

Technical Use Case Analysis

Introduction

A sample set of technical use cases were documented in [1]. The use cases describe scenarios in which the telescopes that comprise the SKA Observatory are used. An analysis of this set of technical use cases was performed as follows:

- Use cases relevant to the SDP were identified
- Current SDP sub-system requirements were compared to those implied by the technical use cases and discrepancies were identified.

Technical Use Case Overview

The sample set of technical use cases are described below.

1. Quality Assurance (QA) Monitoring: The quality assurance use case is sub-divided into the following three parts:
 - Instrumental health checks that confirm the expected operation of the instrument
 - QA checks on imaging observations
 - QA checks on non-imaging observationsQA values are extracted from processing pipelines. The system is automatically alerted when these values exceed thresholds defined by an observation.
2. Equipment alarm monitoring and failure management use case: This use case describes the process followed in the event of an automatic alarm event. The use cases excludes alarms that are triggered by safety and security events (this is dealt with by the Safety and Security use case).
3. Fault Repair: This use case describes a situation in which a sub-system requires repair. Engineering operations are notified of the fault and the predefined method statement for repair is executed. The use case also describes the need for disposal or repair instructions for faulty systems.
4. Firmware update: This use case describes the need to maintain version control and integrity of firmware. Firmware update requests and secure forms of 'write-access' to remote sub-systems are described by this use case.
5. Safety and security alarm monitoring and instigation of defence plans: This use case describes a scenario in which there is a safety or security event and describes the process of identification and triage of said event. This use case does not describe the safety and security policy that will be governed by statutory requirements. However, the primary means for mitigating risk will be to eliminate hazards through design. This use case informs system design requirements by outlining safety and security needs.
6. Instigation of medical emergency defence plans: If a safety or security event is identified as 'Medical', a medical emergency defence plan is instigated. This use case describes the process followed once a medical emergency is identified. In addition, the use case defines categories of hazardous or threatening events.
7. Proposal handling: This use case describes the activities associated with proposals associated with access to the telescope. The assumption is that

proposals will be handled by a web interface with the ability to register users and verify and validate aspects of the submission.

8. Observation preparation: This use case describes the generation of schedule blocks based upon observation proposals identified in the long-term schedule. This process will be automatically carried out by an observation preparation tool.
9. Observation planning and execution (OPE): OPE stages are divided into two:
 - Medium-term: A resource scheduling resource allowing engineering operations to plan maintenance activities.
 - Short-term schedule: Dynamically allocated according to telescope availability and environmental conditions. The short-term schedule will occasionally be interrupted by Target of Opportunity Observations.

SDP Technical Use Cases

Use cases applicable to the SDP were identified by reviewing the SDP system requirements. The use cases highlighted in Figure 1 are relevant to the SDP.

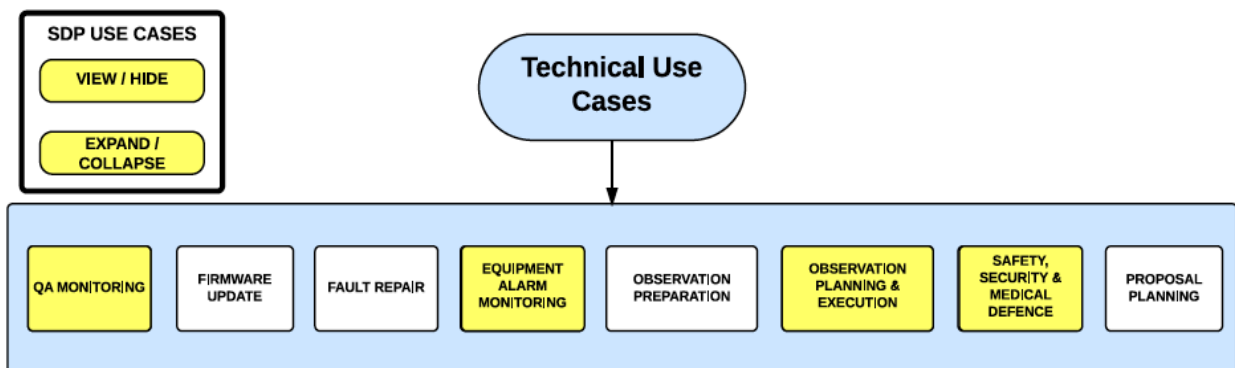


Figure 1 SDP Technical Use Cases

The identification of SDP-relevant use cases is justified below.

1. QA Monitoring (QA): QA values come directly from the processing pipelines. According to the system requirements, the SDP receives QA values from the processing pipelines (imaging and non-imaging pipelines) and generates a QA report on performed observations. In addition, health and monitoring of instrumentation is performed by the SDP.
2. Equipment alarm monitoring and failure management (Alarm): This use case is partially applicable to the SDP. According to system requirements, the SDP performs health monitoring and manages alarms generated as a result of faults. However, the SDP system requirements does not stipulate the diagnosis of faults, establishing repair plans or mobilise a repair team.
3. Observation planning and execution (OPE): The OPE use case is applicable to the SDP in that the SDP receives schedule blocks and performs an observation. The SDP is also responsible for handling interrupts and abandoning an existing schedule block in favour of a time critical observation.

4. Safety and security alarm monitoring and instigation of defence plans (S&S): This use case is *partially* applicable to the SDP in terms of incorporating the mitigation of risks into the design process. The section of this use case that describes the formulation and instigation of defence plans is not currently reflected in the SDP system requirements. The safety and security use case satisfies SDP requirement, SDP_REQ-582.

Table 1 indicates the SDP functionality fulfilled by each SDP-relevant use case. Core technical functionality is satisfied by the identified use cases.

Functionality not covered by the technical use cases are:

- Establishment of archival systems and specifics thereof
- User management (authentication, roles and data access types)
- Data flow management

Number	Name	TUC: QA	TUC: Alarm	TUC: OPE	TUC: S&S	Satisfies
F	SDP L1 Functions					
F.1	Regional Centre Interface					SKA1-SYS_REQ-2116 South African Engineering Operations Centre, SKA1-SYS_REQ-2121 Australian Engineering Operations Centre, SKA1-SYS_REQ-2366 Distribution of data products.,
F.1.1	Data distribution policy					SDP_REQ-106 Product distribution,
F.1.1.1	Maintain remote products					SDP_REQ-107 Identify distribution destination,
F.1.1.1.1	Analyse Data					SDP_REQ-127 RC product renewal, SDP_REQ-114 Analysis output storage,
F.1.1.1.2	Delete Remote Products					SDP_REQ-125 Trigger data removal,
F.1.1.1.3	Update Remote Products					SDP_REQ-126 Trigger data update,
F.1.2	Bulk Data Transfer					SDP_REQ-262 Data Layer Product Distribution,
F.1.2.1	WAN Interface					SDP_REQ-111 RC data transfer rate, SDP_REQ-114 Analysis output storage, SDP_REQ-117 RC unexpected downtime, SDP_REQ-116 RC expected downtime, SDP_REQ-112 RC storage rate, SDP_REQ-115 Metadata replication, SDP_REQ-110 RC storage capacity, SDP_REQ-113 RC analysis execution,
F.1.2.3	Receive Data at Regional Centre					SDP_REQ-108 Delivery performance, SDP_REQ-109 Delivery interruption,

F.1.2.4	Schedule data delivery					SDP_REQ-118 Delivery strategy,
F.1.2.4.1	Check previous deliveries					SDP_REQ-119 Delivery Count Limit, SDP_REQ-124 Delivery strategy data model,
F.1.2.4.2	Check Data Transfer budget					SDP_REQ-122 High priority delivery, SDP_REQ-121 Data delivery budget, SDP_REQ-123 Low priority delivery,
F.1.2.4.3	Prioritise data for delivery					SDP_REQ-120 Data delivery priority,
F.1.2.5	Send data to Regional Centre					
F.11	Calibration					SKA1-SYS_REQ-2621 Spectral stability, SKA1-SYS_REQ-2128 Continuum and spectral line imaging mode., SKA1-SYS_REQ-2729 Calibration and Imaging formalism, SKA1-SYS_REQ-2629 Station beam stability, SKA1-SYS_REQ-2347 Automated Quality Assessment., SKA1-SYS_REQ-2330 Peeling., SKA1-SYS_REQ-2338 Calibration pipeline., SKA1-SYS_REQ-2635 Real time calibration, SKA1-SYS_REQ-2158 Pointing repeatability., SKA1-SYS_REQ-2328 Solution for pointing errors., SKA1-SYS_REQ-2160 Pointing repeatability - Higher wind, SKA1-SYS_REQ-2725 Faraday rotation DDE, SKA1-SYS_REQ-2159 Pointing repeatability - Low wind / day time, SKA1-SYS_REQ-2724 Aperture Array DDE, SKA1-SYS_REQ-2726 PAF DDE, SKA1-SYS_REQ-2727 Dish DDE, SKA1-SYS_REQ-2634 Calibration update rate,
F.13	Health Monitoring					SKA1-SYS_REQ-2280 System status., SDP_REQ-593 Status Logging, SDP_REQ-592 Status Monitoring, SDP_REQ-594 Status Reporting,
F.13.1	Alarms					SDP_REQ-35 Alarms, SDP_REQ-37 Alarm latency, SDP_REQ-36 Alarm timestamps,
F.14	Platform Management					SDP_REQ-376 Platform management interface to LMC, SKA1-SYS_REQ-2224 Frequency agility., SKA1-SYS_REQ-2285

					Latency of TOO scheduling block initiation., SKA1-SYS_REQ-2286 Discard previous scheduling block., SKA1-SYS_REQ-2133 Mode transition, SDP_REQ-375 SDP platform management,
F.14.1	Scheduling				SDP_REQ-379 Scheduler, SDP_REQ-381 Scheduler input, SDP_REQ-382 Component system consistency, SDP_REQ-380 Scheduler Interface,
F.14.2	Platform State Management				SDP_REQ-597 Component system state information,
F.14.3	Deployment				SDP_REQ-382 Component system consistency, SDP_REQ-378 Deployment system,
F.14.4	Health Monitoring				SDP_REQ-377 System health monitoring,
F.15	Simulation				
F.16	Transient Detection Pipeline				SKA1-SYS_REQ-2165 Polarisation Purity, SKA1-SYS_REQ-2236 SKA1_Survey configuration, SKA1-SYS_REQ-2241 Maximum available bandwidth, SKA1-SYS_REQ-2238 RF system frequency range PAF band 1, SKA1-SYS_REQ-2186 RF system sampled bandwidth band 2, SKA1-SYS_REQ-2185 RF system sampled bandwidth band 1, SKA1-SYS_REQ-2240 RF system frequency range PAF band 3, SKA1-SYS_REQ-2242 SKA1_Survey digitised bandwidth, SKA1-SYS_REQ-2131 Transient search mode, SKA1-SYS_REQ-2140 SKA1_Low station diameter, SKA1-SYS_REQ-2239 RF system frequency range PAF band 2, SDP_REQ-389 Slow transient pipeline, SKA1-SYS_REQ-2322 Global sky model., SKA1-SYS_REQ-2345 Slow transient pipeline., SKA1-SYS_REQ-2319 Closed loop calibration., SKA1-SYS_REQ-2252 SKA1_Survey correlator dump period., SKA1-SYS_REQ-2250 SKA1_Survey channelisation., SKA1-SYS_REQ-2148 SKA1_Low channelisation,

					<p>SKA1-SYS_REQ-2195 SKA1_Mid channelisation, SKA1-SYS_REQ-2259 SKA1_Survey spectral dynamic range., SKA1-SYS_REQ-2346 Slow transient data products., SKA1-SYS_REQ-2134 Electromagnetic frequency range., SKA1-SYS_REQ-2153 Diameter, SKA1-SYS_REQ-2178 Combined SKA1_Mid configuration, SKA1-SYS_REQ-2189 RF system sampled bandwidth band 5, SKA1-SYS_REQ-2266 SKA1_Survey PAF rotation., SKA1-SYS_REQ-2262 SKA1_Survey inclusion of ASKAP., SKA1-SYS_REQ-2321 Direction dependent effects., SKA1-SYS_REQ-2256 SKA1_Survey imaging dynamic range., SKA1-SYS_REQ-2174 Combined SKA1_Mid configuration., SKA1-SYS_REQ-2142 SKA1_Low number of stations., SKA1-SYS_REQ-2173 MeerKAT array, SKA1-SYS_REQ-2188 RF system sampled bandwidth band 4, SDP_REQ-372 Early science processing capability, SKA1-SYS_REQ-2247 SKA1_Survey number of beams., SKA1-SYS_REQ-2324 Multi-frequency synthesis imaging., SKA1-SYS_REQ-2147 Instantaneous bandwidth., SKA1-SYS_REQ-2187 RF system sampled bandwidth band 3,</p>
F.17	EoR Pipeline				<p>SKA1-SYS_REQ-2165 Polarisation Purity, SKA1-SYS_REQ-2236 SKA1_Survey configuration, SKA1-SYS_REQ-2241 Maximum available bandwidth, SKA1-SYS_REQ-2238 RF system frequency range PAF band 1, SKA1-SYS_REQ-2186 RF system sampled bandwidth band 2, SKA1-SYS_REQ-2185 RF system sampled bandwidth band 1, SKA1-SYS_REQ-2240 RF system frequency range PAF band 3, SKA1-SYS_REQ-2242 SKA1_Survey digitised</p>

					bandwidth, SKA1-SYS_REQ-2140 SKA1_Low station diameter, SKA1-SYS_REQ-2239 RF system frequency range PAF band 2, SKA1-SYS_REQ-2322 Global sky model., SKA1-SYS_REQ-2319 Closed loop calibration., SKA1-SYS_REQ-2252 SKA1_Survey correlator dump period., SKA1-SYS_REQ-2250 SKA1_Survey channelisation., SKA1-SYS_REQ-2148 SKA1_Low channelisation, SKA1-SYS_REQ-2195 SKA1_Mid channelisation, SKA1-SYS_REQ-2259 SKA1_Survey spectral dynamic range., SKA1-SYS_REQ-2134 Electromagnetic frequency range., SKA1-SYS_REQ-2153 Diameter, SKA1-SYS_REQ-2178 Combined SKA1_Mid configuration, SKA1-SYS_REQ-2189 RF system sampled bandwidth band 5, SKA1-SYS_REQ-2266 SKA1_Survey PAF rotation., SKA1-SYS_REQ-2262 SKA1_Survey inclusion of ASKAP., SKA1-SYS_REQ-2321 Direction dependent effects., SKA1-SYS_REQ-2256 SKA1_Survey imaging dynamic range., SKA1-SYS_REQ-2174 Combined SKA1_Mid configuration., SKA1-SYS_REQ-2142 SKA1_Low number of stations., SKA1-SYS_REQ-2173 MeerKAT array, SKA1-SYS_REQ-2188 RF system sampled bandwidth band 4, SDP_REQ-372 Early science processing capability, SKA1-SYS_REQ-2247 SKA1_Survey number of beams., SKA1-SYS_REQ-2324 Multi-frequency synthesis imaging., SKA1-SYS_REQ-2147 Instantaneous bandwidth., SKA1-SYS_REQ-2187 RF system sampled bandwidth band 3,
F.18	Pipeline Interface				
F.18.1	Receive pipeline configuration parameters				SDP_REQ-449 Pipeline Interface input,
F.18.2	Send pipeline log				SDP_REQ-455 Pipeline Interface

	& QA data to LMC				Output,
F.18.3	Pipeline Processing Log				SDP_REQ-453 Provide Processing Log,
F.18.4	Pipeline Configuration				SDP_REQ-452 Pipeline configuration,
F.18.5	Pipeline Automated QA				SDP_REQ-441 Automated Quality Assessment.,
F.19	QA Displays				SKA1-SYS_REQ-2742 Performance assessment, SDP_REQ-595 QA annotations, SDP_REQ-40 Quality assessment interface, SKA1-SYS_REQ-2347 Automated Quality Assessment., SDP_REQ-43 Quality assessment calculation, SKA1-SYS_REQ-2744 Quality assessment, SDP_REQ-41 Performance assessment, SKA1-SYS_REQ-2357 QA annotation., SKA1-SYS_REQ-2280 System status., SKA1-SYS_REQ-2336 Standard pipeline products., SDP_REQ-42 Performance goals, SKA1-SYS_REQ-2743 Performance goals,
F.2	Astronomer Interface				SKA1-SYS_REQ-2354 Archive API., SKA1-SYS_REQ-2347 Automated Quality Assessment., SKA1-SYS_REQ-2352 Web interface., SKA1-SYS_REQ-2366 Distribution of data products.,
F.2.1	Authenticate and Authorise				SDP_REQ-571 Access to data and metadata, SDP_REQ-274 Single Sign-On,
F.2.1.1	Authorise User				SDP_REQ-90 Anonymous delivery, SDP_REQ-94 User Authorisation,
F.2.1.1.1	Authorise User (Service)				SDP_REQ-95 Delivery by Role,
F.2.1.1.2	Authorise User (Client)				SDP_REQ-97 Authorisation client, SDP_REQ-89 Federated authentication, SDP_REQ-95 Delivery by Role,
F.2.1.2	Authenticate User				SDP_REQ-88 User Authentication,
F.2.1.2.1	Authenticate User (Client)				SDP_REQ-89 Federated authentication, SDP_REQ-91 Certificate Authentication, SDP_REQ-92 Single Sign-On,
F.2.1.2.2	Authenticate User				SDP_REQ-91 Certificate

	(Service)					Authentication, SDP_REQ-92 Single Sign-On,
F.2.1.3	Maintain User Credentials					SDP_REQ-101 Authentication credential master,
F.2.1.3.1	Maintain User Credentials (Client)					SDP_REQ-100 Authorisation credential client, SDP_REQ-102 User Roles,
F.2.1.3.2	Maintain User Credentials (Service)					SDP_REQ-102 User Roles, SDP_REQ-99 Maintain authorisation credentials,
F.2.1.3.3	Associate Identities					SDP_REQ-93 External Credentials,
F.2.2	Discover Data					SDP_REQ-56 Image Archive Metadata, SDP_REQ-62 Data Description, SDP_REQ-58 Data Discovery, SDP_REQ-54 Archive Metadata, SDP_REQ-87 Archive Data File Formats, SDP_REQ-60 SIA Discovery, SDP_REQ-59 TAP Discovery, SDP_REQ-385 Web Interface,
F.2.2.4	Visualise Query Results					SDP_REQ-73 Metadata Visualisation Client, SDP_REQ-74 HTTP Client Metadata Visualisation, SDP_REQ-75 HTTP Client Previews,
F.2.2.5	Select Data Products For Transfer					SDP_REQ-68 Delivery Client,
F.2.2.6	Query Authorised Data					SDP_REQ-66 DataLink Delivery,
F.2.2.7	Filter By Authorisation					SDP_REQ-105 Proprietary data period,
F.2.2.8	Select Destination					SDP_REQ-107 Identify distribution destination,
F.2.2.9	Query Authorised Metadata					SDP_REQ-90 Anonymous delivery, SDP_REQ-103 Proprietary Period,
F.2.2.9.1	Append Authorisation Parameters to Query					SDP_REQ-104 Proprietary metadata period,
F.2.2.9.2	Query Metadata (Client)					SDP_REQ-63 TAP Data Description, SDP_REQ-61 Client Data Discovery, SDP_REQ-64 SIA Data Description,
F.2.2.9.3	Query Metadata (Service)					SDP_REQ-61 Client Data Discovery, SDP_REQ-60 SIA Discovery, SDP_REQ-59 TAP Discovery,

F.2.3	Request Data Delivery					SDP_REQ-118 Delivery strategy,
F.2.4	Deliver Data to end user					SDP_REQ-65 Data Delivery,
F.2.4.1	Log Receiving data					SDP_REQ-98 User access log consistency,
F.2.4.2	Transfer Data to End User					SDP_REQ-67 AccessData Delivery,
F.2.5	Visualise data					SDP_REQ-56 Image Archive Metadata, SDP_REQ-76 Data Visualisation Client, SDP_REQ-131 Supported File Formats, SDP_REQ-82 Maintain Visualization Session,
F.2.5.10	Customise Visualisation Environment					SDP_REQ-572 Display customisations,
F.2.5.10.1	Customise User Display Defaults					SDP_REQ-83 User Visualization Customization,
F.2.5.10.2	Customise Visualisation Display					SDP_REQ-84 Viewer Customizable Plotting,
F.2.5.3	Share Visualisation Session					SDP_REQ-81 Multi-User Viewing,
F.2.5.4	View Data with Core Functionality					SDP_REQ-78 Core viewing functionality,
F.2.5.5	View Data with Core analysis					SDP_REQ-80 Core Analysis Visualization, SDP_REQ-130 Offline Viewing, SDP_REQ-79 Extensible Analysis, SDP_REQ-129 View Large Datasets, SDP_REQ-128 Community Analysis,
F.2.5.6	Annotate Archive Data					SDP_REQ-132 Annotations,
F.2.5.7	Automate Science analysis					SDP_REQ-86 Analysis API,
F.2.5.8	Produce Science Analysis Products					SDP_REQ-85 Viewer Plot Save,
F.2.5.9	Log Data Access					SDP_REQ-96 Data access logging,
F.20	Commissioning					SKA1-SYS_REQ-2657 Processing capability,
F.21	Pulsar Timing Post Processing					SKA1-SYS_REQ-2208 Beamformer S/N ratio: Pulsar timing, SKA1-SYS_REQ-2231 Pulsar timing Dispersion Measure, SKA1-SYS_REQ-2130 Pulsar Timing Mode., SKA1-SYS_REQ-2230 Multiple timings., SKA1-

						SYS_REQ-2207 Number of beams: Pulsar timing., SKA1-SYS_REQ-2738 CSP to SDP Interface,
F.21.1	Pulsar Timing ToA Determination					SDP_REQ-529 Pulsar Timing Precision, SDP_REQ-543 Pulsar Timing Systematic Error, SDP_REQ-542 Pulsar Timing Error Estimation, SDP_REQ-530 Pulsar Timing ToA Determination,
F.21.2	Pulsar Timing Data Preparation					SDP_REQ-524 Pulsar Timing Input, SDP_REQ-534 Pulsar Timing Data Preparation, SDP_REQ-525 Pulsar Timing RFI Mitigation,
F.21.2.1	Data Receptor (Pulsar Timing)					SDP_REQ-548 Pulsar Timing Input Data Reception,
F.21.2.2	RFI mitigation					
F.21.2.3	Calibration					
F.21.2.4	Averaging					
F.21.2.5	Archive products generated					
F.21.2.6	Data Receptor (Pulsar Search)					SDP_REQ-528 Pulsar Search Data Input Data Reception,
F.21.2.7	Data Receptor (Non-Imaging Transient Search)					SDP_REQ-539 Non-imaging Transient Input,
F.21.3	Pulsar Timing Model Fitting					SDP_REQ-525 Pulsar Timing RFI Mitigation, SDP_REQ-565 Pulsar Timing Model Fitting,
F.21.3.1	Generate Residual					SDP_REQ-551 Generate Residual Precision, SDP_REQ-531 Generate Residual Output,
F.21.3.2	Append residuals to update model					SDP_REQ-538 Form Covariance Matrix of Residuals, SDP_REQ-550 Weighting Scheme for Pulsar Timing Model Fitting, SDP_REQ-556 Update Timing Model, SDP_REQ-555 Output of Pulsar Timing Model,
F.22	Control					SKA1-SYS_REQ-2128 Continuum and spectral line imaging mode., SKA1-SYS_REQ-2285 Latency of TOO scheduling block initiation., SDP_REQ-2 Capability Handling, SDP_REQ-28 Precursor integration, SKA1-SYS_REQ-2230 Multiple timings., SKA1-SYS_REQ-2264

					<p>SKA1_Survey sub-arraying., SDP_REQ-29 Targets of Opportunity, SDP_REQ-30 Graceful degradation, SKA1- SYS_REQ-2282 Central location for data bases, SDP_REQ-1 Mode handling, SKA1-SYS_REQ-2263 SKA1_Survey single array operation., SDP_REQ-7 Observation Control, SDP_REQ- 25 Independent Operations, SDP_REQ-38 Metadata input, SDP_REQ-52 Failsafe, SKA1- SYS_REQ-2355 Data product provenance., SKA1-SYS_REQ- 2286 Discard previous scheduling block., SKA1-SYS_REQ-2126 Simultaneous operation of telescopes, SKA1-SYS_REQ-2788 Non-propagation of failures, SKA1-SYS_REQ-2130 Pulsar Timing Mode., SDP_REQ-11 Frequency handling, SKA1- SYS_REQ-2645 Telescope Model, SDP_REQ-50 Invalid input handling, SDP_REQ-51 Engineering Support, SKA1- SYS_REQ-2357 QA annotation., SDP_REQ-49 Telescope Manager API, SKA1-SYS_REQ-2266 SKA1_Survey PAF rotation., SKA1-SYS_REQ-2262 SKA1_Survey inclusion of ASKAP., SKA1-SYS_REQ-2283 Target of opportunity, SKA1- SYS_REQ-2224 Frequency agility., SKA1-SYS_REQ-2786 Safety documentation file, SKA1- SYS_REQ-2312 Alarm latency., SKA1-SYS_REQ-2127 Sub- Arraying., SKA1-SYS_REQ-2129 Pulsar Search Mode., SKA1- SYS_REQ-2173 MeerKAT array, SKA1-SYS_REQ-2474 RFI masking, SKA1-SYS_REQ-2336 Standard pipeline products., SDP_REQ-3 Observation Handling, SKA1-SYS_REQ-2133 Mode transition, SDP_REQ-33 Flagging control,</p>
F.22.1	Availability				<p>SDP_REQ-15 Availability - Data Layer, SDP_REQ-4 Capability availability, SDP_REQ-16 Availability - Delivery,</p>

					SDP_REQ-14 Availability - Compute, SDP_REQ-12 Frequency availability,
F.22.2	Scheduling				SDP_REQ-19 Scheduling - Delivery, SDP_REQ-5 Observation scheduling, SDP_REQ-20 Scheduling - Feedback, SDP_REQ-6 Observation scheduling feedback, SDP_REQ-17 Scheduling - Compute, SDP_REQ-18 Scheduling - Data Layer,
F.22.3	Control				SDP_REQ-10 Observation control - status, SDP_REQ-31 Graceful degradation - evaluation, SDP_REQ-22 Control - Data Layer, SDP_REQ-23 Control - Delivery, SDP_REQ-8 Observation control - start, SDP_REQ-24 Control - Feedback, SDP_REQ-9 Observation control - stop, SDP_REQ-21 Control - Compute, SDP_REQ-32 Graceful degradation - reporting, SDP_REQ-26 Resource sharing, SDP_REQ-13 Frequency control - switch, SDP_REQ-27 Observation control - switching,
F.22.4	Self-test				SDP_REQ-34 Self testing,
F.22.5	Metadata				SDP_REQ-39 Metadata proxy,
F.23	Data Layer Management				SDP_REQ-247 Data Layer Management, SDP_REQ-251 Concurrency, SKA1-SYS_REQ-2322 Global sky model.,
F.23.1	Data Life Cycle Control				SDP_REQ-248 Data Life Cycle Management, SDP_REQ-268 Rejuvenation,
F.23.1.1	Aggregation				SDP_REQ-255 Tracing Data, SDP_REQ-252 Concurrent Workflows,
F.23.1.2	Replication				SDP_REQ-260 Archive Backup,
F.23.1.3	Migration				SDP_REQ-268 Rejuvenation, SDP_REQ-263 Data Migration Design, SDP_REQ-269 Storage Technology Transition,
F.23.1.4	Retirement				SDP_REQ-256 Discard Scheduling Block,
F.23.2	Hierarchical Storage Management				SDP_REQ-598 Storage Hierarchy,

F.23.2.1	Transaction Management					SDP_REQ-383 Data Integrity,
F.23.2.2	Buffering					
F.23.2.3	File Access					
F.23.2.4	Database Access					SDP_REQ-250 DB Interface,
F.23.3	Data Services					SDP_REQ-599 Data Service Layer,
F.23.3.1	Special Purpose Functions					SDP_REQ-257 Sky Model Access,
F.23.3.2	Raw Data Reception					
F.23.3.3	Load Balancing					SDP_REQ-253 Workload Balance,
F.23.3.4	Backup/Recovery					SDP_REQ-260 Archive Backup, SDP_REQ-283 Restore archive from backup, SDP_REQ-261 Restoring Archive Operations of a failed site, SDP_REQ-282 Backup Archive Retrieval, SDP_REQ-281 Backup sites,
F.23.3.5	Aborting/Resetting					SDP_REQ-256 Discard Scheduling Block,
F.23.4	Monitoring					SDP_REQ-266 Status Information,
F.23.4.1	Load Measurement					SDP_REQ-272 Performance Feed, SDP_REQ-265 Continuous Performance Monitoring Metrics,
F.23.4.2	Status Reporting					SDP_REQ-266 Status Information, SDP_REQ-267 Availability Metric,
F.23.4.3	Alerting					SDP_REQ-384 Notification Event,
F.24	Spectral line Pipeline					SKA1-SYS_REQ-2165 Polarisation Purity, SDP_REQ-410 Spectral line emission pipeline performance, SKA1-SYS_REQ-2236 SKA1_Survey configuration, SKA1-SYS_REQ-2241 Maximum available bandwidth, SKA1-SYS_REQ-2238 RF system frequency range PAF band 1, SDP_REQ-411 Spectral line absorption pipeline performance, SDP_REQ-388 Spectral line absorption pipeline, SKA1-SYS_REQ-2186 RF system sampled bandwidth band 2, SKA1-SYS_REQ-2185 RF system sampled bandwidth band 1, SKA1-SYS_REQ-2240 RF system frequency range PAF band 3, SKA1-SYS_REQ-2242 SKA1_Survey digitised

					<p>bandwidth, SKA1-SYS_REQ-2140 SKA1_Low station diameter, SKA1-SYS_REQ-2239 RF system frequency range PAF band 2, SKA1-SYS_REQ-2322 Global sky model., SKA1-SYS_REQ-2319 Closed loop calibration., SDP_REQ-387 Spectral line emission pipeline, SKA1-SYS_REQ-2252 SKA1_Survey correlator dump period., SKA1-SYS_REQ-2250 SKA1_Survey channelisation., SKA1-SYS_REQ-2148 SKA1_Low channelisation, SKA1-SYS_REQ-2195 SKA1_Mid channelisation, SKA1-SYS_REQ-2259 SKA1_Survey spectral dynamic range., SKA1-SYS_REQ-2134 Electromagnetic frequency range., SKA1-SYS_REQ-2153 Diameter, SKA1-SYS_REQ-2178 Combined SKA1_Mid configuration, SKA1-SYS_REQ-2189 RF system sampled bandwidth band 5, SKA1-SYS_REQ-2266 SKA1_Survey PAF rotation., SKA1-SYS_REQ-2262 SKA1_Survey inclusion of ASKAP., SKA1-SYS_REQ-2321 Direction dependent effects., SKA1-SYS_REQ-2256 SKA1_Survey imaging dynamic range., SKA1-SYS_REQ-2174 Combined SKA1_Mid configuration., SKA1-SYS_REQ-2142 SKA1_Low number of stations., SKA1-SYS_REQ-2173 MeerKAT array, SKA1-SYS_REQ-2188 RF system sampled bandwidth band 4, SDP_REQ-372 Early science processing capability, SKA1-SYS_REQ-2247 SKA1_Survey number of beams., SKA1-SYS_REQ-2324 Multi-frequency synthesis imaging., SKA1-SYS_REQ-2147 Instantaneous bandwidth., SKA1-SYS_REQ-2187 RF system sampled bandwidth band 3,</p>
F.25	Gridding				<p>SKA1-SYS_REQ-2197 SKA1_Mid correlator integration rate., SKA1-SYS_REQ-2150 SKA1_Low correlator Integration</p>

						rate.,
F.25.1	Postage Stamp Selection					SDP_REQ-600 Postage Stamp Selection,
F.25.1.1	uv Plane Averaging					SDP_REQ-405 Image plane averaging 2, SDP_REQ-395 Additional Visibility Averaging,
F.25.1.2	Phase Rotation					SDP_REQ-448 Phase Rotation,
F.25.2	Continuum Subtraction					SDP_REQ-601 Continuum Subtraction,
F.26	Public Interface					SKA1-SYS_REQ-2739 Levels of access to the archive, SKA1-SYS_REQ-2352 Web interface., SKA1-SYS_REQ-2366 Distribution of data products.,
F.27	Science Analysis Pipeline					SKA1-SYS_REQ-2335 Stacking., SDP_REQ-372 Early science processing capability, SKA1-SYS_REQ-2333 Continuum source finding., SKA1-SYS_REQ-2334 Spectral line source finding., SKA1-SYS_REQ-2322 Global sky model.,
F.27.1	Calibration Source Finding					SDP_REQ-507 Calibration Source Finding,
F.27.1.1	Fast Point Source Detection					
F.27.2	Input Data Conditioning for Science Analysis					SDP_REQ-510 Science Analysis input data conditioning,
F.27.2.1	Imaging Cube Gridding					SDP_REQ-520 Image Cube management,
F.27.2.2	Image Processing Cadence					SDP_REQ-521 Image Cadence management,
F.27.3	Source Analysis					SDP_REQ-514 Source Analysis (TBC),
F.27.3.1	Rotation Measure Synthesis					
F.27.3.2	Spectral Line Profile Determination					SDP_REQ-515 Spectral Line Profile Determination,
F.27.3.3	Spectral Index Determination					SDP_REQ-509 Spectral Index Determination ,
F.27.3.4	EoR Power Spectrum Determination					SDP_REQ-517 EoR Power spectrum calculation,
F.27.4	Source Finding					SDP_REQ-511 Continuum Source Finding,
F.27.4.1	Point Source Detection					SDP_REQ-518 Point Source Detection,

F.27.4.2	Spectral Line Source Detection					SDP_REQ-516 Spectral Line Source Detection,
F.27.4.3	Extended Source Detection					SDP_REQ-508 Extended Source Detection,
F.27.5	Stacking					SDP_REQ-512 Stacking,
F.27.5.1	Continuum Stacking					SDP_REQ-519 Continuum Stacking,
F.27.5.2	H1 Stacking					SDP_REQ-513 H1 Stacking,
F.3	Archiving					SDP_REQ-271 Data Products, SDP_REQ-57 Spectrum Archive Metadata, SKA1-SYS_REQ-2358 Third party data products., SKA1-SYS_REQ-2821 Archive, SDP_REQ-290 Secure Archive Environment,
F.3.1	Product Ingest					SDP_REQ-276 Data Product Provenance, SDP_REQ-574 Science Data Archive,
F.3.1.1	Indexing					SDP_REQ-255 Tracing Data, SDP_REQ-578 Data Model Compliance,
F.3.1.2	Branding/Provenance					SDP_REQ-254 Provenance,
F.3.2	Distribution/Sharing					SDP_REQ-262 Data Layer Product Distribution, SDP_REQ-275 Remote Processing, SDP_REQ-574 Science Data Archive,
F.3.2.1	Metadata Service					SDP_REQ-523 Archive Database Service, SDP_REQ-577 Decoupling real-time Ops,
F.3.2.2	Data Product Service					SDP_REQ-522 Archive Bulk Data Access Service, SDP_REQ-576 Data Product Replication, SDP_REQ-577 Decoupling real-time Ops,
F.3.3	Archive Policy Tool					SDP_REQ-285 Accessibility, SDP_REQ-270 Archive Security Traceability, SDP_REQ-574 Science Data Archive, SDP_REQ-573 Third party data products,
F.3.3.1	Access Control					SDP_REQ-613 Meta Access, SDP_REQ-286 Levels of access to the archive, SDP_REQ-612 Data Product Types, SDP_REQ-264 Access Rules, SDP_REQ-610 Consistent Release State, SDP_REQ-611 User Roles,
F.5	Continuum Pipeline					SDP_REQ-409 Continuum imaging pipeline performance,

					<p>SKA1-SYS_REQ-2236 SKA1_Survey configuration, SKA1-SYS_REQ-2241 Maximum available bandwidth, SKA1- SYS_REQ-2238 RF system frequency range PAF band 1, SKA1-SYS_REQ-2186 RF system sampled bandwidth band 2, SKA1- SYS_REQ-2242 SKA1_Survey digitised bandwidth, SKA1- SYS_REQ-2185 RF system sampled bandwidth band 1, SKA1- SYS_REQ-2322 Global sky model., SDP_REQ-390 Multi- frequency synthesis imaging, SKA1-SYS_REQ-2319 Closed loop calibration., SKA1- SYS_REQ-2252 SKA1_Survey correlator dump period., SKA1- SYS_REQ-2250 SKA1_Survey channelisation., SKA1-SYS_REQ- 2148 SKA1_Low channelisation, SKA1-SYS_REQ-2195 SKA1_Mid channelisation, SDP_REQ-392 Peeling, SKA1- SYS_REQ-2259 SKA1_Survey spectral dynamic range., SKA1- SYS_REQ-2178 Combined SKA1_Mid configuration, SKA1- SYS_REQ-2262 SKA1_Survey inclusion of ASKAP., SKA1- SYS_REQ-2321 Direction dependent effects., SKA1- SYS_REQ-2142 SKA1_Low number of stations., SKA1- SYS_REQ-2188 RF system sampled bandwidth band 4, SKA1- SYS_REQ-2173 MeerKAT array, SDP_REQ-372 Early science processing capability, SKA1- SYS_REQ-2165 Polarisation Purity, SKA1-SYS_REQ-2240 RF system frequency range PAF band 3, SKA1-SYS_REQ-2140 SKA1_Low station diameter, SKA1-SYS_REQ-2239 RF system frequency range PAF band 2, SDP_REQ-278 Local sky model, SDP_REQ-386 Continuum imaging pipeline, SKA1- SYS_REQ-2134 Electromagnetic frequency range., SKA1- SYS_REQ-2153 Diameter, SKA1- SYS_REQ-2189 RF system</p>
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					sampled bandwidth band 5, SKA1-SYS_REQ-2266 SKA1_Survey PAF rotation., SKA1-SYS_REQ-2256 SKA1_Survey imaging dynamic range., SKA1-SYS_REQ-2174 Combined SKA1_Mid configuration., SKA1-SYS_REQ-2247 SKA1_Survey number of beams., SKA1-SYS_REQ-2324 Multi-frequency synthesis imaging., SKA1-SYS_REQ-2147 Instantaneous bandwidth., SKA1-SYS_REQ-2187 RF system sampled bandwidth band 3,
F.5.1	Initial Calibration (averaged data)				SDP_REQ-417 Calibration pipeline.,
F.5.2	Update GSM				SDP_REQ-505 Global Sky Model Update,
F.5.3	Calibration				SDP_REQ-446 Spectrometric performance metric, SDP_REQ-417 Calibration pipeline., SDP_REQ-445 Polarimetric performance metric, SDP_REQ-441 Automated Quality Assessment., SDP_REQ-444 Radiometric performance metric, SDP_REQ-278 Local sky model, SKA1-SYS_REQ-2322 Global sky model., SDP_REQ-442 Astrometric performance metric, SKA1-SYS_REQ-2319 Closed loop calibration., SDP_REQ-536 Pulsar Timing Polarisation Calibration, SDP_REQ-443 Photometric performance metric, SDP_REQ-424 Polarisation purity., SDP_REQ-412 SKA1_Survey spectral dynamic range., SKA1-SYS_REQ-2330 Peeling., SDP_REQ-437 SKA1_Survey inclusion of ASKAP., SKA1-SYS_REQ-2262 SKA1_Survey inclusion of ASKAP., SKA1-SYS_REQ-2266 SKA1_Survey PAF rotation., SKA1-SYS_REQ-2256 SKA1_Survey imaging dynamic range., SKA1-SYS_REQ-2321 Direction dependent effects., SDP_REQ-553 Pulsar Timing Flux Calibration, SKA1-SYS_REQ-2173 MeerKAT array, SKA1-SYS_REQ-2247

					SKA1_Survey number of beams., SKA1-SYS_REQ-2324 Multi-frequency synthesis imaging.,
F.5.3.1	Solve				SDP_REQ-498 Fit model parameters,
F.5.3.2	Predict				SDP_REQ-501 Predict visibilities,
F.5.3.3	Subtract (calibration)				SDP_REQ-497 Subtract (calibration),
F.5.3.4	Flag (calibration)				SDP_REQ-503 Flag (calibration),
F.5.3.5	Correct				SDP_REQ-499 Correct,
F.5.4	Self-cal loop				SDP_REQ-500 Self-calibration loop,
F.5.5	Deconvolution				SDP_REQ-403 Deconvolution, SDP_REQ-397 Imager, SDP_REQ-447 Major and minor deconvolution cycles, SDP_REQ-504 Scale sensitive deconvolution,
F.5.5.10	Major Cycle Loop				SDP_REQ-403 Deconvolution,
F.5.5.2	Subtract Component in Image Plane				SDP_REQ-403 Deconvolution,
F.5.5.3	Identify Component				SDP_REQ-403 Deconvolution,
F.5.5.5	iFFT				SDP_REQ-402 Fourier Transform Algorithm,
F.5.5.6	De-gridding				SDP_REQ-398 Gridding & de-gridding, SDP_REQ-401 A-kernel, SDP_REQ-399 Anti-aliasing kernel, SDP_REQ-400 w-kernel,
F.5.5.7	Subtract from uv-data				SDP_REQ-396 LSM subtraction,
F.5.5.8	Gridding				SDP_REQ-398 Gridding & de-gridding, SDP_REQ-401 A-kernel, SDP_REQ-399 Anti-aliasing kernel, SDP_REQ-400 w-kernel,
F.5.5.9	FFT				SDP_REQ-402 Fourier Transform Algorithm,
F.5.6	Image Plane Spectral Averaging				SDP_REQ-404 Image plane spectral averaging, SDP_REQ-405 Image plane averaging 2,
F.5.7	Update LSM				
F.6	Metrics				SDP_REQ-48 Spectrometric performance metric, SKA1-SYS_REQ-2742 Performance assessment, SDP_REQ-46 Radiometric performance metric, SDP_REQ-47 Polarimetric performance metric, SKA1-SYS_REQ-2744 Quality

					<p>assessment, SKA1-SYS_REQ-2745 Astrometry performance metric, SKA1-SYS_REQ-2748 Polarimetric performance metric, SKA1-SYS_REQ-2280 System status., SDP_REQ-45 Photometric performance metric, SKA1-SYS_REQ-2749 Spectrometric performance metric, SDP_REQ-44 Astrometric performance metric, SKA1-SYS_REQ-2746 Photometric performance metric, SKA1-SYS_REQ-2747 Radiometric performance metric, SKA1-SYS_REQ-2743 Performance goals,</p>
F.8	Ingest Pipeline				<p>SKA1-SYS_REQ-2236 SKA1_Survey configuration, SKA1-SYS_REQ-2241 Maximum available bandwidth, SKA1-SYS_REQ-2238 RF system frequency range PAF band 1, SKA1-SYS_REQ-2186 RF system sampled bandwidth band 2, SKA1-SYS_REQ-2242 SKA1_Survey digitised bandwidth, SKA1-SYS_REQ-2185 RF system sampled bandwidth band 1, SKA1-SYS_REQ-2264 SKA1_Survey sub-arraying., SKA1-SYS_REQ-2473 RFI excision, SKA1-SYS_REQ-2252 SKA1_Survey correlator dump period., SKA1-SYS_REQ-2250 SKA1_Survey channelisation., SKA1-SYS_REQ-2148 SKA1_Low channelisation, SKA1-SYS_REQ-2195 SKA1_Mid channelisation, SDP_REQ-437 SKA1_Survey inclusion of ASKAP., SKA1-SYS_REQ-2197 SKA1_Mid correlator integration rate., SKA1-SYS_REQ-2178 Combined SKA1_Mid configuration, SKA1-SYS_REQ-2262 SKA1_Survey inclusion of ASKAP., SKA1-SYS_REQ-2321 Direction dependent effects., SKA1-SYS_REQ-2142 SKA1_Low number of stations., SKA1-SYS_REQ-2188 RF system sampled bandwidth band 4, SDP_REQ-372 Early science processing capability, SKA1-</p>

					<p>SYS_REQ-2472 RFI flagging, SKA1-SYS_REQ-2128 Continuum and spectral line imaging mode., SKA1-SYS_REQ-2240 RF system frequency range PAF band 3, SKA1-SYS_REQ-2140 SKA1_Low station diameter, SKA1-SYS_REQ-2239 RF system frequency range PAF band 2, SKA1-SYS_REQ-2347 Automated Quality Assessment., SKA1-SYS_REQ-2134 Electromagnetic frequency range., SKA1-SYS_REQ-2153 Diameter, SKA1-SYS_REQ-2150 SKA1_Low correlator Integration rate., SKA1-SYS_REQ-2189 RF system sampled bandwidth band 5, SKA1-SYS_REQ-2174 Combined SKA1_Mid configuration., SKA1-SYS_REQ-2474 RFI masking, SKA1-SYS_REQ-2147 Instantaneous bandwidth., SKA1-SYS_REQ-2187 RF system sampled bandwidth band 3,</p>
F.8.1	Integrate in time and frequency				SDP_REQ-526 Average Input Data In Time, SDP_REQ-502 Ingest Pipeline,
F.8.1.1	Send (u,v) data to Calibration function				
F.8.1.2	Compress				
F.8.1.3	Integrate in time and frequency (base-line dependant)				SDP_REQ-480 Integrate Data,
F.8.1.4	Transpose, reorder				
F.8.10	Partial gather and transpose				
F.8.10.1	transpose data				SDP_REQ-475 Transpose Data,
F.8.10.2	Combine time, frequency channels, baselines & polarisation				SDP_REQ-485 Combine Data,
F.8.2	Receive and buffer (u,v) data				SDP_REQ-301 SDP ingest data rate, SDP_REQ-470 Receive Data, SDP_REQ-496 Set Weight,
F.8.2.1	Buffer (u,v) data ~0.5s				SDP_REQ-471 Buffer Data,
F.8.2.2	Receive (u,v) data from CSP				

F.8.3	Handle missing and out of order packets					
F.8.3.1	Detect missing packets					SDP_REQ-472 Handle Missing Data, SDP_REQ-483 Missing Data,
F.8.3.2	Order (u,v) data over time					SDP_REQ-482 Order UV Data,
F.8.4	RFI flagging and excision					SDP_REQ-476 Flag RFI, SDP_REQ-525 Pulsar Timing RFI Mitigation, SDP_REQ-487 Flag Data, SDP_REQ-477 Excise RFI, SDP_REQ-490 Data Quality,
F.8.4.1	Determine spatial filter weights					
F.8.4.2	Apply Spatial filter					SDP_REQ-491 Spatial Filtering, SDP_REQ-495 Spatial Filter Weights,
F.8.4.3	Apply t-f flagger					
F.8.4.4	Determine RFI detection threshold					SDP_REQ-486 Determine RFI Threshold, SDP_REQ-489 Covariance Matrices, SDP_REQ-478 Detect RFI,
F.8.5	Merge Metadata from TM					
F.8.5.1	Input Metadata from TM					SDP_REQ-484 Input Meta Data,
F.8.5.2	Merge missing packet info with TM metadata					SDP_REQ-473 Merge Meta Data,
F.8.6	Strong source removal					SDP_REQ-479 Remove Sources,
F.8.7	Receive and Apply Initial Calibration (optional)					SDP_REQ-417 Calibration pipeline.,
F.8.9	Phase Rotation					
F.9	Pulsar Search Post Processing					SKA1-SYS_REQ-2616 SKA1_Mid Pulsar phase binning, SKA1-SYS_REQ-2203 Number of beams: Pulsar search, SKA1-SYS_REQ-2220 Binary search, SKA1-SYS_REQ-2205 Beamformer S/N pulsar search, SKA1-SYS_REQ-2129 Pulsar Search Mode., SKA1-SYS_REQ-2131 Transient search mode, SKA1-SYS_REQ-2216 Time resolution, SKA1-SYS_REQ-2738 CSP to SDP Interface,
F.9.1	Periodicity Search					SDP_REQ-147 Periodicity Search

	Post Processing					Number of Beams, SDP_REQ-552 Periodicity Search Alerts, SDP_REQ-133 Periodicity Search Post Processing, SDP_REQ-527 Pulsar Search Data Input, SDP_REQ-558 Periodicity Search Output,
F.9.1.1	Merge OCLDs from multiple beams					SDP_REQ-560 Identify multi-beam candidates, SDP_REQ-533 Merge Data from Multiple Beams,
F.9.1.2	Generation and extraction of candidate heuristics					SDP_REQ-545 Extract non-imaging transient heuristics, SDP_REQ-559 Extract pulsar search heuristics,
F.9.1.3	Candidate Selection					SDP_REQ-566 Non-imaging Transient List Products, SDP_REQ-557 Periodicity Search List Products,
F.9.1.4	Candidate Classification					SDP_REQ-570 Classify Candidates (transients), SDP_REQ-547 Classify Candidates (pulsars),
F.9.1.5	Alert Generator					SDP_REQ-568 False Alarm Rate for Non-imaging Transients, SDP_REQ-541 False Alarm Rate for Pulsar Alerts, SDP_REQ-537 Response Rate for Pulsar Alerts, SDP_REQ-564 Response Rate for Non-imaging Transients,
F.9.1.6	Archive Periodicity Search Candidates					SDP_REQ-567 Periodicity Search Archive Products,
F.9.2	Non-Imaging Transient Post Processing					SDP_REQ-532 Non-imaging Transient Post Processing, SDP_REQ-148 Non-imaging Transient Search Number of Beams,
F.9.2.1	Archive Transient Search Candidates					SDP_REQ-562 Non-imaging Transient Search Archive Products,
F.9.2.5	Merge SPOCLDs from multiple beams					SDP_REQ-554 Identify Multi-beam Candidates (transients), SDP_REQ-563 Merge Data from Multiple Beams (transients),
TA-1	SDP Test Action 1					
TC-1	SDP Test Case 1					VR.1 Verification by Test,

Table 1 Functionality – Technical Use Case (TUC) Matrix