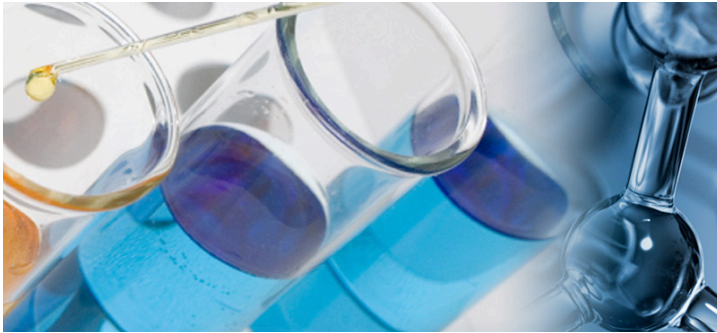


MKS PRODUCTS FOR HIGH ENERGY APPLICATIONS

SYNCHROTRON, LIGHT SOURCES AND LASER FACILITIES





HIGH ENERGY FACILITIES

A synchrotron is a particular type of cyclic particle accelerator, evolved from the cyclotron, in which the accelerating particle beam travels around a fixed closed-loop path. The magnetic field which bends the particle beam into its closed path increases with time during the accelerating process, being synchronized to the increasing kinetic energy of the particles. The synchrotron is one of the first accelerator concepts to enable the construction of large-scale facilities, since bending, beam focusing and acceleration can be separated into different components. The most powerful modern particle accelerators use versions of the synchrotron design. The largest synchrotron-type accelerator, also the largest particle accelerator in the world, is the 27-kilometre-circumference (17 mi) Large Hadron Collider (LHC) near Geneva, Switzerland, built in 2008 by the European Organization for Nuclear Research (CERN). It can accelerate beams of protons to 6.5 teraelectronvolts (TeV)*.

Applications types

Synchrotrons and Free Electron Lasers are generally used in the study of materials or development of processes. Below is a listing of research performed in various synchrotrons:

1. Life sciences: protein and large-molecule crystallography
2. LIGA based microfabrication (Lithography, Electroplating, Molding)
3. Drug discovery and research
4. X-ray lithography
5. Analyzing chemicals to determine their composition
6. Observing the reaction of living cells to drugs
7. Inorganic material crystallography and microanalysis
8. Fluorescence studies
9. Semiconductor material analysis and structural studies
10. Geological material analysis
11. Medical imaging
12. Particle therapy to treat some forms of cancer

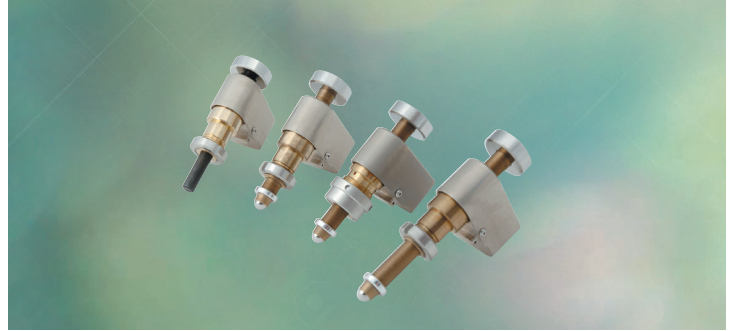


MKS | Newport Products used in High Energy (HE) Facilities

MKS motion, optomech, optics, instruments and laser products can be found in High Energy facilities. Both standard and vacuum compatible products are offered, depending on the environment needs (ambient or vacuum chamber). Two areas of generic application are beam management and sample manipulation. Since the HE beam is usually fixed, the sample is moved relative to the beam. There are rare cases where the beam is diverted in a very controlled manner via the manipulation of beam splitters or mirrors.



UTS100PP, typical type of linear stage used in HE facilities.



Picomotor™ actuators

Standard Products

Off the shelf products are generally available for HE applications in ambient conditions. The offering ranges from linear and rotation stages, actuators and hexapods. One unique feature of standard motion stages is ESP technology, where MKS-Newport Controllers recognize the attached stages automatically.

Vacuum Products

The standard vacuum compatibility goes up to 10^{-6} hPa and there are a few other products, rotation stages and actuators that are prepared for 10^{-9} hPa. The VRU shown below is an example of high load actuators used in synchrotrons. The ESP technology is also available for vacuum actuators as long as the connector provided with them is used outside the chamber to connect to motion controllers.

Non-magnetic UHV

The 8301-UHV-NM picomotor is an ideal actuator to drive optical mounts in synchrotrons.

Hexapods

Newport hexapods have found frequent use in HE facilities due to their 6 DOF, high precision motion capability and the very useful Tool and Work Coordinate systems. These programmable coordinate systems allow manipulation of the workpiece relative to itself and also relative to the beam. Customized hexapods are available, that address various loads and travel requirements.



VRUPPV6- High Load Motorized Actuator, Vacuum compatible



LTAHLPPV6-Motorized Actuator, Vacuum compatible



URS75BPPV6- Motorized Rotary Stage, Vacuum compatible



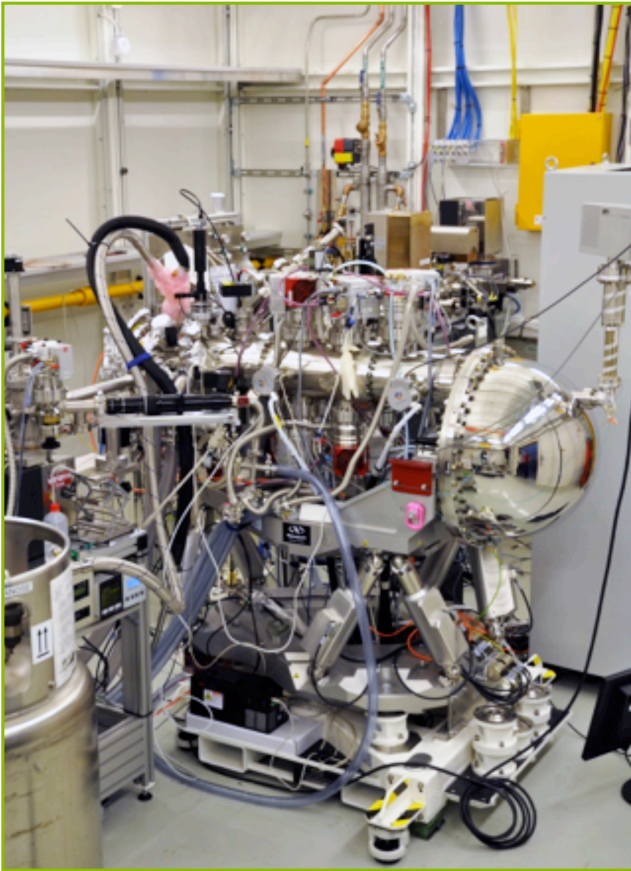
UTSPPV6- Motorized Linear Stage, Vacuum compatible



Standard and custom hexapods

Hexapods

The image shown below is a novel asymmetrical hexapod that was built for a HAXPES application. The dimensional constraints were a challenge to design a hexapod that not only has a high load capacity, but fits within the only available space.



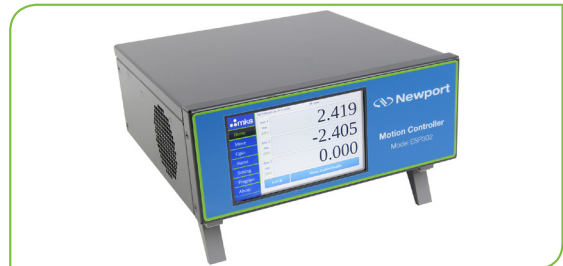
Hard X-Ray Photoelectron Spectroscopy

Controllers

Newport motion controllers enable automated control of the process. The universal XPS-D series can control up to 8 channel simultaneously, while the LCD touch screen of user friendly ESP302 allows making moves and running pre-programmed scripts, without a need to be connected to the PC. XPS-RLD is a 4 axis controller with similar features to XPS-D.



XPS-RLD- Universal Motion Controller, up to 4 axis, Basic GPIO and PCO



ESP302- Motion Controller and Driver, up to 3 axis



XPS-D- Universal Motion Controller, up to 8 axis, High Performance

Beam Profilers

Laser beam profilers make spatial beam profile measurements quickly with intuitive yet powerful application software.

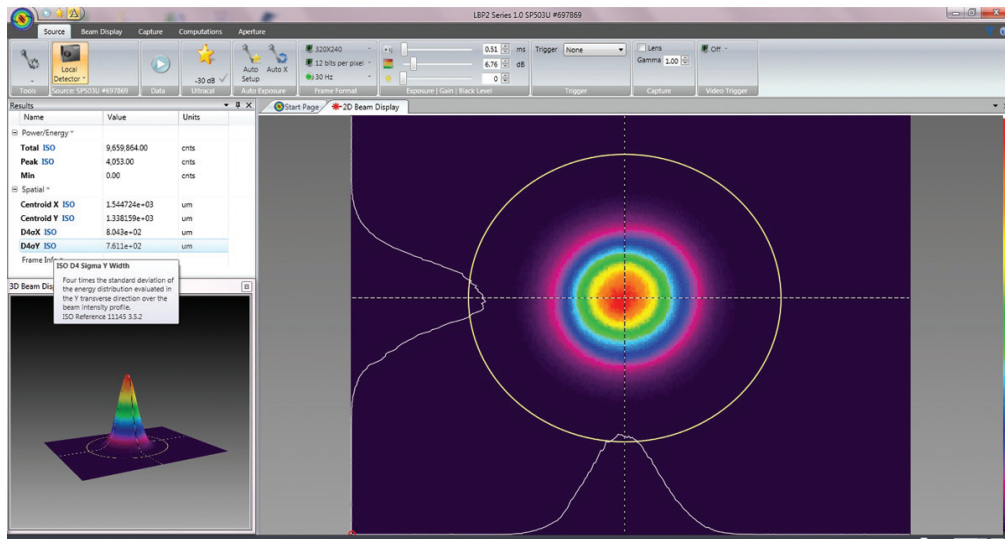
1. Measures beam size, beam shape, beam quality, beam position
2. Used to determine optical alignment, optical elements, laser quality and performance
3. From 190nm to THz wavelengths
4. Full range of beam attenuation optics available



SP928 and SP907 beam profiling systems for 190-1100 nm wavelengths



Pyrocam IV System for beam profiling of infrared and THz beams



Fully featured BeamGage software to capture, analyze and display the profile. Integrates into software applications such as LabView.

Laser Pulse Energy Sensors

1. Captures the laser pulse energy output
2. Determines the efficiency and potential energy losses in the beam path
3. Sensor cover the range Joules to 10's of Joules
4. Wavelength ranges of 150 nm – over 2 microns
5. Accommodates beam sizes all the way up to 100 mm
6. NIST traceable energy measurements



200 Watt, 40 Joule fan cooled pyroelectric energy sensor.



40 Watt, 10 Joule air cooled pyroelectric energy sensor.



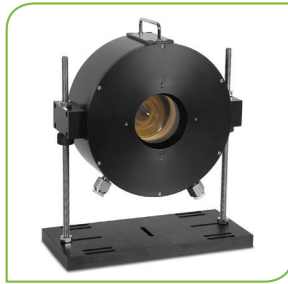
2 Watt, 2 micro Joule to 10 milli Joule pyroelectric energy sensor

Thermopile Power Sensors

1. Measures average power output
2. Determines laser output and optical efficiency along the beam path
3. Covers the range of UV to THz light sources
4. From milli Watt to 120 kilo Watt power range



1100 Watt fan cooled sensor.



30 kWatt water cooled sensor.



150 Watt air cooled sensor

Power meters and detectors



Centauri, fully featured power meter display.



EA-1 Ethernet computer interface.



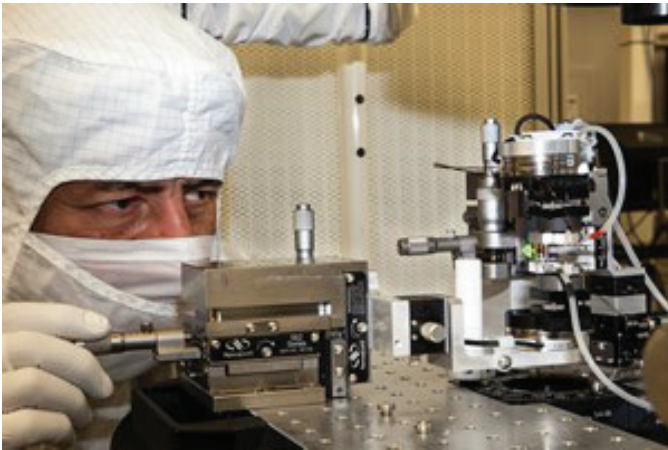
Juno USB computer interface.



Starlab Software: Captures and logs the data on a PC. Supports integration in customized software packages using .COM object.

Optomech

Many of our Optomech products are used in laser systems and facilities, such as the HVM-S series stainless steel top adjust mirror mounts. These mounts are highly stable and allow adjustment from the top, keeping hands and tools safely out of the beam path.



HVM-S series stainless steel top adjust mirror mounts

Optical Tables

MKS offers a large variety of both standard and customized optical tables for HE applications. With their outstanding stability, they help to maintain beam alignment, which is critical as the pulse is stretched, amplified and then compressed at the end of the system. The amplifiers are attached along the length of the table, ensuring successful vibration isolation.



Large variety of optical tables for HE applications

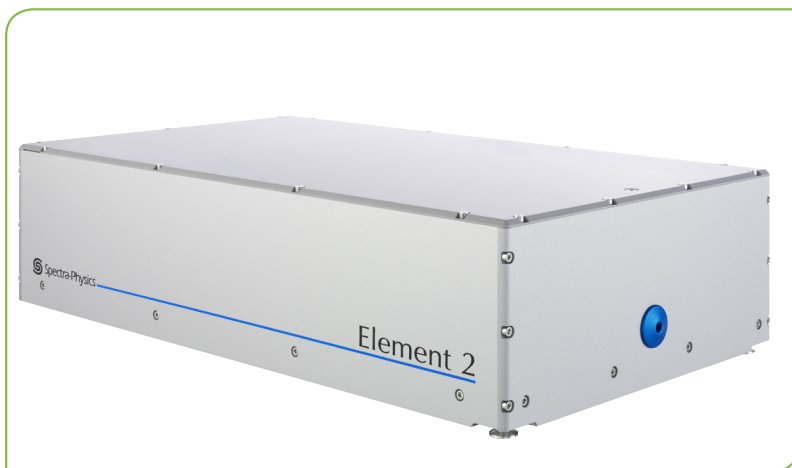
Spectra-Physics Ultrafast Lasers

#1 in Ultrafast means innovation to deliver the broadest portfolio of cutting edge ultrafast lasers and to ensure the right solution for your unique requirements. It means expertise from the widest scope of ultrafast applications and the largest installed base. It means direct access to the largest and most experienced global support team in the industry.

Ultrashort Pulsed Femtosecond Oscillators

Element™ 2 is the newest generation of Spectra-Physics' leading ultrafast few-cycle pulsed oscillators, specifically designed for superior stability, lowest noise, and hands-free operation. When paired with the newest version of our optional carrier envelope phase stabilization (CEP4), the result is the most stable and low-noise source of ultrashort, CEP stable pulses, opening the door to the most demanding ultrafast scientific applications.

- Ultrashort pulses with up to MW-level peak power
- Ultra-low amplitude and phase noise
- Superior power stability
- Hands-free operation; sealed cavity for long-term operation



Element™ 2 ultrafast few-cycle pulsed oscillator

Spitfire® Ace™

The Spectra-Physics Spitfire® Ace™ is our flagship amplifier system. It is the most technically advanced Ti:Sapphire regenerative amplifier commercially available. Equipped with our proprietary Ace cavity design, the Spitfire Ace provides guaranteed long term performance, low noise and reliable day-to-day operation resulting in consistent OPA performance and nonlinear wavelength conversion for use in the most demanding ultrafast applications.

- Revolutionary Ace regenerative cavity design
- More than 16 W of output power
- Superior mode quality ($M^2 < 1.3$)
- Digital synchronization electronics

Applications include time-resolved spectroscopy, amplifier seeding (Element) etc.



Spectra-Physics Spitfire® Ace™ is the most technically advanced Ti:Sapphire regenerative amplifier commercially available.

WHY MKS?

CRITICAL TECHNOLOGIES

World-class technology and development capabilities for leading-edge processes



PROVEN PARTNER

Recognized leader delivering innovative, reliable solutions for our customers' most complex problems



OPERATIONAL EXCELLENCE

Consistent execution across all aspects of our business



COMPREHENSIVE PORTFOLIO

Largest breadth of product and service solutions for the markets we serve



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Newport is a brand within the MKS Instruments Light & Motion division. The Newport product portfolio consists of a full range of solutions including precision motion control, optical tables and vibration isolation systems, photonic instruments, optics and opto-mechanical components. Our innovative Newport solutions leverage core expertise in vibration isolation and sub-micron positioning systems and opto-mechanical and photonics subsystems, to enhance our customers' capabilities and productivity in the semiconductor, industrial technologies, life and health sciences, research and defense markets.

For further information please visit www.newport.com