

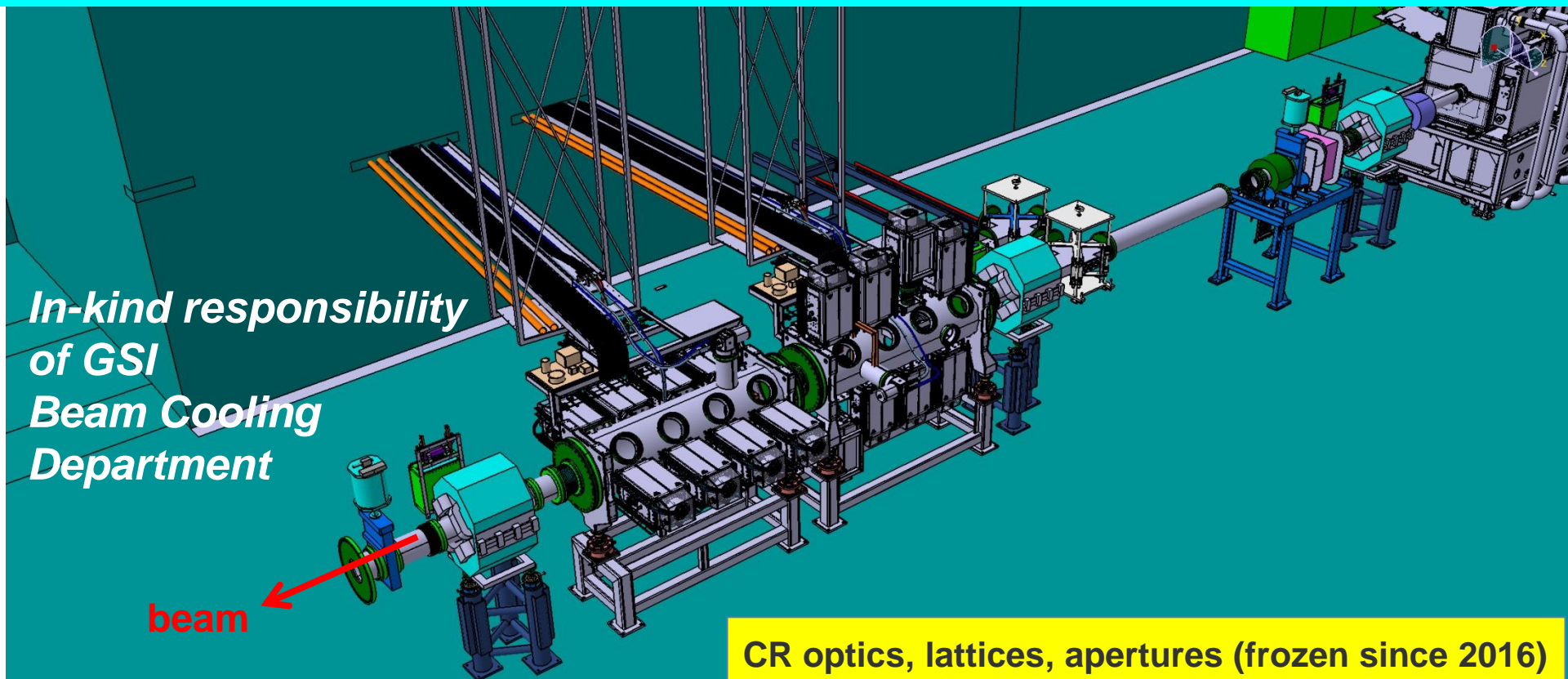
# CR stochastic cooling system (1-2 GHz)

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*3d BINP FAIR Workshop  
Novosibirsk 2019*

**Main task of the CR = efficient collection & fast stochastic cooling of hot secondary beams (antiprotons, rare isotopes) coming from production targets**

**3D stochastic cooling (band 1-2 GHz) of coasting secondary beams, max.  $10^8$  ions (antiprotons @  $v = 0.97c$ , rare isotopes @  $v = 0.83c$ )**



*In-kind responsibility  
of GSI  
Beam Cooling  
Department*

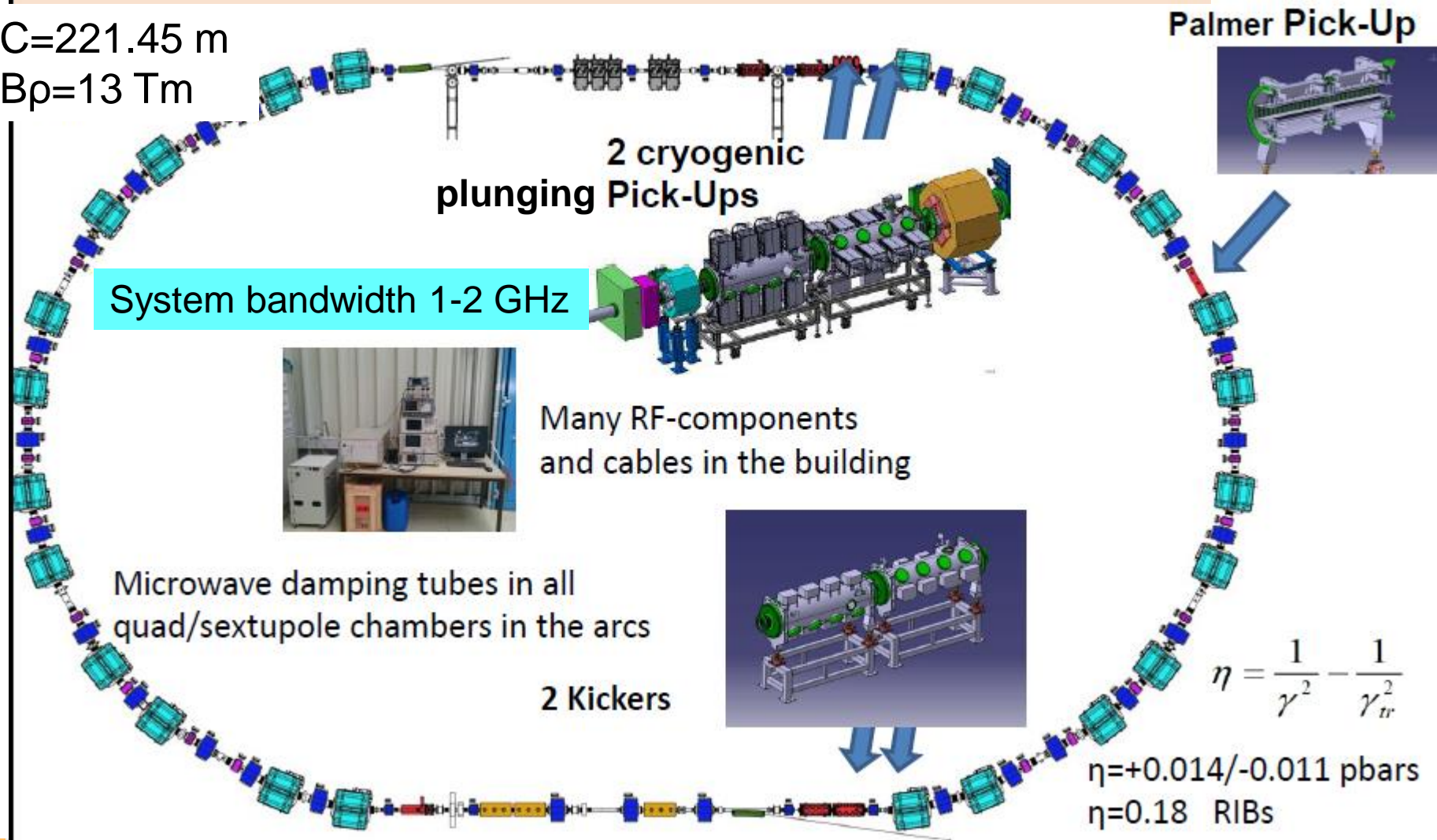
**CR optics, lattices, apertures (frozen since 2016)  
jointly optimized to serve the stoch. cooling**

# CR & its Stochastic Cooling (SC) System



CR UHV aim for requested beam lifetimes of 100 s:  
 basic static  $P \leq 3 \cdot 10^{-9}$  mbar ( $N_2$  equivalent) at room temperature, **without in situ bakeout**

$C=221.45$  m  
 $B_p=13$  Tm



System bandwidth 1-2 GHz

2 cryogenic plunging Pick-Ups

Palmer Pick-Up

Many RF-components and cables in the building

Microwave damping tubes in all quad/sextupole chambers in the arcs

2 Kickers

$$\eta = \frac{1}{\gamma^2} - \frac{1}{\gamma_{tr}^2}$$

$\eta = +0.014/-0.011$  pbars  
 $\eta = 0.18$  RIBs



## LEVEL & ATTITUDE

Technical/engineering updates, exchange, next steps  
Hands-on & at eye level (наравне)

## SPECIFIC

**Focus = mechanical & vacuum engineering/integration**

**Interfaces GSI SC system to BINP CR magnet/vacuum system**

- ceramic microwave absorbers inside all quad./sextupole vacuum chambers
- Palmer Pickup tank with CR-K DN500 flanges (~ ISO K ) recommended by BINP

**Update on mechanical integration (DMU) of CR machine, building**



## GENERAL

**Component level:** BINP and GSI = providers of CR components

### **Preassembly/ alignment/ installation/ logistics (storage, transport)**

- Consolidate information from FAIR project team
- Rules of procedure fixed ? Room for feedback from WPs?
- Who (GSI technical team, BINP team, external staff, other) should do what
- Critical components, critical time lines, limited human resources: pragmatic approach over bureaucracy

### **Machine level:**

Management visions on future CR commissioning & beam operation?

Role of BINP and GSI/FAIR accelerator specialists?

# Microwave Damping-Coated Ceramic Absorbers



140 coated ceramic tube modules inside all hexagonal quad/sextupole vacuum chambers

-Q1/2020: test assembly, full UHV test inside BINP prototype chamber.



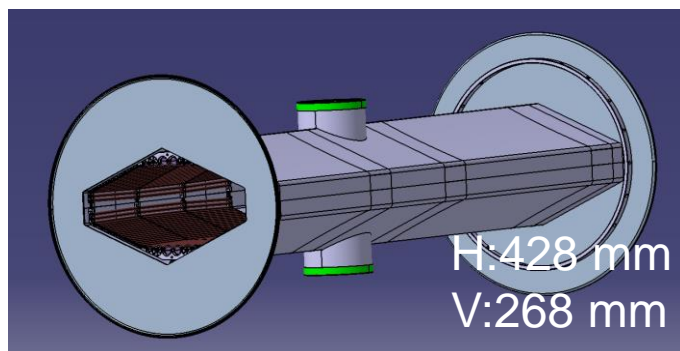
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Vacuum chamber in preparations for electron-welding of two halves.

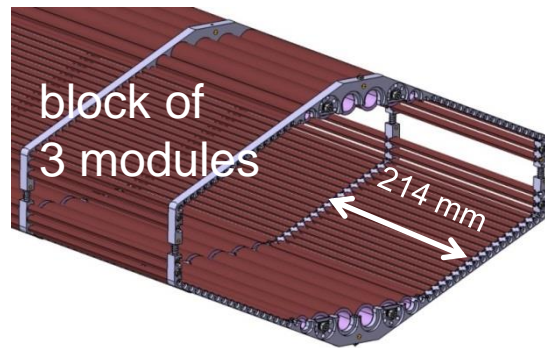
Tuning of e-welding regimes for hexagonal chamber:



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# Microwave Damping-Coated Ceramic Absorbers



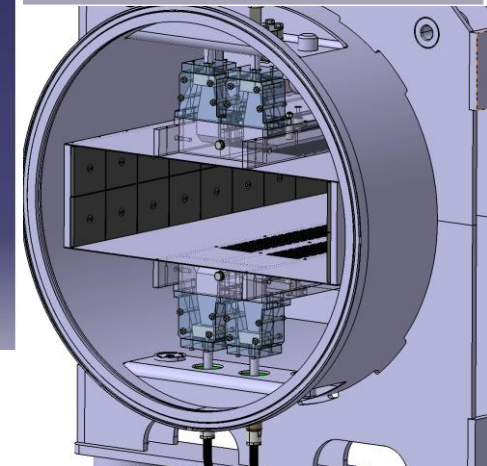
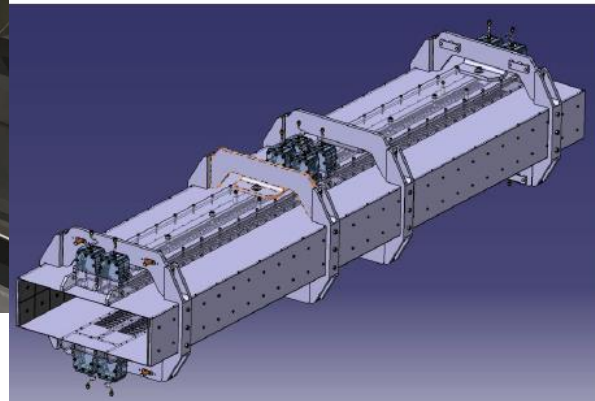
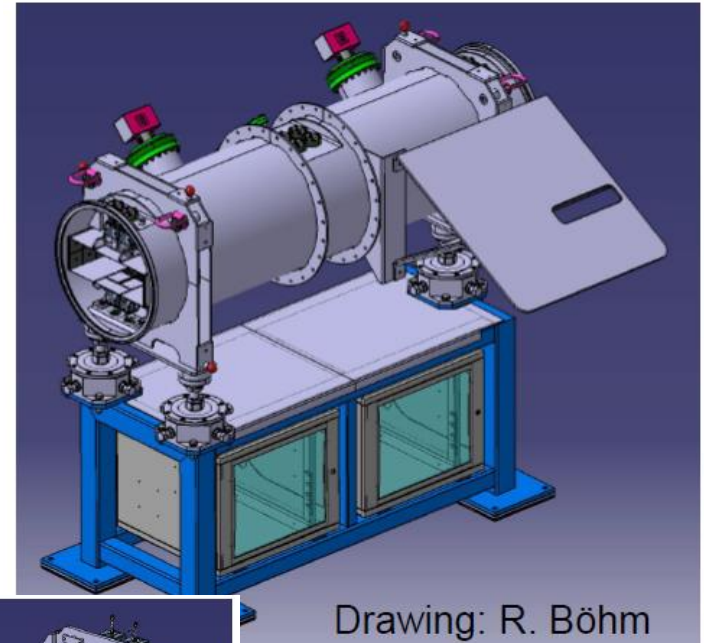
140 modules  
(incl. 5% spares)

**-Prototype: Draft engineering concept.  
First batch of Al<sub>2</sub>O<sub>3</sub> tubes coated  
(by NiCr sputtering at ISE Freiburg).  
UHV test done (outgassing rate acceptable).**

**-Series:  
2019-2020: Procure and coat all tubes.  
2020-2021: assemble and store all modules**

# Palmer Pick-Up

Palmer pick-up (rail electrodes) for precooling of RIBs



- Tank and inner structure in production
- All expected by Jan. 2020
- PU will be assembled in Jülich and tested with 0.83 c protons at COSY in 2020-2021



Thank you for your attention!  
Спасибо за внимание!

