In momentum twistor language we have the n momentum twistors Z_i, which together form the $4 \times n$ matrix

$$K = \begin{pmatrix} z_{11} & \dots & z_{n1} \\ z_{12} & \dots & z_{n2} \\ z_{13} & \dots & z_{n3} \\ z_{14} & \dots & z_{n4} \end{pmatrix}. \tag{1}$$

As long as the first 4 columns are non-singular, we can row reduce K in to the form

$$K' = \begin{pmatrix} 1 & 0 & 0 & 0 & y_{51} & \dots & y_{n1} \\ 0 & 1 & 0 & 0 & y_{52} & \dots & y_{n2} \\ 0 & 0 & 1 & 0 & y_{53} & \dots & y_{n3} \\ 0 & 0 & 0 & 1 & y_{54} & \dots & y_{n4} \end{pmatrix}. \tag{2}$$

The columns of K' define a new set of momentum twistors Z'_i, where for example $Z'_1 = \{1, 0, 0, 0\}$ and $Z'_5 = \{y_{51}, y_{52}, y_{53}, y_{54}\}$. It is easy to check that

$$y_{ij} = (-1)^j \langle \{1, 2, 3, 4\} \setminus \{j\}, i\rangle / \langle 1234\rangle, \tag{3}$$

$$\langle abcd\rangle' = \det(Z'_a Z'_b Z'_c Z'_d) = \langle abcd\rangle / \langle 1234\rangle. \tag{4}$$

You can then define the Sklyanin bracket as an operation on these y_{ij} by

$$\{y_{ij}, y_{ab}\} = (\text{sgn}(a - i) - \text{sgn}(b - j))y_{ib}y_{aj}. \tag{5}$$

Which then extends to a bracket on functions of the y_{ij} via

$$\{f(y), g(y)\} = \sum_{i,a=1}^{n} \sum_{j,b=1}^{4} \frac{\partial f}{\partial y_{ij}} \frac{\partial g}{\partial y_{ab}} \{y_{ij}, y_{ab}\}. \tag{6}$$

Now if we want to evaluate the Poisson bracket between two $\mathcal{X}$-coordinates, we can instead treat them as functions of the y_{ij} and use eq. (6), dividing by an overall factor of 2.[1] To be precise, for each four-bracket $\langle abcd\rangle$ in the $\mathcal{X}$-coordinates, replace them with $\langle abcd\rangle'$ expanded out in terms of y_{ij} (e.g. $\langle 1256\rangle' = y_{53}y_{64} - y_{54}y_{63}$). Then you can calculate eq. (6) directly in terms of the y_{ij}, though note that it will be a VERY long expression.

To actually extract a real value for the Poisson bracket, you need to numerically evaluate the remaining expression. I think you can choose arbitrary numerical values of the y_{ij}, but to be sure I choose some point K in the positive grassmannian and then use eq. (3) to get values for the y_{ij}. After plugging in the numbers, if you get some nasty fraction dependent on

[1] Of course also remember that the Poisson bracket on $\mathcal{X}$-coordinates is actually defined on the Log's of the $\mathcal{X}$-coordinates, so in practice not only do you have to divide by 2 but you also have to divide by the product of the two $\mathcal{X}$-coordinates in order to get what we commonly refer to as "the Poisson bracket".

the particular kinematic choice, then the two $\mathcal{X}$-coordinates have a "bad" Poisson bracket. However if you get some nice number, such as ± 1 or 0 (it's also possible to get values such as ± 2, but in practical cases that doesn't occur), then you can say that the $\mathcal{X}$-coordinates have nice Poisson bracket.

As for why this whole procedure actually works, I have no idea, but apparently it's explained in http://arxiv.org/abs/math/0208033.