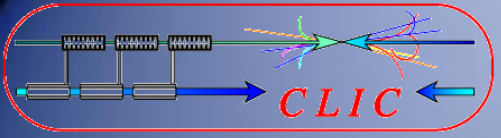
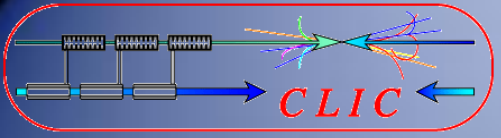



# γ γ-> Hadron Background Events at CLIC

Ozgur Sahin (METU- Ankara)

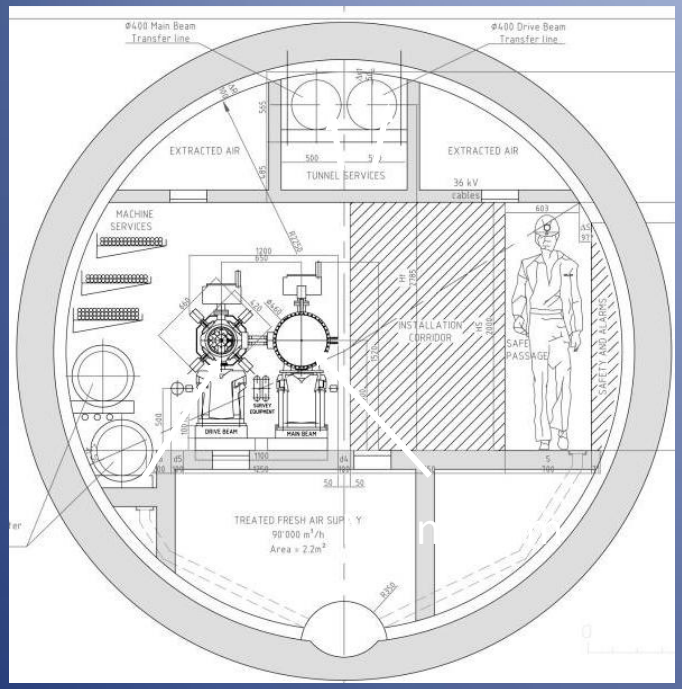
Supervisor: Dominik Dannheim (CERN)

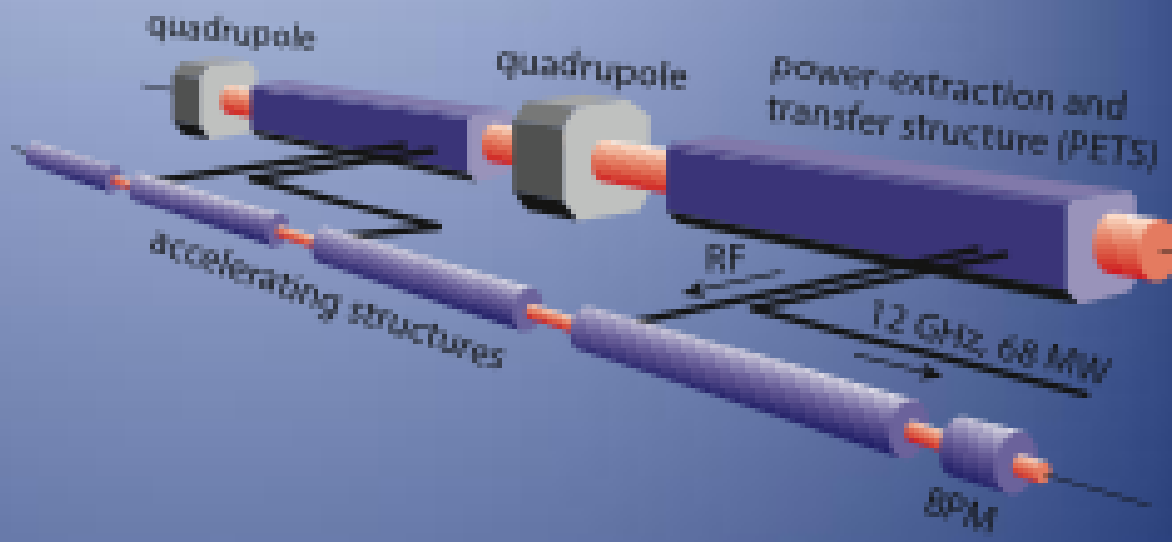



# OUTLINE

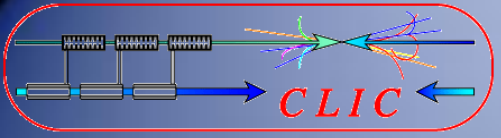
- Introduction
  - CLIC
  - Machine induced Backgrounds
- List of Samples and Comparison of Data Samples
- Summary Table
- Conclusion

# CLIC

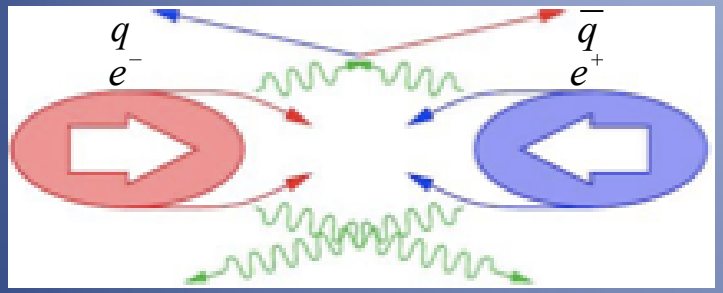



- 3 TeV linear collider
- 20 mRad Crossing angle
- Further reference -> Future Linear Colliders Lectures in the Summer School



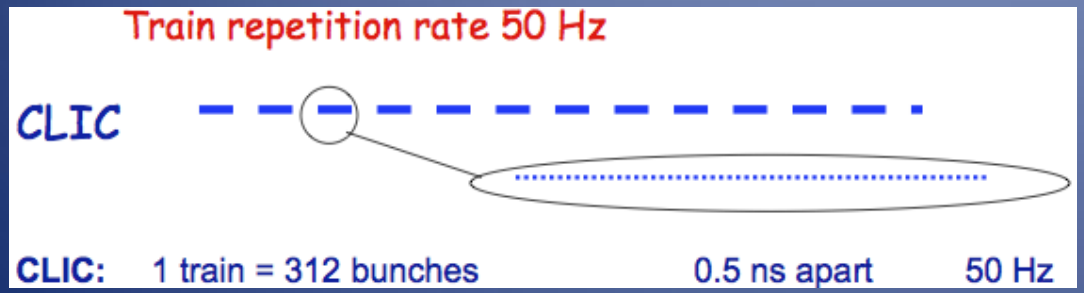

# MACHINE-INDUCED BACKGROUNDS




$$\gamma\gamma \rightarrow e^+ e^-$$
$$\gamma\gamma \rightarrow q\,\bar{q}$$

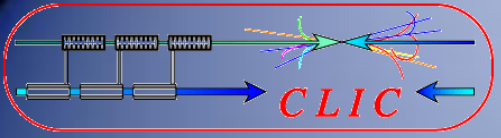
3.3 Events per Bunch Crossing

**RARE**




$$312 \times 50\,[GeV\,] \rightarrow 15\ TeV$$

within 156 ns bunch train



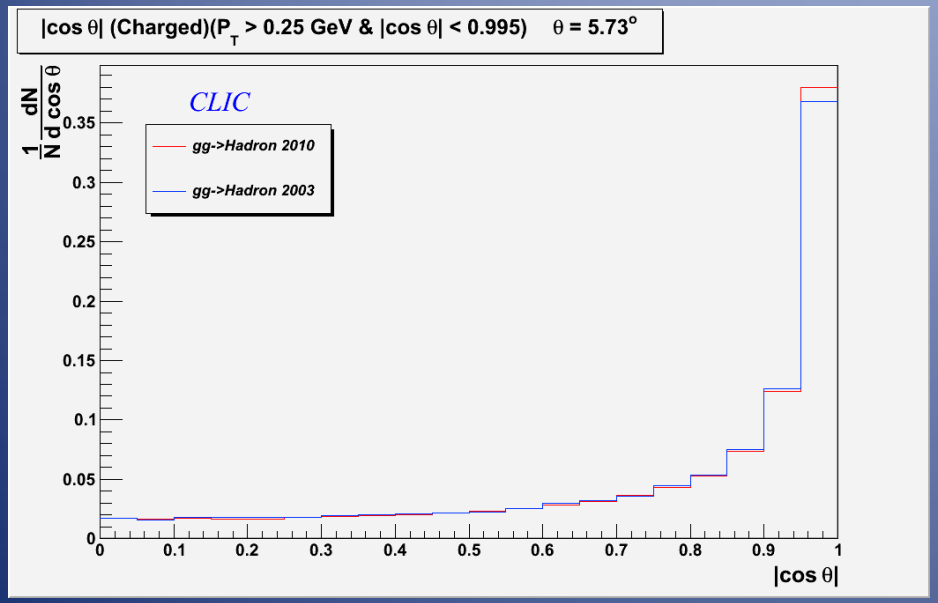

# List of the Samples

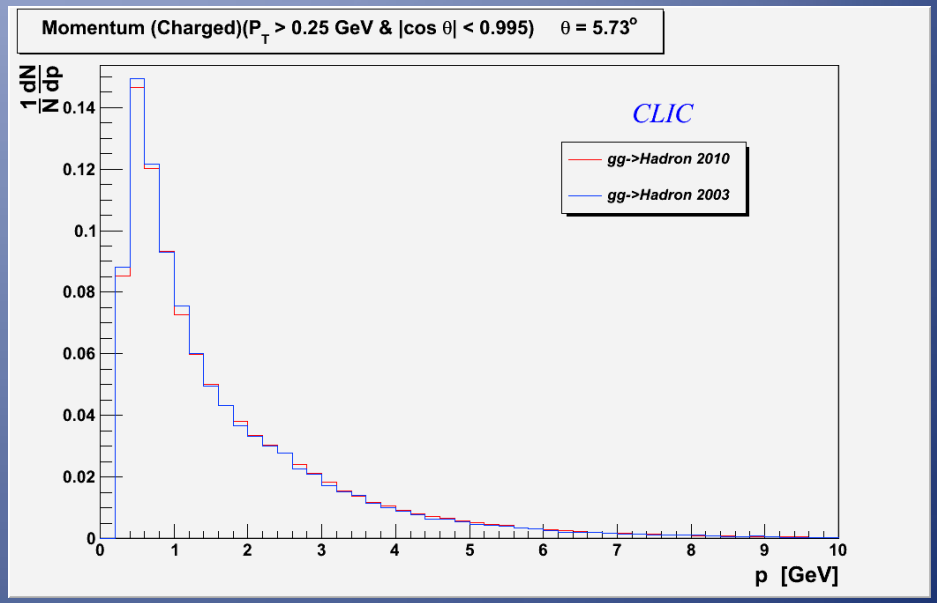
- 2003 Schulte Sample
  - Generated for studies in CERN yellow report 2003
  - Generated by PYTHIA / GUINEA-PIG Monte Carlo generators
  - Number of events: 8 319
  - Invariant Mass Cut: 5 GeV
  - Event/ BX : 4

- 2010 Schulte Sample
  - Generated with PYTHIA / GUINEA-PIG Monte Carlo generators
  - Number of events: 67 587
  - Invariant Mass Cut: 2 GeV
  - Event/ BX : 3.3

# Comparison of Data Samples

angular & momentum distributions for all charged particles within detector acceptance

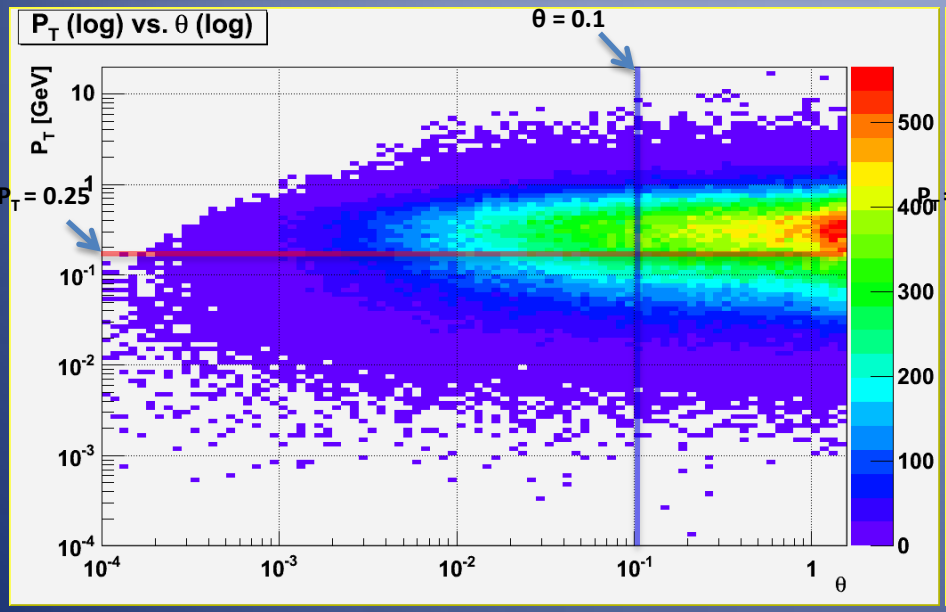


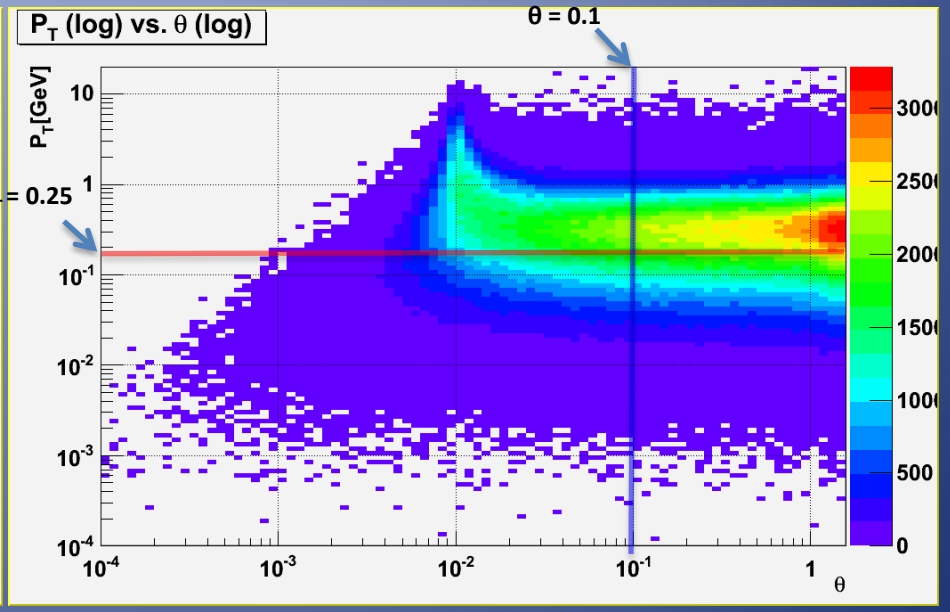

- Most particles in the direction of the beam
- Most particles have low momentum

# DISTRIBUTIONS IN PHASE-SPACE

## SAMPLE 2003- SCHULTE



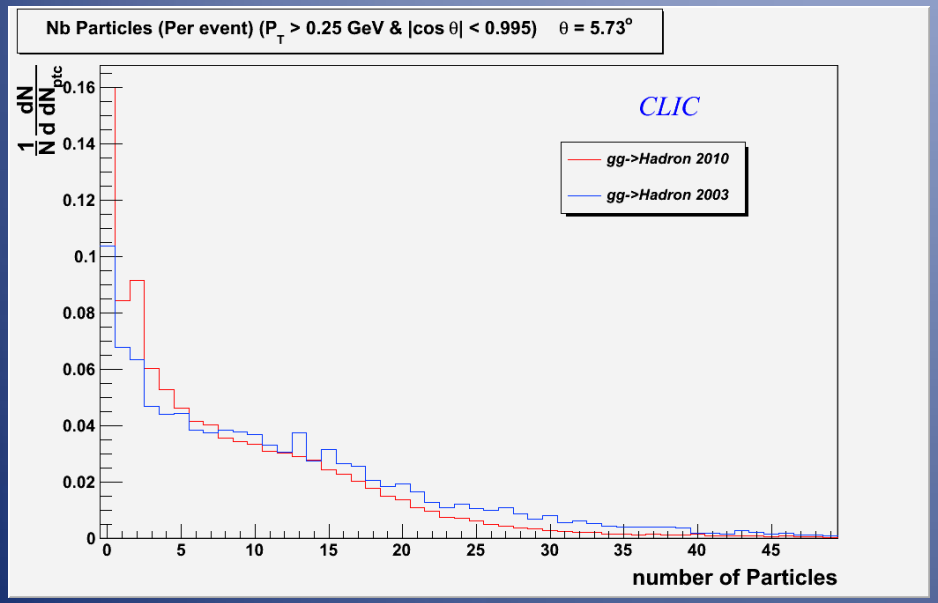

## DATA 2010 - SCHULTE

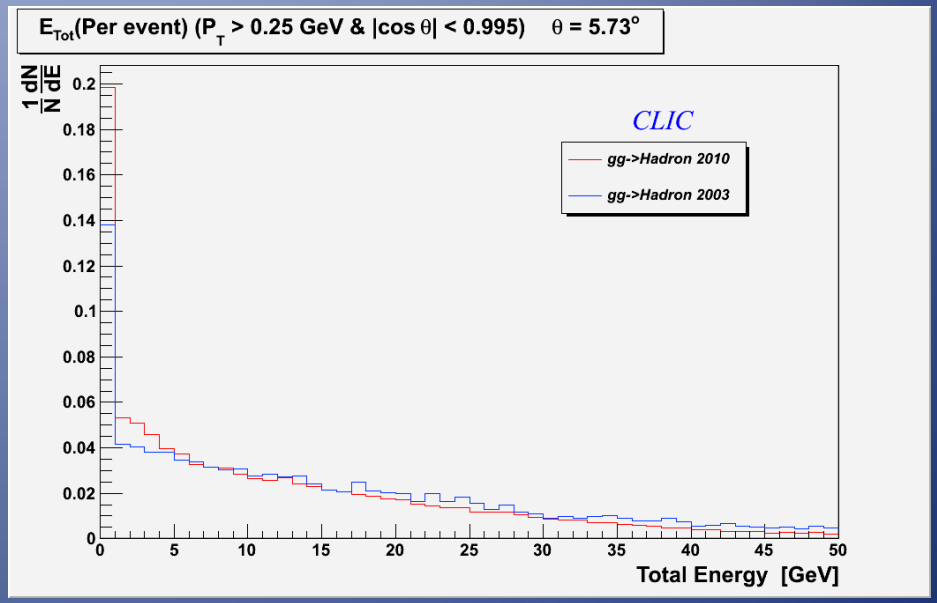



Peak of distributions within detector acceptance

# Comparison of Data Samples

## Number of Particles & Total energy within detector acceptance



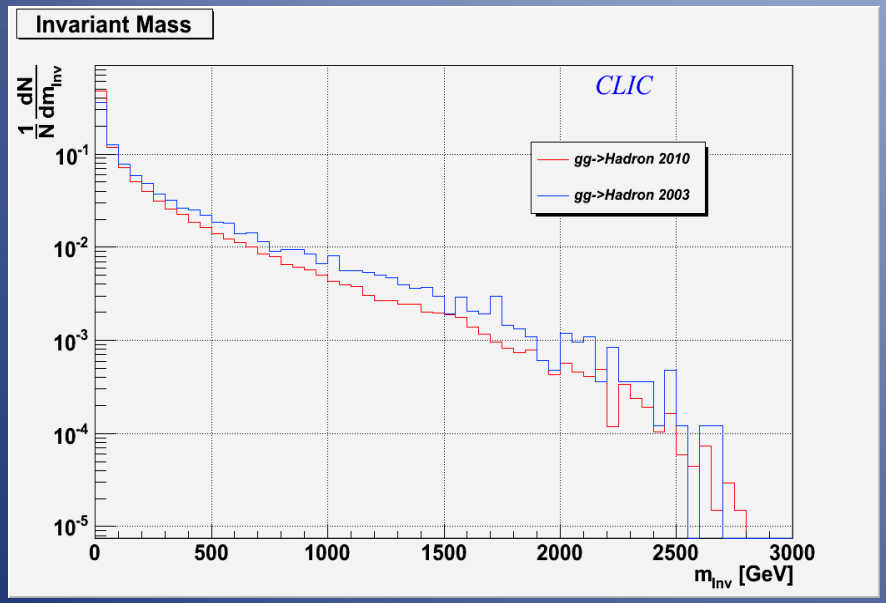



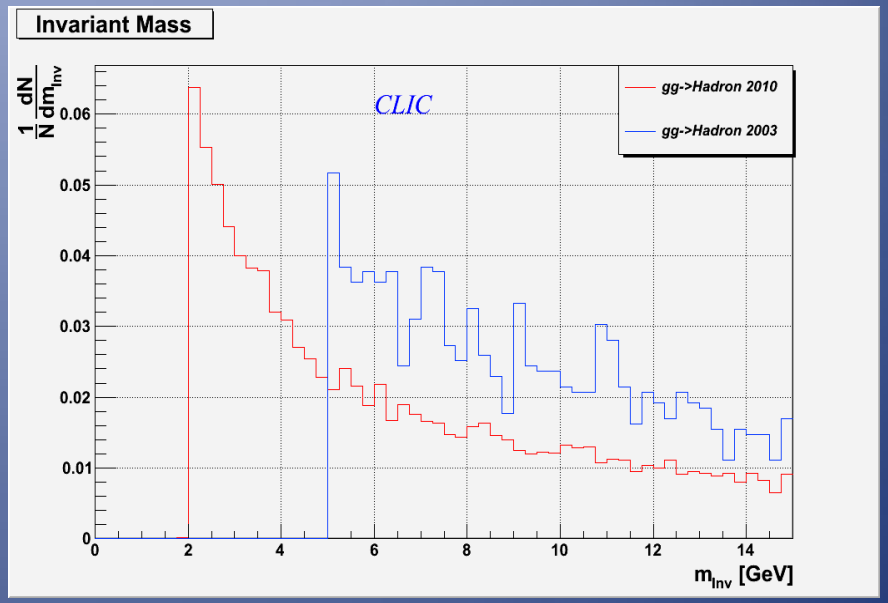

Most events have

- few particles inside the detector
- small amount of energy deposited in the detector

# Comparison of Data Samples

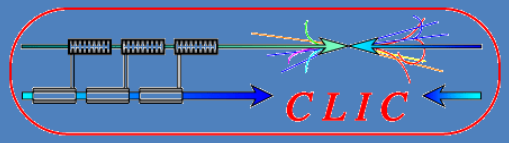
## Invariant Mass on different scales

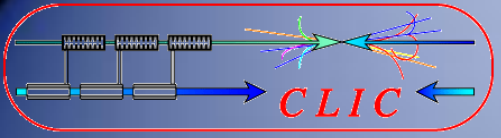



- Most events at low invariant mass
- Upper limit given by 3 TeV CMS energy of primary e+e- beam
- Different lower cut-offs for 2003 (5 GeV) and 2010 (2 GeV) data samples

# SUMMARY TABLE

|  | **Schulte 2003** | **Schulte 2010** |
|---|---|---|
| **Invariant Mass Cut** | 5 GeV | 2 GeV |
| **#Particles (charged) per event $\lvert \cos\theta \rvert < 0.995$ & $P_T > 0.25$ GeV ($\theta > 5.73^o$)** | 11.6 (7.6) | 8.7 (5.7) |
| **#Particles per event $\lvert \cos\theta \rvert < 0.995$ & $P_T > 0.25$ GeV ($\theta > 5.73^o$)** | 20.3 GeV | 15.2 GeV |




# CONCLUSION

- Different γγ->Hadron samples for 3 TeV CLIC parameters compared
- ~29 particles/ bunch crossing are expected in the detector acceptance region
- ~51 GeV/ bunch crossing total energy released in the detector.
- Further samples from different generators currently under study
- This analysis is used to select samples for large-scale MC production for CLIC Conceptual Design Report