

# Present Status of Vacuum System Construction

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for KEKB Vacuum Group**

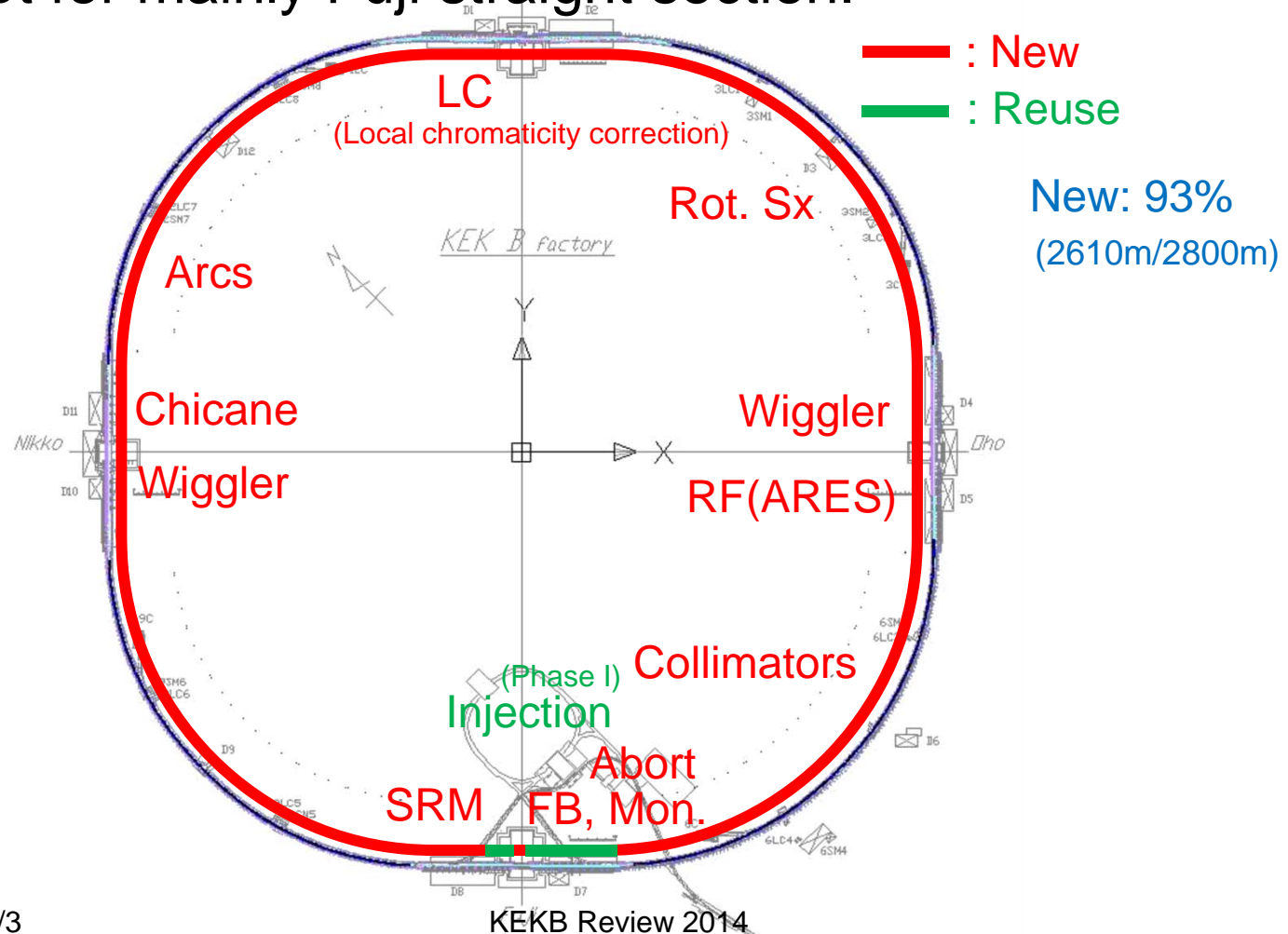
- Production
- Installation
- Schedule
- Summary

**\*Details about the pre-installation work and the beam collimators are presented next by Shibata-san and Ishibashi-san, respectively.**

**\*Vacuum system around IP is presented by Kanazawa-san.**

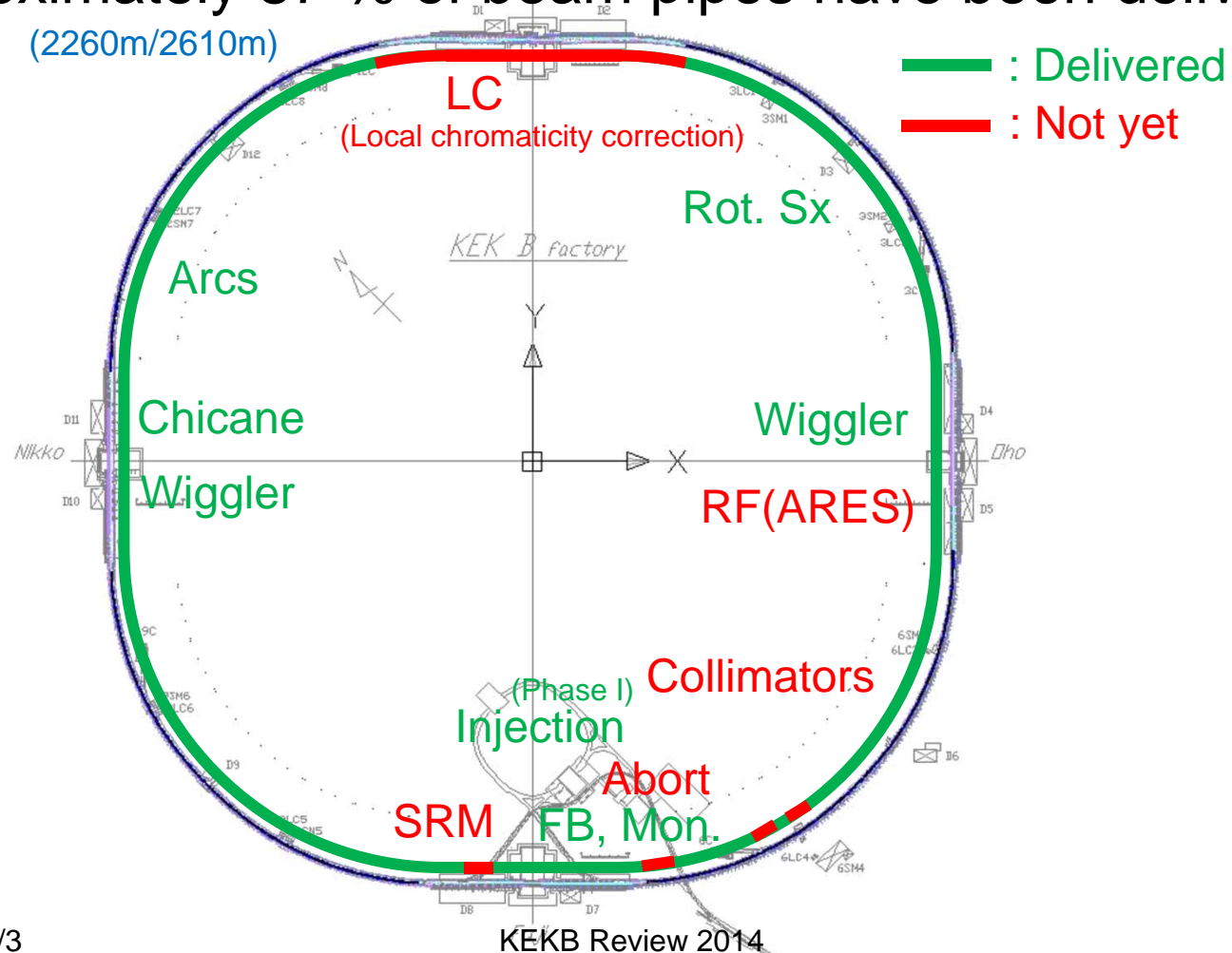
- LER (plan)

- Most of beam pipes and components are newly produced, except for mainly Fuji straight section.

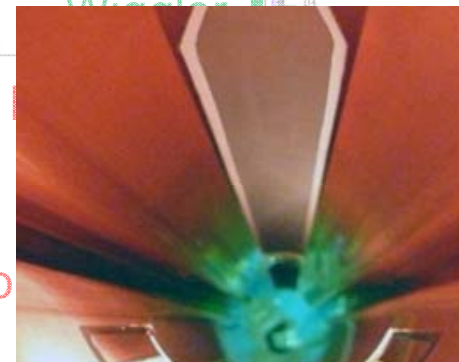
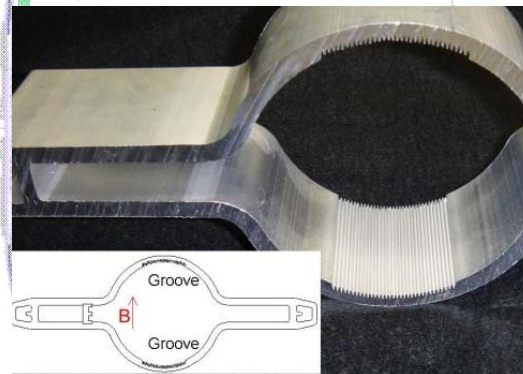


- LER (now)

- All beam pipes were ordered.
- Approximately 87 % of beam pipes have been delivered.



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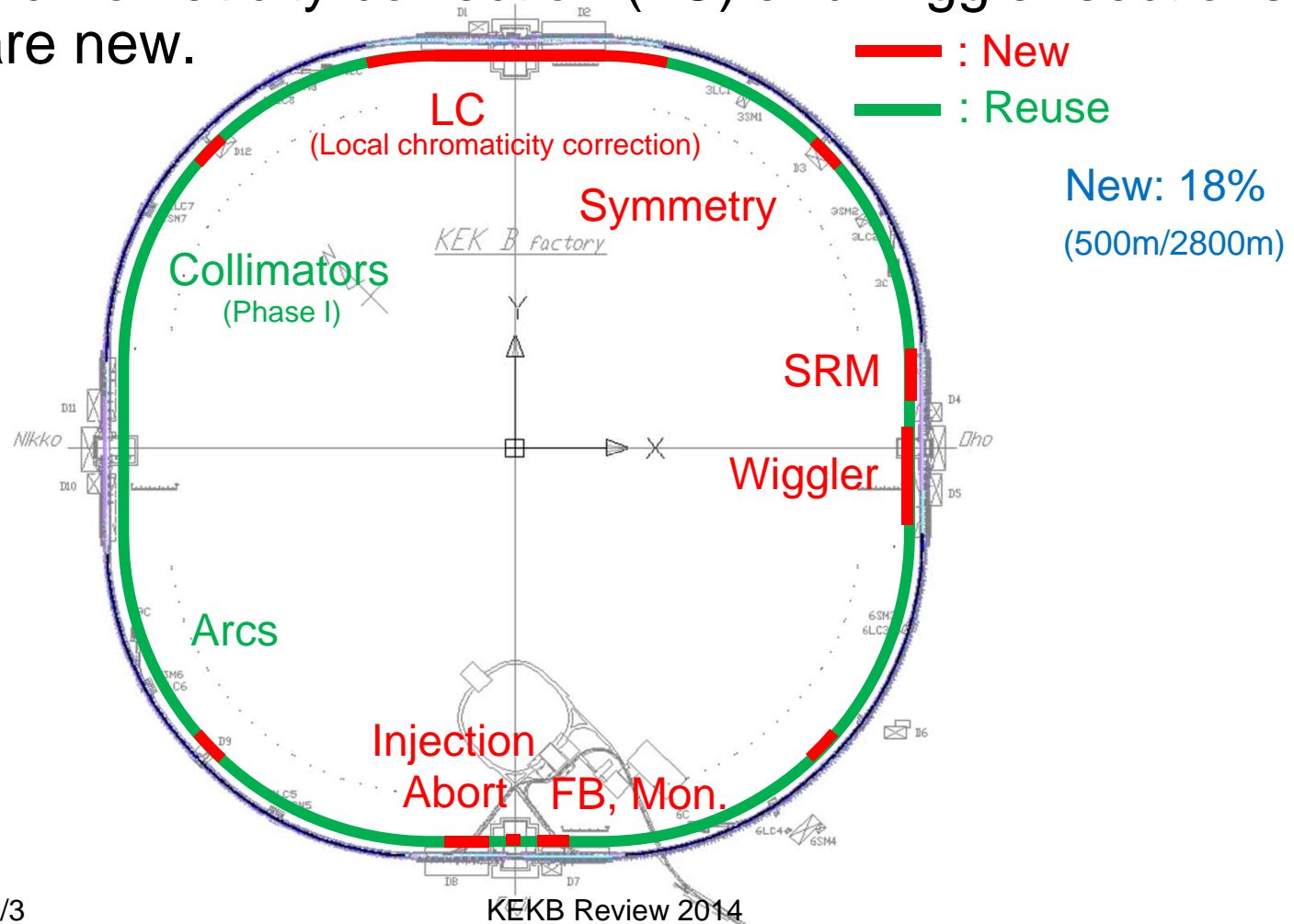
Beam pipes for arcs  
(aluminum-alloy)

Special thanks for  
BINP effort!

Beam pipes for wigglers  
(OFHC)

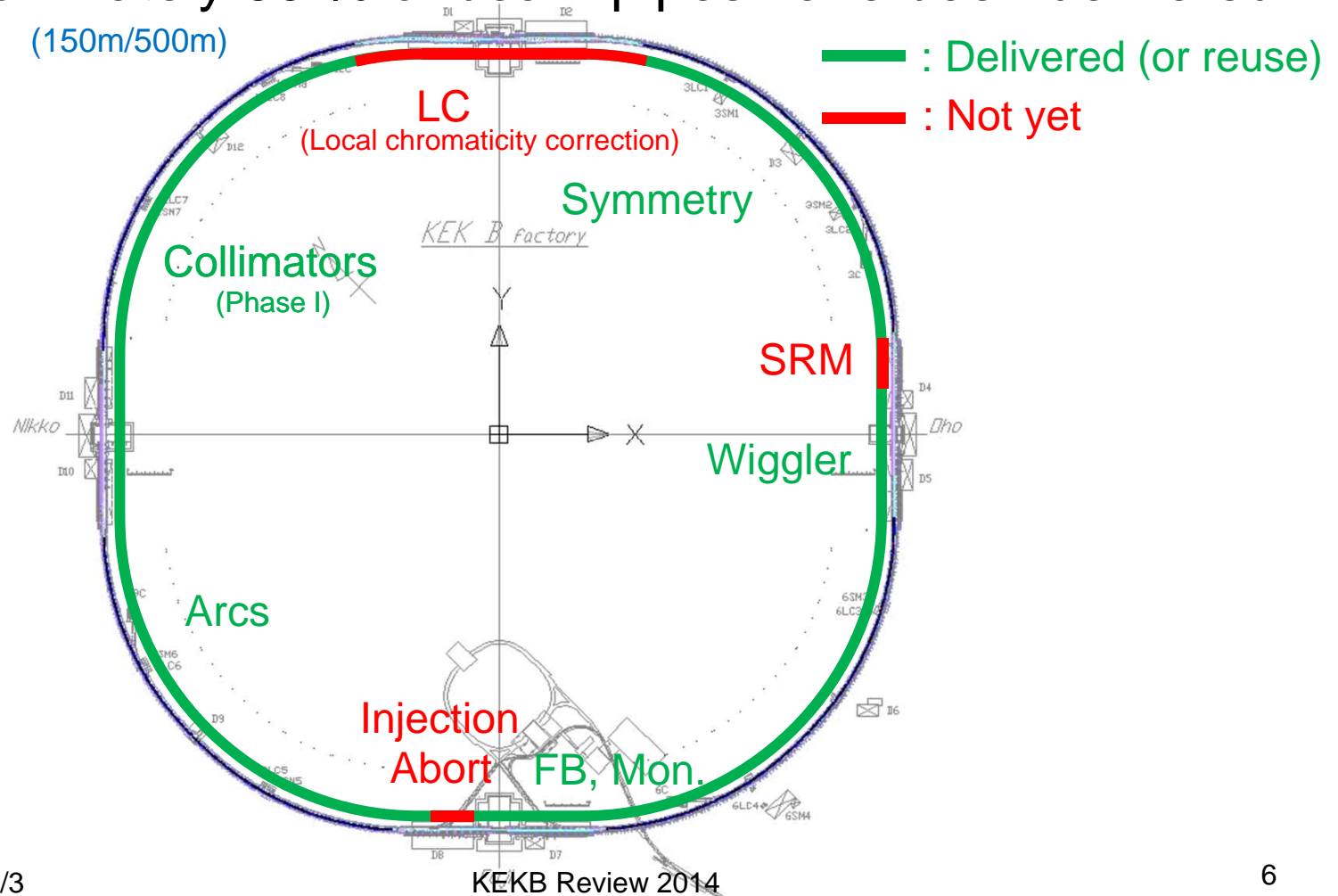
- HER (plan)

- Most of beam pipes and components are reused.
- Local chromaticity correction (LC) and wiggler sections etc. are new.



- **HER (now)**

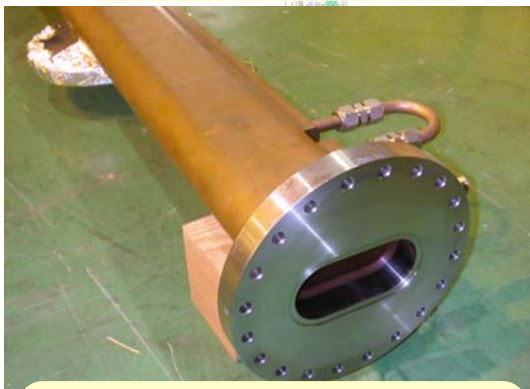
- All beam pipes were ordered.
- Approximately 30 % of beam pipes have been delivered.



- HER (now)
  - All beam pipes were ordered.
  - Approximately 30 % of beam pipes have been delivered.

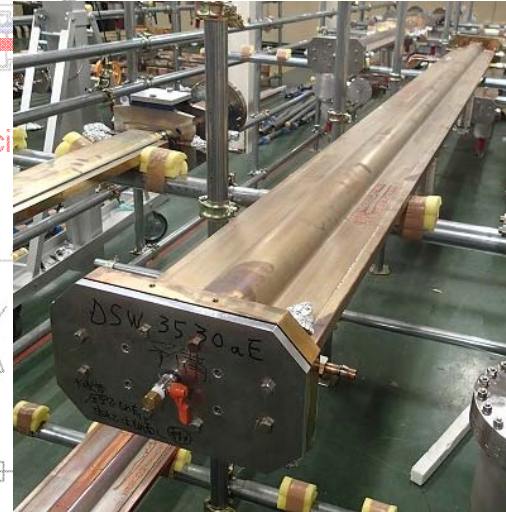


Beam collimators



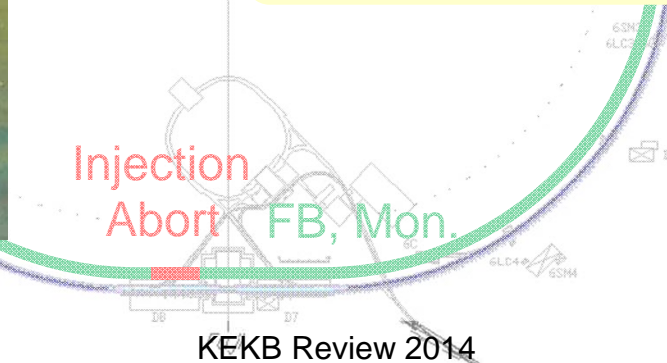
Beam pipes for arcs (OFHC)

2014/3/3



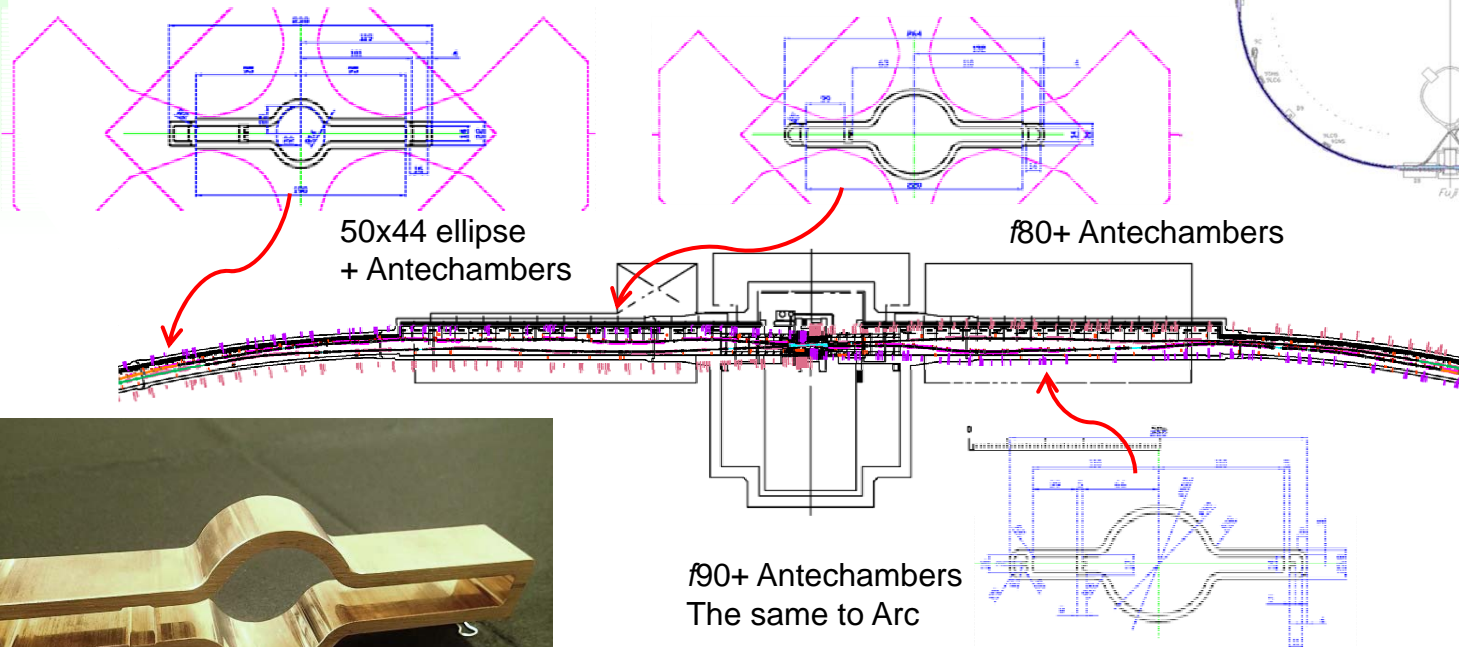
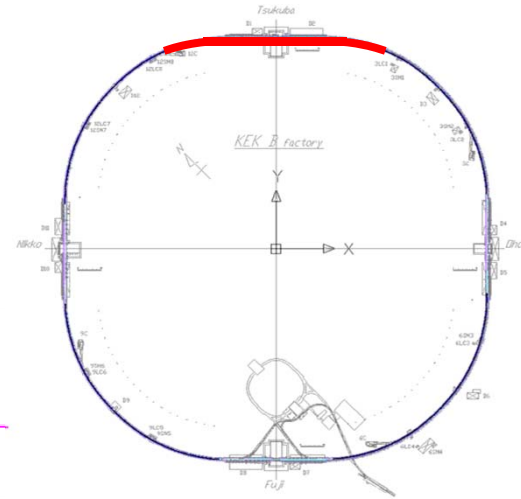
Beam pipes for wigglers (OFHC)

delivered (or reuse)  
not yet



- **Beam pipes for LC under production**

- Basically the same design to the arc section.
- Use copper at upstream side considering back ground of the detector even for LER.
- HER ~270 m, LER ~270 m
- Including beam pipes for dithering coils.

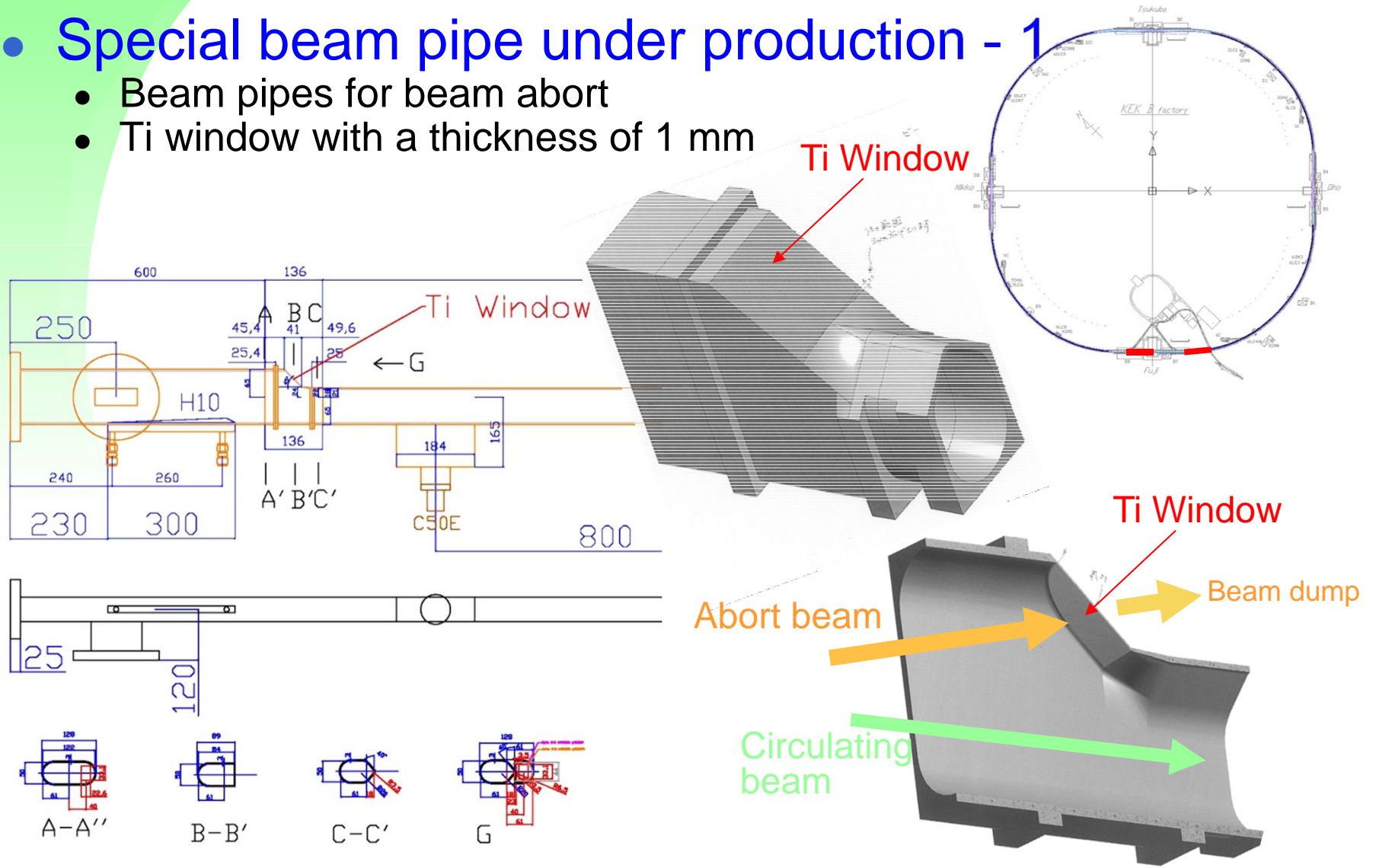


**New antechamber for HER**



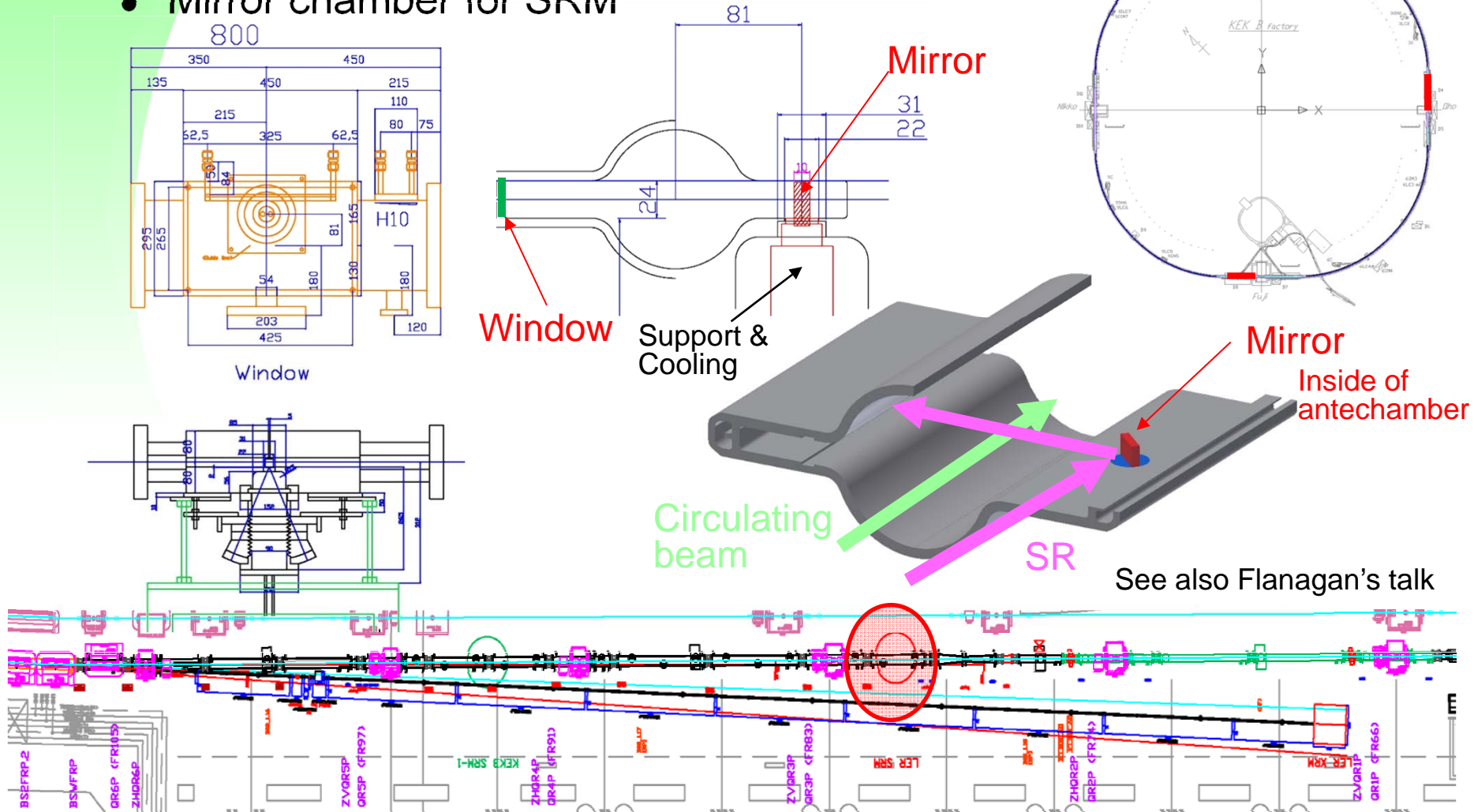
- Special beam pipe under production - 1

- Beam pipes for beam abort
- Ti window with a thickness of 1 mm





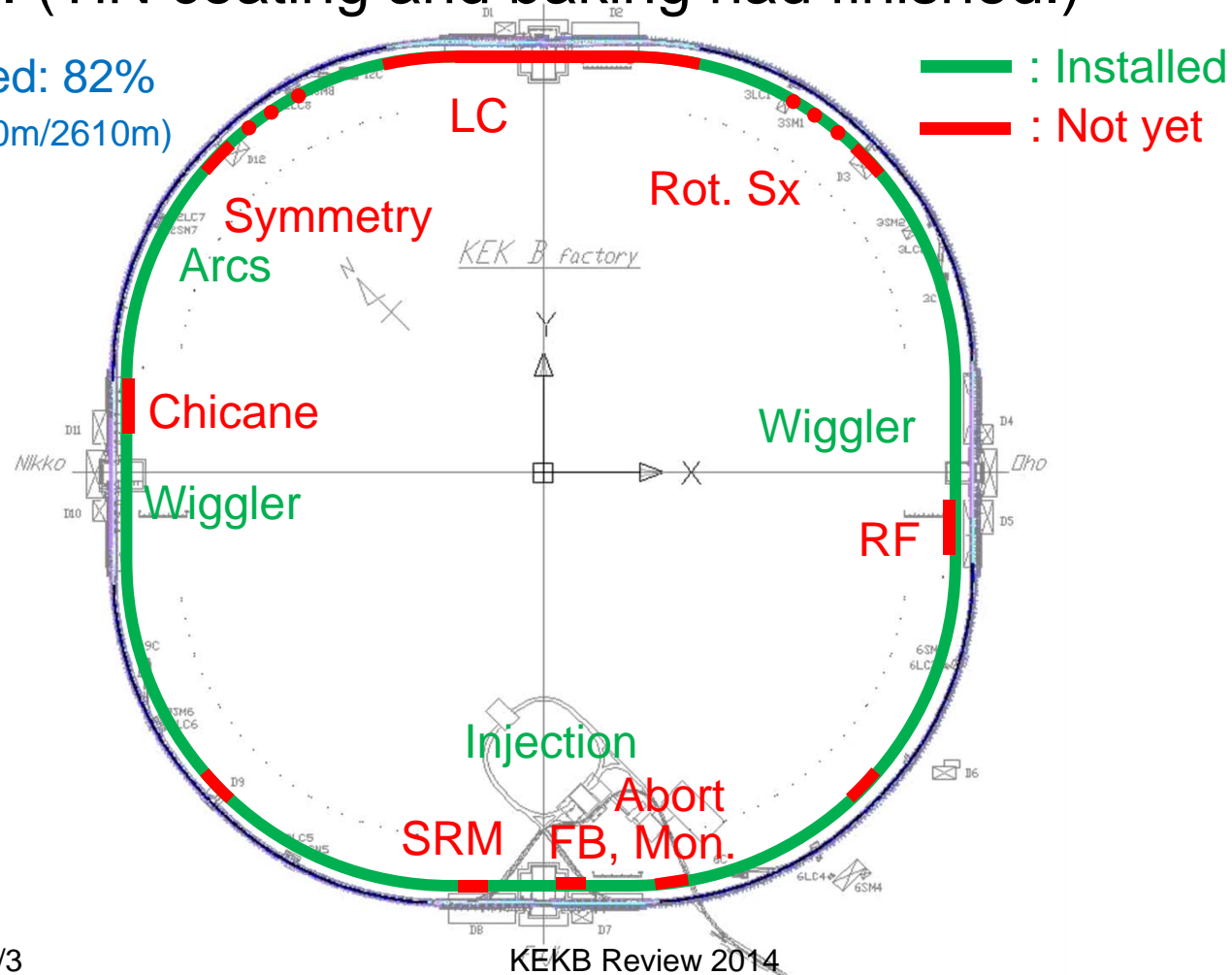
- Special chamber under production - 3
  - Mirror chamber for SRM



- LER

- Installation has almost finished for the delivered beam pipes. (TiN coating and baking had finished.)

Installed: 82%  
(2130m/2610m)

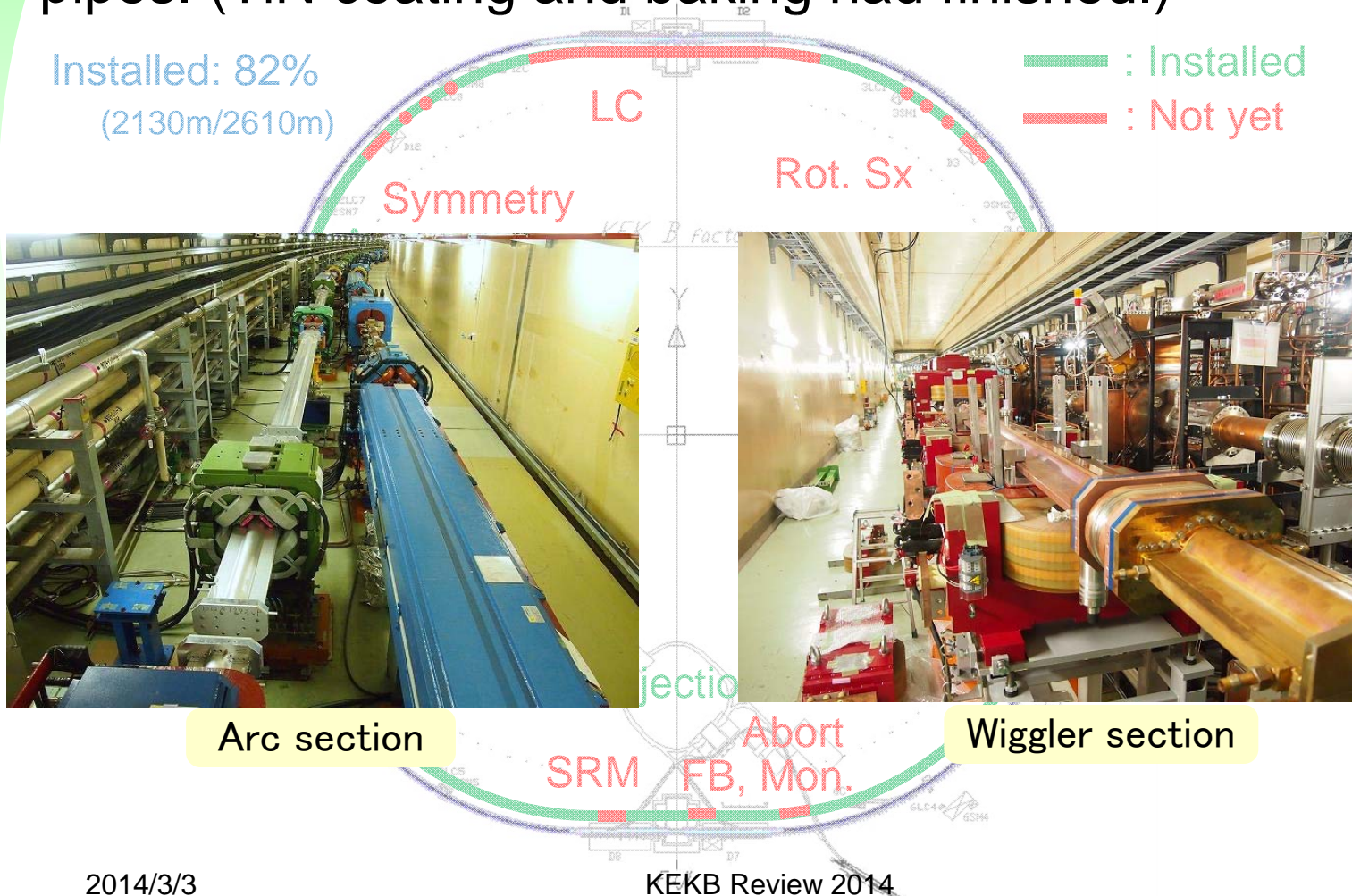


- LER

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Installed: 82%  
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— : Installed  
— : Not yet



- LER

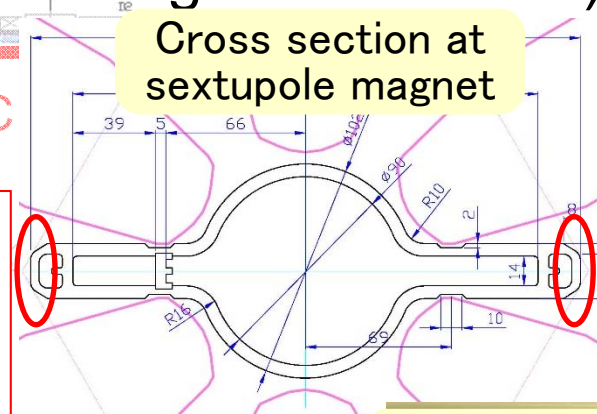
- Installation has almost finished for the delivered beam pipes. (TiN coating and baking had finished.)

Installed: 82%  
(2130m/2610m)

**Problem:**

Interference with coils of sextupole magnets was found at the edges of beam pipe in the installation work. The tolerance was small even in the drawing. The edges were cut *in situ*. to fit in the magnet.

Cross section at sextupole magnet



Interference

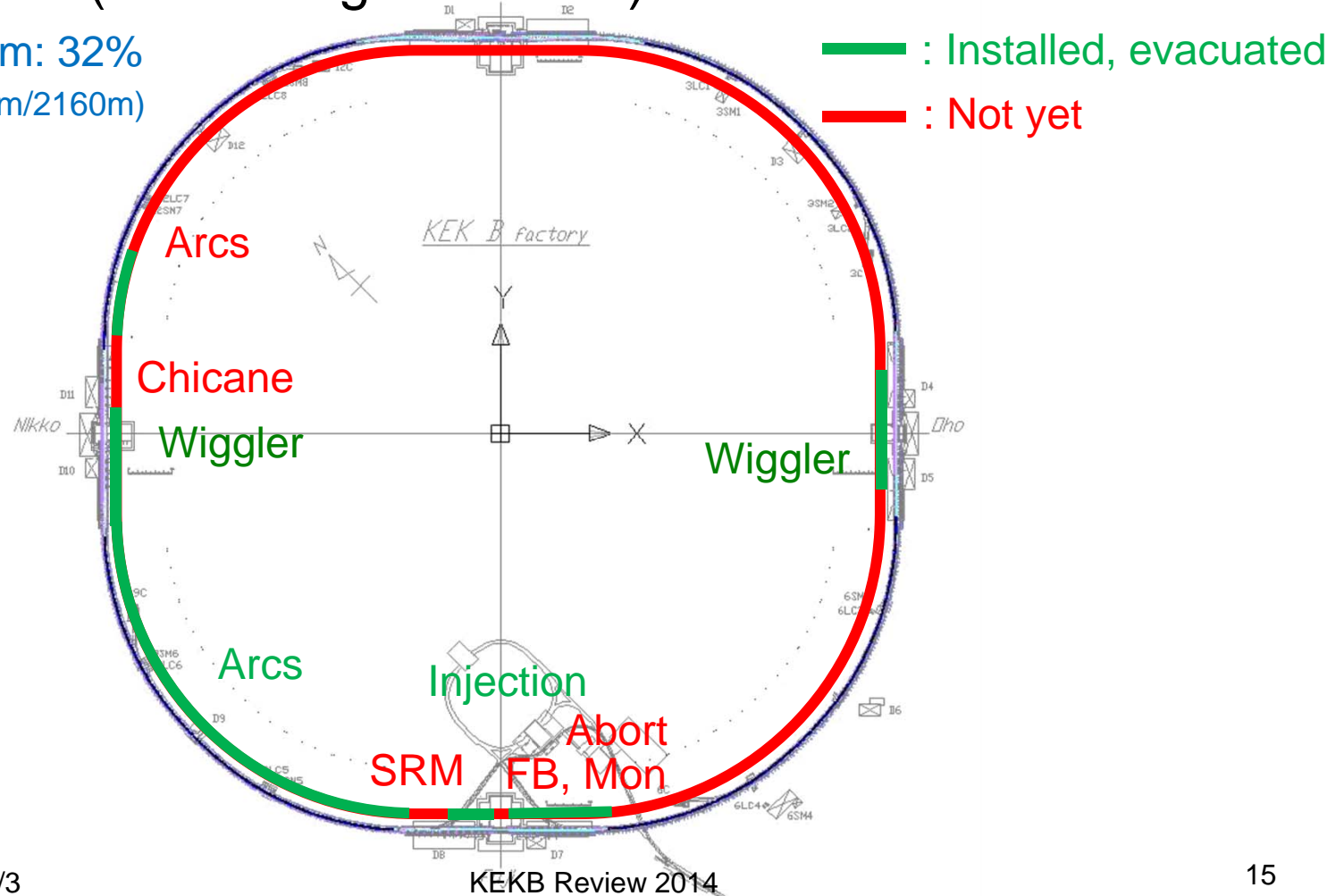


Cutting of edges



- LER bellows chambers (evacuation)
  - Bellows chambers are installed and evacuated in some sections (between gate valves)

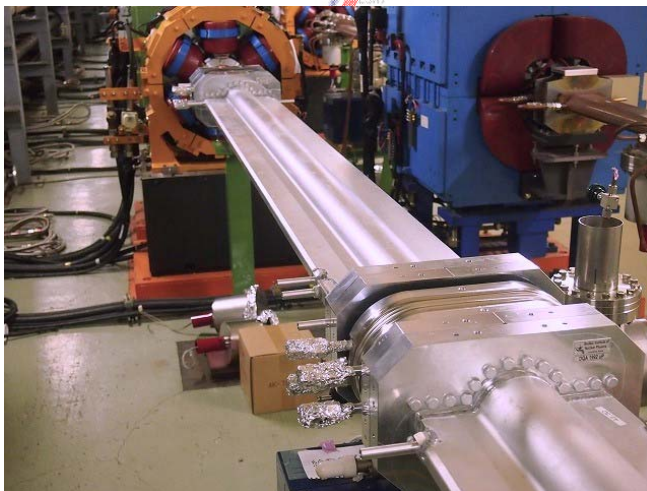
Vacuum: 32%  
(700m/2160m)



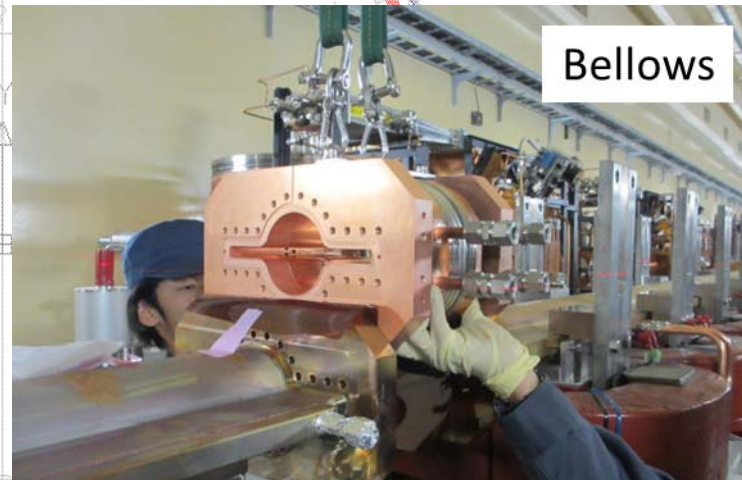
- LER bellows chambers (evacuation)
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Vacuum: 32%  
(700m/2160m)

— : Installed, evacuated  
— : Not yet

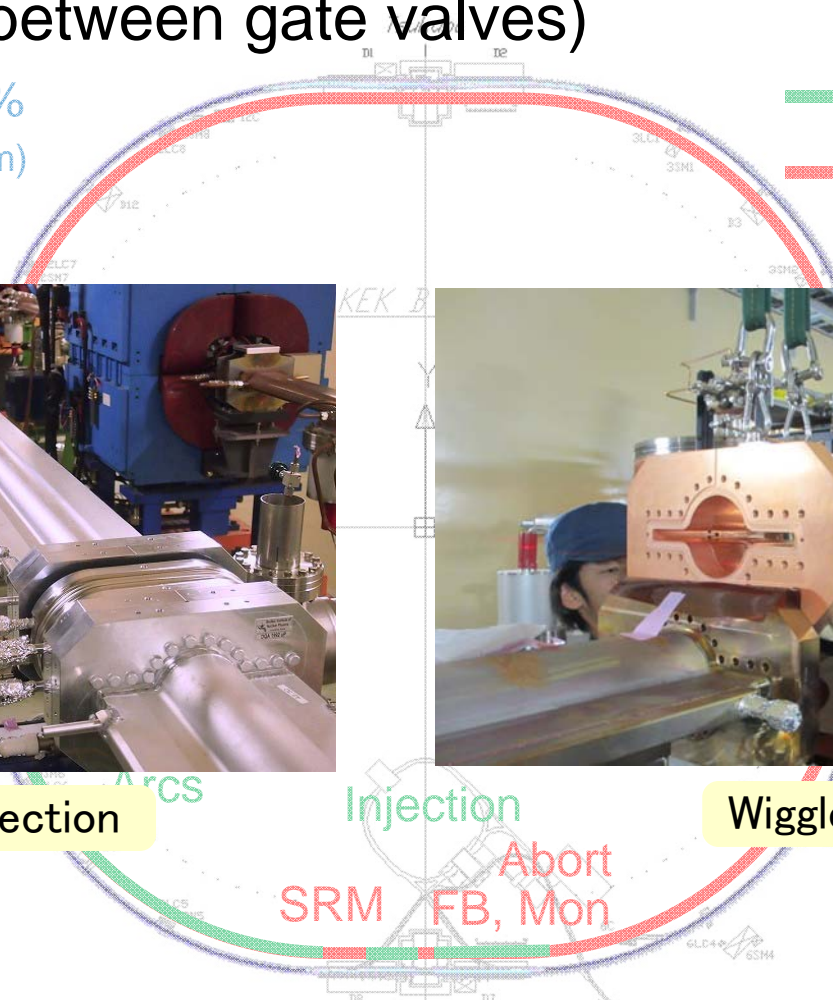


Arc section



Bellows

Wiggler section



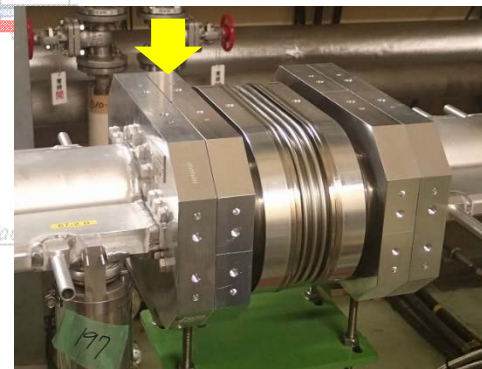


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Vacuum: 32%  
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**Problem:**

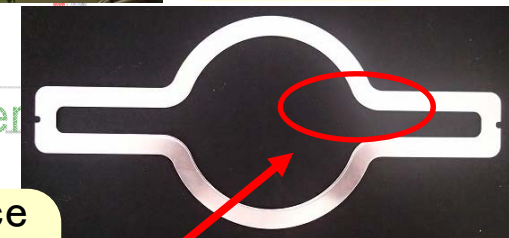
The rate of air leakage at connection flanges are slightly higher in the tunnel than the case of pre-processing at laboratory, i.e., ~10 %. It may be due to some problem in the machining of sealing surface of bellows chambers. The investigation is on going.



Installed, evacuated

Bellows chambers

Aluminum gasket



Sealing surface on the gasket after fastening

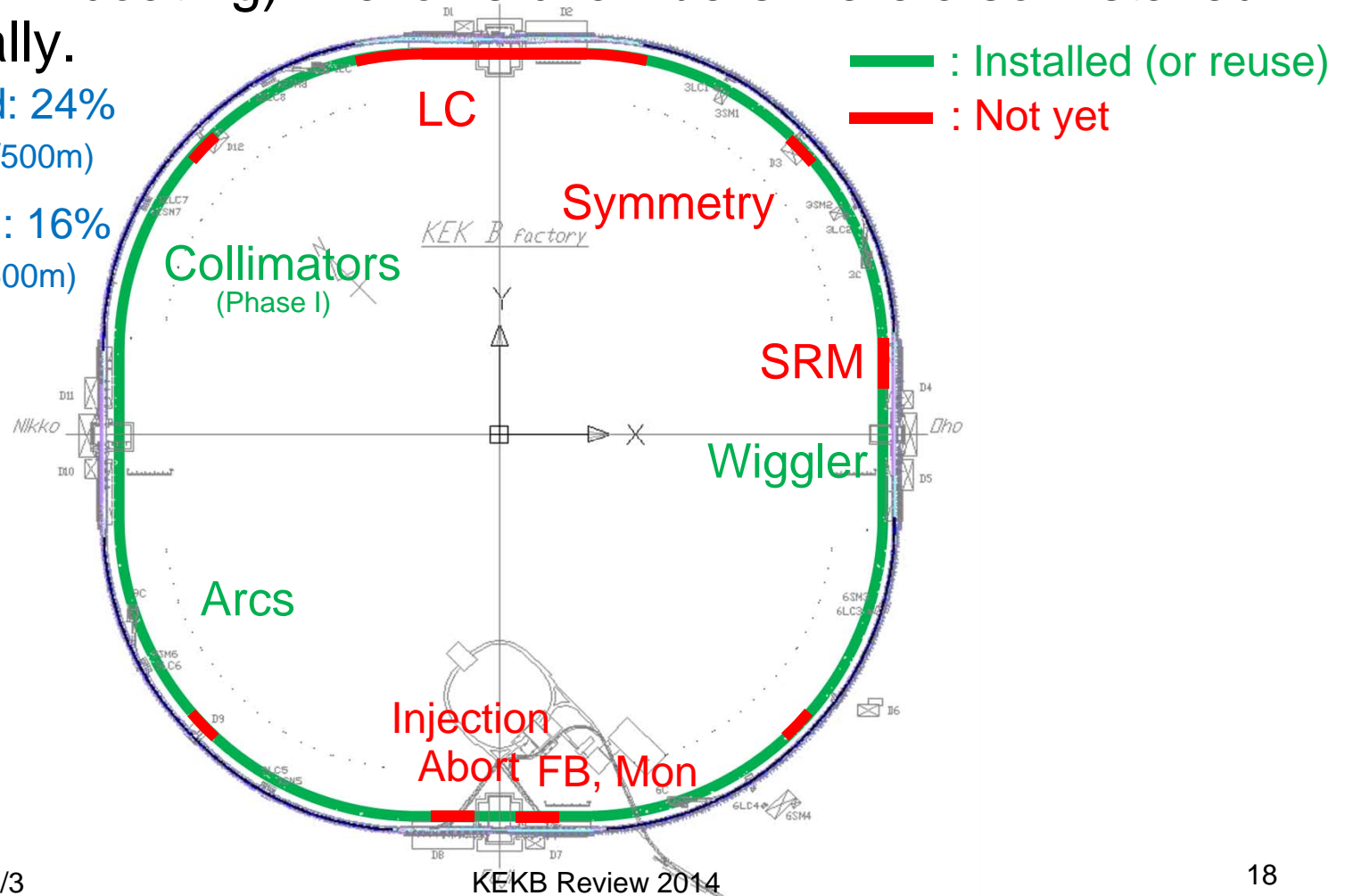


- **HER**

- Beam pipes for wiggler were installed, and evacuated. (No TiN coating). Bellows chambers were also installed partially.

Installed: 24%  
(120m/500m)

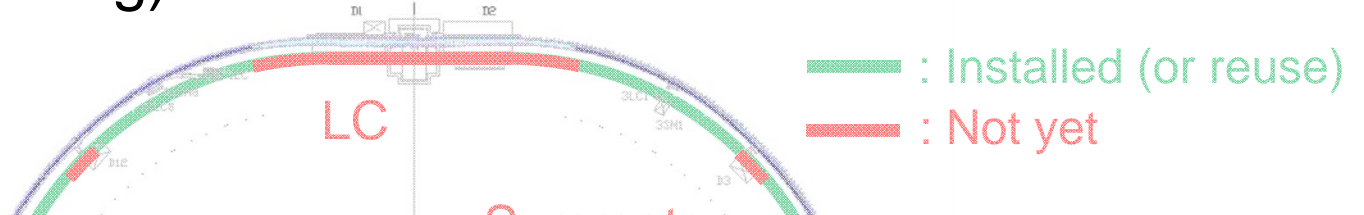
Vacuum: 16%  
(80m/500m)



- **HER**

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Installed: 24%  
(120m/500m)



Arc section



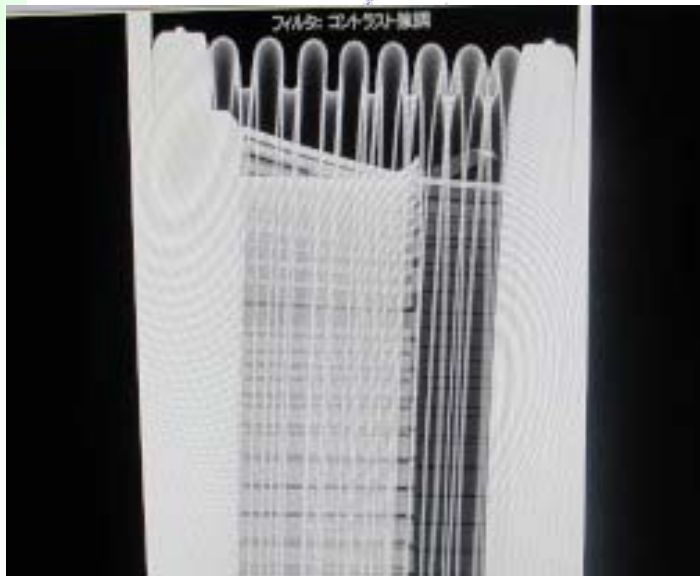
Wiggler section

Injection  
Abort FB, Mon

# Replacement of bellows chamber

- **HER**

- Basically, bellows chambers are reused. But some bellows chambers should be replaced to new ones, since their RF-shield fingers were found to be damaged by the Earthquake, 2011 March.
- The replacement is undergoing.



X-ray photograph

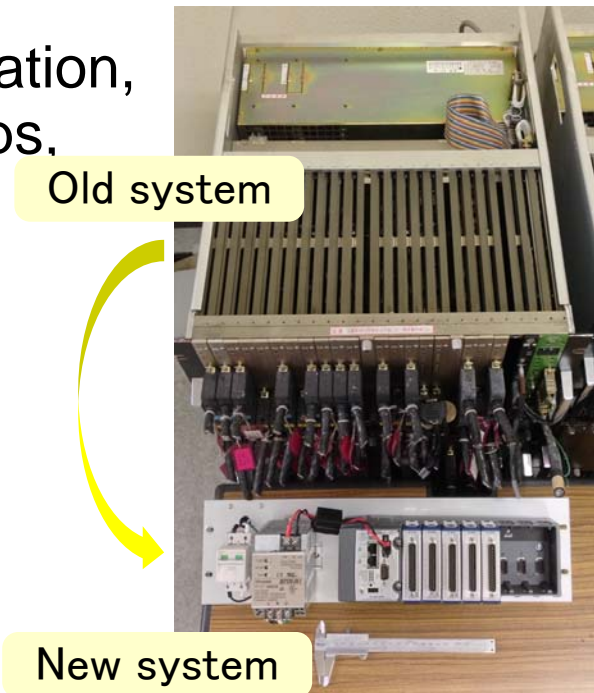


Actual inside view of the same bellows chambers

- **Monitor and Control system**

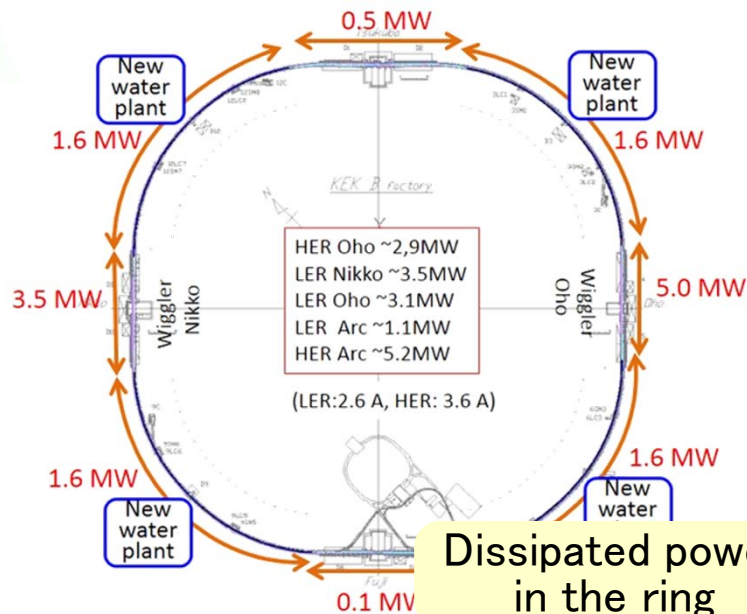
- The control and monitoring system design follows that of the KEKB.
- The vacuum components are controlled based on EPICS.
- The old data acquisition system based on CAMAC and GPIB is replaced by a new compact system based on Ethernet protocols.
- Control of power supplies for NEG activation, control of vacuum gauges and ion pumps, and gate valves were tested.

Monitor and control item	LER (positron)	HER (electron)
Vacuum switch (VSW)	31	33
Gate valve (GV)	33	35
Beam stopper	2	2
Ion pump (IP)	307	307
Cold cathode gauge (CCG)	307	307
Power supply for NEG activation	17	24
Temperature sensor	1484	1244
Flow meter (existing)		376
Flow meter (new for wiggler section)		383

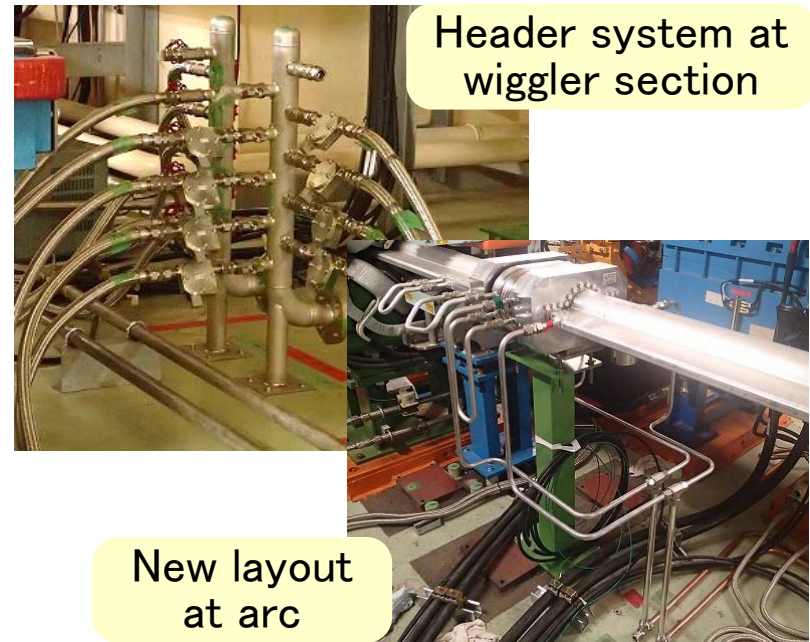


- **Cooling system**

- The power losses are estimated to be approximately **16 MW** in total. The cooling power should be increased due to the power being a factor of **two** higher than that of KEKB.
- Because the dissipation of SR power is concentrated in the wiggler section and the downstream from it, the location of cooling facilities and the pipe arrangement should be considered carefully.



Dissipated power in the ring



- Rough schedule

Place	FY2014										2015		
	4	5	6	7	8	9	10	11	12	1	2	3	
	Tsukuba straight section												
LC													
Arc (T-N)													
Beam pipes													
Nikko straight section													
Beam pipes													
Arc (N-F)													
Beam pipes													
Fuji straight section													
SRM, XRM (LER)													
Beam injection													
Beam abort													
MON, FB													
Arc (F-O)													
Beam pipes													
Collimators													
Oho straight section													
Beam pipes													
Beam Pipes (RF section)													
SRM, XRM (HER)													
Arc (O-T)													
Beam pipes													
Coating and baking													
Cabling													
Arc (F-O, O-T)													
Tsukuba and Fuji													
Cooling water													
Nikko and Oho (wiggler)													
Tsukuba and Fuji													
Arc													

- All of components required for Phase I were ordered. They will be delivered this fiscal year.
- Installation of components into the tunnel are in progress. No serious problem was found up to now. The installation continues coordinating with other hardware works. (very crowded in the tunnel)
- Evacuation has started partially. Only rough pumping and leak check.
- The installation and the final set up schedule seems very tight from summer of next fiscal year... (Final leak check, final alignment, baking of ion pumps, activation of NEG, control system check, cooling water system check, etc.)

**Thank you for the cooperation!**