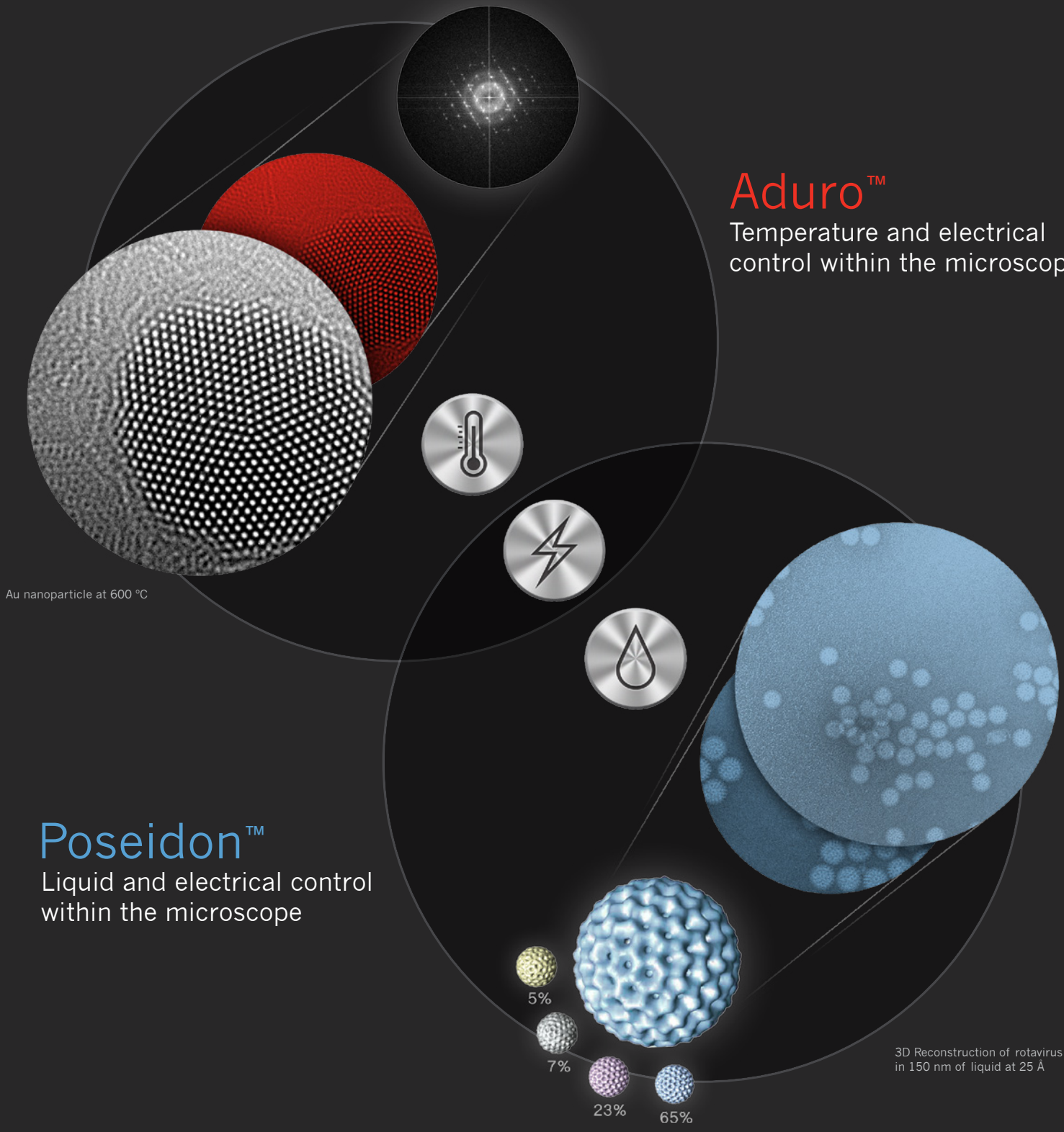
Protochips

Quantifiably Better™



Aduro™

Temperature and electrical control within the microscope

Au nanoparticle at 600 °C

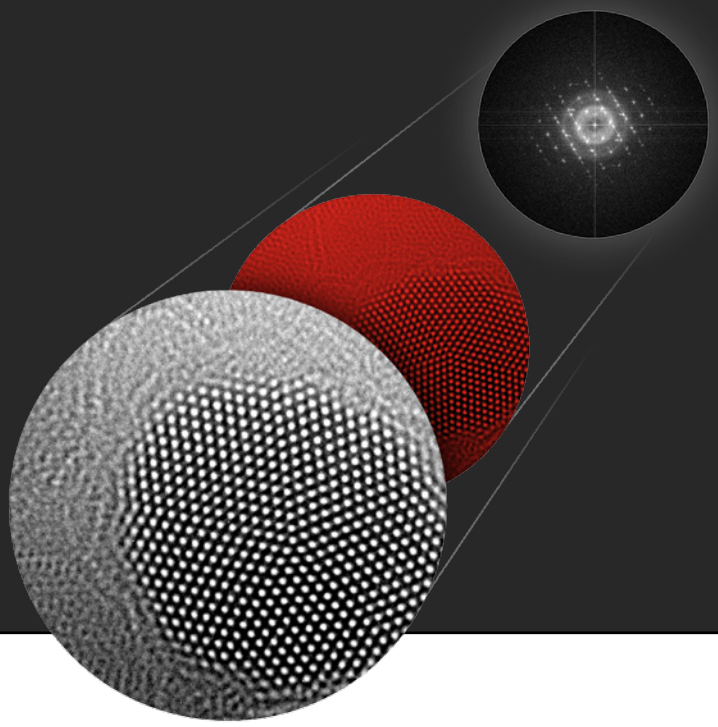
Poseidon™

Liquid and electrical control within the microscope

3D Reconstruction of rotavirus in 150 nm of liquid at 25 Å

Generate accurate, actionable data from innovative *in situ* experiments

Aduro



Aduro Heating and Electrical Biasing

Aduro is a versatile and scalable platform for quantitative electron microscopy. The Aduro products revolutionize the analytical capabilities of electron microscopes by providing the ability to conduct *in situ* studies with electrical stimulus and at temperatures up to 1200 °C, while maintaining the full nanometer resolution of the instrument. No other commercially viable solutions exist that enable real-time, dynamic thermal studies in a fast, versatile, high-resolution and easy-to-use package. Aduro allows you to develop products faster, understand materials better and accomplish more research. Aduro is compatible with all of the new and existing equipment and can bring expanded capability to your system. With better resolution comes quantifiably better analysis and results. If you want to develop materials that will change the world, Aduro is the best platform for you.

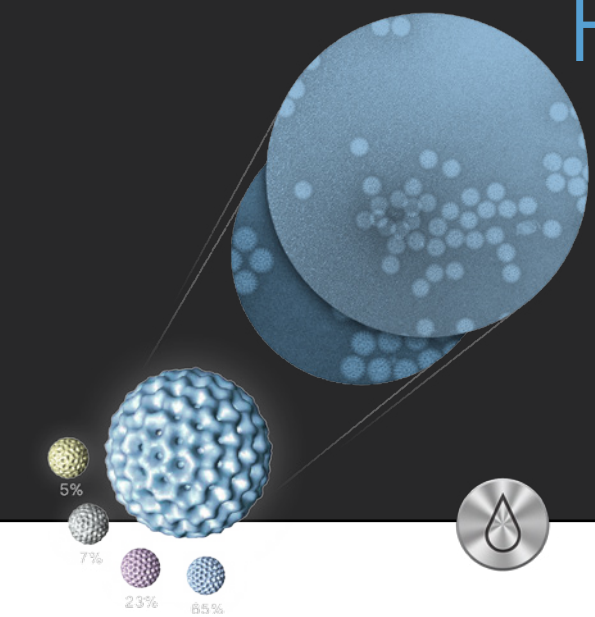
Aduro Capabilities

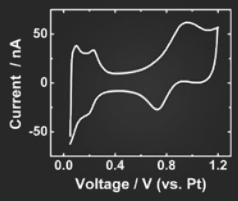
There are Aduro products for all major OEMs and for most modern TEMs and SEMs. All versions of the platforms use the same Aduro E-chips™ allowing for correlative studies between TEM and SEM. Aduro is a very flexible and versatile tool and by simply swapping E-chips it can heat or measure electrical properties of samples. The functionality of the platform depends on the type of E-chip you choose, not the holder. All of the capabilities are included in the software interface. The unique membrane heater on the thermal E-chip provides extremely high thermal stability and low drift which allows you to achieve the maximum resolution of your microscope, even at temperatures over 1000 °C. In addition to having highly accurate temperatures, Aduro can heat and quench with rates up to 1000 °C per millisecond capturing material changes and dramatically increasing your productivity. In addition to heating there are Aduro electrical E-chips with many options on electrode layouts for biasing experiments. Ease of use is a hallmark of the Aduro software interface with capabilities to adjust temperature, current and voltage, or build your own profiles for repeat studies.

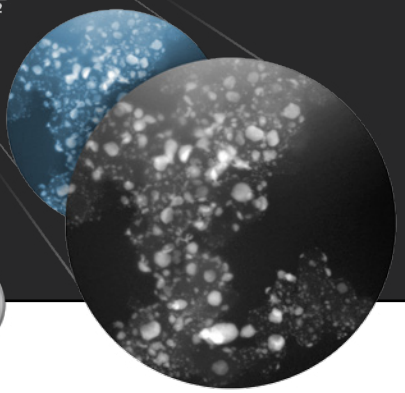
Most importantly to discovery is the fact that Aduro is quantitative and compatible with many different analytical tools like EDS, EELS, STEM and diffraction techniques. With Aduro 300 double-tilt and Precision Electric options are readily available.

Aduro	100	300
E-chip based *in situ* flexible platform	•	•
TEM, STEM and SEM high resolution at high temperature	•	•
Fast thermal ramp rate (1000 degrees C/ms)	•	•
Ultra fast stabilization and low drift at high temperatures	•	•
Quantifiable EDS, EELS and EBSD at high temperatures	•	•
Platform with dual channel thermal and electrical analysis capability		•
Advanced parameter analyzer for electrical characterization		•
Real time temperature logging		•
Double-tilt option		•
Precision Electric option (sensitivity < 10 pA)		•
Price	$$	$$$

Poseidon







Winner of the 2013
R&D 100 Award for
Technological Innovation

Dynamic Imaging and Electrochemistry Studies of Hydrated Materials

Poseidon allows scientists and engineers to image materials and biological samples in a self-contained and fully hydrated flowing and mixing chamber, directly within the TEM. Samples and processes that previously required freezing or could not be imaged in their native operating environment can now be studied and observed in liquid and at high resolutions. From hydrated materials such as inks and gels, to biological materials including whole cells Poseidon allows you to quickly and easily load samples in a sealed environment and image within the TEM. With the Poseidon 500 Electrochemistry cell, you can combine these features with the power to characterize electrochemical reactions in real-time.

Poseidon	200	500
E-chip based flexible platform	•	•
Configurable viewing area and liquid layer thickness	•	•
Compatible with tissue culturing and other attachment chemistries	•	•
Nanometer resolution with hydrated species	•	•
Static or flowing configuration	•	•
High resolution TEM and STEM imaging while flowing	•	•
Optional *ex situ* cell	•	•
Electrochemistry applications		•
Three electrodes (WE, RE, CE)		•
Configurable electrode patterns and materials		•
Price	$$	$$$

Poseidon Capabilities

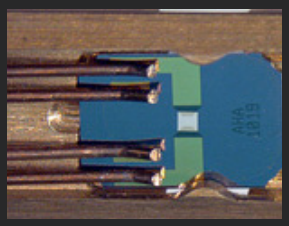
Poseidon products are compatible with a broad range of materials and biological samples. The Poseidon 200 Liquid Cell sample chamber can be configured for flow, mixing, or static operation simply by exchanging the Poseidon E-chips. The unique properties of these E-chips and the sample chamber design enable nanometer resolution imaging of specimens in dynamic liquid environments, bridging the gap between cryo-EM and light microscopy.

Poseidon can be used to flow a sample or solvent through the chamber using the 2-port system, or introduce additional reagents for mixing with the 3-port system. Researchers can dynamically modify the sample's liquid environment during imaging with precise control of flow rates. The result is a unique ability to realize multiple sample environments and image mixing processes in real time. Protochips has developed a wide variety of sample preparation techniques to enable the deposition or chemical attachment of particles or other materials directly on the E-chips.

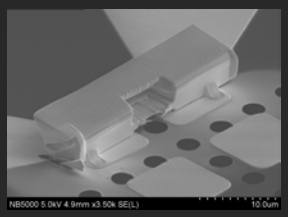
The Poseidon 500 Electrochemistry cell takes liquid research to the next level by introducing electrochemistry capabilities. Working with Gamry, a world leader in electrochemistry and titration products, Protochips brings precision potentiostat/galvanostat instruments to the *in situ* environment. The Poseidon platform is compatible with both TEM and STEM but in addition, is ideal for correlative light and electron microscopy (CLEM) studies. The E-chip devices are compatible with all of the standard tissue culture techniques, sterilization procedures, and surface modification chemistries.

E-Chips

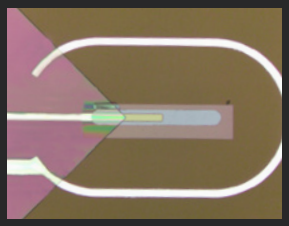
The Protochips Environmental Chips (E-chips) were developed to meet the unique and specific needs of *in situ* researchers. E-chips are a consumable sample support which provide a flexible solution to address needs including high thermal stability, high speed and low drift, beam transparency, the ability to contain liquids and gases, tissue and sample preparation compatibility and the ability to conduct electrical analysis.



Aduro thermal E-chips integrate temperature control directly onto the specimen support through a low-stress ceramic membrane that serves as both the heating element and the sample support. This provides a highly accurate and extremely stable platform for *in situ* research. Several surface coatings are available to meet your needs.

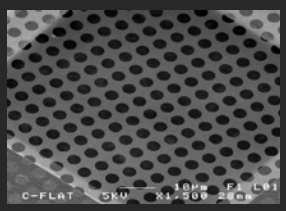


Aduro electrical E-chips come in many electrode and material configurations to meet a wide variety of sample preparation needs. The large variety of materials and patterns provide a flexible solution for electrical analysis. Aduro Electrical E-chips are part of an interchangeable platform with the thermal E-chips.



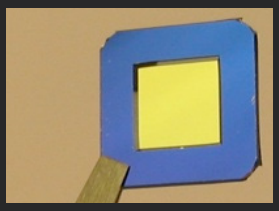
Poseidon E-chips allow the researcher to configure a liquid environment customized to a specific sample and application. By choosing from a selection of designs, researchers can optimize viewing area, liquid layer thickness and configure flow patterns. The electrochemistry Poseidon E-chips offer the added selection of electrode designs and materials to meet all of your electrical analysis needs.

C-flat



C-flat™ is the premium holey carbon film for cryo-transmission electron microscopy. Protochips uses semiconductor-based manufacturing technologies to make C-flat flatter and cleaner while preserving the properties of amorphous carbon. The resulting improved particle dispersion and more uniform ice thickness lead to a higher resolution and higher quality data and make it an ideal support film for biological specimens.

DuraSiN



DuraSiN™ Film and Mesh products are affordably priced, durable, non-organic, low scatter support grids for quantitative TEM and X-ray analysis. DuraSiN Film and Mesh products can withstand harsh chemical and temperature environments. With direct deposition, no longer will you have to prepare a sample on one substrate only to then have to transfer it to a support grid for imaging.

Images Courtesy of Deborah Kelly, Virginia Tech, Abhay Gautam, Lawrence Berkeley National Laboratory, and Donovan Leonard Oak Ridge National Laboratory.

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