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How Did Usain Bolt Run So Fast?

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Usain Bolt is 6 feet 5 inches tall. On August 16, 2009, in Berlin, Germany, he ran 100 meters in 9.58 seconds. As of November 2026, that is still the world record, and it still tops World Athletics's all-time list. How does a person run that fast? There is no single secret. The answer is a chain of smaller things: a start, a stride, the force of each step, and a track that measures every hundredth of a second. This book follows the chain, one link at a time.

Start with the speed. Dividing 100 meters by 9.58 seconds gives an average of about 10.4 meters per second, or 23 miles per hour. But Bolt did not run at one speed. A laser study of the race found that his top speed was 12.32 meters per second, or about 27.6 miles per hour, near the 52-meter mark. Researchers who put collars on five wild cheetahs in Botswana recorded a top speed of 25.9 meters per second in one run. Bolt's best was a little under half of that.

The race begins before the first step. In races up to 400 meters, runners must start from a crouch in starting blocks. The starter calls "On your marks," then "Set," and fires the gun once everyone is steady. Sensors in the blocks measure how soon each runner pushes. Bolt's reaction time in the Berlin final was 0.146 seconds. A study of 1,319 sprinters at world championships from 2003 to 2009 found that male finalists averaged 0.142 seconds in the final. His 0.146 was close to that average.

Reaction time has a floor. The rules treat any reaction under 0.100 seconds as a false start. The idea is that no one can react that fast. Since January 1, 2010, a runner who false starts is disqualified. Before that, each race allowed one false start. Bolt made that one in his Berlin semifinal. He said he was joking with a teammate. In 2011, in Daegu, South Korea, he was disqualified from the World Championships final for a false start. The 0.100 line is a rule. In a 2007 lab study, five of nine athletes beat it in at least one test.

World Athletics reported that Bolt was not the quickest out of the blocks in Berlin. He took control about 30 meters in. The official report timed every runner every 20 meters. Bolt's fastest section was from 60 to 80 meters, which he covered in 1.61 seconds. That is about 12.4 meters per second (20 meters divided by 1.61 seconds). His last section took 1.66 seconds, only 0.05 seconds slower. A sprint is a climb up to top speed, and the top comes past the halfway mark.

How does a runner go faster? Only two things can change: the length of each step and the number of steps each second. In Berlin, Bolt took about 41 steps. His steps grew from about 1.8 meters in the first 20 meters to 2.85 meters in the last 20. His step rate stayed near 4.5 per second for most of the race, and dipped to 4.23 at the end. A 2013 study of three of his

best races concluded that step length did most to set his speed in most 10-meter sections. The authors also pointed to his height and long legs.

Why not simply move the legs faster? A 2000 experiment suggests that top speed is limited by force. Thirty-three people ran at top speed on a force treadmill. The study's fit said that a runner at 11.1 meters per second pushed on the ground 1.26 times as hard as one at 6.2. But the time each person took to swing a leg forward was about the same. A later study found that sprinters reached higher top speeds than other athletes by pushing harder at first on each step. A 2013 study suggested the same of Bolt, but did not measure it.

The race ends when the runner's torso reaches the finish line. The head, arms and legs do not count. A camera in line with the finish takes pictures. At major meets, today's rules say it must take at least 1,000 every second. A runner at Bolt's average speed moves about one centimeter between two pictures. Under today's rule, a time is also rounded up to the next hundredth of a second, so a time recorded as 9.58 means a true time between 9.571 and 9.580.

Wind matters. For a 100-meter race, a gauge stands beside the track 50 meters from the finish and 1.22 meters off the ground. It measures wind for 10 seconds after the gun. In Berlin, it read +0.9 meters per second, a gentle push from behind. A world record cannot be ratified if the wind averages more than 2 meters per second. A 2016 study estimates that a tailwind of 2 meters per second is worth about 0.10 seconds to a man, on average for top sprinters. It found that an altitude of 1,000 meters is worth about the same.

A record is not official when the clock stops. World Athletics must approve it. For a sprint, the rules say the runners must use blocks linked to a certified start system. That puts every reaction time on the results. The meet must be approved in advance, and at least three athletes must compete. The wind must be within the limit. On September 30, 2009, World Athletics announced that it had ratified Bolt's 9.58, and his 19.19 from four days later.

The 100-meter record has a long history. The first official one was 10.6 seconds, run by Donald Lippincott on July 6, 1912. For decades, records were timed by hand, in tenths. Since 1977, they have needed automatic timing, so they can be measured in hundredths. Bolt broke the record three times: 9.72, then 9.69 in Beijing on August 16, 2008, and then 9.58. World Athletics wrote that the cut of 0.11 seconds in Berlin was the largest ever. Bolt said, "I didn't think I could run a tenth (of a second) faster than my World record, but for me, anything is possible."

The 200 meters took place four days later, in the same stadium. Another runner false started, and Bolt's reaction on that start was a slow 0.345 seconds. On the second start, his reaction was 0.133, the fastest in the field. He ran into a headwind of 0.3 meters per second. He finished in 19.19 seconds, 0.11 seconds better than his old record. As of November 2026, that time is still first on the all-time 200-meter list. World Athletics's report asked whether he could

go quicker in better conditions.

At the Olympics, Bolt won the 100 meters and the 200 meters in 2008, 2012 and 2016. That is three Games in a row. He also won the relay, a team race, in 2012 and 2016. That makes eight gold medals, as World Athletics and the Olympic committee count them through November 2026. In Beijing in 2008, he eased down in the last meters of the 100 to celebrate, and still set a record of 9.69. Olympedia still lists his 9.63 from London on August 5, 2012, as the Olympic record.

Is there a limit? A 2008 study looked at race data for greyhounds, horses and elite runners. It found a speed limit for each, and records near it. In February 2025, two statisticians posted a paper that used results from 1991 through 2023. They estimated the best possible men's 100-meter time at 9.56 seconds. Their lowest likely value was 9.49. Bolt's 9.58 is very close. As of November 2026 their paper is a preprint, and other scientists may disagree. A 2015 review of Olympic results from 1896 to 2012 found that gains have slowed a great deal.

Bolt's last World Championships were in London in August 2017. At the end, he took a lap of honor. The trackside clock flashed his Berlin times, 9.58 and 19.19. He stopped for a moment at the 100-meter start and at the 200-meter start. World Athletics quoted him: "I was saying goodbye to the fans and I was saying goodbye to my events also." The clock in Berlin stopped in 2009. The question the numbers raise is still open. How close can a human get to the limit?

Questions

1. What did the official report say about Bolt's start in the Berlin final?

A. He was the quickest out of the blocks in the final
B. He was not the quickest, but took control about 30 meters in
C. He false started and had to run the final again

2. According to the 2000 treadmill experiment, what separated faster runners from slower ones at top speed?

A. How quickly they swung a leg forward
B. How tall they were
C. How hard they pushed on the ground

3. In the sentence "The 0.100 line is a rule," what is the line?

A. The cutoff for a false start
B. The finish line
C. The edge of a lane

4. What is the most a tailwind can average in a race that counts for a world record?

A. 0.9 meters per second
B. 2 meters per second

C. 10 meters per second

5. Why is the 2025 estimate of 9.56 seconds not the final word?

A. It covers women's races, not the men's 100 meters

B. It was written before Bolt ran his record

C. It is a preprint, so scientists may disagree

Words to know

reaction: quick response
ratified: officially approved
tailwind: helping wind
altitude: height above sea
preprint: early paper
torso: upper body

Answer key: How Did Usain Bolt Run So Fast?

1. B. He was not the quickest, but took control about 30 meters in
2. C. How hard they pushed on the ground
3. A. The cutoff for a false start
4. B. 2 meters per second
5. C. It is a preprint, so scientists may disagree