MFAA2014 workshop

Ilse van Bemmel (ASTRON)
Deputy project scientist MFAA
SOC-chair

MFAA2014

Mid-Frequency Aperture Arrays workshop

STIAS Stellenbosch, 22-2-2014

- ASTRON, UCT, Rhodes

Stakeholders:

- AERAP
- MidPrep
- MFAA consortium

AERAP

- Human capital development
- Radio astronomy as an instrument
- Entire continent of Africa

"It's called 'reading'. It's how people install new software into their brains"

MidPrep

- Knowledge exchange
- Radio astronomy as a goal
- Partners:
  - UCT, Rhodes, STIAS (RSA)
  - Chalmers (S)
  - ASTRON (NL)

MFAA consortium

- Instrument building for SKA2
- Radio astronomy as a goal
- Advanced Instrumentation Package

Workshop scope

- MFAA technology as a platform for AERAP
- Support for MFAA technology in Africa
- Next steps for MidPrep

- 35 participants:
  - 50/50 engineers vs astronomers
  - Focus on African participation

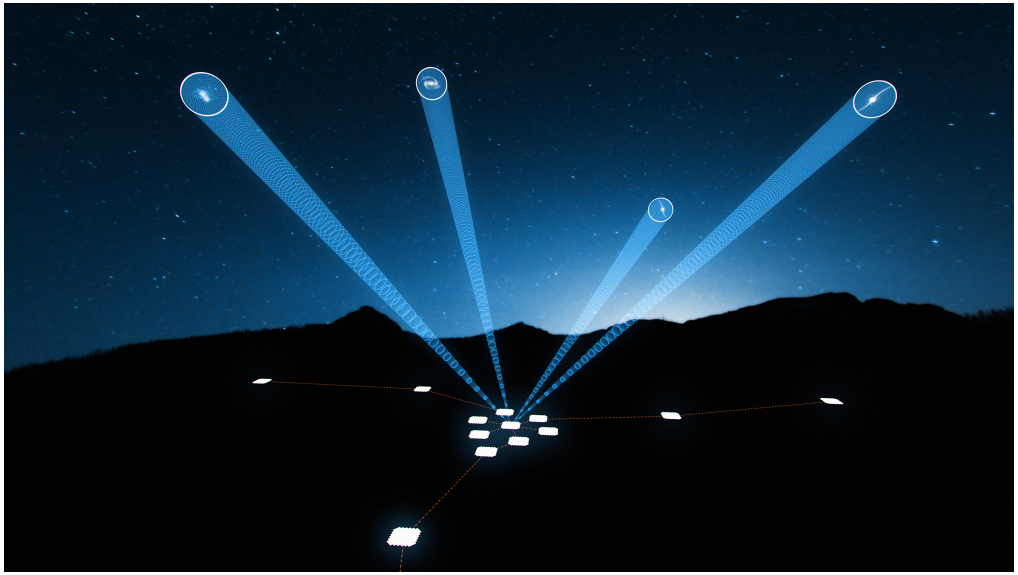
Pathfinder instrument

- Path to SKA2

- EMBRACE:
  - Unpolarized
  - Low sensitivity
  - Single dish

AERA^3

- Science capabable: which science?
- Technology development
- Costing demonstrator
- Human capital development

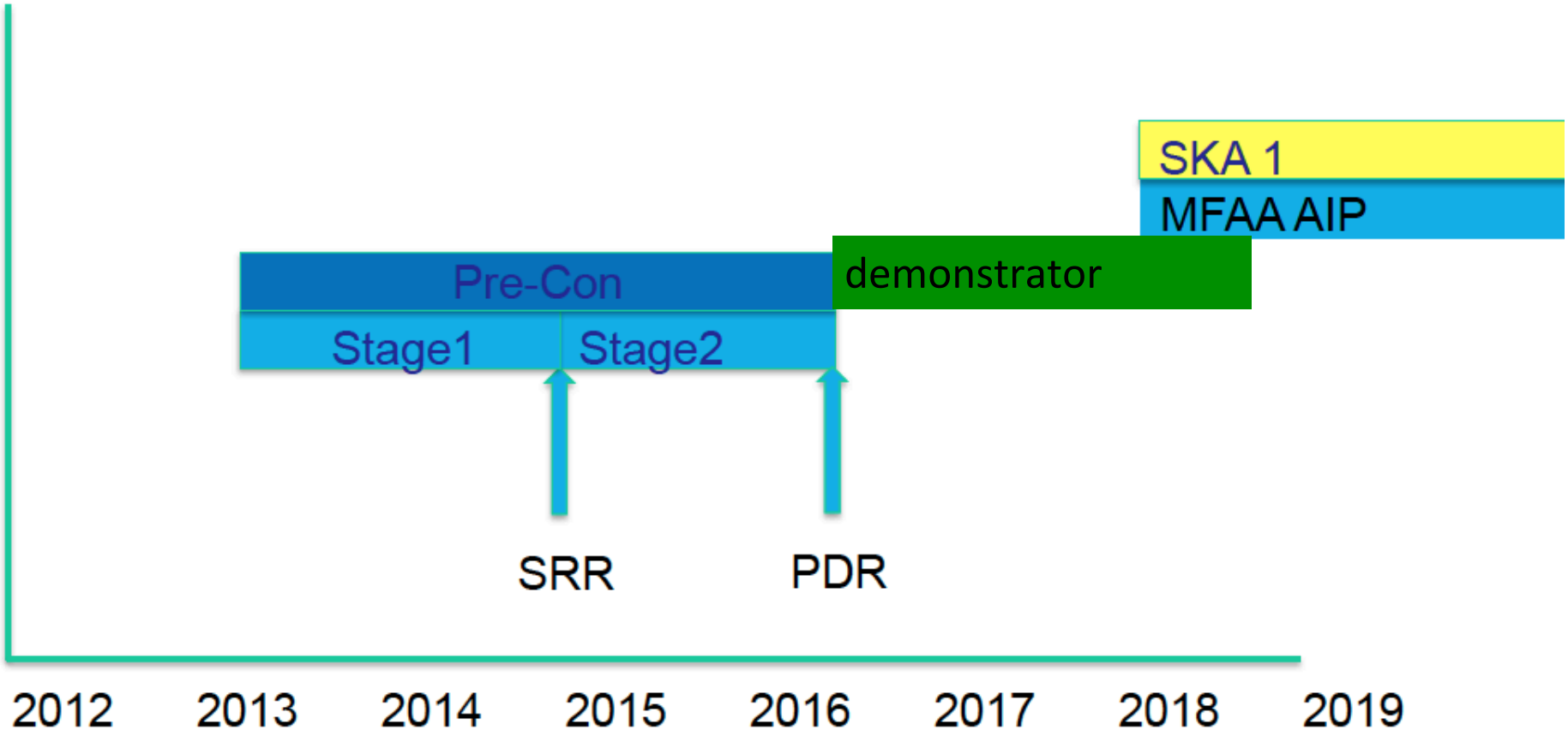


AERA^3

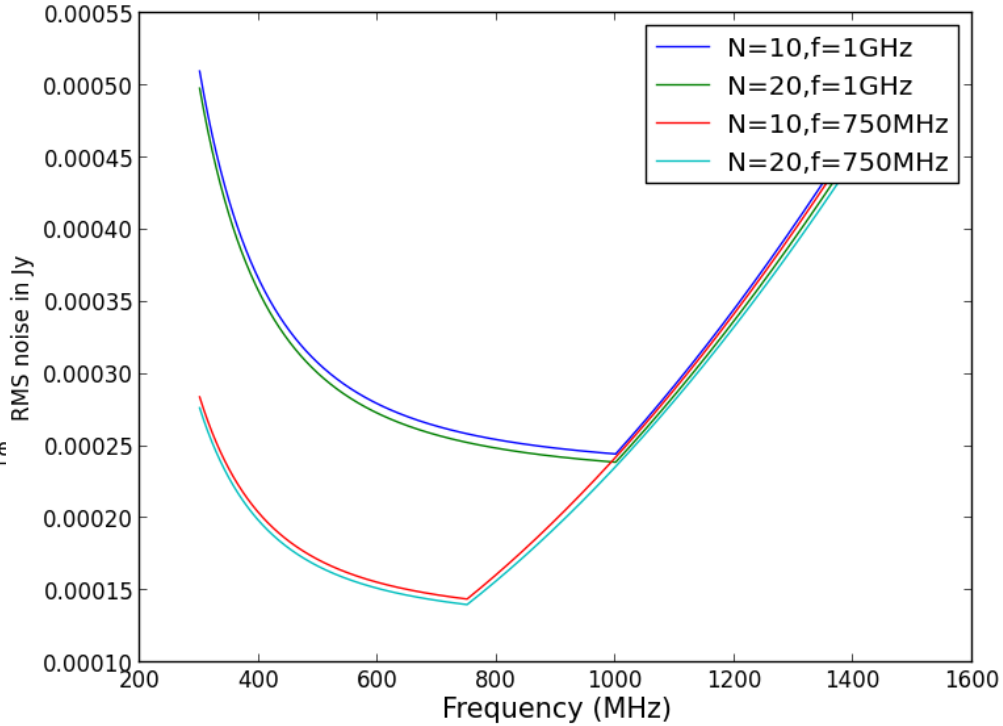
Parameter	Value or range	Units
A_{eff}/T_{sys} at 1GHz	40	m^2/K (see Fig. 1)
Frequency range	300 - 1500	MHz
Bandwidth	300 - 1000	MHz
Baseline length	300 - 1000	m
Compactness	50%	A_{eff} inside 100m
Number of stations	10 - 20	
Independent fields-of-view	≥2	
HPBW (FoV) at 1GHz	15 (175)	deg (deg^2) (see Fig. 2)
Polarizations	Full Stokes	
Time resolution	≥50	μs
Polarization purity	40 (post-calibration)	dB
Scan angle	45	deg

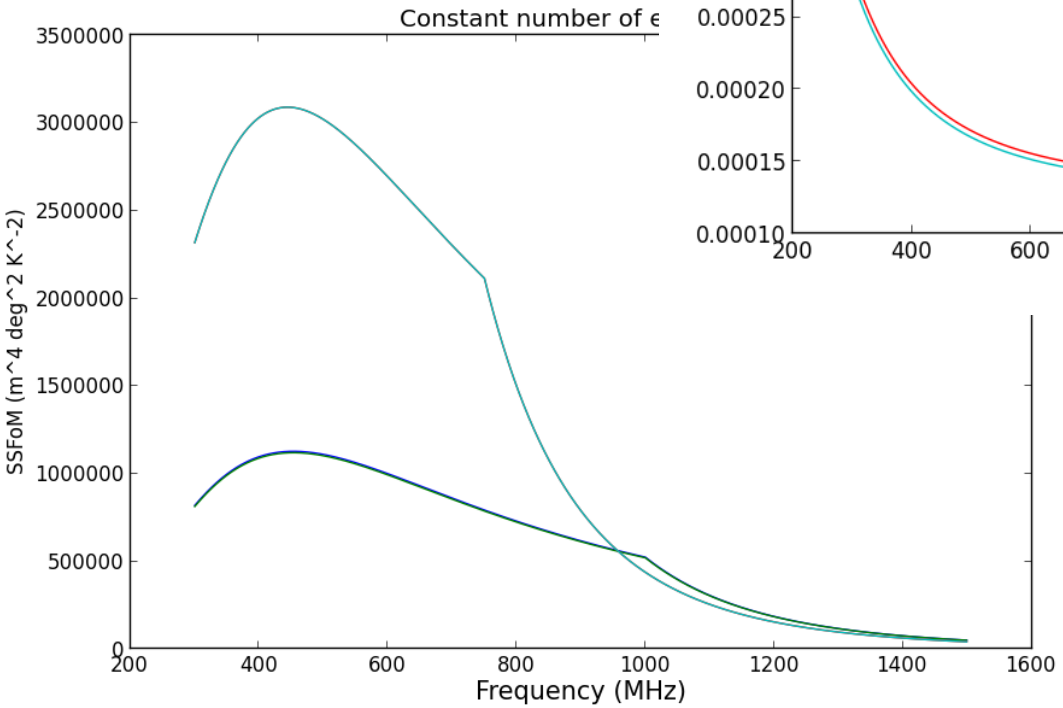
Preliminary specifications as send to speakers before the workshop

Path to SKA

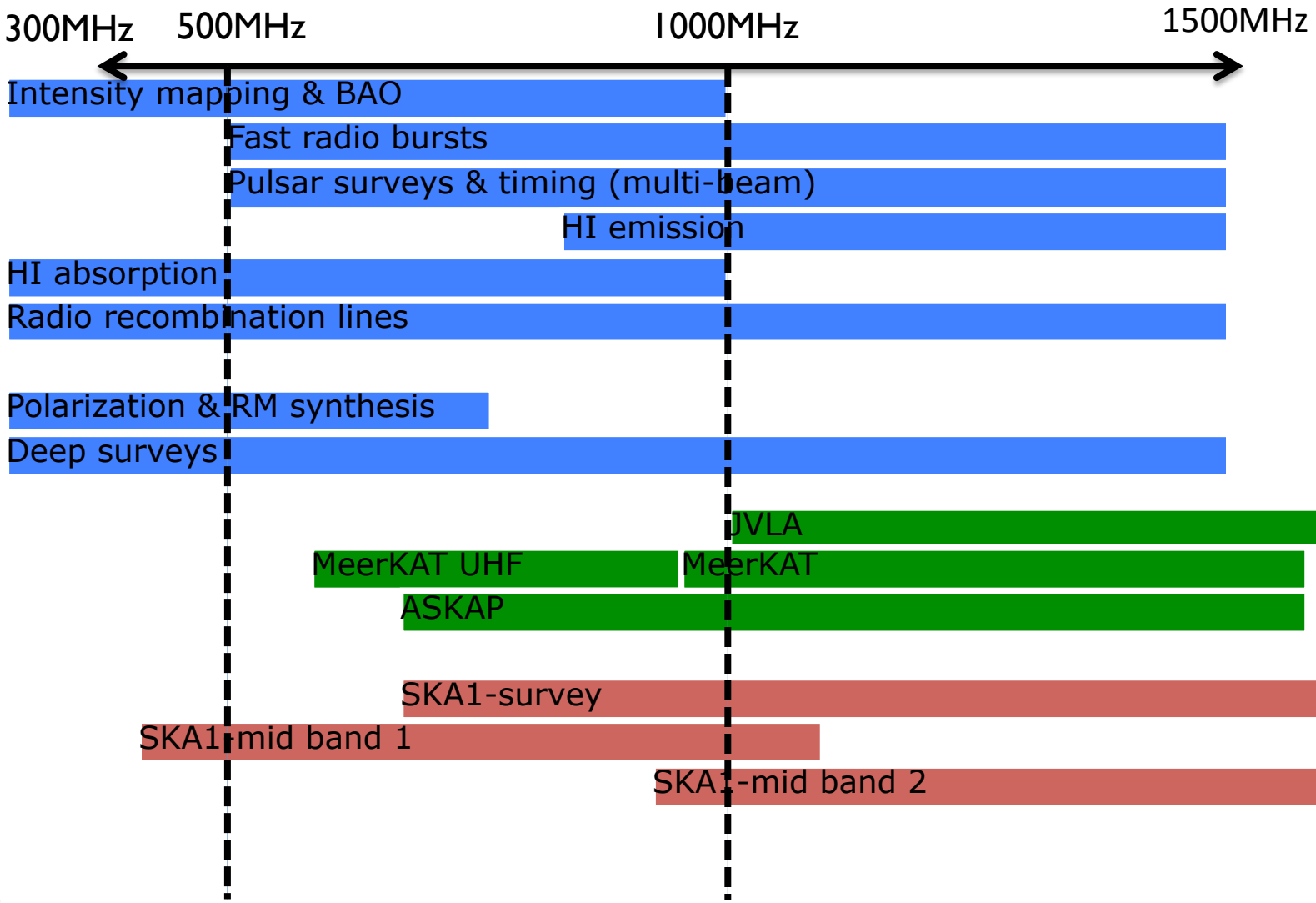

SKA 1
MFAA AIP
Pre-Con
demonstrator
Stage1
Stage2
SRR
PDR
2012
2013
2014
2015
2016
2017
2018
2019

Performance
1 hour
10 MHz





Science frequency coverage



Science related

- Frequency range and bandwidth
  - AERA^3 part of path to SKA2?
- Key science case (experiment): FRB, pulsars
- Configuration
- Location of AERA^3

Technology related

- Dual polarization tiles
- Digital beamforming
- Interferometry
- Post-processing
- Software development
- Transient infrastructure

Lessons

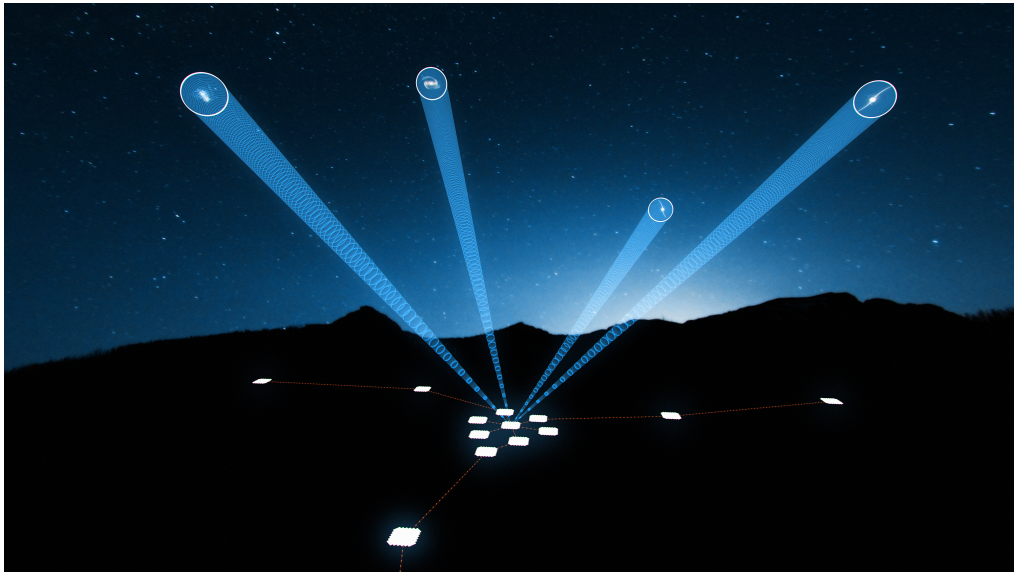
- Planning MFAA towards SKA
- Costing
- Simulations for AERA^3
- Consolidate MFAA performance
- EMBRACE still has much to teach
  - High-cadence monitoring
  - Calibration
  - System stability

Lessons

- Planning MFAA towards SKA
- Costing
- **Simulations for AERA^3**
- **Consolidate MFAA performance**
- **EMBRACE still has much to teach**
  - **High-cadence monitoring**
  - **Calibration**
  - **System stability**

AERA^3

- Science capabable: which science?
- Technology development
- Costing demonstrator
- Human capital development



Costing

- "Dense aperture arrays need to demonstrate cost effectiveness" – SKA Office

- AERA^3:
  - Construction
  - Post-processing
  - Power consumption
  - Operations and maintenance

Human capital

- Construction
- Operations
- Data processing
- Analysis
- Science

Train African people to do this

Buy your own AERA^3 in preparation for SKA

Thanks

- Oleg Smirnov, Patrick Woudt (SOC)
- Jan-Geralt bij de Vaate
- Pieter Benthem
- Arnold van Ardenne
- Michiel van Haarlem
- Gert Kruithof
- Joeri van Leeuwen
- Truus van den Brink
- Erwin de Blok
- MFAA consortium MT