

# Statusbericht S-DALINAC

Norbert Pietralla

- **Überblick**
- **Forschungsbeispiel**
- **Upgrade (3. Rezirkulation)**
- **GRK 2128 „Accelence“**
- **SFB 1245 „Nuclei: From fundamental Interactions to Structure and Stars“**

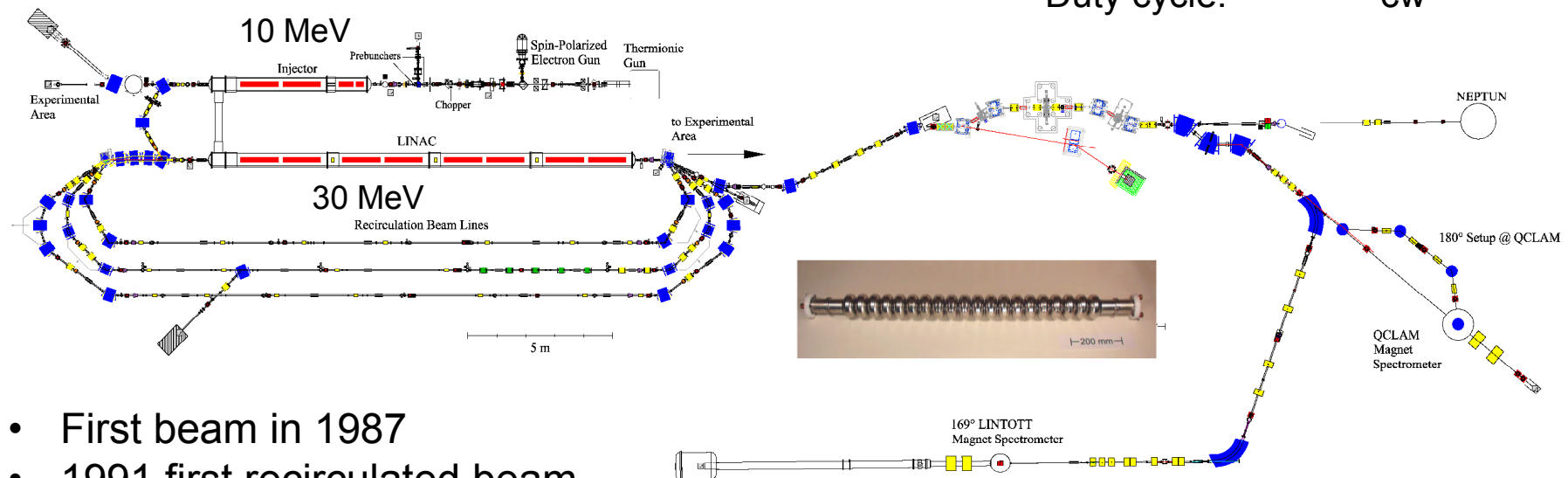


# S-DALINAC Overview

- Built in the 1980s
- 12 Nb-SRF Cavities,  $\lambda = 0.1$  m
- Liquid helium @ 2 K
- Cryo-plant: 100 W cooling power

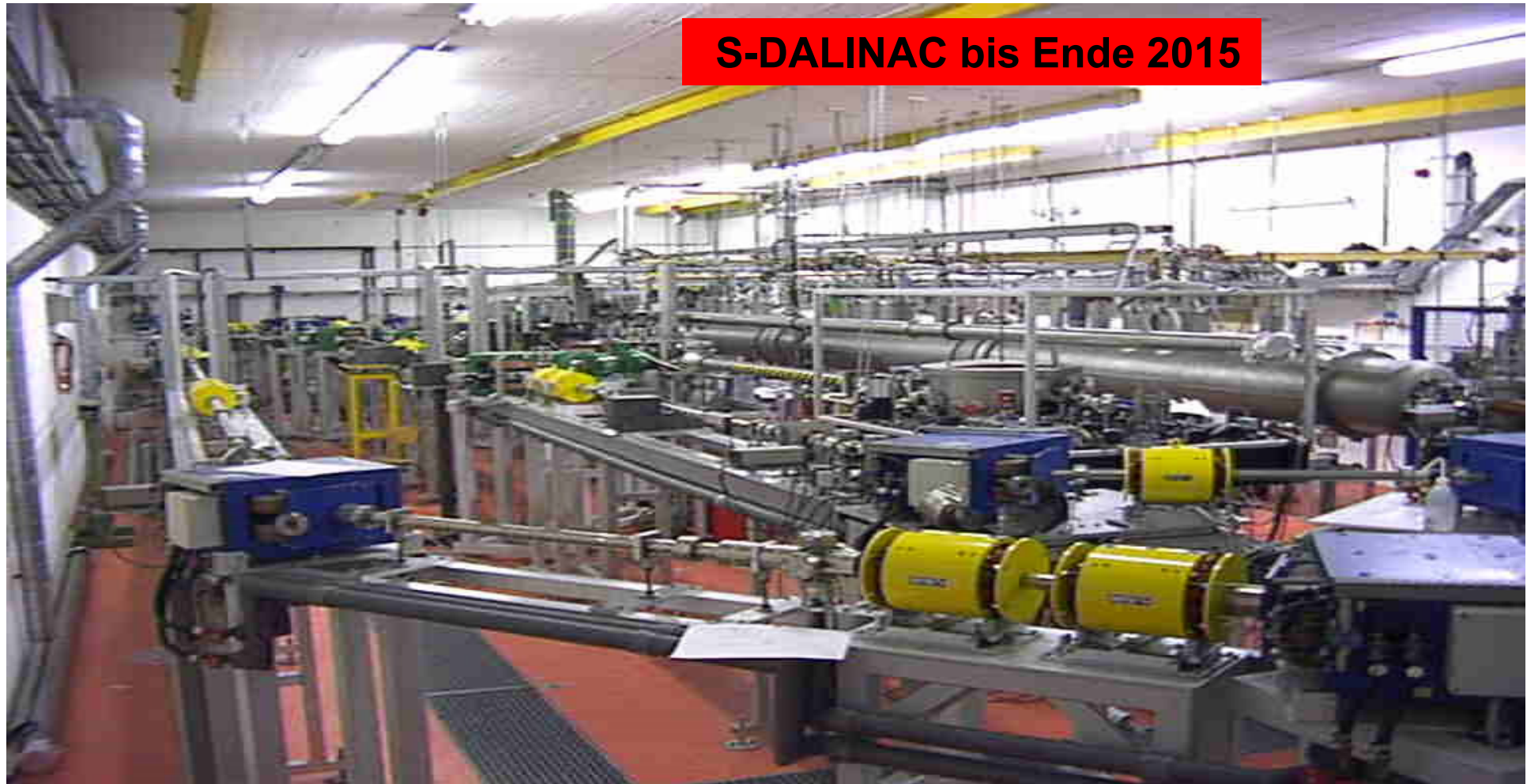
## Parameters:

Max. Energy:	130 MeV
Beam Current:	20 $\mu$ A
Frequency:	3 GHz
RF-power/cavity:	500 W
Duty cycle:	cw



- First beam in 1987
- 1991 first recirculated beam
- **3rd recirculation in 2016**

## Aufbau 3. Rezirkulation: Mitte Nov. 2015





# Spezialität: Hohe Energieauflösung

PRL 117, 172503 (2016)

PHYSICAL REVIEW LETTERS

week ending  
21 OCTOBER 2016



## First Measurement of Collectivity of Coexisting Shapes Based on Type II Shell Evolution: The Case of $^{96}\text{Zr}$

C. Kremer,<sup>1</sup> S. Aslanidou,<sup>1</sup> S. Bassauer,<sup>1</sup> M. Hilcker,<sup>1</sup> A. Krugmann,<sup>1</sup> P. von Neumann-Cosel,<sup>1</sup>  
T. Otsuka,<sup>2,3,4,5</sup> N. Pietralla,<sup>1</sup> V. Yu. Ponomarev,<sup>1</sup> N. Shimizu,<sup>3</sup> M. Singer,<sup>1</sup> G. Steinhilber,<sup>1</sup>  
T. Togashi,<sup>3</sup> Y. Tsunoda,<sup>3</sup> V. Werner,<sup>1</sup> and M. Zweidinger<sup>1</sup>

<sup>1</sup>Institut für Kernphysik, Technische Universität Darmstadt, D-64289 Darmstadt, Germany

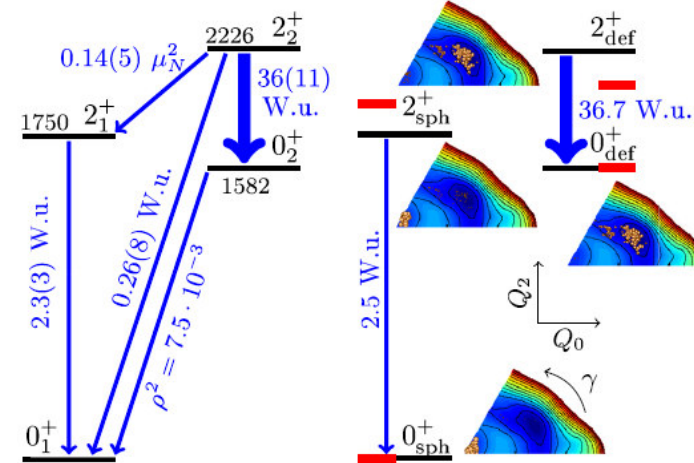
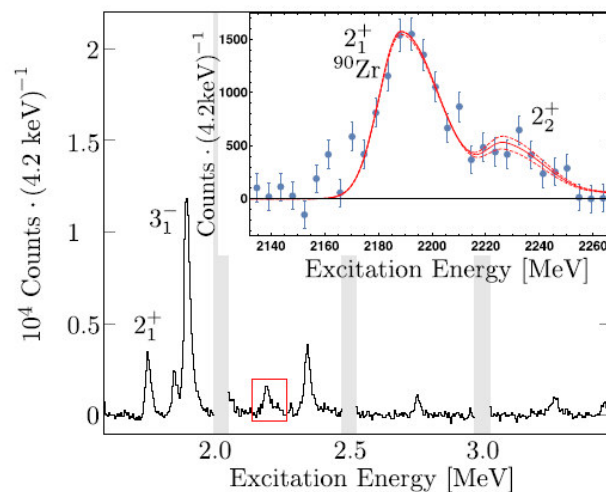
<sup>2</sup>Department of Physics, University of Tokyo, Hongo, Bunkyo-ku, Tokyo 113-0033, Japan

PRL 117, 172503 (2016)

PHYSICAL RE

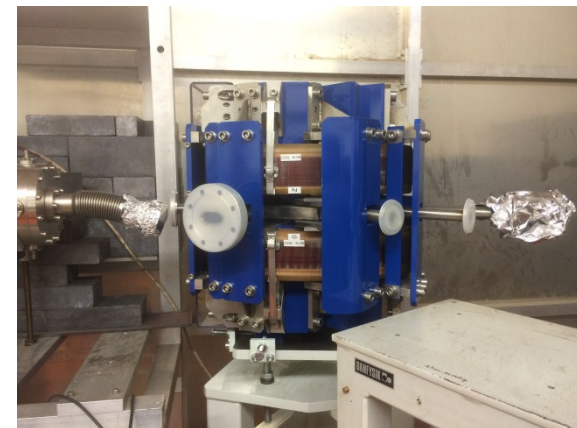
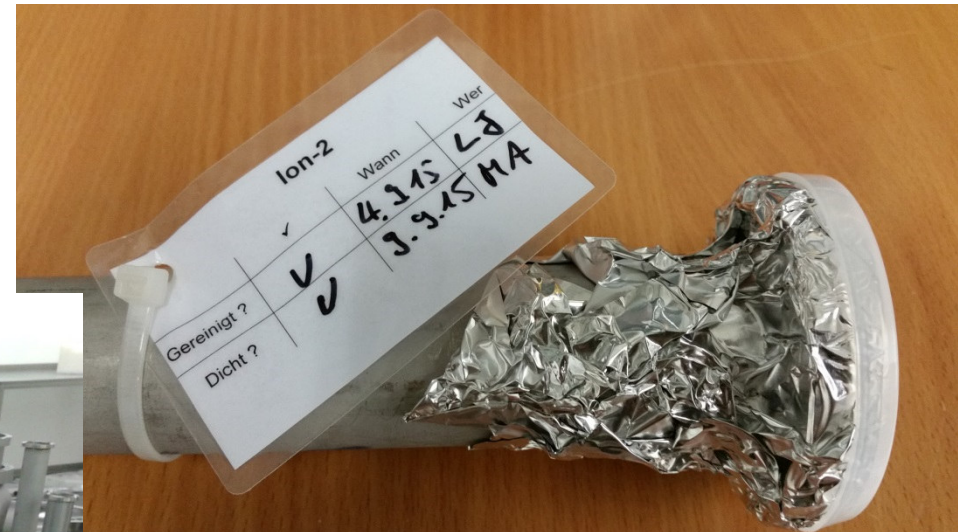
VIEW LETTERS

week ending  
21 OCTOBER 2016



# Stand Ende 2015

- All bits taken apart...











- 15 km cables
- 500 cables
- 500 m copper-pipes for water
- 250 m flexible tubes





Fachbeitrag

Lösler et al., Hochpräzise Erfassung von Strahlführungselementen ...

### Hochpräzise Erfassung von Strahlführungselementen des Elektronenlinearbeschleunigers S-DALINAC

Michael Lösler, Michaela Arnold, Hermann Bähr, Cornelia Eschelbach, Thore Bahlo,  
Ruben Grewe, Florian Hug, Lars Jürgensen, Philipp Winkemann und Norbert Pietralla

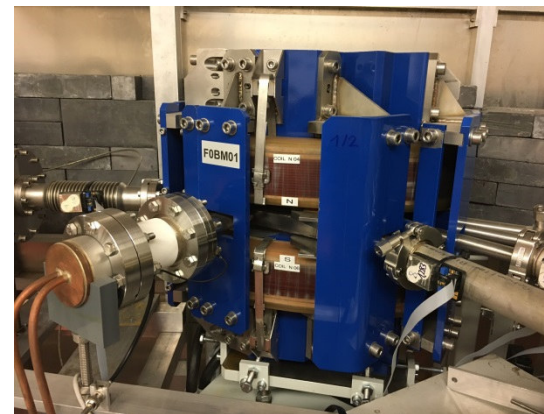
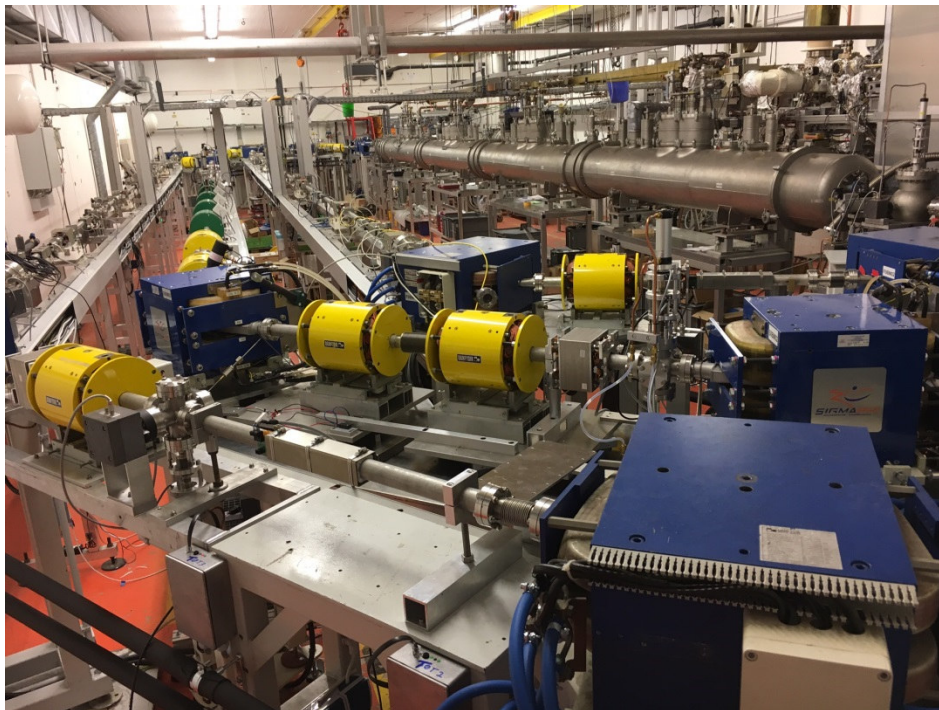
346 | **zfv** 6/2015 140. Jg.



# A Third Recirculation with ERL- Option for the S-DALINAC - Design and Implementation

Fall 2015

Dec. 1<sup>st</sup>, 2016

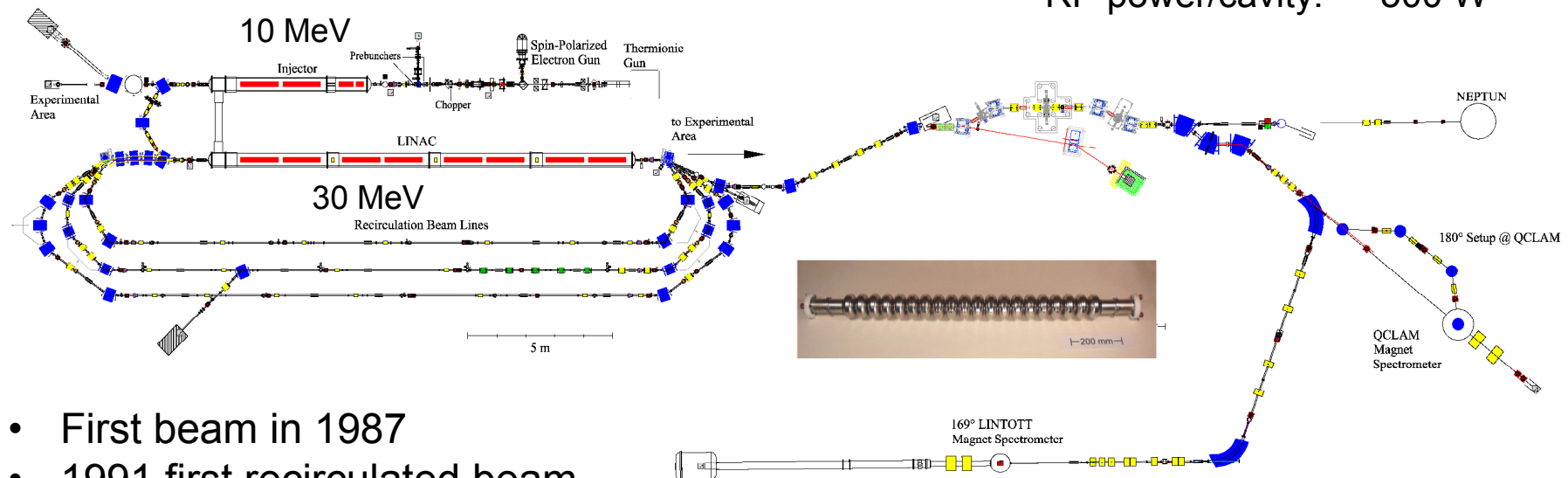


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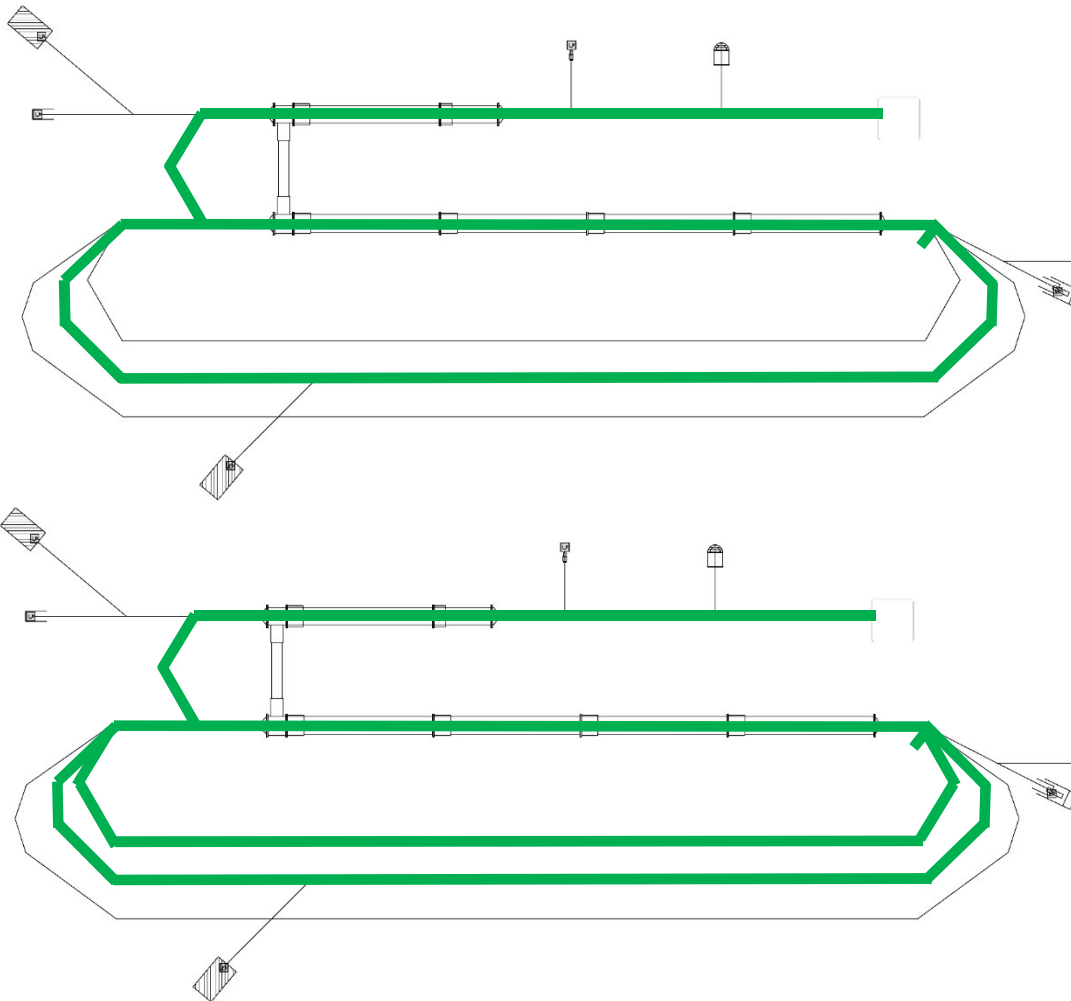
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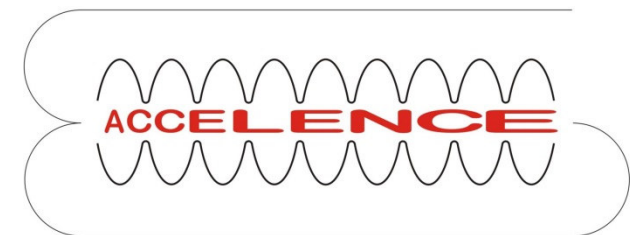
# + ERL Operating Schemes



## Twice-recirculating ERL

Beam dynamics for non-isochronous ERL to be investigated...  
(world-first)

GRK 2128



# DFG – Graduiertenkolleg, GRK 2128 „Accelence“



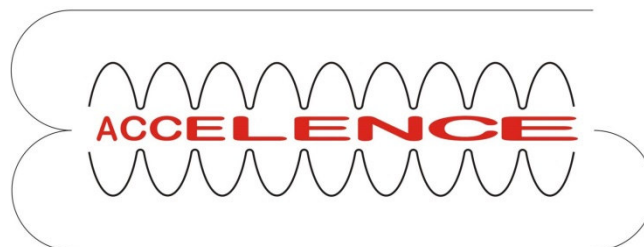
TECHNISCHE  
UNIVERSITÄT  
DARMSTADT

## Accelerator Science and Technology for Energy Recovery LINACs „Accelence“

für Beschleunigerphysik und –technik an TU  
Darmstadt und JGU Mainz  
(→ Aufbau MESA)

Förderentscheidung der DFG am 6.11.2015

1. Periode: 1.4.2016 – 30.9.2020

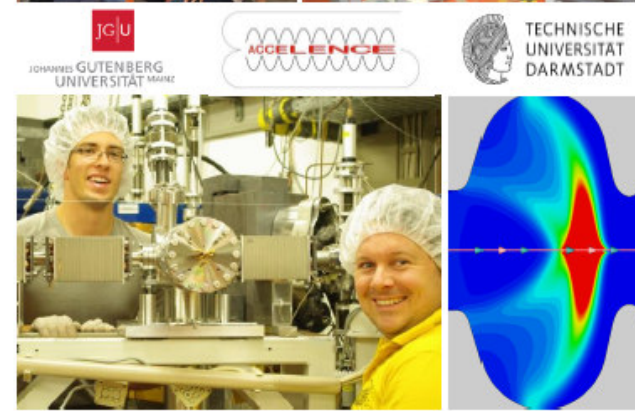
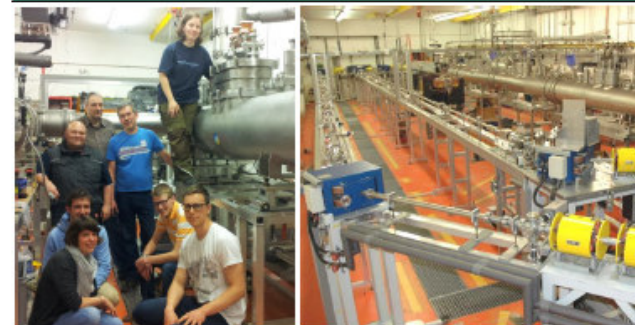


GRK 2128 date: March 31, 2015

### Accelence

Funding period: Apr. 2016 - Sept. 2020  
Coordinating university: Technische Universität Darmstadt  
Spokes-person: Prof. Dr. Dr. h.c. Norbert Pietralla

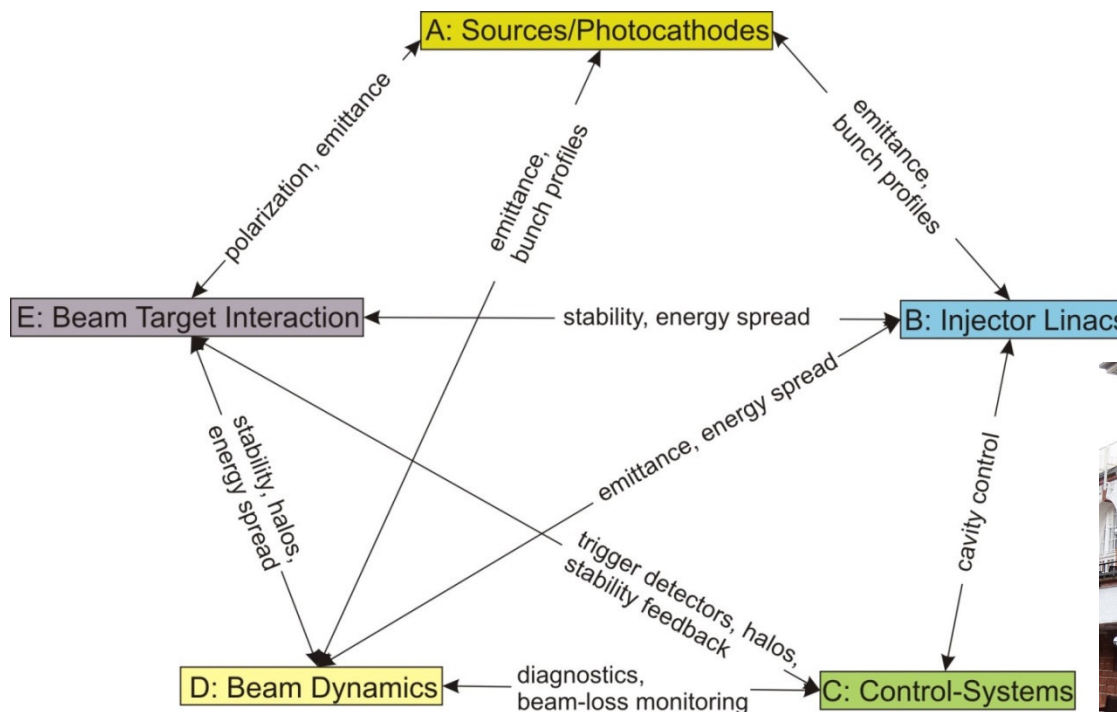
Proposal to Establish a Research Training Group (RTG) in  
“Accelerator Science and Technology for Energy-Recovery Linacs”





# Wissenschaftliches Programm

**5 verzahnte Projektbereiche** zu wissenschaftlichen Aspekten von ERL  
Technologie von Elektronenkanone bis „Strahl-auf-Target“



**5 Projektbereiche**

**24 work packages**

*Trifels, Pfalz, 8.11.2016*

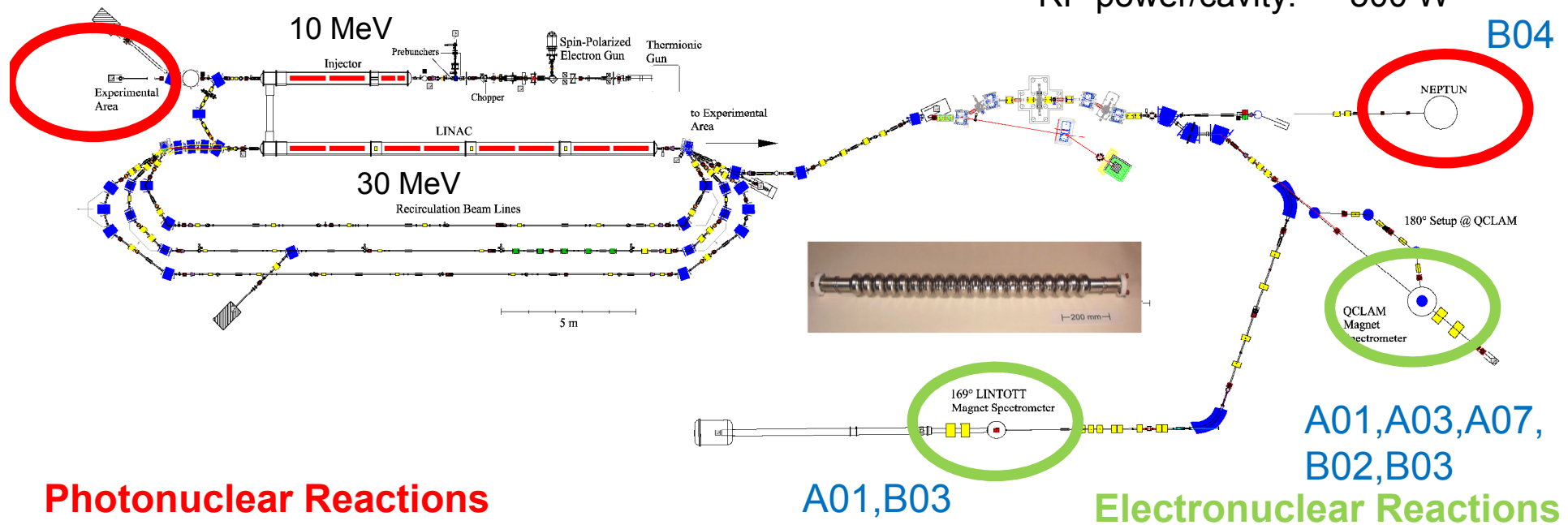


# Hauptforschungsinstrument im SFB 1245

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A01,A03,B03





# SFB 1245 (seit 1.1.2016)

## Sonderforschungsbereich 1245 „Nuclei: From fundamental Interactions to Structure and Stars“

- Explore **strong interactions in nuclei** their **role in astrophysics** and **related fields**
- With unique **experiment-theory synergies** in Darmstadt (Sprecher: A.Schwenk)
- Using precision experiments at **S-DALINAC** and **facilities best suited for experiment**
- Training **next-generation scientists** in low-energy nuclear physics (main funding of SFB 1245)



# SFB 1245: Central questions and research program



- How does the nuclear chart emerge from chiral EFT?
- How do electroweak interactions couple to nuclei?
- How do nuclei, neutrinos, and the equation of state impact the nucleosynthesis in core-collapse supernovae?

dipole response  
of nuclei

advanced  
many-body  
methods

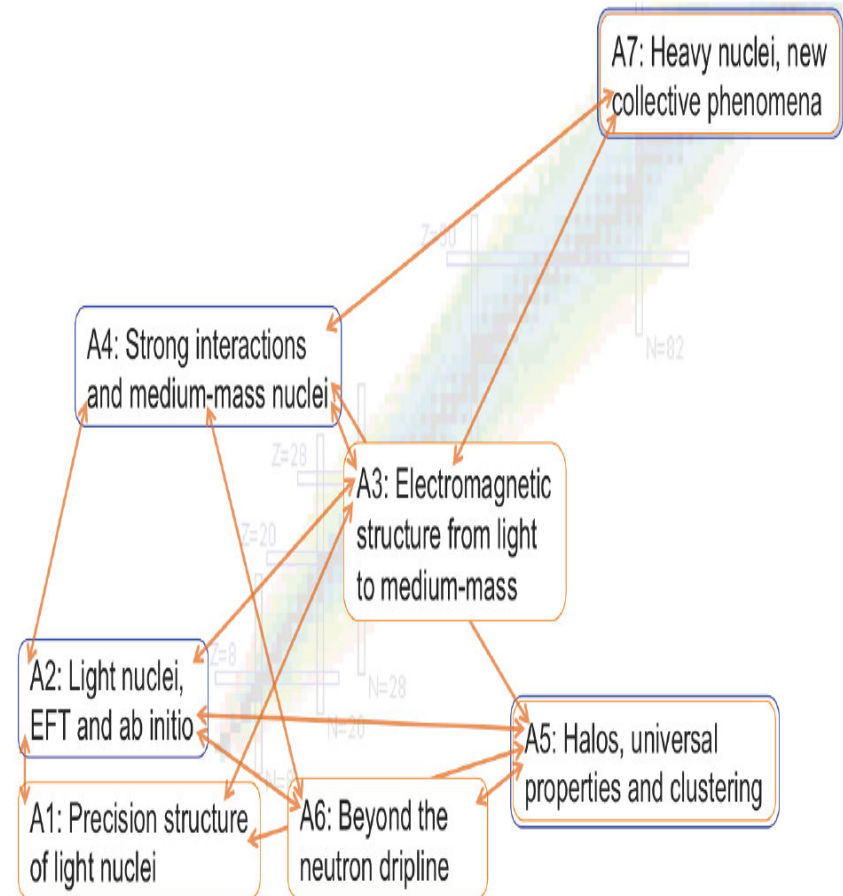
precision  
experiments  
with electromagnetic  
and strong probes

laser  
spectroscopy



# S-DALINAC-Projects in SFB 1245 – Area A

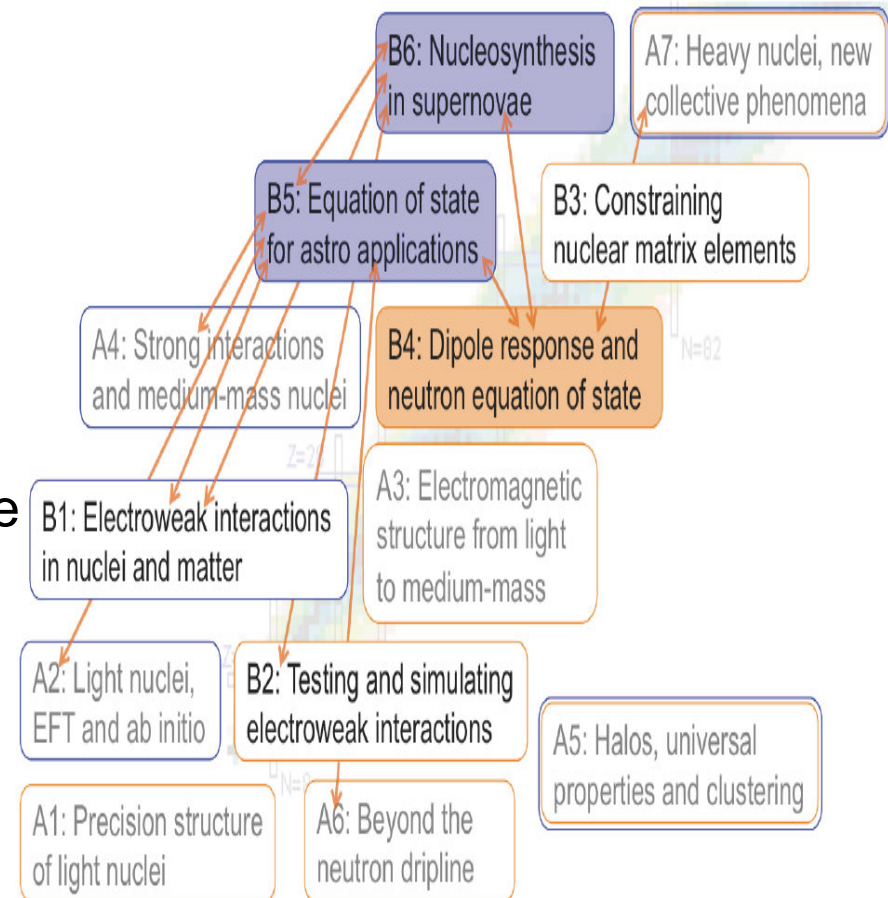
- **A01:**  
Precision measurement of EM-M.E.'s:  
 $^4\text{He}$  in  $(e, e')$  on LHe-Target;  
 $^6\text{Li}$ ,  $^{11}\text{B}$ ,  $^{27}\text{Al}$  in Relat. Self-Absorption,  
Charge radii:  $^6\text{Li}$ ,  $^{11}\text{B}$  in  $(e, e)$
- **A03:**  
 $B(E2)$  in  $^{12}\text{C}$  (NRF),  $B(\pi\lambda)$  in  $^{14}\text{C}$   $(e, e')$
- **A07:**  
Nuclear vorticity  $(e, e'\gamma)$ :  $^{92}\text{Zr}$ ,  $^{208}\text{Pb}$ ,  
 $\gamma$ -decay of GDR (Sn)





# S-DALINAC-Projects in SFB 1245 – Area B

- **B02:**  
q-dependence of magnetic form factors:  $^{10}\text{B}$ ,  $^{16}\text{O}$   $^{40,48}\text{Ca}$  in  $180^\circ$   $-(e,e')$
- **B03:**  
 $\gamma$ -decay and E0 M.E.'s in  $\beta\beta$ -emitters  
NRF:  $^{150}\text{Nd}$ ,  $^{82}\text{Se/Kr}$ ;  $(e,e')$  on  $^{76}\text{Ge/Se}$   
Transition form factors  $^{129,131}\text{Xe}$
- **B04:**  
Complete decay scheme after photoexcitation with tagged photons



**Der S-DALINAC ist fit für eine erfolgreiche  
Zukunft in der kernphysikalischen  
Grundlagenforschung und der Ausbildung in  
der Beschleunigerphysik**

*Vielen Dank!*

