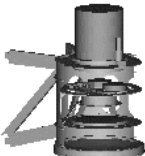
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# Large Binocular Camera

## OBSERVING BLOCK DEFINITION, CONTENTS & SPECIFICATIONS

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## Observing Block Definition, Contents & Specifications


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## 1. INTRODUCTION

Each Observing Block for the LBC camera of the LBT Telescope is saved in a XML-database file (extension .ob).

To the ob-xml file is associated a ob-schema file (extension .xsd), which represents the variable declaration and structure of the relative xml.

The file is subsequently processed by a standard C/C++-library to extract the variables and perform the necessary instrument operations. This C/C++ library is included in the GUI package.

## 2. VARIABLE DEFINITION AND OB STRUCTURE

The Observing Block Structure is composed of three top level fields in the XML-database schema:

- i. **LBC\_Target** field, which represents the relative parameters for the observation of a specific target.
- ii. **LBC\_Channel** field, which represents the total observation parameters to customize in the most powerful way possible every single exposure for the B and R Channel.
- iii. **Constrain Sets** field, which represents an ESO like way to define the range for some observation parameters, ie. *CSS(Constrain Sets for Seeing)* define an interval for the observation seeing, if the place seeing values falls inside that interval the observation should be taken.


*Here is a list of all the inserted variables with the respective meaning:*

### <LBC\_Target>

- **OBName** = Observing block name (string), is the name of the OB as it appear on the disk (without .ob extension) - (String).
- **TargetName** = Target Package Name (string), is the name of the observation target - (String).
- **ClassType** = Class-type of observation, ie. Standard Star, Flat-field, Dark, Scientific Object - (String).
- **TEC\_RA** & **TEC\_DEC** = Target Equatorial Coordinates, Right Ascension and Declination, is the starting point for the observation on the sky in decimal degree format - (float).
- **Equinox** = Equinox of coordinates, 1950 or 2000 - (int).
- **Offset\_RA** & **Offset\_DEC** = Offsett in arcsec for RA and Dec, is the arcsec offsetting from the central RA0-DEC0 position - (float).
- **ProperMotion\_RA** & **ProperMotion\_DEC** = RA DEC Proper Motion, is the proper motion of an observation target/object in arcsec for RA and Dec - (float).
- **TRACKING, Telescope** = Tracking, presetting telescope - (boolean).

*Window settings and parameters:*

- **WXMIN, WXMAX, WYMIN, WYMAX** = pixel settings for X-Y window: X=[1,2048], Y=[1,4600] - (int).

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- **PDIT** = Dithering pattern is the logical operation to calculate the dither, ie. Random, UserDefined, Spiral, Circular, TBD (string).
- **ADIT, SDIT, DITX0 & DITY0** = Dithering Angle, Scale and offset for X-Y axis, parameters to calculate dithering steps – (float).
- **NDIT, DITO** = Number of dithering offsets and Starting item, parameters to calculate dithering steps – (int).
- **XDIT & YDIT** = list of dithering pattern in RA and Dec from the central RA0,DEC0 position – (array of floats).

</LBC\_Target>

-----  
<LBC\_Channel>

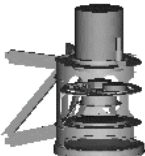
<B> and <R> = the channel name.

*For B and R Arm there are the same parameters, here's a list:*

- **PSB & PSR** = Master, Slave or Off, what kind of setting must perform the Channel – (int: OFF=0, MASTER=1, SLAVE=2).
  - **RA\_B & RA\_R** = Rotation angle for B and R- Arm, is the angle of rotation for each camera in decimal degree format – (float).
  - **Focuss\_B & Focuss\_R** = are flags to focuss the image – (boolean).
  - **Chip1, Chip2, Chip3, Chip4, Shutter** = ON/OFF for Chip 1, 2, 3, 4 and Shutter (boolean).
  - **ReadOutMode\_B & ReadOutMode\_R** = Read Out Mode, ie. fast and slow (boolean)
  - **CCDBin\_B & CCDBin\_R** = CCD Binning Factor, is the bin factor for the image acquisition – (boolean).
  - **FilterNumber** = Is the Filter number selected (max is 8 for each channel) – (int).
  - <Filter> = Filter, is the tag to discern between different filters selected.
  - **FilterName** = Is the name of the Filter selected - (String).
  - **TotExpoTime** = Is the total Exposure Time for the observation with the selected filter – (float).
  - **Nexpo** = Is the number of exposure taken with the selected filter – (int).
  - **Focuss** = Is a flag for focuss the observation for the selected filter – (boolean).
  - **Identifier** = Is the identifier for the observation – (string).
  - **Pipeline** = Are the pipeline instructions for the selected observation – (string).
- </Filter>

*User hidden parameters:*

- **ReadOutTime** = Read Out Time, is the total time to download the acquisition image and be ready to take new one – (float).
- **TimeOffset** = Offsetting Time, is the time necessary to offset the telescope – (float).
- **SEEING** = Seeing of the observation, is the real seeing for the observation, not calculated – (float).
- **MOON** = Moon Phase of the observation, is the real moon phase for the observation, not calculated – (int).

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*Constrain Parameters (like ESO):*


- **CST** = Constrain Sets Timing – (string).
- **CSP** = Constrain Sets Position – (string).
- **CSW** = Constrain Sets Weather – (string).
- **CSS** = Constrain Sets Max Seeing – (String).
- **CSF** = Constrain Sets Frame – (string).

### 3. OB-XML & SCHEMA FILE EXAMPLE

*Here is an example of a saved Observing Block with its schema file:*

#### 3.1 OB XML File


```
<?xml version="1.0" encoding="UTF-8" ?>
- <ObservingBlock>
- <LBC_Target>
  <OBName>OB1</OBName>
  <TargetName>Pg1115+047</TargetName>
  <ClassType>Dark</ClassType>
  <TEC_RA>12.4563</TEC_RA>
  <TEC_DEC>43.7632</TEC_DEC>
  <Equinox>2000</Equinox>
  <OFF_RA>0.0</OFF_RA>
  <OFF_DEC>0.0</OFF_DEC>
  <ProperMotion_RA>0.0</ProperMotion_RA>
  <ProperMotion_DEC>0.0</ProperMotion_DEC>
  <Tracking>1</Tracking>
  <Telescope>1</Telescope>
  <WXMIN>1</WXMIN>
  <WXMAX>2048</WXMAX>
  <WYMIN>1</WYMIN>
  <WYMAX>4600</WYMAX>
  <PDIT>Random</PDIT>
  <ADIT>0.0</ADIT>
  <SDIT>4.0</SDIT>
  <DIT0>0</DIT0>
  <DITX0>0.0</DITX0>
```

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```

<DITY0>0.0</DITY0>
<NDIT>5</NDIT>
<XDIT>0.0 7.214781 0.59198904 -0.3343544 -5.936532</XDIT>
<YDIT>0.0 7.8273206 -1.7054458 0.78919077 -6.1209717</YDIT>
</LBC_Target>
- <LBC_Channel>
- <B_Arm>
  <PSB>1</PSB>
  <RotAngle_B>3.55</RotAngle_B>
  <Focuss_B>1</Focuss_B>
  <Chip1B>1</Chip1B>
  <Chip2B>1</Chip2B>
  <Chip3B>1</Chip3B>
  <Chip4B>1</Chip4B>
  <ShutterB>1</ShutterB>
  <ReadOutMode_B>1</ReadOutMode_B>
  <CCDBin_B>1</CCDBin_B>
  <FilterNumber_B>5</FilterNumber_B>
- <Filter>
  <FilterName>B</FilterName>
  <TotExpoTime>40000</TotExpoTime>
  <NExpo>10</NExpo>
  <Focuss>1</Focuss>
  <Identifier>B_pipe</Identifier>
  <Pipeline>Reduction Instructions</Pipeline>
</Filter>
- <Filter>
  <FilterName>U</FilterName>
  <TotExpoTime>40000</TotExpoTime>
  <NExpo>10</NExpo>
  <Focuss>1</Focuss>
  <Identifier>U_pipe</Identifier>
  <Pipeline>Reduction Instructions</Pipeline>
</Filter>
- <Filter>
  <FilterName>V</FilterName>
  <TotExpoTime>40000</TotExpoTime>
  <NExpo>10</NExpo>
  <Focuss>1</Focuss>
  <Identifier>V_pipe</Identifier>


```

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```

<Pipeline>Reduction Instructions</Pipeline>
</Filter>
- <Filter>
  <FilterName>StdU</FilterName>
  <TotExpoTime>40000</TotExpoTime>
  <NExpo>10</NExpo>
  <Focuss>1</Focuss>
  <Identifier>StdU_pipe</Identifier>
  <Pipeline>Reduction Instructions</Pipeline>
  </Filter>
- <Filter>
  <FilterName>VBess</FilterName>
  <TotExpoTime>40000</TotExpoTime>
  <NExpo>10</NExpo>
  <Focuss>1</Focuss>
  <Identifier>VBess_pipe</Identifier>
  <Pipeline>Reduction Instructions</Pipeline>
  </Filter>
- <Filter>
  <FilterName />
  <TotExpoTime />
  <NExpo />
  <Focuss />
  <Identifier />
  <Pipeline />
  </Filter>
- <Filter>
  <FilterName />
  <TotExpoTime />
  <NExpo />
  <Focuss />
  <Identifier />
  <Pipeline />
  </Filter>
- <Filter>
  <FilterName />
  <TotExpoTime />
  <NExpo />
  <Focuss />
  <Identifier />

```


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```

<Pipeline />
</Filter>
</B_Arm>
- <R_Arm>
  <PSR>2</PSR>
  <RotAngle_R>3.55</RotAngle_R>
  <Focuss_R>1</Focuss_R>
  <Chip1R>1</Chip1R>
  <Chip2R>1</Chip2R>
  <Chip3R>1</Chip3R>
  <Chip4R>1</Chip4R>
  <ShutterR>1</ShutterR>
  <ReadOutMode_R>1</ReadOutMode_R>
  <CCDBin_R>1</CCDBin_R>
  <FilterNumber_R>2</FilterNumber_R>
- <Filter>
  <FilterName>I</FilterName>
  <TotExpoTime>40000</TotExpoTime>
  <NExpo>10</NExpo>
  <Focuss>1</Focuss>
  <Identifier>I_pipe</Identifier>
  <Pipeline>Reduction Instructions</Pipeline>
  </Filter>
- <Filter>
  <FilterName>R</FilterName>
  <TotExpoTime>40000</TotExpoTime>
  <NExpo>10</NExpo>
  <Focuss>1</Focuss>
  <Identifier>R_pipe</Identifier>
  <Pipeline>Reduction Instructions</Pipeline>
  </Filter>
- <Filter>
  <FilterName />
  <TotExpoTime />
  <NExpo />
  <Focuss />
  <Identifier />
  <Pipeline />
  </Filter>
- <Filter>

```




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```

<FilterName />
<TotExpoTime />
<NExpo />
<Focuss />
<Identifier />
<Pipeline />
</Filter>
- <Filter>
  <FilterName />
  <TotExpoTime />
  <NExpo />
  <Focuss />
  <Identifier />
  <Pipeline />
  </Filter>
- <Filter>
  <FilterName />
  <TotExpoTime />
  <NExpo />
  <Focuss />
  <Identifier />
  <Pipeline />
  </Filter>
- <Filter>
  <FilterName />
  <TotExpoTime />
  <NExpo />
  <Focuss />
  <Identifier />
  <Pipeline />
  </Filter>
- <Filter>
  <FilterName />
  <TotExpoTime />
  <NExpo />
  <Focuss />
  <Identifier />
  <Pipeline />
  </Filter>
</R_Arm>

```

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```

<ReadOutTime>7.45</ReadOutTime>
<TimeOffset>13.45</TimeOffset>
<Seeing>0.8</Seeing>
<MoonPhase>0</MoonPhase>
</LBC_Channel>
- <ConstrainSets>
  <CSTime>CSTTTT</CSTime>
  <CSPosition>CSPPPP</CSPosition>
  <CSWeather>CSWWWW</CSWeather>
  <CSSeeing>CSSSSS</CSSeeing>
  <CSFrame>CSFFFF</CSFrame>
</ConstrainSets>
</ObservingBlock>

```

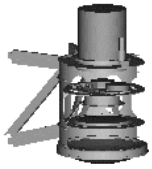
### 3.10B Schema File

```

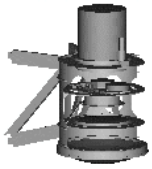
<xsd:schema xmlns:xsd="http://www.w3.org/2001/XMLSchema">
<xsd:annotation>
  <xsd:documentation>
    OBSERVING BLOCK OB for LBC-LBT
  </xsd:documentation>
</xsd:annotation>
<xsd:complexType name="OBType">
  <xsd:sequence>
    <xsd:element name="LBC_Target" type="LBC_TargetType"/>
    <xsd:element name="LBC_Channel" type="LBC_ChannelType"/>
    <xsd:element name="ConstrainSets" type="ConstrainSetsType"/>
  </xsd:sequence>
</xsd:complexType>

<xsd:complexType name="LBC_TargetType">
  <xsd:sequence>
    <xsd:element name="OBName" type="xsd:string"/>
    <xsd:element name="TargetName" type="xsd:string"/>
    <xsd:element name="ClassType" type="xsd:string"/>
    <xsd:element name="TEC_RA">
      <xsd:simpleType>
        <xsd:restriction base="xsd:float">
          <xsd:minExclusive value="0.0"/>
          <xsd:maxExclusive value="360.0"/>
        </xsd:restriction>
      </xsd:simpleType>
    </xsd:element>
    <xsd:element name="TEC_DEC">
      <xsd:simpleType>
        <xsd:restriction base="xsd:float">
          <xsd:minExclusive value="-90.0"/>

```



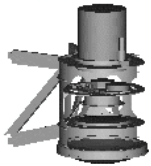
```
<xsd:maxExclusive value="+90.0"/>
</xsd:restriction>
</xsd:simpleType>
</xsd:element>
<xsd:element name="Equinox" type="xsd:integer"/>
<xsd:element name="OFF_RA">
<xsd:simpleType>
<xsd:restriction base="xsd:float">
<xsd:minExclusive value="-9999.9"/>
<xsd:maxExclusive value="+9999.9"/>
</xsd:restriction>
</xsd:simpleType>
</xsd:element>
<xsd:element name="OFF_DEC">
<xsd:simpleType>
<xsd:restriction base="xsd:float">
<xsd:minExclusive value="-9999.9"/>
<xsd:maxExclusive value="+9999.9"/>
</xsd:restriction>
</xsd:simpleType>
</xsd:element>
<xsd:element name="ProperMotion_RA" type="xsd:float"/>
<xsd:element name="ProperMotion_DEC" type="xsd:float"/>
<xsd:element name="Tracking" type="xsd:boolean"/>
<xsd:element name="Telescope" type="xsd:boolean"/>
<xsd:element name="WXMIN">
<xsd:simpleType>
<xsd:restriction base="xsd:integer">
<xsd:minExclusive value="1"/>
<xsd:maxExclusive value="2048"/>
</xsd:restriction>
</xsd:simpleType>
</xsd:element>
<xsd:element name="WXMAX">
<xsd:simpleType>
<xsd:restriction base="xsd:integer">
<xsd:minExclusive value="1"/>
<xsd:maxExclusive value="2048"/>
</xsd:restriction>
</xsd:simpleType>
</xsd:element>
<xsd:element name="WYMIN">
<xsd:simpleType>
<xsd:restriction base="xsd:integer">
<xsd:minExclusive value="1"/>
<xsd:maxExclusive value="4600"/>
</xsd:restriction>
</xsd:simpleType>
</xsd:element>
<xsd:element name="WYMAX">
<xsd:simpleType>
<xsd:restriction base="xsd:integer">
```



```

        <xsd:minExclusive value="1"/>
        <xsd:maxExclusive value="4600"/>
    </xsd:restriction>
</xsd:simpleType>
</xsd:element>
<xsd:element name="PDIT" type="xsd:string"/>
<xsd:element name="ADIT" type="xsd:float"/>
<xsd:element name="SDIT" type="xsd:float"/>
<xsd:element name="DIT0">
    <xsd:simpleType>
        <xsd:restriction base="xsd:integer">
            <xsd:minExclusive value="1"/>
        </xsd:restriction>
    </xsd:simpleType>
</xsd:element>
<xsd:element name="DITX0" type="xsd:float"/>
<xsd:element name="DITY0" type="xsd:float"/>
<xsd:element name="NDIT">
    <xsd:simpleType>
        <xsd:restriction base="xsd:integer">
            <xsd:minExclusive value="1"/>
        </xsd:restriction>
    </xsd:simpleType>
</xsd:element>
    <xsd:element name="XDIT" type="xsd:float" minOccurs="1"
maxOccurs="unbounded" />
    <xsd:element name="YDIT" type="xsd:float" minOccurs="1"
maxOccurs="unbounded" />
    <xsd:element name="FF_B" type="xsd:boolean"/>
    <xsd:element name="FF_R" type="xsd:boolean"/>
</xsd:sequence>
</xsd:complexType>
<xsd:complexType name="FilterType">
    <xsd:sequence>
        <xsd:element name="FilterName" type="xsd:string"/>
        <xsd:element name="TotExpoTime" type="xsd:float"/>
        <xsd:element name="NExpo" type="xsd:integer"/>
        <xsd:element name="Focuss" type="xsd:boolean"/>
        <xsd:element name="Identifier" type="xsd:string"/>
        <xsd:element name="Pipeline" type="xsd:string"/>
    </xsd:sequence>
</xsd:complexType>
<xsd:complexType name="LBC_ChannelType">
    <xsd:sequence>
        <xsd:element name="B_Arm" type="B_ArmType"/>
        <xsd:element name="R_Arm" type="R_ArmType"/>
        <xsd:element name="ReadOutTime" type="xsd:positiveFloat"/>
    </xsd:sequence>
</xsd:complexType>

```




```
<xsd:element name="TimeOffset" type="xsd:positiveFloat"/>
<xsd:element name="Seeing" type="xsd:positiveFloat"/>
<xsd:element name="MoonPhase">
  <xsd:simpleType>
    <xsd:restriction base="xsd:integer">
      <xsd:minExclusive value="0"/>
      <xsd:maxExclusive value="14"/>
    </xsd:restriction>
  </xsd:simpleType>
</xsd:element>
</xsd:sequence>
</xsd:complexType>

<xsd:complexType name="B_ArmType">
  <xsd:sequence>
    <xsd:element name="PSB" type="xsd:integer"/>
    <xsd:element name="RotAngle_B" type="xsd:float"/>
    <xsd:element name="Chip1B" type="xsd:boolean"/>
    <xsd:element name="Chip2B" type="xsd:boolean"/>
    <xsd:element name="Chip3B" type="xsd:boolean"/>
    <xsd:element name="Chip4B" type="xsd:boolean"/>
    <xsd:element name="ShutterB" type="xsd:boolean"/>
    <xsd:element name="ReadOutMode_B" type="xsd:boolean"/>
    <xsd:element name="CCDBin_B" type="xsd:integer"/>
    <xsd:element name="FilterNumber_B" type="xsd:integer" minOccurs="0"
maxOccurs="8"/>
    <xsd:element name="Filter" type="FilterType" minOccurs="0"
maxOccurs="8"/>
  </xsd:sequence>
</xsd:complexType>

<xsd:complexType name="R_ArmType">
  <xsd:sequence>
    <xsd:element name="PSR" type="xsd:integer"/>
    <xsd:element name="RotAngle_R" type="xsd:float"/>
    <xsd:element name="Chip1R" type="xsd:boolean"/>
    <xsd:element name="Chip2R" type="xsd:boolean"/>
    <xsd:element name="Chip3R" type="xsd:boolean"/>
    <xsd:element name="Chip4R" type="xsd:boolean"/>
    <xsd:element name="ShutterR" type="xsd:boolean"/>
    <xsd:element name="ReadOutMode_R" type="xsd:boolean"/>
    <xsd:element name="CCDBin_R" type="xsd:integer"/>
    <xsd:element name="FilterNumber_R" type="xsd:integer" minOccurs="0"
maxOccurs="8"/>
    <xsd:element name="Filter" type="FilterType" minOccurs="0"
maxOccurs="8"/>
  </xsd:sequence>
</xsd:complexType>

</xsd:sequence>
</xsd:complexType>
```


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```

<xsd:complexType name="ConstrainSetsType">
  <xsd:sequence>
    <xsd:element name="CST" type="xsd:string"/>
    <xsd:element name="CSP" type="xsd:string"/>
    <xsd:element name="CSW" type="xsd:string"/>
    <xsd:element name="CSS" type="xsd:string"/>
    <xsd:element name="CSF" type="xsd:string"/>
  </xsd:sequence>
</xsd:complexType>

</xsd:schema>

```

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#### 4. OB Write-Read C/C++ Library

The C/C++ library distributed with this package was created to perform basic operation with the XML OB file generated by the GUI:

- 1) Write an example OB
- 2) Read an OB file and put its content in a variable structure, described later
- 3) self-Check utility
- 4) redirect the output in a standard flow.


Here is the C-variable structure used in the Library:

```

/*! \struct LBC_TARGET
 * Define the Target Variable Structure.
 */
typedef struct {
    char *szOBName;                /*!Observing Block Name, is the name of the OB
without .ob extension.*/
    char *szTargetName;           /*!Target Name, is the name of the target of the
observation.*/
    char *szClassTypeObs;         /*!Class Type of Observation (Dark, Scientific
Object, Standard Star, Flat Field, ecc).*/
    double Ra, Dec;               /*!RA and DEC Coordinates (decimal degree format)*/
    double Offset_Ra, Offset_Dec; /*! RA and DEC Offset (arsec)*/
    double ProperMotion_Ra, ProperMotion_Dec; /*! Proper Motion (arsec)*/
    int iEquinoxOfCoord;         /*!Equinox of Coordinates (1950 or 2000)*/
    int fTracking;               /*!Tracking, flag for tracking*/
    int fTelescope;              /*!Preset LBT Telescope, flag for presetting the LBT
Telescope*/
    int iWinXMin, iWinXMax;       /*!Window X Parameters (pixels)*/
    int iWinYMin, iWinYMax;       /*!Window Y Parameters (pixels)*/
    /*DITHERING PARAMETERS*/
    int iNDit;                   /*!Number of Dithering Offset, number of dithering
steps*/
    double *XDit, *YDit;         /*!X-Y Dithering Steps, from starting point
[RA0,DEC0] (arcsec)*/
} LBC_TARGET;

/*! \struct LBC_FILTERS
 * Define the Structure for Each LBC Channel.
 */
typedef struct {
    char *szFilterName;           /*!Filter Name*/
    int iExpoNumber;             /*!Number of Exposures, number of exposure for
all dithering steps*/
    double TotExpoTime;          /*!Total Exposure Time = (SingleExposureTime *
NExposures) (sec)*/
    int fFocuss;                 /*!Focuss Flag for B & R-Arm*/

```

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```

char *szIdentifier;          /*!Identifier for Arm, identifier for Pipeline
Instructions*/
char *szPipeline;          /*!Pipeline Instruction, to be inserted in the
keyword*/

} LBC_FILTERS;

/*! \struct LBC_CHANNEL
* Define the Structure for Each LBC Channel.
*/
typedef struct {

    int iArmSetting;          /*!Arm Setting (OFF=0 - MASTER=1 - SLAVE=2)*/
    int fReadoutMode;        /*!Read-Out Mode, flag for Read-Out Mode
(slow=0 - fast=1)*/
    int fChip1, fChip2, fChip3, fChip4; /*!Boolean for Chip turned ON-OFF*/
    int fShutter;            /*!Boolean or Shutter ON-OFF*/
    double RotAngle;         /*!Rotation Angle for Arm (degree)*/
    int iCcdBin;             /*!CCD Binning, factor for rebin of the
image*/
    int iNFilters;           /*!Number of Filter for Arm (tot FilterNumber
= 8)*/
    LBC_FILTERS *pFilter;    /*!Filter Vector of iNFilters elements for
Selected Arm */

} LBC_CHANNEL;

/*! \struct LBC_OB
* Define the OB Variable Structure Type
*/
typedef struct {
    LBC_TARGET LBC_Target;
    LBC_CHANNEL B_Arm, R_Arm;

} LBC_OB;

typedef LBC_OB *PLBC_OB;    /*!Define Pointer to Main OB-Structure*/

```