Future possibilities involving the narrow- and broad-band data acquisition setup at FLASH

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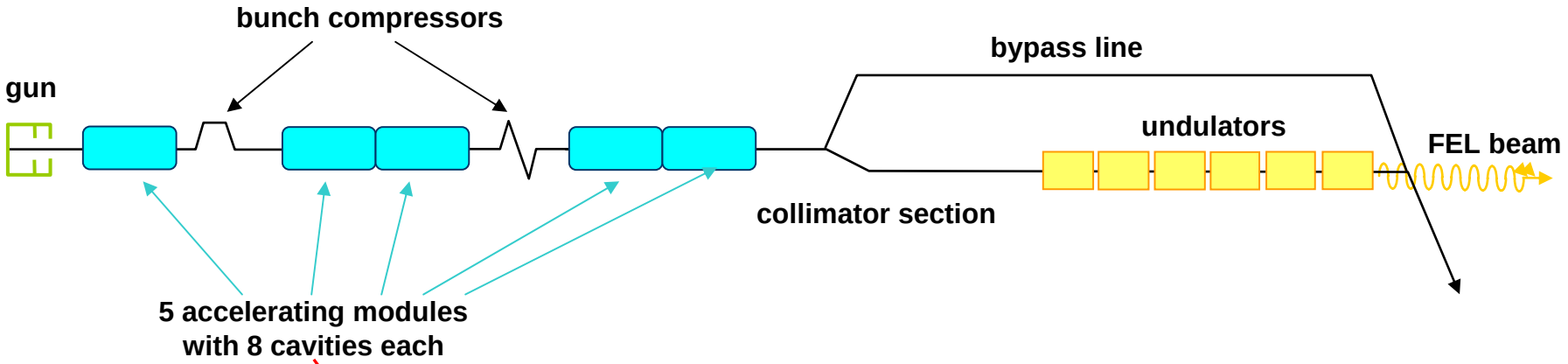
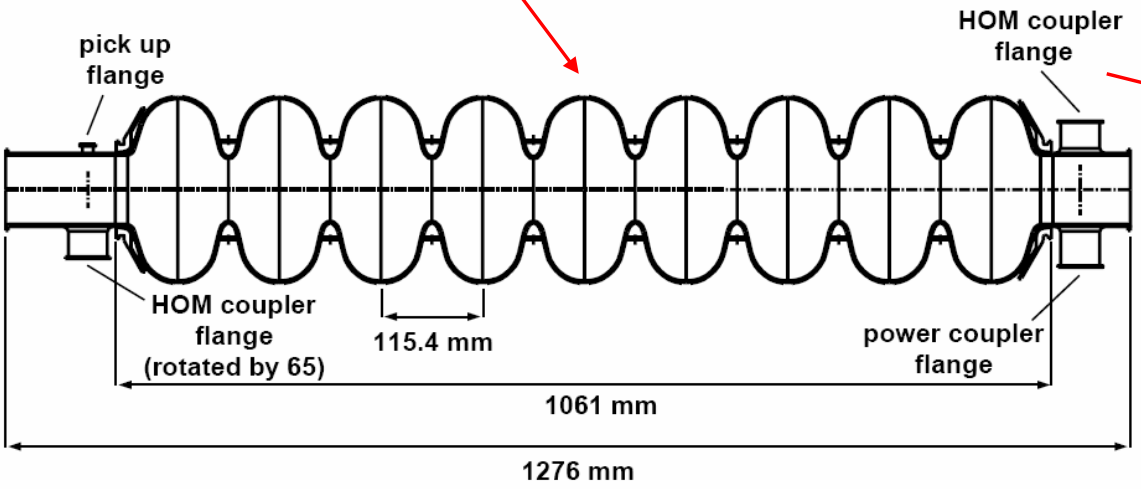
HOM measurements at FLASH





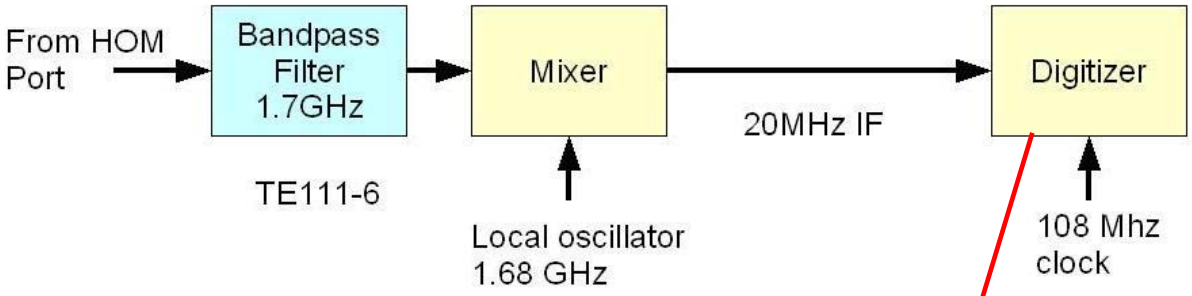
HOM signals

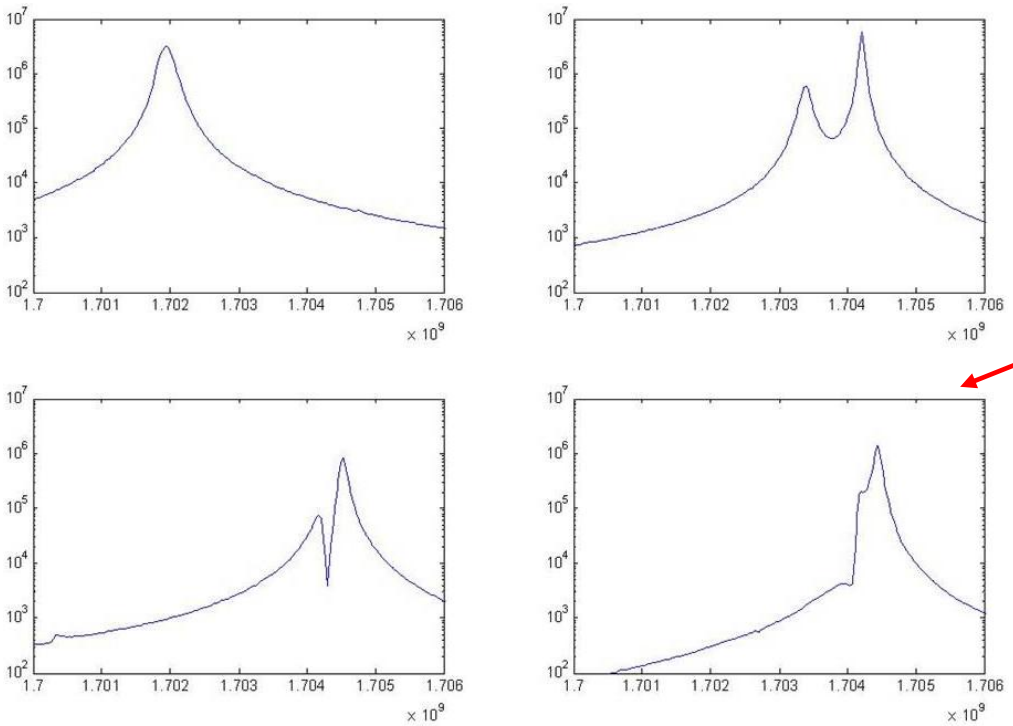
High resolution, narrow bandwidth, measurements.

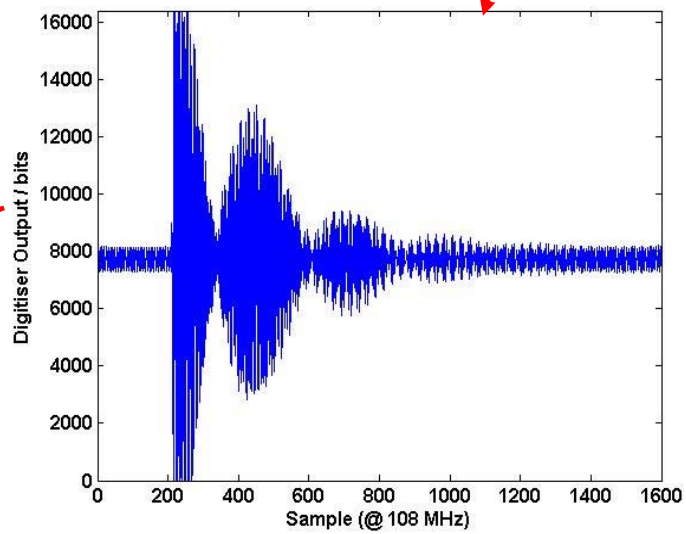
Lower resolution, wide bandwidth, measurements.

Narrow-band System

- Chose TE111-6 mode due to strong coupling with the beam.
- ~1.7 GHz tone added for calibration purposes.
- Cal tone, LO, and digitiser clock all locked to accelerator reference.
- 14 bit, 108 MHz digitiser.







Wideband System

- Narrowband electronics provide raw signal as an output via a 14dB coupler.
- Allows direct measurement of the raw HOM signal.
  - Although this signal will be contaminated by the LO, etc. from the electronics boards.
- Two scopes currently in use:
  - Both 20 GS/s spread over the four channels.
  - Input bandwidth of either 4 GHz or 6 Ghz.
  - 8 bit precision, clock interleaving causes additional Fourier spikes
- Acquisition through a dedicated Linux box
  - Needs to be replaced as it is SLAC property(!)
  - Sufficient for the short term.

Integration with FLASH facility

- A substantial amount of code has been developed to acquire data from these two systems.
  - Although much of the code is in an “experimental” state...
- Runs in the FLASH Matlab environment, which allows access to the control system,
  - Ability to control magnet currents, etc.
  - Read-back from toroids, BPMs, etc.
  - Synchronous data taking from several systems at once.
- The narrowband system is part of the HOM BPM system,
  - The mixed-down HOM signal can be read out independantly
  - But serious changes to the electronics would break this system

Potential?

- Can this system be used to answer any of the questions being raised at this workshop?
- For example,
  - Polarisation direction:
    - The output of the TE111-6 mode due to a 1mm offset in two orthogonal directions may be calculated from the SVD analysis.
    - This mode may be rotated by a simple matrix multiplication.
    - In the case of a cavity with a large frequency splitting, the Fourier spectrum could be observed to determine when the power at one frequency is a minimum.
    - This could be done with many modes with the broadband system.

Potential?

- Example,
  - Mode rotation along the length of the cavity.
    - It has been predicted that the polarisation direction of some modes will be rotated by a small amount from cell to cell.
    - This is due to the effect of the couplers (I think!), and could be measured.
    - An initial attempt was made at this, by moving the beam in a circle in the *xy plane, and recording the HOM output.*
    - *Mode rotation would be seen by observing the phase difference between different offsets.*
  - *Modes that rotate with time are also predicted.*
    - *Can these be measured here?*