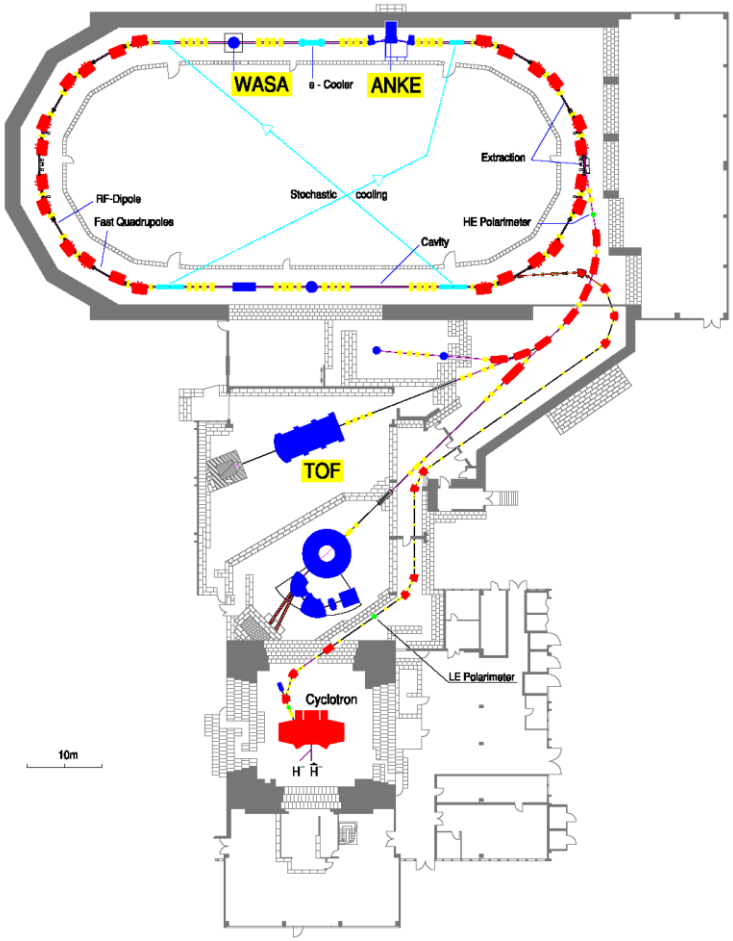
JÜLICH
FORSCHUNGSZENTRUM

Commissioning of the 2 MeV COSY Electron Cooler in Juelich

June 11, 2013 | Vsevolod Kamerdzhiev for BINP and COSY teams

COSY accelerator facility



COSY accelerates (polarized) protons and deuterons between 300/600 and 3700 MeV/c

4 internal and 3 external experimental areas

Electron cooling at low momenta

Stochastic cooling at high momenta

Low energy electron cooler

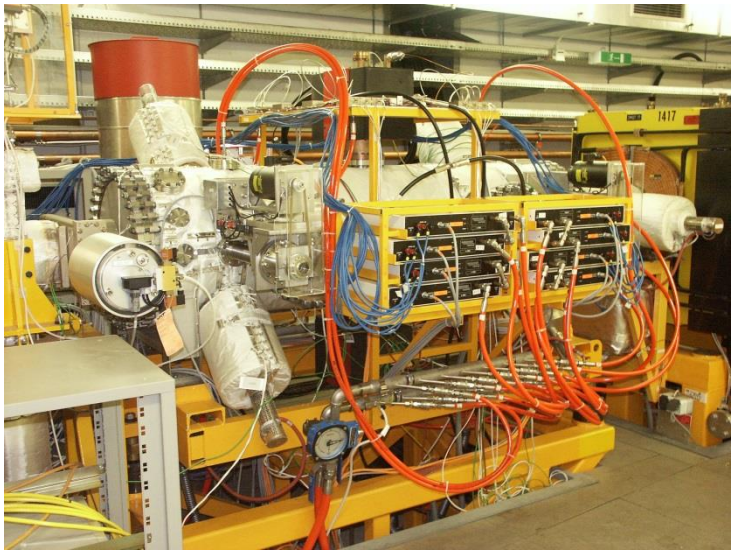
Design values:

Electron energy up to 100 kV

Electron current up to 3 A

Stochastic cooling

2 Pickup-Tanks, 4m long, cooled to 20 K
2 Kicker-Tanks, 2 m long
Frequency range: 1.0-1.8 GHz and 1.8-3.0 GHz
Adjustable delays for different particle velocities above β=0.85
Longitudinal notch filter cooling with the vertical system in „sum-mode“



Internal Target Experiments at COSY

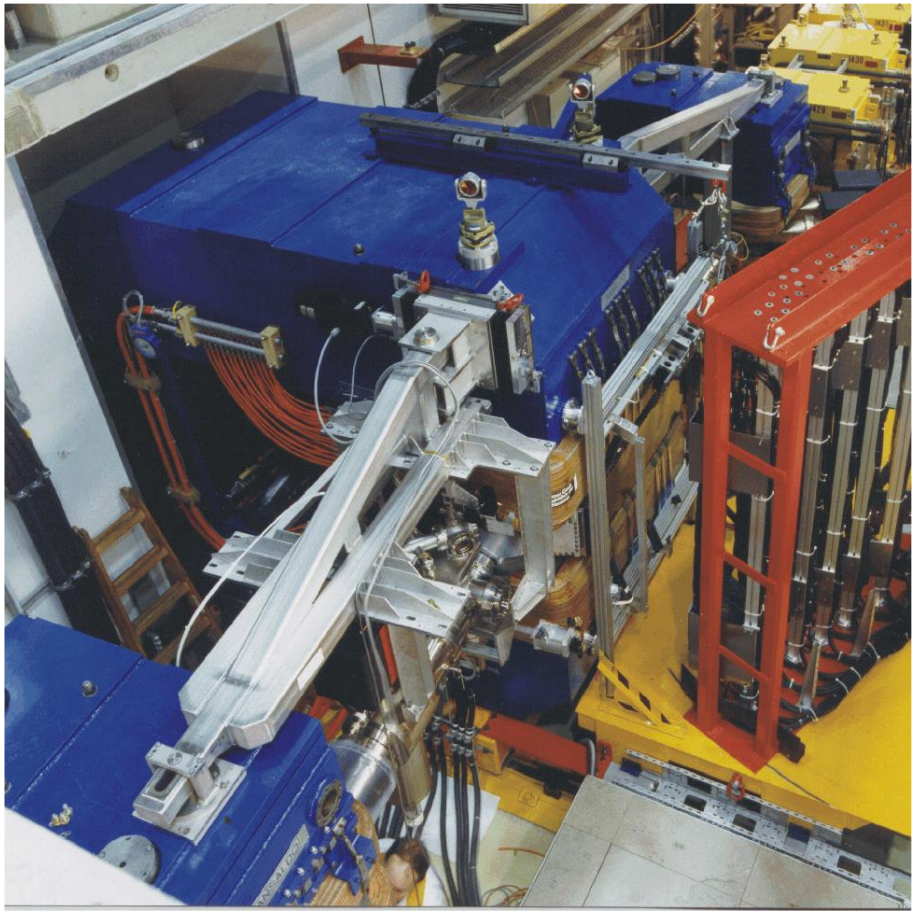
ANKE

Dipole spectrometer

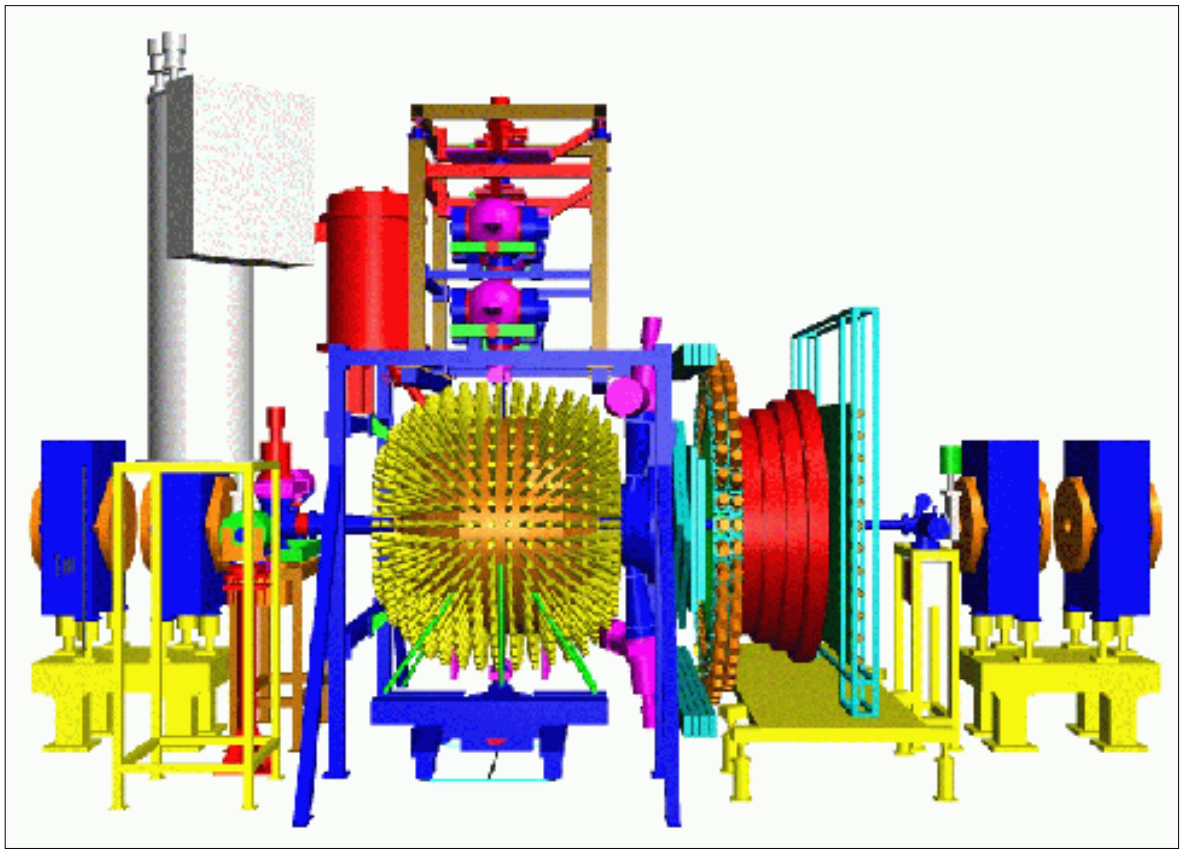
Polarized target

Cluster target

Solid state target



Internal Target Experiments at COSY



WASA

Solenoidal field

Pellet target

Motivation for a 2MeV electron cooler

Electron cooling up to maximum momentum in COSY

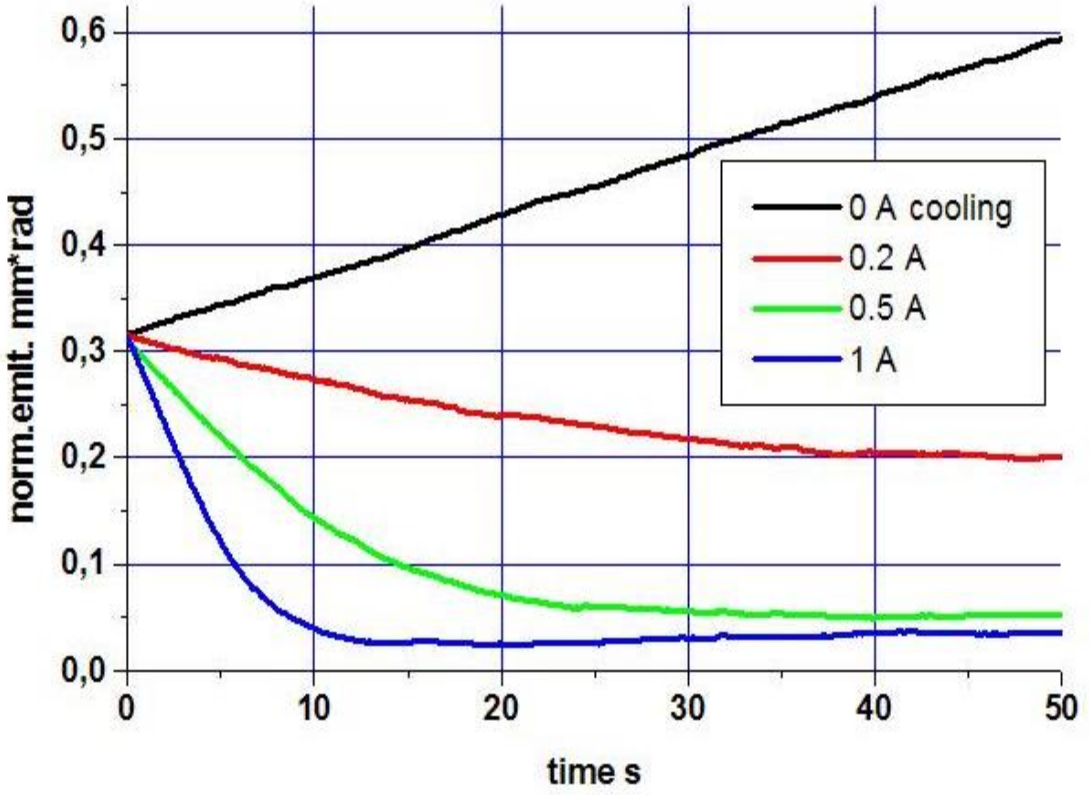
Improve beam quality and beam life time with dense internal targets

Study beam equilibrium under the influence of:

- internal targets
- barrier bucket cavity
- stochastic cooling
- electron cooling

Future developments for HESR@FAIR

Benefits of electron cooling



1 MeV electrons

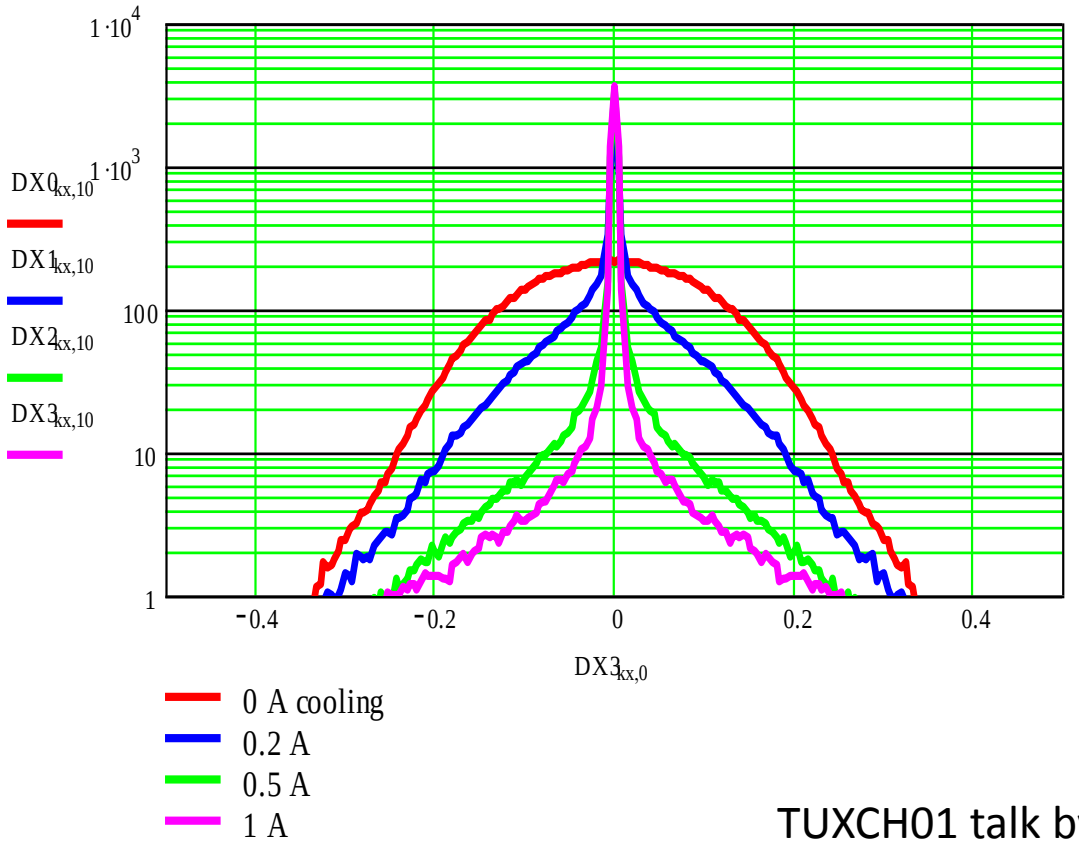
10 mm e-beam Ø

2 kG at cooler section

Target density 10^{15} 1/cm^2

TUXCH01 talk by V.V.Parkhomchuk, RuPAC12

Benefits of electron cooling



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Why BINP?

Electron cooling was proposed by G.I. Budker in 1966

BINP electron coolers for accelerators around the world:

NAP-M, LEIR, SIS18, CSRm, CSRe, COSY

Brief history of the 2MeV cooler project

2003 - initial idea and discussion at BINP, J. Dietrich, V.V. Parkhomchuk

May 2005 – “Feasibility study of 2 MeV electron cooling for COSY” by V.V. Parkhomchuk’s group, BINP

Sept. 2005 – “COSY 2MeV Cooling System Proposal”, talk by J. Dietrich at COOL05, Galena + working group on COSY 2MeV Cooler

March 2009 – funding in Jülich

July 2009 – contract FZJ-BINP

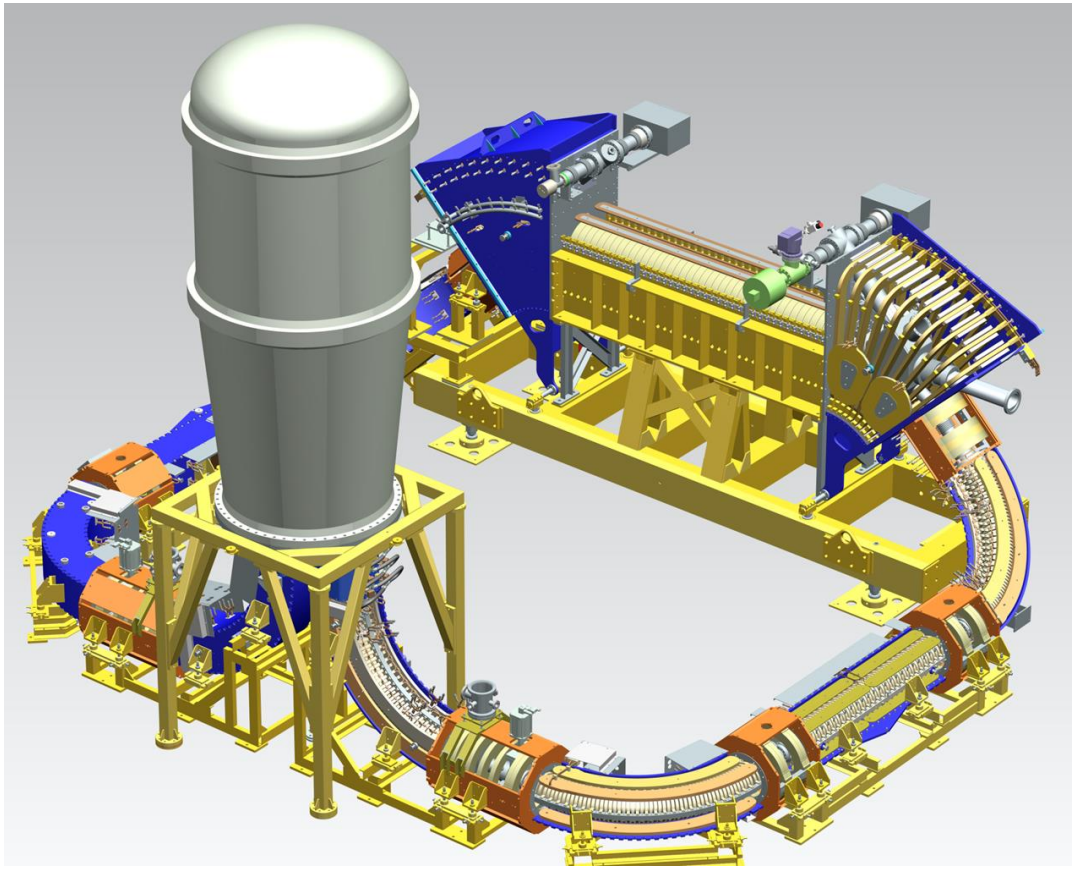
Nov. 2009 - CDR, Electron Cooler for COSY 2 MeV

2012 – e-beam commissioning at BINP

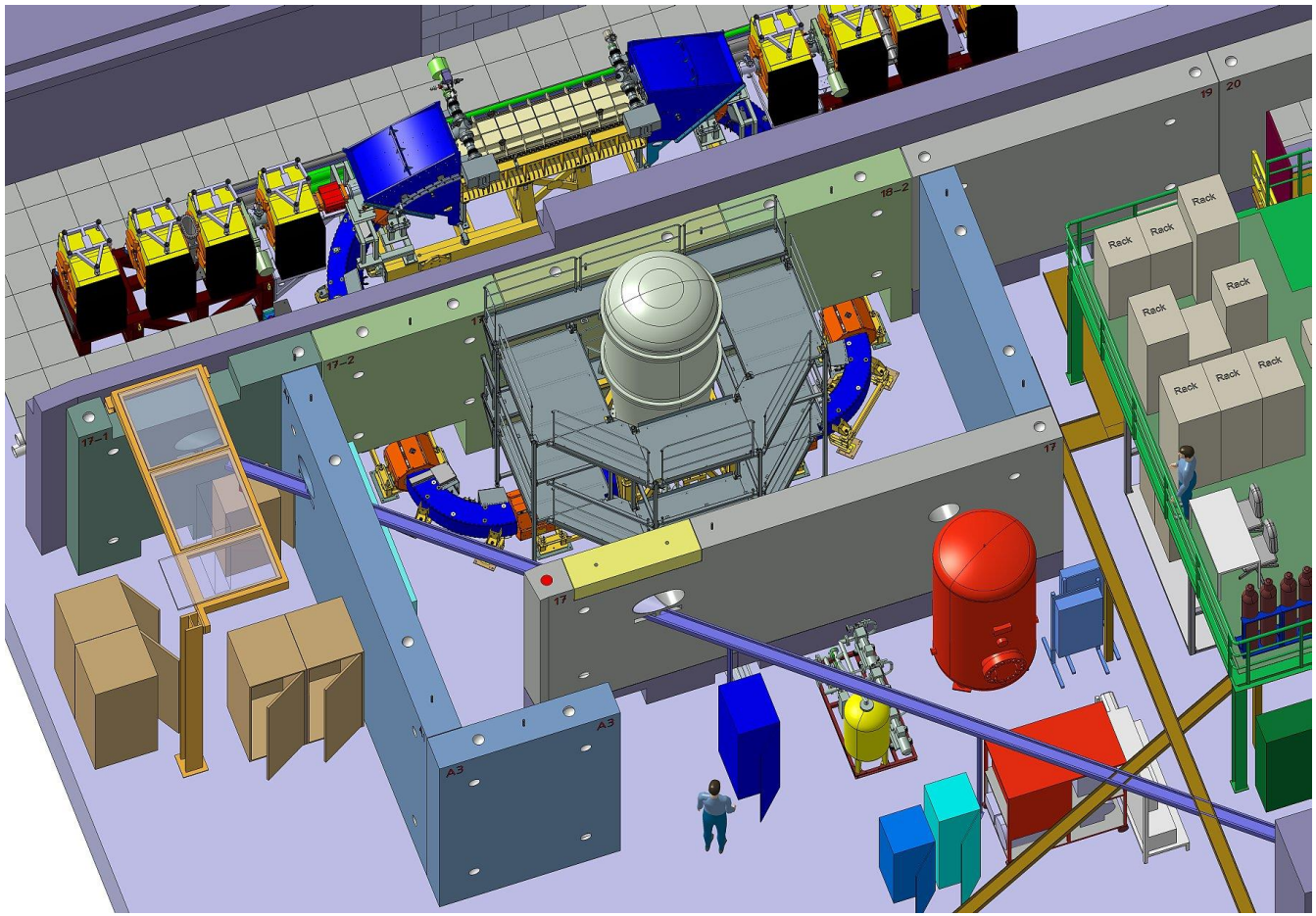
Dec. 2012 - delivery to COSY, Jülich

April 2013 – begin installation into COSY

2MeV electron cooler - design



2MeV electron cooler – integration into COSY



Shipping the cooler

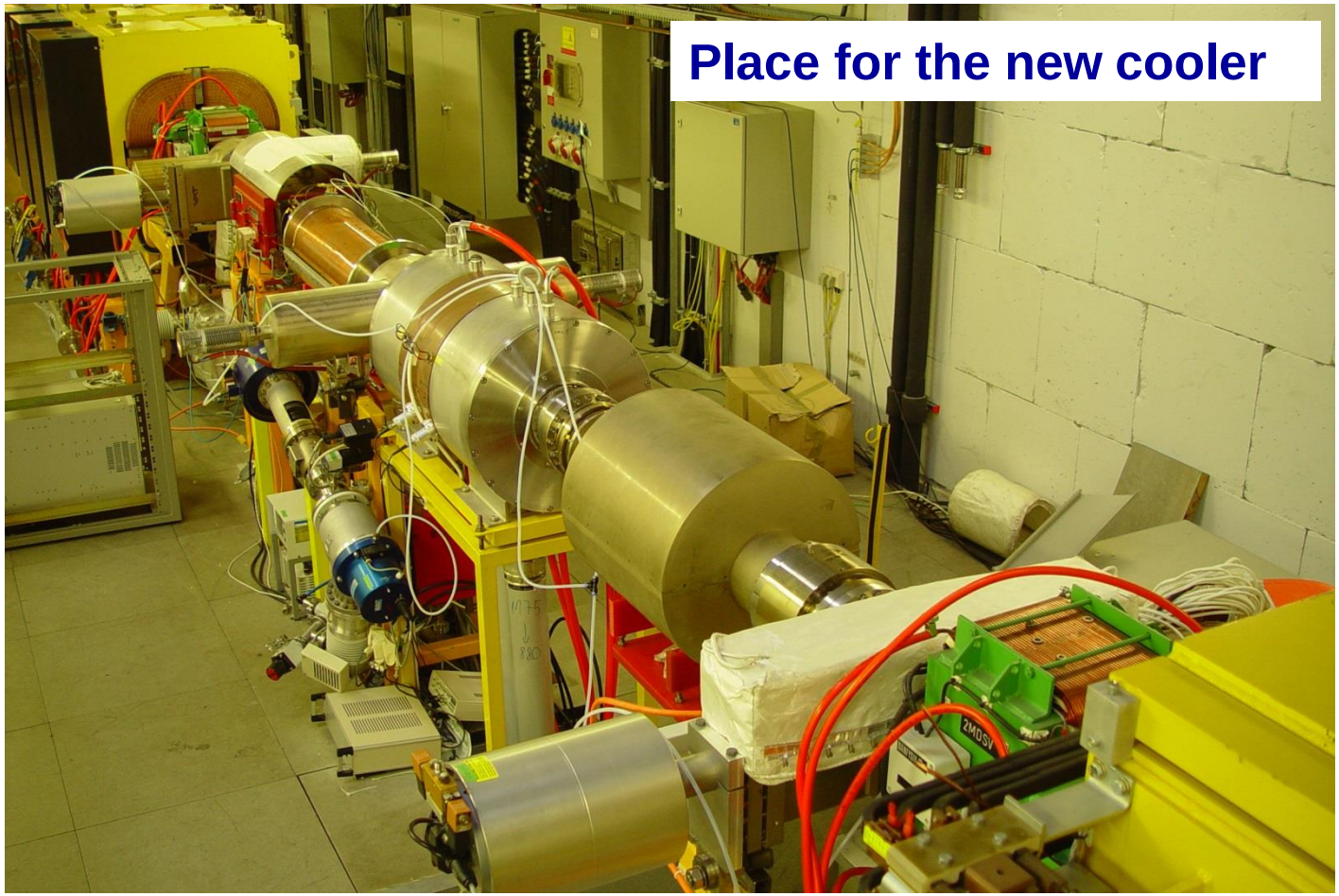
Unloading the trucks in Jülich, 91 items in 2 trucks, 5 Dec. 2012

The Installation team

BINP personnel who attended the installation at COSY (in no particular order):
Reva V.B., Zapyatkin N.P., Bubley A.V., Stebaylo D.L., Ezhkov G.N., Goncharov A.D., German A.A., Gosteev V.K., Panasyuk V.M., Belikov O.V., Protopopov N.P., Skorobogatov D.N., Semenov A.V., Lomakin A.A., Alinovskiy N.I., Bryzgunov M.I., Gusev I.A., Pureskin D.N., Senkov D.V., Chekavinskiy V.A., Bekhtenev E.A., Kondaurov M.N., Meshkov O.I., Fedotov M.G., Isachenko V.I., Vandyshev A.V., Karpov G.V., Markhel A.E., Lekhanov V.V.

COSY team

Making Space Available (shutdown in 2010)

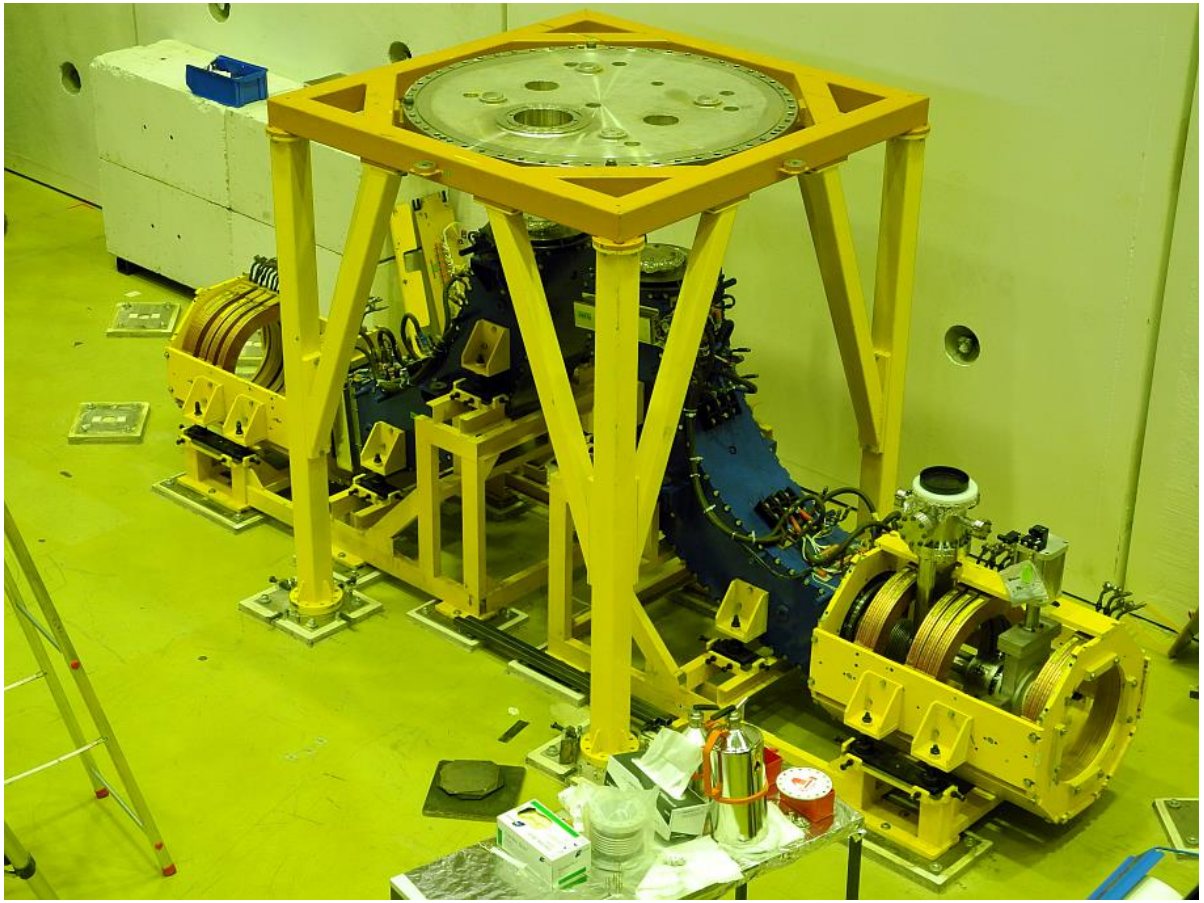


Preparation of COSY

Preparation of cooler components

Installation

Installation



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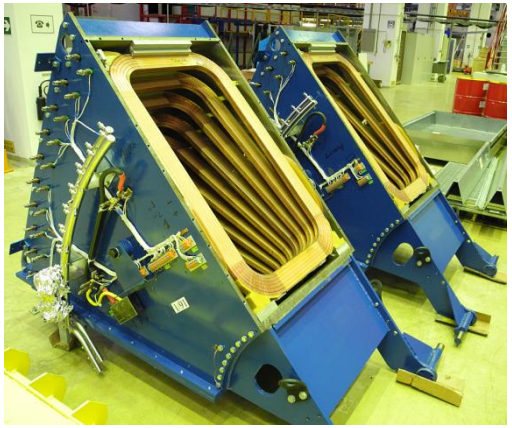

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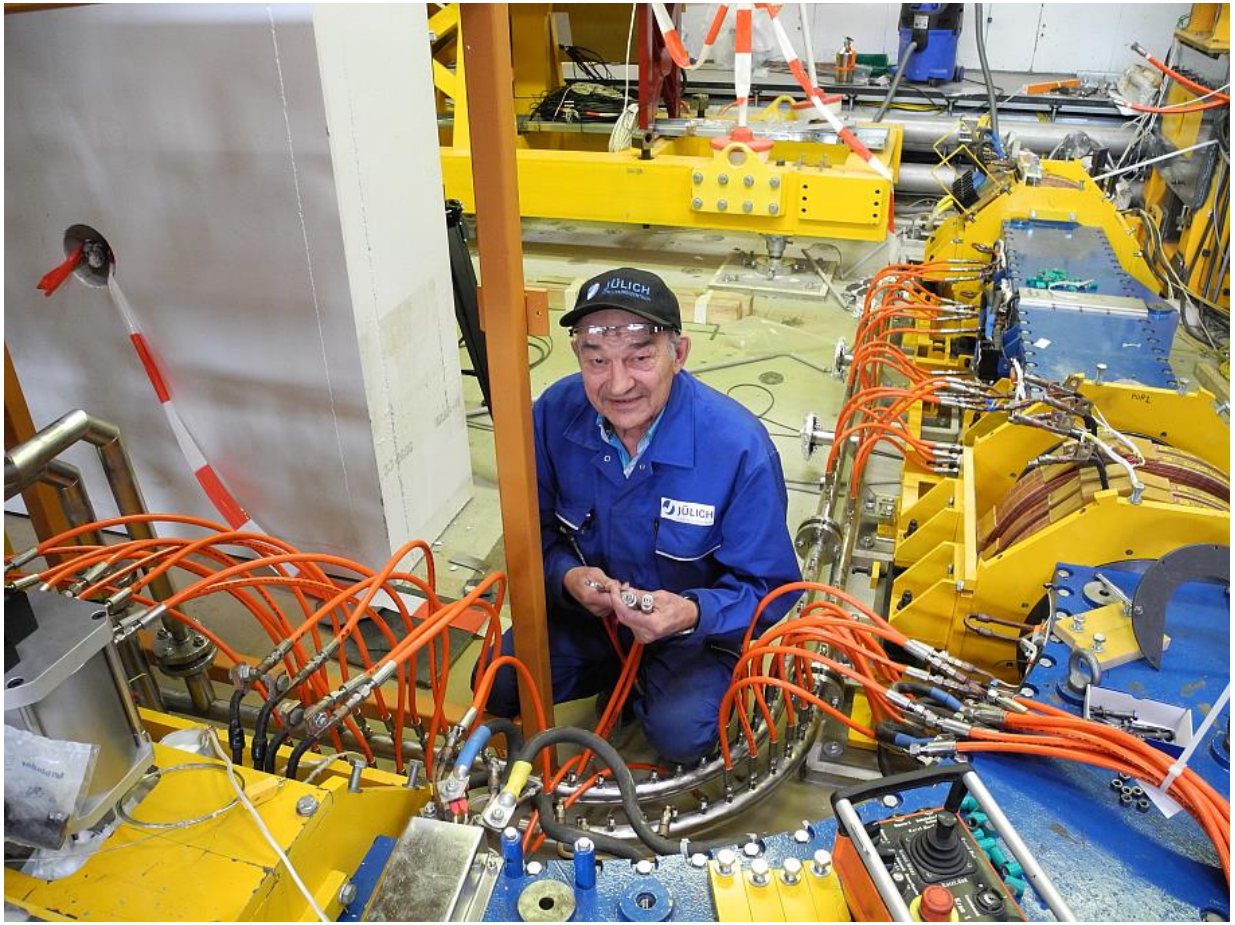

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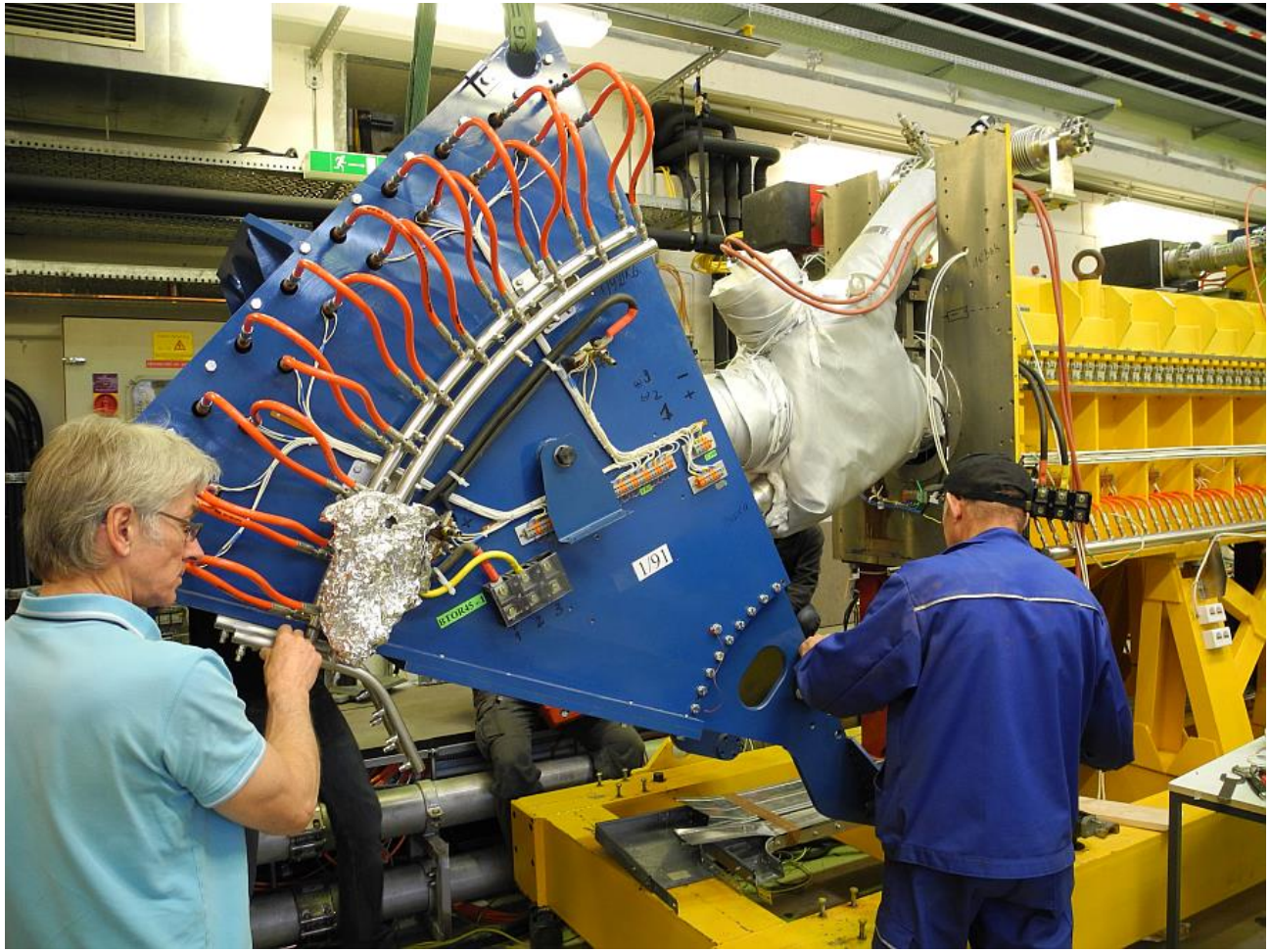

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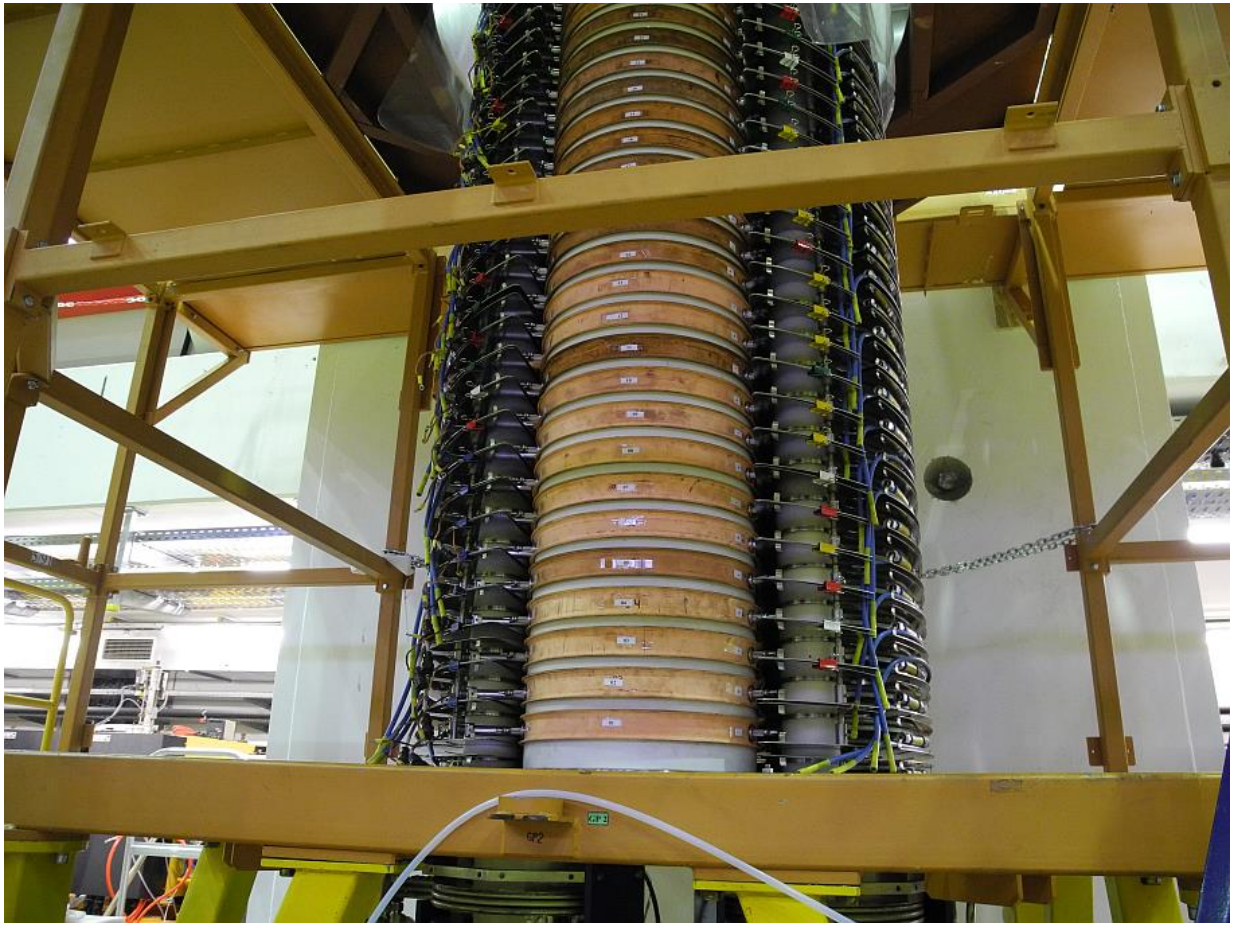

Current status

Magnets installed

Water cooling is established

Vacuum system assembled (except Wien filter and collector)

Vacuum baking complete

HV Sections are installed and tested

Cascade transformer is installed and tested

Oil system installed

BPMs and electronics installed and tested

Wien filter is being repaired

Expected installation in about a week

200 kV voltage demonstrated at HV terminal

Further presentations

Please see poster presentations by the BINP colleagues

Thank you