# ILD and SiD
# detectors for 1 TeV ILC

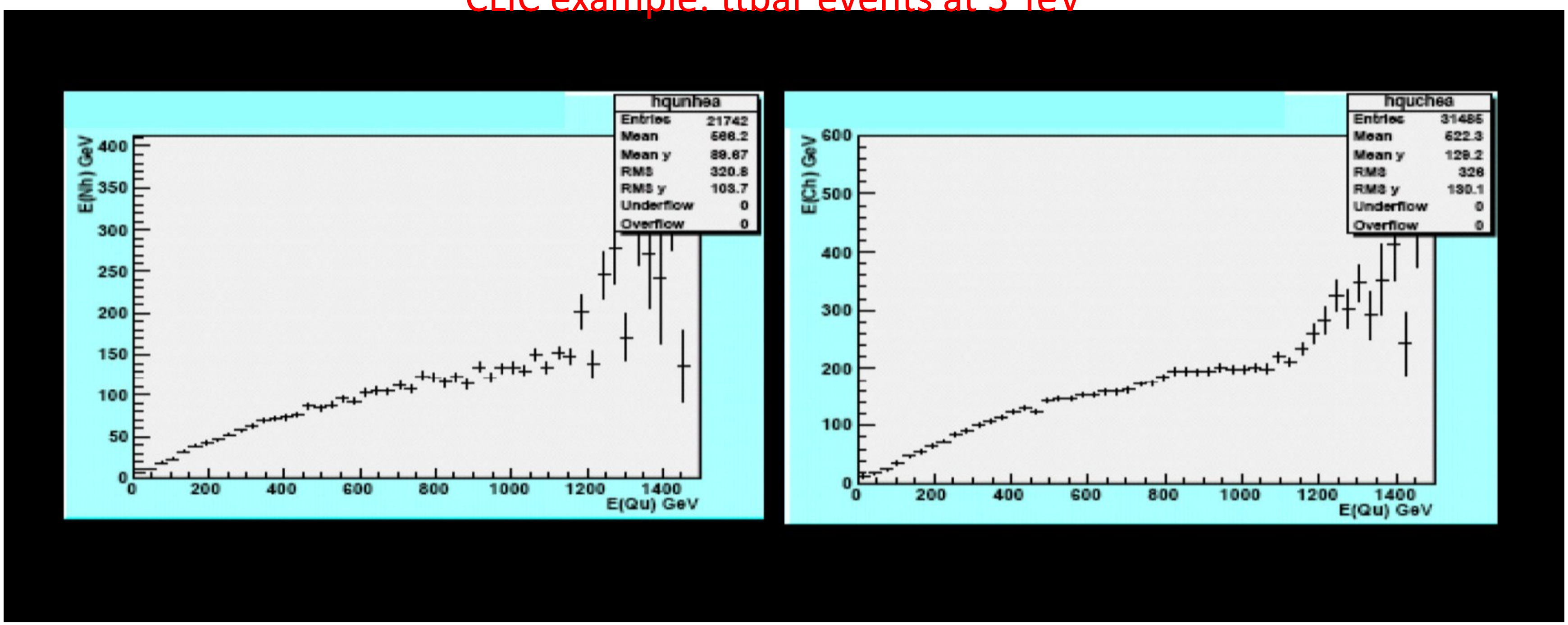
## some recommendations following experience from the CLIC detector study

http://lcd.web.cern.ch/LCD/

# Physics observables

- Get overview of physics observables at 1 TeV
  (just to get familiar with the new domain)
  - e.g. jet energies and particle energies in jets
  - Minimal distances between leading particles in jets
  - Evolution of angular coverage of the physics wrt 500 GeV case

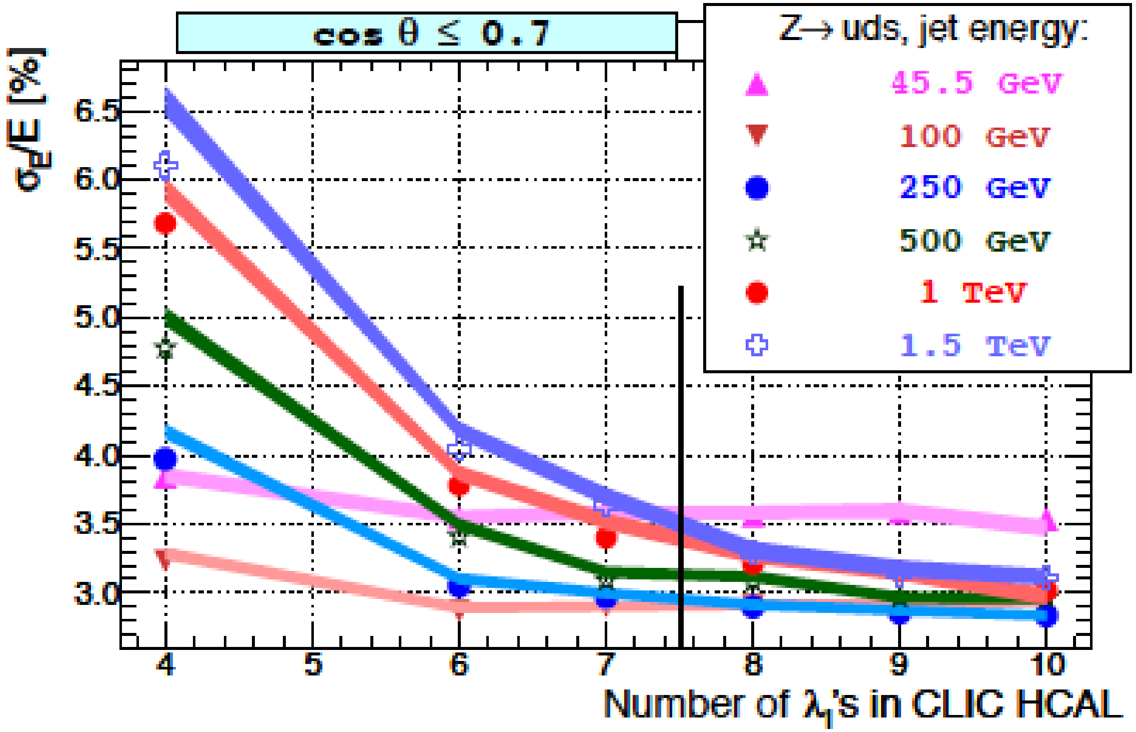
CLIC example: ttbar events at 3 TeV



# Study calorimeter requirements

Assess calorimeter performance for the 1 TeV case

Mostly to ensure that calorimeter depth is sufficient and that confusion remains limited (in fact already proven for the CLIC case)

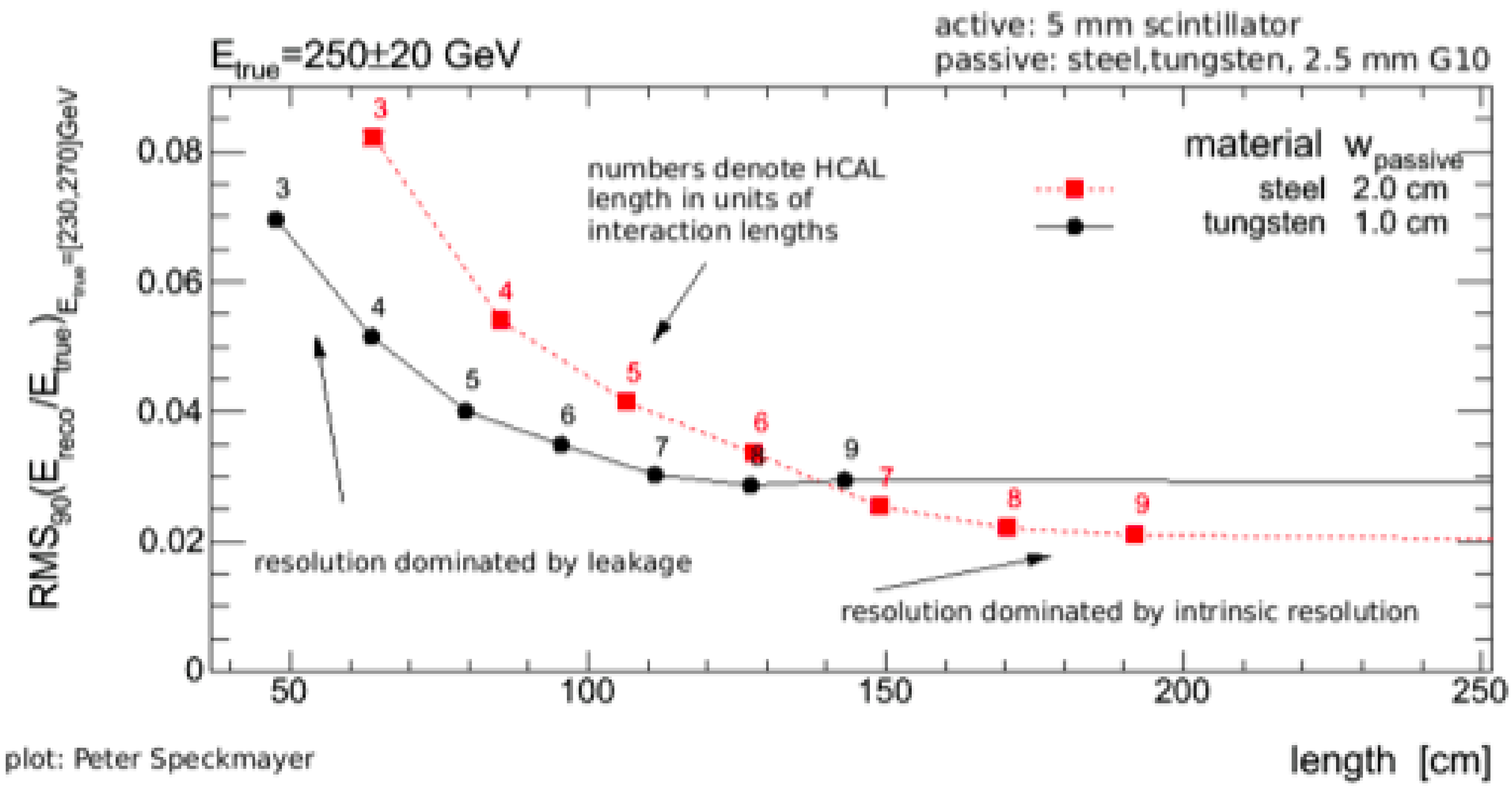



PFA study

Full ILD-type detector barrel with tungsten HCAL absorbers

Solid lines: not tails catcher    Markers: with tail catcher

# Tungsten for HCAL barrel?




Required resolution reached at smaller HCAL outer radius for **tungsten** than for **steel absorber**

# Machine-induced backgrounds

**Understand the main machine backgrounds:**

Overall limited impact expected given the favorable ILC bunch structure

**Coherent pairs**

Ensure that outgoing beam pipe opening and crossing angle of 14 mrad are safe with respect to coherent pairs

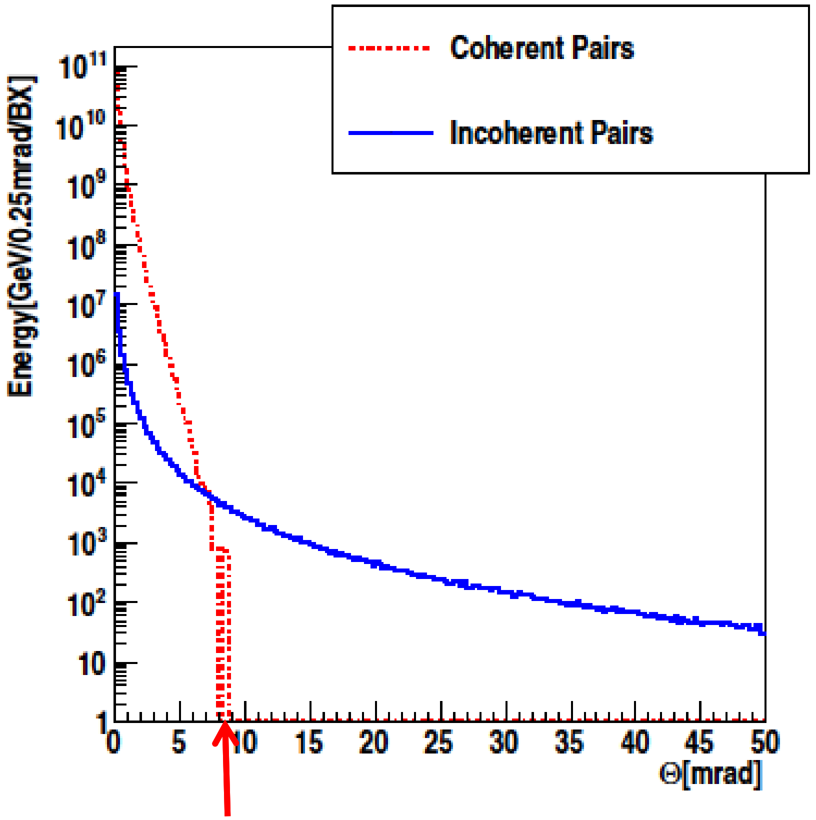
**Incoherent pairs**

- Study of lumical at 1 TeV => may require change in angular range for lumical
- Study optimal geometry for beamcal
  - Trade-off between acceptance and backscattering
- Optimise beam-pipe layout (can have a function of absorbing back-scattered background)
- Verify occupancy in the vertex detector and tracking detectors
  - For direct hits (influence of B-field) and backscattered hits
  - Inner vertex layer may have to be moved to somewhat larger radius

**γγ to hadron background**

- Only few events/bx expected, though with significant energy/bx (few-10 GeV)
- Study $P_t$ cuts and optimal jet reconstruction algorithm to suppress this background

# Coherent pairs and opening angle




CLIC example:
Sharp angular cut-off in coherent pairs drives choice of beam pipe opening and choice of crossing angle

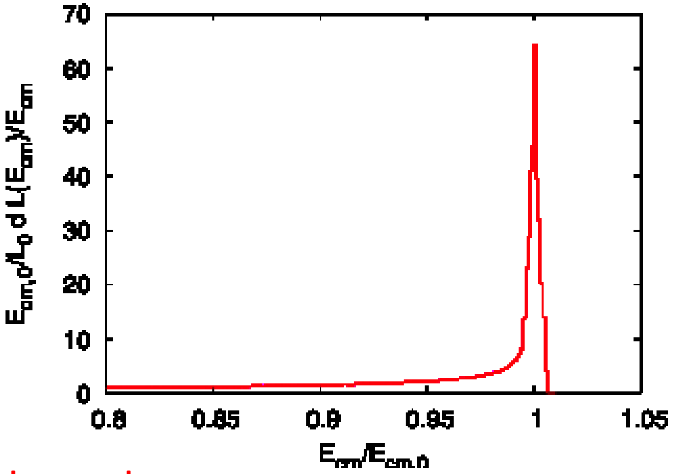
Thoughts for ILC:
"easier" bunch structure, but:
long integration times –
only a few readouts per train

- The total occupancies due to all background processes must be evaluated
- Multi-hit readout capabilities of the on-detector electronics (event buffers) have to be evaluated
- The electronics shall record the time of each hit (with ~300 ns precision)

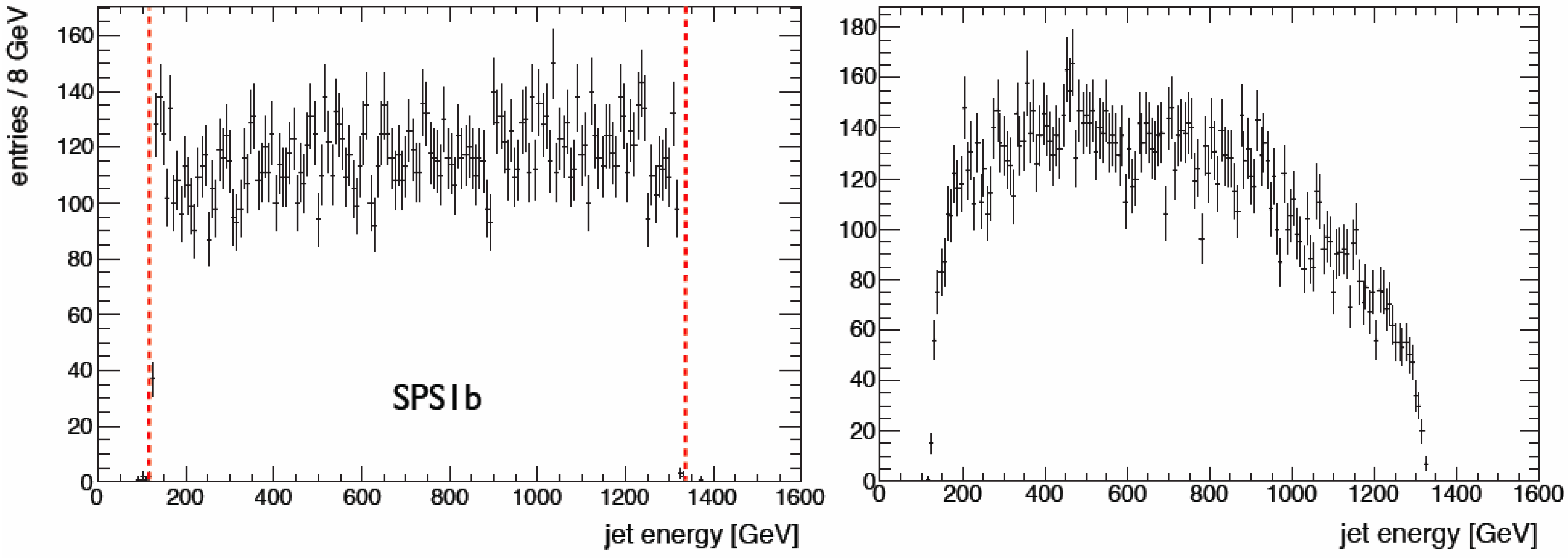
# Luminosity spectrum

**Influence of luminosity spectrum on physics performance:**

E.g. Influence in measuring masses from and-point spectra




Example: CLIC luminosity spectrum and squark end-point spectra



# Software for CLIC

- For the CLIC CDR: Simulation and Reconstruction needed for 3 TeV

- Example: ILD - Several issues encountered, all fixed
  - ILD tracking code: Hard-coded momentum "sanity check" caused high energy tracks to disappear
  - Excessive reconstruction times
  - ...

- PandoraPFA for CLIC
- Background overlay
  - less of a concern for ILC, but due to long readout times, some background will be accumulated: Needs to be studied!

⇨ Simulation and Reconstruction proven in multi-TeV environments!