

Introduction to PACMAN

Paul Shore



Talk Structure

What is PACMAN?

Why might PACMAN be important?

What is PACMAN?

FP7 funded project

Marie Curie Actions project

IDP project



What is PACMAN?

FP7 funded project

The EU-funded 7th Framework Programme (FP7)

has 2 main strategic objectives:

strengthen the scientific and technological base of European industry

and

encourage its international competitiveness,

while promoting research that supports EU policies.

What is PACMAN?

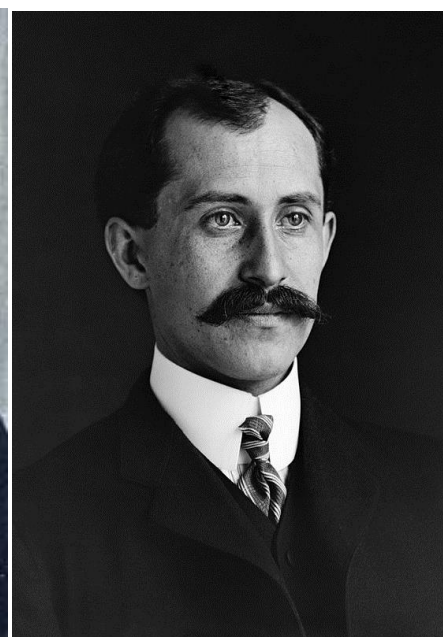
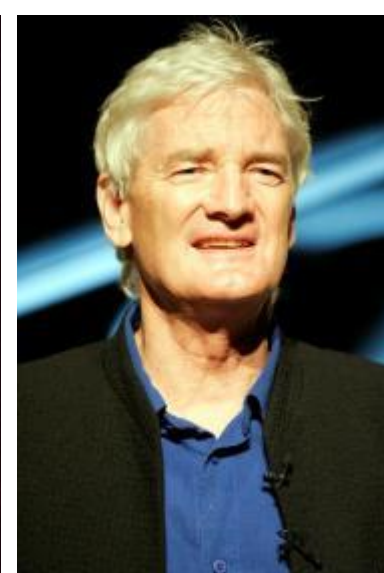
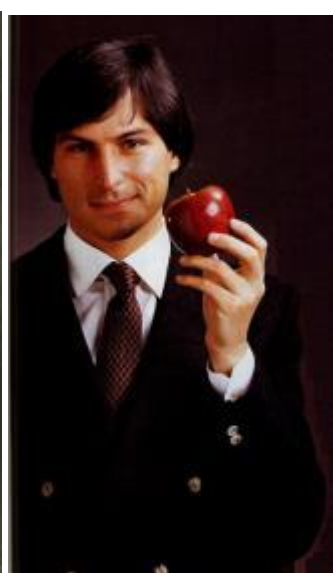
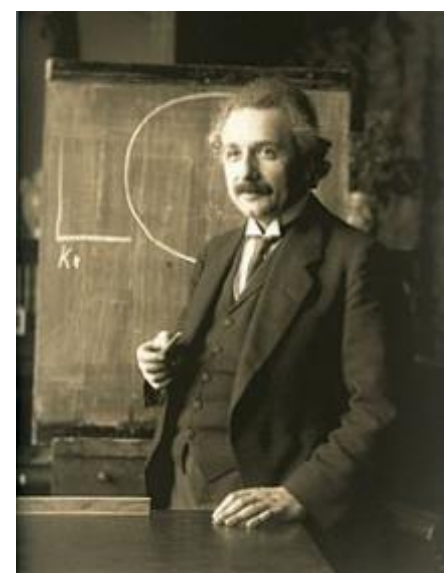
Marie Curie Actions Programme

€4.7 billion over 7 years

entirely dedicated to human
resources (premium funding)

Broad scope across
science and engineering





What is PACMAN?

IDP project



What is PACMAN?

IDP project

International Doctoral Programme whereby early stage researchers (ESR) from across the globe act as a cohesive cohort of researchers addressing relevant subjects concerning EU members and policies.....

Investing in people

Creating new networks

Focussing bright people in front of EU relevant topics

.....

..... **advancing the State-of-the-Art**

Why might PACMAN be important?

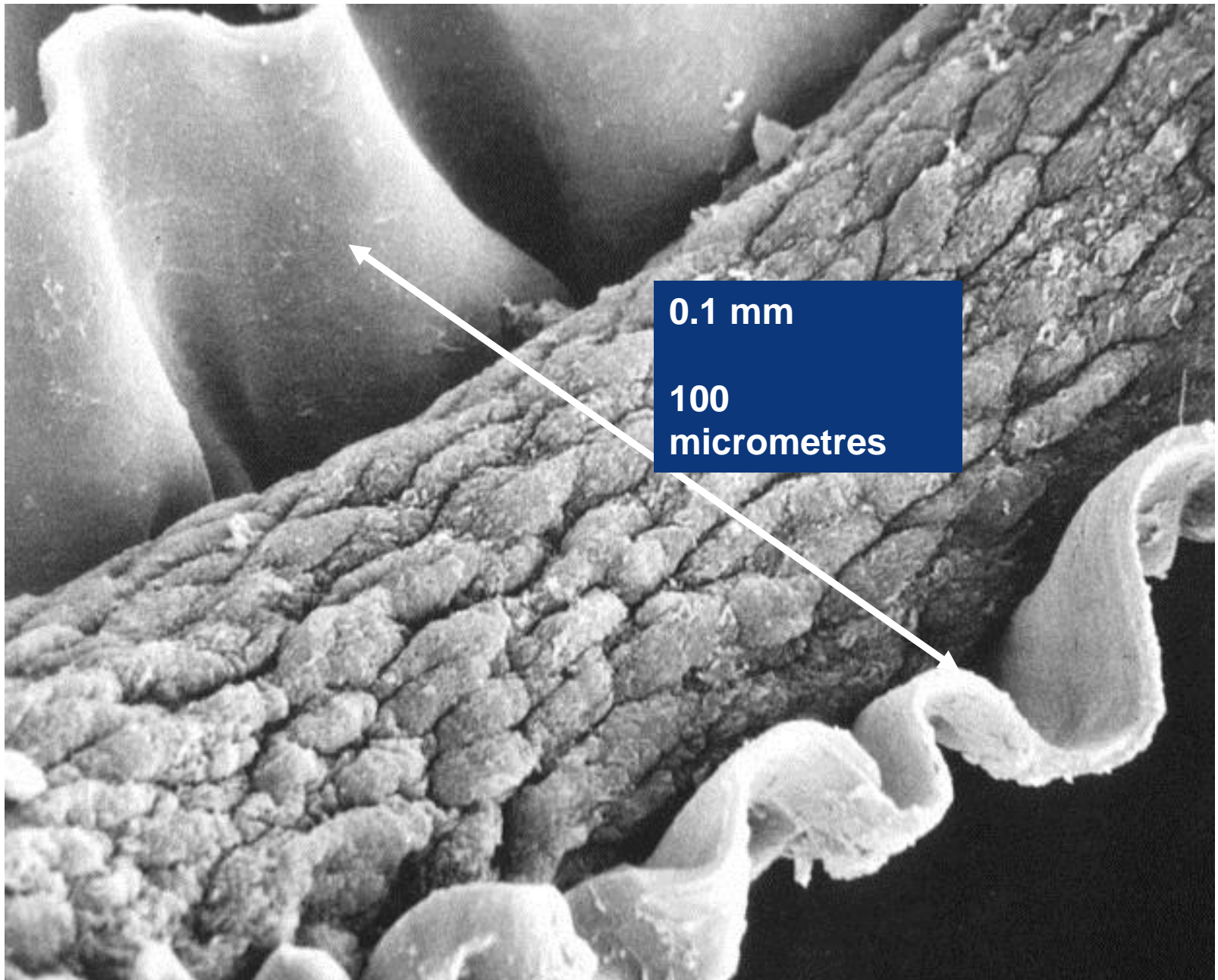
PACMAN, a study on

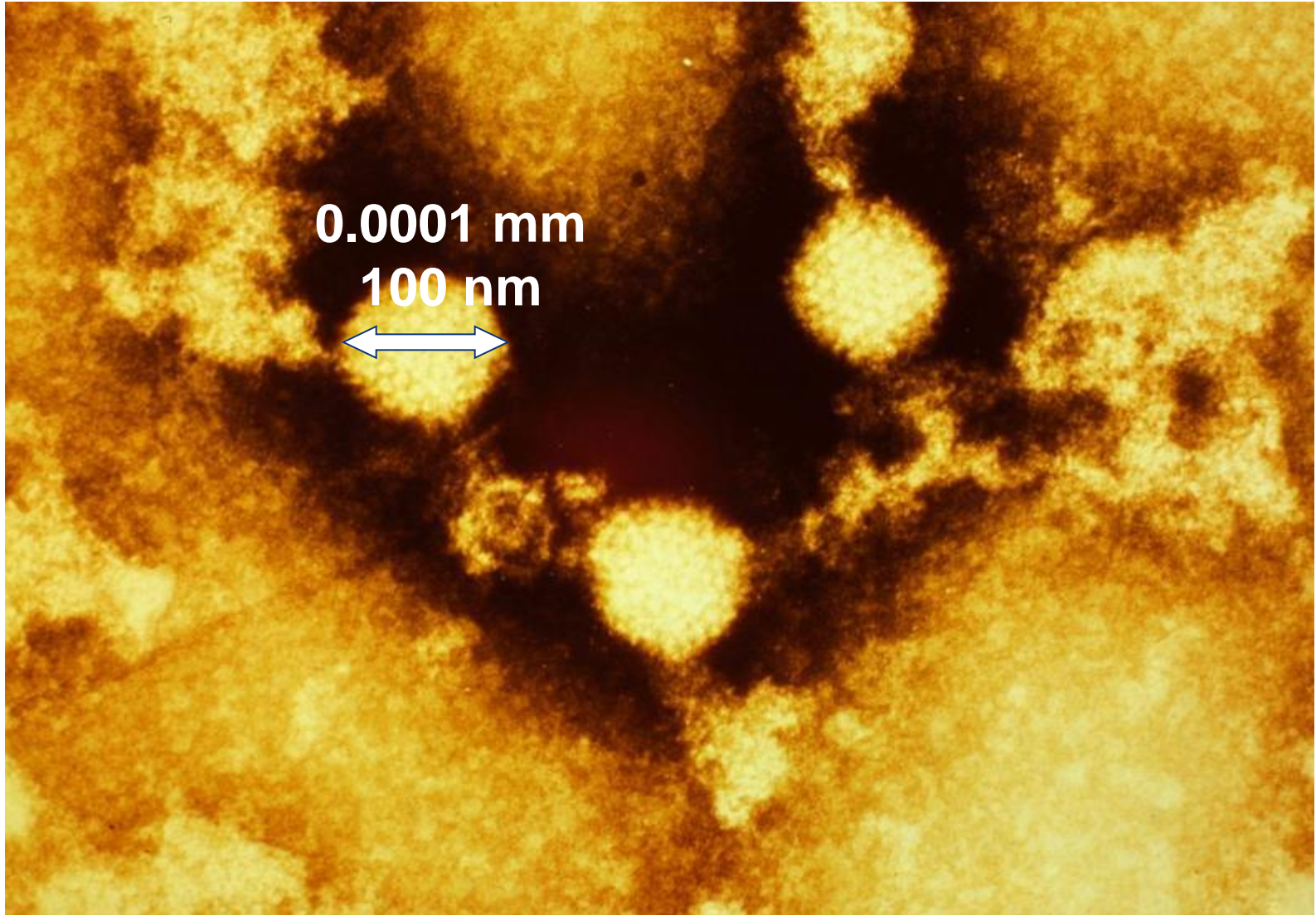
Particle Accelerator Components' Metrology and Alignment at the Nanometre scale

Why might PACMAN be important?

PACMAN, a study on

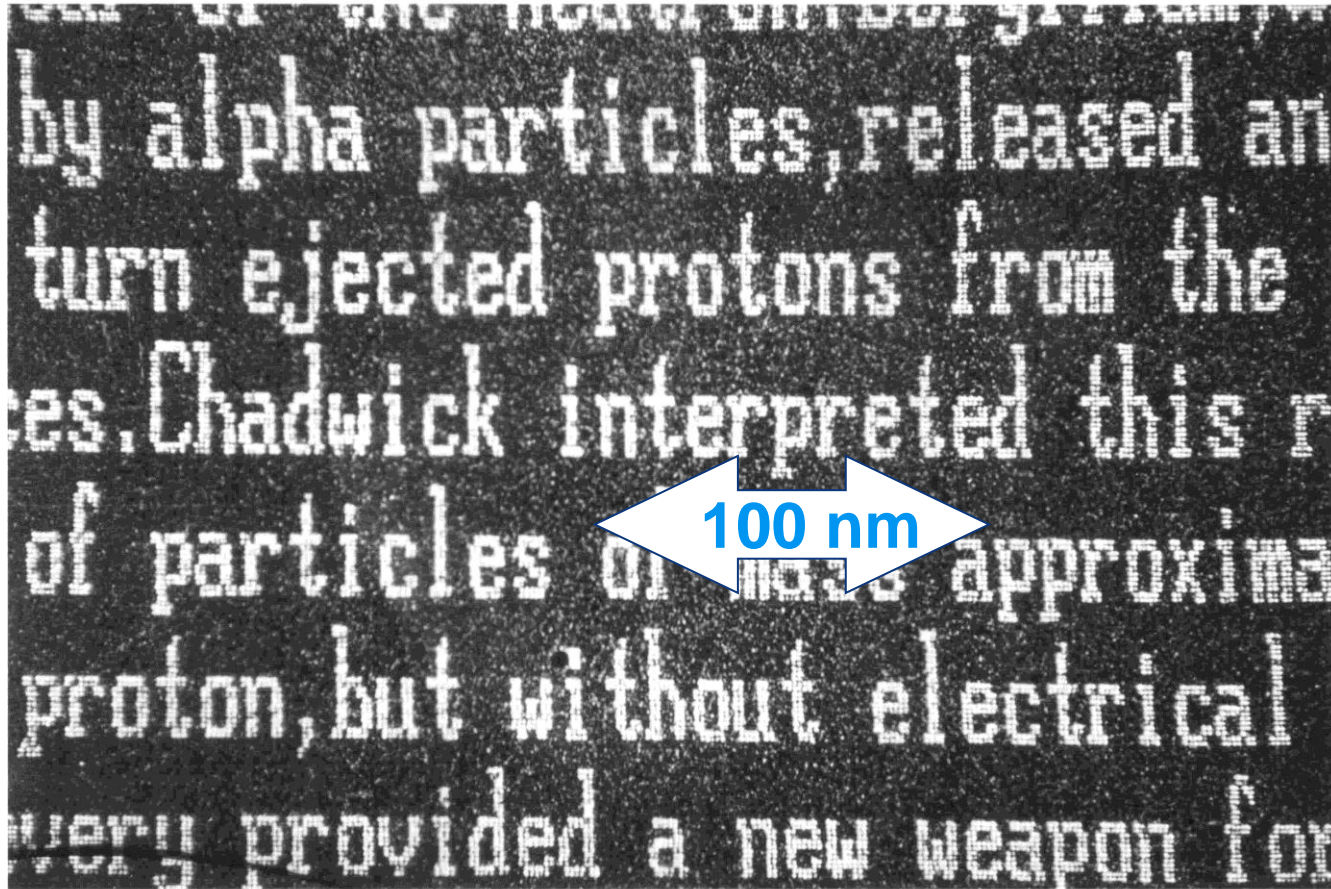
Particle Accelerator Components'
Metrology and Alignment at the **Nanometre
scale**





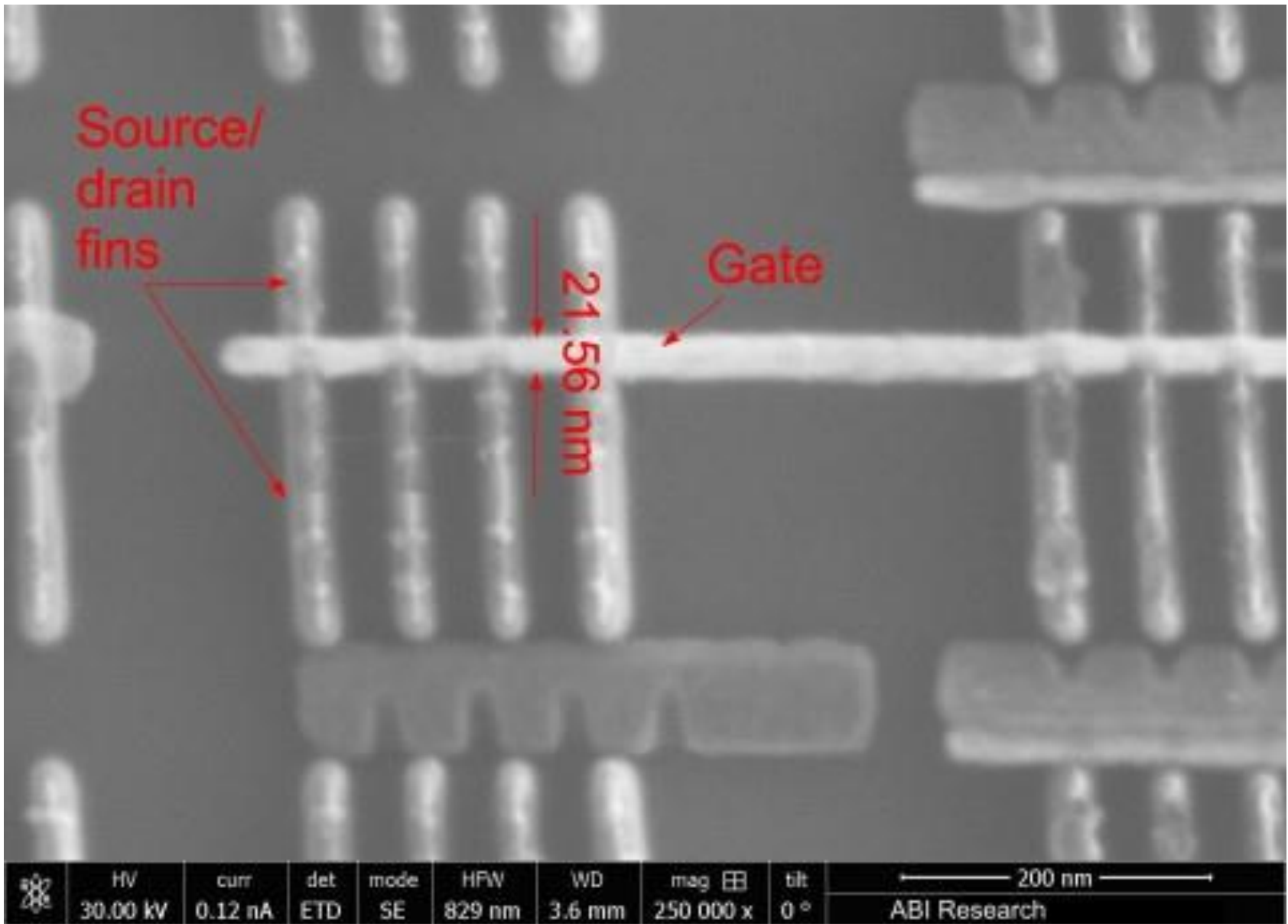
Electron beam writing

Encyclopaedia Britannica on the head of a pin



Each letter is made of holes approximately 4nm diameter

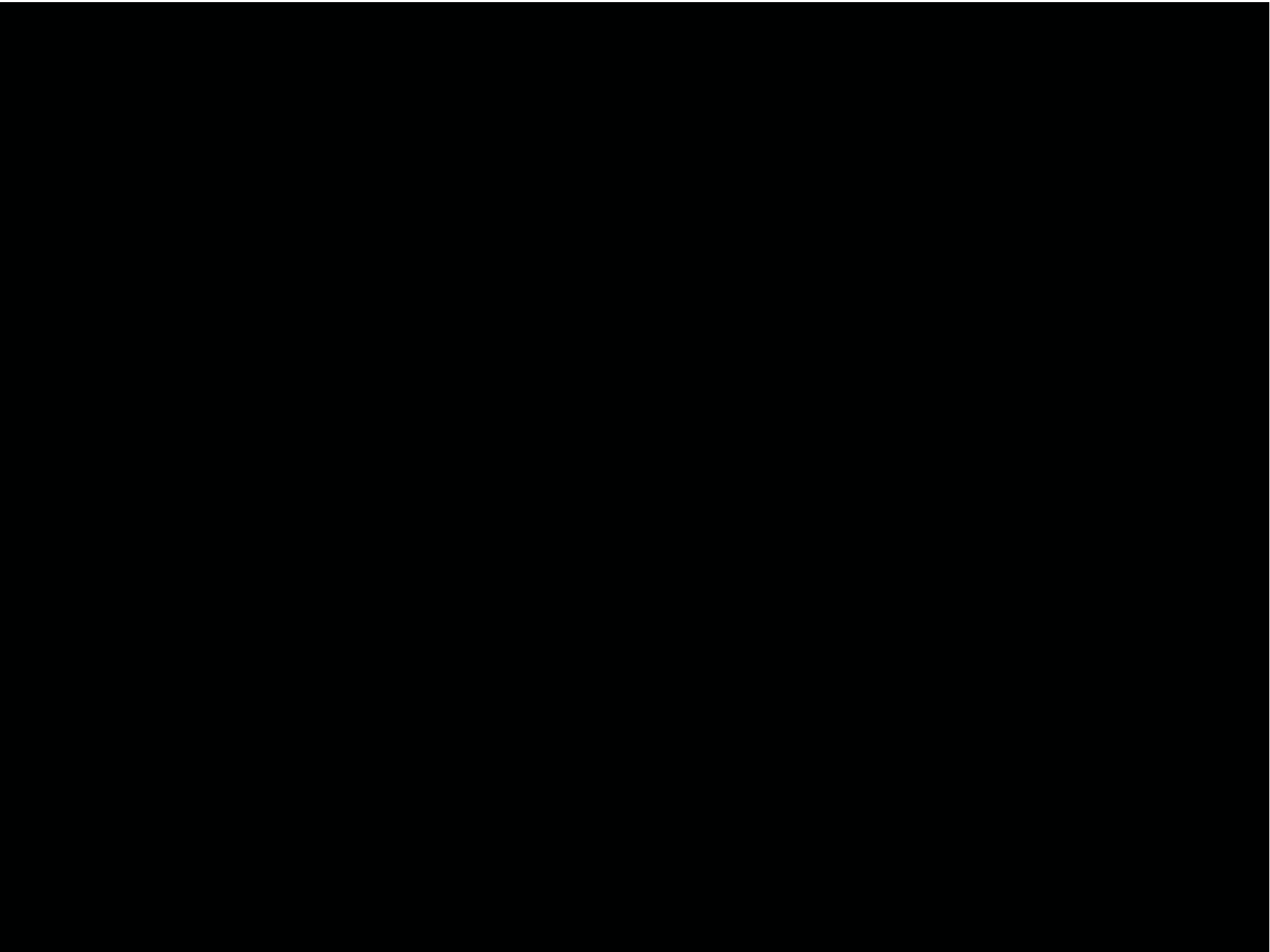
C. Humpheys, 1992, Cambridge University



Why might PACMAN be important?

PACMAN, a study on

Particle Accelerator Components'
Metrology and Alignment at the Nanometre
scale



Why might PACMAN be important?



Chandra X Ray Space Telescope

Specially developed metrology instruments

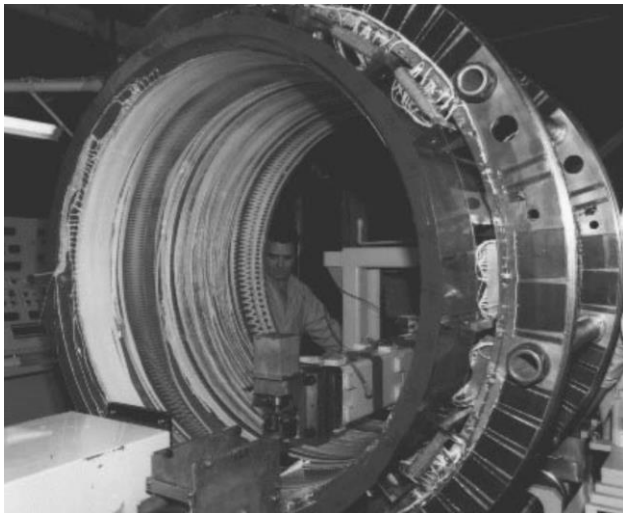
Precision Metrology Station (axial profiles)

Circularity & Inner Diameter Station

Micro phase interferometer (roughness)

Mirror form error: 5 nm RMS (~1m diameter)

Roughness: 0.18 – 0.34nm RMS

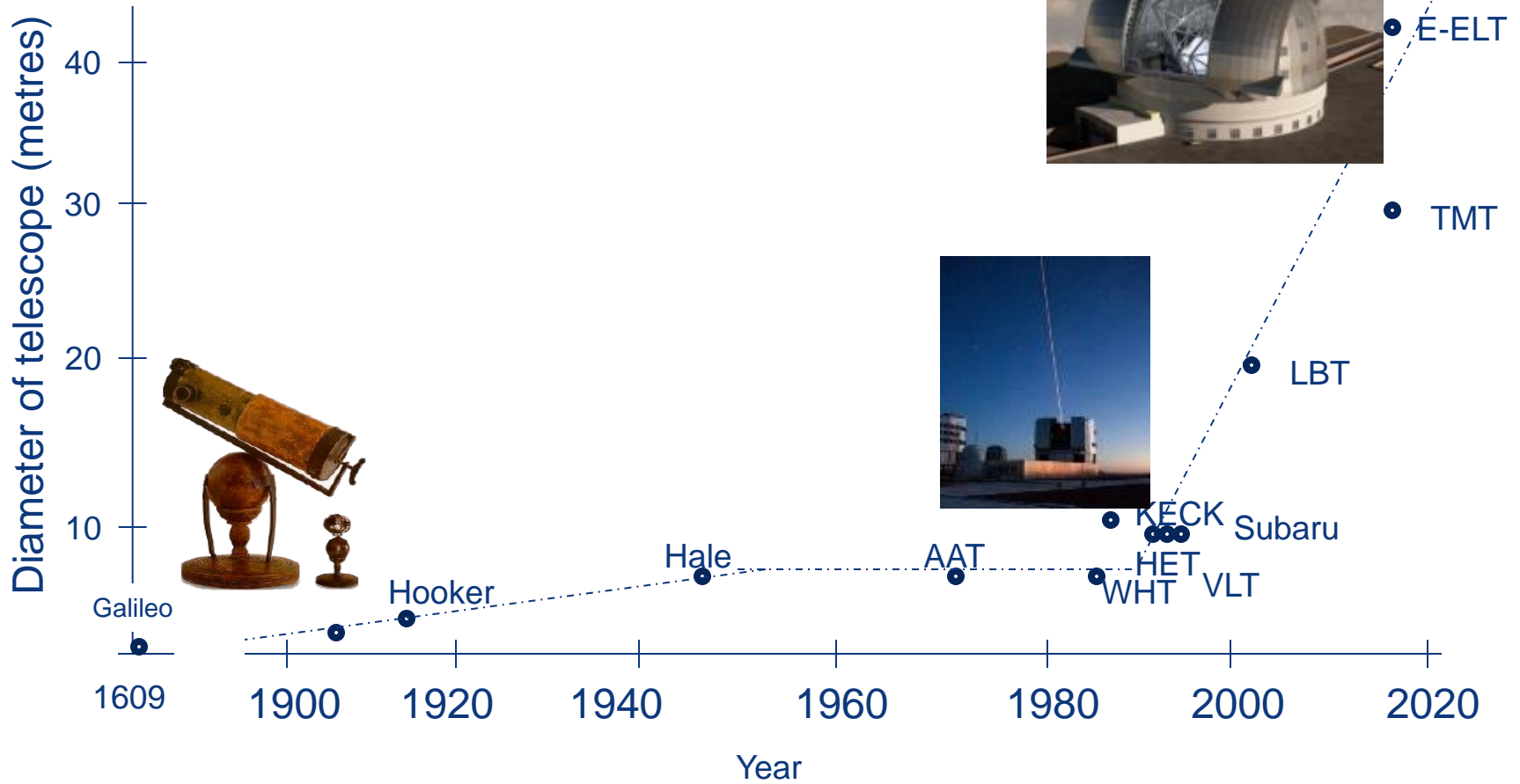


Why might PACMAN be important?

PACMAN, a study on

Large Science Components' Metrology and Alignment at the Nanometre scale

Size “scale up” trend of ground based telescopes



Next generation ground-based telescope - size



Why might PACMAN be important?

FP7 funded project

The EU-funded 7th Framework Programme (FP7)

has 2 main strategic objectives:

strengthen the scientific and technological base of **European industry**

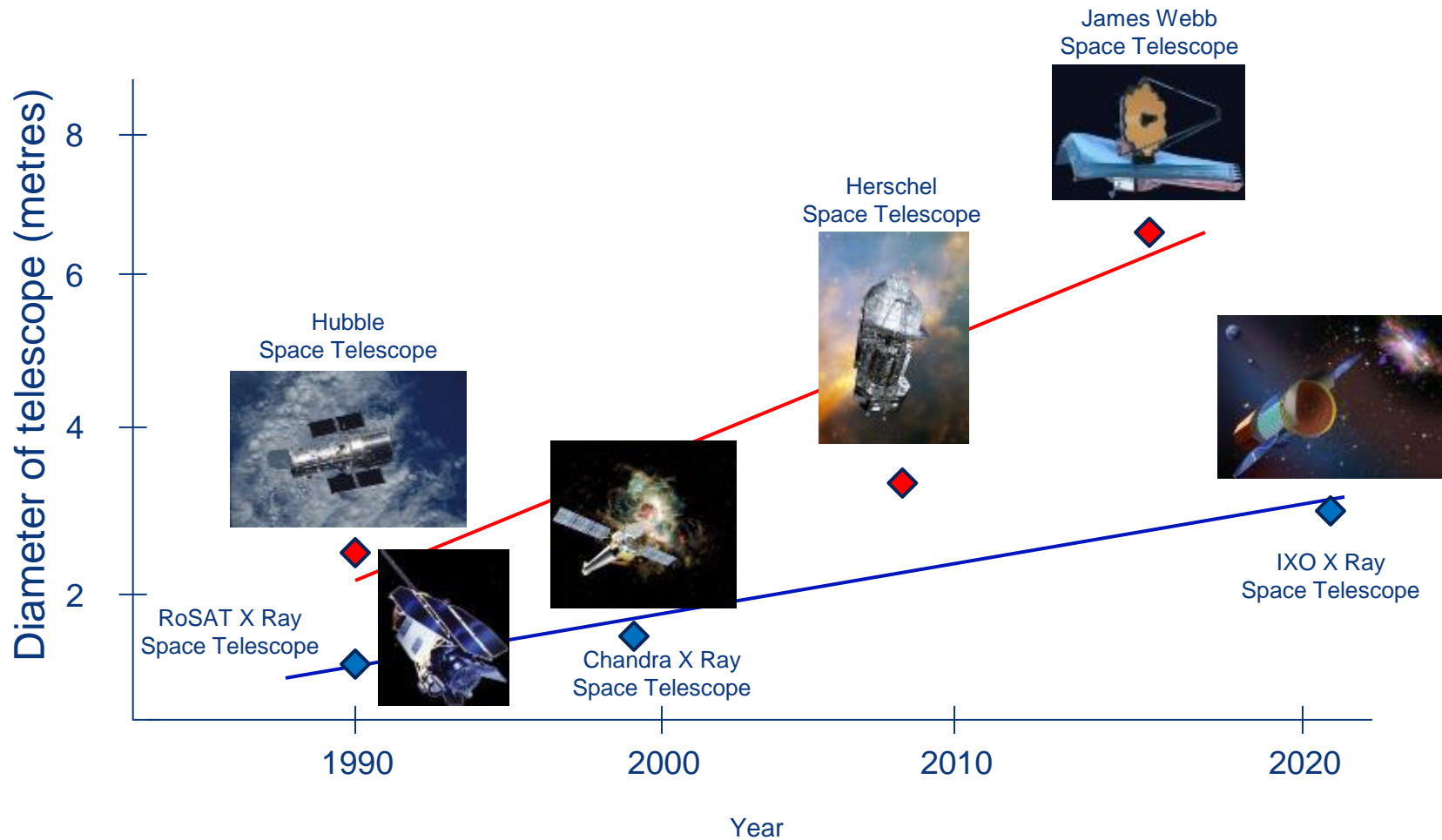
and

encourage its international competitiveness,

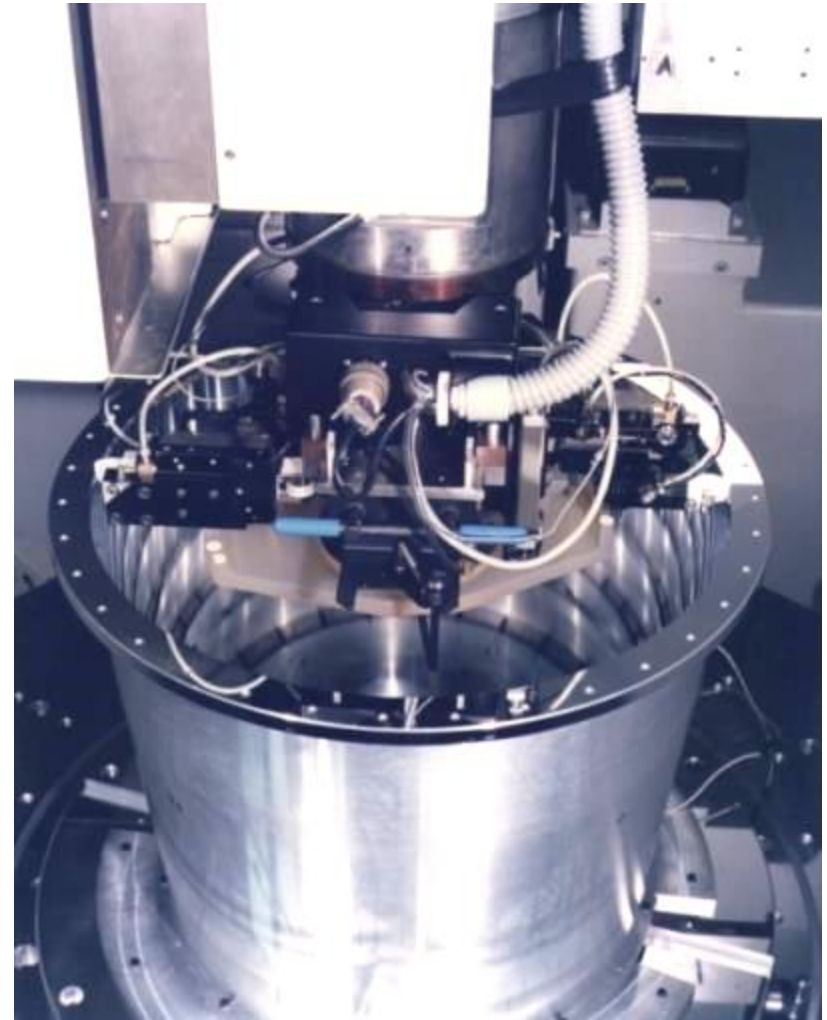
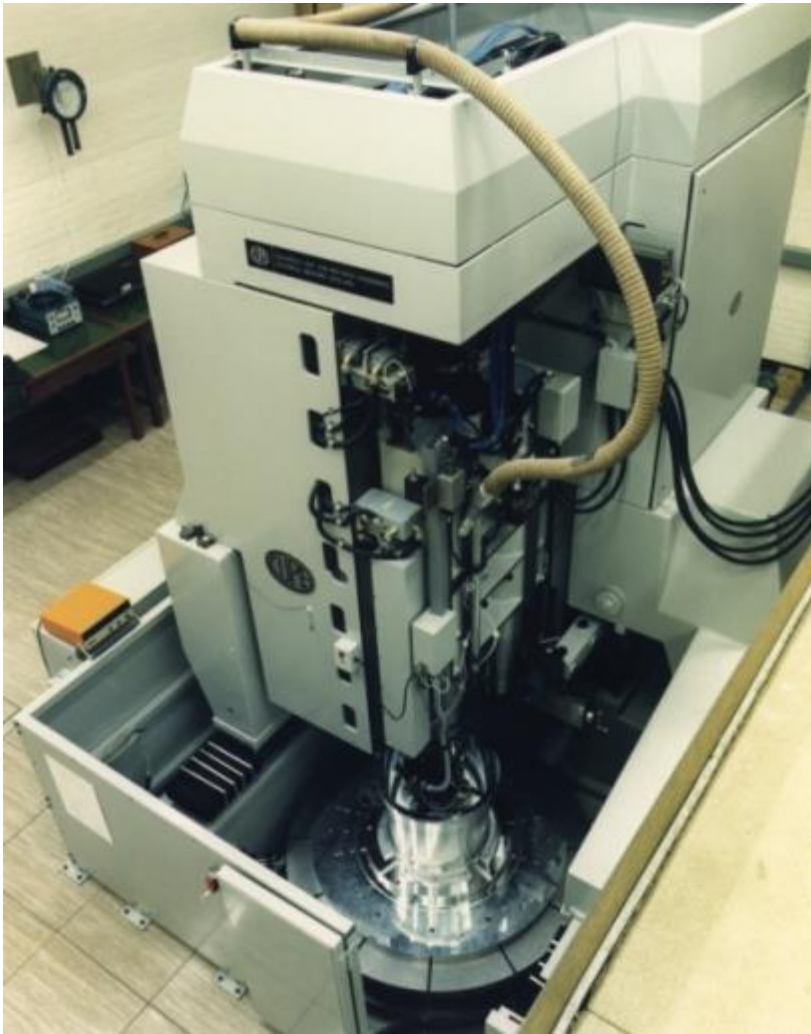
while promoting research that supports EU policies.

Why might PACMAN be important?

Size “scale up” of space telescopes



Why might PACMAN be important?

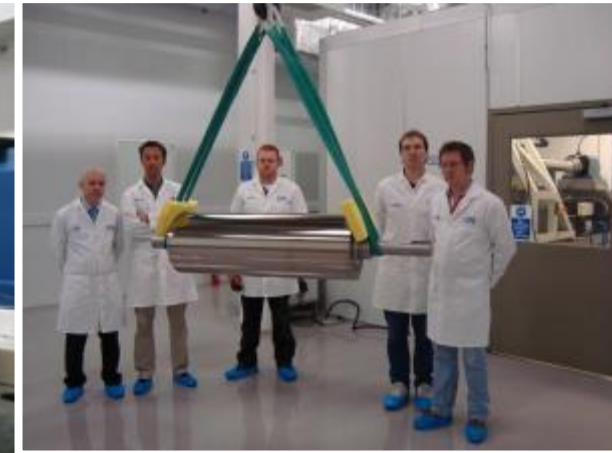
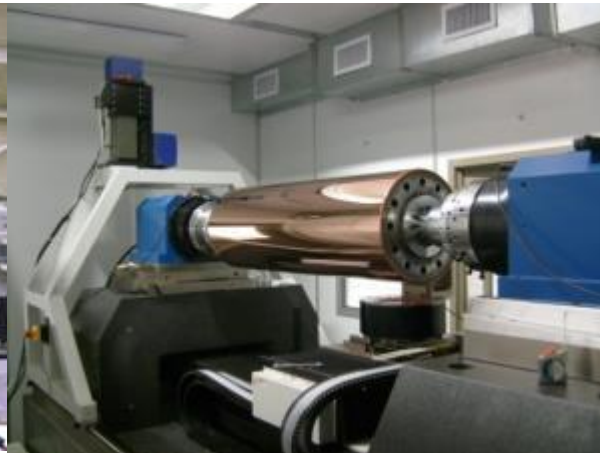


Cranfield Large Diamond Turning Machine (1979)

Why might PACMAN be important?

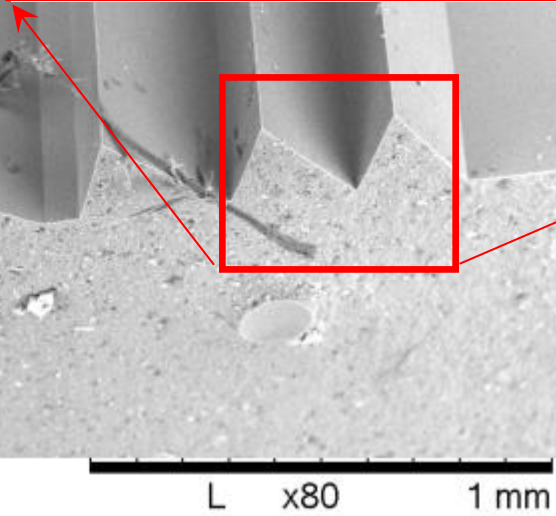
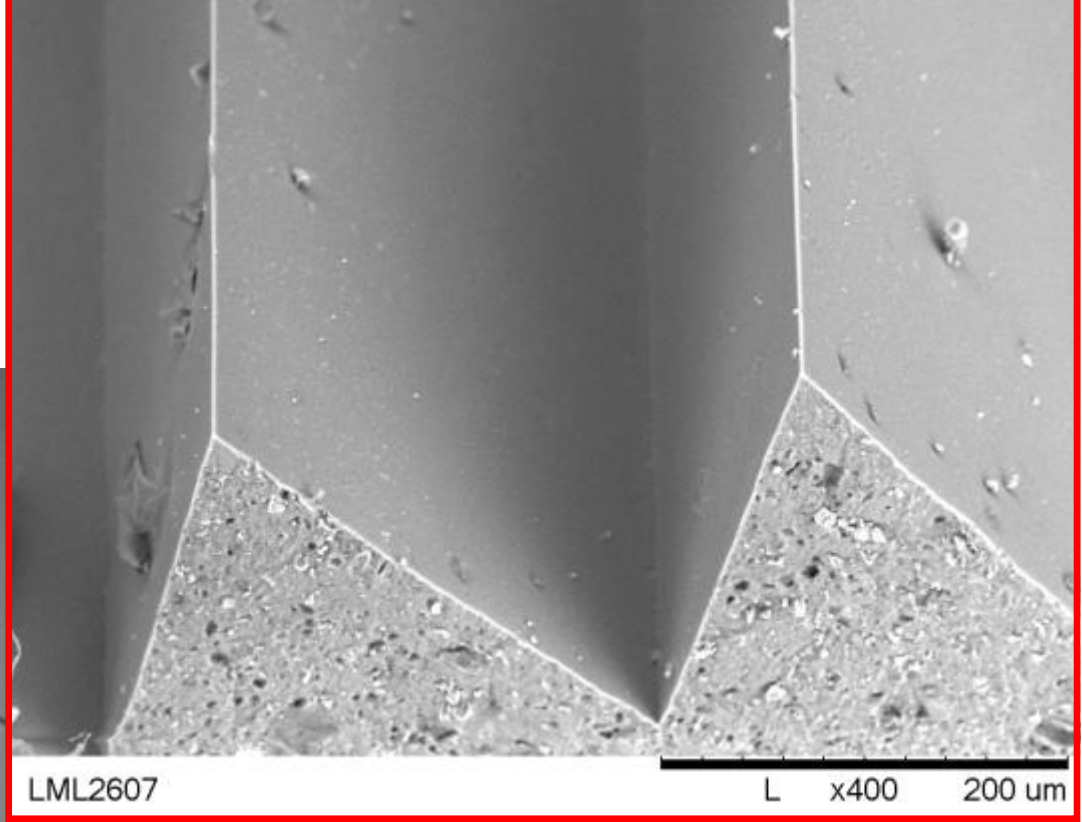
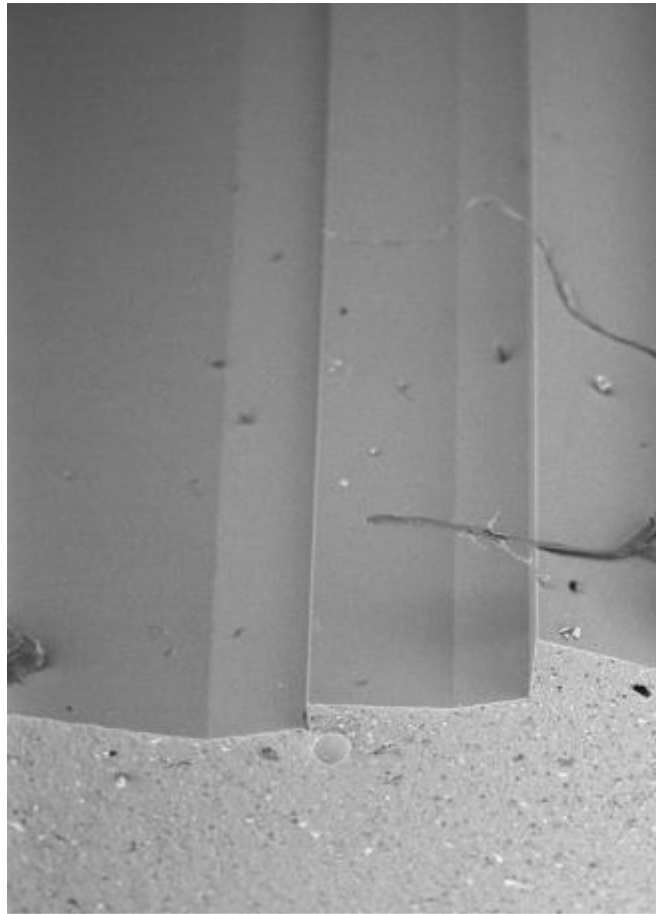
Ultra precision machines developed for astronomy programmes are applied in the fabrication of

solar concentrators
advanced displays
plastic electronics
animated packaging

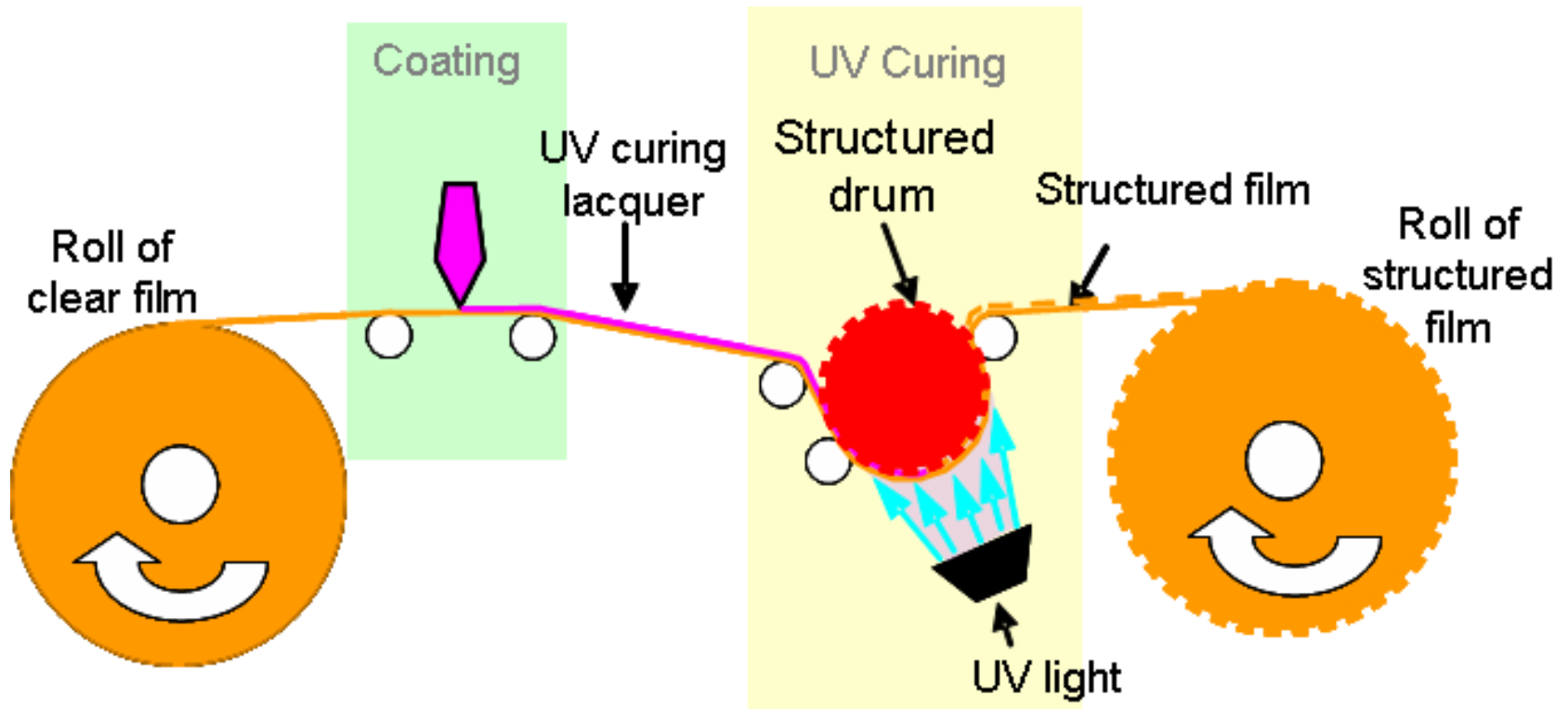


Micro-textured cylindrical mould





Replicating film from a structured drum



Micro-textured “Scotchlite” material by 3M



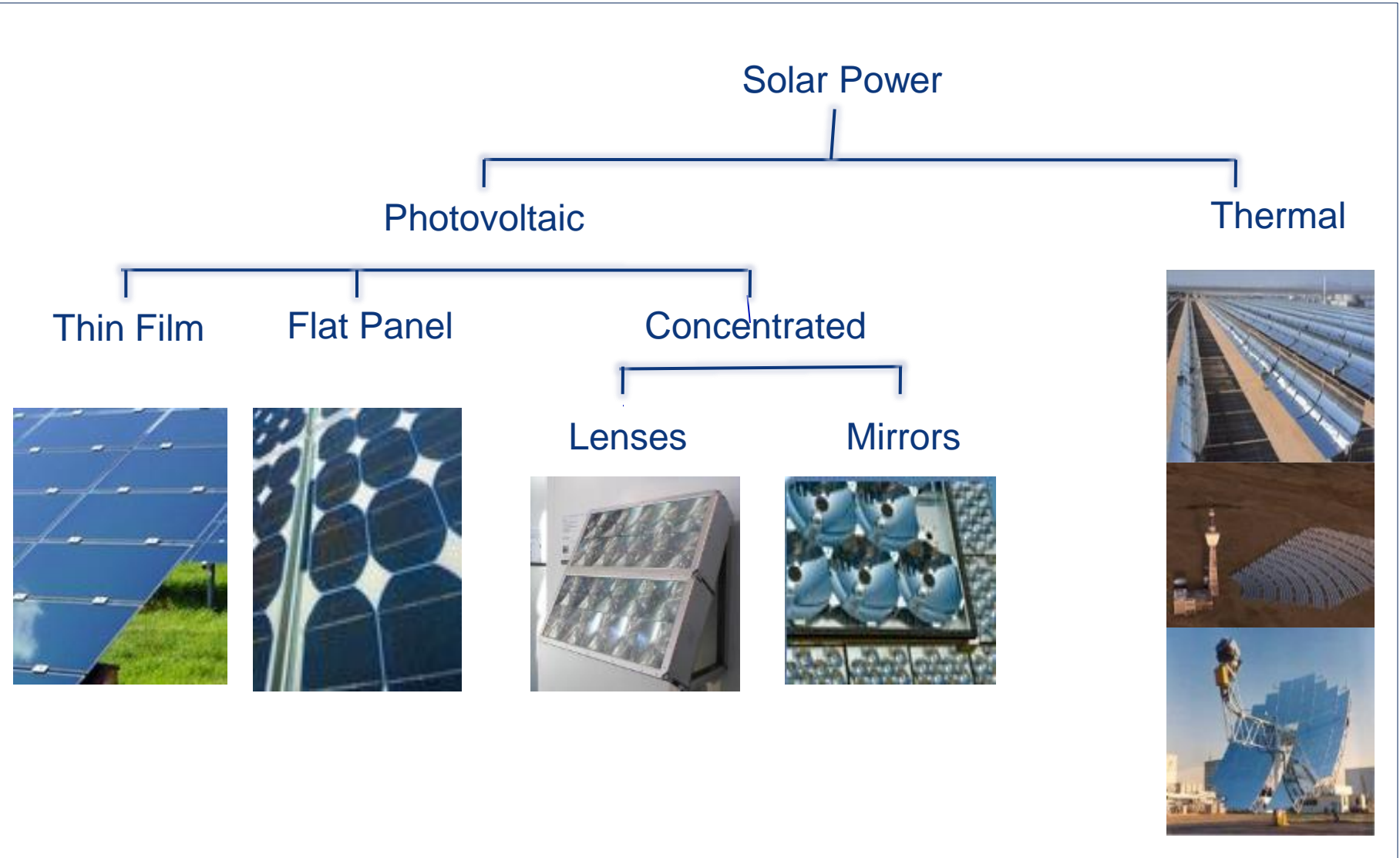
Ref: www.3M.scotchlite

Plastic film based products

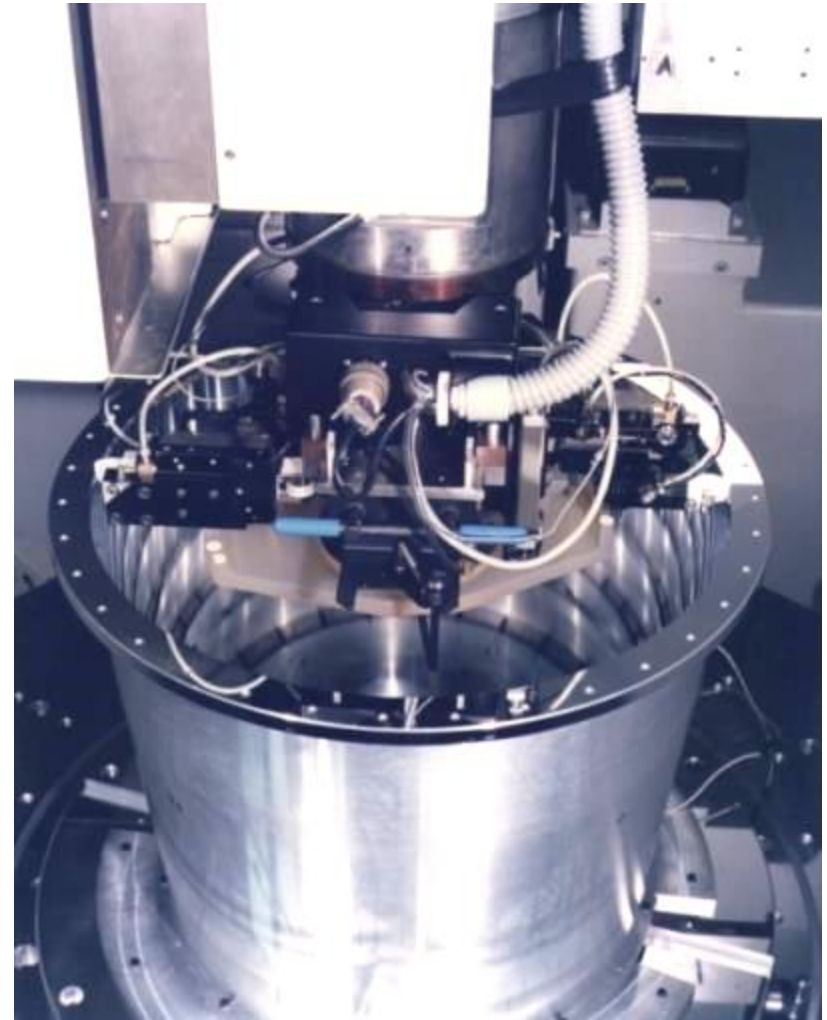
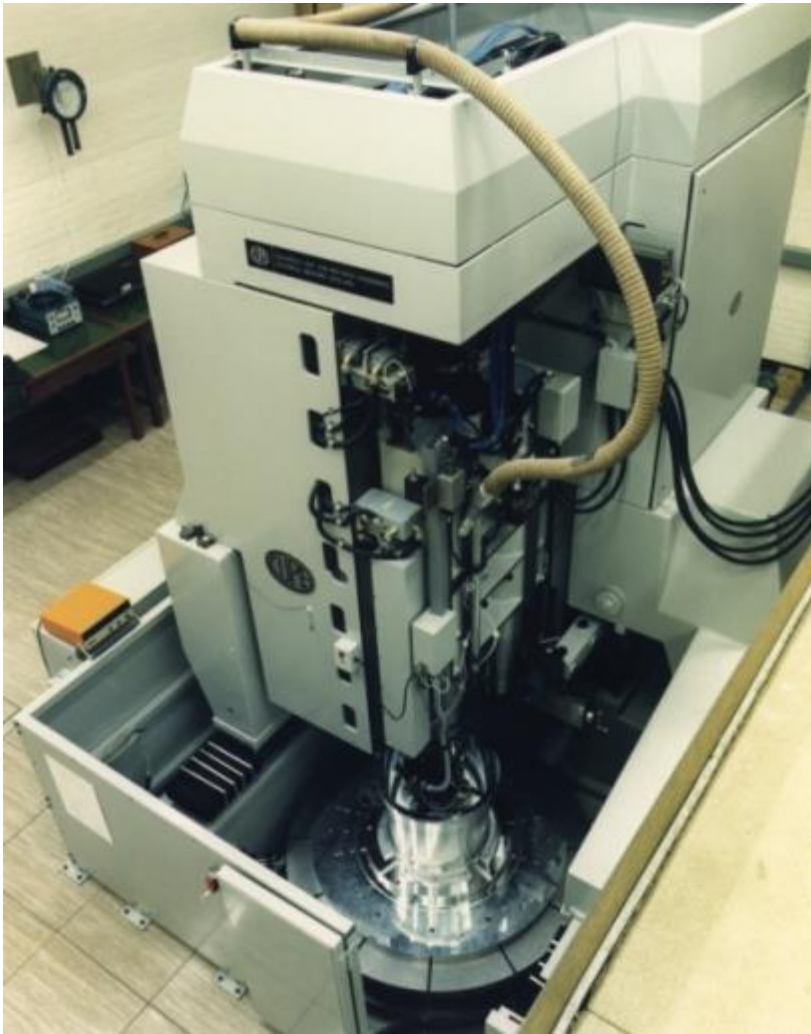


Toppan and Plastic Logic unveiled a 42-inch flexible E-ink display in March 2013

Solar Power technologies



Why might PACMAN be important?



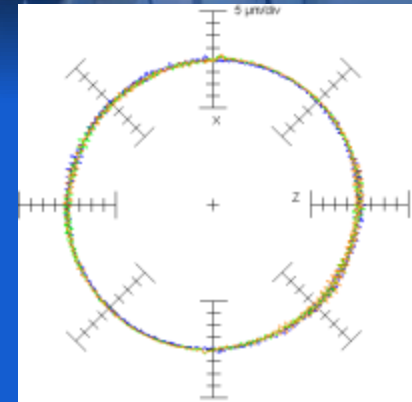
Cranfield Large Diamond Turning Machine (1979)

KMT Lidköping Vertical Precision Machine

- Machine designed for bearing rings.
- In situ metrology.
- Linear motors – ultra precision.
- Short cycle time.
- Hydrostatic slides and workhead.

Machine weight 145 000 kg
Working range, OD 1 300 – 4 000 mm
Max workpiece weight 10 000 kg

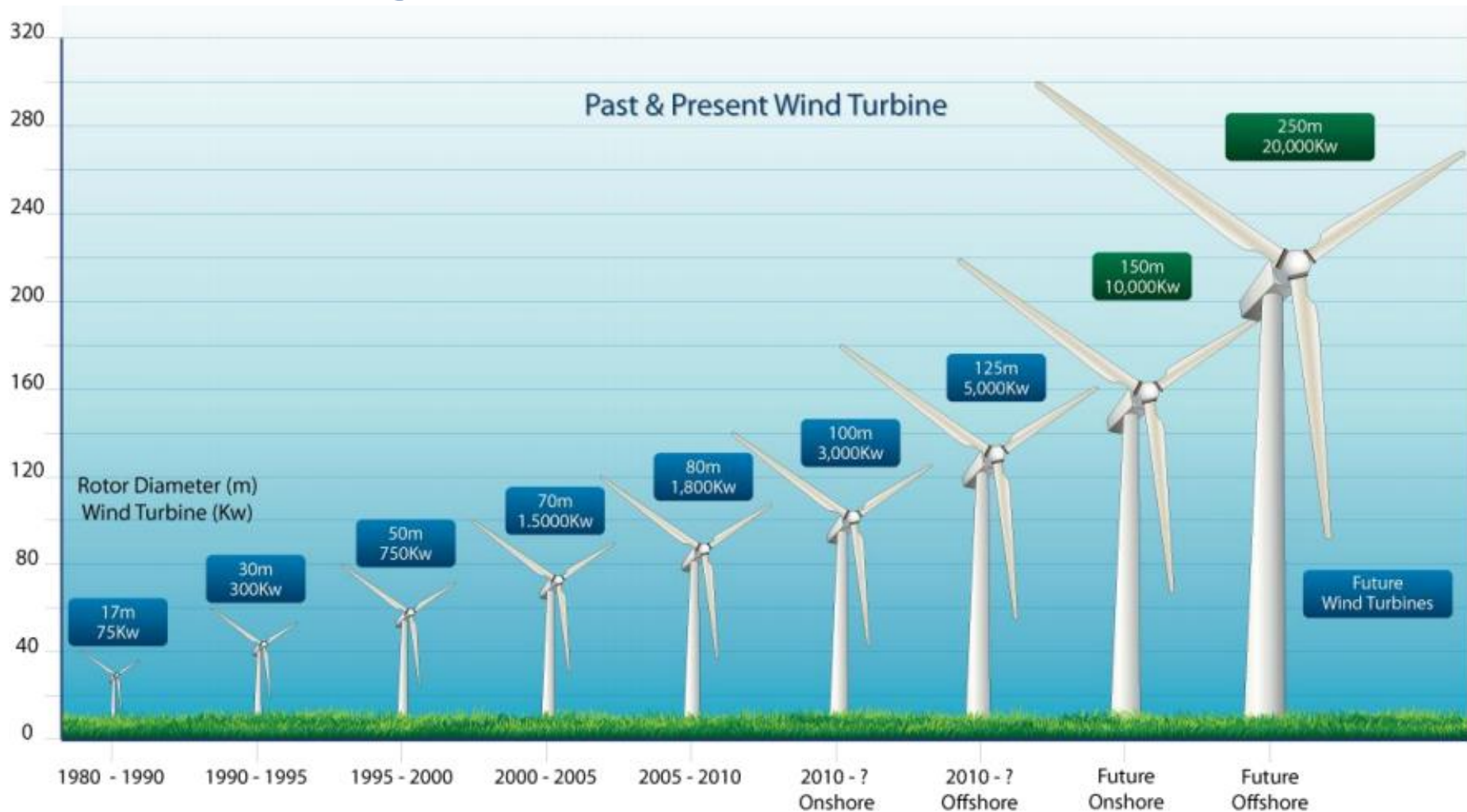
X-Z slide
circular
accuracy
diagram



Wind turbine bearing fabrication



Growth in size of typical commercial wind turbines (height in metres)



IPCC (2011), "Special report on renewable energy"

Possible Fusion Energy Fuel



1mm radius sized pellet

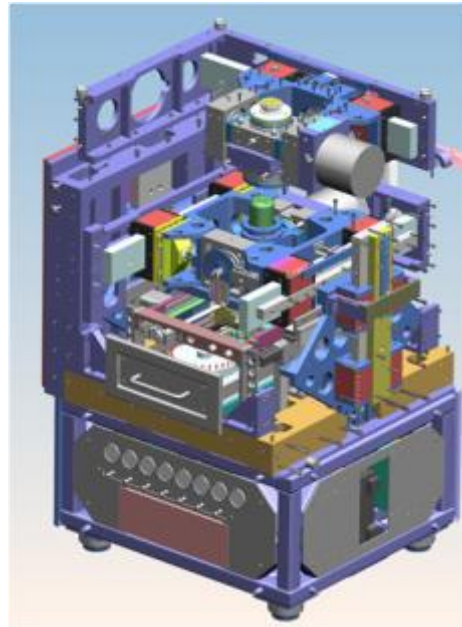
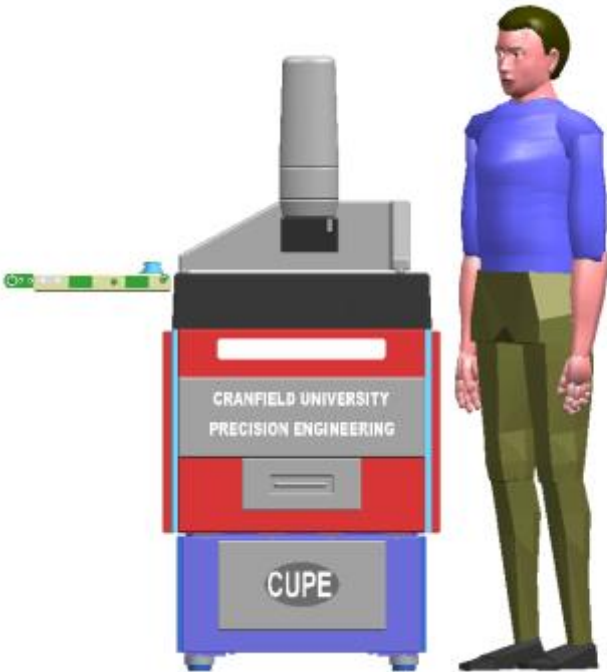
0.1mm thick shells

1 um shell thickness control

25 nm hemispherical accuracy

25nm RMS roughness

Rapid “Fusion target” fabrication system



Automating Ultra Precision

LOXHÅM
PRECISION

Compact 6 axes Ultra Precision Diamond Machining System

The μ -4

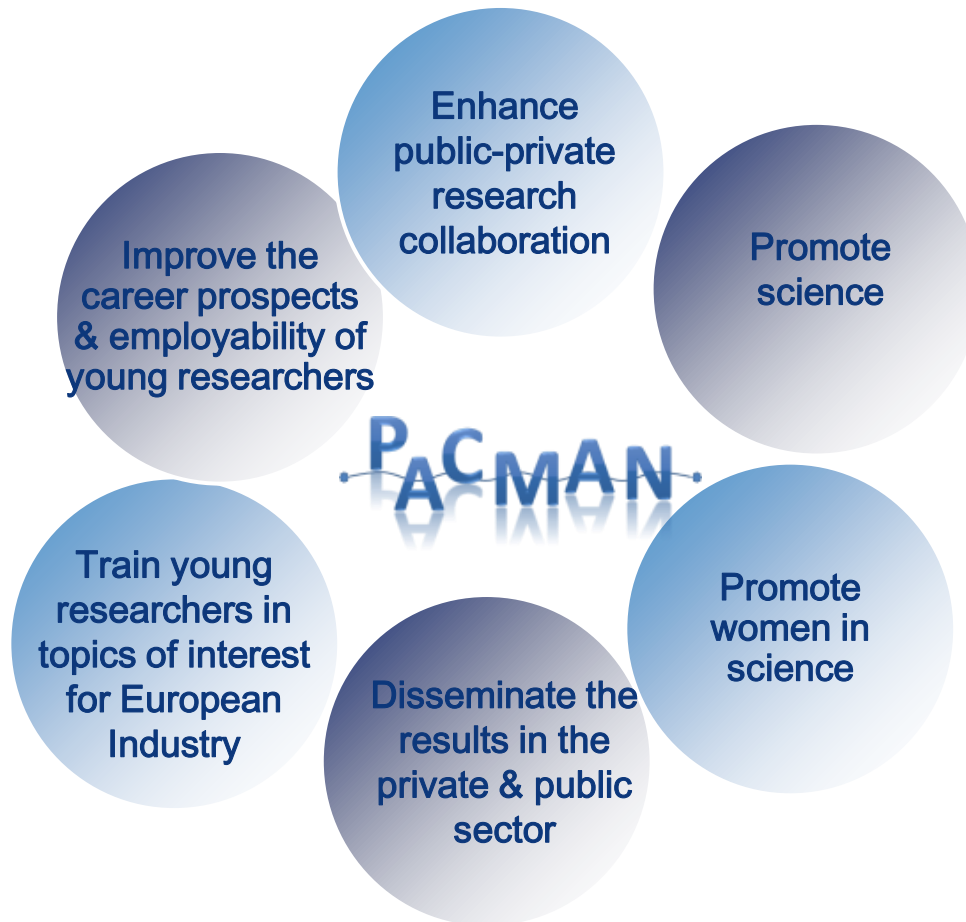
- Extremely compact 6-axes machine
- Highly dynamic control
- Single phase energy
- Integrated tool changer
- Integrated part loading
- Integrated tool and part metrology
- Integrated controller and drives
- Integrated control of thermal stability

- Multi-process capable within one cycle
 - Diamond turning
 - Micro-milling, turn-milling, drilling etc.



info@loxhamprecision.com

www.loxhamprecision.com



Research collaboration between public & private sectors mandatory for the development of accelerators

Knowledge and Transfer (KT) in both directions
Strengthening the network via workshops & common subjects

Research career not attractive

Students with a unique portfolio of technical & transferable skills
Multi-disciplinary training
Substantial network of colleagues & partners

Improve the career prospects & employability of young researchers

Enhance public-private research collaboration

Promote science

Nb of students enrolled in science insufficient

Effective program of outreach activities targeting different layers of society

PACMAN

Train young researchers in topics of interest for European Industry

Disseminate the results in the private & public sector

Promote women in science

Nb of women in science even more insufficient

Targeted outreach activities by female students to communicate their enthusiasm in science to young girls

Research subjects sometimes far away from Industry issues

All disciplines studied in PACMAN are easily transposable in industry

Final achievement of PACMAN objectives determinant for the next colliders

Open access to the results
Dissemination through papers, journals, workshops
New KT portfolio available





Thank you very much for your
attention!