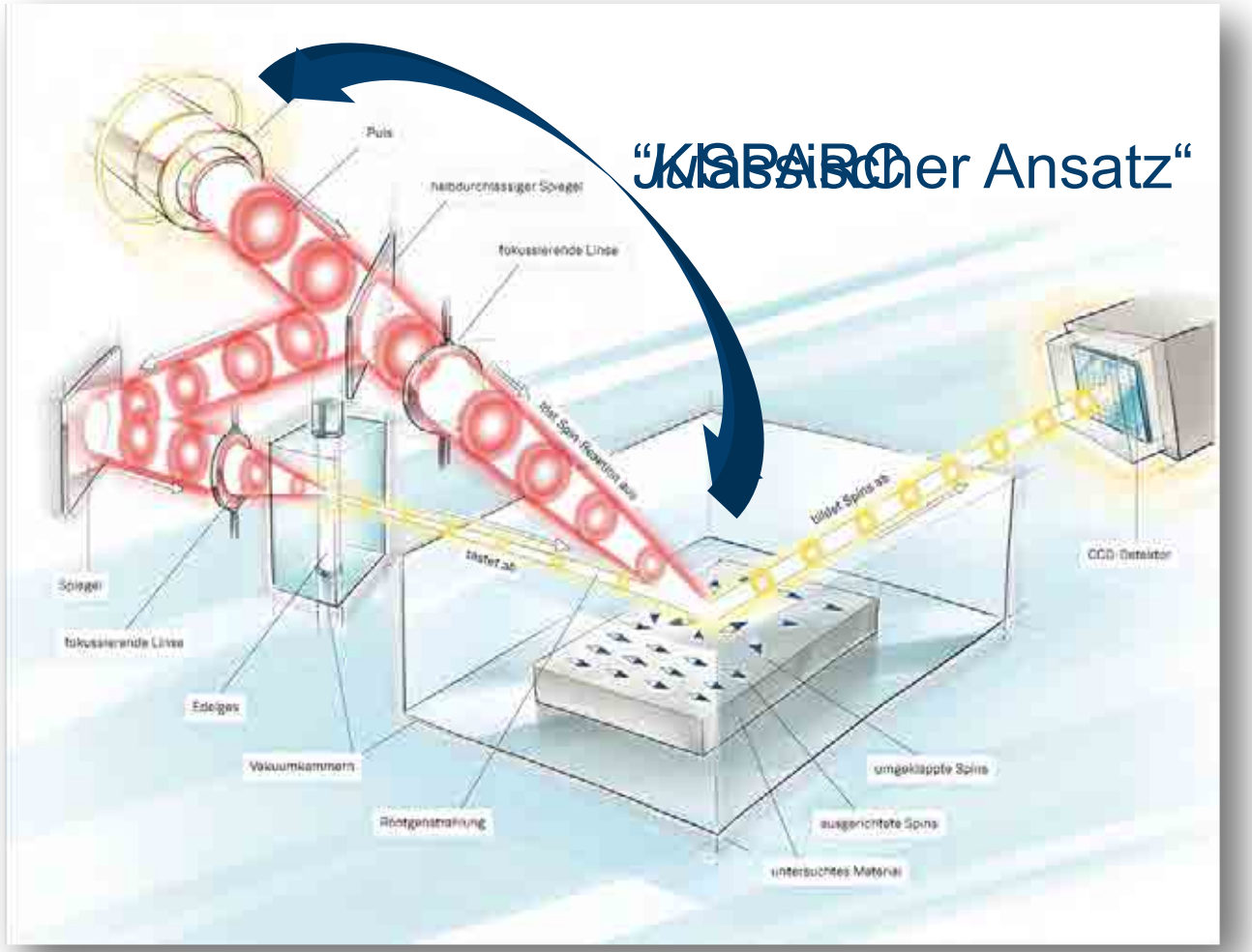
JuSPARC: MEHR ALS “EIN PAAR LASER”

JUSPARC KICK-OFF | 24 JANUAR 2019 | MARKUS BÜSCHER

DIE GRUNDIDEE VON *Ju*SPARC:
"*THE EXPERIMENT DEFINES THE FACILITY*"

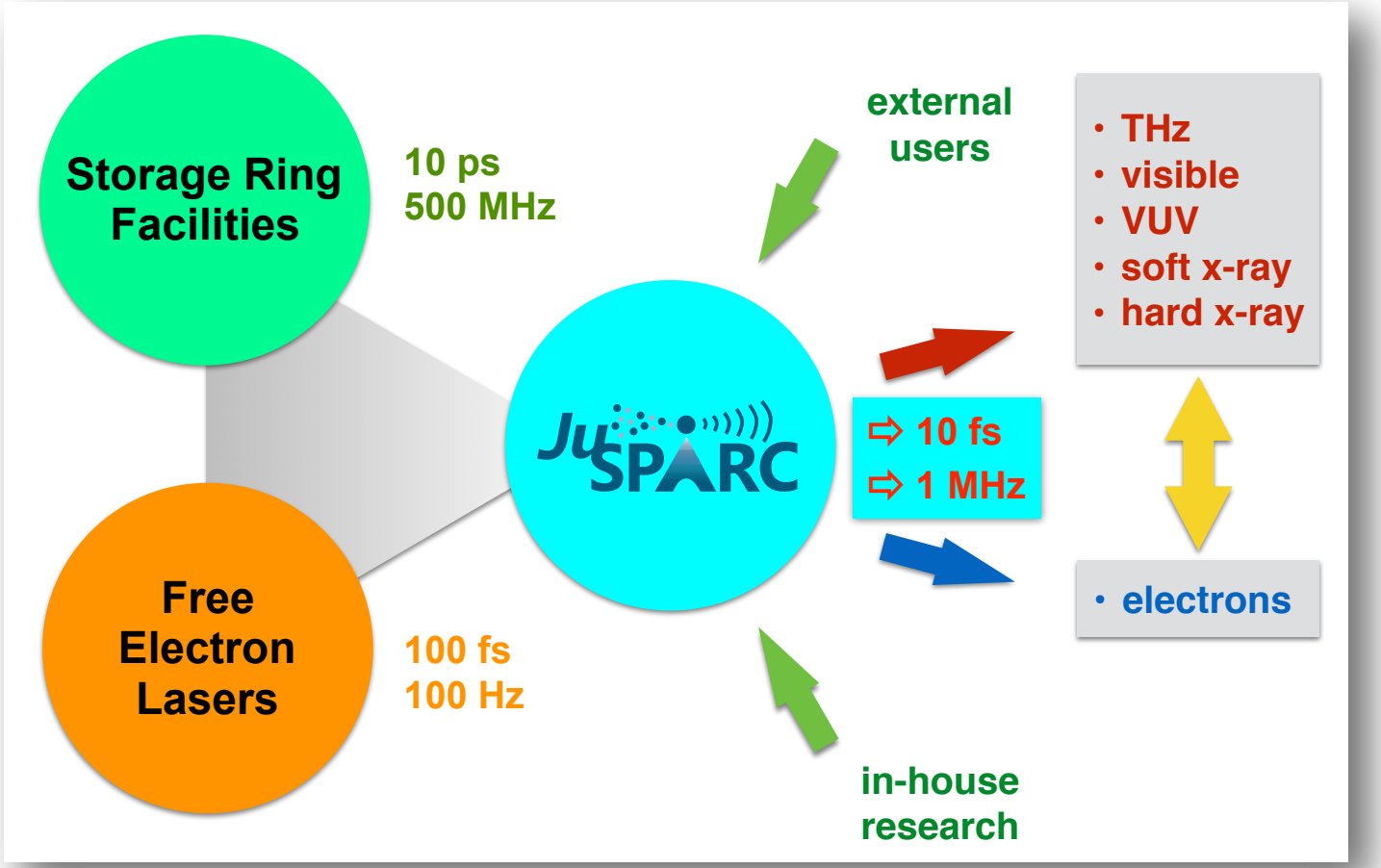


*Ju*SPARC-0: EXISTIERENDES LASERSYSTEM (SEIT 2010)

KMLABS™ inc.
LEADING IN ULTRAFAST

Energie pro Puls 2 mJ
Pulsdauer 35 fs
Wiederholrate 3 kHz

*Ju*SPARC = JÜLICH SHORT-PULSED PARTICLE AND RADIATION CENTER



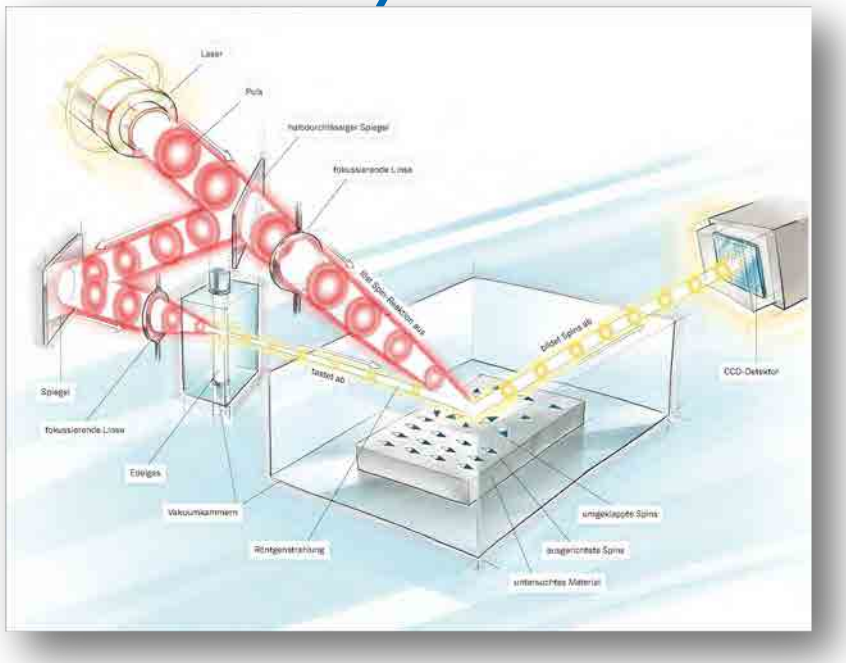
*Ju*SPARC-1: *SOFT X-RAY MAGNETO OPTICS*

THALES

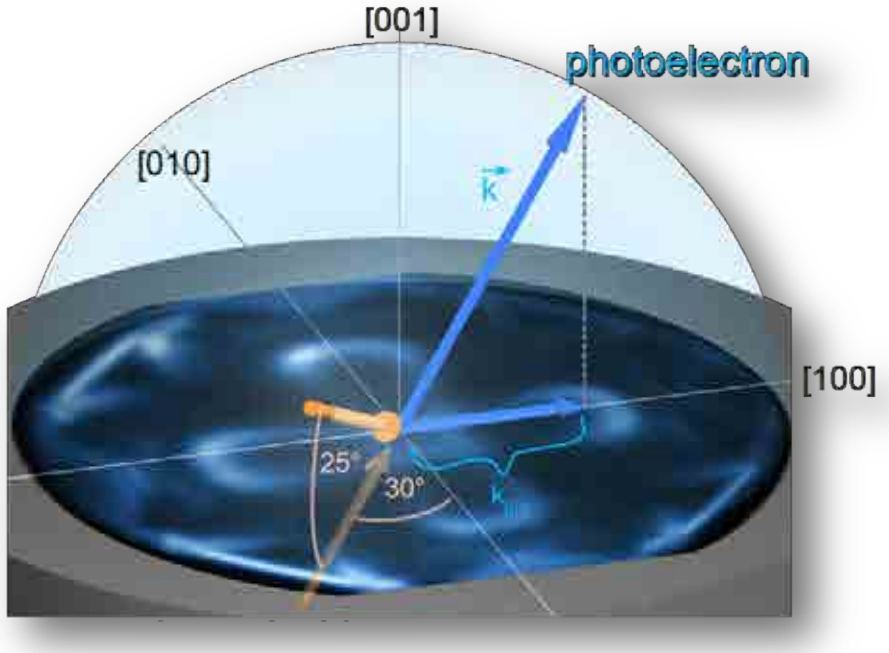
Energie pro Puls 2 mJ → 40 mJ
Pulsdauer 29 fs
Wiederholrate 1 kHz

VERSCHIEDENE KLASSEN VON EXPERIMENTEN

"Photon in / Photon out"



"Photon in / Electron out"



☞ Möglichst hohe Energie pro Puls bei maximaler Wiederholrate

☞ Geringere Pulsenergie ermöglicht noch höhere Wiederholraten

*Ju*SPARC-1: *MOMENTUM MICROSCOPY*

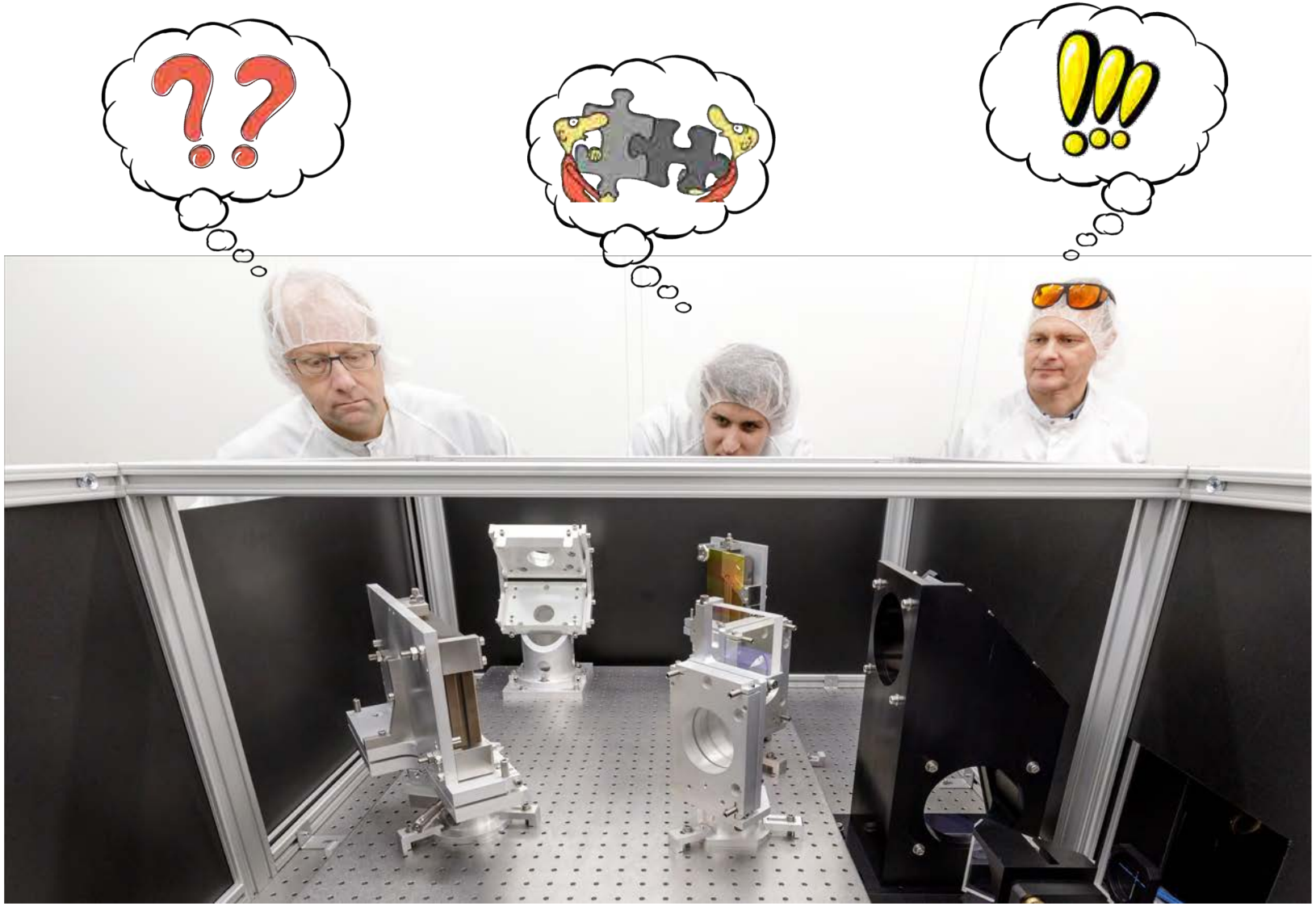
AMPHOS

Fraunhofer ILT

Energie pro Puls 0,05 mJ
Pulsdauer 100 fs
Wiederholrate 10.000 kHz

JÜLICH Forschungszentrum

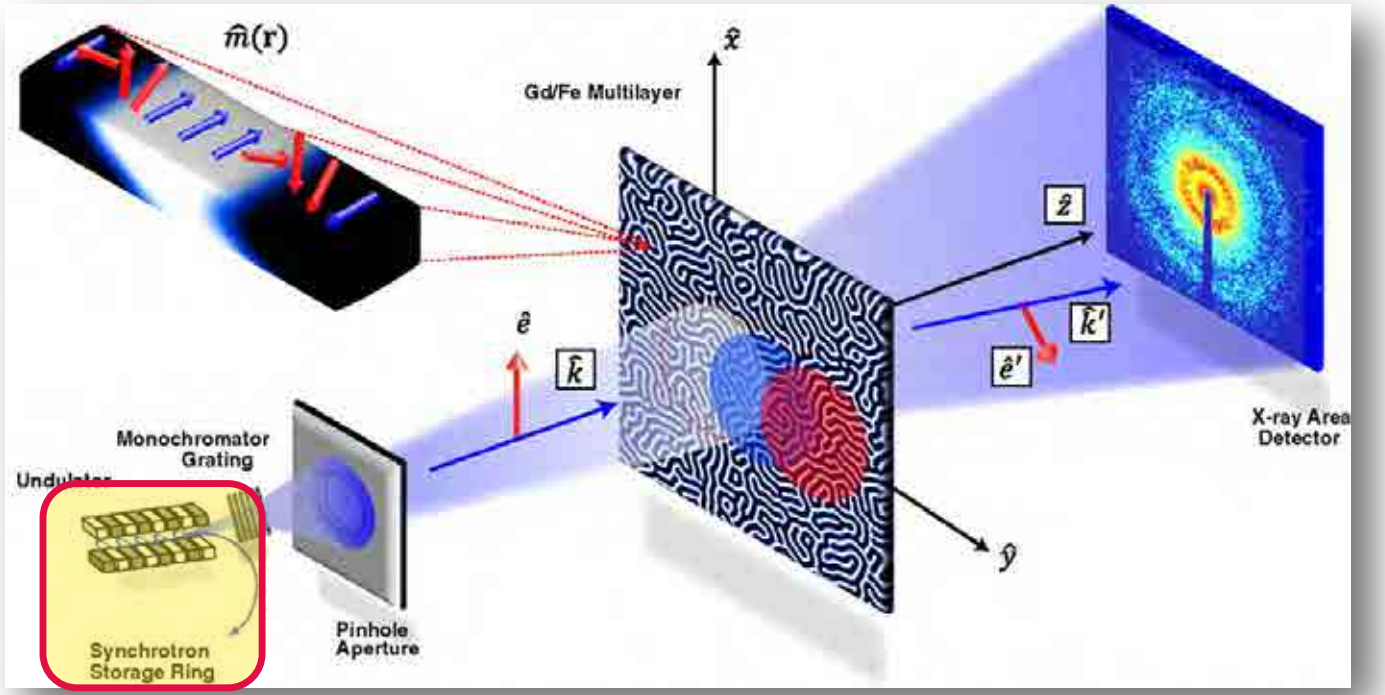
UND JETZT ... ?



UND JETZT ... ?

Jetzt schon sind weitergehende experimentelle Anforderungen in Sicht! Zum Beispiel:

Dichroic coherent diffractive imaging



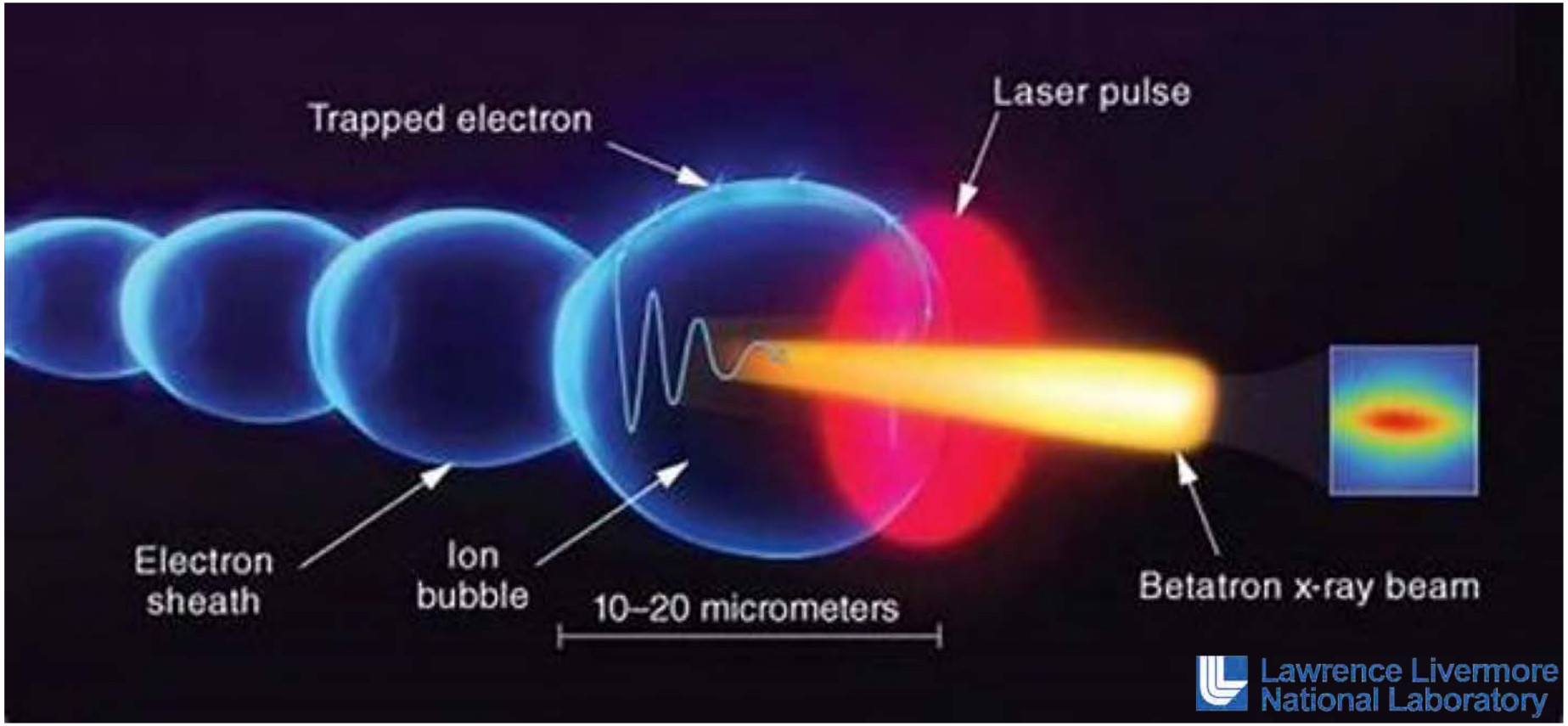
A.Tripathi et al., PNAS, 2011 108 (33) 13393; https://doi.org/10.1073/pnas.1104304108

Für solche Experimente braucht man:

- Photonenenergien: ca. 1000 eV
  (→Elektronenbeschleunigung?)
- Zirkulare Polarisation
- Ultraschnell

AUF DEM WEG ZU *Ju*SPARC-2

Beispiel: Laser-induzierte Elektronen-Beschleunigung mit Betatron-Strahlung



AUF DEM WEG ZU *Ju*SPARC-2

Ca. 3 Millionen € für Weiterentwicklung von *Ju*SPARC-1 (2018-2021)

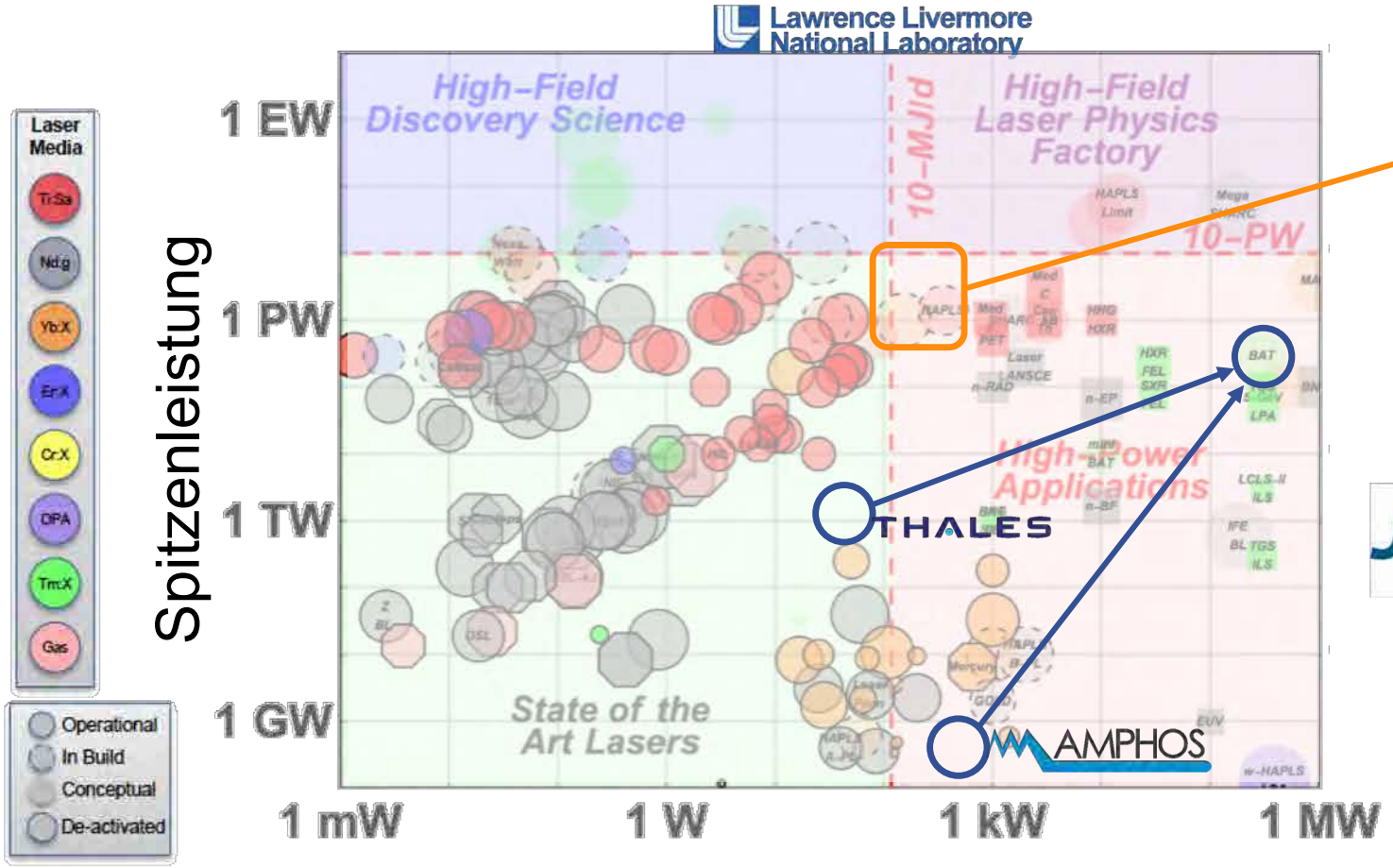
ATHENA
The Helmholtz-Project for Laser-Plasma-Acceleration

JuSPARC

JÜLICH Forschungszentrum

AUF DEM WEG ZU *Ju*SPARC-2

Steigerung der Spitzenleistung unter Beibehalt der hohen Wiederholraten



AUF DEM WEG ZU *Ju*SPARC-2

	Typische Spitzenleistung	*Erzeugte Teilchen*
JuSPARC	1 TW	*Photonen (Röntgen), Elektronen (?)*
IPP Institute of Plasma Physics of the Czech Academy of Sciences	10 TW	*Elektronen*
Düsseldorf DARC turus Laser Facility	100 TW	*Elektronen, Protonen (MeV)*
PHELIX	1 PW	*Protonen (10 MeV)*
SIOM	10 PW	*Protonen (GeV)*

JÜLICH Forschungszentrum

AUF DEM WEG ZU *Ju*SPARC-2

International Journal of High-Energy Physics

Sign in | Forgotten your password? | Sign up

CERN COURIER

OAK RIDGE National Laboratory
The Neutron Sciences Directorate invites applicants for Associate Laboratory Director

Latest issue | Archive | Jobs | Links | Buyer's guide | White papers | Events | Contact us

Search Go

REGISTER NOW

Register as a member of *cerncourier.com* and get full access to all features of the site. Registration is free.

LATEST CERN COURIER ARTICLES

- LS1: on the home straight
- New precision reached on electron mass
- Cracks toughen glass
- Subdiffraction-limited imaging inside a cell
- One-way sound

SHARE THIS

E-mail to a friend
StumbleUpon
Twitter
Facebook
CiteULike
SHARE

RELATED PRODUCTS

Portable Thermal

CERN COURIER

Mar 28, 2014

New results mark progress towards polarized ion beams in laser-induced acceleration

The Arcturus Laser

The field of laser-induced relativistic plasmas and, in particular, laser-driven particle acceleration, has undergone impressive progress in recent years. Despite many advances in understanding fundamental physical phenomena, one unexplored issue is how the particle spins are influenced by the huge magnetic fields inherently present in the plasmas.

Laser-induced generation of polarized-ion beams would without doubt be important in research at particle accelerators. In this context, $^3He^{2+}$ ions have been discussed widely. They can serve as a substitute for polarized neutron beams, because in a ^3He nucleus the two protons have opposite spin directions, so the spin of the nucleus is carried by the neutron. However, such beams are currently not available owing to a lack of corresponding ion sources. A promising approach for a laser-based ion source would be to use pre-polarized ^3He gas as the target material. Polarization conservation of ^3He ions in plasmas is also crucial for the feasibility of proposals aiming at an increase in efficiency of fusion reactors by using polarized fuel, because this efficiency depends strongly on the cross-section of the fusion reactions.

DIGITAL EDITION

CERN Courier is now available as a regular digital edition. **Click here** to read the digital edition.

KEY SUPPLIERS

JANIS Cryogenic Systems
MEGA RF Solutions INDUSTRIES, LLC
More companies ▸

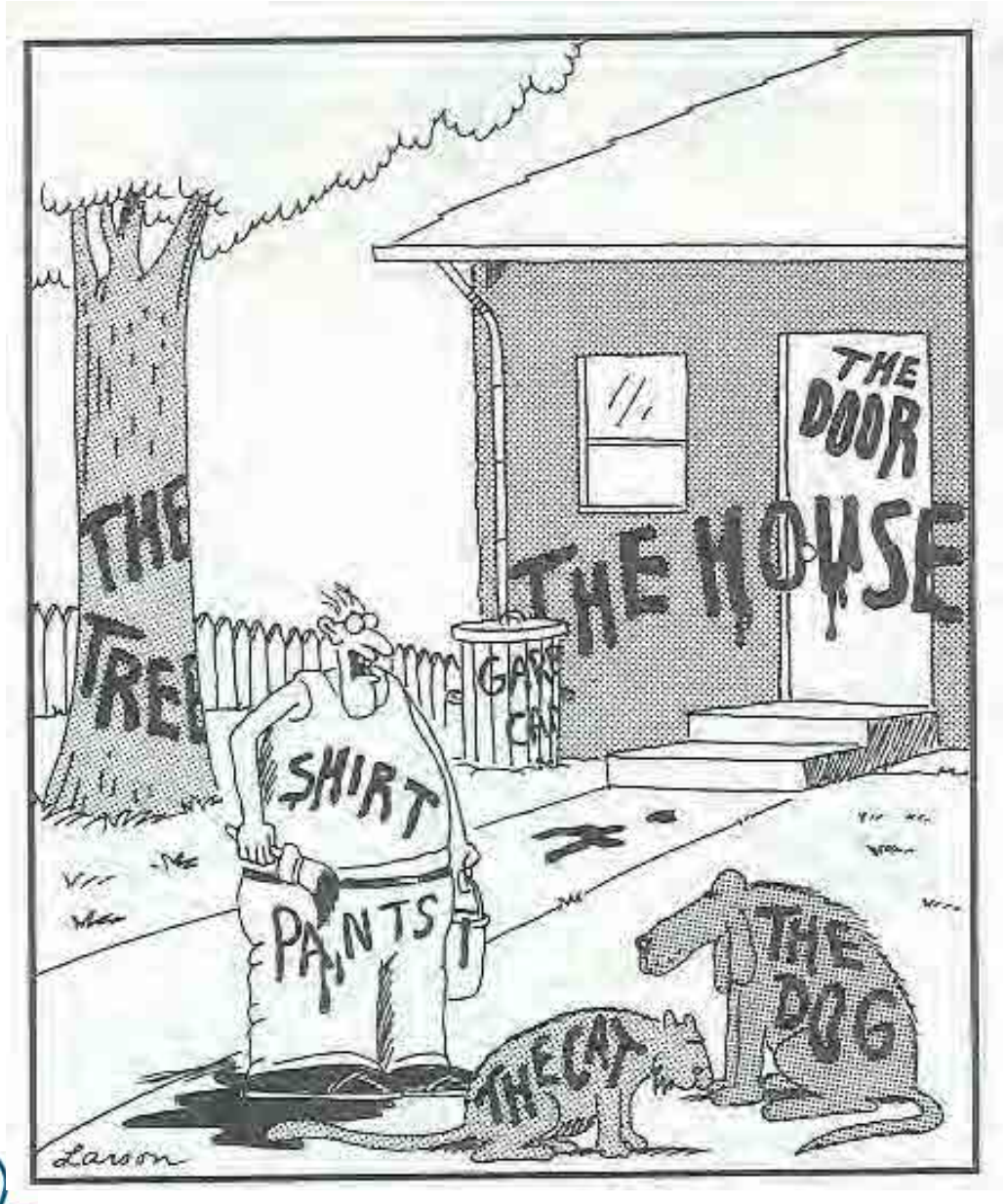
FEATURED COMPANIES

EURODIFROID cooling solutions
GoodFellow Metals and Materials for Research and industry

JÜLICH Forschungszentrum

AM 10 PW LASER IN SHANGHAI

Erste Experimente zur Protonenbeschleunigung: Frühjahr 2019



"So! ... *Das* sollte jetzt einige Dinge klargestellt haben!"