“Stage Current” Monitoring and Endpointing in FIB

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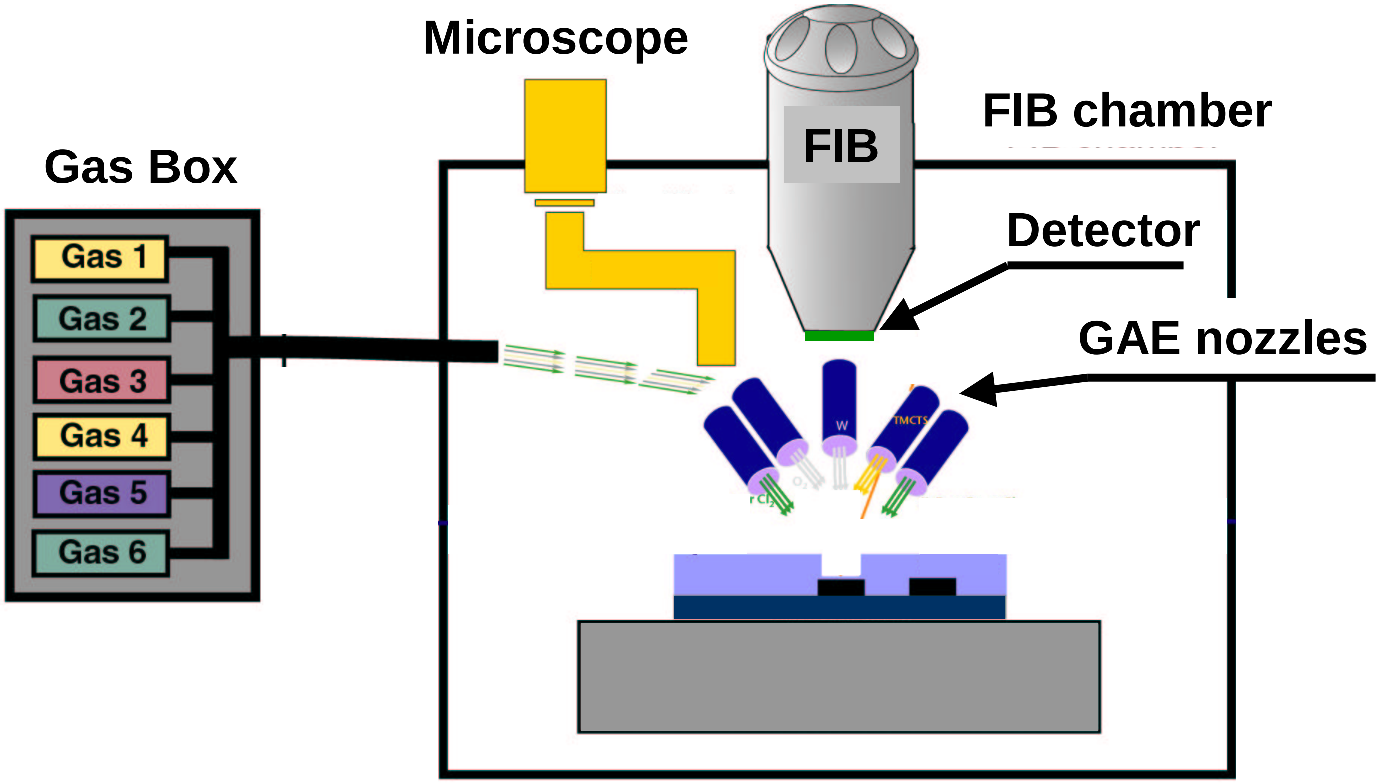
FIB System Overview

VectraVision process module



Microscope

FIB

FIB chamber

Gas Box

Gas 1

Gas 2

Gas 3

Gas 4

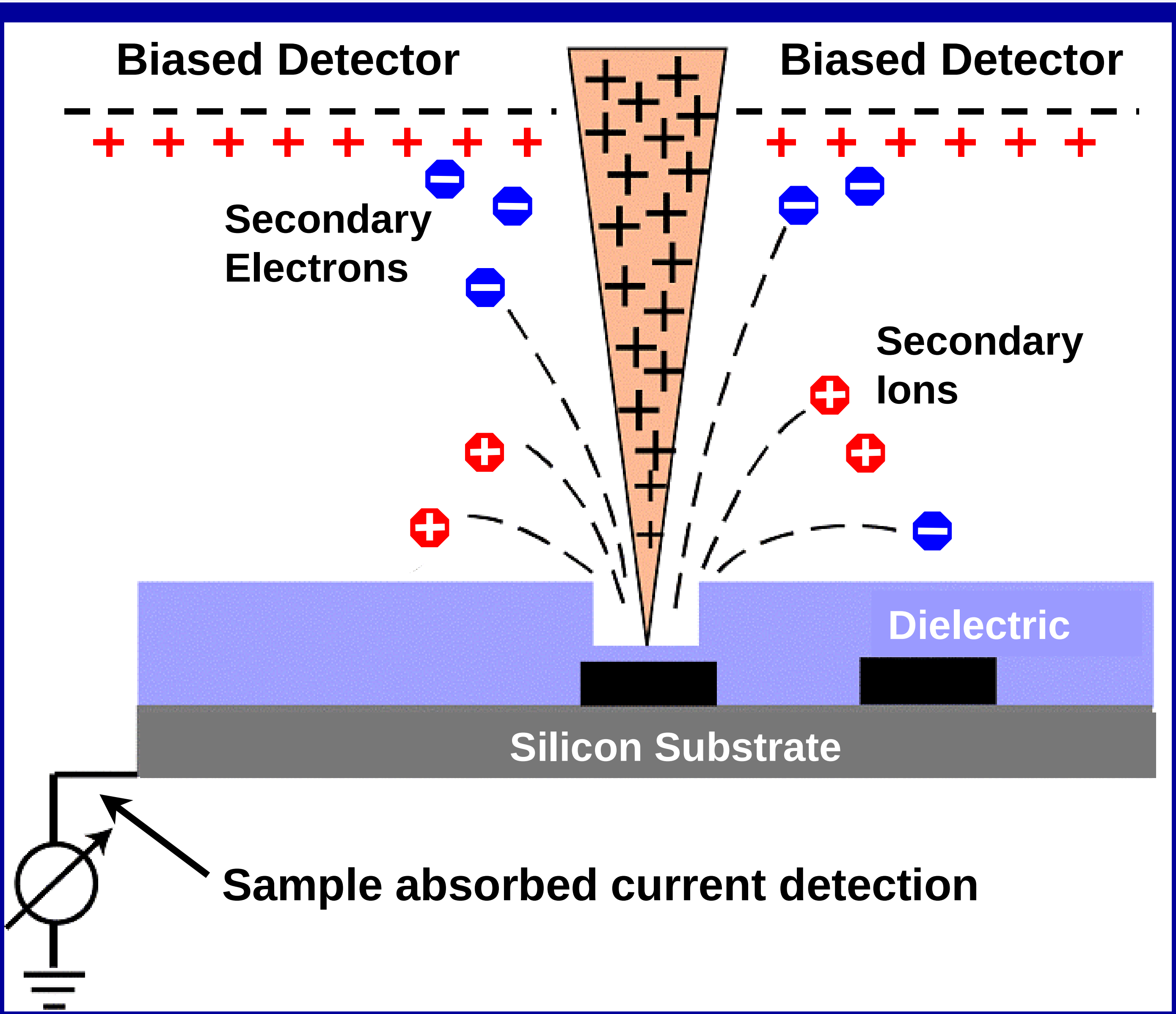
Gas 5

Gas 6

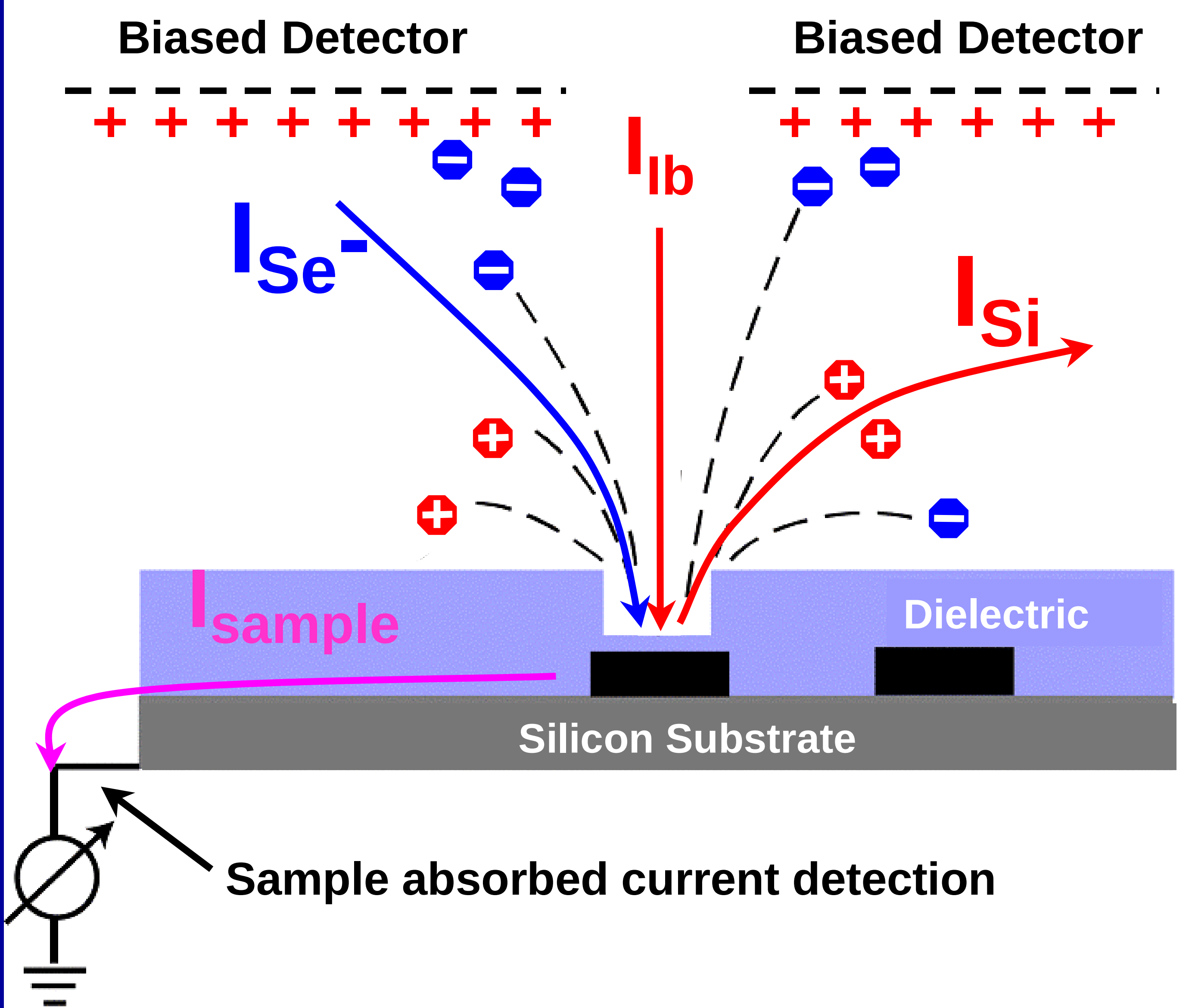
Detector

GAE nozzles

Signals in FIB System



“Stage Current” in FIB System



Sample absorbed current detection

Effective Sample Absorbed Current

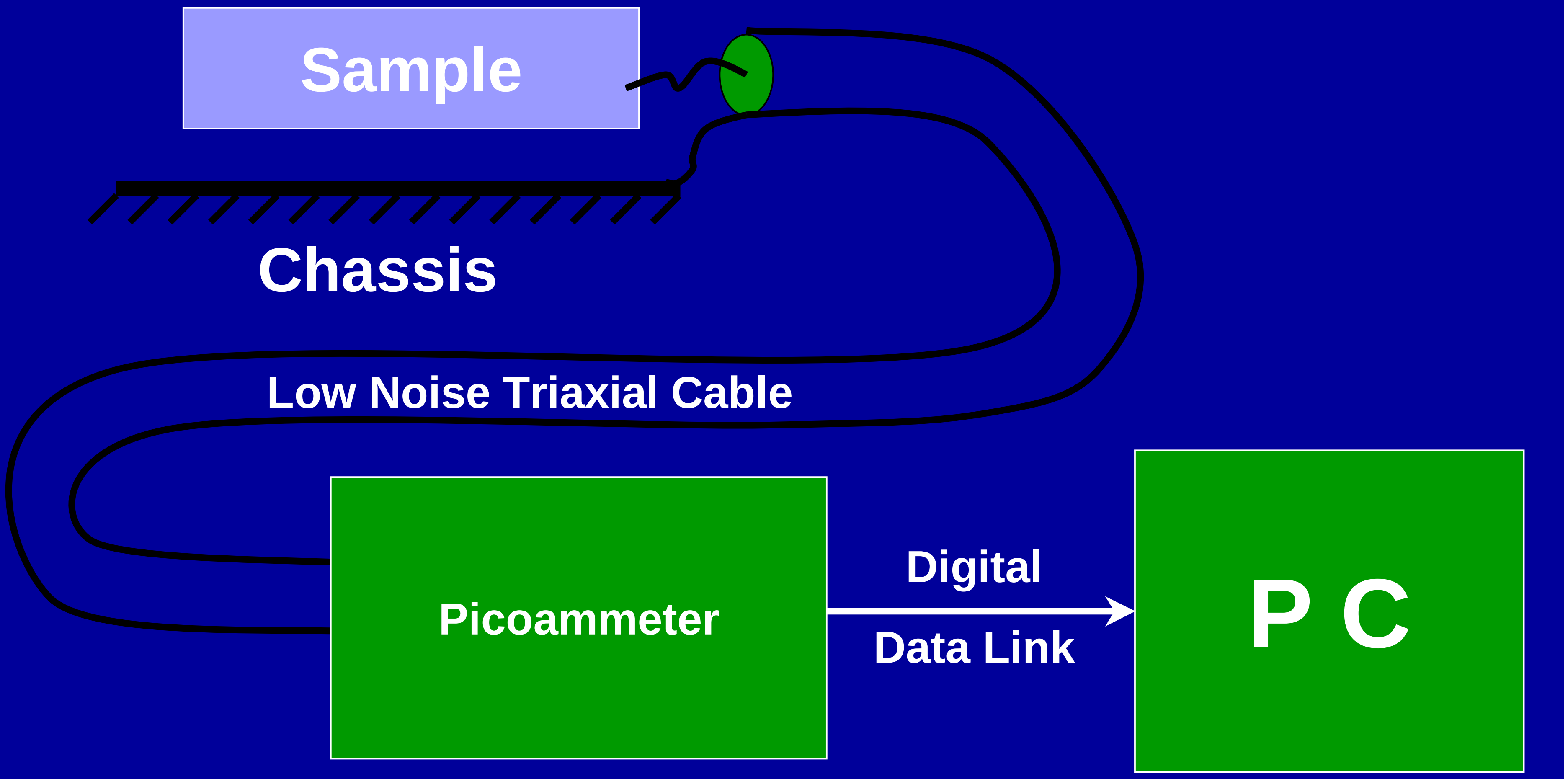
On transition from dielectric to metal:

1. Effective Se$^-$ yield increases;
2. Effective Si$^+$ yield decreases.

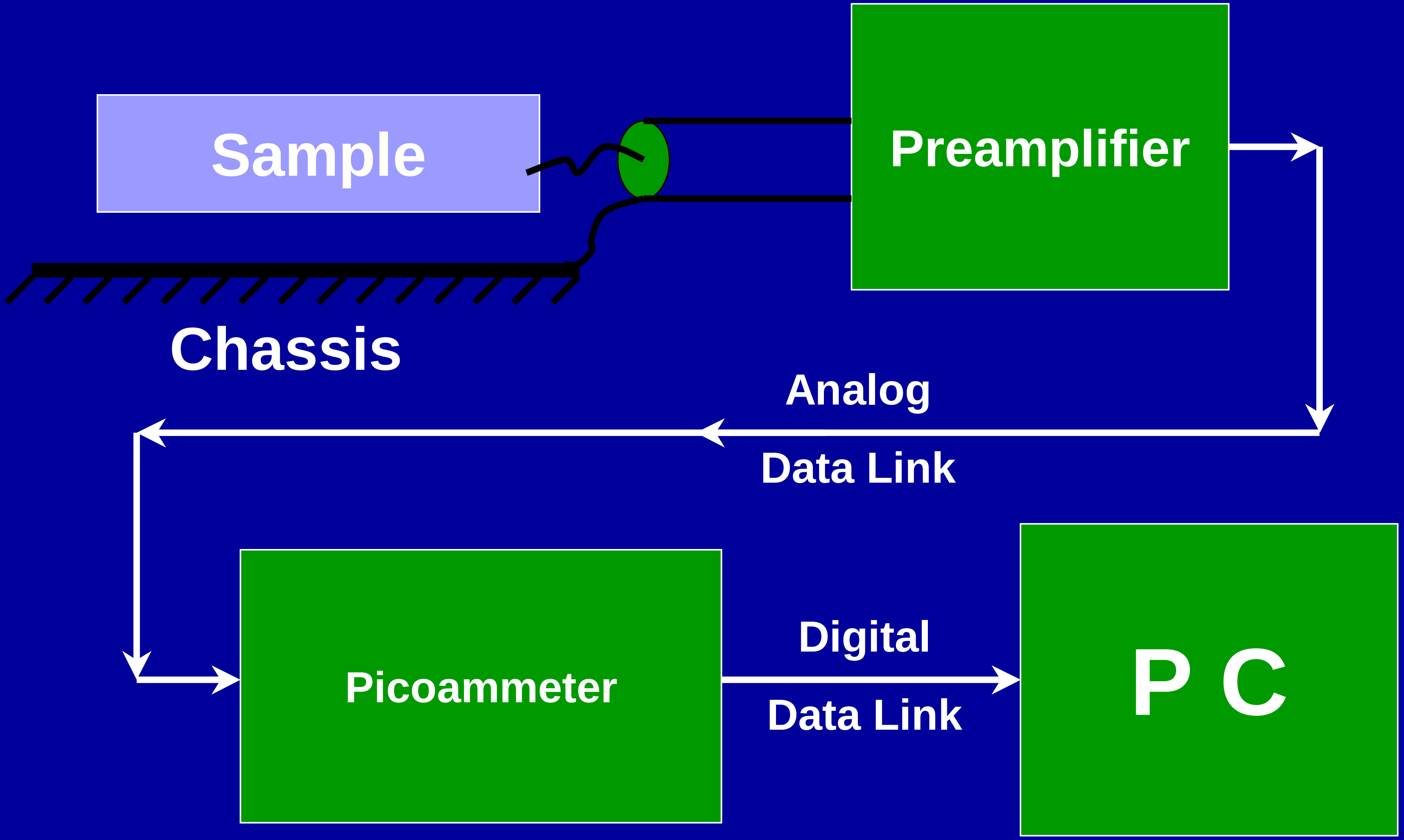
Same effect on the sample current:

$$\boxed{I_{sample} = I_{Ib} + I_{Se^-} - I_{si^+}}$$

Sample Current Monitoring Approach

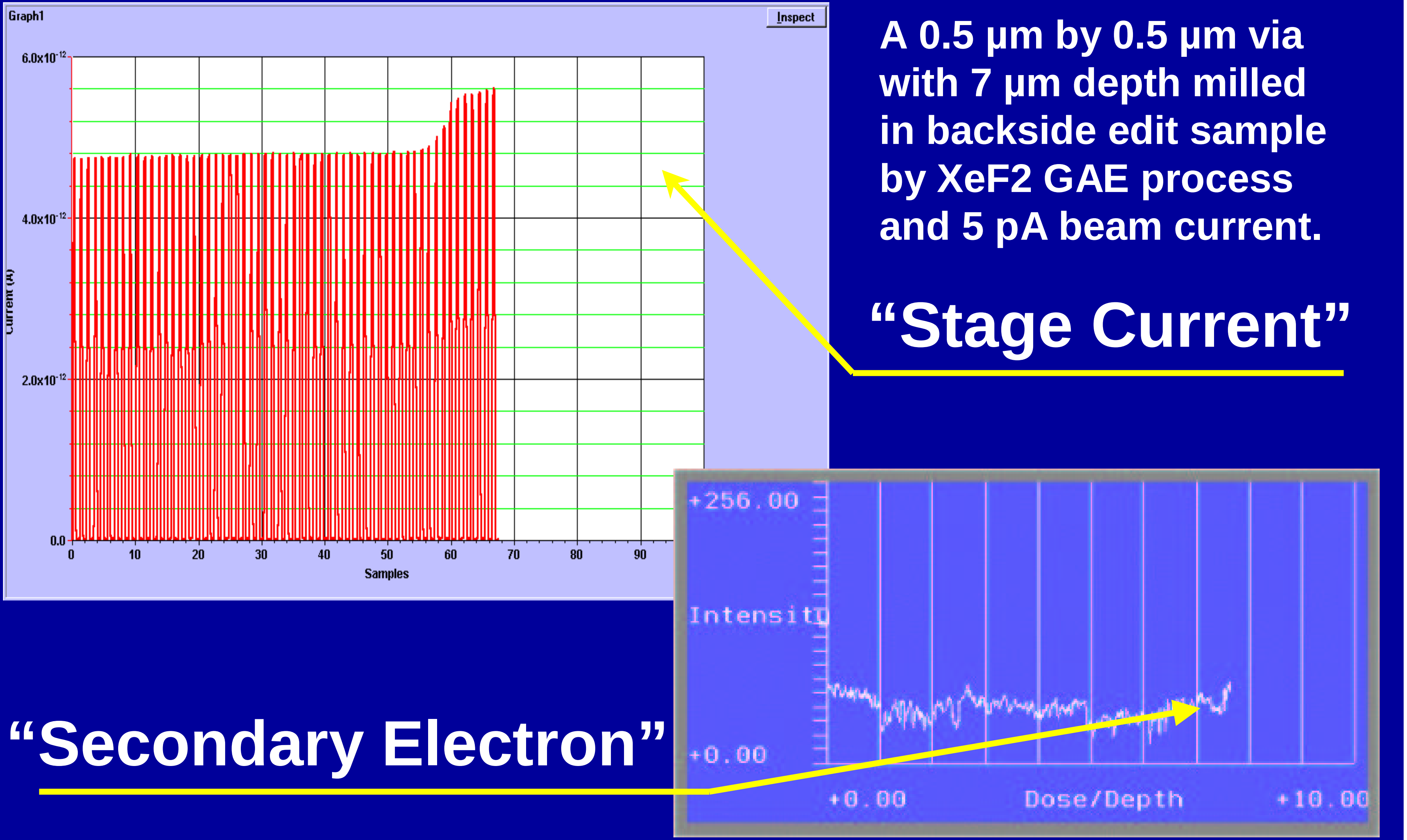


Advanced Sample Current Monitoring



Via Milling Endpoint:

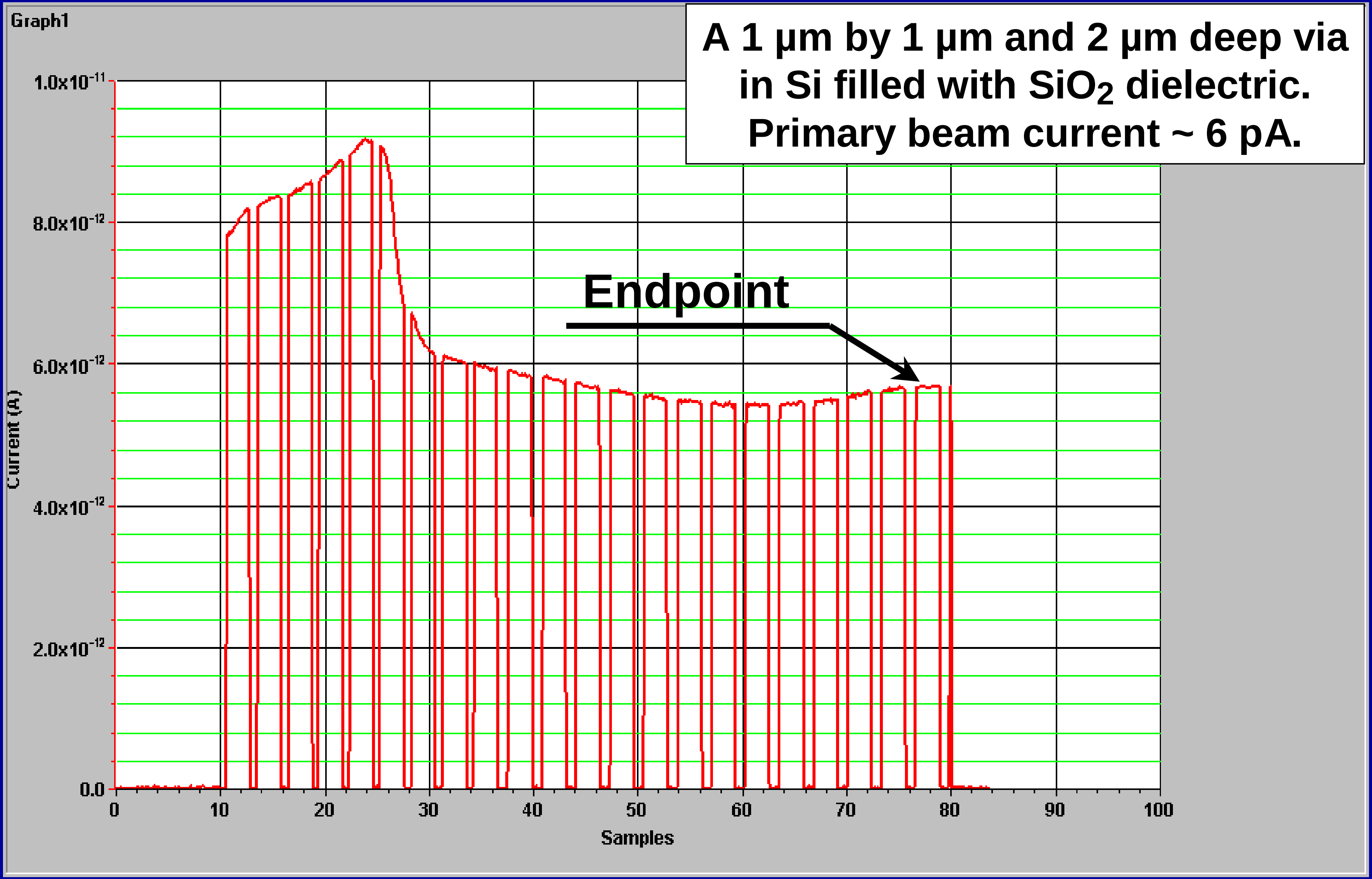
A 0.5 µm by 0.5 µm via with 7 µm depth milled in backside edit sample by XeF2 GAE process and 5 pA beam current.



“Stage Current”

“Secondary Electron”

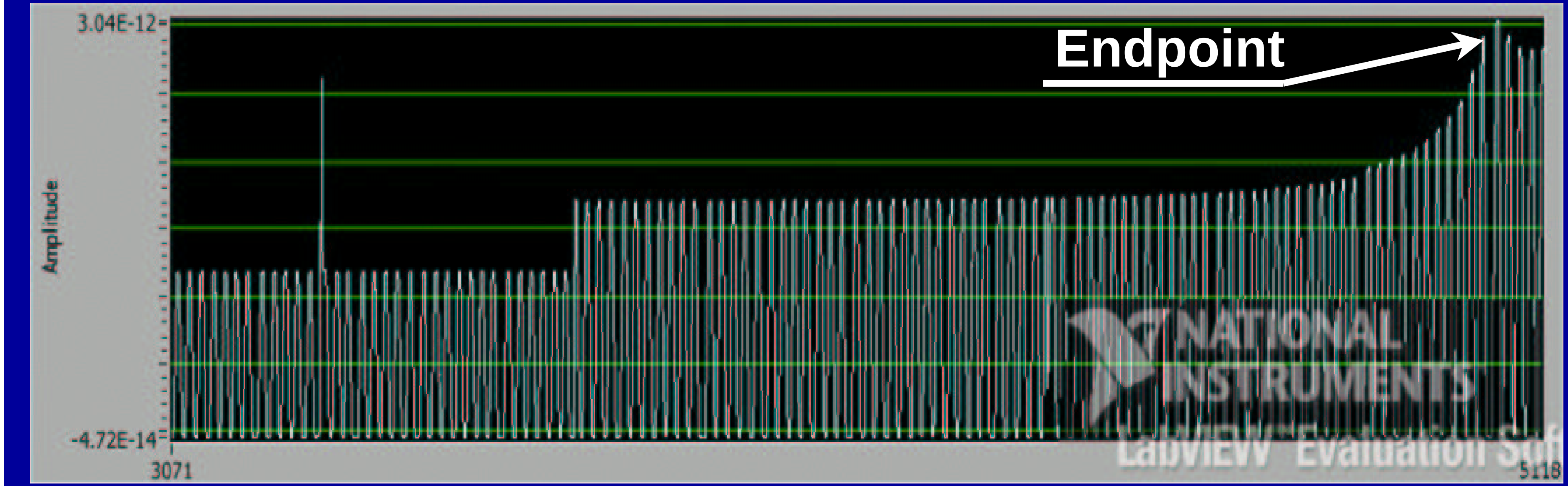
Dielectric Deposition Endpoint



A 1 µm by 1 µm and 2 µm deep via in Si filled with SiO_2 dielectric. Primary beam current ~ 6 pA.

Endpoint

Metal Deposition Endpoint



A 0.4 µm by 0.4 µm and 5 µm deep via is filled with W conductor. Primary beam current ~ 5 pA.

Data is collected by the setup with in-vacuum preamplifier.

Conclusions

- **Sample absorbed current signal includes information from all the charged particles, generated in FIB system during the milling and deposition processes.**

- **“Stage Current” endpointing of HAR via milling process is possible with good S/N ratio.**

- **Dielectric deposition endpointing for backside edit via fill is a unique capability provided by “Stage Current” endpoint detection.**