# HERMES

"HERA4EIC" workshop April 10<sup>th</sup>, 2016



- fixed-target experiment with gaseous target internal to storage ring
  - Iongitudinally & transversely polarized H
  - Iongitudinally polarized D (and <sup>3</sup>He)
  - various unpolarized gases from H, D, ... Kr, Xe

# HERMES (1998-2005) schematically



two (mirror-symmetric) halves
-> no homogenous azimuthal
 coverage

# HERMES (1998-2005) schematically



two (mirror-symmetric) halves -> no homogenous azimuthal coverage

Particle ID detectors allow for

- lepton/hadron separation
- RICH: pion/kaon/proton discrimination 2 GeV < p < 15 GeV HERA4EIC, April 10<sup>th</sup>, 2016 3



HERA4EIC, April 10<sup>th</sup>, 2016

#### kinematic coverage (DIS / SIDIS)



G. Schnell - UPV/EHU Bilbao

HERA4EIC, April 10<sup>th</sup>, 2016

5





### analysis framework

- uDST data (both experimental and Monte Carlo)
  - stored in ADAMO format
  - contains only reduced data
     (clusters, tracks, slow control ...)
  - used for physics analysis
- most analyzer use dedicated analysis framework "Hanna"
  - provides data on event level
  - available both in C and FORTRAN
- a more modular/modern follow-up framework available: "Hanna++" entirely in C++ and uses ROOT as basis

#### infrastructure

- HERMES data copied DESY-DPHEP archival system
  - full archive on tape
  - uDST data for analysis also available on "online" disk storage
- analysis performed on DESY's bird cluster
- hybrid web pages (static and wikimedia pages) for documentation
- dedicated mailing lists
- dedicated office area at DESY (bldg. 3)
  - desks and computers available (albeit somewhat ancient)
- however, only very few people onsite on a regular basis

#### polarized-target data sets

	H (longit.)	H (transv.)	D (longit.)	D (tensor)
Cherenkov	~2.4M DIS	N/A	N/A	N/A
RICH	N/A	~7.3M DIS	~8.7M DIS	~0.7M DIS
RICH & Recoil Detector	N/A	N/A	N/A	N/A

- disclaimer: all numbers not official (and not cross checked;-)

#### unpolarized-target data sets

	Н	D	<sup>3</sup> He	⁴He	Ν	Ne	Kr	Xe
Cher.	~2.8M DIS	~4.5M DIS	~0.7M DIS	N/A	~1.9M DIS	N/A	N/A	N/A
RICH	~8.9M DIS	~13.2M DIS	N/A	~1.4M DIS	~0.1M DIS	~3.8M DIS	~5.2M DIS	~3.0M DIS
RICH & RD	~58.3M DIS	~14.3M DIS	N/A	N/A	N/A	N/A	N/A	N/A

- disclaimer: all numbers not official (and not cross checked;-)

- polarized data not included in DIS yields here
- unpolarized data usually with y<0.85 (polarized data mostly y<0.95)

#### guest analyses

- possibility of guest analyses already foreseen in general
- groups interested in one specific analysis may join (subject to approval)
  - requests to do so will have to be made to the management and will be decided upon during a Council meeting
  - analyses leading to publication in one or the other way need to fulfill the same quality criteria as regular HERMES analyses
  - results are to be published as a HERMES Collaboration publication with special guest authorship of the outside group

### publication procedure

- release requires comprehensive analysis report and presentation
  - leads to preliminary results (e.g., shown at conferences)
- 1<sup>st</sup> circulation
  - main physics conclusions and structure of paper fixed
- 2<sup>nd</sup> circulation
  - (hopefully) only cosmetic changes
- director's circulation
  - final o.k. from DESY and Collaboration
- all involve the Collaboration
- submission and final revision (after referee reports)
- G. Schnell UPV/EHU Bilbao

## selected open analyses

topic	achieved	remarks / challenges	
DVCS D with tagged proton	DVCS H with full kinematic reconstruction published	statistic; proton tagging	
Double DVCS		statistic	
exclusive pion pairs	96-00 data published		
rho SDMES	96-05 published	large 06/07 data set; possibly wit recoil detector	
omega helicity- amplitude ratios	omega SDMEs published rho amplitude ratios partially publ.	large UPE contributions in omega production	
A <sub>LU</sub> excl. mesons	$\pi$ + cross section and $A_{UT}$ published	large data set w/ beam polarization, partially w/ RD	
Aut excl. K <sup>+</sup>	Aut excl. pi <sup>+</sup> published	large asymmetries seen for pion; statistics might be a problem	

### selected open analyses

topic	achieved	remarks / challenges	
hyperons photoproduction	Lambda polarization in DIS	much larger data set for quasi- real photo production	
pi0/eta multiplicities	charged pi & K published pi0 & eta in progress	likely insufficient manpower	
di-hadron multiplicities		input to dihadron SSA phenomenology	
inclusive dihadron A <sub>LU</sub> & A <sub>UT</sub>	inclusive charged π&K Aut published		
inclusive hadron Aut	inclusive charged π&K Aut published	extend to protons, Ks	
ALU with recoil	SIDIS ALU for pi/K/p	correlate with hadrons ×F <o -&gt; fracture functions</o 	

#### conclusions

- HERMES data preserved and still being analyzed
- some important aspects
  - pure gas targets, longitudinal and transverse polarization
  - nuclear targets up to Xe
  - good hadron PID
  - Iepton-beam polarization and both lepton charges available
  - recoil detector during last two running years
- open to new manpower, e.g., as guest authors (in principle foreseen)
- challenge: lack or at least severe limitations of existing manpower for supervision of new analyses

## "productivity" of subgroups



[June 2015 report from Editorial Board]

#### G. Schnell - UPV/EHU Bilbao

17

#### 4th Workshop on the QCD Structure of the Nucleon (QCD-N'16)

#### JULY 11-15, 2016 PALACIO SAN JOSEREN, GETXO, SPAIN



http://tp.lc.ehu.es/QCD-N2016/

https://indico.desy.de//event/QCD-N2016