Bonn / Mainz effort

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Kristof Schmieden, Matthias Schott

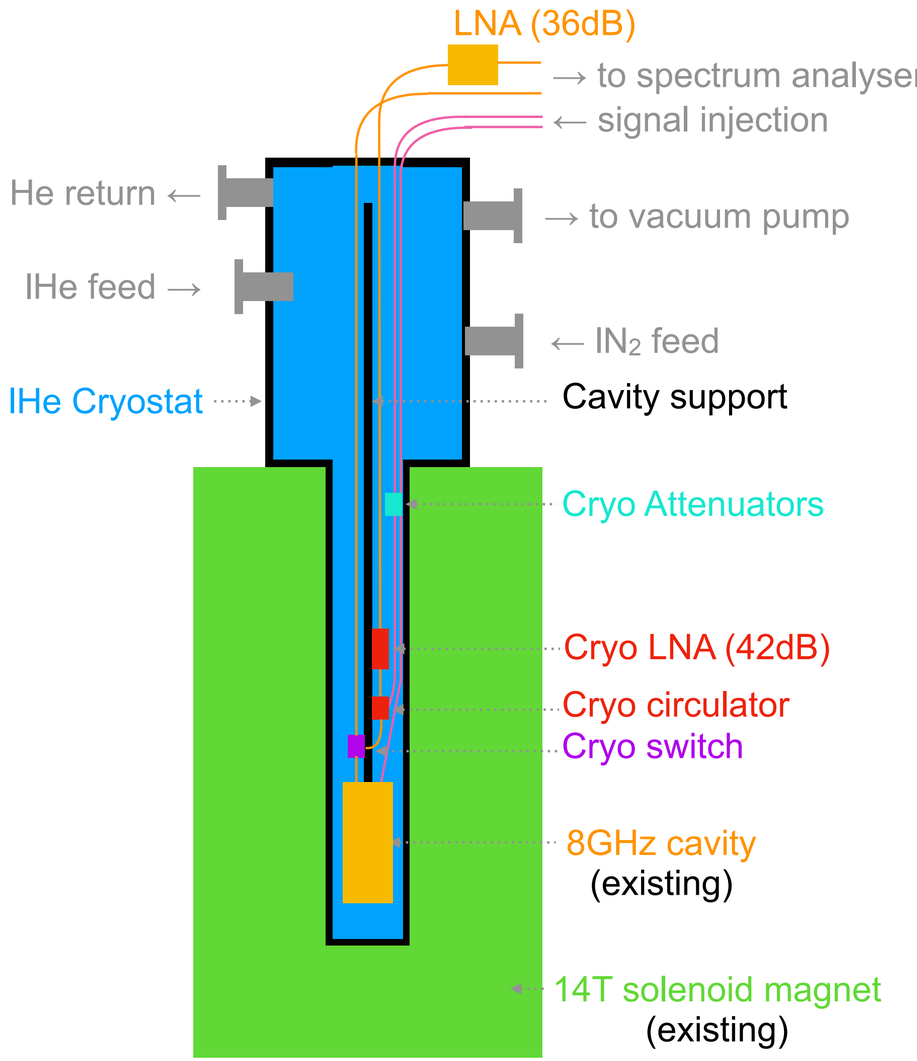
universitätbonn

Cluster of Excellence
PRISMA+
Precision Physics, Fundamental Interactions and Structure of Matter

JG|U

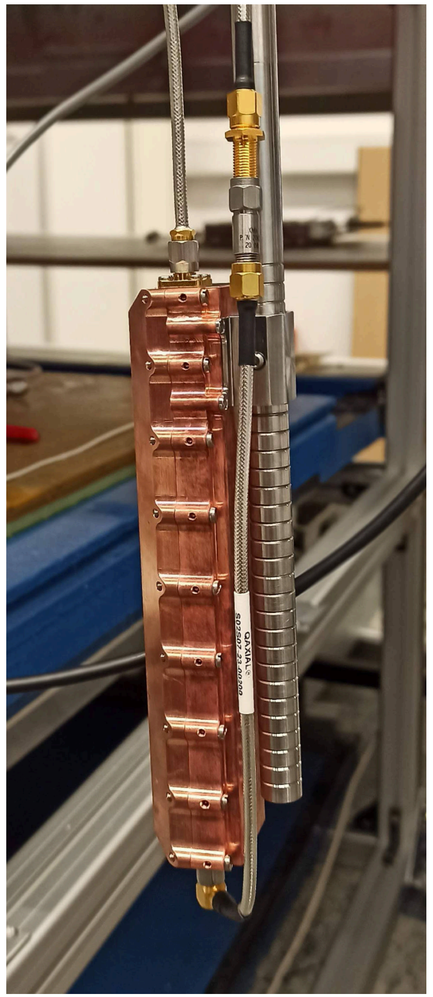
Mainz Current Efforts - GravNet

- **New Haloscope setup**
  - 14T magnet, 2K cryostat, 5cm x 20cm Volume
  - Timeseries readout, 40MHz bandwidth
- **No tuning**
  - No B-field: dark photon search
  - With B-field: axion search, UHFGW search!
    - Measurement run in preparation



Mainz Current Efforts - GravNet

- Data taking in 14T magnet



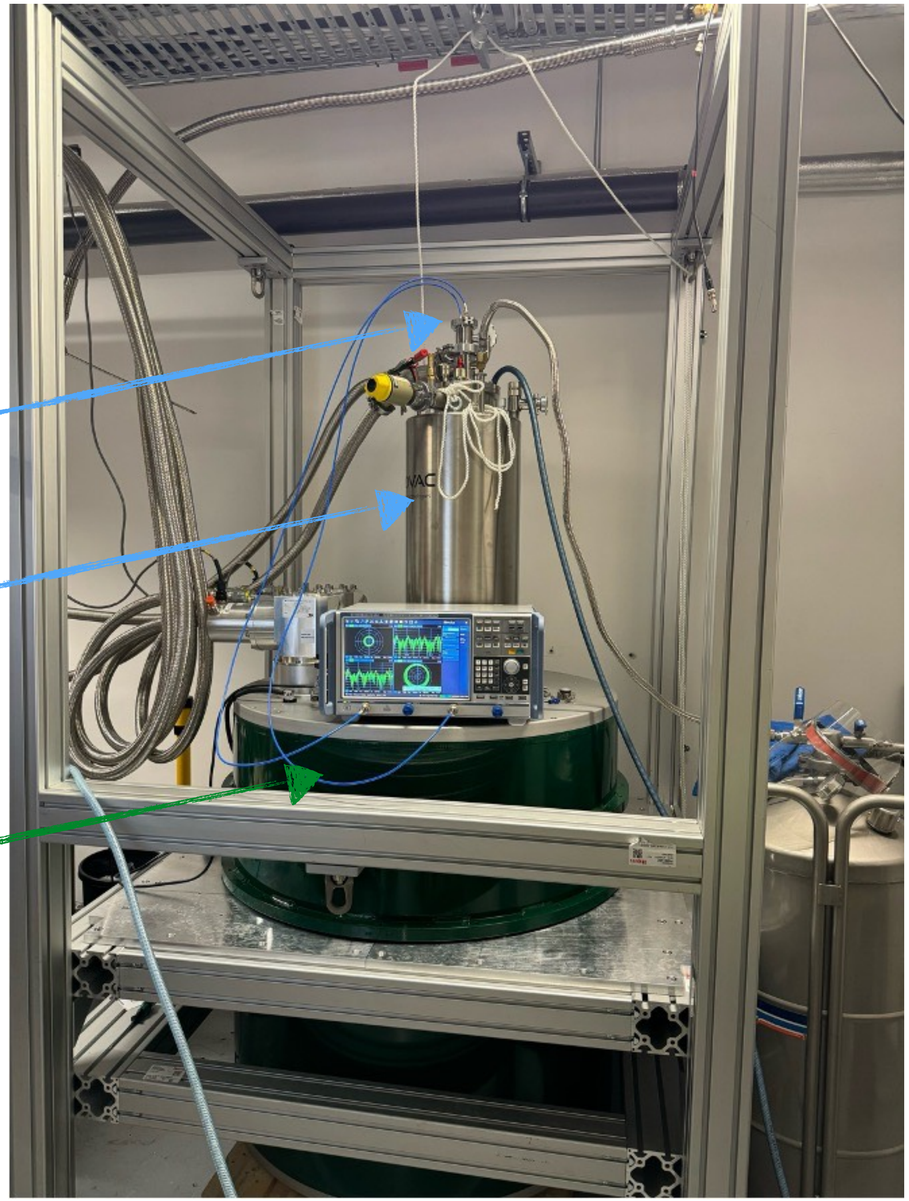
Circulator + Preamp

SC cavity

Inset Top

Cryostat

Magnet (warm bore)



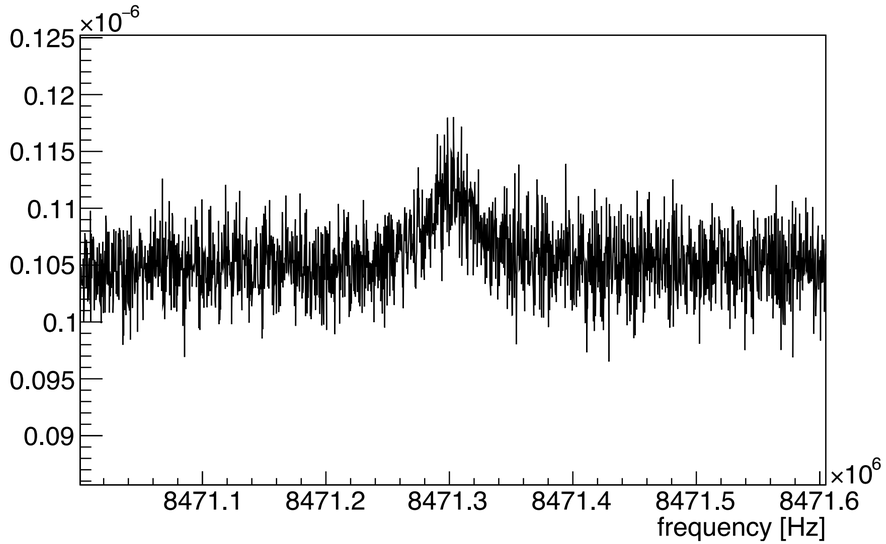
Mainz Current Efforts - DAQ

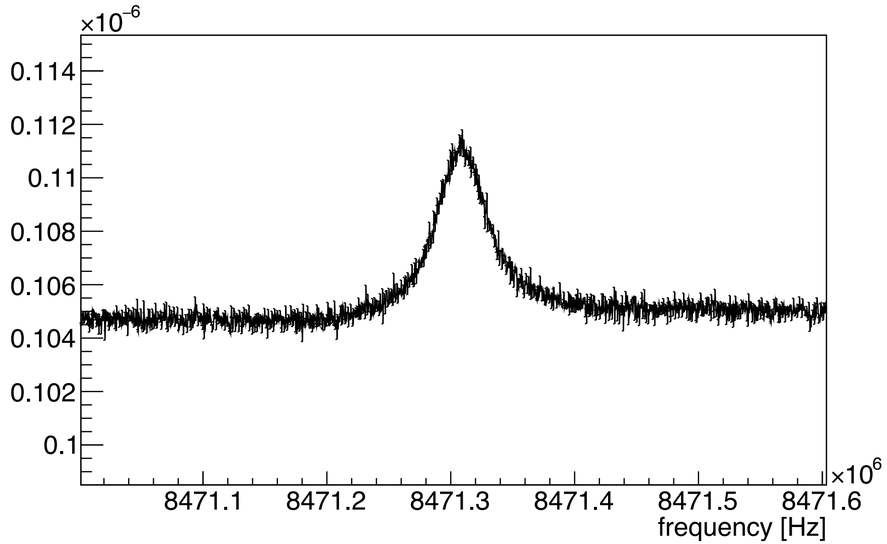
- Single channel readout $f_0 \approx 8.4$ GHz
- Readout via realtime spectrum analyser (Tektronix RSA518)
- DAQ software (C++)
  - Realtime FFT
  - IQ data streaming to disk
- Maximum readout bandwidth: 40MHz. Currently used: 10MHz

- Realtime temperature & pressure monitoring
  - Influx + Grafana

Mainz Current Efforts - Analysis

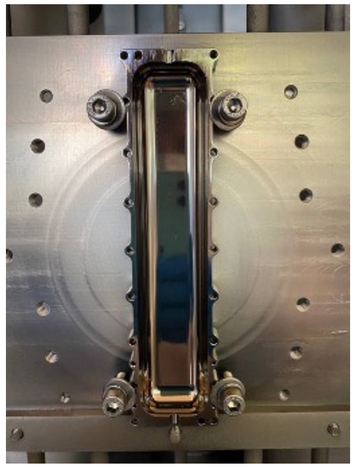
- **Frequency Domain** analysis currently setup
- 1s converted into freq. domain and integrated online
  - Storage currently in ROOT files
  - hdf5 as alternative format implemented as well
- Analysis flow following Haystack analysis outlined in [https://arxiv.org/abs/1706.08388]
  - Python based analysis / C root scripts

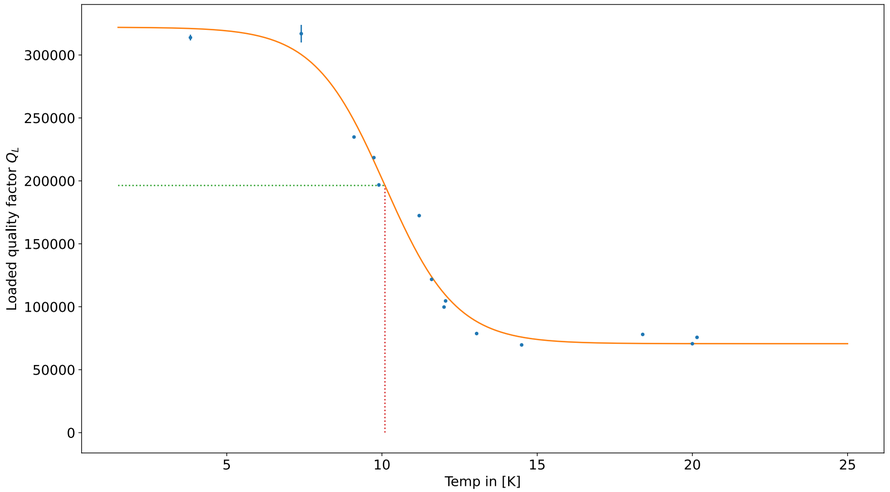


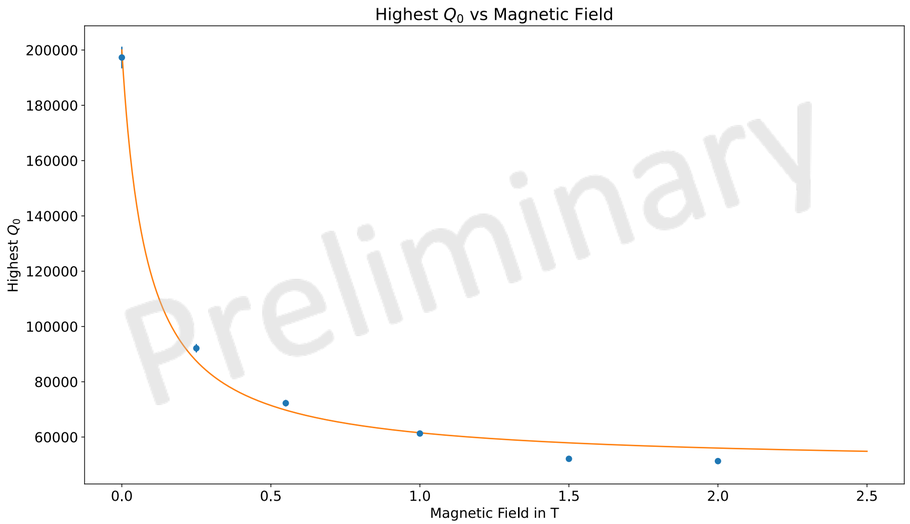


Mainz Current Efforts - Cavity

- NbN cavity produced and characterised







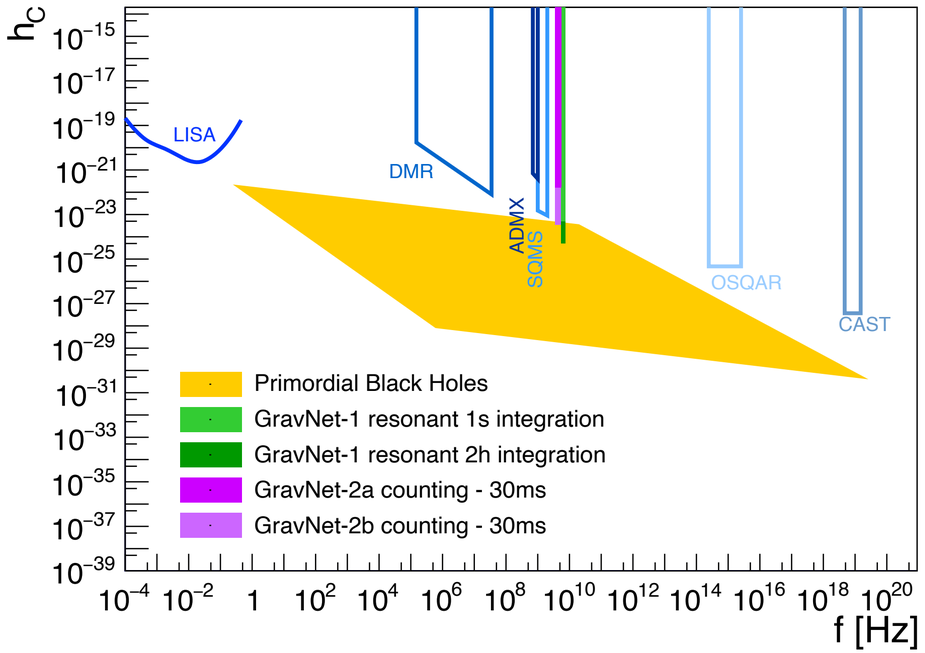
- Optimised cavity for UHFGW search produced
  - To be characterised …

GravNet - Near Future Plans

- **Mainz**:
- Operation of 2 Cavities @ 2K
- Analysis of multiple data streams for time series analysis
  - Classic readout via HEMT amplifier + RSA
- Optimisation of cavities for UHFGW
  - Prototype cavity already produced

- **Bonn**:
- Operation of 3 Cavities @ 10mK
- Analysis of multiple data streams for time series analysis
  - Squid based readout

GravNet idea:
[arXiv:2308.11497]



[PoS(EPS-HEP2023)102]

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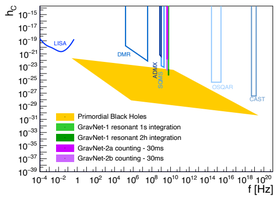

- **Person Power**:
  - Mainz: 1.5 FTE (1 phd Student + 0.5 PostDoc) + engineers
  - Bonn: 2 FTE + engineers

Possible contributions

- Bonn / Mainz are very much interested in contributing
- Possible areas of contribution
  - DAQ
  - Analysis
  - Mechanical constructions (also large scale)