Heavy-Flavor Transport in QCD Matter:

hadronization

The POWLANG team

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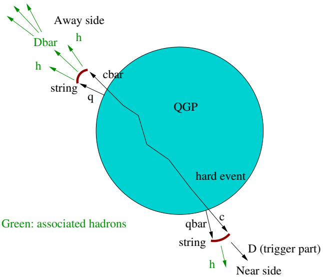
HF hadronization in POWLANG

We describe hadronization through the following Lund-like model interfaced to our POWLANG transport code[1]:

- At $T_{\rm dec}$ c-quarks coupled to light $\overline{q}$'s from a local *thermal distribution*, eventually *boosted* ($u^{\mu}_{\rm fluid} \neq 0$) to the lab frame;
- Strings are formed and given to PYTHIA 6.4 to simulate their fragmentation and produce the final hadrons ($D + \pi + \dots$)

$$2 \to 1^* \to N$$



[1] For details see Eur.Phys.J. C75 (2015) no.3, 121

From quarks to hadrons

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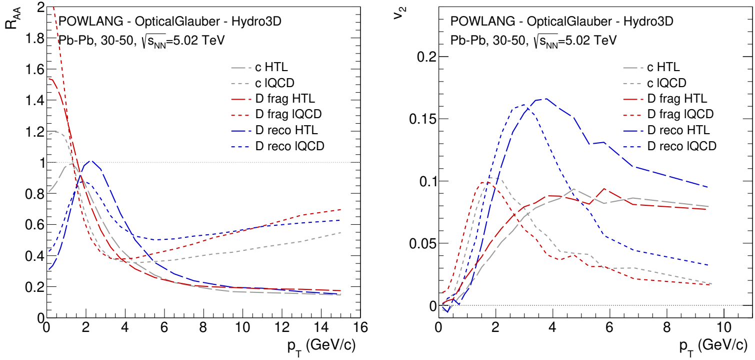
- Let the string fragment calling the PYEXEC routine, storing the information on the particles you are interested in

Some comments

- In-medium string formation occurs with probability 1 (like in any other hadronic collision), no matter how different the velocities of the heavy and light quarks are: one does not need to form a bound hadrons, but an excited intermediate state which will eventually decay;
- Production of strange or baryonic HF hadrons suppressed (as in standard elementary collisions) by the difficulty of exciting $s\bar{s}$ or quark-diquark pairs from the vacuum

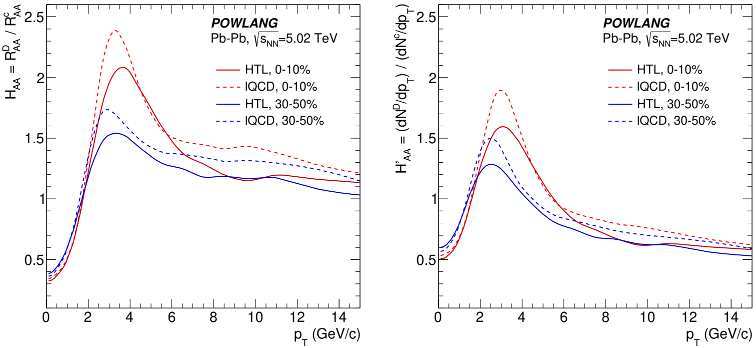
Impact on the observables: R_{AA} and v_2



Hadronization via in-medium recombination + string-fragmentation:

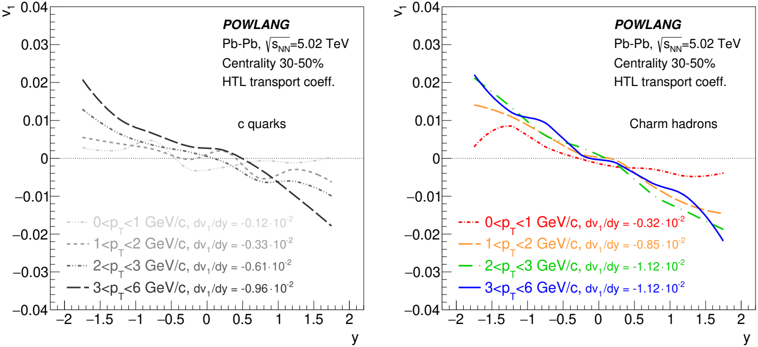
- Strong impact at low-intermediate p_T, HF hadrons inheriting part of the radial and elliptic flow of the light thermal parton;
- Naturally approaches the result of independent fragmentation at high-p_T, without having to switch scheme

H_{AA}



- Enhancement of the spectrum at intermediate p_T stronger for more central collisions (larger radial flow);
- Quenching of the high-p_T HF hadron spectrum wrt HQ one typical of a fragmentation process applied to a steeply falling spectrum

Impact on the observables: directed flow



The space-momentum correlation implemented in our in-medium recombination scheme enhances the D-meson v_n also when the average flow of the thermal partons is small, like in the case of v_1

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- Built-in space-momentum correlation significantly enhances any flow signal going from HQ's to HF hadrons;
- Smooth approach of the results of vacuum-like fragmentation at high p_T: for a high-energy HQ, it doesn't matter whether the second endpoint of the string is a thermal parton (AA case) or some quarks from the underlying event (like in pp)
- No medium-modification of HF hadrochemistry: once produced, the string is fragmented as in a standard hadronic collision. This is something to improve in the near future, including a different decay mechanism for low invariant-mass clusters allowing the HF hadrons to inherit the quantum numbers of the light parent quark (or diquarks from the medium)