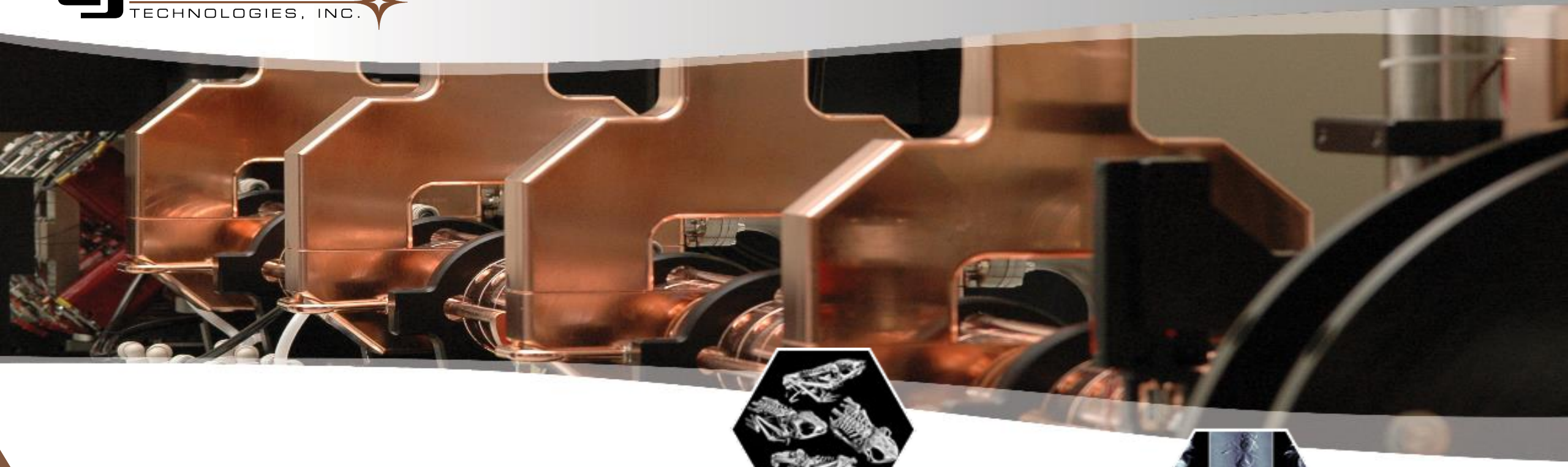
Lyncean TECHNOLOGIES, INC.

illuminating x-ray science™



The Lyncean Compact Light Source

Brief Technical Overview

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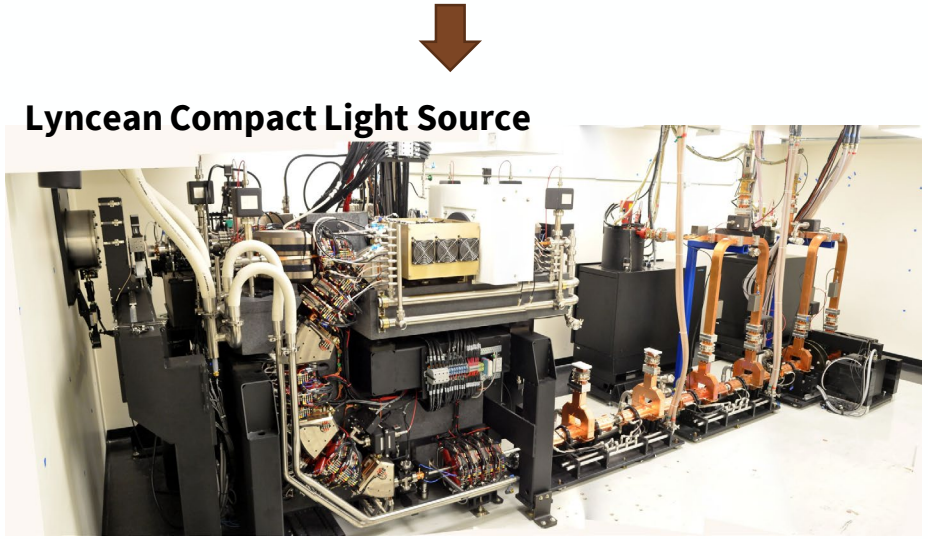
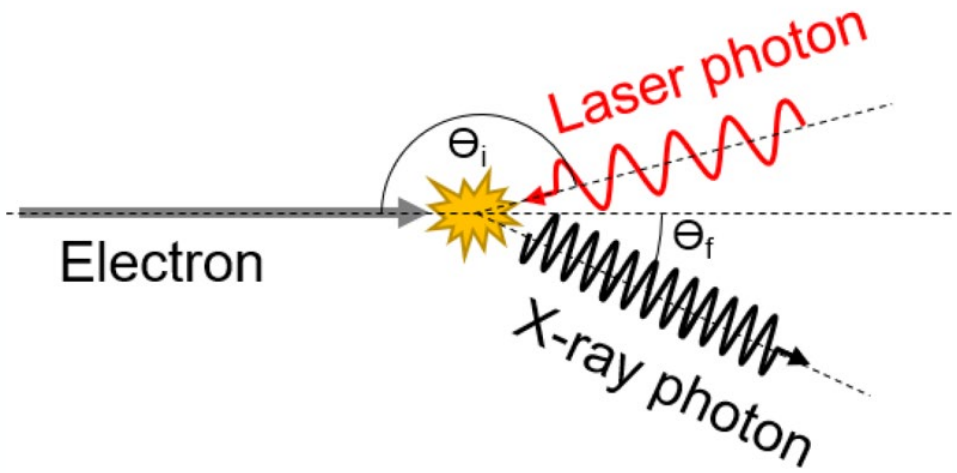
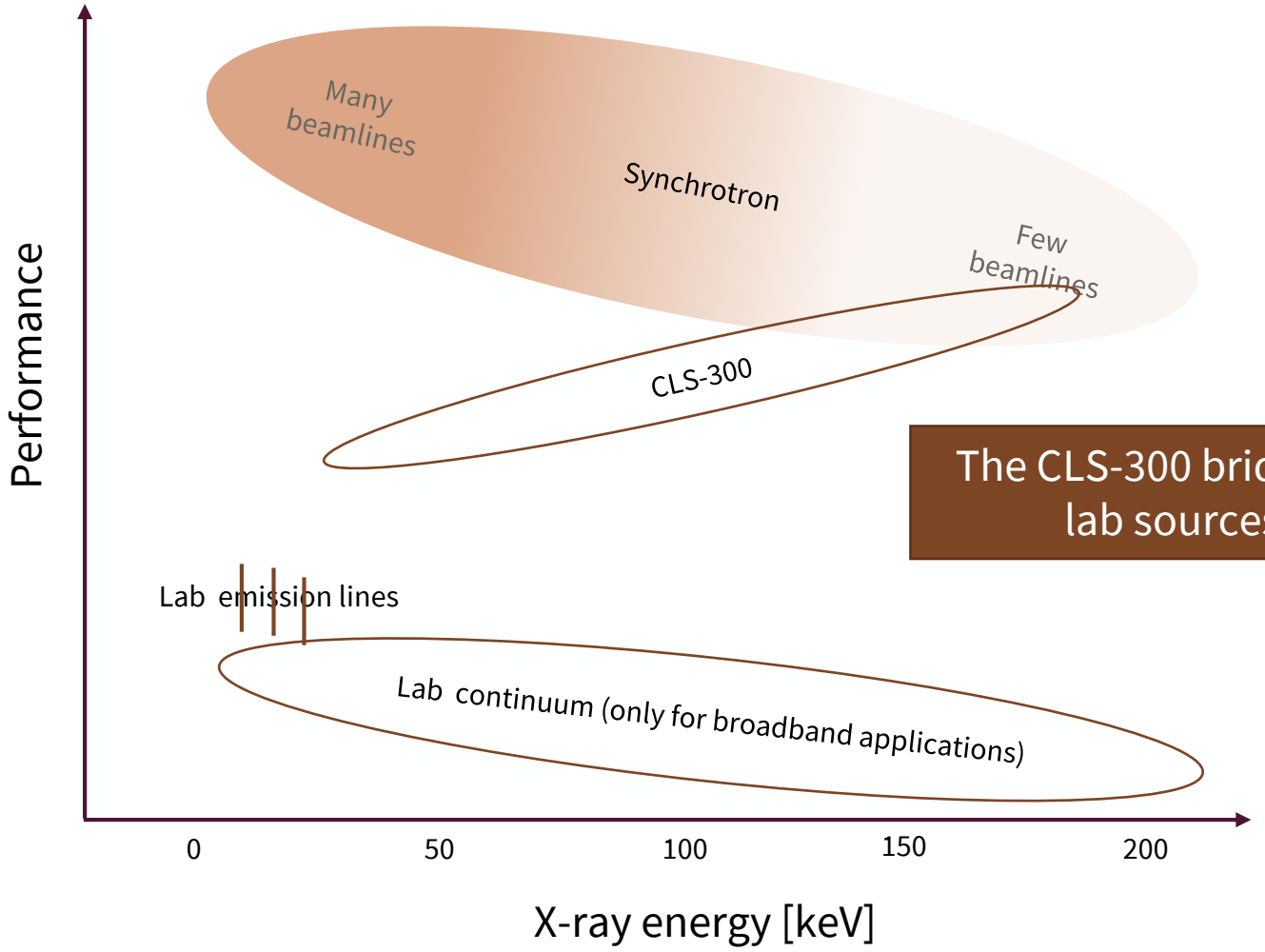
Inverse Compton Scattering (ICS) X-rays



- ICS allows shrinking a synchrotron to laboratory size while maintaining many of the beam properties
- A relativistic electron collides with a high-power laser photon
- The laser photon is back-scattered and its wavelength shifted into the X-ray regime



The X-ray Source Landscape

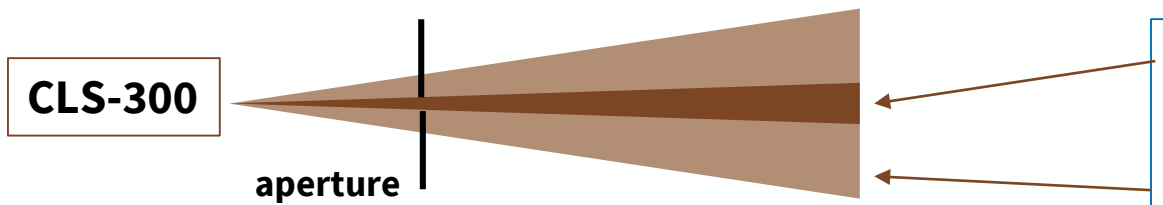


The CLS-300 bridges the gap between traditional lab sources and synchrotron facilities

Lyncean CLS X-ray Source Beam Parameters

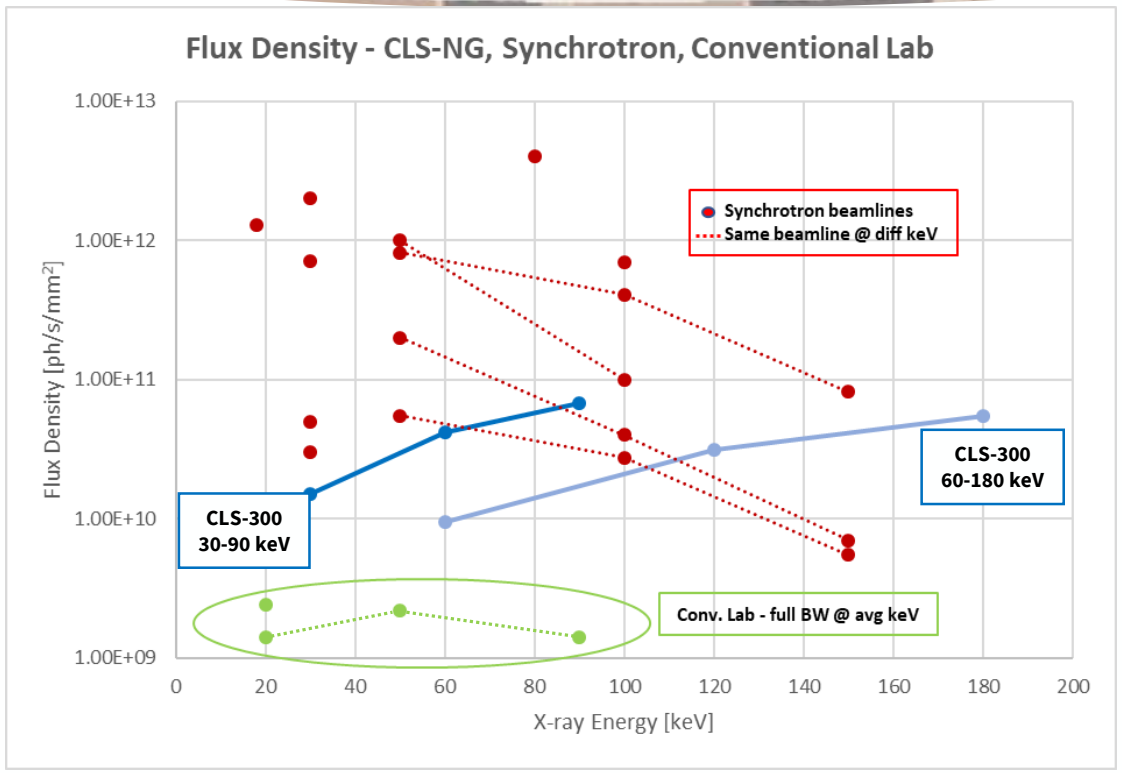
	CLS – 300 Performance Target			
Stored electron energy (max)	~100 MeV			
Optical cavity wavelength	2 µm		1 µm	
X-ray energy range (keV)	~30 – 90		~60 – 180	
Brightness (1/s mrad^2 mm^2 0.1%BW)	~4 x 10^{12} @ 90 keV		~4 x 10^{12} @ 180 keV	
Divergence (mrad)	1	4	1	4
Bandwidth (FWHM)	1.5 - 2.5%	6 - 15%	1.5 -2.5%	6 - 15%
Flux @ max energy (ph/s)	~4 x 10^{11}	~4 x 10^{12}	~4 x 10^{11}	~4 x 10^{12}

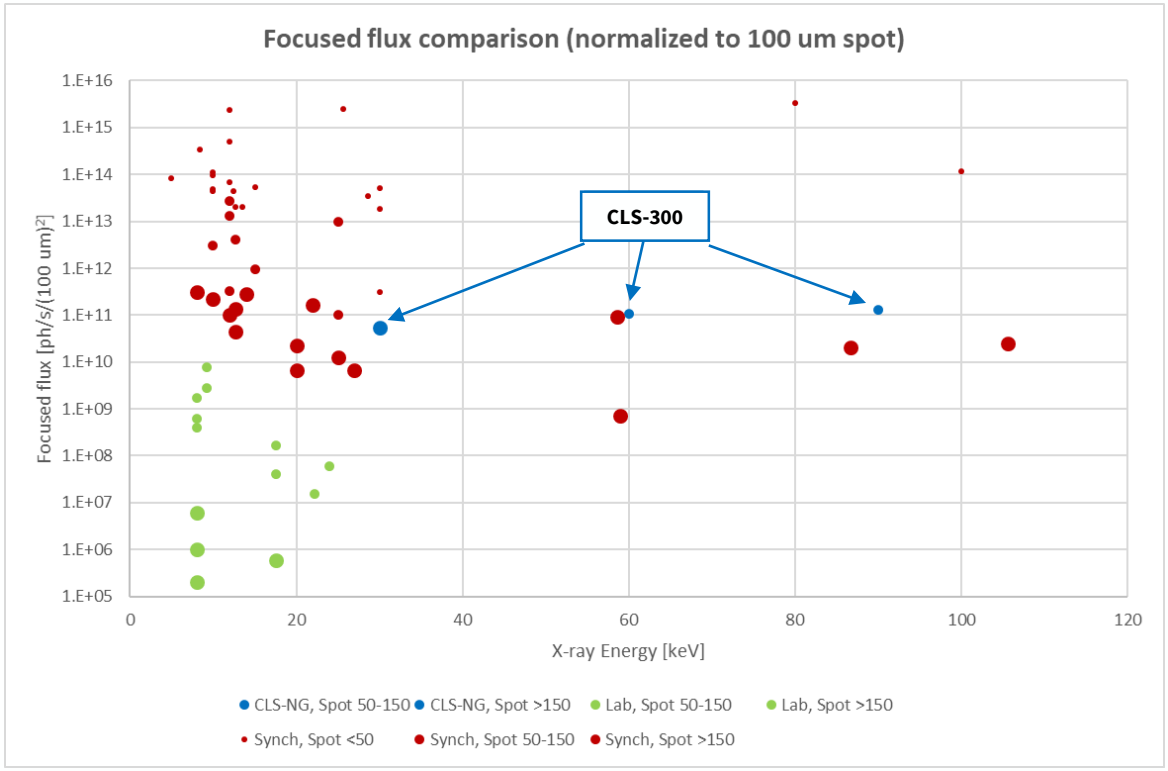
- Two configurations possible
  - 2 µm wavelength optical cavity
  - 1 µm wavelength optical cavity
- Possible to switch between configurations
  - Requires Lyncean support
  - 3 to 5 days of downtime



- Narrow BW + low divergence configuration for focused beam applications
- Larger divergence + high flux configuration for imaging applications

Comparison: CLS-300 vs synchrotron and lab sources



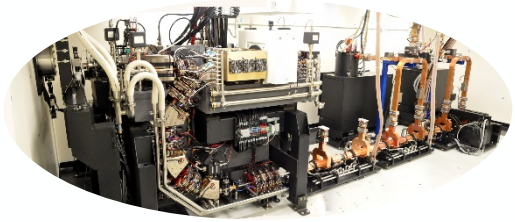


- CLS-NG is particularly competitive at high energies, where synchrotron flux typically drops off and where fewer beamlines exist
- Focused beams not practical with lab sources above ~25 keV, where no suitable emission lines exist
- Notes:
  - Synchrotron beamlines typically tunable but plot shows single energy data points where flux data is available
  - For synchrotron, we present multilayer monochromator data where available (dE/E ~1e-2) but some data points are for crystal monochromators (dE/E ~ 1e-4)

Applications with Synchrotron-level Results

DIFFRACTION

- **Macromolecular crystallography**
  Protein Structure
- **Single crystal diffraction**
  Structure / orientation
- **Powder diffraction**
  Material / phase identification



SCATTERING

- **Small angle x-ray scattering**
  Size / shape of nano-scale objects
- **Pair distribution function**
  short-medium term order

IMAGING / TOMOGRAPHY

- **Absorption Contrast**
  Quantitative density, elemental contrast
- **Spectroscopic Imaging**
  Elemental concentration, functional labels
- **Grating Phase Contrast**
  Sub-resolution structure, quantitative phase
- **Propagation Phase Contrast**
  Low-contrast high-resolution features

SPECTROSCOPY

- **X-ray Fluorescence Mapping**
  Elemental distribution
- **Absorption / Fluorescence Spectroscopy**
  Chemical state, coordination

Access to multiple modalities → Comprehensive characterization

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