HEP-Strategy-Group

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This is a STATUS REPORT - YOUR input into the discussion is WELCOME and NEEDED

Info about meetings, agendae, minutes, etc to be found under:

http://www.desy.de/f/teilchenphysik/strategie/

user: tp pw: future

Mission - 1

Starting and Boundary Conditions:

- Feb. 5th 2003 decision of the bmbf:
  - DESY in Hamburg will receive an XFEL (50% investment costs from D),
  - PETRA should be modified to a 3rd generation synchrotron radiation source,
  - today no German site for the TESLA LC proposed,
  - DESY will remain a world-leading centre of high energy physics,
  - DESY will be able to continue to participate in the international LC R&D to enable the participation in a later global LC project,
  - the decision concerning TESLA does not mean a lowering of the importance of high energy physics (HEP) for Germany.
- HGF (Helmholtz Gemeinschaft) funding scheme changing (PoF - programme oriented funding)
  - HEP is part of the Research Field “Structure of Matter” (+ astro-particle, medium energy, condensed matter, photons-neutron-ions),
  - DESY has to compete with the other HGF centres for funds - until now direct negotiations with the bmbf,
  - 2004 ”Structure of Matter” will be evaluated for the period 2005-2009,
  - 2003: DESY-funding < request, 2004: ?? (certainly no significant increase).

Mission - 2

- The well recognised strength of DESY:

  develop and run accelerators for particle physics and research with synchrotron radiation for and in close collaboration with national and international users.

- Priorities for HEP at DESY:

  given the success of the TESLA-collaboration in sc technology and the world-wide consensus (KET , ACFA, ECFA, HEPAP) that next large HEP project is a high energy (> 500 GeV) LC in time-overlap with LHC

  - the HEP-priority DESY's for the future is a LC,
    - DESY's preferred technology is TESLA,
    - DESY's preference is TESLA at Hamburg/Schleswig-Holstein,
  - the HEP priority at DESY for the present (until ~ 2006/07) is HERAII,
  - the Astro-Particle Physics (AP) priority for DESY is Amanda/IceCube,
  - in addition strong and visible theory groups (incl. Lattice Gauge Theory)

DESY is to remain a leading and attractive HEP lab also after the end of data taking at HERA independent of where a LC will be built (data taking at a LC will not start before ~ 2015!).

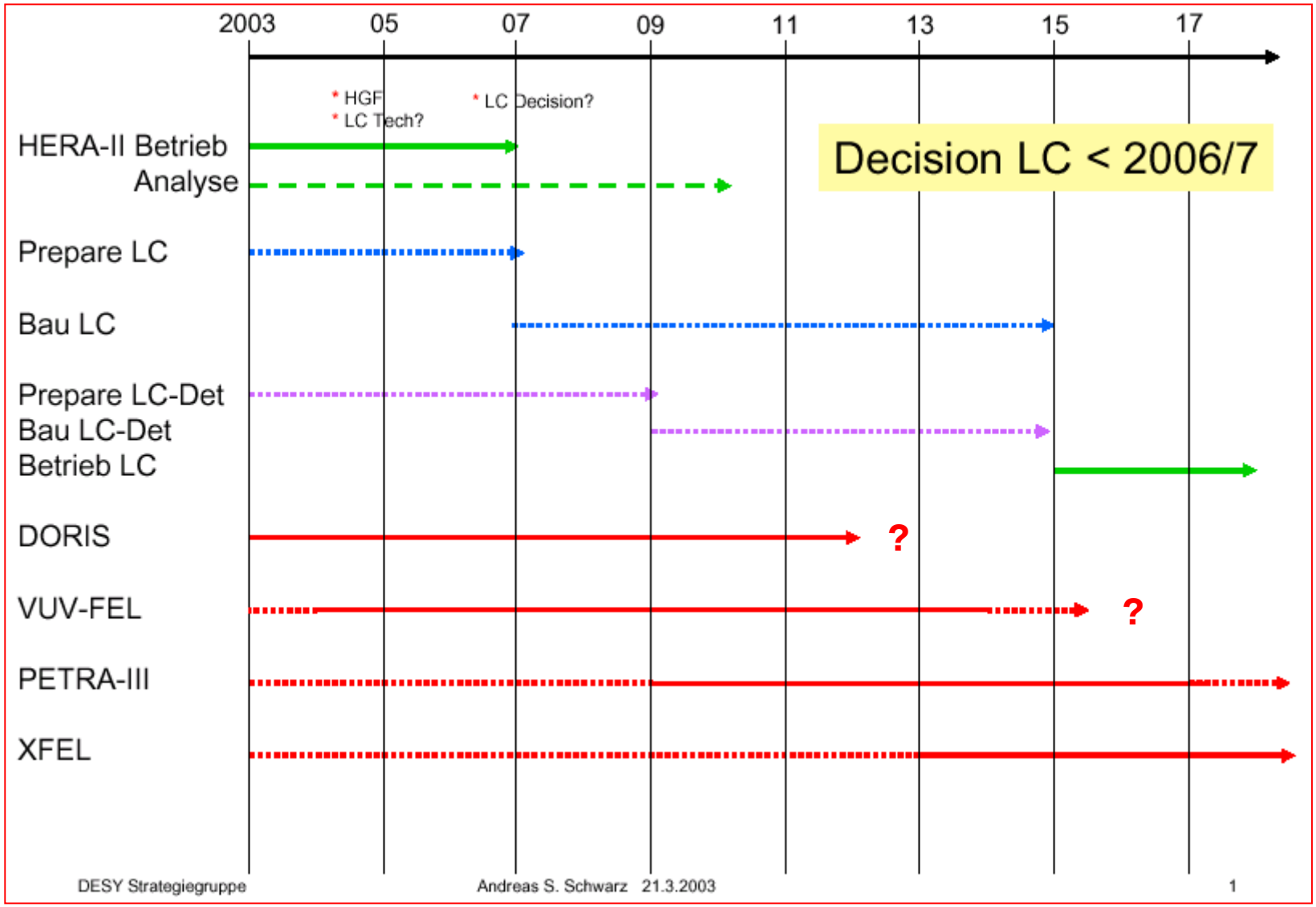
Mission - 3

- DESY's mission as HGF-institute:
  - provide large-scale first-rate scientific infrastructure for fundamental and applied research for national and international scientists,
  - perform high-level technological developments with long lead-times,
  - provide services and co-ordination (e.g.) for University groups which are beyond their possibilities to allow participation in big scientific projects.

- Mission of the Strategy Group:
  - develop a strategy (document by early autumn) for HEP/AP at DESY for the time 2004-2014 for the scenarios
    - LC-decision by 2006 TESLA at HH,
    - LC-decision by 2006 TESLA not at HH,
    - no LC decision by 2006.
  - taking into account the boundary conditions:
    - HERAII and Amanda/IceCube successful,
    - VUV-FEL, PETRAIII and XFEL successfully built and run,
    - maximise the chance that TESLA will be built at Hamburg,
    - DESY remains a leading and attractive HEP-lab after HERAII.

HEP-Strategy-Group

DESY's Projects



HEP-Strategy-Group

Membership

Ex-officio: S.Bethke (WR), R.-D. Heuer (bmbf-GA) T.Naumann (WA), L.Rolandi (PRC), R.Rückl (KET), D.Wegener (DPG),

Unis: R.-D.Heuer(HH), U.Katz (ER), D.Ryckbosch (Gent), H.-C.Schultz-Coulon (DO),

DESY: J.Blümlein, W.Buchmüller, M.Klein, C.Niebuhr, A.Schwarz, C. Spiering A.Stahl, W.Zeuner,

DESY-DIR: U.Gensch, R.Klanner, D.Trines, A.Wagner,

Secretary: M.Fleischer (FHR).

Agreement on an open discussion of members with DESY users, University colleagues and DESY colleagues with the hope for important input

Until now: 4 meetings - 6.3./21.3./11.4./2.5 - next meeting 23.5 in Zeuthen
(http://www.desy.de/f/teilchenphysik/strategie/ {user: tp pw: future})

Work-packages

Following work packages were defined

HERA-Physics:	M.Klein, R.Rückl, T.Naumann,
Astro-Particle-Physics:	A. Schwarz, C. Spiering, W.Buchmüller,
LC Detector:	R-D.Heuer, A.Stahl, W.Zeuner,
R&D for SynchRad. detectors:	U. Kötz, B. Schmidt, A. Schwarz,
R&D LinAc:	R.-D.Heuer, C.Niebuhr, A. Stahl, D. Trines,
Experiments at ext. accel.:	M. Klein, A. Schwarz,
Financial constraints:	M. Fleischer, U. Gensch, R.Klanner.

with the task to study the interests, possibilities and consequences of FH-activities (HH and Z) beyond the presently approved programme (taking into account DESY's resources and mission)

in addition the view from German Universities was summarised

Mission, style and status of strategy groups at other HEP-centres

CERN, FNAL, KEK and SLAC

were presented and discussed - with the exception of the CERN-LHC the approved accelerator based HEP-programmes all end before ~ 2010 !

HERAII:

H1/ZEUS (700 authors)

- approved for HERAII programme with rich physics - given HERAII start-up delays difficult to achieve 1 fb^{-1} + some low energy running by end 2006

HERMES (175 authors)

- approved HERAII programme with rich physics - should be possible to achieve by 2006 - running beyond 2006: more good physics

HERAb (300 authors)

- successful data taking in 2002/3 but only ~ 1/10 of J/ψ – statistics,
- present strength of collaboration insufficient to resume data taking in 2003

clear statement on end HERAII needed before end 2004

DESY support running experiments at present level til end data taking then support analysis to maximise the HERAII physics output

HERAIII:

- 2 EoIs for this PRC (6./7.5.) - evaluate physics + strength of collaboration
- given financial situation + PETRAIII/XFEL comittment it appears difficult to find resources for running HERA and building a new injector

clear decision on HERAIII needed before end 2003

Several options discussed (not in too much detail):

Neutrino-masses, dark matter, dark energy, high energy cosmic rays (charged, gammas, solar neutrinos, gravitational waves, cosmic anti-matter)

In spite of the scientific interest, the link to particle physics at accelerators and its attractiveness (in particular for young scientists), it is difficult to see that a second astro-particle physics programme beyond Amanda/IceCube (in particular at HH) can fulfil DESY's mission

(not unanimous)

LC-Detector - 1

Status:

- The FLC-group (DESY-HH/UNI-HH) + DESY-Z +DESY-T is a major contributor to the European effort on LC-physics and LC-detector,
- besides FLC and Zeuthen there is already some detector R&D in the FH-groups (in collaboration with Uni/Research Institutes),
- detector R&D is an essential asset of leading HEP-laboratory,
- the DESY PRC is reviewing and monitoring LC-detector R&D projects,
- DESY has wide experience in detectors+management of large experiments.

Discussion in Strategy Group - not yet converged:

- LC not at DESY:

- DESY European co-ordination centre for detector R&D,
- DESY's own detector R&D,
- DESY's role in developing GDN (Global Detector Network),
- DESY takes responsibility for a major detector component,
- DESY European co-ordination centre for detector design and construction - or has this co-ordination been done by the lab where the LC is built (as presently usual) **???**

LC-Detector - 2

- LC at DESY:

- DESY European co-ordination centre for detector R&D until LC decision,
- DESY's own detector R&D limited once decision on LC at DESY,
- DESY's role in developing GDN (Global Detector Network),
- DESY to concentrate on detector integration and infrastructure - organisation and management

keep efforts on LC detector R&D on present level

(availabilty of test beams at DESY important!)

further strengthen the international co-ordination of LC-detector activities (including the development of GAN)

R&D Detector for SR

Collaboration on detectors, DAQ, IT, systems:

- collaboration(s) already exist (e.g. FEC-group) - in particular also between Unis and SR-labs,
- HEP-expertise on complex detectors systems, radiation-hardness, electro-nics, data-acquisition, data-storage, data analysis, ... experience with large collaborations can and should impact significantly on SR-research,
- from increased collaboration expect synergy and cross-fertilisation, which so far has not been sufficiently realised (at least at DESY),
- clear interest also from Universities - DESY can help intensify collaboration
- weakening of HERA-programme and/or LC R&D? has to be understood and the possibility of additional resources investigated,
- to better understand requirements and available expertise and interests:

Meeting ESRF + DESY(SR/HEP) + EMBL + Unis on 18./19. June at DESY

Strategy Group considers it important that DESY-HEP and DESY-SR have a co-ordinated R&D programme on detectors

R&D LinAcc

At DESY members from HEP moved to building machines (HERA, PITZ,...)

- Strategy group is of opinion that HEP-physicists from DESY should contribute to the construction of the SC-LinAcc (XFEL - LC)
- the following potential fields have been identified: high gradient programme, cavity-module-test-stand, RF-Controls, beam-diagnosis, data-acquisition and storage, controls-software, beam-simulations, GAN,
- next steps:
  - compile overview of requirements for each project,
  - find interested people/groups (including friends at Unis?),
  - understand resources required - impact on other programmes,
  - assign names and responsibilities.

Strategy Group considers it important that DESY-HEP contributes to LinAcc R&D

Work-out concrete options

Exp. at external Acc.- 1

Why?

A leading experimental HEP lab needs access to exciting data to

- produce first-rate HEP results,
- attract/keep the best in the field,
- retain the expertise - including education of scientific Nachwuchs,

Boundary conditions

- to be consistent with mission of DESY and support of its users,
- don't disperse resources outside of DESY !
- correct timing of such a programme?

Controversial discussions - still to converge!

External programmes discussed: CERN (LHC), SLAC (BaBar), KEK (Belle, JHF-neutrinos), FNAL (TeVatron), BNL (EIC).

Interests of Universities

Priorities of DESY:

1. Lab. with local HEP accelerator (HERA, LC)
2. Lab. with central co-ordination + service tasks beyond the possibilities of Universities, MPIs, ...
   - infrastructure for detector and accelerator development,
   - infrastructure and developments for computing,
   - German- (or European) co-ordination of external international projects (Amanda/IceCube)

External Project which meets the criteria of exciting first-rate physics + interest from German Universities + DESY's mission:

Japanese Hadron Facility (JHF) Neutrino Programme

Update JHFν – 1

JHFν :

- JHF proposed in 1995; ν-programme has been one of the main motivations
- 1999: ν-experiment working group formed
- 2000: EoI submitted - updated EoI Jan. 2003

  (Authors from: Japan (9 Inst.), Canada (5: Alberta, Toronto, TRIUMF, Victoria, York), France (CEA Saclay-DSM/ DAPNIA), Italy (4: Bari, Napoli, Padova, Roma), Korea (8), Poland (1) , Russia(1), Spain (2: Barcelona, Valencia), Switzerland (1: Geneva), UK (3: RAL, IC-London, U.Liverpool), USA (14))
- **stage I: 3x10^{14} 50 GeV protons-on-target every 3.5 sec (0.75 MW)**

  2^0 off axis ν-beam with E(max. int.) = 0.8 GeV (@295km - Δm^2=3 10^{-3}eV^2)
  far detector (SK), near (280m - too close?), intermediate (> 1km - 100 tons)?

Update JHFν – 2

Precision measurement Δm_{23}^2 and Θ_{23} with ν_μ-disappearance:

Discovery of $\nu_\mu \rightarrow \nu_e$ at $\Delta m^2 = 3\ 10^{-3}$ eV^2 down to $\sin^2(2\Theta_{13}) = 0.006$ with ν_e-app.

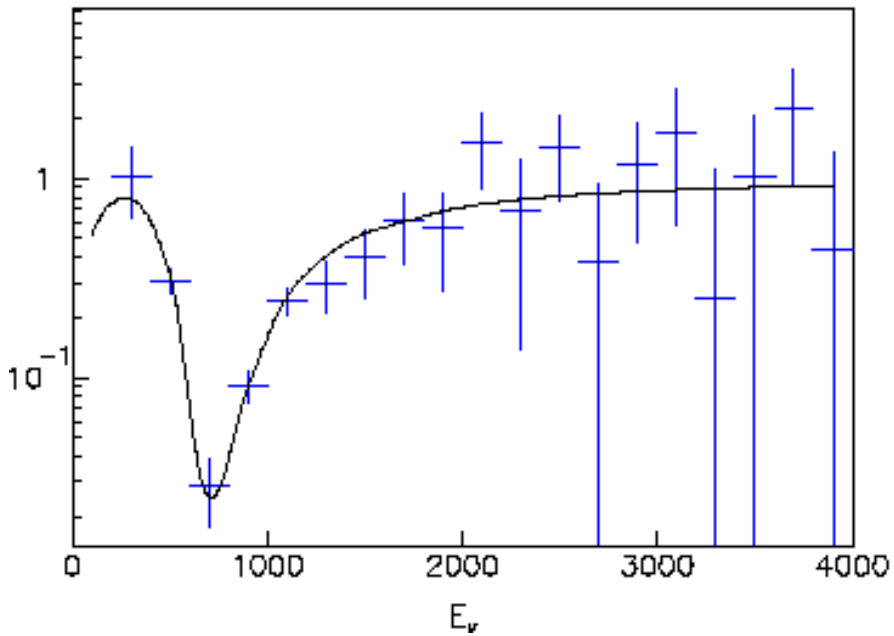


Figure 7: The ratio of the measured spectrum with neutrino oscillation to the expected one without neutrino oscillation after subtracting the contribution of non QE-events. The fit result of the oscillation is overlaid.

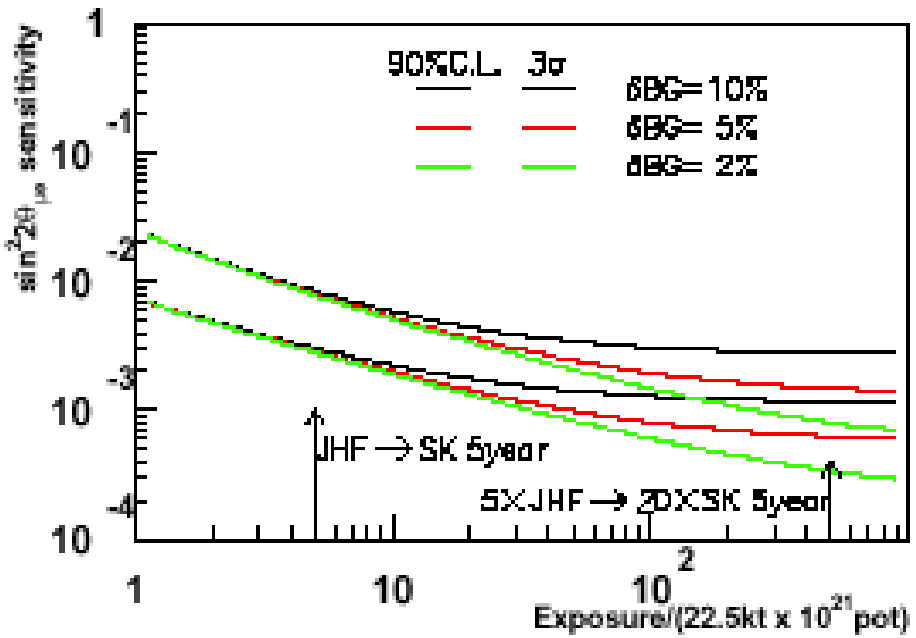


Figure 10: Left:Expected reconstructed neutrino energy distributions of expected signal+BG, total BG, and BG from ν_μ interactions for 5 years exposure of OA2°. Right: Expected (thick lines:) 90%CL sensitivity and (thin lines:) 3σ discovery contours as the functions of exposure time of OA2°. In left figure, expected oscillation signals are calculated with the oscillation parameters: $\Delta m^2 = 3 \times 10^{-3}$ eV^2,$\sin^2 2\theta_{\mu e}(effectivemixingangle = \sin^2\theta_{23} \cdot \sin^2 2\theta_{13}) = 0.05$.(see Appendix) In the right figures, three different contours correspond to 10%, 5%, and 2% uncertainty in the background estimation.

5 years x 130 days:

$\Delta m_{23}^2 = 10^{-4}$eV^2, $\Delta \sin^2 \Theta_{23} \sim 0.01$

Update JHFν – 3

Sensitive search for sterile component in ν_μ-disappearance by NC detection

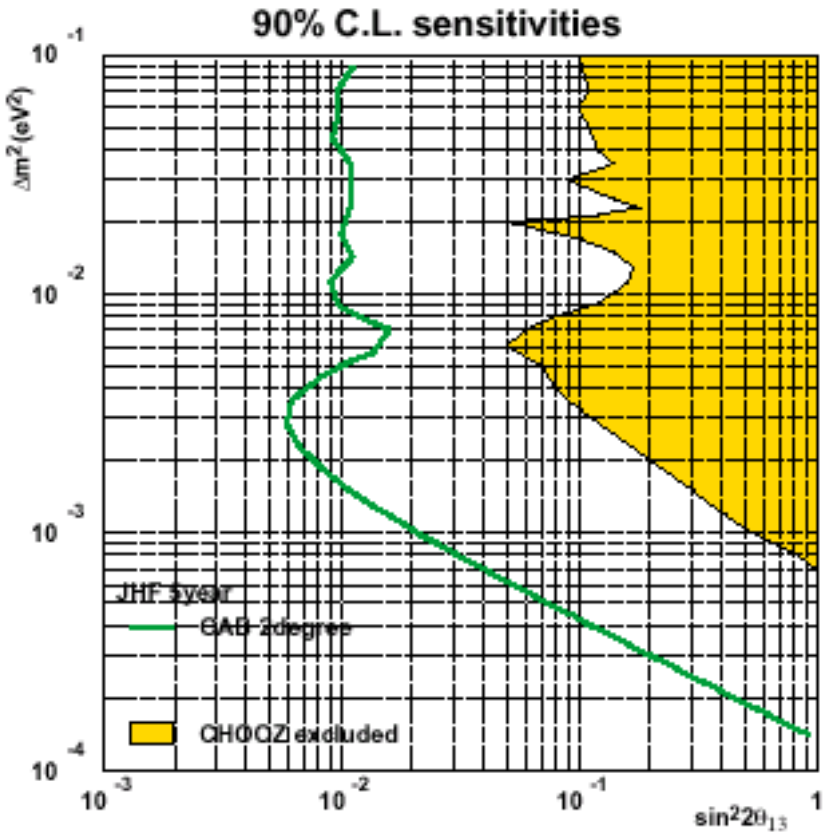


Figure 11: The 90% C.L. sensitivity contours in 5 years of operation with OA2°. The 90% C.L. excluded region CHOOZ is plotted as a comparison. $sin^2\theta_{23}$ is assumed to be 0.5 and the possible contribution due to θ_{12} term assumed to be small compared to the one due to θ_{13} term.

- **2007: ν-beam ready**
- **2008: start of experiment**
- items expected from collaboration: (fast extraction system, 50 GeV proton beam-line, proton beam monitors, target, horn, decay pipe, secondary beam monitors, near detector, intermediate detector
- EU interests: design and construction of beamline (Saclay? CH?), target with help from GSI? near detector(s)
- EU groups applying for FP-6 money: „Proposal for a European network of excellence for μ–factory and superbeams“

stage II: 0.75 → 4 MW - Tochibora Zn-mine, 500m (0.54 Mton fid.) HyperK → increase x5 (beam) x25 (detector) →

- sensitivity to $\sin^2(2\Theta_{13})$ below 10^{-3},
- sensitivity to CP phase δ down to 10-20^0,
- significant unitarity test in lepton sector,
- search for p-decay in $K^+\nu$, $e^+\pi^0$ + more.

Next steps

- Status report/discussion on Tuesday **6.5.03 17:00** in main auditorium
- **PRC (7.-8.5.)** Status HERAII, HERAIII LoI
- **WA (13.5.)** Status report/discuss
- **WR (22.-23.5.)** Presentation of status strategy discussion
- Next meeting of HEP strategy group: beginning of June → discussion on resources
- Discussion with heads of strategy groups at other labs / research directors at LP-conference at FNAL
- **Sept. 03:** 0^{th} version of a report
- **Nov. 03:** Report for 2004 HGF-Evaluation of FB Structure of Matter

Many thanks to all the members of the committee and the DESY users for the input into the strategy discussion