White Light Lasers for HyperSpectral Imaging

Ross Hodder – NKT Photonics

6 May 2020
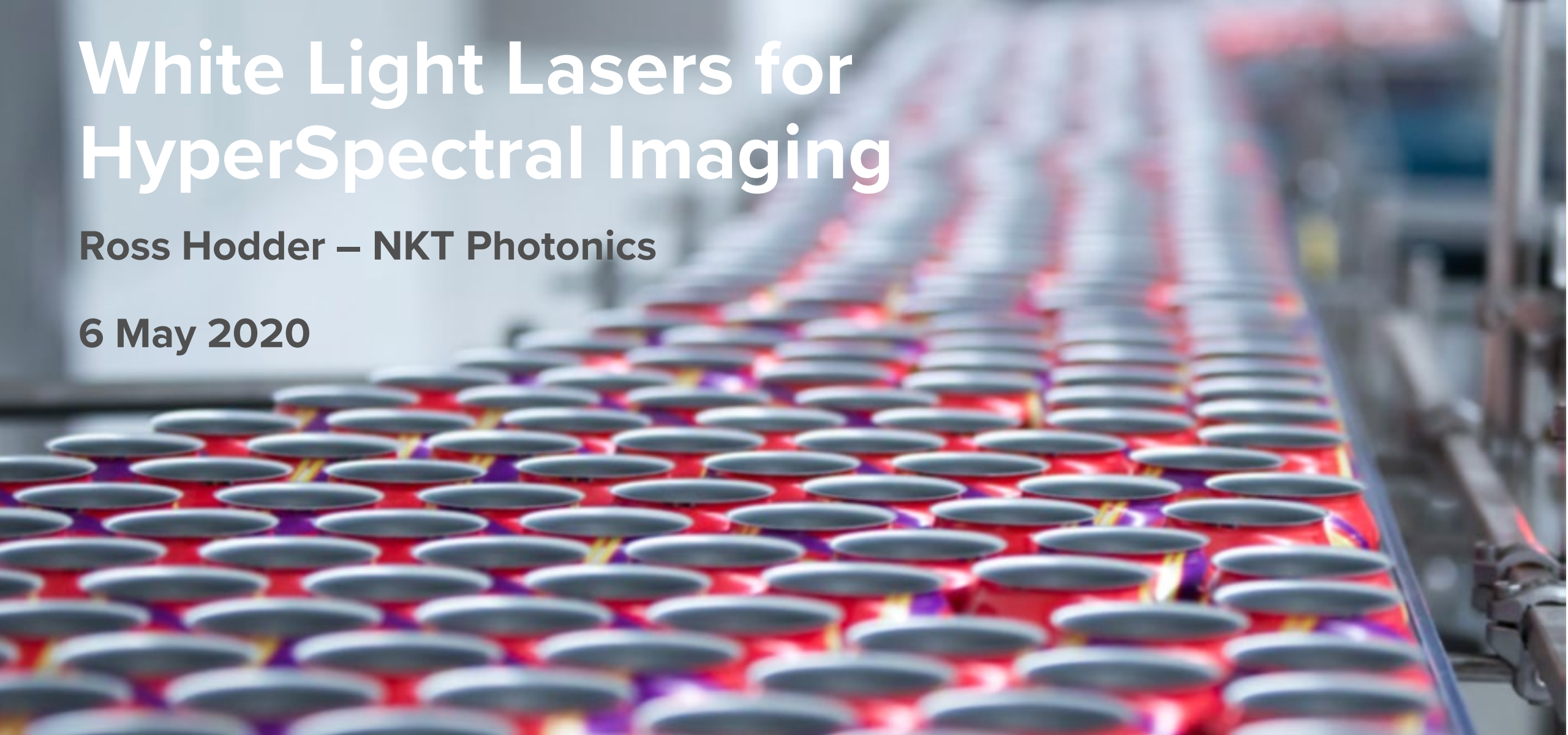
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NKT Photonics at a glance

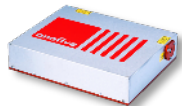| Imaging & Metrology	Sensing & Energy	Material Processing
Bio-imaging & medical Semiconductor Industrial metrology	Energy Security Structural monitoring	Micromachining Medical R&D
White Light Lasers Pulsed Diode Lasers	Distributed Temperature Sensors Single Frequency Fiber Lasers	Femtosecond Industrial Lasers Fiber Amplifier Modules

SuperK & Fianium   Onefive
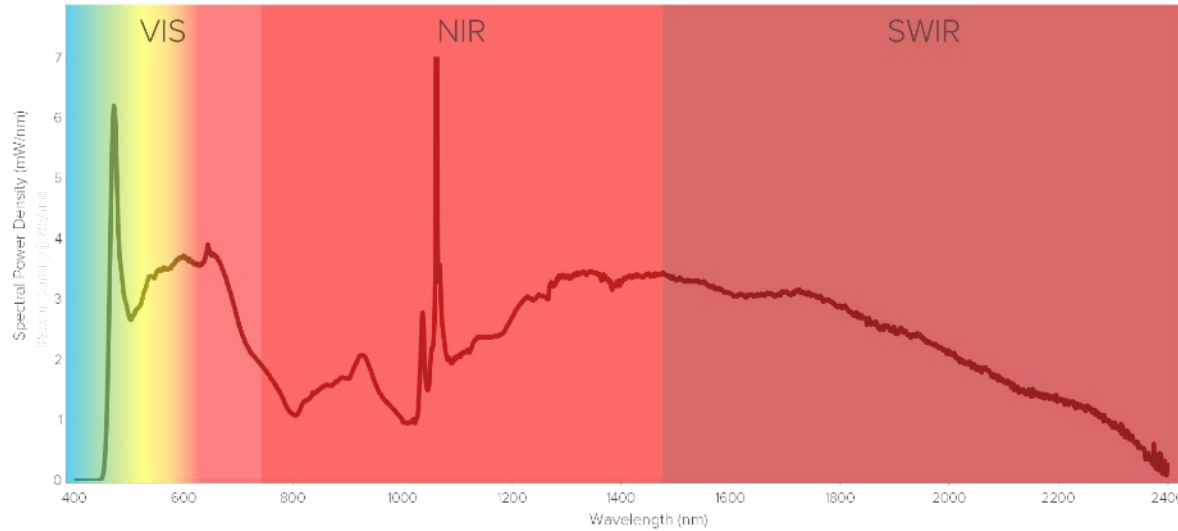
LIOS DTS   Koheras
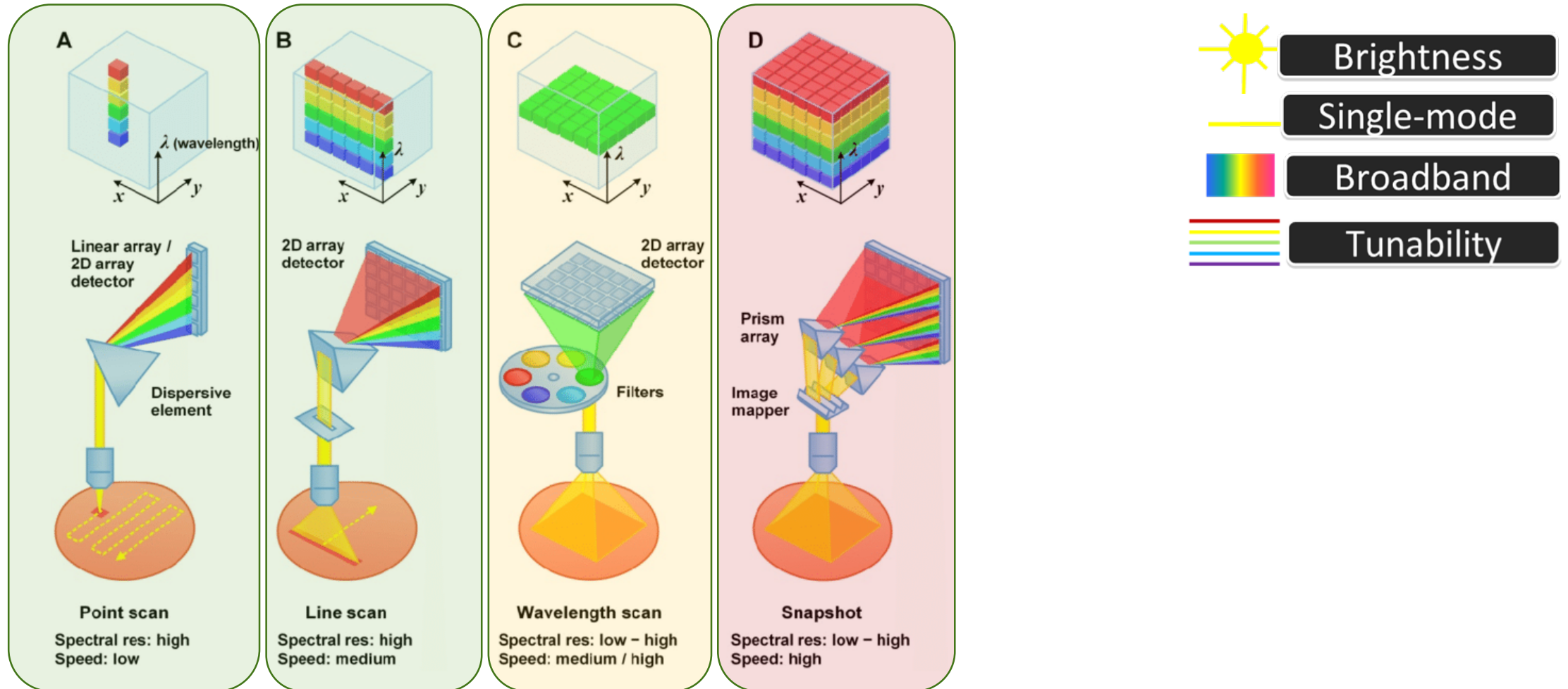
Onefive   aeroGAIN

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White Light (Supercontinuum) Lasers

- Spectrally broadened Fiber Laser
  - No alignment or maintenance
  - Long lifetime

- Spectral properties = lamp
  - UV-Visible-nIR spectral coverage
  - Flat, stable spectrum

- Beam properties = laser
  - Collimated, Single-mode beam
  - Extreme brightness

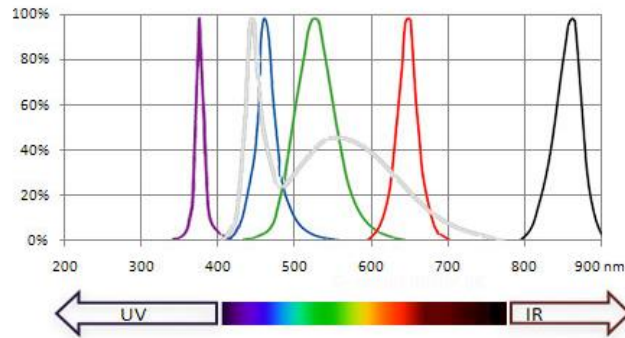NKT Photonics

Hyperspectral Imaging Techniques

Wang, Yu & Reder, Nicholas & Kang, Soyoung & Glaser, Adam & Liu, Jonathan. (2017). Multiplexed Optical Imaging of Tumor-Directed Nanoparticles: A Review of Imaging Systems and Approaches. Nanotheranostics. 1. 369-388. 10.7150/ntno.21136.
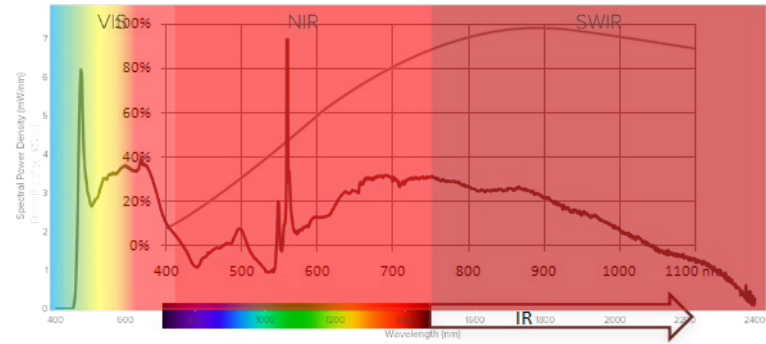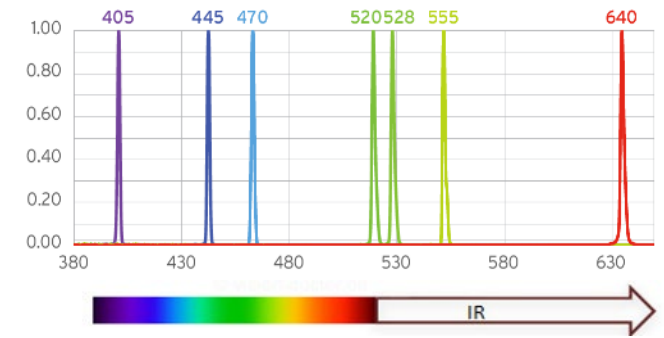
Light Sources for Hyperspectral Imaging

White Light Laser

+ Low cost	+ Very low cost	+ High brightness
+ Long lifetime	+ Wide spectral range	+ High power
+ Low power consumption	+ High power output	+ High spatial resolution
- Narrow spectrum	- Short lifetime	- Higher initial cost
- Gaps in available colours	- High heat generation	- Not broadband
- Limited brightness	- High power consumption	- "multi-spectral" only

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Beyond Spectral Imaging

- 3D Imaging / Profilometry
  - Optical Coherence Tomography / White Light Interferometry
  - Chromatic Confocal measurement
  - Time-of-Flight (ToF)
- Internal Measurements
  - Transmission Spectroscopy
  - Scattering & Diffusion
- Enhanced Imaging
  - Confocal imaging
  - Fluorescence

HDPE
LDPE
PA
PET
POM
PP
PS
PVC

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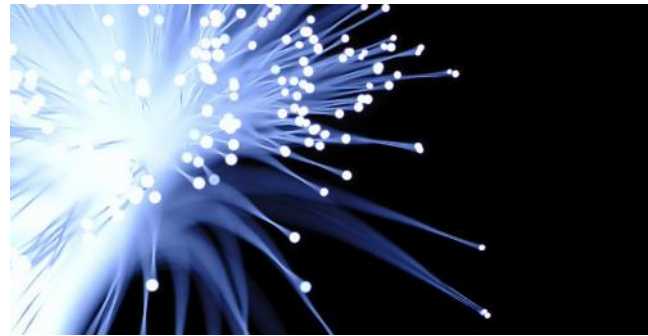
White Light Lasers - Summary

Brightness

- Reduced sensor cost & complexity
- High throughput
- Reflection, transmission and scattering measurement

Single-mode

- High resolution
- Efficient illumination
  - Point-scan
  - Line-scan
- Advanced measurement techniques
  - OCT / WLI
  - Chromatic Confocal

Broadband

- UV-visible & nIR
- Flat, Stable Spectrum

- Long-lifetime
- Low power consumption
- Low heat generation

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