

# Update: GenAI for BIB Team

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# Progress so far: BIB generation

- We have \*even better\* flow models for all 6 tracker detector that are reasonably similar to the data
  - The current approach is to condition the flow on the side, layer, module, sensor
  - Currently, we must “snap” the z coordinates in the endcaps to the sensitive layer of the sensor
- Shiyu Peng (masters student at Brown) is currently working on a diffusion model for BIB generation

	AUC
Outer Tracker Barrel	0.642
Inner Tracker Barrel	0.618
Vertex Barrel	0.549
Outer Tracker Endcap	0.538
Inner Tracker Endcap	0.536
Vertex Endcap	0.548

Target for indistinguishability:  
AUC = 0.5

Total AUC: 0.548

```
Feature importances (full BDT):  
log($E$) [Gev]: 0.0299 ± 0.0000  
$t$: 0.0585 ± 0.0000  
$r$: 0.2580 ± 0.0000  
$\phi$: 0.0421 ± 0.0000  
$z$: 0.1224 ± 0.0000  
side (cond): 0.0803 ± 0.0000  
layer (cond): 0.0839 ± 0.0000  
module (cond): 0.1797 ± 0.0000  
sensor (cond): 0.1453 ± 0.0000
```

Correlations are modeled well. R-modeling (particularly in the barrels) is the limiting factor

# Progress so far: digitization and reconstruction

- Setting ForceHitsOntoSurface in DDPlanarDigiProcessor: **force hits** to sensor:
  - Vertex detector efficiencies look very close to MAIA neutrino gun with this flag enabled.
  - Inner/outer trackers now significantly **more** efficient.
  - We know up to 50% of hits were rejected as out-of-bounds in the official MAIA sample.
- Compare against **updated ML sample** with better AUC.
- Digitization efficiencies in barrel higher but still order of magnitude too low.

Subdetector	MAIA $\nu$ Gun	ML Sample	ML, Forced	ML Sample v2	ML v2, Forced
VB	0.174	0.005	0.196	0.025	0.197
VE	0.264	0.327	0.327	0.314	0.315
IB	0.307	0.006	0.500	0.025	0.467
IE	0.372	0.333	0.498	0.507	0.515
OB	0.167	0.009	0.271	0.011	0.269
OE	0.263	0.309	0.488	0.447	0.487

# Open Tasks and next steps

- Diagnosing why the barrel efficiencies are too low
- More non-AUC evaluations of the BIB AI samples