# Denis Pristinski

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## SKILLS

**Optics** Instrument design for optical detection pushing sensitivity and throughput limits, from Zemax to prototypes to production. Fluorescence, brightfield, and darkfield microscopy. Optical metrology. Laser beam shaping. Real-time laser autofocus. Fluorescence correlation spectroscopy. Dynamic and electrophoretic light scattering. Diffusing wave spectroscopy. Phase modulated ellipsometry. SERS spectroscopy. Small angle light scattering. Spectroscopic reflectometry.

**Engineering** Micro- and nanopositioning. Optical alignment. High throughput step scan and line scan imaging. Lasers and high power LEDs. Photon counting. Machine vision. Zone fluidics and optical flow cells. Valves, pumps, and sensors for low volume liquid handling. Temperature and pressure controlled systems. Motorized positioners and robotic sample manipulation. High speed data acquisition and digital signal processing. Complex instrument and experiment automation and remote control.

**Materials** Fluorescently labeled synthetic polymers, biomolecules, nanoparticles, individual cells and tissue samples. Emulsion droplets and micelles. Surface functionalization, polymer adsorption and release. Responsive polymer multilayers and microgels. Colloidal quantum dots. Noble metal nanoparticles. Single-walled carbon nanotubes. Plasmonic nanostructures. Photonic crystal fibers.

**Programming** Cross-platform data acquisition and analysis software: gcc, mingw-w64, libusb, asio, protobuf. User interfaces and embedded scripting for prototyping and instrument control: C++, FLTK, Lua. Time-stamped and time-correlated photon detection signal processing: Verilog & Altera Quartus II. Linux server administration: Samba, Lighttpd, Postfix, Dovecot, Roundcube, Redis, Node.js, SSL.

## WORK EXPERIENCE

**Principal Engineer** 10x Genomics June '19 – June'23

- Built and managed a team of senior and staff level optical, optomechanical, and mechatronics engineers that can tackle any instrument and process development challenge from concept to pilot.
- Xenium Analyzer spatial transcriptomics instrument development. Lead hardware engineer for feasibility and early development responsible for the instrument architecture; negotiating and defining key requirements and specs; sourcing OTS and custom components; integration and automation, modifications and upgrades, calibration and troubleshooting of prototypes and production units.
- Visium CytAssist transcriptomic probes transfer instrument development. Dual imaging module design, prototyping, integration, and characterization.
- Design and development of internal tools, rigs, and whole instruments for production, inspection, and quality control of parts, assemblies, and consumables.
- Assessment of new technologies and devices, due diligence, system modeling, performance reviews.
- Managing vendors and contract manufacturers of all kinds of catalog and custom hardware components used in modern life science instrumentation.

**Principal Instrument Engineer** Ultima Genomics March '17 – May '19

- Leading a small team of optical engineers through the development of high throughput fluorescence imaging system of the UG 100 sequencer.
- Managing offsite lens designers and manufacturers, optomechanical contractors, and component vendors for the commercial product development.
- Board level research phase fluorescence imaging microscopy prototypes for process development.
- Darkfield imaging and laser based autofocus solutions for fluidic chips with multiple closely spaced surfaces, using embedded Linux on ARM for instrument control and signal processing.
- Custom video streaming software for the instrument operation video logging integrated with data acquisition, using Raspberry Pi camera modules.

- Selection, testing, and validation of optical components from high power CW lasers to beam shaping and imaging optics to high speed area and line scan cameras.
- Working closely with mechanical, electrical, and software engineers on production development and integration, inspection, and automation challenges.
- Supporting material characterization projects with custom-built equipment: gel imaging, contact angle, thin film thickness, particle sizing, contact lithography, fluorescence quantum yield.

**Optical Engineer V** Bio-Rad, Digital Biology Center July '12 – March '17

- Development of a fluorescence & light scattering optical detector for the next generation droplet digital PCR platform. Integration of optics, microfluidics, and motion subsystems. Feasibility and process development instrument prototypes from early breadboards to verification and validation.
- Cross-platform ddPCR signal processing library and user interface from raw amplitudes to DNA concentrations. Producing an extensive list of metrics, charts, and low level data corrections for the individual instrument calibration to circumvent hardware limitations.
- Redesign of an optical detector for the QX200 droplet digital PCR system to reduce cost, eliminate failure modes, and improve manufacturability. Transferring the instrument assembly and service to Bio-Rad's internal manufacturing.
- Integration and retrofitting of silicon photomultipliers into optical detector designs. Patented light collecting and homogenizing optics, temperature compensation of gain, sensor module packaging, absolute sensitivity calibration fixtures and manufacturing software.
- Inspection, alignment and calibration setups and accompanying software. Incoming quality control and assembly procedures and reports, floor personnel training, and close interaction with manufacturing engineers to provide necessary support.

**Senior Research Scientist** NantWorks (formerly Abraxis BioSensors) Jan. '11 – June '12

- Development of an automated optofluidic research platform for rapid multivariate characterization of surface plasmon enhanced Raman scattering spectroscopy sensors. Hyperspectral SERS imaging of multiple analytes in a broad range of concentrations at several excitation wavelengths.
- Design and assembly of a computer-controlled alignment system for precise absolute orientation of large area tiled ultraviolet polarizers for photolithographic and photoalignment applications.

**Optical Engineer** NIST, Polymers and Complex Fluids Group Aug. '07 – Dec. '10

- Design and implementation of three-probe fluorescence resonance energy transfer (FRET) confocal detection and epi-fluorescent imaging setup to study the localization and trafficking of polymer-DNA complexes for the non-viral gene delivery.
- Study of individual single-walled carbon nanotubes (SWCNT) in aqueous environment by fluorescence correlation spectroscopy (FCS) to characterize the efficiency of nanotube type and length fractionation and for the rapid determination of mean nanotube length at low concentrations.
- Building and customization of fluorescence correlation spectroscopy instruments to study the interaction of surface functionalized particles and polymers in solution; polymer diffusion at surfaces; physical properties of quantum dots in solution; and confined flow of blood cells in narrow capillaries.
- Advancing fiber-optic probes based dynamic light scattering (DLS) instrumentation for low volume measurements, high concentration samples, and chemical reaction monitoring. Design of a novel portable fiber probe DLS setup. Integration of DLS with FCS for simultaneous measurements.
- Application of diffusing wave spectroscopy (DWS) to extend the high concentration limit of DLS for the characterization of particle dynamics during colloidal crystal formation. Determining the experimental conditions for the quantitative agreement between DWS and DLS results.
- Development of open source unified photon correlation data analysis program for versatile individual and batch analysis of FCS, DLS, and DWS results collected with various acquisition hardware.

**Postdoctoral researcher** Stevens Institute of Technology June '05 – July '07

- Design and assembly of microstructured optical fiber based surface enhanced Raman scattering (SERS) spectroscopy setups for ultra low volume *in situ* chemical and biological agent detection. Development of calibration-free quantitative Raman spectroscopy using solid core photonic crystal fibers.
- Investigation of surface modified light guiding capillaries, light guiding rods, and optical prisms as a platform for SERS spectroscopy in total internal reflection geometry with large interaction area.
- Design and installation of temperature-controlled cells for confocal microscopy, ellipsometry in solution, and contact angle measurements for thermoresponsive hydrogel characterization.
- Comparative study of hydrogel-like cross-linked polymer substrates swelling and protein uptake and release by a combination of *in situ* phase modulation ellipsometry and quartz crystal microbalance with dissipation.

**Research assistant** Stevens Institute of Technology Jan. '01 – May '05

- Design and assembly of near infrared and visible confocal SERS spectroscopy instrumentation for low volume ultrasensitive chemical and biological detection using transparent flat substrates with immobilized individual noble metal nanoparticles. Raman peaks identification with the Aldrich FT-Raman spectral library.
- Setting up high pressure chambers for large throughput internal surface modification of solid core microstructured optical fibers with noble metal nanoparticles for fiber-based SERS sensor fabrication.
- Installation, customization, and programming of an articulated robot arm for unattended silicon wafer handling, surface modification, and layer-by-layer polymer deposition from solutions.
- Development of a complete automated variable angle phase-modulated ellipsometry setup, including instrument control, data acquisition and analysis software, for fast characterization of thin polymer films in air and in solution. Measurements optimization for low refractive index contrast conditions.
- Building a multichannel scaler based FCS setup and programming photon correlation and data fitting software to measure the conformation of polymer molecules in solution at nanomolar concentrations.
- Training of graduate students in the application of laser-scanning confocal microscopy, phase-modulated ellipsometry, SERS spectroscopy, fluorimetry, and robotic sample handling.

## EDUCATION

**Stevens Institute of Technology**, Hoboken, NJ

Feb. 2006 Doctor of Philosophy in Physics / Chemistry
Thesis *Optical techniques for nanoscale probing and chemical detection in aqueous environment.*
GPA 4.0/4.0

**Saint Petersburg State Polytechnic University**, Russia

June 1998 Master of Science in Engineering Physics
Thesis *Experimental investigation of high-speed InP:Fe photoresistors.*
GPA 4.9/5.0

## LINKS

- List of patents
- Publications
- LinkedIn profile
- CV online