# FACET-II: Status of the First Experiments and the Road Ahead

AAC2022

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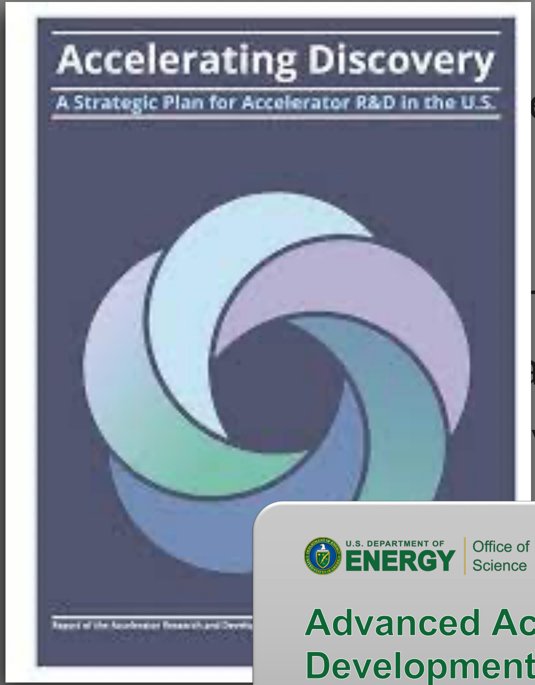
Mark J. Hogan / Senior Staff Scientist / FACET and Test Facilities Division Director

November 8th, 2022

SLAC NATIONAL ACCELERATOR LABORATORY

Stanford University | U.S. DEPARTMENT OF ENERGY

# FACET National User Facility (2012-2016)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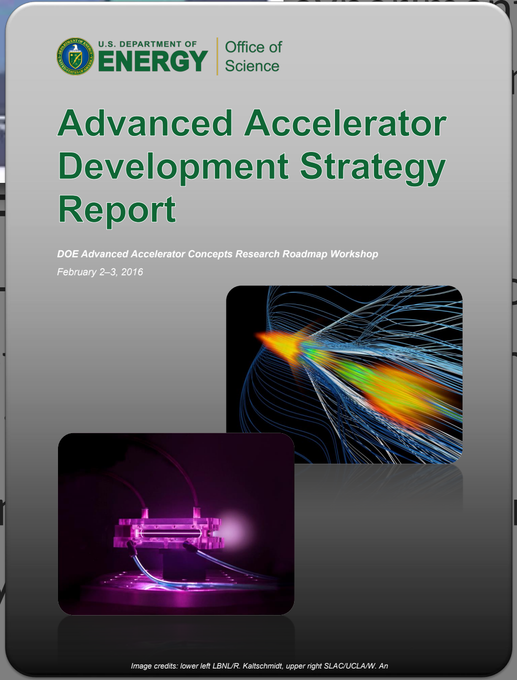
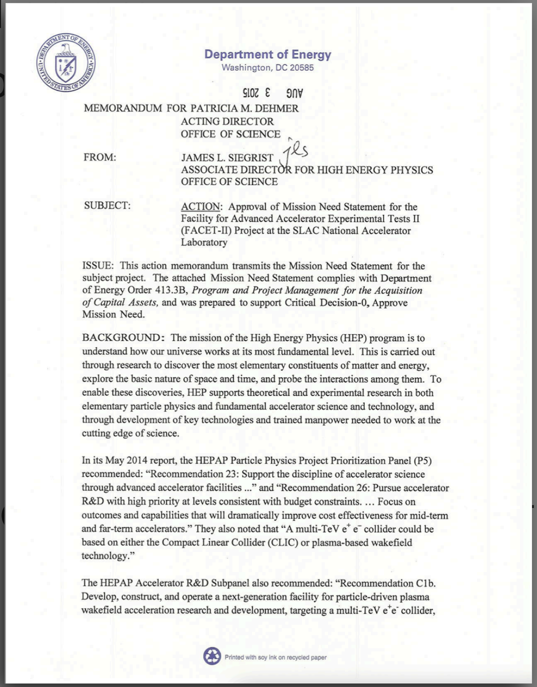
"One potential approach to address this problem is to construct a new facility (FACET-II) in the middle kilometer of the SLAC linac, which reuses much of the infrastructure of FACET."



Department of Energy
Washington, DC 20585

AUG 3 2015

MEMORANDUM FOR PATRICIA M. DEHMER
ACTING DIRECTOR
OFFICE OF SCIENCE

FROM: JAMES L. SIEGRIST jls
ASSOCIATE DIRECTOR FOR HIGH ENERGY PHYSICS
OFFICE OF SCIENCE

SUBJECT: ACTION: Approval of Mission Need Statement for the Facility for Advanced Accelerator Experimental Tests II (FACET-II) Project at the SLAC National Accelerator Laboratory

ISSUE: This action memorandum transmits the Mission Need Statement for the subject project. The attached Mission Need Statement complies with Department of Energy Order 413.3B, *Program and Project Management for the Acquisition of Capital Assets,* and was prepared to support Critical Decision-0, Approve Mission Need.

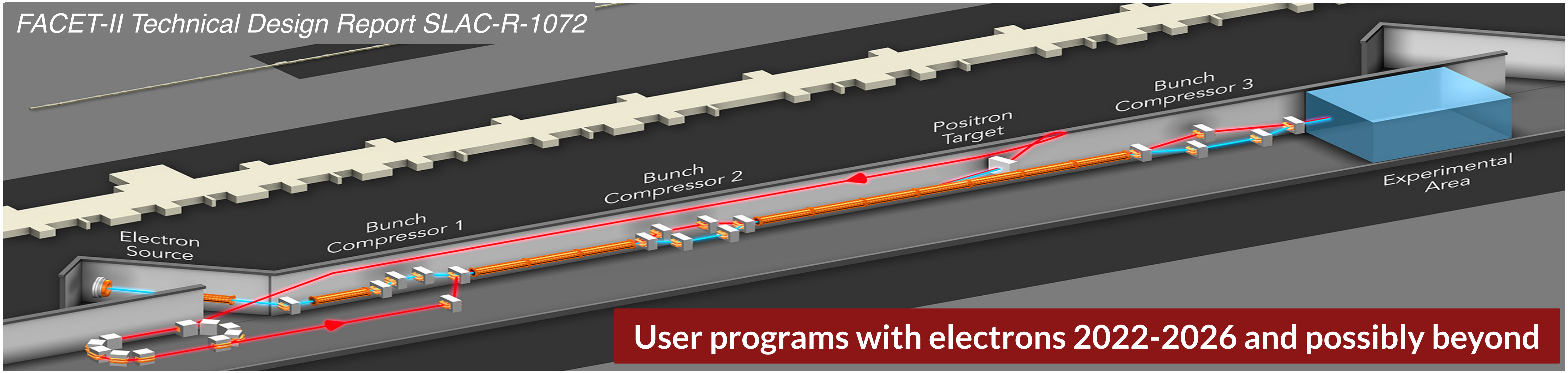
BACKGROUND: The mission of the High Energy Physics (HEP) program is to understand how our universe works at its most fundamental level. This is carried out through research to discover the most elementary constituents of matter and energy, explore the basic nature of space and time, and probe the interactions among them. To enable these discoveries, HEP supports theoretical and experimental research in both elementary particle physics and fundamental accelerator science and technology, and through development of key technologies and trained manpower needed to work at the cutting edge of science.

In its May 2014 report, the HEPAP Particle Physics Project Prioritization Panel (P5) recommended: "Recommendation 23: Support the discipline of accelerator science through advanced accelerator facilities ..." and "Recommendation 26: Pursue accelerator R&D with high priority at levels consistent with budget constraints. … Focus on outcomes and capabilities that will dramatically improve cost effectiveness for mid-term and far-term accelerators." They also noted that "A multi-TeV $e^+ e^-$ collider could be based on either the Compact Linear Collider (CLIC) or plasma-based wakefield technology."

The HEPAP Accelerator R&D Subpanel also recommended: "Recommendation C1b. Develop, construct, and operate a next-generation facility for particle-driven plasma wakefield acceleration research and development, targeting a multi-TeV $e^+e^-$ collider,

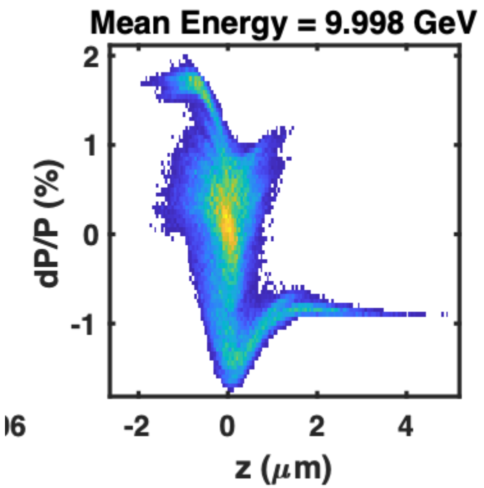
Printed with soy ink on recycled paper

# FACET-II National User Facility

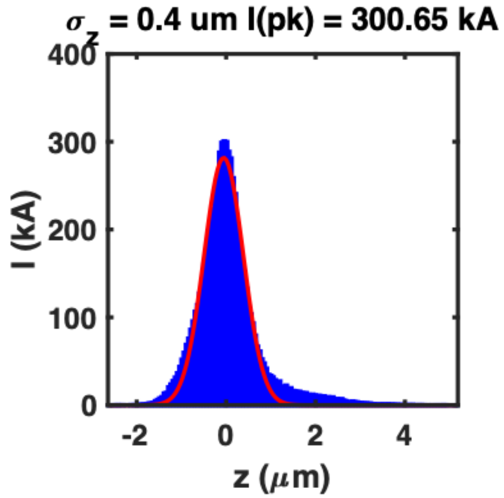



# FACET-II will Access New Regimes

- ~10μm Emittance
- ~100kA Peak current (sub-μm bunch length)
- ~100nm focal size from plasma lens
- ~$10^{12}$ V/cm radial electric field
- ~$10^{24}$ $e^-/cm^3$ beam density

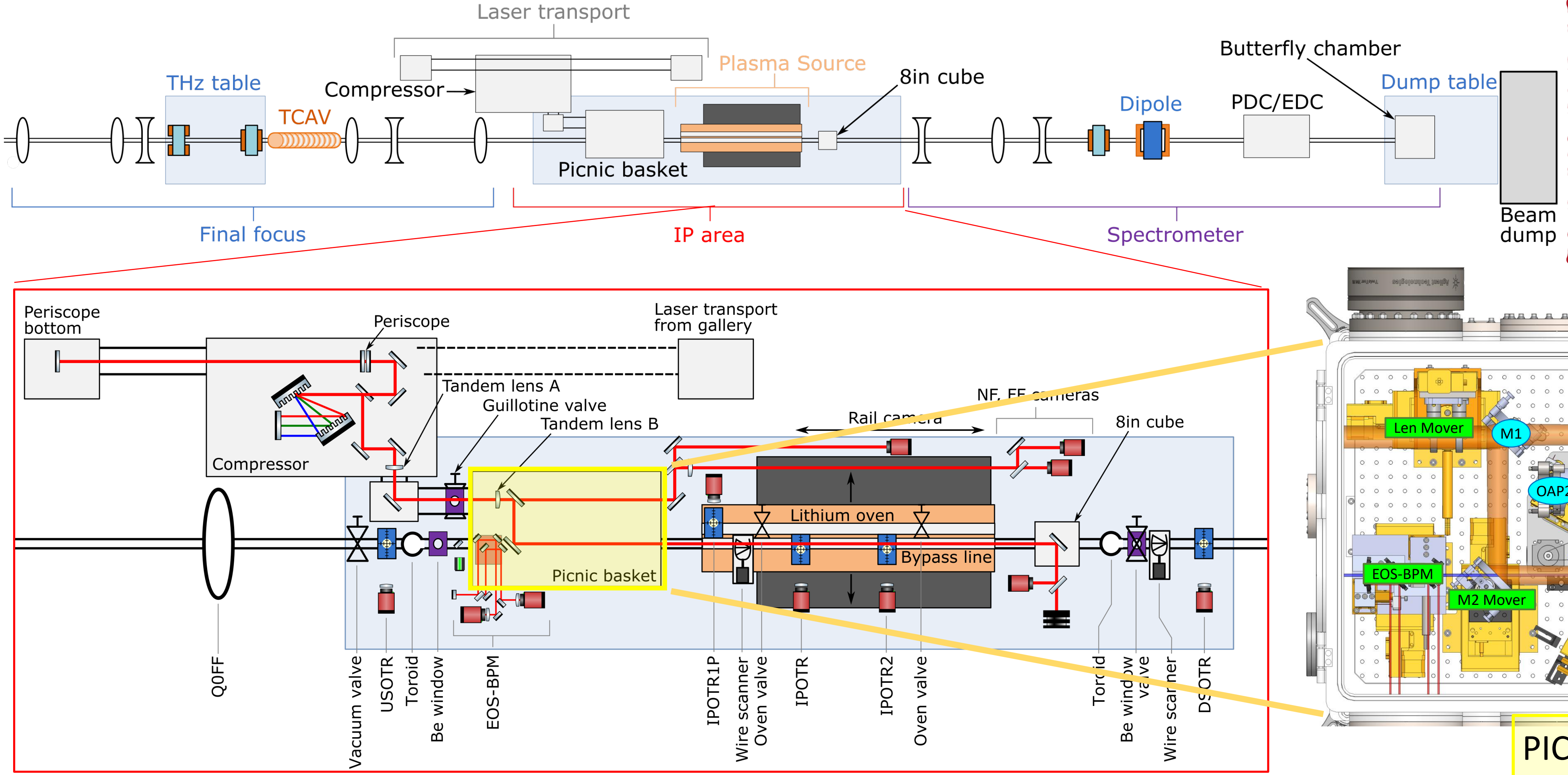



| Electron Beam Parameter | Baseline Design | Operational Ranges |
|---|---|---|
| Final Energy [GeV] | 10 | 4.0-13.5 |
| Charge per pulse [nC] | 2 | 0.7-5 |
| Repetition Rate [Hz] | 30 | 1-30 |
| Norm. Emittance $\gamma\varepsilon_{x,y}$ at S19 [μm] | 4.4, 3.2 | 3-6 |
| Spot Size at IP $\sigma_{x,y}$ [μm] | 18, 12 | 5-20 |
| Min. Bunch Length $\sigma_z$ (rms) [μm] | 1.8 | 0.7-20 |
| Max. Peak current $I_{pk}$ [kA] | 72 | 10-200 |

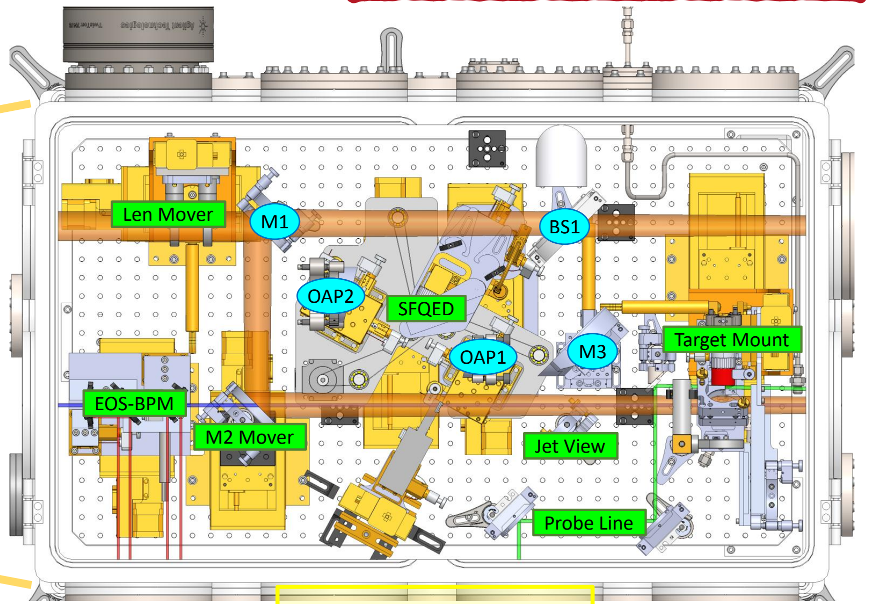



**Improved longitudinal and transverse emittance from the photoinjector allows FACET-II to deliver beams with unprecedented intensities to address HEP roadmaps and open new science directions**

# The Experimental Area Design was Coordinated with the FACET-II User Community to to Accommodate Many Experiments with Minimal Reconfiguration



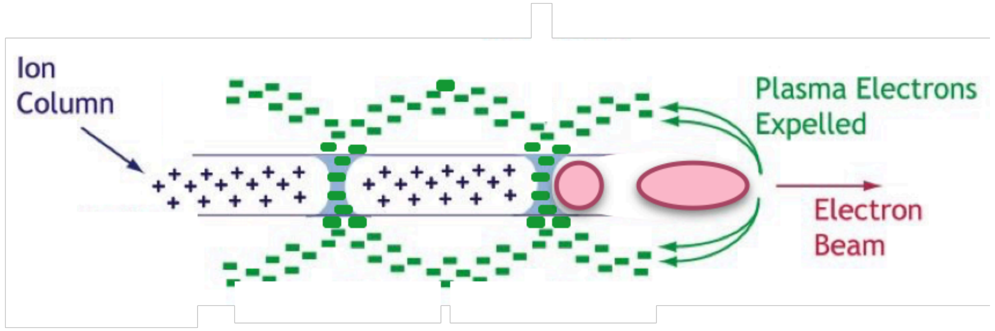

10 TW laser; solid, gas and plasma targets of various density & length; specialized electron, X-ray and Gamma-ray diagnostics

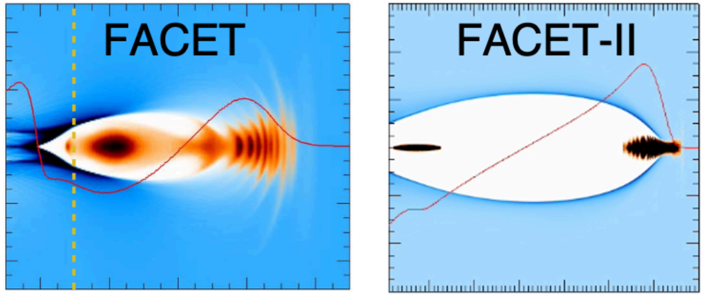


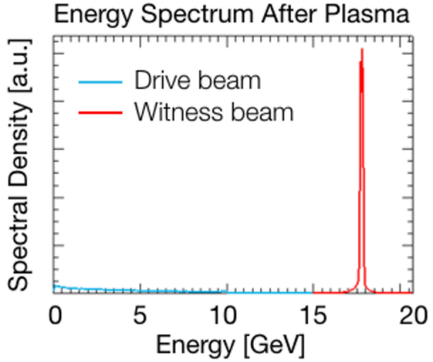

PICNIC BASKET

**Last year we invited 12 of 50 reviewed proposals to install and commission their hardware with the first few months of experimental beam time**

# Plasma Wakefield Acceleration at FACET-II (E-300)

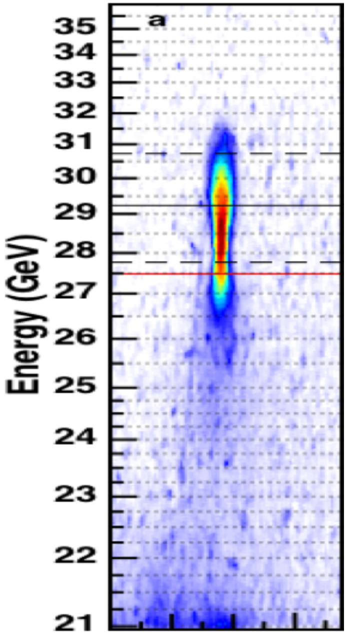


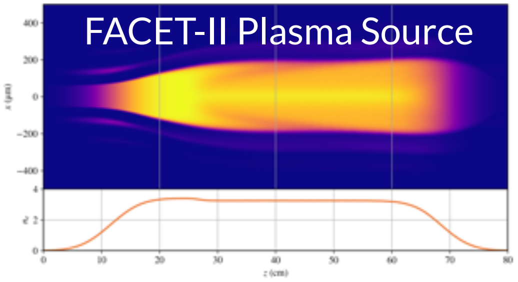

PWFA Experiments at FACET demonstrated:

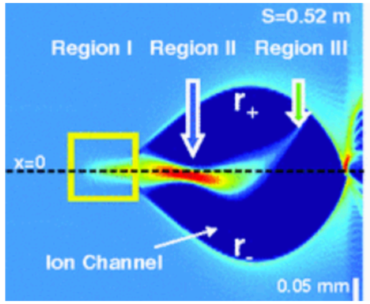
- High-gradients (>10GeV/m)
- Large energy gain (9GeV)
- High instantaneous efficiency (30%)

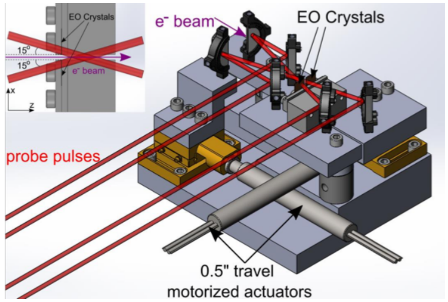



## FACET-II experiments will focus on beam quality

- Facility upgrades: photoinjector beam, final focus, differential pumping
- Users developing upgraded plasma sources and specialized diagnostics
- Combines theory, advanced computation and experiments

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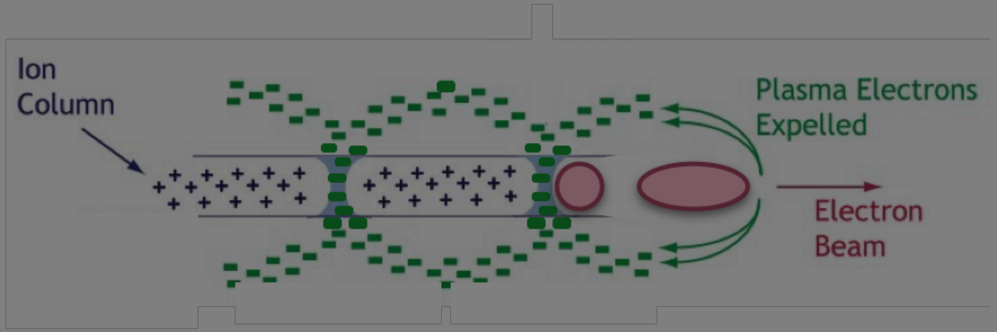


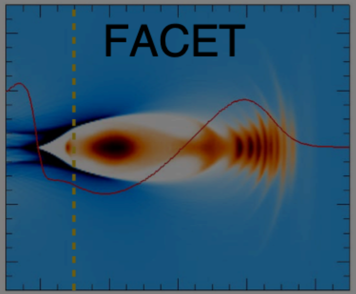


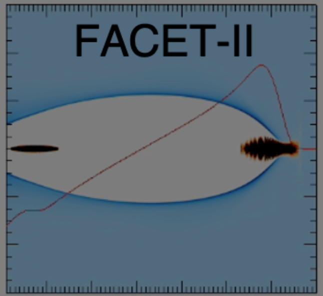


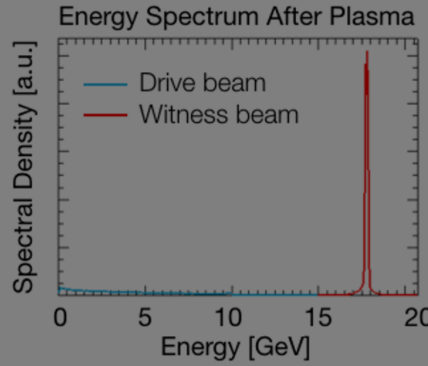


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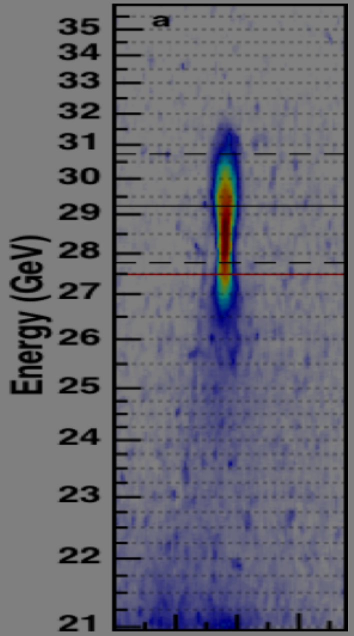


## FACET-II experiments will focus on beam quality

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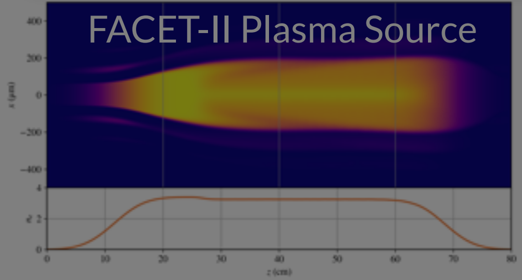
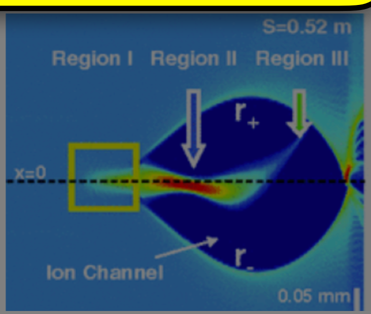
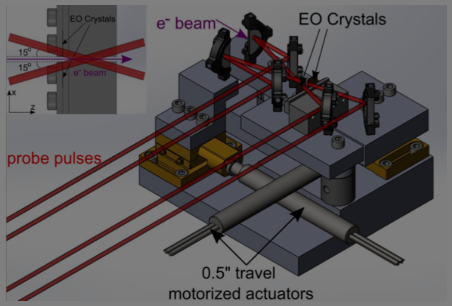
- ...ces and specialized diagnostics
- ...d experiments

Mike Litos T 16:06 WG4-5

Robert Ariniello R 10:30 WG4

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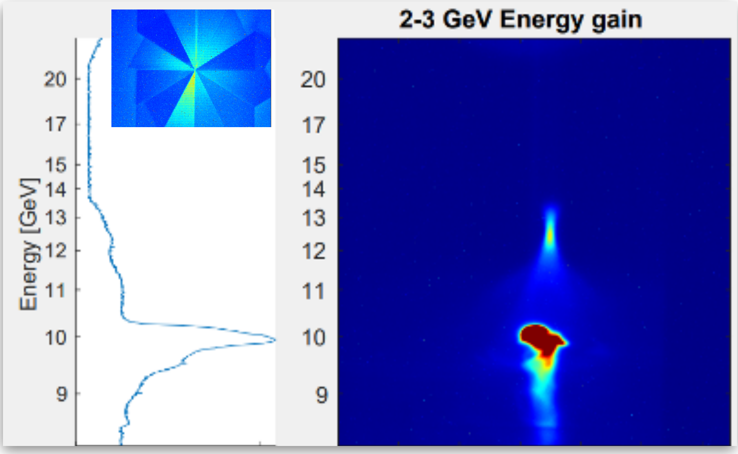
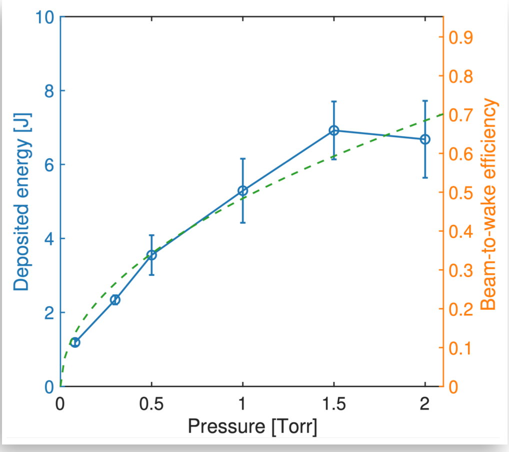
# Started Experimental Programs in May Focussed on Single Bunch

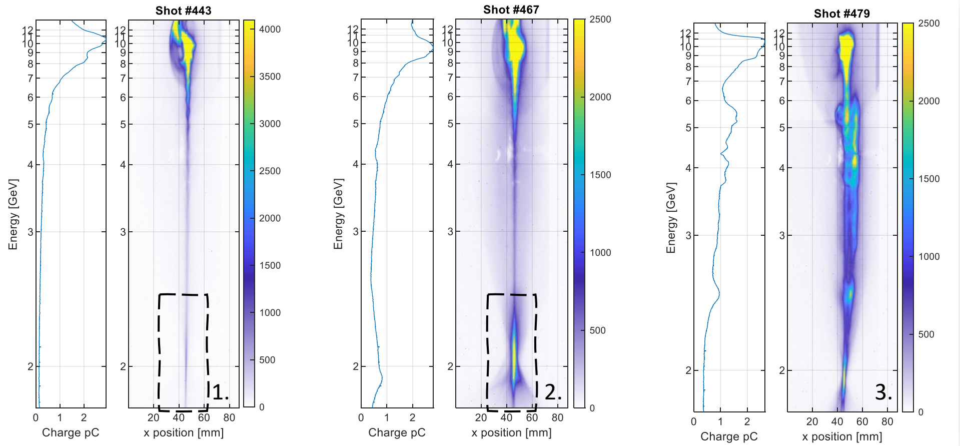
- Beam Ionized $H_2$ and He plasmas
- Qualitatively very similar to single bunch experiments at FFTB & FACET
- Deceleration of beam core down to < 1GeV with few GeV gain by tail particles
- Large energy fraction transferred to the wake
- No obvious reduction in performance due to CSR induced hosing




Sample images:

1. Most shots look like this – smooth energy profile down to <2GeV
2. Some shots show a charge accumulation at low energy
   - 300pC in box 2 at 2 GeV vs box 1.
3. Some shots show a lot of structure
   1. Scalloping due to betatron oscillations
   2. A few discrete charge bunches




**The drive beam is meeting the requirements for two-bunch PWFA to come**
**FY23 will commission the two-bunch setup to add witness bunch to study energy gain**

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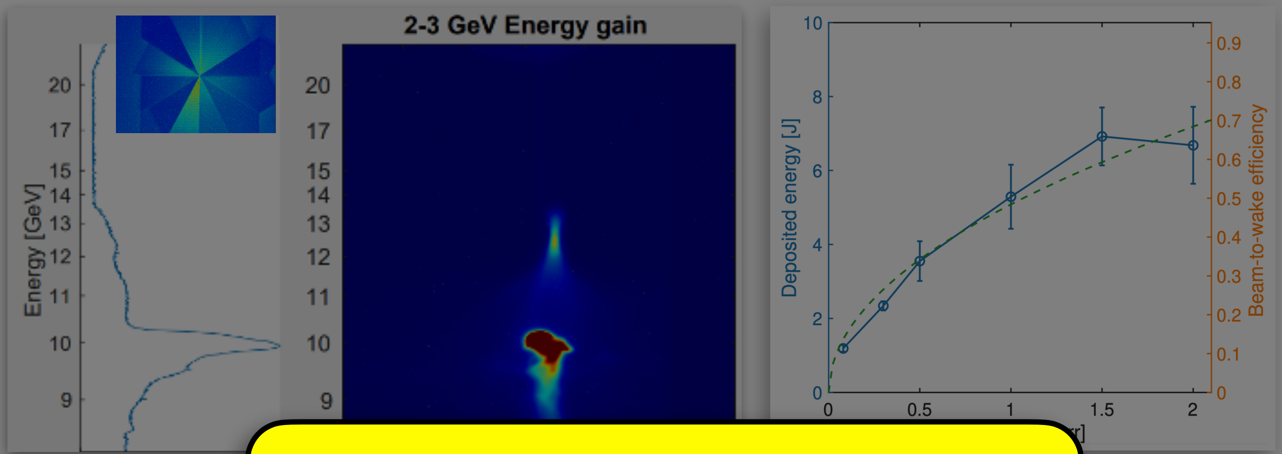


Doug Storey T 13:30 WG4

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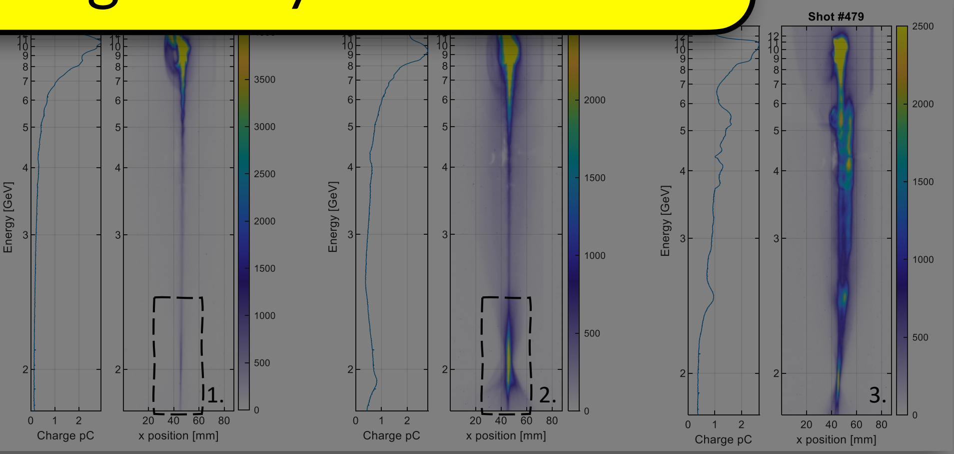


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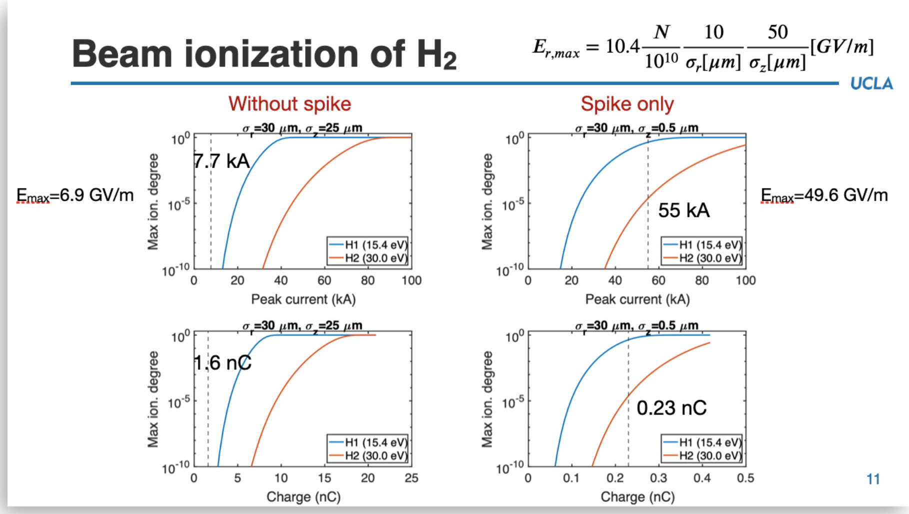
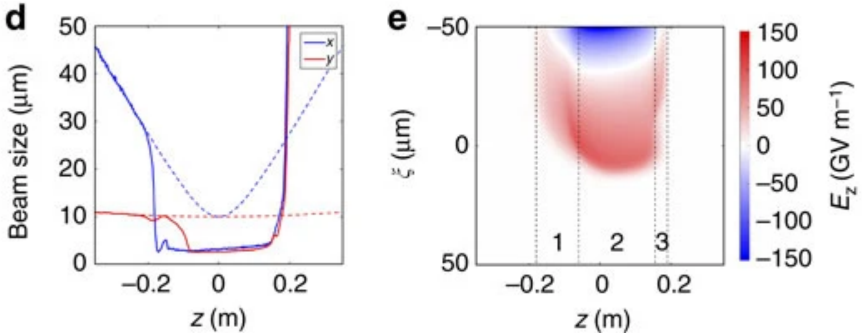
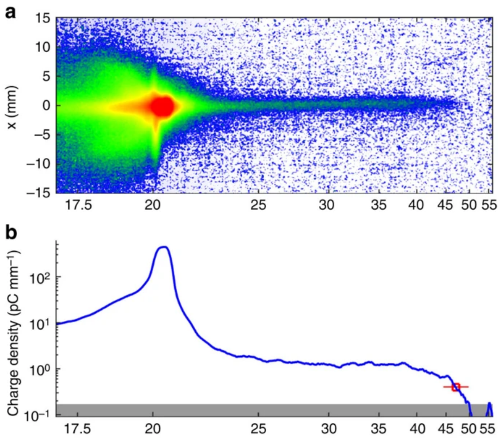
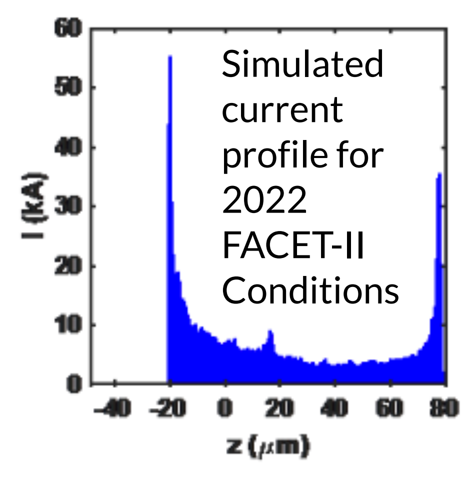
# Peak Beam Intensity Enables Beam Ionized $H_2$ and He Plasmas

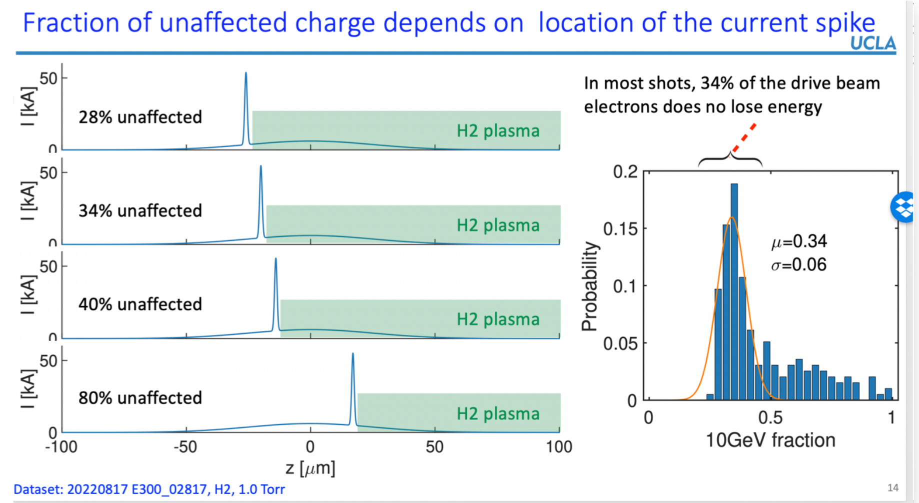



High-field plasma acceleration in a high-ionization-potential gas
S. Corde et al., *Nature Communications* **7**, 11898 (2016)

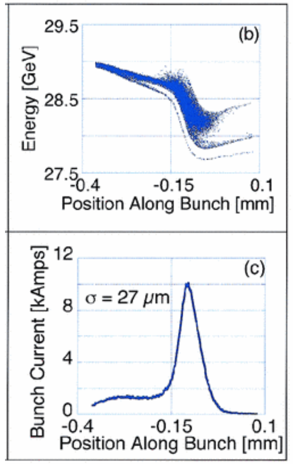


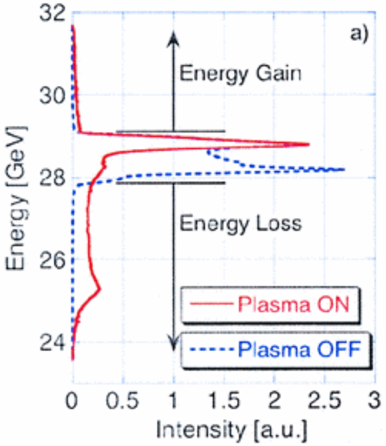




Multi-GeV Energy Gain in a Plasma-Wakefield Accelerator
M.J. Hogan et al., *Phys. Rev. Lett.* **95**, 054802 (2005)




**Drive bunch characterization and optimization will benefit from laser heater installation this Fall**

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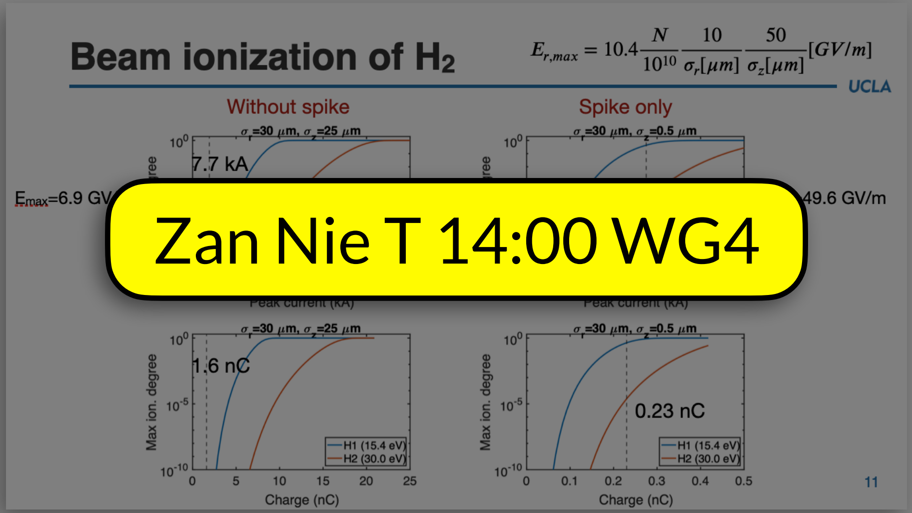
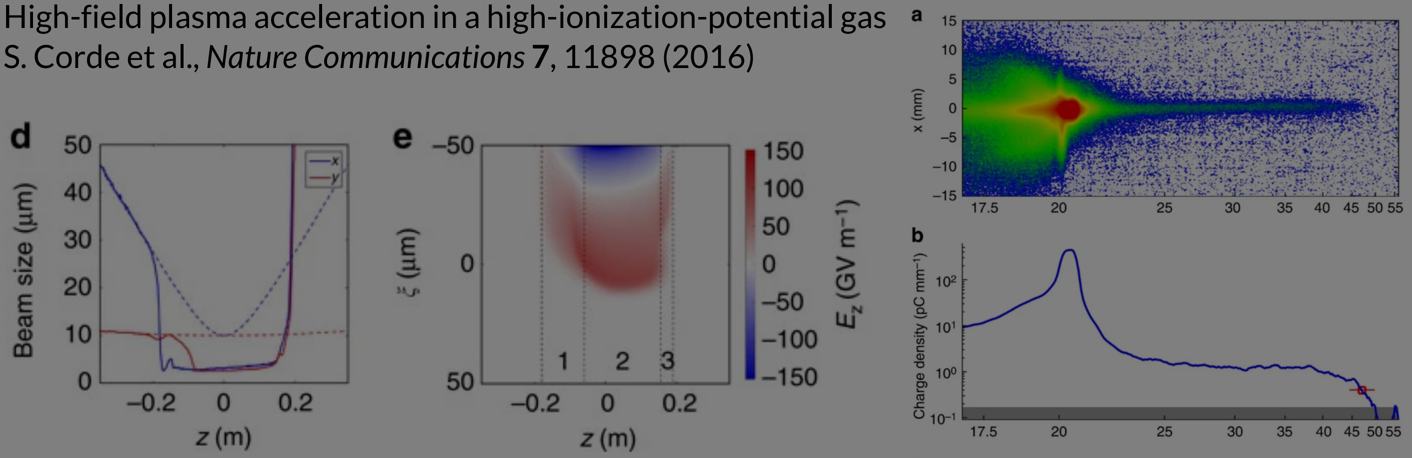
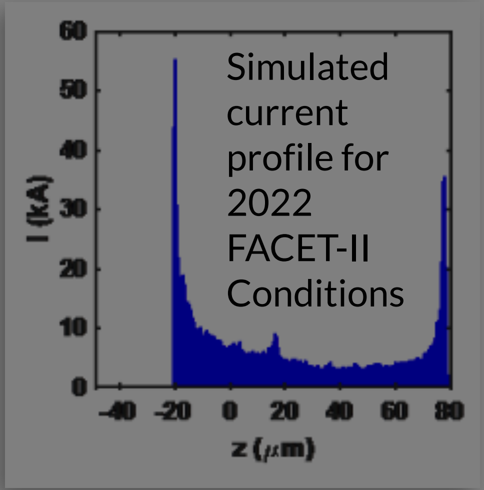
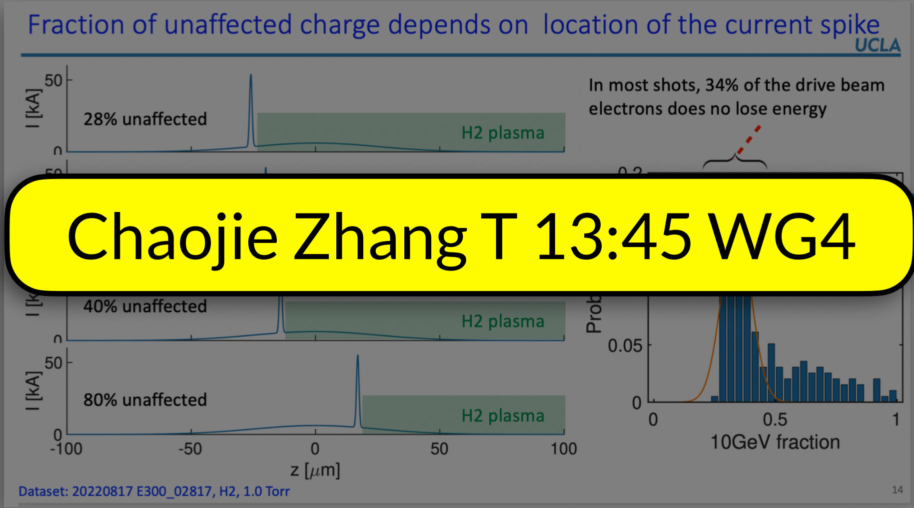



Zan Nie T 14:00 WG4

High-field plasma acceleration in a high-ionization-potential gas
S. Corde et al., *Nature Communications* **7**, 11898 (2016)

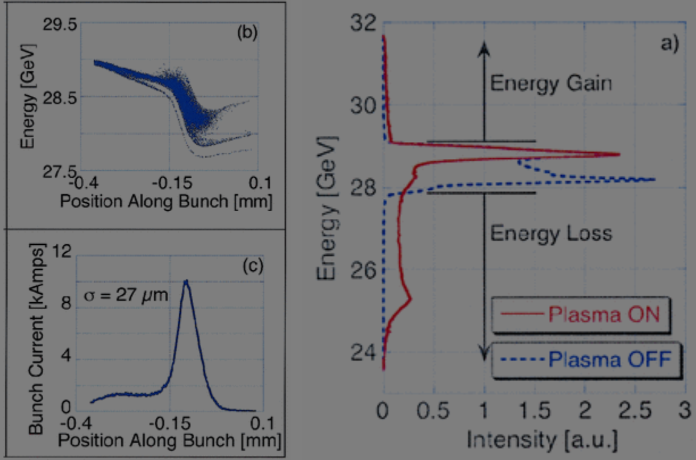



Chaojie Zhang T 13:45 WG4

Multi-GeV Energy Gain in a Plasma-Wakefield Accelerator
M.J. Hogan et al., *Phys. Rev. Lett.* **95**, 054802 (2005)

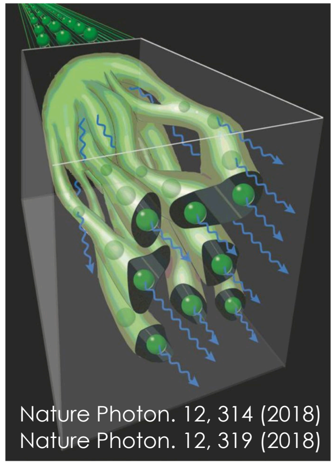


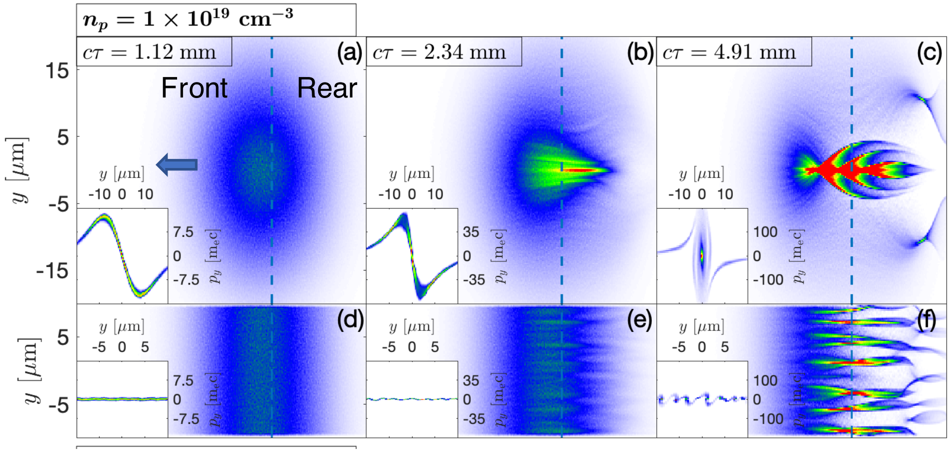

**Drive bunch characterization and optimization will benefit from laser heater installation this Fall**

# E-305: Beam Filamentation and Bright Gamma-ray Bursts

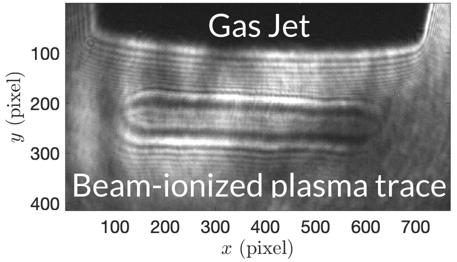
- Relativistic streaming plasma instabilities are pervasive in astrophysics
- CFI and oblique instabilities are believed to:
  - Mediate slow down of energetic flows (e.g. in GRBs and blazars), shock formation and cosmic-ray acceleration
  - Determine radiation signatures of energetic environments

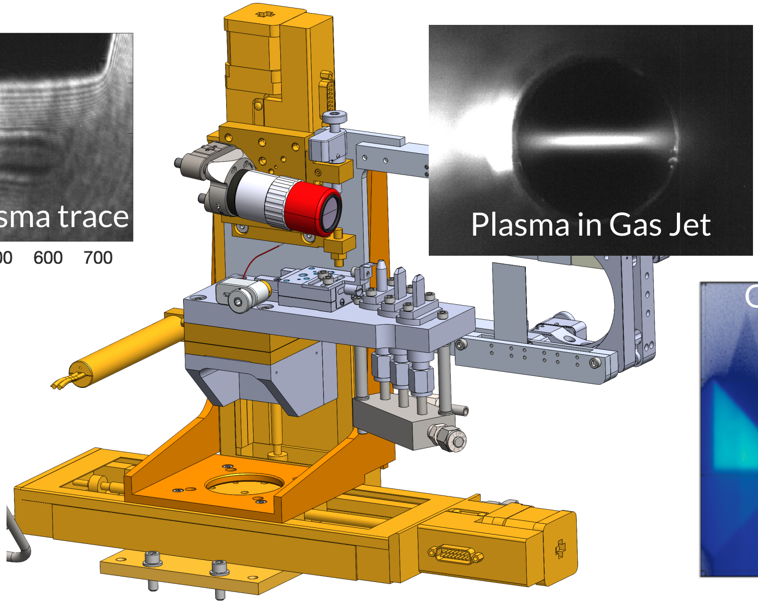
Beam size much larger than bubble size → Beam modulation & filamentation → Large fields → Bent trajectories for filaments → Gamma-ray emission




*Phys. Rev. Research 4, 023085 (2022)*





- Commissioned many parts of the experiment
  - Targets (gas jet and solids)
  - Electron and gamma diagnostics
  - Laser ionization of gas jet with E305 focusing optics
  - Low-resolution shadowgraphy, tests for high-resolution
  - Beam-laser overlap methods
  - Beam-based characterization of laser-generated plasma

# E-305: Beam Filamentation and Bright Gamma-ray Bursts

- Relativistic streaming plasma instabilities are pervasive in astrophysics
- CFI and oblique instabilities are believed to:

Alexander Knetsch W 13:30 WG4+7

ray acceleration
  - Determine radiation signatures of energetic environments

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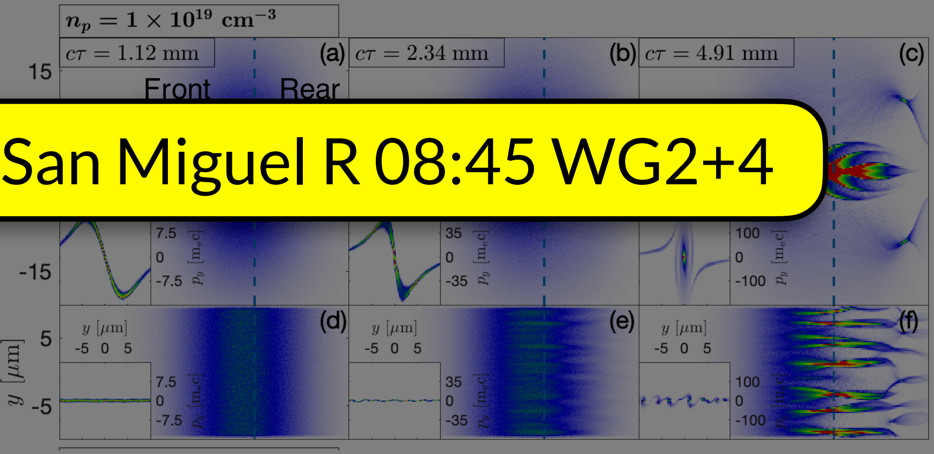
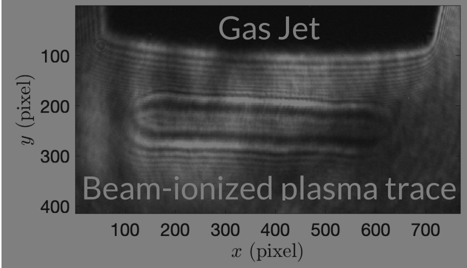
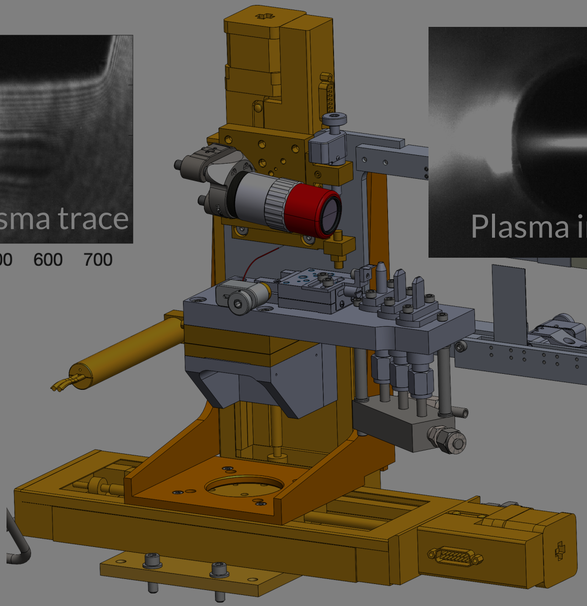
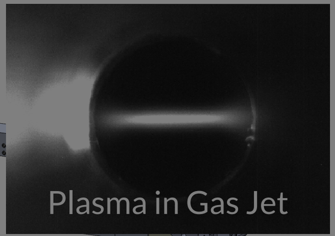



Pablo San Miguel R 08:45 WG2+4

*Phys. Rev. Research 4, 023085 (2022)*







- Commissioned many parts of the experiment

Pablo San Miguel W 13:50 WG4+7

…tics

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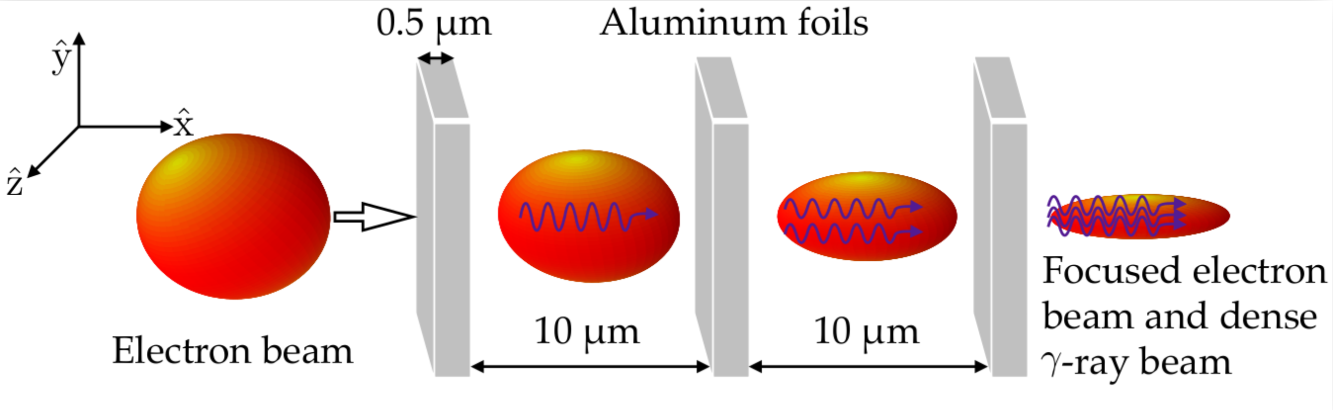
…plasma

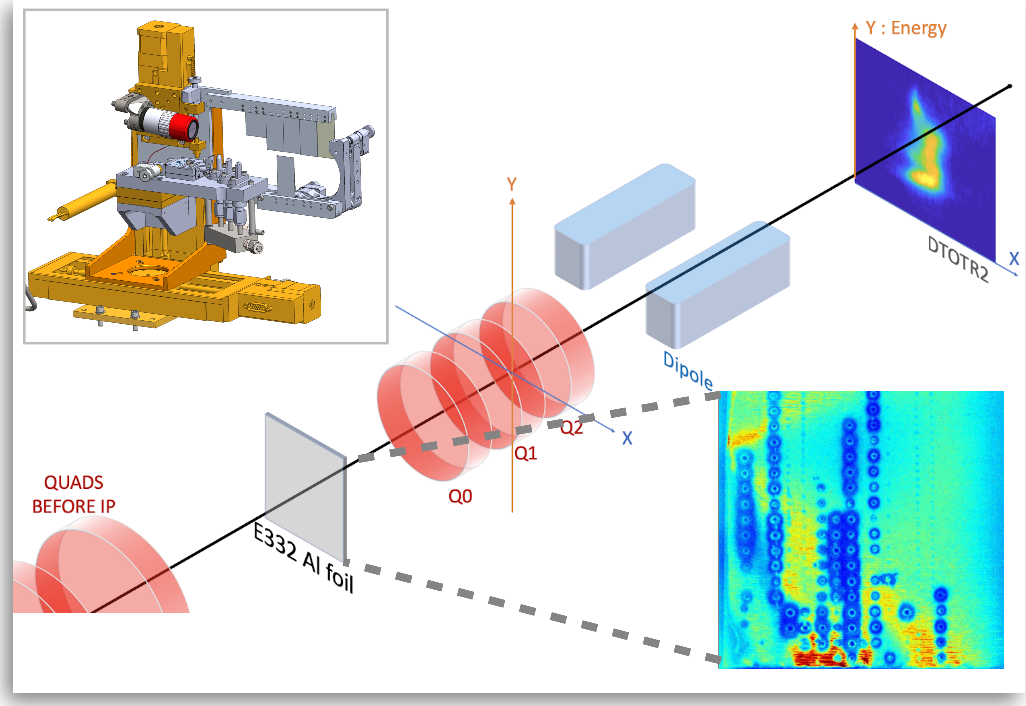
E-336 (nanotubes):
Robert Ariniello M 14:45 WG4
Alexander Knetsch T 16:30 WG3

# E-332: Near-field CTR Focusing and Gammas in Beam-multifoil Collisions




Sampath et al., Phys. Rev. Lett. 126, 064801 (2021)

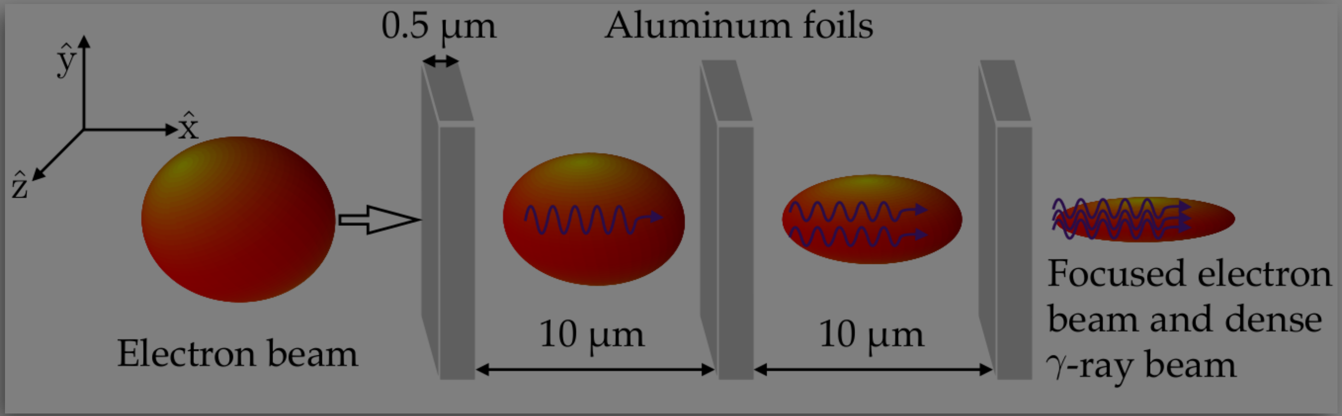
**Schematic of the experiment.** A highly-focused and high-current electron beam collides with a series of foils therefore undergoing strong-focusing by near-field CTR with the generation of a dense gamma-ray pulse




- Validate diagnostics and methods able to observe focusing from near-field CTR
- Foil damage studied in detail as a proxy for strong near-field CTR as they both originate from surface currents
  - The mechanism for foil damage from high-current beams is the Ohmic heating from surface currents
  - Near-field CTR fields are also induced by these surface currents

**First experimental demonstration of near-field CTR focusing expected in near future with smaller emittance and spot size as FACET-II commissioning progresses**

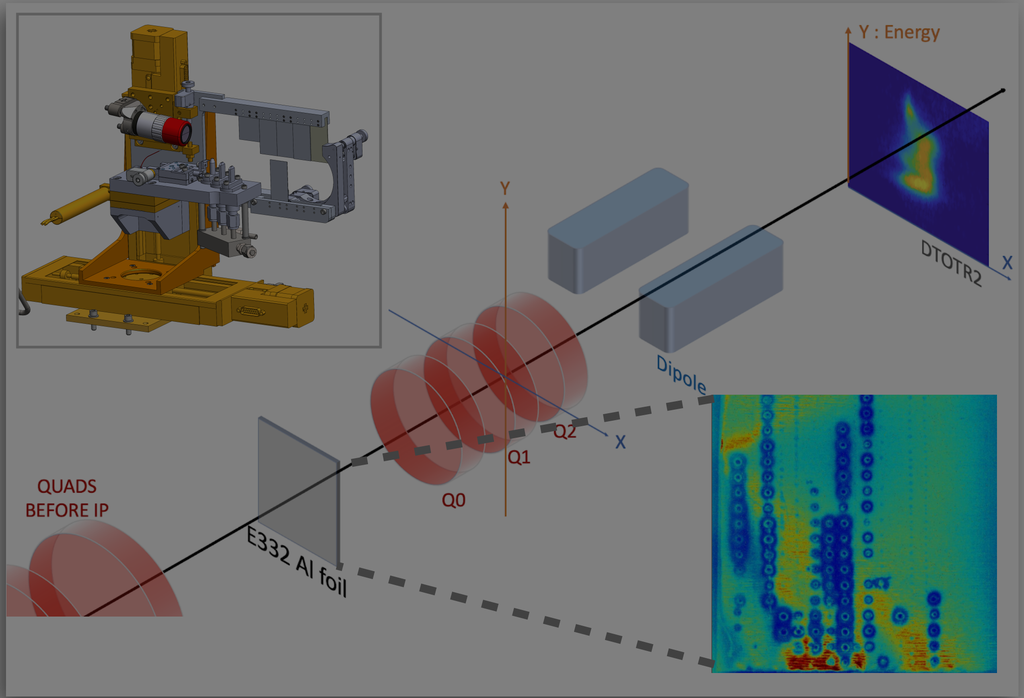
# E-332: Near-field CTR Focusing and Gammas in Beam-multifoil Collisions




Sampath et al., Phys. Rev. Lett. 126, 064801 (2021)

**Schematic of the experiment.** A highly-focused and high- … foils there … CTR with t …

Doug Storey W 14:30 WG4+7



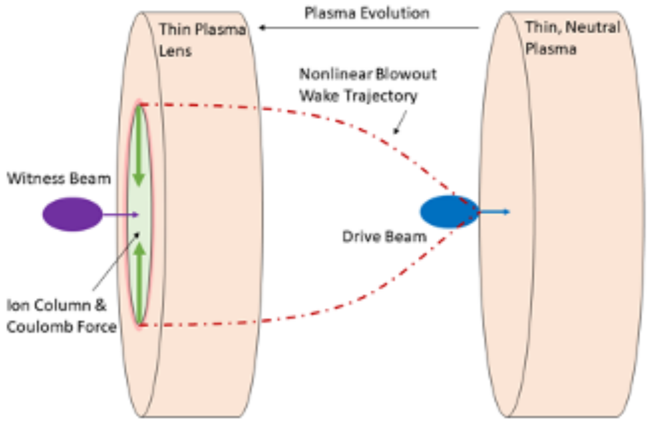

- Valid … focus …

Pablo San Miguel T 13:50 WG2+7

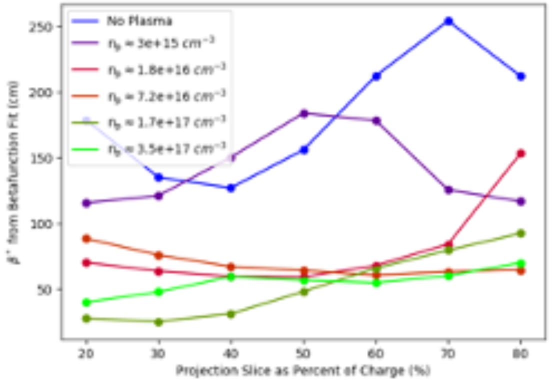
- Foil damage studied in detail as a proxy for strong near-field CTR as they both originate from surface currents
  - The mechanism for foil damage from high-current beams is the Ohmic heating from surface currents
  - Near-field CTR fields are also induced by these surface currents

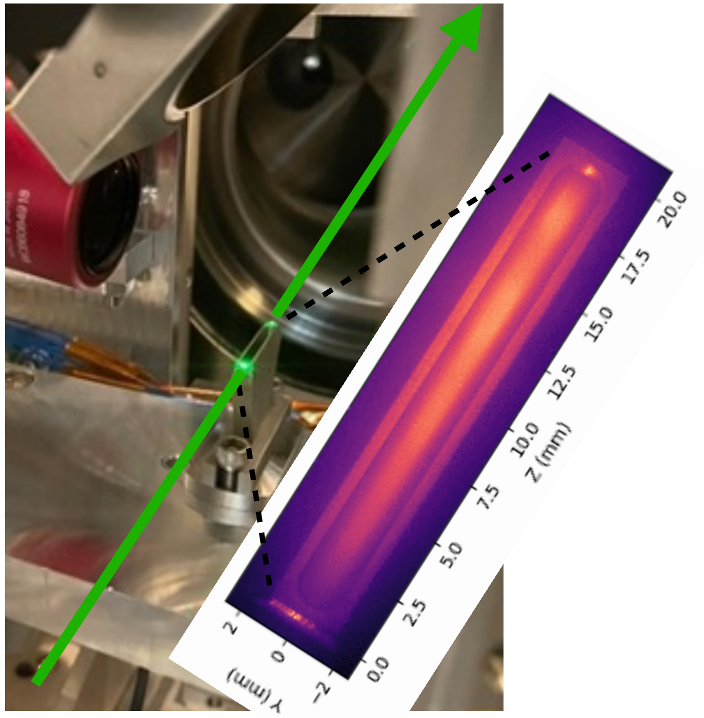
**First experimental demonstration of near-field CTR focusing expected in near future with smaller emittance and spot size as FACET-II commissioning progresses**

# E308: Underdense, Passive Plasma Lens



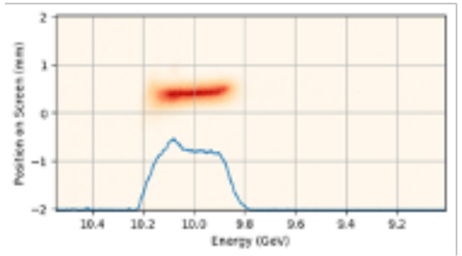

| Type | K [m$^{-2}$] | L [mm] | f [cm] |
|---|---|---|---|
| Conv. Quad | 0.3 | 180 | 1000 |
| PMQ | 150 | 8.2 | 81 |
| Plasma | 88400 | 0.34 | 3.3 |



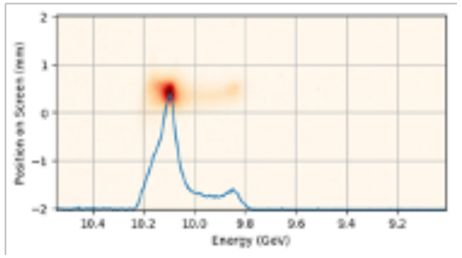




- Passive thin plasma lens in blowout regime
  - Strong, linear, axisymmetric focusing
  - Easily and rapidly tunable
  - Plasma source: laser-ionized gas jet
- Commissioning data from summer 2022
  - 20 mm gas jet (not final config.)
  - β* decreased with density: good, but…
  - emit. likely increased with density

Plasma Off




Plasma On




**Next steps: transverse ionization for optimal lens geometry and control, two-bunch data**

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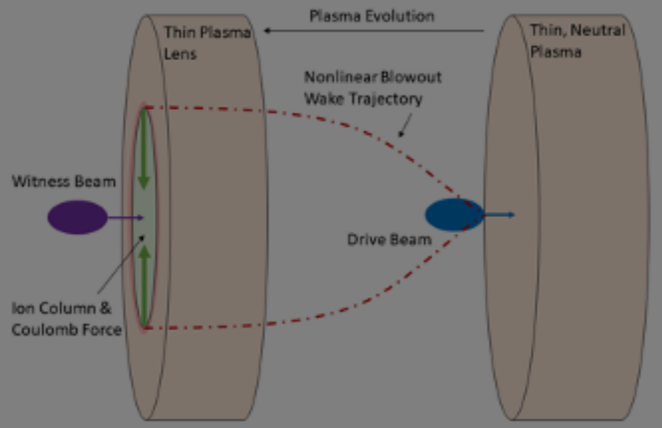


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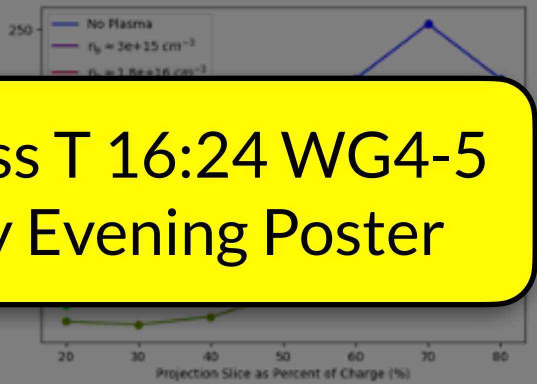


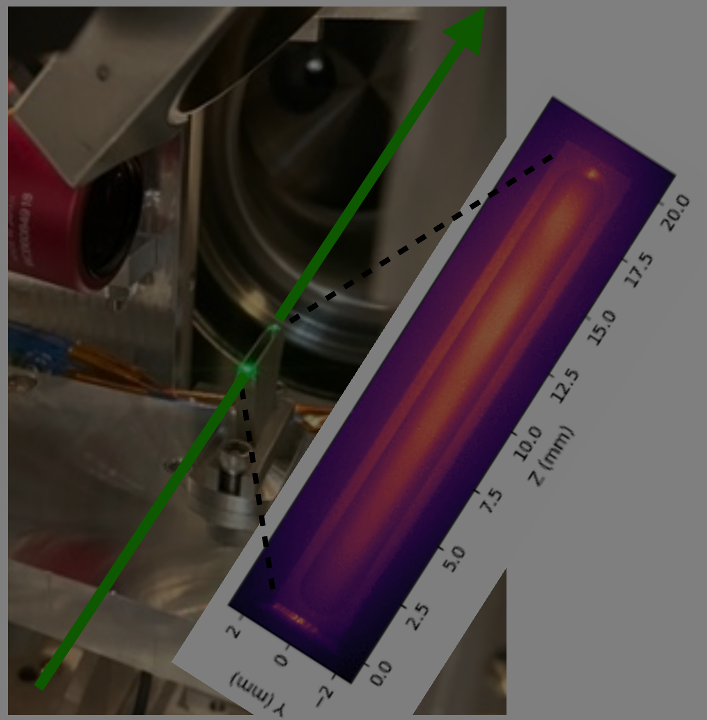


Chris Doss T 16:24 WG4-5
Tuesday Evening Poster

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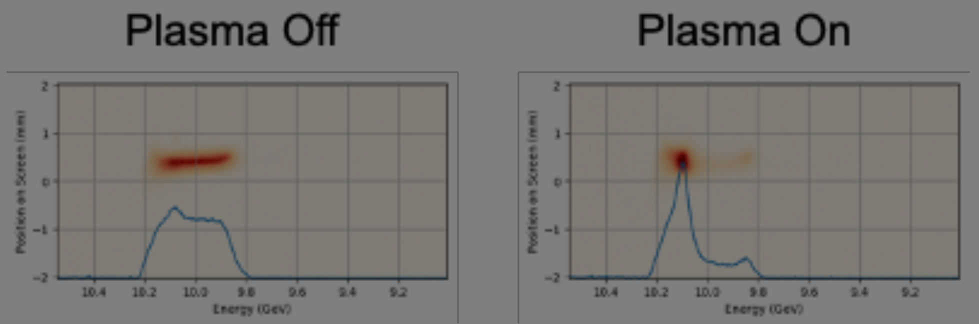
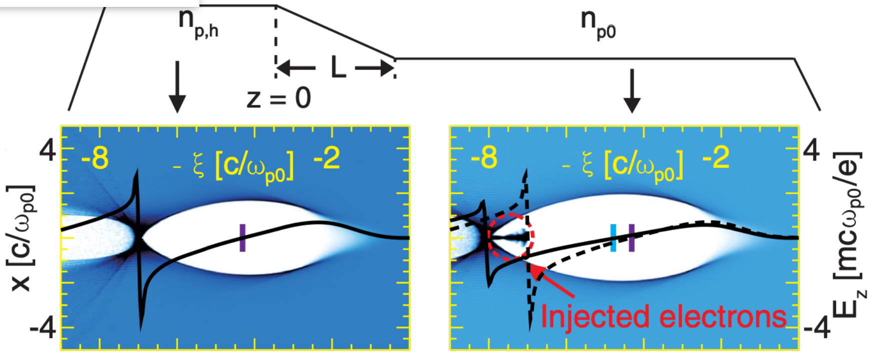



**Next steps: transverse ionization for optimal lens geometry and control, two-bunch data**

# E304: downramp trapping in PWFA for generating ultralow emittance beams

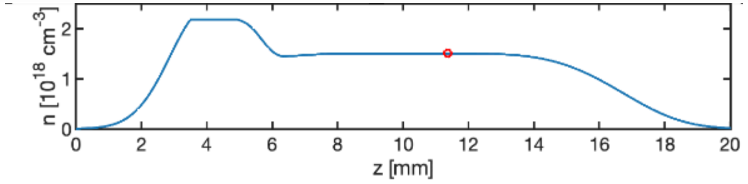
**Concept:** *Xu et al., Phys. Rev. Accel. Beams (2017)*

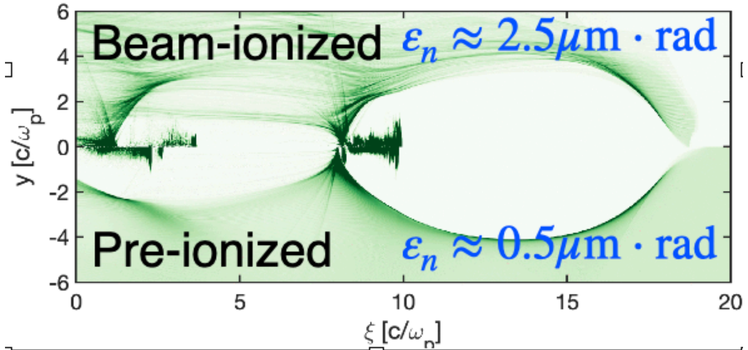



PIC simulation using FACET-II driver and mm scale downramp shows injected bunch with:

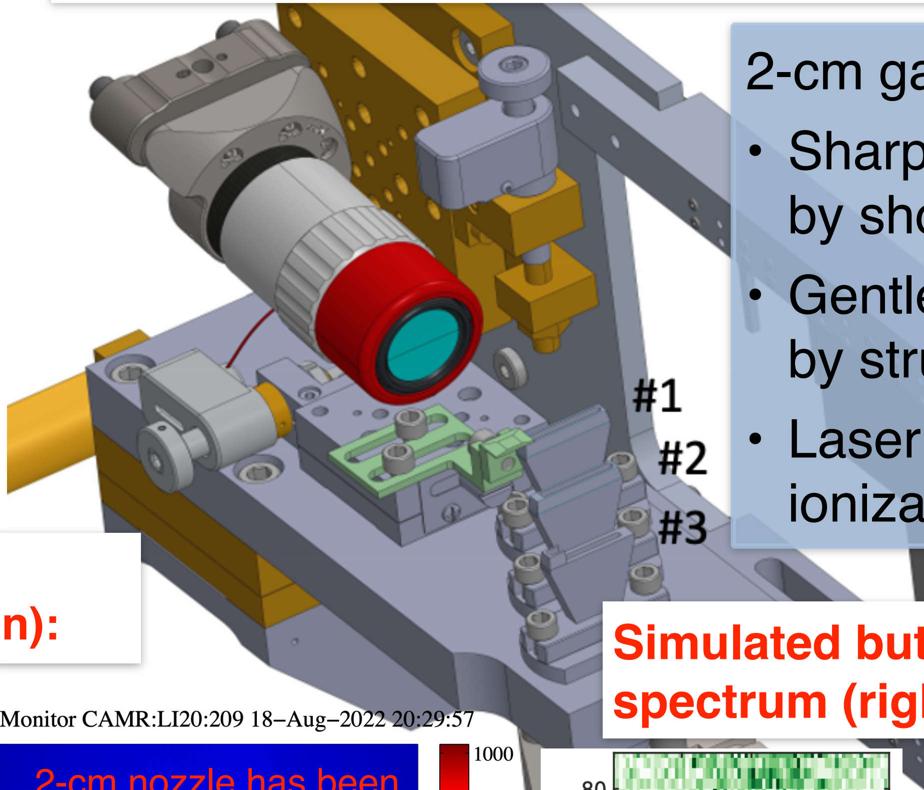
$\varepsilon_n \approx 80\text{nm}\cdot\text{rad},\ B \approx 4\times 10^{18}\text{A/m}^2/\text{rad}^2$

**Plans: understand the key physics leading to ultralow $\varepsilon_n$ (e.g., using beam- vs. laser-ionization):**



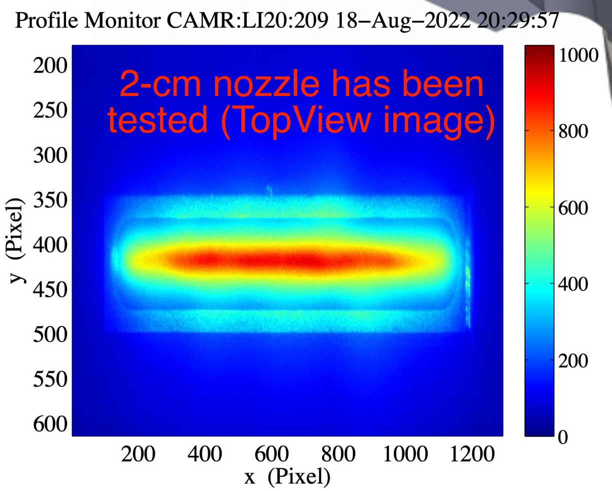




**Progress: plasma targets developed and partially tested**

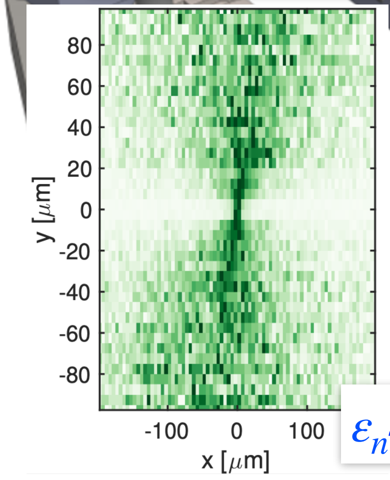



2-cm gas jets

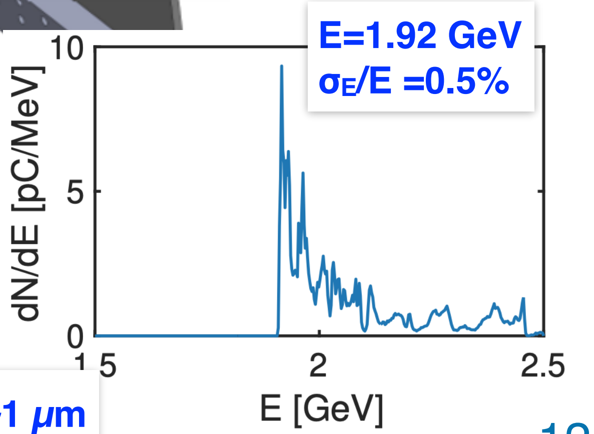
- Sharp downramp (~10 $c/\omega_p$) by shock front
- Gentle downramp (~100 $c/\omega_p$) by structured nozzle
- Laser ionization & beam ionization




**Simulated butterfly image (left) and spectrum (right) of the injected bunch:**




$\varepsilon_n$~1 μm



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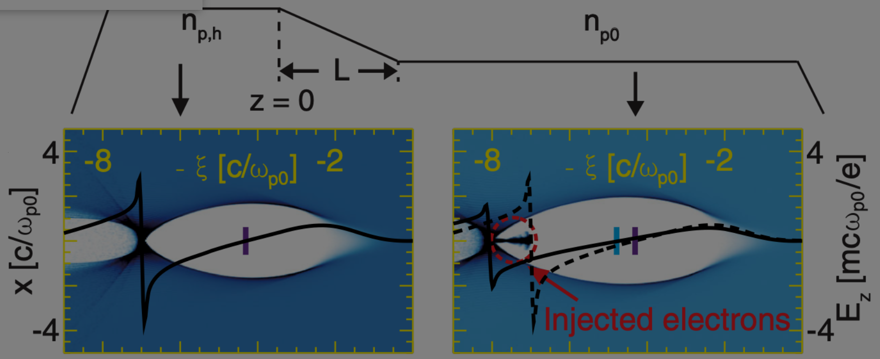


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**Chaojie Zhang M 13:50 WG1**

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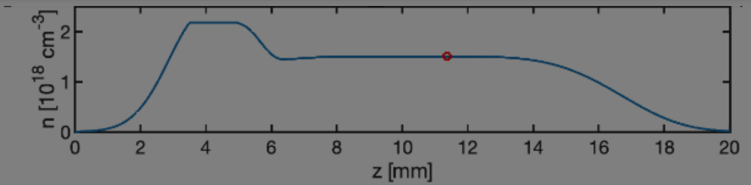


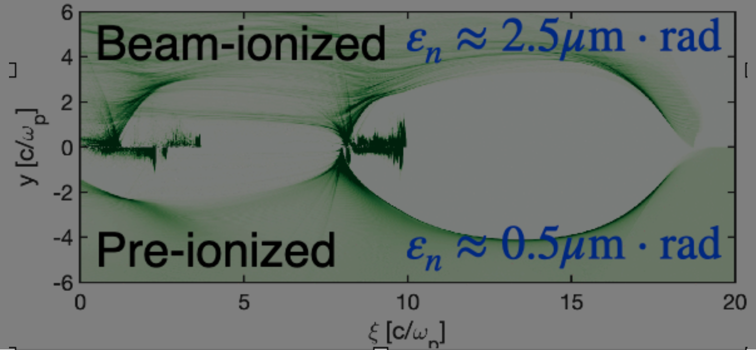


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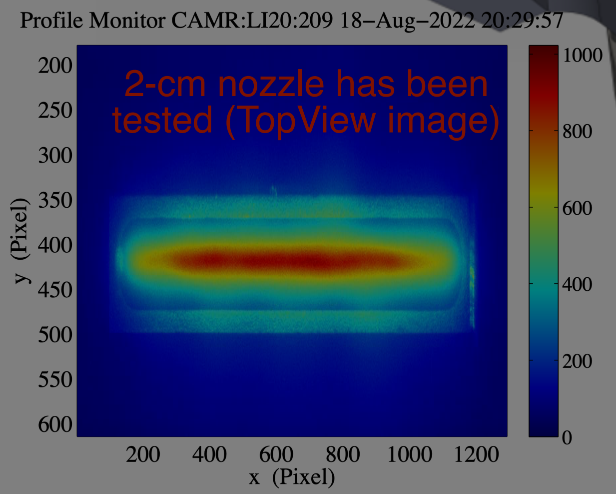


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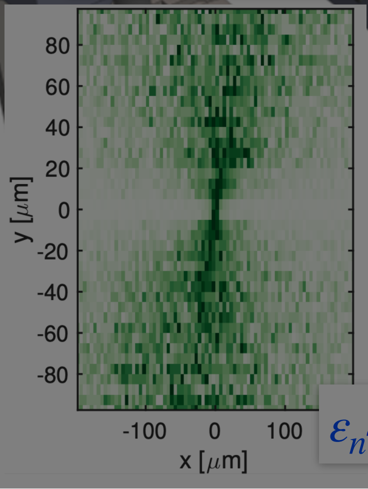


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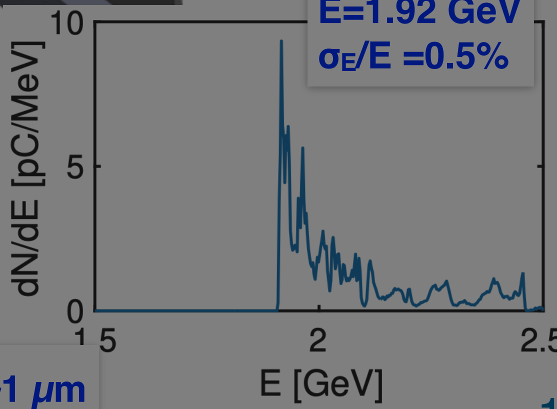
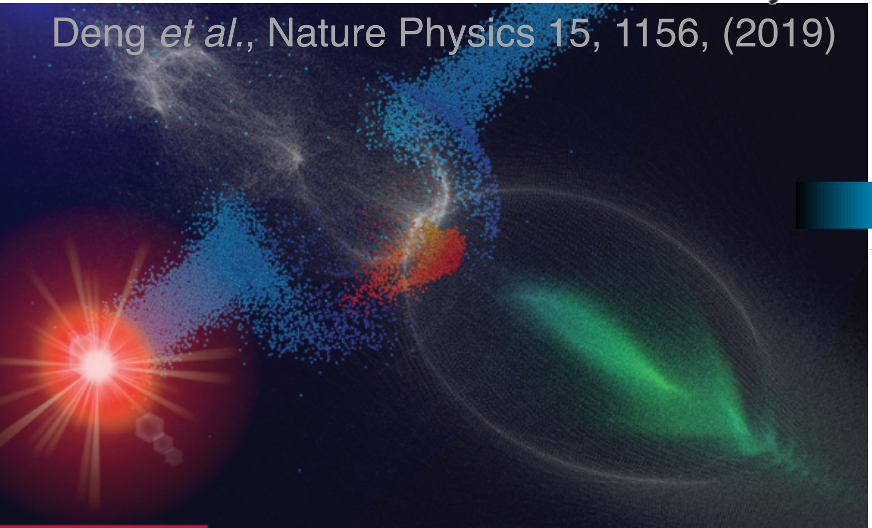


# E-310 Trojan Horse-II

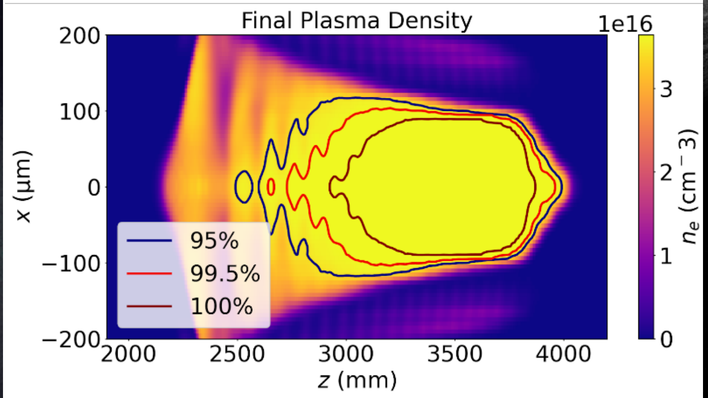
# NeXource (Hidding)

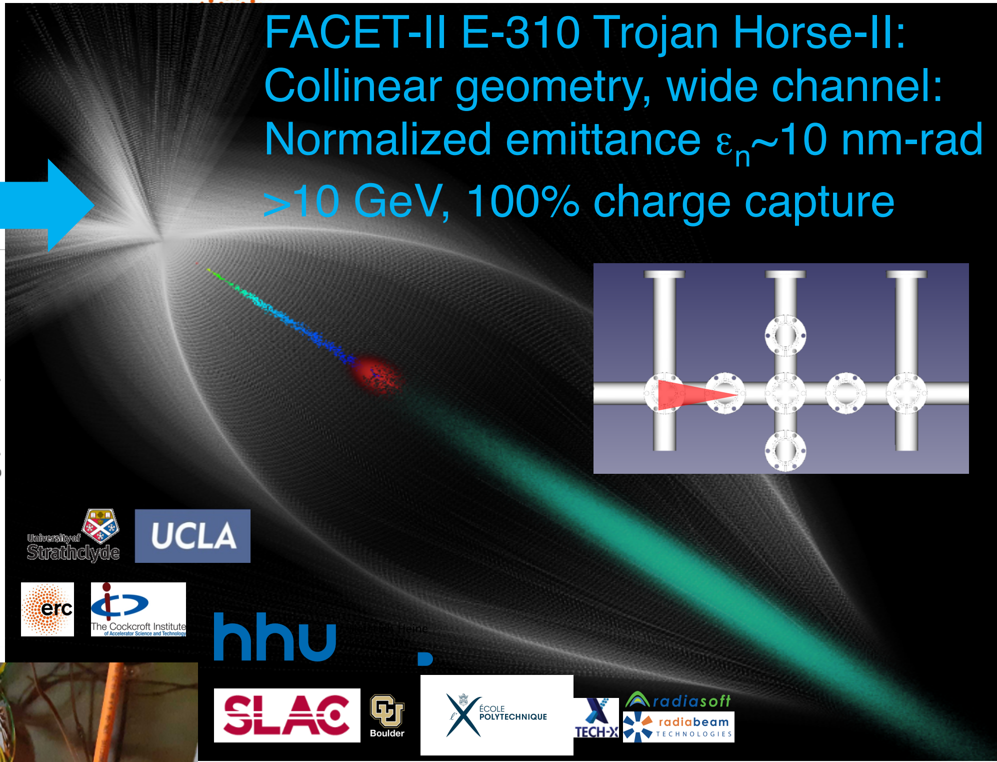


Deng *et al.*, Nature Physics 15, 1156, (2019)

FACET E-210 Trojan Horse: Perpendicular geometry, thin channel bottleneck: $\varepsilon_n$~$\mu$m-rad
~1 GeV, poor charge capture

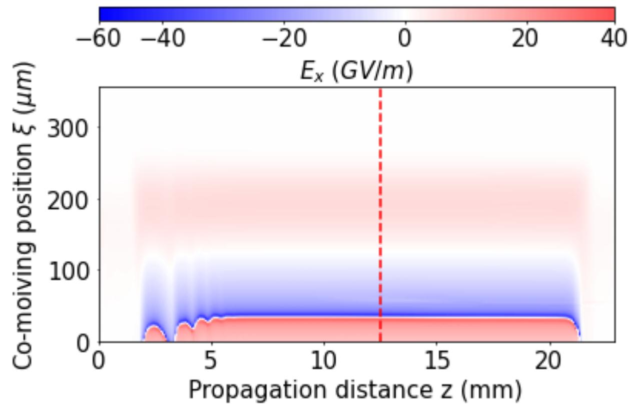
1. Bespoke crossed pipe system to host tailored, wide plasma channel...



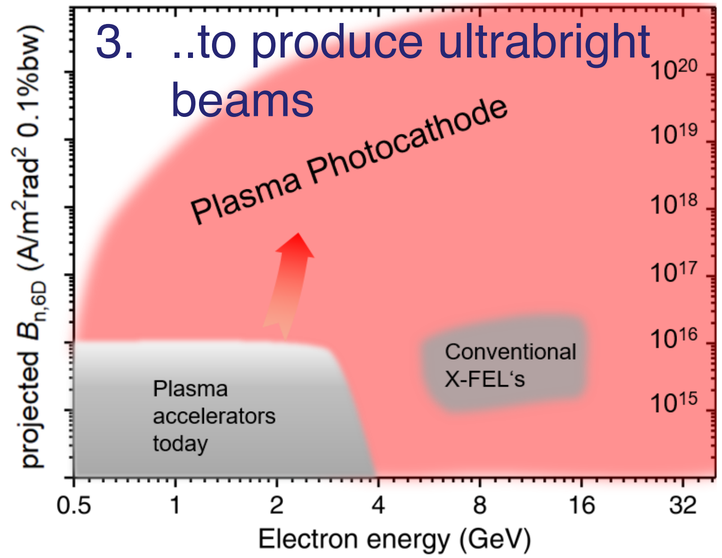



FACET-II E-310 Trojan Horse-II: Collinear geometry, wide channel: Normalized emittance $\varepsilon_n$~10 nm-rad
>10 GeV, 100% charge capture

2. ...to allow stable collinear injection and acceleration...



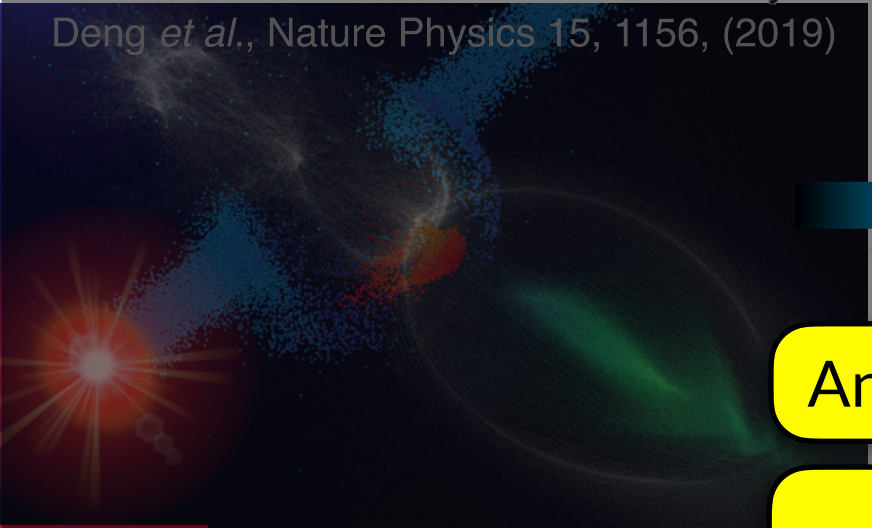

See talks by Andrew Sutherland and Lily Berman



# E-310 Trojan Horse-II

University of Strathclyde UCLA

erc NeXource (Hidding)



Deng *et al.*, Nature Physics 15, 1156, (2019)

THE ROYAL SOCIETY PUBLISHING

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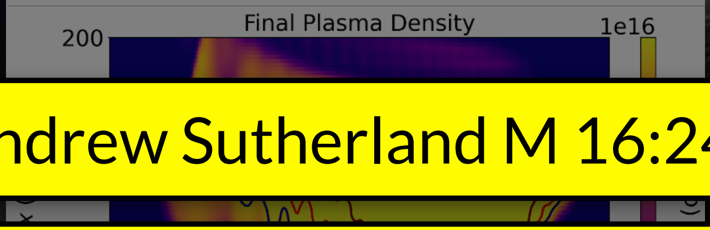


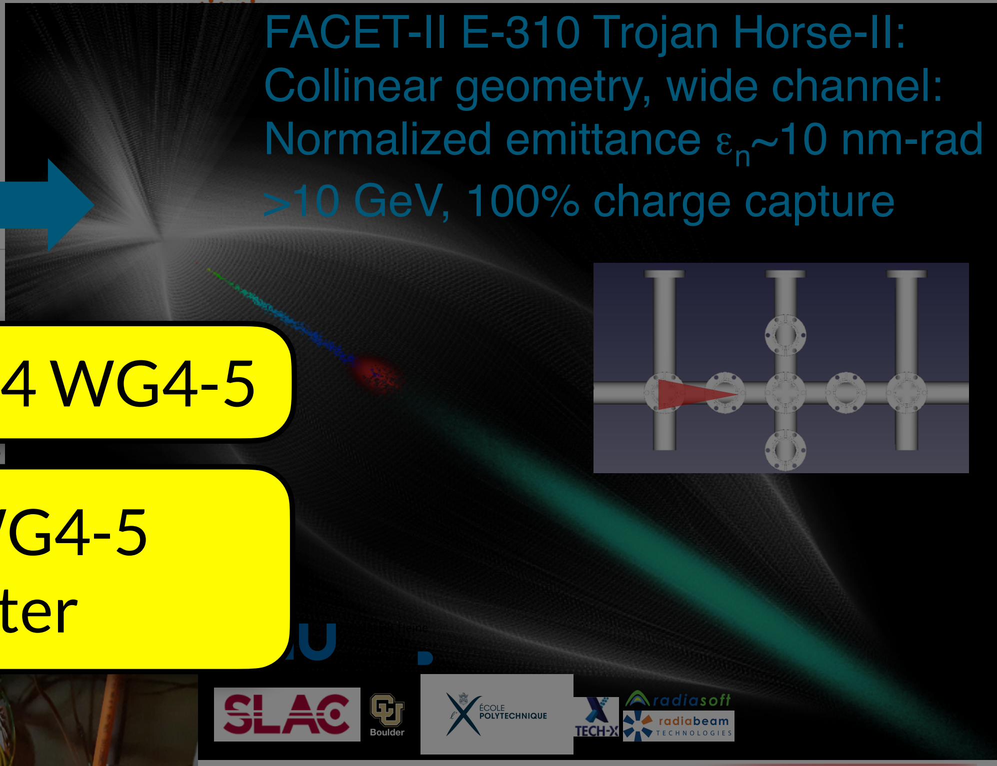

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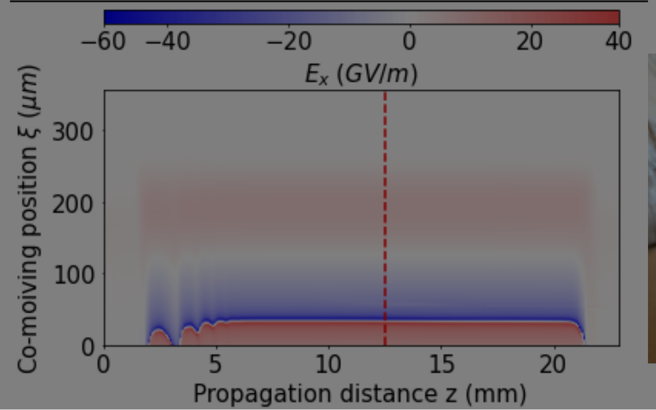
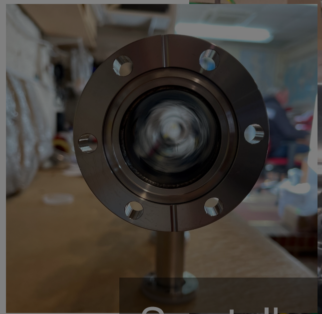
SLAC Boulder ECOLE POLYTECHNIQUE TECH-X radiasoft radiabeam TECHNOLOGIES

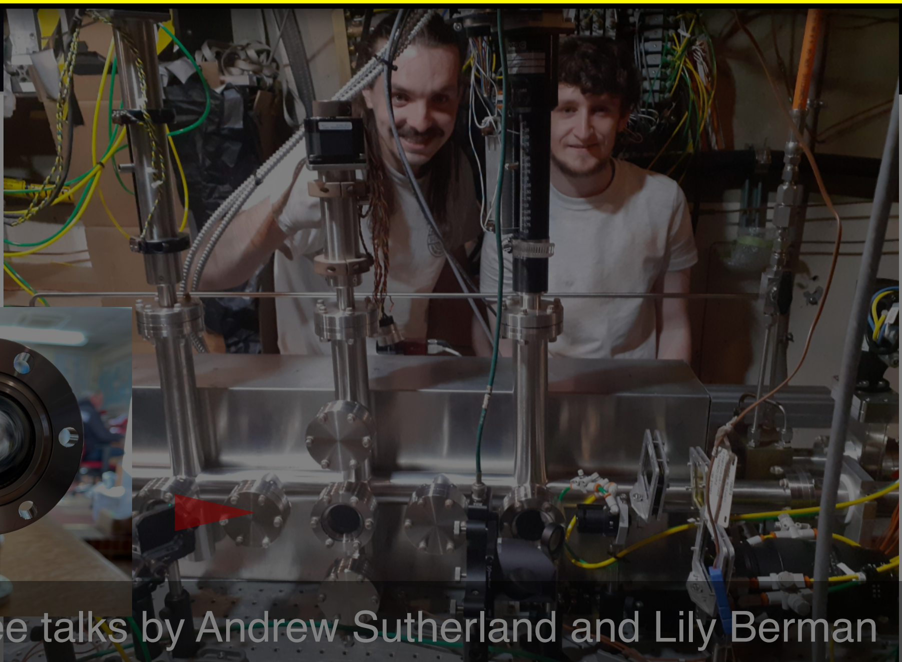
**Andrew Sutherland M 16:24 WG4-5**

**Lily Berman M 16:42 WG4-5**
**Tuesday Evening poster**

2. ...to allow stable collinear injection and acceleration...

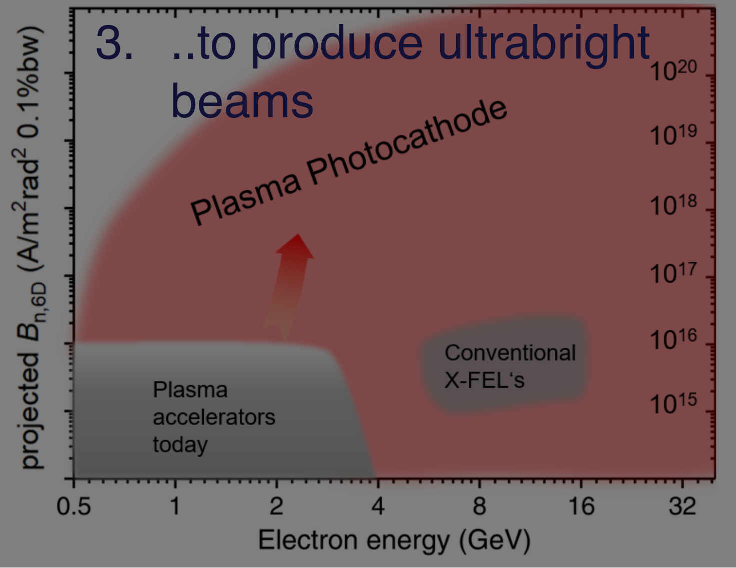




See talks by Andrew Sutherland and Lily Berman

3. ..to produce ultrabright beams



# E338 PAX: Plasma-driven Attosecond X-ray Source

### *Science Goals*

Demonstrate post-plasma sub-fs compression of e- beams

Measure + characterize XUV CSR for compressed e- beam down to 50-100 nm

Using beams from plasma injector, compress + measure coherent XUV at 50 nm or below

### *Phased Approach*

First stage will chirp + compress beams from FACET-II photoinjector

Second stage will compress ultra-high brightness beams generated from plasma injector

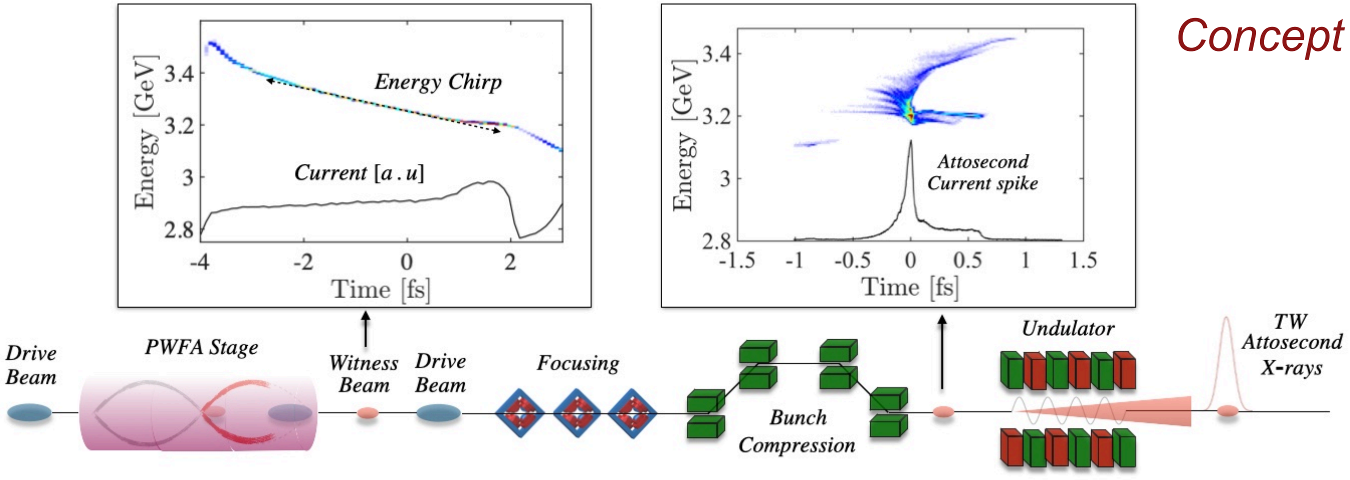
### *Current progress*

UV-vis and XUV spectrometers commissioned in lab

Compressor chicane preliminary design completed. Installation targeting summer-fall 2023

See plenary talk by A. Marinelli, talks in WG7 by C. Emma and R. Hessami

*Concept*



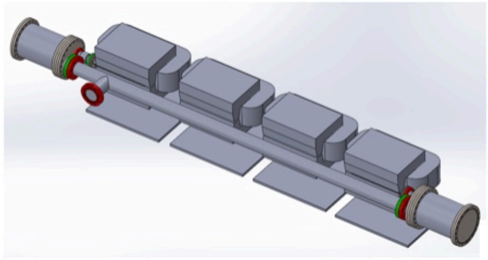

C. Emma et al., APL Photonics, **6**, 076107 (2021)

*FACET-II Experiment Schematic*

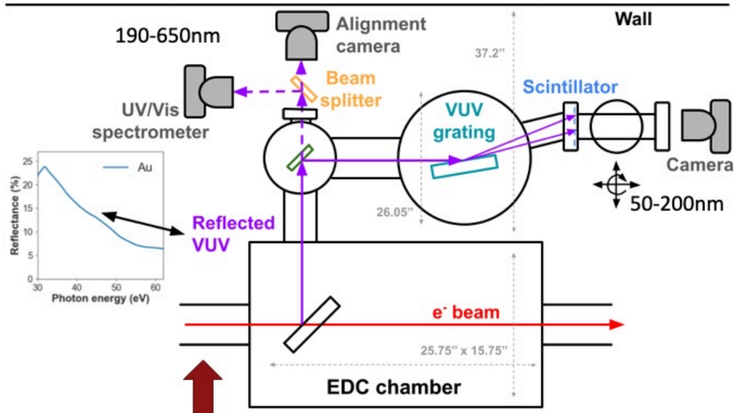
Plasma Sources

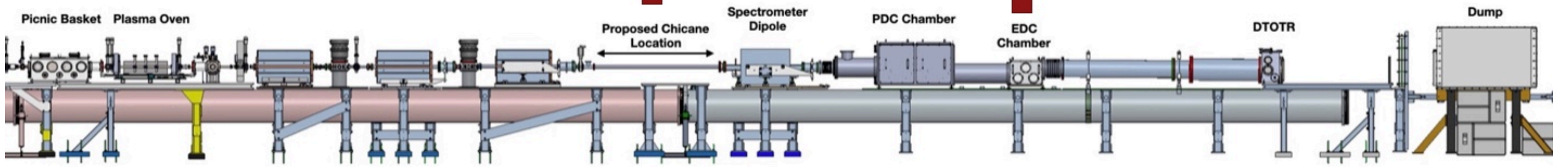
- Gas Jet ne = 1e18 – 1e20 cm^-3
- Li Oven ne = 1e16 cm^-3

Chicane + bypass line design



Spectral Measurement Setup



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Agostino Marinelli F 09:30 Plenary

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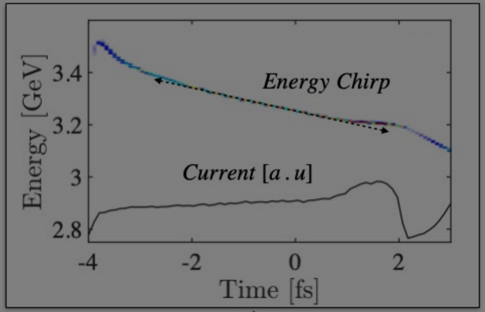


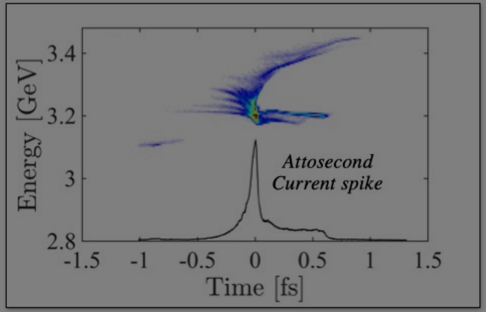


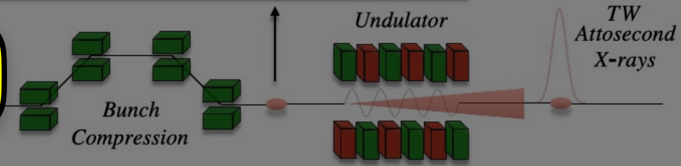


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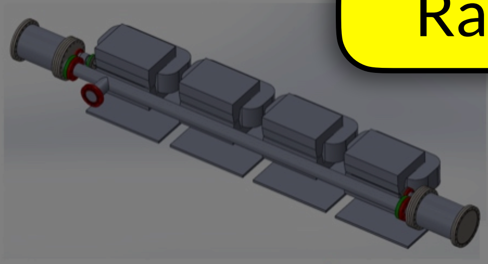
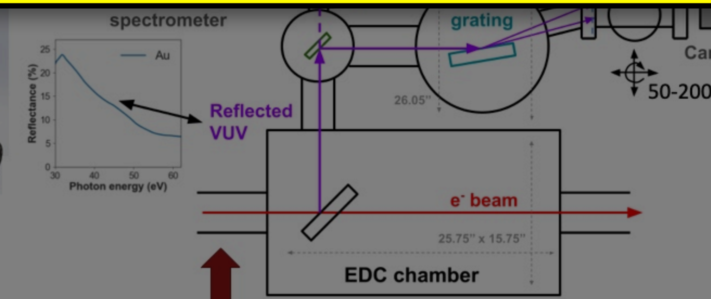
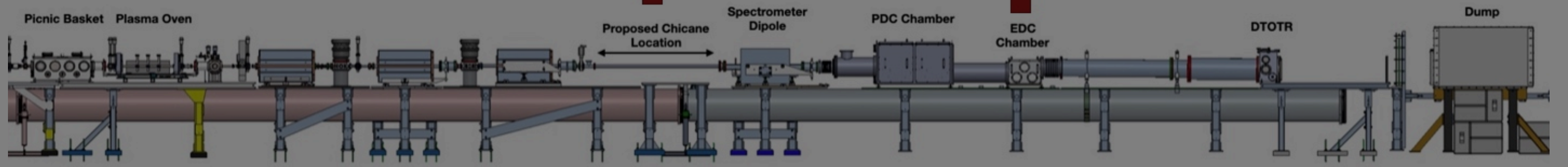


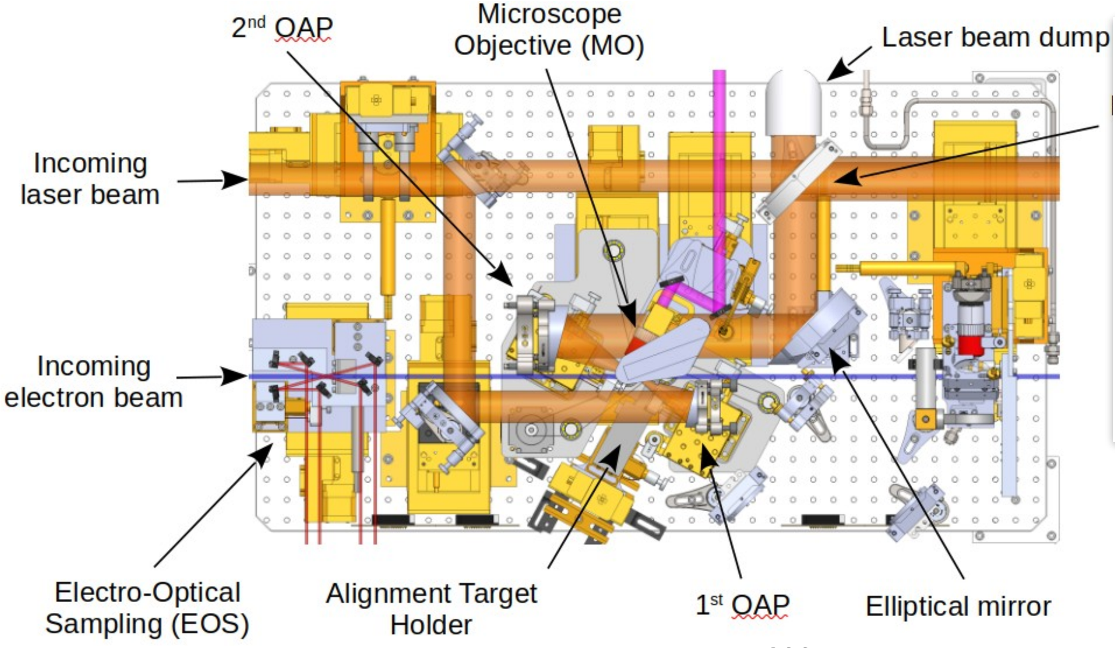
Spectral Measurement Setup

Rafi Hessami M 13:50 WG7

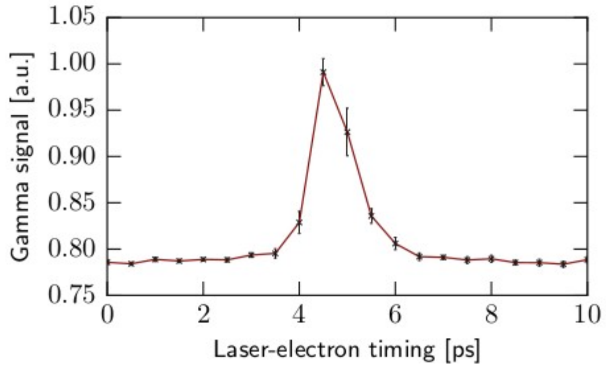


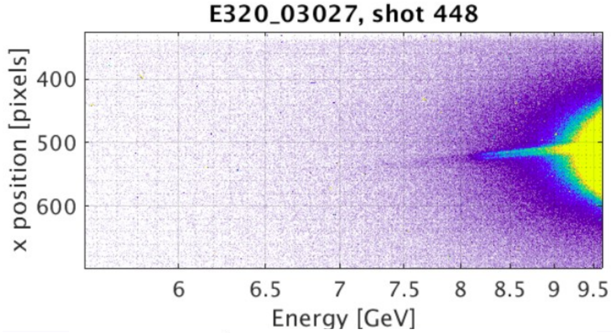
# E-320: Probing Strong-field QED on FACET-II

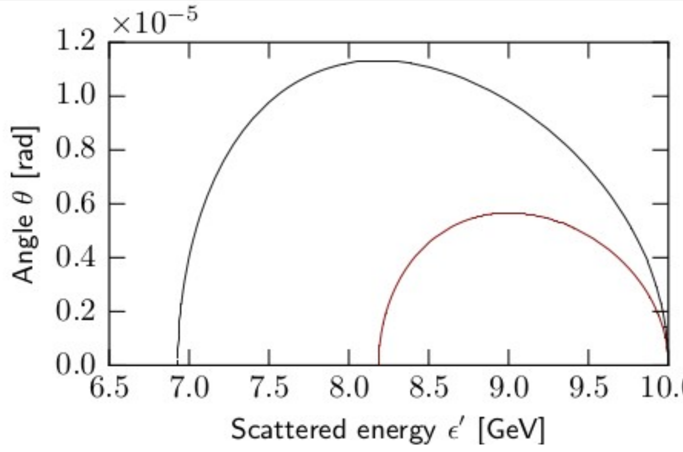



**Electron-laser collisions: gamma signal**



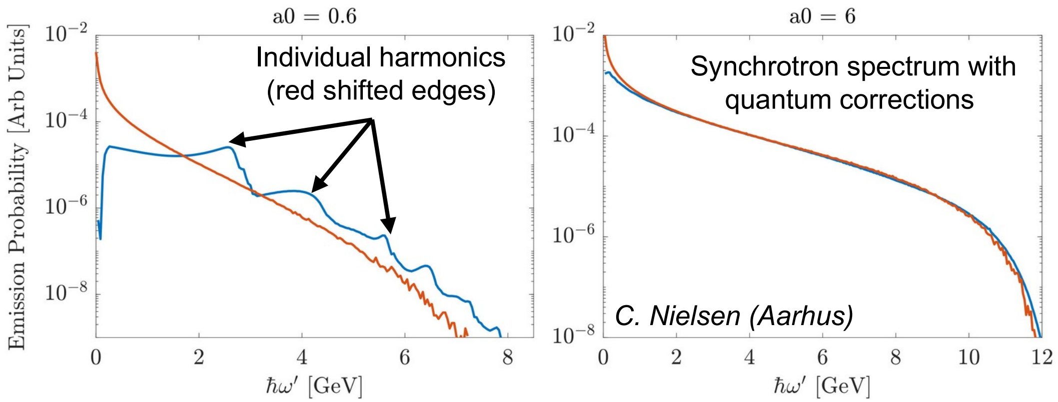

**Scattered electrons – 1st and 2nd harmonic**




- Observe the transition from multi-photon Compton scattering ($a_0$~0.4, χ~0.04) to quantum synchrotron radiation ($a_0$~4, χ~0.4)
- Witness QED-vacuum breakdown via tunneling electron-positron pair production

**2023: Transition from perturbative to non-perturbative regime**




**Nest steps: push the laser intensity up (energy, duration, OAPs) and push the backgrounds down**

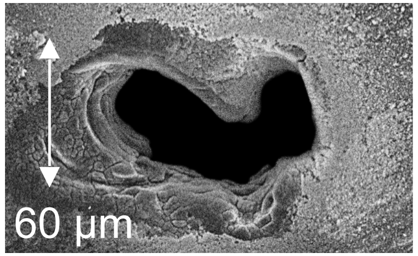
# Extreme Beams Can Be Challenging

- FACET-II has unique challenges related to high intensity beams that require new approaches

Be vacuum window damage at FACET expected for 2nC with

$$\sigma_x = \sigma_x = \sigma_x = 20\mu m$$

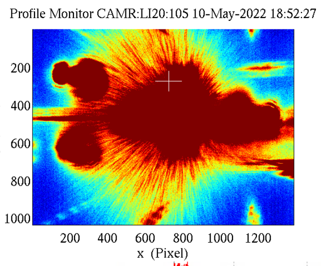
$$P \propto \frac{Q^2}{\sigma_r^2 \sigma_z^2} F\left({}^{\sigma_r}/_{\sigma_z}\right)$$



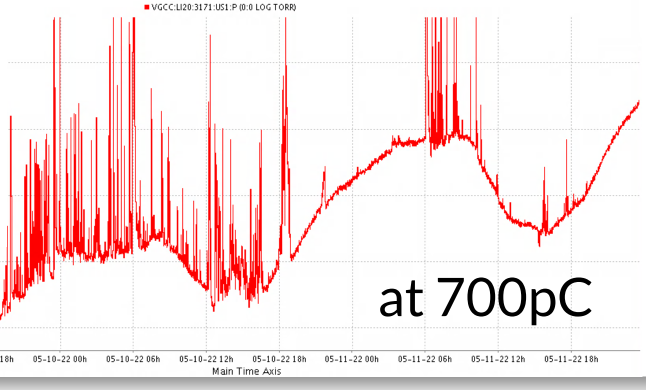

[SLAC-PUB-15729]

New threshold for micro bunched beams at FACET-II?

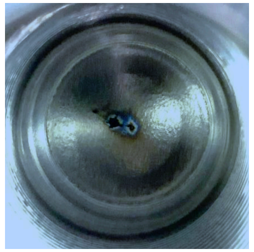
COTR




Vacuum activity

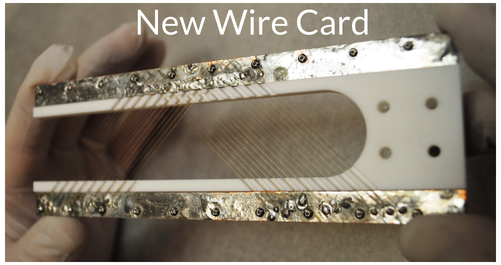



Be window damage



at 700pC

Traditional diagnostics become consumables

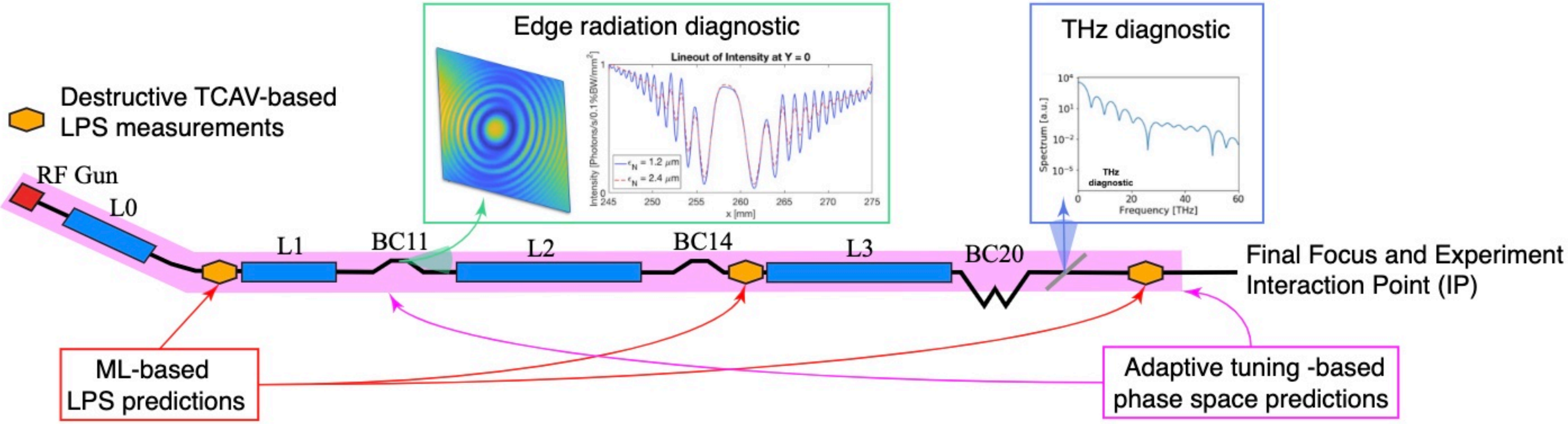


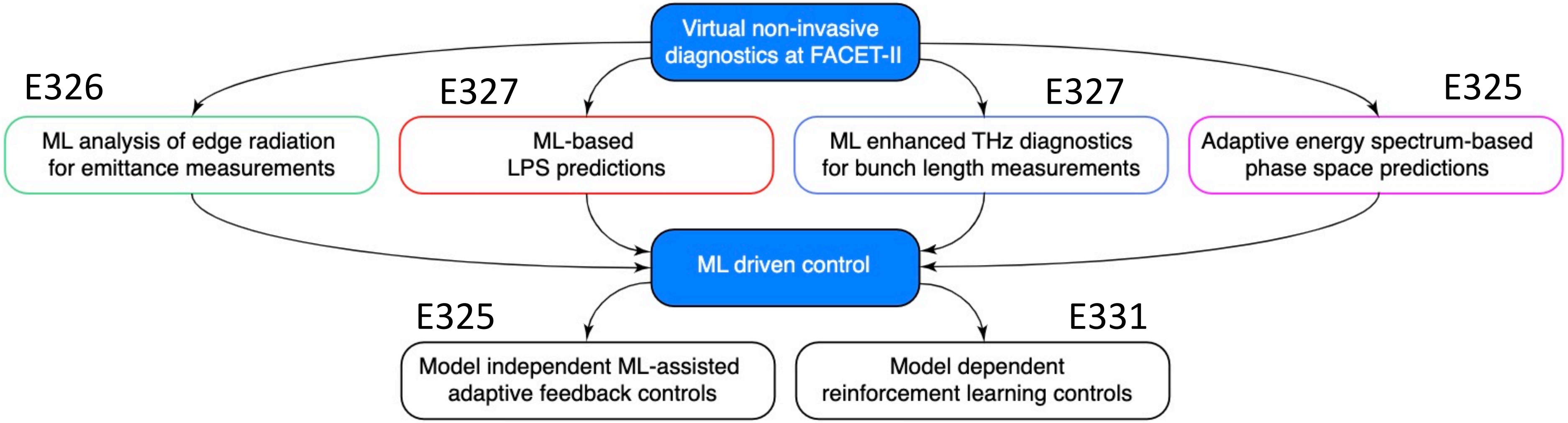


- Laser heater installation (Q4FY22) will mitigate microbunching
- Differential pumping system will remove vacuum windows from experimental area

**New challenges require flexibility in planning and hardware installations that allow pivoting experimental programs based on hardware availability**

# Landscape of AI/ML Activities at FACET-II

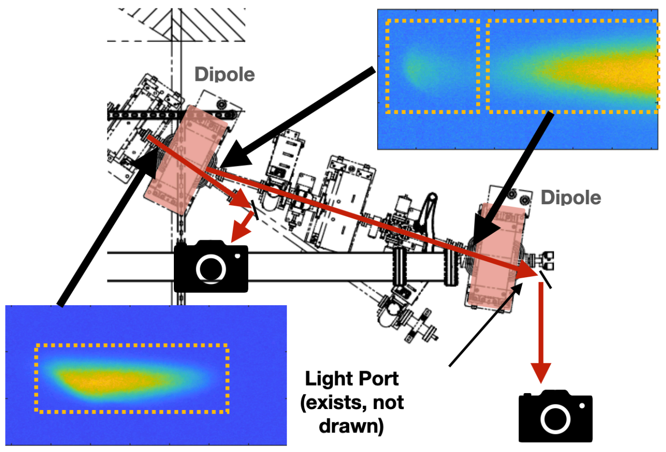


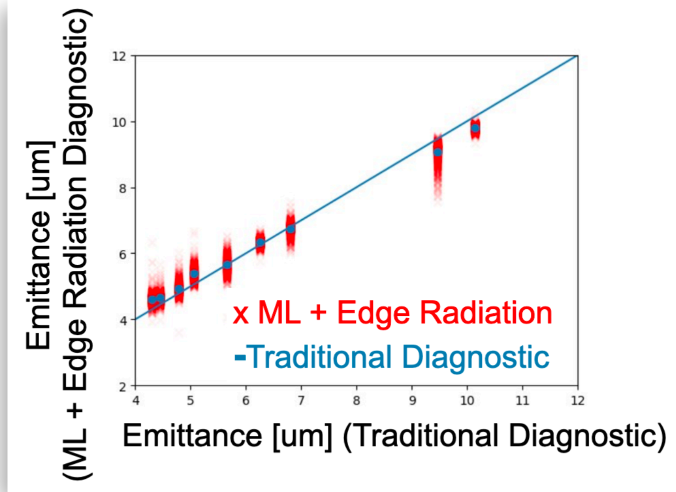



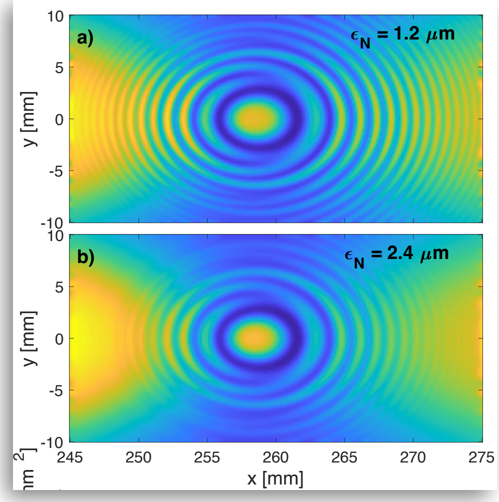

**Synergistic experiments, individual success enhances all research + facility operation**

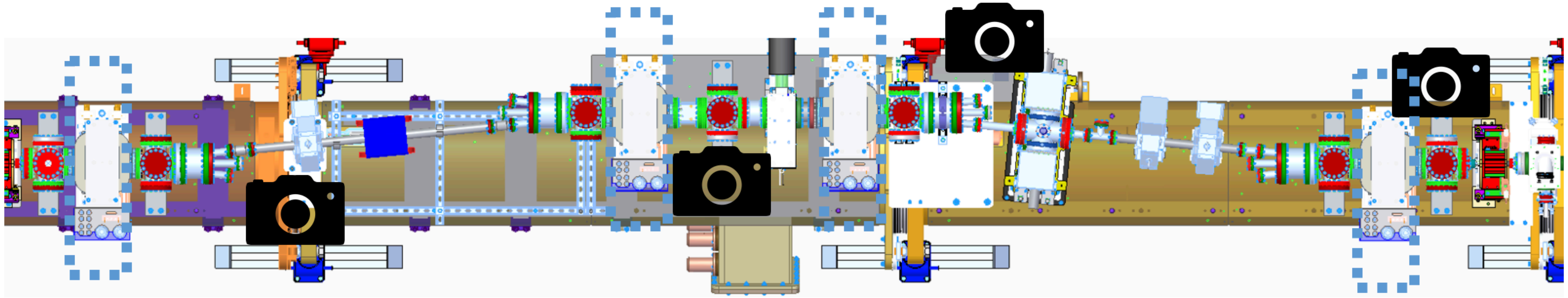
# E-326: Diagnostics Optimized for Artificial Intelligence

- Single shot beam size and divergence measurements give emittance in FACET-II injector dogleg
- Future steps:
  - Commission single shot emittance from fringes in BC11 bunch compressor (installation underway)



**Next steps: bring the analysis 'online' for single shot emittance monitoring and optimization**

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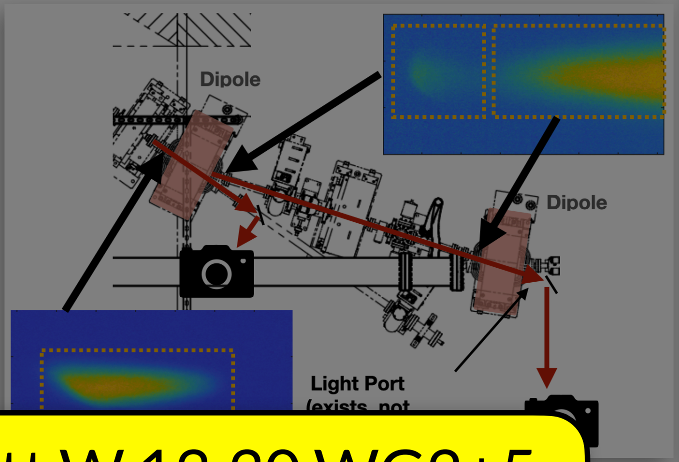
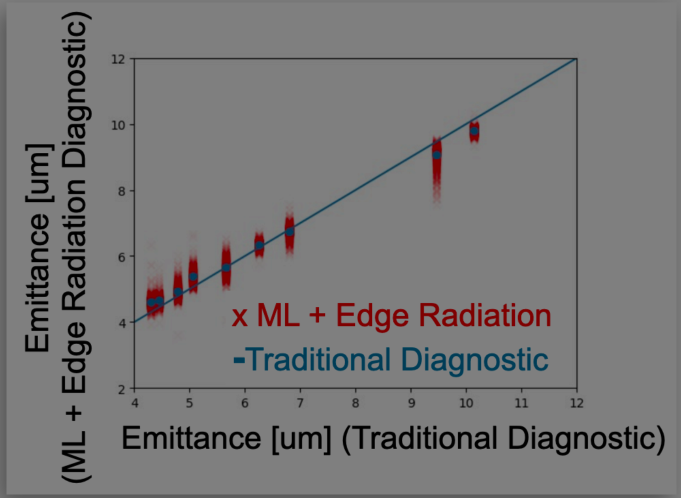
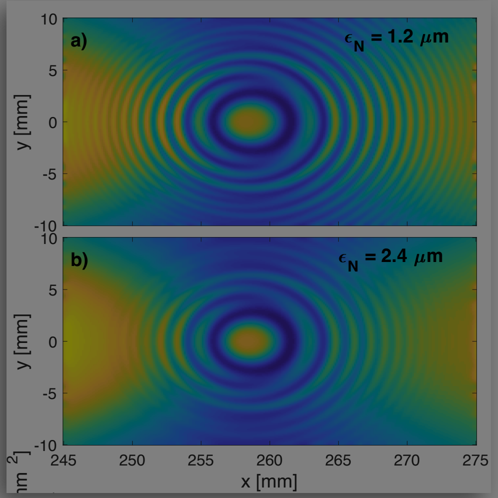
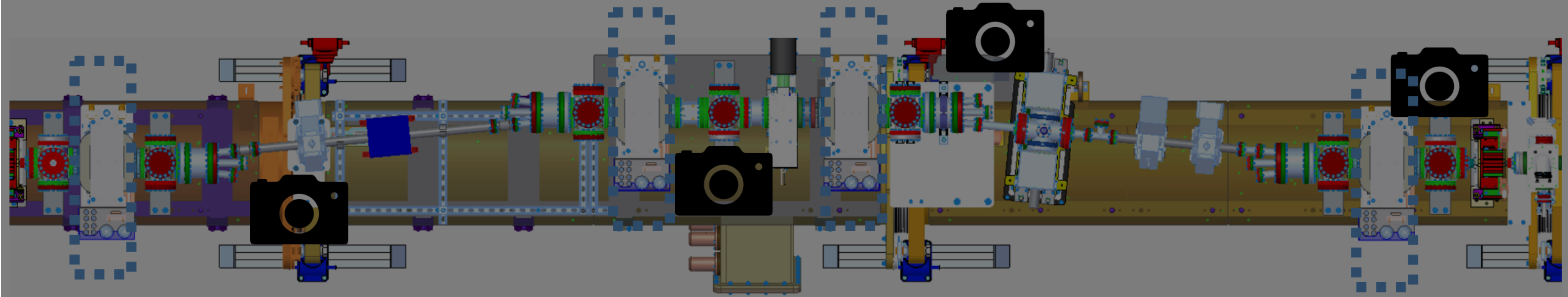
Robbie Watt W 13:30 WG2+5



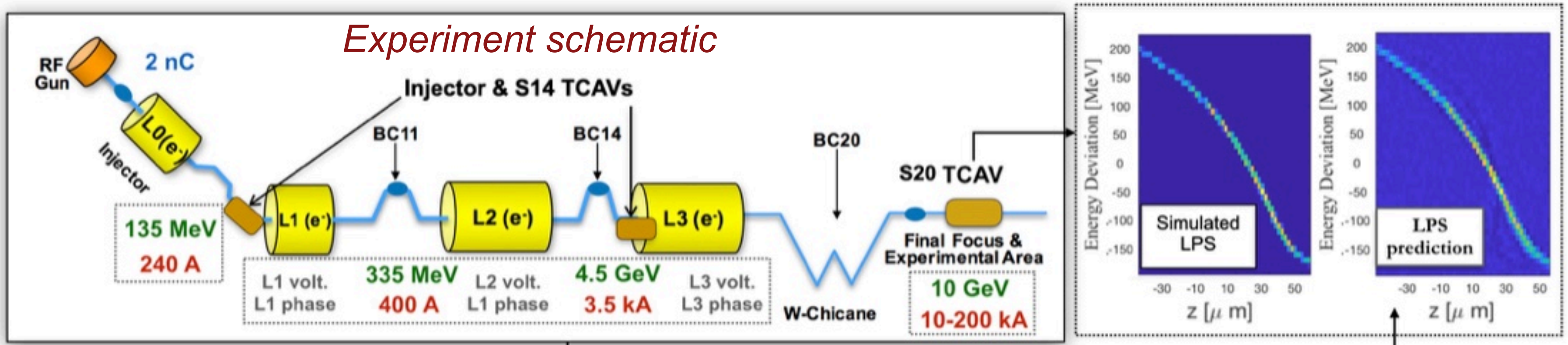
**Next steps: bring the analysis 'online' for single shot emittance monitoring and optimization**

# E327 - Virtual diagnostic for longitudinal phase space prediction and optimization

***Science Goals***

Implement a single-shot non-destructive ML diagnostic to predict the e-beam LPS along the linac.

Use the ML-diagnostic to customize/ control the LPS for different experiments.

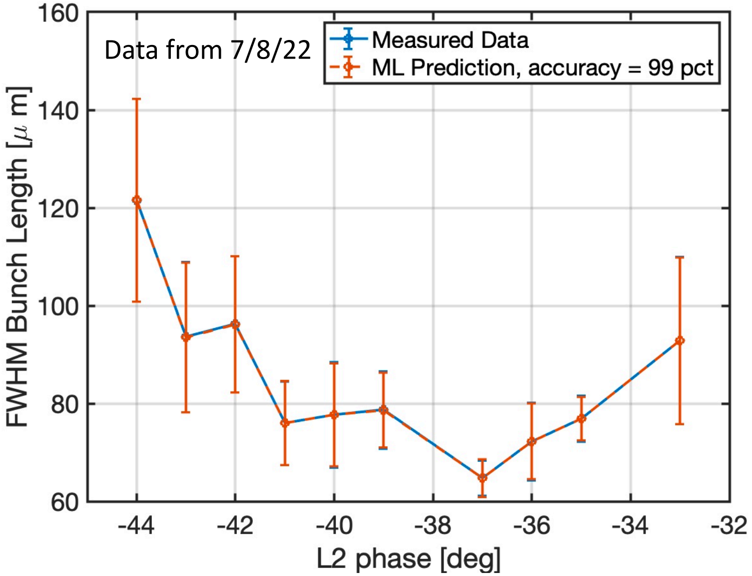


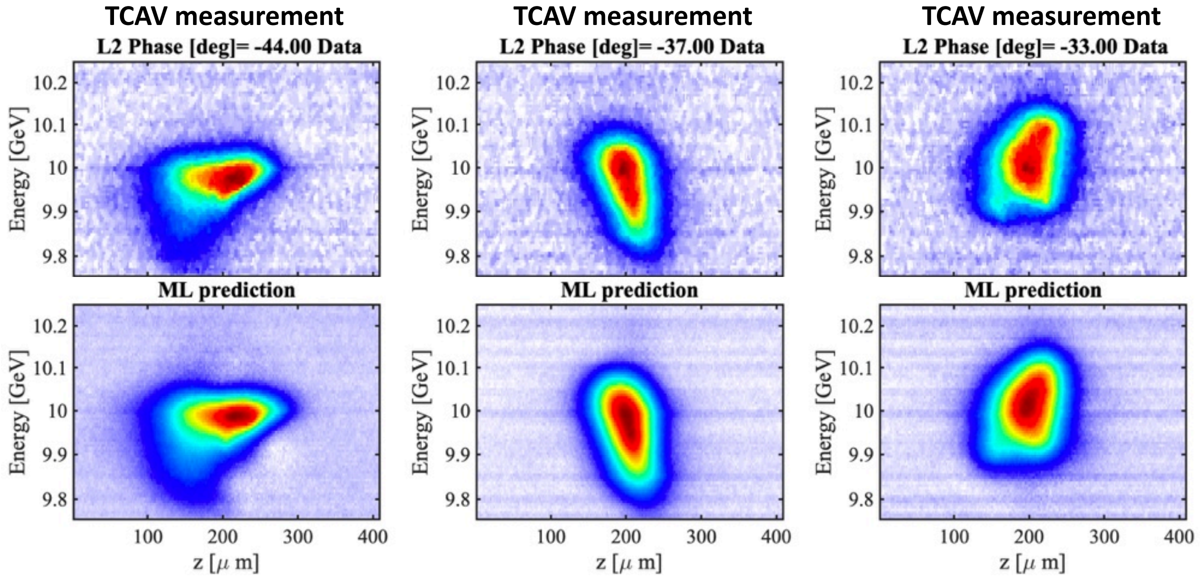

C. Emma and A. Edelen et al.,PRAB 21 112802 (2018)

## *First results*

Neural network prediction of FWHM bunch length and LPS in FACET experimental area

See contributed talk by C. Emma in WG5




ML based LPS diagnostic feasibility demonstrated at FACET-II.
Upcoming work focused on robustness + multiple locations/beam configurations

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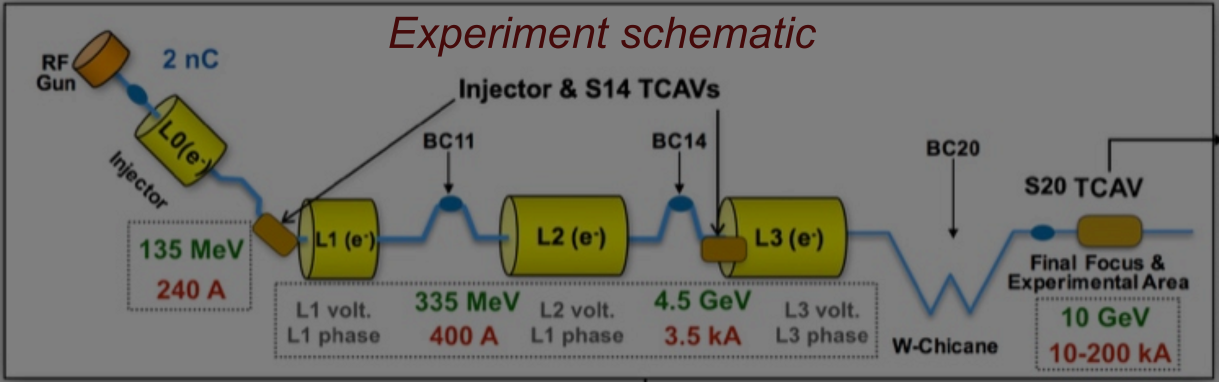
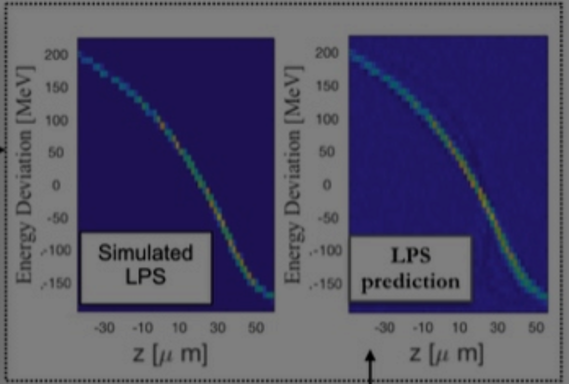



C. Emma and A. Edelen et al.,PRAB 21 112802 (2018)

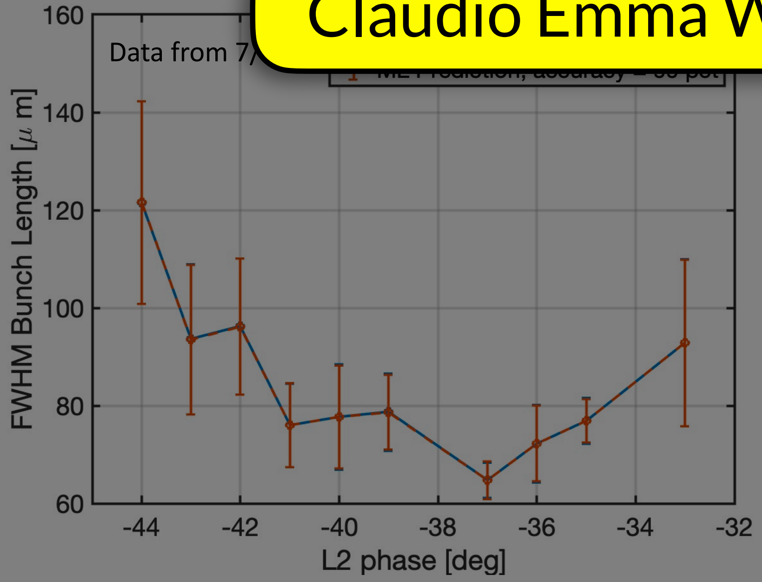
ML based virtual diagnostic

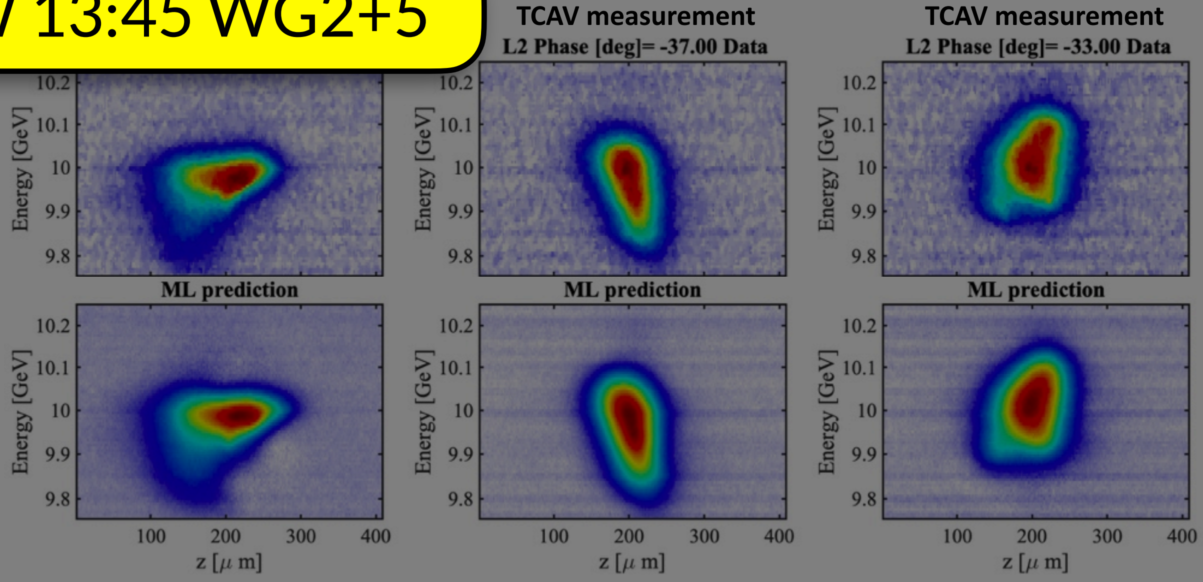
Claudio Emma W 13:45 WG2+5

## *First results*

Neural network prediction of FWHM bunch length and LPS in FACET experimental area

See contributed talk by C. Emma in WG5




ML based LPS diagnostic feasibility demonstrated at FACET-II.
Upcoming work focused on robustness + multiple locations/beam configurations

*See Auralee Edelen for details*

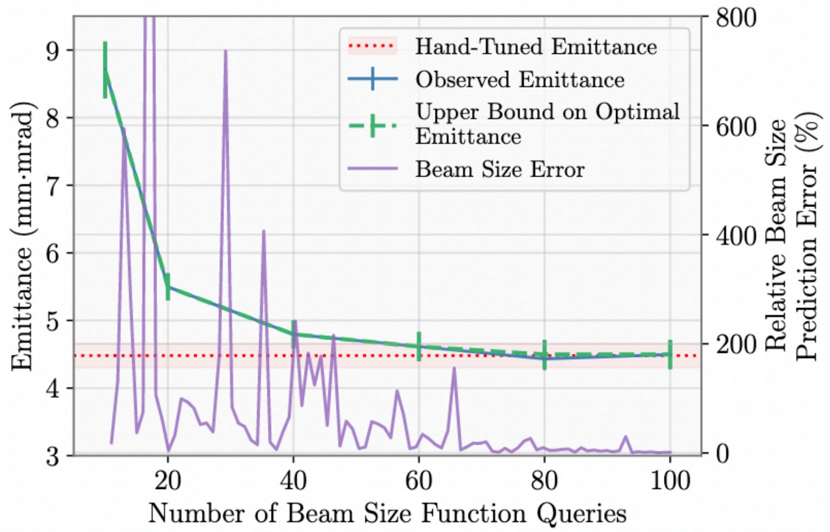
# E331: Machine Learning for Optimization and Control

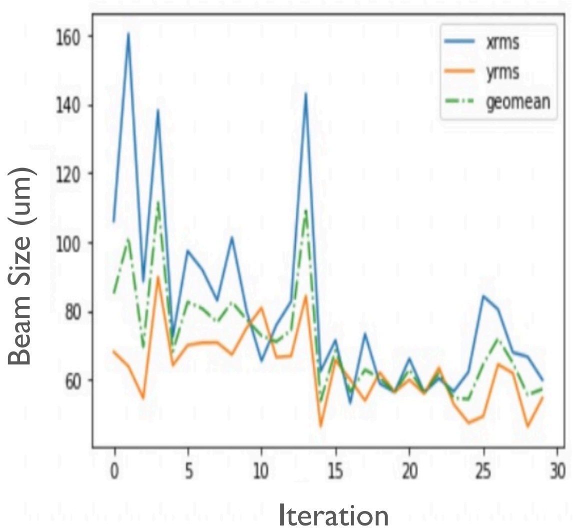
*E331 aims to develop and deploy new algorithms for rapid beam customization and high beam quality*

Highlights so far:

- Automatic, efficient characterization of injector using smart exploration algorithms (10-dim input space)
- New algorithm for 20x speedup in emittance tuning
- Tuning of beam size in IP using sextupole movers

→ **See C. Emma's talk for details (Wed. at 1:45 pm)**



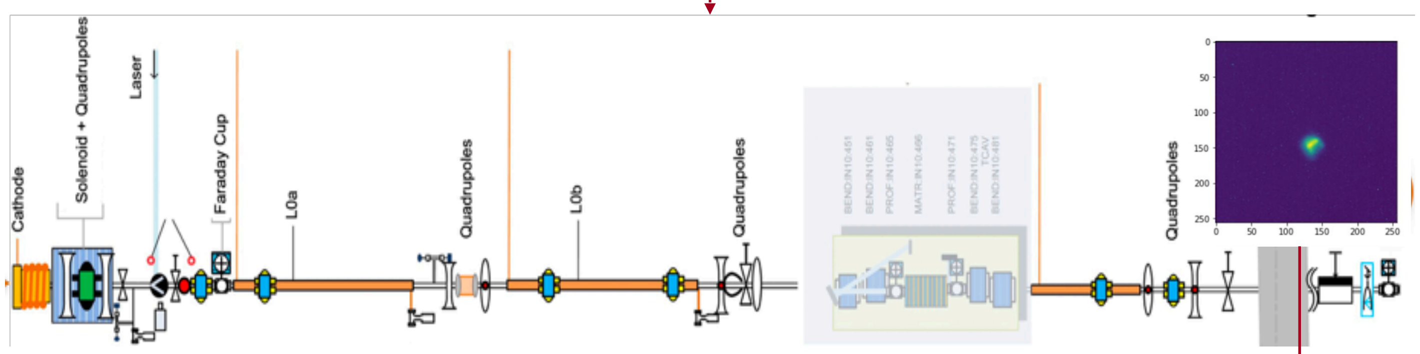




https://arxiv.org/abs/2209.04587

*Setting changes on 10 variables (solenoid, bucking coil, corrector quads and matching quads)*

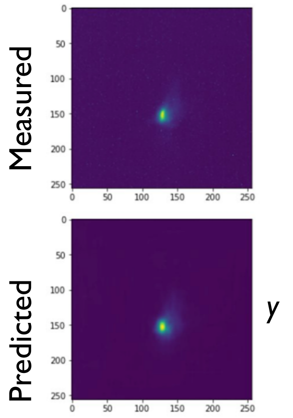
**Automatic Exploration**
*(constrained to useful values of emittance and match)*

**Comprehensive ML Models of Injector**




**FACET-II Injector**

*x-y emit, match, and beam images*



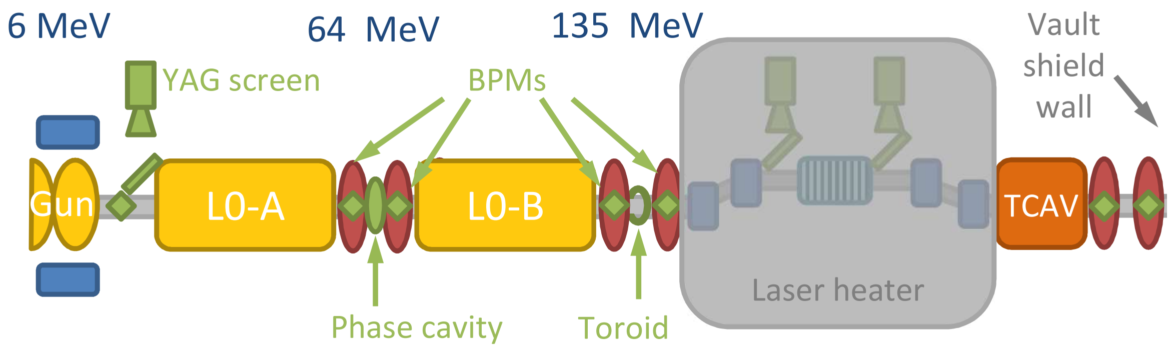

*Algorithm: R. Roussel et al., Nat. Com., Vol. 12, 5612 (2021)*

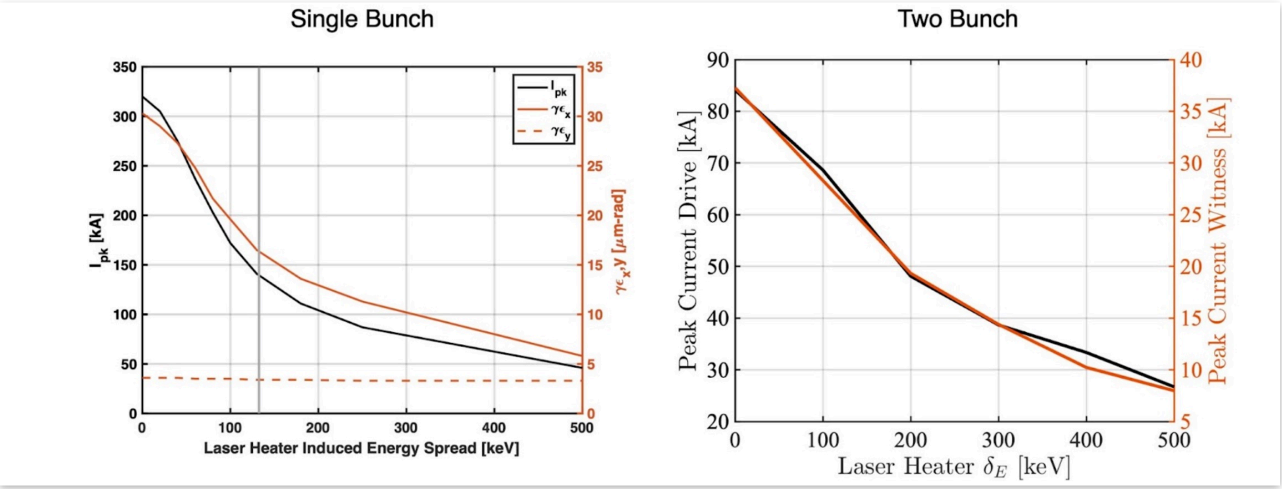
Highly successful first use-cases of AI/ML in optimization of FACET-II → now expanding to more tuning tasks

# Minimize Configuration Changes and Gradually Introduce New (more extreme) Capabilities in the Beams and Hardware

**Three machine configurations** have been identified and are being developed to satisfy all experiments with modest adjustment of parameters:

- **Single bunch** with high peak current (50-300kA, 0.1-10m betas) – 2022
- **Two-bunch** (1.3/0.6nC, 30/15kA , 150μm separation, 5-50cm betas) – 2023
- **Highest Energy low backgrounds** (13GeV, $\sigma_z$ = 100μm, 1m betas) – 2023+




- **Laser Heater** IFEL process increases beam energy spread to mitigate micro bunching instabilities and control maximum peak current
- **Injector TCAV** will ensure correct time structure for two-bunch operation

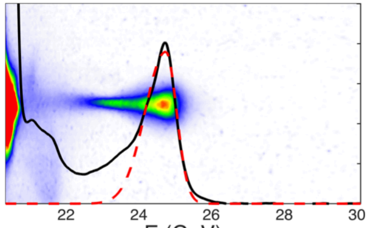
# FACET-II Positron Upgrade

Severin Diederichs Plenary M 10:40

Positrons represent a unique scientific opportunity with global enthusiasm reflected in European Strategy updates, Snowmass preparations and recent workshops

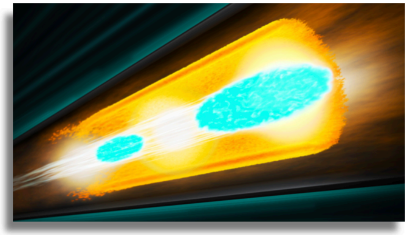
**Demonstrated @ FACET**

**Non-linear wakes** in self-loaded regime of PWFA



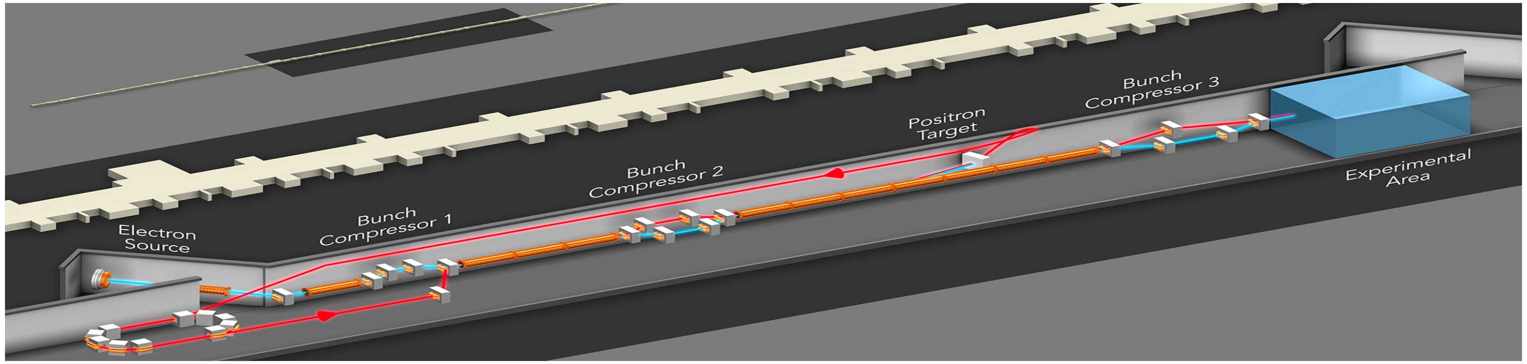

Corde et al., ***Nature*** August 2015

**Hollow Channel Plasma** Wakefield Acceleration



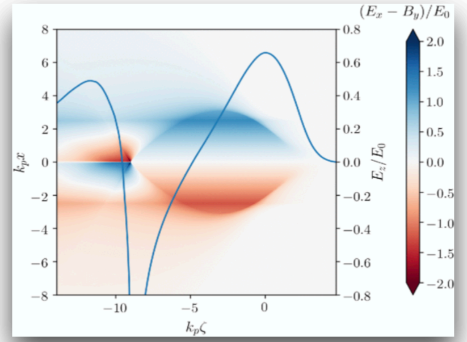
Gessner et al., ***Nature* Communications** 2016
Lindstrom et al., ***Phys. Rev. Lett.*** 2018

- Base infrastructure exists




**Proposed @ FACET-II**

- Finite-channel plasmas are predicted to preserve emittance
- LBNL, DESY and SLAC collaboration




S. Diederichs et al., Phys. Rev. Accel. Beams 22, 081301 (2019)

Potential for experiments on positron PWFA has stimulated creative new ideas

**With a commitment and strong support from SLAC the plan could be executed on 5 year time scale without interruption of existing user program**

# FACET-II | Facility for Advanced Accelerator Experimental Tests

**SLAC has immediate openings for Research Associate (Postdoc) and Associate Staff at FACET-II**

**Overview:**

SLAC National Accelerator Laboratory seeks a Research Associate (Postdoc) and Associate Scientist to join the Advanced Accelerator Research Department within the FACET and Test Facilities Division. The Advanced Accelerator Research Department develops and executes experiments in high-gradient plasma acceleration using the unique facilities at the SLAC National Accelerator Laboratory including FACET-II. FACET-II is a National User Facility in the middle kilometer of the SLAC linear accelerator facility that supports experimental programs combining high energy electron beams and their interaction will lasers, plasmas and solids. The successful candidate will work with other physicists, postdocs, and graduate students from SLAC and external collaborations to develop, conduct and analyze experiments at FACET-II.

For more information or to apply, please go to the following URLs:

**Postdoc:**

https://erp-hprdext.erp.slac.stanford.edu/psp/hprdext/EMPLOYEE/HRMS/c/HRS_HRAM_FL.HRS_CG_SEARCH_FL.GBL?Page=HRS_APP_JBPST_FL&Action=U&FOCUS=Applicant&SiteId=1&JobOpeningId=5057&PostingSeq=1

**Associate Staff:**

https://erp-hprdext.erp.slac.stanford.edu/psp/hprdext/EMPLOYEE/HRMS/c/HRS_HRAM_FL.HRS_CG_SEARCH_FL.GBL?Page=HRS_APP_JBPST_FL&Action=U&FOCUS=Applicant&SiteId=1&JobOpeningId=5140&PostingSeq=1

Alternatively, go to https://careers.slac.stanford.edu and search for **Job ID 5057 and 5140** respectively.

**Please contact Mark Hogan for more information at hogan@slac.stanford.edu**

# Presenting on Behalf of Many Collaborations and Colleagues

## E300 Collaboration

- Presenting on behalf of the E300 collaboration:
  - PIs: C. Joshi (UCLA) and M. Hogan
- SLAC team: J. Allen, R. Ariniello, C. Clarke, C. Emma, E. Gerstmayr, S. Gessner, B. O'Shea, D. Storey, G White, M. Hogan

FACET-II Facility for Advanced Accelerator Experimental Tests

AAC'22, Nov 6-11, 2022 D. Storey E300 – Progress towards Energy Doubling & Emittance Preservation through PWFA at FACET-II 2

## E-304 Collaborations

UCLA: C. Joshi, K. Marsh, W. B. Mori, Y. Wu, Z. Nie, H. Fujii

SLAC: X. Xu, M. Hogan, V. Yakimenko, FACET-II staff

loa: Sebastien Corde's group

CU: Mike Litos' group

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## E-305/E-332 collaboration and institutions

I. Andriyash, S. Corde, M. Gilljohann, A. Knetsch, O. Kononenko, Y. Mankovska, A. Matheron, P. San Miguel Claveria, V. Zakharova

C. Keitel, S. Montefiori, A. Sampath, M. Tamburini

X. Davoine, J. Faure, L. Gremillet, S. Passalidis

H. Ekerfelt, C. Emma, F. Fiuza, E. Gerstmayr, S. Gessner, M. Hogan, A. Marinelli, J. Peterson, B. O'Shea, D. Storey, X. Xu, V. Yakimenko

C. Joshi, K. Marsh, W. Mori, N. Nambu, Z. Nie, Y. Wu, C. Zhang

R. Ariniello, J. Cary, C. Doss, K. Hunt-Stone, V. Lee, M. Litos

E. Adli

J. Yan, N. Vafaei-Najafabadi

AAC'22, Nov 6-11, 2022 30

## E-31x Collaboration

University of Strathclyde; Tech-X; radiasoft; radiabeam technologies; hhu Heinrich Heine Universität Düsseldorf; UCLA; The Cockcroft Institute of Accelerator Science and Technology; École Polytechnique; SLAC; CU Boulder; erc; NeXource

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## The E-320 collaboration

*Additional support: Juan Cruz, Joe Frisch, Shambhu Ghimire, Carl Hudspeth, Cindy Patty, Nadya Smith, Takahiro Sato, the PULSE Team (in particular Ritu Khurana and Sheetal Singhal), and many more*

| | |
|---|---|
| Carleton University, Ottawa, Ontario, Canada | Thomas Koffas |
| Aarhus University, Aarhus, Denmark | **Christian Nielsen**, Allan Sørensen, Ulrik Uggerhøj |
| École Polytechnique, Paris, France | Sébastien Corde, Pablo San Miguel Clave, Aimé Matheron |
| Technical University (TU) of Darmstadt | Christian Rödel |
| University of Hamburg | Tais Gorkhover, Stephan Kuschel |
| MPI für Kernphysik, Heidelberg, Germany | Antonino Di Piazza, Christoph H. Keitel, Matteo Tamburini |
| HI Jena and University of Jena, Germany | Harsh, **Felipe Salgado**, Jannes Wulff, **Matt Zepf** |
| Universidade de Lisboa, Portugal | Thomas Grismayer, Luis Silva, Marija Vranic |
| Imperial College London, UK | Stuart Mangles |
| Queen's University Belfast, UK | Niall Cavanagh, **Elias Gerstmayr,** Gianluca Sarri, Matthew Streeter |
| California Polytechnic State University, CA USA | **Robert Holtzapple,** Maison Singleton, Liam Frank, Jack Kloeckl, Adam Callman, Ben Knudson, Max Varerakis, and Sebastian Turkewitz |
| Lawrence Livermore National Laboratory, CA USA | Félicie Albert |
| SLAC National Accelerator Laboratory and Stanford PULSE Institute, Menlo Park, CA USA | Robert Ariniello, **Phil Bucksbaum**, Christine Clarke, Angelo Dragone, Alan Fisher, Frederico Fiuza, Alan Fry, Spencer Gessner, Siegfried Glenzer, Carsten Hast, Mark Hogan, Chris Kenney, Doug McCormick, **Sebastian Meuren (PI)**, **Rafi Mir-Ali Hessami**, Brendan O'Shea, **David Reis**, **Tania Smorodnikova**, **Douglas Storey**, Glen White, **Vitaly Yakimenko** |
| University of California Los Angeles, CA USA | Chan Joshi, Warren Mori, **Brian Naranjo**, **James Rosenzweig**, Oliver Williams, Monika Yadav |
| University of Colorado Boulder, CO USA | Chris Doss, Michael Litos |
| University of Nebraska - Lincoln, NE USA | Matthias Fuchs, **Junzhi Wang** |
| Former members | **Zhijiang Chen, Henrik Ekerfelt,** Erik Isele |

**FACET-II empowers broad user community and user community enables FACET-II**

# Summary and Outlook

- There has been a lot of progress since the last AAC – we finished the project, commissioned the accelerator and recently began the experimental programs
- FACET-II is delivering high-intensity beams that open new scientific directions strongly aligned with HEP roadmaps
- FACET-II is leveraging SLAC ML/AI initiatives to develop new methods to diagnose and control extreme beams
- In FY23 we will install and commission important hardware & capabilities to further the capabilities of the experimental programs: laser heater, two-bunches, LLRF for more stable delivery

**The team is in place, our Users are engaged, we are excited to be beginning the science programs and we look forward to many face to face discussions at AAC2022**