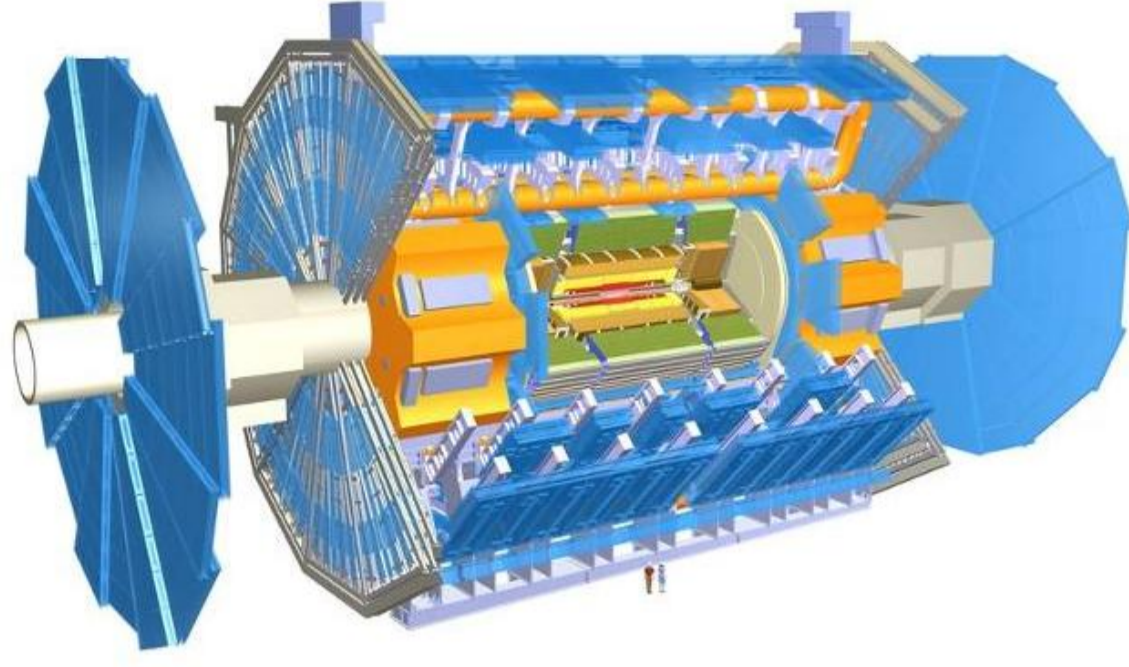


# The ATLAS Barrel Alignment Readout System

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## ATLAS Muon Spectrometer

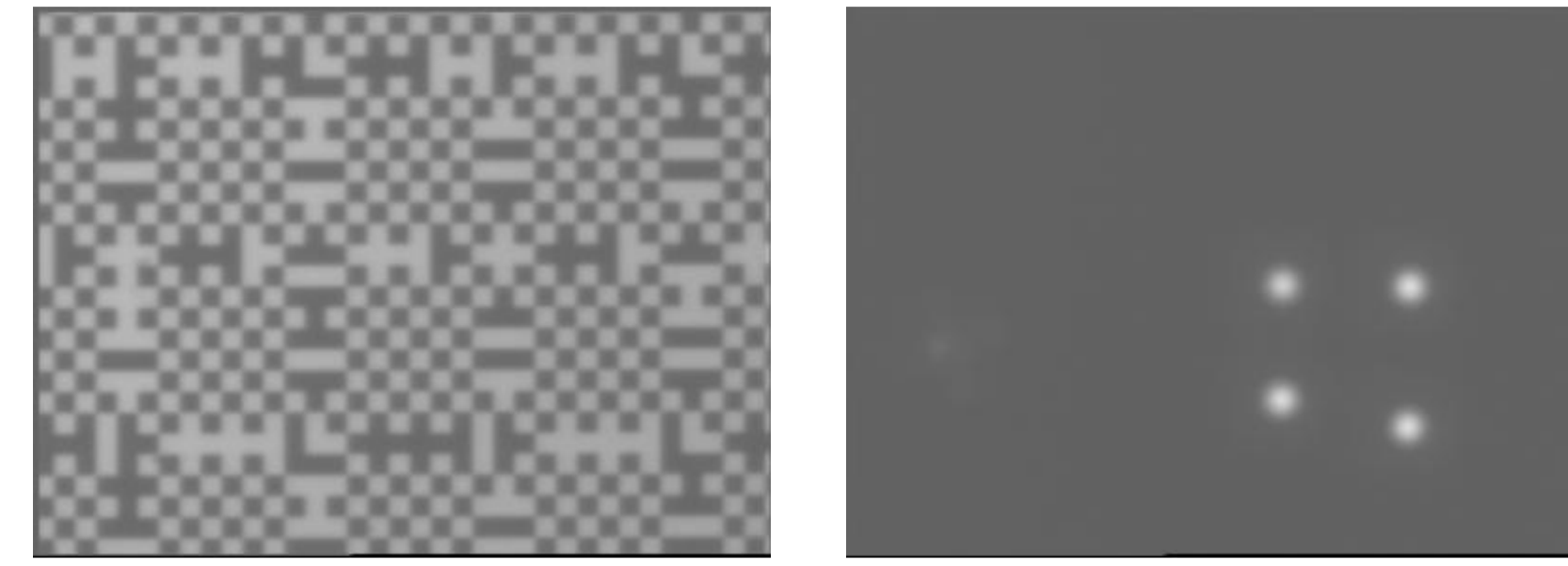


- Precision Track Reconstruction:**
- ± 1200 Monitored Drift Tube Chambers (MDTs)
  - Barrel:** parallel to beam
  - Endcap:** perpendicular to beam

### Barrel Alignment System:

- goal: measure deformation and position of the barrel chambers
- performed by 5812 optical lines (channels)
- data stored into database for off-line analysis
- accuracy of track sagitta: < 50 μm

## Coded Masks



**Rasnik type**  
5296 channels (91.2%)

**Spot type**  
516 channels (8.8%)

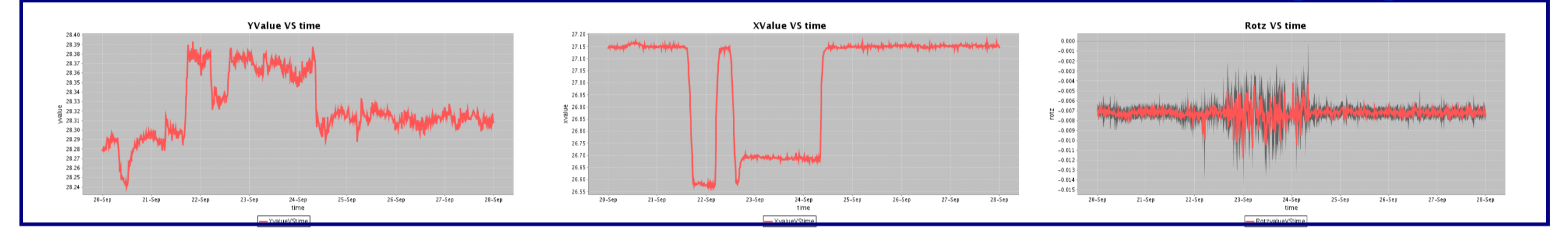
- Channel Types:**
- Inplane MDT deformation
  - Praxial Plane alignment
  - Axial Plane alignment
  - Projective Tower alignment
  - Reference Link to the toroid

- Result parameters:**
- Translation x
  - Translation y
  - Rotation angle θ
  - Magnification

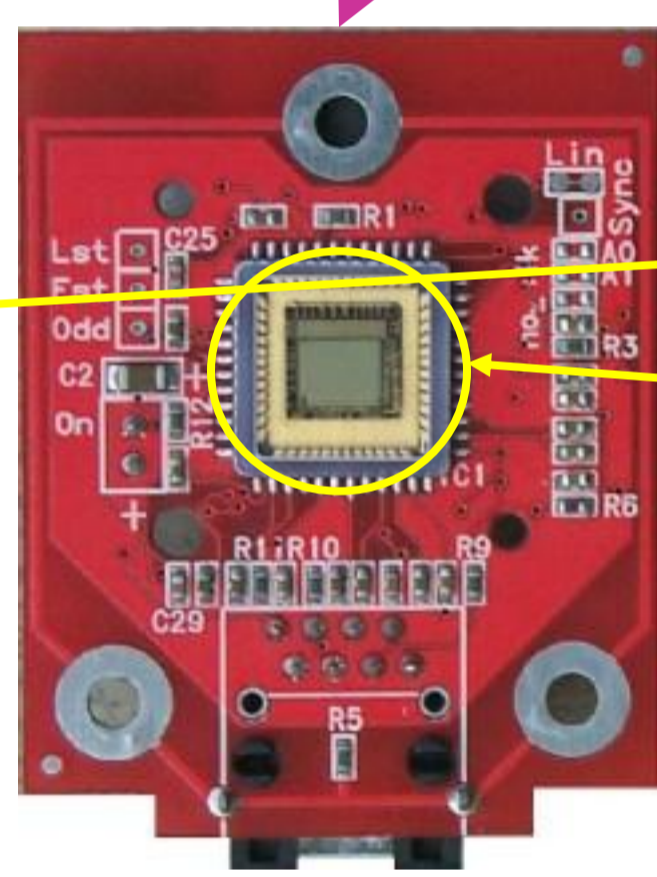
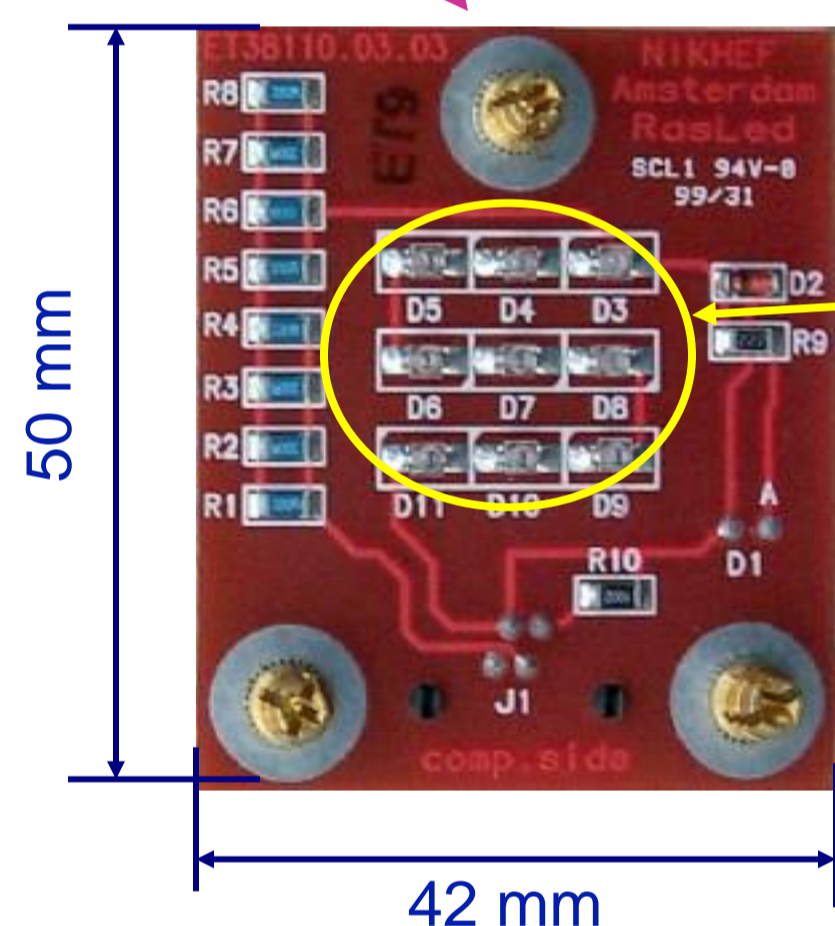
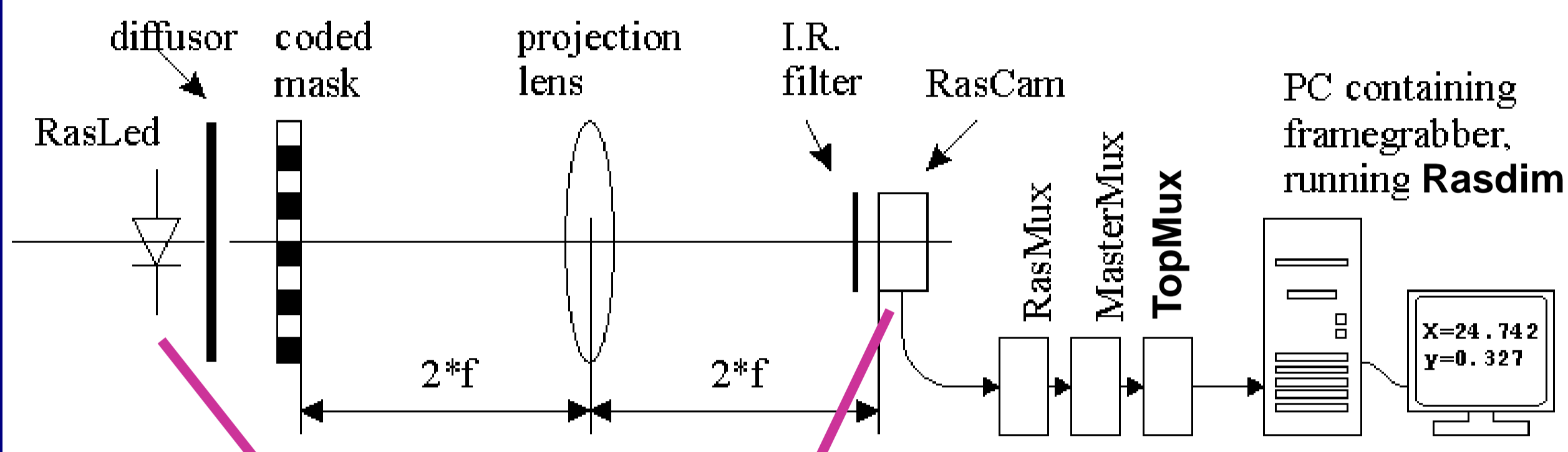
### Rasnik (Red Alignment System NIKHEF)

- Original type developed at NIKHEF Amsterdam
- Chess board with encoded edges
- Analysis: FOAM (FOurier Analysis Method)

### Distortion during magnet test

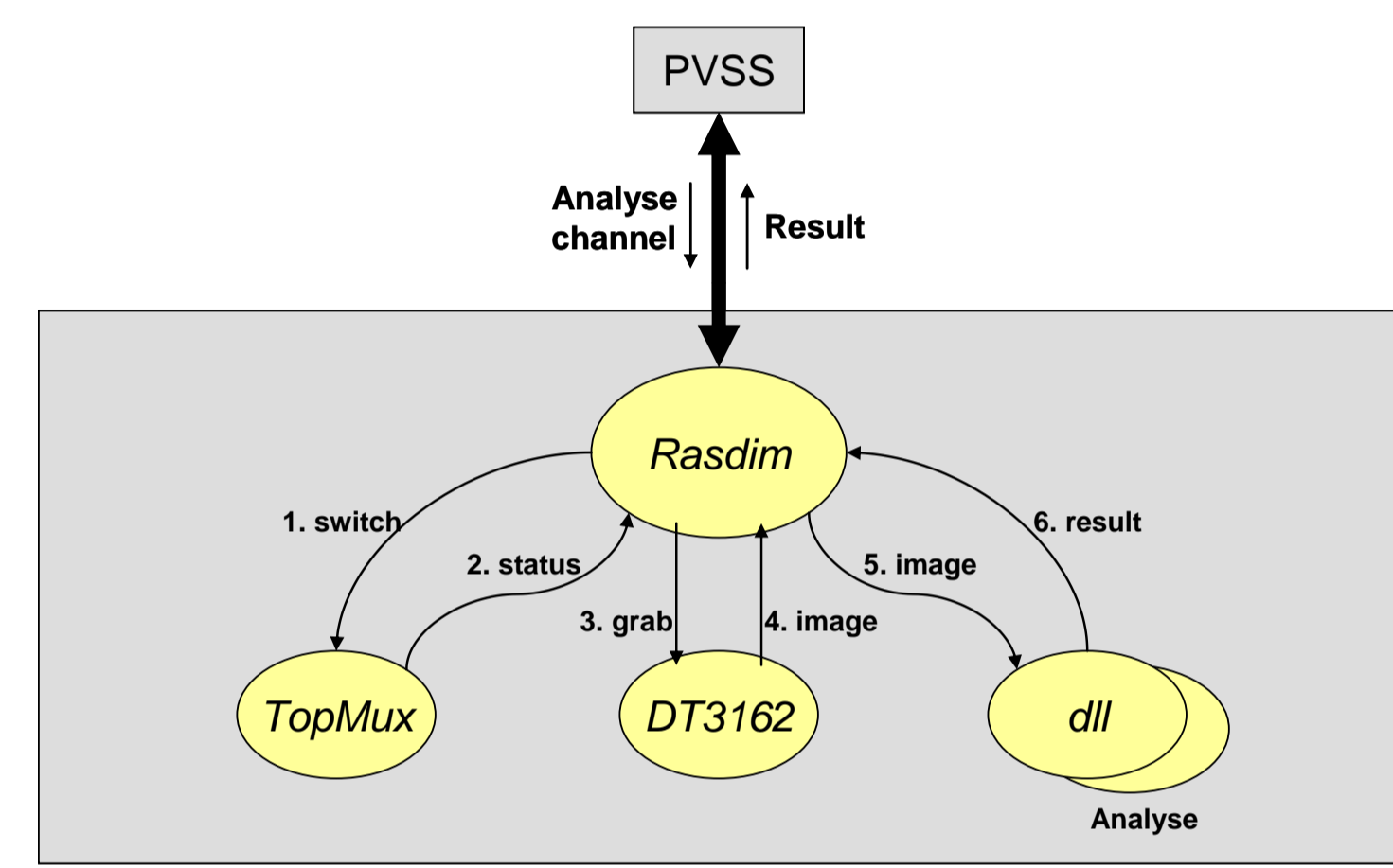


## Optical Line (Channel)



- RasLed:** 9 infra-red LEDs
- RasCam:** CMOS 392 x 292 pixels

## Rasdim & PVSS

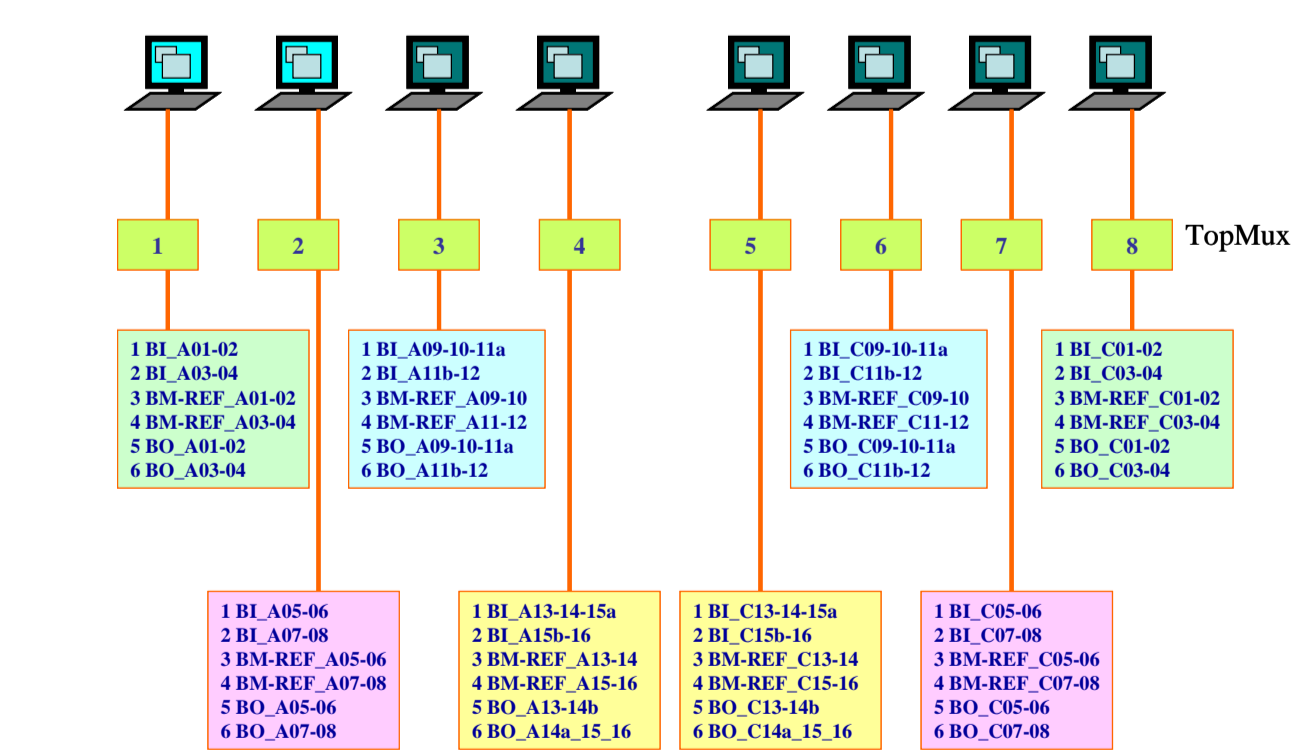
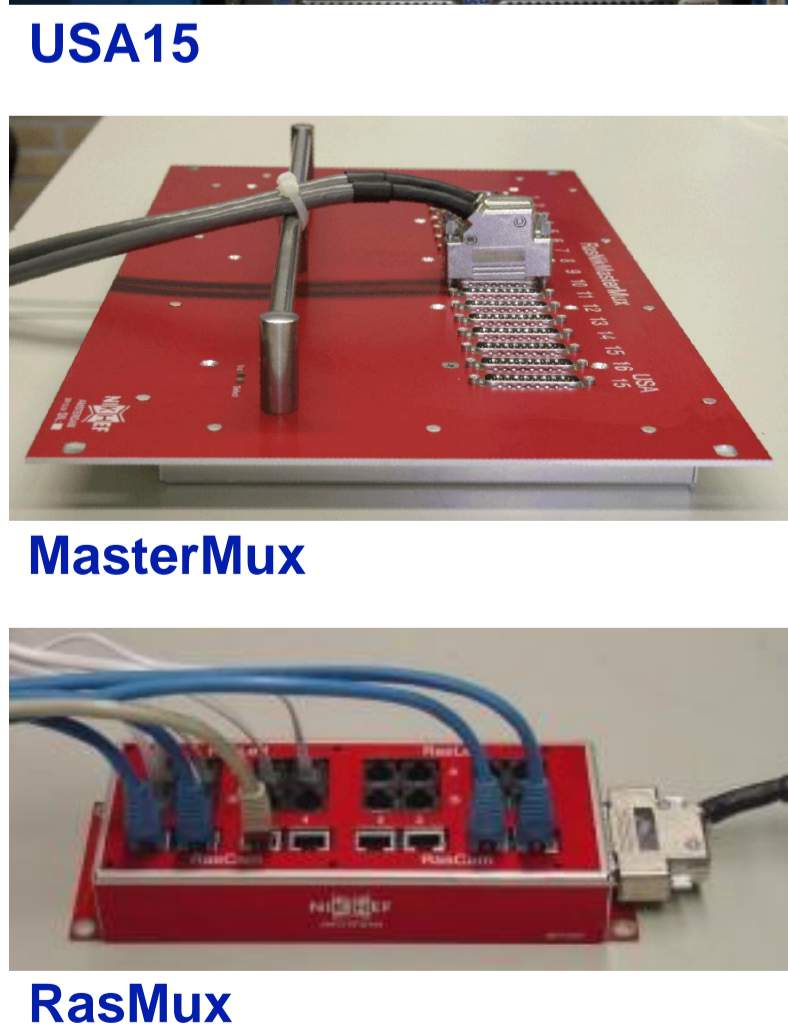
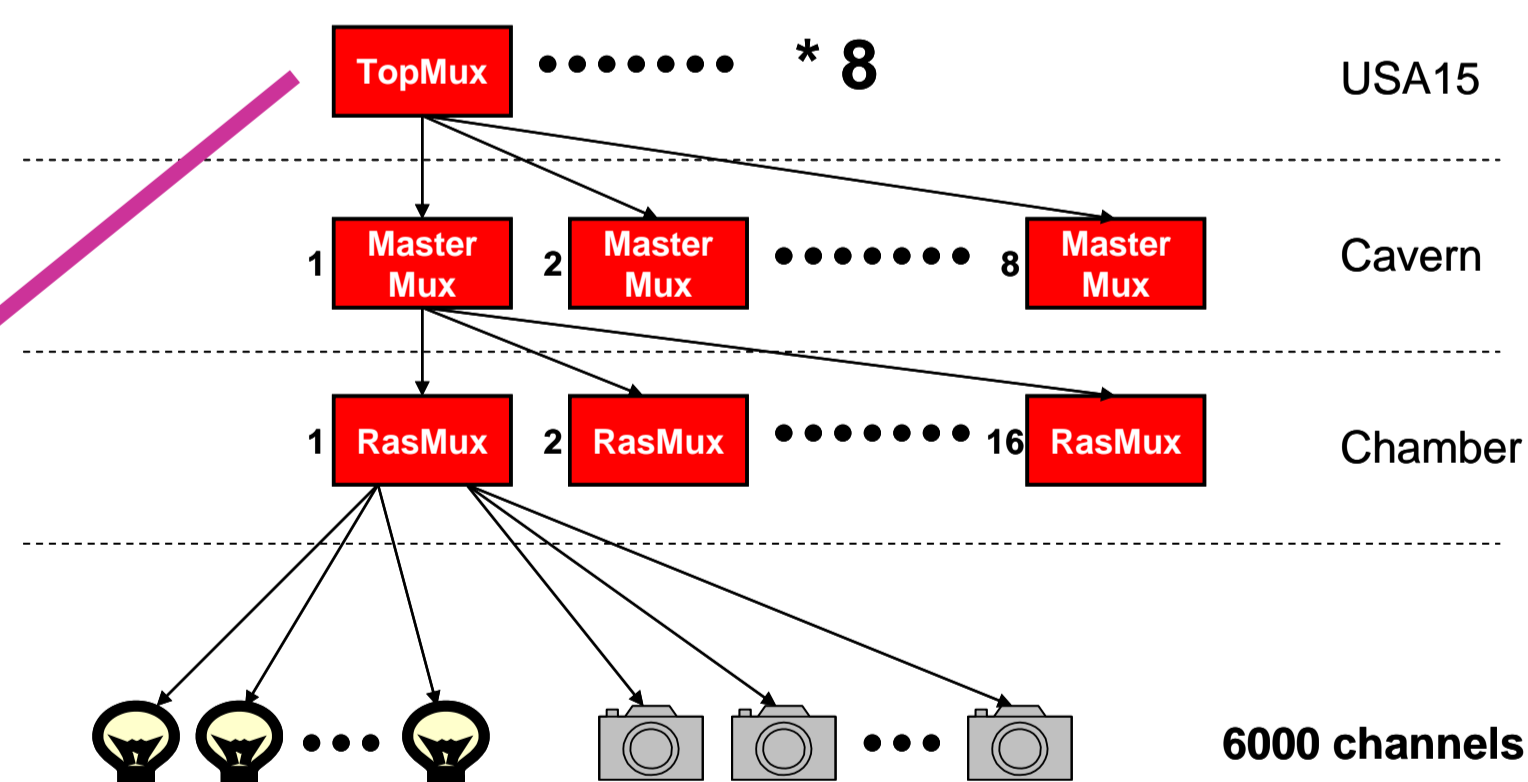
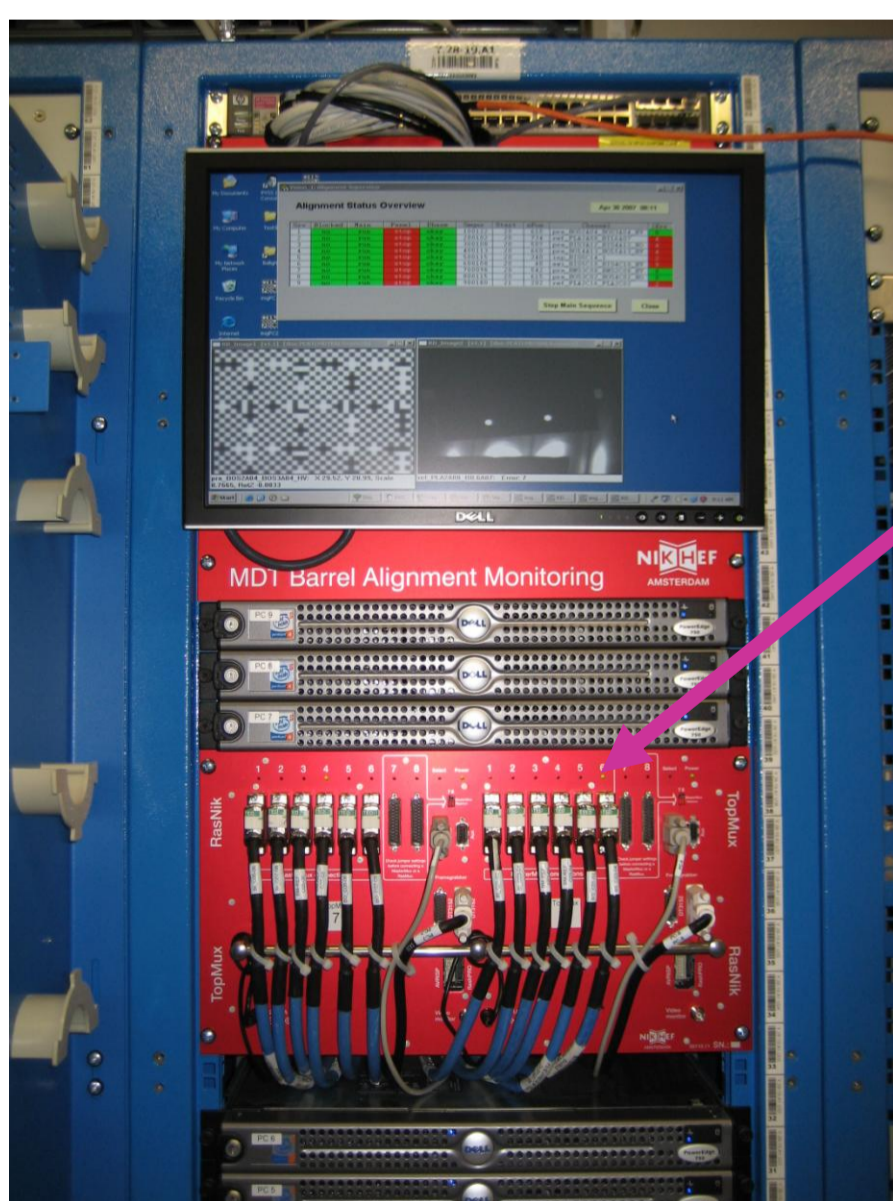


- DIM:**
- Lightweight communication protocol
  - Communication: PVSS ↔ Rasdim
- Rasdim:**
- Server; developed with VC++
  - Controls MUX and Framegrabber
- PVSS:**
- SCADA (Supervisory Control and Data Acquisition)
  - Datapoint concept
  - Database:
    - Results → CondDb
    - Parameters ↔ ConfDb



#	MDI CHANNEL_NAME	SEQ NR	STIME	GLOB_ERR	ANAL_ERR	YVALUE	YVALUE (SCALEVALUE)	ROTVALUE
1	40E760130 mg_BOLA09_3	6689	30-SEP-09 02:16:50.160000 PM	0	0	86.343661072	51.43003736	59.1987109
2	40E760060 mg_BOLA15_5	7255	30-SEP-09 02:16:50.160000 PM	0	0	86.254521239	56.18918653	57.98997144
3	40E760053 mg_BOLA03_4	7670	30-SEP-09 02:16:50.160000 PM	0	0	31.226407715	11.022364616	7.56316875
4	40E760030 mg_BOLA11_3	7948	30-SEP-09 02:16:50.160000 PM	0	0	27.471251488	71.256479201	1.000204531
5	40E760019 mg_BOLA11_3	7363	30-SEP-09 02:16:50.160000 PM	0	0	8.627261465	96.258242255	1.000191269
6	40E760209 mg_BOLA05_4	8013	30-SEP-09 02:16:50.160000 PM	0	0	1.813699961	527.298973	162.399998
7	40E760003 mg_BOLA02_3	7823	30-SEP-09 02:16:50.160000 PM	0	0	26.50265196	88.707035479	98.9776632
8	40E760066 mg_BOLA14_BLA1C13	7255	30-SEP-09 02:16:51.000000 PM	0	0	30.00000000	9469.0026	15491.9997
9	40E760199 mg_BOLA15_5	7491	30-SEP-09 02:16:51.140000 PM	0	0	86.884315491	31.499202438	757.89089
10	40E760191 mg_BOLA15_5	7846	30-SEP-09 02:16:51.410000 PM	0	0	85.546240291	53.3036463	99.9191444
11	40E760143 mg_BOLA09_4	6689	30-SEP-09 02:16:51.430000 PM	0	0	45.656681275	48.83064515	1.00116396

## Hardware Configuration



- 8 PC (W-XP) + 1 super-visor + 1 spare
- Frame-grabber: Data Translation DT3162
- 3-level multiplexing scheme
- ±10 minutes full cycle

## FSM

### FSM: Barrel Alignment Concepts:

- Passive system (no commands)
- State/Status based on number of errors and storage to database

## References

- [1] H.Groenstege et al., "The Rasnik", ATLAS MUON Note 63 (1994)
- [2] Rasnik homepage: <http://www.nikhef.nl/pub/departments/et/experiments/atlas/rasnik/index.html>
- [3] C.Guyot et al., "The alignment system of the ATLAS barrel muon spectrometer", ATLAS Note ATL-MUON-PUB-2008-007