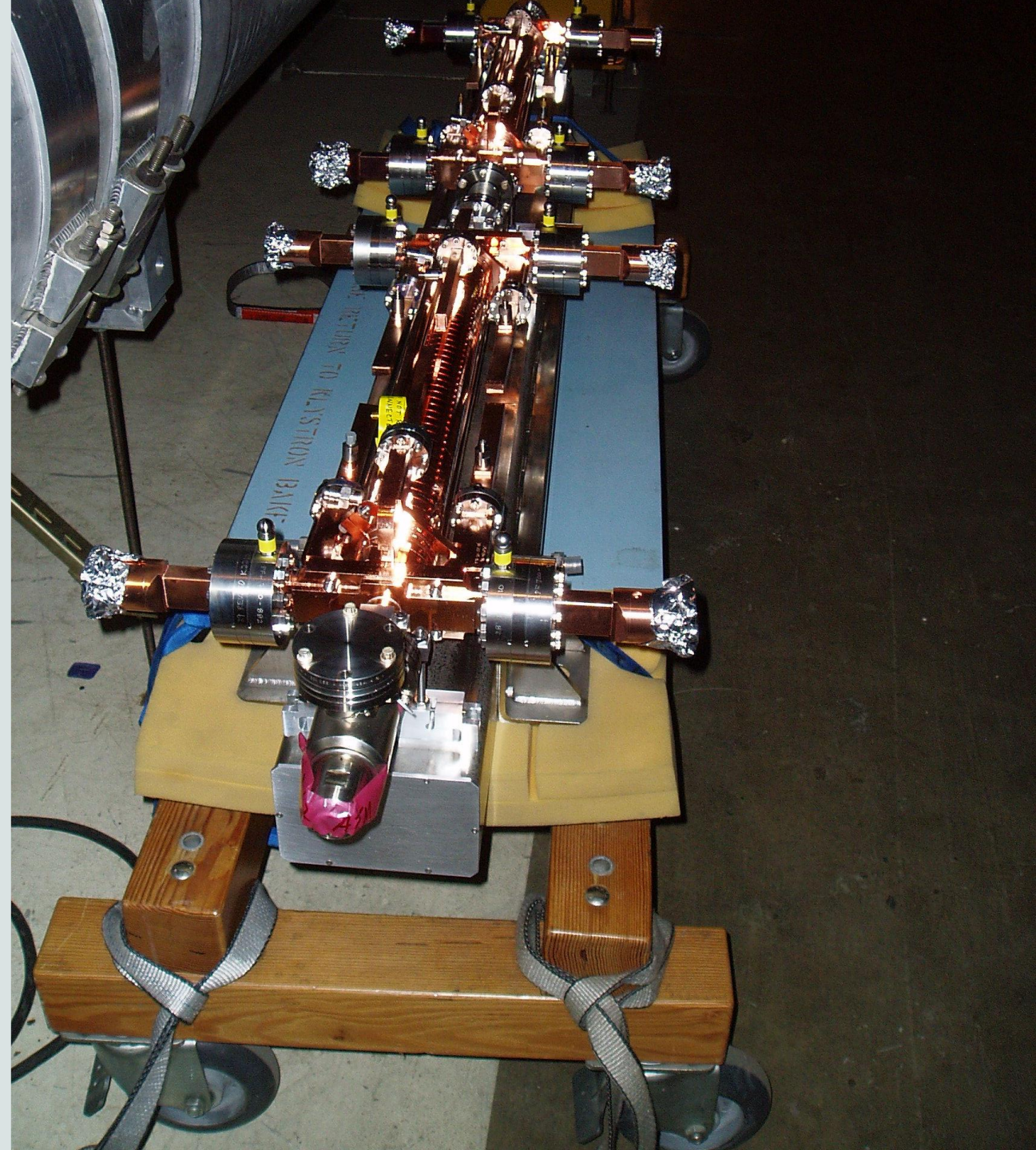




Wake field monitors in NLC structures

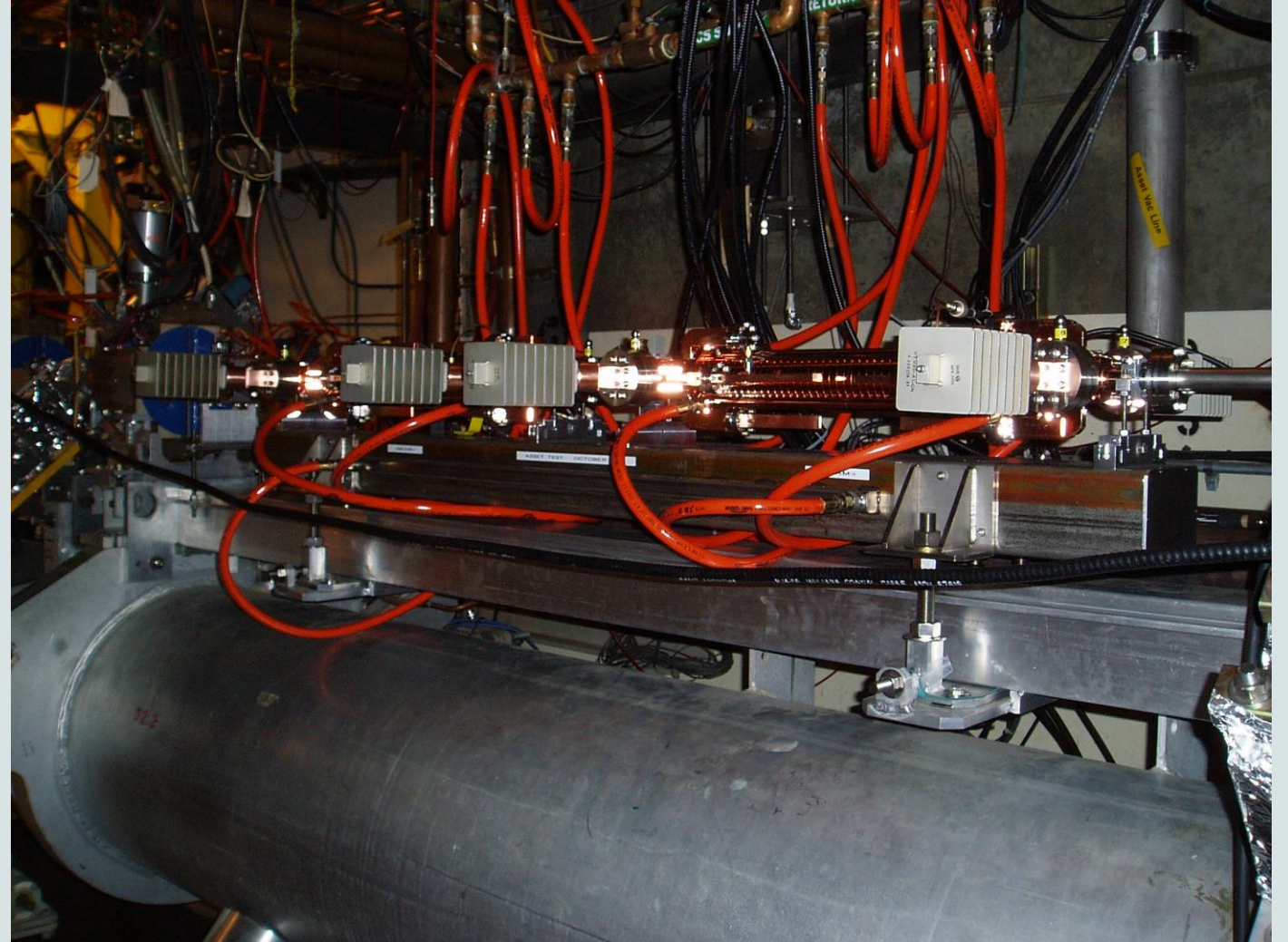
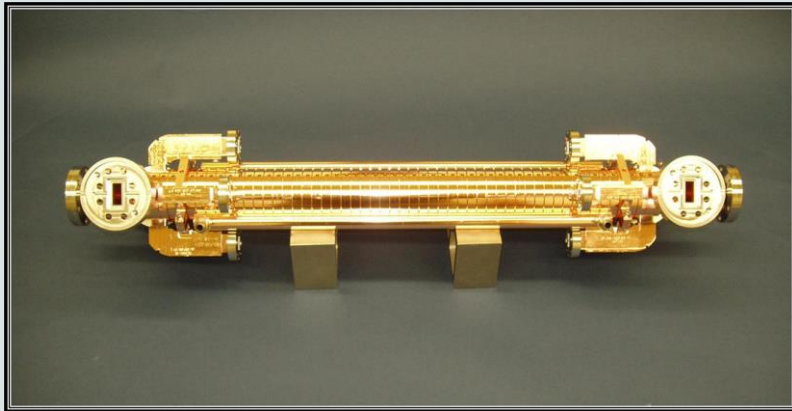
Once upon a time, very long ago,... 2004

We tested two NLC prototype structures equipped with WFM in the ASSET test area at SLAC



NLC damping concept DDS (damped detuned structure + interleaving)

H60vg4SL17-A and B



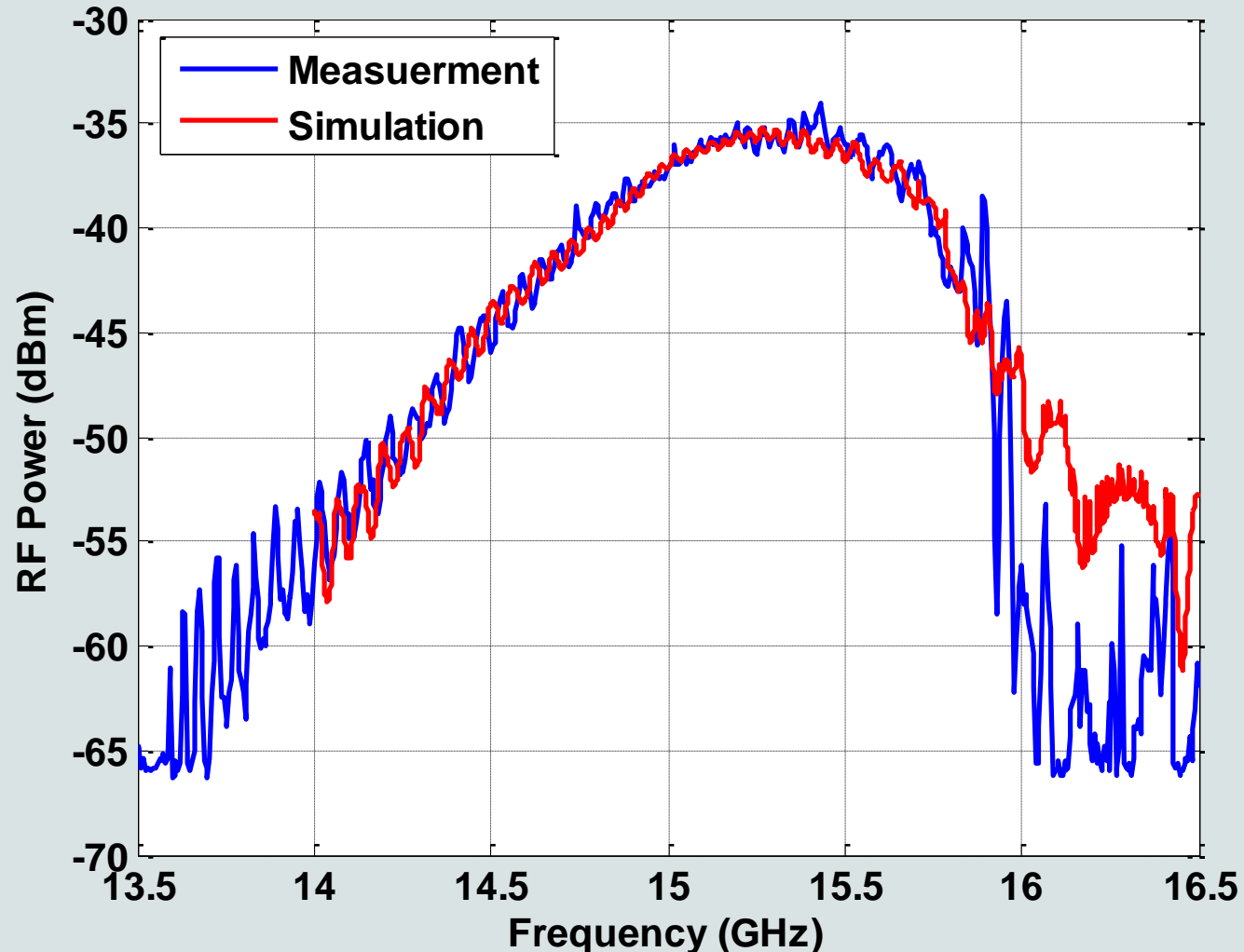
Results published at PAC 2005

**BEAM POSITION MONITORING USING THE HOM-SIGNALS FROM A
DAMPED AND DETUNED ACCELERATING STRUCTURE***

S. Döbert, C. Adolphsen, R. Jones, J. Lewandowski, Z. Li, M. Pivi, J. Wang,
SLAC, Menlo Park, CA 94025, U.S.A.
T. Higo, KEK, Tsukuba, Ibaraki 305-0801, Japan

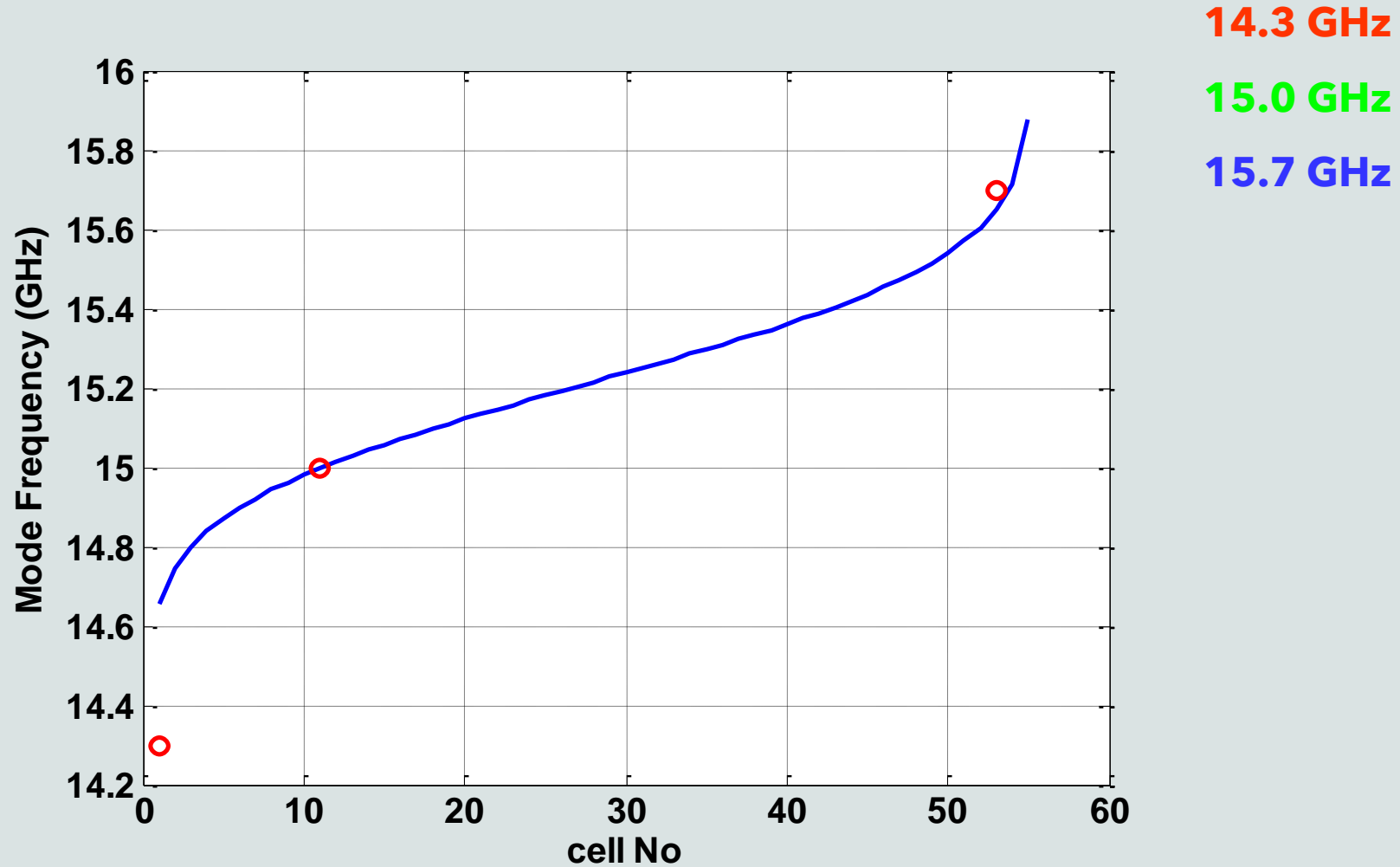
Wake field spectrum

ASSET 2004, H60vg4SL17-B, HOM spectrum (horizontal downstream)



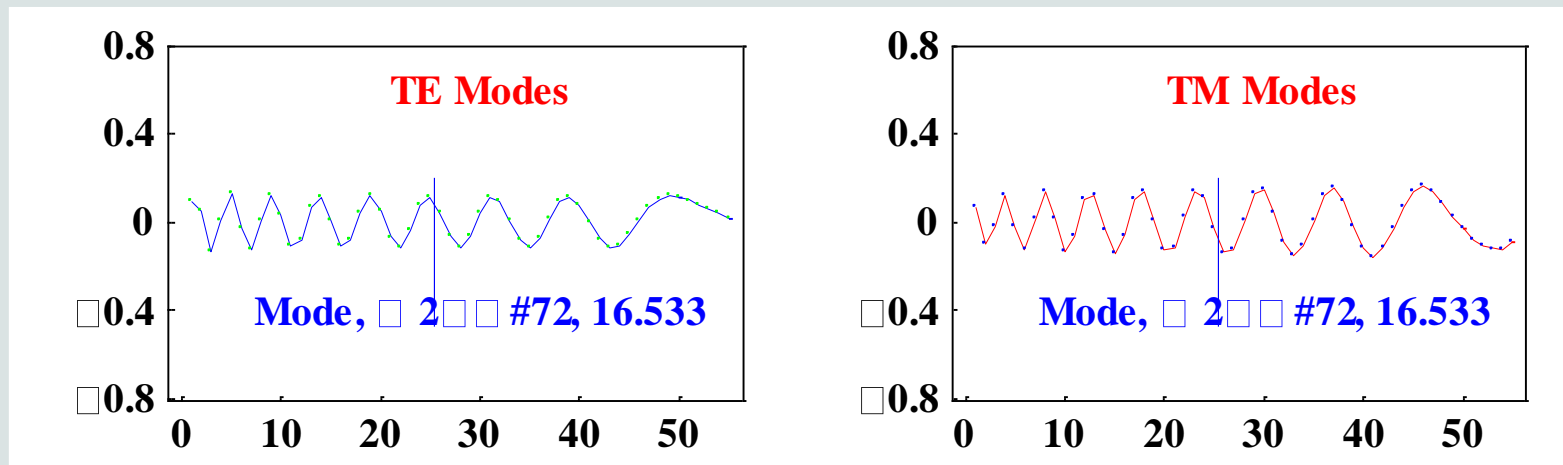
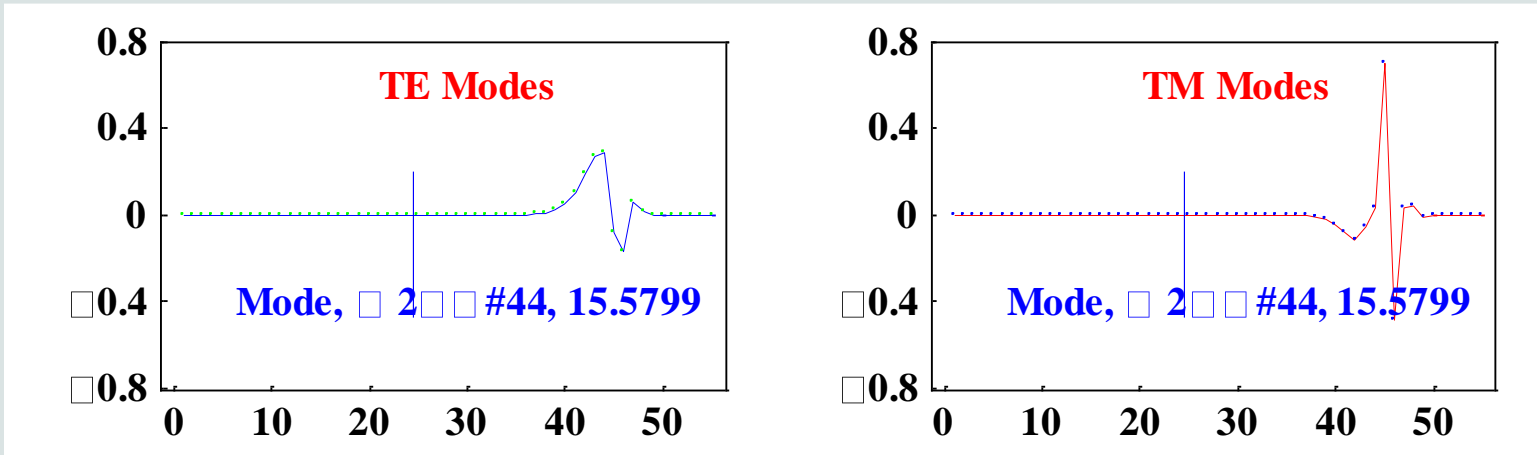
Mode location

Mode location within structure

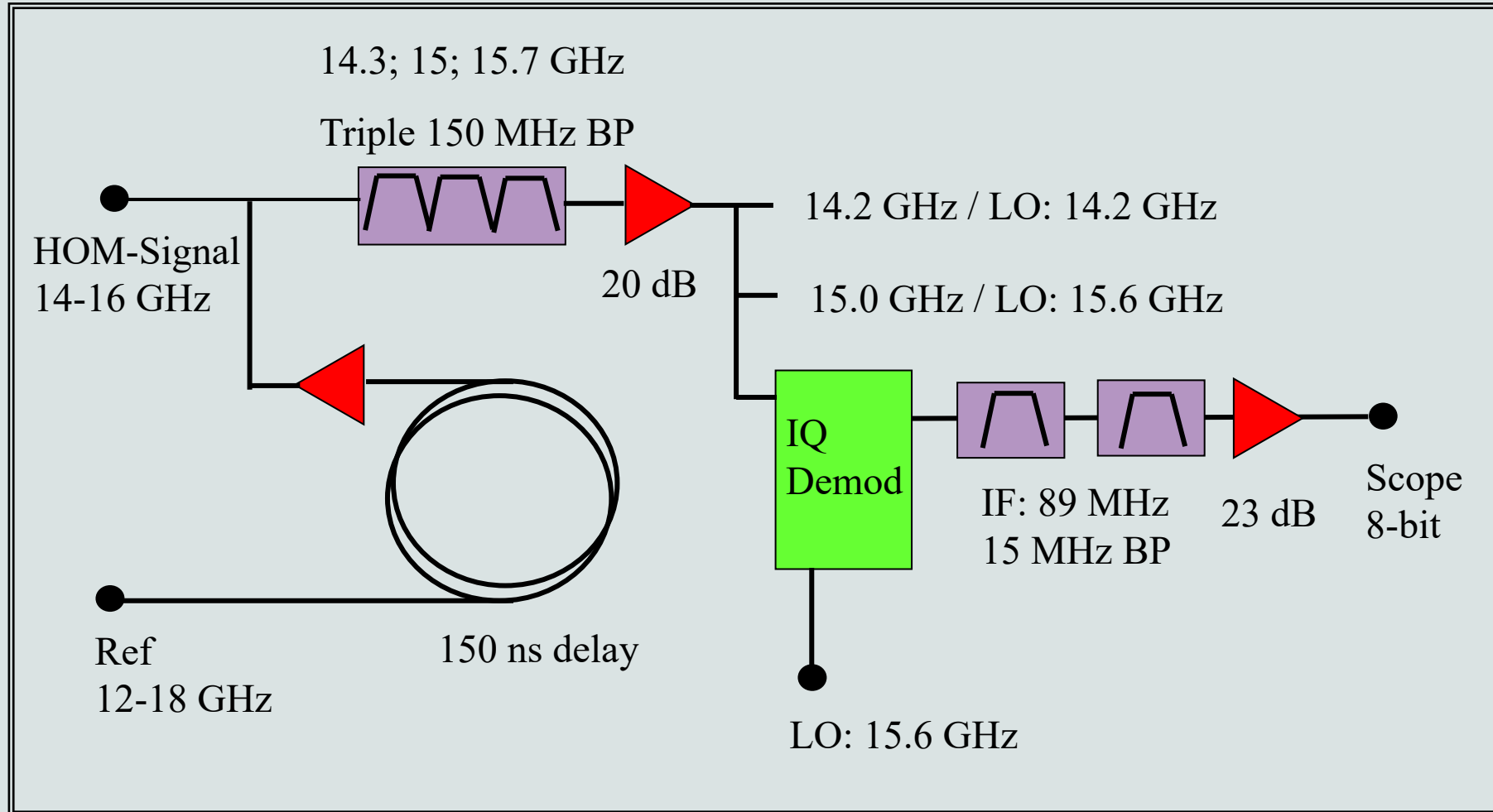


Mode location

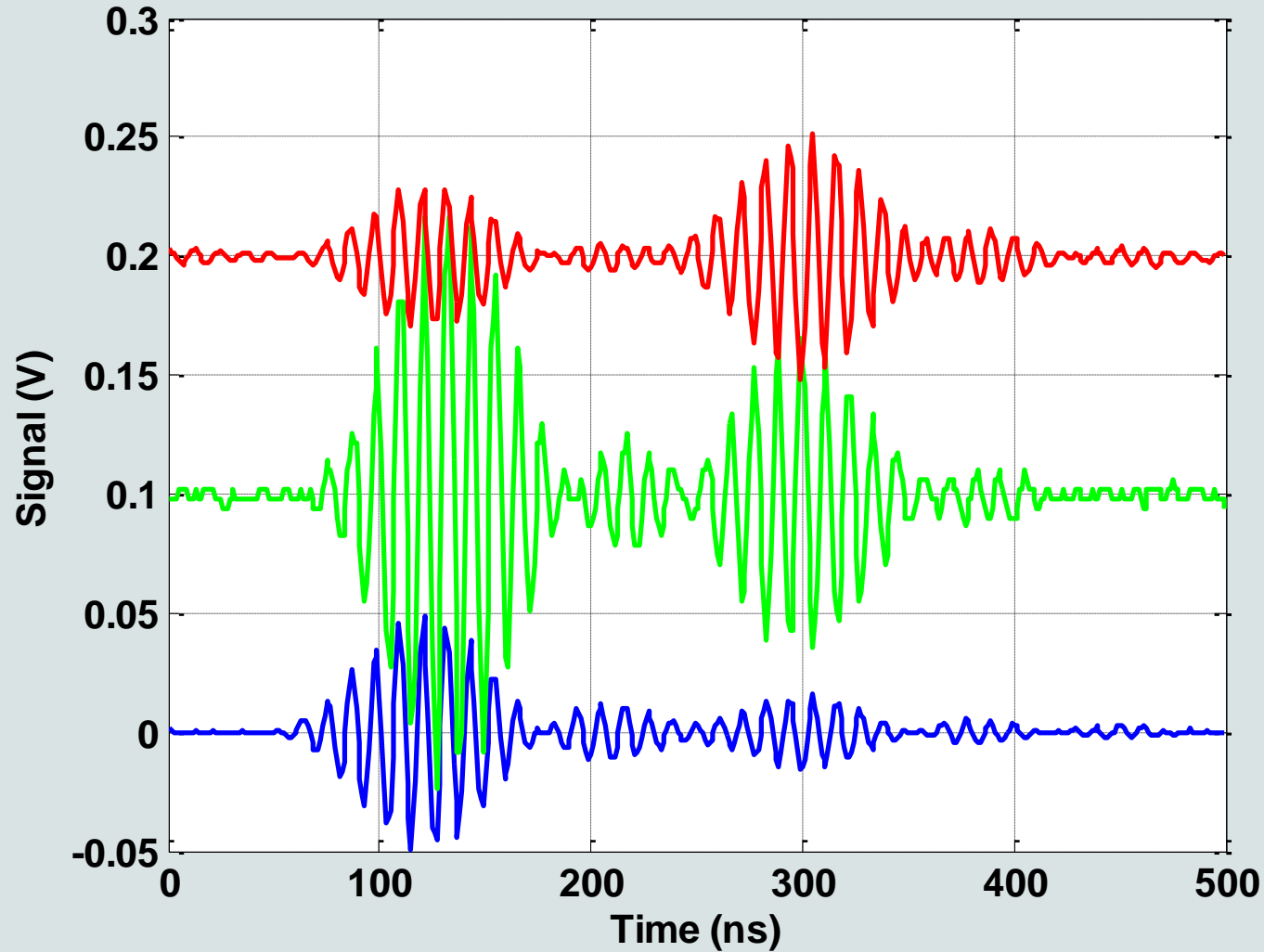
Mode location within structure



Measurement electronics



Raw signals with reference



1.2 GeV single bunch
 $2 \cdot 10^{10}$ electrons

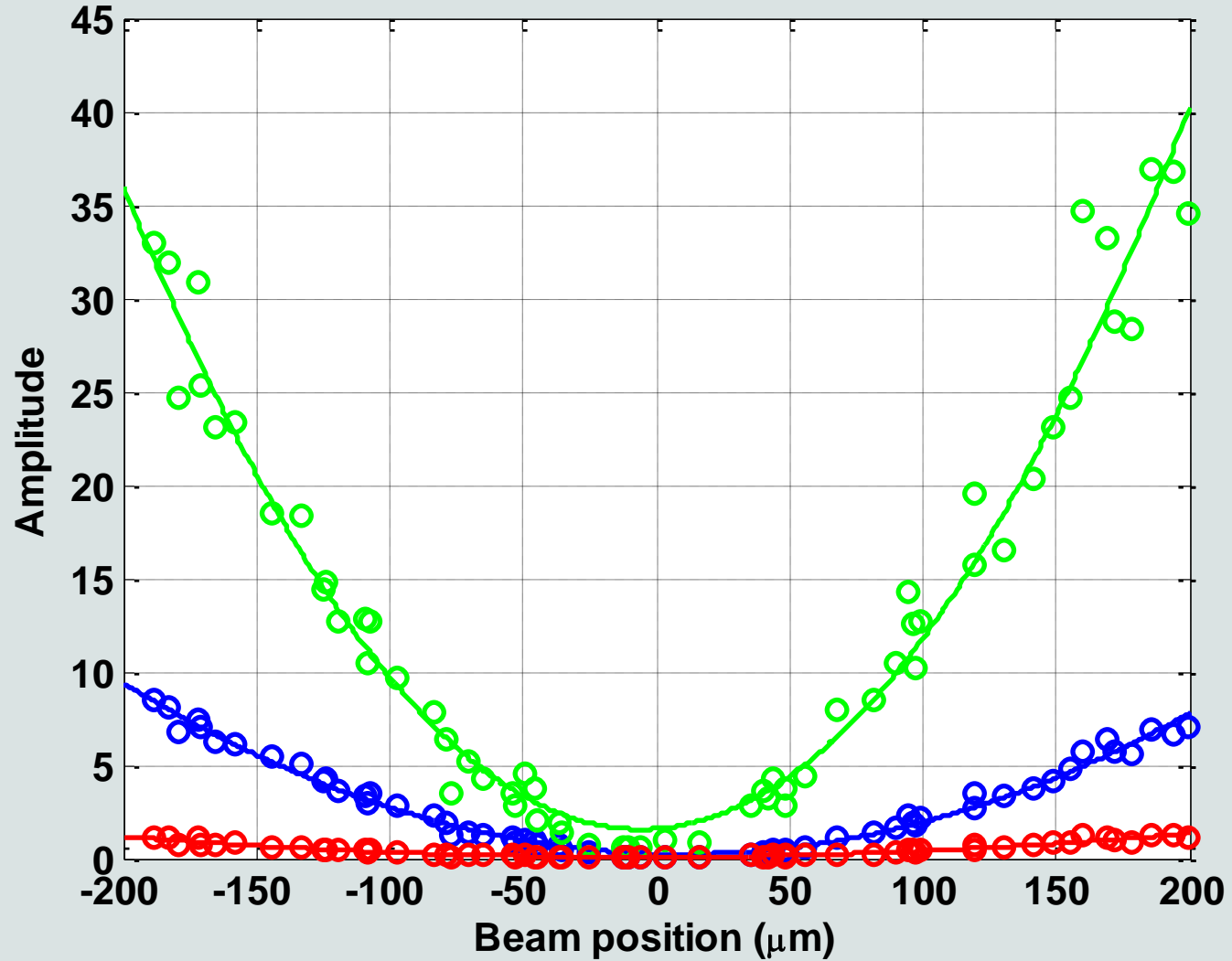
Calibration with strip
line BPMs (20 μm
res.) upstream and
down stream of the
structure

Broad band pick up
for reference

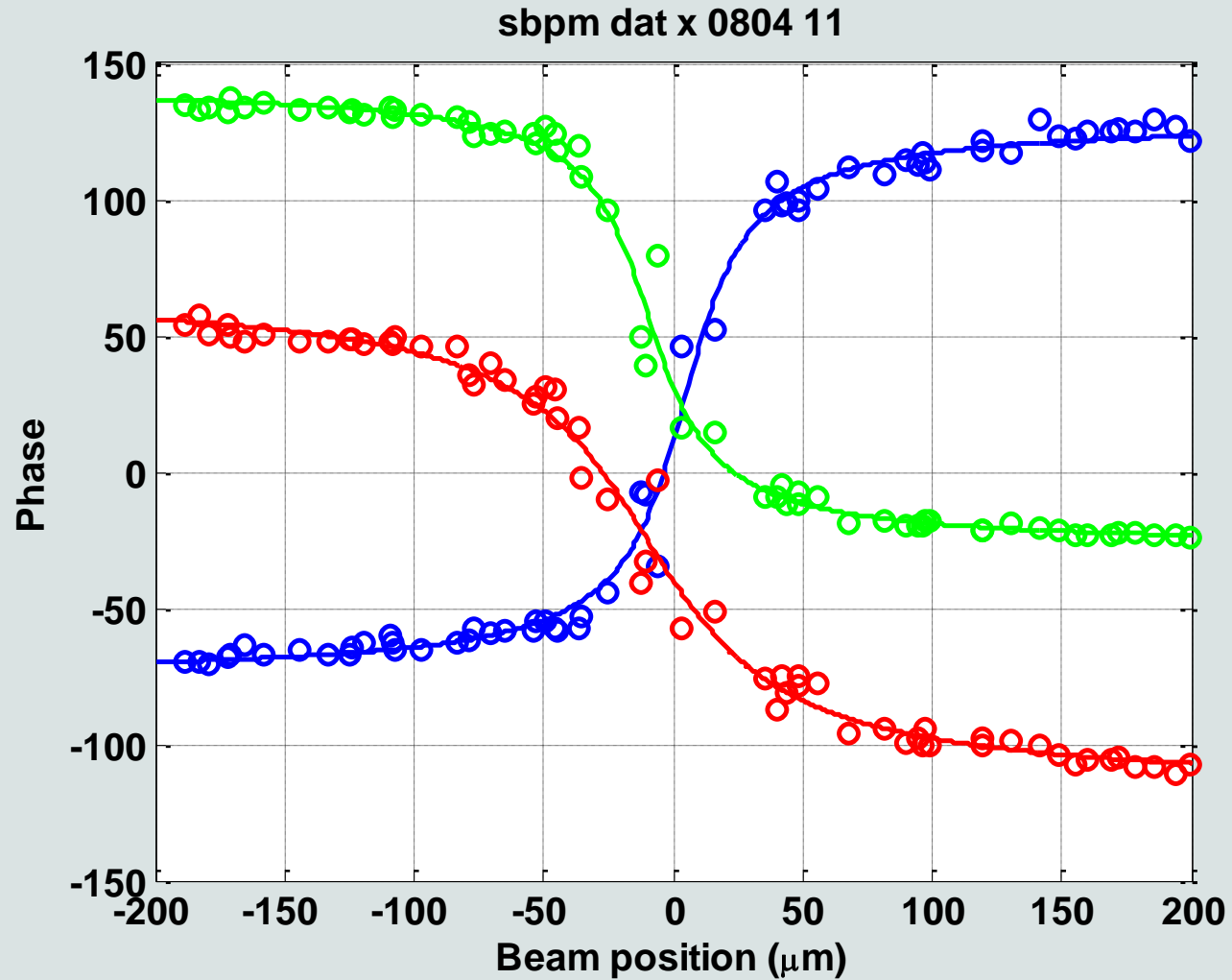
28dB attenuation of
the signal

Wake field amplitudes

sbpm dat x 0804 11



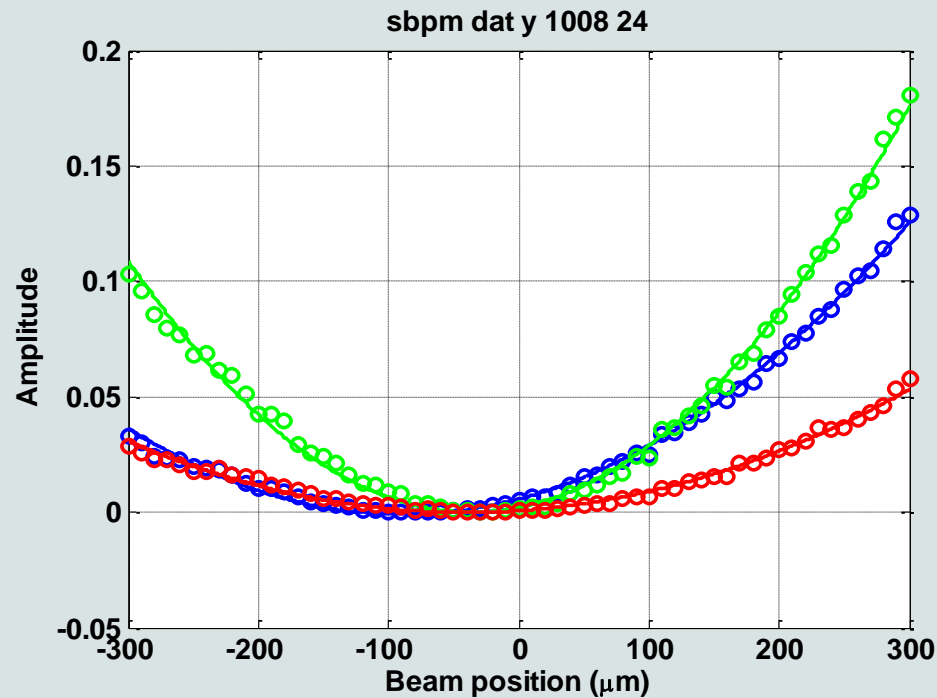
Wake field phases



Beam position $\sim A \cdot \sin(\theta - \theta_0)$

Wake field amplitude and phases

Vertical scan

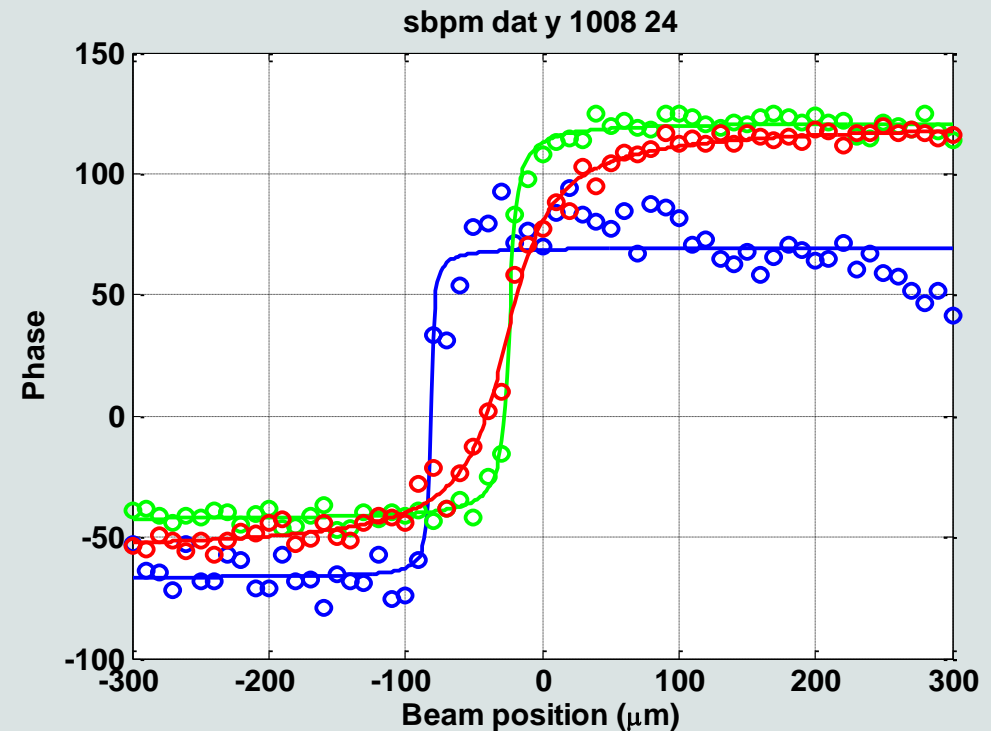


14.3 GHz

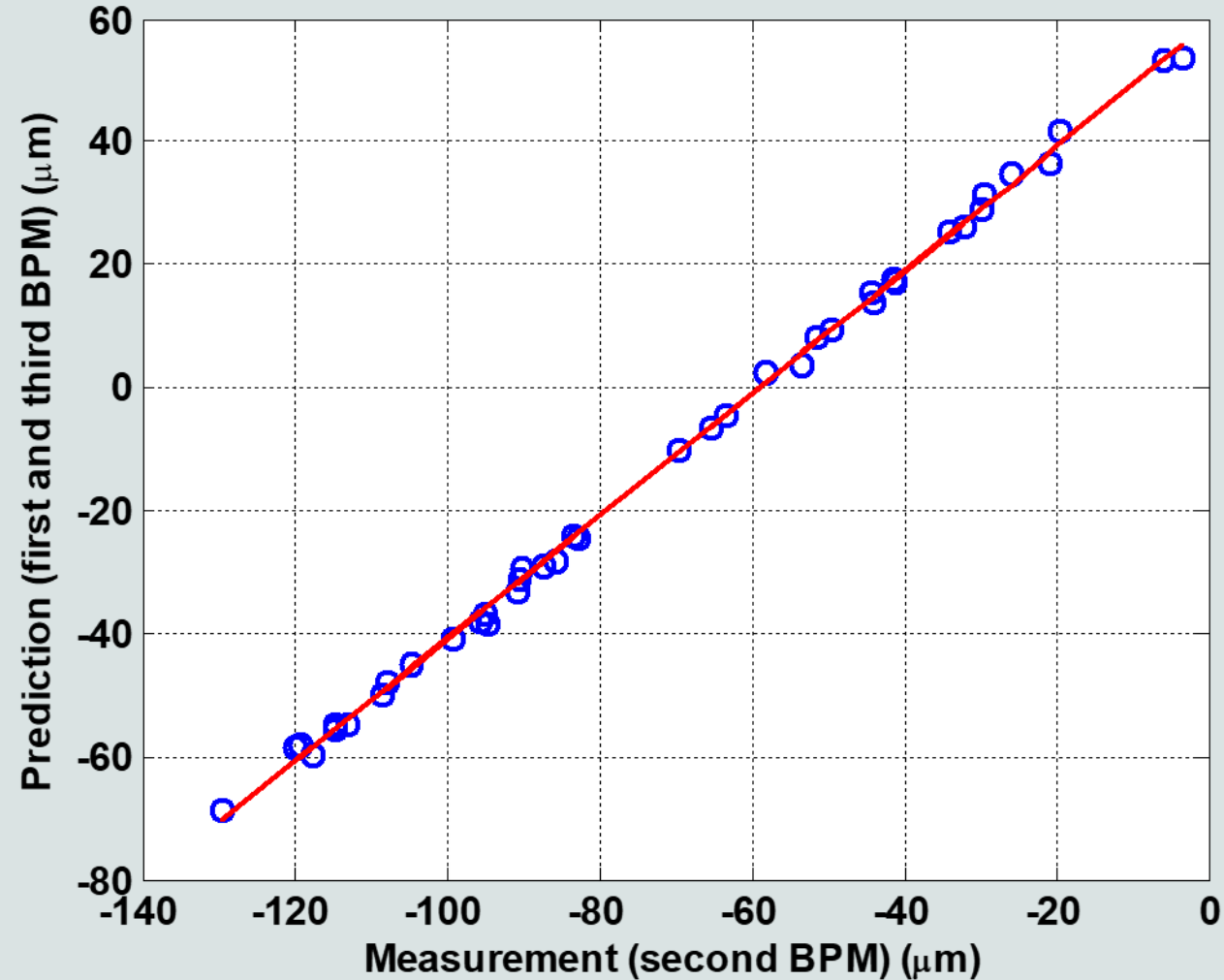
15.0 GHz

15.7 GHz

Shape of the transition can give hint of out of phase components in the HOM. Linear tilts of the bunch can produce such components. Info might be used for tuning the beam.

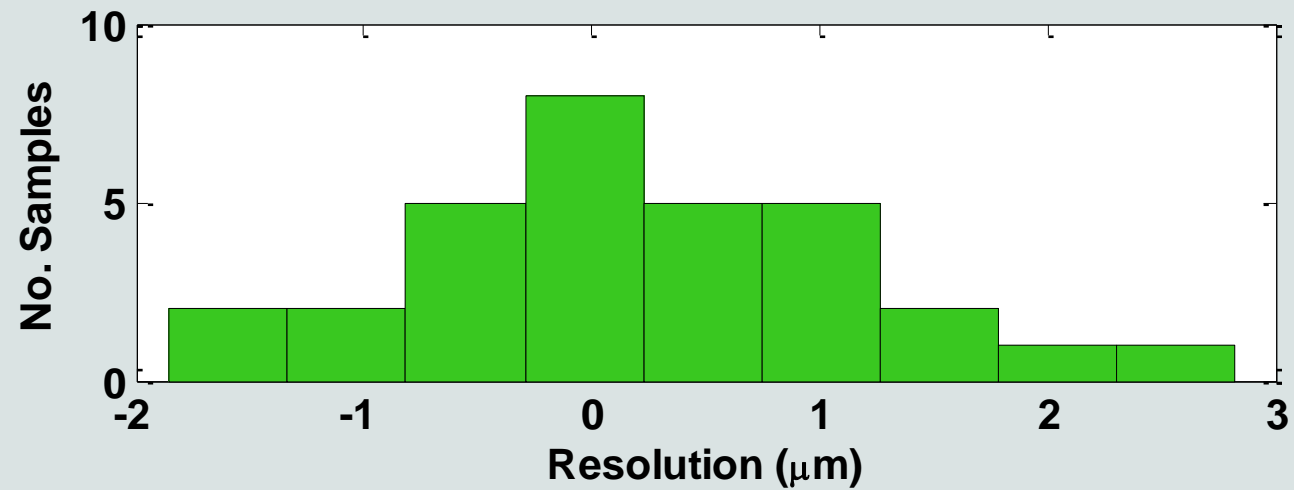
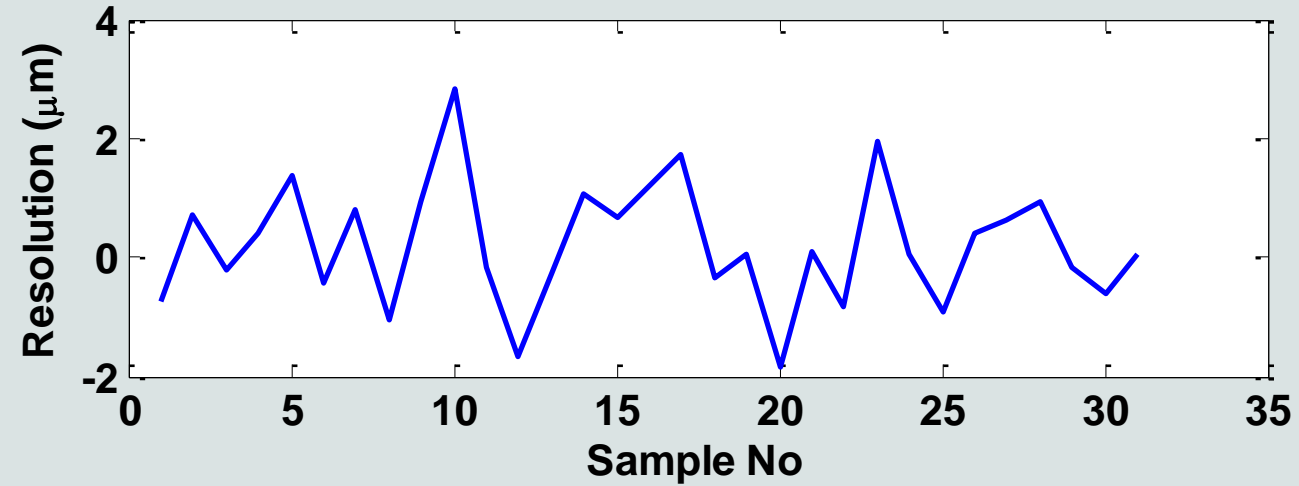


3 BPM set-up to suppress beam jitter



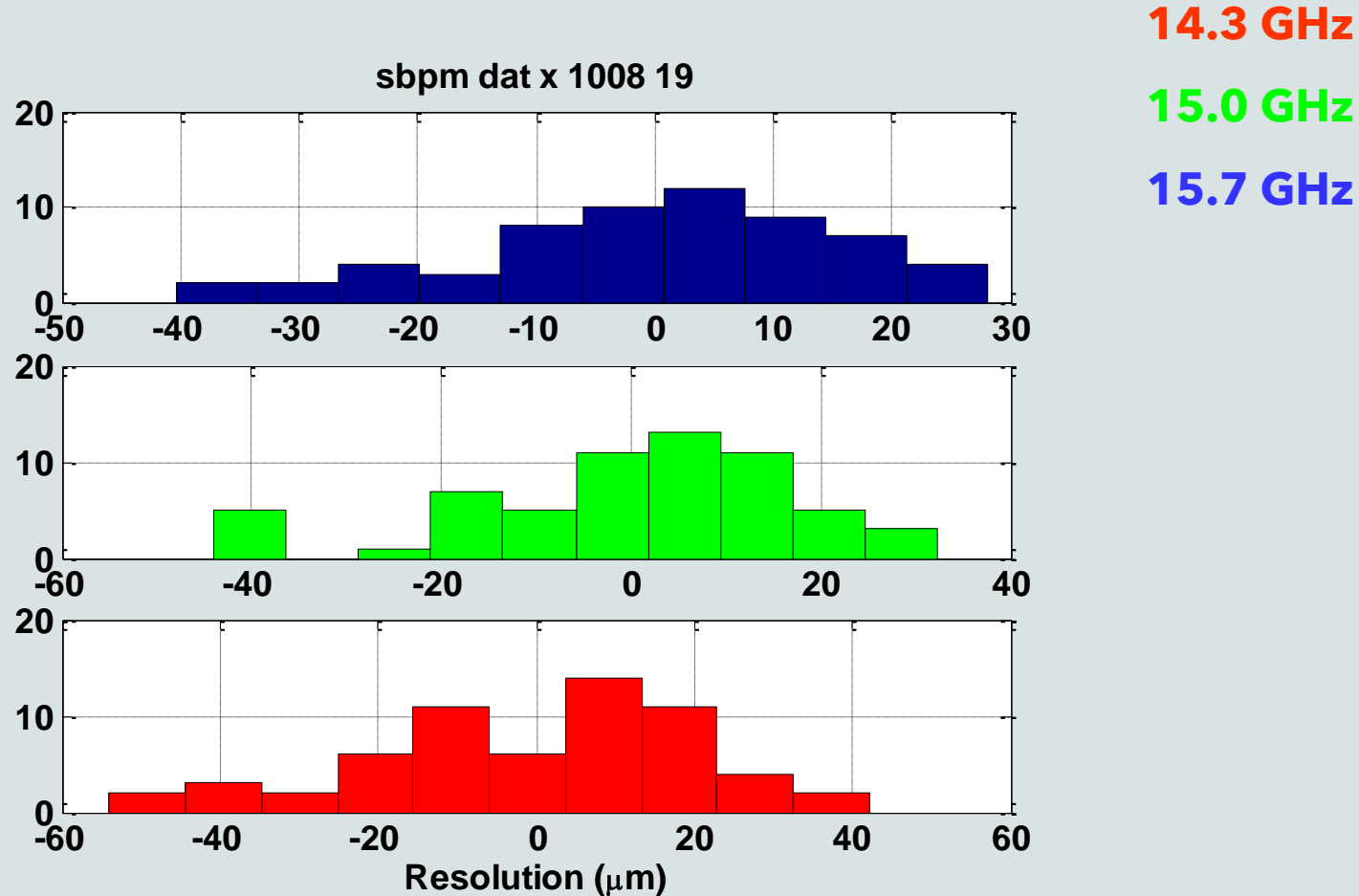
Measured resolution: around 1 micron (850 nm vertical, 1.7 μm horizontal)

Single shot resolution with 3 BPM set up

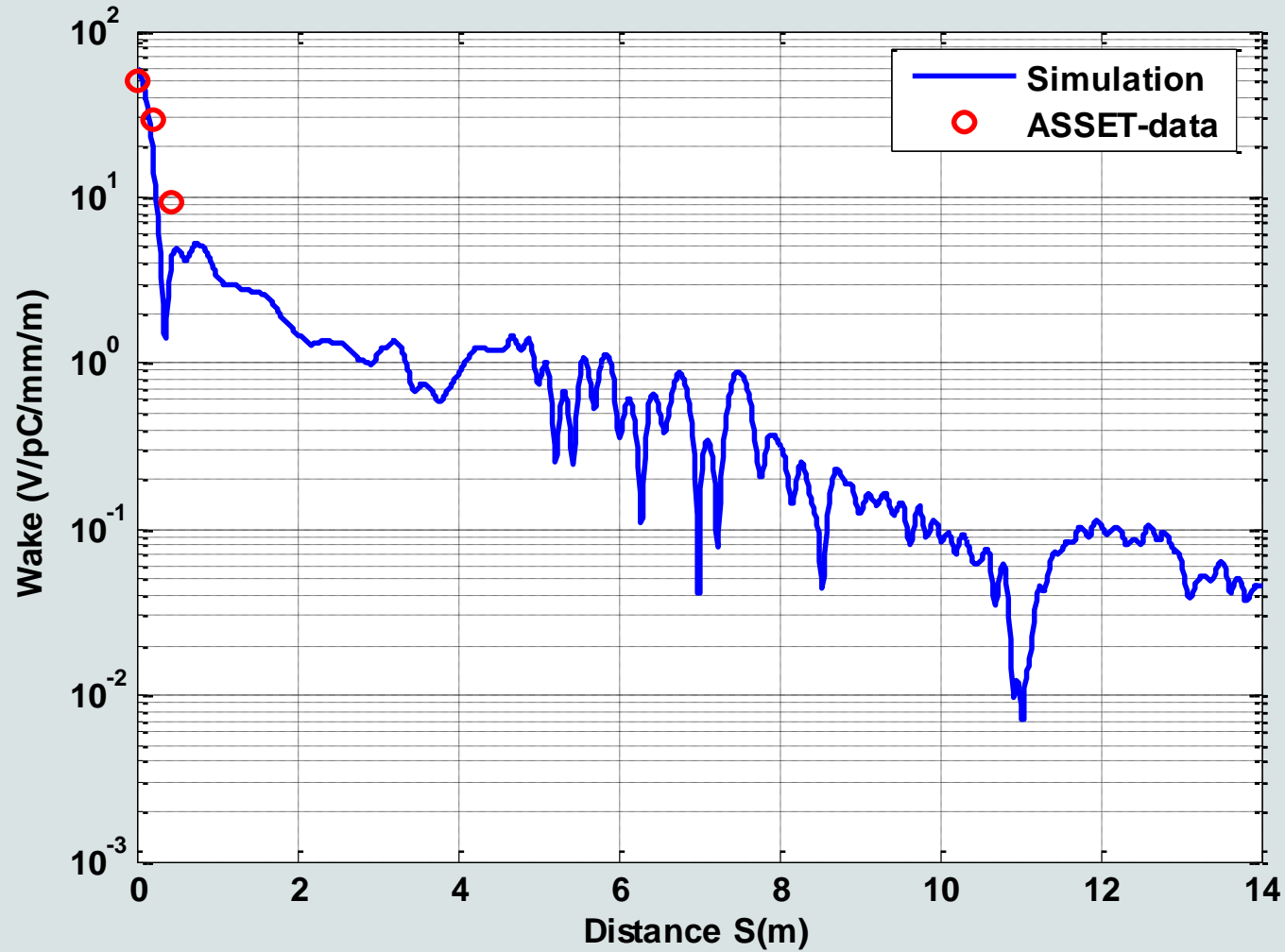


Single BPM resolution limited by strip lines

horizontal scan



Wake field measurements

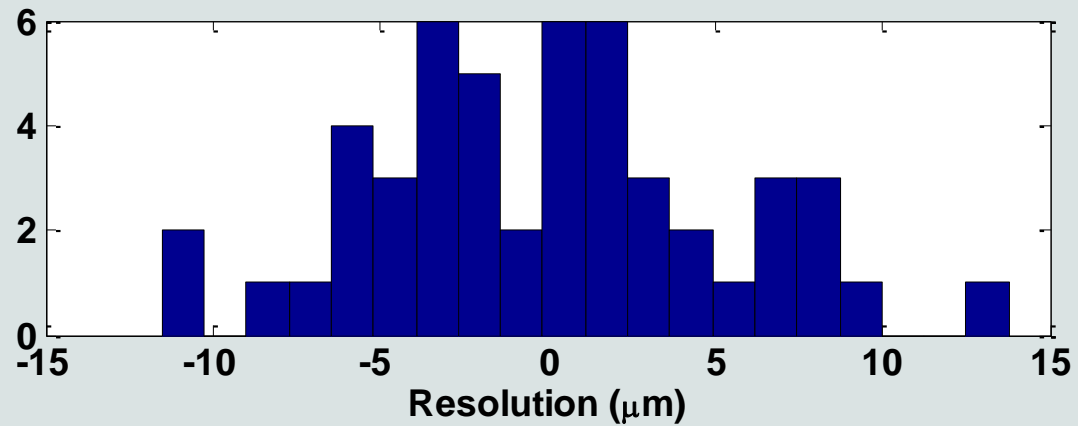
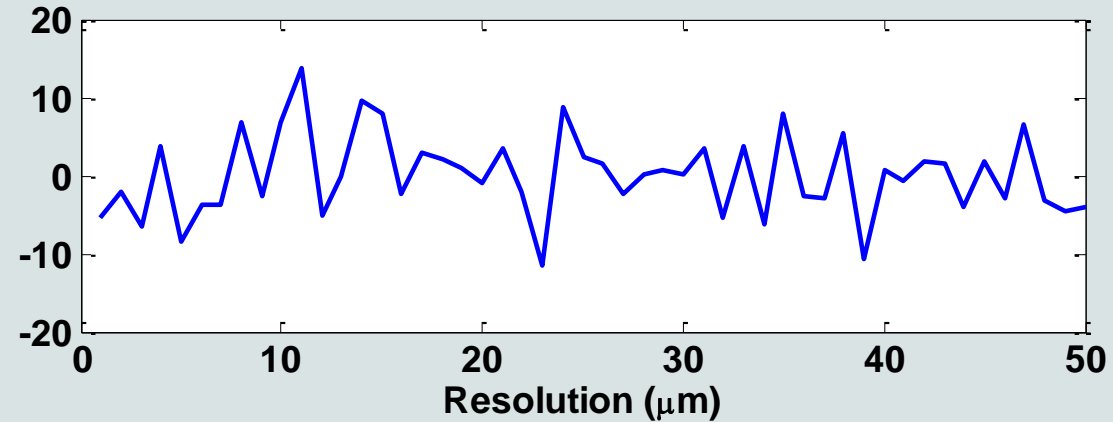


Conclusion

- ❑ Very successful experiment
- ❑ Demonstrated NLC needs for wake field monitoring.
Resolution better than 5 μm .
- ❑ In addition test of interleaving concept for detuned structures
- ❑ Benchmarked wake field simulations, as ASSET tests before
- ❑ Turned out to be a sensitive measurement as well for structure straightness, very good agreement with metrology measurements
- ❑ Relatively simple electronics used (accessible frequency range), but very good beam conditions (high energy, high bunch charge (single bunch), good stability).
Cross check possibilities with SLAC BPMs around.
- ❑ Resolution potential in the few nm range for higher gain and low noise electronics, see discussion in the paper

Wake field monitors in NLC structures

Vertical scan



4.2 μm RMS resolution (5 μm required for NLC)

Offset (straightness): horizontal 1 μm ; vertical 25 μm