PRIMA Astrometric Data Reduction Software (ADRS)

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16 October 2006
ADASS Conference, Tucson AZ

PRIMA Astrometric Operations and Software (PAOS) Consortium:

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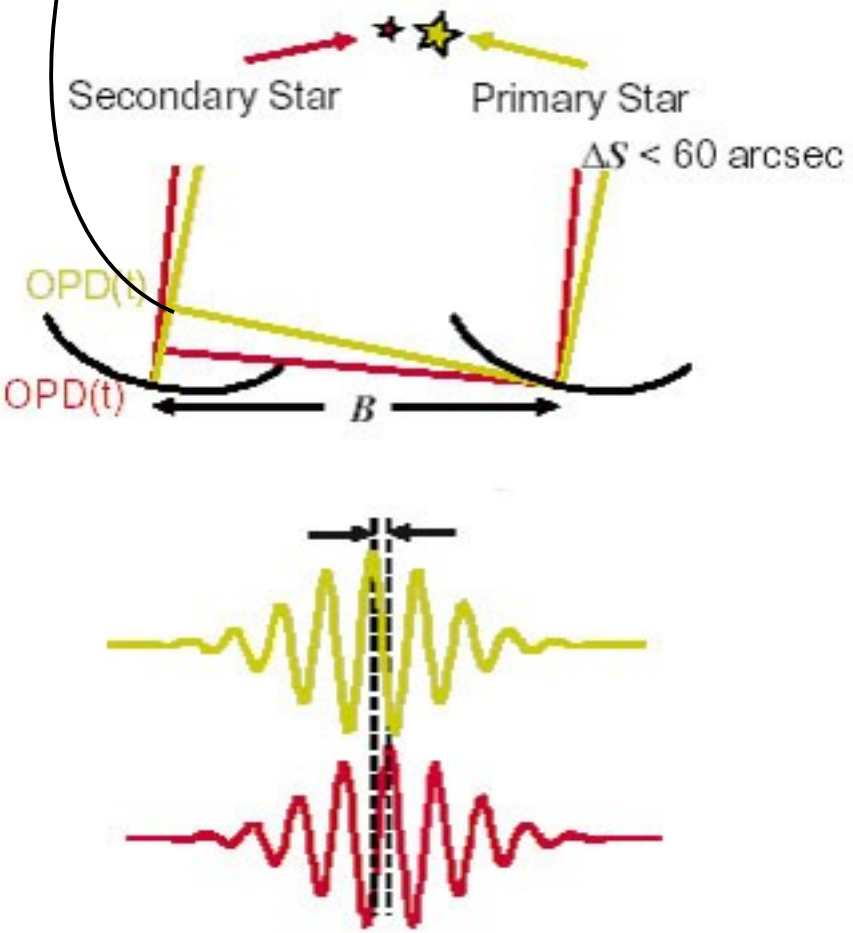
Introduction

- **PRIMA:** Phased Referenced Imaging and Micro-Arcsecond Astrometry instrument for the Very Large Telescope Interferometer (VLTI)
- Main goal of PRIMA astrometry: A search for extra-solar planets and the characterization of their orbits
- This goal requires *10 micro-arcsec* accuracy over a time range of up to several years
- Systematic analysis for long-term trends in the data needed

DOPD

Principle



Differential Astrometry:

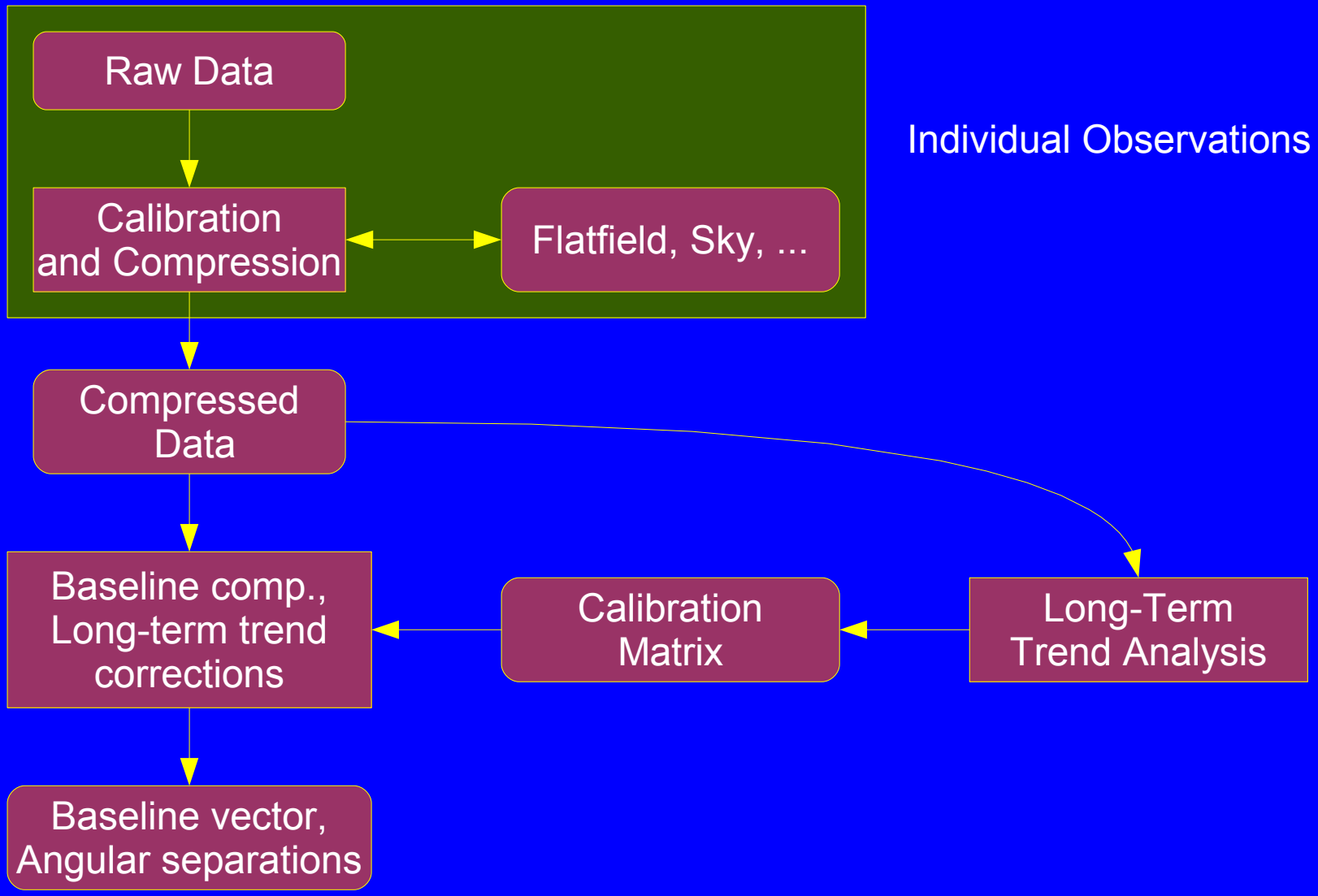
Need to measure the vacuum *Differential Optical Path Difference (DOPD)* and *Baseline (B)* to obtain **ΔS:**

DOPD = **ΔS·B**

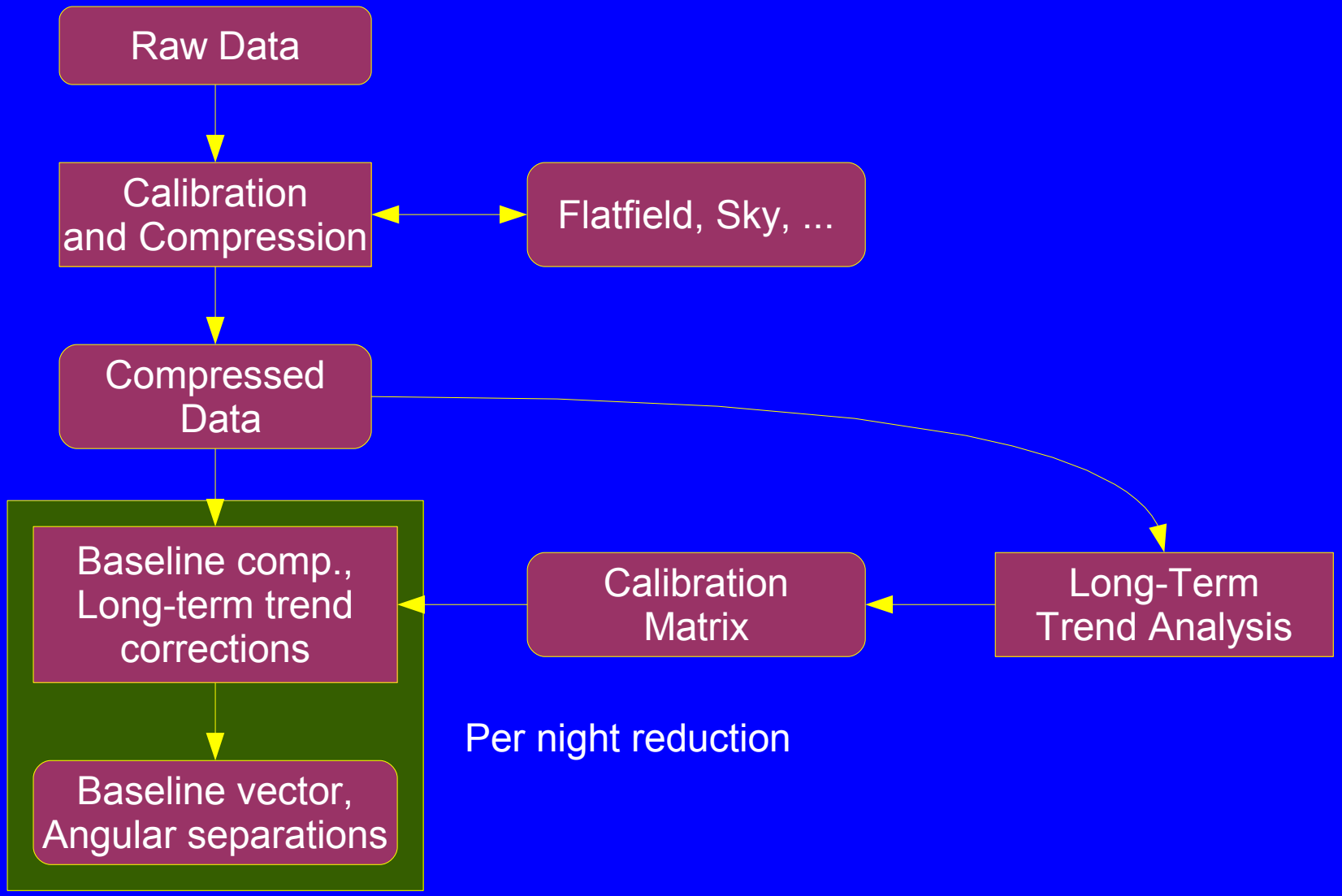
Corrections needed for:
- Atmospheric effects
- Long-term changes in the baseline
- Long-term trends in the VLTI optics and mechanics
- Earth rotation effects
- Detector effects

Required DOPD accuracy: **5 nm**

Data Reduction Overview



Data Reduction Overview



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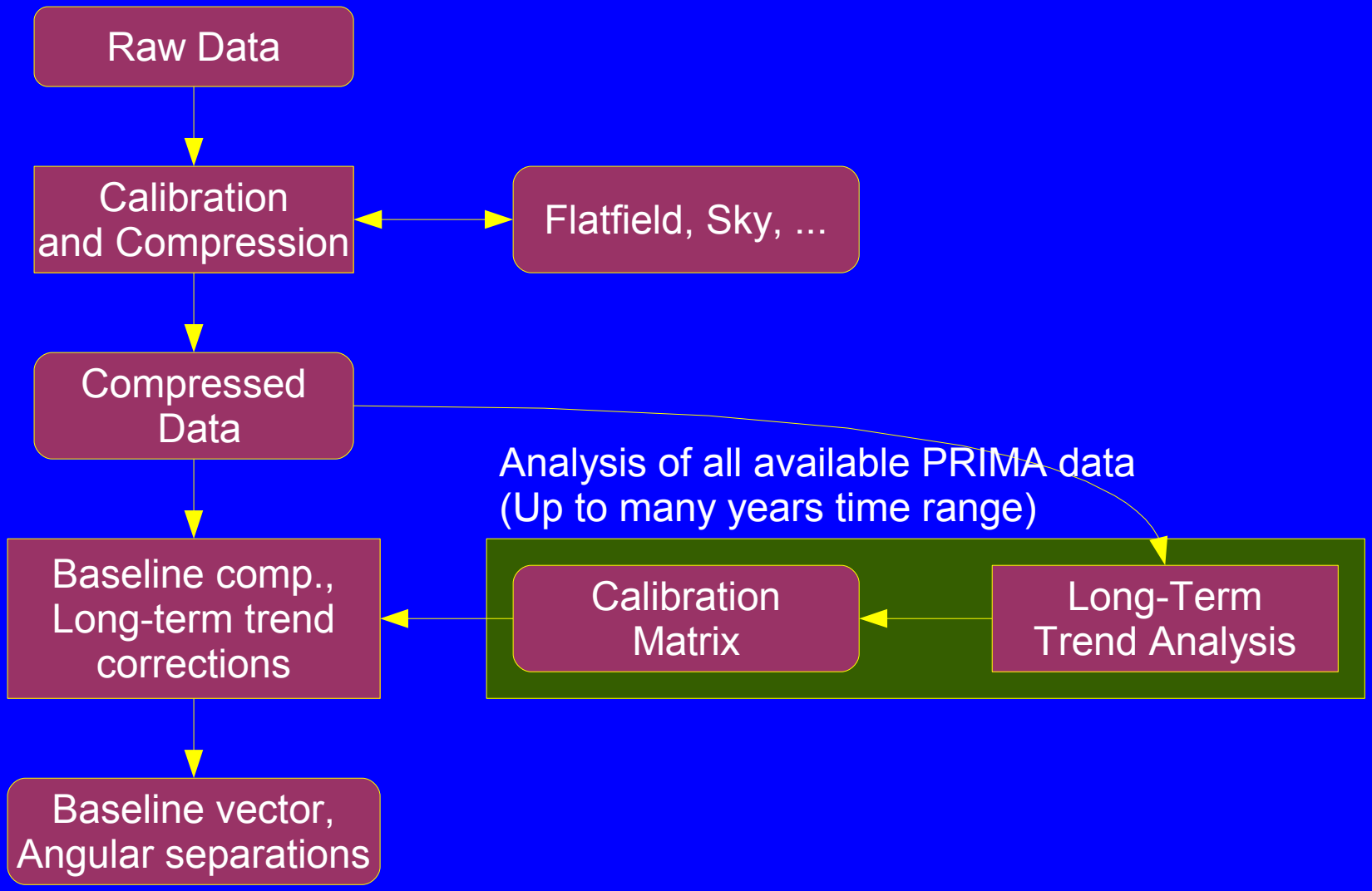


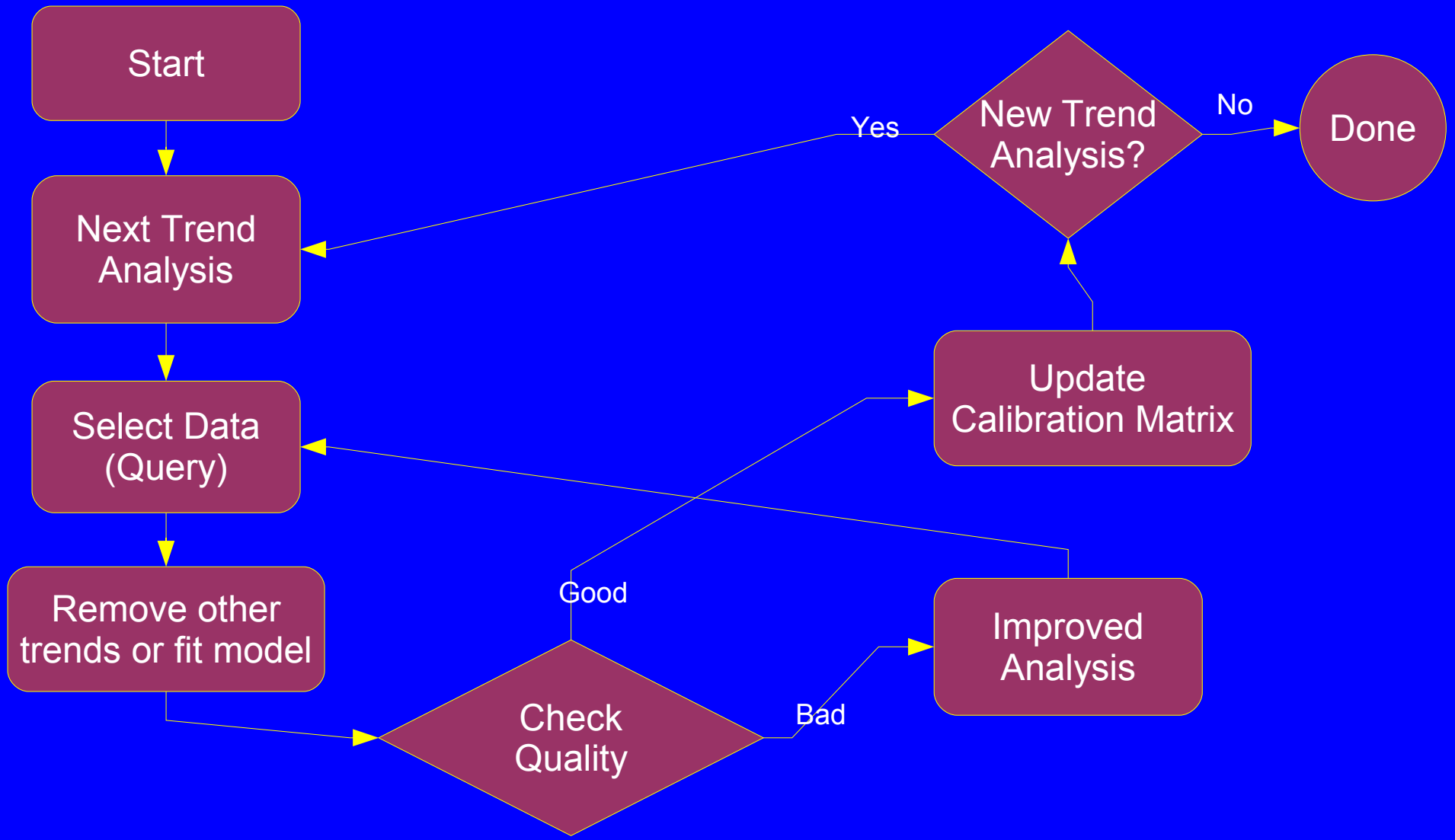
Data Products

- Raw Data: Fringe positions and DOPD metrology at up to 8 Khz rate, flatfields, sky background, ..., *environmental sensor data*
- Compressed Data: same information at 1 second rate and calibrated for detector effects.
- Final products: long-term trend corrected DOPDs, baseline vectors and angular separations.

Long-Term Trend Analysis

- Systematic analysis of all PRIMA compressed data and environmental sensor readings (weather, VLTI environment, optics and mechanics).
  - Interactive identification of trends
  - Recipes will be developed for fitting those trends and producing correction coefficients
  - Automatic **Data Analysis Facility (DAF)** executes all those recipes
  - Results will be stored in the **Calibration Matrix**

Automatic Trend Fitting (DAF)



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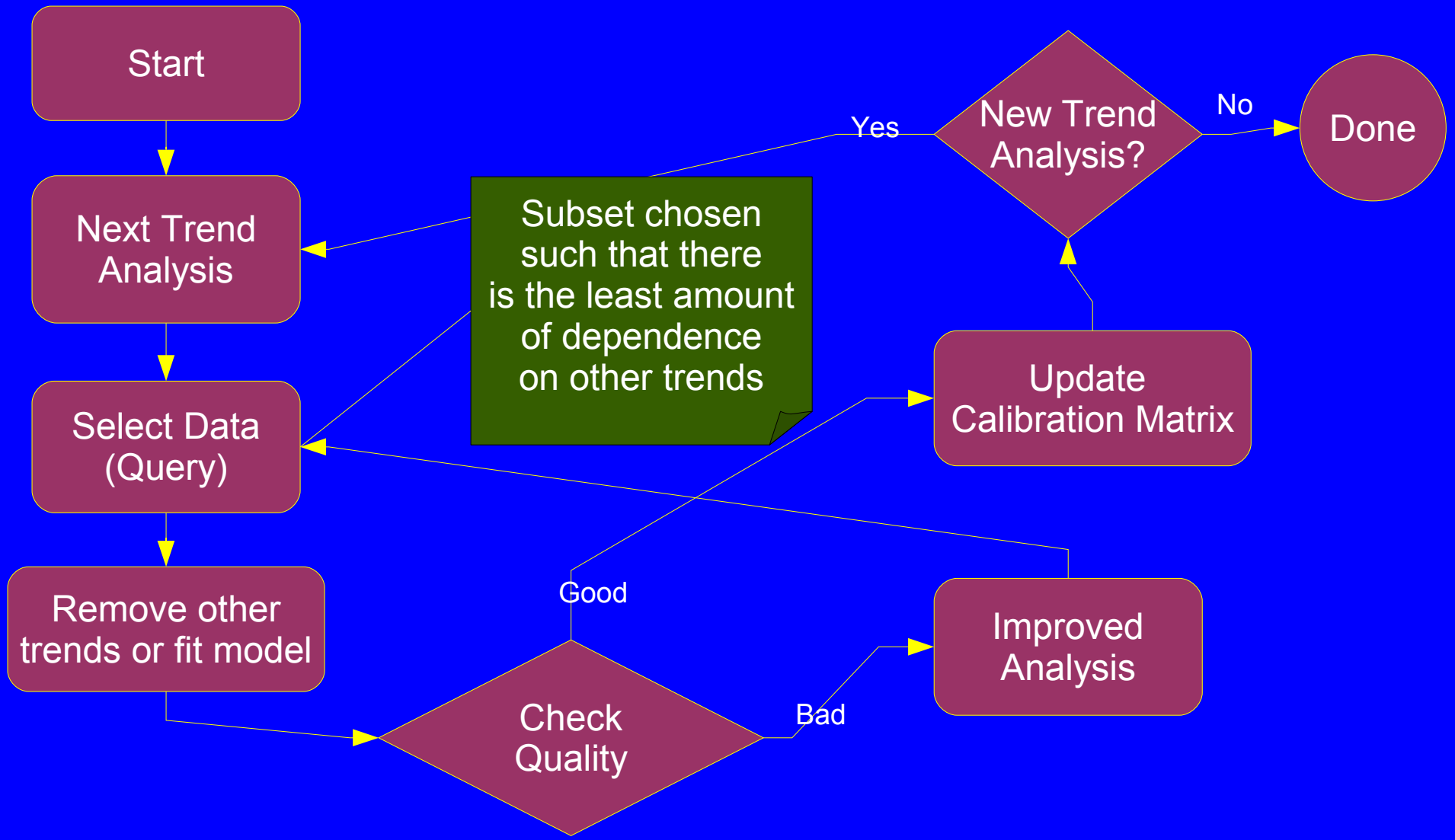

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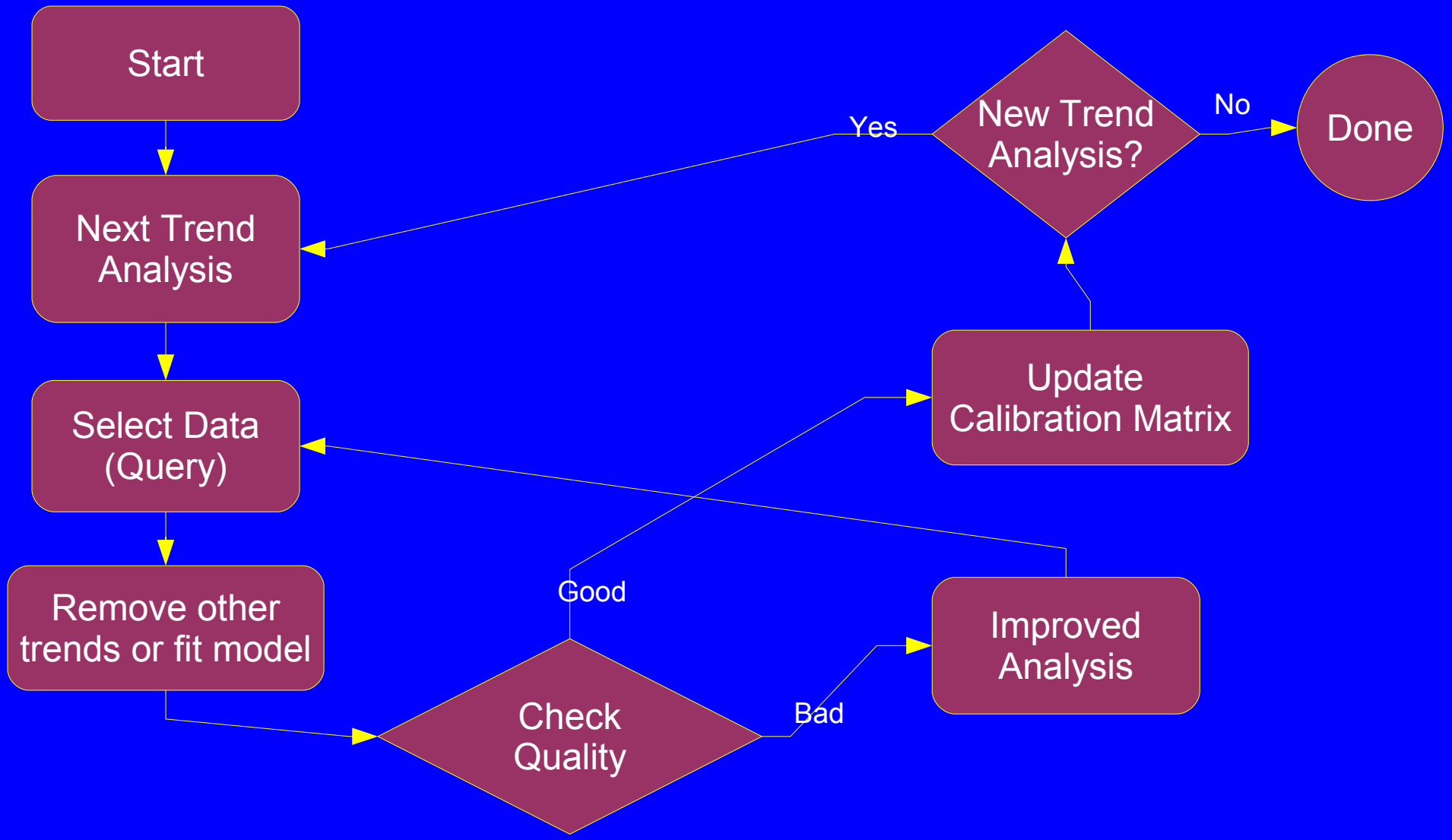
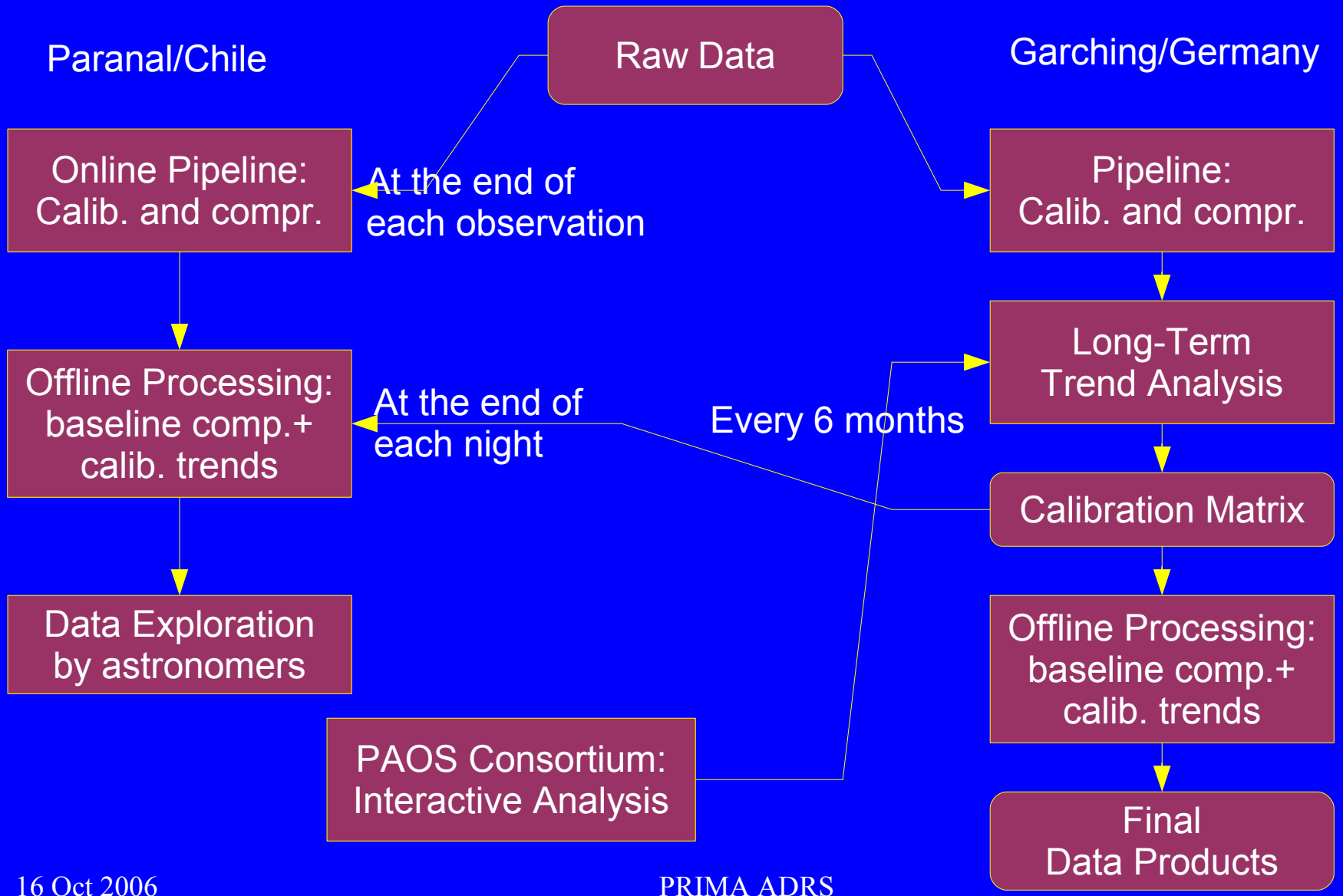


Implementation at ESO



Timeline

- Design is being finalized: Final Design Review in January 2007
- All reduction recipes (online pipeline and offline processing) are defined
- A simulator for raw data is available and prototyping has started
- First production release of all modules is planned at the end of 2007

Problems

- Long-term trend analysis as currently planned depends on the expertise of the PAOS consortium (for the manual identification of trends) as long as available.
- We have no final statistical analysis to assure that no more unknown trends are present in the scientific data.
- The trend analysis queries may become too complicated for our current tools

Conclusion

- We do not expect problems with the pipeline and offline processing (recipes are defined).
- We will have a working ADRS before commissioning.
- We keep in mind that the long-term trend analysis may have to be automated with a sophisticated statistical analysis (data mining)
- *Any input from projects with similar long-term analysis procedures would be welcome*