



STAT PEEL

*Sensing Solution For Airborne Carbon Nanotube Exposure In
Workplaces Based On Surface-Enhanced Raman
Spectroscopy*

Nanosafe 2016 Grenoble

Rudolf Bieri

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Size matters, but
matter matters too!

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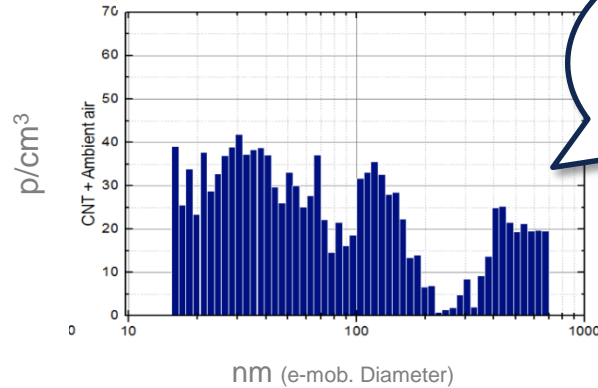


CNT cannot be detected reliably with aerosol detection tools

Today's detection tools cannot distinguish between harmful CNTs and harmless background particles

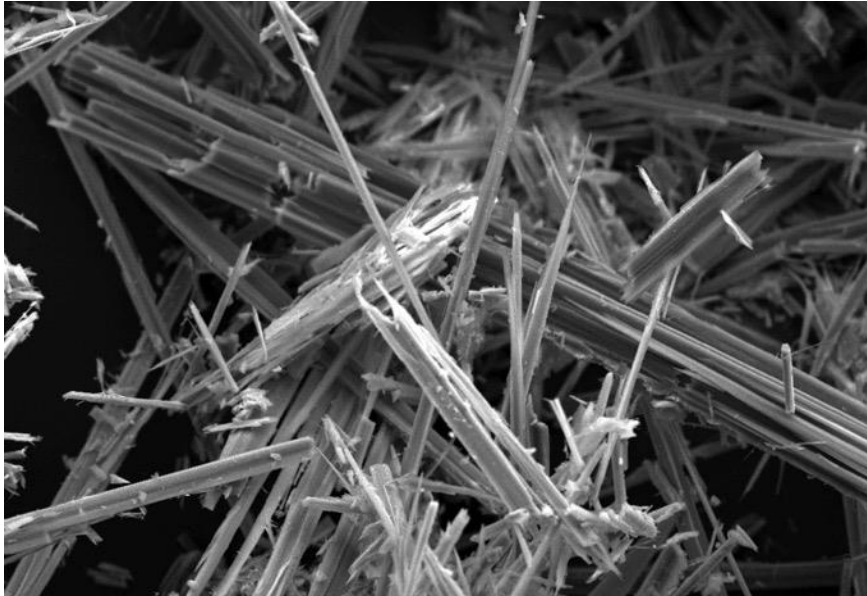


Ambient air & CNT



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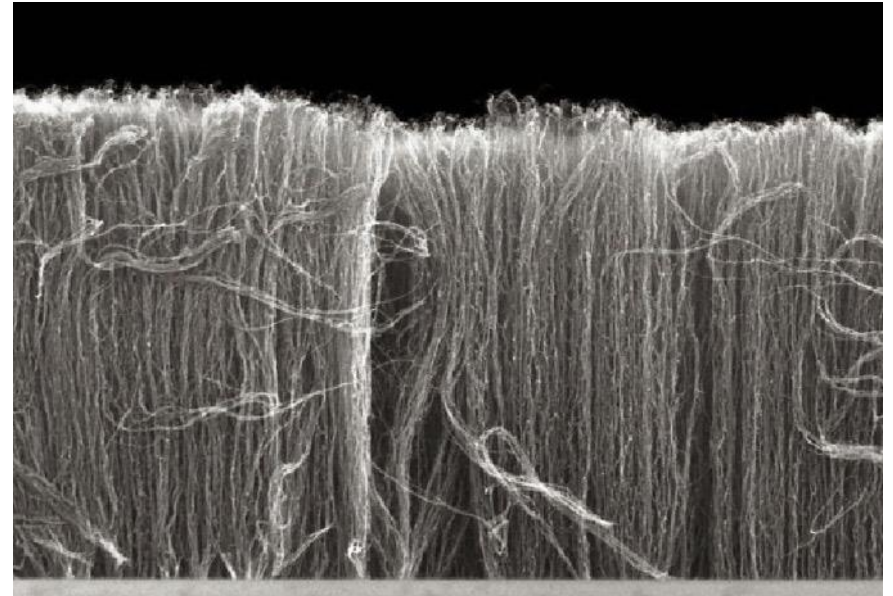
Old and new wonder-materials



Asbestos



Wikipedia

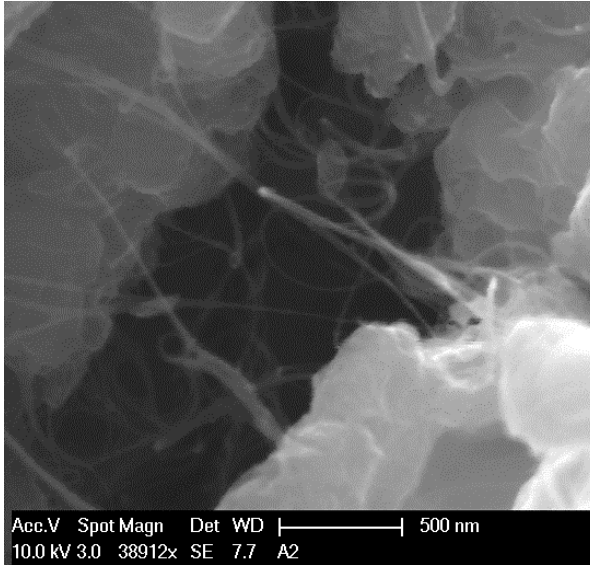


Carbon Nanotubes

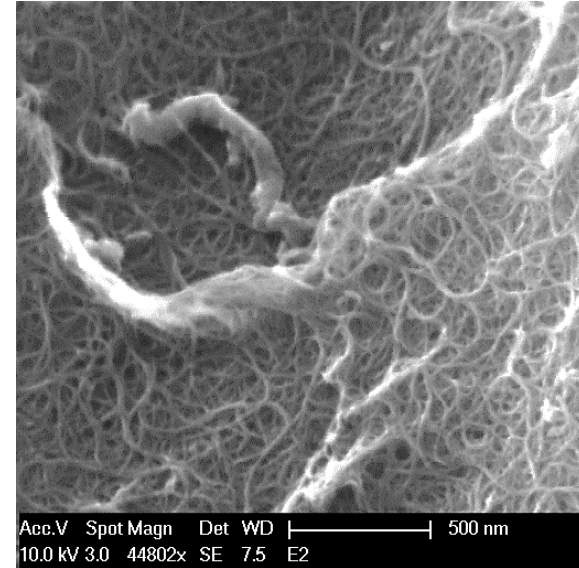


Fraunhofer IKTS

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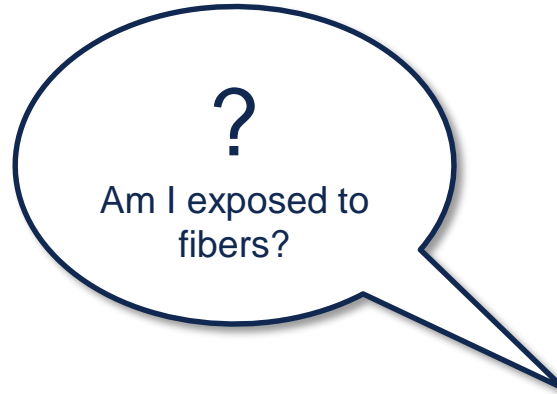
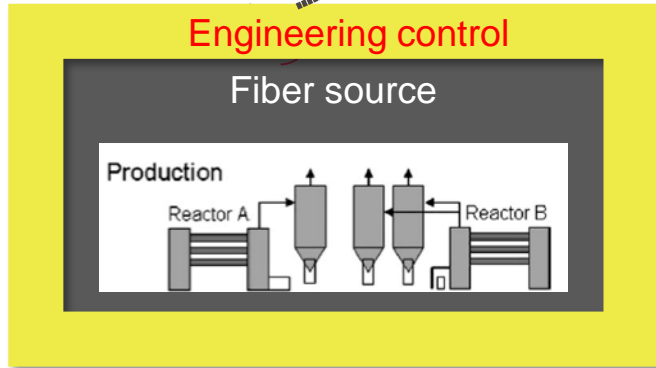
Multi-wall CNT



Single-wall CNT



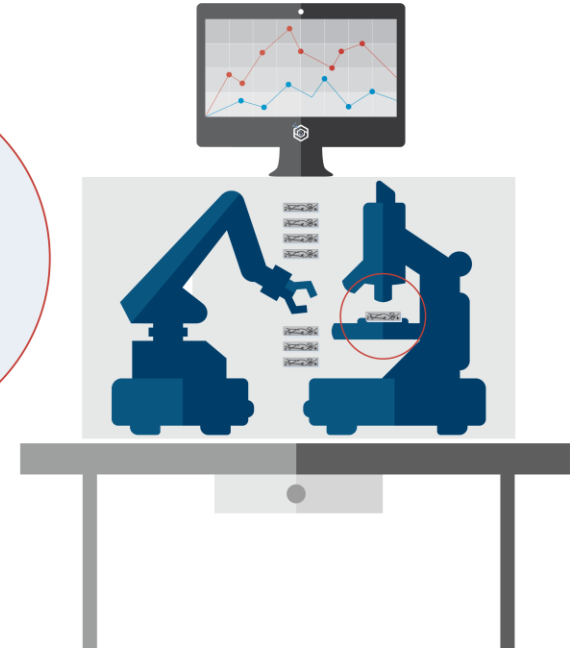
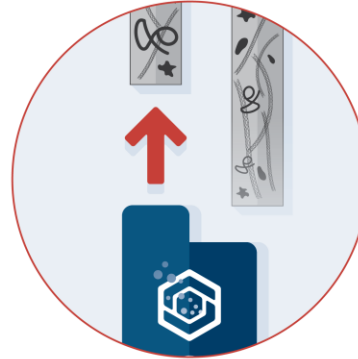
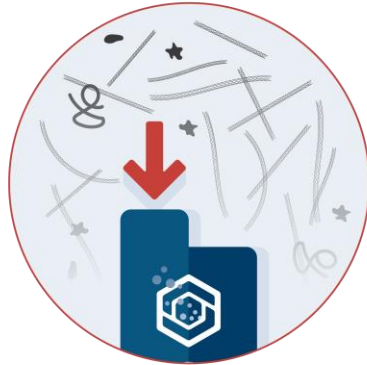
During handling CNTs can fly all over the place. Engineering controls are a must, but...





Our solution: dosimeter collection badge & bench-top reader

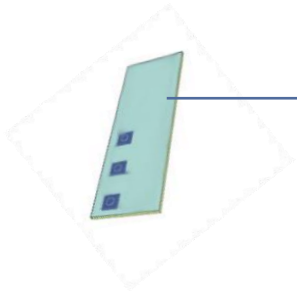
Material selective detection technology for individual, long-term exposure monitoring



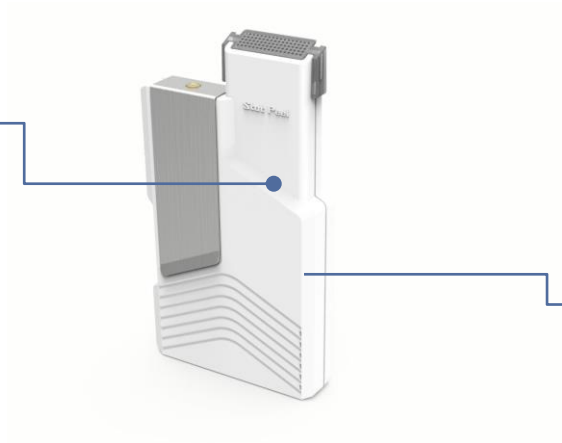


Dosimeter detection system “Identifier”

Integrated system with automatic filtration slide reader, slide exchange, badge charging & data processing



Filtration slide as consumable

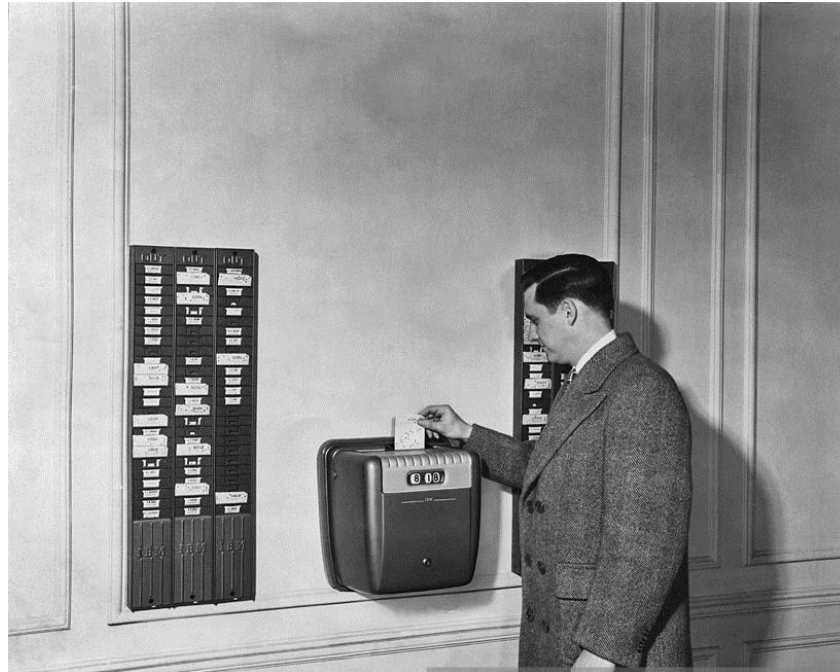


Portable, lightweight filtration badge



Reader with filtration slide exchange, badge charging station and data-management.

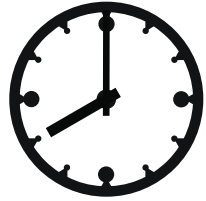
As easy to operate as a punch clock



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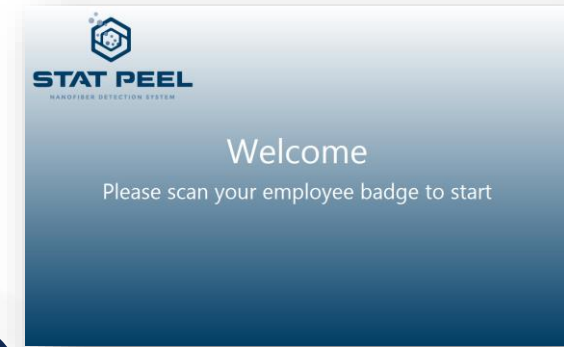
Mode of operation: 1.) load badge with a clean filtration slide



RFID reader for employee identification

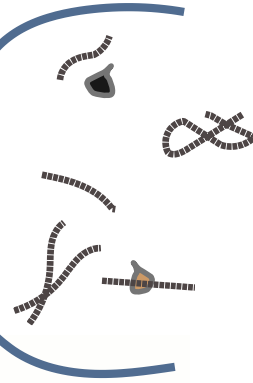
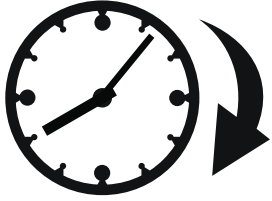


Load badge with clean filtration slide at shift start



2.) Work

up to 10h shift possible

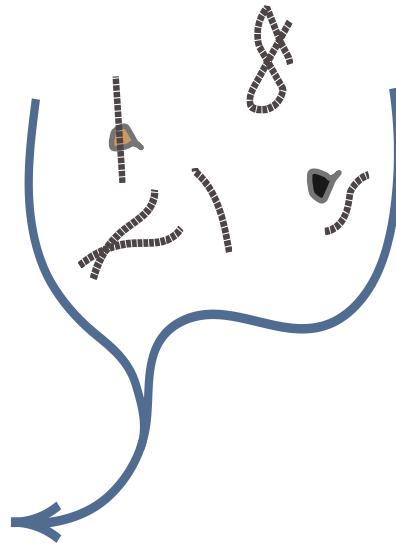
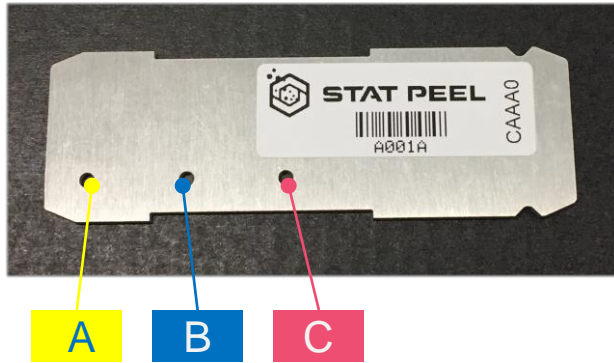


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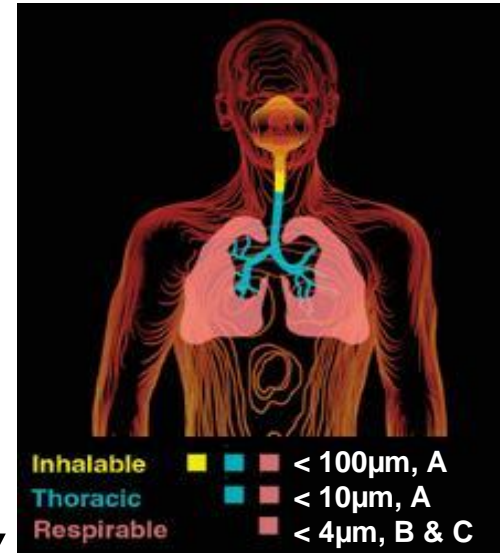


Disposable filtration slide



- Post-inspection with SEM & TEM possible

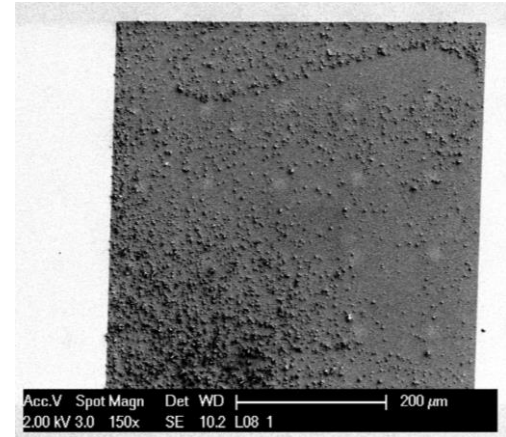
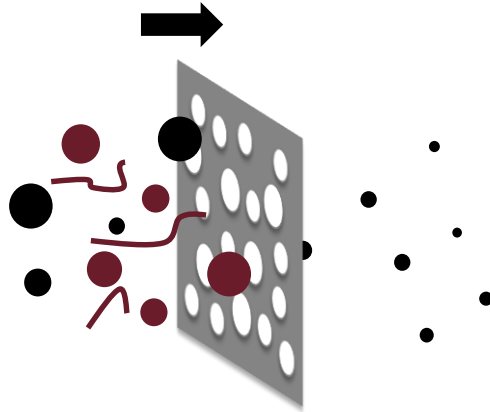
Lower chance of getting cleared ↓



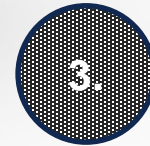
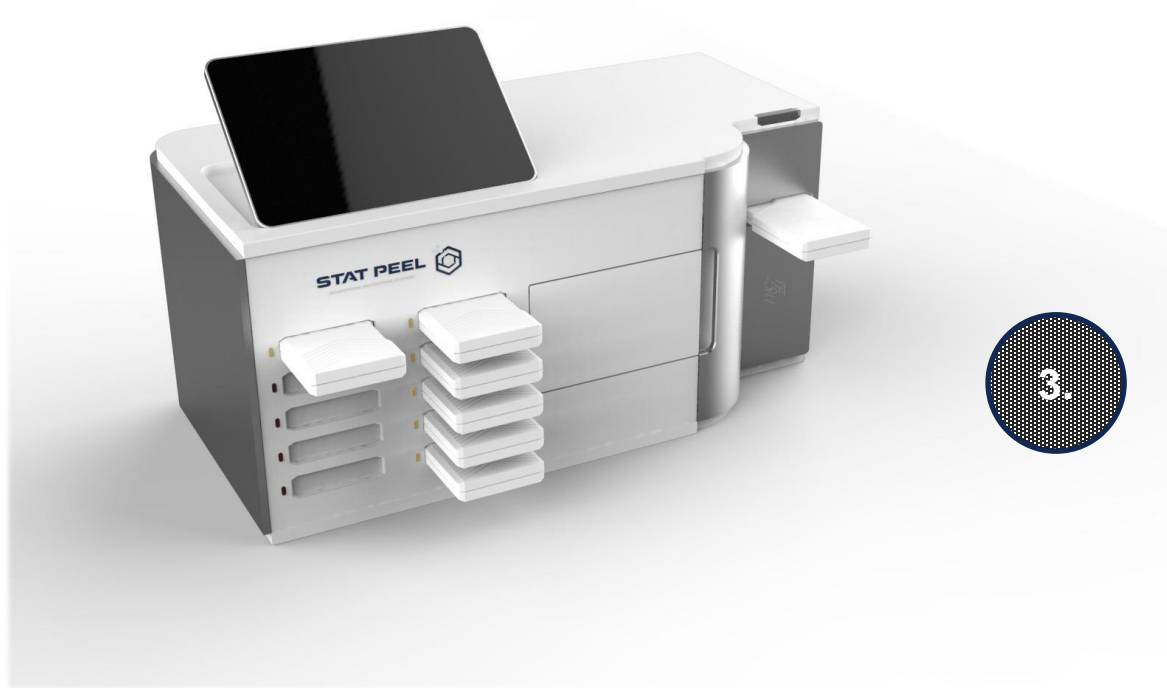
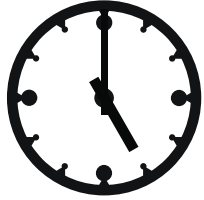


CNTs are captured by a custom functionalized membrane
-> SERS substrate

CNT
&
Back-
ground



3.) Insert badge for filtration slide inspection at end of shift

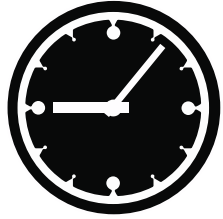


Insert loaded badge at shift end



4.) Charge badge. Filtration slide inspection during off hours

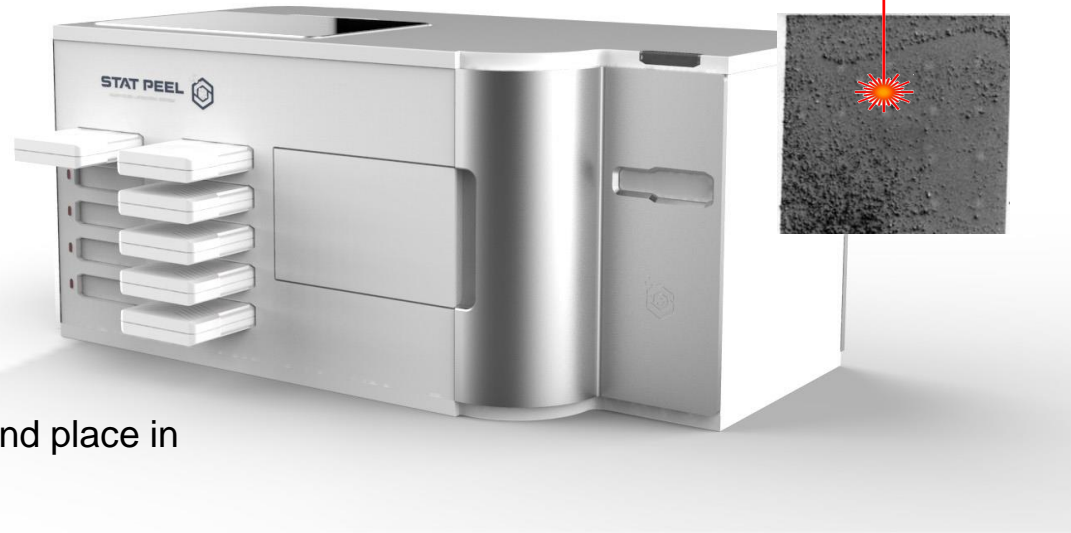
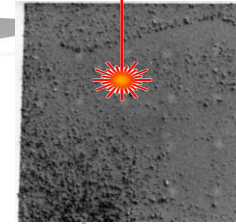
Employees must identify themselves before badge w/o membrane is released for charging bay



4.



Raman measurement

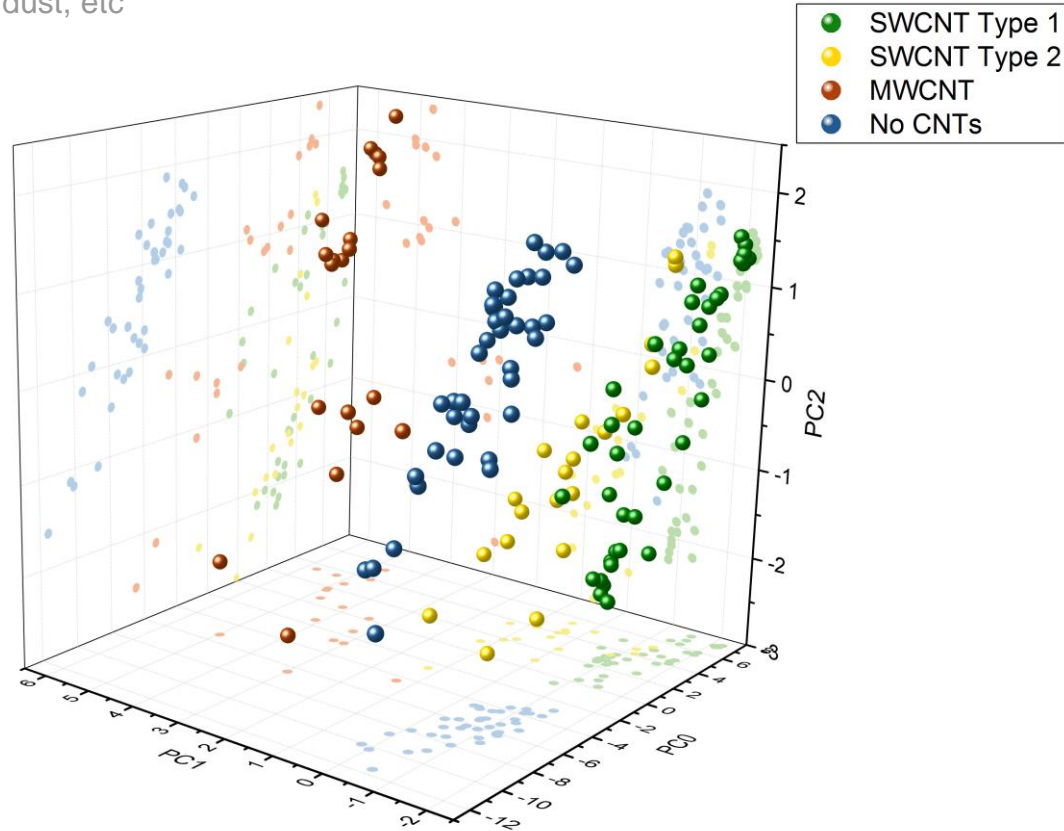


Remove badge w/o slide and place in charging bay

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Spectra processing

SWCNT, MWCNT, carbon black, dust, etc





Benefits for CNT users and integrators

Comply with **US**
exposure
recommendation

Show compliance to
insurance companies

Protect the company
from lawsuits



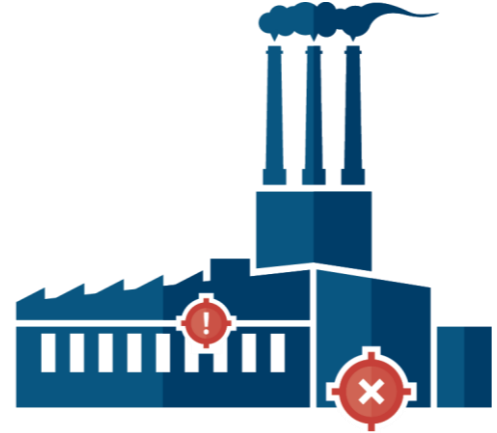
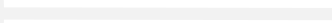
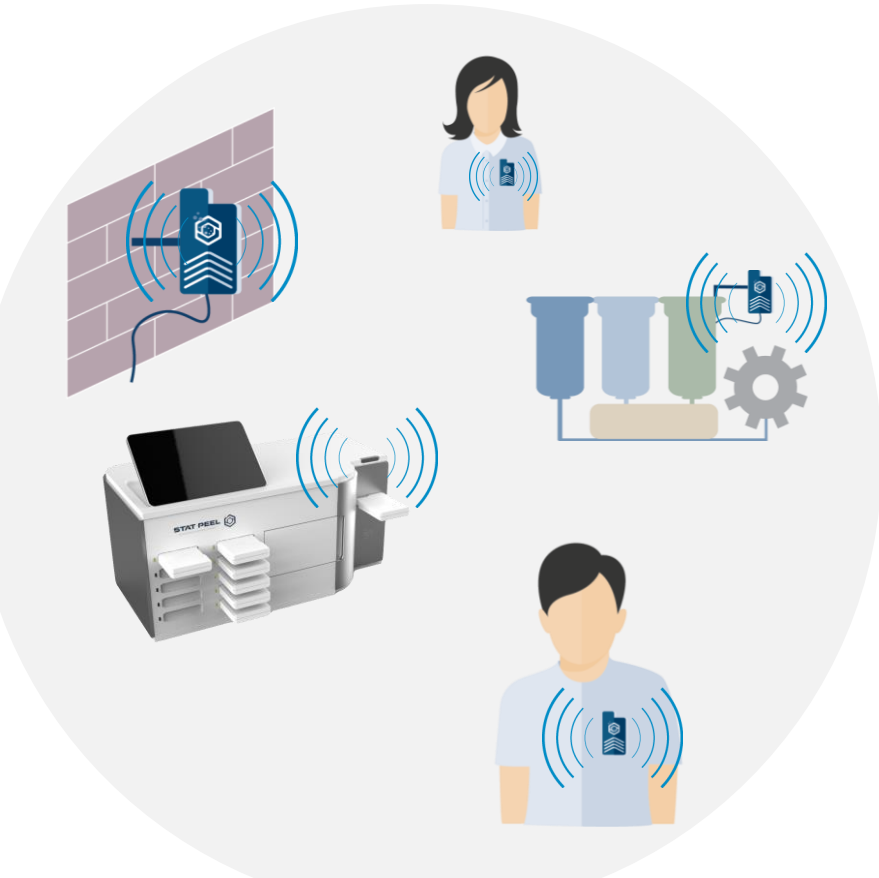
Inspection done in-
house to ensure
product confidentiality

Tamper-proof & easy
to use by anyone

Upgradable and
expandable to facility
monitoring

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Upgrade to comprehensive facility monitoring by integrating stationary devices



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Benefits for occupational hygienists

Pending local privacy regulation

Individual exposure
data set

Slide post inspection
with SEM & TEM

Company-specific
exposure database



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Industry- and value
chain monitoring

Recommend
improvements to
nanofiber users

Data source to
recommend regulation

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Thank you for your attention



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