

32nd NAAE conference

Oslo, Norway, September 8th, 2025



Pre-conference event:

ELECTROSTATIC DISCHARGE

Safety for accelerators



Tim Maas

Introduction of the speaker

Part 1 Introduction into ESD

Part 2 ESD safety on accelerators

Tim Maas – Total ESD solutions



- 28 years experience in EMC/ ESD control
- Member of the Dutch EMC/ ESD association
- Member of ANSI ESD Association
- Chairman Dutch standardisation committee NEN-NEC-TC101 (IEC)
- ANSI certified ESD Control Program Manager
- ANSI certified ESD Specialist
- Total ESD solutions is an



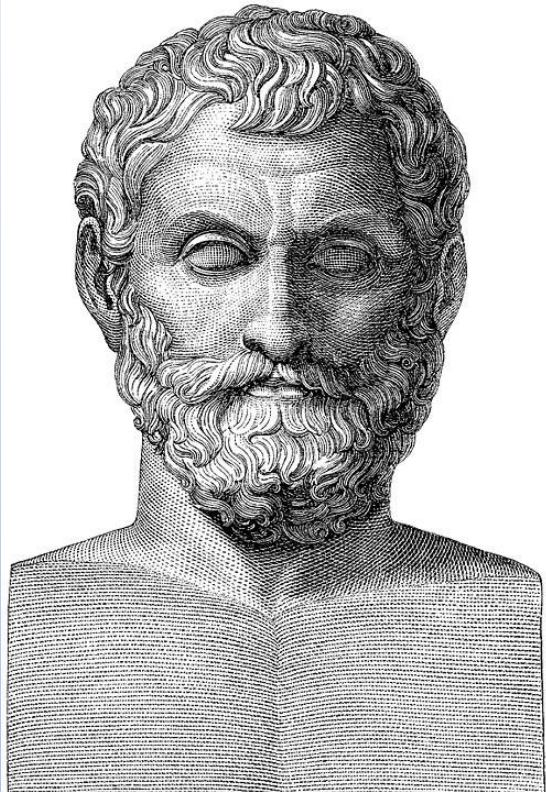
ISO 9001 / ANSI Certified Product Qualification Laboratory

Part 1 Introduction

Electrostatics - basics

Electrostatics in our daily life

Electrostatic charge – basics



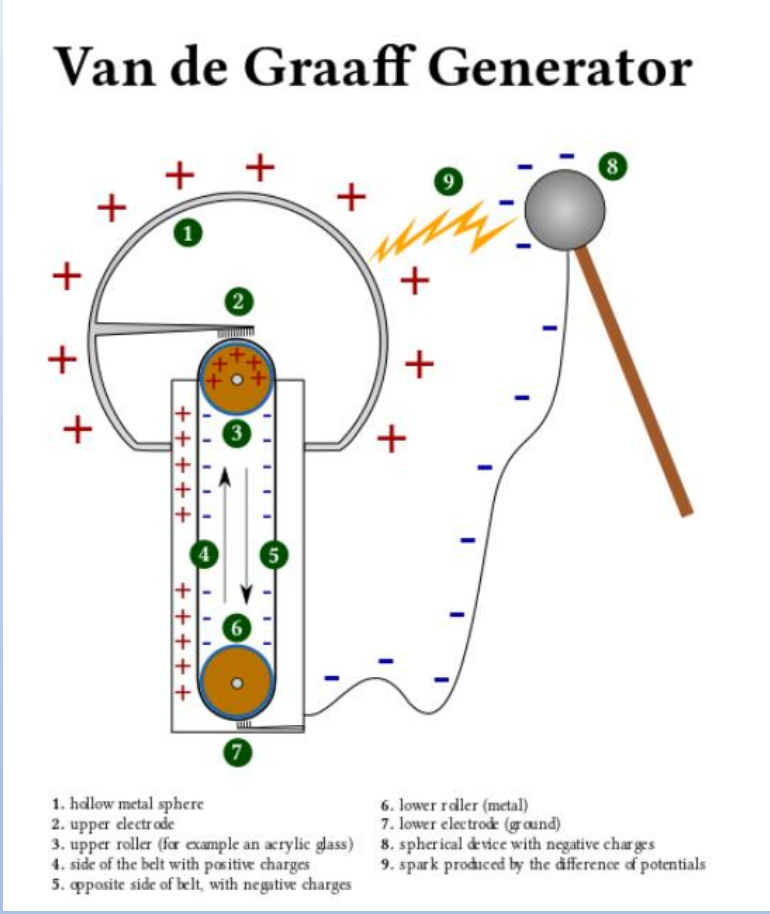
Thales of Miletus
~625 to ~546 BC

Tribo electric effect

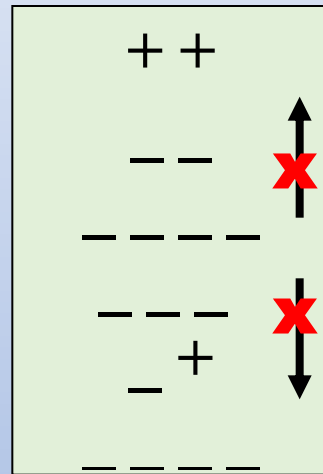


Ancient Greek:
Amber = Elektron
Friction = Tribos

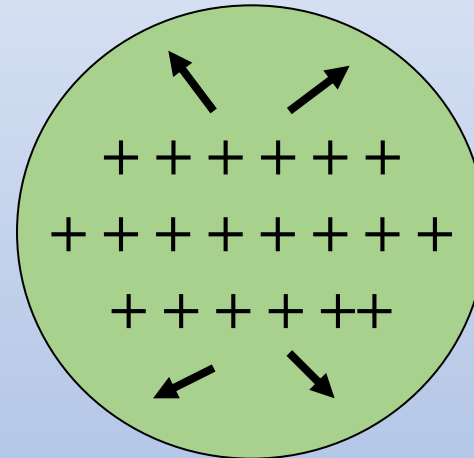
Electrostatic charge – basics



Electrostatic charge - basics

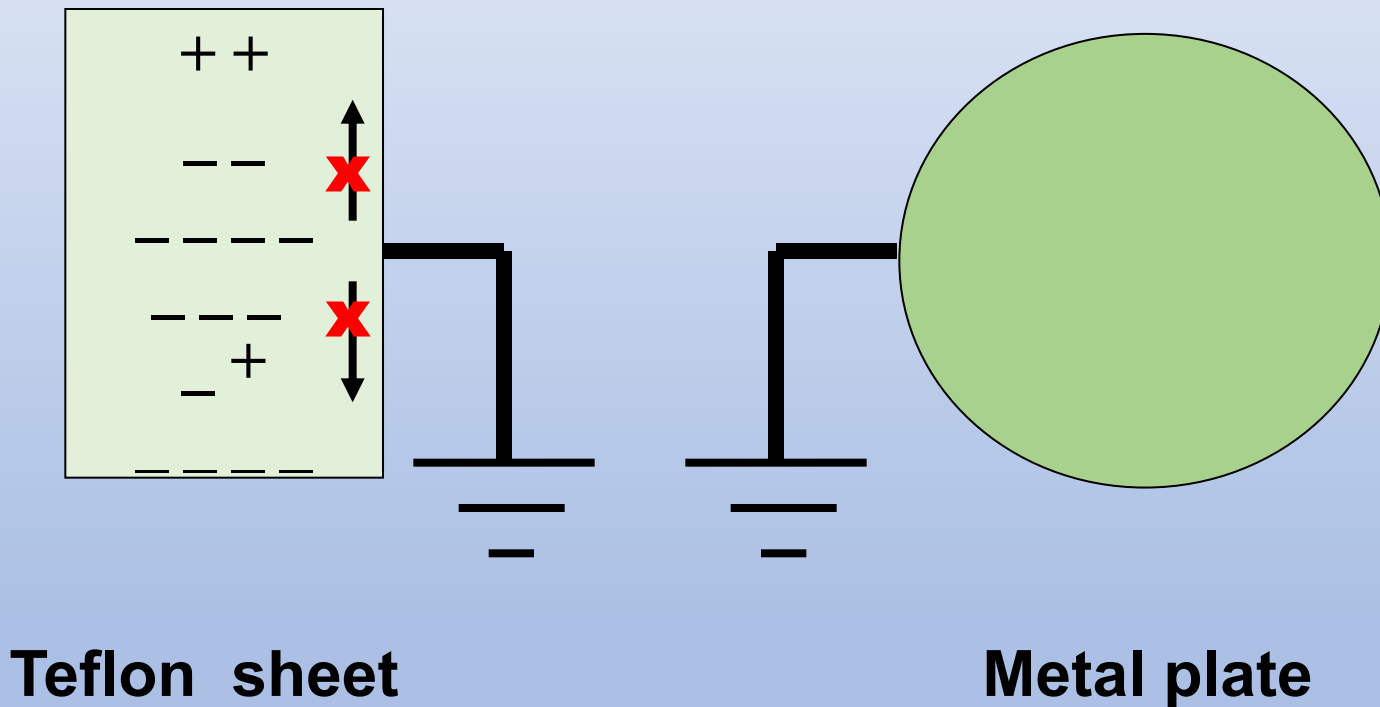


Teflon sheet

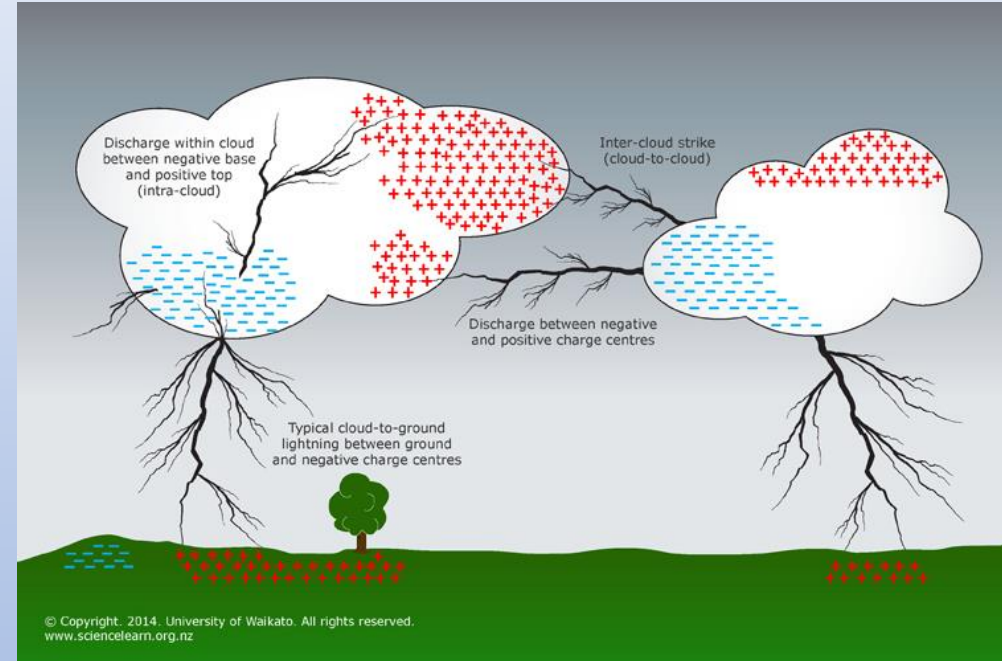


Metal plate

Electrostatic discharge -basics



Electrostatic charge - basics



Electrostatic charge - basics



CE



TOTAL ESD SOLUTIONS
ESD CONSULTANCY, AUDITING, TRAINING & TESTING



Electrostatics in our daily life



Electrostatics and Industry

Electrostatic Precipitation:

Ions attracted to grounded wall - precipitates liquids solid waste

Clean Gas (Smoke Stacks)

Highly Charged Conductor Causes gas to split into ions

Polluted Gas

Ground Wire

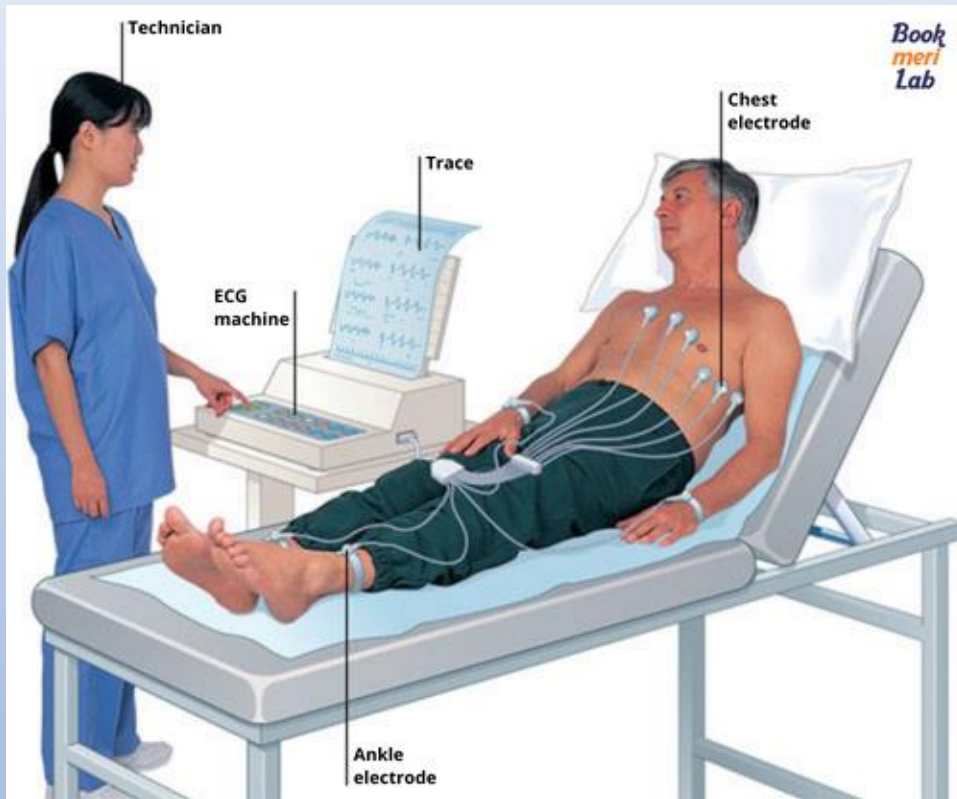
Solid/Liquid Waste



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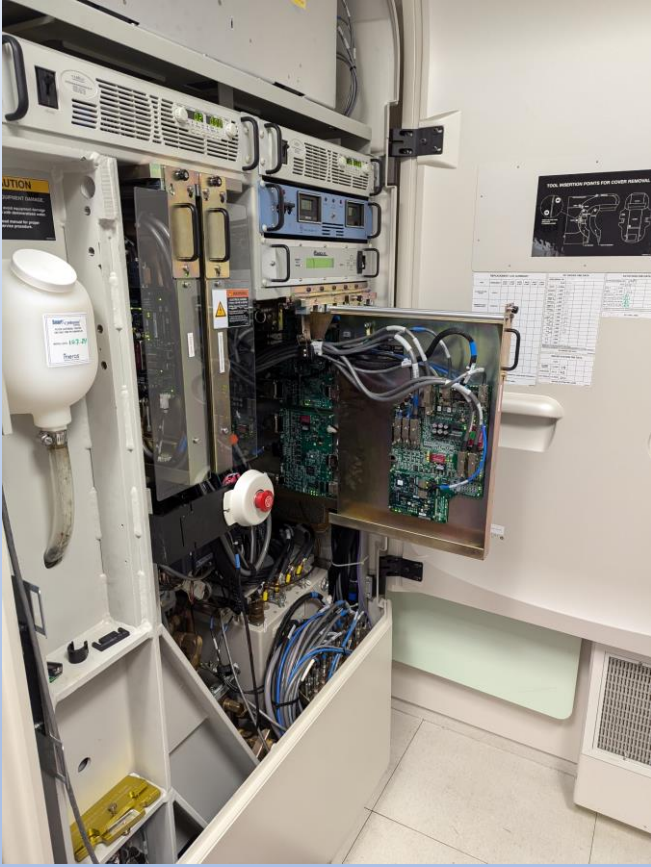
Electrostatics in our daily life



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Part 2 ESD safety on accelerators



Electrostatic (dis)charge in your work environment



What's your body voltage?

Demonstration using the IONA TECH armband

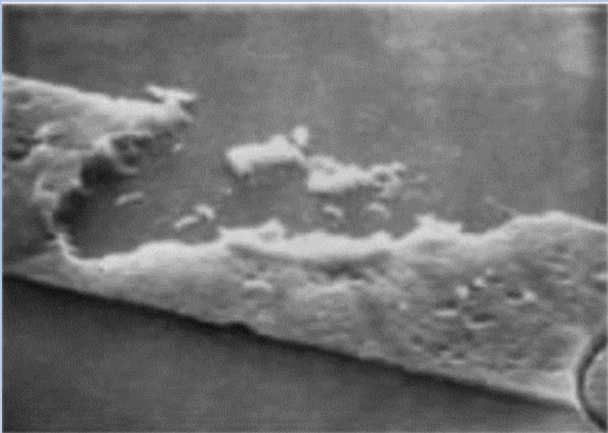
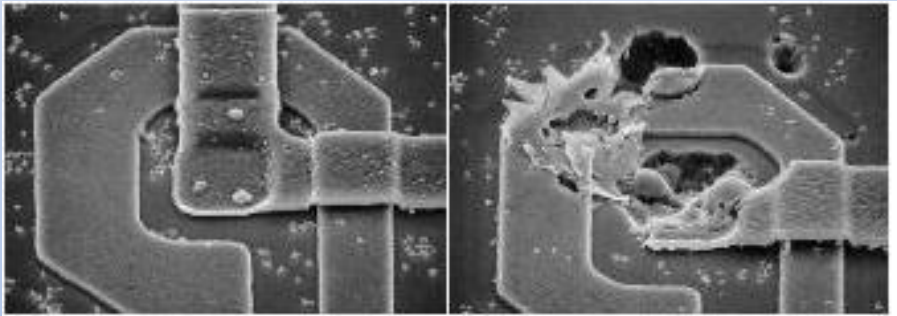
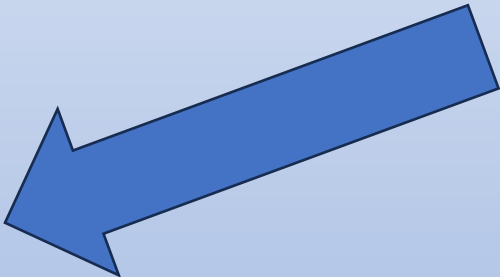


Field induction risks: Seeing is believing...

Demonstration using Charge Plate Monitor
Keyence SK-H050



Why does ESD prevention matter?



Why does ESD prevention matter?

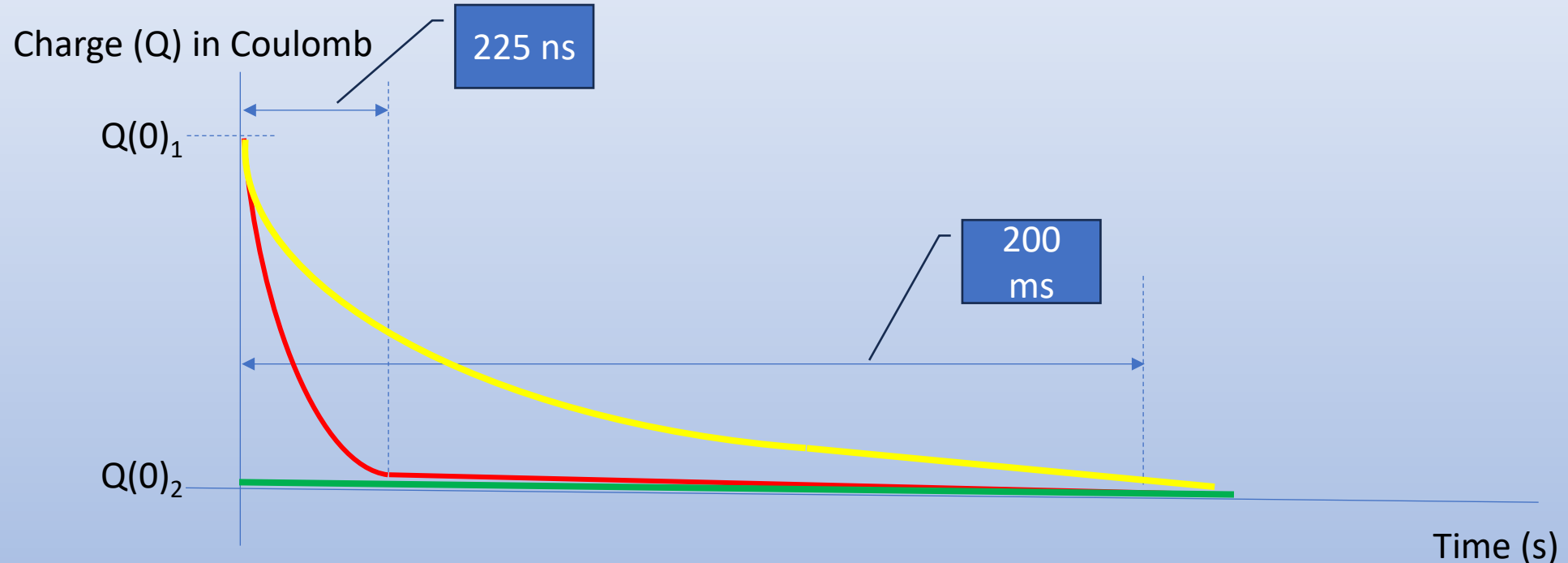
$$Q(t) = Q(0) * (1 - e^{(-t/RC)})$$

Human response time $\sim 250 \text{ ms}^1$

$$R_{\text{human skin}} = 1500 \Omega^2$$

$$C_{\text{human}} = 150 \text{ pF}^2$$

→ RC time constant = 225 ns (too rapid discharge (Damage possible!))



Use ESD gloves during service to control contact resistance

$R_{\text{glove}} = 1 \text{ G}\Omega \rightarrow RC = 200 \text{ ms} \leftarrow$ is still less than human response (OK)

$R_{\text{glove}} = 10 \text{ G}\Omega \rightarrow RC = 2 \text{ s} \leftarrow$ takes more time than human response (risk!)

Personal ESD protective measures - Wrist straps



Personal ESD protective measures – Footwear



Personal ESD protective measures - Garments



Take aways

- Electrostatic charge mainly occurs through friction (electron displacement)
- Electrostatic discharge occurs visibly and invisible → it is always present!
- When you are charged, you emit electrostatics fields → field induction risk!
- The impact of ESD may be delayed (latent damage risk)
- Use appropriate ESD safe PPE and be aware of the electrocution risk!

Thank you for your attention!