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Fish Screen Evaluations

Fish Screen Oversight Committee Workshop
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Purpose

- Ensure water is uniformly distributed over all effective screen area
- Adjust flow control baffles to achieve uniform distribution of flow through screens

The amount of deviation of a discrete measurement from the target value that is deemed acceptable is 10% of the target value, although that value may vary on a case-by-case basis.

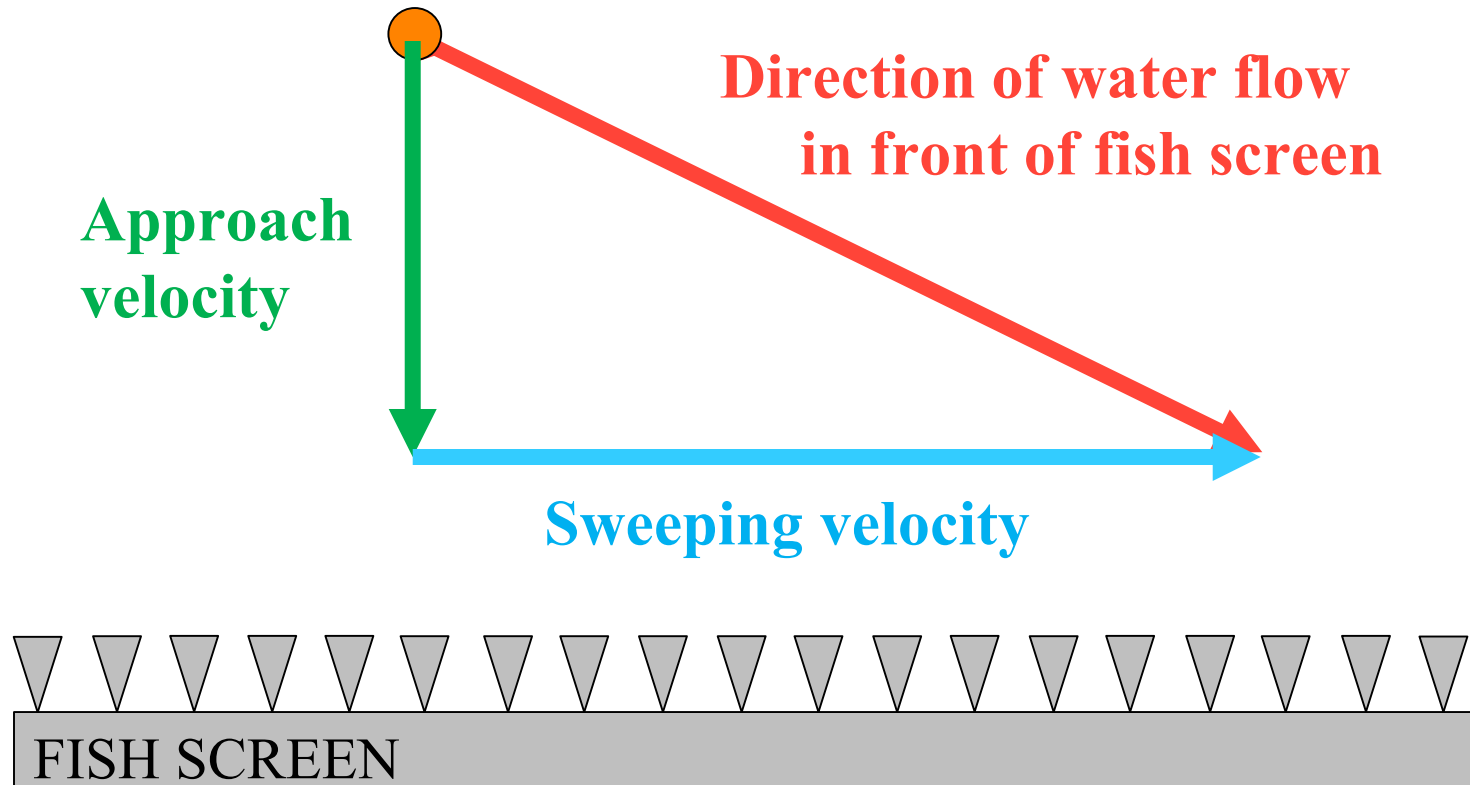
NMFS 2022, Appendix E



Terms

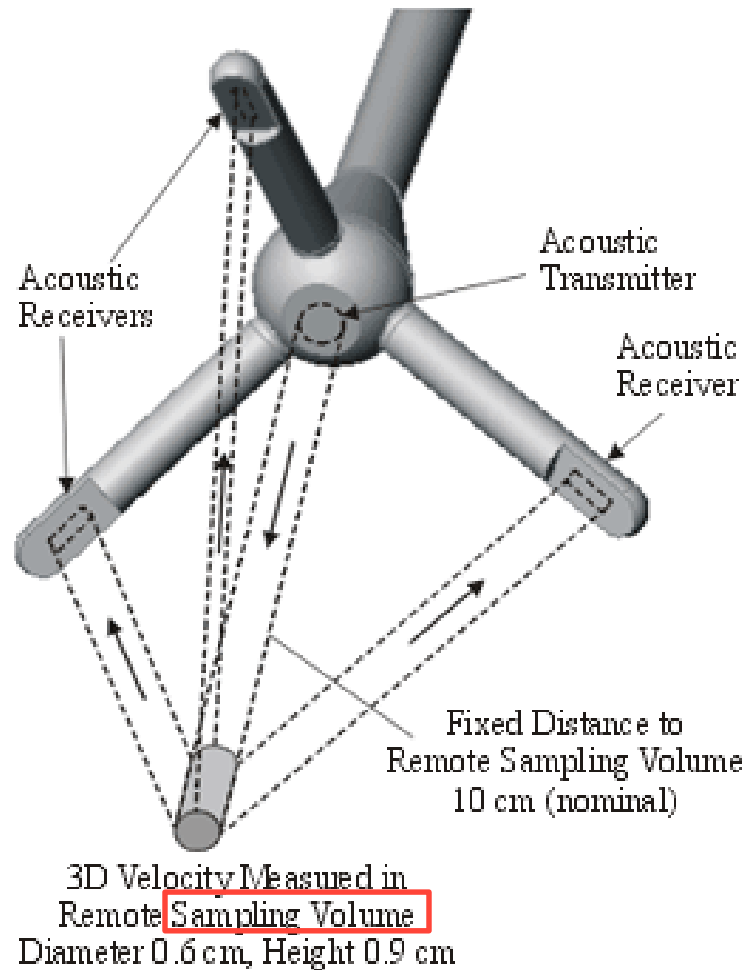
- Target Approach Velocity is the theoretical average approach velocity for a scenario: the current diversion rate divided by total *effective screen area*.
- Design Approach Velocity (given) is used to determine the minimum amount of screen area required based on the diversion capacity. ($A = Q_{\max} / V_a$)
- The actual approach velocity is what's happening right now. If all goes well, this is what we can measure.

Terms



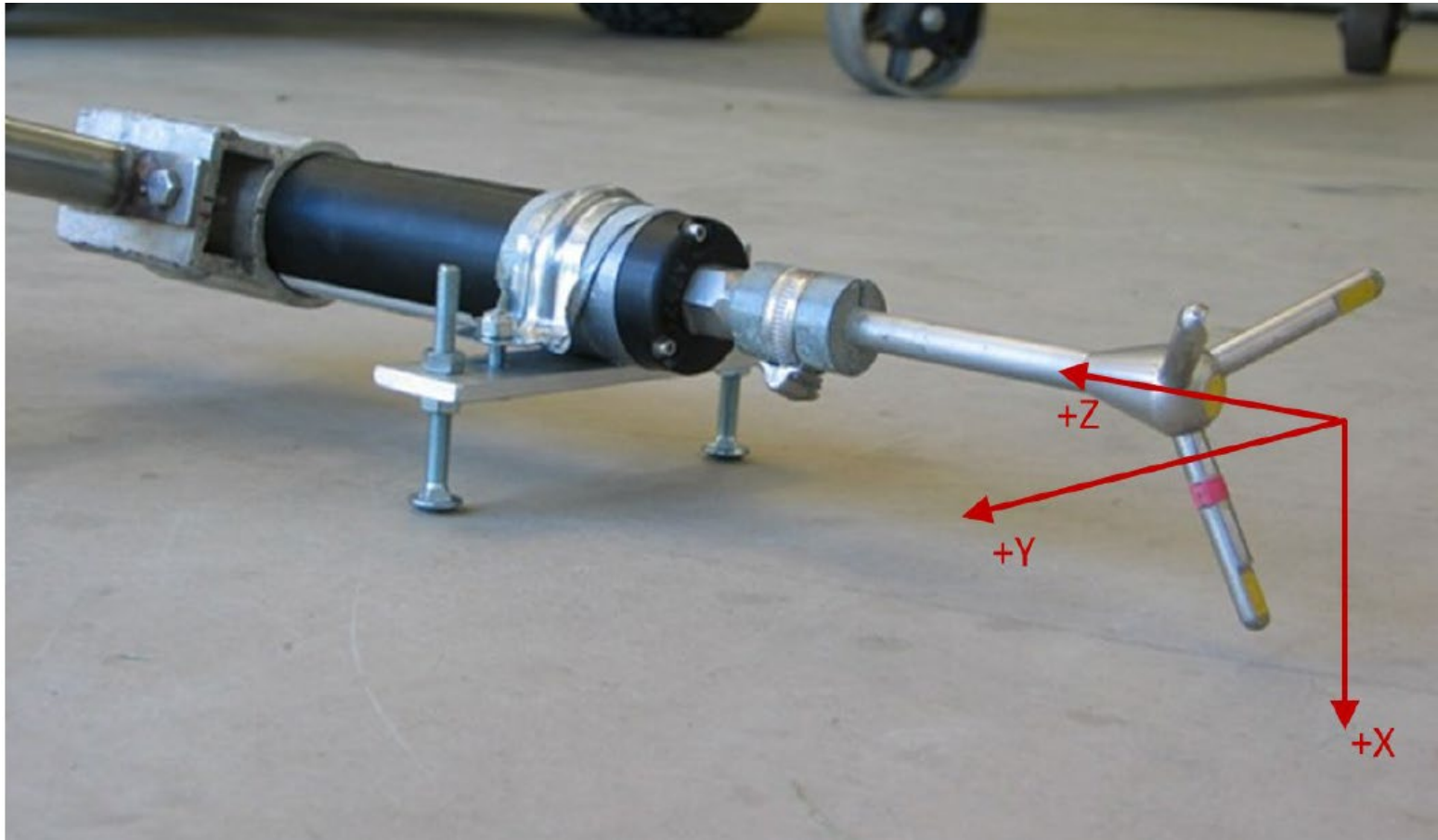
Equipment

- 2D or 3D acoustic Doppler velocity (ADV) probe that measures velocity at a discrete location.
- Nortek & SonTek commonly used.



Images from SonTek, Inc.

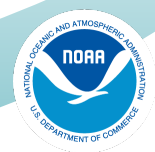
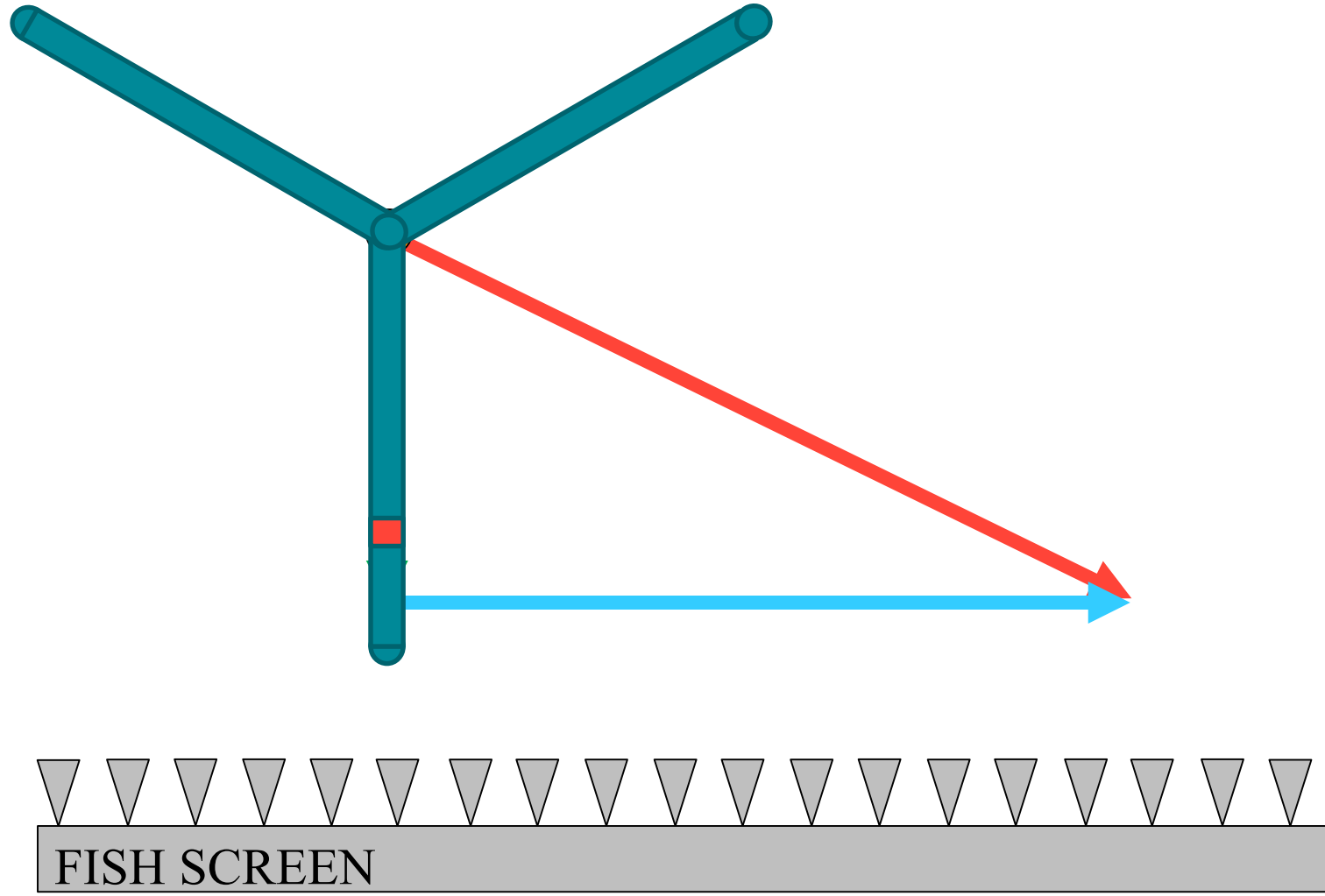
Terms



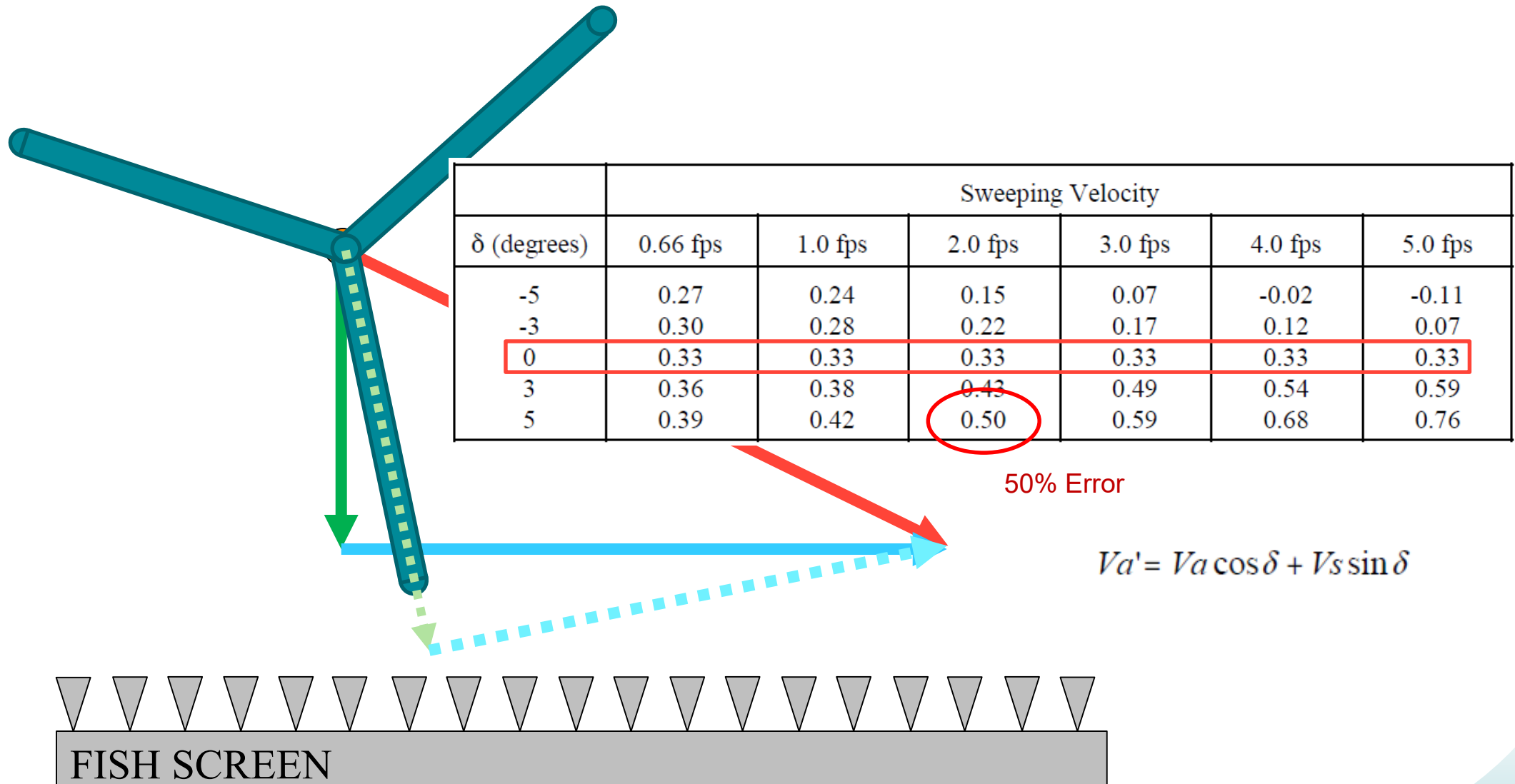
SonTek ADV with down-looking head

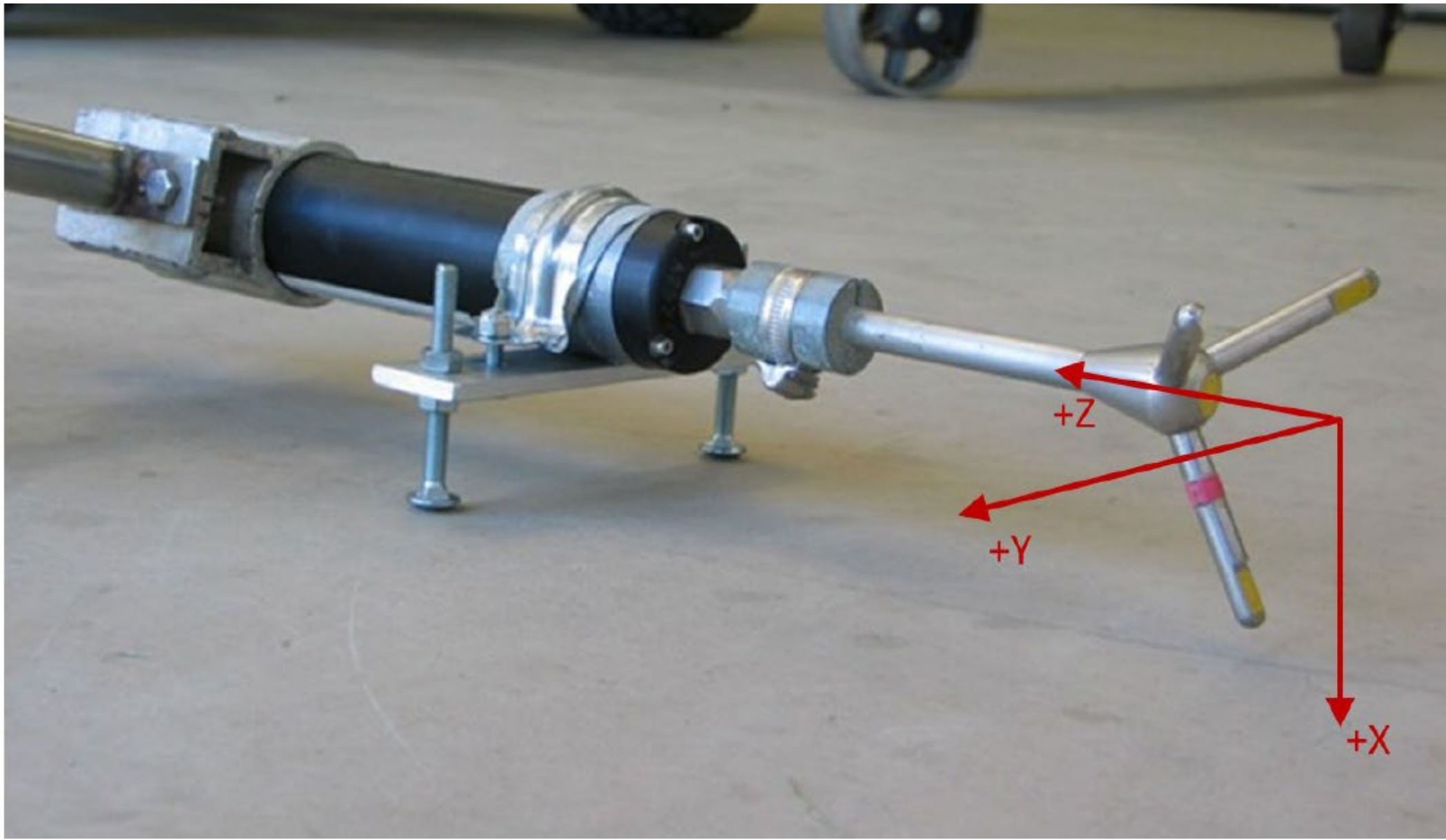
Side-looking head





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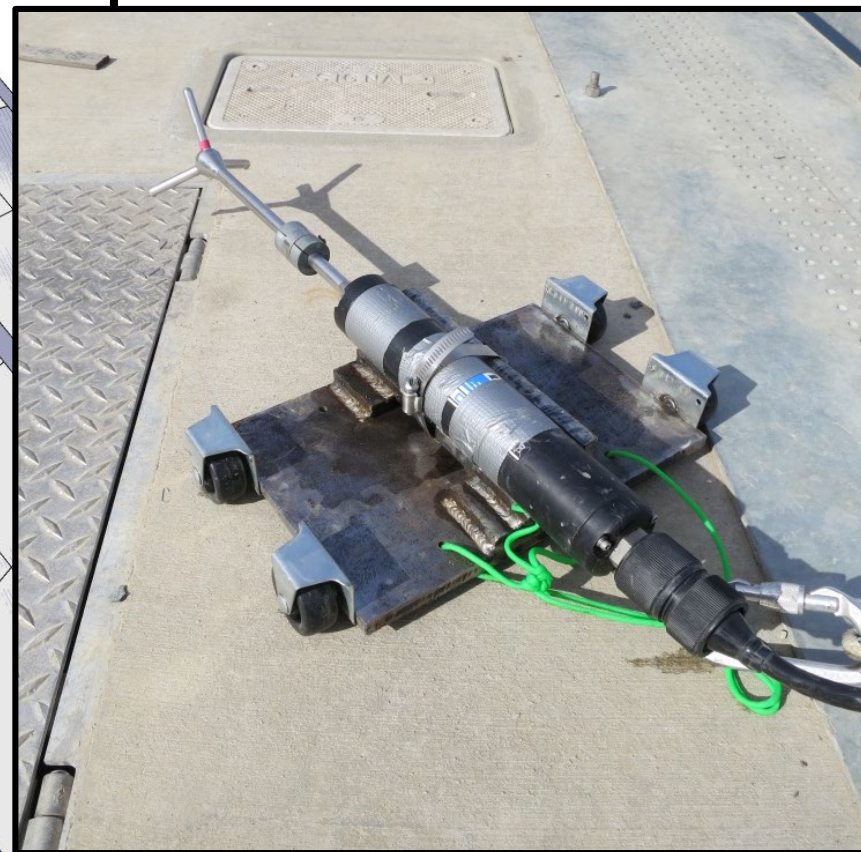
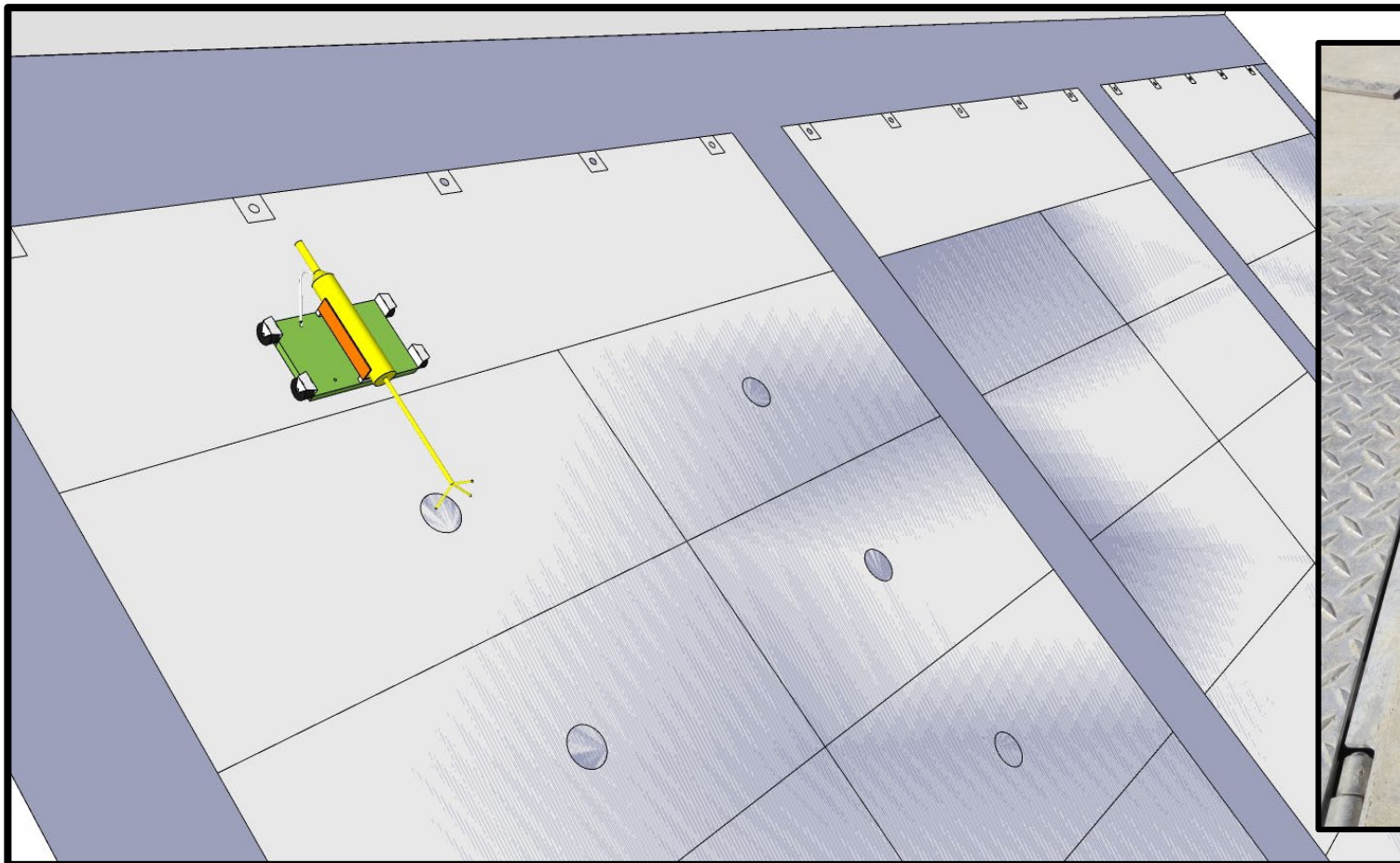




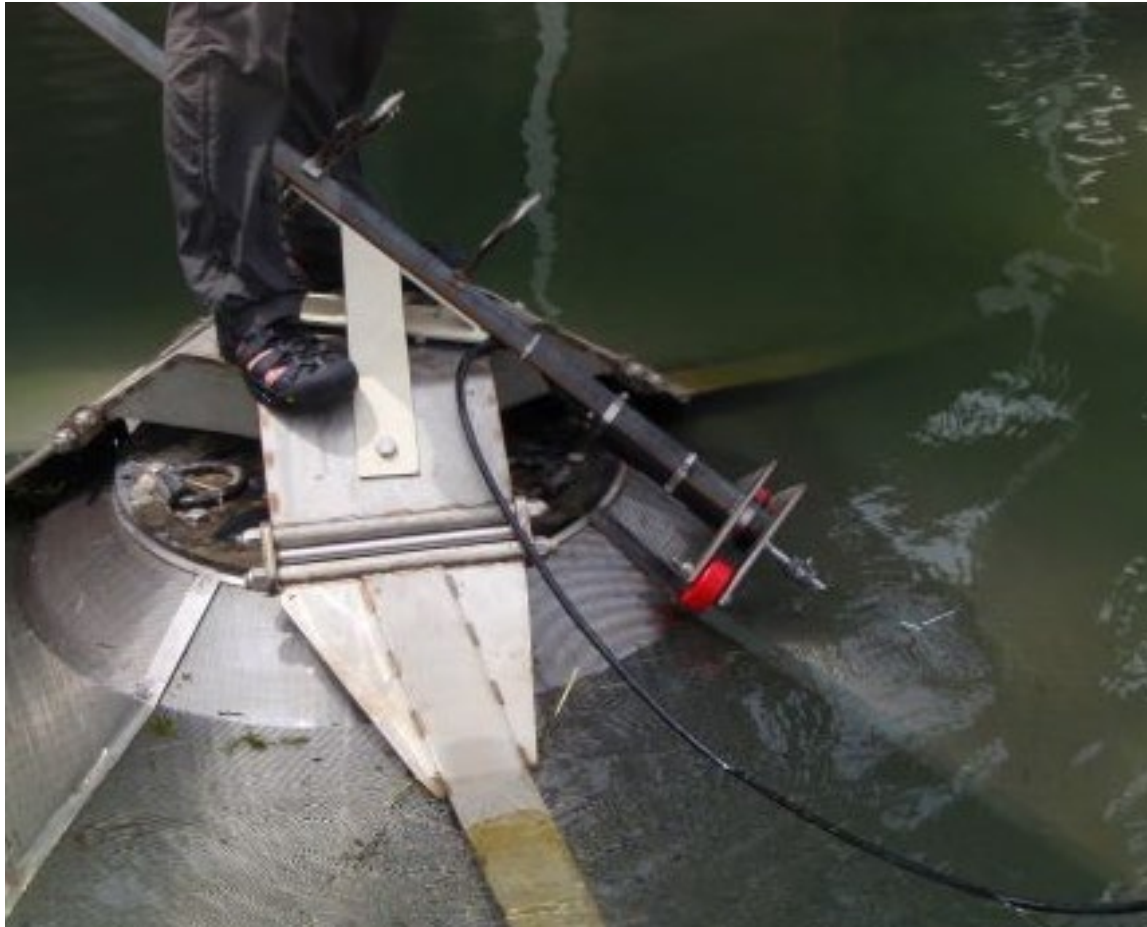
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ADV Sled on Inclined Flat Plate Screen



On Conical Screen

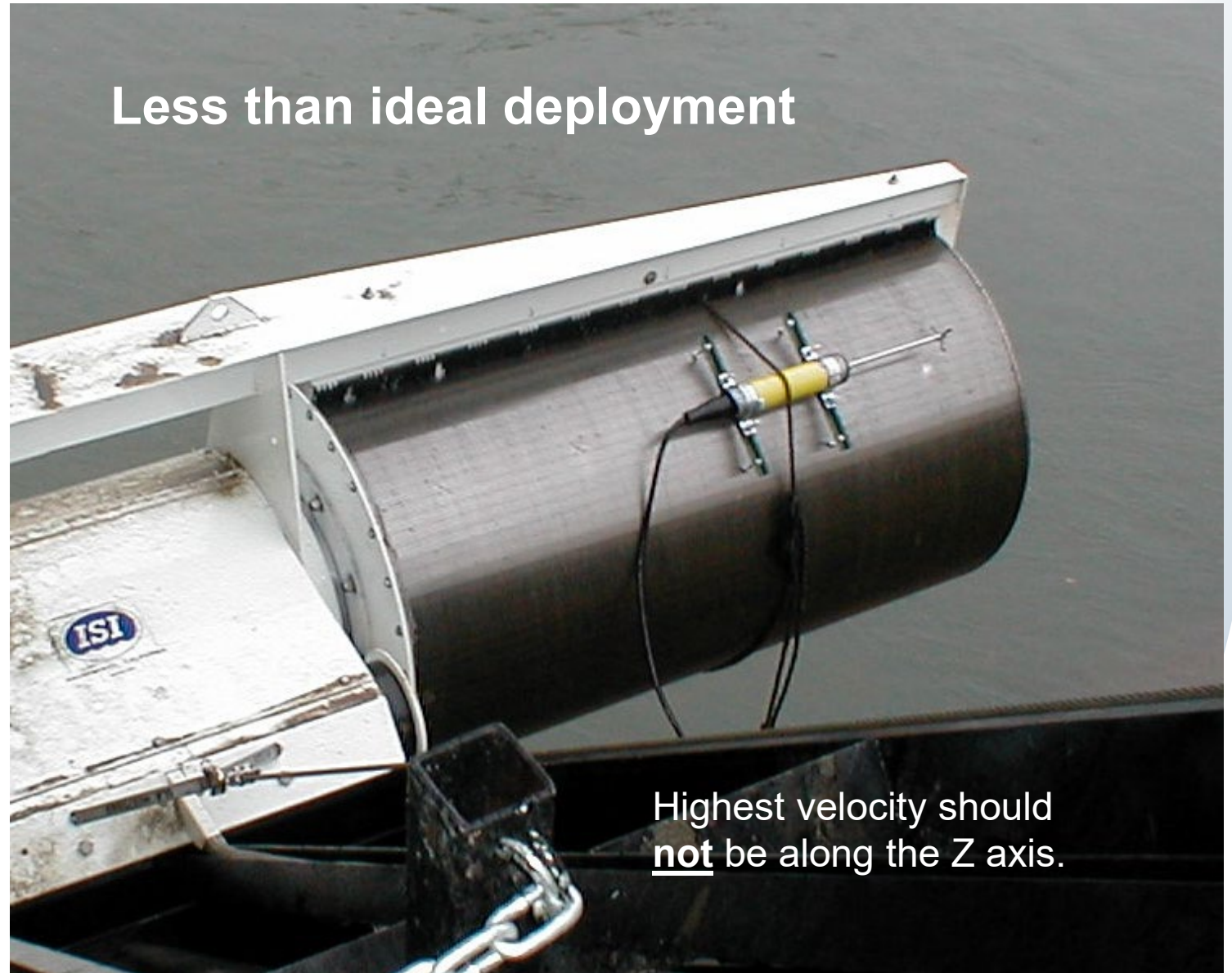


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Cylindrical



Nortek Vectrino probe



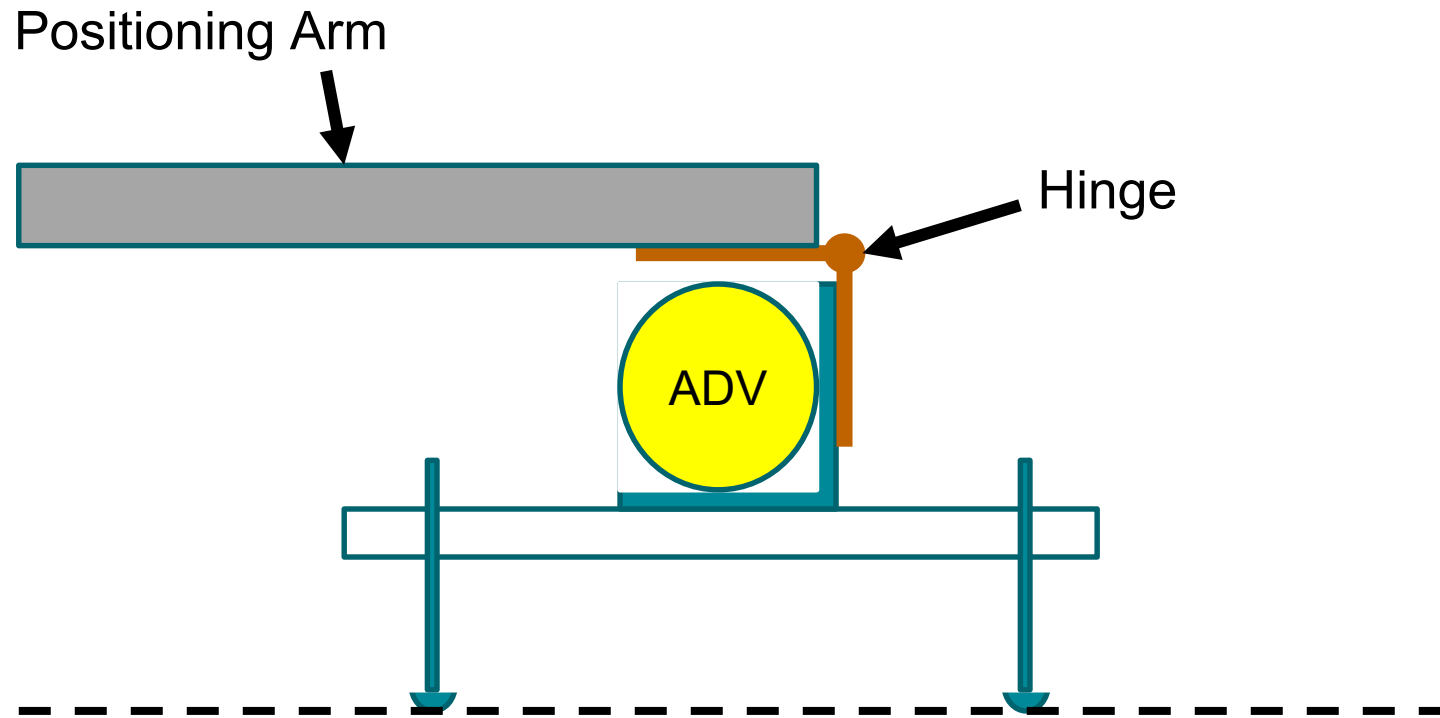
Less than ideal deployment

Highest velocity should not be along the Z axis.



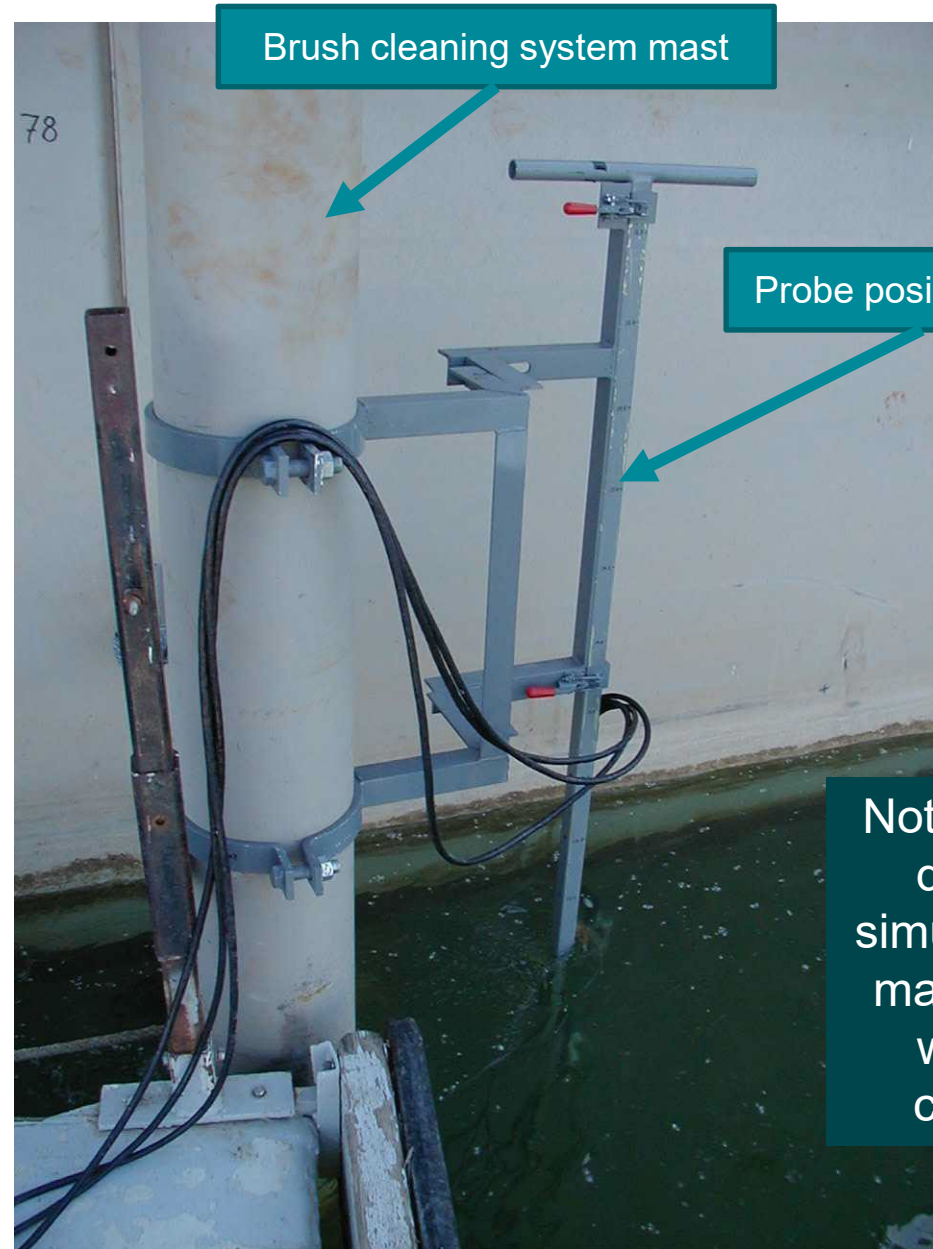
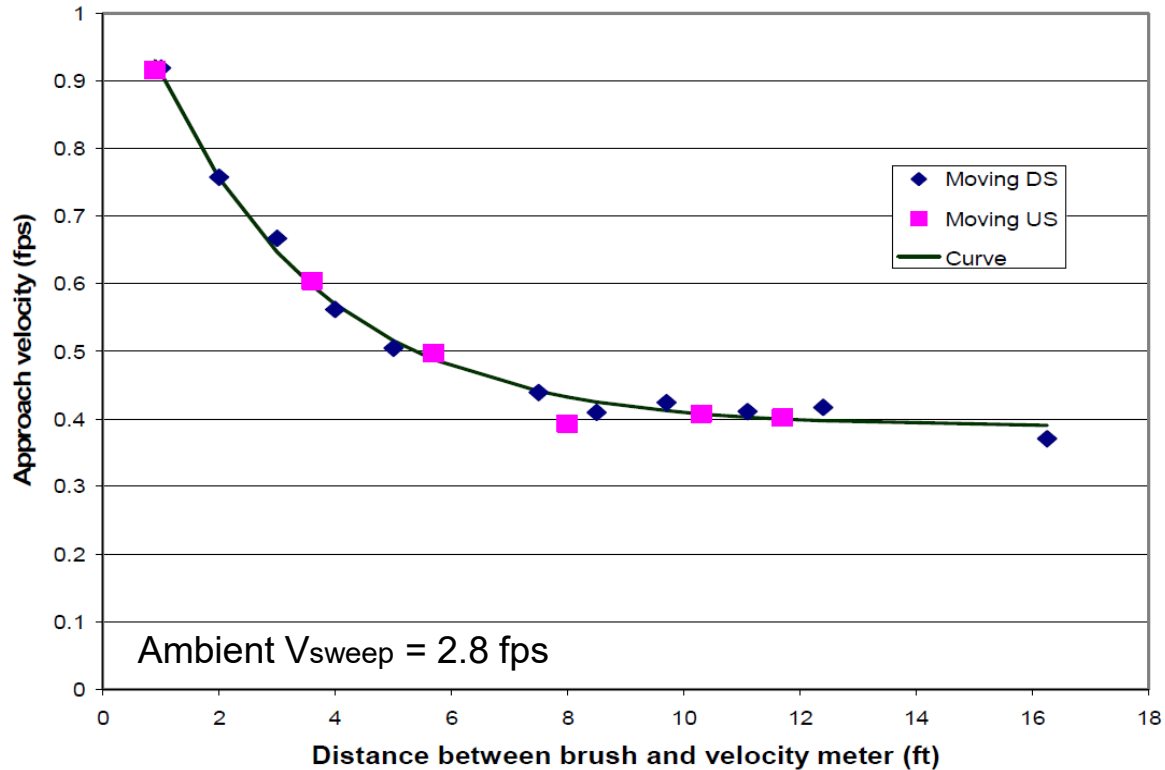
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Self Adjusting ADV Jig



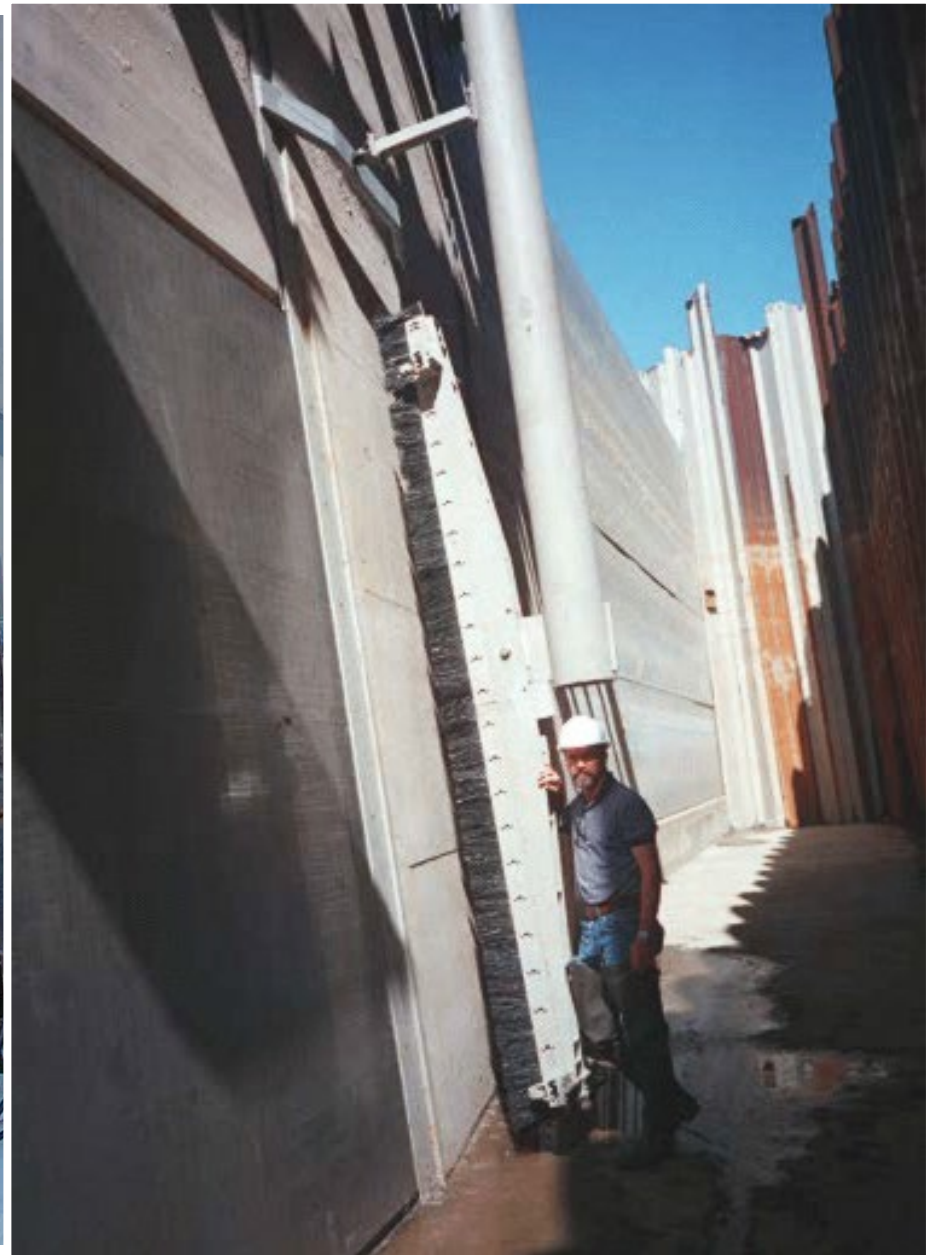
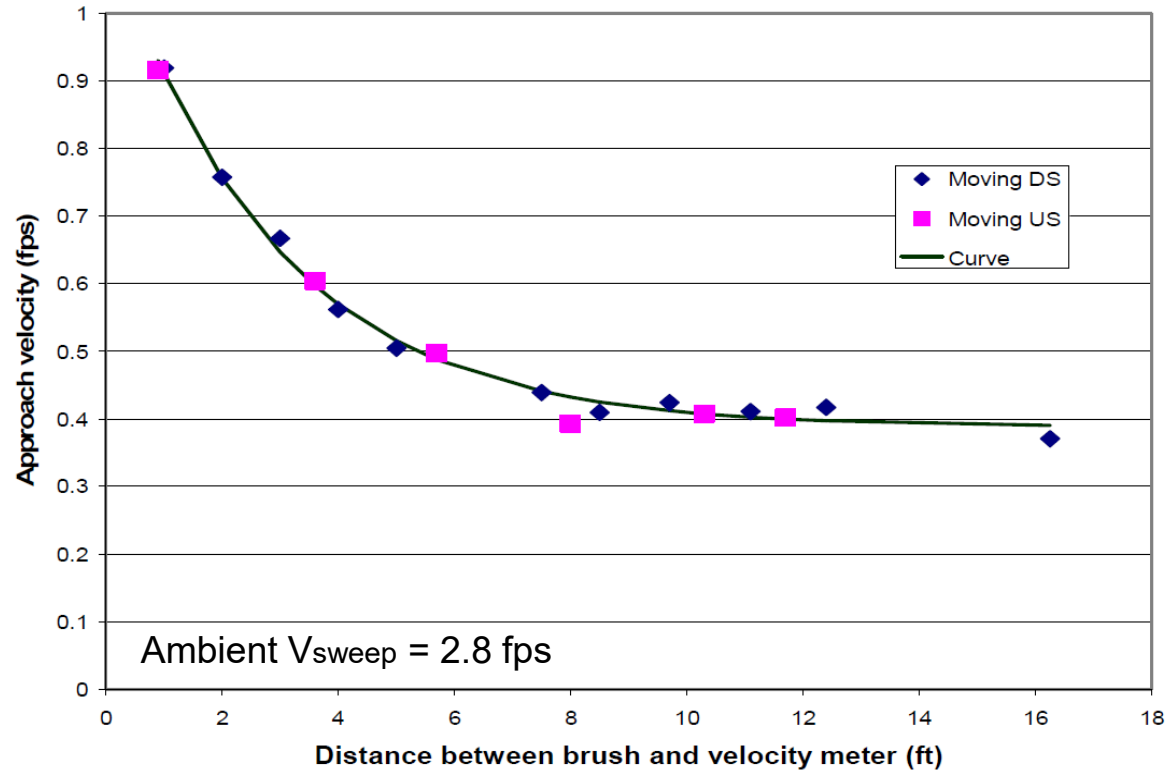
Positioning Probes

Adequate clearance needed.



Positioning Probes

Adequate clearance needed.



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Louver Style Baffles

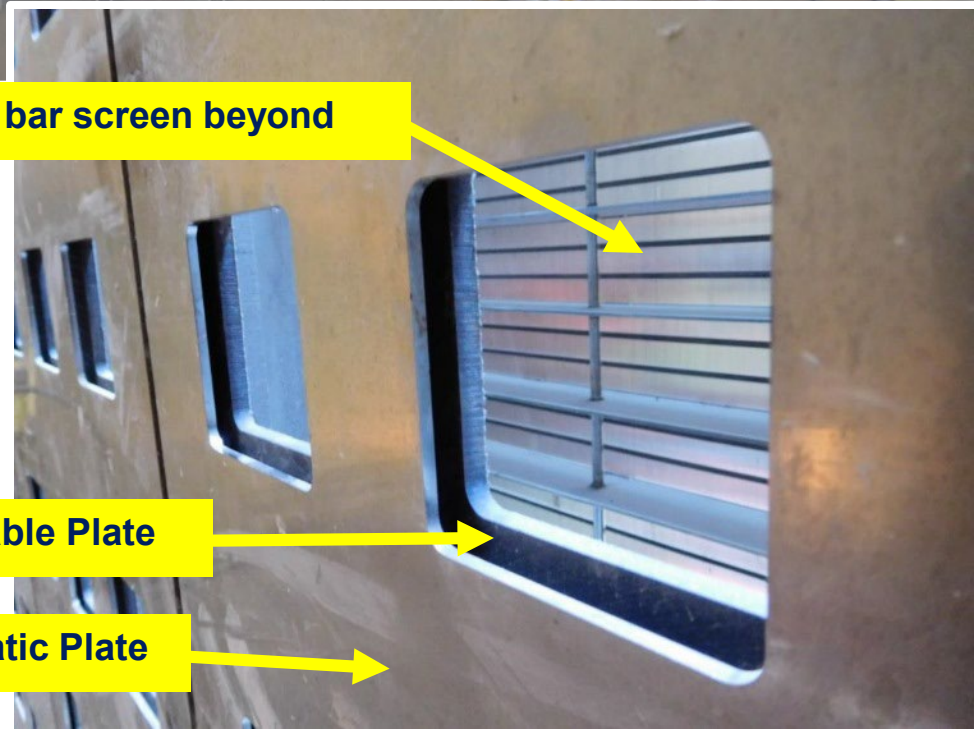




Profile bar screen beyond

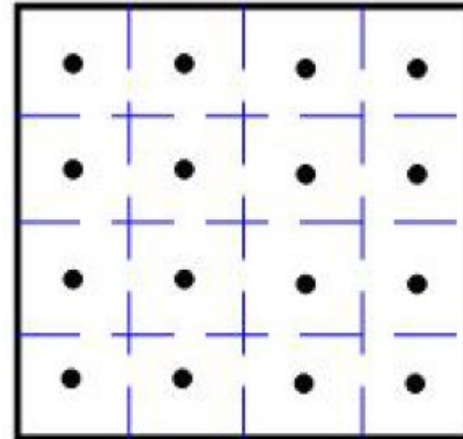
Adjustable Plate

Static Plate



Data Collection

- Sampling volume 3” from screen face.
- 10 Hz
- 30 – 60 sec / location



Continuity Check

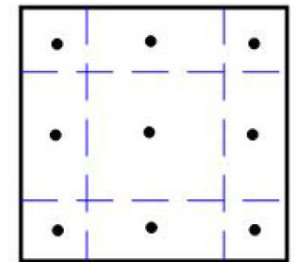
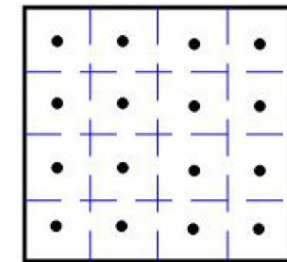
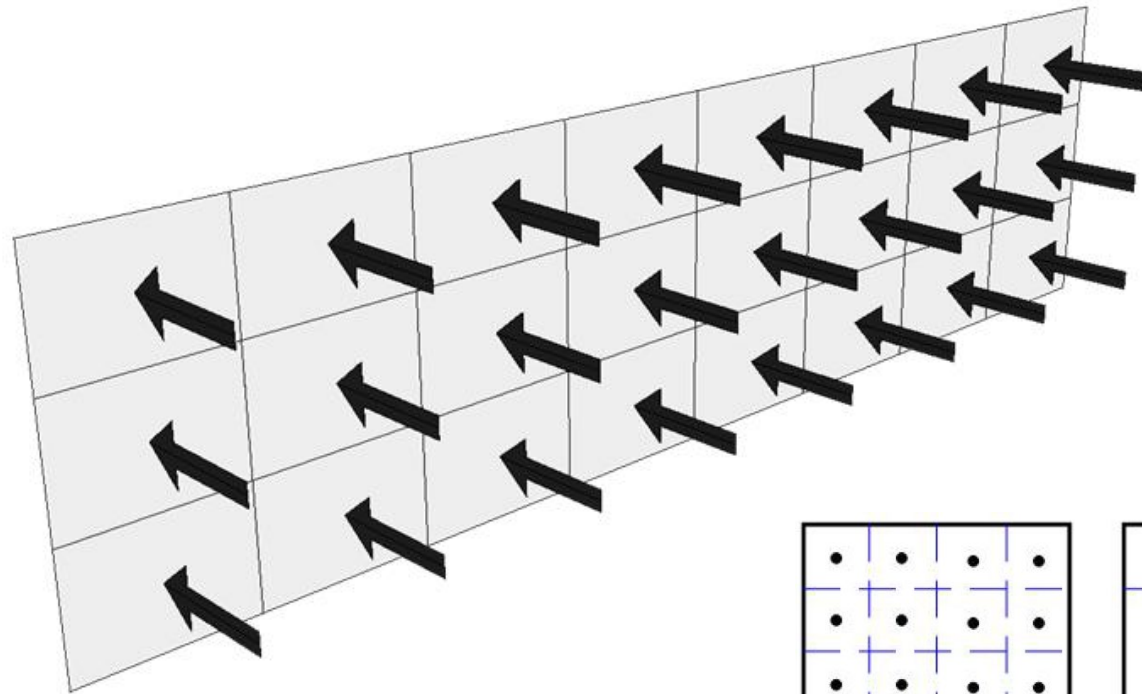
The calculated diversion rate should be nearly equal to the measured diversion rate.

$$Q = vA$$

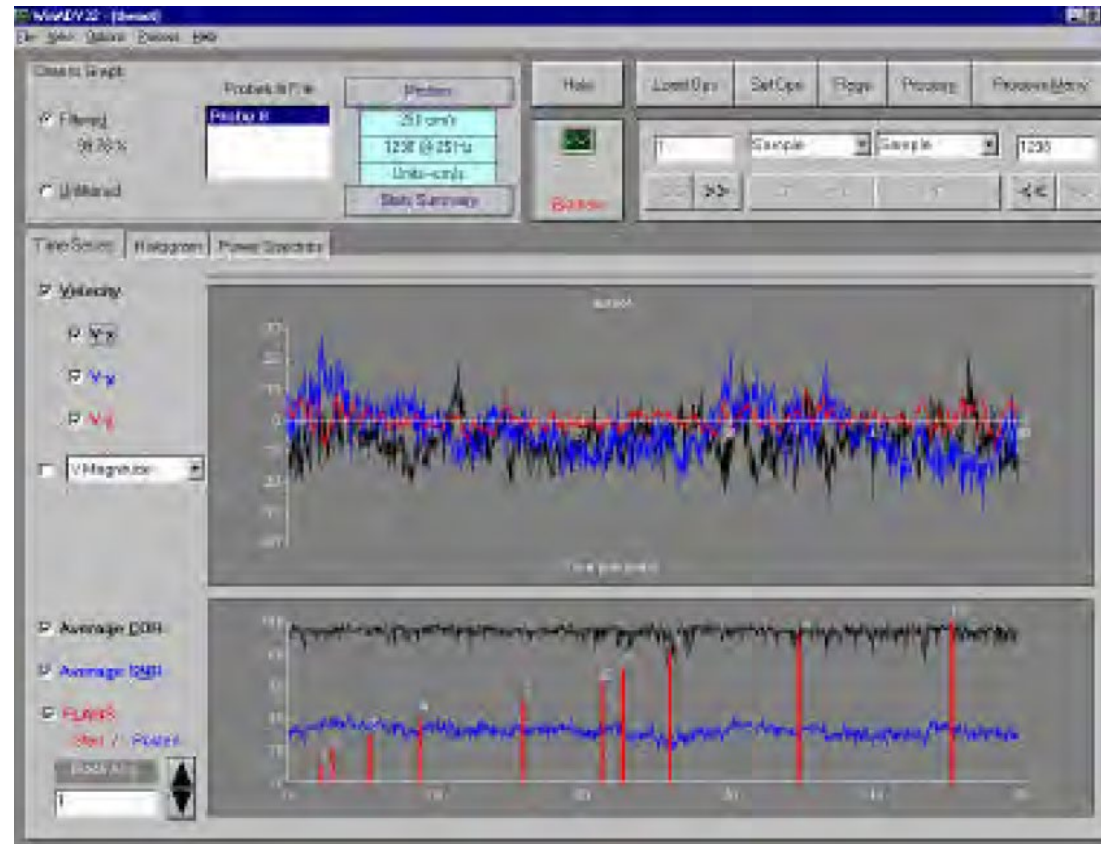
$$Q = \sum v_n A_n$$

$$Q = A_{\text{total}} v_{\text{ave}}$$

when all measurement cells are of equal size



Data Analysis



Use **WinADV**: A Windows-based viewing and post-processing utility for ADV files developed by Tony Wahl at USBR.

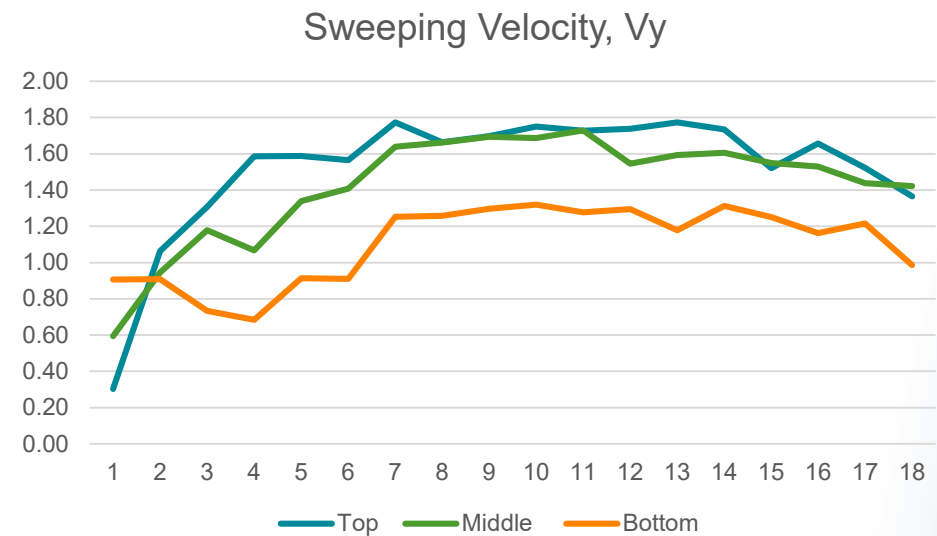
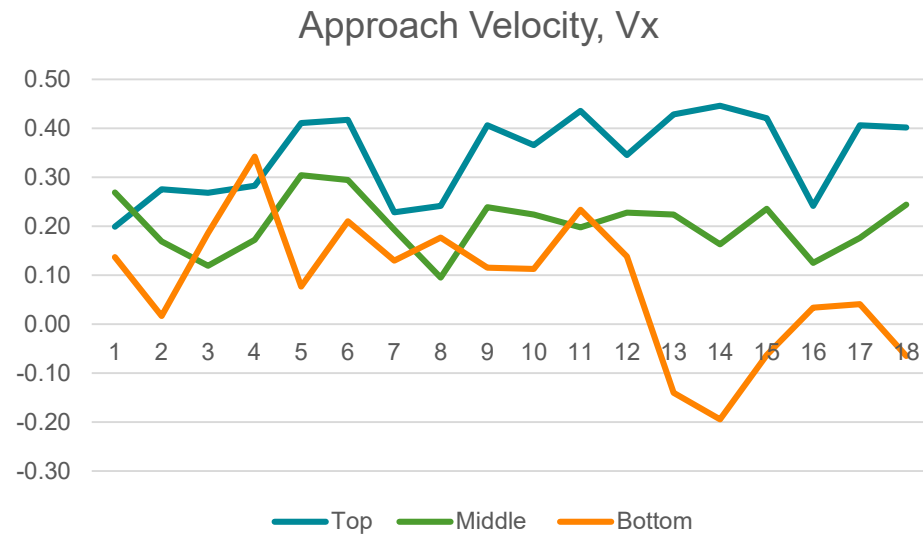
<https://www.usbr.gov/tsc/techreferences/computer%20software/software/winadv/index.html>

Diversion Rate for Testing

- Maximum diversion capacity?
- The most commonly occurring diversion rate?
- What's the worst case scenario?

- Must be able to maintain conditions throughout the testing period.
 - Where to put the water?
 - Tidal considerations
 - Time constraints

Data Presentation



Data Presentation

Flow →

Approach Velocity (fps)		S1				S2		S3		S4		S5		Ave
		0.13	0.08	0.12	0.17	0.11	0.2	0.22	0.19	0.11				0.15
		0.21	0.12	0.20	0.28	0.19	0.17	0.20	0.25	0.27			0.21	
		0.41	0.27	0.36	0.37	0.50	0.5	0.49	0.48	0.54			0.44	
Ave		0.25	0.16	0.23	0.27	0.27	0.29	0.30	0.30	0.31			0.26	

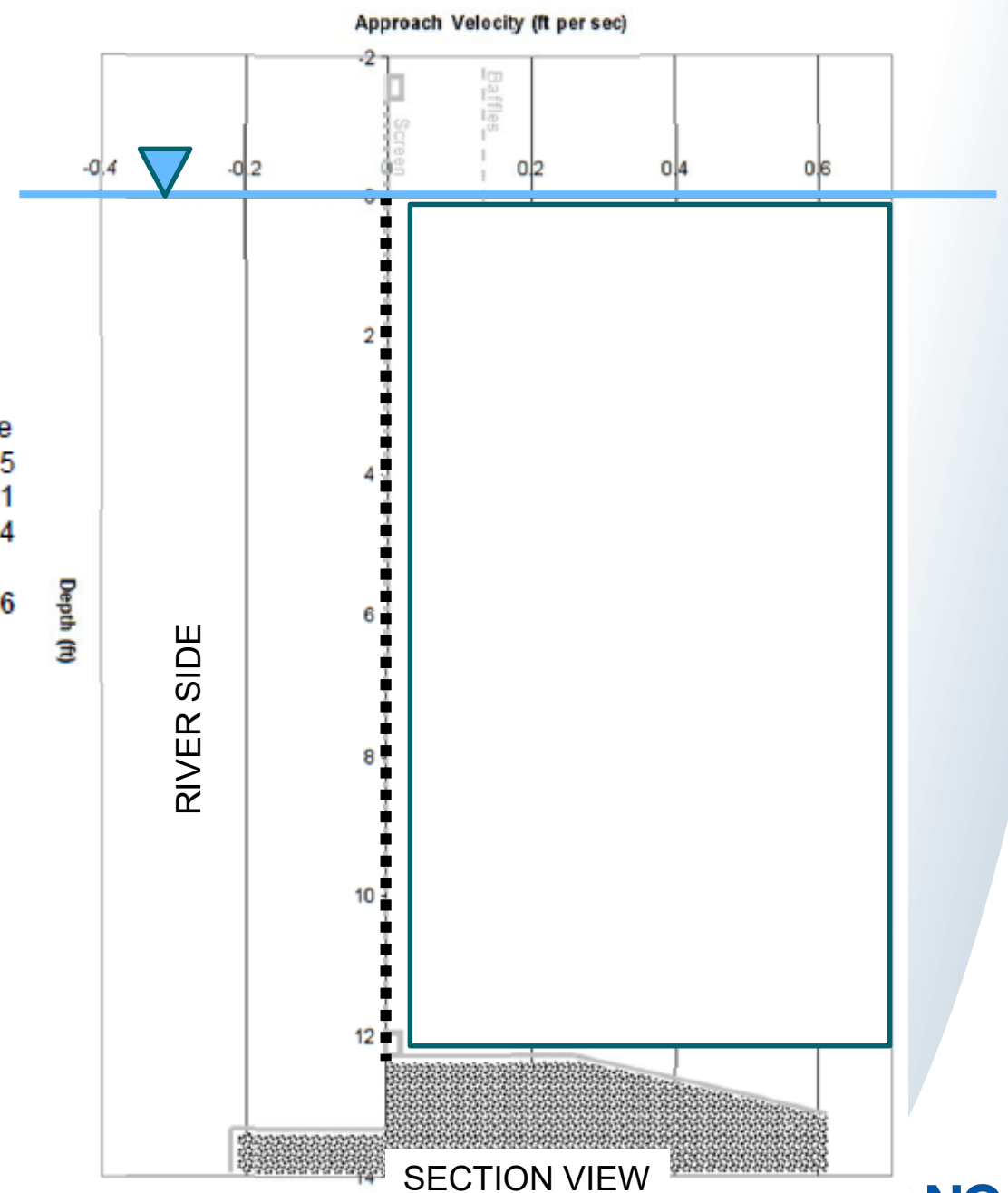
Cells color coded:

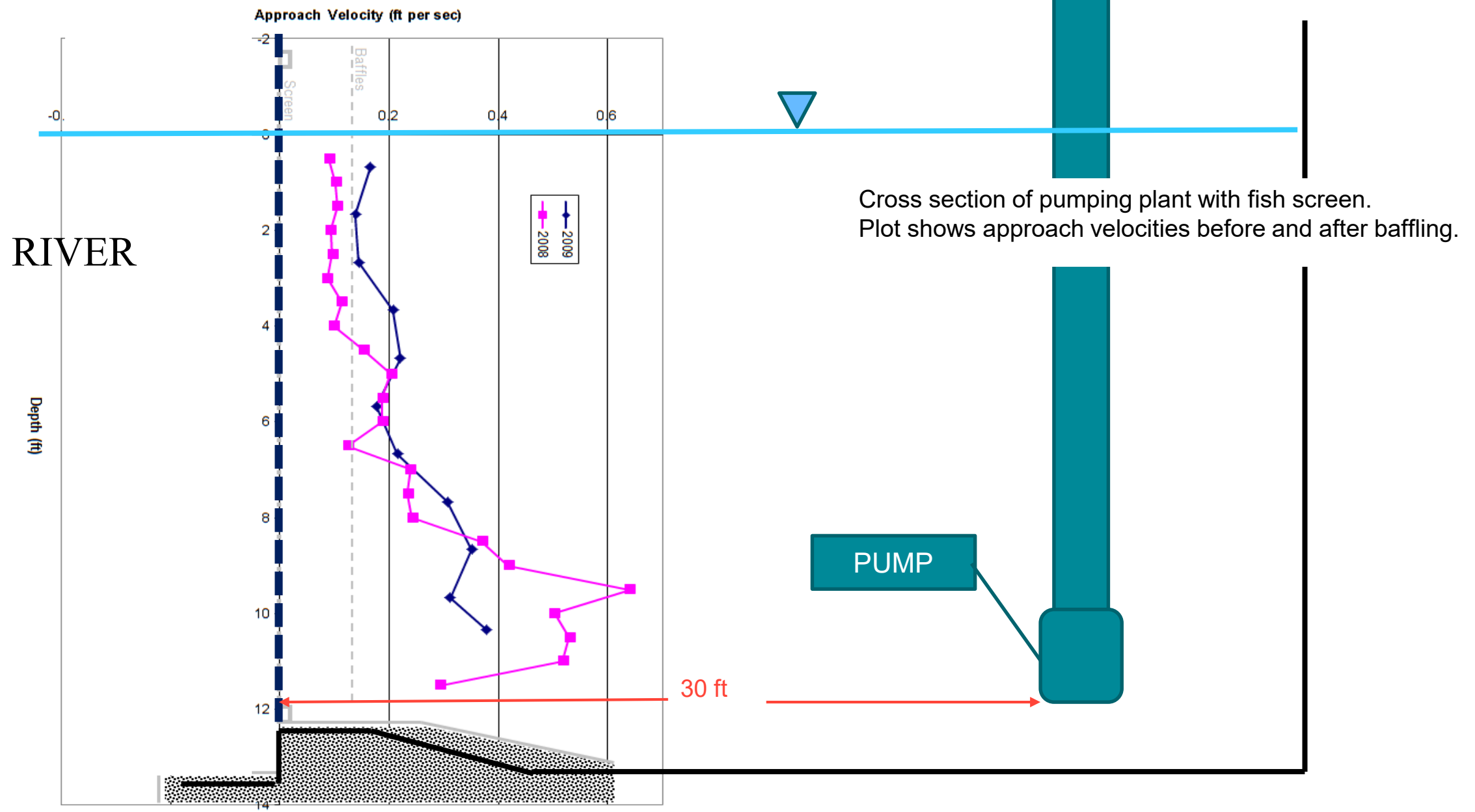
Green: ± 10% of target approach velocity

Blue: < 10%

Red: > 10%

$$\text{Target } V_{\text{approach}} = \frac{\text{Pumping Rate (cfs)}}{\text{Effective Screen Area (ft}^2\text{)}}$$



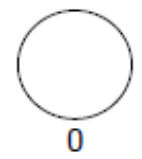




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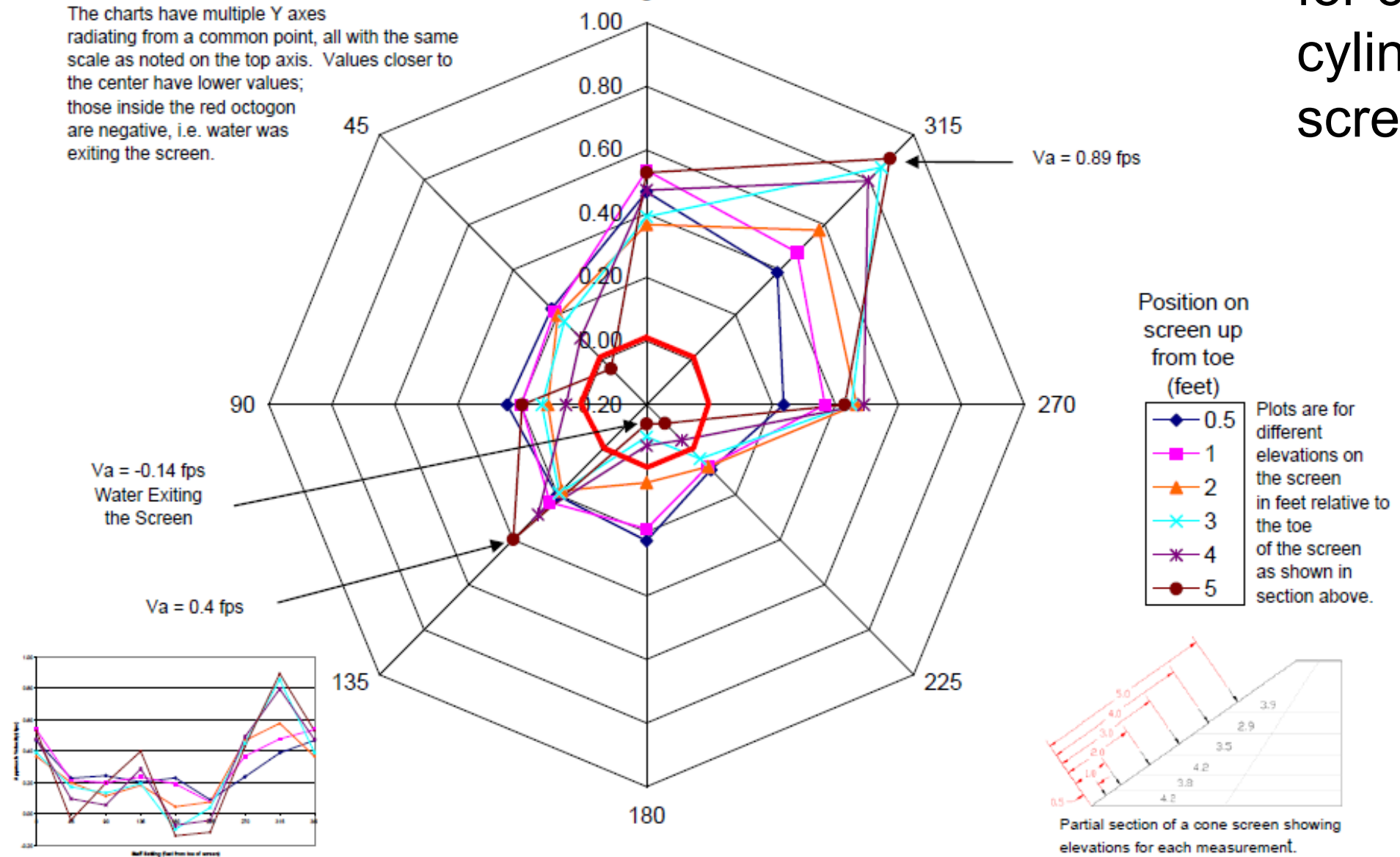
Approach Velocity (fps), Example

Radar charts are typical X-Y charts warped into a circle. In the lower left corner is a chart displaying the same data in another format. The charts have multiple Y axes radiating from a common point, all with the same scale as noted on the top axis. Values closer to the center have lower values; those inside the red octagon are negative, i.e. water was exiting the screen.



← Pump position at bearing "0" for all screens.

Radar Plot for conical or cylindrical screen data



Data Presentation



Questions

