Update on SVT backgrounds

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Previous SVT TIC meeting report

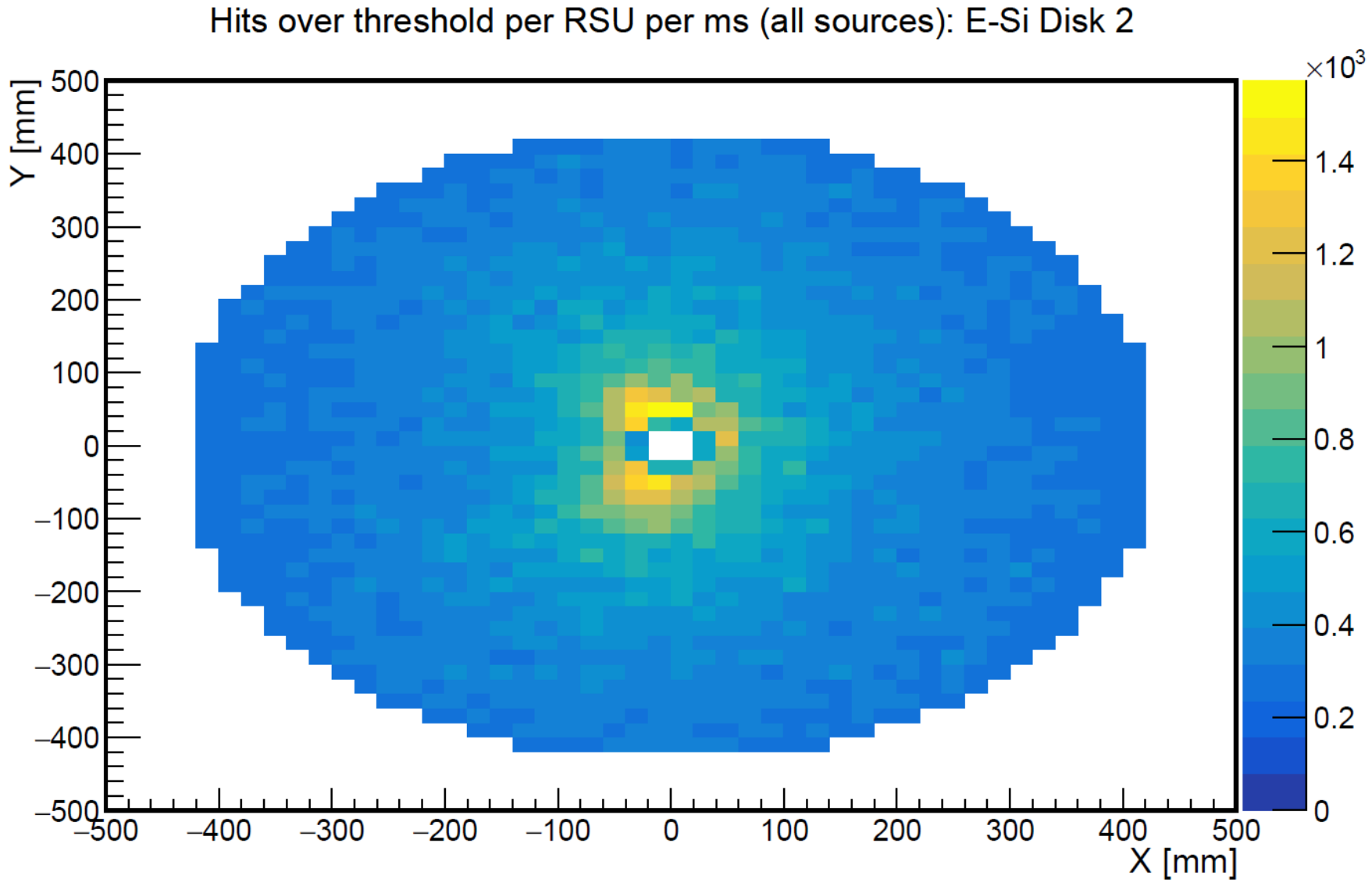
- Previous report was given on March 30th by Shujie. There were several main conclusions:
  1. At the highest electron beam current, SVT hit rates and data rates on the innermost layers are dominated by SR contributions. The SR rate is reduced significantly by increasing the gold coating thickness from 5 um to 10 um (https://github.com/eic/epic/pull/1059).
  2. With the 10-um gold coating thickness, the maximum average SVT data rate per readout unit is within the SVT bandwidth.
  3. Our track reconstruction can largely suppress tracks contaminated by or dominated by background hits if a requirement of at least 4 fit points per track is applied (https://github.com/eic/EICrecon/pull/2590).

Today's report

- Presentation of SVT hit rates subdivided by source
- Summary of ongoing background-related SVT and track reconstruction efforts

Example: Overall hit rates on Electron Endcap Disk 2

- March 2026 simulation campaign at **10x100 GeV setting** – highest electron beam current
- **540 eV hit threshold** used for all SVT layers
- 23.4 ms of data analyzed – 11,700 events (2 us per event).
- Plots all show **hits per ms per RSU.** That is, rates are averaged over 23.4 ms after binning in RSU-sized bins (2x2 cm wide).



Example: Overall hit rates on Electron Endcap Disk 2

All sources:

DIS

SR

Bremsstrahlung

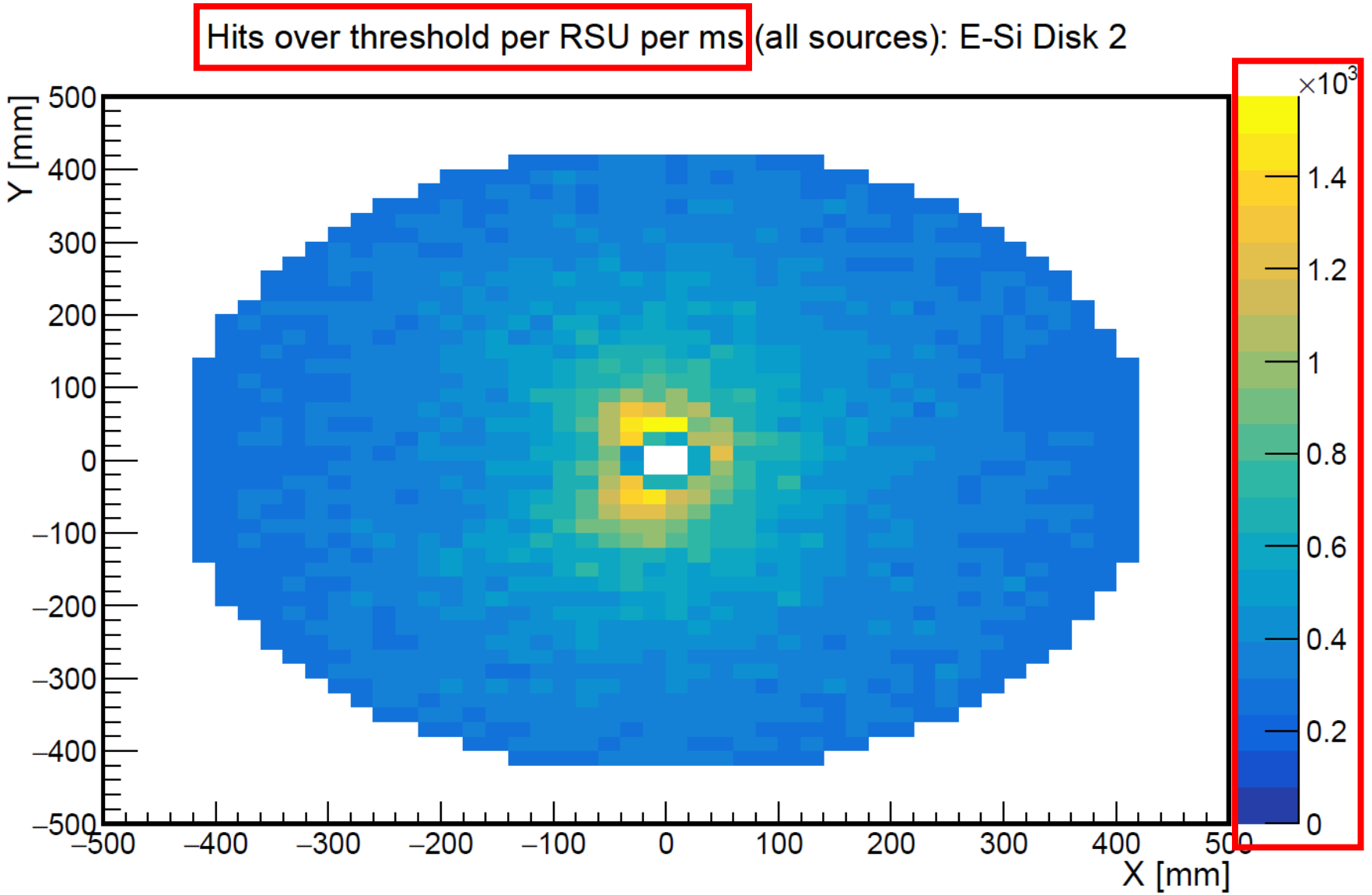
Coulomb

Touschek

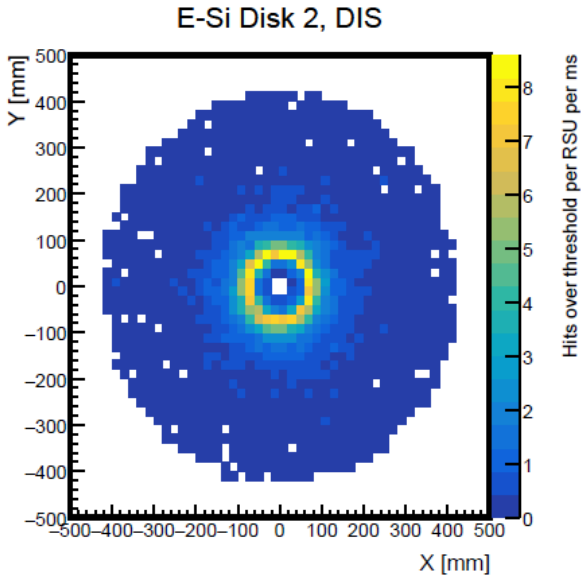
Proton beam gas

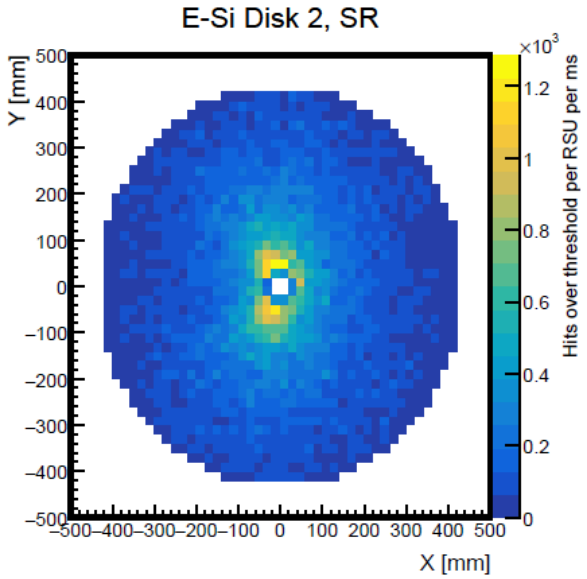
Noise: 250 pixels per RSU per ms

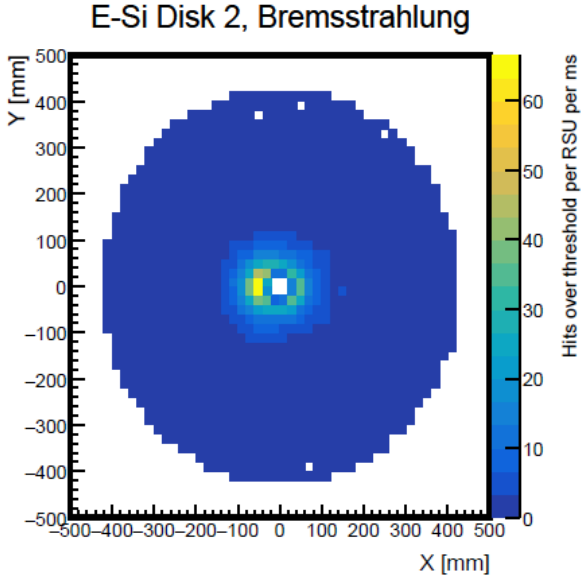
Noise calculated assuming 5×10^{-7} noise hits per pixel per 2us and 1000x1000 pixels per RSU.

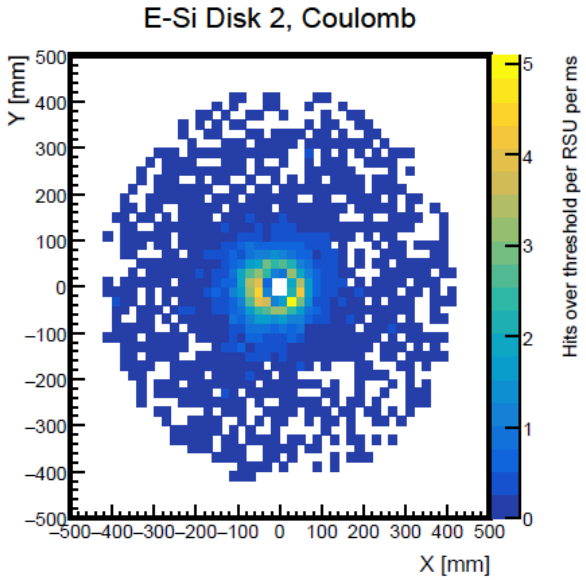


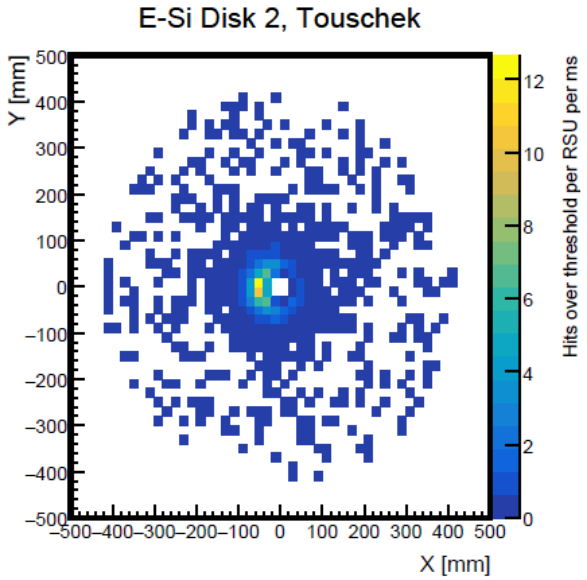
Hit rates on Electron Endcap Disk 2 by source

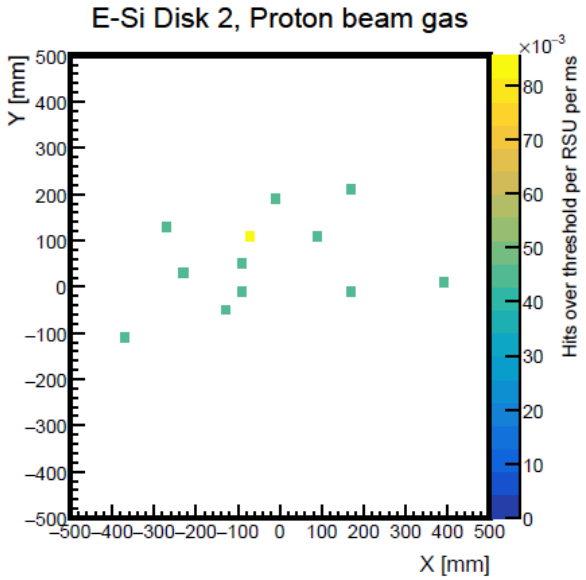






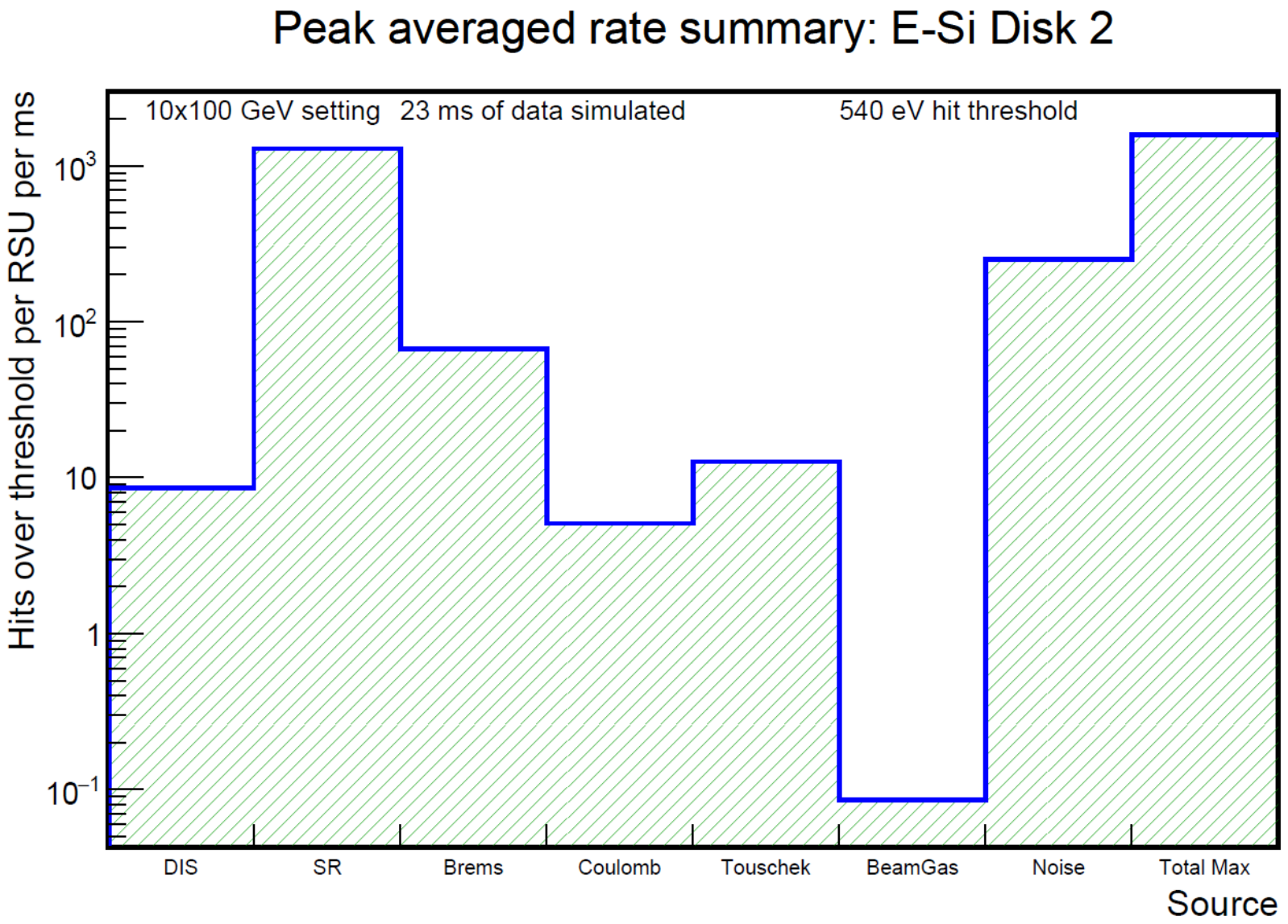






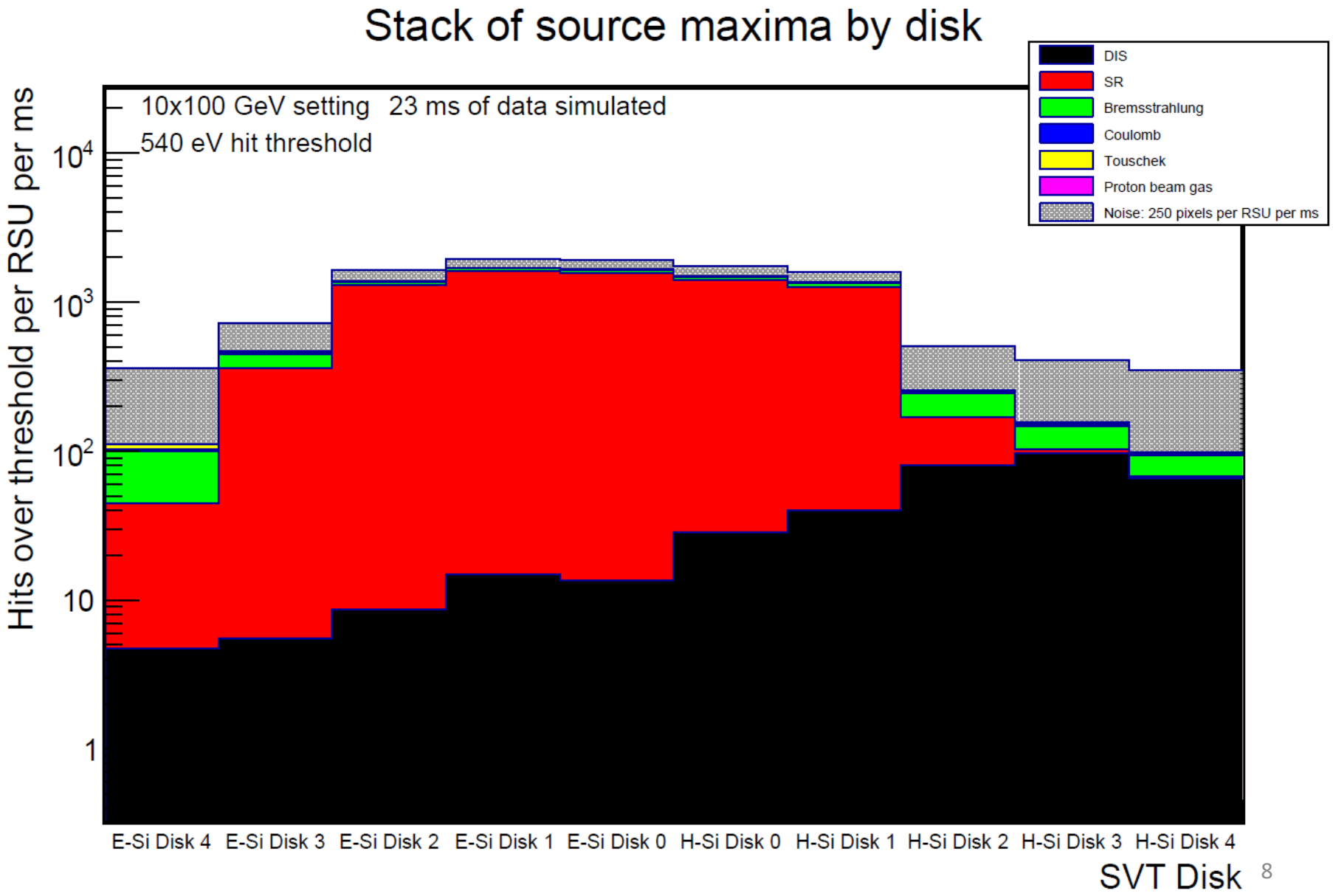
Hit rates on Electron Endcap Disk 2 by source

- Columns 1-7 show the rate on the RSU with the maximum average hit rate for that specific source.
- Column 8 shows the rate on the RSU with the maximum **total** average hit rate.
- Note that column 8 is **not** the sum of columns 1-7.

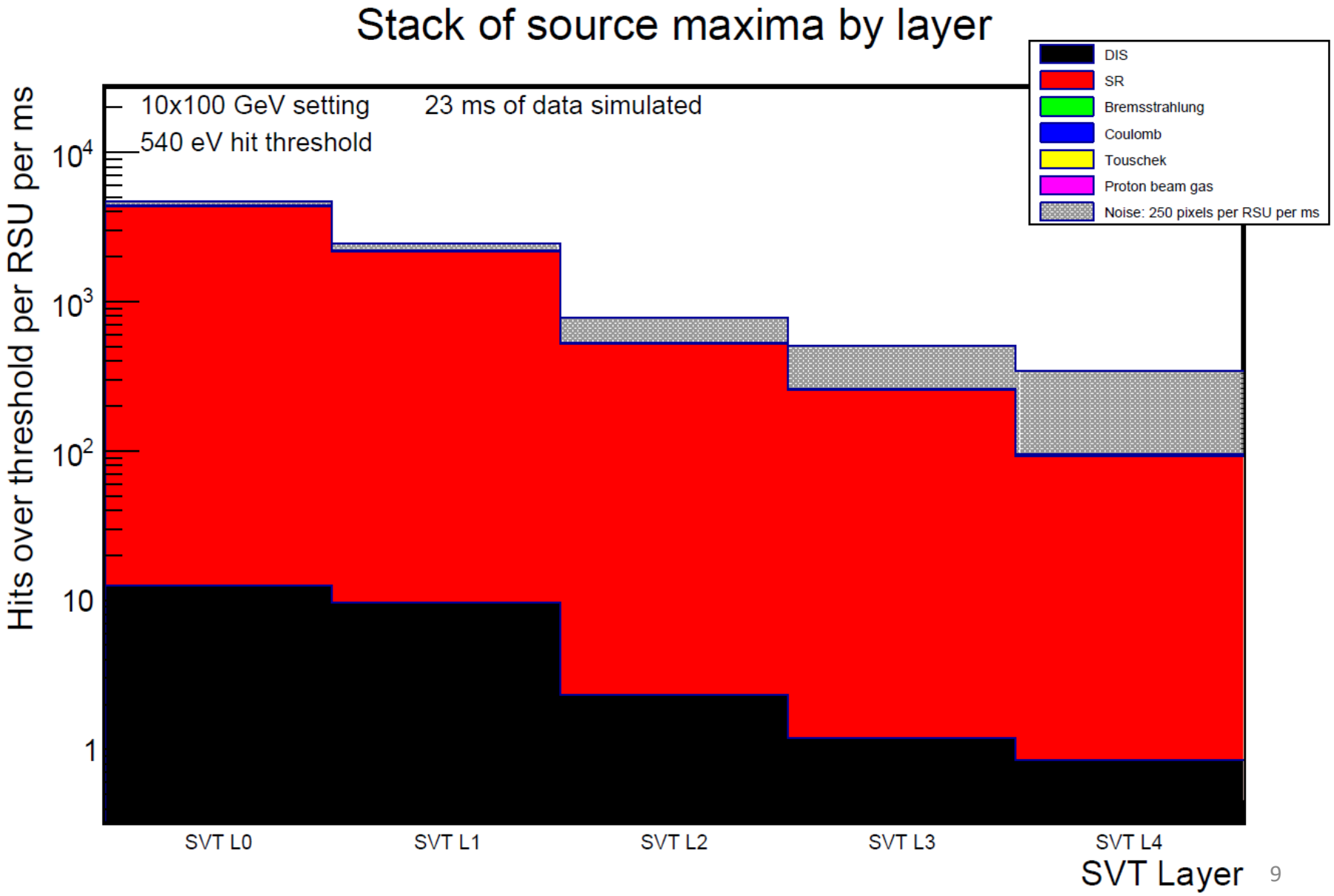


Summary of hit rates for SVT disks

- Similar plots as on the previous slides for the other SVT layers can be found in the additional attachment uploaded with this presentation.
- For each disk, the plot to the right shows a stack histogram of the max average rate for each source. For example, for E-Si Disk 2, it shows columns 1-7 on the previous slide.



Summary of hit rates for SVT Vertex and OB layers



Ongoing work

- SVT hit rates
  1. This presentation showed the average maximum hit rates by source. Work is ongoing to study hit-rate fluctuations. Future studies will use latest campaigns.
  2. Studies on sensor-response function, with impacts on data rates assessed.
- Track reconstruction
  1. Insertion of noise hits for all SVT layers into simulation.
  2. Better quantification of tracking performance in the presence of backgrounds. Figures of merit include: a) track hit efficiency; b) track hit purity; c) track efficiency; d) track purity; e) track chi-square. This will allow us to better study the impact of any SR mitigation, for example.