Setup and Operations with the DBBC3

Introduction and general view

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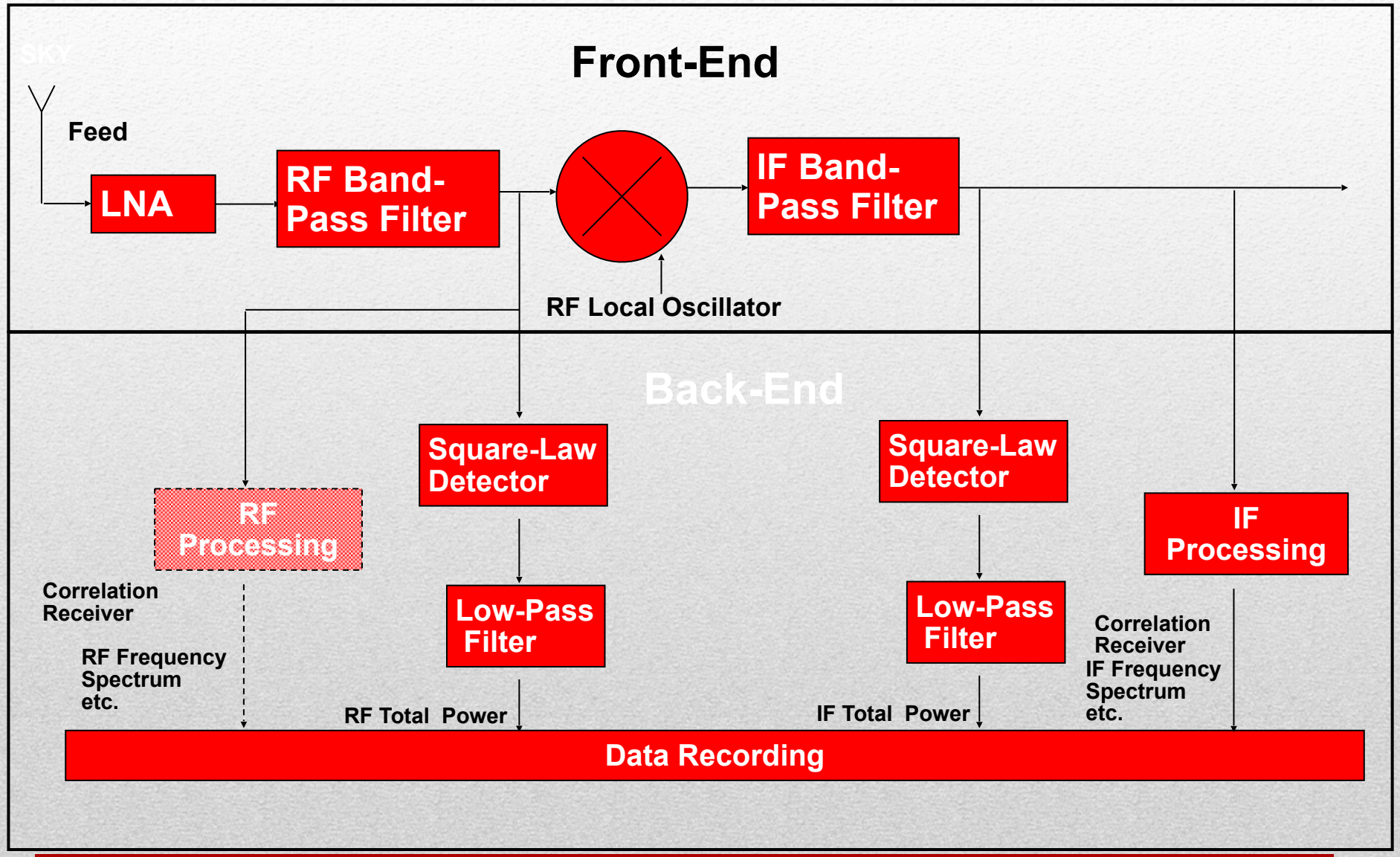
VLBI Signal Chain Schematic Block

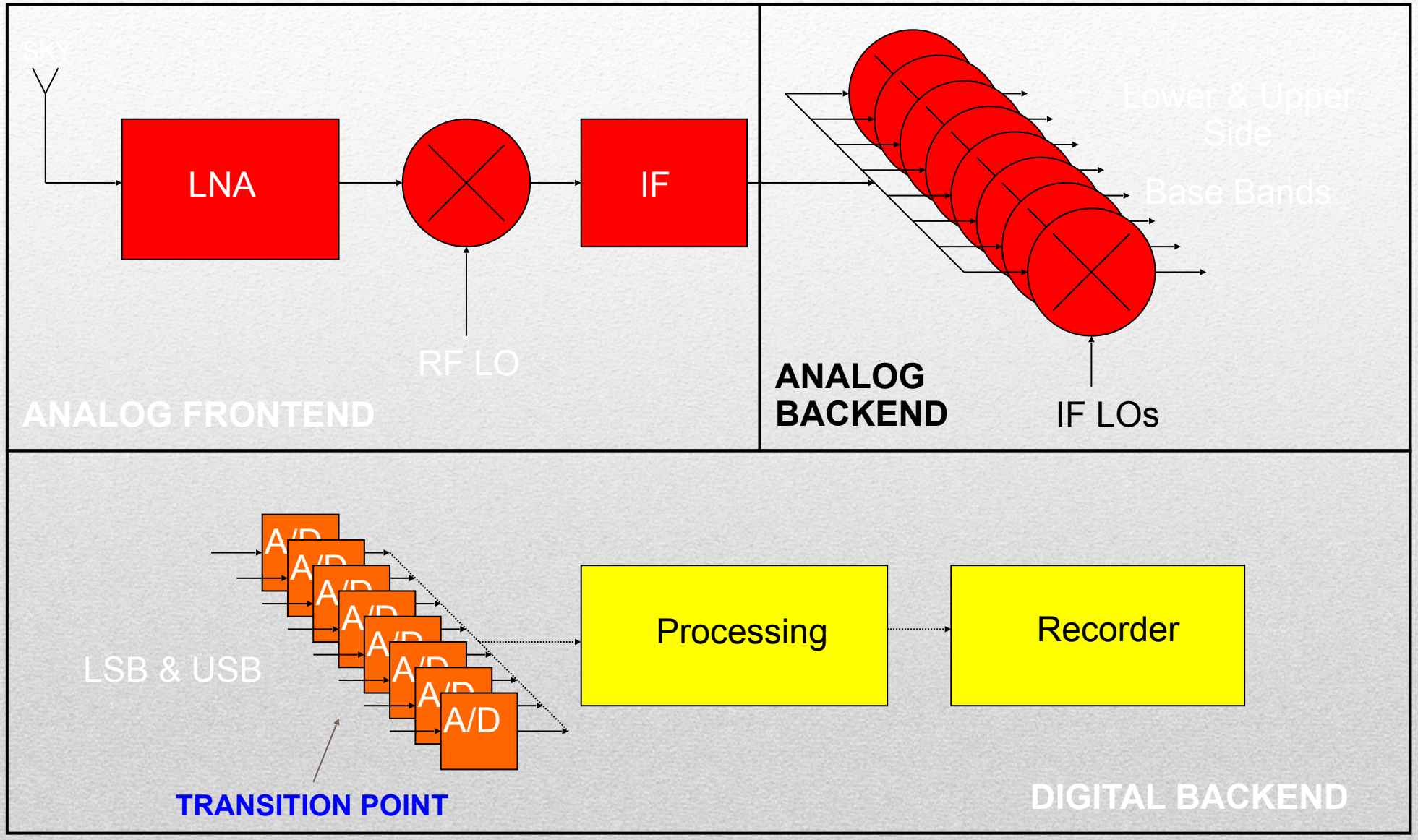
al Functionality

Backend Schematic Block

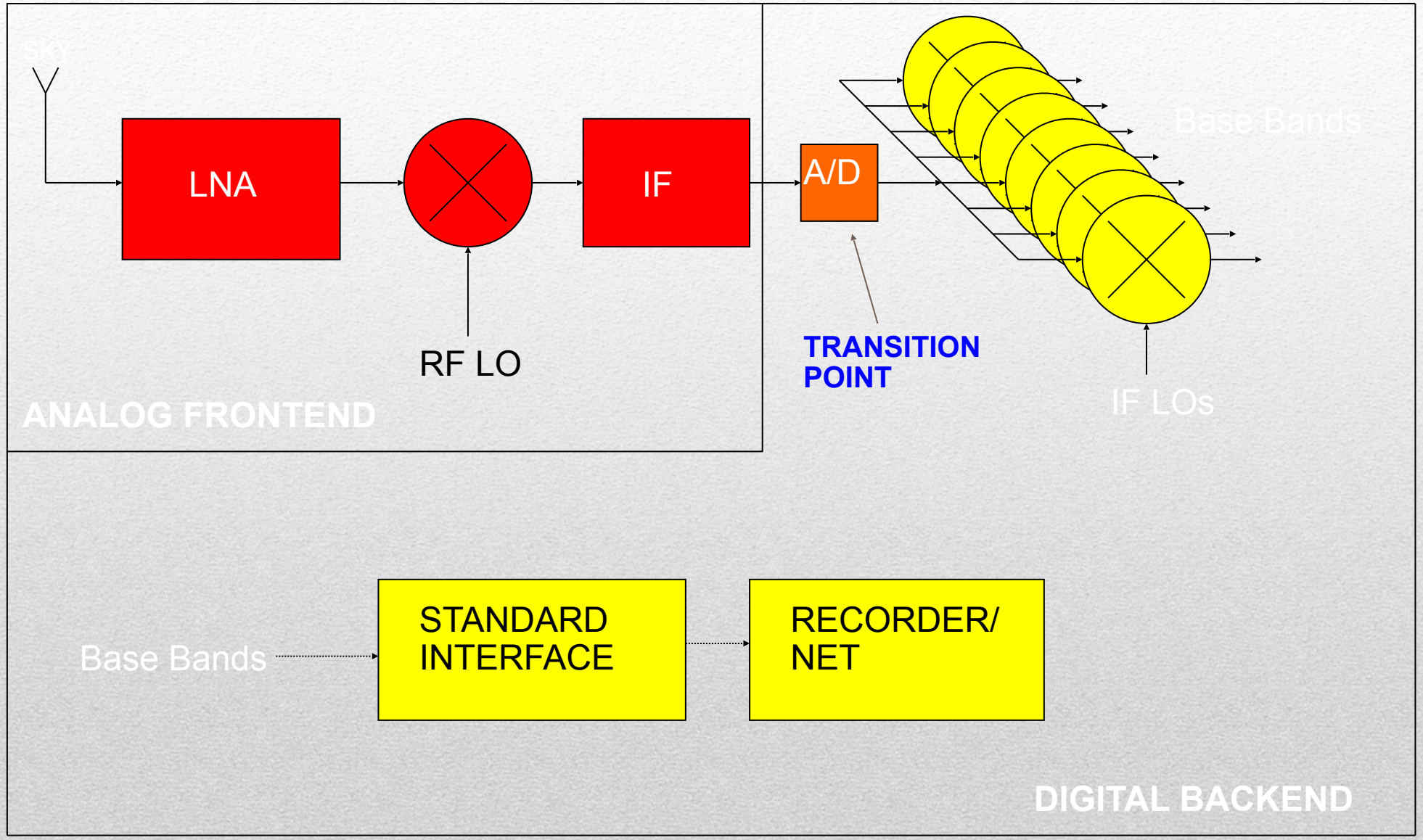
Receiving and Acquisition Chain in the Radiotelescope



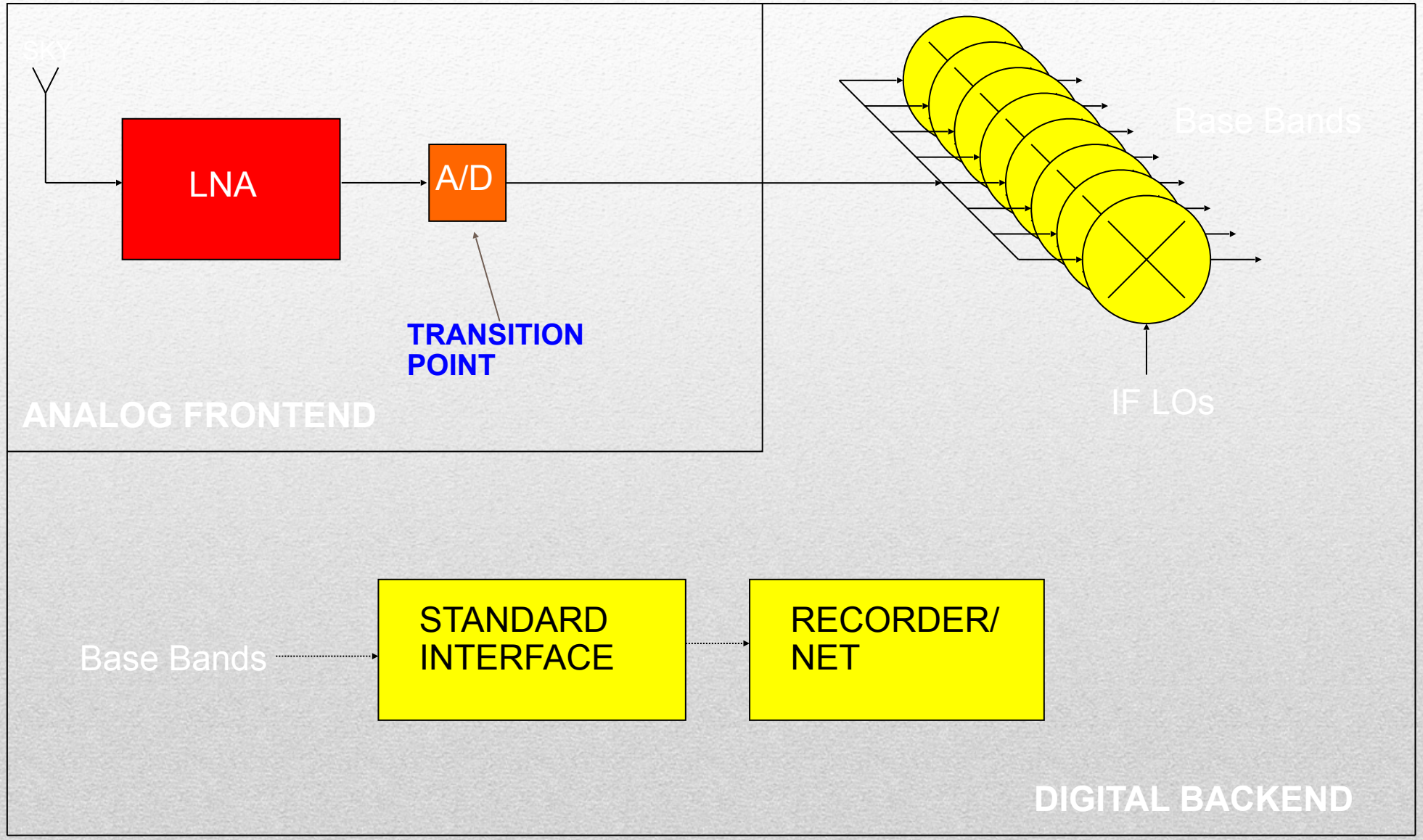
Front- and Back-End Multichannel Chain



Advanced Front- and Backend Chain

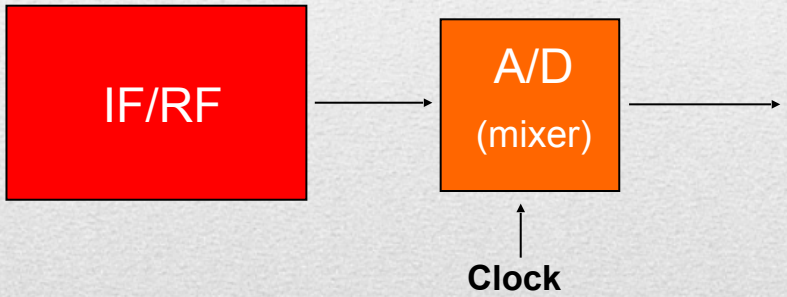


Advanced Front- and Backend Chain

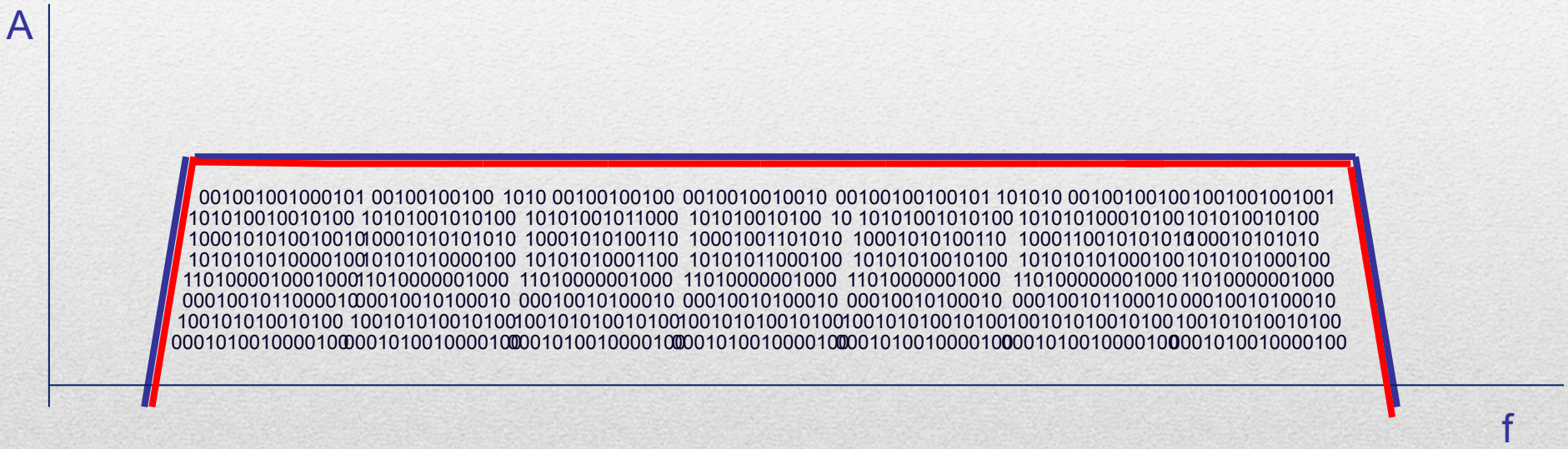


Different modes for down-converting in a digital backend

DSC – Direct Sampling Conversion



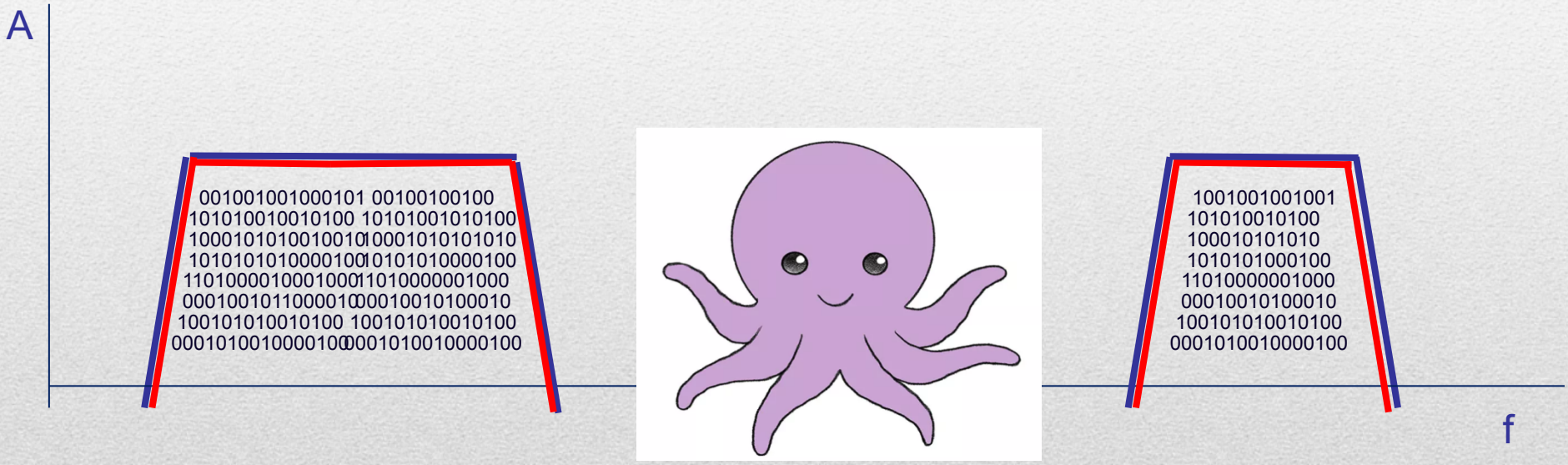
DSC – Direct Sampling Conversion



OCT – Octopus Mode

- Parallel FIR banks
- Dynamically modifiable position in the input spectrum
- Dynamically modifiable bandwidth
- Manual mode or algorithm driven

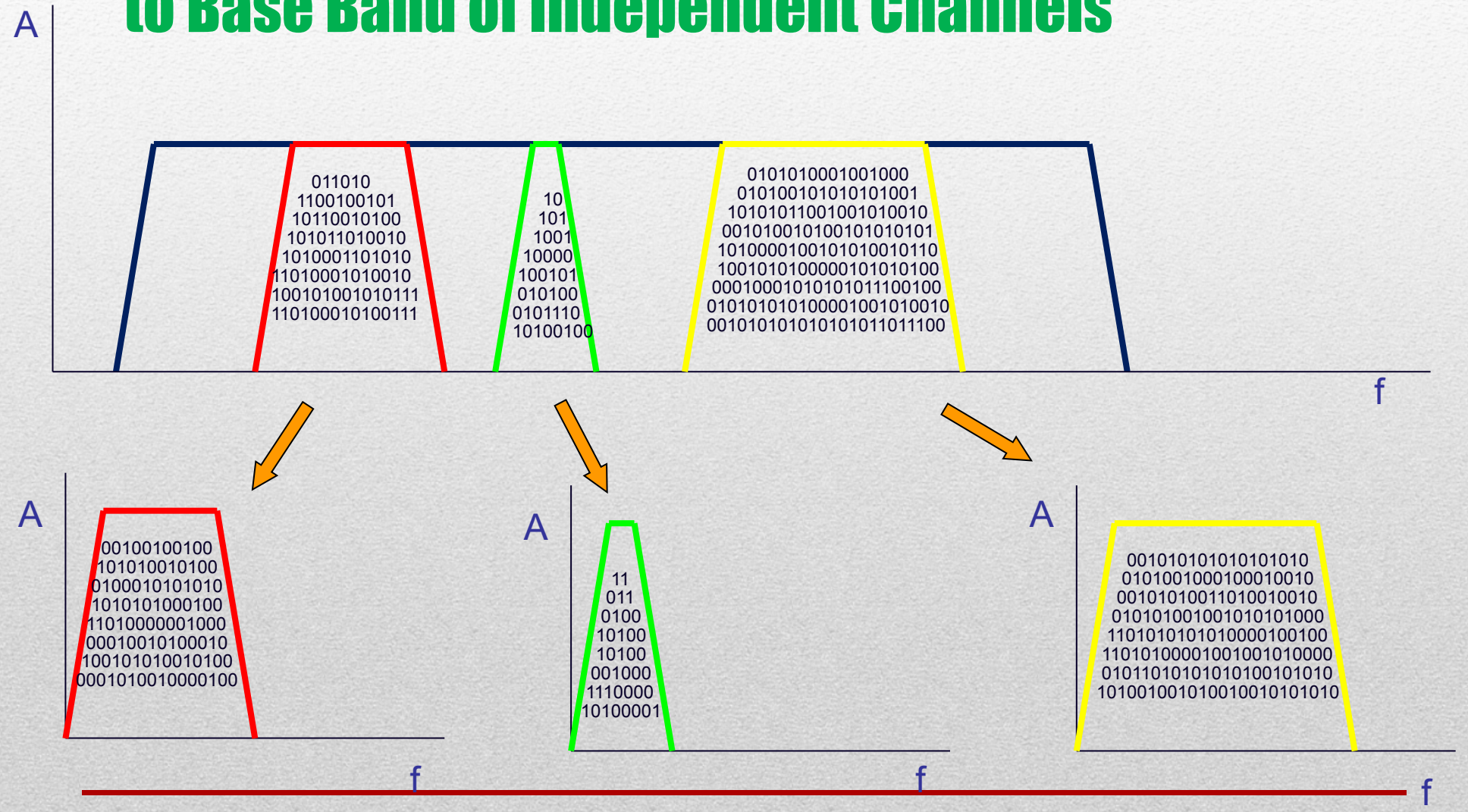
OCT-Dynamic Flexible solution



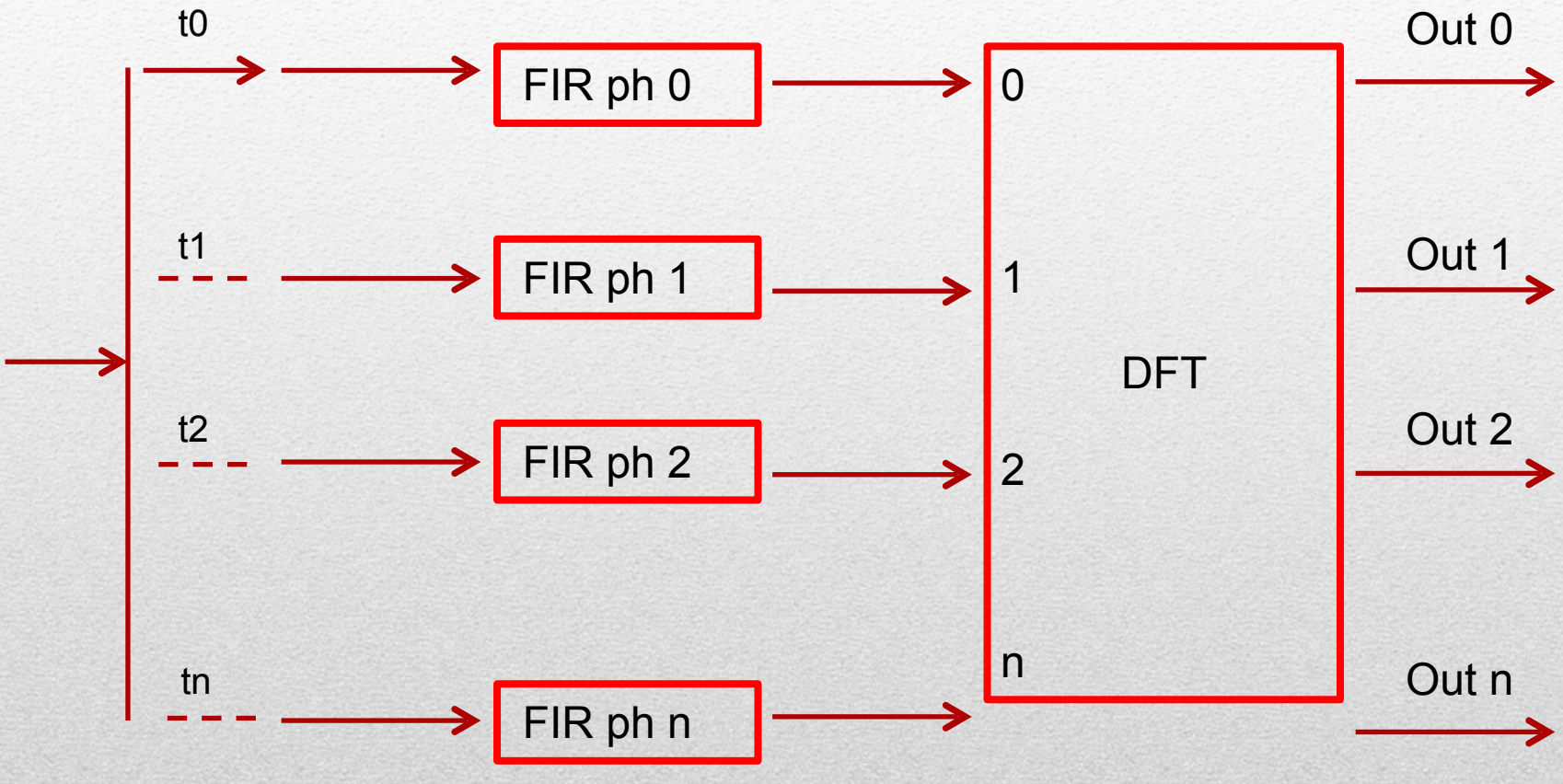
DDC - Digital Down Converter Configuration

- Direct conversion typically between high data rate sampled IF band and lower data rate base band
- LO as a Numerically Controlled Oscillator
- Mixer as Complex Look Up Table multiplier
- Low-pass band filter Finite Impulse Response (FIR) filters cascade
- Decimation because of the high ratio between IF and output data rate performed with multirate/multistage FIR

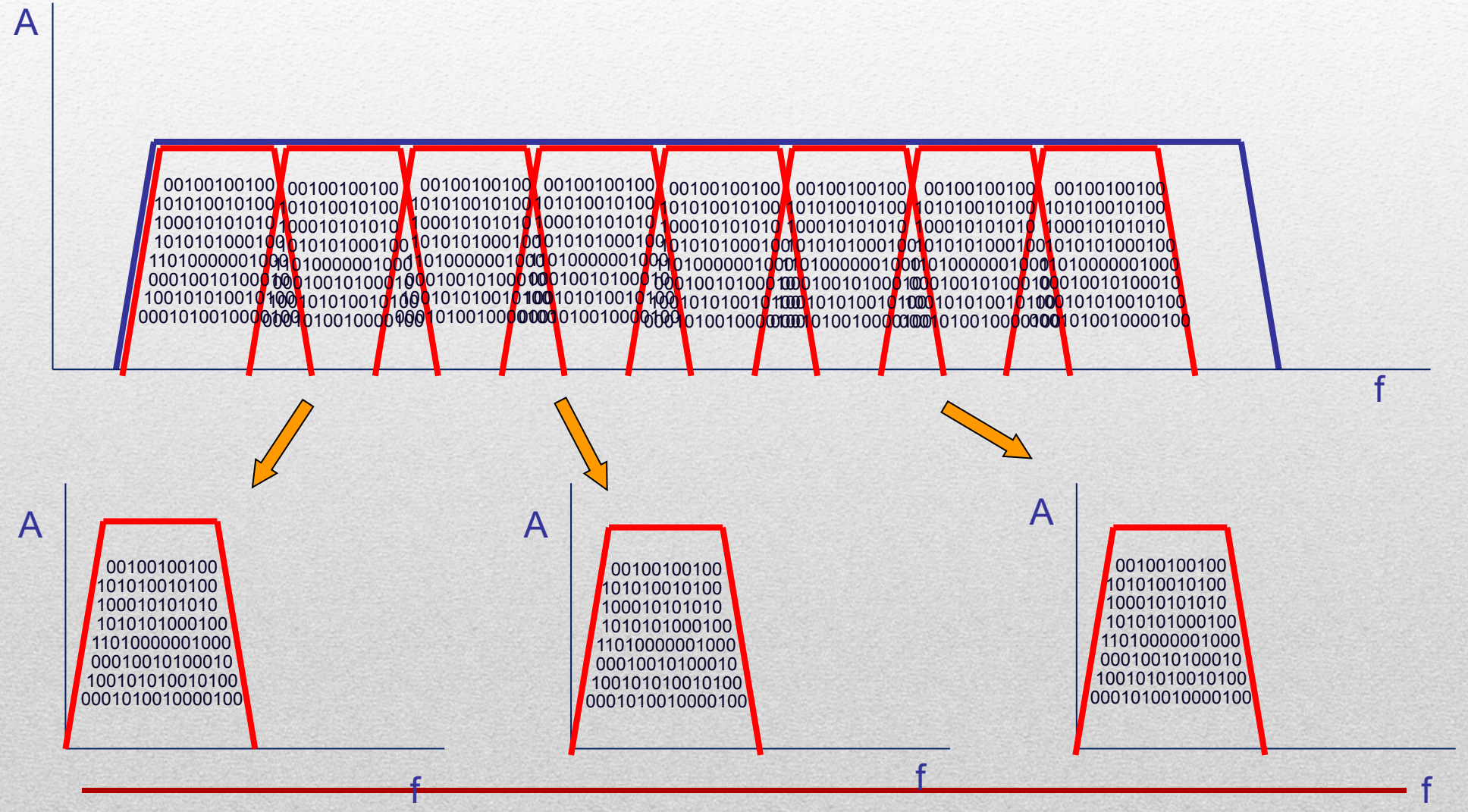
DDC - Digital Down Conversion to Base Band of Independent Channels



PFB – Poly Phase Filter Bank Solution



PFB - Polyphase Filter Bank



DBBC Back-ends evolution

DBBC1 2004 - 2008

in: 4 x IF-512MHz

out: **DDC** 16 x bbc (1-2-4-8-16MHz)@32MHz

0.512/1.024 Gbps

DBBC2 2007 – 2020

in: 4 x IF-512/1024MHz

out: **DDC** 16 x bbc (1-2-4-8-16-32MHz)@32/64MHz

PFB 4 x 16 x (32-64 MHz)@64/128MHz

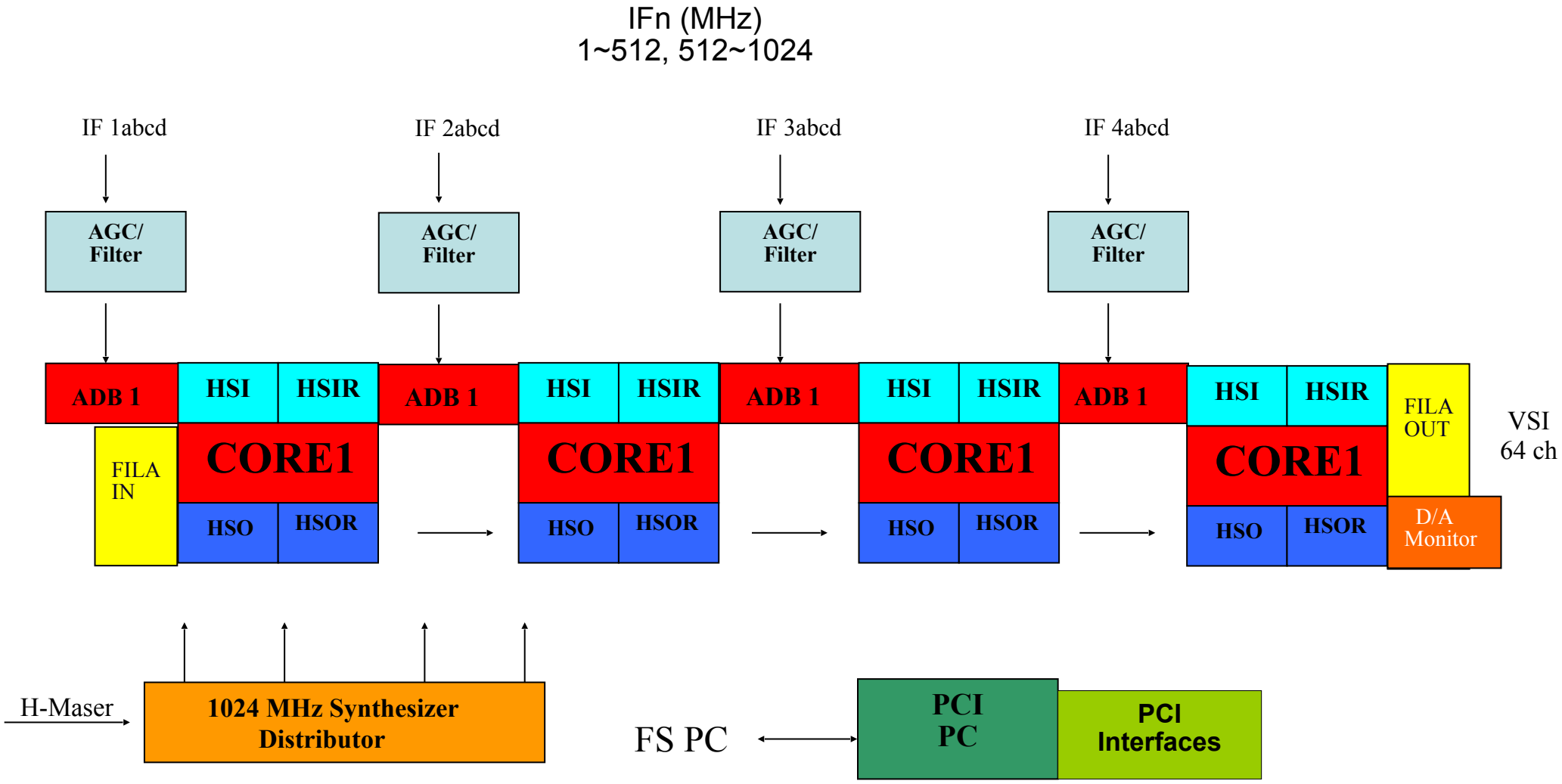
4.096/8.192 Gbps

DBBC2010 2009 – 2020

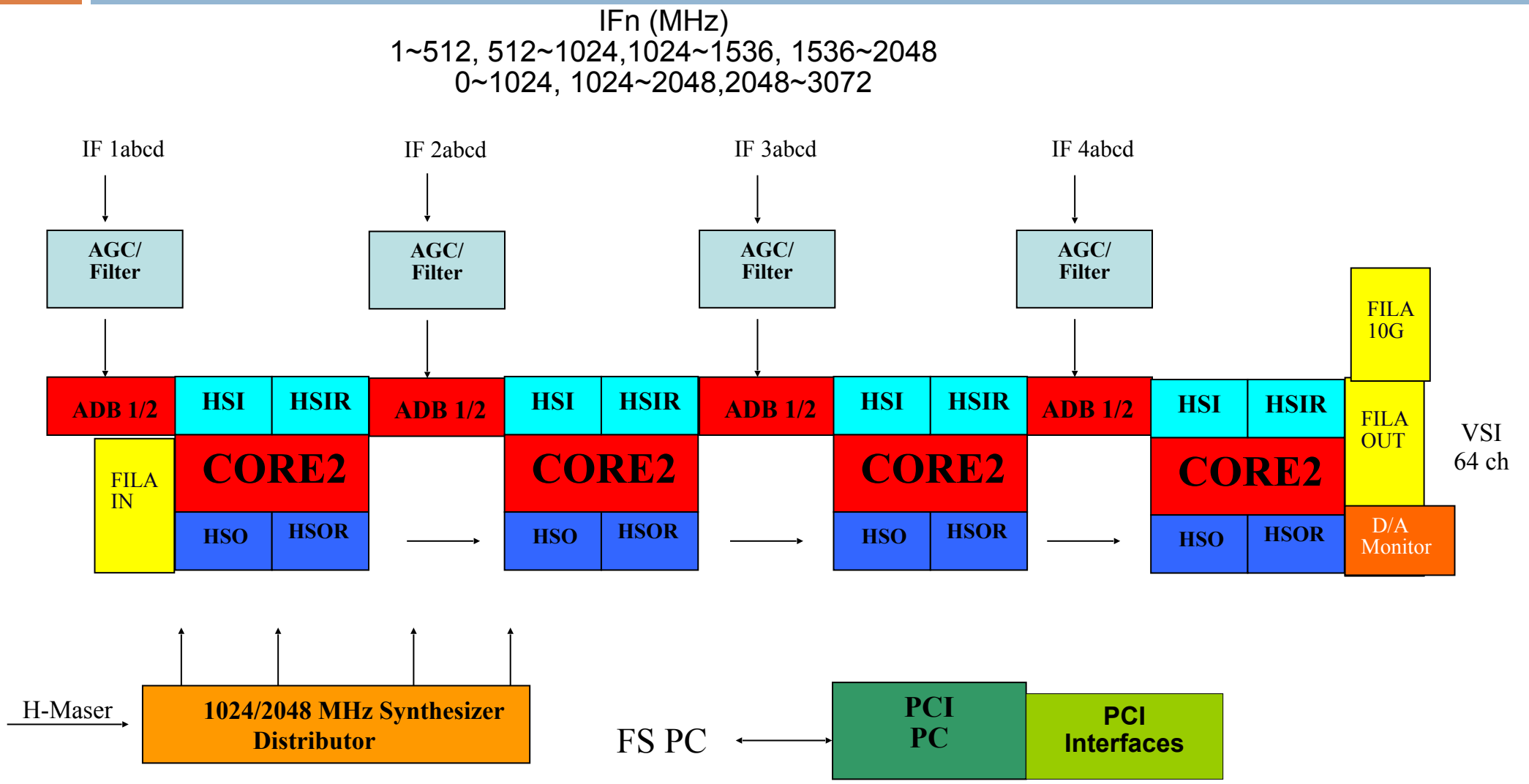
in: 8 x IF – 512/1024MHz

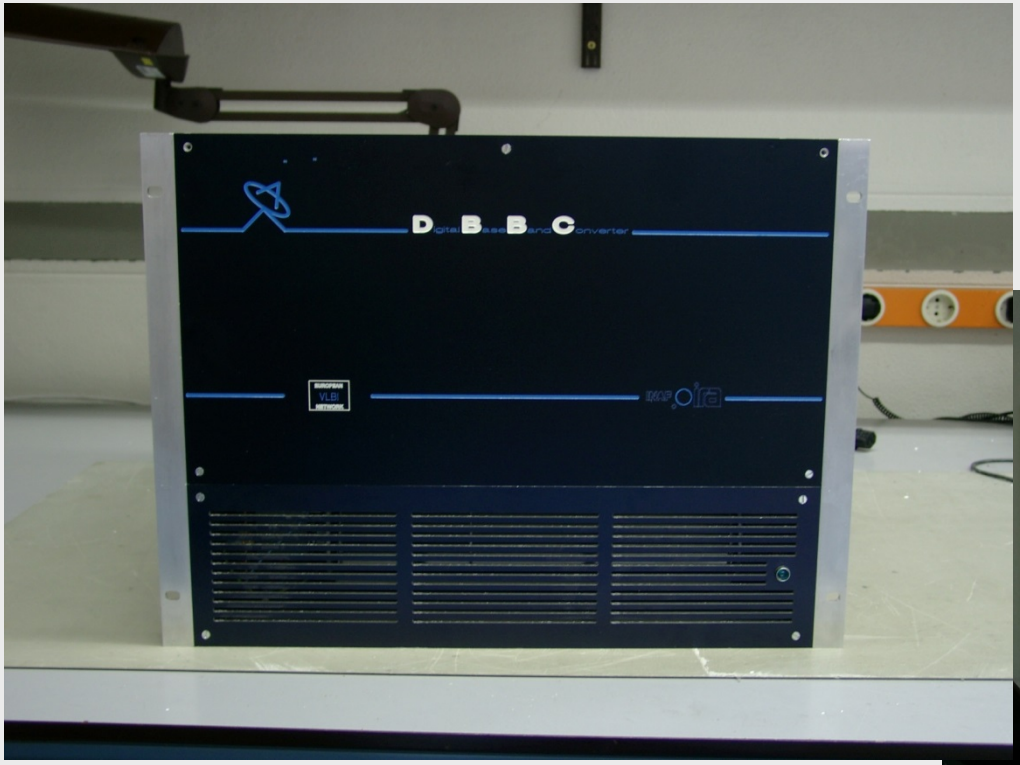
out: **PFB** / **DSC** **16.384/32.768 Gbps**

DBBC1 Architecture



DBBC2 Architecture




DBBC
VLBI
mpifr

The evolution was Radionet3 JRA project

DBBC3 dedicated to:

Astronomy

- **EVN wide-band VLBI backend**
- **mmVLBA network**
- **EHT (Event Horizon Telescope)**

Geodesy

- **VGOS broad-band VLBI system**

DBBC3

- Project supported by EU Radionet3
- Partner:

  INAF – Italy

  MPIfR - Germany

  OSO – Sweden

DBBC Back-ends evolution

DBBC3 (-2L2H) 2016 – today **EVN32Gbps/ EHT**

in: 2 x IF-4096

out: **DSC** 4096 MHz

DDC 2-4-8-16-32-64-128 MHz

OCT 256 - 512 – 1024 - 2048 MHz

16/32 Gbps

DBBC3 (-4L4H) 2016 – today **VGOS half-compliant**

in: 4 x IF-4096

out: **DSC** 4096 MHz

DDC 2-4-8-16-32-64-128 MHz

OCT 256 - 512 – 1024 - 2048 MHz

16/32/64 Gbps

DBBC Back-ends evolution

DBBC3 (-6L6H) 2016 - today **VGOS full-compliant**

in: 6 x IF-4096

out: **DSC** 4096 MHz

DDC 2-4-8-16-32-64-128 MHz

OCT 256 - 512 – 1024 - 2048 MHz

16/32/64/96 Gbps

DBBC3 (-8L8H) 2016 - today **VGOS full-compliant**

in: 8 x IF-4096

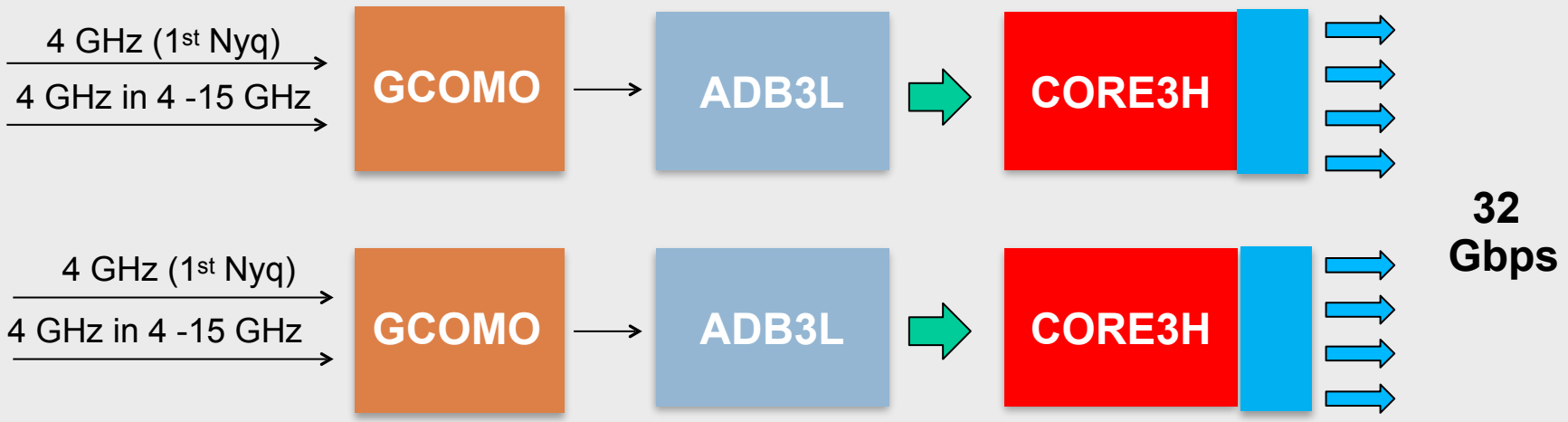
out: **DSC** 4096 MHz

DDC 2-4-8-16-32-64-128 MHz

OCT 256 - 512 – 1024 - 2048 MHz

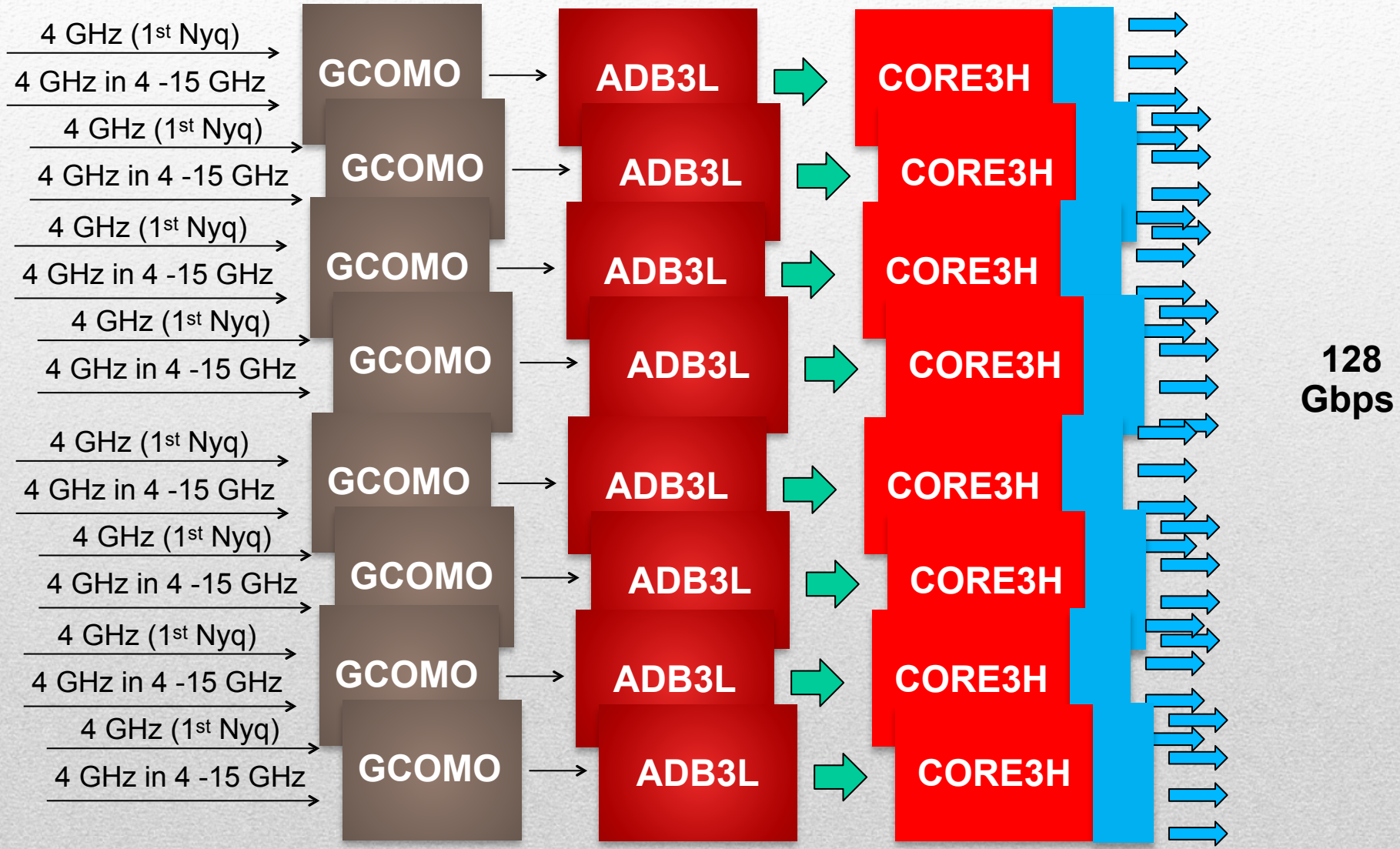
16/32/64/128 Gbps

DBBC3-2L2H Architecture



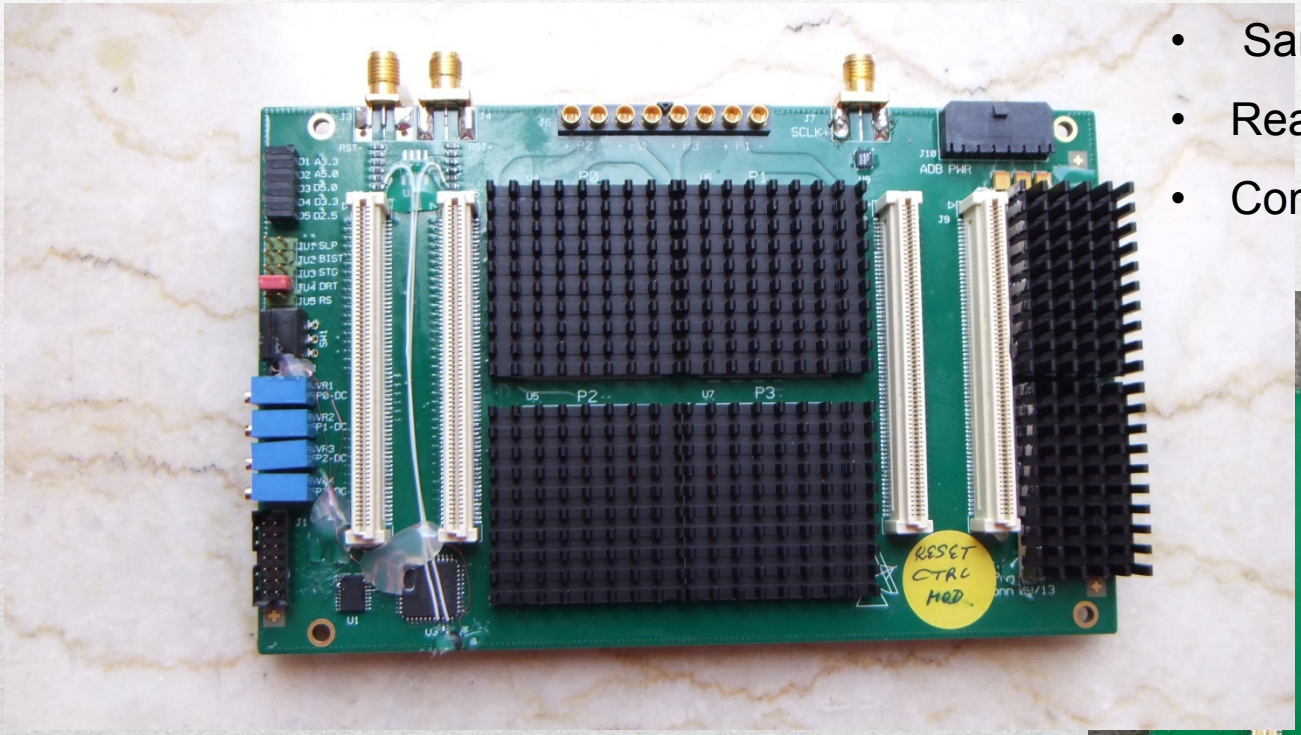
DBBC3-4L4H Architecture

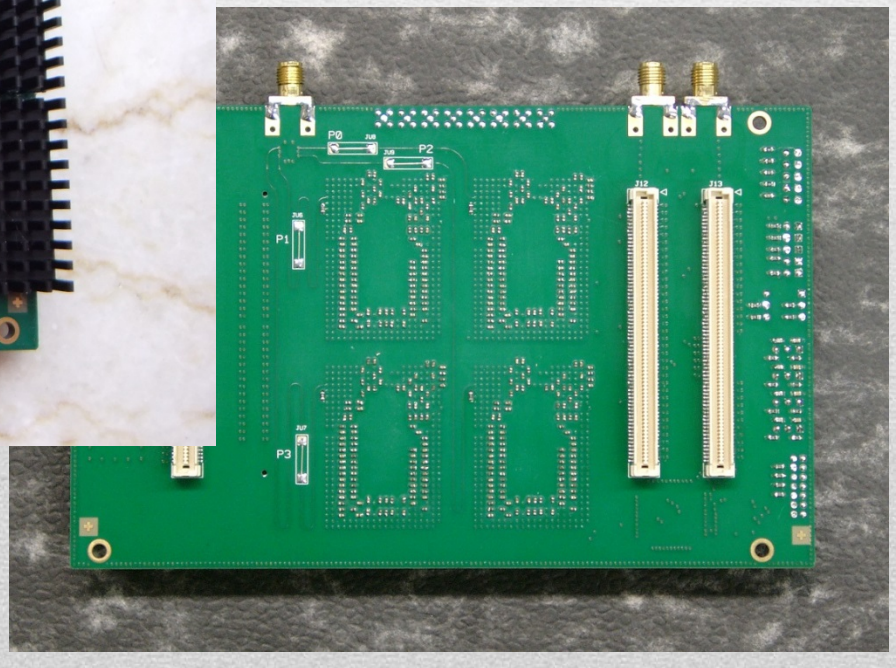
DBBC3-8L8H Architecture



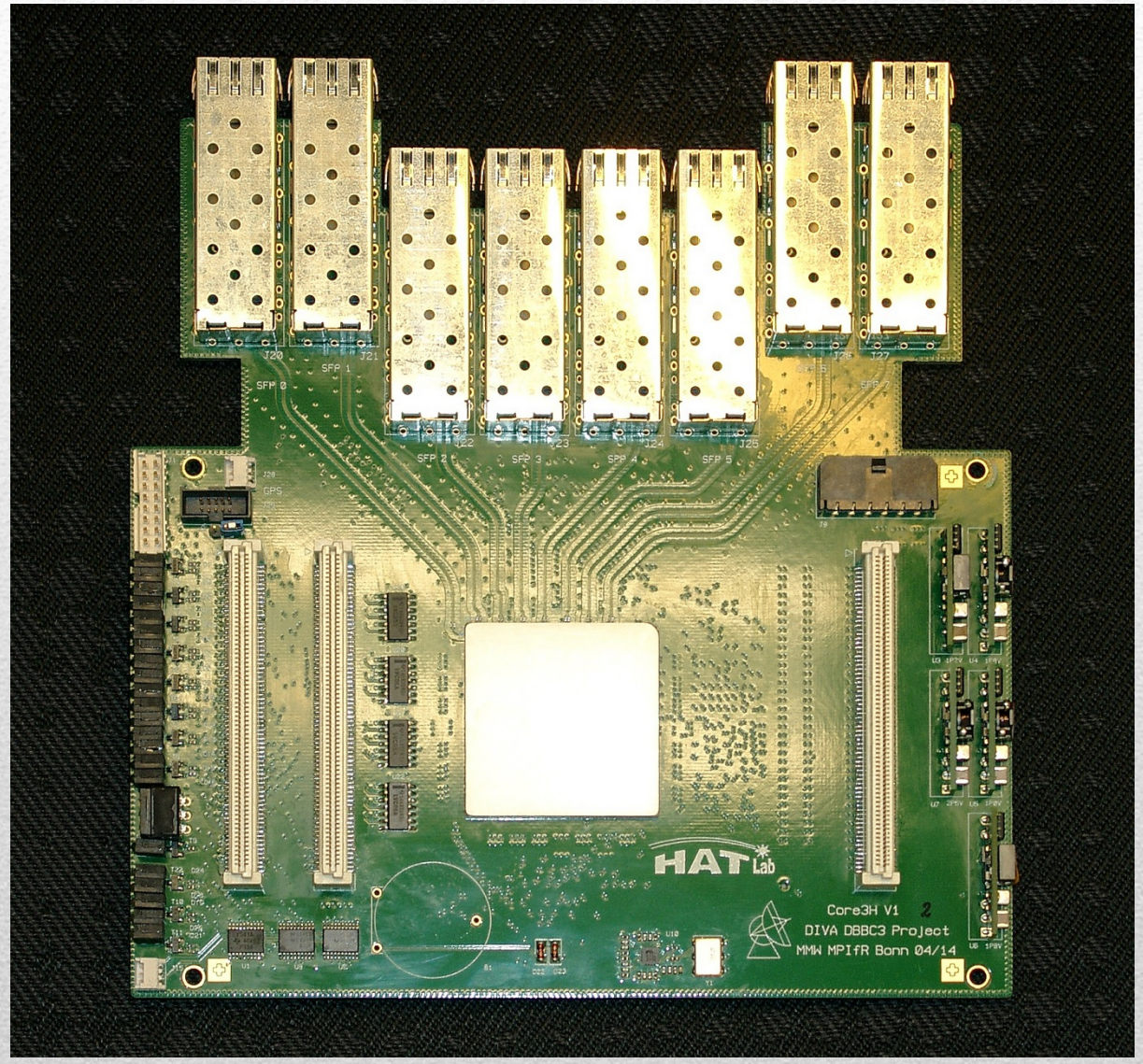
ADB3L

- Number of IFs: **1 - 4**
- Equivalent Sample Rate IF: **8 GSps**
- Instantaneous bandwidth: **4 GHz**
- Sampling representation: **10 bit**
- Real/Complex Sampling
- Compatibility with existing DBBC





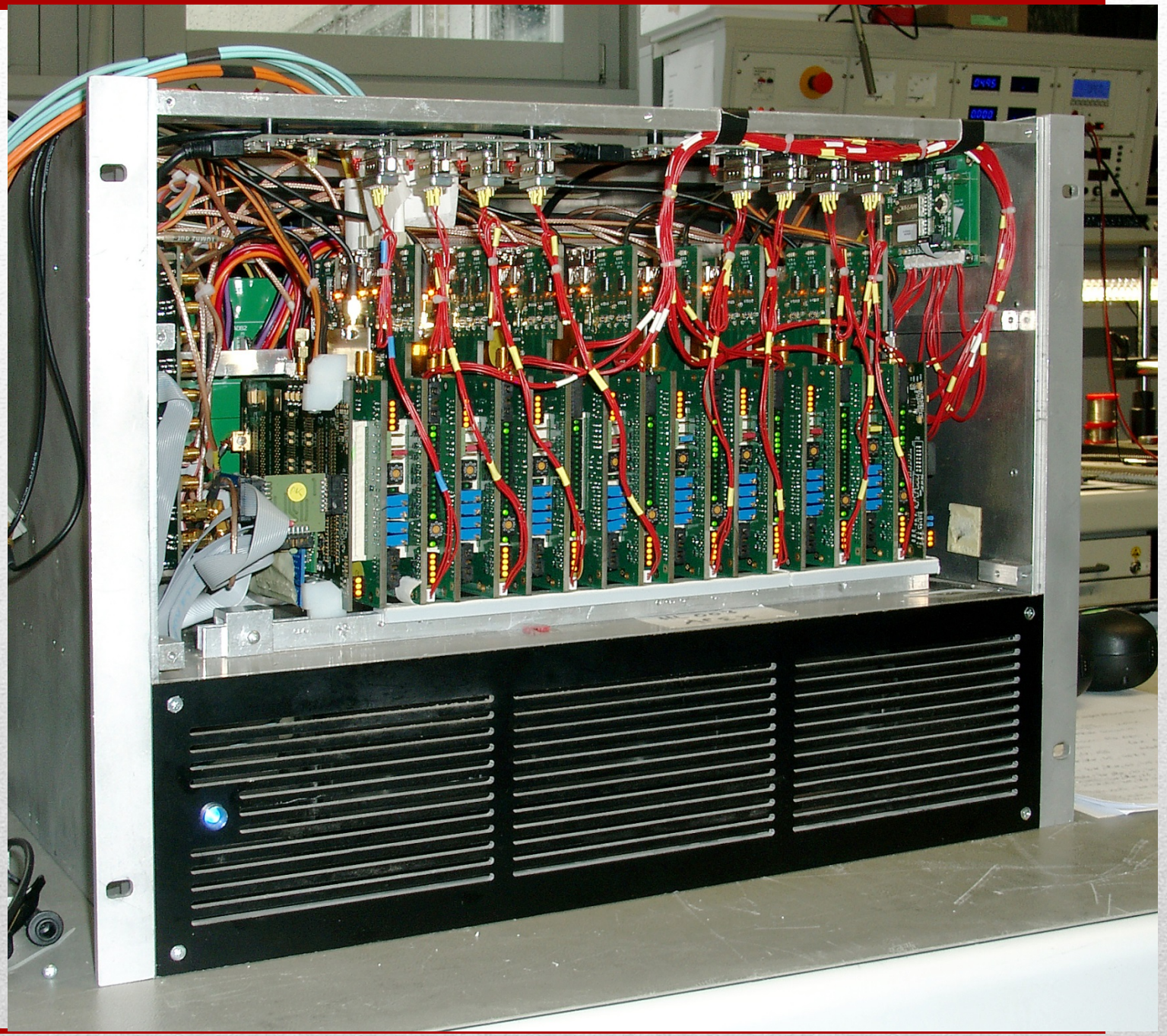
CORE3H

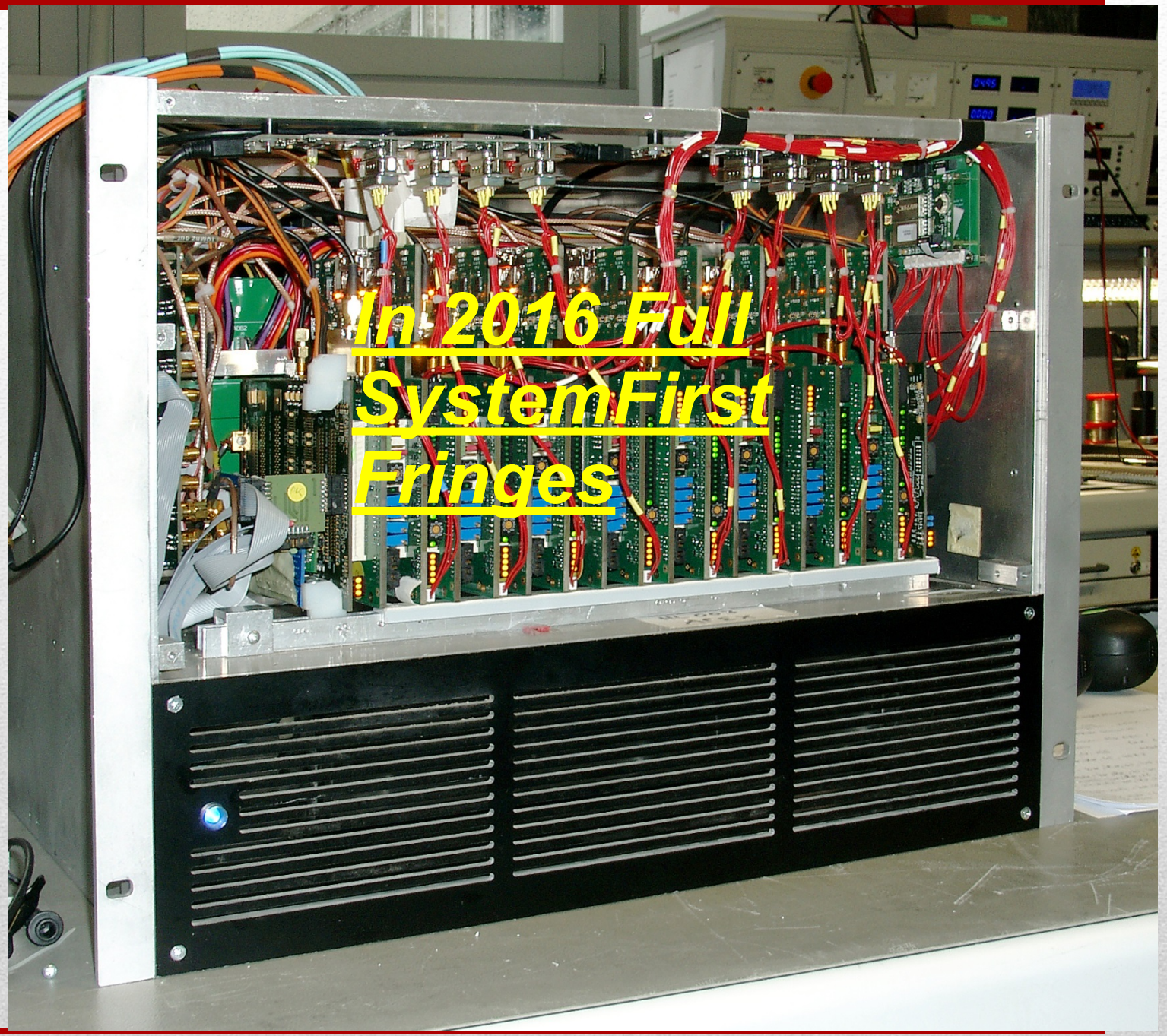


- Input bus: **HSI & HSI2**
- Input sampling representation: **8-10 bit**
- Input bandwidth : 1 x **4GHz, 2 x 2GHz, 4 x 1GHz**
- Processing capability: **DDC, OCT, DSC**
- Output: **8 x 10GE SFP+**
- Inter-board bus: **8 Input 10GE SFP+**
- Compatibility with existing DBBC environment


DBBC 3
EUROPEAN
NETWORK
HAT Lab

VGOS DBBC3-8L8H





More than 40 units on the field, deployed and under construction (Jan 2023)

DBBC2 / DBBC3 PRODUCTION:

HAT-LAB is an INAF spin-off company funded in 2009
Which handles all the commercial aspects for the production and delivery of DBBC2, FILA10G, DBBC3 and related parts

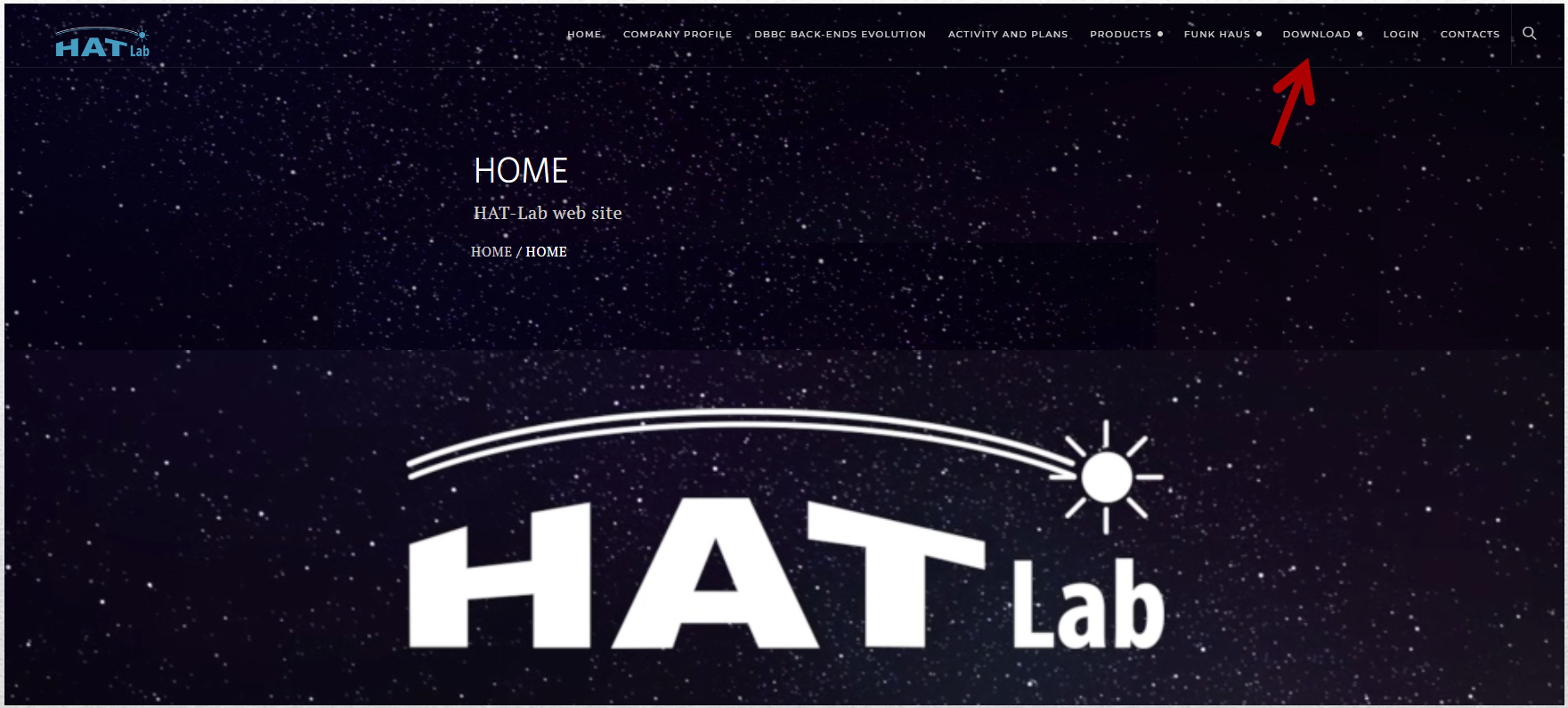
Since 2008 HAT-Lab and MPI have a strict collaboration with the aim to support the EVN network and and more in general the VLBI community developing, producing and testing VLBI technologies related to the digital backend area

The production of the DBBC units is shared between HAT-Lab in Italy and MPI in Germany with few collaborators in Hong Kong and Shenzhen

Nowadays the working flow is straight-forward and as most of the parts are assembled in Italy, the pre-assembled systems received in Bonn where are fully completed, assembled in the final format and finally the entire system fully thoroughly tested

The maintenance and repair of the DBBC units is fully performed in Bonn at the MPI

WEB Pages: https://www.hat-lab.cloud/



To download packages with firmware, software and manuals please register!

Contacts:

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