

**ES&H DIVISION
Radiation Protection (RP) DEPT.**

RP DEPARTMENT

**FACET-II electron beam up to FACET
dump**

SURVEY AND MONITORING PLAN







**RP Dept Document
SLAC-I-780-2A05C-024**



TABLE OF REVISIONS

REVISION #	DATE	SECTION(S)	REASON FOR REVISE

APPROVAL SIGNATURE LIST

Document Author: Ludovic Nicolas  <small>Ludovic Nicolas (Sep 30, 2020 14:44 PDT)</small>	
Owner Group: Radiation Protection Department	
Reviewed, and approved by	
 <small>Henry Brogonia (Oct 1, 2020 09:12 PDT)</small>	
RPFO – Henry Brogonia	Date
 <small>Paul Miller (Oct 8, 2020 22:26 PDT)</small>	
ADSO – Paul Miller or Zoe Van Hoover	Date
 <small>Peter Schuh (Oct 5, 2020 11:59 PDT)</small>	
AOSD – Peter Schuh	Date
 <small>Jerry Yocky (Oct 1, 2020 11:44 PDT)</small>	
FACET-II – Jerry Yocky	Date
Approvals	
 <small>Sayed Rokni (Oct 13, 2020 10:09 PDT)</small>	
Sayed Rokni or Designee, RSO, Radiation Protection Department Head	Date

All changes or additions to this plan must be reviewed, approved and documented in the following table by RP and AOSD.

Changes & Additions		Date/Time & Initial	
Item	Description	AOSD	Radiation Physics

SURVEY PREPARATION AND REQUIREMENTS

A) Introduction:

This document provides radiation protection (RP) survey and monitoring plan for the FACET-II electron beam delivery up to the FACET dump in Sector 20. The goal is to test the integrity of the shielding, to measure residual activity of selected beam line components for various modes of operation and representative beam loss scenarios. This is also used to calibrate the BCS (LIONS and PICs).

The survey will focus on the new aspects of FACET-II with respect to FACET (e.g. Sector 10 Injector, Linac Sector 10 wall), but due to the significant changes of the machine and the long period of inactivity, measurements will also be conducted at locations of interest (e.g. penetrations near the FACET dump). The survey is one item in the 'initial checkout' section of the Beam Authorization Sheet (BAS).

B) Scope

The scope of the survey is RF and electron beam in the Linac. It does not cover a beam directed towards the Positron Vault. In particular, the kicker magnets and Lambertson in S18 are kept OFF such that the electron beam will not be incident on ST193. Another survey plan will need to be conducted when the beam can be directed towards the e⁺ target. Furthermore, another survey plan will be needed when positrons will be transported.

C) Applicability

FACET-II differs from FACET by the origin of the electron beam: It used to be coming from a thermionic gun in CID and now will be coming from an off-axis photoinjector in Sector 10. While there is experience of producing such beam from LCLS runs as well as FACET-II Gun only as RGDAS, it is likely that the start of the operations will not produce immediately the nominal beam parameters that were assumed in the simulations of the radiation environment (2 nC nominal and up to 5 nC at 30 Hz). FACET-II and RP will keep in communication to determine the appropriate beam conditions that will trigger a survey. For instance with 1 pC out of the gun, the beam power at the end (0.3 W) is not high enough to perform the survey. One FACET-II KPP goal is to reach 100 pC (30 W) which is an appropriate condition for survey. Once operations start, regular communications between FACET-II, AOSD, ADSO and RP will take place. A first survey will be conducted within a 2-3 weeks timeframe, with the highest stable charge available. Subsequent surveys will be conducted as higher charge becomes available (e.g. 100 pC, 2nC, 5 nC). This plan indicates the nominal charge of 2 nC in the survey steps as a reference.

D) Survey schedule (tentative)

- 1) October 7th, 2020

E) Hold points: The survey activity shall cease and RSO be informed if any of the following hold points are reached:

- 1) A supplemental electronic dosimeter alarm due to a dose accrual above 10 mR in one day. *(Note: The expected dose rates after 600 W incident on the dump after 1 h cooling time are about 3 mrem/h).*
- 2) The collective dose exceeds 30 mR in one day.
- 3) A BSOIC trips due to beam loss.
- 4) Non-authorized person access posted survey area.

F) Objectives:

- 1) To verify that the dose rates are within the desired limits in the following areas:
 - i. West of the new Linac Sector 10 wall.
 - ii. Near klystrons of interest (e.g. 10-2,3,4,5)
 - iii. Injector side of the shielding wall between the Sector 10 Injector Vault and the Linac
 - iv. Penetrations to the Linac in the Klystron gallery
 - v. The Positron Vault
 - vi. Sector 20 Injector Vault
 - vii. PPS doors on top (Injector and Linac)
- 2) Check for residual dose and contamination after beam operations .
- 3) Calibrate Dump PICs and S19-20 3 LION pairs.

G) Resources (RP personnel only):

- 1) 1 RPFO + 1 RPRP per each survey area as specified in this document.

H) Survey Requirements:

- 1) Pre-survey tasks:
 - i. Review previous survey data
 - ii. Remove extraneous materials in survey areas if needed
 - iii. Briefing and walkthrough to coordinate the installation of postings and ropes to exclude the areas to be surveyed. Report in a document.
- 2) Posting requirements:
 - i. Before the start of operations:

All the identified survey areas must be posted “Caution Keep Out” tape with the following sign: “Caution: Keep Out - Radiation Survey in Progress” with current date and contact information.

The areas can be accessible to authorized personnel only. They may be deposited between surveys provided that the beam parameters will be administratively controlled to the conditions of the last survey or conditions set by RP. Additionally, the area around the FACET dump will be posted as a RADIATION AREA

- ii. After surveys are completed:
 - RP will evaluate survey results and establish conditions for removal of the posting from surveyed areas.
- 3) Requirements for survey crew:
 - i. RWP Job-type to conduct survey: The measurement of prompt dose will be done behind either thick shielding (e.g. walls) or/and far from the radiation source (top of the penetrations) , therefore no significant levels of prompt dose rates are expected such as to require a RWP for prompt radiation survey. Therefore, only a Job Type for initial entry survey inside the accelerator enclosure (for residual radiation survey) will be required.
 - ii. Survey personnel might have to sign the routine RWP when surveying from inside the Positron Vault if they have to pass through the Radiation Area posting in place for the e+ target.
 - iii. RWT-I training for commissioning surveys of prompt radiation.
 - iv. RWT-II training for residual/initial entry surveys as well as the prompt survey from Positron Vault.
 - v. Compliance with COVID-19 JSA.
- 4) Equipment requirements for surveying crew entering posted Radiologically Controlled Areas and Radiation Areas:
 - i. Personnel dosimeter
 - ii. Supplemental electronic dosimeter set to alarm at a dose rate of 100 mR/h and accrued dose of 10 mR in a day.
 - iii. Appropriate PPE for personnel surveying inside the accelerator enclosure as specified by Area Manager at the moment of the survey (including COVID-19 specific).

Prompt radiation surveys above penetrations and outside PPS gates shall be recorded along with the conditions in effect at the time of the measurement. Residual radiological surveys in accelerator housings shall be documented along with conditions and cool down period prior to survey if there was any.

D) Instrumentation:

09/29/2020

- 1) Prompt radiation
 - i. Victoreen/Inovision/Fluke 450 or 451 ion chamber
 - ii. Neutron Remball or HPI 5085
 - iii. Movable radiation monitoring station
- 2) Residual radiation
 - i. RadEye GX with HP-270 detector or equivalent dose rate instrument
 - ii. Ludlum 2241-2 or TBM 15 with GM pancake for contamination

J) Fault study plan:

To complement the measurement of radiation during normal conditions where a beam of intended power travels through its defined channel, fault studies such as for instance where a beam is intentionally mis-steered at moderate power levels to reproduce realistic beam loss events will be carried out to evaluate the accuracy of modeled radiation fields outside and/or inside the accelerator enclosure. This is an essential aspect of the characterization of the radiation environment of FACET-II as some locations where only background is expected during normal operations (e.g. top of BC14 penetrations) are expected to show noticeable dose rates under certain mis-steering conditions.

D) Monitoring plan:

- 1) A movable radiation monitoring station (recording photon and neutron doses) will be placed inside the Linac on the West side of the new wall at Sector 10, a major new feature of the accelerator tunnel that allows to separate the SC accelerating part of LCLS-II with FACET-II. Monitoring stations are very sensitive (they can easily detect a 2×10^{-3} mrem/h increase in photon dose rates and 2×10^{-4} mrem/h increase in neutron dose rates), and will help characterize the radiation environment of the potential construction area of LCLS-II on the West side of this wall.
- 2) Two photon BSOICs interlocked to the PPS system will be active and monitor the prompt dose rates during the operations: One on top of the S10 Injector Vault, and one inside the S20 Injector Vault. Simulations do not predict noticeable dose rates under normal conditions but would radiations above the BSOIC set point be detected, typically 5 mrem/h above background (i.e. 7 mrem/h net with an internal source giving 2 mrem/h), this will trip off the beam by switching off the S10 Injector modulators 10-2,3,4,5.
- 3) Passive area monitors will be placed outside of the shielding (e.g. inside S10 Injector laser room, Klystron Gallery, etc.). Two types will be staged: a new batch of area dosimeters will be deployed for the regular dose accrual over 6 months, and a set of event monitors to focus particularly on this period of restart of operations. A separate document discusses the area dosimeter deployment.

- 4) At a later stage, Residual Dose rates Monitor (RDM) will be added to measure the dose rates at the experimental table in Sector 20 and on the West side of the new Linac shielding wall at Sector 10.

Establish nominal RF representative of nominal baseline running conditions and perform the following survey <i>(photon only)</i>		
Part	Tasks	Expected Measurement duration
1	New Linac Sector 10 wall – from its West side: Bulk shielding, penetrations (cable penetrations on top, lcls2 and HE, alignment penetration, water drain at the bottom)	10 min
2	S10 Injector – wall between the Injector and the Linac, from the Injector side: Bulk shielding, penetrations (beam line, alignment, waveguides at the bottom)	10 min
3	Positron Vault – Wall between the Vault and the Linac	10 min

Notes for survey table below:

- 1) Tasks in table below are not in specific order. Depending on number of survey teams available, some tasks can be performed in parallel, some consecutively.
- 2) Each table lists optimal beam parameters for a given survey, which might be different from actual beam parameters that could be delivered at the survey time. RP will approve the final beam parameters before execution of each part of this survey plan.

Electron beam in Sector 10 injector		
Beam Parameters and/or Beam losses	Tasks	Expected measurement duration
Part a) Normal: 4 MeV electrons to Faraday Cup FC10241 near gun 30 Hz, 2 nC ~ 0.25 W	Perform prompt radiation survey (photon) <ul style="list-style-type: none"> • PPS and equipment door • Laser penetration and abandoned penetration in laser room 	10 min
Part b) Normal: 135 MeV electrons extracted nominally from S10 Injector into the Linac. <i>Without screens inserted</i> 30 Hz, 2 nC ~ 8 W	Perform prompt radiation survey (photon and neutron) for prompt radiation <ul style="list-style-type: none"> • PPS and equipment door • Laser penetration and abandoned penetration in laser room • North road, side of the building • North road, ventilation shaft 	20 min
Part c) Normal: 135 MeV electrons extracted nominally from S10 Injector into the Linac. <i>PR10465 inserted</i> 30 Hz, 2 nC ~ 8 W	Perform prompt radiation survey (photon and neutron) for prompt radiation <ul style="list-style-type: none"> • PPS and equipment door • Laser penetration and abandoned penetration in laser room • North road, side of the building • North road, ventilation shaft 	20 min
Part d) Fault: 64 MeV electrons mis-steered after L0a 30 Hz, 2 nC ~ 4 W	Perform prompt radiation survey (photon and neutron) for prompt radiation <ul style="list-style-type: none"> • PPS and equipment door • Laser penetration and abandoned penetration in laser room • North road, side of the building 	20 min

	<ul style="list-style-type: none"> • North road, side of the building 	
<p>Part e) Fault: 135 MeV electrons extracted from injector, <i>Valve VV10435 inserted</i> 30 Hz, 2 nC ~ 8 W</p>	<p>Perform prompt radiation survey (photon and neutron) for prompt radiation</p> <ul style="list-style-type: none"> • PPS and equipment door • Laser penetration and abandoned penetration in laser room • North road, side of the building • North road, ventilation shaft 	20 min
<p>Part f) Normal: 135 MeV electrons extracted nominally from injector to the Linac, during 1h <i>PR10465 inserted</i> 30 Hz, 2 nC ~ 8 W</p>	<p>Perform residual radiation survey (photon) inside the injector vault after 1 h cooldown.</p>	1 h 15

Electron beam in Linac Middle		
Beam Parameters and/or Beam losses	Tasks	Expected measurement duration
<p>Part g) Normal: 135 MeV electrons to S10 Faraday Cup FCUP 30 Hz, 2 nC ~ 8 W</p>	<p>Perform prompt radiation survey (photon&neutron)</p> <ul style="list-style-type: none"> • New Linac Sector 10 wall (same as item 1 of RF only survey) • Top of penetration p11-01 	20 min
<p>Part h) Normal: 335 MeV electrons through BC11 – with collimator inserted 10 Hz, 2 nC ~ 6.7 W</p>	<p>Perform prompt radiation survey (photon and neutron)</p> <ul style="list-style-type: none"> • Top of penetrations p11-05 and p11-06 	5 min
<p>Part i) Normal: 335 MeV electrons incident on TD11 30 Hz, 2 nC ~ 20 W</p>	<p>Perform prompt radiation survey (photon & neutron)</p> <ul style="list-style-type: none"> • West of new Linac Sector 10 wall (same as item 1 of RF only survey) • Top of penetrations p11-06 and p11-07 	20 min
<p>Part j) Normal: 4.5 GeV electrons Travelling nominally through BC14 30 Hz, 2 nC ~ 270 W</p>	<p>Perform prompt radiation survey (photon & neutron)</p> <ul style="list-style-type: none"> • Top of penetrations p14-14 to p15-01 • South road, cover of large equipment penetration 	10 min

<p>Part k) Fault: 4.5 GeV electrons Mis-steered in BC14 (e.g. with dipole) 30 Hz, 2 nC</p>	<p>Perform prompt radiation survey (photon & neutron)</p> <ul style="list-style-type: none"> • Top of penetrations p14-14 to p15-01 • South road, cover of large equipment penetration 	<p>10 min</p>
<p>Part l) Normal: 9.3 GeV electrons Collimator S18 at nominal beam intercepting parameter 30 Hz, 2 nC</p>	<p>Perform prompt radiation survey (photon & neutron)</p> <ul style="list-style-type: none"> • Top of penetrations 18-17, 19-01, 19-02 (S18 XY collimator) 	<p>10 min</p>
<p>Part m) Normal: 10 GeV electrons Beam to FACET dump 30 Hz, 2 nC 600 W</p>	<p>Perform prompt radiation survey (photon & neutron)</p> <ul style="list-style-type: none"> • Top of penetrations of Sector 19 and 20 • Inside Sector 20 Injector vault if accessible • Inside Positron Vault • West of Sector 10 Linac wall • Calibrate Dump PICs 	<p>30 min</p>
<p>Part n) Normal: 10 GeV electrons Beam to FACET dump with Notch/BC20 collimators IN 30 Hz, 2 nC</p>	<p>Perform prompt radiation survey (photon & neutron)</p> <ul style="list-style-type: none"> • Top of penetrations of Sector 19 and 20. • Inside Sector 20 Injector vault if accessible • Inside Positron Vault • West of Sector 10 Linac wall • Calibrate LIONs S19-LION-1N/S • Verify response in other pairs including ST193/S194 LIONs • Sector 19 PPS door 	<p>30 min</p>

<p>Part o) Normal: 10 GeV electrons Beam to S20 BIDump 30 Hz, 2 nC 600 W (To be performed if/when used)</p>	<p>Perform prompt radiation survey (photon & neutron)</p> <ul style="list-style-type: none"> • Top of penetrations of Sector 19 and 20. • Inside Sector 20 Injector vault. • Inside Positron Vault • Sector 19 PPS door 	<p>30 min</p>
<p>Part p) Normal: After 1h of beam delivery to Sector 20 dump without collimator at nominal beam parameters</p>	<p>Perform residual radiation survey (photon) inside S19-20 after 1 h cooling time</p>	<p>2 h</p>
<p>Part q) Normal: After 1h of beam delivery to Sector 20 dump with Notch/BC20 collimators at nominal beam parameters</p>	<p>Perform residual radiation survey (photon) inside S19-20 after 1 h cooling time</p>	<p>2 h</p>
<p>Part r) Normal: After 1h of beam delivery in the Linac (includes beam to Faraday Cup, BC11 collimator, S18-9 XY collimator)</p>	<p>Perform residual radiation survey in Linac from Sector 10 to 20 after 1 h cooling time</p>	<p>2h30</p>

Survey Record for PART 1:

Date: _____ Start Time: _____ End Time: _____

RF power: _____ Watt

Background dose rate reading: _____ mrem/h

Findings: _____

RPFO: _____ RPRP: _____

Survey Record for PART 2:

Date: _____ Start Time: _____ End Time: _____

RF power: _____ Watt

Background dose rate reading: _____ mrem/h

Findings: _____

RPFO: _____ RPRP: _____

Survey Record for PART 3:

Date: _____ Start Time: _____ End Time: _____

RF power: _____ Watt

Background dose rate reading: _____ mrem/h

Findings: _____

RPFO: _____ RPRP: _____

Survey Record for PART a):

Date: _____ Start Time: _____ End Time: _____

Electron Beam Parameters: _____ GeV, _____ Watt

Background dose rate reading: _____ mrem/h

Findings: _____

RPFO: _____ RPRP: _____

Survey Record for PART b):

Date: _____ Start Time: _____ End Time: _____

Electron Beam Parameters: _____ GeV, _____ Watt

Background dose rate reading: _____ mrem/h

Findings: _____

RPFO: _____ RPRP: _____

Survey Record for PART c):

Date: _____ Start Time: _____ End Time: _____

Electron Beam Parameters: _____ GeV, _____ Watt

Background dose rate reading: _____ mrem/h

Findings: _____

RPFO: _____ RPRP: _____

Survey Record for PART d):

Date: _____ Start Time: _____ End Time: _____

Electron Beam Parameters: _____ GeV, _____ Watt

Background dose rate reading: _____ mrem/h

Findings: _____

RPFO: _____ RPRP: _____

Survey Record for PART e):

Date: _____ Start Time: _____ End Time: _____

Electron Beam Parameters: _____ GeV, _____ Watt

Background dose rate reading: _____ mrem/h

Findings: _____

RPFO: _____ RPRP: _____

Survey Record for PART f):

Date: _____ Start Time: _____ End Time: _____

Electron Beam Parameters: _____ GeV, _____ Watt, T_i = _____ h, T_c = _____ min

Background dose rate reading: _____ mrem/h

Findings: _____

RPFO: _____ RPRP: _____

Survey Record for PART g):

Date: _____ Start Time: _____ End Time: _____

Electron Beam Parameters: _____ GeV, _____ Watt

Background dose rate reading: _____ mrem/h

Findings: _____

RPFO: _____ RPRP: _____

Survey Record for PART h):

Date: _____ Start Time: _____ End Time: _____

Electron Beam Parameters: _____ GeV, _____ Watt

Background dose rate reading: _____ mrem/h

Findings: _____

RPFO: _____ RPRP: _____

Survey Record for PART i):

Date: _____ Start Time: _____ End Time: _____

Electron Beam Parameters: _____ GeV, _____ Watt

Background dose rate reading: _____ mrem/h

Findings: _____

RPFO: _____ RPRP: _____

Survey Record for PART j):

Date: _____ Start Time: _____ End Time: _____

Electron Beam Parameters: _____ GeV, _____ Watt

Background dose rate reading: _____ mrem/h

Findings: _____

RPFO: _____ RPRP: _____

Survey Record for PART k):

Date: _____ Start Time: _____ End Time: _____

Electron Beam Parameters: _____ GeV, _____ Watt

Background dose rate reading: _____ mrem/h

Findings: _____

RPFO: _____ RPRP: _____

Survey Record for PART l):

Date: _____ Start Time: _____ End Time: _____

Electron Beam Parameters: _____ GeV, _____ Watt

Background dose rate reading: _____ mrem/h

Findings: _____

RPFO: _____ RPRP: _____

Survey Record for PART m):

Date: _____ Start Time: _____ End Time: _____

Electron Beam Parameters: _____ GeV, _____ Watt

Background dose rate reading: _____ mrem/h

Findings: _____

RPFO: _____ RPRP: _____

Survey Record for PART n):

Date: _____ Start Time: _____ End Time: _____

Electron Beam Parameters: _____ GeV, _____ Watt

Background dose rate reading: _____ mrem/h

Findings: _____

RPFO: _____ RPRP: _____

Survey Record for PART o):

Date: _____ Start Time: _____ End Time: _____

Electron Beam Parameters: _____ GeV, _____ Watt

Background dose rate reading: _____ mrem/h

Findings: _____

RPFO: _____ RPRP: _____

Survey Record for PART p):

Date: _____ Start Time: _____ End Time: _____
Electron Beam Parameters: _____ GeV, _____ Watt, T_i= _____ h , T_c= _____ min
Background dose rate reading: _____ mrem/h
Findings: _____

RPFO: _____ RPRP: _____

Survey Record for PART q):

Date: _____ Start Time: _____ End Time: _____
Electron Beam Parameters: _____ GeV, _____ Watt, T_i= _____ h , T_c= _____ min
Background dose rate reading: _____ mrem/h
Findings: _____

RPFO: _____ RPRP: _____

Survey Record for PART r):

Date: _____ Start Time: _____ End Time: _____
Electron Beam Parameters: _____ GeV, _____ Watt, T_i= _____ h , T_c= _____ min
Background dose rate reading: _____ mrem/h
Findings: _____

RPFO: _____ RPRP: _____












FACETIISurveyPlan

Final Audit Report

2020-10-13


Created:	2020-09-30
By:	Ludovic Nicolas (nicolas@slac.stanford.edu)
Status:	Signed
Transaction ID:	CBJCHBCAABAAgJ_ufcb9YhGzfA2HcoVK7wqizh6LgxJS

"FACETIISurveyPlan" History


-  Document created by Ludovic Nicolas (nicolas@slac.stanford.edu)
2020-09-30 - 9:40:41 PM GMT- IP address: 98.207.182.17
-  Document emailed to Ludovic Nicolas (nicolas@slac.stanford.edu) for signature
2020-09-30 - 9:44:36 PM GMT
-  Document emailed to Henry Brogonia (brogonia@slac.stanford.edu) for signature
2020-09-30 - 9:44:37 PM GMT
-  Document emailed to Paul Miller (pmiller@slac.stanford.edu) for signature
2020-09-30 - 9:44:37 PM GMT
-  Document emailed to Peter Schuh (schuh@slac.stanford.edu) for signature
2020-09-30 - 9:44:37 PM GMT
-  Document emailed to Jerry S Yocky (yocky@slac.stanford.edu) for signature
2020-09-30 - 9:44:37 PM GMT
-  Document emailed to Sayed Rokni (rokni@slac.stanford.edu) for signature
2020-09-30 - 9:44:37 PM GMT
-  Document e-signed by Ludovic Nicolas (nicolas@slac.stanford.edu)
Signature Date: 2020-09-30 - 9:44:54 PM GMT - Time Source: server- IP address: 98.207.182.17
-  Email viewed by Sayed Rokni (rokni@slac.stanford.edu)
2020-09-30 - 9:45:18 PM GMT- IP address: 134.79.68.148
-  Email viewed by Jerry S Yocky (yocky@slac.stanford.edu)
2020-09-30 - 10:01:16 PM GMT- IP address: 134.79.188.65
-  Email viewed by Peter Schuh (schuh@slac.stanford.edu)
2020-09-30 - 10:24:20 PM GMT- IP address: 107.77.213.71

 Email viewed by Henry Brogonia (brogonia@slac.stanford.edu)

2020-10-01 - 4:09:32 PM GMT- IP address: 134.79.68.233

 Document e-signed by Henry Brogonia (brogonia@slac.stanford.edu)

Signature Date: 2020-10-01 - 4:12:27 PM GMT - Time Source: server- IP address: 134.79.68.233

 Document e-signed by Jerry S Yocky (yocky@slac.stanford.edu)

Signature Date: 2020-10-01 - 6:44:03 PM GMT - Time Source: server- IP address: 134.79.80.248

 Document e-signed by Peter Schuh (schuh@slac.stanford.edu)

Signature Date: 2020-10-05 - 6:59:37 PM GMT - Time Source: server- IP address: 134.79.188.243

 Email viewed by Paul Miller (pmiller@slac.stanford.edu)

2020-10-08 - 10:07:58 PM GMT- IP address: 134.79.188.242

 Document e-signed by Paul Miller (pmiller@slac.stanford.edu)

Signature Date: 2020-10-09 - 5:26:08 AM GMT - Time Source: server- IP address: 24.4.203.17

 Document e-signed by Sayed Rokni (rokni@slac.stanford.edu)

Signature Date: 2020-10-13 - 5:09:26 PM GMT - Time Source: server- IP address: 134.79.68.148

 Agreement completed.

2020-10-13 - 5:09:26 PM GMT