PZ-FLIM-110  Piezo Scanning FLIM System

Based on bh’s Megapixel FLIM Technology

Complete FLIM Microscopes
FLIM Upgrades for Existing Microscopes

Multidimensional TCSPC technique
Sample Scanning by Piezo Stage
Compact Electronics, Controlled by Laptop Computer
Fully Integrated Scanner Control

Confocal detection
Suppression of out-of-focus light
Suppression of lateral scattering
Excellent contrast and resolution
Excitation by bh BDL or BDS series picosecond diode laser
Laser wavelengths 375nm, 405 nm, 445 nm, 473 nm, 488 nm, 515 nm, 640 nm, 685 nm, 785 nm
Compatible with supercontinuum lasers
64-bit SPCM Software for Windows 7, 8, 10

Becker & Hickl GmbH
Nahmitzer Damm 30
12277 Berlin, Germany
Tel. +49 / 30 / 787 56 32  email: info@becker-hickl.com
Fax. +49 / 30 / 787 57 34  www.becker-hickl.com

More than 22 years experience in multi-dimensional TCSPC. More than 1500 TCSPC systems worldwide.
Megapixel FLIM Technology

Record Images with up to 2048 x 2048 pixels

Record FLIM data of a large number of cells under identical conditions

Select regions of interest from recorded data of a large field of view

Lateral and Vertical Scanning

Select between a scan in the x-y plane or a scan in the x-z plane

Run a vertical scan within a fraction of the time needed for a full Z stack

Phosphorescence Lifetime Imaging Simultaneously with FLIM

Obtain unprecedented PLIM sensitivity by multi-pulse excitation

Record phosphorescence and fluorescence lifetime images simultaneously

More than 22 years experience in multi-dimensional TCSPC. More than 1500 TCSPC systems worldwide.
Interactive Scanner Control

Conveniently select scan field, pixel numbers, and scan speed

Select a region of interest within a previously recorded image

Record an image of the region selected

Predefined Setups

Pass from one operation mode or system configuration to another by selecting from a list of ‘Predefined Setups’

Precision FLIM and PLIM Data Analysis

Analyse FLIM and PLIM data pixel by pixel

No need to record an IRF

Up to three exponential decay components

Calculate lifetimes and amplitudes of decay components

Calculate ratios of lifetimes or amplitudes, fractional intensities, FRET efficiencies

Calculate 1D and 2D histograms of decay parameters over the pixels

Analyse large data volumes by batch processing

More than 22 years experience in multi-dimensional TCSPC. More than 1500 TCSPC systems worldwide.
PZ-FLIM-110  Piezo Scanning FLIM System

System Components

**Laser**
- High power
- High repetition rate
- Single-mode fibre coupling

**Repetition rates**
- 20 MHz, 50 MHz, CW
- 80 MHz, CW

**Available wavelengths**
- 375 nm, 405 nm, 445 nm, 473 nm, 488 nm, 515 nm, 640 nm, 685 nm, 785 nm

**Pulse width**
- typ. 60 ps, depending on wavelength version and power

**PZ FLIM Confocal Optics Assembly**
- Laser input
- Excitation / Emission Beam splitter
- Dichroic, different transition wavelength available
- Output to detector
- Confocal pinhole
- Core diameter of detector fibre

**Scan Stage**
- Mad City Labs Nano View 200-3

**Detector**
- Id 100-50-FC SPAD (Standard)
- HPM-100-40 (optional)
- MW FLIM GaAsP (optional)

**Wavelength Range**
- 400 nm to 1000 nm

**Wavelength Channels**
- 1

**TCSPC Module**
- SPC-150 (Standard)
- SPC-150N (Optional)
- SPC-160 (Optional)

**Scan Control Module**
- GVD-120
  - Generation of scan signals
  - Hardware, digital signal synthesis
  - Image size
  - 16 x 16 to 2048 x 2048 pixels
  - Laser multiplexing
  - Inside pixel, line by line, or frame by frame
  - Laser on/off for PLIM
  - Selectable in % of pixel time
  - Beam park function
  - Any location within scan area

**System Computer and Electronics Box**
- Lap-top PC
- PCI-extension box
- Extension box contains:
  - SPC-150, SPC-150N, SPC-160 TCSPC modules
  - GVD-120 scan controller
  - DCC-100 detector controller (optional)
- Also available:
  - SPC, GVD, and DCC modules installed in standard PC

More than 20 years experience in multi-dimensional TCSPC. More than 1500 TCSPC systems worldwide.
Specifications

Scanning
Optical principle
Laser input
Output to detector
Main beamsplitter
Pinhole
Emission filter
Connection to microscope

Scan Controller
Principle
Scan waveform
Scan format
Frame size, frame scan
Line scan
X scan
Y scan
Laser power control, electrical
Laser multiplexing
Beam blanking
Scan rate
Fastest scan rate with piezo stage
Scan area definition
Beam park position
Laser control

Excitation Source
Available Wavelengths
Pulse width, typical
Pulse frequency
Power in picosecond mode
Fast on/off modulation

Detector (standard)
Spectral Range
Peak quantum efficiency
IRF width with bh diode laser
Background count rate, thermal
Power supply

Detector (optional)
Spectral Range
Cathode type
Peak quantum efficiency
IRF width with bh diode laser
Background count rate, thermal
Background from afterpulsing
Power supply and overload shutdown

Detector (optional)
No. of wavelength channels
Wavelength channel width
Spectral Range
Cathode type
IRF width with bh diode laser
Power supply and overload shutdown

Mad City Labs Nano-View 200-3
Sample scanning by piezo stage, confocal detection
Single-mode fibre coupled, Qioptiq fibre coupling system
Fibre coupling, FC connector, multi-mode fibre
Dichroic Mirror
Pinhole is core of detection fibre
Filter slider
adapter to left side port

bh GVD-120
Digital waveform generation, scan waveforms generated by hardware [1]
Line ramp with cycloid flyback. Parameters configurable for different scanners
line, frame, or single point
16x16 to 2048x2048 pixels
16 to 2048 pixels
continuous or pixel-by-pixel
line by line
via electrical signal to lasers
frame by frame, line by line, or within one pixel
during flyback and when scan is stopped
automatic selection of fastest possible rate or manual selection
5 lines / second
via zoom and offset or interactive via image cursors
selectable via cursor in FLIM image
On/off, power, wavelength multiplexing [2]

bh BDL-SMC Series or BDS-Series picosecond diode laser
375nm, 405nm, 445nm, 473nm, 488nm, 510nm, 640nm, 685nm, 785nm
40 to 70 ps
BDL-Series: 20 MHZ, 50 MHz, 80 MHz
BDS Series: 20 MHZ, 50 MHz
Typ. 0.2 mW to 2 mW injected into fibre. Depends on wavelength version
< 1 µs, for PLIM and excitation wavelength multiplexing [2]

Id Quantique id100-50-FC SPAD
400 to 1000 nm
50%
70 to 130 ps
Typ. 100 to 200. LN version with <10 available
6 V wall-mounted power supply

bh HPM-100-40 hybrid detector [1] [4]
400 to 700 nm
GaAsP
40 to 50% 120 to 130 ps
300 to 2000 counts per second
not detectable
via DCC-100 controller of TCSPC system

bh Multi-Wavelength MW-FLIM Detector [1] [4]
16
12.5 nm, other on request
200 nm within a range of 400 to 700 nm
GaAsP
250 ps
via DCC-100 controller of TCSPC system

More than 20 years experience in multi-dimensional TCSPC. More than 1500 TCSPC systems worldwide.
PZ-FLIM-110 Piezo Scanning FLIM System

TCSPC System

Principle
Advanced TAC/ADC principle

Electrical timing jitter
2.3 ps rms

Electrical IRF width
6.8 ps FWHM

Minimum time channel width
813 fs

Dead time
100 ns (80 ns for SPC-160)

Saturated count rate
10 MHz (12 MHz for SPC-160)

Dual-time-base operation
via micro times from TAC and via macro time clock

Source of macro time clock
internal 40MHz clock or from laser

Input from detector
constant-fraction discriminator

Reference (SYNC) input
constant-fraction discriminator

Synchronisation with scanning
via frame clock, line clock and pixel clock pulses

Scan rate
any scan rate, automatic accumulation of frames

Synchronisation with laser multiplexing
simultaneous in all wavelength channels, via routing function

Recording of multi-wavelength data
on-board-buildup of photon distributions

Basic acquisition principles, see [1]
buildup of photon distributions in computer memory

Generation of parameter-tagged single-photon data
online auto or cross correlation and PCH

Operation modes, see [1]
f(t), oscilloscope, f(txy), f(l,T), f(t) continuous flow
FIFO (correlation / FCS / MCS) mode
Scan Sync In imaging, Scan Sync In with continuous flow
FIFO imaging, with MCS imaging, mosaic imaging, time-series imaging
Multi-wavelength operation, laser multiplexing operation

Max. Image size, pixels (SPCM 64 bit software)
2048x2048 1024x1024 512x512 256x256

Max. no of time channels, see [1] 256 1024 4096 4096

SPCM Data Acquisition Software, please see [1] for details

Operating system
Windows 7, Windows 8, or Windows 10, 64 bit

Loading of system configuration
single click in predefined-setup panel

Start / stop of measurement
by operator or by timer, starts with start of scan, stops with end of current frame

Online calculation and display, FLIM, PLIM
in intervals of Display Time, min. 1 second

Online calculation and display, FCS, PCH
in intervals of Display Time, min. 1 second

Number of images displayed simultaneously
max 8

Number of curves (Decay, FCS, PCH, Multiscaler)
8 in one curve window

Cycle, repeat, autosave functions
user-defined, used for
for time-series recording, Z stack FLIM, microscope-controlled time series

Saving of measurement data
User command or autosave function

Link to SPCImage data analysis
automatically after end of measurement or by user command

SPCImage FLIM and PLIM Data Analysis, please see [1] for details

Data types
FLIM, PLIM, single fluorescence or phosphorescence decay curves

Decay models
Single-, double-, triple-exponential decay models, incomplete decay models, first moment

Procedure
Iterative convolution or direct calculation by first moment

Parameters delivered by analysis
lifetimes of components, amplitudes, ratios of amplitudes or lifetimes, FRET efficiency, fractional intensities of decay components

Display
Colour-coded images of decay parameters
Histogram of decay parameters over pixels
2D histograms of decay parameters, phasor plot

Remarks
1. Other scan stages on request. Stage controller must have analog inputs.
2. Laser multiplexing requires second laser and single-mode beam combiner.
3. Limited by piezo stage. Fastest system scan rate depends on stage type. Configurable for different stages.
4. Requires DCC-100 detector controller card.
5. Requires MW FLIM detector.
6. Limited applicability due to slow scan rate of piezo stage.

More than 20 years experience in multi-dimensional TCSPC. More than 1500 TCSPC systems worldwide.
Literature (please contact bh for printed copies)


Related Products

DCS-120 Confocal Scanning FLIM Systems
- Scanning by fast galvanometer mirrors
- 2 laser channels, 2 detector channels
- FLIM, Multi-Wavelength FLIM, PLIM, Z Stack FLIM, Fast Time-Series by temporal mosaic FLIM

DCS-120 MACRO System
- Imaging of cm-size objects
- Scanning by fast galvanometer mirrors
- 2 laser channels, 2 detector channels
- FLIM, Multi-Wavelength FLIM, PLIM, Z Stack FLIM, Fast Time-Series by temporal mosaic FLIM

Modular FLIM Systems for Zeiss LSM 710 / 780 / 880 Family Laser Scanning Microscopes
- Fast galvanometer scanning
- One or two ps diode lasers
- Multiphoton excitation by Ti:Sapphire laser
- Confocal detection or NDD detection
- One, two, three, or four detection channels
- FLIM, Multi-wavelength FLIM, PLIM, Lateral Mosaic FLIM, Z Stack FLIM, Fast Time-Series by temporal mosaic FLIM

Modular FLIM Systems for Zeiss LSM 510 NLO Family Laser Scanning Microscopes
- Fast galvanometer scanning
- Multiphoton excitation
- One or two NDD detection channels
- FLIM, Multi-wavelength FLIM, Lateral Mosaic FLIM, Z Stack FLIM, Fast Time-Series by Temporal Mosaic FLIM

Modular FLIM Systems for Leica, Nikon, Olympus Laser Scanning Microscopes
- Fast galvanometer scanning
- Diode laser excitation and multiphoton excitation
- Various system configurations, please see Handbook [1]

International Sales Representatives

US:
Boston Electronics Corp
tcspc@boselec.com
www.boselec.com

UK:
Photonic Solutions
sales@photonicssolutions.co.uk
www.photonicssolutions.co.uk

Japan:
Tokyo Instruments Inc.
sales@tokyoinst.co.jp
www.tokyoinst.co.jp

China:
DynaSense Photonics Co. Ltd.
info@dyna-sense.com
www.dyna-sense.com