Jet separation study in ee->WW->qqqq events

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Purpose of the study

- Evaluate jet separation capability of our SDHCAL concept:

  -> Study impact of the SDHCAL granularity on jet reconstruction/separation.

  -> Develop, improve, and test SDHCAL reconstruction tools.
- Study Wmass resolution that could be obtained within the ILD concept.

Generated events

Event generated with Pythia in « .stdhep » format:

-> **CM energy:** 0.2, 0.5, 1.5, 2.0, 2.5, 3.0 Tev

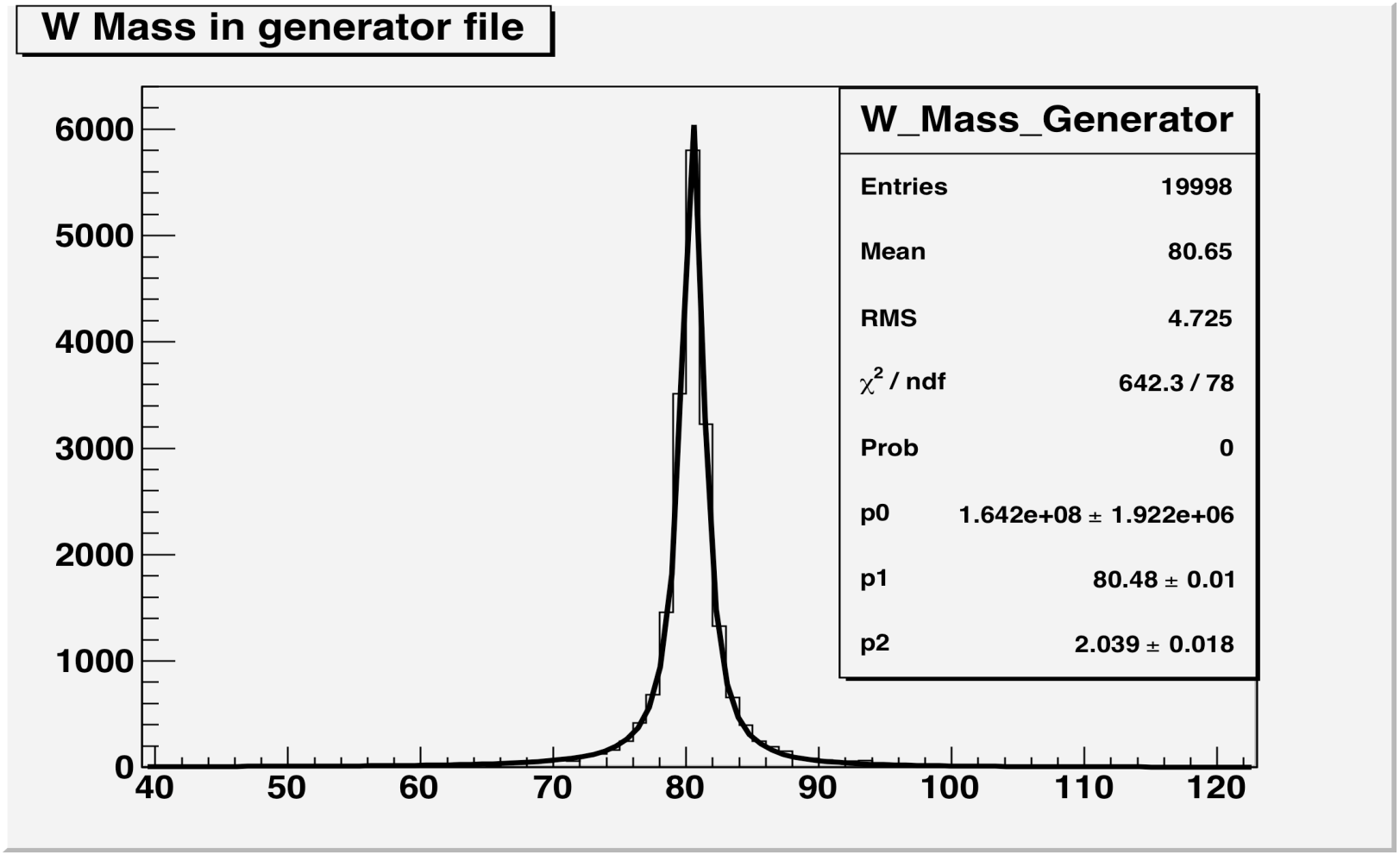
-> For **each energy**, 4 files with different options:

Initial State Radiation (ISR)	**OFF**	**OFF**	**ON**	**ON**
Final State Radiation (FSR)	**OFF**	**ON**	**OFF**	**ON**

-> Stdhep files currently beeing run in **Mokka** to generate LCIO events.

Data availlable on storage element: /grid/calice/SDHCAL/kieffer/eeWW

Generated events quality check



From PDG: W Mass m = **80.399** ± 0.023 GeV Full width Γ = **2.085** ± 0.042 GeV

From Breit Wigner function fit: W Mass m = **80.48**+-0.1 Full width Γ = **2.039** ± 0.018 GeV

Durham algorithm

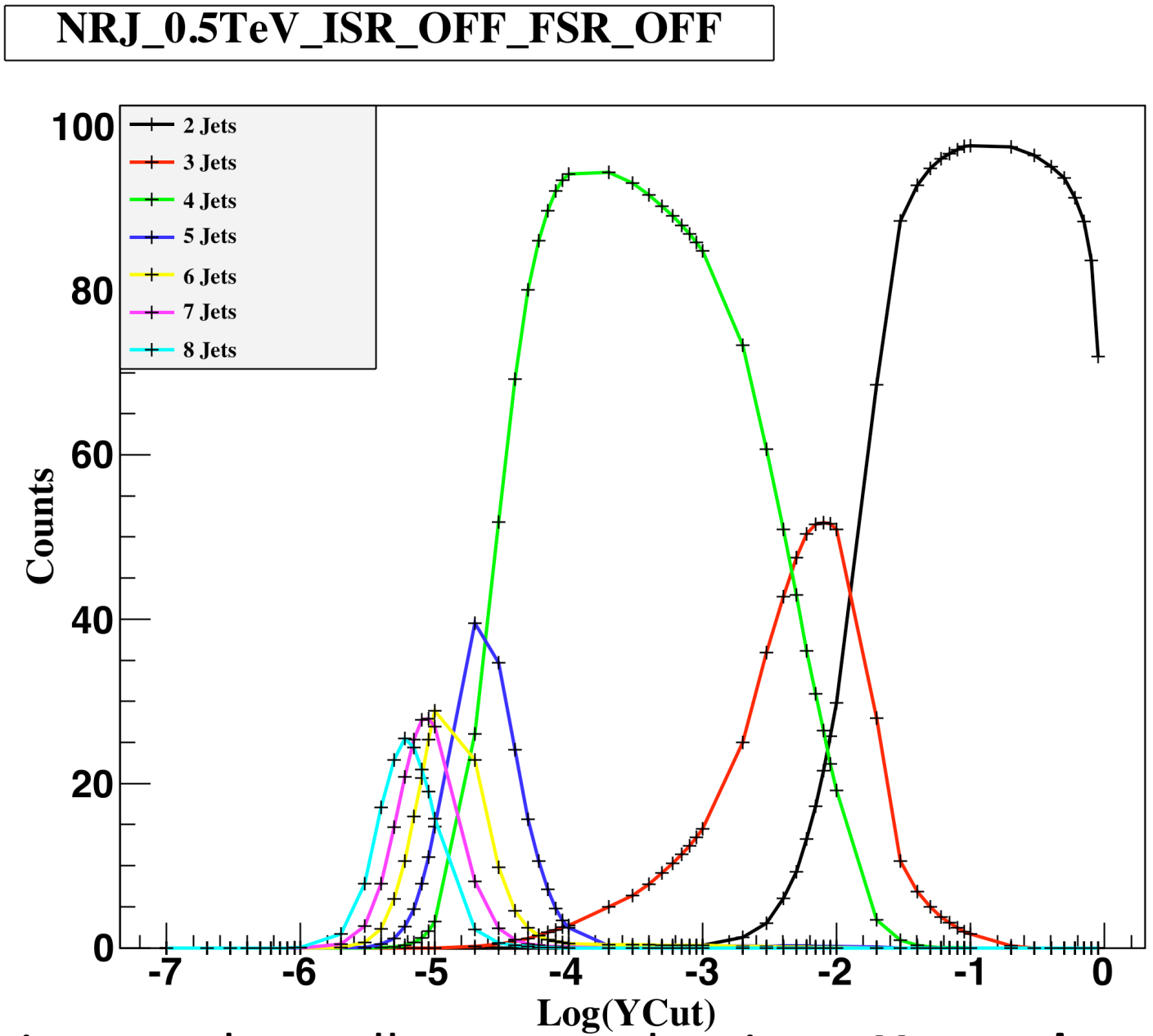
- Angular-ordered algorithm from SatoruJetFinder package (in MarlinReco)
- Compute a pseudo-distance between particles i and j:

$$Y_{ij} = (2\min(E_i^2, E_j^2)(1 - \cos\theta_{ij})) / E_{CM}^2$$

- Use a Ycut value to assemble tracks together.

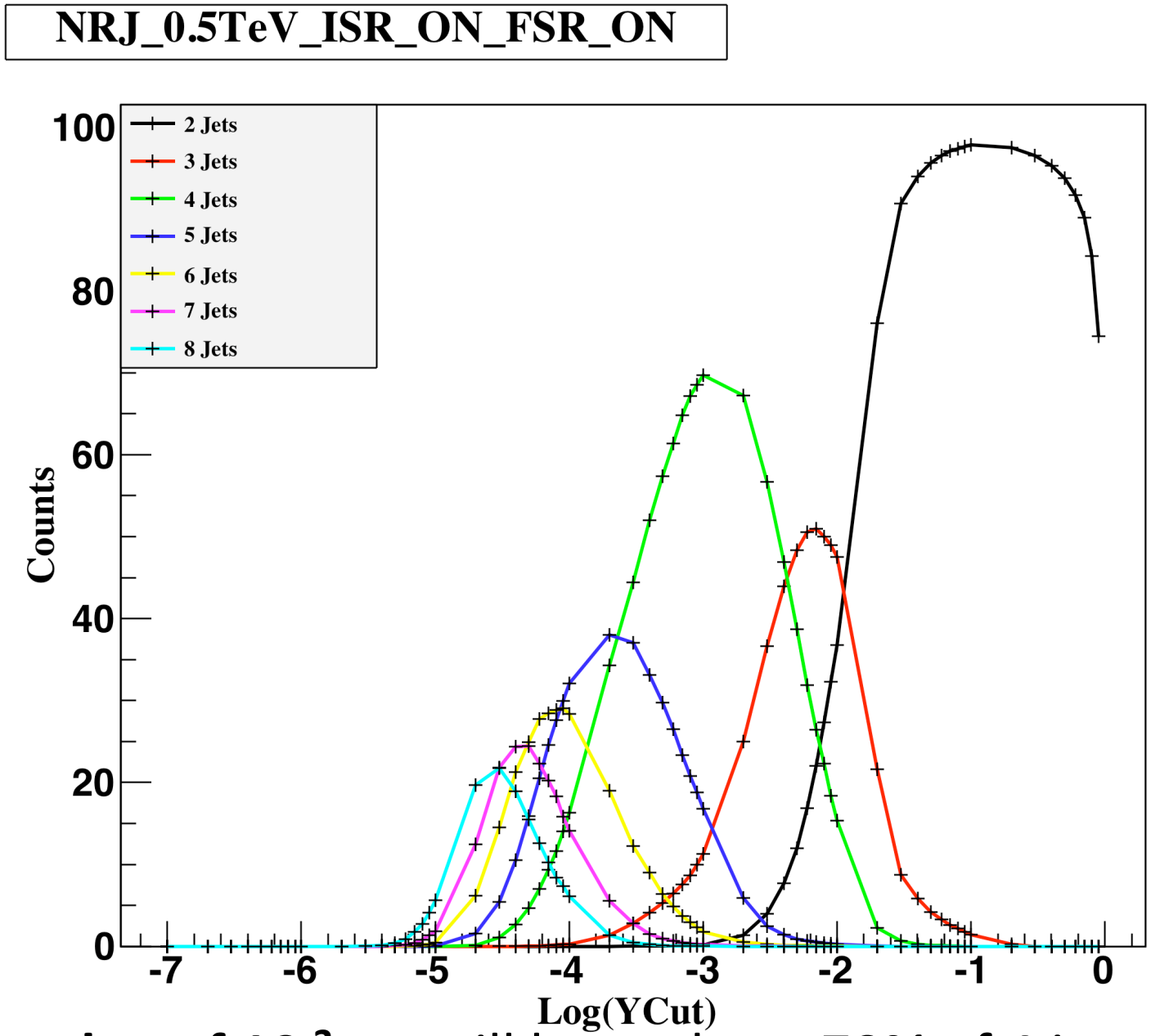
=>**First task:** evaluate Ycut influence on the number of separed jets at the **generator level**.

Low energy no complementary radiation



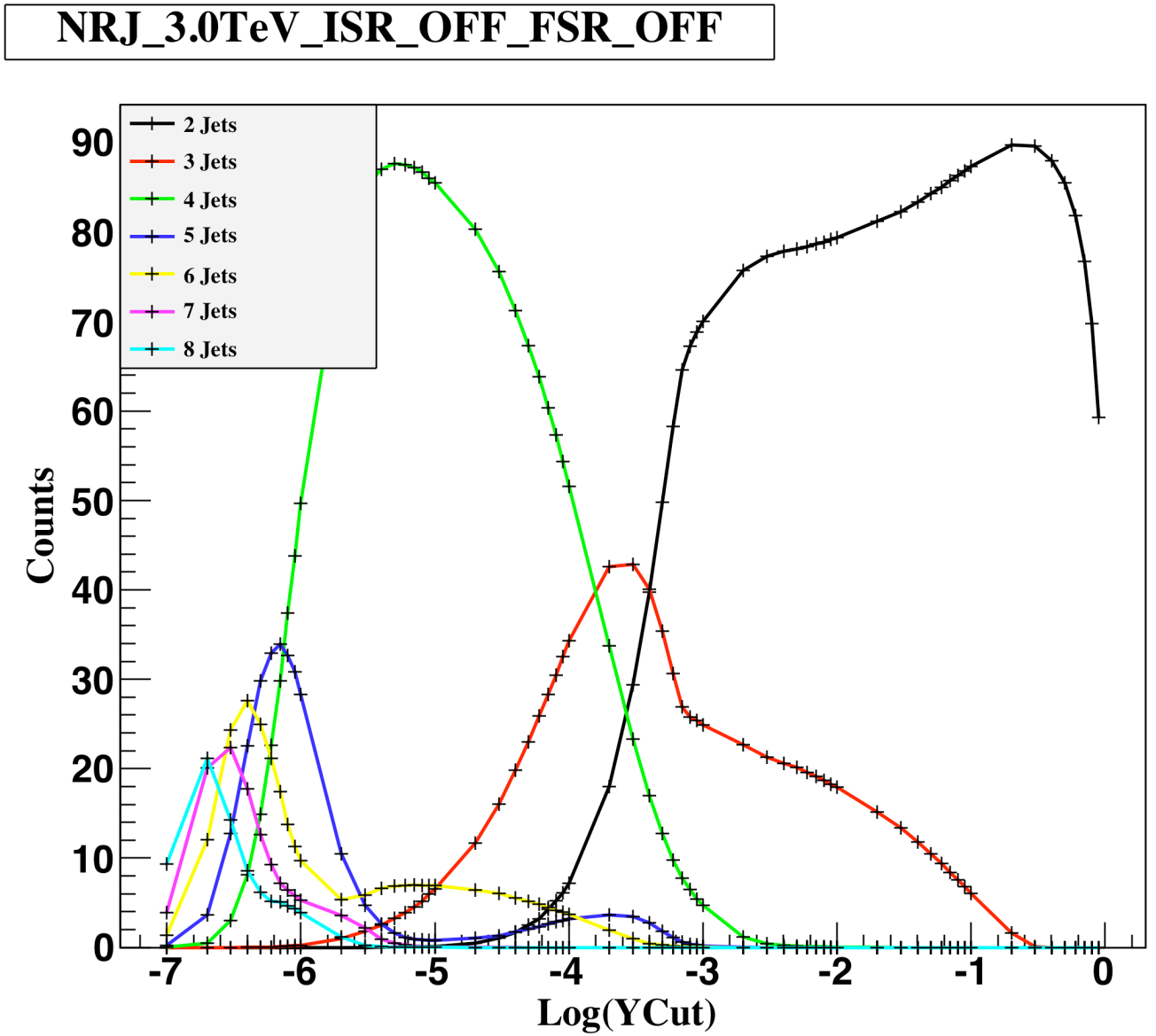
The 4-jets can be well separated using a **Ycut value of $10^{-3.5}$**

Low energy with ISR and FSR



At **Ycut value of 10^{-3}** we still have about **70%** of 4 jets events.

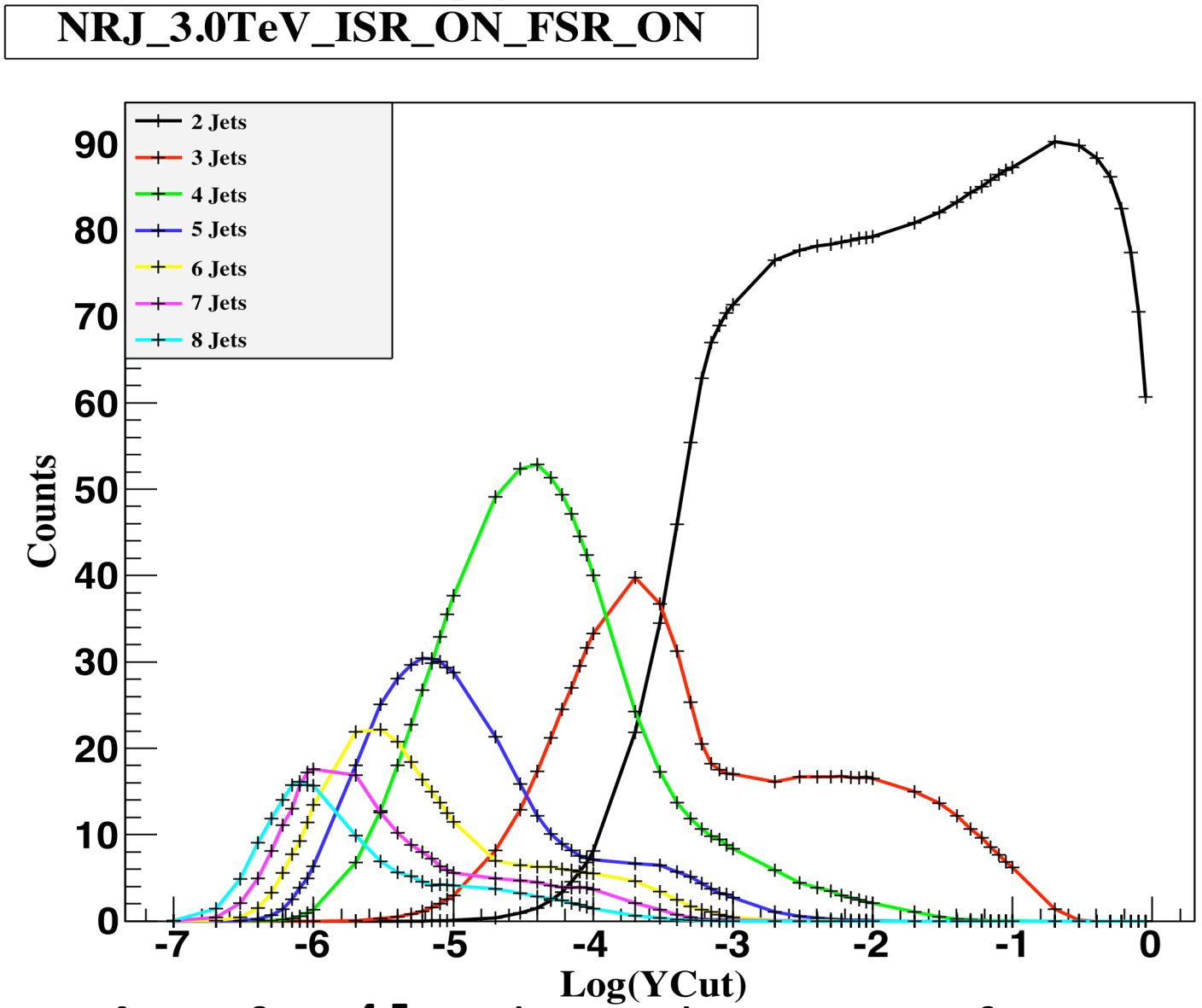
High energy no complementary radiation



Still a good 4-jets separation with **Ycut value of 10^{-5}**

Ycut distance decreasing because of bigger W boost.

Low energy with ISR and FSR



At **Ycut value of $10^{-4.5}$** we have about 55% of 4 jets events.

May we study di-Wjet instead of four-QuarkJets ?s

Conclusions

- We've started to look at jets from MCparticles.
- In a high energy landscape (3TeV), we may have to consider Wjet (study is still ongoing).

Next steps:

- Start to reconstruct jets from simulated tracks and hits.
- Evaluate typical jets characteristics (opening angle, particle fluxes, ...) at ILC/CLIC energies