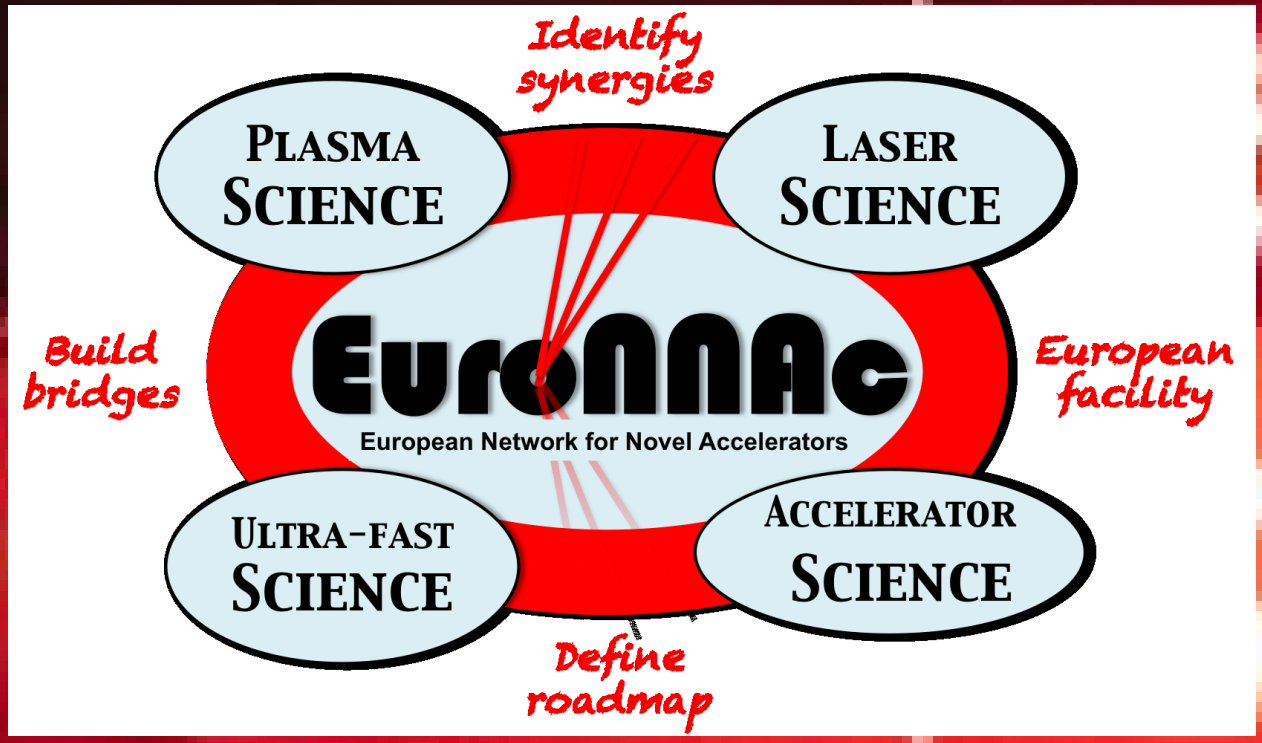
EuroNNAc

(European Network for Novel Accelerators)



Picture courtesy Andreas Tünnermann

R. Assmann, CERN

EuCARD Yearly Meeting

Paris, May 11 – 13, 2011

Introduction

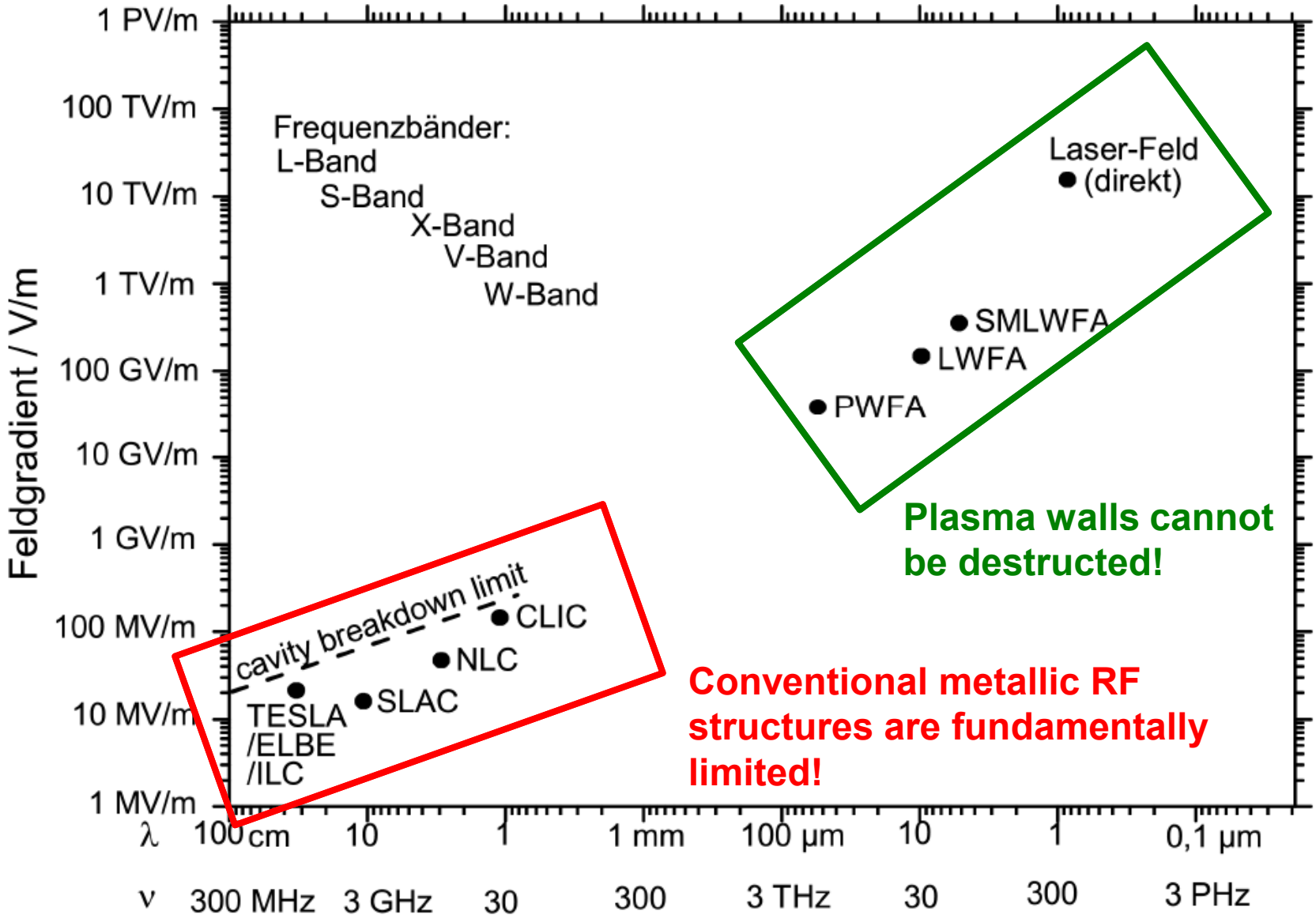
- EuroNNAc = “European Network on Novel Accelerators”.
- It is part of EuCARD and one of the AccNet networks.
- Coordinators: R. Assmann (EuCARD, CERN), J. Osterhoff (U. Hamburg, DESY), H. Videau (ecole Polytechnique)
- Scope: “**Plasma wakefield acceleration and direct laser acceleration for electrons and positrons**”. Includes laser, electron, proton drivers!
- Progress:
  - Dec 2010: Organization committee formed.
  - April 2011: Paris meeting of organization committee.
  - May 2011: CERN forming workshop of EuroNNAc.

EuroNNAc

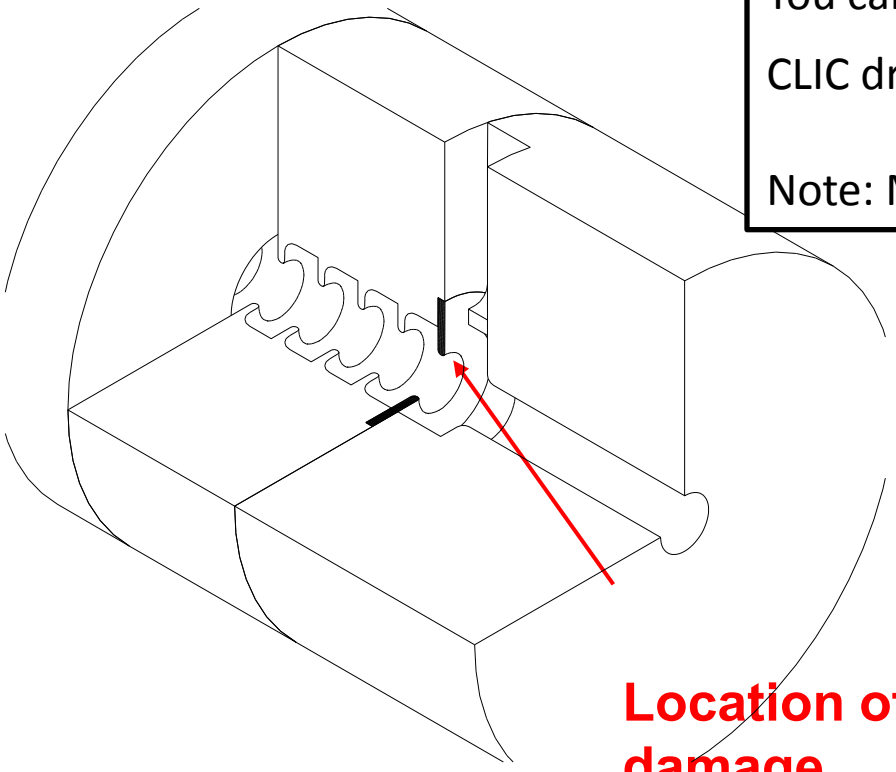
(European Network for Novel Accelerators)

- EuroNNAc is a new network that was approved to go ahead since last summer/autumn.
- A recent CERN workshop was an excellent opportunity for us to get an overview of this thriving but diverse field.
  - Investment into laser infrastructure in Europe: 4.3 B€, 1,600 p
  - **This is becoming big science with Europe taking a lead**
  - Significant part of the effort targeted to novel acceleration.
- Right time to form this network:
  - Our knowledge in “big science” can be a crucial help for success of novel accelerator field.

Very Successful Field…



Damage due to Breakdown



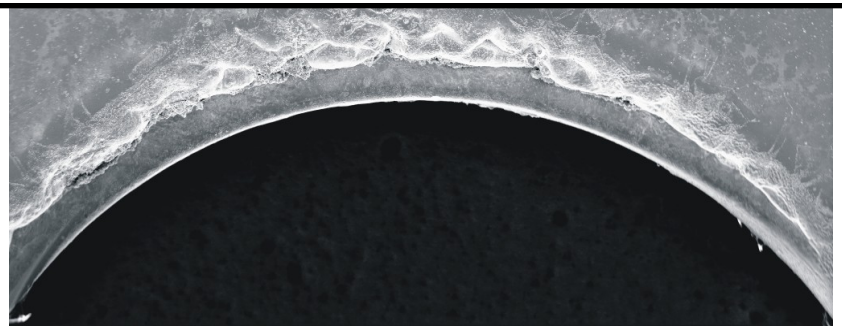
Location of damage

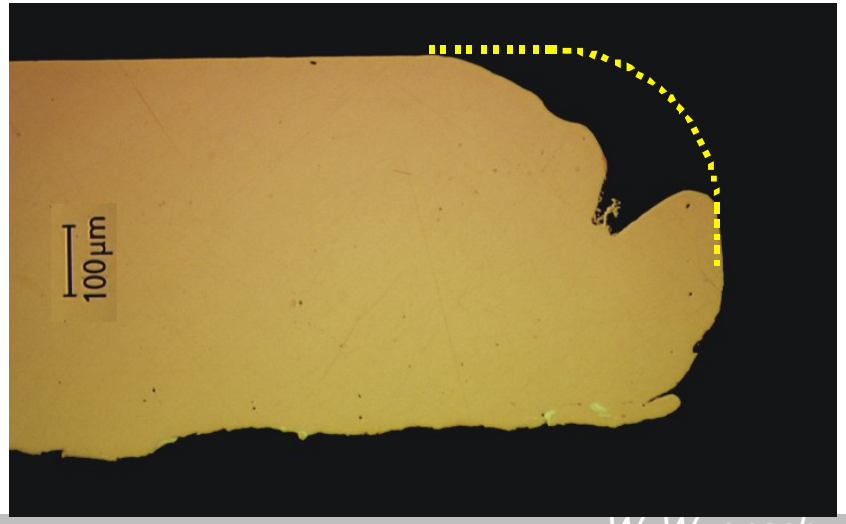
Single feed power coupler
30 GHz, 16 ns, 66 MV/m
local accelerating gradient

You cannot discuss with this…

CLIC dropped back to 11 GHz: 30 GHz not efficient!

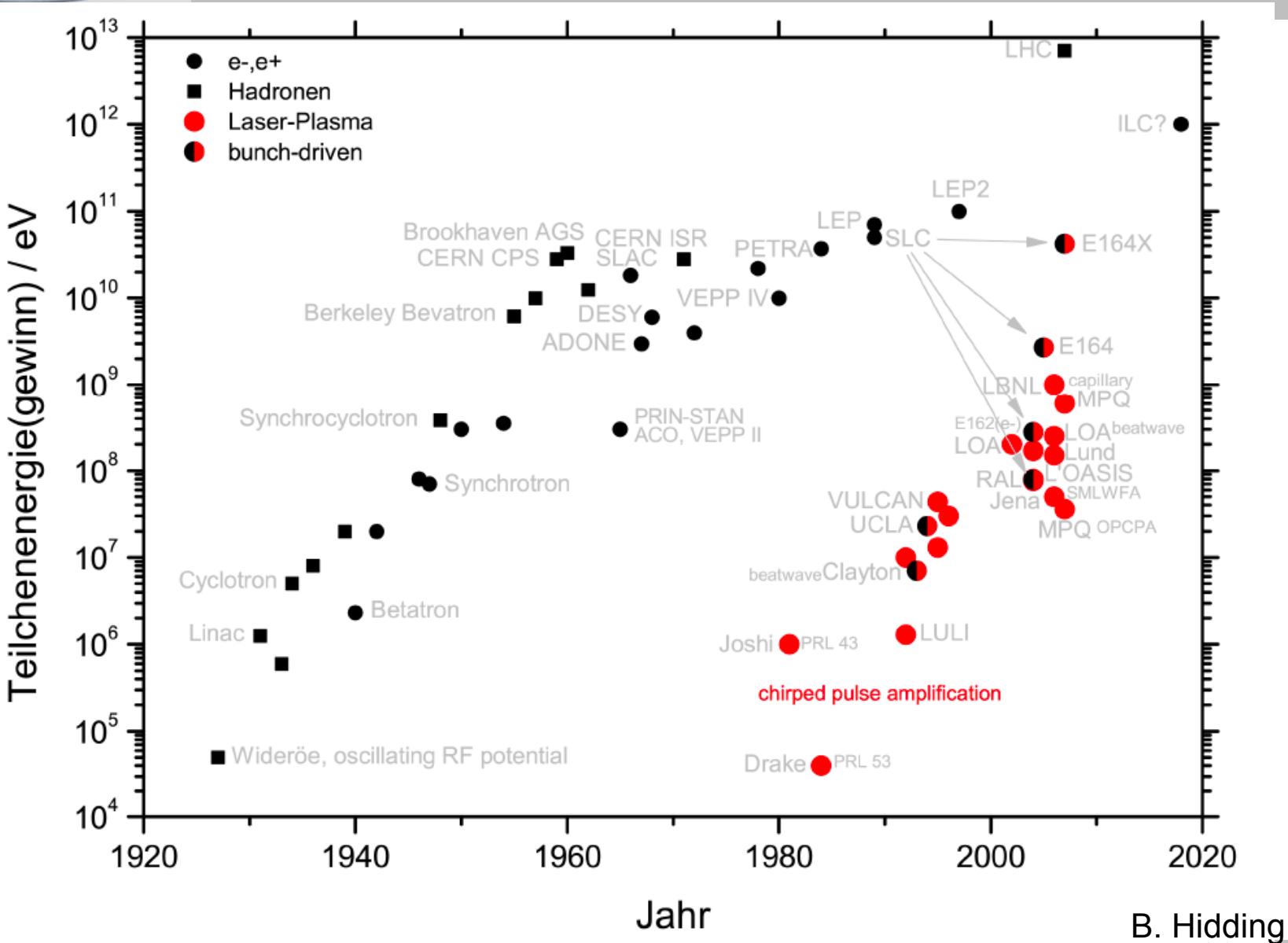
Note: Major progress also in conventional structures!





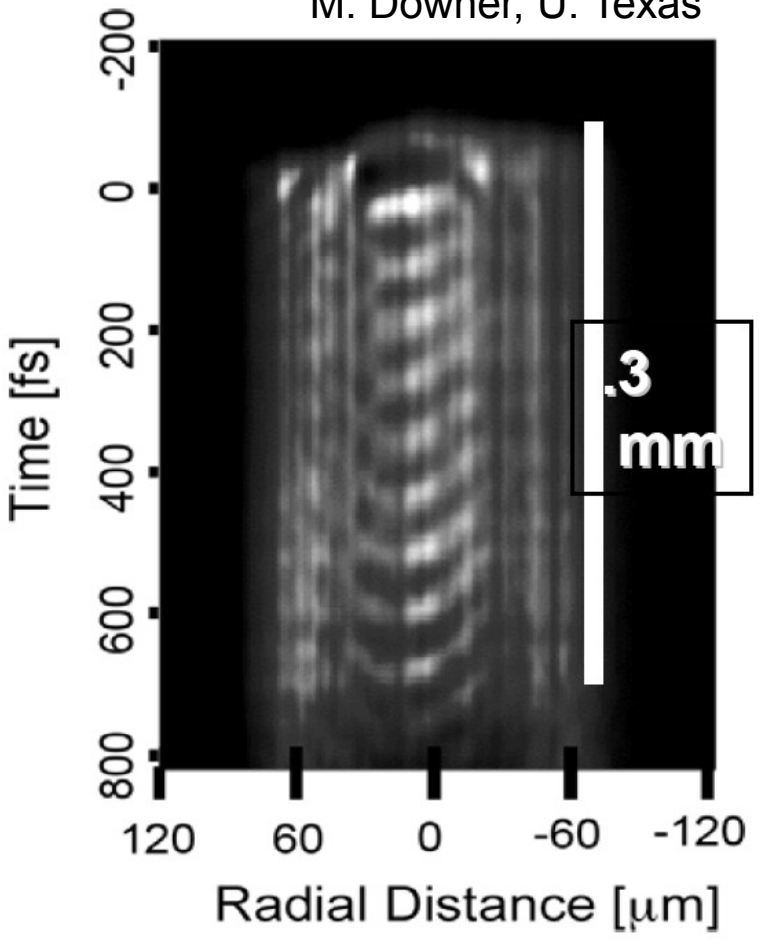
W. Wuensch

The New Livingston Plot

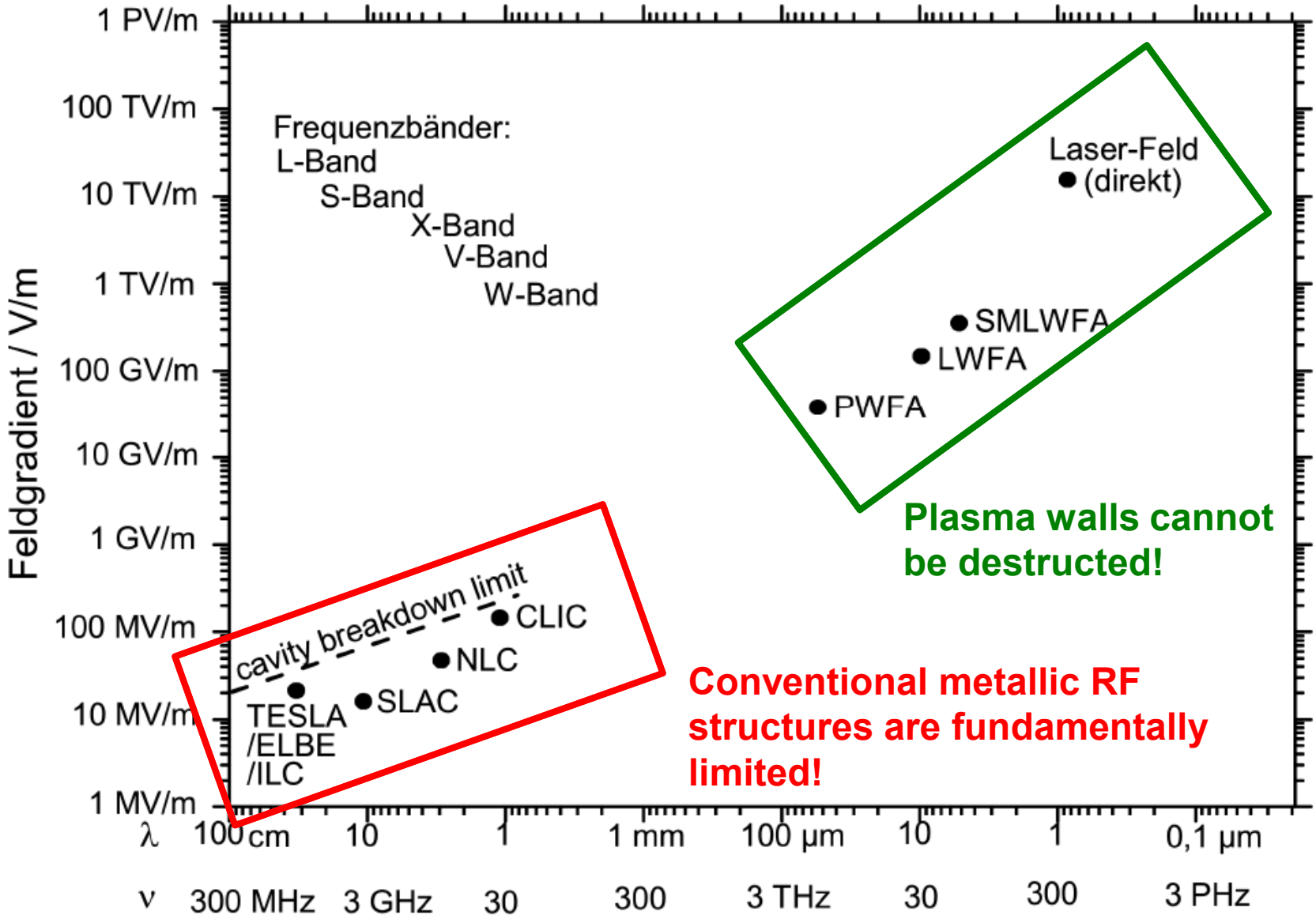


B. Hidding

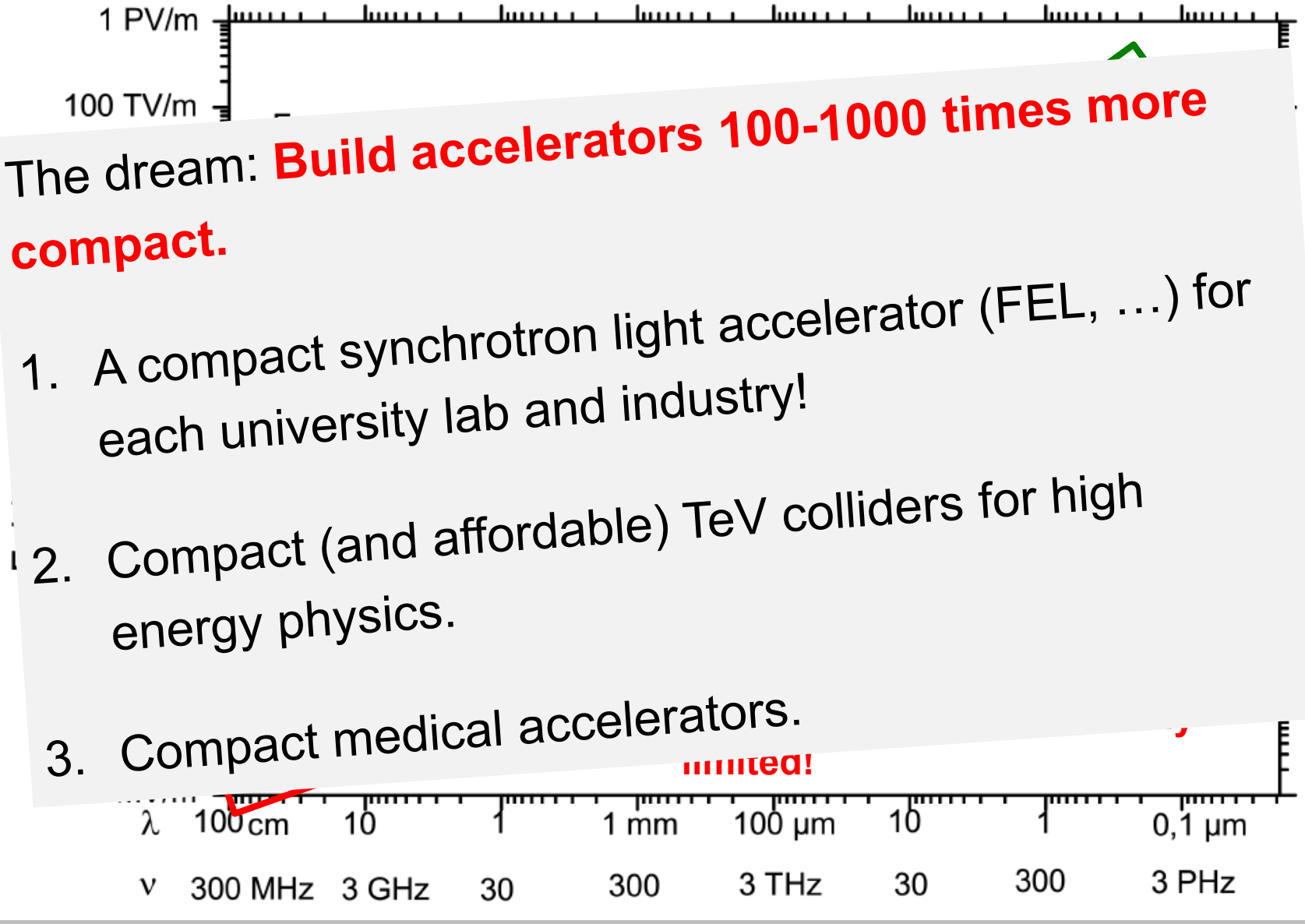
M. Downer, U. Texas



Very Successful Field…



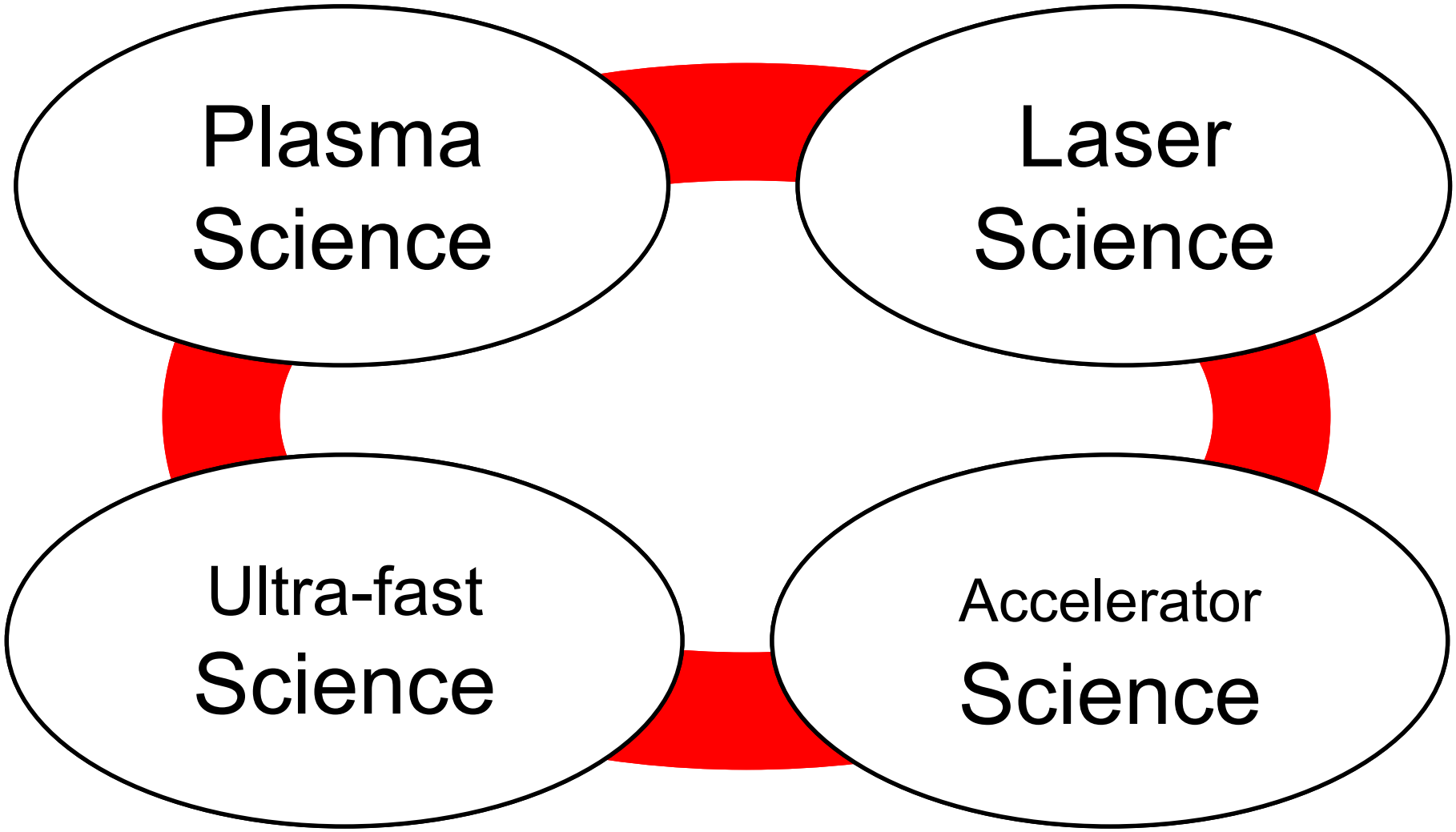
Very Successful Field…



The dream: **Build accelerators 100-1000 times more compact.**

1. A compact synchrotron light accelerator (FEL, …) for each university lab and industry!
2. Compact (and affordable) TeV colliders for high energy physics.
3. Compact medical accelerators.

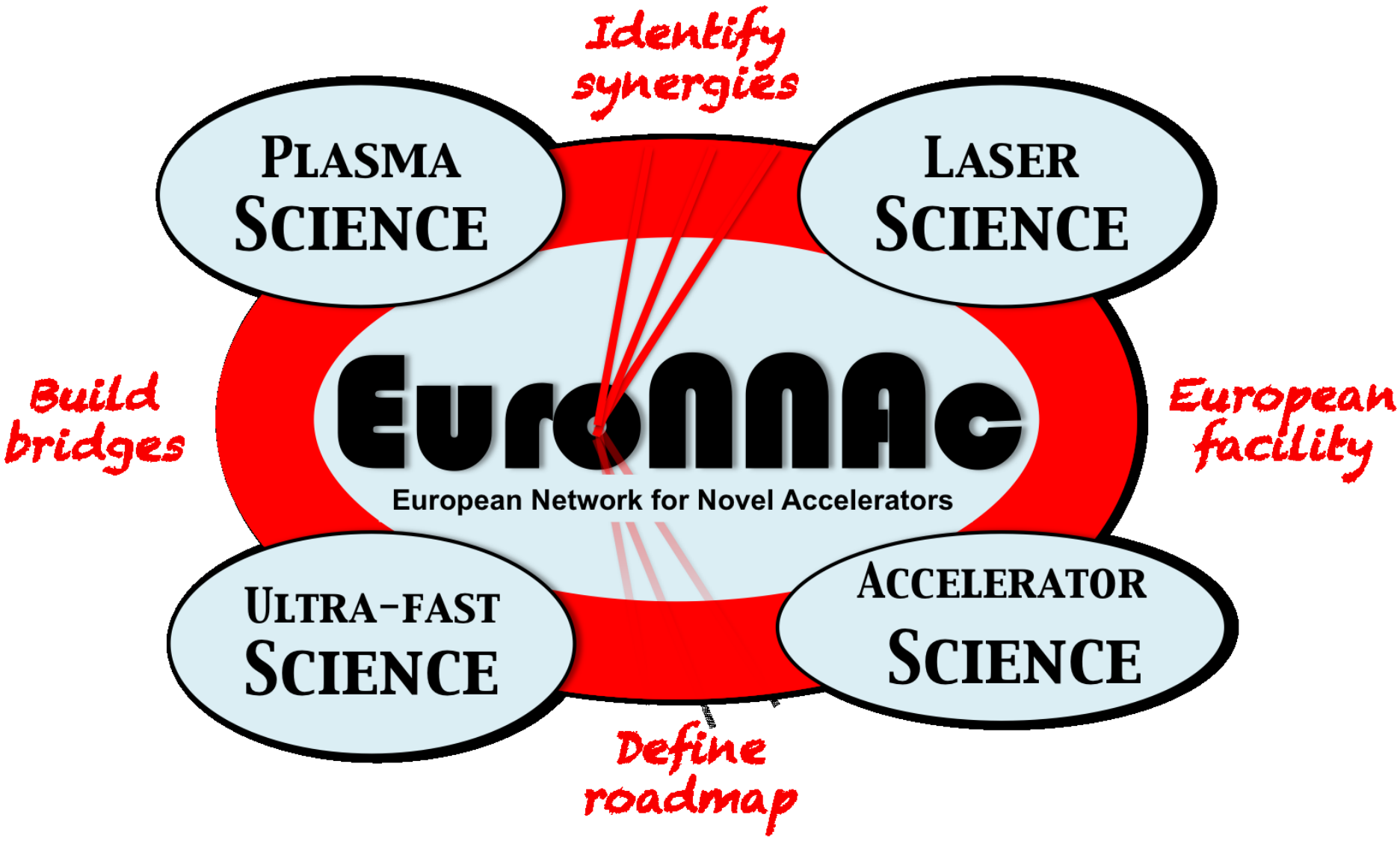
…but also very diverse.



…but also very diverse.

Many challenges:

1. Different notations, language and scientific cultures.
2. Different goals (scientific achievement versus building operational accelerators).
3. More centralized “big science” versus more decentralized university-based research.
4. Complex, inter-disciplinary science problems.


Identify synergies
Plasma Science
Laser Science
Build bridges
EuroNNAc
European Network for Novel Accelerators
European facility
Ultra-fast Science
Accelerator Science
Define roadmap

Network Boundary Conditions

- Network combines synchrotron radiation and particle physics uses.
- Focus on novel methods for e^- acceleration (ion/p not included):
  - Higher chance of success if we focus on one particle type!
  - Only after it works reliably for science applications, medical applications become realistic!
- Network must be **open to all interested parties in Europe**!
  No selection of members!
- Network invites main actors in Asia/US for discussion and decisions!
  Selected international experts will be invited to organization committee.

EuroNNAc 2011 Workshop at CERN

- Workshop quick facts:
  - 93 registrants
  - 14 countries
  - About 50 institutes

All talks online at conference web site:

https://indico.cern.ch/conferenceTimeTable.py?confId=115336#all.detailed

- The CERN workshop was an excellent opportunity for us to get an overview of this thriving but diverse field.
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  - This is becoming big science with Europe taking a lead
  - Significant part of the effort targeted to novel acceleration.
- Right time to form this network:
  - Our knowledge in “big science” can be a crucial help for success of novel accelerator field.

Institutes I

Count	Country	Institution
1	FRANCE	CEA
2		CNRS
3		ILE/ENSTA/Ecole Polytechnique/CNRS/Paris XI
4		LAL / CNRS / Univ. de Paris Sud
5		LLR Ecole Polytechnique- CNRS/IN2P3
6		LPGP-CNRS-Université Paris Sud 11
7		LULI
8		SYNCHROTRON SOLEIL
9	GERMANY	DESY
10		DPG und Max-Born-Institut
11		Faculty of Physics, LMU Munich
12		Helmholtz-Institute Jena
13		Helmholtz-Zentrum Dresden-Rossendorf
14		Max Planck Institut für Physik
15		Max-Planck-Institut für Quantenoptik
16		TU-Darmstadt
17		University of Dusseldorf
18		University of Hamburg
19	HUNGARY	KFKI-RMKI

Institutes II

Count	Country	Institution
20	ITALY	CONSIGLIO NAZIONALE DELLE RICERCHE, INO
21		INFN-LNF
22		INFN-Milan and University of Milan
23		Pisa University and INFN
24		University of Rome LA SAPIENZA
25	NETHERLANDS	EINDHOVEN University oF Technology
26	PORTUGAL	GoLP-IPFN-IST
27	ROMANIA	IFIN-HH
28	RUSSIA	Budker INP
29		Institute of Applied Physics RAS
30	SWEDEN	Lund University
31	SWITZERLAND	CERN
32		PSI / EPFL
33	UNITED KINGDOM	Cockcroft Institute
34		Imperial College
35		John Adams Institute
36		STFC Central Laser Facility
37		STFC Daresbury Laboratory
38		STFC Rutherford Appleton Laboratory
39		University College London
40		University of Oxford
41		University of Strathclyde

Institutes III

Count	Country	Institution
1	CHINA	Inst. of Physics, Chinese Academy of Sciences
2		Shanghai Jiao Tong University
3		Tsinghua University, Beijing
4	JAPAN	KEK
5	UNITED STATES OF AMERICA	BNL
6		Euclid Techlabs LLC
7		Fermilab
8		LBNL
9		SLAC
10		UCLA

Draft Mandate/Mission I

1. Develop goals from photon science and particle physics for advanced e-beam accelerators, including timeline. 5y, 10y, 20y goals and perspectives.
2. Describe coherent program for research on novel e-beam accelerators. What are the main components of this program?
3. Define reference measurements to qualify facilities for photon science and/or particle physics, including definition of standards.
4. Produce white-paper summarizing European efforts/goals with comments on world efforts.

Draft Mandate/Mission II

5. Create framework for open facilities. EuroNNAc to describe and further develop coherent network of test facilities, document capabilities, review requests, discuss work share. "Distributed accelerator test facility for synchrotron science and particle physics"
6. Each facility to propose its main speciality (1-2) on what they want to offer for collaboration.
7. Ask FP7/8 support for such a "distributed open test facility", including support for beam/laser time for users. Use also LaserLab opportunities.

Draft Mandate/Mission III

9. Foster transfer of technology between communities and with industry.
10. Propose adequate funding mechanisms to support university-based accelerator research with long-term scientific benefits.
11. Creation of a "European School: From Conventional to Novel Accelerators", linked to CAS or other series.
12. Support training of students and specialists.
13. Organize a European Advanced Accelerator Conference every second year.

Draft Mandate/Mission III

14. Vision on the time-scale of one or few centralized "big" facilities, beyond present projects.
    - From "distributed test facility" to a "pilot e-beam facility".
    - Pilot facility runs 24h 7/7 to produce agreed e-beam.
    - What does "big" mean? Beam parameters? How many?
    - How to split beam time for synchrotron radiation, medical applications and High Energy Physics applications?
15. Prepare significant FP8 proposal for pilot facility(ies), beyond present projects. Time scale?
16. Foster inter-disciplinary work on theory and simulations.

Draft Collection Goals

- What are the top goals of the field (10y ahead)?
  - Demonstrate working plasma-based FEL at realistic frequencies
  - Reliable 24/7 operation of plasma-based accelerators at 1 GeV
  - Staging
  - High beam quality at 10 GeV from plasma accelerators
  - GV/m positron acceleration with plasma devices while preserving emittance
  - Demonstrate proton drivers for wake acceleration

Conclusion

- The field of novel accelerators is advancing fast.
- CERN and other labs are **interested to participate to the research and to understand potential for High Energy Physics**.
- This includes experiments using the existing infrastructure at CERN, DESY, Frascati, Paris, …
- The advances promise a lot of fruitful applications: synchrotron light, medical applications, material science, particle physics.
- Proton-driven plasma acceleration a possible (likely) CERN experiment → A. Caldwell, MPI et al.
- EuroNNAc (European Network on Novel Accelerators) should help to define coherent approach and to prepare big FP8 proposal by ~2013.

Thank You

CERN involvement

1. Coordination EuCARD: European Coordination Accelerator R&D.
2. Participating to ICFA-ICUIL task force on laser-driven accelerators
3. Proposal for proton-driven plasma acceleration experiment at CERN (A. Caldwell et al, MPI): Expect Letter of Intent.
4. Participation to ICAN proposal:
   "INTERNATIONAL COHERENT AMPLIFICATION NETWORK": solving the peak-average power and efficiency problems in laser for wakefield applications to High Energy Physics"
5. Forming of EuroNNAc network:
   "European Network on Novel Accelerators" → Coherent European strategy for advanced e^+e^- acceleration, FP8 proposal?