Constrained Markovian MC for the initial state PDFs

LCWS 2004

S. Jadach

and

M. Skrzypek

stanislaw.jadach@ifj.edu.pl

HNINP-PAS, Cracow, Poland

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- *Backward Markovian* does not solve evolution eqs. It merely exploits their solutions coming from the *external* non-MC methods
- **Is it possible to invent an efficient MC algorithm for constrained Markovian based on *internal* MC solutions of the evolution eqs?**

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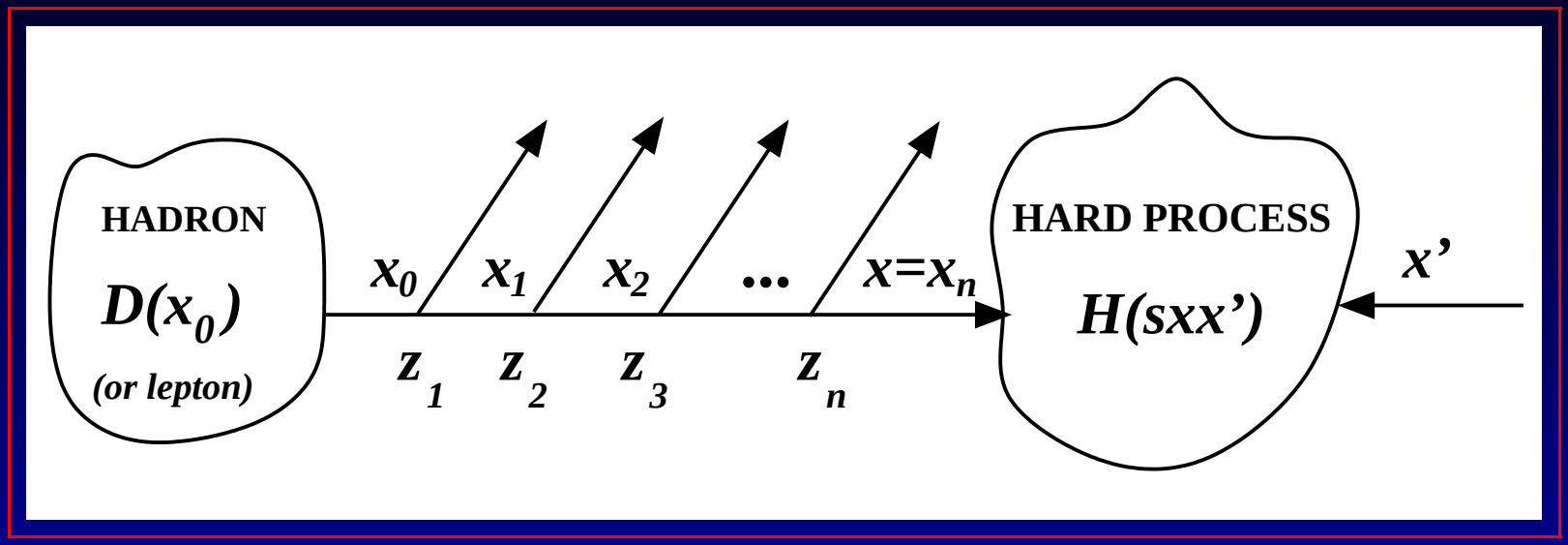
Solutions class I and II



$$\int dx_0\, D(x_0) \int \prod_i dz_i P(z_i)\; H\left(s x_0 \prod z_i\right)$$

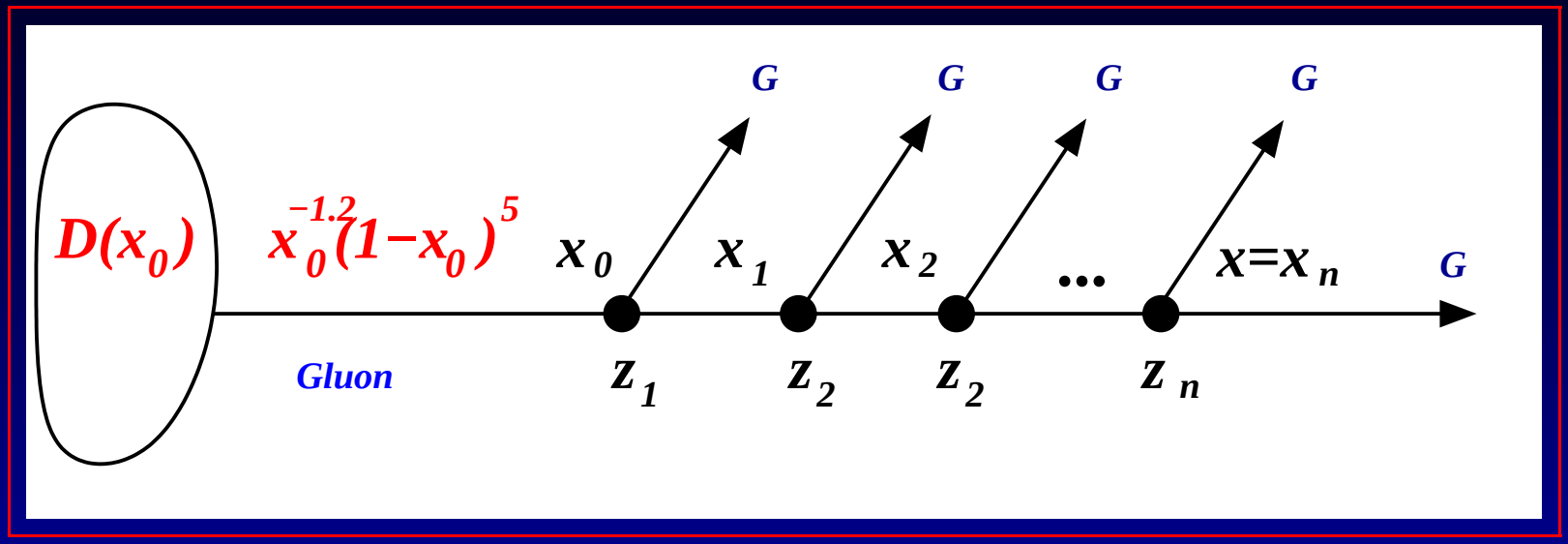
Solutions class I *(more difficult because of $\delta(\ldots)$)*:

$$\int dx\; dx_0\; D(x_0) H\left(sx\right) \int \prod_i dz_i P(z_i) \delta(x - x_0 \prod_i z_i)$$

Solutions class II *(only for QCD)* **NEW!**:

$$\int dx\; H\left(sx\right) \int \prod_i \frac{dz_i}{z_i} P(z_i)\;\; D(x/\prod_i z_i)\; \Theta(\prod z_i - x)$$

Prototype IIB

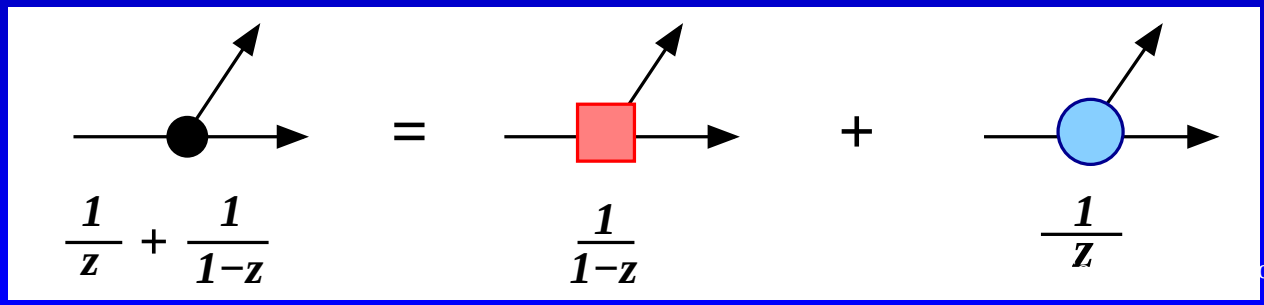


Replace $D(x_0) \to 1/x_0 = x \prod \frac{1}{z_i}$. Compensated by MC weight.

Must generate $P(z_i) = 2C_A\left(\frac{1}{z_i} + \frac{1}{1-z_i}\right)$

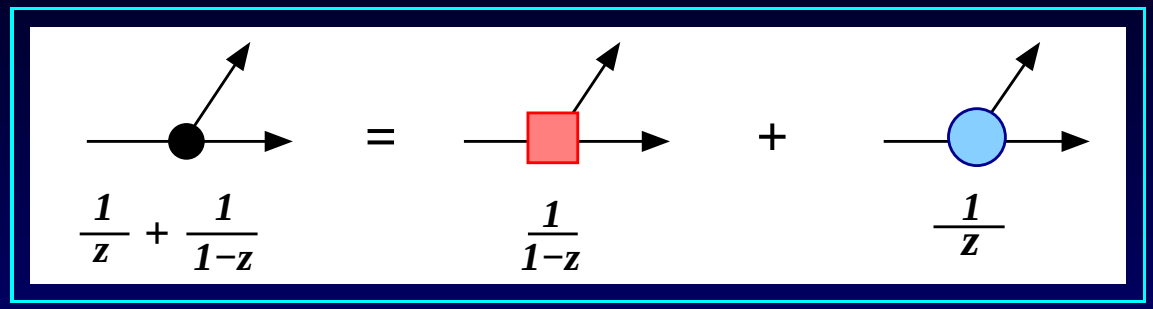
with the constraint $\prod_i z_i \geq x$. Not so trivial!

Solution by the multibranching method:

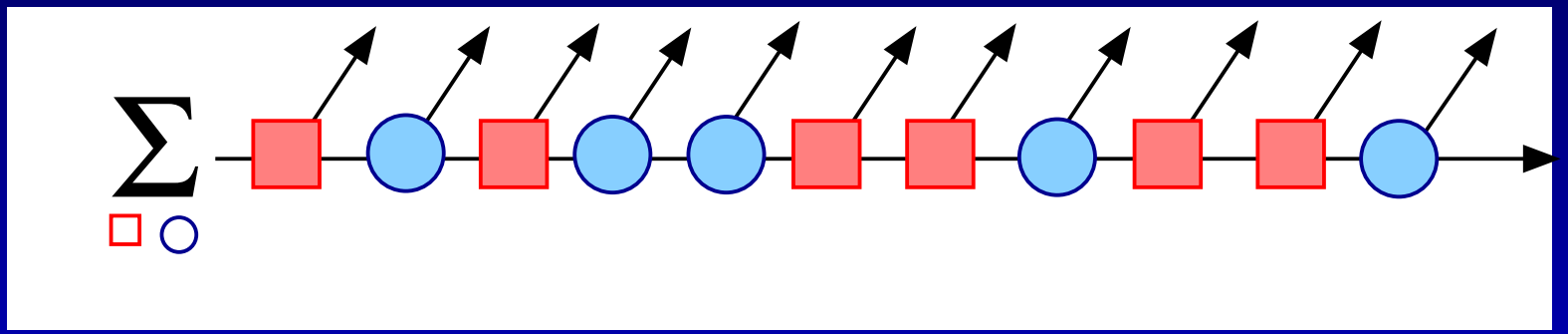


Multibranching in IIB

Using



Leads to sum over branches:



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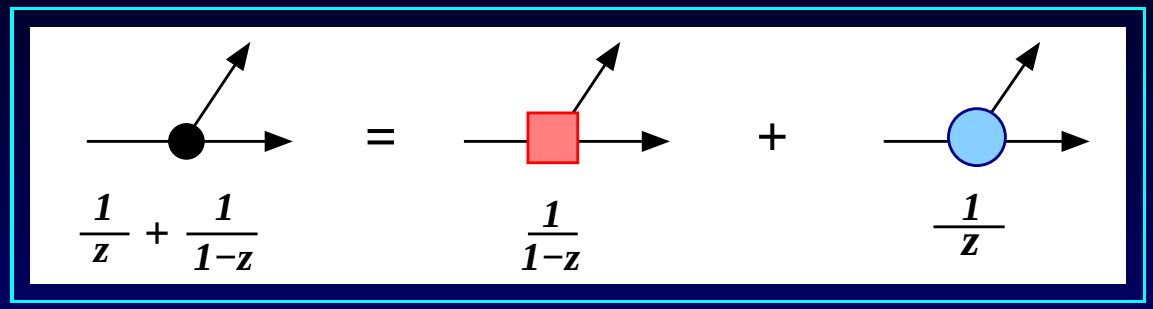

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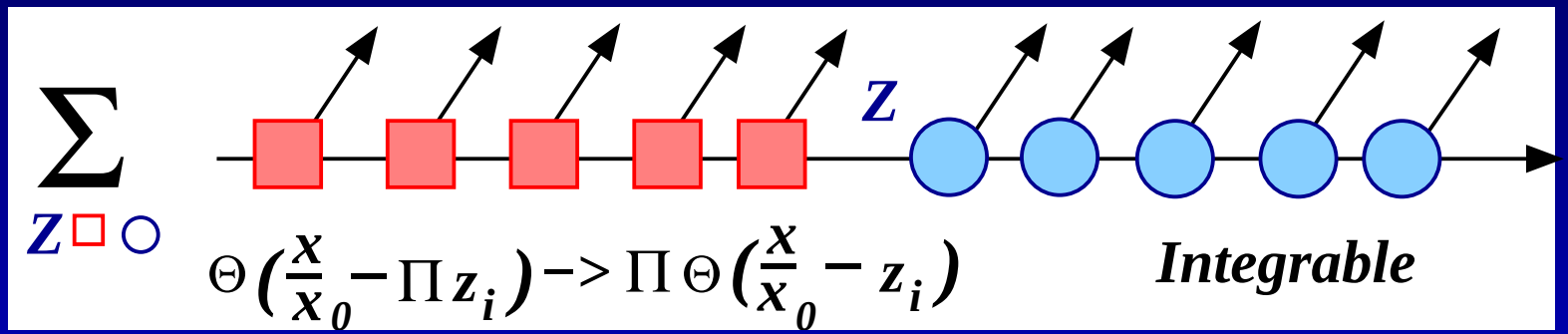

Contributions $1/z$ and $1/(1-z)$ are combined and resummed separately.

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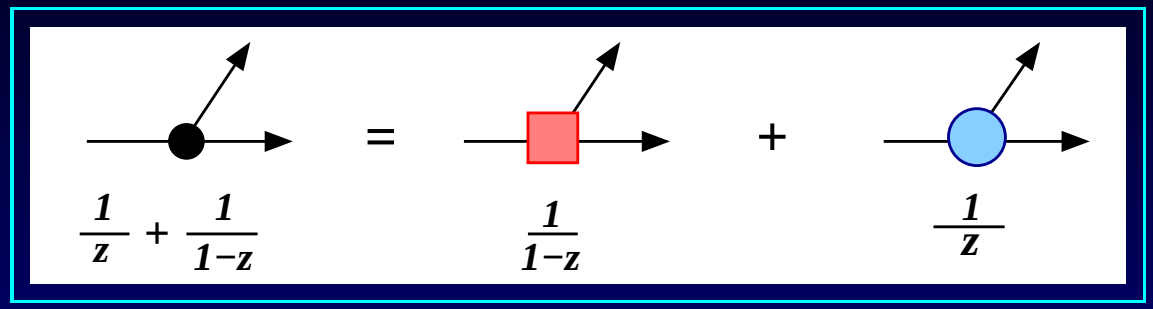

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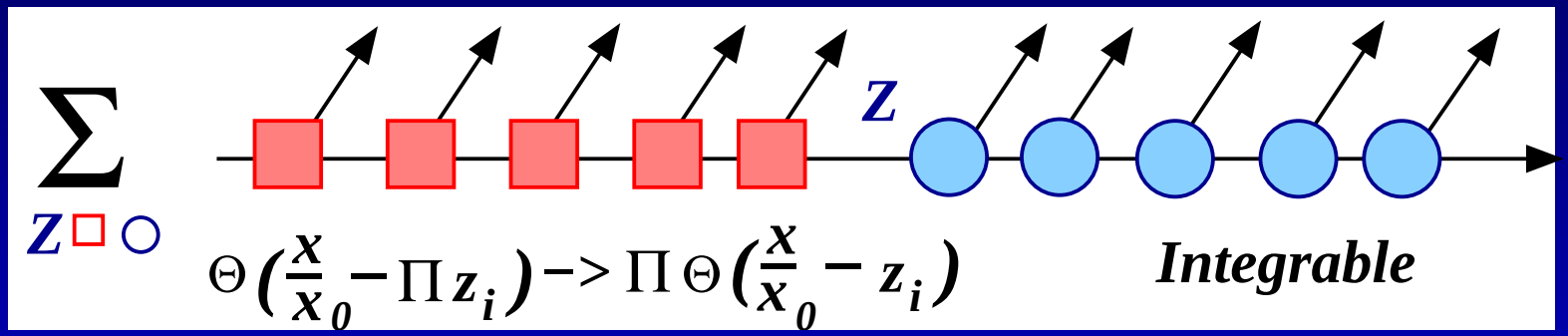

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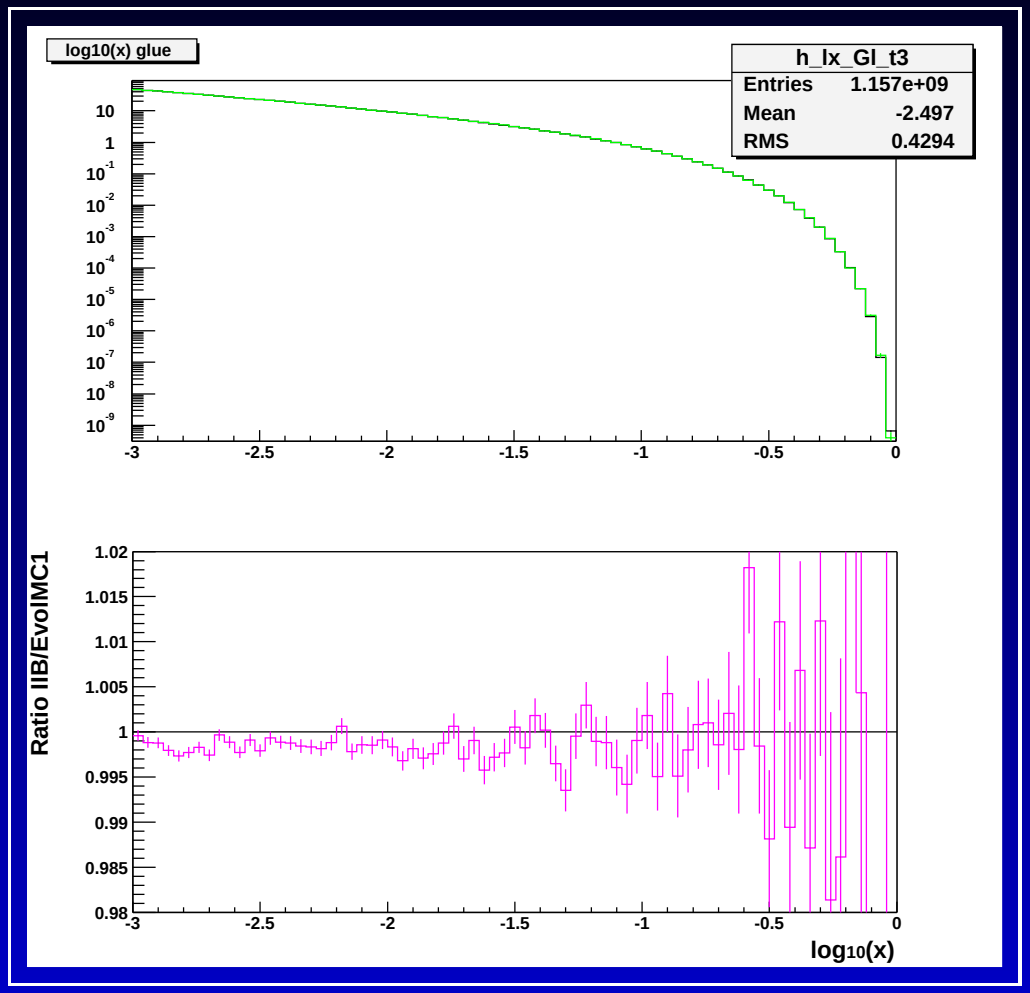
Worst-case scenario (pure gluon bremsstrahlung) is now prototyped and tested.

Testing prototype IIB



Comparison of IIB solution with the Markovian MC EvolMC for pure gluonstrahlung.
Two solutions and the ratio (lower plot).
Agreement to within 0.2%

Short term prospects

- More testing of IIB.
- Numerical test of solutions class I
  (several solutions found, under tests)
- Implementing transitions $Q \to G$ and $G \to Q$
  (at least 2 methods found)
- Adding NLL corrections
  (looks rather trivial)

Most important:
NEW AVENUES are opened in the construction of the ISR PARTON SHOWER type MCs