## High-Mass Diffraction in Pythia (6 \& 8)

- $\sigma_{\text {diff }}$ obtained from parametrizations (Schuler-Sjöstrand) $\sim \mathrm{dM} / \mathrm{M}^{2}$ with exponential $t$ slope, and fudge parameters
- I) $\left(1-M^{2} / s\right)$ to kill distribution at edge of phase space. 2) Smeared-out enhancement in resonance region (no attempt to model individual resonances separately). 3) DD: Suppression for systems overlapping in rapidity.
- String fragmentation. Constrained by LEP, but diffraction is different. Could we constrain multiplicity distributions and momentum (x) spectra, identified-particle ratios (eg K/ $\pi$, K*/K, p/m, $\Lambda / p$ ) directly in diffractive processes (as function of $M$ )?
- P8: $\mathrm{M}>10 \mathrm{GeV}$ (user-definable) modeled as Pomeron-proton collision
- $\quad M$ and $t$ distribution depends on Pomeron flux: several parametrizations
- MPI allowed inside Pomeron-proton system (amount depends on $\sigma_{\mathrm{P}_{\mathrm{P}}}$ )
- Default $\sigma_{P_{p}} \sim 10 \mathrm{mb}$ (larger than nominal value of 2 mb , which would give too much activity). Perceive as effective parameter that lumps together many effects. Includes gap survivial.
- Gap always survives (no MPI involving Pomeron's p remnant)
- To constrain, need data on event shapes in diffractive events, such as multiplicity distributions, UE in diffractive jets. (Still useful if only in restricted fiducial regions.)
- Colour reconnections can mimic large gaps, but now without constraint of no net quantum number transfer $\rightarrow$ measurable?

The diffractive cross sections are given by

$$
\begin{aligned}
\frac{\mathrm{d} \sigma_{\mathrm{sd}(X B)}(s)}{\mathrm{d} t \mathrm{~d} M^{2}} & =\frac{g_{3 \mathbb{P}}}{16 \pi} \beta_{A \mathbb{P}} \beta_{B \mathbb{P}}^{2} \frac{1}{M^{2}} \exp \left(B_{\mathrm{sd}(X B)} t\right) F_{\mathrm{sd}} \\
\frac{\mathrm{~d} \sigma_{\mathrm{sd}(A X)}(s)}{\mathrm{d} t \mathrm{~d} M^{2}} & =\frac{g_{3 \mathbb{P}}}{16 \pi} \beta_{A \mathbb{P}}^{2} \beta_{B \mathbb{P}} \frac{1}{M^{2}} \exp \left(B_{\mathrm{sd}(A X)} t\right) F_{\mathrm{sd}} \\
\frac{\mathrm{~d} \sigma_{\mathrm{dd}}(s)}{\mathrm{d} t \mathrm{~d} M_{1}^{2} \mathrm{~d} M_{2}^{2}} & =\frac{g_{3 \mathbb{P}}^{2}}{16 \pi} \beta_{A \mathbb{P}} \beta_{B \mathbb{P}} \frac{1}{M_{1}^{2}} \frac{1}{M_{2}^{2}} \exp \left(B_{\mathrm{dd}} t\right) F_{\mathrm{dd}}
\end{aligned}
$$

The slope parameters are assumed to be

$$
\begin{aligned}
B_{\mathrm{sd}(X B)}(s) & =2 b_{B}+2 \alpha^{\prime} \ln \left(\frac{s}{M^{2}}\right) \\
B_{\mathrm{sd}(A X)}(s) & =2 b_{A}+2 \alpha^{\prime} \ln \left(\frac{s}{M^{2}}\right) \\
B_{\mathrm{dd}}(s) & =2 \alpha^{\prime} \ln \left(e^{4}+\frac{s s_{0}}{M_{1}^{2} M_{2}^{2}}\right)
\end{aligned}
$$

The fudge factors are:

$$
\begin{aligned}
F_{\mathrm{sd}} & =\left(1-\frac{M^{2}}{s}\right)\left(1+\frac{c_{\mathrm{res}} M_{\mathrm{res}}^{2}}{M_{\mathrm{res}}^{2}+M^{2}}\right) \\
F_{\mathrm{dd}} & =\left(1-\frac{\left(M_{1}+M_{2}\right)^{2}}{s}\right)\left(\frac{s m_{\mathrm{p}}^{2}}{s m_{\mathrm{p}}^{2}+M_{1}^{2} M_{2}^{2}}\right) \\
& \times\left(1+\frac{c_{\mathrm{res}} M_{\mathrm{res}}^{2}}{M_{\mathrm{res}}^{2}+M_{1}^{2}}\right)\left(1+\frac{c_{\mathrm{res}} M_{\mathrm{res}}^{2}}{M_{\mathrm{res}}^{2}+M_{2}^{2}}\right)
\end{aligned}
$$

