中国科学院高能物理研究所
Institute of High Energy Physics
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Status of CEPC ref-TDR Chapter06

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On behalf of the gaseous tracker group

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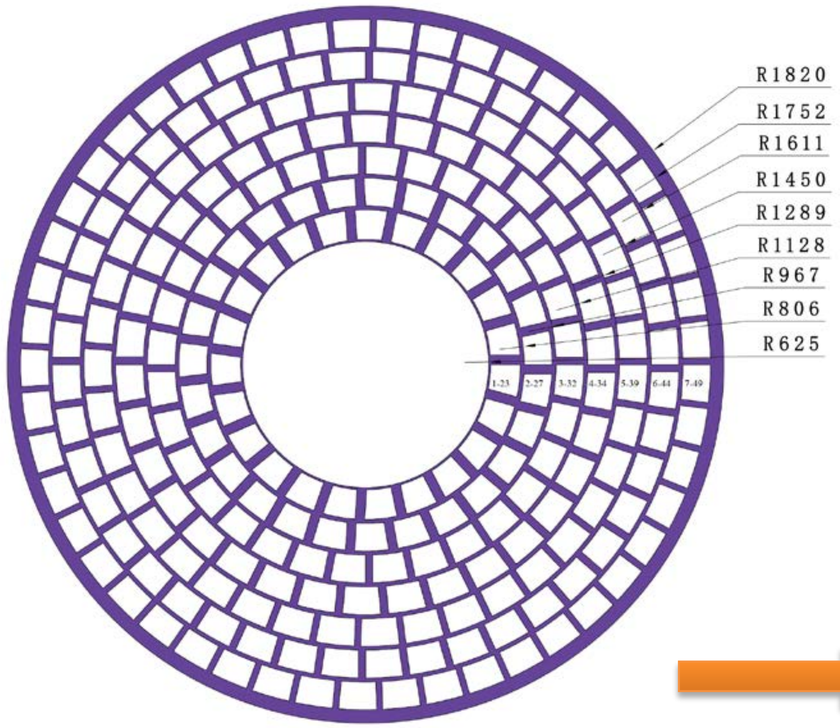
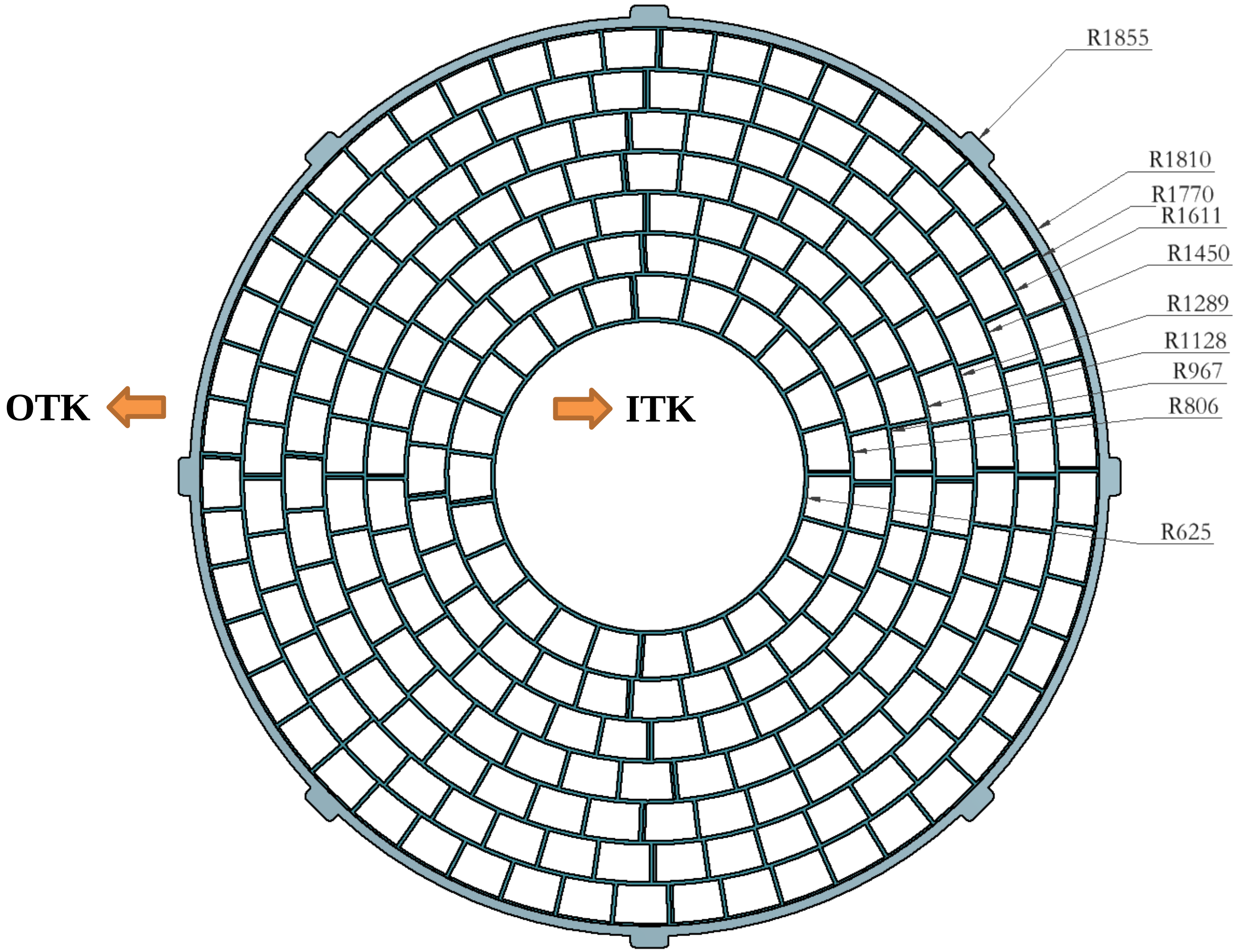
Content

- **BG source and estimation**
- **Status of Chapter6**

Update design of TPC endplate

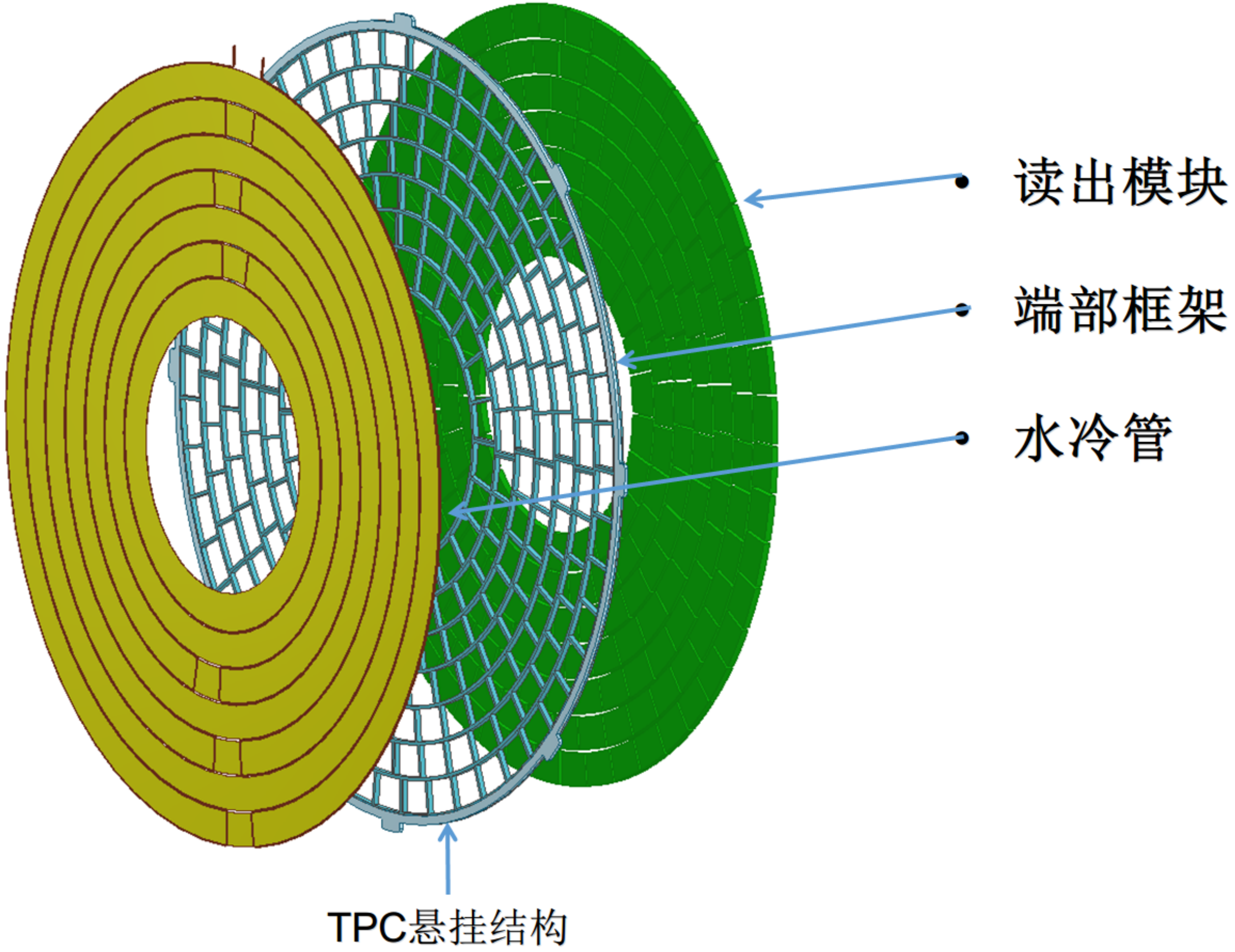
TPC detector	Key Parameters
Modules per endcap	248 modules /endplate
Module size	206mm×224mm×161mm
Geometry of layout	Inner: 1.2m Outer: 3.6m Length: 5.9m
Potential at cathode	- 62,000 V
Gas mixture	T2K: Ar/CF4/iC4H10=95/3/2
Maximum drift time	34μs @ 2.75m
Detector modules	Pixelated Micromegas





Detector Module Water Cooling Design

TPC cooling R&D

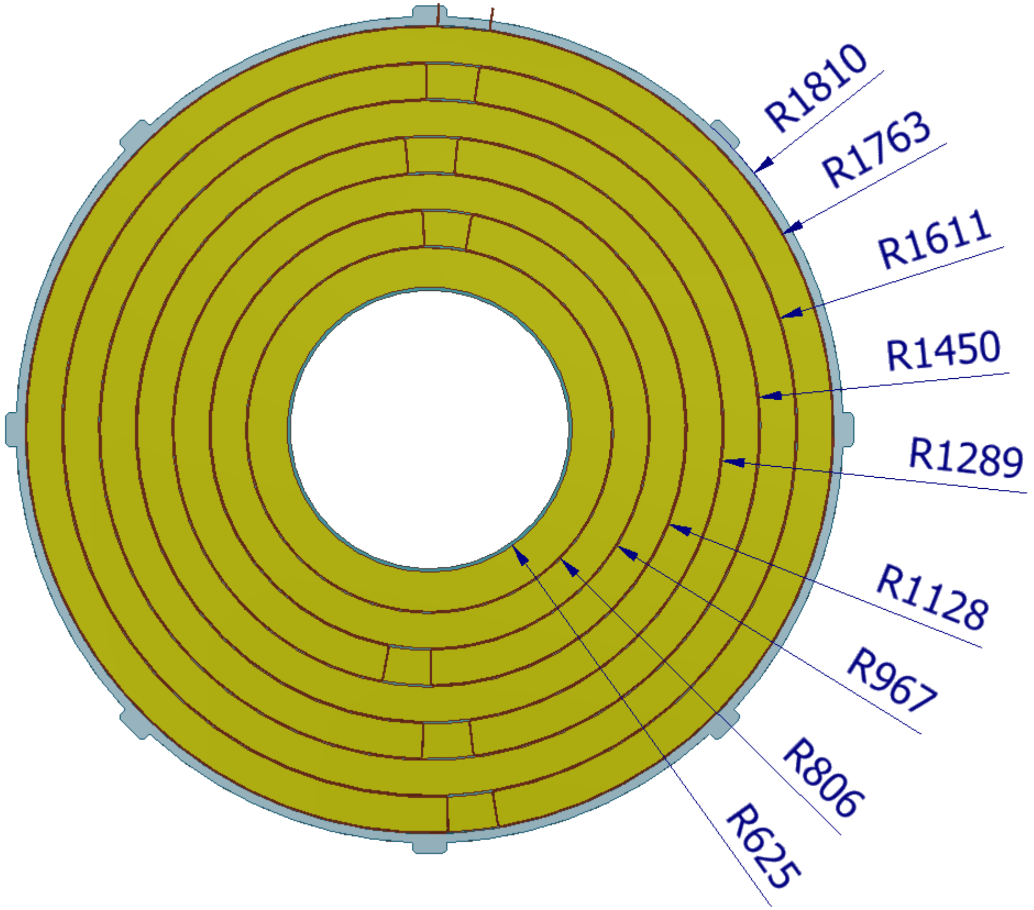


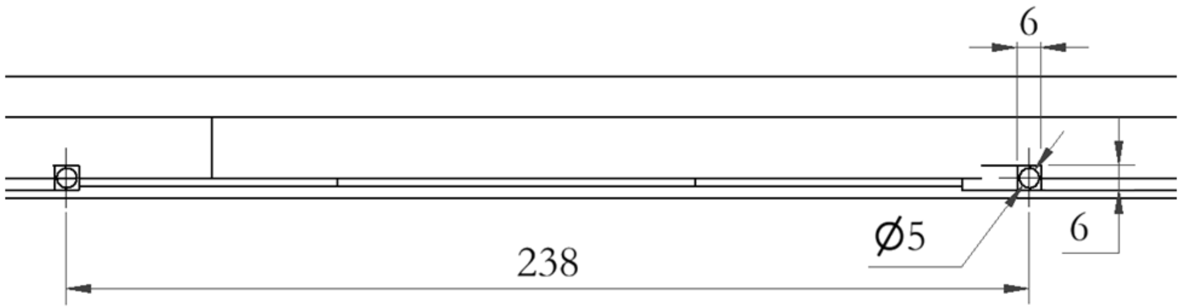
读出电子学模块（绿色部分）

每个模块平均发热功率50W

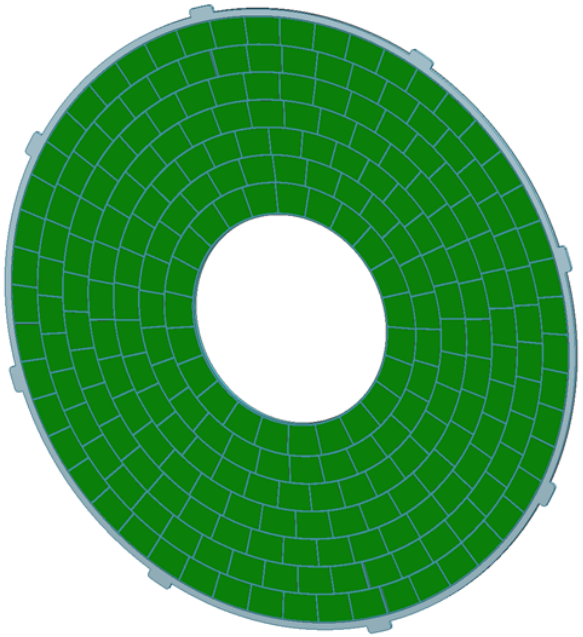
共272块，总功率10KW，实际总功率为 8KW，计算留有余量

TPC cooling R&D





水管尺寸为6X6方管，内部水孔为5mm，水管入水温度为15°



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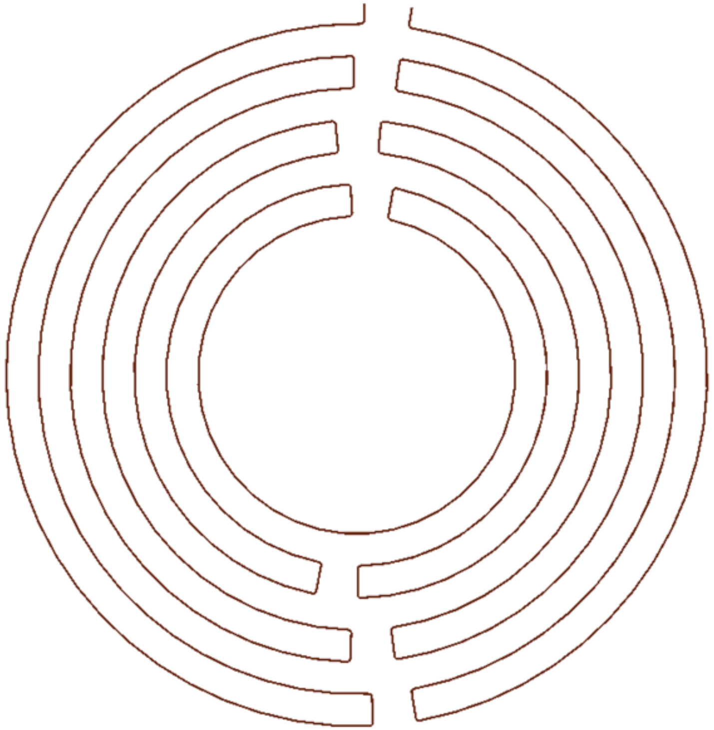
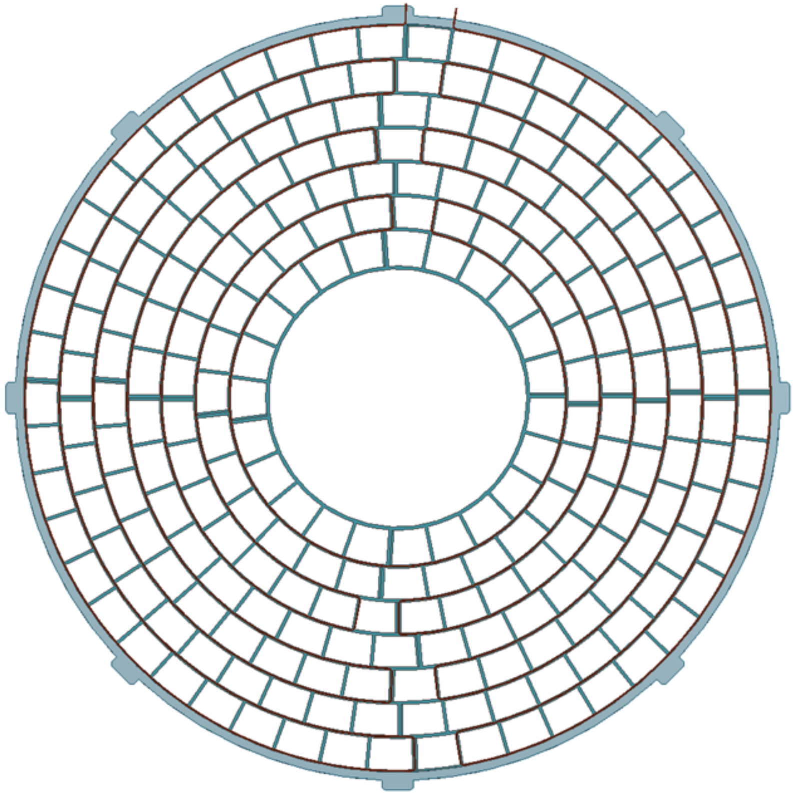
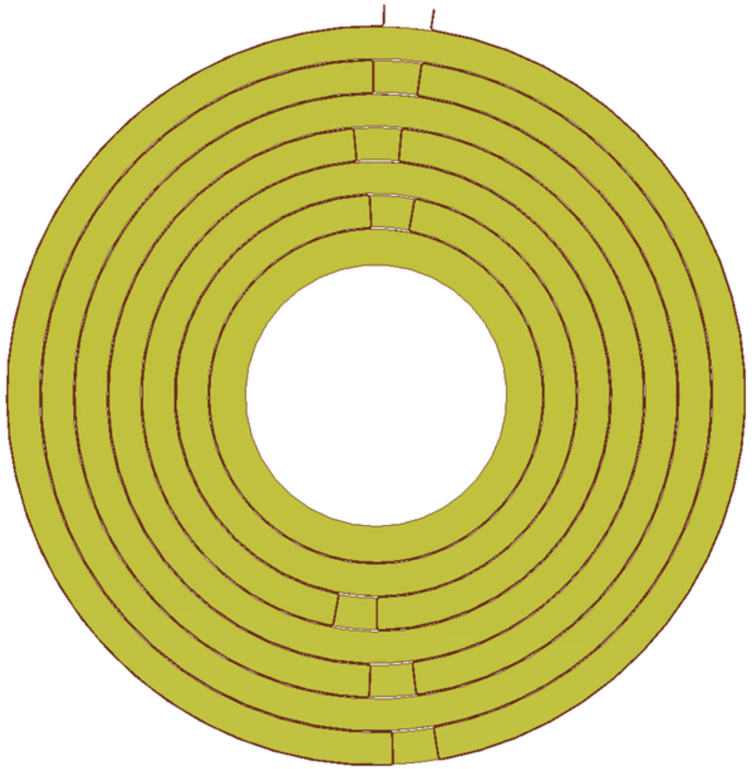


主水管，一进一出



主水管沿着框架筋板布置

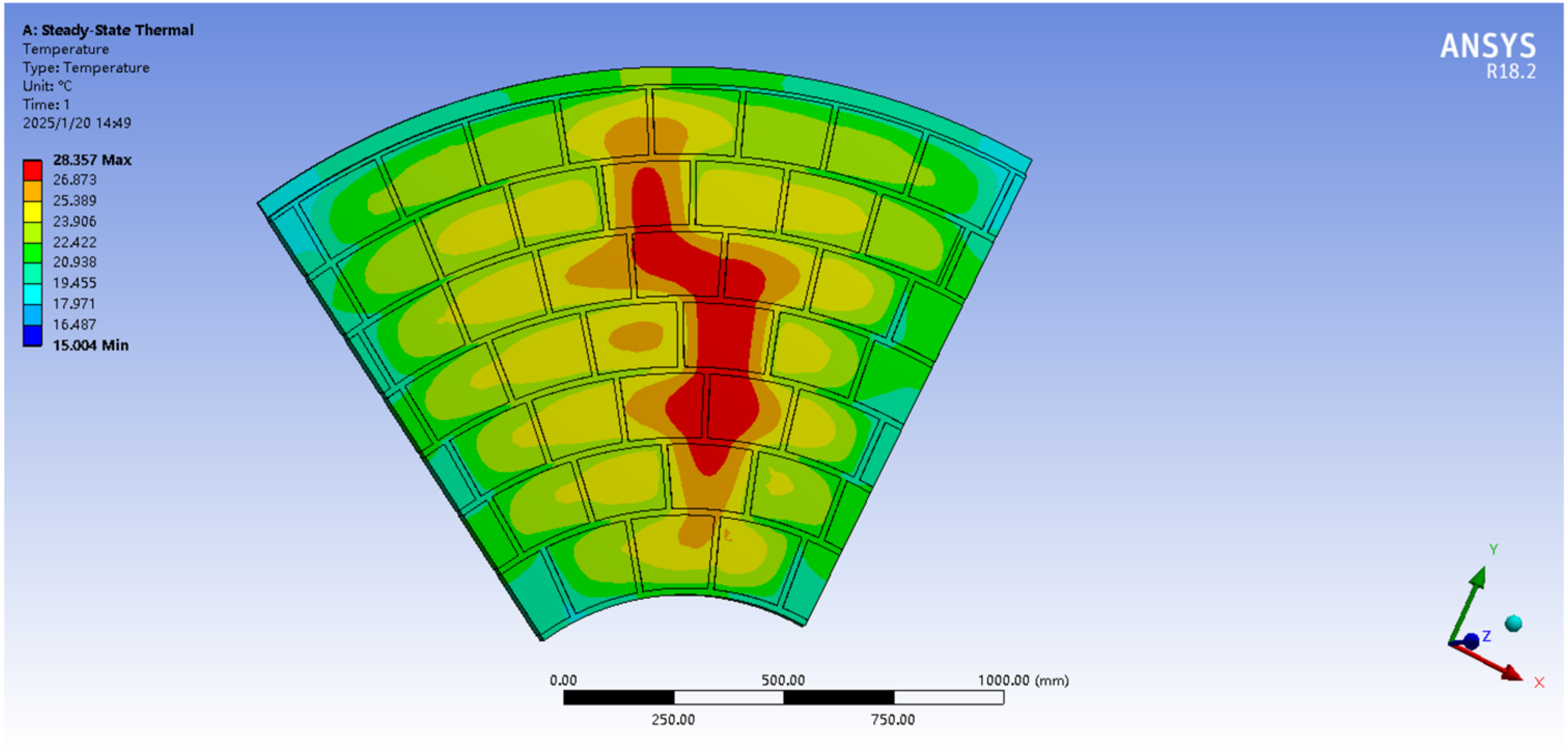


主水管之间的区域为微水管区域，采用2mm厚的平面简化替代

单水路的水阻太大，水温温升也太高，需要分为多水路

微水管区域用于冷却PCB电子学

TPC cooling R&D



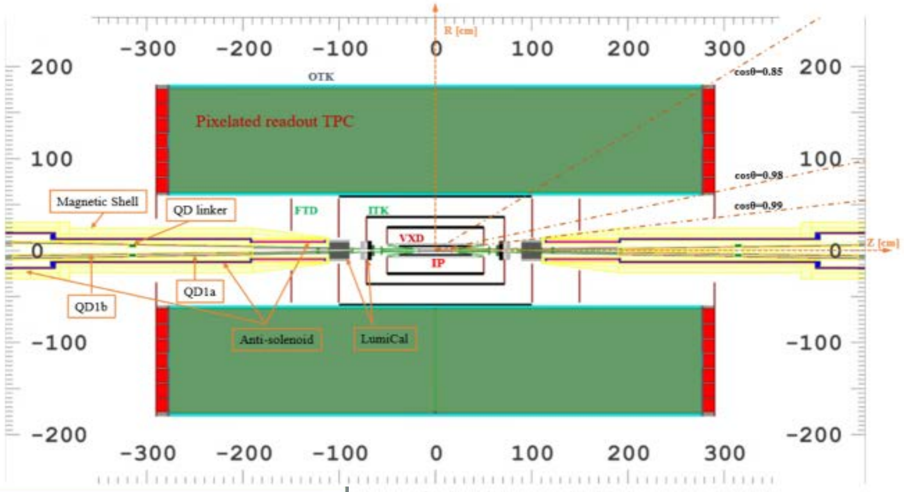
采用静态热力学有限元分析水冷热交换，**读出模块的最大温度28度**，温升约为13度。还需要进一步优化结构，减小温升。

通过估算，入口水温为15°，出口水温为32°，所需要的最小流速为2.63m/s，流量 3.1L/min。

准确的进出口水的流量和温升正在采用flunt分析。

Background Sources at Higgs/ Low luminosity Z @3T

- Higgs/Z background sources
  - I. Pair production (Luminosity related)
  - II. Single Beam (BGB, BGH,Touschek Scatter…)
  - III. Synchrotron Radiation
  - IV. Injection background



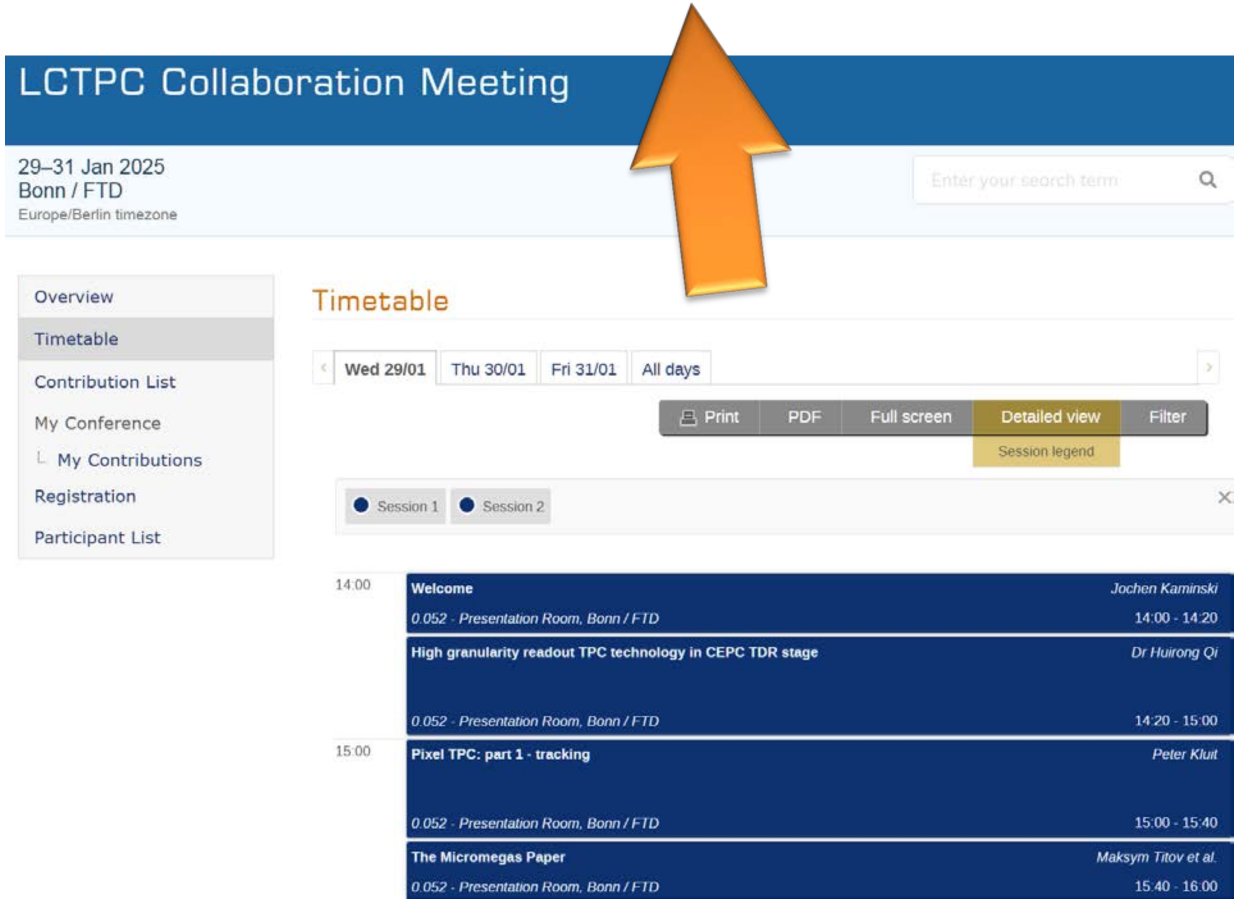
Path	Geometry	EDep/BX	Phy. list	Ave./Max ρ_{sc}	Max ρ_{sc} (w.o. 10MeV low Pt particles)
LZ_Pair_250103	Shldv3,update	2.4 MeV/BX	QGSP_BERT	1.2 / 3.52	<0.05
LZ_BGC_250103	Shldv3,update	56.9 MeV/BX	QGSP_BERT	28. / 80.	1.3
LZ_BTH_250103	Shldv3,update	0	QGSP_BERT	0	0
LZ_BGB_250103	Shldv3,update	0	QGSP_BERT	0	0
LZ_TSC_250103	Shldv3,update	4.64 MeV/BX	QGSP_BERT	2.3/7.6	0.3
LZWhole241227	Shldv3,update	64 MeV/BX	QGSP_BERT	31.4 / 95.	
LZWhole_250107	Shldv4, 2BX/per folder	14.8 MeV/BX	QGSP_BERT	7.27/18.05	<0.2
LZWhole_250115	Shldv4, 10BX/per folder,低温恒温器内部磁场3T	10.42 MeV/BX	QGSP_BERT	5.12 / 13.00	<0.2
LZWhole_250116	Shldv4, 10BX/per folder,低温恒温器内部磁场0T	11.46 MeV/BX	QGSP_BERT	5.62/14.5	<0.18
LZWhole_250117 (TDR2511)	Shldv4, (15mm stainless steels)	**10.26 MeV/BX**	QGSP_BERT	5.03 / 13.0	
LZWhole_250118 (TDR2511)	Shldv5 (5mm Ti + 10 mm W)	**4.88 MeV/BX**	QGSP_BERT	2.40 / 6.00	

- Significant reduction
- >90% low Pt ()0.511MeV

Status of Chapter6

6.1 Physics requirements
6.2 Gaseous tracker system overview
6.2.1 Technology comparison
6.2.2 Baseline gaseous tracker
6.2.3 R&D efforts and results
6.3 Pixelated readout Time Projection Chamber
6.3.1 Time Projection Chamber detector
6.3.2 Pixelated readout electronics
6.3.3 Design of mechanical and cooling
6.3.4 Commissioning and validation of prototype
6.3.5 Challenges and critical R&D
6.3.6 Costs
6.4 Performance
6.4.1 Overview of the simulation framework
6.4.2 Physical process in the framework
6.4.3 Tracking performance
6.4.4 Particle identification
6.4.5 Improvement using the machine learning algorithm
6.4.6 Beam background source and estimation
6.4.7 Alternative the drift chamber
6.5 Prospects and outlook

- **整体文档基本完成**
- **已整合入IHEP Overleaf文本内**
- **Shared with 11 members of ILD and LCTPC collaboration**



Many thanks!