

Selected Publications – a Guide

Early Detector Development

- Messung der Gasverstärkung in Methan bei niedrigen Drucken mit einem Transmissions-Proportional-Zählrohr für Spaltprodukte
H.J. Specht und P. Armbruster
Nukleonik 7 (1965) 8-14

Expanded part of the Diploma thesis, starting a life-long dedication to detector development. Lowest pressure in wire counters ever (0.3 Torr)

Atomic Physics: Inner-Shell Ionization in Heavy Ion Collisions

- Ionisation innerer Elektronenschalen bei fast-adiabatischen Stößen schwerer Ionen
H.J. Specht
Z. Phys. 185 (1965) 301-330

Expanded part of the PhD thesis. Cross sections in collisions with fission fragments across the full periodic table, showing very large oscillations (detection of the 'level matching' effect). First interpretation in terms of quasi-molecular orbits via correlation diagrams. A key contribution to the start of a new field, undetected until 1969 due to German language. First hints on unexpectedly large cross sections by P Armbruster.

- Impact-Parameter Dependence of Noncharacteristic Radiation emitted in 35-Me Cl-Cl Collisions
I. Tserruya, H. Schmidt-Böcking, R. Schulé, K. Bethge, R. Schuch and H.J. Specht
Phys. Rev. Lett. 36 (1976) 1451-1454

Start of a series of papers with R. Schuch et al. on characteristic and non-characteristic X-ray emission in heavy ion collisions (up to 1984)

Nuclear Physics: Central open issues in Nuclear Fission

- Prompt and Delayed Gamma Rays from Fission
H. Maier-Leibnitz, P. Armbruster and H.J. Specht
Physics and Chemistry of Fission, IAEA, Vienna (1965) II, 113-123

Oral presentation by ML. My hardware contributions and the general spirit in P. Armbrusters group led to co-authorship in several papers on nuclear fission and paved the way to the future.

Fission Isomers and the double-humped Fission Barrier

- A High Resolution Study of the ^{239}Pu (d,pf) Reaction
H.J. Specht, J.S. Fraser, J.C.D. Milton and W.G. Davies
Physics and Chemistry of Fission, IAEA, Vienna (1969) 363-373

First transmission-resonance spectroscopy of the double-humped fission barrier, made possible by replacing the then common photo emulsions in magnetic spectrographs by a spark chamber (part of Habilitation thesis)

- Intermediate Structure in the ^{239}Pu (d,pf) Reaction
P. Glässel, H. Rösler and H.J. Specht
Nucl. Phys. A256 (1976) 220-242

Greatly improved with the Munich Q3D spectograph and a multiwire Chamber, invented in the meantime by Charpak (PhD thesis P. Glässel)

- Identification of a Rotational Band in the ^{240}Pu Fission Isomer
H.J. Specht, J. Weber, E. Konecny and D. Heunemann
Phys. Lett. 41B (1972) 43-46

The pioneering paper with the experimental proof for nuclear shape isomerism with a 2:1 deformation (detection of fission isomers 1962 by S. Polikanov; generalized nuclear shell model by V. Strutinski)

- The Quadrupole Moment of the 8 μs Fission Isomer in ^{239}Pu
D. Habs, V. Metag, H.J. Specht and G. Ulfert
Phys. Rev. Lett. 38 (1977) 387-389

First quadrupole moment of a fission isomer (charge plunger technique)

- Spectroscopic Properties of Fission Isomers
V. Metag, D. Habs and H.J. Specht
Physics Reports 65 (1980) 1-41

Review of the unique set of results on fission isomers in Heidelberg

Fission Fragment Mass Distributions

- Symmetric and Asymmetric Fission of Ac Isotopes near the Fission Threshold
E. Konecny, H.J. Specht and J. Weber
Phys. Lett. 45B (1973) 329-331

First of a series of measuring triple-humped fragment mass distributions and their relation to octupole deformations in the late fission process

- Nuclear Fission
H.J. Specht
Rev. Mod. Phys. 46 (1974) 773-787

Heavy-Ion induced Fission and 'Break-up' processes

- Fission of ^{238}U Induced by ^{136}Xe for Energies Close to the Coulomb Barrier
D. Habs, V. Metag, J. Schukraft, H.J. Specht, C.O. Wene, K.D. Hildenbrand
Z. Phys. A283 (1977) 261-268
- Direct Observation of Coulomb Fission of ^{238}U with ^{184}W Projectiles
H. Backe, F. Weik, P.A. Butler, V. Metag, J.B. Wilhelmy, D. Habs, G. Himmele and H.J. Specht
Phys. Rev. Lett. 43 (1979) 1077-1080

Detection of Coulomb Fission, analogous to Coulomb excitation in nuclear structure. First evidence in the 1977 paper (diploma thesis J. Schukraft)

- A Square Meter Position Sensitive Parallel Plate Detector for Heavy Ions
D. v. Harrach and H.J. Specht
Nucl. Instr. Meth. 164 (1979) 477-490

Part of a special installation at the UNILAC at GSI Darmstadt named 'Heidelberger Fass' in the local jargon. An evacuated container of several meter diameter and height housed freely movable large-area parallel-plate detectors and a large ionization chamber (built by H. Sann). The set-up allowed for kinematical complete (exclusive) measurements of 3 or 4 nuclei in the final state at a time, when small Si detectors were the common tool.

- Angular Momentum Transfer in Deeply Inelastic Collisions from Exclusive Sequential-Fission Experiments
D. v. Harrach, P. Glässel, Y. Civelekoglu, R. Manner and H.J. Specht
Phys. Rev. Lett. 42 (1979) 1728-1732
- Three-Particle Exclusive Measurements of the Reactions $^{238}\text{U}+^{238}\text{U}$ and $^{238}\text{U}+^{248}\text{Cm}$
P. Glässel, D. v. Harrach, Y. Civelekoglu, R. Manner, H.J. Specht, J.B. Wilhelmy, H. Freiesleben and K.D. Hildenbrand
Phys. Rev. Lett. 43 (1979) 1483-1486
- Direct Observation of Proximity Effects in Ternary Heavy Ion Reactions
D.v. Harrach, P. Glässel, L. Grodzins, S.S. Kapoor and H.J. Specht
Phys. Rev. Lett. 48 (1982) 1093-1097
- Direct Observation of Non-Equilibrium Effects in Sequential Fission
P. Glässel, D. v. Harrach, L. Grodzins and H.J. Specht
Phys. Rev. Lett. 48 (1982) 1089-1093

Several independent topics from well-defined exclusive final states

- Summary of the Symposium
H.J. Specht
Physics and Chemistry of Fission 1979, Juelich , Proceedings IAEA Wien (1980) II, 459-476

A formal end to an era, having contributed to all 4 IAEA symposia (1965, 1969, 1973, 1979). This was the concluding one

High-Energy Physics: towards Heavy Ions at CERN ('Quark Matter')

- Future Experiments (Summary Talk)
H.J. Specht
in Proc. Workshop on Future Relativistic Heavy Ion Experiments (Darmstadt 1980), GSI 81-6, Darmstadt (1981), 551-558

The workshop at GSI which is unofficially named 'Quark Matter I'. Public plea, in the spirit of the meeting, to use CERN accelerators for Quark Matter research as opposed to a non-competitive machine at GSI (SIS100)

- Production of Prompt Positrons at low p_T in 63 GeV pp Collisions at the ISR
T. Akesson et al, The Axial Field Spectrometer (AFS) Collaboration (for full author list see last page below)
Phys. Lett. 152B (1985) 411-418
- The Production of Prompt Positrons at Low Transverse Momentum increases with the Square of the Associated Charged Multiplicity
T. Akesson et al. (The Axial Field Spectrometer Collaboration)
Phys. Lett. B192 (1987) 463-470

The only hints for an excess of low-mass dileptons in high-energy pp so far

- Soft Photon Production in 450 GeV/c p-Be Collisions
J. Antos, H. Beker, S. Brons, K. Bussmann, S. Dagan, A. Drees, C. Erd, M.J. Esten, C.W. Fabjan, P. Glässel, U. Görlach, V. Hedberg, D. Lissauer, M.A. Mazzone, N.A. McCubbin, M. Neubert, P. Nevski, L. Olsen, A. Pfeiffer, A. Ray, J. Schukraft, D. Shapira, J. Soltani, H.J. Specht, I. Stumer, J. Thompson, R.J. Veenhof, W.J. Willis, C. Woody
Z. Phys. C59 (1993) 547-553

A mysterious photon source with $p_T < 20$ MeV, most recently also observed in the very forward region of jets (in DELPHI)

- Low-Mass Lepton-Pair production in p-Be collisions at 450 GeV/c
T. Akesson et al., HELIOS Collaboration (for full author list see last page below)
Z. Physik C 68 (1995) 47-64

Dielectrons and dimuons from the same experiment. In contrast to previous experiments, no evidence for low-mass 'anomalous' pair production in moderate-energy pp. Soon after also confirmed by NA45/CERES for pBe and pAu

PRE-ALICE Discussion

- Experimental Aspects of Heavy Ion Physics at LHC Energies
H.J. Specht
Proc. ECFA Large Hadron Collider Workshop, Eds.G. Jarlskog and D. Rein, CERN 90-10 (1990) Vol. II, 1236-1251

Convener of the experimental discussion on a future LHC heavy ion program at the Aachen Workshop, providing input to the foundation phase of ALICE 1 year later

Heavy Ion Results / NA34-2-HELIOS / S-beams only

- Inclusive negative particle p_T spectra in p-nucleus and nucleus-nucleus collisions at 200 GeV/u
T. Akesson, HELIOS Collaboration
Z. Phys. C46 (1990) 361-367

Central results from the external spectrometer (PhD thesis A. Drees)

- Inclusive photon production in pA and AA collisions at 200 GeV/u
T. Akesson et al., HELIOS Collaboration
Z. Phys. C46 (1990) 369-375

No significant excess of photons above the known hadron decay sources

- Measurement of the Transverse Energy Flow in Nucleus-Nucleus Collisions at 200 GeV per Nucleon
T. Akesson et al., HELIOS Collaboration
Nucl. Phys. B353 (1991) 1-19

Most accurate measurement of the energy flow at the SPS, thanks to the use of a 4π calorimeter (recycled from R807/808 at the ISR). Targets up to U, showing a softer slope at the kinematic limit than all others due to nuclear deformation ('the most expensive way to measure nuclear deformation')

Heavy Ion Results / NA45-CERES / Electron Pairs

- A Highly Efficient Low-Pressure UV-RICH Detector with Optical Avalanche Recording
A. Breskin, R. Chechik, Z. Fränkel, D. Sauvage, V. Steiner, I. Tserruya, G. Charpak, W. Dominik, J.P. Fabre, J. Gaudean, F. Sauli, M. Suzuki, P. Fischer, P. Glässel, H. Ries, A. Schön and H.J. Specht
Nucl. Instr. Meth. A273 (1988) 798-802

R&D: potentially interesting, but dead-ended due to practical limitations

- In-Beam Experience from the CERES UV-Detectors: Prohibitive Spark Breakdown in Multi-Step Parallel-Plate Chambers as compared to Wire Chambers
R. Baur, A. Drees, P. Fischer, Z. Fränkel, P. Glässel, H. Klein, A. Pfeiffer, A. Schön, A. Shor, H.J. Specht, V. Steiner, I. Tserruya, Th. S. Ullrich
Nucl. Instr. Meth. A343 (1994) 231-240

R&D: a very personal paper, both as to the decisive data on saturation of wire amplication and the spirit of the text, reflecting the frustration of the year 1991 with CERES on beam, but unusable due to prohibitive sparking

- The CERES RICH Detector System
R. Baur, A. Breskin, R. Chechik, A. Drees, U. Faschingbauer, P. Fischer, Z. Fränkel, J. Gläss, P. Glässel, C.P. de los Heros, D. Irmscher, R. Männer, A. Pfeiffer, A. Schön, J. Schukraft, Ch. Schwick, A. Shor, H.J. Specht, V. Steiner, S. Tapprogge, G. Tel-Zur, I. Tserruya, Th. Ullrich, J.P. Wurm
Nucl. Instr. Meth. A343 (1994) 87-98

Successful R&D: the final CERES RICHes have reached the theoretical limits for the number of UV-photons/ring and the spatial resolution of the ring centers, determining the mass resolution of the whole spectrometer

- Enhanced Production of Low-Mass Electron-Pairs in 200 GeV/u S-Au Collisions at the CERN Super Proton Synchrotron
G. Agakichiev, R. Baur, A. Breskin, R. Chechik, A. Drees, C. Jacob, U. Faschingbauer, P. Fischer, Z. Fraenkel, Ch. Fuchs, E. Gatti, P. Glässel, Th. Günzel, C.P. de los Heros, F. Hess, D. Irmscher, B. Lenkeit, L.H. Olsen, Y. Panebrattsev, A. Pfeiffer, I. Ravinovich, P. Rehak, A. Schön, J. Schukraft, M. Sampietro, S. Shimansky, A. Shor, H.J. Specht, V. Steiner S. Tapprogge, G. Tel-Zur, I. Tserruya, Th. Ullrich, J.P. Wurm, V. Yurevich
Phys. Rev. Letters 75 (1995) 1272-1275

The first clear sign of new physics from dileptons: strong excess yield above the known meson decays, attributed to thermal radiation mediated by the ρ meson. Most cited data paper (> 550) of the whole SPS ion program (PhD thesis T. Ullrich). Original CERES set-up

- e⁺e⁻ pair production in Pb-Au collisions at 158 GeV per nucleon
G. Agakichiev et al., CERES Collaboration (for full author list see list below)
Eur. Phys. J. C 43 (2005) 475-413

The final summary paper of all Pb-Au results obtained with the original CERES set-up: on mass spectra, pT spectra and multiplicity dependences. Better resolution than in S-Au; confirmation of the strong excess yield above the known sources, but mass shift and broadening of the ρ remained indistinguishable due to insufficient statistics. For the same reason, no insight into the dilepton mass region > 1 GeV (1995 data PhD thesis C. Vogt, 1996 data PhD thesis B. Lenkeit)

- Enhanced Production of Low-Mass Electron-Positron Pairs in 40 A GeV Pb-Au Collisions at the CERN SPS
D. Adamova et al., CERES Collaboration
Phys. Rev. Lett. 91 (2003) 042301/1-5, nucl-ex/0209024 (2003)

So far, the only dilepton results in the lower energy region close to the onset of the expected QCD phase transitions (PhD thesis S. Damjanovic). Very large dilepton excess. CERES TPC set-up

- Experimental Conference summary
Hans J. Specht
Proc. Quark Matter 2001, Stony Brook, Nucl. Phys. A698 (2002) 341c-359c

A unique moment in the history of the field: the results of the SPS program had just been presented in a CERN Press Release in early 2000 as a 'New State of Matter created at CERN', and the first set of results after the start-up of RHIC later in 2000 had already been analysed with an admirable speed, creating an atmosphere of enthusiasm and allowing for immediate comparisons.

CERN LHC General Interest

- Study of potentially dangerous events during heavy-ion collisions at the LHC
J.P. Blaizot, J.Iliopoulos (Chair of ad-hoc Committee), J. Madson, G.G.Ross, P. Sonderegger, H.J. Specht
Yellow Report CERN 2003-001

A review of dangerous objects such as negatively charged strangelets, gravitational black holes and magnetic monopoles. Conclusion: 'We find no basis for any conceivable threat'.

Heavy ion results / NA60 / Muon Pairs

- First Measurement of the ρ Spectral Function in High-Energy Nuclear Collisions
R. Arnaldi et al, NA60 Collaboration (for full author list see list below)
Phys. Rev. Letters 96 (2006) 16302
- Evidence for Radial Flow of Thermal Dileptons in High-Energy Nuclear Collisions
R. Arnaldi et al., NA60 Collaboration,
Phys. Rev. Lett. 100 (2008) 022302
- First Results on Angular Distributions of Thermal Dileptons in Nuclear Collisions
R. Arnaldi et al., NA60 Collaboration
Phys. Rev. Lett. 102 (2009) 222301
- NA60 Results on Thermal Dimuons
R. Arnaldi et al., NA60 Collaboration
Eur. Phys. J. C 61 (2009) 711
- Evidence for the Production of Thermal Muon Pairs with Masses above 1 GeV in 158A GeV Indium-Indium Collisions
R. Arnaldi et al., NA60 Collaboration
Eur. Phys. J. C 59 (2009) 607

Superior quality of the data compared to all other experiments in this field: effective statistics higher by a factor of nearly 1000. Unreachable at any collider in the future. Another factor of 100 reachable in a future 'NA60+', under development for an energy scan of 20-160 AGeV at the CERN SPS

Main conclusions: (i) close to the QCD transition, the in-medium ρ spectral function broadens ('melts'), but shows no shift in mass; (ii) above masses of 1 GeV, i.e. in the region of flat spectral functions, both the slope $T > T_c$ of the dilepton invariant mass spectrum and the very low radial flow indicate the dominance of partonic emission sources in this region, a clear signal of deconfinement at SPS energies; (iii) zero polarization of the radiation, consistent with a thermalized system.

- Thermal Dileptons from Hot and Dense Strongly Interacting Matter
Hans J. Specht, NA60 Collaboration
AIP Conf. Proceedings 1322 (2010) 1-10, nucl-ex 1011.0615 (2010)

An up-to-date summary of the central NA60 results on thermal dileptons, also emphasizing the model-independence of the average temperature extracted from the high-mass part of the mass spectrum ('the only Lorentz-invariant thermometer of the field').

Hadron Structure / NA60

- Study of the electromagnetic transition form-factors in $\eta \rightarrow \mu^+ \mu^- \gamma$ and $\omega \rightarrow \mu^+ \mu^- \pi^0$ decays with NA60
R. Arnaldi et al, NA60 Collaboration
Phys. Lett. B 677 (2009) 260
- Precision study of the $\eta \rightarrow \mu^+ \mu^- \gamma$ and $\omega \rightarrow \mu^+ \mu^- \pi^0$ electromagnetic transition form-factors and of the rho line shape in NA60
R. Arnaldi et al, NA60 Collaboration
Phys. Lett. B 757 (2016) 437-44

Confirmation of the long-standing strong violation of VMD in the region close to the kinematic cut-off of the ω Dalitz decay as measured in the 80ties, with an improved statistics by factors of 10 and 100, resp. So far, theoretical models are unable to describe this. The results appeared in detail in the PDG editions since 2010 and were then the first ever from a heavy-ion experiment.

Neuroscience of musical relevance

- Morphology of Heschl's gyrus reflects enhanced activation in the auditory cortex of musicians
P. Schneider, M. Scherg, H.G. Dosch, H.J. Specht, A. Gutschalk, A. Rupp
Nature Neuroscience 5 (2002) 688-694

Musical Aptitude ('Talent') visible in the size of the relevant gray matter region in Heschl's gyrus, with a dynamic range of a factor of 2 (> 500 citations). Extended part of PhD thesis P. Schneider (tutors Dosch/Specht)

- Structural and functional asymmetry of lateral Heschl's gyrus reflects pitch perception preference
P. Schneider, V. Sluming, N. Roberts, M. Scherg, R. Goebel, H.J. Specht, H.G. Dosch, S. Bleek, C. Stippig & Andre Rupp
Nature Neuroscience 8 (2005) 1241-1247

Left/right structural and functional asymmetry of Heschl's Gyrus correlates with the capability of differentiating between musical pitch and overtones.

The specific psychoacoustic test ('Schmorenburg') used in this paper was later offered with a test CD by the German magazine AUDIO (January 2006, 8-16) to a readership of about 100.000, out of which 5700 sent back the test results for analysis by the HD group (P. Schneider). Correlations of the listener types with the preference for specific hardware, the driving motivation for the mass test, were not found. The global result agrees with the one in Nature and is essentially independent of age, gender and musical experience

Complete Author Lists of the 4 CERN Experiments

The Axial Field Spectrometer Collaboration: T. Åkesson, M.G. Albrow, S. Almed, R. Batley, O. Benary, H. Bøggild, O. Botner, H. Breuker, H. Brod y, V. Burkert, B. Callen, R. Carosi, A.A. Carter, J.R. Carter, P. Cecil, Y. Choi, W.E. Cleland, D. Cockerill, S. Dagan, E. Dahl-Jensen, P. Dam, G. Damgaard, S. Eidelma n, W.M. Evans, C.W. Fabjan, P. Frandsen, S. Frankel, W. Frati, M. Gibson, U. Görlach, H. Gordon, K.H. Hansen, V. Hedberg, J. Hiddleston, H.J. Hi lke, J. Hooper, G. Jarlskog, P. Jeffreys, T. Jensen, A. Kalinovsky, G. Kessler, T. Killian, R. Kröger, K. Kulka, J.v.d. Lans, J. Lindsay, D. Lissauer, B. Lörstad, T. Ludlam, A. Markou, N.A. McCubbin, U. Mjörnmark, R. Möller, W. Molzon, B.S. Nielsen, A. Nilsson, L.H. Olsen, Y. Oren, L. Rosset, E. Rosso, A. Rudge, R. Schindler, J. Schukraft, H.J. Specht, I. Stumer, M. Sullivan, J. Thompson, G. Thorstenson, E. Vella, J. Williamson, W.J. Willis, M. Winik, W. Witz eling, C. Woody, W.A. Zajc

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CERES Collaboration: G. Agakichiev, H. Appelshäuser, R. Baur, P. Braun-Munzinger, F. Ceretto, A. Cherlin, A. Drees, P. Ernst, S. Esumi, U. Faschingbauer, Z. Fraenkel, Ch. Fuchs, E. Gatti, P. Glässel, C.P. de los Heros, G. Hering, P. Holl, Ch. Jung, B. Lenkeit, A. Marin, M. Messer, D. Miskowiec, O. Nix, Y. Panebrattsev, A. Pfeiffer, J. Rak, I. Ravinovich, S. Razin, P. Rehak, M. Richter, M. Sampietro, N. Saveljic, W. Schmitz, J. Schukraft, W. Seipp, A. Sharma, S. Shimansky, E. Socol, H.J. Specht, J. Stachel, P. Stiller, G. Tel-Zur, H. Tilsner, I. Tserruya, Th. Ullrich, C. Voigt, S. Voloshin, C. Weber, J.P. Wessels, Th. Wienold, B. Windelband, J.P. Wurm, V. Yurevich.

NA60 Collaboration: R. Arnaldi, K. Banicz, K. Borer, J. Castor, B. Chaurand, W. Chen, C. Cicalo, A. Colla, P. Cortese, S. Damjanovic, A. David, A. de Falco, A. Devaux, L. Ducroux, H. En'yo, J. Fargeix, A. Ferretti, M. Floris, A. Foerster, P. Force, N. Guettet, A. Guichard, H. Gulkanian, J. M. Heuser, P. Jarron, M. Keil, L. Kluberg, Z. Li, C. Lourenco, J. Lozano, F. Manso, P. Martins, A. Masoni, A. Neves, H. Ohnishi, C. Oppedisano, P. Parracho, P. Pillot, T. Poghosyan, G. Puddu, E. Radermacher, P. Ramallete, P. Rosinsky, E. Scomparin, J. Seixas, S. Serici, R. Shahoyan, P. Sonderegger, H.J. Specht, R. Tieulent, A. Uras, G. Usai, R. Veenhof, H. K. Woehri

Note: for key results, detectors and other information including photos see 'Emeritus Talk'