IPBPM status and plan

ATF2 project meeting

2008.12.16

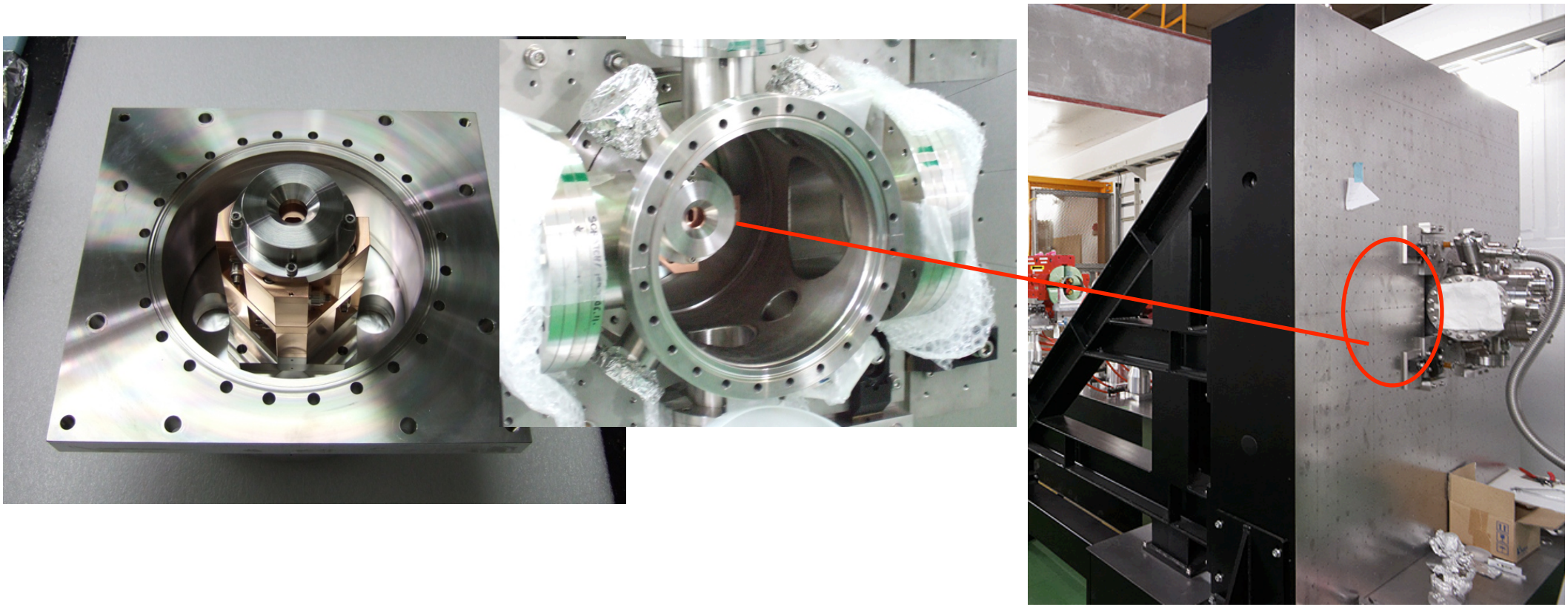
Yosuke Honda

- Plan of IPBPM system improvement for phase 2 goal.
- Status of IPBPM integrated in BSM system for phase 1 goal.
- Low-Q IPBPM (KNU) status.
- Beam Orbit Tilt monitor development (Tohoku-univ.).

IPBPM system

- This is for beam jitter measurement at phase 2 of ATF2. (not a very high priority for now)
- Already achieved the first mile stone of <10nm resolution, but not enough for phase 2 goal. For further improvement, we need additional devices to monitor various parameters of the beam (beam orbit, bunch length, ...).
- At the commissioning phase of ATF2. Its small aperture (6mm x 12mm) might be a problem. So, the BPM system is removed from the beam line.
- The granite girder is placed at the location assigned for IPBPM test.
- LowQ IPBPM(KNU) and Orbit Tilt Monitor will be tested here. After establishing such additional monitors, we should try for higher resolution.

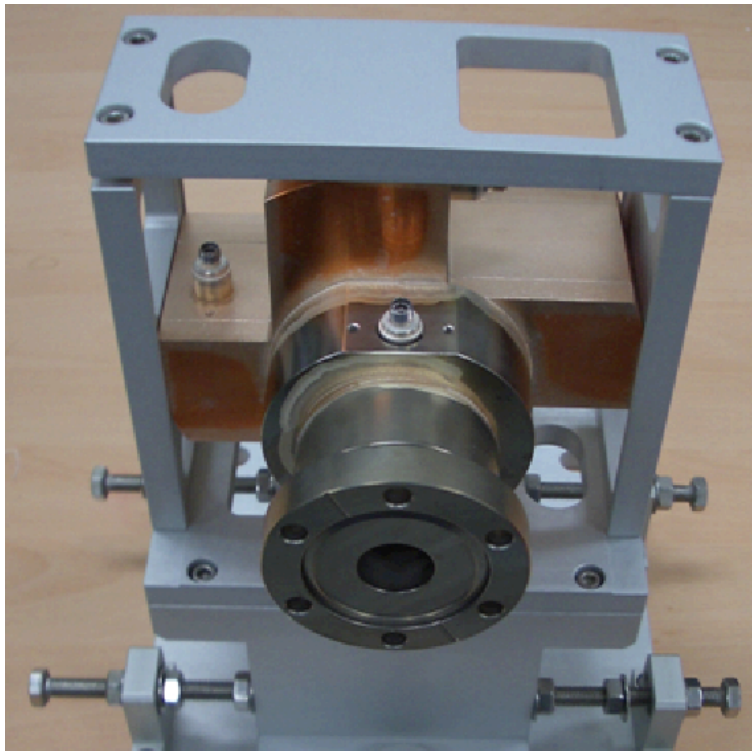
IPBPM in BSM system



- High resolution beam position monitoring is important for the IP-beam size monitor. A new one (a little compact model, not vacuum tight) is made.
- We can use the old IPBPM electronics (developed for phase 2).
- Data acquisition will be included in the BSM system.
- The IPBPM is removed from the vacuum chamber at present concerning its small aperture.
- May be re-installation will be after establishing the commissioning of BSM.

LowQ type IPBPM

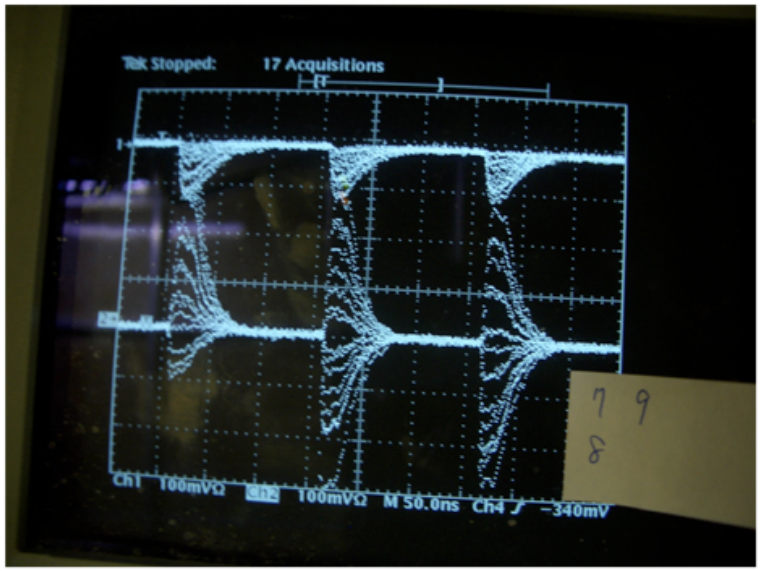
	Freq. (GHz)	Q_0	Q_{ext}	Q_L	β
X1	5.7163	4495	974	801	4.615
X2	5.7163	3422	1050	804	3.257
Y1	6.4332	5947	716	639	8.299
Y2	6.4332	2764	844	647	3.272
X12	5.7161	2526	1182	805	2.137
Y12	6.4332	2492	779	593	3.200
Ref.	6.4287	1117	88570	1103	0.0126



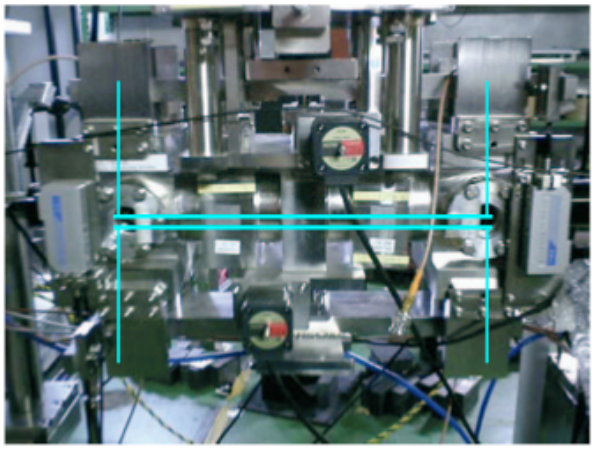
- Designed in KNU (Seunghwan Shin).
- Motivation: Develop a IP cavity BPM optimized for the multi-bunch operation. Good signal separation for ~150 nsec spacing bunches.
- Beam stability measurement in multi bunch mode.
- High resolution, Intra-train feedback system.

diode

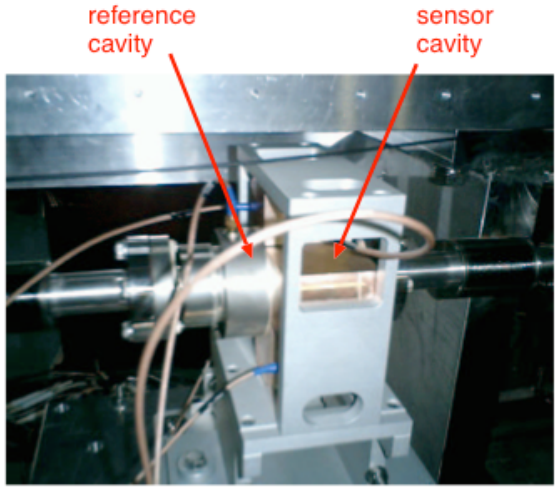
D.C.



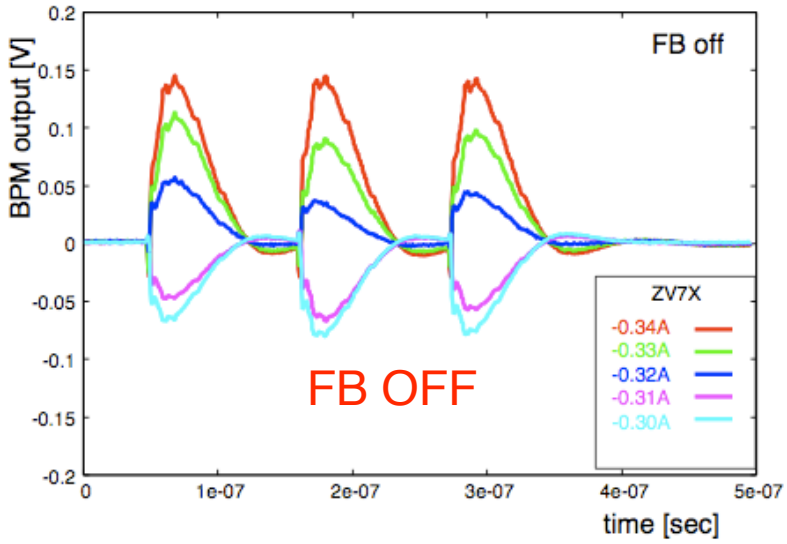
Feedback demonstration

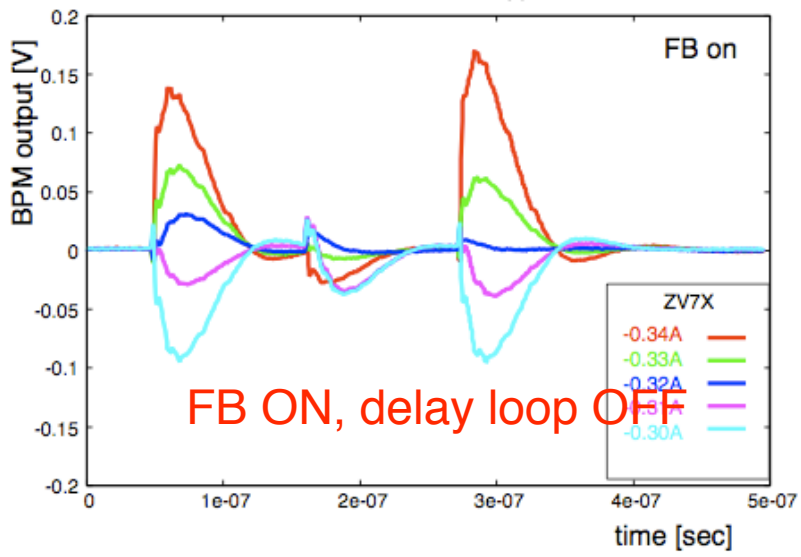


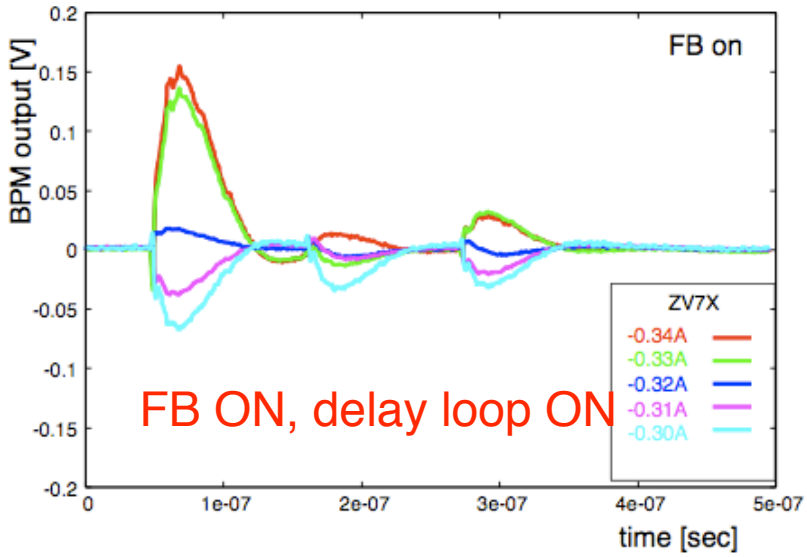
adjustable gap kicker



LowQ type IPBPM

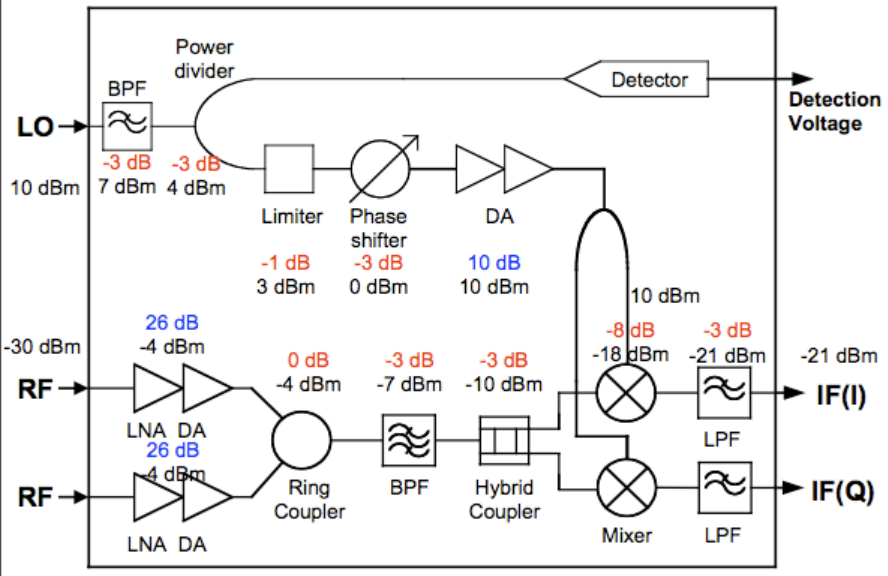


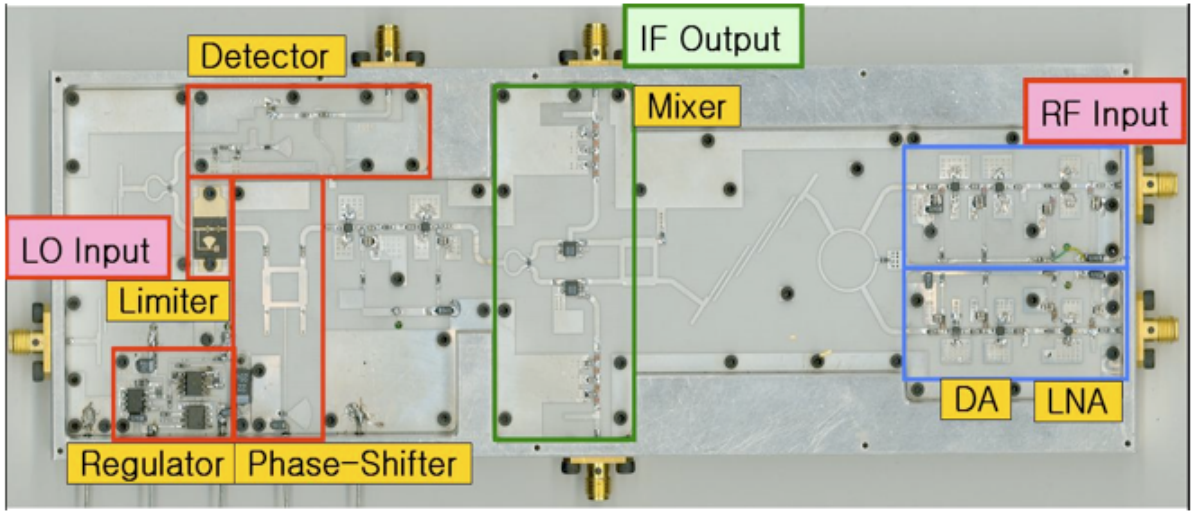




- Demonstration of feedback system with the LowQ IPBPM.
- Done at old extraction line with the feather kicker.
- Incoming beam offset was reduced to 10%.

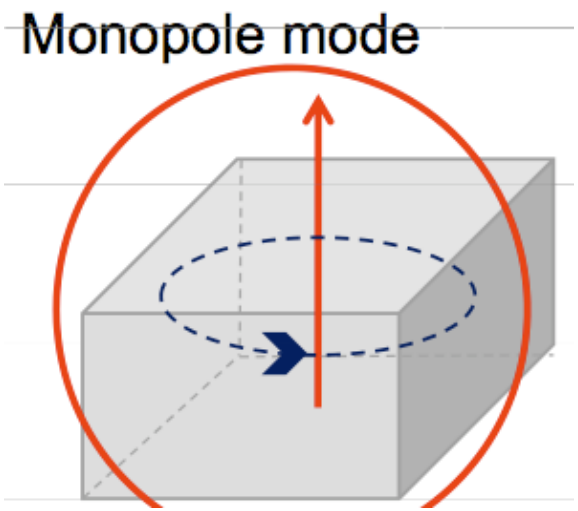
LowQ IPBPM status

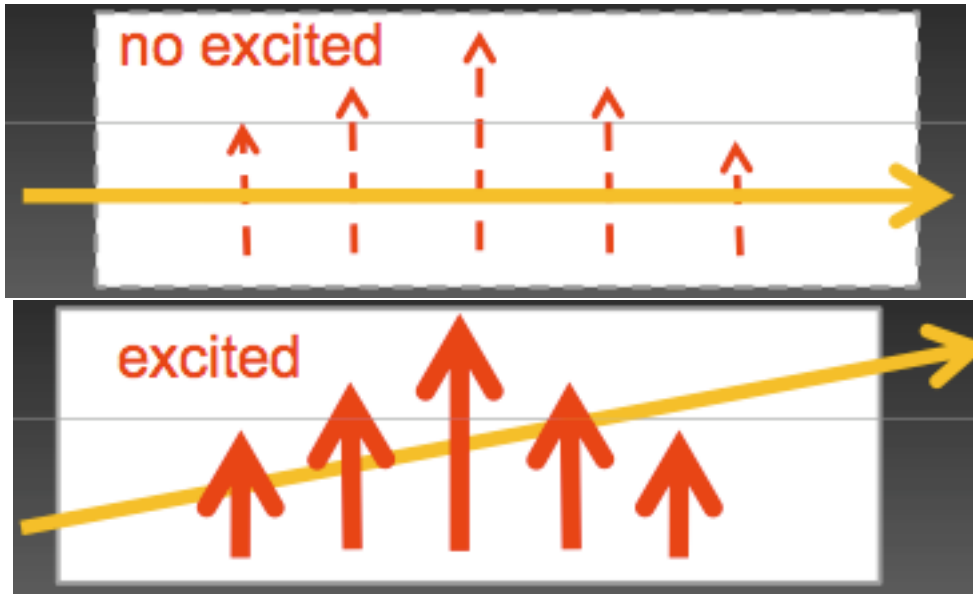


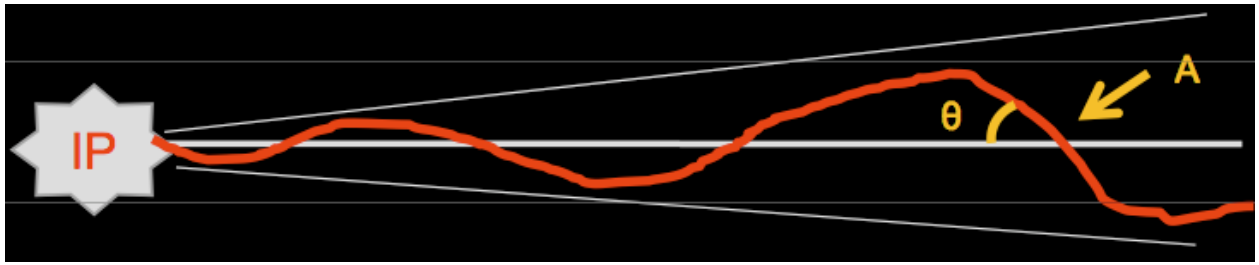


- KNU (Aeyoung Heo, Seunghwan Shin)
- Electronics fabricated in Korea.
- Under testing with a beam signal (use MQD10X c-band QBPM as a signal source).
- Planning to re-install the LowQ IPBPM when we judge the ATF2 beam line is ready to install such a small aperture device.

Beam orbit tilt monitor

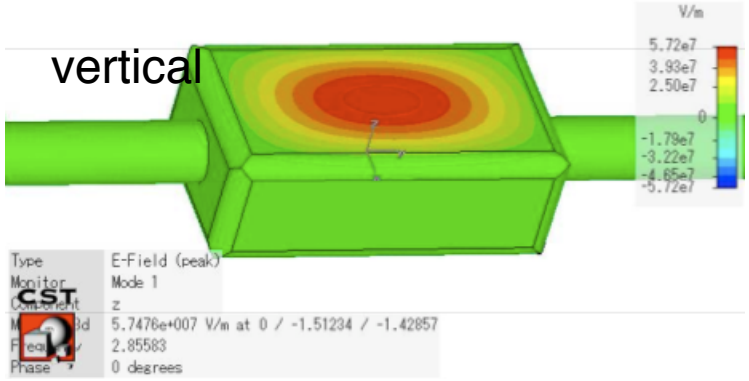


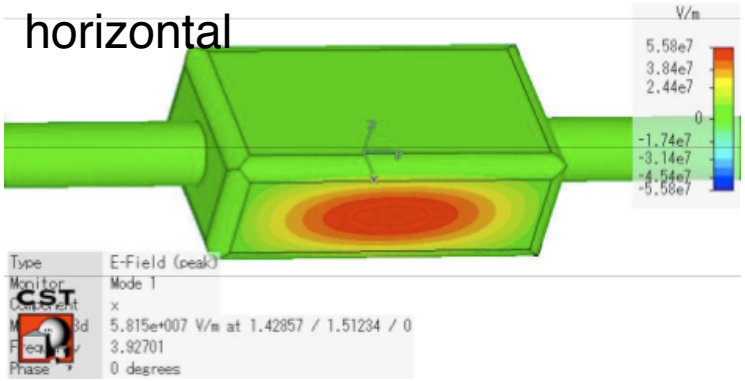




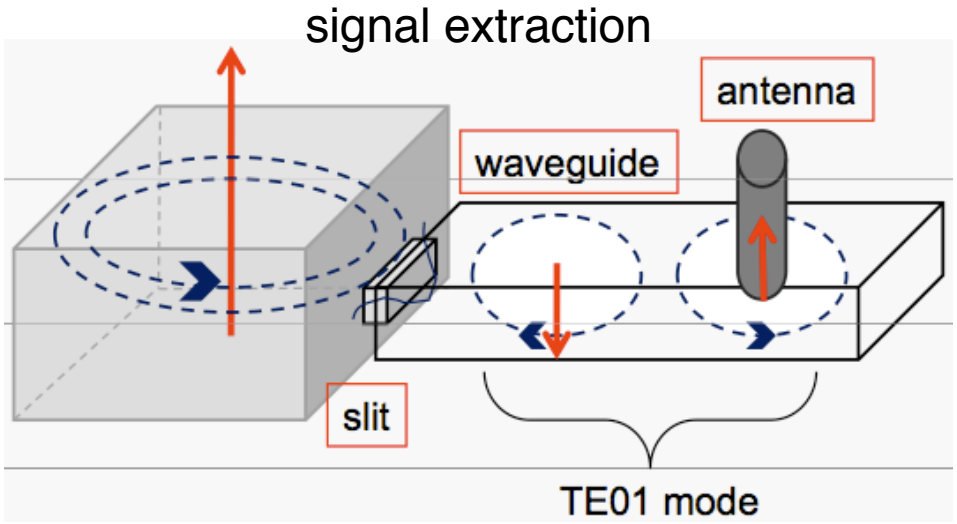
- Work being done at Tohoku university (Okamoto, Sanuki)
- Same principle as cavity BPM, use monopole mode of transverse direction, which is excited by transverse beam orbit variation.
- As a part of IPBPM system to collect additional information of the incoming beam (proposed by V.Vogel in the very first design (2004)).
- It can be a useful tool to monitor beam position at IP if located at a suitable phase advance.

Beam orbit tilt monitor



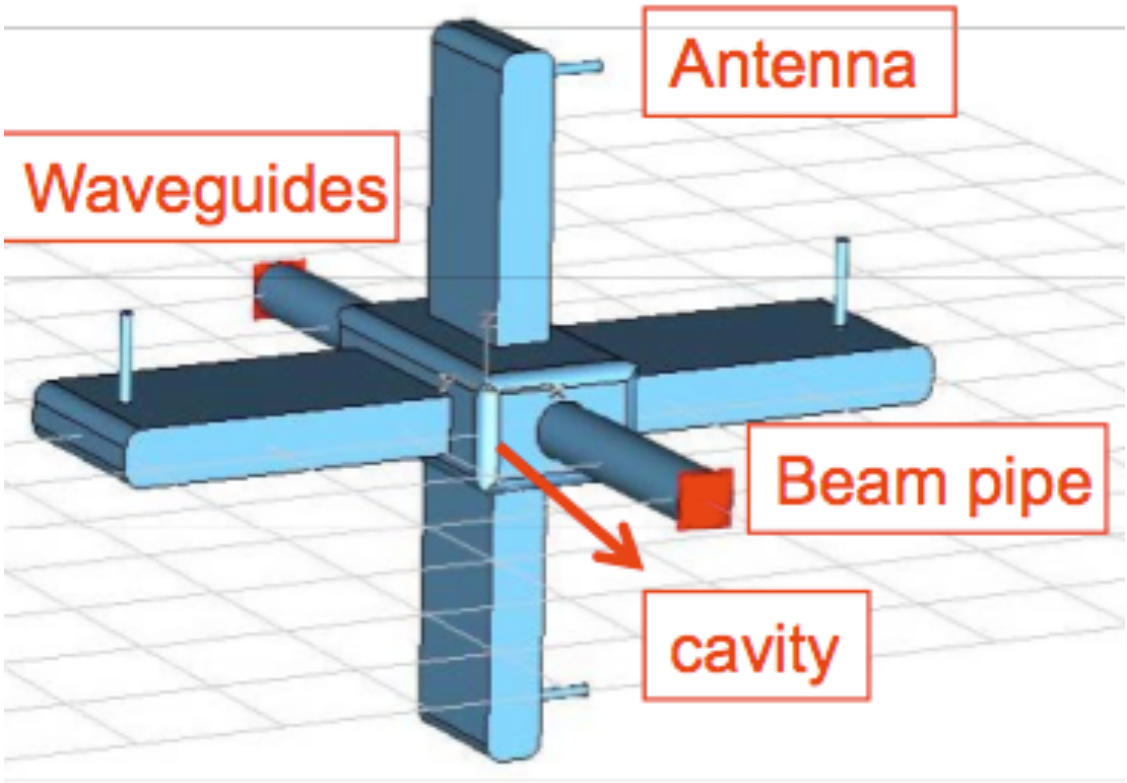


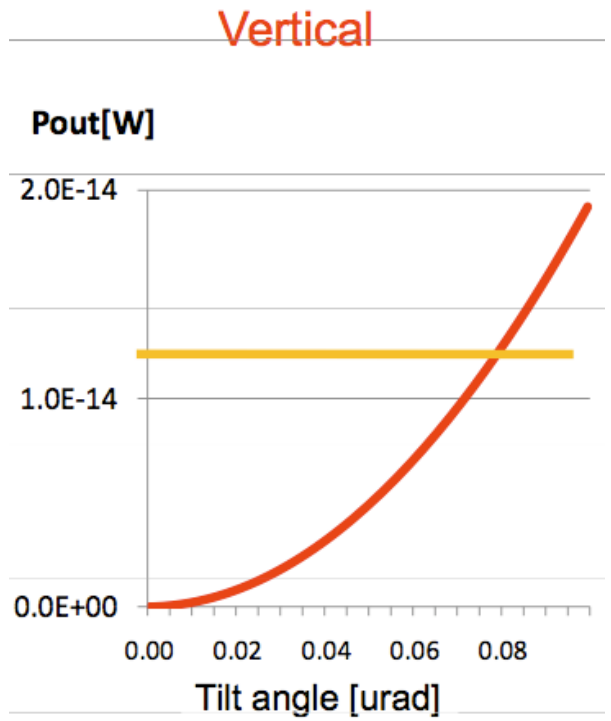
Vertical direction mono	2.856[GHz]	357[MHz]×8
Horizontal direction mono	3.927[GHz]	357[MHz]×11
Longitudinal mono	4.470[GHz]	----------

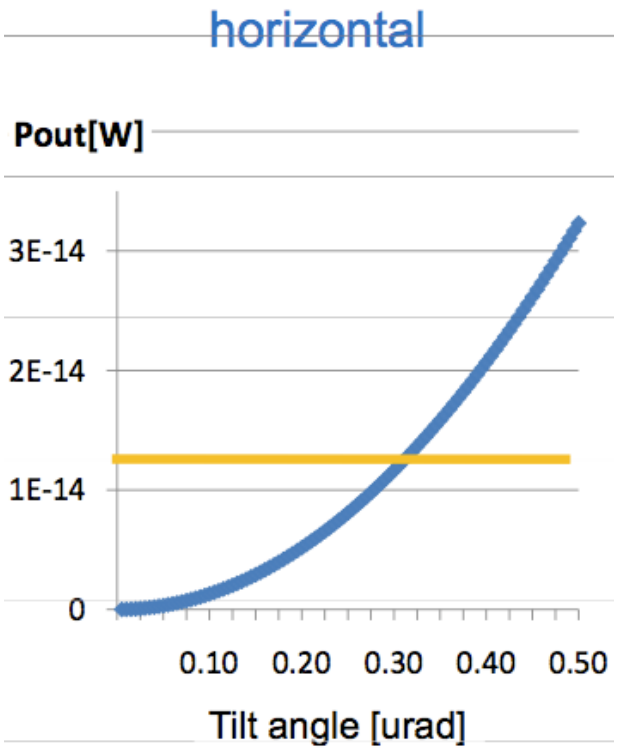


- After consideration of various types of structure (pill-box, pressed-pill-box, etc...), we chose the rectangular design. It can measure both vertical and horizontal.
- 2.856GHz and 3.927GHz.
- slit-to-waveguide coupling, we have many experience.
- No dangerous contamination mode exists as far as our simulation.

Beam orbit tilt monitor







- RF designing done.
- expected resolution:
  - 80nrad (vertical) and 300nrad (horizontal) for 1.6nC, 8mm bunch.