

# MADMAX @ UniHH

Erika Garutti, Alexander Schmidt  
Universität Hamburg

Kick-off meeting  
Saclay, 10-11/05/2017

# The Uni. Hamburg group

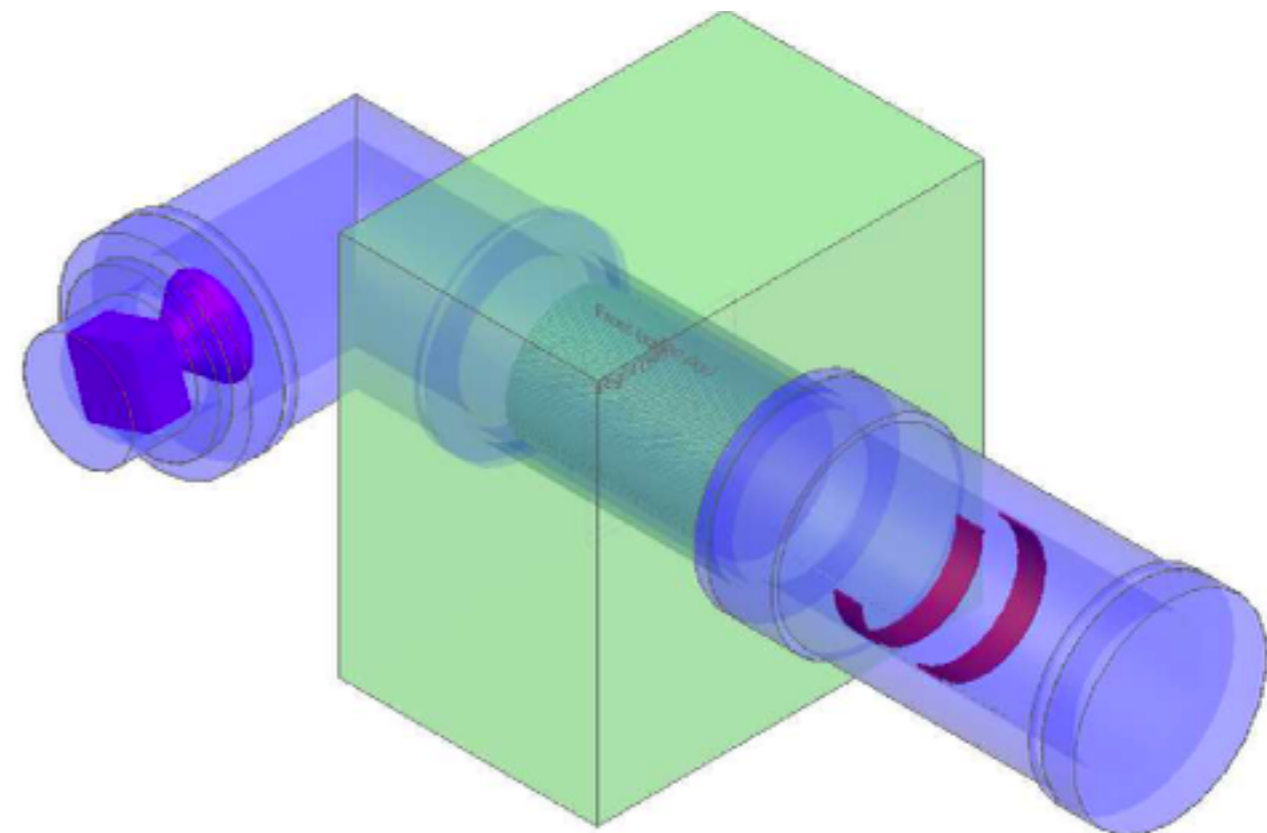
Name	Title	Task
Erika Garutti	Group leader	Mechanics / integration
Alexander Schmidt	Moving to Uni. Aachen	Simulation studies
Michael Matysek	Mech. Eng.	Mechanics
Stephan Martens	Phys.	Tiling test
Nils Böhmer	Elec. Eng.	Tiling test / receiver installation
Jan Schütte-Engel	PHD student	Simulation studies (Jul. 17)
Sara Cerioli	PHD student	Tiling test (Aug. 17)
NN	Post-doc	...

## Available infrastructures:

- mechanical workshop (high precision mechanics)
- large experimental hall (from end of 2018)
- liquid helium (dewar delivery / uni. production)

# Progress so far

- Acquire financial support for lab equipment & experimental hall
- Started purchase Network analyser & dielectric disks
  - Goal: Set-up system for tiling characterisation (a-la MPP)
- Initiated mechanical considerations for prototype booster
  - size of Phase-I experiment
  - cryogenic and power requirements
  - design of cryogenic enclosure (w/o and w/ magnet)
  - ...
  - booster mechanics
- Writing a proposal for MADMAX @ DESY (Phase-II)



# Goals of the prototype booster (Phase-I)

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- Test the scaling of the prototype at MPP Munich to a full 80 discs booster system
- Test the mechanical alignment system
- Investigate behaviour of different dielectric material in a cryogenic environment (and with high magnetic field)
- Check the agreement of simulations & measurements, including boost factor, transmissivity and reflectivity
- Study the required precision and stability of the mechanical alignment system and flatness of disc surface
- First test with a 4 T magnet
- First physics run with reduced sensitivity to obtain exclusion limits on Axion models

# Time line of experiment

## ● Phase-I (Prototype booster)

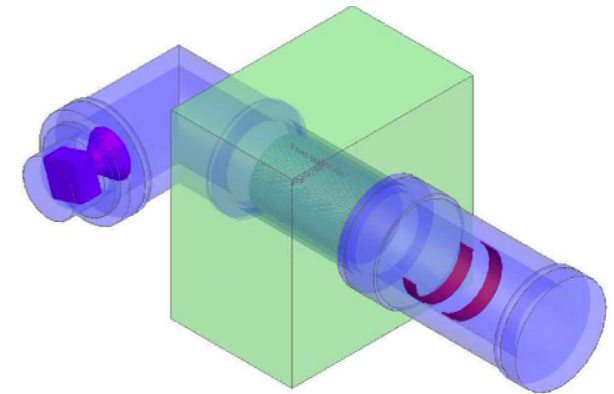
2017-2021

### Requirements:

- Cryogenic vessel enclosure for prototype booster (~10m long, 30 cm diameter). Outsourced design.
- Cryogenics: Liquid helium transport with dewar
- 4 T superconductive magnet (produced by Saclay)
- Expected consumption: 1000 kW / year (~1 kEuro)

### Proposed location:

Uni.HH former cyclotron hall (bunker)



## ● Phase-II (MADMAX experiment)

2021-2031

### Requirements:

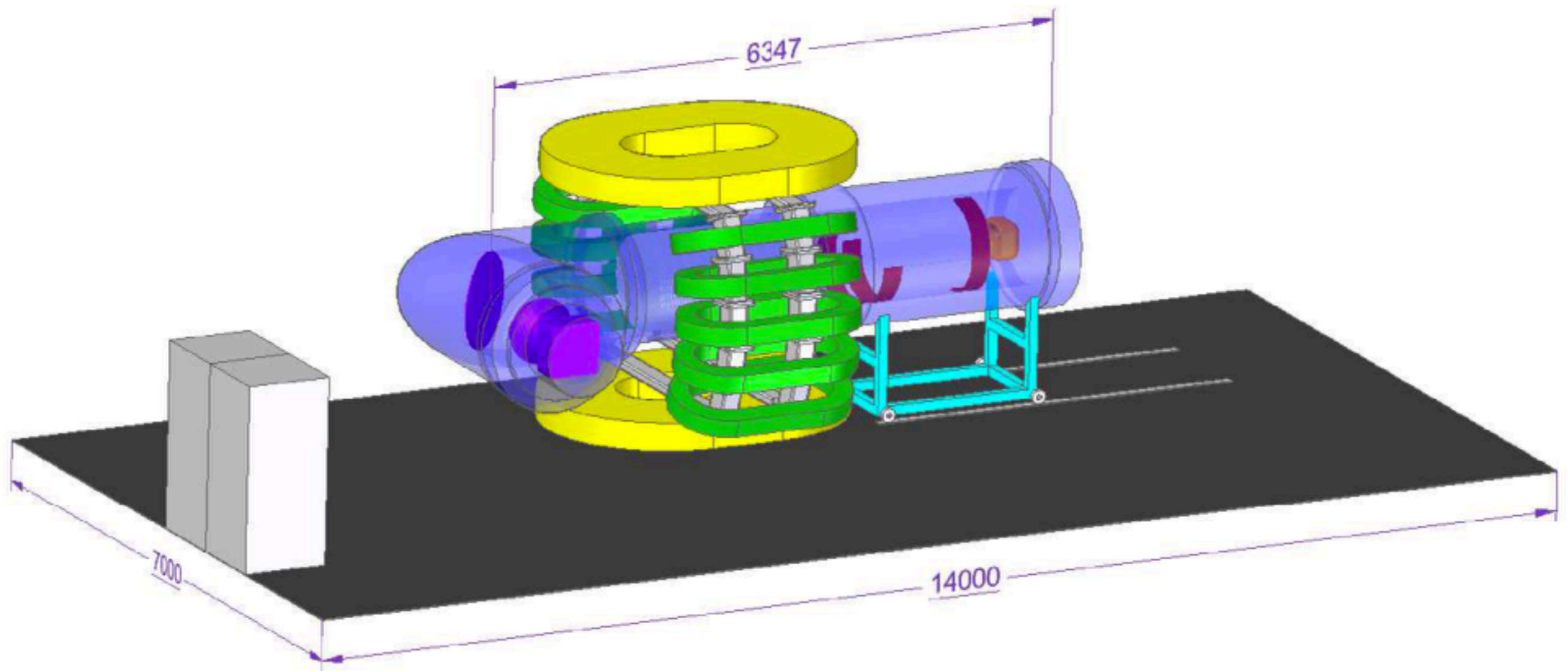
- 20 T crane
- Cryogenic vessel enclosure for prototype booster (~10m long, 100 cm diameter). Outsourced design.
- Cryogenics: Liquid helium transfer line
- 10 T superconductive magnet (produced by MADMAX consortium)
- Expected consumption: 1000 kW / year (~1 kEuro) (+ transfer line, TL)
- Stabilised temperature controlled 23 deg. / humidity control

### Proposed location:

- PLAN A: New location (~200m from cryo plant, TL ~ 200 kEuro / year)
- PLAN B: HERA North Hall (~4 km from cryo plant, TL ~ 1 kEuro / year)

# MADMAX: operation

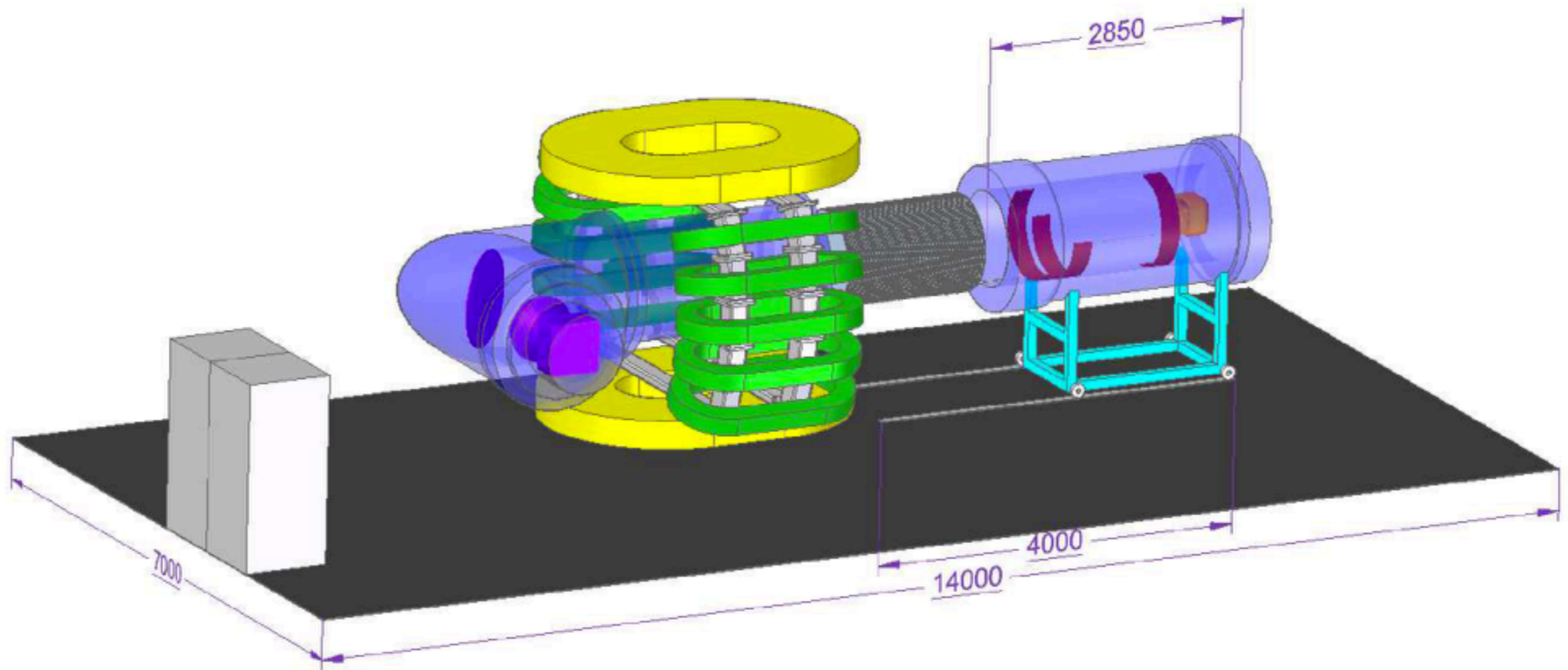
Phase-II



# MADMAX: booster installation

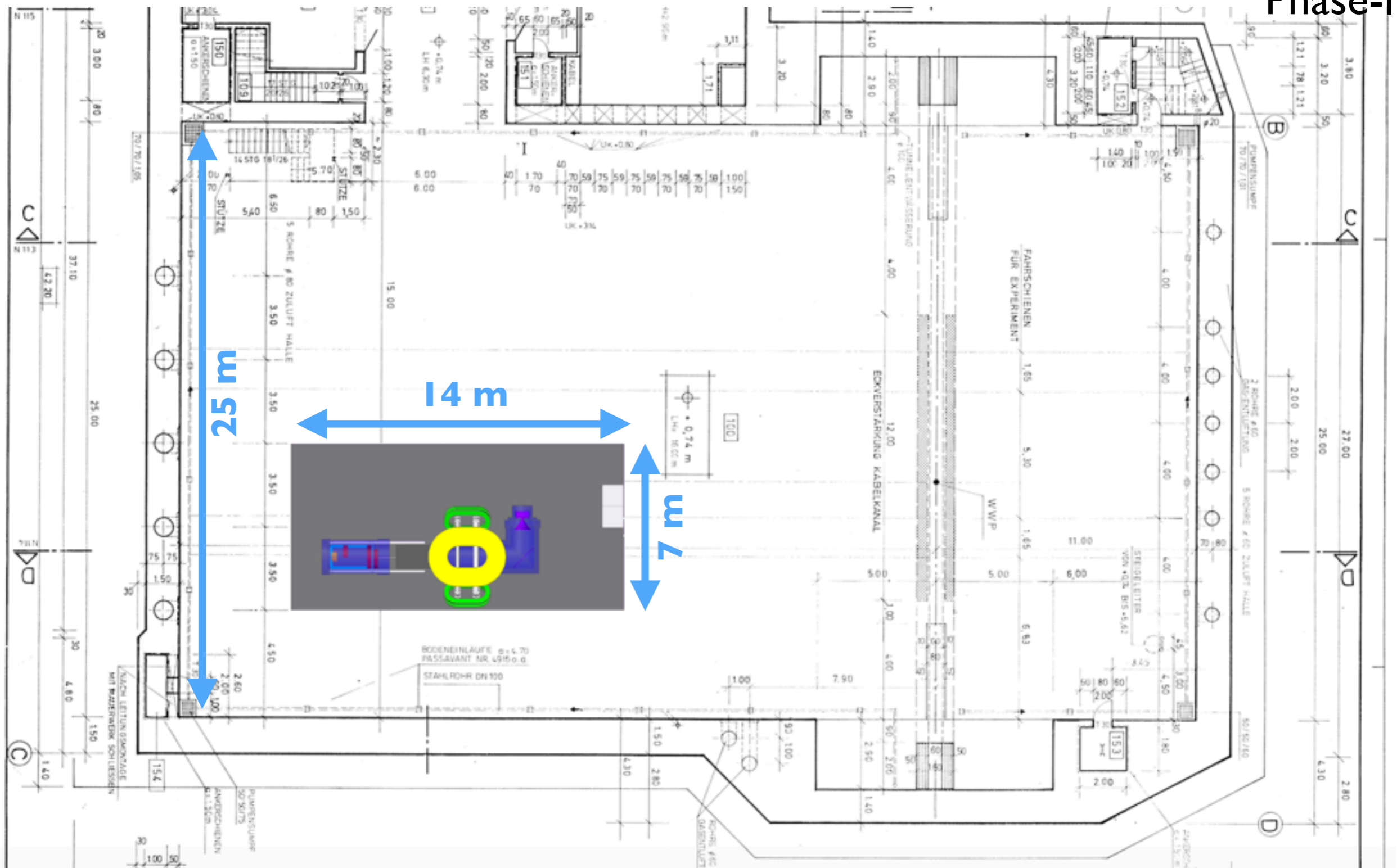
Phase-II

- Discuss installation procedure



# MADMAX in the DESY North Hall (Plan B)

Phase-II





# MADMAX in the DESY North Hall

Phase-II

## PROPOSAL

FOR A NEW EXPERIMENT ON THE SEARCH  
FOR DARK MATTER AXIONS AT DESY

JÖRN SCHAFFRAN, AXEL LINDNER, ALEXANDER SCHMIDT, ERIKA GARUTTI, MICHAEL  
MATYSEK, XYZ

costs of operation

description	number or length	power [W/m]	power [W]	comments
transfer line 80K	1 500	1	1 500	
transfer line 4K	3 000	0.2	600	
LHC magnet 80K	6	8	48	assumption as
LHC magnet 4.5K	6	0.3	1.8	discussed in text

description	equivalent power [W]	primary power [kW]	power 300 days [kW]	costs 300 days
transfer lines (west-north)	684.4	205.3	1 478 250	147.8
distribution system	300	90	648 000	64.8
MADMAX	???	4.5	9720	1
total				213.6 kEUR

Table 2: Description costs for operation of the MADMAX cryostat and magnet.

# List of open questions (Phase-I / Phase-II)

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- requirements on floor vibration
- requirements on RF screening
- magnet power consumption
- magnet liquid helium volume
- ...
- installation procedure

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# Backup

Preparations in the course of the ALPS-II Project (initial costs)

description	nr.	cost/piece	total cost	comments
valves	16	5 000	80 000	controller, regulator, valve socket  bypass until used by MADMAX
controllers, sensors	1	20 000	20 000	
bypass	2	20 000	40 000	
vacuum system for boxes	1	30 000	30 000	
total			170 000	

Link to the MADMAX magnet (later)

description	nr.	cost/piece	total cost	comments
transfer lines	20	5 000	100 000	depends on magnet design
connection for transfer line	1	20 000	20 000	
cooling system	?	?	?	depends on type of cooling power lines, ramping circles
warmgaspanel (?)	12	3 000	36 000	
panel for power lines	2	1 500	3 000	
distribution box - valve	12	35 000	420 000	for magnet/cryostat
transfer line (experiment)	30	1 200	36 000	connection distribution box
connection transfer line	6	20 000	120 000	2 cryostats + 1 magnet
total			735 000	

total			905 000	
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