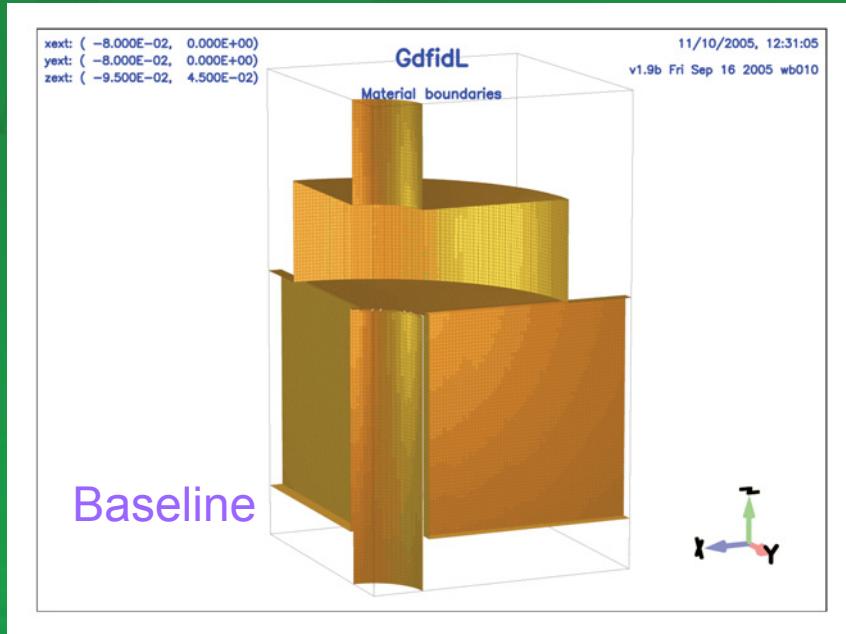


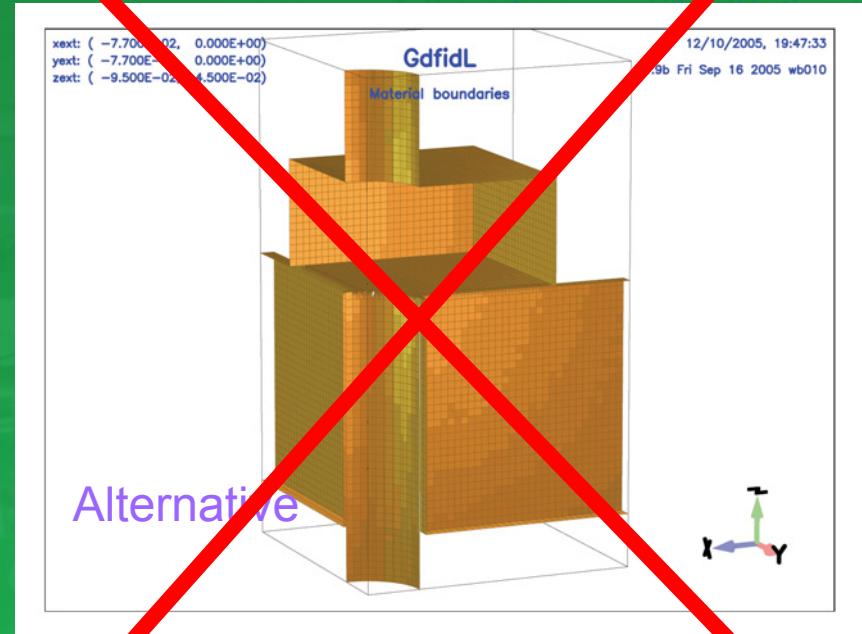
Cavity BPM for Spectrometry: progress and plans

A. Lyapin

BPM for spectrometry



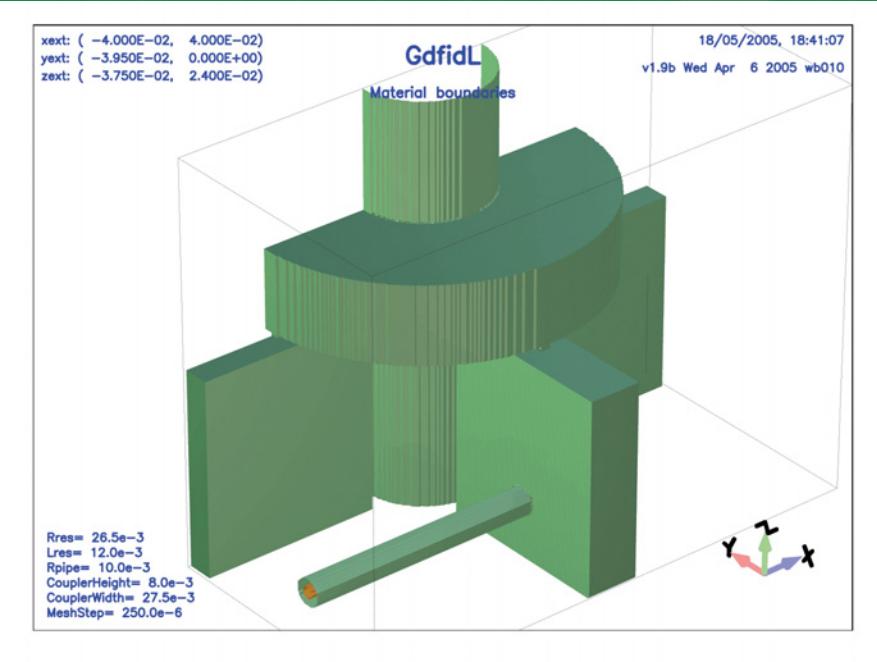
Baseline



Alternative

- Initially planned to test a rectangular cavity – turns out to be unnecessary after successful ATF2 BPM tests
- Basing on existing design concepts (BINP/ATF2)

ATF2 Q-BPM design



- Successor of previous designs
- “Longitudinal” design
- 4-coupler symmetrical structure
- Beam pipe diameter increased to 20 mm to meet the ATF2 beam optics requirements
- Dipole mode frequency 6426 MHz (harmonic of the bunch repetition frequency)

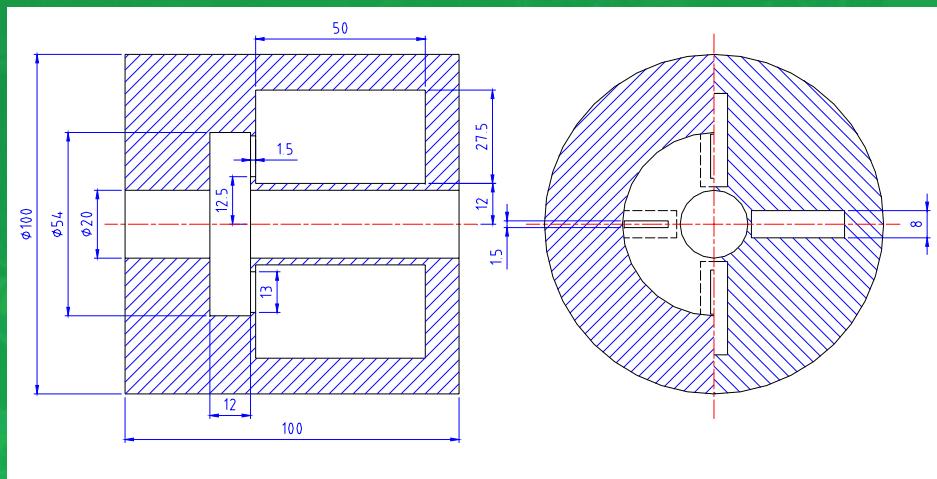
Symmetric mode leakage:

Leakage is less than computation error for the perfect structure

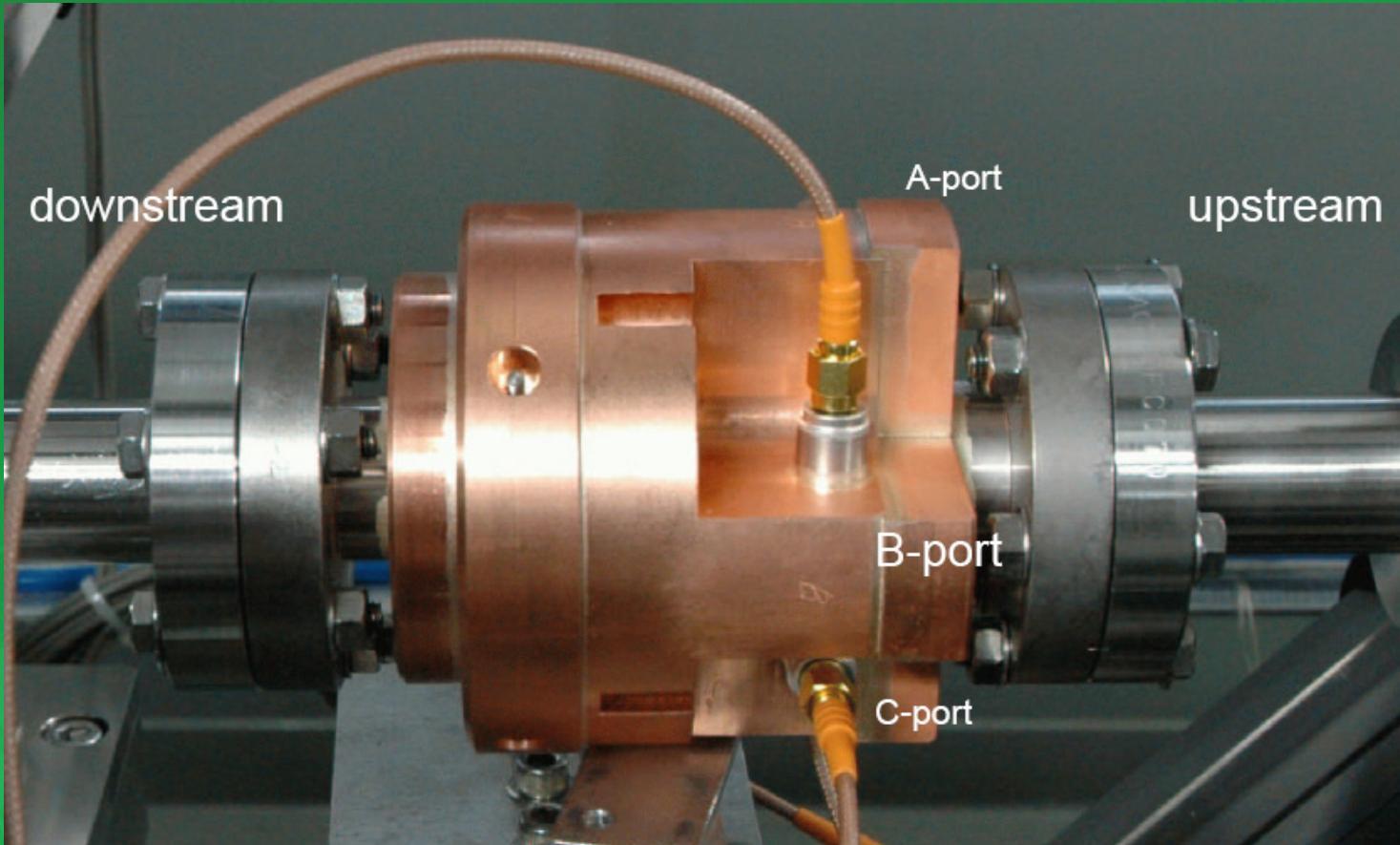
Introducing asymmetries (Slot + wg + feedthrough shifted by 0.5 mm, 0.25 mm meshstep) we get a signal equivalent to 10 μm

Beam tests:

- > 40 dB x-y isolation after tuning
- “Clean” signal if BPF is used
- Sensitivity on the level of the BINP BPMs



ATF2 Q-BPM

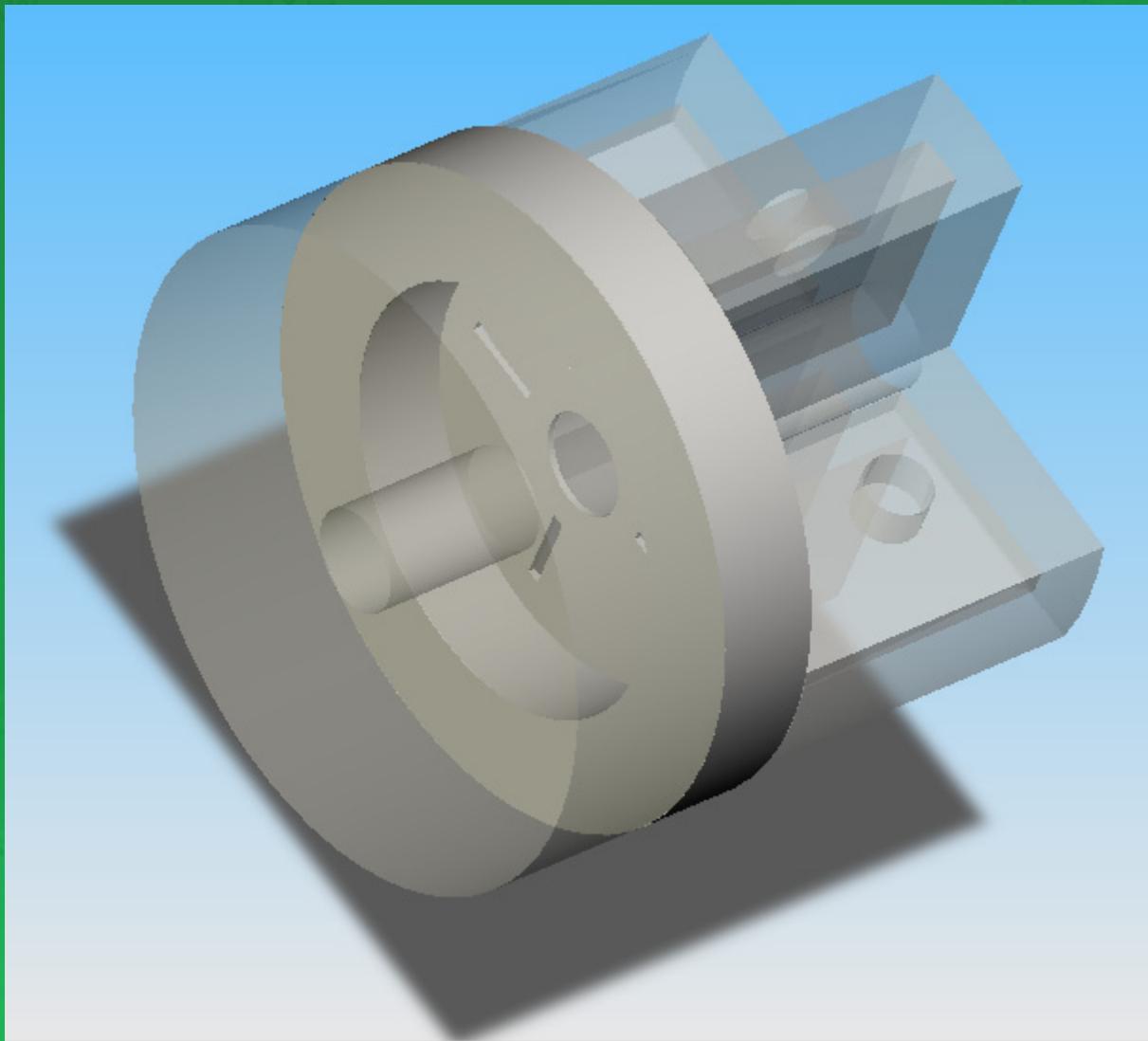


Energy spectrometer meeting, JINR, May 2006

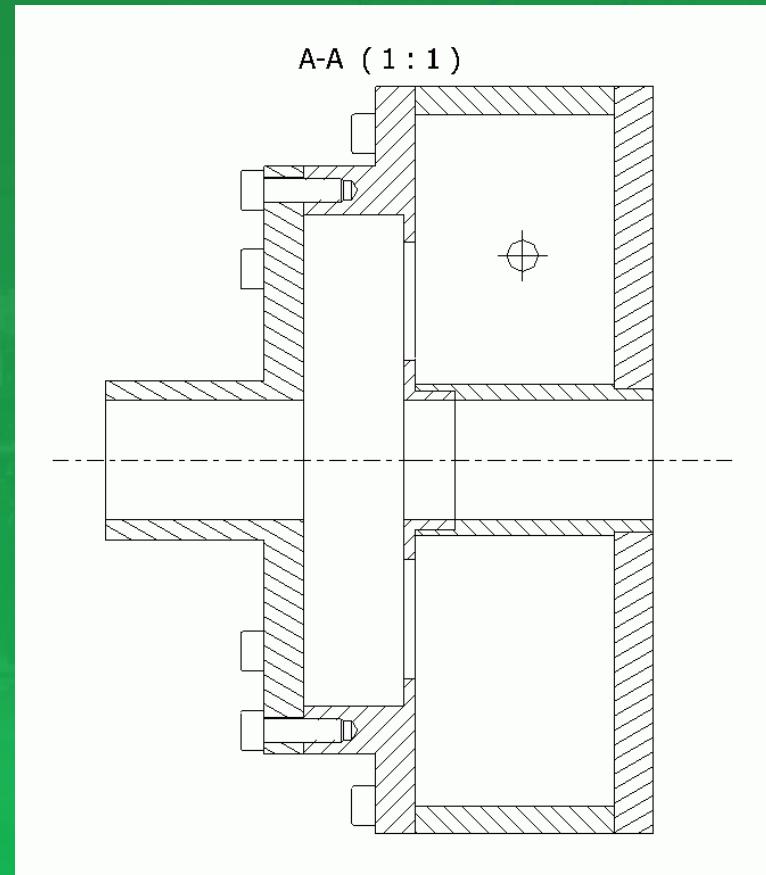
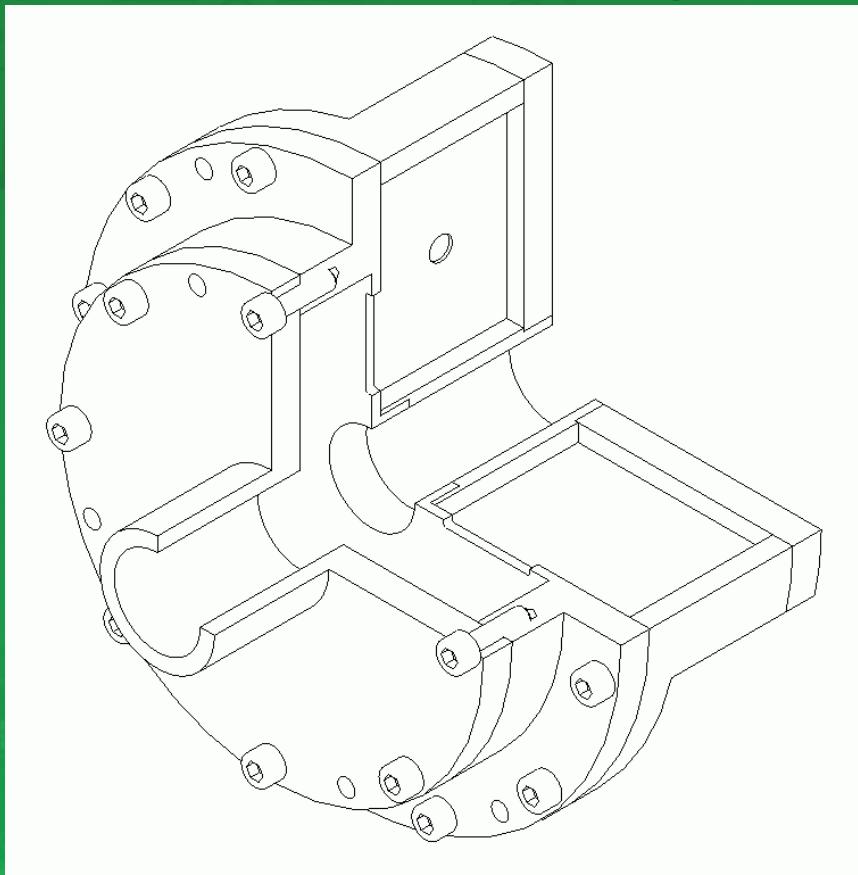
Baseline BPM parameters

- Rectangular waveguides and coupling slots to suppress the monopole mode
- 30 mm beam pipe diameter to allow for higher optics flexibility and safety
- 2.8 GHz cavity to allow beam pipe change and to fit into a well explored frequency range, await a better stability; looser tolerances comparing to 6.5 GHz cavities
- Decay time allowing for a bunch-to-bunch operation
- Downconversion to 10-30 MHz and digitization at 100-150 MSamples/s
- Both DDC and Fitting algorithms applicable
- One reference cavity per triplet, symmetric output

Cylindrical prototype 3D view



Prototype AI model



- Planning to do cold tests before producing a vacuum prototype, a model is being produced in UCL workshop
- Going to introduce an asymmetry (one slot will be off axis), also reduced the waveguide length in order to see the monopole mode coupling; this should allow us to set reasonable tolerances, benchmark the simulation code, and choose a reasonable waveguide length

Vacuum prototype

- Mechanical design is going on
- Mechanical engineering and most of production to be done at MSSL (part of UCL), negotiating with external companies
- Want to test the model first to fix the tolerances

Cavity BPM test bench



- An older prototype of the 5.5 GHz cavity was shipped from TU-Berlin for a “live” tuning and software improvement (next couple of weeks?)

- Borrowed from DESY-Zeuthen
- Shipped to UCL in Nov 2005
- Reassembled in Dec 2005
- Had problems with the movers – seem to be fixed now
- Ordered a 2.8 GHz oscillator
- Should be ready for AI model



Plans

- AI model – ready end June/beg July
- Tests @RHUL (VNA) - ? Tests @UCL (test bench)
- Have to move the UCL lab
- Purchasing VNA for RHUL now, 6 weeks shipping time
- More simulations needed
- Start production of the vacuum prototype in (end?) July (need 2-3 months, mainly shipping?)
- Provide ESA T-474 with a new BPM instrumented with x & y movers and interferometers by the run next year