NED Status Report

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On behalf of the NED Collaboration

KEK
9 March 2004

6th Framework Program

- At the Lisbon Summit in March 2000, EU governments called for a better use of European research efforts through the creation of an internal market for science and technology.
- The so-called 6th Framework Program (FP6) is the financial instrument to help make this market a reality.
- The total budget of FP6 is 17.5 billions euros to be distributed across the various fields of science and technology.

ESGARD

- In October 2002, the European Committee for Future Accelerators (ECFA) set up the European Steering Group for Accelerator R&D (ESGARD).
- The main mandate of ESGARD, chaired by Roy Aleksan (CEA/Saclay), is to prepare of coherent set of bids to apply for EU funding (http://esgard.lal.in2p3.fr).

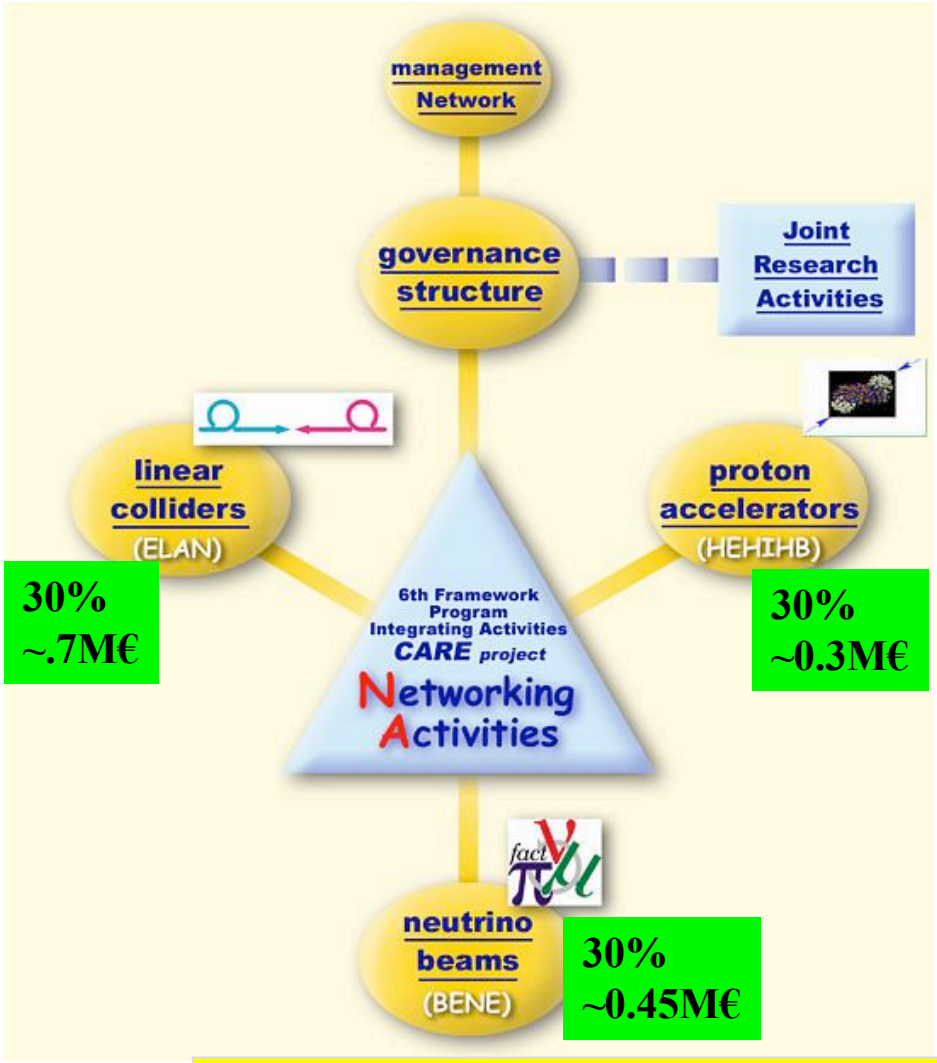
CARE

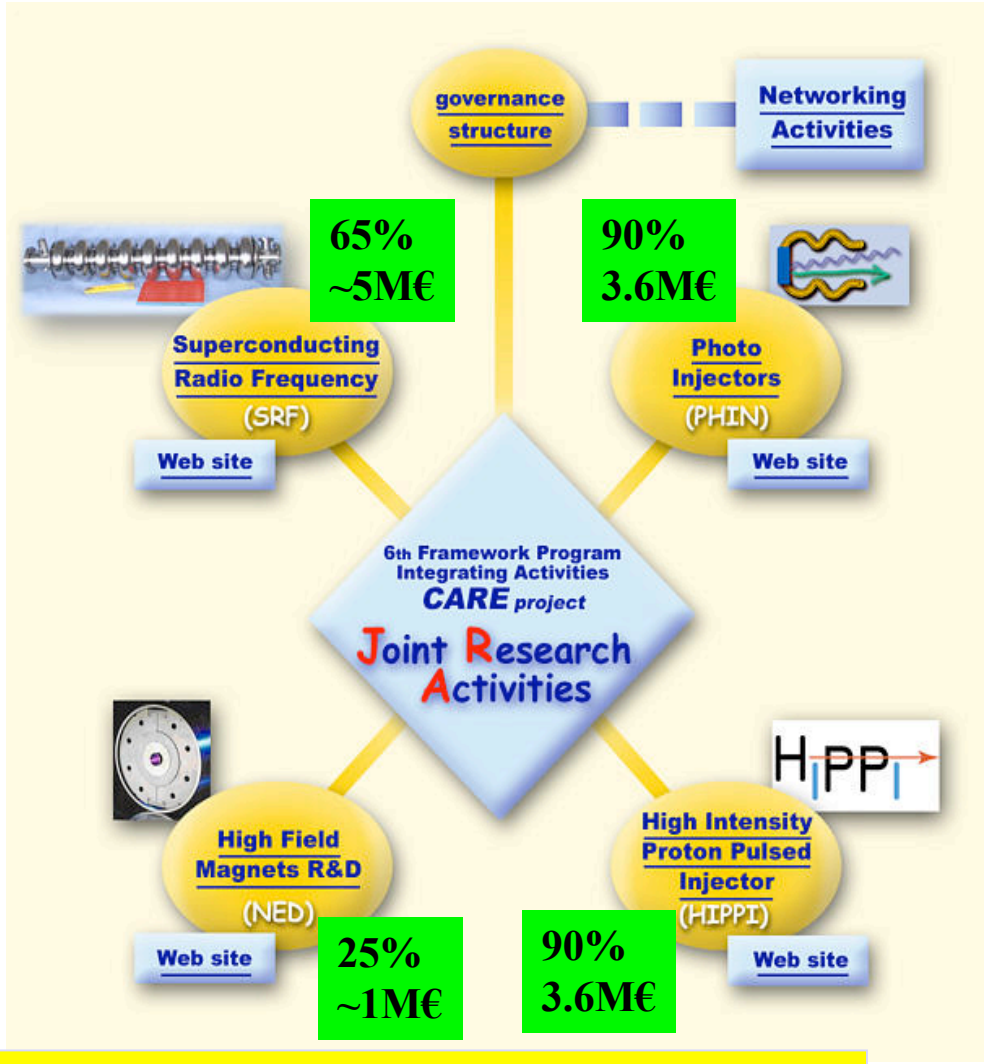
- The first outcome of ESGARD is the Coordinated Accelerator Research in Europe (CARE) proposal of Integrated Acitivies (IA), that was submitted to the EU on April 15, 2003.
- The CARE proposal integrates all HEP-related accelerator R&D in Europe and is supported by more than 100 Institutes.
- It was accepted in July 2003 and has been revised to meet the funding profile allocated by the EU (amounting to a total of 15.2 M€).
- The final contract has been signed in the and work has begun on January 1st, 2004.

Result of the evaluation process

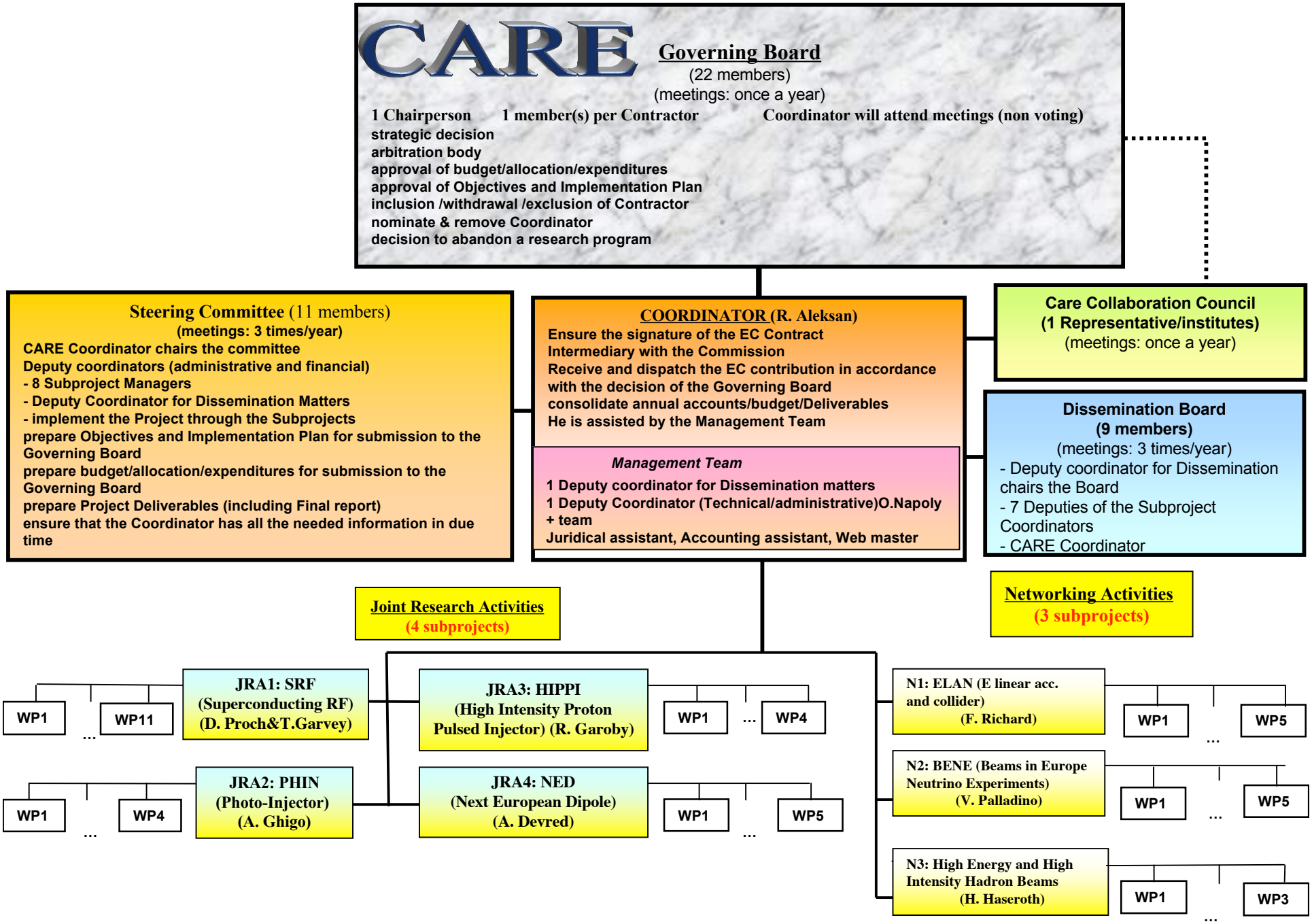
CARE ranked at the 14th position out of 154 project (5th rank of the 58 IA)

CARE is accepted





CARE is recommended for funding at the maximum level of 15.2 M€ (i.e. 52% of initial request) in the Evaluation Summary Report (ESR)


CARE
Governing Board
(22 members)
(meetings: once a year)
1 Chairperson
1 member(s) per Contractor
Coordinator will attend meetings (non voting)
strategic decision
arbitration body
approval of budget/allocation/expenditures
approval of Objectives and Implementation Plan
inclusion /withdrawal /exclusion of Contractor
nominate & remove Coordinator
decision to abandon a research program
Steering Committee (11 members)
(meetings: 3 times/year)
CARE Coordinator chairs the committee
Deputy coordinators (administrative and financial)
- 8 Subproject Managers
- Deputy Coordinator for Dissemination Matters
- implement the Project through the Subprojects
prepare Objectives and Implementation Plan for submission to the Governing Board
prepare budget/allocation/expenditures for submission to the Governing Board
prepare Project Deliverables (including Final report)
ensure that the Coordinator has all the needed information in due time
COORDINATOR (R. Aleksan)
Ensure the signature of the EC Contract
Intermediary with the Commission
Receive and dispatch the EC contribution in accordance with the decision of the Governing Board
consolidate annual accounts/budget/Deliverables
He is assisted by the Management Team
Management Team
1 Deputy coordinator for Dissemination matters
1 Deputy Coordinator (Technical/administrative)O.Napoly + team
Juridical assistant, Accounting assistant, Web master
Care Collaboration Council
(1 Representative/institutes)
(meetings: once a year)
Dissemination Board
(9 members)
(meetings: 3 times/year)
- Deputy coordinator for Dissemination chairs the Board
- 7 Deputies of the Subproject Coordinators
- CARE Coordinator
Joint Research Activities
(4 subprojects)
Networking Activities
(3 subprojects)
JRA1: SRF
(Superconducting RF)
(D. Proch&T.Garvey)
WP1
WP11
JRA2: PHIN
(Photo-Injector)
(A. Ghigo)
WP1
WP4
JRA3: HIPPI
(High Intensity Proton Pulsed Injector) (R. Garoby)
WP1
WP4
JRA4: NED
(Next European Dipole)
(A. Devred)
WP1
WP5
N1: ELAN (E linear acc. and collider)
(F. Richard)
WP1
WP5
N2: BENE (Beams in Europe Neutrino Experiments)
(V. Palladino)
WP1
WP5
N3: High Energy and High Intensity Hadron Beams
(H. Haseroth)
WP1
WP3

HEHIHB Network

- The HEHIHB network includes a Work Package on Accelerator Magnet Technology (AMT), coordinated by L. Rossi (CERN).
- Within the framework of AMT, L. Rossi is organizing a workshop on superconducting materials, from March 22-24, in Archamps, France (by invitation only).

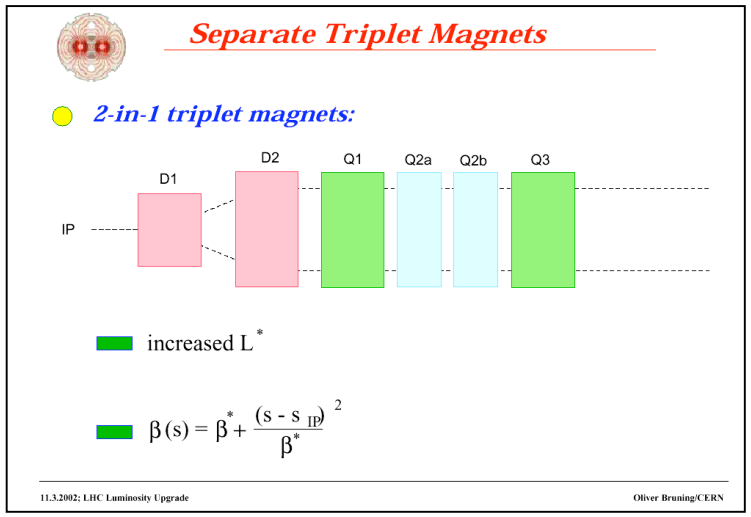
NED JRA

- The ultimate goal of the NED JRA is to build a large aperture (up to 88 mm), high field (up to 15 T) dipole magnet model.
- A. den Ouden is setting up a web page

  www.tn.utwente.nl/lt/project.php?projectid=9

NED Applications

- The proposed magnet model served two main purposes



— (1) preparing LHC IR upgrade, *e.g.*, by studying the feasibility of scenarios where the beam-separation dipole magnets are localized ahead of the final-focusing quadrupole magnets,

— (2) upgrade of CERN MFRESCA cable test facility (presently limited to 10 T) to offer unique services to the entire applied superconductivity community.

- Also, it was complementary to the US-LHC Accelerator Research Program (LARP), whose primary focus is on quadrupole magnets.

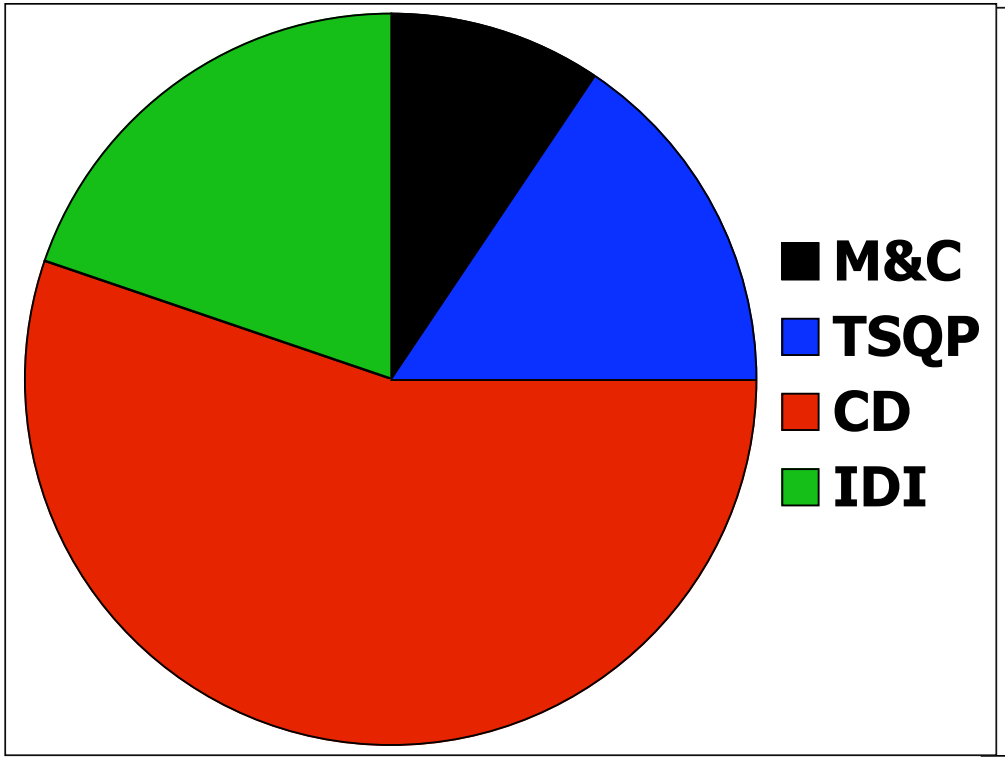
Current Status

- Following EU recommendations, the NED program has been divided into two phases
  - Phase I groups together all the tasks related to conductor development and includes some limited studies on conductor insulation,
  - Phase II groups together all the tasks related to the detailed design, manufacturing and test of a large-aperture (up to 88 mm), high-field (up to 15 T) dipole magnet model.
- Phase I has been approved as part of the CARE project (~13 staff.year over 3 years; total cost: ~2 M€; allocated EU funding: 979 k€).
- A strategy is being devised among NED collaborators to find the funding necessary to carry out Phase II (~22 staff.year, material costs: ~1.2 M€).

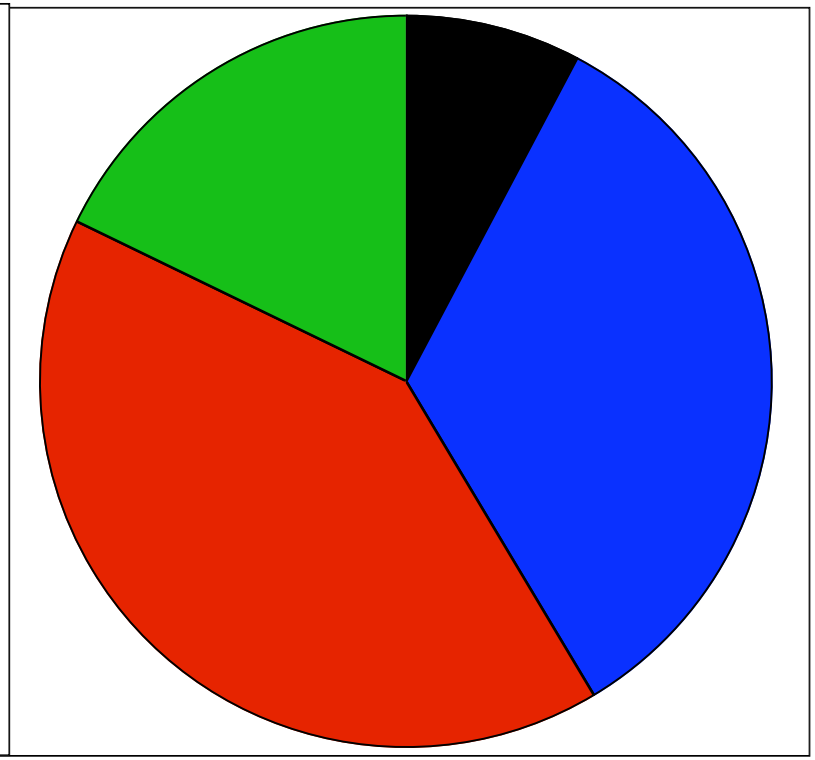
NED Phase I

- The Phase I of the NED Program is articulated around four Work Packages
    1. Management & Communication (M&C),
    2. Thermal Studies and Quench Protection (TSQP),
    3. Conductor Development (CD),
    4. Insulation Development and Implementation (IDI).
- The Activity is coordinated by A. Devred (CEA & CERN), helped by A. den Ouden (Twente University).

Cost and Manpower Distributions Among NED WP



Total Expected Costs
(2,093 k€)

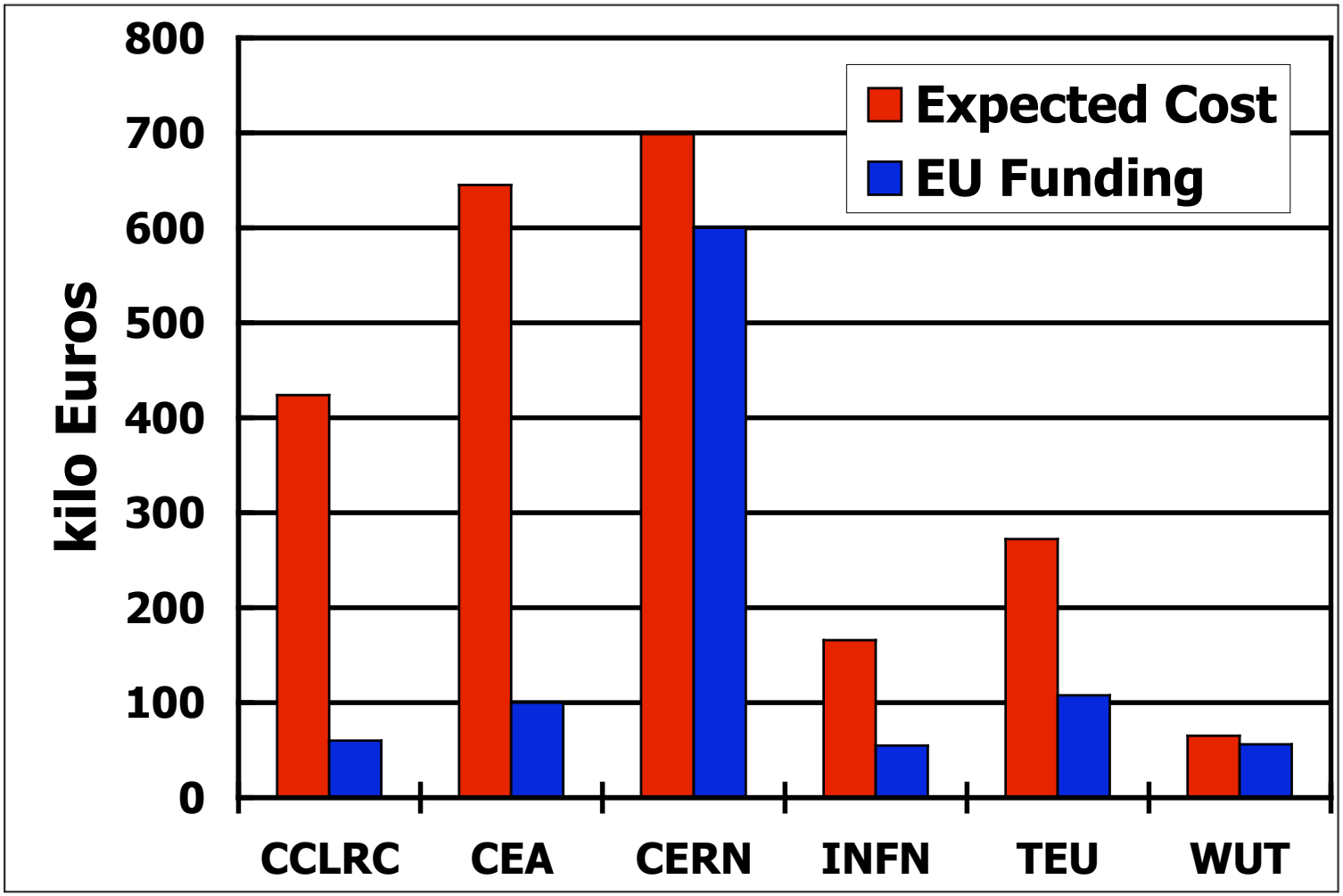


Total Manpower
(152 staff.month)

NED Collaborators

- Six institutes have agreed to collaborate to NED
  - — CCLRC/RAL (UK),
  - — CEA/DSM/DAPNIA (France),
  - — CERN/AT (International),
  - — INFN/Milano-LASA & INFN/Genova (Italy),
  - — Twente University (the Netherlands),
  - — Wroclaw University (Poland).
- A seventh institute (CIEMAT, Spain) has expressed interest in joining the collaboration and is ready to commit 1.5 staff.year of manpower to Phase I and to contribute significantly to Phase II.

Cost and EU Funding Sharing Among NED Collaborators

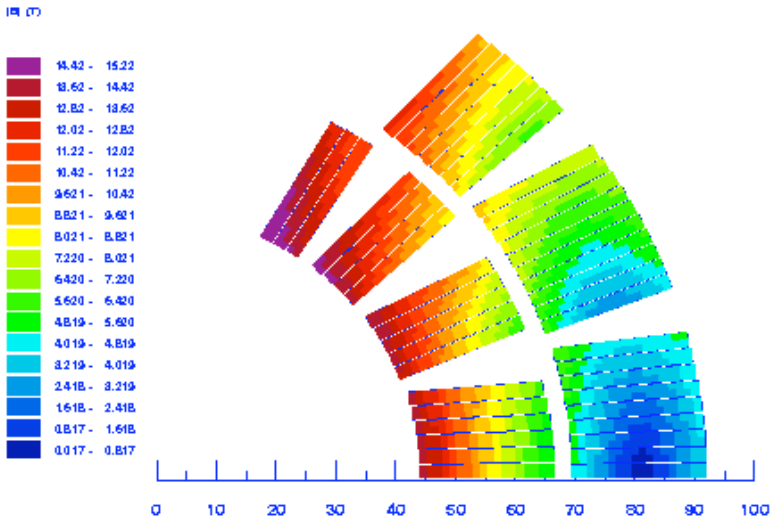


CD Work Package

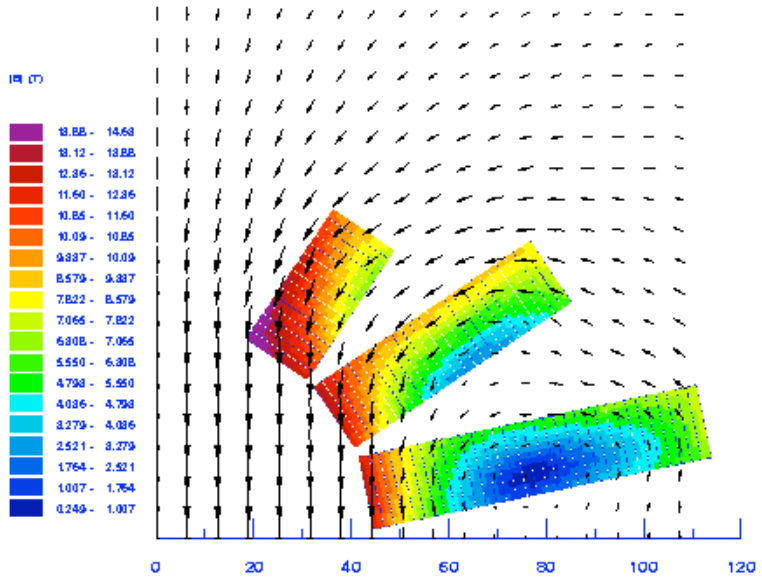
- The CD Work Package is divided up into seven Tasks
  - 3.1 Work Package coordination
  - 3.2 Preliminary magnet design aimed at deriving meaningful specifications (CERN/AT)
  - 3.3 Conductor specifications (CERN/AT)
  - 3.4 Wire development (two industrial sub-contracts, investigating two different manufacturing processes under CERN/AT supervision)
  - 3.5 Wire characterization (CEA/DSM/DAPNIA, INFN/Milano-LASA and /Genova, Twente University)
  - 3.6 Cable development (under CERN/AT supervision)
  - 3.7 Cable Characterization (Twente University)
- It is coordinated by D. Leroy (CERN/AT).

Task 3.2: Preliminary Magnet Design (1/2)

• Olivier Vincent-Viry (CERN/AT) has studied several magnetic designs to achieve ~15 T in a 88-mm aperture



Conventional cosθ design



Motor-type block design

Task 3.2: Preliminary Magnet Design (2/2)

- Results will be published in a report due in March 2004.
- They converge towards the following pre-specifications
  - same cable for all conductor blocks, one strand type
  - strand diameter: 1.25 mm,
  - Cu-to-non-Cu ratio: 1.25,
  - J_C-non-Cu: 1500 A/mm^2 at 4.2 K and 15 T,
  - effective filament diameter < 50 μm (no flux jump),
  - Cu RRR > 70,
  - cable interstrand resistance: TBD,
  - quantity: 500 m of cable, corresponding to ~10 km of wires.

Tasks 3.3, 3.4 & 3.6: Conductor Development (1/4)

- A market survey had been carried out by D. Leroy in early 2003 to which three manufacturers had answered positively
  - Alstom/MSA (France),
  - European Advanced Superconductors (formerly Vacuumschmelze, Germany)
  - ShapeMetal Innovation (the Netherlands)
- The manufacturers had agreed to contribute financially to the Program by at least matching the EU funding.
- EAS and SMI had declared they would study the possibility of forming a joint venture.

Tasks 3.3, 3.4 & 3.6: Conductor Development (2/4)

• A. Devred and D. Leroy have made three preparatory visits to the manufacturers having answered positively to the market survey

– 12 December 2003: Alstom/MSA
(with T. Boutboul and L. Oberli, CERN/AT),

– 15 December 2003: EAS
(with L. Oberli, CERN/AT, and a SMI representative),

– 27 January 2004: SMI
(with T. Boutboul and L. Oberli, CERN/AT, A. Unerwik, CERN/FI, A. den Ouden, TEU and two EAS representatives).

Tasks 3.3, 3.4 & 3.6: Conductor Development (3/4)

- The manufacturers confirmed that our goals were ambitious but feasible.
- Alstom/MSA, on one side (internal tin process), and EAS/SMI, on the other side (PIT process), are developing a strategy to achieve our goals with a methodology scalable to industrial production.
- EAS and SMI are talking to each other and we have reasonable hope that they will respond to our call for tender as a consortium.

Tasks 3.3, 3.4 & 3.6: Conductor Development (4/4)

- The next milestones of the Conductor Development Tasks are
  - ongoing: preparation of conductor specifications,
  - mid-may 2004: call for tender (extended to all EU manufacturers),
  - June 30, 2004: contracts' handout.
- CERN/AT has identified T. Boutboul as the main person responsible for the follow-up of the industrial contracts.

Task 3.5: Wire Characterization (1/3)

- The NED JRA management has decided the creation of a Working Group on Wire Characterization, that will be chaired by A. den Ouden (TEU).
- The Working Group will include
  - one representative from each laboratory involved in the measurements (CEA/DSM/DAPNIA, INFN/Milano and /Genova, TEU)
  - the CERN person responsible for industrial contract follow-up,
  - one representative from each industrial sub-contractor.

Task 3.5: Wire Characterization (2/3)

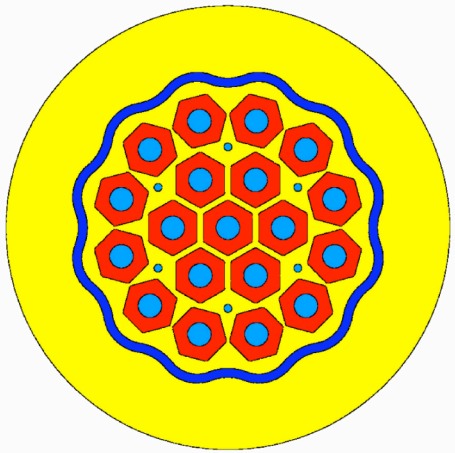
- The charges of the Working Group are
  - to establish an inventory of existing facilities among NED collaborators,
  - to define standardized procedures to characterize the transport-current and magnetization properties of virgin, deformed and extracted wires,
  - to develop and carry out a program of cross-calibration of the various facilities for critical current measurements,
  - to certify the measured data throughout the execution of Task 3.5.

Task 3.5: Wire Characterization (3/3)

- The main milestones and expected deliverables of the Working Group are
  - 25 March 2004: Working Group installation,
  - 30 June 2004: procedures (to be included in industrial sub-contracts) and cross-calibration program,
  - 31 December 2004: report on cross-calibration program,
  - 30 June 2005: first characterization results,
  - 30 December 2005: interim report on wire characterization *(EU Milestone),*
  - 30 June 2006: final report on wire characterization *(EU Deliverable).*

Missing Tasks of CD Work Package

- Two important Tasks have been deleted from the initial proposal
  - pre-reaction studies,
  - mechanical studies.



Numerical model
of internal tin wire
(Courtesy S. Farinon)

- INFN/Genova has agreed to develop FE models of wires to compute the stress/strain distributions upon transverse loading and simulate the effects of cabling.

Preparing for Phase II (1/2)

- The main issue regarding Phase II remains to find the money to put the cables produced in Phase I into a real magnet.

- Grant applications are being submitted to the Dutch Technology Foundation (STW), the French Ministry of Research and INFN.

- Contacts have been taken with Robert Aymar, who became CERN Director General on January 1st, 2004.

Preparing NED Phase II (2/2)

• Preliminary discussions with CIEMAT have shown that they were also interested in participating to NED Phase II (detailed design and manufacturing of model magnet).

• For instance, they would be ready to ask a grant from the Spanish government to cover the material costs needed to manufacture NED coils (~250 k€) and CIEMAT would contribute the manpower to do the job.

• As CIEMAT has little experience with Nb_3Sn technology, they need some training, which could be done by associating them to ongoing programs at CEA/DSM/DAPNIA and TEU.

• Once the coils are manufactured, it should be easier to convince one of the big laboratories to complete model magnet assembly.

Looking Ahead

- The NED project offers a unique opportunity to integrate all accelerator magnet R&D efforts in Europe towards an ambitious goal.
- The coming of Kei Sugita to Saclay next June may enable us to set up some long term work relationship with KEK in the area of high field accelerator magnets.

Preparing NED Phase II (2/2)

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