Status report

1. Status of detector operation
2. Measured performances
3. First experience with HERA beams
4. Work in progress:
   - Streamer tube system
   - Slow control & monitoring
   - H1 triggers
5. Data processing and analysis
6. Conclusions
Typical cosmic crossing all 20 detectors
Summary on Tracker performance

$\sigma_{\text{drift}} = 148 \mu m$
$\varepsilon_{\text{rad}} = 1.5 \text{ cm}$

$\sigma_{\text{drift}} = 170 \mu m$
$\sigma_{y} = 190 \mu m$
$\sigma_{z} = 350 \mu m$
$\sigma_{z} = 320 \mu m$

Fully operational in April and dedicated alignment run
Central Jet Chamber now fully equipped with electronics for the 1st phase.

Last 1920 channels will be added in March '92
Central Jet Chamber Calibration

Resolution from the fit:

HRS gas (not final!)

σ(θφ) = 190 μm
Liquid Argon Calorimeter

- Fully operational since February '91
- Stability
  - ARGON purity: no measurable degradation since April (< 0.2% per year) → see fig.
  - HV to 1500 V: charge collection efficiency very good equivalent to ~0.4 ppm O₂
  - Electronic calibration stable to < 0.5% over 2-3 weeks ⇒ el. cal. foreseen once / week
- Operation problems
  - Dead readout channels: 110 (0.25%) stable since 2/91, no problem
  - HV problem: it was severe problem in April 66 out of 752 HV channels at 2500 V were 'dead' (affected ~ 30% of readout ch.)
  - Status now: HV supply upgraded to full granularity 1504 lines
  - no dead segments! || Operating at 1500 V: 1444 channels at 800-1200 V: 63 chan (4.1%)
  (≥ 90% charge collection eff.)
  ~5% of calorimeter needs 'known' s/w corr. ≤ 5%

- It's a nuisance, but no degradation of calorimeter performance
- Trigger is not affected
Liquid ARGON purity:

3 examples of the monitoring:

probe 5: middle-high and backward variation: - 0.10 % / year
probe 10: bottom and forward variation: - 0.29 % / year
probe 11: middle-high and forward variation: - 0.25 % / year

20/09/91

β+ source readout gaps in cryostat

April

September
HV curve (charge collection efficiency)

Data from cosmic muon run (E on e.m. scale)

- $E_{\text{tot}}$
- Hadron Cal
- EM Cal

$E$ [GeV]

Chosen operation

$U$ [V]

CERN Runs
• **Hard background conditions** (100 kHz rate expected) → special analog electronics (fast shaping + delay line) created and tested Ready for operation in Dec '91.

• Installed, tested in a stand alone mode, will be used in October run.

• **Calibration runs at DESY and CERN.**

  Energy resolution (1 GeV < $E_e$ < 60 GeV):
  
  - **sampling term** = 9% / $\sqrt{E}$
  - **constant term** = 1%
  - **electronic noise** = 100 MeV
  
  $\Rightarrow \Delta E/E = (2 \pm 3)\%$ in the (10 ÷ 30) GeV range

  ! Final aim of 1% energy scale can only be reached with ep data.
Two out of eight detector planes are instrumented and installed and will be used in the first stage.

168 (5cm x 5cm) silicon detectors

Reason: unknown radiation conditions around the beam-pipe

Tests of electronics for DAQ and TRIGGER are in progress
Tail catcher

[Instrumented Iron: analog pad readout of streamer tube system]

- Total number of channels = 4608
  Have been fully operated in April = 828 (18%)
  In October run will be = ~1700 (37%)
  Expected at the beginning of ep= 4,170
  (limited by installation)

- Strong variation of pulseheight with atm. pressure: \( \Delta E/E \approx -2{\%} / \text{torr} \)
  will be actively compensated by changing HV
  (in progress)

- Magnetic field dependence:
  \( \bar{E} (B=0) < \bar{E} (B=1.2 \mu) \)
  - barrel: \( \Delta E \leq 10\% \)
  - endcap: \( \Delta E \leq 5\cdots 10\% \)

  needs more cosmic data to calculate precisely.
Pressure dependence of p at 1.2 Tesla in iron barrel towers

\[
\frac{\Delta E}{E} \propto -2.2 \frac{\text{eV}}{\text{torr}}
\]
Status of energy calibration for calorimeters

- L. Ar. is stable, and el. calibration works very well
- We have adequate test beam data from CERN (DESY) for Liquid Argon Calorimeter, Tail Catcher and Backward E.K. Calorimeter for first data taking. [Exception: P-cracks in L. Ar. stacks → Summer 1992]
- Test data is understood (detailed MC simulation exists)
- Data correction for stack inhomogeneities, dead material, leakage, dead channels... have been studied in detail. Software corrections available and tuned to data

We have reasonably good relative calibration of different calorimeter areas

However...

an absolute energy scale is not transferable from the test beam data to H1 to the designed precision

We need first ep data to get absolute energy scale to better than ~5%!
<table>
<thead>
<tr>
<th>Calorimeter</th>
<th>Relative energy error over calorimeter</th>
<th>Absolute energy scale error</th>
</tr>
</thead>
<tbody>
<tr>
<td>Liquid Argon</td>
<td>&lt; 2%</td>
<td>3%</td>
</tr>
<tr>
<td>electrons</td>
<td>&lt; 3%</td>
<td>5%</td>
</tr>
<tr>
<td>hadrons</td>
<td>~ 2%</td>
<td>~ 5%</td>
</tr>
<tr>
<td>BEMC</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

may be improved

needs e+p data:
(Kin. peak, isolated tracks, p^*_balance)
MWPC's (Trigger chambers)

- 2 cylindrical chambers in central region
  \[25° < \theta < 155°\]
- 3 forward planar chambers
  \[\theta < 20°\]

1. Central MWPC's
   - reliably working since April
   - noise level substantially reduced
     (well below muon signal)
   \[\Rightarrow\] ready for triggering with high efficiency

2. Forward MWPC
   - fully operational in April run
   - however...

50% of preamps now dead
for unknown reason

\[\Rightarrow\] these chambers will only be of very limited use for the first phase of data taking
Some trigger signals still may be obtained, but no topological trigger

Loss of trigger possibilities at forward angles (\(\theta < 20°\))
affecting mainly low multiplicity events
### DAQ and data logging

#### Status
- Fully set up, tested, running stable since Sept '90
- Event Display improved/upgraded
- Event Server and Histogram server added

#### Performance
- Comfortable operator control (can be used by nonexperts, tested by off-line people)
- Design speed of ~500 kbyte/sec achieved 9/90
  Since 9/91 sped up to 600 kbyte/sec (data logging to IBM)
- The F58 link is very stable and reliable
- A local data storage device (Storage Tek 4280) is presently being commissioned
- Total amount of data recorded so far:
  Since Sept '90: 5.000 GB (25,000 cart.)
  During April '91 run: 130 GB (650 cart.)
  Expected data volume in October/November run: ~1300 cartridges.
New compared to April run

H1 CENTRAL DATA ACQUISITION: PHYSICAL LAYOUT

LAN

TO SUBDETECTOR MONITORING COMPUTERS
TCP/IP based
H1 communication protocol

SYSTEM SUPERVISOR MACINTOSH IIx

EVENT DISPLAY MACINTOSH IIx

Event Server Histo Displays MACINTOSH II

FULL EVENT TASKS

DATA LOGGING TO DESY IBM

VMEtaxis

DPM8242s MULTIEVENT BUFFERS FULL EVENT BUFFERS

MacVEEs

R3000 RAIDs

Output Drivers IBM-LINK CONTROLLERS GRAPHICS DRIVERS ULTRA-NET INTERFACE

68020 FICs

Branch 1 C.Trigger

Branch 2 Cal.Trigger

Branch 3 Cal.ADC

Branch 4 C.Tracker

Branch 5 Fwd.Tracker

Branch 6 Fwd.Muon

Branch 7 MWPC

Branch 8 Muon

Branch 9 Luminosity

Branch 10 Fwd. μ trig

Branch 11 C.S.triggers

Branch 12 Test branch

FIBRE-OPTIC RING

H1 DAQ protocol

FINAL LEVEL PARALLEL FILTER

L4 TRIGGER (FILTER FARM)

FILTER OUTPUT FILTER INPUT VSB FEEDBACK UNIT

EVENT COORDINATION

FULL EVENT RECORDS

FULL EVENT TASKS
12:08:12  Data Acquisition Control

Run Control
- Run No.: 4533
- Status: Running
- Run Start: Unknown
- Run Mode: 450882
- Event No.: 450882
- Eventsize: 93
- Current:
- Event Rate: 4.8 Hz
- Deadtime: 100

IBM Status
- Disk: 65823000
- Log Rate: 4.7 Hz
- KByte/s: 407

Control
- Event Display
- Histograms
- Slow Control
- Run Summary
- Message Log
- DAQ Statistics

Full Event Units
- Filter Input
- Filter Output
- Data Logging
- Data Validity
- Histograms
- Event Display
- Backup Tape
- Ultra Net

Magnet

Branch Readout
- On/Off: ON
- Readout Error

System Messages
- 12:07:12 Log File existing: /home/40_SSP_MessageLog f:MsgLog4533
- 12:07:12 Global updated at 12:07:12
- 12:07:15 MESSAGE: FEB Test message
- 12:07:15 TCP opened: 1627476
- 12:07:24 Histograms appear dead
- 12:07:25 Histograms alive again
- 12:07:31 MESSAGE: FEB Test message

Add Message  Show Complete Log
<table>
<thead>
<tr>
<th>Run No.</th>
<th>6837</th>
<th>Trigger1 $</th>
<th>00000002</th>
</tr>
</thead>
<tbody>
<tr>
<td>Status</td>
<td>STOPPED</td>
<td>Trigger2 $</td>
<td>00000000</td>
</tr>
<tr>
<td>Run Start</td>
<td>11:59:33</td>
<td>Sys Mode $</td>
<td>00000000</td>
</tr>
<tr>
<td>Event No.</td>
<td>0</td>
<td>DAQ Mode $</td>
<td>00000005</td>
</tr>
<tr>
<td>Disk 1</td>
<td></td>
<td>Cartridge</td>
<td>G3917U00</td>
</tr>
<tr>
<td>Disk 2</td>
<td></td>
<td>IBM Rate KB/s</td>
<td>389.00</td>
</tr>
</tbody>
</table>

**Branches in Readout**

<table>
<thead>
<tr>
<th>Branch</th>
<th>Status</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Central Trigger</td>
<td>ON</td>
<td></td>
</tr>
<tr>
<td>2 Calo Trigger</td>
<td>OFF</td>
<td></td>
</tr>
<tr>
<td>3 Calo ADC</td>
<td>OFF</td>
<td></td>
</tr>
<tr>
<td>4 Central Tracker</td>
<td>OFF</td>
<td></td>
</tr>
<tr>
<td>5 Fwd Tracker</td>
<td>ON</td>
<td></td>
</tr>
<tr>
<td>6 Forward Muon</td>
<td>OFF</td>
<td></td>
</tr>
<tr>
<td>7 MWPC</td>
<td>OFF</td>
<td></td>
</tr>
<tr>
<td>8 Muon</td>
<td>OFF</td>
<td></td>
</tr>
<tr>
<td>9 Luminosity</td>
<td>OFF</td>
<td></td>
</tr>
<tr>
<td>10 Fwd Muon Trig</td>
<td>OFF</td>
<td></td>
</tr>
<tr>
<td>11 C.S. Triggers</td>
<td>OFF</td>
<td></td>
</tr>
<tr>
<td>12 Test Branch</td>
<td>OFF</td>
<td></td>
</tr>
</tbody>
</table>

**Full Event Units**

<table>
<thead>
<tr>
<th>Unit</th>
<th>Status</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 Filter Input</td>
<td>OFF</td>
<td></td>
</tr>
<tr>
<td>1 Filter Output</td>
<td>OFF</td>
<td></td>
</tr>
<tr>
<td>2 IBM Logging</td>
<td>OFF</td>
<td></td>
</tr>
<tr>
<td>3 Data Validity</td>
<td>ON</td>
<td></td>
</tr>
<tr>
<td>4 Histograms</td>
<td>ON</td>
<td></td>
</tr>
<tr>
<td>5 Event Display</td>
<td>ON</td>
<td></td>
</tr>
<tr>
<td>6 Storage Tek</td>
<td>OFF</td>
<td></td>
</tr>
<tr>
<td>7 IBM Test Link</td>
<td>ON</td>
<td></td>
</tr>
</tbody>
</table>
LUMI measurements with $e^-$ beam at 26.6 GeV. July'91. H1

- **Luminosity for $ep$-collisions:**
  
  $ep \rightarrow e p \gamma \Rightarrow 30\text{kHz at}$
  
  nominal $L$

- **July HERA run:**
  
  $eA \rightarrow e A \gamma \Rightarrow 10 \pm 20 \text{ Hz at}$
  
  coincidence ($\sim 1\%$ of $T_e$)

---

**Luminosity system. Top view**
**Possibilities**

\[ 3^\circ < \theta < 17^\circ \]
\[ 5 < p_\mu < 200 \text{ GeV/c} \]

**Status**

- \( \theta \) chambers - installed with full electronics and readout; tested on e\(^-\) beam; will take muon (p-halo) data on proton beam in October

- \( \phi \) chambers - ready; will be installed in a shutdown (however, no readout during first phase: missing 600 FADC's)

- toroidal magnet - installed, tested at \( B \sim 2T \)
Test operation with $e^-$ beam (x-ray hits only!)

Look - H1 FORWARD MUON SYSTEM

Date 31/07/1991
Background study with p beam

- Ready, tested, checked on cosmic muons. Waiting for high energy proton beam with collision optics

- Some data have been taken with a stable 300 GeV p-beam and being analysed now
  a) Rate at scintillators (→ 50 kHz at nominal Ip)
  b) Energy spectrum in hadron calorimeters
Hadron background from HERA p-beam in H1 I.P.

\[ E_p = 300 \text{ GeV} \]
\[ \text{threshold} = 7 \text{ GeV} \]

\[ E_p = 270 \text{ GeV} \]
\[ \text{threshold} = 1.7 \text{ GeV} \]
Streamertube system

Based on LURANYL extrusion
- Uses non-inflammable gas (CO₂, Ar, Isobutane)
  High safety standard

→ New material → delay in production and instrumentation

- Only partly installed, will not be fully ready in March '92

- However, the rest can be installed in beam position

- Profiles are reliable (<1% failure)
SLOW CONTROL

A BASIC MINIMAL SAFETY SYSTEM FOR H1

**TASKS**

- FAST ALARMS + DIAGNOSTICS FOR FAILURES
- FAST ACTIONS IN CASE OF ALARMS
- CENTRAL H/W ALARM SYSTEM
- BBL3
- SETTING OF DETECTOR STATUS
- MONITORING OF DETECTOR STATUS
- LOGGING OF MEASUREMENTS ("SLOW EVENTS")
- COMPUTER CONTROL AT SUBDETECTOR LEVEL
- CENTRAL STATUS INFORMATION (+CONTROL)

**STATUS**

SIGNIFICANT PROGRESS SINCE APRIL RUN

- H/W ALARM SYSTEM IS OPERATIONAL, WILL BE TESTED IN OCTOBER/NOVEMBER RUN
- 50% OUT OF 132 FORESEEN H/W SIGNALS FROM SUBDETECTORS ARE PRESENTLY CONNECTED
- COMPUTER CONTROL AT SUBDETECTOR LEVEL: BASIC VERSIONS OPERATIONAL FOR ALL SUBDET. IN OCTOBER; HV, GAS FLOWS, CRATES... WILL BE UNDER COMPUTER CONTROL

**CENTRAL SLOW CONTROL**

CENTRALIZED COLLECTION OF INFORMATION VIA LAN

CENTRAL CONTROL (LATER ON)

COMMUNICATION WITH SUBDETECTORS HAS STARTED

BASIC STATES DISPLAY AND DATA LOGGING EXISTS.

WHAT CAN...

- CENTRALLY ⇒ ARGUS DISPLAY

ONE DO...

- LOCALLY ⇒ SUBDETECTOR CONTROL
H1 Trigger Levels

Background \( \sim 100\, \text{kHz} \)
Physics: \( \Delta p \approx 100\, \text{Hz} \)
DIS: \( \sim 1\, \text{Hz} \)

Time

0 2\(\mu\text{s}\) 20\(\mu\text{s}\) 800\(\mu\text{s}\) 200\text{ms}

L1 L2 L3 L4

Number of Events

\(10^5\)
\(10^3\)
\(10\)

Dead Time: 0
Rate: 1kHz

50-100 Hz
In Phase 1
Test in Oct/Nov

Dead Time: 20\(\mu\text{s}\)
Rate: 200Hz
H/W

Dead Time: \(< 800\mu\text{s}\)
Rate: 50 Hz
S/W

COMBINATION of subdetectors

Filter farm
Rate: 5 Hz
Reconstruction
geometry
Tracks
Vertices
Test in Oct/Nov

Stop pipeline
Start digitization
Start readout
Data logging

Not for the phase 1
Trigger information
EVENT ACCEPTED
TO = EVENT RAYS ZVTX DC LAR
DC-L1: NROAD = 7  MULT = 3
DC-L2: NROAD = 2  MULT = 1
<table>
<thead>
<tr>
<th>Subdetector trigger</th>
<th>First operation</th>
<th>March '92</th>
</tr>
</thead>
<tbody>
<tr>
<td>Main calorimeter trigger (L.A., BEMC)</td>
<td>October: readout of FAX</td>
<td></td>
</tr>
<tr>
<td></td>
<td>November: 1. digital sums</td>
<td></td>
</tr>
<tr>
<td>Single electron trigger in Backward El. mag. calorimeter</td>
<td>October '91</td>
<td></td>
</tr>
<tr>
<td>2-vertex trigger (Central MWPC's)</td>
<td>October: 2/16 operational</td>
<td></td>
</tr>
<tr>
<td>RΦ trigger (Central Jet Chamber)</td>
<td>October: 1/15 operational</td>
<td></td>
</tr>
<tr>
<td>2 chamber trigger (22 drift chambers)</td>
<td>In the development stage</td>
<td>Spring 1992</td>
</tr>
<tr>
<td>Digital muon trigger (Instrumented IRON)</td>
<td>October: partly operational</td>
<td></td>
</tr>
<tr>
<td>Forward muon trigger (Fw. muon spectrometer)</td>
<td>December '91</td>
<td></td>
</tr>
<tr>
<td>TOF (scintillator walls)</td>
<td>October '91</td>
<td></td>
</tr>
<tr>
<td>Electron tagger (ET of LUMI system)</td>
<td>July '91</td>
<td></td>
</tr>
</tbody>
</table>
Liquid Argon Trigger

Main work is done:
- analog part installed and tested
- timing adjusted (compensated for different capacities): ~4730 tr. channels

In October run:
- FADC’s will be readout
- measurement of time resolution vs. energy + noise thresholds in real detector

Digital Summing
delayed due to the problem of manufacturing of digital summing boxes.

→ In Nov/Dec '91
Tune jitters of trigger signals from cells measured by electronic calibration system.

L. Ar. Calorimeter

EM trigger cells

$\sigma = 2.9 \text{ ns}$

Hadr. trigger cells

$\sigma = 17 \text{ ns}$
Backward Single Electron Trigger

- Based on measurement of energy of EM cluster.

Single calorimeter stack threshold 50% curve
L4 trigger (parallel filter farm)

- Partial event reconstruction for fast filtering: reject background events

Expected input rate: $50 \div 100 \text{ Hz} \Rightarrow \text{output} \leq 5 \text{ Hz}$

Implementation:
- 15 RISC processors (CES, RAID 8235) in 2 VME crates
  $\Rightarrow 300 \text{ MIPs equivalent to 7.5 IBM 3090 CPU's}$

\[ t \leq 300 \text{ msec/event available} \]

- Filter algorithms
  1) trigger analysis and verification
  2) fast vertex reconstruction in $z$ and $(r \phi)$
     \[ \begin{align*}
     & Z_{vx} \text{ by histogram technique in CJC: } 8 \text{ msec} \\
     & \text{full vertex reconstruction by tracks in CJC: } 80 \text{ msec} \\
     & Z_{vx} \text{ by } Z\text{-chambers link } 60 \text{ msec} \\
     & Z_{vx} \text{ by fast forward track reconstruction: } 120 \text{ msec}
     \end{align*} \]

\[ \langle t \rangle \approx 40 \text{ msec} \]

Rejection factor $\geq 7$ w.r.t. L1 accepted

Remaining background:
- p-gas collisions within interaction region

3) further possibilities:
- analyse energy flow
- kinematic selection
- downscaling of 'uninteresting' physics (low $p_T$, $y$)
Look - Run number 1 Event number 92

BEAM-GAS EVENT

Date 17/01/1991

'good' tracks in Rp. CJC

Backward tracks. Can be rejected by hist.

Forward tracks

Expected vertex

CUTS=0.125

Z chamber link

\[ R(\text{cm}) \]

\[ Z(\text{cm}) \]
- H1 offline software -

H1 Database

Real Data
- CERN tests
- cosmic events
- ep-data

Calibration processors

Monte Carlo
- single e⁻/ν⁻
- cosmic μ⁻/neutrons
- ep-generators

H1REC

H1PHAN

H1PSI

H1LOOK

Modularity
Data structure
Standard IO
Standard framework for graphics
**BASIC PACKAGES**

BOS - Dynamic memory management
Flexible data structure

FPACK - Package for input/output
Machine independent
Remote access via networks
Keyed access (important for DB)
Index feature (event selection)
Data compression (to be added)

LOOK - System for graphics and data analysis
Provide framework for interactive graph. appl.
Includes histogram package
Supports FPACK and BOS formats
Used online and offline
Interactive language interpreter
Fitting

**Standard H1 software**

<table>
<thead>
<tr>
<th>Package</th>
<th>Description</th>
<th>Timing (IBN3090)</th>
</tr>
</thead>
<tbody>
<tr>
<td>H1SIM</td>
<td>best description of H1</td>
<td>300&quot;/DIS event</td>
</tr>
<tr>
<td>H1FAST</td>
<td>main MC for mass production</td>
<td>30&quot;/event</td>
</tr>
<tr>
<td>ARCET</td>
<td>full simulation of CERN data</td>
<td></td>
</tr>
<tr>
<td>H1REC</td>
<td>general H1 reconstruction</td>
<td>1&quot;/event</td>
</tr>
<tr>
<td>H1PSI</td>
<td>superfast parametrized simulation</td>
<td>0.1&quot;/event</td>
</tr>
<tr>
<td>H1PHAN</td>
<td>analysis package</td>
<td></td>
</tr>
<tr>
<td>H1LOOK</td>
<td>H1 Event Display</td>
<td></td>
</tr>
</tbody>
</table>
Reconstruction of ep events in H1 Detector (MC & data)

Fully modular and easy reprocessable program

Status:
Complete version of all modules technically works providing unambiguous detector information:
- linked tracks (including muons)
- calibrated calorimeter cell energies and clusters
- lepton ID estimators
- track-cluster link probabilities

Performance
- MC event reconstruction (tested on 10^3 DIS ev.)
  - SIZE: ≤ 10 KB
  - Speed: 1.1 sec/DIS event on IBM 3090

- Pattern recognition, link eff., ... - reasonable

Reconstruction of cosmic events
- test of data corrections
- calibration algorithms

Access to the database including updating
- Installed and tested on Number Cruncher for 'online' reconstruction

Status is reasonable, but still a lot of work to be done to have a stable, well tested and bug-free production version before March '92
Look - Cosmic muon reconstructed in Forward tracker  

Date 22/09/1991

H1
• Next steps
  - 'online reconstruction' of cosmic $\mu$'s in October
  - to get first calibration set for EP-data
  - mass reconstruction of MC events
    for physics analysis and background studies (Dec '91)

• **Online reconstruction**

  Processing of logged data parallel to the data taking
  ▶ fast filter to reject background (if not on L4)
  ▶ full reconstruction
  ▶ event classification

**Output**

- **POT** (production output tapes): full output of all interesting events
- **DST**: selected 'most important' events
  (limited by disk space ≤20 GB in '92)
- **Index**: files for fast direct access to the events using classification

**Technical realisation**

  → see fig.

**Status**

- Hardware and basic software available, set up and tested
- First complete test - during October run
**H1PHAN** Physics analysis package

[Modelled on examples of ARGUS/ALEPH]

- **POT's**
- **DST's**

- Fast event access and selections (Index files)
- Interpretation of reconstruction output
- Reprocessing features:
  - Association tracks to vertices
  - Particle identification
  - Association of tracks and clusters
- 4-vector bank creation for particles and vertices
- Easy access to the physical variables

- Utility library for analysis:
  - Kinematics
  - Jet algorithms
  - Fitting routines

(Open for user's contribution!)

n-tuples $\Rightarrow \mu$-DST's

Your favourite interactive analysis (LOOK, PAW, ...)

Publication

**Status**

- Basic version exists and tested
- Used for physics analysis within H1
- Manual available
SUMMARY

- H1 is well prepared to move into the beam as soon as machine status allows it.

- Remaining areas of uncertainties:
  
  TRIGGER - the main problem for HERA, needs real proton beam data to see where we stand.

  RECONSTRUCTION - needs still serious work, but reasonably good and well tested version will exist in Spring '92.

We are waiting and hoping for HERA to achieve ep collisions this year, and ep physics early 1992.