

Computing using Quantum Dynamics of Nanostructured Arrays

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Looking at Missions in a New Light

 New Beginnings....

Advanced Optical Filters, Elbit Systems.

Formerly KiloLambda (up until Dec. 2017).



Located in Tel Aviv.

TECHNOLOGICAL FOCUS



Energy Savings



Light attenuation



Laser Protection

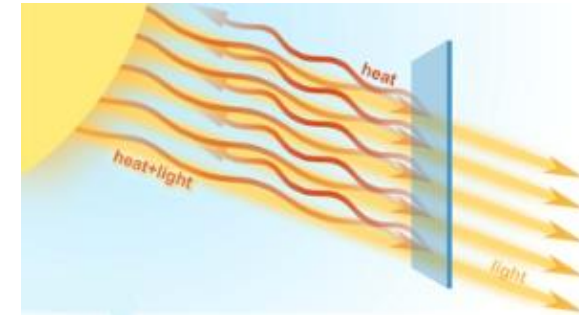
To be utilized in:

Industrial Solutions | Commercial Applications | Defense & HLS Systems



ENERGY SAVING


SOLAR HEAT & RF REDUCTION



 **IR and RF radiation shielding window film**

 **IR reduction acts as an effective energy saving solution**

 **RF radiation shielding protects facilities from electronic eavesdropping**

 **Applicable to the protection of campuses, federal buildings, hospitals, schools, theaters and even private homes**



LIGHT ATTENUATION

 **Unique photochromic solutions**

 **Transparent under normal light conditions**


 **Darkens in strong sunlight**

 **Triggered by the intensity of the light**

 **Quick activation and recovery time - up to 8 times faster than other products on the market**

 **Current applications:**





 **Eyewear**

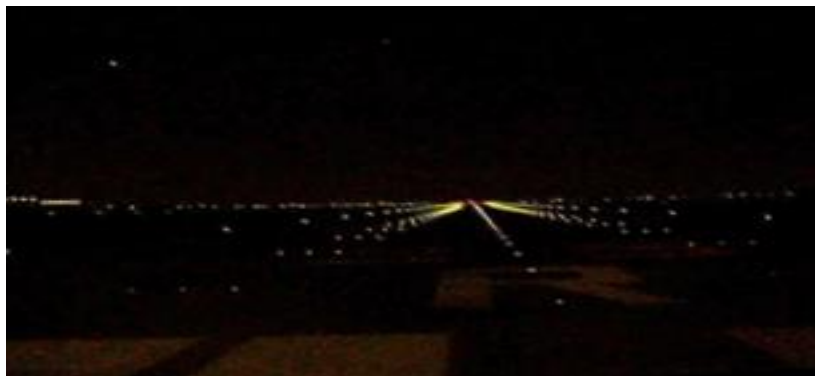
 **Aircraft visors and Head Mounted Displays (HMDs) – Elbit's VTF & VTV**



LASER PROTECTION

LSPE - Laser and Sunlight Protective Eyewear

-  Laser dazzling is a major issue today for commercial and civil aviation as well as security forces
-  The laser protection eyewear available today are for either day or night and one cannot use the same pair since it requires different VLT
-  Common photochromic lenses are UV activated and would not work inside the cockpit since the windshield will block the UV
-  Can be combined with strong sunlight protection



Distraction



LASER PROTECTION

LSPE - Laser and Sunlight Protective Eyewear







 **Green, Red, & Blue** Laser Dazzling protection for aviators

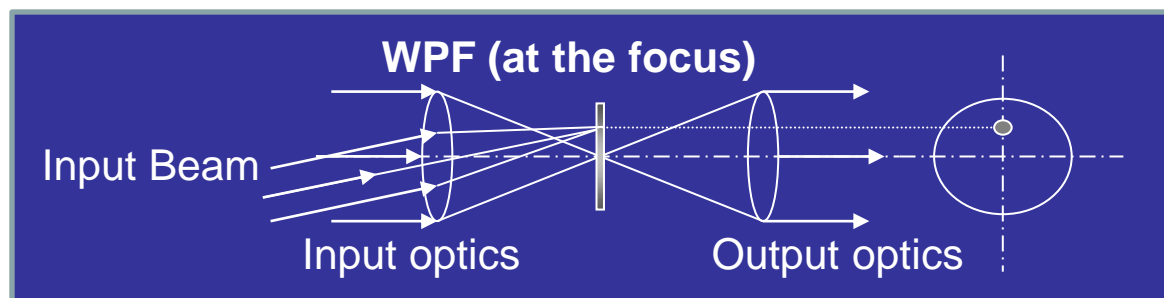
 **V-DSF** – a photochromic coating activated by the visible light, combined with laser protection on Aviator Eyewear is a winner, all-in-one solution, for both laser and sun dazzling



LASER PROTECTION

WPF – Wideband Power Filter

-  Focal plane based solution
-  Customized according to each application and required specifications
-  Passive, Solid state
-  Wideband , not a single wavelength protection
-  Fast Response Time
-  Impingement Angle Independent, direction of damaging laser can be identified, according to damaged spot location



New Approach for Computing using Quantum Dynamics of Nanostructured Arrays

COPAC - Coherent Optical PArallel Computing

Horizon 2020

We are part of a novel computer concept exploiting quantum dynamics.

The project is approved and financed by the EU.

It includes the following six partners, four universities and two industrial partners:



-  The University of Liège , Belgium
-  The Hebrew University of Jerusalem , Israel (2 research groups)
-  University of Padova, Italy, (2 research groups)
-  Consiglio Nazionale delle Ricerche, UoS Bari, Italy
-  ELBIT Systems Ltd./KiloLambda Technologies, Ltd. Tel-Aviv, Israel (Industrial)
-  ProbaYes, Grenoble, France (a spin-off company of CNRS)

<https://cordis.europa.eu/project/rcn/211584/factsheet/en>
<http://www.copac-fet.eu/>



Logic gates

The basis of computing

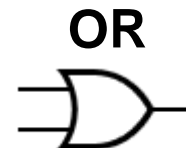


a logic gate is an idealized or physical device implementing a Boolean function; that is, it performs a logical operation on one or more binary inputs and produces **a single binary output**.

AND



Inputs:
 $X, Y = \{0, 1\}$



Output:
 $Z = \{0, 1\}$

NOT



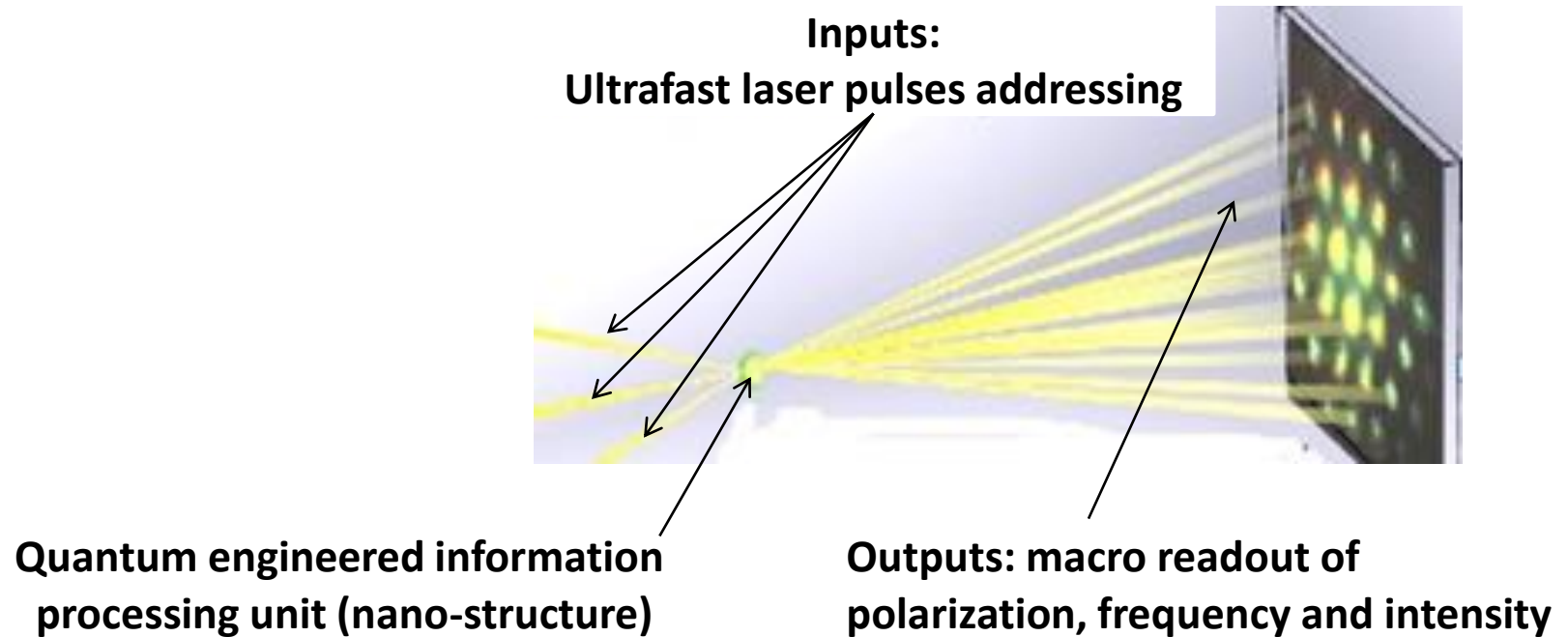
Sophisticated logic gates

The basis of computing



What if we could design logic gates that have:

1. Multiple inputs
2. Multiple outputs



COPAC

2D photon echo spectroscopy scheme

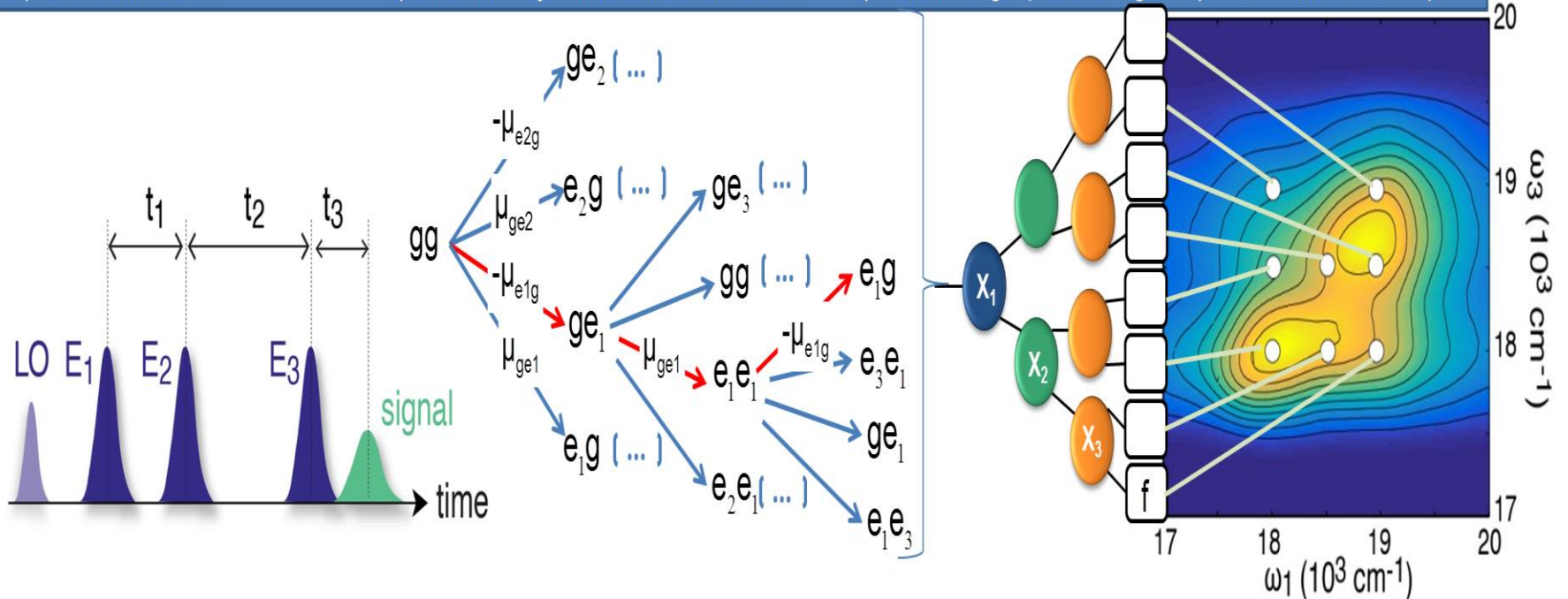


a) Laser excitation

b) Quantum dynamics of observables

c) Parallel logic processing

d) Observables as outputs



Scheme of parallel information processing in one phase matching direction:

a) excitation by 3 laser pulses, b) dynamics of observables, c) implemented decision tree, d) output reading.

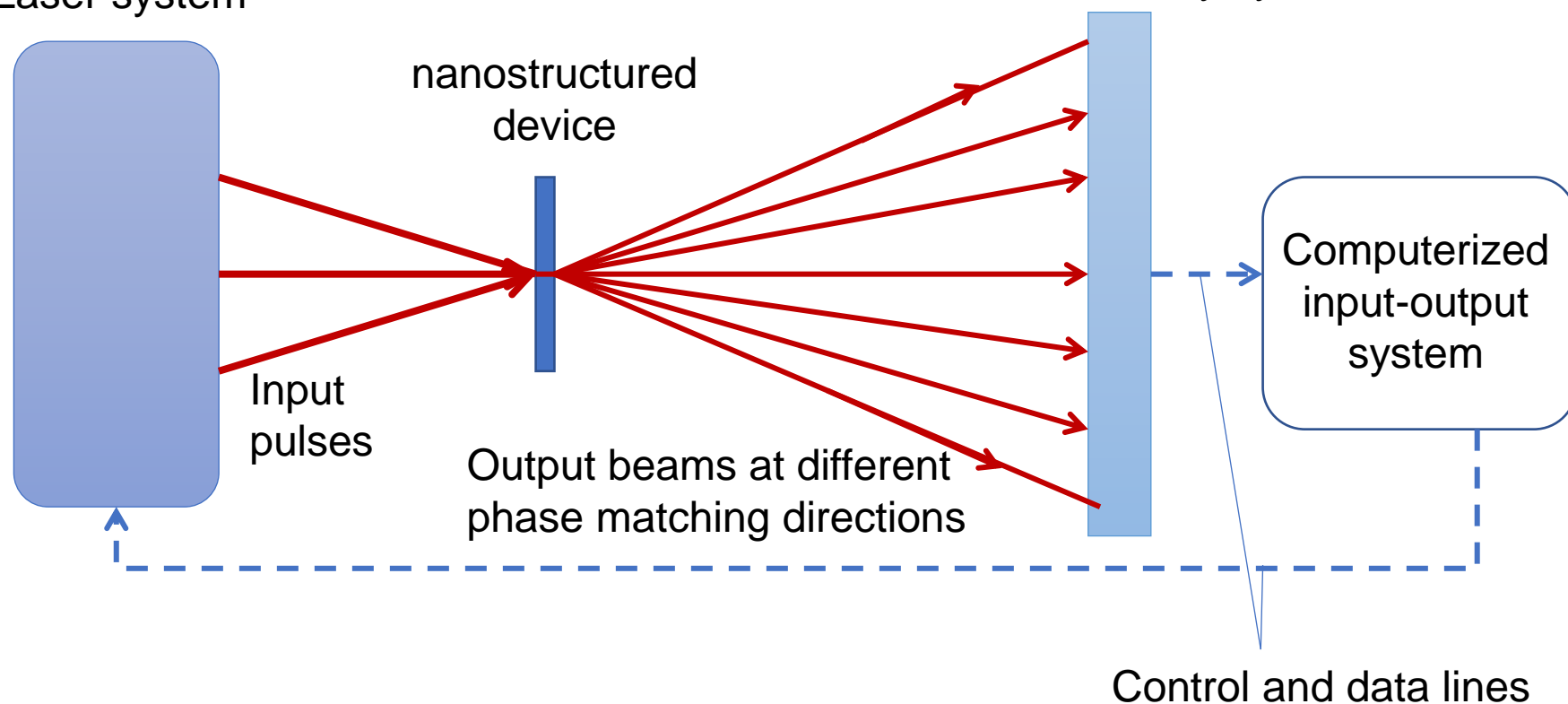
Proposed System

COPAC, Horizon 2020



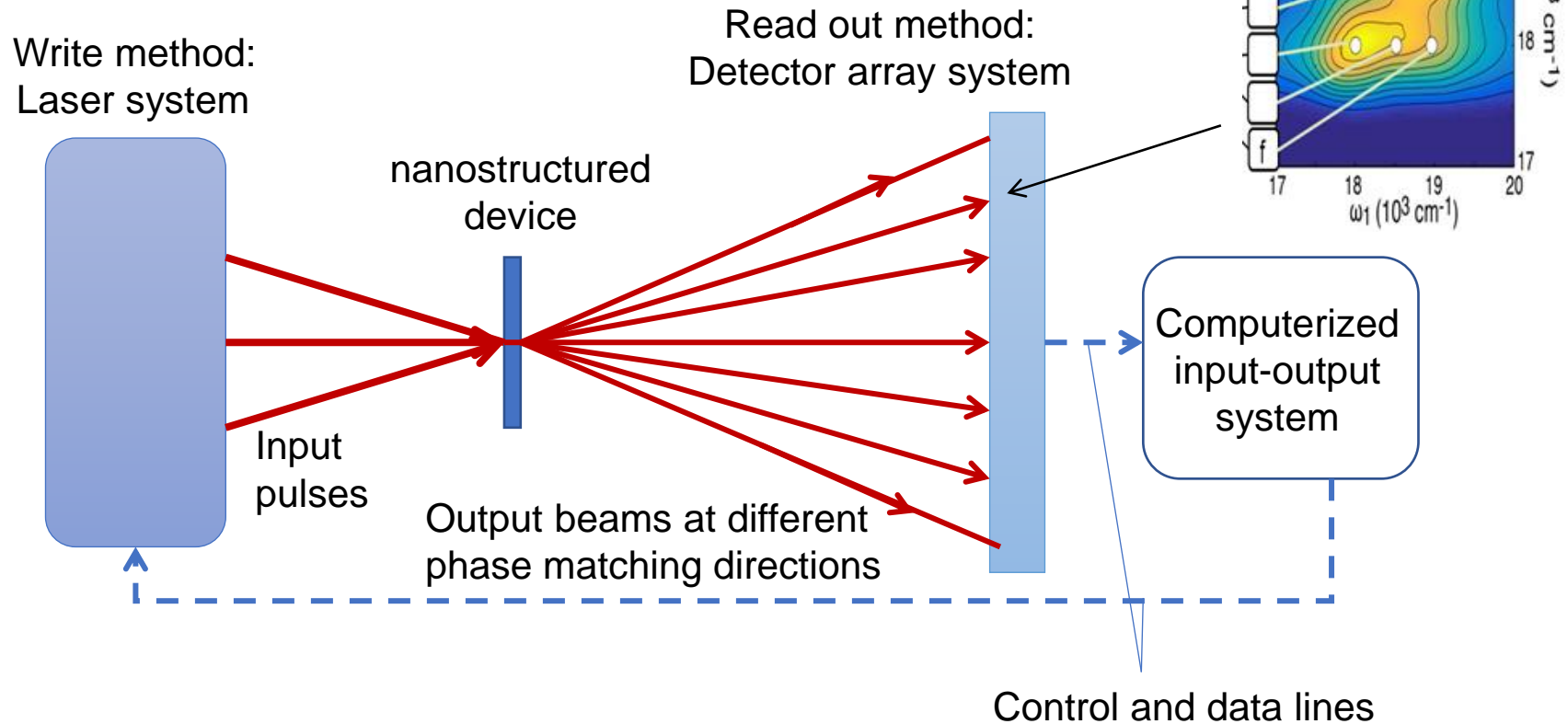
Write method:
Laser system

Read out method:
Detector array system



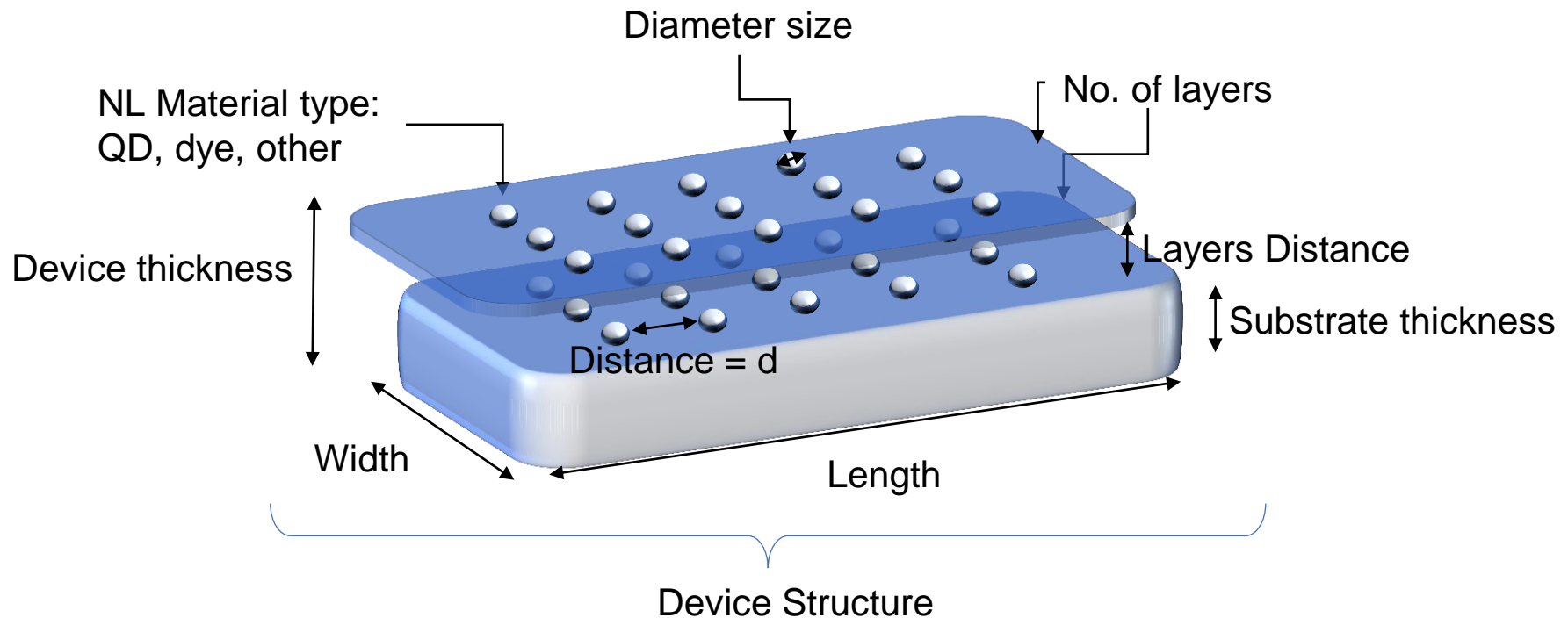
Proposed System

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Device Engineering

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Device Engineering

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Challenges:

For lifetime issue we should take into account the following mechanism:

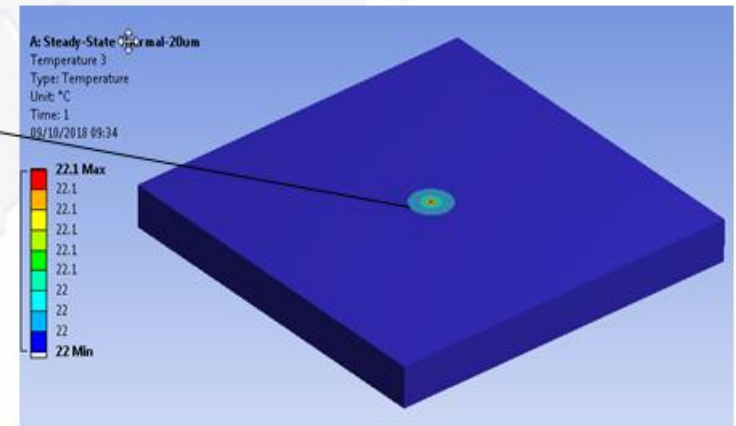
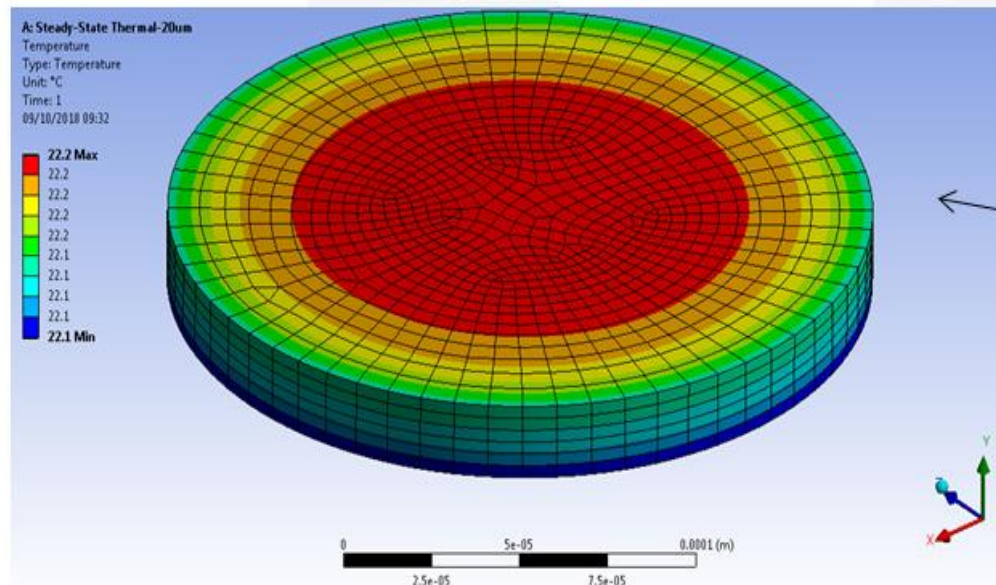
- **Environmental temperature:** storage and operation temperatures → degradation mechanism
- **Local temperature:** absorption of around 20% of the laser beam within the device → degradation → permanent damage within the laser impinging area
 - A careful choice of materials and packaging can minimize degradation.
- **Oxygen:** oxygen barrier → reduce degradation
 - Oxygen barrier can be dielectric layer deposit by evaporation, or wet coating.

Device Engineering

COPAC, Horizon 2020



Thermal modelling:



Temperature Distribution of cylinder spot at steady state load

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Objectives:

Objective 1. To execute dense multivalued parallel logic on a single optically active node in solution

The challenge here is to achieve at least x10 denser level structure acting in parallel in a single photoactive molecular or nanoparticle complex ('*node*') in solution

Objective 2: To develop the capability to implement dense multivalued parallel logic on condensed phase arrays

Obj. 2 expands **Obj. 1** to coupled logic units in the solid phase to show that using arrays bypasses the need for concatenating nodes. COPAC will use tailored Semi-conductor Quantum Dots (SC-QD) in quantum confinement regime, organized in self-assembled or layer-by-layer arrays. SC-QDs of different size and/or composition will be engineered by chemical surface functionalization of the nano-objects

Objective 3. Increasing the number of output directions.

Obj. 3 will provide an independent way of increasing the density of potential outputs; each phase matching direction corresponds to a different set of logic instructions.

Objective 4. To engineer and validate an integrated module.

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Long-term vision:

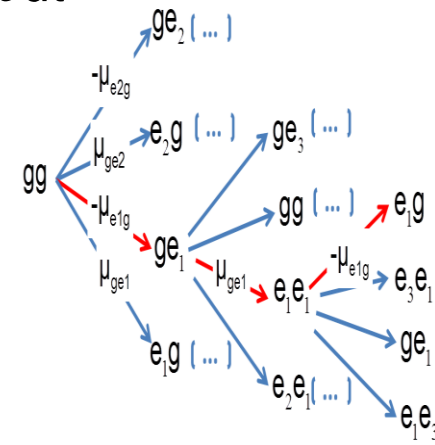
Using atomic and molecular time varying processes to implement information processing in **parallel**

Input = laser pulses

Logic operation = dynamic transitions between states

Output = depends on the node state when it receives the input

Computational model = finite state machine



Meet Us at Booth #645



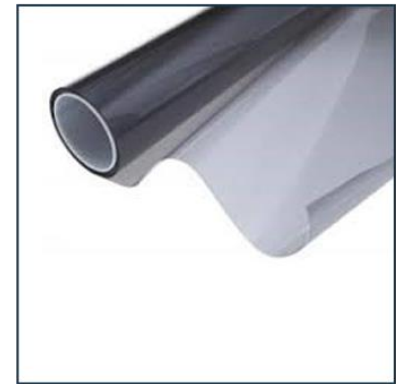
Laser
Protection



Sunlight Protection
Visors



Laser & Sunlight
Protection Eyewear



Energy Saving
Window Film

Thank You

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