Study of
SC Quadrople in Cryomodule

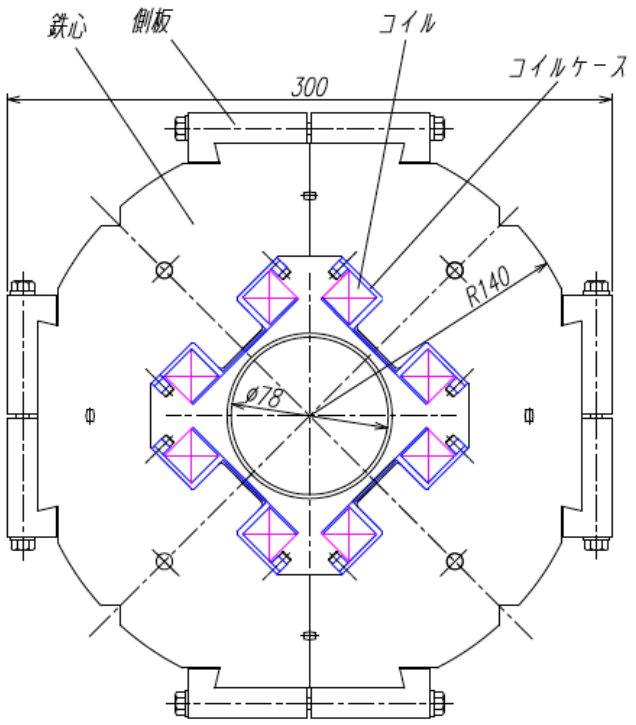
Reported by
Akira Yamamoto

STF weekly meeting, KEK, June 17, 2011

Conduction-Cooled Quadrupoles

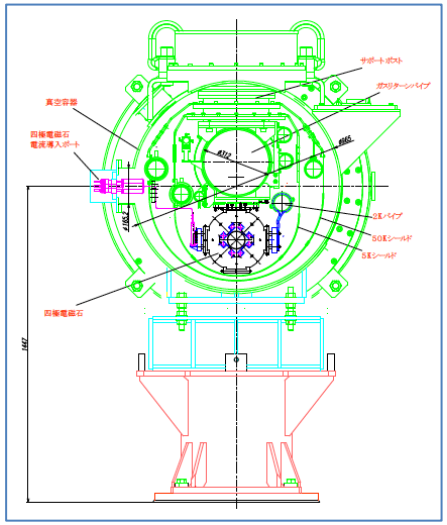
表２．１．１　四極電磁石諸元

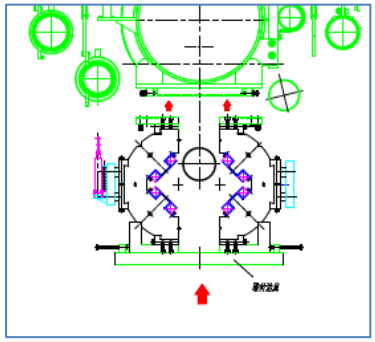
項目	単位	諸量	備考
ＧＬ積	Ｔ	３６	
口径	㎜	７８	
磁場有効長	㎜	６６０	
磁場勾配	T/m	５４	
有効磁場半径	㎜	５	
運転温度	Ｋ	３	伝導冷却のため+1Ｋとした。
運転方法	－	直流	
冷却方向	－	２Ｋパイプより伝熱による冷却	
電流 主４極コイル 補正２極コイル（垂直） 補正２極コイル（水平）	 Ａ Ａ Ａ	 １００ ４０ ４０	
電流リード	本	５	
超伝導線導体材料	－	φ０．５ ＮｂＴｉ／Ｃｕ ホルマール絶縁	
コイル構成	－	エポキシ含浸	
鉄心材料	－	ＳＵＹ電磁軟鉄	積層構造
電磁石重量	ｋｇ	約３８０	ビームモニターを含まず
蓄積エネルギー	ｋＪ	約１０	

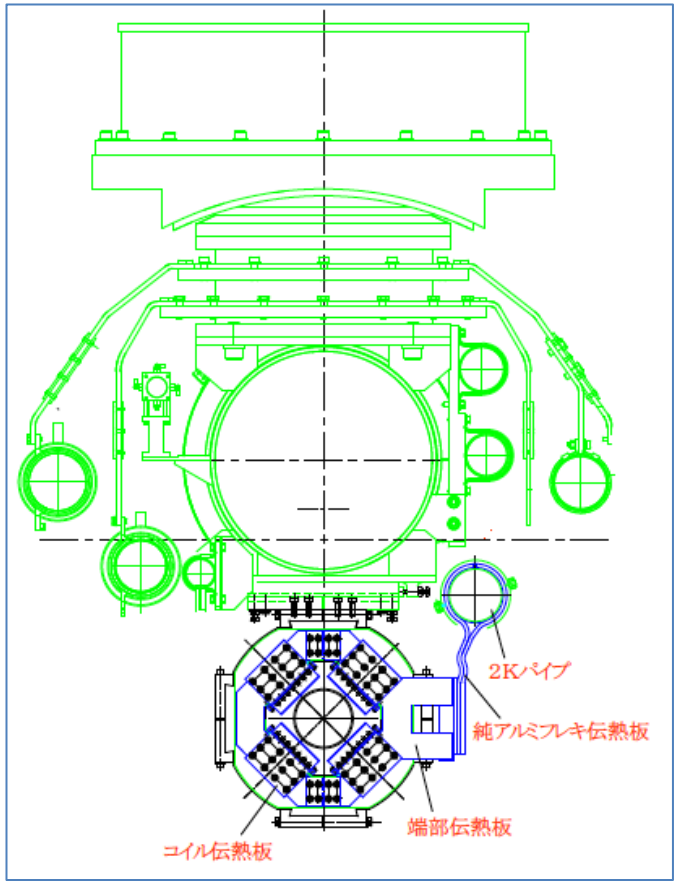


- Magnet itself, originally designed by V. Kasikhin (Fermilab)

Conduction Cooling Concept







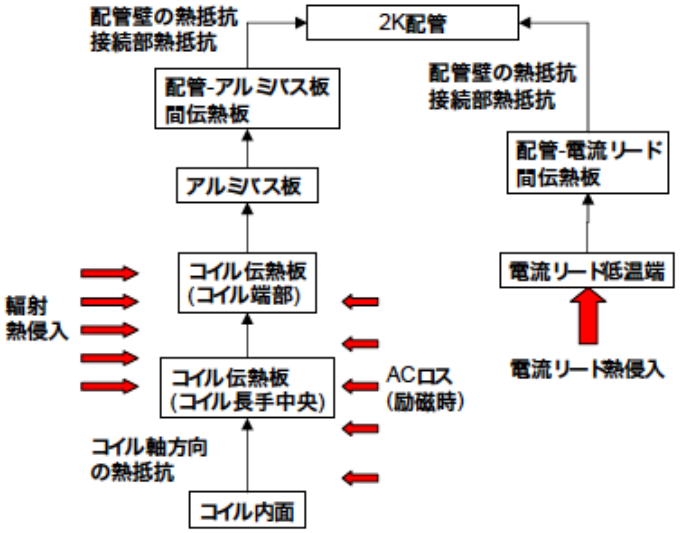
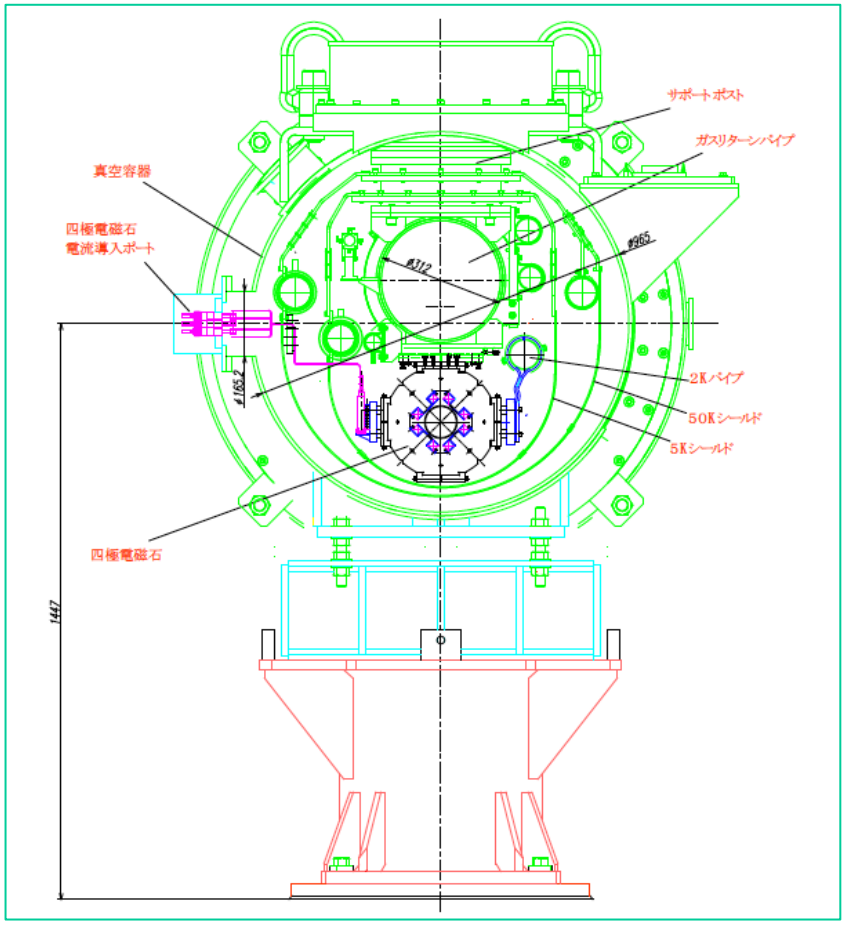
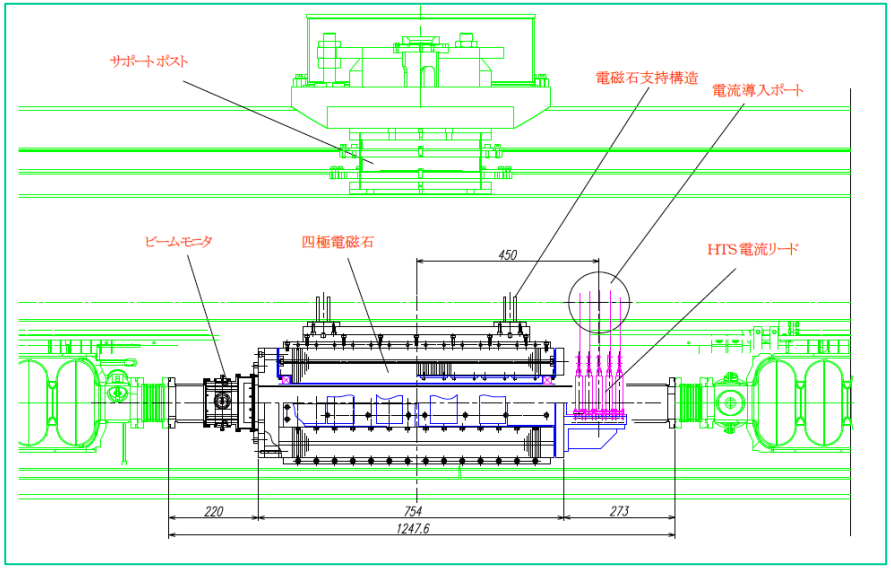


図 5.3.1 四極磁石の伝導冷却系のブロック図

- Cooled through pure-Al strip from 2K LHe line

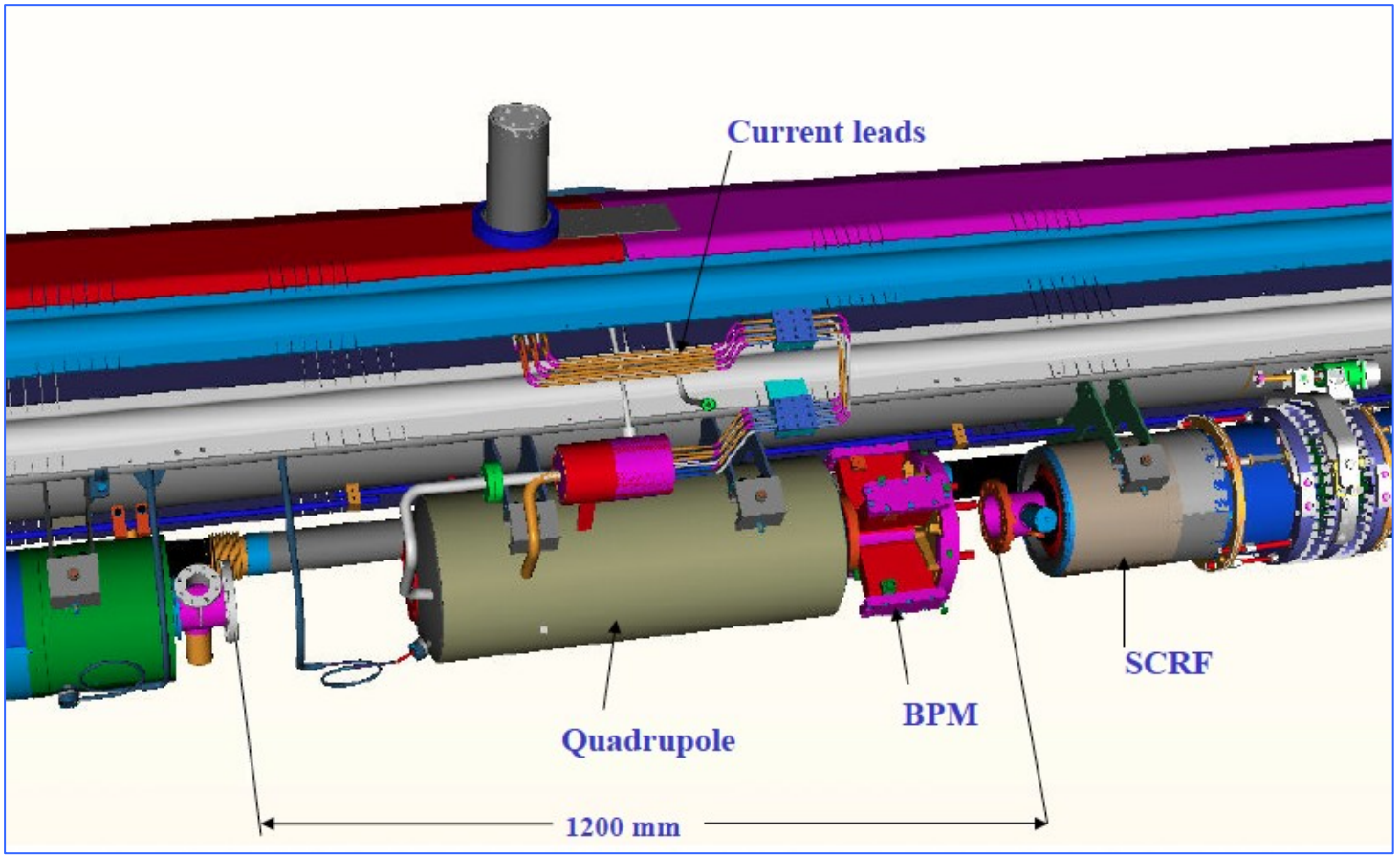
SC Quadrupole in Cryomodule





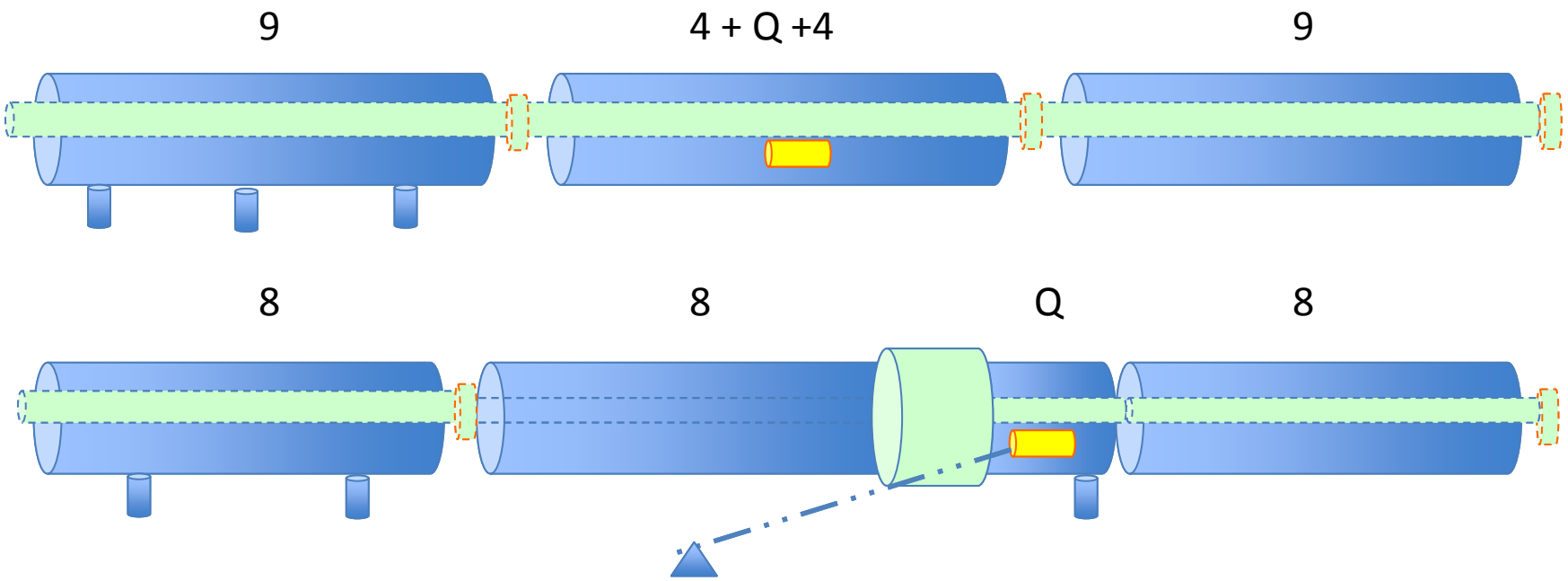
- Suspended by GRP

Current design for connection



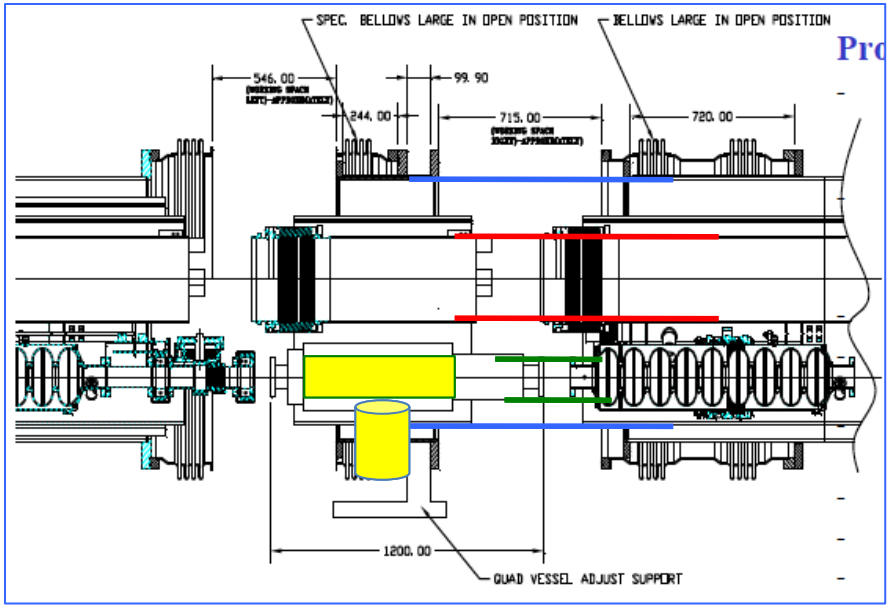
- Quadrupole package located at axial center

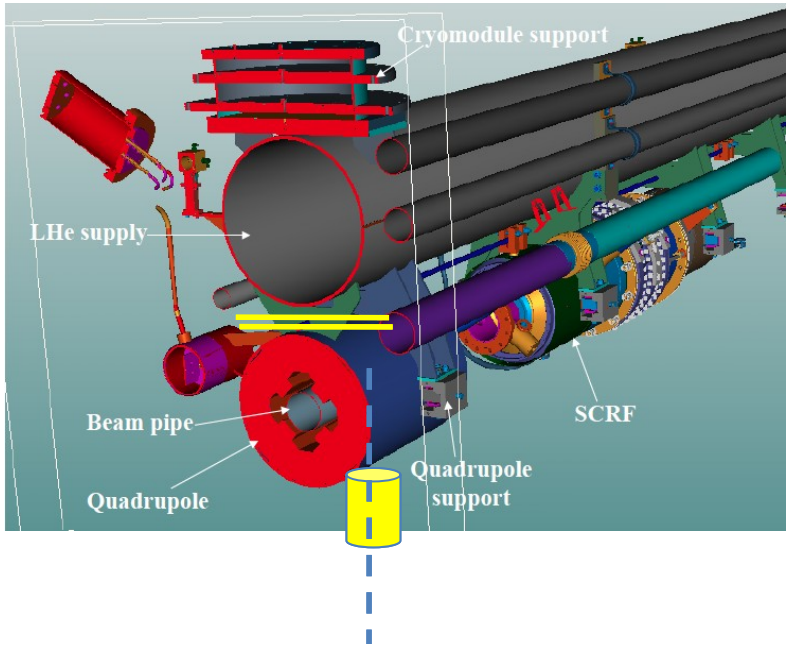
A Proposal / Revival



- Independent stand-off at bottom, mechanically free from GRP,
- Solid pipe work (without bellows) at down stream end
- Minimize additional piping work
  - Not full additional interconnect : not (3 +1 full) but (3 + alpha) interconnect,

Thinking about a cost-effective connection





- We could eliminate flexible/bellows connection one-side, with simple extension of solid pipes
- We would like to seek for a smart/sophisticated solution with expert's contribution.

- Another possibility is to place Q in every 4 cryomodules (instead of every 3 cryomodule)

Advantage/Disadvantage and Necessary Study/Work

- Advantage:
  - Single cryomodule design and manufacturing
  - Independent work between RF and Magnet
  - Easier and direct alignment including BPM, in installation in case of keeping conductive cooling magnet,
- Disadvantage:
  - Additional interconnect work
- Necessary study/work/communication
  - Smart and sophisticated interconnect design and work including connection of beam-pipe,
  - Discussions and consensus in ILC-GDE SCRF group
  - Visit and discussion with key persons
    - 7/5: INFN (Milano), 7/22: Fermilab, 7/24, Workshop, 7/25 ~ SRF,