

pulseCheck NX Modular Autocorrelator

Pulse Measurement Perfection with the Multitalent from APE

The pulseCheck platform grows with your tasks. Suitable for characterizing virtually all ultrafast pulsed lasers, APE's pulseCheck NX autocorrelator covers a wide range of wavelengths and pulse widths. This flexibility is achieved by using interchangeable Optics Sets, typically consisting of a nonlinear crystal and a dedicated detector module.



- Exchangeable Optics Sets for wavelength coverage from 200 nm to 12 μm
- Wide range of sensitivity levels covered with PMT, PD, and TPA
- High temporal resolution with a sampling resolution down to 50 attoseconds
- Toggle between interferometric and intensity autocorrelation
- Integrated controller for data acquisition, data fitting, and fast FPGA data processing
- Software supported wavelength tuning of crystal (phase matching)
- Fully compliant with DIN 58175-2:2021-04 (autocorrelation measurement methods)
- NX-Software and USB as well as Ethernet connection
- TCP/IP remote control with standardized command set for easy programming
- Option: FROG for complete pulse characterization

pulseCheck NX Overview

pulseCheck	NX 50	NX 150	SM 2000
Pulse width	5 fs ... 15 ps	10 fs ... 40 ps	20 fs ... 500 ps
Wavelength range	200 nm ... 12 μm depending on Optics Set		
Recommended repetition rate	PD, TPA: >10 Hz, for UV only: <2 MHz PMT: >250 kHz		
Sensitivity*, typical	1 W ² ... 10 ⁻⁶ W ² depending on Optics Set		
Max. input power, energy	0.5 W for quasi-cw laser 5 μJ for kHz laser		
Input beam polarization	Linear, horizontal polarization rotator optional		
Input beam coupling	Free-space with 6 mm aperture fiber coupling (FC/PC or FC/APC) optional		
Input beam height	76 mm		
Measurement refresh rate	10 Hz	7.5 Hz	120 ps/sec
Delay resolution	50 attoseconds	200 attoseconds	1 femtosecond
Contrast	10 ⁻⁴		
Type of measurement mode	PMT, PD: non-collinear intensity and collinear interferometric - switchable TPA: hybrid collinear intensity		
Available detector types	Exchangeable: Photomultiplier (PMT), Photodiode (PD) and Two-Photon Absorption (TPA)		
Calibration	NIST traceable calibration certificate included		
Electronics	Completely intergrated and self-sustained		
Trigger mode	TTL <50 kHz		TTL <10 kHz
Phase matching	Automatic		Software-supported
Intensity resolution	18 bit		
Connectivity	Ethernet, USB, TCP/IP (SCPI command set)		
Remote control	Programmable via API		

* The sensitivity can be calculated as $(P_{\text{average}} * P_{\text{peak}}) = (P_{\text{average}}^2 / (f_{\text{rep.rate}} * \tau_{\text{pulse duration}})) = W^2$. The resulting value of W^2 must be higher than the specification.

Note: Sensitivity gives an approximation within an order of magnitude as it doesn't take into account other factors such as beam parameters and pulse quality.

... Flexibility for your Experiments

High Resolution & Strong Processing Performance

The advanced system-on-chip based architecture enables measurements with low latency, a high temporal resolution down to 50 attoseconds and an intensity dynamic range of 18 bit. This allows full access to even the tiniest autocorrelation features.

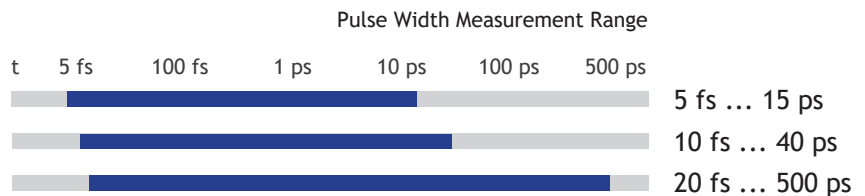
Maximum Functionality through Modular Design

APE meets the growing need for maximum functionality and flexibility with the modular concept on which the pulseCheck NX autocorrelator series is based. Thus, Optics Sets to upgrade the wavelength range or FROG capability can be added at any time.

From Ultrashort to Long Pulses

Various pulseCheck NX configurations can be adapted to the individual needs of pulse width measurements. The measurement of extra long pulse widths up to 500 ps is possible with pulseCheck SM.

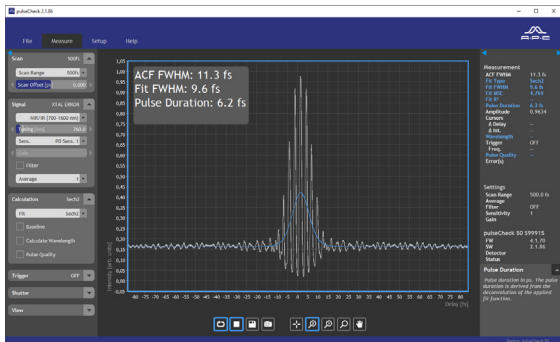
- pulseCheck NX 50
- pulseCheck NX 150
- pulseCheck SM 2000



High Sensitivity and Low Noise with Three Types of Detectors

- Photodiode Detector (PD)
- Photomultiplier (PMT)
- Two-Photon Absorption (TPA)

Standard sensitivity up to 1 W^2
 Highest sensitivity up to 10^{-6} W^2
 High sensitivity up to 10^{-2} W^2



Software GUI for pulseCheck NX



pulseCheck NX

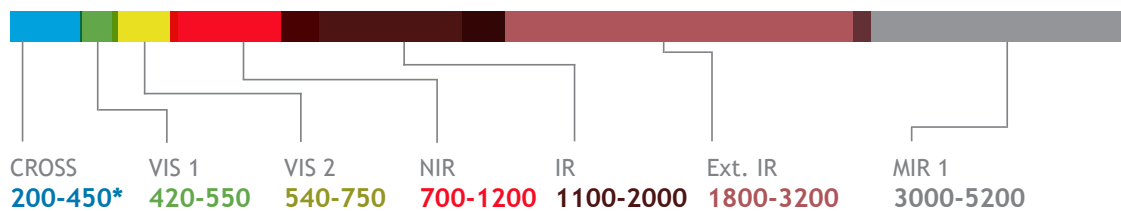
Optics Sets

A variety of different and exchangeable Optics Sets cover a wide wavelength range: from UV at 200 nm to Mid-IR at 12 μm .

Photodiode (PD)

- **Typ. Sensitivity:** 1 W^2 ▪ **Rep. Rate:** $> 10 \text{ Hz}$ ▪ **Measurement Mode:** Collinear and Noncollinear

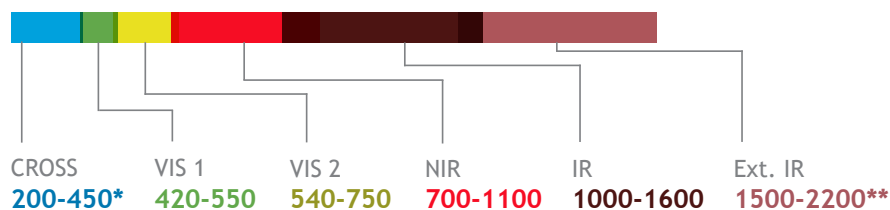
$\lambda[\text{nm}]$



Photomultiplier (PMT)

- **Typ. Sensitivity:** up to 10^{-6} W^2 ▪ **Rep. Rate:** $> 250 \text{ kHz}$ ▪ **Measurement Mode:** Collinear and Noncollinear

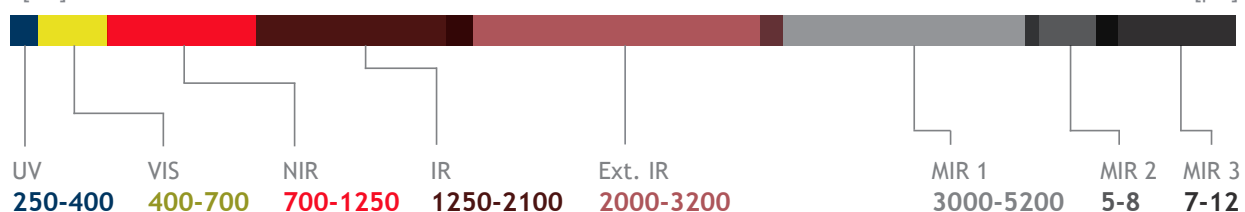
$\lambda[\text{nm}]$



Two Photon Absorption (TPA)

- **Typ. Sensitivity:** $< 0.1 \text{ W}^2$ (NIR/IR) ▪ $< 1 \text{ W}^2$ (VIS) ▪ $< 100 \text{ W}^2$ (UV) ▪ **Rep. Rate:** $> 10 \text{ Hz}$ ▪ **Measurement Mode:** Collinear Intensity

$\lambda[\text{nm}]$



* For cross-correlation: Actual wavelength range to be defined according to customer's specifications.

** For the wavelength range 1500 ... 2200 nm we recommend to use the highly sensitive IR detector "Extended IR PD SELECTED"

FROG

Complete Pulse Characterization with pulseCheck NX and FROG Option

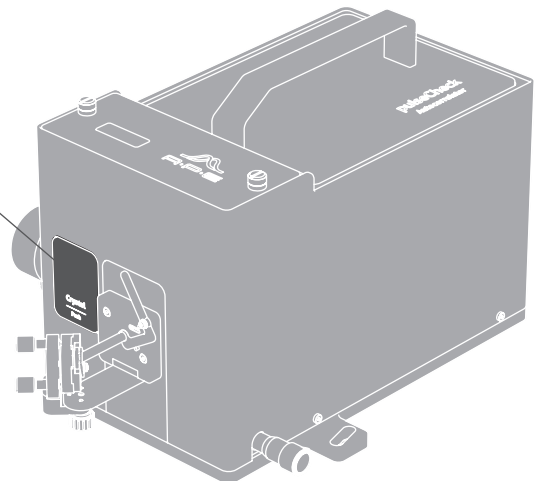
Second harmonic generation FROG is the most popular spectrometer-less Frequency Resolved Optical Gating method. The pulseCheck NX autocorrelators by APE optionally integrate FROG, giving access to complete pulse characterization. This option opens the door to complete spectral and temporal pulse measurements.



Crystal Module

FROG Setup:

1. Crystal module within pulseCheck
2. Replacement focus mirror
3. FROG software upgrade



VIS I
420-550



VIS II
550-700



NIR
700-900



IR I
900-1200



IR II
1200-1600



Ext. IR I
1800-2200

Different crystal modules for various wavelength ranges.

- Complete spectral and temporal pulse characterization
- Different crystal modules available to cover wavelengths from 420 ... 2200 nm
- FROG trace data processing and visualization with included software
- Pulse width ranges from as low as 20 fs up to 6 ps
- High spectral resolution up to 0.1 nm
- Available for the pulseCheck NX autocorrelator*

* Required laser rep. rate >10 kHz

... FROG Pulse Characterization Software

FROG Trace

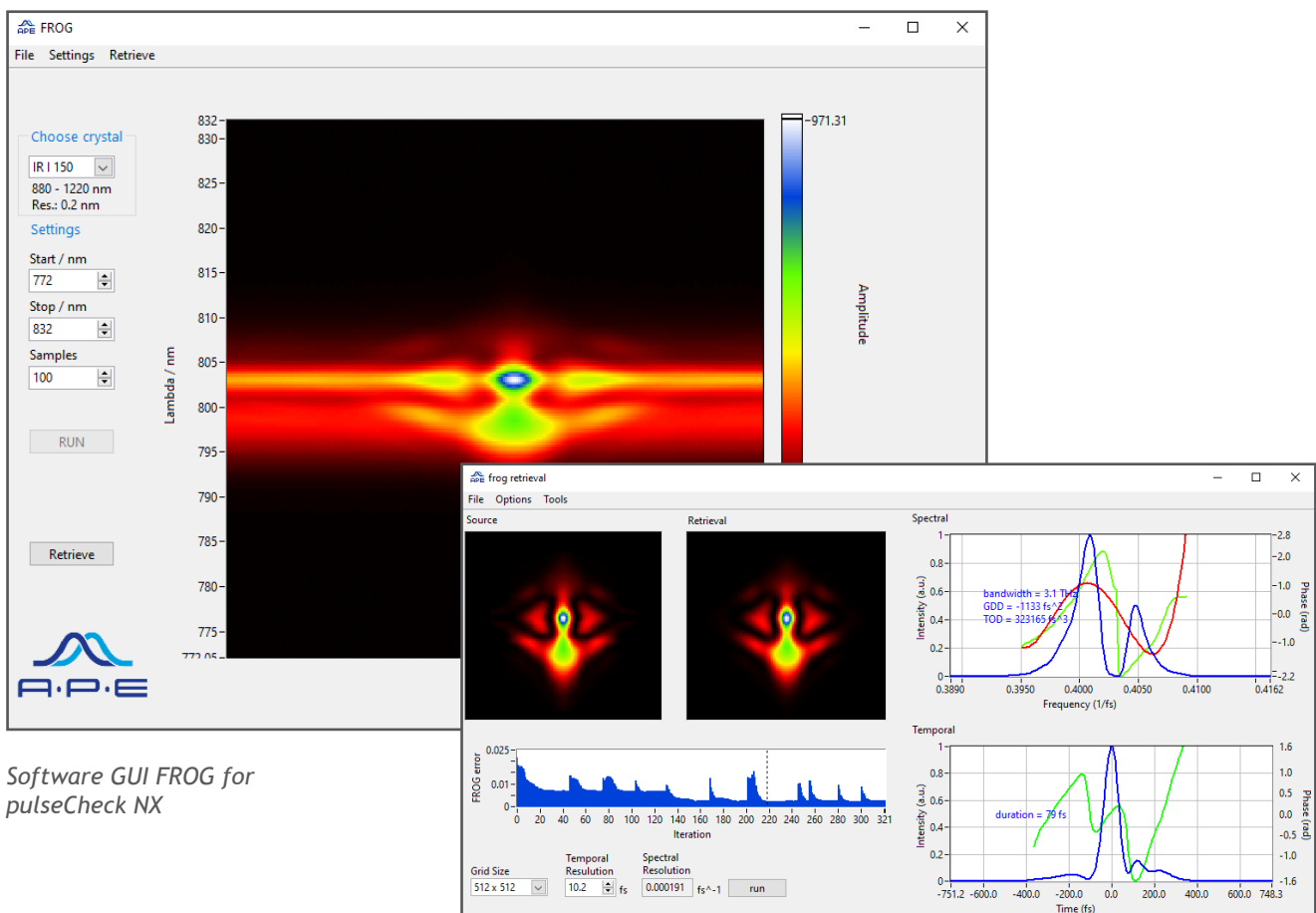
The software provides laser pulse intensity as a function of time and frequency (wavelength). Results are visualized in the form of a FROG trace diagram as well as pulse shape and spectrum.

It is a matter of seconds to automatically find the required phase matching tuning angle - thanks to the automated phase matching routine by pulseCheck NX.

Wavelength and Pulse Width Coverage

Various crystals guarantee coverage of wavelengths from 420 nm up to 2200 nm and pulse widths from 20 fs to 6 ps (numbers given for Fourier transform limited pulses). High spectral resolution down to 0.1 nm is supported.

The FROG option is designed for laser repetition rates above 10 kHz and is available for the pulseCheck NX autocorrelator series (except for pulseCheck SM 2000).



Software GUI FROG for pulseCheck NX

FROG Crystals

FROG crystals	Wavelength range	Pulse width range	Required spectral bandwidth	Spectral measurement resolution
VIS-I-200	420 nm ... 550 nm	>200 fs	>1 nm	0.1 nm
VIS-I-50	420 nm ... 550 nm	50 fs ... 200 fs	>3 nm	0.3 nm
VIS-I-20	420 nm ... 550 nm	20 fs ... 70 fs	>10 nm	1.0 nm
VIS-II-150	550 nm ... 700 nm	>150 fs	>1 nm	0.1 nm
VIS-II-50	550 nm ... 700 nm	50 fs ... 200 fs	>3 nm	0.3 nm
VIS-II-20	550 nm ... 700 nm	20 fs ... 60 fs	>20 nm	2.0 nm
NIR-200	700 nm ... 900 nm	>200 fs	>1 nm	0.1 nm
NIR-50	700 nm ... 900 nm	50 fs ... 500 fs	>2 nm	0.2 nm
NIR-20	700 nm ... 900 nm	20 fs ... 50 fs	>30 nm	3.0 nm
IR-I-150	900 nm ... 1200 nm	>150 fs	>2 nm	0.2 nm
IR-I-60	900 nm ... 1200 nm	60 fs ... 200 fs	>10 nm	1.0 nm
IR-I-30	900 nm ... 1200 nm	30 fs ... 60 fs	>50 nm	5.0 nm
IR-II-100	1200 nm ... 1600 nm	>100 fs	>5 nm	0.5 nm
IR-II-50	1200 nm ... 1600 nm	50 fs ... 100 fs	>20 nm	2.0 nm
IR-II-30	1200 nm ... 1600 nm	30 fs ... 50 fs	>90 nm	9.0 nm
Ext. IR-I-50	1800 nm ... 2200 nm	>50 fs	>190 nm	19 nm

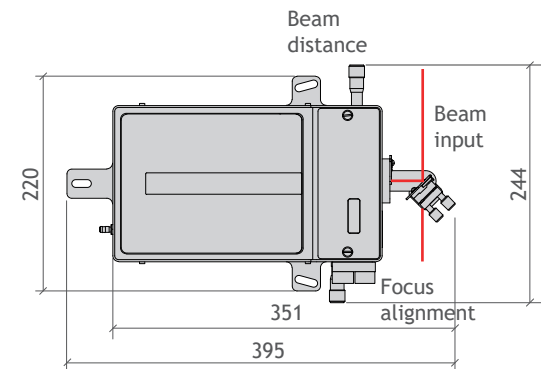
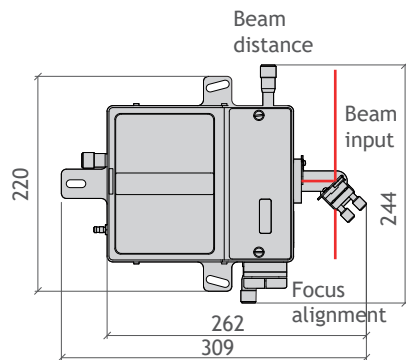
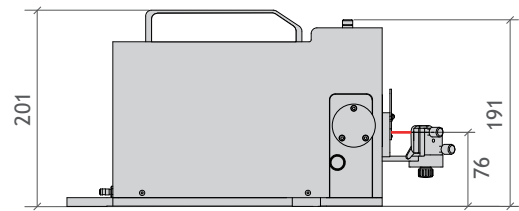
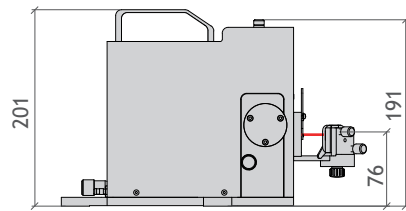
A FROG crystal is suitable if the "Pulse width range" matches or, if the actual spectral bandwidth of the laser is wider than the "Required spectral bandwidth".

Appendix Technical Drawings

All dimensions in mm

pulseCheck NX

- Multitalent
for any task



Contact

APE Angewandte Physik & Elektronik GmbH
Plauener Str. 163-165 | Haus N | 13053 Berlin | Germany
T: +49 30 986 011-30
F: +49 30 986 011-333
E: sales@ape-berlin.de
www.ape-berlin.de

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