# Passive Ranging for Anticollision

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# MWD Survey Misrun Reasons:

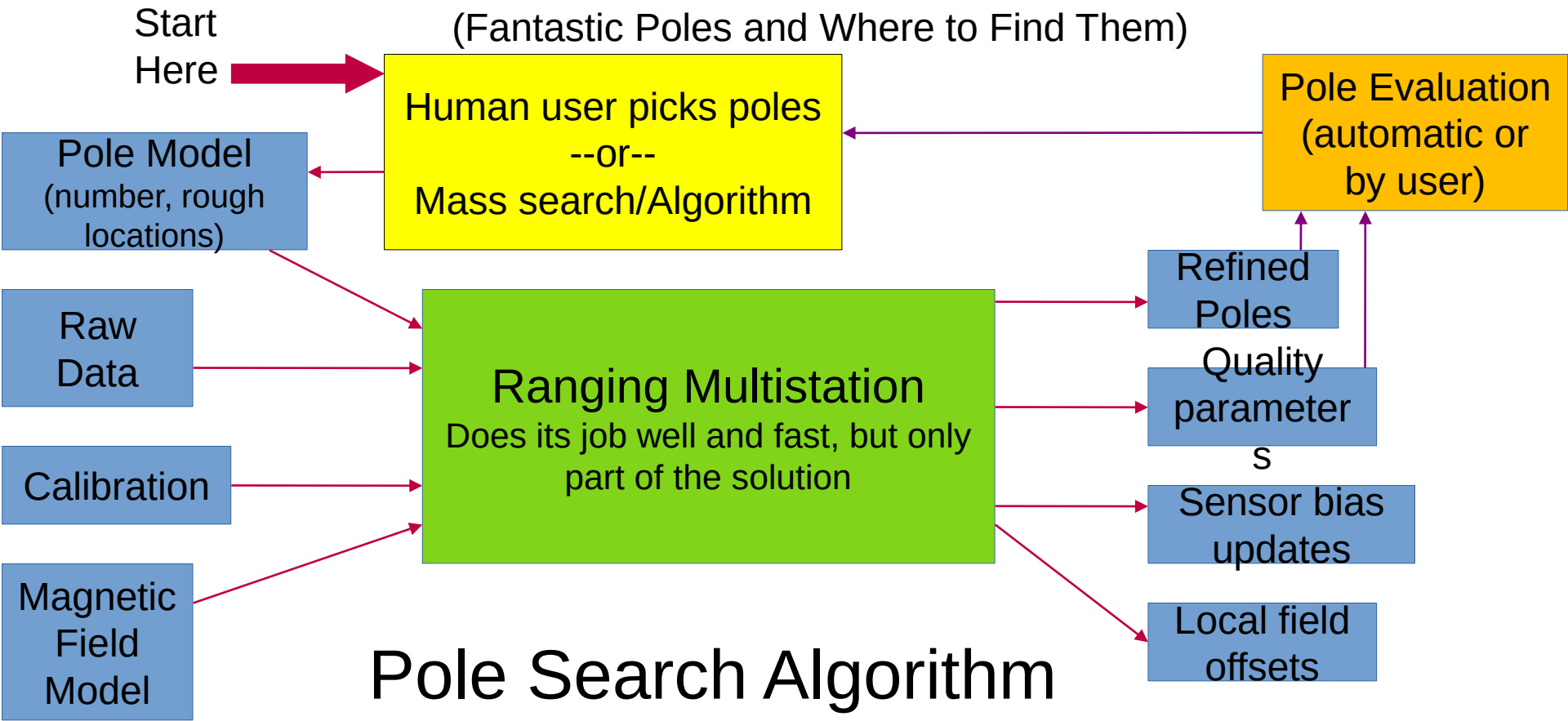
- Sensor Failure
- Reference Field Offsets (Magnetic storm, Crustal Anomaly)
- Magnetization of the MWD
- Proximate Well

Extending the multistation with passive ranging to detect proximate wells:

- Mitigate risk
- No new hardware, but need “good” MWD and:
- Reference field monitoring
- Care to demagnetize MWD

# Passive Ranging

Monopole model—non-distribution
4 degrees of freedom per pole
More general than dipole
Difference is “unenforceable”
Initial conditions: how to place dipoles??


Start Here
(Fantastic Poles and Where to Find Them)
Human user picks poles
--or--
Mass search/Algorithm
Pole Evaluation (automatic or by user)
Pole Model (number, rough locations)
Raw Data
Calibration
Magnetic Field Model
Ranging Multistation
Does its job well and fast, but only part of the solution
Refined Poles
Quality parameters
Sensor bias updates
Local field offsets
Pole Search Algorithm

# A “Traveling Salesman” Problem?

- Lots of local minima:  signal loudness vs distortions
- Solution consistent with set of observations on wellpath.
- Order of adding poles:  some may block or mask off others. Locally best pole vs a good set?
- Want minimum # of poles to encompass substance of observed behavior
- Sensitivity vs “ghost” poles

# Workflow

- New data acquired
- Examine existing poles consistent with new data: baseline
- Existing poleset “sufficient” vs any new poles needed?  Assume new poles are in new spatial area:  parse dense set of pole candidates perpendicular to new wellpath section one pole at a time.
- Criteria for choosing:  best cost drop, greatest effect, other
- How much to automate:  stop when process fails to add pole?
- Lean towards adding too many poles, let user remove extras.
- Are the poles consistent with a well?

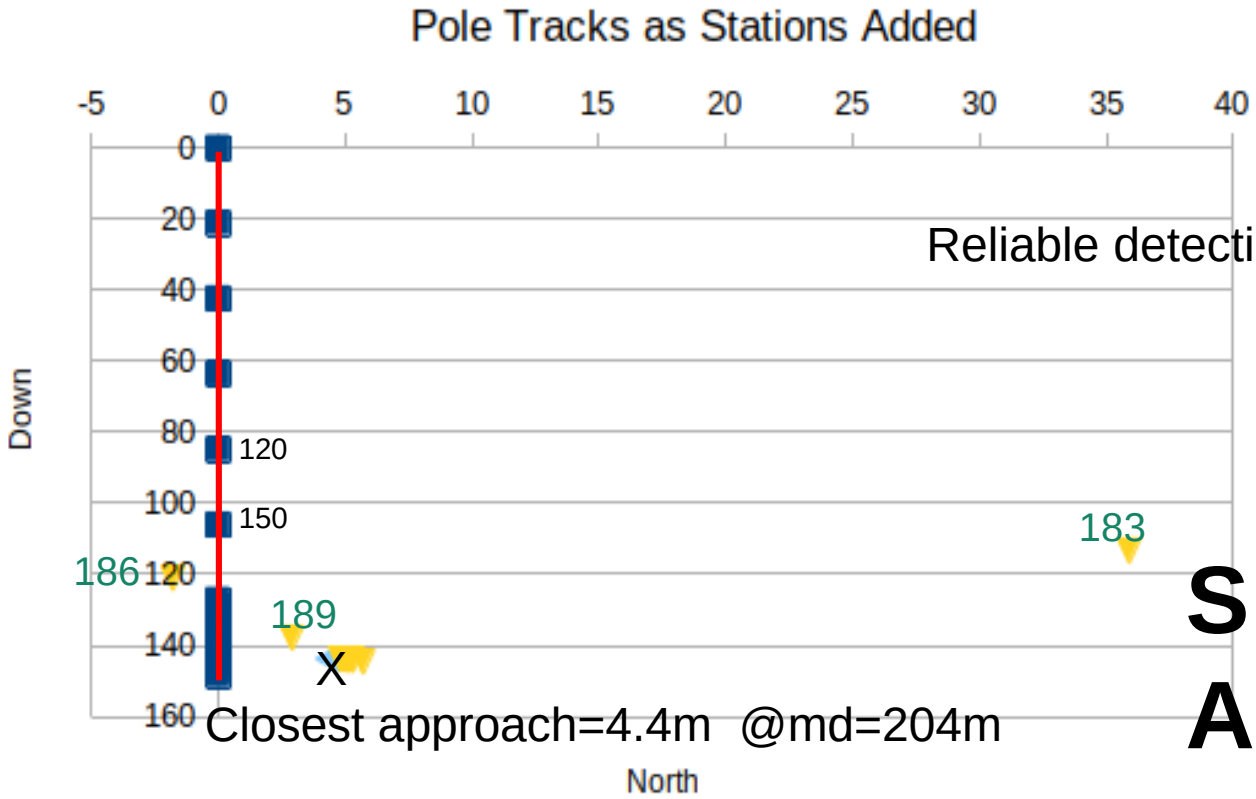
# Start with some simple examples:

- Use of 60μW poles (alternating)
- 30m Spacing
- “Local” straight line wellpaths

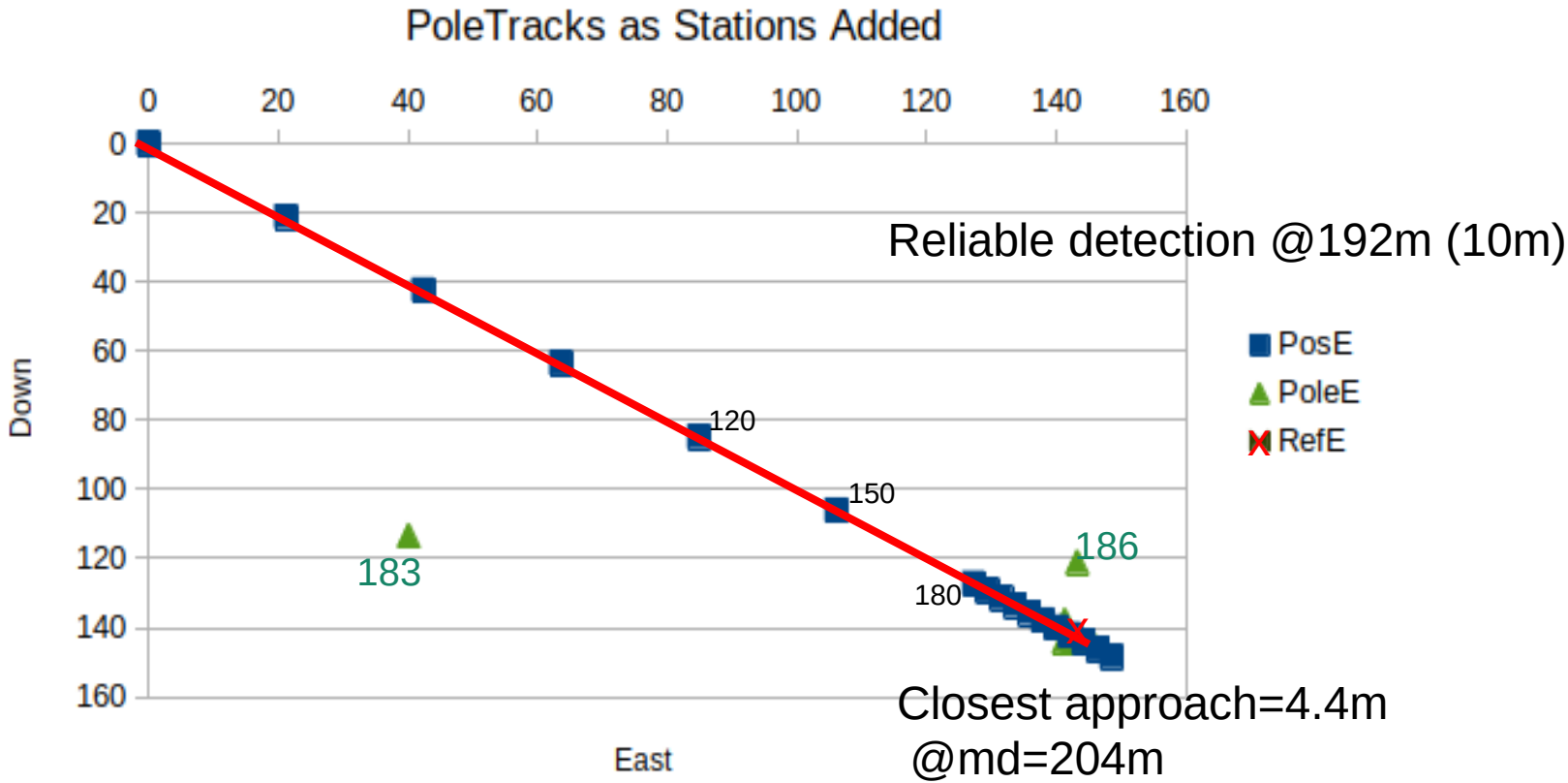
What is the fundamental range for acquiring a pole?
Need to reduce uncertainty levels for sensors, reference fields to make this work

The perceived location of the pole moves as one approaches (this should not be news)
It really helps to go past the point of closest approach (doesn’t help anticollision)

Acquiring more than one pole at a time can be messy: farther pole has lower rate of dropoff as you move towards/away



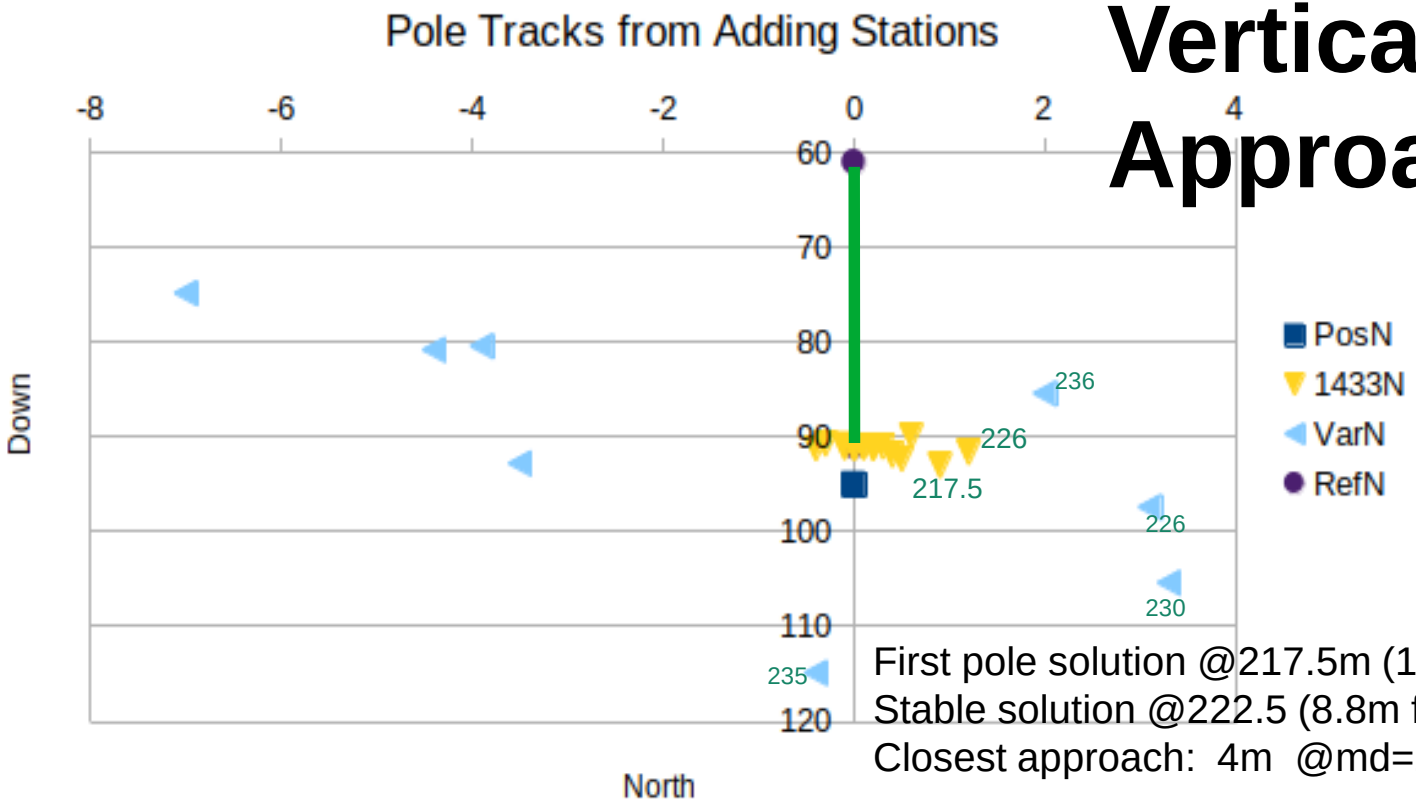

# Single Pole Approach



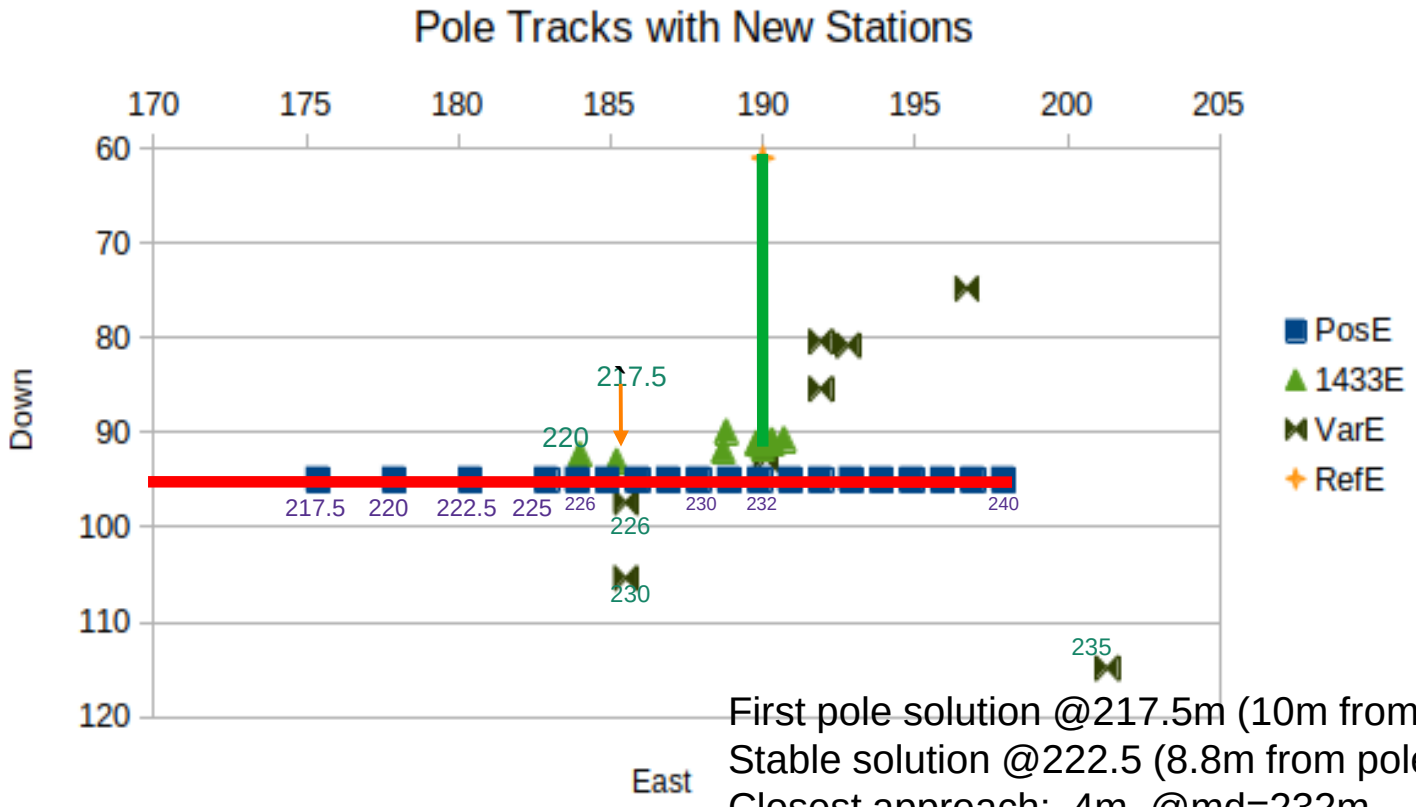

Reliable detection @192m (10m)

Closest approach=4.4m
@md=204m

# Vertical Well Approach




First pole solution @217.5m (10m from perceived pole)
Stable solution @222.5 (8.8m from pole)
Closest approach: 4m @md=232m

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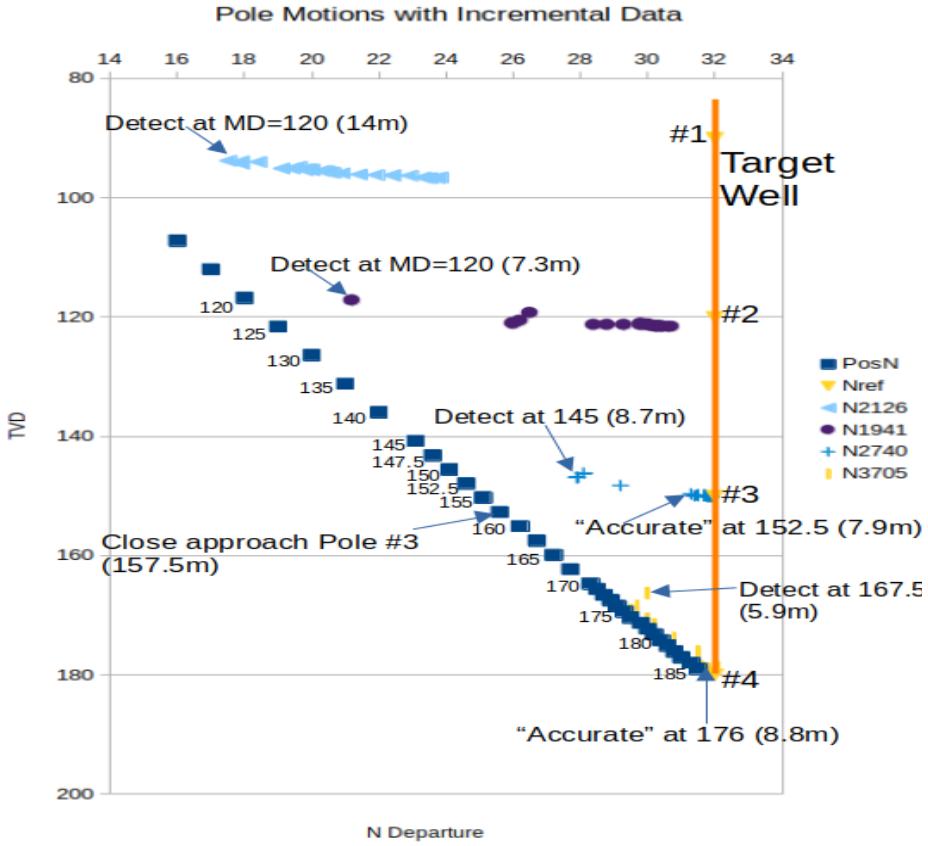
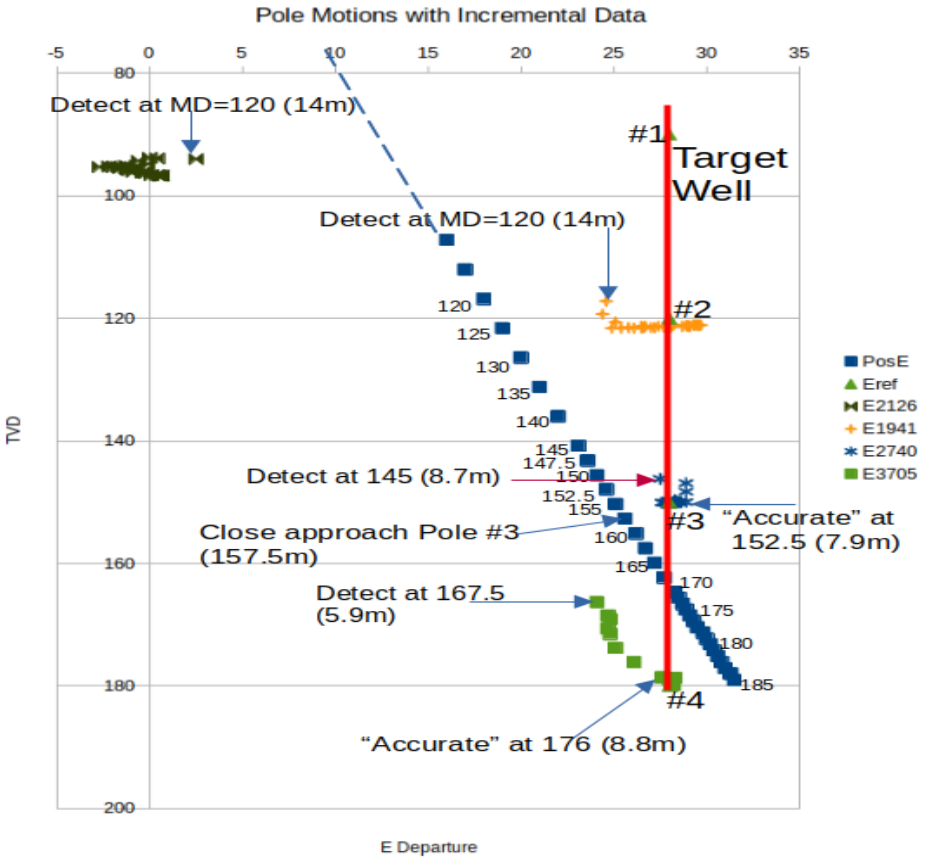

Pole Motions with Incremental Data
Detect at MD=120 (14m)
Detect at MD=120 (7.3m)
Detect at 145 (8.7m)
Close approach Pole #3
(157.5m)
"Accurate" at 152.5 (7.9m)
Detect at 167.5
(5.9m)
"Accurate" at 176 (8.8m)
#1
Target
Well
#2
#3
#4
PosN
Nref
N2126
N1941
N2740
N3705
TVD
N Departure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Passive ranging is possible, but not easy:  every 50 to 100 nT is critical

Will take a lot of procedural discipline:  survey interval, clean MWD

Need to assess probability of detection

Need to figure wellpath from pole record:  very difficult to put into optimization