DYNAMIC POSITIONING CONFERENCE
November 15-16, 2005

Sensors II

CyScan:
The Benefits of Multiple Hypothesis Tracking for Laser Based DP Reference Sensors

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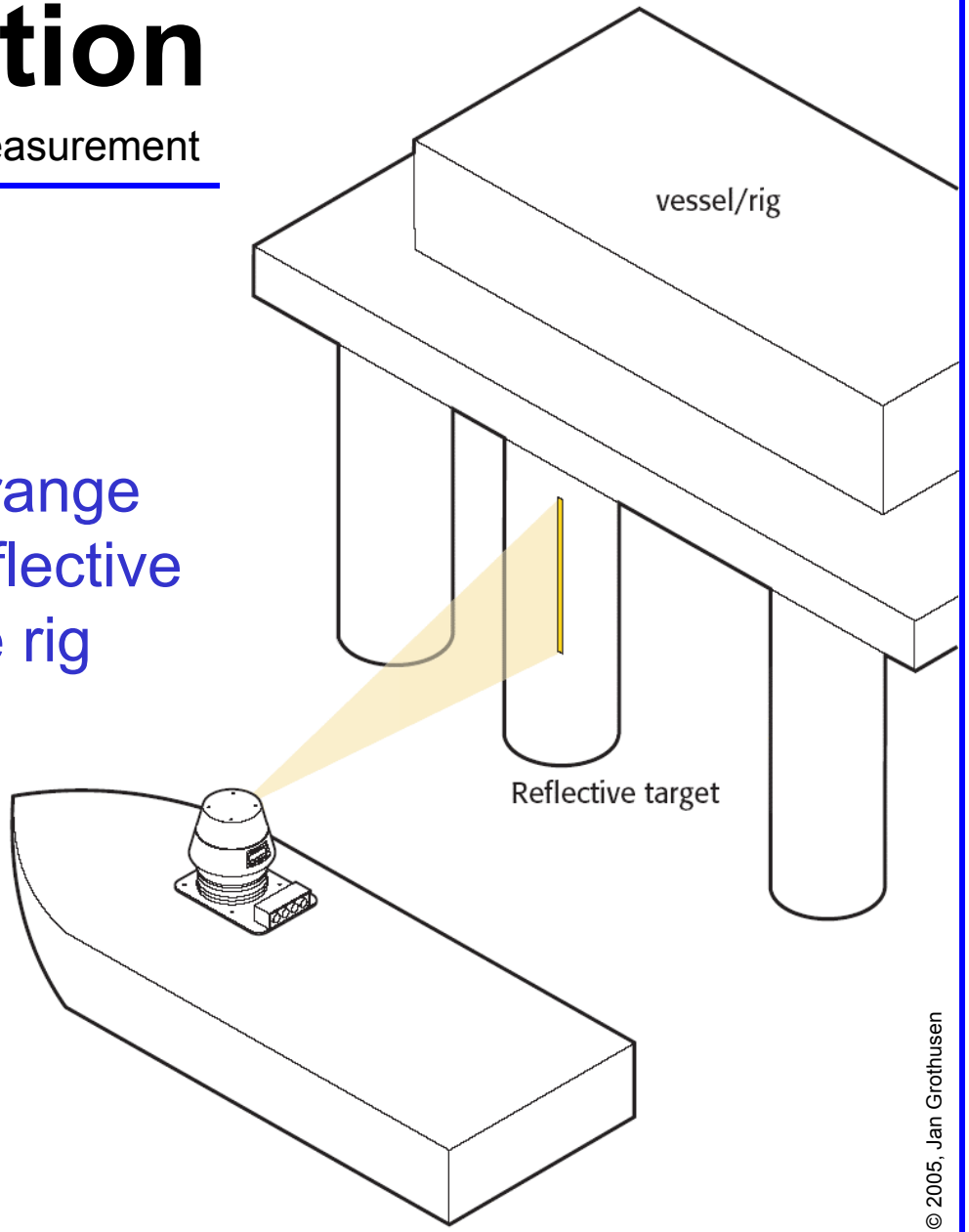
Introduction

Laser Based Position Measurement

Laser measures range and bearing to reflective target on offshore rig



Traditional Approach

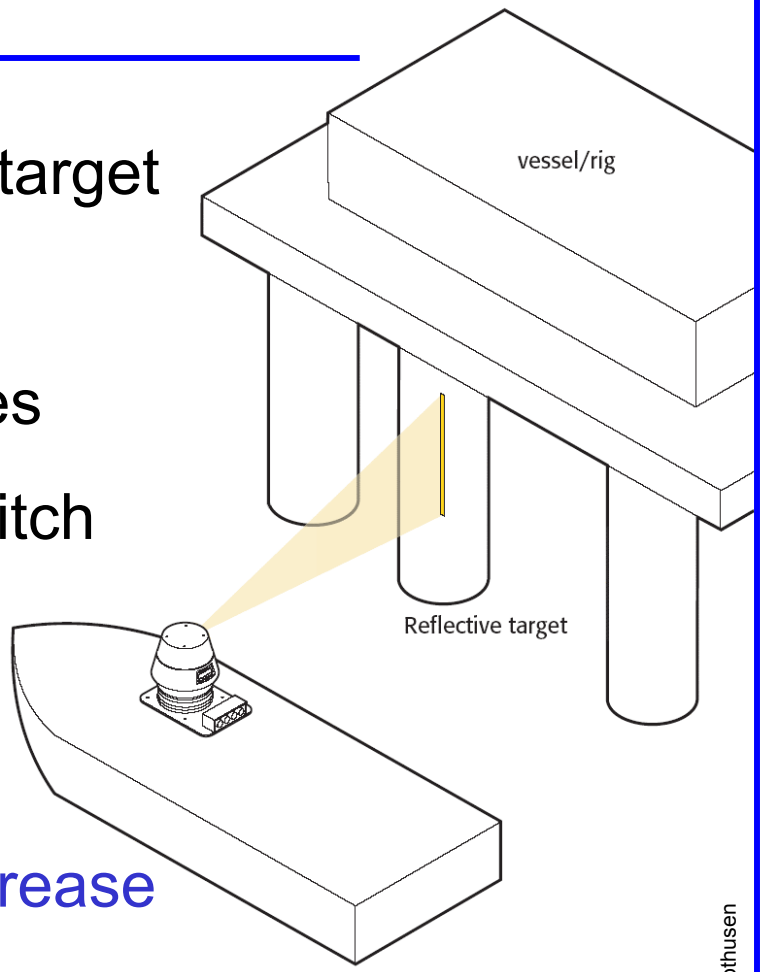
Introduction

Range & Bearing single target

Oscillating sector sweep

Tracking with signal gates

No correction for roll & pitch



Multiple targets →

wide sweep / latency increase

n independent Single Targets

‘Smart’ Sensing

Basic Principles

Continuous rotation 360°/s

Multiple targets (n per rev)

Known Target configuration

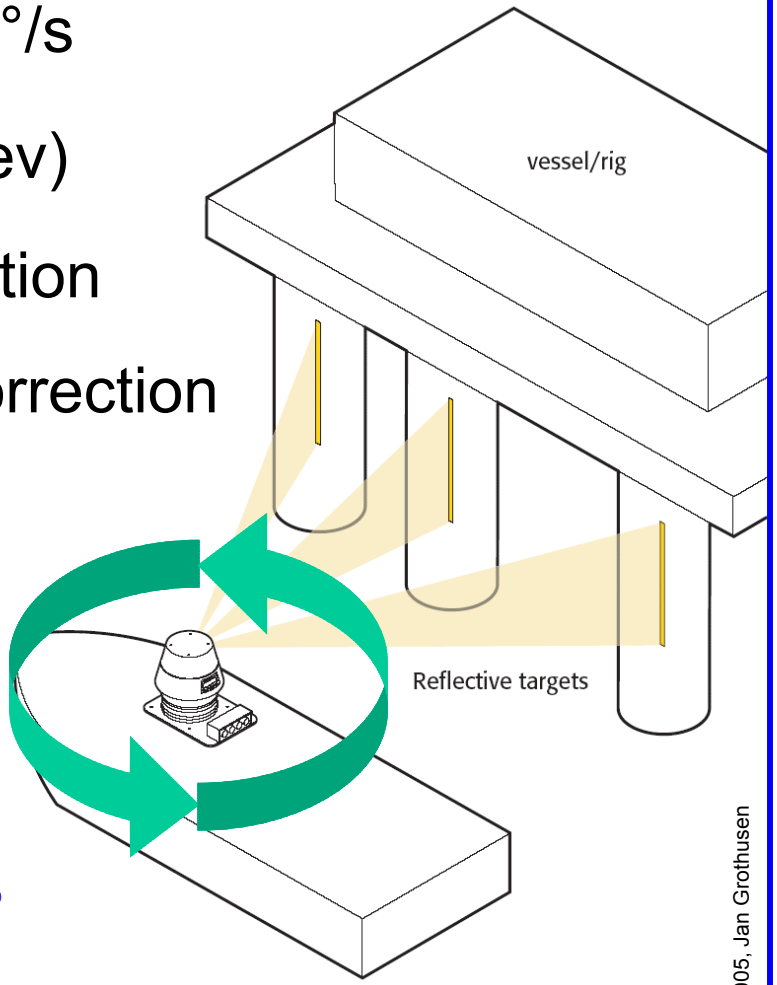
Automatic roll & pitch correction

Designed for DP ops…

→ Auto-survey

→ Draught follow

→ **Multiple Hypothesis Tracking**



CyScan Approach

Basic Principles

Continuously rotating 360°/s vertical fan 16°

→ Sees “all” targets / rev (fixed latency)

3-axis solid-state vertical reference unit

→ Automatically correct ±20° roll & pitch

Multiple hypothesis tracking with Kalman Filter based on ‘Vessel Dynamics’

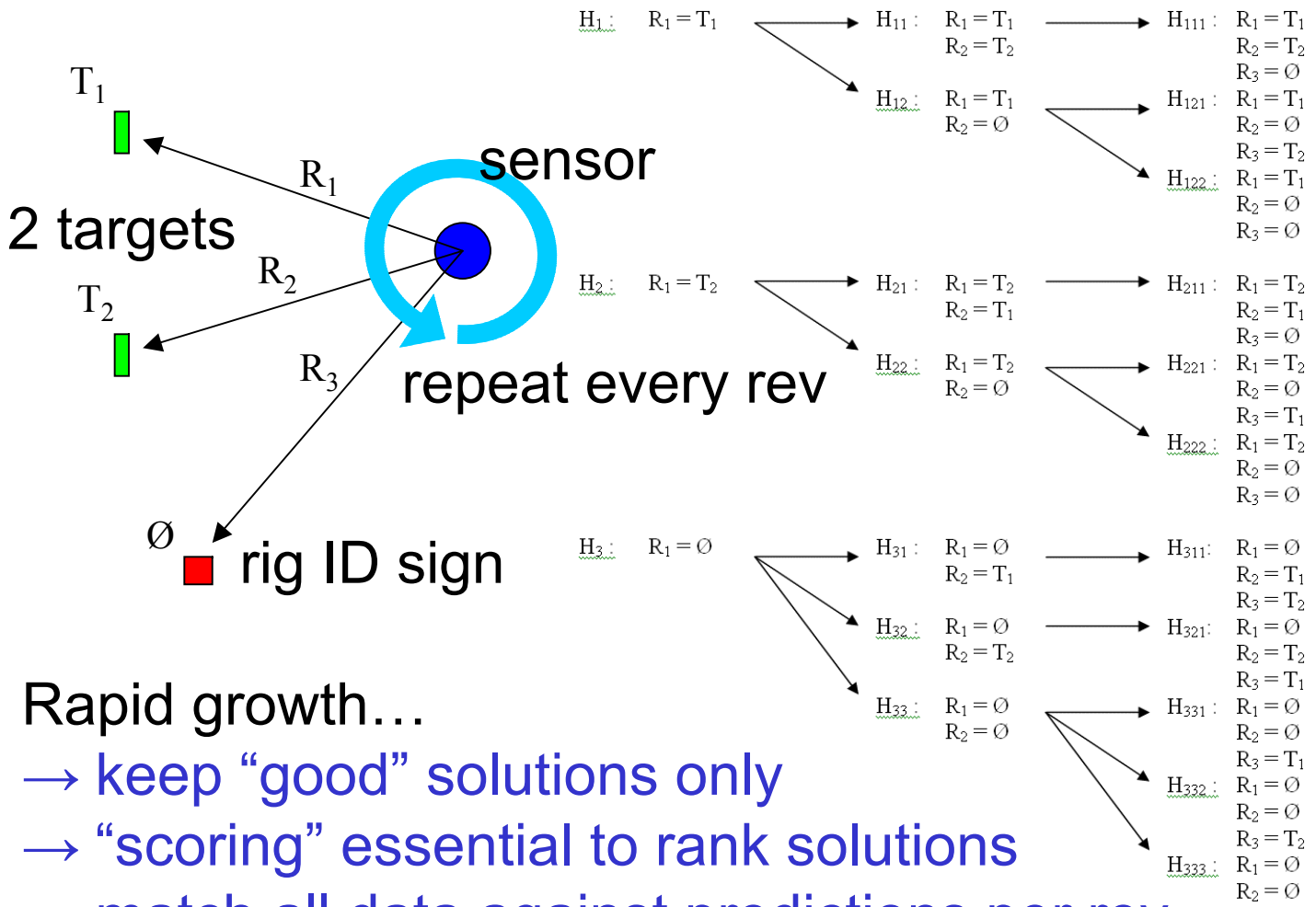
→ Replaces single target “gating”

→ “History” of all previous reflections drives decision making

→ True real-time position & heading fix

Hypothesis Generation

Multiple Hypothesis Tracking



Rapid growth…

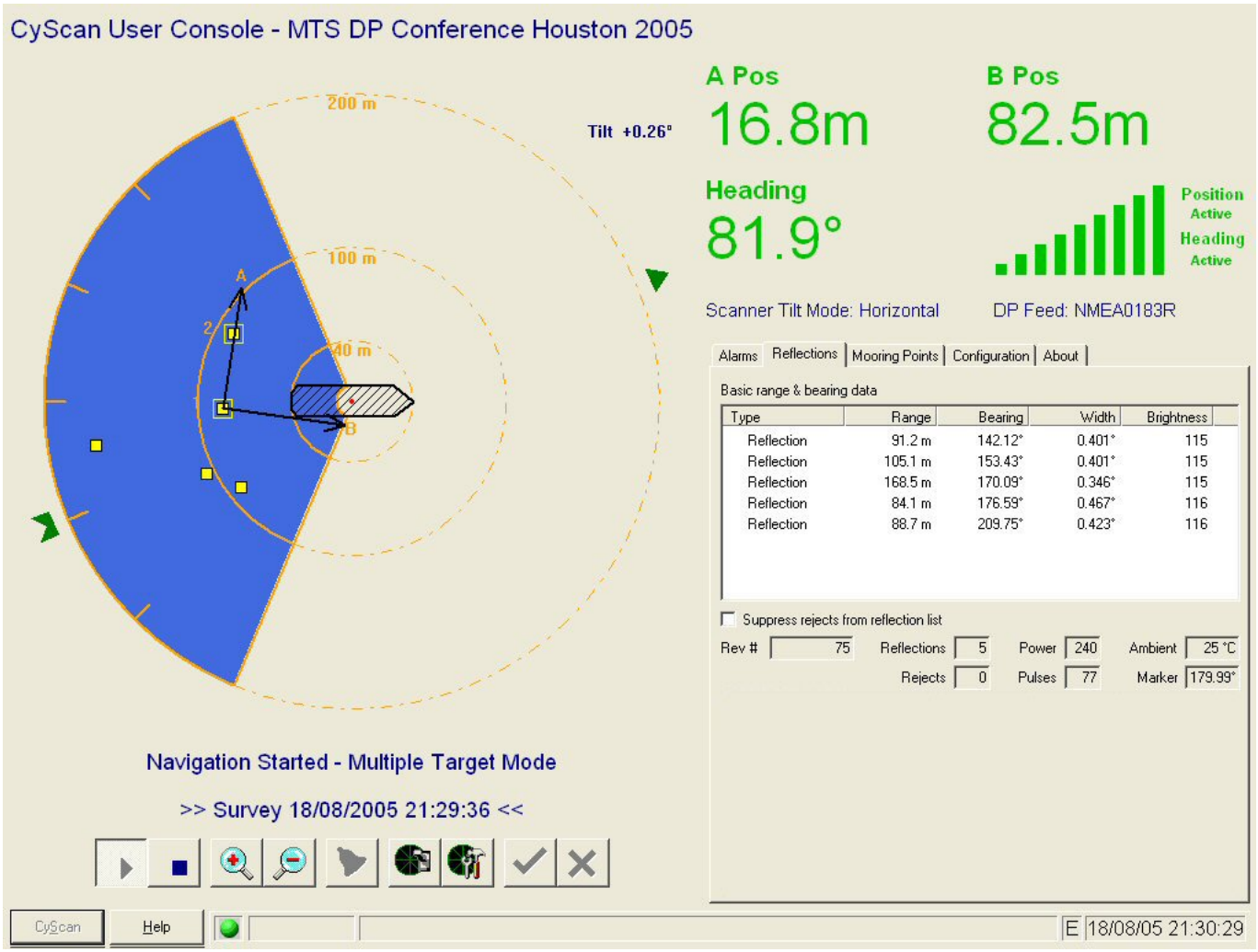
→ keep “good” solutions only

→ “scoring” essential to rank solutions

→ match all data against predictions per rev

Benefit: Robustness

Results & Specifications



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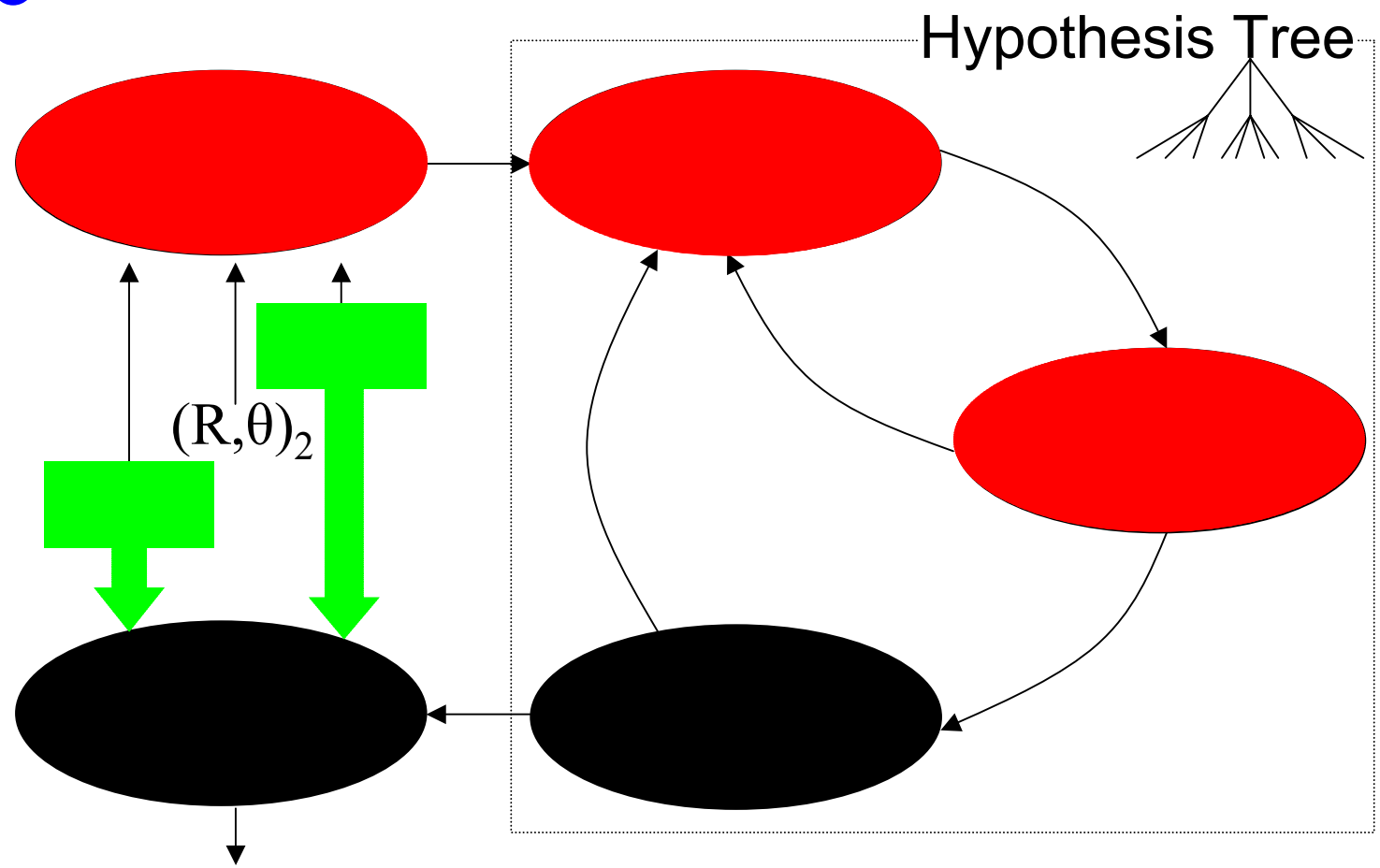
Position Algorithm

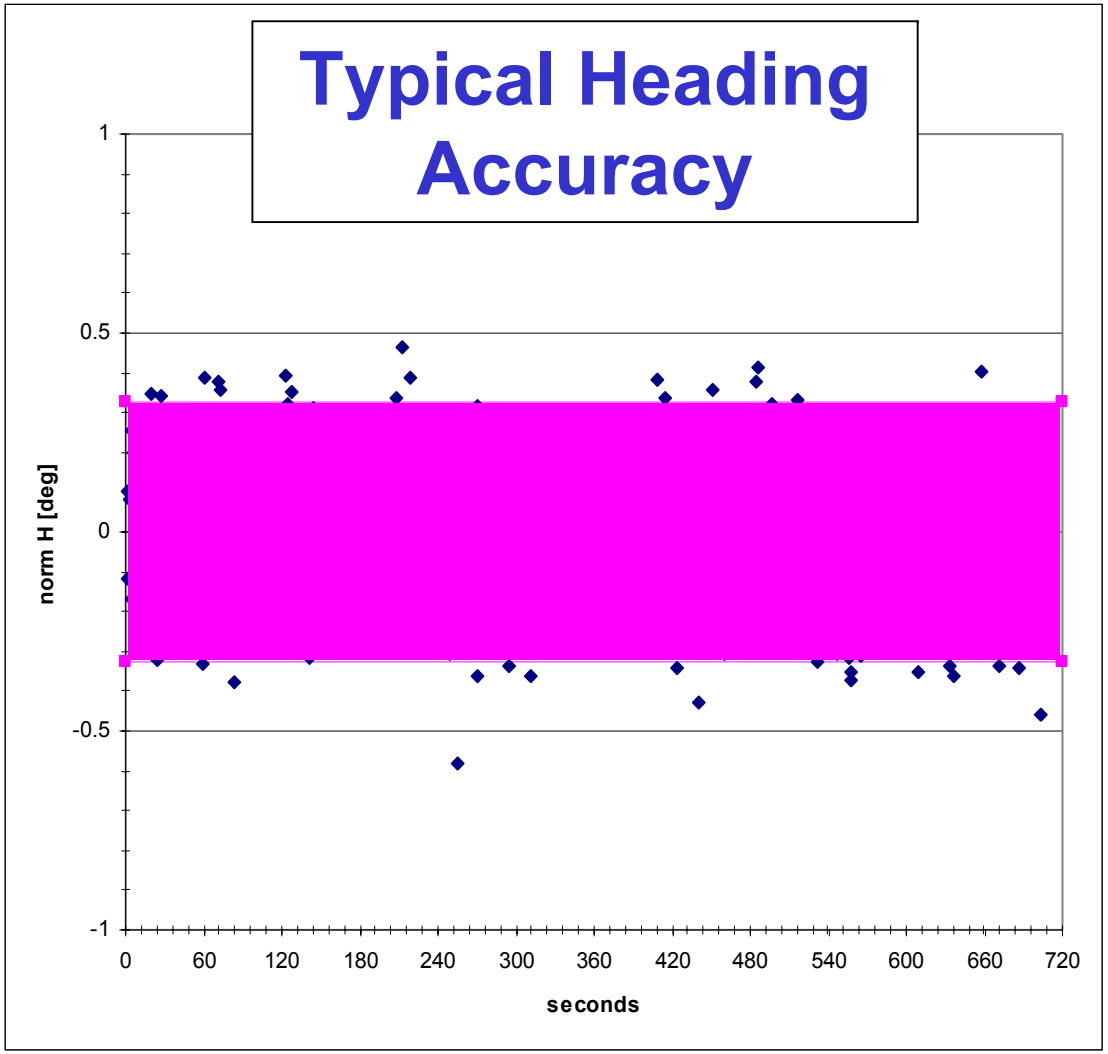
Multiple Hypothesis Tracking



(X,Y,Φ) Position & Heading for DP

Benefit: Accuracy

Results & Specifications



$R_m \approx 200m$

$2\sigma_R \approx 6$ cm
2½ inch

$2\sigma_\theta \approx 3$ cm
1¼ inch

$\Delta_2 \approx 23m$

$2\sigma_\Theta \approx 0.3°$

Sensor Performance

Results & Specifications

Scan rate: uni-directional [illegible]°/s

Beam characteristics: 16° vertic[illegible]20° tilt

Tilt compensation: ±20° r[illegible]and pitch

±5[illegible]5s wave period)

[illegible].5° (5s wave period)

≈ ±9 ft in 600 yds

Angular resolution: 0.006° (0.1 mrad)

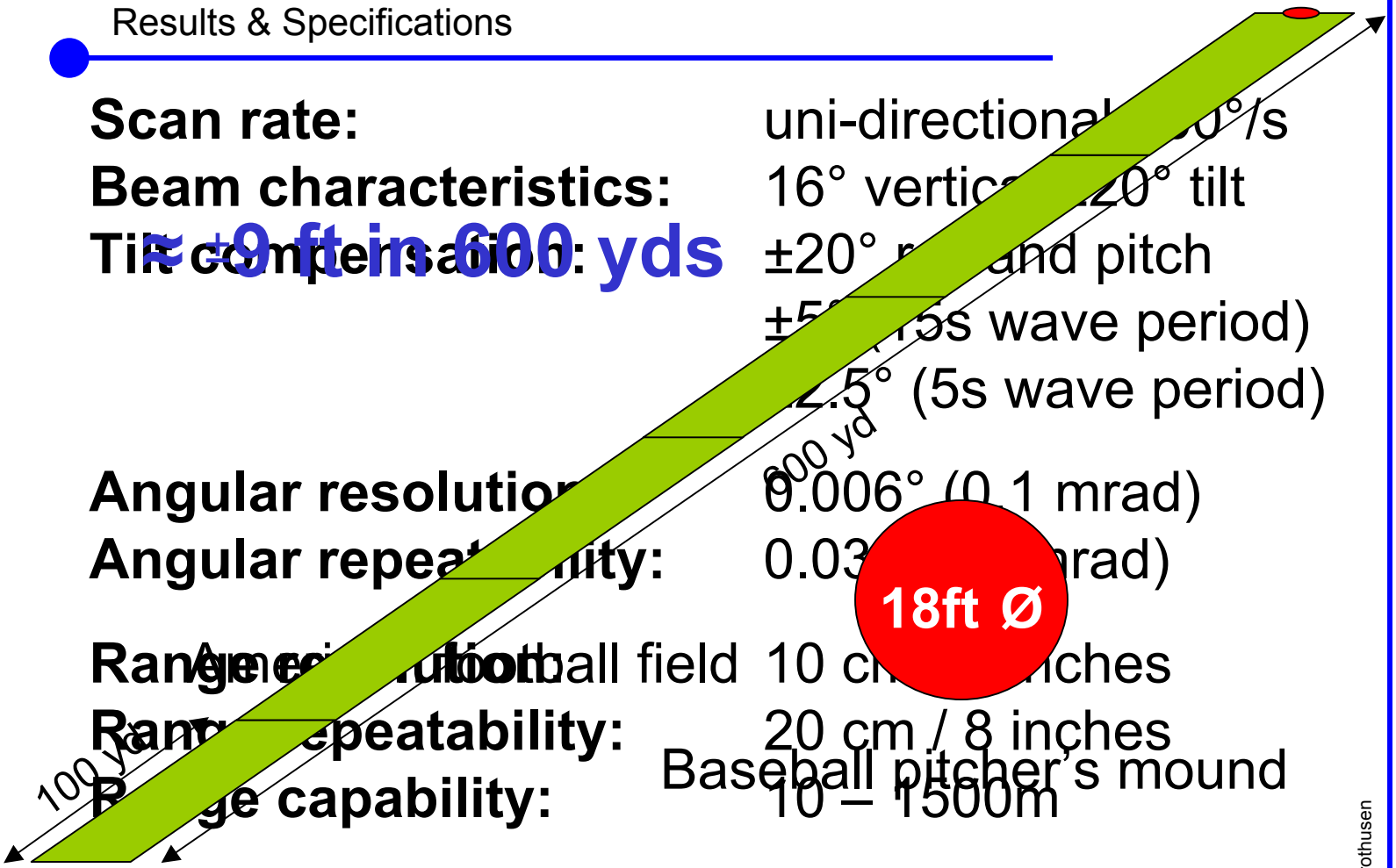
Angular repeatability: 0.03[illegible]rad)

Range resolution: A[illegible]ball field 10 cm / 4 inches

Range repeatability: 20 cm / 8 inches

Range capability: 10 – 1500m

Positional accuracy: better than 0.5% range



Summary

CyScan Laser Position Reference Sensor

Multiple hypothesis tracking gives:

→ More accurate position & heading fix

→ More robust to missing / false targets

→ Designed for multi-target redundancy

→ Fixed latency < 1 second

→ Ease of use

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