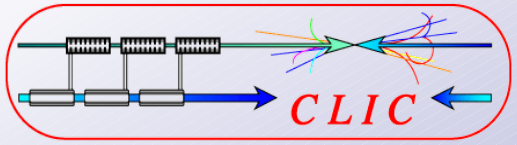
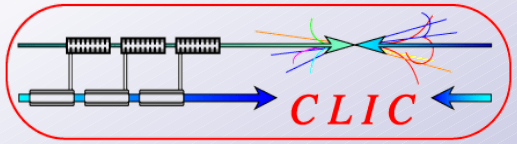


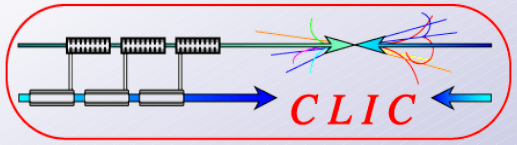
CLIC 000 and first Simulations of a Calorimetry Stack

Christian Grefe



Outline

- Status of the software
- CLIC 000
- Calorimetry Stack
- Outlook

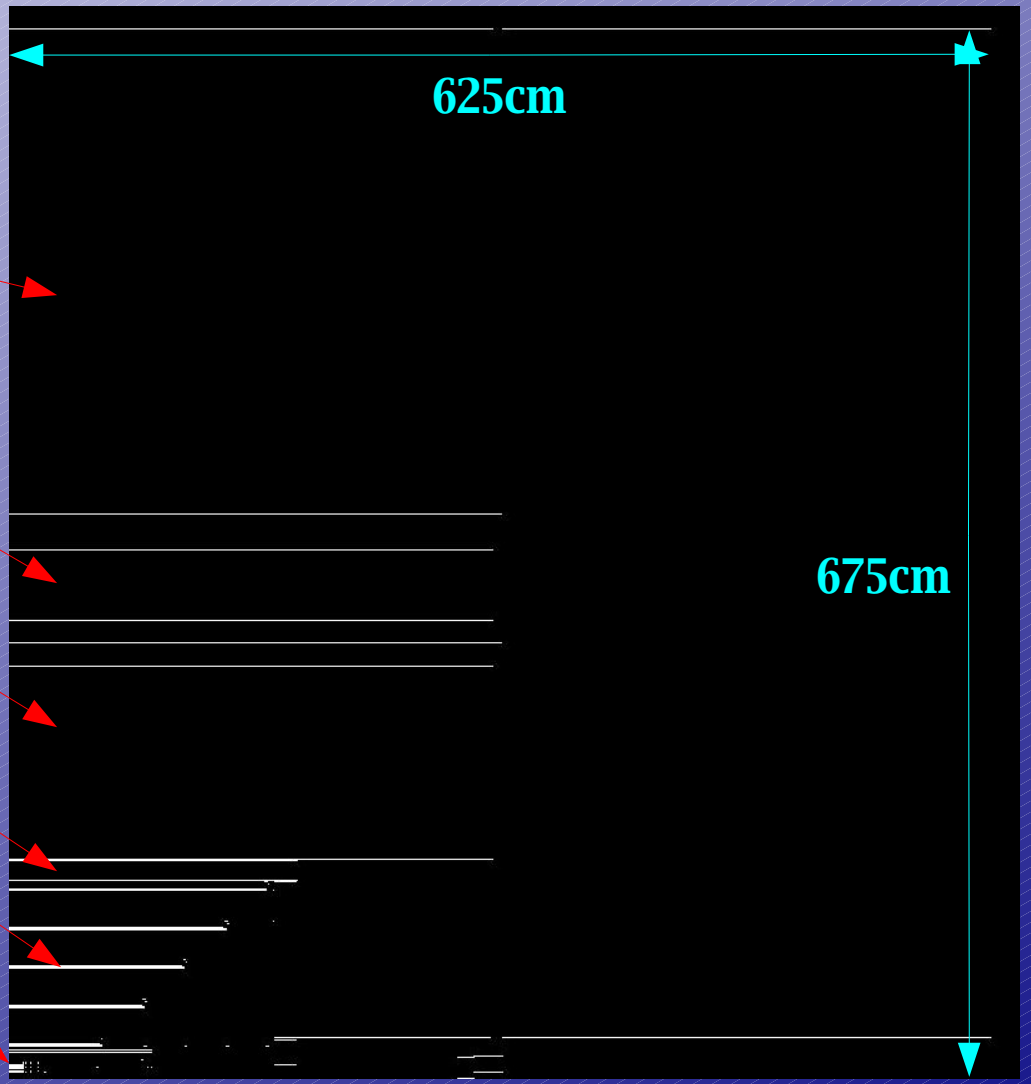


Software

- We use the SiD software for now
  - Everything has been set up and is working fine
    - Pythia: event generation
    - Slic: Geant4 based detector simulation
    - org.lcsim: analysis software
    - JAS3: event display and AIDA gui
  - Common AFS space is available
    - Store all event data and analysis results there
    - The software will be set up there as well in the near future
    - Contact Peter Speckmayer for access rights
  - We also created a CLIC Wiki to document the work
    - https://twiki.cern.ch/twiki/bin/view/CLIC
    - Everyone is welcome to contribute there!
- Physics list used: QGSP_Bert

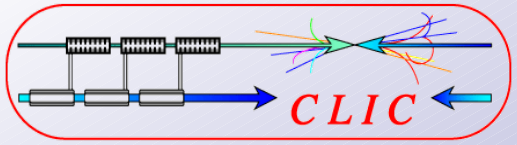
CLIC 000

- Cut through CLIC 000 (drawn by JAS3)
  - Myon system
  - Solenoid
  - HCAL
  - ECAL
  - Tracker
  - Vertex detector



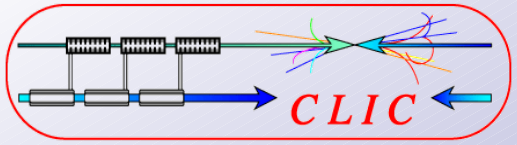
CLIC 000

- Basically the SiD01 detector
- Created as a starting point to have a detector to “play”
- Created by Marcel Stanitzki (RAL)
- Only 2 modifications for now:
  - Beampipe from 1.4cm radius to 4cm (Beamstrahlung)
  - Much bigger HCAL (increased Λ to ~ 9)
  - All other systems moved accordingly



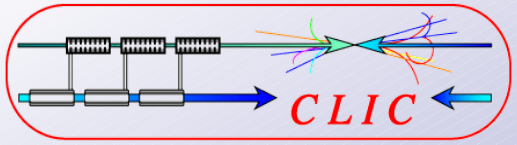
CLIC 000

- Tracking
  - VTX barrel: 0.1mm Si - 5 layers
    - Inner radius: 4.0cm (1.4cm @ SiD01), outer radius 8.6cm (6.0 @ sid01)
  - VTX endcap: 0.1mm Si – 4 layers
    - Inner z: 7.1cm, outer z: 17.0cm
  - TKR barrel: 0.3mm Si - 5layers
    - Inner radius: 21.8cm , outer radius: 121.8cm
  - TKR endcap: 0.3mm Si – 4 layers
    - Inner z: 85.5cm, outer z: 164.0 cm
  - FWD TKR: 0.3mm Si – 3 layers (r = 16.6cm)
    - Inner z: 20.4cm, outer z: 83.3 cm



CLIC 000

- Calorimetry
  - ECAL: 30 layers SiW, 0.35cm*0.35cm cells
    - 20 layers of 0.25cm W + 10 layers of 0.5cm W, each followed by a 0.3mm Si layer. One additional Si layer in front of the ECAL.
    - Barrel: inner radius 127.0cm, outer radius 141.0cm
    - Endcap: inner z 168.0cm, outer z 182.0cm
  - HCAL: 45 layers Wscint, 1.0cm*1.0cm cells
    - 2.0cm W followed by 0.5cm Polysterene for each layer
    - Barrel: inner radius 141.0cm, outer radius 264.8cm
    - Endcap: inner z 182.0cm, outer z 305.7cm
    - Total of ~ 9 Λ
    - Changed from 34 layers of Steel-Gas HCAL @ SiD01 (Λ ~ 4.6)

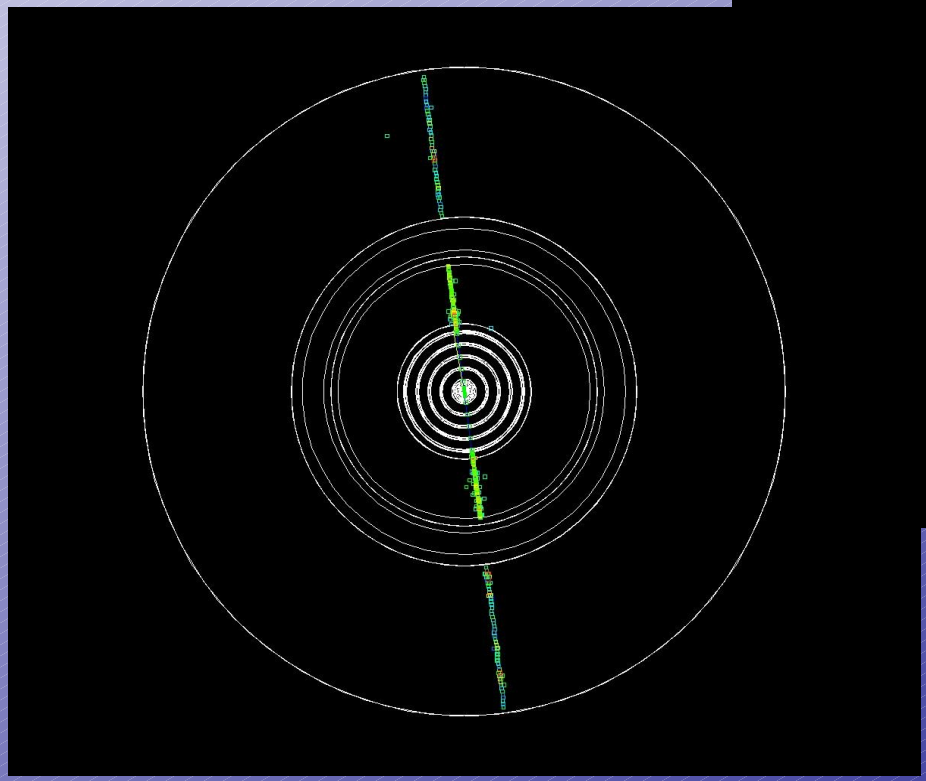


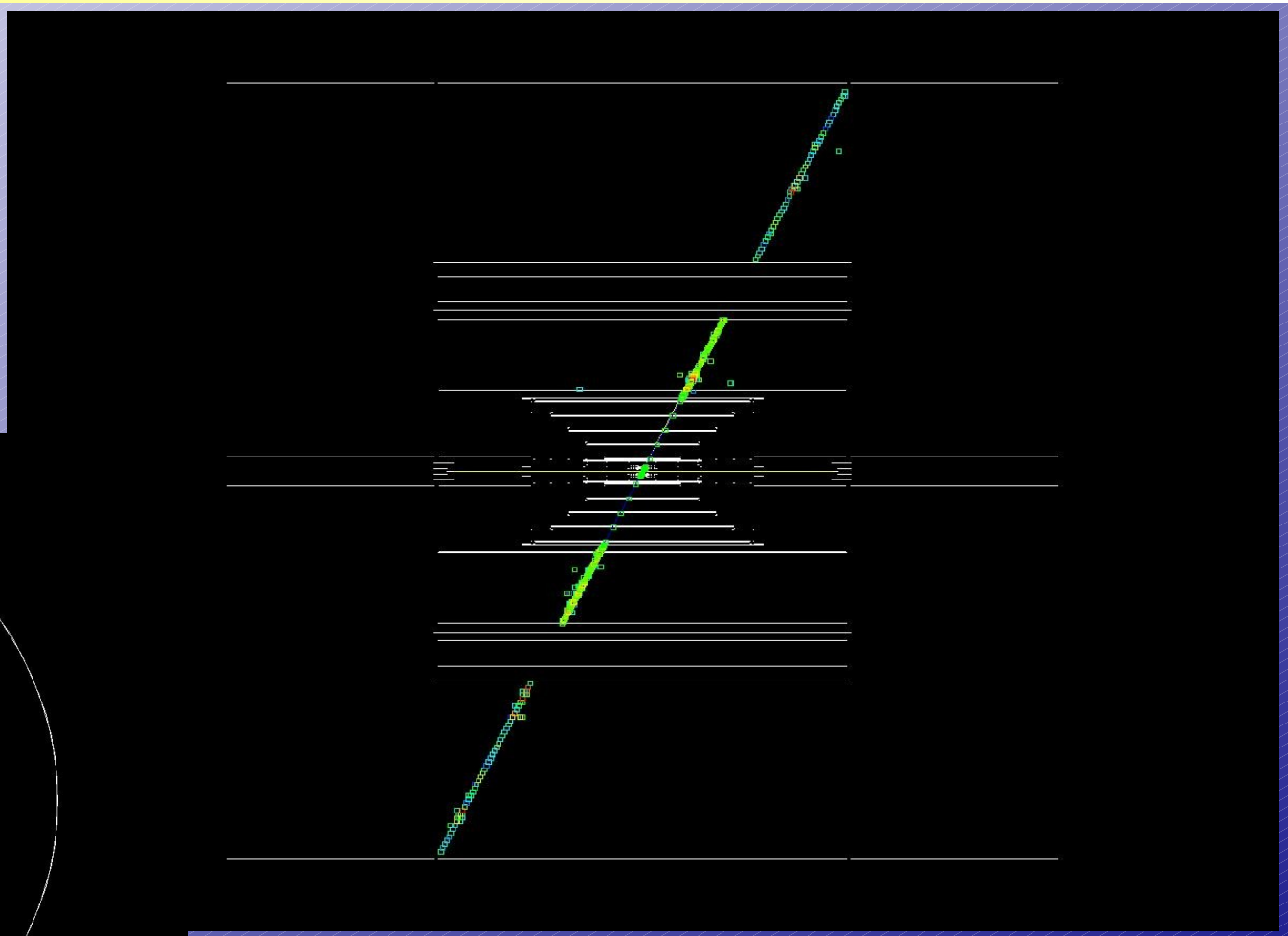
CLIC 000

- Solenoid
  - 5T coil , inner radius: 280.0cm (from 250.0 @ SiD01)
- Muon system
  - 48 layers of steel/gas, 3.0cm*3.0cm cells
  - Barrel: inner radius 363.0cm (333 @ SiD01), outer radius 675.0 cm
  - Endcap: inner z 313.3 cm (277.5 @ SiD01), outer z 625.3cm
- FWD ECAL
  - 2 layers SiW, inner radius 8.7cm, outer radius 25.0cm, z = 168.0cm
- Instrumented luminosity monitor
  - 1 layer SiW, inner radius 4.0cm, outer radius 14.3cm, z = 295.0cm

CLIC 000

- Marcel Stanitzki has also generated 1000 events for CLIC 000 for some processes

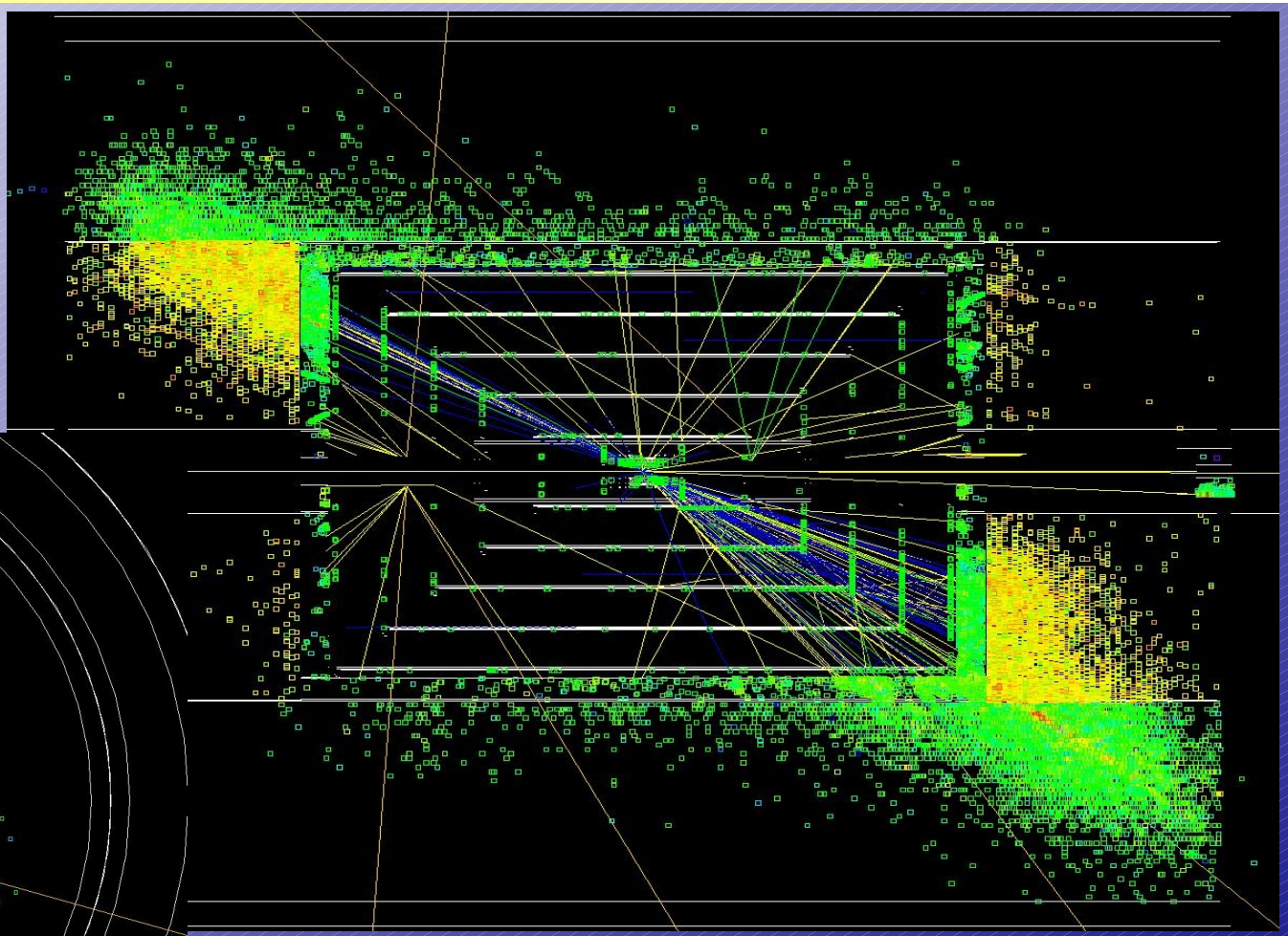


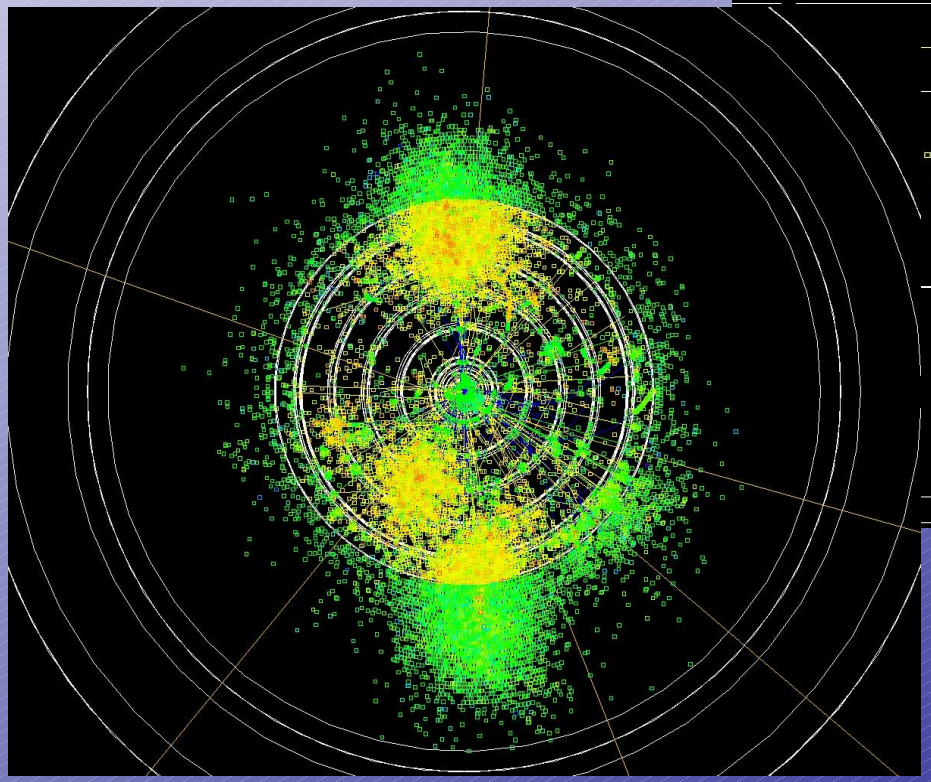


- $Z \rightarrow \mu\mu$

CLIC 000

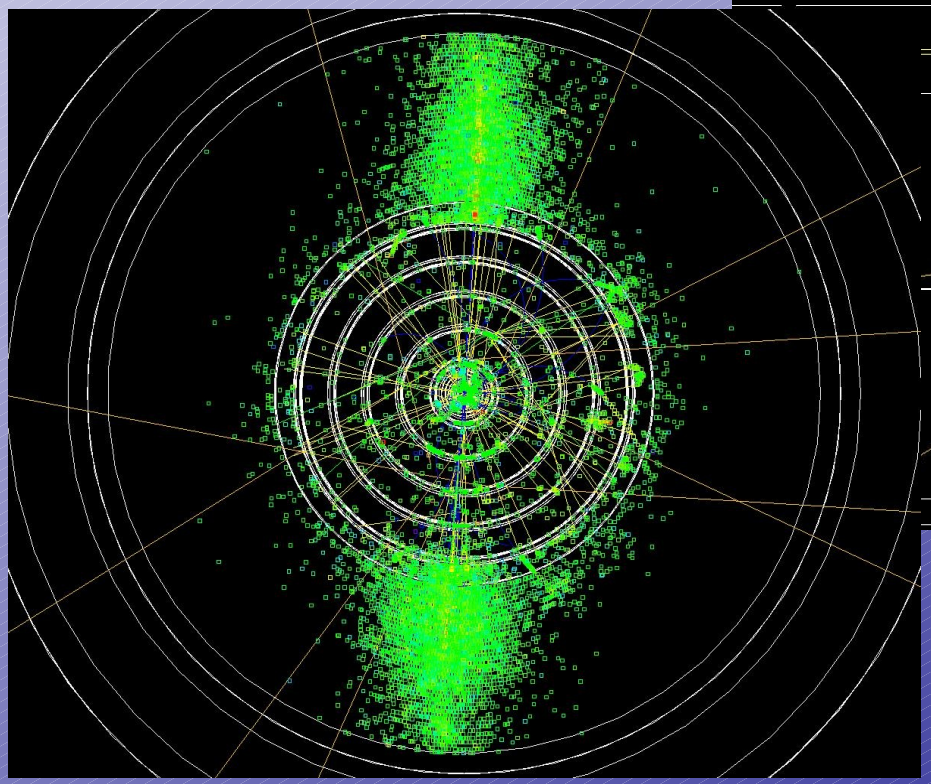
- $Z \rightarrow qq$ (uds)

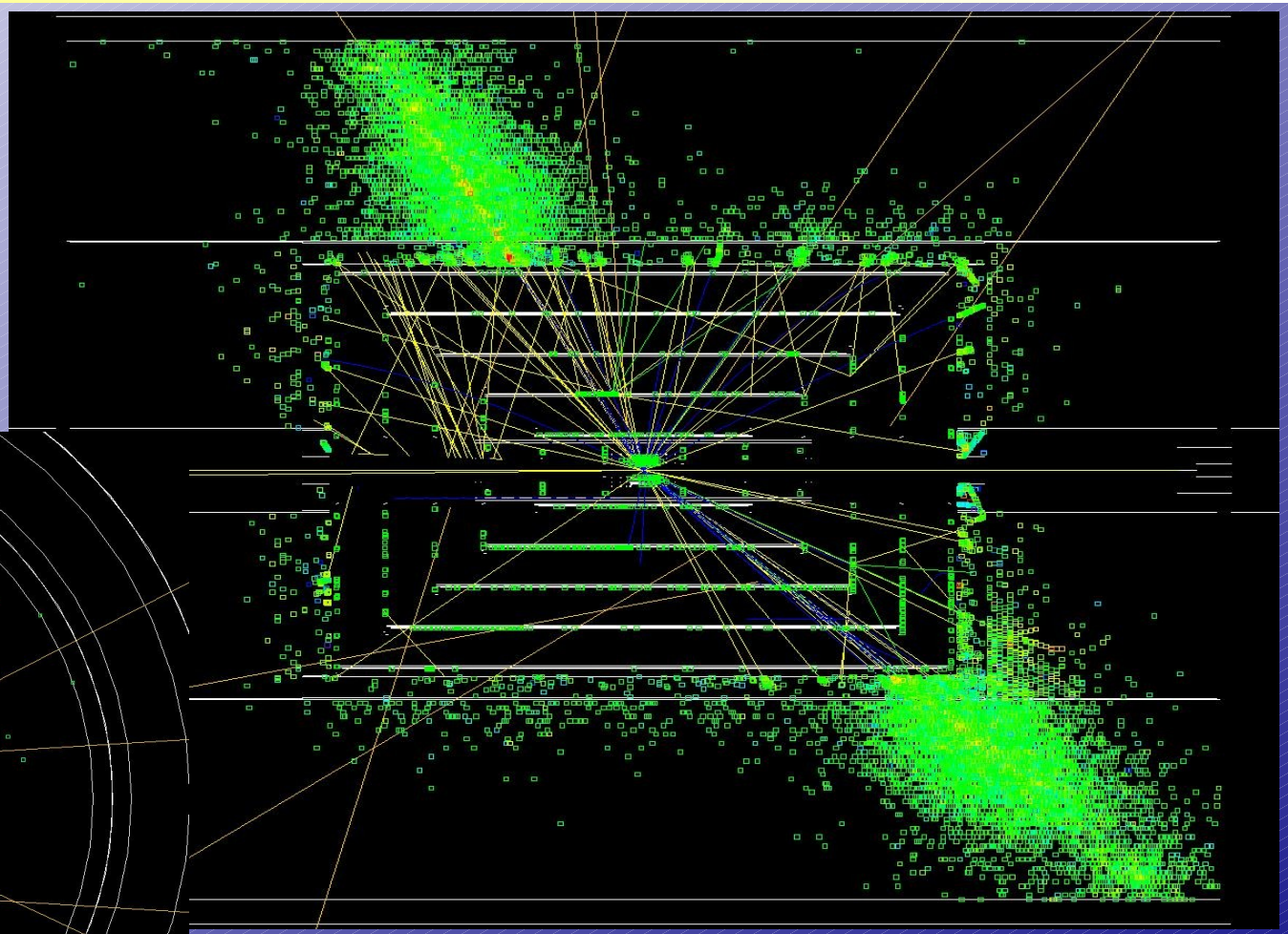




CLIC 000

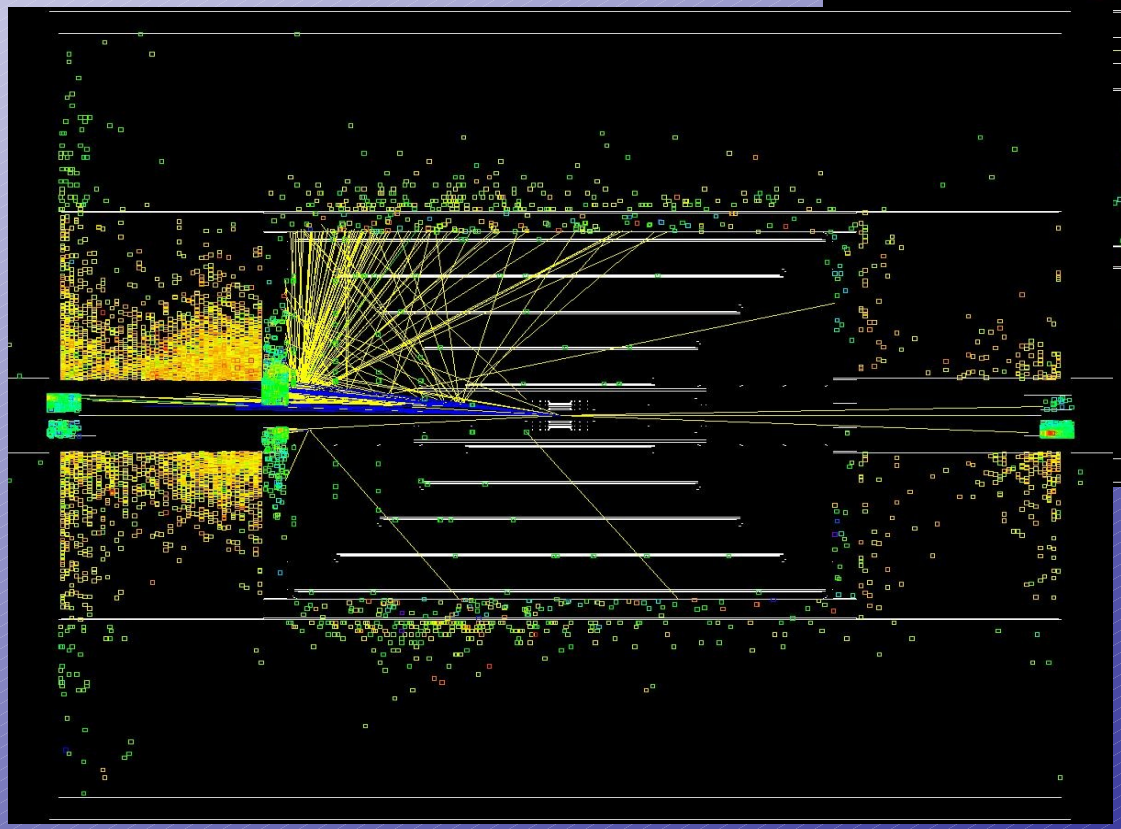
- $Z \rightarrow qq$ (uds)

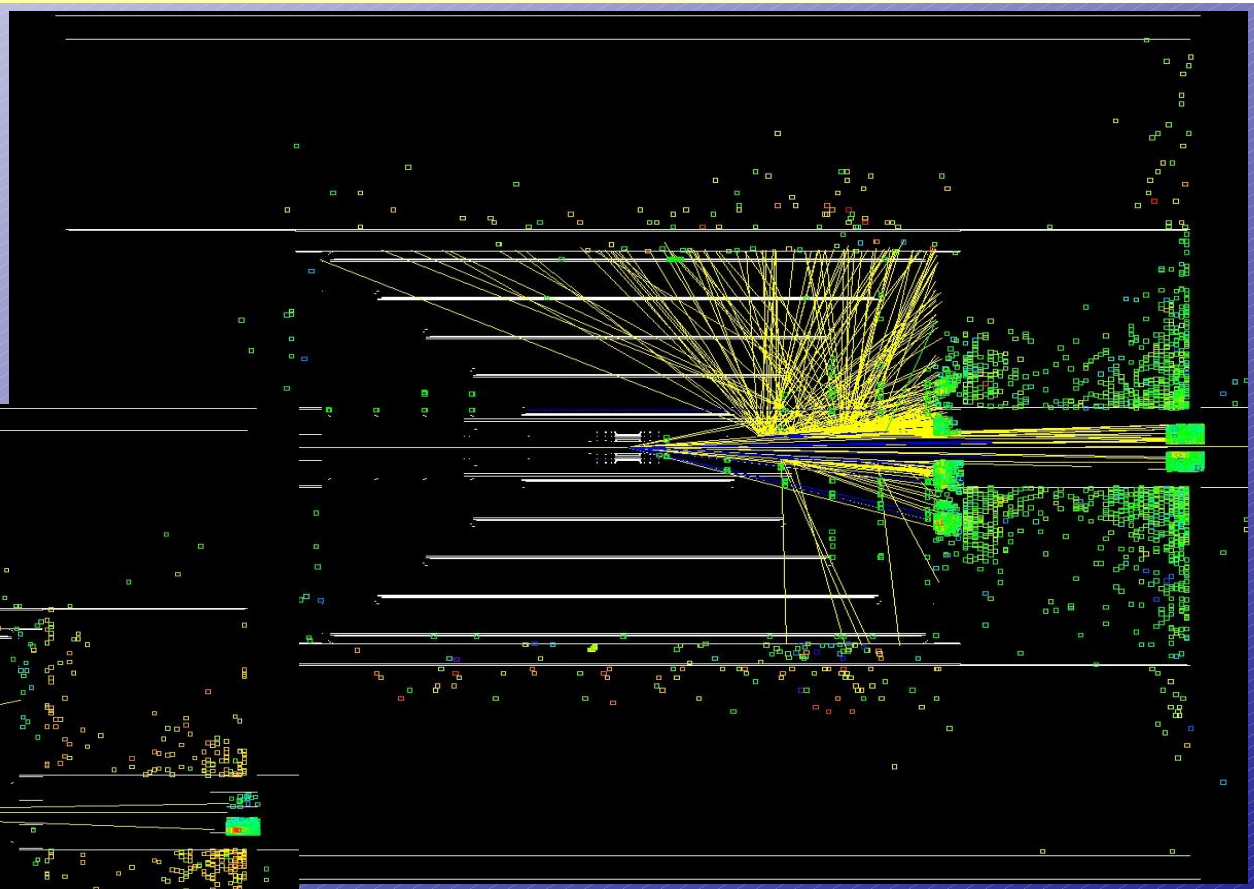




CLIC 000

- $Z \rightarrow qq$ (uds)

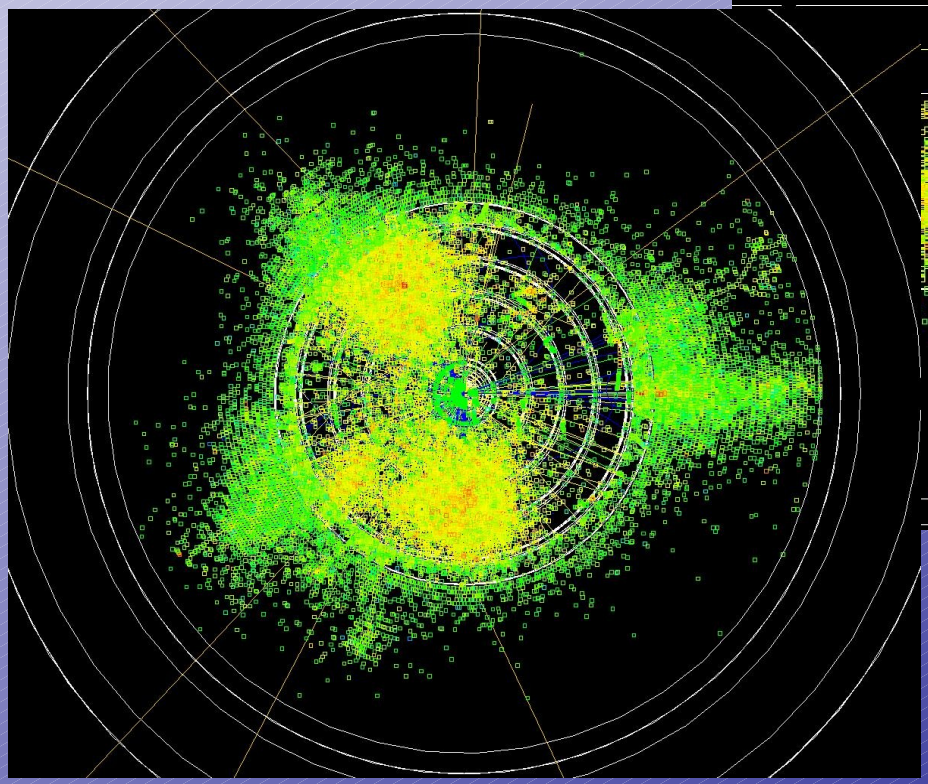


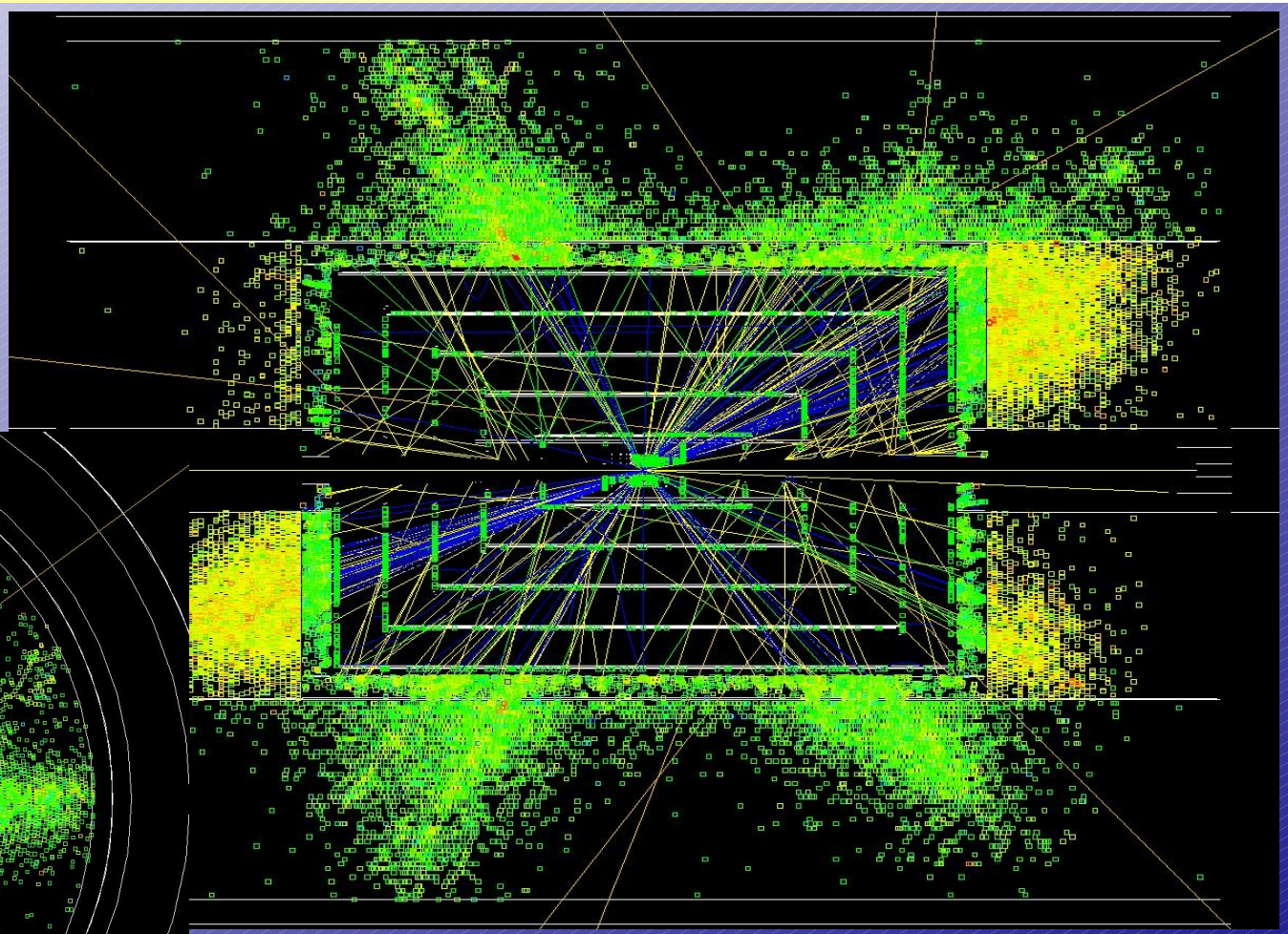


- But most events with huge boost and lots of backscattered γ

CLIC 000

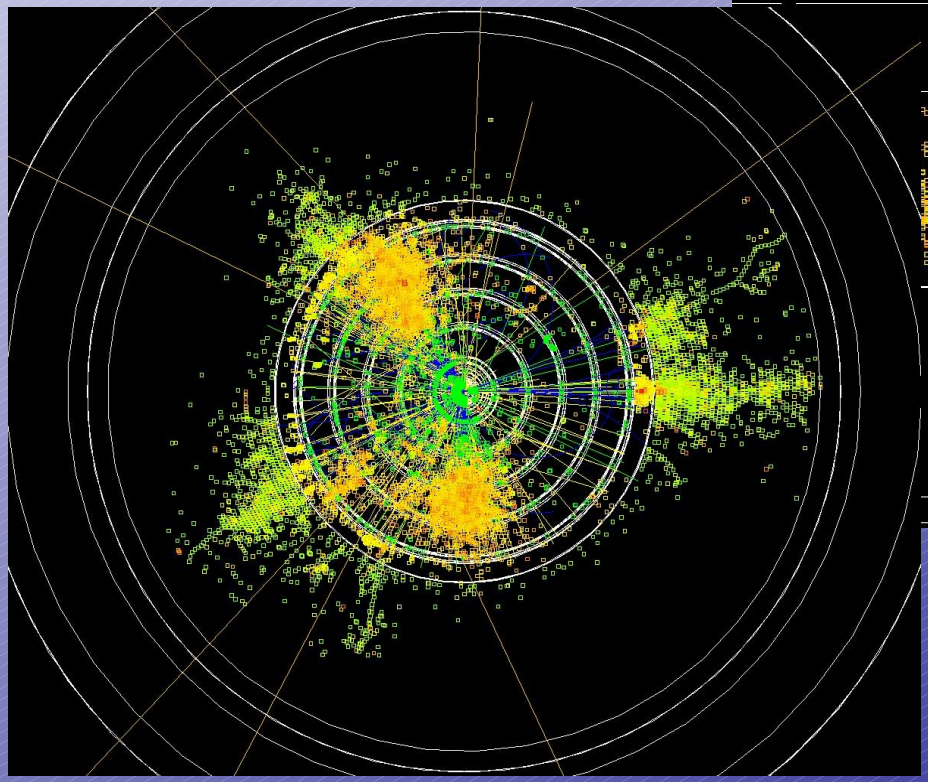
- WW & ZZ

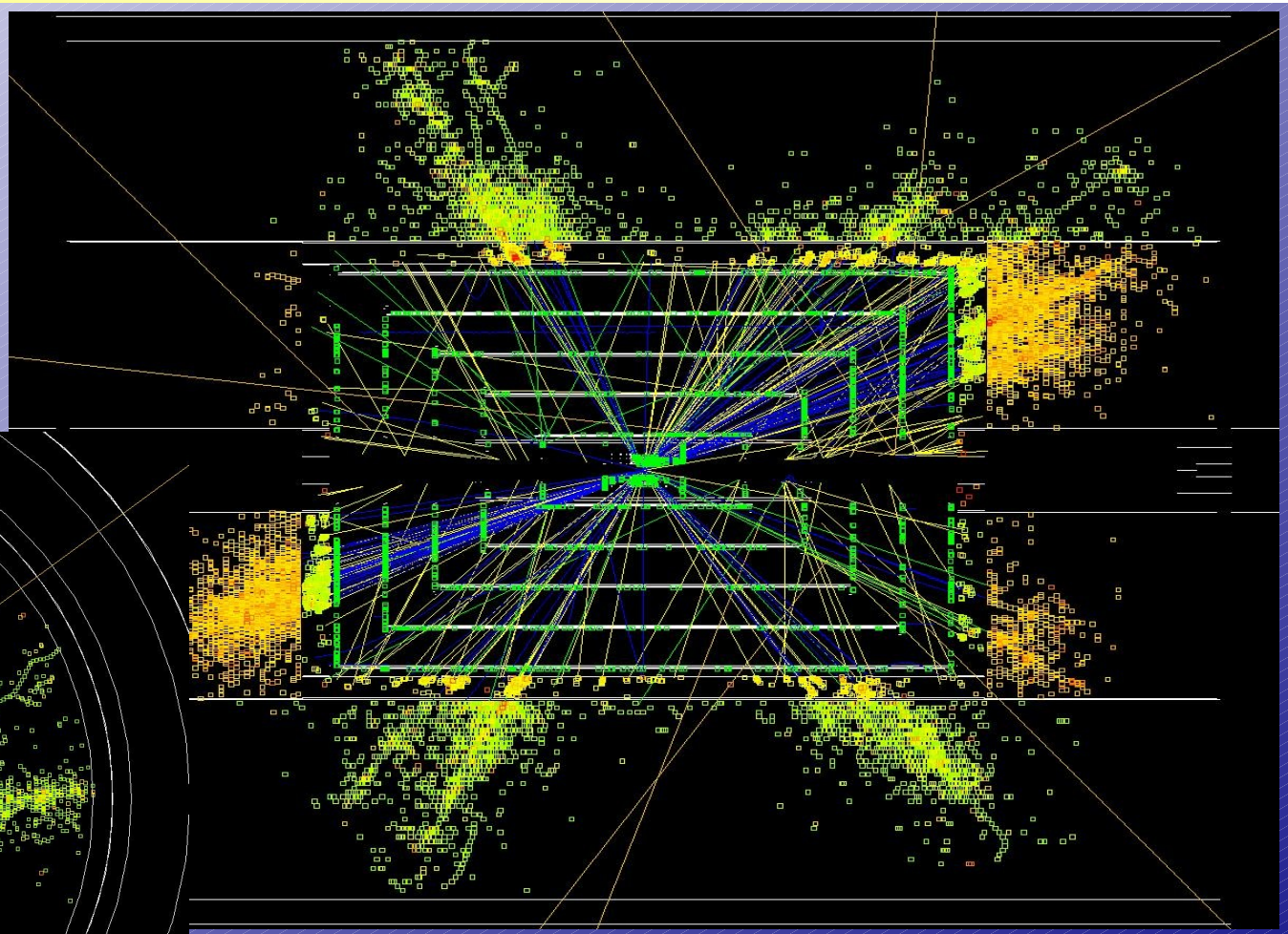




CLIC 000

- WW & ZZ

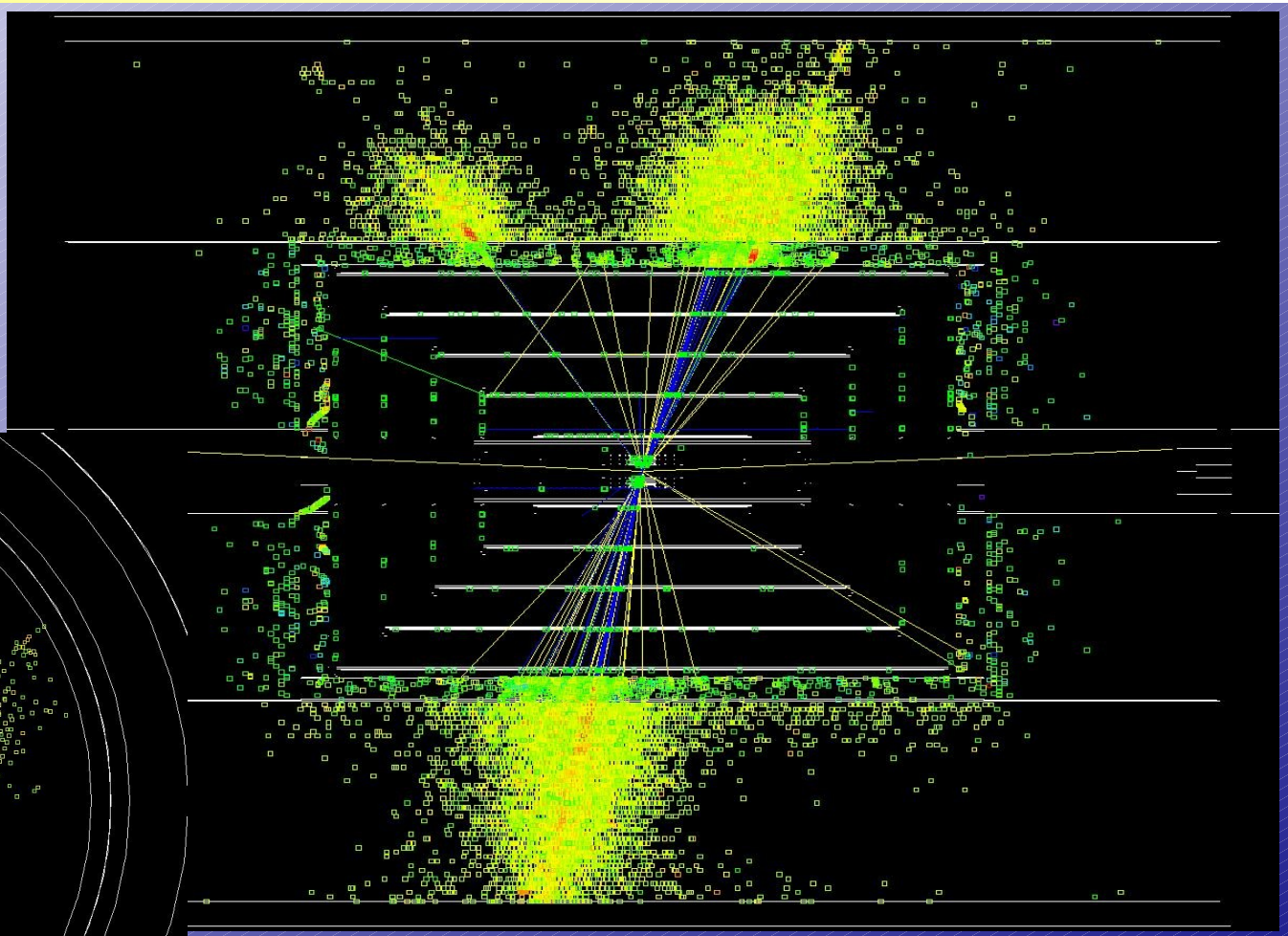


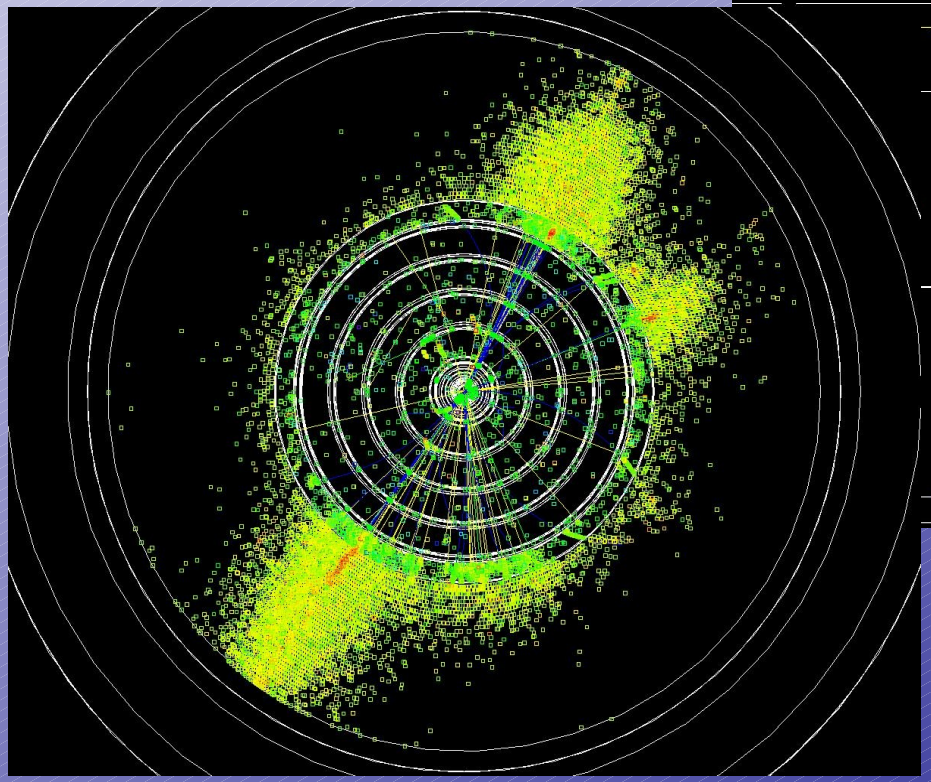


- Same event with low energy cut

CLIC 000

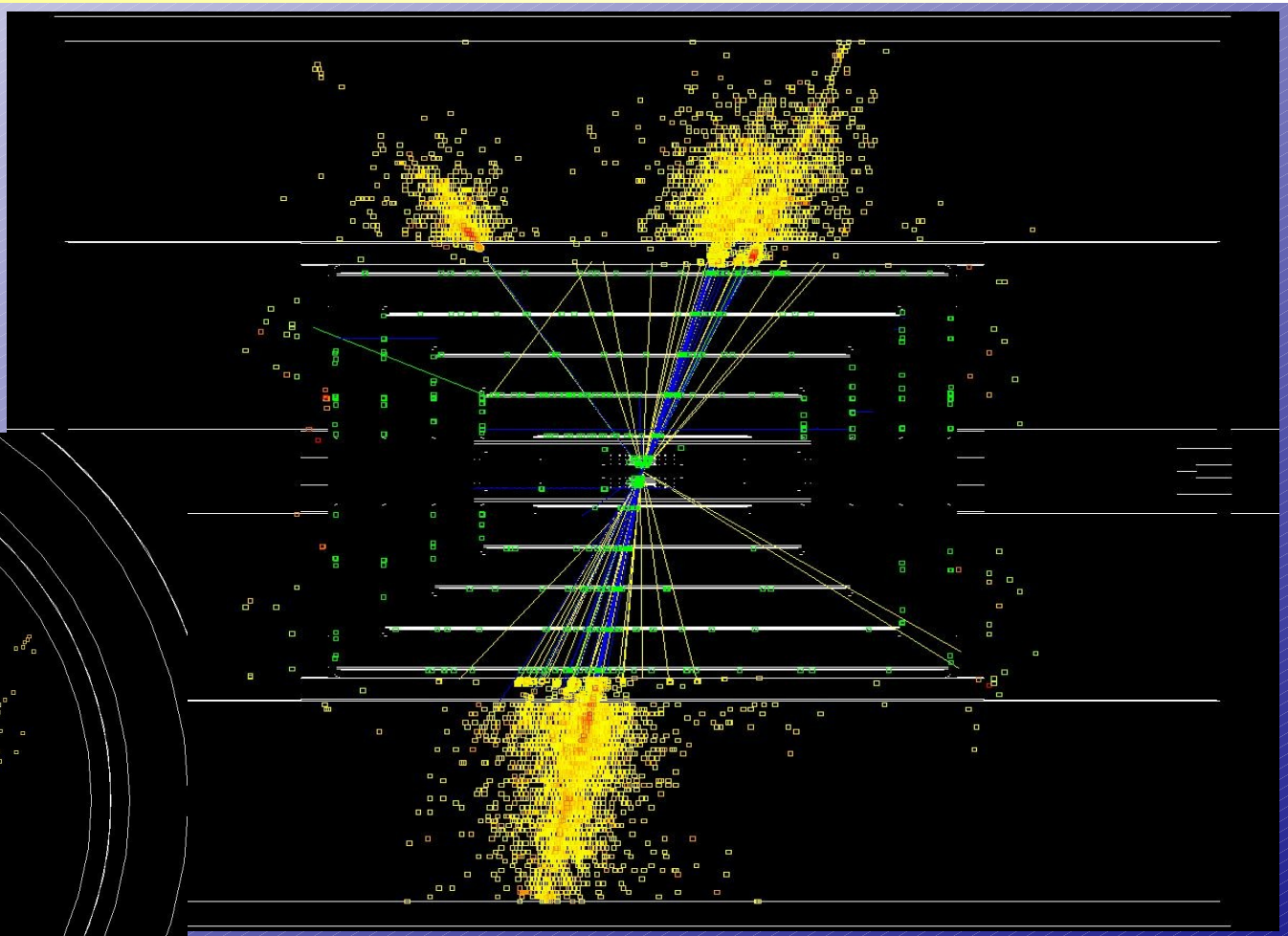
- WW & ZZ

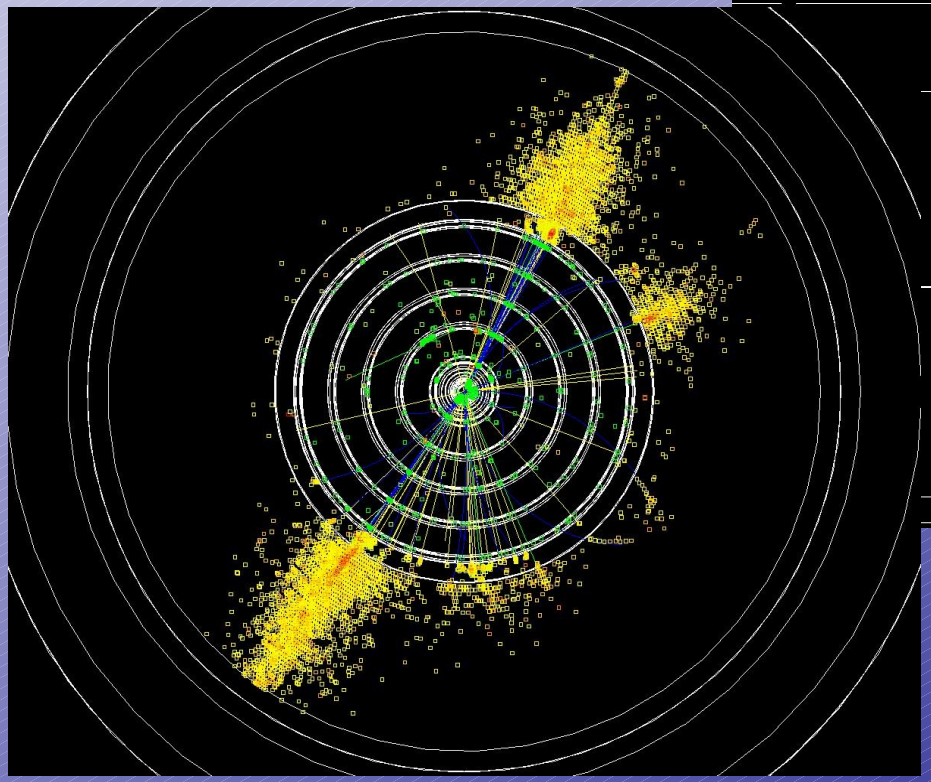




CLIC 000

- WW & ZZ

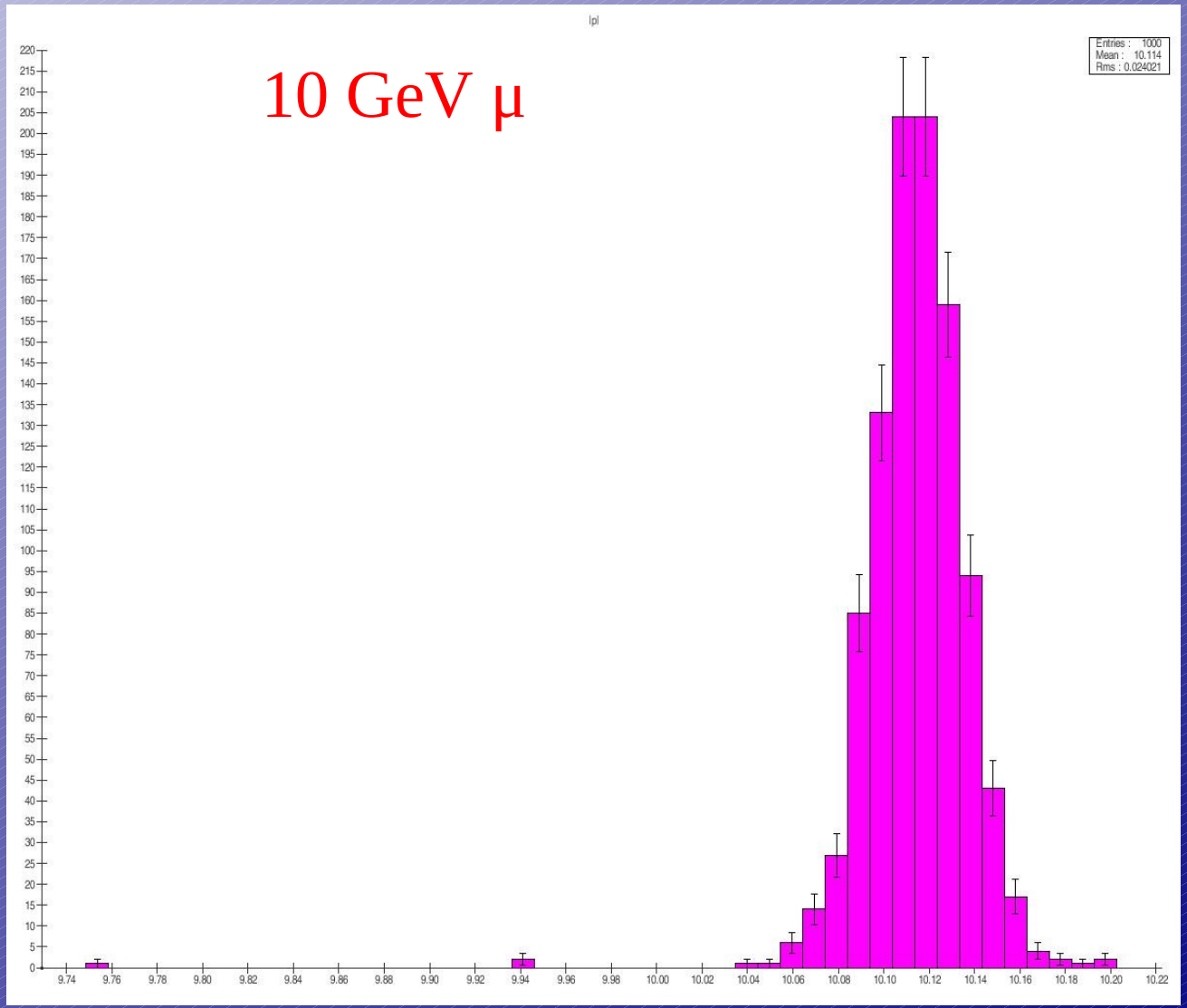




- Same event with low energy cut

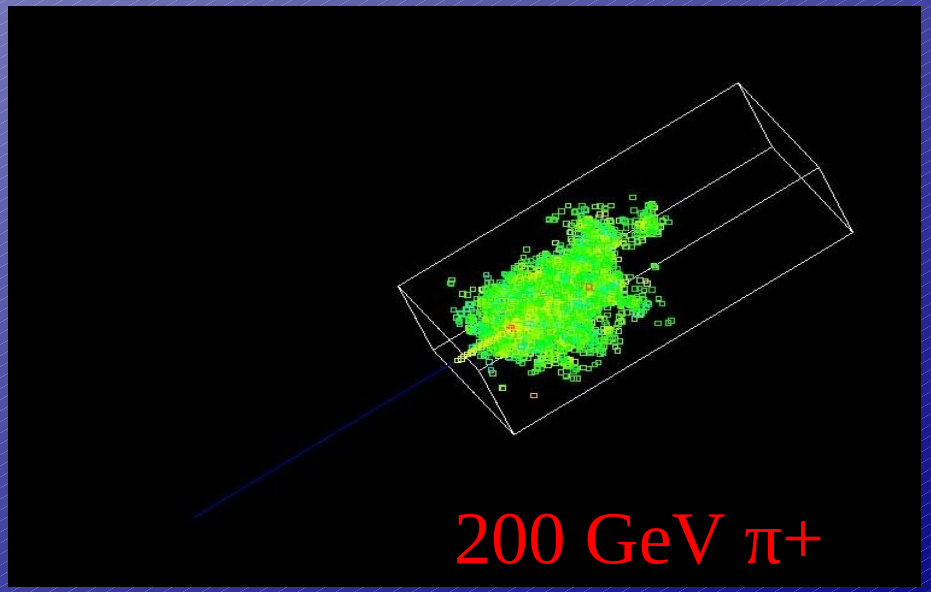
Tracking

- First look in tracking using the SiD tracking algorithm on CLIC 000
- Monochromatic μ from particle gun through CLIC 000 as a test of the algorithm



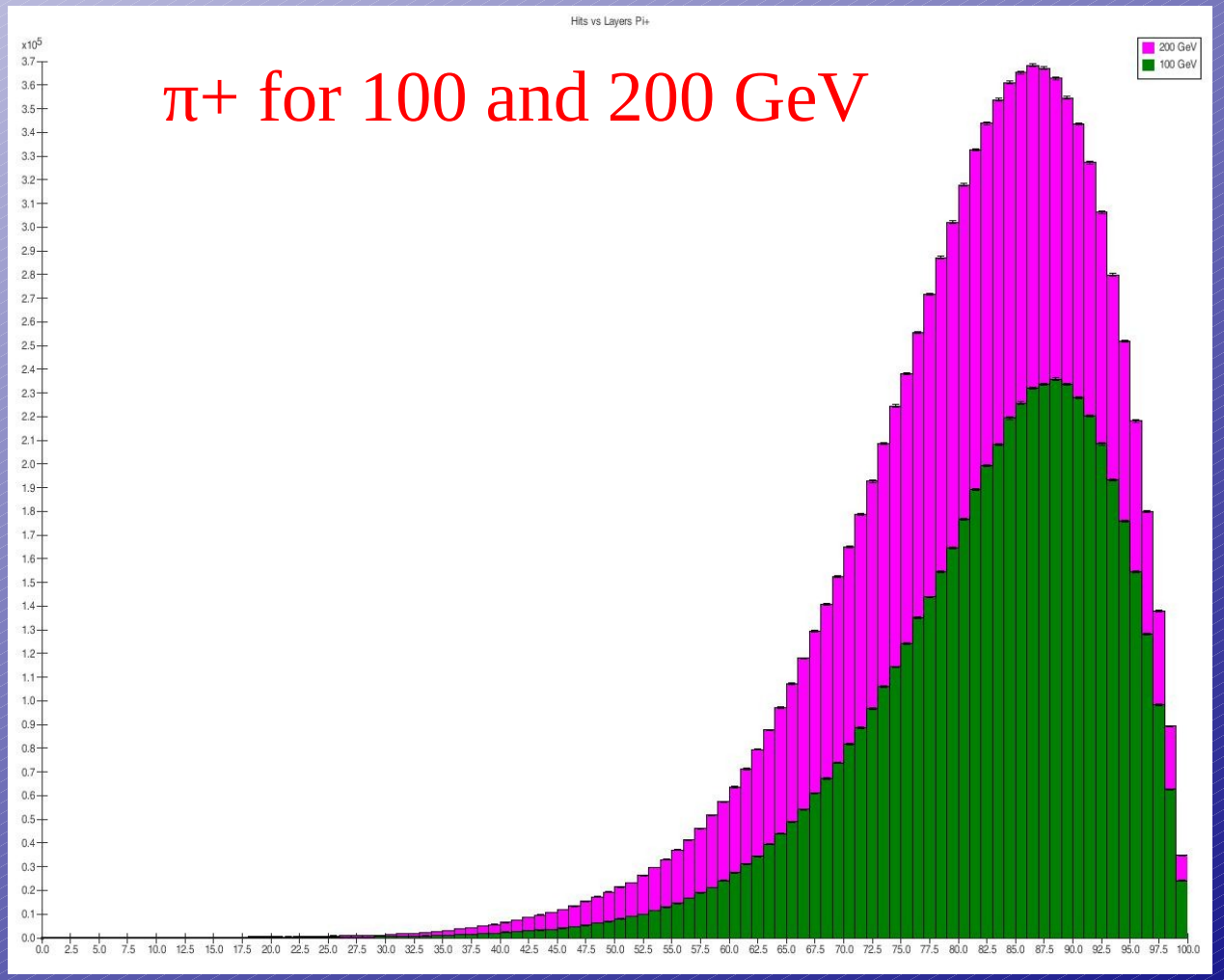
HCAL stack

- Simple detector to investigate the needed HCAL depth
  - 100 layers of WScint (same as in CLIC000: 2cm W + 0.5cm Scint)
  - 1.0cm*1.0cm cell size and a total Λ of ~ 20
- Need input of benchmark processes for estimation of energy range we need to cover
- For now we created some sample events for e-, π+,p and n with an energy of 50-200 GeV



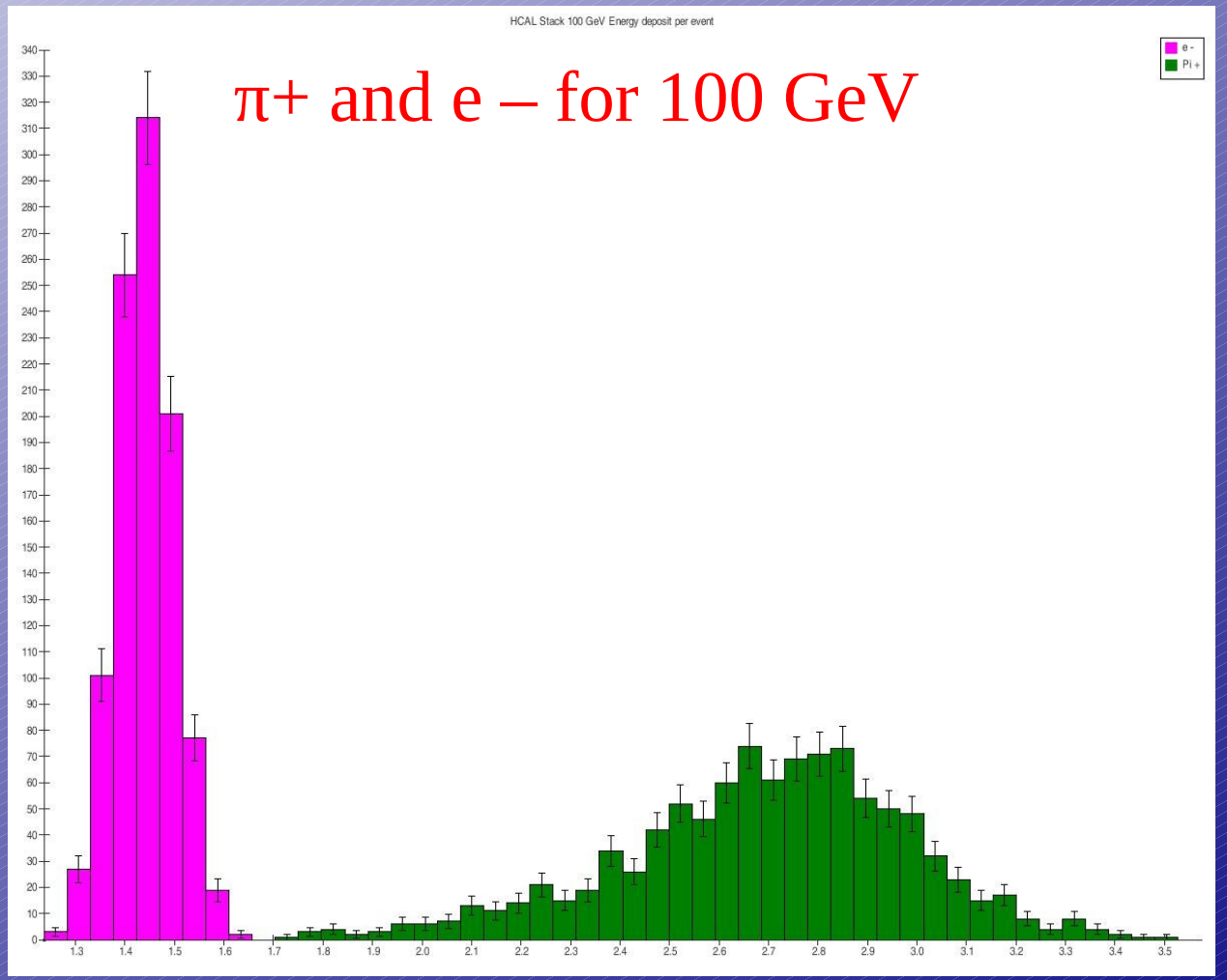
HCAL stack

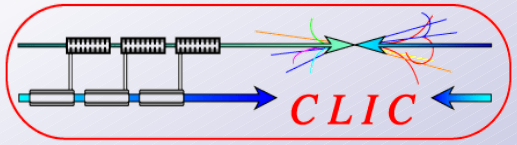
- Shower length: Hits vs. layers
- Needs energy calibration to be useful
- Angular and energy distribution for various processes is being investigated by Aysuhan Ozansoy



HCAL stack

- Calibrate the stack (sampling fraction): Total energy deposit for each event
- Tungsten leads to overcompensation (very short EM-showers)
- We are trying to tweak the active-passive ratio for better results





Summary & Outlook

- The SiD software has been set up and is working fine
- A very first version of a CLIC detector has been created to provide a starting point for the following studies
- We have started to look into the tracking algorithms
- We are using a simple stack to investigate the needed HCAL depth
- Aysuhan Ozansoy is investigating the energy spectrum and will provide the input for our detector studies