Breaking Questions: True or False

- QED and QCD are similar in that they are both local symmetries?
- Leptons can feel the strong force?
- Fermions that carry color must exist in three orthogonal states?
- SU(3) flavor symmetry is exact?
- SU(3) color symmetry is exact?
- The strength of the QCD interaction depends on it color of the fermion?
- Color is conserved?

Hadronization ...





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Running of the electromagnetic coupling ...





Breaking questions

- Give me some reasons why studying QCD in electronpositron colliders would be an advantage over a hadron collider
- What are the disadvantages to an electron-positron collider?
- How could you test that quarks are spin-1/2 here? (hint: Think about e+e- to μ + μ -)







How many jets are in these events?



How many jets?



How many jets



p_T inclusive k_t (p=1) pT^2 R рТ 0,7 1,2 3,8 4,2 4,8 5,5 6,2 F

Table 1

p_T | inclusive k_t (p=1)



Table 1

p_T | inclusive k_t (p=1)



recombine to new object

p_T | inclusive k_t (p=1)



P_T | inclusive k_t (p=1)



	рТ	pT^2	R	1	2	3	В	Α
1	25	625	0,5	0	313	13613	18050	33800
2	55	3025	1,2	2965	0	40898	58141	122513
3	30	900	3,8	19602	12168	0	450	6498
В	55	3025	4,3	87362	58141	1513	0	11858
A	50	2500	5,7	135200	101250	18050	9800	0

Table 1

inclusive k_t (p=1)



В

Α

p_T | inclusive k_t (p=1)



	рТ	рТ^2	R	С	3	В	Α
С	65	4225	0,9	0	71065	97682	194688
3	30	900	3,8	15138	0	450	6498
В	55	3025	4,3	69938	1513	0	11858
Α	50	2500	5,7	115200	18050	9800	0

Table 1

P_T | inclusive k_t (p=1)



	рТ	рТ^2	R	С	3	В	Α
С	65	4225	0,9	0	71065	97682	194688
3	30	900	3,8	15138	0	450	6498
В	55	3025	4,3	69938	1513	0	11858
Α	50	2500	5,7	115200	18050	9800	0

Table 1

p_T | inclusive k_t (p=1)

Table 1

	рТ	pT^2	R	С	В	Α
С	65	4225	0,9	0	86528	194688
В	70	4900	4,1	100352	0	25088
Α	50	2500	5,7	115200	12800	0





















Jet algorithms



As a results, jets do not have to be cones The jet energy is different from algorithm to algorithm Although the physics conclusions don't change (1 parton ~1 jet)

Gell-Mann Matrices







Pseudorapidity Regions



Proton-Proton Scattering @ LHC





M. Thomson, Modern Particle Physics © Cambridge University Press 2013

ATLAS Z' Search Result



QCD Dijet-Production



Inclusive Jet Cross Section



Inclusive Jet Cross Section

