



ITRF / LhARA 6 month review

Christopher Baker
(on behalf of WP1.3)

Work Package members

- 26 members (by mailing list)
 - currently 2 supported to 10% by ITRF
 - +2 seeking to join
- 8 institutions (by email address)
- 8-10 regular attendees of regular Capture update meeting
- Multidisciplinary & multinational
 - Experiment, theory, computational, radiobiology, students, ...

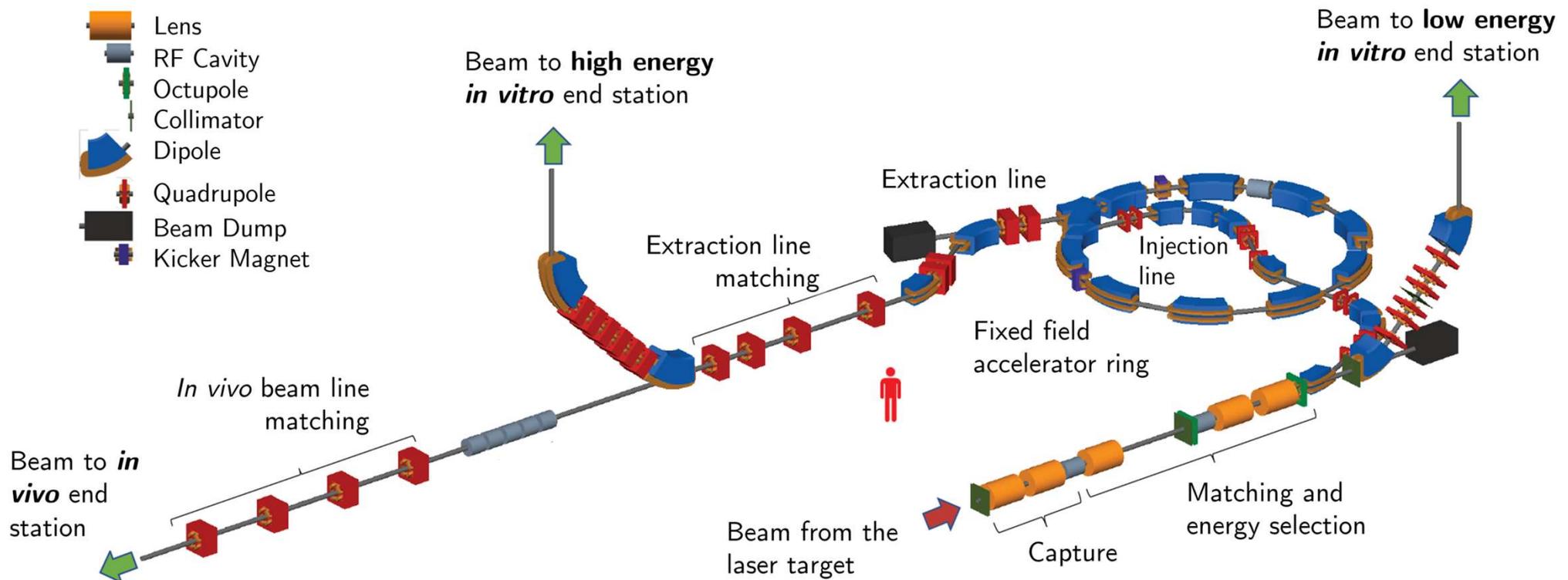
LhARA (ITRF) WP promotion / outreach

- Swansea University
 - Press release & newsletters
 - Chosen as a research highlight of 2022/23!
- Local, “That’s TV”, media interview
- Conferences
 - Capture poster abstract presented at 64th APS DPP meeting
 - Joint Source & Capture poster abstract accepted to IPAC ‘23
 - Capture poster abstract accepted to IOP 49th APPC
- Meetings
 - Regular Work Package meeting(s)
 - IP transfer - Chris, Stefan, Will, Titus - Dec 2022
 - Swansea LhARA Seminar - Ken and Amato – Jan 2023
 - Source / Capture Nozzle discussion – Jan 2023

IAB review (of Capture WP)

- Overall WP3 very happy with all comments!
- Very limited 'concern' for WP3 plan
 - Part due to unfortunate communication
 - Small misconception(s)
 - Aspects not fully articulated
- Strong emphasis on expanding/engaging communities

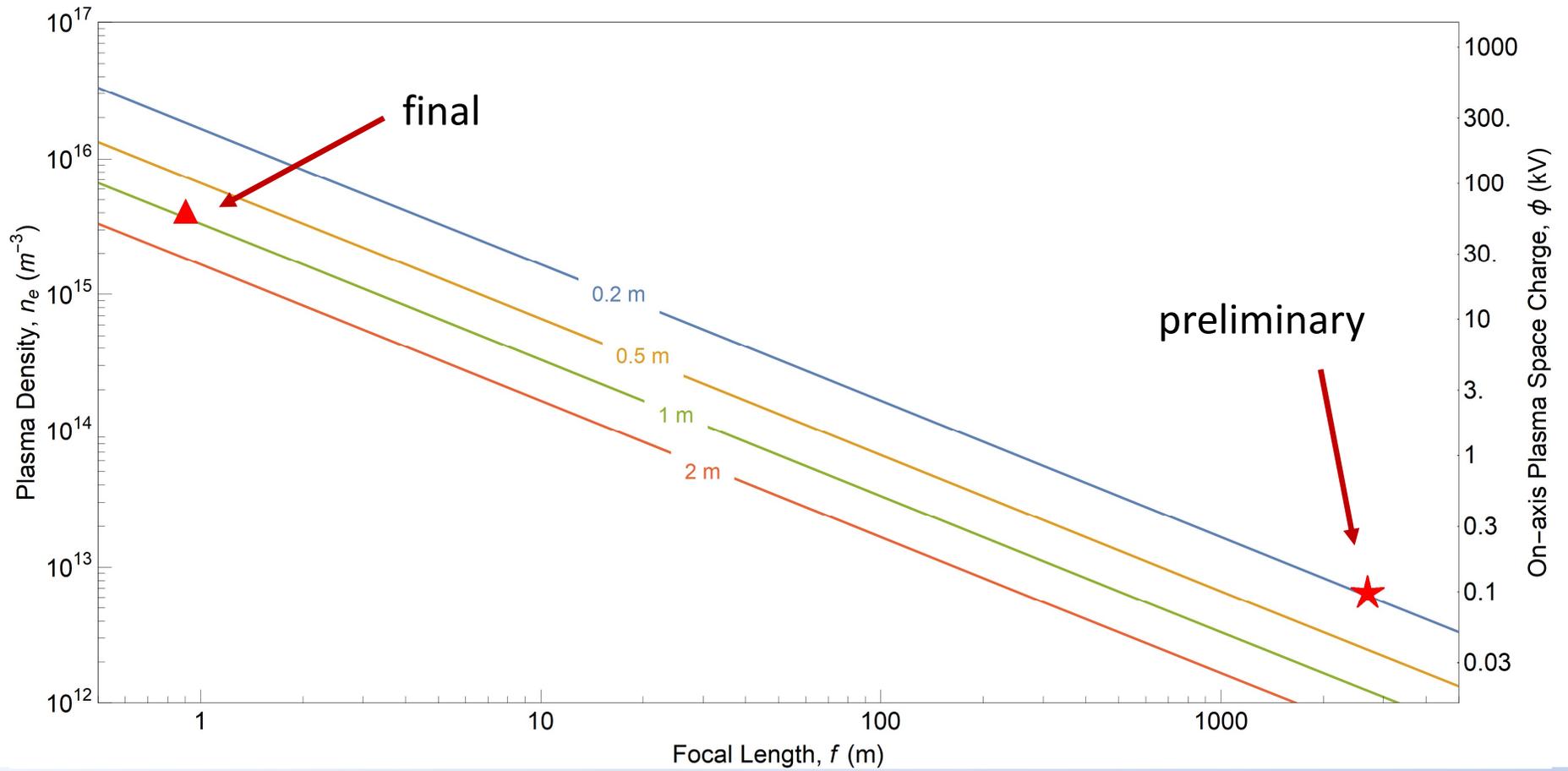
WP3: Proton & Ion Capture



Recall: 'Full' *incremental* schedule

- Year 1: Upgrade existing apparatus, validate simulation (< kV)
- Year 2: Simulate, design & order test bench components
- Year 3: Assemble & commission new test bench (few kV)
- Year 4-5: Study various plasma parameters
- Year 6: Order prototype components
- Year 7: Assemble & commission new prototype apparatus
- Year 8: Study Gabor lens like plasmas (10's kV)
- Year 9: Order & commission multiple Gabor lenses
- Year 10: Use in beamline

Recall: Rationale



ITRF (2 yr) support

- PDRA - Not currently in post (interview stage completed, month timescale)
 - Initial simulations
 - Use existing <0.1 kV apparatus
 - Produce CAD model for test bench
- Likely to request/require a 6 month extension
- Use additional collaboration support/labour
- Expect to complete (as planned) a large fraction of full proposal year 1 goals

Additional (internal) support

- Supercomputing Wales
- AIMLAC CDT
 - PhD position (Oct 2023 start)
- Other Collaboration members

Additional (external) support – in progress

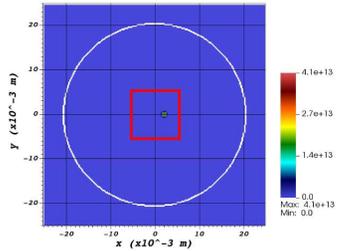
- E.g. STFC Accelerator R&D consortium, etc.
 - Focus on hardware acquisition
 - Target smaller grants to build apparatus / capabilities piecemeal
 - Scaled back test bench (kV)
- Reduced scope of studies, still aim for prototype (10's kV) Gabor lens design
 - Original year 5 goal still planned
 - Risk mitigations (e.g. AIMLAC PhD, etc.)

ITRF Progress – Software validation

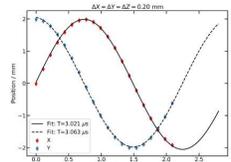
- Low density regime data validation
- ‘Weak’ scaling seen on HPC (below the ideal unity scaling)
 - Being investigated with SCW
- Commercial software seems robust at low densities & high resolution
 - See 31st Jan 2023 LhARA fortnightly meeting & next slide
- Open licence software identified & under test
 - Pro’s: free, ‘accessible’, reported runtime benefits
 - Con’s: Limited tech support, limited user documentation, steep learning curve

Simulation data

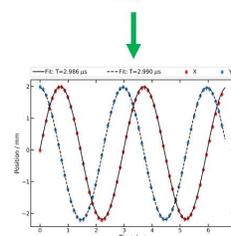
Speed up single simulation



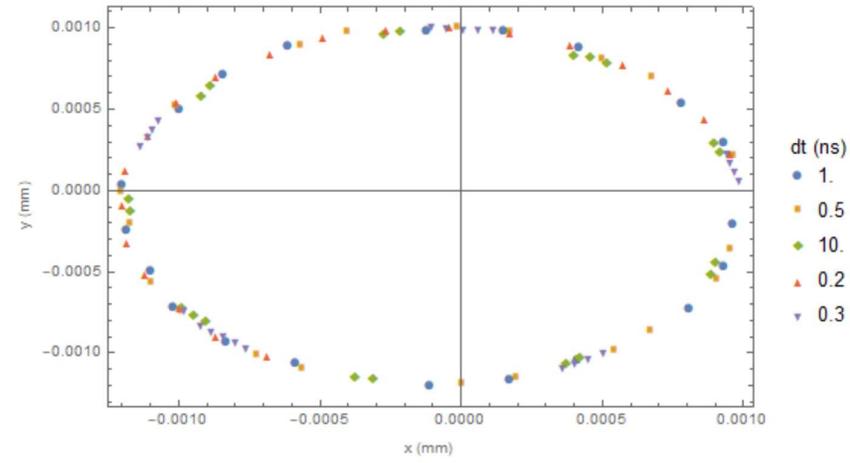
- Fields are kept constant throughout the simulation (no effect of the charges induced in anode wall, ~ 1 kHz for rigid plasma column)



~ 48 hours
(16 CPUs)



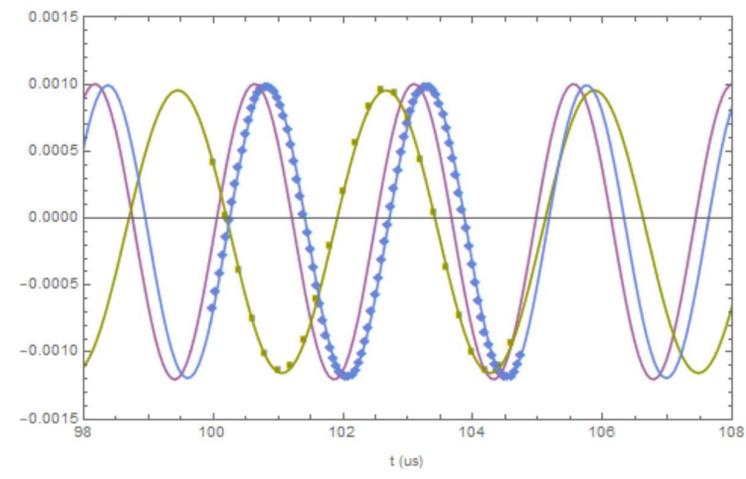
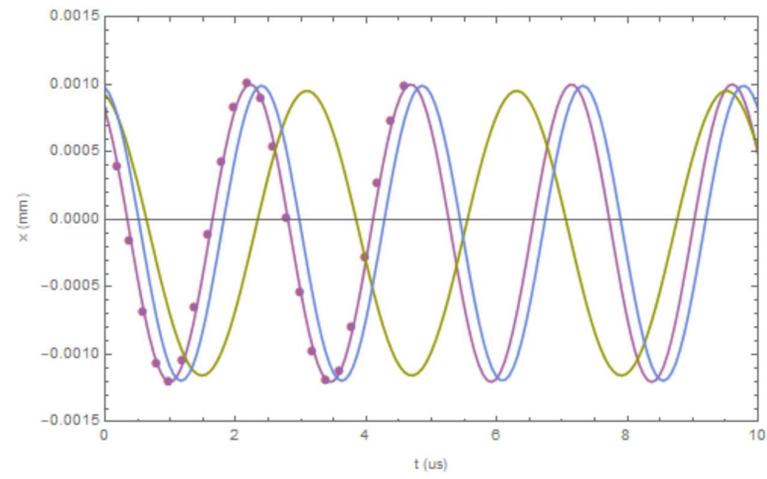
~ 24 hours
(16 CPUs)



0 - 5 μ s, dt = 0.2ns -
f=406.47(3) kHz

0 - 100 μ s, dt = 0.2ns ->
100 - 105 μ s, dt = 0.2ns -
f=406.4(1) kHz

0 - 100 μ s, dt = 10ns ->
100 - 105 μ s, dt = 0.2ns -
f=311.34(2) kHz



Summary

- Large & expanding multidisciplinary team
- Progress is being made towards LhARA goals & plasma lens
- ITRF funding secured, facilitating good early-phase progress
- Further funding identified & being pursued

Questions?