

ON THE DESIGN OF A DEDICATED ELECTRON DIFFRACTOMETER

Dr. E. Hovestreydt, Dr. G. Santiso-Quinones & Dr. G. Steinfeld
 ELDICO Scientific AG, CH-5234 Villigen
www.eldico-scientific.com

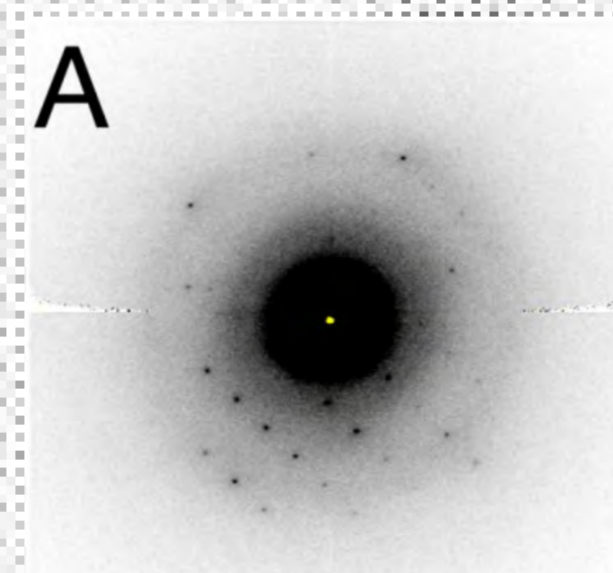
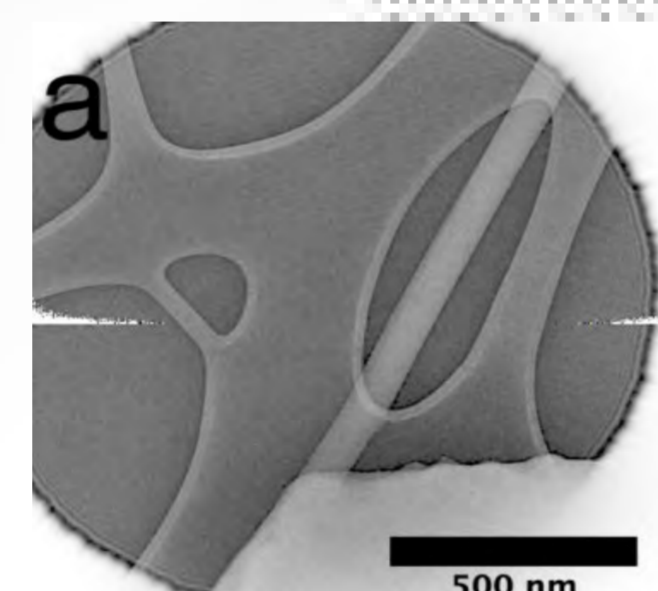
Electron Diffraction (ED) as such has been around since the early days of Electron Microscopy. Once Transmission Electron Microscopes (TEMs) were available with accelerating powers of 200 to 300 kV and 2D detectors became fast enough, Electron Crystallography really took off.

So far, ED has been done in TEMs that are modified, resulting in challenging experiments and limited datasets, yet, structures could be obtained from samples in the range of merely tens of nanometers, that were unsolvable with either conventional or even synchrotron X-ray radiation.

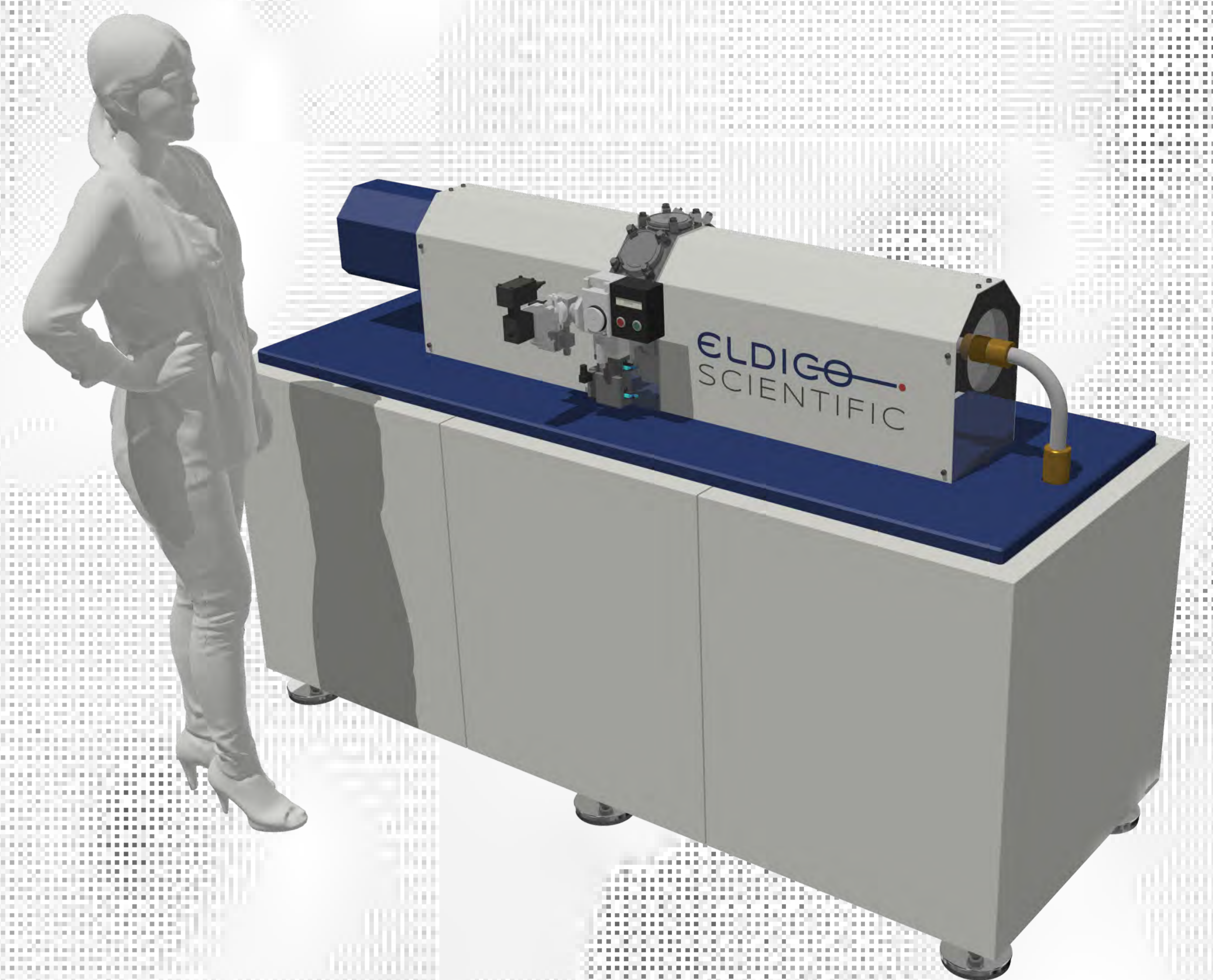
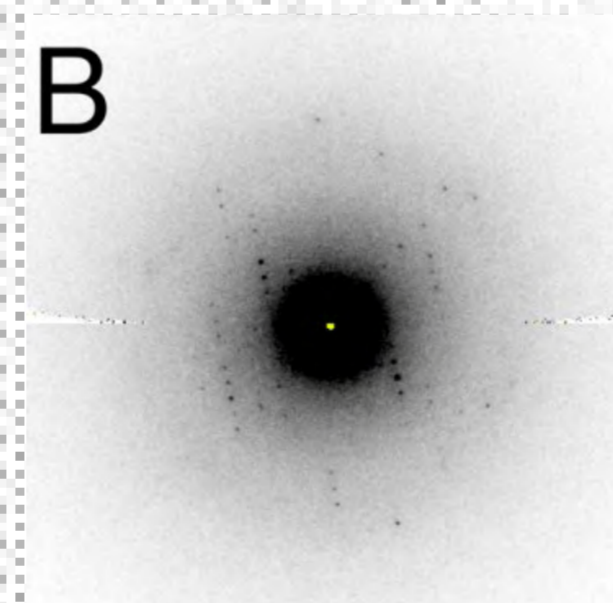
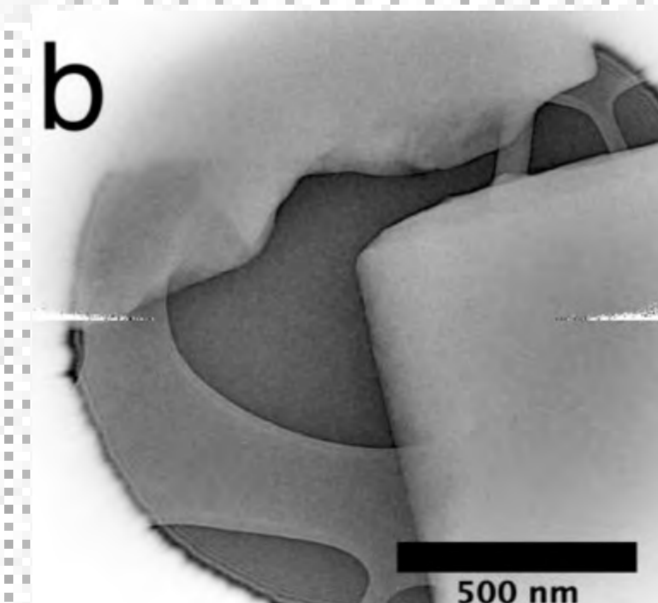
Proof of concept on organic samples: New polymorph of a highly active API

	Experimental
Tecna F30 TEM at 200 kV	$\lambda = 0.02508 \text{ \AA}$
dose rate of $\sim 0.01 \text{ e}^{-\text{\AA}^{-2} \text{ s}^{-1}}$	Crystal thickness: ca. 300 nm
Resolution: 1.0 \AA	Rotation range: 70°
Read frequency 100 Hz	Rotation speed 1.5°/s

Sample A
 (confidential)
 Known polymorph
 Triclinic unit cell



Sample B
 (confidential)
 New polymorph
 Orthorhombic unit cell



Source	
Emitter:	LaB6
Acceleration:	200kV
Beam size:	20 nm in imaging at sample 1.5 μm in diffraction at sample
Imaging	
Mode:	single image scanning
Field of view:	1 mm to 1 μm
Dose per image:	0.025 $\text{e}^{-/\text{\AA}^2}$
Resolution:	20 nm
Diffraction	
Mode:	continuous rotation
Resolution:	0.82 \AA
Goniometer	
Type:	single axis
Rotation:	-70° - +70°
Speed:	1°/s - 10°/s
Accuracy:	0.01° at 1°/s
Sphere of confusion:	< 1 μm
Detector	
Distance to sample:	fixed
Type:	HPAD

CLAIMS:

Sample size from 10 to 1000 nm
 Radically simplified EM design
 Improved goniometer
 R_f below 10%

ELDICO Scientific - The Electron Diffraction Company - is a Swiss hardware company founded 2019 and is located at the Paul Scherrer Institute in Innovation Park Innovaare.

ELDICO develops, produces and sells electron diffractometers for single-crystal structural analysis, enabling scientists to characterise hitherto unmeasurable nano-crystalline systems. So far conventional X-ray methods fail, because crystallisation of bigger samples is often difficult or even impossible.

The proof of principle was achieved in 2018 (ETH Zürich, C-GINA Basel) on scientifically and industrially relevant samples, published recently (Angewandte Chemie, International Edition) and were nominated for "Breakthrough of the Year 2018" by SCIENCE.



Gustavo Santiso
CEO



Eric Hovestreydt
CSO



Gunther Steinfeld
CTO



Nils Gebhardt
CFO

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