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The ancient Roman city of Tarraco, the present day city of Tarragona, in the Catalonia region of north-east Spain, is the most ancient Roman settlement on the Iberian Peninsula and was once capital of the peninsular territory. The architectural remains of the glorious past of Tarragona, include among other ruins, a circus, a theatre, and an amphitheatre. This archaeological ensemble was built 2,000 years ago and forms part of UNESCO World Heritage Sites since the year 2000.

The Catalan Institute of Classical Archaeology (ICAC) and the Architecture School of the URV (ETSA) joined efforts with the help of ARREL Project of the RecerCaixa program to study, preserve and transmit the cultural richness of Catalonia's past using Leica Geosystems' state-of-the-art laser scanning technologies and a unique mobile mapping solution - the Pegasus:Backpack (</products/mobile-sensor-platforms/capture-platforms/leica-pegasus-backpack>).

The committed team of archaeologists are proficient in transforming point clouds and HDR digital imagery into 3D CAD models. These skills, combined with their in-depth historical and archaeological knowledge, helped to unveil and understand the secrets of this Roman city that once served as a model for provincial capitals in the rest of the Roman Empire.

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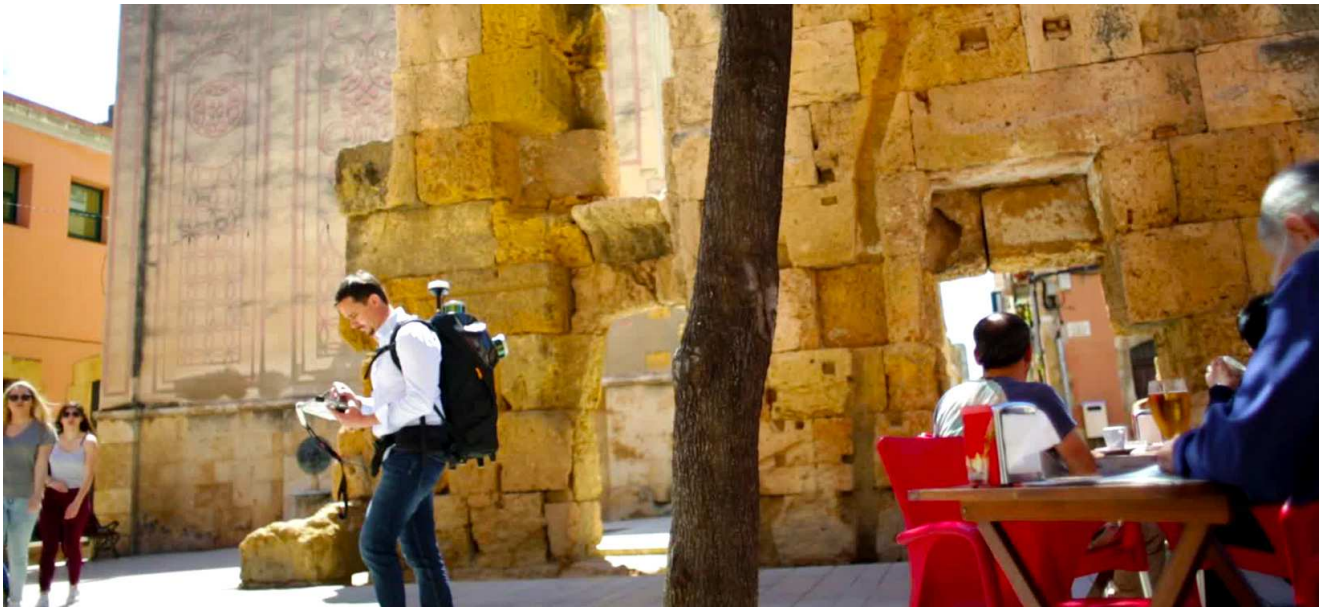
A detailed digital 3D model is a reconstruction of reality that enables the study of a determined space.

The tri-dimensional digital models of the Roman circus, a large open-air entertainment venue for chariot races and horse races, obtained from the point clouds were the basis to study and understand the initial state and transformation that this heritage site has experimented during two millennia.

“The laser scanning solutions from Leica Geosystems allow us to digitally visualise and understand the complex reality of this four hectare enclosure occupied by the Roman Circus, located today in Tarragona’s old town, that represented a real challenge of Roman engineering and that is intensely altered from the actions developed since the fifth century,” said Josep M. Macias Solé, senior investigator at ICAC.

The 3D models generated with the point clouds helped the team of specialists to achieve:

- Reconstruct digitally the Roman circus, and even locate the parts that escape the human eye.
- Interpret the components of the structure to test hypothesis about the circus’ capacity and the logic behind its initial construction and later buildings.
- Decipher the development of the local landscape throughout centuries to determine how this Roman edification conditioned the urban plot of the city in medieval and modern times.



## Putting the pieces together with mobile reality capture

The structure that initially served as a Roman circus, suffered profound architectural changes through the years and now it is inserted and hidden under the urban landscape of Tarragona. The Roman circus, located in the city centre, has exhibition areas opened to visitors, however, the old vaults that support the stage serve today as structures to hosts bars, restaurants and even private residences.

There have been several efforts to digitise the Roman circus using a whole generation of Leica Geosystems' laser scanners, starting with the C5, and C10, to

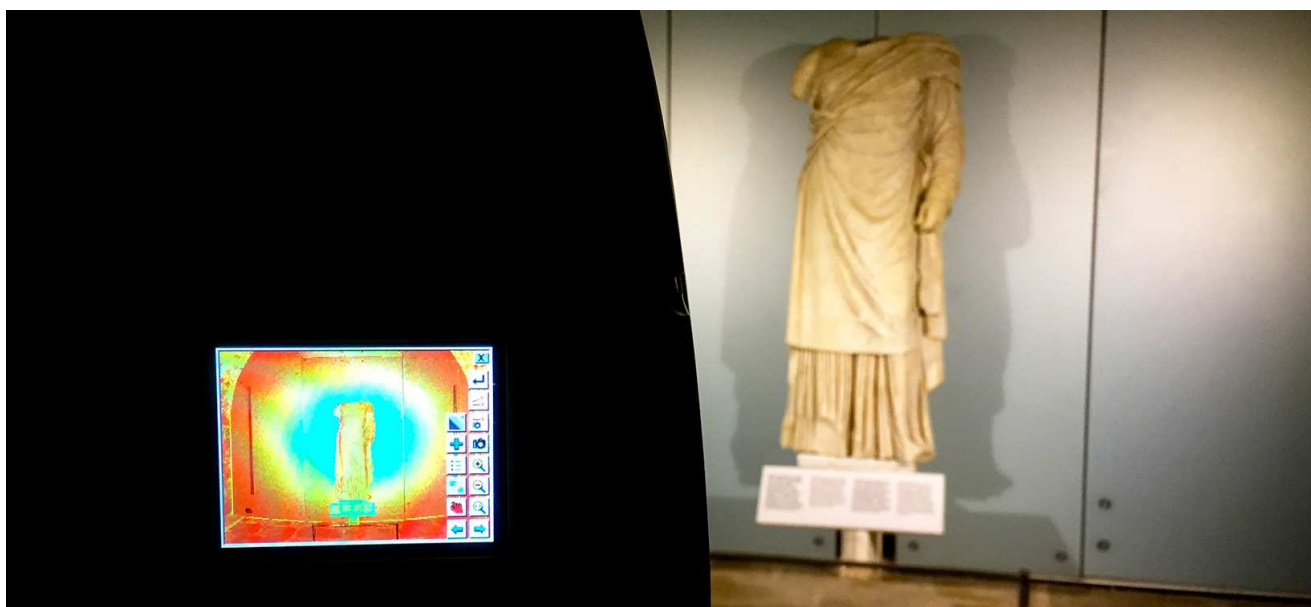
using one of the latest laser scanning technologies - the Leica P30. ICAC and ETSA have culminated these efforts with the reality capture sensor platform that unified all the previous scans - the Pegasus:Backpack (</products/mobile-sensor-platforms/capture-platforms/leica-pegasus-backpack>).

All the visible parts of the Roman circus have been documented with the laser scanners. The Pegasus:Backpack, however, made it possible to capture every step of all the streets and facades of the old town of Tarragona, which are inserted in the area occupied by the Roman circus. The use of this unique reality capture solution also facilitated the graphic integration of the contemporary and ancient architecture of the city into one single workflow.

"The Pegasus:Backpack offers us the great advantage of being able to cover areas that otherwise would be very cumbersome and very expensive with more traditional survey systems. With this tool we could eliminate much of the field work and then process the data and fit it with other projects we have done for the comprehensive documentation of this whole area," said Macias Solé.

"All this process of capturing data with millimetric precision has been extremely agile and effective, and we always counted on the technical support and continuous advice of Leica Geosystems' experts."





## Connecting disciplines

The archaeological remains of the Roman circus are a testimony of Roman architecture and planning and provide the blueprints on how this ancient construction developed and transformed Tarragona's history and landscape with every century.

The 3D documentation of the heritage site in Tarragona allowed archaeologists at ICAC and architecture students at ETSA to develop:

- Historical urban studies
- Pedagogy and museography of the historical heritage
- Archaeological research
- Cadastral plans and a heritage management system

Capturing reality through laser scanning opens a door where specialists from several disciplines, like archaeologists and architects, can converge to study, map, monitor, and conserve any building or asset. As seen in Tarragona, Spain, Leica Geosystems' solutions help professionals become more efficient and accurate on how they produce, share and evaluate information.