

## Publication List J. J. Engelen

### 1. Overview

**Study of K<sup>-</sup>p interactions at 4.2 GeV/c** (1973-1978). Experiment using CERN 2 m Hydrogen Bubble Chamber. Participated in data collection; contributed to data reduction and, mainly, data analysis. The experiment yielded 'state of the art' results on hadron production and spectroscopy ( $Y^*$ ,  $\Xi^*$ ,  $\Omega^*$ ); Partial Wave Analysis techniques were developed starting from Ascoli's code ( $K\pi\pi$  system); I performed a multi-channel analysis, in fully dimensional phase space, of the  $K\pi p$  final state, following a suggestion during a discussion with L. van Hove. The full analysis identified 16 channels, further split up over various partial waves; the method was also sensitive to relatively low cross sections (i.e. spin 3  $K^*$ (1780); clear evidence was also found for the not well-established  $\Sigma(1480)$ ).

**Study of hard processes in  $\gamma p$  interactions at an average photon energy of 90 GeV – CERN** (1979-1984). I joined this experiment (NA14) in an early phase, i.e. when it was still on the drawing board. I was involved in modifying an existing magnet (GOLIATH) to increase its acceptance; in designing magnetic shielding, beam testing lead glass (SF6)-light guide- PM- presampler system, beam testing Cerenkov counter PM's, integrating and running the full experiment, the data reduction process and data analysis. The experiment yielded unique results on 'hard' processes: QED photon-quark Compton scattering, QCD Compton scattering, photon-gluon fusion and was one of the first to allow a quantitative test of perturbative, higher order QCD (pioneering calculations by Aurenche, Fontannaz, Duke, Owens and others). The experiment also concluded against the integrally charged quarks and gluons of the Pati-Salam unified lepton-hadron symmetry.

**Study of electron(positron) proton deeply inelastic scattering at the Hadron Elektron Ring Anlage (HERA) – DESY, Hamburg** (1985 - ~2002). I joined the ZEUS experiment at a very early stage, contributing to Letter of Intent (1985) and Technical Proposal (1986). Contributions to initial physics studies include hard photoproduction (including cross section calculations); a study of luminosity monitoring (using  $ep \rightarrow e\gamma$ ; also  $ep \rightarrow e\mu\mu$ , the former process being very useful in practice, the latter more academic); a study of the reconstruction of Neutral Current kinematics (this included the discovery of the Double Angle formula – the Double Angle method has been crucial for structure function measurements at HERA; work done together with S. Bentvelsen and P. Kooijman). Early work on calorimeter design (with H. Tiecke) concentrating on optimizing the compensation of fluctuations in hadron showers (pioneered in particular by Wigmans). This led to a very substantial NIKHEF contribution to the ZEUS integrated electromagnetic-hadronic uranium-scintillator calorimeter. The NIKHEF ZEUS group also made leading contributions to the high level trigger (introducing transputers), to off-line software etc. The ZEUS experiment (and similarly the 'competing' H1 experiment) produced a wealth of new and important results: proton structure function and parton densities, showing strong increase for low fractional momenta; QCD evolution consistent with DGLAP (Dokshitzer, Gribov, Lipatov, Altarelli, Parisi) picture; extraction of gluon density; discovery of rather spectacular large rapidity gap DIS events; measurement of contribution of charm to proton structure function ( $F_2^c$ ); measurement of charged current scattering and related parton densities; measurement of  $F_3$ ; etc.

**Construction of a deep sea telescope for high energy neutrinos, ANTARES** (1997 - ~2003). Major conceptual design work had already been done, mainly in Marseille and at Saclay, when I decided to join and with me a NIKHEF group. We introduced the 'all data to shore' concept and contributed to its implementation. Today this adds crucially to ANTARES's performance and potential. The first ANTARES detector strings are now operational (2007) and first (astro)physics results should appear soon.

### 2. List of Publications

1. K. Hansen and J. Engelen, ‘ ‘ Comment on ‘ ‘Ultradense protium p(0) and deuterium D(0)and their relation to ordinary Rydberg matter: a review’ (2019 Physica Scripta 94 075005)’ , Phys. Scripta 98 (2023) no.12, 127001 doi:10.1088/1402-4896/ad05c7 [arXiv:2207.08133 [physics.chem-ph]].
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