

FBK IV analysis* @ Ferrara (part 2)

*tested by FBK

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DUNE photo-sensor meeting

12/11/2024

Last meeting

- Analysis of data from FBK HD pre-production
- Differences with CACTUS typical data
- Results

https://indico.fnal.gov/event/66659/contributions/302064/attachments/182669/250861/DUNE_meeting_Tommaso_Giammaria_22_10_2024.pdf

General info

Samples

- 100 SiPM strips
- FBK model (HD pre-production)

Aim

- Compare the IV characterization methods
 - CACTUS : Normalized First Derivative (**NFD**) $\rightarrow \frac{d}{dV} (\ln(I))$
 - Vendor : 2nd logarithmic derivative (**SLD**) $\rightarrow \frac{d^2}{dV^2} (\ln(I))$

General info

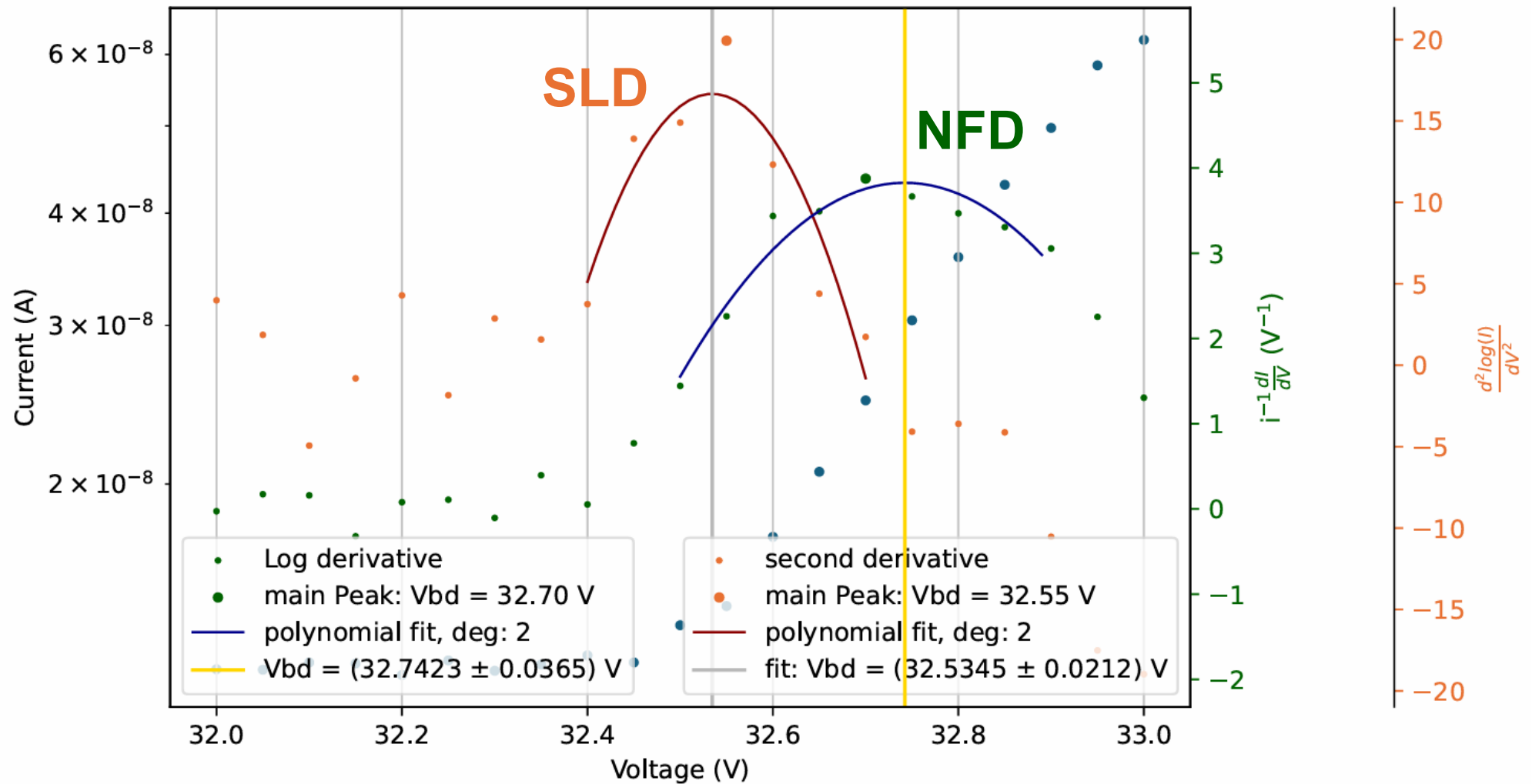
News

- Received results from FBK (both NFD and SLD methods)
- Discussed with FBK about different V_{BD} estimators

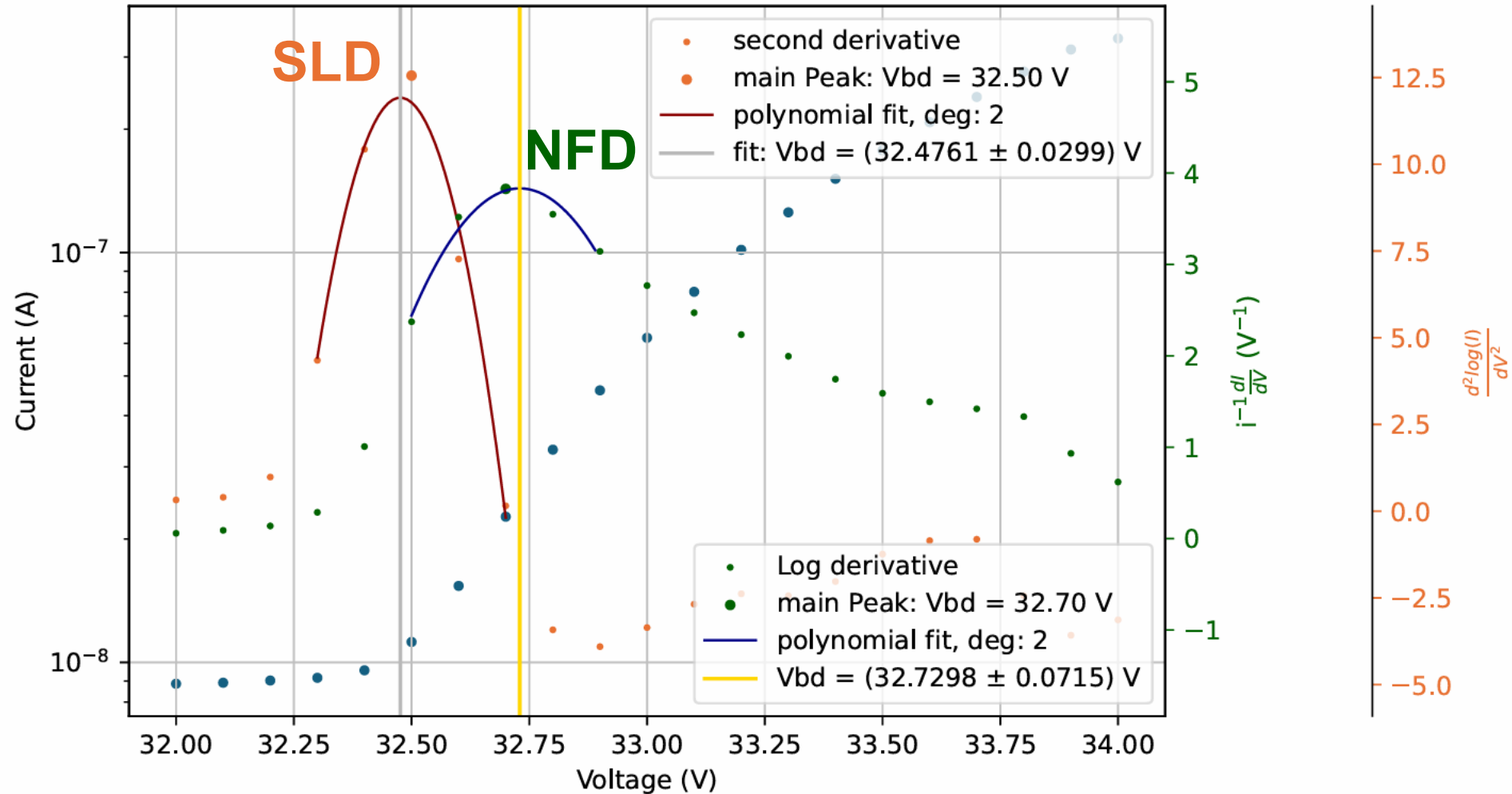
IV curve types (room T)

- Packaging IV:
 - Strip (or single SiPM ?) level
 - Large V_{step} : 50 mV (CACTUS: 20 mV)
- Parametric IV, also called Wafer Level (WL) IV:
 - WL → same temperature for all the SiPMs → more stable
 - Larger V_{step} : 100 mV (!!)

Single IV curve – packaging



Single IV curve – parametric (or WL)



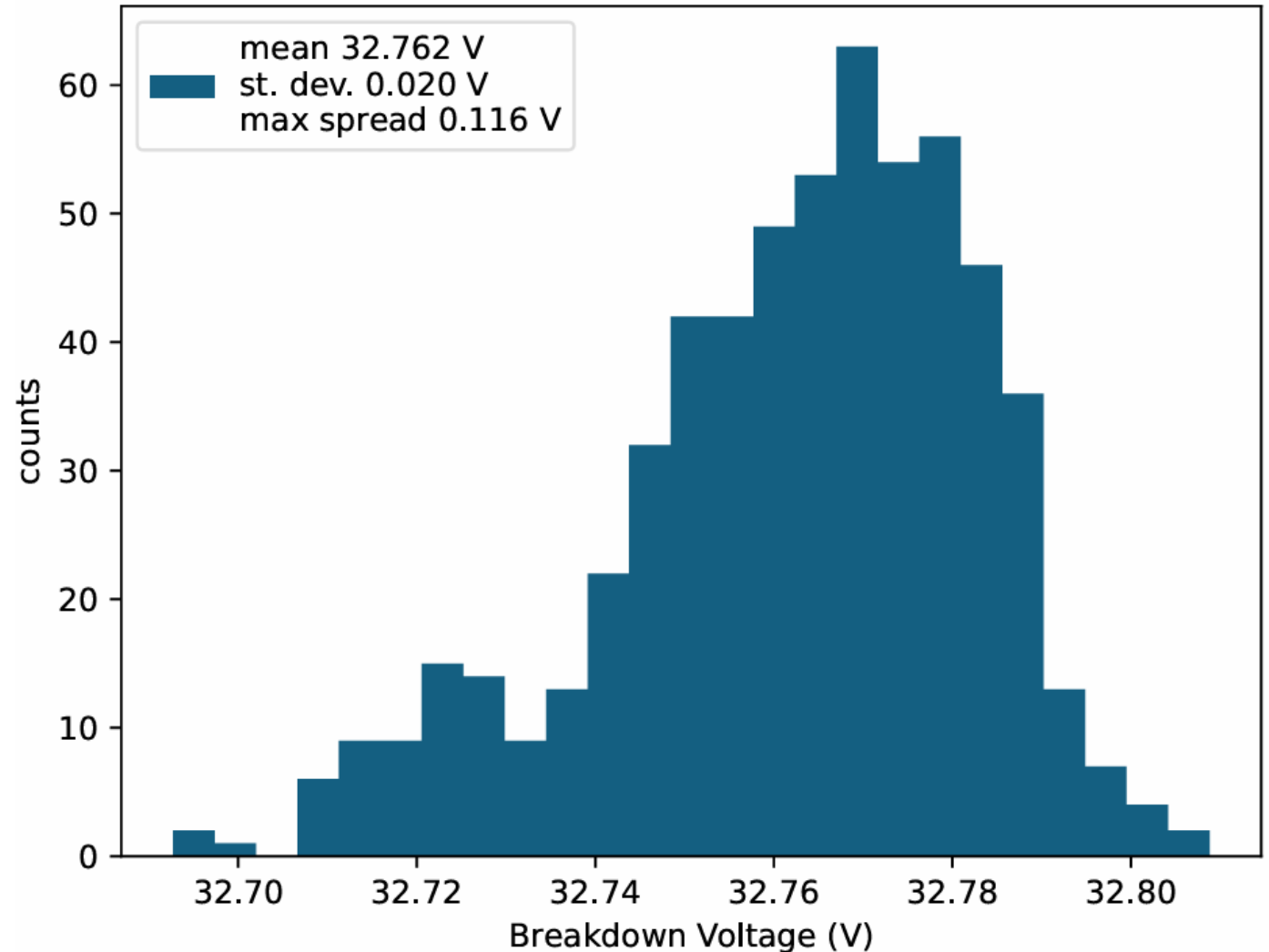
Results – V_{BD} distribution

IV curve type

- Packaging IV
- Parametric IV

Method

- NFD
- SLD



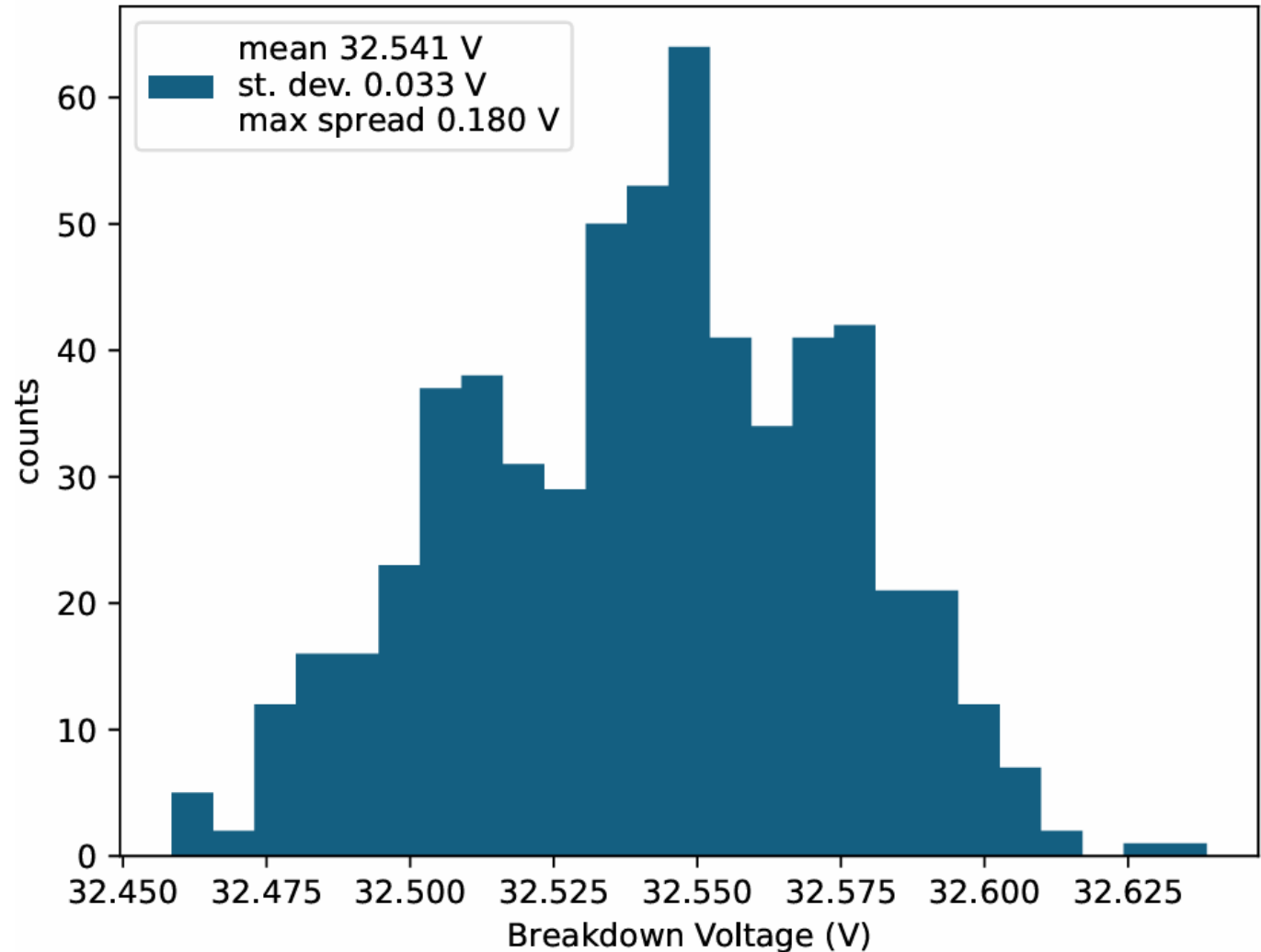
Results – V_{BD} distribution

IV curve type

- Packaging IV
- Parametric IV

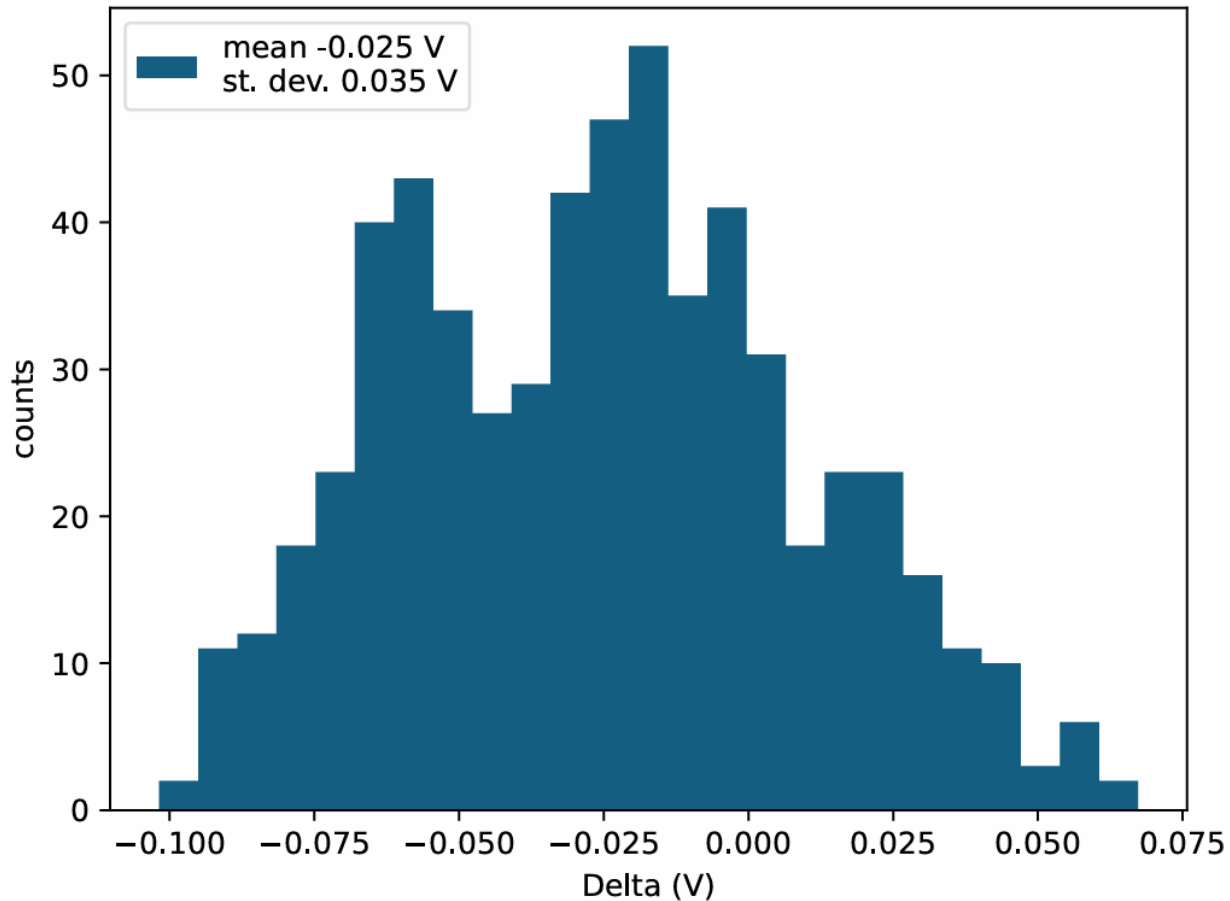
Method

- NFD
- SLD

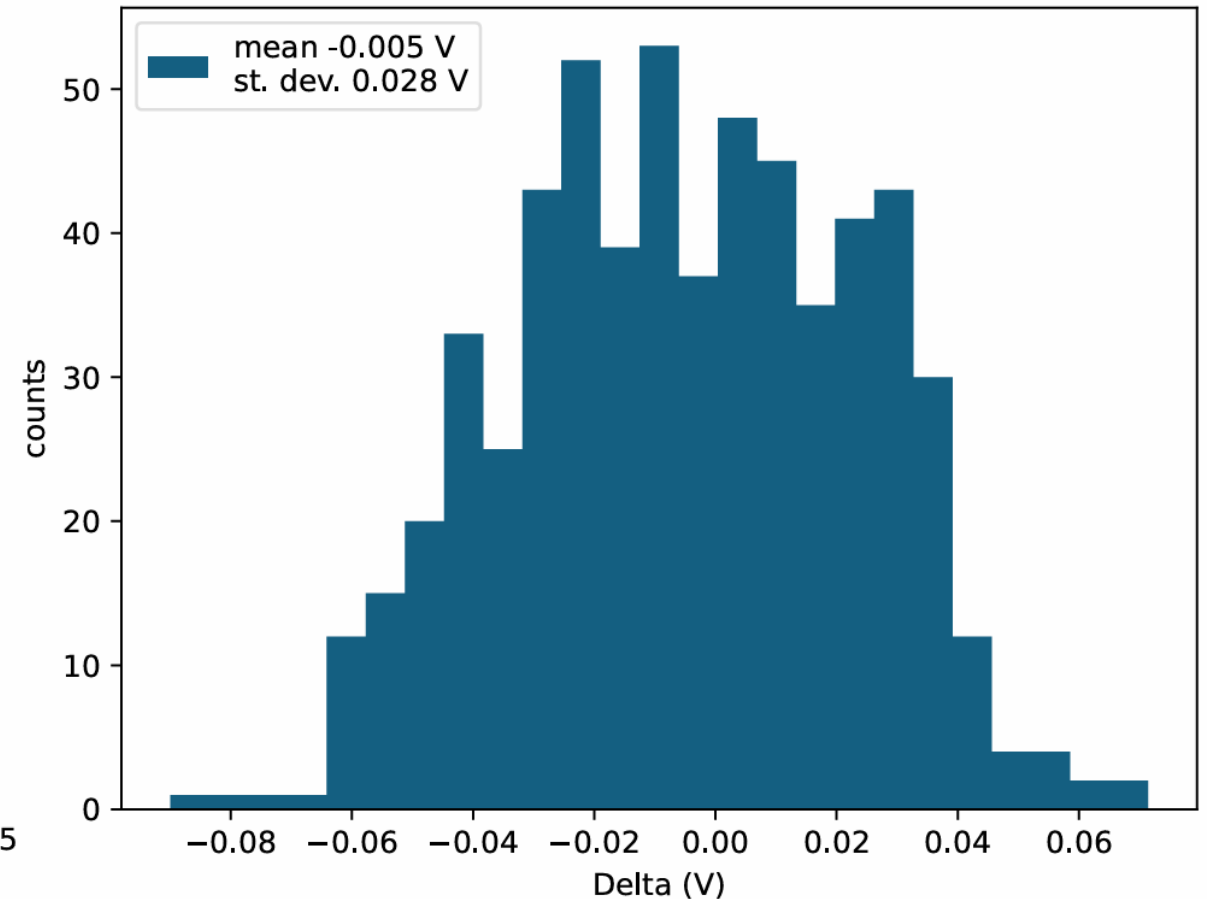


Results – V_{BD} distribution – packaging - differences

NFD differences (packaging)



SLD differences (packaging)



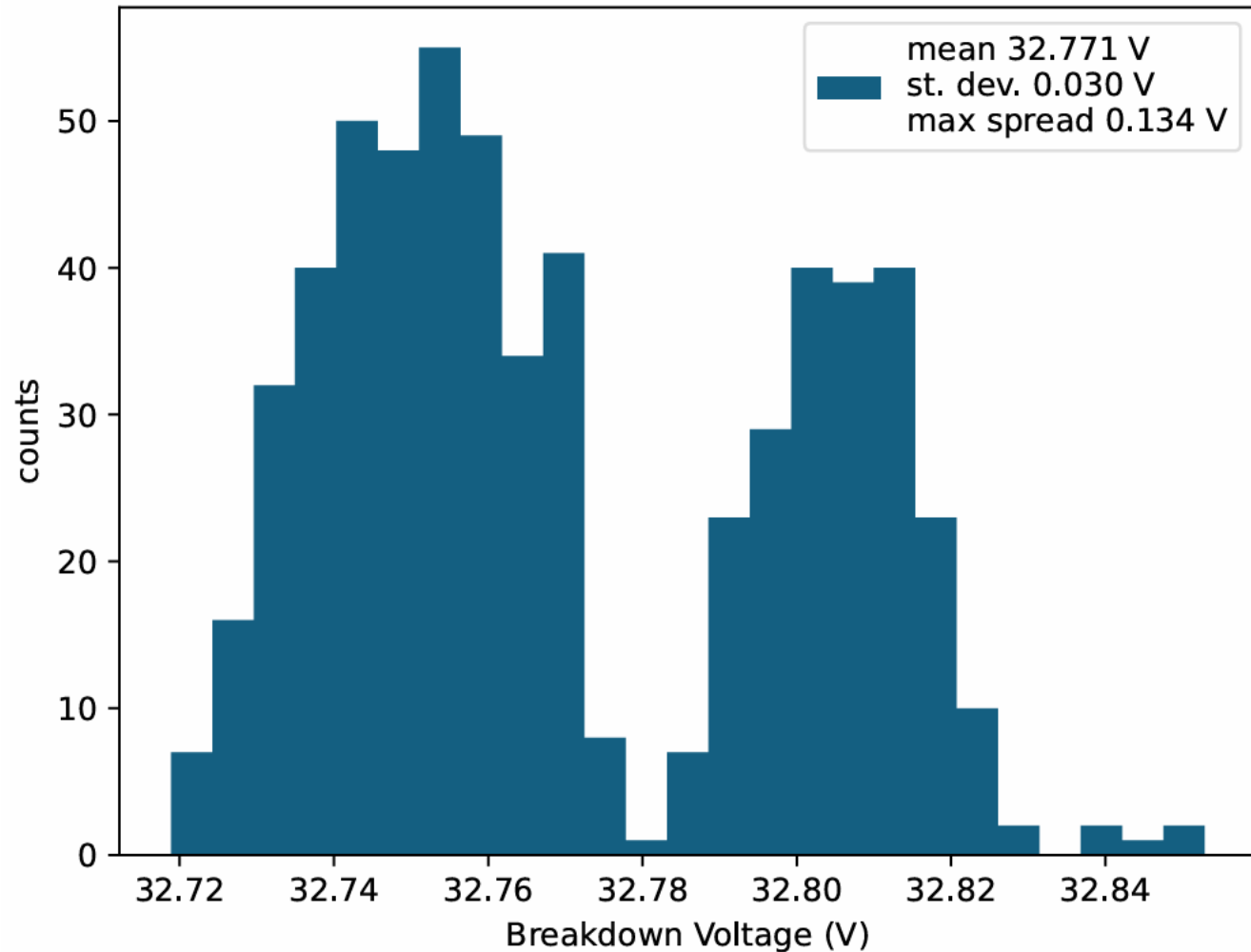
Results – V_{BD} distribution

IV curve type

- Packaging IV
- Parametric IV

Method

- NFD
- SLD



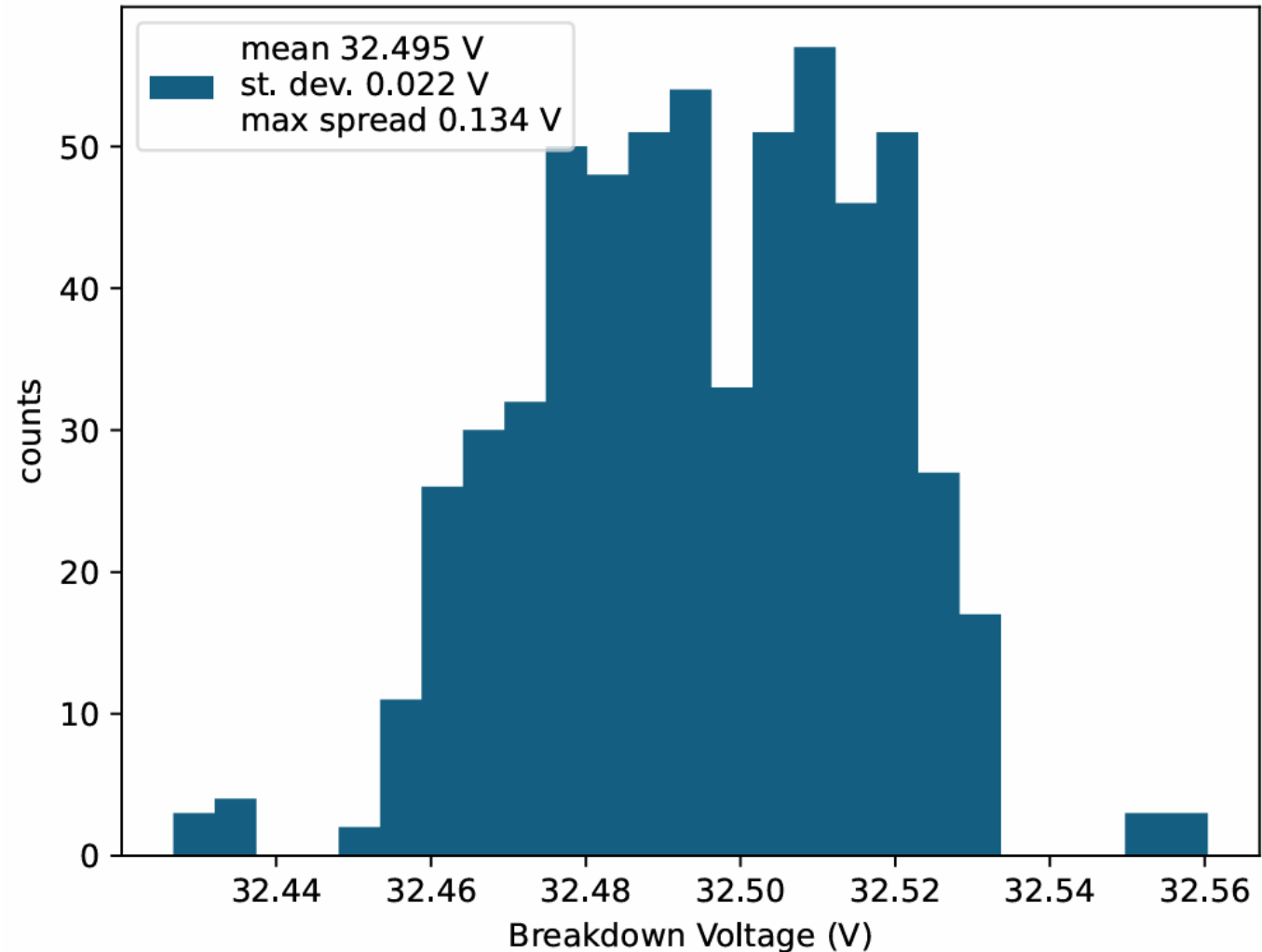
Results – V_{BD} distribution

IV curve type

- Packaging IV
- Parametric IV

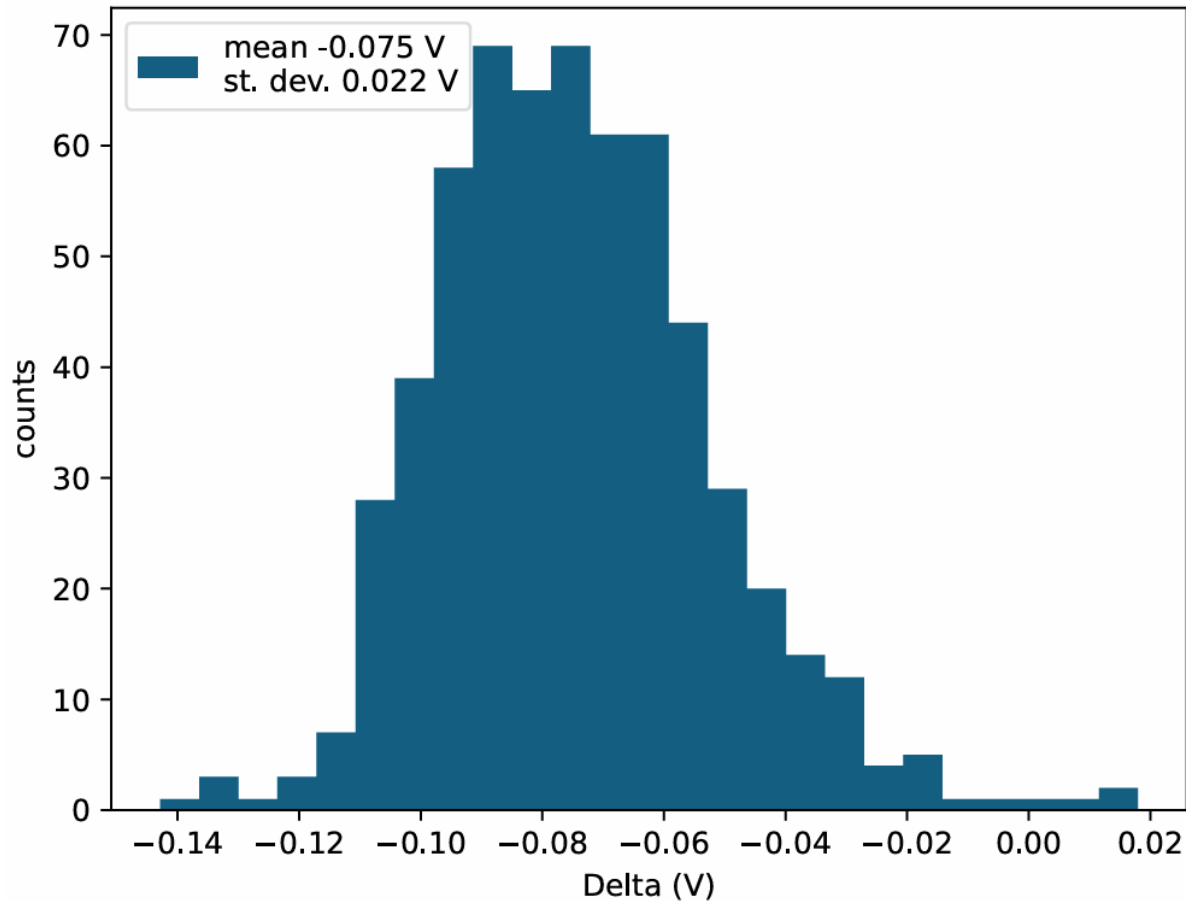
Method

- NFD
- SLD

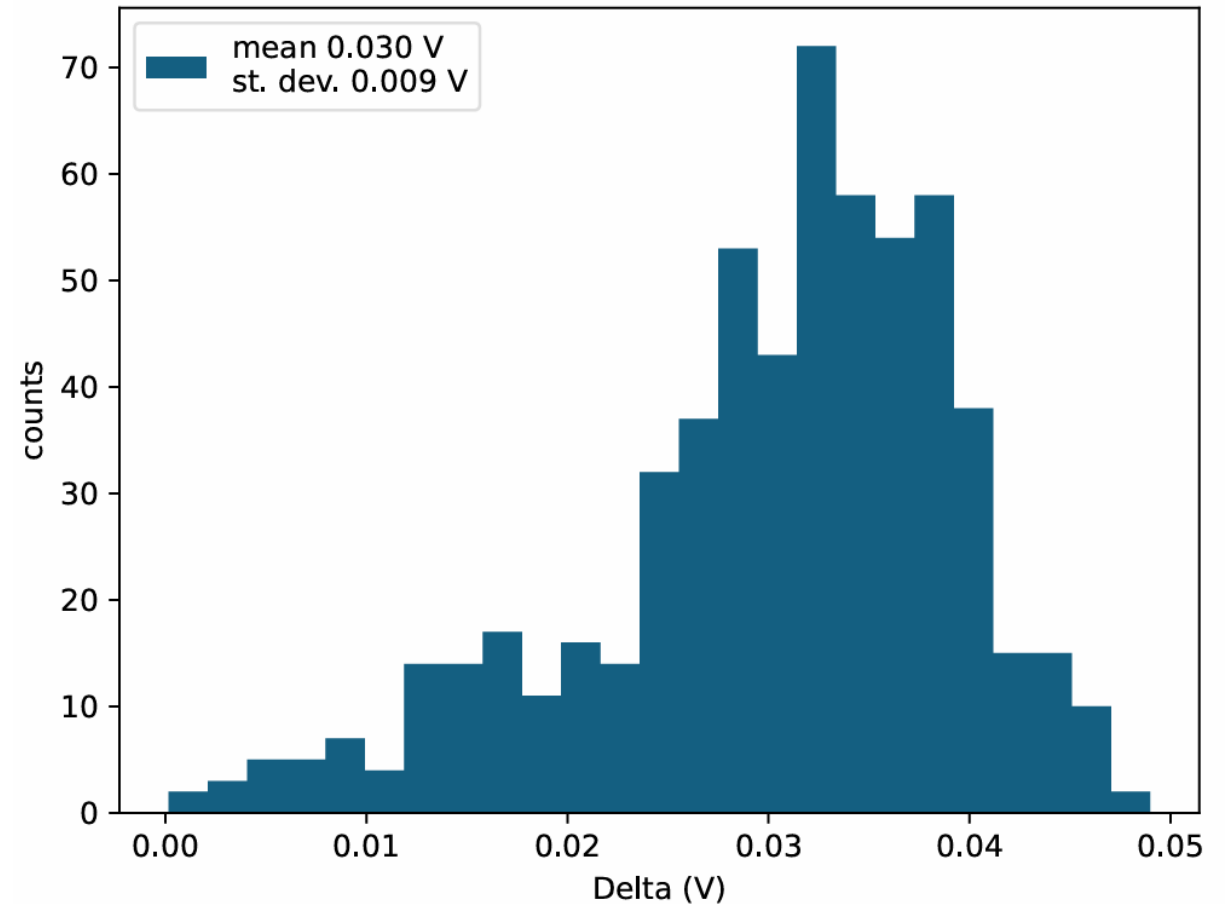


Results – V_{BD} distribution – parametric - differences

NFD differences (parametric)



SLD differences (parametric)



Conclusions

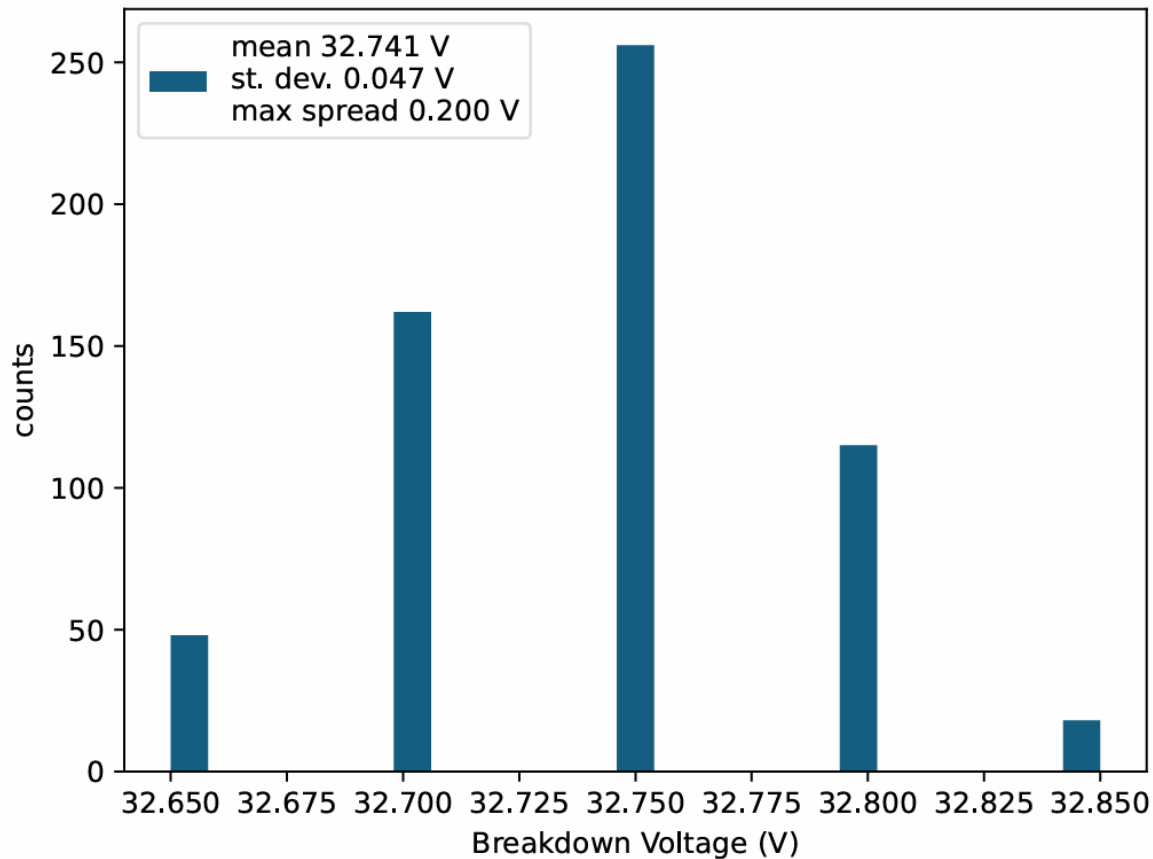
- **Comparison of CACTUS/FBK analyses on the same data set**
 - Parametric (wafer level) IV (**100 mV step**)
 - Packaging IV (**50 mV step**)
- **Need a finer resolution for grouping SiPMs**
 - waiting for data with higher resolution* from FBK

*50 mV step and 10 mV step

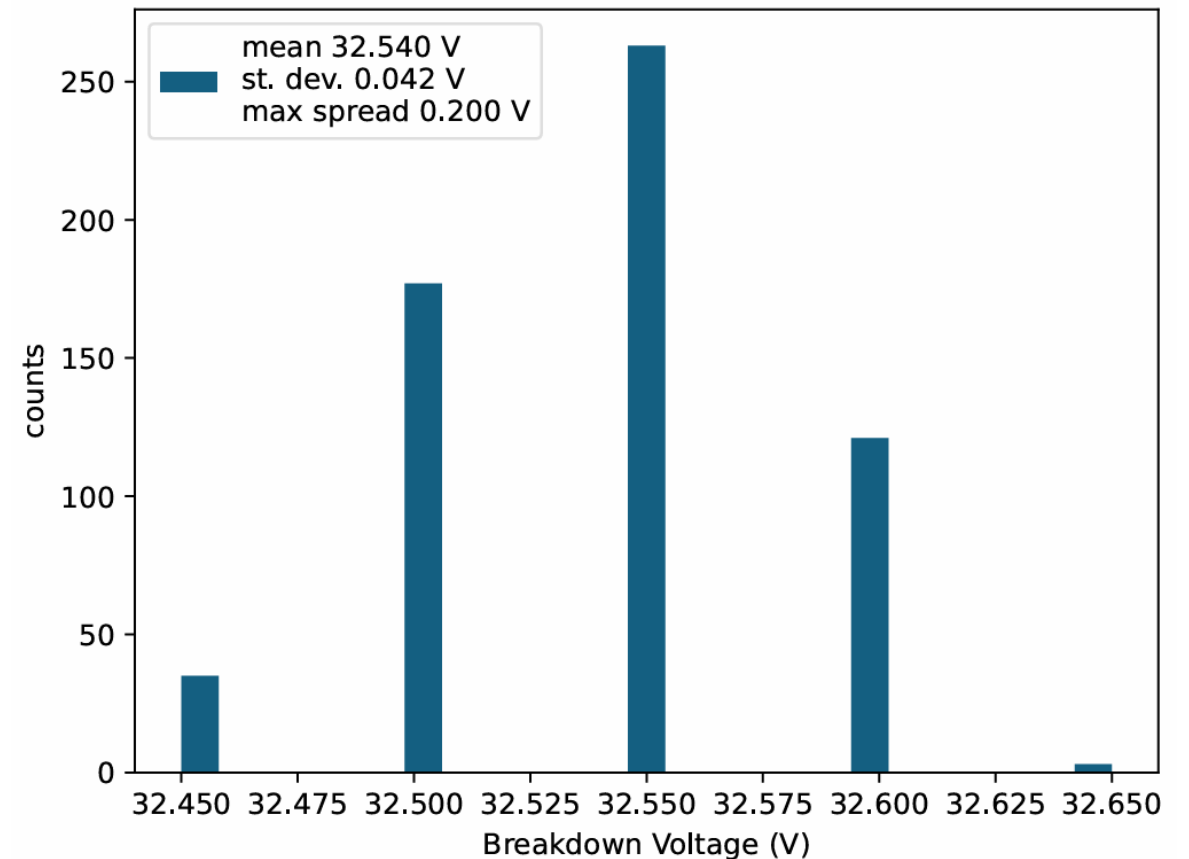
BACKUP

Results – V_{BD} distribution - packaging – max

V_{bd} distribution NFD max

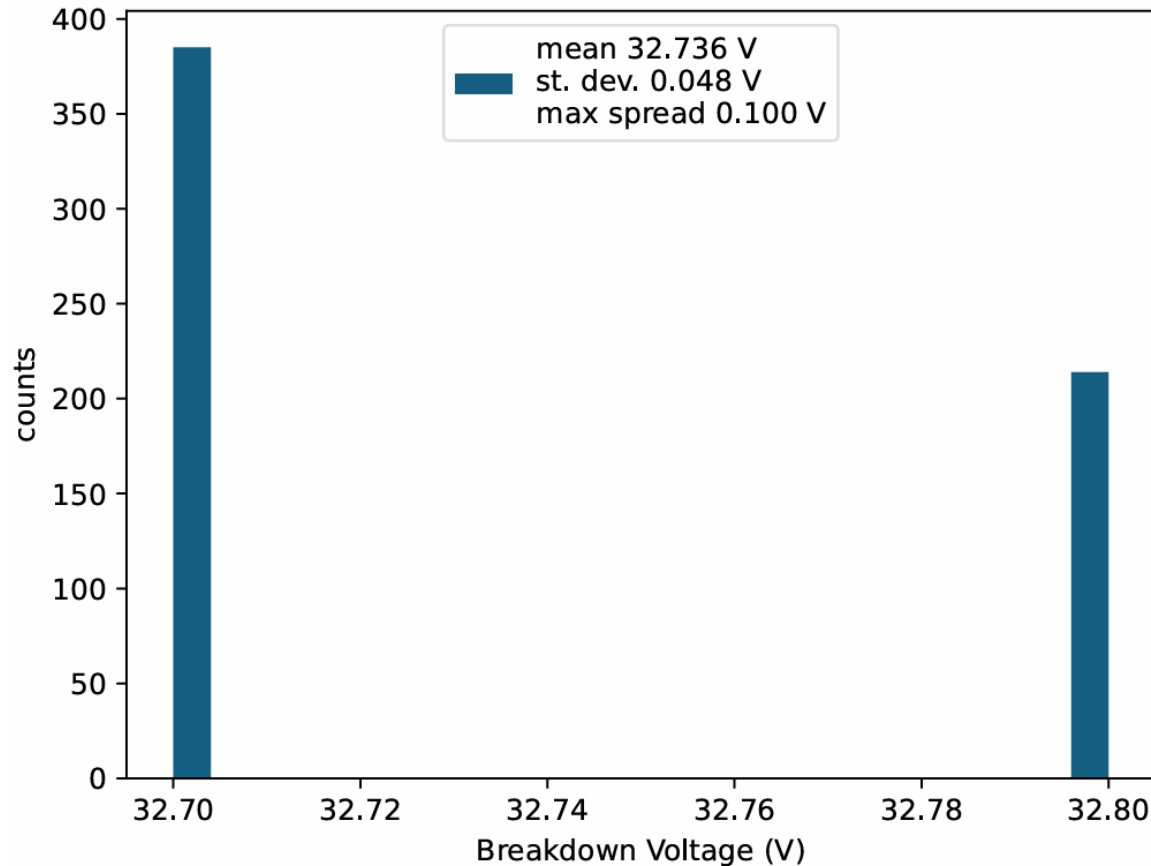


V_{bd} distribution SLD max

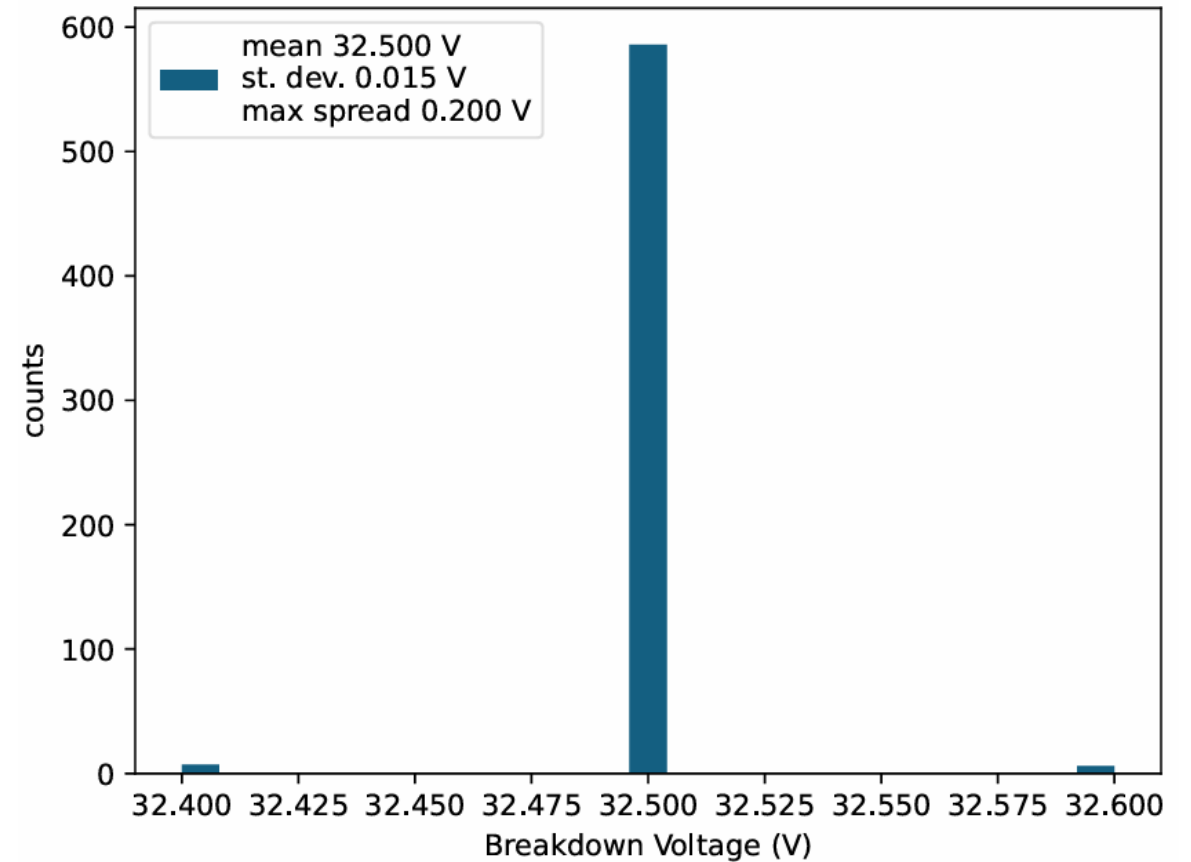


Results – V_{BD} distribution - parametric – max

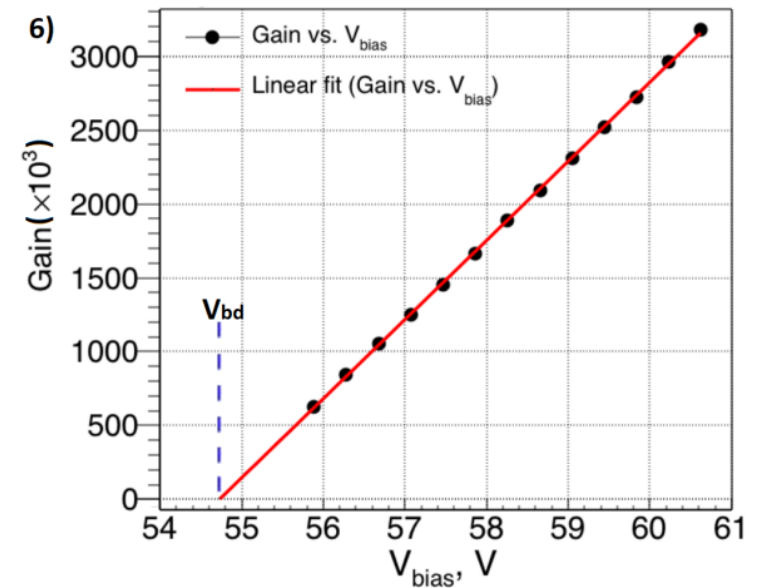
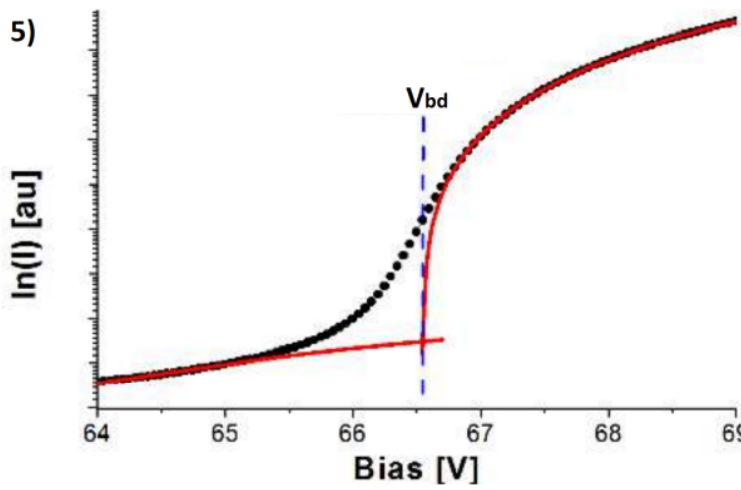
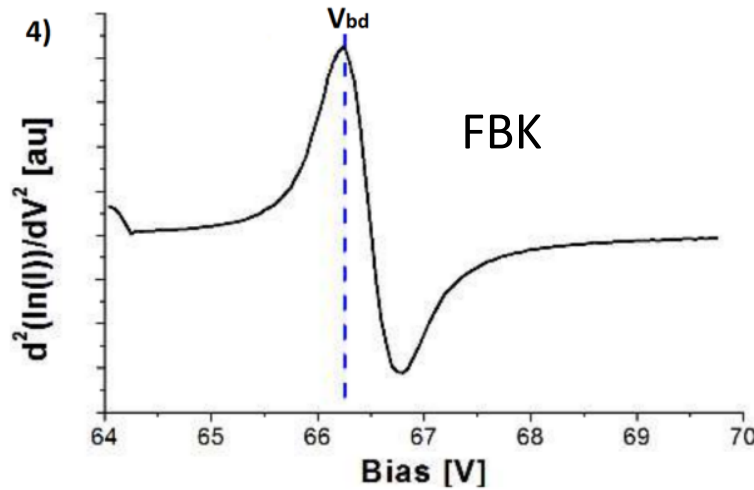
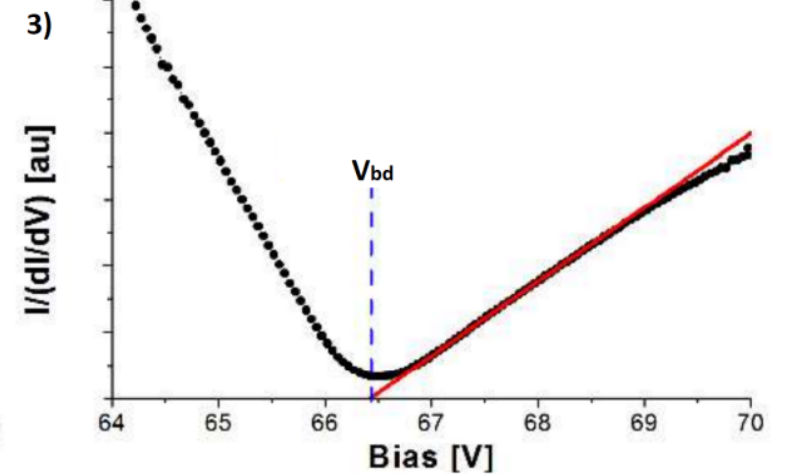
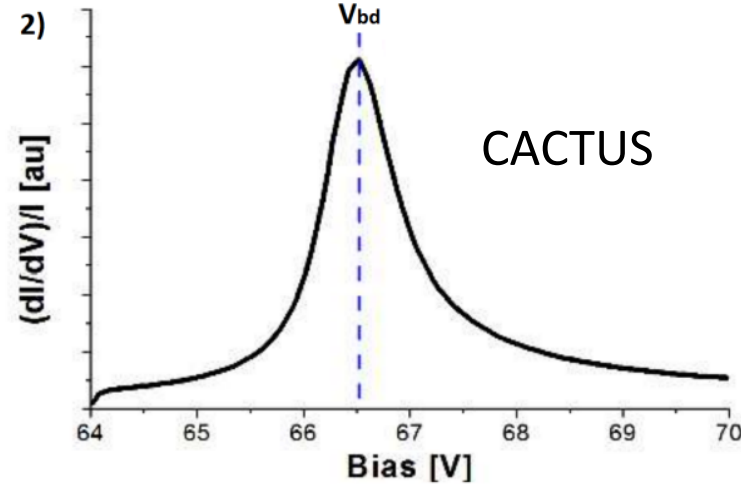
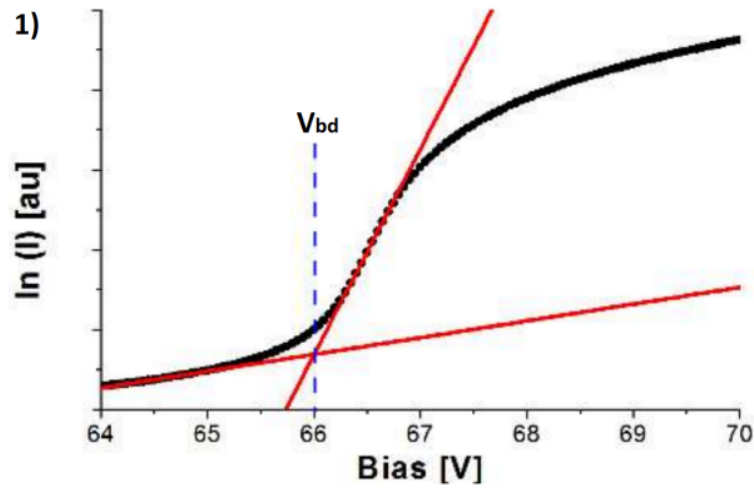
V_{bd} distribution NFD max



V_{bd} distribution SLD max



Reverse IV analysis methods



100 mV step, SLD maximum

