Projectile Spectator Detector for the heavy ion program of the NA61/SHINE experiment at the CERN SPS

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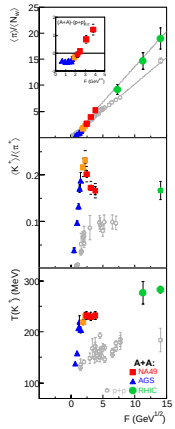
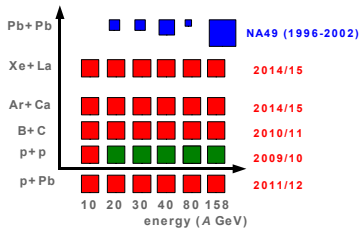
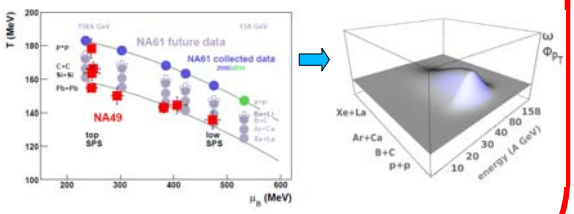
The goal of NA61 is the search for the critical end-point on the phase diagram of strongly interacting matter and study properties of the onset of deconfinement by changing the energy accessible at the SPS (13A – 158A GeV) and the size of the colliding systems. The scan was partly done by the NA49 experiment and several observables *such* as net-baryon distributions, strangness production and fluctuations were studied.

Observed anomalies in previous experiments



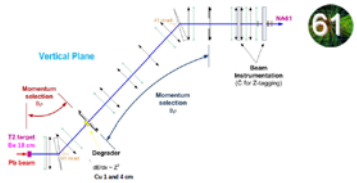
NA61 ion program



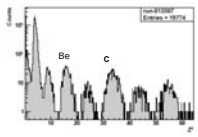


NA61 uses primary and secondary ion beams, as well as secondary hadron beams. To study hadron production in light ion collisions during 2011—2012 ions will be obtained from fragmenting a Pb beam.

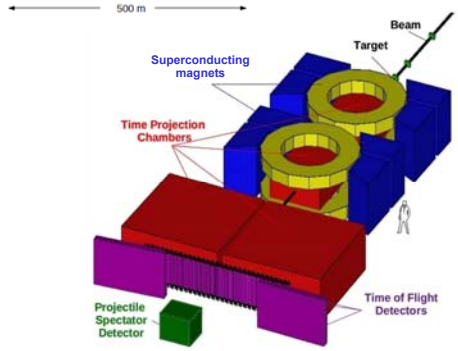
The H2 fragment separator



Beam test results (Dec 2010) of secondary light ions beams performed at the H2 beam line.



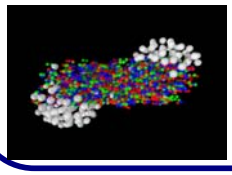
Z² spectrum from fragmentation of primary Pb beam at 13.9A GeV/c.

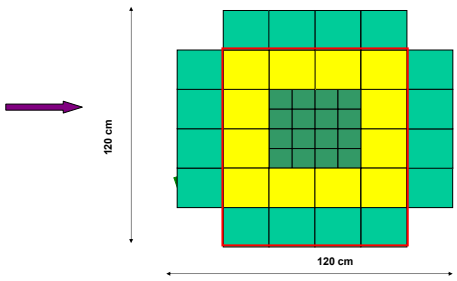


Large acceptance ≈ 50%
High momentum resolution $\sigma(p)/p^2 \approx 10^{-4}$ ((GeV/c)$^{-1}$)
Detector efficiency >95%
Event rate ≈ 70 events/sec
High projectile spectator resolution $\sigma(N_{proj.\ spec.}) \approx 1$

Projectile Spectator Detector - PSD

The PSD measures the energy of projectile spectators.
This allows to determine the number of projectile nucleons which participated in a collision with a precision of about one nucleon.





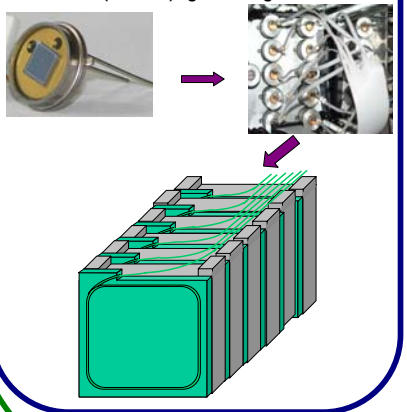
Structure of the PSD:

16 central modules – 10x10x125 cm³
28 outer modules -20x20x125 cm³

Total weight – 17 tons

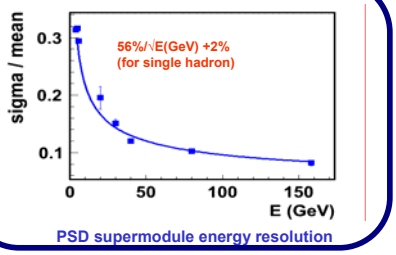
Structure of the module:

60 scintillator/lead layers with WLS and 10 MAPD-3A (Zecotek) light and signal readout.



PSD central part (left- front view, right – rear side)
Beam test, Nov 2010

Analog and digital PSD electronics



PSD supermodule energy resolution