LGC for the NA49 experiment

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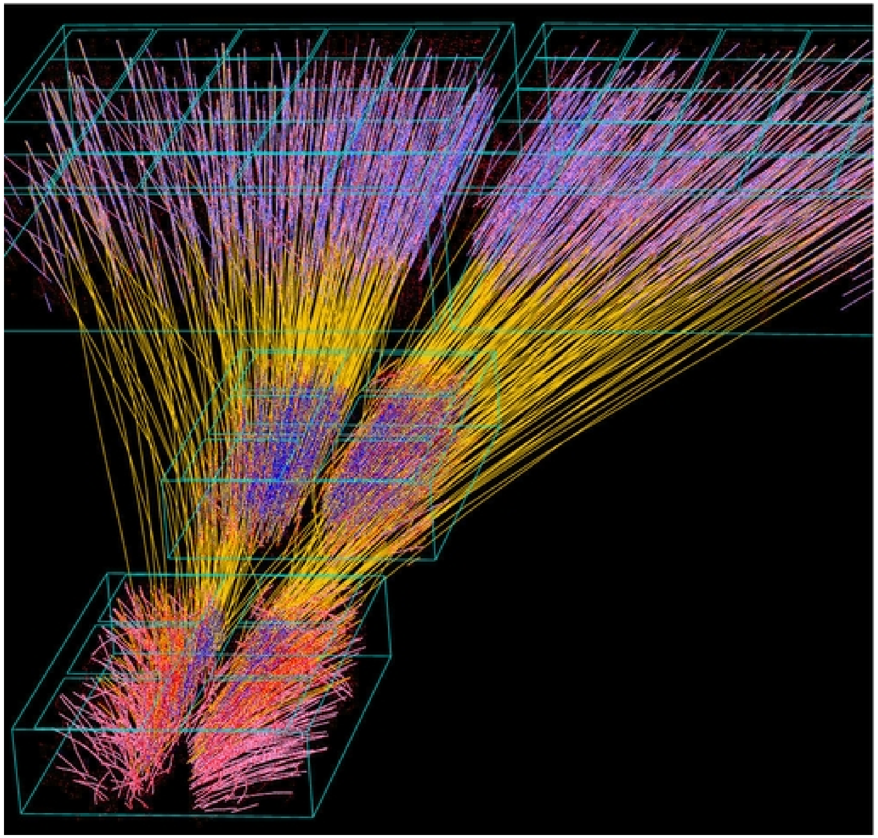
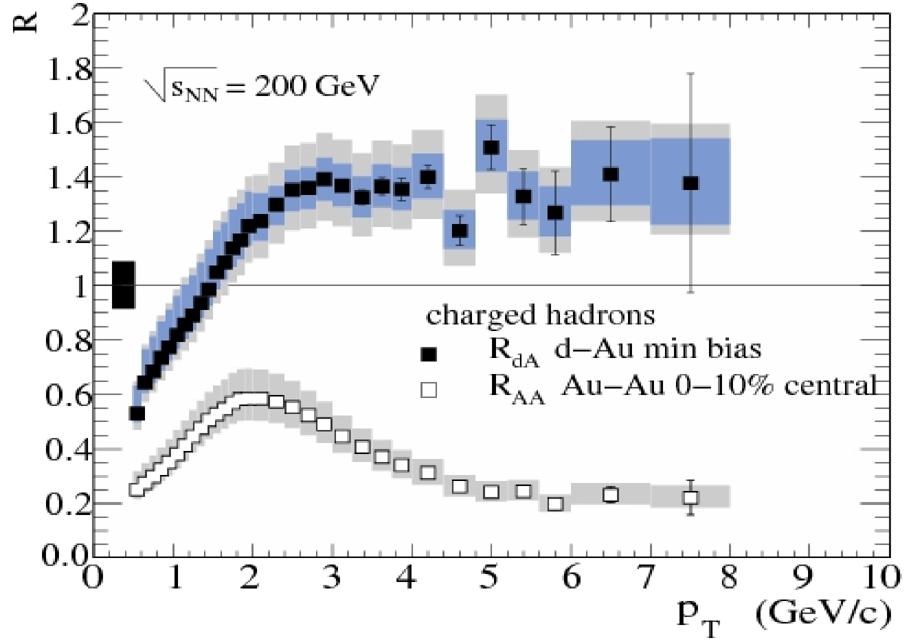


Introduction

- In the years after 2000, lot of excitement was in heavy-ion physics due to new discoveries at RHIC:

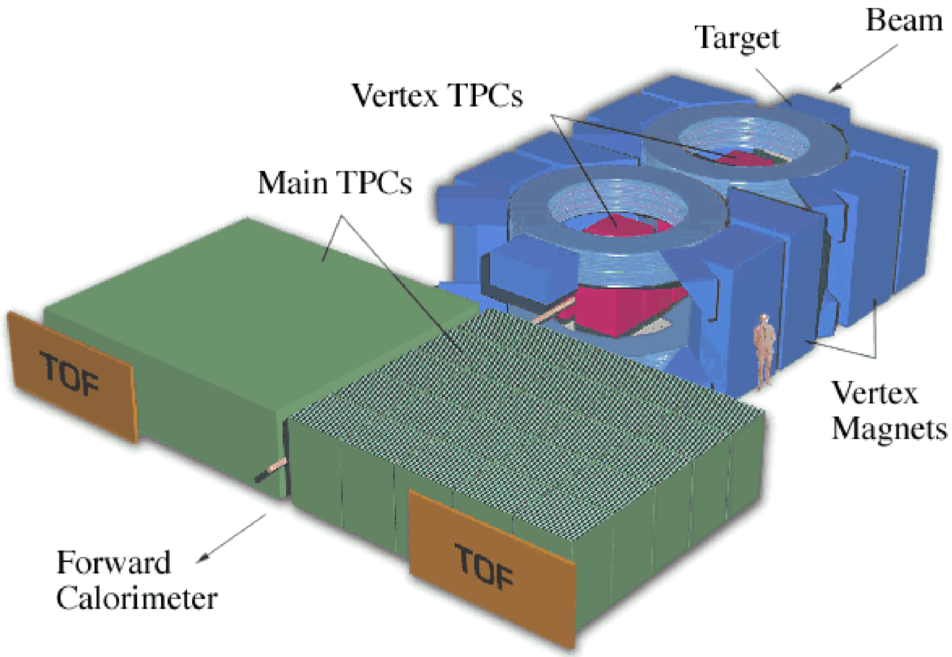
  High p_T particle yield suppression in central heavy-ion collisions relative to that of p+p at $\sqrt{s_{NN}}$=200GeV.



- Signature of QGP?
- Does this have energy dependence? (Try at SPS!)

The NA49 experiment

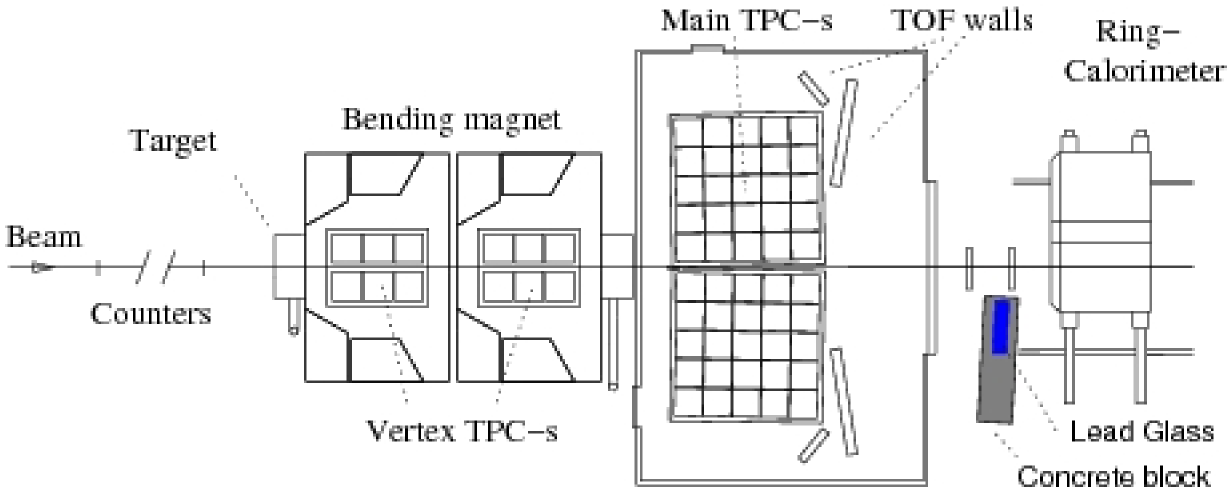
- NA49 was a fixed-target experiment at the CERN-SPS. Its main component was a large acceptance TPC-based hadron spectrometer.

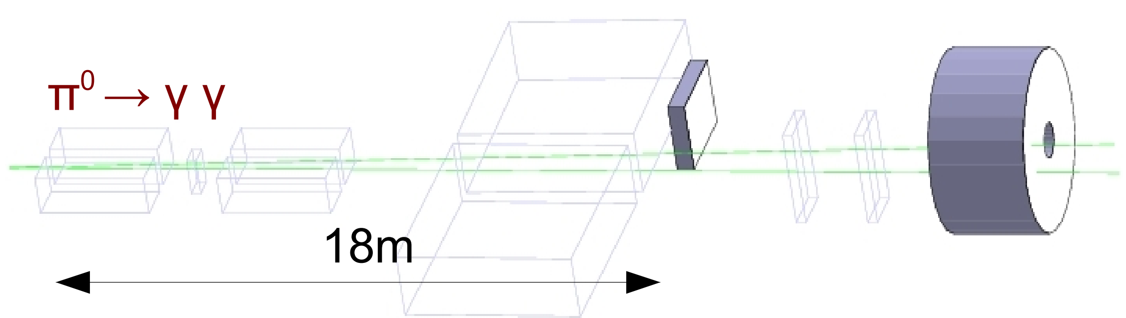


- Pro: excellent tracking and PID performance, etc.
- Contra: too low data rate for high p_T particle yield measurement.
- Idea: introduce high p_T π^0 trigger by γ calorimetry (like WA98).

Extension with LGC

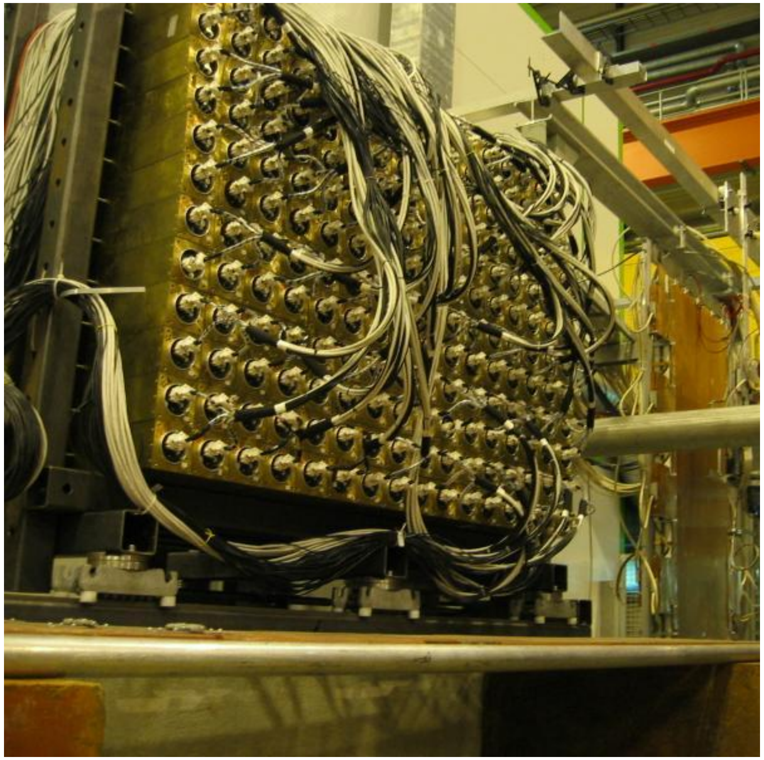
- The elements of the dismantled Endcap calorimeter of OPAL could be used as high p_T γ trigger to enrich the event sample containing midrapidity high p_T π^0 particles. Also acceptance of existing RCAL would be extended in this way.





Geometrical setting of LGC

- Consists of lead-glass calorimeter modules from OPAL Endcap.
- 95mmx95mmx680mm lead-glass Cherenkov radiator block / module.
- Array of 12x16 modules, about 18m downstream of the target.
- Placed on a movable platform for variability of acceptance.



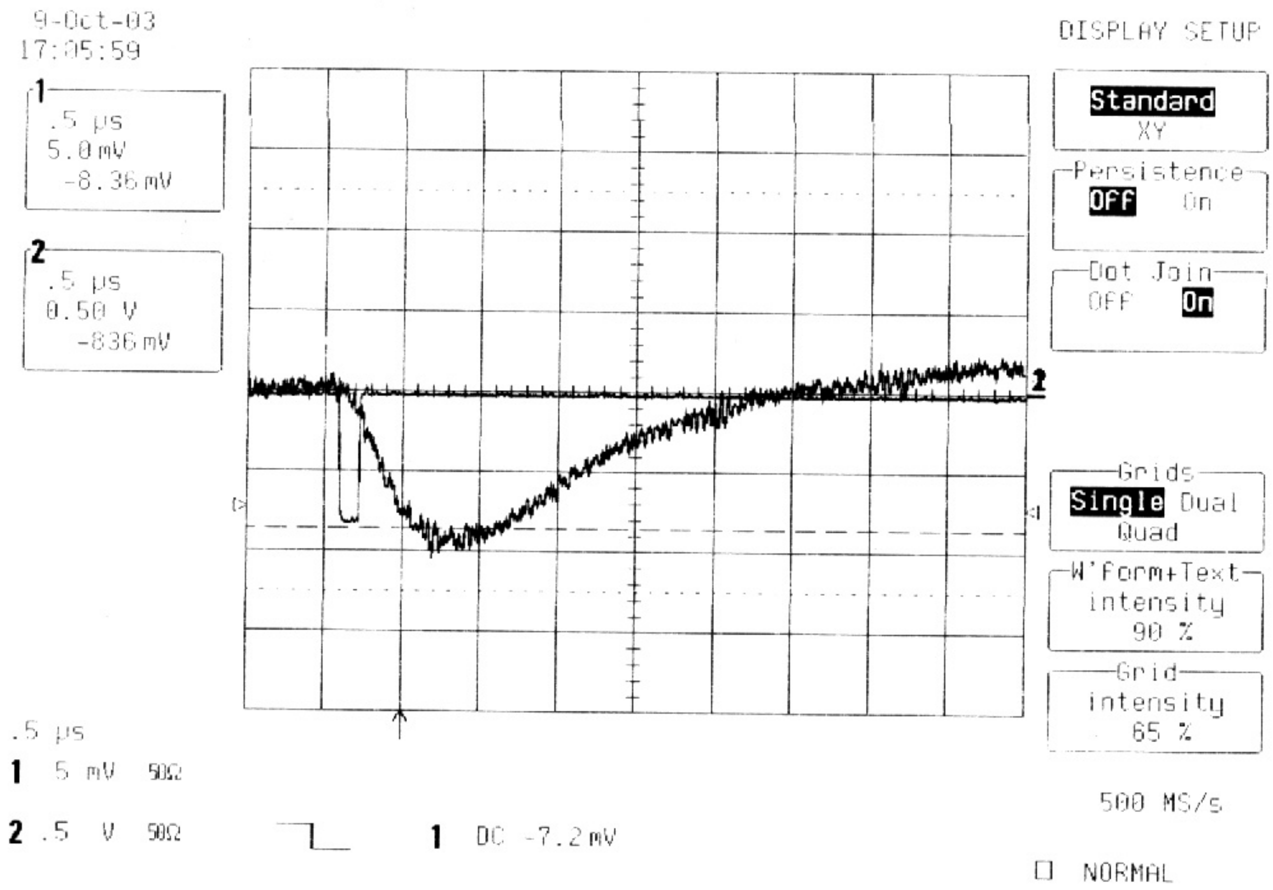
Calorimeter medium, light read-out, HV, DAQ

- EM showers produced in X_0=2.51cm lead-glass Cherenkov radiators with 1.708@400nm refraction index.
- The radiators are directly read out by 1 phototriode / module. Phototriodes operatable in coaxial magnetic field up to 1T.
- Phototriode HV requirement: -1000V, -500V, 0V.
- Phototriode signal needs local amplification due to low amplitude.
- Built-in local operational amplifiers: -12V, +12V, 0V LV supply needed.
- Signal transmission via shielded twisted pair cables.
- Galvanic isolation/decoupling by small transformators on readout electronics side.
- DAQ used FASTBUS-based ADC units.

- Overall E resolution of a module about 5%/√(E/GeV).

LGC as trigger

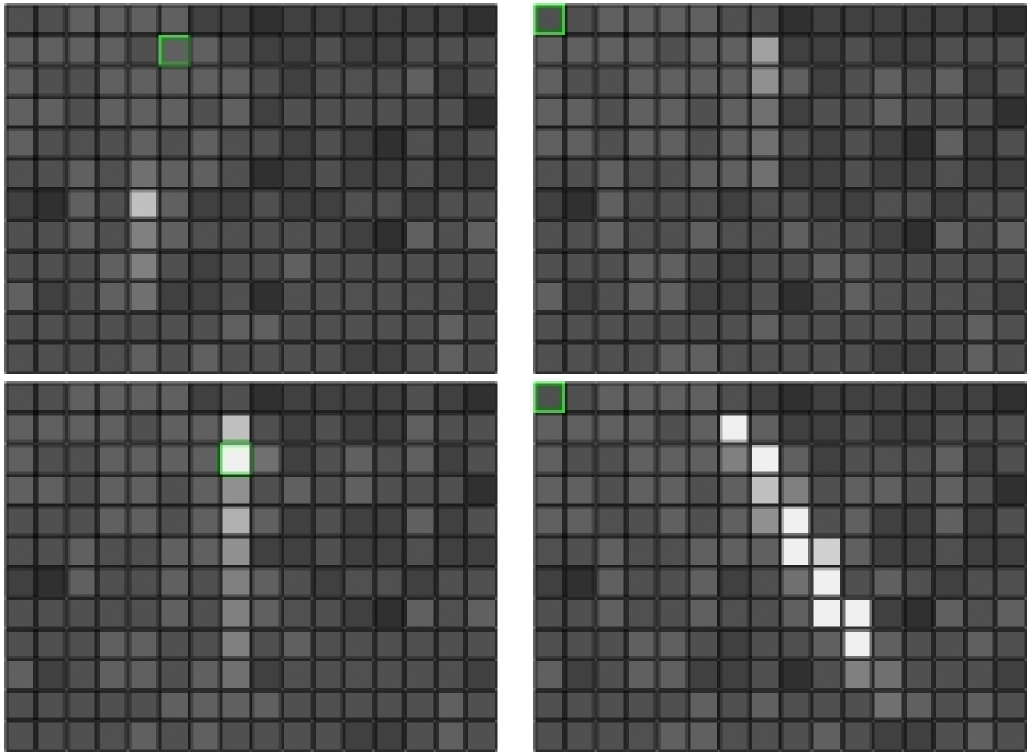
- Used analog weighted summing electronics to add energy deposits of each block in 4 neighboring module. Trigger if exceeded threshold.



- Rise-time of 500ns was bit too long for triggering in NA49. Would need to replace shaper/amplifier of the modules to make it more suitable.

Calibration, monitoring

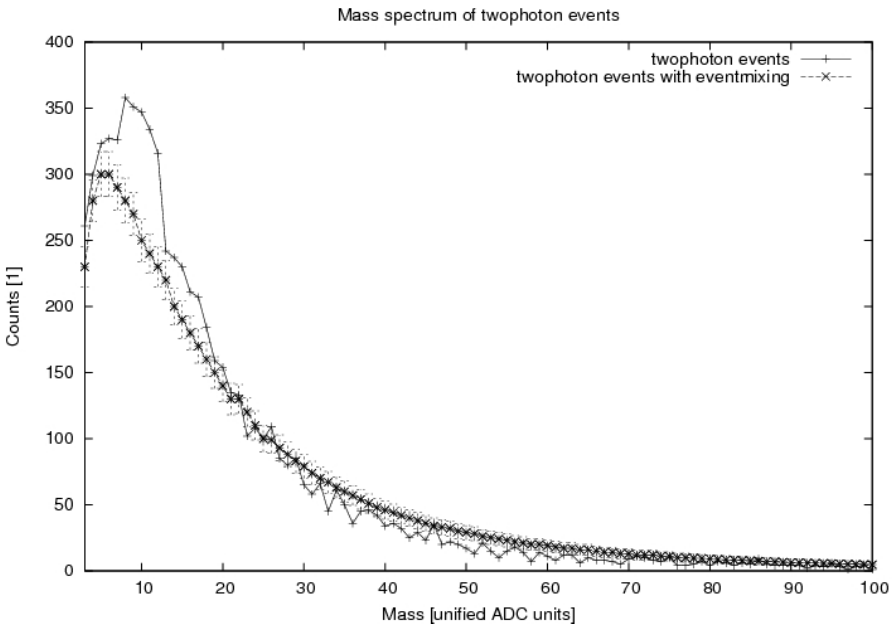
- Horizontal relative calibration using homogeneous flux of cosmics: horizontally homogeneous multinomial distribution of hits in modules, above an energy threshold.

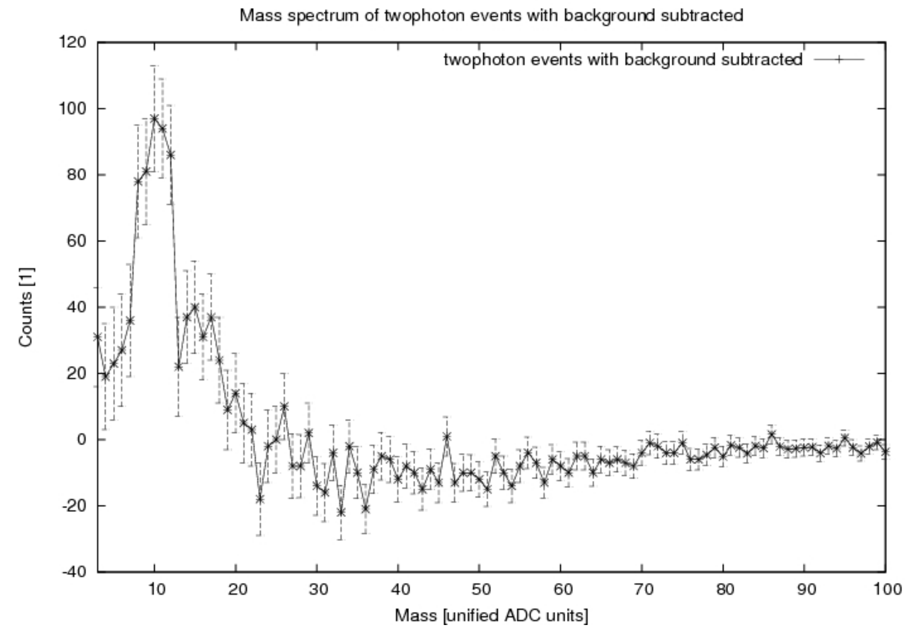


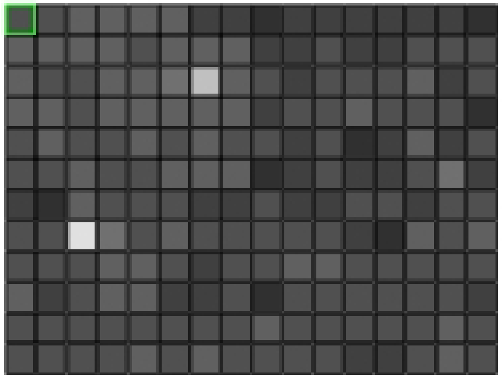
- Vertical relative calibration in the same way: layed out temporarily one vertical column in horizontal direction for relative calibration.
- Time-dependence monitoring of calibration: LED pulser possibility and input for N_2 laser beam is built into each module.

The π^0 mass peak

- π^0 mass peak visible, but resolution is not perfect due to limited accuracy of relative calibration (no beam calibration was performed).







Summary

- The modules of OPAL Endcap calorimeter was used at NA49 to perform gamma calorimetry for π^0 measurements.
- Relative calibration was performed with cosmic rays.
- Absolute calibration was performed with π^0 mass peak.
- Time dependence correction can be performed via built-in pulsing possibility.
- Trigger electronics was built with analog summation of 4-blocks.
- Efficient usage as π^0 trigger would demand replacement of preamplifiers and shapers due to their long rise time.
- Relevant literature collected under:

  `http://www.rmki.kfki.hu/~laszloa/downloads/opallgc`