Disappearing tracks signals update

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Viktor Kutzner

Disappearing tracks signals

- benchmark model `27_200970`
- m(Chi) = 1800 GeV, m(gluino) = 1400 GeV
- N = 100k events
- production with old/new recipe for CMSSW 8/10

	2016 geometry				**2017 geometry**			
ctau [cm]	**10**	**30**	**50**	**100**	**10**	**30**	**50**	**100**
GEN-SIM	✓	✓	✓	✓	✓	✓	✓	✓
GEN-SIM-RAW	✓	✓	✓	✓	✓	✓	✓	✓
AOD	✓	✓	✓	✓	in progress			
miniAOD	✓	✓	✓	✓				
nTuples	✓	✓	✓	✓				

- 50k events available from nTuples:
  /nfs/dust/cms/user/kutznerv/SignalMC(-CMSSW10)

Disappearing track tag

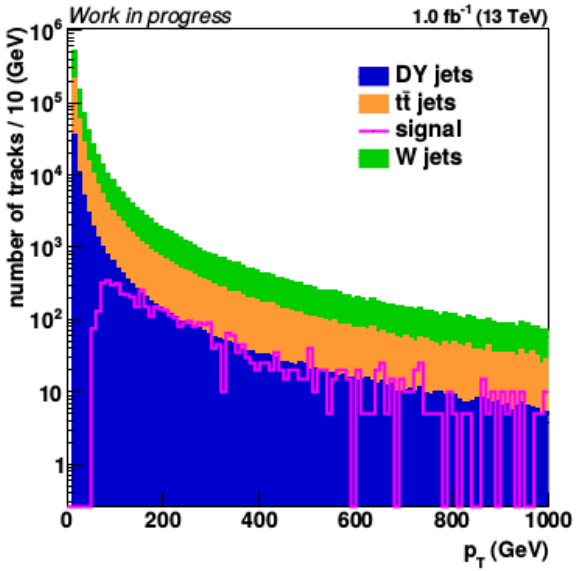
- use added statistics to improve BDTs for signal categories
- shown here: short tracks, best significance for RGS

cuts obtained by RGS for short tracks:

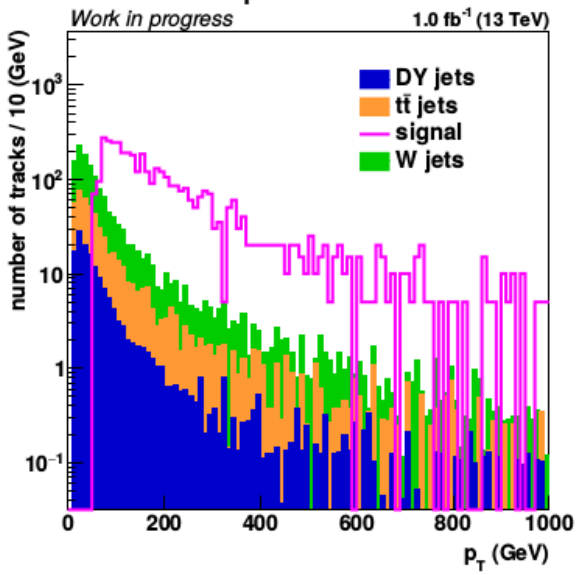
$p_T > 15$ GeV	abs. isolation < 10 GeV
$\lvert\eta\rvert < 2.4$	valid pixel hits ≥ 3
$\lvert d_{xy}\rvert < 0.007$ cm	valid tracker hits ≥ 3
$\lvert d_z\rvert < 0.01$ cm	missing outer hits ≥ 2
$E_{\text{dep}} < 16.3$ GeV	no missing inner hits
rel. isolation < 0.2	$\Delta p_T / p_T^2 < 0.09$ 1/GeV

short tracks	$s/\sqrt{s+b}$
before cuts	0.05
hand-picked cuts	1.19
RGS cuts	**1.60**

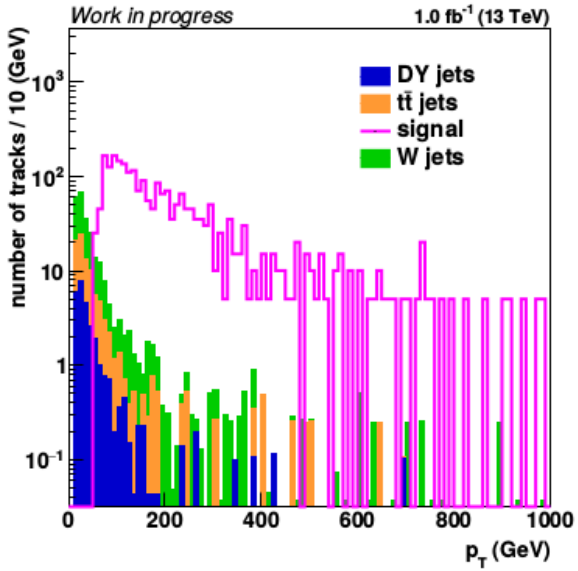
before cuts



hand-picked cuts



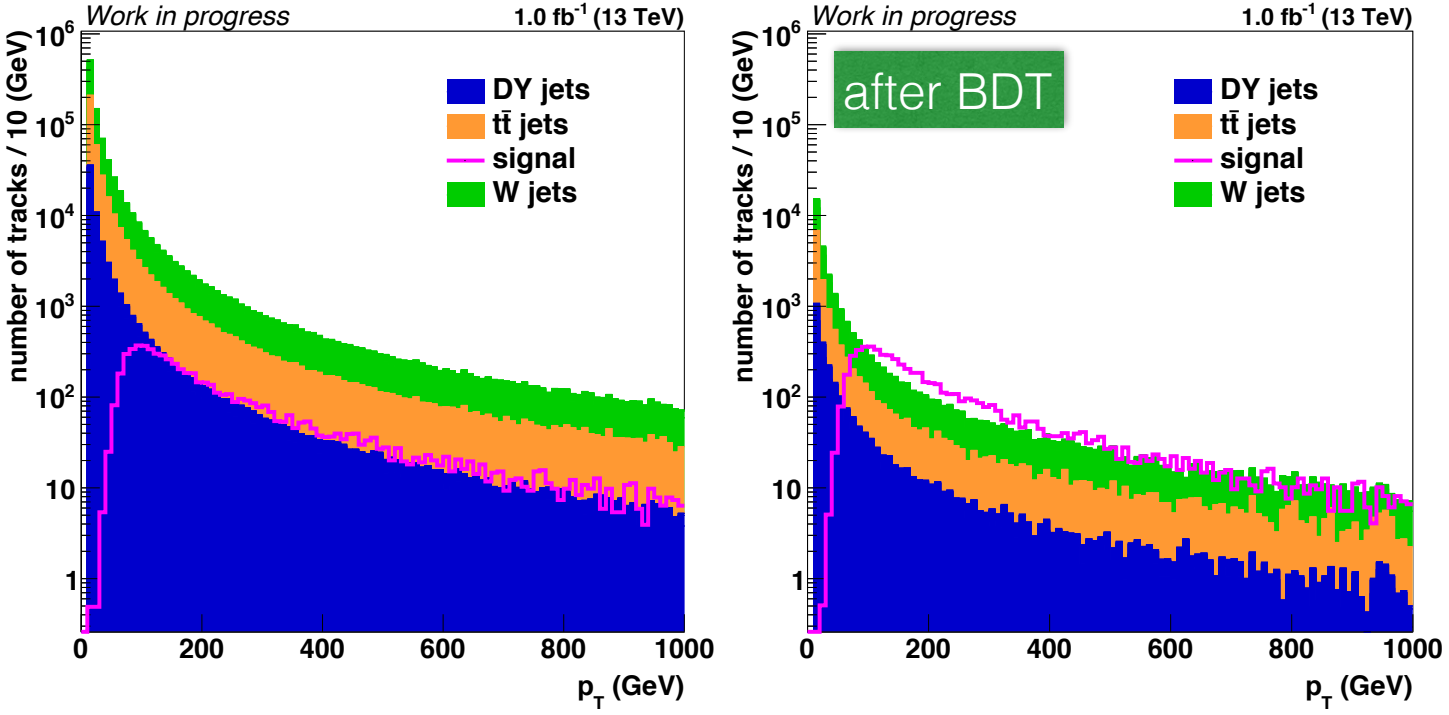
RGS cuts



Disappearing track tag: BDT

- short tracks category
- preselection for ntuples: pT>10 GeV
- BDT: NTrees = 200, max. depth = 4. Further cuts applied in TMVA:

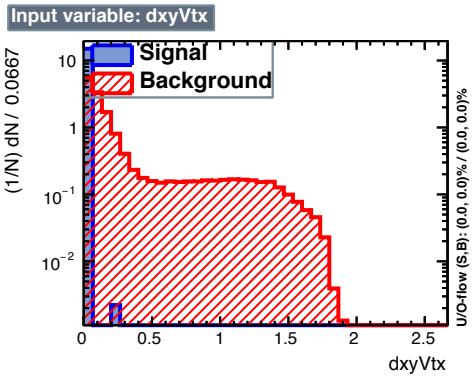
pT	lηl	PF lepton veto	rel. iso.	missing inner hits
> 15 GeV	< 2.4	yes	< 0.2	0

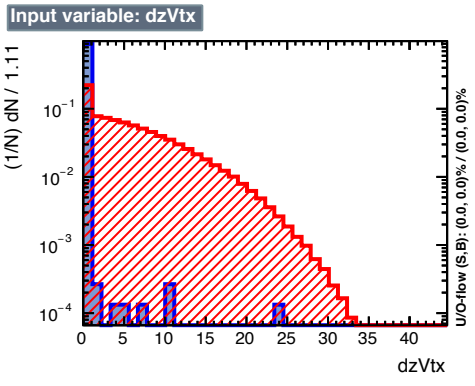


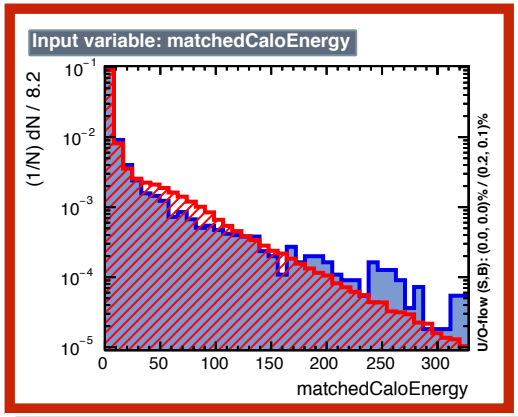
- significance after applying BDT: s/√(s+b) = 0.39

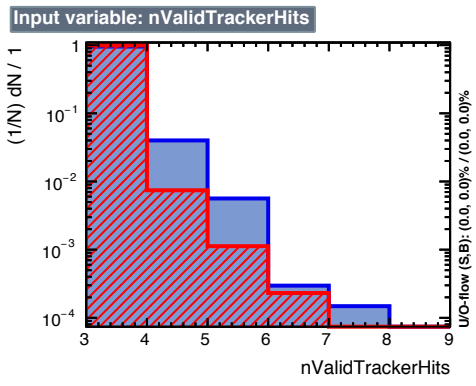
Disappearing track tag: BDT

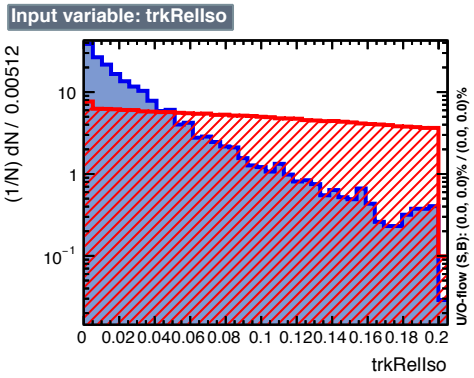
- used weighted signal / backgrounds samples
- input variables:

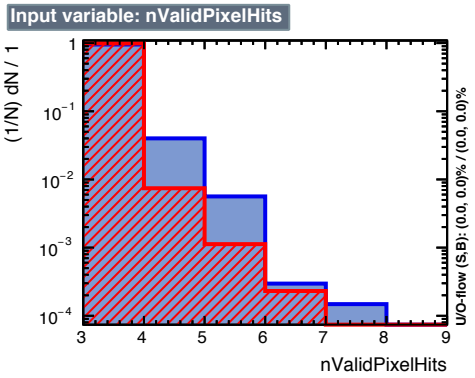


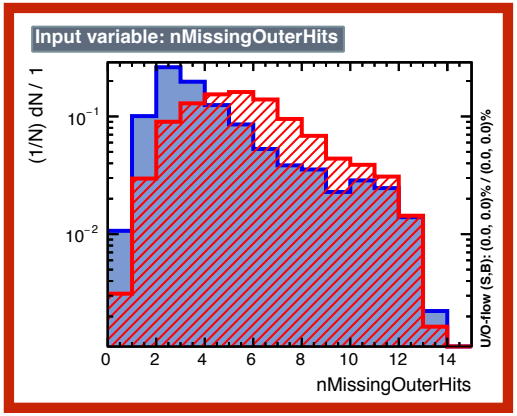


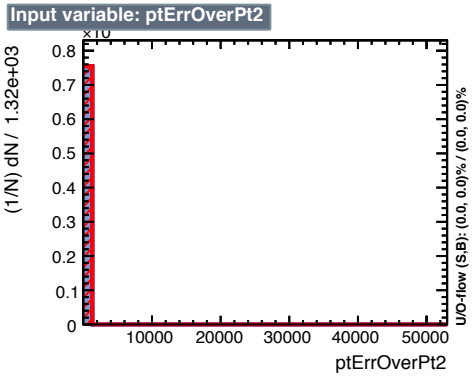


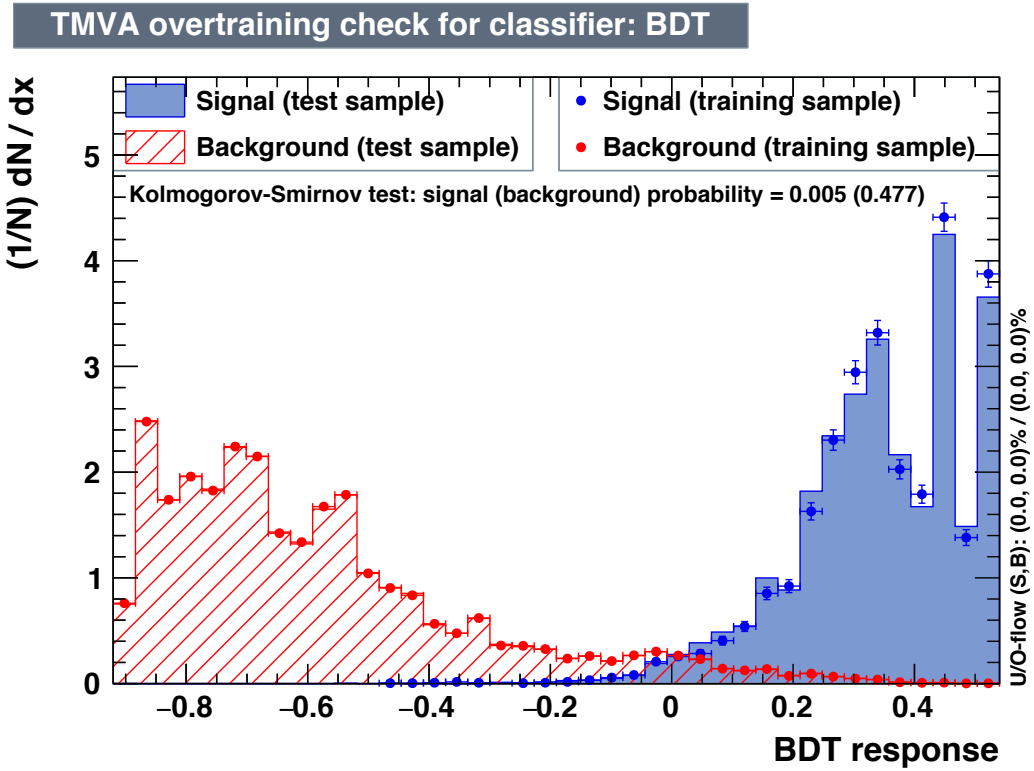




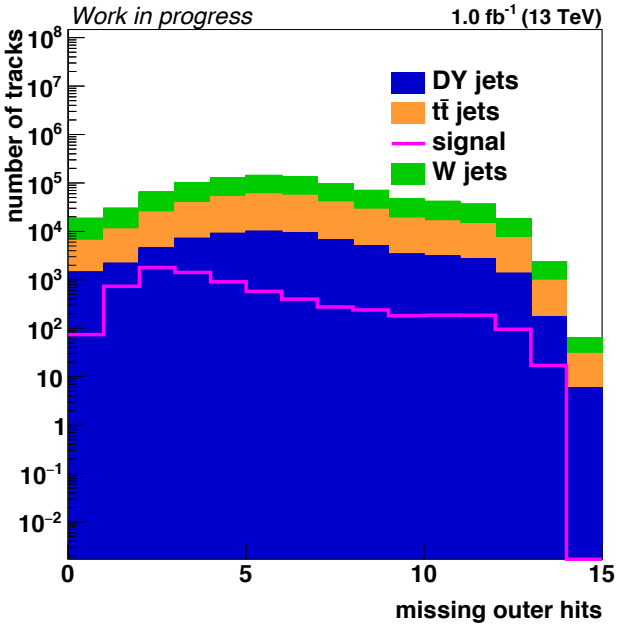


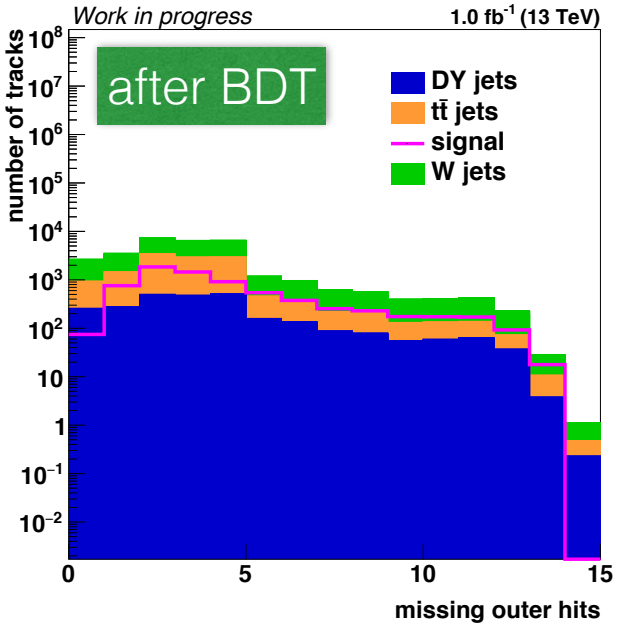


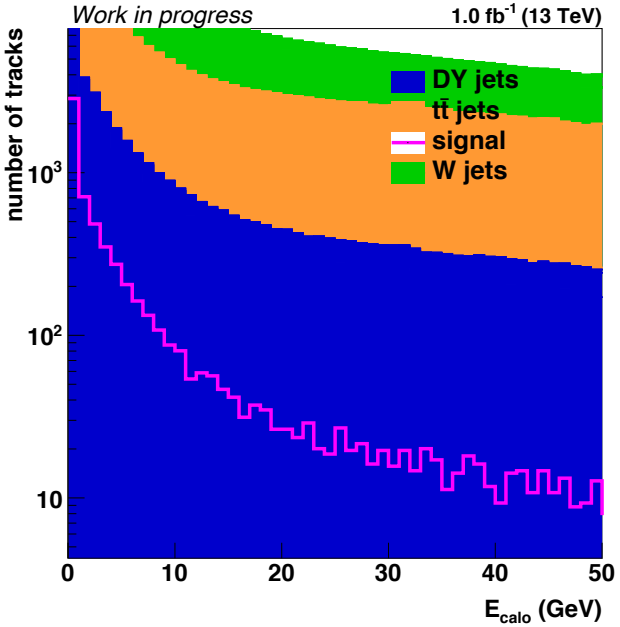


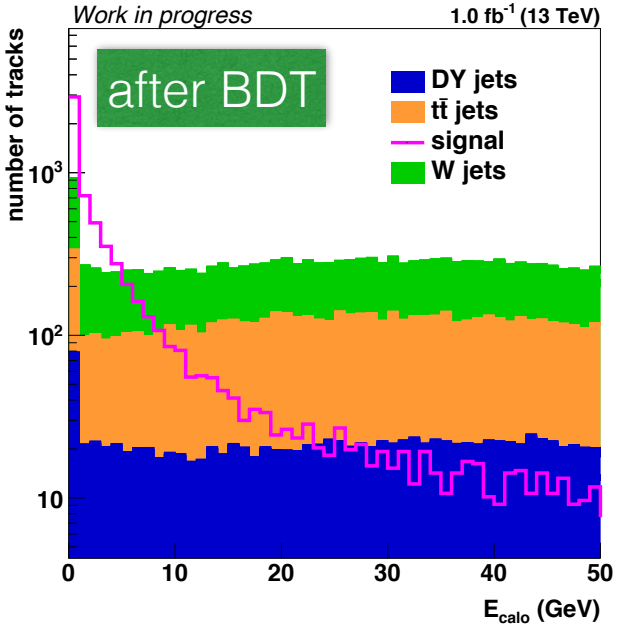


Disappearing track tag: BDT





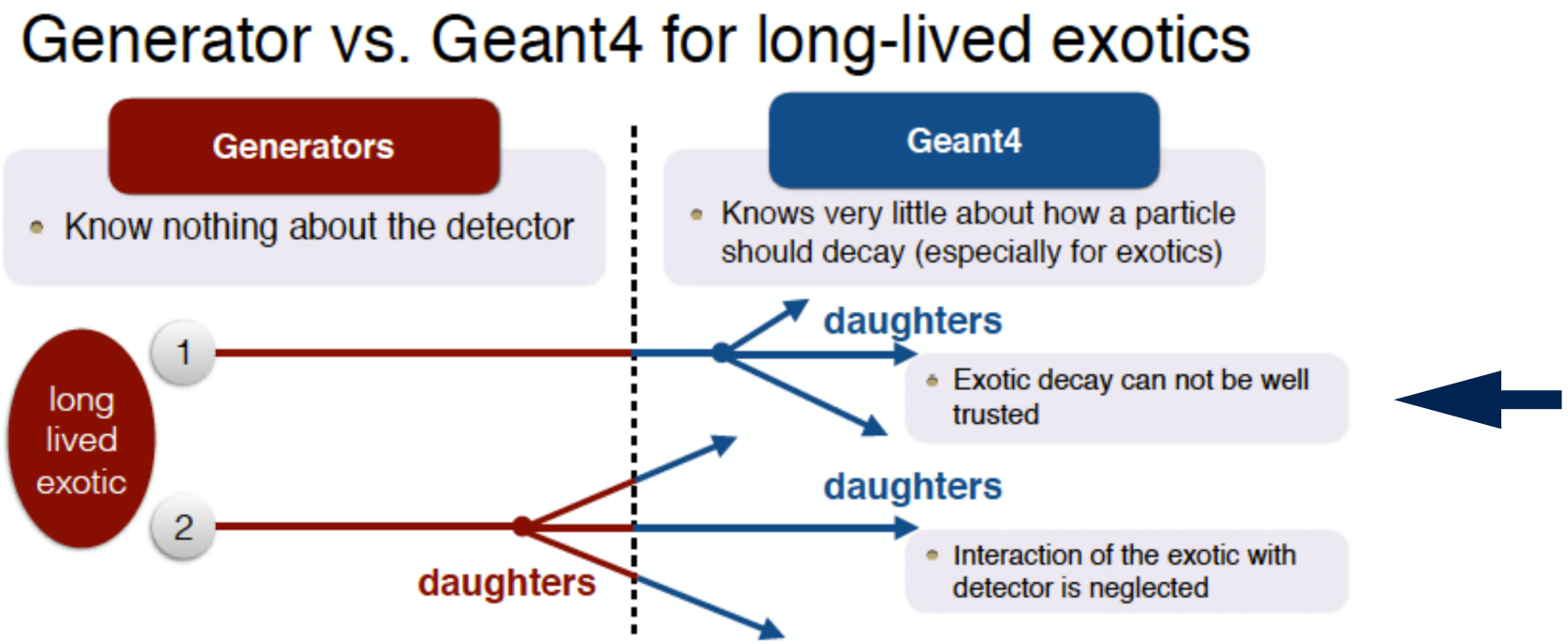




- don't expect large discrepancy in significance,
- expecting better BDT performance with increased statistics

Backup

Long-lived chargino decays



- simulate decay of LL charginos inside of detector volume
- available GEN-SIM recipe from EXO group for CMSSW 7_1_25_patch1:
  - events generated with Pythia8, consider charginos as stable at this stage
  - decay of charginos handled by Geant4 with chosen lifetime