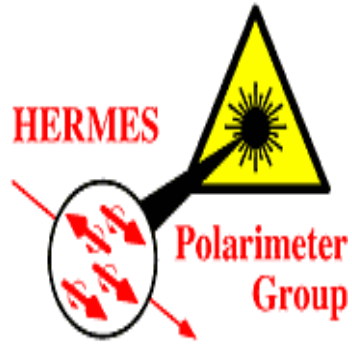
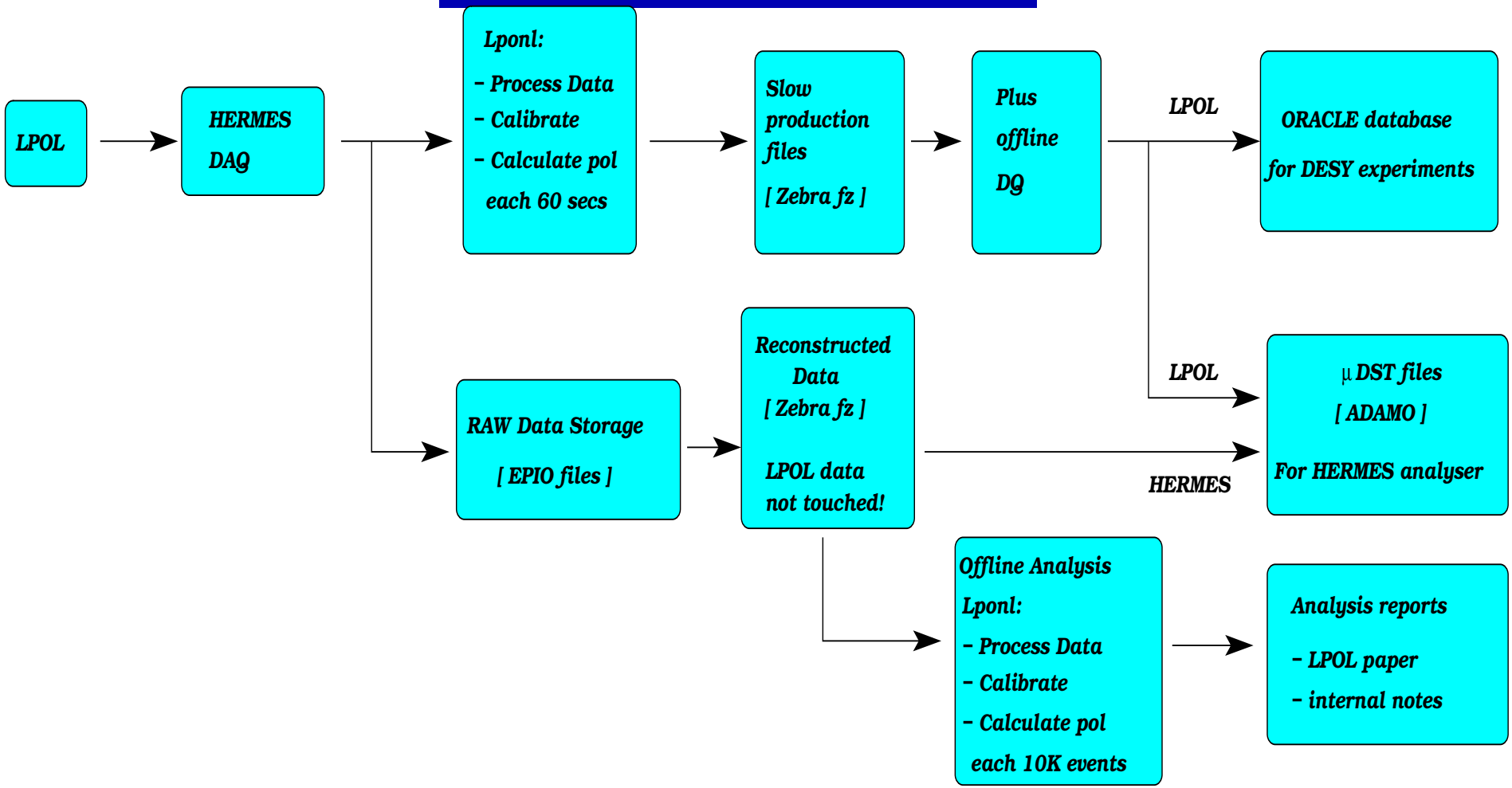
Reorganisation of LPOL Data

Riccardo Fabbri (DESY-FLC)

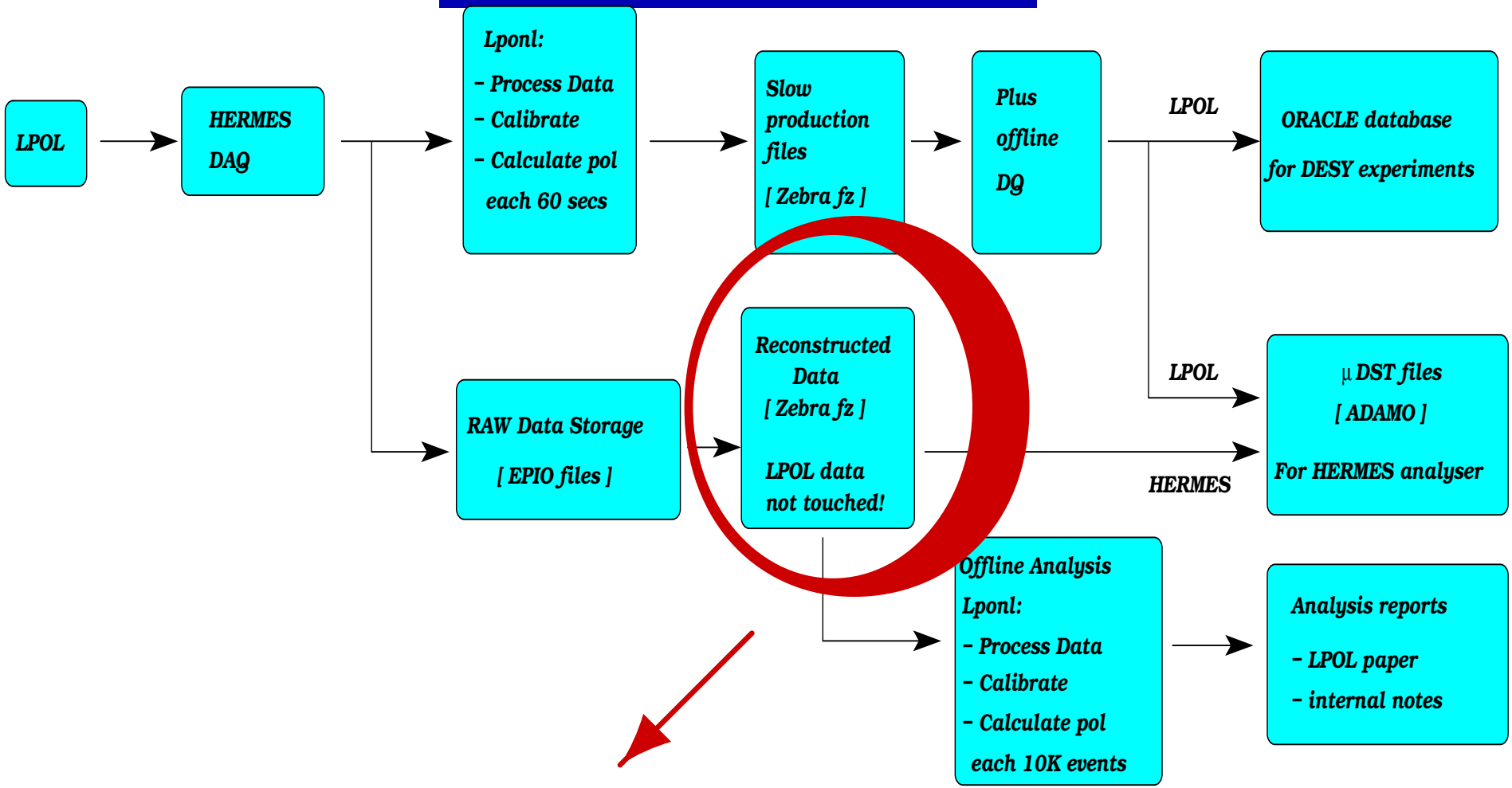


- LPOL Data Storage
- New Format for Data Storage
- Consistency of the New Framework
- Description of Variables Stored
- Conclusions and Future Plans

LPOL Data Storage



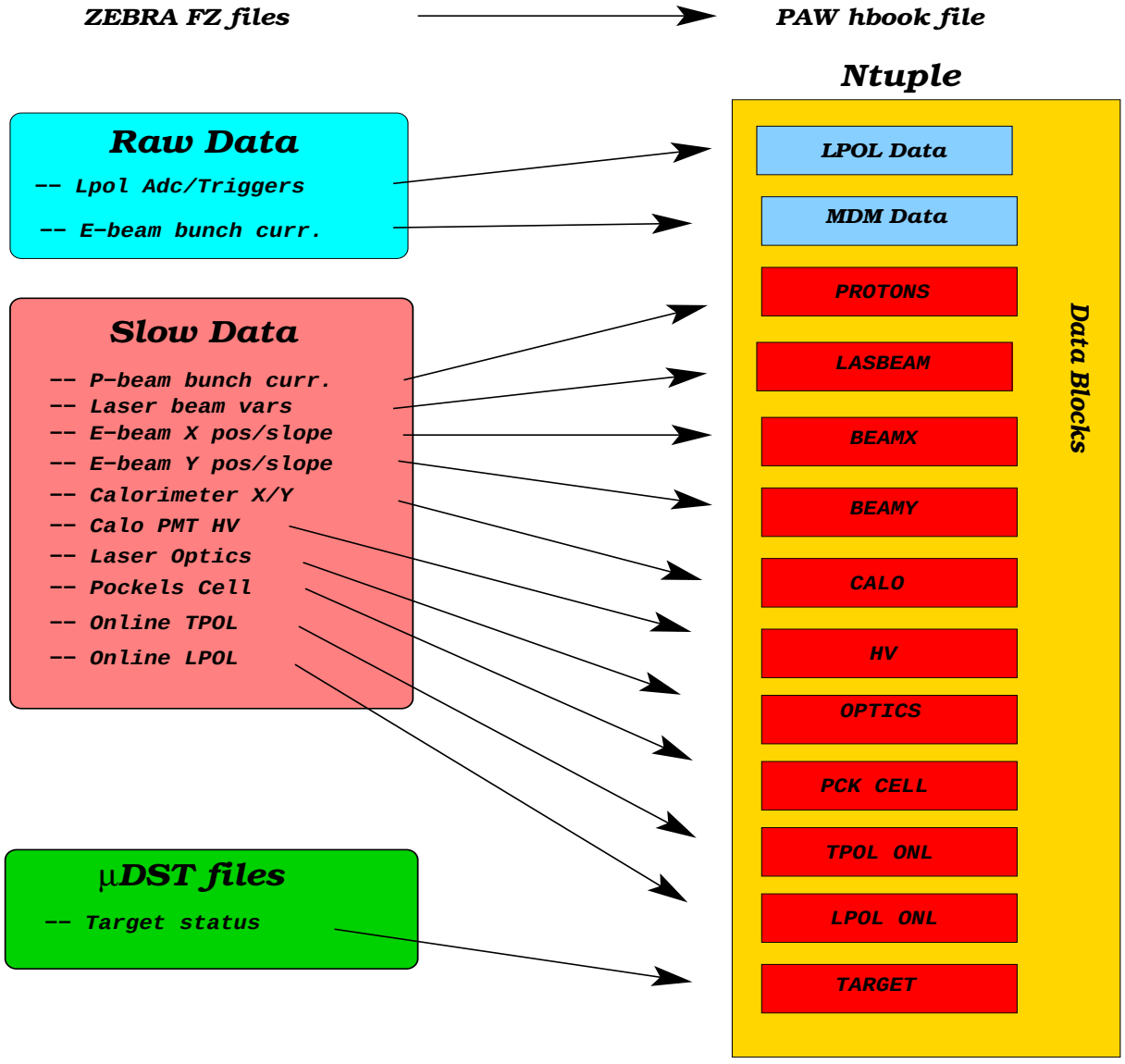
LPOL Data Storage



☞ **We have merged LPOL ADC data with beam/HERMES/detector slow and μDST data into a common storage file (ntuples) to make offline analysis easier to non-HERMES members**

New Format for Data Storage

One set of files per HERMES run



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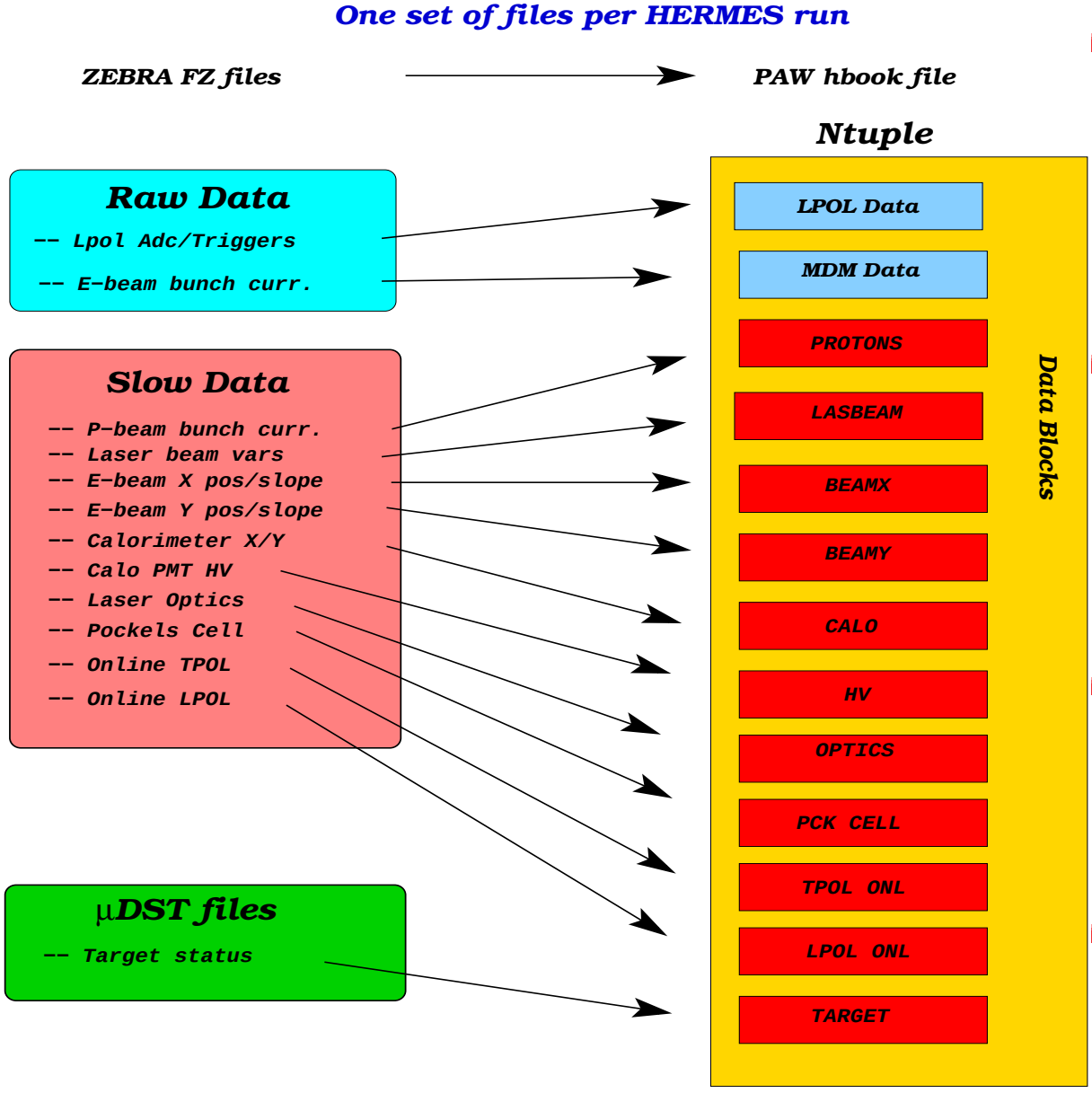
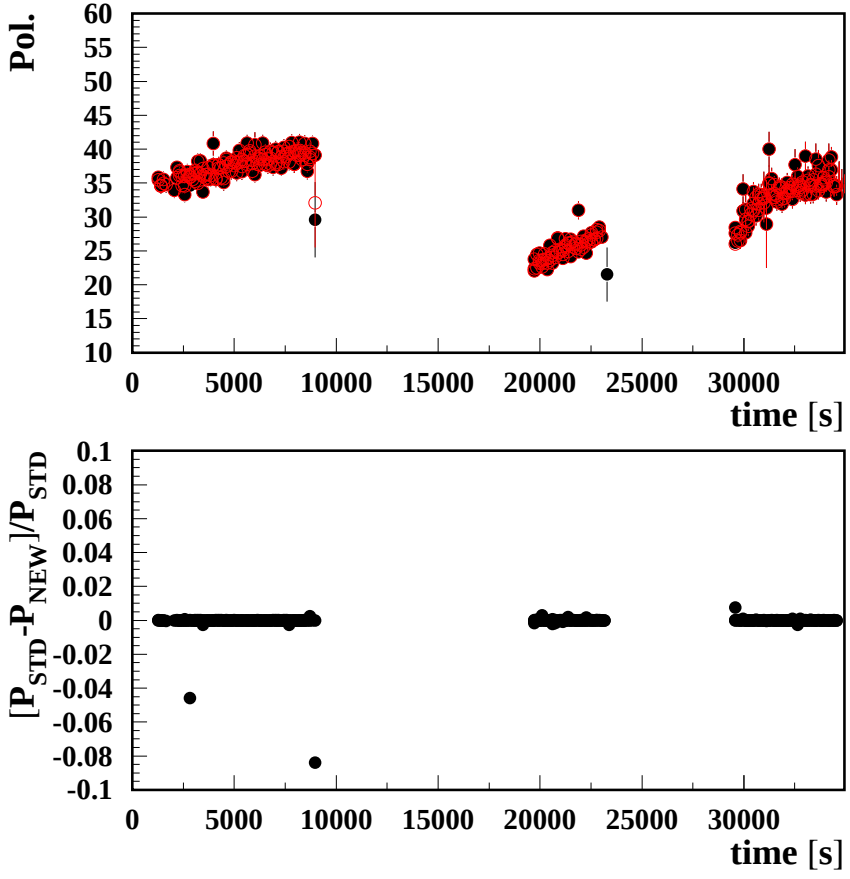


- Program Lponl now runs over HBOOKs instead of FZ files
  $\Longrightarrow$ basic code modifications affect data input processing only
- Processing ”LPOL Data” and ”MDM Data” var. blocks provides same results as obtained by processing original FZ files
- Non-HERMES user has now easy access to raw data
  $\Longrightarrow$ PAW
- Analysis code now not-linked to specific HERMES libraries as ADAMO

Consistency of the New Framework

- **Compare polarization calculated by Lponl program processing FZ and HBOOK files**

  $\Longrightarrow$ **runs: 41338-41449 ($\approx$ 400Mb), 27-28 Nov 2006**



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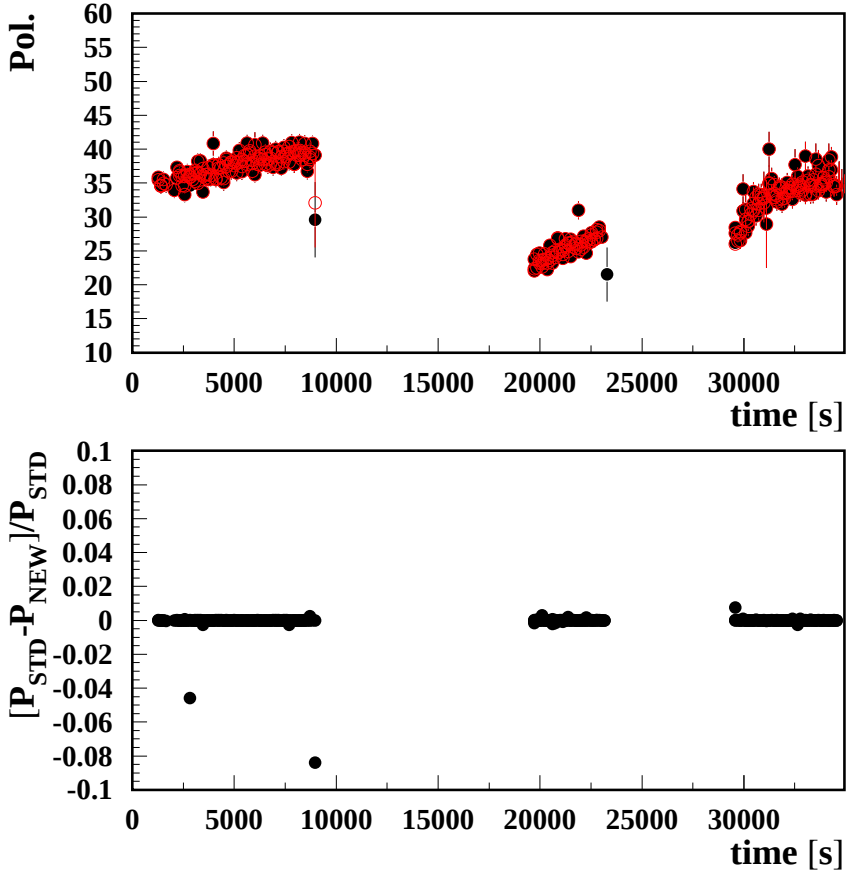
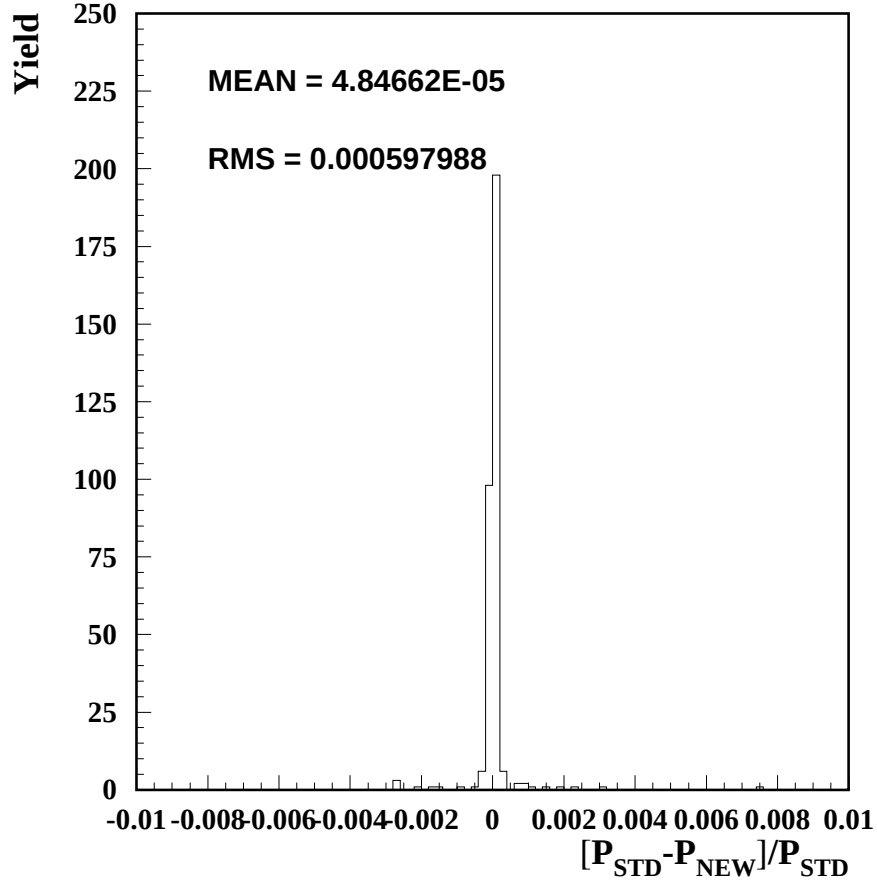


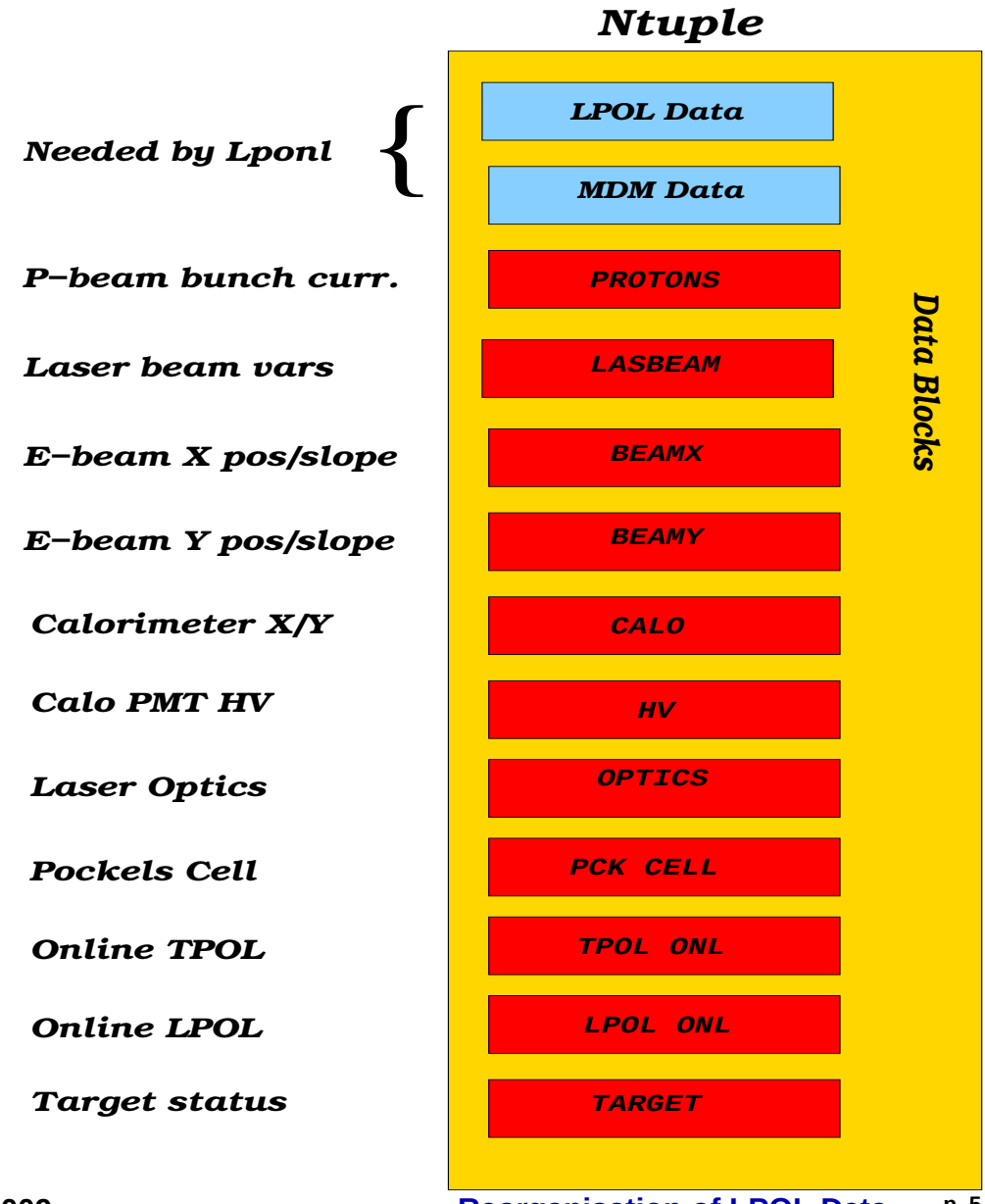


- **Although two results do not match yet at 100% level**

  $\Longrightarrow$ **agreement is better than per-mill level; enough for a reliable offline analysis!**

Additional Feature in Data Reprocessing

- In new HBOOKs additional info is stored with timestamp within time range of LPOL ADC entries
- User can perform analysis of correlation between several relevant variables:
  - LPOL vs Beam X position
  - LPOL vs Laser Power/Energy
  - ...



Reorganisation of LPOL Data

Overview of the Data Tables

- **All tables are not syncronized: their Unix timestamps are not the same**

  $\Longrightarrow$ **data accumulated at different trigger conditions during a HERMES run**

- **STD code processes only the Machine Data Module (MDM) and the LPOL raw ADC tables (LPOL Data and MDM Data)**

  $\Longrightarrow$ **provides same data/results released by the LPOL group**

- **What about the additional info hardware/beam related?**

  $\Longrightarrow$ **(likely) not-minor modifications to the code needed**

  $\Longrightarrow$ **after the polarization is calculated each 10000 events (using LPOL Data and MDM Data tables) info from additional variables has do be syncronized with the polarization timestamp, plus/minus a certain time range**

  $\Longrightarrow$ **scenario: out of reconverted hbook files create new hbooks with calculated polarization and syncronized additional info (at one-minute base)**

Overview of the Data Tables

- **How to access the reconverted data? $\Longrightarrow$ hi/file 1 <LPOL hbook> 4096**

  $\Longrightarrow$ do not forget to set the 4096 words per record

- **How the tables look like?**

```
rfabbri@Antares:~ <4>
PAW > nt/list


 ===> Directory :
          21 (N)   MDM Data
          20 (N)   LPOL Data
          22 (N)   PROTONS
          23 (N)   LASBEAM
          24 (N)   BEAMX
          25 (N)   BEAMY
          26 (N)   CALO
          27 (N)   HV
          28 (N)   OPTICS
          29 (N)   PCK CELL
          30 (N)   TPOL ONL
          31 (N)   LPOL ONL
          32 (N)   TARGET
PAW >
```

The MDM Data Table

- This table stores positron/electron beam current as provided by the Machine Data Module (MDM) each $\approx 10s$

rfabbri@Antares:~ <4>

```
PAW > nt/scan 21
+-------+-------------+------------------+
| Event |   HeraTime  |   eBunchCurrent  |
+-------+-------------+------------------+
|     1 |  1145276953 |                  |
| *   1 |             |  0.187           |
| *   2 |             |  0.188           |
| *   3 |             |  0.194           |
| *   4 |             |  0.153           |
| *   5 |             |  0.195           |
| *   6 |             |  0.194           |
| *   7 |             |  0.131           |
| *   8 |             |  0.199           |
| *   9 |             |  0.198           |
| *  10 |             |  0.203           |
| *  11 |             |  0.15            |
| *  12 |             |  0.239           |
| *  13 |             |  0.107           |
| *  14 |             |  0.183           |
| *  15 |             |  0.179           |
| *  16 |             |  0.133           |
| *  17 |             |  0.202           |
| *  18 |             |  0.198           |
+-------+-------------+------------------+
More...? ( <CR>/N/G )
```

- For each entry (trigger/measurement from MDM) at Unixtime HeraTime the value of the 220 bunches (eBunchCurrent) is given in mA

The LPOL Data Table

- The ADCs from LPOL calorimeter, PIN diodes, laser polarization analyzers (AB1/2) are giv

LpolDAQTime	Unixstamp	DogLeg1Pin	ADC from DogLeg1 PIN diode
Run	HERMES run (≈ 640 Mb data)	DogLeg2Pin	ADC from DogLeg2 PIN diode
Burst	HERMES Burst (≈ 10 sec.)	AB1Pin	ADC from analyser AB1
Bunch	Bunch number	DogLeg1Pin_n	ADC from DogLeg1 (96 ns delayed)
Trigger	Laser event trigger	DogLeg2Pin_n	ADC from DogLeg2 (96 ns delayed)
PmtCR1	ADC from Crystal 1	AB1Pin_n	ADC from AB1 (96 ns delayed)
PmtCR2	ADC from Crystal 2	AB2Pin1	ADC from analyser AB2/1
PmtCR3	ADC from Crystal 3	AB2Pin2	ADC from analyser AB2/2
PmtCR4	ADC from Crystal 4	PmtSW1	ADC from Sandwich Calo
PmtCR1_n	ADC from Crystal 1 (96 ns delayed)	PmtSW1_n	ADC from Sandwich (96 ns delayed)
PmtCR2_n	ADC from Crystal 2 (96 ns delayed)	GmsPin	ADC from GMS
PmtCR3_n	ADC from Crystal 3 (96 ns delayed)	HeraPickup	ADC of HeraPickup signal
PmtCR4_n	ADC from Crystal 4 (96 ns delayed)	HeraClock	ADC of HeraClock signal

- Signal from a subdetector is splitted (same amplitude) and one line is 96 ns delayed.

  From this line the line pedestal (plus possible synchrotron/bremm) is measured

Overview of the SLOW Data Tables

LASBEAM Table: LPOL laser related variables

LaserTime	Unixstamp of of acquisition time
LaserRate	Laser rate (Hz)
LaserInDelay	Time delay (ns) of laser firing
LaserTrigger	Trigger of laser helicity
LaserNrOfShots	Laser event trigger
LaserAngle	Optical attenuator angle
LaserZeroAngle	Optical attenuator angle
LaserStatus1	Laser status
LaserLampVoltage	Voltage (Volts) applied to flash lamp

TARGET Table: HERMES target running mode

TargetTime	Unixstamp of acquisition time
RunType	Running mode:
	0 (Target magnet On) / 1 (Target magnet Off) / 16 (High Density with Target magnet On)

Overview of the SLOW Data Tables

BEAMX Table: positron X position and slope

BEAMTimeX	Unixstamp of event sent by BPMs
BEAMPosX	X-position (mm) at BPM OR52
BEAMSlopeX	X-Slope (rad) calculated from BPM OR46 and OR52

BEAMY Table: positron Y position and slope

BEAMTimeY	Unixstamp of event sent by BPMs
BEAMPosY	Y-position (mm) at BPM OR52
BEAMSlopeY	Y-Slope (rad) calculated from BPM OR46 and OR52

PROTONS Table: proton current

ProtonTime	Unixstamp of acquisition time
pBunchCurrent	current of 220 bunches

Overview of the SLOW Data Tables

CALO Table: LPOL calorimeter location

CALOTime	Unixstamp of acquisition time
CaloX	X-position (mm)
CaloY	Y-position (mm)
CaloStatusX	Status of movement in X
CaloStatusY	Status of movement in Y

HV Table: HV voltage applied to calorimeters PMTs

HVTime	Unixstamp of acquisition time
HVCR1	High voltage (Volts) applied to PMT of Crystal 1
HVCR2	High voltage (Volts) applied to PMT of Crystal 2
HVCR3	High voltage (Volts) applied to PMT of Crystal 3
HVCR4	High voltage (Volts) applied to PMT of Crystal 4
HVSW	High voltage (Volts) applied to PMT of Sandwich Calo

OPTICS Table: orientation and status of eight mirrors in laser transport line

OPTICSTime	Unixstamp of acquisition time	MirrorX	X-orientation (a.u.)
MirrorY	Y-orientation (a.u.)	MirrorStatus	Status of mirrors rotation

Overview of the SLOW Data Tables

- **PCK CELL Table:**

  Pockels Cell HV and Status

PcTime	Unixstamp of acquisition time
PcHvPos	Positive high voltage (Volts) applied to one polarity
PcHvNeg	Negative high voltage (Volts) applied to opposite polarity
PcStatus	Status of device

- **TPOL ONL:**

  TPOL online data retrieved from HERMES slow files

TpolTime	Unixstamp of the measurement
TPOL	Polarization measurement
dTPOL	Statistical uncertainty on the measurement
TpolLumi	Luminosity delivered in the calorimeter
TpolLinLight	Linear light contribution in laser beam
TpolFocus	Focus measurement (mm)
TpolTabPos	Calorimeter table Y-position
TpolVacuum	Vacuum in laser transport line
TpolRateOnL	Rates for laser ON at left helicity
TpolRateOnR	Rates for laser ON at right helicity
TpolRateOffL	Rates for laser OFF at left helicity
TpolRateOffR	Rates for laser OFF at right helicity

Overview of the SLOW Data Tables

- **LPOL ONL:**

  LPOL online data

LpolTime	Unixstamp of the measurement
LPOL	Polarization measurement
dLPOL	Statistical uncertainty on the measurement
LpolCaloNorm	Luminosity normalized to current
LpolReso	Energy resolution (%)
LpolLumi	Luminosity
LpolFracOvfl	Fraction of ADC overflow
SlowEtaX/Y	Calculated η_x / η_y
LpolDelOff	Laser delay offset (ns)
LpolStatus	LPOL analysis status
	100 (110): OK, pol.measurement in progress (sandwich)
	201/702: bad χ^2/no updates from HERA
	301/501: energy resolution/compton cone positions bad
	552: too many ADC overflows
	601/802: low/no calorimeter signal
	1000/1100: LPOL is calibrating/waiting for ramped beam
	902/1300: no heraclock signal/ DAQ down?

Conclusions and Future Plans

- **LPOL data reorganization for offline analysis LPOL data on going: $\approx 1/4$ of 2006 data**
  - $\Longrightarrow$ **46901 Mb out of available 2252121 Mb**
  - $\Longrightarrow$ **data from different sources combined into common HBOOK files**
- **LPOL analysis code (Lponl) can now calculate polarization from new files**
  - $\Longrightarrow$ **agreement old/new procedure within per-mill level**
    - **— enough for performing a reliable offline analysis**
  - $\Longrightarrow$ **Code/documentation on-going**
    - **— this and following presentations (please, provide feedback)**
    - **— LPOL-related thesis on h1repro7.desy.de:/x03/data/lpol/DOCU**
    - **— commenting the analysis code: to be done**
- **Implementation of additional features in analysis code on going**
  - $\Longrightarrow$ **store values per-min values for all relevant vars**
    - **— hopefully to be used in 360^o offline analysis**