Associated production of a photon and a heavy quark jet

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Motivations

Why $\gamma + Q$-jet?

Class of reactions to discover/characterize the Quark-Gluon plasma at LHC (also heavy quark energy loss)

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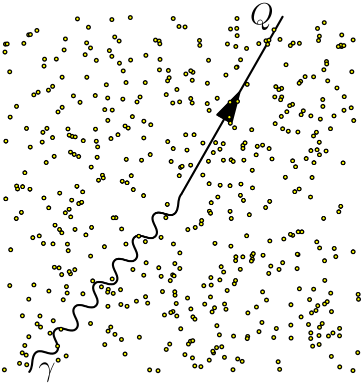

Project

What to study?

Study the correlations $\gamma + Q$-jet in AA, pA and pp collisions

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What to study?

Study the correlations $\gamma + Q$-jet in $A\,A$, $p\,A$ and $p\,p$ collisions

Collaboration with

I. Schienbein, C. Léger (LPSC), F. Arléo, P. Gossiaux (Subatech)
N. Barakat (Lebanese university), G. Kramer, B. Kniehl, (Hamburg university),H. Spiesberger (Mainz university)()

Project

But. . .

This study relies on the fact that $p\,p \to \gamma + Q$-jet is under control, is it true?

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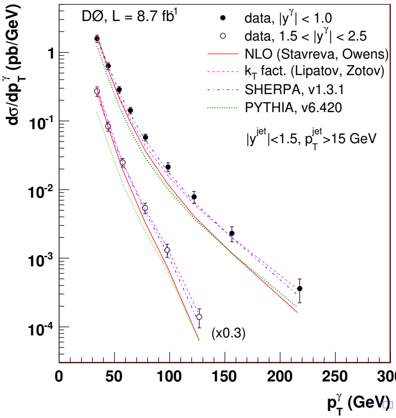


$p\,p$ collisions

Naive approach

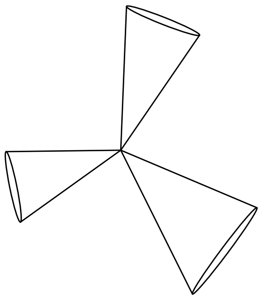
$Q + g \to \gamma + Q$ + H. O. (NLO)

But. . .

- fixed order approach: missed some contributions where the Q is produced in the dressing of light partons
- non orthodox computation: the theoretical result depends on a cut-off which has no experimental counter-part!

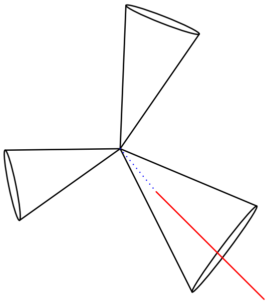
Experimental definition of an *Q*-jet

For an event, reconstruct the hadronic jets



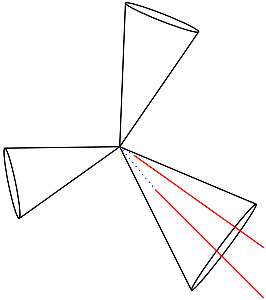
Experimental definition of an Q-jet

Then search for a secondary vertex from which a μ track point to, if this μ track falls in the jet, the jet is called a Q-jet



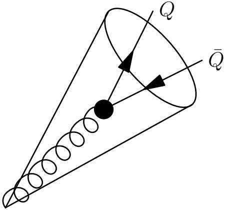
Experimental definition of an *Q*-jet

Q-jet : a jet containing at least one μ track



But. . .

This definition is not colinear safe!



is count as a *Q*-jet

Remember

$$\frac{1}{\varepsilon} \int_0^1 dz \underbrace{\left(P_{gg}(z) + 2\, N_f\, P_{qg}(z)\right)}_{=0}$$

Flavour k_T algorithm

Use the flavour k_T algorithm G. Salam et al.. Unfortunately, not applicable to Tevatron and LHC experiments, need to know the flavour of the energy clusters.

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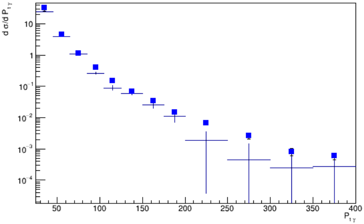
Fragmentation Functions

Use FF of partons into Q hadrons (inside a jet)
Use DiPhox $p\,p \to \gamma +$ hadron at NLO
In the region $P_t \simeq m_Q$, use the massive calculation $p\,p \to Q\,\bar{Q}\,\gamma$ (L. Reina, H. Hartanto)

p p collisions
Status

First step, the naive approach (QJetPhox) versus the ATLAS data (dominated by *q*-*g*)



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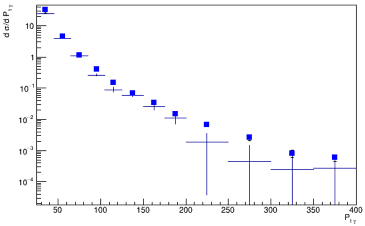

Depending on the first step, move to *p A* and *A A* collisions, refined the theoretical approach