



# **LMU WBB**

## **CROSS-CONFERENCE LINEUP DATA ANALYSIS**

# LINEUP DATA - KEY METRICS



**POSSESSIONS** – the number of possessions (offensive and defensive)

**MINUTES** – cumulative minutes of the lineup

**PLUS MINUS** – points scored by lineup minus points allowed by lineups

**PLUS MINUS PER40** – a normalized version of plus minus to account for minutes played.

Formula is : (plus minus divided by minutes ) \* 40

**OFF RATING** – an estimate of points scored per 100 possessions

**DEF RATING** – an estimate of points allowed per 100 possessions

**NET RATING** – difference between off rating and def rating

LMU  
(Full Season)  
Lineup Data  
Snapshot

## TOP 3 PLAYED LINEUPS

	lineup	possessions	minutes	plusminus	plusminus_per40	netrating	offrating	defrating
0	BWIL-NEVA-ACLA-MHER-CHEI	496.9	317.6	-39	-4.9	-7.8	90.0	97.8
1	BWIL-NEVA-ZOGO-MHER-CHEI	310.7	188.9	-9	-1.9	-2.9	93.0	95.9
2	BWIL-NEVA-ACLA-ASIT-CHEI	122.0	69.6	-26	-14.9	-21.3	80.4	101.7

# LINEUP DATA

## TOP 10 PLAYED LINEUPS

	lineup	possessions	minutes	plusminus	plusminus_per40	netrating	offrating	defrating
0	BWIL-NEVA-ACLA-MHER-CHEI	496.9	317.6	-39	-4.9	-7.8	90.0	97.8
1	BWIL-NEVA-ZOGO-MHER-CHEI	310.7	188.9	-9	-1.9	-2.9	93.0	95.9
2	BWIL-NEVA-ACLA-ASIT-CHEI	122.0	69.6	-26	-14.9	-21.3	80.4	101.7
3	BWIL-NEVA-ACLA-MHER-ASIT	72.3	44.4	3	2.7	4.2	89.8	85.7
4	BWIL-NEVA-ZOGO-ASIT-CHEI	65.2	37.8	13	13.8	19.9	105.8	85.9
5	NEVA-ACLA-ZOGO-MHER-CHEI	57.7	33.7	-2	-2.4	-3.5	107.4	110.9
6	BWIL-NEVA-ZOGO-MHER-ASIT	55.7	31.9	-5	-6.3	-9.0	96.9	105.9
7	BWIL-NEVA-MHER-ASIT-CHEI	44.3	28.6	-3	-4.2	-6.8	85.8	92.5
8	BWIL-NEVA-ACLA-ZOGO-MHER	39.8	24.9	1	1.6	2.5	88.0	85.4
9	BWIL-NEVA-ACLA-AMAT-MHER	39.7	24.6	28	45.5	70.5	143.6	73.1

**BIG QUESTION:**  
**WHEN DO LINEUPS STABILIZE?**  
**HOW MANY MINUTES BEFORE WE CAN SAY**  
**WE'VE SEEN A LARGE-ENOUGH SAMPLE SIZE**  
**AND CAN TRUST WHAT THE NUMBERS ARE**  
**SAYING?**

**BIG QUESTION:  
WHEN DO LINEUPS STABILIZE?  
HOW MANY MINUTES BEFORE WE  
CAN SAY WE'VE SEEN A LARGE-  
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**TO ANSWER THIS,**

- **WE NEED TO ANALYZE LINEUP DATA ACROSS THE WCC AND ACROSS OTHER CONFERENCES TO FIND TRENDS.**
- **WE NEED TO ANALYZE LINE-UP DATA SEQUENTIALLY (I.E LOOK HOW HOW LINEUPS PROGRESS THROUGH THE SEASON)**

## **LINEUP DATA INTERVAL SET UP**

**THE DATA USED TO ANALYZE LINEUPS WAS PULLED FROM FOUR INTERVALS**

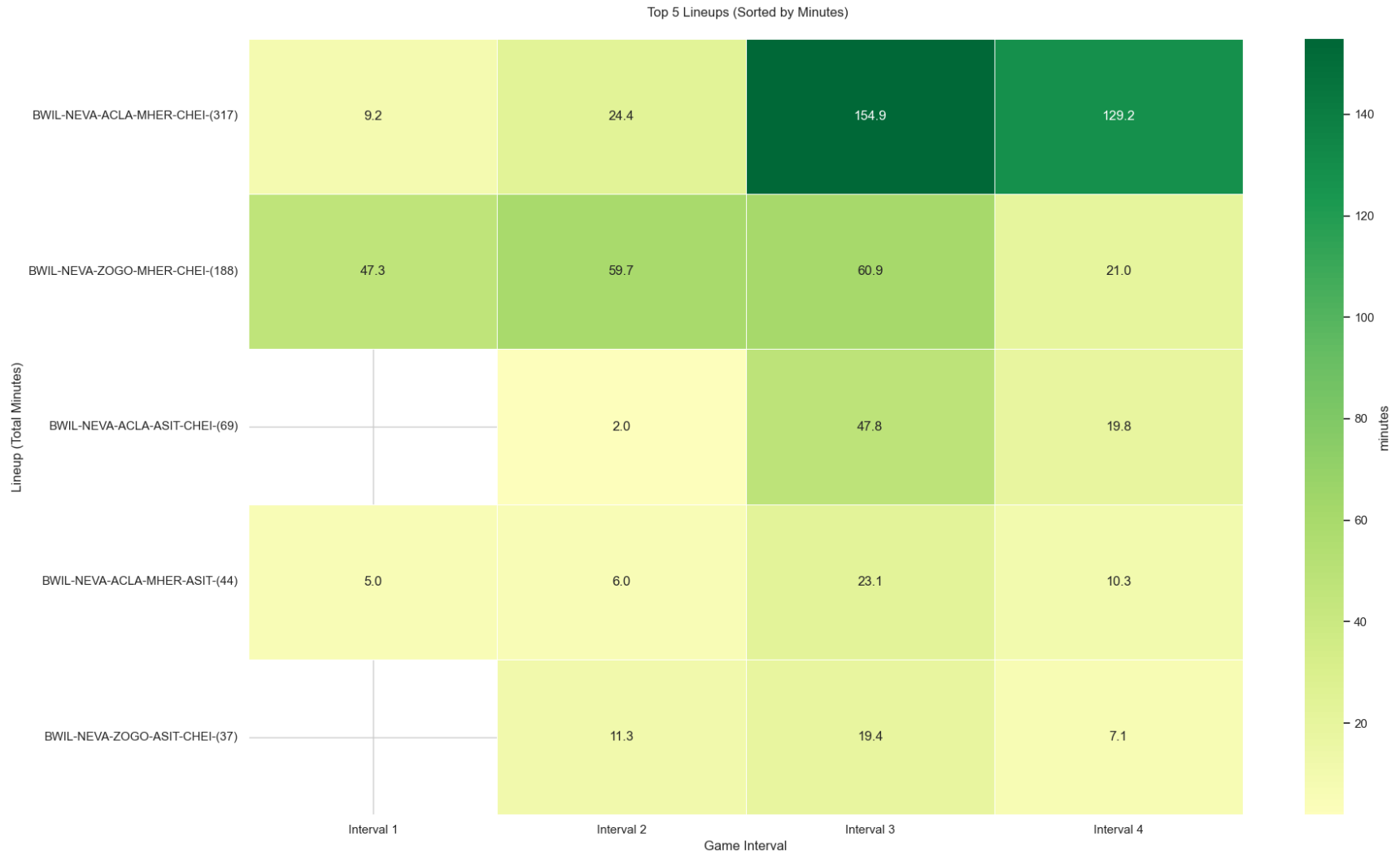
**INTERVAL 1 : START OF SEASON – DEC 15**

**INTERVAL 2 : DEC 16 – JAN 15**

**INTERVAL 3 : JAN 16 – FEB 15**

**INTERVAL 4 : FEB 16 – END OF SEASON**

## FOR EXAMPLE, THIS IS THE DISTRIBUTION OF MINUTES ACROSS OUR TOP 5 LINEUPS



**\*\*Note 155 min is a dataset max\*\***

MY FIRST ANALYSIS WAS ONLY THE WCC, BUT I EXPANDED THE ANALYSIS TO CONSIDER THE IVY AND MAC (TWO COMPARABLE CONFERENCES)

THESE ARE THE BEST (BY PLUSMINUS\_PER40) LINEUPS WITH AT LEAST 50 MINUTES PLAYED IN AN INTERVAL

	lineup	conference	team	interval_num	minutes	plusminus_per40
4605	HTUR-GAND-LCHA-SGLE-EROD	IVY	Harvard	3	68	44.4
6855	MMEE-AMAR-ESHE-MBUR-THUL	WCC	Portland	2	68	36.5
3823	MAVL-KHEN-RWEI-CCOL-SRAF	IVY	Columbia	3	54	24.6
6947	MMEE-AMAR-ESHE-MBUR-THUL	WCC	Portland	3	114	23.8
4991	ACHE-SBEL-OHUT-FTAL-PHIL	IVY	Princeton	1	56	23.6
6750	MMEE-AMAR-ESHE-MBUR-THUL	WCC	Portland	1	88	23.3
6315	AJAM-LSMI-SWAR-EELL-MRAD	WCC	Pacific	2	63	21.7
624	LFLE-AVEL-PKOH-EPOR-KMCG	MAC	Bowling Green	2	67	19.1
5990	BWIL-NEVA-ZOGO-MHER-CHEI	WCC	LMU (CA)	2	60	0.7

OUR “BEST” LINEUP WITH AT LEAST 50 MINUTES IN AN INTERVAL, WAS  
OUR STARTERS #2 FROM DEC 16-JAN 15

\*\*THIS ISN'T A TAKEAWAY, I'M JUST DEMONSTRATING WHAT THE INTERVAL DATA LOOKS LIKE\*\*

# ON AVERAGE, HOW MANY LINEUPS PLAY MORE THAN 50 TOTAL MINUTES FOR EACH TEAM??

	team	num_lineups_over_50
29	Western Mich.	1
11	Harvard	1
30	Yale	2
14	Miami (OH)	2
5	Central Mich.	2
16	Ohio	3
13	LMU (CA)	3
12	Kent St.	3
22	Princeton	3

10	Gonzaga	5
6	Columbia	5
1	Ball St.	5
28	Washington St.	5
15	NIU	6
7	Cornell	7
4	Buffalo	7
26	Santa Clara	8

On the lower end, Western Mich. and Harvard only had **ONE** lineup play more than 50 minutes!

On the upper end, Santa Clara had 8 lineups play more than 50 total minutes.

On average, teams have 3.9 lineups play more than 50 minutes. LMU had 3.



# HOW DO WE MEASURE LINEUP STABILITY?



Our key metrics are PlusMinus\_per40 and minutes played. We have this information for each interval. PlusMinus\_per40 will be abbreviated as PM\_p40.

We can say a lineup has stabilized once the change in PM\_p40 between time intervals is small enough.

Essentially, we want to find: how many minutes a lineup needs to play before the change in PM\_p40 is “small enough” and the change in minutes (between intervals) is “big enough”

# LINEUP STABILITY

Note that the thresholds (the numbers that determine “small enough” and “big enough”) are arbitrary and customizable.

Let's just assume, I correctly handled the math.

Note that there are 2200 lineups in this dataset.

I found that lineups (based on median) typically stabilize after 50 minutes. Of the 2200 lineups in the dataset, only 38% stabilized (with particular thresholds [see appendix]).

## What does this mean??

It means, that if we want to trust lineup data, we need them to have played a minimum of 50 minutes.

For lineups that stabilized after 50 minutes, the mean difference between its `stabilized_plusminus_per40` (the `PM_p40` value when it stabilized) and the `PM_p40` value at the end of the season was -0.53. This means that once a lineup stabilized, it didn't change much through the end of the season [see appendix for more detail].

# ANOTHER MEASURE OF LINEUP STABILITY

=== IVY/MAC/WCC Conference Insights ===

1. Lineups typically stabilize after 50 minutes  
- Median coefficient of variation: 1.17

2. Teams by lineup stability (lower CV is better):

team	
Princeton	0.80
San Francisco	1.01
Buffalo	1.07
Harvard	1.10
San Diego	1.15
Bowling Green	1.19
NIU	1.22
Miami (OH)	1.26
Ohio	1.28
Cornell	1.31
Dartmouth	1.36
Akron	1.38
Yale	1.53
Eastern Mich.	1.54
Saint Mary's (CA)	1.57
Gonzaga	1.60
Santa Clara	1.71
Columbia	1.73

...

3. Evaluation guidelines:

- <50 minutes: Insufficient sample
- 50-100 minutes: Preliminary assessment
- 100+ minutes: Reliable evaluation

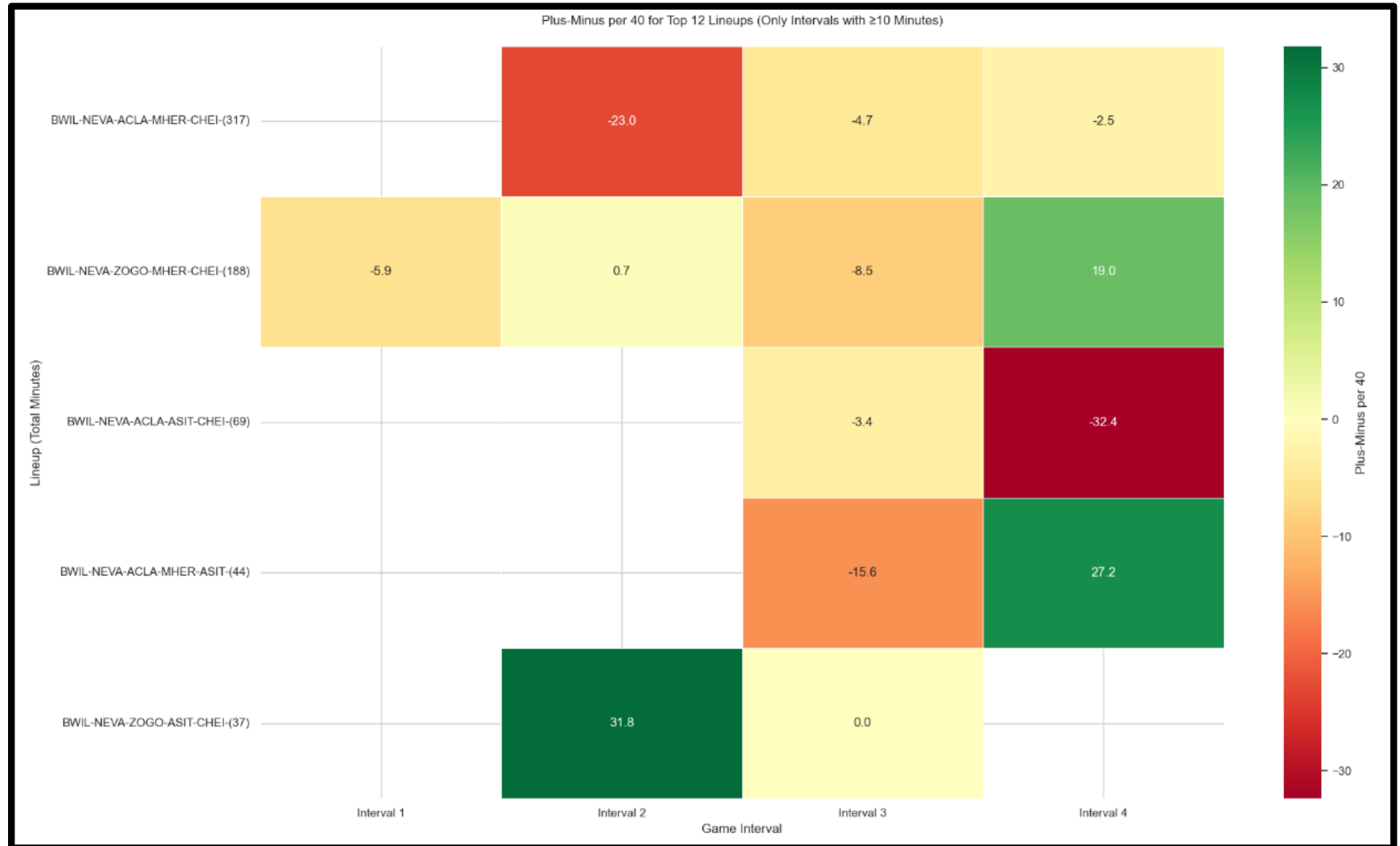
Correlation of Variation (CV) is a way to measure variability. I.e how much a lineup's PM\_p40 changes throughout the season.

The formula for CV is  $CV = (\text{standard deviation}) / (\text{mean})$  [where stdev and mean are weighted by minutes, see appendix].

The teams on the left, experienced the most lineup consistency throughout the four time intervals. LMU has a CV value of 2.32 which is the 4<sup>th</sup> highest in this dataset (not good).

# WHAT CAN WE DO WITH THIS DATA?

CONSIDER THIS CHART WHICH DISPLAYS PM\_P40 FOR OUR TOP 5 MOST PLAYED LINEUPS.



# WHAT CAN WE DO WITH THIS DATA?

One of our thresholds in determining stability was that the difference in minutes played between intervals had to be at least 10.

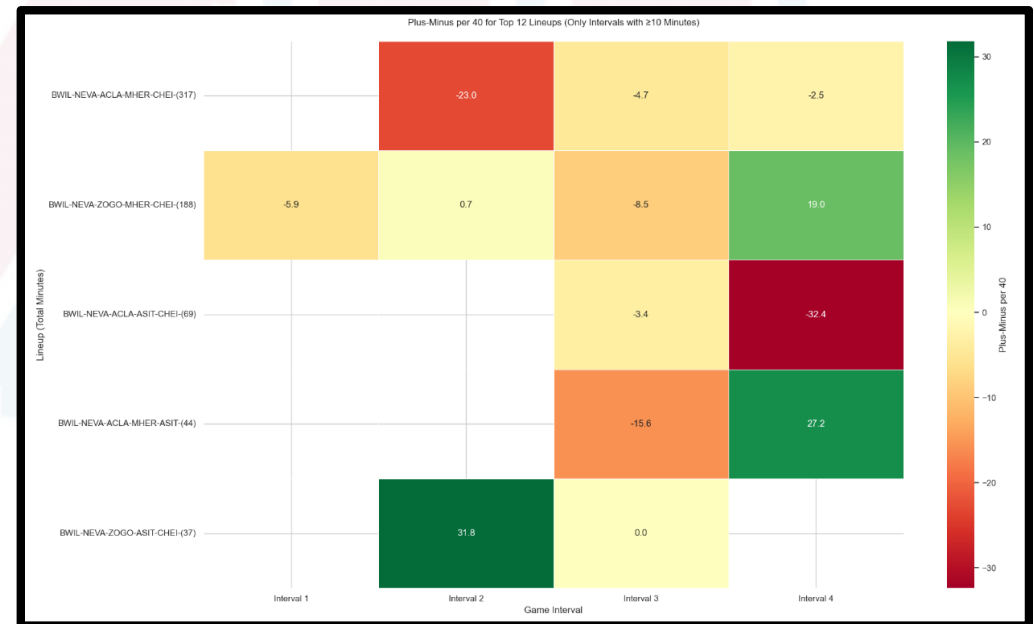
So let's look at our lineups that met that criteria.

If we look at Starters # 1 (AC), we see that the lineup stabilizes from interval 3 to interval 4. Meaning, after Feb 15, this lineup not only met the minimum minutes requirement, but the change in PM\_p40 was consistent.

The only other lineup to stabilize was Starters #2 (ZO). From Nov4 – Jan 15, this lineup reaches the minimum minutes requirement and the change in PM\_p40 is small enough.

Lineup # 3 played at least 50 minutes but the PM\_p40 did not stabilize.

Our other lineups didn't play more than 50 min total and only played at least 10 minutes in 2 intervals.



# LAST VISUALIZATION [JUST OUT OF CURIOSITY] 2-PLAYER COMBOS

OUR BEST TWO-PLAYER COMBO IS AC+ZO WITH A PM\_P40 OF -0.7. FOLLOWED BY AC+MH.

OUR WORST TWO-PLAYER COMBOS ARE AC+CH, BW+CH, AND NE+CH.

MH CONSISTENTLY HAS THE BEST PM\_P40 WITH HER TEAMMATES.

	player1	player2	plusminus	minutes	plusminus_p40
15	BWIL	NEVA	-54	800	-2.7
13	BWIL	MHER	-17	679	-1.0
12	BWIL	CHEI	-81	674	-4.8
8	BWIL	ACLA	-33	482	-2.7
16	BWIL	ZOGO	-24	297	-3.2
26	NEVA	MHER	-19	713	-1.1
25	NEVA	CHEI	-83	708	-4.7
21	NEVA	ACLA	-35	516	-2.7
28	NEVA	ZOGO	-26	331	-3.1
3	ACLA	MHER	-9	446	-0.8
2	ACLA	CHEI	-67	422	-6.3
4	ACLA	ZOGO	-1	59	-0.7
18	MHER	CHEI	-46	587	-3.1
32	ZOGO	MHER	-15	280	-2.1
31	ZOGO	CHEI	-22	274	-3.2

## TO SUMMARIZE

LET'S ASSUME WE CARE ABOUT PLUS MINUS PER 40. AT THE END OF THE DAY, BASKETBALL IS WON BY SCORING MORE POINTS THAN YOUR OPPONENT IN 40 MINUTES. LET'S TAKE THIS METRIC AS OUR GOLD STANDARD.

THIS DATA ANALYSIS CONFIRMS THAT THE MINIMUM SAMPLE SIZE FOR LINEUP DATA IS 50 MINUTES (with certain thresholds [see appendix]).

NEXT SEASON, WE WILL HAVE MORE VARIABILITY IN OUR LINEUPS, SO WE WILL HAVE MORE THAN 3 LINEUPS HIT THE 50-MINUTE MARK. BUT, THAT ALSO MEANS THAT IT IS GOING TO TAKE LONGER FOR OUR LINEUPS, TO HIT THAT MARK.

THE SOLUTION, BREAK DOWN OUR GAME DATA INTO INTERVALS. AFTER DEC 15, WE CAN START WITH 3 GAME INTERVALS. THIS IS ABOUT HALF THE GAMES IN A MONTH. OUR MINIMUM MINUTES THRESHOLD SHOULD BE ABOUT 20-25 MINUTES, AND OUR THRESHOLD BETWEEN INTERVALS WILL BE 5 MINUTES.

THIS WILL GIVE US ADEQUATE SAMPLE SIZE AND THE ABILITY TO ANALYZE HOW OUR LINEUPS ARE PROGRESSING.

LASTLY, IF WE STRUGGLE WITH SAMPLE SIZE DUE TO VARIABILITY IN LINEUP/ROTATIONS, THEN WE COULD CONSIDER PLACING A HIGHER VALUE ON TAKEAWAYS FROM 2-PLAYER COMBOS.