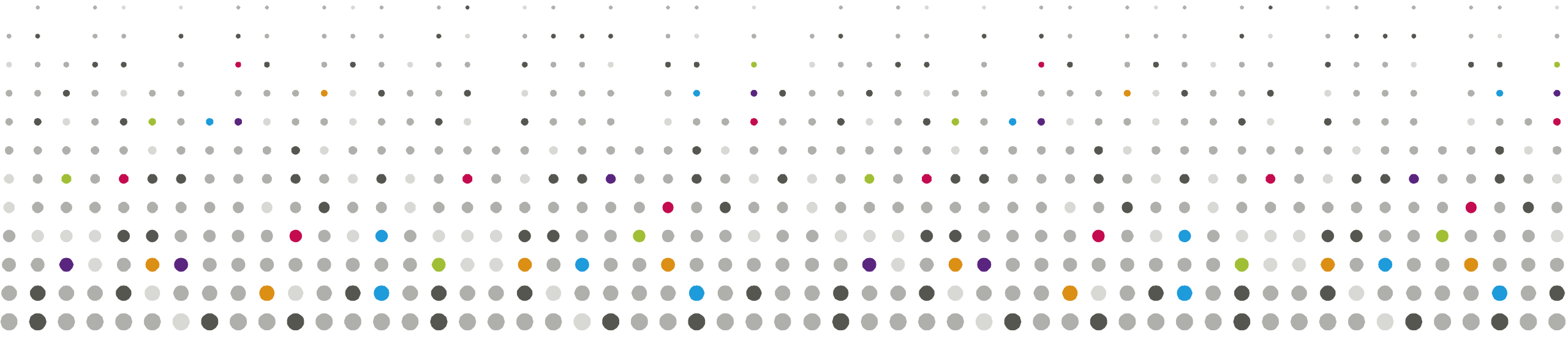# The Mycronic path back to Semiconductors and into Deep Learning

Thomas Kurian, Feb 25th 2020

Mycronic enabling manufacturing of products for every day life

By producing equipment for advanced manufacturing of electrical products

Business area PG
Mask writers & metrology

Business area AS
Assembly equipment

MYCRONIC

Mycronic in short

40
years of experience in innovation

1300
employees in ten countries

50
Mycronic is represented in more than 50 countries

500
patents proves the power of innovation.

3,000
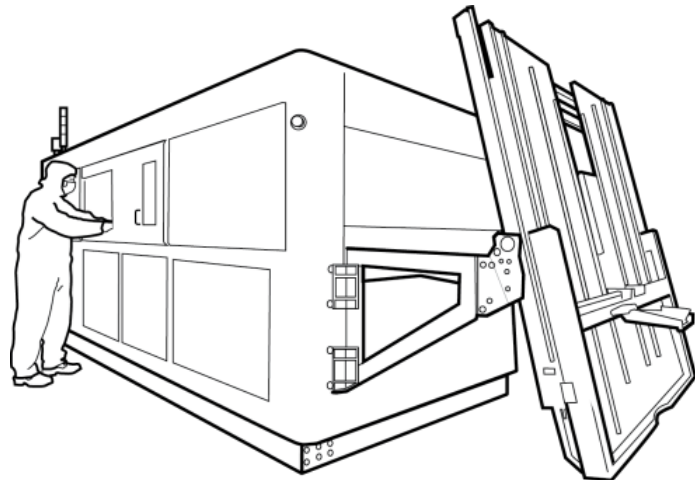customers use production equipment from Mycronic

98%
of consolidated net sales are exports

MYCRONIC

Display production using photomasks

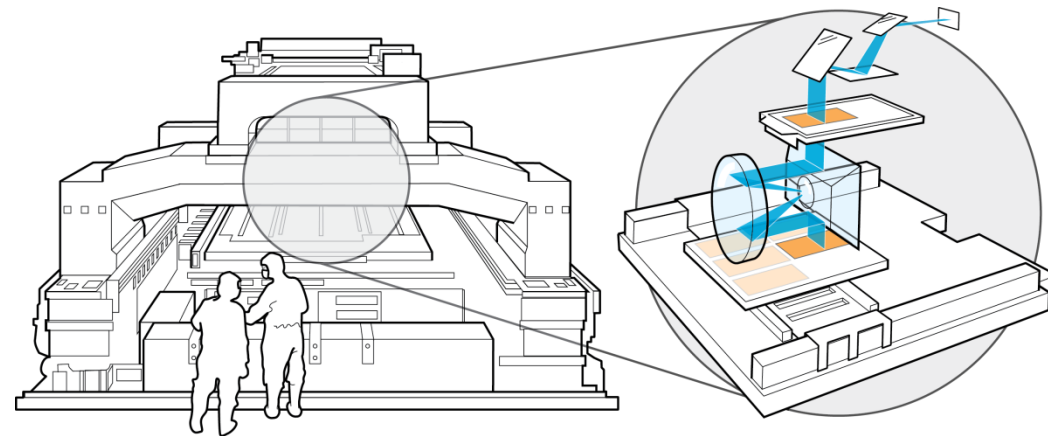## Lithography a capital intensive process but highly cost effective

~ 100,000 times faster than your high speed broad band

Mask writer – writes the photomask

Aligner – copies the photomask

- 24-48 hours writing time
- ~25 Terabyte data
- Transfer rate ~1.2-2.5 Gbit/s

- ~20 seconds to copy the photomask
- ~25 Terabyte data
- Transfer rate ~10 Tbit/s

Lithography using photomasks is the only technology used today in mass production to create high end electronics and high end display TFT back planes
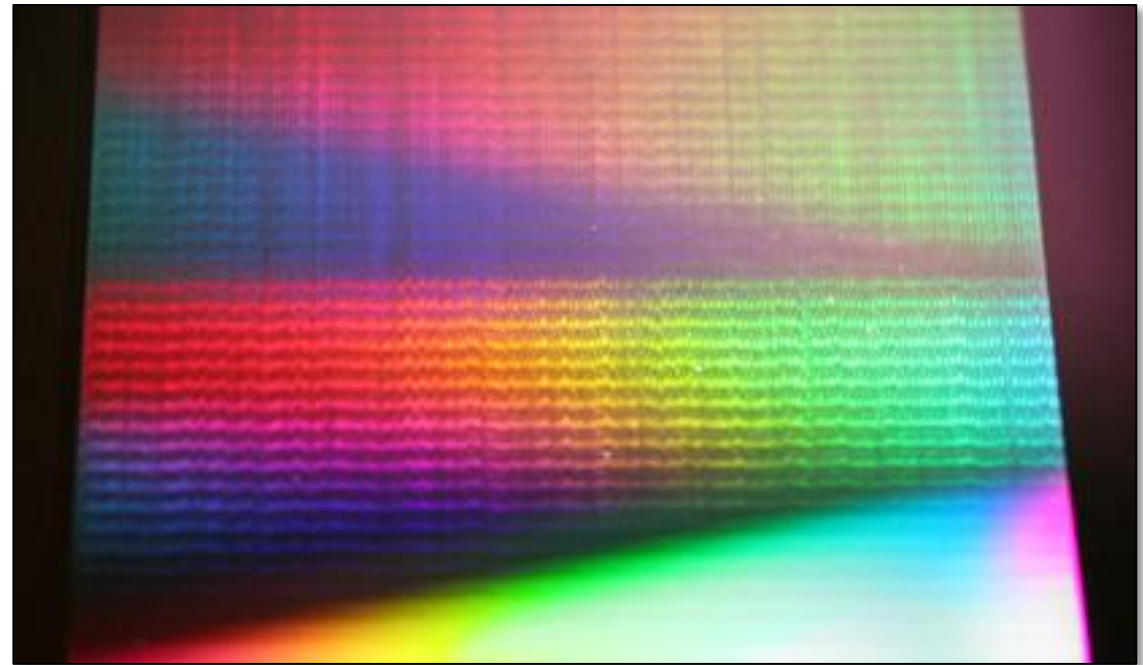
MYCRONIC

Mycronic has a unique position as the sole supplier of mask writers to the display industry
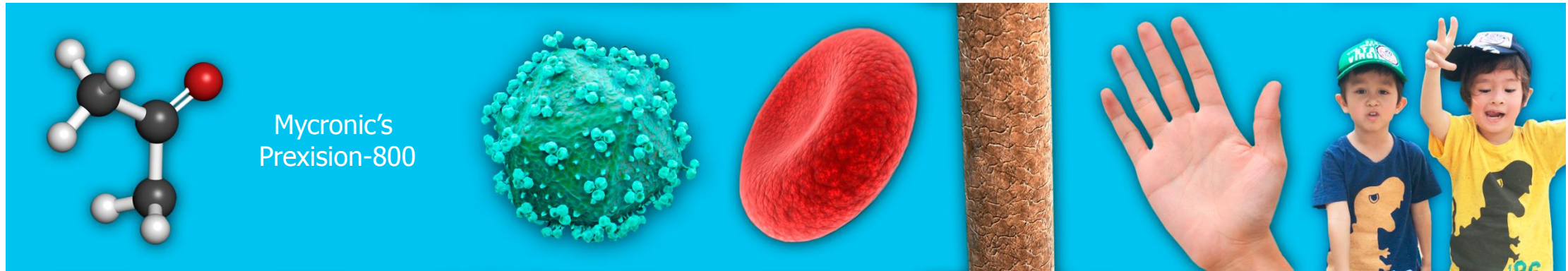
Can handle photomasks up
to 1.8 x 2.0 m

"The mura (斑) challenge"
- Japanese word meaning irregularity

Photo: Courtesy of SKE Electronics

….So literally you could say that all mass produced high end displays in the world has a connection to Mycronic…

MYCRONIC

Mycronic mask writers

Offering nanometer precision

1 ångström	1 nanometer	100 nanometer	10 micrometer	100 micrometer	10 cm	1 meter
Atom		Virus	Red blood cell	Hair	Hand	Child

Mycronic's
Prexision-800

Mycronic's Prexision-800 delivers nanometer precision

MYCRONIC

Display trends in favor for the photomask industry

Transition from LCD to AMOLED

➔ Drives mask complexity

Larger and larger displays

➔ Drives mask size

Higher and higher resolution

~60 PPI   ~160 PPI   ~400 PPI

➔ Drives mask complexity

Displays in new applications

➔ Drives additional demand & new requirements
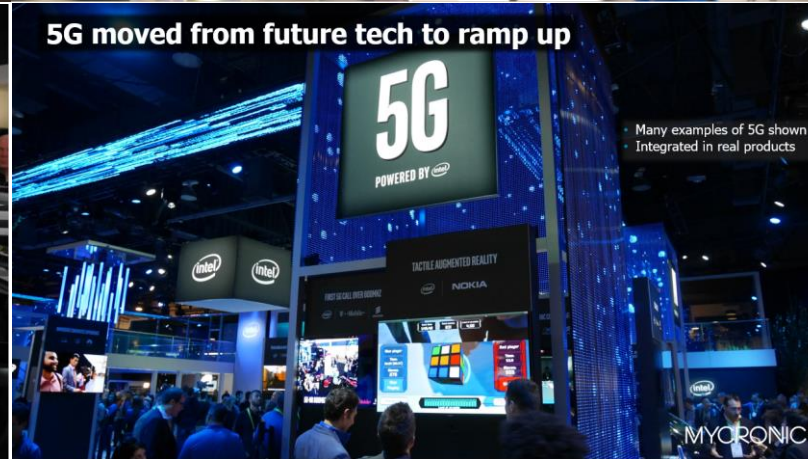
MYCRONIC

The new SLX Series

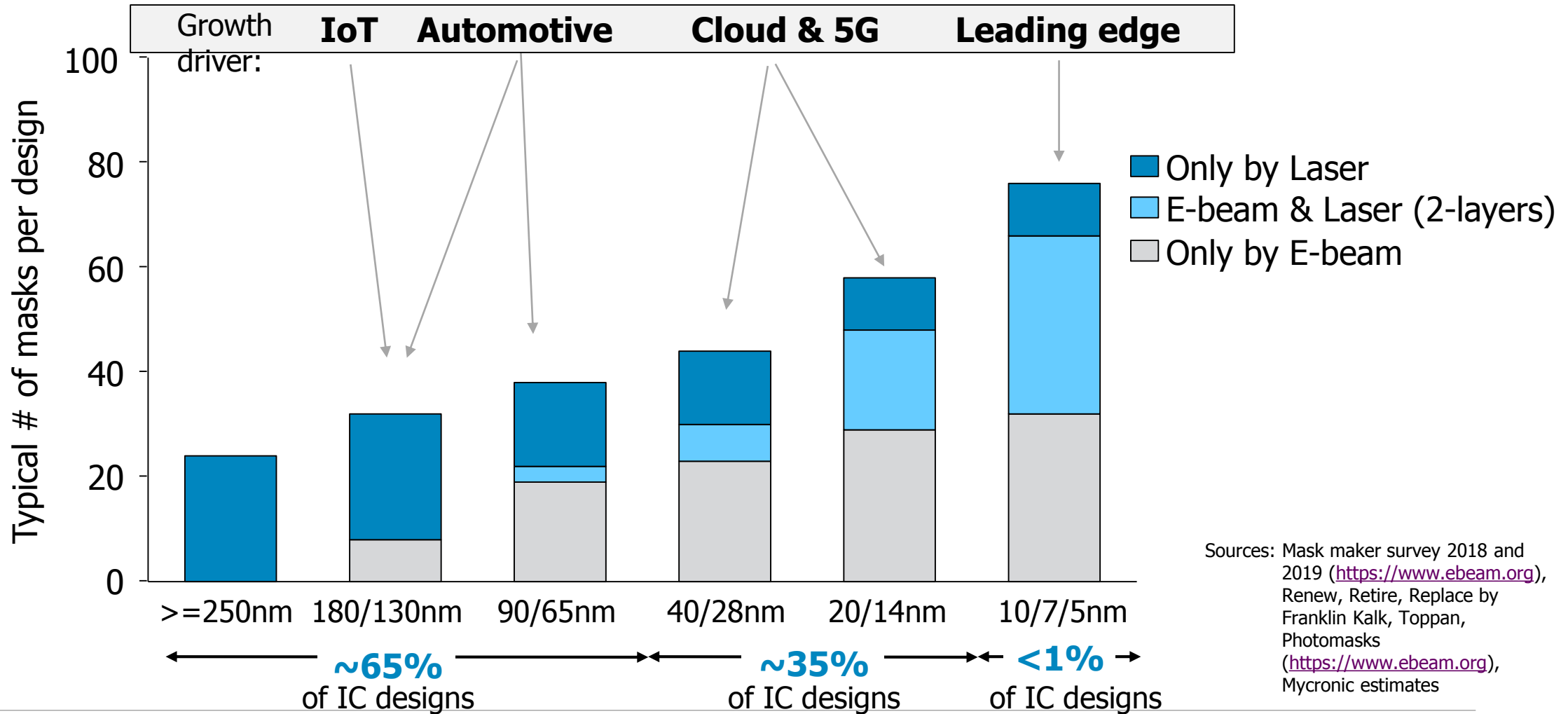**The laser mask writer for tomorrow's semiconductor market**

The electronification of everything

More devices will need processing power to keep up with the pace of change

Laser writer demand on the rise

Additional demand driven by both market trends and technology trends

Sources: Mask maker survey 2018 and 2019 (https://www.ebeam.org), Renew, Retire, Replace by Franklin Kalk, Toppan, Photomasks (https://www.ebeam.org), Mycronic estimates

MYCRONIC

Laser writer demand on the rise

Additional demand driven by both market trends and technology trends
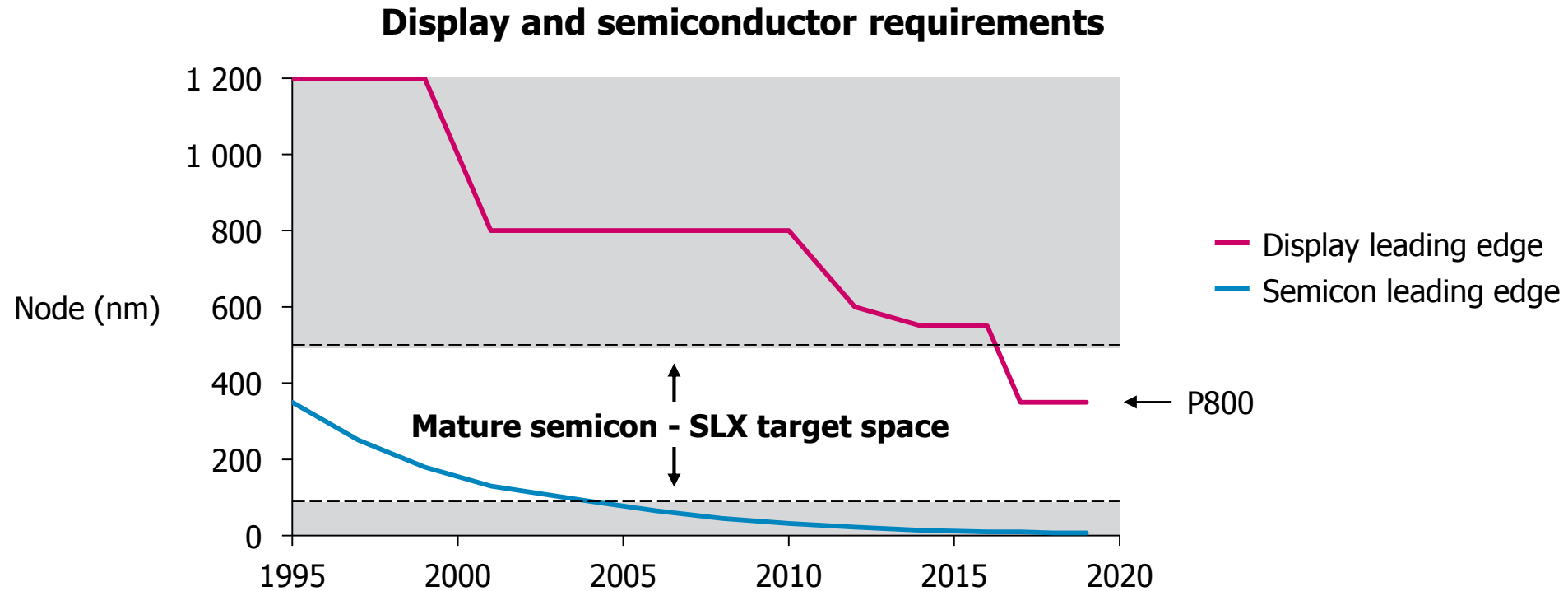
Semiconductor masks produced
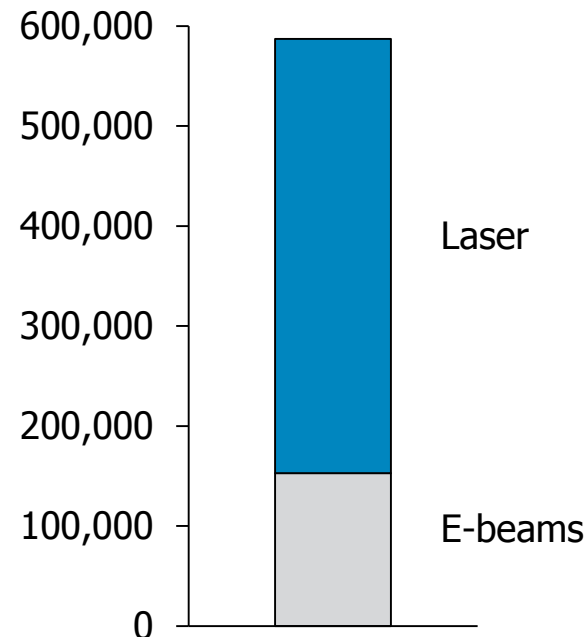
- Around 600 000 photomasks enable the semicon industry today
- 70-75% of these masks are written by laser

MYCRONIC

In excellent position to capture the opportunity

Leveraging existing display technology and customer relationships

Display and semiconductor requirements

Node (nm)

— Display leading edge
— Semicon leading edge

← P800

Mature semicon - SLX target space

1995   2000   2005   2010   2015   2020

Despite competition in segment our ambition is to capture a majority of the upcoming opportunity with the SLX-series and over time establish a strong presence in the mature semicon segment

MYCRONIC

The SLX value proposition

Lowest cost per mask

"Superior writing speed and low running cost"

Reliable and stable operation

"Field proven technology and strong service organization"

A long term committed supplier

"Modern platform with future development possibilities"

Best overall investment

"Attractive entry price and many options to enable a cost efficient production"
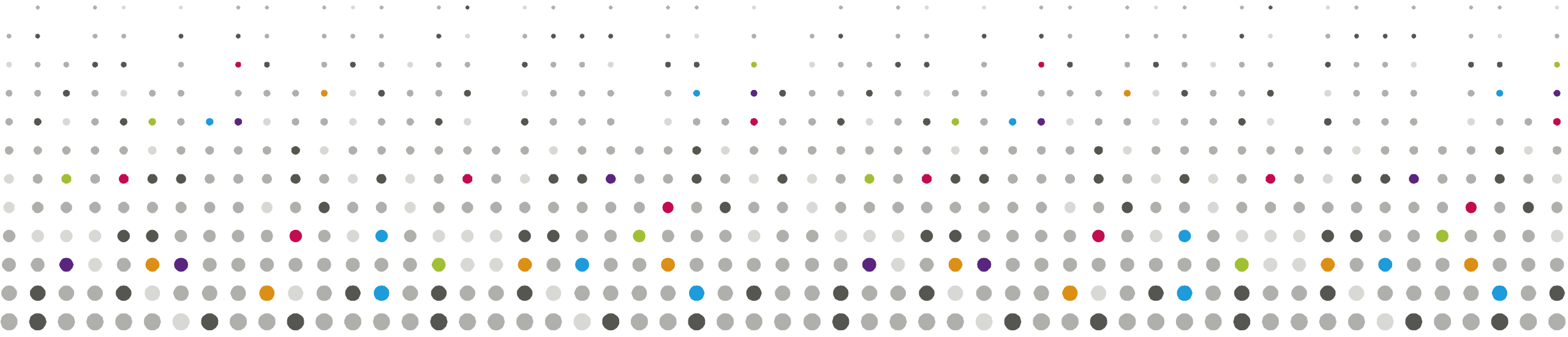
Born to run

(first shipment expected year end 2020/21)

The new SLX Series

The laser mask writer for tomorrow's semiconductor market

- Available in different configurations
- Writing times from 20 minutes
- Meets requirements down to 90 nm node

MYCRONIC

Applying Deep Learning Methodologies to Improve Mask Shop Operation

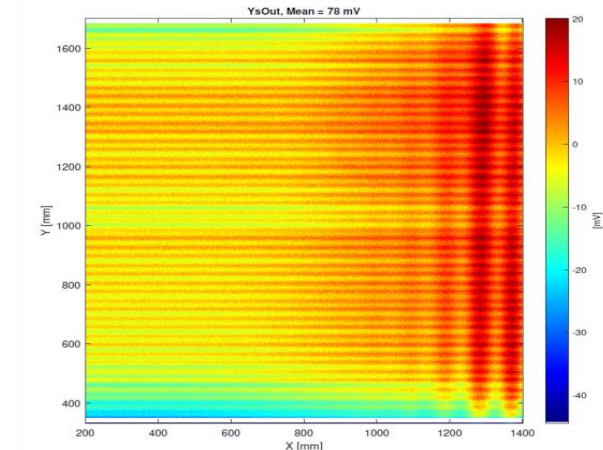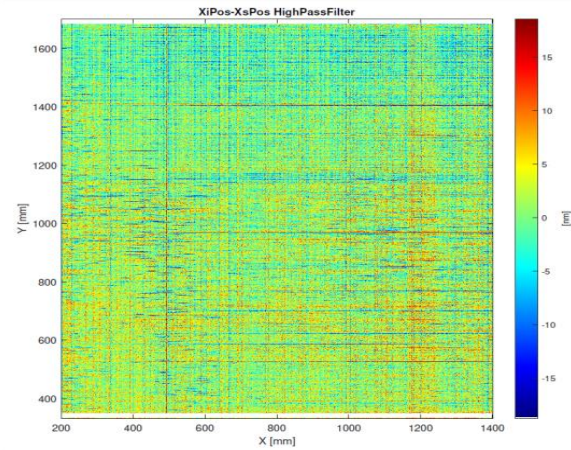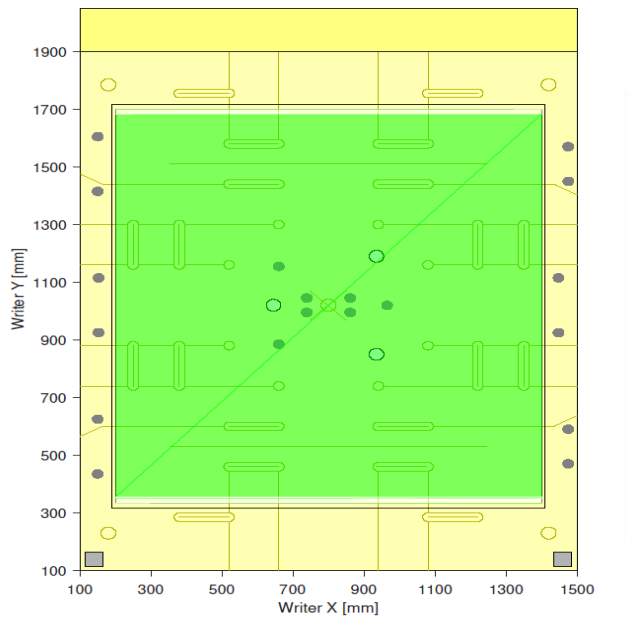# Logging of Writer Servo Data
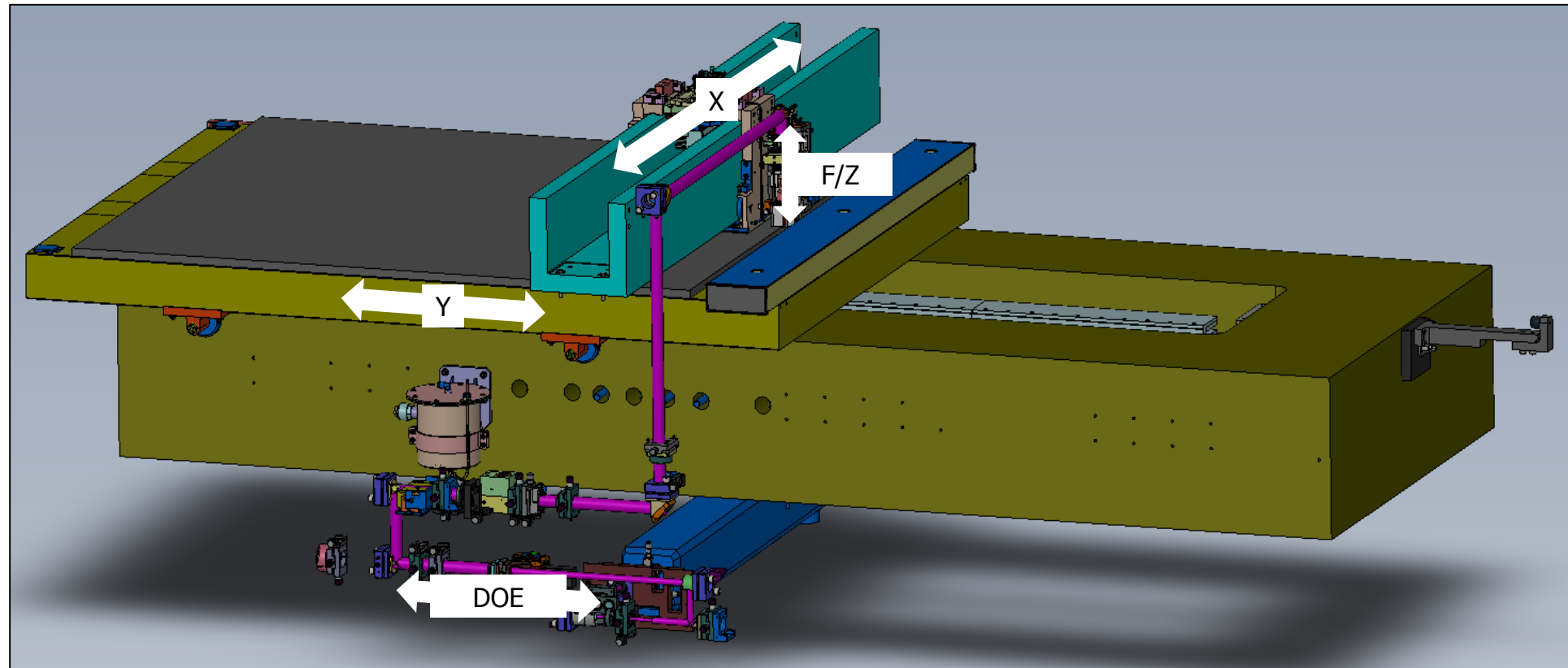
Writer Servo Log Visualization
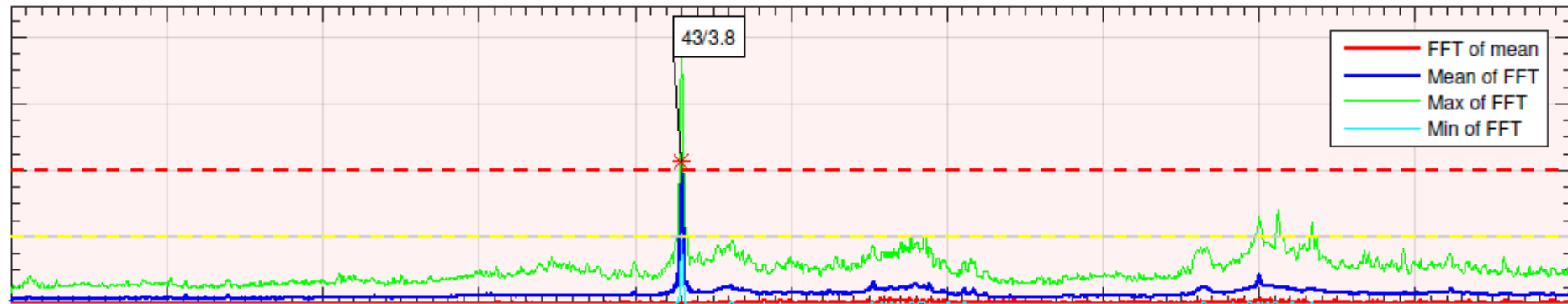
Looking for mura in the data
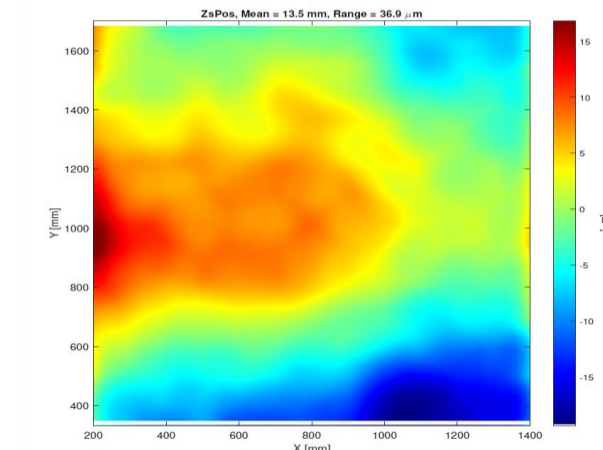
Writer Servo Log Statistical Analysis

FFT of Strip Data

MYCRONIC

Deep Learning

CENTER FOR DEEP LEARNING IN ELECTRONICS MANUFACTURING

MYCRONIC

CDLe & Deep Learning Competence

In planning

Long term Assignee Romain Roux

JP

PnP

PG

CDLe

AEI, MRSI

Mycronic Täby

Royotech

SW engineering partner

VIT

Insp

MFKK

Axxon

- Long Term Assignee

- Short Term Assignee

- Not Yet Assigned

MYCRONIC
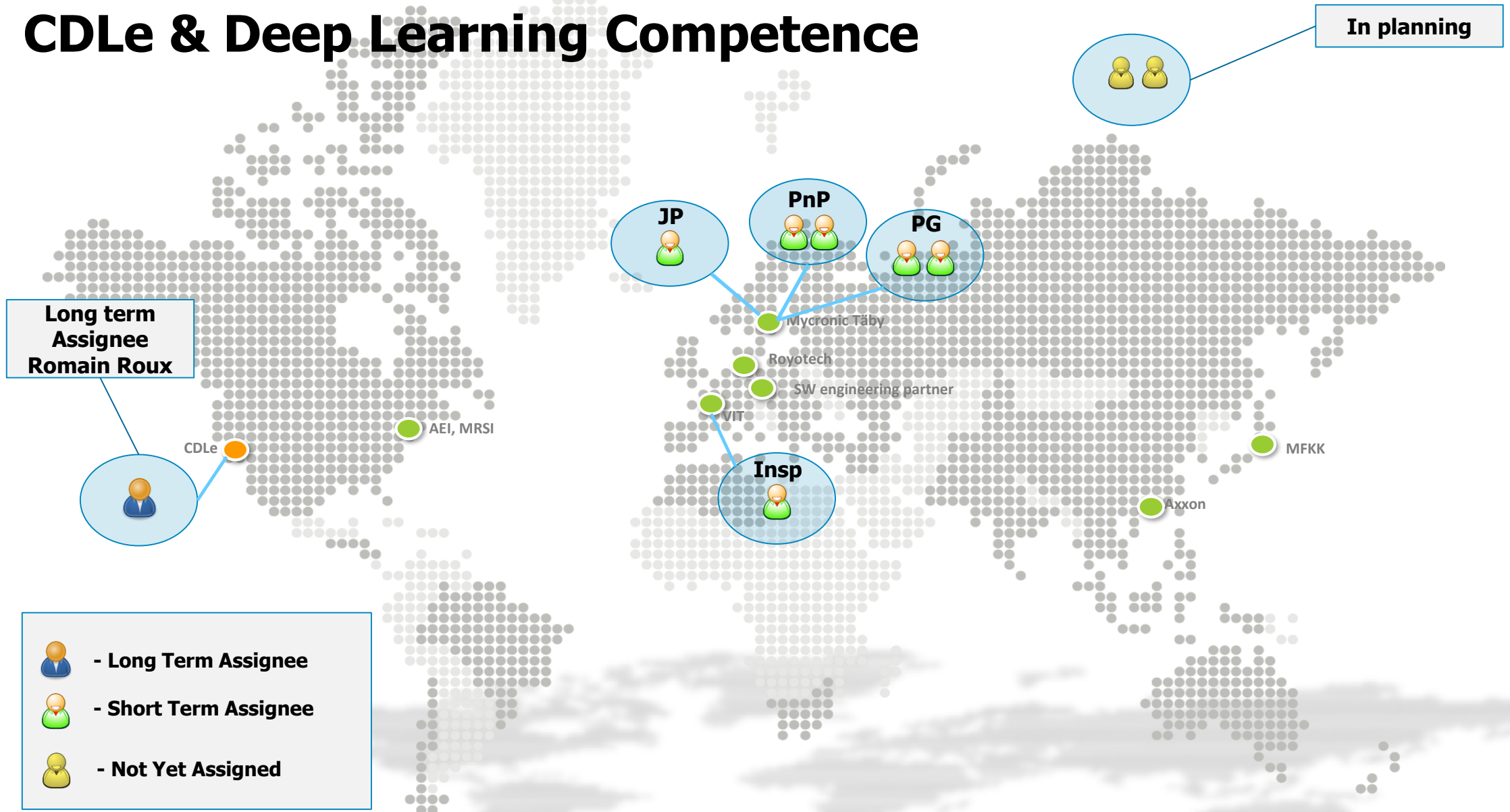
Anomaly Detection Using Autoencoders

Capturing Normal Behavior
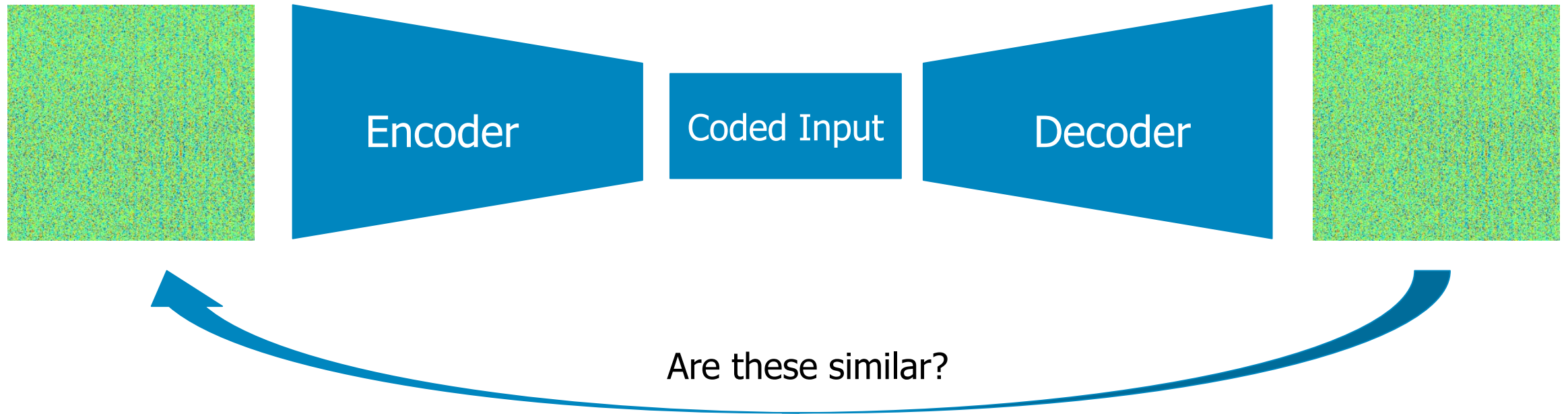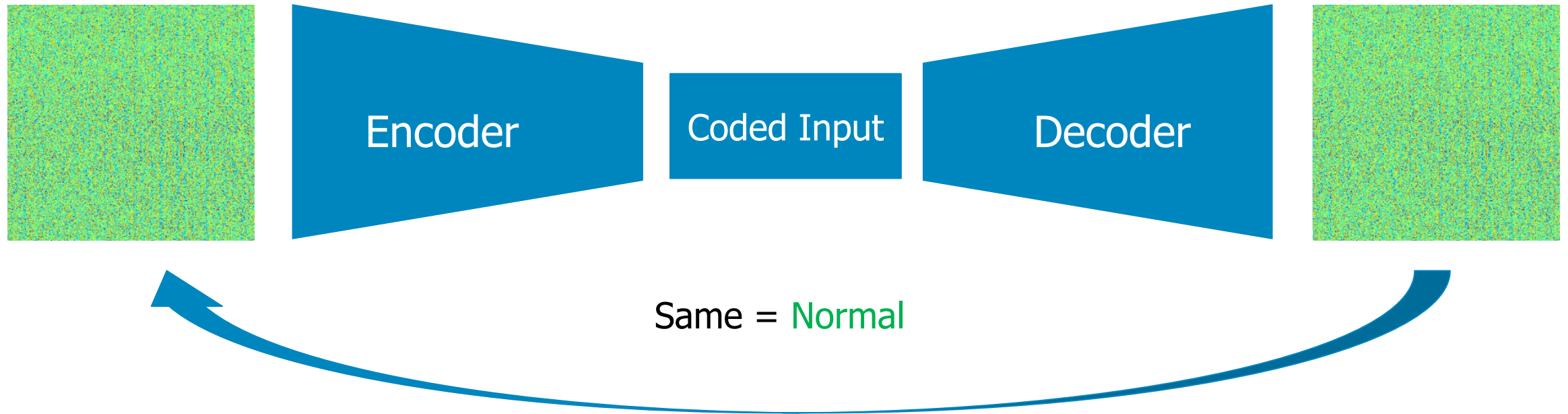
Encoder — Coded Input — Decoder

Are these similar?

MYCRONIC

Anomaly Detection Using Autoencoders

Capturing Abnormal Behavior

Encoder · Coded Input · Decoder

Same = Normal

MYCRONIC

Anomaly Detection Using Autoencoders

Capturing Abnormal Behavior

Encoder

Coded Input

Decoder

Not Same = Abnormal

MYCRONIC

Anomaly Detection Using Autoencoders

Capturing Abnormal Behavior

Encoder → Coded Input → Decoder

MYCRONIC
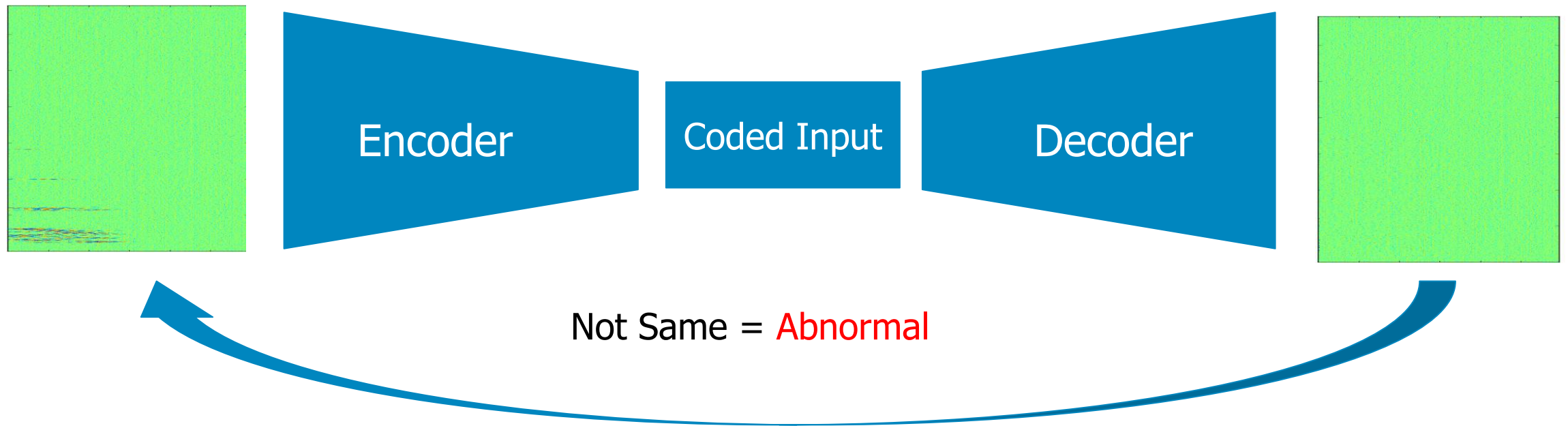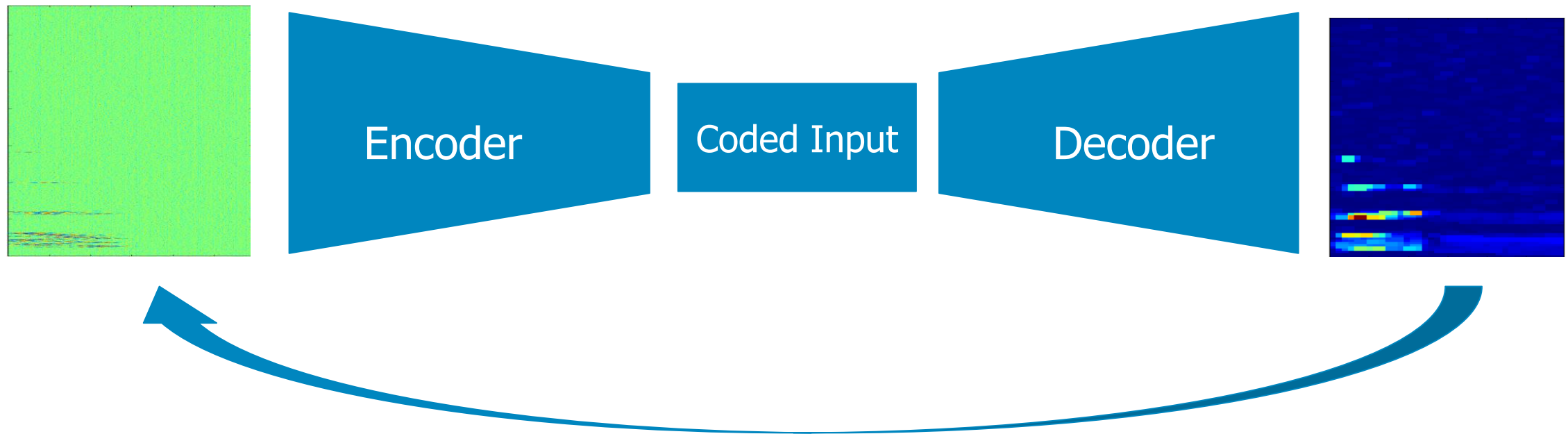
Using the Available Data Efficiently

Deep Learning opens up new possibilities

Step 1: Collect data
- Mask writer log data
- Potentially also mask quality data

Step 2: Analyze data
- Statistical methods
- Deep Learning

Step 3: Turn data into valuable insights
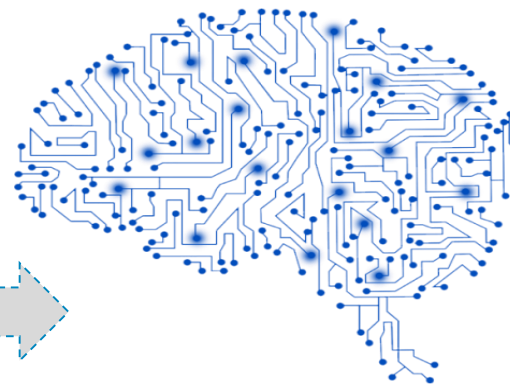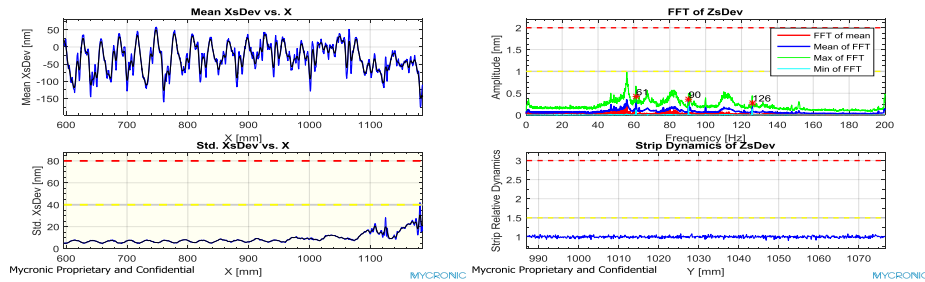
Preventive & Predictive maintenance

Improved Quality control

Generate ideas for improvements

MYCRONIC

Thank You!

MYCRONIC