

Fast, On-site Fuel Scrutineering for Real-time Results and Winning Decisions

Superbike racing is an extraordinarily popular sporting event across the globe. Superbike races are well-known for their close, dramatic endings that draw millions of people to the race courses or television broadcasts each year. Imagine the excitement of watching the riders manoeuvre their bikes among the pack—only inches separating them—at incredible speeds. No wonder it is such a popular attraction.

Did you know that superbikes are based on standard production models to which slight changes are made to increase their performance capabilities? And yet those slight modifications make Superbikes both quick and powerful—1,000 cc engines that can generate more than 180 bhp and are capable of reaching 200 mph. To keep the race teams on an equal footing so races are fair, close, and exciting, the International Motorcycling Federation (FIM) sets strict requirements for Superbikes, such as those for engines, tires, and fuel.

Fuel and Race Equity

The fuel is blended specifically for Superbike racing according to FIM regulations, and all teams are required to use the control fuel. This ensures the race results are not influenced by differences in fuel composition, but truly demonstrate rider skill and bike performance.

The Italian Superbike Championship (Campionato Italiano Velocità: CIV) relies on the TOTAL Group (TOTAL) to supply the official control fuel for all CIV races. TOTAL is one of the largest suppliers of motorsport fuels in the world, so they are no stranger to meeting stringent specifications required by race regulations.



Figure 1. Italian Superbikes reach speeds up to 200 mph using TOTAL Group's ELF fuel.

In addition to supplying the FIM-sanctioned control fuel to the Italian teams, TOTAL also provides CIV with fuel scrutineering services. CIV requires that fuel samples are collected immediately after the race from bikes chosen at random by the race organizers. The fuel samples are then analysed to ensure no one is using an alternative fuel or performance-enhancing additives.

Formerly, the fuel scrutineering process began with real-time, on-site density screening. If a sample's density differed from the control fuel, the sample was sent to an external lab for a detailed analysis using gas chromatography/mass spectrometry (GC/MS). The race organizers received the off-site analysis results in 20 days.

However, they need the fuel testing to be highly accurate and the results available within minutes of sample collection so final decisions can be made about the race results. TOTAL took on the challenge of finding a better solution for the fuel testing. They conducted focused research to find an analytical instrument and service provider with a proven record for state-of-the-art expertise. They found exactly what they needed in PerkinElmer and their portable Torion® T-9 GC/MS.

Accurate On-Site Analytics for Fast Race Results

The Torion T-9 is the world's most compact portable GC/MS. Fully equipped with helium cylinder and battery, it weighs just 14.5 kg (32 pounds). The Torion T-9 provides high-definition sample analysis, including both the identification and quantitation of sample constituents.



Figure 2. Compact and portable, the Torion T-9 GC/MS is easy to install and use within a mobile track-side analytical vehicle.

PerkinElmer assisted TOTAL with installation of the Torion T-9 inside the TOTAL race support van and provided an analytical chemist to train TOTAL staff to run the system and interpret the data. They found the Torion T-9 is easy to operate with the option to use its colour touch-screen user interface or the simple three button navigation. Its rechargeable battery precludes the need for an electrical connection.

On race day, the van is driven to the parc fermé where all of the bikes return after the race. A fuel sample is injected directly from the bike's fuel tank to the Torion T-9, eliminating the potential for sample contamination during manual transfer from the bike to the analyser.

The Torion T-9 presents the fuel sample profile as a chromatogram in three minutes or less. The chromatogram also shows the control fuel profile to allow direct comparison of the fuel sample composition to that of the control. Any suspicious peaks on a sample's chromatogram are identified using an internal library of known compounds. Figure 3 depicts the chromatogram of a fuel sample with a suspicious peak at around the 20 second point of the analytical run. Comparison of the peak's location and mass with those in the internal library identifies it as isopropyl ether, an oxygenated compound that could enhance fuel performance.

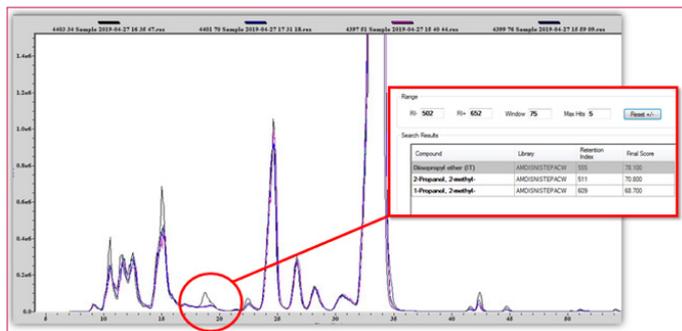


Figure 3. Chromatogram showing control sample (purple) and fuel sample (grey) profiles. A suspicious peak is identified using the internal library of known compounds.

TOTAL began using the Torion T-9 in the 2019 CIV racing season, and since then several fuel samples have been found to be non-conforming to FIM standards. The Torion T-9 enables TOTAL to get the analytical results to race officials in less than 10 minutes. CIV race results are no longer delayed due to slow analytical turnaround or the need for multiple analyses to achieve the accuracy and detail needed.

TOTAL and CIV are experiencing first-hand the many benefits of having the Torion T-9 GC/MS track-side for every race:

- Fast sample turnaround in three minutes per sample
- The ability to check more fuel samples without sacrificing time or accuracy
- The luxury of a mobile analytics vehicle thanks to the compact footprint, ease of use, and low-maintenance design of the Torion T-9
- Elimination of the time and cost of shipping samples to an off-site lab and preparing the careful chain-of-custody documentation required for such transport

These characteristics make the Torion T-9 GC/MS ideal for fast on-site analysis, wherever that may be. This solution is of interest to a wide field of application areas where increasing productivity and meeting tight deadlines for immediate results is crucial.