The Need for Event-Shape Resummation

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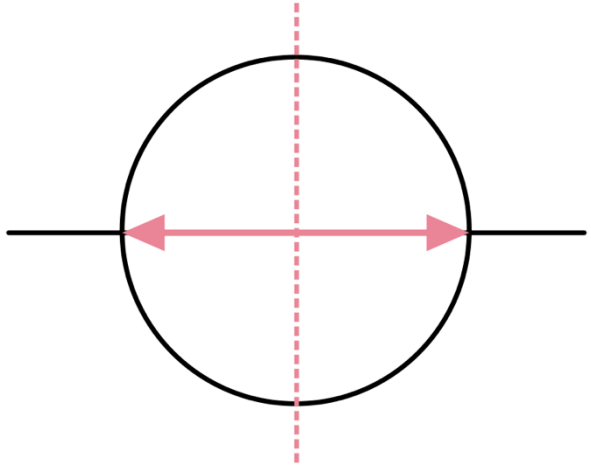
EVENT SHAPE VARIABLES

1. Useful for precise measurements of the strong coupling

2. Event-shapes are a class of observables examining specific features of the ‘shape’ of a hadronic final state

3. Look at different event-shapes depending on the specific process



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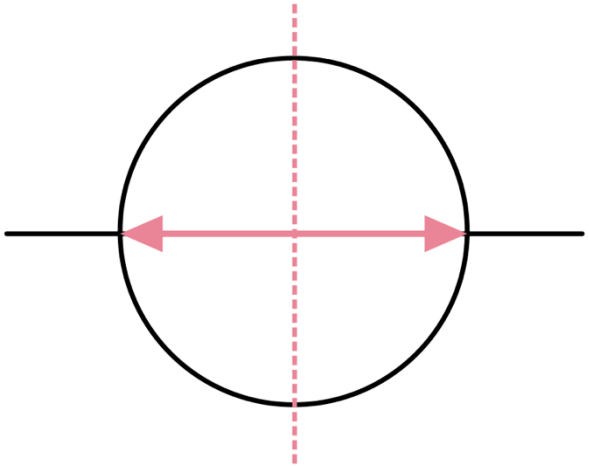
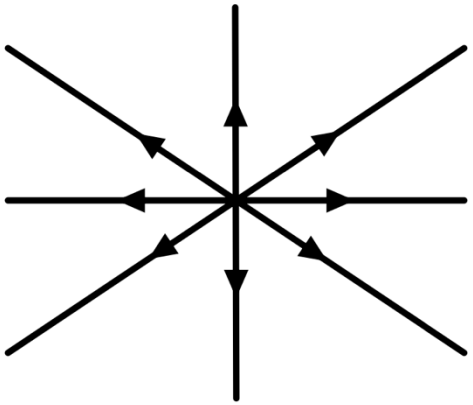
THRUST

$$e^+e^- \to 2 \text{ jet}$$



$\tau = 0$



$\tau = 2/3$

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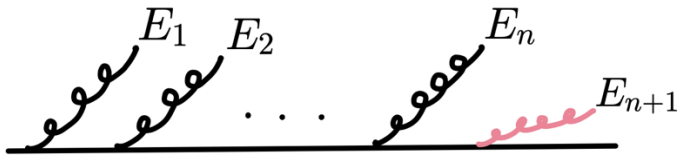
IRC SAFETY

1. Event-shapes are IRC safe observables
2. Inclusive observables: cancellation of divergences between real and finite results
3. Exclusive observables can still have divergences, and therefore must be IRC safe to avoid infinities



IRC Safety is the idea that an additional soft and/or collinear emission will not affect the value of the observable

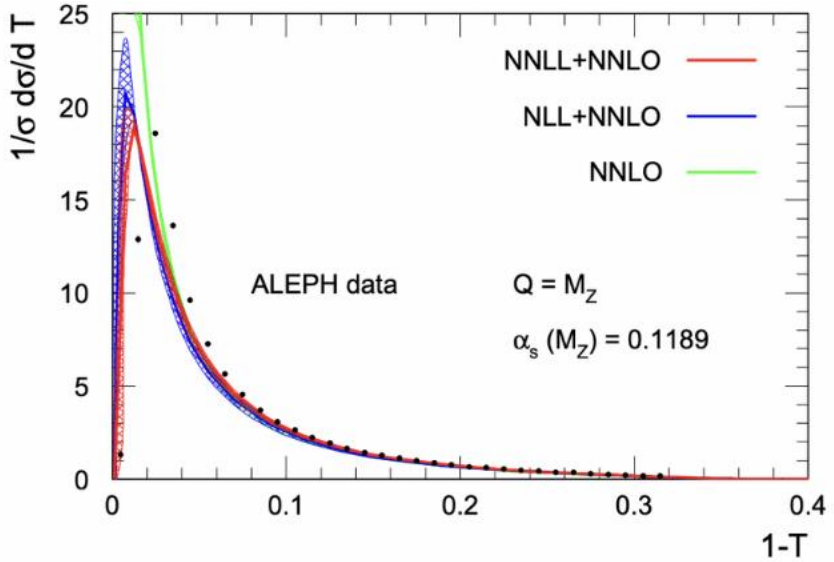
RESUMMATION

1. Large logarithms of the form $L = \ln\frac{1}{v}$ appear at every order in perturbation theory

2. Resummation reorders terms to prioritise higher powers of logarithms rather than lower powers of α_s

$$\Sigma(v) \simeq \exp\{Lg_1(\alpha_s L) + g_2(\alpha_s L) + \alpha_s g_3(\alpha_s L) + \cdots\}$$

$\alpha_s^n L^{n+1}(LL)$ $\alpha_s^n L^n(NLL)$ $\alpha_s^n L^{n-1}(NNLL)$



D. Busklulic et al. [ALEPH Collaboration], 1997, 73, 409; G. Luisoni, S. Marzani, 2015, 42, 103101

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Thank you

We are looking at the NNLL accuracy in our upcoming paper

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