

How many colors does a quark come in?

- we learned how to calculate the R-value and to deduce the number of quark colors.

$$R = \frac{N(\text{light quarks})}{\frac{1}{2} \cdot [N(\text{muons}) + N(\text{taus})]} = N_c \cdot \frac{10}{9}$$

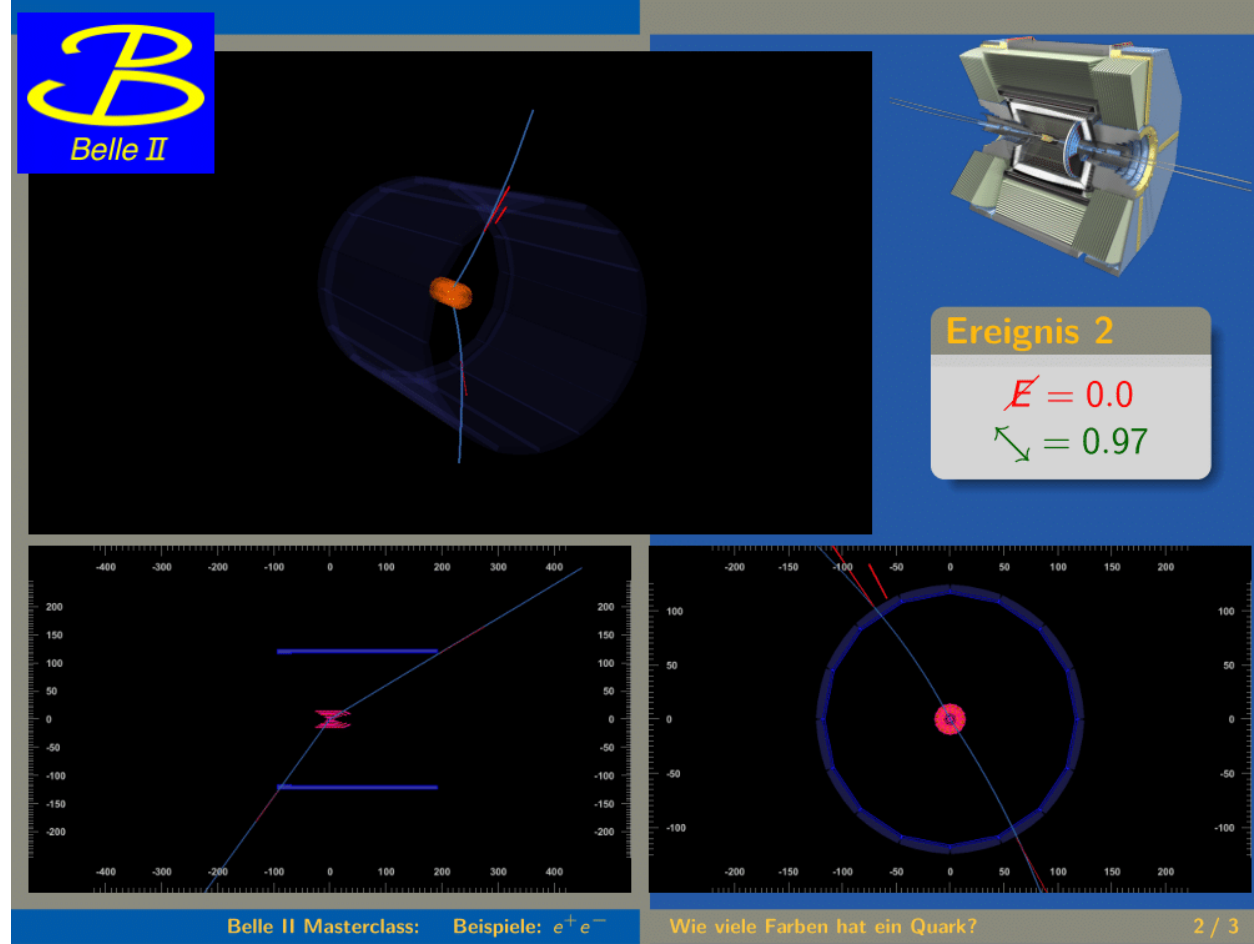
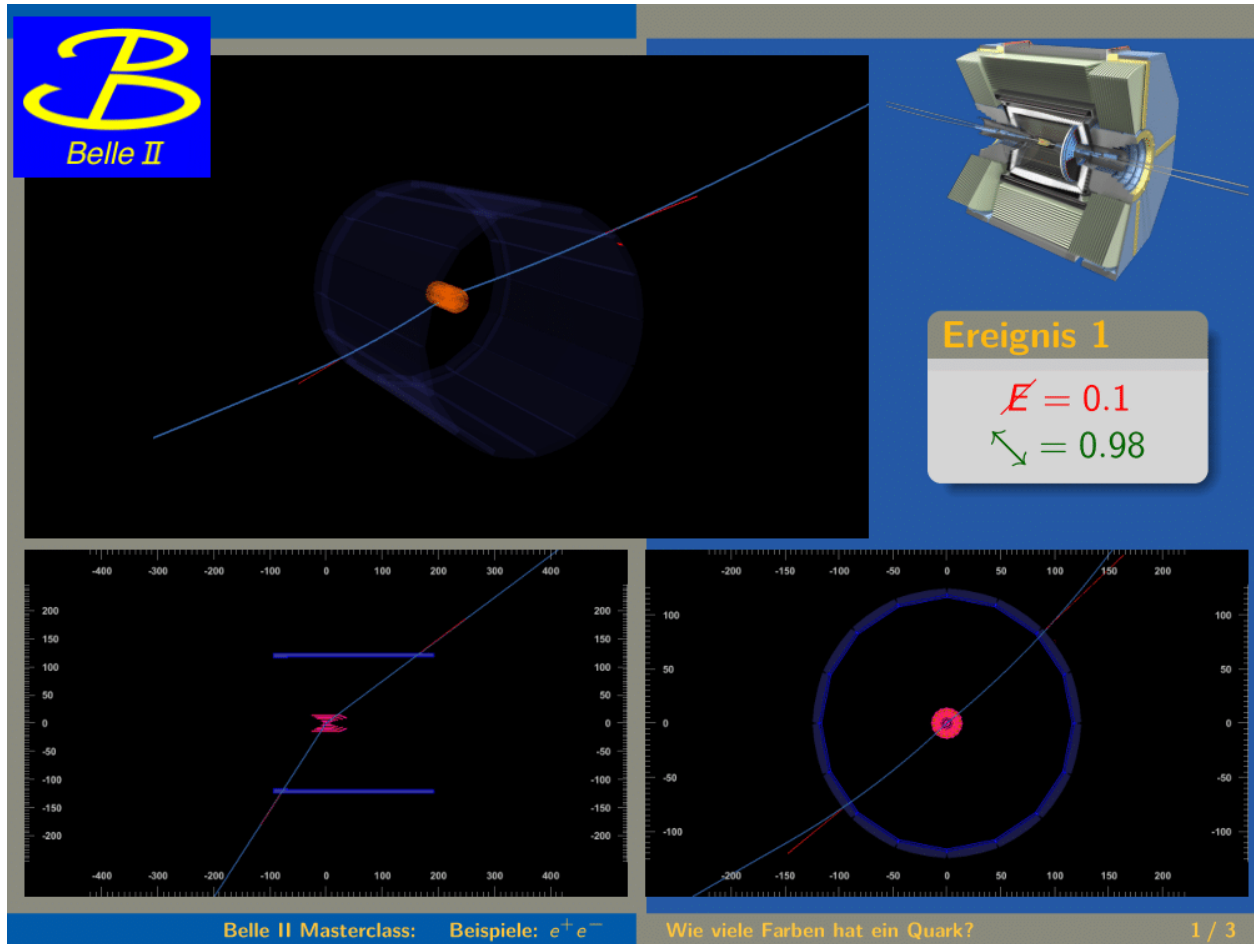
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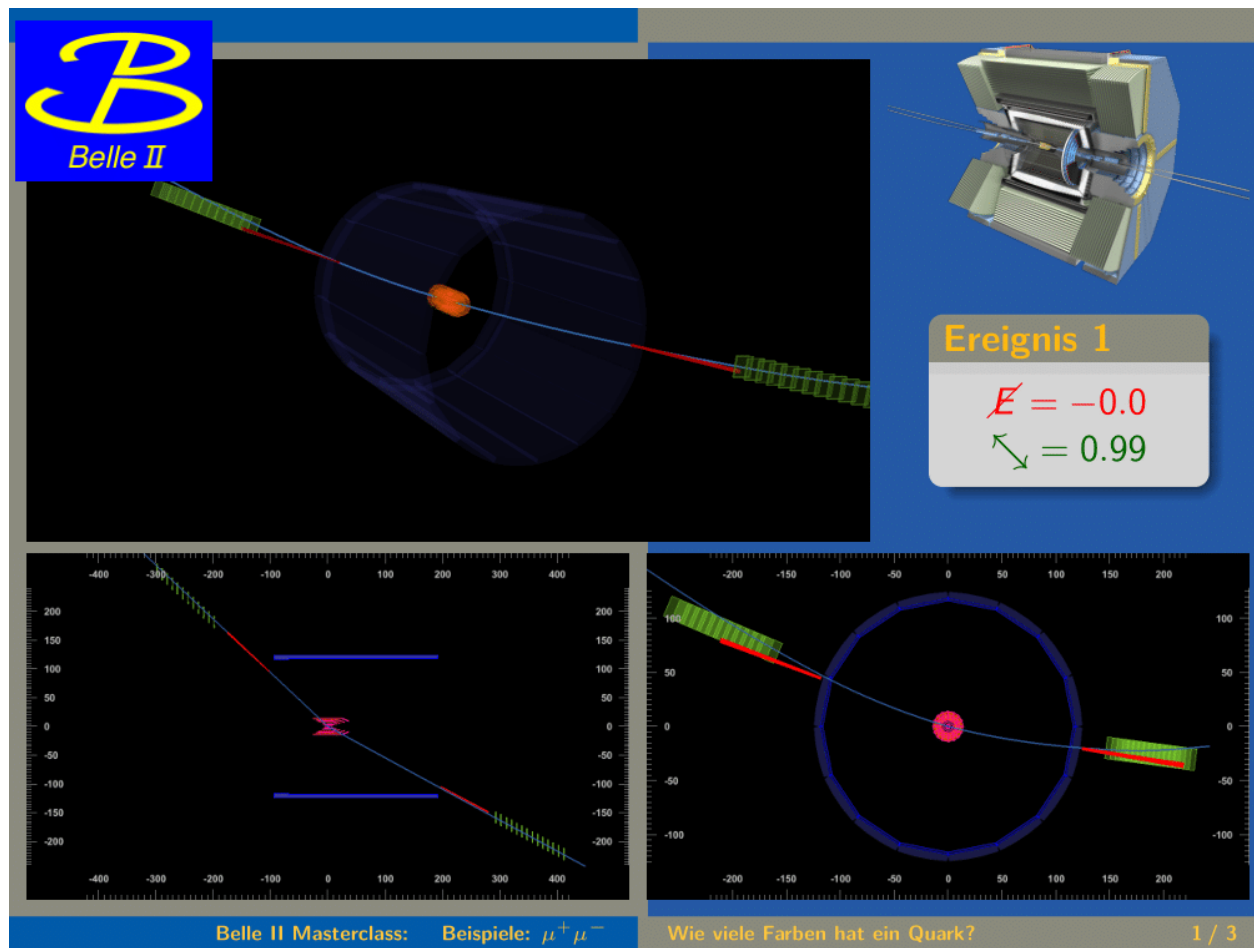
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- To measure the number of colors, we have to count the number of different processes
- Therefore:
 - We want to learn how to distinguish the different processes from each other in the detector

Electron/Positron events

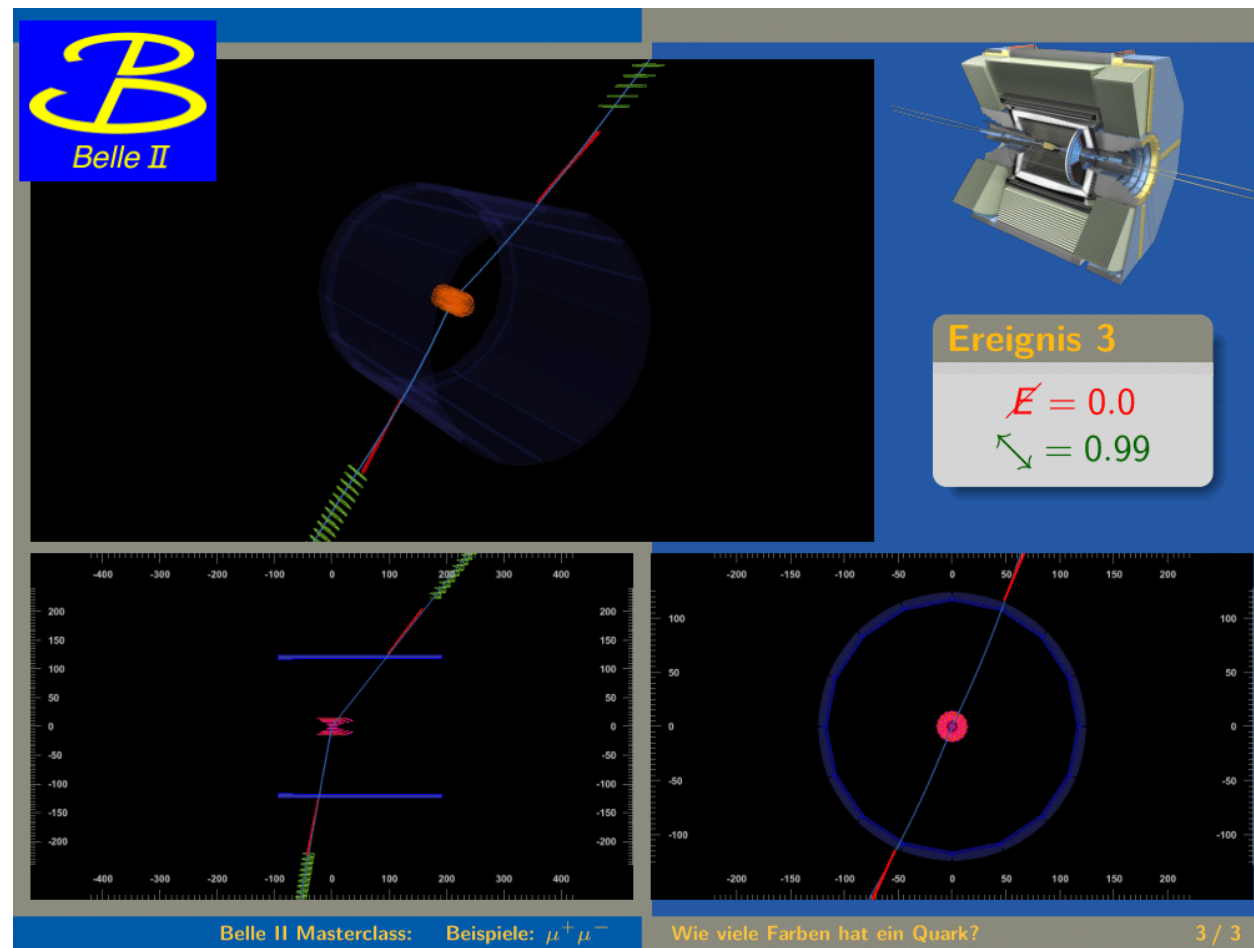


Muon/AntiMuon events



Belle II Masterclass: Beispiele: $\mu^+\mu^-$

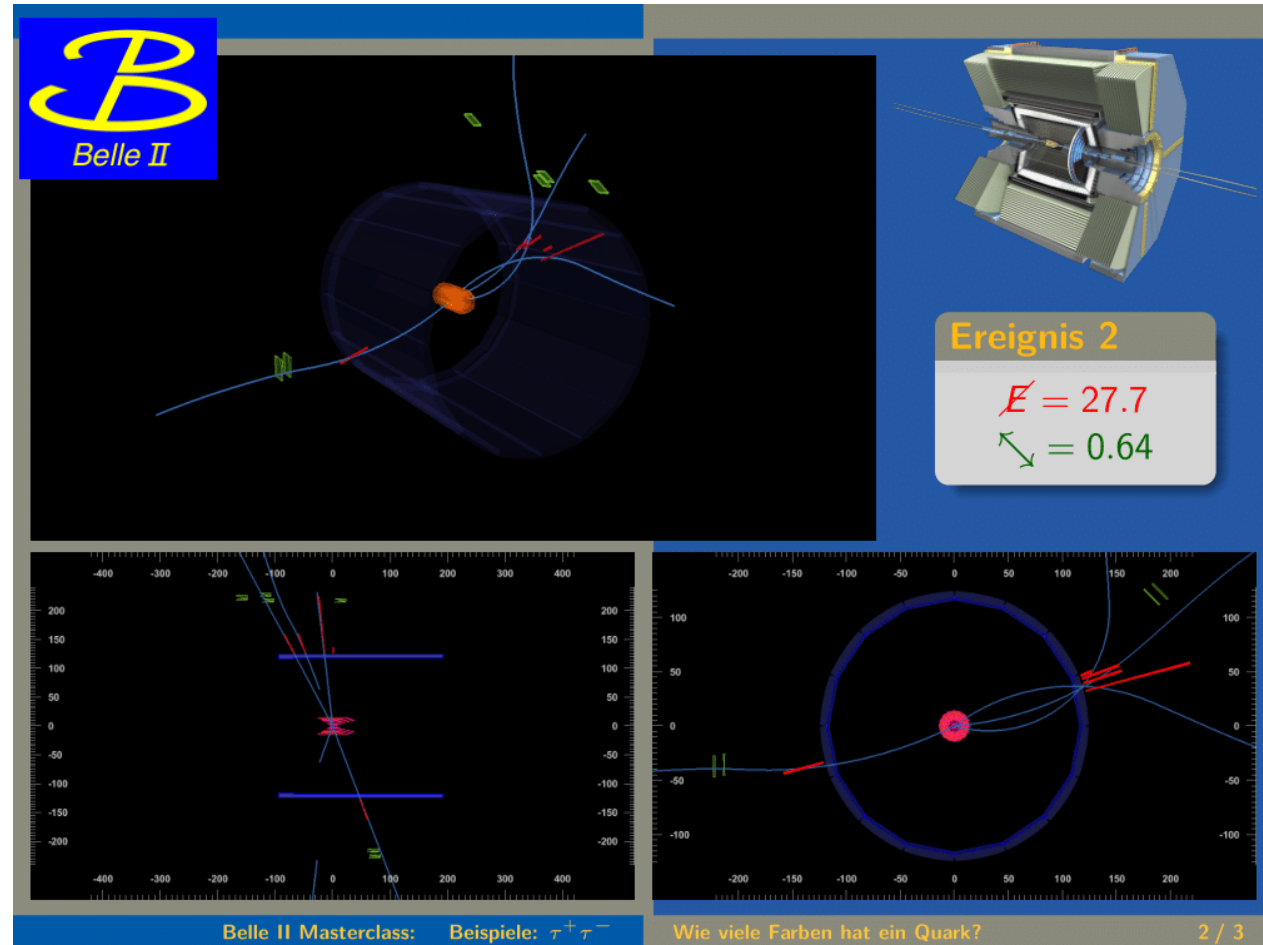
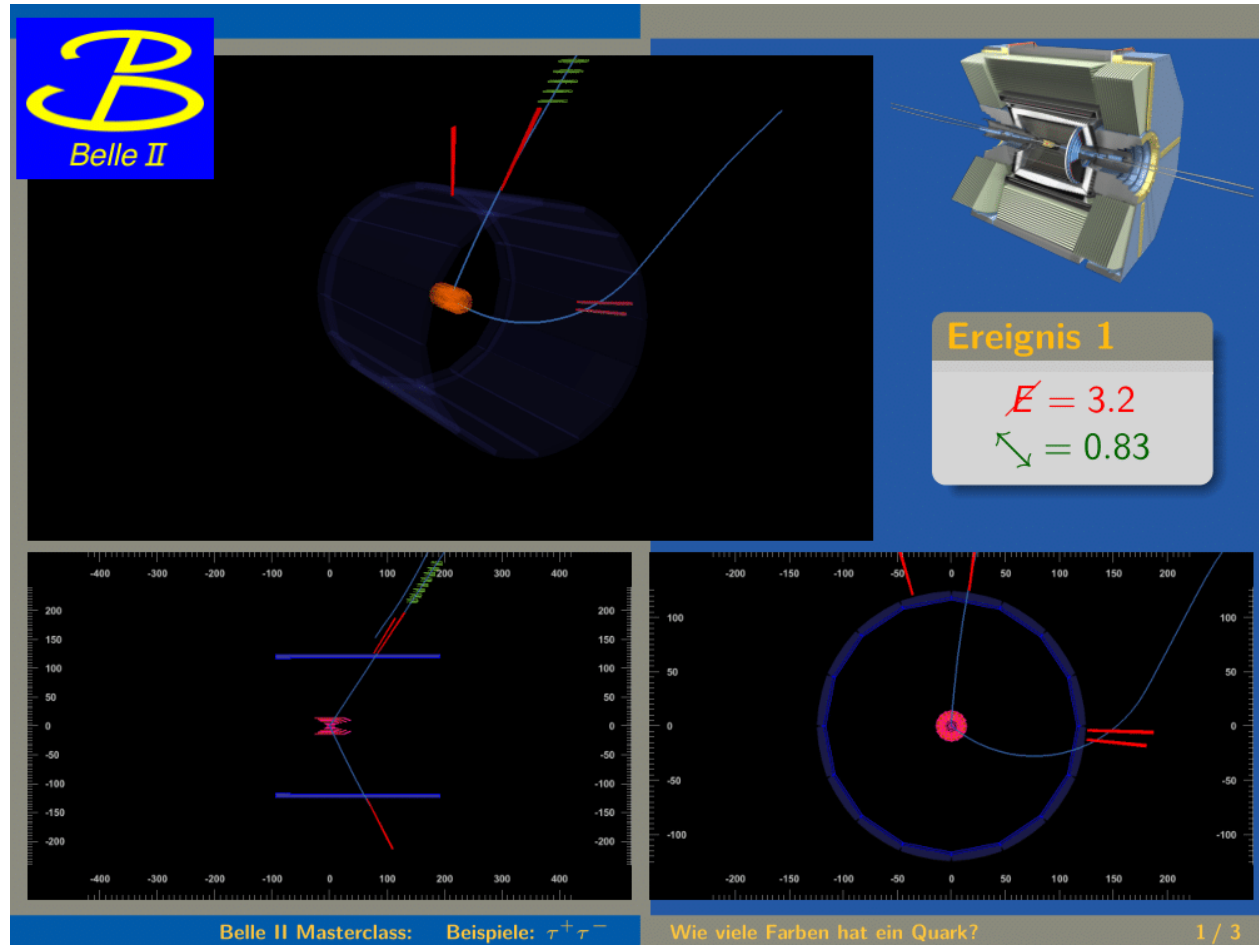
Wie viele Farben hat ein Quark?



Belle II Masterclass: Beispiele: $\mu^+\mu^-$

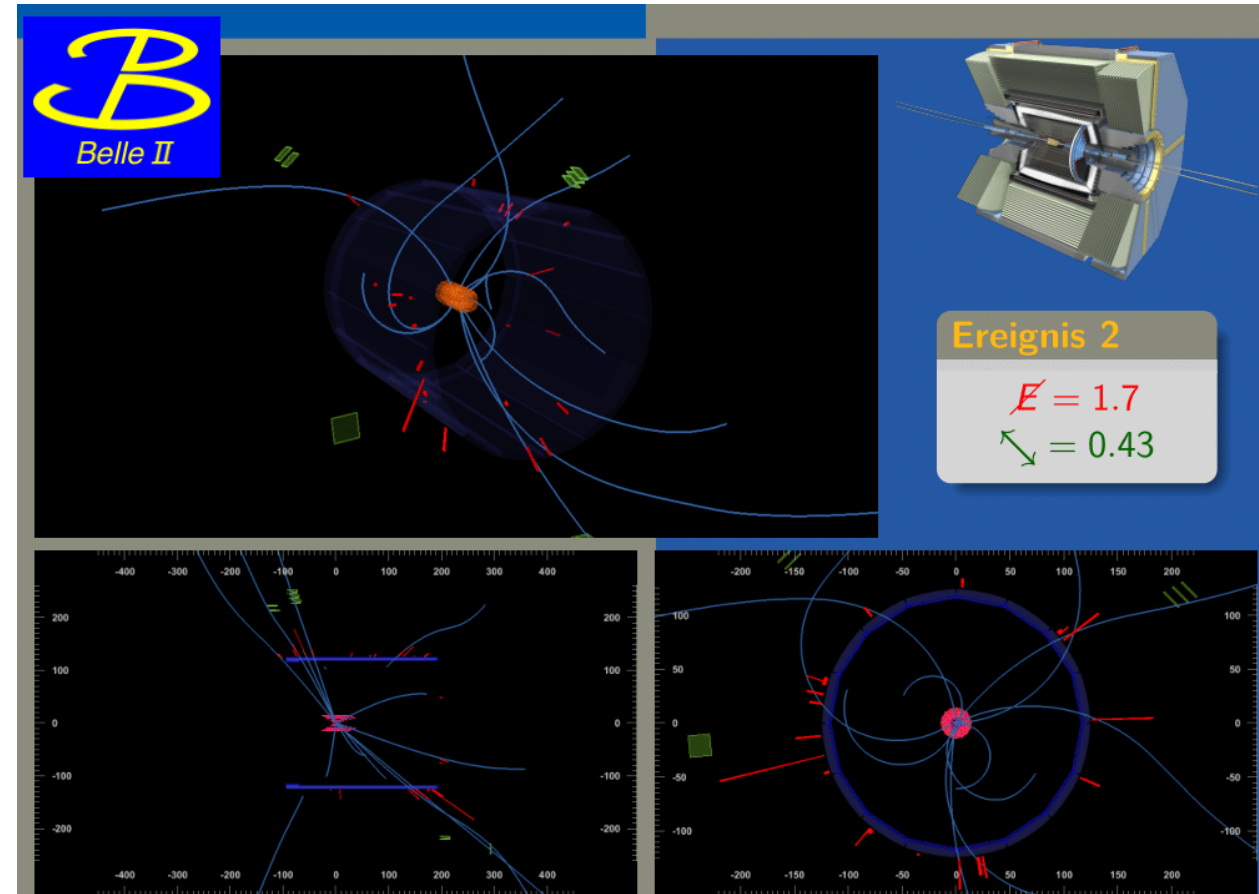
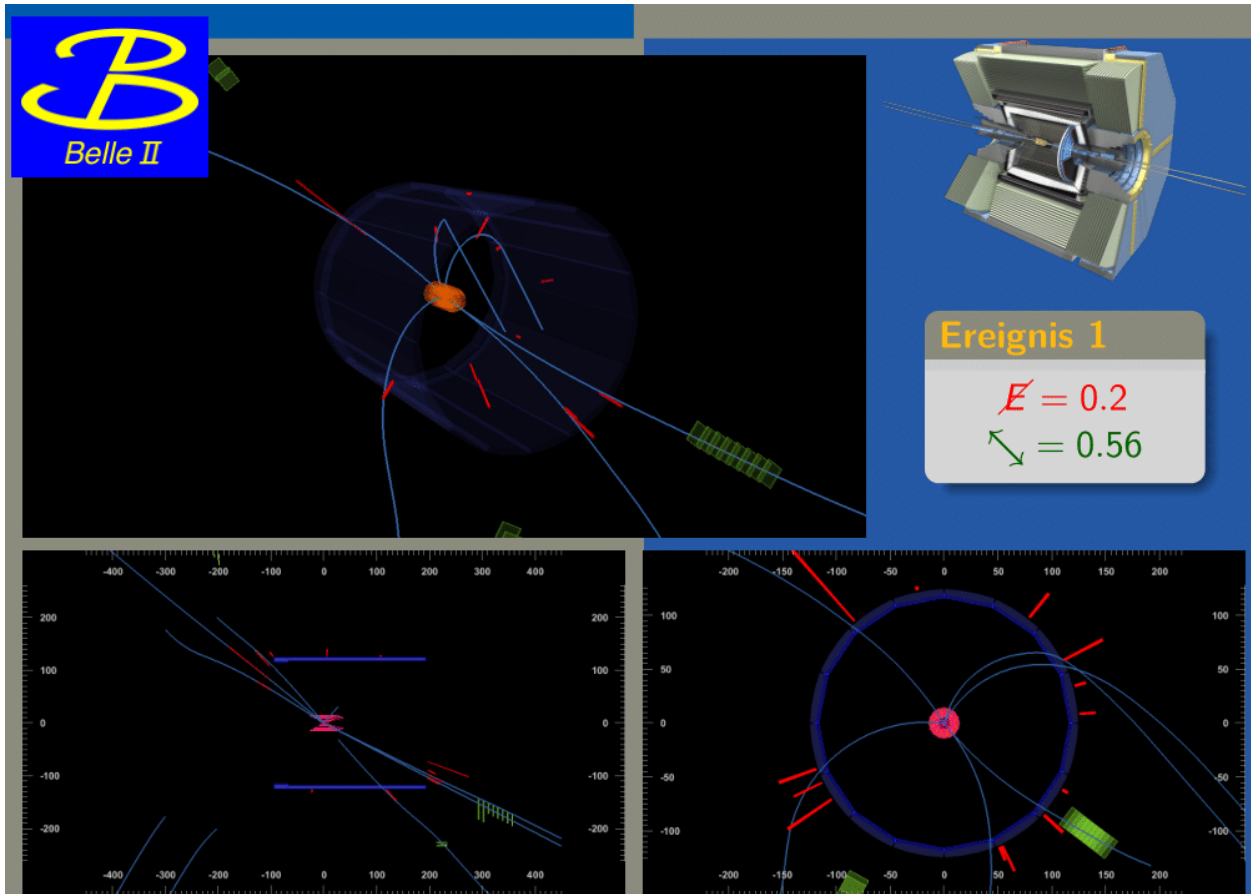
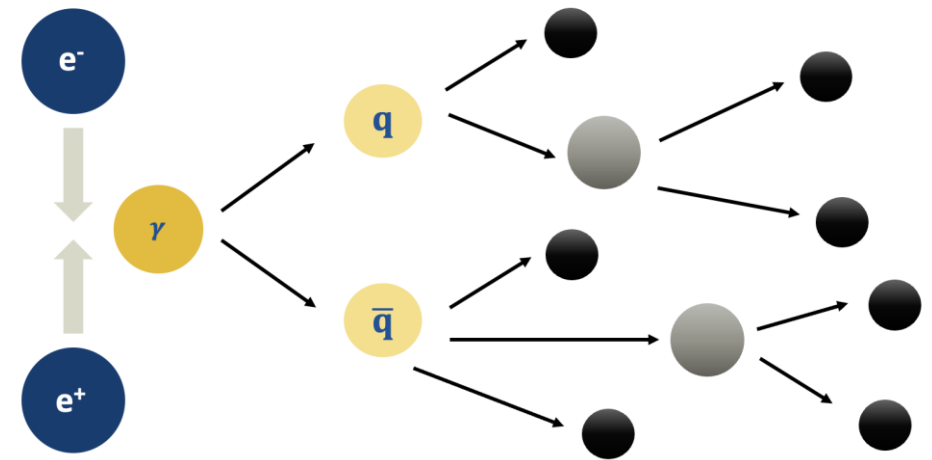
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Tau/AntiTau events

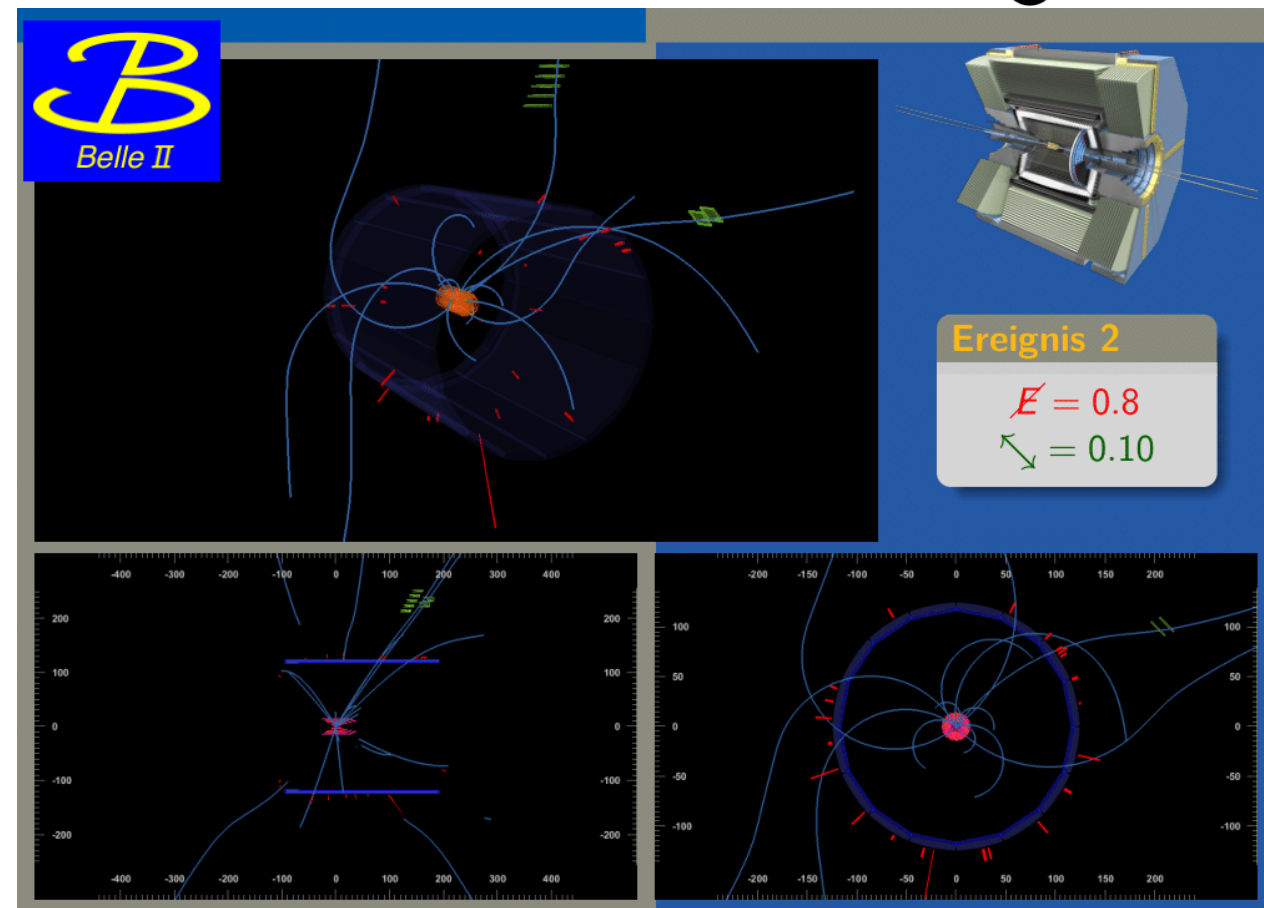
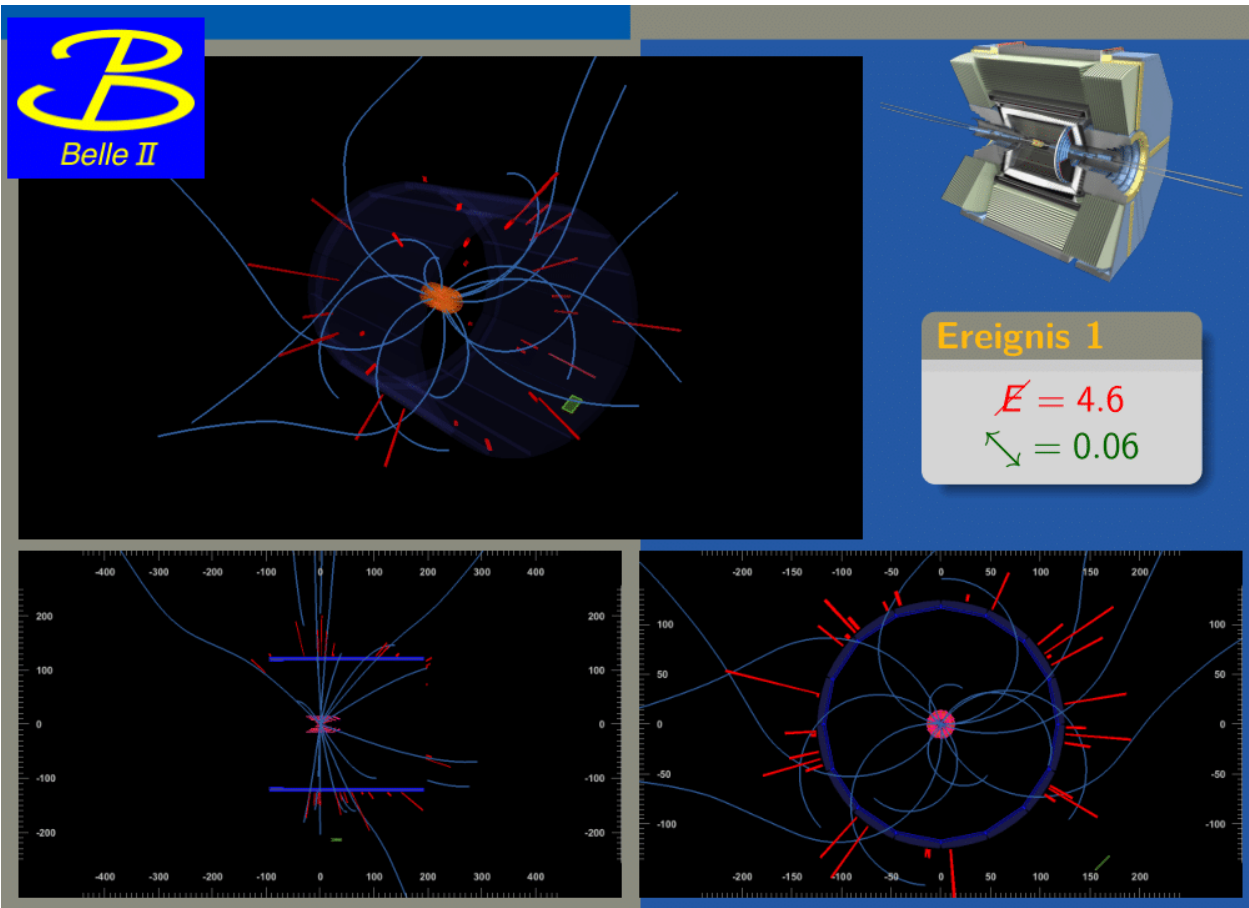
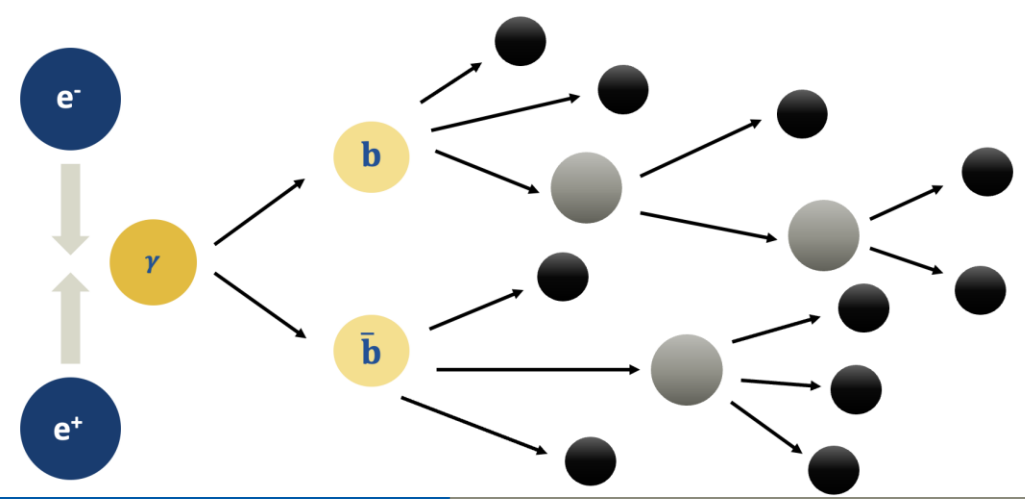


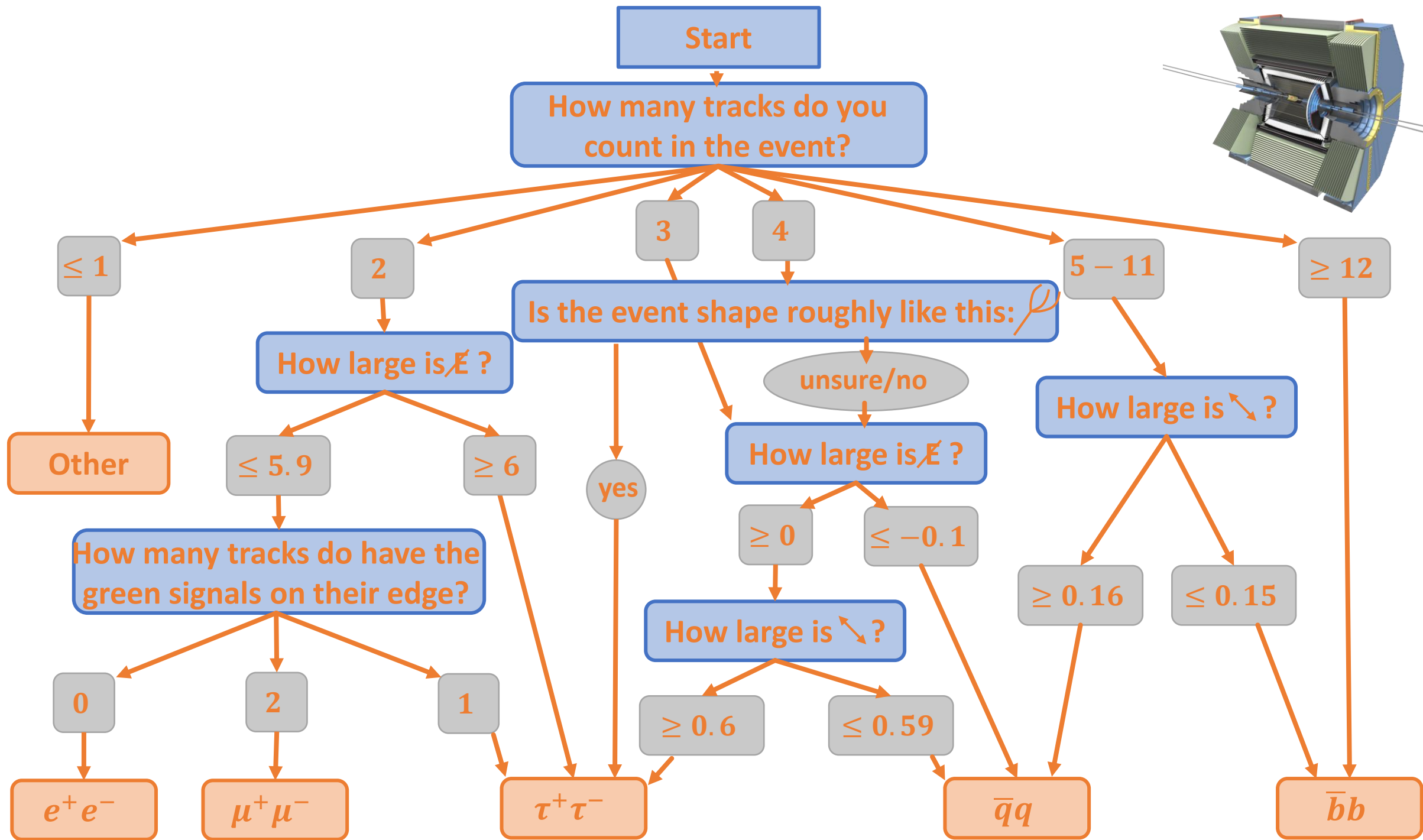
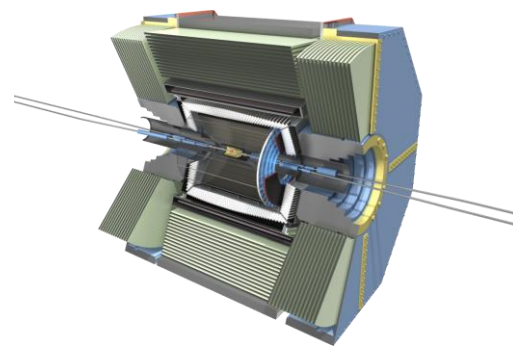
Light Quark/Antiquark events

- Decay into a large variety of final states



b/Anti-b Quark events

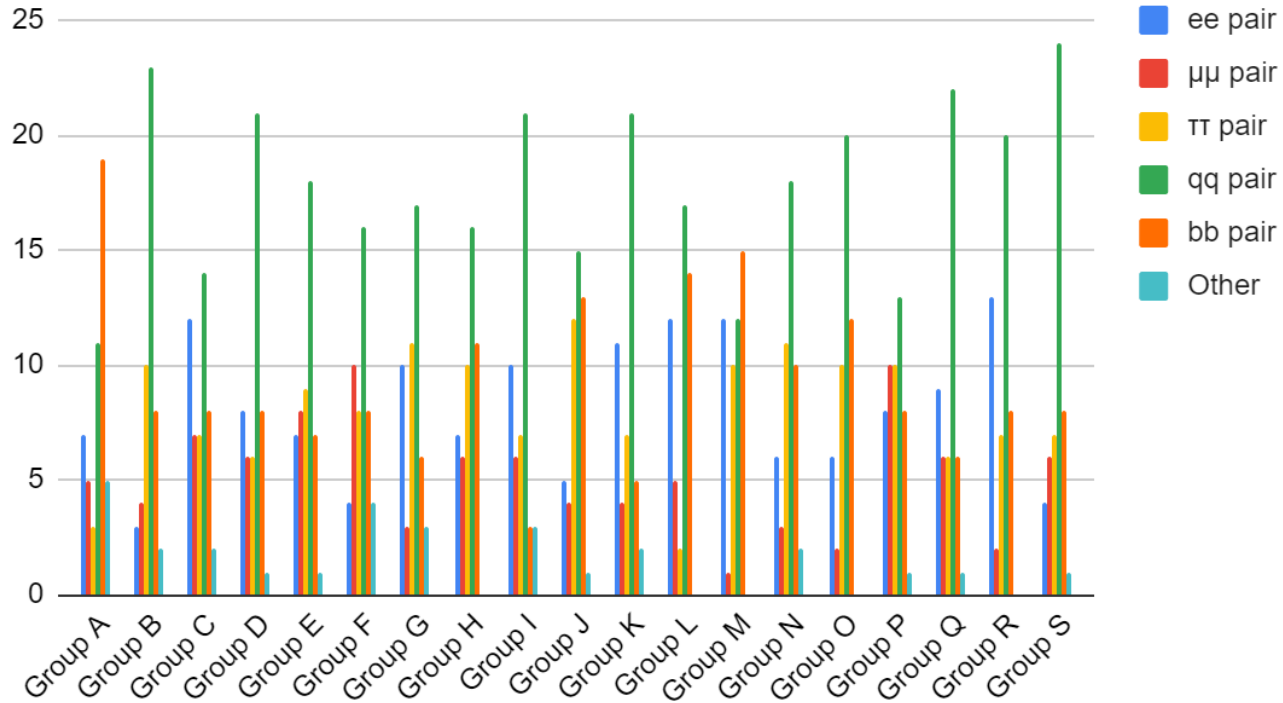




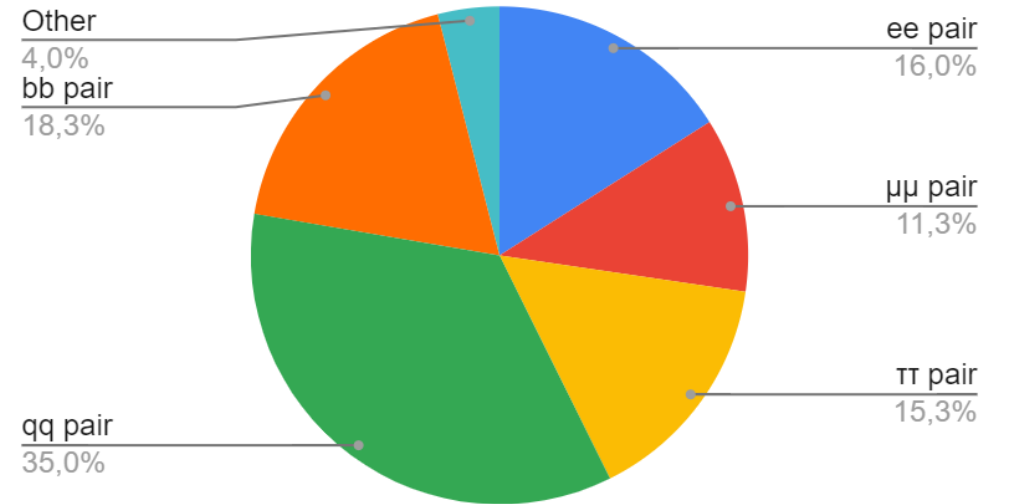
Results

26 students, 19 groups, 50 events each: 950 events in total

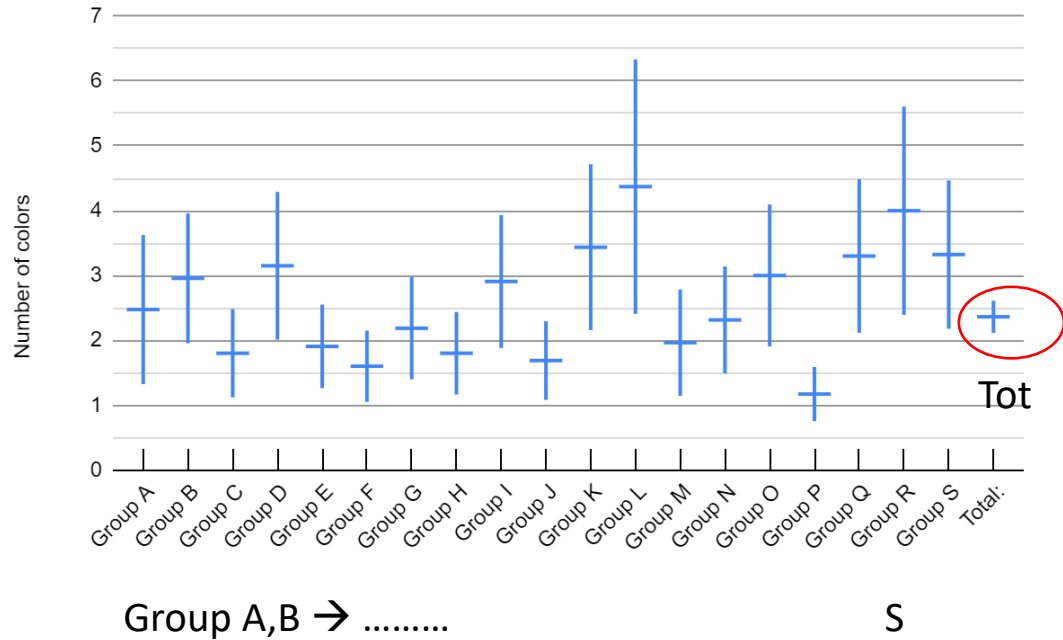
Number of events per group



Total number of events:

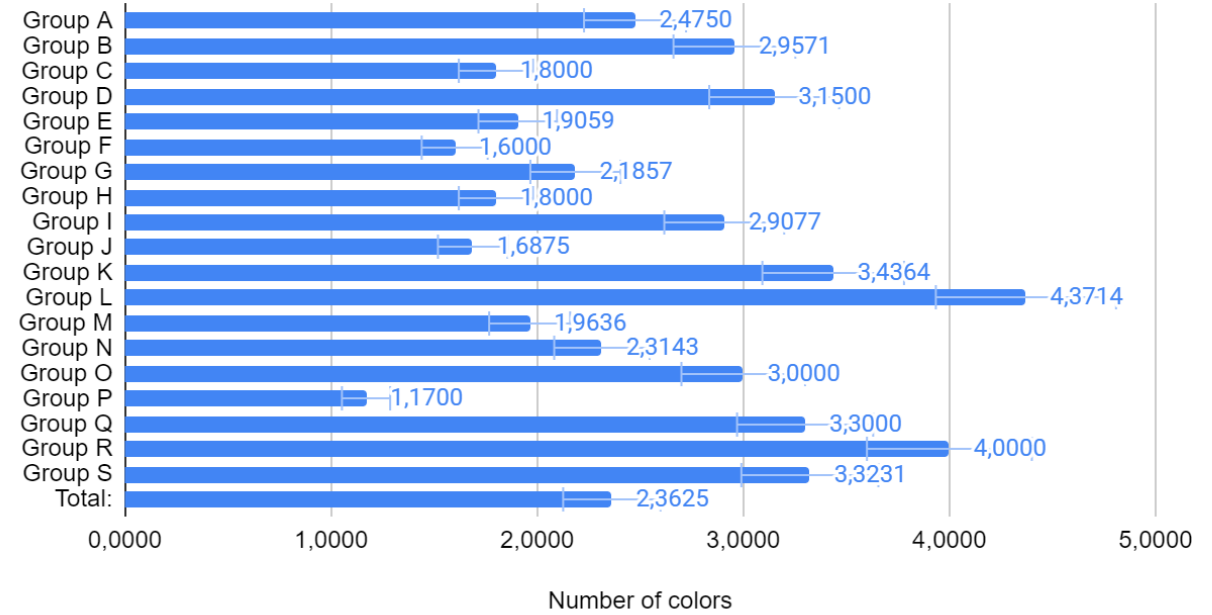


Measured number of different quark colors



$$R = 2.625 \pm 0.276$$

Measured number of colors



$$N_{\text{color}} = 2.3625$$

$$N_{\text{color}} - 1 \sigma = 2.1146$$

$$N_{\text{color}} + 1 \sigma = 2.6104$$