Sensor Technology and Modeling
The Image Chain Approach to Fires Sensor Development

The Fires Group

June 2001

Technical Exchange Meeting

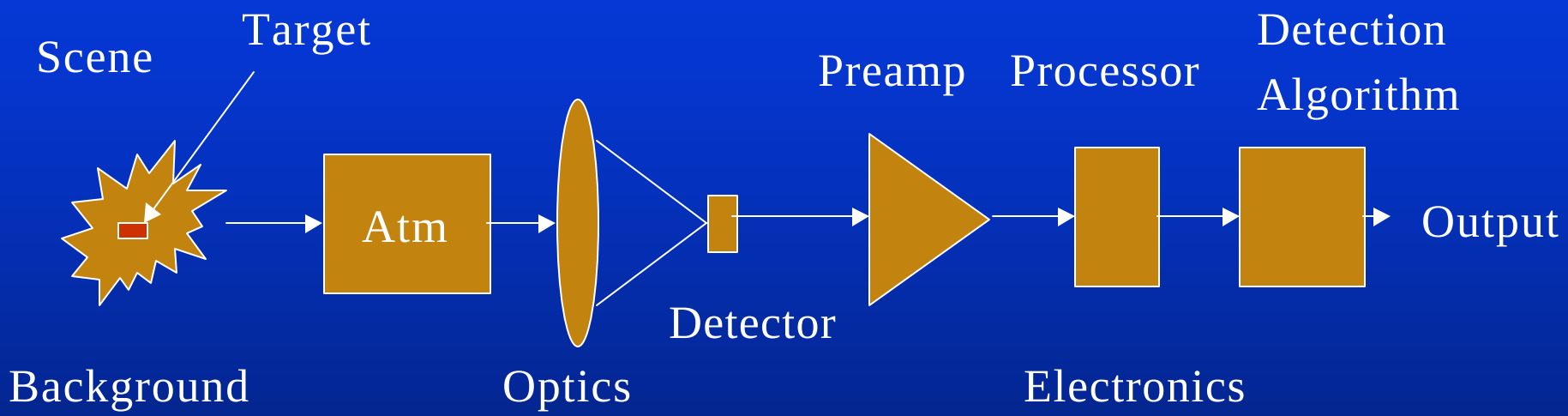
Scope of Task

- Technical Scope: Develop viable sensor model to allow selection and optimization of FIRES satellite detectors
- Deliverable: 1st draft report describing sensor modeling, results, and plans for future development
- Period of Performance: now until September 30
- Team:
  - John Schott
  - Bob Kremens
  - Graduate student gang: Stef, Dom , Andy

Key Milestones

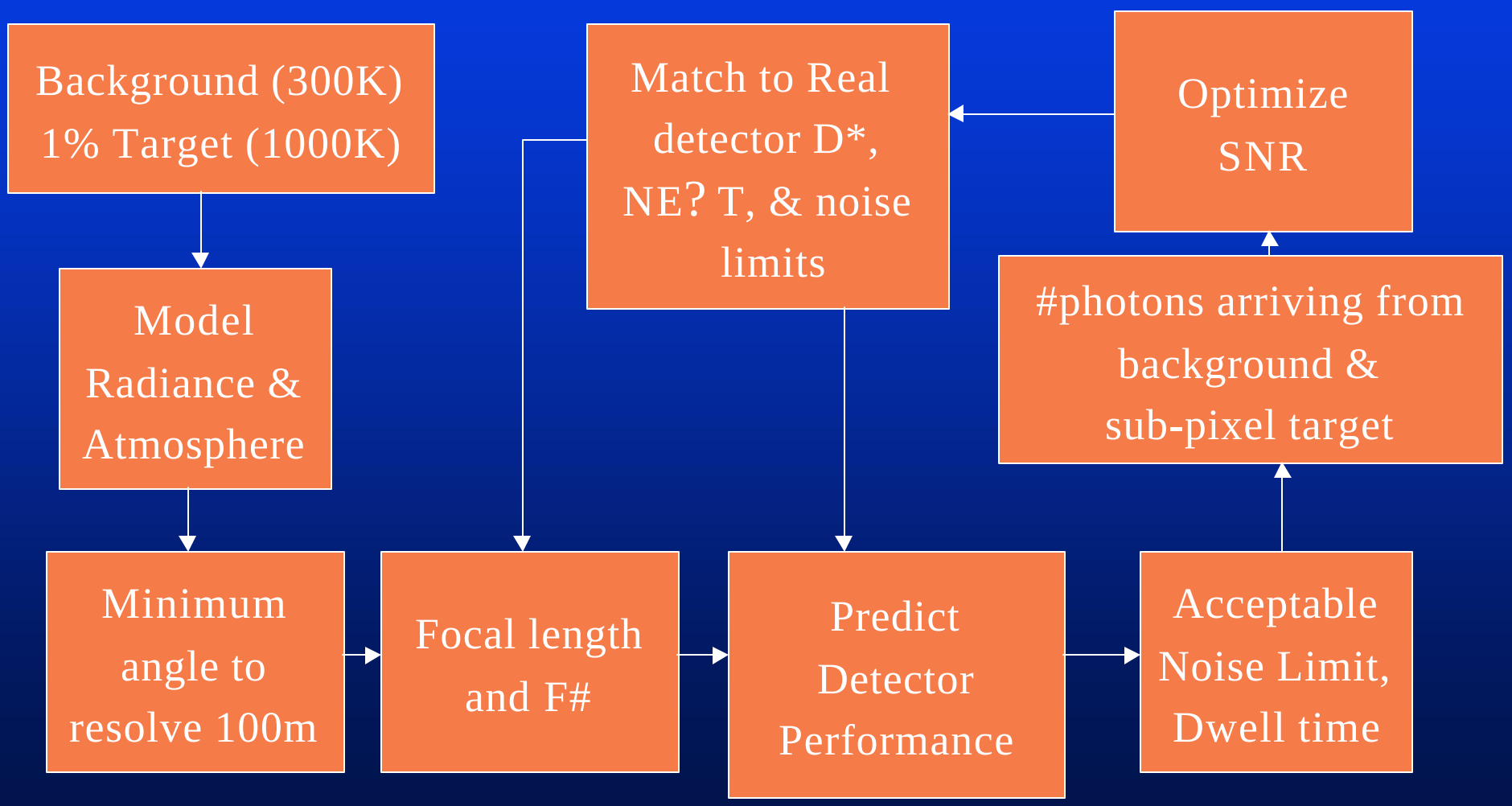
• Tasks defined	by May 30
• Present at TEM	June 21
• Project Review with other team members	by end of July
• Write preliminary report	August 15 - September 30

Sensor modeling will be performed using the image chain methodology



- **Each optical/electronic component modeled independently**
- **Output of one model is input to next component along chain**
- **Iterative/parameterized approach to final design meeting the requirement criteria**

Analysis components are being developed and tested in a modular, iterative model



More emphasis is now placed on uncooled detectors

- Initially, concentrate on uncooled detectors because their inherent simplicity
- Various configurations (staring array, push-broom, whisk-broom) pixilated bolometers being investigated from several vendors
- These detectors have some shortcomings. The study will determine the parameter range (NEΔT, resolution (GSD), temporal bandwidth) possible with these devices
- The extension to cooled detectors and other wavelengths is simple

Some parameters are now calculated using recognized modeling tools

- The ‘main’ program is written in a 4th GL language that is easy to read and verify. The calculations are not extensive.
- Detailed optical modeling performed using Sinclair Optics OSLO. This allows accurate calculation of resolution, especially for fast optics, off axis images
- MODTRAN used for atmospheric transmission modeling
- Research Systems ,Inc. IDL used as a pre-processor to reduce some data for easier MATHCAD input.
- Multi-step process will be trimmed and consolidated as modules are verified

DIRSIG integration will require some rewriting and verification

- As components become ‘solid’ they are re-written in a low level language
- Test suites of data verified on low-level language modules (comparing with original 4th GL language versions)
- MODTRAN is already integrated into DIRSIG
- Optics parameterization (using ray-tracer or physical optics package) will be more difficult