YARR and X-ray irradiations @ Oxford

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LBNL lab meeting

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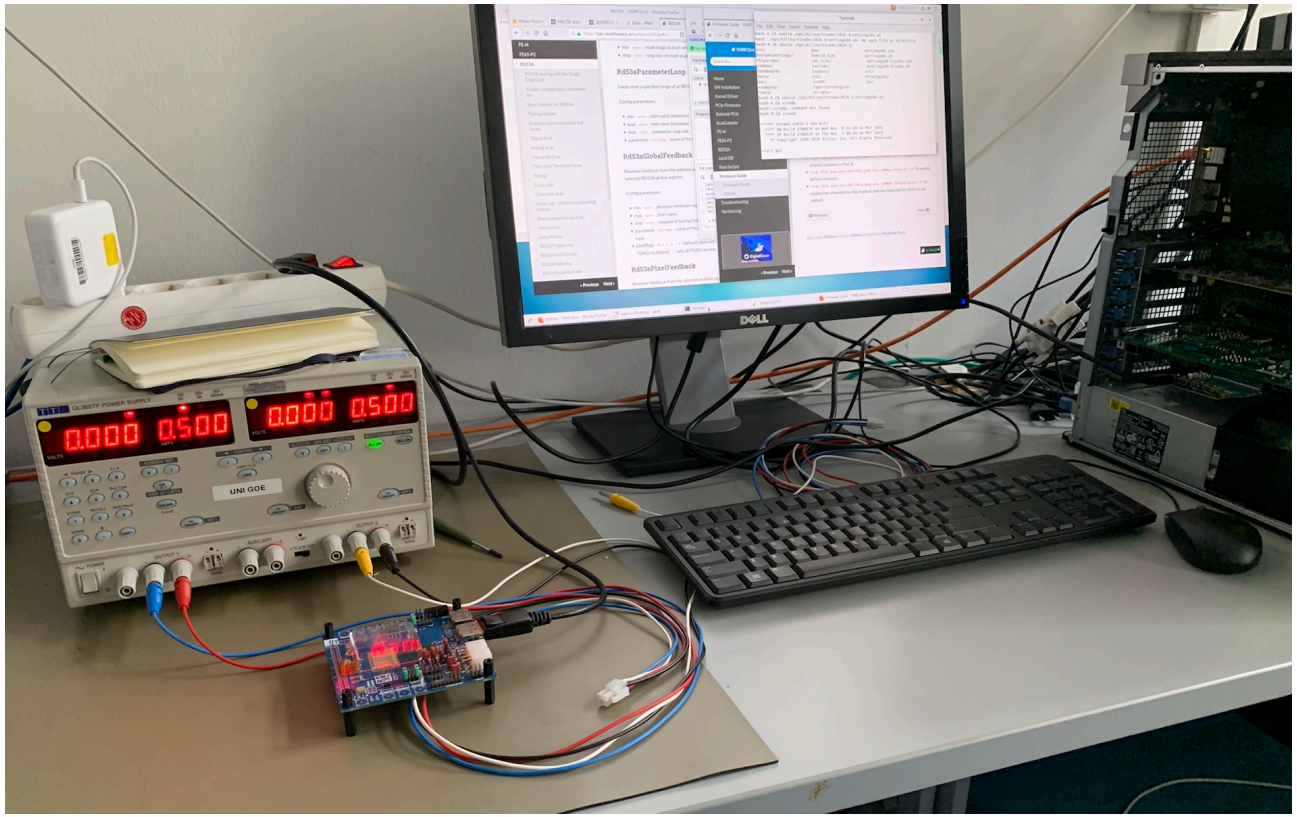
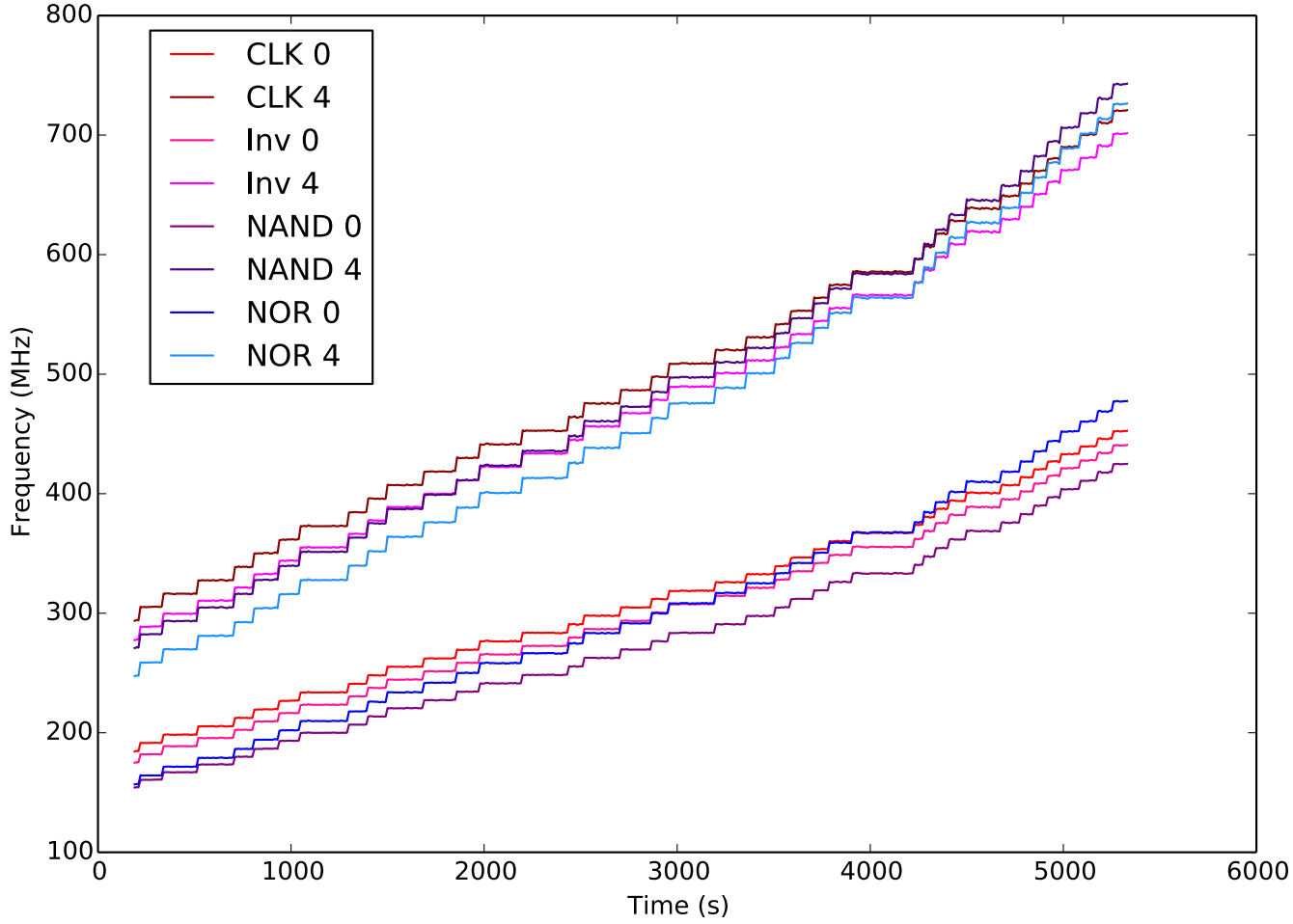
Introduction

- Planned project: X-Ray irradiations of RD53A/B
- As preparation:
- Worked at the University of Göttingen for 1.5 months (~1 lab shift per week)
- Setup YARR with
  - KC705
  - Trenz TEF1001-2 + Ohio card
- Checked the usual tuning chain for both setups



Ring oscillator measurements

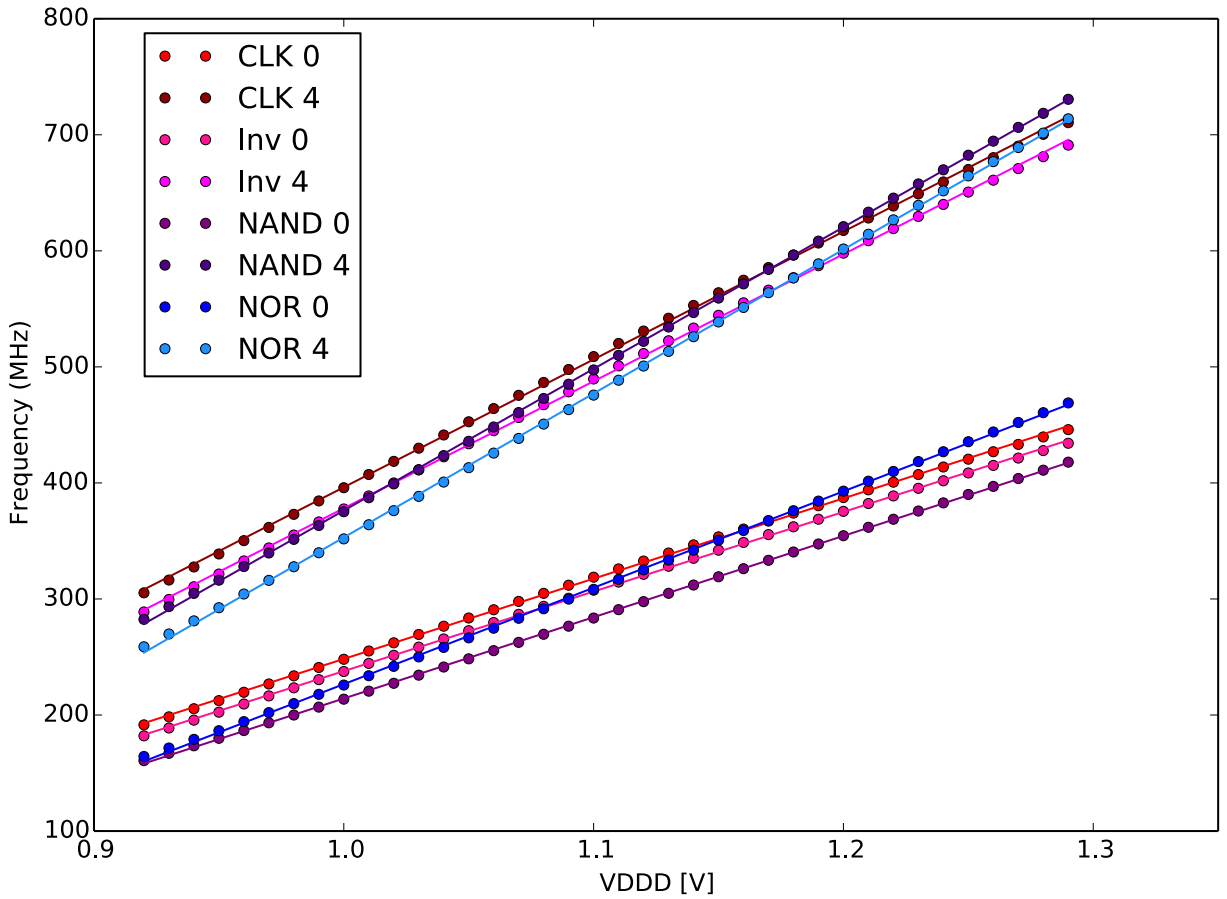
- Set up to run ring oscillator measurements
- Measure the frequency every ~10s for the different oscillators
- Vary VDDD



VDDD calibration

- Plot ring oscillator frequency as a function of VDDD
- Fit linear function

	slope	offset
CLK 0	692.9	-443.5
CLK 4	1101.5	-705.3
Inv 0	685.9	-448.1
Inv 4	1094.9	-716.7
NAND 0	700.6	-486.3
NAND 4	1220.9	-844.7
NOR 0	830.8	-604.2
NOR 4	1240.7	-887.7



Next steps in Oxford - YARR

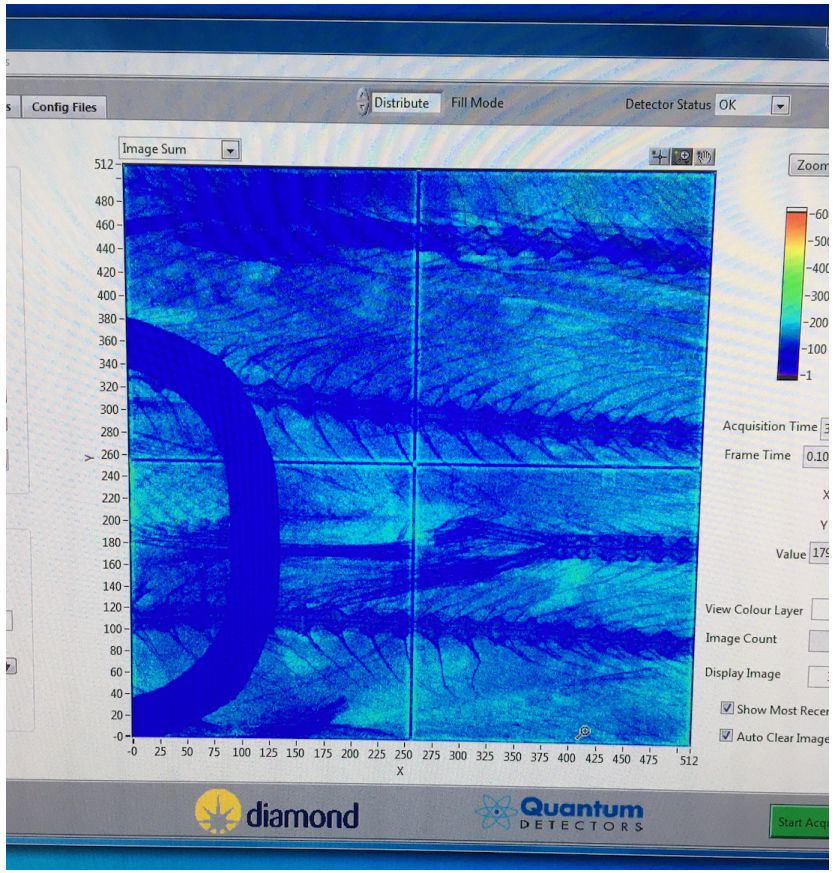
- Oxford has a working YARR setup with the KC705
- Next steps:
  - Set up YARR with Trenz card in Oxford
  - Long term ring oscillator measurement (~1 week), to check systematic effects
  - Set up VDDD monitoring and automatic adjustment for ring oscillator measurements
  - Temperature monitoring & calibration

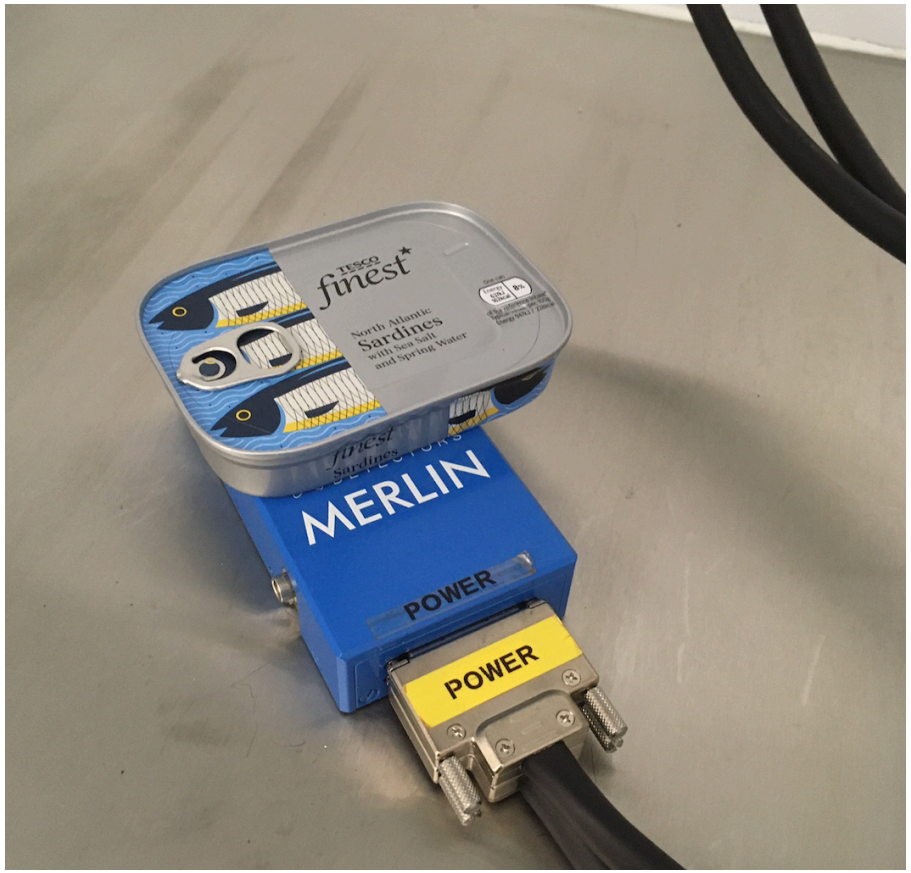
Oxford X-Ray setup

- X-ray set delivered and set up in Oxford
- Specifications:
  - X-ray tube is Comet MXR-160/22
  - Tungsten target
  - Peak X-ray flux at 50kV, 60 mA (3kW)
  - 60x60x100cm space
  - Movable platform to bring samples close to source
- Passed safety inspection and now ready to use!

First Images

- Basic imaging tests with Merlin detector
- Using low flux and “sample” ~1m from the source





First Images

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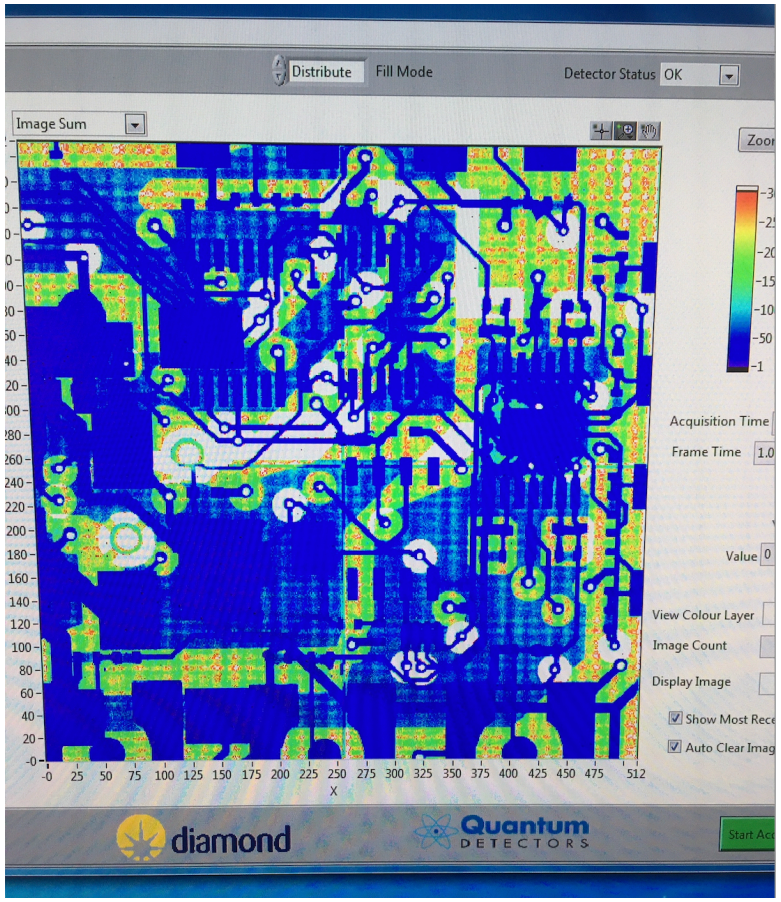
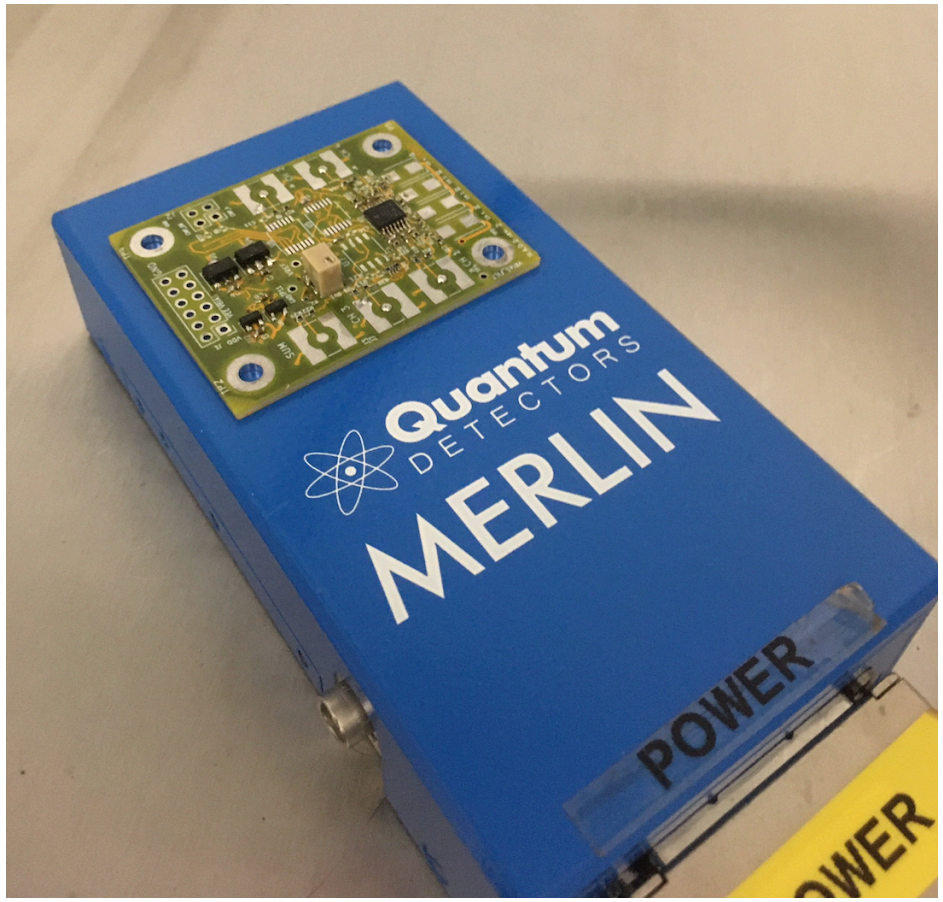


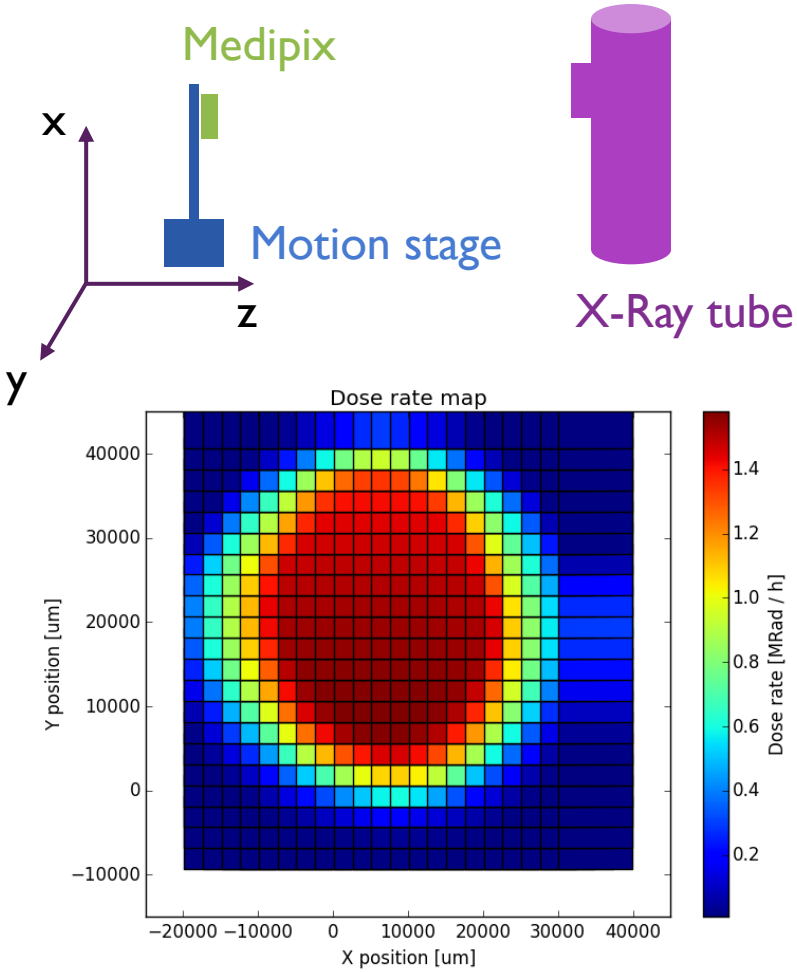


Calibration planning

- Need to understand
  - Dose as a function of distance from the source
  - Beam size and profile
  - Time dependence
- Planned calibration:
  - Borrow silicon drift detector from Diamond Light Source and measure spectrum at different settings
  - Plus using Medipix3 detector in photon counting mode

→ flux as a function of position and distance from source

→ combine with measured spectrum to get dose rate map



Dose rate map from Glasgow (from Dima Maneuski)

Conclusions

- Setup in Oxford in good state to start on irradiations of RD53As soon
- Next steps:
  - Recommission YARR setup in Oxford
  - Calibration of X-ray tube
  - Cooling (water-cooled block + Peltier)
  - Mechanics (support for chips, motion stages)

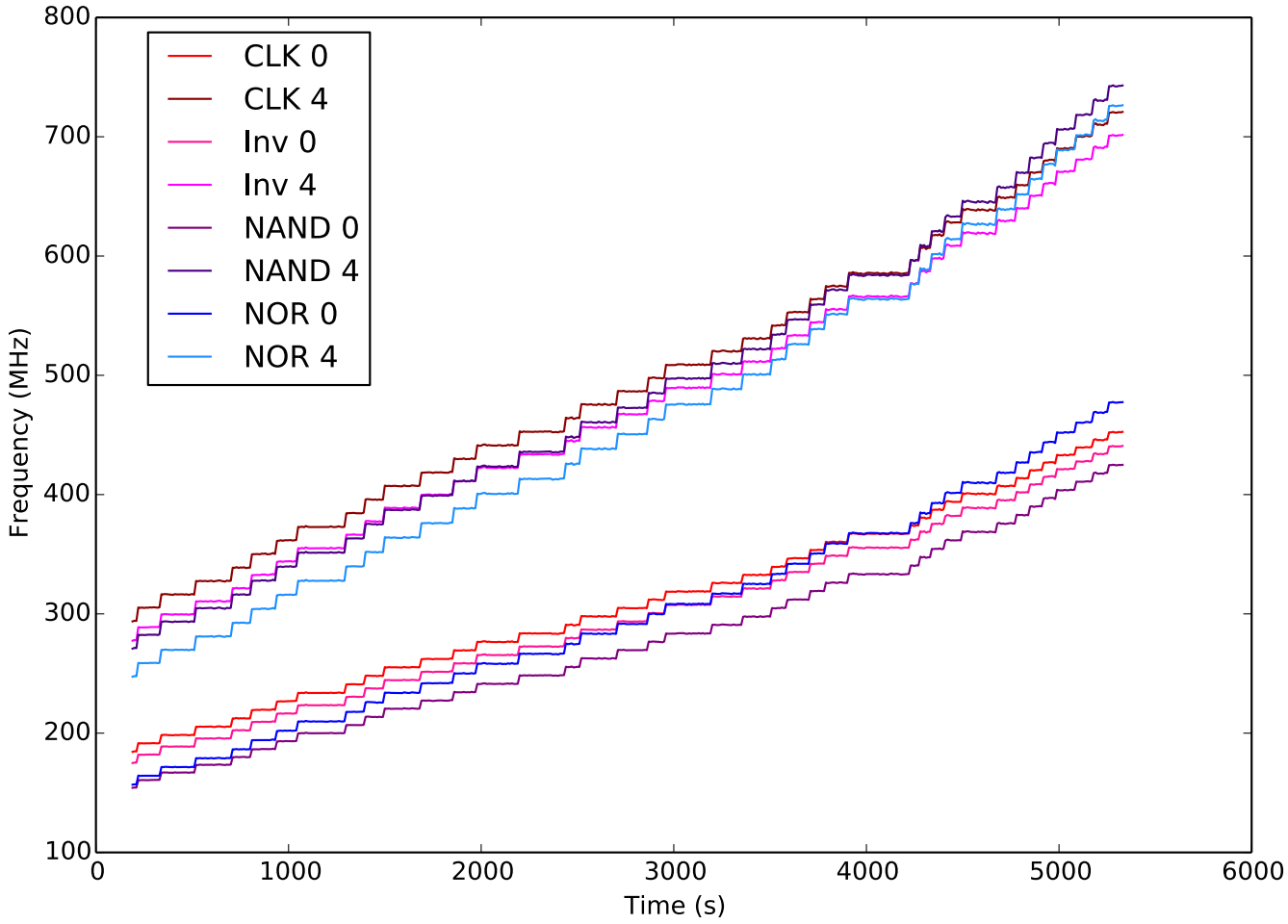
Thank you!

Questions?

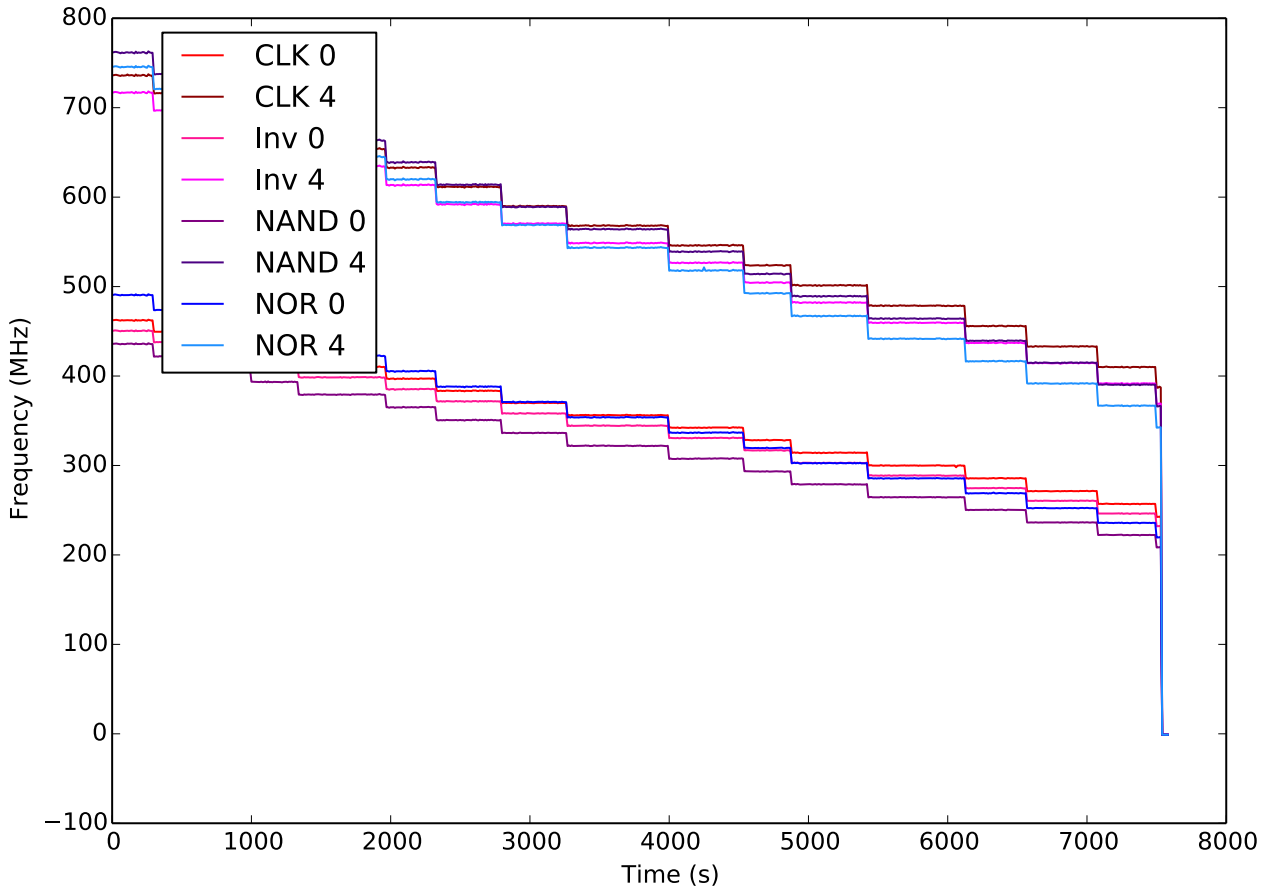
Additional Slides

Oxford X-ray system

VDDD calibration



VDDD calibration



VDDD calibration

	slope	offset
CLK 0	688.1	-429.7
CLK 4	1093.1	-680.5
Inv 0	684.0	-436.4
Inv 4	1090.2	-696.3
NAND 0	713.5	-491.3
NAND 4	1240.5	-850.2
NOR 0	850.4	-615.2
NOR 4	1265.1	-898.6