China SKA Regional Centre prototyping

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Treaty of SKA Observatory

- SKA in China, focus transition from **Preparation** to **Deployment**
- 2018-2020 prototyping phase
- China SRC

SKA Regional Centre Steering Committee

- The mission of the SRCSC is to define and create a long-term operational partnership between the SKA Observatory and an ensemble of independently-resourced SKA Regional Centres.
- Work in this area now changing emphasis as **design** moves to **implementation**

Functionalities of China SRC

- Science return is the primary focus of China’ s participation in SKA
- China SRC will preferentially support EoR, Pulsar science cases

National efforts

- **2018.9-2023.9， 5.8 MEuro**
  - SKA regional centre prototype construction and related scientific pre-research, National Key Research and Development Programme,
- **2017.1-2021.12，1.1 MEuro**
  - SKA regional centre collaboration, Chinese Academy of Sciences, 1.1 M Euro,
- 2021-2030 Dedicated SKA funding, budget plan was initially investigated by government
- 2020-2022.12: ***~40M*** euro pre-research on some selected directions
  - team building, international collaboration, and pipeline development.
  - Call for proposal is expected to be released in early 2020.
- 2020-，Shanghai Government showed interest to host SKA
  - 2020: SHAO plans to apply an initial grant from Shanghai government to foster the science team and to support the SKA and SRC international collaboration, about 1M euro.

China SKA Regional Centre Prototype

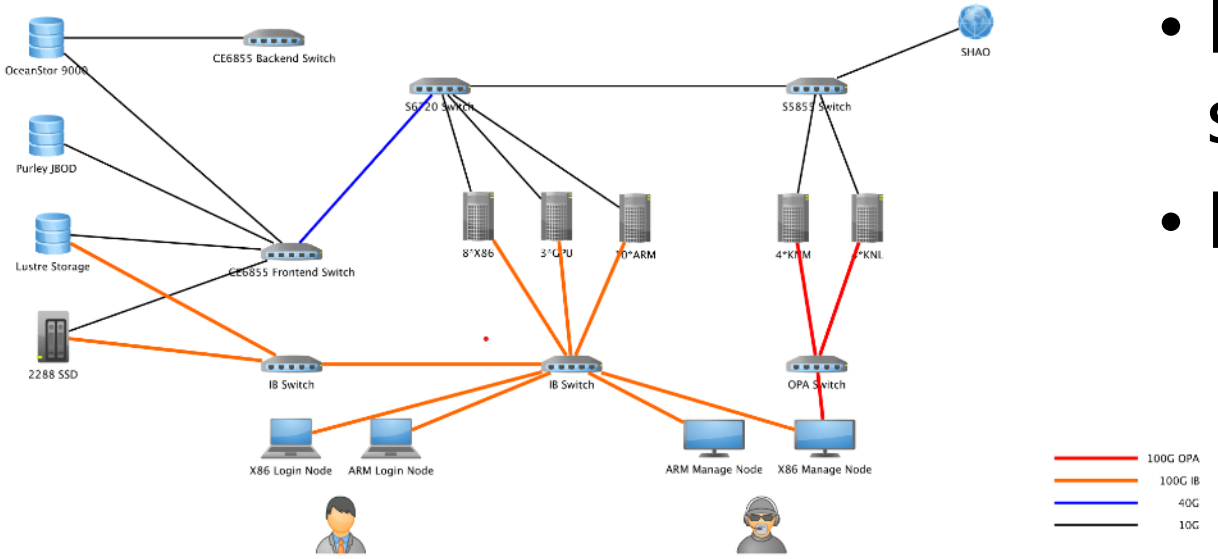
- The first SKA regional centre prototype
  - An, Wu, Hong, Nat Astron 2019

China SKA Regional Centre prototype

- ~200 Tflops
- Mixed heterogeneous system
  - 10 x86 CPU servers: 380 cores
  - 12 ARM servers: 1152 cores
  - 3 GPU servers: 16 V100
- MWA, ASAKP pipelines ready
- Docker ready

China SKA Regional Centre prototype

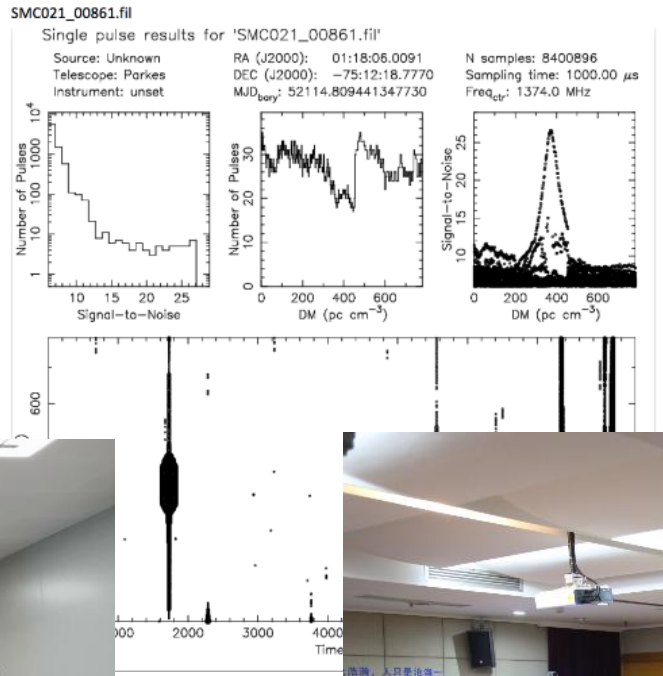
- IB network : 11GBps
- Memory Bandwidth : 122GBps
- Storage:
  - OceanStor 9000 : 6GBps
  - Lustre : 12GBps
  - SSD : 12GBps



- InfiniBand in/bw nodes
- NVMe SSD in compute nodes
- Huawei OceanStor9000 storage
- Lustre file system SSD

China SRC - also an education platform

- Students found FRB signal from tutorial data !



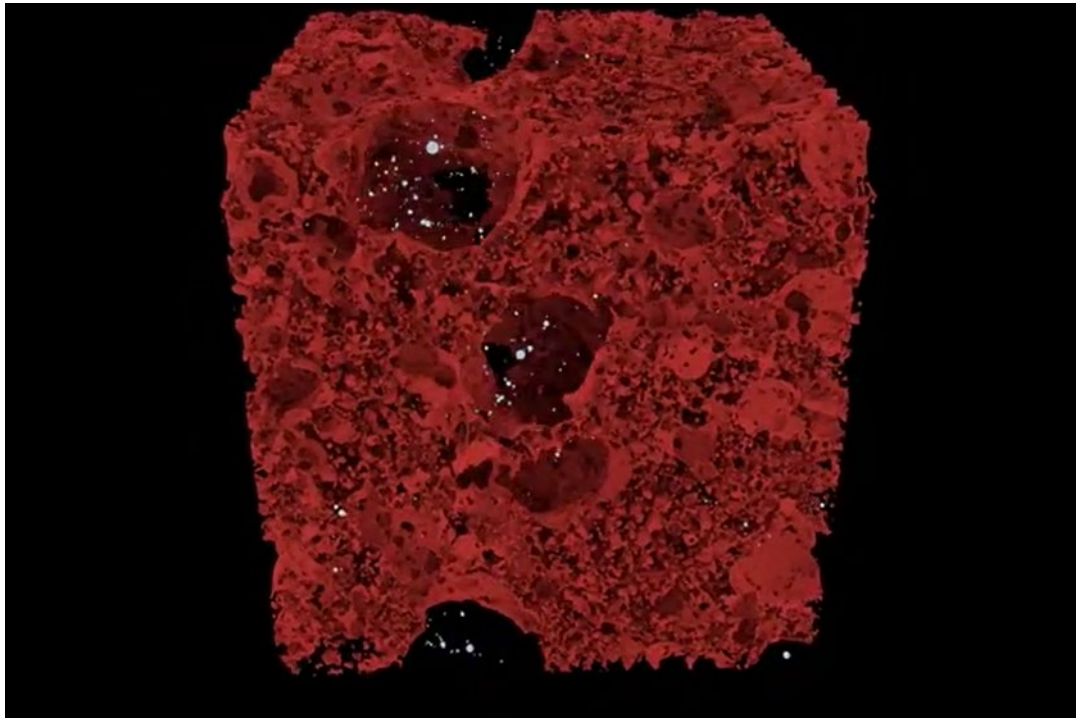
Research highlights
Verification of DALiuGE on Tianhe-2

- Data-Activated Flow (流Liu) Graph Engine (DALiuGE) – Australia-China collaboration achievement !
- Deployed on Tianhe-2 1500 nodes, multiple computing islands, verifying the scalability of DALiuGE to 10 million tasks/drops => **first-time** large-scale SDP test, strong supporting for further integration and **prototyping**
- SHAO SKA team awarded 2016 **"Milky Way Star"**

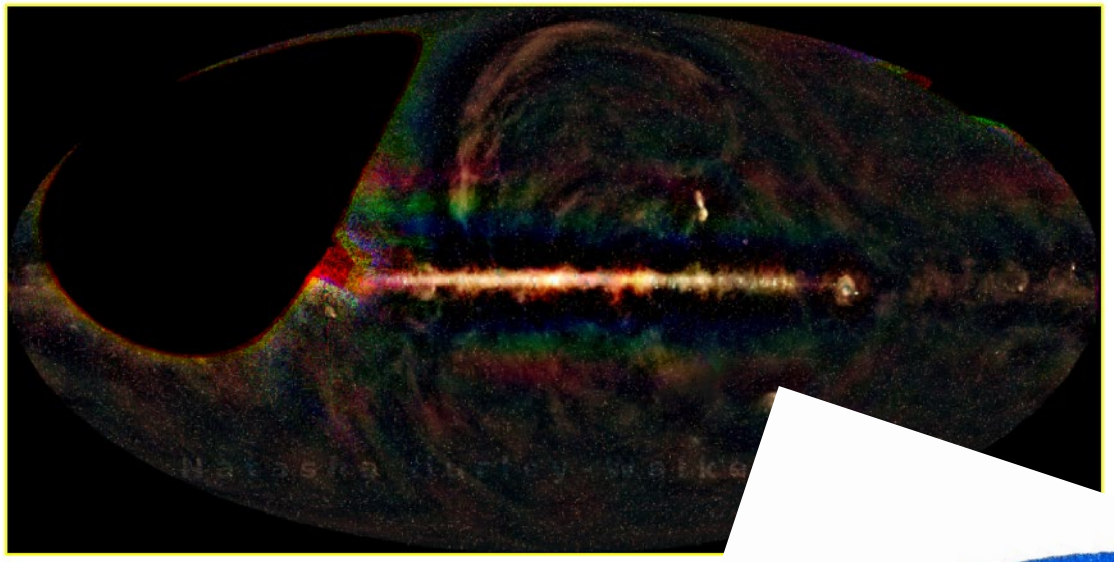
World's largest telescope meets the second fastest computer

Research highlights
SKA shakes hand with Supercomputer SUMMIT

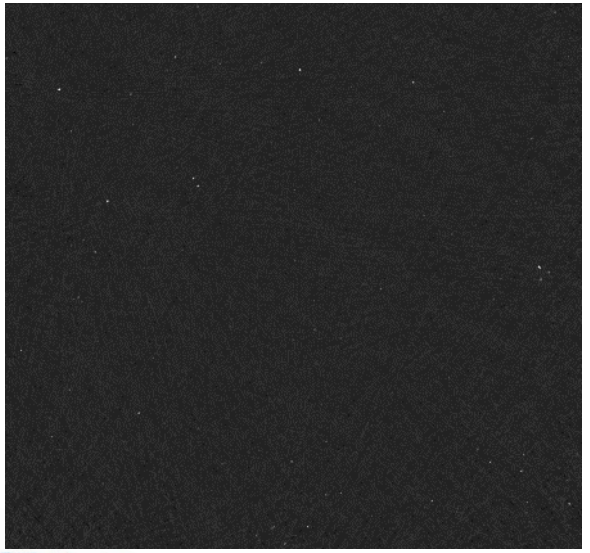
- the first largest SKA-scale data flow
- Credit: ICRAR, ONL, SHAO
- Demo in SKA Engineering Meeting, Nov 25-28

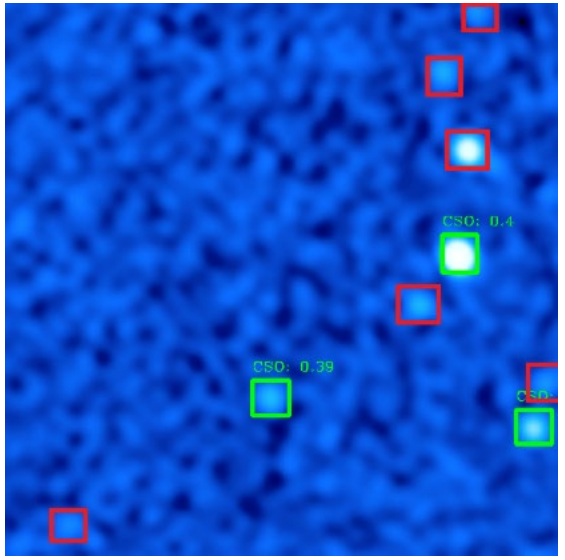


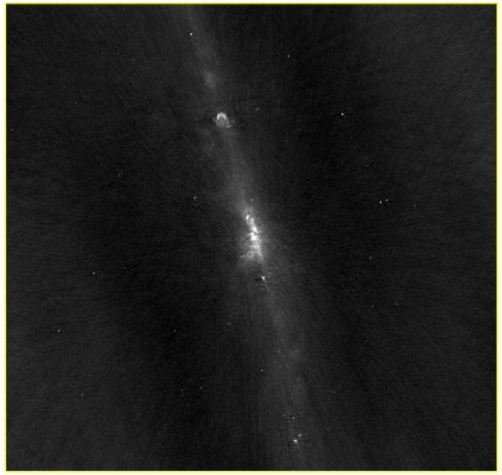
SKA pathfinder data processing



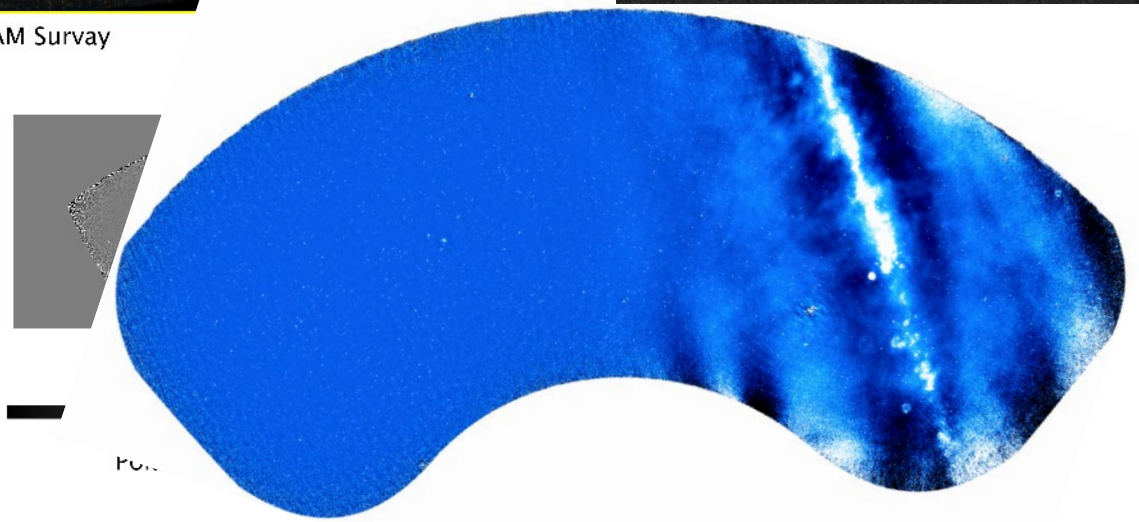
GLEAM Survay

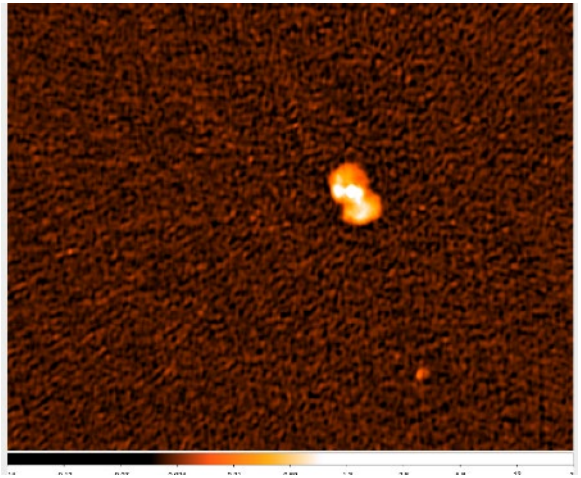






Deep Imaging





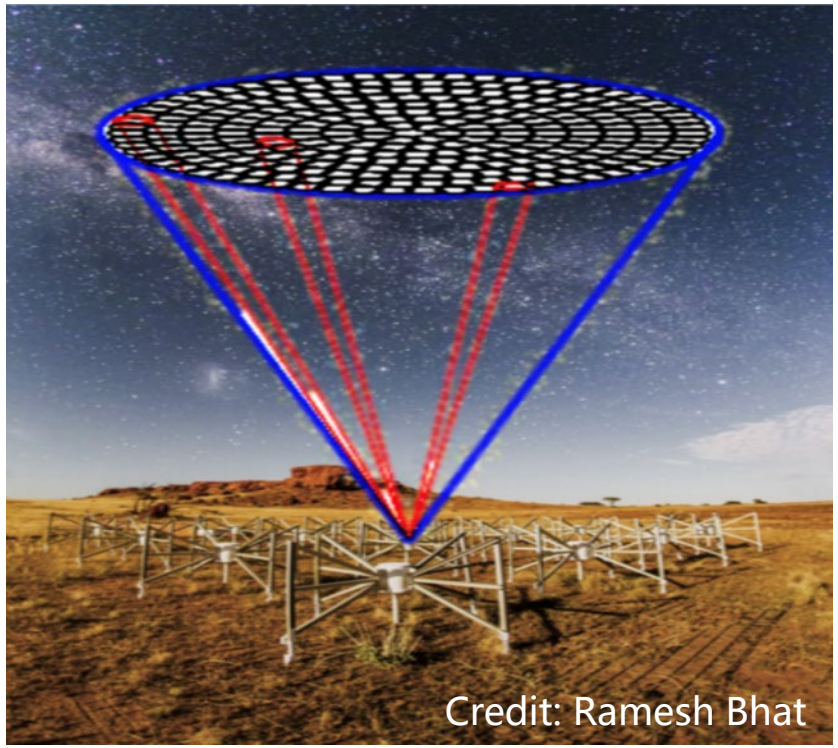
STEP Correlator Benchmark Results

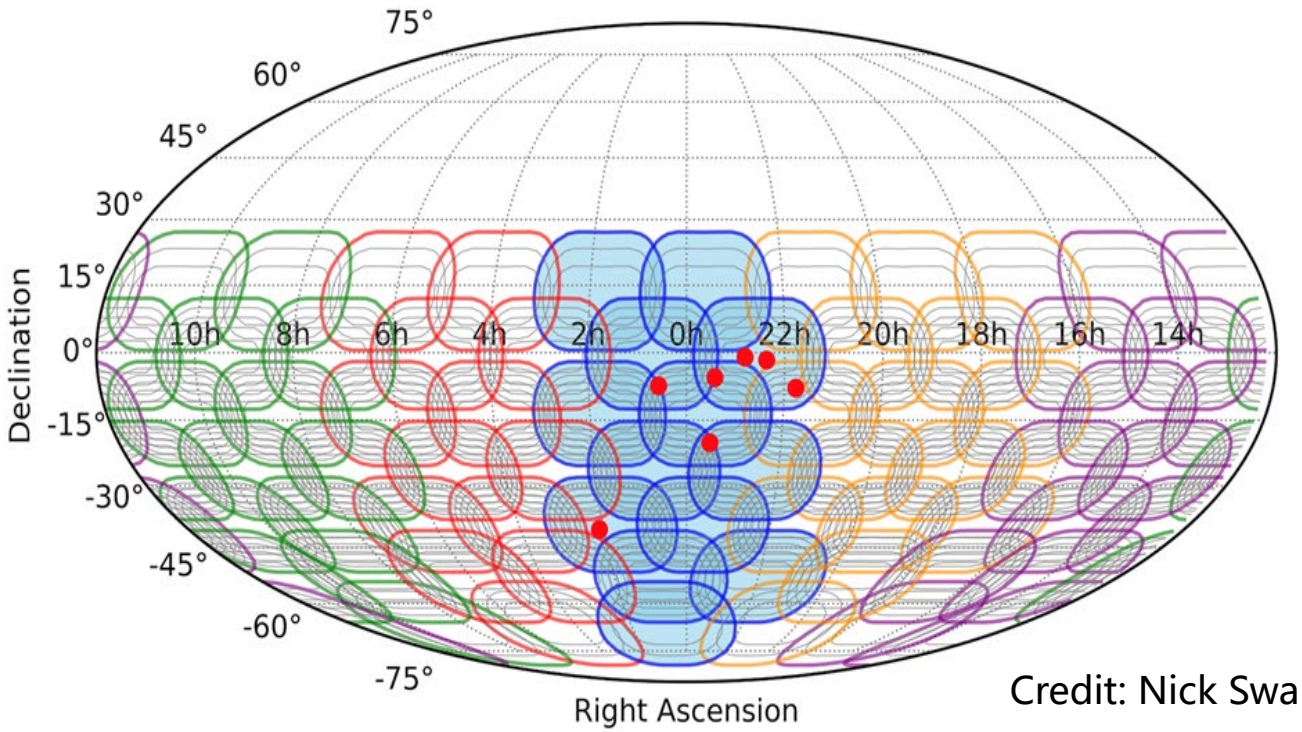
GPU	lib\Blocks	1 (20GB)	2 (10GB)	4 (5GB)	8 (2.5GB)	10 (2GB)	25 (800MB)	40 (500MB)	50 (400MB)	100 (200MB)	200 (100MB)
P3000 (6GB)	Numpy	X	X	1924.9	1821.49	1818.58	1674.94	1682.09	1662.84	1662.63	594.65
	Pytorch	X	X	X	X	X	230.62	359.39	445.34	887.19	1733.16
	Cupy	X	X	X	X	X	93.41	96.97	99.38	134.27	245.89
K80 (12GB)	Numpy	1811.54	1789.27	1632.64	1071.26	1050.32	957.42	967.81	956.2	1007.67	1073.28
	Pytorch	X	X	X	143.02	143.97	186.66	221.09	328.67	636.88	1250.07
	Cupy	X	X	X	X	X	149.73	159.38	166.57	202.74	344.83
V100 (32GB)	Numpy	1793.52	1707.69	1760.38	1131.32	1007.2	943.27	929.21	938.89	951.72	993.05
	Pytorch	X	46.37	46.79	46.7	51.58	128.41	157.68	185.37	363.65	744.61
	Cupy	X	X	X	70.9	70.05	69.63	60.69	73.03	142.6	256.52
V100 (16GB)	Numpy	1582.12	1494.81	1406.29	882.85	845.10	788.73	781.92	771.57	832.26	882.16
	Pytorch	X	X	X	43.95	42.14	86.77	157.31	163.85	288.28	570.55
	Cupy	X	X	X	70.9	70.05	69.63	58.49	59.96	115.21	209.44

SKA-Low (MWA) pulsar search

MWA **SMART** project: dec>30deg pulsar search, coherence => 10x SNR

China SRC prototype provides SMART compute, storage, operation and data analysis FTE





Credit: Nick Swainston

China SRC beyond 2020

Founding plan

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- 2020-2022.12: ~40M euro pre-research on some selected directions
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- 2020-，Shanghai Government showed interest to host SKA
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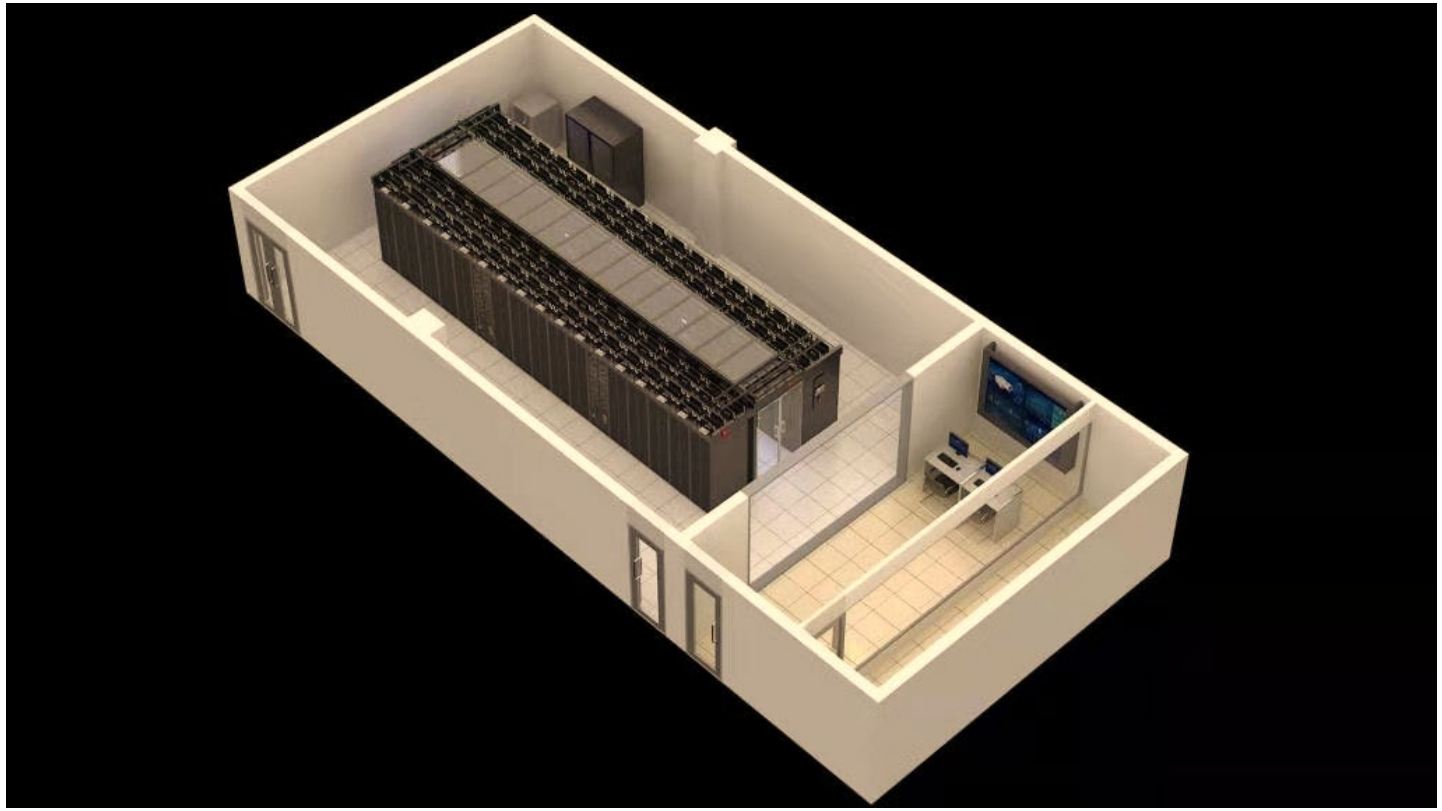
Near-term plan (2020-2024)

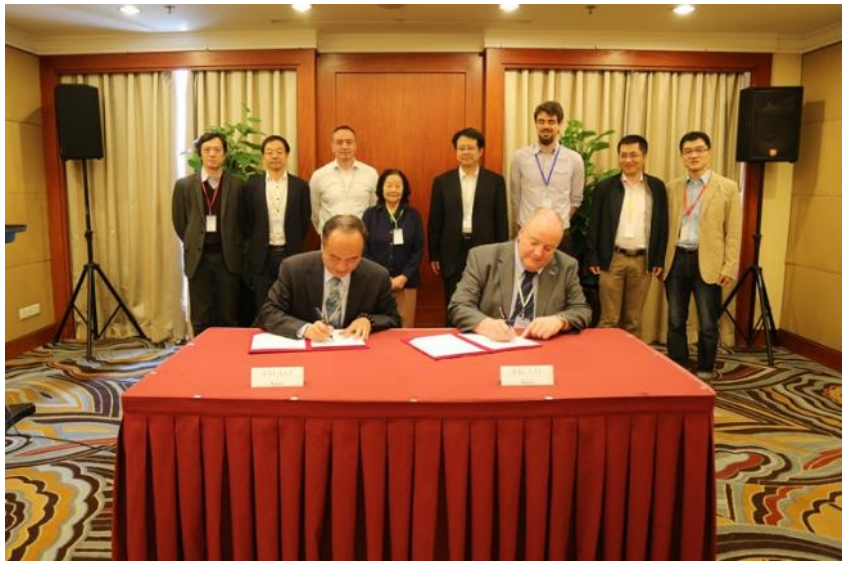
From **4** racks to **20**

Enable to support **SKA pathfinders**



China SKA RC activities

- 2016,
  - Shanghai, SKA SDP&HPC conference, SHAO-ICRAR, SKA Key techniques test on Tianhe-2
- 2017,
  - ERIDANUS and AENEAS initiatives
  - SHAO join MWA Phase II
  - 1st AU-CH SKA Big Data Workshop
- 2018,
  - Australian and China Radio Astronomy joint centre
- **2019**
  - **SHAO-Huawei Collaboration**
  - **SKA Engineering and Operation Conference, Nov 25-28, Shanghai, China , you are welcome !**

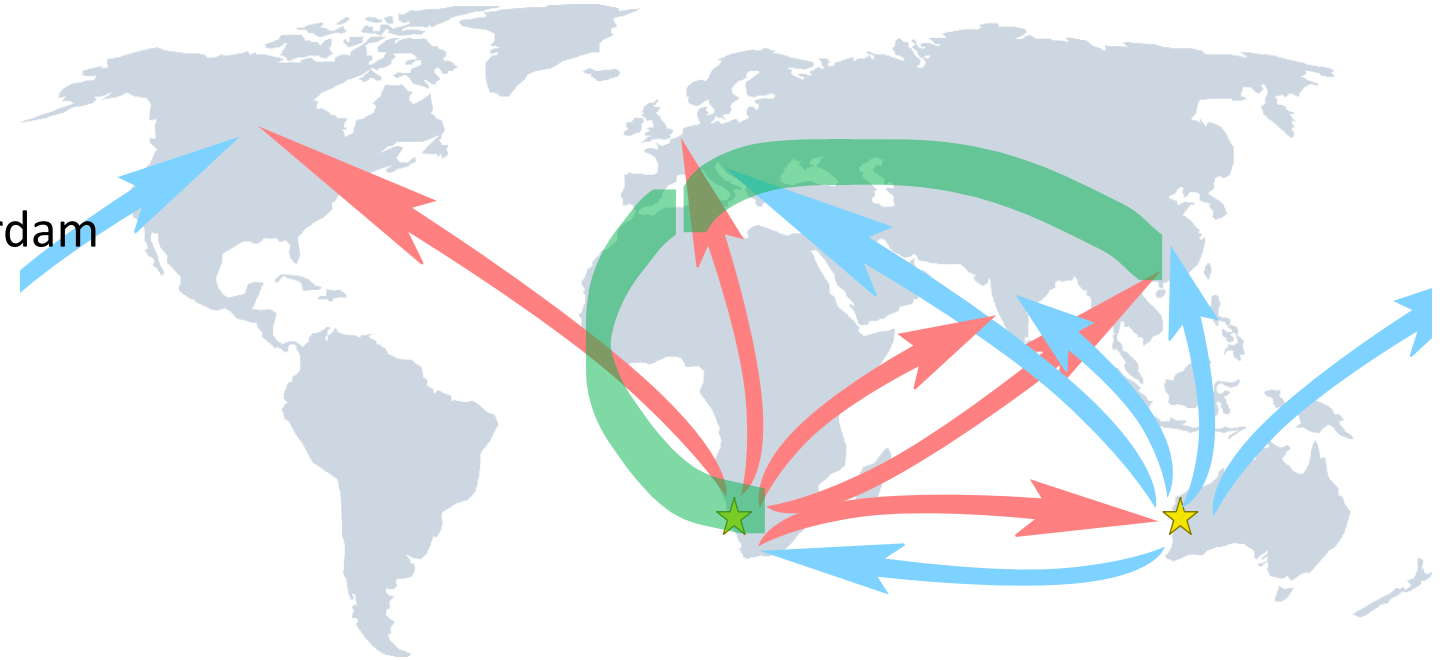


SRC network prototyping

- International port from Shanghai: 5 Gbps in total now
- Shanghai – (via North America)- Perth : 3.5 Gbps done
- Shanghai – JIVE : 2Gbps regular eVLBI

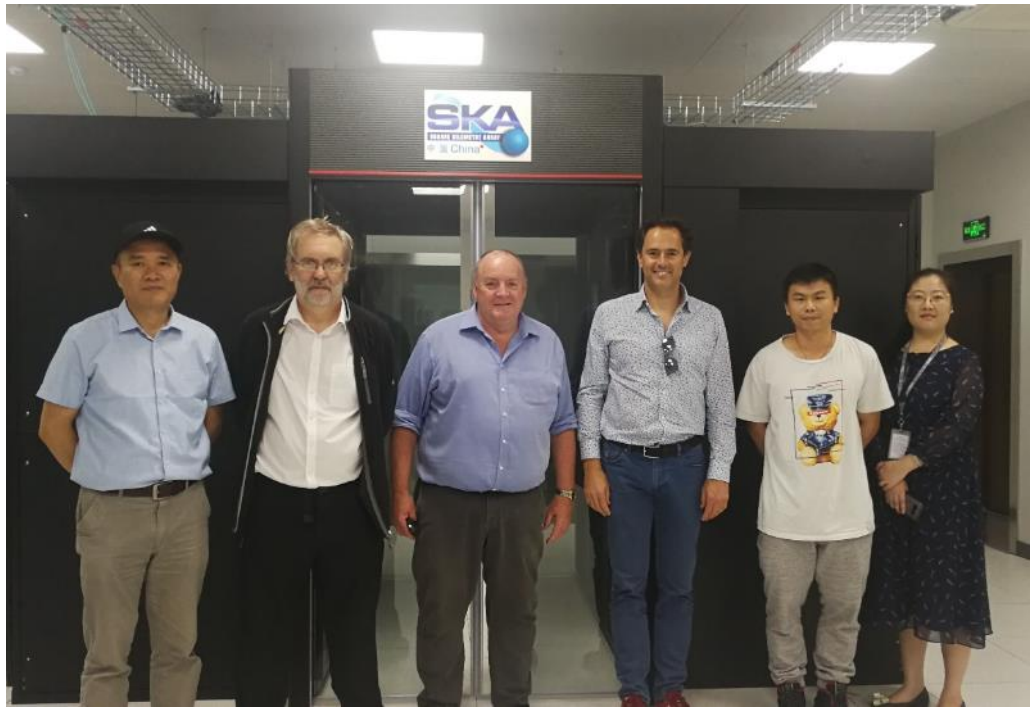
To be done :

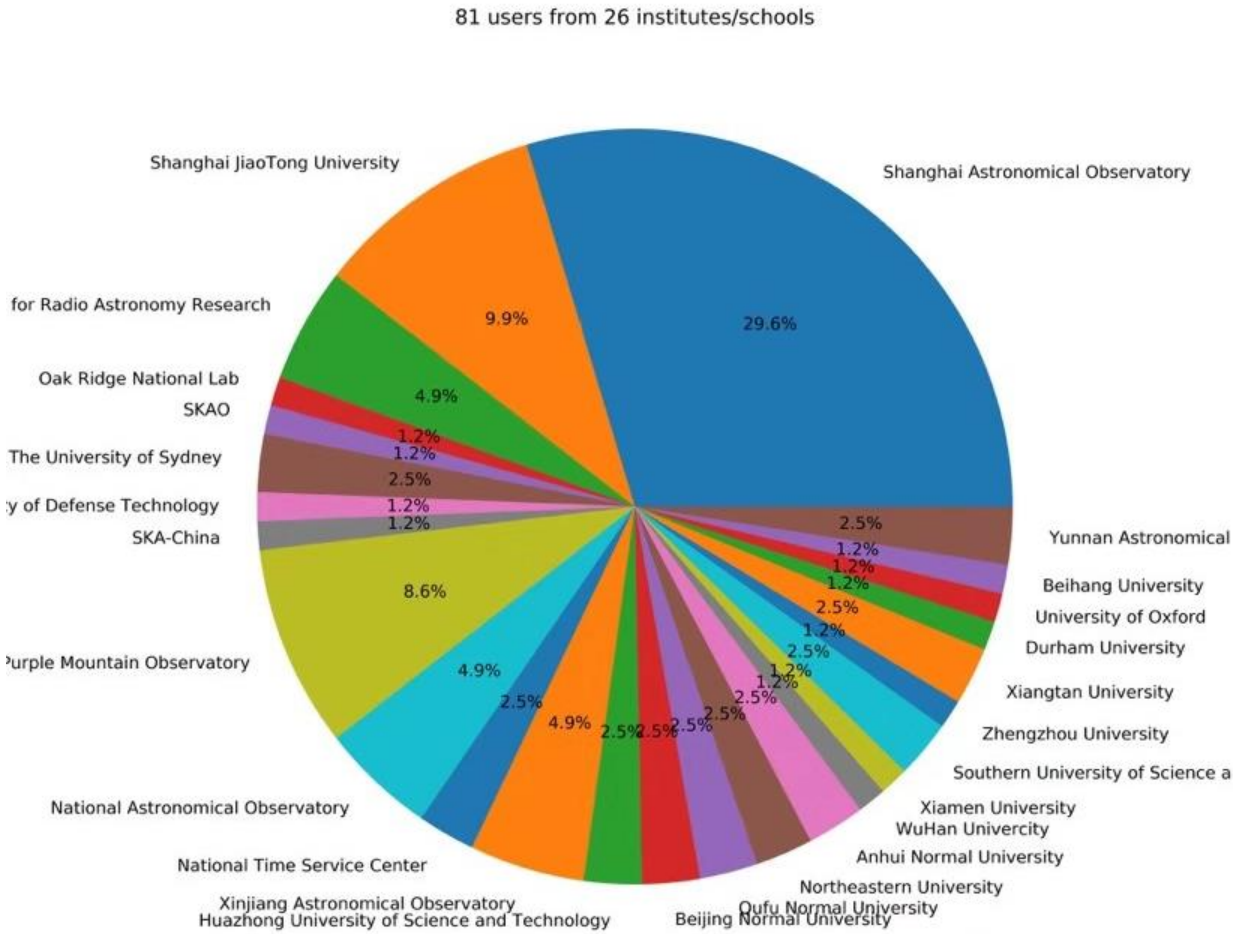
- Shanghai – ASTRON : >2Gbps experiment
- DOMA-SA : Cape Town – Amsterdam – Shanghai
- Dedicate 200Mbps bandwidth, routine 365dx24h, support SKA pathfinder users



China SRC prototype user support

- Commissioning from 2020
- Welcome to users to get access to the resource





Summary

- Chinese government offered preliminary funding
  - to support SRC prototyping and science user team construction & training
- China has finished SKA Regional Centre prototype
  - welcome to your advices
- China SRC prototype will start commissioning soon
  - to support astronomers and also undertakes the proto-SRC network responsibility
- Shanghai Astronomical Observatory is currently leading China SRC preparation and prototype
- **Look forward to more collaborations with European SRC**
  - Eg. SKA-Mid science, LOFAR2 and MeerKAT science and data processing
  - SKA regional centre connections