motion of targets identifies the axes of rotation



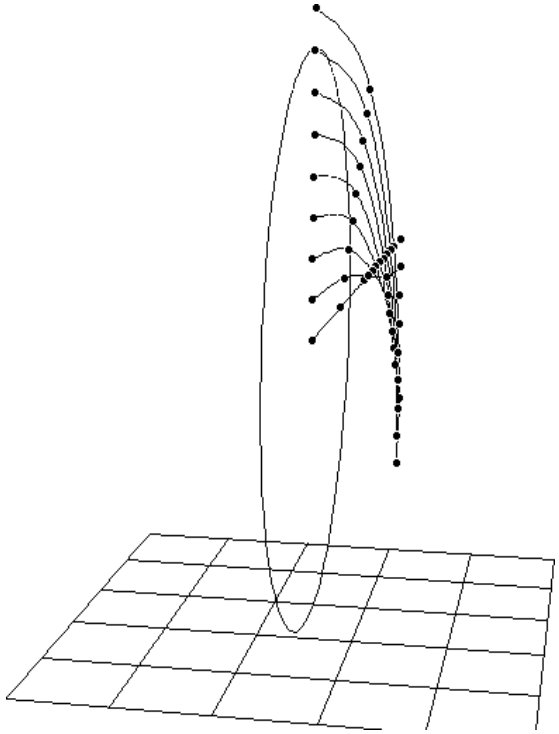


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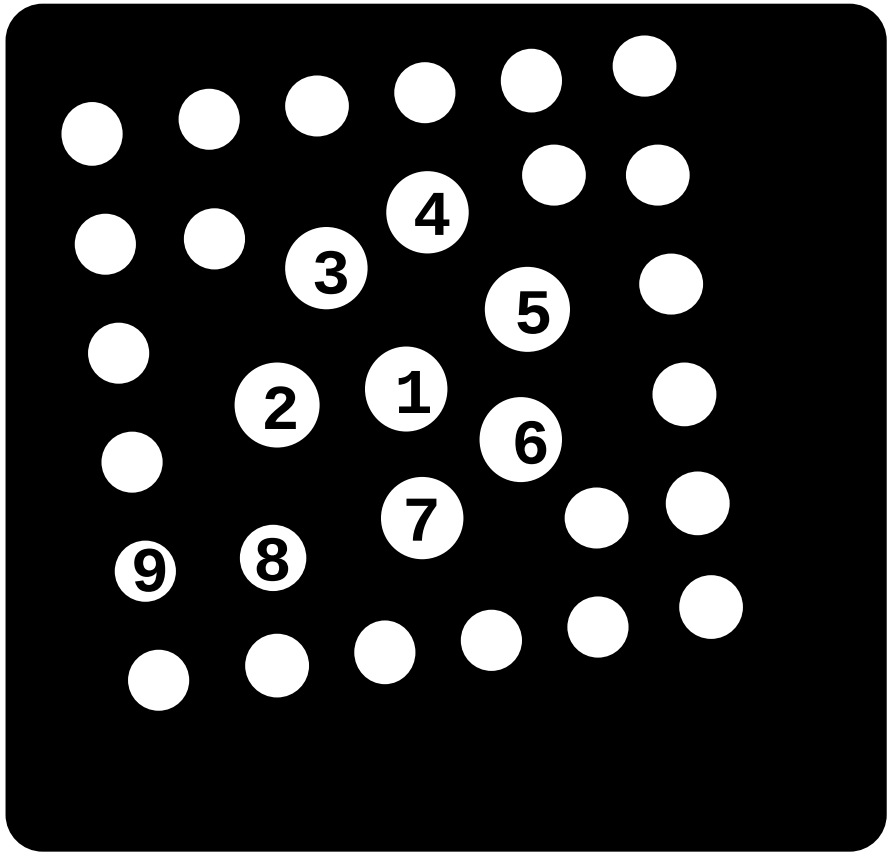
Image Analysis



List of Centroid Coordinate Pairs

#	X	Y
1	251.768	473.112
2	207.449	476.432
3	231.956	573.020
4	266.712	492.909
5	227.193	481.409
6	. . .	
7	. . .	
8	. . .	

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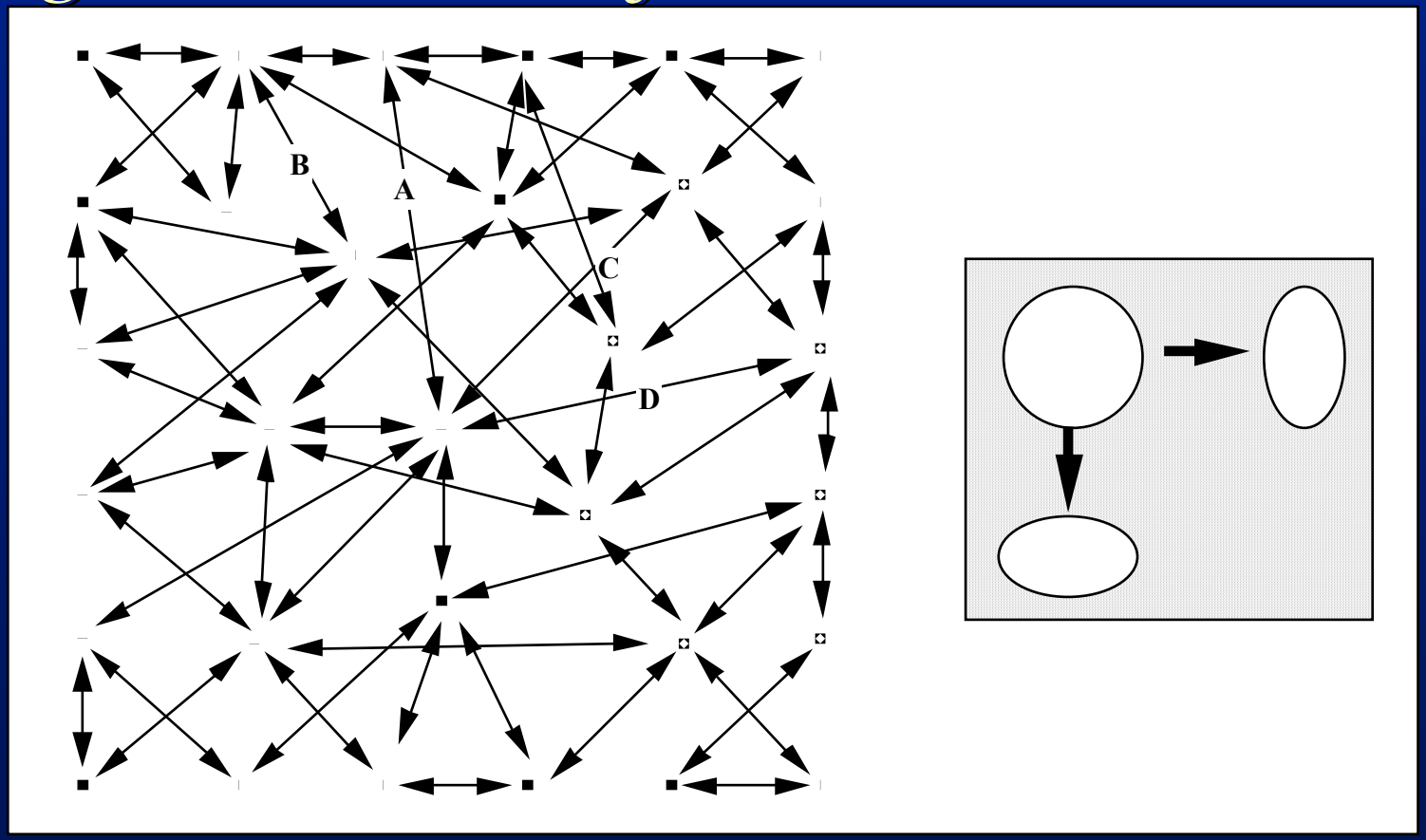
Multiple measurements per image for high total accuracy



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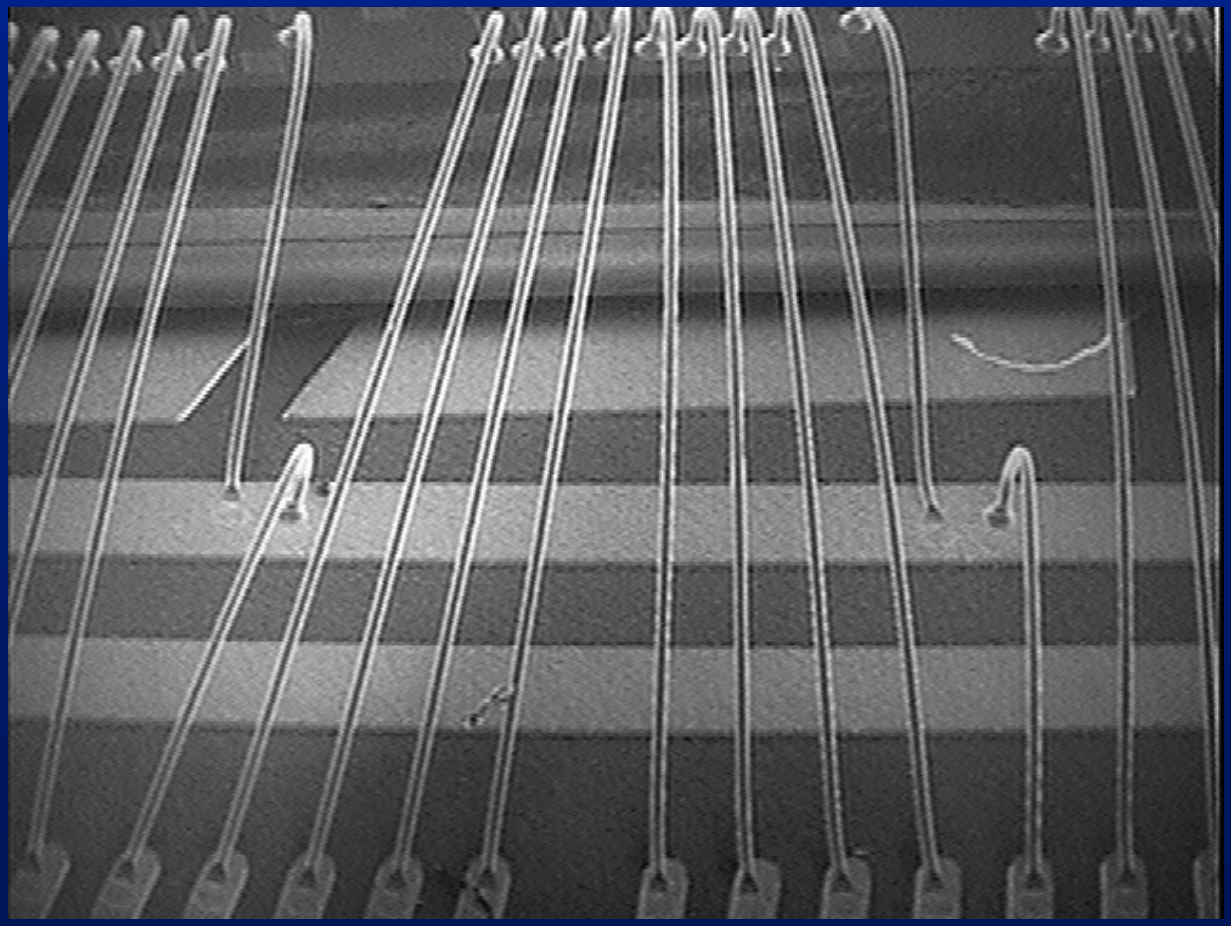
Vehicle wheel alignment is just the latest application of machine vision to precision alignment . . .



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Where can I get my car aligned with machine vision ?

John Bean

Look for a local wheel service shop that uses the “Visualiner 3D”, distributed by the John Bean Co. (a division of Snap-on)