

Issue: Different results for the cutflow from [Easyjet](#) and the CxAOD framework

Aim: Investigate the “exactly 2 leptons” cut and understand why after this cut the number of events differs

Framework modifications:

CxAODMaker:

- [VHbb/CxAODMaker_VHbb/ scripts/submitMaker.py](#)

```
DOLOWERPTZ2CUT="true"  
DOLOWERPTZ2LCUT="false"
```

- [Core/CxAODTools/Root/EventSelection.cxx::passJetCleaning\(\)](#)

```
if(Props::DFCommonJets_IsBadBatman.exists(evtInfo)){  
    if(Props::DFCommonJets_IsBadBatman.get(evtInfo)==1){  
        return false;  
    }  
}
```

- [VHbb/CxAODTools_VHbb/CxAODTools_VHbb/](#)

[VHbbEvtSelection.icc](#)

```
m_cutFlow.count("Preselection jet cleaning", 104);  
}  
// STEFANIE - Return already here true to check selections in the Reader  
return true;
```

- [VHbb/CxAODTools_VHbb/ Root/VHbb2lepEvtSelection.cxx](#)

```
bool passpreselection = VHbbEvtSelection<ResultVHbb2lep>::passPreSelection(containers, isKinVar);  
// STEFANIE - Return already here true to check selections in the Reader  
return passpreselection;
```

=> This ensures that we just have the preselections applied in the CxAODMaker and all further selections are applied at reader level

Thanks to Semen for this idea!

Easyjet:

- [ZCharmAnalysis/share/RunConfig-ZCharm.vaml](#)

```
btag_extra_wps:  
  - GN2v01_FixedCutBEff_70  
  - GN2v01_FixedCutBEff_65  
  - GN2v01_FixedCutBEff_70  
  - GN2v01_FixedCutBEff_70  
  - GN2v01_FixedCutBEff_60  
  
# apply trigger lists to filter events  
do_trigger_filtering: true  
do_trigger_filtering: false  
  
CutList :  
  - PASS_TRIGGER  
  - PASS_TRIGGER  
  - EXACTLY TWO LEPTONS
```

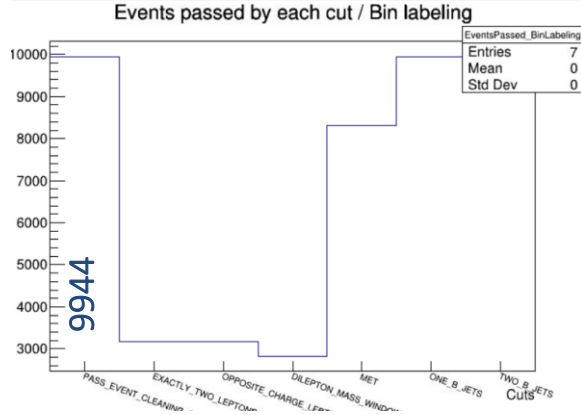
- [ZCharmAnalysis/src/ZCharmSelectorAlg.cxx](#)

```
m_bools.at(ZCC::MET) = false;  
m_bools.at(ZCC::ONE_B_JETS) = false;  
m_bools.at(ZCC::TWO_B_JETS) = false;  
m_bools.at(ZCC::ONE_B_JETS) = true;  
m_bools.at(ZCC::TWO_B_JETS) = true;
```

=> This ensures that the same preselection yields the same number of events as the maker preselections and that the trigger passing is not included in the cutflow

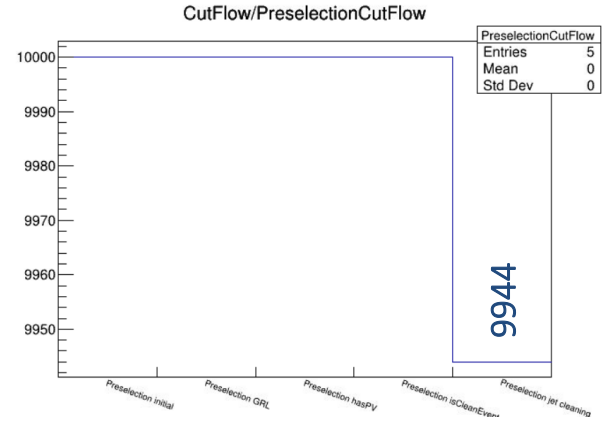
Easyjet:

```
ZCharm-ntupler  
/project/etp3/sgoetz/atlasAnalysis/Zcc/testsamples/mc20_13TeV.700324.Sh_2  
211_Zmumu_maxHTpTV2_CFilterBVeto.deriv.DAOD_PHYS.e8351_s3681_r1316  
7_p5980/DAOD_PHYS.36074740._000051.pool.root.1 \  
--run-config ZCharmAnalysis/RunConfig-ZCharm.yaml \  
--out-file output_PHYS_ZCharm.root \  
--evtMax 10000 \  
-l INFO
```



CxAODMaker:

```
python ../CxAODMakerCore/VHbb/CxAODMaker_VHbb/scripts/submitMaker.py  
-p -x -c 2L -m 20a -s mcdata_Rel24 -l  
/project/etp3/sgoetz/atlasAnalysis/Zcc/testsamples/mc20_13TeV.700324.Sh_22  
11_Zmumu_maxHTpTV2_CFilterBVeto.deriv.DAOD_PHYS.e8351_s3681_r13167_  
p5980/ -n 10000
```



Aim:

- Don't check the preselection implemented in the Reader
- Don't introduce uncertainties on the cutflow comparison by skipping events with a weight of 0
- Core/CxAODReader/Root/AnalysisReader.cxx

```
// Skip event with weight 0 and mcrunnumber 0
if (m_isMC && m_randomRunNumber == 0 && m_weight == 0) {
  if (m_currentVarIsNominal)
    m_countSkippedEvents++;
  return EL::StatusCode::SUCCESS;
}
//if (m_isMC && m_randomRunNumber == 0 && m_weight == 0) {
//  if (m_currentVarIsNominal)
//    //m_countSkippedEvents++;
//  //return EL::StatusCode::SUCCESS;
//}
```

```
// -----
// fill histograms
// -----
if (m_debug)
  Info("execute ()", "Calling the fill function...");
EL_CHECK("AnalysisReader::execute()", m_fillFunction());
//if (m_debug)
//  //Info("execute ()", "Calling the fill function...");
//EL_CHECK("AnalysisReader::execute()", m_fillFunction());
```

- Zcc/CxAODReader/data/framework-read-automatic.cfg

```
bool applyEventPreSelection = true # true for cutflow challenge
bool applyEventPreSelection = false # true for cutflow challenge
```

=> Here we can switch on/off preselections

Easyjet:

| | Number of events |
|---------------------|------------------|
| PASS_EVENT_CLEANING | 9944 |
| EXACTLY_TWO_LEPTONS | 3165 |

Number of muons just before the 2-lepton cut: 10861

Number of electrons just before the 2-lepton cut: 2

CxAODReader:

| | Number of events | Number of events with reader preselection |
|--|------------------|---|
| Events from Maker | 9944 | 9944 |
| Skipped - weight set to 0 by pile-up rw tool | 0 | 0 |
| | | |
| Initial number of events | 9944 | 9944 |
| 2 leptons | 3467 | 3261 |

Number of muons just in initial number of events: 15113
Number of electrons in initial number of events: 28

Number of muons just before the 2-lepton cut: 11354
Number of electrons just before the 2-lepton cut: 2

Number of muons just before the 2-lepton cut: 11033
Number of electrons just before the 2-lepton cut: 2

=> If I count the number of muons of the initial test file for the first 10000 events, there seem to be 24594 muons stored and 75353 electrons

Searching for lost muons and electrons

CxAODMaker:

- ObjectHandler.cxx

Decides if one electron/muon is included in the output container

Number of muons before passAnyVar: 24476
Number of electrons before passAnyVar: 74812

There must have been already some sorting out ...

```
// check if particle passed the selection for any variation (nominal or systematic)
bool passAnyVar = true;
if (m_applyObjectSelection) {
    passAnyVar = passAny( m_inContainer, partIndex, *m_passProperty);
}
if (passAnyVar) {
```

Number of muons after passAnyVar: 15113
Number of electrons after passAnyVar : 28

Same number as in maker ntuples

