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TOCCARE TERRA: APPRODI E CONOSCENZE.
Primo convegno di archeologie flegree

Museo archeologico dei Campi Flegrei nel Castello di Baia
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ACOUSTIC REMOTE SENSING FOR SEABED ARCHAEOLOGY
Ultra-high-resolution multibeam survey of the submerged Baiae

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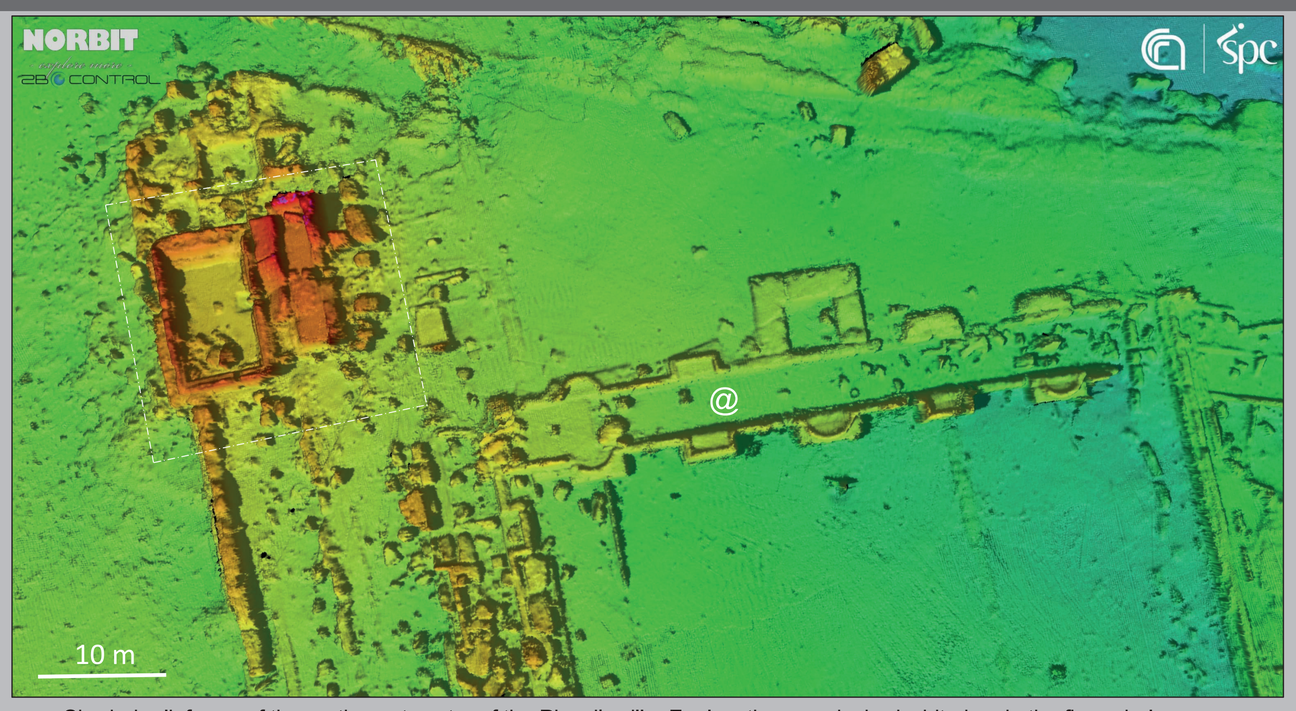
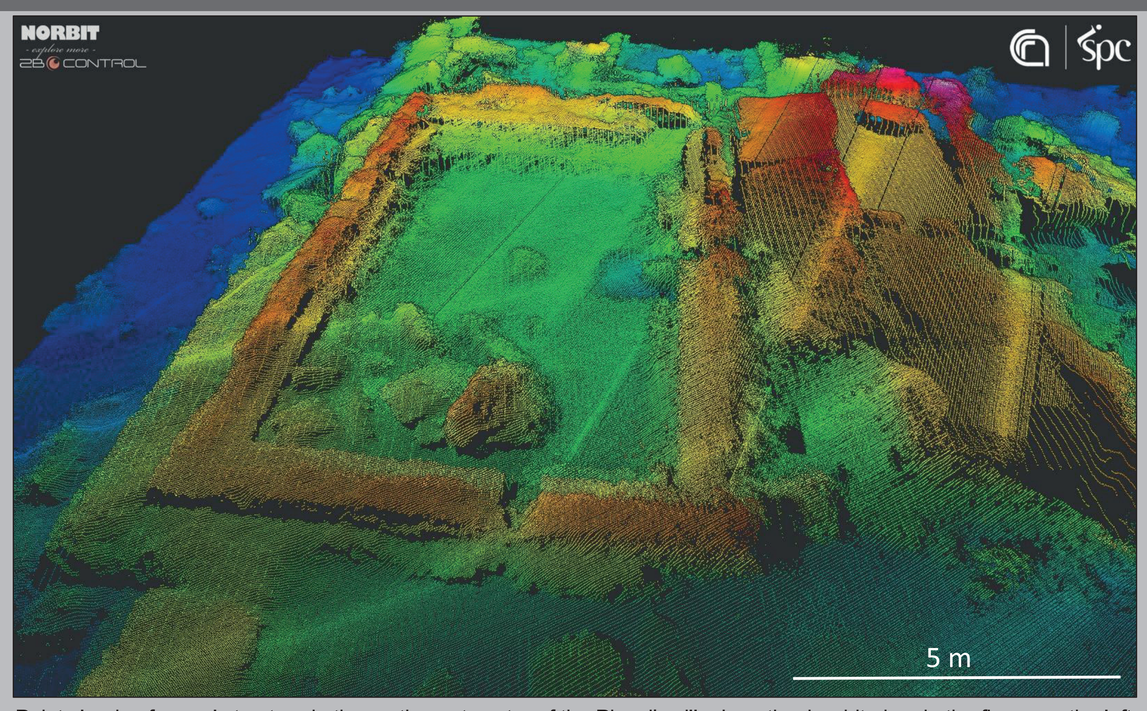
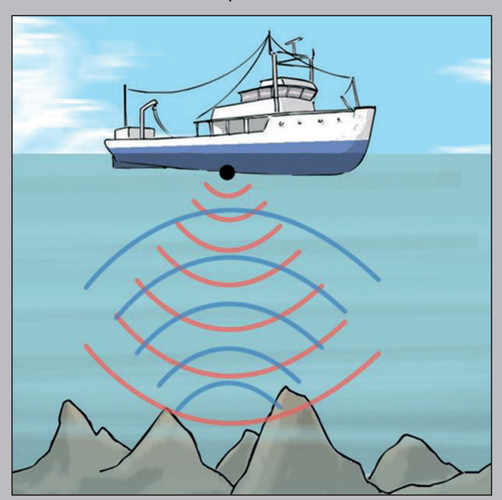
In the last decade, the advent of high-resolution multibeam sonars has enabled to solve the 3-D shape of submerged objects providing a valuable tool for recognizing and describing archaeological resources at the seabed. These systems measure the local configuration of the seabed by transmitting acoustic energy toward the bottom and detecting the arrival times and directions of the acoustic energy that returns from the bottom. The resulting data are of high spatial resolution, repeatable and quantifiable, and can be easily integrated with other scientific and terrestrial data. In the frame of research agreement with the Parco Archeologico dei Campi Flegrei we used the ultra-high-resolution sonar system NORBIT WINGHEAD® i77h in the Baia submerged site to map the Pisoni's villa and surroundings with centimeter-level resolution. Creating of such accurate maps provides a primary record of the current state of the submerged archaeological features and allows for the establishment of various measures for their future preservation and monitoring.



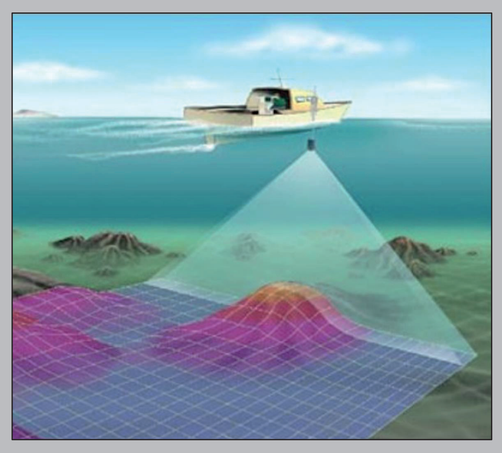
Shaded relief map of the north-west sector of the Pisoni's villa. For location see dashed white box in the figure below.



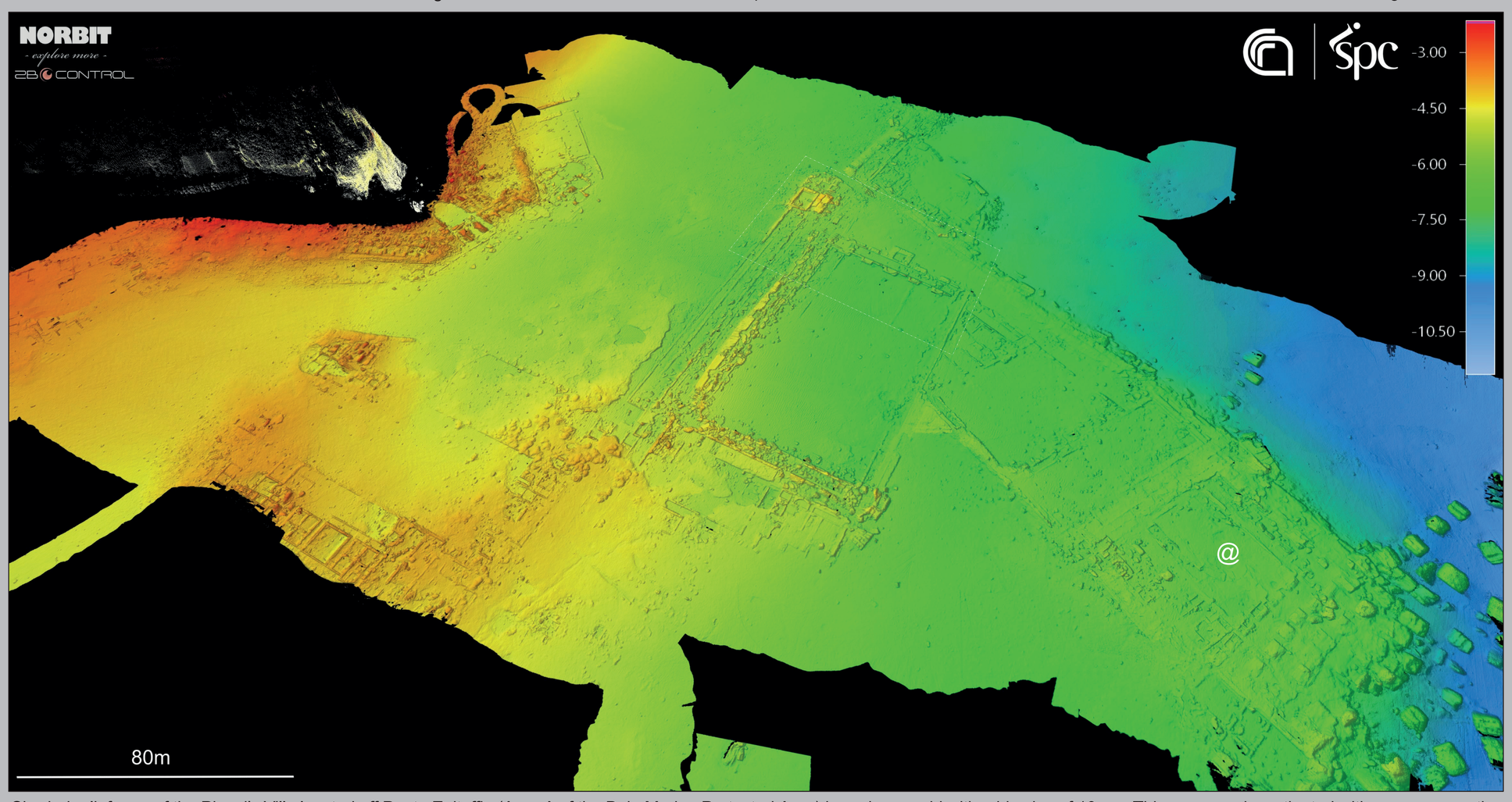
Point clouds of a pool structure in the north-west sector of the Pisoni's villa. Location is white box in the figure on the left.



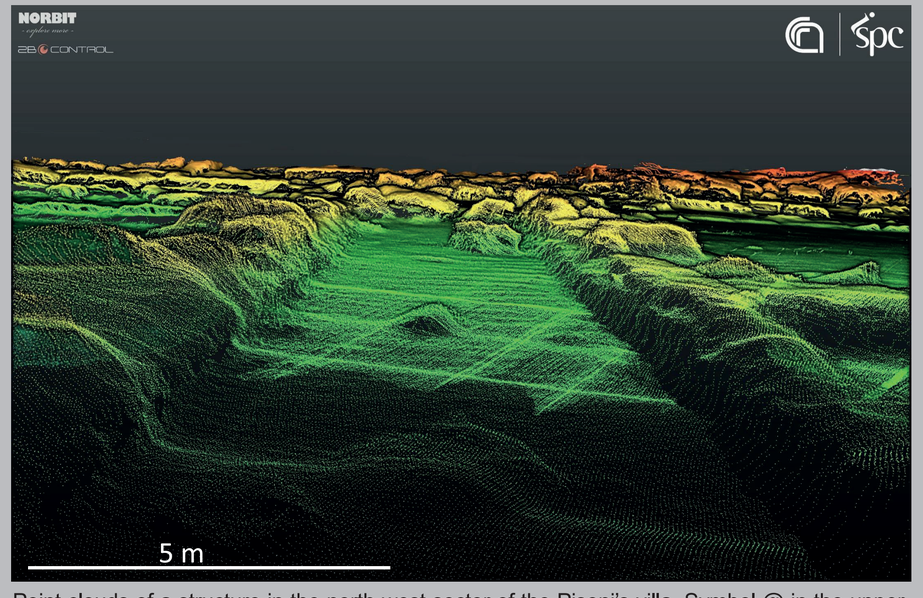
In underwater applications, sound waves are the most efficient means thanks to their long travel distance (up to kilometers) without significant attenuation. When an acoustic wave encounters a sudden change in the properties of the material in which it propagates a part of the acoustic wave will change its direction of propagation. The portion of the acoustic wave that reverses its propagation direction is the echo which echo sounders are designed to exploit for depth measurements.



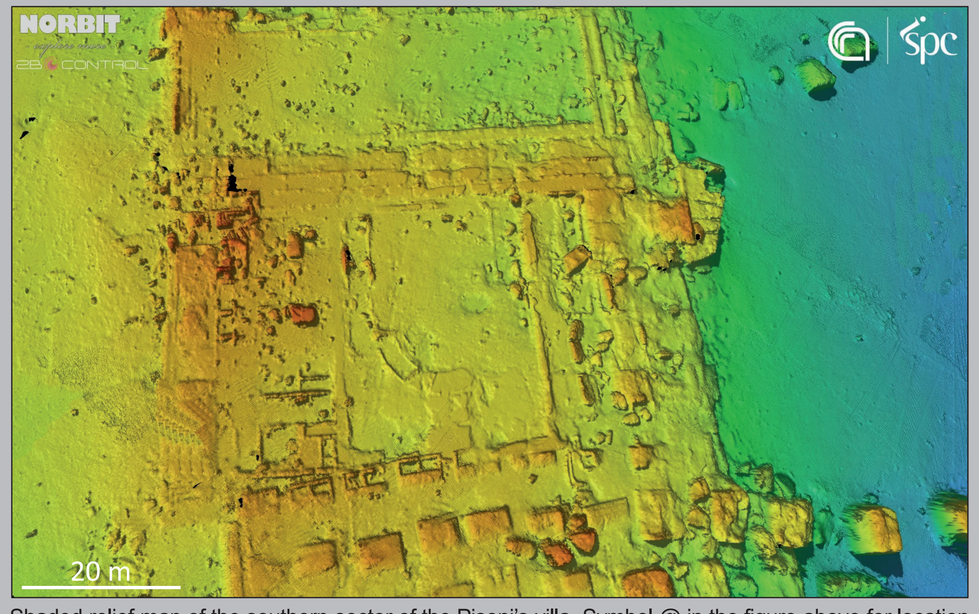
Multibeam sonars are primarily designed to produce quantitative information about the water depths by measuring the acoustic time of flight to the seabed as a function of angle from nadir. Using trigonometric functions, the travel times are converted to a set of points, each with a vertical and horizontal coordinate, relative to the multibeam transducer (depth and position). Water depths are finally obtained by applying the speed of sound in the water column (the sound/velocity profile). Because of the non-vertical measurement geometry, it is absolutely essential that full X-Y-Z inertial motion sensors be installed and operated on the survey platform along with the multibeam sonar.



Shaded relief map of the Pisoni's Villa located off Punta Epitaffio (Area A of the Baia Marine Protected Area) based on a grid with a bin size of 10 cm. This area was investigated with a new generation of multibem NORBIT technology, the WINGHEAD i77h integrated with Applanix POSMV OceanMaster GNSS/IMU, operated with frequencies ranging from 400 kHz to 700 kHz from aboard of the R/V ULISSE. The technical configuration included QPS Qinsy hydrographic acquisition sw on laptop, the NORBIT DCT sw on tablet as support of navigation for the vessel pilot, the HxGN SmartNet GNSS service network for RTK correction.



Point clouds of a structure in the north-west sector of the Pisoni's villa. Symbol @ in the upper-left figure for location.



Shaded relief map of the southern sector of the Pisoni's villa. Symbol @ in the figure above for location.

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