

## Hathor release note 1.2

1.2 — September 2011 (see arXiv:1007.1327 for the original program description)

### PDF error evaluation

Fix concerning the evaluation of PDF uncertainties:

Since LHAPDF does not provide a method to figure out whether asymmetric or symmetric errors are used within the error PDFs it was up to now up to the user to select one or the other by adding the option `PDF_SYM_ERR` (Hathor default is asymmetric error). However even with the option `PDF_SYM_ERR` set the additional factor  $1/\sqrt{N}$  required for NNPDF was not properly taken into account (thanks to U.Husemann for pointing this out).

In version 1.2 we have taken now the following approach:

- New option `NNPDF` is introduced to select the NNPDF error evaluation. This option also forces `PDF_SYM_ERR` to be set.
- If the strings "NNPDF" or "abkm" are found in the PDF name the option `PDF_SYM_ERR` is used and in case of NNPDF the additional factor  $1/\sqrt{N}$  is introduced.
- New functions to register an own function provided by the user to evaluate the PDF uncertainty:

```
void clearErrorFun();
void setErrorFun(void (*fun)(int n, double res[],double & up,
                             double & down))
```

`n` is the number of PDF sets, `double res[]` the result of the integration for each set (`res[0]` is the central value), `up` and `down` are the up and down errors as evaluated by the user in `fun`.

Example:

```
void symerr(int n,double res[], double & up, double & down){
    for(int i=1; i <= n; i++){
        up += pow(res[i]-res[0],2);
    }
    up = sqrt(up);
    down = up;
}
...
Lhapdf lhapdf(pdfname);
Hathor XS(lhapdf);
XS.setErrorFun(symerr);
```

To remove the function use: `XS.clearErrorFun();`

### Runtime

Minor change in phase space mapping and PDF evaluation to improve speed.