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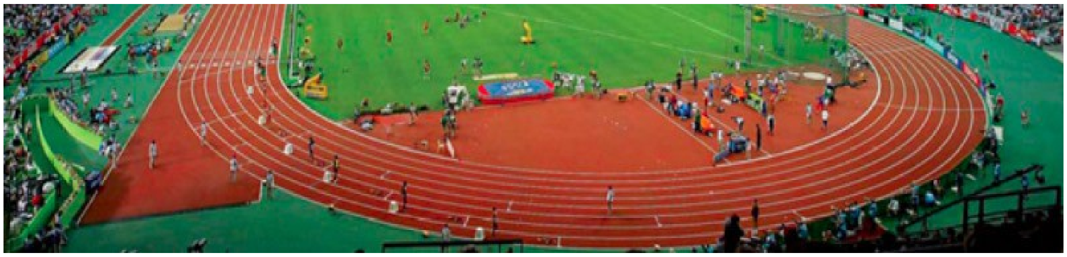
More on Running Tracks



by Miles Mathis

In a recent update to my paper on *pi*, I showed that Olympic running tracks were mismeasured in the turns. One of my loyal readers, who thinks I am right about *pi*, still could not follow me. He recommended I not bring running tracks into it. He pointed out that the straightaways on standard 400m tracks were not 100m but only 84.4m. He said that would account for a large part of the percentage of slowdown I calculated (56% in the turns), and which is admitted (up to 60% in the turns). That is true, but it is not fatal to my calculations, it only forces us to bring in more factors. If we include those factors, it again indicates the turns are grossly mismeasured using *pi*.

My reader may be right in one sense, because this new factor not only complicates the problem, it adds a second layer of novelty to the problem. That is, it requires a second rethinking of the problem. Many are already in over their heads with my *pi* claims and are not prepared for more complications. However, in for a dime, in for a dollar. I can't quit now, so I might as well push on. It turns out the problem with *pi* on the running track is being hidden by layers of mistakes and miscalculations, and the number *pi* is only one of them.

To see what I mean, let us start by looking at lane 8. On the largest tracks, lane 8 has such a large curve the runners should be able to treat it as a straight. But they can't, because even in lane eight we see noticeable (apparent) slowdowns from the straights. This is admitted by all. We are told this is due to curves being harder to run, but I am telling you is because the distances in the curves are longer than is currently thought. There isn't a real slowdown, it just *seems* that there is because the distances are wrong. Plus, from lane 8 in a 200m race, the straight *isn't* 84.4m. It is effectively longer than the straight in lane 1, simply because the *extension* of the straight into lane 8 extends farther than into lane 1. I doubt I even have to demonstrate that. A runner in lane eight can *effectively* enter the straight early compared to his competitors in the lower lanes, and we can see that with our own eyes during a race. All this should have the effect of making lane 8 runners run the curves in almost exactly the same times they run the straights (distances being the same calculated with *pi*), but they don't. Even then, we see big discrepancies unaccountable with current physics.

What this must mean is that the staggering is also wrongly calculated. It is known and admitted that the inner lanes are the worst in a staggered race, but this difference is normally assigned to the tighter curve. I propose that is not the primary difference. I agree it is a factor, but I don't think it is the primary factor. The primary factor is that lane one is in the turn longer. Lane one has to run the entire curve, while lane eight runs about 60% of it (see photo under title, which is a 400m race). You will tell me the distances are calculated to be the same, but I am telling you those distances are calculated with *pi*, and are therefore faulty. The longer you are in any curve, the more the *pi* math will fail. I am telling you the outer lanes have a real advantage, and if it weren't for the small disadvantage they have in not having visible competitors (which I agree is a factor), they would win every race. This is known by some experts, since a disproportionate number of winners come from the outside lanes. This despite the top qualifiers being assigned to the middle lanes. With the top qualifiers assigned to middle lanes, the outer lanes should *never* supply a winner, but they often do.

Those in charge seem to understand this, and I am not sure even they believe it is all due to curvature. Notice that in major 200m races when they have 9 lanes (as in the 2012 Olympics), they now leave lane 1 open and use lane 9. They know the outer lanes are cherry, but they don't know why. This was proved again in Rio this summer, when Van Niekirk set a new world record in the 400m from lane 8, beating Michael Johnson's 17-year-old record by a large margin. This reminds us that Johnson ran one of his best 200m times from lane 8, winning the 1992 Olympic trials with a near WR time.

Now that we know *pi*=4, the distances and staggering on all tracks must be recalculated. I predict this will solve many of the anomalies we see in real-life races.

To do this, the experiments should be run on tracks where the straights are thought to be equidistant to the curves. This will show up the anomalies most easily. In fact, I suspect tracks are built the way they are to hide these anomalies. Why else would you push the standard 400m track to 84m straights? I assume the old 440yd tracks were equidistant tracks, although I couldn't find any confirmation of that online. I will be told it is keep the curves from being too tight. An equidistant 400m track requires a 31.8m radius instead of 36.8. True, but 200m tracks have a radius of only 16m, and runners deal with that without flying off into space [normally now with banking to help them]. Besides, if you really demand larger turns, why not build an equidistant 480m track, which wouldn't take up much more space? It would be the same width and only slightly longer. The 100m race would fit on a leg without painting over the curves, and the 200 would spend less time in the curves. The 400 would spend about the same time in the curves as now, you would just have a backstretch of 120m and a finishing straight of 40m.

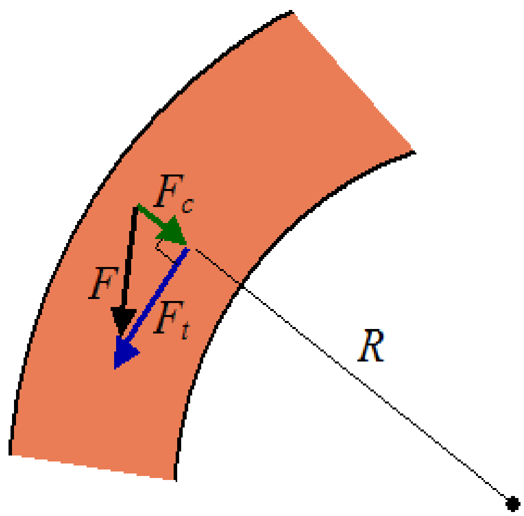
My guess is the 400m track with shorter straights was chosen as a standard to hide the problem with *pi*. It has done that pretty well.

That was the first factor we have to pull back in, and it shows us how the problem with *pi* is hidden. However, there is an even larger factor unaddressed so far. It is the one my reader was shooing me away from. Some runners and physicists have told us *g* aids a runner in the curve by providing an gravity assist due to lean. Most people have ignored that or assumed it was a very minor assist. It isn't. It is not only real, it is far greater than is commonly supposed. Or, even those who calculate it correctly *don't include it* when they solve a problem like the one we are solving with distances through the curves. What this assist tells us is that—**minus all other factors**—runners should run *faster* through the curves, not slower. Many runners claim they are going faster through the curves, and feel like they are decelerating when they leave the curves. But they are told it is just an illusion. Some physicists and engineers admit there should be a gravity assist, but then—knowing of the slower times through the curves—they *assume* other factors must outweigh that assist. So they calculate unequal forces on the legs, decreased traction, centrifugal forces, and so on, to fit the data. That is, they *assume* the body can't make full use of that assist from gravity. And they do that only because they *know* the times are slower through the curves. The body *can't* be making full use of the assist—they think—because if it were, the times would be faster through the curves, and they aren't.

Makes sense, until you realize the calculated distances through the curves are wrong. Using 4 instead of *pi* shows us the runners are running farther through the curves than previously thought, which means —given the times—they are running faster than thought. A lot faster. In fact, in many situations they may be running faster through the curves than on the straights. And, as you see, that again acts to cover the problem with *pi*, since what should be assigned to faster speeds is instead assigned to shorter distances. Current physics has both the speeds and the distances wrong, so the whole thing is a muddle.

But let us back up. Many physicists will say, “Lean can't help you move forward! The force of g is down only and has no vector forward.” Sounds logical, until you actually do it. Get up from your computer chair. Now, lean forward. You will next do one of two things: one, you will fall on your face; two, you will catch yourself with your legs and be propelled *forward*. Although it is true g has no forward vector, your body can capture the downward energy with its muscles and turn it into forward motion. It does that with lean. I will be told vectors can't be turned, but of course they can. Poolballs do it all the time. They turn a force or motion in one direction into force or motion in another.

We see a similar problem with the “centrifugal force”, as calculated by the mainstream. They “know” there is an apparent slowdown in the curves, so they use the centrifugal force to explain it, as here. There we are given this diagram:



Then we are told,

Running around a turn forces the runner to produce a centrifugal force F_c in order to maintain his curved running path around the track. This centrifugal force is in addition to the force necessary to propel him tangentially along the track, which is F_t. The total force F (exerted by the runner on the track) has components F_t and F_c. . . This has the effect of diminishing the force available to the runner for propelling himself around the track.

Terrible physics, all the way round. First of all, that is a centripetal force, not a centrifugal force. Centripetal points in, centrifugal points out. Everyone who has taken highschool physics know that, so we have to wonder who is writing these pages. The centripetal force is always a real force, and the centrifugal is always *a reaction* to the centripetal. But the bigger problem is that the last sentence simply does not follow from the ones before it. They imply that the runner cannot produce both F_c and

F_t at the same time, therefore F must fall from what it was on the straights. However, if we look closely, what the runner was producing on the straights was F_t not F. Therefore, to get a fall in force and speed, F would have to fall below F_t. And the only way that could happen is if we subtracted all or part of F_c from F_t. Since to create the curve, the runner *must* produce F_c, that means they are telling us he must use what he was using to create F_t to create F_c. But there is no evidence of that. Not only do they produce no evidence for it, there is no evidence for it in any real life situation. It is not a zero-sum game, and there is no reason a runner couldn't produce both forces at the same time. The runner doesn't even use the same muscles or motions to create the two forces, so how could one necessarily negate the other? Side lean and the muscle response to side lean creates F_c, which may have little or nothing to do with the forward motions. You will say that if the inner thigh is already maxxed out to create the forward motion, it cannot respond to extra pressure from the lean except by slowing the forward motion, but there is no evidence that all parts of the inner thigh are maxxed out. Even if you could prove the body was already running at 100%, going into the turn would take pressure off the outside leg. The body could then shift that energy to the inside leg. And indeed we know that happens. It is assumed this causes a lower overall speed, but that is just an assumption. The math above does absolutely nothing to prove it, or even indicate it.

The only indication they have is the slower times through the curves, but I am showing you that the velocities calculated from those times aren't right. They are calculated from faulty distances. Velocity is distance over time, and if the distance is wrong the velocity will be, too.

In fact, the analysis and diagram above can just as easily (or *more* easily) be used to indicate a faster speed through the turns. If we assume the body can use lean and the response to it to create F_c in any amount independent of F_t, then the vector addition of those two forces must produce an F greater than F_t. If F is greater than F_t, then the runner is running faster through the turn than on the straight.

We see signs of the cover up even in the diagram above. Since this is the top-listed site on a search on this question, this is not a trivial matter. Notice that as they have drawn it, the black arrow is shorter than the blue arrow. But since it is the hypotenuse, the black arrow should be longer. See how they have cheated, pulling the black arrowhead back? Do you really believe that was an accident? It just accidentally supported their conclusion?

Look at all that lean! If those guys aren't using a gravity assist, why are they leaning so much? The answer is, the gravity assist and the centripetal force are basically the same thing. One is used to create the other. The lean makes use of gravity to create a centripetal impulse. The inner leg resists the gravity vector down and turns it toward the middle of the circle. That is the centripetal vector. Added to the tangential vector, the total vector is created. Notice the word "added" in the last sentence. Vectors are added in the turn, not subtracted. You create a curve by adding vectors, not subtracting them. And yet, above, we saw the mainstream subtracting vectors to explain a slowdown.

Here's another thing. Who is leaning the most in the photo above? Lane 3 and lane 7 (we see runners 2 through 9). Who won this race? Do you know? Lane 7 is Usain Bolt. He won. He has the greatest leg lean of all, and also an astonishing turn out of his foot.

Which brings us to this question: "If runners are actually going faster in the turns, it seems like they would want to stay in the turns as long as possible. But you said above that lane 1 was slower because the runner was in the turn longer. What gives?" What gives is that we have still more factors to consider. The current analysis is not only very incomplete, it makes false assumptions in several crucial places, as we have seen. If we are comparing lane 1 to lane 8, we aren't comparing curve to straight, we are comparing curve to curve. I already showed you one reason lane 1 is worse: that runner runs the entire curve, therefore he experiences the entire miscalculation between *pi* and 4. But there is more. In the 200 and 400 meter races, the runners start in the curve. This is so that they can finish in a straight on the same line. Problem is, starting requires a similar use of lean to what turning does. The runners lean forward a lot at the beginning to get them going and to get them out of their crouch. If they are starting in a turn, they have to lean inwards as well. Lane 1 has to lean inwards the most, because that runner has to create more centripetal force. He has to create a greater curvature in each dt (moment), you see. It appears that in tight curves, these multiple leans really can overwhelm a runner's legs, or his timing. It is harder to start in a tight turn, as any runner knows who has done it. Running lane one is bad enough: starting in lane one is even worse. For this reason, it woud be better to stagger starts on a straight. Then everyone would have the same amount of difficulty in the start. Unfortunately, that isn't feasible at most distances on the current tracks. If you pulled the 200 start back to the end of the straight, every runner would be running different lengths in the straight, which would cause other problems. In my opinion, the 200m should be run entirely in the straight. They spend millions of dollars on these tracks, and having a 200m straight wouldn't add much to the cost.

And we have yet another factor to include here. Although it may be possible to run *some* curves faster than straights, of course that won't apply to all curves. If a curve becomes too tight, the runner cannot deal with the leans and forces required. The same would be true even of a bicycle going through the turns, which has almost infinite stiffness compared to a runner. The frame isn't going to break from the stresses, but the tires are going to lose grip at some point. Neither the friction nor the balance can be maintained after a certain point. Which reminds us that the best curvature for a runner is going to be above some number. Below that number, the vectors can't be added, and the forces really will begin to interfere, as in the mainstream analysis above. That analysis is not completely wrong as a general outline, it is only wrong in applying to all curves. The mainstream applies it to all curves, assuming the human body cannot deal with curvature at all except by breaking down. But I have reminded you that is not a logical assumption. If the body can deal with the curvature, that curvature can actually provide an assist. Only when the body cannot deal with it do we get a centripetal force interfering with the motion forward.

If we take this back to our lane analysis, it tells us outer lanes and possibly even middle lanes may be assisting the runner, while inner lanes don't—or don't as much. The only way to know is to start over, remeasuring velocities run in different lanes. And that can only be done by using 4, not *pi*.