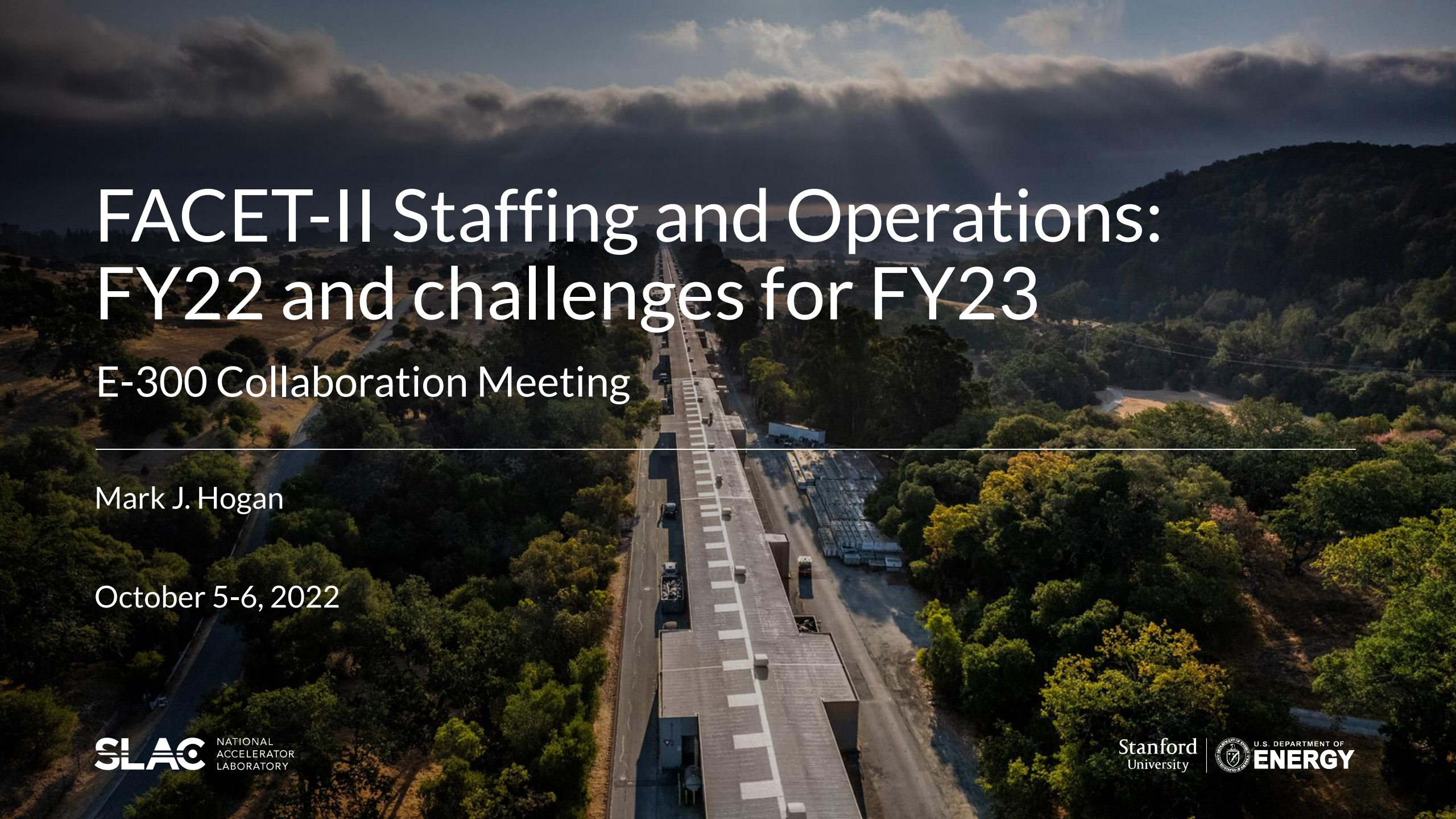


FACET-II Staffing and Operations: FY22 and challenges for FY23

E-300 Collaboration Meeting

Mark J. Hogan

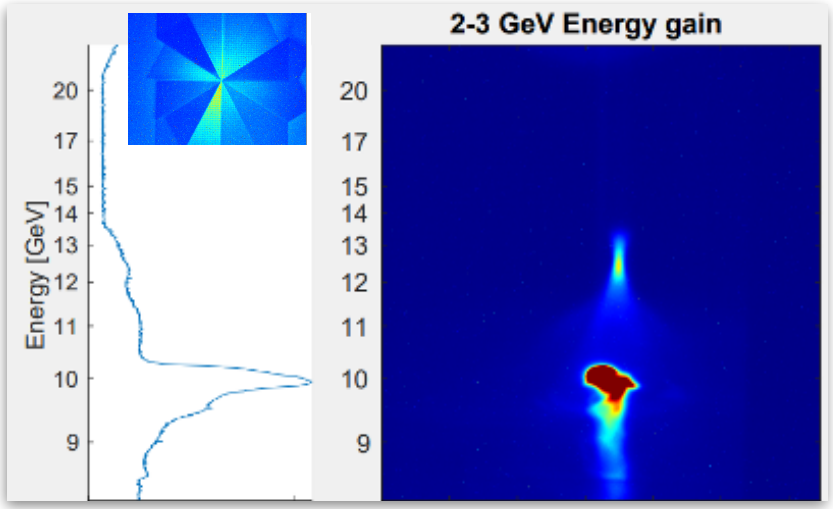
October 5-6, 2022

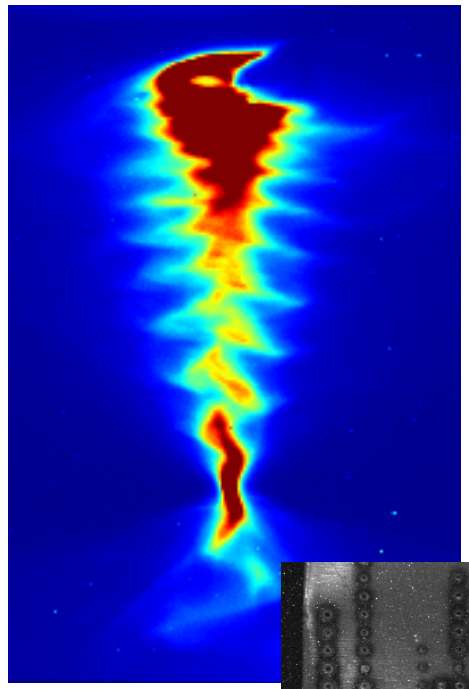
SLAC NATIONAL ACCELERATOR LABORATORY

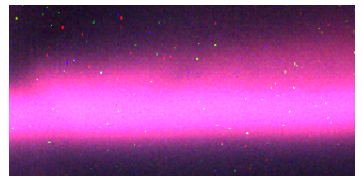
Stanford University | U.S. DEPARTMENT OF ENERGY

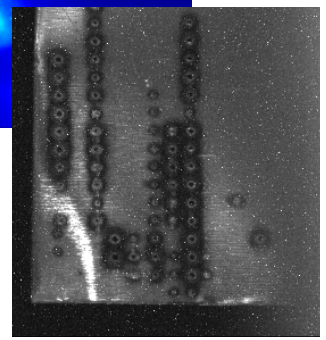
FACET-II Commissioned Accelerator from Threshold KPP to Objective KPP and Started Experimental Programs in May

- Commissioned FACET-II accelerator from Threshold KPP to Objective KPP and started experimental programs in May
- Invited 12 of 47 reviewed proposals for beam time in FY22
- Peak beam intensity at or above levels attained at FACET
- Qualitatively looks very similar to single bunch experiments at FFTB & FACET
- No obvious reduction in performance due to CSR induced hosing
- Progress will be evaluated at the FACET-II PAC in October





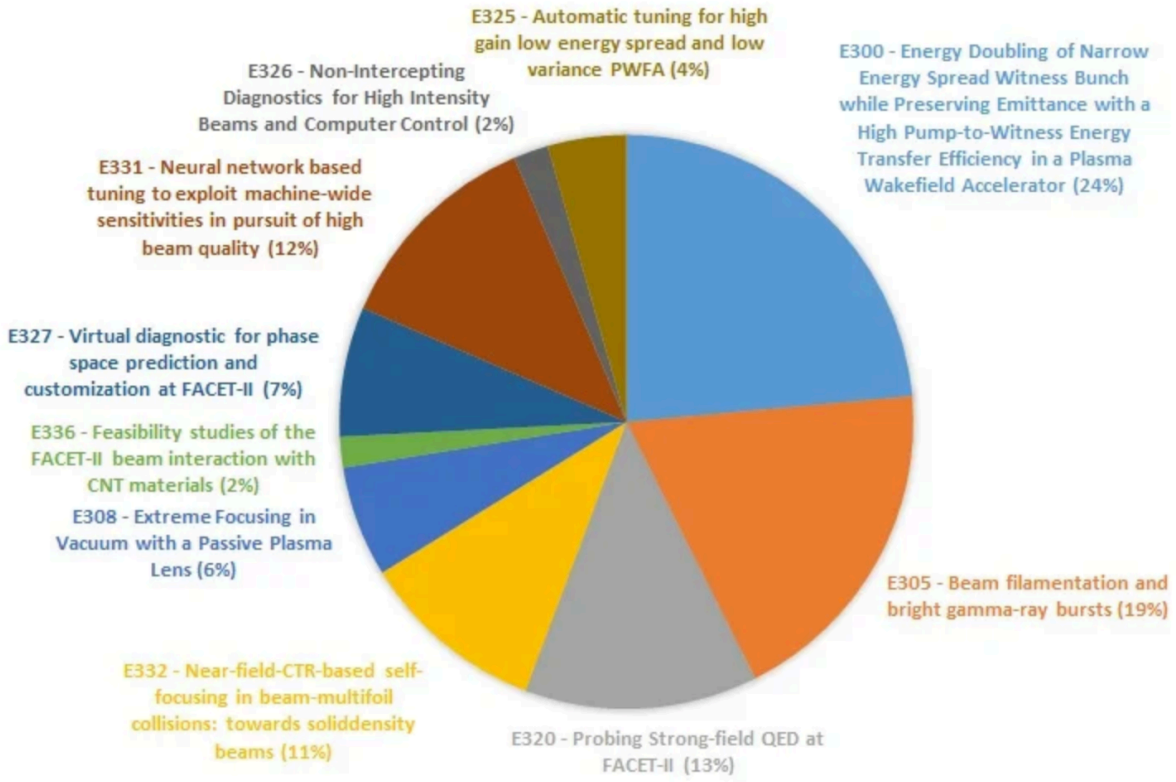




We are excited to have the science programs underway and running on adrenaline. Challenge for FY23 is to settle into sustainable pace for PAMMs, operations and downtimes.

User Hours Increasing

- Peak performance and hours of User delivery are increasing
- Reliability and stability of older accelerator systems remains a challenge for predictable delivery to Users, e.g. RF stability
- Research staff funding to support this level remains a concern



FACET-II FY22

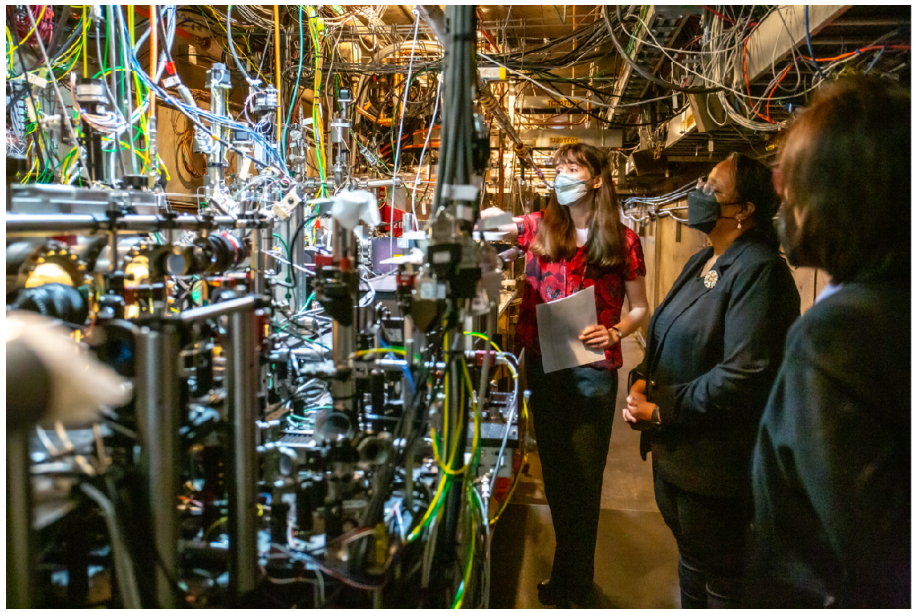
Month	User Hours	User Hours per Week	Notes
May	61	15	
June	59	20	Only three weeks (extended downtime start 6/20
July	113	28	
August	127	42	Only three weeks (off 8/22)

FACET FY16 Run Statistics for Comparison

Time category	Oct 2015	Nov 2015	Dec 2015	Jan 2016	Feb 2016	Mar 2016	Apr 2016
FACET accelerator scheduled off [hrs]	393.6	181.8	488.6	321.5	141.4	70.1	644.5
FACET accelerator down [hrs]	33.8	40.6	30.3	125.7	42	318	5.4
FACET scheduled recovery activity	187.3	0	0	8.8	0	0	0
FACET accelerator beam tuning [hrs]	26	34.8	9.5	11.9	5.3	13.5	0
FACET accelerator config. change	24.1	7	2.6	5.7	4.6	0	2
FACET machine studies [hrs]	54.7	221.1	123.8	146.5	206.3	259.5	8.9
FACET experimental user run [hrs]	24.5	204.2	77.2	123.9	283.8	76.3	53.4
FACET experimental user off [hrs]	0	30.5	12	0	12.6	5.6	5.8
Total time for the month [hrs]	744.0	720.0	744.0	744.0	696.0	743.0	720.0
Summary: Delivered Beam [hrs]	290.6	432.3	213.1	296.8	500	349.3	64.3
Summary: Accelerator Availability [%]	82.9%	85.1%	87.6%	70.2%	92.3%	52.3%	92.3%

Enormous Amount of Work Just to Get Ready for Experiments

- Research staff coordinate design and installation of experimental equipment, organize experimental shifts and collaboration meetings to gather requirements

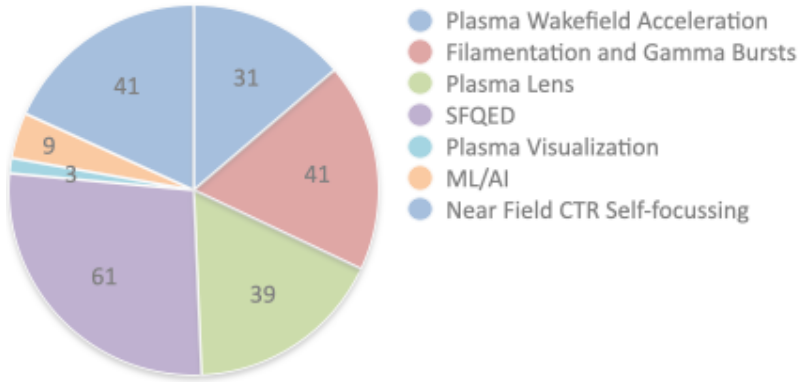


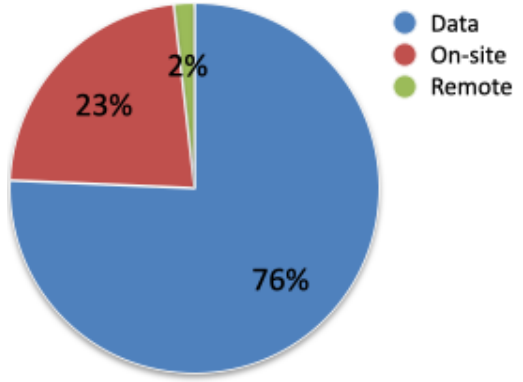
- Rebuilt and commissioned the FACET-II experimental area to accommodate 17 experiments with minimal reconfiguration: chambers, targets, high-power and diagnostic laser lines, differential pumping, electron beamline…
- As Brendan says “Planning is not optional”

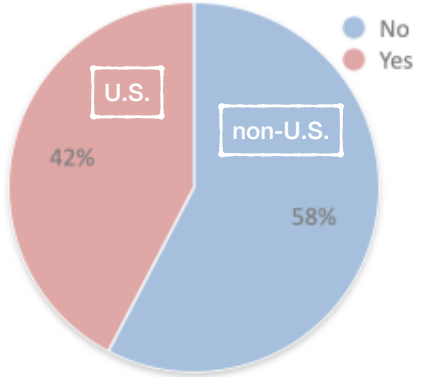
Feedback from Safety stand downs acknowledges the increased burden on existing staff to support User programs and plan and execute PAMMs safely

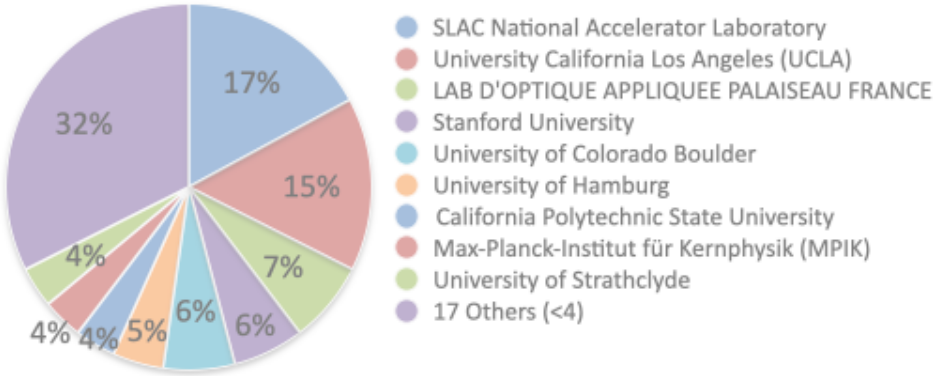
FACET-II FY21 User Statistics for 111 Unique Users

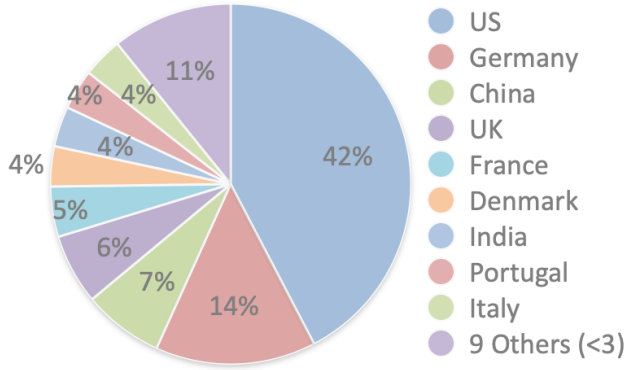
- PAC meetings in 2018 & 2020 reviewed 47 proposals
- 12 experiments invited for FY22











50% of FACET Users were 'On-site' compared to 22% at FACET-II

POC Model

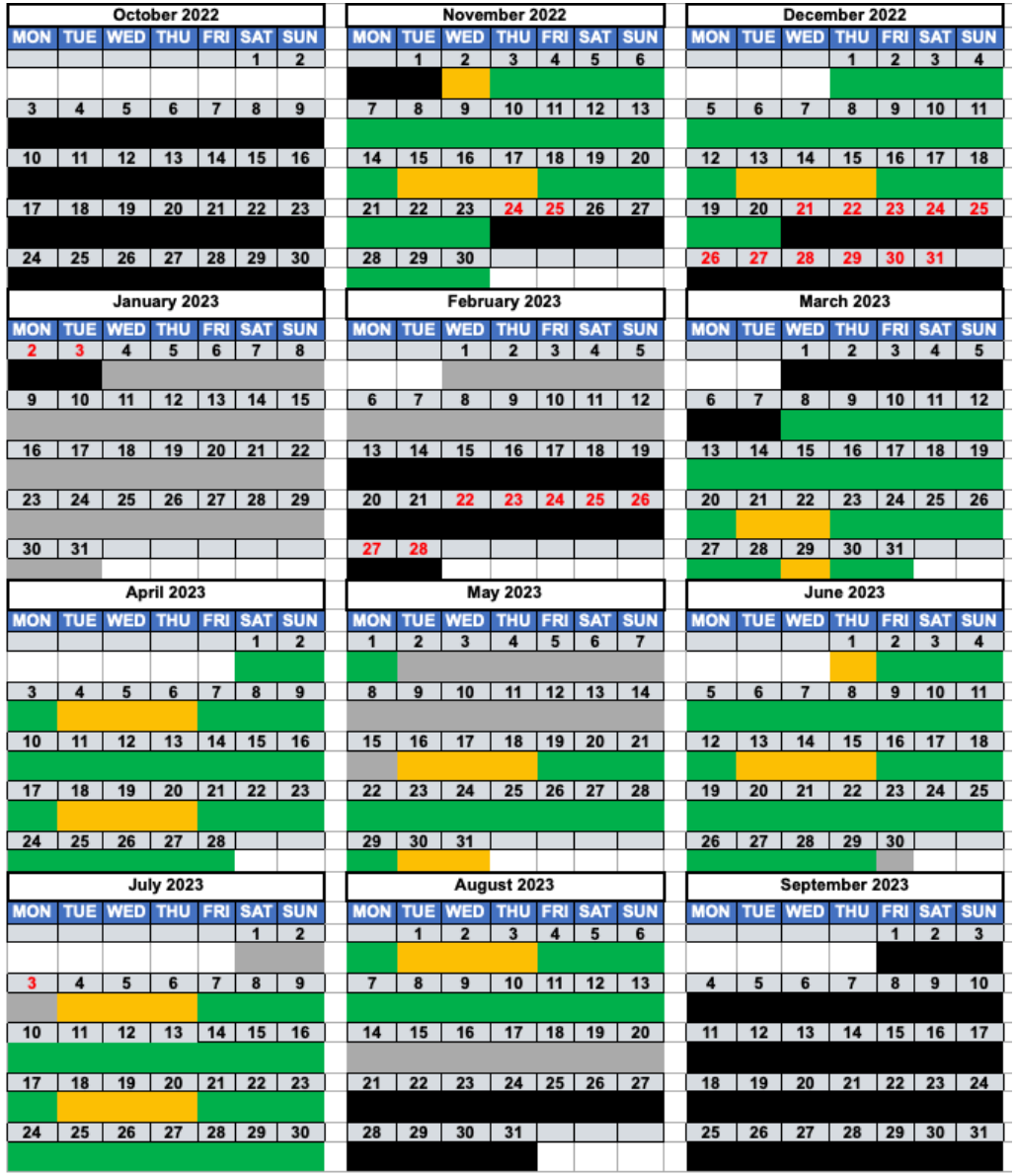
FACET-II POCs May 2022

Experiment		SLAC POC	External POC
EOS/EOS-BPM	Duh	Spencer	Chris Doss
E-300	PWFA	Doug	Ken
E-305	Filimentation/Gamma	Henrik	Sebastien
E-308	Plasma lens	Henrik	Chris Doss
E-320	SFQED	Sebastian	
E-324	Plasma imaging	Henrik	Rafal
E-326	ML/AI ECA	Brendan	
E-327/331	ML/AI	Claudio and Auralee	
E-332	Near field CTR	Doug	Sebastien
E-336	XTAL	Henrik	Henryk
E-338	PAX	Claudio	Ago

- POCs collected requirements, shift plans/procedures, negotiated scheduling and shift start with Ops

- E-300 took 16 shifts
- All coordinated & led by Doug
- Each POC also was involved in many other experiments, e.g. Doug needed for differential pumping system when being used with E-305…
- Detailed shift summaries available here: http://ad-ops.slac.stanford.edu/facet-shift-report/index/?start_date=2022-05-01&end_date=2022-08-23

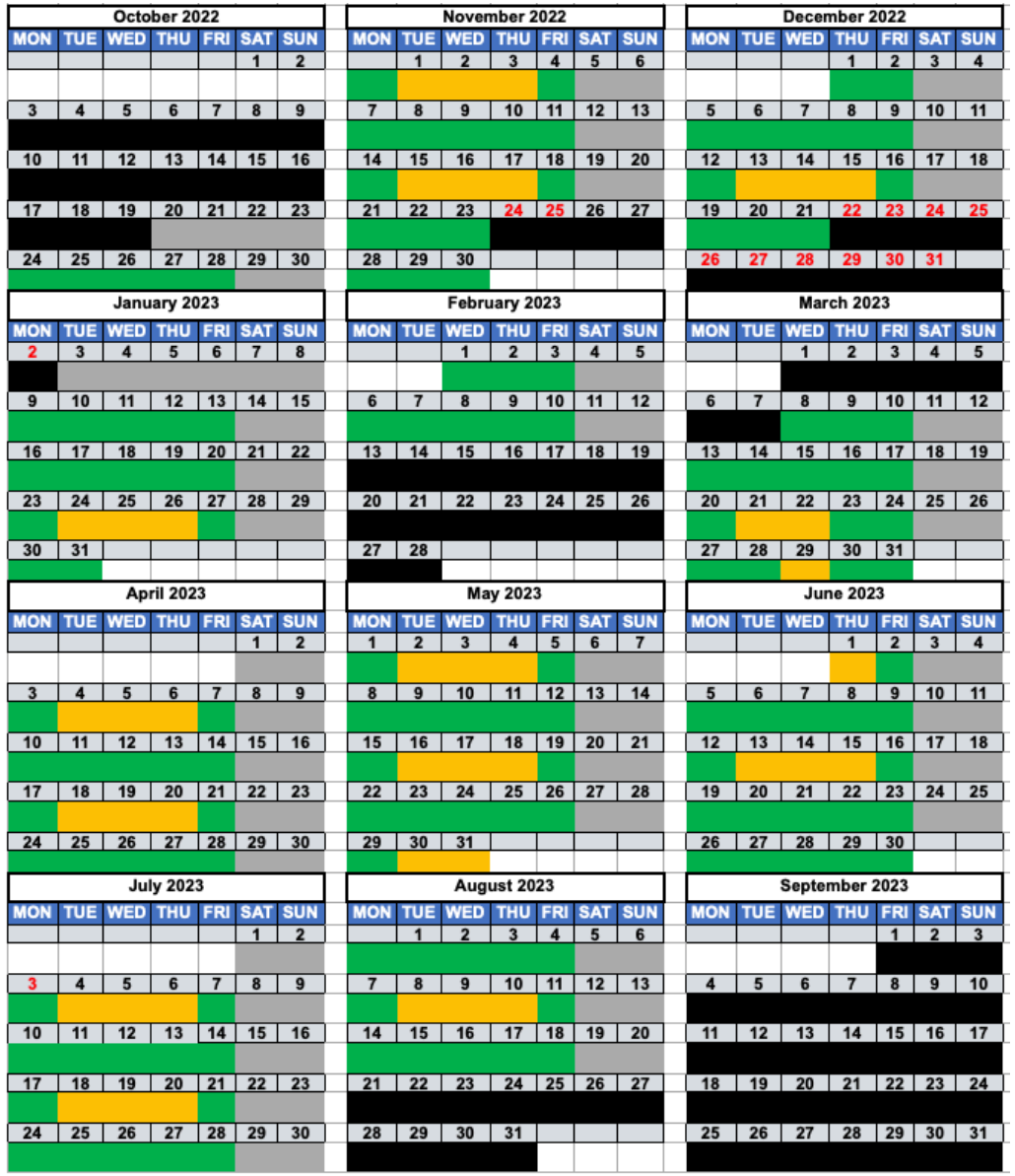
In FY23 FACET-II is Funded for Nominal Six Months Operations



- LCLS and FACET-II accelerators turned off 8/22/22
- FACET-II will re-start after PAC likely early November
- Draft schedules for FY23 are being developed – experimenting with different cadence for On/Off
- Will try for longer blocks for single experiments that can productively use the time
- There is still movement in LCLS & LCLS-II schedules that we will have to adjust to

LCLS PAMM
DOWN
FACET RUN
FLOAT

In FY23 FACET-II is Funded for Nominal Six Months Operations



- LCLS and FACET-II accelerators turned off 8/22/22
- FACET-II will re-start after PAC likely early November
- Draft schedules for FY23 are being developed – experimenting with different cadence for On/Off
- Will try for longer blocks for single experiments that can productively use the time
- There is still movement in LCLS & LCLS-II schedules that we will have to adjust to

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

Summary

- With large COVID carry into FY22, ran through whole year, reached Objective KPP (single bunch), started experiments in May and ran into August
- E-300 led the way developing/commissioning many important diagnostics
- Great news IMHO is that, qualitatively, we have the drive beam in good shape
- At this meeting need to begin refining a message to PAC that communicates that we know what we are doing and that we have a good plan for next year with two bunches
- We will install and commission important hardware & capabilities for E-300 in FY23 (laser heater, two-bunches) as well as BBA FF and Spectrometer + lots of MD
- Scheduling for FY23 (6+1 month run) – considering options to make things sustainable and productive but bottom line we need more boots on the ground!
- I need to understand from Chan, Sebastien, Mike and Erik who can come to SLAC when to aid us drafting a run schedule before the PAC meeting

Agenda

Wednesday, 5 October

12:00 → 17:00 **Day 1**

12:00	**FACET-II Staffing and Operations: FY22 and challenges for FY23** **Speaker**: Mark Hogan (SLAC)	15m
12:15	**Overview of eventual goals of the experiment** **Speaker**: Prof. Chan Joshi (UCLA)	10m
12:25	**FY22 beam parameters** **Speaker**: Glen White (SLAC) BeamConfigs_gwhi...	30m
12:55	**TCAV, LPS, and Laser Heater** ¶ **Speaker**: Claudio Emma (SLAC)	25m
13:20	**EOS correlations and Time of Arrival** **Speaker**: Spencer Gessner (SLAC)	20m
13:40	**Coffee**	30m
14:10	**Emittance Measurements at dump** **Speaker**: Doug Storey (SLAC)	20m
14:30	**Plasma generation and plasma length** **Speaker**: Doug Storey (SLAC)	15m
14:45	**Spectrometer Characterization** **Speaker**: Jiawei Cao (SLAC)	15m
15:00	**Gamma diagnostics** **Speaker**: Pablo San Miguel Claveria (SLAC)	30m
15:30	**E300 Part 1** **Speaker**: Chaojie Zhang (UCLA)	45m

FACET-II | Facility for Advanced Accelerator Experimental Tests

Questions?

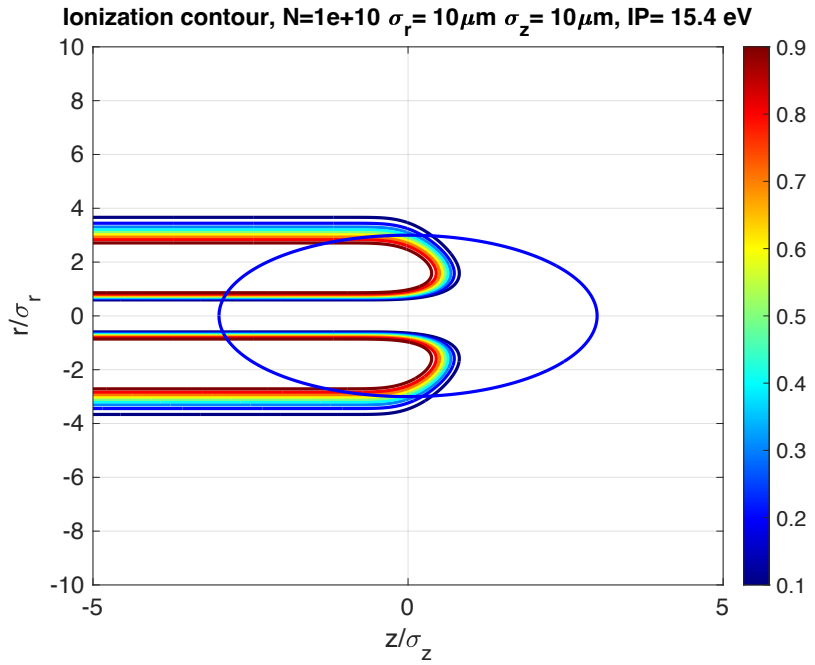
Mark J. Hogan – FACET-II Facility Director

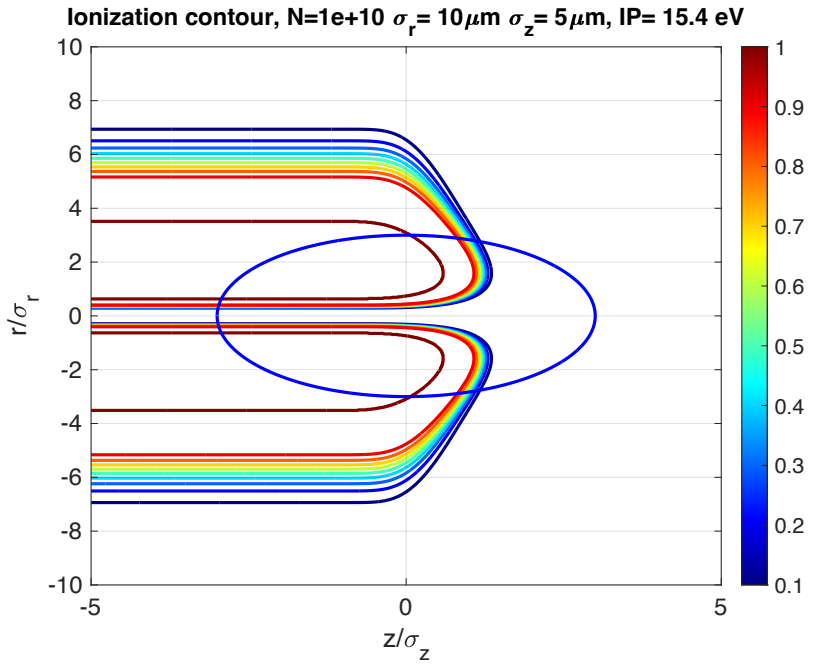
October 5-6, 2022

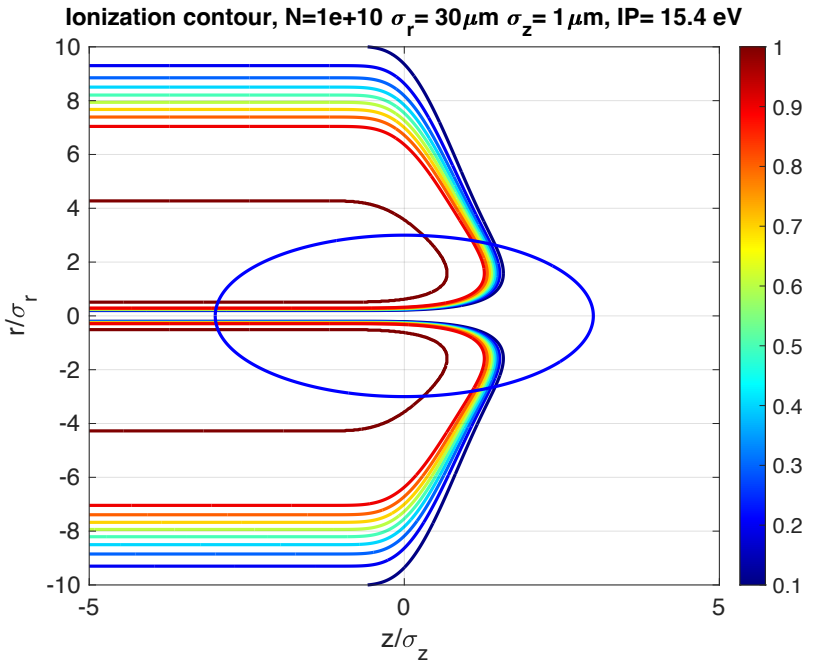
Many fun questions to dig into such as ‘Why do we ionize so well?’

For H2

- 10 GeV, 0.5m betas, 35μm norm. emittance gives 30μm beam size we don’t efficiently ionize H2
- If I assume we are resolution limited on our bunch length diagnostics and that the bunch is much shorter, than I can get strong ionization
- Or is it that even weak ionization leads to focussing that then leads to more ionization and eventually, given long enough gas column, we get strong ionization, blowout etc?







Positrons

- Leveraging our existing infrastructure we can add high-energy high-current positron beam capability to FACET-II and open unique scientific opportunities for our Users
- Will be the only facility in the world to test acceleration of positrons in plasma
- The positron capability was reviewed to the CD-2 level before being descoped from FACET-II project
- LCLS-II HE has advanced considerably in the 5 years since and to operate beyond FY26 (with electrons or positrons) we need to mitigate interferences with LCLS-II HE in S10 – see risk mitigation
- Discussed scenarios (MIE, AIPs) at June FACET-II Ops review
- Need to start the engineering and refine estimates to maintain the opportunity to move forward targeting major installations during long down for LCLS-II HE installation (FY26-27 or FY25-26)
- AIP scenario envisioned increasing Ops funding by $5,000K for design and management over 3 years ($1,700K/year) to update costs and finish engineering designs
- AIP 1: Target revitalization: repair the existing target and demonstrate that with the 10GeV 2nC FACET-II beam we can create, capture and deliver 1nC of positrons to the damping ring location in S10. The revitalized target also strongly benefits the User programs with electrons by allowing more flexibility in beam rate to the IP. ($6,000K)