

Formula 1 Analytics

RAFAEL COELHO



THIS PROJECT WAS BUILT WITH THE FOLLOWING TOOLS:



STREAMLIT



PANDAS



NUMPY



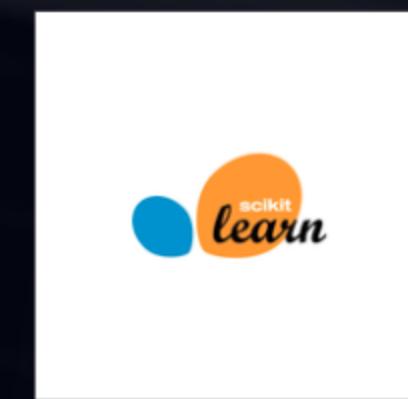
PLOTLY



UMAP



PYTHON



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FastF1 | Streamfy | Matplotlib

Formula 1 Analytics is a portfolio project developed by taking historical data from all Formula 1 seasons, since 1950. You can take some important informations about the most important motorsport in the world.

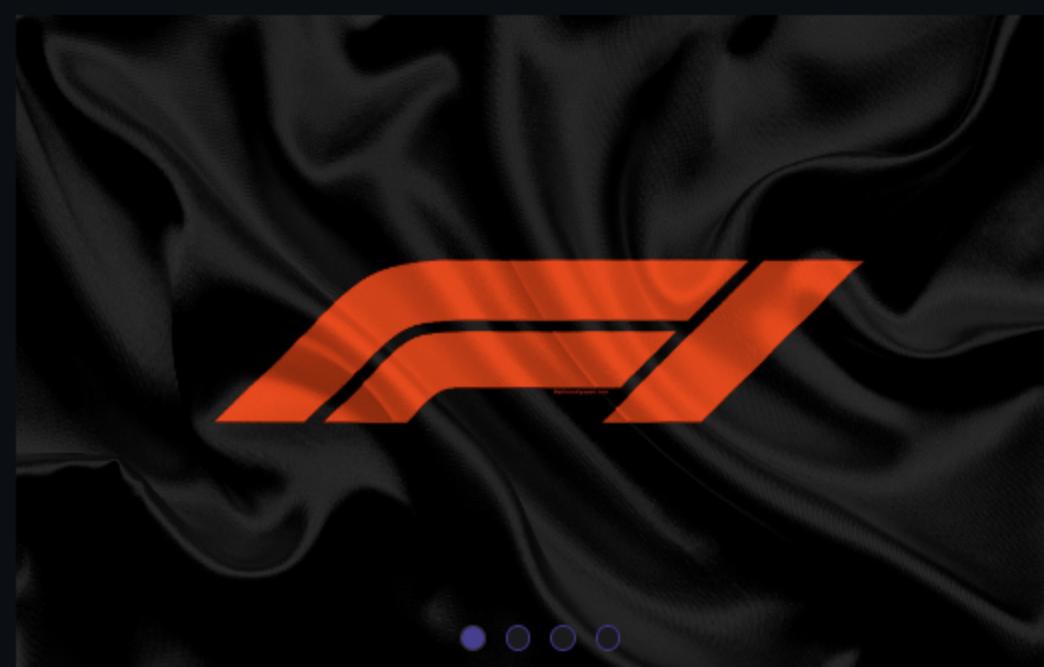
This tool has the following features:

OVERVIEW: Dive into F1's storied history, circuits, and legendary drivers. A rich tapestry of data awaits!

INSIGHTS: Delve into detailed track performance, constructor strategies, and driver skills. It's where data tells the story of speed and strategy.

SEASONS: Experience each F1 season with in-depth analyses. From telemetry data to lap analysis, get closer to the action.

AI SPACE: The future of F1 analytics is here! Combining advanced ML with vast datasets for revolutionary insights and predictions.



Formula 1 Analytics

Formula 1 Analytics

Author: Rafael Silva Coelho

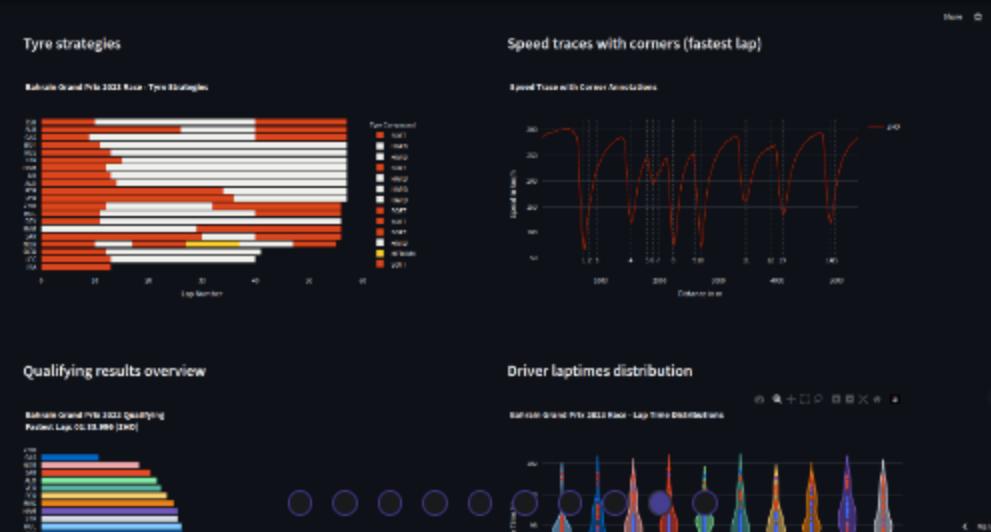
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Insights

Seasons

AI Space

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OVERVIEW

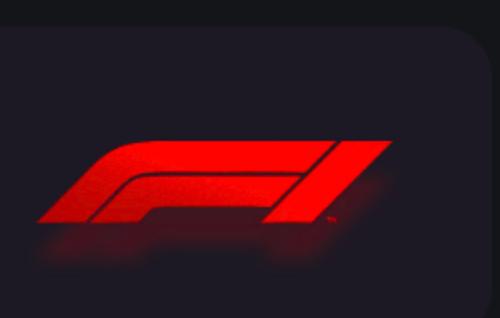
Dive into the heart of Formula 1 racing with our comprehensive Overview section. Here, you'll find a rich collection of data covering every aspect of the sport's storied history. Explore detailed information about the iconic circuits where history was made, learn about the constructors who engineered cutting-edge racing machines, delve into the profiles of legendary drivers who have become household names, and revisit every race that has contributed to the legacy of Formula 1. This section is your gateway to understanding the evolution and grandeur of one of the most thrilling sports in the world.

INSIGHTS

The Insights section is a treasure trove for Formula 1 enthusiasts and statisticians alike. Here, we delve deeper into the analytics of the sport, offering specific and detailed data about circuits, constructors, drivers, and champions. Whether you're looking for intricate details about track performance, constructor strategies, driver skills, or championship journeys, this section provides a wealth of data, enabling a deeper understanding and appreciation of the finer nuances of Formula 1 racing. It's perfect for those who love to analyze and uncover patterns and stories behind the numbers.

SEASONS

Formula 1 Analytics | Overview



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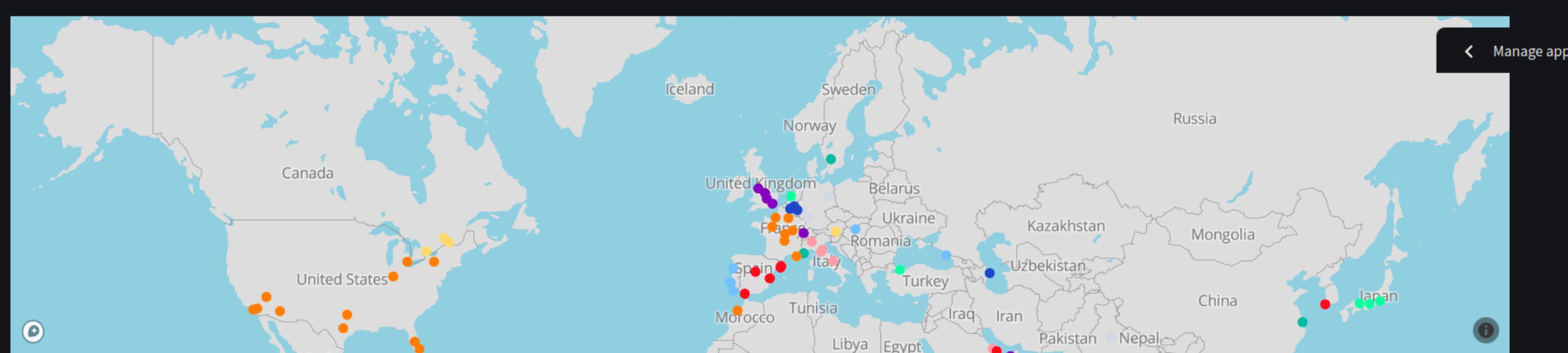
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Circuits

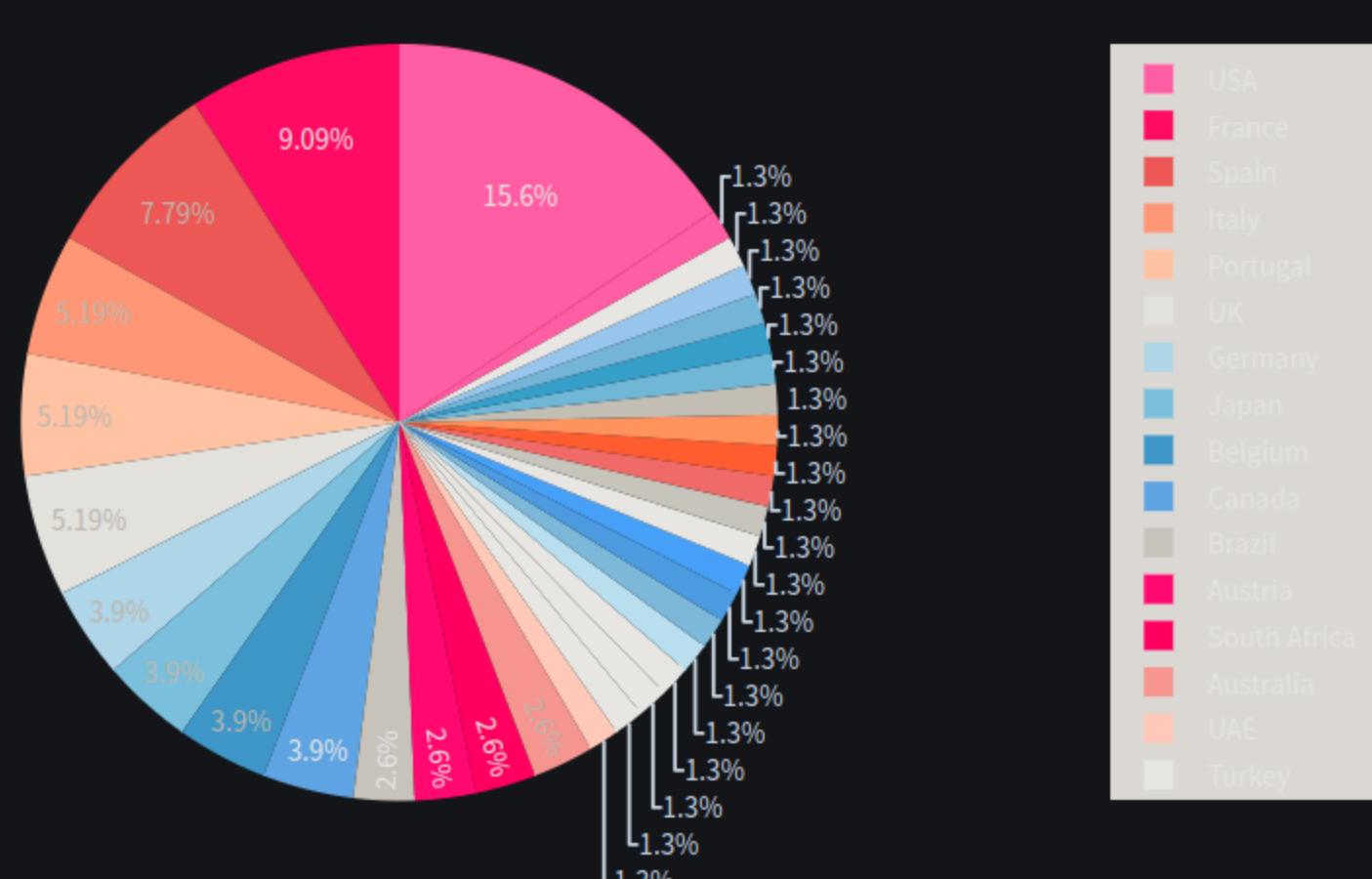
All circuits used by Formula 1 (1950-2023)



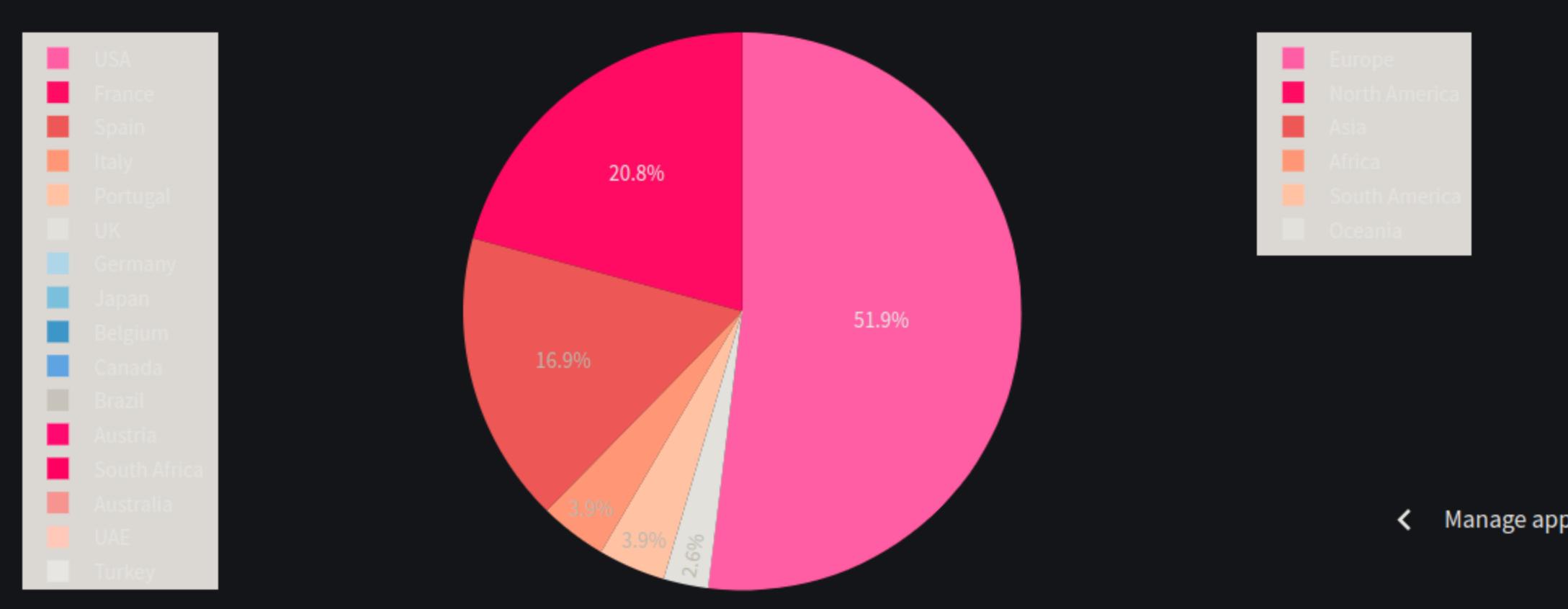
Amount of F1 circuits by country (1950-2023)



Percentage of circuits by country (1950-2023)



Percentage of circuits by continent (1950-2023)



Formula 1 Analytics | Overview



Author: Rafael Silva Coelho

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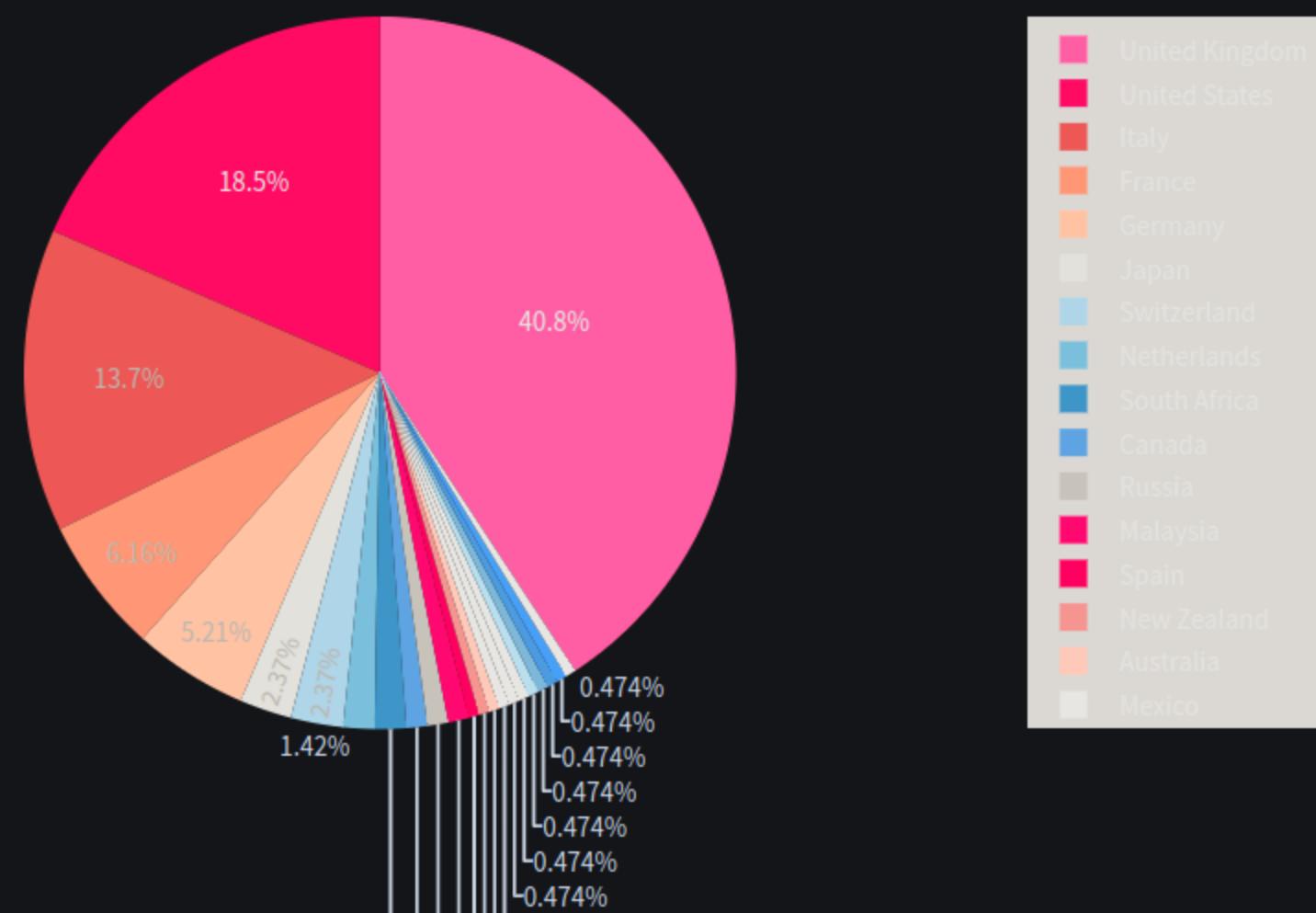
Circuits Constructors Drivers Races

Constructors

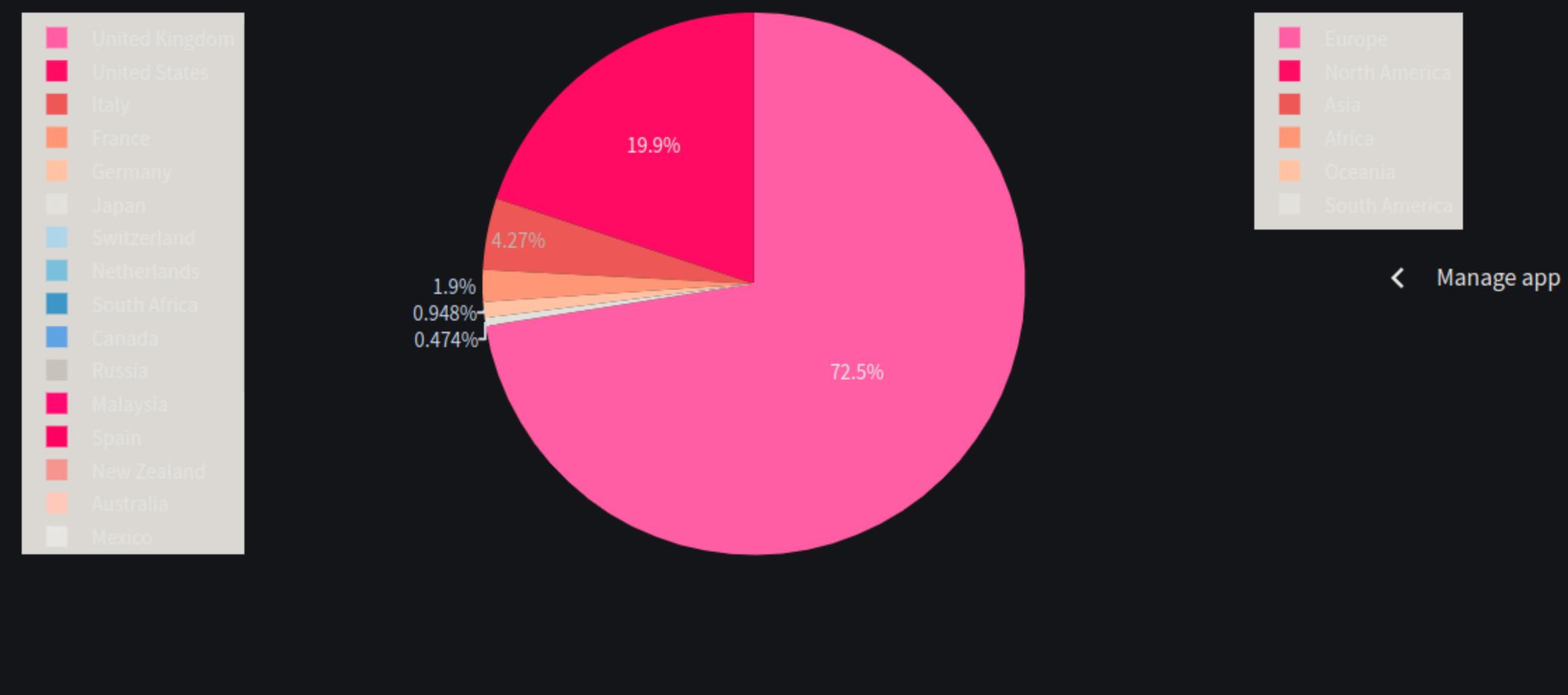
Amount of constructors by country (1950-2023)



Percentage of constructors by country (1950-2023)



Percentage of constructors by continent (1950-2023)



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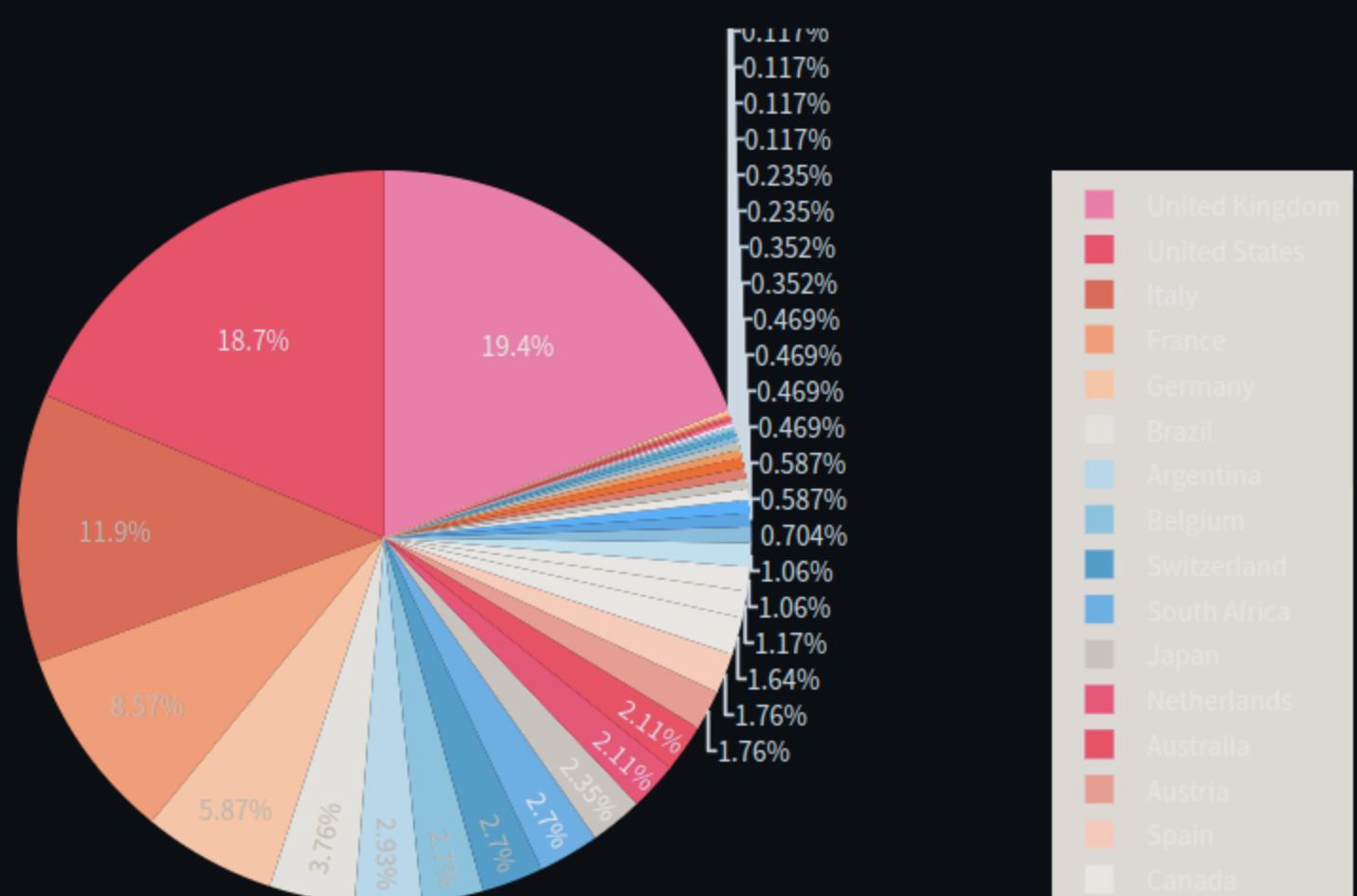
Circuits Constructors Drivers Races

Drivers

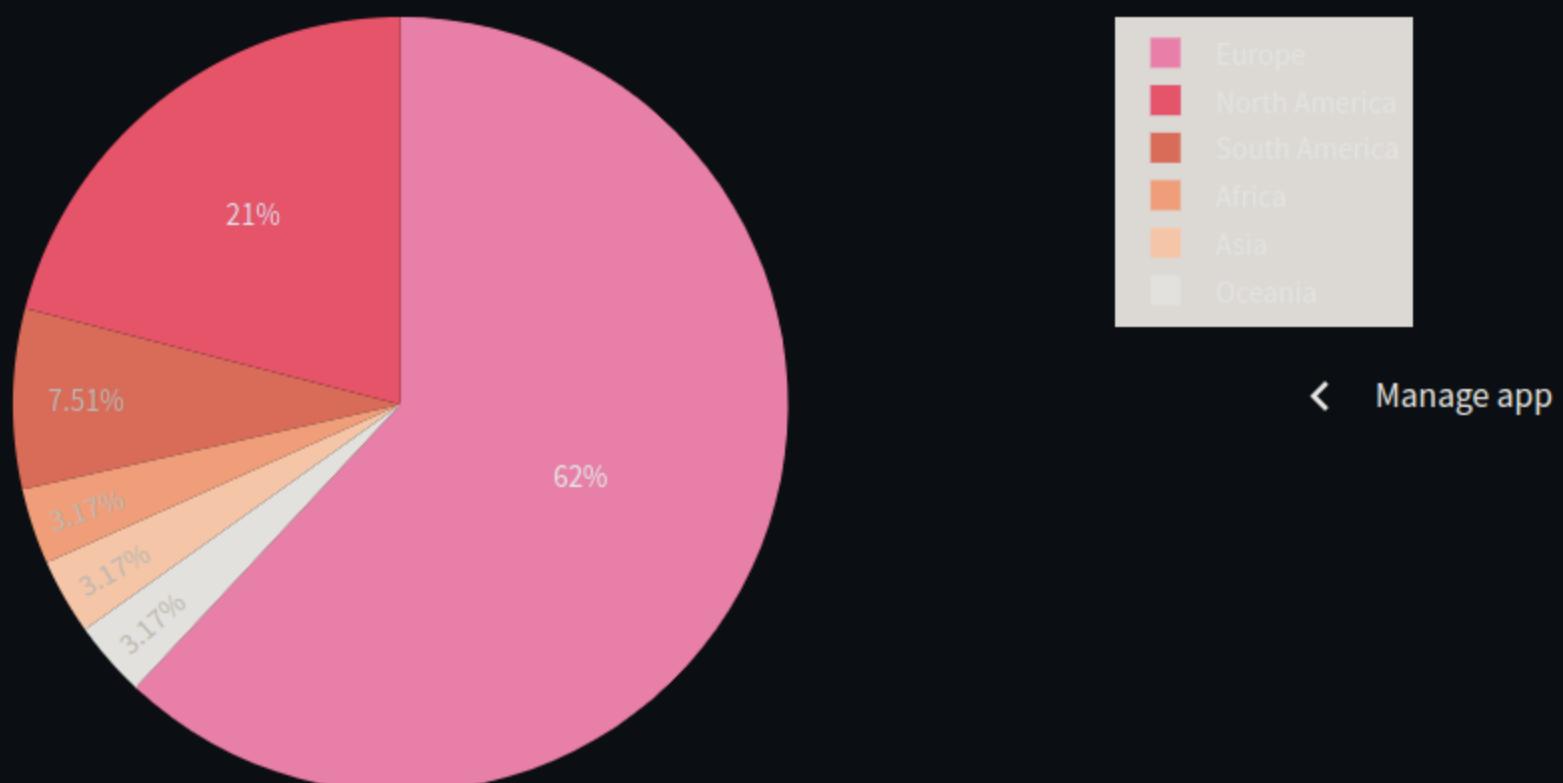
Amount of drivers by country (1950-2023)



Percentage of drivers by country (1950-2023)



Percentage of drivers by continent (1950-2023)



About the drivers

Country

Choose an option

Continent

Choose an option

	Country	Continent	Name	Number	Code	Date of birth	Age		URL (about the driver)
0	United Kingdom	Europe	Lewis Hamilton	44	HAM	1985-01-07	38	http://en.wikipedia.org/wiki/Lewis_Hamilton	
1	Germany	Europe	Nick Heidfeld	\N	HEI	1977-05-10	46	http://en.wikipedia.org/wiki/Nick_Heidfeld	
2	Germany	Europe	Nico Rosberg	6	ROS	1985-06-27	38	http://en.wikipedia.org/wiki/Nico_Rosberg	
3	Spain	Europe	Fernando Alonso	14	ALO	1981-07-29	42	http://en.wikipedia.org/wiki/Fernando_Alonso	
4	Finland	Europe	Heikki Kovalainen	\N	KOV	1981-10-19	42	http://en.wikipedia.org/wiki/Heikki_Kovalainen	

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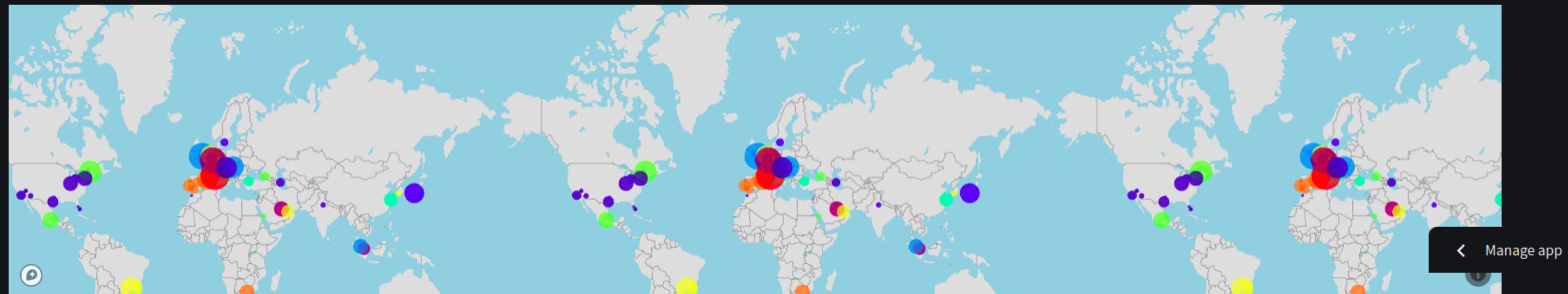
Circuits Constructors Drivers **Races**

Races

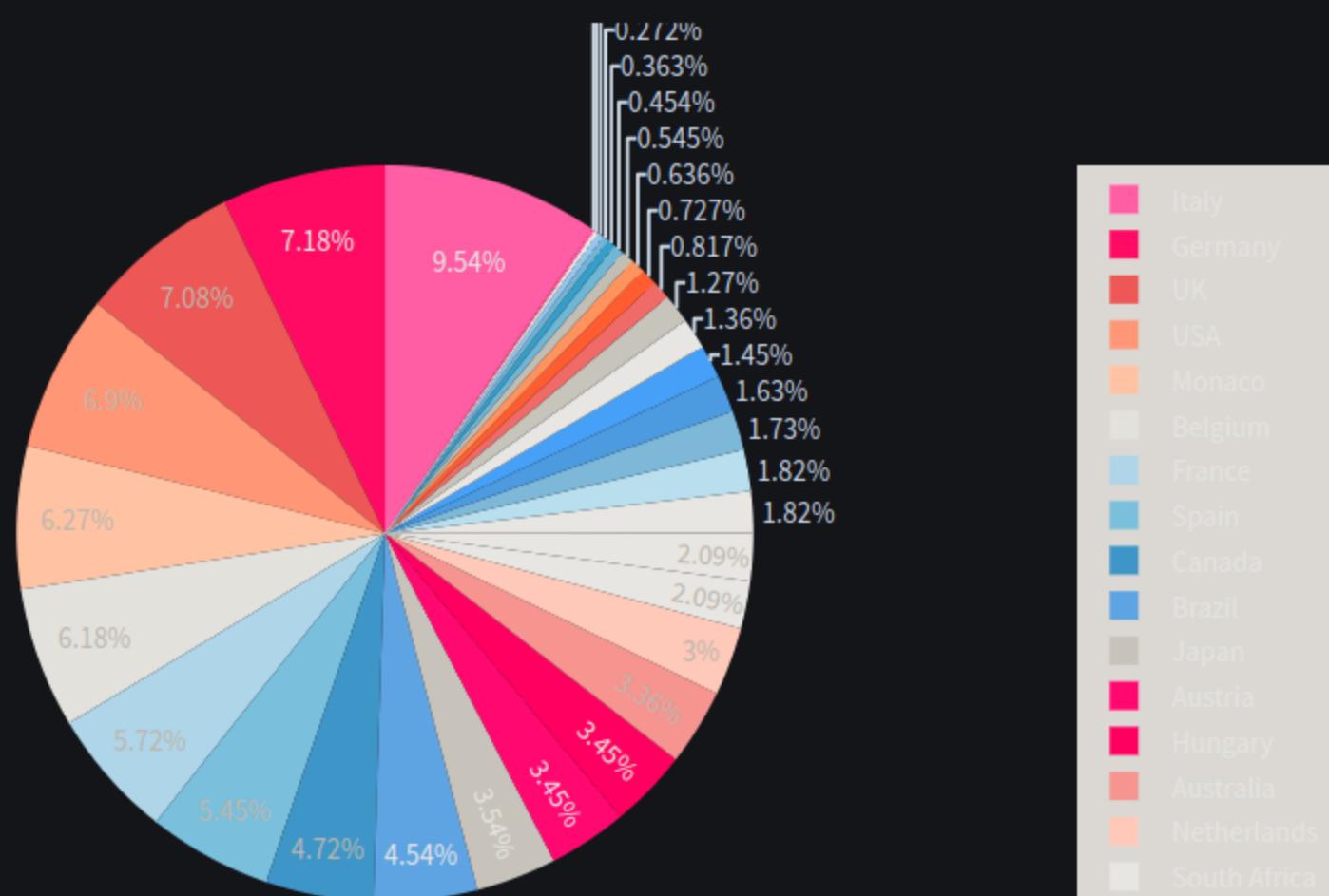
Amount of races by country (1950-2023)



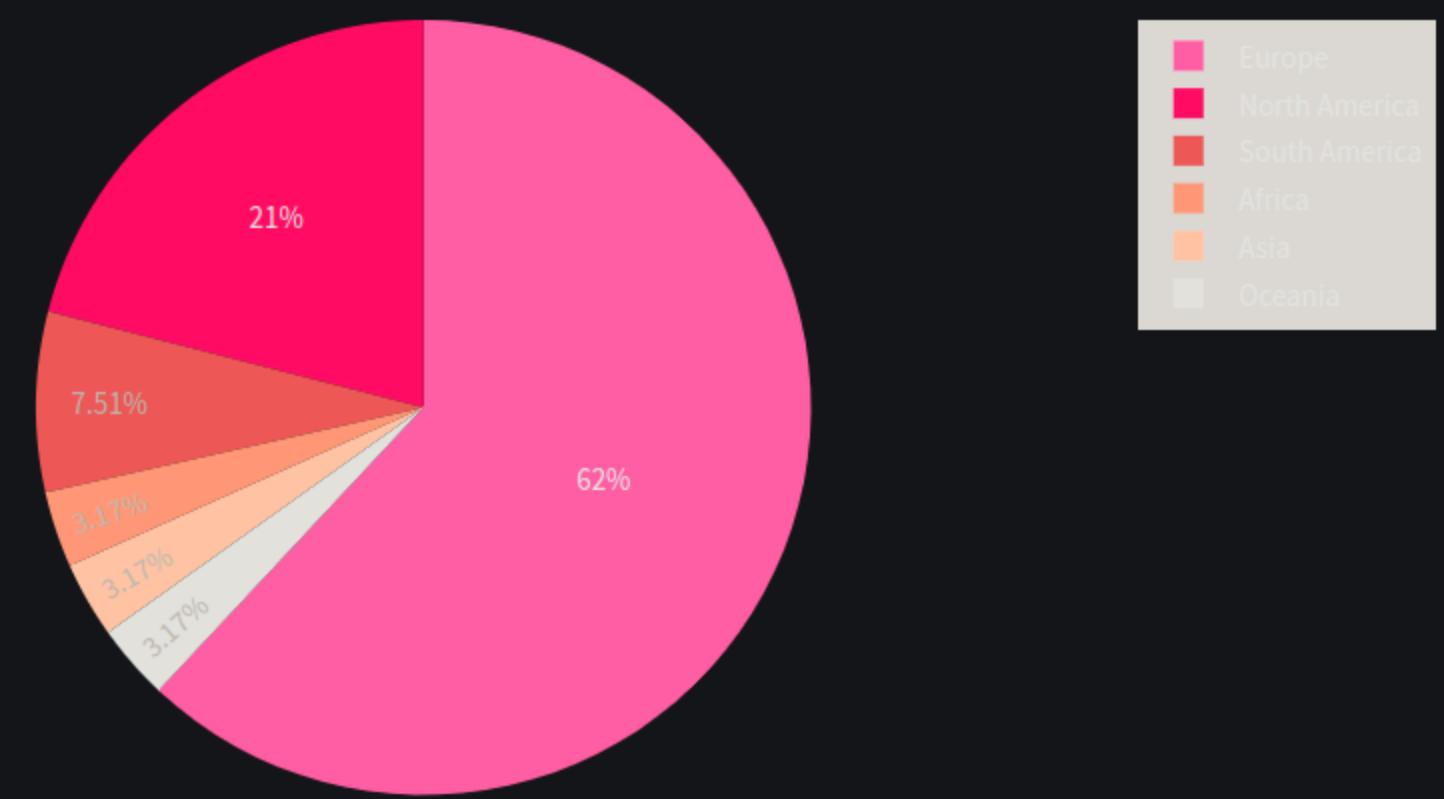
Amount of races by circuit (1950-2023)



Percentage of races by country (1950-2023)

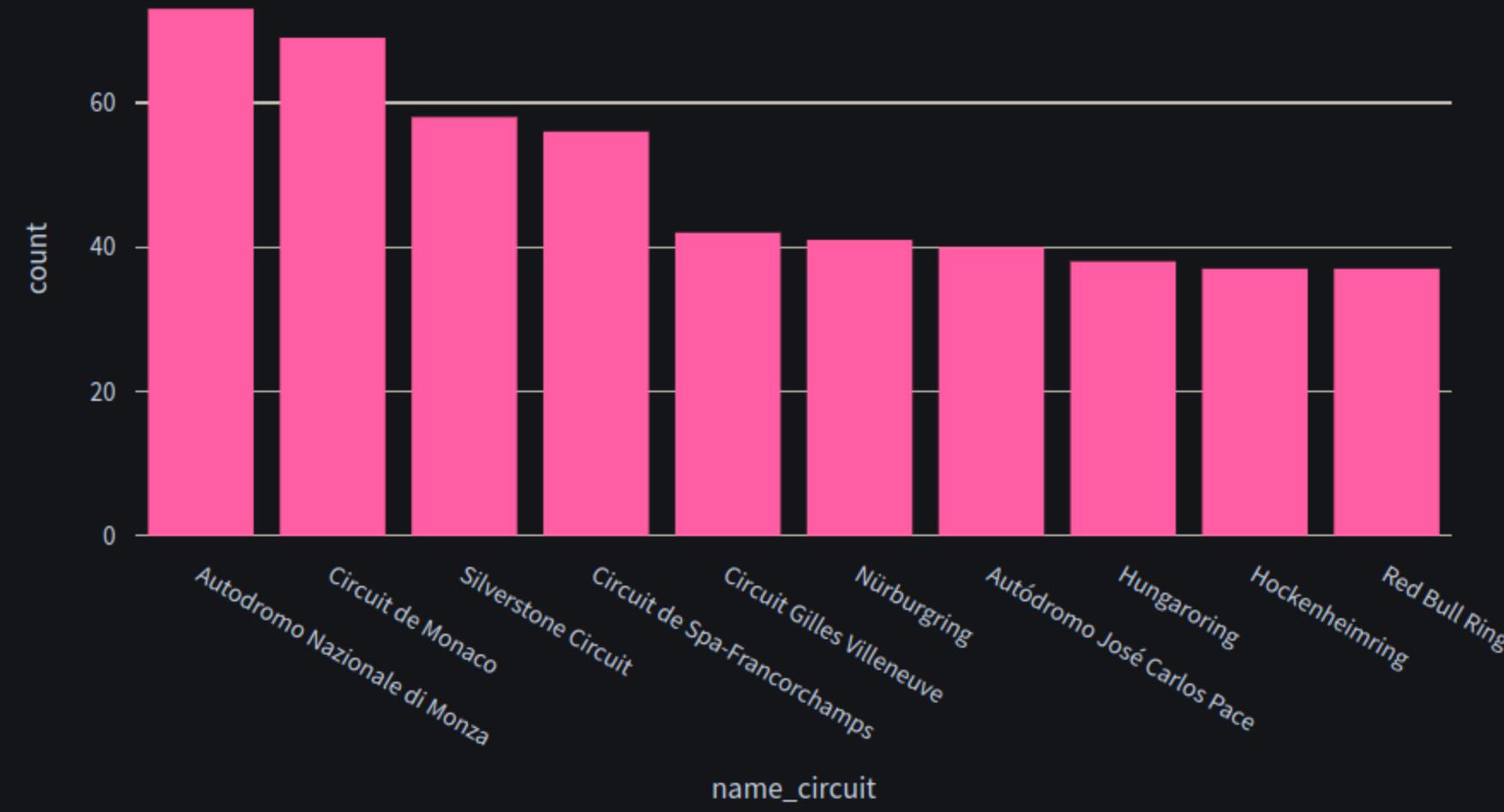


Percentage of races by continent (1950-2023)

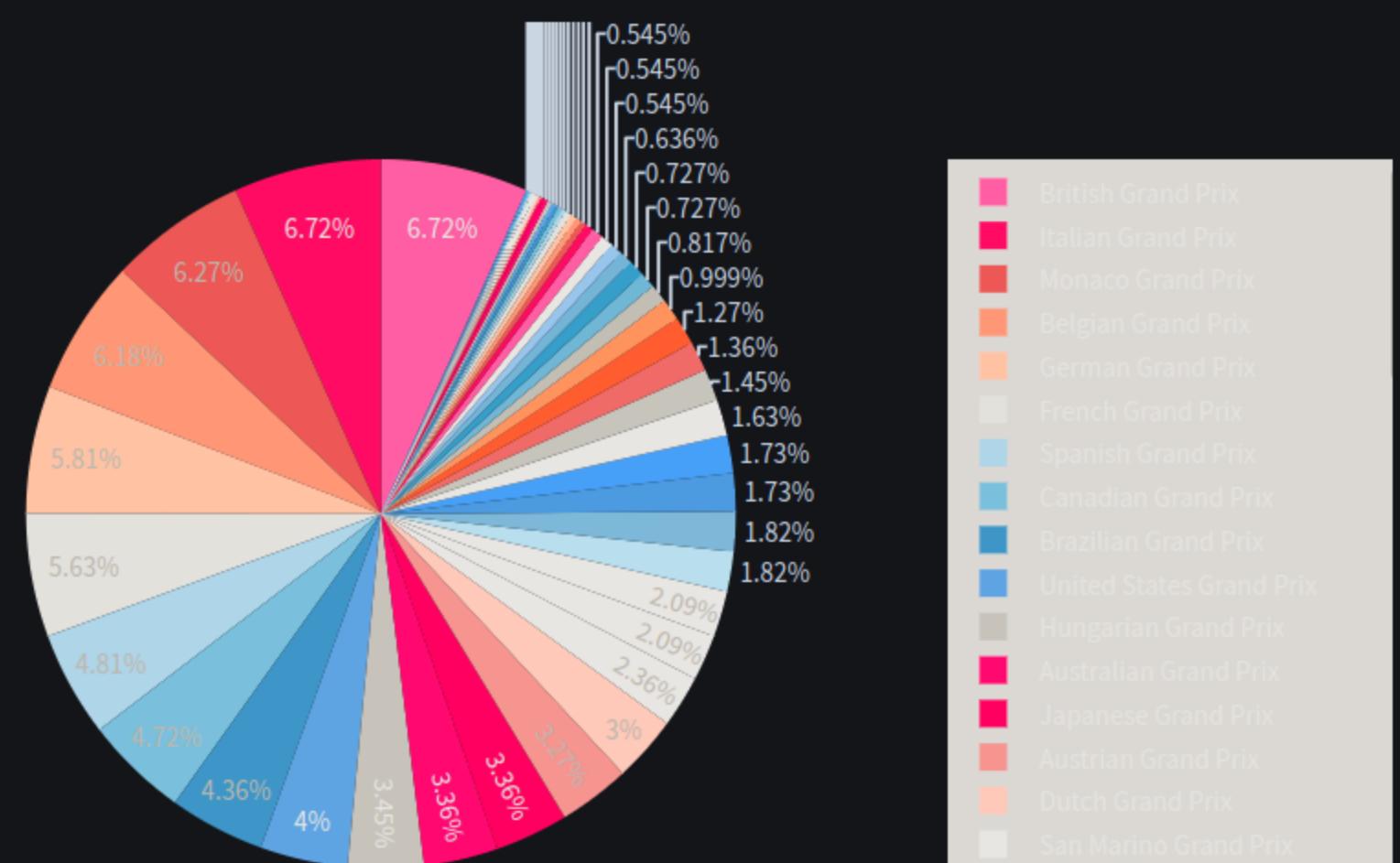


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Top 10 Races (1950 - 2023)



Percentage of Grand Prix (1950-2023)



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About the races

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	Grand Prix	Year	Date	Circuit	Location	Country	Continent	About (Race)
0	Abu Dhabi Grand Prix	2023	2023-11-26	Yas Marina Circuit	Abu Dhabi	UAE	Asia	https://en.wikipedia.org/wiki/2023_Abu_Dhabi_Grand_Prix
1	Las Vegas Grand Prix	2023	2023-11-19	Las Vegas Strip Street Circuit	Las Vegas	USA	North America	https://en.wikipedia.org/wiki/2023_Las_Vegas_Grand_Prix
2	São Paulo Grand Prix	2023	2023-11-05	Autódromo José Carlos Pace	São Paulo	Brazil	South America	https://en.wikipedia.org/wiki/2023_S%C3%A3o_Paulo_Grand_Prix
3	Mexico City Grand Prix	2023	2023-10-29	Autódromo Hermanos Rodríguez	Mexico City	Mexico	North America	https://en.wikipedia.org/wiki/2023_Mexico_City_Grand_Prix
4	United States Grand Prix	2023	2023-10-22	Circuit of the Americas	Austin	USA	North America	https://en.wikipedia.org/wiki/2023_United_States_Grand_Prix
5	Qatar Grand Prix	2023	2023-	Losail International	Al Daaven	Qatar	Asia	https://en.wikipedia.org/wiki/2023_Qatar_Grand_Prix

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Formula 1 Analytics | Insights



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[Circuits](#) Constructors Drivers Champions

Circuits

Autodromo Enzo e Dino Ferrari

Country

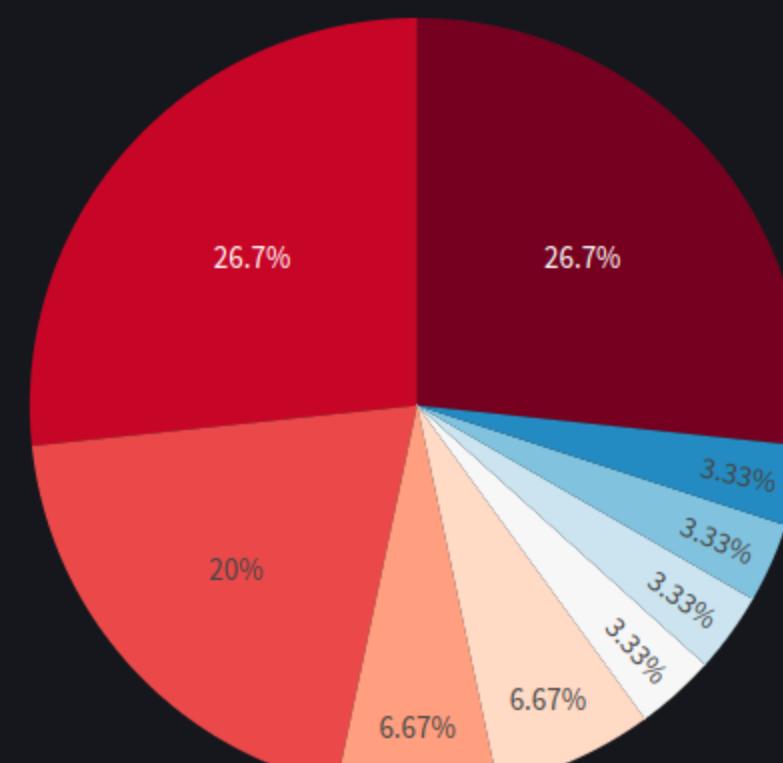
Circuit

Italy 

Autodromo Enzo e Dino Ferrari 

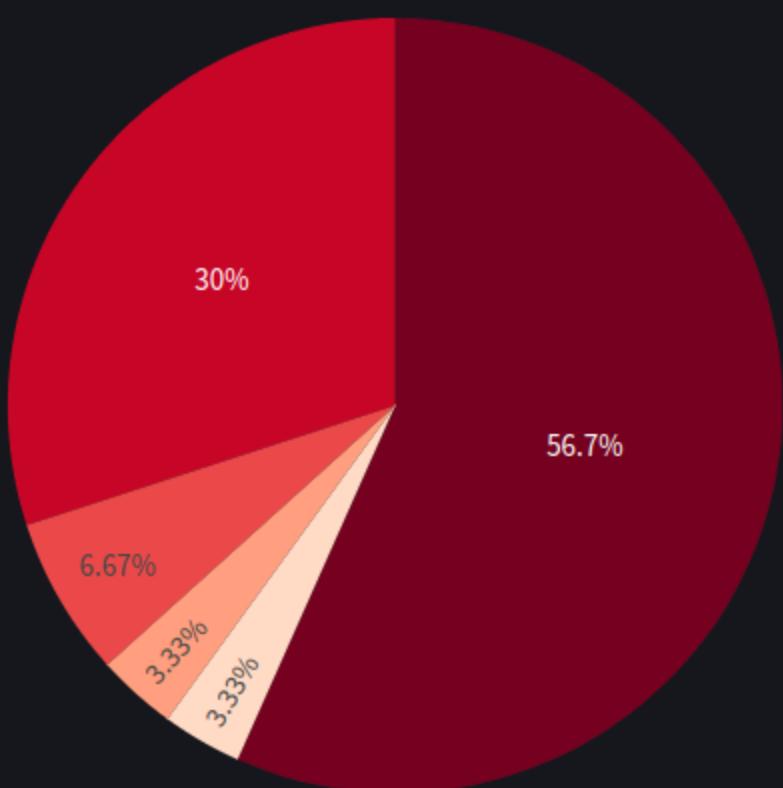
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Winning constructors in this circuit



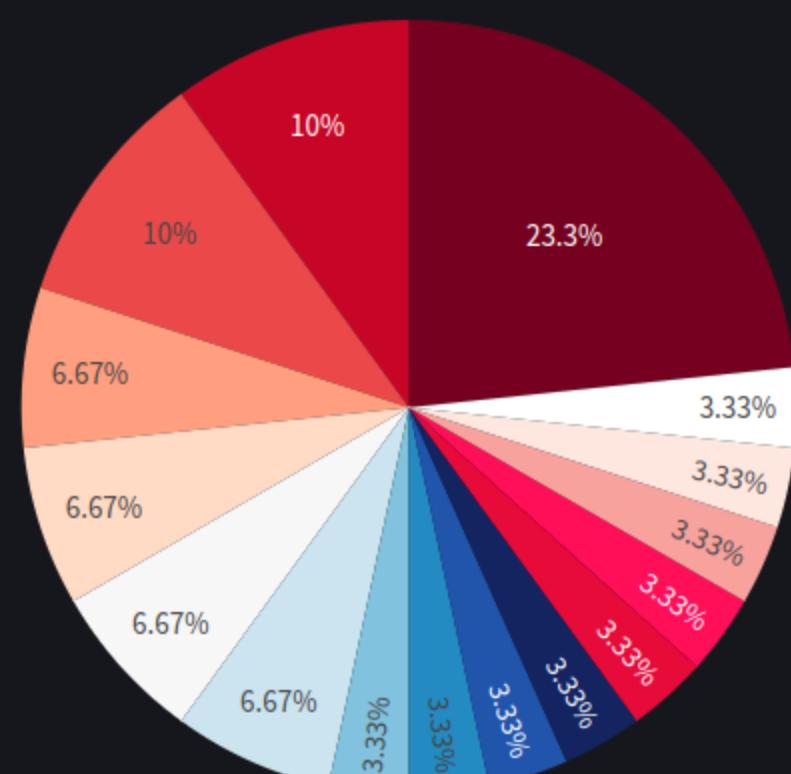
- Ferrari
- Williams
- McLaren
- Brabham
- Red Bull
- Renault
- Benetton
- Team Lotus
- Mercedes

Nationality of the winning constructors in this circuit

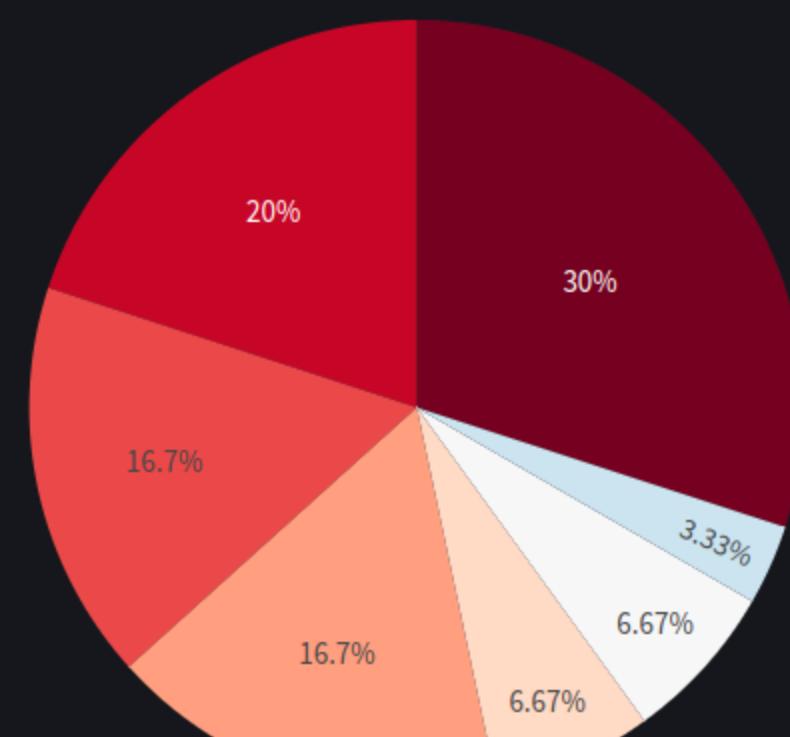


- British
- Italian
- Austrian
- French
- German

Winning drivers in this circuit



Nationality of the winning drivers in this circuit



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The fastest laps in this circuit - Autodromo Enzo e Dino Ferrari

Fastest lap in this circuit		
Driver	Constructor	Season
Lewis Hamilton	Mercedes	2020
Fastest Lap	Fastest Lap Time	Fastest Lap Speed (km/h)
63	1:15.484	234.121

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	year	round	name_race	date	driver_name	constructor_name	position	fastestLap	fastestLapTime	fastestLapSpeed
0	2,020	13	Emilia Romagna Grand Prix	2020-11-01	Lewis Hamilton	Mercedes	1	63	1:15.484	234.121
1	2,020	13	Emilia Romagna Grand Prix	2020-11-01	Valtteri Bottas	Mercedes	2	63	1:15.902	232.831
2	2,020	13	Emilia Romagna Grand Prix	2020-11-01	Alexander Albon	Red Bull	15	63	1:16.177	231.991
3	2,021	2	Emilia Romagna Grand Prix	2021-04-18	Lewis Hamilton	Mercedes	2	60	1:16.702	230.403
4	2,021	2	Emilia Romagna Grand Prix	2021-04-18	Max Verstappen	Red Bull	1	60	1:17.524	227.960
5	2,020	13	Emilia Romagna Grand Prix	2020-11-01	Daniel Ricciardo	Renault	3	62	1:17.552	227.878
6	2,020	13	Emilia Romagna Grand Prix	2020-11-01	Max Verstappen	Red Bull	None	44	1:17.637	227.628
7	2,020	13	Emilia Romagna Grand Prix	2020-11-01	Daniil Kvyat	AlphaTauri	4	62	1:17.666	227.543
8	2,020	13	Emilia Romagna Grand Prix	2020-11-01	Sebastian Vettel	Ferrari	12	44	1:17.767	227.248
9	2,020	13	Emilia Romagna Grand Prix	2020-11-01	Lando Norris	McLaren	8	63	1:18.069	226.368

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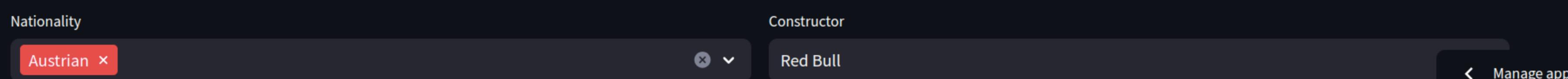


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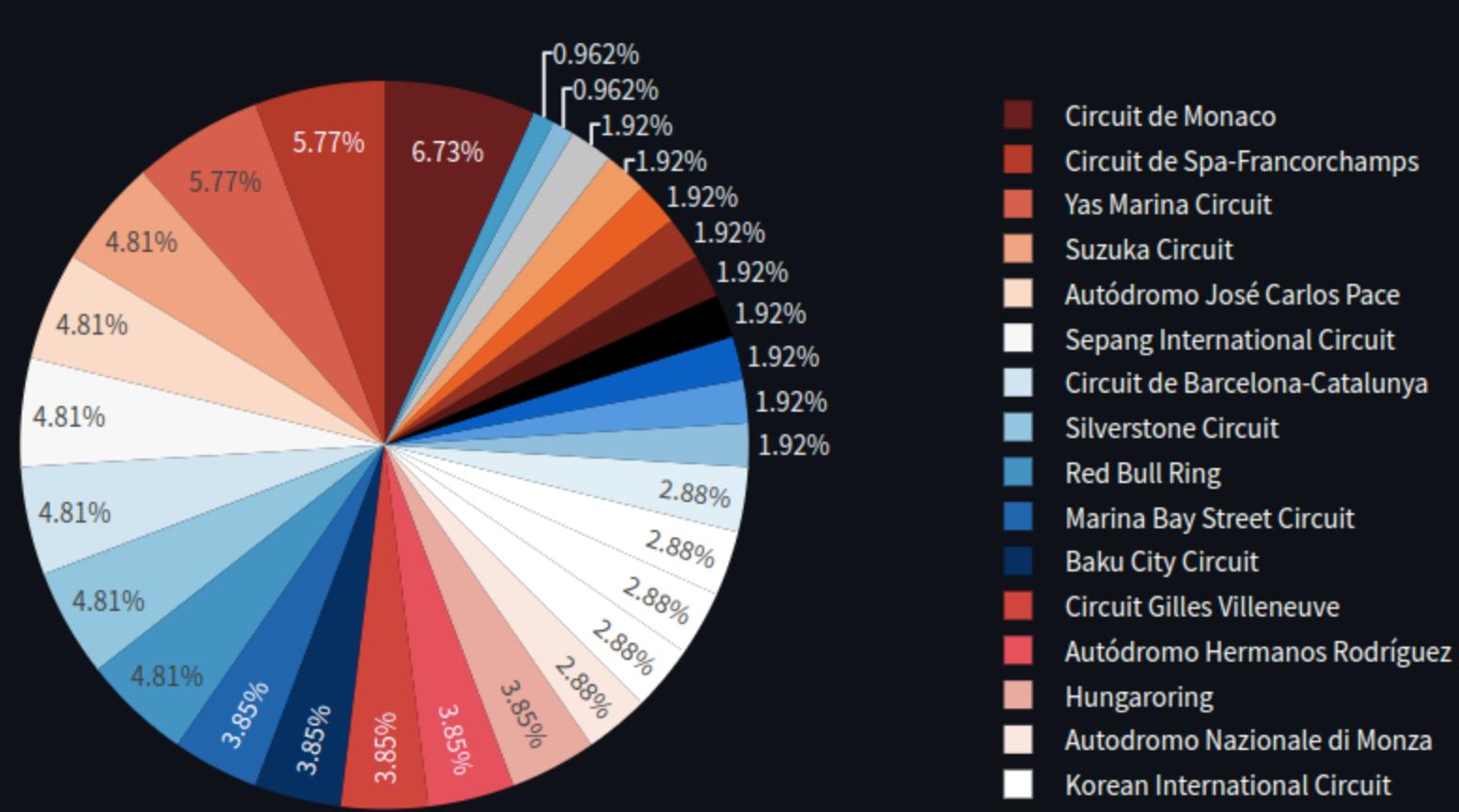
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Constructors

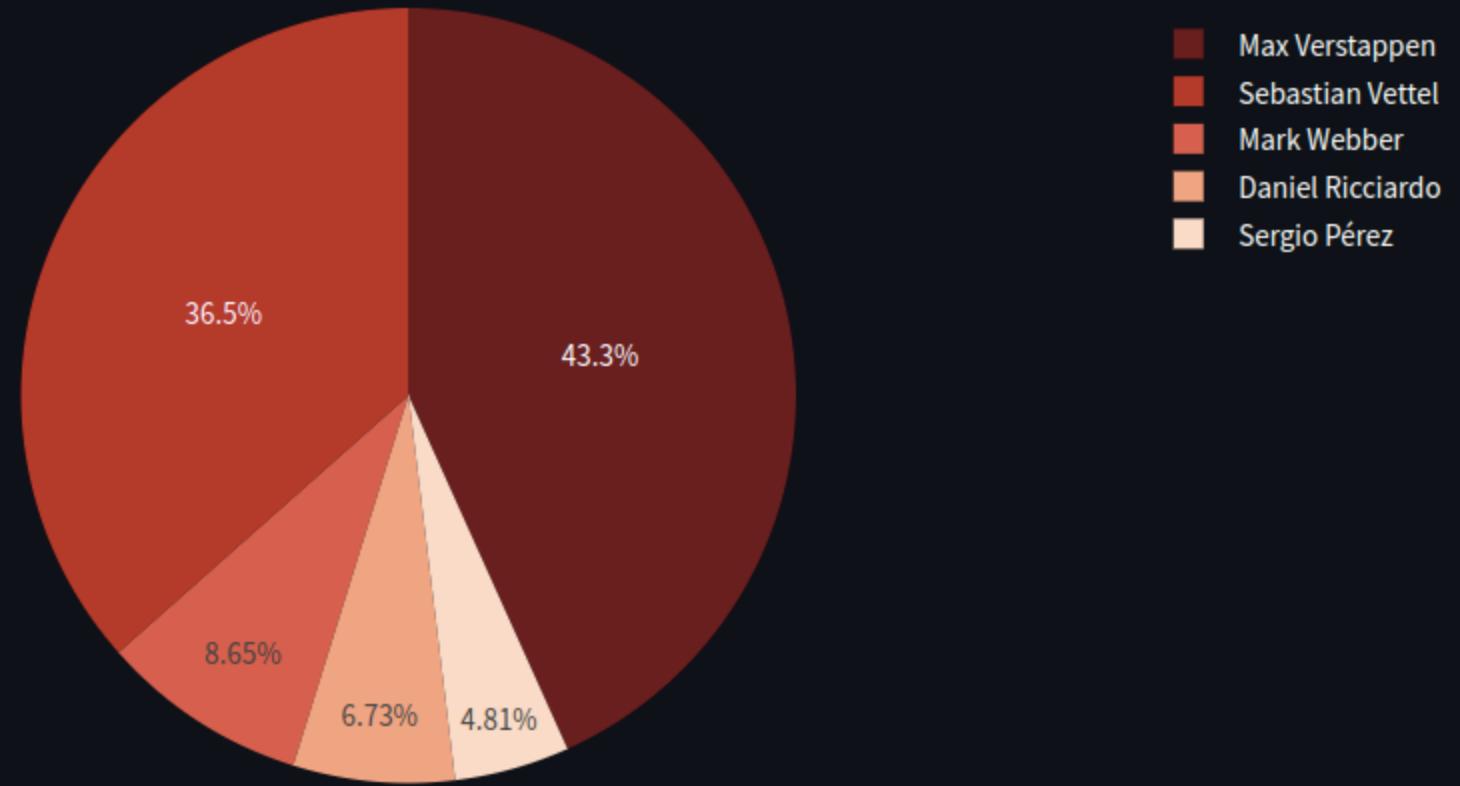
Red Bull



Circuits most won by this constructor



Winning drivers by this constructor



The fastest laps by cars of this constructor - Red Bull

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Fastest lap by this constructor		
Driver	Circuit	Season
Alexander Albon	Bahrain International Circuit	2020
Fastest Lap	Fastest Lap Time	Fastest Lap Speed (km/h)
52	0:57.056	223.548

year	round	name_race	circuit_name	date	driver_name	position	fastestLap	fastestLapTime	fastestLapSpeed
0	2,020	16	Sakhir Grand Prix	2020-12-06	Alexander Albon	6	52	0:57.056	223.548
1	2,020	2	Styrian Grand Prix	2020-07-12	Max Verstappen	3	70	1:06.145	235.010
2	2,021	9	Austrian Grand Prix	2021-07-04	Max Verstappen	1	62	1:06.200	234.815
3	2,023	9	Austrian Grand Prix	2023-07-02	Max Verstappen	1	71	1:07.012	231.970
4	2,022	11	Austrian Grand Prix	2022-07-10	Max Verstappen	2	62	1:07.275	231.063
5	2,020	2	Styrian Grand Prix	2020-07-12	Alexander Albon	4	67	1:07.299	230.981
6	2,017	9	Austrian Grand Prix	2017-07-09	Daniel Ricciardo	3	69	1:07.442	230.491
7	2,018	9	Austrian Grand Prix	2018-07-01	Max Verstappen	1	70	1:07.442	230.491
8	2,019	9	Austrian Grand Prix	2019-06-30	Max Verstappen	1	60	1:07.475	230.378
9	2,018	9	Austrian Grand Prix	2018-07-01	Daniel Ricciardo	None	46	1:07.591	229.983

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Drivers

Alain Prost

Nationality

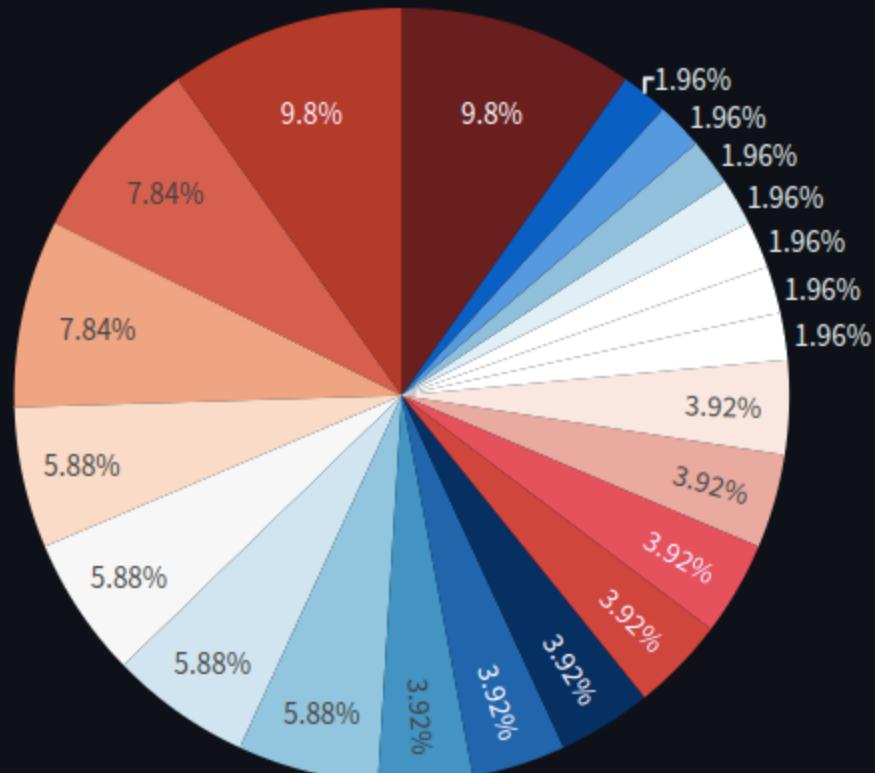
French x

Driver

Alain Prost

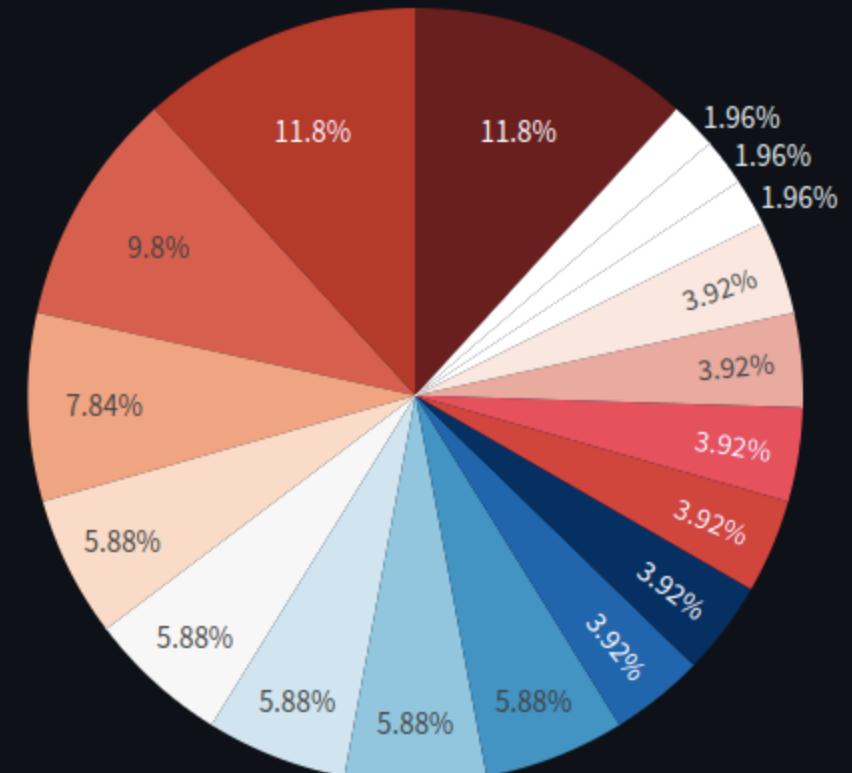
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Circuits most won by this driver



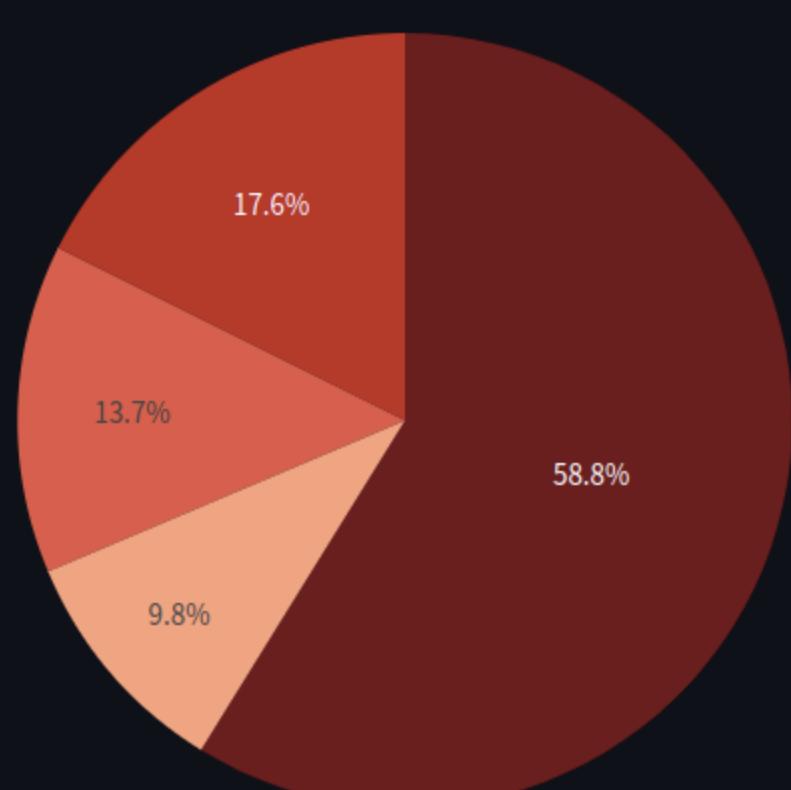
- Silverstone Circuit
 - Autódromo Internacional Nelson Piquet
 - Circuit Paul Ricard
 - Circuit de Monaco
 - Red Bull Ring
 - Autodromo Enzo e Dino Ferrari
 - Autodromo Nazionale di Monza
 - Autódromo do Estoril
 - Kyalami
 - Adelaide Street Circuit
 - Circuit Park Zandvoort
 - Hockenheimring
 - Circuit de Spa-Francorchamps
 - Autódromo Hermanos Rodríguez
 - Circuito de Jerez
 - Nürburgring

Grand Prix most won by this driver



- French Grand Prix
 - Brazilian Grand Prix
 - British Grand Prix
 - Monaco Grand Prix
 - Austrian Grand Prix
 - Spanish Grand Prix
 - San Marino Grand Prix
 - Italian Grand Prix
 - Portuguese Grand Prix
 - South African Grand Prix
 - Dutch Grand Prix
 - German Grand Prix
 - Mexican Grand Prix
 - Australian Grand Prix
 - Belgian Grand Prix
 - United States Grand Prix

Constructor winning by this driver



- McLaren
Renault
Williams
Ferrari

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The fastest laps by cars of this driver - Alain Prost

Fastest lap by this driver

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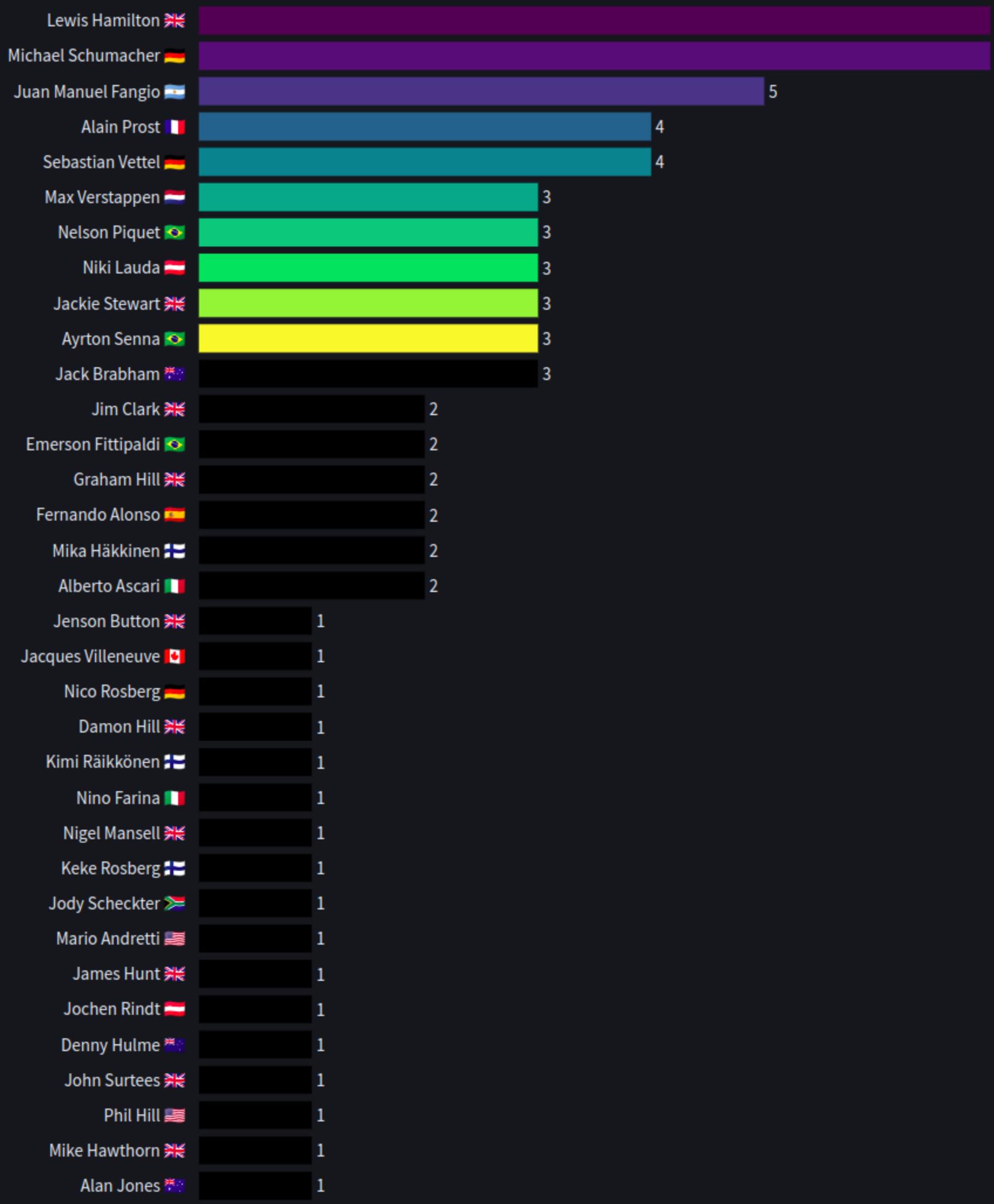


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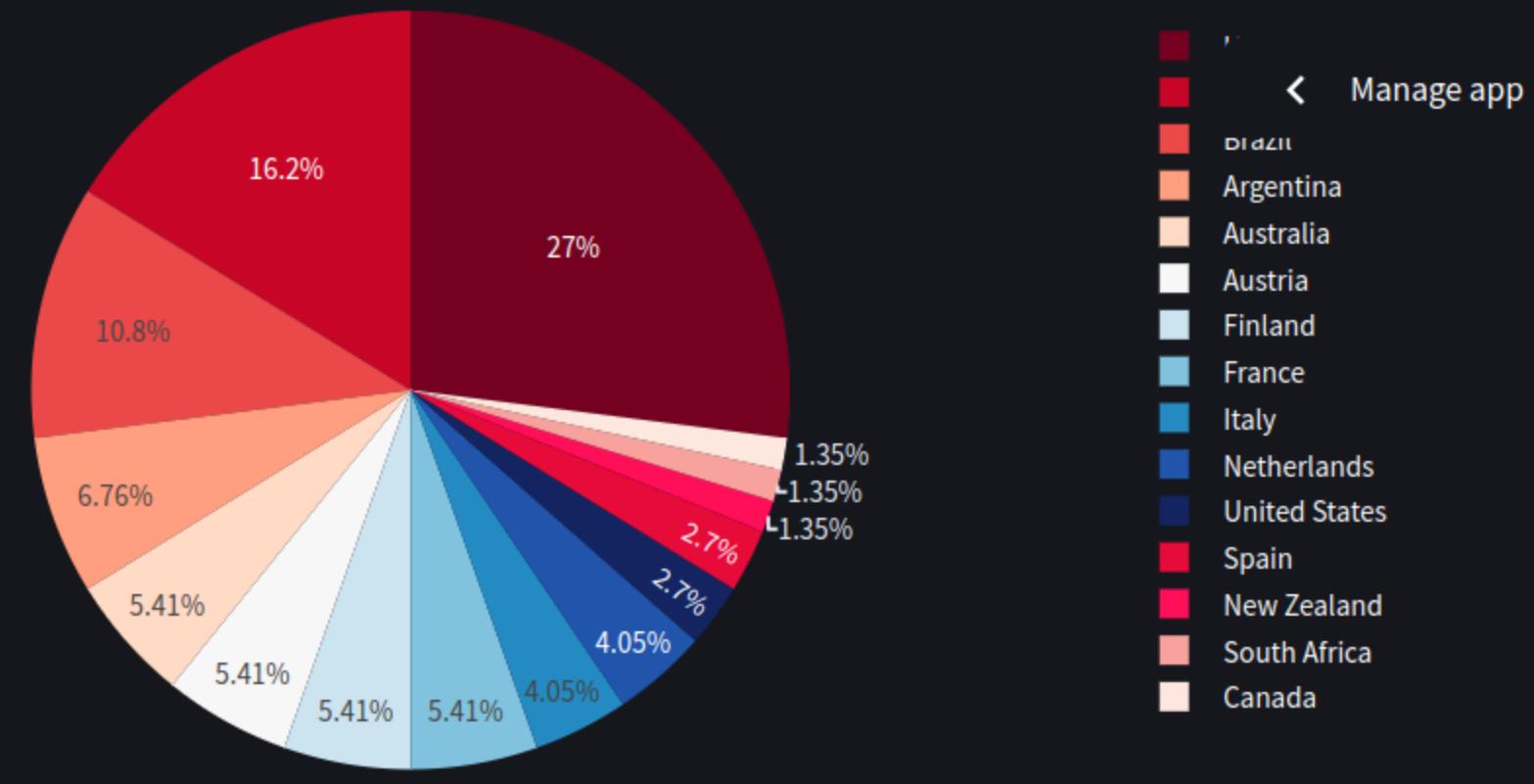
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Champion Drivers

Champion drivers



Countries from champion drivers

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Formula 1 Champions Timeline

1950

NINO FARINA 

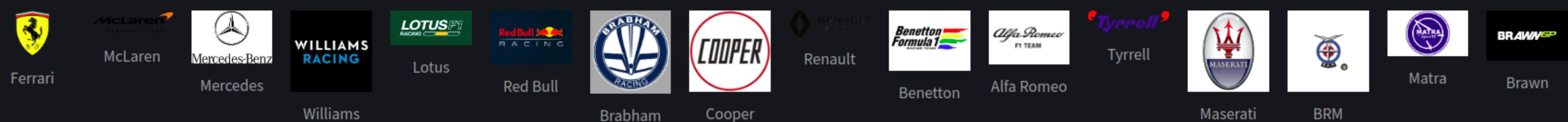
Italy

JUAN MANUEL FANGIO 

Timeline JS

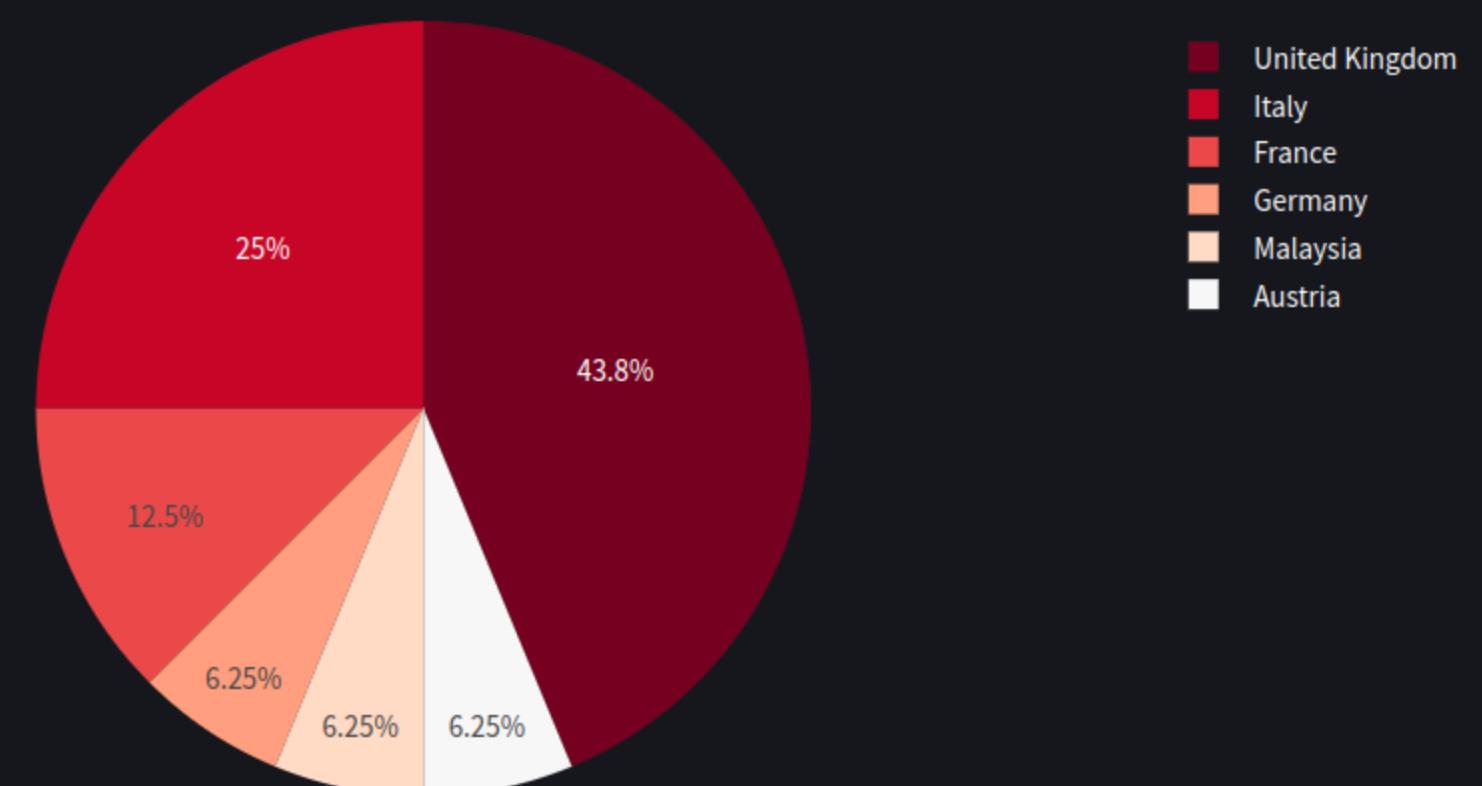
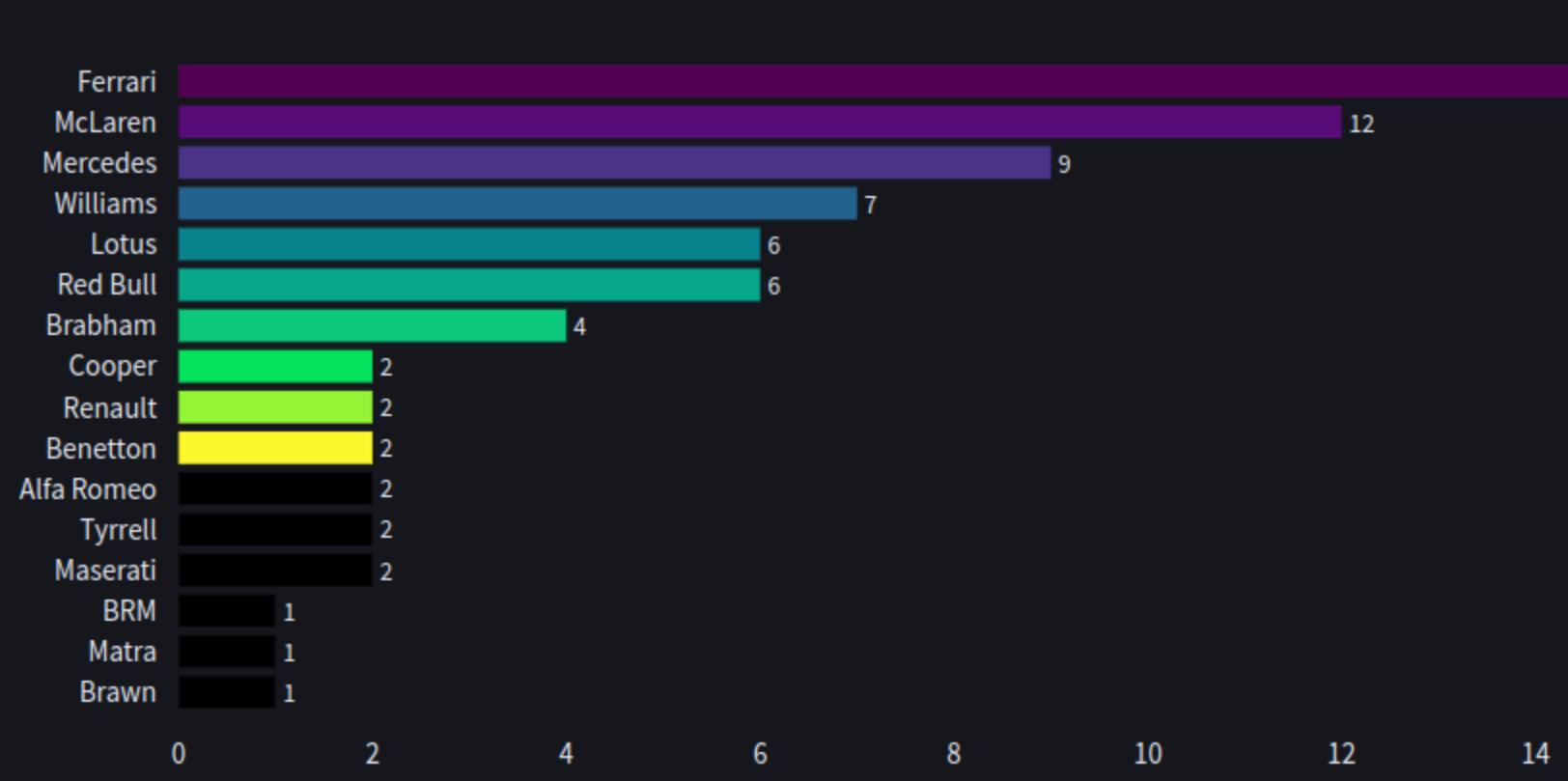
Champion Constructors

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Champion constructors

Countries from champion constructors



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Season

2023

Race

Bahrain Grand Prix

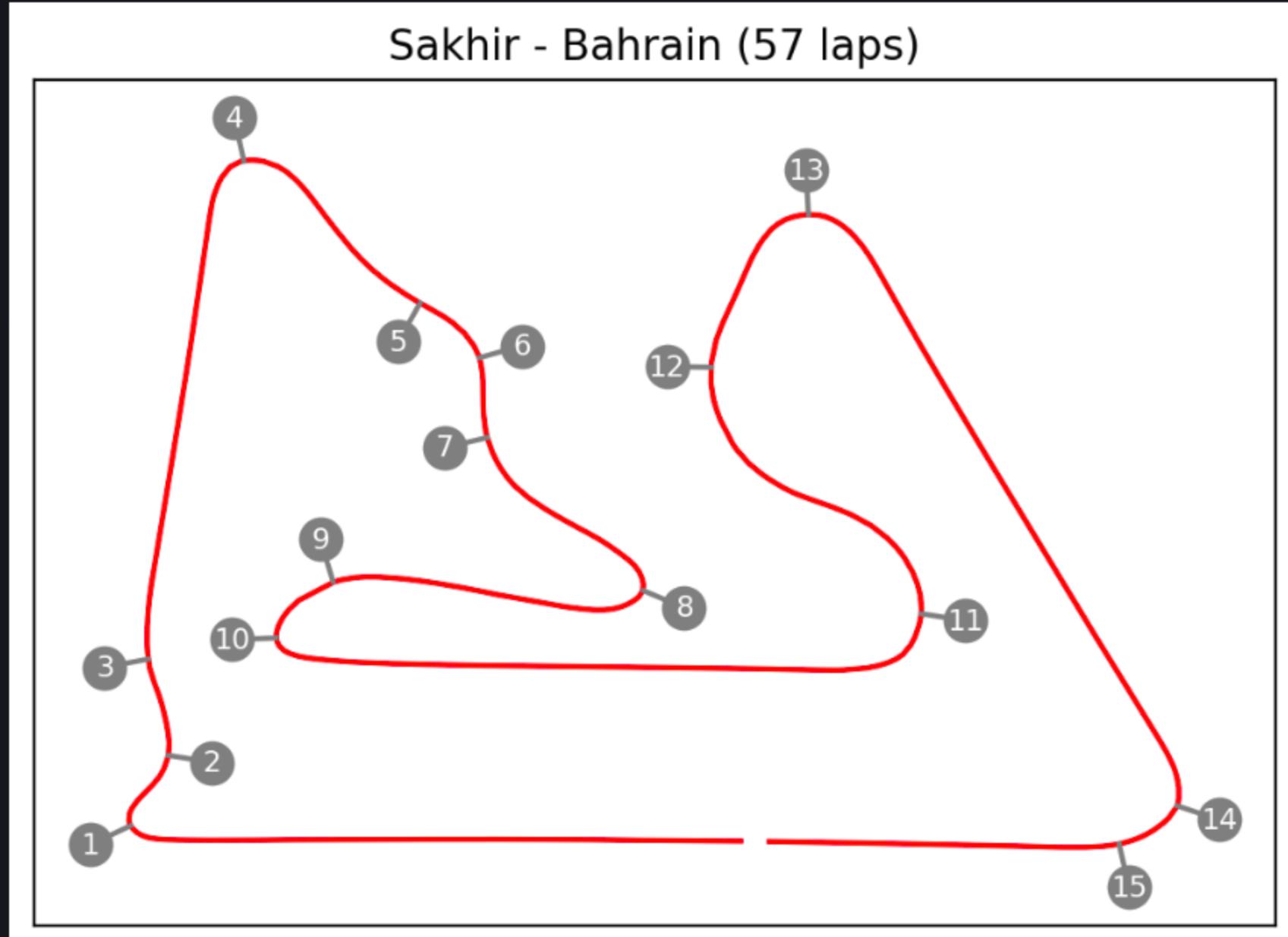
Session

Race

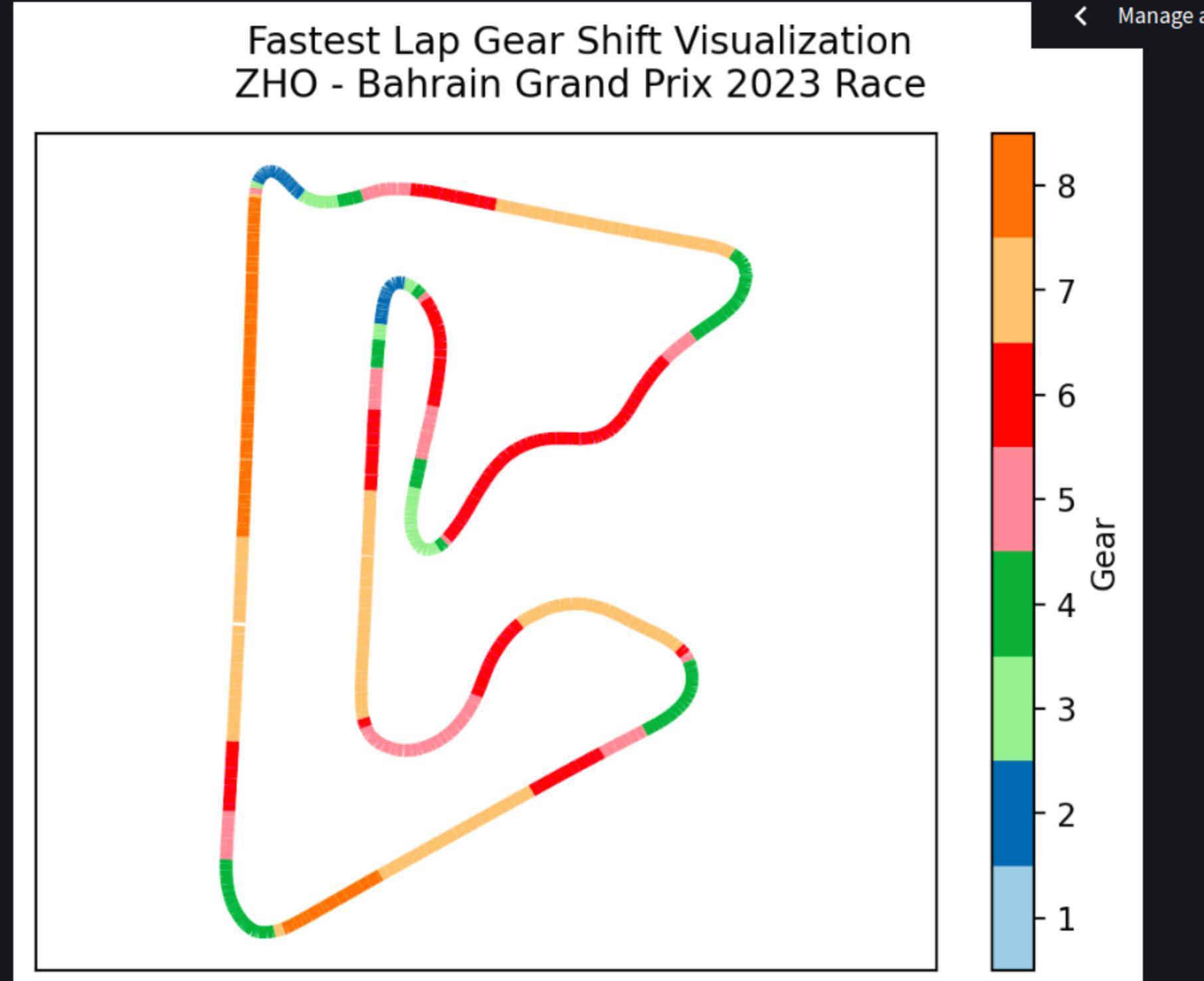
FORMULA 1 GULF AIR BAHRAIN GRAND PRIX 2023

[Championship](#) [Drivers](#)

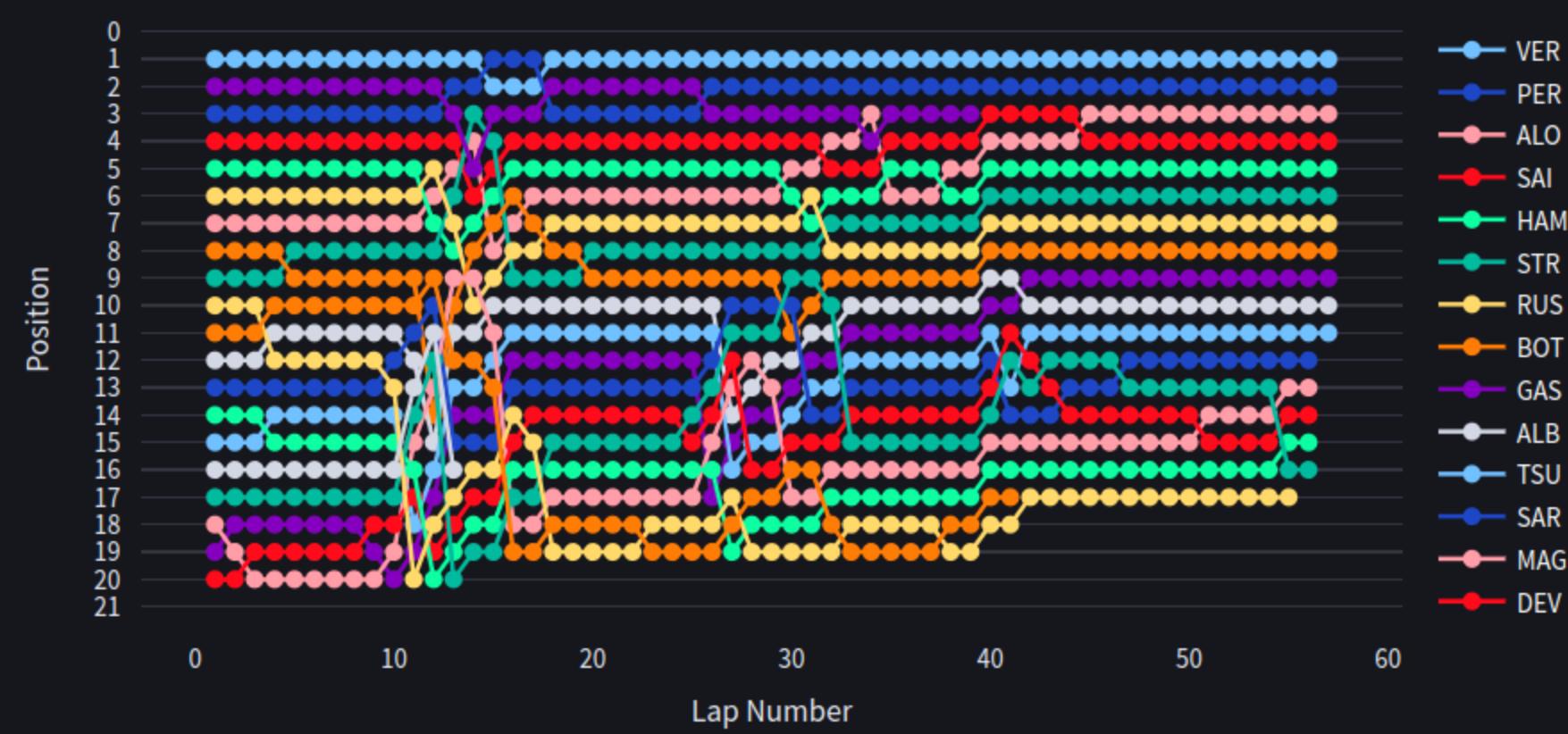
Circuit (track map)



Gear shifts on track



Position changes



Driver standings (2023)

No information.

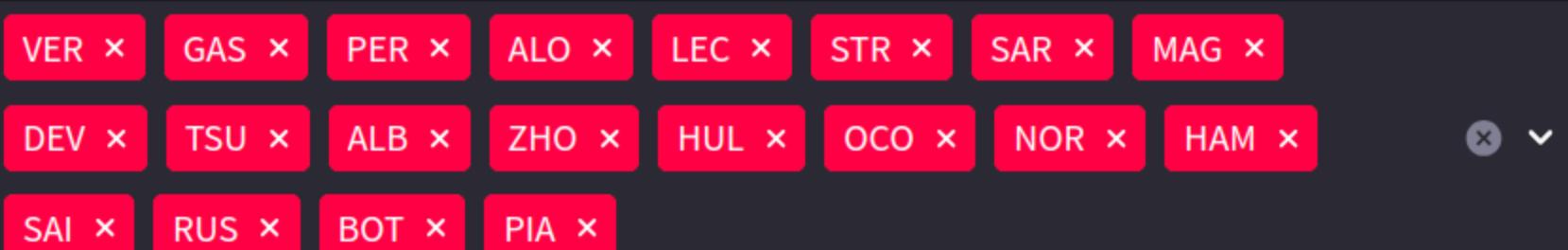
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- VER
- PER
- ALO
- SAI
- HAM
- STR
- RUS
- BOT
- GAS
- ALB
- TSU
- SAR
- MAG
- DEV

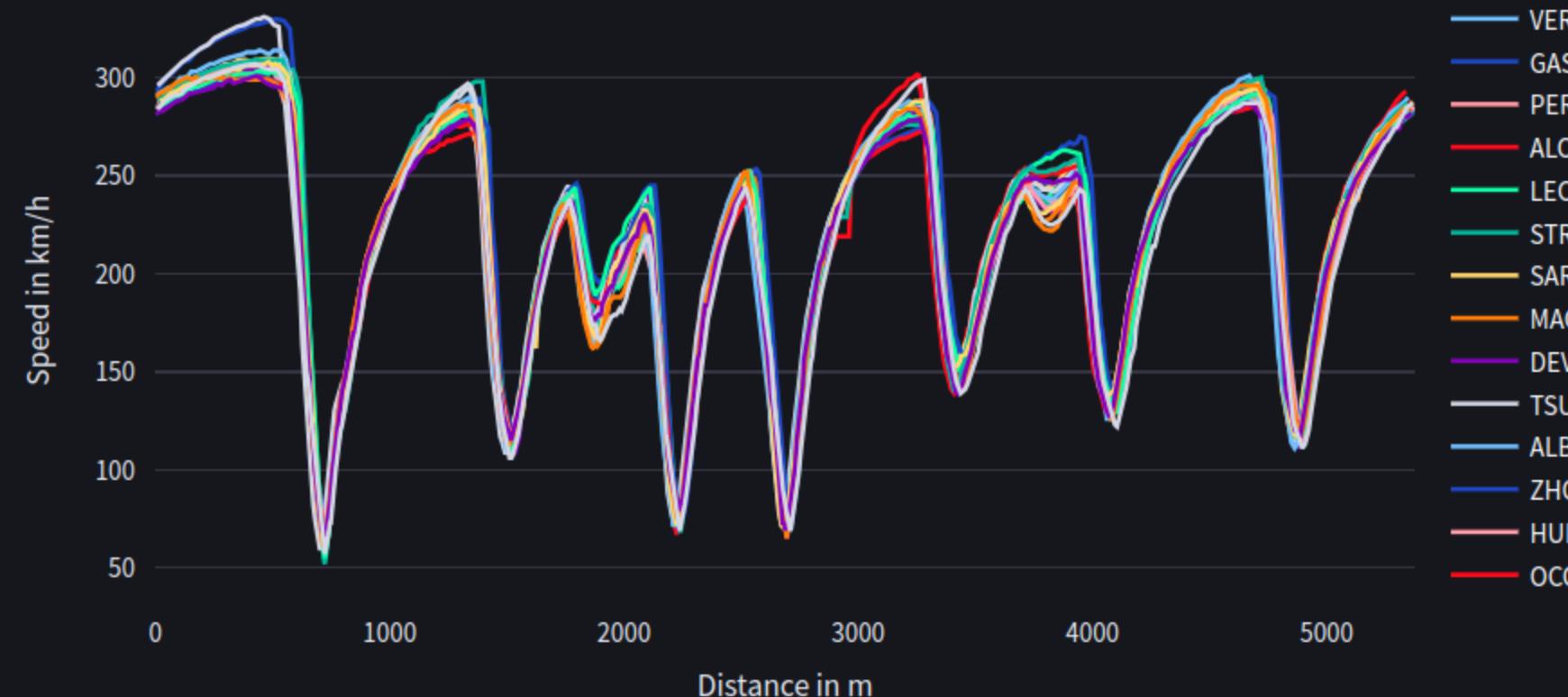
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Overlaying speed traces of fastest laps

Drivers

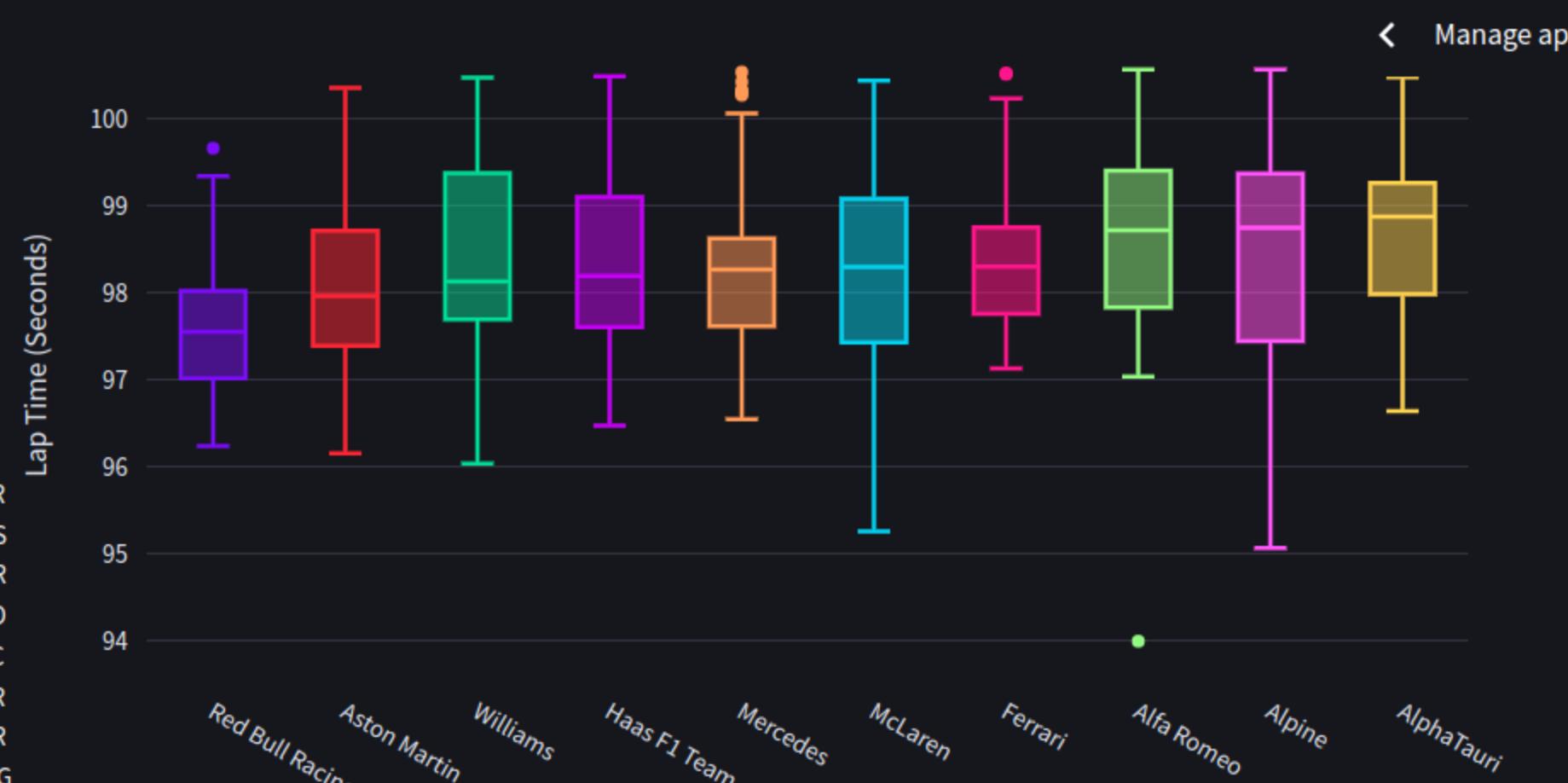


Fastest Lap Comparison
Bahrain Grand Prix 2023 Race



Team pace comparison

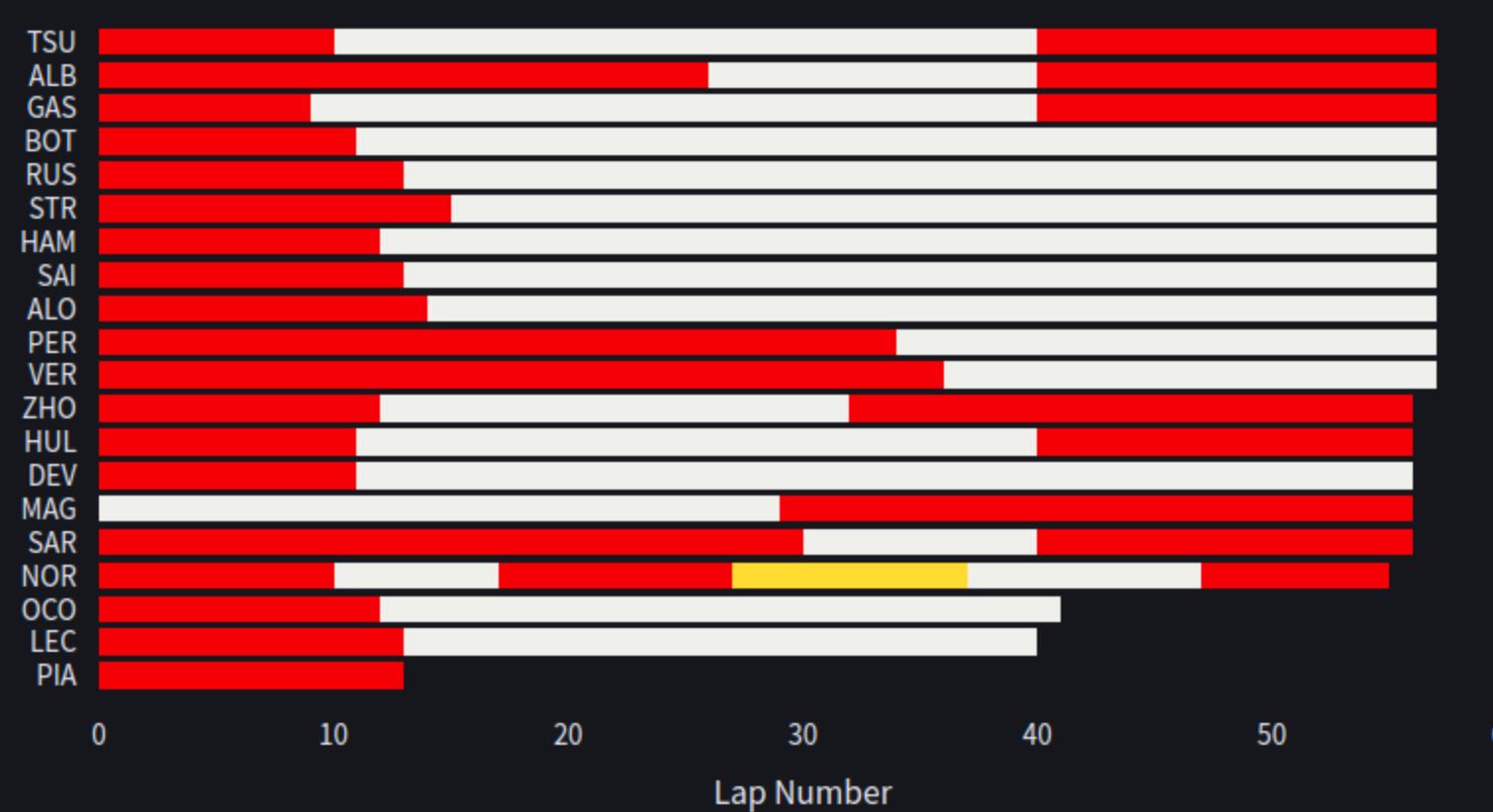
Bahrain Grand Prix 2023 Race - Team Pace Comparison



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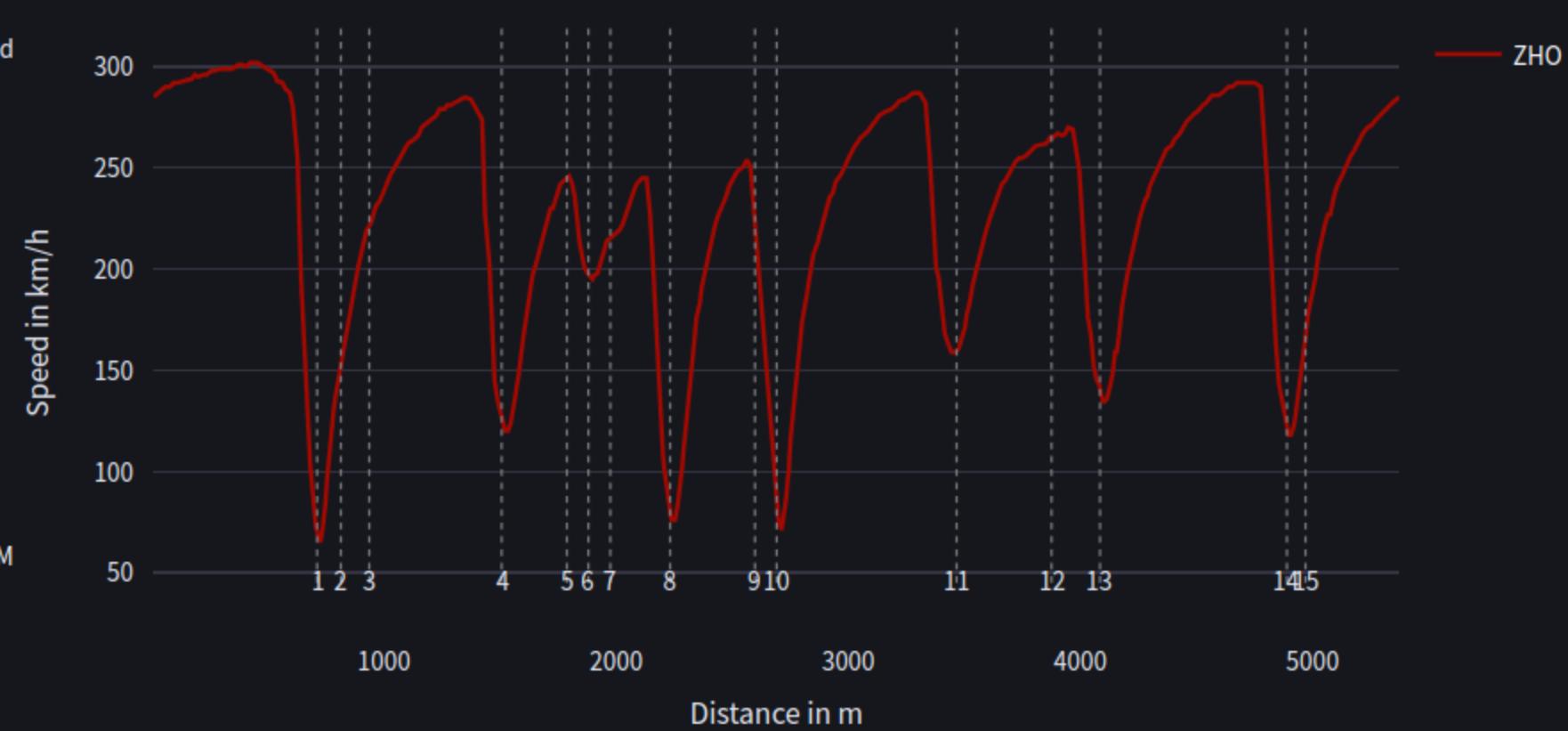
Tyre strategies

Bahrain Grand Prix 2023 Race - Tyre Strategies



Speed traces with corners (fastest lap)

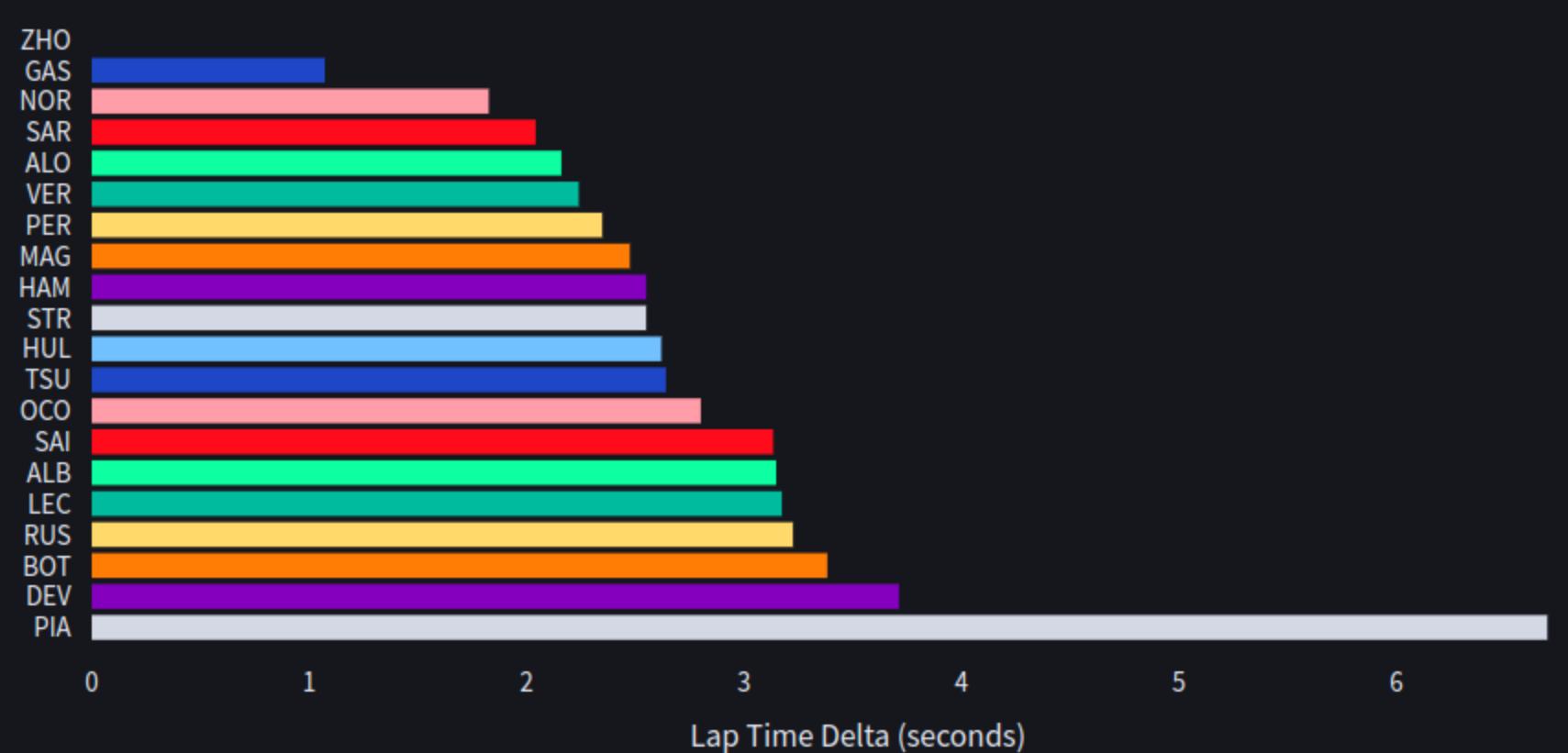
Speed Trace with Corner Annotations



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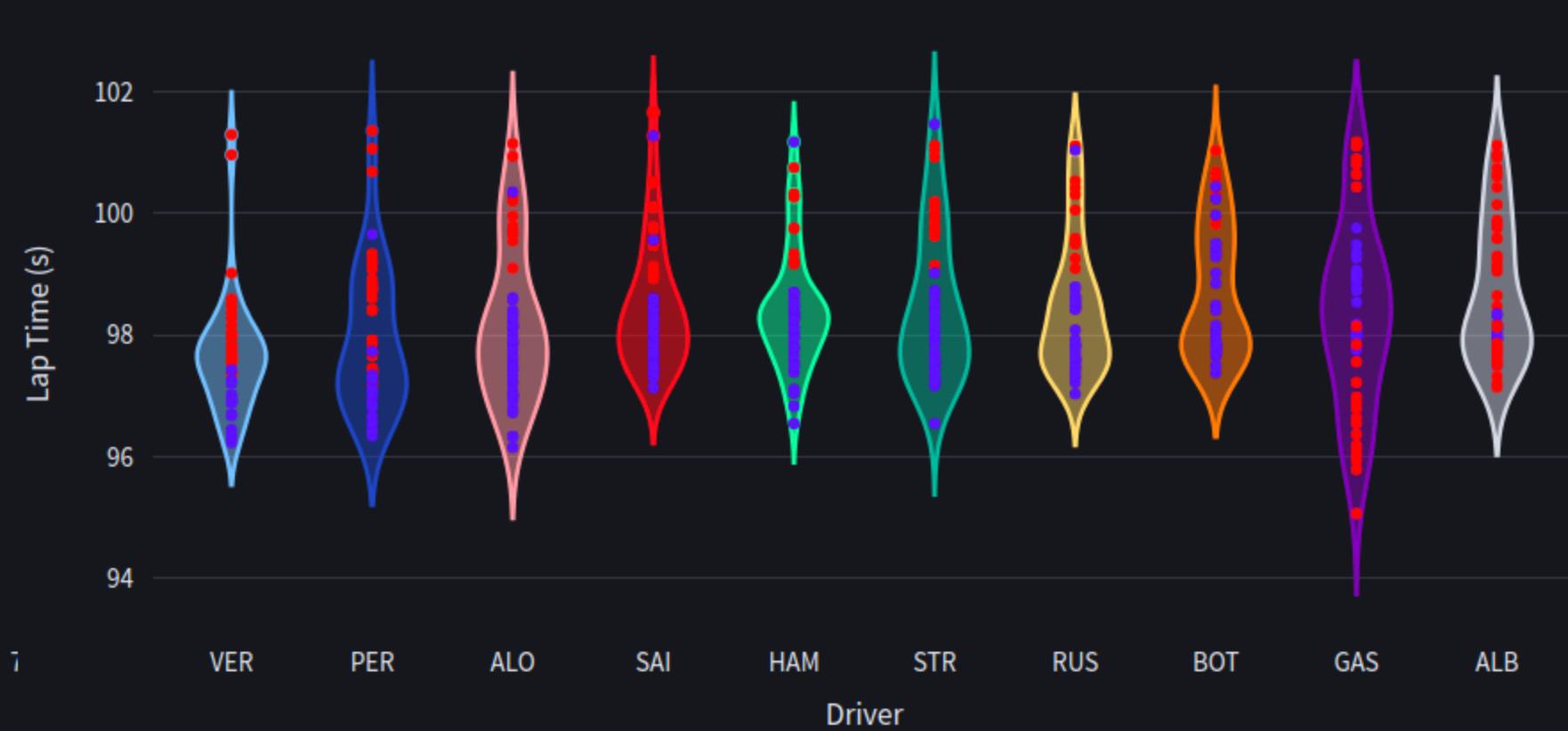
Qualifying results overview

Bahrain Grand Prix 2023 Qualifying
Fastest Lap: 01:33.996 (ZHO)



Driver laptimes distribution

Bahrain Grand Prix 2023 Race - Lap Time Distributions



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Formula 1 Analytics | Seasons



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Season

2023

Race

Bahrain Grand Prix

Session

Race

FORMULA 1 GULF AIR BAHRAIN GRAND PRIX 2023

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Driver

Lewis Hamilton

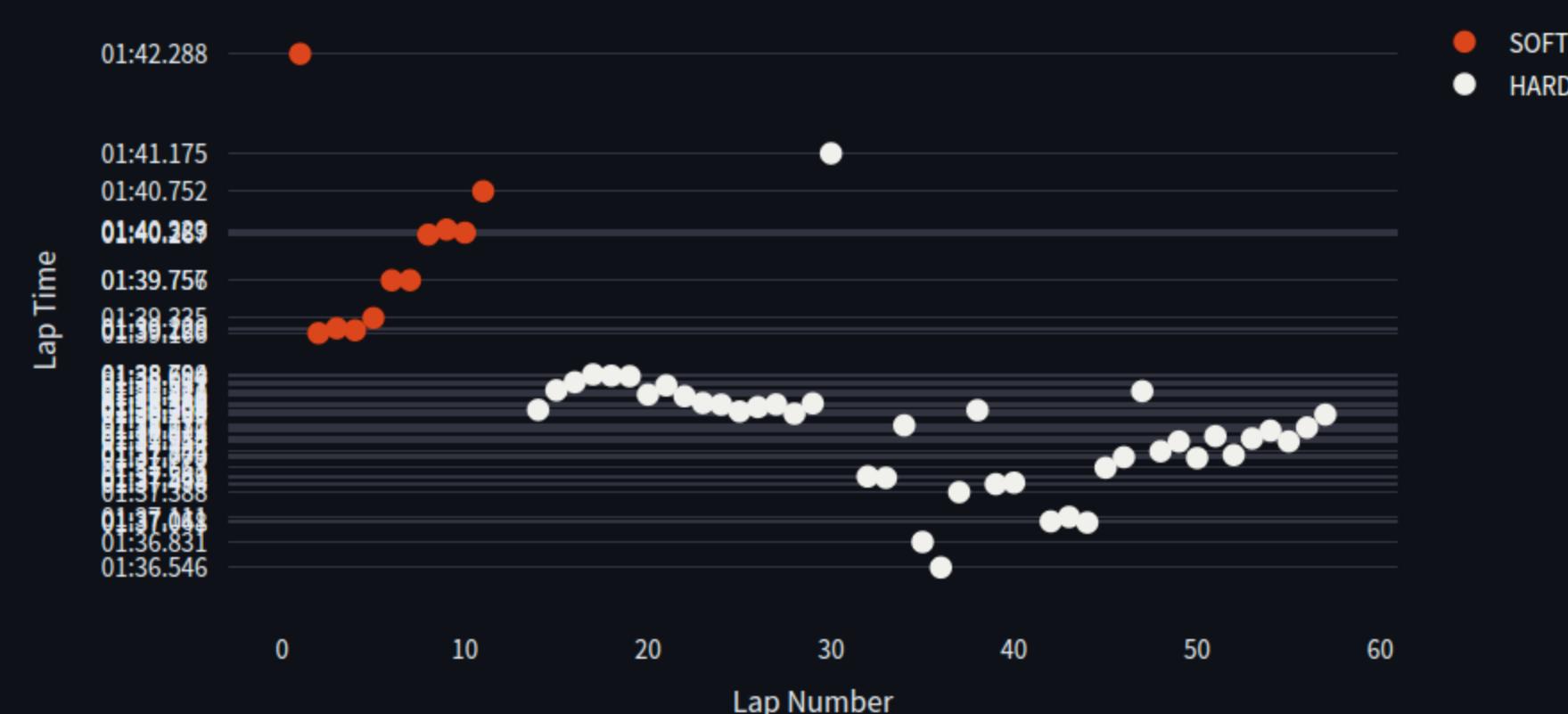
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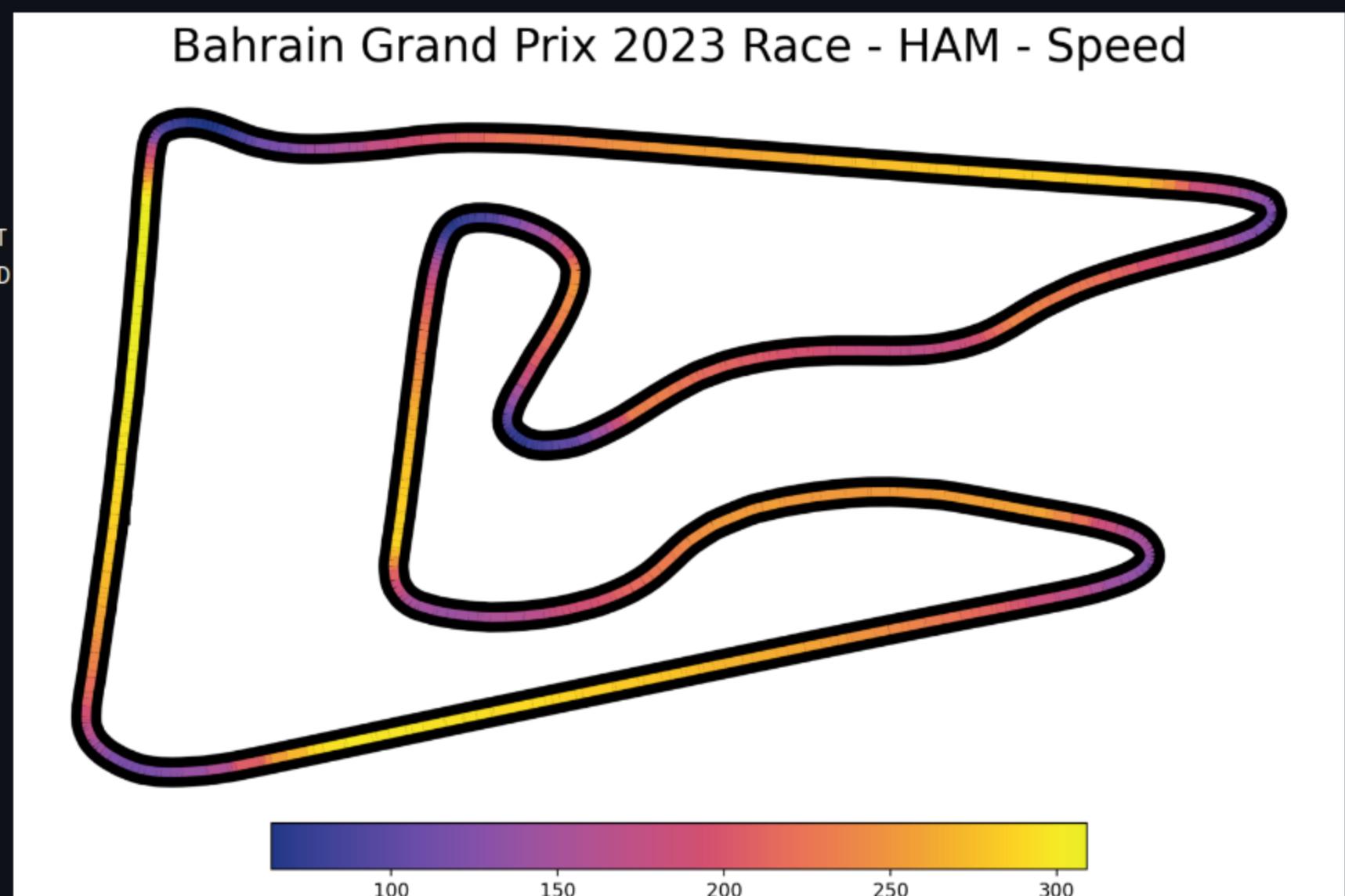
Lewis Hamilton (HAM) - Mercedes

Driver laptimes / Tyre strategies

Lewis Hamilton laptimes - Bahrain Grand Prix 2023 Race



Speed visualization on track map (fastest lap)



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Clustering

Scaler

Minimum-Maximum Scaler

Clustering Model

KMeans

Number of clusters

5

- +

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Dimensionality Reduction

[KMeans](#)

[Uniform Manifold Approximation and Projection \(UMAP\)](#)

Dimensionality Reduction (2D)



Dimensionality Reduction (3D)



Silhouette Score (2D)

44.45%

Calinski-Harabasz Index (2D)

26385.87

Davies-Bouldin Index (2D)

72.67%

Silhouette Score (3D)

46.18%

Calinski-Harabasz Index (3D)

17255.88

Davies-Bouldin Index (3D)

80.25%

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Let's work together!



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