



Blade Slip & Boat Speed Video Analysis

(2019)

“We coach technique to improve speed, but we should be analyzing speed to change technique... to increase speed...”

Mike Purcer

Outline

1) Boat Speed Video Analysis

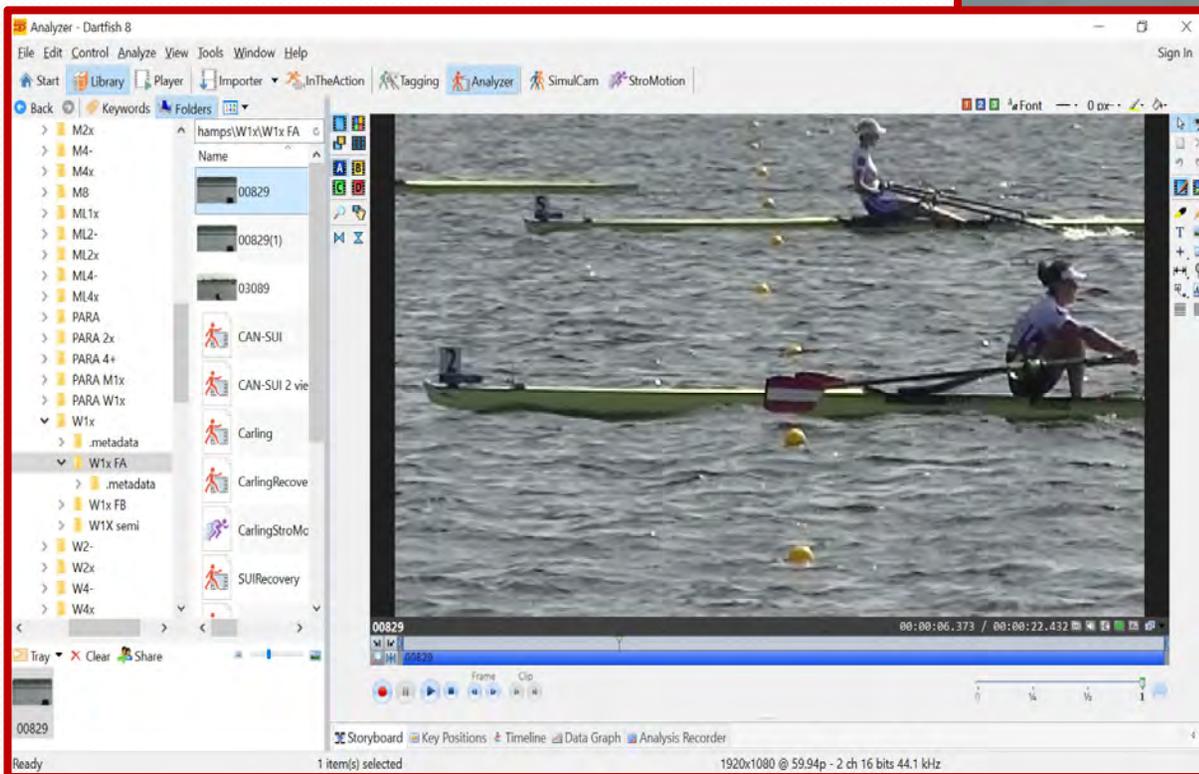
- Develop integrated speed and technique curve
- Analyzing technique from speed development
- Analyzing athlete/crew curve geometry
- Identifying opportunities to improve speed

2) Blade Slip

- what is it?
- negative & positive blade slip
- Comparative Analysis Study (four years)

Capture Data

Camera for
video capture
Sony FDR-AX 53



Software for
data extraction
Dartfish

Video Capture



2016 Rotterdam



2018 Plovdiv

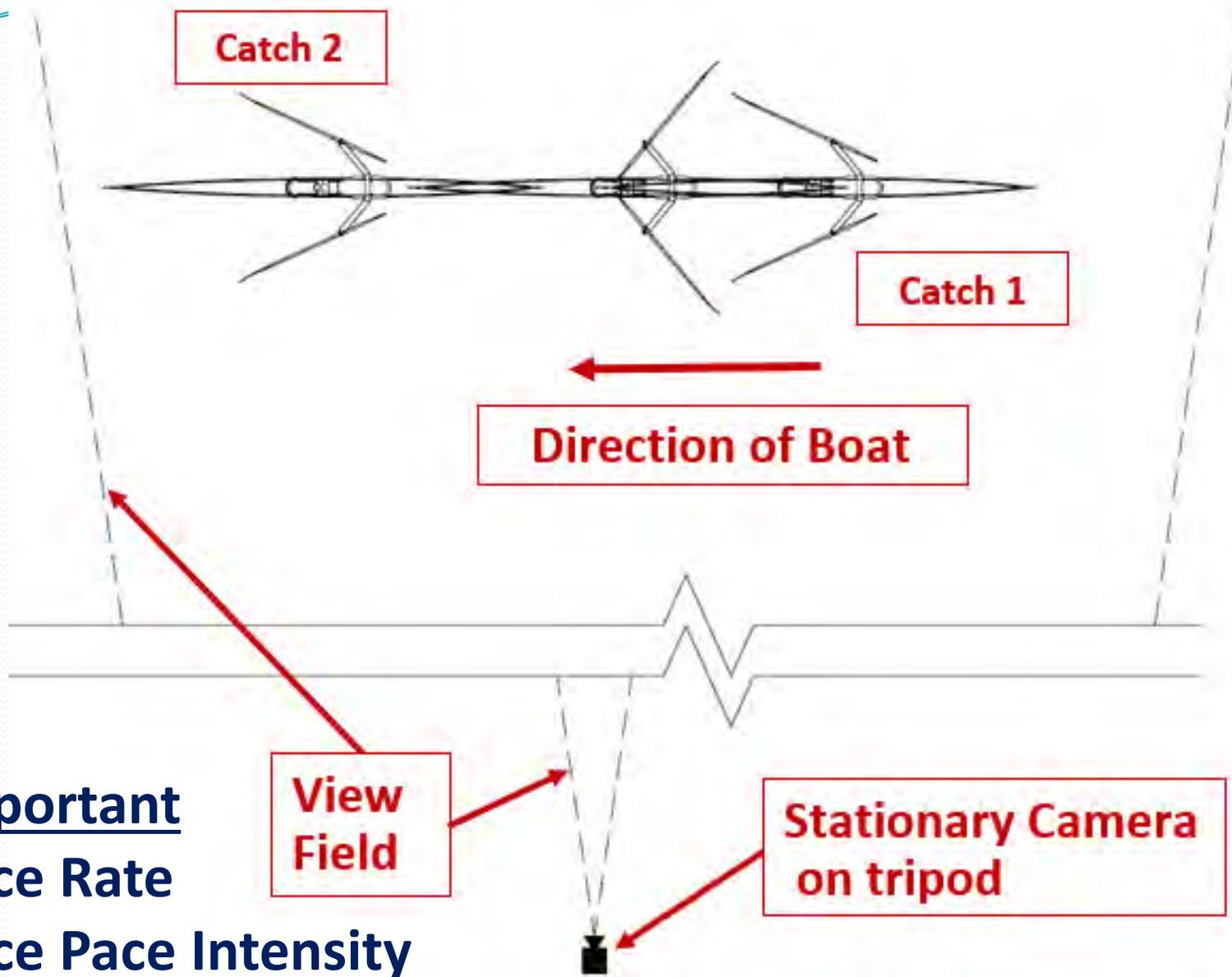


2017 Sarasota



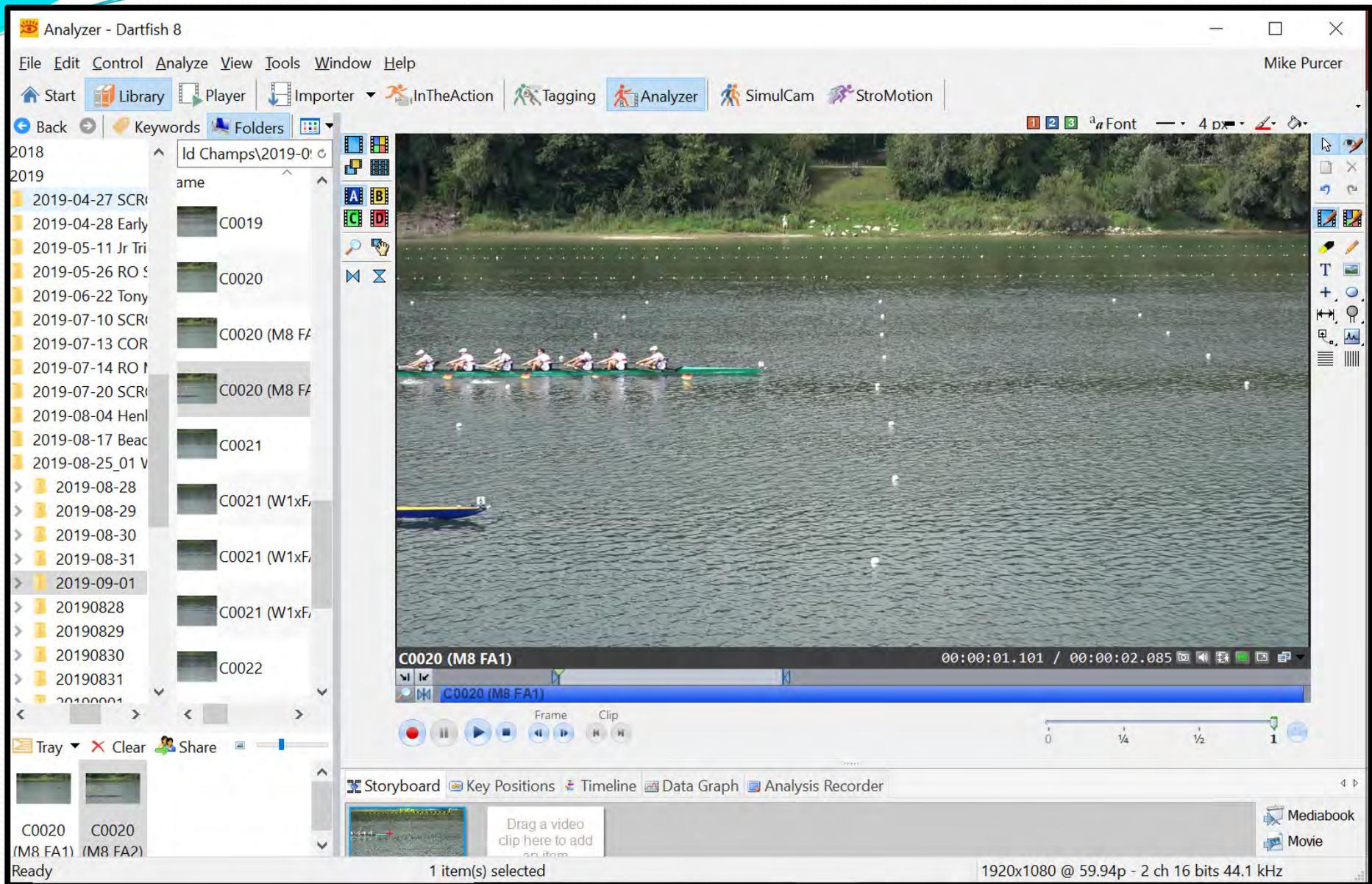
2019 Linz

Video Capture



Important
Race Rate
Race Pace Intensity

1) Open file in video analysis software

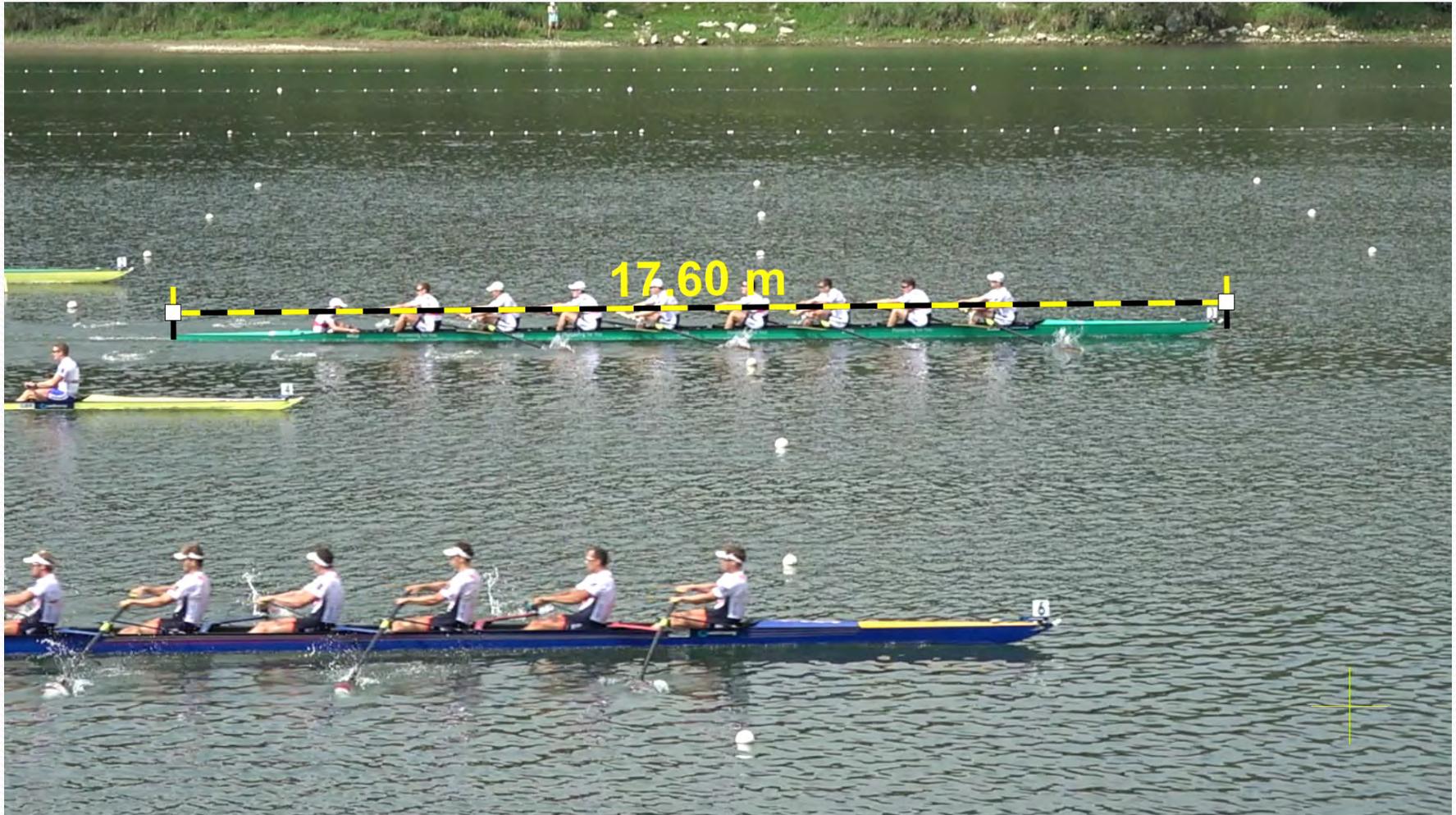


2) Advance video until boat is in mid frame

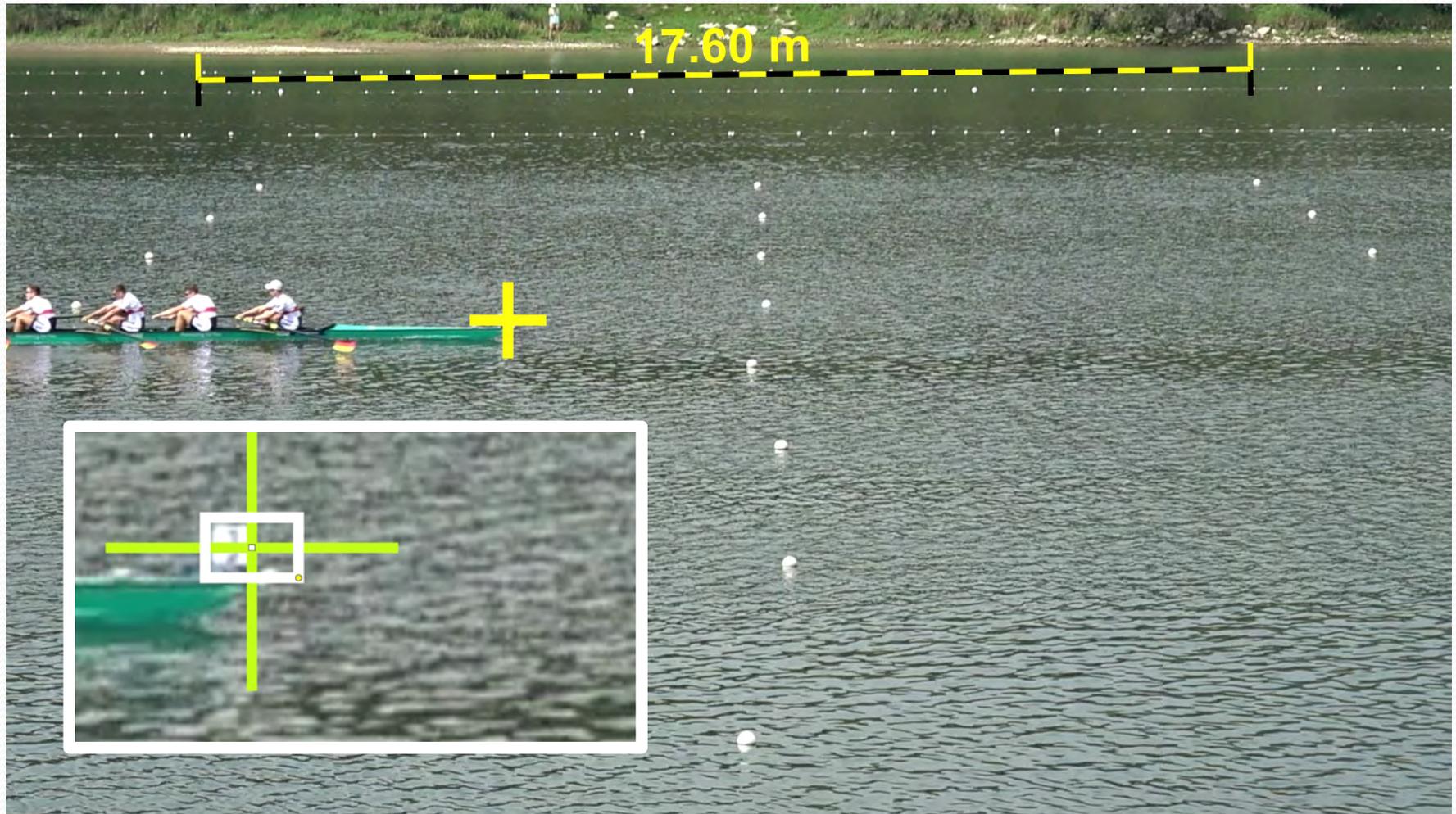


2019 WC M8+ FA

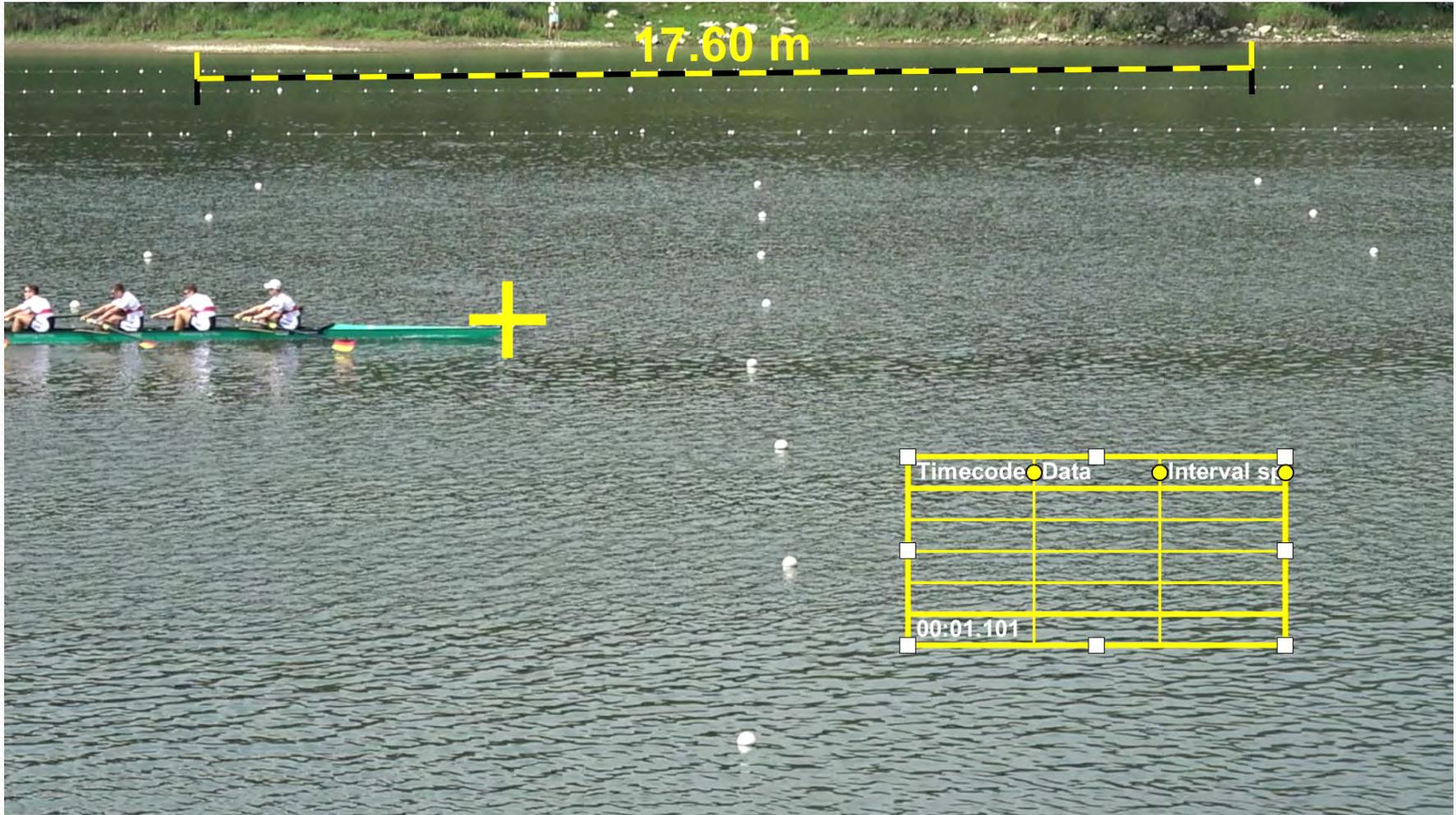
3) Apply reference distance from boat length



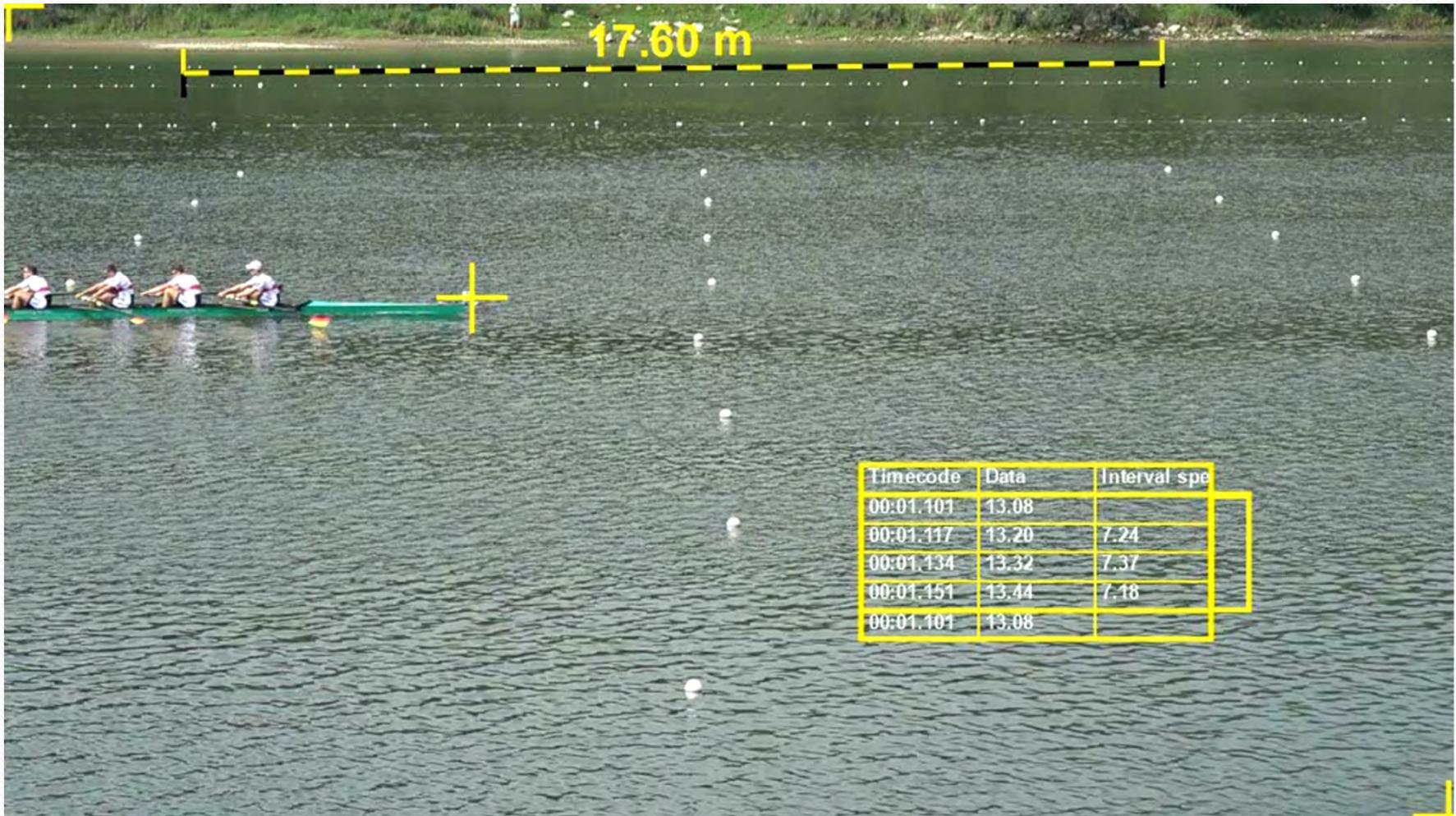
4) Insert tracking node on shell



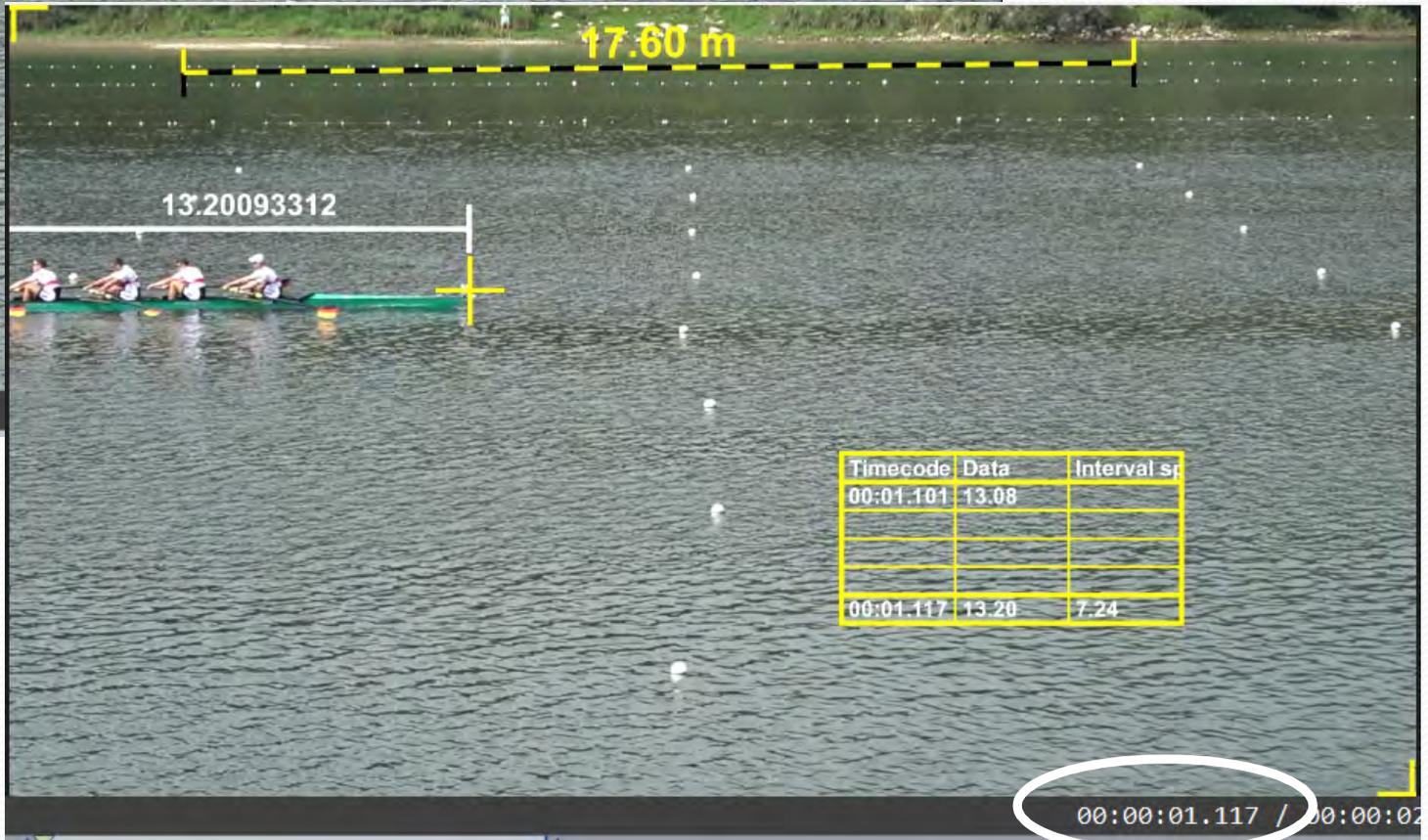
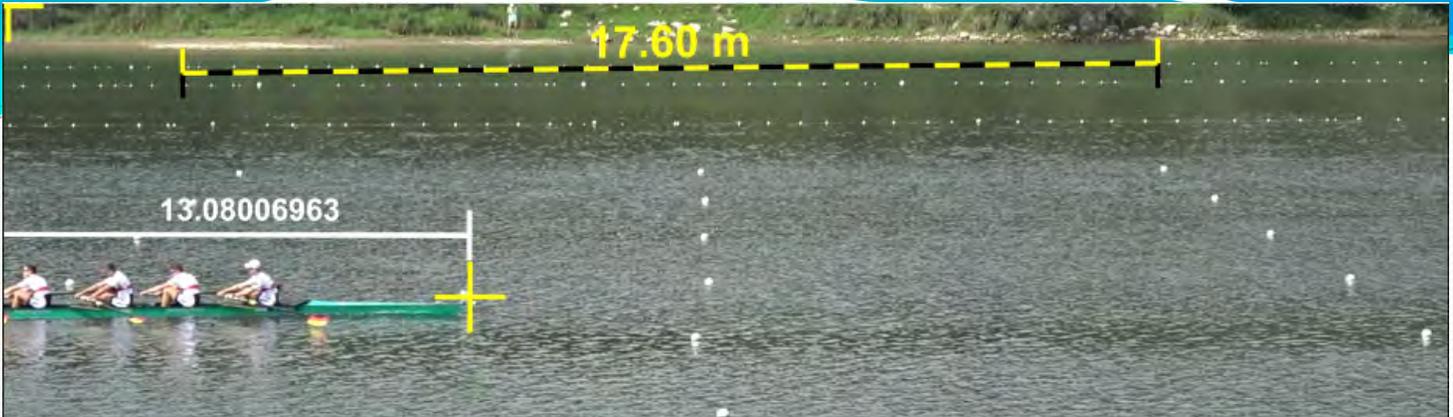
5) Insert data capture table and link to tracker



6) Run video to capture time, distance, speed



Boat Speed Data Capture



00:00:01.117 / 00:00:02

Exported Data from video to spreadsheet

	A	B	C	D
1	Timecode	Data	Interval speed	
2	1.1011	13.08006963		
3	1.1177833	13.20093312	7.24457922	
4	1.1344667	13.32391702	7.37163292	
5	1.15115	13.4437203	7.18103028	
6	1.1678333	13.56458379	7.24457922	
7	1.1845167	13.68332687	7.11743868	
8	1.2012	13.79994953	6.99038346	
9	1.2178833	13.91339158	6.79973664	
10	1.2345667	14.02577342	6.73614732	
11	1.25125	14.13497464	6.54554088	
12	1.2679333	14.24417586	6.54554088	
13	1.2846167	14.35231688	6.48195308	
14	1.3013	14.45515686	6.16424723	
15	1.3179833	14.55693664	6.10069829	
16	1.3346667	14.6544756	5.84646749	
17	1.35135	14.75201456	5.84650253	
18	1.3680333	14.84319228	5.46520889	
19	1.3847167	14.92906896	5.14743333	

raw GER (+)

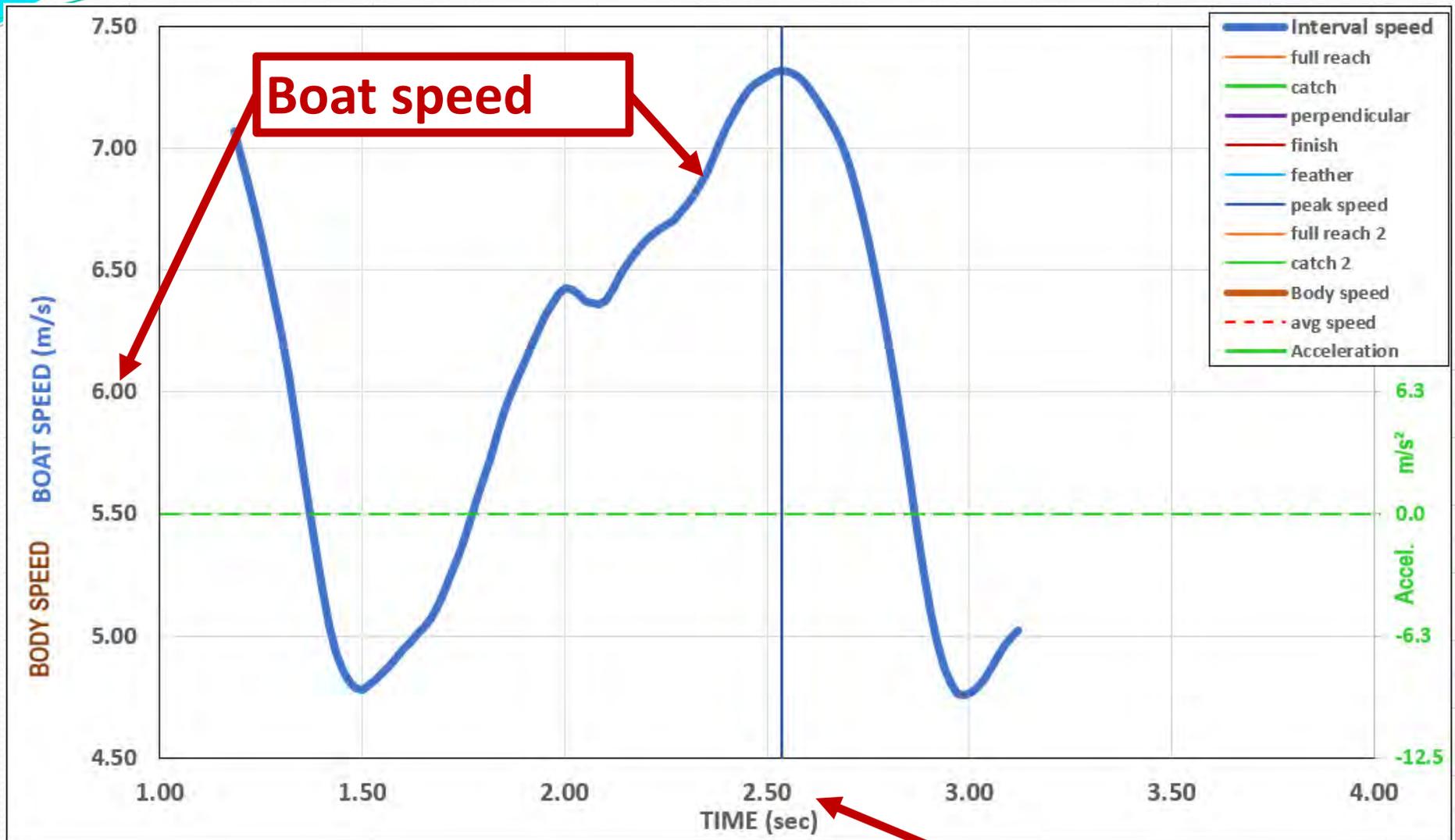
Speed for each frame 0.017 sec.

Data or distance from edge of frame

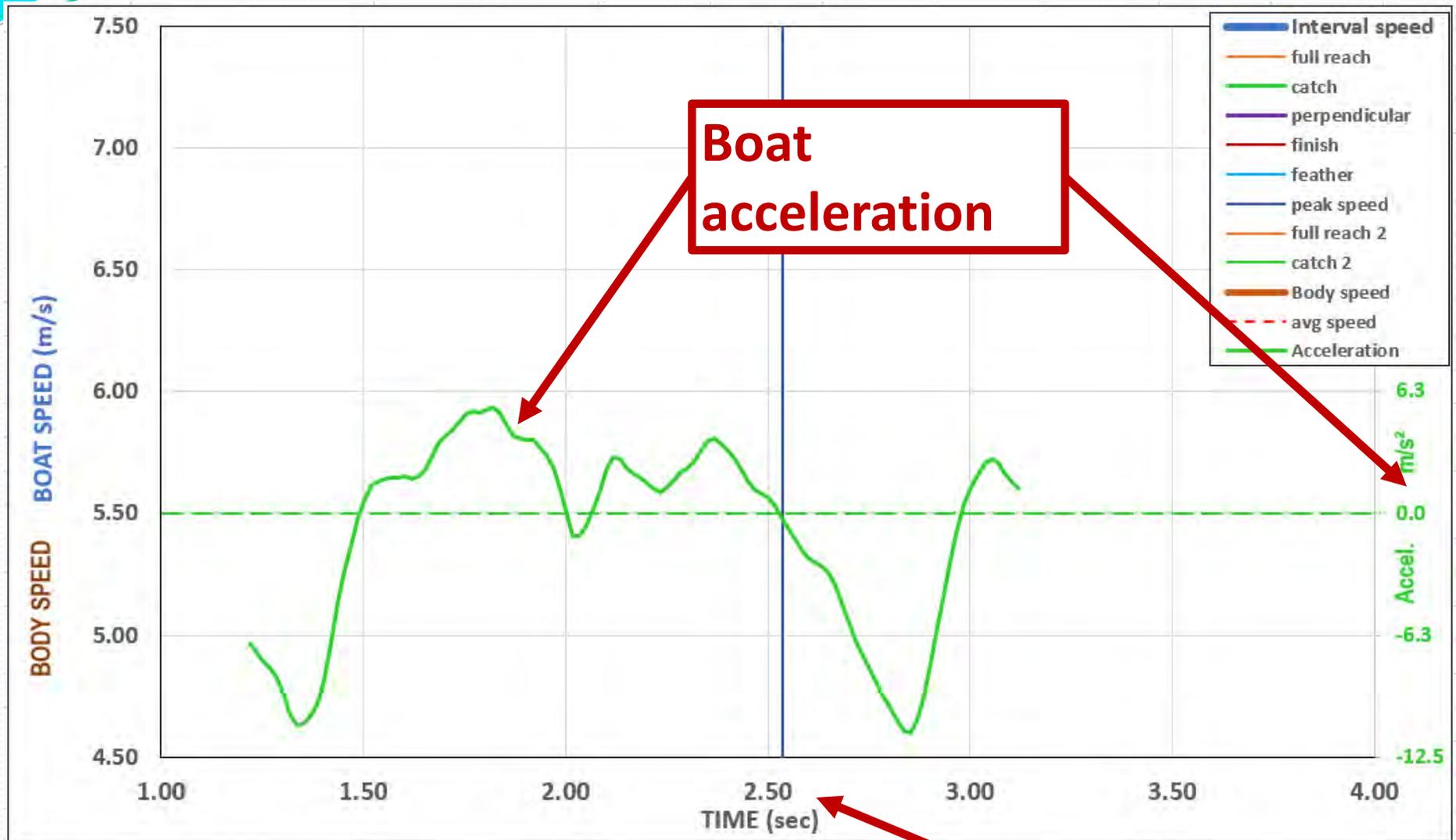
Timecode is video frame time

Each line is one video frame

Boat Speed Curve



Boat Acceleration Curve



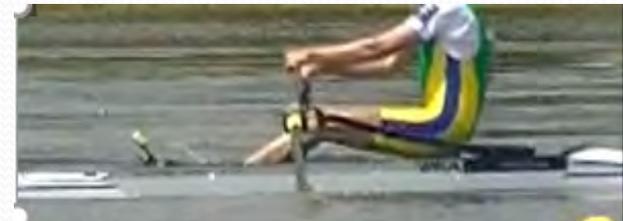
time

Rowing Technique Stroke Position Identification

1. Full Reach



2. Catch (Blade Fully Buried)



3. Oar Perpendicular to Boat

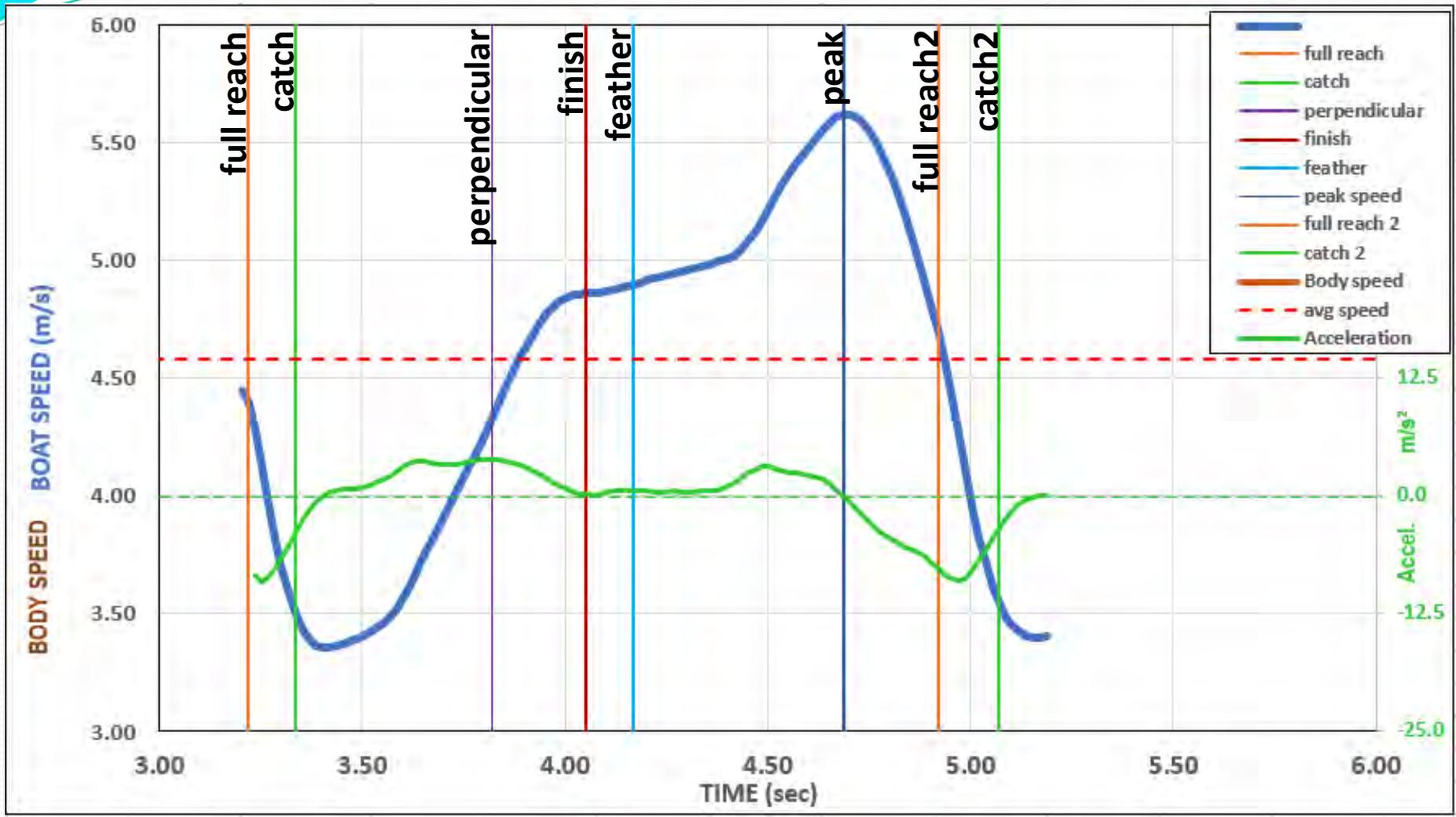


5. Feather



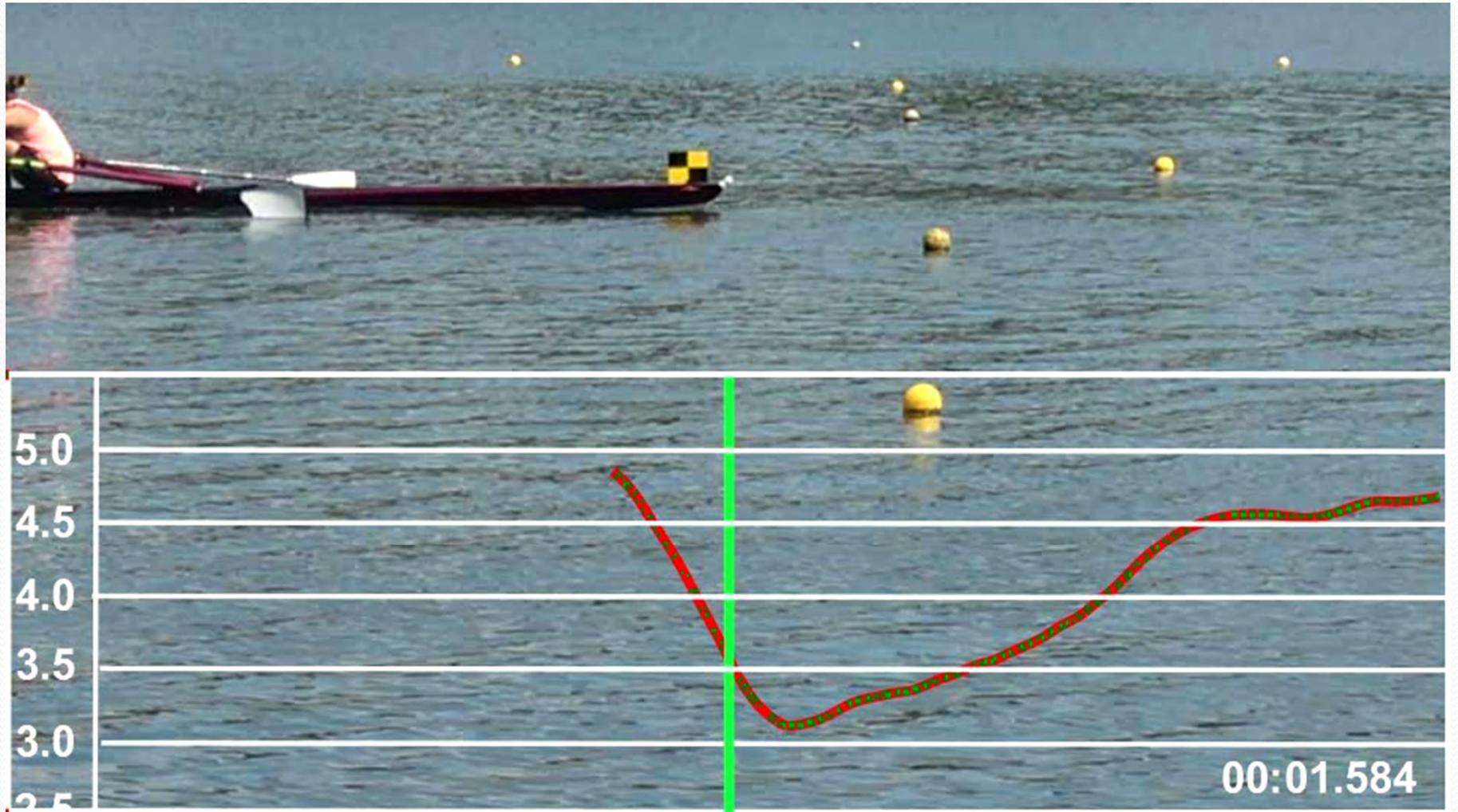
4. Finish (Blade at stern-most position)

Boat Speed Curve

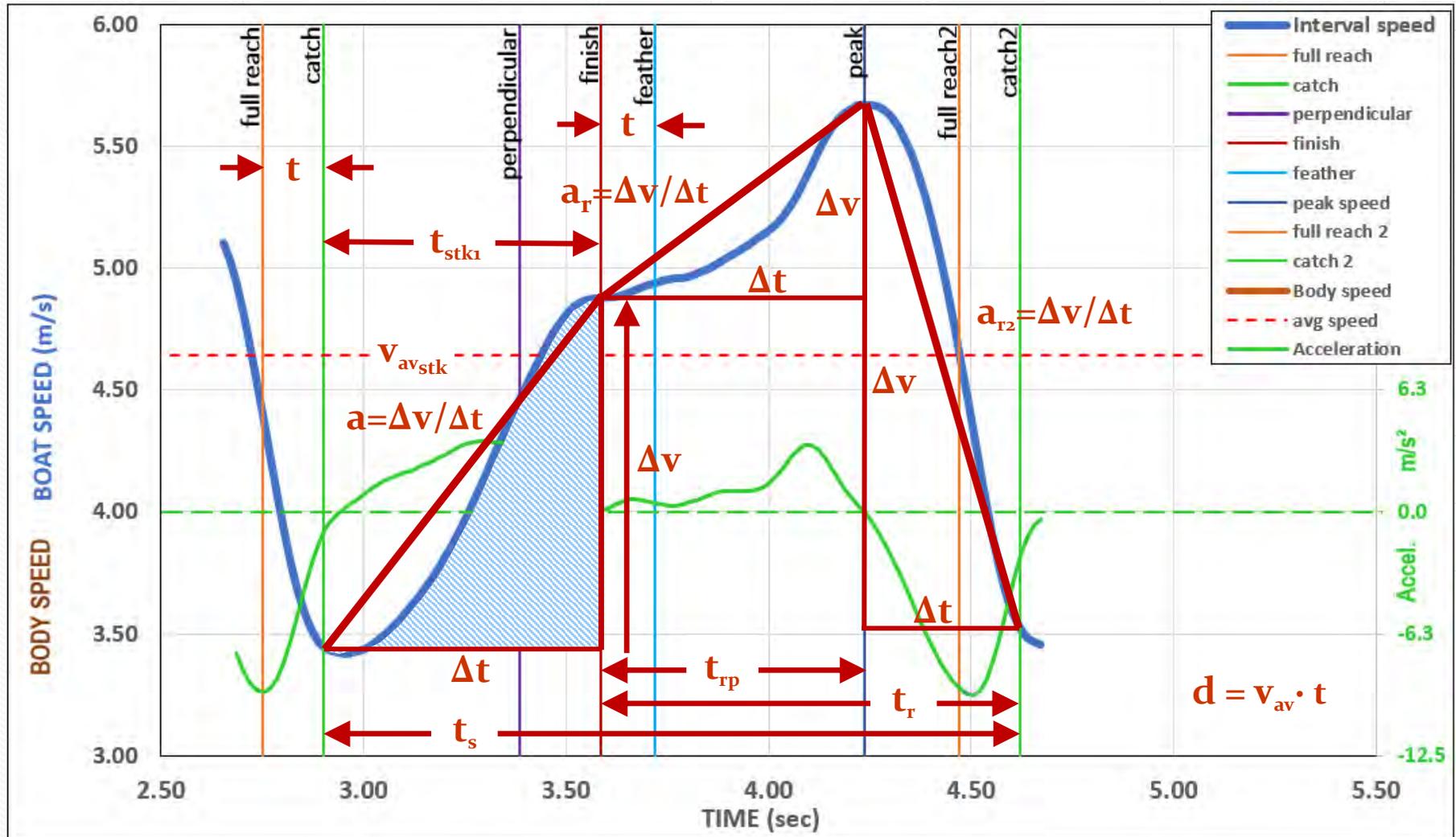


Technique points on curve link technique with speed

Link video and speed to analysis technique



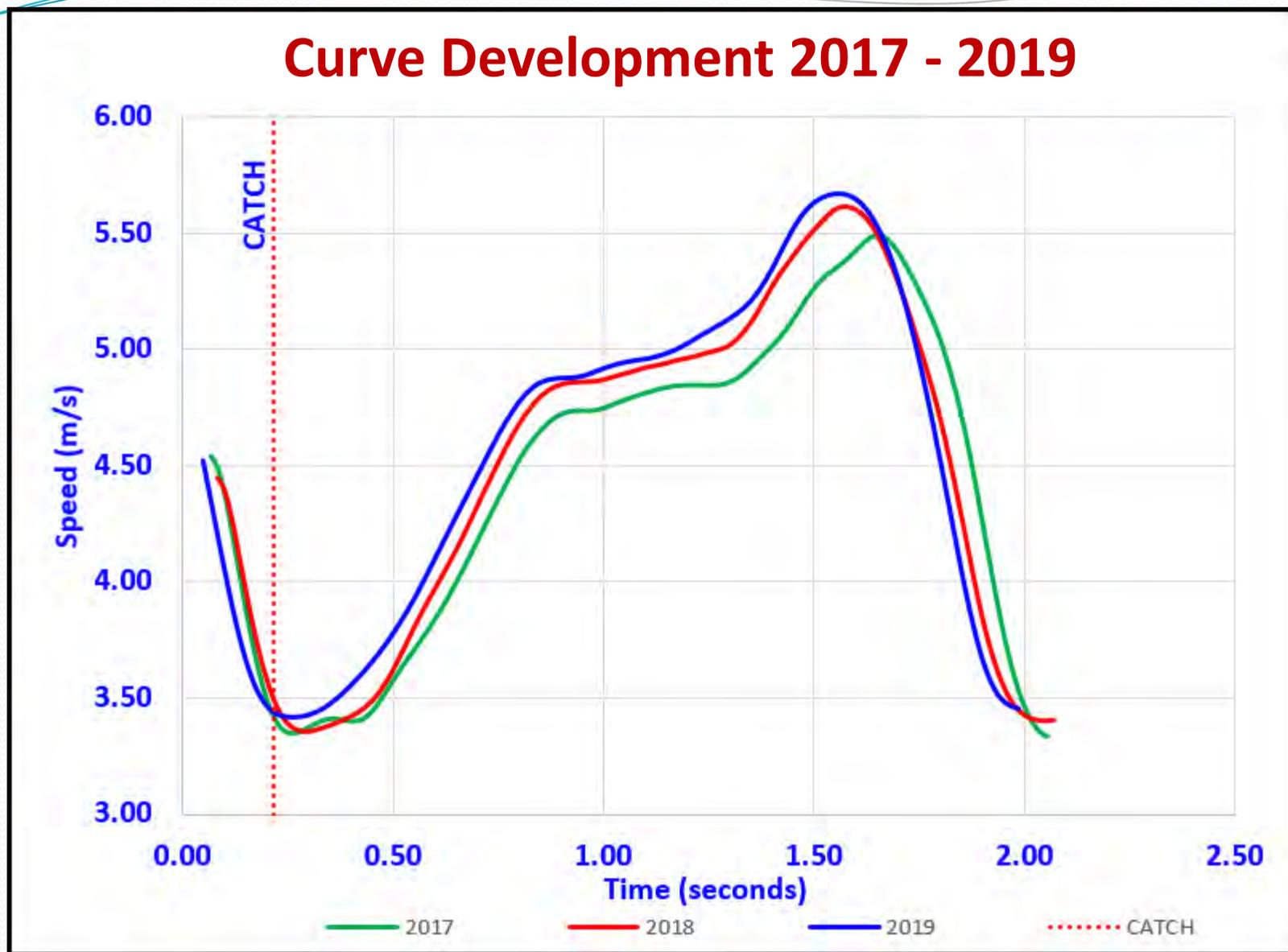
Mathematical Analysis of Curve



Analysis related to Technique Factors

- 1) **Catch Efficiency** (time between full reach and catch, blade buried)
- 2) **Drive Acceleration** (boat acceleration catch to finish)
- 3) **Drive Accel. Efficiency** (curve area relative to lineal acceleration)
- 4) **Perp. To Finish Accel.** (acceleration oar perpendicular to finish)
- 5) **Release Efficiency** (time between finish and feather)
- 6) **Recovery Acceleration** (boat acceleration finish to peak speed)
- 7) **Recovery Accel. Efficiency** (curve area vs. lineal acceleration)
- 8) **Recovery Peak Speed** (percentage of recovery to peak speed)
- 9) **Deceleration** (boat acceleration peak speed to catch2)
- 10) **Deceleration Efficiency** (curve area vs. lineal acceleration)

Speed curve development over time



Analysis related to Technique Factors (compare over time)

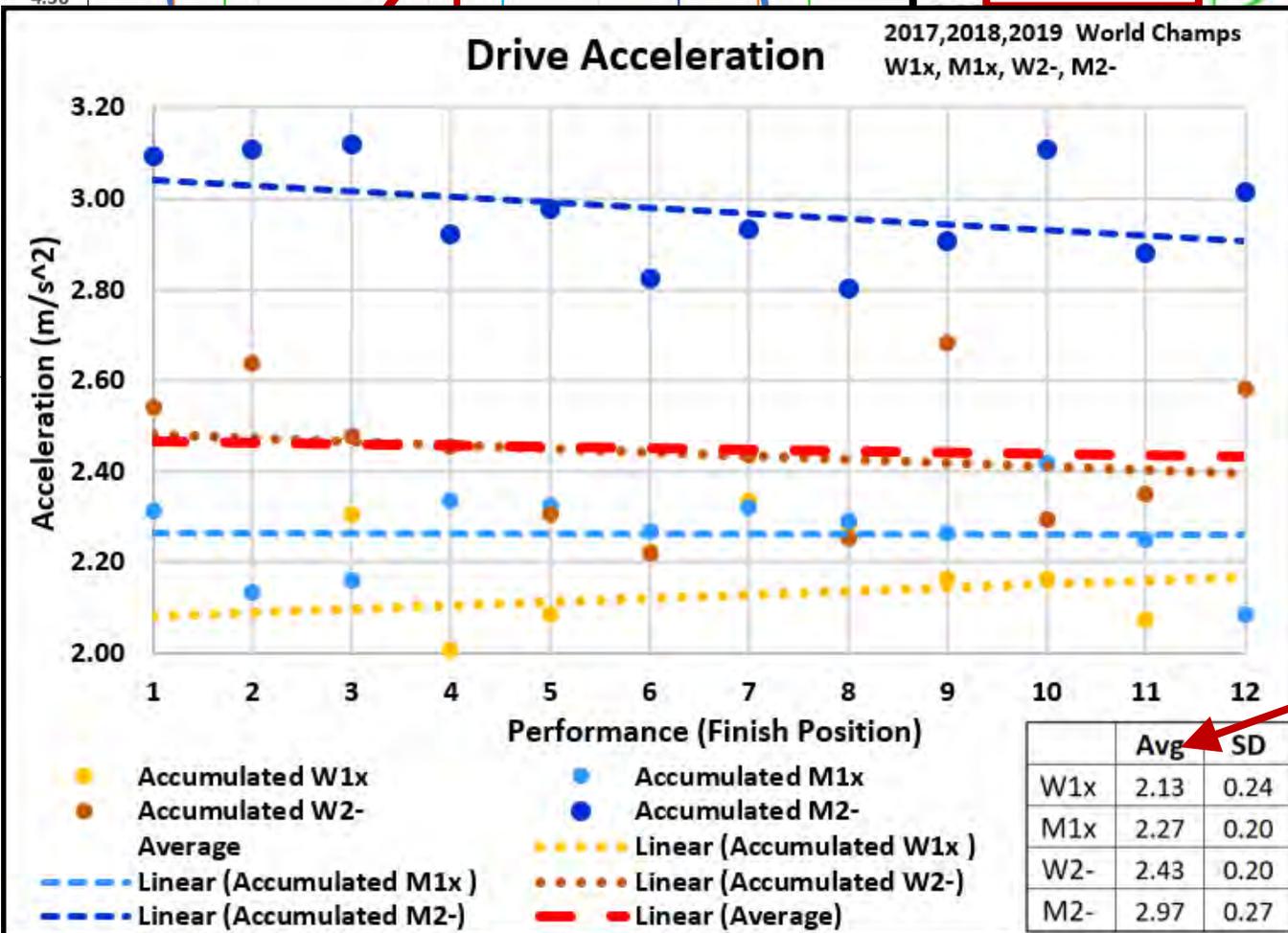
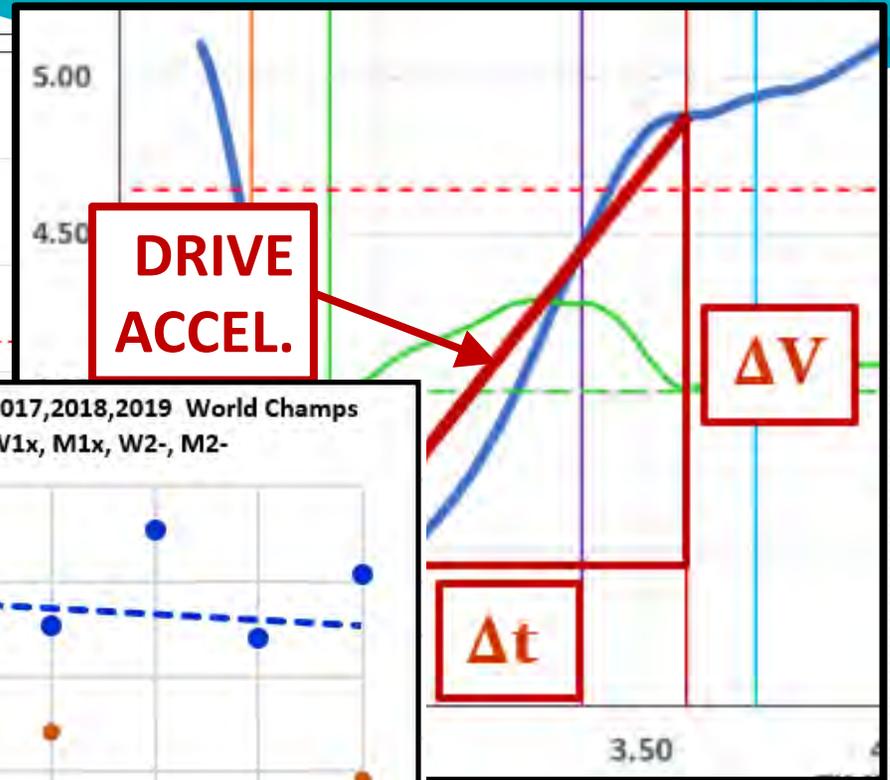
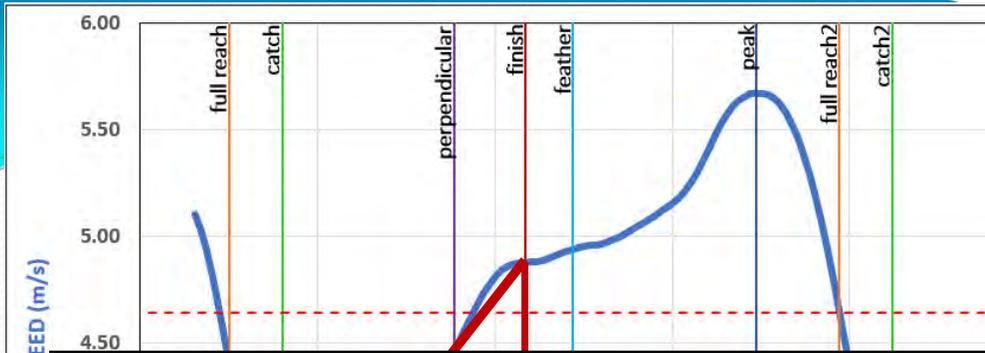
TECHNIQUE					
	2017	2018	2019		
Min. Boat Speed (about catch)	3.35	3.35	3.42		
Catch Effic. (full reach to catch)	0.11	0.12	0.15		
→ Drive Accel. (catch to finish)	1.73	1.91	2.10		
Drive Accl. Eff. (fin to peak)	82.1%	72.3%	84.9%		
Drive Speed Increas (min. to fin.)	1.39	1.51	1.46		
Perp to Finish Accel (perp to fin.)	1.46	2.28	2.09		
Drive Boat Moves (distance)	3.04	2.87	2.79		
Drive Boat Moves (% of total)	37.3%	36.1%	35.0%		
Release Effic. (finish to feather)	0.13	0.12	0.13		
→ Recovery Accel. (finish to peak)	1.13	1.19	1.22		
Recovery Accel Eff. (fin. to peak)	72.6%	64.7%	68.5%		
Recovery Peak Speed (% of Rec.)	63.5%	62.3%	62.9%		
Max. Boat Speed (at peak)	5.49	5.62	5.67		
Total Speed Varies (min to max)	2.14	2.26	2.25		
Deceleration (peak to catch2)	-5.57	-5.41	-5.61		
Decel. Effic. (peak to catch2)	114.2%	122.2%	121.6%		
Recovery Boat Moves (distance)	5.10	5.08	5.19		
Recovery Boat Moves (% of total)	62.7%	63.9%	65.0%		
Total Boat Moves (m per stroke)	8.14	7.95	7.98		

Analysis related to Technique Factors

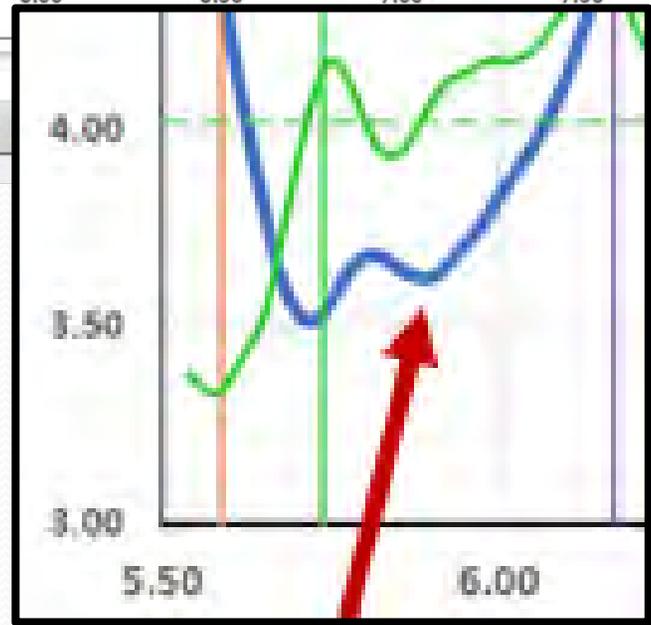
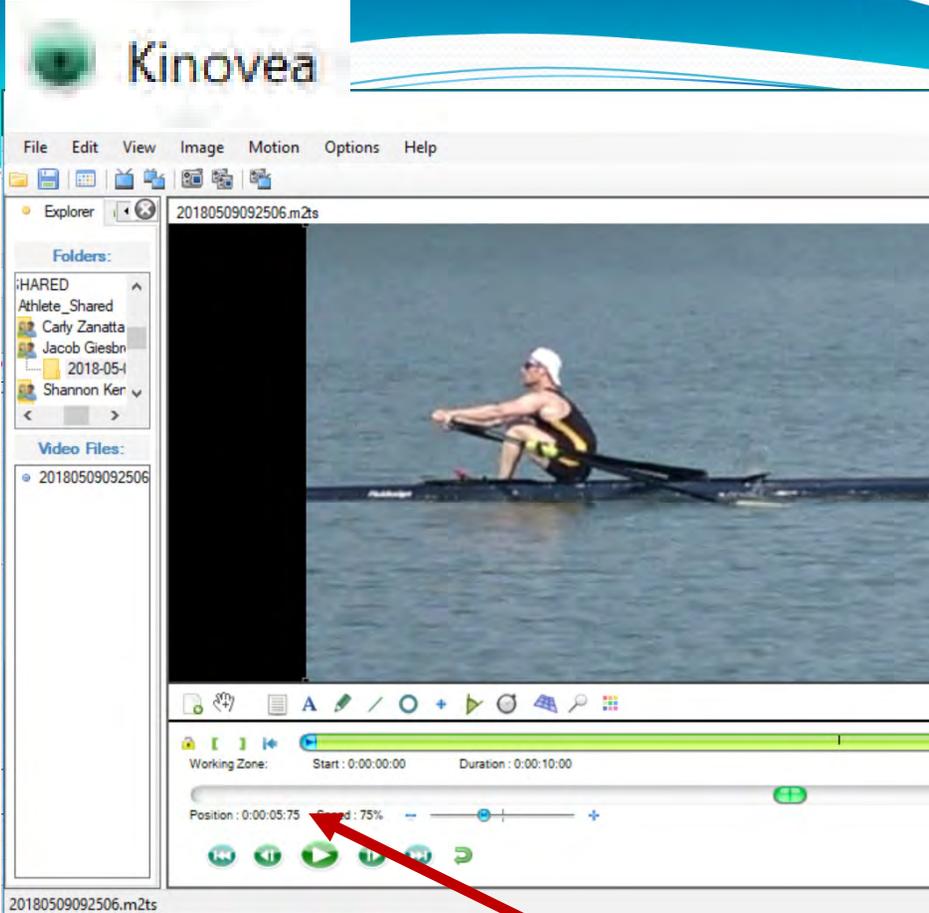
	TECHNIQUE	
	2017	
Min. Boat Speed (about catch)	3.35	3.18
Catch Effic. (full reach to catch)	0.11	0.17
Drive Accel. (catch to finish)	1.73	2.00
Drive Accl. Eff. (fin to peak)	82.1%	84.7%
Drive Speed Increas (min. to fin.)	1.39	1.49
Perp to Finish Accel (perp to fin.)	1.46	2.11
Drive Boat Moves (distance)	3.04	2.79
Drive Boat Moves (% of total)	37.3%	34.8%
Release Effic. (finish to feather)	0.13	0.14
Recovery Accel. (finish to peak)	1.13	0.98
Recovery Accel Eff. (fin. to peak)	72.6%	71.7%
Recovery Peak Speed (% of Rec.)	63.5%	61.2%
Max. Boat Speed (at peak)	5.49	5.32
Total Speed Varies (min to max)	2.14	2.14
Deceleration (peak to catch2)	-5.57	-4.88
Decel. Effic. (peak to catch2)	114.2%	122.4%
Recovery Boat Moves (distance)	5.10	5.23
Recovery Boat Moves (% of total)	62.7%	65.2%
Total Boat Moves (m per stroke)	8.14	8.02

Technique Factors

Individual Curve Analysis versus Average for A & B Finalists



AVERAGES

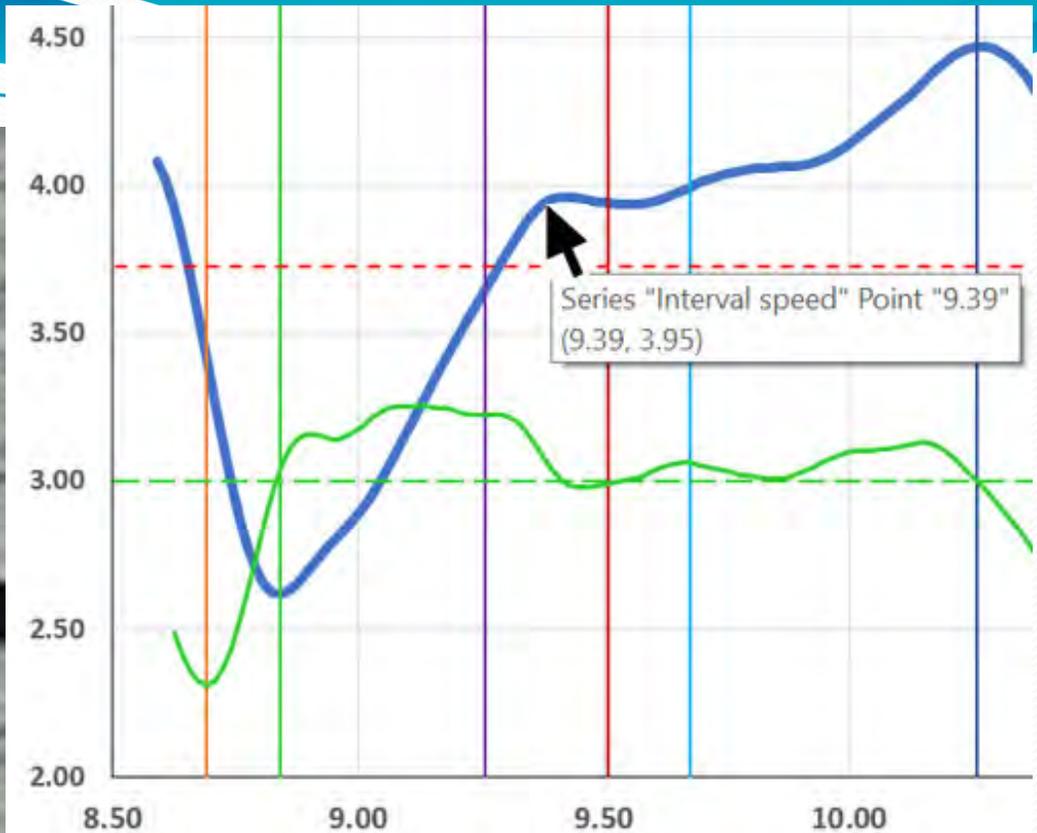
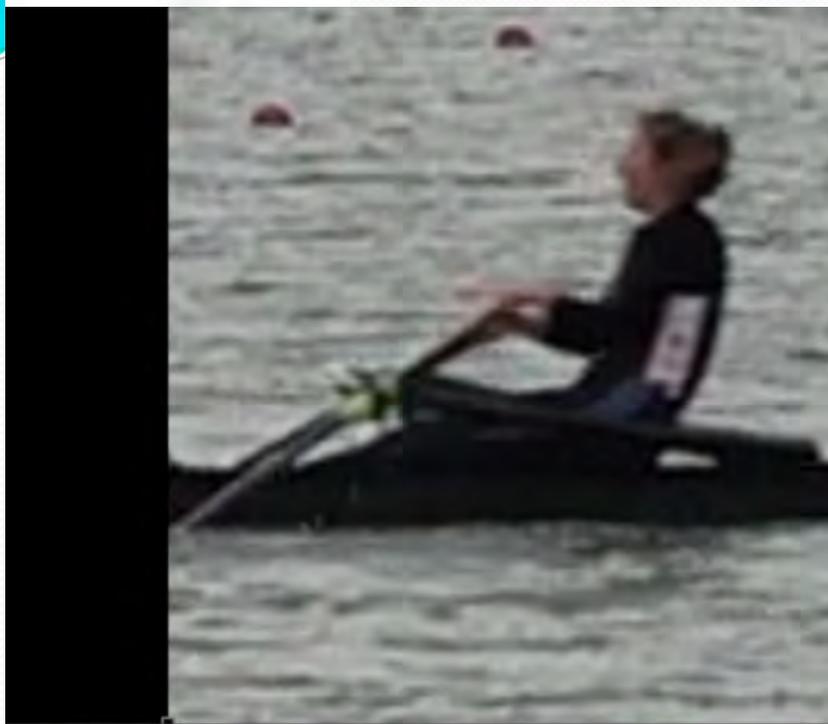


Match curve time with video time to connect technique with speed

<https://www.kinovea.org/>
Purcerverance – World Rowing Coaches Conference 2019



Kinovea



Working Zone: Start : 0:00:00:00 Duration : 0:00:14:51

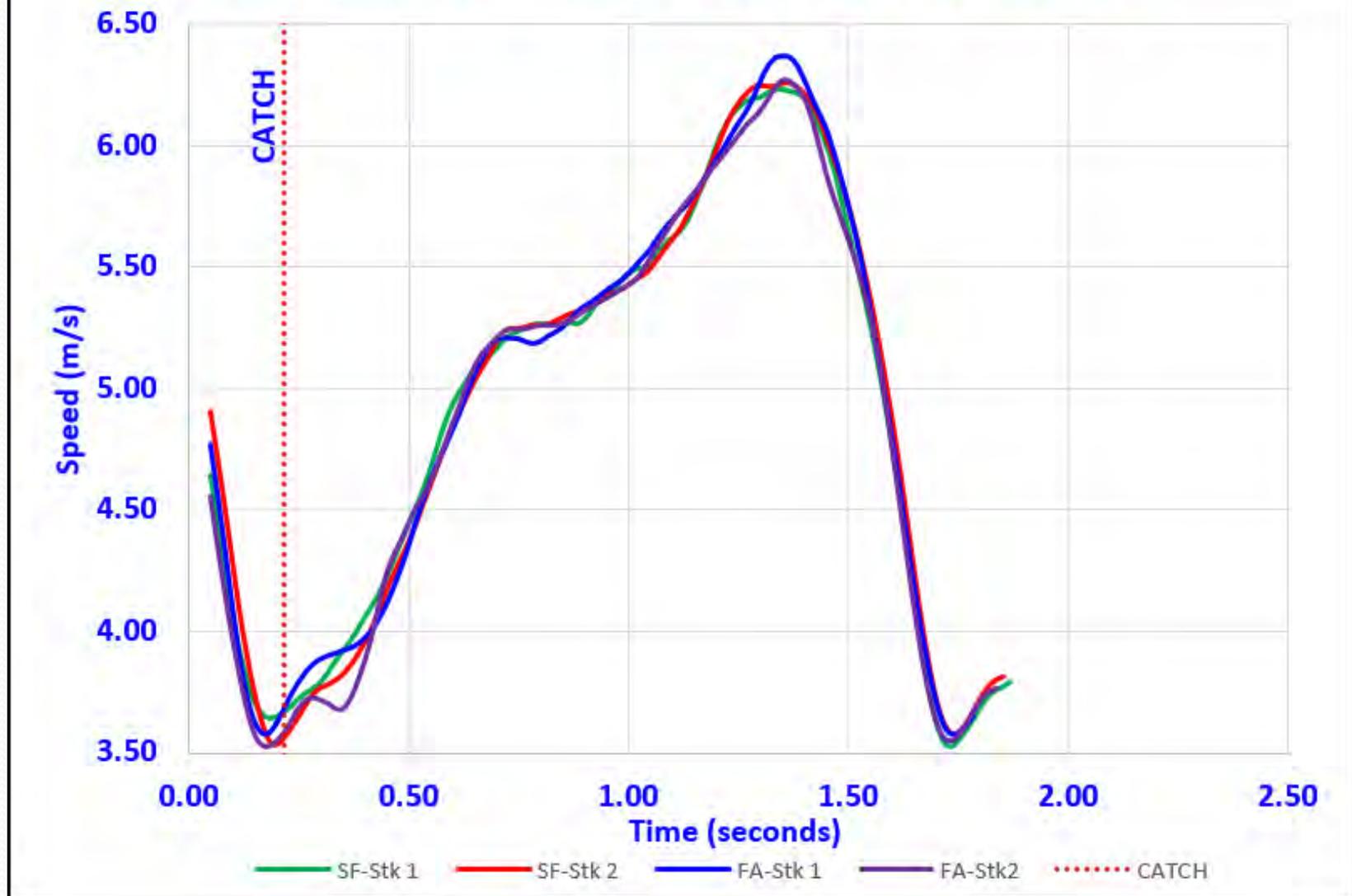
Position : 0:00:09:39 Speed : 100%

Position : 0:00:09:39

Match curve time with video time to connect technique with speed

<https://www.kinovea.org/>

Curve Comparison (2 Stks SF) & (2 Stks FA)



Take away for Boat Speed Analysis

- 1) **Inexpensive** (camera, software, computer)
- 2) **Non-invasive** (no disruptions to training, video races)
- 3) **Provides objective, quantitative and visual feedback linking technique & speed** (coaches & athletes)
- 4) **Only one stroke** (can be misleading with bad or good stroke)
- 5) **Measurement errors on video** (can be misleading)
- 6) **Requires a technical support person 'nerd' for video capture and data analysis.**

Rigging Analysis

- 1) **Drive Time** (time between catch, blade buried and feather)
- 2) **Blade Slip** (movement of blade tip in water during drive)
- 3) **Effective Stroke Length** (boat movement during drive)
- 4) **Stroke Position** (percentage of drive before oar is perpendicular)
- 5) **Stroke Rate** (strokes per minute)
- 6) **Stroke Ratio** (recovery time divided by drive time)

RIGGING								
	2017			2018			2019	
Drive Time	0.90	0.87		0.83	0.83		0.82	0.84
Blade Slip	+0.21	0.09		+0.12	0.02		+0.16	0.03
Eff. Stroke Lngth	3.04	2.79		2.87	2.69		2.79	2.66
Stroke Position	71.4%	67.6%		67.4%	66.5%		70.8%	68.4%
Stroke Rate	33.0	32.9		34.6	34.3		34.9	34.1
Stroke Ratio	1.02	1.11		1.08	1.11		1.10	1.11



Blade Slip

Definition

How we Measure

Study Data

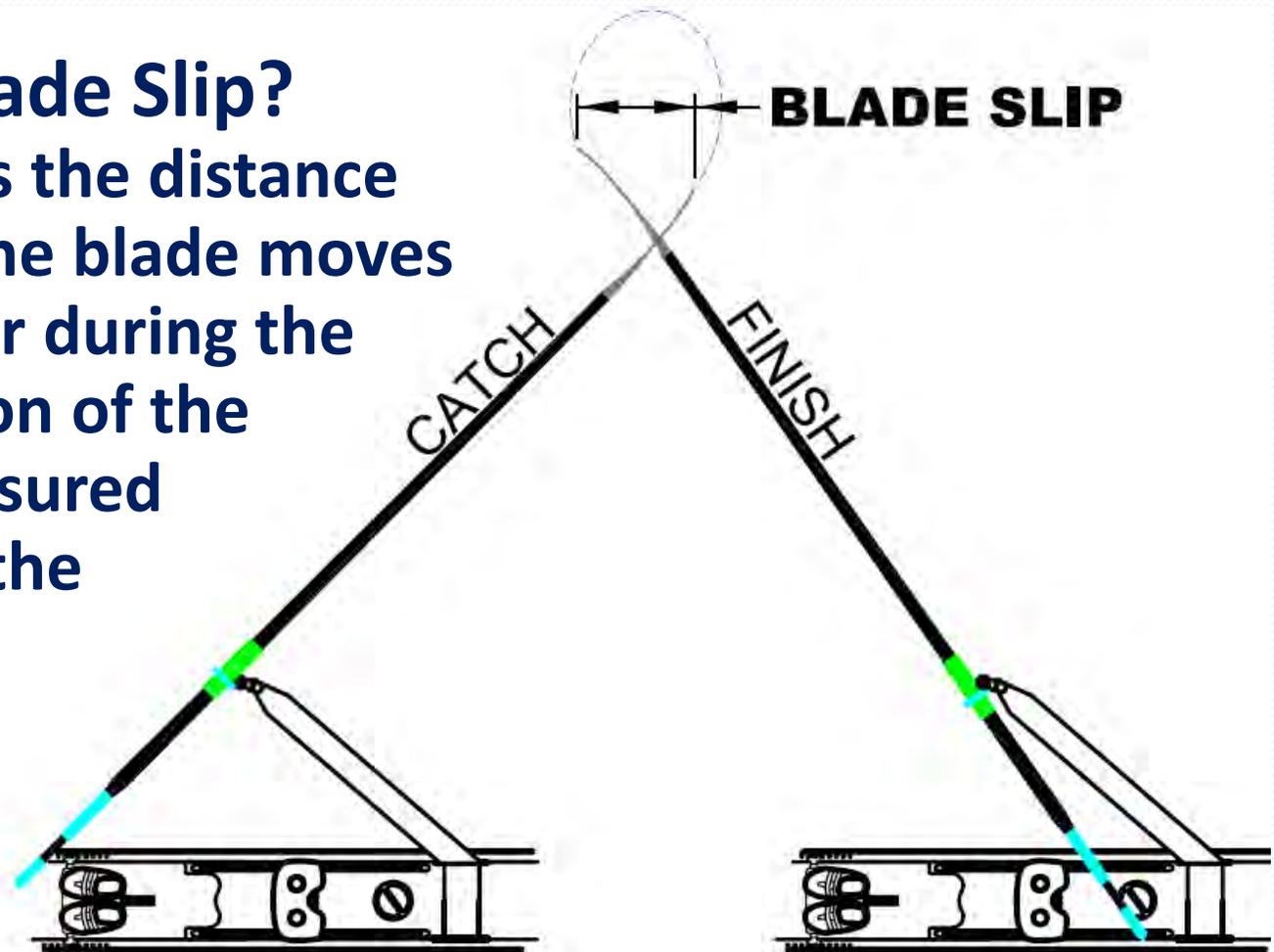
*“What can be measured
can be managed.”*

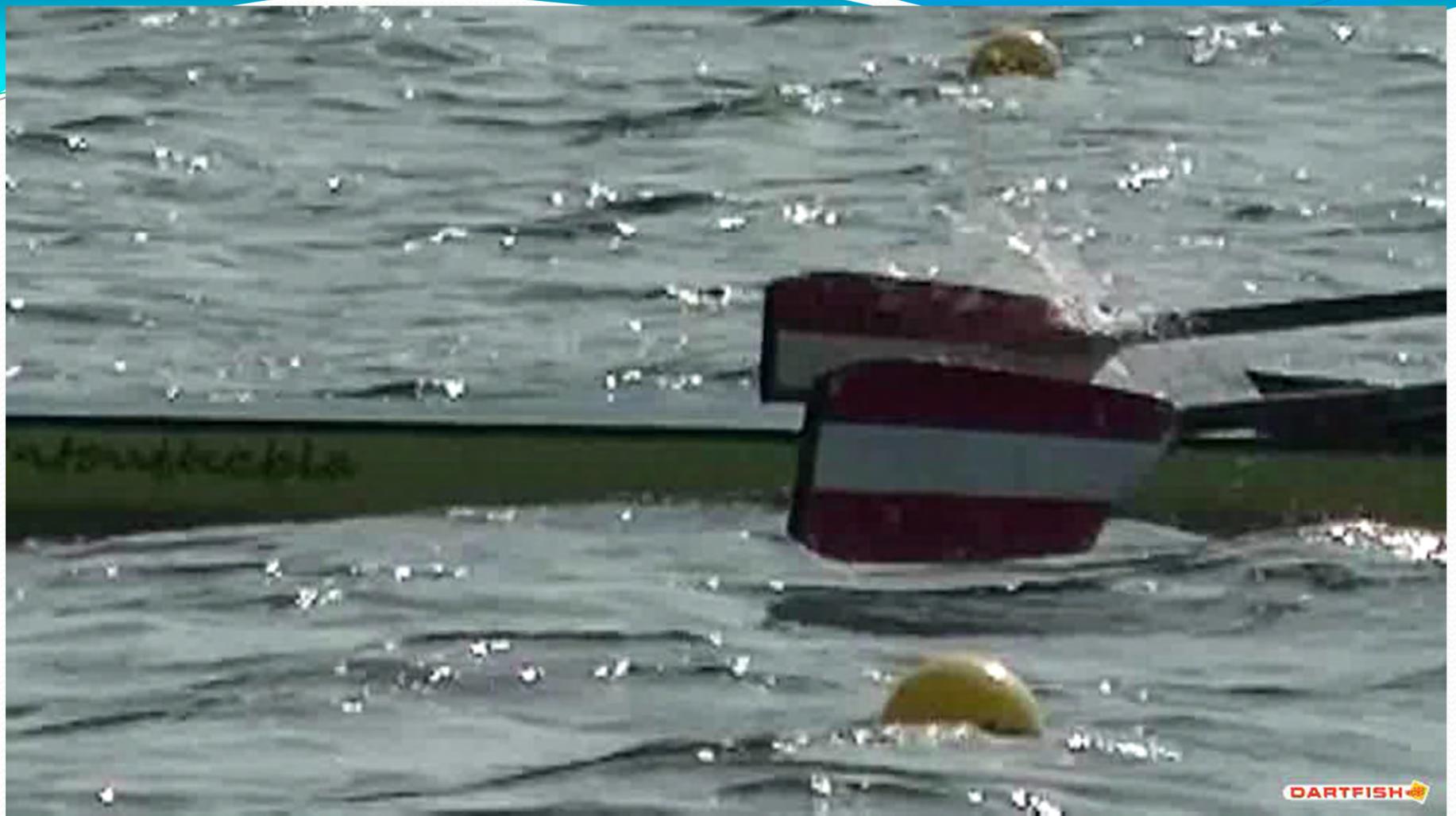
(Peter Drucker)

Outline

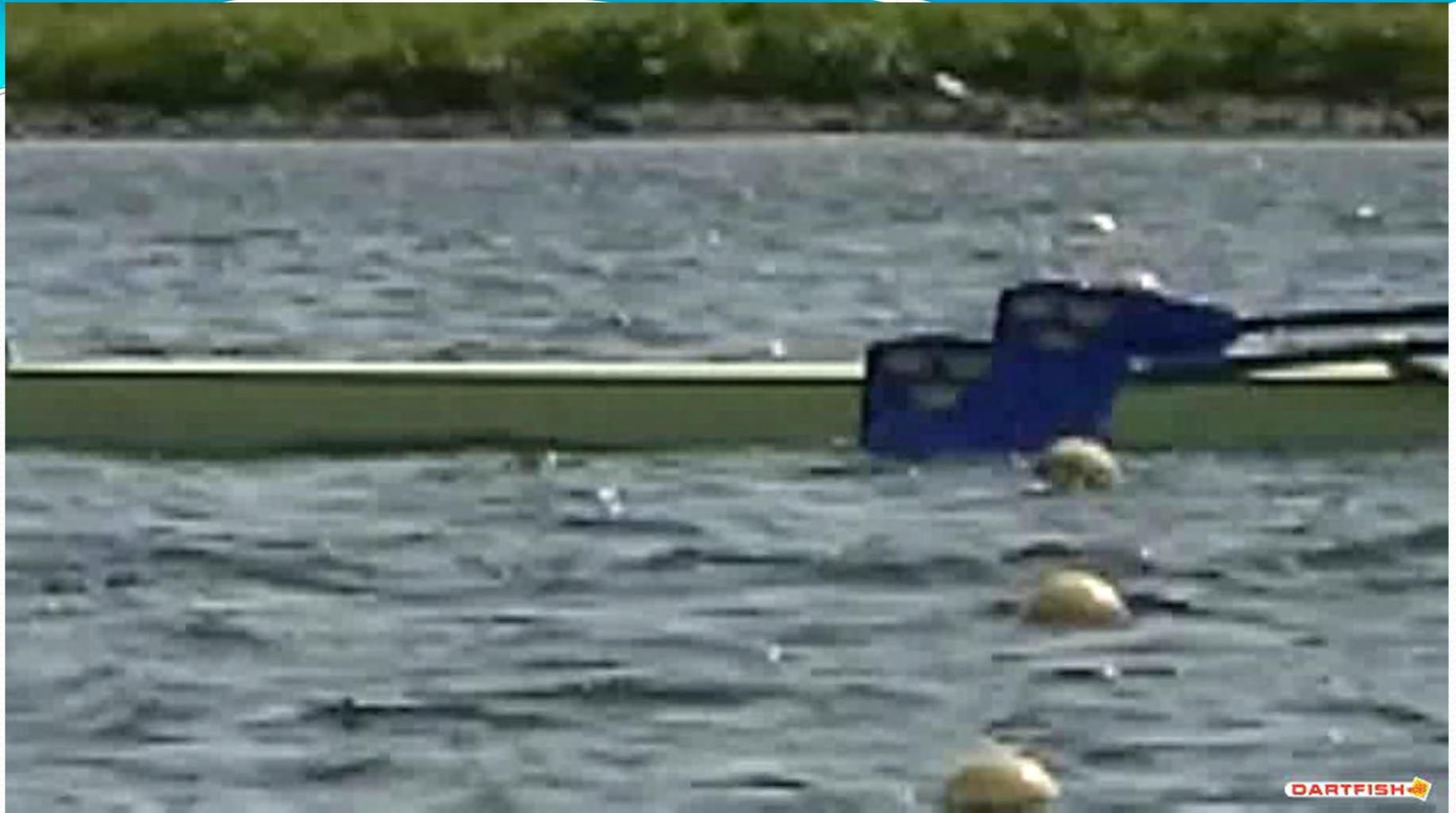
1) What is Blade Slip?

- Blade slip is the distance the tip of the blade moves in the water during the drive portion of the stroke measured parallel to the boat.



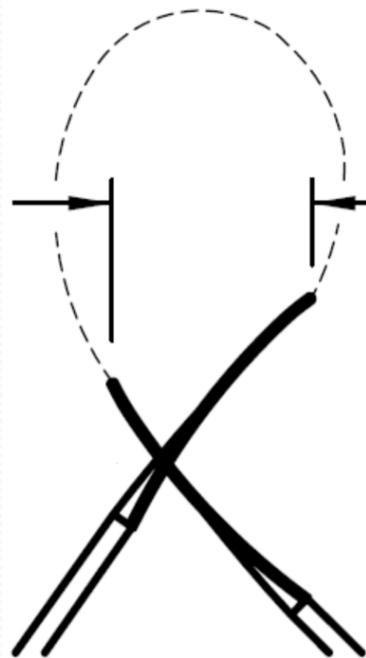
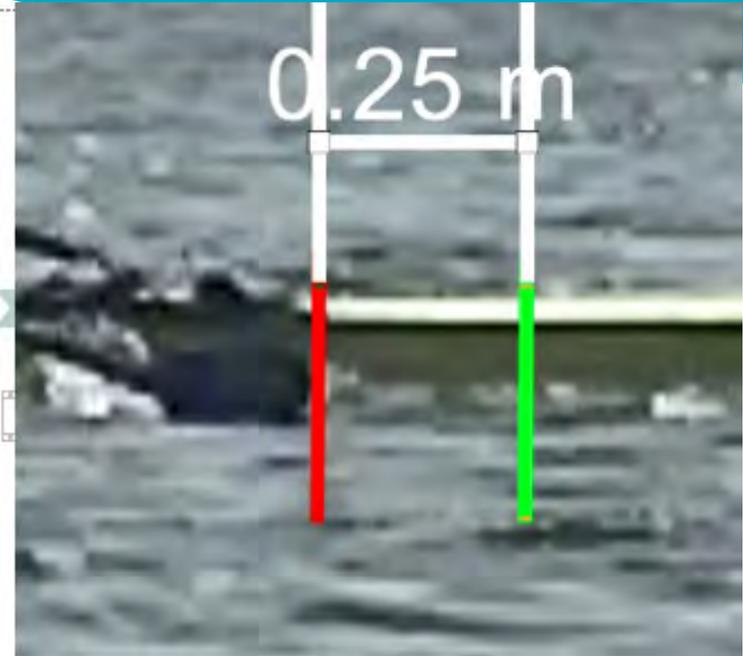
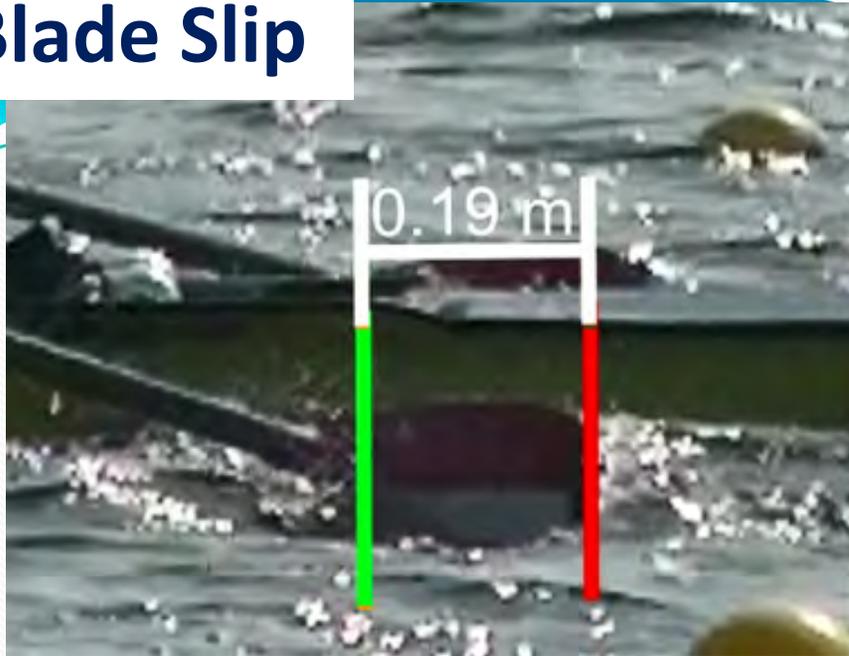


Negative Blade Slip

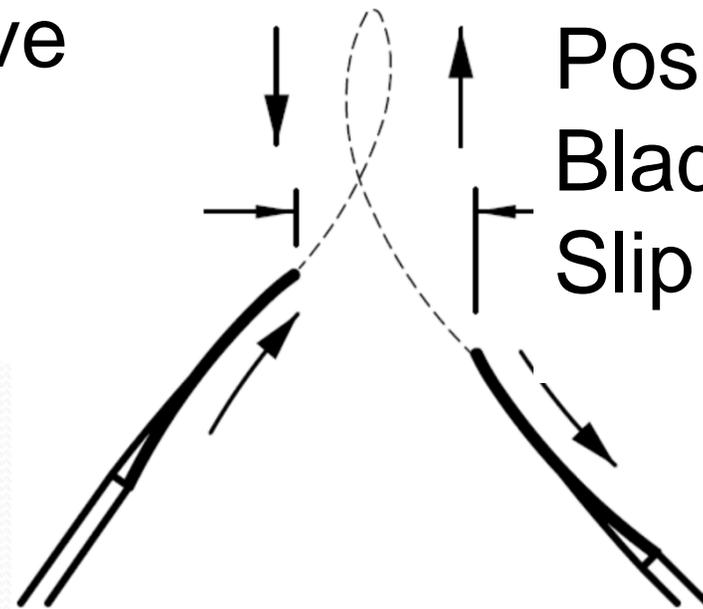


Positive Blade Slip

Blade Slip



Negative
Blade
Slip



Positive
Blade
Slip

8.20



Positive Blade Slip



Comparative Analysis of Rigging Set-Up and Success Amongst Single Scullers at the 2016, 2017 and 2018 FISA World Championships (Rowing)

Lewis, Z.R.¹ & Purcer, M.²

¹Brock University, St. Catharines, Ontario

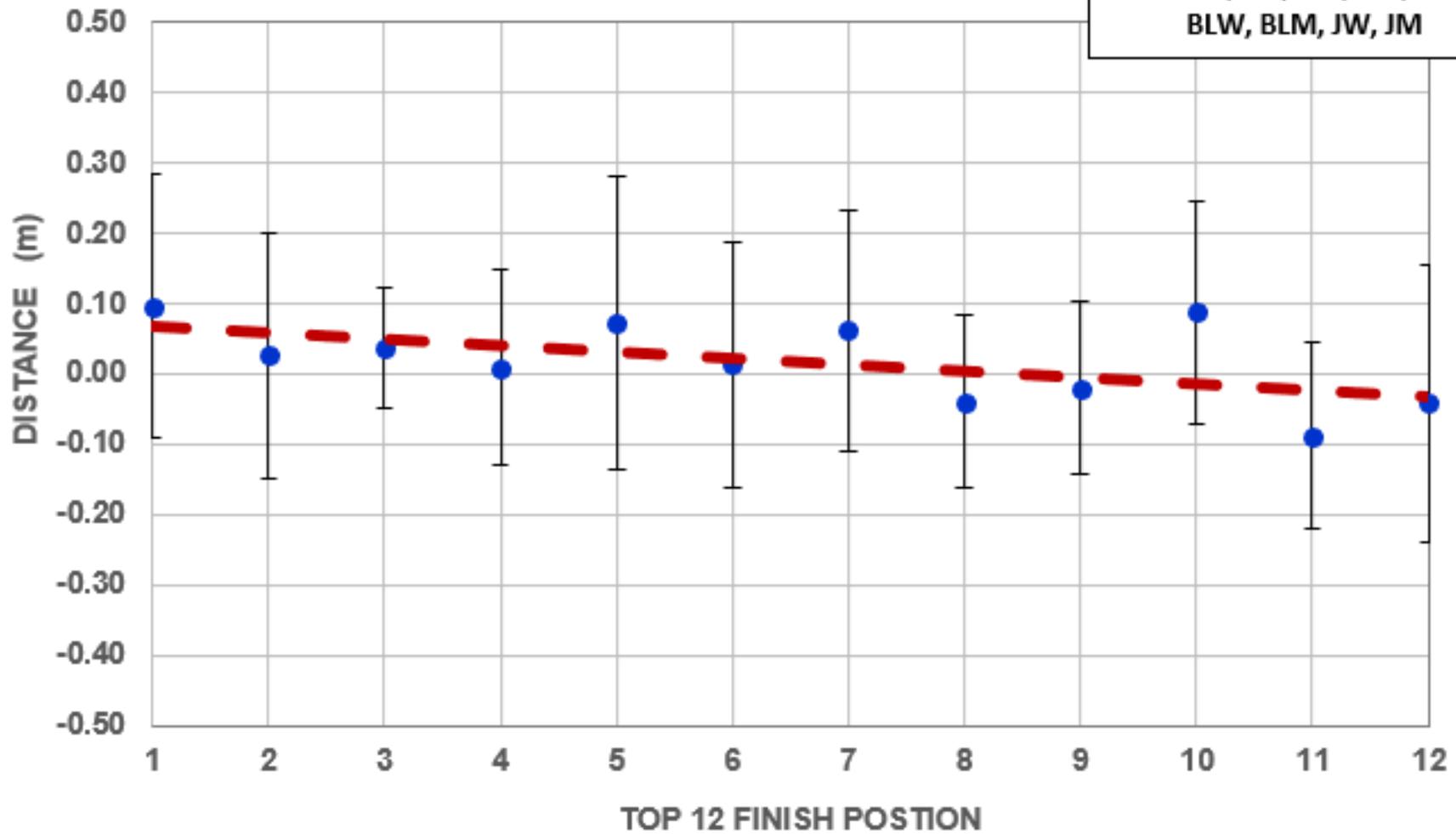
²Master Coach Developer, Purcerverance

Abstract

The aim of this study was to examine the relationship between multiple components of the drive portion of the rowing stroke, directly affected by rigging set-up, and rowing performance. One-hundred and forty-two ($m=70, f=72$) world class single scullers were selected for analysis from the Senior, Under-23 and Junior categories. Subjects' blade slip and drive time were measured and their stroke ratios and stroke arc placement were calculated accordingly. Rowing performance was assessed using finish position from the A and B finals of the 2016, 2017 and 2018 FISA World Championship regattas. While rigging itself is not a primary determinant of rowing performance, results of the current study indicate that there is a correlation between finish position and both drive time and blade slip. Rowers who are rigged to maximize individual positive blade slip and minimize drive time achieve greater amounts of success.

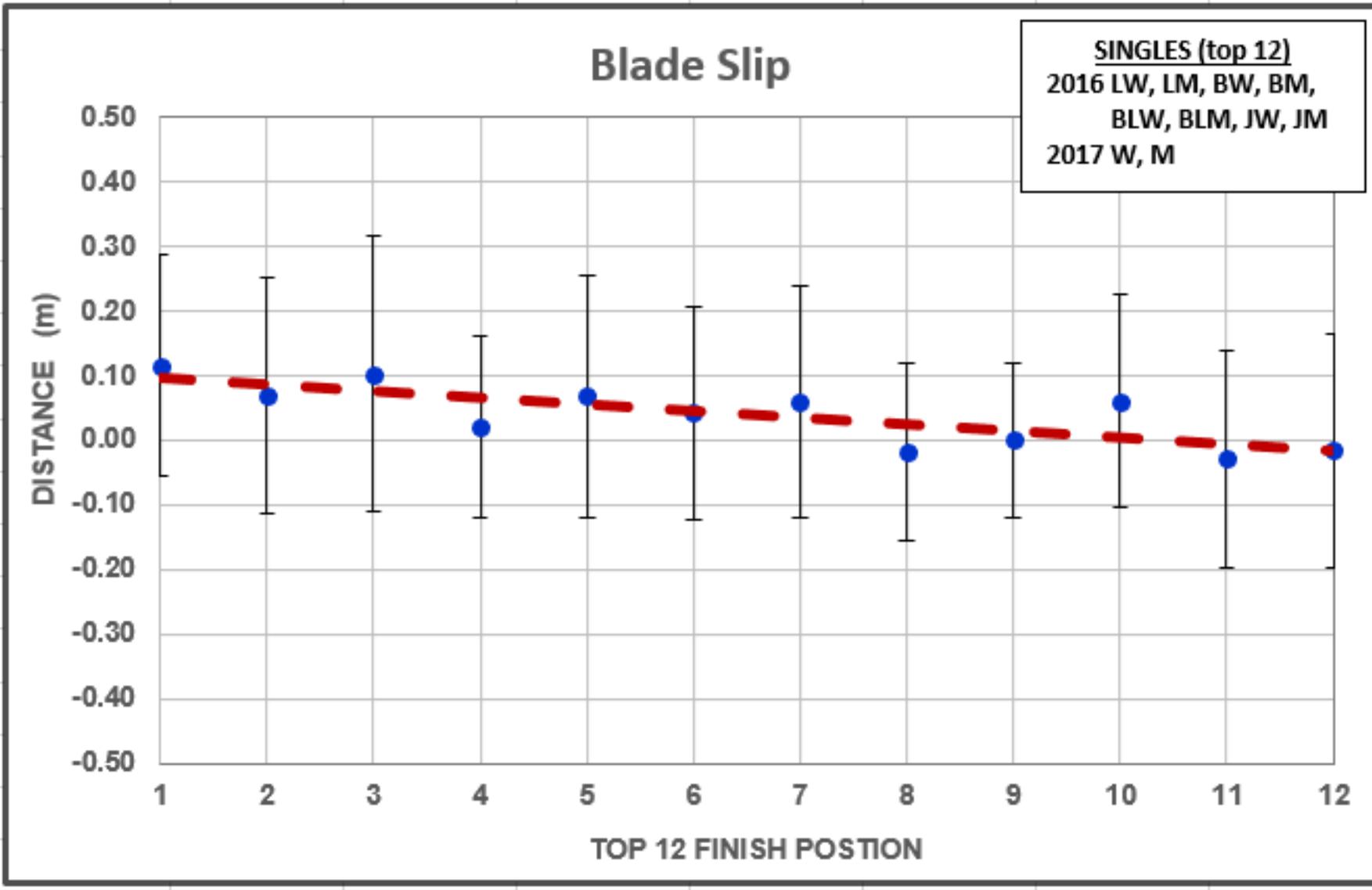
Blade Slip

SINGLES (top 12)
2016 LW, LM, BW, BM,
BLW, BLM, JW, JM



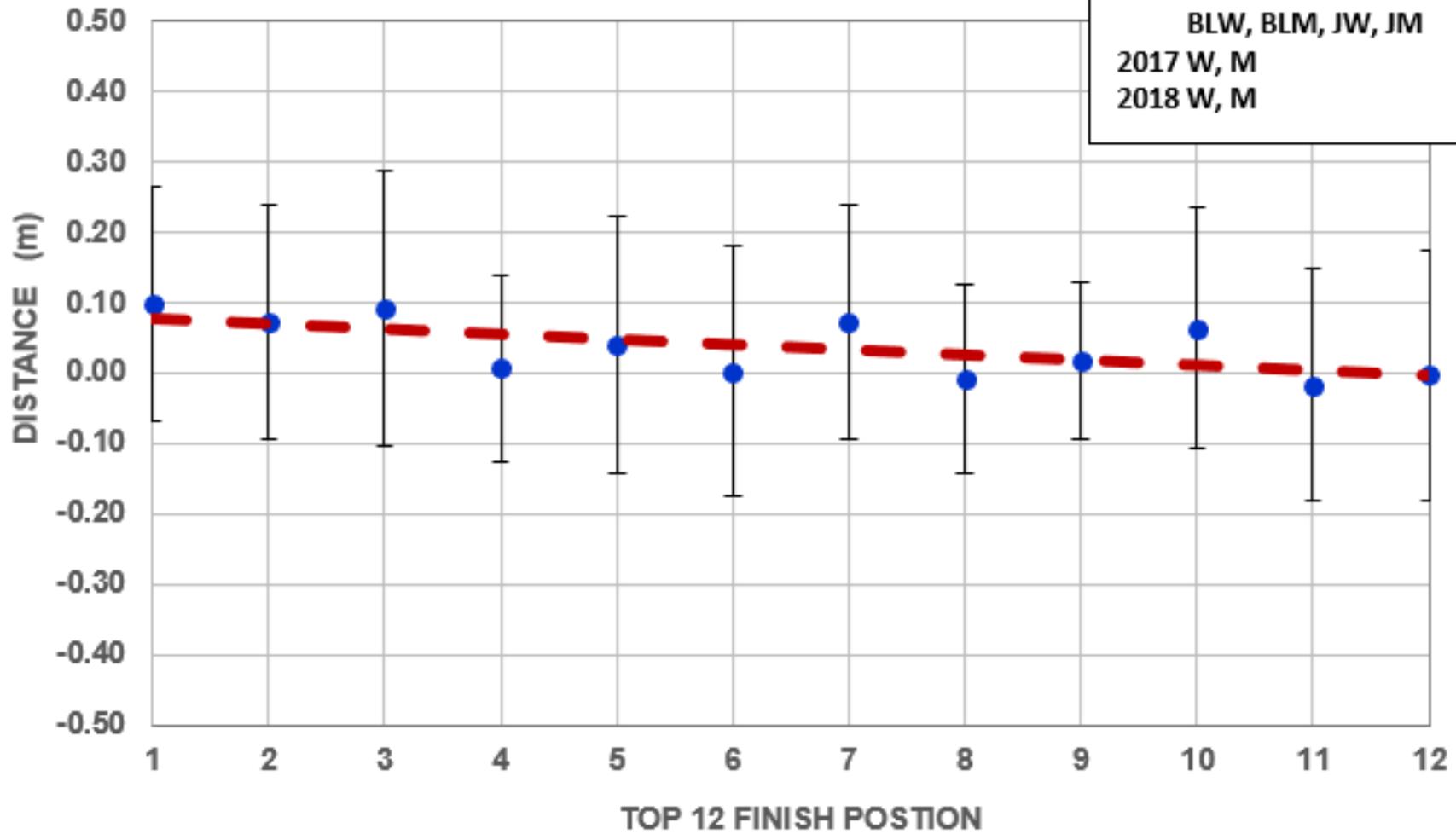
Blade Slip

SINGLES (top 12)
2016 LW, LM, BW, BM,
BLW, BLM, JW, JM
2017 W, M



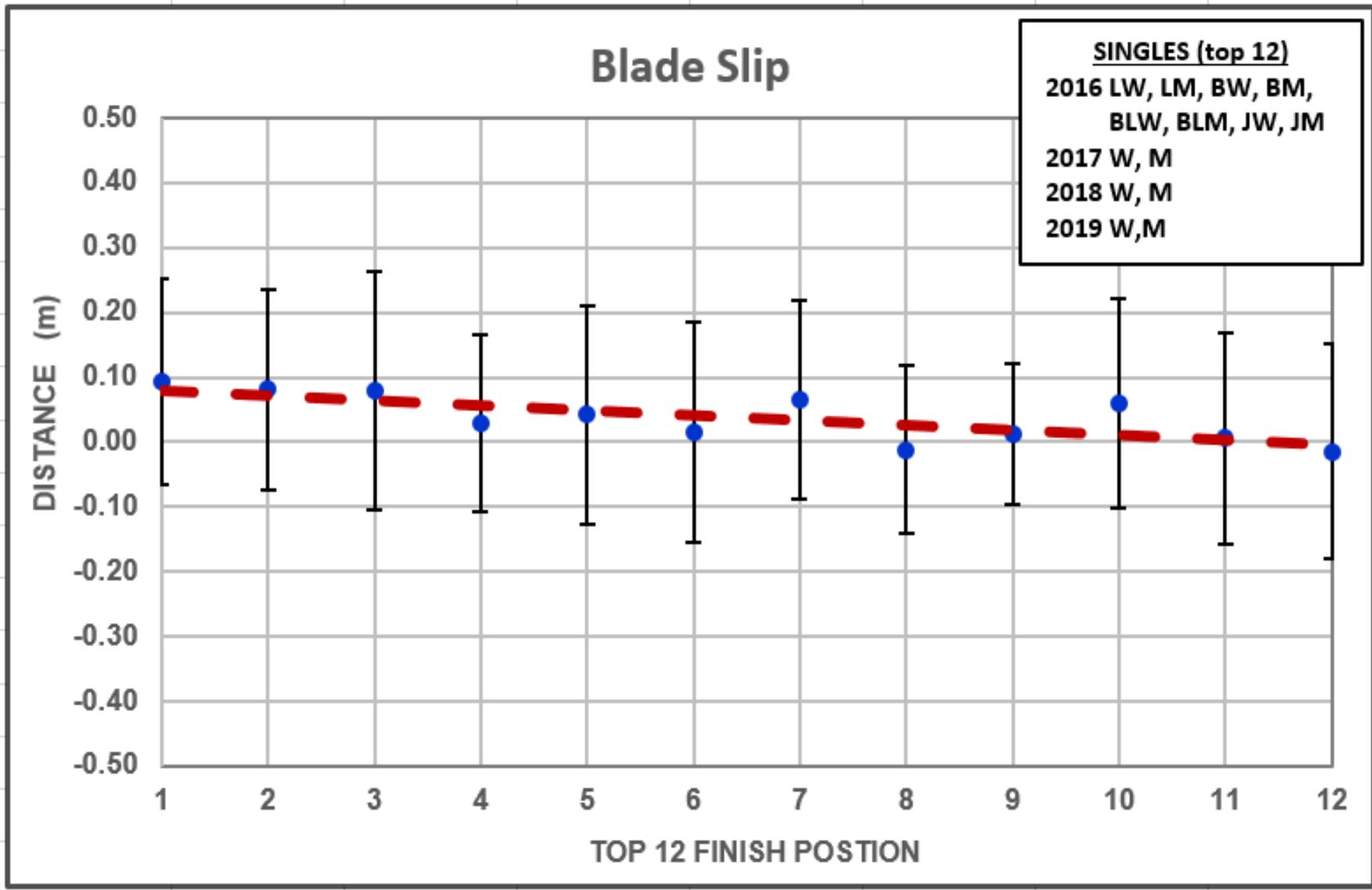
Blade Slip

SINGLES (top 12)
2016 LW, LM, BW, BM,
BLW, BLM, JW, JM
2017 W, M
2018 W, M



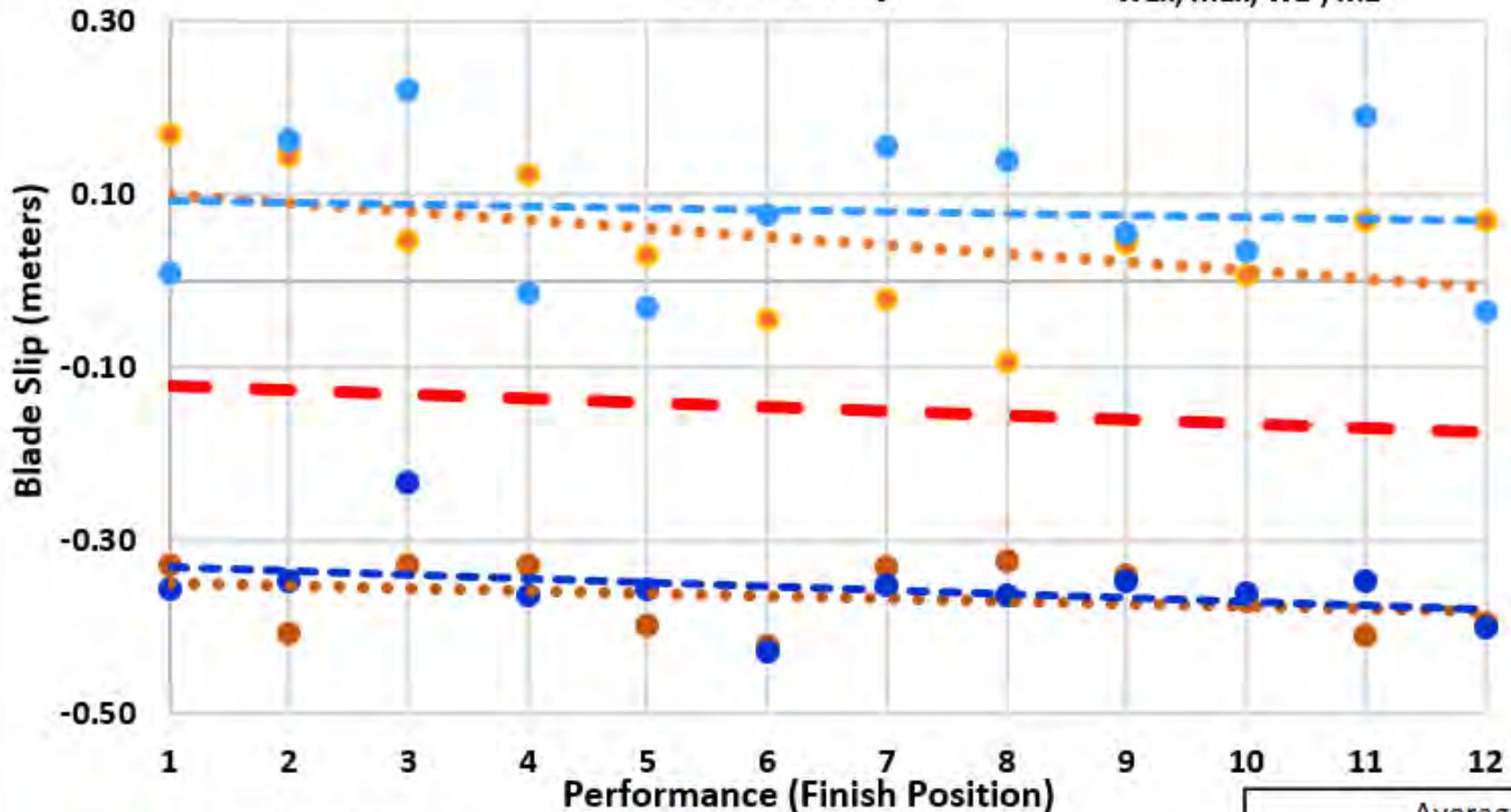
Blade Slip

SINGLES (top 12)
2016 LW, LM, BW, BM,
BLW, BLM, JW, JM
2017 W, M
2018 W, M
2019 W, M



Blade Slip

2017, 2018, 2019 World Champs
W1x, M1x, W2-, M2-



- Accumulated W1x
- Accumulated W2-
- Accumulated M1x
- Accumulated M2-
- - - Linear (Accumulated M1x)
- - - Linear (Accumulated W2-)
- - - Linear (Accumulated M2-)
- - - Linear (Average)

Average	
W1x	0.05
M1x	0.08
W2-	-0.36
M2-	-0.35

Factors Affecting Blade Slip

1. Rigging

- a) Oar angle of entry (catch)
- b) Rigging (outboard, span, blade area, inboard)
- c) Length of stroke

2. Rowing Technique

- a) Bladework (consistent blade depth)
- b) Boat speed
- c) Power application

3. Environmental Conditions

- a) Wind & water conditions
- b) Resistance on boat



Thank You

Questions/comments to:

purcerverance@gmail.com

Facebook group: ROWING PURCERVERANCE

Website: <https://Purcerverance.ca>