Status of RPV samples generation

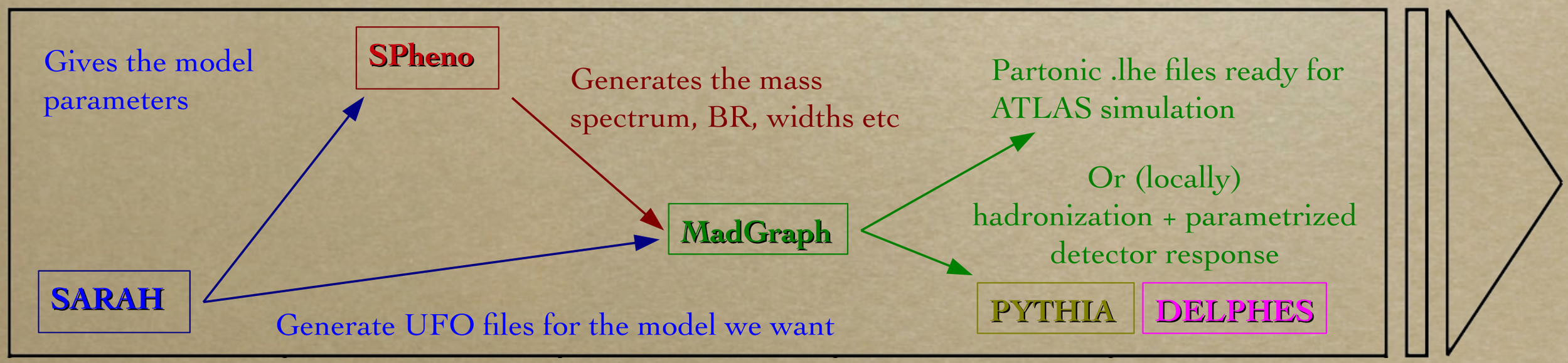
Romain Kukla

26/10/2016

Generation pipeline

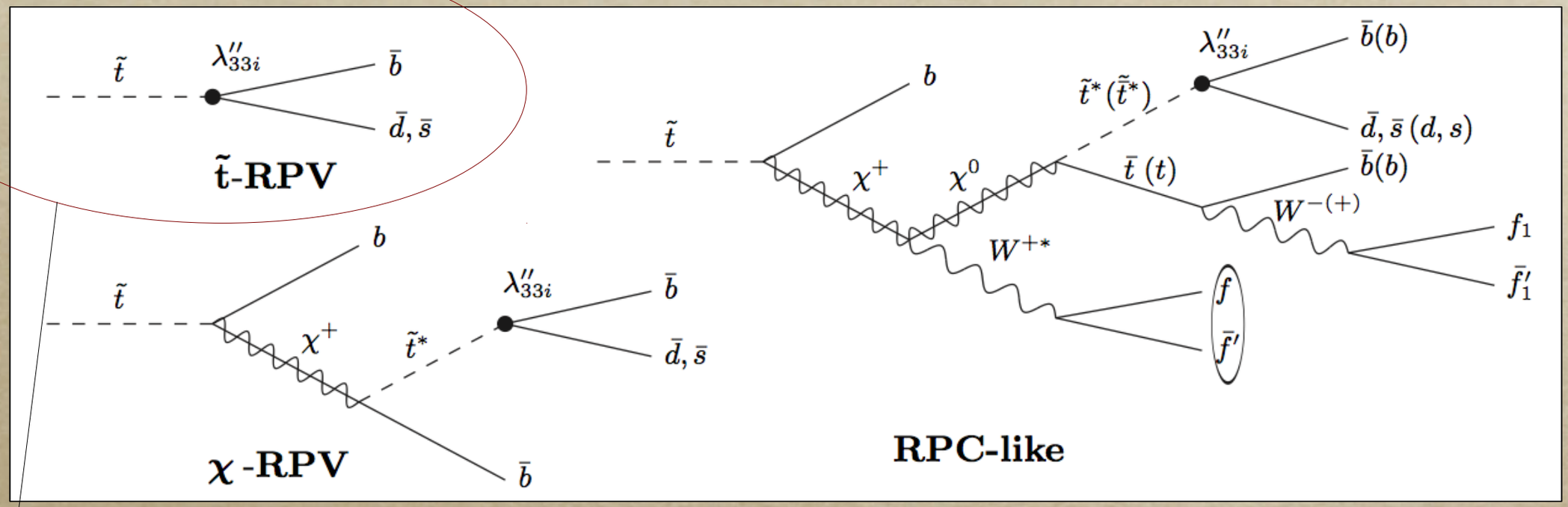
I followed Sara D. guidelines (/atlas/kukla/RPV/INSTRUCTIONS/)
► 1 : generate a model with SARAH 4.5.8 (MSSM RPV + trilinear RPV)
► 2 : use the output with Spheno 3.3.5 with a proper set of parameters
► 3 : import in MG5 2.4.3 both UFO files from SARAH and param_card.dat from Spheno and generate any process

► (4) : either send these .lhe files to athena, or go through Pythia+Delphes



Test sample : 2b2j

Leading RPV stops decays



Stop pair production signature for each type of decay

This is the final state I generated

$\tilde{t}$ / $\bar{\tilde{t}}$	$\tilde{\mathbf{t}}$-RPV	χ-RPV	RPC-like
$\tilde{\mathbf{t}}$-RPV	$2b2j$	$4b2j$	$1t3b2j$
χ-RPV		$6b2j$	$1t5b2j$
RPC-like			$2t4b2j$

Test sample : 2b2j

I took Sara's Benchmark 1 for a 0.1 λ_{33i} coupling

benchmark points	1	2
$\tan\beta$	10	
M_1	2.5 TeV	
M_2	1.5 TeV	
M_3	1.7 TeV	
$(m_{\tilde{Q}})_{33}$	2 TeV	
$(m_{\tilde{U}})_{33}$	570 GeV	964 GeV
$(m_{\tilde{D}})_{33} = (m_{\tilde{U}})_{ii} = (m_{\tilde{D}})_{ii} = (m_{\tilde{E}})_{ii} = (m_{\tilde{Q}})_{ii} = (m_{\tilde{L}})_{ii}, i = 1,2$	3 TeV	
$(T^u)_{33}$	-2100 GeV	-2150 GeV
m_A	2.5 TeV	
μ	400-650 GeV	750-1000 GeV
$\lambda''_{33i} \equiv \sqrt{(\lambda''_{332})^2 + (\lambda''_{331})^2}$	$10^{-7} - 10^{-1}$	
$T^l, T^d, (T^u)_{ij}, (m_{\tilde{Q},\tilde{U},\tilde{D},\tilde{L},\tilde{E}})_{ij}, T''_{33i}$, $i \neq j = 1,2,3$, $(T^u)_{ii}, i = 1,2$	0	

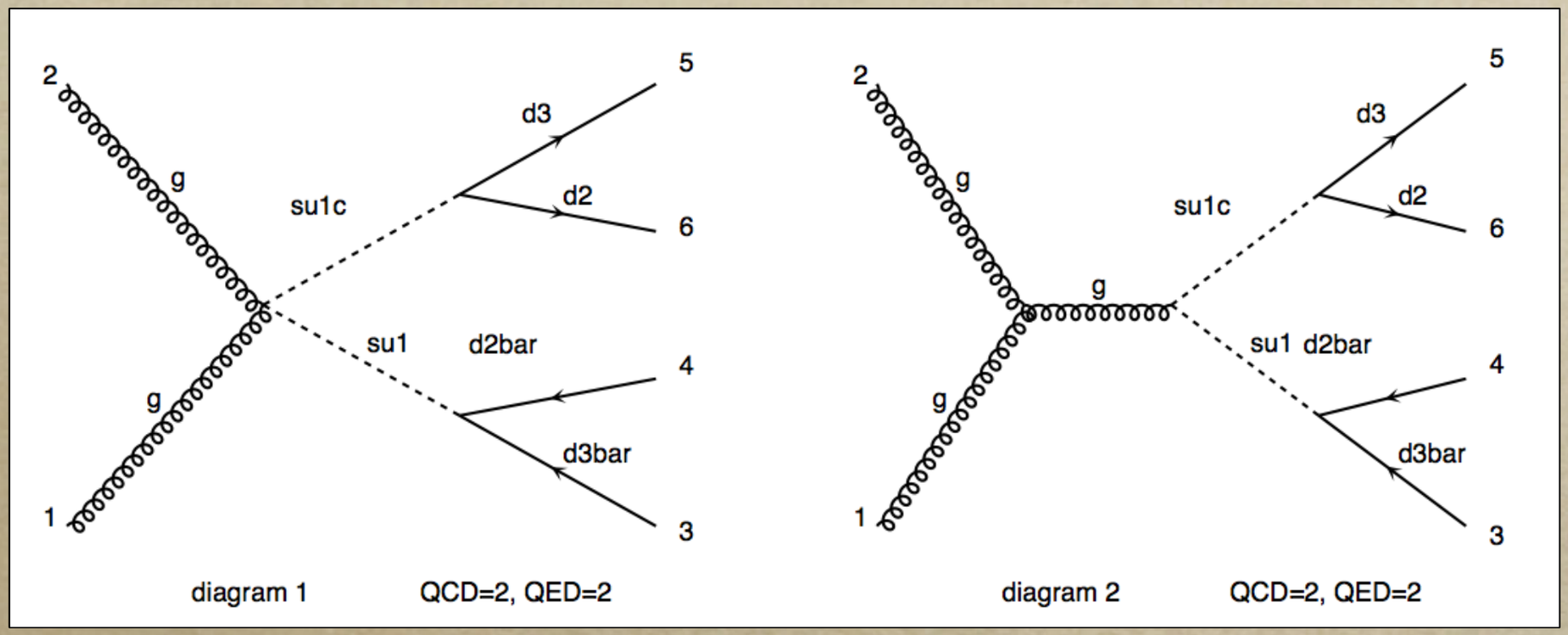
benchmark points	1	2
$m_{\tilde{t}}$	$\sim$ 600 GeV	$\sim$ 1 TeV
m_{χ^+}	$\sim$ 400-650 GeV	$\sim$ 750-1000 GeV
$m_{\chi^+} - m_{\chi^0}$	$\sim$ 1.5-2.5 GeV	
$m_{\tilde{t}} - m_{\chi^+}$	$\sim -45 - 200$ GeV	$\sim$ 1 - 245 GeV
$m_{\chi_2^0} - m_{\chi^+}$	$\sim$ 4-5 GeV	
$m_{\chi_3^0} \sim m_{\chi_2^+}, m_{\chi_4^0}$	$\sim$ 1.5 TeV, $\sim$ 2.5 TeV	
m_{h^0}	$\sim$ 125 GeV	
$m_A \approx m_{H^0} \approx m_{H^\pm}$	$\sim$ 2.5 TeV	
$M_{\tilde{g}}$	$\sim$ 1.87 TeV	
$M_{\tilde{t}2} \approx M_{\tilde{b}1}$	$\sim$ 2 TeV	
$M_{\tilde{b}2} \approx M_{\tilde{u}1,2} \approx M_{\tilde{d}1,2}$	$\sim$ 3 TeV	
$M_{\tilde{l}_{1,2}}, M_{\tilde{\nu}1,2}$	$\sim$ 3 TeV	
$(g-2)_\mu$	$3 - 3.3 \times 10^{-11}$	$3.2 - 3.3 \times 10^{-11}$
$\delta\rho$	$5.7 - 5.9 \times 10^{-5}$	$\sim 5.5 \times 10^{-5}$
$BR(B \to X_s\gamma)/BR(B \to X_s\gamma)^{SM}$	0.89 – 0.92	0.95 – 0.96
$BR(B_s^0 \to \mu\mu)$	$3.36 - 3.39 \times 10^{-9}$	$3.38 - 3.40 \times 10^{-9}$
$BR(B_d^0 \to \mu\mu)$	$1.08 - 1.09 \times 10^{-10}$	$\sim 1.09 \times 10^{-10}$

MG syntax :

```
generate p p > su1 su1c , su1 > d3bar d2bar , su1c > d3 d2 @1
add process p p > su1 su1c , su1 > d3bar d1bar , su1c > d3 d1 @2
```

Test sample : 2b2j

MadGraph diagrams are the one we expected :



Resulting cross-sections : 9,7 fb (13 TeV) and 12,7 fb (14 TeV)

which is different from the paper : should be 4,7 fb at 14 TeV

→ Good that the pipeline works ; need to debug why I don't get the good cross-section (maybe different parameters)