$\Lambda(1520)$ Production in Central Pb+Pb and p+p Collisions at 158 AGeV

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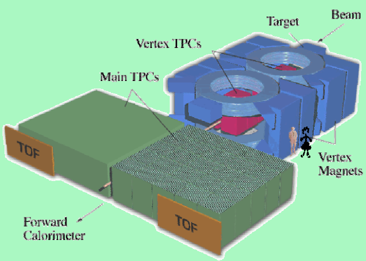
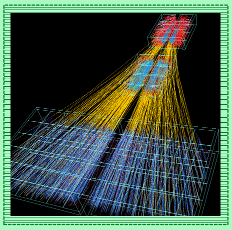
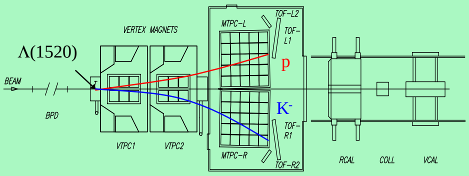
Due to the short lifetime of the $\Lambda(1520)$ resonance a large fraction of the decays will occur inside the reaction zone. This can give rise to medium effects on the resonance itself and to rescattering of the decay products.

The NA49 experiment at the CERN SPS measures the charged particles in a large acceptance hadron spectrometer.





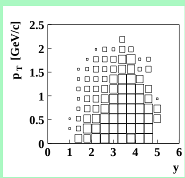
In a central Pb+Pb event we can detect 1200 charged particles. Particles are identified by the momentum and the dE/dx information. The momentum resolution of the tracks is $dp/p = 0.3 \cdot 10^{-4} (GeV/c)^{-1} \cdot p$ [Afa99] and the dE/dx resolution in Pb+Pb $\langle\sigma\rangle \approx 3.8\%$ and in p+p $\langle\sigma\rangle \approx 3.5\%$. The $\Lambda(1520)$ decays into p, K^- (22.5 %) and is observed in the invariant mass distribution of the identified p and K^- pairs.

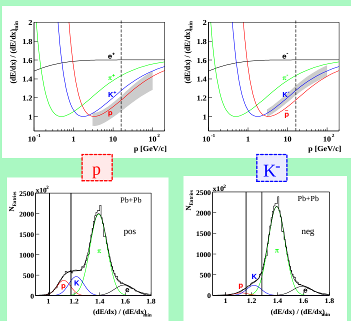


The acceptance correction factors are obtained with the assumed phase space distribution

$$\frac{d^2n}{dp_T\, dy} = C \cdot p_T \cdot \exp\left(\frac{-m_T}{T}\right)$$

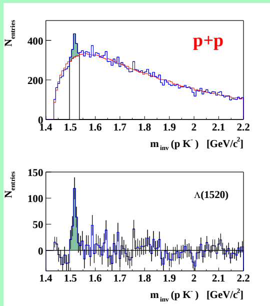
and different y distributions. For p+p the inverse slope parameter is T = 150 MeV with a flat y-distribution for $y \in [0.5, 5.3]$ which leads to a total acceptance of 77%. For Pb+Pb the total acceptance is 82% with T = 300 MeV and a Gaussian y-distribution with a width of $\sigma = 1$.

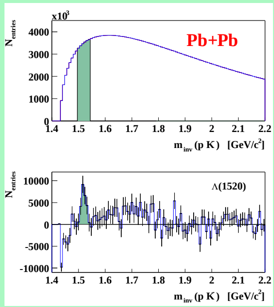




With the cuts around the dE/dx parameterization of proton : $-2\sigma \leq dE/dx_{mean} \leq +\sigma$ and K^-: $-\sigma \leq dE/dx_{mean} \leq +\sigma$ 80% of the proton and 68% of the K^- are selected.

The invariant mass reconstruction is done with every combination of the selected K^- and p candidates. To describe the combinatorial background a mixed event method is used. After the subtraction of the mixed event background from the original invariant mass distribution a clear $\Lambda(1520)$ signal is left.



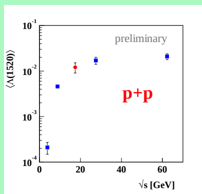


p+p: $\langle\Lambda(1520)\rangle = 0.0121 \pm 0.0019 \pm 0.0011$

Pb+Pb: $\langle\Lambda(1520)\rangle = 1.45 \pm 0.29 \pm 0.28$

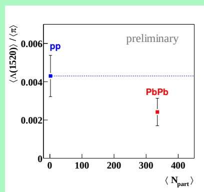
	p+p	Pb+Pb	
events	400 000	400 000	
K^- candidates/event	0.1	19	
p candidates/event	0.5	55	
signal/background	0.15	0.0015	
Breit-Wigner fit:			PDG: [PDG98]
m [MeV/c^2]	1517.6 ± 1.7	1518.7 ± 1.6	1519.5 ± 1.0
Γ [MeV/c^2]	12.8 ± 3.5	15.7 ± 5.2	15.6 ± 1.0

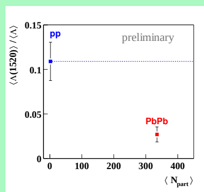
A comparison between total multiplicity for $\Lambda(1520)$ in p+p collisions from NA49 at 158 GeV per nucleon and the values from literature shows good agreement.



√s [GeV]	
3,8	R.E. Ansorge et al., Phys. Rev. **D10** (1974), 32
8,8	V.R. Krastev et al., Preprint JINR, Dubna (1988)
27,5	M. Aguilar-Benitz et al., Z.Phys. **C50** (1991) 405
62,3	G.J. Bobbink et al., Nucl.Phys **B217** (1983) 11

In p+p collisions we find a total multiplicity of 0.012 ± 0.003. A simple extrapolation to central Pb+Pb collisions by scaling with the number of participants would lead to a total multiplicity of about 2 and if we scale with the known Λ strangeness enhancement factor (2.5) $\langle\Lambda(1520)\rangle \approx 5$. The analysis of central Pb+Pb events yields a total multiplicity of 1.45 ± 0.47 which is much lower than the expected value. The lifetime of $\Lambda(1520)$ is of the same order as the lifetime of the dense fireball medium. The $\Lambda(1520)$ signal in the invariant mass peak can get reduced by interactions with the nuclear medium or by interactions of the decay particles in the fireball medium.





UrQMD calculations [Sof00] predict that for only 50% of the $\Lambda(1520)$ both decay particles leave the fireball without interactions.

✰ Supported by GSI and BMBF

[Afa99] S. Afanasiev et al., Nucl. Instr. and Meth. **A430** (1999) 210
[PDG98] Particle Data Group, Eur. Phys J. **C3** (1998)
[Sof00] S.Soff et al, nucl-th/0010103