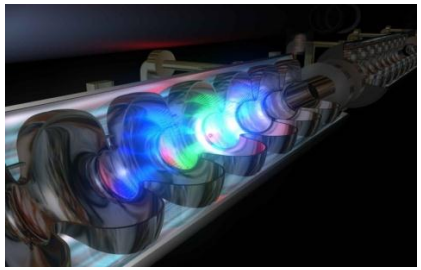
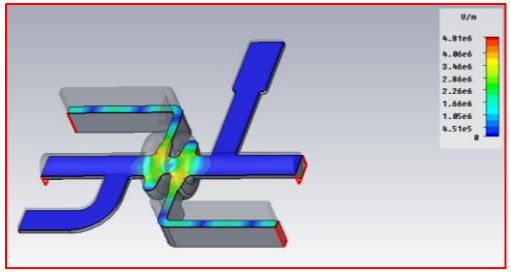
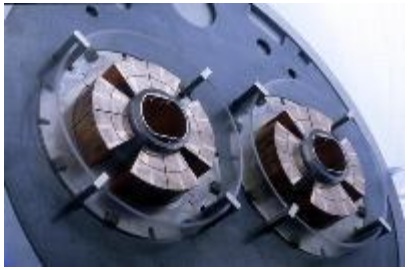
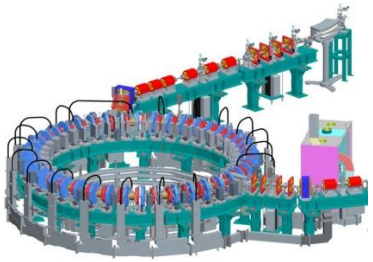




The European Collaboration for Accelerator R&D EuCARD

Status of EuCARD & EuCARD2





J.P. Koutchouk, Project Coordinator, CERN

What is EuCARD?

A joint venture of 38 European « legal entities » representing some 43 accelerator laboratories, universities, research centers and 3 private companies,

To which about 40 laboratories and universities are *associated* **worldwide** through networks,

Taking the form of a **FP7 « Integrating Activities » 4-year** project (1 April 2009 – 31 March 2013), including

- R&D (87%),
- networking (10%)
- and open access to two facilities (« Transnational access », 3%).

Additional charge by the EC: Contribution to the emergence of sustainable collaborative structures in the field of accelerator research and development.

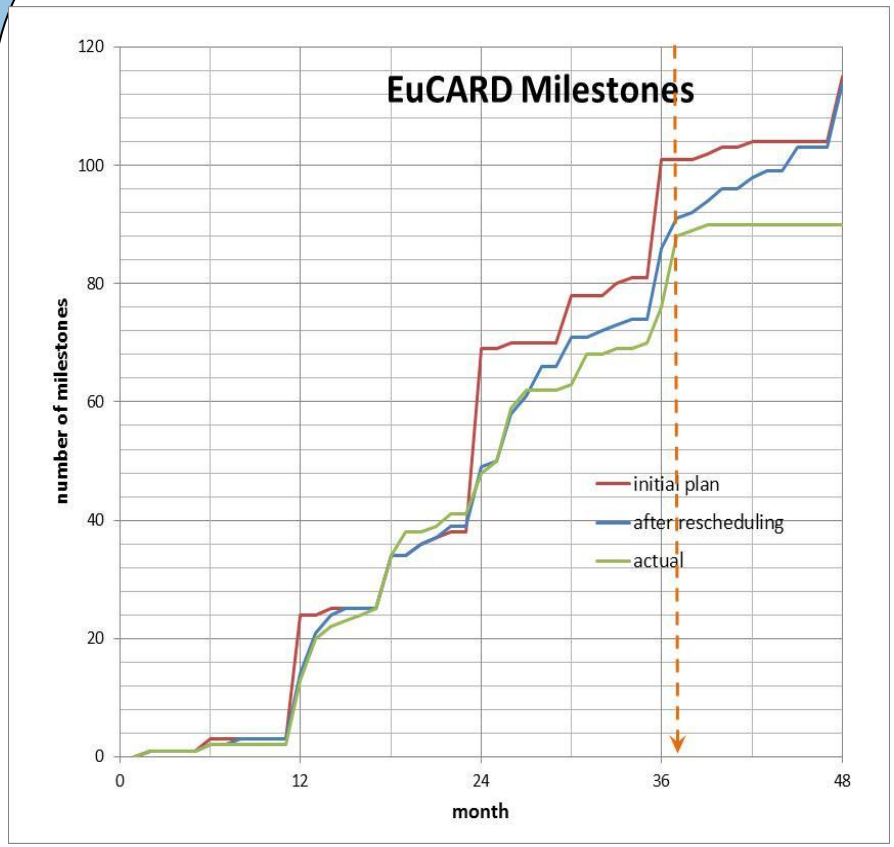
The architecture of EuCARD

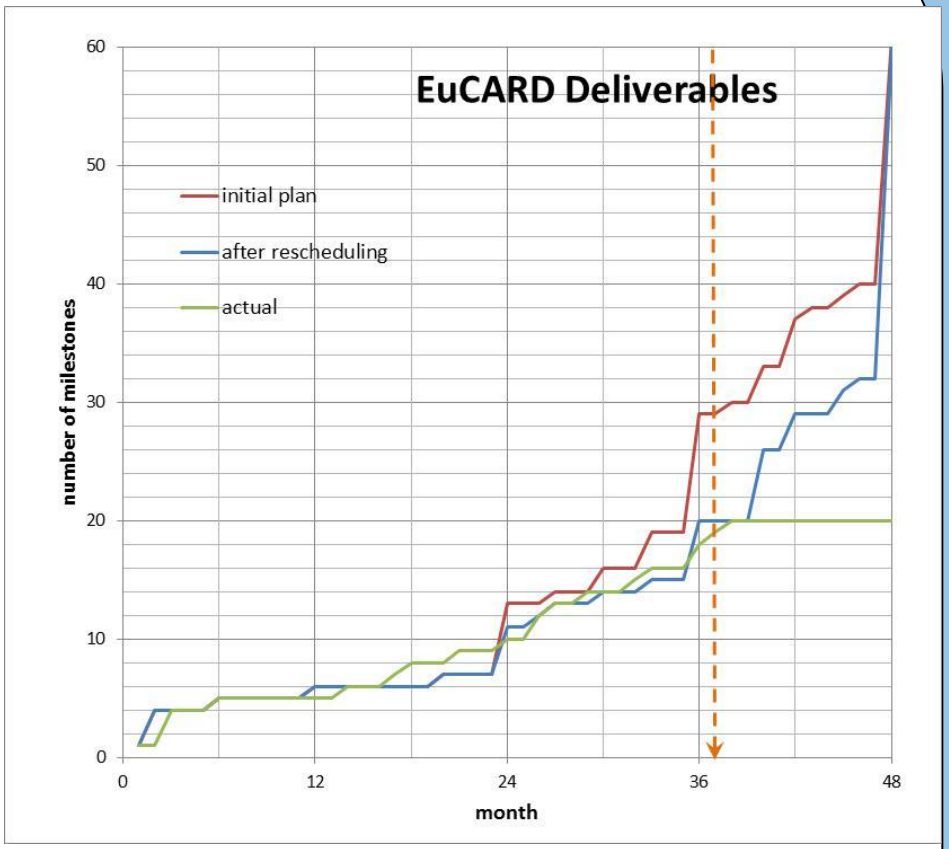
1	MGT	J.P. Koutchouk, F. Zimmermann, S. Stavrev/CERN	0.2%
2	Dissemination	R. Romaniuk/WUT, K. Kahle/CERN	1.5%
3	Neutrino network	V. Palladino/U. Napoli	3%
4	Accelerator sciences networks	F. Zimmermann/CERN, P. Spiller/GSI, V. Scandale/CNRS	6%
5	Access to HiRadMat@SPS	I.Efthymiopoulos/CERN	0.5%
6	Access to MICE	N. McCubbin/STFC-RAL	2%
7	High Field Magnets	G. De Rijk/CERN, F. Kircher/CEA	21%
8	Collimation & Materials	R. Assmann/CERN, J. Stadlmann/GSI	12.8%
9	NC linac technologies	E. Jensen/CERN, G. Blair/RHUL,	20%
10	SC RF technologies	O. Napoly/CEA, O. Brunner/CERN	24%
11	Novel concepts	M. Biagini/INFN, R. Edgecock/STFC-RAL	9%

EuCARD figures

Total budget	31 M €
EC funding	10 M €
EC funding vs direct costs	~ 50%
FTE's	~50
Registered individual members	~270

The EuCARD dashboard

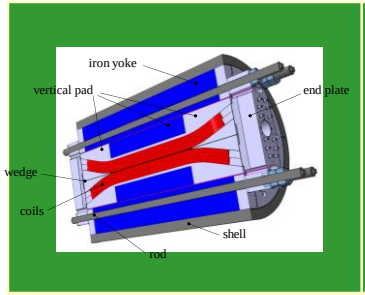




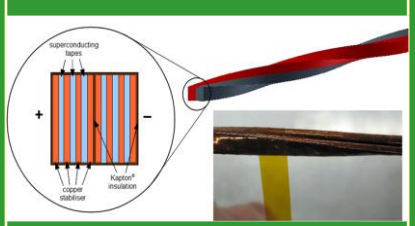
Conf. papers	Presentations	Journal publications	Notes, reports	Academic theses	Books	TOTAL
179	63	49	53	5	8	357

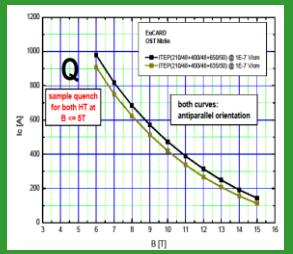
On average, > 2 publications/FTE/year

WP7 High Field Magnets





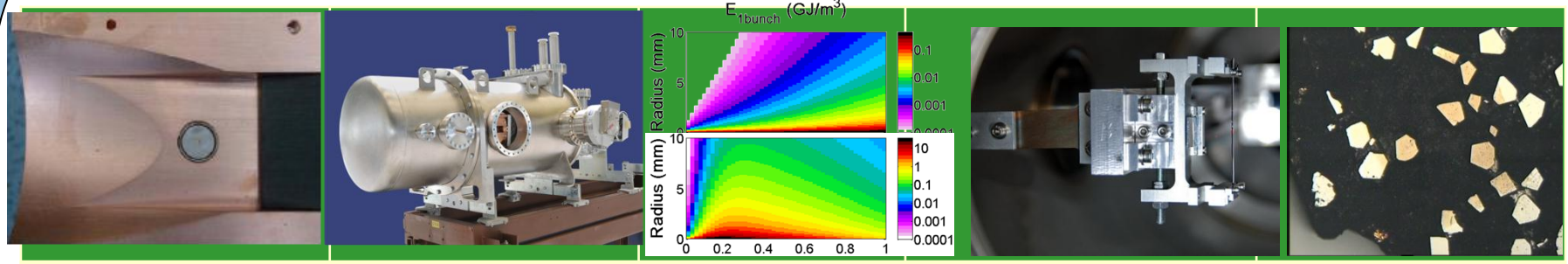




- **13 T magnet**: Certification for radiation resistance defined and on-going; thermal magnet model says design OK and ramping time 2 days; review of 13T magnet says study well mastered but **delay expected of 1.5 years.**
- **Booster inserts:** YBCO solenoids allowed debugging splicing; expected delay of 6 months on dipole. Quench protection remains a challenge.
- **HTS links**: Fast progress
- **Nb3Sn undulator** : suffers from instabilities: cable changed.

EuCARD2: Same ultimate goal of 20 Tesla, but with all requirements of an accelerator magnet: larger beam aperture, high field quality. In addition to YBCO, Bi2212 is as well investigated for the booster HTS inserts.

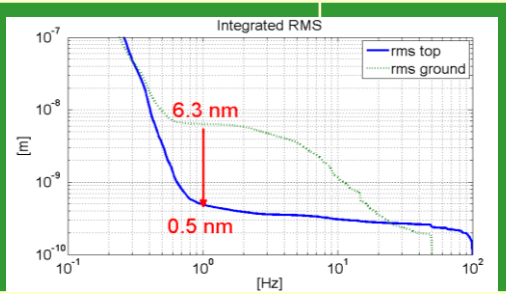
WP8 Collimators & Materials

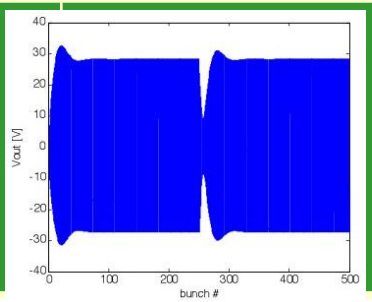


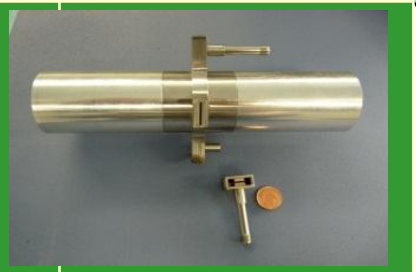
- **Collimators**: LHC smart collimator and FAIR cryocatcher both studied, built, installed and tested with beam.
- **Collimation efficiency**: LHC and FAIR collimation efficiency studies by simulations.
- **Robustness under beam impact**: by simulation. Channeling up to 25 m in C for the LHC beam!
- **Alternative collimation**: Crystals manufactured in INFN, tested at the SPS/CERN: substantial reduction of secondary interactions.
- **Robust materials**: characterization of diamond composite materials

EuCARD2: leave the collimators proper for the labs and focus on the multi-disciplinary studies of efficiency, robustness and materials.

WP9 NC Linacs







- **CLIC technologies**: Validation of double-length PETS (CIEMAT); DDS designed and shown feasible (UNIMAN); Phase control to 20 fs (INFN, CERN, PSI)
- **RF breakdowns:** voids & dislocations under the surface shown to allow migration of dislocations to the surface, acting as breakdown sources (UH + UU).
- **Sub-nanometer stabilization** (CERN and CNRS-LAPP) and nanometer-scale feedback FONT (UOXF).
- **BDS for LC's**: complex and tight beam control (RHUL).

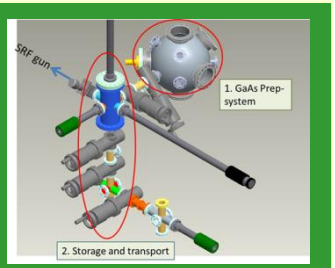
EuCARD2: Single WP on nc and sc RF technologies, including some nc topics:

- Continuation of studies on alternative CLIC structures (DDS)
- X-band power test facility
- WF measurements, LLRF & control electronics
- CLIC Crab cavities: 2nd iteration and phase stabilization

WP10 SRF technologies



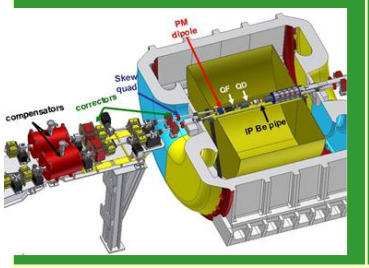


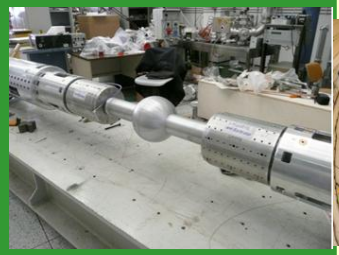


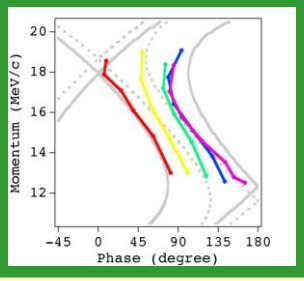
- **RF cavity and coupler studies**: proton linac, LHC and CLIC crab cavities on good tracks to be completed in time, including couplers and LLRF for the two latter. Automated processing of couplers progressing with a delay.
- **HOM signals**: characterization of beam and cavity alignment based on HOM signals progressing well. Simulations, experiments on FLASH.
- **LLRF for FLASH**: new system based on µTCA tested, to be installed on FLASH this month.
- **Thin films & photocathodes:** systematic studies on-going.

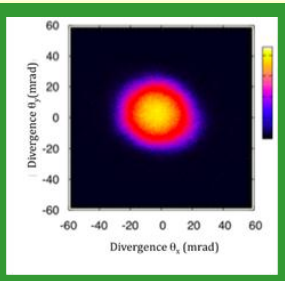
EuCARD2: enhance the research on thin-film coated RF cavities and photocathodes. Continue with HOM beam diagnostics.

WP11 Novel Concepts









- Design & construction of DAFNE IR with crab waist & KLOE detector solenoid done.
- EMMA instrumentation line and commissioning done.
- Emittance measurement monitor for divergence dominated electron beams from LPWA done with reasonable accuracy.

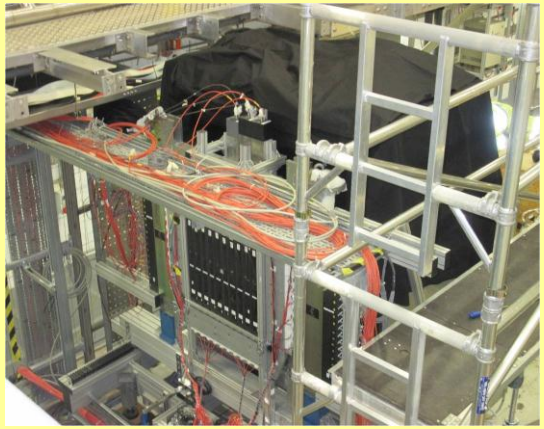
EuCARD2: Increase the focus on Plasma Wakefield Acceleration with laser-driven and proton-driven PWA. Include one task on ultra-fast S/T at femtosecond level.

WP5&6 Transnational access

- ***HiRadMat@CERN now operational***

First access units allocated. Expect to deliver ~ 80% of contractual units

- ***ICTP (former MICE@STFC)***



All EC funding allocated (70% more access units than contract) Users are MICE collaborators: INFN, Bulgaria, UNIGE

Test of Electron Muon Ranger in ICTP

EuCARD2: 3 TA's: keep both and add **MagNet@CERN**.

WP 3& 4 Neutrino & accelerator NAs

- Very convincing roadmap for future neutrino facilities presented in EuCARD2012.
- The Accnet networks, taking over from CARE-HHH, have become the place to talk about accelerators (**projects**: HELHC, (HLLHC), **technologie**s: crab cavities & other RF technologies, *synthesis on SC RF*, **physics**: electron cloud,…) in EU and beyond (Japan, US, Russia,…)
- *New AccNet network on plasma wakefield acceleration in activity.*

EuCARD2: Accnet, focusing on hadron colliders and RF in EuCARD, extended to **all performance frontiers** (XBEAM). Dedicated neutrino facility network discontinued. RF technologies in XBEAM and new network on energy efficiency. **PWA NA** included and funded.

WP 1& 2 Management & Communication

- *Smooth running of these WP's*
- *Very positive mid-term review*
- *EuCARD quarterly newsletter converted to a newsletter for 4 FP7 accelerator projects (EuCARD, EURONU, HiLumi LHC and TIARA). First issue published in April. Agreed to be taken over by TIARA to be made sustainable and gradually extended to the whole accelerator R&D community.*
- *EuCARD monographs (~ 11 published), to be taken over by EuCARD2.*

EuCARD2: WP1 & WP2 combined in same WP with same staff except new PC: Maurizio Vretenar/CERN. In EuCARD, CERN is not funded for management but funded for S/T work. In EuCARD2, it will be the opposite.

The architecture of EuCARD2

1	**MGT& Communication**	**M Vretenar/CERN** + CERN & WUT	8.3%
2	**Innovation & TT**	**G. Anelli/CERN**	1.4%
3	**En. Efficiency**	**M. Seidel/PSI** + ESS, CERN, KIT,GSI	4%
4	**Acc. applications**	**R. Edgecock/HUD** + PSI, CERN, INFN, UNIMAN	4%
5	**Acc. performance**	**F. Zimmermann/CERN** +GSI, ESS, INFN, Mainz	4%
6	**Low emittance rings**	**Y. Papaphilippou/CERN** + INFN, UOXF, PSI, SOLEIL	4%
7	**Novel accelerators**	**R. Assmann/DESY** + X Paris, DESY, CERN	4%
8	**TA ICTF@STFC**	**N. MacCubbin/STFC**	3.3%
9	**TA HiRadmat@CERN** **TA MagNet@CERN**	**I. Efthymiopoulos, M. Bajko/CERN,**	5.5%
10	**HFM**	**L. Rossi/CERN + CEA, CERN INFN**	17%
11	**Collimation**	**J. Stadlman/GSI** + CERN	8%
12	**RF technology**	**P. McIntosh/STFC** + CEA, CERN, IPJ	26%
13	**Novel concepts**	**V. Malka/CNRS** + LLC, DESY, UCL	11%

The new features in EuCARD2

- *An Innovation and TT network, requested by EC*
- ***The importance of networks is enhanced: 9% EC funding in EuCARD → 20% in EuCARD2, with:***
  - ***Energy efficiency New!***
  - ***Accelerator applications (medical, industrial,…) New!***
  - ***Accelerator performance: EuCARD AccNet extended to all accelerators***
  - ***Low emittance rings: New!***
  - ***Plasma wakefield acceleration: EuCARD initiative taken over***
- ***The reduction of the JRA funding leads to the selection of the most high gain/high risk research topics.***
- *The new CERN EC-funding principle aims at enhancing the participation especially of Universities and smaller Institutes.*

Status of EuCARD2

- ***Proposal for IA EuCARD2 extending over the period 2013-2017 submitted in Nov. 2011, requesting an EC funding of 10 M€ for a total budget of 28 M€.***
- ***Scored 14/15, favorably evaluated and placed on stand-by for negotiation.***
- ***Negotiation expected this summer, after the approval of the 2013 EC budget.***
- ***Signals received of a likely reduction of the EC contribution by up to 20%.***
- ***EuCARD2 preparation team active in setting priorities and preparing scenarios to adjust the project to the available EC funding.***

Conclusions

- *Out of the 35 tasks and 60 deliverables, no show-stopper identified so far that would prevent reaching important S/T goals.*
- *A few of these goals however are planned to be reached after the termination of the project: maximum delay is 1.5 years for the 13T magnet model, followed by 0.5 years for the booster inserts.*
- *EuCARD will finish on March 31, 2013 for the scientific work, as foreseen. Some deliverables will be redefined. A small extension will be requested for the Final Meeting to come after scientific reporting, combined with the EuCARD2 kick-off. The financial reporting will hence be delayed by 2 to 3 months.*
- *EuCARD, with a special effort in communication & collaborative dimension, is contributing to tightening the links in the EU accelerator community, with non-EU partners and with the EC. EuCARD2 will take over, capitalizing on experience.*