Hello eveyone, this is Chengxin, I will present recently result about C1N2 ISR on behalf of IHEP SUSY group.  
  
This report will include SRs definition, bkg estimation and initial result. Now we can start it.

As we all know, SUSY is an elegant theory that can resolve several problems in SM, and for now, the exclusion limits on the strong production of SUSY particles are tight, but in electroweak are relatively loose. This report will search chargino 1/ neutralino 2 production via stau/snv decay with ISR in compressed region.   
  
In previous search for this scenario, there is no sensitive show in the red-circle region, our analysis will focus on this region, here we require ISR to boost the susy system and improve the sensitivity. For the search strategy, we use BDT method to optimize SRs, about fake taus, we use fake factor method to estimate, about real taus, we define some CRs to scaled them, and validate them in validation region.  
  
ok now, We can move to the preparation before analysis, for Ntuples, we produced them by MelAnalysis framework with DAOD PHYS, and p-tags we used listed here. Our dataset include full Run2 + partial Run3 data. The main background show in table. And for our signal grid request show in the below figure, in basic grid we use 2tau filter, and in compressed region we use 1tau filter to increase events, the reference point for ML is (100, 70).

For object definition, we follow the EWK group recommendations except the tau pt in baseline decrease from 20GeV to 15GeV since we care soft tau performance here. The full configuration include in these 2 links.  
  
For Overlap removal, we follow the SUSYTools recommendation with tau overlap removal. The detail about the strategy shows in this table.  
  
Since the final state include large MET, here we use MET trigger, and trigger we use show in the table.  
  
Ok, that’s all for the preparation part, we can move to the analysis result.  
  
The right two tables show the pre-selection for the HH channel and LH channel, they are quite similar and only different in tau and lepton selection. Here require jet pt cut to select ISR, b-veto to suppress Top events and invariant mass cut to suppress Z+jets events. About ML, here we use grid search to find the best model with penalty function to balance AUC and overfit. More detail about AUC curve shows in the backup.

First we can see the result in HH channel, we apply score cut at 0.8 to define our signal region and separate into three bins. We can see the binned SR show in the right one figure, and detail about event yields for these three bins show in below table and dominate bkg is fake, VV, the last row give me significance for each bin. The combined Zn for this region is 7.56, it looks good.  
  
For the fake estimation, I already mentioned that we use fake factor method. we define two types of regions to calculate fake factor. one called CR which have similar selection with LH channel, and the other one is SR which have similar selection with HH channel. I know the name use here is quite weird. For each region, we categorize taus based on their ID status: 'ID' refers to taus passing the medium identification, while 'Anti-ID' refers to those passing only the VeryLoose criteria but failing medium. The illustration for fake factor please see the right one figure. For fake calculation, we employ a three-dimensional binning scheme. For prongness, we separate tau into 1-prong and 3-prong. For tau eta, we split that into two bins based on barrel and endcap and we also split barrel bin into two bins to apply in 1-prong. And about tau pt bin, we use auto-binning algorithm. The result shows in the right bottom two figures and the legend corresponds to the specific bin definitions.

Here is the score distribution and some kinematic distribution that used in the training after data-driven and more data/MC can find in the backup. we can see that the agreement of MC and data here looks good.  
  
besides the SR, we define CRs and VRs, each targeting specific processes such as Z+jets and Top. The selection for these regions is similar except use difference kinematic variable to define, as you can see in this table. for these variable distribution show in below figures. Key metrics include purity and data/MC. The fake VR shows excellent agreement and high purity, and the ZCR/VR and VV VR exhibit slightly over-prediction, but it’s acceptable.

Now we can move to LH channel, which is similar in approach to HH channel, just change to score cut to 0.91, and separate into 3 bins. Details for event yields in binned SR show in the table which have same trend with HH channel.

Also for the bkg estimation, it follows the same process, but we can compare the key metrics with HH channel, we can see that the result is better than HH channel, since these region are all dedicated region. We may only define CR in LH channel, the CR in HH channel change to VR.  
  
For the initial result, we show that with sensitivity map, all signal grid with 30% flat systematic uncertainty, the black line stand for the Zn with 1.64. as you can see, the low C1 mass show great sensitivity. For now, the result only for Run2 sample, but it will update to Run2 + partial Run3 sample. There are some holes in the map, that caused by interpolation algorithm, to avoid that, we may change the way to show the result or find better algorithm to fit.  
  
Ok, so next step we will include more signal points in the ML to expand the exclusion limit. And systematics studies is curial but we don’t have any initial result for now, so we will focus on this part in the future work. And That’s all, Thanks!