FLHA: the Flavour Les Houches Accord

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Outline

- Introduction
  - Motivations
  - Main considerations
  - FLHA challenges
- FLHA structure
  - Definition of the blocks
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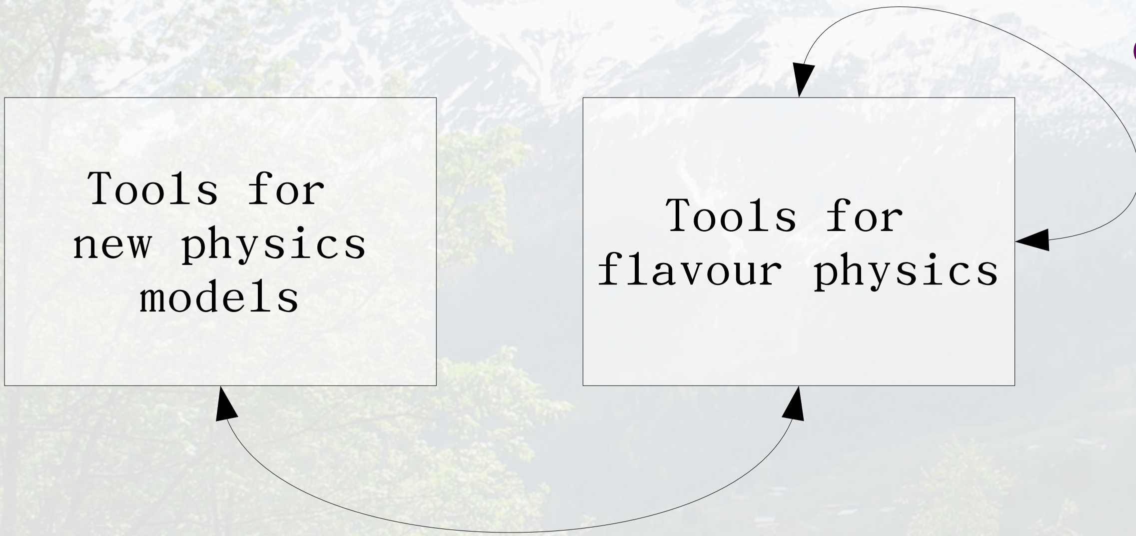
- Discussion

Motivations

Interface between different flavour codes



- Wilson coefficients
- Branching ratios
- Mixing amplitudes
- RGE running
- ...

Interface between new physics and low energy flavour codes?

Need for a set of generic definitions for an input/output file structure

Flavour Les Houches Accord

Standard format for flavour related quantities, providing:

- A model independent parametrization
- A stand-alone flavour output in the ***FLHA*** format
- Based on the existing ***SLHA*** structure
- A clear and well-defined structure for interfacing computational tools of "New Physics" models with low-energy flavour calculations

That will allow different programs to talk and to be interfaced, and users to have a clear and well-defined result that can eventually be used for different purposes.

Main considerations

Based on the same considerations as *SLHA*

- Not only for SUSY
- Flavour quantities are defined in blocks
- *FLHA* can contain *SLHA* blocks
- *FLHA* block names start with "***F***" to avoid confusion, with the exception of:
  - SLHA blocks which keep their names
  - blocks containing imaginary parts ("*IMF*...")
- *FLHA* will not modify *SLHA* blocks
- Avoiding ambiguities, no double blocks,...

FLHA challenges

Flavour quantities can be very complicated ☹

- Different operators bases in the literature
- Different standards for the Wilson coefficients
- Terminology varies with time, authors, ...
- Several decay constants, form factors, ... for each observables
- Different renormalization scales
- ...

General structure

1) Blocks borrowed from SLHA

- SLHA blocks are taken without modification
- SLHA output blocks can be used as input blocks

2) FLHA new blocks

- Blocks for the most common flavour quantities
- Can be an extension of an SLHA block

1) Blocks borrowed from SLHA

BLOCK SMINPUTS

`BLOCK SMINPUTS` is the same as in the SLHA format, which includes the measured values of SM parameters.

BLOCK VCKMIN, VCKM, IMVCKM

BLOCK UPMNSIN, UPMNS, IMUPMNS

These blocks are the same as in the SLHA format, and include values of the CKM and PMNS neutrino mixing matrices.

BLOCK MODSEL

Switches and options for model selection.

The SLHA MODSEL block is therefore extended to Beyond SUSY models (e.g. extradim,...). The adopted model names will be listed in the FLHA web page as soon as they appear in a code.

1) Blocks borrowed from SLHA

- **Three entries:**
  - Minimal type of model
  - Model name
  - Special particle content

To be discussed!

- **Current suggestion:**

1 : -99 : Non-SUSY Model (MODSEL entry 2 must be present)
-1 : SM
0 : General MSSM
1 : (m)SUGRA model
2 : (m)GMSB model
3 : (m)AMSB model
4 : . . .

2 : String specifying model name. Mandatory when MODSEL(1)= -99, ignored otherwise. The FLHA web site will provide a list of which ones have so far been officially defined.

3 : Choice of particle content (ignored when MODSEL(1) = -99)
0 : MSSM (this corresponds to SLHA1).
1 : NMSSM (this corresponds to SLHA2).

2) FLHA blocks

BLOCK FCINFO

Calculator information, including the name of the program and the version.
Similar to block SPINFO in SLHA

```
Block FCINFO   # Program information
   1      SUPERISO   # flavour calculator
   2      2.8_beta   # version number
```

BLOCK FLIFE

Lifetime of the particles using PDG codes of the particles.

```
Block FLIFE  # Lifetime in sec
#PDG code  lifetime        particle
   211     2.60330000e-08  # pi+
   321     1.23800000e-08  # K+
   431     5.00000000e-13  # D_s+
   521     1.63800000e-12  # B+
```

Masses

BLOCK FMASS

To be discussed!

Mass spectrum using PDG codes

Generalization of the SLHA MASS BLOCK

Including the renormalization scheme and the scale at which the masses are calculated.

```
Block FMASS  # Mass spectrum in GeV
#PDG code  mass            scheme  scale    particle
     3     1.05000000e-01  1        2.0e+00 # s
     5     4.68000000e+00  3        0       # b
   211     1.39600000e-01  0        0       # pi+
   313     8.91700000e-01  0        0       # K*
   321     4.93700000e-01  0        0       # K+
   421     1.86484000e+00  0        0       # D0
   431     1.96849000e+00  0        0       # D_s+
   521     5.27950000e+00  0        0       # B+
   531     5.36630000e+00  0        0       # B_s
```

Schemes:

- 0: pole
- 1: MSbar
- 2: DRbar
- 3: 1S
- 4: kin

Decay constants

- Some definitions:

$$\langle 0|\bar{q}\gamma^\mu\gamma_5 Q|P(p)\rangle = -if_P p^\mu$$

$$\frac{1}{\sqrt{2}}\langle 0|\bar{u}\gamma^\mu\gamma_5 u + \bar{d}\gamma^\mu\gamma_5 d|\eta^{(\prime)}(p)\rangle = -if^q_{\eta^{(\prime)}} p^\mu$$

$$\langle 0|\bar{s}\gamma^\mu\gamma_5 s|\eta^{(\prime)}(p)\rangle = -if^s_{\eta^{(\prime)}} p^\mu$$

$$(m_q + m_Q)\langle 0|\bar{q}\gamma_5 Q|P(p)\rangle = ih_P$$

$$\langle 0|\bar{q}\gamma^\mu Q|V(p)\rangle = m_V f_V \epsilon^\mu,$$

$$\langle 0|\bar{q}\sigma^{\mu\nu} Q|V(p)\rangle = if^T_V(p^\nu\epsilon^\mu - p^\mu\epsilon^\nu)$$

- Example of mesons with several decay constants:

321 : K^+.
- 1 : f_K in GeV.
- 11 : h_K in GeV^3.

221 : η.
- 1 : f^q_η in GeV.
- 2 : f^s_η in GeV.
- 11 : h^q_η in GeV^3.
- 12 : h^s_η in GeV^3.

213 : $\rho(770)^+$.
- 1 : f_ρ in GeV.
- 11 : f^T_ρ in GeV.

223 : $\omega(782)$.
- 1 : f^q_ρ in GeV.
- 2 : f^s_ρ in GeV.
- 11 : $f^{T,q}_\rho$ in GeV.
- 12 : $f^{T,s}_\rho$ in GeV.

Decay constants

BLOCK FCONST

Decay constants using PDG codes of the particles, with second entry specifying the particular decay constant.

```
Block FCONST  # Decay constant
#PDG code  number  decay constant   particle
   431      1       2.41000000e-01  # f(D_s+) in GeV
   521      1       2.00000000e-01  # f(B+) in GeV
   321      1       0.15500000e-01  # f(K+) in Gev
   221      1       0.17000000e-01  # f^q(eta) in GeV
   221      2       0.14500000e-01  # f^s(eta) in GeV
```

BLOCK FCONSTRATIO

The ratio of the main decay constants are given in a separate block, with the PDG numbers of the two particles.

```
Block FCONSTRATIO  # Ratio of decay constant
#PDG code1 code2  ratio           comment
   321     211    1.18900000e+00  # f_K/f_pi
```

Bag parameters

BLOCK FBAG

Bag parameters using PDG codes of the particles,with second entry specifying the particular Bag parameter. It is similar to `Block FCONST`.

```
Block FBAG  # Bag parameters
#PDG code B-parameter      particle
   511    1.26709794e+00   # B_d
   531    1.23000000e+00   # B_s
```

Necessity of providing definitions for the Bag parameters.

To be discussed!

Wilson coefficients

- Wilson coefficients classified according to the transition type ΔF

- Real and imaginary parts given in FWCOEF and IMFWCOEF

- The different orders of the Wilson coefficients have to be given separately according to the following convention for the perturbative expansion:

$$
\begin{aligned}
C_i(\mu) &= C_i^{(0)}(\mu) + \frac{\alpha_s(\mu)}{4\pi} C_{i,s}^{(1)}(\mu) + \left(\frac{\alpha_s(\mu)}{4\pi}\right)^2 C_{i,s}^{(2)}(\mu) \\
&\quad + \frac{\alpha(\mu)}{4\pi} C_{i,e}^{(1)}(\mu) + \frac{\alpha(\mu)}{4\pi}\frac{\alpha_s(\mu)}{4\pi} C_{i,es}^{(2)}(\mu) + \cdots \,.
\end{aligned}
$$

- The couplings should therefore not be included in the Wilson coefficients.

Wilson coefficients

Three main transition types:

- $\Delta F=1$ (flavour transitions)
  - $b \leftrightarrow s$
  - $c \leftrightarrow u$
  - ...
- $\Delta F=2$ (flavour mixings)
  - $bb \leftrightarrow ss$
  - $bd \leftrightarrow cu$
  - ...
- $\Delta LF=1$ (leptonic transitions)
  - $\mu \leftrightarrow e$
  - $\tau \leftrightarrow \mu$
  - $\tau \leftrightarrow e$

Wilson coefficients

ΔF=1

$$\mathcal{H}_{eff} = \frac{G_F}{\sqrt{2}} \sum_{p=u,c} V_{ps}^* V_{pb} \sum_{i=1}^{8} C_i(\mu)\, O_i$$

To be discussed!

Four quark operators

$$\begin{aligned}
\mathcal{O}^{q,1}_{VLL} &= (\bar{s}\gamma^\mu P_L b)(\bar{q}\gamma_\mu P_L q),\\
\mathcal{O}^{q,1}_{VLR} &= (\bar{s}\gamma^\mu P_L b)(\bar{q}\gamma_\mu P_R q),\\
\mathcal{O}^{q,1}_{SLL} &= (\bar{s} P_L b)(\bar{q} P_L q),\\
\mathcal{O}^{q,1}_{TLL} &= (\bar{s}\sigma^{\mu\nu} P_L b)(\bar{q}\sigma_{\mu\nu} P_L q),\\
\mathcal{O}^{q,8}_{VLL} &= (\bar{s}\gamma^\mu T^a P_L b)(\bar{q}\gamma_\mu T^a P_L q),\\
\mathcal{O}^{q,8}_{VLR} &= (\bar{s}\gamma^\mu T^a P_L b)(\bar{q}\gamma_\mu T^a P_R q),\\
\mathcal{O}^{q,8}_{SLL} &= (\bar{s} T^a P_L b)(\bar{q} T^a P_L q),\\
\mathcal{O}^{q,8}_{TLL} &= (\bar{s}\sigma^{\mu\nu} T^a P_L b)(\bar{q}\sigma_{\mu\nu} T^a P_L q),\\
& \quad q = u,\, d,\, s,\, c,\, b,
\end{aligned}$$

\+ mirror operators

Semi-leptonic operators

$$\begin{aligned}
\mathcal{O}^{\ell}_{VLL} &= (\bar{s}\gamma^\mu P_L b)(\bar{\ell}\gamma_\mu P_L \ell),\\
\mathcal{O}^{\ell}_{VLR} &= (\bar{s}\gamma^\mu P_L b)(\bar{\ell}\gamma_\mu P_R \ell),\\
\mathcal{O}^{\ell}_{SLL} &= (\bar{s} P_L b)(\bar{\ell} P_L \ell),\\
\mathcal{O}^{\ell}_{SLR} &= (\bar{s} P_L b)(\bar{\ell} P_R \ell),\\
\mathcal{O}^{\ell}_{TLL} &= (\bar{s}\sigma^{\mu\nu} P_L b)(\bar{\ell}\sigma_{\mu\nu} P_L \ell),
\end{aligned}$$

$$\begin{aligned}
\mathcal{O}^{\nu}_{VLL} &= (\bar{s}\gamma^\mu P_L b)(\bar{\nu}\gamma_\mu P_L \nu),\\
\mathcal{O}^{\nu}_{VRL} &= (\bar{s}\gamma^\mu P_R b)(\bar{\nu}\gamma_\mu P_L \nu),
\end{aligned}$$

\+

$$\begin{aligned}
O_7 = (O_\gamma) &= \frac{e}{16\pi^2}\,[\bar{s}\sigma^{\mu\nu}(m_s P_L + m_b P_R) b]\, F_{\mu\nu}\ ,\\
O_8 = (O_g) &= \frac{g}{16\pi^2}\,[\bar{s}\sigma^{\mu\nu}(m_s P_L + m_b P_R) T_a b]\, G^a_{\mu\nu}
\end{aligned}$$

Wilson coefficients

ΔF=1

Numbering:

To be discussed!

1--99	:	Four-quark operators.
101	:	"O_7" or "O_γ". **101 → 107 ?**
102	:	"O_8" or "O_g". **102 → 108 ?**
21x	:	Semileptonic operators for $\ell = e$.
22x	:	Semileptonic operators for $\ell = \mu$.
23x	:	Semileptonic operators for $\ell = \tau$.
24x	:	Semileptonic operators for $\ell = \nu_e$.
25x	:	Semileptonic operators for $\ell = \nu_\mu$.
26x	:	Semileptonic operators for $\ell = \nu_\tau$.

Last digit x in semileptonic operators stands for spinor structure.

Wilson coefficients

ΔF=1

Orders:

$$
\begin{aligned}
0 &: C_i^{(0)}(\mu). \\
1 &: C_{i,s}^{(1)}(\mu). \\
2 &: C_{i,s}^{(2)}(\mu). \\
10 &: C_{i,e}^{(1)}(\mu). \\
11 &: C_{i,es}^{(2)}(\mu). \\
99 &: \text{total (or -1 can be used)}
\end{aligned}
$$

Wilson coefficients

ΔF=2

More work is needed ...

To be discussed!

- Which basis?

$$\begin{aligned}
\mathcal{O}_1 &= (\bar{s}^\alpha \gamma_\mu P_L d^\alpha)(\bar{s}^\beta \gamma^\mu P_L d^\beta), \\
\mathcal{O}_2 &= (\bar{s}^\alpha P_L d^\alpha)(\bar{s}^\beta P_L d^\beta), \\
\mathcal{O}_3 &= (\bar{s}^\alpha P_L d^\beta)(\bar{s}^\beta P_L d^\alpha), \\
\mathcal{O}_4 &= (\bar{s}^\alpha P_L d^\alpha)(\bar{s}^\beta P_R d^\beta), \\
\mathcal{O}_5 &= (\bar{s}^\alpha P_L d^\alpha)(\bar{s}^\beta P_R d^\beta),
\end{aligned}$$

or

$$\begin{aligned}
Q_1^{\rm VLL} &= (\bar{s}^\alpha \gamma_\mu P_L d^\alpha)(\bar{s}^\beta \gamma^\mu P_L d^\beta), \\
Q_1^{\rm LR} &= (\bar{s}^\alpha \gamma_\mu P_L d^\alpha)(\bar{s}^\beta \gamma^\mu P_R d^\beta), \\
Q_2^{\rm LR} &= (\bar{s}^\alpha P_L d^\alpha)(\bar{s}^\beta P_R d^\beta), \\
Q_1^{\rm SLL} &= (\bar{s}^\alpha P_L d^\alpha)(\bar{s}^\beta P_L d^\beta), \\
Q_2^{\rm SLL} &= (\bar{s}^\alpha \sigma_{\mu\nu} P_L d^\alpha)(\bar{s}^\beta \sigma^{\mu\nu} P_L d^\beta),
\end{aligned}$$

- Which normalization?

$$\mathcal{H}_{\rm eff}^{\Delta F=2} = \sum C_i \mathcal{O}_i,$$

or

$$\mathcal{H}_{\rm eff}^{\Delta B=2} = \frac{G_F^2 M_W^2}{16\pi^2} (V_{tb}^* V_{ts})^2 \sum C_i Q_i.$$

Wilson coefficients

To be discussed!

ΔLF=1

Many different operators...

$$\begin{aligned}
\mathcal{O}_1(\tau^+ \to \mu^+\mu^+\mu^-) &= (\bar\tau P_L \mu)(\bar\mu P_L \mu),\\
\mathcal{O}_2(\tau^+ \to \mu^+\mu^+\mu^-) &= (\bar\tau P_R \mu)(\bar\mu P_R \mu),\\
\mathcal{O}_3(\tau^+ \to \mu^+\mu^+\mu^-) &= (\bar\tau \gamma^\mu P_R \mu)(\bar\mu \gamma_\mu P_R \mu),\\
\mathcal{O}_4(\tau^+ \to \mu^+\mu^+\mu^-) &= (\bar\tau \gamma^\mu P_L \mu)(\bar\mu \gamma_\mu P_L \mu),\\
\mathcal{O}_5(\tau^+ \to \mu^+\mu^+\mu^-) &= (\bar\tau \gamma^\mu P_R \mu)(\bar\mu \gamma_\mu P_L \mu),\\
\mathcal{O}_6(\tau^+ \to \mu^+\mu^+\mu^-) &= (\bar\tau \gamma^\mu P_L \mu)(\bar\mu \gamma_\mu P_R \mu),
\end{aligned}$$

$$\begin{aligned}
\mathcal{O}_1(\tau^+ \to \mu^+e^+e^-) &= (\bar\tau P_L \mu)(\bar e P_L e),\\
\mathcal{O}_2(\tau^+ \to \mu^+e^+e^-) &= (\bar\tau P_L \mu)(\bar e P_R e),\\
\mathcal{O}_3(\tau^+ \to \mu^+e^+e^-) &= (\bar\tau P_R \mu)(\bar e P_L e),\\
\mathcal{O}_4(\tau^+ \to \mu^+e^+e^-) &= (\bar\tau P_R \mu)(\bar e P_R e),\\
\mathcal{O}_5(\tau^+ \to \mu^+e^+e^-) &= (\bar\tau \gamma^\mu P_L \mu)(\bar e \gamma_\mu P_L e),\\
\mathcal{O}_6(\tau^+ \to \mu^+e^+e^-) &= (\bar\tau \gamma^\mu P_L \mu)(\bar e \gamma_\mu P_R e),\\
\mathcal{O}_7(\tau^+ \to \mu^+e^+e^-) &= (\bar\tau \gamma^\mu P_R \mu)(\bar e \gamma_\mu P_L e),\\
\mathcal{O}_8(\tau^+ \to \mu^+e^+e^-) &= (\bar\tau \gamma^\mu P_R \mu)(\bar e \gamma_\mu P_R e),\\
\mathcal{O}_9(\tau^+ \to \mu^+e^+e^-) &= (\bar\tau \sigma^{\mu\nu} P_L \mu)(\bar e \sigma_{\mu\nu} e),\\
\mathcal{O}_{10}(\tau^+ \to \mu^+e^+e^-) &= (\bar\tau \sigma^{\mu\nu} P_R \mu)(\bar e \sigma_{\mu\nu} e).
\end{aligned}$$

Suggested numbering:

$$\begin{aligned}
1 &: (\bar\tau \gamma^\mu P_L \mu)(\bar\mu \gamma_\mu P_L \mu),\\
2 &: (\bar\tau \gamma^\mu P_L \mu)(\bar\mu \gamma_\mu P_R \mu),\\
3 &: (\bar\tau P_L \mu)(\bar\mu P_L \mu),\\
4 &: (\bar\tau \gamma^\mu P_L \mu)(\bar e \gamma_\mu P_L e),\\
5 &: (\bar\tau \gamma^\mu P_L \mu)(\bar e \gamma_\mu P_R e),\\
6 &: (\bar\tau P_L \mu)(\bar e P_L e),\\
7 &: (\bar\tau P_L \mu)(\bar e P_R e),\\
8 &: (\bar\tau \sigma^{\mu\nu} P_L \mu)(\bar e \sigma_{\mu\nu} e),\\
101 &: m_\tau \bar\tau \sigma^{\mu\nu} P_L \mu F_{\mu\nu}.
\end{aligned}$$

101→107 ?

+ Semi-leptonic operators:

$$\begin{aligned}
2q4 &: (\bar\tau \gamma^\mu P_L \mu)(\bar q \gamma_\mu P_L q),\\
2q5 &: (\bar\tau \gamma^\mu P_L \mu)(\bar q \gamma_\mu P_R q),\\
2q6 &: (\bar\tau P_L \mu)(\bar q P_L q),\\
2q7 &: (\bar\tau P_L \mu)(\bar q P_R q),\\
2q8 &: (\bar\tau \sigma^{\mu\nu} P_L \mu)(\bar q \sigma_{\mu\nu} q),
\end{aligned}$$

where q=1,2,3 for $q = u, d, s$, respectively.

Wilson coefficients

BLOCK FWCOEF, IMFWCOEF

```
Block FWCOEF Q= 1.60846e+02
#Effective Wilson coefficients in the standard basis
#type sub order number model  value            comment
  1    1    0     2      0    1.00000000e+00   #C02(b↔s)
  1    1    0     7      0    -1.82057567e-01  #C07(b↔s)
  1    1    0     8      0    -1.06651571e-01  #C08(b↔s)
  1    1    1     4      0    5.29677461e-01   #C14(b↔s)
  1    1    2     5      0    8.76122785e-01   #C25(b↔s)
  2    5    0     2      1    XXXXXXXXXXe-XX   #C02(db↔cu)
  3    2    1     1      2    XXXXXXXXXXe-XX   #C11(μ ↔ e)
```

Models:
- 0: SM
- 1: NP
- 2: SM+NP

Type:
- 1: $\Delta F=1$
- 2: $\Delta F=2$
- 3: leptonic

Subtype ($\Delta F=1$):
- 1: $b \leftrightarrow s$
- 2: $b \leftrightarrow d$
- 3: $s \leftrightarrow d$
- 4: $c \leftrightarrow u$

Subtype ($\Delta F=2$):
- 1: $bb \leftrightarrow ss$
- 2: $bb \leftrightarrow dd$
- 3: $ss \leftrightarrow dd$
- 4: $cc \leftrightarrow uu$
- 5: $db \leftrightarrow cu$

Subtype ($\Delta LF=1$):
- 1: $\mu \leftrightarrow e$
- 2: $\tau \leftrightarrow \mu$
- 3: $\tau \leftrightarrow e$

Flavour observables

The decay is defined by the PDG number of the parent, the type of the observable, the value of the observable, the number of daughters, PGD IDs of the daughters.

Type of the observables:

1: branching ratio
2: ratio of the branching ratio to the SM value
3: asymmetry - CP
4: asymmetry - isospin
5: asymmetry - forward-backward
6: asymmetry - lepton-flavor
7: mixing

type>10: user defined

Flavour observables

BLOCK FOBS

```
Block FOBS  # Flavor observables
# ParentPDG type value            NDA  ID1 ID2 ID3 ...  comment
     5       1   3.07350499e-04   2     3   22         # BR(B->Xs gamma)
   521       4   8.25882011e-02   2   313   22         # Delta0(B->K* gamma)
   531       1   3.46978963e-09   2    13  -13         # BR(B_s->mu+ mu-)
   521       1   1.09699841e-04   2   -15   16         # BR(B_u->tau nu)
   521       2   9.96640362e-01   2   -15   16         # R(B_u->tau nu)
   431       1   4.81251996e-02   2   -15   16         # BR(D_s->tau nu)
   431       1   4.96947301e-03   2   -13   14         # BR(D_s->mu nu)
   521       1   6.96556180e-03   3   421  -15  16     # BR(B+->D0taunu)
   521      11   2.97261612e-01   3   421  -15  16     # BR(B+->D0taunu)/BR(B+->D0enu)
   321      11   6.45414388e-01   2   -13   14         # BR(K->mu nu)/BR(pi->mu nu)
   321      12   9.99985822e-01   2   -13   14         # R_123
```

Flavour observables

BLOCK FOBSERR

2 columns for the uncertainties: minus and plus.

```
Block FOBSERR  # Theoretical error for flavor observables at 68% C.L.
# ParentPDG type -ERR      +ERR     NDA  ID1 ID2 ID3 ...  comment
     5       1    0.3e-04  0.3e-04 2    3   22          # BR(B->Xs gamma)
```

BLOCK FnameERR

For every block, we can define a corresponding block for the errors.

BLOCK FOBSSM

Standard Model values of the flavour observables.

```
Block FOBSSM  # SM prediction for flavor observables
# ParentPDG type value             NDA  ID1 ID2 ID3 ...  comment
     5       1    3.07350499e-04   2    3   22          # BR(B->Xs gamma)
```

Form & Shape factors

BLOCK FFORM, FSHAPE

Form factors and shape (nonperturbative phase space) factors.

```
Block FFORM   # Form Factors in GeV
#number    value               name
     1     4.60000000e-01      # Delta(w) in B->D l nu
     2     1.02600000e+00      # G(1) in B->D l nu
     3     1.17000000e+00      # rho^2 in B->D l nu
     4     3.10000000e-01      # T1(B->K*)

Block FSHAPE   # Shape factors
#number    value               name
     1     5.80000000e-01      # C (B->Xs gamma)
```

- Observable dependent
- q^2 dependent
- Not easy to find a general definition

To be discussed!

Conclusions

- The interplay between flavour and collider physics will hopefully be very rich in the next few years
- New physics codes and flavour physics codes would need to be interfaced
- A standard accord would be necessary for easy interfacing

- FLHA is still work in progress...
- **Everybody is welcome to join** the discussions and development of the format
- More details can be found at:

  http://www.lpthe.jussieu.fr/LesHouches09Wiki/index.php/Flavour_Les_Houches_Accord

Discussions

MODSEL

1 : -99 : Non-SUSY Model
-1 : SM
0 : General MSSM
1 : (m)SUGRA model
2 : (m)GMSB model
3 : (m)AMSB model
4 : . . .

2 : String specifying model name.

3 : Choice of particle content

Question:

- Should we use a string to specify the model name?
  - Need to maintain an FLHA web page containing fixed character strings for models
  - Numbers could be easier for an automatic reading

MODSEL

Alternative solution: 3 indices

0 : 0 : 0: SM

1 : 2HDM
- 1 : CP conserved
  - 0 : General. . .
  - 1 : Type I
  - 2 : Type II
  - 3 : Type III
  - 4 : Type IV
- 2 : CP violated
  - 0 : General. . .
  - 1 : Type I
  - 2 : Type II
  - 3 : Type III
  - 4 : Type IV

2 : SUSY
- 1 : SUSY breaking model
  - 0 : General MSSM
  - 1 : (m)SUGRA model
  - 2 : (m)GMSB model
  - 3 : (m)AMSB model
  - 4 : other
- 3 : Particle content
  - 0 : MSSM
  - 1 : NMSSM
  - 2 : other
- 4 : R-parity violation
  - 0 : R-parity conserved
  - 1 : R-parity violated
- 5 : CP violation
  - 0 : CP is conserved.
  - 1 : CKM phase
  - 2 : General CP phases
- 6 : Flavour violation
  - 0 : No flavour violation
  - 1 : Quark flavour
  - 2 : Lepton flavour
  - 3 : Lepton and quark flavour

99 : Other models
Entries defined on demand

FCONST

- Are there alternative definitions for decay constants?
- Do we have a complete list of decay constants?

FBAG

We need to provide the definitions of the Bag parameters, as well as a list with proper numbering of the parameters

FMASS

```
Block FMASS  # Mass spectrum in GeV
#PDG code  mass            scheme  scale     particle
     3     1.05000000e-01  1        2.0e+00  # s
     5     4.68000000e+00  3        0        # b
   211     1.39600000e-01  0        0        # pi+
   313     8.91700000e-01  0        0        # K*
   321     4.93700000e-01  0        0        # K+
   421     1.86484000e+00  0        0        # D0
   431     1.96849000e+00  0        0        # D_s+
   521     5.27950000e+00  0        0        # B+
   531     5.36630000e+00  0        0        # B_s
```

Schemes:
- 0: pole
- 1: MSbar
- 2: DRbar
- 3: 1S
- 4: kin

Should we keep this block or use the SLHA MASS block instead?

Wilson coefficients

- Is the definition of Wilson coefficients general enough?
- Do we have a complete list of operators?
- How to define the mirror operators?
- What is the best normalization for Wilson coefficients?
- Should we include CKM elements in the Wilson coefficients?
- What is the best definition for O_7 and O_8 ?

FOBS

How to use PDG codes for inclusive branching ratios?

Form & Shape factors

Form factors, shape factors, **OR** miscellaneous?

Other blocks

- Block for Yukawa couplings
  - Why not including the SLHA Yukawa coupling blocks in every FLHA files?

- A block for epsilon corrections?

- Other blocks?