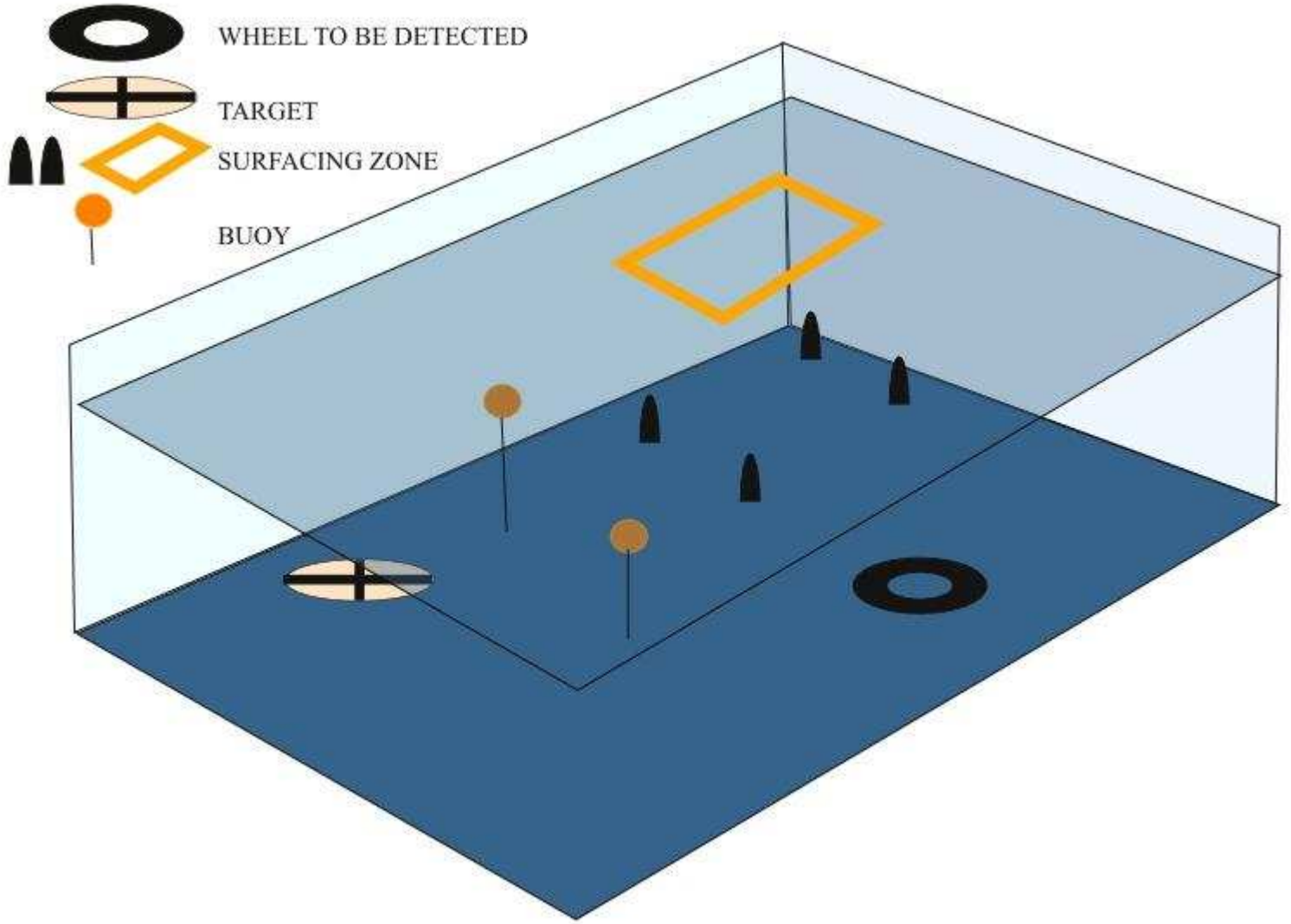
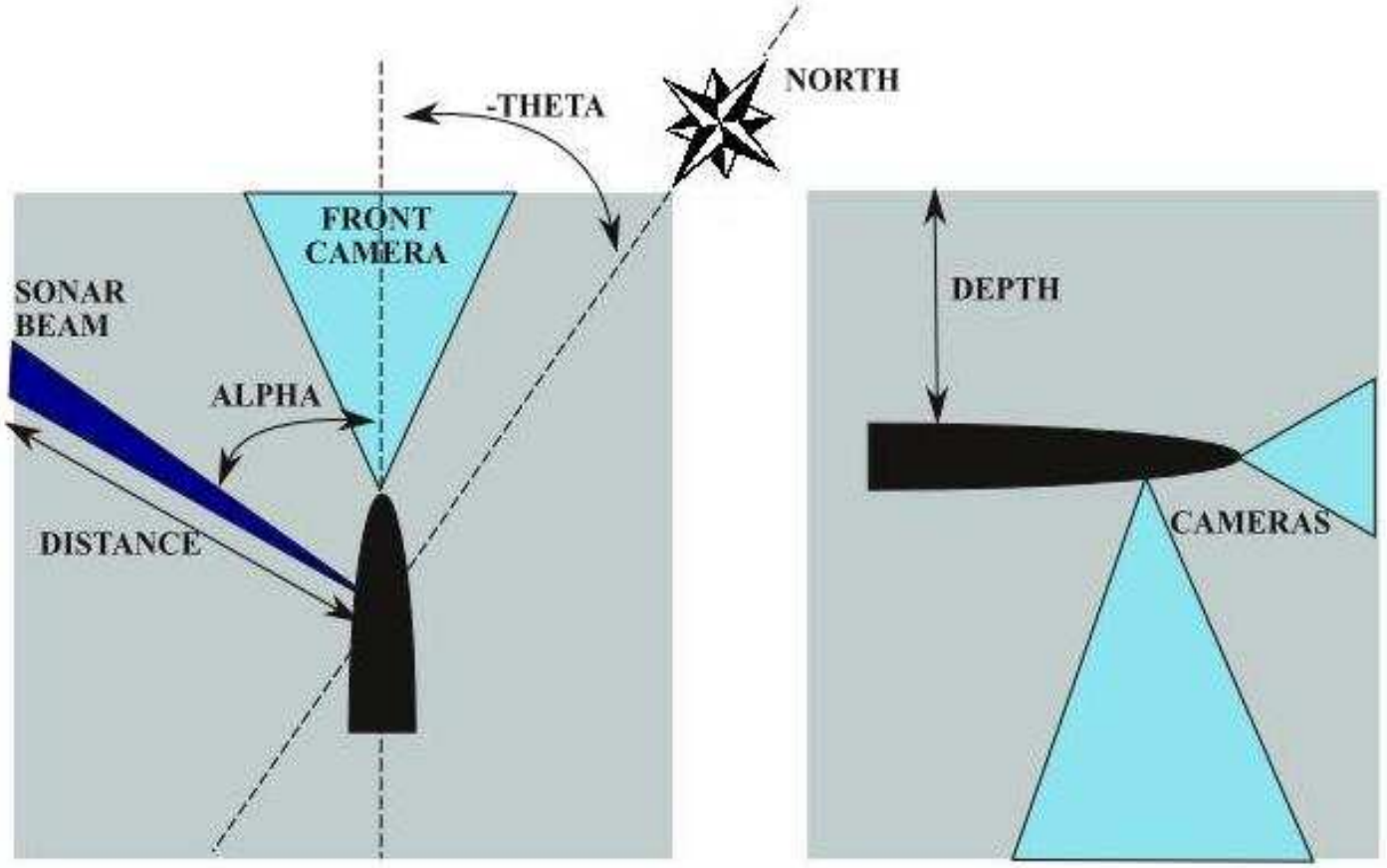
Application of interval propagation

SWIM 08
Jan SLIWKA
June 2008, Thursday 19 and Friday 20

SAUCE Competition

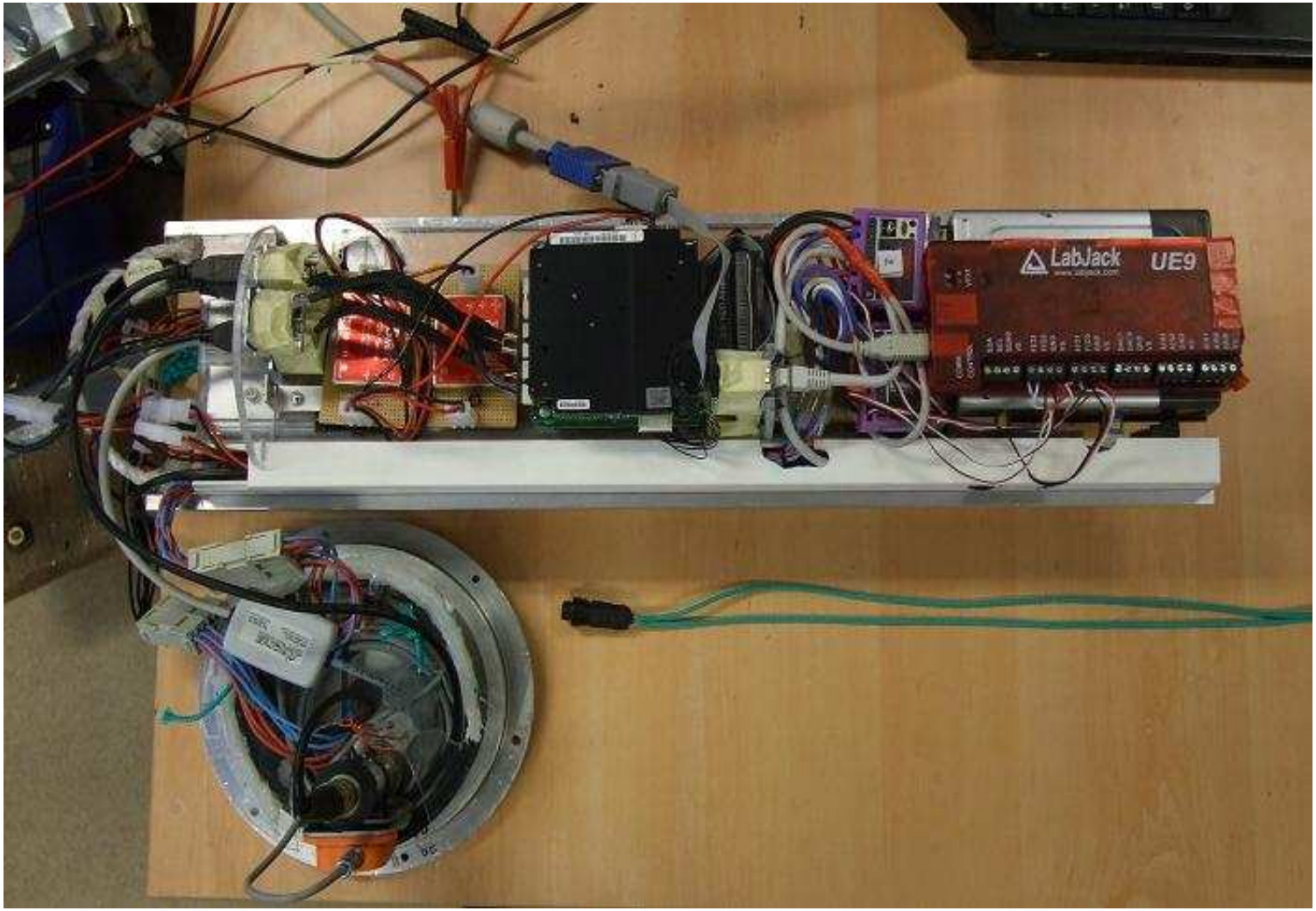


Sensors

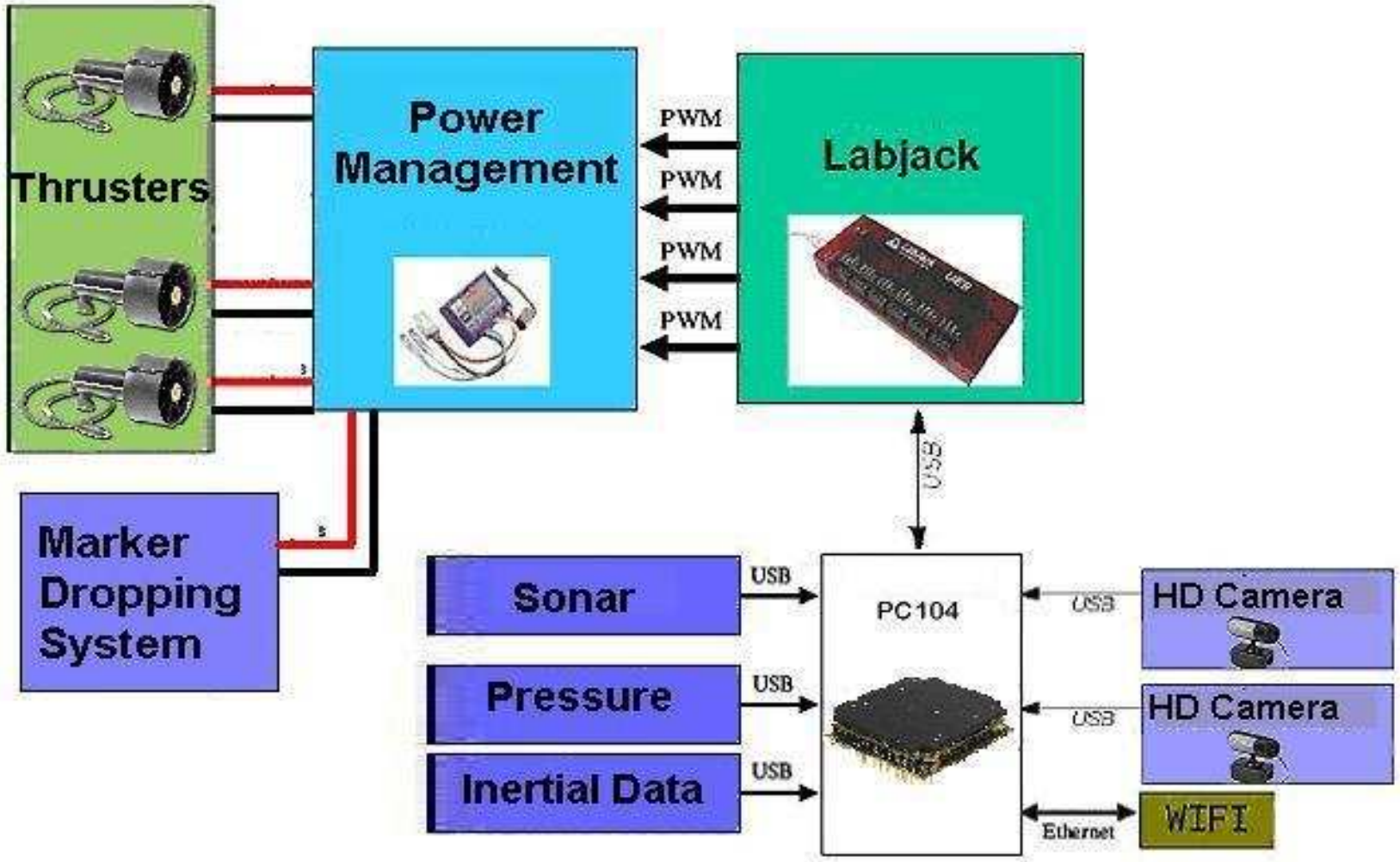

-THETA
NORTH
FRONT
CAMERA
SONAR
BEAM
ALPHA
DISTANCE
DEPTH
CAMERAS

The outside

The inside



The inside


Thrusters
Power Management
PWM
PWM
PWM
PWM
Labjack
USB
Marker Dropping System
Sonar
USB
Pressure
USB
Inertial Data
USB
PC104
USB
HD Camera
USB
HD Camera
Ethernet
WIFI

The Theory

- Algorithm main elements & implementation
  - Contractions
  - Q relaxed intersection
- Simplified example of AUV localisation
- Localisation algorithm

Contractions

Ex. $Z = X + Y$

$Zc = \text{Intersect}(Z, Y+X)$

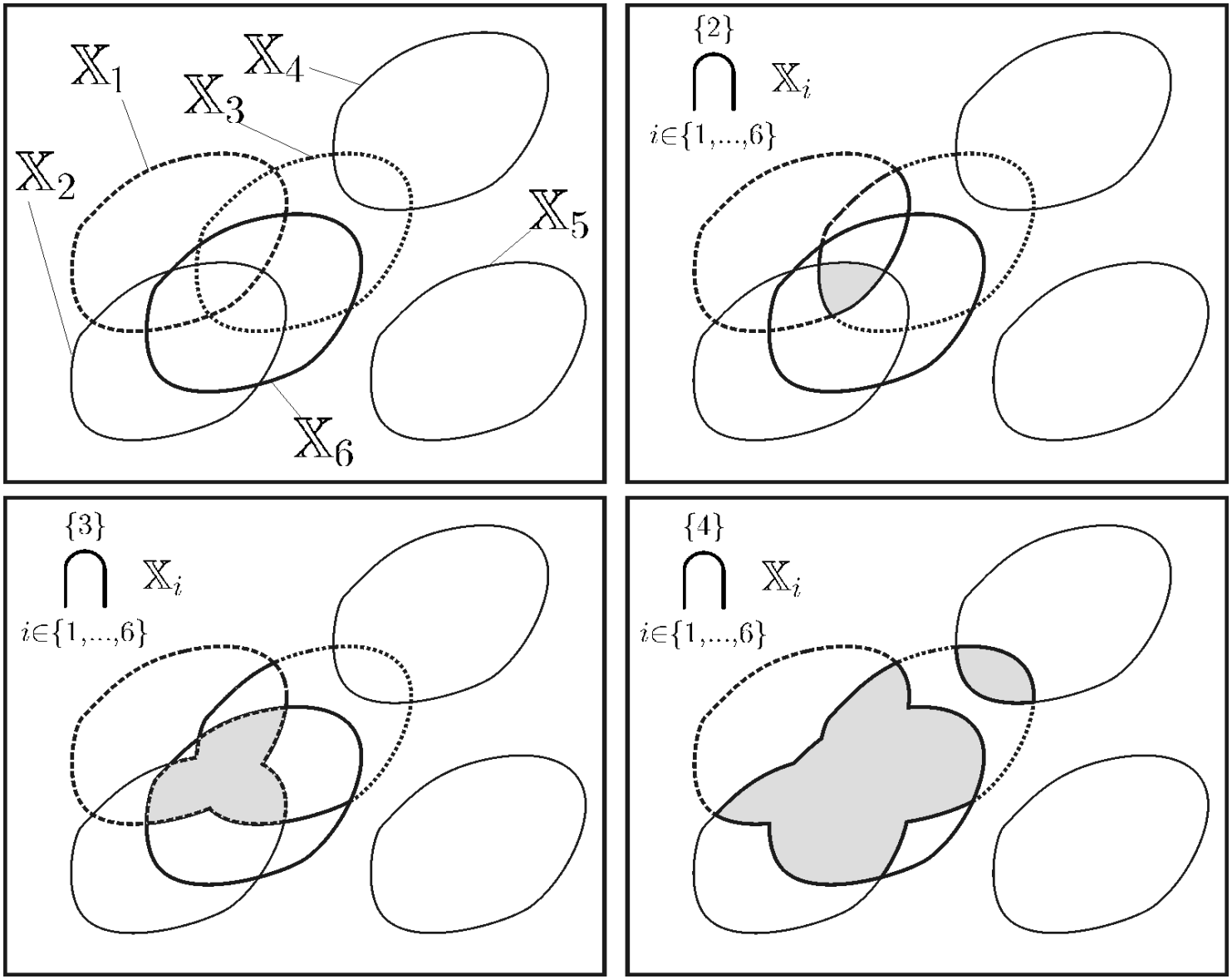
$Yc = \text{Intersect}(Y, Z-X)$, $Xc = \text{Intersect}(X, Z-Y)$

Ex. $X=[1,3]$, $Y=[2,4]$, $Z=[1,4]$

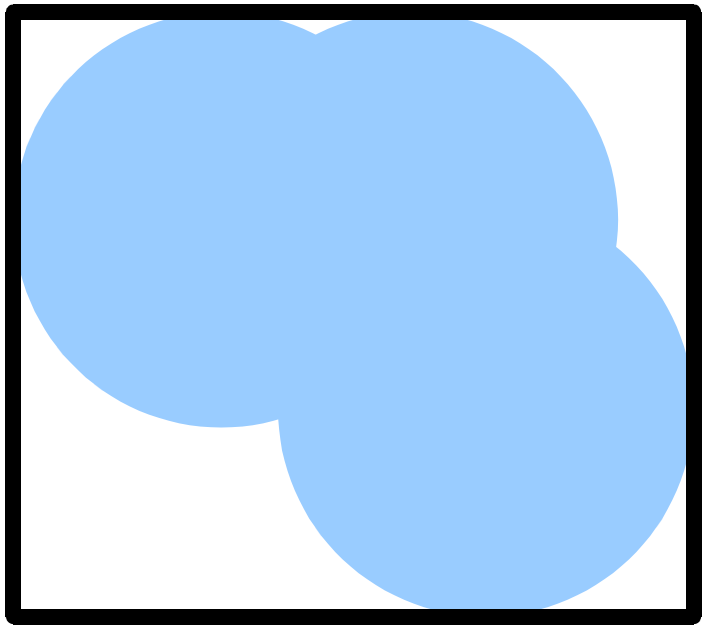
$Zc=[3,4]$

$Xc=[1,2]$, $Yc=[2,3]$

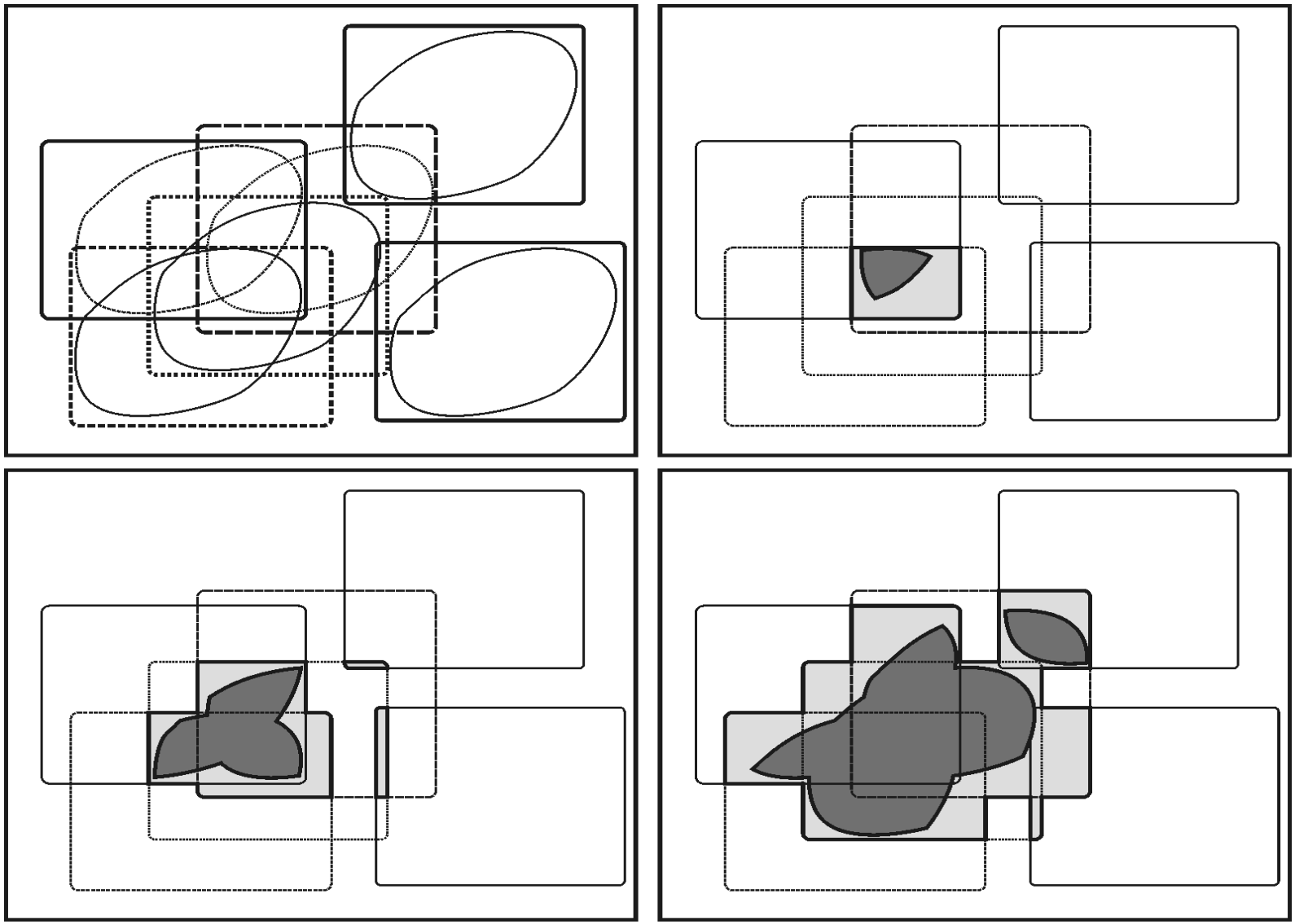
Q Relaxed intersections: Def.



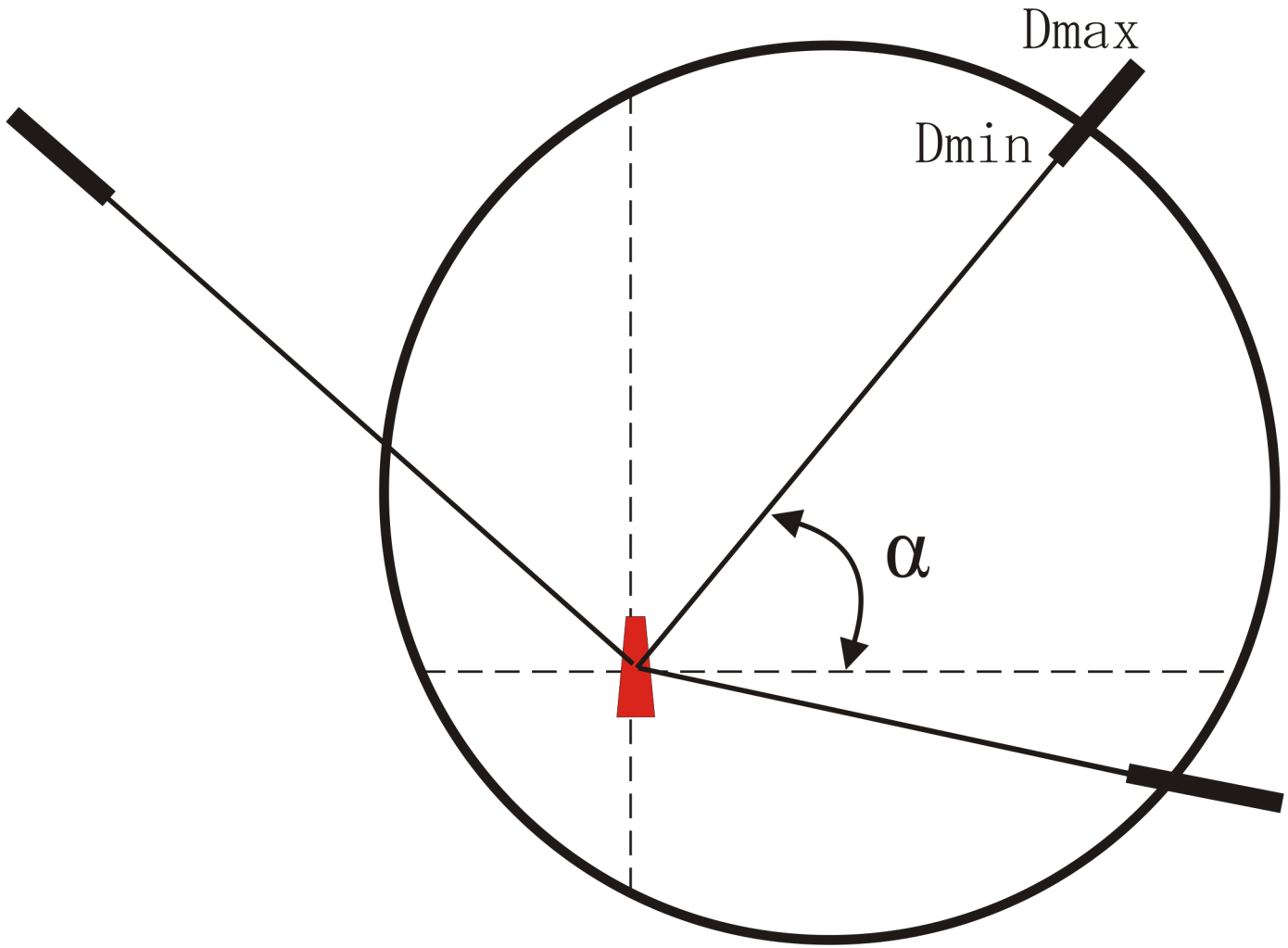
Software Implementation



Software implementation



Simplified real example



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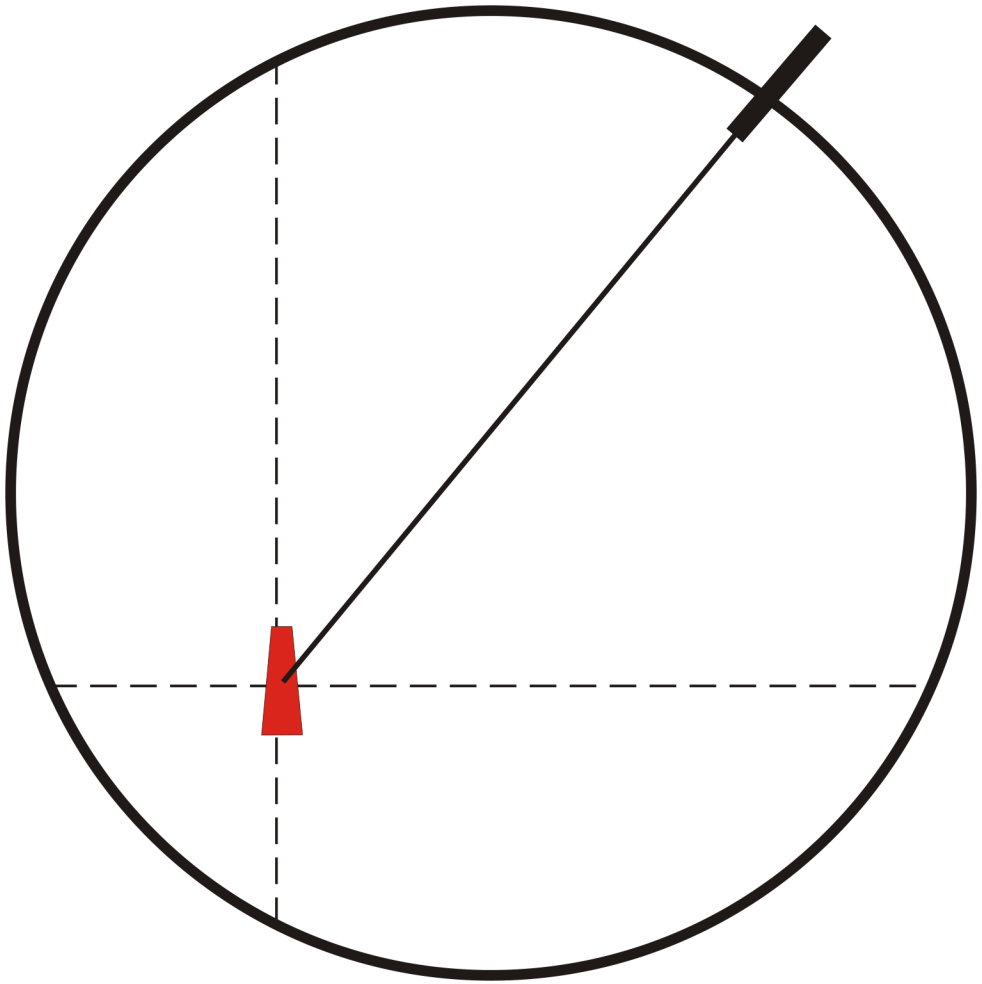

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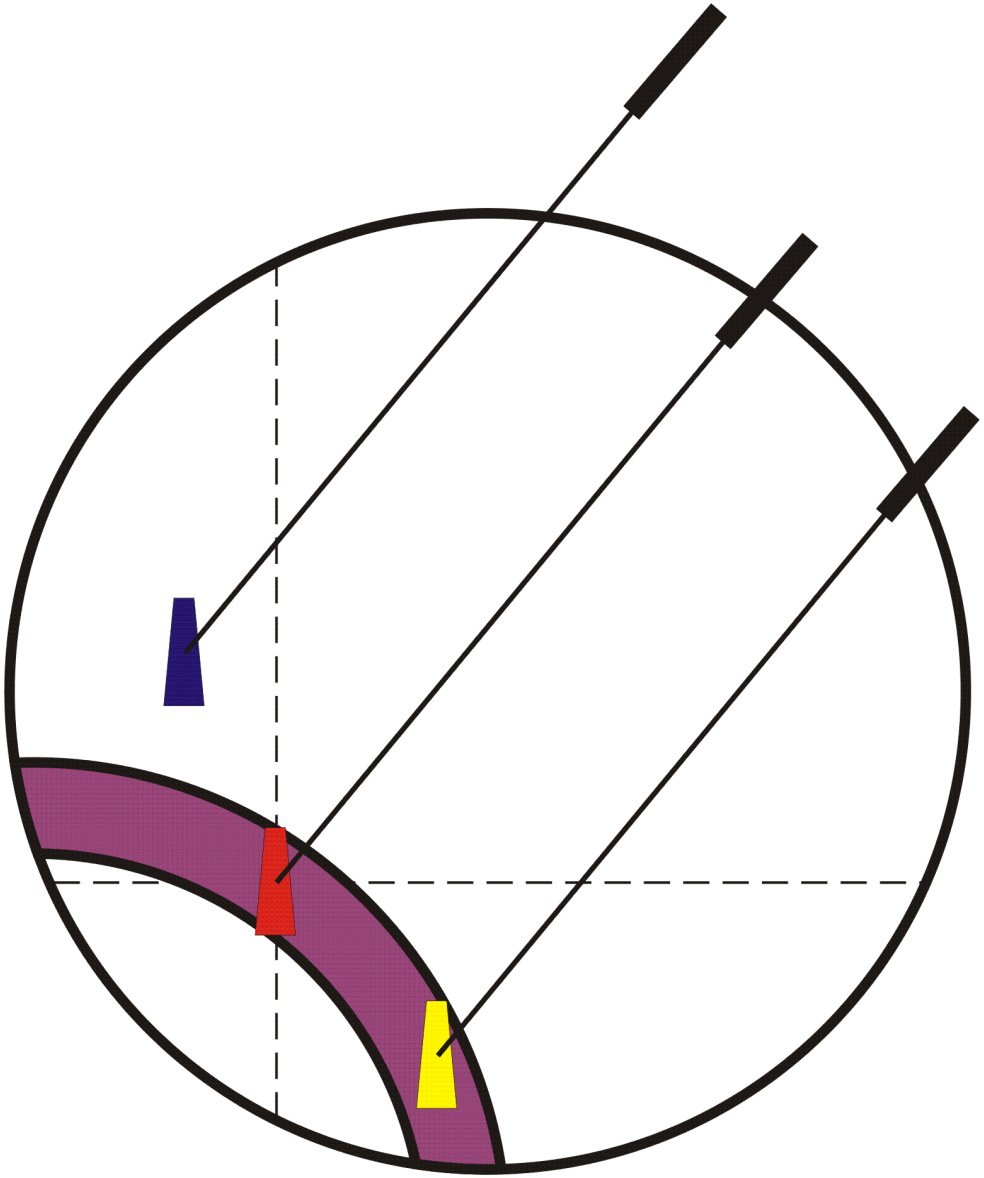

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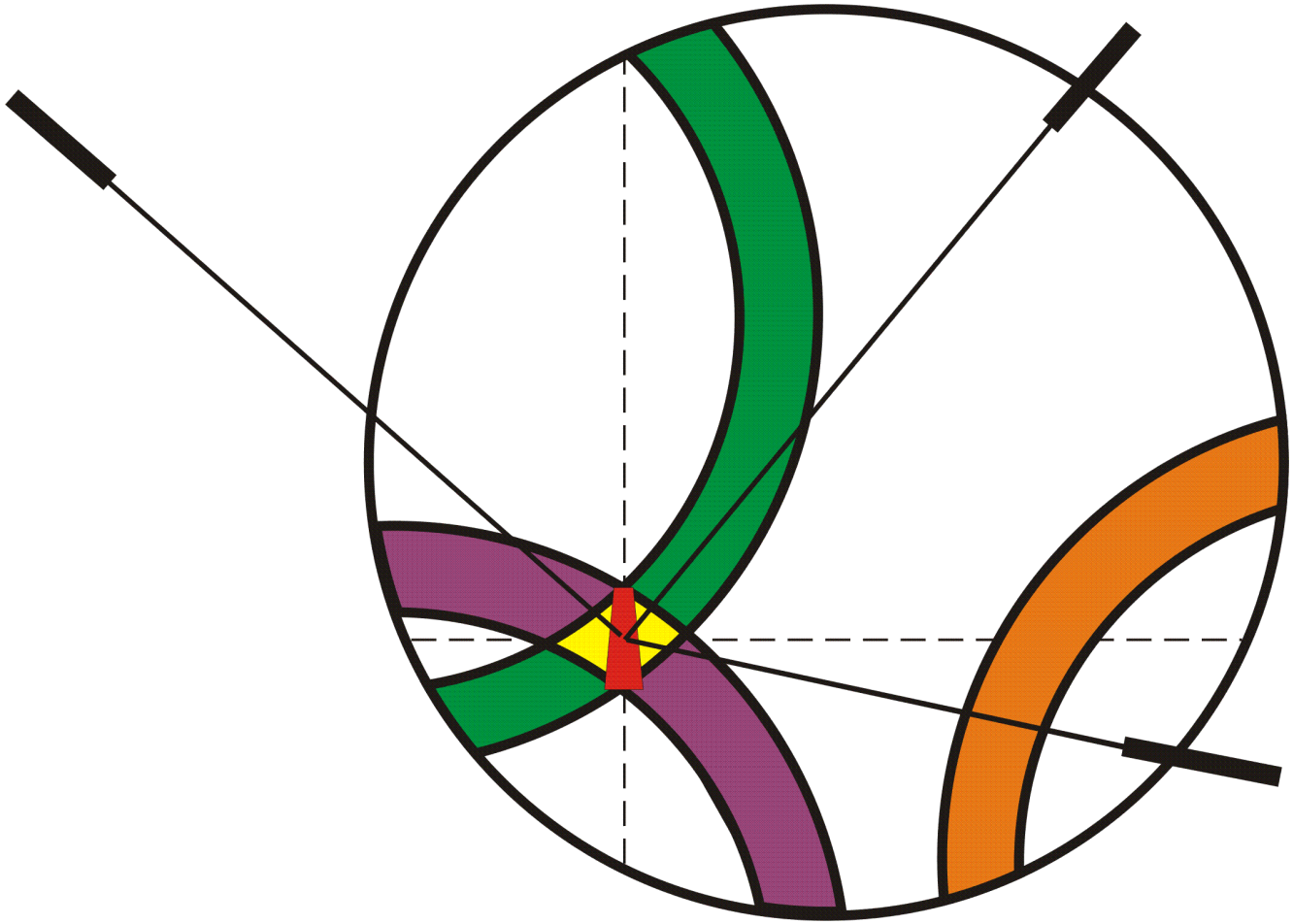

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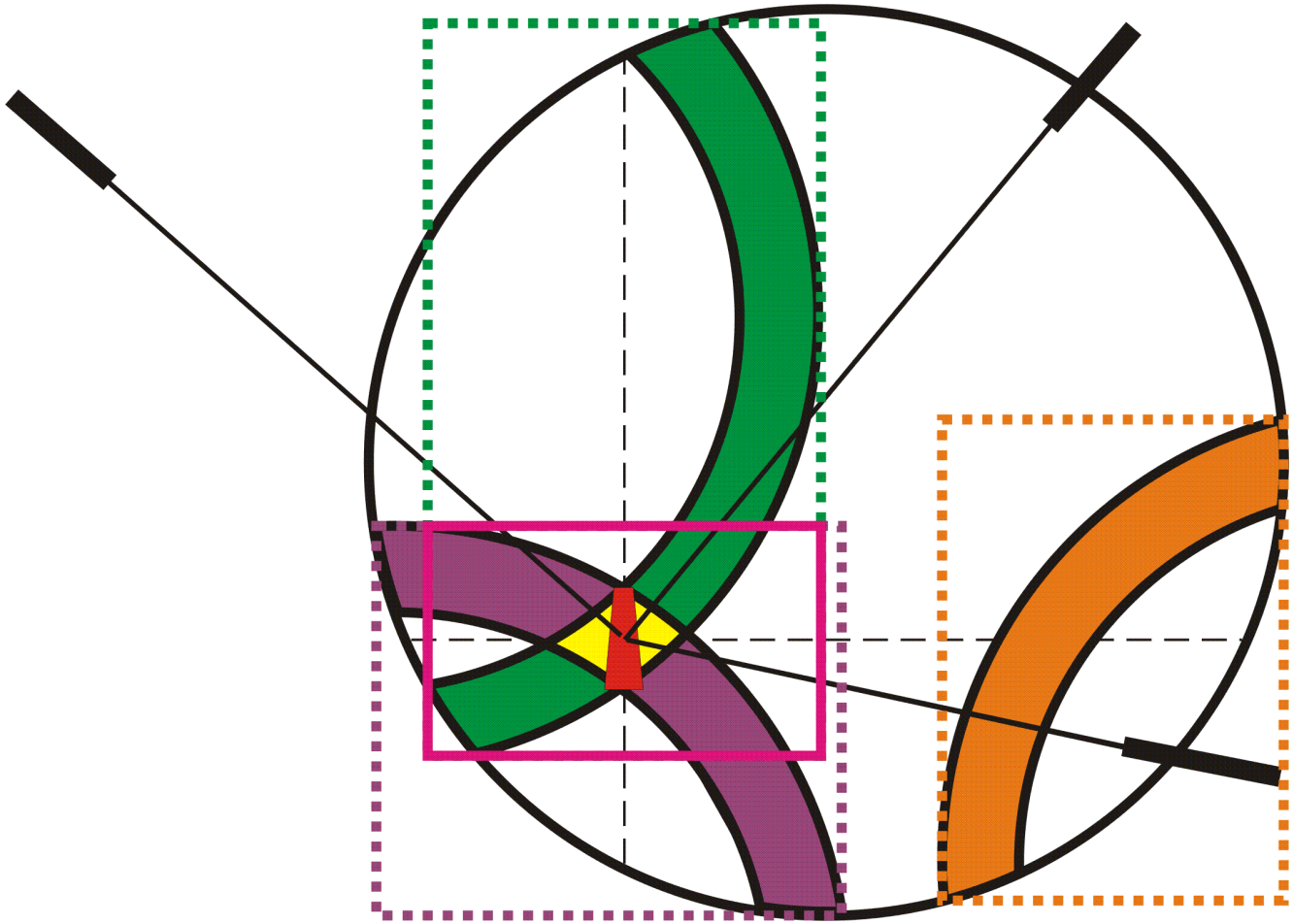

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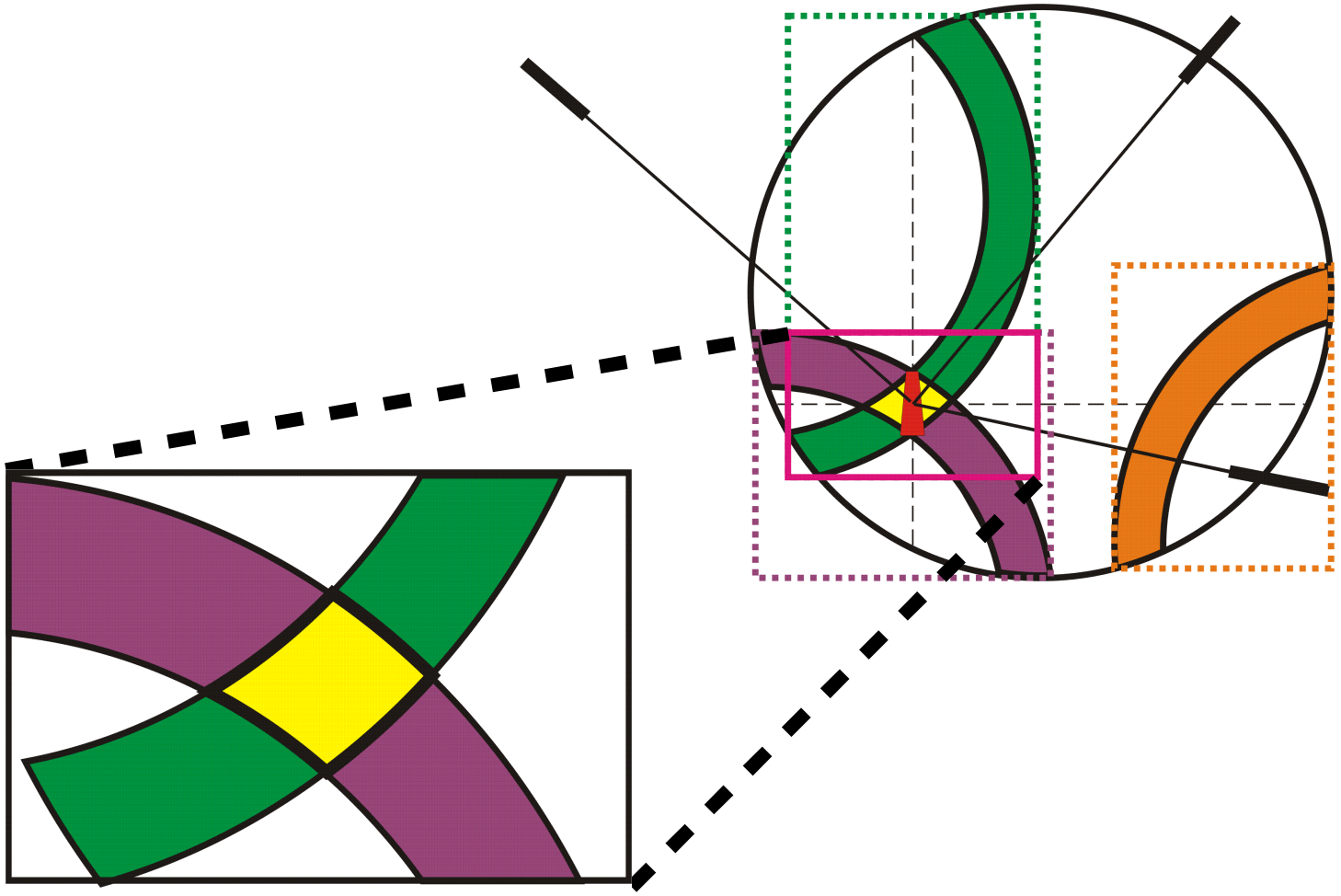

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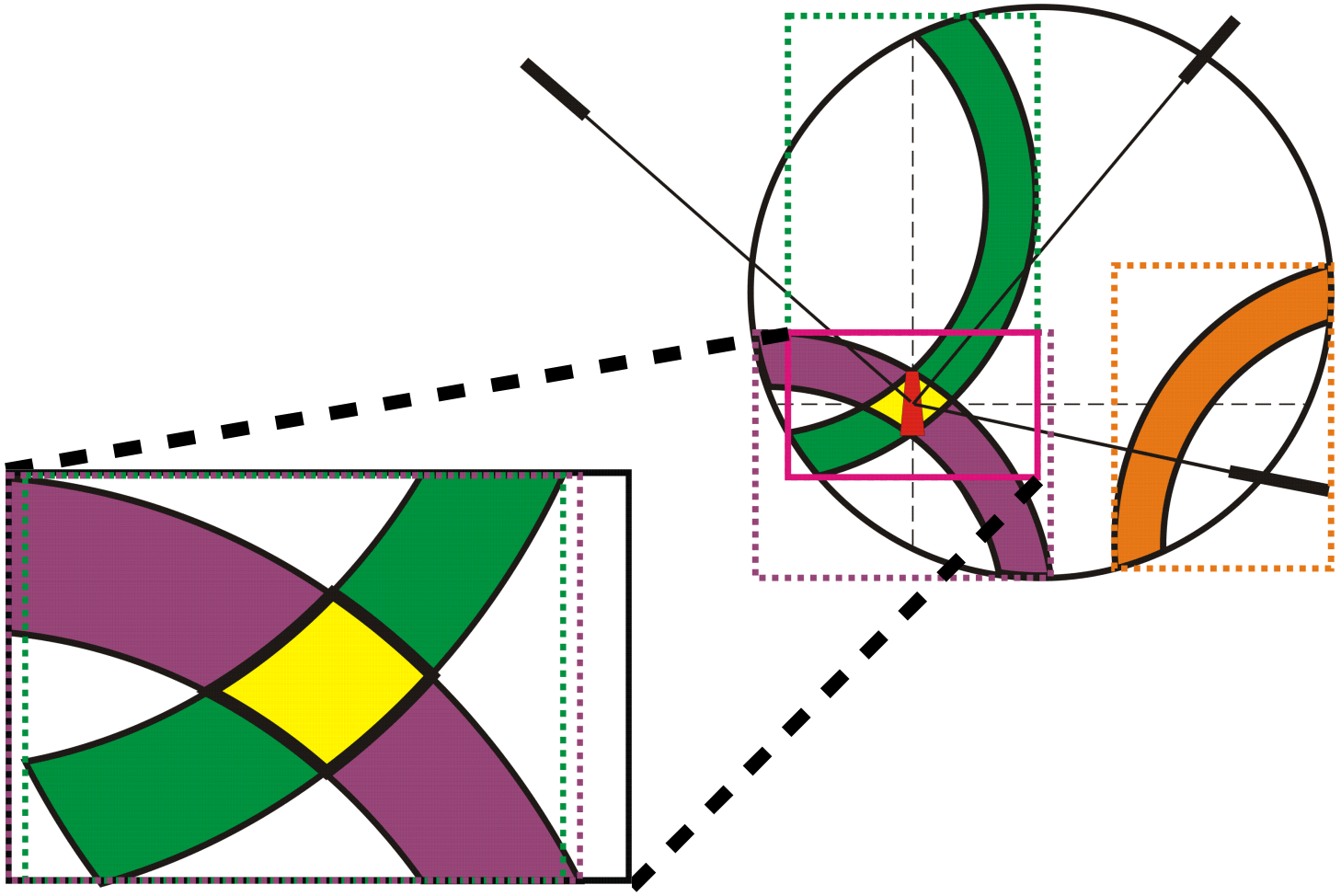
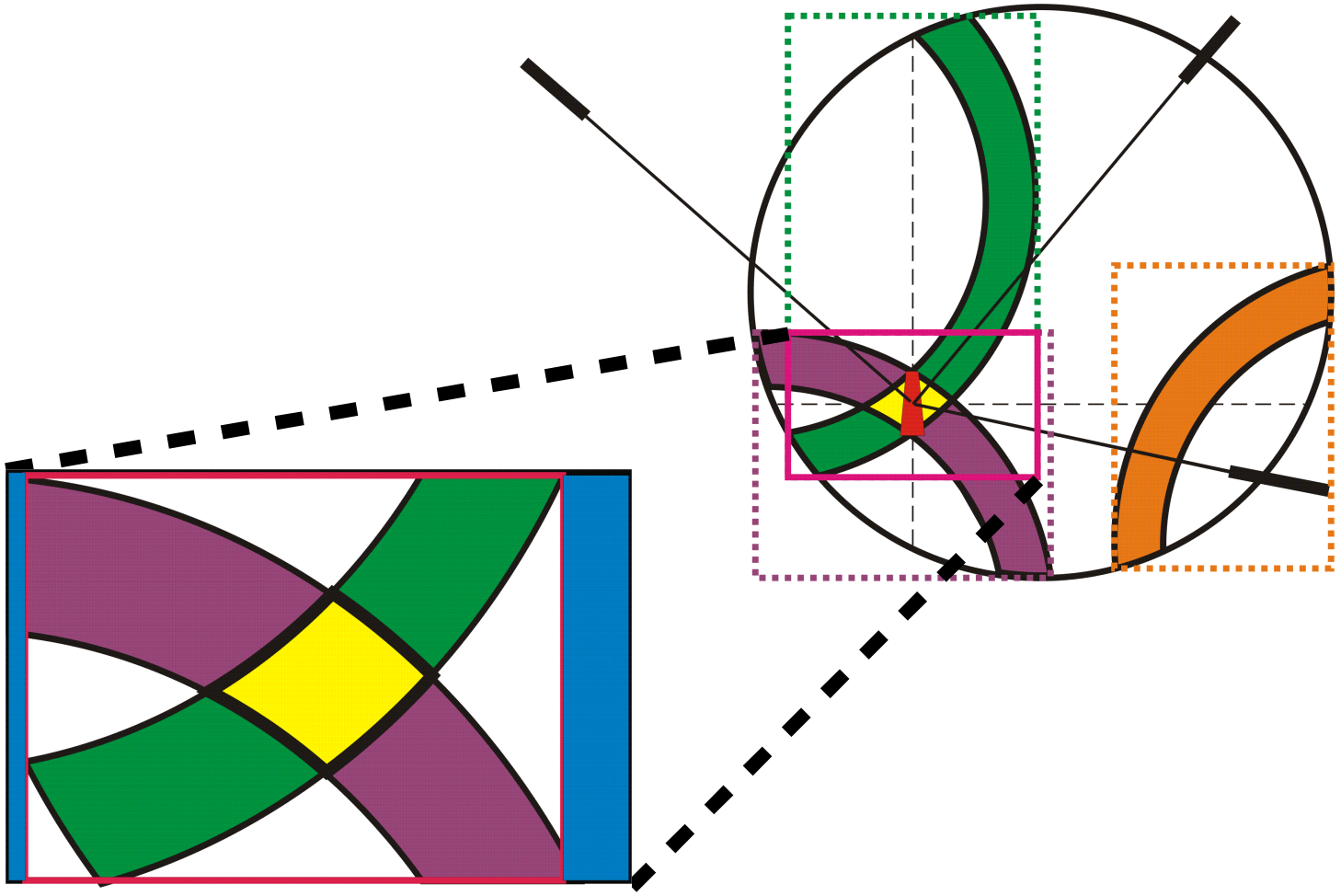


Simplified real example



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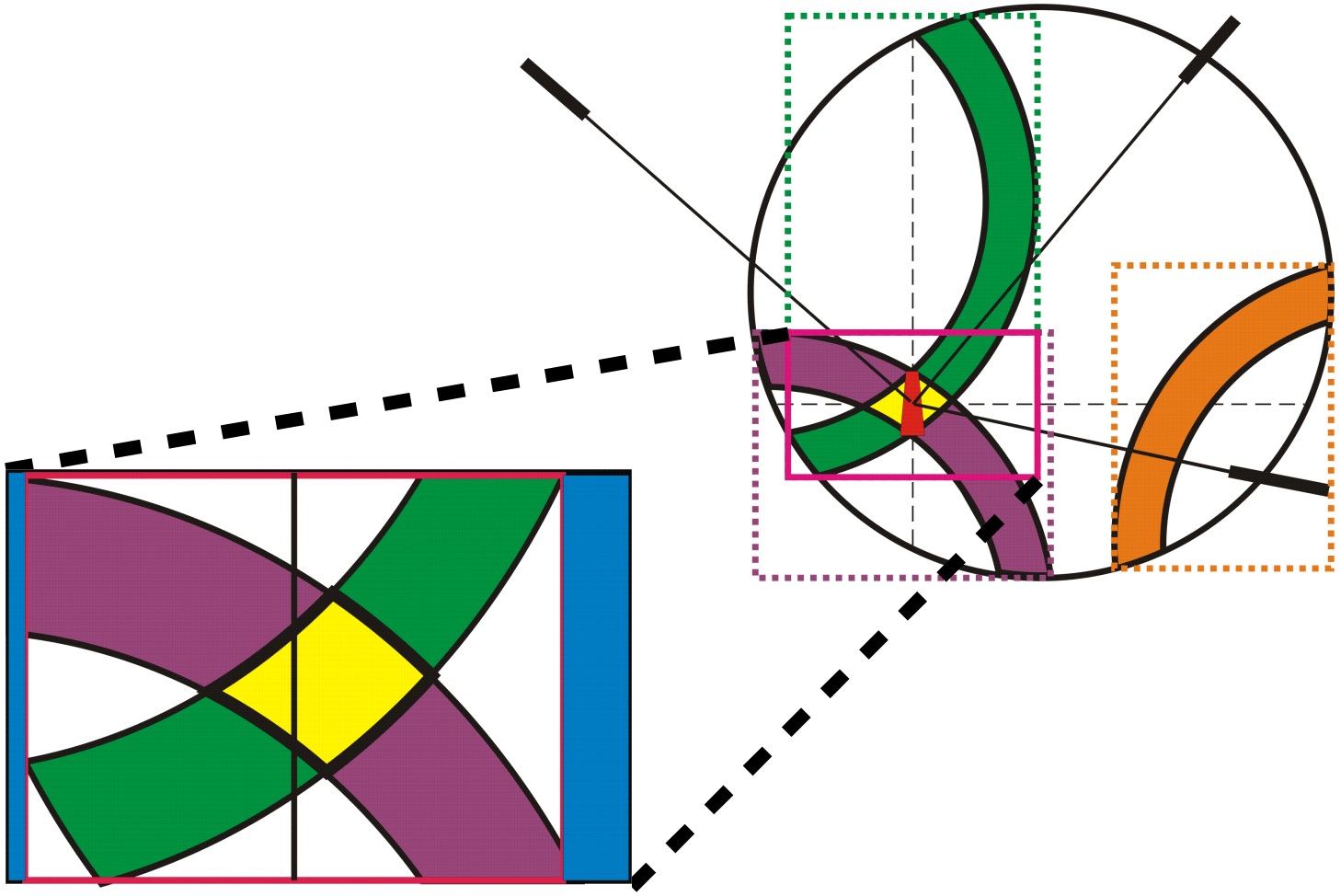

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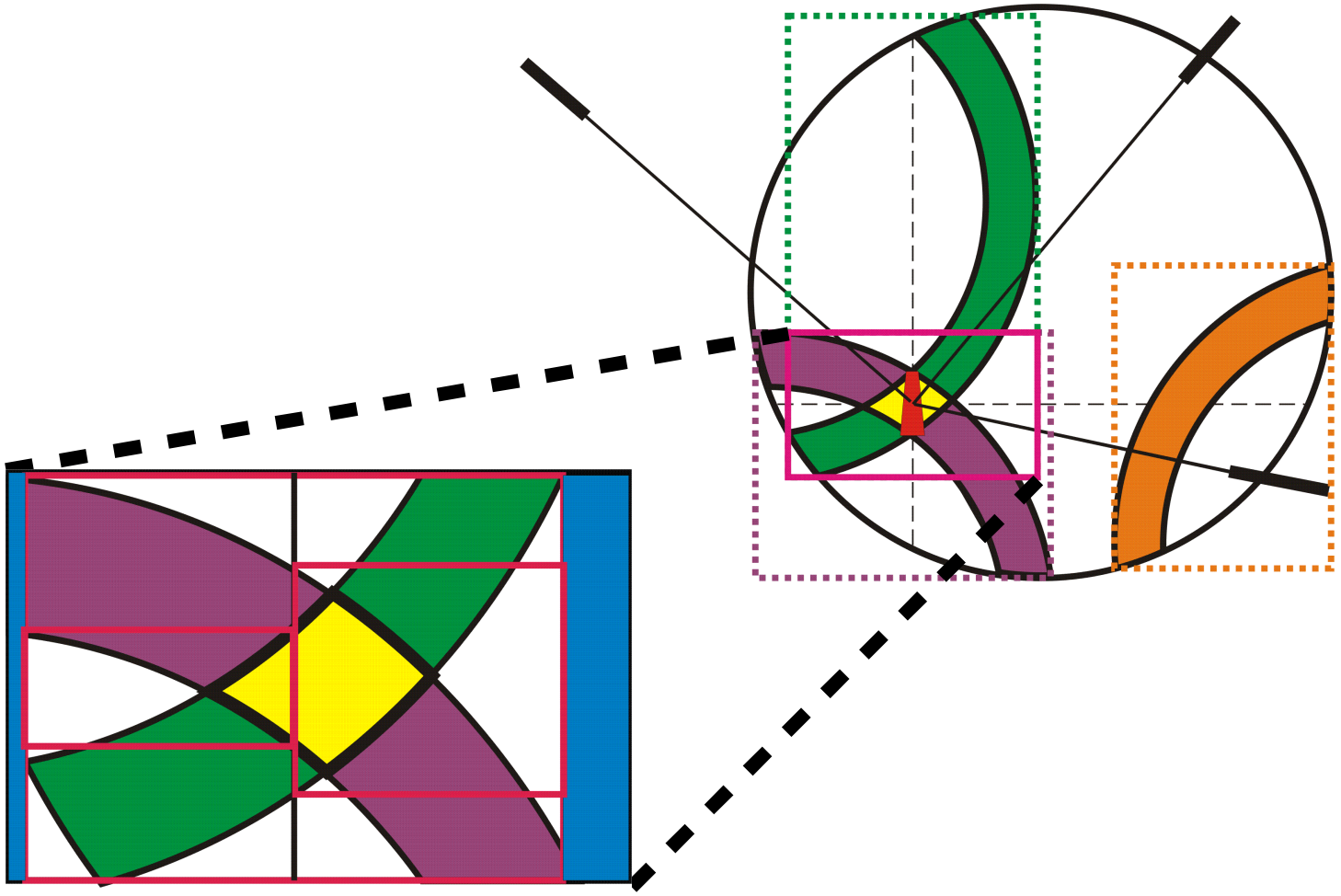

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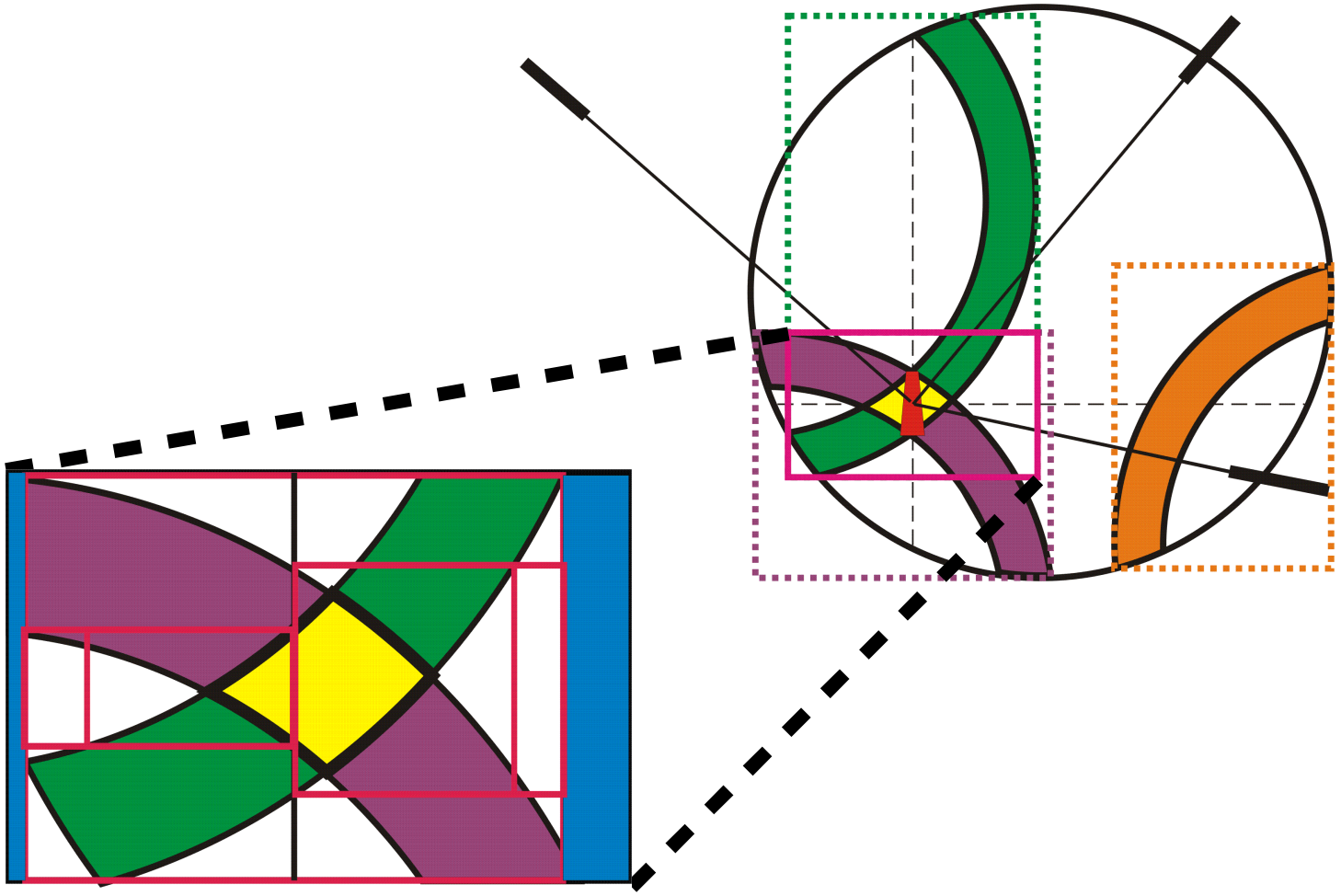

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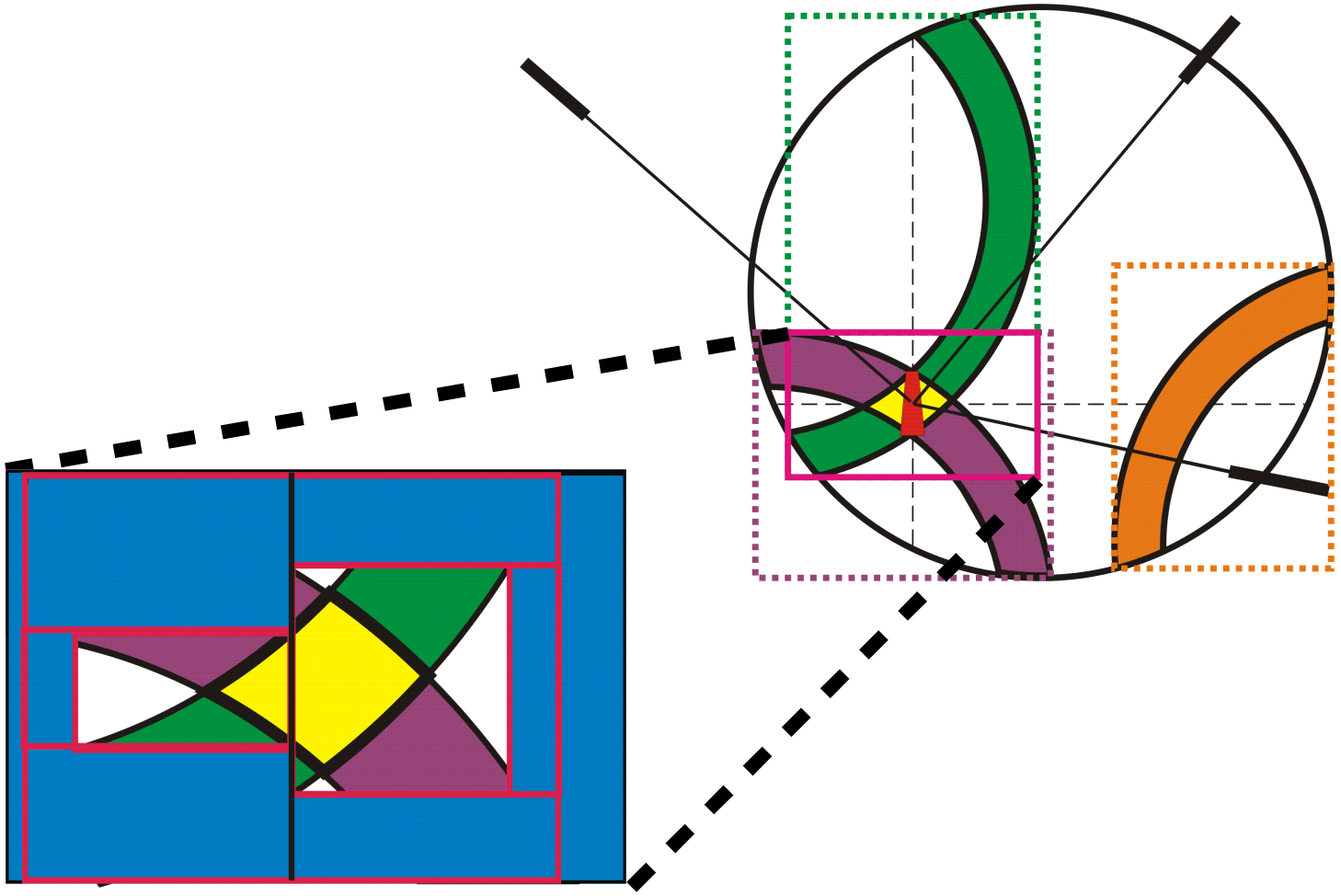

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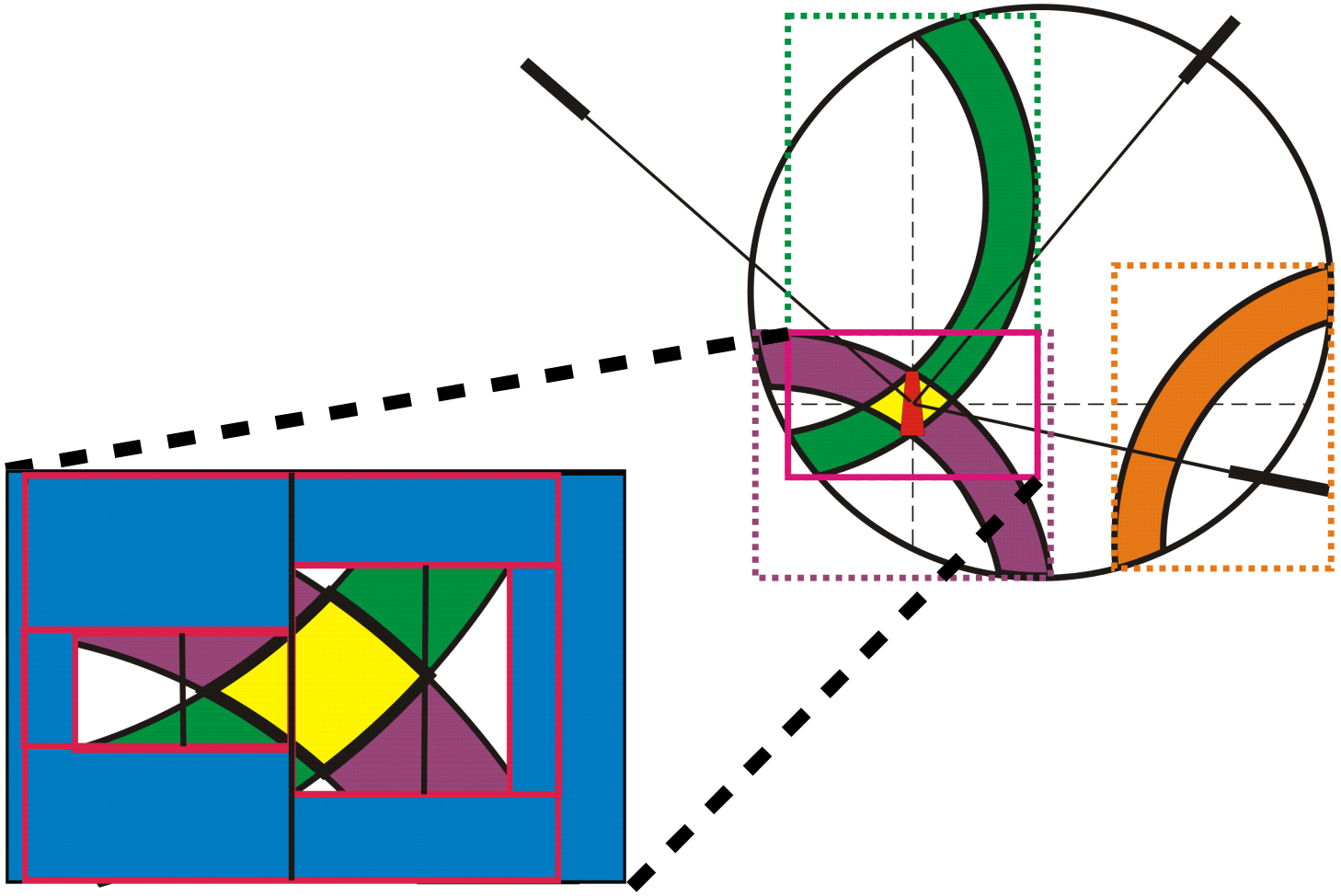

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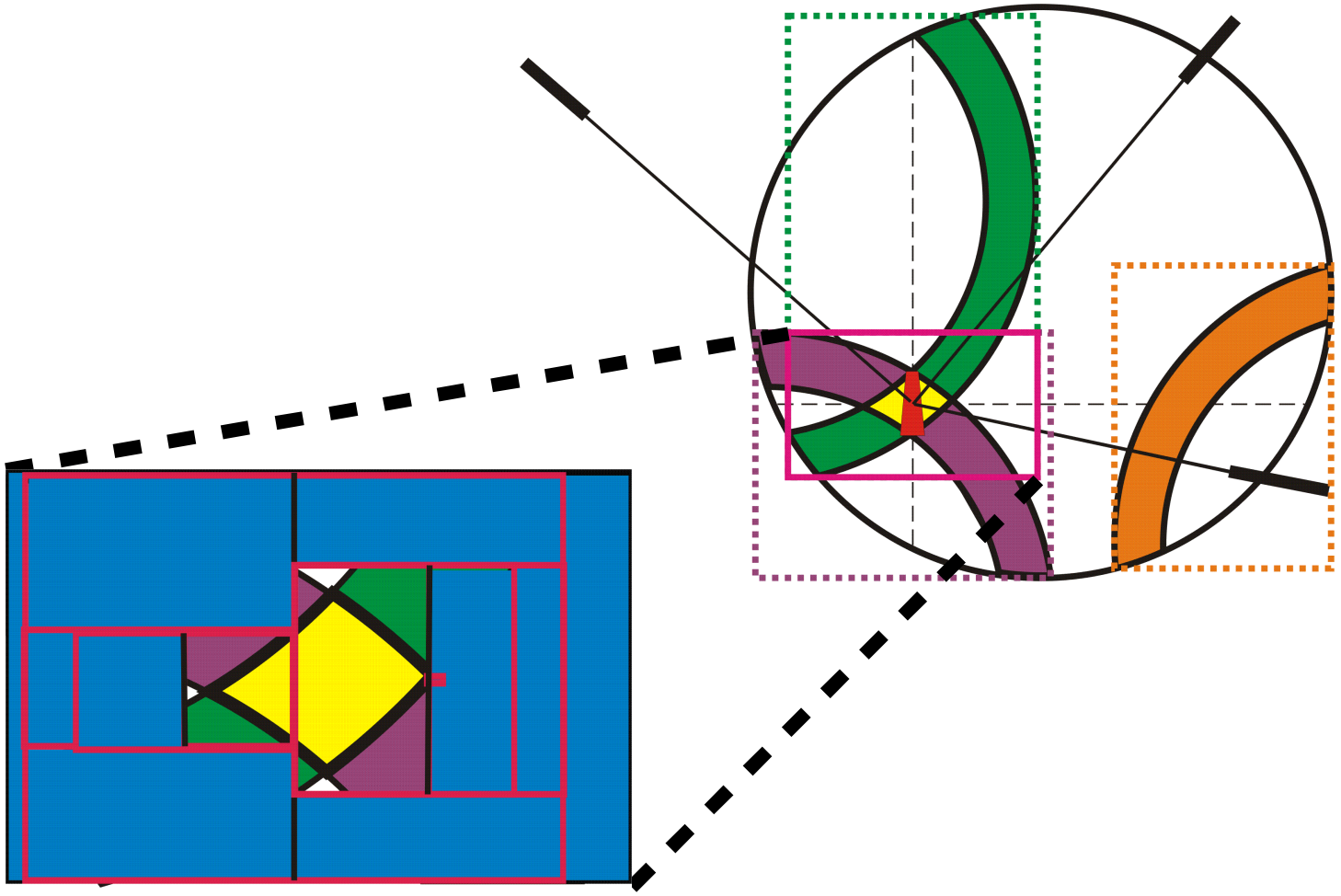

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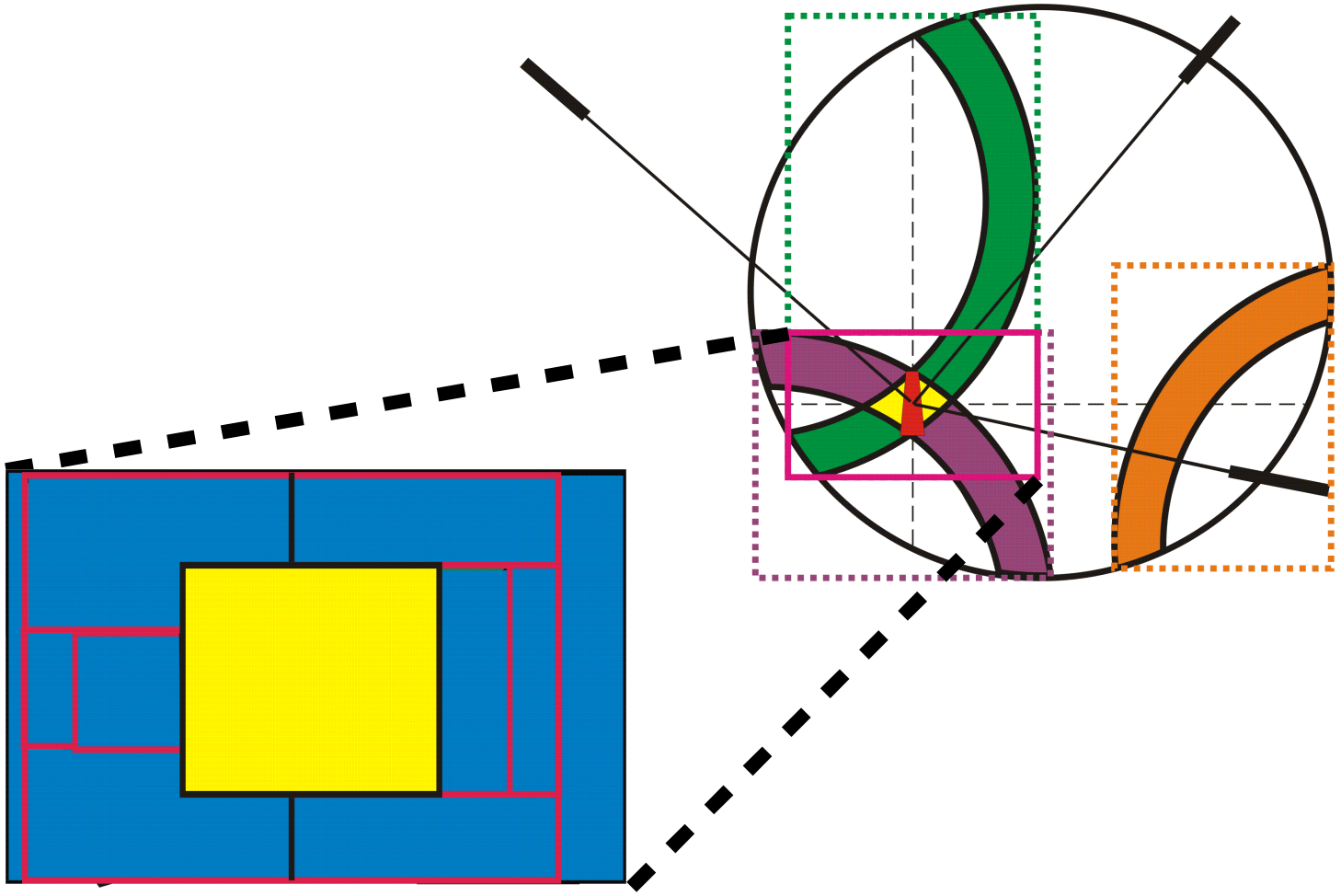
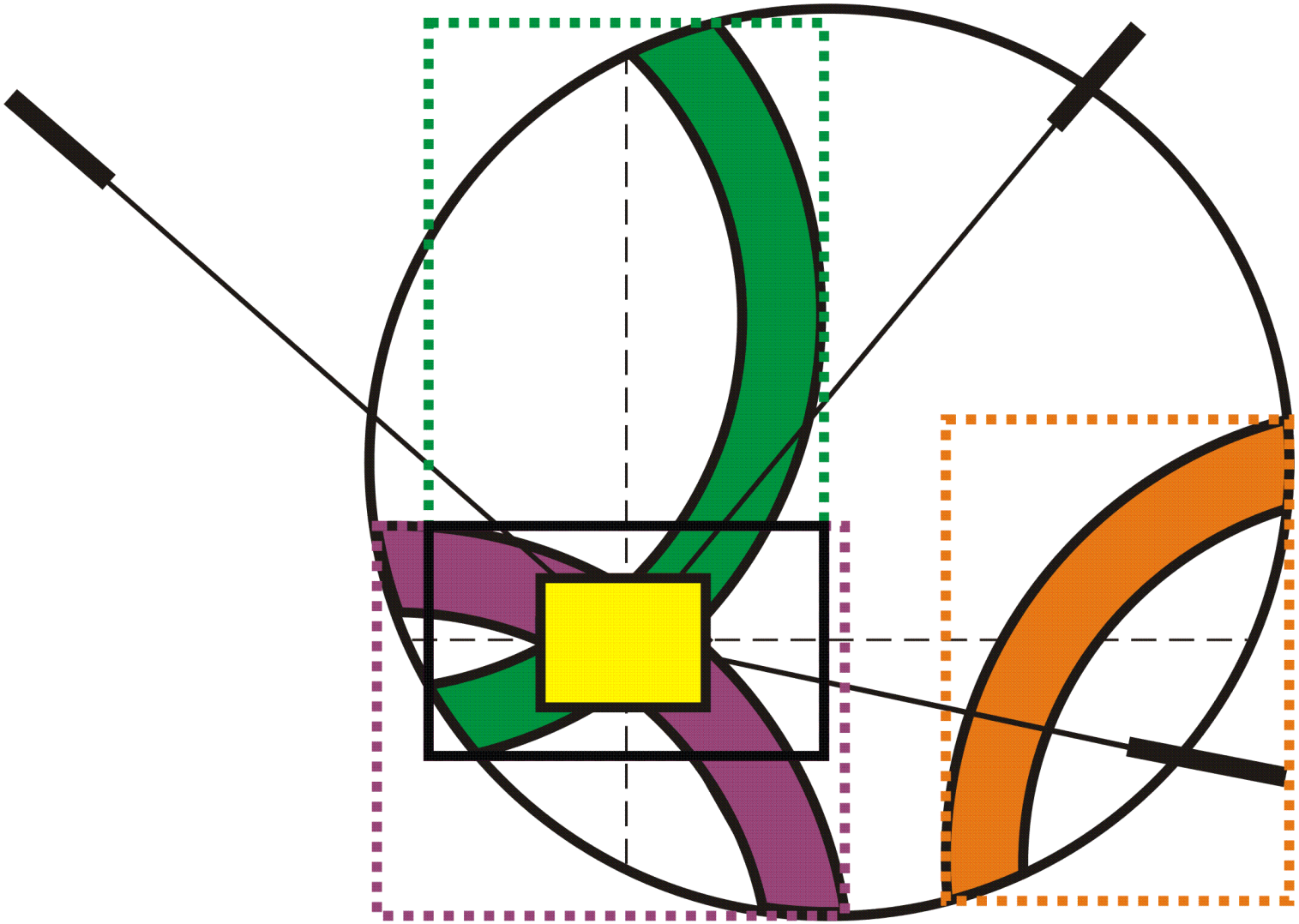
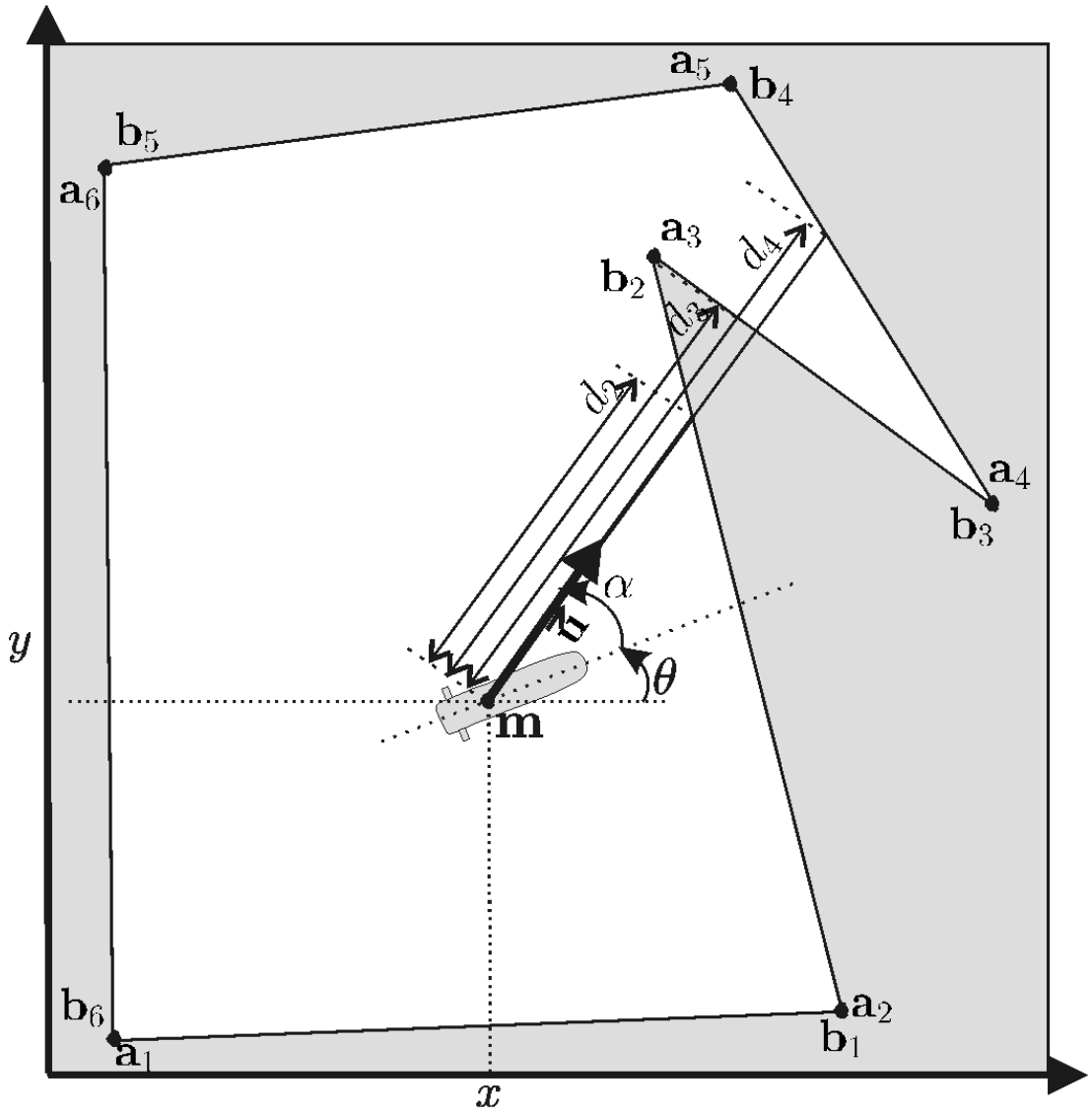


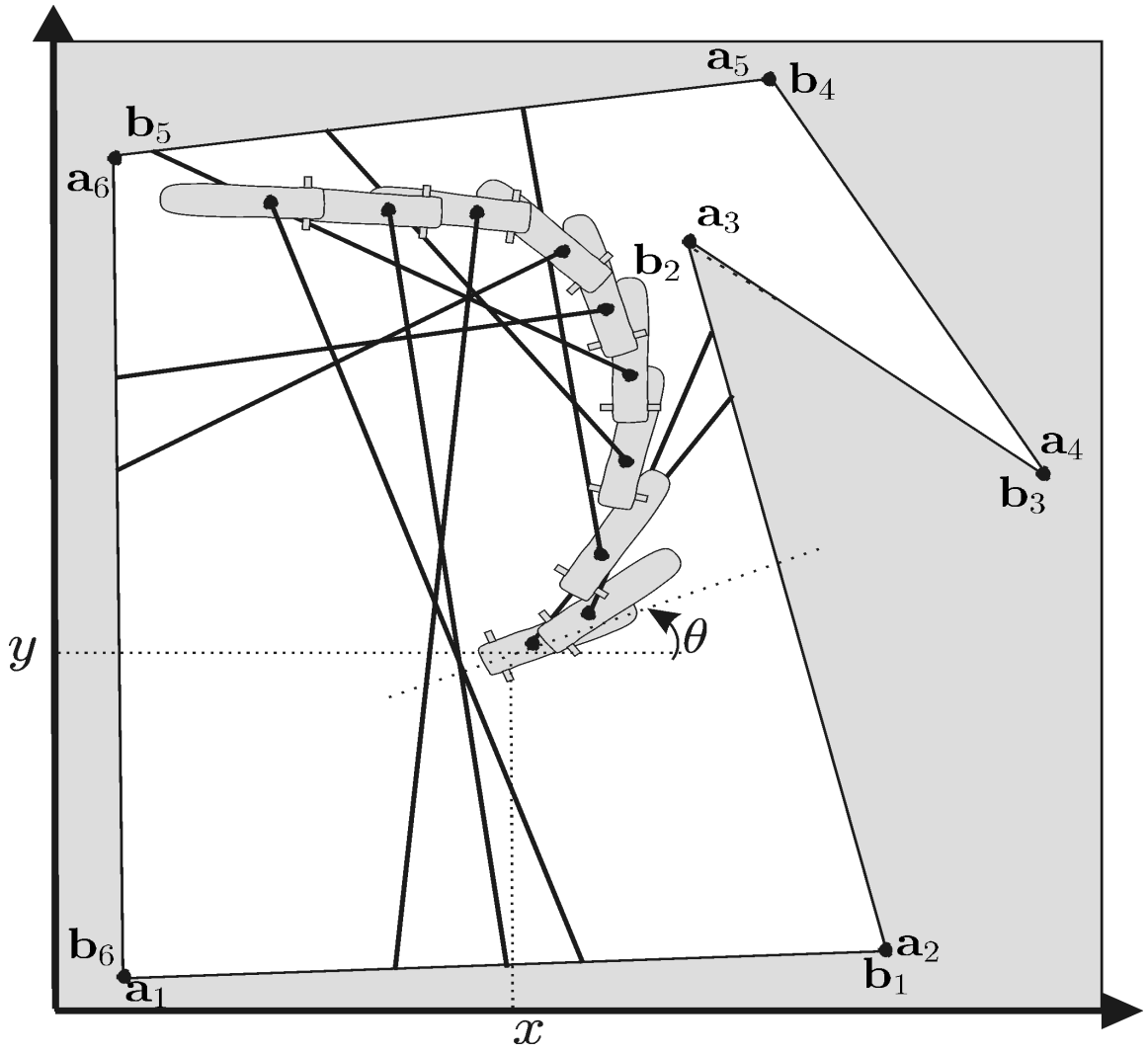
Simplified real example



The algorithm: context

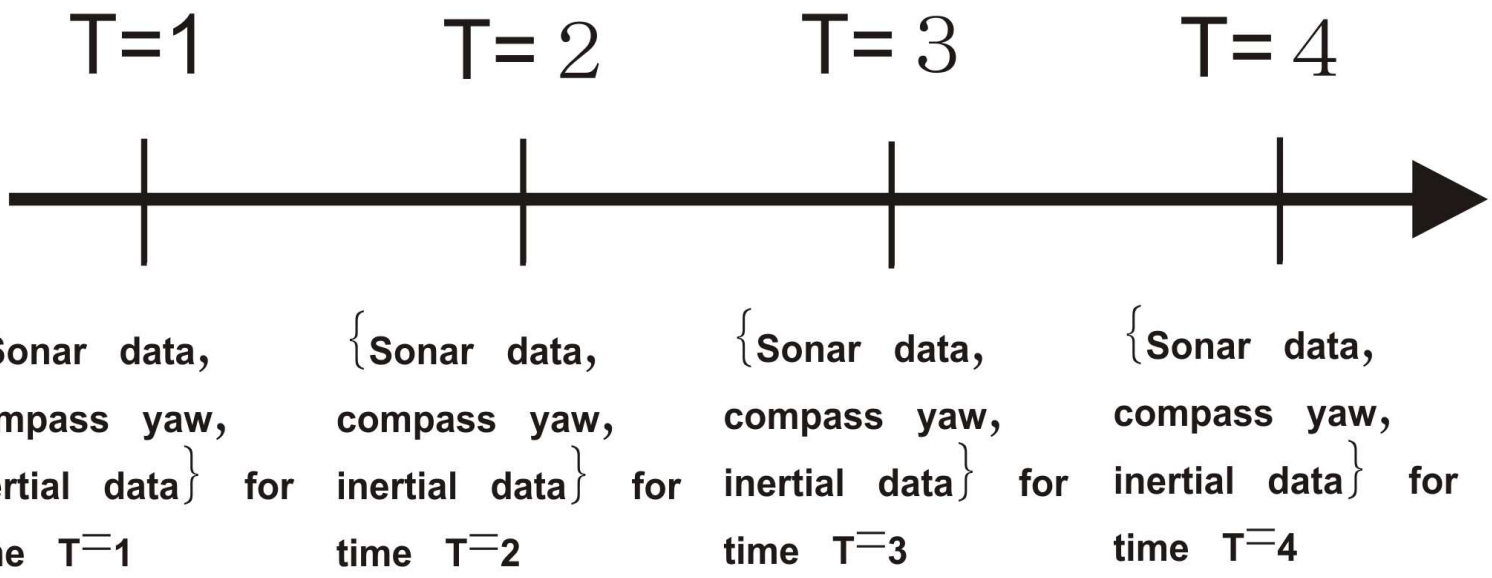


The algorithm: sampling data

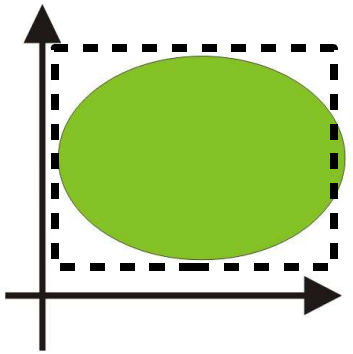


The algorithm

Put X0 into a list //the initial box
Repeat until the list is empty



Pull a box from the list



The algorithm

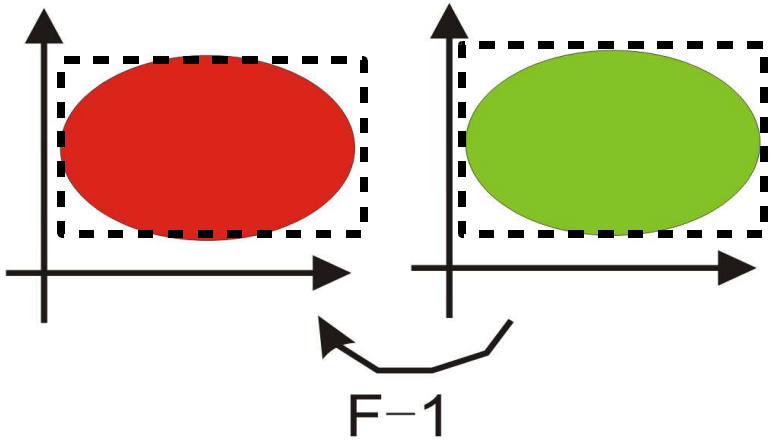
{Sonar data, compass yaw, inertial data} for time T=1

{Sonar data, compass yaw, inertial data} for time T=2

{Sonar data, compass yaw, inertial data} for time T=3

{Sonar data, compass yaw, inertial data} for time T=4

X(k+1)=F(X(k))

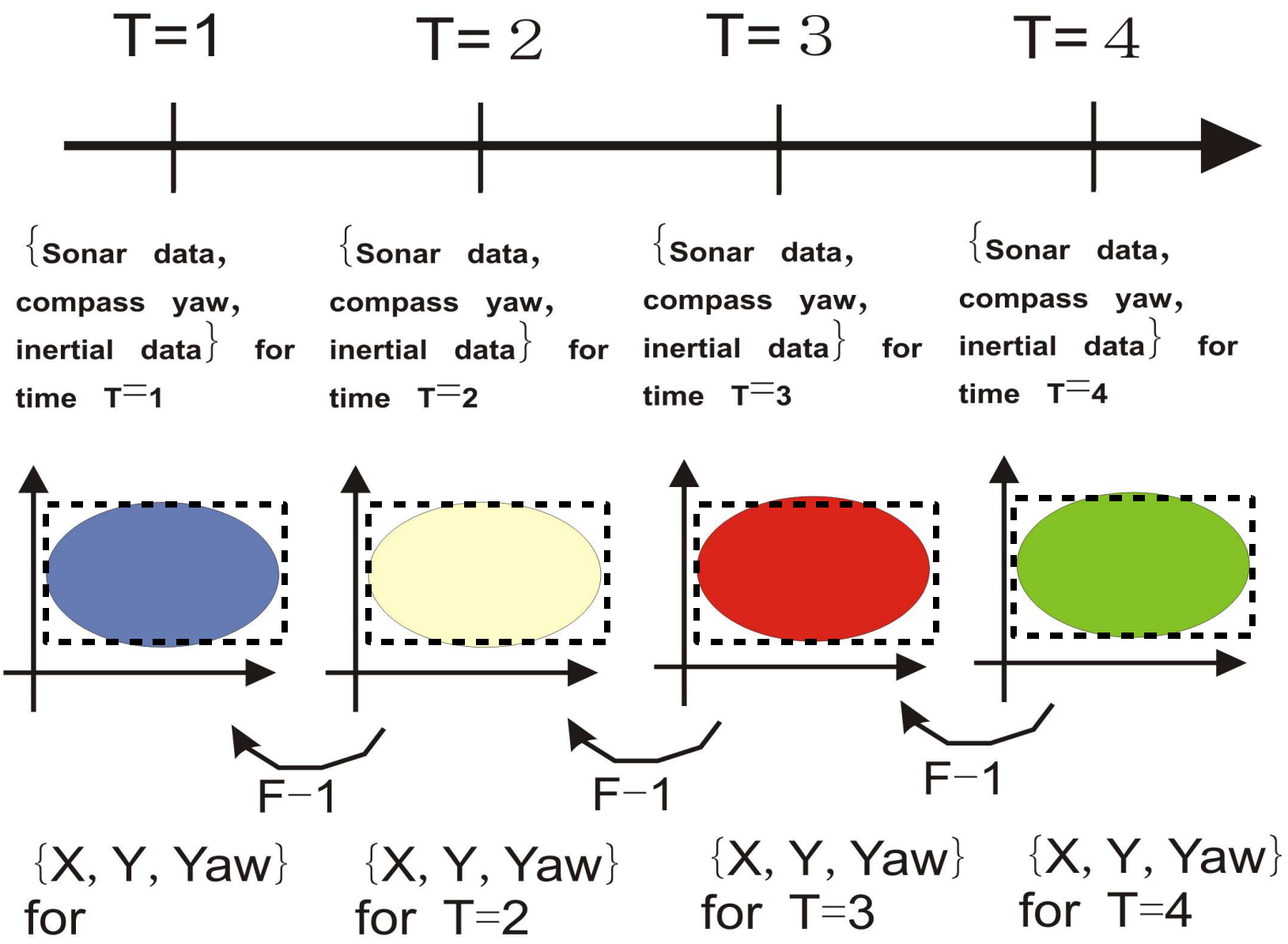


$$\begin{cases} x(k+1) = x(k) + \delta.v(k).\cos(\theta(k)) \\ y(k+1) = y(k) + \delta.v(k).\sin(\theta(k)) \\ \theta(k+1) = \theta(k) + \delta.(u_2(k) - u_1(k)) \\ v(k+1) = v(k) + \delta.(u_1(k) + u_2(k) - v(k)) \end{cases}$$

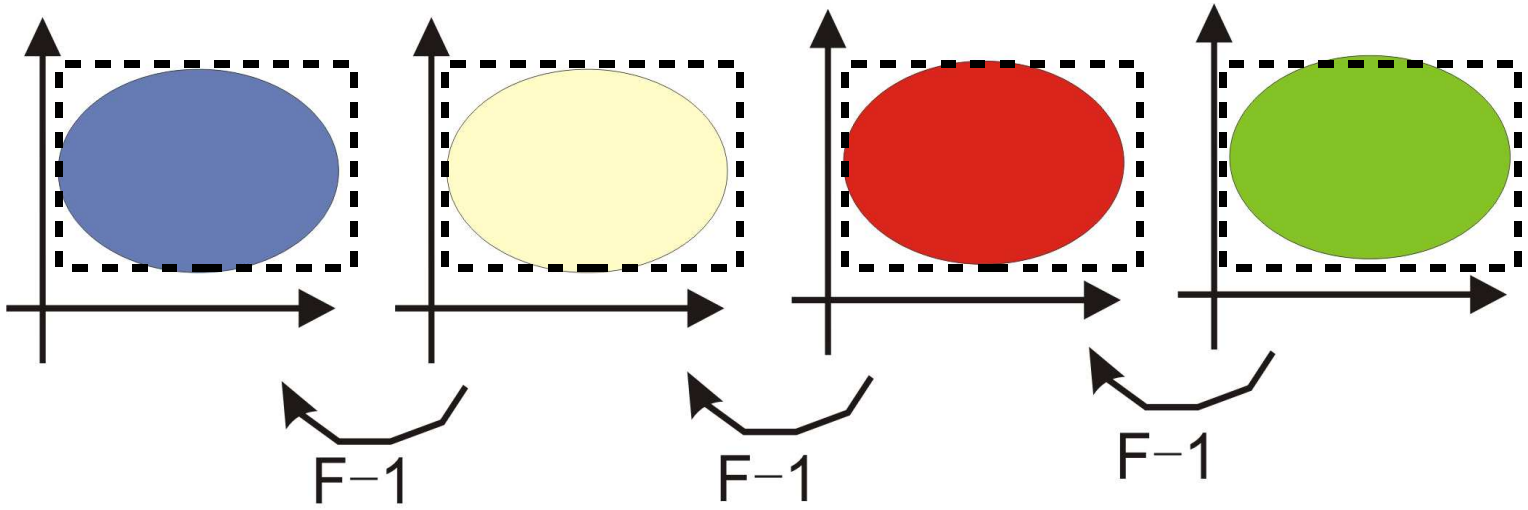
{X, Y, Yaw} for T=3

{X, Y, Yaw} for T=4

The algorithm



The algorithm

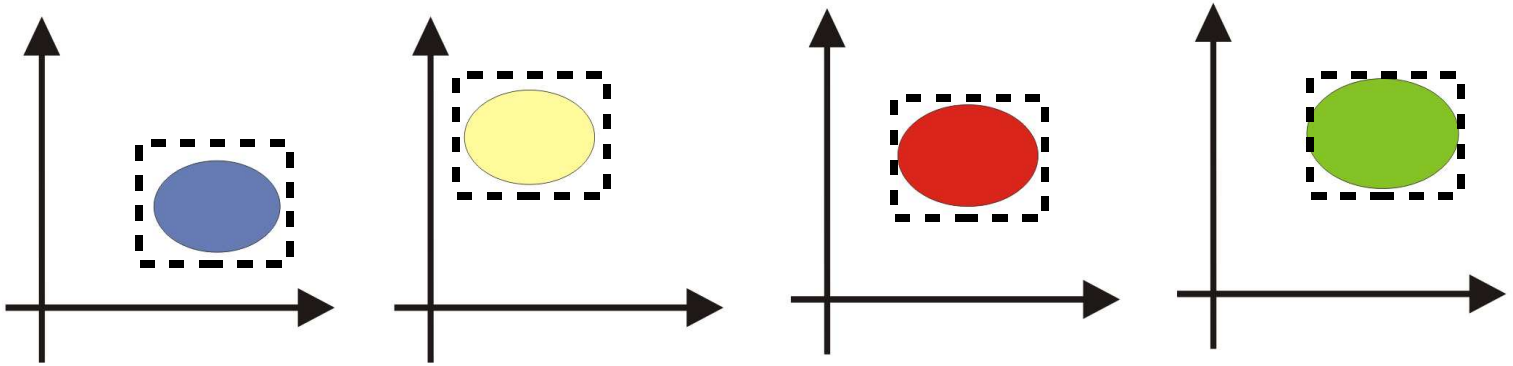


{X, Y, Yaw} for T=1

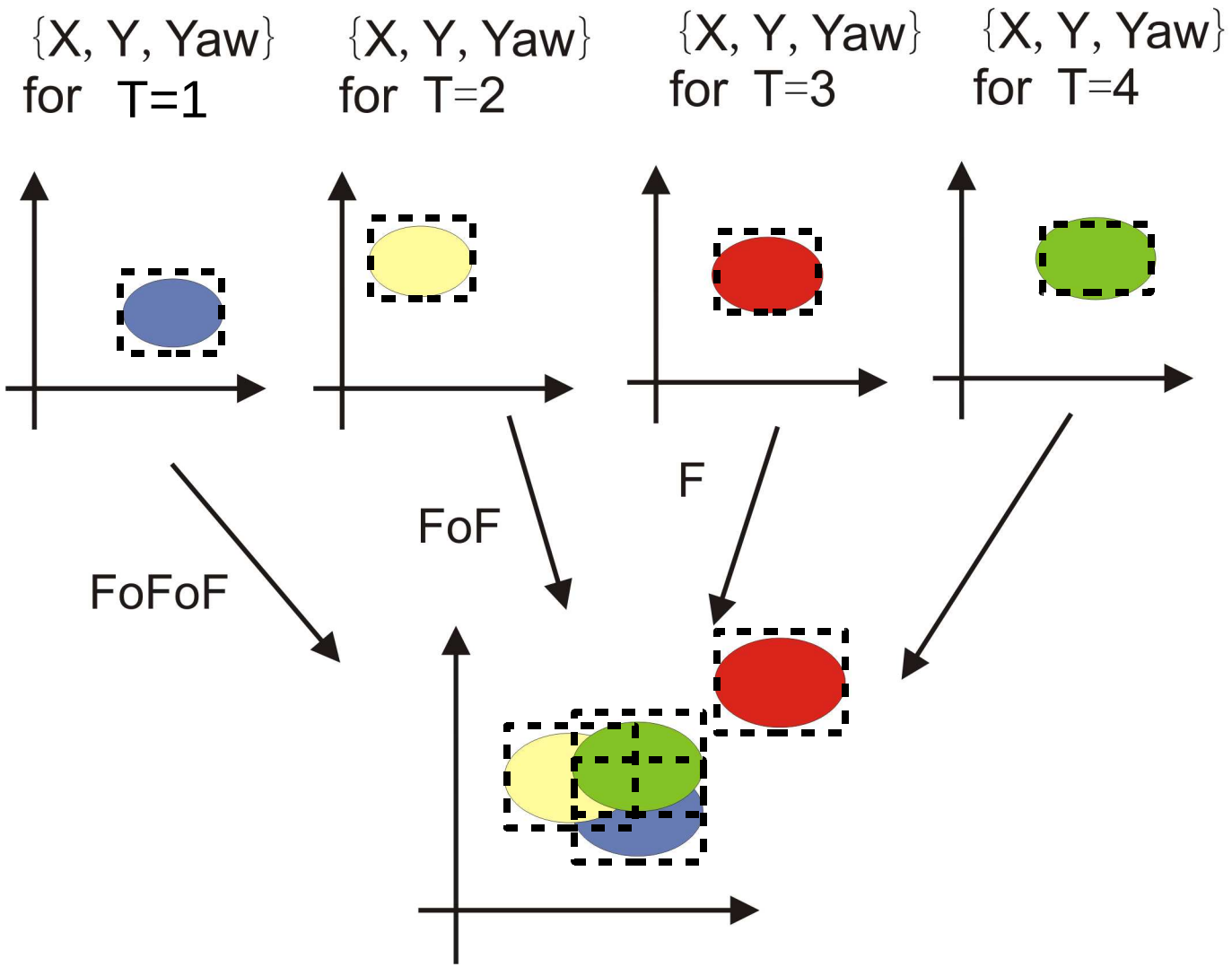
{X, Y, Yaw} for T=2

{X, Y, Yaw} for T=3

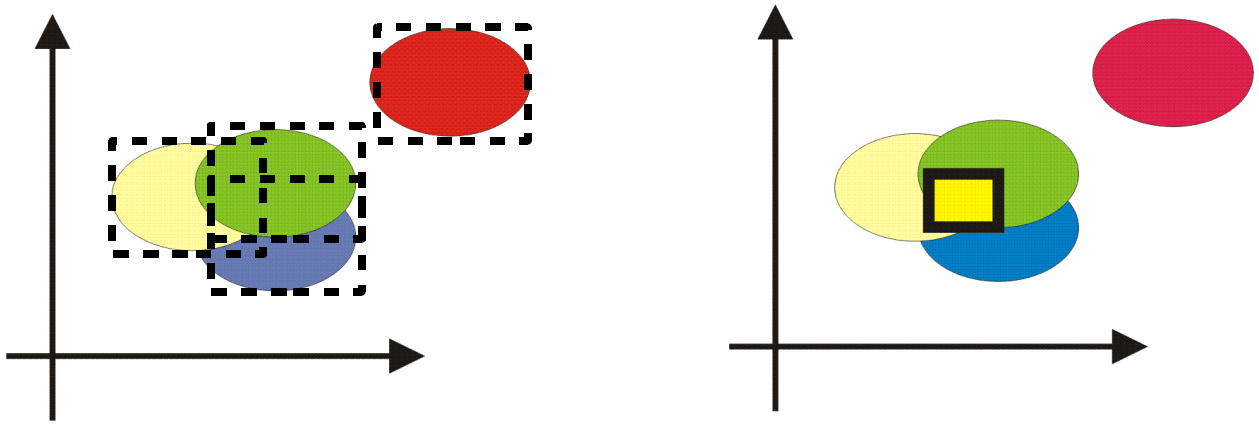
{X, Y, Yaw} for T=4



The algorithm



The algorithm



If the resulting box is not empty split it and put the 2 halves into the list

if we have reached the desired number of bissections we add the box to the result box 'Xhat'

if the list is empty end the loop >> The result is Xhat

Videos and Results