Small Standard Oscillations Update: Overflow Bin Issues

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Overview (I)

- Since our box opening at the collaboration meeting, we've been working on some 'lingering issues'
- One of these issues revealed the reconstruction problem reported by Leigh two weeks ago ([DocDB 11002] and [DocDB 11006])
- Another issue that Leigh and I noticed during the box opening was a large overflow bin in our predicted energy spectrum (270 events)
  - This would correspond to events with $E_{RECO} > 200\text{GeV}$

Overview (II)

- In our case, this large overflow bin came from the NC background.
- This large overflow bin came from a small overflow bin in the CC purity since the NC background is calculated as follows:

$$E_{NC} = \frac{E_{CC}}{\epsilon_{Purity}} - E_{CC}$$

- Though the CC purity histogram in the helper file has no issue, the overflow bin is neglected when reading it in:

```
...
for (int i=1; i<=fPurity_ND->GetNbinsX(); ++i){
  fPurity_ND->SetBinContent(i, 1.0 -
                            fPurity_ND->GetBinContent(i));
...
```

- In ROOT convention, bin 0 is underflow and bin N+1 is overflow.

The ‘Fix’

- **There is no issue with the overflow bins as long as we don’t plan to use them!**
- Three options:
  - Fix all occurrences so that we can make use of our overflow bins (fair amount of work to make sure no errors are introduced)
  - Fix this one occurrence (very little work)
  - Continue ignoring overflow bins!!! (no work ☺)

Here is some of the relevant code for reference:
[NuMMHelperPRL.cxx]