# OPEN ISSUES IN TRANSPORTATION AND PROPAGATION IN FIELD

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# NORMALS

- Optical processes depend on the exit normal
  - Problem in presence of coincident surfaces
  - A partial fix created in October 2014 (included in 10.1)
  - Some cases still give the wrong answer.

# STEPPER ISSUES & DEVEL.

- There are robustness issues with G4NystromRK4 - even tough ATLAS' version works
- New steppers (short presentation in Field Working Session 5C)
  - Templated steppers - efficiency (GSoC 2014)
  - High order steppers (Somnath Banerjee, GSoC 2015)
  - New Nystrom steppers (Jason Suagee, GSoC 2015)

# BIGGEST PROBLEM IN FIELD

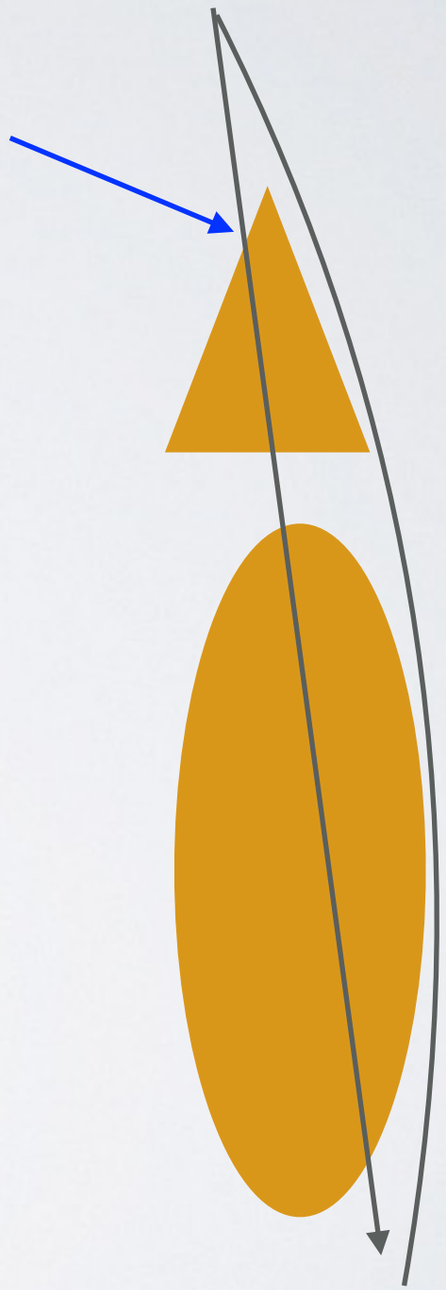
- ATLAS - Particles think they are in poly-cone too long
  - Seen in G4 9.6 and 10.1
- ALICE - Crashes with negative step size
- Both linked to Multi Level Locator

# SYMPTOMS

- ATLAS: Propagation in Field becomes confused: Track continued inside Polycone, much beyond its extent
  - First fix: Navigator uses Solid's response in DistanceToOut(p,v) to identify when track has already left the 'mother volume'
- This improved the behaviour in ATLAS - however the problem persists in 10.1-patch02

# CHALLENGE

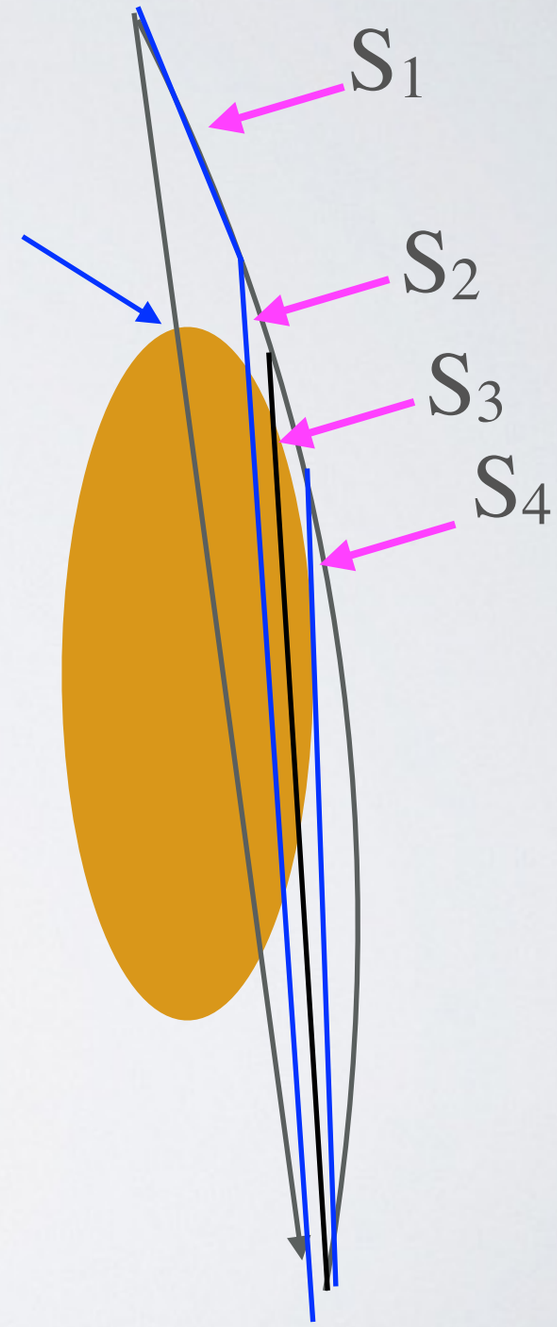
- G4V Intersection Locator role is toCandidate confirm and refine a candidate intersection point.



- Three implementations - challenges
  - “Simple” Locator - ‘linear’
  - Multi-Level Locator - adds ‘bi-section’
  - Brent Locator - adds quadratic conv.

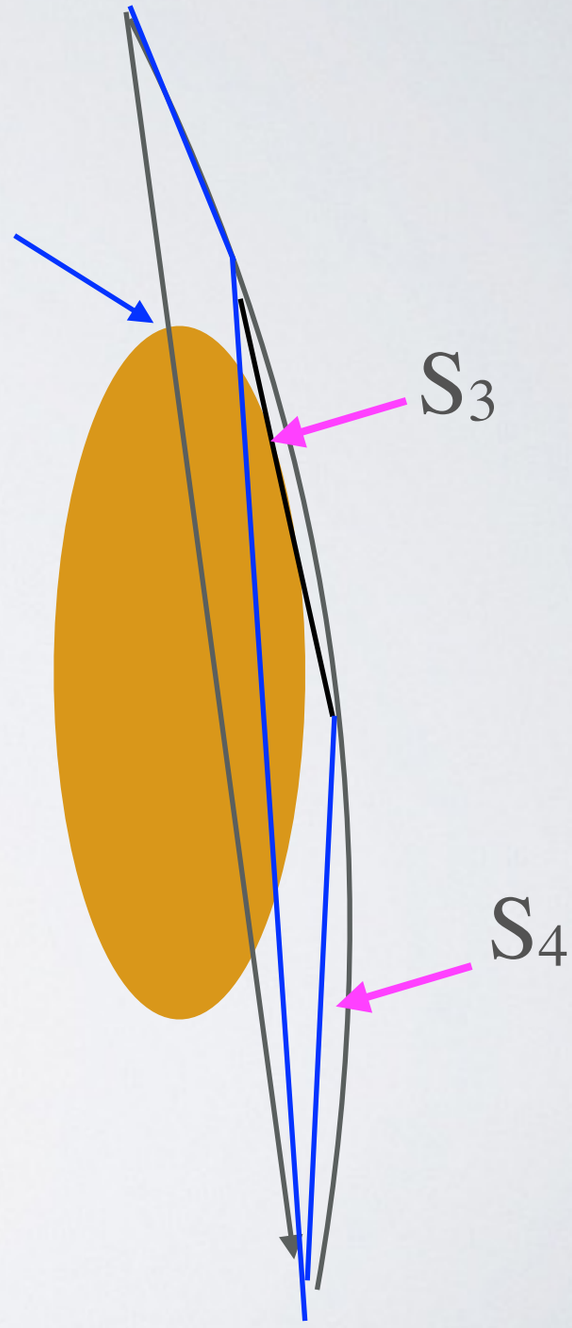
# BASE ALGORITHM

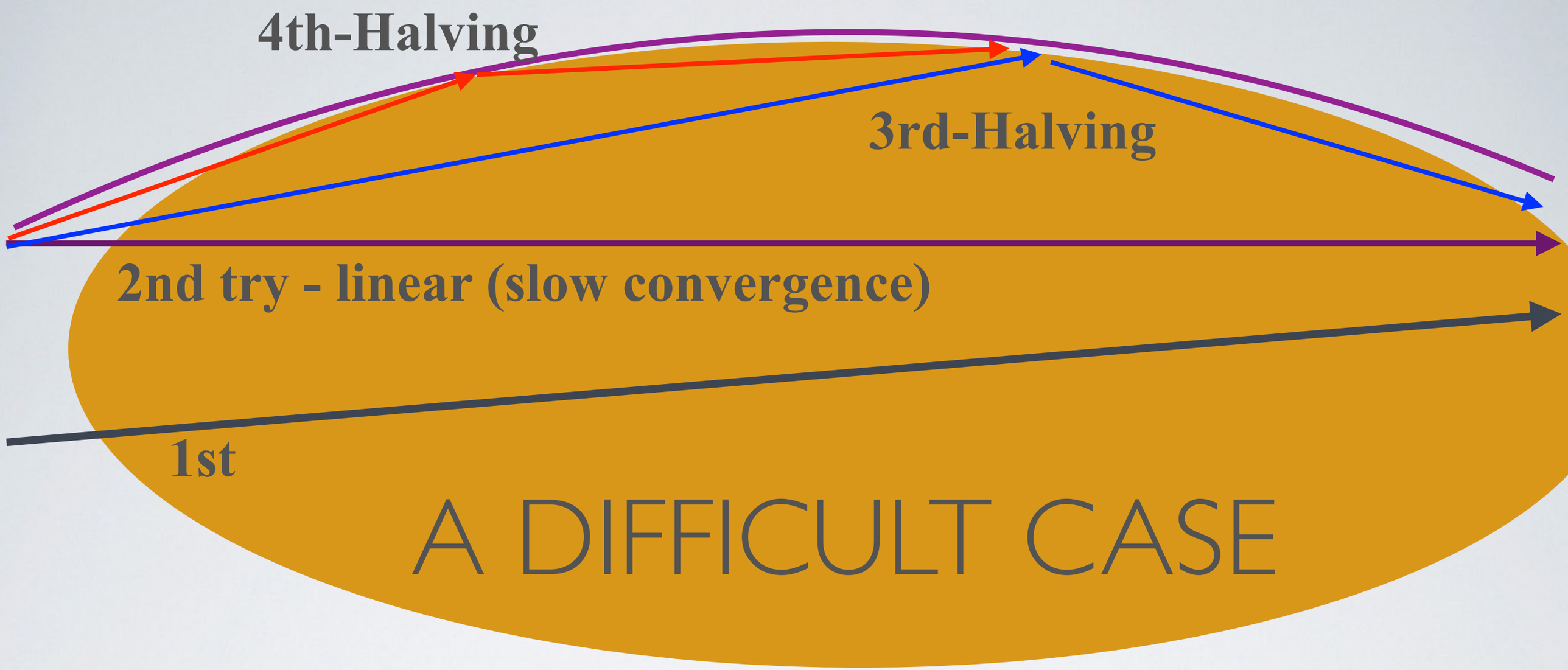
- "Simple" Locator
  - Estimate nearest point on curve
  - Check both segments
- Weaknesses:
  - linear convergence (slow)
  - can fail to converge in 1,000 steps
  - not really simple …



# REFINED ALGORITHM

- Multi-Level Locator
- Check if linear algorithm is not making good progress
- If not, break remainder into two sections - ‘stacking’ the second
- Logic is very complex






- The algorithm must cope with **challenging** cases such as the one above.
- The track just **misses** a surface, but it is almost grazing it for an extended distance.
- If the acceptable sagital accuracy ('miss-distance') is larger than the distance between the curve and the surface,

# MULTI-LEVEL LOCATOR

- When a segment has no intersection, you need to proceed to the next one

- Must make sure that a candidate intersection exists for the next segment

  - This was missing - the old candidate is kept instead (!)

  - A first fix created in August - but it had a 'hole'

  - And problems occur in ALICE so it is not robust - yet.