Summary and Closing Remarks

J. Gao

IHEP

CEPC MDI Workshop, IHEP, May 28-29, 2020

CEPC MDI Workshop

https://indico.ihep.ac.cn/event/11801/#2020-05-28

Totally, 18 talks and about 40 participants

from KEK-Japan, SLAC-USA, Europe (CERN, DESY, RAL-UK,LAL-France ..), IHEP-China

X. C. Lou' s introductory talk

Machine-Detector Interface

a few remarks

Jie Gao, Jianchun Wang, Hongbo Zhu and XinChou Lou

Institute of High Energy Physics, Beijing

- Mandate from the Steering Committee-IAC
- Approach – team, goal & objectives, plan and persistent pursue

  across accelerator, detector and simulation groups
- We need to define: goals, constituents, plan & schedule
- This workshop series will be part of the plan

X. Lou

keep in mind

Goals – to specify, fully adopting the IAC recommendations:

Recommendation 13

Set up a high-level executive working group between accelerator and detector teams to define a workable baseline scenario for the machine-detector-interface area.

Recommendation 11

Build international and domestic collaborations in several critical areas, e.g.
MDI, SC-RF, polarization, ...

Recommendation 8

Define the new parameters as a "new baseline", to make all systems con

Recommendation 9

Clarify the timetable with appropriate milestones, including prototyping

Recommendation 15

Engage engineering expertise to assess various engineering aspects of the detect

Study ...., Reinforce detector studies in the forward region at the interface of the luminosity measurement ....., compatible with expected statistical errors on the p integration and alignment of LumiCal. Perform advanced engineering studies on t forward MDI region, taking all constraints into account..... Taking the impact on tl luminosity performance into account. Preferably make a final choice of the recon CEPC detectors at the earliest possible time.

Vidyo, May 28, 2020

keep in mind

Plus more people, areas of study,
system integration, engineering aspects,
.....
We will need to strengthen the team

keep in mind

Plan

take a "baseline" (even if it is not close to final) to get started;

get organized and start with the simulation, ask & answer questions

work towards the goals; several iterations and optimizations

regular meetings, workshops where major contributors are in one place

.....

Schedule

a workshop in early summer, followed by fall, & prior to CEPC workshop?

draft a schedule according to overall CEPC roadmap

.....

T. Tauchi's talk on MDI international status and international collaboration issues

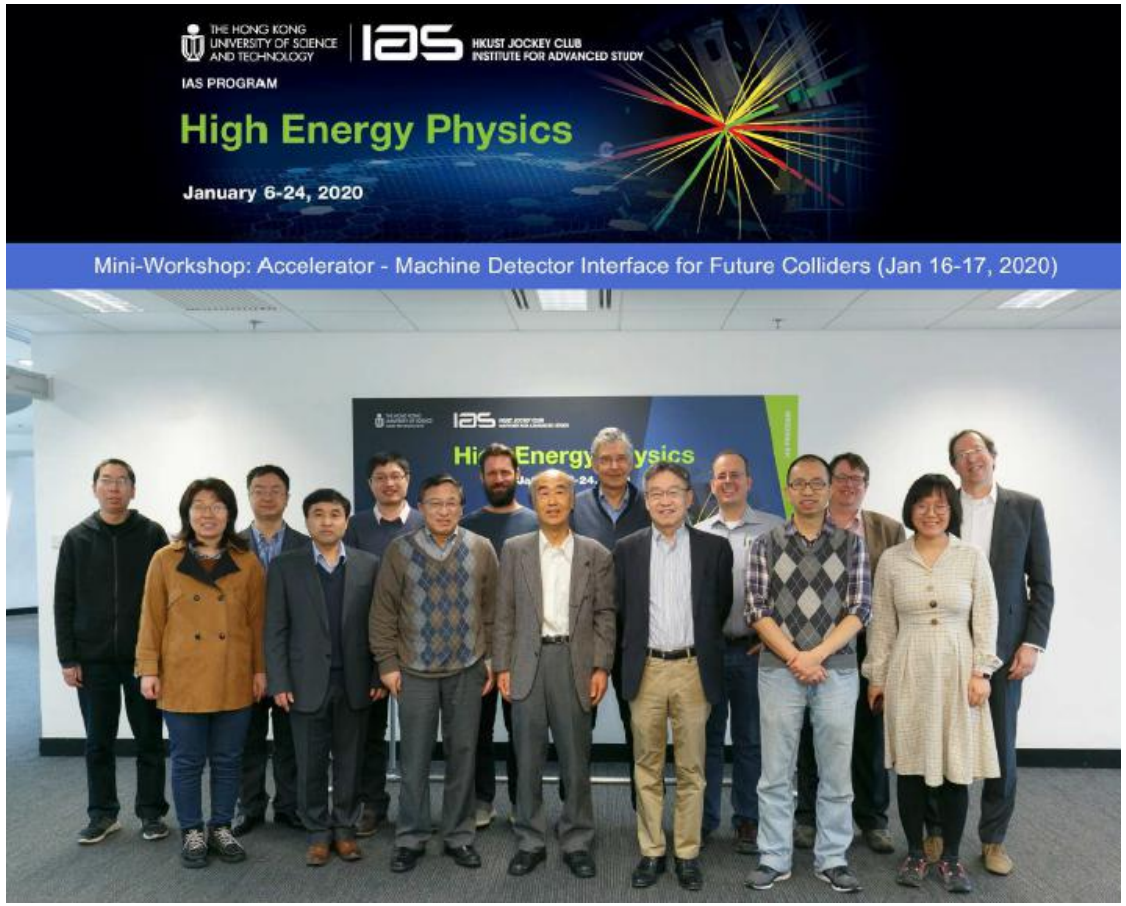
Summary of the MDI mini-workshop

The aim of this mini-workshop is to invite experts of MDI from very different colliders to exchange and share their experiences and knowledge with many common interests, and to promote collaborations among them. 16 - 17 January 2020.

T. Tauchi (KEK)

CEPC MDI workshop, IHEP, Beijing, 28-29 May 2020

The HEP conference, HKUST IAS, Hong Kong, 20 January 2020



Agenda on 16 January 2020

Opening Remarks by Jie Gao 高 杰 (IHEP)

Talks with 25min + 5min Q/As

Introduction : Overview of Different Colliders, Jie Gao 高 杰 (IHEP)

SuperKEKB :

Background Status and Study at Belle II, SuperKEKB, Carsten Niebuhr (DI
Status of the Superconducting Final Focus Magnet at SuperKEKB, Norihit
Stability of the final focus magnets at SuperKEKB, Hiroshi Yamaoka 山岡 /

LEP - FCCee/CEPC :

Lessons Learned from LEP and their Application to FCC/CEPC, Helmut B

CEPC :

CEPC MDI Accelerator Issues, Sha Bai 白莎 (IHEP)
CEPC RADIATION BACKGROUND STUDIES, Hongbo Zhu 朱 宏博 (IHEP)
CEPC MDI SC Magnet System, Yingshun Zhu et al. 朱应顺 (IHEP)
CEPC MDI Mechanics Issues, Haijing Wang 王 海静 (IHEP)
CEPC MDI Detector Issues - In engineering design, Ji Quan 紀 全 (IHEP)
CEPC Detector Overall Facilities and Hall Issues, Zhu Zian 朱 自安 (IHEP)

T. Tauchi

Agenda on 17 January 2020

Circular Colliders :

MDI issues of **BINP Super TauCharm factory**, Anton Bogomyagkov (BINP)
Overview of MDI at **FCC-ee**, Michael Koratzinos (CERN)

ILC :

(Selected) MDI Issues of ILD, Roman Pöschl (IJClab)
ILD Background Studies at ILC, Daniel Jeans (KEK)
The SiD Detector - Machine Backgrounds, Marcel Stanitzki (DESY)

ILC and Future Colliders :

Superconducting Final Focus Magnets at ILC and Future Colliders, Brett Parker (BNL)

CLIC (ILC, FCC) :

CLIC Machine Detector Interface, Philip Burrows (Oxford Univ.) , Lau Gatignon (CERN)
Stabilisation of Final Focus Magnets for CLIC and FCC, Maurizio Serluca, Laurent Brunetti (LAPP)
IP Fast Feedback Systems (FONT) at ILC and CLIC, Philip Burrows (Oxford Univ.)

Discussion on possible future collaboration :

All

T. Tauchi

Discussion on possible future collaboration :

We could successfully exchange MDI issues of SuperKEKB, CEPC, SuperTauCharm factory, FCCee, ILC, CLIC and BNL-EIC. We found a lot of common issues such as superconducting final focus magnets, beam induced backgrouds, mechanical integration, solenoid compensation schemes, beam pipe design, forces and torques management . It is very nice to know current issues at various colliders. Also, we could communicate with experimentalists and accelerator physicists, although they work separately on a daily basis. This workshop place is rather good since many of us leave from their own universities, institutes and we could concentrate in the mini-workshop.

The MDI is a meeting place for experimentalists and accelerator physicists to discuss on realization of future colliders in the energy and luminosity frontiers. Since investment of future collider is huge, all of them can not be realized, even a single collider is difficult to be realized. It is very important to have an international collaboration through common issues such as MDI for us to participate in such a collider with actual contributions as much as possible in future.

There is a suggestion to continue this kind of activity, i.e. MDI mini-workshop by inviting young generations from experimental and accelerator fields. The HKUST IAS seems to be a good place if finantial support is available at least for local expenses to students.

M. Sullivan's talk

MDI Issues During Commissioning and Beyond

M. Sullivan
for the
CEPC MDI Workshop May 28-29, 2020

Outline

- Introduction and some general remarks
- The start of the accelerator
  - Initial
  - Evolvin
  - Final
- Beam tails
- Other concerns
  - Beam aborts
  - Radiation monitoring
  - Temperature monitoring
  - Maintaining luminosity
- Summary and conclusions

- MDI concerns
  - Maximize the detector acceptance
  - Accommodate the machine lattice
    - Help to fit the final focus magnets into the IR design
  - Help to calculate the backgrounds in the detector
    - Supply the sources of backgrounds to the detector simulation team
  - With engineering help
    - Design and support the final focus magnets
    - Maintain the beams in collision (usually with fast orbit feedback correctors)
    - Design the beam pipe in the detector
  - ...

Some more remarks

- This is done through a combination of
  - Collimation
    - To reduce BGB, Coulomb, Touschek, etc. backgrounds
  - Masking
    - To protect the central chamber from direct SR
    - To protect the central chamber from forward scatter and backscatter SR
  - Geometric design
    - Specifying final bend magnet locations and strengths
  - Vacuum requirements
    - Specifying where low vacuum regions are needed
- Once this is done then the team has an IR design that should work

CEPC MDI Workshop (28-May

https://indico.ihep.ac.cn/event/11801/#2020-05-28

10:30 - 11:00 Coffee Break

11:00 - 12:30 WG Talks

Convener: Dr. Haoyu Shi (高能所)

11:00 **CEPC MDI Accelerator Status** *30'*

Speaker: Dr. 莎 Bai (高能所)

Material: **Slides**

11:30 **Mechanics in the IR and Integration Scheme** *30'*

Speaker: Haijing Wang (高能所)

Material: **Slides**

12:00 **Impedance and HOM Heating in IR region of MDI for CEPC** *30'*

Speaker: Yudong Liu

Material: **Slides**

12:30 - 14:00 Lunch Break

14:00 - 15:30 WG Talks

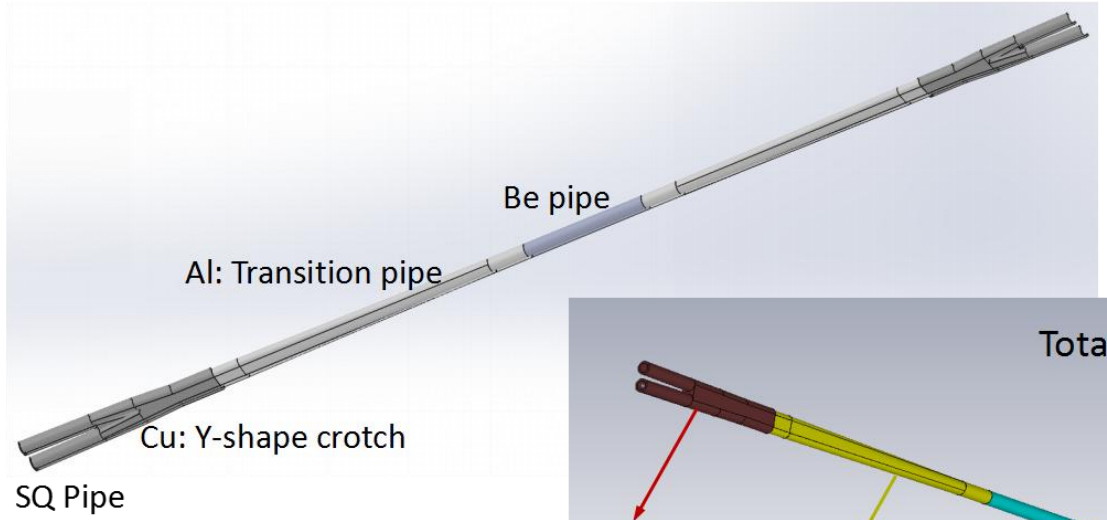
Convener: Dr. Sha Bai (高能所)

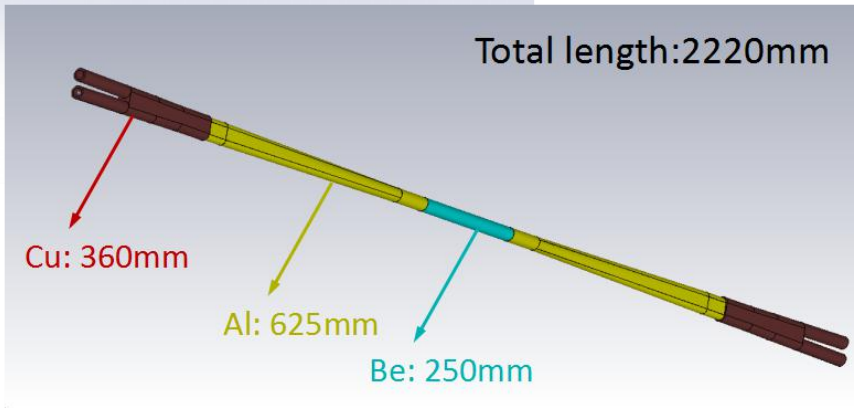
9:45
2020/5/29

Impedance and HOM Heating in IR region of MDI for CEPC

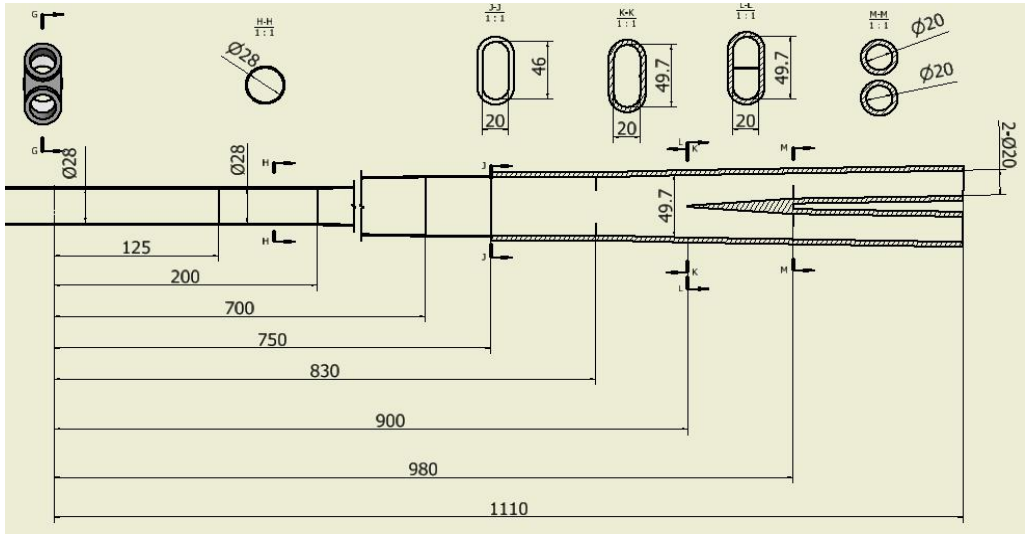
Liu Yu dong, Wang Na, Wang Hai Jing, Bai Sha, Wang Dou

Structure and Layout of IR pipe





Model 3



Summary on HOM heating Power for IR （CDR beam parameters）

Y.D. Liu

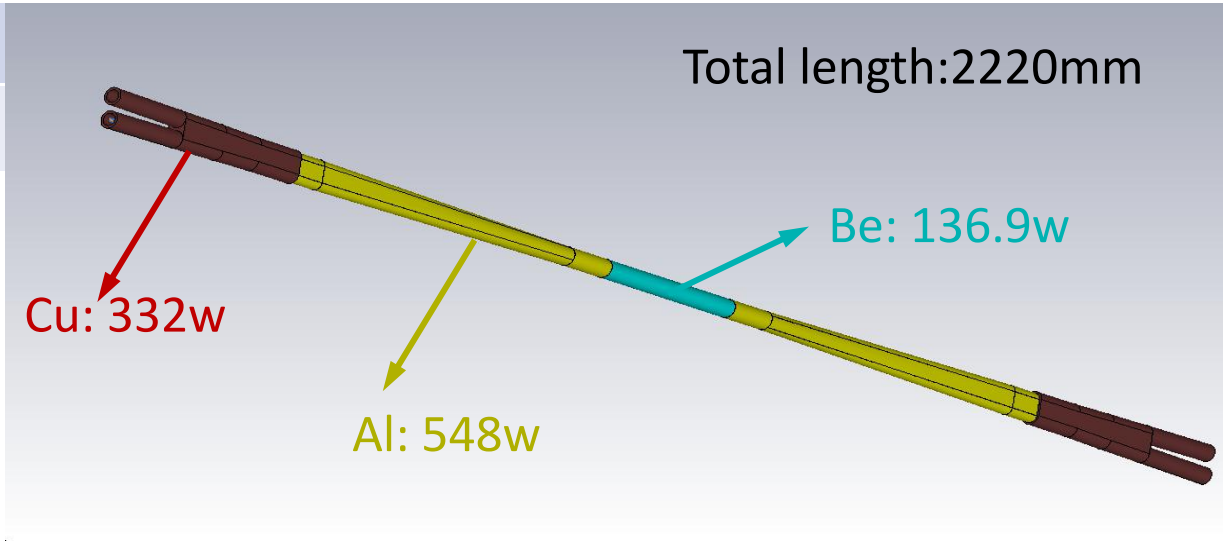
IR Model	H		W		Z	
Model 0 (28mm-28mm)	P_{trap}: 42w	P_{pro}: 26.8w	P_{trap}: 170.4w	P_{pro}: 108.6w	P_{trap}: 595.2w	P_{pro}:379.4w
	P_{total}: 68.8w		P_{total}: 279w		P_{total}: 974.6w	
Model 1 (28mm-20mm)	P_{trap}:12.3w	P_{pro}:10.2w	P_{trap}:49.8w	P_{pro}:41.6w	P_{trap}:174.2w	P_{pro}:145.5w
	P_{total}: 22.5w		P_{total}: 91.4w		P_{total}: 319.7w	
Model 2 (28mm-20mm)	P_{trap}:15w	P_{pro}:7.1w	P_{trap}:60.7w	P_{pro}:28.9w	P_{trap}:212.3w	P_{pro}:101.2w
	P_{total}: 22.1w		P_{total}: 89.6w		P_{total}: 313.5w	
Model 3 (28mm-20mm)	**P_{trap}:14.2w**	**P_{pro}:6.2w**	**P_{trap}:57.5w**	**P_{pro}:25w**	**P_{trap}:201.1w**	**P_{pro}:87.3w**
	P_{total}: 20.4w		**P_{total}: 82.5 w**		**P_{total}: 288.4w**	
Model 4 (20mm-20mm)	P_{trap}:14.5w	P_{pro}:5.2w	P_{trap}:58.9w	P_{pro}:21.0w	P_{trap}:205.9w	P_{pro}:73.4w
	P_{total}: 19.7w		P_{total}: 79.9w		P_{total}: 279.3w	
Model 5 (28mm-11mm)	P_{trap}:**2.2kw**	P_{pro}:**-**	P_{trap}:**9.1kw**	P_{pro}:**-**	P_{trap}:**31.9kw**	P_{pro}:**-**
	P_{total}:**2.2kw**		P_{total}:**9.1kw**		P_{total}:**31.9kw**	

Summary

Y.D. Liu

- ✓ **For Model 3 (with Be pipe aperture 28mm, quadrupole aperture 20mm), the structure is feasible for beam parameters in CDR.**
- ✓ Maximum Power deposition in IR different region:

Maximum Power	CDR beam parameters	High Luminosity beam parameters
Be pipe (w)	50w	136.9
Al: Transition pipe (w)	342	1097
Cu: Y-shape crotch (w)	207	664
Total power in IR pipe (w)	592	1898




CEPC MDI Workshop (28-May
https://indico.ihep.ac.cn/event/11801/#2020-05-28
Lunch Break
14:00 - 15:30
WG Talks
Convener: Dr. Sha Bai (高能所)
14:00 Lattice Design for CEPC 30'
Speaker: Dr. Yiwei Wang (高能所)
Material: Slides
14:30 Impacts of Detector Stray Field on Booster and ttbar Design Parameters 30'
Speaker: Dr. Dou Wang (高能所)
Material: Slides
15:00 Design of Detector Magnet 30'
Speaker: Dr. Feipeng NING (IHEP)
Material: Slides
15:30 - 16:00
Coffee Break
16:00 - 17:30
Invited Talks
Convener: Prof. Jianchun WANG
16:00 FCC-ee MDI 30'
150%
9:46
2020/5/29

D. Wang

Impacts of Detector Stray Field on Booster

Dou Wang, Yuan Zhang, Daheng Ji, Feipeng Ning

- Impacts of detector stray field on booster were calculated with real field distribution.
- Conclusion

Shielding for the detector stray field seems

not necessary if B < 50Gs

Conclusion: CEPC detector stray field impact to booster is under controle without using shielding

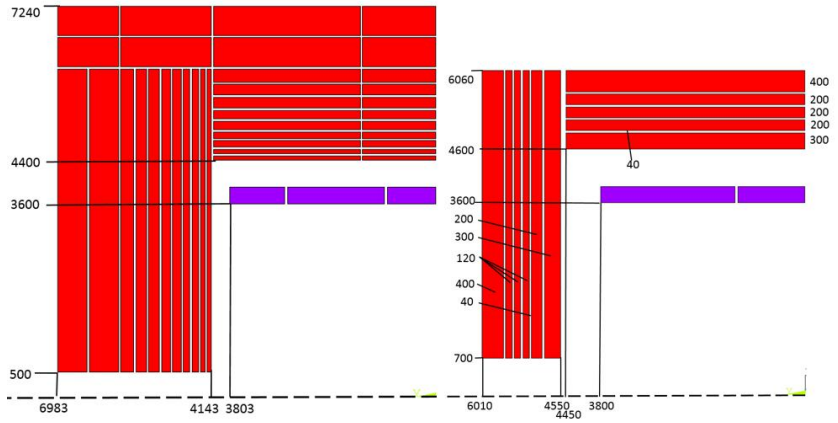
F.P Ning

Magnetic Field Design of CEPC Detector Magnet

Ning Feipeng
For the CEPC Detector Magnet Team

Magnetic field at Booster (radial R=25m)

CDR version	8.4 Gs
New version	28 Gs



CEPC MDI Workshop (28-May

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16:00 - 17:30 **Invited Talks**

Convener: Prof. Jianchun WANG

16:00 **FCC-ee MDI** *30'*

Speaker: Dr. Michael KORATZINOS (CERN and Massachusetts Institute of Technology)

Material: **Slides**

16:30 **Overview of FCAL** *30'*

Speaker: Dr. Maryna Borysova (DESY & Kiev Institute for Nuclear Research (KINR))

Material: **Slides**

17:00 **Lessons learned with the SLD Vertex Detector, relevant to a future Higgs Factory**

Speaker: Prof. Chris Damerell (Rutherford Appleton Laboratory)

Material: **Slides**

Friday, May 29, 2020

09:00 - 12:30 **WG Talks 3**

Convener: Dr. Hongbo ZHU (IHEP)

09:00 **Superconductinog Magnets in the IR** *30'*

9:47 2020/5/29

Overview of MDI at FCC-ee

M. Koratzinos

CEPC MDI Workshop

27/5/2020

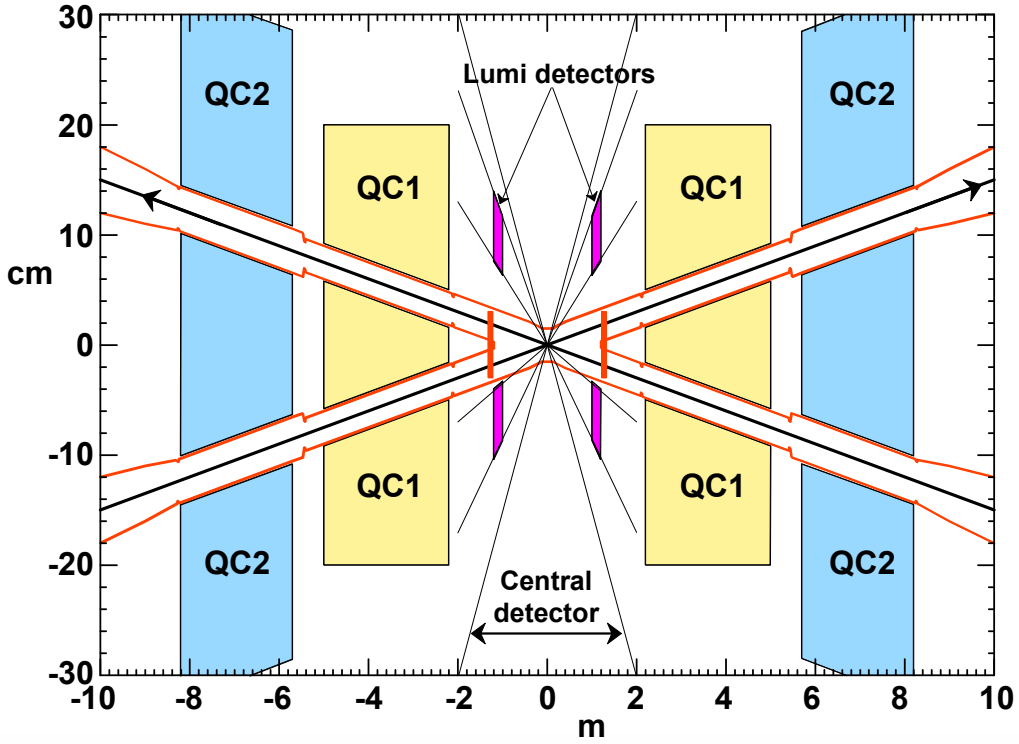
What is MDI?

M. Koratzinos

- MDI (Machine-Detector Interface) is a very loose term covering many different systems, all having in common that can be considered either a part of the machine or a part of the detector
- MDI covers the area close to the beam pipe and around the interaction point of each experiment. It includes
  - The beam pipe around the IP
  - Any final focus elements, if inside the detector
  - The detector solenoid compensation scheme
- Also has to deal with
  - The effects of passing and colliding beam (all types of backgrounds, SR radiation, impedance heating)
- …Without forgetting important engineering aspects
  - tolerances, mechanical vibration, force management, cryogenics
- At the same time, MDI elements should not impede detector quality
  - Hermeticity, adequate coverage for the luminometer, etc.
- Space is at a premium

Beam pipe design around the IP

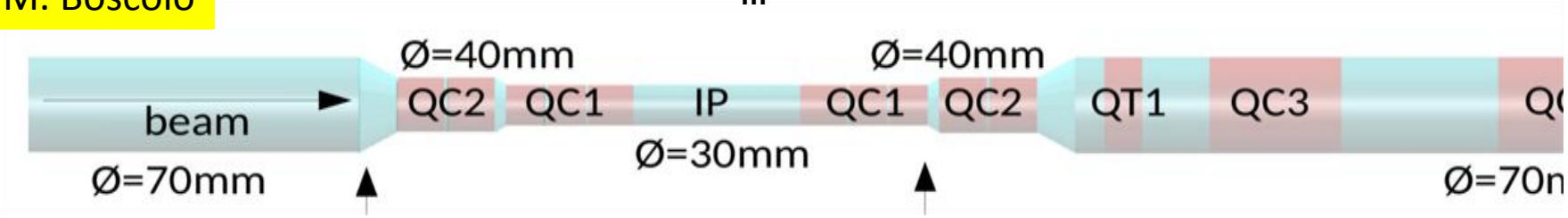
M. Koratzinos



What defines the beam pipe dimensions is:

- SR hitting the detector area
- Beam sizes
- Heating due to impedance
- For physics, we want this as small as possible
- A series of masks and shielding protect from SR

M. Boscolo



Can it be made smaller?

We have opted for a 30mm dimeter beam pipe close to the IP.

- Central region +-12.5cm is water cooled beryllium (5um of gold, 1.5mm beryllium, 1mm of water)
- Beam pipe around the FF quadrupoles (QC1L1, QC1L2, QC1L3) is 30mm diameter

The FCC-ee Final Focus magnets

	Start position (m)	Length (m)	B' @Z (T/m)	B' @$W^{\pm}$ (T/m)	B' @Zh (T/m)	B' @$t\bar{t}$ (T/m)
QC1L1	2.2	1.2	−78.60	−96.16	−99.98	−100.00
QC1L2	3.48	1	+7.01	−40.96	−99.94	−100.00
QC1L3	4.56	1	+28.40	+22.61	+26.72	−100.00
QC2L1	5.86	1.25	+2.29	+40.09	+23.75	+58.81
QC2L2	7.19	1.25	+9.05	+3.87	+39.82	+68.18
QC1R1	−2.2	1.2	−79.66	−100.00	−99.68	−99.60
QC1R2	−3.48	1	+5.16	−37.24	−92.78	−99.85
QC1R3	−4.56	1	+36.55	+24.02	+5.87	−99.73
QC2R1	−5.86	1.25	+7.61	+45.51	+36.45	+63.03
QC2R2	−7.19	1.25	+4.09	+3.95	+44.43	+77.91

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09:00 - 12:30

WG Talks 3

Convener: Dr. Hongbo ZHU (IHEP)

09:00 **Superconductinog Magnets in the IR** *30'*
Speaker: Yingshun Zhgu (高能所)
Material: Slides

09:30 **Cryostat Design in IR** *30'*
Speaker: Mr. Tongxian ZHAO Tongxian (高能所)

10:00 **Estimation of Beam Backgrounds** *30'*
Speaker: Haoyu Shi (高能所)
Material: Slides

10:30 **Break** *15'*

10:45 **LumiCal Design Status** *30'*
Speaker: Suen Hou (IPAS)

11:15 **Progress of Vertex Detector Design** *30'*
Speaker: Prof. Zhijun Liang (IHEP)

11:45 **Progress of beampipe engineering design** *30'*

150%

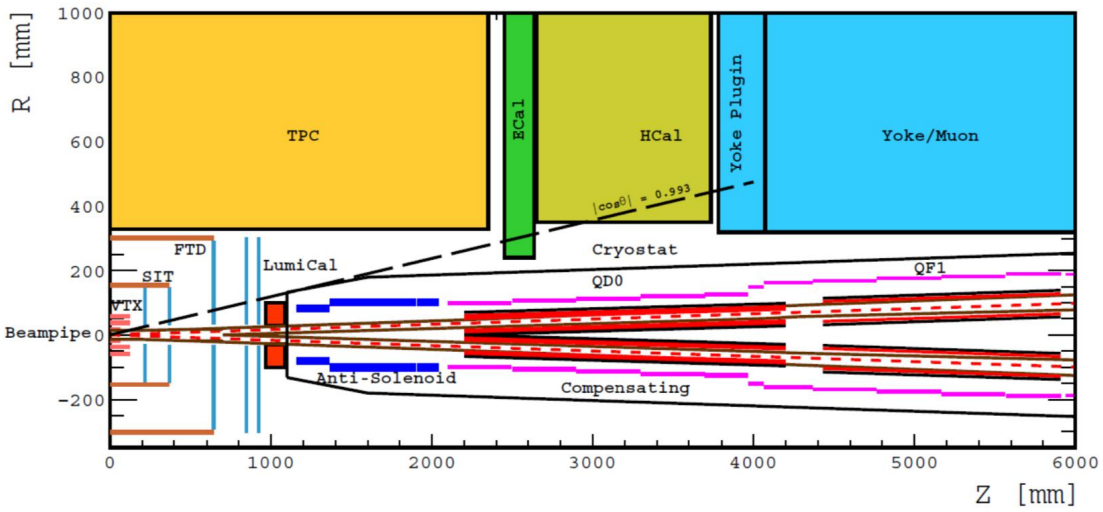
9:48
2020/5/29

Source Analysis

CEPC MDI Beam Backgrounds Study

Haoyu Shi
IHEP
On Behalf of the CEPC MDI BG Study Group
CECP MDI Workshop, Online, 2020

- Effects
  - Single Beam
    - Touschek Scattering
    - Beam Gas Scattering
    - Beam Thermal Photon Scattering
    - Synchrotron Radiation
  - Luminosity Related
    - Beamstrahlung
    - Radiative Bhabha Scattering
  - Injection



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11:15 **Progress of Vertex Detector Design** *30'*

Speaker: Prof. Zhijun Liang (IHEP)

11:45 **Progress of beampipe engineering design** *30'*

Speaker: Quan Ji (IHEP)

12:15 - 12:30 Summary and Closing Remarks *15'*

Speaker: Prof. Jie Gao (高能所)

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9:49
2020/5/29

Overview of FCAL

The CEPC MDI Workshop

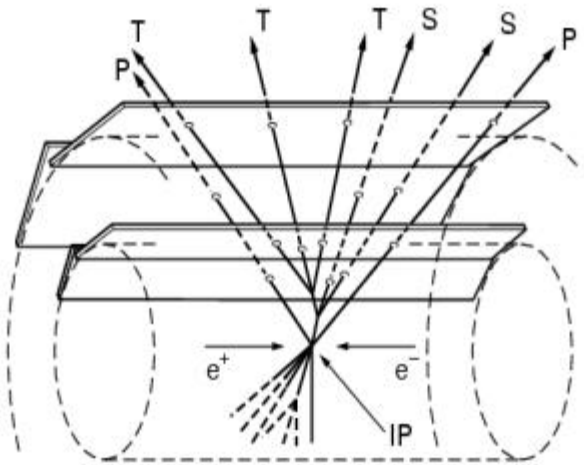
Dr. Borysova Maryna
KINR & DESY
On behalf of the FCAL collaboration

May, 28, 2020

The SLD Vertex Detector
Lessons for MDI at Higgs Factories

Chris Damerell

Rutherford Appleton Lab



General concluding remarks

- This workshop is very fruitful with many useful inputs and contrubutions both from CEPC team and international colleagues
- Key issues should be identified and focused such as IP beam pipe dimension impacts
- Regular MDI meeting be established
- Task charges be assigned to the team members which need to be strengthened
- R&D issues be identified with priority
- International collaboration be persued and extened
- A coherent CEPC MDI design be goaled and significant progress be expected at CEPC Internation Workshop in Oct.2020， Shanghai, China
- …

Thanks