DESY FLASHにおける HOM測定の最新結果

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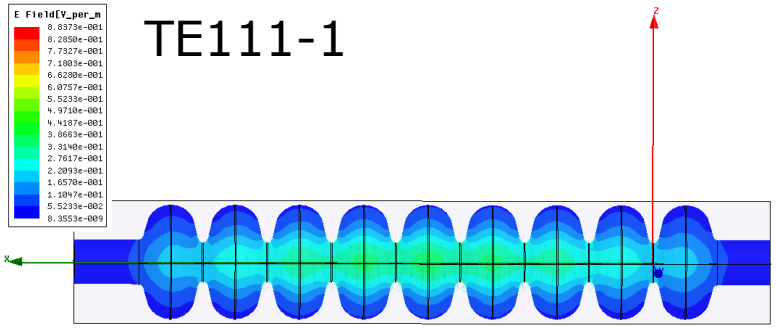
1. Cavity Alignment Detection
2. Beam measurement @ DESY, FLASH
3. Summary

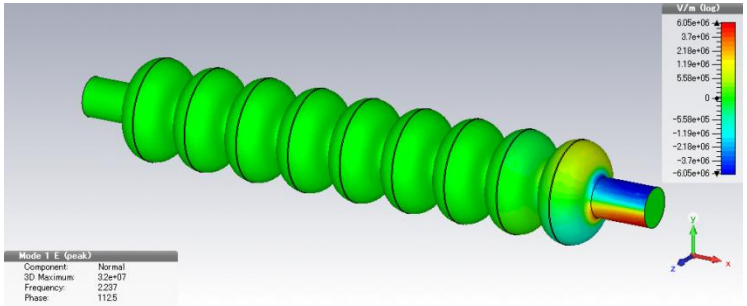
Alignment Detection

- Motivation
- クライモジュール内にある9セル超伝導加速空洞単体内のアライメント(オフセット、傾き、歪み)を検出する

TE111-1



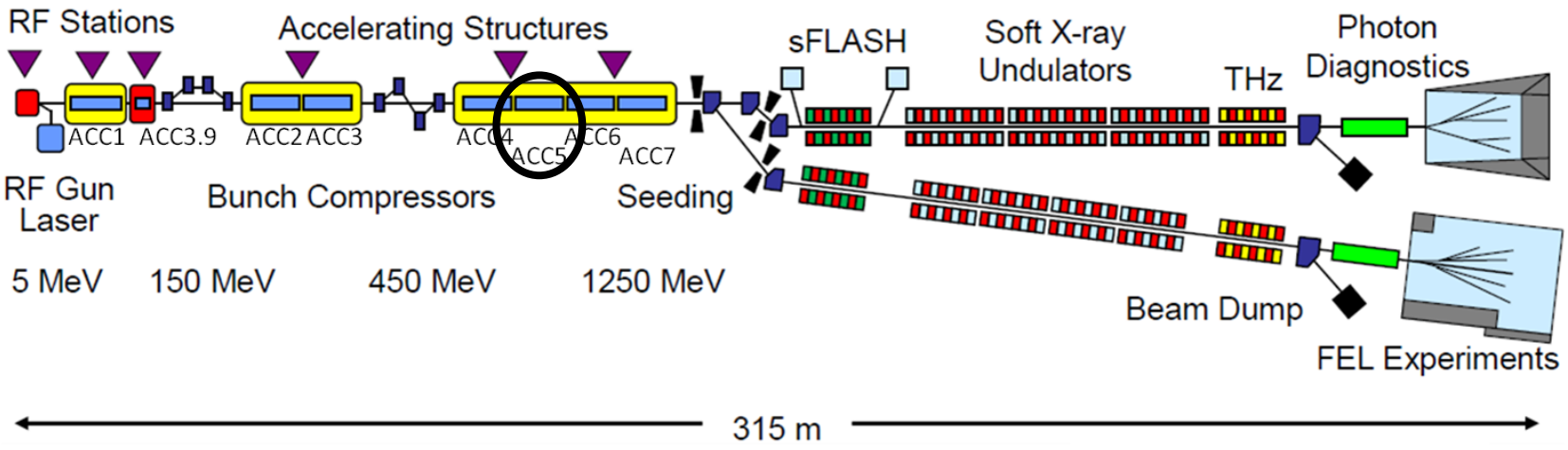
Beam Pipe mode



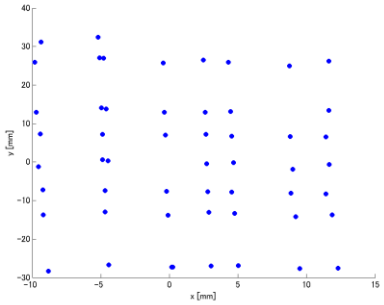
- TE111-1の電気的中心
  ＋
- ビームパイプモードの電気的中心
  ⇓
- 電気的中心の差異から空洞アライメントを得る

FLASH (the Free-Electron Laser in Hamburg)

- DESY (Deutshes Elektronen-Synchrotron)
- 所在地:ドイツ　ハンブルグ
- フェムト秒パルス軟X線を生成する自由電子レーザー

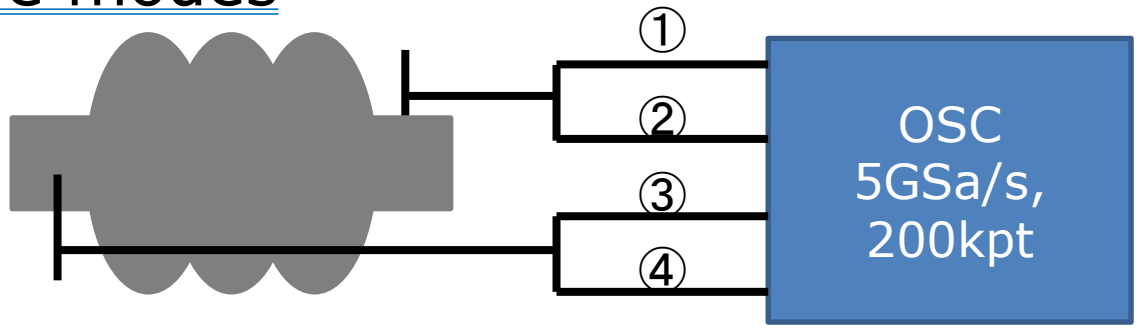


- ACC5#8
- 異なるビーム位置でのHOMのデータの取得
- 電気的中心を求める



Measurement Set Up

- ACC5#8
  - TE111-1
  - Beam pipe modes

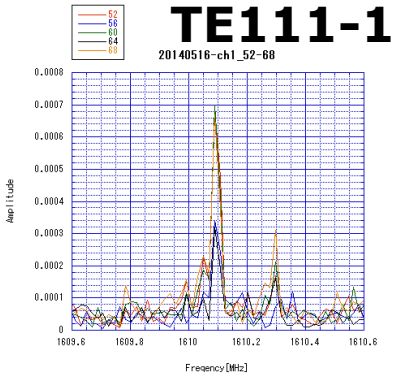


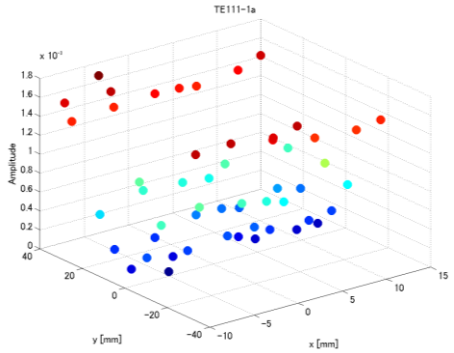
- HOM1-HPF
  - -BPF(TE111)-AMP-OSC
  - -BPF(Beampipe)-AMP-OSC
- HOM2-HPF
  - -BPF(TE111)-AMP-OSC
  - -BPF(Beampipe)-AMP-OSC

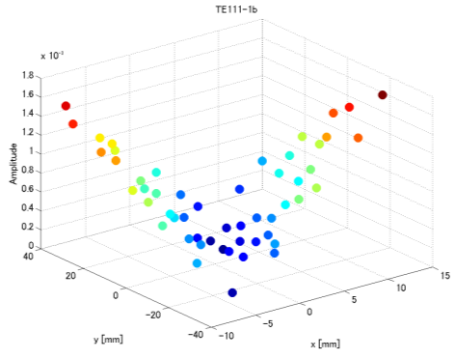
Distribution of magnitudes of TE111-1 and Beam pipe mode from HOM1

- 強度はビーム電流で規格化
- BPMがサチッてる範囲ではACC5#8の中心でのビーム位置がステアリングマグネットの電流値に比例していることを仮定
- ACC4とACC5の間にあるQマグネットによる軌道変化は無視

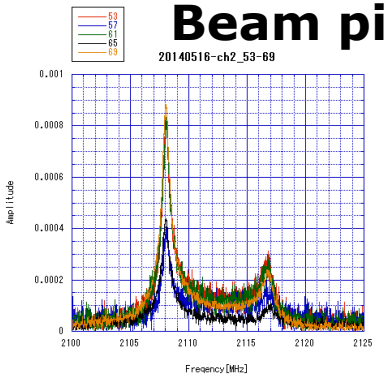
TE111-1

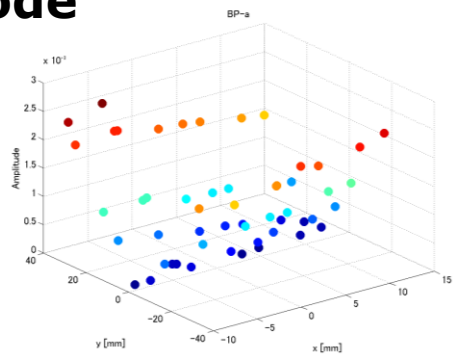


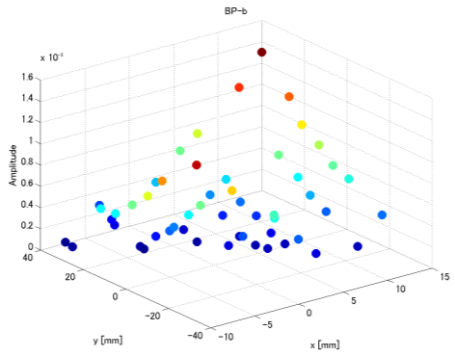




Beam pipe mode







Summary

- ビーム誘起高調波モードを使った空洞アライメント検出を研究している

- @DESY, FLASH
- ビームオフセットに対する強度分布を取得した
- 電気的中心は解析中

ご清聴有難うございました

Back up

Simulation of Beam pipe modes

- TDR-like TESLA cavity was simulated by R. Wanzenberg with the computer code MAFIA (eigenvalue solver). One set of beam pipe modes appeared 2.288 GHz.

  Simulation condition;

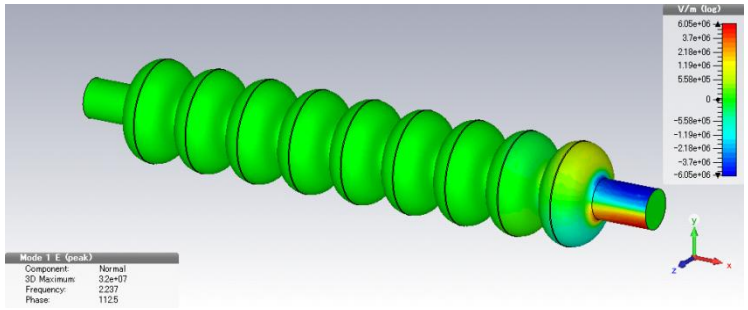
  Only symmetric cavity

  Boundary conditions : MM (i.e. the longitudinal electric field Ez is zero at both ends of the cavity.)

- I calculated the frequencies of beam pipe modes for KEK cavity w/o end groups with CST MICROWAVE STUDIO 2012.

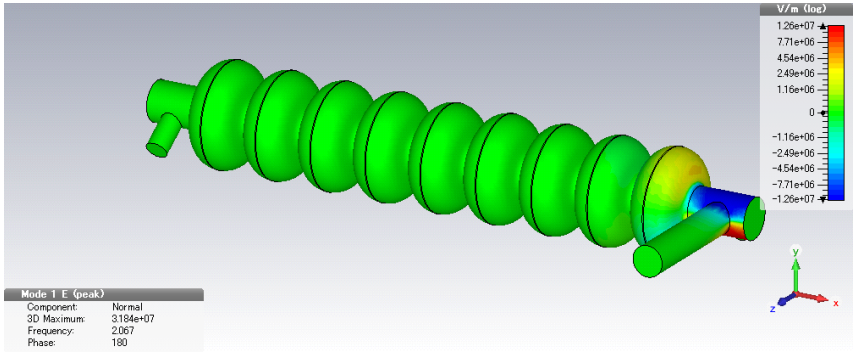
  CST MICROWAVE STUDIO 2012

  2.237 GHz (MM)



Simulation of KEK cavity

- with outer conductors
- CST
- 2.067 GHz (MM)
- 2.169 GHz (EE)
- 2.194 GHz (MM)
- HFSS 2.194 GHz



- The frequencies of beam pipe modes become lower by attaching ports outer conductors and furthermore one mode is added.
- We can expect that the frequencies of beam pipe modes for TESLA cavity also become lower than 2.288 GHz by attaching ports outer conductors and an existence of the other mode. We will simulate TESLA cavity with ports outer conductors in the next.

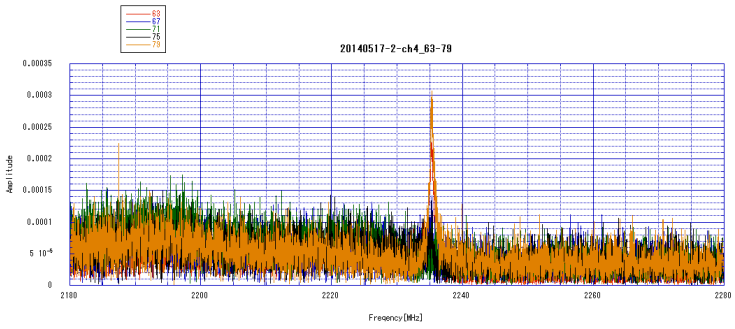
Field Measurement

- Field Measurement is under performance.
- To confirm field distributions.
- To measure differences of positions between electrical centers and the mechanical center.
- Beam pipe structures are asymmetry due to input coupler, HOM coupler, and pick up coupler.
- We can predict that electrical center for beam pipe modes are different from the mechanical center.

Beam pipe mode

ACC5#8 from HOM2

- Only one peak appears.
- No split or the other split mode can’t couple with HOM coupler.



ACC5#8 and ACC7#8

- Spectrums look like different.
- MHI12(KEK) is similar to ACC7#8.