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# NOTE

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**Name:** First processing of r33-22

Date: Dec 2021

Input (CxAOD maker output): HIGG2D4, PFlow\_UFO, mc16a, mc16d, mc16e, data 2015-16, 17, 18

Configuration file: /nfs/kloe/einstein4/HDBS/ReaderOutput/reader\*

Main configuration features:

pDNN scores: none

Location: /nfs/kloe/einstein4/HDBS/ReaderOutput

Comment: EJS has run the latest version of the CxAODReader on all the available MC and data at the time.

Update 28-01-2022: these data have been regenerated (and overwritten) following a fix in the Reader (Radion weights were too small)

Update 24-02-2022: these data have been regenerated (and overwritten) following additional fixes in the Reader (including condor → eos direct writing)

This run of the Reader has been performed with the **pDNN turned off**, as the flat ntuples are meant to be used to train the pDNN.

>>> completo, ma ***IS\_VBF=0 sempre => utilizzabile solo per ggF/DY***  
**— capire quale baco (di configurazione del Reader porta a questo)**

>>> significanza per HVT, Radion(adesso si può' con questo campione), RSG merged e resolved in modalità di produzione GGF/DY

- a che punto siamo ?

- binning di massa invariante ?

- istogrammi di controllo ??

# NOTE: BINNING X MASS INVARIANTE ?

## Resonance Finder

RF **documentation** is [here](#).

RF **tutorial** from a DBL workshop (Fall 2021) is at this [link](#).

### Instructions

(adapted from Rob Les)

After downloading and installing, make the workspaces out of the box with:

```
python /eos/atlas/atlascerngroupdisk/phys-hdb/dbl/VVsemilep2nd/RFScripts/VVSemi_fromNtuples.py 2MergSR 1000
```

the first option specifies to include **2-lepton Merg SR** and the second is the mass point. The output workspace will be in directory output/ws/.  
The python script is copied /afs/le.infn.it/project/itk/VVsemilept\_2nd/RF/ where new adapted scripts are collected.

Similarly to run with PNN score just add that to the first option:

```
python /eos/atlas/atlascerngroupdisk/phys-hdb/dbl/VVsemilep2nd/RFScripts/VVSemi_fromNtuples.py 2MergSRPNN 1000
```

You can run the limits and plot the result then using the scripts in the NPCheck directory: <https://gitlab.cern.ch/rles/NPCheck#limit-and-p-value-plots>

### Extra considerations and info

The RF fills histograms of mVV with number of events using weights stored in the tree from the Reader computed according to the luminosity set in the Reader configuration file. Signal samples get weights defined not in terms of the theory model, but based on the arbitrary assumption of a cross section of 1 fb. Hence the  $\mu$  parameter (signal strength) obtained in the fit directly provides a limit on a cross section measured in units of fb.

If the Reader had been run for 36/fb and you want to scale the limits up to 139/fb you can add lines like this to RF:

**RFAnalysis.scaleSample(sampleName, 139./36)**

Uneven binning is not handled by the underlying RooFit package: the histograms are converted into histograms with the range 0-100 size bins. The Likelihood analysis is clearly not affected.

The binning of the the mVV distributions used for the 2L SR in the fits in Eur. Phys. J. C (2020) 80:1165 can be found [here](#)

Expected limits (only) can obtained by setting `dataName="asimovData"` in <https://gitlab.cern.ch/rles/NPCheck/-/blob/master/runLimits.py#L152>.

Otherwise is data are not available, since they are requested by the RF, the **fakeData** option \*should\* make the data the same as the sum of background with poisson errors (to be checked by Rob).

# NOTE: BINNING X MASS INVARIANTE ?

## SR: Resolved regime, ggF and VBF

```
374 binInfo=[] #store c-style bin arrays in a python list to keep them in memory
375 for region in regions:
376     bins=[]
377     # binning for SRs
378     if "SR" in region:
379         if purity=="Res":
380             if prod=="GGF":
381                 if leptonChannel==2:
382                     if "Tag" in region:
383                         bins = [300,320,350,380,410,440,480,520,560,600,650,700,750,810,870,940,1010,1090,1170,1260,1360,1460,1650,3000]
384                     elif "Untag" in region:
385                         bins = [300,320,350,380,410,440,480,520,560,600,650,700,750,810,870,940,1010,1090,1170,1260,1360,1460,1570,1690,1820,1960,2110,3000]
386                     else:
387                         bins = [300,320,350,380,410,440,470,500,530,560,600,640,680,720,770,820,870,930,990,1060,1130,1210,1290,1380,1470,1570,1680,1790,2140,3000]
388             if leptonChannel==1:
389                 if "Tag" in region:
390                     bins = [300,340,390,440,490,540,590,650,710,770,840,910,990,1070,1160,1250,1350,1460,1570,1690,1820,1960,3000]
391                 elif "Untag" in region:
392                     bins = [300,340,390,440,490,540,590,650,710,770,840,910,990,1070,1160,1250,1350,1460,1570,1690,1820,1960,2150,3000]
393                 else:
394                     bins = [300,340,390,440,490,540,590,650,710,770,840,910,990,1070,1160,1250,1350,1460,1570,1690,1820,1970,2120,3000]
395             if prod=="VBF":
396                 if leptonChannel==2:
397                     if decay=="ZZ":
398                         bins = [300,320,350,380,410,440,470,500,540,580,620,660,710,760,810,870,930,990,1060,1130,1210,1290,1380,1470,1630,1790,3000]
399                     else:
400                         bins = [300,320,350,380,410,440,470,500,540,580,620,660,710,760,810,860,920,980,1040,1110,1180,1250,1330,1410,1640,1870,3000]
401             if leptonChannel==1:
402                 if decay=="WW":
403                     bins = [300,340,390,440,490,540,590,650,720,780,850,920,1000,1080,1170,1270,1370,1480,1600,1730,1860,3000]
404                 else:
405                     bins = [300,340,390,440,490,540,590,650,710,780,850,930,1020,1110,1210,1320,1440,1560,1690,1830,1990,3000]
```

# NOTE: BINNING X MASSA INVARIANTE ?

SR: Merged regime, ggF and VBF

```
406 else:
407     if prod=="GGF":
408         if leptonChannel==2:
409             if "Tag" in region:
410                 bins = [500,530,570,610,650,690,730,770,810,850,890,930,970,1020,1070,1120,1170,1220,1270,1330,1480,1630,1780,1930,2080,2380,6000]
411             elif "Untag" in region:
412                 bins = [500,530,570,610,650,690,730,770,810,850,890,930,970,1020,1070,1120,1170,1220,1270,1330,1390,1450,1510,1570,1640,1710,1780,1850,1920,2000,2080,2150,2220,2300,2380,2450,2530,2600,2680,2750,2830,2900,2980,3060,3140,3220,3300,3380,3460,3540,3620,3700,3780,3860,3940,4020,4100,4180,4260,4340,4420,4500,4580,4660,4740,4820,4900,4980,5060,5140,5220,5300,5380,5460,5540,5620,5700,5780,5860,5940,6020,6100,6180,6260,6340,6420,6500,6580,6660,6740,6820,6900,6980,7060,7140,7220,7300,7380,7460,7540,7620,7700,7780,7860,7940,8020,8100,8180,8260,8340,8420,8500,8580,8660,8740,8820,8900,8980,9060,9140,9220,9300,9380,9460,9540,9620,9700,9780,9860,9940,10020,10100,10180,10260,10340,10420,10500,10580,10660,10740,10820,10900,10980,11060,11140,11220,11300,11380,11460,11540,11620,11700,11780,11860,11940,12020,12100,12180,12260,12340,12420,12500,12580,12660,12740,12820,12900,12980,13060,13140,13220,13300,13380,13460,13540,13620,13700,13780,13860,13940,14020,14100,14180,14260,14340,14420,14500,14580,14660,14740,14820,14900,14980,15060,15140,15220,15300,15380,15460,15540,15620,15700,15780,15860,15940,16020,16100,16180,16260,16340,16420,16500,16580,16660,16740,16820,16900,16980,17060,17140,17220,17300,17380,17460,17540,17620,17700,17780,17860,17940,18020,18100,18180,18260,18340,18420,18500,18580,18660,18740,18820,18900,18980,19060,19140,19220,19300,19380,19460,19540,19620,19700,19780,19860,19940,20020,20100,20180,20260,20340,20420,20500,20580,20660,20740,20820,20900,20980,21060,21140,21220,21300,21380,21460,21540,21620,21700,21780,21860,21940,22020,22100,22180,22260,22340,22420,22500,22580,22660,22740,22820,22900,22980,23060,23140,23220,23300,23380,23460,23540,23620,23700,23780,23860,23940,24020,24100,24180,24260,24340,24420,24500,24580,24660,24740,24820,24900,24980,25060,25140,25220,25300,25380,25460,25540,25620,25700,25780,25860,25940,26020,26100,26180,26260,26340,26420,26500,26580,26660,26740,26820,26900,26980,27060,27140,27220,27300,27380,27460,27540,27620,27700,27780,27860,27940,28020,28100,28180,28260,28340,28420,28500,28580,28660,28740,28820,28900,28980,29060,29140,29220,29300,29380,29460,29540,29620,29700,29780,29860,29940,30020,30100,30180,30260,30340,30420,30500,30580,30660,30740,30820,30900,30980,31060,31140,31220,31300,31380,31460,31540,31620,31700,31780,31860,31940,32020,32100,32180,32260,32340,32420,32500,32580,32660,32740,32820,32900,32980,33060,33140,33220,33300,33380,33460,33540,33620,33700,33780,33860,33940,34020,34100,34180,34260,34340,34420,34500,34580,34660,34740,34820,34900,34980,35060,35140,35220,35300,35380,35460,35540,35620,35700,35780,35860,35940,36020,36100,36180,36260,36340,36420,36500,36580,36660,36740,36820,36900,36980,37060,37140,37220,37300,37380,37460,37540,37620,37700,37780,37860,37940,38020,38100,38180,38260,38340,38420,38500,38580,38660,38740,38820,38900,38980,39060,39140,39220,39300,39380,39460,39540,39620,39700,39780,39860,39940,40020,40100,40180,40260,40340,40420,40500,40580,40660,40740,40820,40900,40980,41060,41140,41220,41300,41380,41460,41540,41620,41700,41780,41860,41940,42020,42100,42180,42260,42340,42420,42500,42580,42660,42740,42820,42900,42980,43060,43140,43220,43300,43380,43460,43540,43620,43700,43780,43860,43940,44020,44100,44180,44260,44340,44420,44500,44580,44660,44740,44820,44900,44980,45060,45140,45220,45300,45380,45460,45540,45620,45700,45780,45860,45940,46020,46100,46180,46260,46340,46420,46500,46580,46660,46740,46820,46900,46980,47060,47140,47220,47300,47380,47460,47540,47620,47700,47780,47860,47940,48020,48100,48180,48260,48340,48420,48500,48580,48660,48740,48820,48900,48980,49060,49140,49220,49300,49380,49460,49540,49620,49700,49780,49860,49940,50020,50100,50180,50260,50340,50420,50500,50580,50660,50740,50820,50900,50980,51060,51140,51220,51300,51380,51460,51540,51620,51700,51780,51860,51940,52020,52100,52180,52260,52340,52420,52500,52580,52660,52740,52820,52900,52980,53060,53140,53220,53300,53380,53460,53540,53620,53700,53780,53860,53940,54020,54100,54180,54260,54340,54420,54500,54580,54660,54740,54820,54900,54980,55060,55140,55220,55300,55380,55460,55540,55620,55700,55780,55860,55940,56020,56100,56180,56260,56340,56420,56500,56580,56660,56740,56820,56900,56980,57060,57140,57220,57300,57380,57460,57540,57620,57700,57780,57860,57940,58020,58100,58180,58260,58340,58420,58500,58580,58660,58740,58820,58900,58980,59060,59140,59220,59300,59380,59460,59540,59620,59700,59780,59860,59940,60020,60100,60180,60260,60340,60420,60500,60580,60660,60740,60820,60900,60980,61060,61140,61220,61300,61380,61460,61540,61620,61700,61780,61860,61940,62020,62100,62180,62260,62340,62420,62500,62580,62660,62740,62820,62900,62980,63060,63140,63220,63300,63380,63460,63540,63620,63700,63780,63860,63940,64020,64100,64180,64260,64340,64420,64500,64580,64660,64740,64820,64900,64980,65060,65140,65220,65300,65380,65460,65540,65620,65700,65780,65860,65940,66020,66100,66180,66260,66340,66420,66500,66580,66660,66740,66820,66900,66980,67060,67140,67220,67300,67380,67460,67540,67620,67700,67780,67860,67940,68020,68100,68180,68260,68340,68420,68500,68580,68660,68740,68820,68900,68980,69060,69140,69220,69300,69380,69460,69540,69620,69700,69780,69860,69940,70020,70100,70180,70260,70340,70420,70500,70580,70660,70740,70820,70900,70980,71060,71140,71220,71300,71380,71460,71540,71620,71700,71780,71860,71940,72020,72100,72180,72260,72340,72420,72500,72580,72660,72740,72820,72900,72980,73060,73140,73220,73300,73380,73460,73540,73620,73700,73780,73860,73940,74020,74100,74180,74260,74340,74420,74500,74580,74660,74740,74820,74900,74980,75060,75140,75220,75300,75380,75460,75540,75620,75700,75780,75860,75940,76020,76100,76180,76260,76340,76420,76500,76580,76660,76740,76820,76900,76980,77060,77140,77220,77300,77380,77460,77540,77620,77700,77780,77860,77940,78020,78100,78180,78260,78340,78420,78500,78580,78660,78740,78820,78900,78980,79060,79140,79220,79300,79380,79460,79540,79620,79700,79780,79860,79940,80020,80100,80180,80260,80340,80420,80500,80580,80660,80740,80820,80900,80980,81060,81140,81220,81300,81380,81460,81540,81620,81700,81780,81860,81940,82020,82100,82180,82260,82340,82420,82500,82580,82660,82740,82820,82900,82980,83060,83140,83220,83300,83380,83460,83540,83620,83700,83780,83860,83940,84020,84100,84180,84260,84340,84420,84500,84580,84660,84740,84820,84900,84980,85060,85140,85220,85300,85380,85460,85540,85620,85700,85780,85860,85940,86020,86100,86180,86260,86340,86420,86500,86580,86660,86740,86820,86900,86980,87060,87140,87220,87300,87380,87460,87540,87620,87700,87780,87860,87940,88020,88100,88180,88260,88340,88420,88500,88580,88660,88740,88820,88900,88980,89060,89140,89220,89300,89380,89460,89540,89620,89700,89780,89860,89940,90020,90100,90180,90260,90340,90420,90500,90580,90660,90740,90820,90900,90980,91060,91140,91220,91300,91380,91460,91540,91620,91700,91780,91860,91940,92020,92100,92180,92260,92340,92420,92500,92580,92660,92740,92820,92900,92980,93060,93140,93220,93300,93380,93460,93540,93620,93700,93780,93860,93940,94020,94100,94180,94260,94340,94420,94500,94580,94660,94740,94820,94900,94980,95060,95140,95220,95300,95380,95460,95540,95620,95700,95780,95860,95940,96020,96100,96180,96260,96340,96420,96500,96580,96660,96740,96820,96900,96980,97060,97140,97220,97300,97380,97460,97540,97620,97700,97780,97860,97940,98020,98100,98180,98260,98340,98420,98500,98580,98660,98740,98820,98900,98980,99060,99140,99220,99300,99380,99460,99540,99620,99700,99780,99860,99940,100020,100100,100180,100260,100340,100420,100500,100580,100660,100740,100820,100900,100980,101060,101140,101220,101300,101380,101460,101540,101620,101700,101780,101860,101940,102020,102100,102180,102260,102340,102420,102500,102580,102660,102740,102820,102900,102980,103060,103140,103220,103300,103380,103460,103540,103620,103700,103780,103860,103940,104020,104100,104180,104260,104340,104420,104500,104580,104660,104740,104820,104900,104980,105060,105140,105220,105300,105380,105460,105540,105620,105700,105780,105860,105940,106020,106100,106180,106260,106340,106420,106500,106580,106660,106740,106820,106900,106980,107060,107140,107220,107300,107380,107460,107540,107620,107700,107780,107860,107940,108020,108100,108180,108260,108340,108420,108500,108580,108660,108740,108820,108900,108980,109060,109140,109220,109300,109380,109460,109540,109620,109700,109780,109860,109940,110020,110100,110180,110260,110340,110420,110500,110580,110660,110740,110820,110900,110980,111060,111140,111220,111300,111380,111460,111540,111620,111700,111780,111860,111940,112020,112100,112180,112260,112340,112420,112500,112580,112660,112740,112820,112900,112980,113060,113140,113220,113300,113380,113460,113540,113620,113700,113780,113860,113940,114020,114100,114180,114260,114340,114420,114500,114580,114660,114740,114820,114900,114980,115060,115140,115220,115300,115380,115460,115540,115620,115700,115780,115860,115940,116020,116100,116180,116260,116340,116420,116500,116580,116660,116740,116820,116900,116980,117060,117140,117220,117300,117380,117460,117540,117620,117700,117780,117860,117940,118020,118100,118180,118260,118340,118420,118500,118580,118660,118740,118820,118900,118980,119060,119140,119220,119300,119380,119460,119540,119620,119700,119780,119860,119940,120020,120100,120180,120260,120340,120420,120500,120580,120660,120740,120820,120900,120980,121060,121140,121220,121300,121380,121460,121540,121620,121700,121780,121860,121940,122020,122100,122180,122260,122340,122420,122500,122580,122660,122740,122820,122900,122980,123060,123140,123220,123300,123380,123460,123540,123620,123700,123780,123860,123940,124020,124100,124180,124260,124340,124420,124500,124580,124660,124740,124820,124900,124980,125060,125140,125220,125300,125380,125460,125540,125620,125700,125780,125860,125940,126020,126100,126180,126260,126340,126420,126500,126580,126660,126740,126820,126900,126980,127060,127140,127220,127300,127380,127460,127540,127620,127700,127780,127860,127940,128020,128100,128180,128260,128340,128420,128500,128580,128660,128740,128820,128900,128980,129060,129140,129220,129300,129380,129460,129540,129620,129700,129780,1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